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**CAL 13-19**

**REPORT TO CORE AREA LIQUID WASTE MANAGEMENT COMMITTEE**
**MEETING OF WEDNESDAY, OCTOBER 9, 2013**

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**SUBJECT** **TECHNICAL AND FINANCIAL IMPLICATIONS OF A REGIONAL DISTRIBUTED TREATMENT SYSTEM**

## ISSUE

To provide a response to a number of concerns raised by the public and the media concerning the current plan for wastewater treatment.

## BACKGROUND

Recent presentations to the Core Area Liquid Waste Management Committee (CALWMC) and local media have raised a number of concerns including:

- The benefits of a decentralized treatment system compared to the current centralized treatment plan, in particular the Dockside Green model;
- The cost implications of a decentralized tertiary treatment system;
- The lack of resource recovery, in particular heat, from the treated effluent;
- The lack of water reuse; and
- The inadequacy of the proposed secondary treatment to address the contaminants of emerging concern in wastewater.

This report addresses the above issues, most of which have previously been considered by the CALWMC.

The core area sewage collection system consists of hundreds of kilometres of collector and trunk sewers pipes and 175 pump stations which convey sewage to the two marine outfalls at Clover Point and Macaulay Point. The sewers are of varying ages with the hydraulic flows strongly influenced by precipitation through inflow and infiltration (I&I) to the municipal sewers. In addition, the Uplands area of Oak Bay contains combined sewers, further exacerbating the entry of rainwater to the sewer system. The entry of rainwater into the sanitary sewer system means that any treatment facility must be able to accommodate a wide range of hydraulic loading in addition to the organic loading.

### Decentralized Treatment Systems – New Developments

Decentralized treatment systems are typically considered for new, high density developments where smaller capacity plants are required. The local example, Dockside Green, will eventually accommodate a population of 2,500 on a 15 acre site or an average of 167 persons per acre. With the smaller size 'package plants' such as factory assembled plants, are feasible. These plants typically do not include sludge treatment. Dockside Green, for example, trucks the screenings to Hartland landfill and the sludge to SPL in Langford for treatment prior to trucking up island for composting. With the design of new, compact, high density developments, I&I is

minimal and does not affect the hydraulic design capacity of the treatment plant. Water reuse for toilet flushing, landscape irrigation and water features are easily incorporated into the development design. The current Core Area Liquid Waste Management Plan (the Plan) can accommodate the development of decentralized treatment systems for new developments provided a developer who wishes to do so and can obtain the necessary approvals, particularly from the Ministry of Environment. An amendment to the Plan would also be necessary as Capital Regional District (CRD) has responsibility for sewage treatment in the core area.

Decentralized Treatment - Existing Developments

Applying a decentralized model to existing development has many challenges. Typically, existing residential developments/neighbourhoods have a much lower density than new, high density developments such as Dockside Green. A typical older neighbourhood in Victoria, for example, has an average density of about 13 persons per acre based on an average of 2.5 persons per household. In areas such as Uplands or Broadmead, the density is much lower at about 3.5 to 6 persons per acre respectively. All of these older neighbourhoods have significant I&I necessitating that treatment plants be designed to accommodate the hydraulic loading as well as the organic loading.

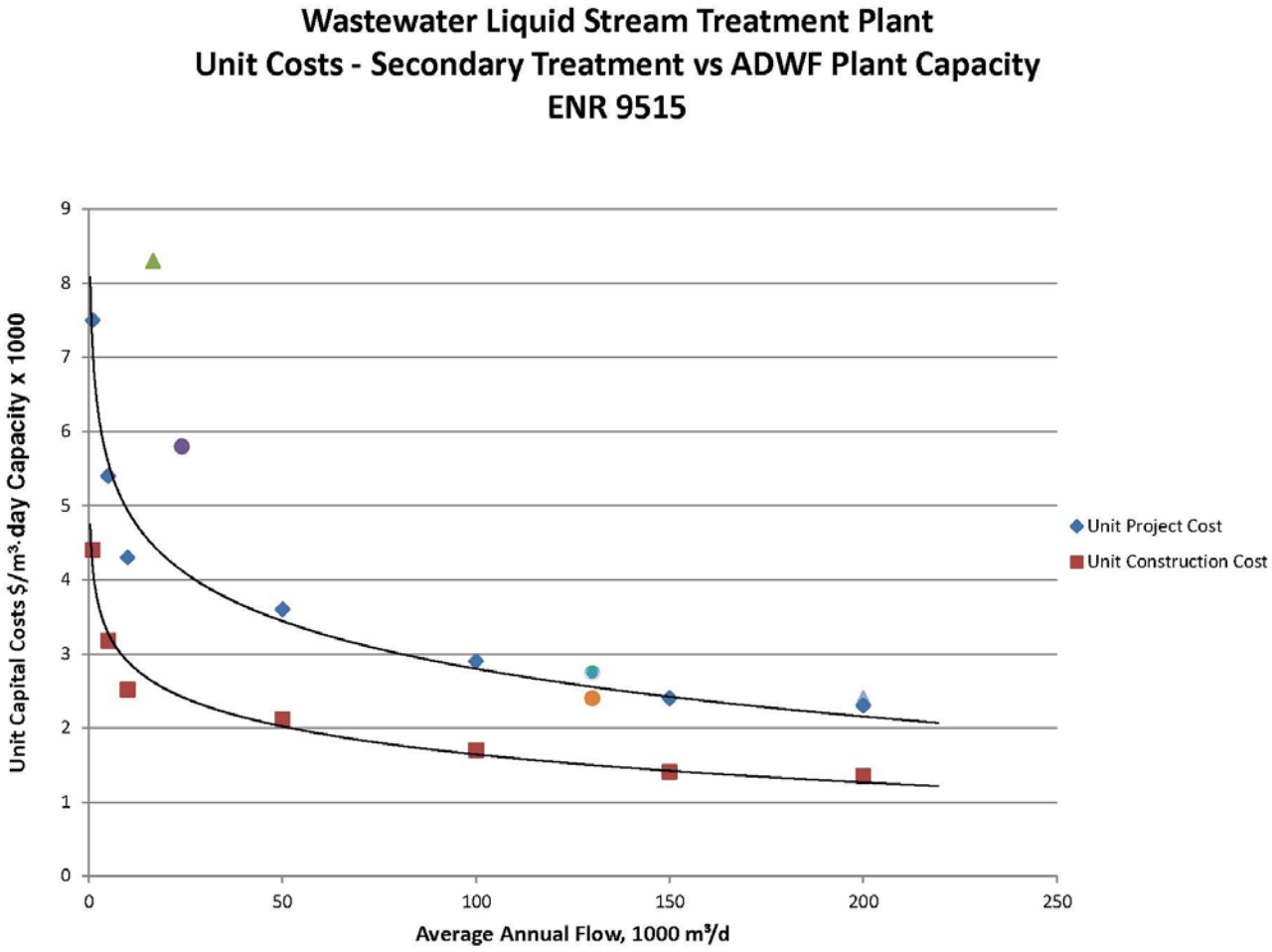
Water reuse for toilet flushing is impractical in existing homes because of the cost of retrofitting homes with purple pipes to segregate potable and non-potable water uses. Water reuse in existing neighbourhoods would also require a recycled water distribution system including pipes and pump stations. Balancing reservoirs would also be required to accommodate landscape irrigation which is typically done by automatic irrigation systems during nighttime hours when treated effluent availability would be at its lowest. The cost of the distribution system for recycled water would be at significant additional cost to the distributed treatment plants. Recycled water would also have to be sold at a lower cost than tap water otherwise, there would be no incentive to make the necessary investments in infrastructure to use it. Also, extensive use of recycled water would impact the revenue requirements of the regional water supply system as approximately 95% of the costs are fixed i.e., costs don't vary significantly with demand. Rates would have to rise to maintain the revenue requirement to operate and maintain the system. A 5.4 Ml/day plant, the smallest size suggested by proponents of a distributed system, would require approximately 0.5 hectares of land. Finding 20 such sites in existing neighbourhoods would be challenging both from the perspective of land availability and public acceptability.

Heat Recovery

The CRD Parks and Environmental Services has undertaken a number of studies to evaluate the feasibility of heat recovery from trunk sewers, trunk water lines and treatment plant effluent. All of the studies have concluded that without significant subsidies, heat recovery is uneconomic. Retrofitting existing homes with electric baseboard heating would be prohibitively expensive as either hydronic or forced air systems would have to be installed. Home owners are unlikely to replace their heating systems without financial incentives.

The Relationship Between Technology, Plant Capacity and Cost

The economy of scale is a significant factor in the unit cost of treatment plants. The following graph is based on actual cost data for treatment plants, recognizing that each plant is unique.




To achieve tertiary treatment levels additional treatment stages e.g., activated carbon filters, or more advanced treatment processes will be required, which are typically more energy intensive e.g. membrane bioreactors. Tertiary treatment will cost more to build and significantly more to operate and maintain. Typically, tertiary treatment is used where the effluent quality from secondary treatment may have a detrimental impact on the receiving waters or where high levels of contaminants are present in the sewage entering the treatment plant.

Operation of Decentralized Treatment Plants in Existing Neighbourhoods.

In a decentralized treatment system each plant will require grit removal and coarse screening prior to the treatment process and in the case of membrane bioreactors, fine screening will also be required to reduce the risk of fouling the membranes. In addition each treatment plant would require either a dedicated marine outfall or connection to an existing marine outfall to discharge excess water not able to be recycled. Each plant will require facilities to collect and remove the grit and screenings for landfill disposal. Enclosed handling facilities for grit and screenings will be required to minimize odour impacts on adjacent neighbourhoods. The sludge removed as part of the treatment process will have to be trucked or piped to a central processing facility. The number of operators for a distributed system will also be greater because of the number of

plants being operated on a continuous basis. All of these factors will translate into higher operating costs and a greater carbon footprint.

Previous Evaluation of Decentralized Treatment

In 2009 three distributed models were evaluated with 3, 5 and 10 secondary treatment plants plus a wet weather plant at Clover Point and a sludge digestion facility. Estimated costs (in 2008 dollars) were $1.2 billion, $1.63 billion and $2 billion respectively. Annual operating costs were $23.5 million, $29 million and $33.4 million respectively.

Amendment No. 7 proposed a distributed system with four treatment plants as follows:

- Saanich East – 16.6 ML/d membrane bioreactor (MBR) tertiary treatment for water reuse
- Clover Point - A 37.8 ML/d wet weather plant to treat storm weather flows
- McLoughlin/Macaulay – 84.5 Ml/d biological aerated filter (BAF) plant with 12 ML/d MBR side stream for water reuse.
- Westshore Treatment Plant – A 14Ml/d secondary treatment plant with a 2ML/d side stream for water reuse.

The cost estimate for Amendment No. 7 was $967.5 million, with annual operating costs of $19.1 million.

Tertiary treatment capacity was included for water reuse. Amendment No. 8 eliminated the plant at Saanich East, the Westshore and the tertiary side stream at McLoughlin Point with the agreement of the Province because of the success of the CRD's demand management programs in reducing water demand. In order to qualify for grants for water systems capacity expansion, the Province requires that 50% of the capacity required to accommodate growth must come from existing capacity. The CRD is well over 100%. The CRD demand management programs have included rebates for 6-litre toilets, high efficiency washing machines (front loading), irrigation system timers, school curricula (elementary and secondary), irrigation and native plant workshops, facts sheets, public education and two days a week outdoor watering restrictions. Watering restrictions allow home owners to use sprinklers a total of 18 hours per week or hand watering at any time. It is universally recognised that demand management is the most cost effective way of managing our water resources and deferring the need to develop new sources.

Emerging Substances of Concern

With the increased ability of modern testing equipment and methods to detect contaminants at increasingly lower levels, the increased use of various medications and the body's limited ability to absorb the medications, pharmaceuticals and other chemicals are being detected more frequently in wastewater flows. Given the sheer number of chemicals (20,000+) analytical methods to detect these substances at micro- and nano-grams per litre are under ongoing development. There is significant ongoing research and debate on the best methods for treatment of substances of emerging concern. The ability of wastewater treatment to remove these chemicals typically increases with the level of treatment, with the lowest removal rates occurring with primary treatment increasing through secondary, tertiary and with the highest levels of removal with tertiary plus advanced oxidation and/or activated carbon filtration. The current request for proposals for the McLoughlin treatment plant requires designers to make

provision for advance oxidation such as ozone or UV plus hydrogen peroxide. This provision will allow the CRD to add advance oxidation in the future if and when required. A more in-depth analysis of emerging substances of concerns will be provided in a report to the CALWMC in November.

## CONCLUSION

Previous studies have concluded that decentralized treatment is not a cost effective option for the Core Area Wastewater Treatment Program. The additional infrastructure necessary for recovering resources such as heat and water make this approach not economically viable. In addition to the higher capital and operating costs associated with a distributed system, there are significant practical implications such as the requirements for plant siting, sludge handling and marine effluent discharges which all add cost and complexities to such systems.

## RECOMMENDATION

That the Core Area Liquid Waste Management Committee receive the report for information.

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