

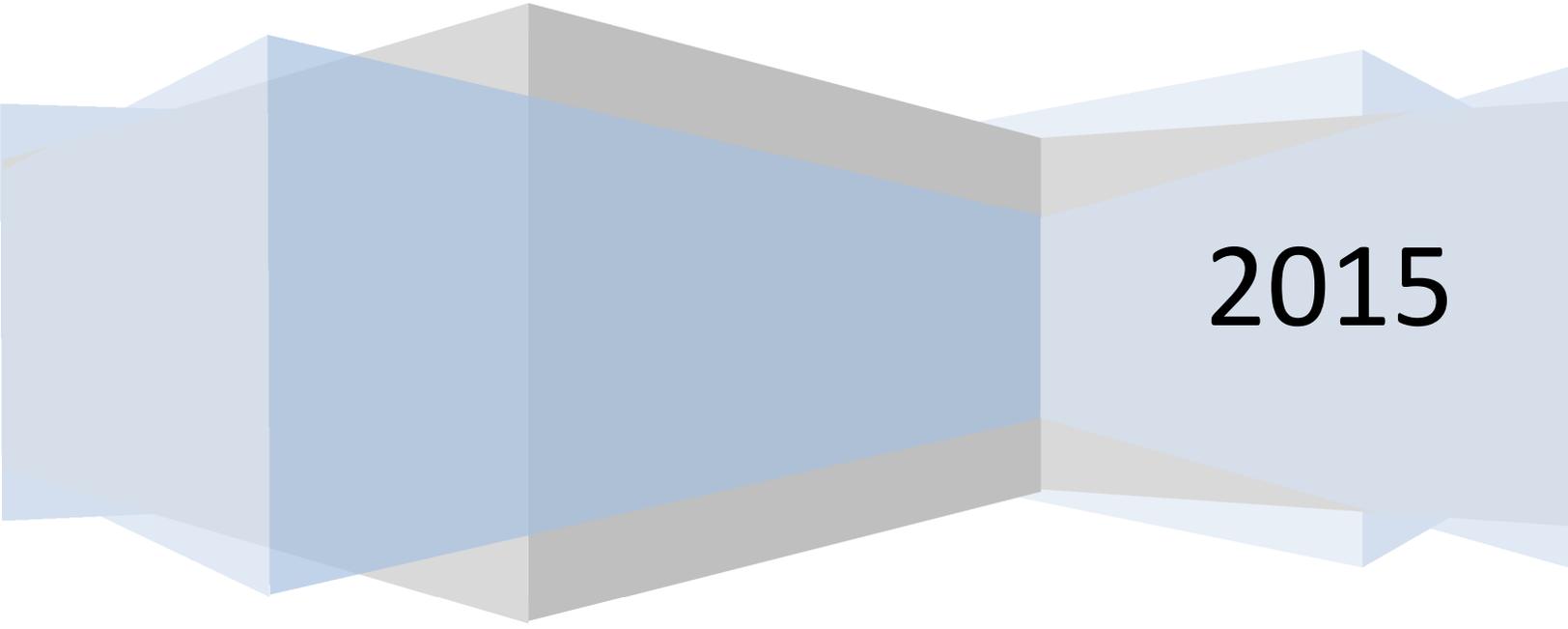


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Musqueam Capital Corporation

Sustainability Analysis toward GHG and Energy Reduction Strategy

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Contents

Introduction	3
Green Building Standards	3
Building Codes / Energy Standards	3
Neighbourhood Energy Utility	4
Adaptable Buildings	5
Building Envelope.....	5
Building Systems	6
Community.....	6
Density	6
Amenities	7
Transit	7
Live / Work.....	7
Forest Park	8
Constructed Wet Land	8
Community Amenity Areas	8
Storm Water Management.....	8
Building Impact:	9
Conclusions	9

Introduction

The purpose of this report is to provide Musqueam Capital Corporation, as applicant for the rezoning of Block F, our analysis of the contribution its Sustainability objectives make towards a GHG and Energy Reduction Strategy.

E3 Eco Group Inc., is a sustainable building and development consulting firm having assisted municipalities, provinces, developers and individuals on providing sustainable development initiatives on many different projects.

Green Building Standards

Based on the rezoning application, the applicant has committed to LEED Gold. There are a number of components to LEED that the project must look at to ensure compliance. LEED breaks down to 5 key credit categories:

- 1) Sustainable Sites
- 2) Water Efficiency
- 3) Energy & Atmosphere
- 4) Materials & Resources
- 5) Indoor Environmental Quality

Of these areas, the key components that apply to GHG reduction are Sustainable Sites and Energy & Atmosphere and some Water Efficiency. Sustainable Sites affect travel and commuting as noted earlier, and the developments' design concepts will have a major impact on GHG emissions. Energy and Atmosphere requires a minimum energy performance; for LEED NC 2009 this requires a 23% energy cost improvement over the Model National Energy Code or MNECB 1997. This is changing with the introduction of LEED Version 4 in October 31st, 2016. As well, the British Columbia Building code requires that all Part 3 buildings meet the Envelope performance under ASHRAE 90.1 2010.

Building Codes / Energy Standards

The two energy components for any development committing to LEED Gold require that the development first meet the BC Building Code requirements - this means the dwelling must meet ASHRAE 90.1 2010 envelope performance requirements which is to say that the residential building envelopes are compliant with insulation requirements of ASHRAE 90.1 2010. This compliance is most often met by using the 'trade-off' method within the ASHRAE 90.1 standard.

Secondly, committing to LEED also requires that buildings demonstrate energy performance under LEED NC or LEED Midrise. The energy performance target requires that buildings undergo full energy modeling. This includes all components of the building; building envelope, lighting, and all mechanical systems that will affect the energy consumption of the building. Currently, this requirement must meet an energy cost budget target.

Energy and green building codes are updated on a regular basis and improvements have been substantial from a code and green building performance perspective. If the energy improvements are taken into consideration and the energy consumption of a residential unit in a wood frame MURB noted above, the GHG reduction from 3.62 tonnes of GHG per unit would be reduced by about 25% from ASHRAE 90.1 2004 levels. All data is estimated as each building varies with glazing ratios, wall details, etc. As building codes improve, overall GHG emissions are being substantially reduced. Code changes are helping the industry adjust gradually.

Overall, building codes and LEED are increasing overall energy performance. As codes are updated, energy consumption is reduced within an adaptable time frame; allowing construction techniques to be improved without deploying unproven building techniques.

Neighbourhood Energy Utility

While it is admirable to review alternative energy systems such a Neighbourhood Energy Utility (NEU), the challenges lie in ensuring the system can meet the loads required. If the system is using fossil fuel *on an interim basis*, it must be running at full load to ensure a high performance. NEU's performance drops dramatically when working on partial loads. It is then essentially running at half capacity and therefore not at full capacity and not at peak performance.

NEU's will always run at a lower performance than a system specifically designed for the development. E3 is not aware of any NEU that runs at high efficiency or greater than 90% based on the fact that there are distribution losses from the NEU to the loads. As well, even if the NEU is designed specifically for this exact development, once another load is added, the efficiency drops because the NEU has to add more capacity and not just for the one new load but for planned expansion. Therefore, the system runs at lower performance until all future load is added. Many NEU's are based on fossil fuels with the hope they will switch to renewable energy. This means most NEU's are running at a lower performance than electric baseboards or even a high efficiency furnace.

Unless the NEU is based on completely renewable energy source or waste heat from some other environment, NEU's using fossil fuels are far from high performance.

NEUs also require a high upfront cost for all involved and if they are using fossil fuels, will achieve lower performance than a high efficiency boiler or heat pumps that are sized for the specific development.

It is better to invest in a more energy efficient building than to adapt the energy source to the building. Reducing the overall energy consumption of the buildings is paramount to providing GHG reductions. Reduce overall heating requirements, lighting requirements and in unit loads by mandating Energy Star appliances will go a long way to reducing overall building emissions. E3 Eco Group has found that often the deciding factor among energy performance models is in fact the installation of Energy Star appliances and high efficiency lighting such as LED – often integral components of achieving LEED Gold.

Adaptable Buildings

It is recommended, that the buildings be made 'Adaptable' to allow for the future connection to alternative energy sources. While NEU's are generally not high performing, however, that isn't to say that they don't have a contribution. If they are designed based on renewable energy and or waste energy from other environments, then this can be a good way to heat buildings. Allowing for a future connectivity is a recommended strategy.

It is understood that air conditioning will be a design component for these residential buildings along with the commercial retail buildings; therefore, water source heat pumps and systems that allow for heating and cooling are preferable as they can be adapted as needed. With a dwelling that is based on this system, the change over from one source of energy to another is much easier than trying to convert a 5 storey MURB from electric baseboards to ground source heat exchange.

Building Envelope

Energy codes across North America are being updated quite vigorously. It is expected that British Columbia building codes will continue to be updated to meet more stringent energy codes over the next 15 years to meet climate change targets.

The European Union and even parts of the United States are enacting standards to ensure buildings are net zero ready by the year 2030. This means extensive retrofits or the addition of renewable energy sources. The best way to reduce or ensure buildings are net zero ready is to enhance the building envelope. It is expected that the BC Building Code will undergo rigorous updates to meet the 2030 requirements; meaning well insulated buildings will reduce overall heating and cooling requirements. We are not suggesting that these buildings meet the 2030 requirements today, as many of the technologies being explored have yet to be studied and effectively implemented under BC climate conditions, but it is expected that future phases of this application may fall under updated and revised BC Building Code requirements as they have noted in requiring all Part 3 buildings meet ASHRAE 90.1 2010.

Developers will see the implementation of more efficient and effective ventilation systems to ensure better air quality for the residents as well as energy and heat recovery from the new ventilation requirements. Both LEED NC and LEED for Midrise have this as part of the mechanical requirements and will provide a healthier environment for the occupants.

This development will be meeting the LEED and BC Building Codes of the day and therefore will be maintaining consistency to ensure the most current codes and green building standards are being met as this development is built out.

Building Systems

LEED NC and LEED for Midrise rating systems place a large emphasis on buildings being commissioned by a third party that reviews the systems to ensure they are functioning as designed and as implemented.

While this sounds pretty basic, the reality is much different. E3 Eco Group has found that most buildings have some kind of issue whether it is design or installation related; there always seems to be an issue with the mechanical systems performing as designed.

Often design issues are missed due to the fact that it is not noticed on the design drawings, only to be noted when the building is nearing completion. The concept of Fundamental Building Commissioning is a LEED NC prerequisite and a LEED for Homes Midrise prerequisite. If implemented correctly, buildings will perform as expected and have less issues down the road.

Due to the fact that this development has committed to meet the LEED Gold requirement, the Commissioning will be a huge benefit to all parties involved. E3 uses the analogy of Commissioning as more of a pre-car sale inspection to ensure everything is running correctly before one makes a purchase. It is similar to a tune up to ensure that issues identified are corrected to ensure a long lasting building that reduces maintenance issues.

Community

This development combines a number of land uses and housing types within the rezoning application. Its comprehensive design is commendable and from a development perspective, it will contribute significantly to the overall carbon reduction strategy.

Density

This project is proposing a number of different residential development projects that have varying densities— this is to be encouraged. However, the addition of density without the creation of liveable spaces can lead to negative environments if the community is not well planned. The density and the multi-unit residential building (MURB) proposals all work in favour of reducing the overall Green House Gas (GHG) emissions. A typical MURB unit, from E3 Eco Group's experience, emits about 3.62 tonnes of GHG's per year; this compares to roughly 7 tonnes of GHG's per single family household that has a relatively high EnerGuide score of 86. The GHG data is being extracted from Natural Resources Canada's HOT 2000 software and does vary based on fuel types and locations. The comparison of the data is to point out that the development with its outcome of creating density on the Block F site versus the surrounding community is setting an example of how to reduce GHG's through strategic, comprehensive community planning.

Amenities

From a GHG & Energy reduction perspective, the amenities of this development are the 30,000 square feet of commercial/retail space and the new 15,000 sq.ft. Community Centre that will be developed in the first phases of this project. This will allow early buyers to access these amenities early on versus having to travel further away to purchase household items or seek recreational facilities. These amenities are crucial to this development and the larger community as they also help reduce commuting to other areas via car trips. These amenities further enhance the potential LEED credits for community resources.

The proximity of this development to other amenities in the area is also very good. The retail outlets located at Western Parkway and University Blvd provide an excellent opportunity to move beyond the village to purchase other groceries, supplies and other products for the household. This proximity is rated as Outstanding under LEED for Homes Midrise rating program with over 11 services located less than 400 metres away from Village Square.

Ideally, more retail services would be located within the development as to ensure that residents living in the south end don't have to walk as far to get necessities that are not available within the Village Square retail. To walk from the south end to the retail shops at Western Parkway and University Blvd would be close to 800 meters of travel. While this is still considered very good, the distance may dissuade some from walking in favour of a vehicle trip.

Transit

Estimated GHG's from commuting are significant. Some estimates put commuting at 0.109 Kg/km of GHG's/ trip/vehicle/household. A conservative extrapolation for this development could account for as much as 204 tonnes of GHG's per year. Due to the excellent multi-modal transportation options and geographic location of the development, it is expected that this will be significantly reduced.

Bus stops at the southeast and northwest corners of Allison Rd. and University Boulevard, 400m from the development site provide access to the 99 B-Line. The 99 B-Line is an express bus service between UBC and Commercial Drive Sky Train station, providing high frequency transit service on one of the busiest transit routes outside downtown Vancouver.

Transit in the area is very good and it is expected to only get better. The bus stop at 5300 block, which is very close to Village Square, presently runs two main buses providing an estimated 360 rides per day. This number is for both directions and is considered excellent for the area. It is expected that there will be rapid transit to UBC sometime in the future and quick access to this will help move people from this development to other parts of Vancouver more efficiently.

Live / Work

The planned development recognizes that commuting has a significant impact on GHG emissions and is working to reduce this with regards to implementing a number of key features to make this a live / work community. The rezoning application includes 30,000 square feet of commercial

and retail amenities as well as the Community Centre. These amenities will help residents reduce commuting for local goods and services.

To assist in changing commuting patterns, the applicant has noted that Translink may implement a Rapid Transit bus stop just East of the Village square in the future. From the farthest residential development at the south, this is still less than 500 meters to the rapid transit stop. Noted, there are closer bus stops to the residential dwellings and the occupants would most likely use those stops.

UBC employs roughly 23,000 people including students, faculty and non-faculty. It is expected that this development will be a desirable community for those working close by and could well be part of their live/work experience. This would further enhance the development's sustainable qualities.

Forest Park

The forest park at a size of 3.1 acres is a sizeable park for such a development and its importance cannot be overlooked. The ability for a forest to capture and store carbon is a fact and the amount of carbon that a forest will capture per year is debateable; figures estimate that a tropical forest can store anywhere from 5 to 20 tonnes of carbon/hectare/year. Taking this on the low side at 10 tonnes of carbon per year would mean that this small 3.1 acre park will roughly capture 12.54 tonnes of carbon per year. This number does not include any other of the parks, forests, or wetlands in the area. Yet, the Forest Park is only a third of the +/-8 acres that are publicly accessible primarily green space. In addition, each development parcel includes a significant amount of landscaped green space.

Constructed Wet Land

While the constructed wetland does not contribute significantly to the reduction of GHG's, it will help enhance and reduce the loss of bird and insect habitat. Overall, the impact for GHG reduction will be minimal, but the wildlife will benefit from the overall development.

Community Amenity Areas

The community spaces will help enhance the live / work aspect of the area and help reduce automotive travel to and from gyms and community areas outside of the development. This will help reduce the reliance on passenger vehiclestrips in the area.

Storm Water Management

The applicant has committed the project to meet predevelopment storm water flows and therefore has committed that all storm water leaving the development will be directed to the constructed wetland through rain-gardens and a bio-swale where the storm water will be 'scrubbed'.. This includes the storm water run off from roads and hardscaped areas.

Building Impact:

Comments from the CACWG noted that there is concern that density is too high and it should be reduced. However, based on LEED for Midrise, the overall density numbers are considered moderate with an earned rating of 'high' and not 'very high' associated with a higher density development.

This development is appropriate with the proposed density and while concerns of too much density are understood, the provision of density needs to occur in the right context to ensure negative effects are not realized. For this application, the units/acre roughly averages 77 units/acre which is only considered moderate under LEED standards as well as other precedents within the lower mainland.

Conclusions

Based on the rezoning application for Block F that E3 Eco Group has reviewed, we believe that if the development meets the LEED requirements as laid out under LEED NC 2009 and or LEED for Midrise 2010 and follows the BC Building Code requirements, this project will contribute significantly to the GHG and Energy Reduction Strategy, without the burden of implementing and maintaining a Neighbourhood Energy Utility. While E3 Eco Group does support the idea of NEU's, they must be implemented under the right conditions and using the right fuels; otherwise they are less efficient and more costly than simply building an efficient building with a high efficiency heating system.

While there is always room for improvement, this community and the design team have done an excellent job at creating a very sustainably focused development that will provide many positive design ideas for other local developments to follow.

This will be a community where the conditions that have been outlined for this development, including the community access, car share, bike storage, high transit access, and retail access will reduce GHG's associated with the commuting of all residents in the village and will provide a vibrant, fun and exciting community to live and work.