DISCUSSION PAPER NO. 4

Capital Regional District

Core Area and West Shore Sewage Treatment
Implementation Sequencing

Issued: February 5, 2007
Previous Issue: January 18, 2007

1 Objective

The wastewater management strategy that will be developed and implemented by the CRD will consist of a number of components involving wastewater conveyance, treatment and reuse / disposal. The sequence in which these components can be implemented is governed by a number of factors. The objectives of this discussion paper are two fold. The first is to review the factors that impact sequencing decisions. The second is to develop a series of conceptual approaches, which will ultimately be explored in greater detail, to meet the wastewater management goals.

2 Impacts on Sequencing Decisions

Sequencing refers to the general order in which the selected wastewater management strategy can be implemented. The decisions on the sequence in which the strategy can move ahead are influenced by a number of factors. These are discussed below:

2.1 Existing Infrastructure

The CRD has a significant investment in existing wastewater infrastructure. This wastewater system currently handles the wastewater from an equivalent population of over 300,000 persons. Decisions on upgrading need to recognize the existing investment, planned future transmission system improvements and, importantly, the need for the existing wastewater system to continue to operate while upgrading is taking place.

2.2 Growth

Population growth projections are presented in Discussion Paper No. 1. Sequencing decisions need to recognize the need for continued expansion of the wastewater system capacity as the service population increases in the future. As discussed in the paper, development and growth rates vary in different areas of the region. Specifically, the West Shore communities will see significant development in the near term and will require wastewater management services. Growth areas and rates may also change over the planning horizon. Decisions on wastewater management strategies need to be sufficiently flexible so that changes can be accommodated.

2.3 Liquid Waste Management Plan

Regulatory authority for wastewater management is a Provincial function. The current regulatory vehicle is the Liquid Waste Management Plan (LWMP), legislated under the Waste Management Act. The CRD is currently embarking on an Amendment process to change the currently approved LWMP. At this time, the Province is involved in a joint Provincial – Federal process to develop guidelines for municipal wastewater management in Canada. It is expected that the outcome of this process will be incorporated into the Provincial legislation and that the CRD system will continue to be regulated under a LWMP.

As discussed in Discussion Paper No. 1, the LWMP legislation provides some flexibility in meeting the overall Provincial goals in wastewater management. As evidenced by the directive from the Minister of Environment and the current amendment process, a LWMP is not “carved in stone”. Changes in policy over time can and do occur, as a result of changes in scientific knowledge and government policy. While sequencing decisions must be made based on the current regulatory direction, the possibility of future changes must also be considered. An example of this is the area of emerging micro-contaminants. While these are not currently regulated under current Provincial policy, it would be prudent to consider a wastewater treatment strategy that could deal with this issue, if required in the future.

2.4 Technological Change

Wastewater treatment technology is not static. As with other technologies, ongoing development is occurring, resulting in higher levels of performance, more compact layouts and more cost effective wastewater management. An example of this is the development and application of membrane separation technology in the wastewater field over the last decade. This development has allowed a change in thinking from disposal to reuse. It has also created opportunities for a more decentralized approach to wastewater management.

In making the decisions on a wastewater management strategy that will span many decades, it is important to recognize the potential of changing technology. Fundamental decision making on centralized versus decentralized wastewater management strategies must consider current technology trends to ensure appropriate flexibility. In addition, the design of individual treatment facility components must consider technological change and the need to update the internal process technology in wastewater treatment facilities, possibly several times over the life of the structure.

Where does technological change come into the sequencing picture? As an example, a decision to utilize a technology such as membrane bioreactors (MBR) could be employed in a wastewater treatment plant situation serving a new development area where flows will increase significantly over time. The modular layout of the MBR, that allows more units to be constructed as required, makes it well suited to this type of situation. A second example is the recent development of high-rate chemically assisted clarification processes that can operate on an intermittent basis. These are well suited to handling surplus wet weather flows. This technology could be used as part of a wet weather flow strategy that would allow the costly separation of combined sewers or replacement of aging sewers to be phased over a longer period of time.

2.5 Community Acceptance

Locating wastewater conveyance and treatment facilities in a neighborhood is seldom without controversy. In situations such as the CRD, where wastewater is conveyed across local municipal boundaries, the issues of where a plant is located and the size of the plant can be a significant challenge. While part of these issues can be tackled in the proper design, architecture and operation of the facilities, sequencing decisions can also play a role. For example, a more decentralized management approach may dictate that a plant located in one neighborhood could be “capped” in size. As future growth occurs in the sewerage area, a second plant could be constructed at another location.

The sequence of implementing a long-term plan will also play a significant role in building community credibility with the plan. Under a more decentralized approach, it is advisable to construct the decentralized plants first. Host communities for a central treatment plant, if scheduled to be built first, may be skeptical of plans that promise decentralized treatment works in the future.

Financial management and, in particular, the community acceptance of increased user rates, may also have a bearing on sequencing decisions. For example, the current decision making will address the issue of how quickly to move towards secondary treatment. Will the triple bottom line analysis conclude that the region should move to secondary treatment as soon as possible or should there be an interim level of treatment, prior to secondary treatment? The community acceptance of the costs of wastewater treatment will undoubtedly influence this decision. This decision will thus impact the sequencing decisions on treatment strategies. Implementing secondary treatment in phases, in terms of the proportion of flow receiving secondary treatment at any one phase and in terms of the level of treatment (primary, advanced primary, and secondary) can be an important element of a sequencing strategy to adapt a plan to meet regulatory requirements, community interests and financial capability.

2.6 Construction Sequencing

Under any scenario of sequencing, the ability to construct the necessary works will be a major factor in determining the sequencing of secondary treatment elements: conveyance pipelines, treatment works, and reuse facilities or outfalls to receiving waters. Depending upon decisions regarding centralized versus decentralized treatment schemes, conveyance works could require long-lead times. In every option to be considered, the timing of facility construction will be a critical element in determining the sequence and timing of facilities to be completed.

3 Option Development Considerations

There are three major factors that influence the selected wastewater management strategy. These factors and their impact on option development are discussed below.

3.1 Centralized versus Decentralized Treatment

Traditionally the wastewater treatment approach in urban areas has been to convey the collected wastewater to a single, large plant. Topographic features and practical considerations in how far the wastewater can be moved have typically dictated the size of the sewerage area. This is termed the “centralized” approach. The two sewerage areas within the CRD system, Macaulay Point and Clover Point, would be considered a centralized wastewater management strategy.

Over the last two decades, the concept of “decentralized” wastewater management has gained acceptance. While there are different degrees of decentralization, in general, the concept refers to a wastewater management concept that utilizes “local” wastewater treatment plants. This direction can be driven by a number of factors. One situation may be the inability to locate a large centralized plant due to lack of a suitable site. A second situation is that there may be an opportunity for reuse of the treated effluent from a decentralized plant in the local area around the plant.

There are also wastewater management strategies that lie between a centralized and decentralized approach. These strategies, that we have termed “integrated strategies”, essentially share the wastewater management functions. Two examples of how this can work are discussed below:

- *Shared Residuals Processing:* A “decentralized plant” may only provide liquid stream treatment. The residuals created from the treatment process can be treated at the “central “plant.

- *Wet Weather Flow Management:* The dry weather wastewater flow may be treated at a “central plant”. The surplus wet weather flow may be split off at a higher point in the sewerage system and treated at a “decentralized” wet weather plant prior to discharge to the receiving environment. This approach reduces the required capacity in the sewers downstream of the wet weather plant.

Each of these scenarios is potentially applicable to the CRD situation.

3.2 Wet Weather Flow Management

As outlined in Discussion Paper No. 1, how the CRD deals with wet weather flow management is one of the most significant elements of the wastewater management strategy. To date, while this situation has been recognized and steps have been taken to manage the issue, it has not been critical, as no treatment beyond screening was in place. As the CRD now moves to a higher level of treatment, how to manage the wet weather flows has taken on considerably more importance.

The CRD is not unique in facing this issue. Many other large urban centers face a similar situation. Their experience can help guide the CRD in development of a possible strategy. Key conclusions from management of the wet weather flow issue in other Canadian and west coast US cities are:

- *Secondary treatment of all flows is not practical*. In general, other similar utilities have concluded that it is cost effective to treat approximately 1.5 to 3.0 times the average dry weather flow (ADWF) through secondary treatment. Above this amount, a lesser level of treatment ranging from enhanced primary to screening is provided. This approach maximizes the use and efficiency of capital investment, while minimizing expenditures on facilities used infrequently, and at the same time providing the required environmental protection.

- *Conveyance of all of the wet weather flow to the central plant may not be practical.* In these cases, wet weather flow treatment is provided at points in the upstream sewerage system. The wet weather flow is then discharged to a surface watercourse. Treatment technologies typically employed include high-rate, chemically assisted clarification, vortex separation or fine screening.

- *Where overflows need to be avoided, temporary storage of the wet weather flows can be provided.* Examples of this are the surface level storage tanks or deep tunnel storage. Following the storm event, the stored wastewater is returned to the sewerage system for treatment at the centralized plant.

- *Long term wet weather management strategies* include inflow and infiltration (I/I) reduction, combined sewer separation and wet weather flow treatment. Given the magnitude of sewer rehabilitation to eliminate wet weather overflows, wet weather sanitary sewer overflow (SSO) and combined sewer overflow (CSO) elimination can take decades to achieve.

The details of a wet weather flow management strategy for the CRD will require a comprehensive engineering analysis, using the TBL approach. This is outside the scope and timeline of the decision information report. The final strategy will likely encompass elements of I/I reduction in sanitary sewers, wet weather flow storage, wet weather flow treatment and combined sewer separation. The decisions that the CRD will make in the coming months need to recognize the wet weather flow issue and set a course of action that is sufficiently flexible to allow the wet weather strategy to be incorporated into the overall wastewater management strategy.

3.3 Potential Wastewater Treatment Plant Sites

Critical to the development of the wastewater management strategy and the sequencing of implementation is the identification of potential wastewater treatment plant sites. As noted, the selection of plant sites will likely be a controversial process. The approved LWMP identifies two sites – Macaulay Point and Clover Point. As outlined in Discussion Paper No. 1, the current areas available on these sites may not be sufficient to accommodate future growth and higher levels of treatment. Therefore, the CRD may need to consider either acquiring more area on or near the existing sites or acquiring additional sites.

A significant amount of work has been done over the last two decades on the issue of plant sites (CH2M, 1991; Axys, 1994; CRD 1997; Stantec, 2006). In addition, CRD and municipal staff have identified additional potential sites. The consultant project team has reviewed this information and the results are presented in Figure 3-1 and Table 3-1. Potential plant locations are shown as large circles at this time, as further discussion will be required on specific properties.

The intent at this stage is to provide a basis of discussion for Workshop No. 2.

Table 3-1
Potential Wastewater Treatment Plant Locations

Location	Discussion
Clover Point	• Existing wastewater plant site. Existing infrastructure requires at least a pumping station at this location and land is available for limited expansion.
Macaulay Point	• Existing wastewater plant site. Existing infrastructure requires at least a pumping station at this location and land is available for expansion.
West Shore ‘A’	• A possible plant location due to proximity to potential ocean outfall location and undeveloped properties in the area.
West Shore ‘B”	• A possible location with local reuse / recovery opportunities, proximity to NW Trunk and undeveloped properties in the area.
West Shore ‘C’	• A potential decentralized plant location with potential local reuse/recovery opportunities.
Saanich East	• Near the existing East Coast Interceptor bypass outfall. A possible decentralized plant location with local reuse / recovery opportunities.

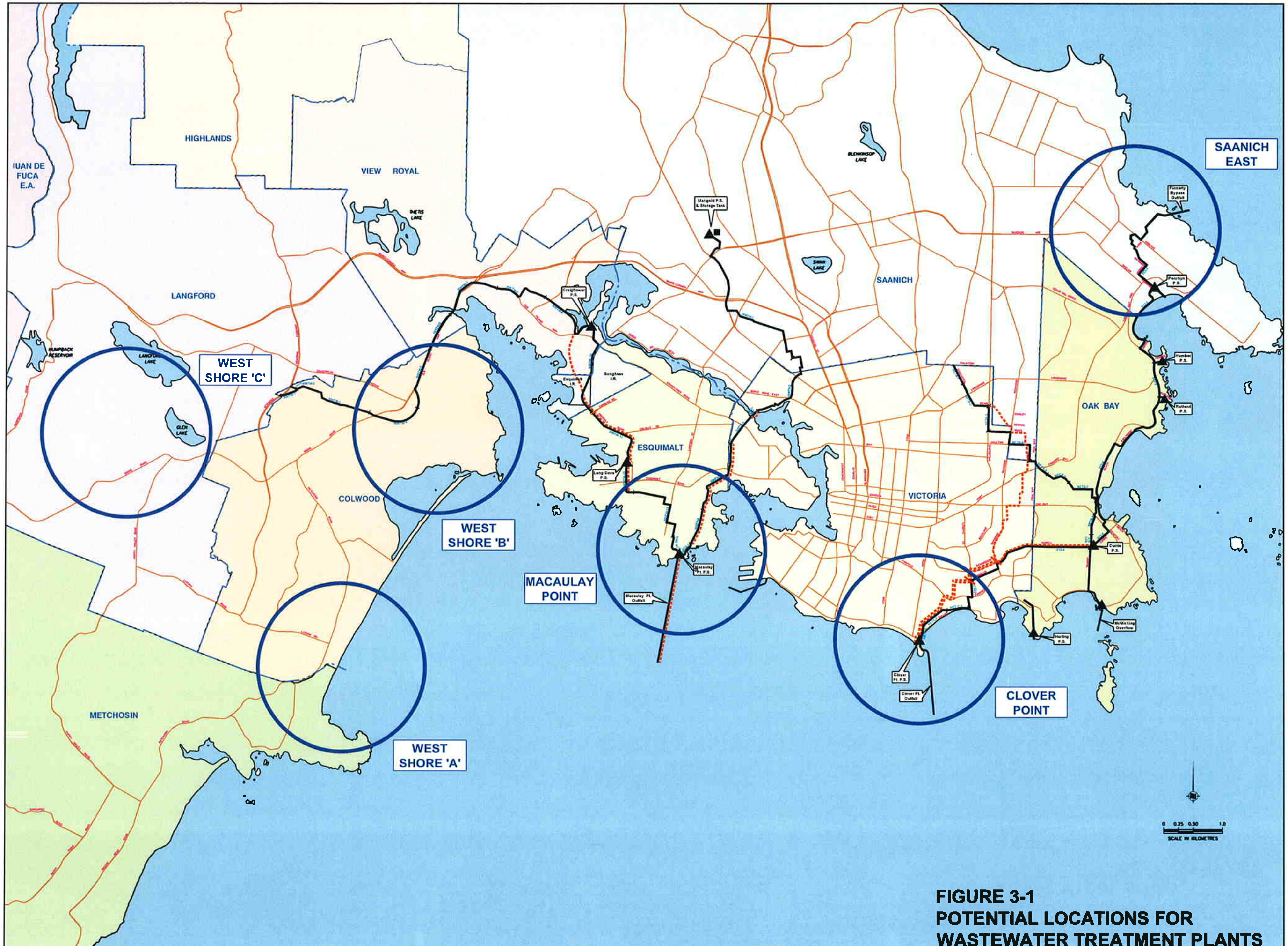

FIGURE 3-1
POTENTIAL LOCATIONS FOR WASTEWATER TREATMENT PLANTS

4 Development of Options

This section commences the development of possible wastewater management strategy options that the Steering Committee may wish to consider. They are presented as an "option series". Within each option series, there are possible variations, which may be analyzed in future discussion papers and workshops.

The option series is presented as a basis for discussion at Workshop No. 2. The intent is to more fully develop the selected options, following the discussion with the Steering Committee at the workshop. Development of the options will include an analysis of each using a TBL analysis of how well each option achieves the social, economic and environmental goals and objectives of the CRD.

4.1 Option Series 1 – Centralized Management Approach

This approach would see a continuation of the current LWMP approach. Macaulay Point and Clover Point would remain as the two plants sites.

The facilities would be expanded to incorporate higher levels of treatment. As previously noted, both sites offer limited space for expansion. Compact treatment technologies and stacking the treatment processes in a vertical fashion will need to be considered. Alternatively, additional site areas through building out into the water or acquiring additional land will be required. Dewatered biosolids would be trucked from the two plants to an off-site location for further processing.

Wet weather management would continue as currently planned. This would see management of wet weather overflow points through additional treatment and eventual upgrading of the sewerage system capacities to route additional wet weather flows to the central plants.

From a sequencing viewpoint, upgrading of the two plants is not linked, as the two sewerage systems function independently. Each plant could be placed on its own sequencing schedule.

4.2 Option Series 2 – Integrated Management Approach

This approach would see the Macaulay Point and Clover Point sites retained but with different functions compared to Option 1. Two additional wastewater treatment plants would be located on the West Shore and in the Saanich East area.

This option would function as follows:

- *The Saanich East Plant* would be a liquid stream only plant, producing a high quality effluent for water use in the local area. Surplus treated effluent would be discharged at the existing Finnerty Cove outfall location. Opportunities for resource recovery in terms of heat energy recovery may be a potential at this location. Residuals from the plant could be trucked, or discharged into the sewer system, for subsequent treatment at a downstream plant. This plant would treat all of the wastewater flow upstream of this point, thus reducing the flow to the Clover Point plant.

- *The Clover Point Plant* would be a wet weather treatment plant only. Dry weather flows would be pumped through a new forcemain across Victoria harbor to the Macaulay Point plant. The Clover Point Plant would utilize either enhanced primary treatment or ultra-fine screening technology to keep the footprint very compact. The treated wet-weather flow effluent would be discharged through the Clover Point outfall.

- *The Macaulay Point Plant* would ultimately provide a secondary level of treatment for a multiple of the dry weather flows from the Clover Point sewerage area and part of the existing Macaulay Point sewerage area. Wet weather flows, above this threshold would receive enhanced primary or primary treatment. Biosolids would be dewatered and trucked to the off-site processing location. In order to accommodate this concept, the plant layout will need to be very compact or additional area acquired.

- *A West Shore Plant at location A or B* would be a secondary plant capable of handling flows from the City of Langford, the City of Colwood and potentially a portion of View Royal. This would reduce the flow that would go to the Macaulay Point plant.

The sequence of implementation of this option is more critical than in Option 1. The West Shore A or B plant would be constructed at an early stage to provide capacity for the growth in Langford and Colwood and to reduce the flow to the Macaulay Point plant. The second plant would be the Saanich East plant. This would reduce the required size of the downstream facilities at Clover Point and Macaulay Point. The third plant in the sequence would be the Macaulay Point plant. This is required to accommodate the diverted flow from the Clover Point system. The Clover Point plant would be the final plant in the sequence. Once completed, the dry weather flow would be diverted to the Macaulay Point plant.

4.3 Option Series 3 – Decentralized Management Approach

This option would be similar to Option 2, but would go further in the direction of decentralized wastewater management. A fifth wastewater treatment plant would be added in the City of Langford (West Shore C). A portion of the wastewater flow from the City of Langford would go to this plant. The plant would employ an advanced technology, producing an effluent suitable for reuse. Surplus effluent could potentially be discharged either by a pipeline or surface watercourse to the ocean, depending on the sensitivity of the receiving environment. This option would reduce the size of the West Shore A or B locations.

Under this option, additional decentralized plants particularly in the northern part of the Macaulay Point sewerage area could be considered. These could be liquid treatment only plants with the residuals trucked, or discharged into the sewerage system, for downstream treatment at the

Macaulay Point plant. Surplus effluent, not used as a resource, would be discharged into surface watercourses.

Sequencing considerations for this option would be similar to Option 2.

5 References

1 Axys Environmental Consulting Ltd. *Initial Environmental Evaluation and Preliminary Site Screening of Seven Potential Sites for Wastewater Treatment Facilities, Final Report*, Capital Regional District, March 1994.

2 Capital Regional District, 1997. *Core Area Liquid Waste Management Plan Site Selection*, Presentation to The Capital Regional District Committee of the Whole, June 25, 1997.

3 CH2M HILL Engineering Ltd., 1991. *Liquid Waste Management Plan – Stage 2, Sewage Treatment Options and Locations of Sites*, Capital Regional District, April 1991.

4 Stantec Consulting Ltd., 2006. *Conceptual Design of Sewage Treatment Plants for Macaulay Point and Clover Point, Final Report,* Capital Regional District, January 2006.