

**EXHIBIT B**  
**MILL CREEK INDUSTRIAL PARK**

**Operation and Maintenance  
of Stormwater Facilities**



December 2006

## Water Quality Treatment at the Mill Creek Industrial Park

Correct operation and maintenance (O & M) is critical to the effectiveness of the water quality treatment facilities. Water discharged to the swales is first pre-treated on the private properties to remove large particles, trash, oil & grease, and other floatable materials. The water is then “polished” through the basic treatment methods, thereby removing suspended sediments and other pollutants. This cleaner water is then discharged to the open space areas of MCIP and supplies water to the regulated wetlands in these areas.

### Vegetated Swales

Vegetated swales (aka “bioswales”) are linear landscaped depressions used to collect, transport and treat stormwater runoff. They depend on vegetation to slow the flow of water to encourage sedimentation of pollutants. Swales also increase the opportunity for stormwater to infiltrate.

The vegetated swales should be aesthetic additions to the landscape, and be integrated into the overall site design. The swales, however, have their own specific O&M requirements that differ from the typical landscape maintenance. For instance, they are designed to not require mowing and depend on a variety and density of native plants to achieve their water quality objectives.

### Swale Planting Requirements

Vegetation in and around stormwater management facilities should be limited to plant species included in Tables 1, 2, and 3, unless otherwise approved by the City of Salem. These tables are divided into planting zones in order to increase survival and longevity of the plant materials, and allow the swales to be ultimately self-sustaining. **These lists supersede the lists provided in the MCIP Stormwater Management Plan (Tables 2.2, 2.3, & 2.4, Otak, October 16, 2006).**

For specific swale design criteria, consult the MCIP Stormwater Management Plan (Otak, October 16, 2006).

Note: These lists supersede the lists provided in the MCIP Stormwater Management Plan (Tables 2.2, 2.3, & 2.4, Otak, October 16, 2006).

| Table 1: Approved Plants for Wet to Moist Planting Zone<br>(Swale Bottom to 1.5 feet up the side slope) |   |
|---|---|
| Rushes, Sedges, Grasses and Groundcovers<br>(Swale bottom only)   | <i>Beckmannia syzigachne</i> , Slough grass<br><i>Camassia quamash</i> , Common Camas<br><i>Carex obnupta</i> , Slough Sedge<br><i>Deschampsia cespitosa</i> , Tufted hairgrass<br><i>Eleocharis ovata</i> , <i>E. palustris</i> , Spikerush<br><i>Festuca rubra</i> , Red fescue<br><i>Hordeum brachyantherum</i> , Meadow Barley<br><i>Juncus ensifolius</i> , Dagger-leaf Rush<br><i>Juncus oxymeris</i> , Pointed Rush<br><i>Juncus tenuis</i> , Slender Rush<br><i>Juncus patens</i> , Grooved Rush; Spreading Rush<br><i>Oenanthe sarmentosa</i> , water parsley<br><i>Glyceria occidentalis</i> , Manna Grass<br><i>Scirpus microcarpus</i> , Small flowered (or fruited) Bulrush<br><i>Sparganium emersum</i> , burreed<br><i>Veronica americana</i> , American speedwell |
| Ferns   | <i>Athyrium filix-femina</i> , Lady Fern  |
| Shrubs<br>(Edges of swale and slopes only)  | <i>Cornus sericea</i> , Redtwig Dogwood<br><i>Rosa pisocarpa</i> , Swamp Rose<br><i>Physocarpus capitatus</i> , Pacific Ninebark<br><i>Spiraea douglasii</i> , Douglas spiraea  |
| Large Shrub / Small Tree<br>(Edges of swale and slopes only, not within 20 feet of sewerlines)          | <i>Salix hookeriana</i> , Hooker's Willow<br><i>Salix lucida</i> (or <i>S. lasiandra</i> ), Pacific Willow<br><i>Salix scouleriana</i> , Scoulers Willow<br><i>Salix sessilifolia</i> , Soft leafed Willow<br><i>Salix sitchensis</i> , Sitka Willow  |
| Conifer and Evergreen Trees<br>(Slope only, not swale bottom)   | <i>Thuja plicata</i> , Western red cedar  |
| Deciduous Trees<br>(Slope only, not swale bottom)   | <i>Fraxinus latifolia</i> , Oregon ash<br><i>Alnus rubra/rhombifolia</i> , Red/white alder  |

**Table 2: Approved Plants for Moist to Dry Planting Zone  
(Side slopes from 1.5 feet to 3 feet)**

|                             |   |
|-----------------------------|---|
| Grasses and Groundcovers    | <i>Aster subspicatus</i> , Douglas' Aster<br><i>Bromus carinatus</i> , California Brome Grass<br><i>Bromus sitchensis</i> , Alaska Brome<br><i>Bromus vulgaris</i> , Columbia Brome Grass<br><i>Lupinus micranthus</i> , Small Flowered Lupine<br><i>Sisyrinchium idahoense</i> , Blue-eyed Grass<br><i>Festuca occidentalis</i> , Western Fescue Grass<br><i>Festuca rubra</i> , Red fescue<br><i>Deschampsia cespitosa</i> , Tufted Hairgrass<br><i>Elymus glaucus</i> , Blue Wildrye<br>Native wildflowers                       |
| Ferns                       | <i>Blechnum spicant</i> , Deer Fern<br><i>Polypodium glycyrrhiza</i> , Licorice Fern<br><i>Polystichum munitum</i> , Sword Fern   |
| Shrubs                      | <i>Berberis aquifolium</i> , Tall Oregon Grape<br><i>Berberis nervosa</i> , Dull Oregon Grape<br><i>Physocarpus capitatus</i> , Pacific Ninebark<br><i>Rosa gymnocarpa</i> , Baldhip Rose<br><i>Rosa nutkana</i> , Nootka Rose<br><i>Rosa pisocarpa</i> , Swamp Rose<br><i>Symphoricarpos albus</i> , Common Snowberry<br><i>Viburnum edule</i> , Highbush Cranberry  |
| Large Shrub / Small Tree    | <i>Acer circinatum</i> , Vine maple<br><i>Ceanothus sanguineus</i> , Oregon Redstem Ceanothus<br><i>Corylus cornuta</i> , Western Beaked Hazelnut<br><i>Holodiscus discolor</i> , Oceanspray<br><i>Philadelphus lewisii</i> , Mock Orange<br><i>Prunus emarginata</i> or <i>P.virginiana</i> Bitter or Choke Cherry<br><i>Rosa nutkana</i> , Nootka Rose<br><i>Rubus parviflorus</i> , Thimbleberry<br><i>Sambucus cerulea</i> , Blue elderberry<br><i>Sambucus racemosa</i> , Red elderberry<br><i>Rhamnus purshiana</i> , Cascara |
| Conifer and Evergreen Trees | <i>Calocedrus decurrens</i> , Incense cedar   |
| Deciduous Trees             | <i>Cornus nuttallii</i> , Western Flowering Dogwood<br><i>Quercus garryana</i> , Oregon White Oak<br><i>Fraxinus latifolia</i> , Oregon ash<br><i>Acer macrophyllum</i> , Bigleaf maple   |

| <b>Table 3: Approved Plants for Dry Planting Zones<br/>(Side slopes above 3 feet and upland)</b> |  |
|--|--|
| Grasses and Groundcovers   | <i>Bromus carinatus</i> , California Brome Grass<br><i>Bromus sitchensis</i> , Alaska Brome<br><i>Bromus vulgaris</i> , Columbia Brome Grass<br><i>Arctostaphylos uva-ursi</i> , Kinnickinnick<br><i>Lupinus micranthus</i> , Small Flowered Lupine<br><i>Sisyrinchium idaboense</i> , Blue-eyed Grass<br><i>Festuca occidentalis</i> , Western Fescue Grass<br><i>Elymus glaucus</i> , Blue Wildrye<br>Native wildflowers |
| Shrubs   | <i>Gaultheria shallon</i> , Salal<br><i>Berberis aquifolium</i> , Tall Oregon Grape<br><i>Berberis nervosa</i> , Dull Oregon Grape<br><i>Ribes sanguineum</i> , Red-flowering Currant<br><i>Holodiscus discolor</i> , Oceanspray<br><i>Philadelphus lewisii</i> , Mock Orange<br><i>Symphoricarpos albus</i> , Common Snowberry<br><i>Vaccinium ovatum</i> , Evergreen huckleberry   |
| Large Shrub / Small Tree   | <i>Amelanchier alnifolia</i> , Western Saskatoon Serviceberry<br><i>Prunus emarginata</i> or <i>P.virginiana</i> , Chokecherry   |
| Conifer and Evergreen Trees  | <i>Calocedrus decurrens</i> , Incense cedar<br><i>Arbutus menziesii</i> , Madrone  |
| Deciduous Trees  | <i>Quercus garryana</i> , Oregon White Oak<br><i>Acer macrophyllum</i> , Big leaf maple  |

### Invasive/Nuisance Plants

Invasive and nuisance plants are native or non-native species that have aggressive growth patterns and/or are harmful to humans. The following list presents species that may occur in the Salem area. This list may be modified as needed to include other plants deemed to be invasive or nuisance plants by the City of Salem or the Oregon Department of Agriculture.

The plants in Table 4 are considered invasive or nuisance plants and shall not be planted, seeded or allowed to become established in the vegetated swales or other landscape areas.

**Table 4 Prohibited Plants**

| <b>Scientific name</b>         | <b>Common name</b>      |
|--------------------------------|-------------------------|
| <i>Acer platanoides</i>        | Norway maple            |
| <i>Acer saccharinum</i>        | Silver maple            |
| <i>Agropyron repens</i>        | Quackgrass              |
| <i>Ailanthus altissima</i>     | tree-of-heaven          |
| <i>Alliaria petiolata</i>      | garlic mustard          |
| <i>Ambrosia artemisiifolia</i> | Ragweed                 |
| <i>Ambrosia tomentosa</i>      | Skeletonleaf bursage    |
| <i>Anchusa officinalis</i>     | Common bugloss          |
| <i>Arum italicum</i>           | arum                    |
| <i>Brachypodium sylvaticum</i> | false-brome             |
| <i>Buddleia alternifolia</i>   | fountain butterfly bush |

| Scientific name                                    | Common name                       |
|--|-----------------------------------|
| <i>Centaurea species</i>                           | Starthistle/knapweed species      |
| <i>Centranthus ruber</i>                           | Jupiter's beard; red valerian     |
| <i>Circuta douglasii</i>                           | Water hemlock                     |
| <i>Cirsium arvense</i> ; <i>C. vulgare</i>         | Canada thistle; common thistle    |
| <i>Clematis vitalba</i>                            | traveler's-joy/Old man's beard    |
| <i>Conium maculatum</i>                            | Poison hemlock                    |
| <i>Convolvulus arvensis</i>                        | Field morning glory               |
| <i>Convolvulus seppium</i>                         | Lady's nightcap                   |
| <i>Cortaderia selloana</i>                         | Pampas grass                      |
| <i>Crataegus monogyna</i>                          | English hawthorn                  |
| <i>Cyperus esulentus</i> ; <i>C. rotundus</i>      | Yellow nutsedge; Purple nutsedge  |
| <i>Cytisus monspessulanas</i> ; <i>C. striatus</i> | French broom;<br>Portuguese broom |
| <i>Cytisus scoparius</i>                           | Scotch broom                      |
| <i>Daphne laureola</i>                             | spurge laurel                     |
| <i>Digitalis purpurea</i>                          | foxglove                          |
| <i>Dipsacus sylvestris</i> ; <i>D. laciniatus</i>  | Common teasel; Cutleaf teasel     |
| <i>Egeria (Elodea) densa</i>                       | Elodea, S. American waterweed     |
| <i>Eichhornia crassipes</i>                        | water hyacinth                    |
| <i>Elaeagnus sp</i>                                | Russian olive                     |
| <i>Erodium cicutarium</i>                          | Crane's bill                      |
| <i>Euphorbia esula</i>                             | Leafy spurge                      |
| <i>Foeniculum vulgare</i>                          | fennel                            |
| <i>Genista monspessulana</i>                       | broom                             |
| <i>Geranium lucidum</i>                            | shining crane's-bill              |
| <i>Geranium robertianum</i>                        | Robert's geranium                 |
| <i>Glecoma hederacea</i>                           | ground ivy; creeping Charlie      |
| <i>Halogeton glomeratus</i>                        | Halogeton                         |
| <i>Hedera helix</i>                                | English ivy                       |
| <i>Helianthus ciliaris</i>                         | Texas blueweed                    |
| <i>Hemizonia pungens</i>                           | Spikeweed                         |
| <i>Heracleum mantegazzianum</i>                    | Giant Hogweed                     |
| <i>Hieracium species</i>                           | Hawkweed species                  |
| <i>Hydrilla verticillata</i>                       | Hydrilla                          |
| <i>Ilex aquifolium</i>                             | English holly                     |
| <i>Iris pseudacorus</i>                            | yellow flag iris                  |
| <i>Laburnum watereri</i>                           | Golden chain tree                 |
| <i>Lamiastrum galeobdolan</i>                      | yellow archangel                  |
| <i>Lathyrus latifolius</i>                         | sweet pea                         |
| <i>Leontodon autumnalis</i>                        | Fall dandelion                    |
| <i>Ligustrum vulgare</i>                           | common privet                     |
| <i>Lonicera japonica</i>                           | Japanese honeysuckle              |
| <i>Lotus corniculatus</i>                          | birdsfoot trefoil                 |
| <i>Lunaria annua</i>                               | honesty; money plant              |
| <i>Lysimachia nummularia</i>                       | moneywort                         |
| <i>Lythrum salicaria</i>                           | purple loosestrife                |
| <i>Melissa officinalis</i>                         | lemon balm                        |

| Scientific name  | Common name   |
|--|---|
| <i>Mentha pulegium</i>   | pennyroyal  |
| <i>Myriophyllum spp</i>  | parrot's feather, water-milfoils                      |
| <i>Nymphaea odorata</i>  | water lily  |
| <i>Paulownia tomentosa</i>   | empress tree  |
| <i>Pennisetum spp.</i>   | fountain grass  |
| <i>Phalaris aquatica</i>   | Harding grass   |
| <i>Phalaris arundinacea</i>  | reed canarygrass                                      |
| <i>Polygonum coccineum</i>   | Water smartweed                                       |
| <i>Polygonum convolvulus</i>   | Climbing bindweed                                     |
| <i>Polygonum cuspidatum</i> ; <i>P. polystachyum</i><br><i>P. cuspidatum</i> x <i>sachalinense</i> | Japanese knotweed; Himalayan knotweed; Giant knotweed |
| <i>Prunus laurocerasus</i>   | English laurel  |
| <i>Pueraria montana</i> var. <i>lobata</i> ( <i>P. lobata</i> )                                    | kudzu   |
| <i>Rhus diversiloba</i>  | Poison oak  |
| <i>Rubus armeniacus</i> ( <i>R. discolor</i> )   | Armenian (Himalayan) blackberry                       |
| <i>Senecio jacobaea</i>  | Tansy ragwort   |
| <i>Silyburn marianum</i>   | Milk thistle  |
| <i>Solanum dulcamara</i>   | bittersweet nightshade                                |
| <i>Solanum elaeagnifolium</i>  | Silverleaf nightshade                                 |
| <i>Solanum nigrum</i>  | Garden nightshade                                     |
| <i>Solanum rostratum</i>   | Buffaloburr   |
| <i>Solanum sarrachoides</i>  | Hairy nightshade                                      |
| <i>Sorbus aucuparia</i>  | European mountain-ash                                 |
| <i>Sorghum halepense</i>   | Johnson grass   |
| <i>Spartina spp.</i>   | Cordgrass species                                     |
| <i>Taeniatherum caput-medusae</i>  | Medusahead rye  |
| <i>Tribulus terrestris</i>   | Puncturevine  |
| <i>Ulex europaeus</i>  | gorse   |
| <i>Utricularia vulgaris</i>  | Common bladderwort                                    |
| <i>Various bamboo spp.</i>   | Bamboo  |
| <i>Vinca major</i> ; <i>Vinca minor</i>  | periwinkle; vinca                                     |
| <i>Xanthium spinosum</i>   | Spiny cocklebur                                       |

For a complete list of noxious weeds, consult the Oregon Department of Agriculture ([http://egov.oregon.gov/ODA/PLANT/weed\\_index.shtml](http://egov.oregon.gov/ODA/PLANT/weed_index.shtml))

## Planting Density and Plant Establishment

Vegetation is a critical component of the swales and must be dense and healthy for maximum water quality treatment and effectiveness. Therefore, minimum planting density per 100 square feet is shown in Table 5.

**Table 5 Vegetated Swale Plant Density**

| Qty | Plant Type               | Size   |
|-----|--------------------------|--|
| 1   | Evergreen Tree <b>or</b> | 5 gallon or equivalent   |
| 1   | Deciduous Tree           | Min. ht: 36-48"  |
| 2   | Large shrubs/small trees | Min. ht.: 24-36"   |
| 4   | Shrubs                   | Min. ht.: 12-18"   |
| --  | Groundcover/emergents    | 1 per 12 inches on center, triangular spacing (bareroot, plug, rhizome or container, depending on species) |
| --  | Seed mix                 | Seeding rate depends on species  |

**Note: Check Salem Revised Code Chapter 132 for compliance with Landscaping requirements if trees in vegetated swale are to be used to meet the Landscaping ordinance.**

Plants should be placed in appropriate zones within the swales to achieve maximum effectiveness, but not block inlets or outlets to the swales. Therefore, woody vegetation should be kept clear from the inlet and outlet structures for a distance of at least five feet.

### Soil Preparation

Vegetated swales are appropriate for all soil types; however, there needs to be at least 12 inches of topsoil in the swale. Soils in the vegetated swales must be protected during construction to avoid compaction and thereby reduce infiltration.

### Plant Establishment

The first three years after planting require extra maintenance considerations to ensure survival of the planted species and to reduce the establishment of weeds. Rodent barriers (browse protection), temporary irrigation systems, and more frequent weeding are advisable during the establishment period. Plantings and seeding needs to occur at the appropriate time of the year. Planting should occur in the fall or winter. Seeding should be done in the spring and fall. Spring seeding should be done before the end of spring rains. Fall seeding should be done prior to October 15 and may need to include soil stabilization measures such as mulch, or erosion control blanket.

### Check Dams

Check dams in the swales are located to control and distribute flow. They shall be constructed of clean, durable materials such as rock. Check dams shall be 12 inches in length, the width of the swale, and 3 to 6 inches in height. Check dams should be placed approximately every 50 feet.

### Sand Filters

Sand filters may be used in lieu of a vegetated swale in some situations of Mill Creek Industrial Park. Sand filters are a basic treatment facility used to trap pollutants. They consist of a layer of



sand in a structural box. The water filters through the sand in the filter reservoir and then flows into the surrounding soils or an under-drain system that conveys the filtered stormwater to a designated discharge point. All facility components need to be inspected for operations and structural stability.

**Detention Basins**

Detention basins at the MCIP site are only allowed in order to regulate runoff volumes to prevent flooding. They are not allowed for water quality on this site. The detention ponds are constructed areas that temporarily store excess rainwater during large storm events. When the amount of stormwater in underground piping approaches capacity, water will begin to back up into the detention basin. The water is stored and released slowly over a matter of hours.

Detention basins should be seeded and planted using plant materials and densities similar to the vegetated swales. Vegetation, landscaping, or other uses of the basin area should not interfere with the functioning of, or access to, basin and stormwater infrastructure (pipes, catchbasins, manholes, etc.). Also, materials that could leach pollutants or pose a hazard to people or wildlife should not be placed within the basin, such as chemically treated wood or lumber. In addition, materials that can block drainage, such as mulch, gravel or other small sized landscape materials should not be used.

**Planting Density and Plant Establishment**

Detention basins, like vegetated swales, have different planting zones based on their hydroperiod. Use Tables 1 to 4 for recommended and prohibited plant materials to be used. Minimum planting density per 250 square feet is shown in Table 6.

**Table 6 Detention Basin Plant Density**

| Qty | Plant Type               | Size   |
|-----|--------------------------|--|
| 4   | Large shrubs/small trees | Min. ht.: 24-36"   |
| 6   | Shrubs                   | Min. ht.: 12-18"   |
| --  | Groundcover/emergents    | 1 per 12 inches on center, triangular spacing (bareroot, plug, rhizome or container, depending on species) |
| --  | Seed mix                 | Seeding rate depends on species  |

**Note: Check Salem Revised Code Chapter 132 for compliance with Landscaping requirements if detention basin plantings are to be used to meet the Landscaping ordinance.**

Plants should be placed in appropriate zones within the basins to achieve maximum effectiveness, but not block inlets or outlets. Therefore, woody vegetation should be kept clear from the inlet and outlet structures for a distance of at least 5 feet.

**Soil Preparation**

Following site clearing and grading, all disturbed basin subsoil should be tilled before capping with 18 inches of topsoil.

## **Operation and Maintenance of Facilities**

In order to ensure that the vegetated swales, sand filters and detention basins are working as designed, a written log of inspection, maintenance, repair and replacement activities is required. A series of inspection check lists are presented to assist in the preparation of the Maintenance Log. The checklists distinguish between the maintenance appropriate for a three-year plant establishment period and expected long-term maintenance. In addition, the following information needs to be documented:

- a) A site plan clearly showing location of water quality pre-treatment and basic treatment facilities.
- b) An O&M inspection schedule that demonstrates how the maintenance/inspection activities relate to storm events and seasonal issues.
- c) Identification of equipment and materials required to perform the maintenance, repair or replacement.

## **Instructions for Inspection Checklist**

Use photocopies of the following pages, or you may develop your own electronic copies. Check off the problems you look for each time you do an inspection. Add comments on problems found and actions taken. Document facility conditions with photographs. Some items do not need to be looked at every time an inspection is done. Use the suggested frequency at the left of each item as a guideline for your minimum inspection frequency.

If you have technical, operational, or maintenance questions, call the City of Salem Public Works Department (phone numbers shown at the end of this document). Please do not hesitate to call, especially if you are unsure whether a situation you have discovered may be a problem.

When compiling the Checklist, use the following as a guide for inspection frequencies:

- A** = Annually, e.g., once in late summer (preferably September)
- E** = Establishment period (three years following planting/seeding)
- M** = Monthly
- S** = After any major storm (use 1-inch in 24-hours as a guideline)
- Q** = Quarterly

Operation and Maintenance  
INSPECTION CHECKLIST COVER SHEET

**Business/ Property Owner**

**Name(s):** \_\_\_\_\_

\_\_\_\_\_

**Date Inspected:** \_\_\_\_\_

**Property Location:** \_\_\_\_\_

**Inspection Period:** \_\_\_\_\_

**Number of Sheets Attached:** \_\_\_\_\_

**Name of Inspector:** \_\_\_\_\_

**Inspector's Signature:** \_\_\_\_\_

# OPERATION AND MAINTENANCE PLAN INSPECTION CHECKLIST

**Key**

- A = Annual (March or April preferred)**
- E = Establishment Period (first 3 years after planting)**
- Q = Quarterly**
- M = Monthly**
- S = After Major Storms**

## Vegetated swales

| Frequency           | Treatment Systems Feature  | √ | Problem  | Conditions To Check For   | Recommendations  |
|---------------------|----------------------------|---|--|---|--|
| M, S                | General                    |   | Trash & debris                                       | Dumping of yard wastes such as grass clippings and branches into basin. Unsightly accumulation of non-degradable materials such as glass, plastic, metal, foam, and coated paper. | Remove trash and debris and dispose of appropriately.  |
| M, S                |                            |   | Trash, or debris in or on swale outlet or trash rack | Trash or debris in front of the swale outlet is blocking capacity by more than 50%.   | Remove trash or debris located immediately in front of, or on, swale outlet.   |
| Q                   |                            |   | Outlet is clogged with vegetation                    | Vegetation or roots growing in inlet/outlet pipe and is blocking capacity by more than 50%.   | Remove or prune vegetation so that outlet is not clogged.  |
| M, S                |                            |   | Sediment buildup                                     | Accumulated sediment that exceeds 20% of the design depth or 4-inches in depth.   | Remove sediment by hand with minimal damage to vegetation. Check for upstream sources of erosion and rectify.  |
| M,S                 |                            |   | Erosion of Ground Surface                            | Noticeable rills are seen in swale or swale slopes.   | Causes of erosion are identified and steps taken to slow down/spread out the water. Eroded areas are filled, contoured, and seeded.  |
| M                   | Check Dams                 |   | Rocks missing or moved or eroded                     | Check dam is not functioning as designed.   | Replace rocks. Repair check dam to design standard.  |
| A                   | Energy Dissipater Rock pad |   | Missing or moved rock                                | Only one layer of rock exists above native soil in area 5 square feet or larger, or any exposure of native soil.  | Replace rocks to design standard.  |
| Q                   |                            |   | Insects  | Mosquitoes become a health risk.  | If sprays are necessary use only a mosquito larvicide such as <i>Bacillus thuringiensis</i>  |
| A                   |                            |   | Swale does not drain                                 | Water stagnation occurs. Plant mortality due to standing water.   | A survey may be needed to check grades. Grades need to be in 1-5% range if possible.   |
| M,S                 |                            |   | Fire hazard or other pollution                       | Presence of chemicals such as natural gas, oil, or gasoline. Obnoxious color, odor, or sludge noted.  | Determine source of pollution and rectify.   |
| E/Q                 | Vegetation                 |   | Browse Protection                                    | Browse protection missing or damaged on trees and single stemmed shrubs; or evidence of rodent damage. Mature vegetation growing into browse protection.                          | Replace or repair as needed. Secure mesh guards to ground with bamboo stake.   |
| E/M (spring-summer) |                            |   | Temporary irrigation system                          | Vegetation shows signs of water stress. Plant mortality due to drought or rot. Areas not covered by irrigation or excessive irrigation. System broken or vandalized.              | Temporary system in good working order and adequate rate and coverage. Repair as necessary. Check system monthly spring-summer. Charge irrigation system in spring and winterize in fall. Check for leaks and coverage. Remove at end of establishment period. |
| E/A                 |                            |   | Weeds  | Competition between herbaceous and woody plants causing mortality or plant stress to trees and shrubs.  | Reduce competition during establishment period by mulching around trees and shrubs on swale slopes (not swale bottom). Apply 3-inch deep mulch around base, but not in direct contact with stem.   |
| E/Q                 |                            |   | Invasive/nuisance vegetation/weeds                   | Weeds growing in more than 20% of the swale and adjacent slopes. Dense grass or weeds competing with plants during establishment period.  | Manually remove weedy vegetation or licensed applicator may spot spray using herbicide approved for use near water.  |

| Frequency | Treatment Systems Feature | √ | Problem   | Conditions To Check For  | Recommendations   |
|-----------|---------------------------|---|---|--|---|
| A         |                           |   | Rodent holes                                      | Evidence of rodent holes undermining slopes, check dams or swale. Swale not functioning as designed.   | If necessary, rodents trapped or removed and damage repaired. Contact the Oregon Dept. of Fish and Wildlife for guidance.                       |
| A         |                           |   | Maintenance access inhibited by vegetation growth | Vegetation growth does not allow maintenance access or interferes with maintenance activity (i.e. silt removal, inlet or outlet maintenance). If vegetation is not interfering with access, leave alone. | Vegetation does not hinder maintenance activities. Selectively prune or remove vegetation to ensure adequate maintenance and function of swale. |
| 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 remove dead or damaged limbs. Replace trees/shrubs with severe damage.   |
| A         |                           |   |   | 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 that are not adequately supported or are leaning over, causing exposure of the roots.  | Place stakes and rubber-coated ties around young trees/shrubs for support.  |
| A         |                           |   | Plant mortality                                   | Trees or shrubs have died.   | If possible, identify cause of death and take appropriate action. Replant trees or shrubs.  |
| A         |                           |   | Bare soil   | More than 10% of area is bare soil.  | Reseed with appropriate seed mix.   |

**Key**

**A = Annual (March or April preferred)**

**E = Establishment Period (first 3 years after planting)**

**Q = Quarterly**

**M = Monthly**

**S = After Major Storms**

**Sand Filters**

| Frequency | Drainage Systems Feature           | √ | Problem   | Conditions To Check For   | Recommendations   |
|-----------|------------------------------------|---|---|---|---|
| M,S       | Filter Inlet                       |   | Filter inlet blocked by trash, debris, or sediment                  | Water is not spreading uniformly over filter. Inlet is blocked by debris, trash or sediment and conveyance capacity is reduced by 40%. Rock splash pads clogged or missing. Sediment accumulation more than 4 inches. | Grate is kept clean and allows water to enter. Identify and remedy source of sediment. Remove sediment if more than 4-inches accumulation. Repair or replenish rock splash pads to prevent erosion. |
| M,S       | Filter Media                       |   | Water not percolating evenly through media.                         | Water remains longer than 36-48 hours after storm. Media clogged with debris or sediment. Holes in media allow bypassing of filter.   | Rake sand filter and remove fallen leaves etc. If necessary, excavate and replace filter media. Fill any holes in media. Determine source of debris and repair or remove.                           |
| M,S       |                                    |   | Erosion   | Rills or sedimentation in filter.   | Ensure water is entering slowly and spreading uniformly over filter media. Address outside sources of sedimentation.  |
| Q         | Filter Box                         |   | Failure of filter box   | Rot, cracks, etc. in structure.   | Structural problems should be repaired upon discovery.  |
| M,S       | Under-drain piping (if applicable) |   | Water not percolating evenly through media.                         | Piping plugged with sediment or debris.   | Check cleanouts and remove sediment or debris to meet design specifications.  |
| A         | Access                             |   | Access to filter, spillway and/or cleanouts inhibited by vegetation | Trees or shrubs are inhibiting access to structural components of filter.   | Prune vegetation to allow access to filter clean-outs and overflow systems. Remove vegetation if necessary.   |
| M,S       | Overflow or emergency spillway     |   | Spillway or overflow conveyance reduced.                            | Spillway or overflow blocked by trash, debris, or sediment, and conveyance reduced by 50% or more.  | Remove debris, trash and sediment from spillway or overflow. Identify sources of sediment and repair. Replace rock at outfall to reduce erosion.  |

# OPERATION AND MAINTENANCE PLAN INSPECTION CHECKLIST

**Key**

- A = Annual (March or April preferred)**
- E = Establishment Period (first 3 years after planting)**
- Q = Quarterly**
- M = Monthly**
- S = After Major Storms**

## Detention Basins

| Frequency                    | Drainage Systems Feature                 | √ | Problem                               | Conditions To Check For   | Recommendations   |
|------------------------------|--|---|---------------------------------------|---|---|
| Q                            | Vegetation                               |   | Invasive/nuisance vegetation/weeds    | Presence of nuisance/invasive plants. Weeds growing in more than 25% of the pond and adjacent slopes.   | Nuisance/invasive plants removed when discovered and shall not be more than 25% coverage. Manually remove weedy vegetation or licensed applicator may spot spray using herbicide approved for use near water. |
| A                            |  |   | Access inhibited by vegetation growth | Vegetation growth does not allow maintenance access or interferes with maintenance activity (i.e. silt removal, inlet or outlet maintenance). If vegetation is not interfering with access, leave alone.        | Selectively prune or remove vegetation to ensure adequate maintenance and function of pond. Establish appropriate groundcover to prevent erosion in access areas.   |
| Q, S                         |  |   | Erosion/lack of vegetation cover      | More than 20% of bottom and slopes without grass or herbaceous cover. Native soils exposed. Signs of rills or sediment deposition in pond or pond sides.  | Causes of erosion are identified and steps taken to slow down/spread out the water. Eroded areas are filled, contoured, and seeded. Pond bottoms should have uniform dense coverage of desired plant species. |
| M,S                          | General                                  |   | Trash & debris buildup in pond        | Dumping of yard wastes such as grass clippings and branches into basin. Unsightly accumulation of non-degradable materials such as glass, plastic, metal, foam, and coated paper.                               | Remove trash and debris and dispose of appropriately.   |
| M,S                          |  |   | Fire hazard or pollution              | Presence of chemicals such as natural gas, oil, and gasoline, Obnoxious color, odor, or sludge noted.   | Find sources of pollution and eliminate them. Water is free from noticeable color, odor, or contamination.  |
| A                            |  |   | Rodent holes.                         | Evidence of water piping through dam or berm via rodent holes.  | Presence of rodents not undermining pond function. If necessary, rodents trapped or removed and damage repaired. Contact the Oregon Dept. of Fish and Wildlife for guidance.                                  |
| M (spring and summer months) |  |   | Insects                               | Stagnant water in summer. Mosquitoes become a health risk.  | Ensure pond outlet is not blocked or impeded. Use Integrated Pest Management. If sprays are necessary use only a mosquito larvicide such as <i>Bacillus thuringiensis</i> .                                   |
| M                            | Embankment, dikes, berms and side slopes |   | Erosion on berms or at entrance/exit  | Check around inlets and outlets for signs of erosion. Check berms for signs of sliding or settling. Action is needed where eroded damage over 2 inches deep and where there is potential for continued erosion. | Find causes of erosion and eliminate them. Then slopes should be stabilized by using appropriate erosion control measure(s); e.g. rock, reinforcement, planting of grass, compaction.                         |
| M                            | Storage area                             |   | Sediment buildup in basin             | Accumulated sediment that impairs basin function.   | Sediment cleaned out to designed pond shape and depth; pond re-seeded and stabilized to prevent erosion.  |
| A, S                         | Pond inlet                               |   | Flow to pond restricted or impacted   | Settlement of pipes, cracks, leakage. Blockage to flows by debris or sediment.  | Clear inlet to ensure unimpeded flow to basin. Repair structural problems upon discovery.   |
| A, S                         | Forebay                                  |   | Sedimentation                         | Sediment build up exceeds 50% of the facility capacity.   | Remove sediment, seed and stabilize area.   |
| A, S                         | Control devices                          |   | Weirs, baffles, orifices etc.         | Conveyance capacity is reduced by 25% or more. Structural problems, such as cracks. Water is not being evenly distributed through detention basin.  | Remove debris etc to restore conveyance capacity to design standard. Repair structural problems upon discovery.   |
| A, S                         | Overflow/spillway/energy dissipater      |   | Rock missing                          | Only one layer of rock exists above native soil in area 5 square feet or larger, or any exposure of native soil.  | Replace rocks to design standards.  |

**References:**

Otak. October 16, 2006. *Mill Creek Industrial Park Stormwater Management Plan*. Prepared for Oregon Department of Administrative Services.

**City of Salem Public Works Department Technical Assistance:**

**Design: Contact Development Services at 503-588-6211**

**Operation or Maintenance: Contact Operations Division at 503-588-6063**

**Stormwater or Environmental Hazard Emergency: Contact Dispatch at 503-588-6333**