

**Preliminary Drainage Report
Ridgeview Estates**

PFN:

for

EDAC, LLC

Contact: Steve Younger
P.O. Box 425
Arlington, WA 98223

SITE LOCATION:

6213 208th Street NE
Arlington, WA 98223

PARCEL NUMBER:

31051000402200 & 31051000402201



Prepared by:
Joseph M. Smeby, P.E.

Job No: 05-014
February 2005
Revised: May 2005

RECEIVED
MAY 24 2005

Utilities Div.

RECEIVED

MAY 13 2005

COA PLANNING DEPT

TABLE OF CONTENTS

<u>ITEM</u>	<u>PAGE</u>
TABLE OF CONTENTS	1
LIST OF FIGURES	2
1. INTRODUCTION	3
2. DRAINAGE INFORMATION SUMMARY FORM	4
3. EXISTING SITE CHARACTERISTICS and ASSUMPTIONS	6
4. NARRATIVE OF DEVELOPED SITE CHARACTERISTICS	7
5. DESCRIPTION OF PROPOSED EROSION CONTROL BMP'S	8
6. OFFSITE DRAINAGE ANALYSIS - UPSTREAM	9
7. OFFSITE DRAINAGE ANALYSIS - DOWNSTREAM	9
8. DETENTION STORAGE CALCULATIONS	10
<u>A. SUMMARY OF DETENTION CALCULATION RESULTS</u>	10
<u>B. SCS CURVE NUMBER CALCULATION</u>	10
9. WATER QUALITY VAULT DESIGN	11
10. CONVEYANCE CALCULATIONS	11
11. MAINTENANCE AND OPERATIONS MANUAL	11
APPENDIX A - STORMWATER CALCULATION	A-1
APPENDIX B – NARRATIVE OF DOE MINIMUM REQUIREMENTS	B-1
APPENDIX C – OPERATIONS AND MAINTENANCE MANUAL	C-1

LIST OF FIGURES

<u>ITEM</u>		<u>PAGE</u>
FIGURE 1	VICINITY MAP	12
FIGURE 2	EXISTING DRAINAGE BASIN MAP	13
FIGURE 3	DEVELOPED DRAINAGE BASIN MAP	14
FIGURE 4	SNOHOMISH COUNTY SOILS MAP.....	15

1. INTRODUCTION

This document is intended to provide engineering information necessary to support the preliminary plat submittal for the 12-lot plat proposed on this site. The site covers 4.15 acres, of which 0.98 acres is creek buffer and steep slopes, which will not be disturbed by this project.

This project proposes to create 12 new single-family lots on this parcel. The existing house on this property will be retained. This project will require the construction of public roads, a private access tract, stormwater facilities and other utilities. A combined sand filter/infiltration vault is proposed for this project to treat and release all runoff associated with the developed roads and landscaping. Each lot will have an individual infiltration trench for roof runoff.

The site is located at the end of 209th Street NE, in the City of Arlington, and in Section 10, Township 31N, Range 5E, Willamette Meridian. See Figure 1 - Vicinity Map.

2. DRAINAGE INFORMATION SUMMARY FORM

Project: **Ridgeview Estates**
 PFN: **C-05-021-LP**
 Engineer: **Omega Engineering, Inc.**
 2210 Hewitt Avenue, #204
 Everett, WA 98201
 Attention: Joseph Smeby, P.E.

Total site area: **4.15 acres**
 Offsite area: **0.00 acres**
 Disturbed area: **3.17 acres**

Applicant: **David Downing & Associates**
 4229 76th Street NE
 Marysville, WA 98270
 Attention: David Downing, PLS

Number of lots/Units: **12**

Drainage Basin Information		
On-site Developed Area		3.17 acres
Types of storage proposed		Infiltration Vault
Approximate total storage volume		11,990 cf
Soil Types		Type B Soils
Basin Data		
Post-developed run-off rates:	2-year	0.21 cfs
(to vault)	10-year	0.51 cfs
	100-year	0.88 cfs
Run-off rates:	2-year	0.02 cfs
(from Roof)	10-year	0.03 cfs
	100-year	0.05 cfs

Description of drainage plan: This project consists of one on-site basin sloping slightly north to south, but this site is nearly flat. Runoff from the developed road and sidewalk areas and the majority of the pervious areas will be collected and conveyed to the proposed vault through a series of catch basins and pipes. Runoff will then be treated and infiltrated within the proposed combined vault and released to the ground near the middle of the project.

Proposed design standards and criteria: See Figure 3 – Developed Drainage Basin Map. This projects stormwater facilities have been designed to meet or exceed the DOE 1992 Stormwater Manual. This requires the calculation for infiltration facility to be done using an SCS-SBUH analysis. The standard precipitation values in this area for the 2, 10 & 100-year, 24-hour storm events are, 1.8, 2.75, 3.75 inches respectively. Please refer to appendix D for a detailed summary of the DOE Minimum Requirements. Water quality treatment design is also based on City standards.

Description of Drainage Basins: (existing and developed basin maps are attached, Figures 2 & 3). The development area lies above a steep slope that falls off to the north. However, the site is slightly sloped to the south so little runoff would sheet flow over the

top of bank. Due to the site grades and the permeable soil little runoff would leave this site as surface flow.

The site is irregular in shape and composed of two lots with some perimeter fencing. One lot contains an existing single-family home, which will be retained. The project will have access through the adjacent plat to the west and will provide for future access to the property to the east. The portion of the site proposed for development is relatively flat, with maximum slopes of less than 2%. However, the steep slope to the north, which will remain undisturbed, has slopes greater than 30%. The site is primarily pasture/lawn with some trees located in the southeast corner of the site. Existing driveways and buildings/structures, excluding the main house and garage, on the site will be demolished as part of the proposed improvements.

3. EXISTING SITE CHARACTERISTICS and ASSUMPTIONS

The site is located at the east end of 209th Street NE, in the City of Arlington, and in Section 10, Township 31N, Range 5E, Willamette Meridian. See Figure 1 - Vicinity Map. The entire property consists of two lots totaling 4.15 acres. Approximately 0.98 acres of the site in the northeast corner of the parcel has been identified as steep slopes and creek buffer. The development proposes to disturb the remaining 3.17 acres.

Land use around the site is primarily single-family lots. There is a newer plat that has been built to the east through which we will access this site. This site contains a single-family house and garage and workshop.

The existing site is irregular in shape longer north and south than east and west. The grades on the site to be disturbed are flat. The maximum slopes on this parcel are contained in the steep slopes to the north, which will not be disturbed as a result of this project. The vegetation found on the existing property mainly consists of pasture/lawn with trees in the southeast corner of the site.

Grades on the site generally run from north to south. Runoff either infiltrates, which is most likely, or if it does sheet flow, it would drain to the south. A site visit was conducted on July 2, 2004. The weather was clear with temperatures in the low-80's.

The soil hydrologic types for this site have been identified as Type B from the Snohomish County Soil Survey Map, see figure 4. The soil, Lynnwood loamy sand, is typically very deep and somewhat excessively drained soil. A Geotechnical Report will be submitted separate from this report as soon as the report is complete.

4. NARRATIVE OF DEVELOPED SITE CHARACTERISTICS

This development proposes to create 12 new lots with associated roads and utilities. It was calculated that approximately 37% of the total site would be converted to impervious surfaces. In order to provide an impervious area for stormwater calculations it was assumed that 2,500 sf of building and 500 sf of driveways/walks would be added to each lot. In addition, the 3,000 sf for the existing house, walks and garage to remain have been included in the developed site areas.

Site Areas

	Total Area (ac)	Impervious (ac)	Landscaping (ac)	Un-Disturbed (ac)
To Pond	3.46	0.39	2.09	0.98
Roof	0.057	0.057	0.00	0.00

This is shown in the stormwater calculations in Appendix A.

This project, topographically, is located near a local high point in the area with roads and development on the south and east. Only a small portion of land could potentially contribute off-site flows onto this project and that is the single-family home to the east. However, the grades are so flat that just slight undulations in the ground that do not show on two-foot contours would provide areas for any surface runoff to collect and infiltrate prior to entering this site. Therefore, no off-site basin has been included in the stormwater calculations.

Site runoff from the roads and landscaping will be collected and conveyed by a system of catch basins and pipes to a combined sand filter/infiltration vault near the center of this project. Roof downspouts will be collected and infiltrated in individual infiltration trenches located on each lot.

5. DESCRIPTION OF PROPOSED EROSION CONTROL BMP's

Clearing, grading, and temporary erosion and sediment control plans have been prepared as part of the civil plan drawings for this submittal. However, since a construction site is dynamic it will be necessary to reassess the erosion control BMP's during construction and install additional measures when necessary. The proposed project is above a steep slope, so to maximize the effectiveness of the onsite BMP's the area between the proposed construction and steep slope will be left undisturbed - as much as possible.

Proposed temporary measures possible for this project will include the following BMP's:

- Installation of stabilized rock construction entrance(s).
- Filter fences
- Straw mulch, hydroseed or other mulching and planting method to stabilized unworked areas.
- Inlet protection of new and existing catch basins.

Permanent measures to reduce or eliminate erosion or water quality degradation will include the following BMP's:

- Paving all traffic areas
- Drainage collection system, including catch basins and floatable material separators
- Permanent landscaping in pervious areas.
- Limiting cut and fill slopes to 2:1 maximum and 3:1 maximum where exposed to standing water.
- Water quality facilities that will include a Sand Filter as required by the design phase.
- Buffer zones and setbacks for steep slopes.
- Routine maintenance and inspection of the grounds and response to developing problems.

The listed erosion control BMP's will be engineered for anticipated conditions in compliance with City of Arlington and DOE guidelines. With proper installation, maintenance and inspection the proposed BMP's should result in minimal impact to the surrounding environment. The City retains the authority by code to require additional measures should the existing measures prove insufficient.

Construction site runoff shall not be directed to the proposed infiltration vault until the entire site has been stabilized or an additional two-foot thick layer of sand shall be placed on filter fabric over the proposed sand filter to protect the permeability of the underlying soils. This layer and filter fabric shall be removed once the entire site has been stabilized.

6. OFFSITE DRAINAGE ANALYSIS - UPSTREAM

From field observation and review of the available aerial topography, it appears that the only locations, which will contribute offsite flows onto this site, are along the east property line. However, due to site grades and the underlying permeable soils this area is not expected to contribute surface flows to this parcel.

7. OFFSITE DRAINAGE ANALYSIS - DOWNSTREAM

Since this project proposes to infiltrate 100% of the stormwater generated on-site, no downstream analysis is necessary.

8. DETENTION STORAGE CALCULATIONS

The calculations and the drainage plan for this project were completed to meet City and DOE 1992 standards, using an SCS-SBUH analysis as required by both agencies. The proposed water quality/infiltration vault is located near the middle of this site. Please refer to Section 9 regarding the sizing of the water quality portion of the vault.

The pond dimensions used for sizing the control structure are as follows:

Node ID: Inf-V

Start El:	100.0000 ft	Max El:	106.0000 ft
Contrib Basin:		Contrib Hyd:	
	Length	Width	Void Ratio
	65.0000 ft	30.0000 ft	100.00
	Bottom area only with infiltration		

A. SUMMARY OF DETENTION CALCULATION RESULTS

Developed Area (On-Site & Off-Site)

Design storm	2-year	10-year	100-year
Pre-developed runoff rate, cfs	0.66	1.60	2.73
Post-developed runoff rate, cfs	1.53	2.77	4.15
Design release from detention, cfs	0.33	1.60	2.73
Required detention volume, unadjusted, cf	8,834	10,136	12,915
Stage in pond	1.05	1.20	1.50

B. SCS CURVE NUMBER CALCULATION

For purposes of determining the detention volume the following assumptions were made to model the existing and proposed site conditions:

Total development area	7.26 acres
Existing curve number	60
Existing impervious:	0.15 acres (existing house and garage to remain)
Developed impervious:	0.39 acres (Roads, Driveways and Walks)
Developed Roof (Each):	0.057 acres
Developed impervious Cn:	98
Developed pervious:	2.09 acres (62 percent of total area)
Developed pervious Cn:	80

These areas are considered to be conservative, with the intent of allowing minor changes to the plans without triggering a recalculation of the results.

See Appendix A for detailed printouts of all stormwater calculations.

9. WATER QUALITY SAND FILTER DESIGN

A sand filter has been designed to treat the runoff for the entire developed site excluding the roof areas. This was done following the DOE manual for sizing sand filters. The size of the sand filter vault is calculated to infiltrate 100% of the site runoff directed to the vault. This will treat more than the required volume, but since the design infiltrated directly beneath the sand layer is it necessary. The vault was sized using SBUH for an infiltration facility with an infiltration rate of 2"/hr. Refer to Storm Shed printouts in Appendix A.

10. CONVEYANCE CALCULATIONS

Mannings Equation was used to analyze a 12" pipe with a slope of 0.5%, which is the most restrictive pipe on this site. It was found that the proposed pipe system has more than adequate capacity for the expected 100-year flows on this site. The following is a summary of the calculations:

100-year peak runoff:	0.88 cfs
12" pipe @ 0.5%:	2.70 cfs

Refer to Appendix A for a detailed printout of the conveyance calculations.

11. OPERATIONS AND MAINTENANCE MANUAL

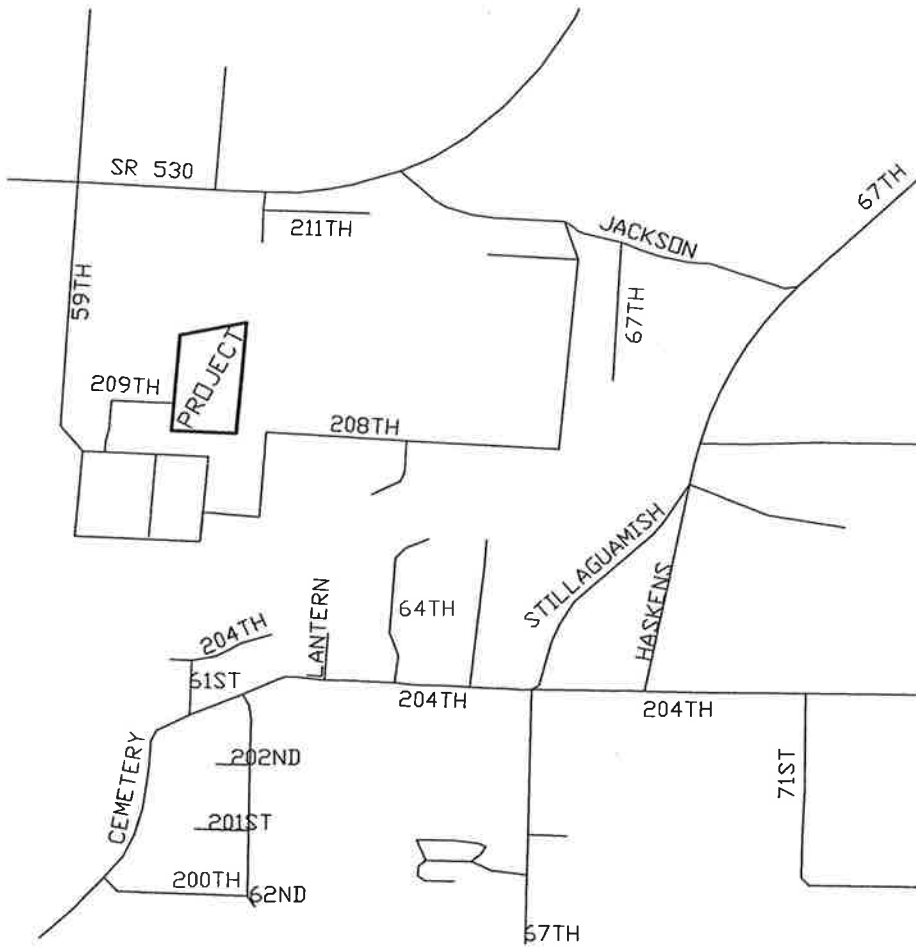
The Condominium/Homeowners Association will be responsible for maintaining the stormwater and landscaping facilities within this development. Included in this manual are checklists for each feature specific to this project. Copies should be made of the checklists as necessary during routine inspections and required maintenance. Specific problems can be recorded along with the appropriate action taken.

These checklists are a guide for inspections and maintenance. The frequency of the inspections/maintenance is identified in the left hand column with the following abbreviations:

- A = Annual (March or April preferred)
- M = Monthly
- S = After Major Storms (Use 1-inch in 24 hours as a guideline)

Routine inspections and maintenance will improve the long-term performance of the stormwater facilities. If at any time you are unsure if a problem exists or how to address a specific problem contact a Professional Engineer.

Refer to Appendix C for a list of each facility to be maintained and the appropriate maintenance checklist.

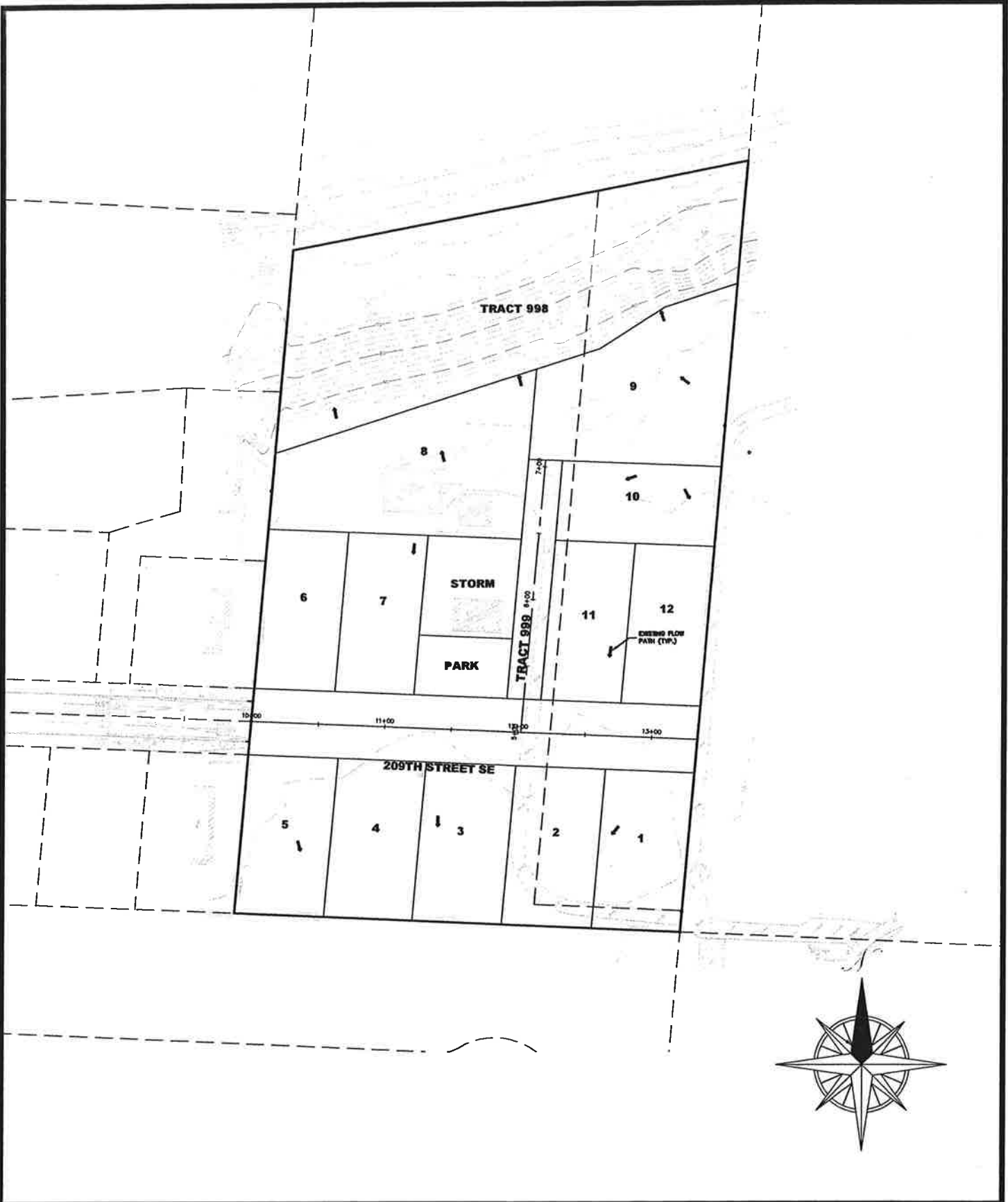


**OMEGA
ENGINEERING, INC.**

2210 Hewit Avenue, #204
Everett, WA 98201
(o)425.387.3820 (f) 425.2591958

VICINITY MAP

DATE	JOB NO.	SCALE	SHEET
2/21/05	05-014	1" = 1000'	1 OF 1

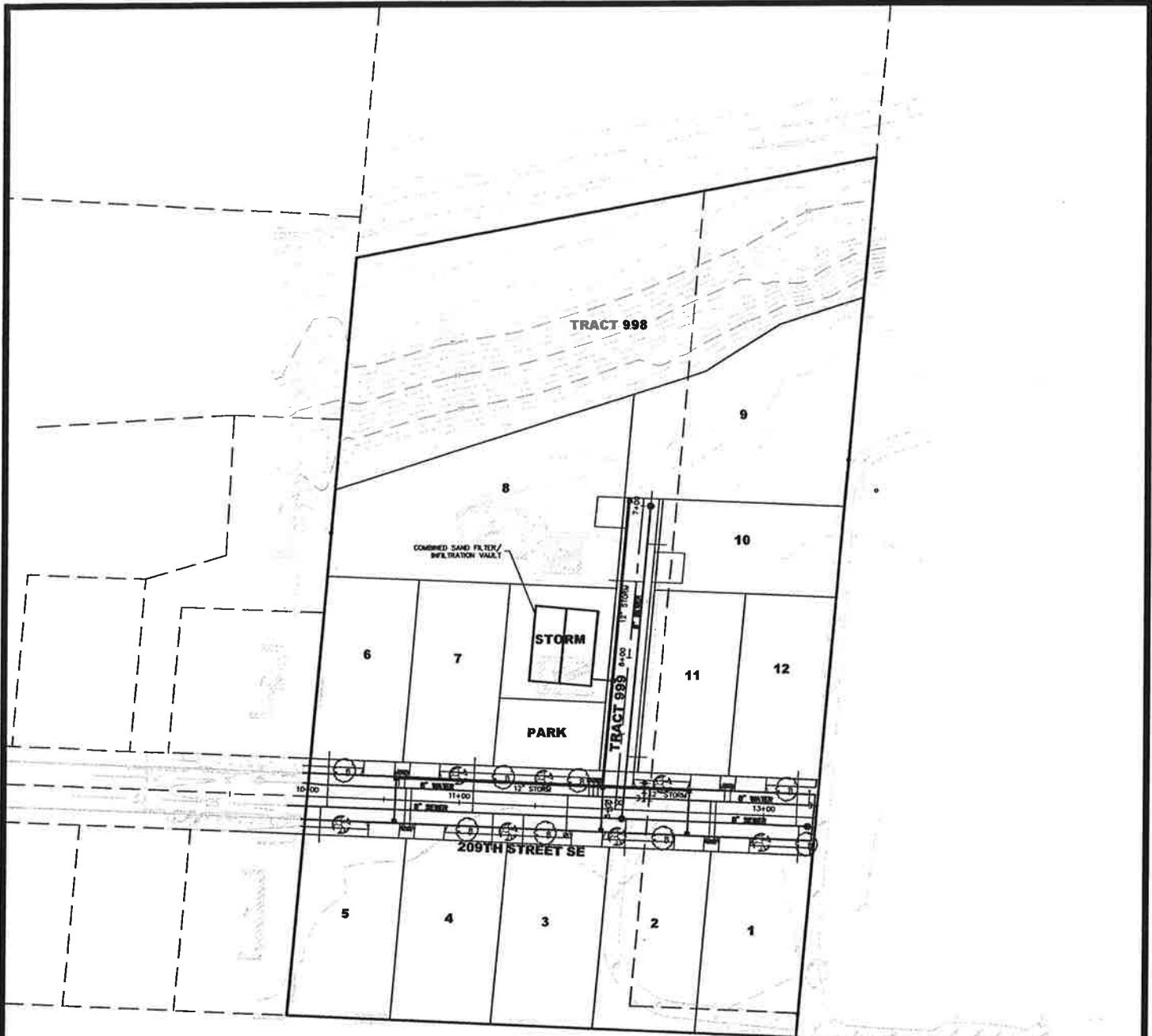


**OMEGA
ENGINEERING, INC.**

2210 Hewit Avenue, #204
Everett, WA 98201
(o)425.387.3820 (f) 425.2591958

EXISTING DRAINAGE
BASIN MAP

DATE	JOB NO.	SCALE	SHEET
2/21/05	05-014	1" = 100'	1 OF 1



**OMEGA
ENGINEERING, INC.**

2210 Hewit Avenue, #204
Everett, WA 98201
(o)425.387.3820 (f) 425.2591958

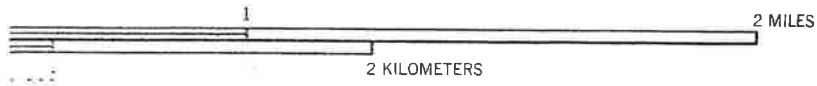
DEVELOPED DRAINAGE
BASIN MAP

DATE	JOB NO.	SCALE	SHEET
2/21/05	05-014	1" = 1000	1 OF 1



(Joins sheet 19)

FIGURE 4
-15-



APPENDIX A
STORMWATER CALCULATIONS

Dev Event Summary:

BasinID	Peak Q	Peak T	Peak Vol	Area	Method	Raintype	Event
-----	(cfs)	(hrs)	(ac-ft)	ac	/Loss		
Dev	0.21	8.00	0.1287	2.48	SBUH/SCS	TYPE1A	2 yr
Dev	0.51	8.00	0.2675	2.48	SBUH/SCS	TYPE1A	10 yr
Dev	0.88	8.00	0.4342	2.48	SBUH/SCS	TYPE1A	100 yr

Drainage Area: Dev

Hyd Method:	SBUH Hyd	Loss Method:	SCS CN Number
Peak Factor:	484.00	SCS Abs:	0.20
Storm Dur:	24.00 hrs	Intv:	10.00 min
	Area	CN	TC
Pervious	2.0900 ac	80.00	0.49 hrs
Impervious	0.3900 ac	98.00	0.11 hrs
Total	2.4800 ac		

Supporting Data:

Pervious CN Data:

Landscaping (Grass) 80.00 2.0900 ac

Impervious CN Data:

Roads and Walks 98.00 0.3900 ac

Pervious TC Data:

Flow type:	Description:	Length:	Slope:	Coeff:	Travel Time
Sheet	None Entered	150.00 ft	0.50%	0.1500	29.13 min

Impervious TC Data:

Flow type:	Description:	Length:	Slope:	Coeff:	Travel Time
Fixed	Min. Value	0.00 ft	0.00%	6.4000	6.40 min

Control Structure ID: Inf. - Infiltration control structure

Start El	Max El	Increment		
100.0000 ft	105.0000 ft	0.10		
Infil:	2.00 in/hr		Multiplier:	1.00

Node ID: Inf-V

Start El:	100.0000 ft	Max El:	106.0000 ft
Contrib Basin:		Contrib Hyd:	
	Length	Width	Void Ratio
	65.0000 ft	30.0000 ft	100.00
Bottom area only with infiltration			

Node ID: RLPool

Start El:	100.0000 ft	Max El:	104.0000 ft
Contrib Basin:		Contrib Hyd:	
Storage Id:	Inf-T	Discharge Id:	Inf.

RLPCOMPUTE [RLPool] SUMMARY

2 yr MatchQ= 0.2115 cfs Peak Out Q: 0.0903 cfs - Peak Stg: 100.25 ft - Active Vol: 491.32 cf
 10 yr MatchQ= 0.5084 cfs Peak Out Q: 0.0903 cfs - Peak Stg: 102.65 ft - Active Vol: 0.1187 acft
 100 yr MatchQ= 0.8818 cfs Peak Out Q: 0.0903 cfs - Peak Stg: 106.15 ft - Active Vol: 0.2753 acft

Manning Pipe Calculator (12" @ 0.5%)

Given Input Data:

Shape Circular
Solving for Flowrate
Diameter 1.0000 ft
Depth 0.9500 ft
Slope 0.0050 ft/ft
Manning's n 0.0130

Computed Results:

Flowrate **2.7070 cfs**
Area 0.7854 ft²
Wetted Area 0.7707 ft²
Wetted Perimeter 2.6906 ft
Perimeter 3.1416 ft
Velocity 3.5123 fps
Hydraulic Radius 0.2865 ft
Percent Full 95.0000 %
Full flow Flowrate 2.5193 cfs
Full flow velocity 3.2077 fps

APPENDIX B
DOE MINIMUM REQUIREMENTS

MINIMUM REQUIREMENT #1: EROSION AND SEDIMENT CONTROL

Erosion and Sediment Control Requirement #1: Stabilization and Sediment Trapping

Minimum BMP's have been designed to protect exposed soil from being disturbed by rainfall and the subsequent runoff. Examples of these are: rock construction entrance, silt fencing and mulch. The construction plan set and stormwater report have provided a construction sequence to help insure that the appropriate BMP's are in place prior to specific construction activities.

Erosion and Sediment Control Requirement #2: Delineate Clearing and Easement Limits

Limits of clearing have been identified on the engineering plan set. Part of the final construction sequence requires that these limits be set in the field by a licensed surveyor prior to any clearing activity. In addition, buffers will be located prior to any construction near the on-site sensitive area.

Erosion and Sediment Control Requirement #3: Protection of Adjacent Properties

All areas downslope of this project are protected from sediment-laden runoff by the construction or installation silt fencing at the limits of construction along with retained vegetation. These sediment control features are shown on the civil engineering plan set, sheet two.

Erosion and Sediment Control Requirement #4: Timing and Stabilization of Sediment Trapping Measures

The construction sequence for this project has been included with the construction plans for this project. This requires the contractor to construct specific BMP's as a first step in the construction process.

Erosion and Sediment Control Requirement #5: Cut and Fill Slopes

The design and placement of cut or fill slopes has been minimized on the proposed grading plan.

Erosion and Sediment Control Requirement #6: Controlling Off-site Erosion

All surface runoff will be allowed to infiltrate during construction. Vegetative areas will be left along the property lines to allow for infiltration prior to runoff exiting the site.

Erosion and Sediment Control Requirement #7: Stabilization of Temporary Conveyance

No temporary conveyance is proposed for this project. The intent is to allow the site runoff to infiltrate over the entire site during construction. However, once the road and storm system has been constructed some runoff will be conveyed via the catch basin and pipe system.

Erosion and Sediment Control Requirement #8: Storm Drain Inlet Protection

All proposed catch basins and existing catch basins directly downstream of this project will be provided with silt socks to protect the drainage system from sediment accumulation.

Erosion and Sediment Control Requirement #9: Underground Utility Construction
Utility construction notes, which require the contractor to meet the specifications laid out in this section, have been added to the plans.

Erosion and Sediment Control Requirement #10: Construction Access Routes
A gravel construction entrance has been designed to help stabilize the access point to this site. The entrance will also aid in retaining soil and sediment on-site and minimize the transport of sediment off-site and deposited on the adjacent paved surfaces.

Erosion and Sediment Control Requirement #11: Removal of Temporary BMPs
The construction sequence for this project has been included with the construction plans for this project. This requires the contractor to remove all erosion and sediment control BMPs within 30 days of site stabilization and clean all permanent systems affected by construction.

Erosion and Sediment Control Requirement #12: Dewatering Construction Sites
Dewatering activities are not anticipated due to the permeability of the existing soils. However, water generated can be disposed of on the retained vegetated areas around the site.

Erosion and Sediment Control Requirement #13: Control of Pollutants Other Than Sediment on Construction Sites

It is not anticipated that the construction practices for this project will require the use of substances that may pollute the runoff. However, the contractor will be required to provide the necessary safety measures to ensure that the contamination of storm runoff will not occur.

Erosion and Sediment Control Requirement #14: Maintenance

Grading and erosion control notes have been included with the construction plans for this project. These require that the proposed BMPs will be cleaned and maintained on a regular basis and all BMPs will be checked after every significant storm event.

Erosion and Sediment Control Requirement #15: Financial Liability

The necessary bonds will be provided by the required party prior to any clearing or grading activity.

MINIMUM REQUIREMENT #2: PRESERVATION OF NATURAL DRAINAGE SYSTEMS

There is no defined drainage course for which this site is tributary. All signs on this site indicate that stormwater infiltrates into the native soil. The proposed storm drainage design will mimic this scenario.

MINIMUM REQUIREMENT #3: SOURCE CONTROL OF POLLUTION

The intended use for this site does not require specific source controls like a high-use site. However, through regular maintenance of the storm drainage system the sediment and pollutants collected can be removed from the site and disposed of properly.

MINIMUM REQUIREMENT #4: RUNOFF TREATMENT BMPs

DOE BMP SELECTION PROCESS:

Step 1: Determine Stormwater Control Scenario

Step 1A: Determine if Oil/Water Separator BMPs are Required

A Single-Family Subdivision Development does not require Oil/Water Separators.

Step 1B: Determine if Nutrient Control is required

No downstream system

Step 1C: Determine if Streambank Erosion Control is required

Infiltration will be used for this site, which meets the Streambank Erosion Control requirement.

Step 1D: Determine Final Stormwater Control Scenario

Based on the answers to steps 1A, B and C, Infiltration is the required system.

Step 2: Select Source Control BMPs

Step 2A: Select Source Control BMPs based on Land Use Type

For a Residential development there no specifically recommended source control measures.

Step 2B: Select Source Control BMPs for Nutrient Control, if Required

Not Required.

Step 2C: Prepare Final Source Control BMP List

Not Required.

Step 3: Select Runoff Treatment and Streambank Erosion Control BMPs

Step 3A: Select type of Oil/Water Separator, if Required

A oil/water separator is not required by Step 1A.

Step 3B: Determine Initial Order of Preference of Runoff Treatment BMPs

Rank 1 – Infiltration is possible on this site, and is the selected system.

Rank 2 – N/A, Rank 1 facility selected.

Rank 3 – N/A, Rank 1 facility selected.

Step 3C: Determine Initial Order of Preference of Streambank Erosion Control BMPs

Rank 1 – Infiltration will be provided in conjunction with a sand filter.

Step 3D: Screen BMPs based on Comparative Stormwater Benefits and Restrictions

The combined sand filter/infiltration vault will provide the required forms of treatment for this project. In addition, by providing these measures in one facility it will reduce future inspection and maintenance costs as well as construction costs.

Step 3E: Screen Runoff treatment and Streambank Erosion Control BMPs Based on Other Physical Factors

There are no limiting physical factors that prohibit the use of an infiltration vault for this site.

Step 3F: Prepare Modified BMP List

The proposed sand filter/infiltration vault works well with the site conditions since it will provide additional space next to the proposed park area and meets the treatment requirements set forth by the City of Arlington.

Step 3G: Prepare Final BMP List

Step 4: Complete Stormwater Site Plan

Step 4A: Complete Permanent Stormwater Quality Control Plan

Refer to construction plans submitted to the City of Arlington contained in the package with this report for the detailed design of the above selected facilities. (To be Provided)

Step 4B: Review Other Stormwater Site Plan Requirements

A "Large Parcel Erosion and Sediment Control Plan" is provided with the construction documents.

A "Permanent Stormwater Quality Control Plan" will be provided with the final construction documents.

Step 4C: Complete Stormwater Site Plan

See construction plan set for the plat of "Ridgeview Estates" residential sub-division development.

Step 5: Submit Final Stormwater Site Plan to the Plan Approval Authority

MINIMUM REQUIREMENT #5: STREAMBANK EROSION CONTROL

The proposed infiltration vault for this project has been designed to meet this requirement. This facility will treat and infiltrate up to the 100-year, 24-hour event Refer to Section 8 of the main body of this report.

MINIMUM REQUIREMENT #6: WETLANDS

Runoff from this site will be infiltrated which will aid the wetlands at the bottom of the steep slope by providing attenuated ground water flows year round.

MINIMUM REQUIREMENT #7: WATER QUALITY SENSITIVE AREAS

Preliminary research has not determined that the downstream system is considered a water quality sensitive area. However, if the City determines it is, the design will be revised accordingly.

MINIMUM REQUIREMENT #8: OFF-SITE ANALYSIS AND MITIGATION

Refer to Section 7 in the main body of this report.

MINIMUM REQUIREMENT #9: BASIN PLANNING

No Basin Plan is currently being prepared for this project.

MINIMUM REQUIREMENT #10: OPERATION AND MAINTENANCE

An Operation and Maintenance Manual has been provided in appendix C with this report.

MINIMUM REQUIREMENT #11: FINANCIAL LIABILITY

The bonds required by the City of Arlington will be provided prior to construction.

APPENDIX C
MAINTENANCE & OPERATIONS MANUAL

Maintenance Checklist for Closed Detention Systems (Pipes/Tanks)

Frequency	Drainage Systems Feature	Problem	Conditions to Check for	Corrective Actions
M	Storage area pipe tank	Plugged air vents (small pipe that connects catch basin to storage pipe)	One-half of the end area of a vent is blocked at any point with debris and sediment. Plugged vent can cause storage area to collapse.	Clean vents and remove debris from vault
M		Debris and sediment.	Accumulated sediment depth exceeds 15% of diameter. Example: 72-inch storage tank would require cleaning when sediment reaches depth of 10 inches.	All sediment and debris removed from storage area. Contact the County for guidance on sediment removal and disposal.
A		Joints between tank/pipe section.	Any crack allowing material to leak into facility.	All joints between tank/pipe sections are sealed.
M, S	Manhole	Cover not in place.	Cover is missing or only partially in place. Any open manhole requires maintenance.	Clean frame and replace lid to fit flush with frame
A		Locking mechanism not working.	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2-inch of thread (may not apply to self-locking lids).	Clean locking mechanism and replace any damaged parts.
A		Cover difficult to remove.	One maintenance person cannot remove lid after applying 80 pounds of lift. Intent is to keep cover from sealing off access to maintenance.	Remove, clean and repair lid to allow for easy access
A		Ladder rungs unsafe.	Maintenance person judges that ladder is unsafe due to missing rungs, misalignment, rust, or cracks. Ladder must be fixed or secured immediately.	Repair or replace ladder to allow maintenance person safe access.

Catch Basins and Inlets

Frequency	Drainage Systems Feature	Problem	Conditions to Check for	Corrective Action
M,S	General	Trash, debris, and sediment in or on basin.	Trash or debris in front of the catch basin opening is blocking capacity by more than 10%.	Remove blocking material on or around grate
M			Sediment or debris (in the basin) that exceeds 1/3 the depth from the bottom of basin to invert of the lowest pipe into or out of the basin.	Dig out accumulated sediment
M,S			Trash or debris in any inlet or pipe blocking more than 1/3 of its height.	Remove blocking material in pipe or inlet
M			Frame is not sitting flush on top slab. I.e., separation of more than 3/4 inch of the frame from the top slab.	Remove grate, clean frame of any accumulated debris and replace grate.
A		Cracks in basin walls/bottom	Cracks wider than 1/2 inch and longer than 3 feet, any evidence of soil particles entering catch basin through cracks, or maintenance person judges that structure is undound.	Basin replaced or repaired to design standards. Contact a professional engineer for evaluation.
A			Cracks wider than 1/2 inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.	No cracks more than 1/4 inch wide at the joint of inlet/outlet pipe. Contact a professional engineer for evaluation.
A		Settlement/ misalignment	Basin has settled more than 1 inch or has rotated more than 2 inches out of alignment.	Basin replaced or repaired to design standards. Contact a professional engineer for evaluation.
M,S		Fire hazard or other pollution	Presence of chemicals such as natural gas, oil, and gasoline. Obnoxious color, odor, or sludge noted.	Dig out and clean catch basin
M,S		Outlet pipe is clogged with vegetation	Vegetation or roots growing inlet/outlet pipe joints that is more than six inches tall and less than six inches apart.	Remove vegetation or roots and repair pipe as necessary.

ATTACHMENT "A" (CONTINUED)

One Time		Sediment trapping area not present	Stormwater enters infiltration area directly without treatment.	Add a trapping area by constructing a sump for settling of solids. Segregate settling area from rest of facility. Contact the County for guidance.
M	Rick filters	Sediment and debris	By visual inspection little or no water flows through filter during heavy rain storms.	Replace gravel in rock filter.

If you are unsure whether a problem exists, please contact a Professional Engineer.
 Comments:

- Key:
- A=Annual (March or April preferred)
 - M=Monthly (see schedule)
 - S=After major storms (use 1-inch in 24 hours as a guideline)

ATTACHMENT "A" (CONTINUED)

Maintenance checklist for Infiltration Systems

Frequency	Drainage Systems Feature	Problem	Conditions to Check for	Conditions that should exist
M,S	General	Trash & debris buildup in pond	See Maintenance Checklist for Ponds.	See Maintenance Checklist for Ponds.
M		Ppoisonous vegetation	See Maintenance Checklist for Ponds.	See Maintenance Checklist for Ponds.
M,S		Fire hazzard or pollution	See Maintenance Checklist for Ponds.	See Maintenance Checklist for Ponds.
M		Vegetation not growing or overgrown	See Maintenance Checklist for Ponds.	See Maintenance Checklist for Ponds.
M		Rodent holes	See Maintenance Checklist for Ponds.	See Maintenance Checklist for Ponds.
M		Insects	See Maintenance Checklist for Ponds.	See Maintenance Checklist for Ponds.
A	Storage area	Sediment buildup in system	A soil texture test indicates facility is not working at its designed capabilities or was incorrectly designed.	Sediment is removed and/or facility is cleaned so that infiltration system works according to design. A sediment trapping area is installed to reduce sediment transport into infiltration area.
A		Storage area drains slowly (more than 48 hours) or overflows	A soil texture test indicates facility is not working at its designed capabilities or was incorrectly designed.	Additional volume is added through excavation to provide needed storage. Soil is aerated and rototilled to improve drainage. Contact the County for information on its requirements regarding excavation.
M		Sediment trapping area	Any sediment and debris filling area to 10% depth from sump bottom to bottom of outlet pipe or obstructing flow into the connector pipe.	Clean out sump to design depth.

Maintenance Checklist for Conveyance Systems (Pipes, Ditches, and Swales)

Frequency	Drainage Systems Feature	Problem	Conditions to Check for	Corrective Action
M,S	Pipes	Sediment and debris	Accumulated sediment that exceeds 20% of the diameter of the pipe.	Clean pipe of all sediment and debris.
M		Vegetation	Vegetation that reduces free movement of water through pipes.	All vegetation removed so water flows freely through pipes.
A		Damaged (rusted, bent, or crushed)	Protective coating is damaged; rust is causing more than 50% deterioration to any part of pipe.	Pipe repaired or replaced.
M			Any dent that significantly impedes flow (i.e., decreases the cross section area of pipe by more than 20%0.	Pipe repaired or replaced.
M			Pipe has major cracks or tears allowing groundwater leakage.	Pipe repaired or replaced.
Varies	Catch basins		See Catch Basins Checklist.	See Catch Basins Checklist.

Maintenance Checklist for Grounds (Landscaping)

Frequency	Drainage Systems Feature	Problem	Conditions to Check for	Corrective Action
M	General	Weeds (nonpoisonous)	Weeds growing in more than 20% of the landscaped area (trees and shrubs only)	Remove weeds to less than 5% of the landscaped area.
M		Insect hazzard	Any presence of poison ivy or other poisonous vegetation or insect nests.	Remove poisonous weeds and insect nests present in landscaped area.
M,S		Erosion of Ground Surface	Noticeable ruts are seen in landscaped areas.	Identify causes of erosion and take steps to reduce erosion. Eroded areas are filled, contoured, and seeded.
A	Trees and shrubs	Damage	Limbs or parts of trees or shrubs that are split or broken which affect more than 25% of the total foliage of the tree or shrub.	Trim trees/shrubs to restore shape. Replace trees or shrubs with severe damage.
M			Trees or shrubs that have been blown down or knocked over.	Replant tree, inspecting for injury to stem or roots. Replace if severely damaged.
A			Trees or shrubs which are no adequately supported or are leaning over. Causing exposure of the roots.	Place stakes and rubber-coated tubes around young trees/shrubs for support.

ATTACHMENT "A" (CONTINUED)

Maintenance Checklist for Access Road/Easements

Frequency	Drainage Systems Feature	Problem	Conditions to Check for	Conditions that should exist
One Time	General	No access road exists	If ponds or other drainage system features needed maintenance by motorized equipment are present, either an access road or access from public streets is required.	Determine whether an easement to drainage feature exists. If yes, obtain the County permits and construct gravel (or equal) access road. If not, report lack of easement to the Municipality.
M		Blocked roadway	Debris which could damage vehicle tires (glass or metal). Any obstructions which reduce clearance above road surface to less than 14 feet. Any obstructions restricting the access to less than 15 feet width.	Roadway free of debris which could damage tires. Roadway overhead clear to 14 feet high. Obstruction removed to allow at least a 15-foot-wide access.
A				
A				
A,S	Road Surface	Settlement, potholes, mush spots, ruts	When any surface irregularity exceeds 6 inches in depth and 6 square feet in area. In general, any surface defect which hinders or prevents maintenance access.	Road surface uniformly smooth with no evidence of settlement, potholes, mush spots, or ruts. Occasionally application of additional gravel or pitrun rock will be needed.
M		Vegetation in road surface	Woody growth that could block vehicular access. Excessive weed cover.	Remove woody growth at early stage to prevent vehicular blockage. Cut back weeds if they begin to encroach on road surface.
M,S	Shoulders and ditches	Erosion damage	Erosion within 1 foot of the roadway more than 8 inches wide and 6 inches deep.	Shoulder free of erosion and matching the surrounding road.

If you are unsure whether a problem exists, please contact a Professional Engineer.
Comments:

Key: A=Annual (March or April preferred)

M=Monthly (see schedule)

S=After major storms (use 1-inch in 24 hours as a guideline)

