Oyama Road & Williams Hill Master Drainage Plan & Geotechnical Investigation

Final Report

Our File: 1157716.1-Sf

District of Lake Country

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August 16, 2001

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District of Lake Country
10951 Okanagan Centre Road E.
Lake Country, BC V4V 1K3

Attention: ***Michael Klymchyk, A.Sc.T.***

RE: ***Oyama Road & Williams Hill***
Master Drainage Plan and Geotechnical Investigation

Please find enclosed two bound copies and one unbound copy of our final report for this assignment. Thank you for the opportunity to assist the District of Lake Country with this matter.

Sincerely,

URBAN SYSTEMS LTD.

Kelly Van Camp, P.Eng.
/lp

Enclosure

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1.0 Engineering Synopsis

1.1 Background

This study was authorized by Mike Klymchyk of the District of Lake Country (DLC). Figure 1 on the following page depicts the limits of the study area.

The objectives of this study are twofold:

- To model and analyse the area hydrology, including the size and arrangement of existing drainage culverts, and
- To examine geotechnical and hydrogeological considerations that may impact future upgrading of Oyama Road.
- To recommend drainage improvements and road structure for a future upgrade of Oyama Road.

This report summarizes our findings on these matters. It is intended to be used as background for future road and drainage works to be constructed on this section of Oyama Road.

1.2 Drainage Improvement Recommendations

The objective of this investigation is to address both the existing and long-term requirements for the area. Mike Reily, the District's Planner was consulted about projected future land use in the study area. The area is expected to remain rural agricultural, with only very limited new residential development along the lakeshore. Therefore, the imperviousness of the upland areas, and hence the quantity and concentration of runoff is not expected to change significantly in the foreseeable future. Once all of the pertinent data was gathered, the area was modeled using Visual SWMM. Details of the modeling of the critical storm events and hydraulic analyses are contained in Appendix A.

There were three occasions during 1997/1998 where intense rainfall runoff reportedly caused damage to homes on the low side of Oyama Road. One of these incidents occurred during a storm event that exceeded the 100-year return period. Although calibration of our computer model was beyond the scope of this assignment, our analyses suggest that the existing drainage infrastructure that is now in place ought to have been able to convey runoff safely to the lake. This then begs the question why did damage occur anyway? There appears to be two main contributing factors.

First, the upland area is moderately sloping agricultural land. There is a layer of organic material overlaying visible bedrock outcroppings in many areas. The topsoil and vegetation is highly erodable. We believe that debris flows were caused by intense storms. The material thus transported was deposited in several areas of the ditch along the upslope side of Oyama Road where a combination of lower grades and/or obstruction existed. These would include the inlets of most culverts, reducing their effective capacity or completely blocking them. This in turn further concentrated runoff in the remaining drainage courses, overwhelming their capacity.

Second, there is evidence to suggest that there may have been a significant groundwater component to the flow. It was reported by one of the residents that wells in the area are very shallow with high yields. This may be due to a near-surface perched water table over the bedrock previously mentioned, although groundwater was only found in only Auger Hole 9, near the uppermost of the cross-culverts on this section of Oyama Road. This theory is supported by the observation made during a number of field visits where a significant flow ($\pm$ 1 – 2 lps) was observed at the discharge end of this culvert, despite the fact that there was little surface water and there had been little or no precipitation over the previous several days.

We understand that Oyama Road may be re-constructed in the near future. Therefore, we have made recommendations for minor and major improvements. The minor improvements could be made immediately without compromising future road improvements. In order to reduce the probability of runoff damage re-occurring, we suggest that the DLC consider the following minor improvements:

- Fitting the three cross-culverts with concrete inlet structures complete with grillage racks to reduce the likelihood of debris blocking the inlets. Ideally, the inlets would have sumps to intercept sediment and vegetation, or a significant forebay area to allow debris to settle out. Preliminary cost estimate: $5,000.
- Constructing headwalls at each driveway crossing to help prevent erosion at these locations. Preliminary cost estimate: $1,000.
- Upgrading the narrow, flat or highly-erodable sections of upslope ditch along Oyama Road by increasing the cross-sectional area and installing rip-rap, where required. Preliminary cost estimate: $10,000.
- Installing erosion-control matting in each of the three upland drainage channels that intersect Oyama Road. Note that to be truly effective, such work would entail work on private land, which would have to be protected by a drainage easement. For the purposes of this report, we have only assumed that work will be done within the right-of-way up to property line. Preliminary cost estimate: $2,000.

Thus, the total estimated cost of these minimal improvements is $18,000, or $20,000 with a small allowance for contingencies.

Major improvements would include diverting runoff from the cross-culverts entirely by constructing an armoured ditch of sufficient size to convey the entire area runoff to a potential siltation pond on the DLC-owned property on the northwest corner of Oyama Road and Woodsdale Road. Although such a facility may be desirable to address regional drainage problems (i.e. Clearwater Subdivision too), it isn't considered necessary for the Williams Hill area alone. This approach would only be cost-effective as a part of a major road re-construction project since considerable rock removal would be required. Other issues would be the requirement for check dams to slow water velocity in the steeper portions of the ditch, the need to involve Kelowna-Pacific Railroad and BC Hydro (due to the proximity of their sub-station). MOE officials have advised that any for any wetland area adjacent to a lake, at a minimum all debris would need to be removed (there are piles of concrete on this particular site) and an environmental review conducted. The cost and complexity of this process might preclude the detention pond apron from further consideration, given that that our analyses suggest that it is not required.

1.3 Road Improvement Recommendations

This section of Oyama Road is comprised of an average 150mm thick layer of asphalt overlaying a relatively thin layer of gravel or directly on native material. The overall bearing capacity of the existing road surface is quite high throughout, so an overlay, as opposed to full-width re-construction is recommended. As the existing paved surface is approximately 1m narrower than the 8m width on the improved sections of Oyama Road, some widening will be required. Design parameters for the road improvements are summarized on the following Figure II.

APPENDIX A

Drainage Modeling and Hydraulic Analyses

APPENDIX B

Geotechnical Report