DRAINAGE FACILITIES

OPERATION AND MAINTENANCE MANUAL

Stone Arrow 1st Addition

Spokane County Plat
P 1858B
July 1, 2003

1.0 PURPOSE

This plan is intended to provide general operations and maintenance guidelines for the 208 swale(s), drainage ditches and other drainage facilities located in Stone Arrow 1st Addition, Plat P1858B serving the runoff from the private road(s) and residential development. 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 systems intended to attenuate the increase of water runoff generated on-site, by routing the storm water through 208 swale(s). The drainage facilities consist primarily of 208 swale(s), drainage ditches, drywells, grated inlets, and storm pipes. It is therefore, of the utmost importance to provide adequate operations and maintenance activities to insure that the drainage facilities remain silt and dirt free, as this silt or dirt loading will affect the storage volume and downstream runoff volumes. Full sets of engineering drawings are available for review at Spokane County Public Works, under file P1858B.

3.0 GENERAL OPERATIONAL CHARACTERISTICS

The drainage facilities for Stone Arrow 1st Addition P1858B 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 swales, ditches, pipes, drainage ditches and appurtenances free of debris and sediment. However, a specific inspection schedule should be followed. See Section 4.0 for recommended maintenance schedules.

3.10 208 Swales. Runoff from the road(s) and lot(s) will go into the ditches and 208 swales, which requires maintenance. The location of the 208 swales, ditches and structures are shown on the approved plans available from Spokane County. The 208 swale elevation information is provided in table 3.10A. The purpose of this table is to provide the maintenance personnel a quick reference of relative depths. More detailed information is provided in the engineering plans on file at Spokane County Public Works under file P1858B.

208 Swale Location	208 Swale Bottom Elevation	208 Swale Top Elevation
Vincent Rd. (East side)	2081.12	2082.12
Vincent Ln. Sta. 14+95 (both sides)	2080.83	2081.83
Vincent Ln. Sta. 19+47 (both sides)	2080.40	2081.40
Vincent Ln. Cul-De-Sac (South side)	2081.50	2082.50

Table 3.10A

4.0 MAINTENANCE REQUIREMENTS AND SCHEDULES

Below is a maintenance description for each of the drainage system elements contained within Stone Arrow 1st Addition, including the swales, ditches, drywells, pipes, and inlet structures. All drainage facilities serving the private road(s) and residential developments are expected to be maintained by the Property Owners Association.

> General: Proper maintenance procedures are a necessity for 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 Stone Arrow 1st Addition Property Owners 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" 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 swales, ditches and drainage appurtenances to make sure that they are clear of debris and obstructions.
2. Inspect the swale berms 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. Clean the trash rack covering the entrance of the pipes (if applicable). An engineer should be consulted if a significant damage or degradation has occurred.
4. Check for any erosion in the ditches and the swales. Temporary repairs should be made immediately if further rainfall or snow melt is anticipated in the near future. Temporary repairs may include installing riprap, 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 "208" Swale(s) / Ditches. Frequency of Inspection: Every 3 months, or after every storm event and snow melt event, whichever is more frequent. The swale(s) and ditches are to be maintained by the Association, as summarized in Table 3.10A. The storm conveyance ditches are constructed from native soils and gently sloped as designed to the 208 swale(s). The swale(s) consist of a bermed depression constructed from native soils. These swale(s) and ditches may be stabilized as follows: sodded and/or hydro-seeded with a dryland grass mixture. A lawn sod can be used for the swales and ditches, if regular irrigating is implemented. Quarterly maintenance and inspections of the swale(s) and ditches 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, berm or bottom has occurred.

4.20 Drywells. Visually inspect the grates, making sure they are clear of debris and checking that they are in place and in good condition. If there are any obstructions present, it should be removed immediately. Visually check for sediment buildup in the drywell. Large amounts of sediment buildup in the drywell shall be removed.

4.30 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 of 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 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 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 amounts 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 ***
208 Swales/Ditches	$150.00	$600.00
Drywells	$25.00	$200.00
Inlets	$0.00	$0.00
Pipes	$25.00	$34.00
Sub-total Annual Cost	$200.00	$834.00

Grand Total / year = $1,034.00

Table 5.00A

Notes:
* Assumes the pipes will be replaced in 20 years, 4.00% inflation, and 6.00% of return on investments for set-aside account.