

EXHIBIT "C"

DRAINAGE PONDS
AND
DRAINAGE FACILITIES

OPERATION & MAINTENANCE
MANUAL

NORTH RIM ESTATES

Spokane County Large Lot Subdivision
PE-1853-98
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By
Bill Bagby (Owner/Developer)
107 S. Howard #600
Spokane, Washington 99201
(509) 622-3532

1.0 PURPOSE

This plan is intended to provide general operations and maintenance guidelines for the drainage ponds and other drainage facilities located in the Northrim Addition large Lot Subdivision PE 1853-98, serving the runoff from the private road. Implementation of these guidelines will insure that the drainage facilities installed will function as intended in the design, and maintain the pre-developed runoff rates which discharge to downstream properties.

2.0 INTRODUCTION

Generally, the drainage system is intended to attenuate the increase of water runoff generated on-site, by routing the storm water through a drainage pond, and discharging the storm water downstream at the pre-developed runoff rates. The drainage facilities consist primarily of drainage ponds, storm pipes, drainage ditches, and flow control structures out of the ponds. It is therefore, of the utmost importance to provide adequate operations and maintenance activities to insure that the drainage facilities remain silt or dirt free, as this silt or dirt loading will affect the storage volume and downstream runoff volumes. Should this result, the only remedy would be to completely reconstruct the site drainage facilities. Therefore, periodic maintenance is a must. Full sets of engineering drawings are available for review at Spokane County Public Works, under County File PE 1853-98.

3.0 GENERAL OPERATIONAL CHARACTERISTICS

The drainage facilities for Northrim Addition Large Lot Subdivision PE 1853-98 are generally very simple, functional, and have low maintenance requirements. A periodic visual inspection of the facilities will identify any required maintenance. Most maintenance will consist of keeping the pond, pipes, drainage ditches, weirs and appurtenances free of debris and sediment. However, a specific inspection schedule should be followed. See Section 4.0 for recommended maintenance schedules.

3.10 Drainage Pond. Runoff from the roads and lots will go into the pond. The pond will store a certain depth of water and then flow out through the orifice flow control structures, as shown in the plans. There is one pond within this plat which requires maintenance. The location of the drainage pond and structures are shown on the approved plan available from the County. The pond elevation information is provided in table 3.10A. The purpose of these tables is to

provide the maintenance personnel a quick reference of relative depth. More detailed information is provided in the engineering plan on file at Spokane County Public Works under File PE 1853-98.

Pond Label	Pond Bottom Elevation	Outflow Elevation	Outflow Structure
"A"	2230.0	2231.0	Multiple Orifice Outlet Structure

Table 3.10A

3.20 Outflow Structures. The outflow structures are used to regulate flow rates out of the pond. The outflow structure types are: multiple orifice outlet structure with staged orifice and overflow components.

3.30 Conveyance Ditches and Storm Pipes. The storm drainage ditches convey the storm water from the road to the ponds, and from the ponds the outflow is piped to the discharge locations, in existing natural drainage courses.

4.0 MAINTENANCE REQUIREMENTS AND SCHEDULES

Below is a maintenance description for each of the drainage system elements contained within the Northrim Addition, including the pond, ditches, pipes, and flow control structures. All drainage facilities serving the private road are expected to be maintained by the 12 individual lot owners within Northrim Estates.

General

Proper maintenance procedures are a necessity for the continued functioning of the drainage facilities. Improper maintenance, or lack of attentive maintenance measures, may result in negative on-site and downstream impacts. It is essential that the North Rim Estates Homeowners Association (*the "Association"*) 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 and snow melt event, associated with a "chinook" melt were to occur in January, February or March when the ground is frozen. For long duration storms, greater than 24 hours, maintenance personnel are to inspect the drainage facilities during the storm event to identify any developing problems and correct them before they become major problems.

1. Inspect the pond, ditches, flow control structures, pipes, and drainage appurtenances to make sure that they are clear of debris and obstructions.

2. Inspect the pond berm to make sure there are no breaches or breaks in the berm. Immediately repair any breaches or breaks, with a sandy loose soil, compacted in place.

3. Inspect the orifice flow control structure in the pond, making sure there is no damage and that the orifices and overflow are not plugged with deleterious material. Immediately repair any damage to the orifice structure, inlet, or discharge outfall. Clean the trash rack covering the entrance pipe to the pipe that leads from the pond to the outlet structure. An engineer should be consulted if significant damage or degradation to the flow control structure has occurred.

4. Check for any erosion in the ditches and the pond outflow structures. Temporary repairs should be made immediately if further rainfall or snow melt is anticipated in the near future. Temporary repairs may include installing riprap, installing geotextile fabric, and/or reconstructing the earthen channel.

These above-noted storm event related visual inspections (no. 1, 2, 3 and 4) are in addition to the maintenance schedules noted for each item.

4.10 Drainage Ditches. Frequency of Inspection: Monthly, and after every storm event & snow melt event. The storm conveyance ditches are constructed from native soils and gently sloped as designed to the pond and site discharge location. These swales may be stabilized as follows: sodded and/or hydro-seeded with a dryland grass mixture or constructed with 2-inch minimum diameter rocks to form a faux stream channel 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.

4.20 Drainage Pond. Frequency of Inspection: Every 3 months, or after every storm event & snow melt event, whichever is more frequent, the pond should be inspected. Again, the drainage pond is to be maintained by the Association, as summarized in Table 3.10A. The pond consists of a bermed depression constructed from native soils; this depression should be sodded and/or hydro-seeded with a dryland grass mixture, at a minimum. A lawn sod can be used if regular irrigating is implemented. Quarterly maintenance and inspections of the ponds will include removal of any accumulated debris, such as leaves, weeds and trash. Any obstructions, which would not allow water to flow freely from the pond via the outflow structures should be removed or repaired. The trash rack at the entrance to the pipe leading from the pond to the outlet structure should be inspected for damage and cleaned of any debris. Additionally, the berm of the pond should be inspected to insure that it is in good repair and structurally competent and that no outflow has occurred other than the outflow structure.

4.30 Outflow Structures. The types of outflow structure for the drainage pond is listed in table 3.10A. Inspections and maintenance should be done during inspections of the pond, making sure that each of these structures are clear of obstructions and debris, and in good condition. If there is any obstruction present, it should be removed immediately.

4.40 Orifices. Periodic maintenance of the orifices should be done during inspections to insure that the orifice is in good condition and no breaking of the piping or its supports has occurred. If the orifice structure has been damaged it should be repaired as soon as possible to minimize any effect downstream.

4.50 Pipes. Visually inspect the pipes, inlets and outlets, making sure they are clear of debris and checking that the pipe is in good condition, without breaks or cracks. A flow test in the pipe can be used to readily detect major obstructions or breaks in the pipe. 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.

5.0 Recommended Set-Aside Funds for Maintenance & 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 Association 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 5.00A. It is recommended that the Association set aside these amount of funds annually to ensure that adequate maintenance and replacement measures of the drainage facilities will be implemented.

Drainage Facility	Annual Maintenance Costs	Annual Set-Aside Funds for Future Replacement or Major Renovation *
Drainage Pond & Drywells	\$200.00	**
Drainage Ditches & Pipes	\$100.00	\$200.00
Flow Control Structures & Drainage Appurtenances	\$100.00	***
Sub-total Annual Costs	\$400.00	\$200.00

Table 5.00A
 Grand Total/year = \$600.00
 Cost per lot/year = \$50.00 (12 lots)

Notes:

- * Assume the pipes will be replaced in 20 yrs. 4% inflation, and 4% of return on investments for set-aside account.
- ** Any renovation costs for ponds are included in the annual maintenance costs.
- *** Cost has been included in Drainage Ditch/Pipes item.