APPENDIX S

DRAFT MITIGATION PLAN FOR
WATERBODY CROSSINGS

Northwest Pipeline Corporation

Mitigation Plan for Waterbody Crossings

Capacity Replacement Project

(Draft)

April 2005

Mitigation Plan for Waterbody Crossings

1.0 INTRODUCTION

Construction of the Capacity Replacement Project will cross 154 waterbodies (55 perennial and 99 intermittent) of which 56 are known or presumed to be inhabited by fish. Project construction will impact 15.73 acres of riparian forest and 30.13 acres of riparian shrub habitat. Most of the riparian impact will occur within Northwest's existing permanent easement and those areas will be restored to riparian shrub habitat upon completion of the project. In addition, many crossing locations do not support desirable riparian vegetation or in-stream characteristics within the existing right-of-way. These areas provide an opportunity to enhance riparian and in-stream habitats. A list of the fish-bearing waterbodies (WDNR Types 1, 2 and 3) traversed by the project is provided in Attachment 1.

In the past four years, Northwest, in consultation with Federal, state and local agencies began improving stream conditions at several pipeline crossings by adding gravel to the streambed, installing large woody debris (LWD), replacing old culverts with new ones that meet fish-passage standards, and planting riparian zones and the existing right-of-way with desirable vegetation. During October 2004 and March 2005, staff from the U.S. Army Corps of Engineers and Washington Department of Ecology conducted field visits to representative restored crossings. In November 2004, representatives from the U.S. Environmental Protection Agency, U.S. Army Corps of Engineers, Washington Department of Ecology and Washington Department of Fish and Wildlife met in Olympia to review options for riparian (and wetland) mitigation. Agency representatives agreed that stream crossing mitigation for the Capacity Replacement Project should be conducted on-site (within the right-of-way and temporary workspace). Therefore, Northwest has prepared this plan to incorporate the enhancement measures agreed upon at the November meeting.

2.0 WETLAND AND WATERBODY MITIGATION

Northwest will reduce or eliminate potential impacts to most aquatic resources first through impact avoidance, then minimization and then habitat restoration and enhancement. Northwest will comply with a number of regulatory requirements/programs designed specifically to protect aquatic resources. For example, Northwest will adhere to conditions in Commission's *Wetland and Waterbody Construction and Mitigation Procedures* (Commission's Wetland and Waterbody Procedures) and *Upland Erosion Control, Revegetation and Maintenance Plan* (Commission's Upland Plan) that are specifically designed to avoid or minimize impact to Waterbodies and riparian areas. In addition, conditions of approval, incorporated into the following permits/approvals, will eliminate or reduce most other project-related impacts to fisheries and fish habitat:

1. WDFW Hydraulic Project Approval (HPA) Permit;
2. WDOE 401 Water Quality Certification;
3. U.S. Army Corps of Engineers 404/Section 10 Permit;

4. Conservation measures required by National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (FWS) through consultation pursuant to the ESA and EFH; and
5. County Shoreline Substantial Development and Critical Area permits.

2.1 AVOIDANCE AND MINIMIZATION

The project has been designed to avoid impacts to the extent practicable. For example, as an alternative to replacing the entire 268 miles of 26-inch diameter pipeline (as directed by a U.S. Department of Transportation Corrective Action Order) Northwest determined that installation of approximately 79.50 miles of 36-inch-diameter pipeline and 10,760 horsepower (hp) of compression at existing compressor stations will replace the required delivery capacity of the 268 miles of 26-inch pipeline. This design avoids impacts to waterbodies within the remaining 188.5 miles of pipeline corridor affected by the Corrective Action Order. In addition, Northwest proposes to co-locate the loops within Northwest's existing 26-inch mainline and 30-inch loop pipeline corridor. Generally, the centerline of the proposed 36-inch loop pipeline will be installed 20 feet to the east of the existing 30-inch loop and within 15-feet of the eastern edge of Northwest's existing permanent easement. The easement is maintained (periodically mowed to maintain a general herbaceous state) for operational purposes, facilitating corrosion and leak surveys as well as aerial surveillance to prevent building encroachments and third party damages.

Northwest will install the pipeline at the stream crossings in the same locations as the existing pipelines, avoiding the creation of a new crossing location and operational right-of-way except at a few crossings. In addition, Northwest's proposal to work over the existing "hot" or "loaded" pipelines during construction of the project will significantly reduce impacts by minimizing the amount of disturbance outside the existing right-of-way and the need for additional operating right-of-way because the new line will be located, for the most part, within Northwest's existing, maintained permanent easement. Where clearing is required, Northwest proposes to mow or shear woody vegetation so that the roots are left intact. This will facilitate sprouting of shrubs such that the recovery time following construction is minimized. The roots will also help stabilize the soils and stream banks so that erosion is minimized.

Northwest has further reduced potential waterbody impacts by incorporating the measures outlined in the Commission's Wetland and Waterbody Procedures and Upland Plan into the project design. The intent of the Commission's Wetland and Waterbody Procedures is to minimize the extent and duration of project-related disturbance in wetlands and waterbodies. The intent of the Commission's Upland Plan is to confine project-related disturbance to certificated areas (including construction right-of-way, temporary extra workspace and access roads), to minimize erosion, and enhance revegetation in areas affected during construction. The Upland Plan and Wetland and Waterbody Procedures have been developed with the participation of other Federal, state and local agencies, industry, and the public nationwide specifically to mitigate potential impacts from pipeline projects.

To minimize the extent of project-related disturbance, Northwest will verify and clearly mark (with flagging) the construction limits and boundaries of all sensitive areas (including waterbodies and wetlands) prior to clearing for construction. Flagged

boundaries will be maintained during construction. Northwest will ensure that all construction activities are confined to the certified work limits authorized for construction.

Temporary extra workspaces have been located a minimum of 50 feet from the edge of wetlands and waterbodies, where possible, to minimize impacts to wetland buffers and riparian zones as required by the Commission's Wetland and Waterbody Procedures. During construction Northwest will have an Environmental Inspector (EI) present during all phases of construction to ensure compliance with the Upland Plan and Wetland and Waterbody Procedures as well as other project permit stipulations/requirements. Section II A. and B. of the Commission's Upland Plan outlines the responsibility of the EIs.

Northwest's proposed erosion control and revegetation techniques have been developed to minimize erosion and the extent and duration of project-related impacts, as well as to maximize revegetation success. Those techniques are described in the Erosion Control and Revegetation Plan (ECRP) provided in Appendix N of the JARPA application. The ECRP incorporates measures outlined in the Commission's Upland Plan and Wetland and Waterbody Procedures.

Silt fences and/or hay bales will be installed at the edges of the construction right-of-way where there is a possibility for excavated trench spoil to flow into undisturbed areas. Dewatering of the trench will be accomplished in a manner such that no heavily silt-laden water flows into any waterbody. Trench breakers will be installed where necessary to maintain hydrologic integrity. After construction, all disturbed areas will be returned to their preconstruction contours, to the extent practicable, to maintain hydrologic characteristics.

To minimize potential for spills and any impact from such spills, a Spill Prevention, Containment, and Countermeasures (SPCC) Plan has been developed and will be implemented (see Appendix O of the JARPA application). Fueling and storage of hazardous materials will be conducted in accordance with Northwest's SPCC Plan and the Commission's Wetland and Waterbody Procedures.

In addition, impacts will be avoided through compliance with WDFW instream construction timing windows for waterbodies not crossed by the HDDs. Northwest proposes to install the pipeline across non-fish bearing waterbodies within the normal sequence of construction. Timing restrictions for crossing specific fish-bearing waterbodies will follow either the Commission's Wetland and Waterbody Procedures or those of respective permitting agencies. Proposed construction techniques and potential instream construction windows may be subject to change by WDFW in their Hydraulic Project Approval Permit with modifications dictated by conditions in the year of construction. The windows are established to avoid periods of fish use and to construct at lowest flow rates.

Northwest has incorporated three Horizontal Directional Drills (HDDs) into the design of the Capacity Replacement Project to place pipelines beneath waterbodies including: 1) North Fork Nooksack River; 2) North Fork Stillaguamish River; and 3) South Fork Stillaguamish River. These HDDs will avoid project-related impacts to important aquatic resources and avoid affecting 13.28 acres of wetlands and 1.27 acres of riparian forest and shrub vegetation. Additional analyses of wetland impacts that will be avoided by HDD construction are included in Tables 1, 2 and 3 in Appendix F of the JARPA

application. Should one or more of the HDDs prove unsuccessful, Table 4 in Appendix F of the JARPA application provides an analysis of the wetland impacts associated with an alternative crossing method for each of the three waterbodies.

Most streams with fishery values that are not crossed by HDDs will be flumed if water is flowing in the streambed at the time of construction (see Appendix H in the JARPA application). A summary of key flume technique elements includes:

- A flume pipe (or pipes) is placed on the bottom of the waterbody and aligned with the flow of the stream. The size of the flume pipe and the number of pipes to be used is determined by the amount of flow in the particular waterbody. The flume pipe is longer than the construction area of the crossing.
- A temporary dam of sandbags and plastic is constructed at the upstream end of the flume, resulting in the entire stream flow passing through the flume and bypassing the construction area. This allows continuous stream flow to downstream reaches.
- A similar temporary dam of sandbags and plastic is constructed at the downstream end of the flume. This prevents the water in the stream from backflowing into the construction area.
- All in-stream excavation is done between the dams. The dams prevent turbid water created by construction from flowing downstream.
- Adequate flow rates will be maintained.
- Temporary spoil placement will be at least 10 feet from the waterbody and will be contained by sediment barriers.
- Clean gravel or cobbles will be placed in the upper one-foot of trench backfill using specifications provided by the WDFW; and
- All banks will be stabilized and temporary sediment barriers will be installed within 24 hours of completing the crossing.

Flumes will be completely installed and functioning prior to any in-stream disturbance. All flumed crossings will be completed as a single effort to minimize the time of in-stream disturbance. The instream activities associated with placing the flume pipe and constructing the sandbag dams are expected to displace most fish either upstream or downstream from the dams. Once stream flow is diverted through the flume pipe, but prior to pipeline trenching, any fish trapped in any water remaining in the work area between the dams will be removed and released downstream. Northwest will contract with either WDFW or a qualified consultant to capture fish. WDFW will be notified of salvage efforts before fieldwork so that they can be onsite to review or assist in fish capture and transport as they determine necessary.

Seines and dip nets will be used to collect fish; electroshocking equipment will be available for use in deep pools where seines or nets fail to capture all the fish. Captured fish will be transported to the lower dam and released downstream from the flume. Since the flume will maintain stream flow, fish may move upstream through the flume. Flumes will be removed as soon as possible following backfilling of the trench.

Northwest proposes to install the pipeline across non-fish bearing waterbodies within the normal sequence of construction. Timing restrictions for crossing specific fish-bearing waterbodies will comply with WDFW's instream construction timing windows. Proposed

construction techniques and potential in-stream construction windows are provided in Table 4 of the JARPA application.

2.2 IMPACT MITIGATION/RECTIFICATION

Waterbody impacts from the Capacity Replacement Project will include the physical removal of riparian vegetation, disturbance to the stream channel, and suspension of sediments (turbidity) all occurring during pipeline installation. Pipeline operation does not result in additional impacts. Avoidance and minimization of these impacts have been extensively incorporated into the design of the Capacity Replacement Project as described above. Therefore, this plan is designed to specifically mitigate for unavoidable impacts to the three main waterbody features (i.e., riparian vegetation, in-stream habitat and turbidity). These unavoidable impacts will be mitigated through a combination of site-specific treatments to restore and enhance riparian and in-stream habitats at the designated crossing location.

2.2.1 Impacts to Riparian Vegetation

The root network of trees and shrubs adjacent to streambanks are essential to maintaining streambank stability (WDNR, 1997). Because root strength decreases significantly at distances beyond one-half the tree crown diameter, trees promoting streambank stability lie within half a tree crown diameter from the streambank. Trees within 25 feet of the streambank are assumed to promote streambank stability (WDNR, 1997). Generally, trees that must be removed during construction will be cut at ground level with the roots left in place, except where located within the trenchline. Although roots will decay overtime, streambank stability will be retained by their presence until revegetation is successful. Shrub areas will be sheared or mowed to facilitate sprouting from existing roots which will shorten the recovery time following construction. The roots will also help hold the soils so that erosion is minimized. A benefit of clearing is that undesirable species such as reed canary grass and blackberry will be removed. The U.S. Army Corps of Engineers has indicated that their recommended seed mix has been shown to minimize the re-establishment of reed canary grass. The removal of blackberry thickets will provide an opportunity for desirable species to become established. This will be enhanced during the maintenance and monitoring schedule.

After completion of construction and during final clean-up, pre-construction topographic conditions and contours of uplands, wetlands and streambeds will be restored to reestablish drainage patterns and wetland hydrology. Any excess backfill will be spread over upland areas and stabilized during cleanup. Where the pipeline trench intersects a waterbody, Northwest will install trench breakers and/or seal the trench bottom as necessary to maintain the original wetland hydrology. A permanent slope breaker and a trench breaker will be installed at the base of slopes near boundaries between the waterbody and adjacent upland area. The trench breaker will be located immediately upslope of the slope breaker.

Once site elevations have been restored, the construction right-of-way and temporary workspace, including the banks, will be revegetated with native woody species and U.S. Army Corps of Engineer's recommended seed mix. A list of proposed woody species and the seed mixes are provided below in Tables 1 and 2. Northwest has retained Natural Recovery, a firm from Vancouver, Washington that specializes in restoration to assess each site and prescribe the appropriate planting regiment in accordance with this plan, at the time of planting.

Table 1. Suggested Native Shrub and Tree Plantings for Riparian Restoration

SHRUBS		Size/Type	Spacing
Wet Ground			
Cornus stolonifera	Red-osier dogwood	36” cuttings	2’
Salix lasiandra (= lucida)	Pacific willow	36” cuttings	2’
Salix sitchensis	Sitka willow	36” cuttings	2’
Moist Ground			
Oemlaria cerasiformis	Indian plum	1 gal	6’
Physocarpus capitatus	Pacific ninebark	1 gal	8’
Sambucus racemosa	Red elderberry	1 gal	8’
Acer circinatum	Vine maple	1 gal	6’
Rubus spectabilis	Salmonberry	1 gal	4’
Rosa pisocarpa	Clustered wild rose	1 gal	6’
Salix scouleriana	Scouler willow	1 gal	8’
Dry Ground			
Symphoricarpos albus	Snowberry	1 gal	4’
Amelanchier alnifolia	Service-berry	1 gal	8’
Holodiscus discolor	Ocean spray	1 gal	8’
Corylus cornuta	Hazelnut	1 gal	8’
TREES		**Size/Type**	**Spacing**
Wet Ground			
Fraxinus latifolia	Oregon ash	1 gal	10’
Picea sitchensis	Sitka spruce	2 gal	15’
Thuja plicata	Western red cedar	2 gal	12’
Populus trichocarpa (balsamifera)	Black cottonwood	1 gal	10’
Populus tremuloides	Quaking aspen	1 gal	10’
Moist Ground			
Rhamnus purshiana	Cascara	1 gal	10’
Thuja plicata	Western red cedar	2 gal	12’
Tsuga heterophylla	Western hemlock	1 gal	12’
Populus trichocarpa (balsamifera)	Black cottonwood	1 gal	10’
Dry Ground			
Pseudotsuga menziesii	Douglas' fir	1 gal	12’
Acer macrophyllum	Big-leaf maple	2 gal	15’

Note: Shrubs will be installed in clusters of 5 to 10, while trees will be individual specimens. Planting densities per unit area will be computed individually for the shrub and tree canopies using the listed average spacings.

With landowner permission, native woody species will be planted across the entire 75-foot permanent easement and within 50 feet of the stream banks or channel migration zones. Where the land use does not support a full 50 feet, Northwest will plant the available space. Species’ placement will be correlated to moisture regime requirements based on three categories of wet, moist or dry ground as indicated in Table 1. Faster growing native trees may be placed closest to the bank top to provide the most rapid canopy recovery possible that can shade and overhang the stream. Plantings would conform to the Commission’s Wetland and Waterbody Procedures (Appendix C, Section VI.D.1) which advise that trees exceeding 15 feet tall grow no closer than 15 feet to the

pipeline. By revegetating streambanks with riparian species, streambank stability will be enhanced over the long-term and will provide for stream shading, sediment intercept, and input of detrital nutrients to the stream, all of which are key functions of riparian zones (WDNR, 1997). The Commission's Wetland and Waterbody Procedures (Appendix C, Section V.D.1) limit vegetation maintenance adjacent to waterbodies to allow development of a riparian vegetative strip. Herbicides or pesticides will not be used within 100 feet of a wetland during maintenance activities for the life of the project.

Table 2. Wetland Seed Mixtures

Seed Mixture 3a- Seed Mixture for Disturbed Emergent Wetlands for all Loops [1]		
Perennial Grasses		**lbs/ac**
Ryegrass, Annual	*Lolium multiflorum*	20.0
Creeping bentgrass	*Agrostis stolonifera*	0.4
Garrison creeping foxtail	*Alopercurus arundianceus*	3.0
Meadow foxtail	*Alopercurus pratensis*	2.0
Red fescue	*Festuca rubra*	2.0
Hairgrass, Tufted	*Deschampsia caespitosa*	0.5
American sloughgrass [2]	*Beckmannia syzigachne*	2.0
Western Mannagrass	(*Glyceria occidentalis*)	3.0
Total Bulk lb/acre		**32.9**
Seed Mixture 4 - Wetland Seed Mixture for all Loops [1]		
Grasses		**lbs/ac**
Ryegrass, Annual	*Lolium multiflorum*	20
Quick Guard [3]		40
Fescue, Fine or Creeping Red	*Festuca rubra*	5
Hairgrass, Tufted	*Deschampsia caespitosa*	2
Mannagrass, Reed [2]	*Glyceria grandis*	2
Barley, Meadow [2]	*Hordeum Brachyantherum*	5
Foxtail Water [2]	*Aleopecurus geniculatus*	2
Rice Cut-grass[2]	*Leersia oryzoides*	2
Clover, Springbank [2]	*Trifolium wormskjoldii*	2
Total Bulk lbs/acre		**80**

[1] Seed mixture numbers correspond to the Seed Mixtures provided in the ECRP.
[2] These species may be included in the seed mixture if they are readily available from a commercial seed supplier.
[3] Quick Guard is a sterile hybrid of wheat and rye.

2.2.2 Impacts to In-Stream Habitat

The primary impact to in-stream habitats is the temporary removal of gravel substrate and the loss of in-stream structure. In most cases, original pipeline construction removed trees, logs and stumps from the pipeline right-of-way such that a loss of actual structure from the Capacity Replacement Project is limited. To restore and enhance affected in-stream habitat Northwest would install large woody debris (LWD) at appropriate areas in the waterbody and/or stream banks within the construction right-of-way to mitigate for potential short-term impacts that may occur to aquatic species from the crossing and in-stream construction. Placement of LWD, particularly large western red cedars (minimum length of 1.5 times channel width), in the stream in a manner prescribed by WDFW can supply habitat for forage species and enhance the rearing potential of an area (Cederholm et al., 1997; Slaney et al., 1997). Placement of LWD on the banks and in the stream can compensate for loss of shade and diminished bank stability while revegetation is maturing. Placement of LWD would occur during construction of the waterbody crossing while the flume is in place to prevent turbidity

during installation. The LWD would be placed after the pipe has been installed, during trench backfilling, and bank restoration or recontouring. The number of LWD pieces and placement will be determined at the time of the crossing and will be dependent on the available locations within the right-of-way. Waterbody locations where LWD would be installed are listed in Attachment 2 of this Plan. In addition, Northwest will install clean gravel or cobbles in the upper one-foot of trench backfill using specifications provided by the WDFW. Where the project traverses streams with culverts on the right-of-way, Northwest will work with WDFW and the landowner to install new culverts that enhance fish passage and prevent additional loss of in-stream habitats that result from improperly sized culverts.

2.2.3 Impacts from Turbidity

Turbidity impacts have been substantially avoided and minimized through the use of HDD and other dry stream crossing methods; proper best management practices; and, implementation of the Commission's Waterbody and Wetland Procedures and Upland Plan. However, it is not possible to avoid short-term turbidity impacts to Pilchuck Creek and the Nisqually River which are not technically feasible to cross by HDD procedures because of geotechnical as well as physical conditions at these crossings (see Appendix C in the JARPA application – HDD Geotechnical and Feasibility Assessment). In addition, should the proposed HDDs fail, Northwest will be required to install these crossings using the open cut method. Northwest understands the primary concern created by turbidity is the potential downstream effects on spawning habitat as well as effect to other habitats that support essential salmonid behaviors and life stages including breeding, spawning, rearing, migrating, feeding or sheltering (National Marine Fisheries Service, 1999).

The amount of sediment produced by open-cutting depends on multiple characteristics at the construction site including depth and width of the stream (affects mixing of the sediment plume in the water column), current velocity and local turbulence at the site and downstream, concentrations of suspended sediment initially at the site and at some distance downstream, particle diameter, specific weight, and settling velocity of the excavated and backfilled materials (Ritter, 1984; Reid et al., 2004).

Northwest contracted Golder Associates (Golder) to estimate the amount of instream sediment produced and extent of downstream effects of suspended sediments during open-cut construction of the North Fork Nooksack River, North Fork and South Fork Stillaguamish River should proposed HDDs fail, and during proposed open-cut construction of Pilchuck Creek and the Nisqually River (see Attachment 3 for the complete report). The estimates were derived from available water quality data for each waterbody during July and August – the period when instream construction would occur in 2006 (from Washington Department of Ecology monitoring stations), historical stream flow data for the same months (from USGS gauging stations), relative abundance of sediment grain size at each crossing site and stream channel physical dimensions (determined by Golder during on-site geological investigations conducted in 2003), and Northwest's proposed open-cut construction technique.

These data were applied to hydraulic analyses that evaluated maximum total suspended sediment (TSS) concentrations at the site of each open-cut and changes in TSS concentrations (mg/L) downstream of the excavations to distances where TSS concentrations were expected to equal background values. The maximum predicted TSS's resulting from an open cut at the five waterbody crossings falls within natural

occurring TSS ranges resulting from natural flow events based on the available water quality data for the streams. The higher TSS's appear to be related to higher stream flows.

In the North Fork Nooksack River, background TSS concentrations during July and August are expected to be 30 mg/L, maximum TSS concentration during construction at the crossing site is estimated at 84 mg/L which would diminish to background levels at approximately 500 feet downstream.

Similarly, background TSS in Pilchuck Creek at the time of construction was estimated at 3 mg/L, peaking at 84 mg/L during construction at the site while resuming background concentrations 400 feet downstream. Background TSS concentrations in the North Fork and South Fork Stillaguamish River are 5 mg/L. In the North Fork, maximum TSS concentration at the crossing site is estimated at 21 mg/L during construction, reaching background concentrations 590 feet downstream while in the South Fork a peak of 10 mg/L is expected during construction at the crossing site which would return to background levels 525 feet downstream.

Of all waterbodies, the Nisqually River has the lowest background TSS concentration estimated at 2 mg/L during July and August. Peak sediment generation at the crossing site during construction is estimated at 42 mg/L but because of the low estimated background levels, hydraulic modeling estimates that TSS concentrations would return to background levels at approximately 1,250 feet downstream from the open-cut construction site.

The chief benefit of open-cutting is the minimization of the amount of time of instream construction while allowing fish to pass through the construction area (Reid et al., 2004). However, fish abundances downstream of pipeline construction sites have rarely been measured but generally are reported as short-term reductions (Reid and Anderson, 1999). Fish emigrate from construction sites to locations where sediment deposition has not affected habitat suitability (Reid and Anderson, 1999). Fish abundance (brook trout) before and after dam-and-pump construction (a "dry-crossing" construction technique typically generating less turbidity than "wet-crossing" construction) indicated lower abundances of fish downstream (but not upstream) one month after construction. One year after construction, no differences (increased abundance was observed downstream in one stream) were found (Reid et al., 2002).

The five waterbodies which may be open cut are classified as Class A. According to WAC Chapter 173-201A, turbidity shall not exceed 5 NTU over background turbidity when the background turbidity is 50 NTU or less, or have more than a 10 percent increase in turbidity when the background turbidity is more than 50 NTU in Class A waterbodies. To monitor the turbidity levels during construction of the open cut crossings, Northwest proposes to take upstream and downstream turbidity samples every three hours. The upstream sampling location will be just off of the right-of-way. The downstream sampling location will be 300 feet from the downstream edge of the in-stream activity. If the sample shows an increase of more than 5 NTU (10 percent for streams with background over 50 NTU), the sample location will be moved to the point of compliance, immediately outside of the mixing zone, which will be a distance determined by WDOE from the downstream edge of the in-stream activity.

In order to mitigate for unavoidable turbidity impacts Northwest is proposing to participate in projects that specifically target the creation or enhancement of spawning and other requisite habitats for salmonids. Specifically, large woody debris (LWD) with attached root wads and tree-trunk lengths and diameters (dbh) specified by WDFW or other regulatory agencies that are cleared from the construction right-of-way and temporary extra workspaces would be collected, transported, and stockpiled at designated locations. Northwest would donate these logs for use as LWD. This material would be made available to organizations conducting in-stream restoration and enhancement projects within the affected WRIAs. Northwest contacted the Nooksack Tribe, Lummi Nation, Stillaguamish Tribe, Nisqually Tribe, Nooksack Salmon Enhancement Association, Stilly-Snohomish Fisheries Enhancement Task Force, Snohomish County Surface Water Management and King County Department of Natural Resources about the LWD. Each of these organizations expressed a strong interest in the LWD and indicated that the material could readily be utilized in their ongoing restoration/enhancement projects.

For the Sumas Loop, within WRIA 1, Northwest would provide LWD to the Nooksack Tribe. Northwest would haul the LWD to the Tribe's existing storage yard or to a specific project site within WRIA 1 where this material will be utilized.

For the Mt. Vernon Loop, within WRIAs 5 and 7, Northwest would provide LWD to the Stillaguamish Tribe and/or the Stillaguamish Implementation Review Committee (SIRC) who would direct the LWD to priority enhancement projects within the watershed. The LWD would be hauled to a centralized location, such as a storage site at the Tribe's nursery, which the Tribe or other enhancement organizations could access. The LWD may also be hauled to a priority project site, as directed by the SIRC, within the watershed where the material would be utilized.

For the Snohomish Loop, within WRIA 8, Northwest would provide LWD to King County Department of Natural Resources. Northwest would haul this material to one of King County's existing yard locations near the construction right-of-way or to a specific project site within the WRIA where this material would be utilized by the county. Alternatively, Northwest would temporarily store the LWD on the edge of the construction right-of-way at a suitable access location so that the county could haul this material to one of their designated yard or project sites.

Northwest would provide LWD to the Nisqually Tribe for the Ft. Lewis Loop within WRIA 11. This material would be hauled to the Nisqually Tribe's existing storage yard or to a project site near the construction right-of-way.

Prior to construction in 2006 Northwest will coordinate with each of the Tribes/organizations to determine the specific LWD hauling locations. After the construction right-of-way has been staked and Northwest has determined the CRP's in-stream LWD requirements for the project's stream crossings, Northwest will approximate the number of LWD pieces that will be available for donation to each of these organizations. Currently, it is not feasible to quantify the amount of LWD that will be available for donation from each of the project's loops. Without the construction limits being staked and knowing the specific number of LWD pieces that will be installed at each of Northwest's stream crossing (based on site-specific conditions at the time of construction) it is not possible to determine the amount of additional LWD that will be available for donation. In addition, large trees on the edge of the construction right-of-

way are typically not available for LWD because equipment cannot maneuver around the trees to push/pull the trees over with an attached rootwad. Furthermore, pulling trees over along the edge of the right-of-way can leave large holes/depressions on the edge of the right-of-way because of the root spread of the trees. These depressions may require off-right-of-way encroachment to refill/recontour.

Currently, Northwest estimates that approximately 15-20 pieces of LWD would be available to the Tribes/organizations from each of the loops totaling approximately 60-80 pieces of LWD for the project. This habitat material would have a current market value of between $21,000 - $60,000 depending on material size and **not** including hauling costs. However, the cost to Northwest of providing this material is considerably higher considering the labor involved to identify and mark the material for LWD salvage, the additional equipment and labor necessary to push/pull the trees over for LWD salvage and the additional time and equipment needed to sort and haul this material which is atypical from general right-of-way clearing operations. The labor and equipment cost of Northwest's union contractors is also significantly higher than the typical non-unionized logging industry rates.

3.0 MITIGATION MONITORING

Monitoring of riparian habitats will be conducted annually for three years following construction to determine the mitigation success. In areas where forested or shrub wetlands are being restored, the monitoring period will likely be extended by permit condition to 10 years (Washington State Department of Ecology - WDOE, 2004). Where a 10-year monitoring period is necessary, monitoring would occur in years 1, 2, 3, 5, 7 and 10. If the success criteria are reached prior to completion of the 10-year monitoring period, Northwest would request suspension of the monitoring program. A qualified biologist will conduct monitoring during the growing season by collecting information on plant survival, percent vegetative cover, as well as hydrologic conditions. Photographs will be taken each year to support the monitoring efforts. Reports will be prepared after each monitoring period to document collected data and the reports will be submitted to the appropriate agencies.

Monitoring will also determine if non-native invasive species that were not present prior to construction have become established. Revegetation will be considered successful if native herbaceous and/or woody species' cover is at least 80 percent of the total area and the diversity of native species is at least 50 percent of the diversity originally found in the wetland. Vegetation cover will be estimated (ocular) within a 2.5-meter radius that is representative of the site. All species will be listed by stratum and percent cover for each species. Monitoring will determine if the seeded and installed species have become established.

If revegetation is not successful at the end of three years, a remedial revegetation plan will be developed and implemented (in consultation with a professional wetland ecologist and the U.S. Army Corps of Engineers, WDOE, and local jurisdictions) to actively revegetate with native herbaceous and woody plant species where appropriate. Monitoring will determine if additional monitoring is required or if other measures or contingencies are required to correct any problems (e.g., if weed control of non-native invasive species is necessary to reduce competition or additional plant stock/cuttings should be installed).

Hydrologic conditions will be monitored by visual inspection to determine if the hydrology has been reestablished. Monitoring will note presence of surface water or if groundwater is present in soil pits. Hydrologic indicators will also be noted (*i.e.,* water marks or drift lines, sediment deposits, evidence of ponding, etc.).

4.0 REFERENCES

Cederholm, C. J., L. G. Dominguez, and T. W. Bumstead. 1997. Rehabilitating Stream Channels and Fish Habitat Using Large Woody Debris. Pages 8-1 to 8-28, *in* P.A. Slaney and D. Zaldokas (editors). Fish Habitat Rehabilitation Procedures; Watershed Restoration Technical Circular No. 9. British Columbia Watershed Restoration Program, Ministry of Environment, Lands and Parks, and Ministry of Forests. Vancouver, B.C.

Slaney, P. A., R. J. Finnigan, and R. G. Miller. 1997. Accelerating the Recovery of Log-jam Habitats: Large Woody Debris-boulder Complexes. Pages 9-1 to 9-24, in P.A. Slaney and D. Zaldokas (editors). Fish Habitat Rehabilitation Procedures; Watershed Restoration Technical Circular No. 9. British Columbia Watershed Restoration Program, Ministry of Environment, Lands and Parks, and Ministry of Forests. Vancouver, B.C.

National Marine Fisheries Service. 1999. Endangered and Threatened Wildlife and Plants; Definition of “Harm”. Federal Register 64(215):60727-60731.

National Marine Fisheries Service. 2000. Designated Critical Habitat: Critical Habitat for 19 Evolutionarily Significant Units of Salmon and Steelhead in Washington, Oregon, Idaho, and California. Federal Register 65(32):7764-7787.

National Marine Fisheries Service. 2003. Proposed Rule: Advance Notice of Proposed Rulemaking to Designate Critical Habitat for 20 Listed Evolutionarily Significant Units of Pacific Salmon and Steelhead. Federal Register 68(188):55926-55932.

Reid, S.M., F. Ade, and S. Metikosh. 2004. Sediment Entrainment During Pipeline Water Crossing Construction: Predictive Models and Crossing Method Comparison. Journal of Environmental Engineering and Science 3:81-88.

Reid, S.M., and P.G. Anderson. 1999. Effects of Sediment Released During Open-cut Pipeline Water Crossings. Canadian Water Resources Journal 24: 23-39.

Reid, S.M., S. Stoklosar, S. Metikosh, and J. Evans. 2002. Effectiveness of Isolated Pipeline Crossing Techniques to Mitigate Sediment Impacts on Brook Trout Streams. Water Quality Research Journal of Canada 37:473-488.

Ritter, P.W. 1984. Water Quality Concerns Associated with Pipeline Stream Crossings. Pages 447-456 in A.E. Crabtree (editor). Proceedings of the Third International Symposium on Environmental Concerns in Rights-of-way Management. Mississippi State University, Mississippi State, MS.

U.S. Fish and Wildlife Service. 2004. Proposed Rule: Proposed Designation of Critical Habitat for the Jarbidge River, Coastal-Puget Sound, and Saint Mary-Belly River Populations of Bull Trout. Federal Register 69(122):35768-35857.

Washington Department of Natural Resources. 1997. Final Habitat Conservation Plan. Washington Department of Natural Resources, Olympia, WA.

Washington Department of Fish and Wildlife and Northwest Indian Fisheries Commission. 2004. Salmon and Steelhead Habitat Inventory and Assessment Program. Online: http://wdfw.wa.gov/hab/sshiap/.

Washington State Department of Ecology. 2004. Draft. Wetlands in Washington State Volume 2: Managing and Protecting Wetlands. Washington State Department of Ecology Publication # 04-06-024.

Attachment 1

Waterbodies Traversed by the Capacity Replacement Project

Attachment 1

WDNR Type 1, 2 and 3 Waterbodies Crossed by the Capacity Replacement Project or Waterbodies within Riparian Zones and Floodplains

Pipeline Loop and Fish-bearing Waterbodies Crossed	Waterbody	MP	WDNR Stream Type	Crossing Method	Riparian Zone Width (feet)	Riparian Vegetation Associated with Waterbody [1]					
						Types in Existing ROW	Area (acres) Present	Types in New ROW	Area (acres) Affected	Types Affected by TEWS&TROW	Area (acres) Affected
Sumas Loop:											
Saar Creek	S-4A and S-4B	1483.10 and 1482.81	1	Dam&Pump	170 and 90	Wetland	0.04	none	0	Wetland	<0.01
Tributary to Lake	S-7	1481.39	3	Flume	140	none	0	none	0	none	0
Kinney Creek	S-21	1479.06	3	Flume	170	Shrub Wetland	0.46 0.41	none	0	Shrub Forest Wetland	0.18 0.16 0.11
Breckenridge Creek	S-22	1478.87	3	Flume	140	Shrub Forest	0.23 0.20	none	0	Shrub Forest	0.55 0.10
Swift Creek	S-23	1477.60	3	Flume	140	Shrub Forest	0.06 0.17	Forest	0.06	Shrub Forest	0.10 0.29
Tributary to Sumas River and Pond Outlet	S-27	1476.80	3	Flume	90	Shrub Wetland	0.02 0.19	none	0	Shrub Wetland	0.02 0.02
Tributaries to Sumas River	S-30 and S-31A, B	1476.16 and 1476.10	5	Flume	170	Shrub Forest Wetland	0.07 0.02 0.06	none	0	Shrub Forest Wetland	0.02 0.05 0.01
Dale Creek	S-32	1475.89	2	Flume	170	Shrub Forest Wetland	0.27 0.05 0.02	none	0	Shrub Forest Wetland	0.02 0.20 <0.01
Tributary to Sumas River	S-47	1473.70	3	Flume	140	Forest	0.56	none	0	Forest	0.30
Smith Creek	S-54	1472.22	3	Flume	140	Forest	0.12	none	0	Forest	0.16
Tributary to Macaulay Creek	S-55	1471.95	3	Flume	140	none	0	none	0	Shrub	<0.01
Macaulay Creek	S-57	1471.04	3	Flume	140	Shrub Forest	0.37 0.11	none	0	Shrub Forest	0.10 0.21
Tributary to Mitchell Creek and Mitchell Creek - ditch	S-57.1 and S-59	1470.85 and 1470.76	3 3	Flume	170 and 90	Shrub Forest Wetland	0.28 0.32 0.31	Shrub Forest	0.03 0.02	Shrub Forest Wetland	0.17 0.01 0.18

Pipeline Loop and Fish-bearing Waterbodies Crossed	Waterbody	MP	WDNR Stream Type	Crossing Method	Riparian Zone Width (feet)	Riparian Vegetation Associated with Waterbody [1]					
						Types in Existing ROW	Area (acres) Present	Types in New ROW	Area (acres) Affected	Types Affected by TEWS&TROW	Area (acres) Affected
Tributaries to Mitchell Creek	S-60 and S-62	1470.14 and 1469.80	3 3	Flume	90	Shrub Forest Wetland	1.38 0.12 0.70	Shrub Wetland	0.01 0.07	Shrub Forest Wetland	0.35 0.59 0.03
Jim Creek, Tributary to Nooksack River North Fork Nooksack River	S-68 S-69 S-70	1468.68 1468.44 1468.20	3(1) 3(1) 1	HDD	140	Shrub Forest	1.58 (0.92)[.2] 0.25 (0.20)[.2]	none	0	Shrub Forest	2.25 2.26
Tributary to South Fork Nooksack River	S-73	1467.41	3	Flume	170	Shrub Forest	0.71 0.01	none	0	Shrub Forest	0.17 0.36
Tributary to South Fork Nooksack River	S-76	1466.81	3	Flume	90	Wetland	0.33	none	0	Wetland	0.09
Tributary to Black Slough Wetland Ditch Tinling Creek Wetland Ditch	S-82 S-82 S-84 S-89A	1465.01 1464.73 1464.60 1463.01	3 3(1) 3(1) 3(1)	Flume	90	Shrub Forest Wetland	5.31 0.18 11.69	Wetland	0.25	Shrub Forest Wetland	0.92 1.03 3.46
Tributary to South Fork Nooksack River	S-91	1461.90	3	Flume	170	Forest Wetland	0.34 0.02	none	0	Forest Wetland	0.22 0.01
Total Riparian Vegetation Affected on Sumas Loop						Shrub Forest Wetland	10.47 (0.92)[.2] 2.69 (0.20)[.2] 13.45	Shrub Forest Wetland	0.08 0.03 0.31	Shrub Forest Wetland	4.84 5.93 3.92
Mt. Vernon Loop:											
Pilchuck Creek	MV-7	1428.60	1	Open Cut	170	Shrub Forest	0.30 0.01	none	0	Shrub Forest Wetland	0.08 0.13 0.12
Armstrong Creek	MV-11	1425.62	2	Flume	170	Shrub Forest	0.98 0.17	none	0	Shrub Forest	0.02 0.61
North Fork Stillaguamish River	MV-14	1424.23	1	HDD	140	none	0	Shrub Forest Wetland	(0.09) [2] (0.09) [2] (0.28) [2]	none	0
South Fork Stillaguamish River and Eagle Creek	MV-15 and MV-16	1423.84 and 1423.49	1 3 (1)	HDD & Flume	140	Shrub Forest Wetland	0.12 0.18 1.22	Shrub Forest Wetland	0.04 0.04 (0.07)[2] 0.41	Shrub Forest Wetland	0.03 0.01 0.32

Pipeline Loop and Fish-bearing Waterbodies Crossed	Waterbody	MP	WDNR Stream Type	Crossing Method	Riparian Zone Width (feet)	Riparian Vegetation Associated with Waterbody [1]					
						Types in Existing ROW	Area (acres) Present	Types in New ROW	Area (acres) Affected	Types Affected by TEWS&TROW	Area (acres) Affected
Tributary to South Fork Stillaguamish River	MV-27	1421.33	3	Flume	170	Shrub Forest	0.75 0.04	Shrub	0.05	Shrub Forest	0.23 0.24
Olson Lake	MV-32A&B	1419.33	2	Push/Pull	170	Shrub Forest Wetland	1.09 0.02 0.89	Shrub Forest Wetland	0.11 0.10 0.33	Shrub Forest Wetland	0.40 0.35 0.18
Star Creek	MV-49.1	1415.32	3	Flume	170	Shrub Forest Wetland	0.83 0.17 0.29	Shrub	0.02	Shrub Forest	0.24 0.07
Tributary to Little Pilchuck Creek	MV-55	1412.12	3	Flume	170	Shrub Forest Wetland	0.75 0.01 0.04	none	0	Shrub Forest Wetland	0.07 0.10 0.05
Little Pilchuck Creek	MV-62 and MV-63	1411.06 and 1410.52	1	Flume	200	Shrub Forest Wetland	0.99 0.42 <0.01	Shrub Forest	0.04 0.01	Shrub Forest	0.46 0.46
Catherine Creek	MV-66	1409.61	1	Flume	170	none	0	none	0	Forest	0.12
Total Riparian Vegetation Affected on Mt. Vernon Loop						Shrub Forest Wetland	5.80 1.02 2.44	Shrub Forest Wetland	0.26 (0.09) [2] 0.15 (0.16) [2] 0.74 (0.28) [2]	Shrub Forest Wetland	1.51 1.82 0.67
Snohomish Loop:											
Tributary to Paradise Lake/Bear Creek	SN-2	1393.77	3	Flume	140	Shrub Forest Wetland	0.35 0.07 0.12	none	0	Shrub Forest Wetland	0.01 0.17 0.01
Tributaries to Paradise Lake/Bear Creek	SN-4 and SN-6	1393.31 and 1393.12	3 3	Flume	140	Shrub Forest Wetland	1.36 0.21 0.83	none	0	Shrub Forest Wetland	0.06 0.20 0.14
Tributary to Paradise Lake/Bear Creek	SN-7	1392.95	3	Flume	140	Shrub Forest Wetland	0.08 0.14 0.17	none	0	Shrub Forest Wetland	0.01 0.10 0.02
Tributary to Paradise Lake/Bear Creek	SN-21	1391.24	3	Flume	140	Shrub Forest Wetland	0.58 0.09 <0.01	none	0	Forest Wetland	0.15 <0.01

Pipeline Loop and Fish-bearing Waterbodies Crossed	Waterbody	MP	WDNR Stream Type	Crossing Method	Riparian Zone Width (feet)	Riparian Vegetation Associated with Waterbody [1]					
						Types in Existing ROW	Area (acres) Present	Types in New ROW	Area (acres) Affected	Types Affected by TEWS&TROW	Area (acres) Affected
Struve Creek	SN-22	1390.20	3	Flume	140	none	0	none	0	Forest	<0.01
Colin Creek	SN-24	1389.40	3	Span	140	Shrub Forest Wetland	0.20 0.01 0.19	none	0	Shrub Forest Wetland	<0.01 0.08 0.05
Tributary to Seidel Creek	SN-28A, B	1388.64	3	Flume	140	Shrub Forest Wetland	0.31 0.03 0.10	none	0	Shrub Forest Wetland	0.11 0.09 0.02
Tributary To Seidel Creek	SN-29	1388.51	3	Flume	140	Shrub Wetland	0.87 0.05	none	0	Shrub Forest Wetland	0.34 0.05 0.02
Evans Creek	SN-42	1383.66	3	Push/Pull	140	Shrub Forest Wetland	0.29 0.12 1.79	none	0	Shrub Forest Wetland	0.03 0.12 0.56
Tributary to Evans Creek	SN-43	1383.41	3	Flume	140	Shrub Forest Wetland	0.84 0.06 0.17	none	0	Shrub Forest Wetland	0.01 0.10 0.03
Total Riparian Vegetation Affected on Snohomish Loop						Shrub Forest Wetland	4.87 0.74 3.41	none	0	Shrub Forest Wetland	0.56 1.06 0.84
Ft. Lewis Loop:											
Muck Creek	FL-12	1332.37	2	Flume	140	Shrub Forest Wetland	0.02 0.04 0.05	Shrub Forest Wetland	<0.01 0.01 <0.01	Shrub Forest Wetland	0.01 0.04 0.01
South Creek	FL-13	1332.11	2	Flume	90	Shrub Wetland	<0.01 0.19	Shrub Wetland	<0.01 0.02	Shrub Wetland	<0.01 0.03
Lacamas Creek	FL-17	1328.71	3	Flume	140	Wetland	0.18	none	0	Wetland	0.26
Murray Creek	FL-23	1327.96	3	Flume	170	Shrub Forest Wetland	0.88 0.05 0.21	none	0	Shrub Forest Wetland	0.50 0.21 0.12

Pipeline Loop and Fish-bearing Waterbodies Crossed	Waterbody	MP	WDNR Stream Type	Crossing Method	Riparian Zone Width (feet)	Riparian Vegetation Associated with Waterbody [1]					
						Types in Existing ROW	Area (acres) Present	Types in New ROW	Area (acres) Affected	Types Affected by TEWS&TROW	Area (acres) Affected
Nisqually River and Centralia Canal	FL-35A,B and FL-37	1324.29 and 1323.85	1 3	Open Cut & Span	170	Shrub Forest Wetland	0.49 0.34 0.15	Shrub Forest Wetland	0.04 0.14 <0.01	Shrub Forest Wetland	0.08 1.24 0.09
Total Riparian Vegetation Affected on Ft. Lewis Loop						Shrub Forest Wetland	1.39 0.43 0.78	Shrub Forest Wetland	0.14 0.04 0.02	Shrub Forest Wetland	0.28 1.78 0.42
Portland Lateral Takeoff											
Tributary to East Fork Lewis River	RF-1	1232.52	3	Flume	140	none	0	none	0	none	0

[1] Only riparian vegetation providing some function is included. Vegetation dominated by grassland, agriculture, residential, urban/industrial sites is omitted.
[2] Vegetation types with areas affected in parenthesis are within the new right-of-way but the areas are not affected since the pipeline will be constructed by HDD.

Attachment 2

Waterbody Locations where LWD would be Installed

Attachment 2
Waterbody Mitigation Treatments

Wetland Number [1]	Milepost[2]	Cowardin Classification [3]	Wetland Seed Mixture [7]	Woody Species Plantings [8]	Planting Location [9]	Large Woody Debris Placement [10]	Streambed Gravel [11]
Sumas Loop (Whatcom County)							
Wetland S-4A, B (Saar Creek)	1483.10	R PEM	3a	Yes	Stream banks	Yes	Yes
Wetland S-7 [4] (Trib. to Lake)	1481.39	R	3a	Yes	Stream banks	Yes	Yes
Wetland S-21 (Kinney Creek)	1479.06	PEM R PSS PFO	4	Yes	Stream banks and riparian buffers	Yes	Yes
Wetland S-22 (Breckenridge Creek)	1478.87	R	4	Yes	Stream banks and riparian buffers	Yes	Yes
Wetland S-23 (Swift Creek)	1477.60	R	4	Yes	Stream banks and riparian buffers	Yes	Yes
Wetland S-27 (Trib to Sumas River)	1476.80	PEM R PFO POW	3a	Yes	Stream banks	Yes	Yes
Wetland S-30 (Trib. to Sumas River	1476.16	PSS PFO R	4	Yes	Stream banks and riparian buffers	Yes	Yes
Wetland S-31 A,B (Trib to Sumas River	1476.10	PEM R PFO	3a	Yes	Stream banks	Yes	Yes
Wetland S-32 (Dale Creek)	1475.86	R PEM	4	Yes	Stream banks and riparian buffers	Yes	Yes
Wetland S-47 (Trib. to Sumas River)	1473.70	R	4	Yes	Stream banks and riparian buffers	Yes	Yes
Wetland S-54 (Smith Creek)	1472.23	R	3a	Yes	Stream banks	Yes	Yes
Wetland S-55 (Trib. to Macaulay Creek)	1471.95	R	3a	Yes	Stream banks	Yes	Yes
Wetland S-57 (Trib. to Macaulay)	1471.04	R	4	Yes	Stream banks and riparian buffers	Yes	Yes
Wetland S-57.1 (Trib. to Macaulay)	1470.85	R	4	Yes	Stream banks and riparian buffers	Yes	Yes
Wetland S-59 (Mitchell Creek-ditch	1470.76	R	4	Yes	Stream banks and riparian buffers	Yes	Yes
Wetland S-60 [4] (Trib. to Mitchell Creek)	1470.14	PEM	3a	Yes	Stream banks	N/A	N/A

Wetland Number [1]	Milepost[2]	Cowardin Classification [3]	Wetland Seed Mixture [7]	Woody Species Plantings [8]	Planting Location [9]	Large Woody Debris Placement [10]	Streambed Gravel [11]
Wetland S-62 (Trib. to Mitchell Creek)	1469.79	R	3a	Yes	Stream banks and riparian buffers	N/A	N/A
Wetland S-68 [6] (Jim Creek)	1468.68	R	N/A	N/A	N/A	N/A	N/A
Wetland S-69 [6] (Trib. to Nooksack)	1468.44	R	N/A	N/A	N/A	N/A	N/A
Wetland S-70 [6] (N. Fork Nooksack River)	1468.20	R	N/A	N/A	N/A	N/A	N/A
Wetland -S-73 (Trib. to S. Fork Nooksack River)	1467.41	R	4	Yes	Stream banks and riparian buffers	Yes	Yes
Wetland S-76 (Trib. to S. Fork Nooksack River)	1466.81	PFO PSS PEM R	3a	Yes-in forested temporary right-of-way areas	Wetland	None	None
Wetland S-82 [4] (Trib. to Black Slough & Ditch)	1465.38	PEM	3a	Yes	Stream banks and riparian buffers & Temporary extra work spaces and right-of-way	Yes	Yes
Wetland S-84 [4] (Tinling Creek)	1464.59	R	3a	Yes	Stream banks and riparian buffers	Yes	Yes
Wetland S-89A,B (Ditches)	1463.01 1463.00	PEM	3a	None	Wetland	None	Yes
Wetland S-91 (Trib. to S. Fork Nooksack River)	1461.9	R PEM PFO PSS	4	Yes	Stream banks and riparian buffers	Yes	Yes
Mt. Vernon Loop (Snohomish County)							
Wetland MV-7 (Pilchuck Creek)	1428.62	R	3a	Yes	Stream banks and riparian buffers	Yes	Yes
Wetland MV-11 (Armstrong Creek)	1425.62	R	4	Yes	Stream banks and riparian buffers	Yes	Yes
Wetland MV-14 [6] (N. Fork Stillaguamish River)	1424.26	R	N/A	N/A	N/A	N/A	N/A
Wetland MV-15 [6] (S. Fork Stillaguamish River)	1423.84	R	N/A	N/A	N/A	N/A	N/A
Wetland MV-16 [4] (Eagle Creek)	1423.46	PEM POW R	3a	Yes	Stream banks	Yes	Yes

Wetland Number [1]	Milepost[2]	Cowardin Classification [3]	Wetland Seed Mixture [7]	Woody Species Plantings [8]	Planting Location [9]	Large Woody Debris Placement [10]	Streambed Gravel [11]
Wetland MV-27 (Trib. to S. Fork Stillaguamish)	1421.33	R	4	Yes	Stream banks and riparian buffers	Yes	Yes
Wetland MV-32A,B (Olson Lake)	1419.33	PSS PEM PFO	4	Yes	Wetland and buffers and in forested temporary workspaces and right -of-way areas	Yes	None
Wetland MV-49.1 (Trib. to Star Creek)	1415.31	R PEM	3	Yes	Stream banks and riparian buffers	Yes	Yes
Wetland MV-55 (Trib. to Little Pilchuck Creek)	1412.12	PEM R PFO PAB	4	Yes	Stream banks and riparian buffers	Yes	Yes
Wetland MV-62 (Little Pilchuck Creek)	1411.06	R	3	Yes	Stream banks and riparian buffers	Yes	Yes
Wetland MV-63 (Little Pilchuck Creek)	1410.52	R	4	Yes	Stream banks and riparian buffers	Yes	Yes
Wetland MV-66 (Catherine Creek)	1409.59	R	3	Yes	Streambanks and riparian buffers	Yes	Yes
Snohomish Loop (Snohomish County)							
Wetland SN-2 (Trib. to Paradise Lake/Bear Creek)	1393.77	PFO PEM R	4	Yes	Stream banks and riparian buffers	Yes	Yes
Wetland SN-4 (Trib. to Paradise Lake/Bear Creek)	1393.32	R PFO PSS PEM	3a	Yes	Stream banks and riparian buffers	Yes	Yes
Wetland SN-6 [4] (Trib. to Paradise Lake/Bear Creek)	1393.11	PFO R PSS PEM POW	3a	Yes	Stream banks and riparian buffers	Yes	Yes
Snohomish Loop (King County)							
Wetland SN-6 [4] (Trib. to Paradise Lake/Bear Creek)	1393.07	PEM PSS PFO R POW	3a	Yes	Stream banks and riparian buffers	Yes	Yes

Wetland Number [1]	Milepost[2]	Cowardin Classification [3]	Wetland Seed Mixture [7]	Woody Species Plantings [8]	Planting Location [9]	Large Woody Debris Placement [10]	Streambed Gravel [11]
Wetland SN-7 (Trib. to Paradise Lake/Bear Creek)	1392.95	PEM PSS PFO R	4	Yes	Stream banks and riparian buffers	Yes	Yes
Wetland SN-21 (Trib. to Paradise Lake/Bear Creek)	1391.24	PSS R	4	Yes	Stream banks and riparian buffers	Yes	Yes
Wetland SN-22 (Struve Creek)	1390.15	R	4	Yes	Stream banks and riparian buffers	Yes	Yes
Wetland SN-24 (Colin Creek)	1389.40	R PFO PSS	4	Yes	Stream banks and riparian buffers	N/A (Span)	None (Span)
Snohomish Loop (City of Redmond)							
Wetland SN-28 A&B (Trib. to Seidel Creek)	1388.64	R PEM PSS PFO	4	Yes	Stream banks and riparian buffers	Yes	Yes
Wetland SN-29 (Trib. to Seidel Creek)	1388.51	R PSS PFO	4	Yes	Stream banks and riparian buffers	Yes	Yes
Snohomish Loop (King County)							
Wetland SN-42 (Evans Creek)	1383.66	PSS PFO PEM POW	4	Yes	Wetland Banks and buffers	Yes	N/A
Wetland SN-43 (Trib. to Evans Creek)	1383.41	PSS PEM R PFO	4	Yes	Stream banks and riparian buffers	Yes	Yes
Snohomish County (City of Sammamish)							
Wetland SN-43 (Trib. to Evans Creek)	1383.41	PSS PEM	4	Yes	Stream banks and riparian buffers	Yes	Yes
Ft Lewis Loop (Ft. Lewis Military Reservation							
Wetland FL-12 (Muck Creek)	1332.35	R PEM	See ECRP for seed mixture (Section 7.9)	Yes	Stream banks and riparian buffers	Yes	Yes
Wetland FL-13 (South Creek)	1332.11	R PEM PFO	See ECRP for seed mixture (Section 7.9)	Yes	Stream banks and riparian buffers	Yes	Yes
Ft Lewis Loop (Pierce County)							
Wetland FL-17 (Lacamas Creek))	1328.71	R PEM	3A	Yes	Stream banks	Yes	Yes

Wetland Number [1]	Milepost[2]	Cowardin Classification [3]	Wetland Seed Mixture [7]	Woody Species Plantings [8]	Planting Location [9]	Large Woody Debris Placement [10]	Streambed Gravel [11]
Wetland FL-23 (Murray Creek)	1327.92	PFO PEM PSS R	3a	Yes	Streambanks and riparian buffers	Yes	Yes
Wetland FL-35A (Nisqually River)	1324.28	R	4	Yes	Stream banks and riparian areas affected by FL-TEWS -58 &59 and temporary right-of-way	Yes	Yes
Ft. Lewis Loop (Thurston County)							
Wetland FL-35B (Nisqually River)	1324.28	R	4	Yes	Stream banks	Yes	Yes
RETIREMENT OF 26-INCH FACILITIES							
Portland Lateral Take-Off (Clark County) Wetland RF-1	1232.53	R	3a	None	N/A	None	N/A

[1] Wetland numbers correspond to the wetland numbers shown on the Environmental Alignment Sheets.
[2] Approximate milepost is at the center of the wetland perpendicular to the pipeline.
[3] Wetland types according to Cowardin *et al.* (1979).
Palustrine Forested (PFO)
Palustrine Scrub-Shrub (PSS)
Palustrine Emergent (PEM)
Palustrine Open Water (POW)
Palustrine Aquatic Bed (PAB)
Riverine (R)
Lacustrine (L)
[4] Farmed Wetlands-COE Jurisdictional.
[5] Impacts to these wetlands are avoided, but they have been included if they are within 100 feet of the project work area as required by county ordinances.
[6] Impacts to this wetland/stream are avoided by HDD.
[7] See Table 2 for seed mixture specifications. The EI may substitute either of the wetland seed mixtures at individual wetland sites based on site specific conditions and the intent of these mixtures (i.e., Seed Mixture 3a is intended for disturbed emergent wetlands dominated by invasive species and Seed Mixture 4 is intended for wetlands dominated by native species). The landowner may specify alternate seed mixtures.
[8] See Table 1 for the suggested woody species plantings based on site moisture regime. Species to be planted will be determined at the time of planting based on site specific conditions and available planting locations.
[9] Planting locations of woody species will be coordinated with landowners based on existing land use conditions (i.e., agricultural areas).
[10] Placement of in-stream LWD will occur during the crossing when the flume or dam and pump is in place. The configuration and number of LWD will be dependent on available placement opportunities and determined by the EI. LWD will consist of conifers (preferably cedar) with root wads attached, and the size will be appropriate for the stream.
[11] The top 12-inches of the trench will be backfilled with clean spawning gravel with gradations specified by WDFW. Gravel may be utilized during trench backfilling at other stream crossings, as determined by the EI to minimize turbidity or to enhance habitat based on site-specific conditions.

Attachment 3

Determination of Downstream Changes in Water Quality Due to In-Stream Trenching in the North Fork Nooksack River, Pilchuck Creek, North Fork Stillaguamish River, South Fork Stillaguamish River, and Nisqually River

Golder Associates Inc.

18300 NE Union Hill Road, Suite 200
Redmond, WA USA 98052-3333
Telephone (425) 883-0777
Fax (425) 882-5498
www.golder.com

April 18, 2005

Our Ref.: 043-1116-007-000

Williams – Northwest Pipelines
295 Chipeta Way
Salt Lake City, Utah 84108

Attention: Ms. Lauri Duncombe

Williams – Northwest Pipelines
2800 Post Oak Boulevard
Houston, Texas 77056

Attention: Ms. Suzanne Hickham

RE: CAPACITY REPLACEMENT PROJECT
DETERMINATION OF DOWNSTREAM CHANGES IN WATER QUALITY DUE TO IN-STREAM TRENCHING IN THE NORTH FORK NOOKSACK RIVER, PILCHUCK CREEK, NORTH FORK STILLAGUAMISH RIVER, SOUTH FORK STILLAGUAMISH RIVER, AND NISQUALLY RIVER

Dear Lauri and Suzanne:

The following summarizes the results of our assessment of changes in downstream water quality due to open-cut excavations across the North Fork Nooksack River, Pilchuck Creek, North Fork Stillaguamish River, South Fork Stillaguamish River, and Nisqually River, as outlined in our scope of work (email transmission dated 4/1/05).

The following data were used in the assessment; no site specific flow or channel sediment samples were collected:

- Hydrology - Historical USGS stream flow data were used to determine typical low-flow values during the month of July at each pipeline crossing location. USGS gauging stations are located very near the pipeline crossings at Pilchuck Creek and the Nisqually River. USGS gauging stations at the North Fork Nooksack, North Fork Stillaquamish, and South Fork Stillaquamish sites are located at other locations in the basins. Flow values at these sites were approximated by scaling contributing basin areas from the USGS gauging locations to the crossing sites.

- Site Characteristics – Crossing widths were determined from drawings provided by Williams – Northwest Pipeline (NWP). Geologic investigations completed by Golder for the proposed horizontal directional drill crossings were used to approximate channel bed material types and sediment grain-size distributions. Water quality data were obtained from available Washington State Department of Ecology (WSDOE) monitoring stations to develop background values for Total Suspended Sediment (TSS). The data are shown in Figures 1 through 6. TSS is reported in units of mg/L. WSDOE monitoring stations were located throughout each basin but were typically not located near the pipeline crossings.

- Construction Activities – Crossing procedures were based on the "Waterbody Crossing Methodology Plan, Capacity Replacement Project, November, 2004", provide by NWP. We assumed a generally trapezoidal trench section for the open-cut excavation across the channel with a depth of approximately 10 to 13 feet below the bottom of the channel. We also assumed the work would be completed using an excavator with a bucket with an approximate two cubic yard capacity.

We completed a hydraulic analysis that evaluated changes in TSS concentrations downstream of an open-cut excavation. The analysis determined the maximum TSS as a result of the in-channel work and the distance downstream of the in-channel excavation where TSS concentrations return to background values. The results are presented for each crossing in the attached table. As shown in Table 1 and Figures 1 through 6, the maximum predicted TSS's for the in-channel work at the 5 stream crossing, all fall within the measured range of TSS based on the limited available water quality data for the streams. The measured TSS's appeared to be related to stream flows with the higher TSS's corresponding to high flows. These results are based on available data as outlined above.

We appreciate our continued involvement with the Capacity Replacement Project. If you have any questions or need additional information please call.

Sincerely,

GOLDER ASSOCIATES INC.

Andreas Q. Kammereck, P.E.
Senior Engineer

Clifford C. Knitter, L.E.G.
Principal, Pipeline Services

AQK/CCK/ngs

TABLE

River Crossing	Est. Channel Width (ft), (1)	Est. Channel flow, Q (cfs), (1)	Est. Flow Depth (ft), (1)	TSS Background (mg/L), (2)	Sediment Grain Size (d50), (mm),(4)	Sediment Distribution (%), (5)			Peak estimated TSS (mg/L)	Return to Background TSS (ft), (6)
						silt/clay	sand	coarse		
NF Nooksack	120	500	1.5	30	10	5	35	60	**~84**	**~ 500**
Pilchuck	75	62	0.5	n/a (3)	10	5	35	60	**~85**	**~ 400**
NF Stillaguamish	230	934	2	5	1	20	60	20	**~21**	**~ 590**
SF Stillaguamish	230	1,280	2	5	1	15	35	50	**~10**	**~ 525**
Nisqually	160	572	2	2	10	5	35	60	**~42**	**~ 1,250**

Notes:

(1) Values estimated from available information.
(2) Water quality data from nearest available WSDOE monitoring sites.
Units shown as Total Suspended Solids (TSS) in mg/L concentrations.
(3) No water quality data were available, assumed backgournd TSS was zero.
(4) Assumed material excavated from open-cut trench across channel - d50 is the median sediment grain size in mm.
(5) Assumed downstream mobilized sediment distribution.
(6) Distance downstream from open-cut excavation.

TABLE 1
SUMMARY OF DOWNSTREAM CHANGES IN TSS AS A RESULT OF OPEN-CUT CROSSING
NWP/STREAM SEDIMENT INVESTIGATION/WA

FIGURES

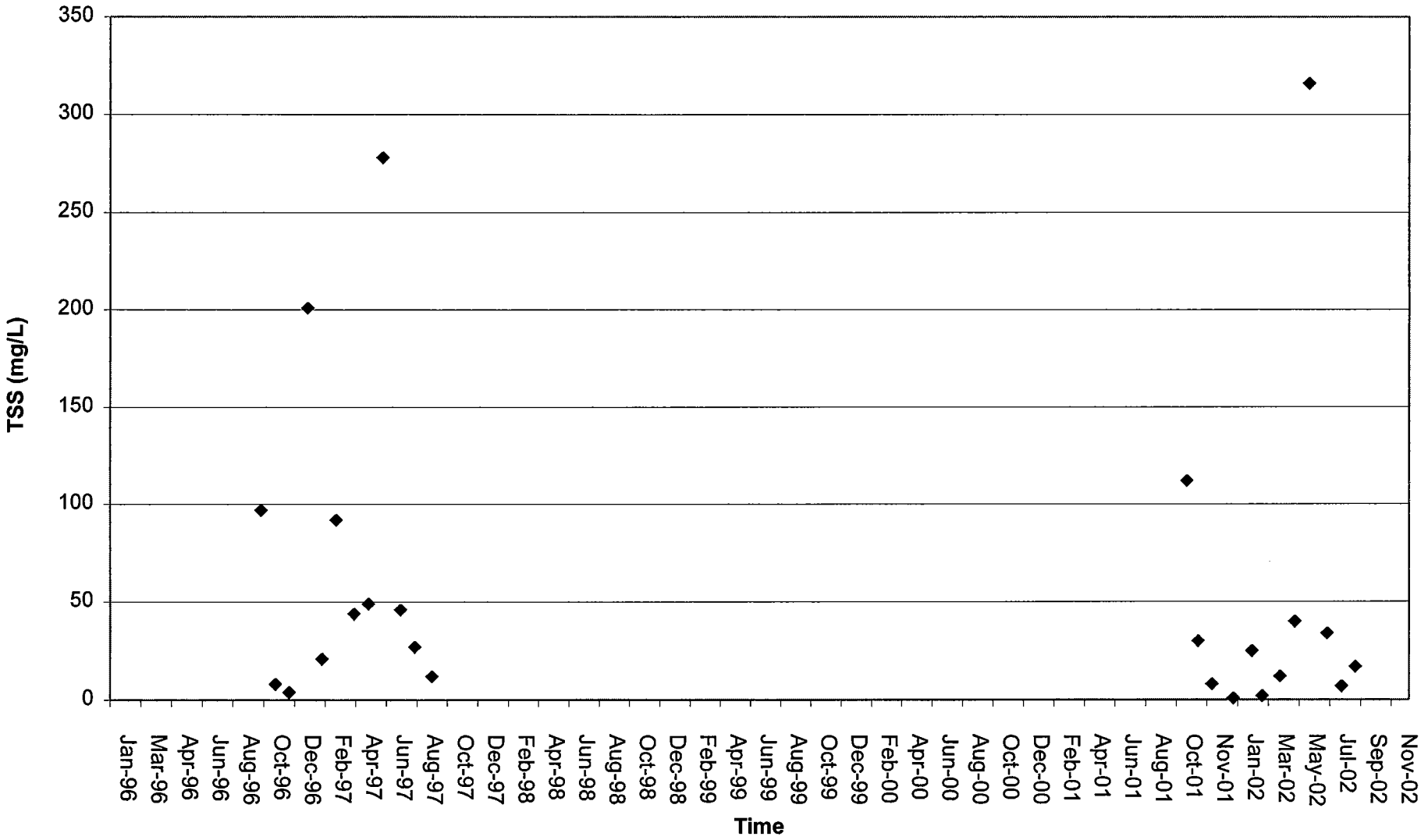

FIGURE 1
NOOKSACK RIVER ABOVE MF WSDOE, STATION No. 01A140
NWP/STREAM SEDIMENT INVESTIGATION/WA

0431116007000fg02.fh11 | Mod: 04/18/05 | EL

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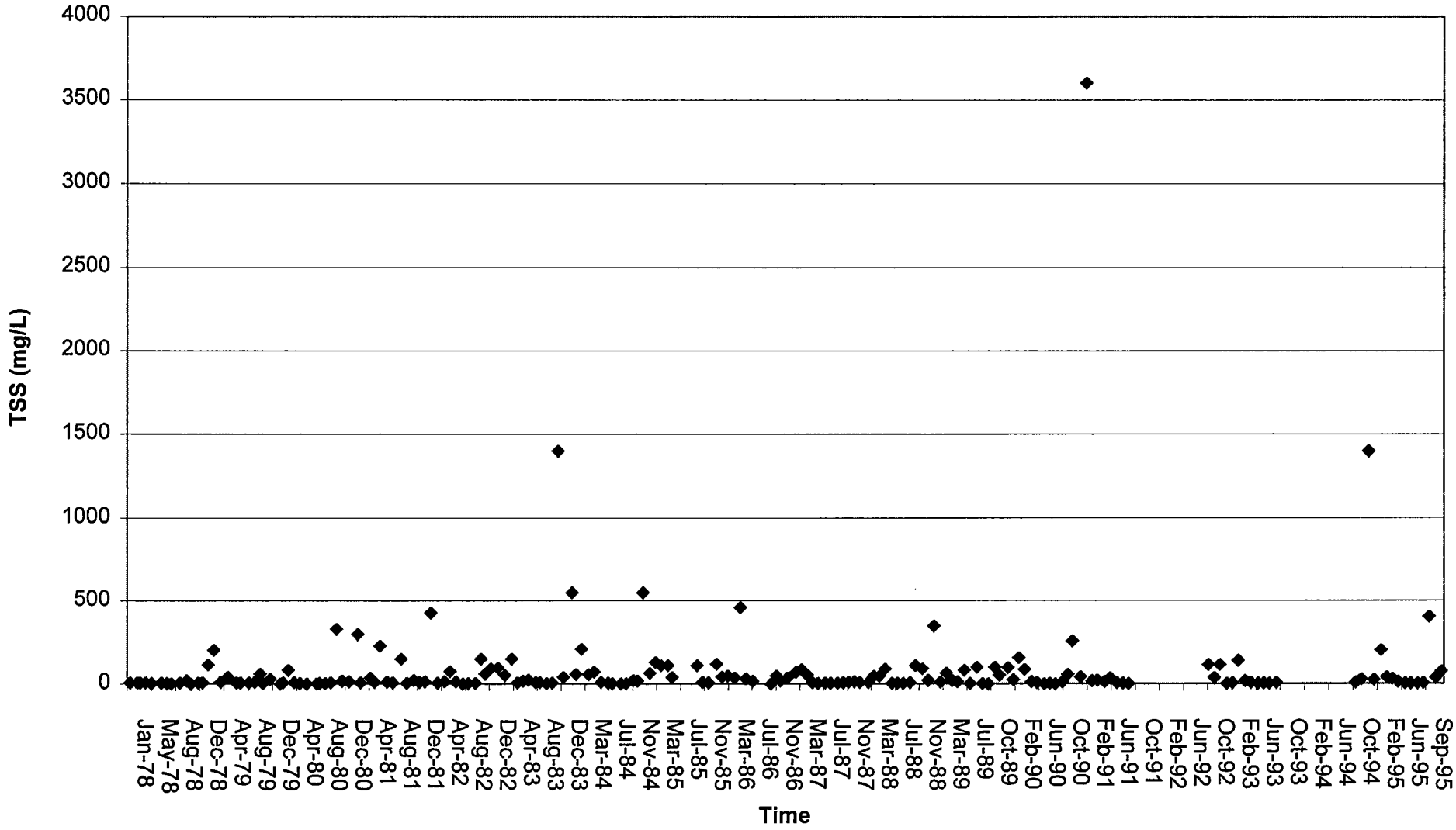

FIGURE **2**

NF STILLAQUAMISH AT CICERO

WSDOE, STATION No. 05B070 (FULL RANGE OF MEASURED TSS)

NWP/STREAM SEDIMENT INVESTIGATION/WA

0431116007000fg03.fh11 | Mod: 04/18/05 | EL

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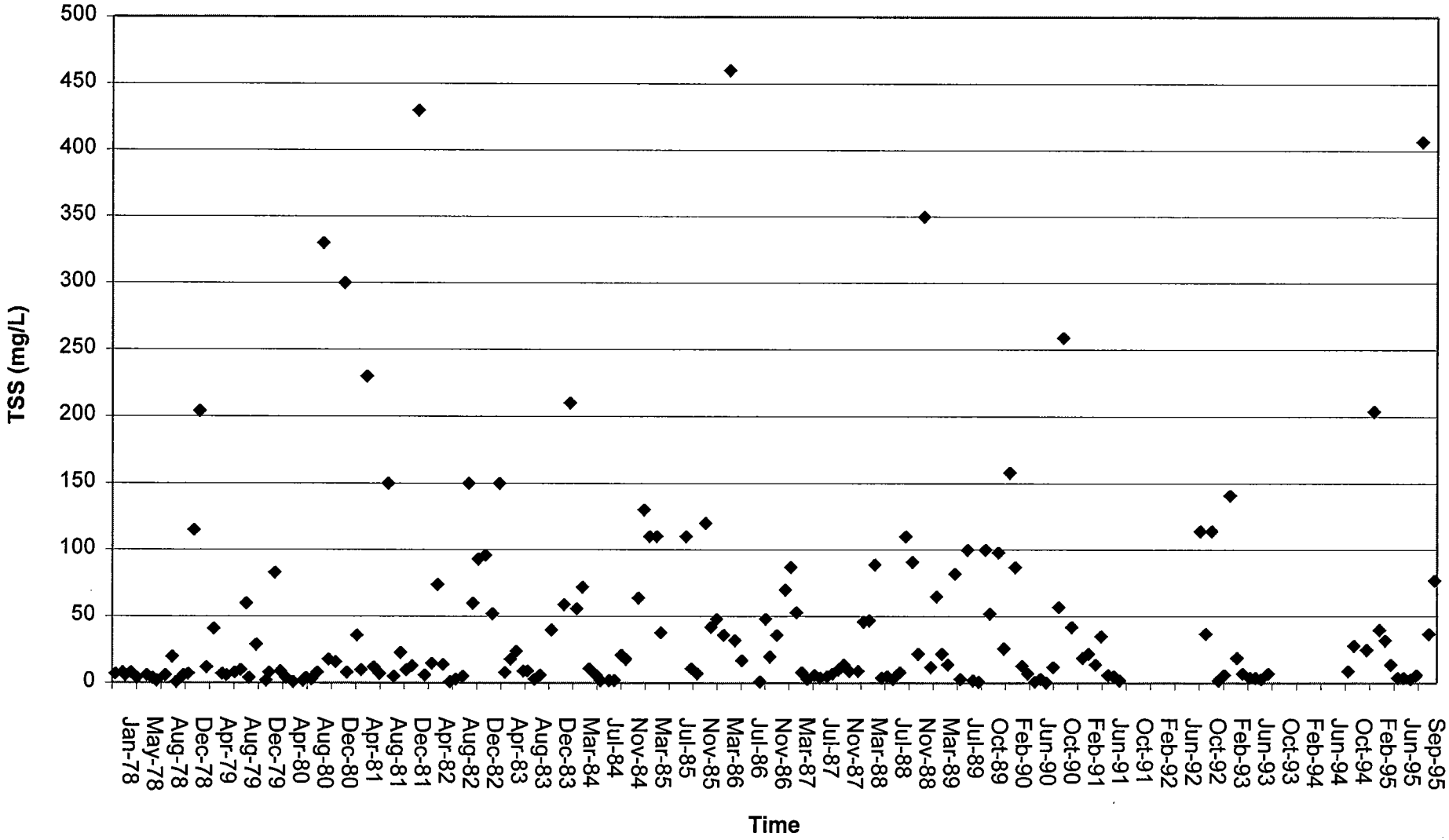

FIGURE **3**

NF STILLAQUAMISH AT CICERO

WSDOE, STATION No. 05B070 (LIMITED TO <500mg/L MEASURED TSS)

NWP/STREAM SEDIMENT INVESTIGATION/WA

0431116007000fg04.fh11 | Mod: 04/18/05 | EL

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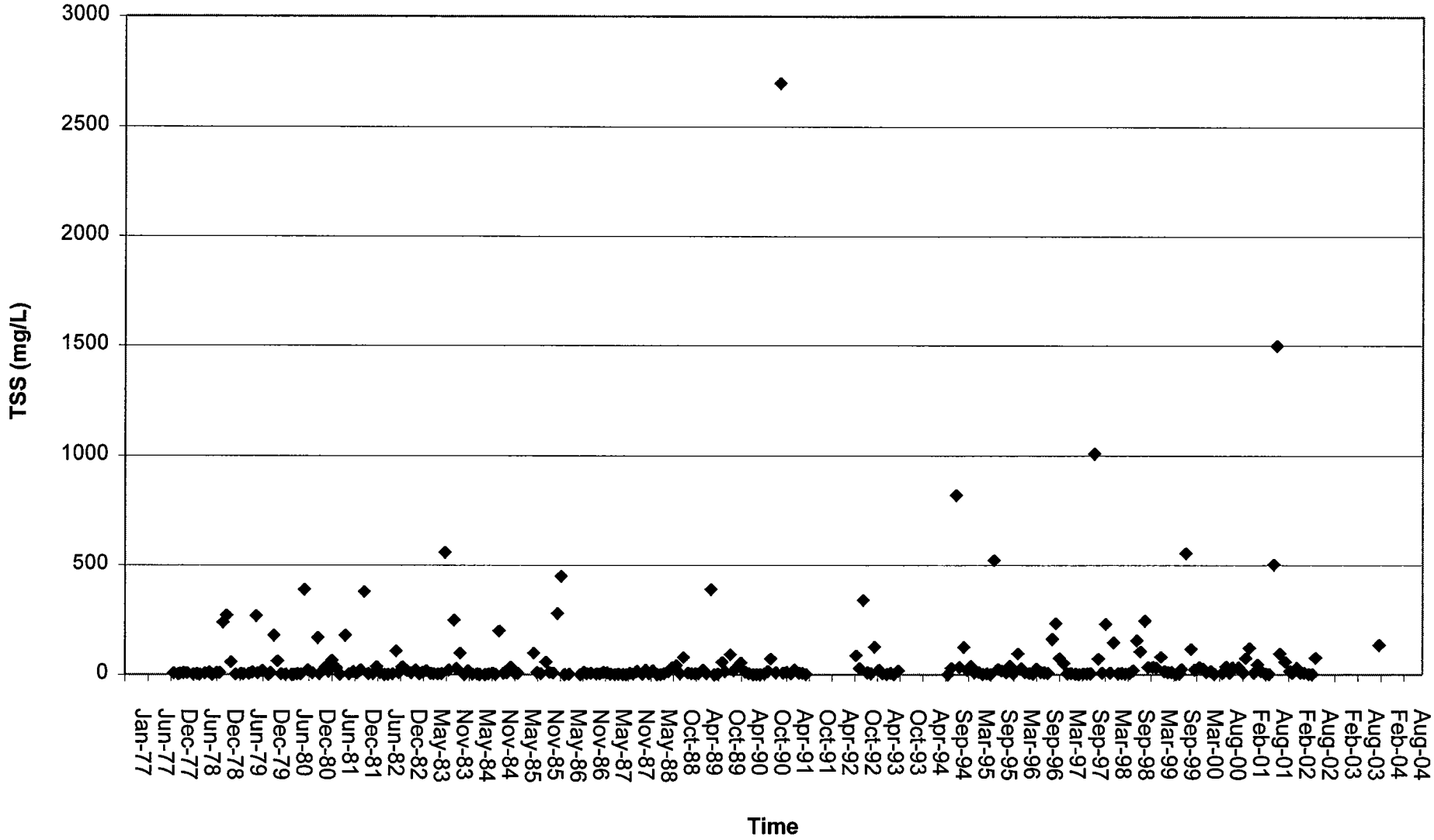

FIGURE **4**

SF STILLAQUAMISH AT ARLINGTON
WSDOE, STATION No. 05A090 (FULL RANGE OF MEASURED TSS)

NWP/STREAM SEDIMENT INVESTIGATION/WA

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Golder Associates

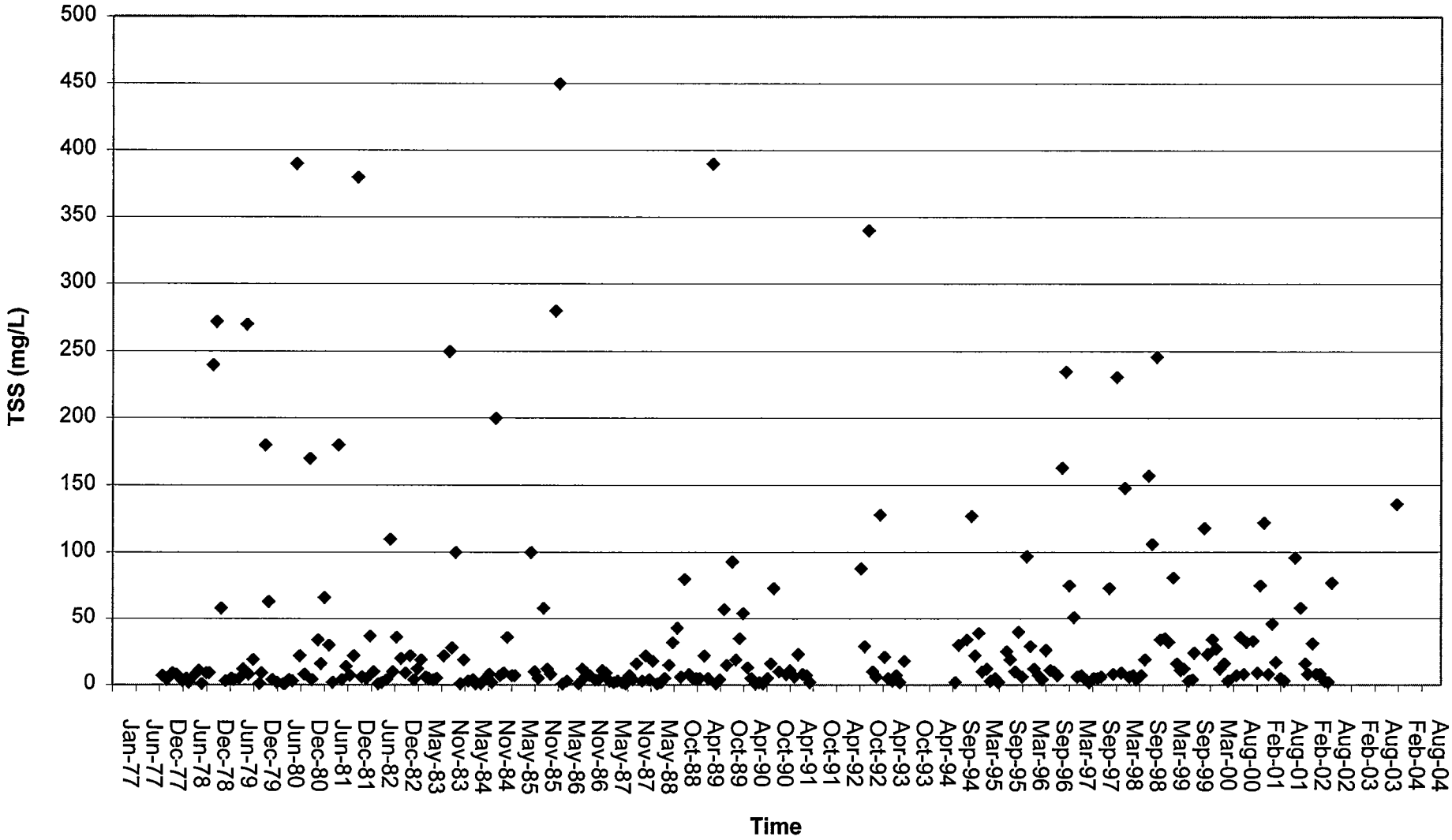

FIGURE **5**

SF STILLAQUAMISH AT ARLINGTON

WSDOE, STATION No. 05A090 (LIMITED TO <500mg/L MEASURED TSS)

NWP/STREAM SEDIMENT INVESTIGATION/WA

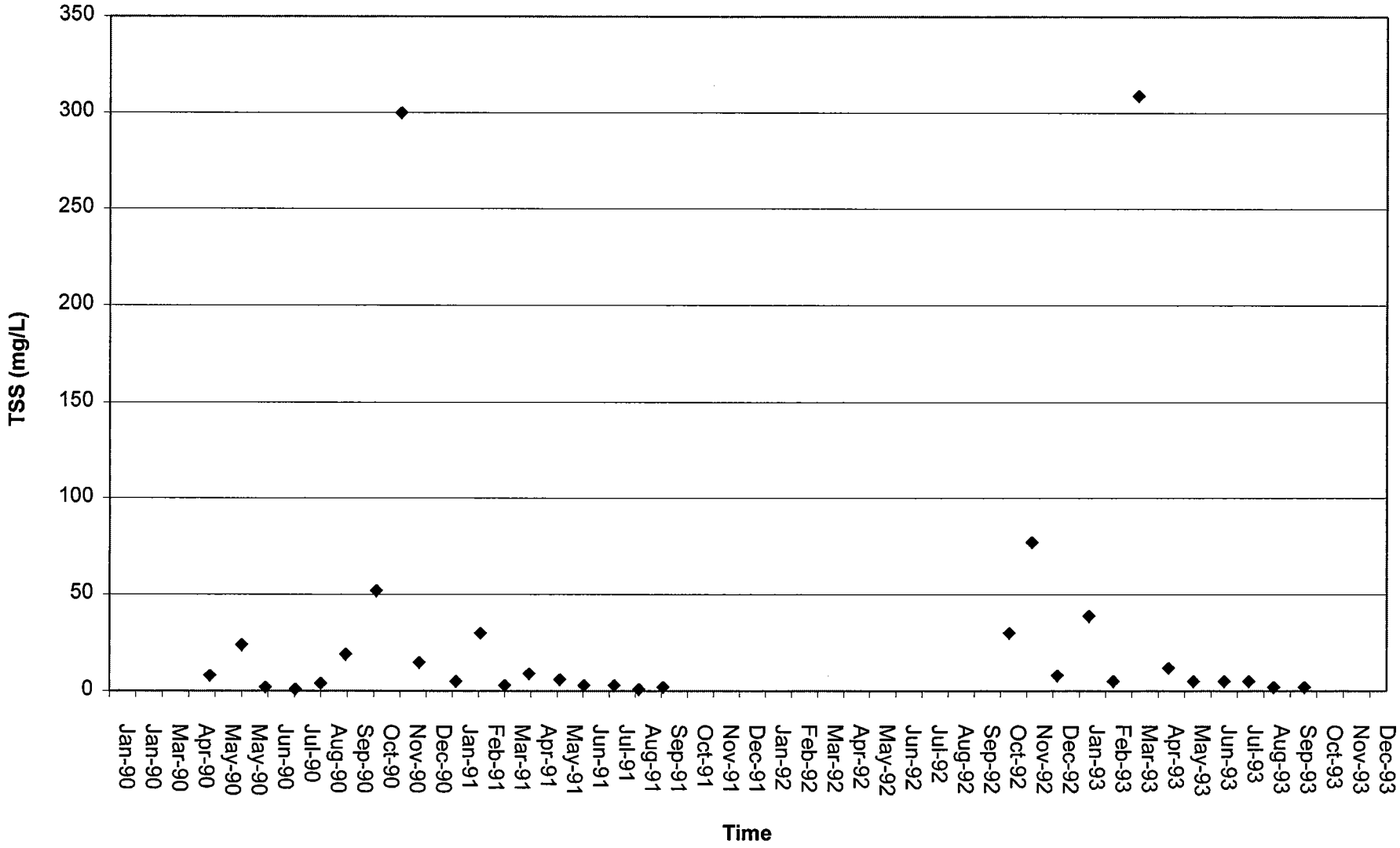

FIGURE **6**

NISQUALLY RIVER AT MCKENNA
WSDOE, STATION No. 011A080
NWP/STREAM SEDIMENT INVESTIGATION/WA

0431116007000fg07.fh11 | Mod: 04/18/05 | EL

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