Making a difference...together

Report #EHQ 09-95

REPORT TO CORE AREA LIQUID WASTE MANAGEMENT COMMITTEE
MEETING OF WEDNESDAY 23 SEPTEMBER 2009

SUBJECT **OPTION 1A, 1B AND 1C ANALYSIS – CORE AREA WASTEWATER TREATMENT PROGRAM**

PURPOSE

To report to the Core Area Liquid Waste Management Committee (CALWMC) the findings of Option 1a, 1b and 1c analysis and select option(s) for further consideration.

BACKGROUND

At its meeting of 02 June 2009, the CALWMC approved the following motion:

1. That the Capital Regional District (CRD) proceed with Option 1 with further investigation of variations on the strategy, including:

    a) Continued analysis of Options 1a, 1b and 1c through the triple bottom line analysis (TBL), including an assessment of biosolids integration with solid waste activities and functions.
    b) Investigation of a wastewater heat recovery system and delivery mechanism in James Bay.
    c) Integration of inflow and infiltration management with appropriate phasing of the wet weather strategy at Clover Point.
    d) Relocation of the solids processing from the liquid processing site to allow potential integration with solid waste activities and functions.
    e) Further development of the biosolids management plan to reduce operational risks associated with biosolids end uses.
    f) Complete siting investigations in Saanich East – North Oak Bay.
    g) Investigation of opportunities for heat recovery and water reuse with the University of Victoria.
    h) Research the possibility of a single larger site in the event that the McLoughlin Point site is not selected.
    i) Evaluation of the financial and rate impacts of the costs and revenues, including revenues and/or carbon tax benefits of resource recovery and use for each option; and

2. That the CRD look at options for sewage treatment in the West Shore by working in cooperation with the administrators and engineers of Colwood and Langford.

The Option 1a, 1b and 1c analysis represents the consulting team's reporting to address item 1a above. The consulting team has completed an impressive amount of work in a very short time. Their work has included a review of the findings of the previous consulting team's work as well as recommendations identified in the report prepared by the Peer Review Team.

The consulting team will present the findings of Option 1a, 1b and 1c analysis. The Executive Summary (Appendix A) provides an overview of their findings.

To enable preparation of cost estimates and assessment of siting options, representative technologies have been selected for evaluation of sites. The final technology selection will be made at the preliminary

design phase and will depend on the procurement strategy implemented. This assessment uses proven technologies which have a track record of performance at the scale required for the CRD facilities. The technologies selected will meet the provincial and national discharge objectives and have a number of installations that operate successfully in North America and Europe.

For the current evaluations the following technologies have been considered:

- Conventional activated sludge for sites with adequate space availability such as the west shore under Options 1a, 1b and 1c.
- Biological aerated filters (BAF) and membrane bioreactor (MBR) for sites with limited space availability such as McLoughlin Point under Option 1a.
- MBR for locations where a small footprint is desired and a high potential for water reuse exists such as the Saanich East-North Oak Bay plant under all options.
- For wet weather treatment facilities with limited site availability a small footprint technology known as ballasted flocculation (Actiflo) has been selected for assessment purposes.

Again it is noted that the final technology selection will be made once the final site is determined and the procurement strategy selected. It is anticipated that larger sites would allow more flexibility in terms of the secondary treatment options that could be considered.

All options present significant opportunities for recovery of resources from wastewater. These resources include:

- effluent reuse for irrigation
- effluent reuse for toilet flushing
- heat extraction for use in buildings and digester heating
- heat extraction for district heating
- biomethane generation
- dried sludge fuel
- wood chips from willow coppice
- soil amendment biosolids products
- phosphorus recovery (struvite)
- metals
- power generation
- bio-cell biomethane

The work completed to date indicates there is higher potential for recovery of resources than was identified in previous CRD studies. Opportunities for heat recovery from effluent and biomethane recovery from the biosolids train are significant. The market for these resources can be explored further as the project progresses.

A greenhouse gases (GHG) assessment has been completed for all options. In wastewater treatment the relevant GHG include carbon dioxide, methane and nitrous oxide. The direct and indirect emissions and offsets of GHG associated with each alternative have been investigated for the initial construction phase and ongoing operations. Carbon footprint analysis indicates that all options have the potential for a net negative carbon footprint depending on the degree of resource recovery implemented. A negative carbon footprint indicates a beneficial environmental impact related to GHG emissions. Saleable heat for district heating and biomethane gas sales provide the largest offsets to make the project a negative carbon footprint facility.

Ideally, biosolids facilities should be located at the same site as the liquid train plant. This is only possible under Options 1b and 1c. Additional land near McLoughlin Point would be required to accommodate this for Option 1a.

For Option 1a, the energy centre (biosolids treatment facilities) would likely have to be located in the industrial area of the Victoria harbour. Another potential site is the Hartland landfill site located approximately 17 kilometers from McLoughlin.

Based on their findings, the consulting team recommends the following:

1. Eliminate Option 1c from further consideration.
2. If the CRD has confidence that a site can be obtained on the west shore, the preferred option is Option 1b and this should be carried forward in the Liquid Waste Management Plan (LWMP) Amendment. Option 1b is the lowest cost (by $90 million) and highest scoring TBL option with the lowest risk rating which would enable integration of all facilities at one site. It can also achieve many of the resource recovery objectives desired by CRD. However, if the CRD feels that public acceptance and site availability will prevent selection of a site on the west shore under 1b prohibiting timely implementation, then the CRD has the option of selecting Option 1a and carrying it forward in the LWMP.
3. Continue with the business case and grant application in consideration of the outcome of recommendation 2 above.
4. Continue to carry forward 1a and 1b until detailed siting investigations and property negotiations are complete. This approach provides advantages to the CRD in the event that one option must be eliminated because of governance or site availability issues. It also provides a fallback position in the event there are issues with site purchase under either option.
5. Proceed with acquisition of a west shore site. A plant on the west shore is part of both Options 1a and 1b.
6. Proceed with further technical development, site acquisition, and public consultation with the Saanich East–North Oak Bay facility.
7. Proceed with further technical development and public consultation regarding the Clover Point pumping station and conveyance pipelines.
8. Proceed to optimize Option 1a by exploring additional land for consolidation of biosolids processing with liquid stream treatment. Alternatives could include additional land adjacent to the McLoughlin site or a new site with sufficient size for consolidated facilities.
9. Continue to further explore the market potential for use of recovered resources and review the return on investment from recovered resources.
10. Continue to further develop and explore opportunities for integrating biosolids and solid waste handling.
11. Continue to discuss the deferment or elimination of the Clover Point wet weather plant with the provincial Ministry of Environment (MOE).

ALTERNATIVES

1. Select Option 1a as the preferred system configuration and maintain 1b as backup pending the outcome of land acquisition.
2. Select Option 1a and 1b with the final selection made after the decision to defer or not defer the west shore wastewater treatment plant.
3. Select Option 1b as the preferred system configuration.

IMPLICATIONS

Option 1a, with the main secondary treatment plant at McLoughlin Point is a viable option because of its proximity to the Macaulay Point outfall and because the site may be available for purchase. A plant at McLoughlin provides an opportunity to remediate a brown field site and provides an immediate opportunity for resource recovery. A facility at this site could treat west shore wastewater if construction of a west shore facility was deferred. This deferment option, Option 1a prime, can reduce the initial capital costs for the project by approximately $200 million. The greatest drawbacks associated with Option 1a are that it has a $90 million higher capital cost, it ranks as having the highest risk because of the potential schedule impacts related to the environmental remediation required at McLoughlin and the construction challenges related to a small site with significant rock excavation at McLoughlin; it has a slightly lower TBL rating than 1b and there are increased capital and operating and maintenance costs associated with having a separate site for biosolids.

Option 1b provides the best flexibility in terms of long term site development, technology selection and ease of construction. This option also provides sufficient space for integration of biosolids at a single site. This option has the lowest capital (by $90 million) and operating costs as well as the best TBL rating and the lowest risk assessment. The drawback to this option is that the conveyance facilities crossing the harbour are necessary to transport flows to the west shore treatment plant and more importantly, there is no site currently available for this option. If the west shore plant is deferred, Option 1b would be approximately $100 million more than Option 1a (prime).

Selecting Option 1a with Option 1b as the backup would give the CRD the opportunity to initiate public consultation for the Clover Point facility and the McLoughlin Point treatment plant location, complete the business case and finalize the LWMP amendment all by year end.

The footprint of the Clover Point facility for Options 1a and 1b is compact and can be accommodated adjacent to the Clover Point screening facility and pump station. The consulting team is recommending that the CRD continue negotiations with the MOE for deferment or elimination of this wet weather facility because of the infrequency of use. The proposed wet weather facility at Clover Point represents an approximate value of $68 million which may be better spent on reducing long term infiltration and inflow.

SUMMARY

The key findings to date include; a significantly smaller footprint for the proposed wet weather facilities at Clover Point; confirmation that the McLoughlin Point site is too small to accommodate both liquid and solids treatment; the Macaulay pump station site can accommodate wet weather facilities, and; there is a cost premium to locate the biosolids management facilities at a separate location from the liquid treatment for Option 1a.

The information developed to-date also shows that each option is technically viable and that Option 1b has the lowest capital (by $90 million) and operating costs. The capital costs are considerably lower than those developed by the previous consultant and are between $865 million and $965 million. The TBL analysis ranks Option 1b slightly better than Option 1a and the risk assessment shows Option 1b with less risk than Option 1a; however, when considering the opportunities and potential revenues from resource recovery, Option 1a provides the best immediate option.

RECOMMENDATIONS

That the Core Area Liquid Waste Management Committee:

1) receive this report for information;
2) remove Option 1c from further consideration; and
3) request staff to undertake further analysis of Option 1a as the preferred system configuration, with Option 1b as a backup configuration in the event that acquisition is unsuccessful for Option 1a.

Tony Brcic, PEng
Project Manager, Core Area Wastewater Treatment

Dwayne Kalynchuk, PEng
Project Director, Core Area Wastewater Treatment
Concurrence

TB:hr:jta
Attachment: 1

Capital Regional District

Core Area Wastewater Treatment Program
Assessment of Wastewater Treatment
Options 1A, 1B and 1C

Prepared by:

Stantec Consulting Ltd.

Brown and Caldwell

September 2009

Table of Contents

Volume 1 Report

Volume II Drawings (Under Separate Cover)

Executive Summary

E.1 Background

The CRD is currently in the process of planning wastewater treatment facilities for the Core Area of Greater Victoria. A Peer Review Team was engaged to review previous planning work and suggested that three additional options, referred to as Option 1A, 1B and 1C in this report, be investigated further using a triple bottom line analysis. **Tables E.1** through **E.3** describe the facilities that are part of each option. They are shown in **Figures E.1 through E.3.**

Table E.1 - Major Facilities to be Constructed Under Option 1 A

Location	Description of Facility
Saanich East - North Oak Bay	New secondary plant, new outfall parallel to existing outfall, collection system modifications, influent pumping station, solids discharged to collection system.
Clover Point	Wet weather treatment for 2 - 4 x ADWF, pump station and forcemain to McLoughlin Point to transfer flows up to 2 X ADWF for secondary treatment. Screening for all flows above 4 X ADWF. Wet weather treatment plant could be deferred or eliminated pending discussions with Provincial and Federal regulators.
McLoughlin Point	Secondary treatment plant to treat flows from Macaulay and Clover catchments up to 2 x ADWF. Primary treatment for all flows up to 4 X ADWF. Pump station at Macaulay to convey flows to McLoughlin for treatment.
Upper Victoria Harbour	Regional biosolids treatment facility to treat biosolids from the McLoughlin Point plant.
Macaulay Point	Pump Station to convey flows to McLoughlin Point. Macaulay wet weather flows are treated at McLoughlin. Screening for all flows above 4 x ADWF.
West Shore Plant	New Secondary Treatment Plant and integrated biosolids treatment facility serving only West Shore communities.
Conveyance Facilities	Forcemain to transfer flows from Clover Point to Macaulay. Tunnel or forcemain to transfer flows to McLoughlin.
Outfalls	New Outfalls at Saanich East - North Oak Bay, Macaulay and West Shore.
Resource Recovery	Water reuse facilities built into plant designs at Saanich East - North Oak Bay, McLoughlin and West Shore. Heat recovery from effluent built into Saanich East - North Oak Bay, McLoughlin and West Shore Plants. Biosolids resource recovery including co-digestion, production of soil amendment, recovery and sale of biogas, sludge drying and phosphorus recovery.

Table E.2 – Major Facilities to be Constructed Under Option 1B

Location	Description of Facility
Saanich East - North Oak Bay	New secondary plant, new outfall parallel to existing outfall, collection system modifications, influent pumping station, solids discharged to collection system.
Clover Point	Wet weather treatment for 2 - 4 x ADWF, pump station and forcemain to Macaulay Point to transfer flows up to 2 X ADWF for secondary treatment at West Shore. Screening for all flows above 4 X ADWF. The Clover Point treatment plant could be deferred or eliminated pending discussions with regulators.
Macaulay Point	Pump station to convey flows to West Shore for treatment. Pump station would convey up to 2 X ADWF Macaulay and Clover catchments for secondary treatment on West Shore. Wet weather treatment is provided at Macaulay for flows from 2- 4 x ADWF. Screening for all flows above 4 X ADWF.
West Shore	A new secondary treatment plant with integrated biosolids facility to treat flows from the West Shore, Macaulay and Clover Point catchments. Biosolids facilities also treat sludge from Saanich East - North Oak Bay.
Conveyance Facilities	Forcemain to transfer flows from Clover to Macaulay Point for pumping to West Shore. Combined tunnel and forcemain to transfer flows from Macaulay to West Shore.
Outfalls	New Outfalls at Saanich East - North Oak Bay and West Shore.
Resource Recovery	Water reuse facilities built into plant designs at Saanich East - North Oak Bay and West Shore. Heat recovery from effluent built into Saanich East - North Oak Bay, and West Shore Plants. Biosolids resource recovery could include co-digestion, sludge drying, phosphorus recovery and sale of biogas.

Table E.3 – Major Facilities to be Constructed under Option 1C

Location	Description of Facility
Saanich East - North Oak Bay	New secondary plant, new outfall parallel to existing outfall plant, collection system modifications, Influent pumping station, solids discharged to collection system.
Clover Point	Pump station and forcemain to Macaulay Point to transfer flows for re -pumping to secondary treatment at West Shore. Screening for all flows above 4 X ADWF.
Macaulay Point	A large pump station to convey flows from Macaulay and Clover Point to West Shore for treatment. Pump station would convey up to 4X ADWF to West Shore for treatment of Macaulay and Clover catchments. Screening for all flows above 4 X ADWF.
West Shore	A new secondary treatment plant with integrated biosolids facility to provide wet weather primary treatment up to 4x ADWF and secondary treatment up to 2 times ADWF from the West Shore, Macaulay and Clover Point Catchments. The plant would have integrated biosolids treatment facilities at the same site as the West Shore plant. Screening for all flows above 4 X ADWF.
Conveyance Facilities	Pump station and forcemain to transfer flows from Clover to Macaulay Point for pumping to West Shore. A large pump station at Macaulay and a combined tunnel and forcemain to transfer flows from Macaulay to West Shore.
Outfalls	New Outfalls at Saanich East - North Oak Bay and West Shore.
Resource Recovery	Water reuse facilities built into plant designs at Saanich East - North Oak Bay and West Shore. Heat recovery from effluent built into Saanich East - North Oak Bay and West Shore Plants. Biosolids resource recovery including co-digestion, sludge drying, recovery and sale of biogas and phosphorus recovery.

E.2 Facility Siting

Potential sites for new facilities are currently being investigated and are summarized in **Table E.4**.

Table E.4 – Current Siting Opportunities for Treatment Facilities

Location	Potential Facilities	Comments
Saanich East - North Oak Bay	Secondary Treatment Plant All Options	Three potential sites identified and under discussion.
Clover Point	Wet weather treatment and pumping	Existing site with limited available space, not enough area for secondary treatment plant. Discussing elimination of plant because of infrequency of overflows.
McLoughlin Point	Secondary Treatment Plant	New site which would require purchase and remediation. Risk associated with remediation and schedule impacts. One of the only available sites which could be purchased in the Core Area. Site is constrained with no room for digestion or expansion. Rock excavation and difficult construction conditions anticipated.
Macaulay Point	Wet weather treatment and pumping	Existing site with limited available space. Adjacent land owned by DND. If land could be obtained from DND sufficient space may be available for a new plant.
West Shore – South Colwood	Secondary Treatment Plant and Biosolids Treatment Facility	New site with enough room for future expansions. Land would have to be purchased. Easier construction than Mc Loughlin.
Upper Victoria Harbour	Biosolids Treatment and Processing Facility	There are potentially two sites. One site is small and it will be difficult to site a biosolids processing facility. Other site options may be available.
South Colwood	West Shore plant under Option 1A	Site is small, biosolids treatment facilities would have to be located on adjacent parcel.

Ideally liquid and biosolids treatment facilities should be located at a single consolidated site. Approximate area requirements for a single site would be 8 to 9 hectares.

E.2.1 Design Criteria for New Facilities

The new treatment facilities must be designed to satisfy the Provincial Municipal Sewage Regulation and Federal National Performance Standards. The National Performance Standards which were recently promulgated require secondary treatment plants to meet a performance requirement of $cBOD_5$ of 25 mg/L and a TSS of 25 mg/L based on a monthly average of at least five samples per week. These standards are similar to the Provincial not to exceed standards of 45 mg/L $cBOD_5$ and 45 mg/L TSS.

It is not anticipated that facilities will have to be designed for ammonia nitrogen limits for discharge to marine waters.

Compounds of emerging concern (COECs) are a controversial topic in wastewater treatment design. COECs include microconstituents such as endocrine disrupting compounds, pharmaceutically active compounds (PhACs) and personal care products (PCPs). There is still much to be learned about COECs and their impacts on the environment and public health. Research is ongoing. However, it is prudent to plan for wastewater treatment facilities to include the capability for removal of these constituents should it become a requirement in the future.

E.2.2 Liquid Train Treatment Design for Options 1A, 1B and 1C

To enable preparation of cost estimates and assessment of siting options, representative technologies have been selected for evaluation of sites. The final technology selection will be made at the preliminary design phase and may be reconsidered depending on the procurement strategy implemented. This assessment uses proven technologies which have a track record of performance at the scale required for the CRD facilities. The technologies selected will meet the discharge objectives and have been successfully used at many installations in North America and Europe.

When undertaking a major wastewater treatment program such as the CRD project, the owner and engineers often receive submissions by numerous technology suppliers who make many claims with respect to new and novel process performance, footprint, and lower costs. Some of these technologies may show promise, but most lack a track record at the scale of facilities required for CRD. The ability of novel technologies to satisfy discharge requirements at reasonable operating costs is often uncertain. If the CRD wants to consider some of these technologies, a thorough independent evaluation should be completed to confirm suppliers' claims.

For the current evaluations, the following representative technologies have been considered :

- Conventional activated sludge for sites without space limitation such as the West Shore under Options 1A, 1B and 1C.

- Biological aerated filters (BAF) and Membrane Bioreactor (MBR) for sites with limited space availability such as Mc Loughlin Point under Option 1A.
- MBR for locations where a small footprint is desired and a high potential for water reuse exists such as the Saanich East - North Oak Bay plant under all options.
- For wet weather treatment facilities with limited site availability a low footprint technology known as ballasted flocculation (Actiflo) has been selected for assessment purposes.

It is anticipated that larger sites would allow more flexibility in terms of the secondary treatment technology options that could be considered at the implementation stage.

E.2.3 Biosolids Design for Options 1A, 1B and 1C

The biosolids treatment train presents significant opportunities for resource recovery. For this initial assessment it has been assumed the biosolids treatment technology will include thermophillic digestion capable of producing a Class A biosolid, biosolids drying, recovery of biomethane to produce pipeline quality gas, struvite recovery and production of soil amendment product for reuse. In addition, the biosolids facilities are designed to accept organic food wastes and fats, oils and greases (FOG) to enhance the production of biomethane gas by as much as 50%.

A Regional Energy Centre will be a key component of the biosolids management plan for the CRD. This energy centre will integrate biosolids and organic wastes and could have a waste to energy facility as part of the centre to accept solid wastes and biosolids as potential fuel sources, depending on the size of site selected.

Ideally the biosolids and liquid waste treatment facilities should be located at a common site. This is not possible under Option 1A, because the McLoughlin site is too small to accommodate the biosolids treatment facilities. If additional land near McLoughlin can be obtained it would be possible to co-locate on the same site. Federal ownership of adjacent land, and challenges to placing fill in Victoria Harbour reduce the likelihood of expanding the site at McLoughlin Point. Under Option 1B and 1C, the biosolids and liquid train can be accommodated on the sites.

Another option for location of integrated biosolids and solid waste facilities would be the Hartland landfill. This site would involve construction of a pumping station and 17 km pipeline to transfer sludge to a biosolids treatment facility at Hartland landfill. This location would provide good synergies for acceptance of FOG and the organic portion of food wastes to enhance digester gas production. In the future waste to energy facilities could be used as an add-on process for solid waste processing.

E.2.4 Conveyance Systems

Conveyance and pumping upgrades are required for all options. Under Option 1A, wastewater will be conveyed from the Macaulay and Clover Point outfalls by pumping through new forcemains to Mc Loughlin Point. For Option 1B, flows up to 2 times the average dry weather

flow (ADWF) from Macaulay and Clover point are to be pumped to the West Shore for secondary treatment. This will require pumping station upgrades and a tunnel conveyance system crossing the harbour. Option 1C is similar to option 1B but conveyance facilities are larger because up to 4 times ADWF is transferred to the West Shore.

Pumping and conveyance facilities are also required for sludge under Option 1A if a site cannot be located adjacent to Mc Loughlin Point.

New outfalls are required as part of this program. The Saanich East - North Oak Bay plant under all options will require a new outfall parallel to the Finnerty Cove outfall.. For Option 1A, the Macaulay outfall must be upgraded. Under Option 1B and 1C, new outfalls are required for the West Shore plant sites.

E.2.5 Resources from Wastewater

All options present significant potential opportunities for recovery of resources from wastewater. These resources include:

POTENTIAL RESOURCE RECOVERY FROM WASTEWATER

- Effluent Reuse for Irrigation
- Effluent Reuse for Toilet Flushing
- Heat Extraction Plant Use in buildings and digester heating
- Heat Extraction for District Heating
- Biomethane Generation
- Dried Sludge Fuel for cement kilns or waste to energy facility
- Wood Chips – Willow Coppice
- Soil Amendment
- Phosphorus Recovery (Struvite)
- Metals
- Power Generation
- Bio-cell Biomethane

The work completed to date indicates that there is higher potential for recovery of resources than previous work. Opportunities for heat recovery and biomethane from the biosolids train are significant. The market for these resources can be explored further as the project progresses.

E.2.6 Carbon Footprint

A greenhouse gas (GHG) assessment has been completed for all options. In wastewater treatment the relevant GHGs include carbon dioxide, methane and nitrous oxide. The direct and indirect emissions and offsets of the GHGs associated with each alternative have been investigated for the initial construction phase and ongoing operations. Carbon footprint analysis indicates that all options have the potential of being carbon positive depending on the degree of resource recovery implemented. Saleable heat for district heating and biomethane gas sales provide the largest offsets to make the project a carbon positive facility.

E.2.7 Opinion of Probable Costs

The capital and life cycle costs have been developed for each option and are summarized as below:

Table E.5 – Capital Costs

Capital Costs	Option 1A	Option 1B	Option 1C
Total Capital Costs	$965,000,000	$875,000,000	$885,000,000

Operations and Maintenance Costs for each option are shown in **Table E.6**.

Table E.6 – Annual O&M Costs

	Option 1A	Option 1B	Option 1C
Annual O&M Costs	19.8 million	19.6 million	19.8 million

Life cycle costs for each option are provided in **Table E.7**.

Table E.7 – Life Cycle Costs

Costs	Option 1A	Option 1B	Option 1C
Life Cycle Costs	$806,000,000	$741,000,000	$750,000,000

From a capital cost perspective Option 1A is the most expensive option, mainly as a result of difficult construction conditions at McLoughlin Point and the fact that biosolids facilities are located at a separate site remote from the liquid train plant at McLoughlin. Option 1B and 1C have similar capital costs.

Annual operation and maintenance costs are similar for all options.

Option 1A has the highest life cycle cost while options 1B and 1C have similar life cycle costs. Life cycle costs assume that facilities will commence operation in 2016 and are calculated for a 25 year period using a discount rate of 6%.

E.2.8 Triple Bottom Line Analysis of Options

A thorough value based triple bottom line assessment has been used to evaluate options. This TBL approach applied the criteria recommended by the Peer Review Team. Social, environmental and economic criteria groups have been assigned the same maximum point allocation (100 points each) to provide a balanced assessment as per feedback received from the public consultation process. The results of the TBL are summarized in **Table E.7**.

Table E.7 – Summary Table of TBL Analysis Results

					Option Results			
Criteria Group	**No.**	**Criteria Categories**	**Measure Description**	**Weight**	**1a**	**1b**	**1c**	**Comments**
Economic	EC-01	Capital Costs	construction cost and markup for soft costs adjusted to midpoint of construction	8	2.5	2.7	2.7	Costs included for resource recovery systems
	EC-02	Capital Costs Eligible for Grants	Not available at this time	-	-	-	-	
	EC-03	Tax Revenue Implications	cost of private property lost and lost revenue from reduced property values	1	3	4	4	
	EC-04	Present Worth of O&M costs	O&M costs	8	2.7	2.8	2.7	Costs included for resource recovery systems
	EC-05	Flexibility for Future Treatment Process Optimization	cost of additional tankage needed for process optimization	1	3	4	4	
	EC-06	Expandability for Population Increases	additional space needed versus available to meet 2065 loading	1	3	4	4	
	EC-07	Flexibility to Accommodate Future Regulations	additional space needed versus available to meet potential regulations	1	3	4	4	
			Economic Subtotal (100 pts max)[1]:		**54**	**60**	**60**	
Environmental	EN-01	Carbon Footprint	tons of eCO2 created	1.67	4	4	4	
	EN-02	Heat Recovery Potential	Heat energy replacing natural gas	1.67	4	2	2	
	EN-03	Water Reuse Potential	megaliters per day available	1.67	4	3	3	
	EN-04	Biomethane Resource Recovery	Recovery of biomethane resources	1.67	3	3	3	
	EN-05	Power (energy) usage	kilowatt hours per year consumed	1.67	3	4	3	Cost also included in EC-04
	EN-06	Transmission Reliability	risk cost of pump station failure	1.67	4	3	1	
	EN-07	Site Remediation	risk cost of site remediation	1.67	2	4	3	
	EN-08	Pollution Discharge	tons of pollutants discharged	1.67	3	3	3	
	EN-09	Non-renewable Resource Use	Gallons of diesel consumed per year	1.67	3	3	3	Cost also included in EC-04
	EN-10	Non-renewable Resource Generated	Struvite and biosolids production	1.67	3	3	3	
	EN-11	Flexibility for Future Resource Recovery	Additional space needed to add 100% additional resource recovery	1.67	2	3	3	
	EN-12	Terrestrial and Inter-tidal Effect	Habitat areas potentially disturbed	1.67	3	3	2	
			Environmental Subtotal (100 pts max):		**63**	**63**	**55**	
Social	SO-01	Impact of Property Values	Lost value to present community	1.82	3	3	3	
	SO-02	Operations Traffic in Sensitive Areas	Cost of traffic inconvenience during operations	1.82	1	3	3	
	SO-03	Operations Noise in Sensitive Areas	Cost of noise inconvenience	1.82	3	3	3	
	SO-04	Odour Potential	Cost of odour issues	1.82	2	4	4	
	SO-05	Visual Impacts	Cost of lost open water or territorial view	1.82	3	3	3	
	SO-06	Construction Disruption	Cost of traffic inconvenience due to construction	1.82	1	3	2	
	SO-07	Public and Stakeholder Acceptability	Lost time due to public disapproval	1.82	3	2	2	
	SO-08	Impacts on Future Development	Loss of value of developable land adjacent to plant	1.82	3	2	1	
	SO-09	Loss of Beneficial Site Uses	Loss of park land due to plant	1.82	4	3	2	
	SO-10	Compatibility with Designated Land Use	Delay due to zoning changes	1.82	3	3	3	
	SO-11	Cultural Resource Impacts	Risk cost of a cultural site find	1.82	3	2	2	
			Social Subtotal (100 pts max):		**53**	**56**	**51**	
			TOTAL SCORE (300 pts max):		**170**	**180**	**166**	

1 - Economic weighting is proportional to NPV results

The results of the analysis indicate that Option 1B has the best TBL score, followed by Option 1A. The difference in scores between Options 1A and 1B is only 10 points and both options are considered viable.

E.2.9 Risk Assessment

A preliminary risk assessment has been completed for each option. Each option was ranked in consideration of the risks associated with construction under each option. Preliminary evaluation indicates that option 1 A has the highest risk mainly due to the unknown impacts of site remediation at the McLoughlin site. Remediation of the site could impact schedule and cost. Option 1B and 1C also have some risk associated with crossing of the harbour with conveyance system tunnels. In terms of siting, Option 1A appears to be the most advanced in terms of the acceptance of plant siting while further negotiations are required for candidate sites on the West Shore.

Risk mitigation strategies can be selected to reduce risks. These strategies will be assessed as the project proceeds and more detailed information becomes available.

E.2.10 Discussion of Analysis and Recommendation

Three options have been reviewed for provision of wastewater treatment to the Core Area. All options are capable of providing wastewater treatment to the Core Area. The CRD is fortunate to have several options available to them. All options have potential for recovery of resources from the liquid and biosolids treatment streams. Options 1B and 1C, located on the West Shore may provide the best flexibility in terms of long term site development, technology selection and ease of construction. There is a real opportunity to extract resources from the wastewater for use in district heating systems and effluent reuse. Dedicated pipelines can be constructed to serve future and existing adjacent residential and commercial areas. Options 1B and 1C also provide sufficient space for integration of biosolids at a single site. Locating liquid stream and biosolids processing at a single site reduces capital and operating costs and optimizes the opportunity for utilizing heat extracted from the effluent for biosolids processing. The drawback to these options are the costs and risks associated with the conveyance facilities crossing the Esquimalt harbour , that are necessary to transport flows to the West Shore for treatment.

Option 1A, with the main secondary plant at McLoughlin Point is also a viable option because of its proximity to the Macaulay and Clover Point outfalls and the fact that the site is available for purchase. The McLouglin site is contaminated and will require remediation. This presents some risk in terms of overall project schedule as the remediation process could take several years. The site is not large enough to accommodate the liquid and biosolids treatment facilities.

Under Option 1A separate site will be required for biosolids facilities. Biosolids transport between McLoughlin and biosolids processing site will be by pipeline which will be routed past areas for downtown areas. . Hot water heating and effluent reuse pipelines will be constructed in the same trench and will provide immediate opportunity for district heating and reuse of water in government, commercial and residential buildings. Ideally, a biosolids treatment site in closer

proximity to the McLoughlin Point site would be preferred, with an expanded McLoughlin site the best biosolids siting scenario for Option 1A.

Under Option 1A initial investigation indicates that the Macaulay wet weather facilities can be incorporated into the McLoughlin Point plant. The footprint of the Clover Point facility is compact and can be accommodated adjacent to the Clover Point pump station. Because of the infrequency of use it is recommended the CRD continue negotiations with MOE for deferment or elimination of the Clover Point plant. Funds may be better spent on reducing long term infiltration and inflow.

The potential for deferment of West Shore facilities under Option 1A , referred to as 1A prime, has also been investigated. There is an opportunity to defer the West Shore plant under Option 1A for a period of up to 10 years until such time that a new plant is constructed on the West Shore. The CRD together with the West Shore communities would have to commence siting and planning for these facilities within several years of completion of the McLoughlin Point Plant. Potential cost savings for the initial project by deferment of the West Shore facilities would be in the order of $ 200 million, but there is a risk of loosing future senior governments funding for the deferred plant on West Shore.

All three options are good and viable alternatives for providing the CRD with it's regional wastewater treatment needs. Comparing alternatives, the only difference between Options 1B and 1C is the location of facilities for handling wet weather flows between 2 and 4 times ADWF. All other site and system components are the same. Despite their similarities, Option 1C rates significantly poorer than 1B on the TBL comparison, principally because of the larger conveyance system for 1C. This results in higher operational costs, less conveyance reliability, and higher construction impacts. For this reason, it appears that of the two similar Options, 1B is more favourable and the project team recommends eliminating 1C from further consideration.

Detailed analysis indicates option 1B has the highest TBL ranking followed closely by 1A with a difference of only 10 points. The CRD has in our opinion two viable options, 1A and 1B which could be considered for implementation.

One of the biggest issues facing the CRD is the availability of plant sites large enough to fit both liquid and biosolids treatment facilities. This fact alone places significant constraints on the project. Ideally a site which is large enough for liquid and biosolids treatment trains (approximately 8-9 hectares) would be preferred, but such a site may not be readily available in the Core Area. Siting investigations are currently being completed to identify candidate sites. It should be noted that the final configuration of the wastewater system will be dictated by the success and results of site identification and acquisition efforts.

Based on the above considerations, the project team recommends the following:

1. Eliminate Option 1C from further consideration.

2. If the CRD has confidence that a site can be obtained on the West Shore, the preferred option is Option 1B and this should be carried forward in the LWMP Amendment. Option 1B is the lowest cost and highest scoring TBL option and would enable integration of all facilities at one site. It can also achieve many of the resource recovery objectives desired by CRD. However, if the CRD feels that public acceptance and site availability will prevent selection of a site on the West Shore under 1B prohibiting timely implementation, then the CRD has the option of selecting Option 1A and carrying it forward in the LWMP.

3. Continue with the Business Case and grant application in consideration of the outcome of recommendation 2 above.

4. Continue to carry forward 1A and 1B until detailed siting investigations and property negotiations are complete. This approach provides advantages to the CRD in the event that one option must be eliminated because of governance or site availability issues. It also provides a fallback position in the event there are issues with site purchase under either option.

5. Proceed with acquisition of a West Shore site. A plant on the West Shore is part of both Options 1A and 1B.

6. Proceed with further technical development, site acquisition, and public consultation with the Saanich East - North Oak Bay facility.

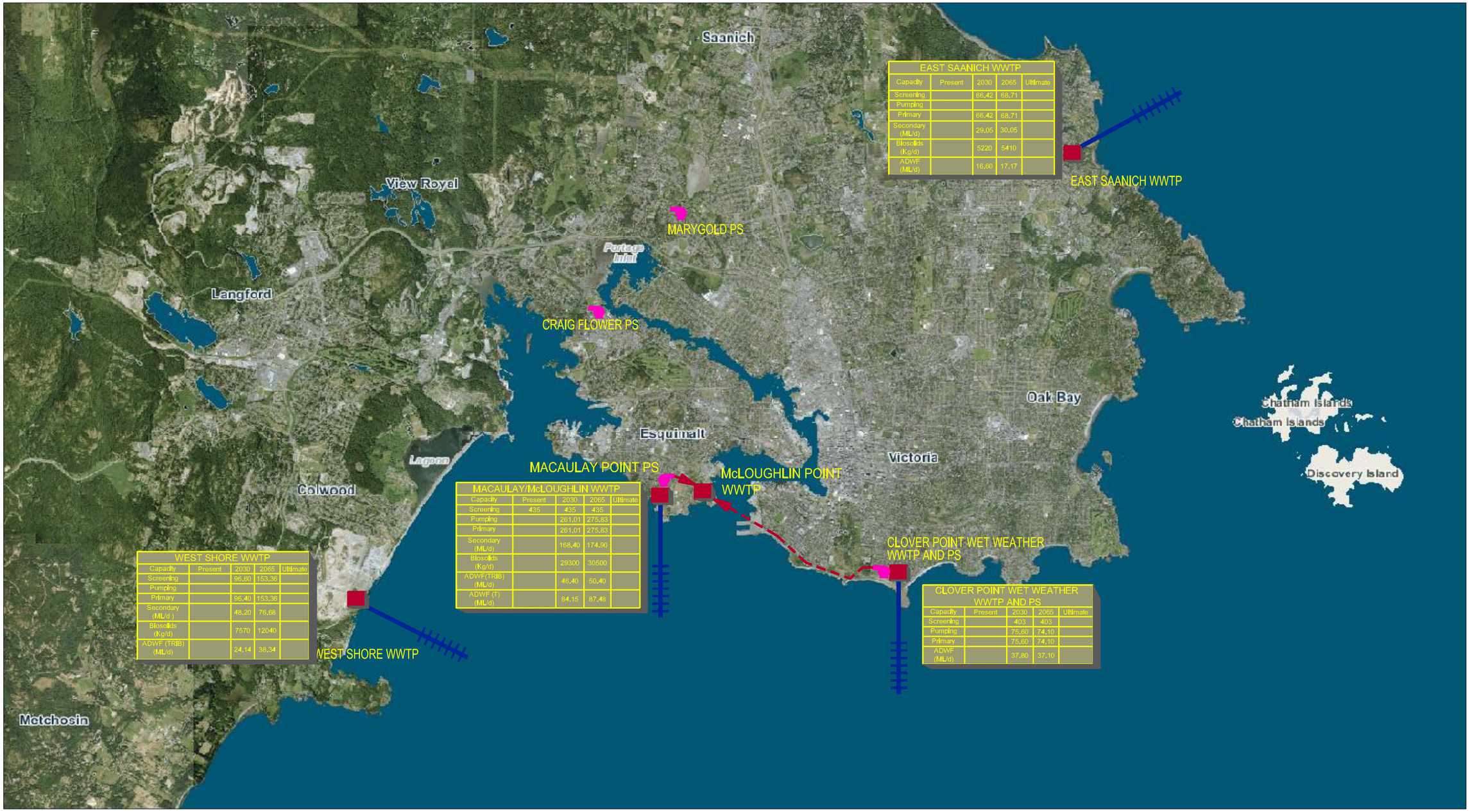
7. Proceed with further technical development and public consultation with the Clover Point pumping station and conveyance pipelines.

8. Proceed to optimize Option 1A by exploring additional land for consolidation of biosolids processing with liquid stream treatment. Alternatives could include additional land adjacent to the McLoughlin site or a new site with sufficient size for consolidated facilities.

9. Continue to further explore the market potential for use of recovered resources and review the return on investment from recovered resources.

10. Continue to further develop and explore opportunities for integrating biosolids and solid waste handling.

11. Continue to discuss the deferment or elimination of the Clover Point wet weather plant with the Provincial Ministry of Environment.

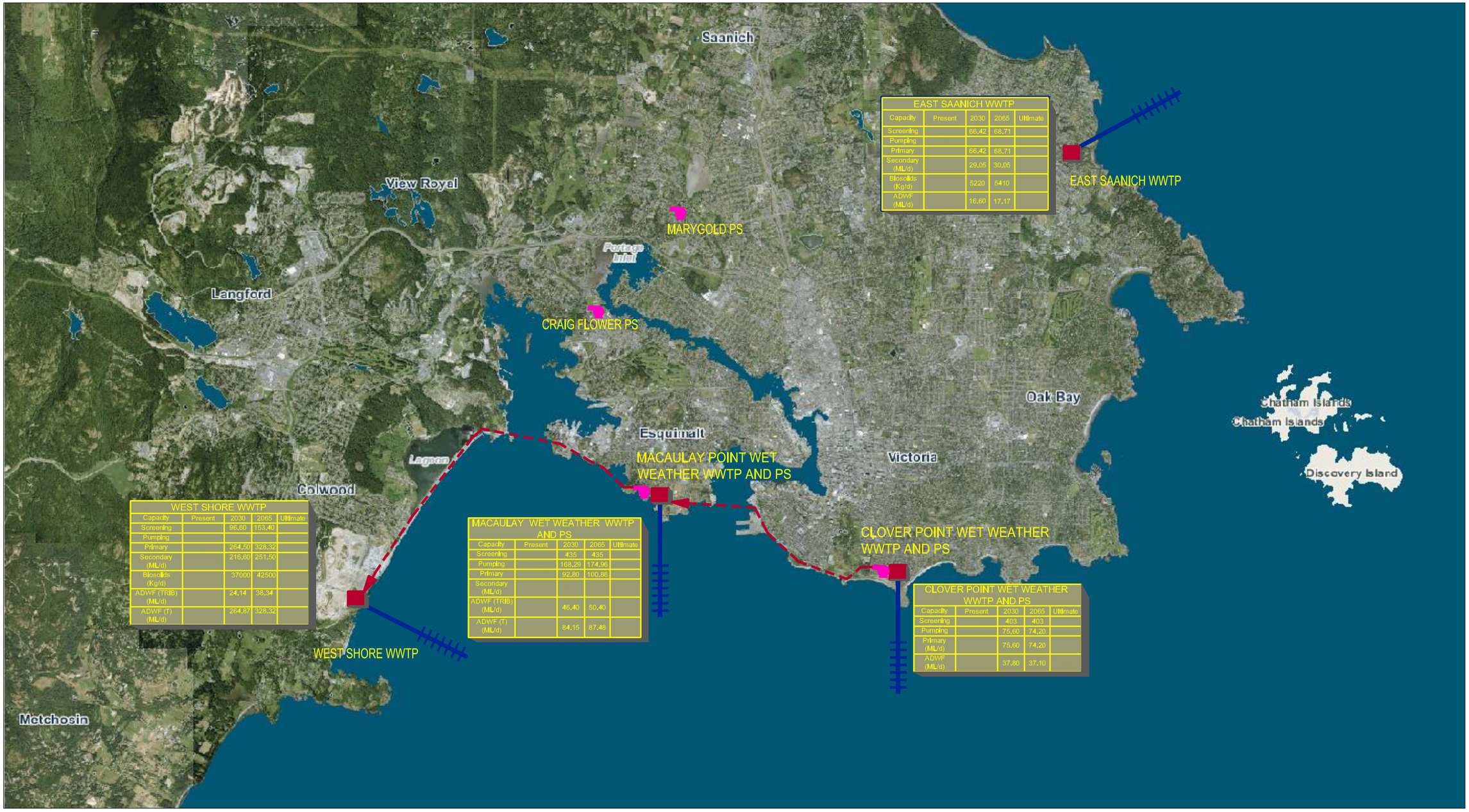


Making a difference...together

CAPITAL REGIONAL DISTRICT

CORE AREA WASTEWATER TREATMENT PROGRAM
OPTION 1A

DESIGNED	DRAWN	SCALE	CHECKED	APPROVED	DATE	CONTRACT NO.	DWG. NO.	REV.	SHT OF
RAF	PC	N.T.S.	–	–	12/08/09	–	FIG. E1	–	1 OF 1



EAST SAANICH WWTP				
Capacity	Present	2030	2065	Ultimate
Screening		66,42	68,71	
Pumping				
Primary		66,42	68,71	
Secondary (ML/d)		29,05	30,05	
Biosolids (Kg/d)		5220	5410	
ADWF (ML/d)		16,80	17,17	

WEST SHORE WWTP				
Capacity	Present	2030	2065	Ultimate
Screening		96,60	153,40	
Pumping				
Primary		264,50	328,32	
Secondary (ML/d)		216,60	251,50	
Biosolids (Kg/d)		37000	42500	
ADWF (TRIB) (ML/d)		24,14	38,34	
ADWF (T) (ML/d)		264,87	328,32	

MACAULAY WET WEATHER WWTP AND PS				
Capacity	Present	2030	2065	Ultimate
Screening		435	435	
Pumping		168,29	174,96	
Primary		92,80	100,86	
Secondary (ML/d)				
ADWF (TRIB) (ML/d)		46,40	50,40	
ADWF (T) (ML/d)		84,15	87,48	

CLOVER POINT WET WEATHER WWTP AND PS				
Capacity	Present	2030	2065	Ultimate
Screening		403	403	
Pumping		75,60	74,20	
Primary (ML/d)		75,60	74,20	
ADWF (ML/d)		37,80	37,10	

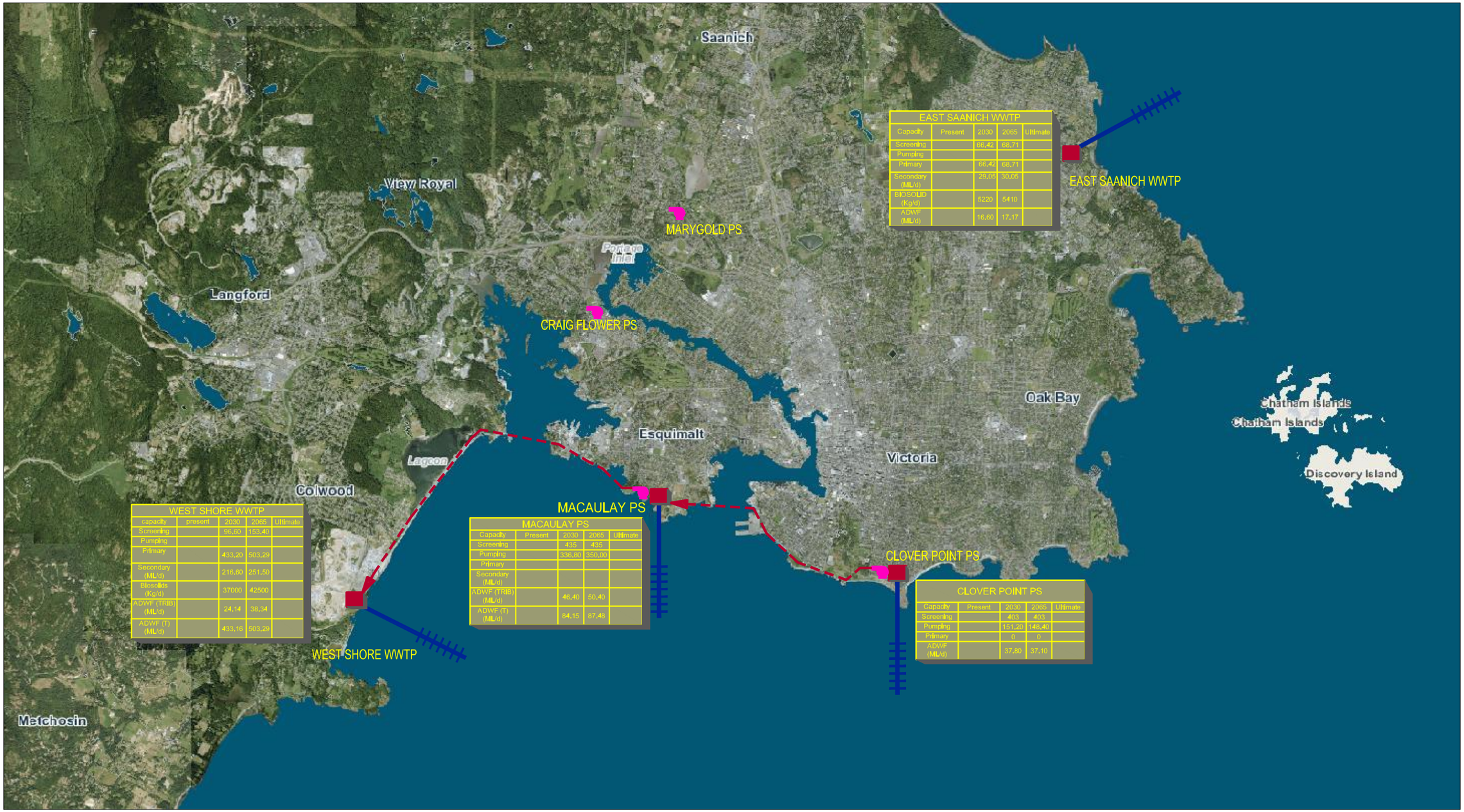
Capital Regional District | Environmental Services

Making a difference...together

CAPITAL REGIONAL DISTRICT

CORE AREA WASTEWATER TREATMENT PROGRAM
WEST SHORE 2X ADWF SECONDARY
OPTION 1B

DESIGNED	DRAWN	SCALE	CHECKED	APPROVED	DATE	CONTRACT NO.	DWG. NO.	REV.	SHT OF
RAF	PC	NTS	–	–	12/08/09	–	FIG. E2	–	1 OF 1



EAST SAANICH WWTP				
Capacity	Present	2030	2065	Ultimate
Screening		66,42	68,71	
Pumping				
Primary		66,42	68,71	
Secondary (ML/d)		29,05	30,05	
BIOSOLID (Kg/d)		5220	5410	
ADWF (ML/d)		16,60	17,17	

WEST SHORE WWTP				
capacity	present	2030	2065	Ultimate
Screening		96,60	153,40	
Pumping				
Primary		433,20	503,29	
Secondary (ML/d)		216,60	251,50	
Biosolids (Kg/d)		37000	42500	
ADWF (TRIB) (ML/d)		24,14	38,34	
ADWF (T) (ML/d)		433,16	503,29	

MACAULAY PS				
Capacity	Present	2030	2065	Ultimate
Screening		435	435	
Pumping		336,80	350,00	
Primary				
Secondary (ML/d)				
ADWF (TRIB) (ML/d)		46,40	50,40	
ADWF (T) (ML/d)		84,15	87,48	

CLOVER POINT PS				
Capacity	Present	2030	2065	Ultimate
Screening		403	403	
Pumping		151,20	148,40	
Primary		0	0	
ADWF (ML/d)		37,80	37,10	

Capital Regional District | Environmental Services

Making a difference...together

CAPITAL REGIONAL DISTRICT

CORE AREA WASTEWATER TREATMENT PROGRAM
WEST SHORE 4X ADWF SECONDARY
OPTION 1C

DESIGNED	DRAWN	SCALE	CHECKED	APPROVED	DATE	CONTRACT NO.	DWG. NO.	REV.	SHT
RAF	PC	NTS	–	–	12/08/09	–	FIG. E3	–	1 OF 1