APPENDIX A - TRIPLE BOTTOM LINE ANALYSIS

Very early on, the Advisory Groups and the PRRD recognized that more than "just dollars" should be considered when assessing the cost-benefit profile of various options. As a result, the consideration of a range of social, environmental and financial factors was included as a guiding principle. This approach to evaluating options is also known as a 'Triple Bottom Line" (TBL) assessment. This approach provides a way of evaluating options that takes into account more than just financial cost or value by incorporating indicators of social and environmental benefits, to provide a more holistic understanding of options for the Plan.

Even though there is a clear understanding that environmental and social values exist, measuring these values is more challenging. While there is considerable work being done on environmental and social economics, the PRRD understood that detailed analysis for the region was well beyond the scope of the Plan. To represent the triple bottom line, key indicators were used to provide a representative picture of environmental and social costs and benefits, along with a range of financial parameters. The full range of possible parameters is shown in the table below, although available information varied from program to program.

Table 1: Triple Bottom Line Evaluation Criteria

PARAMETER TYPE	CRITERIA
Financial	Capital Cost ($)
	Annual Operating Cost ($)
	Operating Cost per tonne ($/tonne)
	Approximate Cost per Household ($/household)
	Landfill cost savings (based on $54/tonne lifecycle costs)
Environmental	Net Waste Diversion Potential (tonnes)
	Greenhouse Gas Reduction Potential in tonnes of CO_2/tonne of waste and equivalent # of Honda Civics taken off the road for 1 year
	Landfill space savings in cubic metres, and equivalent volume in # of school buses
Social	Ability to be equitably implemented across region
	Accessibility and convenience

Since this is a high-level plan, exact costs, sizes and configurations of programs and services are still to be determined. However, there was also a need to provide information about potential costs and benefits of implementing the various programs. The following sections outline how the values for each option were determined.

Capital Costs

Capital costs were determined as the costs of upfront activities, e.g. equipment purchases or facility construction. They include soft costs such as financing, engineering and project management. Capital costs exclude cost of land, business licensing, rezoning, permitting and any requirements to construct bench or pilot scale facilities as precursors to full scale plant development. Existing facilities were used where possible to estimate costs for components, or scaled based on the total facility cost to the appropriate size for PRRD.

The PRRD may opt to fund capital work through the use of reserve funds, or borrow money to perform the necessary work. However, it is unknown at this time which capital costs will be financed by which methods. To address this, it was decided that total capital costs would be reported, and that it would be assumed that the capital costs would be spread out only over the duration of the phase in which they were needed in determining annual capital cost requirements. It is important to note that this may therefore be more of a "worse case scenario" in that capital costs might be spread over longer periods, thereby reducing the annual capital cost needs.

Annual Operating Costs

Operating costs are those costs associated with the day-to-day operation and maintenance of a facility or program. This includes staffing, energy, supplies and equipment, and insurance. These costs were based on estimates for existing facilities or programs and the building of operating cost profiles. No revenues, e.g. from product or energy sales, have been accounted for in the financial evaluations.

Operating Cost per Tonne

This was derived from the total operating cost, divided by the expected annual net tonnage that could be diverted by implementing the program.

Approximate Cost per Household

It was recognized that most residents would be best able to judge the financial implications of a program by considering the "cost per household" rather than an estimate of total costs. To determine this, the PRRD identified the following information:

- For every $100,000 in funding that the PRRD needs to raise, there needs to be a charge of $0.01 per $1000 of assessment, with the current PRRD tax base

- This is the residential rate, and there may be multipliers applied to this rate for utilities, industry and businesses
- An “average household” assessment value of $250,000 was used to determine the approximate cost per household.

Lifecycle Landfill Cost Savings

In order to understand the full implications of diverting waste from the landfill, it was necessary to look at the potential cost savings over the entire life of the landfill. To do this, the following were considered:

- Landfill siting, preliminary investigation and public consultation to select a landfill site
- Landfill construction costs over the whole life of a landfill
- Landfill operating costs over the whole life of a landfill
- Environmental Monitoring costs per year, for the whole operating life of the landfill
- Closure costs at the end of the landfill’s life
- Post-closure environmental monitoring costs, for a mandated 25-year period following the closure of the landfill
- The total capacity of the landfill for waste, as a volume in cubic metres
- The estimated compaction level in the landfill, assumed to be 0.6 tonnes/cubic metre

The Bessborough Landfill was used as a template for developing these costs, as the most recent construction and landfill life and capacity information is available for this site. The total life cycle cost of the landfill was computed, and divided by the total capacity in cubic metres to determine a cost per cubic metre, and a cost per tonne using the compaction density. The following were the results:

- Lifecycle Cost per cubic metre = $33/m^3
- Lifecycle Cost per tonne = $54/tonne

The lifecycle cost per tonne was used to calculate the lifecycle savings achieved by diverting waste from the landfill.

Net Diversion Potential

The net diversion potential relates to the amount of material that could be diverted from landfills, less any waste resulting from this program that cannot be otherwise handled. For example, the net waste diversion potential from a yard waste composting operation would be the amount of yard waste kept out of the landfill, less any “non-compostable” materials such as rocks or pieces of plastic that may be contained in the yard waste and need to be landfilled.

Determination of the net waste diversion potential is also dependent of the amount of the material being targeted that occurs in the waste stream. Generally, this is established through a waste audit at the landfill facilities, to assess what is being put in the landfill. As noted previously, the PRRD has not undertaken a formal waste audit, and therefore there is a factor of uncertainty with respect to waste composition. However, waste composition date from the Thompson Nicola Regional District and the Regional District of Fraser-Fort George was used to develop waste diversion estimates for the PRRD.

Table 2 shows the average waste composition (by weight) based on the 13 primary categories used to identify the overall waste stream, based on the data used.

Table 2: Assumed Waste Composition in PRRD Landfills

PRIMARY CATEGORY	PERCENTAGE COMPOSITION
Paper & paperboard	24.06%
Glass	4.28%
Ferrous Metals	4.27%
Non-Ferrous Metals	1.03%
Plastics	13.28%
Organic Matter	24.95%
Wood & Wood Products	5.99%
Construction & Demolition Materials	5.39%
Textiles	5.64%
Rubber	1.25%
Composite Products	8.29%
Hazardous By-Products	1.55%
Other	0.02%
Total	100.00%

The final refinement to the waste composition information was the application of an assumed combination of food waste and yard waste to make up the total organic component. It was assumed that 40% of the organic fraction was yard waste, and 60% food waste.

Waste generation data from 2006 was used as the baseline year for determination of waste quantities. Table 3 summarizes the waste quantities received for disposal at the four regional landfill sites in 2006. Materials received for recycling at these sites was excluded, as this material is already being successfully diverted from landfill.

Table 3: 2006 Waste Disposal Tonnages

Facility Name	2006 Total Waste Disposed (tonnes)
Fort St. John Landfill	39,898
Rose Prairie Landfill	2,000*
Bessborough Regional Landfill	18,145
Chetwynd Landfill	7,399

* estimate only, no weigh scale on site

The percentage composition data was applied to the total amount of waste landfilled from all four regional facilities. This provided an estimate of the quantities of the various material types on the waste stream. Diversion potential was based on these assumed quantities of material, as well as conservative estimates about the participation rates and capture rates that could be achieved for this material. The participation rate is determined as the percentage of the target group, e.g. residents, that is likely to regularly participate in a program. The capture rate is more material-related, and refers to the portion of a given material that is likely to be readily diverted, e.g. materials typically ending up in a recycling program as compared with smaller amounts that may become litter, and therefore not recycled.

In general, the following were assumed, although other rates may be used as appropriate:

- A participation rate of 75% for programs which involved curbside collection of material, e.g. curbside recycling programs, as it is anticipated that the ease of use will cause participation levels to be high. This participation rate was also used for some ICI programs where it was assumed that significant education efforts targeting this sector would drive participation levels up.
- A participation rate of 50% for drop-off programs, where residents would be required to make a greater effort to participate in the program
- Capture rates of 5% - 50% depending on the type of material and the type of program

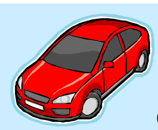
The proportion of the total waste stream contributed by each sector was also taken into account. Where a program or service was expected to consider only one sector's waste, e.g. residential, the capture and participation rates were applied only to the residential portion of the waste stream. Provincial averages for waste generation were used.

It should be noted that in some cases where proposed program options target very specific materials, estimates of diversion potential were unable to be determined, as these categories were not identified separately. For example, one of the potential programs proposes new opportunities for agricultural plastics such as silage wrap, but as all plastics were grouped together, the specific diversion associated with removing silage wrap from the waste stream could not be determined at this time.

Greenhouse Gas Reduction Potential

It is recognized that the implementation of waste diversion programs can have a positive impact to reduce the amount of greenhouse gas emissions that would otherwise arise if the material was landfilled. The amount of greenhouse gas reductions is linked to the type of program or process, as well as the types and quantities of material targeted. Greenhouse gas emissions associated with different programs are based on case studies for different technologies and a representative range of materials in the typical municipal waste stream. These greenhouse gas emissions should be viewed as order of magnitude estimates only, as the actual greenhouse gas emissions will be directly influenced by the specifics of the waste being treated, and the technology or process being applied. Since precise locations of facilities were unknown, no calculations for emissions based on transportation were performed.

A model was used to relate the amounts of material recycled, composted or otherwise diverted from landfill, to greenhouse gas emissions reductions. Since there are many different types of greenhouse gases including carbon dioxide or CO_2, the industry standard is to express the amounts of the various different gases in equivalent amounts of CO_2, which results in the units of "tonnes of CO_2 equivalents".



Greenhouse gas emissions for the Honda Civic were based on standard annual fuel consumption estimates for an annual distance traveled of 25,000 km, with 55 percent city and 45 percent highway driving. Under these parameters, a 2007 automatic Honda Civic produces about 5.7 tonnes of CO_2 eq/year.

In order to make this simple to visualize, the greenhouse gas emissions reductions were presented in terms of "number of Honda Civics taken off the road for 1 year". This is because the savings or reductions are annual, and would occur each year the program was in place.

Landfill Space Savings

This is the amount of space that materials to be diverted would take up in the landfill. It is based on the net diversion potential tonnage and the space taken up per tonne of material.

To assist in visualization, the landfill space savings were converted to an equivalent number of school buses. The typical "big yellow school bus" has a volume of about 60 m^3.

Accessibility and Convenience

All programs or services were rated with these social parameters, as indicators of how easy it would be for residents in the PRRD to access and use the programs. Programs and services that were offered directly to residents, e.g. collection of materials at the residence, were ranked as "High" in these terms, while programs that required more effort on the part of participants were scored lower.

Ability to be Implemented across the Region

As outlined in the guiding principles, there was a need to prioritize those programs that could make access to service more even for both rural and urban areas. Programs that could readily be implemented region-wide scored best, while those programs that were more suited to one or the other scored less favorably.