REGIONAL DISTRICT OF NANAIMO

MEMORANDUM

TO:	Paul Thompson Manager, Long Range Planning	**DATE:**	February 9, 2009
FROM:	Chris Midgley Sustainability Coordinator	**FILE:**	6780 30

SUBJECT: Regional Benefits of Green Building

PURPOSE

The purpose of this report is to provide a summary of the findings of the research report entitled "*Benefits of Green Building in the RDN*".

BACKGROUND

As part of the implementation of the Regional District of Nanaimo's *Green Building Action Plan*, the RDN contracted the services of The Sheltair Group to determine the type and extent of environmental benefits of promoting green buildings and more compact land use patterns in the RDN. The final report is provided under separate cover.

The objective of the research was to provide a quantitative comparison of the impacts of future development under three different scenarios: a business-as-usual scenario, a green building scenario, and a green building-compact community scenario.

The research was based on the best available information, but by necessity relied on a variety of assumptions. As such, the primary importance of the numbers presented is to provide a comparison between the different scenarios and not to provide precise data on future emissions. However, equivalent assumptions were made for each scenario, thus there is a high level of confidence that an accurate comparison across scenarios is presented.

The research included the following tasks:

- Identify the range of impacts associated with new construction in the RDN over the 20 year period between 2011 and 2031.
- Quantify the annual and cumulative impacts of new construction if it were built to a conventional standard.
- Compare these results to the impacts of the same construction if it were built to a specified standard for green building.
- Explore the added environmental benefits of green buildings in compact communities.

For the purpose of this analysis, the range of environmental impacts associated with new construction are:

- Building Energy Use;
- Transportation Energy Use;
- Water Consumption;
- Volume of Wastewater;
- Solid Waste;
- GHG Emissions; and
- Area of Land Converted to use for Housing

To provide a useful comparison, three scenarios were developed:

1. **Business-as-Usual Scenario (BAU)**

   The BAU scenario is based on the minimum required building standards as determined by the BC Building Code, and assumes a development pattern that is equivalent to what is on the ground today. That is, the mix of housing types and the distribution of housing across the region (percent inside versus outside the UCB) is the same in 2031 as today.

2. **Green Building Scenario (GB)**

   The GB scenario calculates the impacts of construction assuming that 100% of new construction takes the form of green buildings. New residential construction is envisioned as EnerGuide 85 for energy performance and Built Green–Gold for non-energy related issues (e.g. water use). Calculations for non-residential construction are based on requirements for achieving LEED–Gold. The overall development pattern is the same as the BAU scenario.

3. **Green Buildings—Compact Communities Scenario (GB-CC)**

   The GB-CC scenario uses the building types envisioned for the Green Building scenario and calculates the additional impacts of dramatically increasing residential density within the UCB. Specifically, this scenario contemplates environmental impacts if all new development after 2011 occurs within the UCB, and all new residential development takes the form of multi-family dwelling types. This includes redevelopment of 30% of the existing single family detached dwelling stock into higher density forms. The result is 83% of the population residing inside existing UCBs by 2031, compared to 67% today. This scenario highlights the efficiencies gained from building a diversity of dwelling types, as well as the reductions in transportation related GHG emissions due to a moderate shift away from private automobiles to buses, bicycles and walking as more people would be living in compact, pedestrian-oriented communities.

After calculating the impacts of new construction for each of the three scenarios, the Green Building scenario results in a 40% reduction in water use and a 16% reduction in GHGs when compared to the BAU scenario.

The Green Building—Compact Communities scenario results in a 48% reduction in water use and a 36% reduction in GHGs when compared to BAU. In addition, by 2031, 13% less land will have been converted to use for housing.

DISCUSSION

This section illustrates the results and provides a brief explanation for each of the impacts listed in the report. All graphs show data for the following milestone years: 2011, 2016, 2021, 2026, and 2031.

For each impact, two graphs are shown. The first, labelled ‘a’, illustrates impacts as absolute quantities and shows trends for each scenario over time. An important insight provided by these graphs is that even in very aggressive green building scenarios, the environmental impacts associated with development continue to rise over time. This is because this research examines new development exclusively. Additional buildings generate additional impacts, no matter how sensitively they are designed, built and operated. This highlights the importance of the second set of graphs, labelled ‘b’, which show the percent reduction in impacts over time for the two green scenarios relative to the business-as usual scenario. For these graphs, the BAU scenario equals 100% for each milestone year.

Building Energy Use

Significant reductions in building energy use arise from building to a green standard. By 2031, green building alone can reduce energy use from a predicted 5,200,000 GJ/ year for new development in the

BAU scenario to 3,700,000GJ/ year in the GB scenario. This constitutes a 30% reduction in building energy use in 2031. By building a greater diversity of dwelling types, including more apartments and row style homes as envisioned in the GB-CC scenario, building energy use for new development could be expected to drop to 2,700,000 GJ/year, or 48% less than the BAU scenario. This is largely due to the fact that more compact units use less energy for space heating than single family detached homes.

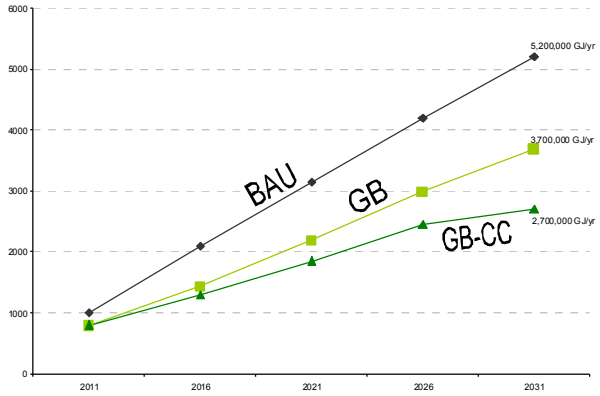

Figure 1a: Building Energy Consumption by Scenario (GJ/year)

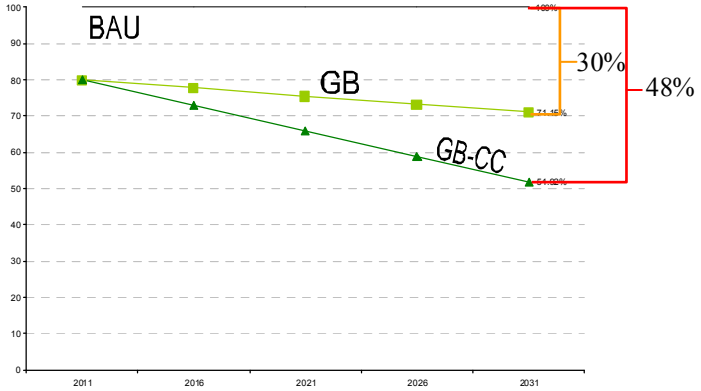

Figure 1b: Percent Reduction in Building Energy Consumption for Green Scenarios (BAU = 100%).

Transportation Energy Use

Transportation energy is measured in litres of fuel consumed and is based on an estimate of vehicle kilometres travelled by residents of new development for each scenario. Land use in the GB scenario mirrors the BAU scenario, so transportation energy is the same in both, rising to 77 million litres of fuel consumed to serve new development in the RDN by 2031. By contrast, reduced transportation demand associated with compact community design results in significant fuel saving in the GB-CC scenario, with 54 million litres of fuel consumed in 2031. This equals about a 30% reduction in fuel consumed to meet transportation needs when compared to the BAU and GB scenarios.

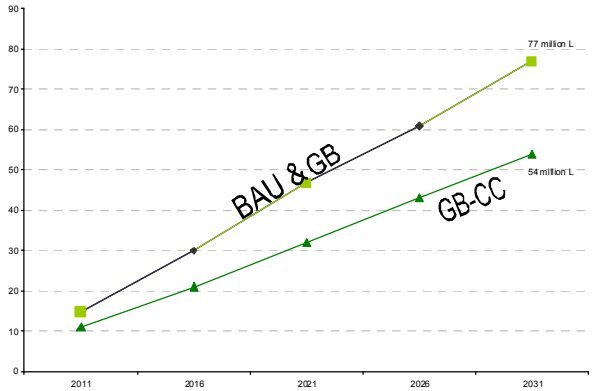

Figure 2a: Transportation Energy Use by Scenario (Millions of Litres/ year)

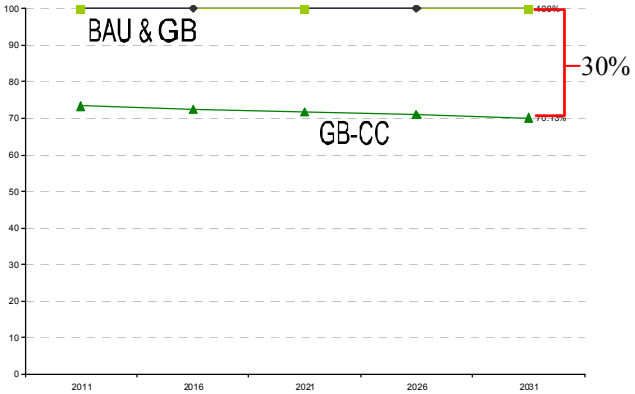

Figure 2b: Percent Reduction in Transportation Energy Use for Green Scenarios (BAU = 100%).

Water Consumption

Figures 3a and 3b highlight the fact that the greatest reductions in water use come from building to a green standard, while less significant reductions are associated with overall development pattern. This is illustrated by the GB and GB-CC scenarios achieving almost the same reductions relative to the BAU scenario. Specifically, in 2031 business-as-usual development will result in 15,000,000 m^3 of water consumed, while green building will consume 8,500,000 m^3 of water (a 43% reduction from BAU), and green buildings in compact communities will consume 8,100,000 m^3 of water (a 48% reduction from

BAU). Volume of wastewater is measured as a percent of total water consumed (84%), consequently the proportions are the same as below, and the graphs are not shown.

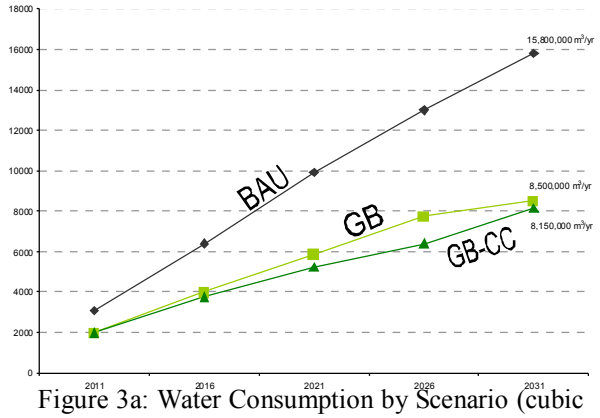

Figure 3a: Water Consumption by Scenario (cubic metres/ year)

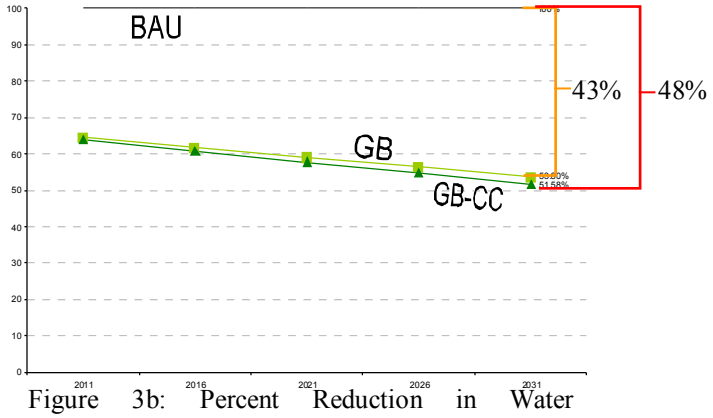

Figure 3b: Percent Reduction in Water Consumption for Green Scenarios (BAU = 100%)

Solid Waste

Solid waste reduction in both green scenarios are achieved through increased diversion potential from implementation of solid waste credits in relevant green building guidelines as well as lower levels of outdoor yard waste due to smaller yards that incorporate sustainable landscape practices. Figures 4a and 4b show that the majority of reductions are achieved through green building, but significant additional reductions will result from more compact development. In 2031, new development in the RDN is predicted to produce 27,000 tonnes of solid waste under BAU conditions, while the GB scenario shows a reduction of 40% to 16,500 tonnes, and the GB-CC scenario shows a reduction of 55% to 12,500 tonnes of solid waste.[1]

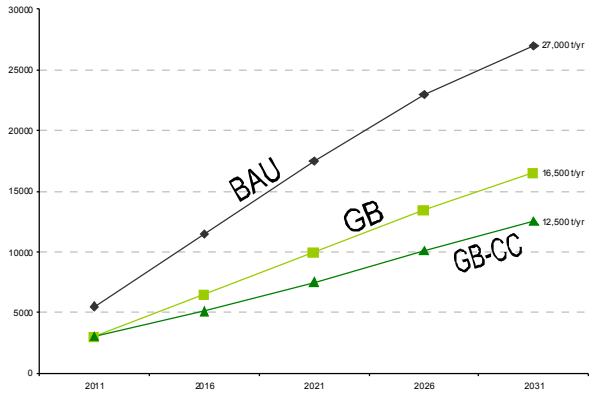

Figure 4a: Solid Waste Generated by Scenario (tonnes/ year)

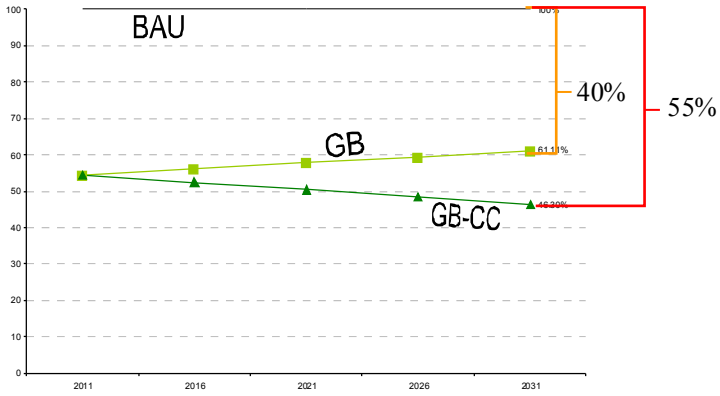

Figure 4b: Percent Reduction in Solid Waste Generated in Green Scenarios (BAU = 100%)

GHG Emissions

Estimates for GHG emissions, measured in tonnes per year, include combined emissions from buildings, solid waste and transportation. In 2031, under business-as-usual conditions, it is estimated that new development in the RDN will emit 339,000 tonnes of GHGs. By building green buildings, that amount can be reduced by 16% to 286,000 tonnes, and by building green buildings in compact communities, GHG emissions can be reduced by 36% of the BAU levels to 218,000 tonnes. This reveals that GHG

[1] This analysis does not take the RDN's Zero Waste Program into consideration.

emissions (and reductions) are more responsive to development pattern than building construction standards.

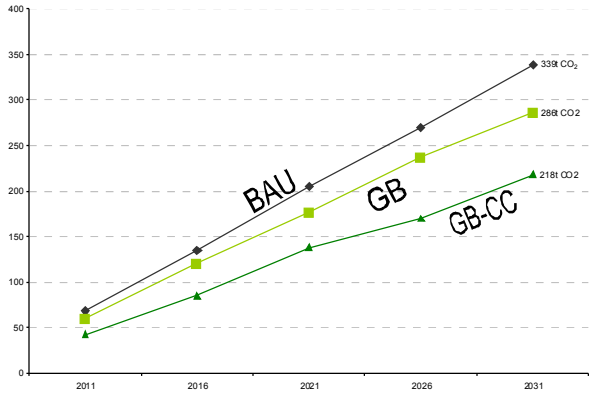

Figure 5a: GHG Emissions by Scenario (tonnes/ year)

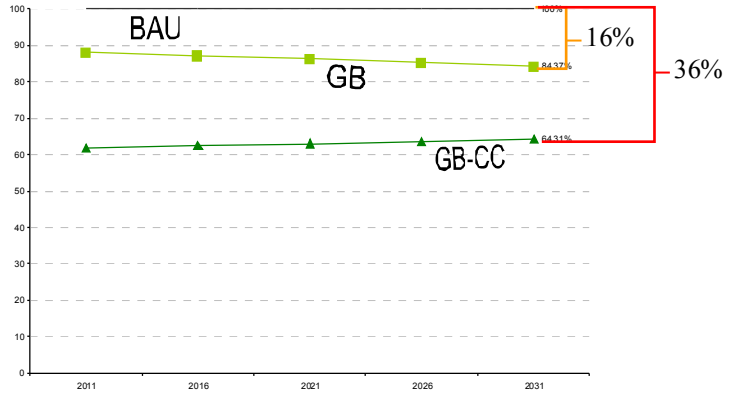

Figure 5b: Percent Reduction in GHG Emissions for Green Scenarios (BAU = 100%)

Land Area

To accommodate new housing development, land must be cleared. Since land use in the BAU and GB scenarios are the same, in both scenarios approximately 2,600 hectares of land will be cleared by 2031to accommodate new housing. Interestingly, this roughly corresponds to the total area of RDN parkland in 2008 (2,632 ha). In the GB-CC scenario, which envisions that all new residential development take the form of multi-family dwellings inside Urban Containment Boundaries, less land is required to accommodate residential development. In 2031, 2,300 hectares, or 13% less land is converted to use for housing.

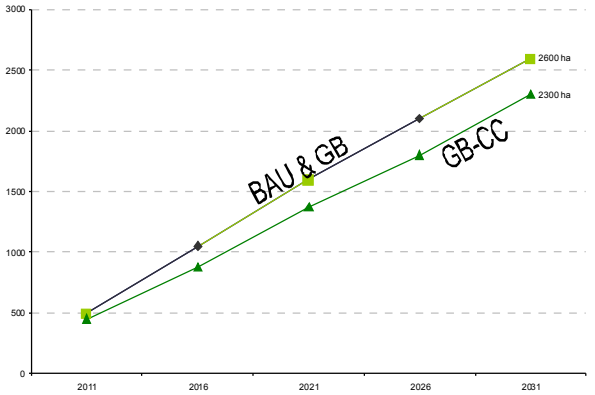

Figure 6a: Land Are Converted by Scenario (hectares)

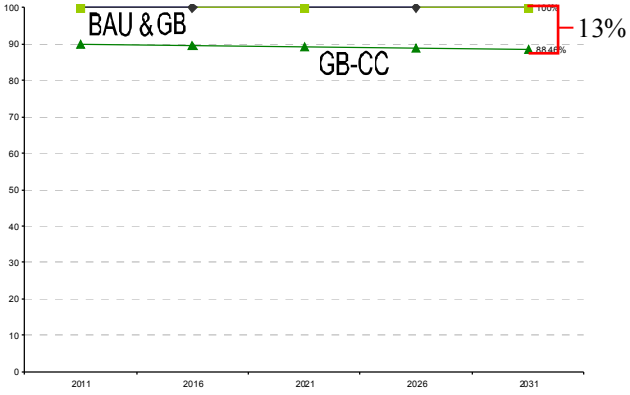

Figure 6b: Percent Reduction Land Are Converted for GB-CC Scenario (BAU and GB = 100%)

ALTERNATIVES

1. That the report "*Benefits of Green Building in the RDN*" be received.

2. That the report "*Benefits of Green Building in the RDN*" be received and staff be directed to continue with the planned research projects identified in the Green Building Action Plan.

FINANCIAL IMPLICATIONS

In addition to quantifying the physical impacts of development, the report also explores the financial implications of the green building scenarios. The annual savings in operating expenditures is estimated to

reach $49 million in 2031 for the Green Building scenario, and $84 million in 2031 for the Green Building-Compact Community scenario. Achieving these savings requires an investment of $640 million and $820 million for the GB and GB-CC scenarios respectively. This investment represents the incremental capital cost of construction over the study period from 2011 to 2031. This incremental capital cost is offset by lower operating costs over the life of the building, represented by a positive net present value of $180 million and $590 million for the GB and GB-CC scenarios respectively. (Sheltair Group, (2008) "*Benefits of Green Building in the RDN"* p. vii).

The direct costs of conducting this research, as well as the remaining research projects identified in the Green Building Action Plan have been incorporated into approved budgets for 2008 and 2009. For 2009, $50,000 has been allocated from the Community Work Fund to hire consultants for two projects:

- Identifying Existing Barriers to the Development of Green Buildings in the RDN
- Identifying Incentives to Create More Green Buildings in the RDN

By measuring and publicly reporting the impacts of new construction in the region, including predicted GHG emissions, this research has the potential to integrate with the evolving emissions measuring, monitoring and reporting protocols currently being established by the Province. Thus, it is expected that this research will have the added value of contributing to the RDNs ability to recoup dollars spent on the Carbon Tax through the Provincial Climate Action Revenue Incentive. The amount the RDN expects to receive through this incentive program remains to be determined.

DEVELOPMENT IMPLICATIONS

The Green Building and Green Building-Compact Community scenarios are extremely aggressive, and it is not envisioned that either scenario will become a reality on the ground. Instead, it is anticipated that the information provided in the report will generate awareness about the benefits of green buildings, as well as greater public demand for green buildings in compact communities. Ideally, this broadened awareness will influence Official Community Plans and the Regional Growth Strategy, and lend the support necessary for the Board to make policy and development decisions that lead to a transition from business-as-usual, toward a more sustainable development pattern for the region.

SUSTAINABILITY IMPLICATIONS

By acting on the findings presented in "*Benefits of Green Building in the RDN*", especially those relating to compact development patterns, the RDN can anticipate reducing the predicted environmental impacts of new development over the next twenty years. This would represent a strong move toward building healthier, more sustainable communities throughout the region, and contribute to fulfilling the goals of the Regional Growth Strategy as well as the Official Community Plans for the municipalities and electoral areas throughout the region.

GROWTH MANAGEMENT IMPLICATION

One of the more striking findings in this research is the significant added benefit of community land-use pattern. In particular, building energy use, transportation energy use and GHG emissions drop significantly when communities are designed to include a diversity of housing types, including higher density multi-family forms. This is because of the increased efficiencies associated with smaller housing forms, and the decreased reliance on the private automobile.

As such, this report provides well-researched quantitative support for the policy direction expressed in the Regional Growth Strategy, and justifies continued effort to promote strong urban containment and vibrant community nodes throughout the region.

PUBLIC CONSULTATION IMPLICATIONS

The "*Benefits of Green Building in the RDN*" report provides an objective quantitative analysis that highlights the environmental and financial benefits of green buildings in compact communities. As such this research will serve an extremely valuable role in the RDN's ongoing efforts at public awareness and education, especially in the review of the Regional Growth Strategy and future OCP reviews. In particular, the report highlights the importance of high density, compact neighbourhood patterns in reducing the impacts of future development in the Region. This is not a widely acknowledged fact. Typically attention focuses on green building as a way to reduce the impacts of new development, and this report clearly shows that in many respects development patterns will produce much more significant benefits than green buildings alone.

SUMMARY/CONCLUSIONS

High performance green homes and buildings mitigate the environmental impacts of the built environment while reducing the lifecycle costs of buildings and infrastructure.

Compact development patterns and a balanced mix of housing types further reduce environmental impacts of the built environment. Urban containment limits the area of land converted to use for housing and encourages transportation alternatives to the automobile. A balanced mix of housing types increases the proportion of multi-family dwellings and apartments, leading to greater energy and water efficiency when compared to single-family detached dwellings.

While these general statements are widely accepted as true, the extent to which green building and compact development patterns actually translate into reductions in the impacts of built form on the environment have rarely been quantified.

While assumptions must necessarily be made to proceed with this type of quantitative analysis, the "*Benefits of Green Building in the RDN"* provides a clear picture showing that significant reductions in the environmental impacts of new development can be achieved by following two courses of action:

1. Building new development to a green standard; and
2. Ensuring that new development includes a diversity of housing types and occurs in a compact pattern within Urban Containment Boundaries.

What is especially interesting about the findings presented here is that development pattern appears to have a greater impact than green building standards on many of the impacts considered, particularly building energy use, transportation energy use, and GHG emissions. Since the Regional District of Nanaimo influences development patterns with zoning and land-use regulations, this is valuable information that provides well-founded, well researched support for the goals of the Regional Growth Strategy.

RECOMMENDATION

That this report be received, and that staff be directed to continue with the research projects outlined in the Green Building Action Plan.

Report Writer	General Manager Concurrence
Manager Concurrence	CAO Concurrence