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**NORTH CREEK PARK
WETLAND RESTORATION PLAN
SNOHOMISH COUNTY, WASHINGTON**

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June 1998

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NORTH CREEK PARK WETLAND RESTORATION PLAN

INTRODUCTION

North Creek Park is located in Snohomish County south of the City of Mill Creek, west of the Bothell-Everett Highway (State Route 527) and just north of 183rd Street S.E. The park is located in a broad valley which is bisected by North Creek approximately seven miles upstream of its confluence with the Sammamish River. North Creek forms the western boundary of the park.

North Creek Park has been designed as a passive recreational park, wildlife sanctuary, and floodwater storage area. Development thus far has included an entry and parking area, a boardwalk, and environmental interpretive signage. A regional stormwater detention facility also is proposed for the site. An environmental impact statement for siting of this facility was prepared in April 1993 (Snohomish County Public Works/Parks, 1993).

The current planning and design effort has been done to identify and interpret existing conditions throughout the park, and to address fish and wildlife habitat conditions and potential through restoration. This document describes existing conditions, goals and objectives, proposed actions of this plan, and recommendations for maintenance and monitoring.

EXISTING CONDITIONS

The North Creek Park site consists of approximately 96 acres owned and managed by Snohomish County Parks, located in one of the fastest growing urban areas in Washington State. It is one of a few remaining large undeveloped areas in the North Creek basin. Historically, this area was a farm and was grazed by cattle and horses. The 114-year old historic Bailey farm along the southeast side of the site is one of the oldest farming homesteads in Snohomish County. It was originally used to raise dairy cows, and later beef cattle.

The area encompassed by North Creek Park is a wetland complex which reflects its past history of farming, grazing, ditching, peat mining, and diking. According to the *Snohomish County Stream and Wetlands Survey* (Snohomish County Planning Division, 1986), wetlands extend off-site to the southwest along the west side of North Creek and several unnamed creeks, as well as to the north along both North Creek and Nickel Creek. The entire wetland area appears to be greater than 200 acres.

Streams, ditches, and ponds

Within the park, North Creek is in a relatively straight channel which flows along the west side of the floodplain and is constrained by a berm along its eastern bank. North Creek's channel was straightened and diked sometime around the turn of the century to improve upon its usefulness as a log-transporting facility, and to provide drainage to the broad, adjacent wetland areas to improve their functioning as agricultural land.

Nickel Creek flows across the site from the northeast and eventually empties into North Creek in the southwest portion of the site. Nickel Creek flows through various ditches or otherwise channelized sections for most or all of its alignment on-site. Historic aerial photos show Nickel Creek in several different ditched configurations over the years. No available information on the native channel of Nickel Creek exists. It is doubtful that any original stream channel remains on-site, if indeed a defined channel was originally present. The actual alignment of Nickel Creek is not entirely clear at various locations, as its flow appears to have been inadvertently captured by and/or divided amongst the various dug drainage ditches.

The fairly extensive network of ditches throughout the site is shown on the accompanying existing conditions map, and on the conceptual enhancement plans which are included with this document. These ditches are no longer actively maintained, and many sections have become overgrown with vegetation and partially filled with sediment. The ditches are generally about four to six feet wide and somewhat rectangular in cross-section. The depth of water in the ditches is typically two to three feet and varies seasonally. Adjacent vegetation consists mostly of reed canarygrass and shrub species, which tend to drape over the ditches from both sides. Since the purpose of these ditches was to provide drainage, they connect with portions of Nickel Creek and throughout the wetlands to eventually direct water into North Creek in the southwest section of the site. As the ditches have become less effective in providing drainage, water has tended to sheet-flow out of them in places especially during wet periods of higher flow. As a result, wetland hydrology has increased and contributed to the vegetation changes which are described below.

Other water features on this site include several on-site ponds which appear to have been formed by farming and possibly peat mining activities, as well as beaver activity; see accompanying maps. It is likely that continued beaver activity will alter some of the existing drainage patterns over time.

Hydrologic and water quality monitoring was conducted for this area as part of the Puget Sound Wetlands and Stormwater Management Research Program (Horner and Horner, 1995 and 1994). Of note, though little temperature data was collected, the reading of 16 degrees C. taken on 7/28/94 is marginally high for salmonid fish. Also, 1994 summer dissolved oxygen levels averaged 6 mg/l with a minimum of 5 mg/l; 1993 summer dissolved oxygen levels averaged 6.4 mg/l with a minimum of 6.2 mg/l. These dissolved oxygen levels are considered marginally low for salmonid

fish. While these marginally high temperatures and marginally low dissolved oxygen levels might not be immediately lethal or problematic for juvenile salmonid fish, neither do they connote ideal or even good summer rearing habitat or conditions in the wetland areas themselves. Refer to the fish section below for additional information.

Vegetation

The plant communities at North Creek Park vary across the site, as shown on the accompanying existing conditions map. There are palustrine forested, scrub/shrub, and emergent plant communities within the wetland areas, as well as open water and aquatic bed communities. Upland areas in the park are found along the south margin near the entry and parking areas, and along the east side between the park and the Bothell-Everett Highway.

The existing forested areas are confined to mostly the east edges of the park, with some smaller patches of trees at the south end and along North Creek. These areas are dominated by a mix of coniferous and deciduous tree species, such as western red cedar (*Thuja plicata*), Douglas-fir (*Pseudotsuga menziesii*), red alder (*Alnus rubra*), and black cottonwood (*Populus balsamifera*). Scrub/shrub communities, which are dominated primarily by willows (*Salix* spp.) and spirea (*Spiraea douglasii*) have taken hold along old ditch lines and in several patches across the site. Wetland shrub and forest communities are particularly well-developed and diverse in the western section of the site near existing beaver ponds.

There are broad expanses of reed canarygrass (*Phalaris arundinacea*) particularly at the south end and throughout the northwest portion of the site. This grass is very invasive and is typically found in wetlands that have been disturbed in the past. There are also several large patches of bristly sedge (*Carex comosa*) and beaked sedge (*Carex rostrata*) which are present mainly in the center and wettest portions of the site. Both of these sedges are fairly uncommon, and are listed as sensitive species by the Washington Natural Heritage Program (1996).

Other emergent plants which have become dominant in patches include cattails (*Typha latifolia*), soft rush (*Juncus effusus*), small-fruited bulrush (*Scirpus microcarpus*), sawbeak sedge (*Carex stipata*), and creeping buttercup (*Ranunculus repens*). Also present in some areas are velvetgrass (*Holcus lanatus*), horsetail (*Equisetum* spp.), birdsfoot trefoil (*Lotus corniculatus*), bedstraw (*Galium* spp.), and stinging nettle (*Urtica dioica*). In and along some of the ditches in the southwest part of the park are diverse ditch communities comprised of American brooklime (*Veronica americana*), bedstraw (*Galium trifidum*), yellow iris (*Iris pseudacorus*), soft rush (*Juncus effusus*), and mannagrass (*Glyceria grandis*).

In 1992, grazing animals were removed from the park and ditch maintenance was discontinued. Beaver activity in this area also reportedly increased at about this time. These actions have caused the plant communities in the park to change dramatically. As the areas of emergent and shrub species mentioned above have

become established throughout the park, they have begun to replace and fragment large areas of pasture grasses. As the ditches have become less effective in providing drainage, wetland hydrology also has increased and encouraged these vegetative changes. Many of the species listed above were probably either marginally present or not present at all during the years that the area was actively maintained as a farm.

A wetland and habitat assessment study was performed in 1992 as part of the supporting documentation for the stormwater detention facility EIS (Parametrix, 1992). At that time, vegetation on the site was described as characteristic of disturbed wetlands dominated by non-native plants such as reed canarygrass, Canadian thistle (*Cirsium arvense*), creeping buttercup and various pasture grasses. Many of the other species mentioned above were present, but not to the extent to which they have now become established. A copy of the wetland plant community map from this 1992 study is included in this report to compare with 1997 existing conditions.

A study to monitor vegetative communities on this site has been in progress since 1993 by Cooke and Azous. This study includes detailed vegetative data from established transects. Discussion of the data indicates that from 1993 to 1995, native plant communities improved in both complexity and richness. The study cited that an increase in the availability of water is a possible explanation for the improvements. Also mentioned was a need for the control of weedy species and continuation of the study.

Recently, another study has been performed to assess the impacts of the proposed stormwater detention facility on the North Creek Park wetlands (Cooke Scientific Services, 1997). This report also discusses the changes in plant community composition which have been observed since the early 1990s.

Fish

The salmonid fish species expected to make primary use of both North and Nickel Creeks in the vicinity of the site are coho salmon (*Oncorhynchus kisutch*) and cutthroat trout (*Oncorhynchus clarki*). Occasional steelhead (rainbow) trout (*Oncorhynchus mykiss*) may also be present. Other, non-salmonid fish species, including sculpins (*Cottus* spp.) and lampreys (*Lampetra* and *Entosphenus* spp.), are also likely to be present. Upstream spawning migrations occur primarily in November and December for coho salmon and March and April for cutthroat trout. Juvenile rearing for both species occurs throughout the year. Inundated wetlands tend to be used for general rearing or for refuge from flood flows primarily during the winter wet season. Downstream smolt migrations for coho tend to occur in the spring, primarily during the months of April and May.

Existing salmonid fish habitat in North Creek itself along the west side of the park consists of pool/riffle sequences along the downstream section and flooded areas formed by beaver dams along the upstream section. The pool/riffle sequences are fairly low gradient, so the riffles consist of gravels that are somewhat small-sized and sandy, but still useable for limited spawning. The pools and the upstream

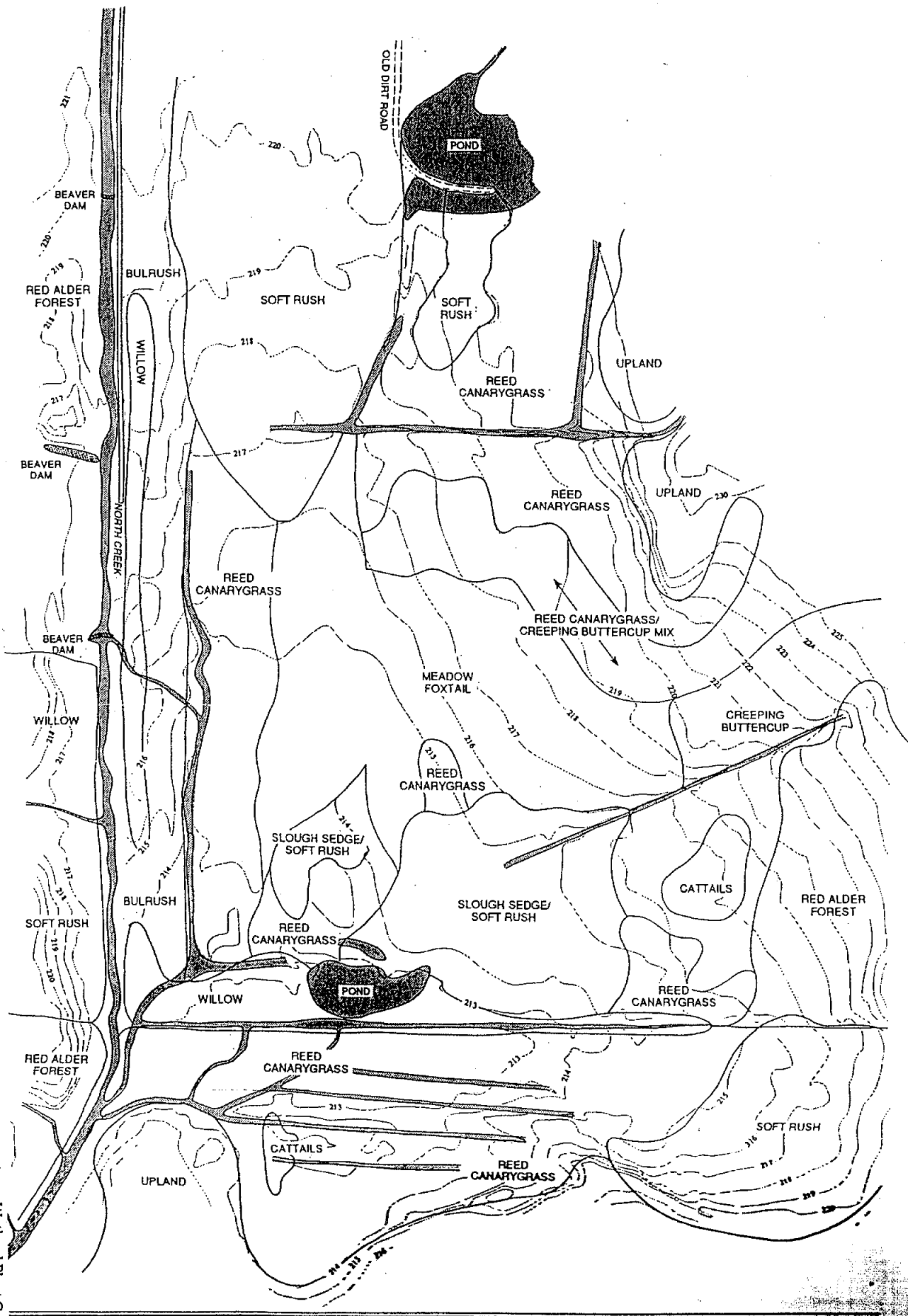
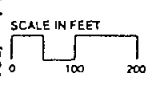


Figure 1. Wetland Plant Communities (199



beaver ponds appear to provide good rearing habitat for juvenile coho salmon and cutthroat trout. Presently, there is little large woody debris in either of the lower sections of North or Nickel Creeks. As such, the rearing habitat for salmonid fish in these areas, and in the associated ditches, is somewhat compromised due to a lack of direct cover for fish and a lack of deeply scoured and varied pools. As supported by the water quality data collected by Horner and Horner, 1995 and 1994, rearing habitat is probably also limited during the summer season by warm temperatures and by low oxygen and pH levels.

The ditches, Nickel Creek, in-stream ponds, and even the wetland floodplain itself may provide refuge areas for juvenile salmonid fish during periods when North Creek is at high or flood-level stages. Although some stranding of fish undoubtedly occurs as flood waters recede, it is not known to what extent this happens. Likewise, it is not known if adult salmonid fish such as coho salmon and cutthroat trout are able to or have difficulty in crossing the extensive wetland areas in the park to reach the upstream sections of Nickel Creek from North Creek. Additional study would be required to determine specifics regarding fish stranding and/or fish passage in and through these extensive wetland areas. Fish stranding which presently occurs in these wetlands is not necessarily a problem, but should be viewed as a part of the functioning of the overall ecosystem as these fish provide food and nutrients for other wildlife which inhabit the area. It is important that care be taken to not make conditions worse as a result of implementing various wetland restoration measures.

Fish and wildlife habitat assessment studies were conducted at North Creek in 1992 for the stormwater detention facility EIS (Parametrix, 1992). According to this work, existing fish habitat at North Creek Park includes both spawning and rearing areas. Species expected to use the site include minnows, sculpins, sticklebacks, cutthroat trout, coho salmon, and possibly steelhead trout.

Wildlife

Existing wildlife habitat at North Creek Park is quite varied across the site. Native plant communities, as described above, include emergent, scrub/shrub, and forested types which provide abundant and varied food and cover opportunities for wildlife. Water is present in both flowing and ponded conditions. The wetlands are extensive and form an integral part of the overall landscape of forests, streams, and wetlands. Special habitat features such as snags and downed wood are present particularly along the forested edges of the valley and associated with the beaver ponds. These special habitat features are generally not present, however, across some of the more centrally located and open expanses.

In addition to the fairly natural and predominately native plant communities, there are broad expanses of reed canarygrass. These areas are monotypic and provide little diversity in terms of wetland and wildlife habitat. Other communities which are evidence of past farming and abandoned pasturelands include fairly large patches of creeping buttercup, soft rush, velvetgrass, birdsfoot trefoil, and horsetail. Many of

these species are invasive and displace native species which are more valuable to wildlife.

The Parametrix study in the stormwater detention facility EIS included an inventory of 43 bird species which were observed on the site including waterfowl, raptors, woodpeckers, and songbirds. Mammals include deer (*Odocoileus hemionus*), black bear (*Ursus americanus*), coyote (*Canis latrans*), beaver (*Castor canadensis*), muskrat (*Ondatra zibethicus*), raccoon (*Procyon lotor*), and a variety of small mammals (*Peromyscus*, *Sorex*, *Sylvilagus*, *Memphitis*, etc.). Reptiles and amphibians expected to occur at this site include garter snake (*Thamnophis* spp.), northwestern salamander (*Ambystoma gracile*), long-toed salamander (*Ambystoma macrodactylum*), tree frog (*Hyla regilla*), red-legged frog (*Rana aurora*) and bullfrog (*Rana catesbeiana*) (Parametrix, 1992).

As explained above, grazing animals were removed from the county-owned lands in 1992. This action, along with cessation of ditch maintenance and increased beaver activity, has allowed the growth of vegetation which has restored fish and wildlife habitat values to some degree. Elimination of cattle grazing also has restored fish habitat by decreasing erosion from trampling of streambanks and improved water quality by lowering nutrient inputs.

Wetland functions and values

The wetlands in their current condition provide fish and wildlife habitat as described above, as well as important hydrologic functions which contribute to the overall quality of the North Creek watershed. These include groundwater discharge, floodwater storage, low flow support, and water quality benefits.

As a large block of open space, North Creek Park is an important community asset. Recreational uses include walking and bird watching. The park provides an excellent public educational opportunity from the standpoint of scientific study, both human and natural history, as well as sociological, cultural, and aesthetic aspects.

The *North Creek Park Wetland Impact Assessment* (Cooke Scientific Services, 1997), prepared for Snohomish County Public Works, includes a wetland functional evaluation. The wetland functions were determined using the Semi-quantitative Assessment Method (Cooke, 1996), and results were presented for existing conditions, as well as for expected conditions after construction of the stormwater detention facility and after complete development of the drainage basin. The results of this assessment are listed here. Expected changes to these values as a result of the North Creek Park Wetland Restoration Plan are indicated in the Goals and Objectives section of this report.

<u>Function</u>	<u>Existing Score</u>	<u>Score After Outlet Constr.</u>	<u>Score After Buildout</u>
Flood/Stormwater Control	10/15	12/15	N/A
Baseflow/Groundwater Support	13/15	same	same
Erosion/Shoreline Protection	6/9	same	5/9
Water Quality Improvement	7/12	8/12	N/A
Natural Biological Support	27/36	same	30/36
Overall Habitat Functions	8/9	same	9/9
Specific Habitat Functions	11/15	same	same
Cultural/Socioeconomic	15/21	same	same

Proposed Regional Stormwater Detention Facility

As stated above, a regional stormwater detention facility is proposed to be built in North Creek at the southwest corner of North Creek Park. An EIS was prepared for this project in 1993 (Snohomish County Public Works/Parks, 1993), and more recently an impact assessment was prepared to detail expected impacts to the North Creek Park wetlands after conversion to a regional stormwater detention facility (Cooke Scientific Services, 1997).

The proposed stormwater detention facility will change the hydrologic conditions within the park by temporarily storing floodwaters in the wetlands. The increases in water depth will be greatest near the facility in the southwest corner, and gradually decrease toward the northeast portion of the site. A map from the EIS is included to show the estimated area of inundation (Parametrix, 1992). Hydrologic evaluation is presented in the impact assessment by Cooke Scientific Services (1997). According to calculations presented in this report, the increased elevation of flooding with the control structure is expected to be approximately one foot higher than current conditions for a 10-year storm, and approximately 1.5 feet higher for a 100-year storm.

Proposed boardwalk extension

As stated above, a boardwalk was built in the park in 1996. It is shown on the existing conditions map and plan area maps included in this document. An extension of the boardwalk to the east side of the site is proposed to be built at some time in the future. This proposed new section also is indicated on the enclosed maps.

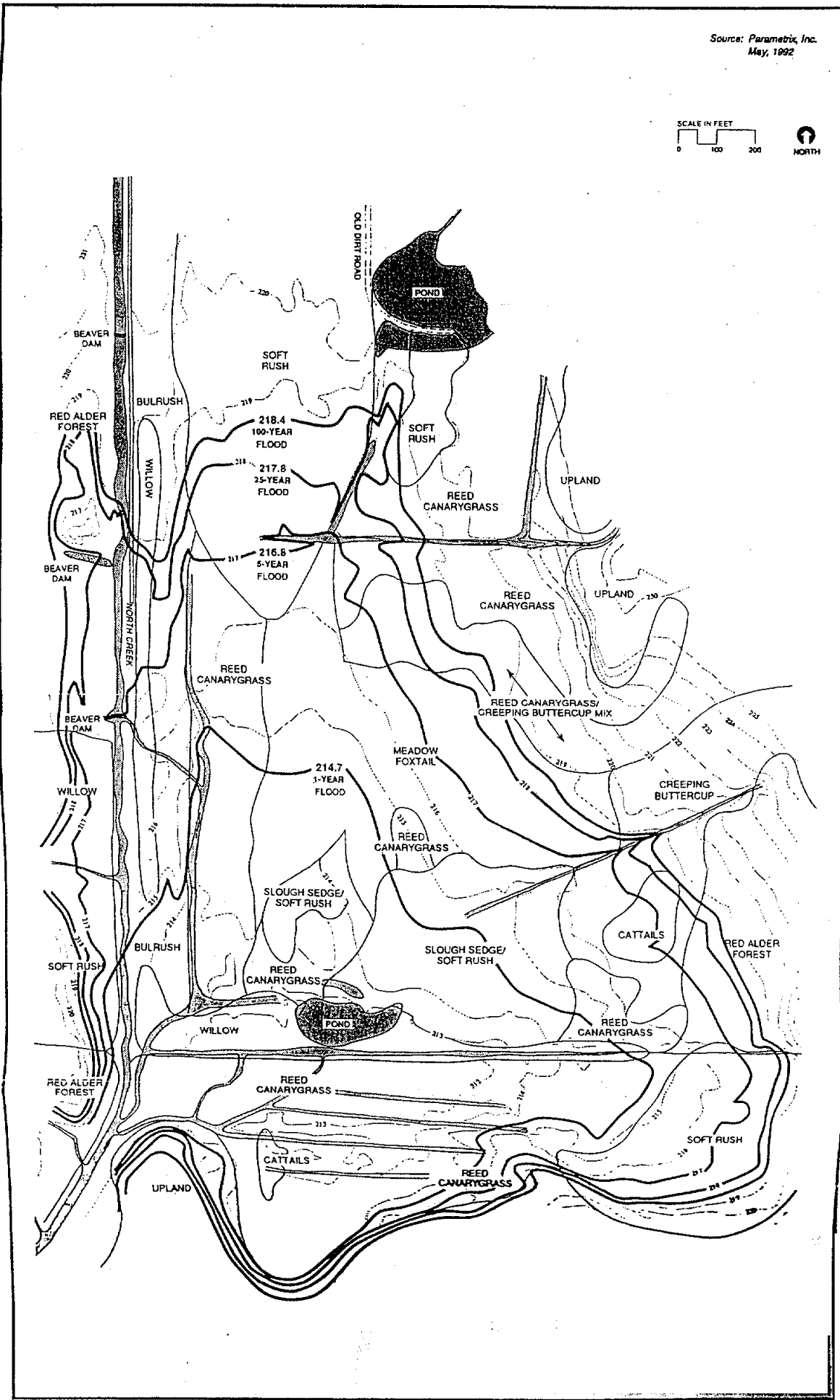
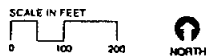


Figure 2. Estimated Area of Inundation

GOALS AND OBJECTIVES

North Creek Park as it is today is an important and valuable wetland complex, as described above. Particularly significant is the large size of the wetland, the arrangement and diversity of habitat types, and the presence of both flowing and ponded water. However, this is also a disturbed system that has undergone significant changes over time that have affected the value of the area in a number of different ways.

The goal of this wetland restoration plan at North Creek Park is to optimize the functions and values of the wetland system, while recognizing that certain existing features are significant and need to be preserved. Restoration activities are planned around existing native plant communities, ponds, streams, and other features which are to be left undisturbed. The intent is to build on these features, add species richness and structural diversity, while at the same time preserving the open, sweeping nature of the park.

The proposed goals and objectives of this plan can be broken down into five central themes, as described below.

1. Restoration of a natural floodplain.

Increasing the degree of hydrologic connection between the wetlands and North Creek by breaching the existing berm along the creek will help to restore a more natural floodplain condition. The ditches, streams, and wetlands will become less separate and begin to function together more as parts of an integral system to provide many different niches for different types of fish and wildlife. The flood capacity of North Creek will be increased and backwater refuge areas for salmonid fish will be created. Increasing the area and time of inundation and saturation in certain areas will help to diversify the overall hydrologic conditions in the park.

2. Creation of a complex of wetland features.

As shown on the accompanying existing conditions map, there are fairly extensive plant communities on site comprised of native emergent, scrub/shrub, and forest species. These areas are to be left as is to continue to grow and develop into more complex communities. As described above, there has been significant development of plant communities since grazing and ditch maintenance were discontinued. The existing communities are expected to continue to evolve in response to these past actions, as well as to the expected increases in hydrology from the proposed stormwater detention facility. Specific restoration efforts will be concentrated in the broad, homogenous, mostly reed canarygrass areas, and are planned to blend into the existing and anticipated features of the ecosystem. Eventually, the park will become a complex mosaic of emergent, scrub/shrub, and forested areas in various successional stages.

3. Enhancement of salmonid fish habitat.

Breaching the existing berms and reducing them to a series of hummocks will reduce the degree of separation between stream and floodplain wetland habitat. With this reduced separation, juvenile salmonid fish will be better able to move into and utilize the wetland floodplain areas as winter rearing or flood refuge habitat while still being able to retreat to the primary stream channels as waters recede again seasonally and/or between flood events. The addition of large woody debris to the various channels will provide cover, accentuate pools, and increase diversity generally. Streamside tree and shrub plantings will indirectly increase the food supply for rearing salmonid fish, provide shade and thereby reduce temperature, and provide a source of large woody debris recruitment in the future.

4. Enhancement of wildlife habitat.

The present and proposed arrangement of plant communities will provide increased habitat diversity in terms of species richness and structural character. Food and cover opportunities for wildlife will be increased with a greater diversity of native plant communities. Valuable edge habitats also will be increased and created between different areas throughout the park. The addition of special habitat features such as downed wood, snags, and cavities will provide perches, cover, and foraging habitat which will attract wildlife that depend on these features as habitat requirements. Eventually, the park will be home to a greater variety and greater numbers of wildlife types.

5. Enhance aesthetic and educational aspects of the park.

Restoration efforts within the park also will increase the aesthetic value of the area. Revegetation is planned to screen out views of adjacent buildings and roads so that park users can become immersed in the natural areas, while at the same time maintaining views and a sense of the expanse of the park. Habitat structures will be placed to simulate a natural condition and will be concentrated along the outer margins of the park and in areas of intensive enhancement activities. Greater diversity of plant and habitat structure will be interesting as well as educational. Various restoration projects can be used as demonstrations of both traditional and more experimental ideas. North Creek Park provides a unique opportunity to display how the forces of nature respond to past, present, and future human interventions.

As presented above, a wetland functional assessment was prepared by Cooke Scientific Services (1997) for Snohomish County Public Works. A number of these wetland functions are expected to increase as a result of the implementation of this wetland restoration plan. The scores indicated by Cooke result from totaling points assigned to wetland characteristics which relate to the quality of each wetland function. The following chart indicates the expected changes in terms of additional points so that the wetland functional performance scores can be calculated with or without the detention facility, and before or after complete development (buildout) of the watershed.

Function	Existing Score	Score After Outlet Constr.	Score After Buildout	Score After Wetland Rest.
Flood/Stormwater Control	10/15	12/15	N/A	+1
Baseflow/Groundwater Support	13/15	same	same	same
Erosion/Shoreline Protection	6/9	same	5/9	+2
Water Quality Improvement	7/12	8/12	N/A	same
Natural Biological Support	27/36	same	30/36	+5
Overall Habitat Functions	8/9	same	9/9	+1
Specific Habitat Functions	11/15	same	same	+2
Cultural/Socioeconomic	15/21	same	same	+1

PROPOSED ACTIONS

The following proposals aim to begin to restore the natural condition of the North Creek floodplain, tributary, and wetland complex at North Creek Park. Although there is considerable overlap between these ideas, they can be tied specifically to the goals and objectives listed above. See conceptual plans included in this document for details of each proposal.

1. Restoration of a natural floodplain.

Berm breaches - North Creek has already breached the berm in a couple of areas with overflow channels. Additional berm breaches would be created to allow for flood flows and backwater areas for salmonid fish. Reducing the berm to a series of hummocks would functionally eliminate it. Since the berm is an entirely artificial feature, its functional elimination is consistent with the goal and concept of restoration. Berm breaches would be designed to prevent the stranding of fish when water recedes. The berm breaches would function as planned regardless of whether they are constructed before or after the proposed stormwater detention facility. In either case, the berm breaches would allow water to circulate more freely throughout the floodplain as water is stored during storm events.

2. Creation of a complex of wetland features.

Blocking ditches - Partial plugs would be placed about every 100 to 200 feet in some or most of the ditches. These would be gravelly soil plugs or simulated beaver dam debris jams. The Nickel Creek alignment would first be identified or designated as it crosses the site. Care would be taken to restrict the flow along its designated alignment less than along other ditched flow pathways, thereby accentuating its function as the primary creek channel.

The ditches, like the berms, are entirely artificial features. Since they are intended to provide *drainage*, they are generally inconsistent with wetland enhancement and restoration efforts. These ditch blockages would be designed in such a way as to create additional amphibian and waterfowl habitat while not additionally restricting fish movements. They would increase the area and time of inundation near the plugs, and greatly increase the area of soil saturation beyond.

Increased topographic diversity

- a. Excavation - This would be limited, shallow excavation in reed canarygrass areas. Connections/outlets would be maintained and created to prevent stranding of fish, and to establish uninterrupted flow of Nickel Creek into North Creek. A variety of emergent, shrub, and tree species would be planted to increase habitat diversity. Spoils could be used to create hummocks for topographic variation and variety in vegetation communities. These would be convenient and natural places to install wildlife habitat structures described below.
- b. Detonation could be used to blast pothole ponds into the peat and create more edges and habitat diversity. If isolated potholes are considered problematic due to concerns with possible fish stranding, the locations where they would be formed could be limited to those along existing or future channel alignments.

Wetland enhancement plantings - Plantings would be concentrated in areas currently dominated by reed canarygrass. These would include primarily fast growing and spreading native species which provide shade, cover, and food value, such as cottonwood, willow, and dogwood (*Cornus stolonifera*). Other species would be included to diversify food and cover types for wildlife, such as Sitka spruce (*Picea sitchensis*), red alder, spirea, small-fruited bulrush, sedges, etc.

In general, trees would be planted approximately 10 feet apart, and shrubs 5 feet apart. Dense cuttings planted 2 to 3 feet apart in patches would be used in some areas particularly to compete with reed canarygrass. A variety of plant conditions such as ball and burlap, container, bare root, cuttings, and emergent plugs would be used for revegetation. Generally, trees and shrubs would be installed during the dormant season between October 15 and April 1. Emergent plants would be planted early in the growing season between March 15 and May 15.

Planting arrangements shown on the attached plan area maps are conceptual, and specific locations of plants may be altered as detailed construction plans are developed. Specific densities for plantings will be tailored to each section of the site depending on intended outcome and consideration of factors such as existing plant communities and increased hydrology from the stormwater detention facility. Individual plants and patches of plants would be installed in a random arrangement to mimic natural conditions. See description of plan areas below.

Depending on how and when elements of this plan eventually are implemented, a variety of age structures of plant communities will result. The maturation of existing communities will further contribute to the overall variety of successional

stages. Also, as installed plant communities grow and mature, additional species could be introduced to encourage and simulate natural succession of the ecosystem. For example, the species proposed to be installed initially are fast-growing, spreading, and invasive to compete with reed canarygrass and create shade. Slower growing species which require shade to succeed could be added to some of these communities in later years. Western red cedar and western hemlock, in particular, would be natural additions to provide a coniferous component and additional diversity to the habitat.

The presence of peat provides an opportunity to install some bog or fen type plantings, such as labrador tea (*Ledum groenlandicum*) and bog laurel (*Kalmia microphylla*). A small demonstration project area is proposed to monitor the success of this, since these plants are typically more difficult to establish. The area immediately south of the northeastern "peat mine" pond (adjacent to Nickel Creek) is a proposed location, and would blend into revegetation work already being done by Snohomish County Parks. See Plan Area B map.

View corridors within the park will be preserved as shown on the plans by maintaining the open nature of the park near the boardwalk and locating more dense plantings along the margins of the park. Forested and shrub communities are planned to eventually screen out surrounding buildings, roads, etc. so as to enhance the "wildland experience".

Wetland buffers along the southern and northeastern wetland boundaries will be enhanced with additional plantings such as red elderberry (*Sambucus racemosa*), black hawthorn (*Crataegus douglasii*), and Pacific crabapple (*Pyrus fusca*). Remaining upland hummocks along berm breaches will also be enhanced with big-leaf maple (*Acer macrophyllum*), western red cedar, western hemlock, red elderberry, and osoberry (*Oemleria cerasiformis*).

Proposed plantings shown on the attached conceptual plans reflect consideration of existing conditions as well as the hydrologic changes expected from wetland restoration efforts and the proposed regional stormwater detention facility. This is described in more detail in the following descriptions of the plan areas.

3. Enhancement of salmonid fish habitat.

North Creek enhancement

- a. Berm breaches would functionally eliminate the berm by reducing it to a series of hummocks or knolls such that the average flow of water out of North Creek and onto the floodplain is not detectably impeded.
- b. The most notable habitat deficiency in the North Creek channel downstream of the beaver ponds is the lack of large, coniferous woody debris. Especially in those areas where heavy equipment access is necessary for the purpose of creating or enlarging berm breaches, a number of large conifer logs and stumps would be

placed in the active stream channel.

c. Vegetation will be planted along North Creek to compete with the reed canarygrass and eventually result in the riparian areas being returned to a forested condition. This will provide shade and long term large woody debris recruitment to the creek.

Nickel Creek enhancement

a. Ditch blocks would be installed to create limited backwatering as described above.

b. Preferential blocking of ditches *other* than the one designated or identified as the Nickel Creek alignment would be done to passively encourage a less dispersed flow pathway (though not a more drained condition) and improve fish passage conditions.

c. Low berms could be used rather than excavation to define Nickel Creek. This would tend to raise the water table rather than lower it as excavation might.

d. Large woody debris structures could be placed in Nickel Creek, particularly in the lowermost section at and downstream of the point where the various ditches and the flows they carry come together. This stream section has a steeper gradient and a gravel substrate and is generally more "stream-like." It is also readily accessible to heavy equipment from an existing access road on high ground.

Riparian enhancement plantings would be installed along streams and ditches. As these areas are mostly wetland, plantings would include the same species listed above such as black cottonwood, willows, red-osier dogwood, and spirea. Higher riparian areas along North Creek and the berm would incorporate other species such as big-leaf maple, western red cedar, elderberry, and osoberry. These streamside communities would provide overhanging vegetation for shade and increased insect populations for fish habitat, increased species and structural diversity for wildlife habitat and also provide competition for would-be invasive colonist plants.

4. Enhancement of wildlife habitat.

Wildlife habitat structures such as snags, fallen trees, woody debris, and nest boxes or platforms would be strategically placed in specific areas in the park. These would be located to maximize aesthetic value and to appear as natural features. Installed habitat structures would be concentrated adjacent to areas of intensive enhancement activities (i.e excavated depressions) and along the outer margins where the park blends into forested areas. Some wildlife habitat structures can provide a focal point of interest, but it also is important to locate these features in secluded areas to encourage use by wildlife species which may be more sensitive to human presence.

Log structures such as snags and fallen trees will generally be western red cedar in a variety of sizes and conditions. They will have a substantial portion of their limbs and roots intact, and the tops will not be trimmed. Damaged or broken tops are preferred to appear natural. Logs also may be partially hollow and contain cavities as long as they are generally sound. Habitat structures to be located in the southern and western portions of the park may require anchoring to hold them in place during times of flood. Anchoring probably will not be necessary in the northern and eastern areas of the park which will experience smaller fluctuations in water levels, both with or without the stormwater detention facility. Detailed installation design will be tailored to each section of the site as enhancement plans are proposed to be implemented.

5. Enhance aesthetic and educational aspects of the park.

All of the above-mentioned actions work towards enhancing the aesthetic and educational features of the park. Preservation of long, sweeping views from the boardwalk has been considered a key to the arrangement of wetland enhancement features. Screening of buildings and roads without hampering the sense of open space is a priority which falls closely behind biological concerns. Care has been taken to preserve the variations in texture and color by using existing vegetation as a background for enhancement efforts.

Restoration features which are visible from public areas are educational to individual park visitors and also provide opportunities for field-trip material, volunteer training, and educational signage. Following is a list of possible themes which could be used for environmental education at North Creek Park.

- Viewing of a specific wetland restoration project. A possible location would be in the southeast part of the park where excavation of small open water areas is proposed. This would be visible from the viewing shelter, the existing boardwalk, and the proposed boardwalk extension. Interpretive signage could highlight the transformation of a homogenous reed canarygrass community to an area with topographic and hydrologic diversity, which in turn results in plant and habitat diversity.
- A similar project including excavation of small depressions is proposed in the northwest portion of the park. This could be visible from both the north end and northernmost western extension of the boardwalk. Interpretive signage could be used to explain what has occurred and point out specific features.
- Description of the demonstration area to be planted with species characteristic of a fen. This is proposed in the northeast section south of a pond which apparently was created from past peat mining. As this area matures, it should be quite obvious from the boardwalk as something different. Signage could be used to explain about the characteristics of bogs and fens.
- Description of an installed snag which is visible from the boardwalk. A possible location would be along the northern section of Nickel Creek near the

north end of the boardwalk. Here a park visitor could learn about the importance of snags, and at times view its use as a perch for a bird of prey or foraging area for a woodpecker.

- Revegetation of the Nickel Creek riparian corridor could be used as another point of interest along the way. The importance of riparian vegetation for both fish and wildlife habitat could be explained.
- Broad expanses of sedges, particularly *Carex comosa*, could be pointed out from the boardwalk. This would be a good example of natural ecosystem transition as a result of a change in land use. The changes caused by the presence or absence of farming, grazing, ditch maintenance, and beaver control could be explained.
- The history of North Creek on this site could be detailed. This could include historic alignment, berm building, and both natural and constructed berm breaches.
- Ditch blocks as wetland restoration features could be explained, although probably not easily viewed. Signage could focus on the results of past and present human manipulation of the ecosystem.
- The proposed regional stormwater detention facility would be of interest to many people. Signs could point out its location and explain its function.

Plan Areas

For the purposes of restoration planning, North Creek Park has been divided into eight Plan Areas, A through H. Conceptual plans for each of these sections have been prepared to illustrate the proposed locations for the above described actions. These plans reflect careful consideration of existing conditions as well as the continuing response of the ecosystem to land use changes and the proposed regional stormwater detention facility.

For example, the southwest portion of the park is the lowest and wettest area now. This is evidenced by the current plant communities and the observed changes in the area in the last five years since farming operations have ceased. According to Cooke Scientific Services (1997), these communities in the low lying southern reaches of the park will be most dramatically impacted by the proposed stormwater facility. Reed canarygrass predominates in this area now, but it is gradually being outcompeted and replaced by sedges, native grasses, and herbs.

The wetland enhancement plan for these areas (Plan Areas E and G) proposes to block selected ditches and breach the berm along North Creek as described above to further increase the depth and duration of water. Enhancement plantings are arranged to establish dense patches of shrubs particularly along ditches, with scattered trees and installed snags along the west margins to blend into the North Creek riparian corridor. The berm sections that will remain between breaches will be supplemented with upland vegetation, as will portions of the wetland buffer along the south wetland boundary. The existing cattail and open water areas are expected to expand both with time and as a result of the stormwater facility. It is

expected that the natural changes occurring now and expected in the future will be the main force in replacing reed canarygrass with native emergent communities.

The southeast portions of the park (Plan Areas F and H) are generally higher than the southwest, and are expected to be impacted less by the proposed stormwater detention facility. There are presently large expanses of sedges with scattered shrub clumps in Plan Area F. The enhancement plan will preserve these existing features and create additional diversity and habitat structure towards the east margin of the park. The existing sedge community in Plan Area F is expected to continue to expand as it has done during the last few years. Plan Area H is mostly a reed canarygrass field at the present. Here the enhancement plan proposes to diversify the topography with excavation of small depressions. These areas will provide a foothold for native emergent plantings and a natural setting for wildlife habitat structures. Tree and shrub plantings are planned in clumps to preserve views and blend into the adjacent areas.

Enhancement ideas in the northwest sections of the park (Plan Areas A and C) are planned to compete with the dominance of reed canarygrass. Existing open water and cattail areas in Plan Area C are expected to expand with time and the increased water levels expected from the stormwater detention structure. Enhancement plantings will complement these changes by providing additional habitat diversity in the form of tree and shrub clumps, riparian revegetation and log structures in Nickel Creek, and a few additional scattered snags to blend into the North Creek corridor. Reed canarygrass is expected to be more persistent in Plan Area A, which is higher in elevation and will be less impacted by the stormwater facility. Here, enhancement plans include excavation to break up the grass community and create hydrologic and plant diversity. These small depressions will allow for establishment of native emergent species and create a natural setting for wildlife habitat structures.

The northeast portions of the park (Plan Areas B and D) will be less impacted by expected water level changes. Sedge and cattail communities have become well-established in Plan Area D during the past few years, and are expected to persist and expand. Enhancement plans propose to connect two large sedge patches with additional plantings, and to add structural diversity with shrub clumps and a few installed snags in the surrounding reed canarygrass areas. Similarly, the intent in Plan Area B is to establish bulrush and sedge patches in areas that are presently dominated by buttercup and other herbs, while competing with reed canarygrass through installation of dense tree and shrub clumps. These are planned to preserve views from the boardwalk and blend into adjacent forest areas. The fen revegetation project described above also is proposed for Plan Area B.

Following is a summary of the ideas which are proposed to be implemented in each plan area. Specific locations of enhancement features shown on the plan area maps may change somewhat when detailed construction plans are developed.

Plan Area A

North Creek enhancement
Nickel Creek enhancement
Wetland enhancement plantings
Increased topographic diversity
Wildlife habitat structures

Plan Area B

Wetland enhancement plantings
Wildlife habitat structures

Plan Area C

North Creek enhancement
Nickel Creek enhancement
Riparian enhancement plantings
Wetland enhancement plantings
Wildlife habitat structures

Plan Area D

Wetland enhancement plantings
Wildlife habitat structures

Plan Area E

Berm breaches
North Creek enhancement
Blocking ditches
Riparian enhancement plantings
Wetland enhancement plantings
Wildlife habitat structures

Plan Area F

Wetland enhancement plantings
Wildlife habitat structures

Plan Area G

North Creek enhancement
Nickel Creek enhancement
Blocking ditches
Riparian enhancement plantings
Wetland enhancement plantings
Wildlife habitat structures

Plan Area H

Wetland enhancement plantings
Increased topographic diversity
Wildlife habitat structures

MONITORING AND MAINTENANCE

This section of the plan details methodology for monitoring the implemented restoration efforts over time. Additionally, maintenance recommendations are made to address and correct specific and general problems that may arise.

Monitoring

The monitoring phase should be carried out on a continual basis by the same entity each year. Vegetation monitoring protocols will involve keeping track of installed plantings, native volunteer species, and non-native and invasive plant species. For consistency and accuracy, monitoring methods should follow those conducted in previous and on-going studies. For precise methodology refer to the *North Creek Regional Stormwater Detention Facility at 180th Street SE Botanical Monitoring Report* (Cooke and Azous, 1995).

An additional, more generalized monitoring of the overall plant communities will also be a useful tool in viewing changes in the site conditions over time. This generalized monitoring should follow the methodology that was used in the development of the wetland enhancement plans. This involves mapping with current aerial photos followed by groundtruthing. First, the outlines of the major vegetation polygons are determined and traced onto paper using a recent aerial photo. The photo and the tracing are then taken to the site to refine and establish identification of plant communities. This new plant community map can be then be compared to the enclosed existing conditions map, and subsequent versions.

Aerial photos may also be used in conjunction with groundtruthing to assess changes in the amount of flow in Nickel Creek as a result of ditch blocking activities proposed by this plan. Changes in inundation patterns also will be useful in generalized monitoring of wetland hydrology.

The berm breaches and habitat structures along North Creek will involve changes noted from baseline surveys. These will include size and depth of newly inundated areas, substrate size and location information, pool riffle sequences, etc.

Monitoring also should involve anecdotal observations such as changes in substrate composition, depth, scour, etc. in both Nickel Creek and North Creek. Wildlife sightings, calls, signs or other detections should similarly be noted.

As indicated above, as installed plant communities grow and mature, other plant species could be introduced to encourage and simulate natural succession of the ecosystem. For example, the species proposed to be installed initially are fast-growing, spreading, and invasive to compete with reed canarygrass and create shade. Slower growing species which require shade to succeed could be added to some of these communities in later years. Western red cedar and western hemlock, in particular, would be natural additions to provide a coniferous component and additional diversity to the habitat.

Maintenance Recommendations

The success of the North Creek Park Restoration Master Plan depends not only on the successful design and implementation of the project, but also on the long term maintenance efforts of various public, private, and volunteer entities. The maintenance recommendations are designed to be followed by any number of different individuals and institutions, operating solely or together, and spanning a wide range of skill levels.

Reed canarygrass and its roots should be removed from the bases of all installed plantings yearly in the spring for at least three years following installation. This removal around individual plants should be done using hand-tools. Open areas may be cut with a string trimmer or brush mower. However a string trimmer should not be used near plants as this may kill young plants and/or injure larger ones. Similarly, if invasion of other undesirable species becomes a problem, weeds should be removed by handpulling and cutting. This will allow preferred species to become established and out-compete weed species. Removal of weeds will be followed by supplemental plantings if needed.

Mortality of cuttings from black cottonwood, red osier dogwood, and willow species is expected to be higher than for bare root or containerized stock. Supplemental and additional cuttings could be installed as routine maintenance in any of the areas of the plan that use this revegetation method. Other replanting recommendations may also be made.

CONCLUSION

The eight plan areas used in this document are separated for presentation purposes only, and are not intended to be used as a phasing of the park's wetland restoration efforts. Specific enhancement plans could proceed in any number of ways, depending on resources and opportunities. These enhancement plans can also proceed regardless of the timing of the proposed stormwater detention facility.

Breaching of the berm along North Creek, blocking selected ditches in the southwest section of the park, and revegetation along Nickel Creek are priorities in terms of creating significant and far-reaching changes in the ecosystem. The conceptual plan area maps can be used with the existing conditions map to plan for future implementation as opportunities become available. Many of these enhancement ideas also could be extrapolated to other areas in the event of future acquisition of additional land.

North Creek Park preserves a large and significant block of open space. As time goes on and surrounding areas change and develop, this large natural area will become more and more valuable in terms of habitat, educational opportunities, recreation, and as an overall community treasure. The North Creek Park Wetland Restoration Plan aims to increase ecosystem functions to make the most of this valuable resource.

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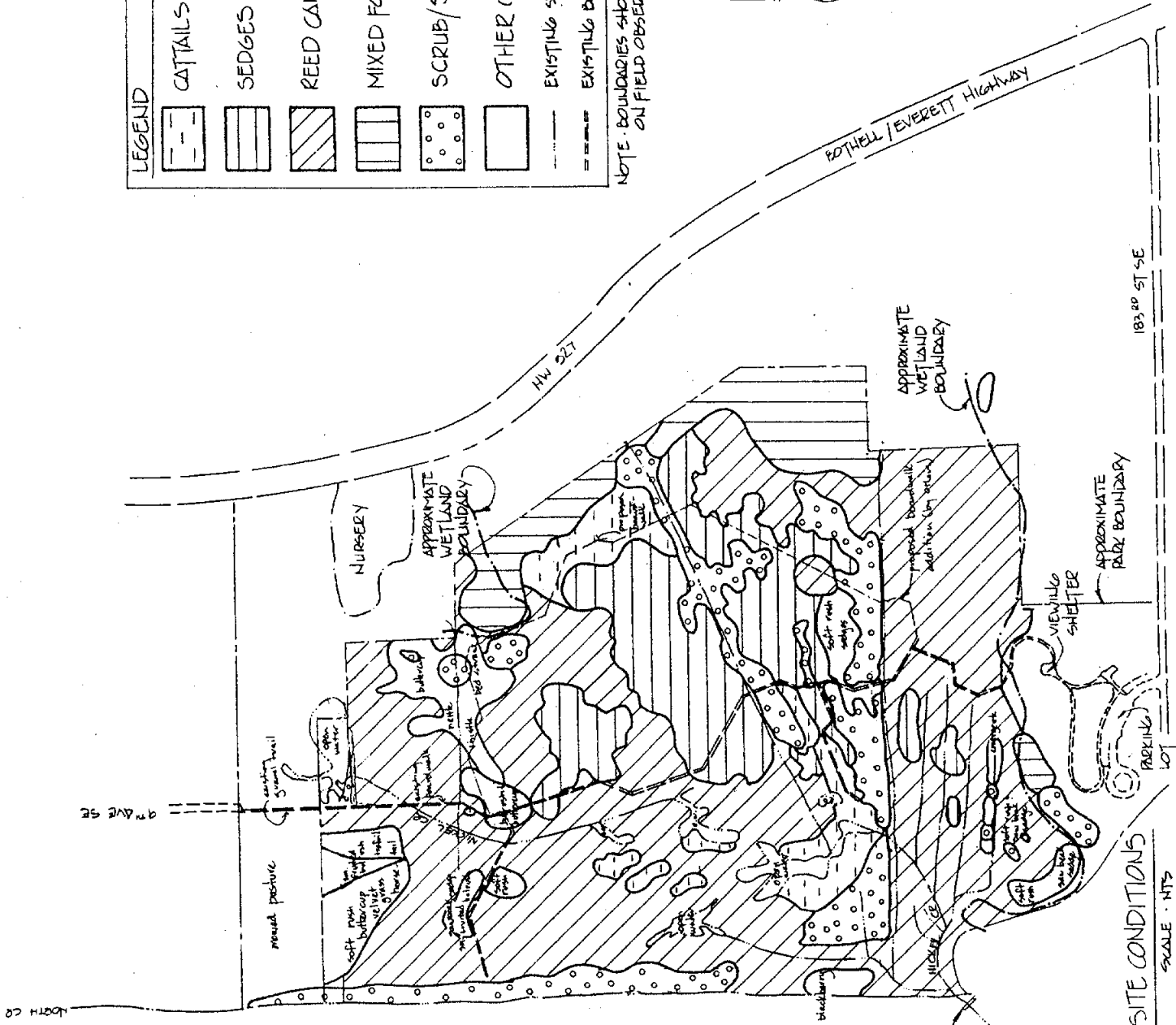
NORTH CREEK PARK

The Watershed Company
1410 Market St., P. O. Box 1180, Everett, WA 98203

Fig. 3-1

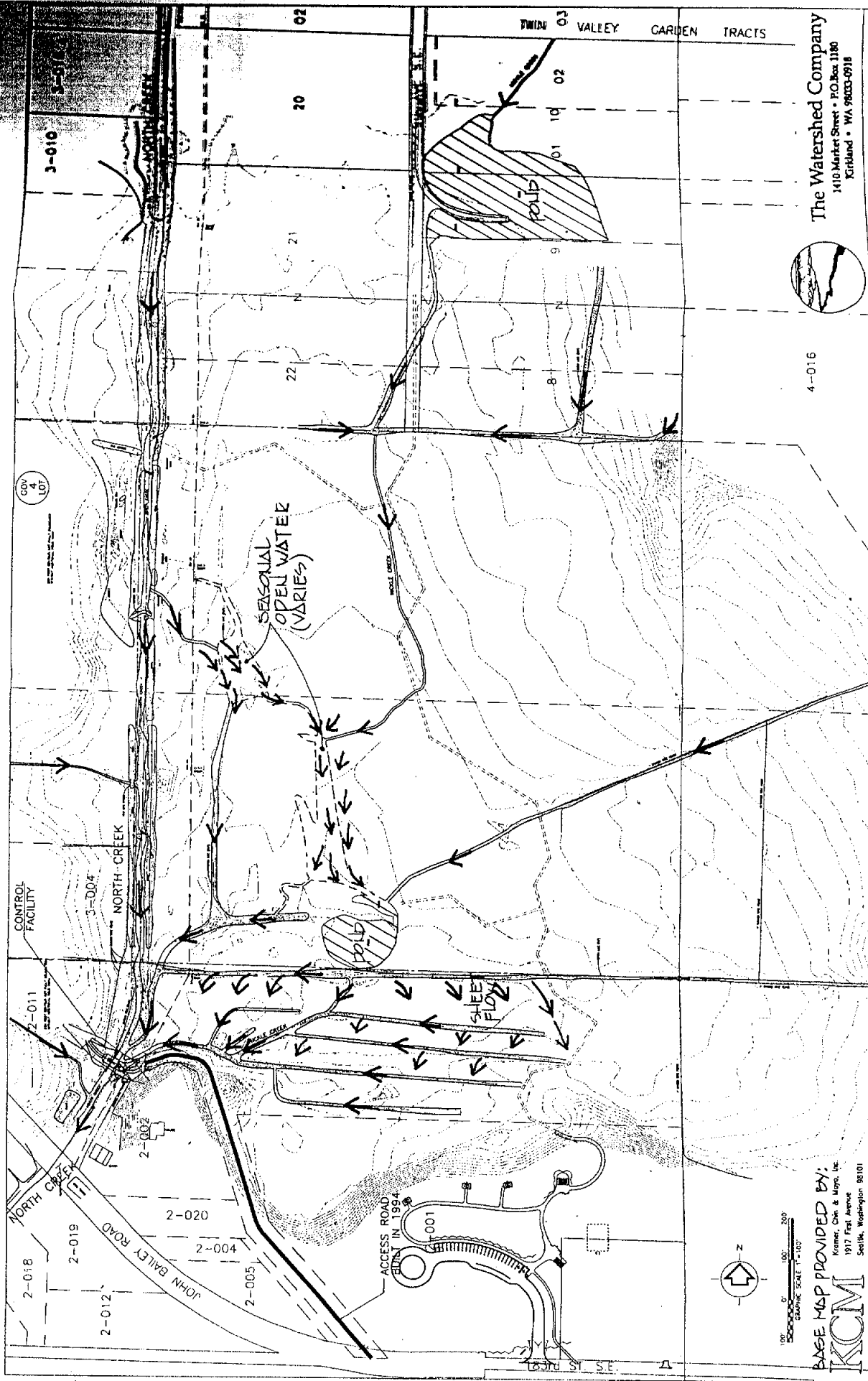
LEGEND	
	CATTAILS
	SEDGES
	REED CANARY GRASS
	MIXED FOREST
	SCRUB/SHRUB (WILLOW, SPIREA)
	OTHER (SEE PLAN FOR SPECIFICS)
	EXISTING STREAMS; PONDS
	EXISTING BOARDWALK
	FUTURE BOARDWALK

NOTE: BOUNDARIES SHOWN ARE NOT SURVEYED, BUT ARE BASED ON FIELD OBSERVATION AND AERIAL PHOTO INTERPRETATION

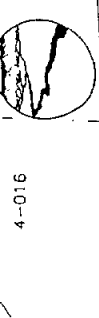


EXISTING SITE CONDITIONS
SCALE: 1" = 20'





The Watershed Company
 1410 Market Street • P.O. Box 1180
 Kirkland • WA 98033-0918



4-016

PLAN CHECK BY DATE	ROOM STATE NO.	FED. AID PROJ. NO.	SHEET NO.
	10		

SNOWHOMISH COUNTY DEPARTMENT OF

BASE MAP PROVIDED BY:
KCM
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