vegetative cover[5], low flow, slight slopes with constricted outlets and the pollutant (sedimentation) input. The rating indicates the potential for a wetland to perform this function based on the actual presence of a pollutant, and assumed ground cover. The existing condition however allow for significant sedimentation and pollutant introduction from the cornfield area, but the ditch allows opportunity for reduction due the dense reed canary grass cover.

The proposed plant site and mitigation south of the wooded area will improve on this function by eliminating the source of agricultural related pollutants. The plant sedimentation will be detained by the stormwater detention facility, and the proposed mitigation area will be seeded and planted with trees and shrubs, both which will eliminate erosion, sedimentation and nutrient inputs. The 660 linear feet of wetland ditch is to replaced with approximately 880 linear feet of channel constructed for drainage, and secondly for water quality. The new ditch is expected to provide the ability to perform the same wetland hydrologic functions as the filled segment of the wetland ditch, depending on the frequency of grass maintenance. The additional proposed mitigation in the east mitigation area will provide a swale-like wetland feature that will provide additional residence time for treated runoff, which will increase the opportunity for water quality improvement.

Flood and stormwater retention rates as *low* due to the small storage capacity, low position in the watershed, and size. Additional points were provided for the dense ground cover in the wetland ditch and its connection to Sumas Creek 1,600 feet to the east. Ground water geologists, Robinson and Noble, Inc., reports that the site does not store significant amounts of surface water for subsequent release due to the shallow surface soil and its silt and clay nature. Robinson and Noble estimates that 4.088 gpd would be discharged from the entire 20-acre site, but only after sufficient rain has fallen to saturate soils. They have estimated that 1.6 acre-feet of water are released from the site on an annual basis.

The proposed detention pond is designed to detain surface water such that no increase in downstream flow occurs. The proposed planting of the mitigation area south of the wooded area will allow the interception of rainfall, and reduce runoff, both which will mitigate for impacts related to the plant site. During significant flood events, the trees and shrubs slow water velocity and increases residence time. The proposed mitigation area on the east mitigation area will provide a swale-like wetland feature that will provide additional residence time for stormwater runoff, and add a small amount of floodwater capacity.

Shoreline stabilization is not viewed as being applicable because the wetlands do not possess a shoreline.

6.4 Indirect Impacts

1. Potential secondary impact to adjacent wetlands from interception of surface runoff by development.

[5]Applies to wetland ditch and also when FWP is fallow; does not apply when FWP is in corn.

Anticipated Impacts: Filling of the plant site is not expected to decrease surface hydrology for the remaining wetlands. The farmland where the plant site is proposed drains primarily to the south. Any drainage to the west is intercepted by the north-south ditch on the west boundary and then carried to the main wetland ditch. Other parts of the plant site drain directly in to the main wetland ditch. The offsite wetlands west of the plant site receive surface runoff mostly from farmland to the west. Wetland hydrology is also attributed to a high ground water table, which will not be disrupted. The remaining wetlands are expected to remain sufficiently saturated to maintain their existing hydrologic regime. The ditch located between the preserved wooded area and the proposed plant site (west edge) will be relocated to the north. Existing hydrology within the remaining wetlands are not expected to be significantly affected, due their lower elevation and the seasonal high water table. Treated stormwater will also be routed through the wetland for added hydrology. The wooded area is expected to benefit from the ditch relocation because it may promote drainage at the east edge of the wooded area.

Filling of the FWP and PC lands is not expected to significantly decrease or increase the hydrology of the remaining wetlands because the hydrology is provided by the high ground water table. It should be noted that the wooded area is not a depression, but is similar to elevations to the east and west. According to the previous landowner, the wooded area was retained to provide shade for livestock and is not due to abnormal wetness.

2. Introduction of pollutants (oil/grease, refuse, sedimentation) is a potential secondary impact to wetlands.

   Anticipated Impacts and Mitigative Measures: Site runoff requires onsite detention and treatment prior to release. Site runoff is to be detained in the multi-cell stormwater detention facility prior to release into the proposed drainage and water quality channel. Treated water will first enter the mitigation wetlands and provide additional treatment prior to entering the new ditch system. During construction, the erosion and sediment control plan should also provide for the installation of silt fencing or straw bales at wetlands and ditches which are adjacent to fill areas. The proposed project will produce some positive impacts to water quality through the cessation of the agricultural operation and associated pollutants, such as sedimentation, fertilization and herbicide application.

3. Potential impacts to wildlife in the approximate 9-acre shrub and wooded block west of the plant site.

   Anticipated Impacts and Mitigative Measures: The shrub and wooded block is surrounded by agricultural or industrial activity and is separated from other significant habitats through agricultural lands approved for industrial development, and a railroad grade. Due to the zoning of this area, the block will likely become further isolated which will most likely affect larger mammals, such as deer and coyote. Small mammals and passerines should not be significantly affected. To mitigate for the buffer encroachment, the

9-acre block is to be preserved and assured protection by placing it into a conservation easement recorded.

4. Potential impacts associated with the relocation of two existing drainage ditches.

   The approximate 880 linear feet of relocated channel (water quality and drainage) to be constructed will provide similar hydrologic functions afforded by the filled 660 linear feet. This channel is being constructed to accommodate stormwater runoff, after detention. The relocation of the 600-foot ditch is not expected to significantly affect the hydrology of the farmed wetland, or the wooded area, which it borders. To the contrary, the relocation of the ditch will remove a drainage feature that potentially drains part of the wooded area. The lower emergent wetland which it borders will continue to have hydrology from the seasonal high water table and proposed treated runoff from the stormwater detention facility.

7.0 PLANT SITE WETLAND MITIGATION

7.1 General

Two areas which provide a total of 19.41 acres are being dedicated to mitigation and preservation. The mitigation more than offsets impacted wetland functions associated with the proposed plant site.

The proposed mitigation is on or adjacent to the site and consists of a 5.87-acre tract located west of the plant site, and a 4.1-acre tract immediately east of the plant site, and a 9.44-acre area that is a palustrine forested and shrub wetland with an emergent fringe. A diagram showing the areas is provided in Appendix E.

Proposed tree species for the various mitigation areas are indicated in Table 8-2. All species are considered to be native, compatible and similar to naturally occurring species in existing adjacent wetland areas.

The proposed mitigation will compensate for the lost wetland habitat of small mammals and passerines, and may provide additional habitat opportunities for amphibians. The lower elevations of the constructed wetland are intended to mitigate for floodwater capacity lost by the filling of the 1.9 acres of wetlands. The shrub and tree plantings are also expected to reduce stormwater runoff through the interception of rainfall.

	West Area	East Area	Preserved Area	Total
Wetland Enhancement	4.17 ac.	1.82 ac.		5.99 ac.
Wetland Creation	0.99 ac.	2.18 ac.		3.17 ac.
Buffer/Nonwetland	0.71 ac.	0.10 ac.		0.81 ac.
Total	5.87 ac.	4.10 ac.	9.44 ac.	19.41 ac.

7.2 West Mitigation Area

A description of the vegetation, soil and hydrology is previously described in Section 3.4.3.

The west mitigation area is mostly farmed, but also contains a lower wetland area (kidney shaped) that is periodically farmed depending on seasonal wetness. When fallow, this area supports a dense stand of reed canary grass (*Phalaris arundinacea*). This lower area will contain most of detention pond Cell No. 2, which will provide different levels of mitigation. The proposal within the west mitigation area is to construct some wetland areas by slightly lowering nonwetland areas, and enhanced wetland areas by planting them with native shrubs, and trees at more elevated landscape positions. Treated stormwater from Cell No. 2 will be discharged in the wetland proposed for enhancement, which will provide an additional measure of water quality treatment and stormwater attenuation.

Surface hydrology for the enhanced wetland area is expected to remain unchanged due to the regionally high groundwater table. Any encountered drain tile in the mitigation area will be removed.

Water quality treatment and flood storage, over and above that which is required, is being provided in Cell No. 2 by the area above the permanent pool elevation of 38.9 feet. Fill associated with Cell No. 2 has been included in the wetland fill calculation, and the area below the permanent pool elevation of 38.9' has not been included as mitigation acreage. Nonetheless, this area will be planted with native shrubs to also provide wildlife benefits.

This mitigation area will compliment the existing wooded area immediately to the north. The existing ditch, which is located between the proposed plant site and the wooded area, is to be relocated north of the plant site. Hydrology from this ditch outfalls into the lower part of the existing wetland, however lost hydrology is not expected to affect the wetland, which will be replaced with outfall water from Cell # 2 and the seasonal high water table.

7.3 East Mitigation Area

The 4.1-acre mitigation east of the plant site is fallow pasture occupied with invasive and exotic grass species such as reed canary grass, timothy *(Phleum pratense)*, quackgrass *(Agropyron repens)*, bluegrass *(Poa compressa)*, creeping buttercup *(Ranunculus repens)*, water foxtail *(Alopecurus geniculatus)* and other less abundant species including common plantain, curly dock *(Rumex crispus)*, lady's-thumb knotweed *(Polygonum amphibium)*, and ovate spikerush *(Eleocharis ovata)* (David Evans and Associates, 1991). North of this mitigation area, the land had been filled and may be used as a construction staging area. Bob Mitchell Avenue forms the east boundary and Hesselgrave Way the south boundary. A gravel road is present along the west part of the property, and also buried road gravel in areas parallel to Bob Mitchell Avenue. The gravel will have to be removed and replaced with suitable soils.

The proposed mitigation is somewhat similar to the west area in that existing wetland areas will be enhanced with native shrubs and a minor component of trees tolerant of wet conditions. Surrounding nonwetland area will be lowered as wetland creation, and subsequently planted with native shrubs and trees. The existing gravel road area will be removed, and replaced with a wetland community. A wetland swale is proposed to enter the northwest part of the site and exit the northeast part of the site. This swale will accommodate treated runoff from the plant site bioswale, and then reconnect and outfall into an existing culvert. The swale will have a minimum 10-foot bottom with 4:1 to 6:1 side slopes, and will provide additional water quality treatment, storage for floodwater, and maintenance of stream base flows.

Created wetland areas will be lowered by one to two feet, topsoil replaced or imported, and planted with native grass and shrub species. The seasonal high water table, and also the proposed swale will provide wetland hydrology.

Reed canary grass will have to be eliminated from both mitigation areas and maintained for a 10-year period. The proposed vegetative assemblage is provided in Table 7-2, which contains those species recently recommended by the Washington Department of Fish and Wildlife.

Surface hydrology for the enhanced wetland area is expected to remain unchanged due to the regionally high groundwater table.

TABLE 7-2 SE2 MITIGATION PLANT LIST

Species	Constructed/ Created & Enhanced Wetlands (Blue)*	Constructed/ Created & Enhanced Wetlands (Yellow)	Buffer & Detention Pond Berms[6] (Drk Green)	Status
Trees				
Red alder *(Alnus rubra)*		•	•	FAC
Paper birch *(Betula papyrifera)*				FAC
Pacific crabapple *(Malus fusca)*				FACW
Black cottonwood *(Populus balsamifera)*		•	•	FAC
Douglas fir *(Pseudotsuga menziesii)*				FACU
Western red cedar *(Thuja plicata)*		--	•	FAC
Western hemlock *(Tsuga heterophylla)*			•	FACU-
Shrubs, Ferns and Vines			•	
Red-osier dogwood *(Cornus sericea)*	•	•	•	FACW
Oceanspray *(Holodiscus discolor)*				NI
Nootka rose *(Rosa nutkana)*			•	FAC+
Thimbleberry *(Rubus parviflorus)*				FAC-
Salmonberry *(Rubus spectabilis)*		•		FAC
Red elderberry *(Sambucus racemosa)*				FACU
Pacific willow *(Salix lasiandra)*	•	•		FAC+
Scouler's willow *(Salix scouleriana)*	•	•	•	FAC
Snowberry *(Symphoricarpus albus)*			•	FACU

* Colors refer to colors found on diagram in Appendix E.

[6] No trees to be planted in Detention Pond Cell #2, or on berms so as to maintain structural integrity. Pacific willow to be planted within Cell #2, but away from berm area.

Forbs				
Spike bentgrass *(Agrostis exarata)*		•		FACW
Hair bentgrass *(Agrostis scabra)*			•	FAC
Bluejoint *(Calamagrostis canadensis)*		•		FACW+
Slough sedge *(Carex obnupta)*	•	•		OBL
Beaked sedge *(Carex rostrata)*		•		OBL
Bearded fescue *(Festuca subulata)*			•	FACU+
Northern mannagrass *(Glyceria borealis)*		•		OBL
Tall mannagrass *(Glyceria elata)*	•			FACW+
Native bluegrass *(Poa nervosa)*			•	FACU-

7.4 Preserved Wooded Area

9.4 acres of wetlands will also be preserved for mitigation. This includes 8.8 acres of palustrine forested and shrub wetlands, and a 0.64 palustrine emergent fringe. The wooded wetland area is a City of Sumas Conservancy Area, therefore adding the mitigation to the south will increase overall habitat area and guarantee a significant buffer to this existing wooded area.

7.5 Proposed Vegetative Assemblage

The proposed overall long-term vegetative assemblage for the enhanced and created areas is a mosaic of emergent, shrub and forested areas (see Table 7-2). It is expected that the proposed plant communities will be mostly influenced by the site hydrology.

Tree plantings are proposed at ten (10) foot centers and shrubs on five (5) foot centers in the areas planted. Plant individuals are to be planted in random groupings and clumps, including the enhanced buffer.

Within detention pond Cell No. 2, areas below the permanent pool elevation of 38.9' will be planted with Pacific willow, Scouler's willow and red-osier dogwood. Above this elevation the pond is to be planted with Nootka rose, snowberry, Scouler's willow and red-osier dogwood.

7.6 Proposed Soil Structure

The constructed wetland will be over-excavated by 10 inches and replaced with topsoil, possibly with existing surface soils which will be reserved for subsequent use. Soils within the constructed wetland should resemble the Sumas or Puget silt loam series, which are the soil NRCS mapped soil units for this site. These soils possess surface organic content and subsurface clay content as indicated in Table 8-3. Any surface soils removed from areas vegetated with reed canary grass will not be used for mitigation topsoil.

The surface organic content is necessary for plant nutrients, and the subsurface clay content is necessary to slow permeability. Soils in the buffer area are to be left intact and not disturbed.

The soils in the proposed enhanced farmed wetland are considered to be suitable for mitigation and will not be require alteration or amendment.

Table 8-3		
Soil Unit	*% Organic (surface)*	*% Clay (subsurface)*
Sumas silt loam	3 to 9	18 to 35
Puget silt loam	3 to 9	18 to 35
Recommended	9 to 15	18 to 35

7.7 Proposed Hydrology

A seasonally high ground water table drives the existing hydrologic regime. Permeability is poor and the surface becomes saturated near the surface during the winter and early spring, and then dissipates during the spring and summer. The groundwater at this location is not believed to be influenced by flows within the wetland ditch except during significant flood events at which time floodwaters enter and exit the site at an accelerated rate.

Hydrology within the created wetlands is to be derived from precipitation and the seasonally high ground water table. Seasonal ponding is expected with prolonged saturation through the winter and spring. The created wetland is expected to be dry to moist, but not saturated in August and September. Flows in or out of the lowered mitigation area are not proposed to connect with the realigned wetland ditch system. The existing hydrologic regime in the enhanced buffer area is adequate and is not to be modified. Once trees and shrubs are semi-mature, additional moisture will be retained from rainfall interception and decreased evaporation.

Within detention pond Cell No. 2, the permanent pool elevation is set at 38.9'. Seasonal ponding is expected up to this elevation, but is expected to decline significantly from July through September and expose the majority of the pond banks.

The southeast part of the west mitigation area will receive treated stormwater and drain into the new relocated ditch, which is similar to the existing condition.

The hydrology for the relocated wetland ditch will be slightly altered. Surface runoff will continue to be received from south of Highway 9, however after flowing under Hesselgrave Way, flow will be directed to the east into the proposed water quality and drainage channel. The existing segment of channel from Hesselgrave Way to the proposed plant site edge will remain open. The proposed water quality and drainage channel will be 880 linear feet and will accommodate existing runoff from the south and also treated plant site stormwater runoff discharged from the stormwater retention pond. Runoff from the water quality and drainage channel will outfall into the existing drainage channel at the east side of the plant site as described below.

Runoff collected at the east edge of the plant site will be directed to the south-southeast into a proposed new wetland swale aligned through the east mitigation area. The swale will reconnect to an existing storm sewer located at the northeast corner of the east mitigation, From this point the runoff flows

through approximately 400 feet of storm sewer, and hence through approximately 1,200 feet of open channel to its confluence with Sumas Creek.

The wetland swale in the east mitigation area will be 1 to 2 feet in depth, a minimum 10-foot width, and with 4:1 to 6:1 side slopes. It is expected to be inundated November through May, with only saturation, and periodic ponding from July through September.

7.8 Proposed Habitat Features

Proposed habitat features include the placement of large woody debris, such as downed logs and stumps, in the two mitigation areas. Placement is to be at a density of approximately 135m^3/hectare and of a size in which 30% are at least 21cmf (8.25") in diameter (Azous, 1998). This also equates to an approximate minimum of 49 snags per hectare. This density equates to an approximate minimum of 23 downed snags or stumps per acre for a total of approximately 47 stumps or logs. This assumes a stump sized at 6 feet long by 3 diameter feet.

7.9 Sequencing and Schedule

Earthwork for the mitigation areas will likely occur at the same period when wetlands are filled if during summer months. Trees and shrubs are to be planted in the late fall, winter or early spring. Western red cedar may be planted in Year 3 in developed shade areas.

8.0 OBJECTIVES

8.1 General

The proposed mitigation should more than offset potential adverse impacts associated with the filling of plant site wetlands. The mitigation will replicate the current discharge of stormwater runoff and the existing release to the ditch system that ultimately outfalls into Sumas Creek.

The created wetland area will offset lost or impaired hydrologic and wildlife functions. The created wetland will provide additional stormwater capacity and area to entrap sediments, however the mitigation area is not intended for use as a stormwater facility. Seasonally ponded areas in the constructed wetland will offer diversity and potential amphibian habitat. The mitigation areas will receive treated stormwater and therefore provides additional water quality treatment, and resident time prior to release into the existing offsite storm water sewer.

The enhanced wetlands and associated plantings will increase wildlife functions of the 8.8-acre acre shrub and wooded block. Wildlife functions of the impacted farmed wetlands, PC lands and wetland ditch are low due to the agricultural setting and disturbed conditions, therefore wildlife stand to benefit through the enhancement of more functional systems, such as the 8.8 acre

block. The plantings and enhancement will provide decreased sedimentation and soil exposure, and add structural diversity for rainfall interception.

The preserved 8.8-acre shrub and wooded tract of land has been designated by the City of Sumas as a Natural System Protection Area. The block is sited in a very desirable and strategic industrial location, therefore its preservation at this opportunity is significant. This area actually totals 9.44 acres when 0.64 acres of emergent fringe is added.

8.2 Mitigation Ratios

Using the revised mapping, which includes PC lands, the combined mitigation ratio for the wetland creation and wetland enhancement is greater than 1:1. A 1:1 ratio would be appropriate in consideration of the disturbed nature of the wetland to be affected, and the 8.8-acre shrub and wooded area that are being preserved. The entire wetland mitigation area, including wetland creation/enhancement, buffers and preservation totals 19.41 acres.

9.0 PERFORMANCE STANDARDS

9.1 Vegetation

Table 10-1 represents the desired standards for the proposed mitigation area. Long-term standards, or goals, are based on a recent study under a King County grant (Azous, 1998). The percent cover values for the trees and shrubs represent plantings on 10 and 5-foot centers respectively. Trees will typically be 4 to 5 feet in height and shrubs 2 to 3 feet.

Reed canary grass (*Phalaris arundaceae*) and barnyard grass (*Echinochloa crusgalli)* are considered to be the problematic species and are to be maintained to a 10% or less cover for the duration of the monitoring period. The intent of this maintenance is to allow successful propagation of the planted trees and shrubs.

Subsequent to plant installation, personnel licensed by the state of Washington will pursue control of invasive plants on an annual basis manually and with the application of herbicide.

Table 9-1 Performance standards

Rated Item	Year 1	Year 2	Year 3	Year 5	Year 7	Year 10	Long Term
Survival (%)	100	> 80	> 80	> 80	> 80	80	natural mortality
Trees (% cover)*	< 5%	< 5%	< 5%	7%	10%	15	25-67%
Shrubs (% cover)*	< 5%	< 5%	5%	7%	7-10%	15	20-48%

Emergent (% cover)	< 50%	65%	75%	75%	75%	75	50%
Canopy closure*	< 5%	< 5%	7.5 - 10%	12 - 15%	20%	25	35-60%
Strata	1	1	1-2	2	3	3	3

* Percent cover for planted areas, e.g. tree % cover does not apply to areas designed as PSS. Natural recruitment by native species will be counted as part of the cover.

9.2 Soils

Where possible, topsoil will be taken from filled wetland areas, however, if this is not feasible, topsoil will be imported. No soils will be used from areas with reed canary grass. Based on the Soil Conservation Service soil survey (see Table 8-3), topsoil imported to the constructed wetland should possess a minimum of 10% organic matter in the top 10 inches. Soils are to be sampled and observed for hydromorphic features such as mottles and/or low matrix chromas, or oxidized rhizospheres. Existing soils within the enhanced buffer area are to remain.

9.3 Hydrology

A perched water table exists throughout the mitigation area, therefore, plants will be selected and planted according to existing topography. Created wetlands are to be saturated at or near the surface (10 inches) for no less than 5 to 12.5% of the growing season (March 30 to November 2) and are expected to remain saturated for most of November through March. Lower areas are expected to be ponded from mid-December through May, with little or no water from July to September. For October/November and June, water levels are expected to vary according to rainfall. As an indication of sufficient wetland hydrology, surface soils should exhibit hydromorphic features such as mottles and/or low matrix chromas, or oxidized rhizospheres.

A mitigating performance standard is to design the stormwater detention pond system and the mitigation areas such that stormwater runoff will be at a pre-developed quantity and rate. Floodwaters released from the site will not be significantly different than that modelled by the City's floodplain management study.

With respect to the **support of stream base flow**, the existing support is compromised by the fact that the runoff occurs when site conditions are saturated or ponded in the winter and spring, which is when Johnson Creek does not require support. Johnson Creek requires support in the drier summer months, which coincides with a period of little or no runoff from the site. Therefore, so as to address potential impacts to the **support of stream base flow**, the SE2 detention pond system and mitigation areas will be designed to release surface water to the storm sewer/ditch that connects to Johnson Creek, at a rate and quantity modelled under existing conditions.