

DRAINAGE FACILITIES

**OPERATION AND MAINTENANCE
MANUAL**

For:

ELK RIDGE ESTATES

November 7, 2007

Storhaug Engineering
Project #06-327

1.0 PURPOSE

This plan is intended to provide general operations and maintenance guidelines for the drainage ditches and culverts associated with the Elk Ridge Estates project, managing the runoff from the private road and the associated development. The proposed project includes the development of a residential subdivision located north of Morris Road, in Newman Lake. The project site is located within Section 22, Township 26 North, Range 45 East, Willamette Meridian, Spokane County, Washington. Implementation of these guidelines will help the drainage facilities function as intended in the design.

INTRODUCTION

Generally, the intent of the drainage system is to attenuate the increase of water runoff generated on-site by routing the storm water through a lined road ditch slowing velocity then under the private road via culverts into natural ravines. The drainage facilities consists primarily of a lined ditch on the north side of the private road, two catch basins and eight culverts with rock outfall pads. It is therefore, of the utmost importance to provide adequate operation and maintenance activities to ensure that the drainage facilities remain in good operation following their construction. Full sets of engineering drawings are available for review at Spokane County.

2.0 GENERAL OPERATIONAL CHARACTERISTICS

The drainage facilities for the subject site are generally simple, functional, and have low maintenance requirements. A periodic visual inspection of the facilities should identify any required maintenance. Most maintenance will consist of keeping the ditch, pipes, and outfall pads free of debris and sediment. However, a specific inspection schedule should be followed. See Section 3.0 for recommended maintenance schedules.

2.10 Catch Basins. The catch basins are used to collect runoff from the road and associated development.

2.20 Storm Pipe. The underground piping system conveys storm water runoff from the proposed ditches under the private road.

2.30 Conveyance Ditch. The road side drainage ditch conveys the storm water from the road and lots directing to storm pipes used to convey storm water under road to natural ravines.

2.40 Outfall pads. The pads are located on the downstream end of culverts and used to dissipate runoff energy and direct runoff downstream to naturally vegetated ravines.

3.0 MAINTENANCE REQUIREMENTS AND SCHEDULES

Below is a maintenance description for each of the drainage system elements associated with the subject site. All drainage facilities located outside the public right-of-way are expected to be maintained by the homeowners association.

General. Proper maintenance procedures are a necessity for the continued functioning of the drainage facilities. It is essential that the Elk Ridge Estates property owners be responsible for making sure the maintenance measures are implemented.

Generally, maintenance personnel are to conduct a visual inspection of the drainage facilities immediately following a substantial rainfall event or snow melt event, such as when it has rained noticeably hard for a short period (30 minutes or less), or it rained steady for a long period (8 hours or more), or if a significant rainfall or snow melt event,

associated with a “Chinook” were to occur in January, February, or March when the ground is frozen. For long duration storms, greater than 24 hours, maintenance personnel should inspect the drainage facilities during the storm event to identify any developing problems and correct them before they become major problems.

1. Inspect the catch basins and culverts to make sure that they are clear of debris and obstructions.
2. Inspect the road side ditch to make sure there are no breaches or breaks in the ditch. Immediately repair any breaches or breaks with a sandy, loose soil, compacted in place.
3. Inspect the outflow pads and downstream of pads, making sure there is no damage. Immediately repair any damage to the rock. An engineer should be consulted if significant damage or degradation to any of the structures or storm water management features has occurred.

The above-noted storm event related visual inspections (no. 1, 2, and 3) are in addition to the maintenance schedules noted for each item.

3.10 Drainage Ditches. Frequency of Inspection: Monthly and after every storm event and snow melt event. The storm conveyance ditches are constructed from native soils and gently sloped as designed to the ponds and site discharge location. These swales may be stabilized as follows: sodded and/or hydro-seeded with a dryland grass mixture, erosion control blanket or constructed with 2-inch minimum diameter rocks to form faux stream channels or other landscaped options capable of conveying water. Monthly maintenance and inspections of these swales will include removal of any accumulated debris, such as leaves, weeds and trash. Any obstructions, which would not allow water to flow freely through the swales, as designed should be removed. Additionally, the side slopes of the swales should be inspected to insure that they are in good repair and structurally competent and that no erosion of the swale side slopes or

bottom has occurred. Where erosion has occurred, the channel wall and bottom can be stabilized with riprap or geotextile fabric. An engineer should be consulted when determining the size of the riprap or type of geotextile fabric, and for placement of these materials.

3.20 Catch basins. Inspections and maintenance should be done during inspections of the ditch, making sure that the catch basins associated with the storm drain system are clear of obstructions and debris, and in good condition. If there are any obstructions present, they should be removed immediately.

3.30 Pipes. Visually inspect the culverts. The inlets and outlets of the pipes should be clear of all debris. Check that the pipes are in good condition, without breaks or cracks. A flow test in the pipes can be conducted to readily detect major obstructions or breaks in the pipes. This test requires a water source (hydrant or water truck) and a person at the downstream end of the pipe observing the flow exiting out of the pipe section being tested. Visually inspect the rip rap outfall pads at each location, making sure that each are clear of obstructions and debris, and in good working condition.

4.0 RECOMMENDED SET-ASIDE FUNDS FOR MAINTENANCE AND
FUTURE REPLACEMENT COSTS

There will be annual costs to maintain the drainage facilities. Similarly, there will be replacement costs and major renovation costs of all drainage facilities, which will occur in the future. These costs are the responsibility of the property owners or its successors in interest. Future replacement and major renovation costs have been converted to annual costs, in the form of recommended set-aside funds.

The estimated annual maintenance costs and recommended annual set-aside costs are listed below in Table 4.00A. It is recommended that the property owners set aside these amounts of funds annually to ensure that adequate maintenance and replacement measures of the drainage facilities will be implemented.

Drainage Facility	Annual Maintenance Costs
Drainage Ditch	\$300.00
Catch basins and Pipes	\$300.00
rip-rap outfall pads	\$300.00
Sub-total Annual Cost	\$900.00

Table 4.00A

Grand Total / year = \$900.00

Notes:

*** Cost has been included in annual maintenance costs.

Sinking Fund Reserve Account

Project Name: Elk Ridge Estates
Project Number: 06-327
Date: November 7, 2007
Prepared by: KSN

Calculations for Operation & Maintenance Costs plus Replacement Costs

Annual Operation and Maintenance Costs	\$	900.00
Present Value of Storm System	\$	40,241.95
Assume 50% replacement in 20 years	\$	20,120.97
Future Value of System to replace in 20 years, assume inflation=4%, n=20	\$	44,087.07
Annual set-aside for future replacement of system, assume conservative investment, interest=6%, n=20	\$	1,199.17
Total Annual Charges	\$	2,099.17

PRESENT VALUE ESTIMATE

Project Name: Elk Ridge Estates
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Item Description	Qty	Unit	Unit Price	Total
Drainage Items - PRIVATE				
1 Ditch Excavation	20,250	SF	\$ 0.25	\$ 5,062.50
2 12" Cmp Culvert	403	LF	\$ 20.00	\$ 8,060.00
3 15" Cmp Culvert	200	LF	\$ 25.00	\$ 5,000.00
4 18" Cmp Culvert	98	LF	\$ 28.00	\$ 2,744.00
5 Rock Outfall pads	42	CY	\$ 50.00	\$ 2,100.00
6 Catch Basin	2	EA	\$ 750.00	\$ 1,500.00
7 Rock ditch lining	394	CY	\$ 20.00	\$ 7,880.00
8 Fabric ditch lining	650	SY	\$ 4.00	\$ 2,600.00
9 Seed ditch lining	9,555	SF	\$ 0.05	\$ 477.75
			<i>Drainage Items Sub-Total</i>	\$ 35,424.25
			5% Contingency	\$ 1,771.21
			8.6% Tax	\$ 3,046.49
			Total	\$ 40,241.95