Introducing sustainability measures to retail district retrofits

Edmonton’s Westmount Centre Case Study

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1.0 ABSTRACT

Many North American suburban shopping malls have become under-performing retail islands drifting in oceans of asphalt parking lots. This thesis examined three potential future scenarios for the aging retail shopping mall landscape;

1. Maintaining status quo
2. Upgrading the property for a mixed-use neighbourhood centre
3. Implementing strategies for attainable sustainability targets

These scenarios were examined using a proposed retrofit of Edmonton, Canada’s Westmount Centre as a case study, to determine if this retrofitting approach could be a pilot for other districts.

The principles of 2030 District (2030 District, 2012) guided this thesis, a concept which proposed that by 2030 all newly constructed districts be energy neutral and that existing districts be retrofitted to use less than 50% of the energy that they presently consume. The Spider charts developed by Haas & Troglio (Haas & Troglio, 2011) were used to create strategies that included incorporating existing proven, economically viable technologies to the proposed retrofit. The three resulting scenarios were then evaluated using Leadership in Energy and Environmental Design - Neighbourhood Design, version 4 (LEED-ND v4), to make a case for raising the threshold for sustainability and mitigation measures when planning new and retrofit projects in North America (USGBC, 2014). The goal of the thesis was to find a solution that holistically meets the goals of LEED-ND, where partnerships between numerous stakeholders provide a business model for urban sustainability, which includes planning, implementation and verification (2030 District, 2012).

By examining proven sustainability measures and applying them to the normative scenario, makes the case that strategic implementation during a situation of opportunity, through timely stakeholder interaction, will result in a district that is both sustainable (environmentally, socially and economically) and provides a good return on investment.

This thesis is a starting point for the iterative process, a compelling argument and business case for further investigation and action for Westmount Centre and by extension, to other retail districts.
2.0 INTRODUCTION

North American shopping malls are a dying species; attempts to revive them by beautification are proving to be ineffective, unsustainable, short-term solutions. It will take holistic actions across all disciplines to resuscitate and invigorate these dated archetypes.

Across North America, most of the urban environment is already in place. As attractive as starting anew appears; analysis shows that retrofitting is more fiscally responsible than tearing down an existing structure to build a new one in its place (Trusty, 2000). Although significant energy savings are possible in new construction, new and replacement building stock rates are low. For example, only 1.6% of existing Canadian housing stock of 12,462,435 units was new or replacement in 2011 (Canada Mortgage and Housing Corporation, 2012). Experts agree that due to a slow turnover in North American building stock, significant energy savings in existing buildings can only be accomplished through intensive retrofits and replacing equipment with more energy efficient alternatives (Levine, 2007).

As not keeping the buildings aesthetically updated has been shown to affect foot traffic and the bottom line negatively, many municipalities have provided seed money to promote the revitalization of existing retail areas for restoring/improving the economic picture. The updating of the design and upgrading infrastructure met the goal of increasing employment and increasing the sales/square foot, in the short term (Delaware Valley Regional Planning Commission, 2013). Maintaining the premises to be comparable to similar facilities by expansion, updating the façade and building envelope, improving the efficiency of the HVAC equipment, lighting (CommONEnergy Project, 2013) and plumbing fixtures, shows some savings over a short payback period. Crucial stakeholders are not challenging the existing paradigms of tear down and rebuild new, nor green-washing (the deliberate promotion of false environmental claims). Inertia is less complicated, and business as usual or minimal upgrades are simpler to justify to management and investors, compared to strategies that are not well known, therefore deemed riskier. However, even introduced changes often did not go far enough to significantly impact the triple bottom line: improvements to the environmental, social and economic sustainability of a retail district. Recent reports from Canadian commercial real estate analysts (Buckner, 2017) indicate that due to changes in shopping habits, as well as other societal changes, the North American shopping centres are increasingly shutting down; creating significant decay in the local environmental, social and economic outlook. To reverse this degradation it would be more productive to look at the site in holistic, innovative ways to be more sustainable, to generate a significantly smaller environmental footprint compared to generally accepted practices and improve the triple bottom line in the long-term.

This period of reassessment and anticipated change, present a Situation of Opportunity, a time when innovation can be initiated with a higher probability of acceptance, compared to attempting to introduce innovation when no other changes have been anticipated (Svane, 2009).

Presently, opportunities for changes that could have wide-reaching positive implications are either not considered or set aside for a variety of reasons, chief among them the lack of persuasive evidence regarding Return on Investment (ROI). A holistic review of the sustainability of the district, not only the environmental performance of a building, would generate a series of integrated strategies that when implemented, would provide a more stable and profitable long-term enterprise.

2.1 Defining the problem

Since the post-WWII era, the dominant urban development model in North America has been the Conventional Suburban Development (CSD). Building on greenfield (previously undeveloped) sites, this model has combined the availability of both land and inexpensive fossil fuel to create a wasteful and unhealthy, car-dependent way of life. The sprawling shopping mall is a significant feature of the
suburban landscape; a collection of retail stores, surrounded by hectares of asphalt parking lots, which, along with commercial areas of employment is segregated from the surrounding residential monoculture of predominantly stand-alone single-family dwellings.

With observable climate and weather changes, and increasing evidence of environmental degradation, North American society is starting to realize that it needs to cut back on the use of non-renewable resources drastically and that the price of providing municipal services to outlying low-density areas is too costly compared to the compensation from development charges. Some municipalities are looking at under-performing areas within their boundaries as targets for intensification for cost savings and improving the tax base (Canadian Centre for Policy Alternatives, Manitoba Office, 2014). The areas near existing major transit hubs are ideal targets for intensification and diversification in the form of mixed-use compact development. The shopping mall landowners and developers are also looking at intensifying these areas for economic benefit (Florida, 2010). Builders are finding that the emerging trend for new homeowners is not the enormous mansions (465-560 sq.m. /5,000-6,000 sq.ft.) on the city outskirts of the early 2000’s, but residences in walkable developments with green areas, amenities and cultural institutions. Also, there has been a significant shift to highly energy efficient homes that are approximately 120 sq.m. (1,300 sq.ft.). Although proven technology exists for improving the sustainability of the suburbs, a potential improvement in ROI compared to the ROI of the present business-as-usual model is something many sceptical investor/stakeholders are not willing to consider (Said, 2014).

A 2015 report from the Global Commission on Climate and Economy has indicated that municipal investments in public transportation, waste management and energy initiatives made by 2020 could significantly decrease Green House Gas (GHG) production and produce direct savings of $22 US Trillion (2015 value) to the US economy by 2050. These investments could also introduce significant secondary monetary impacts. Princeton economists Socolow and Pacala showed that existing proven technologies and strategies could significantly decrease GHG emissions and climate change effects (Socolow, 2006). Key stakeholders taking responsibility for employing innovative policies, planning and financial instruments to implement established, well-documented, sustainable energy efficient technologies, strategies and construction methods should be prerequisites for new projects.

New construction in North America is only a small percentage of the total built stock; even if all new construction projects met sustainability targets, the impact would be inadequate to alleviate ongoing environmental deterioration. Therefore, opportunities must be found to decrease the overall future impact of the existing structures as well as mitigate the environmental degradation of the past. Also, as globalization increases, the North American lifestyle and Gross Domestic Product (GDP) growth is seen as a model to follow (Goldsmith, 1997). North America should take the opportunity to lead by example, creating a model for 3rd world countries to emulate, especially as their populations and urban areas are growing at a faster rate than those in developed countries (Worldwatch Institute, 2012).

2.2 Defining the problem at Westmount Centre

Westmount Centre was Edmonton’s first shopping mall, opening in August 1955 (Figure 2.1), and had several decades of popularity, which prompted several expansions.

It has faced increasingly hard times, which started a few years after the completion of the West Edmonton Mall, an enormous shopping mall, in 1981, just over 9 km away, whose many attractions include a regulation-sized hockey rink, a wave pool, a trained seal show and an indoor amusement park. Many in the area getting into a car to shop for anything but the regular weekly grocery shopping are more likely to drive a little further to have more of their retail needs met, as well as get some of the other cultural and social needs met; something that Westmount Centre no longer does satisfactorily. (Figure 2.2)
2.3 Proposing a solution

As the retail real estate stock undergoes upgrades for aesthetic, economic and structural reasons, this thesis proposes that these are the Situations of Opportunity for introducing strategies and technologies for long-term returns in all aspects of sustainable development.
In the past, individual buildings have been singled out, built, retrofitted or analyzed for their sustainability and optimal energy efficiency. Likewise, social and economic issues were treated in isolation. It is more advantageous to consider urban nodes as interdependent districts rather than individual components, as a subject of study and implementation, as there are opportunities to holistically and synergistically improve infrastructure and enhance the network between constituents of a system.

Although this area is not one of Edmonton’s Business Revitalization Zones (BRZ), the City of Edmonton Planning department is aware of the need for an intervention. They are at the early stages of considering solutions to this underperforming area.

Presently, the existing urbanized areas that show the most significant change are the suburban shopping malls, some which are undergoing revitalization with the introduction of mixed-use development on what were previously parking lots (Dunham-Jones & Williamson, 2009). Using methods of back-casting (to be explored in Theory), this thesis investigated how these areas could be developed to perform more sustainably in the future.

Despite a slow start relative to Europe in adapting to an increasingly sustainable lifestyle, there is cause for optimism; the American Millennial generation is likely to push solutions to environmental issues past the tipping point, where far-reaching sustainability measures are the standard and compliance is mandatory. A 2009 study by Madland & Teixeira (2009) showed that 84% of the millennial generation members studied support stronger environmental laws. Other reports indicate decreased interest in driving in recent college graduates (DelBosc & Currie, 2012), as well as in theteenaged population (California Department of Housing and Community Development, 2012, Penn, 2015). Also, US suburban homes are the most difficult to re-sell (Florida, 2010). For those investing in homes and car purchases, the potential future resale value of an investment made today can play a significant part in the buying decision (Miller, 2012). If current sales become increasingly difficult because of a perceived future inability to re-sell unviable and socially unacceptable technology, builders and developers may have to reconsider their offerings. For example research by the California Department of Housing and Community Development (CDHCD, 2012) shows that 77% of the Millennial generation would prefer to live in rental units in the urban core, rather than in the detached housing of the suburbs. These choices are due in part to student debt, but mostly the lifestyle preferences of proximity to amenities and services. They are also willing to live in smaller scale homes on smaller lots or smaller apartments, compared to those where they had grown up. Future development and district retrofits should, therefore, reflect the preferences of this market segment and future generations.

Typical shopping centre retrofits concentrate on improving lighting, HVAC, building envelope and aesthetics (CommONEnergyproject.eu, 2013). At present, the more progressive suburban shopping centre retrofits focus on:

- The creation of a “sense of space”, place-making – for improvement of the social aspect of sustainability

The intensification of serviced land through increased commercial density and introduction of dense residential areas in former parking lots

- The reduction in overall Vehicle Miles Travelled (VMT) - the proportion of the end-users that require the use of a private vehicle to access this retail district (numerous factors influence VMT: costs associated with automobile ownership and maintenance, levels of available public transport and the extent of sprawl).

- Increased accessibility to services and parkland
This thesis layered these retrofit approaches with a holistically improved infrastructure for sustainability. In doing so, it demonstrates that district-specific projects are not only necessary for the growth of a city but also economically feasible and desirable due to the resulting increased self-sufficiency concerning energy, water and resources.

While technologies are ever changing and ever improving, the intent of this thesis, was to explore the potential to holistically incorporate environmentally and financially proven techniques as part of an integrated design approach.

### 2.4 Research question

This thesis examined the feasibility of meeting and surpassing the goals of 2030 DISTRICT (2012) (energy targets proposed by an architect, Edward Mazria to transform the built environment from a greenhouse gas emitter to climate change mitigator), through the inter-dependent use of existing, proven strategies as a starting point. These environmental strategies were balanced with social and economic considerations, as environmental remedies in isolation are inadequate to overcome the present issues at Westmount Centre (Figures 2.3a and 2.3b).

![Figure 2.3a Westmount Centre and area. Bound by 114th Avenue on the north, Groat Road to the east, 111th Avenue to the south and 135th Street to the west. (Base map source: www.maps.google.com)](image)

Given the best intentions of the stakeholders in re-imagining the Westmount Centre site as an economically feasible, mixed-use retrofit/development, what phased strategies can be implemented over the next 15-20 years to make the resulting district more sustainable (environmentally, socially and economically)? When are the stakeholder actions required to ensure the success of this endeavour? How well will the proposed strategies meet the targets of LEED-ND?
Figure 2.3b Present day Westmount Centre and area. (Source: www.maps.google.com)
3.0 BACKGROUND

3.1 A brief history of the city

Historically, in many societies, especially aboriginal, sustainable living has always been a way of life. The ability to live off the land, while living in a permanent settlement dates from Neolithic times, when humans learned plant cultivation and animal husbandry. For centuries, these were settlements that were sustainable and resilient, with local water and negligible inorganic waste. Ironically, the introduction of sewers to Rome caused pollution of the Tiber River and depleted the local agricultural lands of minerals. Conversely, Mumford (1956) states that as recently as the beginning of the 20th century, locally grown fruits and vegetables were able to sustain even a city the size of New York. This symbiotic relationship developed as the city supplied the refuse to enrich the soil.

Depending on the location, a tipping point was reached at the time when the local resources were unable to sustain the city and increasingly required importing supplies from a distance. Industrial areas sprang up on the perimeters of cities, where land was less expensive. During the industrial revolution, the noxious effluent of some of these industries led to the first regulations stipulating the separation of different types of land use (Duany et al., 2000). Planners started segregating land uses, creating a hierarchy; isolating functions that were deemed unhealthy (Corburn, 2004).

3.2 North American suburban development model

In pre-WWII neighbourhoods, walking was the primary mode of transportation. Between the wars, most city residents lived within walking distance of work or a streetcar that would take them to work. After the Second World War, there was a significant push to build new roads and support the automotive industry. North American cities, unlike many of their European counterparts, grew the suburban areas exponentially because there appeared to be little reason to conserve either land or seemingly endless resources. Large infrastructure projects were subsidized and encouraged by all levels of government. Characteristics of these suburbs are large patches of low-density land-use and dysfunctional traffic networks which make necessary the reliance on the automobile by all members of a family for almost all functions outside the home including learning, working, shopping and entertainment. This suburban sprawl can be defined as the rigidly planned and explosive growth of built-up areas into the countryside, resulting in the inefficient and wasteful use of natural resources and land.

This sprawl meant that while many young families could move to the suburbs to have their own home on a substantial lot, they required a car to go just about anywhere, including shopping.

Unlike many US cities, Canadian cities have retained a vibrant life and real estate values at the city centre. Typically a cross-section of income levels is represented in a dense urban fabric, as well as a variety of residential typologies.

Across North America, suburban residential areas are very uniform; large individual plots of land with detached houses and attached garages or carports. Entire subdivisions are dedicated to specific segments of the population; typically the young family, within well-defined income brackets (Duany et al, 2000). This is a model that is very easy to reproduce, therefore very attractive for a developer. (Mukhija, 2014)

While initially designed for the growing family, suburbs do not have the capacity for aging in place due to the limited number of housing types and are especially poorly suited for:

• Students with limited budgets; unaffordable cars, infrequent suburban bus schedules, lengthy commutes are not compatible with the student lifestyle.

• Singles – costs of large houses are too high for one person, distant from social amenities
Seniors – deteriorating health issues are incompatible with large houses and their decreasing ability to drive.

Since the 1950’s, the number of women in the US workforce has more than tripled (Calthorpe, 2011), requiring suburban households to acquire a second car. Parents or school buses are needed to shuttle the children to school daily, as the distances from schools and amenities are more considerable than is practically feasible for young children to walk. As the children become teenagers, they too need automobiles to allow some form of independence (Duany et al, 2000).

These subsidized suburbs are greatly compartmentalized. The separation of residential areas from workplaces meant that there was a duplication of amenities and services (such as restaurants and parking spots) near both. In fact, in a North American survey of car ownership and land use, found that there are eight parking spots (up to 20 in Austin Texas, USA) for every car on the road (De Chant, 2011).

Parking space use is determined by the occupancy of an area during the day; the office areas are deserted in the evenings, and the residential areas are deserted in the daytime; a harder economic model to sustain. Most suburban parking is “free”, but subsidized by the taxpayers who do not drive (Shoup, 2011).

Office jobs that are located in the Canadian downtown cores are well served by public transport. Workplaces located in suburban office parks, retail areas or outlying industrial districts are typically sprawling single-story structures surrounded by hectares of parking, as there is no motivation for creating multi-level buildings or parking. Both suburban residences and workplaces are commonly poorly served by public transport due to the lack of critical mass for it to make financial sense for the municipality.

3.3 A brief history of retail

Concentrations of retail establishments can be traced back to ancient Greece; areas set outside the city walls and demarcated by stones established a neutral space for local and non-local merchants to sell their wares. The Agora, bazaars and marketplaces developed from this early model.

The late 18th-century Parisian arcades brought the retail experience inside, away from the unpredictability of weather, eventually creating shopping as an entertaining experience, not only one of necessity (Chung, 2001).

The 1930’s, New York City saw the introduction of the first supermarket (see Appendix 1 for North American retail definitions), followed by the wholly enclosed shopping centre in 1956 in Southdale, Minneapolis, USA (Mate, 2012).

Changing demographics, shopping trends and economic conditions are amongst the drivers for change in the North American shopping centres. Approximately 20% of the largest shopping centres in the USA closed between 2007 and 2009. The growing demand for the online experience is providing a challenge for the stores that have invested in a physical location (Mate, 2012). The popularity of department stores is diminishing, and the closing of an anchor store within a shopping centre often hastens its decline. Without intervention, shopping centres become economically underperforming, socially weak and environmental liabilities for the surrounding neighbourhood. When abandoned, the buildings, as well as acres of parking, are referred to as grey-field sites. (Sobol, 2001). Aesthetically unattractive and economically unviable retail centres, the sites themselves have great potential in the existing serviced land and a future as an increased tax base.

3.4 Suburban retail typology

The Urban Transect Theory, devised by the Congress for the New Urbanism (CNU), is based on the ecological succession theory that describes the evolution of a mature ecosystem from the
introduction of pioneering species to an area, creating footholds for subsequent species (See Appendix 2 for Transect descriptions and Edmonton examples) and increased complexity.

The presence of the various species changes the substrate and microclimates, which permit the eventual establishment of the mature ecosystem. This end-state shows some changes internally due to multiple stressors, but the overall function of the fully developed, resilient ecosystem remains constant. Likewise, with few exceptions, most urban areas had their start as small human settlements. With time, the original core becomes the historic centre, surrounded by high-density commercial structures, which evolve with changes to economy and aesthetics, but remains a central economic engine. The transect separates urbanized areas into distinct transect zones (T1-T6), which represent stages in the evolution of an urban area.

Urban Transect theory was used to locate the new development on an intensity gradient, to size the services and amenities accordingly. Implementing the strategies would mean that the provision of a local code wouldn’t just be developed for building aesthetics, but also prescribe requirements for maximum power usage for example. Low volume plumbing fixtures, power cogeneration, waste management and all other strategies would be coded, according to the location on the spectrum of the transect, potentially as a pilot project for more stringent local building codes.

The retail function is present in various typologies throughout an Urban-Rural transect (Steuteville, 2003). These differences are shown through images of the several locations, from the Central Business district through to the Rural. (Figure 3.1)

T-6 – The retail function at the Urban Core is seen as shops on the ground floor of multi-floored office towers. These take advantage of the workers in the downtown core; most of the clients are pedestrians, while those who made the trip specifically downtown by car, find paid street parking or parking garages nearby.

T-5 In the Urban Centre, the retail function occupies the ground floor of 2-3 story buildings along main street retail areas. Here the traffic is primarily local and pedestrian, with car-dependent customers finding metered parking on the main road and small paid parking lots just off the main road, or free parking amongst the homes on the side streets. The sidewalks may be wider, to accommodate pedestrians, cafes, sidewalk sales.

T-4 - Westmount Centre is located in the General Urban zone, where retail exists as islands within large monolithic residential areas. This thesis proposes that Westmount Centre become a T-5 node, which allows for greater diversity in land-use and residents.

The Suburban (T-3) and Rural (T-2) zones require different interventions for sustainability. T-1 is the Natural Zone.

These areas are also most likely to be governed by self-organized Business Improvement Areas (BIA), (TABIA, 2014), which communally provide planters and benches, plan and execute events, among other inducements, to encourage shopping in a community.

As one enters the suburban areas, typically where development started after the 1950’s, there is a monumental change from the pedestrian based retail of pre-war neighbourhoods. These areas reflect the shift in shopping patterns post-war, as the automobile and refrigeration allowed less frequent food shopping trips and bulk purchasing to reduce unit costs, compared to daily food shopping that was the norm in pre-WWII North American and present day urban Europe (Ellickson, 2015)

Although the terminology is not consistent in general usage, for this thesis, a shopping centre is a retail destination, where there are numerous shops and restaurants with a shared parking lot; whereas, in a mall/shopping mall, the retail stores are under a single roof. In the USA, there are approximately 109,000 shopping centres (small strip malls to large regional shopping centre), of which about 1,000 are malls, or about 1%, but account for over 17% of the leasable space (ISCS,
2017). In Canada, there are 2,700 shopping centres with areas exceeding 3,700 sq.m. (40,000 sq.ft) (ISCS, 2017). However, the proportion of Canadian shopping centres being malls would be considerably higher than in the USA due to the colder climate.

Typically most of the shoppers arrive by car rather than by public transportation, by bicycle or by foot; as the distances to travel from the residential areas, or even between the various stores, are not considered pleasant, convenient or safe.

There are limited opportunities for meaningful community connections, as the argument could be made that shopping is the only option for social and cultural interactions in the suburbs. Socially, this type of development could discriminate against those who would use public transportation; the elderly and those with young children, as the dominance of the automobile, makes crossing the parking lot a potential hazard. The design emphasis is more on the convenience of the drivers rather than that of the pedestrians.
Environmentally, these acres of asphalt parking lots block natural water infiltration, requiring an extensive storm sewer system, which can be overwhelmed in heavy rainfalls. Solutions are necessary if water infiltration into the substrate is to be promoted. There are lost opportunities for agriculture, as this was usually the original zoning of the area.

Economically, this type of development might also unnecessarily impoverish households that feel that they require a car, as smaller shopping trips are inconvenient and impractical.

Common factors in land use in suburbs are;

- **The reliance on the automobile** to get inhabitants between the various functions (work, shopping, entertainment and education) over the course of a week.

- **Wasteful use of land and resources.** Older mall buildings are energy inefficient as the exposed roof and wall surfaces are higher than they would be for a multi-floor structure with equal volume and area. Unnecessarily high ceilings cause significant energy waste in heating and cooling unproductive volume. Mall parking lots are significantly underutilized most of the year.

- **A lack of coordinated, cohesive mechanisms** for maximizing opportunities for sustainability and resilience. As a large-scale maintenance or system upgrade becomes necessary, opportunities for a symbiotic, multi-faceted strategy are often overlooked in the name of short-term payback, rather than long-term investment, which would provide higher dividends

### 3.5 A brief history of Edmonton’s Westmount Centre

The Westmount Shoppers’ Park opened to much fanfare in 1955. Table 3.1 encapsulates the history of Westmount Centre as part of Edmonton’s History (Appendix 3).

<table>
<thead>
<tr>
<th>Date</th>
<th>Milestone (Bold type indicates change of ownership)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1952</td>
<td>First <strong>New Amsterdam</strong> bought 30 acres and eight houses (assessed at a total of $26,700) (Edmonton Journal, 1957)</td>
</tr>
<tr>
<td>1955</td>
<td>August 18, 1955 - Westmount Shoppers Park (approximately 320,000 sq.ft or 29,700 sq.m.), costing $5,000,000 opened for business, featuring 40 stores and 24 acres of parking /3000 parking spots (Edmonton Journal (A), 1955). In present terminology, this would be a strip mall. 8,000 Edmonton residents lived within a 5-minute walk, 127,000 residents or 60% of Edmonton’s population lived within a 10-minute drive. Innovative for the time, two bus routes served the centre. For the convenience of the shoppers, there was a sheltered route connecting the transit stop and an entrance to the shopping centre. (Edmonton Journal, 1957)</td>
</tr>
<tr>
<td>1966</td>
<td>The mall was expanded and enclosed, air-conditioning added, costing $1,200,000. The area increased to a total of 420,000 sq.ft (approx 39,000 sq.m.) and home to 56 businesses. (Edmonton Journal, 1966)</td>
</tr>
<tr>
<td>1981</td>
<td>Phase 1 of West Edmonton Mall opens.</td>
</tr>
<tr>
<td>1985</td>
<td>Bought by <strong>Triple 5 Corporation</strong> for $12,000,000. 14,900 sq.m. (@160,000 sq.ft.) including sixty new businesses, seven movie theatres and fountains were added and the centre was refurbished, spending $33,000,000 in total. (Edmonton Journal, 1985)</td>
</tr>
<tr>
<td>1993</td>
<td>Woodwards, the anchor store, leaves the Centre. (Edmonton Journal, 1993)</td>
</tr>
<tr>
<td>Year</td>
<td>Event</td>
</tr>
<tr>
<td>------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>1995</td>
<td><strong>Park Gate Holdings and GE Capital</strong> take ownership of the mall, promising $10,000,000 of cosmetic renovations. (Edmonton Journal, 1995)</td>
</tr>
<tr>
<td>1999</td>
<td><strong>Dundee</strong>, a division of <strong>GE Capital</strong> start a major renovation, in which the business community has little faith, as the previous renovation did not halt the decline in the mall, as West Edmonton Mall and Kingsway Mall are taking away businesses. Occupancy is 83%, the area is increased to 46,7000 sq.m. (524,000 sq.ft.) (Edmonton Journal, 1999)</td>
</tr>
<tr>
<td>2001</td>
<td>Dundee Realty Management completed $30,000,000 renovation - taking out the fountains, added skating rink. (Edmonton Commerce and Industry, 2001)</td>
</tr>
<tr>
<td>2003</td>
<td><strong>Sandalwood Management Company of Texas</strong> bought Westmount. Stand-alone restaurant and fast-food buildings built in the parking lot. Decide to re-theme as a discount centre. 10% of space used for professional offices. (Edmonton Journal, 2004)</td>
</tr>
<tr>
<td>2005</td>
<td>Westmount celebrates 50 years. (Edmonton Sun, 2005)</td>
</tr>
<tr>
<td>2007</td>
<td>Sold to <strong>First Realty Capital</strong> for $70,000,000. Several under-performing stores were replaced with a $21,000,000 small Home Depot store (Home improvement store selling building supplies) in an attempt to establish a new anchor store. (Edmonton Journal, 2007)</td>
</tr>
</tbody>
</table>

Initially, the centre was marketable, as it had variety amongst the 44 shops and services along with an outdoor sidewalk (Figure 3.2), including significant anchor shops and a thriving community presence. It’s location next to a high school; it appeared to be well placed for constant use.

Due to the 1980’s construction of the world’s largest covered retail project, The West Edmonton Mall, just a few minutes further west, by car, and the 1976 construction of the Kingsway Mall (Edmonton’s second largest mall) a few minutes further east by car, Westmount Centre is no longer a sought-after destination for those getting into their cars.

Since the 1990’s the centre’s popularity has been decreasing despite efforts by subsequent owner/developers to update and innovate. The supermarket at the south end of the mall (Figure 3.3) is always busy. However, the food court is mostly active during lunch hour due to the students from the neighbouring school.
Figure 3.3 Present layout of Westmount Centre. (Source: Shopping-Canada.com)
The rest of the time, small groups of area senior citizens, who may or may not make any food purchases, use the food court for an informal meeting area. During numerous visits to the shopping centre, most stores appeared to be lacking customers (Fig 3.4).

![Figure 3.4 Westmount Centre, on a Saturday afternoon – should be a busy time, but only the food court seems to have any business.](image)

The Westmount Centre bus terminal is served by seven bus routes, (which are part of the Edmonton Transit Service (ETS) and located directly in front of one of the major entrances. The Westmount Centre’s management seems to have made sure that this is most inconvenient by fencing the direct route and forcing pedestrians to navigate a parking lot to access the centre (Figure 3.5).

![Figure 3.5 The Edmonton Transit Service (ETS) bus terminal is across the street from the main entrance, yet blocked by a fence.](image)

This misdirection in part could have contributed to the present state that the mall has a neglected feel to it, many empty storefronts being overtaken by several medical and government offices. These symptoms point to the management’s need to drop leasing rates due to lack of retailers willing to move into this location, which is one of the indicators of an impending demise of a mall (Sobol, 2001).

In the massive parking lot, several businesses (a gas station, bank and several fast food restaurants/drive-throughs) have become small isolated outlets along the road. Even these can only be accessed
from the parking area and not from the sidewalk. Despite being located within a walkable
eighbourhood, the excessive width of Groat Road on the east side (Figure 2.3) and the fast-moving
traffic discourage much of the pedestrian traffic, as local residents are not being provided with a safe
and engaging environment through which to walk to the mall.

3.5.1 Existing conditions and North American attitudes

Many aspects of urban and suburban life are location dependent. What might seem commonplace
and taken for granted in Europe, might be uncommon and unacceptable in North America, and vice
versa.

1. Private vehicle vs. public transport

The increasing affordability of the car, inexpensive gasoline and ever-expanding road network means
that distances are easily traversed. Public transportation in North American suburbs is uncommon,
as the density is rarely high enough to sustainably support bus routes in a manner that would be
appealing to the suburbanites (Farr, 2008). A right of passage for a majority of North American
post-WWII teenagers was obtaining their learner’s driving permit shortly after turning sixteen, in
anticipation of increased mobility with their own automobiles. Shopping has also changed in the
suburbs to be more concentrated; formerly in covered shopping plaza’s or malls, or more recently;
endless parking lots with numerous big box stores, both of which are dependant on accessibility by
car, not by public transport and not by pedestrians.

2. Prevalent model of development

Another overwhelming consideration is the economic one. Due to the nature of North American
market forces, it is not enough to do the “right thing” (i.e. stop and mitigate polluting, mitigate
overpopulation, GHG emissions) for the planet and the inhabitants. North American businesses and
developers have been using the same business model for decades:

Developers purchase an inexpensive Greenfield site on the outskirts of the city.
The city provides infrastructure services to the location.
Developers design a subdivision with identical houses, sell them quickly and move onto the next
project - no concerns about infrastructure costs per unit, nor the provision and maintenance of
amenities.

In a highly competitive arena of real estate investment, especially in light of the economic turmoil
since 2008, most developers are only willing to turn away from a previously proven development
model if they are shown one with a better return on investment. Considerations such as
environmental and social sustainability had been deemed to be frivolous or indeed expensive extras
that the developer could not foresee recouping in the sale of the property. Their first concern is to
ensure that the development will be acceptable with financiers and desirable for those who would be
buying, renting or leasing (Dair, 2006). Additionally, as North America is a throwaway society,
where so much is designed for a short lifecycle, it has become acceptable to start fresh with increased
frequency, compared to neighbourhoods elsewhere in the world.

3. Attitudes towards sustainability

Of the impacts on the ecosystems by a variety of human activities; the most discussed are the
increasing levels of GHG’s (Greenhouse gases) in the atmosphere and potentially irreversible
damage globally at certain carbon dioxide level thresholds (United Nations Framework Convention
on Climate Change, 2013).
With the increased numbers of upper and middle-class families in the developing world influenced by the images of the developed world, they strive to emulate the material success of European and North American cultures, without having the legislative brakes of pollution controls (Hubacek, 2007). The Germans and Swedes, for example, have accepted that their previous lifestyles were not sustainable and had created systems that allow for the ongoing introduction of strategies for improved sustainability. At the other extreme are USA and Canada where the lifestyles are the least sustainable, and yet it is their populations who most believe that they can make a difference (National Geographic, 2012). Lack of significant constraints to land and subsidized energy use has led to a false sense of security that diminishes the need to pursue aggressive measures, not only to improve ecological and economic performance going forward but also mitigation to overcome the decades of damage inflicted on the environment.

4. Lobbying

Intense lobbying by special interest groups such as fossil fuel, the automotive industries and developers; the reluctance to change economic models that have previously been profitable, have led to the implementation of half measures and an unwillingness to accept additional changes. These actions do little to improve, and in many cases exacerbate the current environmental situation (Beder, 2014).

5. Alberta’s present energy mix

Given Alberta’s significant fossil fuel resources, it is not surprising that in 2015, Alberta’s power generations comes from the following sources (National Energy Board, 2016):

- 51% coal
- 39% natural gas
- 5% wind
- 3% biomass
- 2% hydro

6. Economic meltdown

It has taken an economic meltdown in the USA to directly or indirectly pushed the market to new realizations and business models. As this is the age of peak oil (Kerr, 2011) with increasingly apparent symptoms of escalating ecological vulnerability, there is an increasing awareness of human impact on the health of the planet.

Even so, many North American decision-makers find ways to postpone the remediation of previously built districts. Part of this strategy is the downloading of manufacturing and waste disposal to developing countries (which lack adequate facilities), which, in the long-term cannot afford to repair the resulting environmental damage. This approach gives the false impression that progress is being made in clean up of the local ecological messes of the past century (Goldenberg, 2014).

Return on Investment (ROI) however does not include the hidden costs of ecosystem services, which broadly include: air and climate, water cycling, soil and nutrient quality, waste treatment, biological systems (such as pollination, photosynthesis and food production). These are the services embedded in the natural world which humanity would find difficult to replicate (Chouinard et al, 2011). Ecosystem services are challenging to compartmentalize and very costly to replicate on a large scale; facts which are not taken into account by present business models (Swinton et al., 2007, Costanza et al, 1997).
7. Social implications

There is also greater recognition of the effects of sprawl on human health due to lack of exercise, lack of access to healthy food and polluting of the environment (Younger, 2008).

8. Status quo regarding building methods

Innovation in building sciences meant that exterior walls could get thinner as thickness was no longer structurally required, the amount of glazing on perimeter walls could increase. Progressively more sophisticated power and HVAC systems, requiring ever-greater amounts of energy to maintain optimal conditions are the consequences of abandoning aspects of traditional vernacular construction methods and materials from pre-HVAC days. Full height glazed curtain walls are constructed with an at best R-value of 4 (though often, significantly less) when better energy saving performance can be achieved with increased insulation of perimeter walls incorporating 35% (Berardi and Anaraki, 2016) to 40% glazing with negligible impact on interior lighting (Straube, 2008).

9. Dealing with waste

All large Canadian municipalities collect waste at the curb

- Paper, cardboard, glass, metals are separated and sent for recycling

  **In Edmonton, most beverage containers (both alcoholic and non-alcoholic) are charged a disposal fee when bought, to be refunded when the containers are returned to a few inconveniently located recycling depots.**

- Household organic waste is composted and used for soil improvement

Construction and industrial waste is also sorted to various degrees for recycling

- The diversion methods listed above had reduced landfill by 50%. The City of Edmonton now has a facility that will convert non-recyclable and non-compostable waste to clean fuels and bio-chemicals. Although there have been setbacks, the intent is for 90% of Edmonton’s waste to be diverted from landfill. (City of Edmonton, 2014a).

10. Green misconceptions

There is also the belief that green strategies are more expensive than presently accepted technologies, both for the long and short-term. The challenge is that countries with similar physical environments to Canada take advantage of many technologies and strategies that decrease the ecological footprint of city-dwellers; while in Canada there are impediments to widespread acceptance and implementation of both technologies and strategies. Opportunities to introduce sustainable techniques and approaches to the existing urban structures in North America have often been rejected due to lobbying, political expediency or perceived notion that the initial cost of implementation cannot be recovered in an acceptable period, as well as insufficient legislative pressure to implement/comply with stricter codes. Energy prices have been artificially low through various subsidies, with Alberta receiving approximately $1 Billion CDN on average 2004-2009 (Sawyer, 2010). Many technologies that are commonplace in other parts of the world are met with prejudice and scepticism. Unsurprisingly, the outcome is a high resistance to change.

A study conducted in 2014 concluded that Combined Heat and Power (CHP) with Ground Source Heat Pump (GSHP) provided optimal savings in energy use, utility costs and GHG reduction when tested against other systems in a mid-rise apartment in Calgary, an Alberta city, having a climate similar to that of Edmonton (Kegel, 2014). Rising energy costs will only make this system more attractive.
In a study comparing neighbourhood sustainability frameworks (or assessment tools), Sullivan (2014), found that significant barrier to government implementation of sustainability initiative was found to be the lack of staff training. Politicians, planners and other key stakeholders are also lacking crucial information and incentives for driving sustainable practices. Perceived higher cost was a result of some projects picking inappropriate technology or incorrect size, the cost/benefit analysis had not been completed, nor proper sequencing considered (The Global Commission on Climate and Economy, 2015), (Ziem, 2015).

Existing site conditions and infrastructure might not be suitable for the implementation of the latest technology. A study of introducing green roofs to the Central Business District in Melbourne, Australia showed that only 3.1% of the 526 buildings examined had conditions that could be suitable for green roofs. Additionally, the actual percentage might be even lower, as structural suitability had not been calculated for these structures (Wilkinson, 2009).

Advances in manufacturing and transportation have been made and economies have been built at the expense of the planet. North Americans contemplate that for the first time in history, the life expectancy of future generations is predicted to be lower than those now living (Mariani et al., 2010). To counter this trend, every generation from now on will need to actively identify and implement ways to leave this planet in better shape than they found it.

It is crucial to examine many background aspects of Westmount Centre when considering incorporating changes; not only the physical-environmental elements of the site but also the historical-cultural and economic characteristics of the surrounding neighbourhoods and the needs of the residents and other stakeholders. Placing changes in context ensures that the resulting development meshes well with the realities of the existing neighbourhood for long-term success.
4.0 THEORY AND LITERATURE REVIEW

Building a vision for a positive outcome is based on a theoretical foundation. Some ideas formed the basis for an action, while others were being used to evaluate the appropriateness of these proposed measures.

4.1 Sustainability - Definition

Sustainability has been defined as the confluence of equally important spheres of economic, social/community and environmental forms of sustainability. (Figure 4.1),

However mainstream financial forces conspire to make economic sustainability the central driver, forcing social and environmental aspects of sustainability to the periphery (Figure 4.2). Social and Environmental forms of sustainability are seen as tangential, with the aims mostly separate from those of the economic sustainability.

The bulls-eye suggests that a strong economy is entirely a subset of a strong society, which in turn is entirely constrained by Earth’s ecosystems (Figure 4.3). This thesis built a case with similar emphasis.
4.2 Sustainable Development

The classic Brundtland definition from 1987 is “Sustainable development is that which meets the needs of the present without compromising the ability of future generations to meet their own needs”. (Brundtland, 1987, The Global Commission on Climate and Economy, 2015). This far-reaching iconic document has been distilled to this one sentence, which does not convey the urgency for action, nor alludes to the consequences of inaction in addressing the human activities that contribute to the deterioration of the planet’s ecosystems.

The UN has adopted UNESCO’s (2015) ambitious 17 overlapping sustainable development goals, which concentrate more on the social and environmental concerns, rather than economic goals (Figure 4.4).
As any human activity is bound to influence a given ecosystem; how and who decides where the line is drawn between the needs of today and the future and the extent to which specific actions are acceptable (Desjardins, 2016), are valid and critical ethical questions. This balance varies between projects, depending on the willingness of the major stakeholders to holistically mitigate destructive actions of previous generations.

For this thesis, the assumption was that the Westmount Centre site stakeholders were willing to invest in proven sustainable strategies, knowing that this was a long-term investment, with returns evident in the mid and long-term.

### 4.3 Future Studies Theory

There are different approaches to plan for the future; reactively one can hope that a solution will present itself when difficult circumstances arise. Alternatively one can take action, assuming that successful implementation will guide you towards an outcome that is an improvement on the present situation. Lastly, one can set a target and then implement the necessary action to achieve the required results.

This thesis is an exploration of possible futures by examining potential scenarios and their outcomes. “Futures” denotes that there are different possible outcomes given the actions (or inactions) that society can undertake. There are several ways of approaching these studies; according to Börjeson et al. (2006), these are the three future scenario types:

1. **Predictive Scenario (up to 5 years into the future) “What would happen?”**

   The benchmark could be the “Business as usual”, predictive scenario, which would follow the development of an existing set of strategies to their natural conclusion. The timeline for this is the shortest, about five years; as without intervention unanticipated outside forces reduce the predictability of the results.

2. **Explorative Scenario (5-10 years into the future) “What could happen?”**

   The next option would be to explore a variety of options and extrapolate an outcome for a set of strategies were to be implemented. This scenario is an illustration of action without vision - hoping that an action taken will over the long term produce positive results. External forces for change can be anticipated for the short term. Therefore there is a slightly greater opportunity for certainty and the outlook is more certain for 5-10 years.

3. **Normative Scenario (15-20 years into the future) “What are the goals that need to be achieved, and what strategies need to be implement to attain these goals?”**

   Setting targets or goals for the future, then “back-casting”, or working back from these targets to determine strategies and stakeholders required to achieve these goals within a specific time frame would define the Normative scenario. The Normative scenario is one where the question is “how can we realise a specific goal (qualitative or quantitative)?” The goals can be simple (how to increase the efficiency of a manufacturing plant by 50% over ten years), or more wide-ranging societal aims - decreased material consumption and increased education level of citizens over 20 years. It is difficult to predict past this timeline as world events, natural disasters, technology and innovation have an impact that is difficult to anticipate; for example, consider where GPS, cell phones and the Internet were 25 years ago.
The act of looking ahead, involving the stakeholders at strategic periods in the process, as well as anticipating and mitigating potential risks, would suggest the certainty that these actions have a better chance of achieving suitable goals over the course of 15-20 years.

For this thesis, numerical analysis of the predicted results was not completed, however, highlighting successful strategies as examples, shows that synergistically their impact on sustainability would be significant.

### 4.4 Situation of Opportunity

The Situation of Opportunity is a theoretical concept (Svane, 2009), which proposes that the timing of introducing significant changes to an urban environment would be ideal when resistance to change is low. By considering innovative ideas for this proposed project near the beginning of the process, the introduction of strategies for increasing sustainability might be less controversial when Edmonton is looking for recommendations for changes to their regulations to encourage or enforce densification in the Westmount Centre area.

### 4.5 2030 District / Architecture 2030

“Through the unique public/private partnerships, property owners and managers are coming together with local governments, businesses, and community stakeholders to provide a business model for urban sustainability through collaboration, leveraged financing, and shared resources. Jointly, they are developing and implementing creative strategies, best practices, and verification methods for measuring progress towards a common goal.” (2030 District, 2012)

This is a global concept based on the earlier “Architecture 2030”, developed by architect Edward Mazria, which proposed that by 2030 all new architecture be energy neutral and that existing buildings be retrofitted to use no more than 50% of the energy that they presently consume. 2030 Districts are a grass-roots organizations that are committed to measurable decreases in energy, water and vehicle usage, committed to net zero emissions in new developments and halving present emissions for retrofitting existing districts. 2030 Districts are becoming established in several North American cities. This thesis supports the case for the establishment of an Edmonton 2030 District at Westmount Centre, to be emulated elsewhere.

### 4.6 LEED – ND (Leadership in Energy and Environmental Design – Neighbourhood Development)

LEED is the most recognised North American assessment tool, due to involvement by the CNU, The Sierra Club and the United States Green Building Council (USGBC) in developing the evaluation criteria. The Canadian Green Building Council (CaGBC), administers this program in Canada. It is a points-based system (Table 4.1), which determines a level of compliance. The stated aims of this rating system is to effect change in the built environment to:

- Mitigate the effects of climate change
- Improve human health and well-being
- Safeguard and re-establish water resources
- Promote and protect biodiversity as well as ecosystem services
- Establish and grow a greener economy
- Improve social equality, environmental justice, health and quality of life on the neighbourhood level.
A past criticism of LEED has been that it has a low threshold for compliance, that equivalent points have inconsistent levels of initial effort vs. long-term impact. The tendency has been to pick what is least inconvenient to do to maximize points earned, often in isolation from other points, which may not result in as a significant holistic reduction in energy as the awarded points might indicate. However, this approach has introduced energy and environmental awareness to the conscientious consumer. Therefore LEED’s merits should not be overlooked (Chithra, Anildumar, 2013), as successive versions have been increasingly stringent. The three generated Westmount scenarios were evaluated with the LEED-ND version 4; Table 4.1 shows the criteria, rating and the accreditation levels.

Table 4.1 LEED-ND Project checklist (Source; USGBC, 2012)

4.7 Stakeholder “What? Who? When?”

It is optimistic to consider that the presence of suitable solutions is adequate to ensure a strategy is implemented. For each approach, it is necessary to examine the role that the stakeholders, i.e. the people or agencies that are influenced or have the power to impact the direction of progress in a specific area. For any given innovation, it is essential that all key stakeholders be identified early in the process, so that they can cooperatively develop a strategy for successful implementation, suitable for the specific area in the time, environmental, social and fiscal context. The intent of this paper
was not to devise the mechanism by which the stakeholders interact; instead, it will be left to the stakeholders to let the unique mix of multi-disciplinary practitioners and context determine the best route to take to optimize the opportunities.

Dair et al. (2006) in their analysis of successful implementation of sustainable projects in England, noted several criteria were important;

The influence of stakeholders is tied to their participation in the project development process. Stakeholders should be involved at the appropriate time in the process, so that their input could be considered and holistically introduced. Unfortunately, excluding various design groups might limit their potential to optimize their impact in achieving sustainability goals. Likewise, excluding experienced contractors in the consulting process could diminish the ways that their insight could be applied to detailing the forthcoming project.

The absence of commitment and power to enforce sustainability goals can be the most significant deterrent to the attaining of sustainability goals. The more stakeholders bought into the sustainability goals of the project, the higher the potential for success. Inspectors were receptive to innovation, however they noted that meeting minimum requirements was a challenge for many projects, so greater engagement by stakeholders meant better results.

The attitude towards previously unknown strategies and technologies by those that would be responsible for these aspects of the project was proportional to their willingness to explore new materials and technologies and take on the responsibility for their implementation and operational success.

Defining what constitutes success of a project should be determined ahead of time so that the result can be evaluated. Most looked at the economic and social data for sustainability.

The level of knowledge of and commitment of the stakeholders was the most crucial in achieving an environmentally successful project, as well as the timing of their involvement.

However, if stakeholders with the most influence, specifically owners, developers, politicians and investors had little interest in sustainability goals of a project, then the impact of professional advisors and local interest groups, was limited and their advice unlikely to be followed.

Canadian informal governance structures or community-based activism / Community-based planning is becoming a method for the end-users, the neighbourhood to get involved in decision-making as it pertains to planning for a given area. It is a way to build and maintain social capital, defined as the social relations amongst individuals, societal norms and trust that is developed over time, which eases coordination, cooperation symbiotically (Stockholm Resilience Centre, 2014).

No two situations are similar, so instigators of the process should be evaluating whom to invite and when to incorporate their participation / feedback in the process.

The parameters of the planning exercise – block / neighbourhood / district?

The best method for getting necessary information from the various stakeholder groups and who will do the analysis and what are the targets?

How best to ensure political support and developer engagement in pursuing sustainability targets?

How to determine if timing and the target milestones have been achieved?

### 4.8 Business Improvement Area (BIA’s)

In the early 1970s retail establishments in Toronto’’s west end joined forces to make their retail area more attractive and to promote it outside their neighbourhood. Since then many popular retail districts in Canada have formed community associations, which have both economic and political
power (TABIA, 2014). In Edmonton, these are known as Business Revitalization Zones (BRZ’s) (City of Edmonton Planning, 2010B).

The future establishment of a Westmount neighbourhood BRZ would be central to coordinating neighbourhood organizations as indispensable shareholders in the promotion and implementation of a local sustainability initiative.

### 4.9 Governance – Federal, Provincial, Municipal and NGOs

The Canadian federal government provides direction for urban development through various departments and agencies such as:

- Natural Resources Canada (NRCan)
- Canadian Mortgage and Housing Commission (CMHC)
- National Research Council (NRC)
- Federation of Canadian Municipalities (FCM).

Although municipalities are autonomous, their by-laws are dependent on provincial legislation. The Province of Alberta provides policy, guidance and coordination to municipalities through:

- The Municipal Government Act (Province of Alberta, 2017)
- The Capital Region Board Growth Plan
- Growing Forward
- The Public Lands Act
- The Water Act
- The Wetland Management in the Settled areas of Alberta
- Wetland policy

It is the municipal structure that provides the most control of local developments through a coordinated set of:

- City of Edmonton Policies,
- Designing New Neighbourhoods
- Complete Streets
- Environmental
- Natural areas Systems
- Public Involvement
- Urban Traffic Noise
- City of Edmonton Guidelines (City of Edmonton, 2014b)
- Complete Streets Guidelines
- Design guide for a safer City
- Designing new Neighbourhoods; Guidelines for Edmonton’s future Residential Communities
• Transit Oriented Development (TOD) Guidelines
• Fresh; Edmonton’s Food and Urban Agriculture Strategy
• Arterial Roadway Assessment
• City Design and Construction Standards and procedures

The iterative development of the Westmount Centre site would simultaneously incorporate the progressive directions of the legislation and challenge existing accepted zoning and societal NIMBY-ism (Not In My Back-Yard). The necessity of an evolving and engaged political support system is crucial to the implementation of strategies that are new to the locale.

4.10 Return on Investment (ROI)

The perception of low Return on Investment (ROI) is the single most common reason given for postponing the implementation of green practices and construction methods. Also, financial institutions are reluctant to consider loans for unfamiliar technology. The strategies that follow have been proven successful financially elsewhere, but this thesis did not determine cost implications of implementation.

4.11 Literature review

Numerous books and articles have been written about upgrading of the retail district.

• Retrofitting Suburbia (Dunham-Jones & Williamson, 2009) shows the success stories in the US with some Canadian examples of re-imagining the suburbs and suburban shopping centres as mixed-use communities. There are some examples of alternative energies, but not as the focus
• Sustainable Urbanism (Farr, 2008), makes the early case for LEED-ND.
• Designing Suburban Futures (Williamson, 2013), provides insight into proposed suburban futures, with emphasis on design and place-making.
• “Remediating shopping centres for sustainability” (Mate, 2012), tackles the topic looking at shopping centres as “temples of mass consumption”, relative to the impact that rampant consumerism and shopping as entertainment has on the health of the planet.

There has been much work done on theoretical as well as practical approaches to retrofitting existing districts for sustainability as isolated strategies. In North America there is a need to coordinate proven strategies to symbiotically accelerate the environmental mitigation of underutilized urban districts to ultimately address all aspects of sustainable development.
5.0 RESEARCH STRATEGY AND METHODOLOGY

This thesis is presented as a case study, a research methodology, which is characterised by:

The study of a subject within a real-life context, by studying Westmount Centre as part of the existing neighbourhood and in contrast to communities with similar characteristics.

Explanation of causal links – examined historical information and looked for common threads to the success or failure of similar North American projects.

Developing a theory, during research, regarding the feasibility of introducing sustainability measures as part of a future redevelopment.

Used multiple sources of information, which supported the thesis through triangulating, in this case;

a. Proposed a solution through examination and evaluation of various future scenarios.

b. Demonstrated how specific aspects of this solution were successfully implemented strategies elsewhere.

c. Showed how this approach would be complementary to the goals of this project.

The resulting strategy is meant to be replicable in other retail districts facing comparable challenges, (Wang, 2002) uses Westmount Centre as the case study to prove the validity of the strategy.

The thesis used examples of both successful and unsuccessful models to guide parameters to be included in the strategy to retrofit Westmount Centre into a sustainable, fiscally successful, mixed-use district. This approach was combined with a starting point of a block plan to suggest that this solution was based on a realistic design paradigm.

Meetings with city officials and visits to the study site for observation generated suggestions for creating a path towards the goal of energy self-sufficiency, mitigation of existing and potential site disruptions. Possible strategies were proposed, keeping in mind that they should have been advantageously implemented elsewhere. As far too many approaches are considered in isolation, it has been proven that impactful developments use the synergy of linked strategies to obtain results that can optimise results and mitigate existing and potential environmental negatives. Figure 5.1 illustrates the flow-chart detailing the methodology.
The potential scenarios for Westmount Centre will be based on benchmarks developed by Hass and Troglio (2011) and visually illustrated with spider charts. Table 5.1 shows the criteria and ratings, which were the basis for the spider chart.

The Predictive scenario was briefly analysed: “What will happen? What is the future of a shopping mall where the expected trajectory is maintained?” This scenario was taken to be the baseline for comparison of the other two scenarios.
More time was spent examining the potential success of the Explorative scenario, where some key aspects are changed, with the intention of improving the current situation. This scenario is where variables are defined. However, the actual goal is less defined. Who are the stakeholders who would be involved in this strategy? Existing solutions typically address just a few areas, are not comprehensive, and neglect to explore the range of possibilities, even in the present day.

A Normative Scenario was developed considering successful previous projects and the stakeholders that will need to be brought into the project strategically; design, planning and implementation. The concepts suggested should be further developed iteratively through feedback from city officials at different departments transportation. How can an established target be met - the future of the shopping mall where specific measures can be established regarding environmental, social and economic parameters? Who are the stakeholders who would be required to participate in the establishment of the future vision and at what stages would they be most active? What types of enticements and deterrents would need to be implemented to achieve the optimal results? The Normative scenario was developed further, with the goal being the strategy to attain 2030 District (2030 District, 2012) designation, as well as establishing sound social and economic practices to provide for ongoing and expanding sustainable practices. The proposed strategy would consist of measures that have been proven elsewhere or an extrapolation of existing practices.

The strategies were determined by proposing solutions that respond to the list of requirements as per the Spider chart introduced by Haas (2011). Each approach had a success story, corresponding to the appropriate district as per the Urban transect. This correlation was to show that the solution had been successfully implemented elsewhere. Stakeholders were identified, as well as their involvement in the iterative process.

The Sustainable Development Technology Canada report (SDTC, 2007) recommends that the approach to increase the implementation of sustainable strategies should be two-fold: technical (policy) and non-technical (standards).

The thesis will not examine policy, which would typically consider: carbon pricing, supply chain, financing, codes, commissioning, and development of international best practices and integration of sustainability into all relevant areas of study.

The technical aspects of sustainable development are:

- **Integrated Building design**: a holistic approach to design systems that reduce resource consumption (construction and operational) at various scales, from districts to individual structures.
- **Improvements to the thermal qualities of the building and optimize natural lighting opportunities**.
- **Operations and Maintenance procedures and tools** – informed and pro-active building operators and end-users are crucial to the maintenance of optimal operation of building systems.
- **Improvements to efficiency of equipment and systems** – introduction of energy efficient equipment and monitoring
- **Optimizing of all assets** – taking advantage of onsite resources such as rainwater capture, treatment and storage; solid waste separation and conversion, geothermal and district heating, the reuse, re-purpose, recovery, renewal and recycling of existing materials and optimising the use of local resources.

To optimize the opportunities inherent in the site, within each category, the priority given to strategies were:

- **Basic Building Design** – to anticipate and take advantage of the site characteristics to the highest degree possible, means that there will be less need for mitigation later on in the process. This design formed the foundation for next stages.
• Passive systems – this took advantage of the inherent properties of the native and building materials, microclimates and other external factors particular to the site.
• Mechanical systems – make up that which cannot be accomplished through sustainable design principles and passive systems, for human comfort.

This strategy advocated by those in the sustainable building industry looks to make the most of the available resources. (Lechner, 2009)

A block plan was prepared that physically demonstrated the proposed changes to be implemented. This plan was only a starting point for future discussions regarding design, as it was essential to the study of both environmental and social forms of sustainability of not only the site, but also the neighbourhood.

There was a discussion how the proposed design and strategies would contribute to the goals of the 2030 District.

An assessment was required to determine if this project could meet performance specifications that provide a standard set of measurable criteria for evaluation. These can be very specific, such as a Walk Score (Speck, 2012, Walk Score, 2017), which uses a logarithm to assess the number of available amenities, from a standardized list, which is then correlated to the walking distance from a given location. The most dimensional tools are the Total Quality Assessment Tools, which attempt to quantify various interrelated criteria to typically obtain a single number or descriptor that demonstrates the standard of performance of a project relative to the series of predetermined benchmarking levels (Berardi, 2011).

Lastly, the proposed project was evaluated by the accepted evaluation system of LEED-ND version 4, which represented the present best practices in North America and the need to surpass the targets of existing codes and policies. This method has, over time, become increasingly stringent, such that strategies can be better assessed as to their ability to meet standards and mitigate past environmental degradations.

By adhering to this methodology, this thesis shows that existing technologies are already able to make a significant difference in addressing urban sustainability when considering upgrades to existing suburban retail centres.
6.0 RESULTS

The evaluation of the current state of Westmount Centre (Figure 6.1) points out the areas that need to be addressed to make a significant impact on the local environmental footprint, as well as for the economic and social well being of the surrounding neighbourhood.

The purpose of the analysis of upgrading the suburban retail model for sustainably is to lay a foundation and guide other Canadian towns and cities that are considering similar retrofits accounting for efficient and effective use of:

- Materials
- Energy
- Water
- Transportation

This thesis was undertaken with the understanding that the land is privately owned and that the landowners will be looking for economic justification for including green infrastructure in their
projects. In a small study of strategies that successfully engaged stakeholders to complete a sustainable brown-field project, the favourable result was due to the educated attitudes of the local authorities and developer (Dair, 2006).

6.1 Predictive Scenario; “What will happen?”

Consider the potential future of a shopping area, when the strategies are purely reactive, without a cohesive direction, only reacting to external forces.

Toronto’s Honeydale mall is close to two other larger, more profitable malls. The previous owners did not keep the mall aesthetically current; the quality and quantity of retailers decreased and the profitability of the mall has suffered to the point that it has permanently closed down and is now considered a ghost mall (Wikipedia, 2017).

In the future, not considering available interventions at Westmount Centre will lead to a deterioration of the tenant quantities and quality. Specifically, the tenants with unacceptable financial returns will either abandon the location, or let their lease run out and vacate the premises. Increasing numbers of vacant shops will prevent new tenants from moving in, even with lowered rents. The cost of operating and maintaining will no longer make long-term economic sense. Unsustainable short-term solutions to date have shown little success for the bottom line. Cost cutting measures will be attempted, such as decreasing the frequency and quality of routine maintenance. At some point the real estate holding company will be bankrupted due to lack of rental income, as the supermarket might be the lone profitable business. The present average Walkscore in the neighbourhood is about 68, which would decrease with declining number of Westmount centre tenants, increasing the local residents’ need of a car. It might be years before the price of the property drops significantly for a new owner to come along and demolish the existing buildings, as lack of maintenance would have probably deemed them unsafe for use. Meanwhile, loss of jobs and lack of a sustainable tax base and potential drop in local residential real estate values would have economic implications, as well as social ones, as the local seniors would no longer have a gathering point. Appendix 4 shows the calculations for the predictive scenario spider chart for Westmount Centre. The LEED-ND evaluation (Appendix 5) shows a score of 10 out of a potential 110. This scenario should not be considered a viable option as it will negatively impact all aspects of local sustainability.

6.2 Explorative Scenario; “What could happen?”

A number of North American malls are now being re-imagined as mixed-use centres. This has revitalized a number of under-performing locations, providing a centre for the community that did not previously exist.

A study of such retrofits has been examined by New Urbanists such as Ellen Dunham Jones and June Williamson in their book Retrofitting Suburbia (2009). There are a few malls that have achieved success by not only introducing mixed use into the suburban landscape, but have also by implementing some sustainability measures.

The Belmar Shopping Mall in Lakewood, Colorado, USA was partially demolished, the site reconfigured for a mixed-use town centre. While the social and economic fortunes of the area improved significantly, other than the installation of a photovoltaic array on top of a newly constructed 6 storey parking garage (Figure 6.2), no other environmental innovations have been implemented.

Like Westmount Shopping Centre, the Don Mills Centre in Toronto, Canada seemed to have a similar trajectory. It was originally conceived as an 18-hectare (44 acre) open strip plaza in the centre of a planned community in the 1950’s. After a slow decline, in 2009 it was re-imagined as
“The Shops at Don Mills”, an upscale retail destination; a series of internal streets, with street and multi-level parking, as well as a central public space. Only a few shops remain from the previously enclosed mall. There are significant high-rise residential towers being built at the perimeter, part of an ongoing redevelopment process, replacing the hectares of parking.

Despite acclaim from the design community, citing street connectivity, public spaces and connections to Toronto’s transit network, “high quality sustainable commercial and retail service”, (OALA, 2011) there is still a disconnect with the surrounding neighbourhood, with a significant part of the parcel remaining a sizable surface parking lot, which separates the neighbourhood from the centre and still encouraging car use for the local residents.

Although the design of the redevelopment rated higher than the original (Duong, 2012), the new shops were more aimed at the upscale market and did not mesh with the income levels of the surrounding neighbourhoods. While this was a better solution compared to the previous condition, it appears that many opportunities for improved environmental and social sustainability were not realized

Likewise, the Westmount Centre site is an opportunity to introduce mixed-use development in to the neighbourhood.

This could be accomplished through the building of multi-storied office and residential towers adjacent to the existing mall (Figure 6.3). The existing building would remain, as the new development would be ongoing; cosmetic upgrades would be done to attract new customers in a retrofitted community, and mechanical upgrades would be done as part of the operational improvements. The new construction would follow existing codes and specifications for efficient construction, electrical and mechanical systems. This would be possible to implement in 6 years.

Although this could be an economic improvement over the existing situation, there would be missed opportunities.

- The towers not improve the view from the neighbouring communities to the north and east of the development, potentially decreasing property values, thereby alienating the stakeholders that would be impacted by this (Figure 6.4).
- The separation of residences from the commercial may mean lost opportunities for thermal and power loading over the course of the day
• Without onsite remediation of storm water and wastewater, the existing municipal infrastructure capacity will need to increase.

Appendix 6 shows how the strategies for the Explorative scenario spider chart for Westmount Centre were assessed. Appendix 7 shows that these strategies barely met LEED-ND Certification, netting 42 out of a potential 110 points. This solution will also not be given further consideration, as it does not forward a solution that significantly mitigates the existing environmental degradation, nor significantly improves social and economic forms of sustainability.
6.3 Normative Scenario; “How do we achieve specific target or goals within 20 years?”

The Normative goal was to achieve LEED-ND platinum level – and include all aspects of sustainability features that are feasible, given the existing site conditions. A scenario where owners, residents, municipal officials, businesses and other stakeholders agree that an upgrade to Westmount Centre is required for the health and well-being of the end-users, it is more likely that these stakeholders will be open to the idea (Svane, 2006) of increasing the sustainability of the area through these proposed strategies (Hass, 2011), especially if a case can be made for long-term profitability. Generation of the strategies, summarized in Appendix 8, include:

- Compact mixed-use district design (environmental/ social/ economic sustainability)
- Siting for optimization of solar and wind power (environmental / economic sustainability)
- Multi-modal access to the site, includes inhabitant behaviour (social / environmental / economic sustainability)
- Proximity to green and water structures (social/environmental sustainability)
- Technology and building material (environmental / economic sustainability)

This could be accomplished through Form-based code planning (Farr, 2008), where the built form can accommodate a variety of functions. In this phased approach, the existing tenants would be moved into newly built premises. The existing mall would be emptied and updated for better electrical and mechanical systems, improved thermal performance and optimal power and water efficiencies – to meet the criteria of 2030 District. It would be evaluated and structurally upgraded to accommodate a rooftop Urban Agriculture facility. An ongoing study of facility requirements in a changing world would dictate the final use of this retrofitted building.

Appendix 9 summarizes the Stakeholder groups and their involvement in the various strategies, as well as the sustainability goals accomplished through these strategies. Appendix 10 shows how the level of stakeholder involvement varies through the life of the project.

It has been found that the more the efforts are spread out between these strategies, rather than concentrate on one or two of them, the better the end result in reducing then environmental footprint in the area. This study also evaluated the morphology of buildings and determined that fewer exposed surfaces reduces building heating and cooling (Troglio, 2012).

Strategies should be layered, with ones that have been proven effective in other parts of the world with similar climatic conditions, such as northern Europe. The characteristics of vernacular architecture (sometimes known as “architecture without architects”) should be examined for opportunities for emulation, as these are the strategies, which allowed the historical inhabitants to survive in these climates, followed by low-tech, passive strategies, such as optimizing use of glazing, insulation and use of local materials.

Finally, supplement that which cannot be otherwise produced locally with higher-tech or imported solutions, such as local power generation, solar, wind, foot-power, photo-voltaics (PV) and power generated off-site.

An existing building is a sustainable building - the energy to replace existing structures can often be difficult to justify from a life-cycle point of view. New York City generates 7 million tons (6.35 metric tonnes) of construction waste every year. Build it Green! NYC (BIGNYC) collects and offers reclaimed construction materials for re-use. (Noe, 2012). This is what could be done with the construction waste from the reconfiguration of the original shopping mall. Attention should be brought to this aspect of reuse. This would save on the use of virgin materials and potentially create a unique statement in the creativity of the end product.
6.3.1 Compact design / mixed use

In order that the strategies for increased sustainability for the Westmount Centre be deemed realistic, a basic design has been developed (Figure 6.5) to illustrate these concepts. The proposed strategy would be to introduce the new construction in phases and evaluate after each phase to fine-tune the balance of the project. After the new additions were proven successful, changes to the main existing structure would be implemented.

Figure 6.5 Normative scenario Phase 2; theoretical proposed site plan for the Westmount Centre.

The existing freestanding structures on the east side of the site would be removed and the substrate remediated as required, to make way for the proposed expansion.
The proposed site highlights strategies to optimize Environmental, Social and Economic sustainability opportunities according to the following categories developed by Haas (2011).

### 6.3.1.1 High density of residential / workplaces

This is the intensification of the site and introduction of new land use. As per the detail drawing Figure 6.6

- 2-3-storey townhouses with roof-top gardens and minimal front yards would line the perimeter of the new construction, to mirror the residential nature of the bungalows on the east side of this major artery. This has proven successful in the Boca Raton Community redevelopment, where townhouses face residential areas across the street, as they back onto parking garages (Dunham-Jones, 2009).
- There would be ground level retail, which would back onto a parking garage, with ground level access, which would be adequate to accommodate delivery truck heights.
The multi-level parking would be temporally shared between the retail, office staff and residential units over the course of the day.

2 levels of office / commercial use would be above the retail / parking garage levels, which would sustain the retail and restaurant businesses on site.

Two or three additional levels of residential would top the stepped back building, to minimize the visual change in density at the street level and allow light internally. Figure 6.7 shows a downtown Stockholm shopping centre / high-density example.

6.3.1.2 Brownfield re-use

Much of the existing asphalt would be torn up for the new construction, and the parking relocated to the parking garages. The substrate surrounding the existing gasoline station would need to be treated to ensure that it meets the provincial standards for remediation (City of Edmonton, 2010). The replacement for the asphalt would be a permeable pavement, suitable for northern climates which would allow for greater storm-water infiltration, decreasing peak flows during high precipitation events (Drake et al., 2012).

There would be street level shopping along the new internal roadways, extending 18.2 m. (60 ft.), a typical store depth. There would be entrances to the offices and residences above from the street level.

Commercial

The office space would take 2 floors above the ground floor retail, providing experimental work-hubs for private and public employers. The office space would also be stepped back to allow for sunlight to reach street level. These terraces would allow for green roofs for insulation, microclimate reduction of heat island effect and water retention for high precipitation events, so as not to overwhelm city storm-water systems. This is a system that was successfully implemented in Augustenberg, Sweden, as shown in Figure 6.8.
Urban agriculture

The large flat roof of the mall would be structurally enforced to support an insulated greenhouse. The southwest corner of the property would be the site of an urban agriculture facility, which would be convenient to the school next door. This would combine a commercial venture with teaching opportunities, for students and entrepreneurs, highlighting strategies for year-round city farming. The growing season would be extended due to collected heat supplying the nursery (Sprecht et al., 2014) from the retail area to provide optimal growing temperatures. This would be similar to the technology used to shift generated heat from Stockholm’s train station to a neighbouring building (Eurocities, 2014, Casey, 2011). There are already several businesses that grow selected produce in Edmonton warehouses (Reclaim, 2017).

Institutional

In the northeast corner of the site there would be provisions for children’s daycare, low income and retirement housing, on-site social services, close to the existing retirement home. This allows for aging in a familiar community (Katz, 1994), as well as the benefits of seniors, students and children interacting (MacRae-Krisa, 2013).

6.3.1.3 Public Spaces

A public square stretching from Groat Road to the existing shopping centre would provide opportunities for outdoor community events; outdoor markets, displays or open-air concerts; providing much needed local venues for social interactions. The retrofitted mall would be able to accommodate other indoor public venues such as galleries, as is presently done in Belmar, Colorado (Greco, 2009).

6.3.1.4 Other Strategies and Benefits

In summary, in many municipalities, the intensification of available land and infrastructure is already being promoted for many reasons:

More units per hectare, decreases the unit cost of infrastructure services. (Farr, 2008).

Having compact design with a variety of housing types in the neighbourhood, will allow for aging in place. Young couples could rent a starter apartment, then buy a small townhouse then larger home followed by smaller condo unit for the empty-nester, followed by nursing or group home (Duany et al, 2000).
Compact development also results in energy savings through shared walls, floors / ceilings - less heat being radiated into the atmosphere.

Provision of low-income housing is to blend in with market priced housing, as is done in Poundbury, UK (ULI, 2001).

### 6.3.2 Solar gain and wind design

The majority of the new buildings in this scenario line up such that the long axis is parallel to the east-west direction to optimize the use of sun for passive heating and lighting opportunities, as well as for optimal photovoltaic cell installation. The power generated would decrease the use of non-renewable energy sources. Until large-scale energy storage becomes economically viable, use of conventional power sources would ensure that local core services would be powered in times of larger-scale weather uncertainties.

The new construction itself would rely on passive strategies, by designing for thermal mass and improving building envelope performance. Technology would be used to top-up the requirements, rather than be the leading strategy. The existing mall retrofit would increase the thermal insulating properties, as well as efficiencies in energy and water usage, incorporating low-flow fixtures and grey water usage for irrigation. Appendix 11 summarizes the proposed energy and material cycles at Westmount Centre. Commercial buildings built to take advantage of passive solar strategies used 10-35% of the heat required in conventional construction (GPP, 2012)

#### 6.3.2.1 Passive solar design

The use of solar should be exploited, as Edmonton has a high annual photo-voltatic potential compared to other Canadian location (Figure 6.9) and other world cities, as seen in Table 6.1, surprisingly similar to that of Rio De Janeiro.

![Figure 6.9 Edmonton’s photovoltaic potential is one of the highest among Canadian Cities (Source NRCAN, 2015)](image-url)
Power generated this way would be sold to the retail businesses.

<table>
<thead>
<tr>
<th>Major Canadian Cities</th>
<th>Yearly PV potential (kWh/kW)</th>
<th>Major cities worldwide</th>
<th>Yearly PV potential (kWh/kW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regina, SK</td>
<td>1361</td>
<td>Cairo Egypt</td>
<td>1635</td>
</tr>
<tr>
<td>Calgary, AB</td>
<td>1292</td>
<td>Capetown, SA</td>
<td>1538</td>
</tr>
<tr>
<td>Winnipeg, MB</td>
<td>1277</td>
<td>New Delhi, India</td>
<td>1532</td>
</tr>
<tr>
<td>Edmonton, AB</td>
<td><strong>1245</strong></td>
<td>Los Angeles, USA</td>
<td>1485</td>
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<tr>
<td>Ottawa, ON</td>
<td>1298</td>
<td>Mexico City, Mexico</td>
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<td>Montreal, PQ</td>
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<tr>
<td>Fredericton, NB</td>
<td>1145</td>
<td>Rio de Janeiro, Brazil</td>
<td><strong>1253</strong></td>
</tr>
</tbody>
</table>

### 6.3.2.2 Use of solar energy (active / passive)

The stepping back of the levels of commercial and residential floors would allow natural light access into buildings and site. This would be optimized to the extent possible as shown in Figures 6.10a-c, by the use of light shelves, which enable significant penetration of natural light into a building, with an added bonus of reducing glare. An interior light level sensor would allow the natural light to be supplemented by low energy LED lighting. Berardi & Anaraki (2016) also showed that the window/ wall ration of approximately 35% was adequate for daylighting, which allows for better overall insulation value for an exterior wall assembly, compared to the typical curtain wall construction.

![Figure 6.10a Light Shelf dimensions. Source: Berardi and Anaraki, 2016](image)
The use of thermal / solar chimneys should be piloted as a strategy for cooling the buildings, which, along with district cooling should decrease the amount of air-conditioning required by the development. Theoretical work, combined with a physical experiment in the Edmonton area (Bilgen, 2005) shows that this concept is a mechanism for natural ventilation with potential as an air turbine power generator. Tesche (2014) indicates that this has been successfully implemented in UK office building.

The existing mall would have the common areas lit by efficient use of skylights, paired with light sensors and LED fixtures, which would significantly decrease the lighting requirements seasonally.

### 6.3.2.3 Thermal / Reflective characteristics of materials

High albedo (light coloured or reflective) finishes on the building envelope as well as roads will significantly reduce heat gain. Solar thermal is suitable to use in northern climates, as solar combi-system (use of solar heated water for both space heating and hot domestic water) with a façade integrated solar collector allows for 20–60% of domestic heating demand to be met in Sweden.
(Charron, Athienitis 2006). Selective use of darker materials can be used in solar water heating for domestic use (Figure 6.11), as is used by Algonquin College in Ottawa.

![Solar thermal water heating at Algonquin College in Ottawa.](image)

6.3.2.4 Microclimate control

Green roofs also contribute to reduced re-radiation of solar energy, decreasing the urban heat-island effect. Use of local trees and other vegetation in the public square and around the perimeter of the site will moderate temperature and humidity levels, as seen in Figure 6.7.

6.3.2.5 Energy production from wind

At this time the available technology is not a good investment for the quality and quantity of wind in the city. There are many exciting developments such as a bladeless wind power generator as seen in Figure 6.12, which would provide preferable alternatives (Wener-Fligner, 2015) however, it is a promising prototype without proven long-term data to support its implementation at this site. Until such time as a viable wind energy technology is available, it would be cost effective to provide backbone and supports required for a future wind production installation.
6.3.3 Mobility

More compact design means that public transport is more viable. Unfortunately, Edmonton’s plans for expanding their Light Rapid Train (LRT) network (Figure 6.13) does not include Westmount on the Valley-Line West route; the closest proposed station being Glenora, almost 2 km south of Westmount Centre. However, present plans show that the existing transit hub will remain. The better solution would be reached when the city and the owner would negotiate relocating the bus terminal to be on the site, rather than outside – running along the roadway between the existing structure and proposed expansion. This convenience could encourage participating in the centre on the way home for transit users.
Membership in car sharing cooperative would be an amenity for those living or working in the new district as an inducement for reducing the requirement for resident parking spots. The reduction in cars moving into the area could stimulate better uses for the land previously allocated to parking. For example, Hammarby Sjöstad in Stockholm had tried to reduce the amount of residential car use compared to the Stockholm average, with ownership rates being 210 cars /1000 residents (compared to Stockholm’s 370 cars/ 1000 residents), even though the proportion of parking spots is the same for both at 0.65 parking spots/residence (Foletta, 2011). The ownership rate in Edmonton in 2014 was approximately 800 cars / 1000 residents (Platt, 2014).

The North American ownership of hybrid and electric vehicles is growing. Installation of monitored vehicle powering stations in premium locations would be another enticement to encourage conversion to more energy efficient vehicles, when automobile owners need a replacement.

6.3.3.1 Accessibility and connections

It is important that the retrofitted Westmount Centre be accessible and connected to the surrounding neighbourhood. It would have to be pedestrian friendly and have opportunities for cycling. Onsite bicycle rentals would be provided, in increasing numbers over time. Edmonton’s bike lane strategy is a work in progress, as gaps are being filled in connecting Westmount Centre to downtown Edmonton. Secure bicycle racks and workplace showers will be part of the strategy to encourage cycling to work.

Multiple access points to the centre would facilitate incoming and outgoing traffic flows. Providing internal roads and sidewalks on-site will increase pedestrian safety (Figure 6.14)
6.3.3.2 Walkability

A useful metric is the walkability score – which evaluates the number of amenities that are available within walking distance, which makes a neighbourhood more attractive to residents. (Speck, 2012) Existing walking scores in the Westmount neighbourhood average 68, which means that only some errands can be accomplished on foot (Walkscore, 2017). By providing a greater diversity of available amenities, retail, commercial, institutional and recreational options on-site, walkscores for the immediate neighbourhood should be above 90, which means that all errands can be accomplished without the need for a car.

Figure 6.14 Internal pedestrian friendly roadways and sidewalks proposed for the Westmount Centre site
6.3.3.3 Urban grid and street design

The Westmount Centre will be more connected to the neighbourhood by re-introducing blocks, streets and sidewalks onto the site. The ability to slow down the vehicular traffic through street design, such as introducing planters and trees, makes the site safer for pedestrians. To facilitate the movement of shopping carts through the parking garages will require moving ramp escalators such as that shown in Figure 6.15, which allows for safe transit of shopping carts to different levels.

![Figure 6.15 Ramp escalator to lower level parking. Source: Ottawa Now (2014)](image)

6.3.3.4 Policy effectiveness among the residents / stakeholders

A BRZ would be implemented for the Westmount district before the consultative process, developing a common set of rules / policies / guidelines, which would allow the local stakeholders in the retrofitted space to make adjustments, as well as joint decisions regarding increasingly stringent sustainability goals going forward. There would be an ongoing commissioning of the technologies re-evaluation of the future of existing technologies going forward.

6.3.4 Green and water design

Although the site is distant from the North Saskatchewan River park system, water features in the common green area, as well as interior green walls and running water features inside the buildings would contribute to the well-being of the site occupants, by connecting them with nature, which has numerous healthy attributes (Kellert, et al., 2008).

Outdoor water features (Figure 6.16a) provide interest and cooling in summer months. Interior green walls (Figure 6.16b) improve air quality, provide humidity and a connection to nature.
6.3.4.1 Microclimate control

The use of water features on the common green area, would be a temperature moderating strategy. Xeriscaping, the use of plant species local to Edmonton would require minimal attention after the plants become established and provide shade in the public square.

6.3.4.2 Green infrastructure

As Westmount Centre’s environs are not connected to wilderness areas, it would not be wise nor useful to invest in schemes to connect to wildlife corridors.

6.3.4.3 Water management

Local water management would allow the intensification of Westmount Centre to have decreased storm-water collection requirements, compared to conventional developments.

Pavers on the roadways and sidewalks, as well as plantings in bio-swales would be used to improve on water infiltration into the substrate. The green roofs would be part of the strategy to delay and decrease stormwater release to the Edmonton storm-water management system, hopefully negating the need to scale up the existing stormwater pipes. Appendix 12 summarizes the proposed Westmount site water cycle.

- Water conservation techniques, used in both residential and commercial units include:
- Washrooms, through low flow fixtures, grey-water use in commercial toilets
- Energy efficient shared laundry facilities with energy smart appliances
- Using grey-water for irrigating the landscaping features on Westmount Centre site.
The UV treatment of water would take place on-site at the north end of the property. Negotiations with the city would result in part of the school grounds to the west of the site to be used as a subsurface water treatment facility. Research and stakeholder acceptance would be required to allow more aggressive on-site treatment of black-water to truly create a local solution. Edmonton’s existing wastewater utility already uses UV when treating the water to be returned to the North Saskatchewan River. At Westmount Centre, the treated water would further undergo UV radiation to rid cleaned water of remaining bacteria, as UV radiation systems have been shown to perform better than chlorination in meeting acceptable e-coli levels in potable water (Environmental Protection Agency, 1999).

However Edmonton occasionally experiences high precipitation events, when untreated effluent is released into the river. By having more local storm-water retention and treatment of effluent, there should be reduced risk of local overflows of untreated water and mitigation of local flooding events.

### 6.3.4.4 Energy production

There has been significant research into anaerobic co-digestion methods, where combining municipal, agricultural and industrial waste-streams improve the yields of biogas produced (Khalid et al., 2011). The burning of the methane, as part of a power co-generation, reduces the GHG impact of the methane, which otherwise would be released into the atmosphere. The City of Edmonton has a facility in the east end of the city (City of Edmonton, 2017b), a second location in the west end would provide resilience in anticipating Edmonton’s growth long-term, but also providing back-up for times of breakdown or maintenance of the existing waste management facility.

### 6.3.4.5 Other green strategies

Designing the construction of the new development, so that it can be unassembled for upgrading or at the end of the useful life for reuse or recycling. This would be important, as technologies become available, their introduction to Westmount Centre would create minimal construction waste. Brown and Buranadarn (2002) found that the recycling construction waste significantly contributes to decreased lifecycle costs of most construction materials.

Ventilation with fresh air could take place overnight in summer, through allowing cool air in at ground level and allowing warm air to escape through the motorized opening of skylights (CommONEnergy Project, 2017).

### 6.3.5 Technologies

Ideally the stakeholders would take advantage of the site, benefiting from inherent natural amenities: sun, opportunities for ground-source heating, and the availability of municipal infrastructure of western Edmonton. Technology should supplement that which cannot be achieved through site intervention and passive methods.

#### 6.3.5.1 District heating and CHP plants

The use of ground source heating could be used for district heating plant, with combined heat and power (CHP) plants and use of solar energy generated on-site should provide the creation of an ideal energy mix, which would be determined to be both financially and environmentally beneficial. Excess heat would be used for heating water and eventually funnelled for heating the urban greenhouse nurseries.

A solar thermal system was devised a residential area in Okotoks, Alberta which used roof mounted flat plate collectors to absorb heat, to be stored in the soil, and used for 90% of space heating as required as district heating. Individual solar collectors supplied each residence with 50% of the required hot water. (Sibbitt et al., 2011)
6.3.5.2 District cooling

This would also be part of the geothermal energy strategy – the substrate would extract heat in winter and return heat to the bedrock in the summer time. This seasonal approach has proven useful even in Yellowknife, Northwest Territories Canada (62 degrees North), where 10 years of experience with the Greenstone building has surpassed expectations regarding energy use (Manasc Isaac, 2008).

6.3.5.3 Energy from waste incineration

McDonough noted that nature does not have waste products in its cycles; waste from one process is food for the next (McDonough. Braungart, 2002). To this end, east Edmonton’s Waste Management Centre is an evolving processing and research facility where strategies are tested and implemented. The intent is to eventually divert 90% of Edmonton’s waste from landfill (Figure 6.17).


Figure 6.17 Edmonton Waste Management Centre (Edmonton, 2017b)
The introduction of tube based waste collection and separation, using lessons learned from Hammarby Sjöstad, would decrease the amount of garbage truck traffic through Westmount Centre. The feasibility of smaller scale local facilities for generating biogas for Combined Heat and Power (CHP) process for power and hot water for district heating in the northwest corner of the project site, would require further study.

### 6.3.5.4 Photovoltaic panels

The townhouses and the two-story high-density residential terraces would have green roofs and the uppermost roof surface would have a combination green roof and photo-voltaic arrays, a mandated strategy implemented in Toronto (City of Toronto, 2014).

The solar and energy production might not always be able to fully power the Westmount Centre district and there may be times when the overall energy production of the district exceeds its needs, which would require the use of storage battery to capture excess energy for reuse when needed. Large-scale batteries are being developed, however, until such time that they are commonplace, alternating between power sources would be the strategy for continuous power supply. The power generation needs to be part of the provincial energy grid to allow for supplementing power needs when stored energy is inadequate, or to supply energy, when excess power can be put back into the system.

The Greenstone Government of Canada Building in Yellowknife, NWT (1000 km north of Edmonton) also employs Building Integrated Photo-Voltaics (BIPV), which combined photo-voltaic film within a quadruple pane unit (Figure 6.18), which provided over 8% of the required energy over the year, as well as an R-Value of over 7, which almost doubles the performance of other higher-performing windows for insulation value (Stamenic, Lubun, 2007).

![Figure 6.18 – Photovoltaic array in the Greenstone building](image)

### 6.3.5.5 Building materials and energy performance

The building design and construction would ensure the optimum glazing (the best R-value for windows is approximately 4) vs. masonry (proportion to optimize available light vs. R-value. This strategy can be quite complex, evaluating how to introduce more insulating properties into existing
building. At Canadian latitudes, incorporating approximately 35% percentage glazing provides the optimal proportion of day lighting vs. building envelope thermal performance. At higher percentage of glazing, most occupants require blinds or other shading devices, which defeats the purpose of larger windows.

The use of in-floor water-based heating and cooling will provide an excellent even temperature throughout all habitable spaces. Unlike baseboard heaters, the heating is evenly distributed. Unlike duct-based systems, there is less heat transmission loss.

The existing structure would be retrofitted with high R value insulation and new buildings would be designed to take advantage of best design practices in energy conservation.

The use of locally sourced items, especially building materials should be highly recommended. In Baltic countries, the use of local aggregate is highly developed, so that materials from excavation are used in the construction of the building, which minimizes the destruction of environments distant from the project and minimizes delivery costs (Baltic Inert Material Management Symposium, 2011). To the extent possible, the demolition waste that would be generated from any buildings should be assessed for re-use locally.

The design of the infrastructure should consider the possibility of future innovations and provide for redundant systems, which will decrease future costs of retrofitting, if the initial project does not allow for this strategy to be implemented from the start.

These proven strategies (as of 2017), provide ample proof that they are viable solutions to a mixed-use retrofit of Westmount Centre. Combining these strategies holistically would provide a triple bottom line benefit to the City of Edmonton. Appendix 10
7.0 Assessment

Figure 7.1 is a spider chart, which represents the strategies undertaken as per Haas (2011) and summarized in Appendices 4, 6 and 8 and shows how having complementary strategies, over several categories creates a symbiotic relationship in the normative scenario compared to the other scenarios.

LEED-ND (USGBC, 2014) is the North American standard for evaluating the sustainability of a project. The assessment sheets have been filled out (Appendices 5, 7 and 13), according to the level of probable compliance at the completion of the timeline.

The Predictive scenario LEED assessment (Appendix 5) shows what is likely to happen, given that no additional strategies are imposed within the next 5 years. The 10 points that have been awarded, are due to the existing conditions, such as the presence of schools in the neighbourhood, the present location of the bus terminal and the limited availability of bicycle racks. With minimal intervention, it is evident that going forward, Westmount Centre would not be sustainable in any aspect.

The Explorative Scenario LEED assessment (Appendix 7), the stakeholders have chosen to go with the simplest upgrades, to provide the appearance of an improved situation and minimal compliance with LEED-ND to attain basic certification of 42 points over 10 years. Though the construction of office and residential towers improves the mix by default, without significant deviation from the standard development template and without consideration for the holistic design, the resulting development would have limited impact on the environmental sustainability of Westmount Centre.
The social sustainability has not been addressed either and this solution will not reduce the appeal of West Edmonton Mall. Unfortunately this proposed development would not mesh well with the existing neighbourhoods, potentially resulting in the dropping of property value eventually.

The Normative Scenario LEED assessment (Appendix 13) portrays the coordinated holistic efforts of the numerous stakeholders, resulting in a multi-pronged approach to addressing environmental concerns, which provides a basis for social improvements and creates opportunities for economic sustainability over the next 15-20 years.
8.0 Discussion

In North America retrofitting existing buildings is commonplace for maintenance and aesthetic reinvention, however few are taking opportunities to holistically address environmental sustainability issues at a district level. Westmount Centre presents a Situation of Opportunity, as when the major stakeholders in this project decide that a change is required to improve the economic bottom line, this proposed, multi-pronged, long-term approach would do much to address all aspects of sustainability.

8.1 Potential area of study

Had space permitted, each of the scenarios would have been evaluated for energy impacts, specifically using RETScreen (Natural Resources Canada, 2014), an evaluation tool which uses local information including NASA-supplied weather and climate data to determine the optimal mix of strategies when building or modifying the built environment, giving estimates of payback periods. Additional evaluations would include Life Cycle Assessment (LCA), to determine the suitability of materials and Return On Investment (ROI), which would estimate payback periods for various strategies, compared to “business as usual” plan of action.

8.2 Obstacles to implementation

Considering that North American society has a significant amount of catching up to do when looking at the implementation of sustainability measures, vigorous tactics are necessary to encourage sustainable behaviour at all levels and types of governance. New construction rarely incorporates proven strategies, paying lip-service to green initiatives, at best. It might be difficult to convince investors to be innovative for existing projects, when new construction codes do not require progressive sustainability measures. A coordinated end-user education by the stakeholders is also required, as behaviour can override the benefits of sustainable features. For example, North American cars have become more efficient, but also more powerful, which overrides the efficiency. There is also a significant population which agrees that sustainability is necessary, just not when it affects them, also known as the NIMBY’s (Not In My BackYard)

8.2.1 Legislative obstacles

Sometimes the best intentions lead to unintentional blockage of innovation and investment.

- Specifications and standards vary between jurisdictions internationally, so processes and equipment require significant testing and re-calibration or redesign.
- Obstacles to zoning – Potential for NIMBY activism
- Contrary aims of various forms of government, compartmentalized thinking and processes.

8.2.2 Stakeholders

As the property owner is the major stakeholder, much depends on the willingness to further invest, as all real estate transactions carry significant risk. The next influential stakeholders are the municipal and provincial government departments and agencies, as zoning would be revised. Fiscal support for the property owner would be negotiated with financial institutions and government, as this proposal would be a new previously untested strategy. The adjacent neighbourhoods would demand input, as they would be living with the results of the changes to their lifestyle.
The design and construction team would have had a steep learning curve, to fine-tune the design parameters of this project. However, the payback would be in the experience obtained in this project to be used and expanded on in future developments.

### 8.2.3 Large scale investment

Research should be linked to investment opportunities and support innovation to cost savings and / or profit.

- Tax breaks for innovation investing
- Subsidies for manufacturing
- Provision of proof of profit-making potential based on success elsewhere.
- Employment opportunities

The municipal, provincial and federal governments should invest in technologies and implementation. The payback would be in the form of increased tax base.

### 8.3 Potential for implementation

As many of these strategies have been implemented previously, is not unrealistic to propose these strategies in tandem. As seen in the LEED-ND assessment chart, these strategies could deliver a strong sustainable solution to the Westmount Centre site. The LEED-ND should in fact demand more on the technical front, to promote re-use, to encourage innovation.

Stakeholder education and involvement is key, as each team will need to find ways to complement the work of the others. Any changes to the status quo, would initially have to be followed up with strong educational initiatives and monitoring for the new residents, tenants and other users of the space. If the end-users unintentionally or deliberately act in a way to counter the functioning of the various measures, then the performance outcomes of the plan of action will be affected.

An interesting design and construction concept, Integrated Project Delivery (IPD), which encourages and supports stakeholder interaction and innovation, by tying reward to shared project outcome (Love, 2011), is a model that was successfully implemented in the world’s northern-most Net zero office building (Mosaic Centre, 2017) in Edmonton and would be an economic model worth emulating.

The European Union had commissioned a study on the retrofitting of shopping centres and studied the benefits of the retrofits which resulted in 75% energy savings overall and a payback period of 7 years (CommONEnergy Project, 2017). If these comprehensive guidelines are encouraged and implemented over the next 15 years (as seen in Table 3.1 Westmount undergoes a significant retrofit every 10 years on average), and other malls are enabled to do likewise, this would result in significant energy reductions, which could be adopted by other district types.

Since 1998, Japan has instituted a policy at the national level, which could be a model for fast implementation of best practices. The Top Runner program targets high energy-using industries. The best performing product within each category is used as a benchmark that others in the field have to equal or surpass in a specified period. These targets are applied to both locally produced items as well as imports; government and industry cooperate to set targets, time periods and penalties for non-compliance (Renner, 2012, Nordqvist, 2006). This clearly would lead to the fast-tracking of innovative thinking and industry acceptance of their responsibility for decreasing levels of toxins in the environment (Worldfuture Council, 2012). Similarly, a process of constant re-evaluation and updating of best practices by government, designers, manufacturers and construction companies means that future mall retrofits would be building on the success or Westmount Centre,
rather than merely replicating it. Codes should be regularly updated to reflect the success of innovative projects and proven strategies. The various LEED programs should further strengthened, increasing the benchmarks to reflect best practices and encourage additional innovations.

The interconnectedness of strategies on a continental basis, as well as coordinated research efforts and the understanding of the global nature of the challenges can only be considered a positive step.

8.3.1 Lifestyle changes (individual and societal)

These are individual choices that inhabitants and societies make everyday as a result of habit, encouragement or under risk of penalty. Paying more for water above a specific level, user fees, competition, encouragement to be more self-sufficient by participating in urban agriculture, decreased use of private cars, decreased emphasis on consumerism as an indicator of wealth, decreasing hours of work, so more people can work.

Strategies and information / education is required from all segments of society for buy-in that a sustainable lifestyle is not only the right thing to do, but that this will have monetary, societal and environmental benefits.

Local schools – many young adults have already gone through an education system that has brought environmental awareness to the newest generations, who are and will be demanding more from regulatory bodies and from industries.

Pilot projects or implementation over phases allows for local businesses and residents to see the results of the strategies over time. Phasing also allows for fine-tuning of the development and technology. Increased implementation and local finessing of strategies lead to greater affordability of the technologies.

Residents can be encouraged to participate in the change through communication, charrettes, incentives, regulatory changes and disincentives for unwanted behaviours (such as new or increased parking fees).

Measuring, reporting and broadcasting of changes would result in efforts to improve performance. Commissioning of systems would be necessary to ensure that the employed strategies were meeting pre-determined targets. On-going training of designers, end-users and maintenance personnel as well as careful observation would also add to the ability to fine-tune and improve on performance of inter-related systems.

8.3.2 Regulations and incentives; next steps

These are a number of strategies that would require encouragement in the forms of regulations or incentives

First and foremost Government must institute a program similar to the Japanese Best Runner, which encourages innovation in all aspects of sustainability and then makes that the new baseline. This would involve for example increased energy efficiency, more use of non-renewable technology, designing districts for better walkability, healthier environments, more low-income and rental properties developed and enforced for all developments. Otherwise there is little incentive to try better. The bar must be constantly evaluated and raised on a regular basis to stimulate innovation. The improved performance due to innovations must become the new baseline for stimulating future innovation

Zoning would be challenged to allow for the mixed-use implementation, as well as the inclusion of on-site waste management facilities.
An energy simulation would need to be completed to determine the best strategy for Westmount Centre, given that site differences lead to significant impact regarding the suitability of a given strategy (Charron, Athienitis, 2006).

Government officials must stay strong and consistent in the application of the regulations; otherwise builders go to the level of least resistance and cost. These measures would be in conjunction with intensive professional training and public awareness campaigns.

The offering of incentives such as lowered development costs or grants to be a pilot project for new technologies – promoting the work of industry leaders that embrace change. The grants would cover the cost difference between conventional technologies and innovations, such as onsite waste disposal and wind technology. An intermediate step might be to have parallel codes, so that approval is granted quickly for more holistic code compliance, vs. standard code compliance.

Form based codes – which encourage good overall design, as malls are more appealing inside rather than outside. People cannot get excited about the least expensive option for the exterior of malls, which these days are typically a monolithic block, with no thought put forward to aesthetics. An attractive building also adds to the social improvement and economic well-being.

Grants from the Federation of Canadian Municipalities should be encouraged – mandatory reviews of large projects to determine if all reasonable opportunities have been explored to take advantage of what the site, passive strategies and available technology can offer.

Support for research, development and Canadian manufacturing of technologies to ensure that not only existing environmental requirements are met, but increasingly higher standards are also set and exceeded.

Replicating and improving successful strategies for resilience, such as waste separation and biofuel production, so that repair and maintenance of existing facilities do not negatively impact the progress in achieving sustainability targets.

In terms of meeting the objectives of 2030 District, despite Edmonton’s high annual fluctuations in temperature, the existing technologies sited should allow the project to approach energy neutrality. There also appears to be an increasing acceptance of alternative energy sources, which is accompanied by price drops and increasing innovation and efficiency, so optimistically the goals of District 2030 can be met by the development and retrofit of Edmonton, Canada’s Westmount Centre.
9.0 Conclusions

If we use financial terms to consider that the Earth’s natural capital is the principal, then it does well if the interest generated is less than the resources that are used, over time (Roseland, 1998). Recently, we have been using increasingly greater amounts of the principal, with only token amounts being paid back through remediation. At this time, it is no longer enough to bring the “spending” in line with the “repayment”. Aggressive and coordinated efforts are needed to bring the principal back in line; otherwise we are ever-increasingly overspending our natural capital towards an irreversible environmental bankruptcy.

Energy is seen as the basis for mediating the seemingly incompatible goals of economic development, societal progress, social justice and environmental protection. Therefore, there need to be strong policies in place to encourage this. (European Union, 2012) There is agreement to cut emissions by a fifth by 2020, compared to 1990; save 20% of energy consumption, compared to current projections. Also in the agreement; a significant shift to increasing biofuel shares in transportation, power production, heating and cooling. The belief is that becoming increasingly dependant on low emission technologies will allow the reaching of climate change goals, while creating the economic growth necessary for stability.

Sustainability is commonplace in Northern Europe, generally pursued and implemented by their mainstream politicians, businesses and citizens. In North America, the case for sustainability is being made, but practical implementation is moving far too slowly to halt and reverse present ecological changes. In this era of peak oil extraction, climate change and general degradation of the environment, the retrofitting of existing suburban shopping centres for sustainability would be an opportunity for environmental, social and economic benefits to the urban ecosystem. Aggressively mitigating the urban environment is necessary for diminishing the ecological footprint of North American urban areas. Projects such as Edmonton’s Mosaic Centre and Yellowknife’s Greenstone building should be used as local baselines for all future new construction and guideposts for the retrofitting of existing buildings and neighbourhoods. Existing proven strategies could mitigate the negative environmental impacts of the Westmount Centre, thereby creating a baseline for remediation strategies for other existing commercial, institutional, industrial and educational districts; the argument for making 2030 District the baseline condition has been made for the North American context. Increasing social sustainability as a strategy by design creates the potential for a more cooperative and just society. This in turn will create more equitable economic opportunities, overall improving the triple bottom line.

Westmount Centre has the potential for meeting the criteria of 2030 districts, as well as improving the social and economic prospects of the neighbourhood and acting as a baseline for future developments, as future innovations will provide additional opportunities.
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## Appendix 1 – North American retail terminology

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Anchor Store</strong></td>
<td>A large department store, or major retail chain, which acts as a retail magnet for a shopping centre. Typically located at nodes, to encourage shopping between anchor stores.</td>
</tr>
<tr>
<td><strong>Department Store</strong></td>
<td>A retail entity with a large variety of merchandise across numerous consumer goods categories, typically without groceries</td>
</tr>
<tr>
<td><strong>Mall</strong></td>
<td>An enclosed shopping centre with internal circulation</td>
</tr>
<tr>
<td><strong>Shopping Centre</strong></td>
<td>A centralized single use retail area, typically under a single owner / management which leases space to numerous retailers of various sizes</td>
</tr>
<tr>
<td><strong>Supermarket</strong></td>
<td>A large grocery store with a variety of foods and household goods</td>
</tr>
</tbody>
</table>
Appendix 2 – Transect descriptions

Comparison of succession zones to the New Urban transect zones and finally to the situation in EDMONTON using examples of retail districts from the downtown to the rural areas to track the applicable solutions (Steuteville, 2003).

<table>
<thead>
<tr>
<th>Transect</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>T1</strong> The Natural Zone</td>
<td>Areas that can be potentially build up in the future, but presently farmland or left in natural state.</td>
</tr>
<tr>
<td></td>
<td>Transportation – personal, each adult probably has a car</td>
</tr>
<tr>
<td></td>
<td>Retail is the rural equivalent of a corner store – potentially connected to a gas station.</td>
</tr>
<tr>
<td></td>
<td>Convenience store, 30 km from downtown Edmonton</td>
</tr>
<tr>
<td><strong>T2</strong> The Rural Zone</td>
<td>Small Town, surrounded by farmland or wilderness</td>
</tr>
<tr>
<td></td>
<td>Transportation – personal, each adult probably has a car</td>
</tr>
<tr>
<td></td>
<td>Retail may consist of a small “Main Street”, with a few key businesses</td>
</tr>
<tr>
<td></td>
<td>Wabaum, Alberta, 70 km. from downtown Edmonton</td>
</tr>
<tr>
<td><strong>T3</strong> The Suburban zone</td>
<td>Has a rural feel with larger lots on curved streets, often without sidewalks – the lowest residential density; mostly residential character. Bedroom community for large urban centre</td>
</tr>
<tr>
<td></td>
<td>Limited and inconvenient public transportation, high probability that each adult in the household has a car</td>
</tr>
<tr>
<td></td>
<td>Stand-alone retail as well as regional Shopping centres.</td>
</tr>
<tr>
<td></td>
<td>West Edmonton Mall, 12 km west of downtown Edmonton</td>
</tr>
<tr>
<td><strong>T4</strong> The General Urban Zone</td>
<td>Primarily Residential – variety of housing types on grid layout. Often back alleys for parking</td>
</tr>
<tr>
<td></td>
<td>Transportation – Public Transport available, at least one car per household</td>
</tr>
<tr>
<td></td>
<td>Shopping centres at different scales</td>
</tr>
<tr>
<td></td>
<td>Westmount Centre, 6 km from Edmonton’s downtown</td>
</tr>
<tr>
<td><strong>T5</strong> The Urban Centre</td>
<td>2-3 storey retail / commercial buildings with denser residential areas off the highly travelled streets.</td>
</tr>
<tr>
<td></td>
<td>Well served by public transport</td>
</tr>
<tr>
<td></td>
<td>Retail along corridors with offices or residential above</td>
</tr>
<tr>
<td></td>
<td>Jasper Avenue retail area, 2.5 km. from downtown Edmonton</td>
</tr>
<tr>
<td><strong>T6</strong> The Urban Core</td>
<td>Multi-storied mixed-use buildings, including residential.</td>
</tr>
<tr>
<td></td>
<td>Well served by public transit, car ownership can be optional</td>
</tr>
<tr>
<td></td>
<td>Retail in a downtown city shopping centre and on the ground floor of most high-rises.</td>
</tr>
<tr>
<td></td>
<td>City Centre and area, downtown Edmonton</td>
</tr>
<tr>
<td><strong>DA</strong> Assigned Districts</td>
<td>Areas that have a specific single function use – light manufacturing, airport, research facilities, university campuses, etc.</td>
</tr>
</tbody>
</table>
Appendix 3 – Milestones in the history of Edmonton, Canada
(sources: www.Edmonton.ca (City of Edmonton, 2004) and Wikipedia.com (Wikipedia.org, 2016))

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1754</td>
<td>Anthony Henday, an explorer for the Hudson Bay Company, was recorded as being in the Edmonton area.</td>
</tr>
<tr>
<td>1795</td>
<td>Edmonton House (later Fort Edmonton) a trading post for the Hudson Bay Company was established on the north shore of the North Saskatchewan River</td>
</tr>
<tr>
<td>1871</td>
<td>Beginnings of settlement outside the fort – mostly farmland</td>
</tr>
<tr>
<td>1904</td>
<td>Incorporated as a city, population 8,350 and a year later became the provincial capital when Alberta joined the Dominion of Canada, arrival of the Canadian Northern Railroad – started building boom shortly after.</td>
</tr>
<tr>
<td>1914</td>
<td>Tail end of building boom, population 72,500</td>
</tr>
<tr>
<td>1947</td>
<td>Oil discovered in Leduc, south of Edmonton</td>
</tr>
<tr>
<td>1950's</td>
<td>Oil boom population up to 269,000</td>
</tr>
<tr>
<td>1955</td>
<td>Edmonton’s first shopping centre – Westmount Centre opens – first major shopping district outside of Downtown</td>
</tr>
<tr>
<td>1970's</td>
<td>A major construction boom</td>
</tr>
<tr>
<td>1976</td>
<td>The opening of Kingsway Shopping Centre</td>
</tr>
<tr>
<td>1978</td>
<td>The start of Construction of the Edmonton Light Rail System (now known as ETS – Edmonton Transit System)</td>
</tr>
<tr>
<td>1981</td>
<td>The end of second oil boom, population at 521,000</td>
</tr>
<tr>
<td>1981</td>
<td>The opening of the world’s largest shopping centre – West Edmonton mall, presently largest in North America, 10th in the world.</td>
</tr>
<tr>
<td>2008</td>
<td>Edmonton’s Metropolitan population surpasses 1,000,000 – the most northern North American city to reach this milestone.</td>
</tr>
<tr>
<td>2016</td>
<td>The Canada-wide census listed the City of Edmonton to have a population of 933,000, in an area of 685 sq.km., making it Canada’s 5th most populous city after Toronto, Montreal, Calgary and Ottawa.</td>
</tr>
</tbody>
</table>
### Westmount Centre - Predictive Scenario

<table>
<thead>
<tr>
<th></th>
<th>Explanation</th>
<th>Score 2/10</th>
<th>Main results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compact city and mix of</td>
<td><strong>High density of residential/working places</strong>&lt;br&gt;Low density&lt;50/hectare /</td>
<td>0</td>
<td>Single landuse</td>
</tr>
<tr>
<td>functions</td>
<td>High&gt;70/H</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Brown field reuse</strong>&lt;br&gt;No = 0 / Yes =2</td>
<td>0</td>
<td>Has not been addressed</td>
</tr>
<tr>
<td></td>
<td><strong>Mix of functions</strong>&lt;br&gt;1 function=0&lt;br&gt;2 functions=1&lt;br&gt;social housing included=2&lt;br&gt;2&gt;2 functions =3</td>
<td>1</td>
<td>Retail / minimal institutional functions</td>
</tr>
<tr>
<td></td>
<td><strong>Public service</strong>&lt;br&gt;Local vs urban scale</td>
<td>1</td>
<td>Low-rent government &amp; health services</td>
</tr>
<tr>
<td></td>
<td><strong>Solar gain and wind design</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Passive solar design</strong>&lt;br&gt;Building orientation, seasonal comfort</td>
<td>1</td>
<td>Several skylights in the central concourse</td>
</tr>
<tr>
<td></td>
<td><strong>Use of solar energy (active / passive)</strong>&lt;br&gt;Use of photo-voltaics for</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>power production</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Thermal/reflective characteristics of materials</strong>&lt;br&gt;Thermal absorption</td>
<td>0</td>
<td>Negligible</td>
</tr>
<tr>
<td></td>
<td>vs. solar reflectance</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Microclimate control</strong>&lt;br&gt;Study of wind patterns for climate control</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td><strong>Energy production from wind</strong>&lt;br&gt;Active passive use of wind for ventilation and power</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td><strong>Mobility</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Accessibility &amp; connections</strong>&lt;br&gt;Degree of public transit and connections</td>
<td>1</td>
<td>Not well coordinated with ETS</td>
</tr>
<tr>
<td></td>
<td><strong>Walkability</strong>&lt;br&gt;Pedestrian, cycling and transit network</td>
<td>1</td>
<td>A few of the services available</td>
</tr>
<tr>
<td></td>
<td><strong>Urban grid &amp; street design</strong>&lt;br&gt;Quality of street cross-section design</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td><strong>Policy effectiveness among the residents</strong>&lt;br&gt;Reduction in local car</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>ownership / use</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Green and water design</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Microclimate control</strong>&lt;br&gt;Green area water connectivity impact</td>
<td>0</td>
<td>Minimal landscaping - negligible effect</td>
</tr>
<tr>
<td></td>
<td><strong>Green infrastructure</strong>&lt;br&gt;Green corridors continuity</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td><strong>Water Management</strong>&lt;br&gt;Management of district water cycle</td>
<td>1</td>
<td>A few partial bioswales in parking lot.</td>
</tr>
<tr>
<td></td>
<td><strong>Energy production (biomass, etc.)</strong>&lt;br&gt;Local sewage and waste treatment</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td><strong>Technologies</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>District heating &amp; CHP plants</strong>&lt;br&gt;Extent and efficiency of district CHP</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td><strong>District cooling</strong>&lt;br&gt;Extent and efficiency of district cooling</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td><strong>Energy from waste incineration</strong>&lt;br&gt;Extent of CHP / decrease in landfill</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td><strong>Solar &amp; photovoltaic panels</strong>&lt;br&gt;Local solar use integrated into the grid.</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td><strong>Building materials &amp; energy performance</strong>&lt;br&gt;Life Cycle analysis on</td>
<td>0</td>
<td>None</td>
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<tr>
<td></td>
<td>building</td>
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<td></td>
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<tr>
<td></td>
<td><strong>Total score</strong></td>
<td>6</td>
<td>Total score: 6/50</td>
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## Project Checklist LEED-ND

### Smart Location & Linkage

<table>
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<th>Yes</th>
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<tr>
<td>9</td>
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**Criteria**
- Smart Location
- Impervious Species and Ecological Communities
- Wetland and Water Body Conservation
- Agriculture Land Conservation
- Floodplain Avoidance
- Preferred Locations
- Brownfield Remediation
- Access to Quality Transit
- Bicycle Facilities
- Housing and Jobs Proximity
- Steep Slope Protection
- Site Design for Habitat or Wetland and Water Body Conservation
- Restoration of Habitat or Wetlands and Water Bodies
- Long-Term Conservation Management of Habitat or Wetlands and Water Bodies

### Green Infrastructure & Buildings

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
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<tbody>
<tr>
<td>0</td>
<td>31</td>
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</table>

**Criteria**
- Certified Green Building
- Minimum Building Energy Performance
- Indoor Water Use Reduction
- Construction Activity Pollution Prevention
- Certified Green Buildings
- Optimize Building Energy Performance
- Outdoor Water Use Reduction
- Building Reuse
- Historic Resource Preservation and Adaptive Reuse
- Minimized Site Disturbance
- Rainwater Management
- Heat Island Reduction
- Solar Orientation
- Renewable Energy Production
- District Heating and Cooling
- Infrastructure Energy Efficiency
- Wastewater Management
- Recycled and Reused Infrastructure
- Solid Waste Management
- Light Pollution Reduction

### Neighborhood Pattern & Design

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>41</td>
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</table>

**Criteria**
- Walkable Streets
- Compact Development
- Connected and Open Community
- Mixed-Use Neighborhoods
- Housing Types and Affordability
- Reduced Parking Footprint
- Connected and Open Community
- Transit Facilities
- Transportation Demand Management
- Access to Civic & Public Space
- Access to Recreation Facilities
- Visibility and Universal Design
- Community Outreach and Involvement
- Local Food Production
- Tree-Lined and Shaded Streetscapes
- Neighborhood Schools

### Innovation & Design Process

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
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</thead>
<tbody>
<tr>
<td>0</td>
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**Criteria**
- Innovation
- IFPP Certified Professionals

### Regional Priority Credits

<table>
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<th>No</th>
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</thead>
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<tr>
<td>0</td>
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**Criteria**
- Regional Priority Credit: Region Defined
- Regional Priority Credit: Region Defined
- Regional Priority Credit: Region Defined
- Regional Priority Credit: Region Defined

### Project Totals (Certification estimates)

- Certified: 40-49 points
- Silver: 50-59 points
- Gold: 60-79 points
- Platinum: 80+ points
### Appendix 6 - Basis for explorative scenario spider chart

<table>
<thead>
<tr>
<th>Westmount Centre - Explorative Scenario</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>Main results</th>
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</thead>
<tbody>
<tr>
<td><strong>Compact city and mix of functions</strong></td>
<td></td>
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<td>Score 8/10</td>
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<tr>
<td>High density of residential/working places</td>
<td>Low density&lt;50/hectare / High&gt;70/H</td>
<td>2</td>
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<td></td>
<td>High density office and residential</td>
</tr>
<tr>
<td>Brown field reuse</td>
<td>No = 0 / Yes =2</td>
<td>2</td>
<td></td>
<td></td>
<td>Standard remediation</td>
</tr>
<tr>
<td>Mix of functions</td>
<td>1 function=0, 2 functions=1, social housing included=2, &gt;2 functions =3</td>
<td>2</td>
<td></td>
<td></td>
<td>Mixed use - office and residential added</td>
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<tr>
<td>Public service</td>
<td>Local vs. urban scale</td>
<td>2</td>
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<td></td>
<td>Increased services</td>
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<tr>
<td><strong>Solar gain and wind design</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Score 2/10</td>
</tr>
<tr>
<td>Passive solar design</td>
<td>Building orientation, seasonal comfort</td>
<td>1</td>
<td></td>
<td></td>
<td>Typical construction with oversized glazing.</td>
</tr>
<tr>
<td>Use of solar energy (active / passive)</td>
<td>Use of photovoltaics for power production</td>
<td>0</td>
<td></td>
<td></td>
<td>Not considered</td>
</tr>
<tr>
<td>Thermal/reflective characteristics of materials</td>
<td>Thermal absorption vs. solar reflectance</td>
<td>1</td>
<td></td>
<td></td>
<td>Minimal consideration, appearance of green methods. Typical construction methods used</td>
</tr>
<tr>
<td>Microclimate control</td>
<td>Study of wind patterns for climate control</td>
<td>0</td>
<td></td>
<td></td>
<td>Not considered</td>
</tr>
<tr>
<td>Energy production from wind</td>
<td>Active passive use of wind for ventilation and power</td>
<td>0</td>
<td></td>
<td></td>
<td>Not considered</td>
</tr>
<tr>
<td><strong>Mobility</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Score 4/10</td>
</tr>
<tr>
<td>Accessibility &amp; connections</td>
<td>Degree of public transit and connections</td>
<td>1</td>
<td></td>
<td></td>
<td>Not coordinated with ETS (Edmonton Transit System)</td>
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<tr>
<td>Walkability</td>
<td>Pedestrian, cycling and transit network</td>
<td>2</td>
<td></td>
<td></td>
<td>A few of the services available</td>
</tr>
<tr>
<td>Urban grid &amp; street design</td>
<td>Quality of street cross-section design</td>
<td>1</td>
<td></td>
<td></td>
<td>New structures with sidewalks introduced</td>
</tr>
<tr>
<td>Policy effectiveness among the residents</td>
<td>Reduction in local car ownership / use</td>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>Green and water design</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Score 1/10</td>
</tr>
<tr>
<td>Microclimate control</td>
<td>Green area water connectivity impact</td>
<td>0</td>
<td></td>
<td></td>
<td>Negligible</td>
</tr>
<tr>
<td>Green infrastructure</td>
<td>Green corridors continuity</td>
<td>0</td>
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<td></td>
<td>None</td>
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<tr>
<td>Water Management</td>
<td>Management of district water cycle</td>
<td>1</td>
<td></td>
<td></td>
<td>Minimal water conservation implemented</td>
</tr>
<tr>
<td>Energy production (biomass, etc.)</td>
<td>Local sewage and waste treatment</td>
<td>0</td>
<td></td>
<td></td>
<td>Not considered</td>
</tr>
<tr>
<td><strong>Technologies</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Score 1/10</td>
</tr>
<tr>
<td>District heating &amp; CHP plants</td>
<td>Extent and efficiency of district CHP</td>
<td>0</td>
<td></td>
<td></td>
<td>Not considered</td>
</tr>
<tr>
<td>District cooling</td>
<td>Extent and efficiency of district cooling</td>
<td>0</td>
<td></td>
<td></td>
<td>Not considered</td>
</tr>
<tr>
<td>Energy from waste incineration</td>
<td>Extent of CHP / decrease in landfill</td>
<td>0</td>
<td></td>
<td></td>
<td>Not considered</td>
</tr>
<tr>
<td>Solar &amp; photovoltaic panels</td>
<td>Local solar use integrated into the grid</td>
<td>0</td>
<td></td>
<td></td>
<td>Not considered</td>
</tr>
<tr>
<td>Building materials &amp; energy performance</td>
<td>Life Cycle analysis on building</td>
<td>1</td>
<td></td>
<td></td>
<td>Replacement of existing systems, independently-minimal improvement</td>
</tr>
</tbody>
</table>

| 6  | 10  | Total score: 16/50 |
### Appendix 7 - LEED-ND evaluation for explorative scenario

#### Project Checklist LEED-ND

<table>
<thead>
<tr>
<th>Credit</th>
<th>Description</th>
<th>Certification Requirement</th>
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<tbody>
<tr>
<td>14</td>
<td>10</td>
<td>Smart Location &amp; Linkage</td>
</tr>
<tr>
<td>28</td>
<td>10</td>
<td>Green Infrastructure &amp; Buildings</td>
</tr>
<tr>
<td>31</td>
<td>10</td>
<td>Neighborhood Pattern &amp; Design</td>
</tr>
<tr>
<td>41</td>
<td>10</td>
<td>Innovation &amp; Design Process</td>
</tr>
<tr>
<td>6</td>
<td>10</td>
<td>Regional Priority Credits</td>
</tr>
<tr>
<td>4</td>
<td>10</td>
<td>PROJECT TOTALS (Certification estimates)</td>
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</table>

**Certified:** 40-49 points. **Silver:** 50-59 points. **Gold:** 60-79 points. **Platinum:** 80+ points.
### Appendix 8 - Basis for normative scenario spider chart

<table>
<thead>
<tr>
<th>Compact city and mix of functions</th>
<th>Explanation</th>
<th>Score 10/10</th>
</tr>
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<tbody>
<tr>
<td>High density of residential / Offices</td>
<td>Low density&lt;50/hectare / High&gt;70 H</td>
<td>2</td>
</tr>
<tr>
<td>Brown field reuse</td>
<td>No = 0 / Yes =2</td>
<td>2</td>
</tr>
<tr>
<td>Mix of functions</td>
<td>1 function=0 2 functions=1 social housing incl.=2 &gt;2 functions =3</td>
<td>3</td>
</tr>
<tr>
<td>Public service</td>
<td>Local vs urban scale</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Solar gain and wind design</th>
<th>Score 10/10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passive solar design</td>
<td>Building orientation, seasonal comfort</td>
</tr>
<tr>
<td>Use of solar energy (active / passive)</td>
<td>Use of photo voltaics for power production</td>
</tr>
<tr>
<td>Thermal/reflective characteristics of materials</td>
<td>Thermal absorption vs. solar reflectance</td>
</tr>
<tr>
<td>Microclimate control</td>
<td>Study of wind patterns for climate control</td>
</tr>
<tr>
<td>Energy production from wind</td>
<td>Active/passive use of wind for ventilation and power</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mobility</th>
<th>Score 9/10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessibility &amp; connections</td>
<td>Degree of public transit and connections</td>
</tr>
<tr>
<td>Walkability</td>
<td>Pedestrian, cycling and transit network</td>
</tr>
<tr>
<td>Urban grid &amp; street design</td>
<td>Quality of street cross-section design</td>
</tr>
<tr>
<td>Policy effectiveness amongst residents</td>
<td>Reduction in local car ownership / use</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Green and water design</th>
<th>Score 5/10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microclimate control</td>
<td>Green area water connectivity impact</td>
</tr>
<tr>
<td>Green infrastructure</td>
<td>Green corridors continuity</td>
</tr>
<tr>
<td>Water Management</td>
<td>Management of district water cycle</td>
</tr>
<tr>
<td>Energy production (biomass, etc.)</td>
<td>Local sewage and waste treatment</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Technologies</th>
<th>Score 5/10</th>
</tr>
</thead>
<tbody>
<tr>
<td>District heating &amp; CHP plants</td>
<td>Extent and efficiency of district CHP</td>
</tr>
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<td>District cooling</td>
<td>Extent and efficiency of district cooling</td>
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<tr>
<td>Energy from waste incineration</td>
<td>Extent of CHP / decrease in landfill</td>
</tr>
<tr>
<td>Solar &amp; photovoltaic panels</td>
<td>Local solar use integrated into the grid.</td>
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<tr>
<td>Building materials &amp; energy performance</td>
<td>Life Cycle analysis on building</td>
</tr>
</tbody>
</table>

7 20 12 Total score: 39/50
### Appendix 9A - Stakeholder Interests

#### Stakeholder groups and functions (Source: based on Dair, 2006)

*see legends next page*

<table>
<thead>
<tr>
<th>Phases (see sub-headings below)</th>
<th>1.0 Compact Design</th>
<th>2.0 Solar Gain / Wind Design</th>
<th>3.0 Mobility</th>
<th>4.0 Green &amp; Water Design</th>
<th>5.0 Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1: Land use planning and regulation</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Local politicians</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Municipal elected representatives</td>
<td>E-$ E-$ E-$ E-$ E-$ E-$ E-$ E-$ E-$ E-$ E-$</td>
<td></td>
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<tr>
<td>Provincial elected representatives</td>
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<td>Municipal / provincial agencies</td>
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<tr>
<td>Regulators</td>
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<td>Utility providers</td>
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<tr>
<td>Interest groups and individuals</td>
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<td>Lobbyists</td>
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<td>Individuals</td>
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<tr>
<td>Public and private sector developers</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Investors, investing institutions and their shareholders</td>
<td>E-$ E-$ E-$ E-$ E-$ E-$ E-$ E-$ E-$ E-$ E-$</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Construction companies and their workers</td>
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<td></td>
<td></td>
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<tr>
<td>Professional advisors</td>
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<td>Legal</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Design, landscaping and planning professionals</td>
<td>E-$ E-$ E-$ E-$ E-$ E-$ E-$ E-$ E-$ E-$ E-$</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Civil, Structural and Environmental engineers</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Insurance and valuation professionals</td>
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<td>End users</td>
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<tr>
<td>Corporate clients of Developers</td>
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<tr>
<td>Residential renters and owners</td>
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<td></td>
</tr>
<tr>
<td>Commercial business owners</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Manufacturers, their suppliers and customers</td>
<td>E-$ E-$ E-$ E-$ E-$ E-$ E-$ E-$ E-$ E-$ E-$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Key Stakeholders, from list above

**Group 6**

1. Invested Land-owners, politicians, developers, investors, and users had the most influence, but for them, sustainability is not an important goal.
2. Regulators and service providers - their positive and negative influence on project sustainability reflected both organizational and personal position on sustainability.
3. Although professional advisers and interest groups might be most vocal, their influence was limited, as their advice was least likely to be followed.

### Sub-headings for chart above

<table>
<thead>
<tr>
<th>Sub-heading</th>
<th>Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.0 Solar gain and wind design</strong></td>
<td>1.1 High density of residential / work places</td>
</tr>
<tr>
<td>1.2 Brown field reuse</td>
<td></td>
</tr>
<tr>
<td>1.3 Mix of functions</td>
<td></td>
</tr>
<tr>
<td>1.4 Public space</td>
<td></td>
</tr>
<tr>
<td><strong>2.0</strong></td>
<td>Passive solar design</td>
</tr>
<tr>
<td>2.2 Use of solar energy (active / passive)</td>
<td></td>
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### Types of Sustainability

- E - Environmental Sustainability
- S - Social Sustainability
- G - Economic Sustainability

Example: E-G Represents both environmental and economic sustainability.
## Appendix 10 Stakeholder timing

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Appendix 11 – Proposed material and energy cycle
Appendix 12 – Proposed Urban water cycle

Showing proven strategies to synergistically reduce the environmental footprint of Westmount Centre
### Project Checklist LEED-ND

#### Smart Location & Linkage

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### Westmount Centre - Normative Scenario (2027)

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#### Innovation & Design Process

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#### Regional Priority Credits

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**PROJECT TOTALS (Certification estimates)**: 110

Certified: 40-49 points, Silver: 50-59 points, Gold: 60-79 points, Platinum: 80+ points