DISCUSSION PAPER

Capital Regional District
Core Area Wastewater Management Program

Discussion Paper - Identification and Evaluation of Resource Recovery Opportunities
036-DP-1

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1 Introduction

At the request of the Provincial Government, the Capital Regional District (CRD) is advancing plans to provide secondary wastewater treatment to the Victoria region. The principles of Integrated Resources Management will be the framework for the planning and design of this secondary treatment program. Integrated Resources Management means the consideration of many elements, including provisions to provide means of adapting to climate change and reducing impacts to global warming. The CRD has embraced the need for additional wastewater treatment as an opportunity to integrate resource management into its Core Area Wastewater Management Program.

The Core Area Wastewater Management Program consists of four key elements:

- Source control
- Distributed wastewater treatment
- Resource recovery
- Wet weather flow management

This discussion paper presents a summary of the initial steps, data, assumptions, and results involved in the resource recovery evaluation element to date. This includes the identification and evaluation of the resource recovery opportunity areas as a component of selecting and siting wastewater treatment system options.

Technical Memoranda are appended to this document to provide more detail. Table 1 lists the appendices.

Table 1
Appendices

Appendix A	
	TM No. 1: Potential Uses for Reclaimed Heat from Raw Wastewater and Treated Effluent
	TM No. 2: Wastewater Heat Recovery—Site Evaluation Screening Process
	TM No. 3: Wastewater Heat Recovery—Options for Effluent Heat Recovery at Treatment Plants
	TM No. 4: Heat Recovery Systems Minimize Sizing Criteria
	TM No. 5: Wastewater Heat Recovery—Heating Options in Non-plant Uses
	TM No. 6: Available Wastewater Heat Reclamation Technologies
	TM No. 7: Comparison of Wastewater to Ambient Air as Heat Sources for Heat Pumps
	TM No. 8: Technical Analysis of Available Heat Exchangers and Heat Pumps
	TM No. 9: Viability of Using Raw Wastewater or Plant Effluent for Space Cooling
Appendix B—Projecting Energy Demand for the Core Municipalities in 2020 and 2065	
Appendix C—Heat Energy Recovery from the CRD Wastewater System	
Appendix D—Resource Recovery Evaluation Methodology, Performance Ratings, and Results	
Appendix E—Utilization of Recovered Heat Energy from Municipal Wastewater	
Appendix F—Energy Recovery Opportunity Areas—Environmental Analysis	

2 Resource Recovery Approach

Wastewater is not a waste product. It is a resource containing rejected energy (organics, heat, and nutrients) from homes, businesses, institutions, and industries; and it contains reclaimable water for non-potable use. Recognizing that wastewater systems contain a resource and not a waste product lies at the heart of a resource recovery focus in the CRD secondary treatment program. Recovery of these resources has the potential to meaningfully reduce fossil fuel use, greenhouse gas emissions, and the demand on water systems for non-potable uses. Because of the meaningful potential, resource recovery must be a fundamental element in the selection of the most appropriate wastewater treatment system.

The CRD has identified five potential areas of opportunity within the wastewater system for resource recovery:

1. Energy and residuals from organic solids
2. Wastewater heat energy
3. Water reuse

4. Nutrient recovery
5. Pressure energy

The focus of this Discussion Paper is the wastewater heat energy recovery and the water reuse opportunities within a distributed wastewater treatment system. Energy recovery from organics is discussed in more detail in Discussion Paper 031-DP-3 entitled "*Biosolids Management/Organic Residuals Energy and Resource Recovery*" and will be further discussed in 031-DP-9. Nutrient recovery is discussed in Discussion Papers 031-DP-5 entitled "*Phosphorus Recovery*" and 031-DP-8 entitled "*Urine Separation*".

2.1 Heat Energy Recovery

Heat energy recovery from wastewater can be conducted from both the raw wastewater and the effluent. The low-grade heat extracted from raw wastewater and effluent can be used for space heating and water heating. The basic process by which heat energy can be extracted from wastewater is the heat exchange between the wastewater and a carrier fluid. A closed-loop pipe system would distribute the heat to end users. Heat exchangers and heat pumps are technologies that can be used for wastewater heat energy extraction. Captured energy may then be used in both heating and cooling.

The utilization of wastewater as a source for heat reclamation is more effective than the method of utilizing outside air. Wastewater supplied heat will be consistently more efficient year round and up to 1.5 times more efficient in the colder months. (Appendix A—Resource Recovery Technologies—provides a great deal more information on heat recovery technologies.) For these reasons, heat recovery from wastewater is an important component of an integrated resource strategy.
Energy supply in the form of heat contained in the wastewater and demand for space heating was used for this analysis. Energy recovery was assumed to be an important driver in defining the location of resource recovery opportunities in 2020 and 2065.

2.2 Water Reuse

Water reuse can be defined simply as the use of treated wastewater (i.e. effluent) in a beneficial manner. Such reuse is dependent on water reclamation, where wastewater treatment provides product water that meets definable criteria for reuse. On the basis that suitably high-quality water can and is produced from municipal wastewater, the potential for reclaimed wastewater reuse spans a broad category range—from agricultural and landscape irrigation to groundwater recharge and industrial uses.

Note that water reuse is clearly differentiated from water recycling. Water recycling refers to both development-level and household-level collection of water from sources such as roofs, showers, and laundry and use of this 'grey-water' in areas such as lawn irrigation or toilet flushing. Water recycling is not part of water reuse and was not part of this analysis.

Development of water reuse systems is not a significant challenge from a technical perspective. Many areas are already doing this, and the means and methods of accomplishing water reuse are fairly well understood. However, water reuse must be tailored to local conditions and this is where the challenges emerge. A gradual increase of water reclamation for both indoor and outdoor uses will occur over time as a demand management tool and as a financial strategy for developers. The constraint in planning for water reuse in a decentralized plan results from the very limited time period water reuse will occur for irrigation and the difficulty in forecasting any significant indoor re-use demand.

Given these challenges, for the purposes of this evaluation, we have incorporated water reuse wherever an efficient and effective energy recovery opportunity exists so those together—reuse and energy recovery—make use of treatment facilities. This will enable both inside and outside water reuse development in conjunction with energy recovery and heating district systems. While heat energy recovery and water reuse are the focus in the short term, the CRD is planning for several decades in the future. The intent is to establish the fundamental concept and facility siting decisions so that, over time, wastewater management truly becomes part of the water and energy resources in the community.

3 Heat Demand Analysis

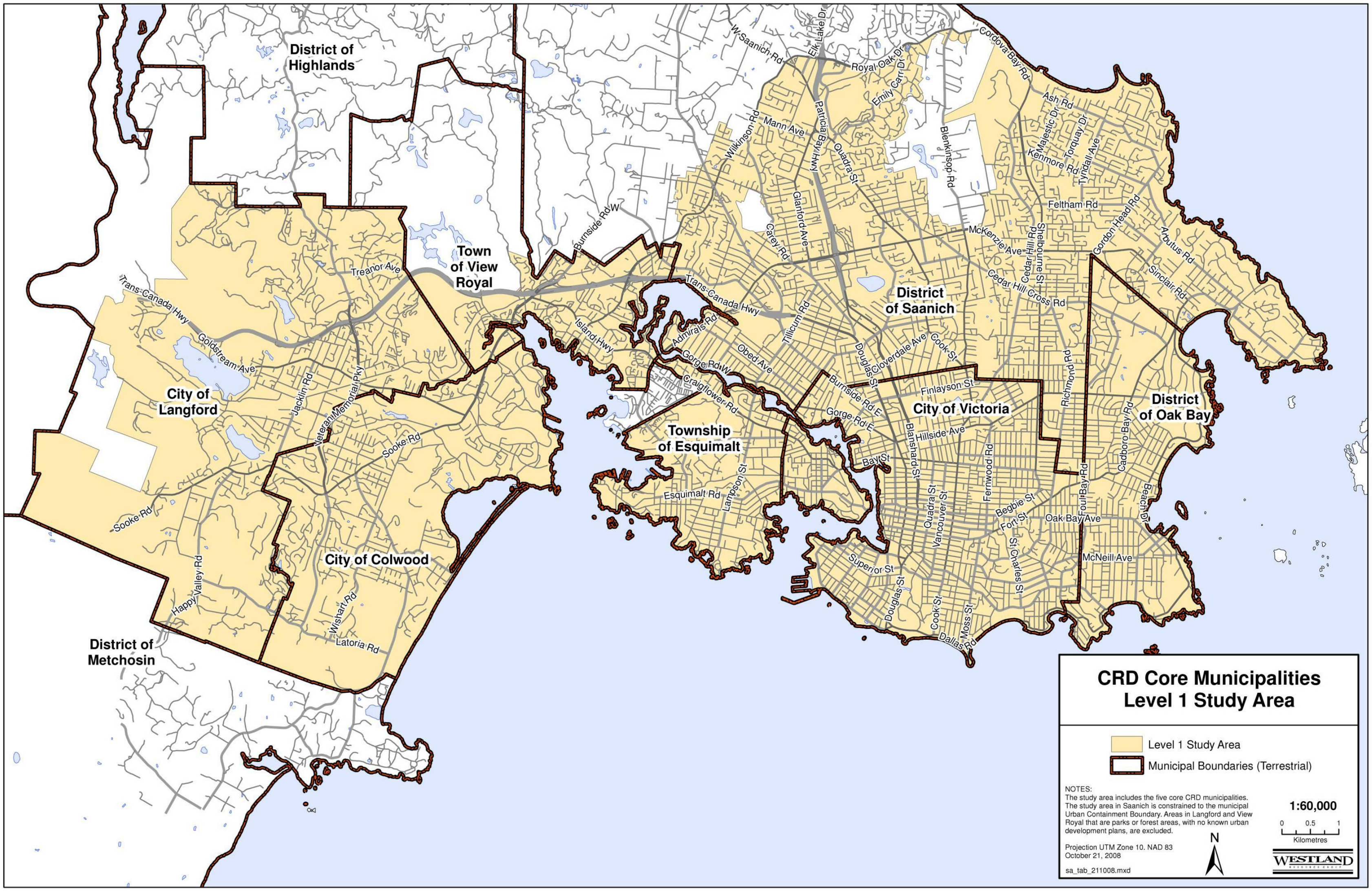
In order to better understand the heat recovery opportunities that may exist in the CRD, energy demand estimates were developed for the CRD study area in the current, 2020, and 2065 timeframes for the municipalities of Colwood, Esquimalt, Langford, Oak Bay, Saanich, Victoria, and View Royal (Figure 1). The estimated energy demand was projected for relatively large areas, not individual land parcels, based on existing and future planned land use.

Since the heat recovered from wastewater is a low-grade heat, the most effective use of the energy would be with a District Energy System (DES) arrangement through boiler systems and/or water heaters. In a DES arrangement, heat pumps in buildings would typically transfer the heat energy from the closed-loop system to either a forced-air or radiant floor heating system to distribute heat throughout the building. The DES arrangement does not currently exist within the CRD study area; however, new development and redevelopment opportunities in the future can integrate DES arrangements into the design.

Current hot water systems for most buildings consist of an electric or gas powered water heater boiler that serves the domestic hot water needs. Changing to a system that is primarily heated by recovered heat from wastewater would require a few changes. First, the boiler would be taken off the primary loop, and the piping would run either directly through a large heat pump, or from a storage tank. For a majority of the operating time the 55ºC water, preheated from the wastewater, would be enough to service the needs of most buildings' consumers.

The current heat recovery opportunities are with existing boilers. Existing boiler locations, unit types, and capacity were supplied by the BC Safety Authority (BCSA) in February 2008. Boilers

Figure 1
Level 1 Study Area



were classified into three types in the BCSA database: hot water, low-pressure steam, and high-pressure steam. Of these, only hot water boilers are compatible with the low-grade heat supplied, and as such, boiler inventories evaluated for heat recovery opportunities only include hot water boilers. The hot water boiler's capacity was then used to estimate a total heat demand for a given building. Figure 2 shows the existing boiler demands.

The process for developing 2020 and 2065 energy demand estimates for the core area involved three main phases: Information Collection, Floor Area Ratio Calculation, and Energy Demand Projection. Details of this methodology and results can be found in Appendix B—Projecting Energy Demand for the Core Municipalities in 2020 and 2065.

3.1 Information Collection

The intent of the Information Collection phase was to provide a better understanding of existing and planned land uses in the study area. Information on the existing and planned land uses was obtained from Official Community Plans (OCPs) for seven municipalities, the CRD Regional Growth Strategy (RGS), and zoning bylaws for the various municipalities. An OCP builds on the input of community members, municipal staff, and consultants to create a broad strategy to direct growth, servicing, and development in a municipality.

Once the land use data was obtained and reviewed, further discussions with the planners and representatives from the City of Colwood, CRD, Department of National Defence (DND), District of Oak Bay, District of Saanich, Juan De Fuca Recreation Centre, Queen Alexandra Foundation, Royal Roads University, Town of View Royal, and the University of Victoria was conducted to refine the data with the most current assumptions.

The data from the OCPs, RGS, and zoning bylaws were then converted into Geographic Information System (GIS) layers to show all the land use designations for the various municipalities.

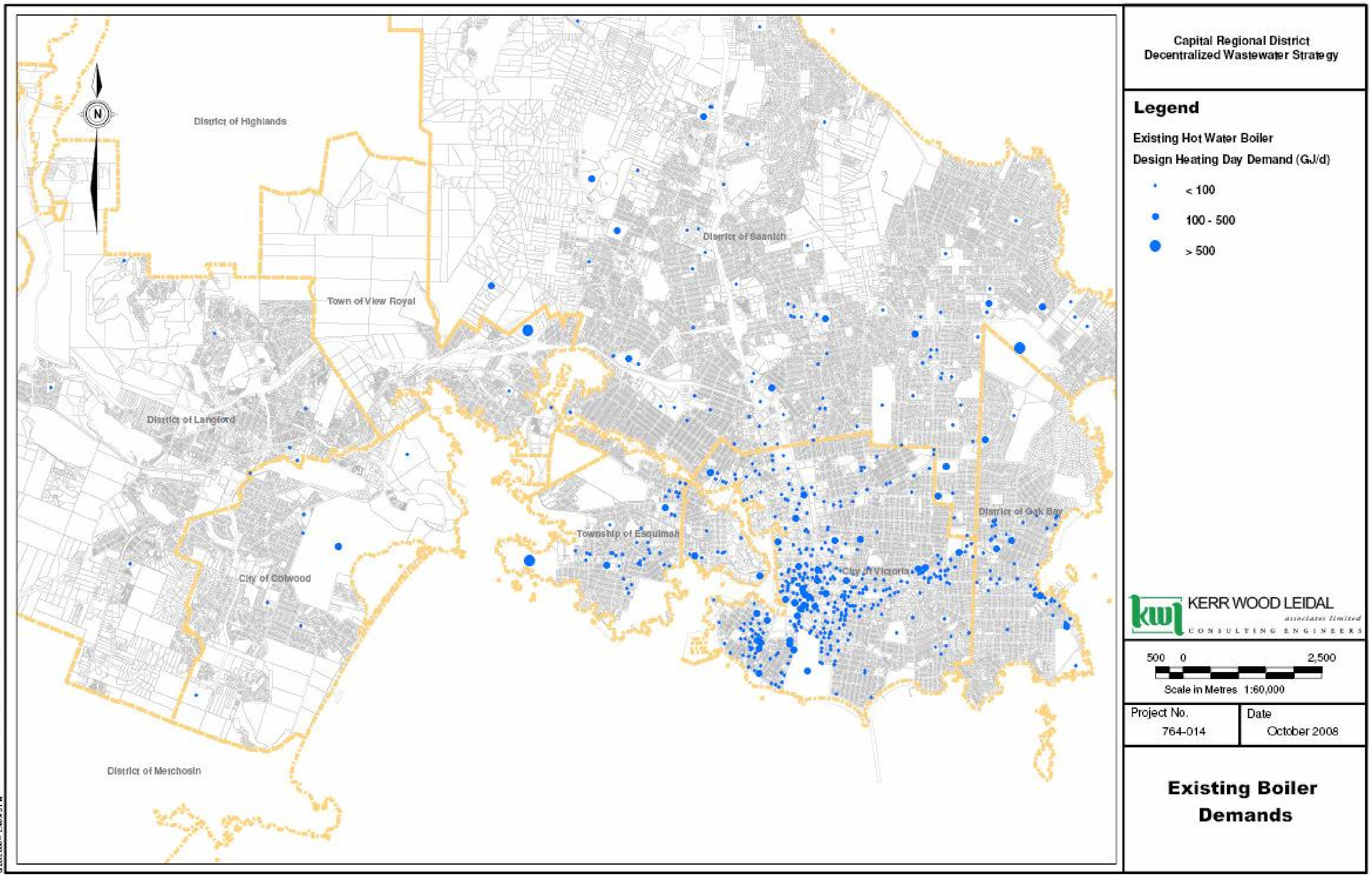
3.2 Floor Area Ratio (FAR) Calculation

Based on information collected through the review of OCPs, zoning bylaws, ortho photos, and local experience, preliminary floor area ratios (FARs) were developed for each of the land use categories. A FAR is a measure of development density, presented as the area of buildings relative to the size of the land parcel. FARs are used to estimate the building area that requires energy, either for heating or cooling. Population projections for the 2015, 2045, and 2065 time periods were also reviewed to determine FARs for 2020 and 2065.

3.3 Energy Demand Projection

To develop energy demand values for the land use designations, energy use values based on building types were applied to the land use designation and the FARs.
Energy use values were determined for five building types:

Figure 2
Existing Boiler Demands



1. Education
2. Office
3. Health care
4. Retail trade
5. Residential

For each of these five building types, energy demand values were provided for space heating, water heating, and space cooling, measured as megajoules per square metre per year (MJ/m2/yr). The calculated energy values (FARs multiplied by energy demand values) were then assigned to each of the land use designations. If the land uses in a specified area were uniform (e.g., residential), then a single energy value could be applied. For mixed use areas, the energy values reflect the proportional area of each land use in the area. For instance, if an area is 50% office and 50% residential, these proportions would be reflected in the calculation of energy demand.

Figures 3 and 4 show the annual energy demand values in Gigajoules per hectare per year (GJ/ha/year) for years 2020 and 2065.

4 Heat Supply Analysis

The amount of heat recovered from raw wastewater or treated effluent depends on the amount of heat available in the system. Parameters such as wastewater and effluent temperature, flow rate, heat transfer efficiency, and specific heat capacity will impact the amount of heat energy available. Taking all these factors into consideration, for the heat recovery technology to be feasible, pipes in the existing collection system greater than 450 mm diameter carrying raw wastewater were considered suitable for heat extraction. This formed the basis for development of a GIS-based sewer heat energy supply model, with heat estimates for 920 individual pipe segments within the CRD study area.

Figures 5, 6, and 7 contain a breakdown of the current (2005) and future (2020 and 2065) gross heat supply potential using the current gravity interceptors and force mains system within the study area. The units presented are Giga-joules per day. The color coding on the maps classifies the size of heat supply per pipe section.

Appendix C— Heat Energy Recovery from the CRD Wastewater System addresses the details of the supply analysis. Discussion paper 31-DP-06 *Heat Recovery* provides an overview of technology that can be used to recover heat from wastewater and effluent.

5 Identification of Energy Recovery Opportunity Areas

There are two goals in this identification task. The first goal is to identify those areas within the CRD where there is an efficient and effective opportunity to recover heat within the wastewater conveyance system and/or an opportunity to use the wastewater system as a receptor of waste heat in cooling systems. The second goal is to identify areas where water reuse can be

Figure 3
Energy Demand 2020

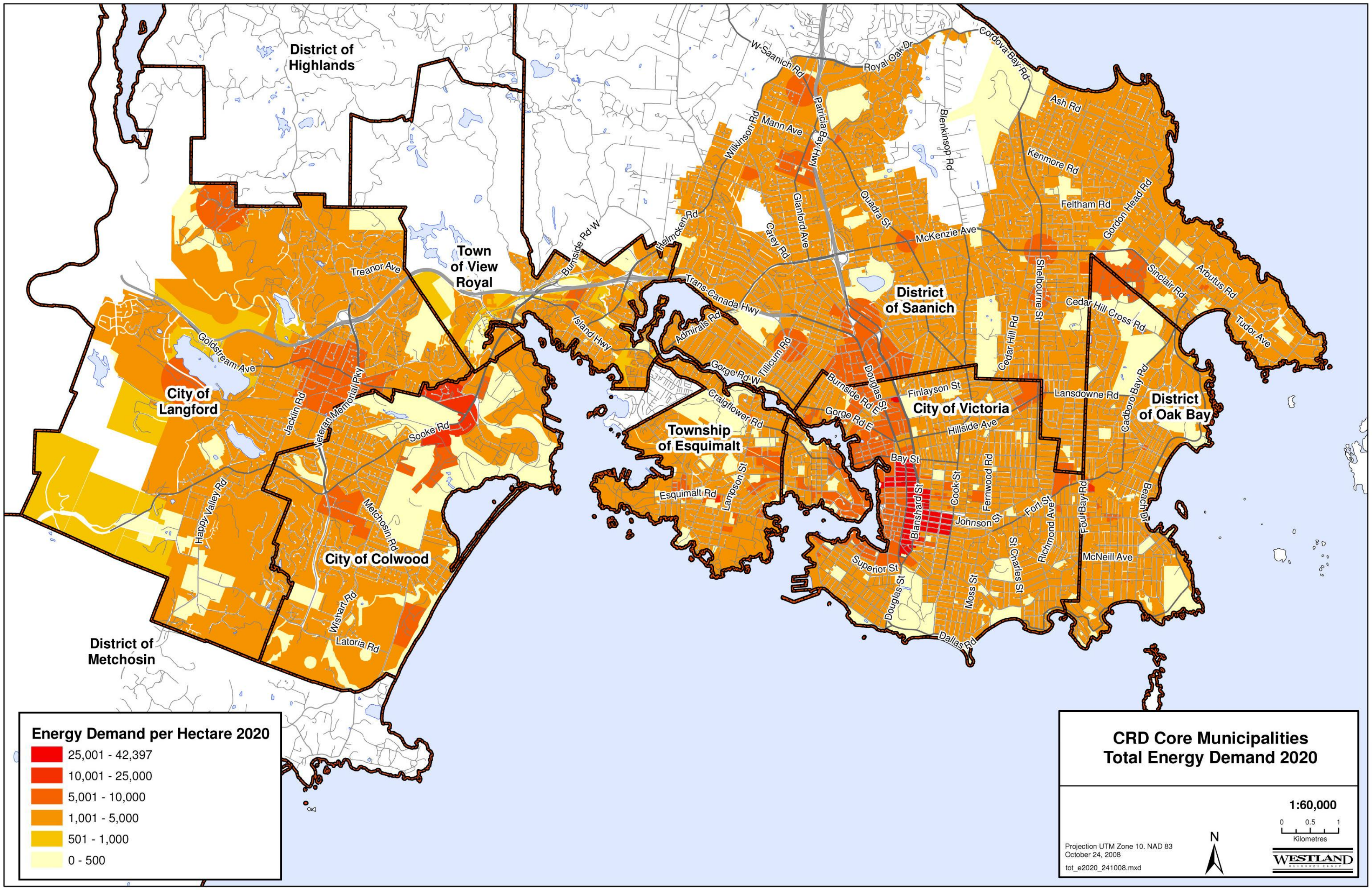


Figure 4
Energy Demand 2065

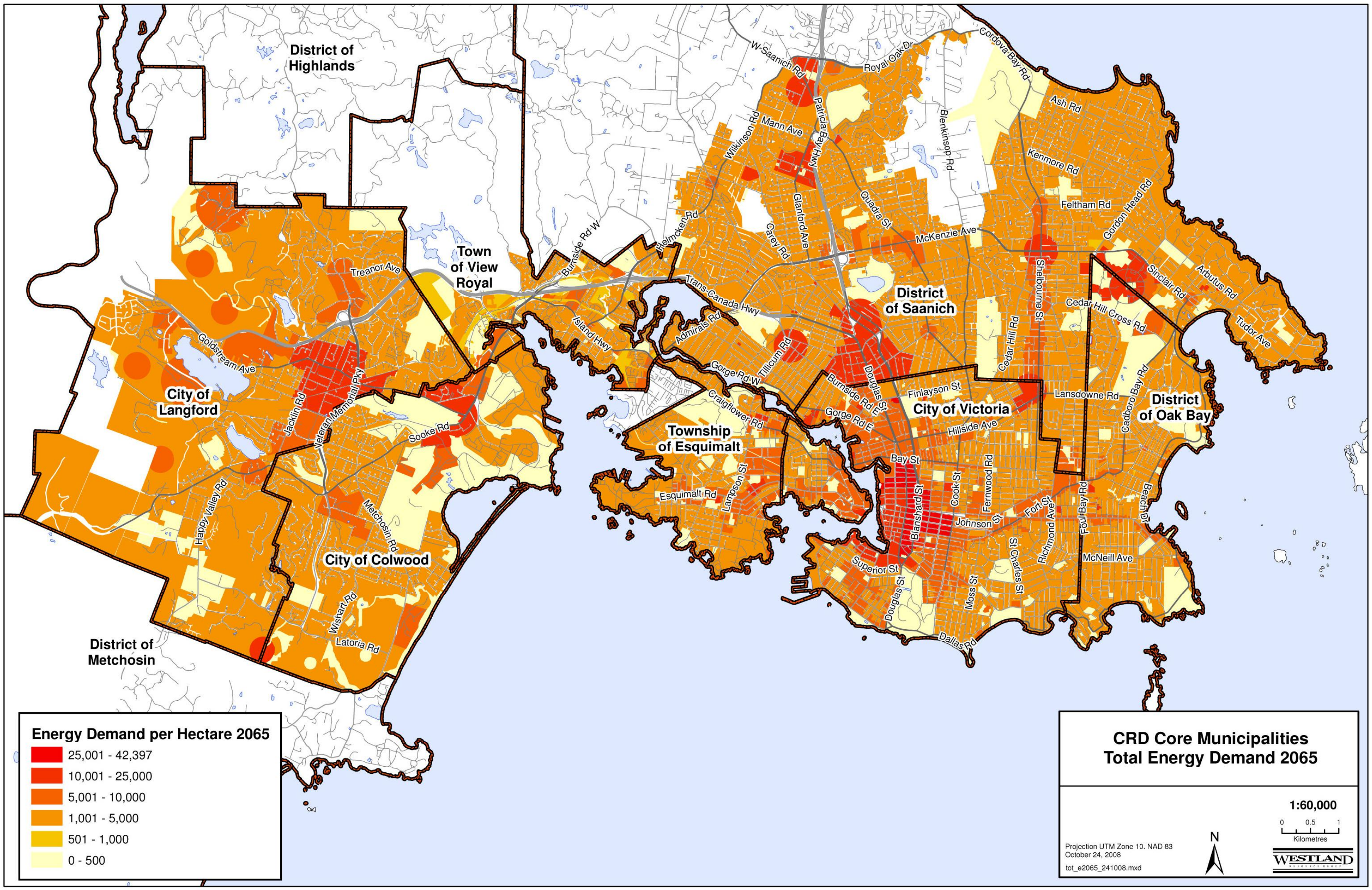
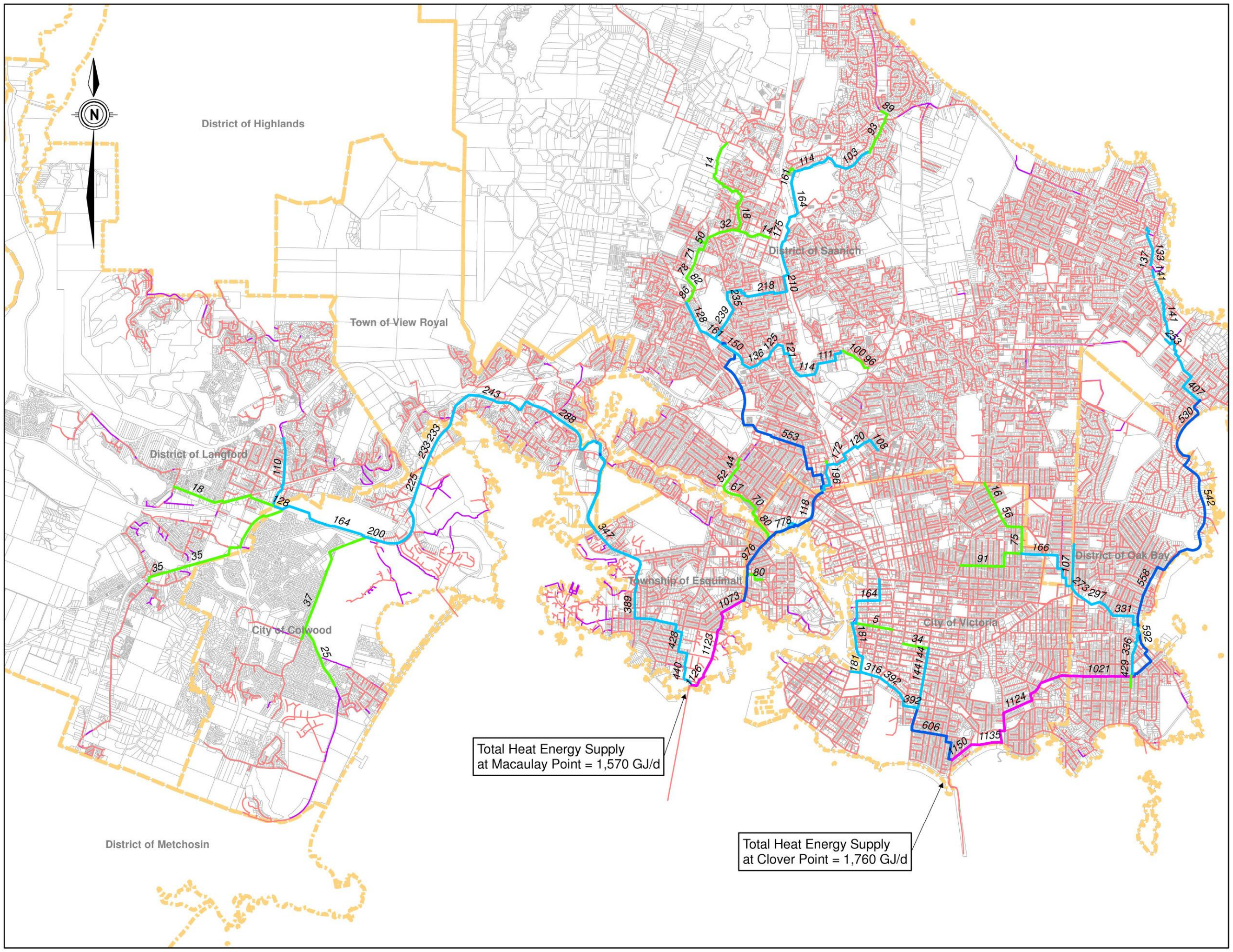


Figure 5
2005 Sewer Heat Energy Supply Potential



Capital Regional District
Decentralized Wastewater Strategy

Legend

Existing Trunk Sewer (450+ mm dia.)
Heat Energy Supply (GJ/d)

- < 100
- 100 - 500
- 500 - 1000
- > 1000
- Existing Gravity Sewer Main
- Existing Pressure Sewer Main

Notes:

(1) Numbers in *Italics* indicate heat energy supply in GJ/d for each pipe section.

(2) Heat energy is based on Average Dry Weather Flow (ADWF) from regional sewer model data.

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CONSULTING ENGINEERS

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Project No.	Date
764-014	October 2008

2005 Sewer Heat Energy Supply Potential

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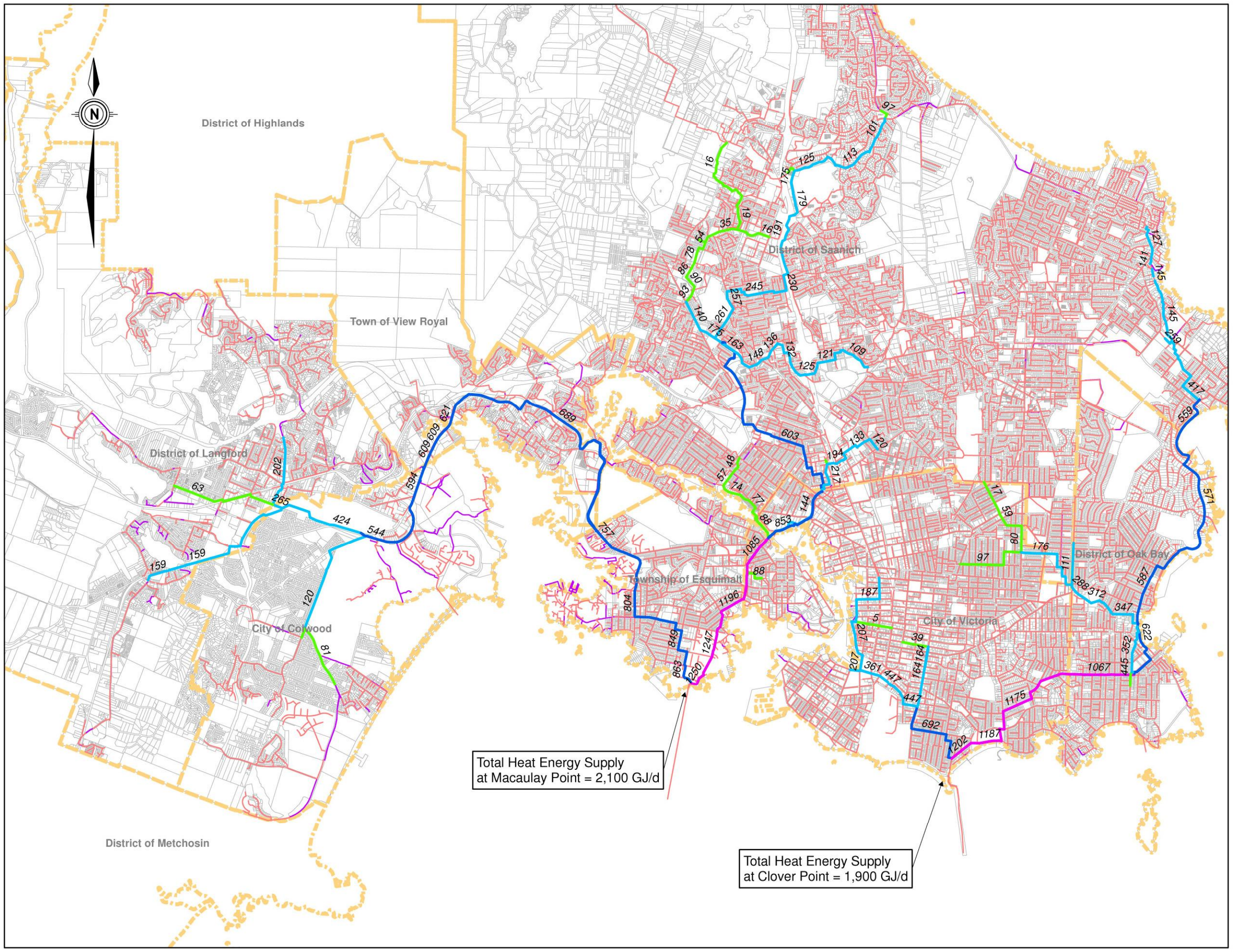
Figure 6
2020 Sewer Heat Energy Supply Potential



Capital Regional District
Decentralized Wastewater Strategy

Legend

Existing Trunk Sewer (450+ mm dia.)

Heat Energy Supply (GJ/d)

- < 100
- 100 - 500
- 500 - 1000
- > 1000
- Existing Gravity Sewer Main
- Existing Pressure Sewer Main

Notes:

(1) Numbers in *Italics* indicate heat energy supply in GJ/d for each pipe section.

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2020 Sewer Heat Energy Supply Potential

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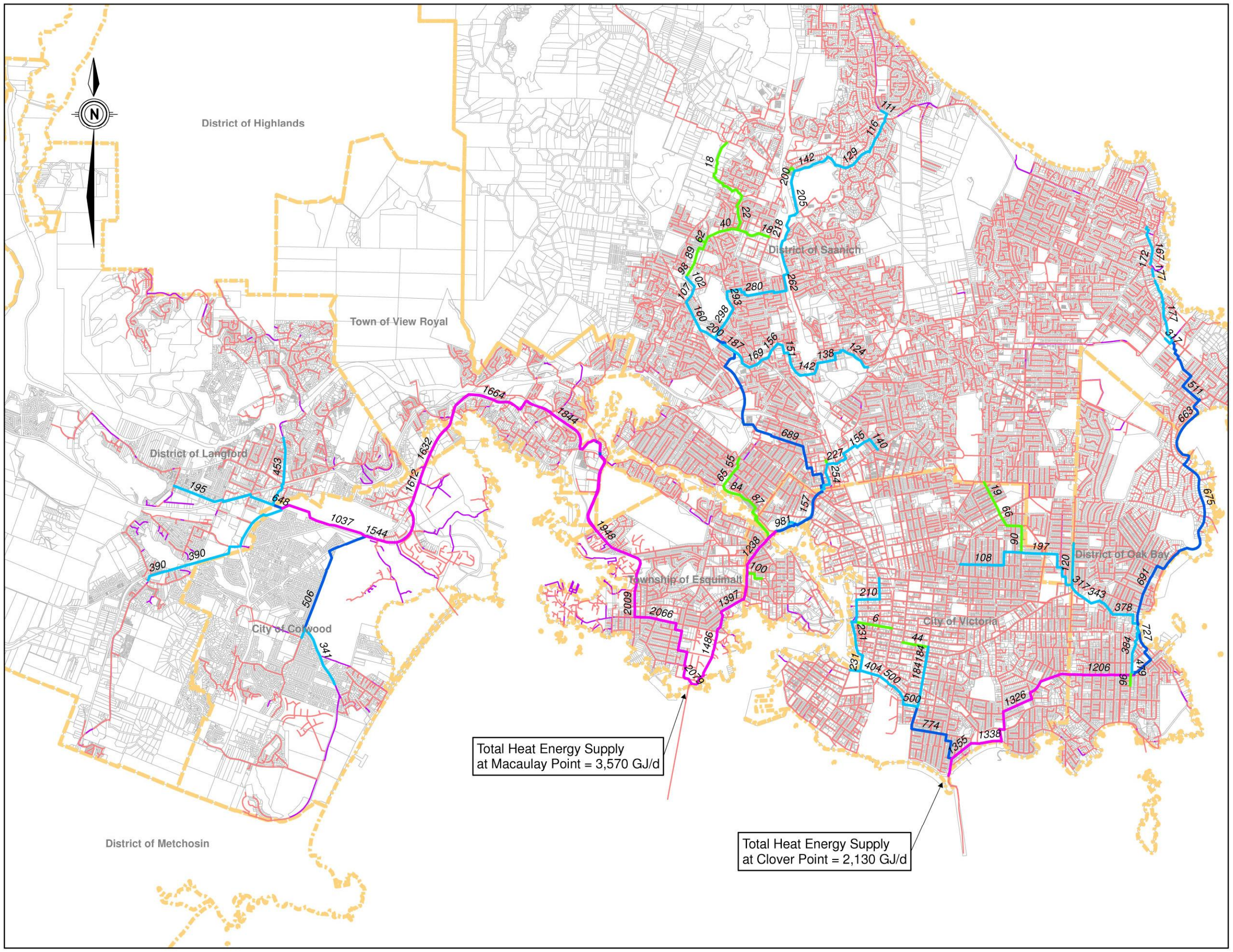
Figure 7
2065 Sewer Heat Energy Supply Potential



Capital Regional District
Decentralized Wastewater Strategy

Legend

Existing Trunk Sewer (450+ mm dia.)

Heat Energy Supply (GJ/d)

- < 100
- 100 - 500
- 500 - 1000
- > 1000
- Existing Gravity Sewer Main
- Existing Pressure Sewer Main

Notes:

(1) Numbers in *Italics* indicate heat energy supply in GJ/d for each pipe section.

(2) Heat energy is based on Average Dry Weather Flow (ADWF) from regional sewer model data.

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Project No.	Date
764-014	October 2008

2065 Sewer Heat Energy Supply Potential

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accomplished in conjunction with heat recovery and tertiary treatment facilities. While water reuse is an important part of the integrated resource strategy, the current infrastructure within Victoria does not allow CRD to maximize the use of water reuse. However, CRD's pursuit of a distributed wastewater management strategy will provide the organization with the flexibility to adopt a more aggressive water reuse recovery strategy in the future. Therefore, energy recovery was the driving force behind defining opportunity areas.

5.1 Identification Process

Location is critical to the process of heat recovery, as there must be not only a large enough cache of heat within the wastewater, but there must also be a ready consumer nearby to make heat recovery an efficient choice. Energy losses between the heat source and end user will increase with temperature and distance. In addition, preference should be given to large point loads over distributed small loads to take advantage of the density of heat demands.

Four steps were used to define areas of resource recovery opportunity.

1. Forecasting space heating demand. This forecast of heat demand was based on mapping of land use and floor area ratios.

2. Identification of space heating density notes or aggregation of heat demand that might possibly support a heating district or large heat recovery facility based on boiler-based heating systems.

3. Defining technology for heat recovery and limiting factors. (This information is further detailed in the Appendix A.)

4. Forecasting heat supply contained within the wastewater conveyance system.

GIS maps were created with "polygons" identifying the location of areas of opportunity using the information developed in each of the four steps. Polygons are shapes based upon the results of the analysis and the natural and land use features of the area. The GIS system allowed an analysis to be performed on the relationship between demand and supply, with a focus on identifying areas that offered the greatest opportunity to maximize the recovery of energy.

Based on the heat demand and supply GIS maps generated, locations having a greater-than-average opportunity for using heat reclaimed from wastewater were identified. Such areas have one or more of the following characteristics:

- High density of commercial or residential development

- Aggregations of institutional structures, such as hospitals or universities

- Redevelopment potential during the timeframe of the wastewater project as determined from OCPs and local knowledge
- Presence of hot water (not steam) boilers

5.2 EROAs Defined

Considering these characteristics, the distributed plant analysis team delineated 39 Energy Recovery Opportunity Areas (EROAs) in the Core Area. The EROAs represent areas within the CRD where there is an efficient and effective opportunity to recover heat within the wastewater conveyance system. The EROAs are listed in Table 2 below by number and name, and displayed graphically on Figure 8.

The EROAs are different sizes and shapes. The shapes vary because the EROAs identified by the study team represent:

- Generalized “neighbourhoods,” such as James Bay and Old Town
- “Developed” portions of institutional properties, such as the University of Victoria or Royal Roads University, excluding ecologically sensitive or other undevelopable areas
- Concentrations of structures with boilers, such as Fort Street
- “Circles” that depict development nodes identified in official community plans (OCPs) and the Regional Growth Strategy (RGS), such as Burnside-Tillicum, Westhills and Olympic View
- General boundaries of areas slated for redevelopment, such as Town and Country, Rock Bay, Colwood Corners, and Esquimalt Centre

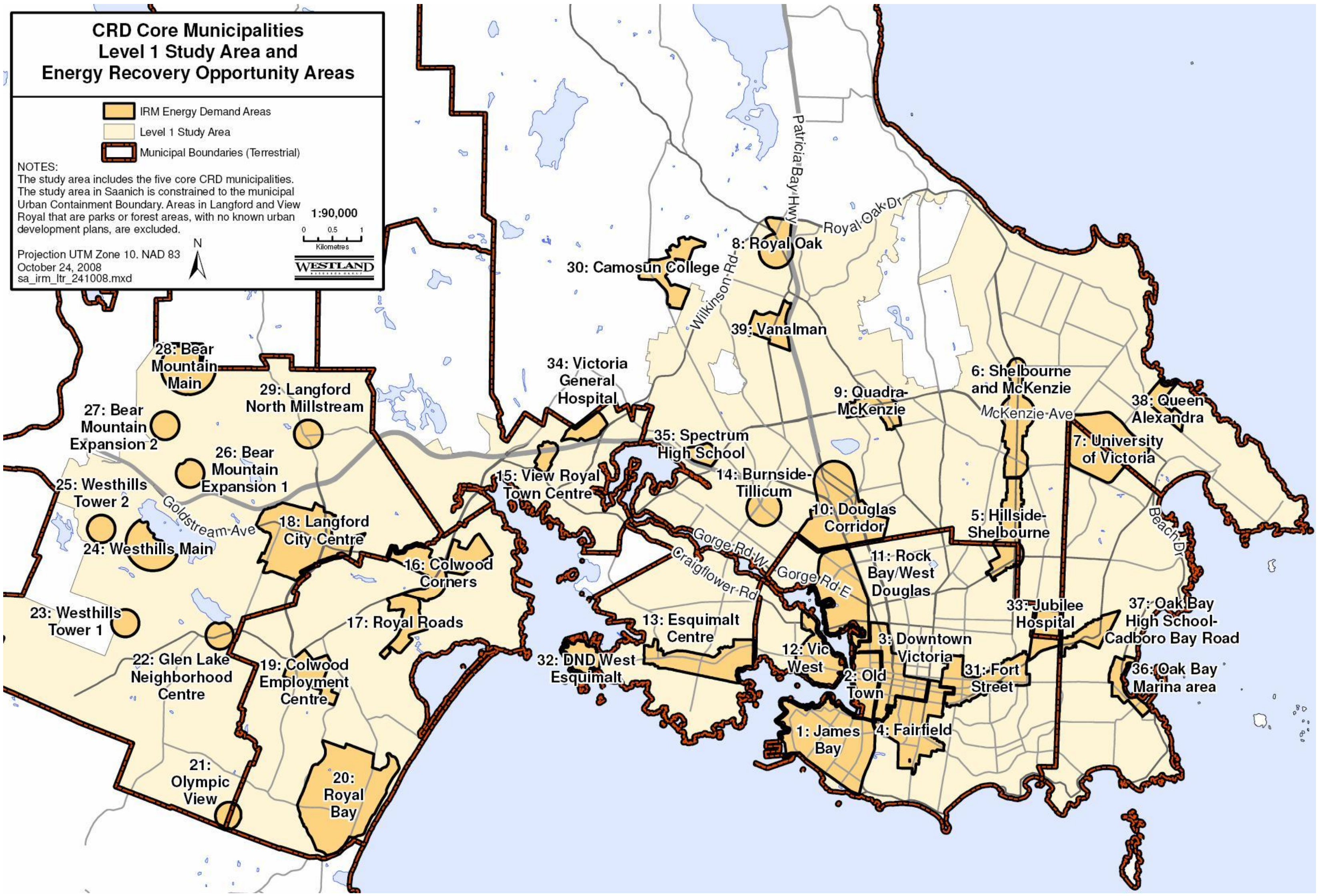
Once selected, the EROAs formed the basis of further analysis of resource recovery potential.

Table 2
Energy Recovery Opportunity Areas

Number	Name
1.	James Bay and Legislative District
2.	Old Town
3.	Downtown Victoria
4.	Fairfield
5.	Hillside Mall-South Shelbourne

Number	Name
6.	Shelbourne and McKenzie
7.	University of Victoria
8.	Royal Oak
9.	Quadra-McKenzie
10.	North Douglas Corridor-Town and Country Mall
11.	Gorge-Rock Bay
12.	Vic West
13.	Esquimalt Centre
14.	Burnside-Tillicum
15.	View Royal Town Centre
16.	Colwood Corners
17.	Royal Roads
18.	Langford City Centre
19.	Colwood Employment Centre
20.	Royal Bay
21.	Olympic View
22.	Glen Lake Neighborhood Centre
23.	Westhills Tower 1
24.	Westhills Main
25.	Westhills Tower 2
26.	Bear Mountain Expansion 1
27.	Bear Mountain Expansion 2
28.	Bear Mountain Main
29.	Langford North Millstream
30.	Camosun College Interurban Campus
31.	Upper Fort Street
32.	DND West Esquimalt
33.	Jubilee Hospital
34.	Victoria General Hospital
35.	Spectrum High School
36.	Oak Bay Marina area
37.	Oak Bay High School-Cadboro Bay Road
38.	Queen Alexandra
39.	Vanalman

Figure 8
Energy Recovery Opportunity Areas



6 Evaluation of Energy Recovery Opportunity Areas

6.1 Evaluation of Methodology

Resource recovery has been incorporated into the mix of selecting the preferred distributed treatment wastewater system by identifying resource recovery opportunity areas within the study area and evaluating the relative performance of those areas and screening the opportunity areas with the multi-objective alternative analysis (MOAA) methodology. Figure 9 summarizes this methodology. Further description of this evaluation is found in Appendix D—Evaluation Methodology, Performance Ratings, and Results.

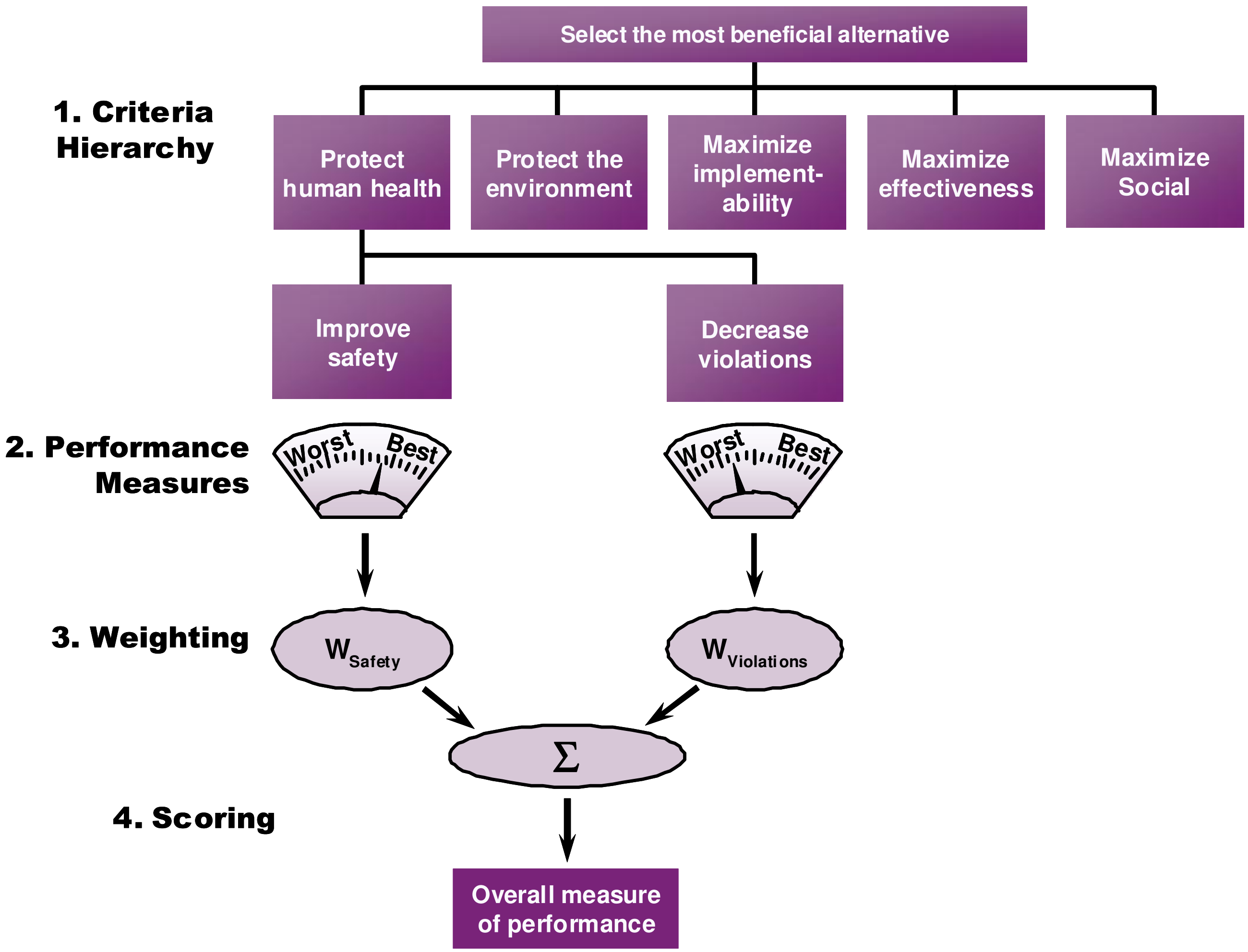
6.2 Criteria Hierarchy

This set of criteria was created by the distributed plant analysis team as a reflection of the Provincial direction, the CRD mission, and the data pertinent to the performance of the resource recovery areas. This set of criteria is designed to be a first step in the assessment of performance of energy recovery areas and the screening of the energy recovery opportunity areas. Performance measures for these criteria were created to reflect the reasonably available data. Much of the data lent to quantitative performance measurements. In other cases, a qualitative assessment was more appropriate to reflect performance.

Nine criteria and associated performance measures were generated as part of this analysis:

1. Supply of source heat
2. Amount of heat demand (further refined in Appendix E— Utilization of Recovered Heat Energy from Municipal Wastewater)
3. Boiler availability as a percentage of heat demand
4. Demand Development Timing
5. Number of parties involved
6. Treatment and energy recovery potential
7. Reuse production
8. Suitability of reuse demand
9. Combined environmental considerations (this evaluation is further refined in Appendix F—Energy Recovery Opportunity Areas—Environmental Analysis)

Figure 9
Multi-Objective Alternative Analysis



6.3 EROAs Evaluation

Each EROA was rated relative to the performance criteria. The product of this analysis is a weighted calculation of the relative performance of the 39 EROAs. For this screening effort, the assumption was that each of the nine criteria were of equal weight.
The rank order results are presented in Table 3.

Table 3
Performance Scores of EROAs

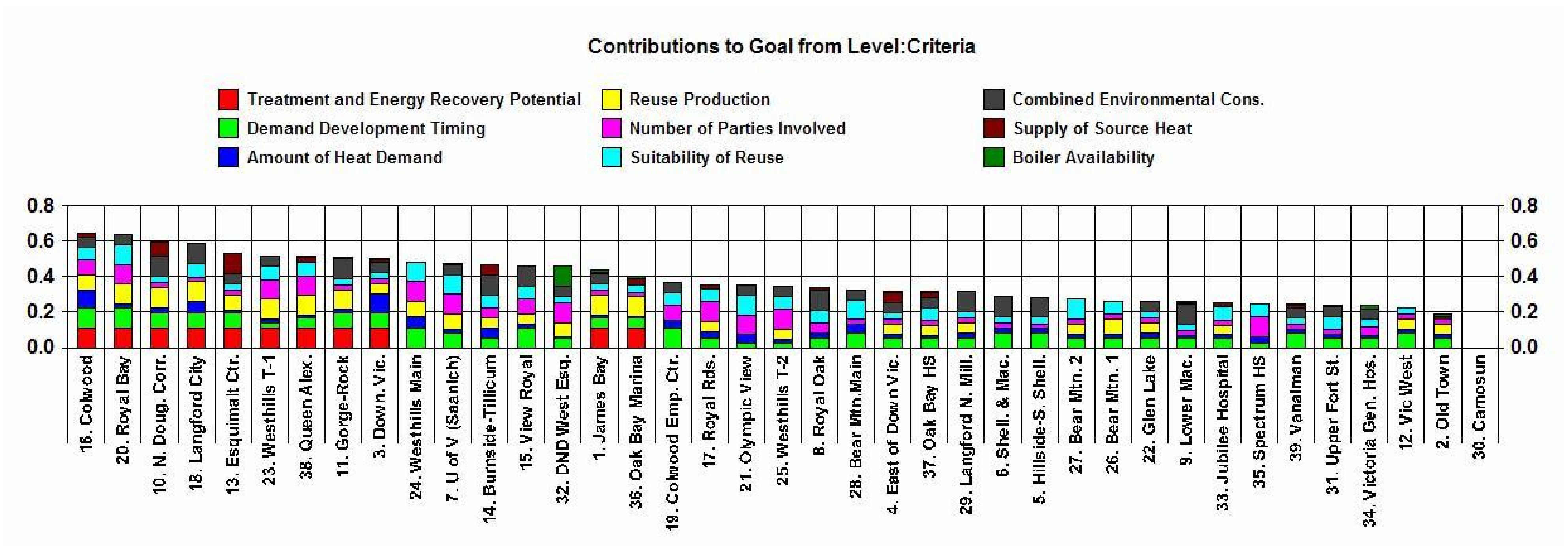
Rank	EROAs	Relative Performance Score
1	16. Colwood	0.64
2	20. Royal Bay	0.63
3	10. N. Doug. Corr.	0.60
4	18. Langford City	0.59
5	13. Esquimalt Ctr.	0.53
6	23. Westhills T-1	0.51
7	38. Queen Alex.	0.51
8	3. Down. Vic.	0.50
9	11. Gorge-Rock	0.50
10	24. Westhills Main	0.48
11	7. U of V (Saanich)	0.47
12	14. Burnside-Tillicum	0.47
13	15. View Royal	0.46
14	32. DND West Esq.	0.46
15	1. James Bay	0.43
16	36. Oak Bay Marina	0.40
17	19. Colwood Emp. Ctr.	0.37
18	17. Royal Rds.	0.35
19	21. Olympic View	0.35
20	25. Westhills T-2	0.35
21	8. Royal Oak	0.34
22	4. East of Down Vic.	0.32
23	28. Bear Mtn.Main	0.32

Rank	EROAs	Relative Performance Score
24	37. Oak Bay HS	0.32
25	29. Langford N. Mill.	0.31
26	6. Shell. & Mac.	0.29
27	5. Hillside-S. Shell.	0.28
28	27. Bear Mtn. 2	0.27
29	9. Lower Mac.	0.26
30	22. Glen Lake	0.26
31	26. Bear Mtn. 1	0.26
32	33. Jubilee Hospital	0.25
33	35. Spectrum HS	0.25
34	31. Upper Fort St.	0.24
35	34. Victoria Gen. Hos.	0.24
36	39. Vanalman	0.24
37	12. Vic West	0.23
38	2. Old Town	0.19
39	30. Camosun	0.00

Figure 10 shows a powerful means to display this information. This graphic lists the 39 EROAs from best to worst performing, from left to right. It is in the same rank order as found in Table 3. The colored bars represent the total performance score of each EROA (e.g., the 0.64 performance score of Colwood Corner, the top performing resource recovery opportunity area, is displayed as a point just above the 0.6 demarcation on the y-axis). The different colors of the bar represent the individual contribution of performance from each of the nine criteria. The size of the individual coloured bars showcases the contribution an individual EROA received from that criterion—the larger the colored segment, the better the performance of the EROA on that criterion. For example, Colwood Corners performed well on ‘Treatment and Energy Recovery Potential’ and therefore received a contribution as showcased by the red segment. A number of other EROAs also performed well and in ‘Treatment and Energy Recovery Potential’ and received the same contribution as Colwood Corners.

This graph also shows the relative value or importance an individual criterion has on the performance score. The legend presents the most influential criterion at the top with decreasing influence moving down, then the second and then third columns. The results suggest that ‘Treatment and Energy Recovery Potential’ has the single largest contribution to differentiating the 39 EROAs. On the other hand, ‘Supply of Source Heat’ and ‘Boiler Availability’ have the least influence. Some EROAs receive contribution from these two criteria (the colored segment

Figure 10
Contributions by Criteria



representing these two criteria show up in some EROAs performance bar), but they provide very little differentiation among the 39 EROA options.

This graph is also particularly helpful in displaying the relative performance of the options. The gradual decrease in relative performance shows that there is no obvious break point between the higher performing EROAs and the lower performing EROAs. The only exception is Camosun. That option should be removed from consideration.

The results of this ranking can be used to focus the selection of EROAs in terms of the potential to maximize energy recovery and water reuse. The distributed wastewater treatment system creation can then optimize the use of energy recovery and water reuse.

7 Key Findings and Next Steps

Wastewater is not a waste product. It is a resource containing rejected energy from homes, businesses, institutions, and factories; and it contains reclaimable water for non-potable use. This is the premise that drove the evaluation of resource recovery as a crucial element in developing an appropriate distributed wastewater system.

7.1 Key Findings

Thirty-nine resource recovery opportunity areas have been identified with the CRD core area. Screening these 39 areas produced an impression of the relative performance in regards to heat energy recovery and water reuse potential.

One of the EROAs, Camosun College’s Interurban Campus, was subsequently dropped from further consideration. This institution is outside of Saanich’s Urban Containment Boundary and is also “upstream” on the wastewater system, where the amount of heat in the system is relatively small.

The remaining 38 areas indicate a broad spectrum of performance in resource recovery. The screening points to the perspectives that more value will be received from resource recovery areas with a few characteristics:

- Located closely with a treatment plant
- Demand for energy is scheduled/possible in a timeframe after 2010
- The amount of heat demand is high
- Water reuse production is associated with a treatment facility
- The number of parties involved in development of heat recovery are few

- Water reuse is centered around large users

7.2 Additional Analysis and Next Steps

Distributed wastewater treatment will be based, in part, on the development of opportunities for resource recovery, primarily energy resource recovery, from heat contained in the wastewater flow and, concurrently, water reuse.

The next step is to determine viable distributed treatment scenarios that utilize a selection of the 39 resource recovery opportunities. This will involve creating a set of distributed treatment scenarios, then further evaluating them with more refined criteria, including revenue and costs. This more detailed evaluation will require the assessment of more refined and site specific data. Another application of the screening process will advance the identification of a preferred scenario. These scenarios are the subject of detail for the next Discussion Paper.