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Report #EES 08-29

**REPORT TO CORE AREA LIQUID WASTE MANAGEMENT COMMITTEE
MEETING OF WEDNESDAY, 26 MARCH 2008**

**SUBJECT CORE AREA LIQUID WASTE MANAGEMENT PLAN – DISTRICT OF OAK BAY'S
COMMITMENT TO SEPARATE COMBINED SEWERS IN UPLANDS**

PURPOSE

To inform the committee of the District of Oak Bay's commitment to separate combined sewers in Uplands in response to condition No. 11 in the minister of environment's 26 March 2003 approval letter of the Core Area Liquid Waste Management Plan (LWMP), and to request approval to submit Oak Bay's response to the Ministry of Environment.

BACKGROUND

When the Core Area LWMP was approved on 26 March 2003, the minister included the following condition No. 11 with respect to the combined sewers in Oak Bay:

On or before March 31, 2008, complete cost/benefit studies and an implementation schedule directed at the elimination of combined sewers in Oak Bay to be consistent with the Municipal Sewage Regulation (MSR).

Condition 15 (1) of the MSR states the following:

On and after January 1, 2004, the discharger must ensure that no person allows a combined sewer overflow to occur during storm or snowmelt events with less than a 5-year return period,...

Therefore, Oak Bay retained a consultant to investigate options and prepare a report to respond to the minister's condition. The combined sewer areas in Oak Bay are the Humber and Rutland catchments of Uplands, which are approximately 13% of Oak Bay's total land area. These combined sewer catchment areas have been studied many times previously and various solutions have been presented to the ministry for consideration, such as storage/treatment tanks. However, the ministry has consistently replied that the only acceptable solution is to separate the combined sewers.

Consequently, Oak Bay's current plan is to separate about 80% of its combined sewers by installing 5,600 and 5,150 metres of new storm drain in the Rutland and Humber catchments, respectively. These lengths were calculated by the consultant's hydraulic model in order to meet the MSR criteria. The proposed schedule is to commence with detailed design in 2008 and start construction in 2009. Work will commence at the Rutland and Humber outfalls and extend upstream by about 100 metres in each catchment so that inflow can be reduced each year as the work progresses. Additionally, Oak Bay's public sewer bylaw will require homeowners to separate their storm and sewer laterals within one year from when the new storm drain is commissioned.

Oak Bay intends to fund this work using its portion of the federal gas tax rebate, estimated to be \$275,000 this year. By installing 200 metres of new storm drain each year, it will take approximately 50 years to complete the Uplands sewer separation program.

Core Area Liquid Waste Management Committee – 26 March 2008
Re: District of Oak Bay's Commitment to Separate Combined Sewers in Uplands
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For more detailed information on Oak Bay's sewer separation program, see its consultant's technical memo attached in Appendix A. Also attached as Appendix B are copies of the three Oak Bay council resolutions adopting its consultant's plans.

FINANCIAL IMPLICATIONS

This is a municipal program and the District of Oak Bay is planning to use its portion of the annual federal gas tax rebate to fund 100% of its combined sewer separation project. In the event that the gas tax rebate program was discontinued in the future, Oak Bay would maintain its commitment to the sewer separation schedule using its own revenue sources.

SUMMARY/CONCLUSIONS

Condition No. 11 in the minister of environment's approval letter of the Core Area LWMP required Oak Bay to submit a plan directed at eliminating its combined sewers consistent with the Municipal Sewage Regulation. The District of Oak Bay has responded to this condition by submitting the attached combined sewer separation plan.


RECOMMENDATIONS

That the Core Area Liquid Waste Management committee recommend to the Board that:

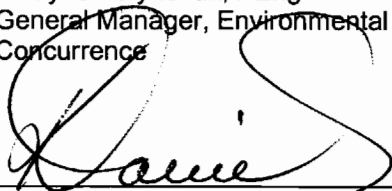
1. this report be received as a response to condition No. 11 in the minister of environment's 26 March 2003 approval letter of the Core Area Liquid Waste Management Plan; and
2. staff be instructed to forward the District of Oak Bay's plan to separate its combined sewers, in Uplands, to the Ministry of Environment.



Malcolm J. Cowley, PEng
Manager, Engineering Design Services



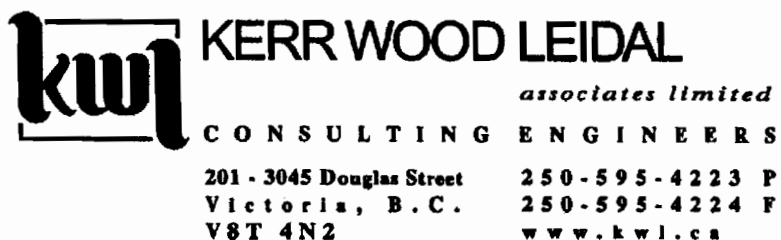
Dwayne Kalynchuk, PEng
General Manager, Environmental Services
Concurrence



Kelly Daniels
CAO Concurrence

COMMENTS

Attachments: 2



Technical Memorandum

DATE: February 13, 2008

TO: Mr. Dave Marshall
 The Corporation of the District of Oak Bay
 2167 Oak Bay Avenue
 Victoria, BC, V8R 1G2

FROM: Robert Warren, P.Eng.

RE: **UPLANDS SEWERAGE SYSTEM MODELLING**
Rutland and Humber Catchments
Our File 547-012 - 300

1. INTRODUCTION

The District of Oak Bay (Oak Bay) has reviewed a variety of options in order to comply with the Provincial Municipal Sewage Regulations (MSR) and the Capital Regional District's (CRD) Liquid Waste Management Plan (LWMP) for the Uplands area. In order to comply with these commitments, a combined sewer separation program must be undertaken to lower inflow and infiltration (I&I) rates in the existing Upland's combined sanitary sewer system. These I&I rates are to be lowered so that no combined sewer overflows (CSOs) occur at frequencies lower than a 5-year return period.

During significant flows in the East Coast Interceptor, the pumping rates for the Rutland and Humber pump stations are limited to 1 pump each (about 90 L/s). Therefore, in order to comply with the LWMP and MSR, the I&I rate must be reduced, so that an overflow does not occur during the 5-year storm event. The I&I rate must be reduced to 90 L/s minus the peak sanitary flow.

The Humber and Rutland catchments have been studied many times previously, in particular as part of many reports prepared for the CRD regarding the East Coast Interceptor (ECI). Several of the key reports include the following:

- 1987 ECI Design Memorandum¹
- Investigation of Alternatives to Combined Sewer Separation in the Rutland Drainage Basin².

¹ East Coast Interceptor Design Memorandum, Kerr Wood Leidal Associates, 1987

▪ Assessment of ECI Pressure Siphon Capacity and Arbutus Peak Flow Storage Tank³

A key point to be noted from the 1987 ECI Design Memorandum is that the “preferred plan” for the Humber and Rutland Pump Stations was to capture the first flush of storm events. Therefore, it appears that the intention of these pump stations was to allow overflows during storm events. Apparently this was deemed acceptable as long as the early portion of the flow, which contains the greatest concentration of environmentally deleterious substances, was pumped to the ECI. The ECI Design Memorandum report also discussed that it is not practical to eliminate overflows for the 1-year return period event for Oak Bay without separating the sewer system. The current requirement according to the LWMP and MSR is for no overflows during the 5-year event.

In the Rutland Separation Alternatives Report a number of options were developed for the Rutland Catchment. These options were developed to meet the following criteria:

- Eliminate all CSOs in the summertime;
- Remove all floatables and materials of obvious sewage origin;
- Reduce the total number of treated CSOs per year to 4 or less; and,
- Provide treatment for all CSOs less than the 5-year storm.

The “preferred plan” developed to meet this criteria included the construction of one to three storage/treatment tanks (total volume of 500 m³ to 1500 m³) and a fine screening facility. However, the criteria above was not accepted by the Ministry of Environment as the Ministry required all combined sewers to be separated. Therefore, this option was not developed further.

The Assessment of ECI Pressure Siphon Capacity and Arbutus Peak Flow Storage Tank technical memorandum reviewed the capacity of the pressure siphon portion of the ECI and developed future design flows and upgrading programs through the year 2045. One option in the technical memorandum assumed that the combined sewers in the Upland areas would be separated and that the maximum flows from Humber and Rutland pump stations would be reduced to 22 L/s and 30 L/s in a 5-year storm event, respectively. However, Oak Bay has decided to set the I&I reduction target at 90 L/s minus the peak sanitary flow, as described above.

Recently, Associated Engineering (AE) was commissioned to investigate options to meet the above commitments. The AE report entitled *Uplands Subdivision Combined Sewerage System, Compliance with Core Area Liquid Waste Management Plan and Municipal Sewerage Regulation, April 2005* presented 4 options. Although the report did not recommend a preferred option, Oak Bay staff have preliminarily determined that a program of new storm sewer construction is the most logical.

² Investigation of Alternatives to Combined Sewer Separation in the Rutland Drainage Basin, Kerr Wood Leidal Associates, June 1995

³ Assessment of ECI Pressure Siphon Capacity and Arbutus Peak Flow Storage Tank, Kerr Wood Leidal Associates, September 2004

The purpose of this study is to confirm the proposed CSO reduction strategy selected by Oak Bay staff, and investigate the extent of new storm sewers to meet the above target

2. DEVELOPMENT OF A COMPUTER MODEL

The modelling for this project was completed using the hydrodynamic software package *XP-SWMM*. Oak Bay provided KWL with mapping information from their geographic information system and aerial photos for development of modelling parameters. The study area is illustrated on Figure 1.

The models were setup for the Rutland and Humber catchments using physical parameters obtained from the GIS database (i.e. tributary area, slope, percent impervious, etc.). Actual flow and rain data was obtained from the CRD for the winter of 2001/2002, and imported into the model. The rainfall information was provided from the CRD's rainfall station located at the Penrhyn Pump Station. The Penrhyn Pump Station is located immediately north of the study area in the District of Saanich. The flows are measured at the inlets to the Rutland and Humber pump stations by the CRD with weir structures.

The models were then calibrated by reducing the directly connected impervious area until the predicted flow signals matched the actual flows recorded. It was assumed that all of the municipal roads were connected to the combined sewer system. Therefore, in order to calibrate the model, the area of building roof tops was adjusted. This calibration resulted in the following conclusion: 30% of the roof tops in the Rutland catchment and 89% of the building roof tops in the Humber catchment are directly tied to the combined sewer system. The surprisingly low connection rate in the Rutland catchment may be attributable to the more permeable soil conditions in the area. If rain water can easily infiltrate into the ground, homeowners are less likely to connect roof leaders.

Figures 2 and 3 illustrate the calibration results comparing measured flows and predicted flows at the Rutland and Humber pump stations. The results are considered very good as the two lines are nearly identical. This indicates that the model can now accurately predict the impact of various storm events and can predict the frequency of future CSOs once a new storm sewer is constructed.

3. DETERMINATION OF DESIGN FLOWS

Based on the LWMP and MSR commitments outlined above, a 5-year storm was run through these models to determine the current design I&I rate. The 5-year storm pattern selected was the SCS Type 1a 24-hour storm. The resulting peak flow rates resulting from this storm are 442 L/s (520,000 L/ha/day) and 539 L/s (860,000 L/ha/day) for the Rutland and Humber catchments, respectively. In other words, assuming a new storm sewer is not constructed, the Humber and Rutland Pump and all of the downstream East Coast Interceptor would need to be upgraded to

accommodate these flows. Hydrographs showing the results over 24-hours along with the allowable I&I rates are illustrated on Figure 4. The allowable I&I rates were calculated based on the existing pumping capacities of the Humber and Rutland pump stations (i.e. 90 L/s minus the peak sanitary flow). Since the allowable I and I rate is significantly below the design 5 year peak flows, combined sewer overflows from storms much smaller than the 5-year event will occur.

4. CALCULATION OF REQUIRED LENGTHS OF NEW STORM SEWER CONSTRUCTION

The calculated storm sewer lengths required to meet the LWMP and MSR criteria are 5,630 m and 5,150 m for the Rutland and Humber catchments respectively. The total length of storm drains⁴ to service the entire Rutland and Humber catchments are 7000 m and 6500 m, respectively. The construction of all these mains will not reduce the I&I to the required level unless separate stormwater connections for the houses currently on combined services are also undertaken. This is appropriate considering Oak Bay has a municipal policy requiring the separation of storm and sanitary service laterals for all new and reconstructed homes in the Uplands subdivision.

In order to estimate the rate that homes will be connected to the new storm drain, some assumptions must be made. These assumptions are as follows:

- On average 100 m of storm drain will be installed per year in each catchment. This is based on spending \$100,000 per year in each catchment at a cost of \$1,000 per metre of main line storm drain including 150 mm service laterals to just outside of the roadways, connection of the existing catch basins and asphalt resurfacing of the entire road width (2006 construction dollars). The budget amount of \$100,000 per catchment was provided by Oak Bay staff.
- In 50 years, all houses, next to a storm main, in the Uplands area will have separate storm and sanitary service connections as a result of house reconstruction or new construction.

5. STORMWATER QUALITY

A separated sewer system will also result in flows to the outfalls which currently do not occur. Stormwater will be discharged to the ocean more frequently. We have discussed this matter with the Department of Fisheries and Oceans (DFO), the Ministry of Environment (MoE) and the CRD's Environmental Services division. In discussions with the DFO it is our understanding that a permit from them will not be required because the existing outfalls can be used for the stormwater discharge. The MoE has a policy to prevent deleterious substances from being discharged. In discussions with the MoE, it is our understanding that because the catchments do not involve industrial activities, the MoE would not get involved in this project. Rather, the MoE would leave it up to the local or regional government to establish policies to prevent

⁴ Uplands Subdivision Combined Sewerage System, Compliance with Core Area Liquid Waste Management Plan and Municipal Sewage Regulation, Associated Engineering, April 2005.

discharges of deleterious substances. In discussions with the CRD Environmental Services division, it is our understanding that the CRD has focused on source controls to prevent stormwater pollution. In reviewing the CRD's Code of Practice for Streets and Roads, catch basins alone will provide an adequate level of stormwater treatment. Furthermore, the CRD stated that there are only a few instances where stormwater treatment units have been added to an existing system in the capital region and these have only been for discharges to the Inner Harbour.

In the future more stringent requirements could be adopted and at that time treatment options will be assessed. Technologies such as curbside rain gardens that treat road runoff would provide an effective removal mechanism for common road runoff pollutants.

6. IMPLEMENTATION SCHEDULE

Based on the construction of 100 m of new storm mains per year per catchment it would take approximately 54 years to reach the LWMP and MSR targets. It is likely that most if not all of the existing houses, that have roof drains connected to the sewer, will have constructed separate storm water services or disconnected from the sewer by this time. Design of the storm sewers will start in 2008 with construction starting in 2009.

7. ADDITIONAL ISSUES

The above analysis is contingent on the connection of houses to the new storm drain. The current municipal policy requires the separation of storm and sanitary service laterals for all new and reconstructed homes. As well the Public Sewer Bylaw states that homeowners separate their storm and sewer laterals within one year of the commissioning for the new storm system.

8. RECOMMENDATIONS AND CLOSING REMARKS

Based on the above results, the following recommendations are made to comply with the LWMP and MSR commitments.

- 5,600 metres of new storm drain system be installed in the Rutland catchment to remove approximately 80% of the existing roadways from the existing combined sewer system.
- 5,150 metres of new storm drain system be installed in the Humber catchment to remove approximately 79% of the existing roadways from the existing combined sewer system.
- The storm drain systems should be designed at sufficient depth and with sufficient capacity so that the new storm drain service laterals can be connected.
- All new building permits to include the provision that roof, area drains, and foundation drains be disconnected from the sewer connection.

The estimated total cost of this project based on 2006 levels is approximately \$10,750,000. Based on a total funding level of \$200,000 per year, it is estimated that it will take up to 54 years to construct the new storm sewer system.

The lengths of storm drains presented above will eliminate overflows at the Humber and Rutland Pump Stations during the 5-year storm event for 1 pump in operation at each station. However, there will still be significant portions of each catchment that do not have a storm drain system. As a result the I&I rates will not be reduced to the levels as indicated in the Assessment of ECI Pressure Siphon Capacity and Arbutus Peak Flow Storage Tank study, which assumed for a completely separated system.

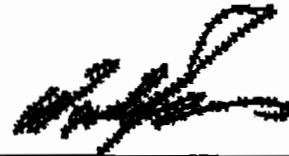
We trust this submission meets your requirements for this project. However, if further information or clarification is required please contact the undersigned.

Prepared by:

Reviewed by:



Rob Warren, P.Eng.
Project Manager



Wendy Yao, P.Eng.
Technical Reviewer

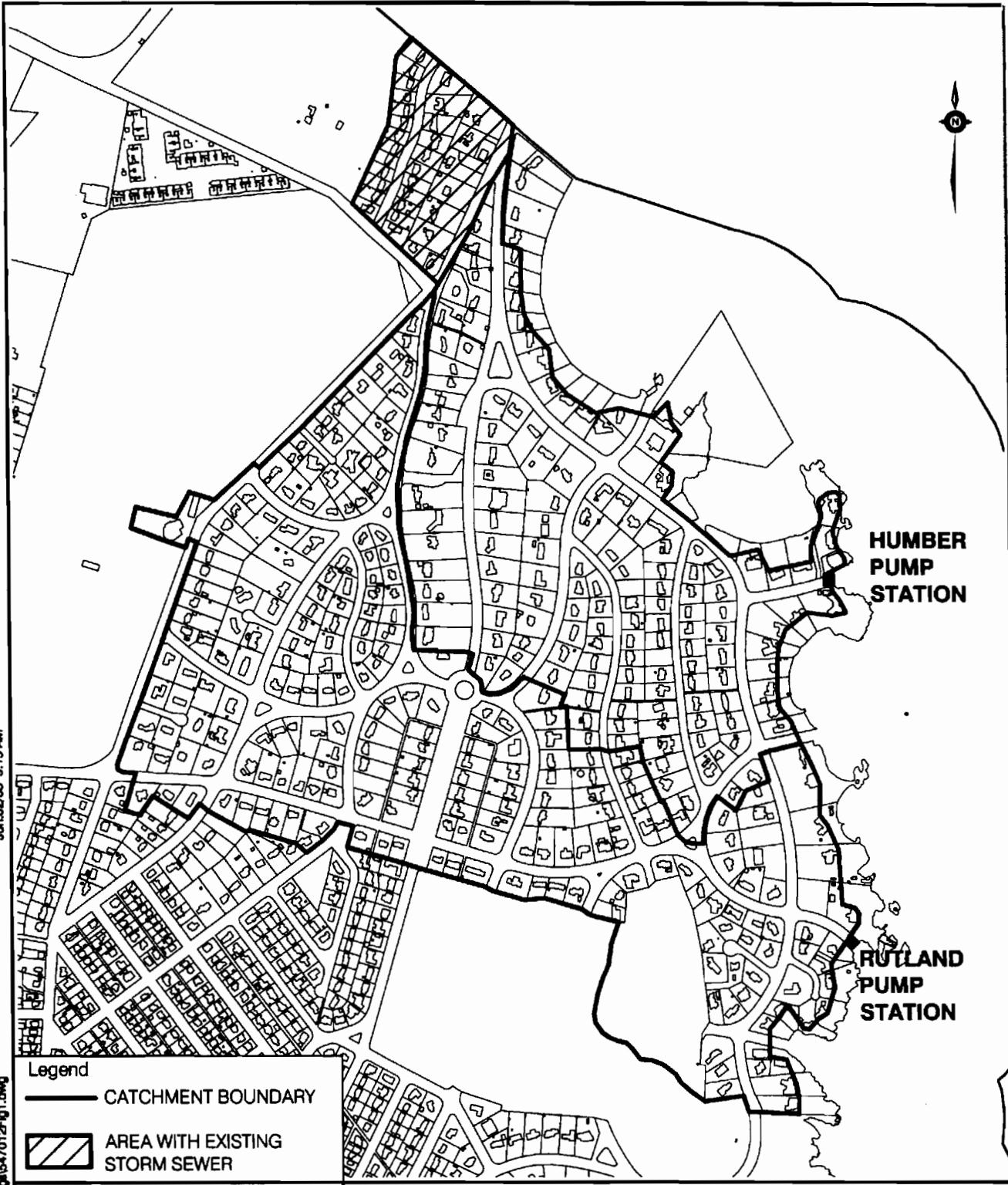
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STATEMENT OF LIMITATIONS



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This document represents KWL's best professional judgement based on the information available at the time of its completion and as appropriate for the project scope of work. Services performed in developing the content of this document have been conducted in a manner consistent with that level and skill ordinarily exercised by members of the engineering profession currently practising under similar conditions. No warranty, express or implied, is made.

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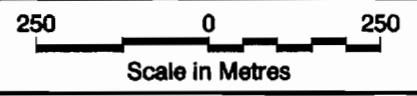


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Legend	
	CATCHMENT BOUNDARY
	AREA WITH EXISTING STORM SEWER


KERR WOOD LEIDAL
associates limited
 CONSULTING ENGINEERS

Project No.	Date
547.012	JUNE 2006



UPLANDS SEWERAGE SYSTEM MODELLING
RUTLAND AND HUMBER CATCHMENTS

STUDY AREA
AND CATCHMENTS

FIGURE 1

Rutland Model Calibration

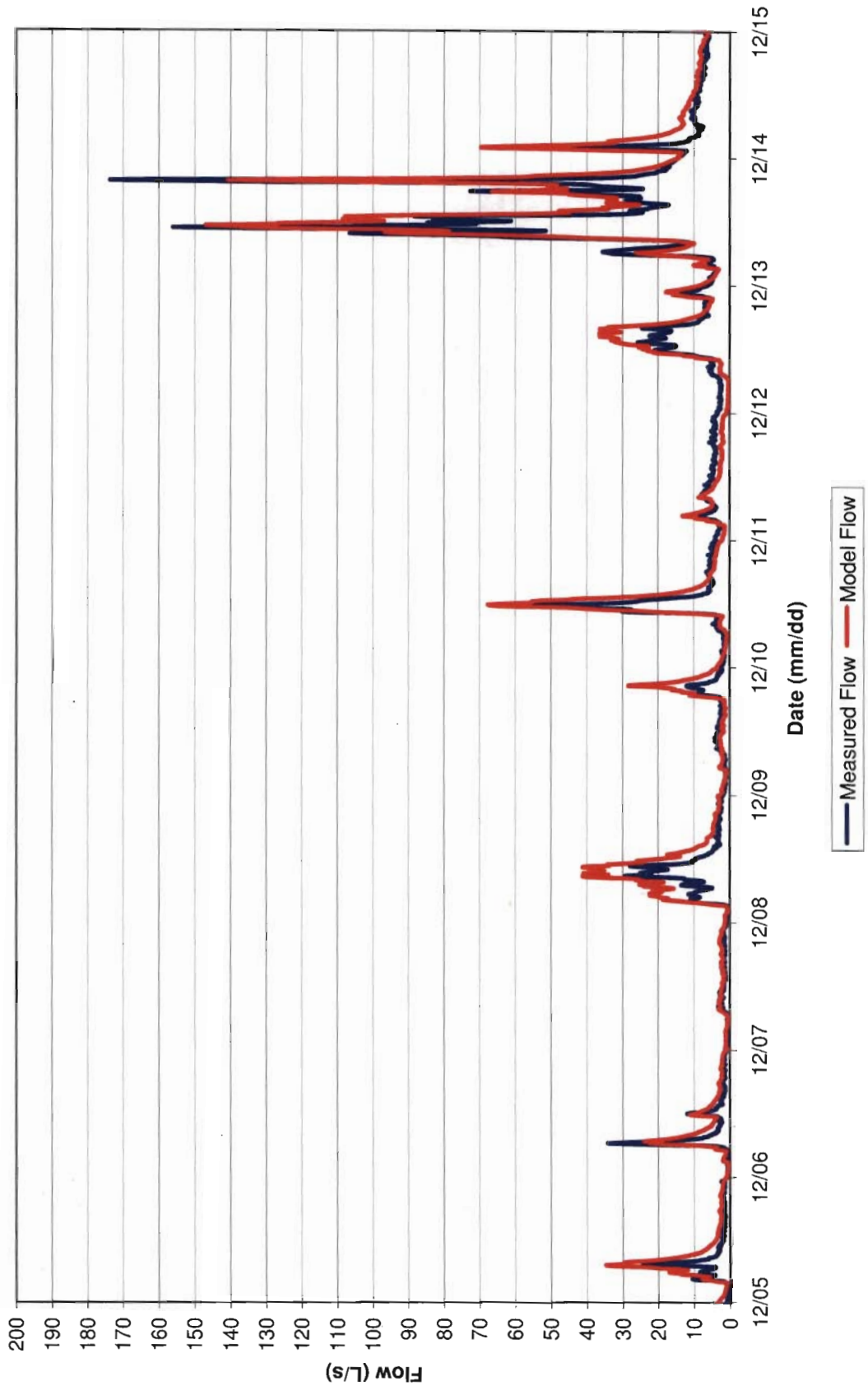


Figure 2

Humber Model Calibration

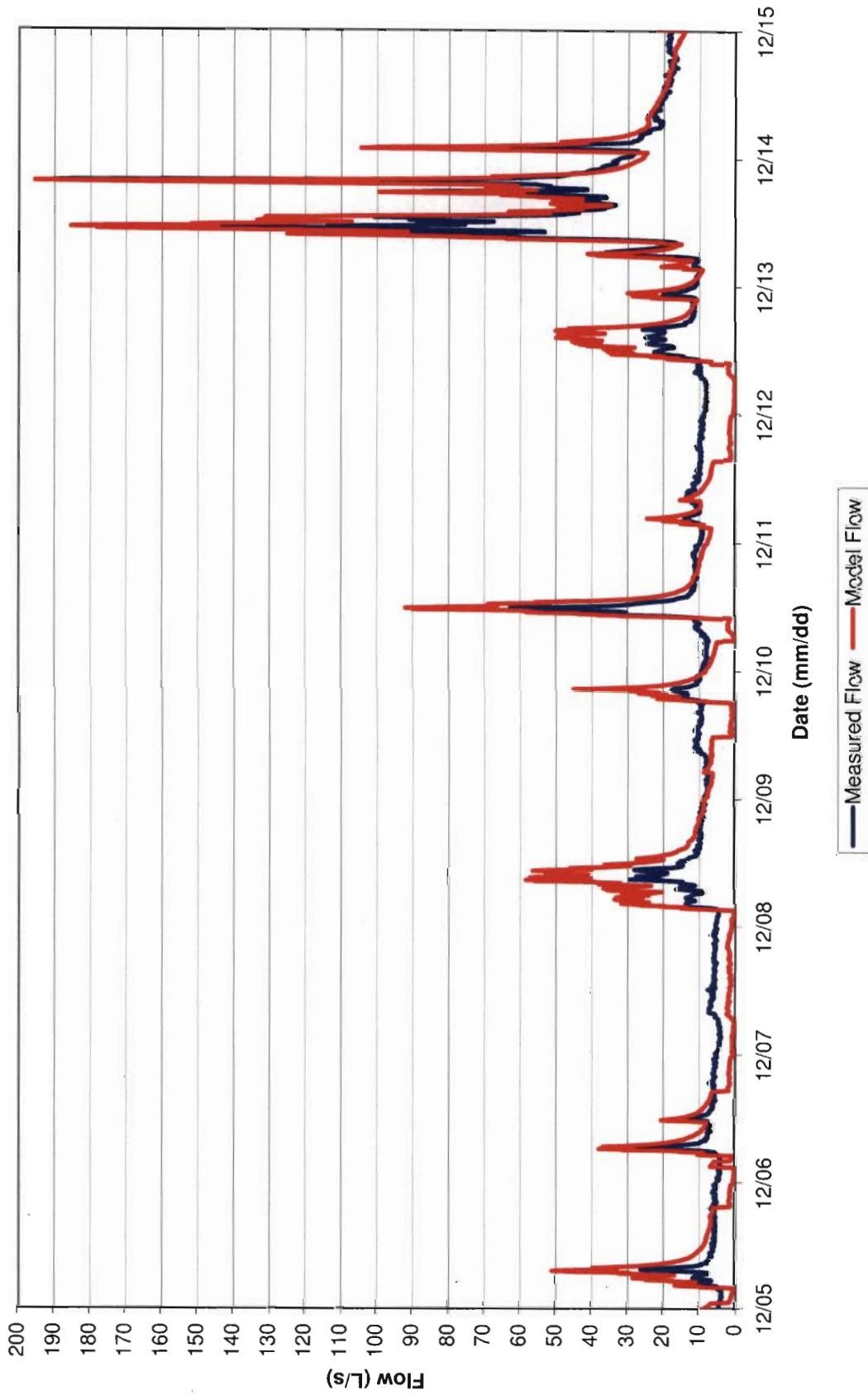


Figure 3

Model Results
SCS Type 1A 5-Year 24-Hour Design Storm

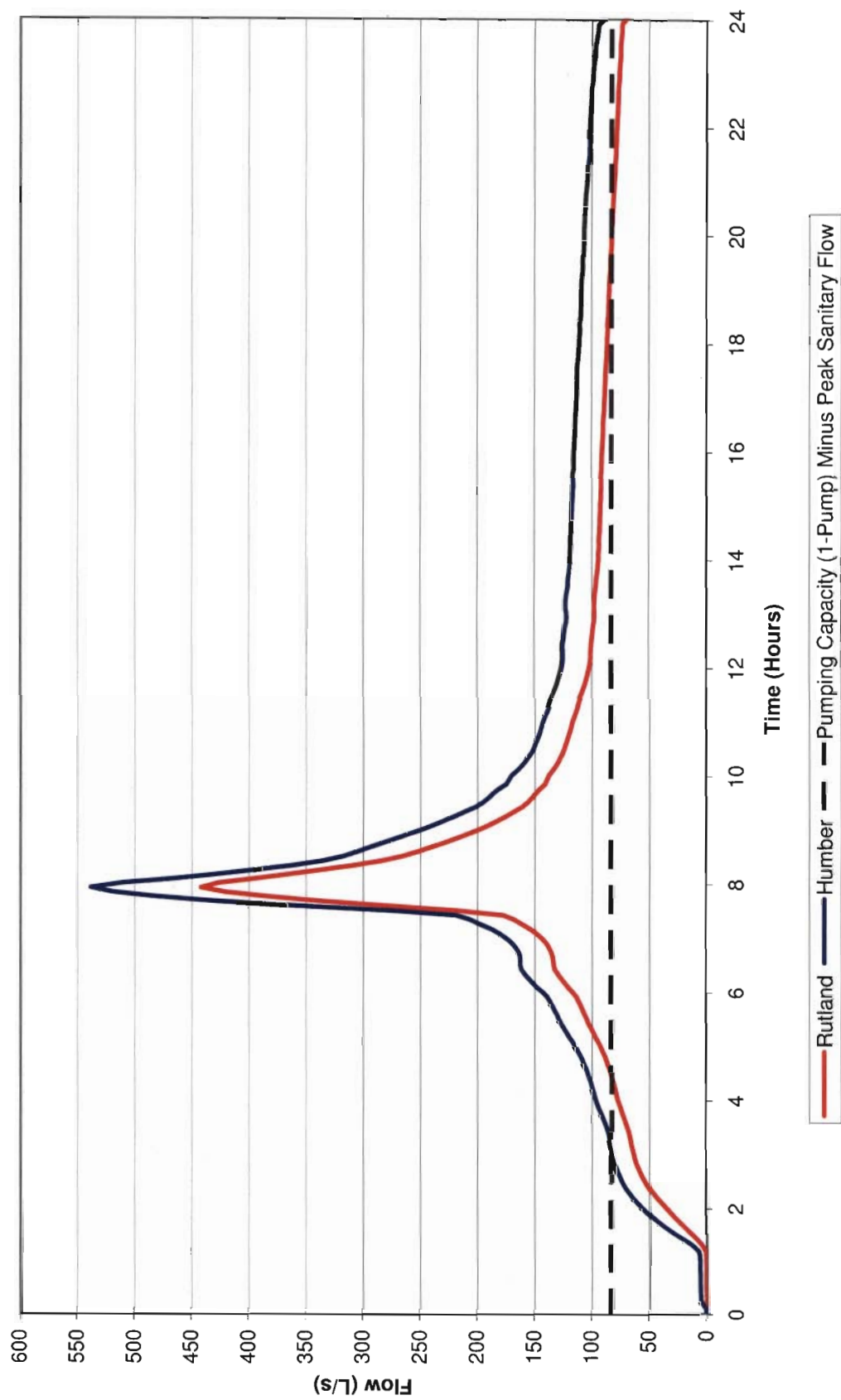


Figure 4



THE CORPORATION OF THE DISTRICT OF OAK BAY
MUNICIPAL HALL – 2167 OAK BAY AVENUE – VICTORIA, B.C. V8R 1G2
PHONE (250) 598-3311 FAX (250) 598-9108 WEBSITE: www.oakbay.ca

**RESOLUTION OF THE MUNICIPAL COUNCIL OF THE CORPORATION OF THE
DISTRICT OF OAK BAY**

**CRD CORE AREA LIQUID WASTE MANAGEMENT PLAN:
COMBINED SEWERS, UPLANDS CATCHMENTS**

That Oak Bay Council adopt the plan for the elimination of combined sewers in the two Uplands catchment areas consistent with the *Municipal Sewage Regulation*, as set out in the Technical Memorandum prepared by Kerr Wood Leidal Associates dated February 13, 2008, as the District of Oak Bay's response to the directive represented by Condition No. 11 in the 2000 letter from the Minister of Water, Land and Air Protection approving the Capital Regional District Core Area Liquid Waste Management Plan.

Certified a true and correct copy of a
resolution adopted by the Municipal Council
of The Corporation of the District of Oak Bay
on February 25, 2008.

A handwritten signature in cursive script, reading "Lorraine Hilton", written over a horizontal line.

Lorraine Hilton
Municipal Clerk
February 26, 2008



THE CORPORATION OF THE DISTRICT OF OAK BAY
MUNICIPAL HALL - 2167 OAK BAY AVENUE - VICTORIA, B.C. V8R 1G2
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**RESOLUTION OF THE MUNICIPAL COUNCIL OF THE CORPORATION OF THE
DISTRICT OF OAK BAY**

**CRD CORE AREA LIQUID WASTE MANAGEMENT PLAN:
COMBINED SEWERS, UPLANDS CATCHMENTS**

That implementation of the plan with regard to the separation of combined sewers in the Uplands be delayed until it is known whether or not the Capital Regional District's sewage treatment strategy will result in a reduction of flows in the East Coast Interceptor Trunk Sewer, to allow for analysis of the extent to which the reduced flows in the trunk sewer would free up capacity to accommodate peak combined sewer flows from the Uplands and thereby reduce the incidence of storm event overflows to the 5 year return period required by the *Municipal Sewage Regulation*.

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Lorraine Hilton
Municipal Clerk
February 26, 2008



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**RESOLUTION OF THE MUNICIPAL COUNCIL OF THE CORPORATION OF THE
DISTRICT OF OAK BAY**

**CRD CORE AREA LIQUID WASTE MANAGEMENT PLAN:
SANITARY SEWER OVERFLOWS, INFLOW AND INFILTRATION**

That Oak Bay Council endorse the plan described in the Technical Memorandum prepared by Kerr Wood Leidal Associates dated September 25, 2006, as the method of determining the most cost-effective expenditure of public funds within Oak Bay in support of the Capital Regional District's requirement to eliminate sanitary sewer overflows consistent with the *Municipal Sewage Regulation*, conveyed as Condition No. 10 in the 2000 letter from the Minister of Water, Land and Air Protection approving the Capital Regional District Core Area Liquid Waste Management Plan.

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Lorraine Hilton
Municipal Clerk
February 26, 2008