Engineering Design Report – Levee Zone Interim Action for Cleanup

BNSF Former Maintenance and Fueling Facility
Skykomish, Washington

Prepared by:

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RETEC Project Number: BN050-16423-520

Prepared for:

BNSF Railway Company
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May 3, 2006

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May 3, 2006

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1 Introduction

This document presents the *Engineering Design Report – Levee Zone Interim Action for Cleanup* (EDR) for the Levee Zone and part of the Northwest Developed Zone of the BNSF Railway Company's Former Maintenance and Fueling Facility located in Skykomish, Washington, prepared by The RETEC Group, Inc. (RETEC) for the BNSF Railway Company (BNSF). The EDR is one in a series of documents required under the Model Toxics Control Act (MTCA; Revised Code of Washington 70.105D; Washington Administration Code 173-340) cleanup process. The *Remedial Investigation* (RI) (RETEC, 1996) and the *Supplemental RI* (RETEC, 2002) presented the results of investigations of the nature and extent of contamination at the site. The Feasibility Studies (RETEC, 1999 and 2005) evaluated the extent of impacts and the feasibility of remedial alternatives for the site. BNSF completed the RI, Supplemental RI and the FS pursuant to Agreed Order No. DE 91TC-N213.

A site-wide Cleanup Action Plan (CAP) is being written by the Washington State Department of Ecology (Ecology) and that document will guide all remedial actions of the Former BNSF Railway Maintenance and Fueling Facility. BNSF submitted a Draft CAP Outline to Ecology on September 16, 2005, pursuant to Agreed Order No. DE 91TC-N213.

BNSF and Ecology initiated discussions early in 2005 regarding a mutually acceptable final cleanup action for Skykomish; these discussions are on-going. BNSF voluntarily began early design, access and permitting work so that remediation of the Levee Zone might proceed in 2006 as the initial phase of a final cleanup action that is acceptable to BNSF, Ecology and the community. This initial phase of work will be an Interim Action for Cleanup performed by BNSF at Ecology's direction pursuant to an Agreed Order. This work will take place in the Levee Zone and part of the Northwest Developed Zone of the Former BNSF Maintenance and Fueling Facility (referred to as the Project Area throughout this document). This document is BNSF's engineering design for final remedial actions at the levee and South Fork Skykomish River. These actions consist of temporary relocation of five residences, excavation of the levee, underlying soils and sediments along the south bank of the South Fork Skykomish River, reconstruction of the levee, and restoration of natural resources, private property and public infrastructure that are disturbed by the remedial action.

1.1 Site Background and History

The Former BNSF Maintenance and Fueling Facility (site) in the east King County town of Skykomish is owned and operated by BNSF. The location of Skykomish (Town) and the BNSF facility is shown on Figures C-1 and C-3. Historical activities since the facility opened in the late 1890s included refueling and maintaining locomotives and operating an electrical substation for electric engines. Some of these activities released contaminants to the surrounding environment. BNSF has accepted responsibility for cleaning this historical contamination at the site consistent with MTCA.

Bunker and diesel fuel were stored in above and underground storage tanks at the site until 1974, when BNSF discontinued most fuel handling activities at the Skykomish facility. The BNSF facility is currently used as a base of operations for track maintenance and snow removal crews.

Railroad Avenue separates BNSF property from the main commercial district of the Town. In early 1991, Ecology designated the Former BNSF Fueling and Maintenance Facility as a high priority cleanup site. Later that year, BNSF indicated a desire to initiate a Remedial Investigation/Feasibility Study (RI/FS) in accordance with MTCA. At that time, formal negotiations for Agreed Order No. DE 91TC-N213 were initiated. Negotiations were completed in mid-1993. Following a public comment period, the Agreed Order, which includes detailed work plans for the RI/FS process and early interim action for cleanup work, was signed by Ecology and BNSF. BNSF and Ecology signed a separate agreed order (No. DE 01TCPNR-2800) in 2001 for additional interim action for cleanup work near the South Fork Skykomish River and the levee west of Fifth Street. The work required by the 2001 order is now complete.

Portions of the commercial and residential zones including 13 historic buildings and the Skykomish Bridge are registered in the National Register of Historic Places. The levee remediation will involve moving one historic building—the Teacherage—located near West River Road to allow for the excavation and levee reconstruction. Portions of the school yard may be used as staging areas.

The levee itself was built by the U.S. Army Corps of Engineers (USACE) and is currently owned by the Town and maintained by King County. King County will continue to maintain the levee during and after levee remediation. The Town of Skykomish owns and will continue to own the levee and the land beneath the levee. BNSF and the Town are currently negotiating access. BNSF and/or Ecology will pursue access agreements with the property owners affected by this phase of cleanup. Washington State owns the sediments below the ordinary high water mark, defined as the annual high water mark of 922.0 ft NAVD88. The Department of Natural Resources manages the sediments for the state.

1.2 Existing Levee Conditions

This section describes the existing conditions in the project area including the existing levee, groundwater hydraulics, contamination, and barrier wall. The existing levee, forming the south bank of the South Fork Skykomish River, was designed by the USACE in 1951 (Drawing No. E-2-6-74). It consists of

6,900 cubic yards (cy) of embankment material (assumed to be sand and gravel) placed on existing ground and of 2,000 cy of armor rock (12-inch minus rock) placed as a 2-foot thick layer over the embankment material on a 2:1 slope.

1.2.1 Levee Topography

The top of the levee is at approximate elevation 930 feet (NAVD88). The levee is approximately 550 feet long and slopes down to the river with a 2:1 slope to a swale at elevation 916.5 feet. A bank-parallel river bar rises to about elevation 917 feet and is about 10 feet wide, before sloping into the river. A topographic survey was completed by Bush, Roed, & Hitchings, Inc. in May 2005. The resulting survey data are shown on Figure C-3.

1.2.2 Subsurface Soil Conditions

Lithologic information for the site is presented in the Supplemental RI report (RETEC, 2002). The primary soil units in Skykomish consist of at least 50 feet (corresponding to total depth of deep borings) of sand and gravelly sand with discontinuous silty and clayey lenses. The local lithology can be broken up into three distinct units within the shallow Quaternary deposits found underlying the site: (1) upper topsoil and fill (1 to 2 feet thick); (2) gravelly sand and sandy gravel (11 to 22 feet thick); and (3) lower silt (3 to 10.5 feet thick where encountered).

Subsurface soil lithology encountered during the installation of the barrier wall beneath West River Road and parallel to the levee are illustrated on the as-built drawing included in Appendix A. As shown on the as-built drawings, the subsurface soils in the barrier wall area consisted of mostly sand, gravel and cobbles, with scattered boulders and discontinuous silt deposits. The most significant silt deposit was encountered at a depth of approximately 6 feet below ground surface (bgs) between Station 1+20 and Station 2+50, shown in Figure 3-2 of Appendix A. This silt deposit corresponds to and is consistent with the product-free zone typically shown on the light nonaqueous phase liquid (LNAPL) plume maps for the site (for example, Figure 3-1 of the FS). Generally, boulders were present at deeper zones of the barrier wall trench. Free product was encountered at depths between 4 and 8 feet bgs between Station 2+20 and Station 5+10. Locations of the free product encountered during excavation appeared to be consistent with the recent 2005 and 2006 site data.

Subsurface conditions encountered during investigation of the levee and river bottom are illustrated on cross-sections A-A' (Figure 4-2) and B-B' (Figure 4-3) included in the *River and Levee Supplemental Site Investigation Report* (Appendix B).

Based on the USACE levee construction as-built drawings (USACE, 1951), the levee embankment was constructed on native soils. Fill materials were placed above the pre-existing ground surface where the elevations were lower than the design levee elevations. The fill materials are comprised of mostly sand and gravel. Pre-existing sewer and storm drain pipes were shown to extend through the embankment to the river side, although pre-trenching operations associated with the barrier wall demonstrated the existence of only two storm sewer lines penetrating through the levee.

1.2.3 Hydrology

The watershed of the South Fork Skykomish River above the Project Area is approximately 242 square miles. The river headwaters are on the western flanks of the Cascade Mountains of eastern King and Snohomish Counties. The river flow mostly results from rain in the fall and snowmelt in the winter and spring. The river stage (water level elevation) at the levee site is measured by a sonic gage mounted on the 5th Street Bridge (The John Glick Henry Memorial Bridge 2/115A). Stages are measured and recorded by the Snohomish County Department of Public Works – Surface Water Management. The period for the gage is from May 12, 1999 to the present. The correction from river stage to elevation is zero (0.0) feet on the river stage gage equals 914.2 feet NAVD88.

1.2.4 Hydraulics

The water stage at the 5th Street Bridge gage can be correlated with the flow in the South Fork of the Skykomish River at the levee by extrapolating flood study data. The flood study data (FEMA, 2001) include elevations and peak discharges for the 10-year, 50-year, 100-year, and 500-year flood levels. River peak discharge and flood stage are assumed to be directly related (see Appendix C).

1.2.5 Riverbed

The riverbed is composed of sand, gravel, and cobbles. Based on a visual inspection of the riverbed, the estimated median grain size (D50) is 2 inches (50 mm, 0.17 feet). The coarse, cohesionless nature of the riverbed material suggests that the riverbed should support in-river cofferdams (necessary for levee excavation) without significant settlement. The riverbed load is assumed to be subject to some transport during flood stages of the river and the distribution of the bed load is assumed to change seasonally in response to river flow.

The riverbed in front of the levee slopes from 917.11 feet (NAVD88) just downstream of the bridge to 915.64 feet at 550 feet downstream of the bridge. This is a slope of 0.0028 (1.47 feet/530 feet = 0.28 ft/100 ft = 0.16º).

Localized scour may occur in the riverbed due to flood flows and a cofferdam restricting the river cross-section. Calculations indicate that during flood flows in excess of 12,000 cfs the local scour is on the order of 2 feet (see Appendix D).

Sediments are defined at this site as the solids which directly underlie the area beneath and waterward of the ordinary high water mark (OHWM). The OHWM was estimated based on the average annual mean high water mark (MHW) based on historic river gauge and flow measurements. The MHW has been identified as 922 feet in elevation, but which remains somewhat dependent upon the elevation measurement location. Generally, the MHW at the eastern end of the levee is approximately 926 feet in elevation, and the MHW at the western end of the levee is approximately 921 feet in elevation.

1.2.6 Contamination

The contamination in the levee area consists of free petroleum product (LNAPL). The free product acts as sources for both soil and sediment contamination and dissolved hydrocarbons in groundwater. Free product is also seeping into the South Fork Skykomish River adjacent to the upland plumes.

BNSF's remedial approach for the levee involves excavating portions of the levee and upgradient areas to remove free product and contaminated soil and, excavating surface and subsurface sediment along and within the South Fork Skykomish River at the base of the levee. The need for further groundwater treatment (i.e., air sparging) will depend on the scope, nature and timing of additional upland remediation activities.

1.2.7 Habitat

The current shoreline along the levee provides low velocity, seasonal aquatic edge habitat for juvenile salmon. The shoreline habitat along the base of the existing levee provides edges of large armor rock and cobble substrate of approximately 1-2 feet in height. This habitat is seasonally available when river flows are above approximately 2,500 cfs, typically from November through January, and again from May through July.

This shoreline edge habitat offers rearing and refuge habitat to juvenile salmonids. The larger armor rock and boulders also reduce flow velocities near the bank by creating eddies where water flows around these larger substrates. Low-velocity areas are also present within the interstices of the larger boulders and armor rock.

Overhanging vegetation present throughout the Project Area provides some cover for juvenile salmonids and provides shade that contributes to decreased water temperatures. It also offers foraging opportunities when insects fall from the vegetation. Overhanging vegetation in this area typically consists of young willow (*Salix* spp.) and pacific ninebark (*Physocarpus capitatus*), with young red alder (*Alnus rubra*) and black cottonwood (*Populus balsamifera*) present.

Salmonid species found in the Project Area include chinook, coho, pink, and chum salmon, and steelhead and bull trout (Pentec, 1999). Suitable spawning habitat for salmonids does not exist within the Project Area; however, river sockeye salmon were recently identified to be spawning within the Project Area. In addition, several species of juvenile salmonids utilize the Project Area for migration, rearing, and refuge habitat. Several of these species would be expected to utilize the shoreline edge of the Project Area for rearing habitat.

Outmigrating coho and bull trout juveniles could also be expected to use this habitat, although their use is limited in extent given these species typically rear for one year or more in upstream areas before emigrating. Data on bull trout use of the Project Area is limited. Data on juvenile chinook use of South Fork habitats above Sunset Falls is also scarce; however, use of Project Area habitat for rearing is likely for chinook juveniles from Beckel, Foss, and Tye Rivers (Pentec, 1999). Additional information on fish species present in the South Fork Skykomish River is included in the Draft Final Environmental Impact Statement (EIS) (RETEC, 2003) and Skykomish Levee Remediation Project Biological Evaluation (BE) (Grette Associates, 2005).

The riparian zone along the levee is of low quality for other terrestrial species due to the extent of development close to the shoreline. Animals that may use the shoreline habitat include, but are not limited to, common crow, coyote, raccoon, and mink.

1.3 Upland Area

The site is located within the Skykomish River valley. The glaciofluvial sediments filling the valley consist mainly of poorly- to moderately-sorted sand, gravel, and cobbles. The base of the sediments is estimated to be located 200 to 250 feet bgs. The upper 50 feet of subsurface soils have been described in the subsurface soil conditions section above.

The aquifer at the site is unconfined to a depth of at least 47 feet bgs based on previous investigations. The hydraulic conductivities of aquifer materials at the site were determined via slug tests to range from 0.4 feet per day (1.42×10^{-4} cm/s) to 79 feet per day (2.79×10^{-2} cm/s) during the remedial site investigation (RI; RETEC, 1996). An average hydraulic conductivity of 50 feet per day has been used in previous groundwater modeling work performed for the site.

Groundwater occurs at a shallow depth beneath the site (generally 5 to 15 feet bgs). Groundwater elevations are the highest at the southeast corner of the site and decrease northwestward toward the Skykomish River, indicating groundwater flow is generally from the southeast to the northwest. Historic gauging data indicate the seasonal variation in groundwater elevation ranged from about 2.5 to 10.5 feet bgs in the area where the barrier wall was constructed.

Groundwater levels are generally higher during late fall, winter, and spring (November to April) and lower in the summer and early fall (June to early November). For a potentiometric surface map showing the groundwater gradient in April 1998 and a figure showing the groundwater gradient in September 1998, please see Figures 6-8 and 6-9 from the Supplemental Remedial Investigation (RETEC, 2002). These figures are representative of the typical seasonal high and low groundwater levels, respectively, at the site and are consistent with more recent gauging data.

1.3.1 Barrier Wall

A continuous subsurface barrier wall was constructed parallel to the South Fork Skykomish River in August 2001 as part of the interim action for cleanup to block free product from entering the river. The alignment of the barrier wall is shown on the as-built drawing in Appendix A. Several wing walls were added for protection against LNAPL flow around the downgradient (i.e., west) end of the wall and to enhance product recovery. The barrier wall was constructed using cement-bentonite (CB) slurry wall method. Based on the completion report (RETEC, 2002b), the barrier wall is 572 feet long, and extends approximately 15 feet bgs vertically from near the ground surface (above the water table) to below the seasonal low table. The barrier wall was constructed of materials that are compatible with, and capable of, withstanding long-term exposure to bunker C and diesel petroleum hydrocarbons present in the LNAPL plume. The average hydraulic conductivity of the barrier wall is 9.0×10^{-6} cm/sec. The wet density of the CB slurry ranged from 74 to 85 pounds per cubic foot (pcf), with an average density of approximately 80 pcf.

1.3.2 Utilities

Overhead power and telephone lines are present within the Project Area. These utilities will be relocated prior to the commencement of construction work by the utilities. The utilities within the proposed levee remediation area will be located by using public utility locating services (e.g., Washington Underground Utility Location Center at 1-800-424-5555) and private utility locating services to ensure that all utilities are addressed.

Based on the barrier wall completion report (RETEC, 2002b), during the barrier wall construction in August 2001, one water supply line and a previously damaged storm sewer pipe were located along West River Road corridor. The locations of the pipes are shown on the as-built drawing in

Appendix A. These pipes will be replaced as part of this interim action for cleanup.

1.4 Public Access

Public access to the levee is currently not provided. A dirt path is located immediately west of the 5th Street Bridge, but blackberry bushes and other vegetation covers much of the top (flat) portion of the levee restricting access. Also, signs are posted along W. River Road stating "*Oil discharge to river. Do not access.*" During cleanup work, public access will be controlled to prevent exposure to hazardous substances and minimize physical safety hazards. Additionally, five residences will be temporarily relocated to facilitate the excavation.

1.5 Overview of Interim Action for Cleanup

The Levee Zone Interim Action for Cleanup is one component of the overall, final cleanup action for the site. This interim action for cleanup is intended to be the final cleanup for the levee zone and will be consistent with Ecology's Cleanup Action Plan to be completed along with a Consent Decree in the fall of 2006. The interim action for cleanup will consist of excavating and replacing the flood control levee and underlying contaminated sand and gravel, excavating contaminated sediment and the underlying impacted sand and gravel adjacent to the levee and in the riverbed to the extent practical given the site conditions, and excavation of upland (Northwest Developed Zone) areas. The interim action for cleanup also includes restoration of the Levee Zone including replacement foundations and temporary septic systems for the temporarily relocated residences, a replacement stormwater sewer system, and replacement of the levee. The EDR is one of many documents being prepared to guide this work. Other documents that will guide the work include the contractor specifications and plans and the Technical Execution Plan that will be prepared by the contractor.

2 Regulatory Framework

2.1 MTCA Design Requirements

This remedial design is being implemented in accordance with the Washington Administration Code (WAC) 173-340-400 – Implementation of the Cleanup Action. This chapter is a part of WAC 173-340 also known as the MTCA Cleanup Regulations. Site-specific cleanup levels (CULs) and remediation levels (RLs) were developed by Ecology and are presented in the FS (RETEC, 2005a) and in Table 2-1. These criteria define the extent of remediation required to prevent public and ecological receptor exposure to impacted areas of the site.

Table 2-1 Remediation Levels and Cleanup Levels

Environmental Medium	Remediation Level	Cleanup Level
Soil	3,400 mg/kg NWTPH-Dx	22 mg/kg NWTPH-Dx and VPH/EPH
Groundwater	477 µg/L EPH/VPH and NWTPH-Dx beneath residential and commercial areas	208 µg/L NWTPH-Dx and VPH/EPH
Sediment	NA	Bioassay Pass/Fail or 40.9 mg/kg NWTPH-Dx and VPH/EPH
Surface Water	NA	208 µg/L NWTPH-Dx and VPH/EPH

NA – Not applicable

2.2 Applicable or Relevant and Appropriate Requirements

Other regulatory requirements include health and safety regulations, stormwater management, noise and odor control, waste characterization, hauling of excavated materials, zoning and land use, historic preservation, solid waste management, excavation, backfilling, grading, endangered species protection, air and water quality, and relocation of residents. These are described further in Sections 2.2.1 through 2.2.9.

2.2.1 Health and Safety Regulations

Health and safety regulations are specified in the Washington Administrative Code, Title 296—Department of Labor & Industries, Chapter 296-155WAC. This code specifies health and safety standards for responding to releases or substantial threats of releases of hazardous substances at hazardous waste sites. Occupational Safety and Health Administration (OSHA) specifies health and safety requirements for hazardous waste sites (29 CFR 1910.120).

All operating personnel and all operations will be subject to compliance with OSHA and Washington Industrial Safety and Health Act (WISHA) health and safety requirements. All personnel will be required to receive the necessary training and supervision, and follow the applicable health and safety protocols. Construction activities will be conducted within the guidelines established in a site-specific health and safety plan for this project.

Applicable health and safety regulations and publications include, but are not limited to, the following:

- OSHA, Title 29 CFR Part 1910, Occupational Safety and Health Standards, and Title 29 CFR Part 1926, Safety and Health Regulations for Construction
- National Fire Protection Association (NFPA), Flammable and Combustible Liquids Code, NFPA 30, most recent revision
- United States Environmental Protection Agency (USEPA), Standard Operating Safety Guidelines, July 1988
- United States Department of Health and Human Services (DHHS), "Manual of Analytical Methods," 3rd Edition, Volumes I and II, DHHS (National Institute for Occupational Safety and Health [NIOSH]) Publication 84-100
- American National Standards Institute (ANSI), Practices for Respiratory Protection, Z88.2, most recent version
- ANSI, Emergency Eyewash and Shower Equipment, Z358.1, most recent version
- ANSI, Protective Footwear Z41.1, most recent version
- ANSI, Respirator Use Physical Qualification for Personnel, Z88.6, 1984
- ANSI, Practice for Occupational and Educational Eye and Face Protection, Z87.1, most recent version
- NIOSH/OSHA/United States Coast Guard (USCG)/USEPA, Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, DHHS/Public Health Services (PHS)/Centers for Disease Control (CDC)/NIOSH, October 1985
- NIOSH Pocket Guide to Chemical Hazards, DHHS/PHS/CDC/ NIOSH, June, 2000 or most recent

- USEPA, Health and Safety Requirements for Personnel Engaged in Field Activities, USEPA Order No. 1440.2

- Departments of Transportation (DOT) Standards and Regulations, 49 CFR 171 and 49 CFR 172

- American Conference of Governmental Industrial Hygienists (ACGIH), Threshold Limit Values and Biological Exposure Indices (most recent version)

- Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, USEPA/625/R-96/010b, January 1999

- Washington Department of Labor and Industries, WAC 296-155.

Where two or more regulations/documents conflict the one(s) offering the greatest degree of protection will be applied. The on-site contractor(s) will comply with any and all state and local ordinances and regulations. A site-specific Health and Safety Plan will be implemented.

Personnel involved in the construction of the project will be required to comply with the health and safety training requirements commensurate with the task(s) they are performing. Prior to initiating the construction work, the contractor(s) and subcontractor(s) will provide documentation of employee and applicable sub-subcontractor training and medical certifications required by 20 CFR 1910.120, or other regulations as appropriate for the specific tasks to be performed. Additionally, if a specific contractor will access BNSF property as part of their work, they must provide documentation that they have received BNSF Contractor Safety Orientation training available at the Internet Web site: http://contractororientation.com/new_site/default.asp.

2.2.2 Stormwater Management

Stormwater management must adhere to the substantive requirements of both the General Permit to Discharge Stormwater Associated with Construction and the General Stormwater Permit for Industrial Facilities. Both of the stormwater permits are National Pollution Discharge Elimination System Permits and are incorporated into the Individual National Pollution Discharge Elimination System (NPDES) Permit that dictates discharges from the construction water treatment system. As part of the requirements for the Construction NPDES permit, a Stormwater Pollution Prevention Plan will be prepared that includes Best Management Practices (BMPs) for managing stormwater during remedial activities. These BMPs are outlined in the Stormwater Management Manual for Western Washington (Ecology, 2005). A site-specific Operations and Monitoring Plan for the temporary water treatment system will be prepared 30 days from the date the NPDES is issued.

2.2.3 Noise Control

The Washington Noise Control Act (RCW 70.107; WAC 173-60) provides maximum permissible decibel (dB) levels for all site activities, construction equipment and portable powered equipment in temporary locations. Site activities will comply with these regulations and the Town's Noise Ordinance (347).

2.2.4 Waste Characterization

Waste generated during remediation will be characterized as dangerous (hazardous) or non-hazardous in accordance with WAC 173-303. Based on the historical data for the site, it is anticipated that excavated materials will be classified as non-hazardous.

2.2.5 Hauling of Excavated Soils

The Revised Code of Washington (RCW) Title 46, Motor Vehicles, governs the transportation of non-hazardous soils. Transportation of dangerous waste from the site will comply with the RCW 46 code and the requirements of WAC 173-303-240 through WAC 173-303-270. WAC 173-303-240 lists the requirements for transporters, while the other sections detail the requirements for the actual transport and record keeping. The transporter will have a current EPA/State identification number and abide by these codes.

WAC 173-303-190 provides the requirements necessary for preparing dangerous waste for transport. These requirements include specifics for packaging, labeling, marking and placarding.

2.2.6 Solid Waste Management

Requirements for solid waste management are applicable to the non-hazardous waste generated during remedial activities that is to be disposed of off-site. WAC 173-350 outlines the requirements that will be followed for the proper handling of all solid waste materials. A Solid Waste Management Plan is being developed in accordance with the NPDES Permit.

2.2.7 Air Quality

The Puget Sound Clean Air Agency (PSCAA) and Ecology (WAC 173-460) provide air emissions criteria for the site. Measures will be provided to suppress any fugitive dust generated during site excavation and grading that exceeds these criteria. Reasonable measures as outlined in PSCAA Regulation I Section 9.15 include:

- The use of control equipment, enclosures, and wet (or chemical) suppression techniques, as practical, and curtailment during high winds

- Surfacing roadways and parking areas with asphalt, concrete, or gravel

- Treating temporary, low-traffic areas (e.g., construction sites) with water or chemical stabilizers, reducing vehicle speeds, constructing pavement or riprap exit aprons, and cleaning vehicle under-carriages before they exit to prevent the track-out of mud or dirt onto paved public roadways

- Covering or wetting truck loads or allowing adequate freeboard to prevent the escape of dust-bearing materials.

The Site-Specific Health and Safety Plan and air monitoring plan will evaluate acceptable levels of particulates and organic vapors in the air that are protective of site workers and adjacent residents during remediation efforts based on organics and metal concentrations found in site soils and the potential for this material to become airborne. The air monitoring plan will include perimeter air monitoring protocols and action levels.

2.2.8 Oil and Hazardous Substance Releases to Surface Water

Section 311 of the Clean Water Act addresses pollution from oil and hazardous substance releases, providing EPA and the U.S. Coast Guard with the authority to establish a program for preventing, preparing for, and responding to oil spills that occur in waters of the United States. RCW 90.56 outlines plans, standards, and penalties associated with oil and hazardous substance spill prevention and response. All work will comply with these federal and state regulations. A Spill Response contractor will be on-call for the duration of the remedial action. The Spill Response Contractor will be responsible for developing the spill response plan for the interim action for cleanup. Additionally, the general contractor will be required to keep a minimum amount of spill response materials such as absorbent booms and pads on-site for immediate deployment in the event of a release to the South Fork Skykomish River. The general contractor will not have the capabilities to fully respond to a significant spill in the South Fork Skykomish River but will be able to respond immediately to a small release.

2.2.9 Guidelines for Temporary Relocation of Residents

EnviroIssues (acting for BNSF) and Ecology have developed guidelines for the temporary relocation of residents from the Project Area and are referenced in the Agreed Order Exhibit D. These guidelines were drawn from Federal and State laws applicable to the relocation of residents and include:

- Provide adequate and timely notification to temporarily relocated residents.
- Identify and provide comparable temporary housing for affected residents for the duration of the project.
- Reimburse eligible affected residents of reasonable out-of-pocket expenses incurred in connection with the temporary relocation, including the cost of moving to and from the temporary housing, the monthly rent and utility costs of the temporary housing, and storage of residents' personal property for the duration of the project.
- Provide temporary relocation of residential dwellings as outlined in the project plan. Determine appropriate and agreeable options for returning residential dwellings to real estate property. This will include documentation of original conditions and specifying what can be salvaged or replaced in kind.
- Provide regular communications to temporarily displaced residents. Develop a process for reporting and addressing complaints and concerns including meetings with affected home owners as needed.
- Payment for eligible claims will be made as soon as possible following a move or receipt of documentation to support the claim. Advance payments will be considered for residents who demonstrate a need.

These guidelines will be implemented throughout the cleanup.

2.2.10 Historical and Archeological Cultural Resources

Northwest Archeological Associates, Incorporated (NWAA) completed a cultural resource assessment for the site. In the cultural resource assessment, NWAA identified areas where there is a potential for historical and archeological cultural resources to be encountered. During ground disturbing activities in these areas, an archeologist will be on-site. NWAA is currently developing a Cultural Resources Monitoring and Discovery plan that will be implemented prior to and during the cleanup.

2.3 Permitting

Certain federal permits are required for the levee remediation (levee remediation permits). All proposed work will be conducted at Ecology's direction under a MTCA Order. In accordance with Ecology Policy 130B

(Permit Exemptions for Remedial Actions under MTCA, February 17, 1995), and MTCA (RCW 70.105D.090), work conducted pursuant to a MTCA order is exempt from the procedural requirements of state and local permits, including chapters 70.94, 70.95, 70.105, 75.20 (Hydraulic Permit), and 90.58 (Shorelands) RCW. Chapter 90.48 (Water Quality) will not be exempted by Ecology due to the potential of significant water quality impacts. Ecology and BNSF must ensure that all local and state substantive requirements are addressed during remedial design, in lieu of obtaining local and state permits that are normally required.

For the levee remediation, federal permits will be required from the following agencies:

- USACE for a 404 Permit (Section 404 of the Clean Water Act), either individual or Nationwide 38 permit. The USACE will initiate consultation with the National Marine Fisheries Service (NMFS) and the United States Fish and Wildlife Service (USFWS), with respect to federally-listed threatened or endangered species or designated critical habitat prior to issuing a 404 Permit (Section 7 of the Endangered Species Act).

- Ecology (as the delegated federal authority) for a 401 Water Quality Certification (Section 401 of the Clean Water Act), unless the work is authorized under a nationwide 38 permit.

- Ecology (as the delegated federal authority) for National Pollution Discharge Elimination System (NPDES) permits (Section 402 of the Clean Water Act).

A Joint Aquatic Resource Permit Application (JARPA) was submitted by BNSF to the Corps and Ecology as well as the appropriate state and local agencies. The application was submitted to the state and local agencies to assist those agencies in identifying applicable substantive requirements for Ecology and BNSF.

2.3.1 Federal Permits

Section 404 Permit

Activities requiring Section 404 permits include placing a structure, excavating (including land clearing), or discharging dredged or fill material in waters of the United States, including wetlands. This permit will be required because dredging (excavation) is planned for material waterward of the ordinary high water mark in the South Fork Skykomish River. The ordinary high water mark at this site is based on a vegetation survey.

The Section 404 permit may either be an individual permit or a Nationwide 38 permit, which is a permit designed for cleanup of hazardous and toxic waste. Generally, permitting times for Nationwide 38 permits are reduced.

Endangered Species Act Section 7 Compliance

Section 7 of the Endangered Species Act (ESA) outlines the procedures for federal agencies (such as the USACE, called Action Agencies) to cooperate in order to conserve federally-listed threatened and endangered species (listed species) and designated critical habitats. ESA requires Action Agencies to consult or confer with the National Marine Fisheries Service (NMFS) and/or the US Fish and Wildlife Service (USFWS) (the Service Agencies) if a project requires federal approval or utilizes federal funding.

ESA Section 7 consultation applies to listed species and designated critical habitats. There are three types of consultations:

1) **Conferencing –** An informal process to determine listed species and a project's potential impact to that species.

2) **Informal Consultation –** A more formal process whereby NMFS and USFWS determine whether there may be impacts to listed species. A determination of no effect may occur and terminate the process. If there is a determination of an effect, then the process goes to the third type of consultation.

3) **Formal Consultation –** Under this consultation NMFS and the USFWS must issue a biological opinion in which the listed species are either in or not in jeopardy from the project. If there is a determination of jeopardy, then there will be a series of requirements in order to obtain an Incidental Take Permit (take permit).

The Biological Evaluation (BE) concluded that the project will cause "no jeopardy" or "may affect, but is not likely to adversely affect" species that are listed under the ESA (Grette, 2005). It also found that critical habitat for ESA listed species will experience "no destruction or adverse modification." Therefore, based on the findings in the BE, the project will be reviewed by the Service Agencies as an Informal Consultation.

NPDES Permit

National Pollution Discharge Elimination System (NPDES) permits regulate the discharge of pollutants into the state's surface waters. Ecology issues these permits under authority delegated by the U.S. Environmental Protection Agency (EPA). This permit is typically issued to a commercial or industrial facility, or municipality for discharge of any pollutant to surface waters. This remedial action will require discharge of treated wastewater into the South

Fork Skykomish River. Therefore, an Individual NPDES permit will be required for the project. In addition, other NPDES permits covered by the individual permit described above include a general stormwater construction permit and a general industrial stormwater permit.

General construction stormwater permits are required for all construction activities (including grading) on sites one acre or larger and when there is a discharge of stormwater to a surface water (e.g., wetlands, creeks, rivers, marine waters, ditches, estuaries) and/or storm drains that discharge to a surface water. Ecology issued the final general permit for 1- to 5-acre construction sites on November 16, 2005. The permit is subject to public notice and SEPA requirements must be met. The applicant must also complete a Stormwater Pollution Prevention Plan (SWPPP) prior to starting construction.

However, a general construction stormwater permit is not required for stormwater from any site that is covered under an NPDES individual permit in which stormwater management and/or treatment requirements are included for all stormwater discharges associated with construction activity.

Similarly, for general industrial stormwater permits, any facility authorized to discharge stormwater under an existing NPDES individual or other general permit is excluded from the requirements of a general industrial stormwater permit. General industrial stormwater permits cover discharge of stormwater to a surface waterbody or to a municipal storm sewer system for existing and new facilities. Ecology can require permit coverage of any facility on a case-by-case basis in order to protect waters of the state.

An NPDES application was submitted by BNSF to Ecology on October 3, 2005, along with a Draft Engineering Report on July 20, 2005 and an Addendum to the Engineering Report on November 9, 2005. A letter was received from Ecology dated January 4, 2006 stating that the application is complete. As mentioned above, Ecology intends to issue one NPDES permit, which will contain conditions for the general construction and general industrial stormwater permits.

401 Water Certification

Section 401 of the Clean Water Act specifies that water quality certifications are issued for projects that require Section 404 permits (described above), unless the Corps issues a Nationwide permit. The work is expected to be approved under a Nationwide 38 permit (Cleanup of Hazardous and Toxic Waste). By issuing a Nationwide 38 permit, the Corps is responsible for the water quality certificate and has a general set of criteria that applies. Ecology may impose additional site specific criteria required by Washington State, which may be added as an administrative order or other means.

If an individual Section 404 permit is required rather than a Nationwide 38 permit, issuance of a certification by Ecology means that Ecology anticipates that the applicant's project will comply with water quality standards and other aquatic resource protection requirements under Ecology's authority. The 401 Certification can cover both the construction and operation of the proposed project. Conditions of the 401 Certification become conditions of the Federal permit or license. Specific certification requirements may include a mixing zone with turbidity limits downstream from the Project Area, in addition to other criteria.

Ecology's Shoreline and Environmental Assistance Office within each regional office conducts the review of the 401 Water Certification application. Regional staff members review the applications for completeness and send out a letter or call if additional information is needed. Once the application is considered complete, the regional staff starts reviewing the project to recommend approval or denial. Modifications to plans submitted may be required. A site visit may also be required as part of the process.

401 Certification becomes part of the Federal permit or license. The duration of the 401 Certification would be in effect for the same time period as the permit or license, however Ecology issues 401 Certifications as 90.48 administrative orders, so they may have conditions that apply to the project longer than the Federal permit or license.

Individual 401 certification requires a minimum twenty days of public notice and may take up to one year to approve, condition, or deny. The process usually takes less than three months.

2.3.2 State Permits

Hydraulic Project Approval

Hydraulic Project Approval (HPA) is required from the State Department of Fish and Wildlife (DFW) for any work that uses, diverts, obstructs, or changes the natural flow or bed of any fresh water or saltwater of the state, except for cleanup projects conducted under MTCA by administrative order. As stated above, a HPA is not formally required because the cleanup is being performed under an order with Ecology; however, the project must meet the substantive requirements of the HPA.

A complete application package for an HPA must include a completed Joint Aquatic Resource Permit Application (JARPA) form, general plans for the overall project, and complete plans and specifications of the proposed work within the ordinary high water line in fresh waters of the state, complete plans and specifications for the protection of fish life, and notice of compliance with any applicable requirements of the State Environmental Policy Act (SEPA).

A determination of substantive requirements should be issued by DFW within 45 calendar days after the complete application is received. Processing of an application can be placed on hold if applicant cannot be reached, if project site is inaccessible, or the applicant requests it.

State Environmental Policy Act (SEPA)

The Washington State Environmental Policy Act (SEPA) provides a way to identify and mitigate probable environmental impacts that may result from governmental decisions. These decisions may be related to issuing permits for private projects, constructing public facilities, or adopting regulations, policies or plans. Information provided during the SEPA review process helps agency decision-makers, applicants, and the public understand how a proposal will affect the environment. This information can be used to change a proposal to reduce likely impacts, or to condition or deny a proposal when adverse environmental impacts are identified.

For this project, Ecology is the lead agency responsible for issuing all SEPA determinations. The SEPA review process is a tool to help agencies identify and evaluate the likely environmental consequences of a proposal. The elements of the environment evaluated include the natural environment (earth, air, water, plants and animals, energy and natural resources) and the built environment (environmental health, land and shoreline use, transportation, public services and utilities).

The threshold determination process is the process used to evaluate the environmental consequences of a proposal and determine whether the proposal is likely to have any "significant adverse environmental impact." This determination is made by the lead agency and is documented in either a determination of nonsignificance (DNS), or a determination of significance (DS) and subsequent preparation of an environmental impact statement (EIS). As described below, a DS has been issued for this site.

Environmental Impact Statement (EIS)

Ecology issued a DS for the levee interim cleanup action in Skykomish in January 2006 stating that a focused EIS is required. An EIS has been prepared by Ecology. The document provides an impartial discussion of significant environmental impacts, reasonable alternatives, and mitigation measures that would avoid or minimize significant adverse impacts that the proposed levee interim action for cleanup is likely to have on the natural and built environment. The EIS was presented along with the Draft EDR and other documents needed for the cleanup work for formal public comment in March 2006. The final EIS was issued on April 27, 2006.

2.3.3 Town of Skykomish Permits

Shoreline Development

A Shoreline Substantial Development Permit is a written permit issued by local government for development on shorelines, as required under the state Shoreline Management Act. Many types of development are exempt from this permit requirement. After completion of the local process the permits are sent to Ecology for filing but Ecology does not have authority to approve or deny them when the permits are consistent with an existing shoreline management plan that has been previously approved by Ecology. Because this work is under a MTCA Order, no formal permit is required, but the substantive requirements of the Town's shoreline management plan must be met. The Town will also review the proposed work, determine whether the work complies with the substantive requirements of its shoreline program and regulations, and recommend mitigation measures to Ecology based on the Town's existing substantive requirements in its shoreline program. Ecology will determine whether the proposed work complies with the substantive requirements of the Town's shoreline program.

Land Use and Zoning

Each local government has land use and zoning regulations that govern construction, excavation and demolition activities within its jurisdiction. Because this work will be subject to an agreed order with Ecology, no formal zoning or land use permits are required, but the substantive land use and zoning requirements of the Town of Skykomish must be met. The Town will also review the proposed work, determine whether the work complies with the substantive requirements of its land use and zoning ordinances, and recommend mitigation measures to Ecology based on the Town's existing substantive requirements in its land use and zoning ordinances. Ecology will determine whether the proposed work complies with the substantive requirements of these ordinances.

Floodplain Management

Local governments participating in the National Flood Insurance Program (NFIP) administered by the Federal Emergency Management Agency (FEMA) are required to review proposed development projects to determine if they are in identified floodplains as shown on the FEMA maps. If a project is located in a mapped 100-year floodplain (A or V zone), the local government must require that a permit be obtained prior to development. Again, because this work is under an agreed order with Ecology, no formal permit is required, but the substantive requirements of the permit must be met.

Proposed projects are reviewed and conditions imposed on any permits issued to reduce the potential for damage from floodwater. Permits are required for any development as well as for filling or grading activities in the floodplain.

Permit processing time varies by jurisdiction and project complexity. Though a public hearing is not normally required, there are exceptions. State law requires that local entities have a local floodplain ordinance that meets or exceeds NFIP requirements.

The Project Area lies within the 100-year floodplain based on the FEMA Flood Insurance Map for the Town (FEMA, 2001).

Critical Area Ordinance

The Town of Skykomish developed the Critical Area Ordinance (CAO) to designate and classify environmentally sensitive and hazardous areas and to protect these areas and their values. Critical areas protected in the ordinance include wetlands, geologically hazardous areas, aquifer recharge areas, fish and wildlife habitats, and flood hazard areas. The ordinance limits development and alteration of the critical areas. The CAO is a requirement of local governments under the state Growth Management Act (GMA) to protect critical area lands. The Town will review the proposed work, determine whether it will adversely affect critical areas as outlined in the CAO, and recommend mitigation measures to Ecology based on the Town's existing substantive requirements in its CAO. Ecology will determine whether the proposed work complies with the substantive requirements of the CAO and other local land use and development standards.

Clearing and Grading

Under the Town of Skykomish Ordinance Number 267, property owners need to obtain a Clearing and Grading Permit before doing any work in a drainage course, wetlands, environmentally sensitive areas, areas of special flood hazard, or archeological sites.

The backfill placed in the excavated areas will be compacted to a minimum density specified in the Uniform Building Code version most recently adopted by the Town. The Town will also review the proposed work and recommend mitigation measures to Ecology based on the Town's existing substantive requirements in Ord No. 267. Ecology will determine whether the proposed work complies with the substantive requirements of Ord. No. 267.

2.3.4 King County

Special Use Permit

King County owns the current flood control levee, although the Town owns the land underlying the levee. For the use of property in which King County has an ownership interest a Special Use Permit is required. The Special Use Permit is submitted in the form of a letter; there may be fees required for the processing, administration, land use, inspection, and plan review associated with the permit request. Additionally, there may be a requirement to add King

County as an additional insured party on the project insurance policy and/or bonding requirements to reduce King County exposure to liability and damage.

Sewer System Permitting

Title 13 of the Code of the King County Board of Health, known as the "On-Site Sewage Code," governs the design, construction, use, maintenance and repair of on-site sewage systems throughout King County. These systems are commonly known as septic tank systems. As part of the displacement of residences, existing septic systems will be demolished. Replacement of these septic systems will be performed after excavation is completed in conjunction with restoration of home sites. Septic system replacement must comply with the substantive requirements stipulated in an on-site sewer system construction permit. Since replacement of septic systems in fill material (i.e., backfill material used to fill excavations) is not typically allowed by Title 13, BNSF anticipates that an informational permit application will be rejected as not meeting substantive requirements. Based on meetings with the King County Health Department, BNSF would then submit an Application for Reconsideration of Decision/Order to the King County Sewage Review Committee. An application will need to be completed for each residence and signed by property owners. It is expected that King County will allow septic systems to be constructed in engineered fill on a temporary basis pending implementation of a community-wide septic management plan.

2.3.5 Native Sovereign Nations

The Draft EIS scoping were circulated to the Tulalip, Stillaguamish, and Snoqualmie tribes in order to determine if any of these Tribes would be adversely affected. None of these tribes provided comments on the DS, Draft EIS scoping, Draft EIS, and draft EDR. NOAA-Fisheries and the USFWS also reportedly consulted with these tribes during the ESA process.

3 Design Criteria

The approval of the design criteria for the reconstructed levee and restored home sites and public rights-of-way will be three-fold:

1) The river face of the levee will meet with existing substantive standards for habitat and resource restoration of Ecology, the Town, DFW, NOAA-Fisheries, USFWS, and USACE

2) The levee interior will meet the existing substantive standards of King County, USACE, and the Town for flood control and public safety

3) The levee crest, back-slope, home sites and public rights-of-way will meet the existing substantive standards of the Town for land use, zoning and building codes.

The criteria are detailed below. The design of the levee itself is simplified by the fact that the existing levee will be replaced in-kind by using the current configuration as a guide during replacement. However, the new levee will include aquatic habitat features and improvements on the river face and recreational/aesthetic features and improvements on the crest and back-slope.

3.1 Design Requirements

This section outlines the codes, standards and guidelines applicable to the design of the new levee and the restoration of home sites and public rights-of-way.

3.1.1 Codes

The Town of Skykomish Building Code is to be used and is found in Title 15 of the Skykomish Municipal Code adopted under Ordinance 360. This document is primarily for buildings, but details fences and other appurtenances may be relevant to the levee design. “Design Guidelines for Skykomish, WA,” sponsored by the Town of Skykomish Design Review Board, was written with a grant from the King County Landmarks and Heritage Commission 1995 King County Arts and Heritage Initiative, December 1996. These guidelines were adopted under Ordinances 259, 351, and 234 and should also be used.

The Standards for the Treatment of Historic Properties issued by the Secretary of the U.S. Department of the Interior are relevant and appropriate because 13 historic buildings and the Skykomish Bridge have been designated a cultural resource worthy of preservation by the National Register of Historic Places, and some of the residences subject to temporary relocation are designated historic buildings.

3.1.2 Standards and Guidelines

Guidelines for levee design and/or restoration can be found in federal, state, and county publications. The publications to be consulted on this project are listed below.

Federal design guidelines for levees and for excavation shoring can be found in:

- **Design and Construction of Levees.** U.S. Army Corps of Engineers, Engineer Manual EM 1110-2-1913, 30 April 2000
- **Retaining and Flood Walls.** U.S. Army Corps of Engineers, Engineer Manual EM 1110-2-2502, 29 September 1989
- **Gravity Dam Design.** U.S. Army Corps of Engineers, Engineer Manual EM 1110-2-2200, 30 June 1995.

State design guidelines for levees and streambanks can be found in:

- **Integrated Streambank Protection Guidelines.** Washington State Aquatics Habitat Guidelines Program, 2003
- **California Bank and Shore Rock Slope Protection Design.** State of California Department of Transportation, Engineering Service Center, Final Report No. FHWA-CA-TL-95-10, Caltrans Study No. F90TL03, October 2000.

County design standards and guidelines for levees and roads can be found in:

- **Guidelines for Bank Stabilization Projects in the Riverine Environments of King County.** King County Department of Public Works, Surface Water Management Division, Seattle, Washington, June 1993.
- **King County Road Standards 1993.** King County Department of Transportation, Road Services Division, King County, Washington, 1993.

Other guidelines, plans and recommendations will be referenced as they are used or quoted.

3.2 South Fork Skykomish River

The South Fork Skykomish River forms in the Cascade Mountains and flows westward. Near Monroe, it joins with the Snoqualmie River, becomes the Snohomish River and empties into Puget Sound at Everett.

3.2.1 River Levels during Construction Months

Anticipated river levels during construction were used to determine the cofferdam design and to assess the dewatering needs. Construction below the ordinary high water mark will be limited to the "fish window" from July 1st to August 31st but may be as late as September 15th, based on the final decision of the Department of Fish and Wildlife regarding fish window start and end dates. The maximum water level in the river during the fish window is needed to select the design height of the top of the cofferdam. The minimum water level is provided for reference.

An evaluation of river stage and discharge is included in Appendix C. River stages of the South Fork Skykomish River are measured by a sonic gauge on the 5th Street Bridge. Mean monthly stage statistics are available for the years 2000 through 2004, for a total of five years, as shown in Table 3-1. To determine whether these stages are representative of the typical range of river stages, the data were compared to the mean monthly discharges of the South Fork Skykomish River at Gold Bar, for which data was available for the years 1929 through 2004, for a total of 76 years. Based on the evaluation presented in Appendix C, the years 2001 and 2003 represent "dry" years fairly consistently (i.e., low river stage). The years 2000 and 2002 represent fairly "wet" years (i.e., high river stage) for June and July, and the years 2000 and 2004 represent "wet" years for August and September. To be conservative, the maximum stage statistics for the year 2000 will be used to guide design of the cofferdam height. If maximum stage statistics for the year 2000 are exceeded, the adequacy of the cofferdam height and procedures for construction will be evaluated to assess whether changes need to be made to proceed safely with construction.

Table 3-1 Mean Monthly Stages of the South Fork of the Skykomish River at the 5th Street Bridge

Year and Month	Minimum (ft)	Mean (ft)	Maximum (ft)
2000 June	5.8	6.6	8.2
2001 June	4.7	5.2	6.0
2002 June	5.9	7.2	8.7
2003 June	4.4	5.4	6.8
2004 June	4.4	5.4	6.4
2000 July	4.2	4.9	6.0
2001 July	3.6	4.1	4.9
2002 July	4.2	5.5	6.7
2003 July	3.2	4.0	4.8
2004 July	3.4	4.0	4.7

Year and Month	Minimum (ft)	Mean (ft)	Maximum (ft)
2000 August	3.2	3.8	4.4
2001 August	3.2	3.5	3.9
2002 August	3.3	3.9	4.6
2003 August	2.9	3.3	3.6
2004 August	3.2	3.8	5.9
2000 September	2.9	3.7	7.6
2001 September	2.7	3.2	3.5
2002 September	2.9	3.4	3.9
2003 September	2.7	3.2	3.8
2004 September	3.5	4.6	7.0

3.2.2 Flooding Events

The water stage at the 5th Street Bridge gage can be correlated with the flow in the South Fork Skykomish River at the levee by extrapolating flood study data. The flood study data (FEMA, 2001) include elevations and peak discharges for the 10-year, 50-year, 100-year, and 500-year flood levels. River peak discharge and flood stage are assumed to be directly related. Correlation of river elevation and peak discharge for three sections along the river in front of the levee are given in Table 3-2. Table 3-2 also shows the river stage at the gage on the bridge. Flooding in the South Fork Skykomish River typically occurs October through June, not during the anticipated construction period of July through September.

Table 3-2 Flood Frequency Elevations and Discharges at the Town of Skykomish

Location	Flood Frequency	Elevation, ft NGVD29*	Elevation, ft NAVD88	Peak Discharge, cfs	River Stage, Gage ft
At 5th Street Bridge	1-yr**	921.9	926.0	20,500	11.8
	2-yr**	922.6	926.6	24,000	12.4
	5-yr**	923.5	927.6	30,000	13.4
	10-yr	924.1	928.2	32,200	14.0
	50-yr	925.7	929.8	47,400	15.6
	100-yr	926.3	930.4	54,300	16.2
320 Ft Downstream of Bridge	1-yr**	920.2	924.2	20,500	N/A
	2-yr**	921.0	925.0	24,000	N/A
	5-yr**	922.0	926.0	30,000	N/A
	10-yr	922.8	926.8	32,200	N/A
	50-yr	924.6	928.6	47,400	N/A
	100-yr	925.4	929.4	54,300	N/A

Location	Flood Frequency	Elevation, ft NGVD29*	Elevation, ft NAVD88	Peak Discharge, cfs	River Stage, Gage ft
650 Ft Downstream of Bridge	1-yr**	918.5	922.6	20,500	N/A
	2-yr**	919.5	923.6	24,000	N/A
	5-yr**	920.8	924.8	30,000	N/A
	10-yr	921.8	925.8	32,200	N/A
	50-yr	924.2	928.4	47,400	N/A
	100-yr	925.2	929.2	54,300	N/A

* Per FEMA Flood Study, 2001.

** Extrapolated, based on semi-log plot of 10-yr., 50-yr., and 100-yr. for elevations and log-log plot for discharges.

There is a possibility that the river will be at such a high stage at the anticipated start of construction that it will make construction impossible given the amount of work that needs to occur within the short fish window. Should the river stage be unseasonably high on June 1st, discussions with Ecology will be held to determine how best to complete the in-river work as outlined in Section 4.3 below.

3.2.3 Fish

Measures that are intended to reduce the potential for short-term effects on fish from in-water construction activities and long-term effects from habitat change will be incorporated into the design. These provisions include timing of construction and temporary exclusion from the work area to avoid direct effects to fish, implementation of construction best management practices (BMPs), and restoration of the area following construction.

The following conservation measures will be implemented in order to reduce the effects on fish during and following construction:

Fish Window

Work below the ordinary high-water mark must occur between July 1 and September 15. Other timing restrictions that may be established by the Corps, NOAA Fisheries, USFWS, or WDFW would also be strictly observed.

BMPs

- Project construction will be completed in compliance with Washington water quality standards (WAC 173-201a).
- Corrective actions will be taken in the event of any discharge of oil, fuel, or chemicals into the South Fork Skykomish River.
- Ecology has requested that tertiary containment be used to isolate the excavation and construction work from the river. A primary temporary river exclusion wall (cofferdam) will be placed waterward of the proposed excavated prism. The cofferdam will

be placed within the south portion of the river channel, and will prevent water from entering the construction site in the event of high flows. The wall will also exclude migrating fish from entering the construction area. A second cofferdam will be located just beyond the primary cofferdam to provide secondary containment to ensure that soil, sediment and organic contaminants are not released to the river. Tertiary containment will consist of oil absorbent booms placed outside of the second cofferdam. Since a construction water treatment plant will be available on site as part of the project facilities, there will also be provisions for pumping of water as necessary (and as treatment capacity allows) in the event contaminants are released beyond the primary cofferdam. Additional contingencies could also include the placement of sorbent material between the two cofferdams.

- Booms and silt screens may be used as contingencies adjacent to the excavation area to prevent any oily sheen or suspended sediments from reaching surface waters during construction. These materials will be listed in the Spill Prevention and Emergency Cleanup Plan.

- BNSF and its contractors will be required to capture any debris associated with project construction and not allow it to enter the South Fork Skykomish River.

- Any contact water will be treated through a treatment train, as discussed in Section 4.4 and in the NPDES permit application and associated documents. Treated water will then be pumped back into the river channel downstream of the excavation prism at the outfall of the NPDES-permitted water treatment system.

Restoration Activities

- After completion of the excavation, sediment substrate of comparable type and gradation to existing materials will be replaced.

- Once the new levee is constructed, native vegetation will be replanted along the face. The newly planted vegetation will provide cover and foraging opportunities for migrating juvenile salmonids along the toe of the new levee. Additionally, the configuration of the toe of the levee will provide habitat complexity, which will include placement of large woody debris (LWD) and root wads. Large boulders will be placed upstream of the LWD for protection.

3.3 Shoring

The excavation shoring design will be completed by the contractor to federal and state standards and will be stamped by a contractor-selected licensed Washington state professional engineer prior to excavation. The shoring will consist of driven sheet piles with lagging or an alternate approved by the engineer.

The general concept of shoring is that it will be installed along the southern end of the excavation to facilitate continuation of the remedy to the south in future phases of the work. Shoring is also intended to be used on a contingency measure if excavation depths deeper than that shown on the plans cannot be accommodated by sloping.

3.4 Cofferdam

Five design options were analyzed for the cofferdam construction:

- Curtain
- Bladder
- Block/jersey barriers
- Flexible intermediate bulk containers
- Elongated bags.

The curtain cofferdam is an impervious fabric membrane supported by a free standing, welded, tubular steel framework support system (see http://www.portadam.com). The literature claims that this system can retain water up to 100 percent of its height up to 12 feet.

The bladder cofferdam is a water-inflated tube (see http://www.aquabarrier.com or http://www.wippsystem.com) that can be inflated up to a height of 8 feet. However, this type of structure is only capable of retaining water heights that are 75 percent of the tube height (i.e. an 8-foot high tube can retain a maximum of 6 feet of water).

The curtain and bladder are proprietary, temporary cofferdam designs with limited height. There are also instability issues for the bladder design should the river overtop the cofferdam during a freshet. These options are not recommended for use on the levee remediation project

Plastic jersey barriers filled with sand or water, and lock-blocks were also considered for the cofferdam. The jersey barriers are limited to a height of 4 feet, may be unstable if overtopped, and required inter-barrier gaps to be plugged. The lock-block wall is stable (see http://www.ultrablock.com) even when overtopped and is not height limited, but takes a relatively long time to assemble when compared to the other options.

Based on their past performance being used in cofferdam construction, the recommended options for this project are the flexible intermediate bulk containers (FIBC) and the elongated bags. Both of the FIBC cofferdams (see http://www.fibca.com) could be filled before July 1st with uncontaminated clean overburden excavated from the levee and placed in the river to divert the water around the excavation area. An impermeable liner will be wrapped around the cofferdams, as shown on Figure C-15. The liner will be below the cofferdams and on both the inside of the inner cofferdam and the outside of the outer cofferdam. Valuable construction time would be saved with the FIBCs filled and ready to be placed when the fish-window opens. Sand bags will be used to tie the cofferdams to the shore in order to prevent leakage or a breach. BNSF is continuing to evaluate options for placement of FIBCs on a level surface on the riverbed and limiting flows under the cofferdams.

Elongated bags, in particular the WALL™ by Hydrolevee, are trapezoidal bags made of polypropylene fabric with impermeable end skirts and impermeable liners. The bags, when filled, can be up to 12 feet x 10 feet x 2 feet x 26 feet (base width x height x top width x length). They would be placed using a mechanical frame from shore. Since the WALL™ has an impermeable liner, one does not need to be wrapped around the coffer dams.

3.5 Excavation

It is currently anticipated that the existing levee will be removed and excavated to the ground elevations indicated on Figures C-13 and C-14. Work will proceed from upstream to downstream. The excavation prism shown in these drawings is based on soil and sediment investigations conducted in the project area in September and December 2005. The objective of the investigation was to provide adequate data to define the lateral and vertical extent of excavation. Appendix B presents a report with the methodology and results of the investigation. This excavation prism was defined based on the borings along the levee and in the river, as well as previous data collected during remedial investigations at the site. Analytical data from the borings completed in the levee and in the river are provided in Appendix B. The technical memorandum also presents the data analysis that was used to define the excavation prism. The anticipated vertical extent of the excavation is based on the depth at which soil/sediment analytical results indicate TPH concentrations are below the remediation level of 3,400 ppm NWTPH-Dx for soil or the cleanup level of 40.9 ppm NWTPH-Dx for sediments.

Once the planned limits of excavation are achieved, samples will be taken to determine if the applicable remediation or cleanup level has been achieved. Excavations waterward of the OHWM will meet the sediment cleanup level of 40.9 ppm NWTPH-Dx or extend 10 feet below the bottom of the river, whichever is shallower. The uplands excavation 25 feet landward of the OHWM, must be as deep as the sediment excavation in elevation or meet the soil cleanup level of 22 ppm or the Practical Quantitation Limit as outlined in the Sampling and Analysis Plan (SAP [Appendix G]).

The anticipated maximum depth of the excavation is 19.5 feet bgs or an elevation of 905 feet (NAVD88). Contingencies are described below to allow for deeper excavation in isolated areas to elevation 895 feet (NAVD88) based on confirmation sampling results.

3.5.1 Excavation Prism

A "maximum extent excavation prism" was shown in engineering design drawings submitted with the JARPA on January 11, 2006 and calls for excavation to depths as great as elevation 895 feet (NAVD88). The anticipated excavation prism shown in Figures C-13 and C-14 is based largely on the December 2005 levee investigation results. The actual extent of excavation may increase beyond that shown in the JARPA or Figures C-13 and C-14 during construction based on: 1) on-site visual inspection, 2) confirmation (post-dredge) sampling analytical results, and 3) surface water inspection. Ecology will be present to make in-field decisions re: the extent of excavation.

Lateral and Vertical Extent of the Levee and River Excavation Prism

The eastern edge of the excavation prism at boring location LEV-9 will be extended as close as practical to the 5th Street Bridge (within the structural constraints of the bridge, or 40 feet west of the bridge) and the same depth as that of LEV-8 (approximately 910 feet NAVD88). It is anticipated that the eastern end of the excavation can be accommodated in a stable manner using slopes that are 2H:1V above the anticipated depth of groundwater, and 4H:1V below the water table. Driven sheet piles will be used if required by the excavation depth encountered in the field at the time of removal. This shoring design will be approved prior to the start of excavation.

The western extent of the excavation prism at boring location LEV-1 will extend to a depth of 907 feet NAVD88. However, an additional boring may be advanced west of LEV-1 in January 2006 that may impact the final design. The excavation depth at LEV-2, LEV-3 and LEV-4 will be 910, 910 and 905 feet NAVD88, respectively. As stated above, all excavation "extents" will also be subject to laboratory confirmation that the appropriate standards have been met. Field conditions may dictate the maximum extents of excavation as described below in Section 3.5.3.

Lateral and Vertical Extent in the Upland Portion

The lateral extent of the upland excavation needs to be sufficient to allow for a reasonable work zone. This work zone will include removal or demolition of five residences to provide adequate space.

Vertical excavation will need to be sufficient to meet the direct contact cleanup level (3,400 ppm TPH NWTPH-Dx, or the remediation level) in soil a minimum of 15 feet bgs, as well as meet the groundwater remediation levels. This may require excavation to elevation 908 NAVD88 where there is a significant subsurface silt layer present beneath residences located on the south side of West River Road near 5th and 6th Streets. Sediments will have to meet the sediment cleanup level of 40.9 ppm TPH NWTPH-Dx.

3.5.2 Excavation Dewatering

It is anticipated that the bulk of the excavation will be completed under wet conditions or "in the wet," depending on the river level and excavation depth using a combination of excavator and drag line technologies. It is anticipated that some pumping of water from the excavation will be required to create a gradient toward the excavation pit, and away from the river or surface water. A nominal 500 gpm (maximum 1,000 gpm) treatment system is currently being permitted to handle dewatering and other water generated during construction. Calculations predicting the water inflow are in Appendix E. All saturated material removed from the excavation pits must be dewatered prior to final transport. Saturated soils and sediment removed from the excavation can be placed on top of the ground surface (designated for excavation) at the edge of the excavation to allow water to drain back into the excavation prior to transport to a contained stockpile area on the railyard. All water from the contaminated stockpiles must be controlled and collected within a containment area and transferred into the NPDES-permitted treatment system. Trucks will be lined as necessary with watertight material to prevent spillage both before and after dewatering has occurred, as material will still be moist. Any accidental spillage will be identified and immediately remedied. Additional details will be presented in the Dewatering Plan (part of the Technical Execution Plan from the contractor).

3.5.3 Contingencies

Increased side-sloping, shoring or other methods will be used in limited areas if it is determined that excavation below those shown on the drawings is required based on visual inspection and/or soil/dredge confirmation results. Provisions will be available on the site at the time of soil removal to facilitate soil excavation down to elevation 895 feet NAVD 88 in limited areas. A combination of locally increased side slopes (still maintaining side slope stability) and driven/trenched sheet pile shoring will be used as conditions warrant.

Another contingency measure that will be considered in the event excavation can not safely be completed to the required depths within the fish window time constraints is that of soil mixing. Soil could be mixed in place to release sediment-affixed contaminants into the water for removal and treatment (via the NPDES-permitted treatment system) below the excavation depth achieved via conventional excavation/shoring/dredging, down to the maximum required depth to remove documented contaminants to the concentrations required. This is considered a "last resort" option and will be approved by Ecology only in the event that other techniques fail to provide adequate resolution. The contaminants released into the water column would be removed by a skimming or vacuum process for treatment.

A spill plan will be developed by the on-call spill response contractor that will address contingencies to be implemented in the event of a breach of the cofferdams and downstream escape of contamination.

3.6 Upland Source Control

Measures to control upland sources that will remain following the levee cleanup have been evaluated for the inclusion in the final design. Options considered included installation of a recovery trench along the southern boundary of the excavation, installation of sheet piles to form a physical barrier, or use of any shoring used along the southern excavation face in a funnel-and-gate array to control lateral flow and allow directed recovery of contaminants pending upland remediation. A sheet pile barrier along the southern excavation face will be used to control the upland sources and to minimize the potential for re-contamination of newly placed fill. Based on groundwater flow modeling performed during the design of the barrier wall and fluid level gauging behind the barrier wall, less than 1 foot of groundwater mounding is expected behind the sheet pile wall. The sheet pile wall will not be impermeable (the joints will not be sealed) and any mounding impacts will be temporary.

3.7 Construction Water Treatment

Construction water treatment will be needed during construction for the water that is pumped from the excavation. The treatment system will be located in a lined facility to handle any minor leaks. This water will be treated according to the processes outlined in the Draft Water Treatment Engineering Report (RETEC, 2005b). The nominal capacity of the treatment is 500 gpm, with a maximum flow of 1,000 gpm in accordance with the NPDES permit issued for the project. Decontamination water generated from decontamination procedures will not be treated on-site. Decontamination water will be stored on-site and taken to an off-site licensed facility for disposal or treatment.

3.8 Levee Design Sections

Several levee design criteria result from replacement in-kind or have been developed from the site conditions and remedial criteria previously described. These include:

- **Levee crest elevation –** minimum 930 feet (NAVD88)
- **Levee face slope –** minimum 2 horizontal to 1 vertical

- **Levee embankment material and gradation –** sandy gravel

- **Levee protection material and gradation –** armor rock with median diameter at least 18 inches, or withstand a 100-year peak river flow of 11 fps

- **Levee face plantings –** 100 percent vegetation cover above ordinary high water mark (OHWM) within three years

- **Habitat mitigation or enhancement features –** large woody debris and rock stilling ponds or curvilinear groins.

The plan is to recycle as much of the uncontaminated existing levee material as practicable, including the facing armor rock.

3.8.1 Levee Materials

The materials used for the levee construction will consist of: (1) excavated clean overburden, (2) clean armor rock rocks, (3) imported backfill for levee and river fill material, and (4) soil for plantings. Armor rock will be washed with high pressure water if contaminated. Water resulting from the steam cleaning will be collected and treated at the NPDES-permitted treatment facility prior to discharge. If the rock is unable to be cleaned, it will be shipped to a Subtitle-D landfill with the rest of the contaminated soil and sediment for disposal. Imported material will be similar to the existing levee and river material as described in the boring logs in Appendix B.

3.9 Embankment Slope Protection

Embankment stabilization/slope protection will be accomplished through the use of both armor rock and vegetation. The current face of the levee appears to be stable with the facing of 12 inch nominal armor rocks. The rocks have acquired a green moss covering. Trees, shrubs and grass have taken root on the armor rock face.

3.9.1 Armor Rock

The rock size and weight affects the ability of the armor rock to resist the river flow. The armor rock will be designed to resist the maximum river flow velocities. The 100-year average flood velocity at the levee site is 11 feet per second (fps) according to the recent FEMA (2001) flood study results. According to the USACE Engineering Manual-Hydraulic Design of Flood Control Measures (1994), the rock size is calculated based on the estimated river velocities and a minimum factor of safety of 1.1. The rock size calculations are provided in Appendix D. Based on these calculations, the armor rock/armor rock layer will be increased in thickness from the existing 2 feet to a minimum of 3 feet and the median size will be increased from median size of 12 inches in diameter to a median size of at least 18 inches in diameter. The imported rock will be graded such that $D_{30} \geq 21$ inches, $D_{50} \geq 28$ inches, $D_{90} \geq 40$ inches. This rock will be mixed with the existing recycled armor rock to achieve a median of 18 inches. The increase in layer thickness will also offset the destabilizing potential of plant roots dislodging stones if and when they fall down or are uprooted by flood currents while an increased rock size will provide a more stable shell under flood conditions. If plant roots or flood currents dislodge armor rock stones, it will be necessary for King County to assess the damage and possibly provide emergency repair. Emergency repair is anticipated to include some form of dumped rock during or immediately after the flood event.

3.9.2 Armor Rock Characteristics

Rock Shape Requirements

The rock used for armor rock shall have sharp, angular, clean edges at the intersections of relatively flat faces and meet the following criteria:

- The rock shall be predominantly angular in shape
- Not more than 30 percent of the rocks distributed throughout the gradation should have a ratio of a/c (the rock dimensions of ‘a’ and ‘c’ are perpendicular to each other and defined as the long and short axes of a rock, respectively) greater than 2.5
- Not more than 15 percent of the rocks distributed throughout the gradation should have a ratio of a/c greater than 3.0
- No rocks should have a ratio of a/c greater than 3.5.

Rock Size and Weight

The USACE Engineering Manual specifies that a minimum factor of safety of 1.1 and an estimated 100-year flood river velocity should be used in calculating the size of rock to be used for the armor rock. However, the factor of safety should be increased if the following conditions are considered:

- **Impact from River Floating Objects:** Impact forces on the armor rock resulting from logs, uprooted trees, ice, vessels and other types of large floating objects. Based on the observations conducted at the site, large trees and logs have been found resting on the armor rock after the high river stage.
- **Rock Size Calculations:** An increased factor of safety should be applied to compensate for inaccuracies in estimating the parameters in determining the rock size using the equation described above. This compensation should be used to the extent that the accuracy of the rock size is not compromised. Due to the

various degree of sensitivity of the parameters in the equation, the value of each parameter should be carefully selected to determine the rock size and minimize the need to increase the factor of safety.

- **Vandalism/Theft:** Vandalism and/or theft of the rock armor rock will affect the integrity of the slope protection. This tends to occur in urban areas. The weight of the rock will help prevent theft and vandalism.

- **Quality Control:** Undersized rocks can be eliminated or minimized by effective quality control to ensure the rocks delivered meet gradation requirements. Prior to placement of the armor rock, the rocks may require stockpiling and additional handling, which could potentially result in undersized rocks due to breakage. A screening process will be established to ensure no undersized rocks be used for the armor rock construction. Armor rock will be a mixture of existing recycled rock of 6- to 18-inch rock, with a median size of about 12 inches, and imported rock of 21- to 42-inch rock, with a median size of 28 inches. The final mixture should have a rock range from 6 to 42 inches, with a median rock size of at least 18 inches.

- **Freeze and Thaw:** Higher factor of safety should be used in severe freeze-thaw conditions. The climate in Skykomish is relatively mild and average low temperatures only fall slightly below freezing point during approximately two months per year. Freeze-thaw should not pose a concern at the site.

Based on the above discussion, the conditions that could affect the factor of safety including impact by floating objects and rock size equation parameters, a factor of safety of 1.3 was selected.

3.9.3 Armor Rock Top and End Protection

The proposed armor rock will be installed on the entire length of the riverside slope of the embankment, as shown on Figure C-19. Vertically, the armor rock will extend from below the river scour depth to above the 100-year flood level. The lateral alignment of the revetment will be extended on the upstream and downstream ends to non-eroding velocities and relatively stable banks. A smooth transition from the end of the revetment to the end protection zones will be provided. See EM 1110-2-1601, Plate 41 for end protection design.

3.9.4 Armor Rock Toe Protection

Revetment toe scour depth is estimated using the design charts (Plate 42). The toe protection will be provided by installing armor rock rocks to the estimated maximum scour depth, as shown on Figure C-19. The rocks will be installed before the removal of the cofferdam. At the toe of the embankment, the armor rock will extend into the riverbed as show on Figure C-19.

3.9.5 Delivery and Placement

Delivery and placement of the armor rocks must meet the following requirements:

- Machine placing will be used as the primary placement method of the armor rock. Hand placing will be used as secondary method to assist the machine placement to ensure the long axes of the rocks are oriented perpendicular to the bank.

- When using machine placement, only small increments of rocks should be placed to the final positions to avoid additional handling of the rocks. Any additional handling required due to the large quantity of armor rock being placed on the side slope can result in segregation and/or breakage of the rocks.

- To avoid breakage, rocks should not be dropped from an excessive height or dumped from the top of the levee.

- After the armor rock has been placed, a layer of soil will be added over the rock and worked into the interstices hydraulically (by spray hosing the soil into the spaces between the rocks). This allows control over the final thickness of the soil on top.

3.9.6 Quality Control

Specific requirements for sampling and testing of the rock size and gradation were described in the bidding specification documents. Provisions will be established for the loading, transporting, stockpiling, and placing the armor rock materials. Inspections and observations by qualified personnel will be completed during the placement of the armor rock to demonstrate that the armor rock meets specifications.

3.10 Cleanup Standards

The design criteria include cleanup/remediation levels and construction performance standards. Approval of the design criteria for the river face of the levee will be determined by Ecology, USACE, and USF&W. RETEC will approve the design criteria of the interior of the levee and the Town of Skykomish will review and comment on the levee crest and back slope design.

Cleanup levels under MTCA are defined as the concentrations of hazardous substances that are protective of human health and the environment under exposure conditions. Site-specific cleanup levels (CULs) and remediation levels (RLs) were developed by Ecology and are presented in the FS (RETEC, 2005a). Total petroleum hydrocarbons (TPH) by both NWTPH-Dx and VPH/EPH analytical methods are driving the cleanup of the site. However, cleanup levels have also been developed for associated carcinogenic and non-carcinogenic polynuclear aromatic hydrocarbons (PAHs), and PCBs, lead and arsenic. TPH was used as the surrogate for the PAHs in developing cleanup levels for some media and exposure pathways including soil direct contact and sediment protective of benthic organisms. TPH will therefore be the surrogate compound during the interim action for cleanup of the levee zone. PAH concentrations are not expected to exceed the applicable cleanup levels in soil containing NWTPH-Dx concentrations meeting the remediation level of 3,400 mg/kg.

The levee zone interim action for cleanup is intended to protect benthic and aquatic receptors in the river, the quality of water in the river, as well as humans who may come into contact with surface and subsurface soils, the levee and adjacent water through recreational activities. The objective of this cleanup action is to eliminate product seeps into the river, remove the contaminated sediment impacting aquatic receptors, and prevent dissolved petroleum in the groundwater from contaminating surface water and sediment. To achieve these goals, the groundwater flowing into the river must meet a cleanup level of 208 µg/L NWTPH-Dx and VPH/EPH.

Remediation levels may be used at sites where a combination of interim actions for cleanup are used to achieve cleanup levels at the point of compliance. Remediation levels are not the same as cleanup levels. Remediation levels under MTCA are defined as a concentration (or other method of identification) of a hazardous substance in soil, water, air, or sediment above which a particular cleanup action component will be required as part of a cleanup action at a site. Cleanup levels under MTCA are concentrations of a hazardous substance in soil, water, air, or sediment that is determined to be protective of human health and the environment under specified exposure conditions. Remediation and cleanup levels are summarized in Table 2-1.

3.10.1 Soil

Soil within the Project Area will be removed to address free product and to remove soil with concentrations above 3,400 mg/kg NWTPH-Dx. Soil 25 feet landward of the OHWM will be removed up to a depth of 10 feet if concentrations exceed the soil cleanup level of 22 mg/kg NWTPH-Dx. This 25 foot wide and 10 foot deep buffer area is to prevent recontamination of the sediments. Excavation to this remediation level will remove soil with the potential to impact groundwater to above the cleanup level, and will also be protective against recontamination of sediments when combined with the uplands cleanup. Excavated soil with concentrations exceeding 3,400 mg/kg NWPTH-Dx will be transported off-site to a licensed commercial landfill for disposal or reuse as daily cover as detailed in Section 4.

3.10.2 Groundwater

The cleanup level for groundwater is 208 µg/L for NWTPH-Dx and VPH/EPH (whichever is more conservative), which will protect sediment and surface water where groundwater discharges to the river.

An air sparging system may be installed in the levee to address remaining dissolved phase groundwater impacts by enhanced biodegradation. This system would include vertical wells to inject the air and associated piping and blowers. This system is considered a contingency. BNSF's calculations in the FS indicate that groundwater will meet the cleanup level of 208 µg/L where groundwater discharges to surface water. A decision will be made prior to completion of the final design whether or not to include subsurface infrastructure such as wells or piping for a potential future air sparging system. The operation of an air sparging system would be part of the site-wide cleanup action and is beyond the scope of this interim action for cleanup.

3.10.3 Sediments

The anticipated excavation area encompasses the area identified in the FS as requiring surface sediment removal based on bioassay testing. The area is estimated to be 440 feet long and 20 feet wide, and will include subsurface sediments. Sediment within the Project Area will be removed to the cleanup level of 40.9 mg/kg NWTPH-Dx.

3.10.4 Surface Water

As with the groundwater, the cleanup level for surface water is 208 µg/L for NWTPH-Dx and VPH/EPH.

3.11 Community Amenities

The Town of Skykomish led a visioning project to identify and describe a Vision for the future of Skykomish (Berryman & Henigar & University of Washington, August 2005). As part of the Vision, the Town passed Resolution No. 212 on July 11, 2005 to make recommendations for the levee design. Resolution No. 213 was passed on September 12, 2005, and replaced Resolution No. 212 with recommendations for the levee design. The overall vision for the levee is to create a "park-like area that affords views and access to the river." Most of the recommendations included in Resolution No. 213 are associated with landscaping and river access to achieve their park-like vision for the levee. BNSF and the Town are currently negotiating the conditions under which BNSF would pay to incorporate some or all of the concepts articulated in Resolution No. 213 as part of BNSF's individual settlement agreements. The following nine elements were recommended by the Town for inclusion in the final design of the levee:

- Multi-disciplinary design team of both engineers and landscape architects.

- West River Road from 6th Street to the end of the school grounds will be closed during construction. A right of way west of the school grounds will be opened temporarily to provide access to residences at the south end of W. River Road.

- Direct water access should be provided at 5th Street, just west of the bridge to facilitate hand launching of boats and kayaks, as well as fishing and nature viewing.

- A trail should be provided along the length of the top of the levee for foot travel, extending from the end of the levee just west of the school grounds, and culminating at the river access area at the eastern tip of the levee near the 5th Street Bridge.

- Access to the levee trail should be provided at a minimum of three points – at the west end of the levee just beyond the school property, at the north of 6th Ave., and at the eastern end of the levee adjacent to the bridge. The trail access from the end of 6th Ave. should include a ramp meeting ADA accessibility standards.

- A landscape buffer consisting of small shrubs and grasses (to enable unobstructed views) should be planted along the edges of the levee trail. Trees should be planted to selectively enhance landscaping while maintaining view corridors.

- Seating should be provided at occasional points along the levee trail.

- An outlook should be created along the levee trail, at the 6th Street intersection.

- W. River Road should be maintained between 5th and 6th Streets and widened to at least 20 feet. A retaining wall should be used from the eastern edge of the levee to the point where West River Road narrows, to accommodate the widening of the road.

The Town has made other levee design recommendations through their participation in levee design meetings.

- Levee Infrastructure – the Mayor of Skykomish provided an e-mail dated October 20, 2005 from the Town of Skykomish Planning Commission that requests that consideration of the Town's need for infrastructure be included in the construction plan for the levee. Specifically, the Town requests that underground hand holes and conduits (with three to four inner ducts and pulling lines pre-installed) be installed. Hand holes are requested at each end of the levee and at any location where present or future access (viewing platform, boat launch, etc.) would be needed. The inner ducts would be used for communications, power, or security as needed. Power for street lights, outdoor electrical outlets, holiday lighting, etc. could be installed in one inner duct and fiber optic cable in the second, which would leave one or two ducts available for future access. The Town also requests placement of all aerial utility and communications (telephone, power and cable TV) cables to underground ducts along Railroad Ave. and any other roads that are affected by future cleanup activities. This request includes the phone and power lines crossing the railyard east of the library. Finally, the Town requests that a sprinkler system be installed to facilitate maintenance of the newly planted vegetation and habitat restoration.

- **Levee Aesthetics –** The Town has requested that handrails installed at the top of the retaining wall be a dark green color, however, they desire the railings to be low maintenance (i.e., painting not required). Thus a baked on coating or the like should be used. The Town is also interested in coloring the concrete retaining wall (the concrete itself, not a stain applied on the surface to minimize maintenance) and also in having a decorative relief pattern molded on the outer surface of the retaining wall (leaves, fish or similar).

The Town's recommendations will be used as a guide for the design of the levee, and incorporated into the design where technically possible. Specific elements of the Town's recommendations that are not expressly required to meet substantive requirements, standards or regulations, and that are deemed to be more expensive than restoration to current conditions, are currently considered optional by BNSF, and identified as such in the design drawings and throughout this report. BNSF and the Town are currently negotiating the conditions under which BNSF would pay to incorporate some or all of the Town's requests and recommendations as part of BNSF's settlement agreement with the Town.

3.12 Construction Safety

The primary safety concern is the traffic flow on West River Road and 6th Street during construction. West River Road will be included as part of the remediation area; therefore, the entire road will not be accessible by the general public, including emergency vehicles. Temporary access roads for the residents living west of the school on West River Road will be required. BNSF will coordinate with the community for temporary access roads to those residential areas. The school entrance and some residential houses are located on 6th Street. The street will be used as an access and haul road but will remain open throughout the construction.

At least one lane of travel shall be provided along all the streets (except West River Road) within the Town limits throughout the construction period. Signage related to the project will be that typical of a road construction project with traffic controls and authorized personnel access. A traffic plan has been prepared for review by all affected agencies and persons including fire department, police department (county and state), residents and the school and is included as Figure C-11. Additionally, the contractor will prepare a Traffic Plan as part of the Technical Execution Plan.

In addition to the contractor personnel, at least one RETEC or BNSF project supervisor representative will be on-site at all times when field work is in progress. This field representative or supervisor may be the site health and safety officer, and will endeavor to restrict access to the active work zone by any unauthorized personnel.

Air quality monitoring will be done for the duration of this remedial action to ensure the safety of both the on-site contractor personnel and the public. This monitoring will be done in accordance with the air monitoring plan that will be developed.

3.13 Survey Control

Existing Site information and construction of the levee remediation are based on survey control markers in the area and on recent topographic surveys of the levee and hydrographic surveys of the river. There are three control markers (monument and bench mark) near the site. The marker IDs and locations are shown on Figure C-3.

The National Geodetic Survey (NGS) marker is in the park next to the railroad tracks in the center of the Town of Skykomish. A description and coordinates (latitude, longitude, and elevation) of the marker are given on the Data Sheet for "Z58 1934 931.438" available at internet website http://www.ngs.noaa.gov/cgi-bin/ds_mm.prl. Information on this marker is also available on a Washington State Department of Transportation (WSDOT) Survey Mark Report available at the Internet website http://www.wsdot.wa.gov/Monument/report.cfm?monumentid=2762.

There is a discrepancy in the elevation given by the two reports. The NGS Data Sheet reports an elevation of 285.164 meters or 935.58 feet relative to the North American Vertical Datum of 1988 (NAVD88), whereas the WSDOT Survey Mark Report gives an elevation of 285.140 meters (NAVD88), which is an elevation of 935.50 feet using U.S. Survey Feet. The resolution of the discrepancy is discussed below.

WSDOT has a marker next to Highway Route 2 about 2,500 feet downstream of the bridge. A description and coordinates (latitude, longitude, and elevation) of the marker "2761" are given on WSDOT Survey Marker Report available at internet website http://www.wsdot.wa.gov/Monument/report.cfm?monumentid=2761.

King County has a marker in the sidewalk between the bridge and Town. Information for marker "GPS 8823 1995" is available from King County.

Resolution of the survey marker discrepancies and verification of the marker coordinates was done by using the King County marker "GPS 8823 1995" as the primary reference mark. Survey traverses were run to the NGS marker "Z58 1934 931.438" and the WSDOT marker "2761." Washington State Plane coordinates per North American Datum of 1983/1991 and elevations per NAVD88 were corrected. The results are reported in the table on Figure C-3. These markers, with the corrected coordinates, will be used as survey control for the levee remediation.

3.14 EDR Amendment Protocol

Should Ecology or BNSF determine that this EDR needs to be amended due to field conditions following Ecology approval of this document, the EDR Amendment Form (Appendix F) will be used. This form requires Ecology approval of any modifications to this EDR or the SAP (Appendix G). Other stakeholders involved in the interim action for cleanup of the levee zone must go through Ecology in order to amend the EDR or SAP.

4 Scope of Work

4.1 Approach

The design process involves identification and pre-qualification of up to five contractors that have the ability to do the levee remediation and provide input on the final design. BNSF issued a Request for Proposals (RFP) based on the design drawings that were included in the Draft EDR. Responses to RFP will be evaluated and a contractor will be selected to become part of the design team. In addition to the main contractor, a contractor specializing in house moving will also be selected. RETEC will continue to lead the design process and coordination between Ecology and BNSF.

4.1.1 Solicitation Package

A solicitation package consisting of detailed plans and specifications for prospective BNSF contractors was prepared to accompany the Draft EDR. In most respects, the solicitation package was a summary of the Draft EDR; however, it differed from the content of the Draft EDR in that it focused on the work that the contractor will be expected to accomplish during the construction period.

4.1.2 Drawings

Drawings were prepared in an iterative process. The permit drawings, considered as conceptual (30%) drawings, were completed and submitted by BNSF with the permit applications. As the Town of Skykomish and the agencies voiced opinions and concerns, the drawings have been modified and additions made to result in the drawings that accompany this report.

4.2 Permits

As outlined in Section 2.3, this work is exempt from the procedural requirements of state and local permits. Substantive requirements for all state and local permits will be met and federal permit applications will be completed as required.

4.3 Weather Related Contingency Plan

Prior to mobilization of equipment to the site, river levels, precipitation levels, weather forecasts and snow melt predictions need to be carefully evaluated. Sections 3.2.1 and 3.2.2 describe historic river levels and trends and also define a river level at or above which project implementation is not possible. If river levels are unseasonably high on June 1, 2006, there are unusually wet weather conditions, large snow melt, or similar unusual weather conditions, discussions between BNSF and Ecology will be held to determine what contingencies, such as a delayed start date or modification of project scope would be appropriate. These contingencies could require an amendment to the Agreed Order.

4.4 Mobilization and Site Preparation

Mobilization and site preparation will consist of bringing equipment and materials to the site and preparing the Project Area for the remedial action as described below.

4.4.1 Utility Locate

Prior to commencing any on-site activities, all underground public and private lines will be located and marked with paint. Figures C-4 and C-5 show the approximate locations of all known utility lines on the site.

4.4.2 Clearing and Grubbing

Clearing and grubbing of the vegetation (including brush and trees) and debris along the existing levee will be done to facilitate remediation activities. If reasonable within the time frame, access will be allowed to the Town so that they can remove a few trees for replanting by the Town outside of the project boundary. Other vegetation and debris will be disposed of at an appropriate municipal landfill.

4.4.3 Temporary Relocation of Structures

The levee zone interim action for cleanup involves temporary relocation of five buildings:

- The Teacherage on School property
- The Mackner residence on West River Drive
- The Moore residence on 6th Street
- The two Mitchell residences on the corner of West River Drive and 5th Street.

Prior to relocation of buildings, utilities will be disconnected. This work is typically limited to the confines of the crawl space of the home. The existing sewer, water, gas, and heat ducts will be removed prior to the installation of rigging gear. The buildings will be temporarily relocated within Town during the levee cleanup implementation. It will not be possible for residents to inhabit the structures while they are displaced – the buildings will remain vacant. Any existing foundations, garages, porches, out-buildings, side walks, patios, driveways and landscaping will be cleared and materials disposed of appropriately. BNSF will provide alternative housing and moving expenses pursuant to access agreements with each property owner. Each house will be restored to its original location at the end of the project unless the owner elects to have BNSF demolish the structure so that the owner can build a new structure consistent with the Town's current zoning, shoreline development, building codes and SEPA ordinance. Building new houses is not part of the proposed action. Any outbuildings demolished because it is unfeasible to move them will be replaced as part of the proposed action.

The process by which buildings are typically moved involves jacking the structure onto large beams that span the length of the structure. The buildings would then be moved in their entirety to an appropriate area somewhere in Town. However, the building would remain on the beams throughout the levee cleanup in anticipation of their restoration to their original locations, orientations, etc. It will not be possible for residents to inhabit the structures while they are displaced – the buildings will remain vacant. To mitigate against potential damage to the historic residential structures by vandalism and theft, security will be provided by fencing, lighting and security personnel.

Any existing foundations, porches, side walks, patios, driveways and landscaping will be cleared and materials disposed of appropriately.

4.4.4 Shoring

Shoring is anticipated to be used along the southern edge of the excavation to facilitate continuation of the remediation to the south. It is anticipated that this shoring will consist of driven/trenched sheet piles placed to facilitate a 10-foot tall vertical excavation. Sheet pile installation using standard vibratory equipment is expected to difficult due to the possibility of boulders hindering advance of the piles. Removal of the boulders by trenching may be required. Typical anticipated excavation cross sections are shown on the attached drawings.

This same shoring method will be used as a contingency measure if additional excavation depth is required to achieve confirmation requirements outlined in this document and MTCA regulations. The installation of contingency shoring is anticipated to be similar to methods previously described in this section, although the top of the shoring may be at different depths as dictated by the particular situation. Additional sloping will also be used as a contingency measure as required by the particular situation. As detailed above, the contractor will prepare an excavation shoring design prior to excavation. The contractor's design will be presented in the Excavation and Shoring Monitoring Plan as part of the Technical Execution Plan.

The important aspect of the contingency measures will be the ability to determine the appropriate contingency measure(s) and implement them quickly so that progress is not slowed. Sheet pile shoring designs to accommodate a number of conditions will be determined prior to construction so that they can be enacted when appropriate to accommodate sampling results.

4.4.5 Cofferdams

As outlined in Section 3.4. Two parallel cofferdams will be placed in the South Fork Skykomish River to divert the river away from the active excavation.

4.4.6 Spill Response

A spill response contractor will be retained to be on-call during the duration of the remedial action. The contractor will mobilize spill response materials such as booms and pads to the Project Area. The contractor will also be responsible for developing a spill response plan in compliance with Section S7 of the NPDES Permit. The Spill Response Plan will be included in the Technical Execution Plan.

4.5 Temporary Facilities

Several temporary facilities will be in place during the implementation of the levee remedial action including access and haul roads, construction offices, utilities, fencing, sediment and erosion controls, staging areas, and spill/emergency equipment. Additionally, power, telecommunications, and water will be needed. Water will be supplied by the Town water supply instead of withdrawing water from the river.

4.5.1 Access/Haul Roads

The construction access and haul roads to the project site will be selected to ensure the maximum safety and efficient traffic flow. The northern half of the school yard may be used as the construction staging area, with the only available existing access roads to the Project Area being via 6th Street and West River Road. An entrance gate will be established at the south side of the school yard staging area. The proposed access/haul roads on Figure C-11 will be presented to Town officials, emergency personnel, and local residents for comment. It should be noted that construction is planned to not interfere with the school's drain field. The southern extent of remediation and associated shoring are placed so that no activity will occur over the drain field during this interim action for cleanup.

4.5.2 Construction Offices

There will be three construction offices: one for RETEC, one for the contractor, and one for Ecology. A temporary RETEC engineering field office will be located in the BNSF house on 5th Street. Contractor and RETEC trailers will be located in the rail yard. Temporary power and a telephone line will need to be installed to the trailers on the railyard. Ecology will establish their construction office location at a later date.

4.5.3 Utilities

Utilities in the Project Area include power lines, telephone lines, and a storm drain system. Puget Sound Energy has been contacted to relocate the overhead power lines that are next to the levee excavation area. These lines, as well as the telephone line (Verizon) that runs on the same poles, will either be moved to private property on the south side of West River Road or these utilities will be rerouted through the lines on the south side of the school to the affected homes. The storm drain system in the project area will be replaced as part of this remedial action. The details of the temporary rerouting of utilities and the final permanent establishment of the utilities will be worked out with the utility companies, the Town and associated affected residents (where appropriate) prior to construction.

4.5.4 Enclosures and Fencing

Temporary chain link fencing will be installed along the perimeter of the Project Area, and around all stockpile, excavation, staging, and work areas. Warning signs will be posted at every entrance gate and at least every 50 feet along the fence warning the general public that the project site contains physical and chemical hazards and that access is forbidden to unauthorized personnel. Additionally, a security guard will patrol the house storage area regularly and the project area after hours.

4.5.5 Sediment and Erosion Controls

The sediment and erosion controls shall meet the following requirements and will be detailed and implemented in the Stormwater Pollution Prevention Plan (to be prepared):

- Use ditches, berms, pumps and other methods necessary to divert and drain surface water away from excavations and other work areas.

- Prevent sediment from entering the river, roadways, storm sewers, or catch basins.

- Any storm water coming in direct contact with source material or any other contaminants shall not be allowed to leave the project site.

- Divert seepage water into sumps and pump to storage tank for testing and, if necessary, on-site treatment or disposal at an approved off-site facility.

- Install a temporary outfall from the construction stormwater treatment system to the river as per NPDES requirements.

- Inspect and repair or replace damaged components of temporary erosion and sediment controls on a regular basis as described in the project specifications. Inspect immediately after rain or flooding events, and inspect daily during prolonged rain events.

4.5.6 Staging Areas

The staging area(s) will be used to store materials and equipment. There are four possible locations for staging areas. These include the rail yard, either end (east and west) of West River Road, the north end of 6th Street, and the northern half of the school yard. BNSF is currently negotiating with property owners regarding access. All staging areas will be secured with temporary fencing to restrict access to unauthorized personnel.

Since the drain field for the school is under the playground, no heavy materials will be stored near the playground on the drainfield. Heavy equipment will need to be staged in the rail yard. The recyclable levee materials not used in the cofferdam construction and dewatering tanks are the most likely items to be stored on the school yard. If the school yard is used, it will be returned to pre-existing conditions upon project completion, including reinstallation of chain-link fence and grass.

The Town has requested permission to use a portion of the Railyard north of the main line and west of the 5th Street crossing for parking during the annual antique car show scheduled for August 26, 2006. During this time heavy equipment that will usually be staged on the railyard may be staged at the Town's "burn dump," an approximately 1.6-acre area about a five-minute drive from town.

4.5.7 Spill/Emergency Response Equipment

Spill and emergency response equipment will be mobilized to the Project Area during the mobilization phase of the remedial action. This equipment will include oil absorbent booms and pads to capture any free-phase petroleum hydrocarbons that are released. The spill response contractor will be responsible for determining the types and quantities of materials and equipment to be kept on-site in the spill response plan. This plan is subject to Ecology approval.

4.6 Water Treatment Facilities

The water treatment facility design is outlined in the *Draft Engineering Report – Levee Remediation Process Water Treatment and Discharge* (RETEC, 2005b) which was submitted to Ecology. The report provides the basis of design and process design considerations for treatment of the excavation water. Water treatment facilities will be operated in accordance with the NPDES permit issued for the treatment system.

4.7 Excavation

The armor rock on the existing levee will be removed and the impacted rock will be segregated from the clean rock into separate stockpiles. The contaminated rock may be cleaned on-site using steam wash and reused for the new levee construction. If the impacted rock cannot be satisfactorily cleaned and reused, the rock will be disposed of at a licensed facility.

The levee materials will be removed from the existing levee and the contaminated fill (material with concentrations greater than 3,400 mg/kg NWTPH-Dx) will be segregated from the clean fill. The clean excavated embankment material will be stockpiled for reuse in construction of the new levee. Contaminated materials will be transported to the rail yard, stockpiled, placed in rail boxes, gondolas, or trucks and subsequently transported to a licensed Subtitle D landfill for disposal.

The remedial action will remove an estimated 70,000 cubic yards (cy) from the site. It is estimated that on the order of 20 to 30 percent of this total volume will be clean overburden, resulting in 49,000 to 56,000 cy being removed from the Project Area. The excavation area is shown on Figures C-13 and C-14. The impacted area was delineated based on the previous analytical and characterization results performed during the site investigation (Appendix B). The extent of excavation may vary depending upon the field conditions during excavation activities. Dry side slopes are expected to stand at a stable slope somewhere between 1.5H:1V (horizontal to vertical) to 2H:1V depending on soil conditions. However, it is anticipated that the bulk of the excavation will be completed in the wet. It is known that underwater angles of repose of unconsolidated sediments are much shallower than in the dry. A slope value of 4H:1V has been incorporated into the anticipated excavation prism below anticipated water levels. Debris encountered during excavation will be sampled and disposed of properly.

4.7.1 Screening of Oversized Material

Excavation soil is expected to consist of mixtures of silt, sand, gravel, cobbles and boulders. Of these different grain sizes, contaminants are typically trapped in the finer portions of the soil, or in this case, the silt, sand and to a lesser degree the gravel. Unless there is a coating on the oversized material, very little contamination is retained in the coarse gravel, cobbles and boulders that are found in the deposit. BNSF may set up and operate a soil screening operation on the rail yard within the soil handling area to screen out material greater than 2 inches from the finer portions of the soil. The oversized material may be further split up to facilitate screening operations. The oversized material will be characterized in accordance with the SAP, and either disposed of, or cleaned as necessary and blended with backfill in the excavation.

4.7.2 Stockpiling Uncontaminated Soil and Sediment

Overburden soil, excavated sediment, and material with TPH concentrations equal to or less than the RL of 3,400 ppm NWTPH-Dx will be stockpiled separately from material with TPH concentrations greater than the RL during the remedial action. Samples will be collected from the stockpiles in accordance with the sampling and analysis plan included in Appendix G. Results of the laboratory analytical testing will be used to determine the handling of the stockpiles. The material will be used as backfill on-site or designated for off-site disposal if the sample indicates concentrations greater than 3,400 ppm NWTPH-Dx. Soils containing concentrations less than 3,400 ppm NWTPH-Dx may be segregated into two piles: soil with concentrations less than 22 ppm NWTPH-Dx and soil with concentrations between 22 and 3,400 ppm NWTPH-Dx. Material with concentrations between 22 and 3,400 ppm NWTPH-Dx will not be placed in the watertable fluctuation zone. This material will not be placed as backfill under residences or the Levee but may be used on the Railyard, if appropriate.

A site layout plan showing areas available for soil stockpiling is included in the drawings. Some of the uncontaminated soil may be used to fill the flexible intermediate bulk containers (FIBCs) as part of the cofferdam. Appropriate erosion and sedimentation controls will be put in place to prevent run-on and run-off.

4.7.3 Transportation and Disposal of Contaminated Materials

Excavated contaminated materials (material with TPH concentrations exceeding the soil RL of 3,400 ppm NWTPH-Dx) from the excavation will be loaded into dump trucks and transported to a lined spoils staging area on the railyard. The dump trucks will be lined if necessary to prevent leaks and spills of any liquid, sediment or soil on the Town roadways. The spoils will be amended with fly ash or other stabilizing agent as required to pass the paint filter test prior to being loaded into rail shipping containers or into over-the-road trucks for shipment to a licensed disposal facility.

4.7.4 Confirmation Sampling and Testing

Once excavation has proceeded to the required depths using pre-excavation data and on-site inspections, the water in the excavation pits will be allowed to settle ("cleared") while any visible sheen and petroleum products will be removed via skimmer or pump to the NPDES-permitted treatment system. The approximate time for water to clear is expected to be within one hour depending on the size of the pit, and rate of water removal. The reason that water clearing is desired is that silt/clay particles in the water within the pit may be impacted. Extracting a sample from the bottom of the water column and bringing it up through the water column may result in contamination levels in the sample that are higher than the in-place soil due to the influence of these fine particles that may remain in suspension. An additional consideration is that the surface water may have a constant sheen despite soil and sediment concentrations being below the applicable remediation and cleanup levels. Skimming and pumping operations will be used to address any sheen present.

Once "clearing" has occurred, a post-dredge sample will be collected from the pit (using the excavation equipment) and prepared for analysis. This may be performed at an on-site lab or prepared for expedited shipment for off-site analysis. Logistical considerations must be made for continued excavation of other areas between the time samples are taken and results are obtained. In the event that water in the pit doesn't clear in a reasonable amount of time due to silt or other suspended solids, the sampling plan will be modified. Refer to the SAP provided in Appendix G for additional details of confirmation sampling and testing.

The south sidewall will not attain remediation levels during the levee replacement as the uplands cleanup in the Northwest Developed Zone will be completed as a separate phase of the cleanup.

4.7.5 Dewatering

The river stage at the time of construction will dictate the excavation and dewatering methods utilized. It is anticipated that excavation a few feet below the level of the river can be completed in a relatively dry state by pumping from sumps within the excavation. However, it is anticipated that the bulk of the deeper portions of the excavation will be performed in the wet. A nominal water treatment capacity of 500 gpm (maximum 1,000 gpm) will be available for the entire levee cleanup project as per the NPDES permit. Therefore, the contractor will need to select an excavation method and dewatering design and operation within the water treatment capacity constraints. Several intake locations will be provided. The following dewatering standards shall be adhered to:

- Establish a dewatering plan to describe the methods, equipment and operation to collect and store water from disturbed areas.
- Set up site controls to divert and collect water from disturbed areas to allow for remediation activities to be conducted.
- Excavation areas are not expected to be dewatered to maintain a relatively dry work area during the entire period that the excavation remains open. Excavations and backfilling below about 917 feet will likely be done in the wet depending on the river level.

- All dewatering equipment shall be provided and maintained by the Contractor to ensure sufficient capacity to meet the requirements for the removal of water in the disturbed areas.
- BNSF's Contractor shall grade the excavation area using slopes, berms and sumps in conjunction with dewatering systems to channel water away from the immediate work areas to minimize dewatering.
- BNSF's Contractor shall be responsible for preventing impacted water from leaving the site.
- BNSF's Contractor shall monitor the weather and site conditions 24 hours per day, seven days per week and perform dewatering as necessary to prevent impacted water runoff from the site.
- Liquids generated from dewatering processes will be collected.
- The water will be treated using the permitted water treatment system. After treatment to meet the required standards, the water will be returned to the river in accordance with an NPDES permit.
- An operations and maintenance plan will be developed in accordance with the NPDES permit guidelines in Section S4 that will outline around the clock operations, contingencies, and emergency procedures for the water treatment system.

4.8 Monitoring

4.8.1 Air Monitoring

An air monitoring program will be implemented during construction to ensure the air quality meets the criteria established in the site-specific Health and Safety Plan (HASP) and air monitoring plan. The purpose of the air monitoring program will be to ensure protection of site workers and nearby residents from airborne particulates and petroleum vapors. The air monitoring plan will outline perimeter monitoring stations and site-specific action levels for airborne particulates and petroleum vapors.

4.8.2 Surface Water and Discharge Monitoring

The effluent from the construction water treatment system must be sampled and submitted for chemical analysis in accordance with the National Pollutant Discharge Elimination System (NPDES) permit. Surface water monitoring will be conducted in accordance with 401 Water Quality Conditions (see Section 2.3.1) issued via the Corps Nationwide permit and the Water Quality Significant Requirements under the MTCA Agreed Order for this work.

4.8.3 Cofferdam Monitoring

The cofferdams will be monitored during the remedial action to ensure that minimum leakage into or out of the active excavation area occurs. Should a breach of either cofferdam occur, work will immediately be stopped and measures will be taken to repair the dam. The on-call Spill Response contractor will be called in as needed to recover any substances that have accidentally been released.

4.8.4 Performance Monitoring

WAC 173-340-410 outlines monitoring for final cleanup actions. This work is an interim action for cleanup and will include protection and performance monitoring. Protection monitoring will be conducted to "confirm that human health and the environment are adequately protected during construction and operation and maintenance period" (WAC 173-340-410). Protection monitoring will consist of air monitoring for workers and neighboring residents. Performance Monitoring will be conducted to "confirm that the … cleanup action has attained cleanup standards." Soil and sediment samples will be collected at the limits of the excavation to confirm that the applicable remediation and cleanup levels have been attained.

Since the levee cleanup action is a component of the Ecology's overall cleanup plans for the site, a compliance monitoring plan will be developed and implemented in conjunction with the overall site-wide CAP and CD. This compliance monitoring plan will include a long-term sediment and groundwater monitoring plan with contingencies.

4.9 Backfilling

Backfilling will take place after the limits of excavation have been reached and applicable cleanup and remediation levels have been attained. In the event that field conditions such as depth of contamination make it infeasible to attain remediation and cleanup levels, backfilling may proceed with Ecology approval. Imported backfill will be analyzed for indicator substances to demonstrate it contains no hazardous substances exceeding MTCA Method A or site-specific cleanup levels, whichever is more conservative. Recycled overburden will meet site-specific cleanup levels. The imported backfill material will be clean, free-draining sandy and/or gravelly soils. Samples of the proposed import backfill will be approved by the site construction engineer-in-charge prior to use. Sediment backfill will consist of material similar to that removed and of appropriate quality for salmon rearing.

Backfill material for the excavation areas will include stockpiled clean excavated soil or approved additional imported soil. Significant compaction of the backfill placed in standing water will not be feasible. Backfill placed in standing water will be free-draining, granular material that can be placed in a fairly compact state in standing water. Larger (4 to 8 inch) rock may be mixed into the backfill that is placed in standing water that is below residential structures to make sure that the fill performs as desired with minimal settlement.

Backfill above the water table will be placed in maximum loose lifts of one foot and compacted to at least 90 percent maximum dry density as determined by ASTM D-1557 for the material placed in the river and in the levee foundation, and 95% of ASTM D-1557 for the levee itself for areas below residential structures, and within the upper two feet of fill below the planned roadway surface. There may be isolated areas where backfill has to be placed in the wet in standing water. This backfill shall be placed and compacted to the maximum extent practical. Compaction testing of this material will not be possible. The ground surface of the backfilled excavation areas will be graded to the final elevations indicated on the design drawings.

4.10 Replacement and Restoration

Regardless of the type of foundations (basements, concrete foundations, slab on grade, or post and pier foundations) currently existing beneath the five residences to be relocated, new concrete crawl space foundations will be designed and constructed for all of the buildings. Building codes will require this as a minimum due to seismic requirements. Town Ordinance 255 may require existing foundations to be raised for flood protection. BNSF is working with the Town to ensure that all work complies with Town codes and ordinances. Following construction of foundations, the buildings will be moved back to their original locations and placed on top of the new foundations. Utility infrastructure will be restored and utilities will be reconnected. Site features specific to each residence will be restored including but not limited to replacement of topsoil, porches, sidewalks, garages, sheds, patios, driveways and landscaping. Repairs will be made to damage resulting from moving of the buildings such as crack repair and repainting as needed based on documentation of the current condition of the buildings.

Roadways demolished as part of this interim action for cleanup will be replaced according to King County Road Standards (1993) and any damage to existing roadways and sidewalks will be repaired in kind. Utilities including power, telephone, and stormwater drainage along West River Road will be restored to initial or better conditions. Any hard surfaces that are damaged as part of this remediation effort will be replaced in-kind when excavation and backfill is completed. For instance, if an existing asphalt area is damaged during construction, it will be patched with asphalt.

4.11 Stormwater Sewer System

The Town’s existing stormwater sewer system within the footprint of the excavation will be demolished during the implementation of the remedial action. A replacement stormwater sewer system has been designed and is detailed in Figures C-22 and C-23. The calculations used in designing the stormwater sewer system are provided in Appendix H, Stormwater System Design.

5 Levee Construction Control

This section focuses on the construction phase of the project. The USACE will not require BNSF to prepare a Construction Quality Plan because the work being completed is a MTCA cleanup. The lines and grades of the levee will be controlled by progress surveys to be done by the contractor and periodically checked by RETEC or an independent surveyor under contract to RETEC.

Shoring will be controlled by the contractor, but copies of shop drawings and calculations will be submitted to RETEC for review. All other activities will be controlled as laid out in the plans, specifications, and EDR. RETEC will provide oversight to other BNSF contractors to document conformance with the plans, specifications, and the EDR.

5.1 Habitat Restoration

Restoration will occur in the disturbed area of the river as well as along the levee. River bottom substrate will be replaced in the disturbed area and matched to existing substrate types. Amenities will be added to the shoreline that will improve habitat quality for salmon. Improvements include placement of large woody debris (LWD) in the riverbank. The LWD will provide cover for juvenile salmonids and will create areas along the shoreline with slower flows. Boulders will be placed just upstream of the woody debris to protect recreational users of the river from floating into the debris.

Once the new levee is constructed, native vegetation will be replanted along the waterward face. The newly planted vegetation will provide cover and foraging opportunities for migrating juvenile salmonids along the toe of the new levee during high flows. A planting plan is included in the Biological Evaluation submitted to the USACE (Grette Associates, 2005) and in the drawings attached to this document. Vegetation is to be placed above the ordinary high water mark (OHWM). The OHWM is based on the annual, or 1-year, flood level of 922.0 feet.

Landscape planting on the levee will enhance the environment and help preserve the natural resources. The landscaping must meet all federal, state and local laws and necessary permits must be obtained, if applicable. The design criteria for landscaping on the levee include:

1) **Vegetation-Free Zone:** The vegetation-free zone is an area provided for access to the levee for maintenance and flood-fighting (i.e. sandbag placement) activities. No vegetation will be planted in this zone.

2) **Shrubbery:** Shrubs tolerant of flooded conditions will be placed along the levee bench to the top of the levee slope. Clusters of

trees will be placed along the top of the levee slope in areas consistent with view corridors created as part of the design.

3) **Topsoil:** One foot of topsoil will be placed along the levee face to facilitate plant growth. In addition, a topsoil or topsoil/sand mix will be placed between boulders (upper four feet). Following topsoil placement, coir mesh (which will slowly decompose) will be placed along the levee to prevent erosion.

Safety and stability of the levee structure is the most important consideration of the design. Maintenance of the completed structure should be coordinated through local agencies during planning and design, and it must be determined if the responsible local agency has the capability to maintain the restored levee upon completion of the project. It is BNSF's understanding that King County will maintain the restored levee.

5.2 Levee Landscaping and River Access

Where possible, the Town recommendations for the levee design have been included in the EDR. In addition to specific recommendations included in Resolution No. 213, the Town has participated throughout the levee remediation design process and has participated on design decisions throughout the design process. The following amenities and enhancements have been included in the design at the Town's request:

- Direct water access at 5th Street (*optional*).
- A trail along the length of the top of the levee (*optional*).
- Access to the levee trail at two points (5th Street & west of the school grounds) – access at the north end of 6th is not possible while maintaining the King County standard width for West River Road (22 feet) and King County surface water management levee width requirements to allow for access by levee maintenance equipment (*optional*).
- A river outlook structure is provided at 6th Street intersection (*optional*).
- West River Road will be widened to 22 feet per King County standards. A retaining wall will be used to accommodate the widening of the road.

Other recommendations that are considered optional during the subsequent design phases include a boat launch, professional landscaping, decorative patterns/colored concrete for retaining wall, colored railings, conduits/wires for future installation of electrical, phone and cable infrastructure, installation of below ground power and telephone lines, and installation of a sprinkler system. With the exception of the sprinkler system these enhancements are considered "optional" because they are not required as part of the cleanup and/or levee reconstruction. It will be at BNSF's discretion whether or not to implement these portions of the Town's vision, or whether the Town will have to fund/complete this work themselves.

5.3 Community Concerns

It is BNSF's and Ecology's goal to implement this interim action for cleanup in a manner that addresses public concerns. Concerns identified in this section are in part based on previous experience implementing interim actions and investigation work at the site, and through working closely with Town representatives throughout the design process. The Public Participation Plan (to be revised spring 2006) for the project identifies other methods for obtaining public input, including meetings with the Skykomish Town Council, Skykomish School Board, and the Skykomish Environmental Coalition (SEC). Issues and/or concerns identified by these public involvement efforts are identified in this section. This draft EDR, along with a draft EIS is being provided for public review and comment to help explain the cleanup action and obtain further public input. Should any additional issues/comments/ concerns arise from the public review, they can be addressed in the final design documents.

The following is a summary of issues/concerns and how BNSF is responding to these concerns.

- **Disruption to School.** The levee remediation construction work will create noise and traffic disruption that can not be avoided to the Skykomish School due to its proximity to the levee. BNSF is working with the Skykomish School District to obtain access to a portion of their playground for use as a staging area. As part of these discussions, the school has generously offered to modify their 2006-2007 school calendar to accommodate the project. Construction work north of the levee (below the high water mark) can not begin until July 1, 2006 based on the "fish window." However, it is likely that equipment mobilization to the site and moving of residences will begin June 1, 2006, and construction work on and south of the levee will begin mid-June 2006, at the latest. Every effort will be made to coordinate the initiation of work in June 2006 with the end of the 2005-2006 school year. All work on and north of the levee must be completed by September 15, 2006 unless the entire levee construction is postponed due to unusually high river levels. Equipment demobilization and the majority of the disruptive work should be completed prior to Monday, October 2, 2006. This might be an appropriate date for school to begin for the 2006-2007 school year, if the district is flexible. Further, since the school yard will likely be needed as a staging area for subsequent remediation work in other parts of Town, it may not be worthwhile restoring the school yard during the fall of 2006. In this event, arrangements will be made to provide the school/students with transportation to an alternate play field (e.g., Skykomish ball field). In addition, a flagger or traffic control officer may be employed and strategically located throughout the duration of the project when school is in session.

- **Disruption to Town.** The levee remediation construction work will create noise and traffic disruption to the Town that can not be avoided. Also, a portion of Railroad Avenue adjacent to the railyard has been identified as a staging area for the project. A temporary road will be constructed west of the school to provide access for residents located at the west end of West River Road.

- **Disruption to Residents.** The levee remediation work will create noise and traffic disruption, as well as temporary power shut off, to residents located immediately south of the excavation area. Five residences/families along and near West River Road will be temporarily relocated. Access for emergency response vehicles (fire, ambulance) will be maintained at all times. A temporary road will be constructed west of the school to provide access for residents located at the west end of West River Road. It is anticipated that most construction work will occur during daylight hours, 7:00 a.m. to 7:00 p.m. It is also anticipated that the construction water treatment plant may operate 24 hours per day and that some construction activities may extend past daylight hours on occasion. It is currently anticipated that work will occur Monday through Saturday in order to complete work during the fish window.

- **Disruption to Business.** With previous projects, businesses have indicated concerns regarding disruption and aesthetics. In general, the contractor will be required to maintain a neat and orderly operation within the limits of their work areas. Signage related to the project will be that typical of a road construction project with traffic controls and authorized personnel access.

- **Excavated Materials Handling.** Excavated materials from the work zone, identified for off-site disposal, will be immediately moved to the railyard for temporary storage prior to rail or truck shipment to the disposal facility. A temporary spoils stockpile area will consist of a lined and bermed storage cell.

- **Dust.** Excavation work is anticipated to generate dust. Engineering controls, such as application of water, will be used to minimize dust generation, and the Site-Specific Health and Safety Plan and air monitoring plan (to be prepared under separate cover) will specify air monitoring requirements and limits for nuisance dust. In the event specified limits for nuisance dust and volatile gases are exceeded, the health and safety officer on site will assess the concern and take appropriate action (the on-site health and safety officer will have authority to immediately stop work if necessary and notify Ecology thereafter). No health and safety concerns are anticipated to persons on adjacent properties.

- **Restricted Access to Construction Zone.** A project exclusion zone will be designated in the Site-Specific Health and Safety Plan. Unauthorized personnel and persons without adequate HAZWOPER training will not be allowed inside the exclusion zone. The exclusion zone will be marked using temporary fencing, caution tape or other appropriate means.

- **Traffic.** Temporary traffic plans for the West River Road corridor are provided in Figure C-11 for review by all affected agencies and persons including fire department, police department (county and state), residents and the school.

- **Use of Local Businesses and Personnel.** BNSF and its contractors will use local businesses to the extent practicable. BNSF will encourage use of local motels/hotels, restaurants and supply vendors by personnel involved with the project. The contractor will be encouraged to use local labor to the extent practicable.

- **On-Site Personnel.** In addition to contractor personnel, at least one RETEC or BNSF project supervisor representative will be on-site at all times that field work is in progress. This supervisor may be the site health and safety officer, and will restrict access to the active work zone by any unauthorized individuals including children. In addition, Ecology personnel or Ecology contractors will be present on site during all times work is in progress, along with public participation personnel (EnviroIssues and/or Ecology) to address public concerns and answer questions about the work.

- **Glare.** Although it is not anticipated that construction activities will occur outside of daylight hours, portable construction lighting may be necessary due to construction delays or timing constraints that make working during the evening hours necessary. Light and glare impacts caused by portable construction lighting would be directed away from homes and roads as much as possible and focused on the work areas. The lights would be shielded and turned off when not necessary.

5.4 Schedule

Construction below the OHWM and all work in the river will take place between July 1st and August 31st to accommodate the fish window. Depending on the final decision by the Department of Fish and Wildlife, the fish window may be extended. This work is anticipated to be completed in 2006. However, if unusually high river levels preclude work in 2006, 2007 will be targeted for the work. The construction method for the levee remediation includes installing primary and secondary cofferdams, shoring, excavation, and backfill. The levee construction is anticipated to proceed in the following sequence:

To Be Completed Prior to July 1

- Set up temporary facilities and site controls, including fencing, job trailers, staging areas, access roads and other requirements as specified
- Clear and dispose of the debris and vegetation (including brush and trees) on the existing levee
- Relocate utility lines along south side of levee
- Move affected buildings
- Begin removing the armor rock and embankment fill from existing levee down to ordinary high water mark and stockpile
- Fill FIBCs with “recyclable” levee material (or imported materials) for cofferdam construction
- Install the shoring on the south boundary of the excavation.

To Be Completed Between July 1 and September 15

- Install two parallel cofferdams and tertiary containment (booms) along the north edge of the excavation prism.
- Excavate the levee and underlying contaminated material; the approximate excavation depths have been determined in accordance with the remediation levels described in Section 3 of this report and the results of the field test boring program (Appendix B). The lateral and vertical extent of the excavation prism may be modified at the time of the excavation based on monitoring data collected during the excavation.
- Transport contaminated rock/fill materials via railcar or truck to a Subtitle D landfill for disposal.

- Import material to replace the contaminated material.
- Reconfigure the levee to the lines and grades shown on the drawings and per the specifications, and install retaining wall.
- Install infrastructure requested by Town (under negotiations between BNSF and the Town).

To Be Completed After Levee Replacement

- Install storm sewer
- Replacement and restoration of affected buildings and install individual replacement septic systems.
- Plant new vegetation on the face of the levee as specified in the design.
- Asphalt patching of damaged portions of W. River Road pending uplands cleanup
- Construction of paths, outlook (under negotiations between BNSF and the Town)
- Installation of lighting (may be necessary to postpone until after cleanup or NWDZ is complete)
- Landscaping of levee crest and town side of levee (under negotiations between BNSF and the Town)
- Demobilize equipment and personnel
- Utility installation.

6 Construction Quality Assurance

This section discusses construction quality assurance for the project, including the quality assurance structure, responsibilities and requirements. Quality assurance includes compliance with health and safety requirements and performance standards outlined herein and within the specifications

6.1 Quality Assurance Monitoring Structure

All aspects of construction will be performed under the oversight of a RETEC professional engineer registered in the State of Washington or a qualified field technician under the direct supervision of RETEC professional engineer registered in the State of Washington. A BNSF Engineer or qualified representative will be on-site throughout construction and will be responsible for ensuring compliance with the performance standards outlined in Section 5.2.2.

6.2 Construction Quality Requirements

6.2.1 Health and Safety

As outlined in Section 2.2.1, personnel involved in the construction of the project will be required to comply with the health and safety training requirements commensurate with the task(s) they are performing. BNSF Contractors and subcontractors who may come into contact with hazardous materials are required to use workers trained for hazardous waste work. The contractor personnel will also obtain BNSF Contractor Orientation training to work in the railyard. It is the remedial contractor's responsibility to meet all the requirements of WAC 296-155, Safety Standards for Construction, and the applicable provisions of the hazardous waste operations regulations, WAC 296-62, Part P and 29 CFR 1910.120. The Contractor shall also have a site health and safety (H&S) officer who will ensure that all contractor personnel adhere to H&S regulations. Prior to starting work, the BNSF Contractor shall submit an H&S plan to the BNSF Engineer for review. The plan shall include written documentation of employee training and medical certifications as required under WAC 296-62, Part P. Documentation of the following items is required for each site worker where work falls under the requirements of WAC 296-62, Part P:

- Initial 40-hour health and safety training and annual 8-hour refresher training
- Eight-hour supervisory training, required for the field supervisor
- Medical clearance from a licensed physician certifying that the worker is fit to participate in field activities and use personal protective equipment

- Current respirator fit test certification
- Current CPR and first aid certification for at least one member of each crew
- Provision of personal protective equipment for each worker at the highest level of protection for this site (Level D).

6.2.2 Performance Standards

Performance standards address environmental and public health issues, such as emission control and compliance with environmental regulations. Monitoring efforts of the Engineer will be conducted to demonstrate compliance with performance standards.

The following sections identify performance standards for activities at the site. Table 6-1 lists the construction performance standards and the contractor quality assurance testing requirements.

Table 6-1 Construction Performance Standards

Standard	Parameter	Level of Performance	Testing Method or Specification	Frequency of Testing	Comments
Preconstruction Testing					
Backfill	Gradation	Granular material with less than 15% non-plastic fines (passing the #200 sieve) will be used above standing water. Granular material with less than 10% fines will be used below standing water.	ASTM D4318 ASTM D422	For each source	Backfill not exceeding MTCA Method A CULs.
Construction Testing					
Grading	Grade	Within 1.5 inches	Field Surveying	Continuous	
Emission Controls	Dust	< 5 mg/m^3 OSHA PEL	MiniRam and Site Perimeter Monitoring	Continuous	Contractor shall provide dust suppression measures
Surface Water Quality	Turbidity Oil	No excessive turbidity No sheen outside of containment area	Turbidity Monitoring Visual	Continuous	Implement Permits
Backfill Compaction	Density	Material below the base of the levee and above standing water shall be compacted to at least 90% ASTM D-1557 density. Material in the levee itself shall be compacted to at least 95% ASTM D-1557.	ASTM D1557 ASTM D2922	One test event per 750 CY of fill placed.	
		Material outside of the levee and above standing water will be compacted to 90% ASTM-D-1557, except below residential structures and within 2 feet of the roadway surface where fill will be compacted to 95% ASTM D-1557. Backfill placed below standing water will be placed as compact as practical, but no testing can be completed.	ASTM D1557 ASTM D2922	One test event per 750 CY of fill placed.	
Retaining Wall Elements	TBD	To be determined upon final determination of retaining wall type.			

Backfill

Chemical testing and gradation of backfill will be required for each source. Analytical testing will be performed for selected analytes to ensure that backfill does not exceed MTCA Method A or site-specific cleanup level concentrations. Gradation testing will ensure that the import material is free of deleterious material and is non-plastic. Testing will comply with ASTM D4318 and ASTM D422.

Emission Controls

Excavation, grading, and capping activities will be carried out in a manner that controls emissions of odors and dust (fugitive emissions). Dust and vapor monitoring will be carried out according to an Ecology approved monitoring plan (to be submitted under a separate cover). This plan will detail the location of perimeter monitoring stations for dust and organic vapors and present action levels that will protect workers and residents surrounding the site. The Contractor will provide measures to suppress fugitive dust generated during site grading that the BNSF deems excessive based on visual and other monitoring criteria.

Excavation and Shoring Monitoring

An excavation and shoring monitoring plan will be developed and implemented jointly by RETEC and the contractor chosen to perform the work, and will be subject to Ecology review. The plan will address monitoring activities that will be necessary to demonstrate that the excavation slopes and shoring are performing as designed, and mitigation plans that will be required if performance is not as anticipated. This plan is being developed after the contractor is chosen for the work since the contractor will design the shoring and it may differ from the shoring envisioned at this time.

6.2.3 Record Keeping and Reporting

Records will be maintained by onsite RETEC/BNSF representatives to document the work performed. These records include, but are not limited to, the following:

- **Daily Activity Log.** A daily activity log will be completed to describe general site activity and personnel working on-site. The records may be used to substantiate invoices as related to measurement and payment of site work. Health and Safety levels will also be noted in the daily logs as well as field H&S monitoring.

- **Material Testing Results.** All material testing results will be maintained. Material testing logs will, at a minimum, include the date and time of testing, testing site and location, identification of tester and company, test results, and any relevant comments.

- **Completion Report.** Upon completion of remedial activities, the Engineer will submit a draft completion report as required in WAC 173-340-400(b)(ii) by March 30, 2007 for work completed prior to December 31, 2006 and another draft report by July 31, 2007 for work completed between January 1, 2007 and June 30, 2007. The reports will include as-built drawings, work accomplished, materials used, inspections and tests conducted, results of inspections and tests, nature of defects found (if any), and corrective actions taken.

7 References

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Figures

Appendix A

Levee and Barrier Wall As-Built Drawings

Appendix B

River and Levee
Supplemental Site Investigation Report

Appendix C

South Fork Skykomish River
Mean Discharge Ranking in Summer

Appendix D

Scour Hydraulic Analysis

Appendix E

Dewatering Calculations

Appendix F

EDR Amendment Form

Appendix G

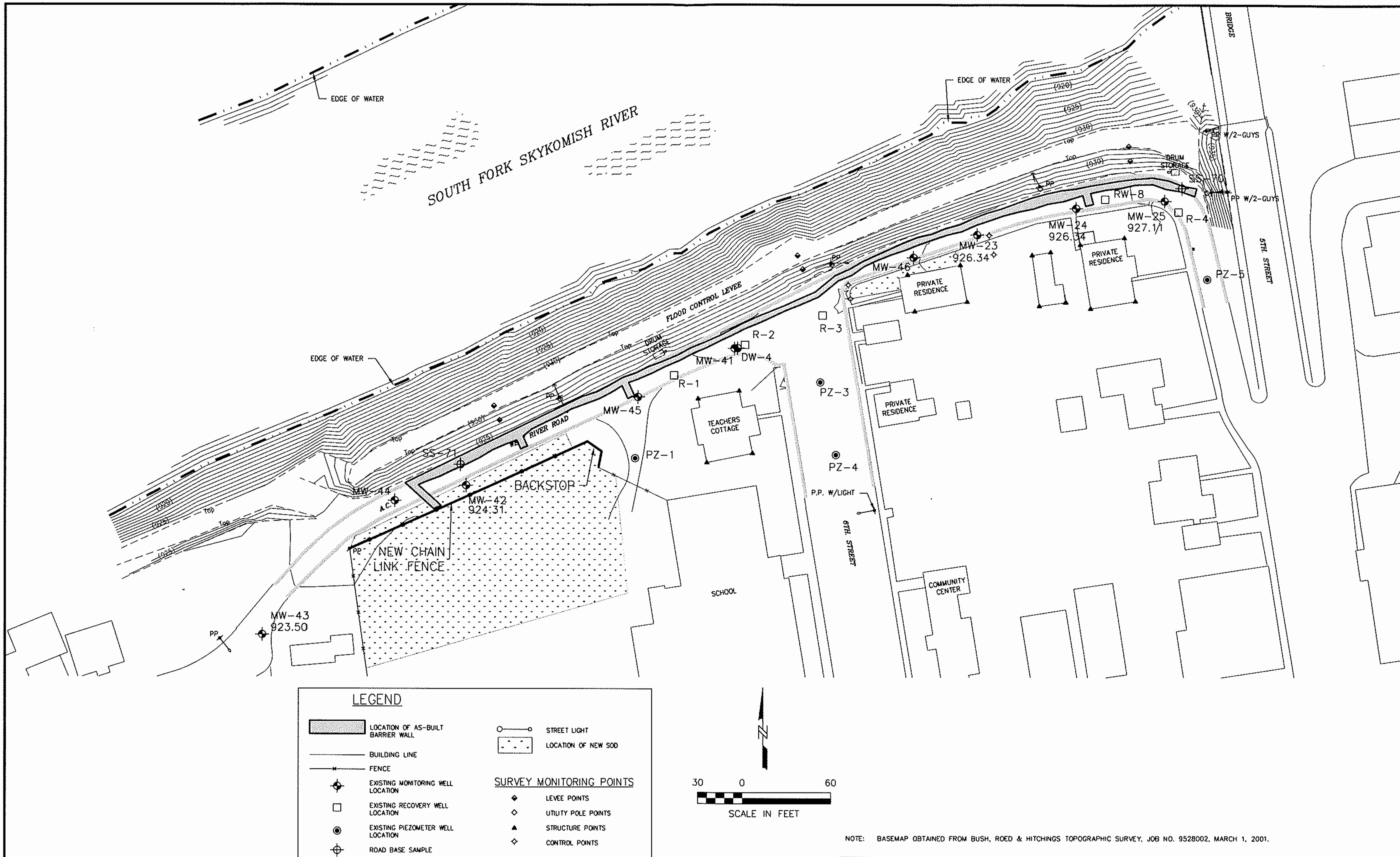
Sampling and Analysis Plan

Appendix H

Stormwater System Design

Appendix A

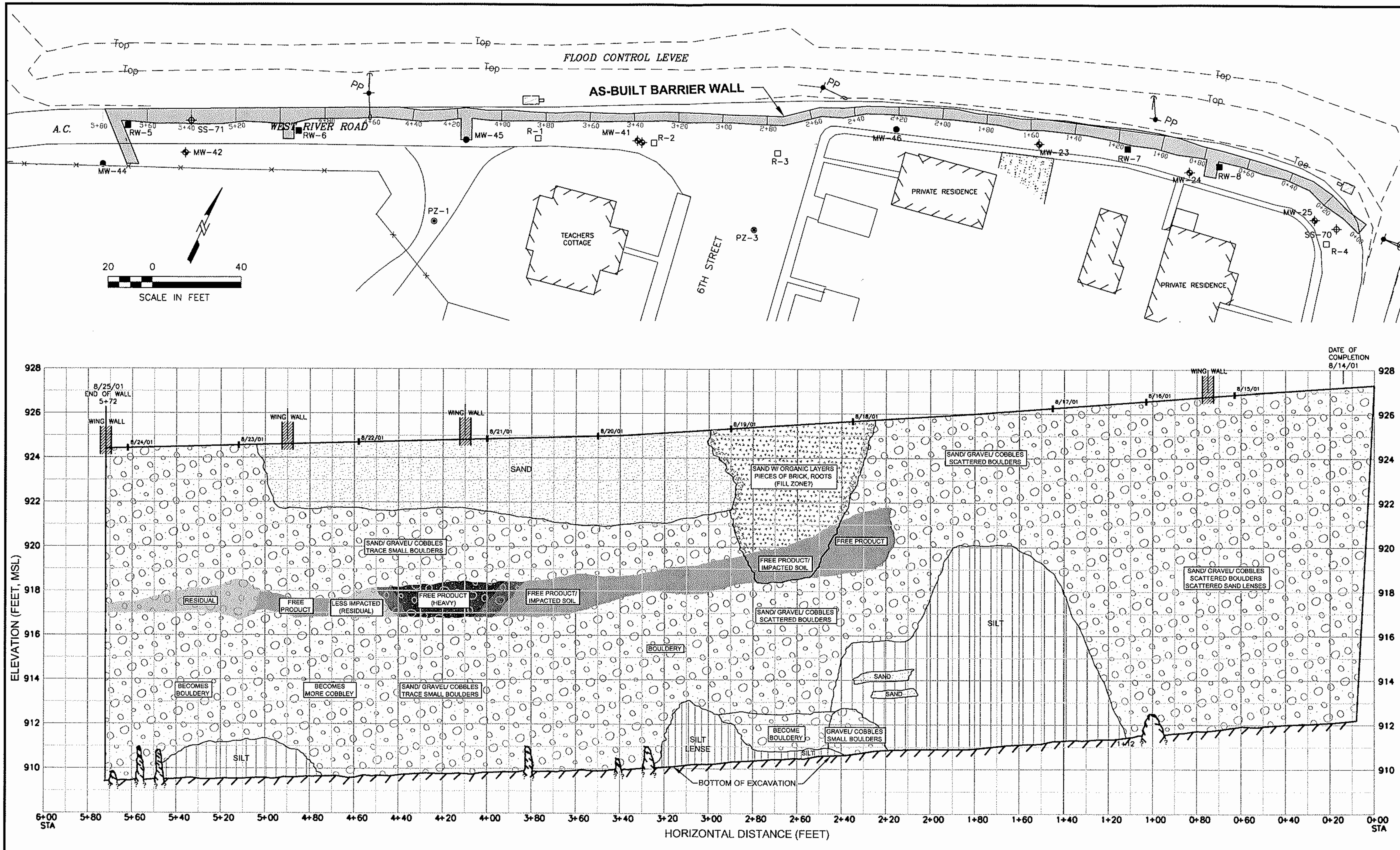
Levee and Barrier Wall As-Built Drawings



NOTE: BASEMAP OBTAINED FROM BUSH, ROED & HITCHINGS TOPOGRAPHIC SURVEY, JOB NO. 9528002, MARCH 1, 2001.

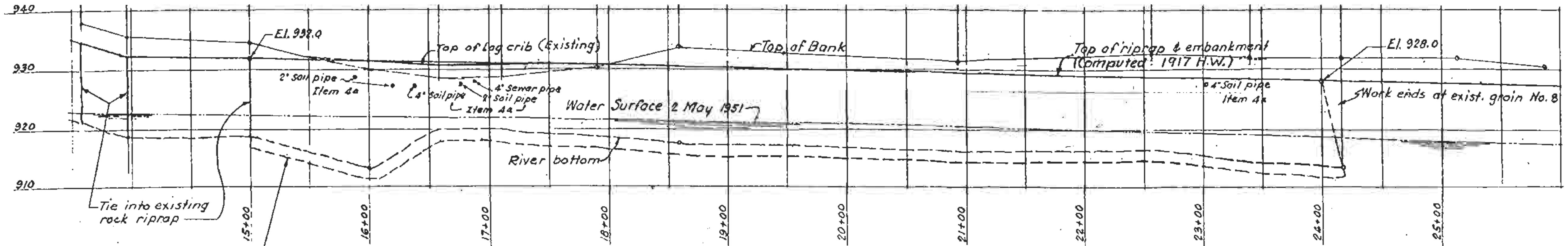
RETEC

PHASE 1 INTERIM ACTION BNSF - SKYKOMISH, WA BN050-04018-470			AS-BUILT BARRIER WALL LOCATION
DATE: 12/19/01	DRWN: A.S./UKN	FILE: 4018s260	LAYOUT: ANSI_BI-LJ — FIGURE 3-1



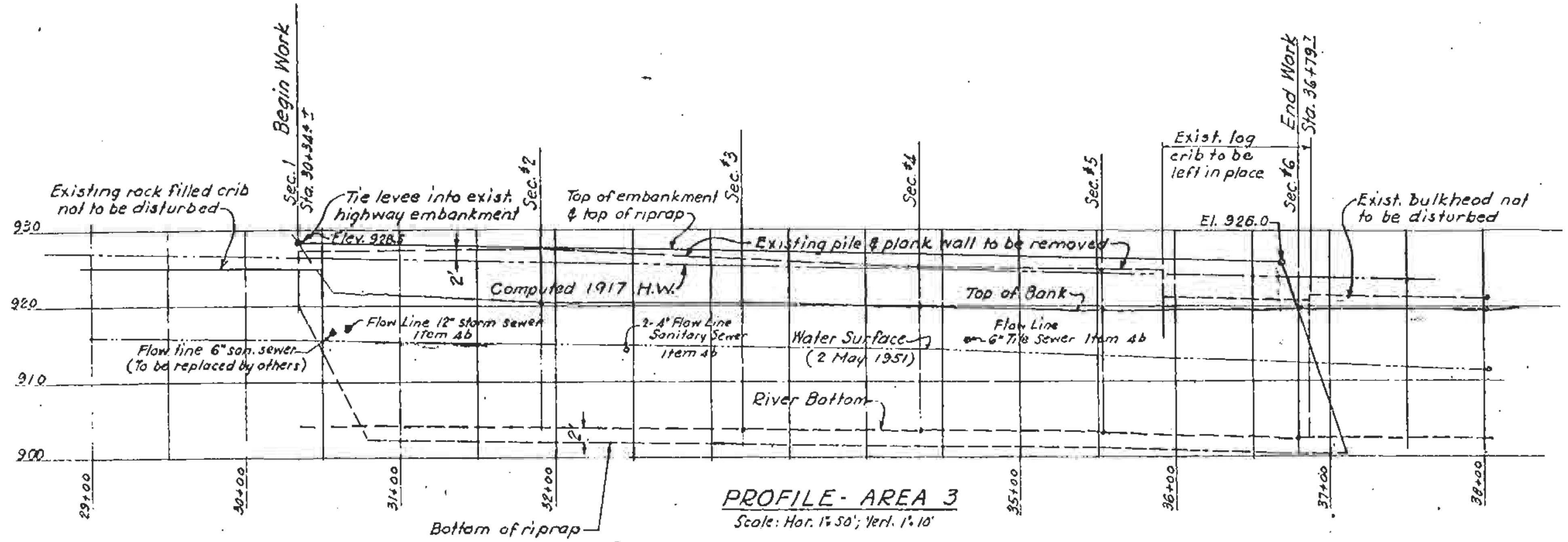
RETEC

PHASE 1 INTERIM ACTION BNSF-SKYKOMISH, WASHINGTON BN050-04018-470			AS-BUILT BARRIER WALL SUBSURFACE PROFILE	
DATE: 12/19/01	DRWN: A.S./UKN	FILE: 4018s261	LAYOUT: ANSI_BI-CP	FIGURE 3-2



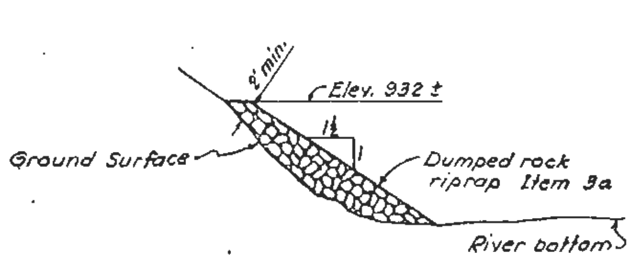
PROFILE - AREA 1 & 2

Scale: Hor. 1"=50; Vert. 1"=10'



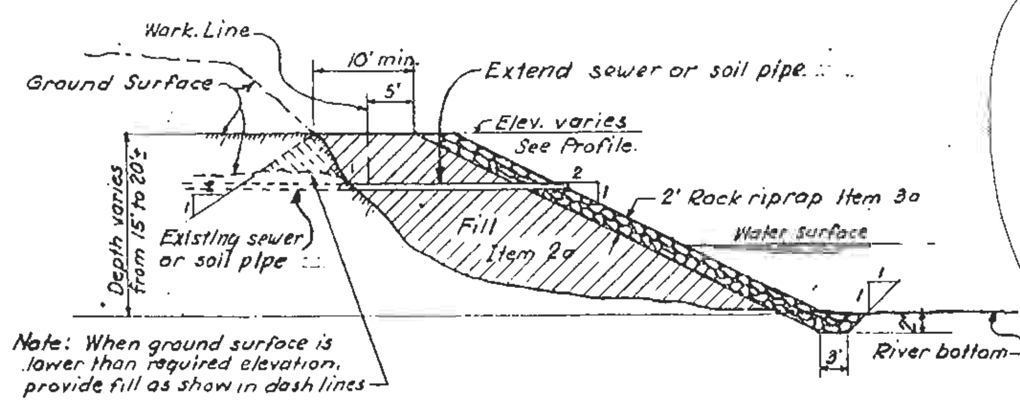
PROFILE - AREA 3

Scale: Hor. 1"=50'; Vert. 1"=10'



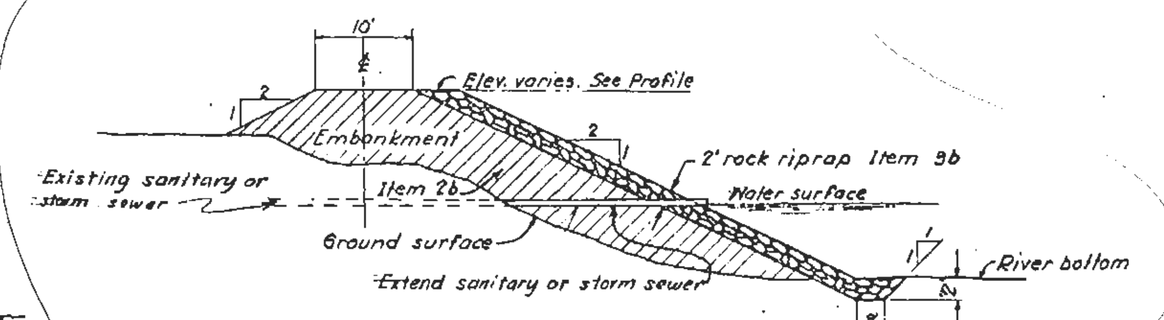
TYPICAL SECTION - AREA 1

Scale: 1"=10'



TYPICAL SECTION - AREA 2

Scale: 1"=10'



TYPICAL SECTION - AREA 3

Scale: 1"=10'

ESTIMAT

ARE.

Item No.	Des
1a	Clear
2a	Emb
3a	Roc
4a.	Sewe. e
1b	Clea
2b	Emb
3b	Roc
4b	Sewe exte

REVISION	DATE

CORPS

OFFICE OF THE D

DRAWN BY: JAE

TRACED BY:

CHECKED BY:

PREPARED:

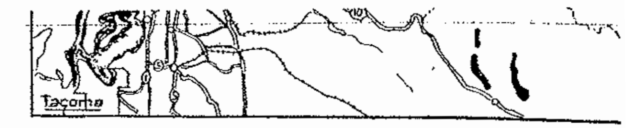
CHIEF, STRUCT. DESIGN SEC.

REVIEWED:

CHIEF, SAFETY BRANCH

RECOMMENDED

APPROV.



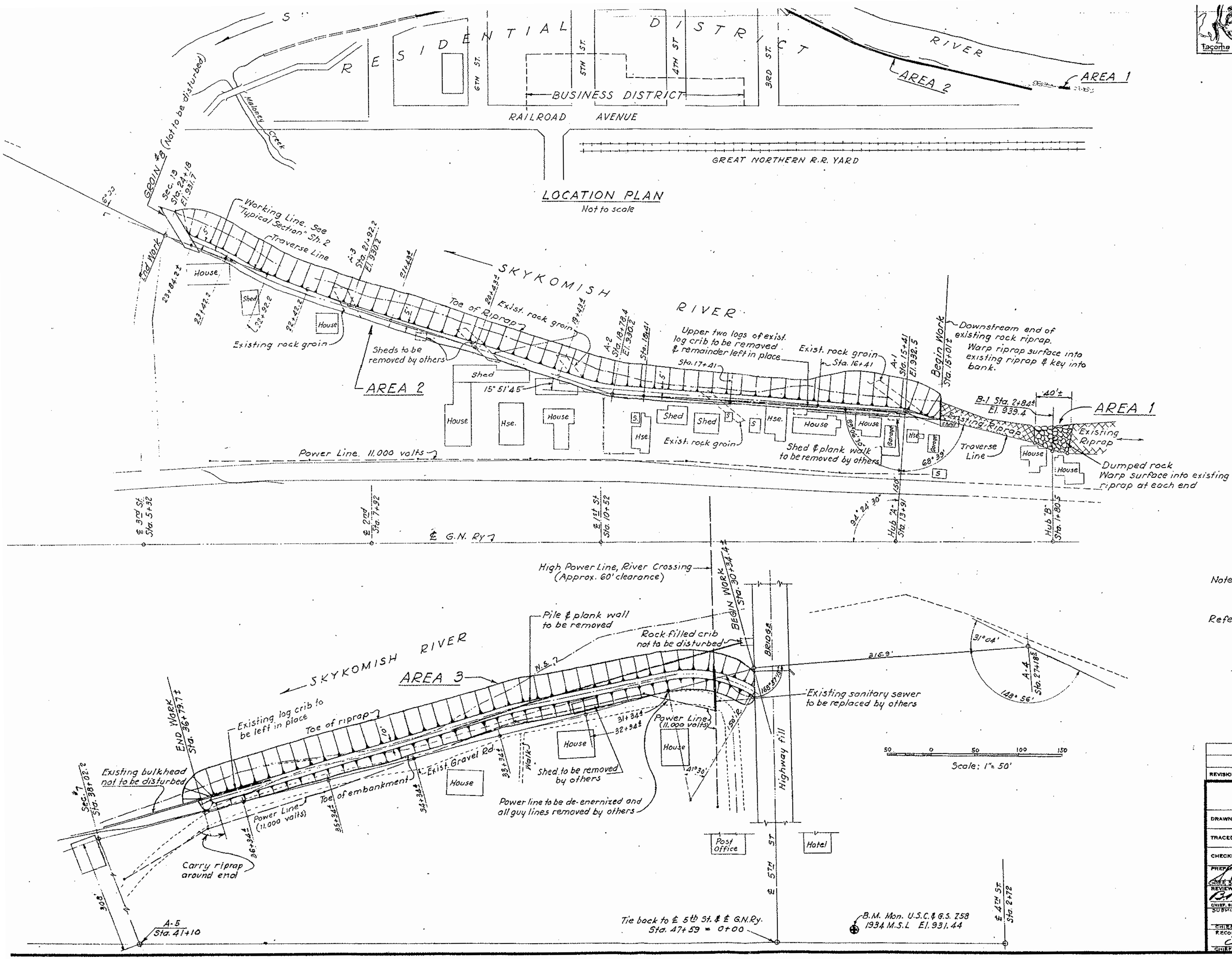


TABLE OF OFFSETS - AREA 2

(Looking Downstream)

Station	Distance From Traverse line To Working Line
15+01	6' Left
15+41	2' "
16+41	0
17+41	3' Right
18+41	4' "
18+78.4	5' "
19+43±	0
20+43±	0
21+43±	2' Left
21+92.2	2.5' "
22+42.2	5' "
22+92.2	5' "
23+42.2	2' Right
23+84.2	5' "

OFFSETS - AREA 3

(Looking Downstream)

Station	Distance from Traverse Line to ℄ of Embankment
30+34±	25'± Left
31+34±	10' Right
32+34±	25' "
33+34±	20' "
34+34±	23' "
35+34±	19' "
36+34±	15' "

Note: Water surface shown is that of 1 May 1951 H.
BENCH MARK: Monument U.S.C.& G.S. Z58 19
Elev. 931.448 (1947 Supp. Adj.

Reference: Field books, File No. 9-153 Books 1

REVISION	DATE	DESCRIPTION

CORPS OF ENGINEERS, U. S. ARMY
OFFICE OF THE DISTRICT ENGINEER, SEATTLE, WAS

SKYKOMISH RIVER
SKYKOMISH, WASHINGT
REVETMENT AND LE
GENERAL PLAN

DRAWN BY: JAE
TRACED BY:
CHECKED BY:
PREPARED: T. D. Moss
CHIEF, STRUCT. DESIGN SEC.
REVIEWED: B. F. Brooks
CHIEF, SAFETY BRANCH
SUBMITTED: A. A. Bodley
CHIEF, DESIGN BRANCH
RECOMMENDED:
CHIEF, ENGINEERING DIVISION
APPROVED: John P. Buehler
LT. COL., CORPS OF ENGINEERS
SCALE: AS SHOWN
DRAWING N
E-2-
SHEET 1 OF 2

Appendix B

River and Levee
Supplemental Site Investigation Report

River and Levee Supplemental Site Investigation Report

Former Maintenance and Fueling Facility
Skykomish, Washington

Prepared by:

The RETEC Group, Inc.
1011 SW Klickitat Way, Suite 207
Seattle, Washington 98134-1162

RETEC Project Number: BN050-16423-520

Prepared for:

BNSF Railway Company
2454 Occidental Street, Suite 1A
Seattle, Washington 98134

January 13, 2006

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1 Introduction

A supplemental soil and sediment investigation was completed in two phases, during September[1] and December[2] 2005, to characterize the extent of petroleum hydrocarbon contamination in the bed of the South Fork Skykomish River and the levee along West River Drive to the west of Fifth Street. This Skykomish River and Levee Supplemental Site Investigation (SSI) Report describes the overall scope and objectives for the investigation, and presents the results. This investigation provided data for developing an Engineering Design Report (EDR) for levee remediation.

1.1 Background

The former railway maintenance and fueling facility in Skykomish is owned and operated by BNSF. Historical activities since the facility opened in the late 1890s included refueling and maintaining locomotives and operating an electrical substation for electric engines. These activities released contaminants to the surrounding environment. BNSF is investigating and remediating the site consistent with the Model Toxics Control Act, RCW 70.105D (MTCA).

Fuel was stored in above and below ground storage tanks at the site until 1974, when most fuel handling activities were discontinued at the Skykomish facility. The site is currently used as a base of operations for track maintenance and snow removal crews.

Railroad Avenue separates BNSF property from the main commercial district of the town. Maloney Creek flows south of BNSF property and west to the South Fork of the Skykomish River. The site encompasses an area of about 40 acres and includes BNSF property and adjacent property. The approximate boundaries of the site are as follows: the Skykomish River to the north, approximately the Old Cascade Highway to the south, Maloney Creek to the west, and approximately Fourth Street to the east.

In early 1991, Ecology designated the former maintenance and fueling facility a high priority cleanup site. Later that year, BNSF indicated a desire to initiate a Remedial Investigation/Feasibility Study (RI/FS) in accordance with MTCA. At that time, formal negotiations for a legal agreement (called an Agreed Order) were initiated. Negotiations were completed in mid-1993. Following a public comment period, the Agreed Order, which includes detailed work plans for the RI/FS process and early interim cleanup work, was signed by Ecology and BNSF. BNSF and Ecology signed a second Agreed

[1] In accordance with the *River and Levee Investigation Work Plan*; RETEC, September 28, 2005.
[2] In accordance with the *Draft Work Plan for Additional Investigation Activities*; RETEC, December 14, 2005.

Order in 2001 for additional interim cleanup work near the Skykomish River and the levee west of Fifth Street.

Investigations performed by BNSF in cooperation with Ecology since 1993 have revealed petroleum contamination in soil, groundwater, sediments and surface water. Detailed information about the scope of prior investigations and the results appear in the 1996 Remedial Investigation Report, in the 2002 Supplemental RI Report, and in the Final Feasibility Study that was submitted in March 2005.

In 2001, BNSF installed a subsurface barrier wall along West River Drive, west of Fifth Street pursuant to Agreed Order No. DE 01TCPNR-2800. The wall was installed to reduce the quantity of total petroleum hydrocarbons (TPH) in the form of mobile free product that seeps into the Skykomish River. Recovery wells were also installed on the upgradient side of the wall and have been recovering oil since installation. Oil seeps have continued since the wall was constructed, and are thought to be from free product contained within the levee behind the barrier wall. The oil seeps occur in the riverbank and are located downgradient from the upland plume. The oil seeps in the river have been restricted to the riverbank and bed within approximately five feet of the riverbank.

Surface sediment samples have been collected from the bank and bed of the South Fork of the Skykomish River; however no deeper samples have been collected. In addition, only two soil samples have been collected from the levee. These samples were collected by Ecology in November 2004.

1.2 Purpose and Objectives

This investigation was intended to provide more precise data regarding the nature and extent of TPH contamination in the levee and within the bed of the Skykomish River for defining the excavation prism for remediation of the levee and adjacent areas. Remedial action in the river and levee areas of the site, if approved by federal permitting agencies, will likely consist of extensive excavation. The data obtained from this investigation will be used to help define the vertical and lateral extent of TPH contamination and therefore the extent of excavation required to meet applicable remediation or cleanup levels.

Boreholes were also advanced around the Skykomish School at Ecology's request. These boreholes were intended to more closely define the western boundary of the free product around the school. The results of this additional sampling will be used in developing a clean up action plan for the Site.

1.3 SSI Report Organization

This report presents the results of an investigation of the nature and extent of TPH contamination in the levee west of the Fifth Street bridge and in the sediments of the Skykomish River, adjacent to the levee. Section 1 describes the background and the purpose and objectives of the investigation. Section 2 discusses the scope of sampling. Section 3 details of the methods used to complete the investigation. Section 4 discusses the subsurface conditions of the areas investigated. Section 5 discusses the analytical results of the investigation. Section 6 discusses the extent of TPH contamination in the levee, the Skykomish River and the western plume boundary near the school. Section 7 presents conclusions and recommendations. Section 8 provides the references cited in the report.

2 Sampling Activities

Subsurface soil and sediment samples were collected for analysis from boreholes advanced through the levee, into the bed of the South Fork Skykomish River, and in areas around the Skykomish School. This section provides the scope of sampling, the rationale behind the borehole locations and the depth of the boreholes and samples.

2.1 Levee Sampling

The investigation of TPH extent in, and under, the levee was conducted in two phases. Phase I was conducted in September 2005 and Phase II was conducted during December 2005. Table 2-1 presents the borehole names, depths, dates of installation and investigation phase.

2.1.1 Phase I Investigation – September 2005

Soil samples were collected from ten locations along the crest of the levee between September 9 and September 14, 2005 (Figure 2-1). These samples were located downgradient of the known product plumes that are delineated upgradient of the barrier wall and upgradient from the riverbank seeps, within areas on the margins of the plumes, and in areas believed to be outside the plumes.

In boreholes in which contamination was evident from visual observations or odor, the boreholes were advanced to the apparent base of the contamination to determine the vertical extent of TPH contamination. Several samples were taken from each borehole and field analyzed using PetroFLAG field-screening test kits to estimate TPH. In general, once the field analysis estimated the depth at which the PetroFLAG test indicated that TPH was at approximately one half of the sediment remediation level, a sample was collected for laboratory verification using NWTPH-Dx analysis to determine depth of TPH exceeding remediation goals. In order to gather additional TPH data, some additional analytical testing was performed from some of the boreholes.

Boreholes in which no contamination was apparent from visual observations or odor were also advanced to approximately the same distance as adjacent borings. Soil samples were collected for analysis from the interval exhibiting the highest PetroFLAG TPH detections.

2.1.2 Phase II – December 2005

An additional seven boreholes were advanced between December 19 and December 22, 2005; four of these boreholes were co-located with Phase I boreholes, while the remaining three boreholes were advanced between previously advanced boreholes.

This second phase of investigation was conducted to supplement the existing dataset obtained from Phase I of the Investigation and provide additional design data for the EDR. The PetroFLAG data and the analytical results (NWTPH-Dx) obtained during Phase I showed a weak correlation with each other and the existing dataset did not provide adequate certainty regarding the total depth of contamination above remediation levels.

During Phase II, soil samples were collected from 2.5 to 5-foot intervals from near the top of the smear zone, to the base of the contamination (or to the depth at which NWTPH-Dx analyses performed under Phase I of the investigation indicate that the TPH contamination is less than the direct contact remediation level (3,400 mg/Kg). Soil samples were not field-screened using PetroFLAG during Phase II.

2.2 South Fork Skykomish River

Sediment samples were collected from 20 boreholes (Figure 2-1) advanced in the bed of the South Fork Skykomish River on September 13 and 14, 2005. These boreholes were located in areas that are submerged during some of the year but were outside the river channel at the time of drilling.

The timing of the investigation was constrained by the regulatory fish window, which permitted activities in the river through September 15, 2005. The river level typically drops to the seasonal low after the fish window ends, and therefore, the drilling and sampling was scheduled for the end of the fish window. However, due to recent precipitation immediately prior to and during the investigation, the extent of available sample locations along the river was limited due to a small rise in the river level. Twenty boreholes were advanced within 50 feet from the toe of the levee; these were located as close as possible to the toe of the levee[3].

Field observations, including visual observations and/or hydrocarbon odor, and PetroFLAG field screening test kits were used to estimate the degree of contamination within the borehole samples. Generally boreholes were profiled by recording observations of visual contamination and any hydrocarbon odor, by collecting soil samples throughout the boring, and by estimating the TPH concentrations in those samples using PetroFLAG field screening test kits. Approximately one verification sample was collected and submitted to Test America (formerly, North Creek Analytical Laboratories, Inc.) for NWTPH-Dx analysis; this sample was typically collected from the depth with the highest apparently concentration of TPH.

If no contamination was apparent from visual or olfactory observations, the boring was field screened for TPH using PetroFLAG test kits. One soil

[3] The River and Levee Investigation Work Plan (RETEC, September 28, 2005) specified a grid of primary borehole locations and contingency borehole locations. While the plan was adhered to as closely as possible, the river level did not allow boreholes to be advanced at all specified locations.

sample was typically collected for analysis from the estimated smear zone interval.

Three in-river borings were selected for additional data collection. Samples were collected from near the center of the potential excavation prism, and from the east and west ends of the prism. These data were collected for input in site-specific calculations regarding the migration of contaminated materials and the scouring of cap materials should the need arise to cap any of the sediments either in the river or under the new levee. In the 3 borings sediment samples were collected for analysis of NWTPH-Dx, total organic carbon (TOC), specific gravity and dry weight (or percent solids). The overall boring depth was determined by estimating the elevation in which contamination appeared in the adjacent borings in the levee.

2.3 Skykomish School

Soil samples were collected from three designated boreholes and two contingency boreholes advanced around the school (Figure 2-1). These boreholes are identified in Table 2-1.

Boreholes located within these plume areas were advanced to the apparent base of the contamination to determine the vertical extent of TPH contamination. Several samples were taken from each borehole and PetroFLAG field-screening test kits were used to estimate TPH. Once the field analysis estimated the depth at which the TPH was at approximately one half of the sediment remediation level, a sample was collected for laboratory verification. In order to determine additional depth information, field analysis was generally conducted from at least two additional depths per borehole.

Soil samples were also collected from the surface soils near the school for lead analysis.

3 Methodology

This section provides the methodology used to advance the boreholes and collect the subsurface soil and sediment samples.

3.1 Drilling Sampling

Soil and sediment samples were collected for description and analysis from boreholes advanced using a minisonic drill rig. Sonic drilling was identified as the most suitable drilling technology for the investigation based on the past success with sonic drilling at the site, the ability of the method to provide highly representative continuous core samples, and because the method enables drilling without introducing drilling fluids. The track-mounted minisonic rig was the most suitable sonic rig for the investigation because of the portability of the rig and its ability to reach difficult to access locations while causing minimal disturbance to the natural surroundings.

The minisonic rig was used to collect continuous soil or sediment samples from each borehole. All drilling equipment was decontaminated between impacted boreholes. The borehole samples were logged and described by a RETEC field geologist, and samples were collected for analysis from select intervals, as described in Section 2. Copies of the boring logs are presented in Appendix A. All drilling locations were exposed (i.e. below OHWM but above the river level) and access to those locations was over dry land and dry riverbed.

Upon completion of Phase I boring activities, a registered land surveyor calculated the coordinates and elevation of the borings in relation to a USGS benchmark. A copy of the survey results are presented in Appendix B. The Phase II boreholes have not been surveyed yet because additional investigation activities are scheduled for January 2006; the Phase II boreholes will be surveyed upon completion of this work.

3.2 PetroFLAG Analysis

The PetroFLAG field portable test method was used for determining TPH concentrations in soil at the site during Phase I of the investigation. This test method was proposed for use at the Site by Ecology because it can determine hydrocarbon contamination levels in real time to help facilitate on site decisions.

The test was performed in three steps: extraction, filtration, and analysis. In the first step a solvent system was used to extract hydrocarbons from the recovered subsurface material. Moisture content had no effect on extraction efficiency. The second step involves filtering out all suspended materials from the extract so that they don't interfere with the test results. Finally, a developing solution was added and the solution extract developed a response in proportion to the amount of hydrocarbons contained in the soil sample. Within ten minutes the developing solution equilibrated and a reading was obtained using the analyzer. If the type of hydrocarbon is known, then the specific response factor could be selected from the on-board menu to calibrate for the analyte; the response factor selected for PetroFLAG analysis was for diesel range hydrocarbons.

If the reading was above the range detectible by the analyzer then the amount of sample collected was reduced for a diluted reading. Dilution multiplication factors of 2 and 10 times were used at the site. If the sample reading continued to be above the detectible range after 10 times dilution the sample was assumed to have a concentration of greater than 100,000 mg/Kg. When PetroFLAG analysis was complete, the date, time, dilution factor and results were recorded on a field sheet. A copy of the field sheets are presented in Appendix C.

3.3 Laboratory Analysis

The selected verification soil samples collected during drilling activities were logged onto an chain-of-custody form and delivered by RETEC field personnel to Test America (Formerly, North Creek Analytical Laboratories, Inc. (NCA)) for NWTPH-Dx analysis[4]. Select samples were also submitted for analysis of lead and total organic carbon (TOC). A copy of the laboratory analytical results is presented in Appendix D.

In addition, samples of contaminated sediment were collected and retained for use, by prospective vendors, for treatability testing in support of the water treatment processes that may be employed during the remediation activities during summer 2006. These samples have been archived for future use, as necessary.

3.4 Investigation Derived Waste

One of the benefits of sonic drilling is that little waste was generated. All drill cuttings, decontamination water and other investigation-derived waste were drummed and labeled. The drums were transported to a staging area on the railyard, and the drums will remain at the staging area pending disposal.

[4] NWTPH-Dx quantifies petroleum hydrocarbons with carbon ranges between C12 and C36.

4 Subsurface Conditions

Subsurface conditions were further defined in the levee and river during the SSI. This information was used to construct east-west cross sections along the levee and adjacent to the levee, under the Skykomish River channel. The locations of the cross sections are presented in Figure 4-1.

4.1 Levee Subsurface

The upper layer of sediment of the levee subsurface consists of well-graded coarse gravel to cobble sized fill material. This layer varies in depth from approximately 10 to 25 feet bgs. Sample recovery was generally poor in this unit. Underneath this layer discontinuous lenses of silt and clay exist within sand and gravel.

A layer of silt was present within the sand and gravel; however, it did not appear to extend continuously throughout the levee. This layer of silt varies in thickness from 1 to 10 feet and is present from approximately 15 to 35 feet below ground surface.

During the Phase I investigation, groundwater was encountered in the boreholes at depths ranging from 17 feet (LEV-1) to 33 feet (LEV-5). This wide range is due to the variations in surface elevation and lithologic heterogeneities. A cross section of the levee is presented on Figure 4-2.

4.2 River Subsurface

Surficial observations of the South Fork Skykomish River indicated the riverbed surface was armored by cobbles and large boulders. Below the armor, the subsurface sediment is mostly well-graded gravel. A discontinuous silt or clay-rich layer is present at an elevation that varies from 900 to 910 feet msl; this layer varies in thickness to greater than 5 feet. Thin clay, silt and sand discontinuous interbeds are also present within the predominant gravel above and below the silt zone. A cross section of the river is presented on Figure 4-3.

4.3 School Subsurface

The observations of the subsurface near the school were consistent with previous investigations at the site. The soils consisted mainly of sand and gravel, and underneath a generally thin layer of topsoil. There were also discontinuous lenses of silt and clay within the sand and gravel. Little variance occurred in depth to groundwater in this area of the investigation. Depths to groundwater ranged from 8-10 feet below ground surface.

5 Soil Analytical Results

Soil samples were collected and analyzed using PetroFLAG and Laboratory analysis during the field investigation. PetroFLAG and Laboratory analytical results are presented in this section. Laboratory analytical data has not yet been validated.

5.1 Levee Analytical Results

5.1.1 PetroFLAG Results

Fifty-five soil samples were collected for PetroFLAG analysis in the nine borings advanced in the levee. The results of the field screening analysis are summarized in Table 5-1 and plotted on Figure 5-1.

Hydrocarbons were detected in fifty of the fifty-five samples. The reported detected concentrations ranged from 1 mg/Kg to greater than 100,000 mg/Kg.

5.1.2 Laboratory Analytical Results

Ten soil samples were collected for laboratory analysis of TPH by NWTPH-Dx during Phase I of the Investigation and 73 samples were collected during Phase II. The Phase I and II analytical results are summarized in Table 5-2 and 5-3, respectively, and plotted on Figure 5-1. TPH concentrations ranged from concentrations below the method reporting limit (MRL) to 33,500 mg/Kg. The remediation level for TPH was exceeded in eleven soil samples collected from elevations between 916.5 and 907 feet below mean sea level (ft-msl).

5.2 River Sediment Analytical Results

5.2.1 PetroFLAG Results

Sixty-five sediment samples were collected for PetroFLAG analysis in the twenty borings advanced in bank of the river. The results of the field screening analysis are summarized in Table 5-1 and plotted on Figure 5-2.

5.2.2 Laboratory Analytical Results

Twenty-five sediment samples were collected for laboratory analysis of TPH by NWTPH-Dx. The results of samples collected for laboratory analysis are summarized in Table 5-2 and plotted on Figure 5-2.

TPH concentrations ranged from concentrations below the MRL to 576 mg/Kg. The remediation level for TPH was not exceeded in any sample; the cleanup level (22 mg/Kg) was exceeded in six samples.

Six sediment samples were collected for Total Organic Carbon (TOC) analysis. The results of samples collected for laboratory analysis are summarized in Table 5-2. TOC ranged from 1,560 mg/Kg to 5,930 mg/Kg.

5.3 School Soil Analytical Results

5.3.1 PetroFLAG Results

Thirty-one soil samples were collected for PetroFLAG analysis in the five borings advanced around the Skykomish school. The results of the field screening analysis are summarized in Table 5-1.

5.3.2 Laboratory Analytical Results

Seven soil samples were collected for laboratory analysis of TPH by NWTPH-Dx. The results of samples collected for laboratory analysis are summarized in Table 5-2.

TPH concentrations ranged from 22.9 to 3,800 mg/Kg. The remediation level for TPH was exceeded one sample that was collected from 15 to 20 feet bgs from 5-B-8.

Two soil samples were collected, from 5-B-11, for laboratory analysis of lead by EPA 6000/7000 series methods. The results of samples collected for laboratory analysis are summarized in Table 5-2. Lead was detected below cleanup level (250 mg/Kg) in the two samples. Lead was detected at 103 mg/Kg in the soil sample collected from 0 to 1 feet bgs and at 41.9 mg/Kg in the sample collected from 2 to 4 feet bgs.

5.4 Correlation of PetroFLAG and NWTPH-Dx

In general, PetroFLAG results were significantly higher (in some instances over an order of magnitude) than the corresponding laboratory analyzed sample. A statistical analysis was performed to determine if the PetroFLAG data correlated with the laboratory confirmation samples. The results of the analysis are presented in Figure 5-3.

The best correlation was obtained with a power series, using the following equation:

$$y = 4.3399x^{0.9346}$$

The correlation (R^2) using this power series was 0.6783. This indicates a weak correlation between the PetroFLAG field screening data and the laboratory confirmation samples.

The reason for the poor correlation is unclear. One explanation for the higher detections of TPH in the PetroFLAG analysis is the presence of naturally occurring hydrocarbons in soil which can cause high readings with PetroFLAG. Whatever the reasons, any conclusions drawn from PetroFLAG data will be highly speculative, and for this reason, use of the PetroFLAG data in defining the extent of TPH contamination has been minimal.

6 Extent of Contamination

The data obtained from this investigation has been used to define the vertical and lateral extent of TPH contamination beneath the levee and the Skykomish River, and provide data for the Levee Remediation EDR.

The subsurface sediment samples from around the Skykomish School were collected to more closely define the western boundary of the free product around the school.

6.1 Vertical and Lateral Extent of TPH in the Skykomish Levee

The extent of TPH in the Skykomish Levee has been defined largely based on laboratory analyses using NWTPH-Dx. As described in Section 5.4, the PetroFLAG data have a weak correlation with NWTPH-Dx and as such cannot be used with confidence. Physical observations of the soil samples collected during drilling also provide useful qualitative information regarding the extent of contamination, however the quantitative results obtained from NWTPH-Dx data are the highest quality data and are accordingly given the most weight.

The data indicate that the NWTPH-Dx concentrations appear to be below the direct contact remediation level below 905 ft-msl, and throughout much of the length of the levee, the impacts are restricted to higher elevations. Also, there is an area of the levee that does not appear to be contaminated with petroleum hydrocarbons at concentrations above the remediation level; this area includes boreholes LEV-6A and LEV-7.

The depth of excavation within the levee has been defined, for design purposes, based on the NWTPH-Dx data obtained from this investigation. Further details are provided in the EDR for Levee Remediation.

6.2 Vertical and Lateral Extent of TPH in the Skykomish River

The extent of TPH along the bank of the Skykomish River has been defined based on visual observations and NWTPH-Dx analyses. As described in Section 5.4, the PetroFLAG data have a weak correlation with NWTPH-Dx and as such cannot be used with confidence. Physical observations of the soil samples collected during drilling also provide useful qualitative information regarding the extent of contamination, however the quantitative results obtained from NWTPH-Dx data are the highest quality data and are accordingly given the most importance.

The investigation data indicates that TPH contamination appears to be restricted to the riverbed within 10 feet of the toe of the levee as shown by LEV-10 and LEV-3, and a limited area on the west end of the levee, as defined by RIV-2 and RIV-3. NAPL was observed in the upper four inches in LEV-2, LEV-3 and LEV-10 and elevated TPH concentrations were detected in some deeper sediment samples from these boreholes.

7 Conclusions and Recommendations

The data obtained during this investigation have been used to define the vertical and lateral extent of TPH contamination beneath the levee, the Skykomish River, and to provide additional definition of contamination around the margin of the Skykomish School.

The levee investigation was performed in two phases because the initial phase of the investigation, conducted during September 2005, yielded ambiguous data, primarily due to a weak correlation between the majority of the TPH data that was provided by a field screening test (PetroFLAG) and NWTPH-Dx samples. The data from the two phases were combined to provide a more complete understanding of the vertical and lateral extent of TPH underlying the levee. The data show that TPH concentrations in excess of the remediation level may extend to a minimum elevation of 905 ft-msl under the western half of the levee, and that this contamination is separated from contamination under the eastern quarter of the levee by a relatively clean zone that corresponds to the un-impacted upland area that is immediately upgradient from the levee. TPH contamination above the remediation level in the eastern quarter of the levee appears to extend to a minimum elevation of approximately 910 to 915 ft-msl.

The analysis of data collected from the riverbed concluded that NAPL was present in the upper four inches of sediment in RIV-2, RIV-3 and RIV-10; however testing did not measure TPH at a concentration exceeding the RL in any sediment samples. Generally, TPH concentrations in the riverbed are less than the cleanup levels, and there are no signs of contamination. However, TPH impacts at concentrations above the CUL are suspected in some discrete areas of the riverbed. These areas include the following: (1) an area just west of the 5th Street bridge encompassing RIV-2 and RIV-3. This area contains TPH impacts (above the CUL) to an elevation of approximately 907 ft-msl; (2) the area around RIV-10, this borehole also showed TPH impacts above the CUL to an approximate elevation of 907 ft-msl.

Finally, a borehole advanced beneath the bridge (RIV-20) contained TPH at a concentration (43 mg/Kg) greater than the soil CUL in the top one foot of sediment. The source of this TPH is unknown, since sediment in this area may be impacted by stormwater runoff from a nearby culvert that drains portions of the Town of Skykomish and discharges into the river near the bridge. This borehole location is outside the currently-proposed remediation area.

8 References

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Tables

Table 2-1 Borehole Details

Borehole ID	Investigation Area	Total Depth (ft)	Installation Date	Investigation Phase
LEV-1	Levee	20	9/9/2005	Phase I
LEV-2	Levee	20	9/9/2005	Phase I
LEV-3	Levee	35	9/9/2005	Phase I
LEV-4	Levee	50	9/12/2005	Phase I
LEV-5	Levee	60	9/11/2005	Phase I
LEV-5B	Levee	55	9/16/2005	Phase I
LEV-6	Levee	50	9/14/2005	Phase I
LEV-7	Levee	50	9/15/2005	Phase I
LEV-8	Levee	52	9/15/2005	Phase I
LEV-9	Levee	50	9/15/2005	Phase I
LEV-2A	Levee	40	12/22/2005	Phase II
LEV-4A	Levee	35	12/22/2005	Phase II
LEV-5C	Levee	35	12/21/2005	Phase II
LEV-6A	Levee	45	12/21/2005	Phase II
LEV-7A	Levee	35	12/20/2005	Phase II
LEV-8A	Levee	35	12/19/2005	Phase II
LEV-8B	Levee	35	12/20/2005	Phase II
5-B-7	School	35	9/10/2005	Phase I
5-B-8	School	35	9/10/2005	Phase I
5-B-9	School	30	9/10/2005	Phase I
5-B-11	School	30	9/11/2005	Phase I
5-B-12	School	35	9/11/2005	Phase I
RIV-1	River	10	9/12/05	Phase I
RIV-2	River	10	9/12/05	Phase I
RIV-3	River	12	9/12/05	Phase I
RIV-4	River	23	9/12/05	Phase I
RIV-5	River	15	9/13/05	Phase I
RIV-6	River	15	9/13/05	Phase I
RIV-7	River	15	9/13/05	Phase I
RIV-8	River	15	9/13/05	Phase I
RIV-9	River	15	9/13/05	Phase I
RIV-10	River	25	9/13/05	Phase I
RIV-11	River	15	9/13/05	Phase I
RIV-12	River	25	9/13/05	Phase I
RIV-13	River	15	9/13/05	Phase I
RIV-14	River	15	9/14/05	Phase I
RIV-15	River	15	9/14/05	Phase I
RIV-16	River	15	9/14/05	Phase I
RIV-17	River	15	9/14/05	Phase I
RIV-18	River	15	9/14/05	Phase I
RIV-19	River	15	9/14/05	Phase I
RIV-20	River	15	9/14/05	Phase I

Table 5-1 Summary of PetroFLAG Field Screening Results

Sample Location	PetroFLAG Result (mg/Kg)
5-B-7 - 6-7'	> 100,000
5-B-7 - 10-13'	10,280
5-B-7 - 15-20'	578
5-B-7 - 20-25'	1898
5-B-7 - 25-28'	342
5-B-7 - 28-30'	38
5-B-8 - 8'	7,550
5-B-8 - 12'	9,720
5-B-8 - 15-20'	7,600
5-B-8 - 20-25'	990
5-B-8 - 29-30'	27
5-B-9 - 7'	2,751
5-B-9 - 12'	1,130
5-B-9 - 17'	4,770
5-B-9 - 22'	1,186
5-B-9 - 26'	564
5-B-9 - 29'	53
5-B-11 - 5-10'	49
5-B-11 - 10-15'	85
5-B-11 - 15-20'	269
5-B-11 - 20-25'	57
5-B-11 - 25-27'	0
5-B-11 - 27-30'	0
5-B-12 - 6-10'	11,890
5-B-12 - 13'	2,830
5-B-12 - 15'	17
5-B-12 - 15-20'	580
5-B-12 - 20-25'	3,490
5-B-12 - 25-30'	940
5-B-12 - 30-33'	1,260
5-B-12 - 34-35'	0
LEV-1 - 16-19'	2,330
LEV-2 - 18'	9,400
LEV-2 - 19'	5,820
LEV-3 - 15.5-19.5'	10,310
LEV-3 - 21-25'	110
LEV-4 - 15'	> 100,000
LEV-4 - 25-30'	11,000
LEV-4 - 30-35'	7,640
LEV-4 - 35-39'	1,650
LEV-4 - 39-40'	0
LEV-4 - 40-45'	3
LEV-4 - 45-50'	8
LEV-5 - 29-30'	7,010
LEV-5 - 32-35'	119
LEV-5 - 35-40'	3,270
LEV-5 - 42'	212
LEV-5 - 45'	409
LEV-5 - 50-55'	130
LEV-5 - 55-60'	126
LEV-5B - 15'	> 100,000
LEV-5B - 20'	> 100,000
LEV-5B - 25'	3,050
LEV-5B - 30'	150
LEV-5B - 33'	0
LEV-5B - 38'	702
LEV-5B - 43'	6,730
LEV-5B - 46'	1
LEV-5B - 55'	0
LEV-6 - 5'	7
LEV-6 - 28'	0
LEV-6 - 30'	25
LEV-6 - 33'	9,190
LEV-6 - 43'	12
LEV-6 - 47'	57
LEV-7 - 7'	27
LEV-7 - 23'	106
LEV-7 - 33'	52
LEV-7 - 38'	50
LEV-7 - 45'	48
LEV-7 - 47'	29
LEV-7 - 50'	16
LEV-8 - 10	21,320
LEV-8 - 12	47
LEV-8 - 16	> 100,000
LEV-8 - 25	14,450
LEV-8 - 35	3,160
LEV-8 - 43	77
LEV-8 - 50'	80
LEV-9 - 14'	26
LEV-9 - 23'	1,168
LEV-9 - 25'	61
LEV-9 - 33'	269
LEV-9 - 41'	342
LEV-9 - 46'	465
LEV-9 - 50'	24
RIV-2 - 0-1'	5,700
RIV-2 - 10'	18
RIV-3 - 0-5'	1,750
RIV-3 - 5-10'	4,880
RIV-3 - 15'	44
RIV-4 - 0-4'	201
RIV-4 - 4-10'	143
RIV-4 - 10-15'	144
RIV-4 - 15-18'	139
RIV-4 - 18-20'	0
RIV-4 - 20-23'	0
RIV-5 - 0-3'	6
RIV-5 - 3-5'	90
RIV-5 - 5-10'	182
RIV-5 - 13-14'	42
RIV-5 - 14-15'	15
RIV-6 - 0-3'	32
RIV-6 - 3-5'	21
RIV-7 - 0-5'	155
RIV-7 - 5-10'	10
RIV-7 - 10-13'	72
RIV-7 - 13-15'	48
RIV-8 - 0-2'	31
RIV-8 - 4-6'	12
RIV-8 - 15'	95
RIV-9 - 0-5'	0
RIV-9 - 5-10'	38
RIV-9 - 12-15'	18
RIV-10 - 10-12'	17
RIV-10 - 12-14'	35
RIV-10 - 15-20'	17
RIV-10 - 20-21'	33
RIV-10 - 21-25'	16
RIV-11 - 5-10'	3
RIV-11 - 10-13'	75
RIV-11 - 13-15'	29
RIV-12 - 5'	10
RIV-12 - 10'	585
RIV-12 - 14'	19
RIV-12 - 16'	0
RIV-12 - 25'	9
RIV-13 - 3'	4
RIV-13 - 15'	1
RIV-14 - 1'	109
RIV-14 - 9'	7
RIV-14 - 15'	6
RIV-15 - 1'	219
RIV-15 - 6'	9
RIV-15 - 8'	0
RIV-15 - 15'	86
RIV-16 - 1'	50
RIV-16 - 9'	30
RIV-16 - 15'	12
RIV-17 - 1'	7
RIV-17 - 7'	26
RIV-17 -15'	5
RIV-18 - 1'	13
RIV-18 - 10'	9
RIV-18 - 15'	61
RIV-19 - 1'	27
RIV-19 - 11'	66
RIV-19 - 15'	35
RIV-20 - 1'	79
RIV-20 - 8'	5
RIV-20 - 15'	0

Table 5-2 Summary of Laboratory Analytical Results – Phase I Investigation

Levee Analytical Results

Compound	Method	LEV-1 18-19' 9/9/2005	LEV-2 19' 9/9/2005	LEV-3 21-25' 9/9/2005	LEV-4 35-39' 9/12/2005	LEV-5 35-40' 9/11/2005	LEV-5B 39' 9/16/2005	LEV-5B 43' 9/16/2005	LEV-6 47' 9/14/2005	LEV-8 35' 9/15/2005	LEV-9 23' 9/15/2005
Diesel Range Hydrocarbons	NWTPH-Dx	1740	1430	380	95.9	ND	186	961	8.13	311	367
Lube Oil Range Hydrocarbons	NWTPH-Dx	2010	1770	475	130	4.43	234	1160	9.33	386	487
Total Petroleum Hydrocarbons	NWTPH-Dx	3750	3200	855	225.9	4.43	420	2121	17.46	697	854
Lead	6000/7000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Organic Carbon	APHA/EPA Average	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

River Analytical Results

Compound	Method	RIV-2 0-1' 9/12/2005	RIV-3 5-10' 9/12/2005	RIV-4 15-18' 9/12/2005	RIV-5 0-3' 9/14/2005	RIV-6 0-3' 9/14/2005	RIV-7 0-5' 9/14/2005	RIV-8 0-2' 9/14/2005	RIV-9 0-5' 9/14/2005	RIV-10 10-12' 9/14/2005	RIV-11 5-10' 9/14/2005
Diesel Range Hydrocarbons	NWTPH-DX	201	41.2	ND	2.54	1.6	2.43	ND	ND	11.1	3.55
Lube Oil Range Hydrocarbons	NWTPH-DX	375	91.2	5.03	5.14	3.19	7	ND	3.29	12.4	5.31
Total Petroleum Hydrocarbons	NWTPH-Dx	576	132.4	5.03	7.68	4.79	9.43	ND	3.29	23.5	8.86
Lead	6000/7000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Organic Carbon	APHA/EPA Average	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Compound	Method	RIV-12 0-5' 9/14/2005	RIV-12 3' 9/13/2005	RIV-12 14' 9/13/2005	RIV-13 3' 9/14/2005	RIV-14 1' 9/14/2005	RIV-15 1' 9/14/2005	RIV-16 1' 9/14/2005	RIV-17 1' 9/14/2005	RIV-17 3' 9/14/2005	RIV-17 13' 9/14/2005
Diesel Range Hydrocarbons	NWTPH-DX	5.28	2.28	ND	1.76	2.23	4.1	1.85	ND	ND	1.96
Lube Oil Range Hydrocarbons	NWTPH-DX	6.43	8.03	6.63	ND	7.18	16.8	4.27	ND	ND	5.48
Total Petroleum Hydrocarbons	NWTPH-Dx	11.71	10.31	6.63	1.76	9.41	20.9	6.12	ND	ND	7.44
Lead	6000/7000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Organic Carbon	APHA/EPA Average	NA	2280	3660	NA	NA	NA	NA	NA	2100	4380

Compound	Method	RIV-18 1' 9/14/2005	RIV-19 1' 9/14/2005	RIV-20 1' 9/14/2005	RIV-20 3' 9/14/2005	RIV-20 13' 9/14/2005
Diesel Range Hydrocarbons	NWTPH-DX	2.88	2.03	8.04	5.64	3.04
Lube Oil Range Hydrocarbons	NWTPH-DX	7.4	5.34	35.4	16.8	10.7
Total Petroleum Hydrocarbons	NWTPH-Dx	10.28	7.37	43.44	22.44	13.74
Lead	6000/7000	NA	NA	NA	NA	NA
Total Organic Carbon	APHA/EPA Average	NA	NA	NA	2800	5490

School Adjacent Analytical Results

Compound	Method	5-B-7 20-25' 9/10/2005	5-B-8 15-20' 9/10/2005	5-B-9 22' 9/10/2005	5-B-11 0-1' 9/11/2005	5-B-11 2-4' 9/11/2005	5-B-11 15-20' 9/11/2005	5-B-12 30-33' 9/11/2005
Diesel Range Hydrocarbons	NWTPH-DX	383	1550	282	10.9	15.7	3.21	36.9
Lube Oil Range Hydrocarbons	NWTPH-DX	567	2250	366	86.8	62.9	19.7	92.6
Total Petroleum Hydrocarbons	NWTPH-Dx	950	3800	648	97.7	78.6	22.91	129.5
Lead	6000/7000	NA	NA	NA	103	41.9	NA	NA
Total Organic Carbon	APHA/EPA Average	NA	NA	NA	NA	NA	NA	NA

ND = Not Detected and the Method Reporting Limit
NA = Not Analyzed

Table 5-3 Summary of Laboratory Analytical Results – Phase II Investigation

			NWTPH-Dx (mg/Kg)		
ID	**Sample Date**	**Depth**	**TPH-D**	**TPH-O**	**NWTPH-Dx**
LEV2A	12/22/2005	10	161	231	392
LEV2A	12/22/2005	15	10800	13500	24300
LEV2A	12/22/2005	17.5	1600	1650	3250
LEV2A	12/22/2005	20	ND	ND	ND
LEV2A	12/22/2005	22.5	83.4	105	188.4
LEV2A	12/22/2005	25	ND	ND	ND
LEV2A	12/22/2005	30	ND	ND	ND
LEV2A	12/22/2005	32.5	ND	ND	ND
LEV2A	12/22/2005	35	ND	ND	ND
LEV2A	12/22/2005	37.5	108	126	234
LEV2A	12/22/2005	40	40.3	54.4	94.7
LEV4A	12/22/2005	10	ND	ND	ND
LEV4A	12/22/2005	15	47	89.3	136.3
LEV4A	12/22/2005	17.5	2780	2270	5050
LEV4A	12/22/2005	20	1990	1910	3900
LEV4A	12/22/2005	22.5	2090	1940	4030
LEV4A	12/22/2005	25	385	378	763
LEV4A	12/22/2005	27.5	21.7	ND	21.7
LEV4A	12/22/2005	30	ND	ND	ND
LEV4A	12/22/2005	32.5	40.3	44.9	85.2
LEV4A	12/22/2005	35	23.7	ND	23.7
LEV5C	12/21/2005	10	ND	ND	ND
LEV5C	12/21/2005	15	18900	14600	33500
LEV5C	12/21/2005	17.5	4620	3910	8530
LEV5C	12/21/2005	20	9740	8290	18030
LEV5C	12/21/2005	22.5	124	118	242
LEV5C	12/21/2005	25	ND	ND	ND
LEV5C	12/21/2005	27.5	ND	ND	ND
LEV5C	12/21/2005	30	ND	ND	ND
LEV5C	12/21/2005	32.5	ND	ND	ND
LEV5C	12/21/2005	35	ND	ND	ND
LEV6A	12/21/2005	10	ND	ND	ND
LEV6A	12/21/2005	15	33.5	75.8	109.3
LEV6A	12/21/2005	17.5	ND	ND	ND
LEV6A	12/21/2005	20	ND	ND	ND
LEV6A	12/21/2005	22.5	ND	ND	ND
LEV6A	12/21/2005	25	ND	ND	ND
LEV6A	12/21/2005	27.5	ND	ND	ND
LEV6A	12/21/2005	30	ND	ND	ND
LEV6A	12/21/2005	32.5	ND	ND	ND
LEV6A	12/21/2005	35	ND	ND	ND
LEV6A	12/21/2005	37.5	ND	ND	ND
LEV6A	12/21/2005	40	ND	ND	ND
LEV6A	12/21/2005	42.5	ND	ND	ND
LEV6A	12/21/2005	45	ND	ND	ND

Table 5-3 Summary of Laboratory Analytical Results – Phase II Investigation

			NWTPH-Dx (mg/Kg)		
ID	**Sample Date**	**Depth**	**TPH-D**	**TPH-O**	**NWTPH-Dx**
LEV7A	12/20/2005	10	963	2270	3233
LEV7A	12/20/2005	15	2080	2490	4570
LEV7A	12/20/2005	17.5	1770	1440	3210
LEV7A	12/20/2005	20	ND	ND	ND
LEV7A	12/20/2005	22.5	17.4	ND	17.4
LEV7A	12/20/2005	25	ND	ND	ND
LEV7A	12/20/2005	27.5	ND	ND	ND
LEV7A	12/20/2005	30	129	130	259
LEV7A	12/20/2005	32.5	ND	ND	ND
LEV7A	12/20/2005	35	ND	ND	ND
LEV8A	12/19/2005	10	ND	ND	ND
LEV8A	12/19/2005	15	47.2	54.9	102.1
LEV8A	12/19/2005	17.5	879	866	1745
LEV8A	12/19/2005	20	3070	2540	5610
LEV8A	12/19/2005	25	60.2	54.4	114.6
LEV8A	12/19/2005	30	18.1	ND	18.1
LEV8A	12/19/2005	32.5	ND	ND	ND
LEV8A	12/19/2005	35	35	30	65
LEV8B	12/20/2005	10	48.6	107	155.6
LEV8B	12/20/2005	15	1320	1420	2740
LEV8B	12/20/2005	17.5	3140	2660	5800
LEV8B	12/20/2005	20	11.9	ND	11.9
LEV8B	12/20/2005	22.5	ND	ND	ND
LEV8B	12/20/2005	25	ND	ND	ND
LEV8B	12/20/2005	27.5	12.9	ND	12.9
LEV8B	12/20/2005	30	ND	ND	ND
LEV8B	12/20/2005	32.5	ND	ND	ND
LEV8B	12/20/2005	35	ND	ND	ND

Note:

ND Not Detected at the Method Reporting Limit

Figures

LEGEND

- riv-12 916.58 — PHASE I INVESTIGATION BOREHOLE LOCATION GROUND SURFACE ELEVATION IN FT-MSL
- lev-4A — PHASE II INVESTIGATION BOREHOLE LOCATION

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SKYKOMISH, WASHINGTON
BN050-16423-522

DATE: 01/17/06 DRWN: A.S./SEA

BOREHOLE LOCATION MAP

FIGURE 2-1

File: H:\16423\16423S395.dwg Layout: FIGURE 2-1 User: astenberg Plotted: Jan 17, 2006 - 2:06pm Xref's: 16423B003, NWTPH-DX-NONSILICA-FEB2005, SMEAR-CONTOURS-FEB2005, FREE-PRODUCT-FEB2005, B.

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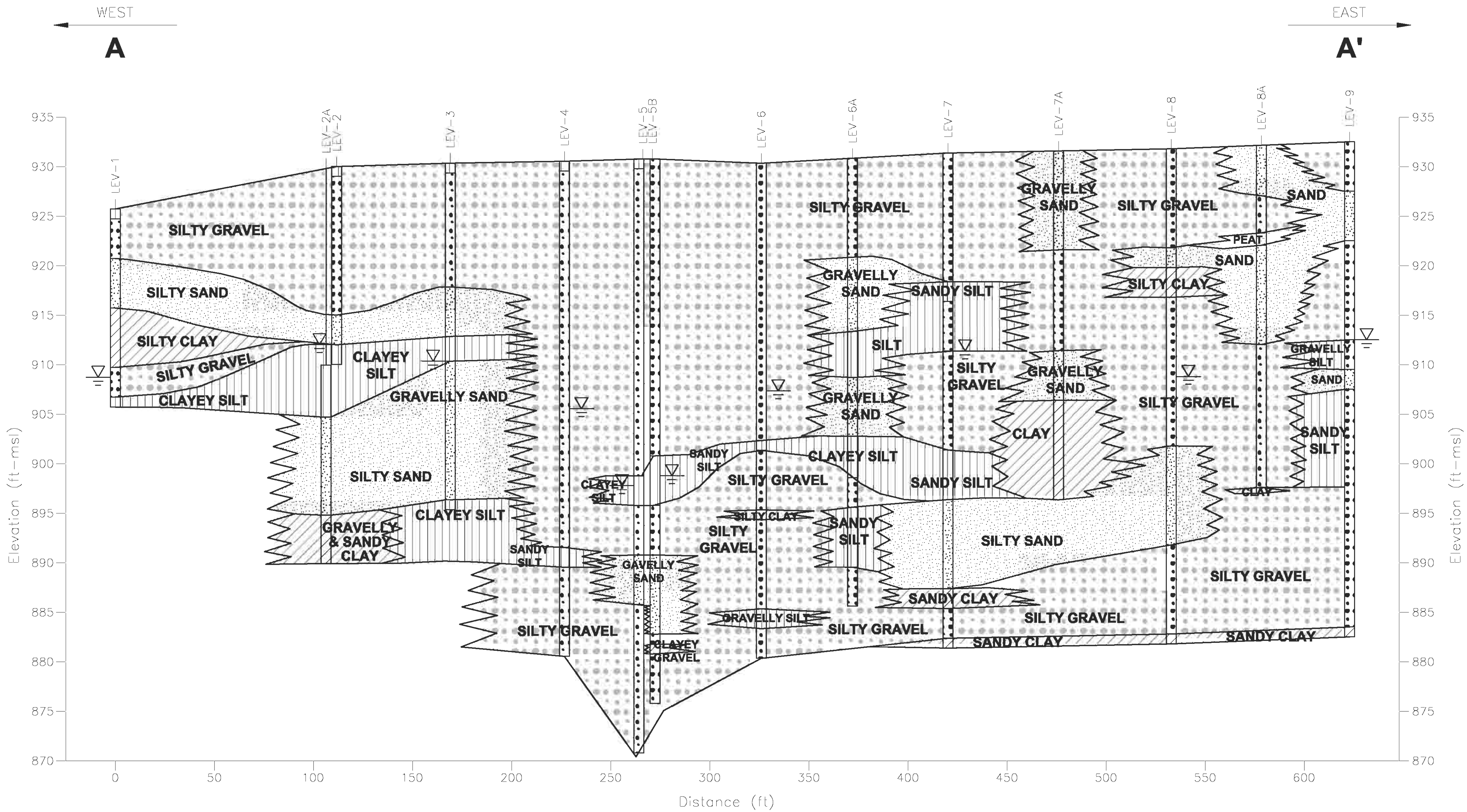
CROSS-SECTION LOCATION MAP

DATE: 01/17/06 | DRWN: A.S./SEA

FIGURE 4-1



LEGEND

CLAY
SAND
GRAVEL
SILT
WATER LEVEL

25 0 50
HORIZONTAL SCALE IN FEET
Vertical Exaggeration: 5

NOTE: Section is not projected, it is shown as direct distance

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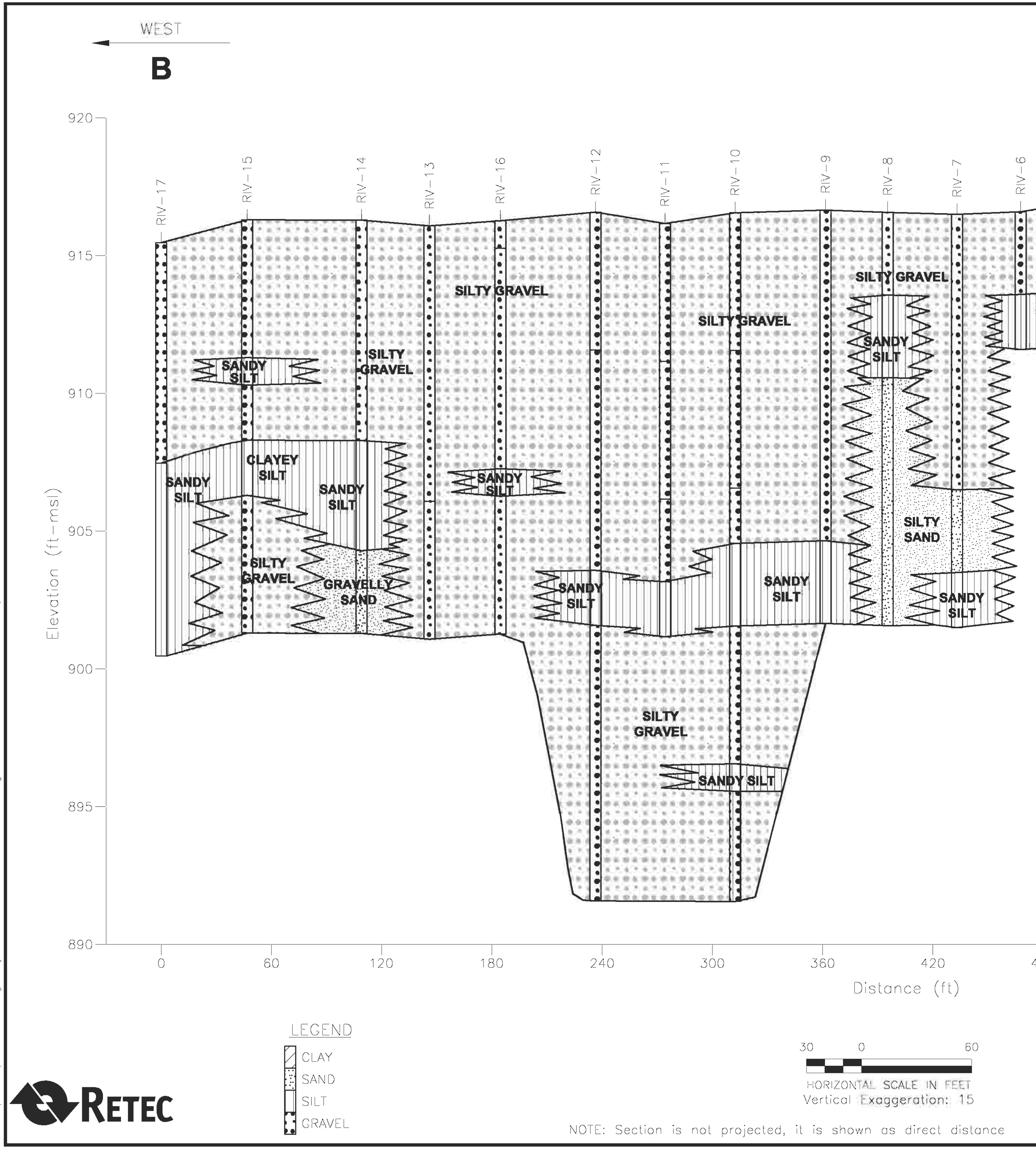
THE BNSF RAILWAY COMPANY SKYKOMISH, WASHINGTON BN050-16423-522	CROSS-SECTION A-A'
DATE: 01/16/06 DRWN: A.S./SEA	FIGURE 4-2

File: H:\16423\16423C014.dwg Layout: FIGURE 4-2 User: astenberg Plotted: Jan 17, 2006 - 2:09pm Xref's:

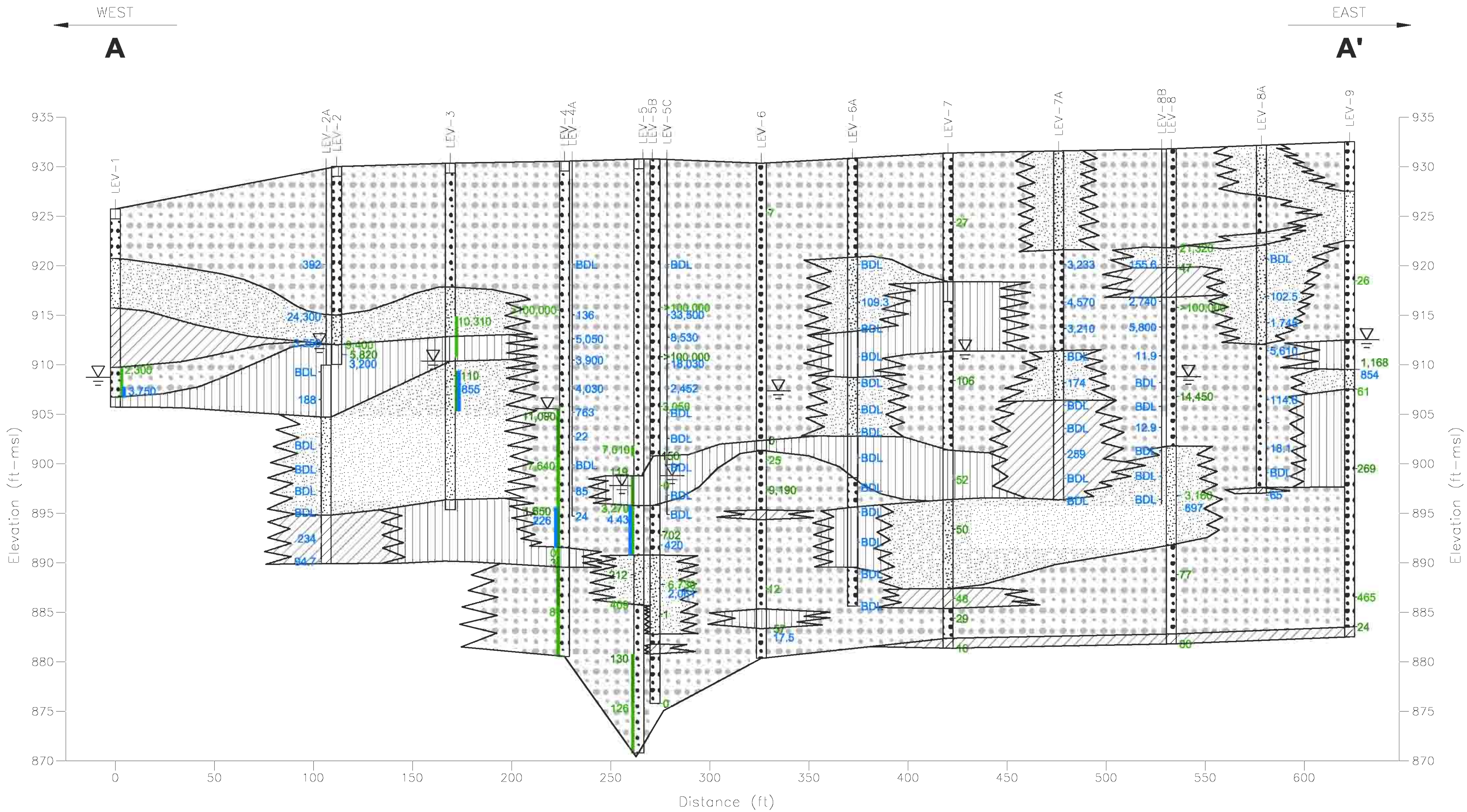


THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON
BN050-16423-522

DATE: 01/17/06 | DRWN: A.S./SEA

CROSS-SECTION B-B'

FIGURE 4-3



LEGEND

CLAY

SAND

GRAVEL

SILT

WATER LEVEL

Petro FLAG data (mg/kg)

NWTPH-Dx (mg/kg)

25 0 50

HORIZONTAL SCALE IN FEET

Vertical Exaggeration: 5

NOTE: Section is not projected, it is shown as direct distance

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THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON
BN050-16423-522

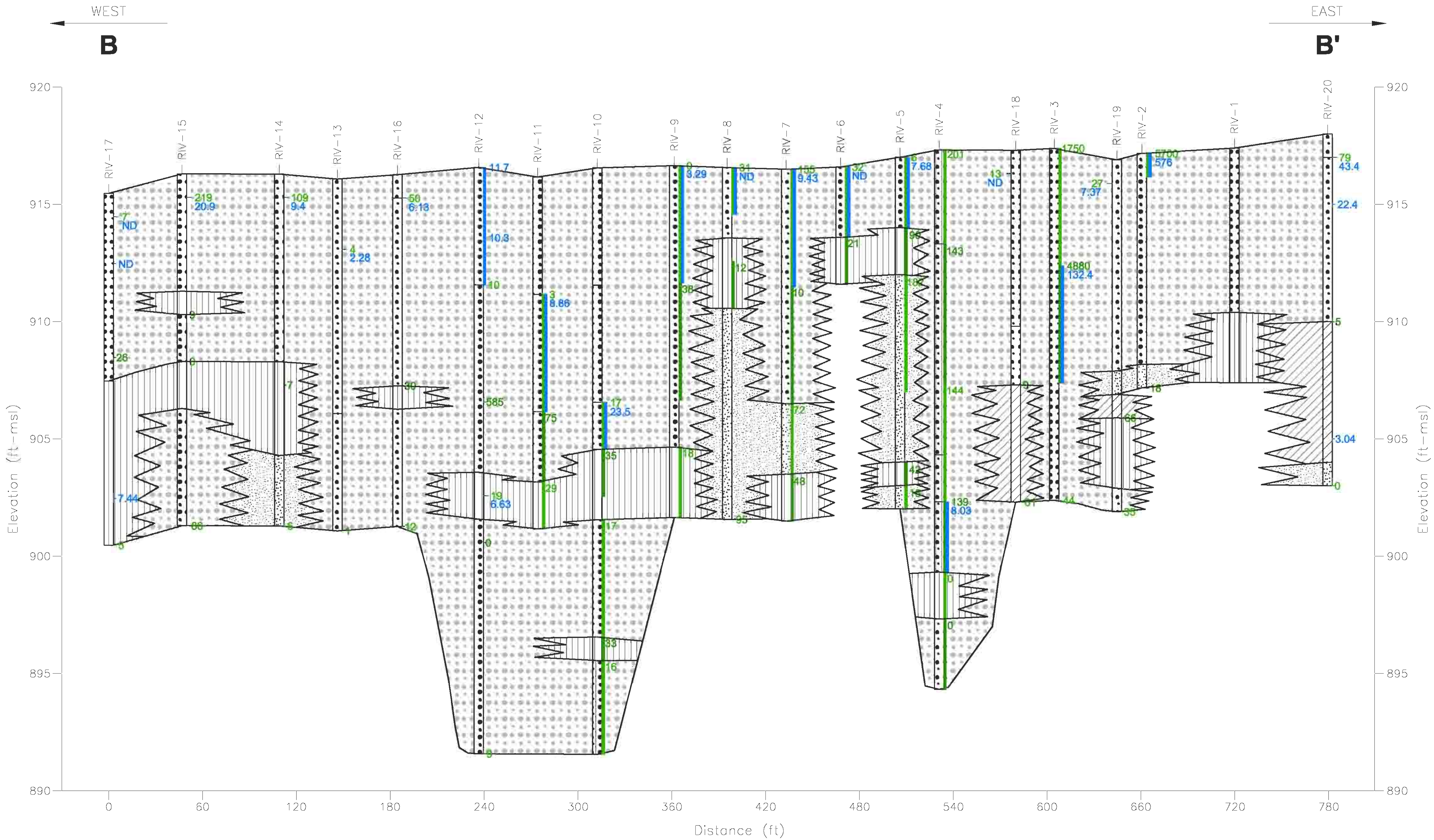
DATE: 01/16/06

DRWN: A.S./SEA

CROSS-SECTION A-A' WITH ANALYTICAL RESULTS

FIGURE 5-1

File: H:\16423\16423C015.dwg Layout: FIGURE 5-1 User: ostenberg Plotted: Jan 17, 2006 - 2:12pm Xref's:



LEGEND

- CLAY
- SAND
- SILT
- GRAVEL

Petro FLAG data (mg/kg)
NWTPH-Dx (mg/kg)

30 0 60
HORIZONTAL SCALE IN FEET
Vertical Exaggeration: 15

NOTE: Section is not projected, it is shown as direct distance

RETEC

THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON
BN050-16423-522

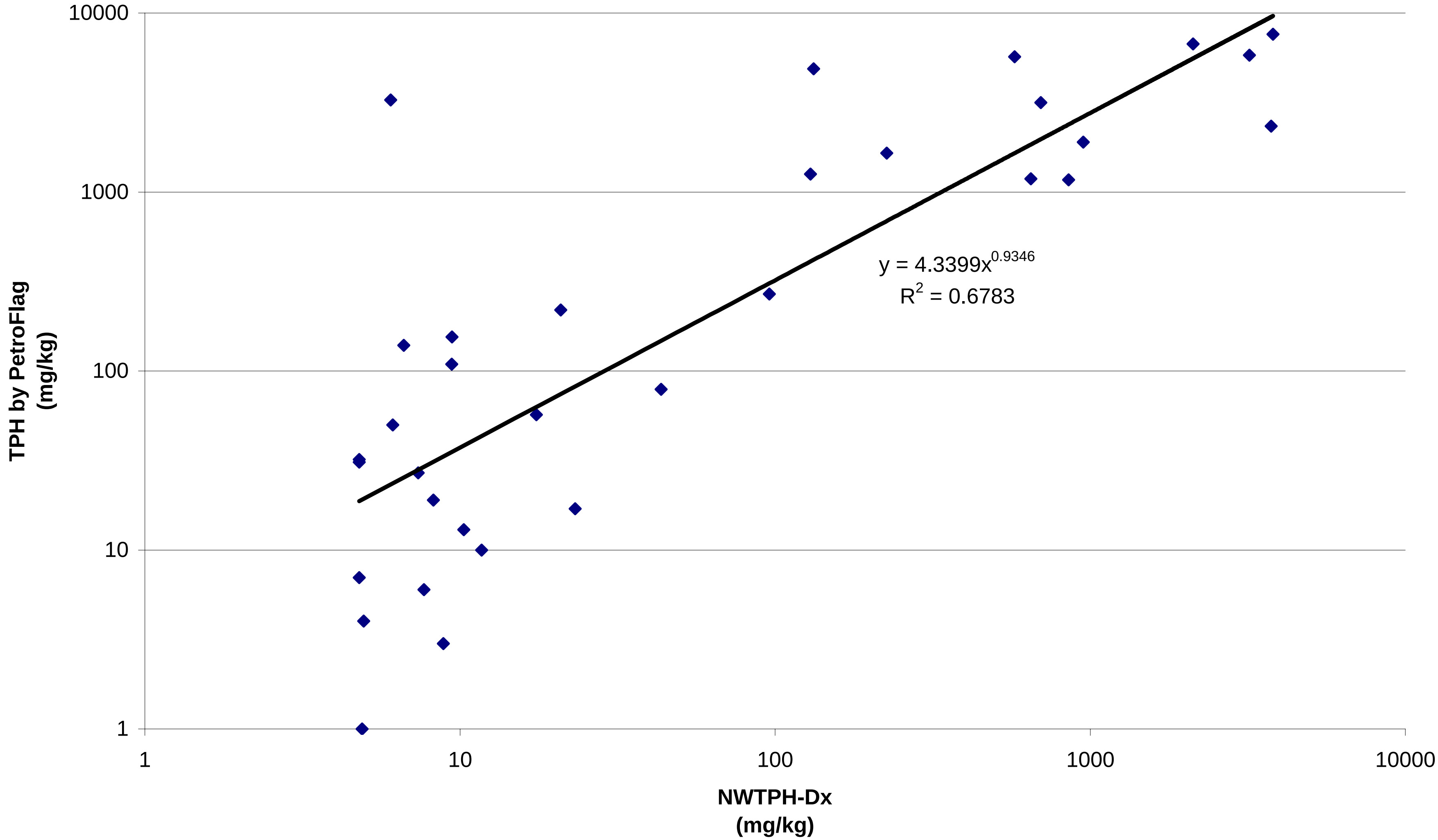
DATE: 01/17/06 | DRWN: A.S./SEA

CROSS-SECTION B-B' WITH ANALYTICAL RESULTS

FIGURE 5-2

File: H:\16423\16423C016.dwg Layout: FIGURE 5-2 User: cstenberg Plotted: Jan 17, 2006 - 2:16pm Xref's:

Figure 5-3
Field Screening Results (PetroFlag) vs NWTPH-Dx



Appendix A

Soil Boring Logs

Appendix B

Surveyors Report

Appendix C

PetroFLAG Field Sheets

Appendix D

Laboratory Analytical Data

Appendix A

Soil Boring Logs

Boring Log

RETEC

Boring #: 5-B-7
Sheet 1 of 2

Project: **BNSF Skykomish**	Operator: **Justin Aekaret**	Location: **Skykomish, WA**
Project #: **BN050-16423-522**	Drill Rig Type: **Mini-Sonic**	Northing: **259307.2** Easting: **1510204.2**
Client: **BNSF**	Method: **Sonic Drilling**	Ground Elevation: **925.47**
Contractor: **Holt Drilling/Boart Longyear**	Casing ID:	Total Depth: **35'**
Start Date & Time: **9/10/05 1000**	Bit Type: **Tungsten Carbide**	Seal: **Hole Plug**
Finish Date & Time: **9/10/05 1200**	Boring ID: **4 inch**	Logged By: **Jim Schneider**

Sample: Depth Range (ft.)	Sample: Recovery	Sample: Depth	Sample: PetroFLAG (ppm)	Sample: NWTPH-Dx (mg/Kg)	Depth (ft.)	Soil and Rock Description (Classification Scheme: USCS/ASTM)	Elevation (ft-msl)	Comments
0-5	T 2.0' N 2.0' S 0.0'				0	Brown sandy silt, loose, soft, dry, no odor, no staining.	925, 924	
						Dark brown gravelly (1-10 cm poorly sorted) silt, soft, slightly moist, no odor, no staining.	923, 922, 921	
5-10	T 3.0' N 1.5' S 1.5'	6-7'	> 100,000		5	Brownish gray gravelly (1-10 cm poorly sorted) coarse grained sand, medium dense, moist, slight odor at 7', no staining.	920, 919	
						Brownish gray gravelly (1-10 cm poorly sorted) coarse grained sand, loose, moist, no odor, no staining.	918, 917, 916	
10-15	T 3.0' N 3.0" S 0.0'	10-13'	10,280		10	Brown coarse grained sandy gravel (1-10 cm poorly sorted), very loose, wet, strong odor, NAPL and heavy sheen present.	915, 914, 913, 912, 911	Groundwater at 10'. NAPL present in upper 3' of water table
15-20	T 4.0' N 4.0' S 0.0'	15-20'	578		15	Gray gravelly (1-10 cm poorly sorted) coarse grained sand, loose, wet, strong odor 15-17', slight sheen 15-17', slight odor 17-20', no staining 17-20'	910, 909, 908, 907, 906	
20-25	T 3.0' N 3.0' S 0.0'	20-25'	1,898	950	20	Gray gravelly (1-10 cm poorly sorted) coarse grained sand, loose, wet, no odor, no staining.	905, 904, 903, 902, 901	
					25			

Remarks and Datum Used: Surveyors BRH, Inc. NAD83/91 and NAVD88

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Fax: (206) 624-2839

Notes
T = Total Rec (ft)
N = Native Rec (ft)
S = Slough Rec (ft)

Groundwater: Date	Time	Depth (ft.)

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Boring Log

Boring #: 5-B-7

Sample: Depth Range (ft.)	Recovery	Depth	PetroFLAG (ppm)	NWTPH-Dx (mg/Kg)	Graphic Log	Depth (ft.)	Soil and Rock Description (Classification Scheme: **USCS/ASTM**)	Below Ground Surface (ft.)	Comments
25-30	T 4.0' N 3.5' S 0.5'	25-28'	342				Light brown gravelly (1-10 cm poorly sorted) coarse grained sand, loose, wet, no odor, no staining.	900 899 898	
		28-30'	38			30	Reddish brown gravelly (1-10 cm poorly sorted) coarse grained sand, loose, wet, no odor, no staining.	897 896 895	
30-35	T 1.5' N 1.5' S 0.0'						Gray clayey silt, medium stiff, wet, no odor, no staining.	894 893	
						35	Gray gravel (1-5 cm poorly sorted) with trace of silt, loose, wet, no odor, no staining.	892 891	

Remarks and Datum Used:	Surveyors BRH, Inc. NAD83/91 and NAVD88

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N = Native Rec (ft)
S = Slough Rec (ft)

Groundwater		
Date	Time	Depth (ft.)

Boring Log

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Boring #: 5-B-8

Project: BNSF Skykomish	Operator: Justin Aekaret	Location: Skykomish, WA
Project #: BN050-16423-522	Drill Rig Type: Mini-Sonic	Northing: 259300.5 Easting: 1510145.7
Client: BNSF	Method: Sonic Drilling	Ground Elevation: 925.14
Contractor: Holt Drilling/Boart Longyear	Casing ID:	Total Depth: 35'
Start Date & Time: 9/10/05 1730	Bit Type: Tungsten Carbide	Seal: Hole Plug
Finish Date & Time: 9/10/05 1800	Boring ID: 4 inch	Logged By: Jim Schneider

Sample: Depth Range (ft.)	Sample: Recovery	Sample: Depth	Sample: PetroFLAG (ppm)	Sample: NWTPH-Dx (mg/Kg)	Depth (ft.)	Soil and Rock Description (Classification Scheme: USCS/ASTM)	Elevation (ft-msl)	Comments
					0	Brown sandy silt, loose, soft, dry, no odor, no staining.	925–924	
0-5	T 1.5' N 1.5' S 0.0'				0–5	Dark brown gravelly (1-10 cm poorly sorted) silt, soft, slightly moist, no odor, no staining.	923–920	
5-10	T 2.5' N 2.5' S 0.0'	8'	7,550		5–12.5	Gray sandy gravel (1-10 cm poorly sorted) very loose, wet below 8', slight odor no staining.	920–913	Groundwater at 8'.
10-15	T 4.0' N 3.5' S 0.5'	12'	9,720		12.5–15	Gray silty sandy gravelly (1-10 cm poorly sorted) clay, wet, medium stiff, slight odor, NAPL spotting present.	912–910	
15-20	T 3.5' N 3.5' S 0.0'	15-20'	7,600	3,800	15–25	Gray gravelly (1-10 cm poorly sorted) coarse grained sand, very loose, wet, slight odor, hydrocarbon sheen present.	910–900	
20-25	T 3.5' N 3.5' S 0.0'	20-25'	990		25		900	

Remarks and Datum Used: Surveyors BRH, Inc. NAD83/91 and NAVD88

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Notes
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N = Native Rec (ft)
S = Slough Rec (ft)

Groundwater: Date	Time	Depth (ft.)

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Boring Log

Boring #: 5-B-8
Sheet 2 of 2

Depth Range (ft.)	Recovery	Depth	PetroFLAG (ppm)	NWTPH-Dx (mg/Kg)	Graphic Log	Depth (ft.)	Soil and Rock Description Classification Scheme: **USCS/ASTM**	Below Ground Surface (ft.)	Comments
25-30	T 3.0' N 3.0' S 0.0'	29-30'	27			30	Gray gravelly (1-10 cm poorly sorted) coarse grained sand, very loose, wet, strong odor, NAPL present. Gray clayey silt, soft, wet, slight odor, staining present on outside of sample from upper interval, not present on inside of sample.	899 898 897 896 895	
30-35	T 2.0' N 2.0' S 0.0'					35	Gray silty gravelly (1-10 cm poorly sorted) coarse grained sand, very loose, wet, slight odor, spots of NAPL present (from upper layer).	894 893 892 891	

Remarks and Datum Used:	Surveyors BRH, Inc. NAD83/91 and NAVD88

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Notes
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N = Native Rec (ft)
S = Slough Rec (ft)

Groundwater		
Date	Time	Depth (ft.)

RETEC

Boring Log

Boring #: 5-B-9
Sheet 1 of 2

Project: **BNSF Skykomish**	Operator: **Justin Aakaret**	Location: **Skykomish, WA**
Project #: **BN050-16423-522**	Drill Rig Type: **Mini-Sonic**	Northing: **1510226.7** Easting: **259242.0**
Client: **BNSF**	Method: **Sonic Drilling**	Ground Elevation: **925.52**
Contractor: **Holt Drilling/Boart Longyear**	Casing ID:	Total Depth: **30'**
Start Date & Time: **9/10/05 840**	Bit Type: **Tungsten Carbide**	Seal: **Hole Plug**
Finish Date & Time: **9/10/05 1040**	Boring ID: **4 inch**	Logged By: **Jim Schneider**

Sample: Depth Range (ft.)	Sample: Recovery	Sample: Depth	Sample: PetroFLAG (ppm)	Sample: NWTPH-Dx (mg/Kg)
0-5	T 1.5' N 1.5' S 0.0'			
5-10	T 4.0' N 2.0' S 2.0'	7'	2,751	
10-15	T 3.5' N 2.5' S 1.0'	12'	1,130	
15-20	T 2.0' N 2.0' S 0.0'	17'	4,770	
20-25	T 3.0' N 2.5' S 0.5'	22'	1,186	648

Depth (ft.)	Soil and Rock Description (Classification Scheme: **USCS/ASTM**)	Comments
0–1	Brown sandy silt, loose, soft, dry, no odor, no staining.	
1–5	Dark brown gravelly (1-10 cm poorly sorted), silt, soft, slightly moist, no odor, no staining.	
5–7.5	Brownish gray gravelly (1 cm well sorted) sandy silty clay, stiff, slightly moist, faint odor, no staining.	
7.5–10	Gray gravel (1-10 cm poorly sorted) with trace of silt, loose, hard dry, slight odor, no staining.	Groundwater at 10'.
10–13	Gray sandy gravel (1-10 cm poorly sorted) wet, slight odor, slight staining.	
13–15	Light brown clayey silt, soft, moist, no odor, no staining.	
15–20	Brownish gray gravelly (1-10 cm poorly sorted), coarse grained sand, very loose, wet, strong odor, trace of NAPL	
20–25	Brown gravelly (1-10 cm poorly sorted) coarse grained sand, very loose, faint odor no staining.	

Depth (ft.): 0, 5, 10, 15, 20, 25

Elevation (ft-msl): 925, 924, 923, 922, 921, 920, 919, 918, 917, 916, 915, 914, 913, 912, 911, 910, 909, 908, 907, 906, 905, 904, 903, 902, 901

Remarks and Datum Used: Surveyors BRH, Inc. NAD83/91 and NAVD88

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Notes
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N = Native Rec (ft)
S = Slough Rec (ft)

Groundwater

Date	Time	Depth (ft.)

RETEC

Boring Log

Sample: Depth Range (ft.)	Recovery	Depth	PetroFLAG (ppm)	NWTPH-Dx (mg/Kg)	Graphic Log	Depth (ft.)	Soil and Rock Description (Classification Scheme: USCS/ASTM)	Below Ground Surface (ft.)	Comments
		26'	564					900	
								899	
25-30	T 3.0' N 3.0' S 0.0'						Gray clayey silt, soft, wet, no odor, no staining.	898	
								897	
		29'	53			30	Brown coarse grained sand with trace of silt, very loose, wet, no odor, no staining.	896	

Remarks and Datum Used:	Surveyors BRH, Inc. NAD83/91 and NAVD88	Notes	Groundwater		
		T = Total Rec (ft)	Date	Time	Depth (ft.)
		N = Native Rec (ft)			
		S = Slough Rec (ft)			

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Boring Log

Boring #: 5-B-11

Project: **BNSF Skykomish**	Operator: **Justin Aekaret**	Location: **Skykomish, WA**
Project #: **BN050-16423-522**	Drill Rig Type: **Mini-Sonic**	Northing: **259221.4** Easting: **1510120.4**
Client: **BNSF**	Method: **Sonic Drilling**	Ground Elevation: **925.02**
Contractor: **Holt Drilling/Boart Longyear**	Casing ID:	Total Depth: **30'**
Start Date & Time: **9/11/05 1100**	Bit Type: **Tungsten Carbide**	Seal: **Hole Plug**
Finish Date & Time: **9/11/05 1230**	Boring ID: **4 inch**	Logged By: **Jim Schneider**

Sample: Depth Range (ft.)	Recovery	Depth	PetroFLAG (ppm)	NWTPH-Dx (mg/Kg)	Depth (ft.)	Soil and Rock Description (Classification Scheme: USGS/ASTM)	Elevation (ft-msl)	Comments
					0		925	
0-5	T 1.0' N 1.0' S 0.0'	0-1'		648		Brown sandy silt, loose, soft, dry, no odor, no staining.	924	Hand dug to 2.5' to prevent contact with unknown utilities.
		2-4'		78.6		Dark brown gravelly (1-10 cm poorly sorted) silt, soft, slightly moist, no odor, no staining.	923–921	
5-10	T 3.5' N 3.5' S 0.0'	5-10'	49		5	Gray (reddish gray from 8-9') sandy gravel (1-10 cm poorly sorted), very loose, wet at 10', no odor, no staining.	920–916	Groundwater at 10'
10-15	T 3.0' N 3.0' S 0.0'	10-15'	85		10		915–911	
15-20	T 2.0' N 2.0' S 0.0'	15-20'	269		15		910–906	
20-25	T 2.5' N 2.5' S 0.0'	20-25'	57		20		905–901	
					25		900	

Remarks and Datum Used: Surveyors BRH, Inc. NAD83/91 and NAVD88

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Notes
T = Total Rec (ft)
N = Native Rec (ft)
S = Slough Rec (ft)

Groundwater		
Date	Time	Depth (ft.)

RETEC

Boring Log

Sample: Depth Range (ft.)	Sample: Recovery	Sample: Depth	Sample: PetroFLAG (ppm)	Sample: NWTPH-Dx (mg/Kg)	Graphic Log	Depth (ft.)	Soil and Rock Description, Classification Scheme: USGS/ASTM	Below Ground Surface (ft.)	Comments
25-30	T 2.0' N 2.0' S 0.0'	25-27'	0					899	
							Gray clayey silt, soft, moist, no odor, no staining.	898, 897	
		27-30'	0			30	Brown clayey silt, soft, wet, no odor, no staining.	896	

Remarks and Datum Used:	Surveyors BRH, Inc. NAD83/91 and NAVD88	Notes	Groundwater: Date	Time	Depth (ft.)
The RETEC Group, Inc. 1011 SW Klickitat Way, Suite 207 Seattle, WA 98134-1162 Phone: (206) 624-9349 Fax: (206) 624-2839		T = Total Rec (ft) N = Native Rec (ft) S = Slough Rec (ft)			

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Boring Log

Boring #: 5-B-12
Sheet 1 of 2

Project: **BNSF Skykomish**	Operator: **Justin Aekaret**	Location: **Skykomish, WA**
Project #: **BN050-16423-522**	Drill Rig Type: **Mini-Sonic**	Northing: **259182.3** Easting: **1510235.9**
Client: **BNSF**	Method: **Sonic Drilling**	Ground Elevation: **925.67**
Contractor: **Holt Drilling/Boart Longyear**	Casing ID:	Total Depth: **35'**
Start Date & Time: **9/11/05 0830**	Bit Type: **Tungsten Carbide**	Seal: **Hole Plug**
Finish Date & Time: **9/11/05 1030**	Boring ID: **4 inch**	Logged By: **Jim Schneider**

Sample					Graphic Log	Depth (ft.)	Soil and Rock Description Classification Scheme: **USCS/ASTM**	Elevation (ft-msl)	Comments
Depth Range (ft.)	Recovery	Depth	PetroFLAG (ppm)	NWTPH-Dx (mg/Kg)					
						0	Brown sandy silt, loose, soft, dry, no odor, no staining.	925	
								924	
0-5	T 2.5' N 2.5' S 0.0'						Dark brown gravelly (1-10 cm poorly sorted) silt, soft, slightly moist, no odor, no staining.	923	
								922	
								921	
						5	Gray sandy gravel (1-10 cm poorly sorted) very loose, wet at 10', slight odor, no staining.	920	
								919	
5-10	T 3.5' N 3.5' S 0.0'	6-10'	11,890					918	
								917	
								916	
						10	Gray sandy gravel (1-10 cm poorly sorted) very loose, wet, slight odor, no staining.	915	Groundwater at 10'
								914	
10-15	T 4.0' N 3.5' S 0.5'	13'	2,830					913	
							Gray clayey silt, soft, moist, no odor, no staining.	912	
								911	
		13.5-15'	17			15	Gray sandy gravel (1-10 cm poorly sorted) very loose, wet, slight odor, no staining.	910	
								909	
15-20	T 4.0' N 3.5' S 0.5'	15-20'	580					908	
								907	
								906	
						20		905	
								904	
20-25	T 3.0' N 3.0' S 0.0'	20-25'	3,490					903	
								902	
								901	
						25			

Remarks and Datum Used:	Surveyors BRH, Inc. NAD83/91 and NAVD88	Notes	Groundwater		
		T = Total Rec (ft)	Date	Time	Depth (ft.)
		N = Native Rec (ft)			
		S = Slough Rec (ft)			

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Boring Log

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Boring #: 5-B-12
Sheet 2 of 2

Sample					Graphic Log	Depth (ft.)	Soil and Rock Description Classification Scheme: **USCS/ASTM**	Below Ground Surface (ft.)	Comments
Depth Range (ft.)	Recovery	Depth	PetroFLAG (ppm)	NWTPH-Dx (mg/Kg)					
								900	
								899	
25-30	T 3.0' N 3.0' S 0.0'	30-35'	940					898	
								897	
								896	
						30	Brown gravelly (1-10 cm poorly sorted) coarse grained sand, loose, wet, slight odor, no staining.	895	
		30-33'	1,260	129.5				894	
30-35	T 4.0' N 4.0' S 0.0'							893	
		34-35'	0				Brownish gray clayey silt, wet, soft, no odor, no staining.	892	
						35		891	

Remarks and Datum Used:	Surveyors BRH, Inc. NAD83/91 and NAVD88

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Notes
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N = Native Rec (ft)
S = Slough Rec (ft)

Groundwater		
Date	Time	Depth (ft.)

Boring Log

RETEC

Boring #: LEV-1
Sheet 1 of 1

Project: **BNSF Skykomish**	Operator: **Jim Robinson**	Location: **Skykomish, WA**
Project #: **BN050-16423-522**	Drill Rig Type: **Mini-Sonic**	Northing: **259299.1** Easting: **1509905.0**
Client: **BNSF**	Method: **Sonic Drilling**	Ground Elevation: **925.72**
Contractor: **Holt Drilling/Boart Longyear**	Casing ID:	Total Depth: **20'**
Start Date & Time: **9/9/05 1330**	Bit Type: **Tungsten Carbide**	Seal: **Hole Plug**
Finish Date & Time: **9/9/05 1430**	Boring ID: **4 Inch**	Logged By: **Jim Schneider**

Sample					Graphic Log	Depth (ft.)	Soil and Rock Description Classification Scheme: USCS/ASTM	Elevation (ft-msl)	Comments
Depth Range (ft.)	Recovery	Depth	PetroFLAG (ppm)	NWTPH-Dx (mg/Kg)					
						0	Dark brown sandy silt, soft, dry, no odor, no staining.	925	
0-5	20%						Light gray brown silty gravel (1-10 cm poorly sorted), very loose, dry, no odor, no staining.	924–921	
5-10	30%					5	Medium brown silty sand, very loose, moist, no odor, no staining.	920–916	
10-15	20%					10	Dark brown, sandy silty clay, soft, moist, slight odor, no staining.	915–910	Groundwater at 17'
15-20	60%	16-19'	2,300			15	Dark gray sandy gravel, very loose, wet at 17', strong odor, no staining.	909–908	
		18-19'		3,750			Light brown clayey fine grained sandy silt, soft, wet, no odor, no staining.	907–906	
						20			

Remarks and Datum Used:	Surveyors BRH, Inc. NAD83/91 and NAVD88	Notes	Groundwater		
		T = Total Rec (ft)	Date	Time	Depth (ft.)
		N = Native Rec (ft)			
		S = Slough Rec (ft)			

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Boring Log

Boring #: LEV-2
Sheet 1 of 1

Project: **BNSF Skykomish**	Operator: **Jim Robinson**	Location: **Skykomish, WA**
Project #: **BN050-16423-522**	Drill Rig Type: **Mini-Sonic**	Northing: **259351.7** Easting: **1510003.5**
Client: **BNSF**	Method: **Sonic Drilling**	Ground Elevation: **930.01**
Contractor: **Holt Drilling/Boart Longyear**	Casing ID:	Total Depth: **20'**
Start Date & Time: **9/9/05 1430**	Bit Type: **Tungsten Carbide**	Seal: **Hole Plug**
Finish Date & Time: **9/9/05 1530**	Boring ID: **4 inch**	Logged By: **Jim Schneider**

Sample: Depth Range (ft.)	Sample: Recovery	Sample: Depth	Sample: PetroFLAG (ppm)	Sample: NWTPH-Dx (mg/Kg)	Depth (ft.)	Soil and Rock Description (Classification Scheme: USCS/ASTM)	Elevation (ft-msl)	Comments
					0–1.5	Dark brown sandy silt, soft, dry, no odor, no staining.	930–928.5	
0-5	20%				1.5–5	Light brown silty gravel (1-10 cm poorly sorted), very loose, dry, no odor, no staining	928.5–925	
5-10	25%				5–10	Light brown grading to reddish brown silty gravel (1-10 cm poorly sorted), very loose, dry, no odor, no staining	925–920	
10-15	10%				10–15	Brown/gray, silty sand, very loose, dry, no odor, no staining.	920–915	Groundwater at 18'
15-20	40%				15–18	Gray clayey silty sand, loose to medium dense, wet, slight odor, no staining.	915–912	
		18'	9,400		18–20	Gray clayey silt, soft, moist, no odor, no staining.	912–910	
		19'	5,820	3,200				

Remarks and Datum Used:	Surveyors BRH, Inc. NAD83/91 and NAVD88	Notes	Groundwater: Date	Time	Depth (ft.)
		T = Total Rec (ft)			
		N = Native Rec (ft)			
		S = Slough Rec (ft)			

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Boring #: LEV-3
Sheet 1 of 2

Project: **BNSF Skykomish**	Operator: **Jim Robinson**	Location: **Skykomish, WA**
Project #: **BN050-16423-522**	Drill Rig Type: **Mini-Sonic**	Northing: **259373.4** Easting: **1510056.6**
Client: **BNSF**	Method: **Sonic Drilling**	Ground Elevation: **930.35**
Contractor: **Holt Drilling/Boart Longyear**	Casing ID:	Total Depth: **35'**
Start Date & Time: **9/9/05 1630**	Bit Type: **Tungsten Carbide**	Seal: **Hole Plug**
Finish Date & Time: **9/9/05 1830**	Boring ID: **4 inch**	Logged By: **Jim Schneider**

Sample: Depth Range (ft.)	Recovery	Depth	PetroFLAG (ppm)	NWTPH-Dx (mg/Kg)	Graphic Log	Depth (ft.)	Soil and Rock Description (Classification Scheme: USCS/ASTM)	Elevation (ft-msl)	Comments
						0	Dark brown sandy silt, soft, dry, no odor, no staining.	930	
0-5	20%						Light brown silty gravel (1-10 cm poorly sorted), very loose, dry, no odor, no staining	929–926	
5-10	20%					5		925–921	
10-15	10%					10	Gray clayey silty sand, medium dense, soft, wet, strong odor, NAPL present.	920–916	
15-20	10%	15.5 - 19.5	10,310			15	Gray clayey silt, soft, moist, slight odor, no staining.	915–911	Groundwater at 20'
20-25	T 3.5' N 1.0' S 2.5'	21-25'	110	855		20	Gray gravelly (1-10 cm poorly sorted) coarse grained sand, medium dense, wet, slight odor, slight staining.	910–906	
						25		905	

Remarks and Datum Used: Surveyors BRH, Inc. NAD83/91 and NAVD88

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Notes
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N = Native Rec (ft)
S = Slough Rec (ft)

Groundwater: Date	Time	Depth (ft.)

Boring Log

Boring #: LEV-3

Sample: Depth Range (ft.)	Recovery	Depth	PetroFLAG (ppm)	NWTPH-Dx (mg/Kg)	Graphic Log	Depth (ft.)	Soil and Rock Description Classification Scheme: **USCS/ASTM**	Below Ground Surface (ft.)	Comments
								904	
25-30	T 3.5' N 2.0' S 1.5'							903 902 901	
						30		900	
30-35	T 4.0' N 3.0' S 1.0'						Brown coarse grained sand, very loose, wet, no odor, no staining.	899 898	
						35	Brown clayey silt, soft, very moist, no odor, no staining.	897 896	

Remarks and Datum Used:	Surveyors BRH, Inc. NAD83/91 and NAVD88	Notes	Groundwater		
		T = Total Rec (ft)	Date	Time	Depth (ft.)
The RETEC Group, Inc. 1011 SW Klickitat Way, Suite 207 Seattle, WA 98134-1162 Phone: (206) 624-9349 Fax: (206) 624-2839		N = Native Rec (ft) S = Slough Rec (ft)			

Boring Log

Boring #: LEV-4
Sheet 1 of 2

Project: BNSF Skykomish	Operator: Jim Robinson	Location: Skykomish, WA
Project #: BN050-16423-522	Drill Rig Type: Mini-Sonic	Northing: 259400.9 Easting: 1510107.2
Client: BNSF	Method: Sonic Drilling	Ground Elevation: 930.54
Contractor: Holt Drilling/Boart Longyear	Casing ID:	Total Depth: 50'
Start Date & Time: 9/12/05 7:45	Bit Type: Tungsten Carbide	Seal: Hole Plug
Finish Date & Time: 9/12/05 10:00	Boring ID: 4 Inch	Logged By: Jim Schneider

Sample					Graphic Log	Depth (ft.)	Soil and Rock Description Classification Scheme: USCS/ASTM	Elevation (ft-msl)	Comments
Depth Range (ft.)	Recovery	Depth	PetroFLAG (ppm)	NWTPH-Dx (mg/Kg)					
						0	Brown sandy gravelly (1-2 cm) silt, soft, dry, no odor no staining	930 929	
0-5	T 3.5' N 3.5' S 0.0'						Light brown, silty gravel (1-10 cm poorly sorted), very loose, dry, no odor, no staining.	928 927 926	
5-10	T 3.0' N 3.0' S 0.0'					5	Light brown silty gravel (1-10 cm poorly sorted), very loose, dry, no odor, no staining.	925 924 923 922 921	
10-15	T 3.0' N 2.0' S 1.0'					10	Light brown silty gravel (1-10 cm poorly sorted), very loose, dry, no odor, no staining.	920 919	
		15'	> 100,000			15	Gray gravel (1-10 cm poorly sorted) with trace of silt, very loose, slightly moist, slight odor and no staining. Strong odor and hydrocarbon staining were present at 15'.	918 917 916 915 914 913 912	
15-25	T 1.0' N 0.0' S 1.0'					20 25		911 910 909 908 907 906	Groundwater at 25'

Remarks and Datum Used:	Surveyors BRH, Inc. NAD83/91 and NAVD88	Notes	Groundwater		
		T = Total Rec (ft)	Date	Time	Depth (ft.)
		N = Native Rec (ft)			
		S = Slough Rec (ft)			

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Depth Range (ft.)	Recovery	Depth	PetroFLAG (ppm)	NWTPH-Dx (mg/Kg)	Soil and Rock Description (Classification Scheme: USCS/ASTM)	Comments
25-30	T 4.5' N 3.0' S 1.5'	25-30'	11,000		Gray silty sandy gravel (1-10 cm poorly sorted), very loose, wet, slight odor. Strong odor and staining present from 25-26'.	
30-35	T 1.0' N 0.5' S 0.5'	30-35'	7,640			
35-40	T 3.5' N 3.5' S 0.0'	35-39'	1,650	225.9		
		39-40'	0		Brown very fine grained sandy silt, soft, wet, no odor no staining.	
40-45	T 3.5' N 3.5' S 0.0'	40-45'	3		Brown coarse grained sandy gravel (1-10 cm poorly sorted), very loose, wet, no odor, no staining.	
45-50	T 3.5' N 3.5' S 0.0'	45-50'	8			

Depth (ft.): 30, 35, 40, 45, 50

Below Ground Surface (ft.): 905, 904, 903, 902, 901, 900, 899, 898, 897, 896, 895, 894, 893, 892, 891, 890, 889, 888, 887, 886, 885, 884, 883, 882, 881

Remarks and Datum Used: Surveyors BRH, Inc. NAD83/91 and NAVD88

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S = Slough Rec (ft)

Groundwater		
Date	Time	Depth (ft.)

RETEC Boring Log

Project: **BNSF Skykomish**	Operator: **Jim Robinson**	Location: **Skykomish, WA**
Project #: **BN050-16423-522**	Drill Rig Type: **Mini-Sonic**	Northing: **259417.8** Easting: **1510143.1**
Client: **BNSF**	Method: **Sonic Drilling**	Ground Elevation: **930.77**
Contractor: **Holt Drilling/Boart Longyear**	Casing ID:	Total Depth: **60'**
Start Date & Time **9/11/05 1300**	Bit Type: **Tungsten Carbide**	Seal: **Hole Plug**
Finish Date & Time **9/11/05 1700**	Boring ID: **4 inch**	Logged By: **Jim Schneider**

Sample: Depth Range (ft.)	Recovery	Depth	PetroFLAG (ppm)	NWTPH-Dx (mg/Kg)	Graphic Log	Depth (ft.)	Soil and Rock Description (Classification Scheme: USCS/ASTM)	Elevation (ft-msl)	Comments
						0	Brown sandy gravelly (1-2 cm) silt, soft, dry, no odor no staining	930	
							Light brown, silty gravel (1-10 cm poorly sorted), very loose, dry, no odor, no staining.	929	
0-5	T 2.0' N 2.0' S 0.0'							928	
								927	
						5		926	
								925	
								924	
5-10	T 3.0' N 3.0' S 0.0'							923	
								922	
						10		921	
								920	
								919	
10-15	T 4.0' N 4.0' S 0.0'							918	
								917	
						15		916	
								915	
								914	
								913	
								912	
								911	
15-25	T 2.0' N 2.0' S 0.0'					20		910	
								909	
								908	
								907	
						25		906	

Remarks and Datum Used: Surveyors BRH, Inc. NAD83/91 and NAVD88

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S = Slough Rec (ft)

Groundwater: Date	Time	Depth (ft.)

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Boring Log

Sample: Depth Range (ft.)	Recovery	Depth	PetroFLAG (ppm)	NWTPH-Dx (mg/Kg)	Depth (ft.)	Soil and Rock Description (Classification Scheme: USCS/ASTM)	Comments
25-30	T 3.5' N 3.5' S 0.0'	29-30'	7,010		30	Gray clayey silty sandy gravel (1-10 cm poorly sorted), very loose, moist, slight odor, no staining.	
30-35	T 3.5' N 3.5' S 0.0	32-35'	119			Gray clayey silt, soft, wet, no odor, no staining.	Groundwater at 33'
					35	Brown clayey silt, soft, wet, no odor, no staining.	
35-40	T 3.5' N 3.5' S 0.0'	35-40'	3,270	4.43	40	Gray coarse grained sandy gravel (1-10 cm poorly sorted), very loose, wet, slight odor, hydrocarbon sheen.	
40-45	T 3.0' N 3.0' S 0.0'	42'	212		45	Gray gravelly (1-5 cm poorly sorted) coarse grained sand, loose, wet, slight odor, no staining.	
		45'	409				
45-50	T 3.5' N 3.5' S 0.0'				50	Gray gravel (1-10 cm poorly sorted), with trace of silt, very loose, wet, no odor, no staining.	
50-55	T 3.5' N 3.5' S 0.0'	50-55'	130		55	Gray coarse grained sandy gravel (1-10 cm poorly sorted), very loose, wet, no odor, no staining.	

Below Ground Surface (ft.): 905, 904, 903, 902, 901, 900, 899, 898, 897, 896, 895, 894, 893, 892, 891, 890, 889, 888, 887, 886, 885, 884, 883, 882, 881, 880, 879, 878, 877, 876, 875

Remarks and Datum Used: Surveyors BRH, Inc. NAD83/91 and NAVD88

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Notes
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S = Slough Rec (ft)

Groundwater		
Date	Time	Depth (ft.)

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Boring Log

Sample					Graphic Log	Depth (ft.)	Soil and Rock Description Classification Scheme: **USCS/ASTM**	Below Ground Surface (ft.)	Comments
Depth Range (ft.)	Recovery	Depth	PetroFLAG (ppm)	NWTPH-Dx (mg/Kg)					
55-60	T 3.5' N 3.5' S 0.0'	55-60'	126			60		874 873 872 871	

Remarks and Datum Used:	Surveyors BRH, Inc. NAD83/91 and NAVD88

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Notes
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S = Slough Rec (ft)

Groundwater		
Date	Time	Depth (ft.)

Boring Log

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Boring #: LEV-5B

Project: **BNSF Skykomish**	Operator: **Justin Aakaret**	Location: **Skykomish, WA**
Project #: **BN050-16423-522**	Drill Rig Type: **Mini-Sonic**	Northing: **259421.3** Easting: **1510146.4**
Client: **BNSF**	Method: **Sonic Drilling**	Ground Elevation: **930.78**
Contractor: **Holt Drilling/Boart Longyear**	Casing ID:	Total Depth: **55'**
Start Date & Time: **9/16/05 0630**	Bit Type: **Tungsten Carbide**	Seal: **Hole Plug**
Finish Date & Time: **9/16/05 0930**	Boring ID: **4 inch**	Logged By: **Jim Schneider**

Sample Depth Range (ft.)	Recovery	Depth	PetroFLAG (ppm)	NWTPH-Dx (mg/Kg)	Graphic Log	Depth (ft.)	Soil and Rock Description (Classification Scheme: USCS/ASTM)	Elevation (ft-msl)	Comments
						0	Brown silty gravel (1-10 cm poorly sorted), very loose, dry, no odor, no staining	930	
								929	
0-5	T 1.5' N 1.5' S 0.0'							928	
								927	
						5		926	
								925	
								924	
5-10	T 2.0' N 2.0' S 0.0'							923	
								922	
						10		921	
								920	
								919	
10-15	T 3.0' N 3.0' S 0.0'						Dark brown silty gravel (1-10 cm poortly sorted), very loose, slightly moist, strong odor at 15', slight staining.	918	
								917	
		15'	> 100,000			15		916	
								915	
								914	
15-20	T 3.5' N 1.5' S 2.0'						Gray silty gravel (1-10 cm poorly sorted), very loose, moist, strong odor at 20', slight staining.	913	
								912	
								911	
		20'	> 100,000			20	Dark brown silty gravel (1-10 cm poortly sorted), very loose, slightly moist, strong odor at 25', no staining.	910	
								909	
20-25	T 3.0' N 1.0' S 2.0'							908	
								907	
		25'	3,050			25		906	

Remarks and Datum Used:	Surveyors BRH, Inc. NAD83/91 and NAVD88	Notes	Groundwater		
		T = Total Rec (ft)	Date	Time	Depth (ft.)
		N = Native Rec (ft)			
		S = Slough Rec (ft)			

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Boring Log

Boring #: LEV-5B
Sheet 2 of 2

Sample: Depth Range (ft.)	Sample: Recovery	Sample: Depth	Sample: PetroFLAG (ppm)	Sample: NWTPH-Dx (mg/Kg)	Depth (ft.)	Soil and Rock Description (Classification Scheme: **USCS/ASTM**)	Below Ground Surface (ft.)	Comments
25-30	T 2.5' N 2.5' S 0.0'					Gray coarse grained sandy gravel (1-10 cm poorly sorted), very loose, moist, no odor, no staining.	905 904 903 902 901	
		30'	150		30	Brown very fine grained sandy silt, very soft, wet below 32', no odor, no staining.	900 899 898 897 896	Groundwater at 32'
30-35	T 2.0' N 1.5' S 0.5'	33'	0					
35-40	T 1.5' N 1.5' S 0.0'	38'	702		35	Brown coarse grained sandy gravel (1-5 cm poortly sorted), very loose, wet, no odor, no staining.	895 894 893 892 891	
		39'		420				
40-45	T 3.0' N 3.0' S 0.0'	43'	6,730	2,121	40	Brown silty very fine grained sand, loose, wet, strong odor, heavy sheen with few NAPL globules present.	890 889 888 887 886	
		46'	1		45	Brown gravelly (1-10 cm poorly sorted) coarse grained sand, loose, wet, no odor, no staining.	885 884	
45-50	T 3.0' N 3.0' S 0.0'					Gray clayey gravel (1-10 cm poorly sorted), loose, very moist, no odor, no staining.	883 882	
					50	Gray gravelly (1-10 cm poorly sorted) silty clay, stiff, moist, no odor, no staining.	881 880	
50-55	T 3.0' N 3.0' S 0.0'					Brown coarse grained sandy gravel (1-10 cm poorly sorted), very loose, wet, no odor, no staining.	879 878 877 876	
					55			

Remarks and Datum Used: Surveyors BRH, Inc. NAD83/91 and NAVD88

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S = Slough Rec (ft)

Groundwater		
Date	Time	Depth (ft.)

Boring Log

Boring #: **LEV-6**
Sheet 1 of 2

Project: **BNSF Skykomish**	Operator: **Justin Aekaret**	Location: **Skykomish, WA**
Project #: **BN050-16423-522**	Drill Rig Type: **Mini-Sonic**	Northing: **259443.2** Easting: **1510196.8**
Client: **BNSF**	Method: **Sonic Drilling**	Ground Elevation: **930.34**
Contractor: **Holt Drilling/Boart Longyear**	Casing ID:	Total Depth: **50'**
Start Date & Time: **9/14/05 1530**	Bit Type: **Tungsten Carbide**	Seal: **Hole Plug**
Finish Date & Time: **9/14/05 1830**	Boring ID: **4 inch**	Logged By: **Jim Schneider**

Sample: Depth Range (ft.)	Recovery	Depth	PetroFLAG (ppm)	NWTPH-Dx (mg/Kg)	Depth (ft.)	Soil and Rock Description (Classification Scheme: USCS/ASTM)	Elevation (ft-msl)	Comments
					0	Light brown silty gravel (1-10 cm poorly sorted), very loose, dry, no odor, no staining	930	
0-5	T 2.0' N 2.0' S 0.0'						929–926	
		5'	7		5		925	
5-10	T 1.0' N 1.0' S 0.0'						924–921	
					10		920	
10-15	T 3.0' N 3.0' S 0.0'						919–916	
					15		915	
15-20	T 3.5' N 3.5' S 0.0'						914–911	
					20		910	
20-25	T 3.0' N 3.0' S 0.0'						909–908	
						Brown coarse grained sandy gravel (1-10 cm poorly sorted), very loose, wet, strong odor, NAPL present.	907–906	Groundwater at 23'
					25		905	

Remarks and Datum Used: Surveyors BRH, Inc. NAD83/91 and NAVD88

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Notes
T = Total Rec (ft)
N = Native Rec (ft)
S = Slough Rec (ft)

Groundwater		
Date	Time	Depth (ft.)

Boring Log

Depth Range (ft.)	Recovery	Depth	PetroFLAG (ppm)	NWTPH-Dx (mg/Kg)
25-30	T 4.0' N 3.0' S 1.0'	28'	0	
		30'	25	
30-35	T 2.5' N 2.5' S 0.0'	33'	9,190	
35-40	T 3.5' N 3.0' S 0.5'			
40-45	T 3.5' N 3.5' S 0.0'	43'	12	
45-50	T 3.0' N 3.0' S 0.0'	47'	57	17.46

Soil and Rock Description
Classification Scheme: **USCS/ASTM**

Depth (ft.)	Soil and Rock Description
	Brown coarse grained sandy gravel (1-10 cm poorly sorted), very loose, wet, strong odor, NAPL residue.
	Gray clayey silt, soft, wet, no odor, no staining.
30	Brown coarse grained sandy gravel (1-10 cm poorly sorted), very loose, wet, no odor, no staining.
	Brown very fine grained sandy gravel (1-10 cm poorly sorted), loose, wet, strong odor, NAPL sheen present.
35	Gray silty gravelly (1-2 cm) clay, medium stiff, moist, no odor, no staining.
	Brown coarse grained sandy gravel (1-10 cm poorly sorted), very loose, wet, no odor, no staining.
40	
45	Brown gravelly (1-10 cm poorly sorted) clayey silt, soft, no odor no staining.
	Gray coarse grained sandy gravel (1-10 cm poorly sorted), very loose, wet, no odor, no staining.
50	

Below Ground Surface (ft.): 904, 903, 902, 901, 900, 899, 898, 897, 896, 895, 894, 893, 892, 891, 890, 889, 888, 887, 886, 885, 884, 883, 882, 881

Comments

Remarks and Datum Used: Surveyors BRH, Inc. NAD83/91 and NAVD88

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Groundwater		
Date	Time	Depth (ft.)

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Boring Log

Boring #: LEV-7
Sheet 1 of 2

Project: **BNSF Skykomish**	Operator: **Justin Aekaret**	Location: **Skykomish, WA**
Project #: **BN050-16423-522**	Drill Rig Type: **Mini-Sonic**	Northing: **259481.0** Easting: **1510283.1**
Client: **BNSF**	Method: **Sonic Drilling**	Ground Elevation: **931.37**
Contractor: **Holt Drilling/Boart Longyear**	Casing ID:	Total Depth: **50'**
Start Date & Time: **9/15/05 0730**	Bit Type: **Tungsten Carbide**	Seal: **Hole Plug**
Finish Date & Time: **9/15/05 0930**	Boring ID: **4 inch**	Logged By: **Jim Schneider**

Sample: Depth Range (ft.)	Recovery	Depth	PetroFLAG (ppm)	NWTPH-Dx (mg/Kg)	Graphic Log	Depth (ft.)	Soil and Rock Description (Classification Scheme: USCS/ASTM)	Elevation (ft-msl)	Comments
						0	Light brown silty gravel (1-10 cm poorly sorted), very loose, dry, no odor, no staining	931	
0-5	T 2.5' N 2.5' S 0.0'							930 929 928 927	
						5		926 925	
5-10	T 3.0' N 3.0' S 0.0'	7'	27					924 923 922	
						10		921 920 919	
10-15	T 4.0' N 3.0' S 0.0'						Gray medium grained sandy silt, with large amount of wood debris, medium stiff, moist, no odor, no staining.	918 917	
						15	Gray gravelly (1-3 cm medium sorting) silt, soft, dry, no odor, no staining.	916 915	
15-20	T 4.0' N 3.0' S 1.0'							914 913 912	
						20	Brown coarse grained sandy gravel (1-10 cm poorly sorted), very loose, wet, no odor, no staining.	911	Groundwater at 20'
20-25	T 3.5' N 3.5' S 0.0'	23'	106					910 909 908 907	
						25		906	

Remarks and Datum Used: Surveyors BRH, Inc. NAD83/91 and NAVD88

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Groundwater Date	Time	Depth (ft.)

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Boring Log

Sample: Depth Range (ft.)	Recovery	Depth	PetroFLAG (ppm)	NWTPH-Dx (mg/Kg)
25-30	T 4.0' N 4.0' S 0.0'			
30-35		33'	52	
35-40	T 3.0' N 3.0' S 0.0'	38'	50	
40-45	T 3.5' N 3.5' S 0.0'	45'	48	
45-50	T 3.5' N 3.5' S 0.0'	47'	29	

Depth (ft.)	Soil and Rock Description (Classification Scheme: **USCS/ASTM**)
30	Brown very fined grained sandy silt, soft, wet, no odor, no staining.
	Gray very fined grained sandy silt, soft, wet, no odor, no staining.
35	Brown gravelly (1-3 cm medium sorting) coarse grained sand, very loose, wet, no odor no staining.
40	Brown gravelly (1-3 cm medium sorting) coarse grained sand, very loose, moist, no odor no staining.
	Gray medium grained sandy clay, soft, moist, no odor, no staining.
45	Brown gravelly (1-5 cm poorly sorted) silty clay, very stiff, slightly moist, no odor, no staining.
	Brown gravel (1-10 cm poorly sorted) with trace of silt, very loose, dry from 46'-49', wet at 49', no odor, no staining.
50	Gray coarse grained sandy clay, very stiff, moist, no odor, no staining.

Below Ground Surface (ft.): 905, 904, 903, 902, 901, 900, 899, 898, 897, 896, 895, 894, 893, 892, 891, 890, 889, 888, 887, 886, 885, 884, 883, 882

Comments

Remarks and Datum Used: Surveyors BRH, Inc. NAD83/91 and NAVD88

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S = Slough Rec (ft)

Groundwater

Date	Time	Depth (ft.)

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Boring Log

Boring #: LEV-8
Sheet 1 of 2

Project: **BNSF Skykomish**	Operator: **Justin Aekaret**	Location: **Skykomish, WA**
Project #: **BN050-16423-522**	Drill Rig Type: **Mini-Sonic**	Northing: **259543.6** Easting: **1510387.2**
Client: **BNSF**	Method: **Sonic Drilling**	Ground Elevation: **931.80**
Contractor: **Holt Drilling/Boart Longyear**	Casing ID:	Total Depth: **52'**
Start Date & Time: **9/15/05 1200**	Bit Type: **Tungsten Carbide**	Seal: **Hole Plug**
Finish Date & Time: **9/15/05 1600**	Boring ID: **4 inch**	Logged By: **Jim Schneider**

Sample: Depth Range (ft.)	Sample: Recovery	Sample: Depth	Sample: PetroFLAG (ppm)	Sample: NWTPH-Dx (mg/Kg)	Graphic Log	Depth (ft.)	Soil and Rock Description (Classification Scheme: USCS/ASTM)	Elevation (ft-msl)	Comments
0-5	T 1.0' N 1.0' S 0.0'					0	Light brown silty gravel (1-10 cm poorly sorted), very loose, dry, no odor, no staining	931, 930, 929, 928	
5-10	T 2.0' N 2.0' S 0.0'					5	Gray silty gravel (1-10 cm poorly sorted), very loose, dry, no odor, no staining	927, 926, 925, 924, 923, 922	
		10'	21,320			10	Brown silty coarse grained sand, very loose, moist, no odor, no staining.	921, 920	
10-15	T 3.0' N 3.0' S 0.0'	12'	47				Dark gray to black silty clay with large quantity (60-70%) wood debris, soft, moist, strong odor, no staining.	919, 918, 917	
15-20	T 3.0' N 1.0' S 2.0'	16'	> 100,000			15	Dark gray to black gravel (1-5 cm poorly sorted) with trace of silt, with approximately (20%) wood debris, loose, moist, strong odor, no staining.	916, 915, 914, 913, 912	
20-25						20	Brown coarse grained sandy gravel (1-5 cm poorly sorted) with wood debris present at 30', very loose, wet below 23', strong odor, NAPL residue present.	911, 910, 909, 908, 907	Groundwater at 23'
	T 3.0' N 3.0'	25'	14,450			25			

Remarks and Datum Used:	Surveyors BRH, Inc. NAD83/91 and NAVD88	Notes	Groundwater: Date	Groundwater: Time	Groundwater: Depth (ft.)
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		S = Slough Rec (ft)			

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Boring Log

Boring #: LEV-8
Sheet 2 of 2

Depth Range (ft.)	Recovery	Depth	PetroFLAG (ppm)	NWTPH-Dx (mg/Kg)	Depth (ft.)	Soil and Rock Description (Classification Scheme: USCS/ASTM)	Below Ground Surface (ft.)	Comments
25-30	S 0.0'						906, 905, 904, 903, 902	
30-35					30	Brown gravelly (1-5 cm poorly sorted) coarse grained sand with wood present from 30-32', very loose, wet, strong odor, hydrocarbon sheen.	901, 900, 899, 898, 897	
35-40	T 2.5' N 2.5' S 0.0'	35'	3,160	697	35		896, 895, 894, 893, 892	
40-45	T 4.0' N 4.0' S 0.0'	43'	77		40	Gray coarse grained sandy gravel (1-10 cm poorly sorted), very loose, wet, no odor, no staining.	891, 890, 889, 888, 887	
45-50	T 4.0' N 4.0' S 0.0'				45	Brown coarse grained sandy gravel (1-10 cm poorly sorted), very loose, wet, no odor, no staining. Brown silty gravelly (1-3 cm poorly sorted) clay, stiff, no odor, no staining.	886, 885, 884, 883, 882	Large boulder at 52'
50-52	T 0.0" N 0.0' S 0.0'	50'	80		50	No recovery. Boulder encountered at 52'	881, 880	

Remarks and Datum Used:	Surveyors BRH, Inc. NAD83/91 and NAVD88

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Groundwater		
Date	Time	Depth (ft.)

Boring Log

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Project: **BNSF Skykomish**	Operator: **Justin Aekaret**	Location: **Skykomish, WA**
Project #: **BN050-16423-522**	Drill Rig Type: **Mini-Sonic**	Northing: **259543.6** Easting: **1510475.0**
Client: **BNSF**	Method: **Sonic Drilling**	Ground Elevation: **932.51**
Contractor: **Holt Drilling/Boart Longyear**	Casing ID:	Total Depth: **50'**
Start Date & Time: **9/15/05 1630**	Bit Type: **Tungsten Carbide**	Seal: **Hole Plug**
Finish Date & Time: **9/15/05 1845**	Boring ID: **4 inch**	Logged By: **Jim Schneider**

Sample: Depth Range (ft.)	Sample: Recovery	Sample: Depth	Sample: PetroFLAG (ppm)	Sample: NWTPH-Dx (mg/Kg)	Depth (ft.)	Soil and Rock Description (Classification Scheme: USCS/ASTM)	Comments
0-5	T 1.5' N 1.5' S 0.0'				0	Light brown silty gravel (1-10 cm poorly sorted), very loose, dry, no odor, no staining	
5-10	T 2.0' N 1.0' S 1.0'				5	Brown silty gravelly (1-3 cm) medium grained sand, very loose, dry, no odor, no staining.	
10-15	T 3.0' N 1.5' S 1.5'	14'	26		10	Light gray silty gravel (1-5 cm poorly sorted), very loose, dry, no odor, no staining.	
15-20	T 3.5' N 2.0' S 1.5'				15		Groundwater at 20'
20-25	T 3.5' N 3.0' S 0.5'	23'	1,168	854	20	Brown gravelly (1-10 cm poorly sorted) silt, very soft, wet, slight odor, no staining.	
						Brown silty coarse grained sand, very loose, wet, slight odor, no staining.	
		25'	61		25		

Elevation (ft-msl): 932, 931, 930, 929, 928, 927, 926, 925, 924, 923, 922, 921, 920, 919, 918, 917, 916, 915, 914, 913, 912, 911, 910, 909, 908

Remarks and Datum Used:	Surveyors BRH, Inc. NAD83/91 and NAVD88	Notes	Groundwater: Date	Time	Depth (ft.)
		T = Total Rec (ft)			
		N = Native Rec (ft)			
		S = Slough Rec (ft)			

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Boring Log

Sample Depth Range (ft.)	Recovery	Depth	PetroFLAG (ppm)	NWTPH-Dx (mg/Kg)	Graphic Log	Depth (ft.)	Soil and Rock Description (Classification Scheme: USCS/ASTM)	Below Ground Surface (ft.)	Comments
25-30	T 2.0' N 0.5' S 1.5'						Brown coarse grained sandy gravelly (1-10 cm poorly sorted) clayey silt, soft, wet, slight odor, no staining.	907, 906, 905, 904, 903	
30-35	T 1.0' N 1.0' S 0.0'	33'	269			30	Brown coarse grained sandy gravelly (1-10 cm poorly sorted) clayey silt, soft, moist, slight odor, no staining.	902, 901, 900, 899	
35-40	T 3.0' N 3.0' S 0.0'					35	Light brown gravel (1-10 cm poorly sorted) with trace of silt, very loose, moist, no odor, no staining	898, 897, 896, 895, 894, 893	
40-45	T 3.0' N 3.0' S 0.0'					40	Brown coarse grained sandy gravel (1-10 cm poorly sorted), very loose, wet, no odor, no staining. (Possibly slough)	892, 891, 890, 889, 888	
45-50	T 3.0' N 3.0' S 0.0'	46'	465			45	Dark gray silty clayey gravel (1-5 cm poorly sorted), very loose, moist, no odor, no staining.	887, 886, 885	Refusal at 50'
		50'	24			50	Dark gray silty coarse grained sandy clay, stiff, moist, no odor, no staining.	884, 883	

Remarks and Datum Used: Surveyors BRH, Inc. NAD83/91 and NAVD88

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Groundwater		
Date	Time	Depth (ft.)

Boring Log

RETEC

Boring #: RIV-1
Sheet 1 of 1

Project: **BNSF Skykomish**	Operator: **Justin Aekaret**	Location: **Skykomish, WA**
Project #: **BN050-16423-522**	Drill Rig Type: **Mini-Sonic**	Northing: **259614.3** Easting: **1510457.8**
Client: **BNSF**	Method: **Sonic Drilling**	Ground Elevation: **917.40**
Contractor: **Holt Drilling/Boart Longyear**	Casing ID:	Total Depth: **10'**
Start Date & Time: **9/12/05 11:30**	Bit Type: **Tungsten Carbide**	Seal: **Native Material**
Finish Date & Time: **9/12/05 13:00**	Boring ID: **4 inch**	Logged By: **Jim Schneider**

Sample					Graphic Log	Depth (ft.)	Soil and Rock Description Classification Scheme: **USCS/ASTM**	Elevation (ft-msl)	Comments
Depth Range (ft.)	Recovery	Depth	PetroFLAG (ppm)	NWTPH-Dx (mg/Kg)					
0-5'	T 1.0' N 1.0' S 0.0'					0 5	Brown coarse grained sandy gravel, very loose, wet, no odor, no staining.	917 916 915 914 913 912 911	
5-10'	T 4.5' N 4.5' S 0.0'					10	Brown clayey silt, soft, wet, no odor, no staining.	910 909 908	

Remarks and Datum Used:	Surveyors BRH, Inc. NAD83/91 and NAVD88	Notes
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Groundwater		
Date	Time	Depth (ft.)

Boring Log

Boring #: RIV-2
Sheet 1 of 1

Project: **BNSF Skykomish**	Operator: **Justin Aekaret/Boart Longyear**	Location: **Skykomish, WA**
Project #: **BN050-16423-522**	Drill Rig Type: **Mini-Sonic**	Northing: **259604.1** Easting: **1510399.5**
Client: **BNSF**	Method: **Sonic Drilling**	Ground Elevation: **917.18**
Contractor: **Holt Drilling**	Casing ID:	Total Depth: **10'**
Start Date & Time: **9/12/05 13:30**	Bit Type: **Tungsten Carbide**	Seal: **Native Material**
Finish Date & Time: **9/12/05 13:50**	Boring ID: **4 Inch**	Logged By: **Jim Schneider**

Sample					Graphic Log	Depth (ft.)	Soil and Rock Description Classification Scheme: USCS/ASTM	Elevation (ft-msl)	Comments
Depth Range (ft.)	Recovery	Depth	PetroFLAG (ppm)	NWTPH-Dx (mg/Kg)					
0-5'	T 1.0' N 1.0' S 0.0'	0-1'	5,700	576		0	Brown coarse grained sandy gravel (1-10 cm poorly sorted), very loose, wet, strong odor, NAPL present near top of boring.	917 916 915 914 913	
5-10'	T 3.0' N 3.0' S 0.0'					5	Brown coarse grained sandy gravel (1-10 cm poorly sorted), very loose, wet, strong odor and sheen from 5-6.5' less odor and sheen with depth.	912 911 910 909	
		10'	18			10	Brown well sorted coarse grained sand, very loose, wet, no odor, no staining.	908	

Remarks and Datum Used:	Surveyors BRH, Inc. NAD83/91 and NAVD88	Notes	Groundwater		
		T = Total Rec (ft)	Date	Time	Depth (ft.)
		N = Native Rec (ft)			
		S = Slough Rec (ft)			

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Boring Log

Boring #: RIV-3
Sheet 1 of 1

Project: BNSF Skykomish	Operator: Justin Askaret	Location: Skykomish, WA
Project #: BN050-16423-522	Drill Rig Type: Mini-Sonic	Northing: 259580.4 Easting: 1510382.4
Client: BNSF	Method: Sonic Drilling	Ground Elevation: 917.38
Contractor: Holt Drilling/Boart Longyear	Casing ID:	Total Depth: 15'
Start Date & Time: 9/12/05 1430	Bit Type: Tungsten Carbide	Seal: Native Material
Finish Date & Time: 9/12/05 1530	Boring ID: 4 inch	Logged By: Jim Schneider

Sample					Graphic Log	Depth (ft.)	Soil and Rock Description Classification Scheme: USCS/ASTM	Elevation (ft-msl)	Comments
Depth Range (ft.)	Recovery	Depth	PetroFLAG (ppm)	NWTPH-Dx (mg/Kg)					
	T 1.5' N 1.5' S 0.0'	0 -5'	1,750			0	Brown coarse grained sandy gravel (1-10 cm poorly sorted), very loose, wet, strong odor, NAPL present in upper 4 inches of boring.	917 916 915 914 913	
	T 2.0' N 2.0' S 0.0'	5-10'	4,880	132.4		5	Brown coarse grained sandy gravel (1-10 cm poorly sorted), very loose, wet, slight odor, slight hydrocarbon sheen.	912 911 910 909 908	
	T 3.0' N 3.0' S 0.0'					10	Brown coarse grained sandy gravel (1-10 cm poorly sorted), very loose, wet, slight odor, no staining.	907 906 905	
		15'	44			15	Brown coarse grained sandy gravel (1-10 cm poorly sorted), very loose, wet, no odor, no staining.	904 903	

Remarks and Datum Used:	Surveyors BRH, Inc. NAD83/91 and NAVD88	Notes	Groundwater		
		T = Total Rec (ft)	Date	Time	Depth (ft.)
		N = Native Rec (ft)			
		S = Slough Rec (ft)			

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Boring Log

RETEC

Boring #: RIV-4
Sheet 1 of 1

Project: **BNSF Skykomish**	Operator: **Justin Aekaret**	Location: **Skykomish, WA**
Project #: **BN050-16423-522**	Drill Rig Type: **Mini-Sonic**	Northing: **259565.9** Easting: **1510332.0**
Client: **BNSF**	Method: **Sonic Drilling**	Ground Elevation: **917.33**
Contractor: **Holt Drilling/Boart Longyear**	Casing ID:	Total Depth: **23'**
Start Date & Time: **9/12/05 1730**	Bit Type: **Tungsten Carbide**	Seal: **Native Material**
Finish Date & Time: **9/12/05 1830**	Boring ID: **4 inch**	Logged By: **Jim Schneider**

Sample					Graphic Log	Depth (ft.)	Soil and Rock Description Classification Scheme: USCS/ASTM	Elevation (ft-msl)	Comments
Depth Range (ft.)	Recovery	Depth	PetroFLAG (ppm)	NWTPH-Dx (mg/Kg)					
0-4'	T 1.5' N 1.5' S 0.0'	0-4'	201			0	Brown gravel (1-10 cm poorly sorted) with trace of silt, very loose, wet, no odor no staining.	917 916 915 914	
4-10'	T 1.5' N 1.5' S 0.0'	4-10'	143			5	Gray gravel (1-10 cm poorly sorted) with trace of silt, very loose, wet, no odor, no staining.	913 912 911 910 909 908	
10-15'	T 3.0' N 3.0' S 0.0'	10-15'	144			10		907 906 905	
							Gray clayey gravel (1-10 cm poortly sorted) , very loose, wet, no odor, no staining.	904 903	
15-20'	T 3.5' N 3.5' S 0.0'	15-18'	139	8.03		15	Brown coarse grained sandy gravel (1-10 cm poorly sorted), very loose, wet, no odor, no staining.	902 901 900	
		18-20'	0				Brown gravelly (1-2 cm medium sorted) clayey silt, soft, wet, no odor, no staining.	899 898	
20-23'	T 3.0' N 3.0' S 0.0'	20-23'	0			20	Gray gravel (1-10 cm poorly sorted) with trace of silt, very loose, dry, no odor, no staining.	897 896 895	Drilling difficult at 20'

Remarks and Datum Used:	Surveyors BRH, Inc. NAD83/91 and NAVD88	Notes	Groundwater		
		T = Total Rec (ft)	Date	Time	Depth (ft.)
		N = Native Rec (ft)			
		S = Slough Rec (ft)			

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Boring Log

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Boring #: RIV-5
Sheet 1 of 1

Project: **BNSF Skykomish**	Operator: **Justin Aekaret**	Location: **Skykomish, WA**
Project #: **BN050-16423-522**	Drill Rig Type: **Mini-Sonic**	Northing: **259549.6** Easting: **1510313.1**
Client: **BNSF**	Method: **Sonic Drilling**	Ground Elevation: **917.02**
Contractor: **Holt Drilling/Boart Longyear**	Casing ID:	Total Depth: **15'**
Start Date & Time: **9/13/05 0800**	Bit Type: **Tungsten Carbide**	Seal: **Native Material**
Finish Date & Time: **9/13/05 0830**	Boring ID: **4 inch**	Logged By: **Jim Schneider**

Sample					Graphic Log	Depth (ft.)	Soil and Rock Description Classification Scheme: USCS/ASTM	Elevation (ft-msl)	Comments
Depth Range (ft.)	Recovery	Depth	PetroFLAG (ppm)	NWTPH-Dx (mg/Kg)					
0-5'	T 3.0' N 3.0' S 0.0'	0-3'	6	7.68		0	Brown coarse grained sandy gravel (1-10 cm poorly sorted), very loose, wet, no odor no staining.	917	
		3-5'	90				Brown fine grained sandy silt, soft, wet, no odor, no staining.	913	
5-10'	T 1.0' N 1.0' S 0.0'	5-10'	182			5	Gray coarse grained sand with trace of silt, very loose, wet, no odor, no staining.	912	
10-15'	T 3.5' N 3.5' S 0.0'	13-14'	42			10		907	
							Gray clayey silt, soft, wet, no odor, no staining.	904	
		14-15'	15			15	Brown gravelly coarse grained sand, very loose, wet, no odor, no staining.	903	

Remarks and Datum Used:	Notes	Groundwater		
Surveyors BRH, Inc. NAD83/91 and NAVD88	T = Total Rec (ft)	Date	Time	Depth (ft.)
	N = Native Rec (ft)			
	S = Slough Rec (ft)			

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Boring Log

Boring #: **RIV-6**
Sheet 1 of 1

Project: **BNSF Skykomish**	Operator: **Justin Aekaret**	Location: **Skykomish, WA**
Project #: **BN050-16423-522**	Drill Rig Type: **Mini-Sonic**	Northing: **259545.0** Easting: **1510240.5**
Client: **BNSF**	Method: **Sonic Drilling**	Ground Elevation: **916.60**
Contractor: **Holt Drilling/Boart Longyear**	Casing ID:	Total Depth: **15'**
Start Date & Time: **9/13/05 0830**	Bit Type: **Tungsten Carbide**	Seal: **Native Material**
Finish Date & Time: **9/13/05 0900**	Boring ID: **4 inch**	Logged By: **Jim Schneider**

Sample					Graphic Log	Depth (ft.)	Soil and Rock Description Classification Scheme: USCS/ASTM	Elevation (ft-msl)	Comments
Depth Range (ft.)	Recovery	Depth	PetroFLAG (ppm)	NWTPH-Dx (mg/Kg)					
0-5'	T 3.0' N 3.0' S 0.0'	0-3'	32	ND		0	Brown coarse grained sandy gravel (1-10 cm poorly sorted), very loose, wet, no odor no staining.	916 915 914	
		3-5'	21				Brown very fine grained sandy silt, soft, wet, no odor, no staining.	913 912	
5-10'	T 0.0' N 0.0' S 0.0'					5	5-15' No Sample Recovery. Driller did not observe NAPL during drilling activities.	911 910 909 908 907	
10-15'	T 0.0' N 0.0' S 0.0'					10		906 905 904 903 902	
						15			

Remarks and Datum Used:	Surveyors BRH, Inc. NAD83/91 and NAVD88	Notes	Groundwater		
		T = Total Rec (ft)	Date	Time	Depth (ft.)
		N = Native Rec (ft)			
		S = Slough Rec (ft)			

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Boring Log

Boring #: RIV-7
Sheet 1 of 1

Project: BNSF Skykomish	Operator: Justin Aakaret	Location: Skykomish, WA
Project #: BN050-16423-522	Drill Rig Type: Mini-Sonic	Northing: 259544.5 Easting: 1510240.5
Client: BNSF	Method: Sonic Drilling	Ground Elevation: 916.50
Contractor: Holt Drilling/Boart Longyear	Casing ID:	Total Depth: 15'
Start Date & Time: 9/13/05 0900	Bit Type: Tungsten Carbide	Seal: Native Material
Finish Date & Time: 9/13/05 0930	Boring ID: 4 inch	Logged By: Jim Schneider

Sample					Graphic Log	Depth (ft.)	Soil and Rock Description Classification Scheme: USCS/ASTM	Elevation (ft-msl)	Comments
Depth Range (ft.)	Recovery	Depth	PetroFLAG (ppm)	NWTPH-Dx (mg/Kg)					
0-5'	T 3.0' N 3.0' S 0.0'	0-5'	155	9.43		0	Brown coarse grained sandy gravel (1-10 cm poorly sorted), very loose, wet, no odor no staining.	916 915 914 913 912	
5-10'	T 3.0' N 3.0' S 0.0'	5-10'	10			5		911 910 909 908 907	
10-15'	T 2.5' N 2.5' S 0.0'	10-13'	72			10	Brown silty very fine grained sand with trace of silt, loose, wet, no odor, no staining.	906 905 904	
		13-15'	48			15	Brown very fine grained sandy silt, soft, wet, no odor, no staining.	903 902	

Remarks and Datum Used:	Surveyors BRH, Inc. NAD83/91 and NAVD88	Notes	Groundwater		
		T = Total Rec (ft)	Date	Time	Depth (ft.)
		N = Native Rec (ft)			
		S = Slough Rec (ft)			

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RETEC Boring Log

Boring #: RIV-8
Sheet 1 of 1

Project: BNSF Skykomish	Operator: Justin Aekaret	Location: Skykomish, WA
Project #: BN050-16423-522	Drill Rig Type: Mini-Sonic	Northing: 259530.3 Easting: 1510205.6
Client: BNSF	Method: Sonic Drilling	Ground Elevation: 916.57
Contractor: Holt Drilling/Boart Longyear	Casing ID:	Total Depth: 15'
Start Date & Time: 9/13/05 0930	Bit Type: Tungsten Carbide	Seal: Native Material
Finish Date & Time: 9/13/05 1000	Boring ID: 4 inch	Logged By: Jim Schneider

Sample					Graphic Log	Depth (ft.)	Soil and Rock Description Classification Scheme: USCS/ASTM	Elevation (ft-msl)	Comments
Depth Range (ft.)	Recovery	Depth	PetroFLAG (ppm)	NWTPH-Dx (mg/Kg)					
		0-2'	31	ND		0	Brown coarse grained sandy gravel (1-10 cm poorly sorted), very loose, wet, no odor no staining.	916 915 914	
0-5'	T 3.0' N 3.0' S 0.0'						Brown very fine grained sandy silt, soft, wet, no odor, no staining.	913 912 911	
		4-6'	12			5			
5-15'	T 4.0' N 4.0' S 0.0'					10	Brown very fine grained sand with trace of silt, loose, wet, no odor, no staining.	910 909 908 907 906 905 904 903 902	
		15'	95			15			

Remarks and Datum Used:	Surveyors BRH, Inc. NAD83/91 and NAVD88	Notes	Groundwater		
			Date	Time	Depth (ft.)
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Boring Log

Boring #: RIV-9
Sheet 1 of 1

Project: BNSF Skykomish	Operator: Justin Aakaret	Location: Skykomish, WA
Project #: BN050-16423-522	Drill Rig Type: Mini-Sonic	Northing: 259514.7 Easting: 1510175.7
Client: BNSF	Method: Sonic Drilling	Ground Elevation: 916.65
Contractor: Holt Drilling/Boart Longyear	Casing ID:	Total Depth: 15'
Start Date & Time: 9/13/05 1000	Bit Type: Tungsten Carbide	Seal: Native Material
Finish Date & Time: 9/13/05 1030	Boring ID: 4 Inch	Logged By: Jim Schneider

Sample					Graphic Log	Depth (ft.)	Soil and Rock Description Classification Scheme: USCS/ASTM	Elevation (ft-msl)	Comments
Depth Range (ft.)	Recovery	Depth	PetroFLAG (ppm)	NWTPH-Dx (mg/Kg)					
0-5'	T 1.5' N 1.5' S 0.0'	0-5'	0	3.29		0	Brown coarse grained sandy gravel (1-10 cm poorly sorted), very loose, wet, no odor no staining.	916 915 914 913 912	
5-10'	T 1.5' N 1.5' S 0.0'	5-10'	38			5		911 910 909 908 907	
10-15'	T 3.5' N 3.5' S 0.0'	12-15'	18			10	Gray very fine grained sandy silt, medium stiff, wet, no odor, no staining.	906 905 904 903 902	
						15			

Remarks and Datum Used:	Surveyors BRH, Inc. NAD83/91 and NAVD88	Notes	Groundwater		
		T = Total Rec (ft)	Date	Time	Depth (ft.)
		N = Native Rec (ft)			
		S = Slough Rec (ft)			

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Boring #: RIV-10
Sheet 1 of 1

Project: **BNSF Skykomish**	Operator: **Justin Aakaret**	Location: **Skykomish, WA**
Project #: **BN050-16423-522**	Drill Rig Type: **Mini-Sonic**	Northing: **259470.4** Easting: **1510154.1**
Client: **BNSF**	Method: **Sonic Drilling**	Ground Elevation: **916.56**
Contractor: **Holt Drilling/Boart Longyear**	Casing ID:	Total Depth: **25'**
Start Date & Time: **9/13/05 1030**	Bit Type: **Tungsten Carbide**	Seal: **Native Material**
Finish Date & Time: **9/13/05 1200**	Boring ID: **4 inch**	Logged By: **Jim Schneider**

Sample Depth Range (ft.)	Recovery	Depth	PetroFLAG (ppm)	NWTPH-Dx (mg/Kg)	Depth (ft.)	Soil and Rock Description (Classification Scheme: USCS/ASTM)	Elevation (ft-msl)	Comments
0-5'	T 1.5' N 1.5' S 0.0'				0-5	Brown coarse grained sandy gravel (1-10 cm poorly sorted), very loose, wet, strong odor, NAPL present in upper 4" of sample, heavy sheen throughout.	916–912	
5-10'	T 1.5' N 1.5' S 0.0'				5-10	Brown coarse grained sandy gravel (1-10 cm poorly sorted), very loose, wet, strong odor, NAPL present (may be from upper sample interval), heavy sheen throughout.	911–907	
10-15'	T 3.5' N 3.5' S 0.0'	10-12'	17	23.5	10-12	Gray coarse grained sandy gravel (1-10 cm poorly sorted), very loose, wet, slight odor, no staining.	906–905	
		12-14'	35		12-15	Gray very fine gained sandy silt, soft, wet, slight odor no staining.	904–902	
15-20'	T 1.5' N 1.5' S 0.0'	15-20'	17		15-18.5	Brown coarse grained sandy gravel (1-10 cm poorly sorted), very loose, no odor, no staining.	901–898	Product from contacting impacted drill rods @ 15'
					18.5-21	Brown coarse grained sandy gravelly (1-3 cm medium sorted) clayey silt, soft, no odor, no staining.	897–896	
20-25'	T 3.5' N 3.0' S 0.5'	20-21'	33					
		21-25'	16		21-25	Brown coarse grained sandy gravel (1-10 cm poorly sorted), very loose, no odor, no staining.	895–892	

Remarks and Datum Used: Surveyors BRH, Inc. NAD83/91 and NAVD88

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N = Native Rec (ft)
S = Slough Rec (ft)

Groundwater		
Date	Time	Depth (ft.)

Boring Log

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Boring #: RIV-11
Sheet 1 of 1

Project: **BNSF Skykomish**	Operator: **Justin Aekaret**	Location: **Skykomish, WA**
Project #: **BN050-16423-522**	Drill Rig Type: **Mini-Sonic**	Northing: **259491.7** Easting: **1510122.3**
Client: **BNSF**	Method: **Sonic Drilling**	Ground Elevation: **916.17**
Contractor: **Holt Drilling/Boart Longyear**	Casing ID:	Total Depth: **15'**
Start Date & Time: **9/13/05 1300**	Bit Type: **Tungsten Carbide**	Seal: **Native Material**
Finish Date & Time: **9/13/05 1330**	Boring ID: **4 Inch**	Logged By: **Jim Schneider**

Sample					Graphic Log	Depth (ft.)	Soil and Rock Description Classification Scheme: USCS/ASTM	Elevation (ft-msl)	Comments
Depth Range (ft.)	Recovery	Depth	PetroFLAG (ppm)	NWTPH-Dx (mg/Kg)					
0-5'	T 1.5' N 1.5' S 0.0'					0	Brown coarse grained sandy gravel (1-10 cm poorly sorted), very loose, wet, no odor, no staining.	916	
5-10'	T 1.0' N 1.0' S 0.0'	5-10'	3	8.86		5		911	
10-15'	T 3.0' N 3.0' S 0.0'	10-13'	75			10	Brown coarse grained sandy gravel (1-10 cm poorly sorted), very loose, wet, no odor, slight sheen observed - possibly due to contact with impacted tools from previous location.	906	
		13-15'	29				Gray very fine grained sandy silt, soft, wet, no odor, no staining.	903	
						15			

Remarks and Datum Used:	Surveyors BRH, Inc. NAD83/91 and NAVD88	Notes	Groundwater		
		T = Total Rec (ft)	Date	Time	Depth (ft.)
		N = Native Rec (ft)			
		S = Slough Rec (ft)			

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RETEC Boring Log

Boring #: RIV-12
Sheet 1 of 1

Project: **BNSF Skykomish**	Operator: **Justin Aekaret**	Location: **Skykomish, WA**
Project #: **BN050-16423-522**	Drill Rig Type: **Mini-Sonic**	Northing: **259479.0** Easting: **1510086.8**
Client: **BNSF**	Method: **Sonic Drilling**	Ground Elevation: **916.58**
Contractor: **Holt Drilling/Boart Longyear**	Casing ID:	Total Depth: **25'**
Start Date & Time: **9/13/05 1430**	Bit Type: **Tungsten Carbide**	Seal: **Native Material**
Finish Date & Time: **9/13/05 1530**	Boring ID: **4 inch**	Logged By: **Jim Schneider**

Sample					Graphic Log	Depth (ft.)	Soil and Rock Description Classification Scheme: USCS/ASTM	Elevation (ft-msl)	Comments
Depth Range (ft.)	Recovery	Depth	PetroFLAG (ppm)	NWTPH-Dx (mg/Kg)					
0-5'	T 2.5' N 2.5' S 0.0'	0-5' 3'		11.71 10.31		0	Brown coarse grained sandy gravel (1-10 cm poorly sorted), very loose, wet, faint odor, no staining.	916 915 914 913 912	
		5'	10			5	Brown coarse grained sandy gravel (1-10 cm poorly sorted), very loose, wet, no odor, no staining.	911 910 909 908 907	
5-10'	T 1.5' N 1.5' S 0.0'								
		10'	585			10		906 905 904	
10-15'	T 3.5' N 3.5' S 0.0'						Gray very fine grained sandy silt, soft, wet, no odor, no staining.	903 902	
		14'	19	6.63					
		16'	0			15	Gray coarse grained sandy gravel (1-10 cm poorly sorted) very loose, wet, no odor, no staining.	901 900 899 898 897	
15-20'	T 3.5' N 2.5' S 1.0'								
20-25'	T 3.5' N 3.5' S 0.0'					20		896 895 894 893 892	
		25'	9			25			

Remarks and Datum Used:	Surveyors BRH, Inc. NAD83/91 and NAVD88	Notes	Groundwater		
		T = Total Rec (ft)	Date	Time	Depth (ft.)
		N = Native Rec (ft)			
		S = Slough Rec (ft)			

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Boring Log

Boring #: RIV-13
Sheet 1 of 1

Project: BNSF Skykomish	Operator: Justin Aekaret	Location: Skykomish, WA
Project #: BN050-16423-522	Drill Rig Type: Mini-Sonic	Northing: 259439.1 Easting: 1510007.4
Client: BNSF	Method: Sonic Drilling	Ground Elevation: 916.08
Contractor: Holt Drilling/Boart Longyear	Casing ID:	Total Depth: 15'
Start Date & Time 9/13/05 1630	Bit Type: Tungsten Carbide	Seal: Native Material
Finish Date & Time 9/13/05 1700	Boring ID: 4 inch	Logged By: Jim Schneider

Sample					Graphic Log	Depth (ft.)	Soil and Rock Description Classification Scheme: USCS/ASTM	Elevation (ft-msl)	Comments
Depth Range (ft.)	Recovery	Depth	PetroFLAG (ppm)	NWTPH-Dx (mg/Kg)					
0-5'	T 3.5' N 3.5' S 0.0'	3'	4	2.28		0	Brown coarse grained sandy gravel (1-10 cm poorly sorted), very loose, wet, no odor, no staining.	916 915 914 913 912	
5-10'	T 2.0' N 2.0' S 0.0'					5		911 910 909 908 907	
10-15'	T 3.5' N 3.0' S 0.5'	15'	1			10 15	Dark gray clayey coarse grained sandy gravel (1-10 cm poorly sorted) very loose, wet, no odor, no staining.	906 905 904 903 902	

Remarks and Datum Used:	Surveyors BRH, Inc. NAD83/91 and NAVD88	Notes	Groundwater		
			Date	Time	Depth (ft.)
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RETEC Boring Log

Boring #: RIV-14
Sheet 1 of 1

Project: **BNSF Skykomish**	Operator: **Justin Aekaret**	Location: **Skykomish, WA**
Project #: **BN050-16423-522**	Drill Rig Type: **Mini-Sonic**	Northing: **259429.3** Easting: **1509971.7**
Client: **BNSF**	Method: **Sonic Drilling**	Ground Elevation: **916.29**
Contractor: **Holt Drilling/Boart Longyear**	Casing ID:	Total Depth: **15'**
Start Date & Time: **9/14/05 0930**	Bit Type: **Tungsten Carbide**	Seal: **Native Material**
Finish Date & Time: **9/14/05 1000**	Boring ID: **4 inch**	Logged By: **Jim Schneider**

Sample: Depth Range (ft.)	Recovery	Depth	PetroFLAG (ppm)	NWTPH-Dx (mg/Kg)	Depth (ft.)	Soil and Rock Description (Classification Scheme: USCS/ASTM)	Elevation (ft-msl)	Comments
0-5'	T 2.0' N 2.0' S 0.0'	1'	109	9.41	0–8	Brown coarse grained sandy gravel (1-10 cm poorly sorted), very loose, wet, no odor, no staining.	916–908	
5-10'	T 3.5' N 3.0' S 0.5'	9'	7		8–12	Brown very fine grained sandy silt, soft, wet, no odor, no staining.	908–904	
10-15'	T 2.5' N 2.5' S 0.0'	15'	6		12–15	Brown gravelly (1-5 cm poorly sorted) coarse grained sand, very loose, wet, no odor, no staining.	904–902	

Remarks and Datum Used:	Notes	Groundwater		
Surveyors BRH, Inc. NAD83/91 and NAVD88	T = Total Rec (ft)	Date	Time	Depth (ft.)
	N = Native Rec (ft)			
	S = Slough Rec (ft)			

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Boring Log

Boring #: RIV-15
Sheet 1 of 1

Project: BNSF Skykomish	Operator: Justin Aekaret	Location: Skykomish, WA
Project #: BN050-16423-522	Drill Rig Type: Mini-Sonic	Northing: 259400.6 Easting: 1509877.9
Client: BNSF	Method: Sonic Drilling	Ground Elevation: 916.30
Contractor: Holt Drilling/Boart Longyear	Casing ID:	Total Depth: 15'
Start Date & Time: 9/14/05 1000	Bit Type: Tungsten Carbide	Seal: Native Material
Finish Date & Time 9/14/05 1030	Boring ID: 4 inch	Logged By: Jim Schneider

Sample				
Depth Range (ft.)	Recovery	Depth	PetroFLAG (ppm)	NWTPH-Dx (mg/Kg)
0-5'	T 2.0' N 2.0' S 0.0'	1'	219	20.9
5-10'	T 4.5' N 4.0' S 0.5'	6'	9	
		8'	0	
10-15'	T 0.5' N 0.5' S 0.0'	15'	86	

Graphic Log

Depth (ft.)	Soil and Rock Description (Classification Scheme: USCS/ASTM)	Elevation (ft-msl)	Comments
0–5	Brown coarse grained sandy gravel (1-10 cm poorly sorted), very loose, wet, no odor, no staining.	916, 915, 914, 913, 912	
5–6	Reddish brown very fine grained sandy silt, soft, wet, no odor, no staining.	911	
6–8	Brown coarse grained sandy gravel (1-10 cm poorly sorted), very loose, wet, no odor, no staining.	910, 909	
8–10	Gray clayey silt, soft, wet, no odor, no staining.	908, 907	
10–15	Brown coarse grained sandy gravel (1-10 cm poorly sorted), very loose, wet, no odor, no staining.	906, 905, 904, 903, 902	

Remarks and Datum Used: Surveyors BRH, Inc. NAD83/91 and NAVD88

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N = Native Rec (ft)
S = Slough Rec (ft)

Groundwater		
Date	Time	Depth (ft.)

Boring Log

RETEC

Boring #: RIV-16
Sheet 1 of 1

Project: **BNSF Skykomish**	Operator: **Justin Aekaret**	Location: **Skykomish, WA**
Project #: **BN050-16423-522**	Drill Rig Type: **Mini-Sonic**	Northing: **259400.6** Easting: **1509916.4**
Client: **BNSF**	Method: **Sonic Drilling**	Ground Elevation: **916.27**
Contractor: **Holt Drilling/Boart Longyear**	Casing ID:	Total Depth: **15'**
Start Date & Time: **9/14/05 1040**	Bit Type: **Tungsten Carbide**	Seal: **Native Material**
Finish Date & Time: **9/14/05 1110**	Boring ID: **4 inch**	Logged By: **Jim Schneider**

Sample: Depth Range (ft.)	Recovery	Depth	PetroFLAG (ppm)	NWTPH-Dx (mg/Kg)	Depth (ft.)	Soil and Rock Description (Classification Scheme: USCS/ASTM)	Elevation (ft-msl)	Comments
		1'	50	6.12	0	Brown coarse grained sandy gravel (1-10 cm poorly sorted), very loose, wet, no odor, no staining.	916	
0-5'	T 2.0' N 2.0' S 0.0'						915 914 913 912	
5-10'	T 3.5' N 3.5' S 0.0'				5		911 910 909 908	
		9'	30			Gray coarse grained sandy silt, soft, wet, no odor, no staining.	907	
10-15'	T 3.0' N 3.0' S 0.0'				10	Brown coarse grained sandy gravel (1-10 cm poorly sorted), very loose, wet, no odor, no staining.	906 905 904 903	
		15'	12		15		902	

Remarks and Datum Used: Surveyors BRH, Inc. NAD83/91 and NAVD88

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S = Slough Rec (ft)

Groundwater: Date	Time	Depth (ft.)

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Boring Log

Boring #: RIV-17
Sheet 1 of 1

Project: **BNSF Skykomish**	Operator: **Justin Askaret**	Location: **Skykomish, WA**
Project #: **BN050-16423-522**	Drill Rig Type: **Mini-Sonic**	Northing: **259374.1** Easting: **1509877.9**
Client: **BNSF**	Method: **Sonic Drilling**	Ground Elevation: **915.5**
Contractor: **Holt Drilling/Boart Longyear**	Casing ID:	Total Depth: **15'**
Start Date & Time: **9/14/05 1130**	Bit Type: **Tungsten Carbide**	Seal: **Native Material**
Finish Date & Time: **9/14/05 1200**	Boring ID: **4 inch**	Logged By: **Jim Schneider**

Sample					Graphic Log	Depth (ft.)	Soil and Rock Description Classification Scheme: USCS/ASTM	Elevation (ft-msl)	Comments
Depth Range (ft.)	Recovery	Depth	PetroFLAG (ppm)	NWTPH-Dx (mg/Kg)					
						0	Gray coarse grained sandy gravel (1-10 cm poorly sorted), very loose, wet, no odor, no staining.	915	
		1'	7	ND				914	
0-5'	T 2.5' N 2.5' S 0.0'							913	
		3'		ND				912	
								911	
						5		910	
								909	
5-10'	T 3.5' N 3.5' S 0.0"	7'	26					908	
							Gray clayey very fine grained sandy silt, soft, wet, no odor, no staining.	907	
								906	
						10		905	
								904	
10-15'	T 4.0' N 4.0' S 0.0'							903	
		13'		7.44				902	
		15'	5					901	
						15			

Remarks and Datum Used:	Surveyors BRH, Inc. NAD83/91 and NAVD88	Notes	Groundwater		
		T = Total Rec (ft)	Date	Time	Depth (ft.)
		N = Native Rec (ft)			
		S = Slough Rec (ft)			

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Boring Log

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Boring #: RIV-18
Sheet 1 of 1

Project: **BNSF Skykomish**	Operator: **Justin Aakaret**	Location: **Skykomish, WA**
Project #: **BN050-16423-522**	Drill Rig Type: **Mini-Sonic**	Northing: **259599.8** Easting: **1510367.3**
Client: **BNSF**	Method: **Sonic Drilling**	Ground Elevation: **917.31**
Contractor: **Holt Drilling/Boart Longyear**	Casing ID:	Total Depth: **15'**
Start Date & Time: **9/14/05 1315**	Bit Type: **Tungsten Carbide**	Seal: **Native Material**
Finish Date & Time: **9/14/05 1345**	Boring ID: **4 inch**	Logged By: **Jim Schneider**

Sample: Depth Range (ft.)	Recovery	Depth	PetroFLAG (ppm)	NWTPH-Dx (mg/Kg)	Depth (ft.)	Soil and Rock Description (Classification Scheme: USCS/ASTM)	Elevation (ft-msl)	Comments
					0	Reddish brown coarse grained sandy gravel (1-10 cm poorly sorted), very loose, wet, no odor, no staining.	917	
		1'	13	ND			916	
0-5'	T 2.0' N 2.0' S 0.0'						915	
							914	
							913	
					5		912	
							911	
							910	
5-10'	T 2.0' N 2.0' S 0.0"					Gray coarse grained sandy gravel (1-10 cm poorly sorted), very loose, wet, no odor, no staining.	909	
							908	
		10'	9		10	Dark brown to black silty clay, stiff, wet, no odor, no staining.	907	
							906	
10-15'	T 4.5' N 4.5' S 0.0'						905	
							904	
		15'	61				903	
					15			

Remarks and Datum Used:	Surveyors BRH, Inc. NAD83/91 and NAVD88	Notes	Groundwater: Date	Time	Depth (ft.)
		T = Total Rec (ft)			
		N = Native Rec (ft)			
		S = Slough Rec (ft)			

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Boring Log

Boring #: RIV-19
Sheet 1 of 1

Project: **BNSF Skykomish**	Operator: **Justin Aekaret**	Location: **Skykomish, WA**
Project #: **BN050-18423-522**	Drill Rig Type: **Mini-Sonic**	Northing: **259618.8** Easting: **1510393.2**
Client: **BNSF**	Method: **Sonic Drilling**	Ground Elevation: **916.90**
Contractor: **Holt Drilling/Boart Longyear**	Casing ID:	Total Depth: **15'**
Start Date & Time: **9/14/05 1400**	Bit Type: **Tungsten Carbide**	Seal: **Hole Plug**
Finish Date & Time: **9/14/05 1430**	Boring ID: **4 inch**	Logged By: **Jim Schneider**

Sample					Graphic Log	Depth (ft.)	Soil and Rock Description Classification Scheme: USCS/ASTM	Elevation (ft-msl)	Comments
Depth Range (ft.)	**Recovery**	**Depth**	**PetroFLAG (ppm)**	**NWTPH-Dx (mg/Kg)**					
						0			
		1'	27	737			Brown coarse grained sandy gravel (1-10 cm poorly sorted), very loose, wet, no odor, no staining.	916	
0-5'	T 1.0' N 1.0' S 0.0'							915 914 913	
						5		912 911 910	
5-10'	T 2.5' N 2.0' S 0.5'						Gray gravelly (1-10 cm poorly sorted) coarse grained sand, very loose, wet, no odor, no staining.	909 908	
						10	Gray silty clay, stiff, wet, no odor, no staining.	907 906	
		11'	66						
10-15'	T 4.0' N 4.0' S 0.0'						Gray clayey silt, soft, wet, no odor, no staining.	905 904	
		15'	35			15	Reddish brown clayey coarse grained sandy gravel (1-10 cm poorly sorted), very loose, wet, no odor, no staining.	903 902	

Remarks and Datum Used:	Surveyors BRH, Inc. NAD83/91 and NAVD88	Notes	Groundwater		
		T = Total Rec (ft)	Date	Time	Depth (ft.)
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Boring Log

Boring #: RIV-20
Sheet 1 of 1

Project: **BNSF Skykomish**	Operator: **Justin Askaret**	Location: **Skykomish, WA**
Project #: **BN050-16423-522**	Drill Rig Type: **Mini-Sonic**	Northing: **259627.9** Easting: **1510515.8**
Client: **BNSF**	Method: **Sonic Drilling**	Ground Elevation: **918.01**
Contractor: **Holt Drilling/Boart Longyear**	Casing ID:	Total Depth: **15'**
Start Date & Time: **9/14/05 1500**	Bit Type: **Tungsten Carbide**	Seal: **Native Material**
Finish Date & Time: **9/14/05 1530**	Boring ID: **4 inch**	Logged By: **Jim Schneider**

Sample					Graphic Log	Depth (ft.)	Soil and Rock Description Classification Scheme: USCS/ASTM	Elevation (ft-msl)	Comments
Depth Range (ft.)	Recovery	Depth	PetroFLAG (ppm)	NWTPH-Dx (mg/Kg)					
						0	Brown coarse grained sandy gravel (1-10 cm poorly sorted), very loose, wet, no odor, no staining.	918	
		1'	79	43.44				917	
0-5'	T 1.5' N 1.5' S 0.0'	3'		22.44				916 915 914	
						5		913 912 911	
5-10'	T 3.5' N 3.5' S 0.0"	8'	5				Gray silty clay, stiff, wet, no odor, no staining.	910 909	
						10		908 907 906	
10-15'	T 4.0' N 3.5' S 0.5'	13'		13.74			Gray and red silty clayey very fine grained sand, dense, very moist, no odor, no staining.	905 904	
		15'	0			15			

Remarks and Datum Used:	Surveyors BRH, Inc. NAD83/91 and NAVD88	Notes	Groundwater		
			Date	Time	Depth (ft.)
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		N = Native Rec (ft)			
		S = Slough Rec (ft)			

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RETEC Boring Log

Boring #: LEV-2A
Sheet 1 of 2

Project: **BNSF Skykomish**	Operator: **Justin Aekaret**	Location: **Skykomish, WA**
Project #: **BN050-16423-522**	Drill Rig Type: **Mini-Sonic**	Northing: Easting:
Client: **BNSF**	Method: **Sonic Drilling**	Ground Elevation:
Contractor: **Holt Drilling/Boart Longyear**	Casing ID: **6 inch**	Total Depth: **40'**
Start Date & Time: **12/22/05 11:00**	Bit Type: **Tungsten Carbide**	Seal: **Hole Plug**
Finish Date & Time: **12/22/05 12:30**	Boring ID: **4 inch**	Logged By: **Cliff Baines**

Sample				Graphic Log	Depth (ft.)	Soil and Rock Description Classification Scheme: **USCS/ASTM**	Elevation (ft-msl)
Depth Range (ft.)	Recovery	Depth (ft.)	NWTPH-Dx (mg/Kg)				
0-5'	19"				0–5	Gravelly sand, SW, fine to coarse, trace fines, max clast 4", moist to wet, loose, no odor. 60% sand, 40% gravel, brownish.	0 to -5
5-10'					5–10	Gravelly sand, SW, fine to coarse, brownish, moist, 70% sand, 30% gravel, pocket of black organic material (OL) plant pieces.	-5 to -10
10-15'	28"	10'	392		10–15	Grades to 60% sand, 40% gravel, moist, no odor, max clast size 4.5 inches, last 9" grades to more gray, moist to wet, some NAPL, odor	-10 to -15
15-20'	43"	15' 17.5'	24,300 3,250		15–20	Same as last 9" above except 60% gravel, 40% sand for 19" then 6"silty and gravelly sand, brown, wet, very loose (soupy), no odor, sheen(?), then silt (ML) fine sandy to with sand, brown, stiff, some FeO staining, gravelly first 6"	-15 to -20
20-25'	44"	20' 22.5'	BDL 188.4		20–25	34" of above silt, but sandy with fine sand interbeds and pockets, up to 70mm thick, micaceous, bottom of unit has 20 mm FeO stained bright red, fine sand, sharp contact with clay, CH with fine sand, high to medium plasticity, 90% clay, 10% sand, medium to dark gray, soft, wet, no odor.	-20 to -25
		25'	BDL		25		-25

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N = Native Rec (ft)
S = Slough Rec (ft)

Groundwater		
Date	Time	Depth (ft.)

RETEC

Boring Log

Boring #: LEV-2A
Sheet 2 of 2

Sample: Depth Range (ft.)	Recovery	Depth (ft.)	NWTPH-Dx (mg/Kg)	Depth (ft.)	Soil and Rock Description (Classification Scheme: **USCS/ASTM**)	Elevation (ft-msl)
25-35'	37"	30'	BDL	30	Driller said he did 10' run 25 - 35', liner looks like it only has 30 - 35 ' - logged as such. 13" of silty fine sand, brown, 70% sand, 30% silt, wet, loose - very loose, no odor (SP), 6", fine to medium grained sand, trace coarse, wet, no odor., lt - med brown, then gravelly sand, SW, fine - coarse, more plag & qz, wet, no odor, loose	-26 to -35
		32.5'	BDL			
		35'	BDL	35	14" gravelly and sandy silty-clay, ML - CL, very soft (soupy), 50% fines, 30% gravel, 20% sand, wet, no odor. Gray-brown, then 9" gravelly sand, SW, fine to coarse, reddish-tan color, loose, wet, no odor, clasts to 2", soupy could be slough.	-35 to -40
35-40'	23"	37.5'	234			
		40'	94.7	40		

Remarks and Datum Used:		Notes	Groundwater: Date	Time	Depth (ft.)
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Boring Log

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Boring #: LEV-4A
Sheet 1 of 2

Project: BNSF Skykomish	Operator: Justin Aekaret	Location: Skykomish, WA
Project #: BN050-16423-522	Drill Rig Type: Mini-Sonic	Northing: Easting:
Client: BNSF	Method: Sonic Drilling	Ground Elevation:
Contractor: Holt Drilling/Boart Longyear	Casing ID: 6 inch	Total Depth: 35'
Start Date & Time: 12/22/05 8:50	Bit Type: Tungsten Carbide	Seal: Hole Plug
Finish Date & Time: 12/22/05 10:15	Boring ID: 4 inch	Logged By: Cliff Baines

Sample				Graphic Log	Depth (ft.)	Soil and Rock Description Classification Scheme: USCS/ASTM	Elevation (ft-msl)
Depth Range (ft.)	Recovery	Depth (ft.)	NWTPH-Dx (mg/Kg)				
0-5'	26"				0	Gravelly sand, SW, fine to coarse, trace fines, max clast 4", moist to wet, loose, no odor. 60% sand, 40% gravel, brownish.	0
5-10'	26"				5	same as above, grades to 5% fines, 60% sand, 35% gravel, 20% recovered	-5
		10'	BDL		10	Sandy gravel, GP, 60% gravel, 40% sand, moist to wet, no odor., trace fines, broken cobbles (large gravel)	-10
10-15'	19"						
		15'	136.3		15	same as above but wet, NAPL, odor, max clast 5.5"	-15
15-20'	19"	17.5'	5,050				
		20'	3,900		20	same as above, 70% gravel, 30% sand for 29", 3" fine to coarse gravelly sand, brown, 60% sand, 40% gravel, then clay, CH, brown-gray, high plasticity, fine sand stringers, thinkly bedded to varved, no odor, moist to wet, medium stiff	-20
20-25'	36"	22.5'	4,030				
		25'	763		25		-25

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Notes

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N = Native Rec (ft)
S = Slough Rec (ft)

Groundwater		
Date	Time	Depth (ft.)

Boring Log

Boring #: LEV-4A
Sheet 2 of 2

Sample: Depth Range (ft.)	Sample: Recovery	Sample: Depth (ft.)	Sample: NWTPH-Dx (mg/Kg)	Graphic Log	Depth (ft.)	Soil and Rock Description (Classification Scheme: USCS/ASTM)	Elevation (ft-msl)
						Sandy gravel, GP, sand fine to coarse, gravel to 3", 60% gravel, 40% sand, then clay, CL-CH, very soft, wet, blue gray-tan-tan, soupy, no odor.	-26
							-27
		27.5'	21.7				-28
							-29
25-35'		30'	BDL		30		-30
							-31
							-32
	19"	32.5'	85.2				-33
							-34
		35'	23.7		35		-35

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S = Slough Rec (ft)

Groundwater: Date	Time	Depth (ft.)

Boring Log

RETEC

Boring #: LEV-5C

Project: **BNSF Skykomish**	Operator: **Justin Aakaret**	Location: **Skykomish, WA**
Project #: **BN050-16423-522**	Drill Rig Type: **Mini-Sonic**	Northing: Easting:
Client: **BNSF**	Method: **Sonic Drilling**	Ground Elevation:
Contractor: **Holt Drilling/Boart Longyear**	Casing ID: **6 inch**	Total Depth: **35'**
Start Date & Time: **12/21/05 1330**	Bit Type: **Tungsten Carbide**	Seal: **Hole Plug**
Finish Date & Time **12/21/05 1615**	Boring ID: **4 inch**	Logged By: **Stephen Howard**

Sample				Graphic Log	Depth (ft.)	Soil and Rock Description Classification Scheme: **USCS/ASTM**	Elevation (ft-msl)
Depth Range (ft.)	Recovery	Depth (ft.)	NWTPH-Dx (mg/Kg)				
0-5'					0	Gravelly sand (SW), brown, moist, no odor or visual contamination, 45% gravel, angular to sub-angular to 1.5 inch clast; 45% sand, fine to coarse, angular to sub-angular; 10% silt. Cobbles at surface 1'	0
5-10'					5	Poor recovery, hit boulder. Recovered sample as above. One cobble present.	-5
10-15'		10'	BDL		10	As above, moist, brown, no odor or visual contamination, root fragments	-10
						Black stained sandy gravel (GW). 75% gravel, sub rounded to rounded, fine to coarse; 25%sand, medium to coarse, angular to sub-angular, strong odor, NAPL staining throughout	-13
15-20'		15'	33,500		15	Water Table at 17'. Gravel, medium to coarse, gray, sub-angular - rounded, some NAPL staining	-15
		17.5'	8,530			As above with trace sand. 20% brown silt (slurry)	-17
						NAPL saturated material; Gravelly sand (SW). 25% gravel, angular to rounded, fine to coarse, equant to elongate; 70% sand, coarse, angular; 5% silt	-18
20-25'		20'	18,030		20	As above. NAPL spotting	-21
		22.5'	242			Cobbly gravel, GW, gray, moderate odor. 15% cobble, 75% gravel, fine to coarse; 10% sand, trace silt. Becoming more sandy toward base. 10% silt, 65% sand, 25% gravel	-22
		25'	BDL		25	Brown sand, SW, gravelly, slightly silty, no odor or visual contamination.	-25

Remarks and Datum Used:	Notes	Groundwater		
		Date	Time	Depth (ft.)
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Boring Log

Sample: Depth Range (ft.)	Sample: Recovery	Sample: Depth (ft.)	Sample: NWTPH-Dx (mg/Kg)	Graphic Log	Depth (ft.)	Soil and Rock Description (Classification Scheme: USCS/ASTM)	Elevation (ft-msl)
						Gravel, fine to coarse, sub rounded to rounded. 80% sand, fine; 2% silt.	-26
25-30'		27.5'	BDL			Gray hard dry friable/brittle sandy gravel, SW. Appearance of weathered diorite. Slight odor. No visual contamination. Hard coarse gravel clasts present. 50% gravel, 30% sand, 20% silt. Dense.	-27, -28
		30'	BDL		30	Brown, wet, gravelly sand. 10% gravel, sub rounded, med (1-inch); 89%sand, med; 1%silt. One cobble present. Occasionally more silty (10%). No odor or visual contamination.	-29, -30, -31
30-35'		32.5'	BDL			As above. Slight odor.	-32
						Clay, slightly silty, gray to orange/brown, firm	-33
		35'	BDL		35	Silt, slightly clayey, brown, no odor or visual contamination	-34, -35
						As above becoming sandy w/ fine sand. Very slight odor	

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S = Slough Rec (ft)

Groundwater: Date	Time	Depth (ft.)

Boring Log

Boring #: LEV-6A
Sheet 1 of 2

Project: **BNSF Skykomish**	Operator: **Justin Aakaret**	Location: **Skykomish, WA**
Project #: **BN050-16423-522**	Drill Rig Type: **Mini-Sonic**	Northing: Easting:
Client: **BNSF**	Method: **Sonic Drilling**	Ground Elevation:
Contractor: **Holt Drilling/Boart Longyear**	Casing ID: **6 inch**	Total Depth: **45'**
Start Date & Time: **12/21/05 845**	Bit Type: **Tungsten Carbide**	Seal: **Hole Plug**
Finish Date & Time **12/21/05 1230**	Boring ID: **4 inch**	Logged By: **Stephen Howard**

Sample: Depth Range (ft.)	Recovery	Depth (ft.)	NWTPH-Dx (mg/Kg)	Depth (ft.)	Soil and Rock Description (Classification Scheme: **USCS/ASTM**)	Elevation (ft-msl)
0-5'				0	Sandy gravel, GW, moist, brown, abundant plant matter at top, no odor or visual contamination. 5% cobble, 50% gravel, fine to coarse, subangular to rounded; 40% sand, 5% fines	0
5-10'				5	As above. Finer, more woody debris, no odor or visual contamination, , 25% gravel, fine to coarse, angular to sub-rounded; 65% sand, angular - subrounded; 10% silt, occasional cobble	-5
10-15'		10'	BDL	10	Silty, gravelly sand (SW), brown, moist, no odor or visual contamination, 5% cobbles to 15 cm, 20% sand, sub-angular to sub-rounded; 55% sand, very fine to fine; 20% silty, trace wood debris. At base is a woody horizon ~1 inch - 100% wood.	-10
		15'	109.3	15	Gray, gravelly sand (SW), no odor or visual contamination, abundant wood fragments in upper foot (~20%), little wood below. Some bodies of organic-rich brown, soft silty, otherwise, 70% sand, fine to coarse; 25% gravel, angular to sub-rounded, 1-inch diameter. Silt gray. Abundant carbonaceous black specks.	-15
15-20'		17.5'	BDL		Gravelly sand, SW, Gray, wet, no odor or visual contamination. 10% cobbles to 15 cm, 10% gravel, fine to medium, sub-angular to sub-rounded; 78% sand, medium to coarse; 2% silt	
		20'	BDL	20	Sand, SP, 100%, fine to medium, angular to sub-rounded, brown, no odor or visual contamination, wet	-20
					Silt, medium soft, low plasticity, upper 8" oxidized orange/brown layers. Brown below. No clay. 100%silt. No odor or visual contamination	
20-25'		22.5'	BDL		As above w/ trace fine micaceous sand.	
		25'	BDL	25	Sand, gravelly, brown-bray, no odor or visual contamination, sub-rounded to rounded, gravel, angular to sub-angular sand. 20% gravel, 80% sand,	-25

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Notes
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S = Slough Rec (ft)

Groundwater		
Date	Time	Depth (ft.)

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Boring Log

Boring #: LEV-6A
Sheet 2 of 2

Sample Depth Range (ft.)	Recovery	Depth (ft.)	NWTPH-Dx (mg/Kg)	Depth (ft.)	Soil and Rock Description (Classification Scheme: USCS/ASTM)	Elevation (ft-msl)
					no fines	-26
25-30'		27.5'	BDL		Brown, very fine micaceous sand, 100% wet, soft, almost fine enough to be a silt. No odor or visual contamination	-27, -28
					Silt, brown, soft, low plasticity, 100% silt, no odor or visual contamination	-29
		30'	BDL	30	Silty, soft to firm, gray to brown/orange, no odor or visual contamination	-30, -31
30-35'		32.5'	BDL		Silt, sandy, brown, soft, no odor or visual contamination, ~60% sand, low plasticity	-32
					Gravel, sandy, GW, brown, moist, 85% gravel fine to coarse, sub-angular to sub-rounded, 10% sand, 5% silt, no odor or visual contamination	-33, -34
		35'	BDL	35	50% recovery. Brown, moist, no odor or visual contamination. Gravelly sandy silt. 15% cobbles, 10% gravel rounded to subrounded; 50-60% sand, fine to coarse; 15-25% silt.	-35, -36, -37
35-40'		37.5'	BDL			-38, -39
		40'	BDL	40		-40, -41
4045'		42.5'	BDL		Cobble zone, no odor or visual contamination. Rounded cobbles ~10cm diameter. Highly weathered, granitic, breaks easilty in the hand mainly. Approximately 30% of cobbles are hard	-42, -43
			BDL	45		-44, -45

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Groundwater		
Date	Time	Depth (ft.)

Boring Log	Boring #: LEV-7A Sheet 1 of 2

Project: BNSF Skykomish	Operator: Justin Aakaret	Location: Skykomish, WA
Project #: BN050-16423-522	Drill Rig Type: Mini-Sonic	Northing: Easting:
Client: BNSF	Method: Sonic Drilling	Ground Elevation:
Contractor: Holt Drilling/Boart Longyear	Casing ID: 6 Inch	Total Depth: 35'
Start Date & Time: 12/20/05 1320	Bit Type: Tungsten Carbide	Seal: Hole Plug
Finish Date & Time 12/20/05 1505	Boring ID: 4 Inch	Logged By: Cliff Baines

Sample: Depth Range (ft.)	Sample: Recovery	Sample: Depth (ft.)	Sample: NWTPH-Dx (mg/Kg)	Graphic Log	Depth (ft.)	Soil and Rock Description Classification Scheme: USCS/ASTM	Elevation (ft-msl)
0-5'					0	Same as 8B but approximately 5 to 10% fines	0 to -5
5-10'					5	Same as 8B except no wood fragments or black staining, possibly increased moisture at bottom. Poor recovery caused by 4" spherical gravel	-5 to -10
10-15'		10'	3,233		10	Broken gravel, wood fragments and a jagged piece of metal, then clayey/silty sandy gravel, GM - GC, 40% gravel, 30% sand, 30% fines. Sand medium gray, gravel to 20 mm, Non plastic to low plasticity, soft, moist to wet, no odor or visual contamination	-10 to -15
15-20'		15' 17.5'	4,570 3,210		15	Probably same as above, mixture of clay, gravel, sand, GC to CH, 19" thick, variable % clay throughout, some portions organic rich, almost OH, NAPL and ordor present, gravel to 4" med dark gray, clay very soft, Low to high plasticity, sharp contact w/ fine sand, SP, grayish red, moist to wet, medium density, no odor. no NAPL, micaceous, massive. NAPL ends at sand.	-15 to -20
20-25'		20' 22.5' 25'	BDL 17.4 BDL		20 25	Same sand as above	-20 to -25

Remarks and Datum Used:	Notes	Groundwater: Date	Time	Depth (ft.)
	T = Total Rec (ft)			
	N = Native Rec (ft)			
	S = Slough Rec (ft)			

The RETEC Group, Inc.
1011 SW Klickitat Way, Suite 207
Seattle, WA 98134-1162
Phone: (206) 624-9349
Fax: (206) 624-2839

RETEC

Boring Log

Sample Depth Range (ft.)	Sample Recovery	Sample Depth (ft.)	Sample NWTPH-Dx (mg/Kg)	Graphic Log	Depth (ft.)	Soil and Rock Description (Classification Scheme: USCS/ASTM)	Elevation (ft-msl)
25-30'		27.5'	BDL			17" of clay, CL, medium gray, low plasticity, no odor, wet, soft, grades to very soft and pale red, last 6" is silty to clayey fine sand, SC - SM, 80% sand, 20% fines, LP - NP, pale red, loose.	-26 -27 -28 -29
		30'	259		30	~3"sand, clay, gravel mixture, then ~ 3" clay, CL, pale red, soft, then ~ 3" sand as at LEV8B near 20 ', then ~ 20" clay, CL, variagated coloring in bedding up to 1/2 " thick, gray to reddish (brownish), low plasticity, no odor, wet, soft, grades gray and stratified with partings and seams last 7", then silty fine sand, SM, wet, (wetter), strong FeO staining, ~3" thick, then clayey sand last 3", CL, low plasticity, soft, wet, pale red.	-30 -31 -32 -33 -34
30-35'		32.5'	BDL				
		35'	BDL		35		-35

Remarks and Datum Used:

The RETEC Group, Inc.
1011 SW Klickitat Way, Suite 207
Seattle, WA 98134-1162
Phone: (206) 624-9349
Fax: (206) 624-2839

Notes

T = Total Rec (ft)
N = Native Rec (ft)
S = Slough Rec (ft)

Groundwater		
Date	Time	Depth (ft.)

Boring Log

RETEC

Boring #: LEV-8A
Sheet 1 of 2

Project: **BNSF Skykomish**	Operator: **Justin Aekaret**	Location: **Skykomish, WA**
Project #: **BN050-16423-522**	Drill Rig Type: **Mini-Sonic**	Northing: Easting:
Client: **BNSF**	Method: **Sonic Drilling**	Ground Elevation:
Contractor: **Holt Drilling/Boart Longyear**	Casing ID: **6 inch**	Total Depth: **35'**
Start Date & Time: **12/19/05 1515**	Bit Type: **Tungsten Carbide**	Seal: **Hole Plug**
Finish Date & Time: **12/19/05 1600**	Boring ID: **4 inch**	Logged By: **Stephen Howard**

Sample: Depth Range (ft.)	Recovery	Depth (ft.)	NWTPH-Dx (mg/Kg)	Depth (ft.)	Soil and Rock Description (Classification Scheme: **USCS/ASTM**)
0-5'				0–5	SW, Brown moist, no odor or visual contamination: 0 - 3.5 ft, 20% gravel, fine to coarse; 75% sand, fine to coarse, 5%silt. 3.5 - 5ft as above with finer gravel; 15% gravel fine to medium; 80% sand, fine to coarse, 5% silt
5-10'				5–7	GW, 60% gravel, fine to coarse, ~38% sand, fine to coarse, 2% silt
				7–9	As above with 30% gravel, 65% sand, 5% silt. Brown, moist, no odor or visual sign of contamination
				9–10	Peat layer, dark brown, no odor
		10'	155.6	10–11	Sand, SP, 100%, fine, no odor or visual contamination
10-15'				11–13	Moist, brown, no odor or visual contamination, 20% gravel, fine to coarse; 70% sand, 10% silt
				13–15	Dry, pale, broken rock. 5% cobbles, 15% gravel, 65% sand, 15% silt. No odor or visual contamination
		15'	2,740	15–19	40% gravel, 50% sand, 10% silt, moist, no odor or visual contamination above 17'. Odor 17 - 19 ft.
15-20'		17.5'	5,800		
				19–20	Water table at 20 ft. Lithology as above. Strong odor to 20'
		20'	11.9	20–25	50% recovery. 50% sand, coarse, 50% gravel, fine, some NAPL, strong odor. Boulder reported by driller at 25'
20-25'		22.5'	BDL		
		25'	BDL		

Elevation (ft-msl): 0, -1, -2, -3, -4, -5, -6, -7, -8, -9, -10, -11, -12, -13, -14, -15, -16, -17, -18, -19, -20, -21, -22, -23, -24, -25

Remarks and Datum Used:

The RETEC Group, Inc.
1011 SW Klickitat Way, Suite 207
Seattle, WA 98134-1162
Phone: (206) 624-9349
Fax: (206) 624-2839

Notes
T = Total Rec (ft)
N = Native Rec (ft)
S = Slough Rec (ft)

Groundwater: Date	Time	Depth (ft.)

Boring Log

RETEC

Boring #: LEV-8A

Sample: Depth Range (ft.)	Recovery	Depth (ft.)	NWTPH-Dx (mg/Kg)	Graphic Log	Depth (ft.)	Soil and Rock Description (Classification Scheme: **USCS/ASTM**)	Elevation (ft-msl)
							-26
							-27
25-30'		27.5'	12.9				-28
							-29
		30'	BDL		30	Gravel, 50% fine to coarse, brown, wet, 10% cobbles, 25% sand (fine to coarse), 15% silt, no odor or visual contamination	-30
							-31
							-32
30-35'		32.5'	BDL				-33
		35'	BDL			Clay, brown, soft to firm, no odor or visual contamination, slightly sandy, silty	-34
					35		-35

Remarks and Datum Used:

The RETEC Group, Inc.
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Seattle, WA 98134-1162
Phone: (206) 624-9349
Fax: (206) 624-2839

Notes
T = Total Rec (ft)
N = Native Rec (ft)
S = Slough Rec (ft)

Groundwater: Date	Time	Depth (ft.)

Boring Log

Boring #: **LEV-8B**

Project: **BNSF Skykomish**	Operator: **Justin Askaret**	Location: **Skykomish, WA**
Project #: **BN050-16423-522**	Drill Rig Type: **Mini-Sonic**	Northing: Easting:
Client: **BNSF**	Method: **Sonic Drilling**	Ground Elevation:
Contractor: **Holt Drilling/Boart Longyear**	Casing ID: **6 inch**	Total Depth: **35'**
Start Date & Time: **12/20/05 0950**	Bit Type: **Tungsten Carbide**	Seal: **Hole Plug**
Finish Date & Time: **12/20/05 1230**	Boring ID: **4 inch**	Logged By: **Cliff Baines**

Soil and Rock Description — Classification Scheme: **USCS/ASTM**

Sample Depth Range (ft.)	Recovery	Sample Depth (ft.)	NWTPH-Dx (mg/Kg)	Graphic Log	Depth (ft.)	Soil and Rock Description	Elevation (ft-msl)
					0		0
0-5'					1-5	Gravelly sand, SW, 60% sand, 40% gravel, trace fines, sand is fine to coarse, gravel to 4", subangular to subrounded, pale yellowish brown, loose, moist, no odor, some roots & grass	-1 to -5
5-10'					5-7.5	Grades to 20% gravel, 20% silt, light olive gray, max clast 5", loose - very loose	-5 to -7
					7.5-10	hard drilling, driller says boulder. Core has gravel and gravel fragments, then as 5-8 except higher moisture content, black organic staining, wood fragments, possible odor, fines, slightly more plastic	-8 to -10
10-15'		10'	BDL		10-15	Gravelly sand, SW, as at 1-5', sharp contact with sand (SP), trace fines, fine to medium, trace coarse, loose, no odor, moist, dark yellow/orange, no gravel.	-10 to -15
15-20'		15'	102.1		15-20	6" silty sand with gravel, SM, 60% sand, 30% silt, 10% gravel, to 30mm, sand fine to coarse, fines, low plasticity to no plasticity (slightly clayey) medium gray, slight HC odor, loose, moist to wet, then 20" sandy gravel, GP, trace fines, medium gray to light gray, sand fine to coarse, 60% gravel, 40% sand, clasts to 5", loose, odor, NAPL in pores and on clast surface, wet, last 6" grades less NAPL, then gravelly sand, SW, 80% sand, 10 - 20% gravel to 50mm, med-light gray, no odor, wet, loose.	-15 to -20
		17.5'	1,745				
20-25'		20'	5,610		20-25	above sand continues for 16", frequent plagioclase grains, no odor., no staining, then grades gravelly with 30% gravel to 5" size, then 5" sand with gravel, SP, fine to medium, trace, coarse gravel to 20 mm, 90% sand, 10% gravel, increased fines, 25%, wet, no odor, loose - medium dense, then 11" gravelly sand, SW, fine to coarse, 80% sand, 20% gravel to 3". Last 6" is silty to clay, ML-CL, trace gravel to 15mm and sand, LP to NP, soft, reddish brown, with FeO staining, moist to wet, occasional organics	-20 to -25
		25'	114.6		25		-25

Remarks and Datum Used:

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Phone: (206) 624-9349
Fax: (206) 624-2839

Notes
T = Total Rec (ft)
N = Native Rec (ft)
S = Slough Rec (ft)

Groundwater Date	Time	Depth (ft.)

RETEC

Boring Log

Sample: Depth Range (ft.)	Sample: Recovery	Sample: Depth (ft.)	Sample: NWTPH-Dx (mg/Kg)	Graphic Log	Depth (ft.)	Soil and Rock Description Classification Scheme: USCS/ASTM	Elevation (ft-msl)
25-30'						~2' of gravelly sand with clay, SC, 60% sand, 30% gravel, 10% clay, wet, no odor, gray, loose, clay then increases to 30%, sand 60% gravel 19%. Clay is H.P., reddish gray, no odor, wet, clay is soft then gravelly silty, grading to silt, moderate plasticity to non-plastic, mottling colors from gray to reddish (oxide?), med stiff, moist, no odor.	-26 -27 -28 -29
		30'	18.1		30	silt as above but laminations visible, last 6" is gray, no mottling and low plasticity, could be clay but shows dilatency, moist to wet	-30 -31 -32
30-35'		32.5'	BDL				-33
		35'	65		35		-34 -35

Remarks and Datum Used:		Notes	Groundwater		
		T = Total Rec (ft)	Date	Time	Depth (ft.)
		N = Native Rec (ft)			
		S = Slough Rec (ft)			

The RETEC Group, Inc.
1011 SW Klickitat Way, Suite 207
Seattle, WA 98134-1162
Phone: (206) 624-9349
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Appendix B

Surveyors Report

BUSH, ROED & HITCHINGS, INC.

Civil Engineers and Land Surveyors

October 4, 2005

Mr. Steve Howard
Retec Corporation
1011 SW Klickitat Way, Suite 207
Seattle, WA 98134-1162

Re: BRH Job No. 95280.11
Skykomish
New Boreholes surveyed on September 10, 2005

Borehole	**Northing**	**Easting**	**Elevation**
riv-1	259614.3	1510457.8	917.4
riv-2	259604.1	1510399.5	917.2
riv-18	259599.8	1510367.3	917.3
riv-19	259618.8	1510393.2	916.9
riv-3	259580.4	1510382.4	917.4
riv-4	259565.9	1510332.0	917.3
riv-6	259545.0	1510275.3	916.6
riv-5	259549.6	1510313.1	917.0
riv-7	259544.5	1510240.5	916.5
riv-8	259530.3	1510205.6	916.6
riv-9	259514.7	1510175.7	916.7
riv-11	259491.7	1510122.3	916.2
riv-10	259470.4	1510154.1	916.6
riv-12	259479.0	1510086.8	916.6
riv-16	259463.4	1510037.4	916.3
riv-13	259439.1	1510007.4	916.1
riv-14	259429.3	1509971.7	916.3
riv-15	259400.6	1509916.4	916.3
riv-17	259374.1	1509877.9	915.5

2009 Minor Avenue East, Seattle, Washington 98102-3513 - Phone 206/323-4144; Fax 206/323-7135
1-800-935-0508 Internet: brhinc.com

Borehole	**Northing**	**Easting**	**Elevation**
riv-20	259627.9	1510515.8	918.0
lev-9	259543.6	1510475.0	932.5
lev-8	259524.2	1510387.2	931.8
lev-7	259481.0	1510283.1	931.4
lev-6	259443.2	1510196.8	930.3
lev-5	259417.8	1510143.1	930.8
lev-4	259400.9	1510107.2	930.5
lev-3	259373.4	1510056.6	930.3
lev-2	259351.7	1510003.5	930.0
lev-5B	259421.3	1510146.4	930.8
lev-1	259299.1	1509905.0	925.7
5-b-12	259182.3	1510235.9	925.7
5-b-9	259242.0	1510226.7	925.5
5-b-7	259307.2	1510204.2	925.5
5-b-8	259300.5	1510145.7	925.1
5-b-11	259221.4	1510120.4	925.0

Sincerely,

BUSH, ROED & HITCHINGS, INC.

Johann G. Wassermann, P.L.S.
Project Manager

JGW/ekk

Appendix C

PetroFLAG Field Sheets

PetroFLAG®

Hydrocarbon Test Kit - Field Data Sheet

Date: 9/11/2005 Calibration Time/Date: ______________
Operator: Elly Leaverton Calibration Temperature: ______________
Location: Skykomish

copied from field book

No.	Sample ID	Weight	Time/Date	Reading (ppm)	DF[1]	RF[2]	Actual (ppm)	Comments
1	5-B12-6-10	1g		1189	10		11,890	
2	13	1g		283	10		2,830	
3	15	10g		17	1.0		17	
4	15-20	1g		58	10		580	
5	20-25	1g		349	10		3,490	
6	25-30	1g		94	10		940	
7	30-33	1g		126	10		1,260	
8	34-35	10g		Ø	1.0		Ø	
9	5-B11-5-10	10g		49	1.0		49	
10	10-15	10g		85	1.0		85	
11	15-20	10g		269	1.0		269	
12	20-25	10g		57	1.0		57	
13	25-27	10g		Ø	1.0		Ø	
14	27-30	10g		Ø	1.0		Ø	
15	LEVS 32-35	10g		119	1.0		119	
16	29-30	1g		701	10.0		7,010	
17	35-40	1g		327	10.0		3,270	
18	55-60	10g		126	1.0		126	
19	50-55	10g		130	1.0		130	
20	42	5g		106	2.0		212	
	45	10g		409	1.0		409	

[1]DF = Dilution Factor, e.g., for 5 gram soil sample DF=10g/5g=2, and actual concentration equals reading times DF (reading (ppm) x DF = actual concentration).

[2]RF = Response Factor, selected for the hydrocarbon contamination at the site.

PetroFLAG®

Hydrocarbon Test Kit - Field Data Sheet

Date: 9-12-05
Calibration Time/Date: 8:20am / 9-12-05
Operator: Elly Leaverton
Calibration Temperature: ______
Location: Skykomish

No.	Sample ID	Weight	Time/Date	Reading (ppm)	DF[1]	RF[2]	Actual (ppm)	Comments
1	LEV-4-39-40	10g	9:47	0	1.0		0	
2	LEV4-40-45	10g	9:48	3	1.0		3	
3	LEV4-45-50	10g	9:49	8	1.0		8	
4	LEV4-25-30	1g	10:03	1100	10.0		11,000	
5	LEV4-30-35	10g	10:04	EEEE	1.0		—	
6	LEV4-35-39	1g	10:05	165	10.0		1,650	
7	LEV4-15	5g	10:18	EEEE	2.0		—	
8	LEV4-15	1g	10:30	EEEE	10.0		—	
9	LEV4-30 35	1g	10:31	764	10.0		7,640	
10	RIV 0-1	1g	14:19	570	10.0		5,700	
11	RIV ~~8~~ ~~[illegible]~~10	10g	14:20	18	1.0		18	
12	RIV3 0-5	1g	16:20	175	10.0		1,750	
13	RIV3 5-10	1g	16:21	488	10.0		4,880	
14	RIV3 15	10g	16 22	44	1.0		44	
15	RIV4 0-4	10g	19:26	201	1.0		201	
16	RIV4 4-10	10g	19:27	143	1.0		143	
17	RIV4 10-15	10g	19:28	144	1.0		144	
18	RIV4 15-16	10g	19:30	139	1.0		139	
19	RIV4 18-20	10g	1931	0	1.0		0	
20	RIV4 20-23	10g	1932	0	1.0		0	

[1]DF = Dilution Factor, e.g., for 5 gram soil sample DF=10g/5g=2, and actual concentration equals reading times DF (reading (ppm) x DF = actual concentration).

[2]RF = Response Factor, selected for the hydrocarbon contamination at the site.

PetroFLAG®

Hydrocarbon Test Kit - Field Data Sheet

Date: 9-13-05
Operator: Elly Leaverton
Location: Skykomish

Calibration Time/Date: 8:30 / 9/13/05
Calibration Temperature: ______________

No.	Sample ID	Weight	Time/Date	Reading (ppm)	DF[1]	RF[2]	Actual (ppm)	Comments
1	RIV5 0-3	10g	1327	6	1.0		6	
2	RIV5 3-5	5g	1329 ek	45	2.0		90	
3	RIV5 5-10	10g	1330	182	1.0		182	
4	RIV5 13-14	10g	1331	42	1.0		42	
5	RIV5 14-15	10g	1332	15	1.0		15	
6	RIV10 10-12	10g	14:40	17	1.0		17	
7	RIV10 12-14	10g	14:41	35	1.0		35	
8	RIV10 15-20	10g	14:42	17	1.0		17	
9	RIV10 20-21	10g	14:43	33	1.0		33	
10	RIV10 21-25	10g	14:44	16	1.0		16	
11	RIV8 0-2	10g	14:45	31	1.0		31	
12	RIV8 4-6	10g	14:46	12	1.0		12	
13	RIV8 15	10g	14:47	95	1.0		95	
14	RIV6 0-3	10g	15:13	32	1.0		32	
15	RIV6 3-5	10g	15:14	21	1.0		21	
16	RIV7 0-5	10g	15:15	155	1.0		155	
17	RIV7 5-10	10g	15:16	10	1.0		10	
18	RIV7 10-13	10g	15:17	72	1.0		72	
19	RIV7 13-15	10g	15:42	48	1.0		48	
20								

[1]DF = Dilution Factor, e.g., for 5 gram soil sample DF=10g/5g=2, and actual concentration equals reading times DF (reading (ppm) x DF = actual concentration).

[2]RF = Response Factor, selected for the hydrocarbon contamination at the site.

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Hydrocarbon Test Kit - Field Data Sheet

Date: 9-13-05
Calibration Time/Date: 8:30 9-13-05
Operator: Elly Leaverton
Calibration Temperature: ____________
Location: Skykomish

No.	Sample ID	Weight	Time/Date	Reading (ppm)	DF[1]	RF[2]	Actual (ppm)	Comments
x 1	RIV9 0-5	10g	1519	0	1.0		0	
2	RIV9 5-10	10g	1520	38	1.0		38	
3	RIV9 12-15	10g	1521	18	1.0		18	
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								

[1]DF = Dilution Factor, e.g., for 5 gram soil sample DF=10g/5g=2, and actual concentration equals reading times DF (reading (ppm) x DF = actual concentration).

[2]RF = Response Factor, selected for the hydrocarbon contamination at the site.

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Hydrocarbon Test Kit - Field Data Sheet

Date: 9-14-2005

Operator: Elly Leaverton

Location: Skykomish

Calibration Time/Date: 13:21 9-14-05 (soil blank)

Calibration Temperature: __________

No.	Sample ID	Weight	Time/Date	Reading (ppm)	DF[1]	RF[2]	Actual (ppm)	Comments
1	RIV14-1	10g	1618	109	1.0		109	
2	RIV14-9	10g	1619	7	1.0		7	
3	RIV14-15	10g	1620	6	1.0		6	
4	RIV18-1	10g	1647	13	1.0		13	
5	RIV18-10	10g	1648	9	1.0		9	
6	RIV18-15	10g	1700	61	1.0		61	
7	RIV13-3	10g	1638	4	1.0		4	
8	RIV13-15	10g	1639	1	1.0		1	
9	RIV19-1	10g	1718	27	1.0		27	
10	RIV19-11	10g	1721	66	1.0		66	
11	RIV19-15	10g	1722	35	1.0		35	
12	RIV20-1	10g	1742	79	1.0		79	
13	RIV20-8	10g	1743	5	1.0		5	
14	RIV20-15	10g	1744	0	1.0		0	
15								
16								
17								
18								
19								
20								

[1] DF = Dilution Factor, e.g., for 5 gram soil sample DF=10g/5g=2, and actual concentration equals reading times DF (reading (ppm) x DF = actual concentration).

[2] RF = Response Factor, selected for the hydrocarbon contamination at the site.

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Hydrocarbon Test Kit - Field Data Sheet

Date: 9-14-2005
Operator: Elly Leaverton
Location: Skykomish

Calibration Time/Date: soil blank 13:21 9-14-05
Calibration Temperature: ______

No.	Sample ID	Weight	Time/Date	Reading (ppm)	DF[1]	RF[2]	Actual (ppm)	Comments
1	RIV15-1	10g	1355	219	1.0		219	
2	RIV15-6	10g	1356	9	1.0		9	
3	RIV15-8	10g	1357	0	1.0		0	
4	RIV15-15	10g	1358	86	1.0		86	
5	RIV17-1	10g	1417	7	1.0		7	
6	RIV17-7	10g	1418	26	1.0		26	
7	RIV17-15	10g	1419	5	1.0		5	
8	RIV16-1	10g	1448	50	1.0		50	
9	RIV16-9	10g	1449	30	1.0		30	
10	RIV16-15	10g	1450	12	1.0		12	
11	RIV11 5-10	10g	1523	3	1.0		3	
12	RIV11 10-13	10g	1524	75	1.0		75	
13	RIV11 13-15	10g	1525	29	1.0		29	
14	RIV12-5	10g	1356	10	1.0		10	
15	RIV12-10	10g	1357	585	1.0		585	
16	RIV12-14	10g	1358	19	1.0		19	
17	RIV12-16	10g	1359	0	1.0		0	
18	RIV12-25	10g	1400	9	1.0		9	
19								
20								

[1]DF = Dilution Factor, e.g., for 5 gram soil sample DF=10g/5g=2, and actual concentration equals reading times DF (reading (ppm) x DF = actual concentration).

[2]RF = Response Factor, selected for the hydrocarbon contamination at the site.

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Hydrocarbon Test Kit - Field Data Sheet

Date: 9-14-2005
Operator: Elly Leaverton
Location: Skykomish

Reagent Calibration Time/Date: 1819 9-14
Calibration Temperature:

No.	Sample ID	Weight	Time/Date	Reading (ppm)	DF[1]	RF[2]	Actual (ppm)	Comments
1	LEV6-5	10g	1841	7	1.0		7	
2	LEV6-28	10g	1842	0	1.0		0	
3	LEV6-30	10g	1843	25	1.0		25	
4	LEV6-33	1g	1844	919	10.0		9,190	
5	LEV6-43	10g	1845	12	1.0		12	
6	LEV6-47	10g	1846	57	1.0		57	
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								

[1]DF = Dilution Factor, e.g., for 5 gram soil sample DF=10g/5g=2, and actual concentration equals reading times DF (reading (ppm) x DF = actual concentration).

[2]RF = Response Factor, selected for the hydrocarbon contamination at the site.

PetroFLAG®

Hydrocarbon Test Kit - Field Data Sheet

Date: 9-15-05
Calibration Time/Date: 9:46 / 9-15-05
Operator: Elly Leaverton
Calibration Temperature: 22.2°C
Location: Skykomish

No.	Sample ID	Weight	Time/Date	Reading (ppm)	DF[1]	RF[2]	Actual (ppm)	Comments
1	LEV7-7	10g	9:58	27	1.0		27	
2	LEV7-23	10g	9:59	106	1.0		106	
3	LEV7-33	10g	10:00	52	1.0		52	
4	LEV7-38	10g	10:01	50	1.0		50	
5	LEV7-45	10g	10:47	48	1.0		48	
6	LEV7-47	10g	10:48	29	1.0		29	
7	LEV7-50	10g	10:49	16	1.0		16	
8	LEV8-10	10g	14:51	EEEE	1.0		—	
9	LEV8-12	10g	14:52	47	1.0		47	
10	LEV8-16	1g	14:53	EEEE	10.0		—	
11	LEV8-25	1g	14:54	1,445	10.0		14,450	
12	LEV8-35	1g	14:55	316	10.0		3,160	
13	LEV8-10	1g	15:15	2,132	10.0		21,320	
14	LEV8-43	10g	15:44	77	1.0		77	
15	LEV8-50	10g	15:45	80	1.0		80	
16	LEV9-14	10g	19:04	26	1.0		26	
17	LEV9-23	10g	19:05	1168	1.0		1,168	
18	LEV9-25	10g	19:06	61	1.0		61	
19	LEV9-33	10g	19:07	269	1.0		269	
20	LEV9-41	10g	19:22	342	1.0		342	

[1]DF = Dilution Factor, e.g., for 5 gram soil sample DF=10g/5g=2, and actual concentration equals reading times DF (reading (ppm) x DF = actual concentration).

[2]RF = Response Factor, selected for the hydrocarbon contamination at the site.

PetroFLAG®

Hydrocarbon Test Kit - Field Data Sheet

Date: 9-15-05
Operator: Elly Leaverton
Location: Skykomish

Calibration Time/Date: 9:46 / 9-15-05
Calibration Temperature: 22.2°C

No.	Sample ID	Weight	Time/Date	Reading (ppm)	DF[1]	RF[2]	Actual (ppm)	Comments
1	LEV9-46	10g	1924	465	1.0		465	
2	LEV9-50	10g	1925	24	1.0		24	
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								

[1]DF = Dilution Factor, e.g., for 5 gram soil sample DF=10g/5g=2, and actual concentration equals reading times DF (reading (ppm) x DF = actual concentration).

[2]RF = Response Factor, selected for the hydrocarbon contamination at the site.

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Hydrocarbon Test Kit - Field Data Sheet

Date: 9-16-2005
Operator: Elly Leaverton
Location: Skykomish

Calibration Time/Date: 0820 / 9-16-2005
Calibration Temperature: 17.9 °C

No.	Sample ID	Weight	Time/Date	Reading (ppm)	DF[1]	RF[2]	Actual (ppm)	Comments
1	LEV5B-15	10g	9:59	EEEE	1.0		—	
2	LEV5B-20	1g	10:00	EEEE	10.0		—	
3	LEV5B-25	1g	10:01	305	10.0		3,050	
4	LEV5B-30	10g	10:02	150	1.0		150	
5	LEV5B-33	10g	10:03	0	1.0		0	
6	LEV5B-38	10g	10:04	702	1.0		702	
7	LEV5B-43	1g	10:05	673	10.0		6,730	
8 el	LEV5B-~~52~~46	10g	10:06	1	1.0		1	
9	LEV5B-55	10g	10:07	0	1.0		0	
10	LEV5B-15	1g	10:18	EEEE	10.0		—	
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								

[1]DF = Dilution Factor, e.g., for 5 gram soil sample DF=10g/5g=2, and actual concentration equals reading times DF (reading (ppm) x DF = actual concentration).

[2]RF = Response Factor, selected for the hydrocarbon contamination at the site.

Appendix D

Laboratory Analytical Data

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02 October 2005

Stephen Howard
The RETEC Group, Inc.
1011 SW Klickitat Way, Suite 207
Seattle, WA 98134

RE: BNSF-Skykomish-1

Enclosed are the results of analyses for samples received by the laboratory on 09/16/05 12:55. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Kortland Orr For Kate Haney
Project Manager

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The RETEC Group, Inc.	Project: BNSF-Skykomish-1	
1011 SW Klickitat Way, Suite 207	Project Number: BN050-16423-522	**Reported:**
Seattle, WA 98134	Project Manager: Stephen Howard	10/02/05 15:29

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
LEV-2-19'	B5I0376-01	Soil	09/09/05 11:18	09/16/05 12:55
LEV-1-18'-19'	B5I0376-02	Soil	09/09/05 15:15	09/16/05 12:55
LEV-3-21'-25'	B5I0376-03	Soil	09/09/05 19:30	09/16/05 12:55
5-B-9-22'	B5I0376-04	Soil	09/10/05 10:50	09/16/05 12:55
5-B-7-20'-25'	B5I0376-05	Soil	09/10/05 13:00	09/16/05 12:55
5-B-8-15'-20'	B5I0376-06	Soil	09/10/05 19:45	09/16/05 12:55
5-B-12-30'-33'	B5I0376-07	Soil	09/11/05 11:40	09/16/05 12:55
5-B-11-15'-20'	B5I0376-08	Soil	09/11/05 13:41	09/16/05 12:55
LEV 5-35'-40'	B5I0376-09	Soil	09/11/05 18:55	09/16/05 12:55
LEV 4-35'-39'	B5I0376-10	Soil	09/12/05 10:35	09/16/05 12:55
RIV 2-0'-1'	B5I0376-11	Soil	09/12/05 14:40	09/16/05 12:55
RIV 3-5'-10'	B5I0376-12	Soil	09/12/05 16:30	09/16/05 12:55
RIV 4-15'-18'	B5I0376-13	Soil	09/12/05 19:45	09/16/05 12:55
RIV-12-3'	B5I0376-14	Soil	09/13/05 16:50	09/16/05 12:55
RIV-12-14'	B5I0376-15	Soil	09/13/05 16:50	09/16/05 12:55
RIV-17-3'	B5I0376-16	Soil	09/14/05 12:15	09/16/05 12:55
RIV-17-13'	B5I0376-17	Soil	09/14/05 12:20	09/16/05 12:55
RIV-5-0'-3'	B5I0376-18	Soil	09/14/05 16:20	09/16/05 12:55
RIV-6-0'-3'	B5I0376-19	Soil	09/14/05 16:25	09/16/05 12:55
RIV-7-0'-5'	B5I0376-20	Soil	09/14/05 16:30	09/16/05 12:55
RIV-8-0'-2'	B5I0376-21	Soil	09/14/05 16:35	09/16/05 12:55
RIV-20-3'	B5I0376-22	Soil	09/14/05 16:35	09/16/05 12:55
RIV-9-0'-5'	B5I0376-23	Soil	09/14/05 16:40	09/16/05 12:55
RIV-10-10'-12'	B5I0376-24	Soil	09/14/05 16:45	09/16/05 12:55
RIV-20-13'	B5I0376-25	Soil	09/14/05 16:45	09/16/05 12:55
RIV-11-5'-10'	B5I0376-26	Soil	09/14/05 18:50	09/16/05 12:55
RIV-12-0'-5'	B5I0376-27	Soil	09/14/05 18:55	09/16/05 12:55
LEV-6-47'	B5I0376-28	Soil	09/14/05 19:00	09/16/05 12:55
RIV-13-3'	B5I0376-29	Soil	09/14/05 20:00	09/16/05 12:55

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The RETEC Group, Inc.	Project:	BNSF-Skykomish-1	
1011 SW Klickitat Way, Suite 207	Project Number:	BN050-16423-522	**Reported:**
Seattle, WA 98134	Project Manager:	Stephen Howard	10/02/05 15:29

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
RIV-14-1'	B5I0376-30	Soil	09/14/05 20:05	09/16/05 12:55
RIV-15-1'	B5I0376-31	Soil	09/14/05 20:10	09/16/05 12:55
RIV-16-1'	B5I0376-32	Soil	09/14/05 20:15	09/16/05 12:55
RIV-17-1'	B5I0376-33	Soil	09/14/05 20:20	09/16/05 12:55
RIV-18-1'	B5I0376-34	Soil	09/14/05 20:25	09/16/05 12:55
RIV-19-1'	B5I0376-35	Soil	09/14/05 20:30	09/16/05 12:55
RIV-20-1'	B5I0376-36	Soil	09/14/05 20:40	09/16/05 12:55
LEV8-35'	B5I0376-37	Soil	09/15/05 16:35	09/16/05 12:55
LEV9-23'	B5I0376-38	Soil	09/15/05 19:30	09/16/05 12:55
5-B-11-2'-4'	B5I0376-39	Soil	09/11/05 14:00	09/16/05 12:55
5-B-11-0'-1'	B5I0376-40	Soil	09/11/05 14:16	09/16/05 12:55
LEV 5B-39	B5I0376-41	Soil	09/16/05 10:50	09/16/05 12:55
LEV 5B-43	B5I0376-42	Soil	09/16/05 10:55	09/16/05 12:55

North Creek Analytical - Bothell

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Kortland Orr For Kate Haney, Project Manager

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The RETEC Group, Inc.	Project:	BNSF-Skykomish-1	
1011 SW Klickitat Way, Suite 207	Project Number:	BN050-16423-522	**Reported:**
Seattle, WA 98134	Project Manager:	Stephen Howard	10/02/05 15:29

Semivolatile Petroleum Products by NWTPH-Dx (w/o Acid/Silica Gel Clean-up)
North Creek Analytical - Bothell

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
LEV-2-19' (B5I0376-01) Soil Sampled: 09/09/05 11:18 Received: 09/16/05 12:55										**D-15**
Diesel Range Hydrocarbons	**1430**	16.0	100	mg/kg dry	10	5I20017	09/20/05	09/22/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	**1770**	31.9	250	"	"	"	"	"	"	
Surrogate: 2-FBP	*106 %*		*50-150*			"	"	"	"	
Surrogate: Octacosane	*106 %*		*50-150*			"	"	"	"	
LEV-1-18'-19' (B5I0376-02) Soil Sampled: 09/09/05 15:15 Received: 09/16/05 12:55										**D-15**
Diesel Range Hydrocarbons	**1740**	16.0	100	mg/kg dry	10	5I20017	09/20/05	09/22/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	**2010**	31.9	250	"	"	"	"	"	"	
Surrogate: 2-FBP	*112 %*		*50-150*			"	"	"	"	
Surrogate: Octacosane	*113 %*		*50-150*			"	"	"	"	
LEV-3-21'-25' (B5I0376-03) Soil Sampled: 09/09/05 19:30 Received: 09/16/05 12:55										**D-15**
Diesel Range Hydrocarbons	**380**	3.20	20.0	mg/kg dry	2	5I20017	09/20/05	09/22/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	**475**	6.38	50.0	"	"	"	"	"	"	
Surrogate: 2-FBP	*80.9 %*		*50-150*			"	"	"	"	
Surrogate: Octacosane	*99.8 %*		*50-150*			"	"	"	"	
5-B-9-22' (B5I0376-04) Soil Sampled: 09/10/05 10:50 Received: 09/16/05 12:55										**D-15**
Diesel Range Hydrocarbons	**282**	1.60	10.0	mg/kg dry	1	5I20017	09/20/05	09/22/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	**366**	3.19	25.0	"	"	"	"	"	"	
Surrogate: 2-FBP	*84.1 %*		*50-150*			"	"	"	"	
Surrogate: Octacosane	*95.7 %*		*50-150*			"	"	"	"	
5-B-7-20'-25' (B5I0376-05) Soil Sampled: 09/10/05 13:00 Received: 09/16/05 12:55										**D-15**
Diesel Range Hydrocarbons	**383**	8.00	50.0	mg/kg dry	5	5I20017	09/20/05	09/24/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	**567**	16.0	125	"	"	"	"	"	"	
Surrogate: 2-FBP	*57.0 %*		*50-150*			"	"	"	"	
Surrogate: Octacosane	*102 %*		*50-150*			"	"	"	"	

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The RETEC Group, Inc.	Project: BNSF-Skykomish-1	
1011 SW Klickitat Way, Suite 207	Project Number: BN050-16423-522	**Reported:**
Seattle, WA 98134	Project Manager: Stephen Howard	10/02/05 15:29

Semivolatile Petroleum Products by NWTPH-Dx (w/o Acid/Silica Gel Clean-up)
North Creek Analytical - Bothell

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
5-B-8-15'-20' (B5I0376-06) Soil	**Sampled: 09/10/05 19:45**		**Received: 09/16/05 12:55**							**D-15**
Diesel Range Hydrocarbons	**1550**	16.0	100	mg/kg dry	10	5I20017	09/20/05	09/22/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	**2250**	31.9	250	"	"	"	"	"	"	
Surrogate: 2-FBP	*105 %*		*50-150*			"	"	"	"	
Surrogate: Octacosane	*111 %*		*50-150*			"	"	"	"	
5-B-12-30'-33' (B5I0376-07) Soil	**Sampled: 09/11/05 11:40**		**Received: 09/16/05 12:55**							**D-15**
Diesel Range Hydrocarbons	**36.9**	1.60	10.0	mg/kg dry	1	5I20017	09/20/05	09/22/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	**92.6**	3.19	25.0	"	"	"	"	"	"	
Surrogate: 2-FBP	*81.4 %*		*50-150*			"	"	"	"	
Surrogate: Octacosane	*99.3 %*		*50-150*			"	"	"	"	
5-B-11-15'-20' (B5I0376-08) Soil	**Sampled: 09/11/05 13:41**		**Received: 09/16/05 12:55**							
Diesel Range Hydrocarbons	**3.21**	1.60	10.0	mg/kg dry	1	5I20017	09/20/05	09/22/05	NWTPH-Dx	J
Lube Oil Range Hydrocarbons	**19.7**	3.19	25.0	"	"	"	"	"	"	J
Surrogate: 2-FBP	*71.2 %*		*50-150*			"	"	"	"	
Surrogate: Octacosane	*93.5 %*		*50-150*			"	"	"	"	
LEV 5-35'-40' (B5I0376-09) Soil	**Sampled: 09/11/05 18:55**		**Received: 09/16/05 12:55**							
Diesel Range Hydrocarbons	ND	1.60	10.0	mg/kg dry	1	5I20017	09/20/05	09/22/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	**4.43**	3.19	25.0	"	"	"	"	"	"	J
Surrogate: 2-FBP	*74.2 %*		*50-150*			"	"	"	"	
Surrogate: Octacosane	*99.2 %*		*50-150*			"	"	"	"	
LEV 4-35'-39' (B5I0376-10) Soil	**Sampled: 09/12/05 10:35**		**Received: 09/16/05 12:55**							**D-15**
Diesel Range Hydrocarbons	**95.9**	1.60	10.0	mg/kg dry	1	5I20017	09/20/05	09/22/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	**130**	3.19	25.0	"	"	"	"	"	"	
Surrogate: 2-FBP	*77.7 %*		*50-150*			"	"	"	"	
Surrogate: Octacosane	*95.4 %*		*50-150*			"	"	"	"	

North Creek Analytical - Bothell

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Kortland Orr For Kate Haney, Project Manager

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The RETEC Group, Inc.	Project: BNSF-Skykomish-1	
1011 SW Klickitat Way, Suite 207	Project Number: BN050-16423-522	**Reported:**
Seattle, WA 98134	Project Manager: Stephen Howard	10/02/05 15:29

Semivolatile Petroleum Products by NWTPH-Dx (w/o Acid/Silica Gel Clean-up)
North Creek Analytical - Bothell

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
RIV 2-0'-1' (B5I0376-11) Soil	**Sampled: 09/12/05 14:40**		**Received: 09/16/05 12:55**							**D-15**
Diesel Range Hydrocarbons	**201**	1.60	10.0	mg/kg dry	1	5I20017	09/20/05	09/22/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	**375**	3.19	25.0	"	"	"	"	"	"	
Surrogate: 2-FBP	*76.9 %*		*50-150*			"	"	"	"	
Surrogate: Octacosane	*95.1 %*		*50-150*			"	"	"	"	
RIV 3-5'-10' (B5I0376-12) Soil	**Sampled: 09/12/05 16:30**		**Received: 09/16/05 12:55**							**D-15**
Diesel Range Hydrocarbons	**41.2**	1.60	10.0	mg/kg dry	1	5I20017	09/20/05	09/22/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	**91.2**	3.19	25.0	"	"	"	"	"	"	
Surrogate: 2-FBP	*82.6 %*		*50-150*			"	"	"	"	
Surrogate: Octacosane	*101 %*		*50-150*			"	"	"	"	
RIV 4-15'-18' (B5I0376-13) Soil	**Sampled: 09/12/05 19:45**		**Received: 09/16/05 12:55**							
Diesel Range Hydrocarbons	ND	1.60	10.0	mg/kg dry	1	5I20017	09/20/05	09/22/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	**5.03**	3.19	25.0	"	"	"	"	"	"	J
Surrogate: 2-FBP	*78.2 %*		*50-150*			"	"	"	"	
Surrogate: Octacosane	*101 %*		*50-150*			"	"	"	"	
RIV-12-3' (B5I0376-14) Soil	**Sampled: 09/13/05 16:50**		**Received: 09/16/05 12:55**							
Diesel Range Hydrocarbons	**2.28**	1.60	10.0	mg/kg dry	1	5I20017	09/20/05	09/22/05	NWTPH-Dx	J
Lube Oil Range Hydrocarbons	**8.03**	3.19	25.0	"	"	"	"	"	"	J
Surrogate: 2-FBP	*77.4 %*		*50-150*			"	"	"	"	
Surrogate: Octacosane	*99.8 %*		*50-150*			"	"	"	"	
RIV-12-14' (B5I0376-15) Soil	**Sampled: 09/13/05 16:50**		**Received: 09/16/05 12:55**							
Diesel Range Hydrocarbons	ND	1.60	10.0	mg/kg dry	1	5I20017	09/20/05	09/22/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	**6.63**	3.19	25.0	"	"	"	"	"	"	J
Surrogate: 2-FBP	*77.5 %*		*50-150*			"	"	"	"	
Surrogate: Octacosane	*98.2 %*		*50-150*			"	"	"	"	

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The RETEC Group, Inc. 1011 SW Klickitat Way, Suite 207 Seattle, WA 98134	Project: BNSF-Skykomish-1 Project Number: BN050-16423-522 Project Manager: Stephen Howard	**Reported:** 10/02/05 15:29

Semivolatile Petroleum Products by NWTPH-Dx (w/o Acid/Silica Gel Clean-up)
North Creek Analytical - Bothell

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
RIV-17-3' (B5I0376-16) Soil Sampled: 09/14/05 12:15 Received: 09/16/05 12:55										
Diesel Range Hydrocarbons	ND	1.60	10.0	mg/kg dry	1	5I20019	09/20/05	09/23/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	ND	3.19	25.0	"	"	"	"	"	"	
Surrogate: 2-FBP	*93.7 %*		*50-150*			"	"	"	"	
Surrogate: Octacosane	*96.6 %*		*50-150*			"	"	"	"	
RIV-17-13' (B5I0376-17) Soil Sampled: 09/14/05 12:20 Received: 09/16/05 12:55										
Diesel Range Hydrocarbons	**1.96**	1.60	10.0	mg/kg dry	1	5I20019	09/20/05	09/23/05	NWTPH-Dx	J
Lube Oil Range Hydrocarbons	**5.48**	3.19	25.0	"	"	"	"	"	"	J
Surrogate: 2-FBP	*92.6 %*		*50-150*			"	"	"	"	
Surrogate: Octacosane	*93.4 %*		*50-150*			"	"	"	"	
RIV-5-0'-3' (B5I0376-18) Soil Sampled: 09/14/05 16:20 Received: 09/16/05 12:55										
Diesel Range Hydrocarbons	**2.54**	1.60	10.0	mg/kg dry	1	5I20019	09/20/05	09/23/05	NWTPH-Dx	J
Lube Oil Range Hydrocarbons	**5.14**	3.19	25.0	"	"	"	"	"	"	J
Surrogate: 2-FBP	*87.5 %*		*50-150*			"	"	"	"	
Surrogate: Octacosane	*92.4 %*		*50-150*			"	"	"	"	
RIV-6-0'-3' (B5I0376-19) Soil Sampled: 09/14/05 16:25 Received: 09/16/05 12:55										
Diesel Range Hydrocarbons	ND	1.60	10.0	mg/kg dry	1	5I20019	09/20/05	09/23/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	ND	3.19	25.0	"	"	"	"	"	"	
Surrogate: 2-FBP	*92.9 %*		*50-150*			"	"	"	"	
Surrogate: Octacosane	*97.3 %*		*50-150*			"	"	"	"	
RIV-7-0'-5' (B5I0376-20) Soil Sampled: 09/14/05 16:30 Received: 09/16/05 12:55										
Diesel Range Hydrocarbons	**2.43**	1.60	10.0	mg/kg dry	1	5I20019	09/20/05	09/23/05	NWTPH-Dx	J
Lube Oil Range Hydrocarbons	**7.00**	3.19	25.0	"	"	"	"	"	"	J
Surrogate: 2-FBP	*95.7 %*		*50-150*			"	"	"	"	
Surrogate: Octacosane	*98.9 %*		*50-150*			"	"	"	"	

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The RETEC Group, Inc.	Project: BNSF-Skykomish-1	
1011 SW Klickitat Way, Suite 207	Project Number: BN050-16423-522	**Reported:**
Seattle, WA 98134	Project Manager: Stephen Howard	10/02/05 15:29

Semivolatile Petroleum Products by NWTPH-Dx (w/o Acid/Silica Gel Clean-up)
North Creek Analytical - Bothell

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
RIV-8-0'-2' (B5I0376-21) Soil Sampled: 09/14/05 16:35 Received: 09/16/05 12:55										
Diesel Range Hydrocarbons	ND	1.60	10.0	mg/kg dry	1	5I20019	09/20/05	09/23/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	ND	3.19	25.0	"	"	"	"	"	"	
Surrogate: 2-FBP	*92.6 %*		*50-150*			"	"	"	"	
Surrogate: Octacosane	*94.9 %*		*50-150*			"	"	"	"	
RIV-20-3' (B5I0376-22) Soil Sampled: 09/14/05 16:35 Received: 09/16/05 12:55										
Diesel Range Hydrocarbons	**5.64**	1.60	10.0	mg/kg dry	1	5I20019	09/20/05	09/23/05	NWTPH-Dx	J
Lube Oil Range Hydrocarbons	**16.8**	3.19	25.0	"	"	"	"	"	"	J
Surrogate: 2-FBP	*99.6 %*		*50-150*			"	"	"	"	
Surrogate: Octacosane	*99.5 %*		*50-150*			"	"	"	"	
RIV-9-0'-5' (B5I0376-23) Soil Sampled: 09/14/05 16:40 Received: 09/16/05 12:55										
Diesel Range Hydrocarbons	ND	1.60	10.0	mg/kg dry	1	5I20019	09/20/05	09/23/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	**3.29**	3.19	25.0	"	"	"	"	"	"	J
Surrogate: 2-FBP	*92.7 %*		*50-150*			"	"	"	"	
Surrogate: Octacosane	*89.5 %*		*50-150*			"	"	"	"	
RIV-10-10'-12' (B5I0376-24) Soil Sampled: 09/14/05 16:45 Received: 09/16/05 12:55										
Diesel Range Hydrocarbons	**11.1**	1.60	10.0	mg/kg dry	1	5I20019	09/20/05	09/23/05	NWTPH-Dx	D-09
Lube Oil Range Hydrocarbons	**12.4**	3.19	25.0	"	"	"	"	"	"	J
Surrogate: 2-FBP	*92.7 %*		*50-150*			"	"	"	"	
Surrogate: Octacosane	*96.3 %*		*50-150*			"	"	"	"	
RIV-20-13' (B5I0376-25) Soil Sampled: 09/14/05 16:45 Received: 09/16/05 12:55										
Diesel Range Hydrocarbons	**3.04**	1.60	10.0	mg/kg dry	1	5I20019	09/20/05	09/23/05	NWTPH-Dx	J
Lube Oil Range Hydrocarbons	**10.7**	3.19	25.0	"	"	"	"	"	"	J
Surrogate: 2-FBP	*91.2 %*		*50-150*			"	"	"	"	
Surrogate: Octacosane	*93.0 %*		*50-150*			"	"	"	"	

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Semivolatile Petroleum Products by NWTPH-Dx (w/o Acid/Silica Gel Clean-up)
North Creek Analytical - Bothell

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
RIV-11-5'-10' (B5I0376-26) Soil	**Sampled: 09/14/05 18:50**		**Received: 09/16/05 12:55**							
Diesel Range Hydrocarbons	**3.55**	1.60	10.0	mg/kg dry	1	5I20019	09/20/05	09/23/05	NWTPH-Dx	J
Lube Oil Range Hydrocarbons	**5.31**	3.19	25.0	"	"	"	"	"	"	J
Surrogate: 2-FBP	*92.1 %*		*50-150*			"	"	"	"	
Surrogate: Octacosane	*89.8 %*		*50-150*			"	"	"	"	
RIV-12-0'-5' (B5I0376-27) Soil	**Sampled: 09/14/05 18:55**		**Received: 09/16/05 12:55**							
Diesel Range Hydrocarbons	**5.28**	1.60	10.0	mg/kg dry	1	5I20019	09/20/05	09/23/05	NWTPH-Dx	J
Lube Oil Range Hydrocarbons	**6.43**	3.19	25.0	"	"	"	"	"	"	J
Surrogate: 2-FBP	*89.2 %*		*50-150*			"	"	"	"	
Surrogate: Octacosane	*92.8 %*		*50-150*			"	"	"	"	
LEV-6-47' (B5I0376-28) Soil	**Sampled: 09/14/05 19:00**		**Received: 09/16/05 12:55**							
Diesel Range Hydrocarbons	**8.13**	1.60	10.0	mg/kg dry	1	5I20019	09/20/05	09/23/05	NWTPH-Dx	J
Lube Oil Range Hydrocarbons	**9.33**	3.19	25.0	"	"	"	"	"	"	J
Surrogate: 2-FBP	*86.6 %*		*50-150*			"	"	"	"	
Surrogate: Octacosane	*87.6 %*		*50-150*			"	"	"	"	
RIV-13-3' (B5I0376-29) Soil	**Sampled: 09/14/05 20:00**		**Received: 09/16/05 12:55**							
Diesel Range Hydrocarbons	**1.76**	1.60	10.0	mg/kg dry	1	5I20019	09/20/05	09/23/05	NWTPH-Dx	J
Lube Oil Range Hydrocarbons	ND	3.19	25.0	"	"	"	"	"	"	
Surrogate: 2-FBP	*95.4 %*		*50-150*			"	"	"	"	
Surrogate: Octacosane	*95.3 %*		*50-150*			"	"	"	"	
RIV-14-1' (B5I0376-30) Soil	**Sampled: 09/14/05 20:05**		**Received: 09/16/05 12:55**							
Diesel Range Hydrocarbons	**2.23**	1.60	10.0	mg/kg dry	1	5I20019	09/20/05	09/23/05	NWTPH-Dx	J
Lube Oil Range Hydrocarbons	**7.18**	3.19	25.0	"	"	"	"	"	"	J
Surrogate: 2-FBP	*91.8 %*		*50-150*			"	"	"	"	
Surrogate: Octacosane	*90.2 %*		*50-150*			"	"	"	"	

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The RETEC Group, Inc.	Project: BNSF-Skykomish-1	
1011 SW Klickitat Way, Suite 207	Project Number: BN050-16423-522	**Reported:**
Seattle, WA 98134	Project Manager: Stephen Howard	10/02/05 15:29

Semivolatile Petroleum Products by NWTPH-Dx (w/o Acid/Silica Gel Clean-up)
North Creek Analytical - Bothell

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
RIV-15-1' (B5I0376-31) Soil	**Sampled: 09/14/05 20:10**		**Received: 09/16/05 12:55**							
Diesel Range Hydrocarbons	**4.10**	1.60	10.0	mg/kg dry	1	5I20019	09/20/05	09/23/05	NWTPH-Dx	J
Lube Oil Range Hydrocarbons	**16.8**	3.19	25.0	"	"	"	"	"	"	J
Surrogate: 2-FBP	*92.4 %*		*50-150*			"	"	"	"	
Surrogate: Octacosane	*94.1 %*		*50-150*			"	"	"	"	
RIV-16-1' (B5I0376-32) Soil	**Sampled: 09/14/05 20:15**		**Received: 09/16/05 12:55**							
Diesel Range Hydrocarbons	**1.85**	1.60	10.0	mg/kg dry	1	5I20019	09/20/05	09/23/05	NWTPH-Dx	J
Lube Oil Range Hydrocarbons	**4.27**	3.19	25.0	"	"	"	"	"	"	J
Surrogate: 2-FBP	*92.7 %*		*50-150*			"	"	"	"	
Surrogate: Octacosane	*90.6 %*		*50-150*			"	"	"	"	
RIV-17-1' (B5I0376-33) Soil	**Sampled: 09/14/05 20:20**		**Received: 09/16/05 12:55**							
Diesel Range Hydrocarbons	ND	1.60	10.0	mg/kg dry	1	5I20019	09/20/05	09/23/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	ND	3.19	25.0	"	"	"	"	"	"	
Surrogate: 2-FBP	*95.7 %*		*50-150*			"	"	"	"	
Surrogate: Octacosane	*92.0 %*		*50-150*			"	"	"	"	
RIV-18-1' (B5I0376-34) Soil	**Sampled: 09/14/05 20:25**		**Received: 09/16/05 12:55**							
Diesel Range Hydrocarbons	**2.88**	1.60	10.0	mg/kg dry	1	5I20019	09/20/05	09/23/05	NWTPH-Dx	J
Lube Oil Range Hydrocarbons	**7.40**	3.19	25.0	"	"	"	"	"	"	J
Surrogate: 2-FBP	*90.9 %*		*50-150*			"	"	"	"	
Surrogate: Octacosane	*87.5 %*		*50-150*			"	"	"	"	
RIV-19-1' (B5I0376-35) Soil	**Sampled: 09/14/05 20:30**		**Received: 09/16/05 12:55**							
Diesel Range Hydrocarbons	**2.03**	1.60	10.0	mg/kg dry	1	5I20019	09/20/05	09/23/05	NWTPH-Dx	J
Lube Oil Range Hydrocarbons	**5.34**	3.19	25.0	"	"	"	"	"	"	J
Surrogate: 2-FBP	*93.8 %*		*50-150*			"	"	"	"	
Surrogate: Octacosane	*95.6 %*		*50-150*			"	"	"	"	

The RETEC Group, Inc. 1011 SW Klickitat Way, Suite 207 Seattle, WA 98134	Project: BNSF-Skykomish-1 Project Number: BN050-16423-522 Project Manager: Stephen Howard	**Reported:** 10/02/05 15:29

Semivolatile Petroleum Products by NWTPH-Dx (w/o Acid/Silica Gel Clean-up)
North Creek Analytical - Bothell

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
RIV-20-1' (B5I0376-36) Soil Sampled: 09/14/05 20:40 Received: 09/16/05 12:55										
Diesel Range Hydrocarbons	**8.04**	1.60	10.0	mg/kg dry	1	5I20021	09/20/05	09/23/05	NWTPH-Dx	J
Lube Oil Range Hydrocarbons	**35.4**	3.19	25.0	"	"	"	"	"	"	D-06
Surrogate: 2-FBP	*79.2 %*		*50-150*			"	"	"	"	
Surrogate: Octacosane	*95.3 %*		*50-150*			"	"	"	"	
LEV8-35' (B5I0376-37) Soil Sampled: 09/15/05 16:35 Received: 09/16/05 12:55										**D-15**
Diesel Range Hydrocarbons	**311**	3.20	20.0	mg/kg dry	2	5I20021	09/20/05	09/24/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	**386**	6.38	50.0	"	"	"	"	"	"	
Surrogate: 2-FBP	*81.0 %*		*50-150*			"	"	"	"	
Surrogate: Octacosane	*96.6 %*		*50-150*			"	"	"	"	
LEV9-23' (B5I0376-38) Soil Sampled: 09/15/05 19:30 Received: 09/16/05 12:55										**D-15**
Diesel Range Hydrocarbons	**367**	3.20	20.0	mg/kg dry	2	5I20021	09/20/05	09/24/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	**487**	6.38	50.0	"	"	"	"	"	"	
Surrogate: 2-FBP	*87.0 %*		*50-150*			"	"	"	"	
Surrogate: Octacosane	*101 %*		*50-150*			"	"	"	"	
5-B-11-2'-4' (B5I0376-39) Soil Sampled: 09/11/05 14:00 Received: 09/16/05 12:55										
Diesel Range Hydrocarbons	**15.7**	1.60	10.0	mg/kg dry	1	5I20021	09/20/05	09/23/05	NWTPH-Dx	D-09
Lube Oil Range Hydrocarbons	**62.9**	3.19	25.0	"	"	"	"	"	"	D-06
Surrogate: 2-FBP	*75.7 %*		*50-150*			"	"	"	"	
Surrogate: Octacosane	*82.8 %*		*50-150*			"	"	"	"	
5-B-11-0'-1' (B5I0376-40) Soil Sampled: 09/11/05 14:16 Received: 09/16/05 12:55										
Diesel Range Hydrocarbons	**10.9**	1.60	10.0	mg/kg dry	1	5I20021	09/20/05	09/23/05	NWTPH-Dx	D-09
Lube Oil Range Hydrocarbons	**86.8**	3.19	25.0	"	"	"	"	"	"	D-06
Surrogate: 2-FBP	*82.4 %*		*50-150*			"	"	"	"	
Surrogate: Octacosane	*93.0 %*		*50-150*			"	"	"	"	

North Creek Analytical - Bothell

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Kortland Orr For Kate Haney, Project Manager

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The RETEC Group, Inc.	Project: BNSF-Skykomish-1	
1011 SW Klickitat Way, Suite 207	Project Number: BN050-16423-522	**Reported:**
Seattle, WA 98134	Project Manager: Stephen Howard	10/02/05 15:29

Semivolatile Petroleum Products by NWTPH-Dx (w/o Acid/Silica Gel Clean-up)
North Creek Analytical - Bothell

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
LEV 5B-39 (B5I0376-41) Soil	**Sampled: 09/16/05 10:50**		**Received: 09/16/05 12:55**							**D-15**
Diesel Range Hydrocarbons	**186**	1.60	10.0	mg/kg dry	1	5I20021	09/20/05	09/23/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	**234**	3.19	25.0	"	"	"	"	"	"	
Surrogate: 2-FBP	*84.5 %*		*50-150*			"	"	"	"	
Surrogate: Octacosane	*98.3 %*		*50-150*			"	"	"	"	
LEV 5B-43 (B5I0376-42) Soil	**Sampled: 09/16/05 10:55**		**Received: 09/16/05 12:55**							**D-15**
Diesel Range Hydrocarbons	**961**	8.00	50.0	mg/kg dry	5	5I20021	09/20/05	09/24/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	**1160**	16.0	125	"	"	"	"	"	"	
Surrogate: 2-FBP	*93.3 %*		*50-150*			"	"	"	"	
Surrogate: Octacosane	*103 %*		*50-150*			"	"	"	"	

North Creek Analytical - Bothell

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Kortland Orr For Kate Haney, Project Manager

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The RETEC Group, Inc.	Project: BNSF-Skykomish-1	
1011 SW Klickitat Way, Suite 207	Project Number: BN050-16423-522	**Reported:**
Seattle, WA 98134	Project Manager: Stephen Howard	10/02/05 15:29

Total Metals by EPA 6000/7000 Series Methods
North Creek Analytical - Bothell

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
5-B-11-2'-4' (B5I0376-39) Soil	**Sampled: 09/11/05 14:00**		**Received: 09/16/05 12:55**							
Lead	**41.9**	0.0260	0.500	mg/kg dry	1	5I20047	09/20/05	09/21/05	EPA 6020	
5-B-11-0'-1' (B5I0376-40) Soil	**Sampled: 09/11/05 14:16**		**Received: 09/16/05 12:55**							
Lead	**103**	0.0260	0.500	mg/kg dry	1	5I20047	09/20/05	09/21/05	EPA 6020	

North Creek Analytical - Bothell

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Kortland Orr For Kate Haney, Project Manager

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The RETEC Group, Inc.	Project:	BNSF-Skykomish-1	
1011 SW Klickitat Way, Suite 207	Project Number:	BN050-16423-522	**Reported:**
Seattle, WA 98134	Project Manager:	Stephen Howard	10/02/05 15:29

Conventional Chemistry Parameters by APHA/EPA Methods
North Creek Analytical - Bothell

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
RIV-12-3' (B5I0376-14) Soil Sampled: 09/13/05 16:50 Received: 09/16/05 12:55										
Total Organic Carbon - Average	**2280**		500	mg/kg dry	1	5I26053	09/19/05	09/23/05	EPA 9060 mod	
Total Organic Carbon - High	**2430**		500	"	"	"	"	"	"	
Total Organic Carbon - Low	**2110**		500	"	"	"	"	"	"	
RIV-12-14' (B5I0376-15) Soil Sampled: 09/13/05 16:50 Received: 09/16/05 12:55										
Total Organic Carbon - Average	**3660**		500	mg/kg dry	1	5I26053	09/19/05	09/23/05	EPA 9060 mod	
Total Organic Carbon - High	**3800**		500	"	"	"	"	"	"	
Total Organic Carbon - Low	**3550**		500	"	"	"	"	"	"	
RIV-17-3' (B5I0376-16) Soil Sampled: 09/14/05 12:15 Received: 09/16/05 12:55										
Total Organic Carbon - Average	**2100**		500	mg/kg dry	1	5I26053	09/19/05	09/23/05	EPA 9060 mod	
Total Organic Carbon - High	**3190**		500	"	"	"	"	"	"	
Total Organic Carbon - Low	**1560**		500	"	"	"	"	"	"	
RIV-17-13' (B5I0376-17) Soil Sampled: 09/14/05 12:20 Received: 09/16/05 12:55										
Total Organic Carbon - Average	**4380**		500	mg/kg dry	1	5I29044	09/20/05	09/29/05	EPA 9060 mod	
Total Organic Carbon - High	**4780**		500	"	"	"	"	"	"	
Total Organic Carbon - Low	**4010**		500	"	"	"	"	"	"	
RIV-20-3' (B5I0376-22) Soil Sampled: 09/14/05 16:35 Received: 09/16/05 12:55										
Total Organic Carbon - Average	**2800**		500	mg/kg dry	1	5I29044	09/20/05	09/29/05	EPA 9060 mod	
Total Organic Carbon - High	**3450**		500	"	"	"	"	"	"	
Total Organic Carbon - Low	**2350**		500	"	"	"	"	"	"	
RIV-20-13' (B5I0376-25) Soil Sampled: 09/14/05 16:45 Received: 09/16/05 12:55										
Total Organic Carbon - Average	**5490**		500	mg/kg dry	1	5I29044	09/20/05	09/29/05	EPA 9060 mod	
Total Organic Carbon - High	**5930**		500	"	"	"	"	"	"	
Total Organic Carbon - Low	**5140**		500	"	"	"	"	"	"	

North Creek Analytical - Bothell

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The RETEC Group, Inc.	Project: BNSF-Skykomish-1	
1011 SW Klickitat Way, Suite 207	Project Number: BN050-16423-522	**Reported:**
Seattle, WA 98134	Project Manager: Stephen Howard	10/02/05 15:29

Physical Parameters by APHA/ASTM/EPA Methods
North Creek Analytical - Bothell

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
LEV-2-19' (B5I0376-01) Soil Sampled: 09/09/05 11:18 Received: 09/16/05 12:55										
Dry Weight	**87.1**		1.00	%	1	5I22046	09/22/05	09/23/05	ƷOPSPL003R(	
LEV-1-18'-19' (B5I0376-02) Soil Sampled: 09/09/05 15:15 Received: 09/16/05 12:55										
Dry Weight	**90.9**		1.00	%	1	5I22046	09/22/05	09/23/05	ƷOPSPL003R(	
LEV-3-21'-25' (B5I0376-03) Soil Sampled: 09/09/05 19:30 Received: 09/16/05 12:55										
Dry Weight	**87.2**		1.00	%	1	5I22046	09/22/05	09/23/05	ƷOPSPL003R(	
5-B-9-22' (B5I0376-04) Soil Sampled: 09/10/05 10:50 Received: 09/16/05 12:55										
Dry Weight	**82.7**		1.00	%	1	5I22046	09/22/05	09/23/05	ƷOPSPL003R(	
5-B-7-20'-25' (B5I0376-05) Soil Sampled: 09/10/05 13:00 Received: 09/16/05 12:55										
Dry Weight	**91.6**		1.00	%	1	5I22046	09/22/05	09/23/05	ƷOPSPL003R(	
5-B-8-15'-20' (B5I0376-06) Soil Sampled: 09/10/05 19:45 Received: 09/16/05 12:55										
Dry Weight	**94.3**		1.00	%	1	5I22046	09/22/05	09/23/05	ƷOPSPL003R(	
5-B-12-30'-33' (B5I0376-07) Soil Sampled: 09/11/05 11:40 Received: 09/16/05 12:55										
Dry Weight	**94.0**		1.00	%	1	5I22046	09/22/05	09/23/05	ƷOPSPL003R(	
5-B-11-15'-20' (B5I0376-08) Soil Sampled: 09/11/05 13:41 Received: 09/16/05 12:55										
Dry Weight	**84.3**		1.00	%	1	5I22046	09/22/05	09/23/05	ƷOPSPL003R(	
LEV 5-35'-40' (B5I0376-09) Soil Sampled: 09/11/05 18:55 Received: 09/16/05 12:55										
Dry Weight	**94.1**		1.00	%	1	5I22046	09/22/05	09/23/05	ƷOPSPL003R(	

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The RETEC Group, Inc. 1011 SW Klickitat Way, Suite 207 Seattle, WA 98134	Project: BNSF-Skykomish-1 Project Number: BN050-16423-522 Project Manager: Stephen Howard	Reported: 10/02/05 15:29

Physical Parameters by APHA/ASTM/EPA Methods
North Creek Analytical - Bothell

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
LEV 4-35'-39' (B5I0376-10) Soil Sampled: 09/12/05 10:35 Received: 09/16/05 12:55										
Dry Weight	**92.7**		1.00	%	1	5I22046	09/22/05	09/23/05	SOPSPL003R(	
RIV 2-0'-1' (B5I0376-11) Soil Sampled: 09/12/05 14:40 Received: 09/16/05 12:55										
Dry Weight	**79.9**		1.00	%	1	5I22046	09/22/05	09/23/05	SOPSPL003R(	
RIV 3-5'-10' (B5I0376-12) Soil Sampled: 09/12/05 16:30 Received: 09/16/05 12:55										
Dry Weight	**86.1**		1.00	%	1	5I22047	09/22/05	09/23/05	SOPSPL003R(	
RIV 4-15'-18' (B5I0376-13) Soil Sampled: 09/12/05 19:45 Received: 09/16/05 12:55										
Dry Weight	**92.3**		1.00	%	1	5I22047	09/22/05	09/23/05	SOPSPL003R(	
RIV-12-3' (B5I0376-14) Soil Sampled: 09/13/05 16:50 Received: 09/16/05 12:55										
Dry Weight	**92.0**		1.00	%	1	5I22047	09/22/05	09/23/05	SOPSPL003R(	
RIV-12-14' (B5I0376-15) Soil Sampled: 09/13/05 16:50 Received: 09/16/05 12:55										
Dry Weight	**73.9**		1.00	%	1	5I22047	09/22/05	09/23/05	SOPSPL003R(	
RIV-17-3' (B5I0376-16) Soil Sampled: 09/14/05 12:15 Received: 09/16/05 12:55										
Dry Weight	**90.3**		1.00	%	1	5I22047	09/22/05	09/23/05	SOPSPL003R(	
RIV-17-13' (B5I0376-17) Soil Sampled: 09/14/05 12:20 Received: 09/16/05 12:55										
Dry Weight	**68.6**		1.00	%	1	5I22047	09/22/05	09/23/05	SOPSPL003R(	
RIV-5-0'-3' (B5I0376-18) Soil Sampled: 09/14/05 16:20 Received: 09/16/05 12:55										
Dry Weight	**91.2**		1.00	%	1	5I22047	09/22/05	09/23/05	SOPSPL003R(	

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The RETEC Group, Inc.	Project: BNSF-Skykomish-1	
1011 SW Klickitat Way, Suite 207	Project Number: BN050-16423-522	**Reported:**
Seattle, WA 98134	Project Manager: Stephen Howard	10/02/05 15:29

Physical Parameters by APHA/ASTM/EPA Methods
North Creek Analytical - Bothell

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
RIV-6-0'-3' (B5I0376-19) Soil Sampled: 09/14/05 16:25 Received: 09/16/05 12:55										
Dry Weight	**85.4**		1.00	%	1	5I22047	09/22/05	09/23/05	ƷOPSPL003R(	
RIV-7-0'-5' (B5I0376-20) Soil Sampled: 09/14/05 16:30 Received: 09/16/05 12:55										
Dry Weight	**91.8**		1.00	%	1	5I22047	09/22/05	09/23/05	ƷOPSPL003R(	
RIV-8-0'-2' (B5I0376-21) Soil Sampled: 09/14/05 16:35 Received: 09/16/05 12:55										
Dry Weight	**89.2**		1.00	%	1	5I22047	09/22/05	09/23/05	ƷOPSPL003R(	
RIV-20-3' (B5I0376-22) Soil Sampled: 09/14/05 16:35 Received: 09/16/05 12:55										
Dry Weight	**88.6**		1.00	%	1	5I22047	09/22/05	09/23/05	ƷOPSPL003R(	
RIV-9-0'-5' (B5I0376-23) Soil Sampled: 09/14/05 16:40 Received: 09/16/05 12:55										
Dry Weight	**84.5**		1.00	%	1	5I22047	09/22/05	09/23/05	ƷOPSPL003R(	
RIV-10-10'-12' (B5I0376-24) Soil Sampled: 09/14/05 16:45 Received: 09/16/05 12:55										
Dry Weight	**76.3**		1.00	%	1	5I22047	09/22/05	09/23/05	ƷOPSPL003R(	
RIV-20-13' (B5I0376-25) Soil Sampled: 09/14/05 16:45 Received: 09/16/05 12:55										
Dry Weight	**72.3**		1.00	%	1	5I22047	09/22/05	09/23/05	ƷOPSPL003R(	
RIV-11-5'-10' (B5I0376-26) Soil Sampled: 09/14/05 18:50 Received: 09/16/05 12:55										
Dry Weight	**89.4**		1.00	%	1	5I22047	09/22/05	09/23/05	ƷOPSPL003R(	
RIV-12-0'-5' (B5I0376-27) Soil Sampled: 09/14/05 18:55 Received: 09/16/05 12:55										
Dry Weight	**94.0**		1.00	%	1	5I22047	09/22/05	09/23/05	ƷOPSPL003R(	

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The RETEC Group, Inc.	Project: BNSF-Skykomish-1	
1011 SW Klickitat Way, Suite 207	Project Number: BN050-16423-522	**Reported:**
Seattle, WA 98134	Project Manager: Stephen Howard	10/02/05 15:29

Physical Parameters by APHA/ASTM/EPA Methods
North Creek Analytical - Bothell

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
LEV-6-47' (B5I0376-28) Soil Sampled: 09/14/05 19:00 Received: 09/16/05 12:55										
Dry Weight	**89.2**		1.00	%	1	5I22047	09/22/05	09/23/05	SOPSPL003R(	
RIV-13-3' (B5I0376-29) Soil Sampled: 09/14/05 20:00 Received: 09/16/05 12:55										
Dry Weight	**91.9**		1.00	%	1	5I22047	09/22/05	09/23/05	SOPSPL003R(	
RIV-14-1' (B5I0376-30) Soil Sampled: 09/14/05 20:05 Received: 09/16/05 12:55										
Dry Weight	**90.2**		1.00	%	1	5I22047	09/22/05	09/23/05	SOPSPL003R(	
RIV-15-1' (B5I0376-31) Soil Sampled: 09/14/05 20:10 Received: 09/16/05 12:55										
Dry Weight	**90.7**		1.00	%	1	5I22047	09/22/05	09/23/05	SOPSPL003R(	
RIV-16-1' (B5I0376-32) Soil Sampled: 09/14/05 20:15 Received: 09/16/05 12:55										
Dry Weight	**92.0**		1.00	%	1	5I22048	09/22/05	09/23/05	SOPSPL003R(	
RIV-17-1' (B5I0376-33) Soil Sampled: 09/14/05 20:20 Received: 09/16/05 12:55										
Dry Weight	**93.3**		1.00	%	1	5I22048	09/22/05	09/23/05	SOPSPL003R(	
RIV-18-1' (B5I0376-34) Soil Sampled: 09/14/05 20:25 Received: 09/16/05 12:55										
Dry Weight	**89.8**		1.00	%	1	5I22048	09/22/05	09/23/05	SOPSPL003R(	
RIV-19-1' (B5I0376-35) Soil Sampled: 09/14/05 20:30 Received: 09/16/05 12:55										
Dry Weight	**91.1**		1.00	%	1	5I22048	09/22/05	09/23/05	SOPSPL003R(	
RIV-20-1' (B5I0376-36) Soil Sampled: 09/14/05 20:40 Received: 09/16/05 12:55										
Dry Weight	**79.4**		1.00	%	1	5I22048	09/22/05	09/23/05	SOPSPL003R(	

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The RETEC Group, Inc. 1011 SW Klickitat Way, Suite 207 Seattle, WA 98134	Project: BNSF-Skykomish-1 Project Number: BN050-16423-522 Project Manager: Stephen Howard	**Reported:** 10/02/05 15:29

Physical Parameters by APHA/ASTM/EPA Methods
North Creek Analytical - Bothell

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
LEV8-35' (B5I0376-37) Soil Sampled: 09/15/05 16:35 Received: 09/16/05 12:55										
Dry Weight	**82.4**		1.00	%	1	5I22048	09/22/05	09/23/05	SOPSPL003R(	
LEV9-23' (B5I0376-38) Soil Sampled: 09/15/05 19:30 Received: 09/16/05 12:55										
Dry Weight	**86.5**		1.00	%	1	5I22048	09/22/05	09/23/05	SOPSPL003R(	
5-B-11-2'-4' (B5I0376-39) Soil Sampled: 09/11/05 14:00 Received: 09/16/05 12:55										
Dry Weight	**76.9**		1.00	%	1	5I22048	09/22/05	09/23/05	SOPSPL003R(	
5-B-11-0'-1' (B5I0376-40) Soil Sampled: 09/11/05 14:16 Received: 09/16/05 12:55										
Dry Weight	**93.1**		1.00	%	1	5I22048	09/22/05	09/23/05	SOPSPL003R(	
LEV 5B-39 (B5I0376-41) Soil Sampled: 09/16/05 10:50 Received: 09/16/05 12:55										
Dry Weight	**86.0**		1.00	%	1	5I22048	09/22/05	09/23/05	SOPSPL003R(	
LEV 5B-43 (B5I0376-42) Soil Sampled: 09/16/05 10:55 Received: 09/16/05 12:55										
Dry Weight	**84.7**		1.00	%	1	5I22048	09/22/05	09/23/05	SOPSPL003R(	

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The RETEC Group, Inc.	Project: BNSF-Skykomish-1	
1011 SW Klickitat Way, Suite 207	Project Number: BN050-16423-522	**Reported:**
Seattle, WA 98134	Project Manager: Stephen Howard	10/02/05 15:29

Semivolatile Petroleum Products by NWTPH-Dx (w/o Acid/Silica Gel Clean-up) - Quality Control
North Creek Analytical - Bothell

Analyte	Result	MDL	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 5I20017: Prepared 09/20/05 Using EPA 3550B											
Blank (5I20017-BLK1)											
Diesel Range Hydrocarbons	ND	1.60	10.0	mg/kg							
Lube Oil Range Hydrocarbons	ND	3.19	25.0	"							
Surrogate: 2-FBP	*6.60*			"	*8.33*		*79.2 %*	*50-150*			
Surrogate: Octacosane	*8.27*			"	*8.33*		*99.3 %*	*50-150*			
LCS (5I20017-BS1)											
Diesel Range Hydrocarbons	59.8	1.60	10.0	mg/kg	66.7		89.7	71-120			
Surrogate: 2-FBP	*6.95*			"	*8.33*		*83.4 %*	*50-150*			
LCS Dup (5I20017-BSD1)											
Diesel Range Hydrocarbons	59.0	1.60	10.0	mg/kg	66.7		88.5	71-120	1.35	40	
Surrogate: 2-FBP	*7.05*			"	*8.33*		*84.6 %*	*50-150*			
Duplicate (5I20017-DUP1)						**Source: B5I0374-01**					
Diesel Range Hydrocarbons	ND	1.60	10.0	mg/kg dry		ND			NA	40	
Lube Oil Range Hydrocarbons	ND	3.19	25.0	"		ND			NA	40	
Surrogate: 2-FBP	*9.29*			"	*12.2*		*76.1 %*	*50-150*			
Surrogate: Octacosane	*11.6*			"	*12.2*		*95.1 %*	*50-150*			
Batch 5I20019: Prepared 09/20/05 Using EPA 3550B											
Blank (5I20019-BLK1)											
Diesel Range Hydrocarbons	ND	1.60	10.0	mg/kg							
Lube Oil Range Hydrocarbons	ND	3.19	25.0	"							
Surrogate: 2-FBP	*7.28*			"	*8.33*		*87.4 %*	*50-150*			
Surrogate: Octacosane	*7.28*			"	*8.33*		*87.4 %*	*50-150*			

The RETEC Group, Inc.	Project: BNSF-Skykomish-1	
1011 SW Klickitat Way, Suite 207	Project Number: BN050-16423-522	**Reported:**
Seattle, WA 98134	Project Manager: Stephen Howard	10/02/05 15:29

Semivolatile Petroleum Products by NWTPH-Dx (w/o Acid/Silica Gel Clean-up) - Quality Control
North Creek Analytical - Bothell

Analyte	Result	MDL	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 5I20019: Prepared 09/20/05 Using EPA 3550B											
LCS (5I20019-BS1)											
Diesel Range Hydrocarbons	59.0	1.60	10.0	mg/kg	66.7		88.5	71-120			
Surrogate: 2-FBP	*8.00*			*"*	*8.33*		*96.0 %*	*50-150*			
LCS Dup (5I20019-BSD1)											
Diesel Range Hydrocarbons	57.8	1.60	10.0	mg/kg	66.7		86.7	71-120	2.05	40	
Surrogate: 2-FBP	*7.91*			*"*	*8.33*		*95.0 %*	*50-150*			
Duplicate (5I20019-DUP1)						**Source: B5I0376-16**					
Diesel Range Hydrocarbons	ND	1.60	10.0	mg/kg dry		ND			NA	40	
Lube Oil Range Hydrocarbons	3.69	3.19	25.0	"		ND				40	J
Surrogate: 2-FBP	*8.12*			*"*	*9.23*		*88.0 %*	*50-150*			
Surrogate: Octacosane	*8.26*			*"*	*9.23*		*89.5 %*	*50-150*			
Batch 5I20021: Prepared 09/20/05 Using EPA 3550B											
Blank (5I20021-BLK1)											
Diesel Range Hydrocarbons	ND	1.60	10.0	mg/kg							
Lube Oil Range Hydrocarbons	ND	3.19	25.0	"							
Surrogate: 2-FBP	*6.49*			*"*	*8.33*		*77.9 %*	*50-150*			
Surrogate: Octacosane	*8.76*			*"*	*8.33*		*105 %*	*50-150*			
LCS (5I20021-BS1)											
Diesel Range Hydrocarbons	77.4	1.60	10.0	mg/kg	66.7		116	71-120			
Surrogate: 2-FBP	*9.39*			*"*	*8.33*		*113 %*	*50-150*			
LCS Dup (5I20021-BSD1)											
Diesel Range Hydrocarbons	68.4	1.60	10.0	mg/kg	66.7		103	71-120	12.3	40	
Surrogate: 2-FBP	*8.42*			*"*	*8.33*		*101 %*	*50-150*			

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Semivolatile Petroleum Products by NWTPH-Dx (w/o Acid/Silica Gel Clean-up) - Quality Control
North Creek Analytical - Bothell

Batch 5I20021: Prepared 09/20/05 Using EPA 3550B

Analyte	Result	MDL	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Duplicate (5I20021-DUP1)						**Source: B5I0376-36**					
Diesel Range Hydrocarbons	5.49	1.60	10.0	mg/kg dry		8.04			37.7	40	J
Lube Oil Range Hydrocarbons	27.3	3.19	25.0	"		35.4			25.8	40	
Surrogate: 2-FBP	*7.72*			"	*10.3*		*75.0 %*	*50-150*			
Surrogate: Octacosane	*9.38*			"	*10.3*		*91.1 %*	*50-150*			

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The RETEC Group, Inc.	Project: BNSF-Skykomish-1	
1011 SW Klickitat Way, Suite 207	Project Number: BN050-16423-522	**Reported:**
Seattle, WA 98134	Project Manager: Stephen Howard	10/02/05 15:29

Total Metals by EPA 6000/7000 Series Methods - Quality Control

North Creek Analytical - Bothell

Analyte	Result	MDL	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 5I20047: Prepared 09/20/05 Using EPA 3050B											
Blank (5I20047-BLK1)											
Lead	ND	0.0260	0.500	mg/kg							
LCS (5I20047-BS1)											
Lead	38.3	0.0260	0.500	mg/kg	39.2		97.7	80-120			
LCS Dup (5I20047-BSD1)											
Lead	35.9	0.0260	0.500	mg/kg	37.7		95.2	80-120	6.47	20	
Matrix Spike (5I20047-MS1)						**Source: B5I0423-01**					
Lead	33.3	0.0211	0.407	mg/kg dry	33.8	1.41	94.3	29-162			
Matrix Spike Dup (5I20047-MSD1)						**Source: B5I0423-01**					
Lead	38.2	0.0260	0.500	mg/kg dry	39.6	1.41	92.9	29-162	13.7	30	
Post Spike (5I20047-PS1)						**Source: B5I0423-01**					
Lead	0.0955			ug/ml	0.100	0.00269	92.8	75-125			

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Conventional Chemistry Parameters by APHA/EPA Methods - Quality Control
North Creek Analytical - Bothell

Analyte	Result	MDL	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 5I26053: Prepared 09/23/05 Using General Preparation											
Blank (5I26053-BLK1)											
Total Organic Carbon - Average	ND		500	mg/kg							
Total Organic Carbon - High	ND		500	"							
Total Organic Carbon - Low	ND		500	"							
LCS (5I26053-BS1)											
Total Organic Carbon - Average	33600		500	mg/kg	29900		112	70-130			
Total Organic Carbon - High	36000		500	"	29900		120	70-130			
Total Organic Carbon - Low	33700		500	"	29900		113	70-130			
LCS Dup (5I26053-BSD1)											
Total Organic Carbon - Average	31400		500	mg/kg	29900		105	70-130	6.77	30	
Total Organic Carbon - High	32900		500	"	29900		110	70-130	9.00	30	
Total Organic Carbon - Low	29000		500	"	29900		97.0	70-130	15.0	30	
Duplicate (5I26053-DUP1)						**Source: B5I0276-01**					
Total Organic Carbon - Average	7650		500	mg/kg dry		9580			22.4	200	
Total Organic Carbon - High	8650		500	"		11000			23.9	200	
Total Organic Carbon - Low	6890		500	"		7830			12.8	200	
Matrix Spike (5I26053-MS1)						**Source: B5I0376-16**					
Total Organic Carbon - Average	3130		500	mg/kg dry	1500	2100	68.7	70-130			Q-14
Batch 5I29044: Prepared 09/29/05 Using General Preparation											
Blank (5I29044-BLK1)											
Total Organic Carbon - Average	ND		500	mg/kg							
Total Organic Carbon - High	ND		500	"							
Total Organic Carbon - Low	ND		500	"							

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Conventional Chemistry Parameters by APHA/EPA Methods - Quality Control

North Creek Analytical - Bothell

Analyte	Result	MDL	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 5I29044: Prepared 08/18/05 Using General Preparation											
LCS (5I29044-BS1)											
Total Organic Carbon - Average	34100		500	mg/kg	29900		114	70-130			
Total Organic Carbon - High	35400		500	"	29900		118	70-130			
Total Organic Carbon - Low	33200		500	"	29900		111	70-130			
LCS Dup (5I29044-BSD1)											
Total Organic Carbon - Average	32000		500	mg/kg	29900		107	70-130	6.35	30	
Total Organic Carbon - High	32800		500	"	29900		110	70-130	7.62	30	
Total Organic Carbon - Low	30800		500	"	29900		103	70-130	7.50	30	
Duplicate (5I29044-DUP1)						**Source: B5I0376-17**					
Total Organic Carbon - Average	4080		500	mg/kg dry		4380			7.09	200	
Total Organic Carbon - High	4200		500	"		4780			12.9	200	
Total Organic Carbon - Low	3920		500	"		4010			2.27	200	
Matrix Spike (5I29044-MS1)						**Source: B5I0376-22**					
Total Organic Carbon - Average	4160		500	mg/kg dry	1870	2800	72.7	70-130			

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Physical Parameters by APHA/ASTM/EPA Methods - Quality Control

North Creek Analytical - Bothell

Analyte	Result	MDL	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 5I22046: Prepared 09/22/05 Using Dry Weight											
Blank (5I22046-BLK1)											
Dry Weight	99.8		1.00	%							
Batch 5I22047: Prepared 09/22/05 Using Dry Weight											
Blank (5I22047-BLK1)											
Dry Weight	100		1.00	%							
Batch 5I22048: Prepared 09/22/05 Using Dry Weight											
Blank (5I22048-BLK1)											
Dry Weight	99.8		1.00	%							

Notes and Definitions

D-06	The sample chromatographic pattern does not resemble the fuel standard used for quantitation.
D-09	Results in the diesel organics range are primarily due to overlap from a heavy oil range product.
D-15	Hydrocarbon pattern most closely resembles a heavy fuel oil range hydrocarbon product.
J	Estimated value.
Q-14	Visual examination indicates the RPD and/or matrix spike recovery is outside the control limit due to a non-homogeneous sample matrix.
DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference

Chain of Custody Record

№ 101108

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RETEC

Project Name: SkyKomish	Project Number: BN030-16423-522
Send Report To: Steve Howard	Sampler (Print Name): Jim Schneider
Address: See Above	Sampler (Print Name): Elly Leaverton
	Shipment Method:
	Airbill Number:
Phone: 206-624-9349	Laboratory Receiving: NCA
Fax: 206-624-2839	

Page 1 of 3

Purchase Order #:

Analysis Requested: NW TPH Dx

Field Sample ID	Sample Date	Sample Time	Sample Matrix	Number of Containers	NW TPH Dx	Comments, Special Instructions, etc.	Lab Sample ID (to be completed by lab)
LEV-2-19'	9-9	1118	Soil	1	X		B5I0376-01
LEV-1-18'-19'	9-9	1515	↓	↓	X		02
LEV-3-21'-25'	9-9	1930			X		03
S-B-9-22'	9-10	1050			X		04
S-B-7-20'-25'	9-10	1300			X		05
S-B-8-15'-20'	9-10	1945			X		06
S-B-12-30'-33'	9-11	1140			X		07
S-B-11-15'-20'	9-11	1341			X		08
LEV 5-35'-40'	9-11	1855			X		09
LEV 4-35'-39'	9-12	1035			X		10
RIV 2-0'-1'	9-12	1440			X		11
RIV3-5'-10'	9-12	1630			X		12
RIV4-15'-18'	9-12	1945			X		13
RIV-12-3'	9-13	1650			X		14
RIV-12-14'	9-13	1650			X		15
RIV-17-3'	9-14	1215			X		16
RIV-17-13'	9-14	1220			X		17

Relinquished by: (Signature)	Received by: (Signature)	Date:	Time:
E. Leaverton	Cathy Gamble	9/16/05	12:55
Relinquished by: (Signature)	Received by: (Signature)	Date:	Time:
Relinquished by: (Signature)	Received by: (Signature)	Date:	Time:

Sample Custodian Remarks (Completed By Laboratory):

QA/QC Level	Turnaround	Sample Receipt	
Level I ☐	Routine ☐	Total # Containers Received?	
Level II ☐	24 Hour ☐	COC Seals Present?	
Level III ☐	1 Week ☐	COC Seals Intact?	
Other ☐	Other ____	Received Containers Intact?	
		Temperature?	

White: Lab Copy Yellow: PM Copy Pink: Field Copy Gold: PM/QA/QC Copy

Chain of Custody Record

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RETEC

Project Name: SkyKomish	Project Number: BN050-16423-522	Analysis Requested: NW TPH Dx	Page 2 of 3
Send Report To: Steve Howard	Sampler (Print Name): Jim Schneider		
Address: See Above	Sampler (Print Name): Elly Leaverton		
	Shipment Method:		
	Airbill Number:		Purchase Order #:
Phone: 206-624-9349	Laboratory Receiving: NCA		
Fax: 206-624-2839			

Field Sample ID	Sample Date	Sample Time	Sample Matrix	Number of Containers	NW TPH Dx	Comments, Special Instructions, etc.	Lab Sample ID (to be completed by lab)
RIV-5-0'-3'	9-14	1620	Soil	1	X		B5I0376-18
RIV-6-0'-3'	↓	1625	↓	↓	X		19
RIV-7-0'-5'		1630			X		20
RIV-8-0'-2'		1635			X		21
RIV-20-3'		1635			X		22
RIV-9-0'-5'		1640			X		23
RIV-10-10'-12'		1645			X		24
RIV-20-13'		1645			X		25
RIV-11-5'-10'		1850			X		26
RIV-12-0'-5'		1855			X		27
LEV-6-47'		1900			X		28
RIV-13-3'		2000			X		29
RIV-14-1'		2005			X		30
RIV-15-1'		2010			X		31
RIV-16-1'		2015			X		32
RIV-17-1'		2020			X		33
RIV-18-1'		2025			X		34

Relinquished by: (Signature)	Received by: (Signature)	Date:	Time:
E Leaverton	Cathy Gamble	9/16	12:55
Relinquished by: (Signature)	Received by: (Signature)	Date:	Time:
Relinquished by: (Signature)	Received by: (Signature)	Date:	Time:

Sample Custodian Remarks (Completed By Laboratory):

QA/QC Level	Turnaround	Sample Receipt	
Level I ☐	Routine ☐	Total # Containers Received?	
Level II ☐	24 Hour ☐	COC Seals Present?	
Level III ☐	1 Week ☐	COC Seals Intact?	
Other ☐	Other ______	Received Containers Intact?	
		Temperature?	

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Chain of Custody Record

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RETEC

Page 3 of 3

Project Name: Skykomish	Project Number: BN050-16423-522
Send Report To: Steve Howard	Sampler (Print Name): Jim Schneider
Address:	Sampler (Print Name): Elly Leaverton
See Above	Shipment Method:
	Airbill Number:
Phone: 206-624-9349	Laboratory Receiving: NCA
Fax: 206-624-2839	

Analysis Requested

Purchase Order #:

Field Sample ID	Sample Date	Sample Time	Sample Matrix	Number of Containers	NW TPH Dx	Lead	TOC									Comments, Special Instructions, etc.	Lab Sample ID (to be completed by lab)
RIV-19-1'	9-14	2030	Soil	1	X												B5I0376-35
RIV-20-1'	9-14	2040			X												36
LEV8-35'	9-15	1635			X												37
LEV9-23'	9-15	1930			X												38
5-B-11-2'-4'	9-11	1400	Soil	1		X										4oz jars	39
5-B-11-0'-1'	9-11	1416				X											40
RIV-12-3'	9-13	1650					X										14
RIV-12-14'	9-13	1650					X										15
RIV-17-3'	9-14	1215					X										16
RIV-17-13'	9-14	1220					X										17
RIV-20-3'	9-14	1635					X										22
RIV-20-13'	9-14	1645					X										25
LEV5B-39	9-16	1050	soil	1	X												41
LEV5B-43	9-16	1055			X												42
~~LEV5B-46~~	~~9-16~~	~~1100~~			~~X~~											cancel + discard	

Relinquished by: (Signature)	Received by: (Signature)	Date:	Time:
E Leaverton	Cathy Gamble	9/16	12:55
Relinquished by: (Signature)	Received by: (Signature)	Date:	Time:
Relinquished by: (Signature)	Received by: (Signature)	Date:	Time:

Sample Custodian Remarks (Completed By Laboratory):

QA/QC Level	Turnaround	Sample Receipt	
Level I ☐	Routine ☐	Total # Containers Received?	
Level II ☐	24 Hour ☐	COC Seals Present?	
Level III ☐	1 Week ☐	COC Seals Intact?	
Other ☐	Other ______	Received Containers Intact?	
		Temperature?	

White: Lab Copy Yellow: PM Copy Pink: Field Copy Gold: PM/QA/QC Copy

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CASE NARRATIVE FOR B5L0547

Client: The RETEC Group, Inc
Project Manager: Stephen Howard
Project Name: BNSF – Skykomish
Project Number: BN050-16423-522

1.0 DESCRIPTION OF CASE

Eighty soil samples were submitted for the analysis of:

- Semivolatile Petroleum Products by NWTPH-Dx (w/o Acid/Silica Gel Clean-up)
- Conventional Chemistry Parameters by APHA/EPA Methods

2.0 COMMENTS ON SAMPLE RECEIPT

The samples were received December 22, 2005 by North Creek Analytical Bothell. The temperature of the samples at the time of receipt was 3.5 degrees Celsius. Duplicate samples B5L0547-73 through B5L0547-80 were added December 29, 2005 for Semivolatile Petroleum Products by NWTPH-Dx (w/o Acid/Silica Gel Clean-up) analysis per the revised COC.

3.0 PREPARATIONS AND ANALYSIS

Semivolatile Petroleum Products by NWTPH-Dx (w/o Acid/Silica Gel Clean-up)

For laboratory batches 5L22069, 5L23010 and 5L27049, the spike recovery of diesel range hydrocarbons in the batch blank spike and/or blank spike duplicate was above the laboratory established control limits of 71-120. It was determined that the spike had concentrated and as a result, the blank spike and blank spike duplicates were high due to the incorrect calculated amount of spike added to the spiked samples. A virtual spike (BS2/BSD2) was created with the correct concentration of diesel range hydrocarbons and uploaded for each diesel range hydrocarbon batch (5L22068, 5L22069, 5L23010 and 5L27049) with passing spike recoveries for diesel range hydrocarbons. The blank spikes were qualified and reported.

No additional anomalies, discrepancies, or issues were associated with sample preparation, analysis and quality control other than those already qualified in the data and described in the Notes and Definitions page at the end of the report.

Conventional Chemistry Parameters by APHA/EPA Methods

No additional anomalies, discrepancies, or issues were associated with sample preparation, analysis and quality control other than those already qualified in the data and described in the Notes and Definitions page at the end of the report.

Kate Haney

Kate Haney
Project Manager
North Creek Analytical

www.ncalabs.com

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10 January 2006

Stephen Howard
The RETEC Group, Inc.
1011 SW Klickitat Way, Suite 207
Seattle, WA 98134

RE: BNSF-Skykomish

Enclosed are the results of analyses for samples received by the laboratory on 12/22/05 16:55. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Kate Haney

Kate Haney
Project Manager

The RETEC Group, Inc.	Project: BNSF-Skykomish	
1011 SW Klickitat Way, Suite 207	Project Number: BN050-16423-522	**Reported:**
Seattle, WA 98134	Project Manager: Stephen Howard	01/10/06 17:50

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
LEV8A-10'	B5L0547-01	Soil	12/19/05 16:30	12/22/05 16:55
LEV8A-15'	B5L0547-02	Soil	12/19/05 16:30	12/22/05 16:55
LEV8A-17.5'	B5L0547-03	Soil	12/19/05 16:30	12/22/05 16:55
LEV8A-20'	B5L0547-04	Soil	12/19/05 16:30	12/22/05 16:55
LEV8A-25'	B5L0547-05	Soil	12/19/05 16:30	12/22/05 16:55
LEV8A-30'	B5L0547-06	Soil	12/19/05 16:30	12/22/05 16:55
LEV8A-32.5'	B5L0547-07	Soil	12/19/05 16:30	12/22/05 16:55
LEV8A-35'	B5L0547-08	Soil	12/19/05 16:30	12/22/05 16:55
LEV8B-10'	B5L0547-09	Soil	12/20/05 11:30	12/22/05 16:55
LEV8B-15'	B5L0547-10	Soil	12/20/05 11:30	12/22/05 16:55
LEV8B-17.5'	B5L0547-11	Soil	12/20/05 11:30	12/22/05 16:55
LEV8B-20'	B5L0547-12	Soil	12/20/05 11:30	12/22/05 16:55
LEV8B-22.5'	B5L0547-13	Soil	12/20/05 11:30	12/22/05 16:55
LEV8B-25'	B5L0547-14	Soil	12/20/05 11:30	12/22/05 16:55
LEV8B-27.5'	B5L0547-15	Soil	12/20/05 11:30	12/22/05 16:55
LEV8B-30'	B5L0547-16	Soil	12/20/05 11:30	12/22/05 16:55
LEV8B-32.5'	B5L0547-17	Soil	12/20/05 11:30	12/22/05 16:55
LEV8B-35'	B5L0547-18	Soil	12/20/05 11:30	12/22/05 16:55
LEV7A-10'	B5L0547-19	Soil	12/20/05 16:00	12/22/05 16:55
LEV7A-15'	B5L0547-20	Soil	12/20/05 16:00	12/22/05 16:55
LEV7A-17.5'	B5L0547-21	Soil	12/20/05 16:00	12/22/05 16:55
LEV7A-20'	B5L0547-22	Soil	12/20/05 16:00	12/22/05 16:55
LEV7A-22.5'	B5L0547-23	Soil	12/20/05 16:00	12/22/05 16:55
LEV7A-25'	B5L0547-24	Soil	12/20/05 16:00	12/22/05 16:55
LEV7A-27.5'	B5L0547-25	Soil	12/20/05 16:00	12/22/05 16:55
LEV7A-30'	B5L0547-26	Soil	12/20/05 16:00	12/22/05 16:55
LEV7A-32.5'	B5L0547-27	Soil	12/20/05 16:00	12/22/05 16:55
LEV7A-35'	B5L0547-28	Soil	12/20/05 16:00	12/22/05 16:55
LEV6A-10'	B5L0547-29	Soil	12/21/05 10:30	12/22/05 16:55

North Creek Analytical - Bothell

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Kate Haney, Project Manager

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The RETEC Group, Inc.	Project: BNSF-Skykomish	
1011 SW Klickitat Way, Suite 207	Project Number: BN050-16423-522	**Reported:**
Seattle, WA 98134	Project Manager: Stephen Howard	01/10/06 17:50

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
LEV6A-15'	B5L0547-30	Soil	12/21/05 10:30	12/22/05 16:55
LEV6A-17.5'	B5L0547-31	Soil	12/21/05 10:30	12/22/05 16:55
LEV6A-20'	B5L0547-32	Soil	12/21/05 10:30	12/22/05 16:55
LEV6A-22.5'	B5L0547-33	Soil	12/21/05 10:30	12/22/05 16:55
LEV6A-25'	B5L0547-34	Soil	12/21/05 10:30	12/22/05 16:55
LEV6A-27.5'	B5L0547-35	Soil	12/21/05 10:30	12/22/05 16:55
LEV6A-30'	B5L0547-36	Soil	12/21/05 10:30	12/22/05 16:55
LEV6A-32.5'	B5L0547-37	Soil	12/21/05 10:30	12/22/05 16:55
LEV6A-35'	B5L0547-38	Soil	12/21/05 10:30	12/22/05 16:55
LEV6A-37.5'	B5L0547-39	Soil	12/21/05 10:30	12/22/05 16:55
LEV6A-40'	B5L0547-40	Soil	12/21/05 10:30	12/22/05 16:55
LEV6A-42.5'	B5L0547-41	Soil	12/21/05 10:30	12/22/05 16:55
LEV6A-45'	B5L0547-42	Soil	12/21/05 10:30	12/22/05 16:55
LEV5C-10'	B5L0547-43	Soil	12/21/05 14:30	12/22/05 16:55
LEV5C-15'	B5L0547-44	Soil	12/21/05 14:30	12/22/05 16:55
LEV5C-17.5'	B5L0547-45	Soil	12/21/05 14:30	12/22/05 16:55
LEV5C-20'	B5L0547-46	Soil	12/21/05 14:30	12/22/05 16:55
LEV5C-22.5'	B5L0547-47	Soil	12/21/05 14:30	12/22/05 16:55
LEV5C-25'	B5L0547-48	Soil	12/21/05 14:30	12/22/05 16:55
LEV5C-27.5'	B5L0547-49	Soil	12/21/05 14:30	12/22/05 16:55
LEV5C-30'	B5L0547-50	Soil	12/21/05 14:30	12/22/05 16:55
LEV5C-32.5'	B5L0547-51	Soil	12/21/05 14:30	12/22/05 16:55
LEV5C-35'	B5L0547-52	Soil	12/21/05 14:30	12/22/05 16:55
LEV4A-10'	B5L0547-53	Soil	12/22/05 10:15	12/22/05 16:55
LEV4A-15'	B5L0547-54	Soil	12/22/05 10:15	12/22/05 16:55
LEV4A-17.5'	B5L0547-55	Soil	12/22/05 10:15	12/22/05 16:55
LEV4A-20'	B5L0547-56	Soil	12/22/05 10:15	12/22/05 16:55
LEV4A-22.5'	B5L0547-57	Soil	12/22/05 10:15	12/22/05 16:55
LEV4A-25'	B5L0547-58	Soil	12/22/05 10:15	12/22/05 16:55

North Creek Analytical - Bothell

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ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
LEV4A-27.5'	B5L0547-59	Soil	12/22/05 10:15	12/22/05 16:55
LEV4A-30'	B5L0547-60	Soil	12/22/05 10:15	12/22/05 16:55
LEV4A-32.5'	B5L0547-61	Soil	12/22/05 10:15	12/22/05 16:55
LEV4A-35'	B5L0547-62	Soil	12/22/05 10:15	12/22/05 16:55
LEV2A-10'	B5L0547-63	Soil	12/22/05 13:15	12/22/05 16:55
LEV2A-15'	B5L0547-64	Soil	12/22/05 13:15	12/22/05 16:55
LEV2A-17.5'	B5L0547-65	Soil	12/22/05 13:15	12/22/05 16:55
LEV2A-20'	B5L0547-66	Soil	12/22/05 13:15	12/22/05 16:55
LEV2A-22.5'	B5L0547-67	Soil	12/22/05 13:15	12/22/05 16:55
LEV2A-25'	B5L0547-68	Soil	12/22/05 13:15	12/22/05 16:55
LEV2A-30'	B5L0547-69	Soil	12/22/05 13:15	12/22/05 16:55
LEV2A-32.5'	B5L0547-70	Soil	12/22/05 13:15	12/22/05 16:55
LEV2A-35'	B5L0547-71	Soil	12/22/05 13:15	12/22/05 16:55
LEV2A-37.5'	B5L0547-72	Soil	12/22/05 13:15	12/22/05 16:55
LEV2A-40'	B5L0547-73	Soil	12/22/05 13:15	12/22/05 16:55
LEV8A-17.5' DUP	B5L0547-74	Soil	12/19/05 16:30	12/22/05 16:55
LEV8B-20' DUP	B5L0547-75	Soil	12/20/05 11:30	12/22/05 16:55
LEV7A-20' DUP	B5L0547-76	Soil	12/20/05 16:00	12/22/05 16:55
LEV6A-20' DUP	B5L0547-77	Soil	12/21/05 10:30	12/22/05 16:55
LEV5C-22.5' DUP	B5L0547-78	Soil	12/21/05 14:30	12/22/05 16:55
LEV4A-15' DUP	B5L0547-79	Soil	12/22/05 10:15	12/22/05 16:55
LEV2A-22.5' DUP	B5L0547-80	Soil	12/22/05 13:15	12/22/05 16:55

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The RETEC Group, Inc.	Project: BNSF-Skykomish	
1011 SW Klickitat Way, Suite 207	Project Number: BN050-16423-522	Reported:
Seattle, WA 98134	Project Manager: Stephen Howard	01/10/06 17:50

Semivolatile Petroleum Products by NWTPH-Dx (w/o Acid/Silica Gel Clean-up)

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
LEV8A-10' (B5L0547-01) Soil Sampled: 12/19/05 16:30 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	ND	11.3	mg/kg dry	1	5L22068	12/22/05	12/23/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	ND	28.2	"	"	"	"	"	"	
Surrogate: 2-FBP	*92.0 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*105 %*	*50-150*			"	"	"	"	
LEV8A-15' (B5L0547-02) Soil Sampled: 12/19/05 16:30 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	**47.2**	11.0	mg/kg dry	1	5L22068	12/22/05	12/23/05	NWTPH-Dx	D-15
Lube Oil Range Hydrocarbons	**54.9**	27.4	"	"	"	"	"	"	D-15
Surrogate: 2-FBP	*94.9 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*107 %*	*50-150*			"	"	"	"	
LEV8A-17.5' (B5L0547-03) Soil Sampled: 12/19/05 16:30 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	**879**	109	mg/kg dry	10	5L22068	12/22/05	12/23/05	NWTPH-Dx	D-15
Lube Oil Range Hydrocarbons	**866**	272	"	"	"	"	"	"	D-15
Surrogate: 2-FBP	*86.5 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*111 %*	*50-150*			"	"	"	"	
LEV8A-20' (B5L0547-04) Soil Sampled: 12/19/05 16:30 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	**3070**	221	mg/kg dry	10	5L22068	12/22/05	12/23/05	NWTPH-Dx	D-15
Lube Oil Range Hydrocarbons	**2540**	553	"	"	"	"	"	"	D-15
Surrogate: 2-FBP	*101 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*120 %*	*50-150*			"	"	"	"	
LEV8A-25' (B5L0547-05) Soil Sampled: 12/19/05 16:30 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	**60.2**	11.5	mg/kg dry	1	5L22068	12/22/05	12/23/05	NWTPH-Dx	D-15
Lube Oil Range Hydrocarbons	**54.4**	28.8	"	"	"	"	"	"	D-15
Surrogate: 2-FBP	*97.6 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*109 %*	*50-150*			"	"	"	"	

The RETEC Group, Inc.	Project: BNSF-Skykomish	
1011 SW Klickitat Way, Suite 207	Project Number: BN050-16423-522	**Reported:**
Seattle, WA 98134	Project Manager: Stephen Howard	01/10/06 17:50

Semivolatile Petroleum Products by NWTPH-Dx (w/o Acid/Silica Gel Clean-up)

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
LEV8A-30' (B5L0547-06) Soil Sampled: 12/19/05 16:30 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	**18.1**	11.5	mg/kg dry	1	5L22068	12/22/05	12/23/05	NWTPH-Dx	D-06
Lube Oil Range Hydrocarbons	ND	28.8	"	"	"	"	"	"	
Surrogate: 2-FBP	*94.3 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*108 %*	*50-150*			"	"	"	"	
LEV8A-32.5' (B5L0547-07) Soil Sampled: 12/19/05 16:30 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	ND	11.7	mg/kg dry	1	5L22068	12/22/05	12/23/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	ND	29.2	"	"	"	"	"	"	
Surrogate: 2-FBP	*93.6 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*108 %*	*50-150*			"	"	"	"	
LEV8A-35' (B5L0547-08) Soil Sampled: 12/19/05 16:30 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	**35.0**	11.9	mg/kg dry	1	5L22068	12/22/05	12/23/05	NWTPH-Dx	D-15
Lube Oil Range Hydrocarbons	**30.0**	29.8	"	"	"	"	"	"	D-15
Surrogate: 2-FBP	*98.1 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*111 %*	*50-150*			"	"	"	"	
LEV8B-10' (B5L0547-09) Soil Sampled: 12/20/05 11:30 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	**48.6**	10.6	mg/kg dry	1	5L22068	12/22/05	12/23/05	NWTPH-Dx	D-09
Lube Oil Range Hydrocarbons	**107**	26.6	"	"	"	"	"	"	
Surrogate: 2-FBP	*99.1 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*112 %*	*50-150*			"	"	"	"	
LEV8B-15' (B5L0547-10) Soil Sampled: 12/20/05 11:30 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	**1320**	113	mg/kg dry	10	5L22068	12/22/05	12/23/05	NWTPH-Dx	D-15
Lube Oil Range Hydrocarbons	**1420**	282	"	"	"	"	"	"	D-15
Surrogate: 2-FBP	*83.6 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*113 %*	*50-150*			"	"	"	"	

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The RETEC Group, Inc.	Project: BNSF-Skykomish	
1011 SW Klickitat Way, Suite 207	Project Number: BN050-16423-522	**Reported:**
Seattle, WA 98134	Project Manager: Stephen Howard	01/10/06 17:50

Semivolatile Petroleum Products by NWTPH-Dx (w/o Acid/Silica Gel Clean-up)
North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
LEV8B-17.5' (B5L0547-11) Soil Sampled: 12/20/05 11:30 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	**3140**	225	mg/kg dry	10	5L22068	12/22/05	12/23/05	NWTPH-Dx	D-15
Lube Oil Range Hydrocarbons	**2660**	564	"	"	"	"	"	"	D-15
Surrogate: 2-FBP	*92.6 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*114 %*	*50-150*			"	"	"	"	
LEV8B-20' (B5L0547-12) Soil Sampled: 12/20/05 11:30 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	**11.9**	10.8	mg/kg dry	1	5L22068	12/22/05	12/23/05	NWTPH-Dx	D-06
Lube Oil Range Hydrocarbons	ND	27.0	"	"	"	"	"	"	
Surrogate: 2-FBP	*96.6 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*111 %*	*50-150*			"	"	"	"	
LEV8B-22.5' (B5L0547-13) Soil Sampled: 12/20/05 11:30 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	ND	13.3	mg/kg dry	1	5L22068	12/22/05	12/23/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	ND	33.2	"	"	"	"	"	"	
Surrogate: 2-FBP	*96.4 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*110 %*	*50-150*			"	"	"	"	
LEV8B-25' (B5L0547-14) Soil Sampled: 12/20/05 11:30 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	ND	12.7	mg/kg dry	1	5L22068	12/22/05	12/23/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	ND	31.7	"	"	"	"	"	"	
Surrogate: 2-FBP	*97.2 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*113 %*	*50-150*			"	"	"	"	
LEV8B-27.5' (B5L0547-15) Soil Sampled: 12/20/05 11:30 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	**12.9**	11.3	mg/kg dry	1	5L22068	12/22/05	12/23/05	NWTPH-Dx	D-06
Lube Oil Range Hydrocarbons	ND	28.3	"	"	"	"	"	"	
Surrogate: 2-FBP	*97.6 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*112 %*	*50-150*			"	"	"	"	

North Creek Analytical - Bothell

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Semivolatile Petroleum Products by NWTPH-Dx (w/o Acid/Silica Gel Clean-up)

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
LEV8B-30' (B5L0547-16) Soil Sampled: 12/20/05 11:30 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	ND	12.8	mg/kg dry	1	5L22068	12/22/05	12/23/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	ND	32.0	"	"	"	"	"	"	
Surrogate: 2-FBP	*98.1 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*111 %*	*50-150*			"	"	"	"	
LEV8B-32.5' (B5L0547-17) Soil Sampled: 12/20/05 11:30 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	ND	13.2	mg/kg dry	1	5L22068	12/22/05	12/24/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	ND	32.9	"	"	"	"	"	"	
Surrogate: 2-FBP	*95.5 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*110 %*	*50-150*			"	"	"	"	
LEV8B-35' (B5L0547-18) Soil Sampled: 12/20/05 11:30 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	ND	12.4	mg/kg dry	1	5L22068	12/22/05	12/24/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	ND	31.0	"	"	"	"	"	"	
Surrogate: 2-FBP	*95.2 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*110 %*	*50-150*			"	"	"	"	
LEV7A-10' (B5L0547-19) Soil Sampled: 12/20/05 16:00 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	**963**	105	mg/kg dry	10	5L22068	12/22/05	12/24/05	NWTPH-Dx	D-09
Lube Oil Range Hydrocarbons	**2270**	262	"	"	"	"	"	"	
Surrogate: 2-FBP	*90.2 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*109 %*	*50-150*			"	"	"	"	
LEV7A-15' (B5L0547-20) Soil Sampled: 12/20/05 16:00 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	**2080**	114	mg/kg dry	10	5L22068	12/22/05	12/24/05	NWTPH-Dx	D-15
Lube Oil Range Hydrocarbons	**2490**	284	"	"	"	"	"	"	D-15
Surrogate: 2-FBP	*96.3 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*124 %*	*50-150*			"	"	"	"	

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The RETEC Group, Inc.	Project: BNSF-Skykomish	
1011 SW Klickitat Way, Suite 207	Project Number: BN050-16423-522	**Reported:**
Seattle, WA 98134	Project Manager: Stephen Howard	01/10/06 17:50

Semivolatile Petroleum Products by NWTPH-Dx (w/o Acid/Silica Gel Clean-up)

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
LEV7A-17.5' (B5L0547-21) Soil Sampled: 12/20/05 16:00 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	**1770**	120	mg/kg dry	10	5L22069	12/22/05	12/27/05	NWTPH-Dx	D-15
Lube Oil Range Hydrocarbons	**1440**	300	"	"	"	"	"	"	D-15
Surrogate: 2-FBP	*87.5 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*112 %*	*50-150*			"	"	"	"	
LEV7A-20' (B5L0547-22) Soil Sampled: 12/20/05 16:00 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	ND	13.8	mg/kg dry	1	5L22069	12/22/05	12/27/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	ND	34.4	"	"	"	"	"	"	
Surrogate: 2-FBP	*87.8 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*105 %*	*50-150*			"	"	"	"	
LEV7A-22.5' (B5L0547-23) Soil Sampled: 12/20/05 16:00 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	**17.4**	12.5	mg/kg dry	1	5L22069	12/22/05	12/27/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	ND	31.3	"	"	"	"	"	"	
Surrogate: 2-FBP	*100 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*119 %*	*50-150*			"	"	"	"	
LEV7A-25' (B5L0547-24) Soil Sampled: 12/20/05 16:00 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	ND	13.2	mg/kg dry	1	5L22069	12/22/05	12/27/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	ND	33.1	"	"	"	"	"	"	
Surrogate: 2-FBP	*91.8 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*110 %*	*50-150*			"	"	"	"	
LEV7A-27.5' (B5L0547-25) Soil Sampled: 12/20/05 16:00 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	ND	14.3	mg/kg dry	1	5L22069	12/22/05	12/27/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	ND	35.7	"	"	"	"	"	"	
Surrogate: 2-FBP	*97.5 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*117 %*	*50-150*			"	"	"	"	

North Creek Analytical - Bothell

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The RETEC Group, Inc.	Project: BNSF-Skykomish	
1011 SW Klickitat Way, Suite 207	Project Number: BN050-16423-522	**Reported:**
Seattle, WA 98134	Project Manager: Stephen Howard	01/10/06 17:50

Semivolatile Petroleum Products by NWTPH-Dx (w/o Acid/Silica Gel Clean-up)
North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
LEV7A-30' (B5L0547-26) Soil Sampled: 12/20/05 16:00 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	**129**	13.3	mg/kg dry	1	5L22069	12/22/05	12/27/05	NWTPH-Dx	D-15
Lube Oil Range Hydrocarbons	**130**	33.2	"	"	"	"	"	"	D-15
Surrogate: 2-FBP	*95.5 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*109 %*	*50-150*			"	"	"	"	
LEV7A-32.5' (B5L0547-27) Soil Sampled: 12/20/05 16:00 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	ND	13.9	mg/kg dry	1	5L22069	12/22/05	12/27/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	ND	34.7	"	"	"	"	"	"	
Surrogate: 2-FBP	*89.7 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*112 %*	*50-150*			"	"	"	"	
LEV7A-35' (B5L0547-28) Soil Sampled: 12/20/05 16:00 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	ND	12.7	mg/kg dry	1	5L22069	12/22/05	12/27/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	ND	31.8	"	"	"	"	"	"	
Surrogate: 2-FBP	*99.1 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*120 %*	*50-150*			"	"	"	"	
LEV6A-10' (B5L0547-29) Soil Sampled: 12/21/05 10:30 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	ND	10.9	mg/kg dry	1	5L22069	12/22/05	12/27/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	ND	27.2	"	"	"	"	"	"	
Surrogate: 2-FBP	*103 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*121 %*	*50-150*			"	"	"	"	
LEV6A-15' (B5L0547-30) Soil Sampled: 12/21/05 10:30 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	**33.5**	11.2	mg/kg dry	1	5L22069	12/22/05	12/27/05	NWTPH-Dx	D-09
Lube Oil Range Hydrocarbons	**75.8**	28.0	"	"	"	"	"	"	
Surrogate: 2-FBP	*91.3 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*107 %*	*50-150*			"	"	"	"	

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The RETEC Group, Inc.	Project: BNSF-Skykomish	
1011 SW Klickitat Way, Suite 207	Project Number: BN050-16423-522	**Reported:**
Seattle, WA 98134	Project Manager: Stephen Howard	01/10/06 17:50

Semivolatile Petroleum Products by NWTPH-Dx (w/o Acid/Silica Gel Clean-up)

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
LEV6A-17.5' (B5L0547-31) Soil Sampled: 12/21/05 10:30 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	ND	11.3	mg/kg dry	1	5L22069	12/22/05	12/27/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	ND	28.4	"	"	"	"	"	"	
Surrogate: 2-FBP	*93.5 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*111 %*	*50-150*			"	"	"	"	
LEV6A-20' (B5L0547-32) Soil Sampled: 12/21/05 10:30 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	ND	14.6	mg/kg dry	1	5L22069	12/22/05	12/27/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	ND	36.4	"	"	"	"	"	"	
Surrogate: 2-FBP	*102 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*121 %*	*50-150*			"	"	"	"	
LEV6A-22.5' (B5L0547-33) Soil Sampled: 12/21/05 10:30 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	ND	13.7	mg/kg dry	1	5L22069	12/22/05	12/27/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	ND	34.3	"	"	"	"	"	"	
Surrogate: 2-FBP	*104 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*122 %*	*50-150*			"	"	"	"	
LEV6A-25' (B5L0547-34) Soil Sampled: 12/21/05 10:30 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	ND	14.3	mg/kg dry	1	5L22069	12/22/05	12/27/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	ND	35.8	"	"	"	"	"	"	
Surrogate: 2-FBP	*89.1 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*110 %*	*50-150*			"	"	"	"	
LEV6A-27.5' (B5L0547-35) Soil Sampled: 12/21/05 10:30 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	ND	13.3	mg/kg dry	1	5L22069	12/22/05	12/27/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	ND	33.4	"	"	"	"	"	"	
Surrogate: 2-FBP	*86.8 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*105 %*	*50-150*			"	"	"	"	

North Creek Analytical - Bothell

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The RETEC Group, Inc.	Project: BNSF-Skykomish	
1011 SW Klickitat Way, Suite 207	Project Number: BN050-16423-522	Reported:
Seattle, WA 98134	Project Manager: Stephen Howard	01/10/06 17:50

Semivolatile Petroleum Products by NWTPH-Dx (w/o Acid/Silica Gel Clean-up)

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
LEV6A-30' (B5L0547-36) Soil Sampled: 12/21/05 10:30 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	ND	13.9	mg/kg dry	1	5L22069	12/22/05	12/27/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	ND	34.8	"	"	"	"	"	"	
Surrogate: 2-FBP	*96.6 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*115 %*	*50-150*			"	"	"	"	
LEV6A-32.5' (B5L0547-37) Soil Sampled: 12/21/05 10:30 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	ND	10.9	mg/kg dry	1	5L22069	12/22/05	12/28/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	ND	27.3	"	"	"	"	"	"	
Surrogate: 2-FBP	*88.1 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*106 %*	*50-150*			"	"	"	"	
LEV6A-35' (B5L0547-38) Soil Sampled: 12/21/05 10:30 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	ND	10.4	mg/kg dry	1	5L22069	12/22/05	12/28/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	ND	26.0	"	"	"	"	"	"	
Surrogate: 2-FBP	*92.6 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*111 %*	*50-150*			"	"	"	"	
LEV6A-37.5' (B5L0547-39) Soil Sampled: 12/21/05 10:30 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	ND	11.0	mg/kg dry	1	5L22069	12/22/05	12/28/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	ND	27.5	"	"	"	"	"	"	
Surrogate: 2-FBP	*100 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*118 %*	*50-150*			"	"	"	"	
LEV6A-40' (B5L0547-40) Soil Sampled: 12/21/05 10:30 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	ND	10.8	mg/kg dry	1	5L22069	12/22/05	12/28/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	ND	27.0	"	"	"	"	"	"	
Surrogate: 2-FBP	*91.9 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*112 %*	*50-150*			"	"	"	"	

North Creek Analytical - Bothell

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The RETEC Group, Inc.	Project: BNSF-Skykomish	
1011 SW Klickitat Way, Suite 207	Project Number: BN050-16423-522	Reported:
Seattle, WA 98134	Project Manager: Stephen Howard	01/10/06 17:50

Semivolatile Petroleum Products by NWTPH-Dx (w/o Acid/Silica Gel Clean-up)

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
LEV6A-42.5' (B5L0547-41) Soil Sampled: 12/21/05 10:30 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	ND	10.8	mg/kg dry	1	5L23010	12/23/05	12/28/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	ND	26.9	"	"	"	"	"	"	
Surrogate: 2-FBP	*83.3 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*102 %*	*50-150*			"	"	"	"	
LEV6A-45' (B5L0547-42) Soil Sampled: 12/21/05 10:30 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	ND	10.6	mg/kg dry	1	5L23010	12/23/05	12/28/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	ND	26.4	"	"	"	"	"	"	
Surrogate: 2-FBP	*86.4 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*107 %*	*50-150*			"	"	"	"	
LEV5C-10' (B5L0547-43) Soil Sampled: 12/21/05 14:30 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	ND	10.8	mg/kg dry	1	5L23010	12/23/05	12/28/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	ND	27.0	"	"	"	"	"	"	
Surrogate: 2-FBP	*88.8 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*106 %*	*50-150*			"	"	"	"	
LEV5C-15' (B5L0547-44) Soil Sampled: 12/21/05 14:30 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	**18900**	1040	mg/kg dry	50	5L23010	12/23/05	12/28/05	NWTPH-Dx	D-15
Lube Oil Range Hydrocarbons	**14600**	2600	"	"	"	"	"	"	D-15
Surrogate: 2-FBP	*ND*	*50-150*			"	"	"	"	*S-01*
Surrogate: Octacosane	*ND*	*50-150*			"	"	"	"	*S-01*
LEV5C-17.5' (B5L0547-45) Soil Sampled: 12/21/05 14:30 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	**4620**	246	mg/kg dry	10	5L23010	12/23/05	12/28/05	NWTPH-Dx	D-15
Lube Oil Range Hydrocarbons	**3910**	615	"	"	"	"	"	"	D-15
Surrogate: 2-FBP	*88.8 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*115 %*	*50-150*			"	"	"	"	

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1011 SW Klickitat Way, Suite 207	Project Number: BN050-16423-522	**Reported:**
Seattle, WA 98134	Project Manager: Stephen Howard	01/10/06 17:50

Semivolatile Petroleum Products by NWTPH-Dx (w/o Acid/Silica Gel Clean-up)

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
LEV5C-20' (B5L0547-46) Soil Sampled: 12/21/05 14:30 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	**9740**	348	mg/kg dry	10	5L23010	12/23/05	12/28/05	NWTPH-Dx	D-15
Lube Oil Range Hydrocarbons	**8290**	871	"	"	"	"	"	"	D-15
Surrogate: 2-FBP	*96.9 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*120 %*	*50-150*			"	"	"	"	
LEV5C-22.5' (B5L0547-47) Soil Sampled: 12/21/05 14:30 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	**124**	10.8	mg/kg dry	1	5L23010	12/23/05	12/28/05	NWTPH-Dx	D-15
Lube Oil Range Hydrocarbons	**118**	27.0	"	"	"	"	"	"	D-15
Surrogate: 2-FBP	*92.4 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*107 %*	*50-150*			"	"	"	"	
LEV5C-25' (B5L0547-48) Soil Sampled: 12/21/05 14:30 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	ND	12.7	mg/kg dry	1	5L23010	12/23/05	12/28/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	ND	31.7	"	"	"	"	"	"	
Surrogate: 2-FBP	*83.4 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*106 %*	*50-150*			"	"	"	"	
LEV5C-27.5' (B5L0547-49) Soil Sampled: 12/21/05 14:30 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	ND	11.0	mg/kg dry	1	5L23010	12/23/05	12/28/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	ND	27.4	"	"	"	"	"	"	
Surrogate: 2-FBP	*86.5 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*106 %*	*50-150*			"	"	"	"	
LEV5C-30' (B5L0547-50) Soil Sampled: 12/21/05 14:30 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	ND	11.5	mg/kg dry	1	5L23010	12/23/05	12/28/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	ND	28.8	"	"	"	"	"	"	
Surrogate: 2-FBP	*87.2 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*106 %*	*50-150*			"	"	"	"	

North Creek Analytical - Bothell

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1011 SW Klickitat Way, Suite 207	Project Number:	BN050-16423-522	**Reported:**
Seattle, WA 98134	Project Manager:	Stephen Howard	01/10/06 17:50

Semivolatile Petroleum Products by NWTPH-Dx (w/o Acid/Silica Gel Clean-up)

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
LEV5C-32.5' (B5L0547-51) Soil Sampled: 12/21/05 14:30 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	ND	11.7	mg/kg dry	1	5L23010	12/23/05	12/28/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	ND	29.3	"	"	"	"	"	"	
Surrogate: 2-FBP	*83.1 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*103 %*	*50-150*			"	"	"	"	
LEV5C-35' (B5L0547-52) Soil Sampled: 12/21/05 14:30 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	ND	12.0	mg/kg dry	1	5L23010	12/23/05	12/28/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	ND	29.9	"	"	"	"	"	"	
Surrogate: 2-FBP	*80.0 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*99.5 %*	*50-150*			"	"	"	"	
LEV4A-10' (B5L0547-53) Soil Sampled: 12/22/05 10:15 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	ND	10.9	mg/kg dry	1	5L23010	12/23/05	12/28/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	ND	27.2	"	"	"	"	"	"	
Surrogate: 2-FBP	*87.3 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*105 %*	*50-150*			"	"	"	"	
LEV4A-15' (B5L0547-54) Soil Sampled: 12/22/05 10:15 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	**47.0**	10.5	mg/kg dry	1	5L23010	12/23/05	12/28/05	NWTPH-Dx	D-09
Lube Oil Range Hydrocarbons	**89.3**	26.3	"	"	"	"	"	"	
Surrogate: 2-FBP	*90.1 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*109 %*	*50-150*			"	"	"	"	
LEV4A-17.5' (B5L0547-55) Soil Sampled: 12/22/05 10:15 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	**2780**	122	mg/kg dry	5	5L23010	12/23/05	12/28/05	NWTPH-Dx	D-15
Lube Oil Range Hydrocarbons	**2270**	304	"	"	"	"	"	"	D-15
Surrogate: 2-FBP	*86.2 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*107 %*	*50-150*			"	"	"	"	

North Creek Analytical - Bothell

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Kate Haney, Project Manager

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Semivolatile Petroleum Products by NWTPH-Dx (w/o Acid/Silica Gel Clean-up)

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
LEV4A-20' (B5L0547-56) Soil Sampled: 12/22/05 10:15 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	**1990**	112	mg/kg dry	10	5L23010	12/23/05	01/03/06	NWTPH-Dx	D-15
Lube Oil Range Hydrocarbons	**1910**	280	"	"	"	"	"	"	D-15
Surrogate: 2-FBP	*72.7 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*110 %*	*50-150*			"	"	"	"	
LEV4A-22.5' (B5L0547-57) Soil Sampled: 12/22/05 10:15 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	**2090**	105	mg/kg dry	5	5L23010	12/23/05	01/03/06	NWTPH-Dx	D-15
Lube Oil Range Hydrocarbons	**1940**	262	"	"	"	"	"	"	D-15
Surrogate: 2-FBP	*75.4 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*109 %*	*50-150*			"	"	"	"	
LEV4A-25' (B5L0547-58) Soil Sampled: 12/22/05 10:15 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	**385**	22.7	mg/kg dry	2	5L23010	12/23/05	01/03/06	NWTPH-Dx	D-15
Lube Oil Range Hydrocarbons	**378**	56.7	"	"	"	"	"	"	D-15
Surrogate: 2-FBP	*87.1 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*112 %*	*50-150*			"	"	"	"	
LEV4A-27.5' (B5L0547-59) Soil Sampled: 12/22/05 10:15 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	**21.7**	10.6	mg/kg dry	1	5L23010	12/23/05	12/28/05	NWTPH-Dx	D-06
Lube Oil Range Hydrocarbons	ND	26.6	"	"	"	"	"	"	
Surrogate: 2-FBP	*85.5 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*108 %*	*50-150*			"	"	"	"	
LEV4A-30' (B5L0547-60) Soil Sampled: 12/22/05 10:15 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	ND	12.7	mg/kg dry	1	5L23010	12/23/05	12/28/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	ND	31.7	"	"	"	"	"	"	
Surrogate: 2-FBP	*70.5 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*78.0 %*	*50-150*			"	"	"	"	

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Semivolatile Petroleum Products by NWTPH-Dx (w/o Acid/Silica Gel Clean-up)

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
LEV4A-32.5' (B5L0547-61) Soil Sampled: 12/22/05 10:15 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	**40.3**	11.4	mg/kg dry	1	5L27049	12/27/05	12/28/05	NWTPH-Dx	D-15
Lube Oil Range Hydrocarbons	**44.9**	28.6	"	"	"	"	"	"	D-15
Surrogate: 2-FBP	*105 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*110 %*	*50-150*			"	"	"	"	
LEV4A-35' (B5L0547-62) Soil Sampled: 12/22/05 10:15 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	**23.7**	14.5	mg/kg dry	1	5L27049	12/27/05	12/28/05	NWTPH-Dx	D-15
Lube Oil Range Hydrocarbons	ND	36.2	"	"	"	"	"	"	
Surrogate: 2-FBP	*117 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*124 %*	*50-150*			"	"	"	"	
LEV2A-10' (B5L0547-63) Soil Sampled: 12/22/05 13:15 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	**161**	10.7	mg/kg dry	1	5L27049	12/27/05	12/28/05	NWTPH-Dx	D-15
Lube Oil Range Hydrocarbons	**231**	26.8	"	"	"	"	"	"	D-15
Surrogate: 2-FBP	*114 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*119 %*	*50-150*			"	"	"	"	
LEV2A-15' (B5L0547-64) Soil Sampled: 12/22/05 13:15 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	**10800**	1110	mg/kg dry	50	5L27049	12/27/05	12/28/05	NWTPH-Dx	D-15
Lube Oil Range Hydrocarbons	**13500**	2790	"	"	"	"	"	"	D-15
Surrogate: 2-FBP	*ND*	*50-150*			"	"	"	"	*S-01*
Surrogate: Octacosane	*ND*	*50-150*			"	"	"	"	*S-01*
LEV2A-17.5' (B5L0547-65) Soil Sampled: 12/22/05 13:15 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	**1600**	106	mg/kg dry	5	5L27049	12/27/05	12/28/05	NWTPH-Dx	D-15
Lube Oil Range Hydrocarbons	**1650**	264	"	"	"	"	"	"	D-15
Surrogate: 2-FBP	*117 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*126 %*	*50-150*			"	"	"	"	

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Semivolatile Petroleum Products by NWTPH-Dx (w/o Acid/Silica Gel Clean-up)

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
LEV2A-20' (B5L0547-66) Soil Sampled: 12/22/05 13:15 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	ND	13.5	mg/kg dry	1	5L27049	12/27/05	12/28/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	ND	33.8	"	"	"	"	"	"	
Surrogate: 2-FBP	*100 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*105 %*	*50-150*			"	"	"	"	
LEV2A-22.5' (B5L0547-67) Soil Sampled: 12/22/05 13:15 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	**83.4**	14.1	mg/kg dry	1	5L27049	12/27/05	12/28/05	NWTPH-Dx	D-15
Lube Oil Range Hydrocarbons	**105**	35.3	"	"	"	"	"	"	D-15
Surrogate: 2-FBP	*100 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*108 %*	*50-150*			"	"	"	"	
LEV2A-25' (B5L0547-68) Soil Sampled: 12/22/05 13:15 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	ND	14.3	mg/kg dry	1	5L27049	12/27/05	12/29/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	ND	35.7	"	"	"	"	"	"	
Surrogate: 2-FBP	*108 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*119 %*	*50-150*			"	"	"	"	
LEV2A-30' (B5L0547-69) Soil Sampled: 12/22/05 13:15 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	ND	13.6	mg/kg dry	1	5L27049	12/27/05	12/29/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	ND	34.0	"	"	"	"	"	"	
Surrogate: 2-FBP	*98.2 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*111 %*	*50-150*			"	"	"	"	
LEV2A-32.5' (B5L0547-70) Soil Sampled: 12/22/05 13:15 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	ND	11.5	mg/kg dry	1	5L27049	12/27/05	12/29/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	ND	28.7	"	"	"	"	"	"	
Surrogate: 2-FBP	*101 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*111 %*	*50-150*			"	"	"	"	

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The RETEC Group, Inc.	Project: BNSF-Skykomish	
1011 SW Klickitat Way, Suite 207	Project Number: BN050-16423-522	**Reported:**
Seattle, WA 98134	Project Manager: Stephen Howard	01/10/06 17:50

Semivolatile Petroleum Products by NWTPH-Dx (w/o Acid/Silica Gel Clean-up)
North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
LEV2A-35' (B5L0547-71) Soil Sampled: 12/22/05 13:15 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	ND	11.8	mg/kg dry	1	5L27049	12/27/05	12/29/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	ND	29.5	"	"	"	"	"	"	
Surrogate: 2-FBP	*93.7 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*108 %*	*50-150*			"	"	"	"	
LEV2A-37.5' (B5L0547-72) Soil Sampled: 12/22/05 13:15 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	**108**	14.5	mg/kg dry	1	5L27049	12/27/05	12/29/05	NWTPH-Dx	D-15
Lube Oil Range Hydrocarbons	**126**	36.4	"	"	"	"	"	"	D-15
Surrogate: 2-FBP	*101 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*106 %*	*50-150*			"	"	"	"	
LEV2A-40' (B5L0547-73) Soil Sampled: 12/22/05 13:15 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	**40.3**	12.2	mg/kg dry	1	5L27049	12/27/05	12/29/05	NWTPH-Dx	D-15
Lube Oil Range Hydrocarbons	**54.4**	30.6	"	"	"	"	"	"	D-15
Surrogate: 2-FBP	*95.1 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*111 %*	*50-150*			"	"	"	"	
LEV8A-17.5' DUP (B5L0547-74) Soil Sampled: 12/19/05 16:30 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	**1540**	111	mg/kg dry	10	5L29040	12/29/05	12/31/05	NWTPH-Dx	D-15a
Lube Oil Range Hydrocarbons	**1500**	278	"	"	"	"	"	"	D-15
Surrogate: 2-FBP	*99.1 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*103 %*	*50-150*			"	"	"	"	
LEV8B-20' DUP (B5L0547-75) Soil Sampled: 12/20/05 11:30 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	**19.4**	10.8	mg/kg dry	1	5L29040	12/29/05	12/31/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	ND	27.0	"	"	"	"	"	"	
Surrogate: 2-FBP	*91.7 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*103 %*	*50-150*			"	"	"	"	

North Creek Analytical - Bothell

Kate Haney, Project Manager

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Semivolatile Petroleum Products by NWTPH-Dx (w/o Acid/Silica Gel Clean-up)
North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
LEV7A-20' DUP (B5L0547-76) Soil Sampled: 12/20/05 16:00 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	ND	13.7	mg/kg dry	1	5L29040	12/29/05	12/31/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	ND	34.2	"	"	"	"	"	"	
Surrogate: 2-FBP	*93.0 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*104 %*	*50-150*			"	"	"	"	
LEV6A-20' DUP (B5L0547-77) Soil Sampled: 12/21/05 10:30 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	ND	14.9	mg/kg dry	1	5L29040	12/29/05	12/31/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	ND	37.2	"	"	"	"	"	"	
Surrogate: 2-FBP	*89.5 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*101 %*	*50-150*			"	"	"	"	
LEV5C-22.5' DUP (B5L0547-78) Soil Sampled: 12/21/05 14:30 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	**138**	11.3	mg/kg dry	1	5L29040	12/29/05	01/03/06	NWTPH-Dx	D-15a
Lube Oil Range Hydrocarbons	**136**	28.3	"	"	"	"	"	"	D-15
Surrogate: 2-FBP	*92.0 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*104 %*	*50-150*			"	"	"	"	
LEV4A-15' DUP (B5L0547-79) Soil Sampled: 12/22/05 10:15 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	**34.3**	10.7	mg/kg dry	1	5L29040	12/29/05	01/03/06	NWTPH-Dx	D-09
Lube Oil Range Hydrocarbons	**79.7**	26.8	"	"	"	"	"	"	
Surrogate: 2-FBP	*87.8 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*103 %*	*50-150*			"	"	"	"	
LEV2A-22.5' DUP (B5L0547-80) Soil Sampled: 12/22/05 13:15 Received: 12/22/05 16:55									
Diesel Range Hydrocarbons	**26.2**	14.0	mg/kg dry	1	5L29040	12/29/05	12/31/05	NWTPH-Dx	
Lube Oil Range Hydrocarbons	ND	35.1	"	"	"	"	"	"	
Surrogate: 2-FBP	*91.5 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*104 %*	*50-150*			"	"	"	"	

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The RETEC Group, Inc.	Project: BNSF-Skykomish	
1011 SW Klickitat Way, Suite 207	Project Number: BN050-16423-522	**Reported:**
Seattle, WA 98134	Project Manager: Stephen Howard	01/10/06 17:50

Conventional Chemistry Parameters by APHA/EPA Methods

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
LEV8A-10' (B5L0547-01) Soil Sampled: 12/19/05 16:30 Received: 12/22/05 16:55									
Total Organic Carbon - Average	**5850**	564	mg/kg dry	1	6A09026	12/27/05	01/06/06	EPA 9060 mod.	
Total Organic Carbon - High	**6560**	564	"	"	"	"	"	"	
Total Organic Carbon - Low	**5210**	564	"	"	"	"	"	"	
LEV8A-35' (B5L0547-08) Soil Sampled: 12/19/05 16:30 Received: 12/22/05 16:55									
Total Organic Carbon - Average	**2190**	597	mg/kg dry	1	6A09026	12/27/05	01/06/06	EPA 9060 mod.	
Total Organic Carbon - High	**2580**	597	"	"	"	"	"	"	
Total Organic Carbon - Low	**1500**	597	"	"	"	"	"	"	
LEV8B-10' (B5L0547-09) Soil Sampled: 12/20/05 11:30 Received: 12/22/05 16:55									
Total Organic Carbon - Average	**8140**	532	mg/kg dry	1	6A09026	12/27/05	01/06/06	EPA 9060 mod.	
Total Organic Carbon - High	**9160**	532	"	"	"	"	"	"	
Total Organic Carbon - Low	**6800**	532	"	"	"	"	"	"	
LEV8B-35' (B5L0547-18) Soil Sampled: 12/20/05 11:30 Received: 12/22/05 16:55									
Total Organic Carbon - Average	**4780**	620	mg/kg dry	1	6A09026	12/27/05	01/06/06	EPA 9060 mod.	
Total Organic Carbon - High	**5500**	620	"	"	"	"	"	"	
Total Organic Carbon - Low	**4140**	620	"	"	"	"	"	"	
LEV7A-10' (B5L0547-19) Soil Sampled: 12/20/05 16:00 Received: 12/22/05 16:55									
Total Organic Carbon - Average	**20500**	524	mg/kg dry	1	6A09026	12/27/05	01/06/06	EPA 9060 mod.	
Total Organic Carbon - High	**24700**	524	"	"	"	"	"	"	
Total Organic Carbon - Low	**16900**	524	"	"	"	"	"	"	
LEV7A-35' (B5L0547-28) Soil Sampled: 12/20/05 16:00 Received: 12/22/05 16:55									
Total Organic Carbon - Average	**2150**	647	mg/kg dry	1	6A09026	12/27/05	01/06/06	EPA 9060 mod.	
Total Organic Carbon - High	**2300**	647	"	"	"	"	"	"	
Total Organic Carbon - Low	**2020**	647	"	"	"	"	"	"	

North Creek Analytical - Bothell

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The RETEC Group, Inc.	Project: BNSF-Skykomish	
1011 SW Klickitat Way, Suite 207	Project Number: BN050-16423-522	**Reported:**
Seattle, WA 98134	Project Manager: Stephen Howard	01/10/06 17:50

Conventional Chemistry Parameters by APHA/EPA Methods

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
LEV6A-40' (B5L0547-40) Soil Sampled: 12/21/05 10:30 Received: 12/22/05 16:55									
Total Organic Carbon - Average	**2970**	547	mg/kg dry	1	6A10032	12/27/05	01/09/06	EPA 9060 mod.	
Total Organic Carbon - High	**3680**	547	"	"	"	"	"	"	
Total Organic Carbon - Low	**2220**	547	"	"	"	"	"	"	
LEV5C-10' (B5L0547-43) Soil Sampled: 12/21/05 14:30 Received: 12/22/05 16:55									
Total Organic Carbon - Average	**3390**	542	mg/kg dry	1	6A10032	12/27/05	01/09/06	EPA 9060 mod.	
Total Organic Carbon - High	**3460**	542	"	"	"	"	"	"	
Total Organic Carbon - Low	**3340**	542	"	"	"	"	"	"	
LEV4A-10' (B5L0547-53) Soil Sampled: 12/22/05 10:15 Received: 12/22/05 16:55									
Total Organic Carbon - Average	**4200**	548	mg/kg dry	1	6A10032	12/27/05	01/09/06	EPA 9060 mod.	
Total Organic Carbon - High	**5180**	548	"	"	"	"	"	"	
Total Organic Carbon - Low	**3520**	548	"	"	"	"	"	"	
LEV4A-35' (B5L0547-62) Soil Sampled: 12/22/05 10:15 Received: 12/22/05 16:55									
Total Organic Carbon - Average	**3870**	725	mg/kg dry	1	6A10032	12/27/05	01/09/06	EPA 9060 mod.	
Total Organic Carbon - High	**4250**	725	"	"	"	"	"	"	
Total Organic Carbon - Low	**3370**	725	"	"	"	"	"	"	
LEV2A-10' (B5L0547-63) Soil Sampled: 12/22/05 13:15 Received: 12/22/05 16:55									
Total Organic Carbon - Average	**9010**	544	mg/kg dry	1	6A10032	12/27/05	01/09/06	EPA 9060 mod.	
Total Organic Carbon - High	**11200**	544	"	"	"	"	"	"	
Total Organic Carbon - Low	**6650**	544	"	"	"	"	"	"	
LEV2A-35' (B5L0547-71) Soil Sampled: 12/22/05 13:15 Received: 12/22/05 16:55									
Total Organic Carbon - Average	**1750**	596	mg/kg dry	1	6A10032	12/27/05	01/09/06	EPA 9060 mod.	
Total Organic Carbon - High	**1920**	596	"	"	"	"	"	"	
Total Organic Carbon - Low	**1590**	596	"	"	"	"	"	"	

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1011 SW Klickitat Way, Suite 207	Project Number: BN050-16423-522	**Reported:**
Seattle, WA 98134	Project Manager: Stephen Howard	01/10/06 17:50

Physical Parameters by APHA/ASTM/EPA Methods

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
LEV8A-10' (B5L0547-01) Soil Sampled: 12/19/05 16:30 Received: 12/22/05 16:55									
Dry Weight	**88.6**	1.00	%	1	5L27043	12/27/05	12/28/05	BSOPSPL003R08	
LEV8A-15' (B5L0547-02) Soil Sampled: 12/19/05 16:30 Received: 12/22/05 16:55									
Dry Weight	**91.2**	1.00	%	1	5L27043	12/27/05	12/28/05	BSOPSPL003R08	
LEV8A-17.5' (B5L0547-03) Soil Sampled: 12/19/05 16:30 Received: 12/22/05 16:55									
Dry Weight	**92.0**	1.00	%	1	5L27043	12/27/05	12/28/05	BSOPSPL003R08	
LEV8A-20' (B5L0547-04) Soil Sampled: 12/19/05 16:30 Received: 12/22/05 16:55									
Dry Weight	**90.4**	1.00	%	1	5L27043	12/27/05	12/28/05	BSOPSPL003R08	
LEV8A-25' (B5L0547-05) Soil Sampled: 12/19/05 16:30 Received: 12/22/05 16:55									
Dry Weight	**86.8**	1.00	%	1	5L27043	12/27/05	12/28/05	BSOPSPL003R08	
LEV8A-30' (B5L0547-06) Soil Sampled: 12/19/05 16:30 Received: 12/22/05 16:55									
Dry Weight	**86.8**	1.00	%	1	5L27043	12/27/05	12/28/05	BSOPSPL003R08	
LEV8A-32.5' (B5L0547-07) Soil Sampled: 12/19/05 16:30 Received: 12/22/05 16:55									
Dry Weight	**85.7**	1.00	%	1	5L27043	12/27/05	12/28/05	BSOPSPL003R08	
LEV8A-35' (B5L0547-08) Soil Sampled: 12/19/05 16:30 Received: 12/22/05 16:55									
Dry Weight	**83.8**	1.00	%	1	5L27044	12/27/05	12/28/05	BSOPSPL003R08	
LEV8B-10' (B5L0547-09) Soil Sampled: 12/20/05 11:30 Received: 12/22/05 16:55									
Dry Weight	**94.0**	1.00	%	1	5L27044	12/27/05	12/28/05	BSOPSPL003R08	

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Seattle, WA 98134	Project Manager: Stephen Howard	01/10/06 17:50

Physical Parameters by APHA/ASTM/EPA Methods

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Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
LEV8B-15' (B5L0547-10) Soil Sampled: 12/20/05 11:30 Received: 12/22/05 16:55									
Dry Weight	**88.7**	1.00	%	1	5L27044	12/27/05	12/28/05	BSOPSPL003R08	
LEV8B-17.5' (B5L0547-11) Soil Sampled: 12/20/05 11:30 Received: 12/22/05 16:55									
Dry Weight	**88.7**	1.00	%	1	5L27044	12/27/05	12/28/05	BSOPSPL003R08	
LEV8B-20' (B5L0547-12) Soil Sampled: 12/20/05 11:30 Received: 12/22/05 16:55									
Dry Weight	**92.7**	1.00	%	1	5L27044	12/27/05	12/28/05	BSOPSPL003R08	
LEV8B-22.5' (B5L0547-13) Soil Sampled: 12/20/05 11:30 Received: 12/22/05 16:55									
Dry Weight	**75.4**	1.00	%	1	5L27044	12/27/05	12/28/05	BSOPSPL003R08	
LEV8B-25' (B5L0547-14) Soil Sampled: 12/20/05 11:30 Received: 12/22/05 16:55									
Dry Weight	**78.9**	1.00	%	1	5L27044	12/27/05	12/28/05	BSOPSPL003R08	
LEV8B-27.5' (B5L0547-15) Soil Sampled: 12/20/05 11:30 Received: 12/22/05 16:55									
Dry Weight	**88.2**	1.00	%	1	5L27044	12/27/05	12/28/05	BSOPSPL003R08	
LEV8B-30' (B5L0547-16) Soil Sampled: 12/20/05 11:30 Received: 12/22/05 16:55									
Dry Weight	**78.2**	1.00	%	1	5L27044	12/27/05	12/28/05	BSOPSPL003R08	
LEV8B-32.5' (B5L0547-17) Soil Sampled: 12/20/05 11:30 Received: 12/22/05 16:55									
Dry Weight	**75.9**	1.00	%	1	5L27044	12/27/05	12/28/05	BSOPSPL003R08	
LEV8B-35' (B5L0547-18) Soil Sampled: 12/20/05 11:30 Received: 12/22/05 16:55									
Dry Weight	**80.6**	1.00	%	1	5L27044	12/27/05	12/28/05	BSOPSPL003R08	

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Physical Parameters by APHA/ASTM/EPA Methods

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
LEV7A-10' (B5L0547-19) Soil Sampled: 12/20/05 16:00 Received: 12/22/05 16:55									
Dry Weight	**95.4**	1.00	%	1	5L27044	12/27/05	12/28/05	BSOPSPL003R08	
LEV7A-15' (B5L0547-20) Soil Sampled: 12/20/05 16:00 Received: 12/22/05 16:55									
Dry Weight	**88.1**	1.00	%	1	5L27044	12/27/05	12/28/05	BSOPSPL003R08	
LEV7A-17.5' (B5L0547-21) Soil Sampled: 12/20/05 16:00 Received: 12/22/05 16:55									
Dry Weight	**83.2**	1.00	%	1	5L27044	12/27/05	12/28/05	BSOPSPL003R08	
LEV7A-20' (B5L0547-22) Soil Sampled: 12/20/05 16:00 Received: 12/22/05 16:55									
Dry Weight	**71.4**	1.00	%	1	5L27044	12/27/05	12/28/05	BSOPSPL003R08	
LEV7A-22.5' (B5L0547-23) Soil Sampled: 12/20/05 16:00 Received: 12/22/05 16:55									
Dry Weight	**79.5**	1.00	%	1	5L27044	12/27/05	12/28/05	BSOPSPL003R08	
LEV7A-25' (B5L0547-24) Soil Sampled: 12/20/05 16:00 Received: 12/22/05 16:55									
Dry Weight	**75.5**	1.00	%	1	5L27044	12/27/05	12/28/05	BSOPSPL003R08	
LEV7A-27.5' (B5L0547-25) Soil Sampled: 12/20/05 16:00 Received: 12/22/05 16:55									
Dry Weight	**70.0**	1.00	%	1	5L27044	12/27/05	12/28/05	BSOPSPL003R08	
LEV7A-30' (B5L0547-26) Soil Sampled: 12/20/05 16:00 Received: 12/22/05 16:55									
Dry Weight	**74.2**	1.00	%	1	5L27044	12/27/05	12/28/05	BSOPSPL003R08	
LEV7A-32.5' (B5L0547-27) Soil Sampled: 12/20/05 16:00 Received: 12/22/05 16:55									
Dry Weight	**70.8**	1.00	%	1	5L27044	12/27/05	12/28/05	BSOPSPL003R08	

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Physical Parameters by APHA/ASTM/EPA Methods

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
LEV7A-35' (B5L0547-28) Soil Sampled: 12/20/05 16:00 Received: 12/22/05 16:55									
Dry Weight	**77.3**	1.00	%	1	5L27045	12/27/05	12/28/05	BSOPSPL003R08	
LEV6A-10' (B5L0547-29) Soil Sampled: 12/21/05 10:30 Received: 12/22/05 16:55									
Dry Weight	**91.5**	1.00	%	1	5L27045	12/27/05	12/28/05	BSOPSPL003R08	
LEV6A-15' (B5L0547-30) Soil Sampled: 12/21/05 10:30 Received: 12/22/05 16:55									
Dry Weight	**88.9**	1.00	%	1	5L27045	12/27/05	12/28/05	BSOPSPL003R08	
LEV6A-17.5' (B5L0547-31) Soil Sampled: 12/21/05 10:30 Received: 12/22/05 16:55									
Dry Weight	**87.0**	1.00	%	1	5L27045	12/27/05	12/28/05	BSOPSPL003R08	
LEV6A-20' (B5L0547-32) Soil Sampled: 12/21/05 10:30 Received: 12/22/05 16:55									
Dry Weight	**67.5**	1.00	%	1	5L27045	12/27/05	12/28/05	BSOPSPL003R08	
LEV6A-22.5' (B5L0547-33) Soil Sampled: 12/21/05 10:30 Received: 12/22/05 16:55									
Dry Weight	**72.7**	1.00	%	1	5L27045	12/27/05	12/28/05	BSOPSPL003R08	
LEV6A-25' (B5L0547-34) Soil Sampled: 12/21/05 10:30 Received: 12/22/05 16:55									
Dry Weight	**69.6**	1.00	%	1	5L27045	12/27/05	12/28/05	BSOPSPL003R08	
LEV6A-27.5' (B5L0547-35) Soil Sampled: 12/21/05 10:30 Received: 12/22/05 16:55									
Dry Weight	**74.2**	1.00	%	1	5L27045	12/27/05	12/28/05	BSOPSPL003R08	
LEV6A-30' (B5L0547-36) Soil Sampled: 12/21/05 10:30 Received: 12/22/05 16:55									
Dry Weight	**71.6**	1.00	%	1	5L27045	12/27/05	12/28/05	BSOPSPL003R08	

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Physical Parameters by APHA/ASTM/EPA Methods

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
LEV6A-32.5' (B5L0547-37) Soil Sampled: 12/21/05 10:30 Received: 12/22/05 16:55									
Dry Weight	**90.4**	1.00	%	1	5L27045	12/27/05	12/28/05	BSOPSPL003R08	
LEV6A-35' (B5L0547-38) Soil Sampled: 12/21/05 10:30 Received: 12/22/05 16:55									
Dry Weight	**94.5**	1.00	%	1	5L27045	12/27/05	12/28/05	BSOPSPL003R08	
LEV6A-37.5' (B5L0547-39) Soil Sampled: 12/21/05 10:30 Received: 12/22/05 16:55									
Dry Weight	**89.9**	1.00	%	1	5L27045	12/27/05	12/28/05	BSOPSPL003R08	
LEV6A-40' (B5L0547-40) Soil Sampled: 12/21/05 10:30 Received: 12/22/05 16:55									
Dry Weight	**91.4**	1.00	%	1	5L27045	12/27/05	12/28/05	BSOPSPL003R08	
LEV6A-42.5' (B5L0547-41) Soil Sampled: 12/21/05 10:30 Received: 12/22/05 16:55									
Dry Weight	**91.4**	1.00	%	1	5L27045	12/27/05	12/28/05	BSOPSPL003R08	
LEV6A-45' (B5L0547-42) Soil Sampled: 12/21/05 10:30 Received: 12/22/05 16:55									
Dry Weight	**93.6**	1.00	%	1	5L27045	12/27/05	12/28/05	BSOPSPL003R08	
LEV5C-10' (B5L0547-43) Soil Sampled: 12/21/05 14:30 Received: 12/22/05 16:55									
Dry Weight	**92.2**	1.00	%	1	5L27045	12/27/05	12/28/05	BSOPSPL003R08	
LEV5C-15' (B5L0547-44) Soil Sampled: 12/21/05 14:30 Received: 12/22/05 16:55									
Dry Weight	**92.9**	1.00	%	1	5L27045	12/27/05	12/28/05	BSOPSPL003R08	
LEV5C-17.5' (B5L0547-45) Soil Sampled: 12/21/05 14:30 Received: 12/22/05 16:55									
Dry Weight	**81.8**	1.00	%	1	5L27045	12/27/05	12/28/05	BSOPSPL003R08	

North Creek Analytical - Bothell

Kate Haney

Kate Haney, Project Manager

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Physical Parameters by APHA/ASTM/EPA Methods

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
LEV5C-20' (B5L0547-46) Soil Sampled: 12/21/05 14:30 Received: 12/22/05 16:55									
Dry Weight	**82.8**	1.00	%	1	5L27045	12/27/05	12/28/05	BSOPSPL003R08	
LEV5C-22.5' (B5L0547-47) Soil Sampled: 12/21/05 14:30 Received: 12/22/05 16:55									
Dry Weight	**92.6**	1.00	%	1	5L27045	12/27/05	12/28/05	BSOPSPL003R08	
LEV5C-25' (B5L0547-48) Soil Sampled: 12/21/05 14:30 Received: 12/22/05 16:55									
Dry Weight	**78.7**	1.00	%	1	5L27046	12/27/05	12/28/05	BSOPSPL003R08	
LEV5C-27.5' (B5L0547-49) Soil Sampled: 12/21/05 14:30 Received: 12/22/05 16:55									
Dry Weight	**90.0**	1.00	%	1	5L27046	12/27/05	12/28/05	BSOPSPL003R08	
LEV5C-30' (B5L0547-50) Soil Sampled: 12/21/05 14:30 Received: 12/22/05 16:55									
Dry Weight	**86.9**	1.00	%	1	5L27046	12/27/05	12/28/05	BSOPSPL003R08	
LEV5C-32.5' (B5L0547-51) Soil Sampled: 12/21/05 14:30 Received: 12/22/05 16:55									
Dry Weight	**85.0**	1.00	%	1	5L27046	12/27/05	12/28/05	BSOPSPL003R08	
LEV5C-35' (B5L0547-52) Soil Sampled: 12/21/05 14:30 Received: 12/22/05 16:55									
Dry Weight	**84.1**	1.00	%	1	5L27046	12/27/05	12/28/05	BSOPSPL003R08	
LEV4A-10' (B5L0547-53) Soil Sampled: 12/22/05 10:15 Received: 12/22/05 16:55									
Dry Weight	**91.2**	1.00	%	1	5L27046	12/27/05	12/28/05	BSOPSPL003R08	
LEV4A-15' (B5L0547-54) Soil Sampled: 12/22/05 10:15 Received: 12/22/05 16:55									
Dry Weight	**93.9**	1.00	%	1	5L27046	12/27/05	12/28/05	BSOPSPL003R08	

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Physical Parameters by APHA/ASTM/EPA Methods

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
LEV4A-17.5' (B5L0547-55) Soil Sampled: 12/22/05 10:15 Received: 12/22/05 16:55									
Dry Weight	**81.1**	1.00	%	1	5L27046	12/27/05	12/28/05	BSOPSPL003R08	
LEV4A-20' (B5L0547-56) Soil Sampled: 12/22/05 10:15 Received: 12/22/05 16:55									
Dry Weight	**88.3**	1.00	%	1	5L27046	12/27/05	12/28/05	BSOPSPL003R08	
LEV4A-22.5' (B5L0547-57) Soil Sampled: 12/22/05 10:15 Received: 12/22/05 16:55									
Dry Weight	**92.3**	1.00	%	1	5L27046	12/27/05	12/28/05	BSOPSPL003R08	
LEV4A-25' (B5L0547-58) Soil Sampled: 12/22/05 10:15 Received: 12/22/05 16:55									
Dry Weight	**86.7**	1.00	%	1	5L27046	12/27/05	12/28/05	BSOPSPL003R08	
LEV4A-27.5' (B5L0547-59) Soil Sampled: 12/22/05 10:15 Received: 12/22/05 16:55									
Dry Weight	**92.6**	1.00	%	1	5L27046	12/27/05	12/28/05	BSOPSPL003R08	
LEV4A-30' (B5L0547-60) Soil Sampled: 12/22/05 10:15 Received: 12/22/05 16:55									
Dry Weight	**78.0**	1.00	%	1	5L27046	12/27/05	12/28/05	BSOPSPL003R08	
LEV4A-32.5' (B5L0547-61) Soil Sampled: 12/22/05 10:15 Received: 12/22/05 16:55									
Dry Weight	**87.4**	1.00	%	1	5L27046	12/27/05	12/28/05	BSOPSPL003R08	
LEV4A-35' (B5L0547-62) Soil Sampled: 12/22/05 10:15 Received: 12/22/05 16:55									
Dry Weight	**69.0**	1.00	%	1	5L27046	12/27/05	12/28/05	BSOPSPL003R08	
LEV2A-10' (B5L0547-63) Soil Sampled: 12/22/05 13:15 Received: 12/22/05 16:55									
Dry Weight	**91.9**	1.00	%	1	5L27046	12/27/05	12/28/05	BSOPSPL003R08	

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The RETEC Group, Inc.	Project: BNSF-Skykomish	
1011 SW Klickitat Way, Suite 207	Project Number: BN050-16423-522	**Reported:**
Seattle, WA 98134	Project Manager: Stephen Howard	01/10/06 17:50

Physical Parameters by APHA/ASTM/EPA Methods

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
LEV2A-15' (B5L0547-64) Soil Sampled: 12/22/05 13:15 Received: 12/22/05 16:55									
Dry Weight	**89.1**	1.00	%	1	5L27046	12/27/05	12/28/05	BSOPSPL003R08	
LEV2A-17.5' (B5L0547-65) Soil Sampled: 12/22/05 13:15 Received: 12/22/05 16:55									
Dry Weight	**91.6**	1.00	%	1	5L27046	12/27/05	12/28/05	BSOPSPL003R08	
LEV2A-20' (B5L0547-66) Soil Sampled: 12/22/05 13:15 Received: 12/22/05 16:55									
Dry Weight	**73.9**	1.00	%	1	5L27046	12/27/05	12/28/05	BSOPSPL003R08	
LEV2A-22.5' (B5L0547-67) Soil Sampled: 12/22/05 13:15 Received: 12/22/05 16:55									
Dry Weight	**70.1**	1.00	%	1	5L27046	12/27/05	12/28/05	BSOPSPL003R08	
LEV2A-25' (B5L0547-68) Soil Sampled: 12/22/05 13:15 Received: 12/22/05 16:55									
Dry Weight	**69.3**	1.00	%	1	5L27047	12/27/05	12/28/05	BSOPSPL003R08	
LEV2A-30' (B5L0547-69) Soil Sampled: 12/22/05 13:15 Received: 12/22/05 16:55									
Dry Weight	**72.6**	1.00	%	1	5L27047	12/27/05	12/28/05	BSOPSPL003R08	
LEV2A-32.5' (B5L0547-70) Soil Sampled: 12/22/05 13:15 Received: 12/22/05 16:55									
Dry Weight	**86.3**	1.00	%	1	5L27047	12/27/05	12/28/05	BSOPSPL003R08	
LEV2A-35' (B5L0547-71) Soil Sampled: 12/22/05 13:15 Received: 12/22/05 16:55									
Dry Weight	**83.9**	1.00	%	1	5L27047	12/27/05	12/28/05	BSOPSPL003R08	
LEV2A-37.5' (B5L0547-72) Soil Sampled: 12/22/05 13:15 Received: 12/22/05 16:55									
Dry Weight	**68.3**	1.00	%	1	5L27047	12/27/05	12/28/05	BSOPSPL003R08	

North Creek Analytical - Bothell

Kate Haney, Project Manager

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The RETEC Group, Inc.	Project: BNSF-Skykomish	
1011 SW Klickitat Way, Suite 207	Project Number: BN050-16423-522	**Reported:**
Seattle, WA 98134	Project Manager: Stephen Howard	01/10/06 17:50

Physical Parameters by APHA/ASTM/EPA Methods

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
LEV2A-40' (B5L0547-73) Soil Sampled: 12/22/05 13:15 Received: 12/22/05 16:55									
Dry Weight	**81.7**	1.00	%	1	5L27047	12/27/05	12/28/05	BSOPSPL003R08	
LEV8A-17.5' DUP (B5L0547-74) Soil Sampled: 12/19/05 16:30 Received: 12/22/05 16:55									
Dry Weight	**88.9**	1.00	%	1	5L30045	12/30/05	01/03/06	BSOPSPL003R08	
LEV8B-20' DUP (B5L0547-75) Soil Sampled: 12/20/05 11:30 Received: 12/22/05 16:55									
Dry Weight	**91.9**	1.00	%	1	5L30045	12/30/05	01/03/06	BSOPSPL003R08	
LEV7A-20' DUP (B5L0547-76) Soil Sampled: 12/20/05 16:00 Received: 12/22/05 16:55									
Dry Weight	**72.8**	1.00	%	1	5L30045	12/30/05	01/03/06	BSOPSPL003R08	
LEV6A-20' DUP (B5L0547-77) Soil Sampled: 12/21/05 10:30 Received: 12/22/05 16:55									
Dry Weight	**66.4**	1.00	%	1	5L30045	12/30/05	01/03/06	BSOPSPL003R08	
LEV5C-22.5' DUP (B5L0547-78) Soil Sampled: 12/21/05 14:30 Received: 12/22/05 16:55									
Dry Weight	**87.9**	1.00	%	1	5L30045	12/30/05	01/03/06	BSOPSPL003R08	
LEV4A-15' DUP (B5L0547-79) Soil Sampled: 12/22/05 10:15 Received: 12/22/05 16:55									
Dry Weight	**94.3**	1.00	%	1	5L30045	12/30/05	01/03/06	BSOPSPL003R08	
LEV2A-22.5' DUP (B5L0547-80) Soil Sampled: 12/22/05 13:15 Received: 12/22/05 16:55									
Dry Weight	**70.3**	1.00	%	1	5L30045	12/30/05	01/03/06	BSOPSPL003R08	

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Semivolatile Petroleum Products by NWTPH-Dx (w/o Acid/Silica Gel Clean-up) - Quality Control

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 5L22068: Prepared 12/22/05 Using EPA 3550B										
Blank (5L22068-BLK1)										
Diesel Range Hydrocarbons	ND	10.0	mg/kg							
Lube Oil Range Hydrocarbons	ND	25.0	"							
Surrogate: 2-FBP	*7.64*		"	*8.33*		*91.7*	*50-150*			
Surrogate: Octacosane	*8.59*		"	*8.33*		*103*	*50-150*			
LCS (5L22068-BS1)										
Diesel Range Hydrocarbons	78.8	10.0	mg/kg	66.7		118	71-120			
Surrogate: 2-FBP	*7.88*		"	*8.33*		*94.6*	*50-150*			
LCS (5L22068-BS2)										**X**
Diesel Range Hydrocarbons	78.8	10.0	mg/kg	87.8		89.7	71-120			
Surrogate: 2-FBP	*7.88*		"	*8.33*		*94.6*	*50-150*			
LCS Dup (5L22068-BSD1)										
Diesel Range Hydrocarbons	78.0	10.0	mg/kg	66.7		117	71-120	1.02	40	
Surrogate: 2-FBP	*7.89*		"	*8.33*		*94.7*	*50-150*			
LCS Dup (5L22068-BSD2)										**X**
Diesel Range Hydrocarbons	78.0	10.0	mg/kg	87.8		88.8	71-120	1.02	40	
Surrogate: 2-FBP	*7.89*		"	*8.33*		*94.7*	*50-150*			
Duplicate (5L22068-DUP1)					**Source: B5L0547-01**					
Diesel Range Hydrocarbons	4.56	11.3	mg/kg dry		3.43			28.3	40	
Lube Oil Range Hydrocarbons	11.1	28.2	"		11.1			0.00	40	
Surrogate: 2-FBP	*8.75*		"	*9.41*		*93.0*	*50-150*			
Surrogate: Octacosane	*9.95*		"	*9.41*		*106*	*50-150*			

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Semivolatile Petroleum Products by NWTPH-Dx (w/o Acid/Silica Gel Clean-up) - Quality Control

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 5L22069: Prepared 12/22/05 Using EPA 3550B										
Blank (5L22069-BLK1)										
Diesel Range Hydrocarbons	ND	10.0	mg/kg							
Lube Oil Range Hydrocarbons	ND	25.0	"							
Surrogate: 2-FBP	*7.94*		*"*	*8.33*		*95.3*	*50-150*			
Surrogate: Octacosane	*9.85*		*"*	*8.33*		*118*	*50-150*			
LCS (5L22069-BS1)										
Diesel Range Hydrocarbons	84.0	10.0	mg/kg	66.7		126	71-120			X
Surrogate: 2-FBP	*8.14*		*"*	*8.33*		*97.7*	*50-150*			
LCS (5L22069-BS2)										**X**
Diesel Range Hydrocarbons	84.0	10.0	mg/kg	87.8		95.7	71-120			
Surrogate: 2-FBP	*8.14*		*"*	*8.33*		*97.7*	*50-150*			
LCS Dup (5L22069-BSD1)										
Diesel Range Hydrocarbons	87.0	10.0	mg/kg	66.7		130	71-120	3.51	40	X
Surrogate: 2-FBP	*8.38*		*"*	*8.33*		*101*	*50-150*			
LCS Dup (5L22069-BSD2)										**X**
Diesel Range Hydrocarbons	87.0	10.0	mg/kg	87.8		99.1	71-120	3.51	40	
Surrogate: 2-FBP	*8.38*		*"*	*8.33*		*101*	*50-150*			
Duplicate (5L22069-DUP1)					**Source: B5L0547-23**					
Diesel Range Hydrocarbons	8.87	12.6	mg/kg dry		17.4			64.9	40	Q-06
Lube Oil Range Hydrocarbons	7.66	31.4	"		15.8			69.4	40	Q-06
Surrogate: 2-FBP	*10.1*		*"*	*10.5*		*96.2*	*50-150*			
Surrogate: Octacosane	*12.5*		*"*	*10.5*		*119*	*50-150*			

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The RETEC Group, Inc.	Project: BNSF-Skykomish	
1011 SW Klickitat Way, Suite 207	Project Number: BN050-16423-522	Reported:
Seattle, WA 98134	Project Manager: Stephen Howard	01/10/06 17:50

Semivolatile Petroleum Products by NWTPH-Dx (w/o Acid/Silica Gel Clean-up) - Quality Control

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 5L23010: Prepared 12/23/05 Using EPA 3550B										
Blank (5L23010-BLK1)										
Diesel Range Hydrocarbons	ND	10.0	mg/kg							
Lube Oil Range Hydrocarbons	ND	25.0	"							
Surrogate: 2-FBP	*7.20*		*"*	*8.33*		*86.4*	*50-150*			
Surrogate: Octacosane	*9.02*		*"*	*8.33*		*108*	*50-150*			
LCS (5L23010-BS1)										
Diesel Range Hydrocarbons	81.0	10.0	mg/kg	66.7		121	71-120			X
Surrogate: 2-FBP	*7.53*		*"*	*8.33*		*90.4*	*50-150*			
LCS (5L23010-BS2)										**X**
Diesel Range Hydrocarbons	81.0	10.0	mg/kg	87.8		92.3	71-120			
Surrogate: 2-FBP	*7.53*		*"*	*8.33*		*90.4*	*50-150*			
LCS Dup (5L23010-BSD1)										
Diesel Range Hydrocarbons	80.1	10.0	mg/kg	66.7		120	71-120	1.12	40	
Surrogate: 2-FBP	*7.42*		*"*	*8.33*		*89.1*	*50-150*			
LCS Dup (5L23010-BSD2)										**X**
Diesel Range Hydrocarbons	80.1	10.0	mg/kg	87.8		91.2	71-120	1.12	40	
Surrogate: 2-FBP	*7.42*		*"*	*8.33*		*89.1*	*50-150*			
Duplicate (5L23010-DUP1)					**Source: B5L0547-42**					
Diesel Range Hydrocarbons	5.19	10.5	mg/kg dry		3.04			52.2	40	Q-05
Lube Oil Range Hydrocarbons	7.62	26.3	"		7.50			1.59	40	
Surrogate: 2-FBP	*7.16*		*"*	*8.76*		*81.7*	*50-150*			
Surrogate: Octacosane	*8.24*		*"*	*8.76*		*94.1*	*50-150*			

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Semivolatile Petroleum Products by NWTPH-Dx (w/o Acid/Silica Gel Clean-up) - Quality Control

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 5L27049: Prepared 12/27/05 Using EPA 3550B										
Blank (5L27049-BLK1)										
Diesel Range Hydrocarbons	ND	10.0	mg/kg							
Lube Oil Range Hydrocarbons	ND	25.0	"							
Surrogate: 2-FBP	*8.80*		*"*	*8.33*		*106*	*50-150*			
Surrogate: Octacosane	*9.31*		*"*	*8.33*		*112*	*50-150*			
LCS (5L27049-BS1)										
Diesel Range Hydrocarbons	83.1	10.0	mg/kg	66.7		125	71-120			X
Surrogate: 2-FBP	*8.10*		*"*	*8.33*		*97.2*	*50-150*			
LCS (5L27049-BS2)										**X**
Diesel Range Hydrocarbons	83.1	10.0	mg/kg	87.8		94.6	71-120			
Surrogate: 2-FBP	*8.10*		*"*	*8.33*		*97.2*	*50-150*			
LCS Dup (5L27049-BSD1)										
Diesel Range Hydrocarbons	83.9	10.0	mg/kg	66.7		126	71-120	0.958	40	X
Surrogate: 2-FBP	*8.10*		*"*	*8.33*		*97.2*	*50-150*			
LCS Dup (5L27049-BSD2)										**X**
Diesel Range Hydrocarbons	83.9	10.0	mg/kg	87.8		95.6	71-120	0.958	40	
Surrogate: 2-FBP	*8.10*		*"*	*8.33*		*97.2*	*50-150*			
Duplicate (5L27049-DUP1)					**Source: B5L0547-61**					
Diesel Range Hydrocarbons	45.4	11.3	mg/kg dry		40.3			11.9	40	
Lube Oil Range Hydrocarbons	48.8	28.2	"		44.9			8.32	40	
Surrogate: 2-FBP	*10.3*		*"*	*9.41*		*109*	*50-150*			
Surrogate: Octacosane	*11.3*		*"*	*9.41*		*120*	*50-150*			

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The RETEC Group, Inc.	Project: BNSF-Skykomish	
1011 SW Klickitat Way, Suite 207	Project Number: BN050-16423-522	**Reported:**
Seattle, WA 98134	Project Manager: Stephen Howard	01/10/06 17:50

Semivolatile Petroleum Products by NWTPH-Dx (w/o Acid/Silica Gel Clean-up) - Quality Control

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 5L29040: Prepared 12/29/05 Using EPA 3550B										
Blank (5L29040-BLK1)										
Diesel Range Hydrocarbons	ND	10.0	mg/kg							
Lube Oil Range Hydrocarbons	ND	25.0	"							
Surrogate: 2-FBP	*7.65*		*"*	*8.33*		*91.8*	*50-150*			
Surrogate: Octacosane	*8.88*		*"*	*8.33*		*107*	*50-150*			
LCS (5L29040-BS1)										
Diesel Range Hydrocarbons	65.9	10.0	mg/kg	66.7		98.8	71-120			
Surrogate: 2-FBP	*7.67*		*"*	*8.33*		*92.1*	*50-150*			
LCS Dup (5L29040-BSD1)										
Diesel Range Hydrocarbons	65.4	10.0	mg/kg	66.7		98.1	71-120	0.762	40	
Surrogate: 2-FBP	*7.61*		*"*	*8.33*		*91.4*	*50-150*			
Duplicate (5L29040-DUP1)					**Source: B5L0547-79**					
Diesel Range Hydrocarbons	26.4	10.6	mg/kg dry		34.3			26.0	40	
Lube Oil Range Hydrocarbons	61.4	26.6	"		79.7			25.9	40	
Surrogate: 2-FBP	*7.62*		*"*	*8.87*		*85.9*	*50-150*			
Surrogate: Octacosane	*9.05*		*"*	*8.87*		*102*	*50-150*			

North Creek Analytical - Bothell

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Conventional Chemistry Parameters by APHA/EPA Methods - Quality Control

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 6A09026: Prepared 01/06/06 Using TOC Preparation										
Blank (6A09026-BLK1)										
Total Organic Carbon - High	ND	500	mg/kg							
Total Organic Carbon - Low	ND	500	"							
LCS (6A09026-BS1)										
Total Organic Carbon - Average	33100	500	mg/kg	29900		111	70-130			
Total Organic Carbon - High	33600	500	"	29900		112	70-130			
Total Organic Carbon - Low	32300	500	"	29900		108	70-130			
LCS Dup (6A09026-BSD1)										
Total Organic Carbon - Average	33500	500	mg/kg	29900		112	70-130	1.20	30	
Total Organic Carbon - High	34800	500	"	29900		116	70-130	3.51	30	
Total Organic Carbon - Low	32800	500	"	29900		110	70-130	1.54	30	
Duplicate (6A09026-DUP1)					**Source: B5L0547-01**					
Total Organic Carbon - Average	6290	564	mg/kg dry		5850			7.25	200	
Total Organic Carbon - High	6590	564	"		6560			0.456	200	
Total Organic Carbon - Low	5520	564	"		5210			5.78	200	
Matrix Spike (6A09026-MS1)					**Source: B5L0547-01**					
Total Organic Carbon - Average	9980	564	mg/kg dry	3700	5850	112	70-130			
Batch 6A10032: Prepared 01/09/06 Using TOC Preparation										
Blank (6A10032-BLK1)										
Total Organic Carbon - Average	ND	500	mg/kg							
Total Organic Carbon - High	ND	500	"							
Total Organic Carbon - Low	ND	500	"							

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509.924.9200 fax 509.924.9290
Portland 9405 SW Nimbus Avenue, Beaverton, OR 97008-7132
503.906.9200 fax 503.906.9210
Bend 20332 Empire Avenue, Suite F-1, Bend, OR 97701-5711
541.383.9310 fax 541.382.7588
Anchorage 2000 W International Airport Road, Suite A-10, Anchorage, AK 99502-1119
907.563.9200 fax 907.563.9210

Conventional Chemistry Parameters by APHA/EPA Methods - Quality Control

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 6A10032: Prepared 12/29/05 Using TOC Preparation										
LCS (6A10032-BS1)										
Total Organic Carbon - Average	33500	500	mg/kg	29900		112	70-130			
Total Organic Carbon - High	34100	500	"	29900		114	70-130			
Total Organic Carbon - Low	32800	500	"	29900		110	70-130			
LCS Dup (6A10032-BSD1)										
Total Organic Carbon - Average	34000	500	mg/kg	29900		114	70-130	1.48	30	
Total Organic Carbon - High	34700	500	"	29900		116	70-130	1.74	30	
Total Organic Carbon - Low	33300	500	"	29900		111	70-130	1.51	30	
Duplicate (6A10032-DUP1)					**Source: B5L0547-62**					
Total Organic Carbon - Average	3680	725	mg/kg dry		3870			5.03	200	
Total Organic Carbon - High	3970	725	"		4250			6.81	200	
Total Organic Carbon - Low	3390	725	"		3370			0.592	200	
Matrix Spike (6A10032-MS1)					**Source: B5L0547-62**					
Total Organic Carbon - Average	5230	725	mg/kg dry	1990	3870	68.3	70-130			Q-01

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907.563.9200 fax 907.563.9210

The RETEC Group, Inc.	Project: BNSF-Skykomish	
1011 SW Klickitat Way, Suite 207	Project Number: BN050-16423-522	**Reported:**
Seattle, WA 98134	Project Manager: Stephen Howard	01/10/06 17:50

Physical Parameters by APHA/ASTM/EPA Methods - Quality Control

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 5L27043: Prepared 12/27/05 Using Dry Weight										
Blank (5L27043-BLK1)										
Dry Weight	99.8	1.00	%							
Batch 5L27044: Prepared 12/27/05 Using Dry Weight										
Blank (5L27044-BLK1)										
Dry Weight	100	1.00	%							
Batch 5L27045: Prepared 12/27/05 Using Dry Weight										
Blank (5L27045-BLK1)										
Dry Weight	100	1.00	%							
Batch 5L27046: Prepared 12/27/05 Using Dry Weight										
Blank (5L27046-BLK1)										
Dry Weight	100	1.00	%							
Batch 5L27047: Prepared 12/27/05 Using Dry Weight										
Blank (5L27047-BLK1)										
Dry Weight	100	1.00	%							
Batch 5L30045: Prepared 12/30/05 Using Dry Weight										
Blank (5L30045-BLK1)										
Dry Weight	100	1.00	%							

North Creek Analytical - Bothell

Kate Haney, Project Manager

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

The RETEC Group, Inc.	Project: BNSF-Skykomish	
1011 SW Klickitat Way, Suite 207	Project Number: BN050-16423-522	**Reported:**
Seattle, WA 98134	Project Manager: Stephen Howard	01/10/06 17:50

Notes and Definitions

D-06	The sample chromatographic pattern does not resemble the fuel standard used for quantitation.
D-09	Results in the diesel organics range are primarily due to overlap from a heavy oil range product.
D-15	Hydrocarbon pattern most closely resembles a heavy fuel oil product.
D-15a	Hydrocarbon pattern most closely resembles a heavy fuel oil. product.
Q-01	The spike recovery for this QC sample is outside of established control limits. Review of associated batch QC indicates the recovery for this analyte does not represent an out-of-control condition for the batch.
Q-05	Analyses are not controlled on RPD values from sample concentrations less than 10 times the reporting limit.
Q-06	Analyses are not controlled on RPD values from sample concentrations less than 5 times the reporting limit.
S-01	The surrogate recovery for this sample is not available due to sample dilution required from high analyte concentration and/or matrix interferences.
X	See case narrative.
DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference

nca

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2000 W International Airport Rd Ste A10, Anchorage, AK 99502-1119 907-563-9200 FAX 563-9210

CHAIN OF CUSTODY REPORT

Work Order #: B5L0547

NCA CLIENT: BNSF
REPORT TO: STEPHEN HOWARD
ADDRESS: THE RETEC GROUP, INC - SEATTLE
PHONE: 206 624-9349 FAX: 206 624-2839
INVOICE TO: BRUCE SHEPPARD THE BNSF RAILWAY COMPANY, INC.
P.O. NUMBER: TT0100 - F07
PROJECT NAME: SKYKOMISH
PROJECT NUMBER: BN050-16423-522
SAMPLED BY: VLADO ARSOV

TURNAROUND REQUEST in Business Days *
Organic & Inorganic Analyses: 10 Std. 7 5 4 3 2 1 <1
Petroleum Hydrocarbon Analyses: 5 Std. 4 ~~3~~ 2 1 <1
OTHER Specify:
* Turnaround Requests less than standard may incur Rush Charges.

PRESERVATIVE / REQUESTED ANALYSES

	CLIENT SAMPLE IDENTIFICATION	SAMPLING DATE/TIME	NWTPH-Dx	TOC	MATRIX (W, S, O)	# OF CONT.	LOCATION / COMMENTS	NCA WO ID
1	LEV8A - 10'	DEC 19, 2005 / 1630	X	X	S	1		-01
2	LEV8A - 15'	↓	X		S	1		-02
3	LEV8A - 17.5'	↓	X		S	1		-03
4	LEV8A - 20'	↓	X		S	1		-04
5	LEV8A - 25'	↓	X		S	1		-05
6	LEV8A - 30'	↓	X		S	1		-06
7	LEV8A - 32.5'	↓	X		S	1		-07
8	LEV8A - 35'	↓	X	X	S	2		-08
9	LEV8B - 10'	12/20/05 11:30	X	X	S	1		-09
10	LEV8B - 15'	-11-	X		S	1		-10

RELEASED BY: Vlado Arsov DATE: 12/22/05
PRINT NAME: Vlado ARSOV FIRM: RETEC TIME: 1655
RECEIVED BY: [signature] DATE: 12/22/05
PRINT NAME: FRANCY TONG FIRM: NCA TIME: 1655

RELEASED BY: DATE:
PRINT NAME: FIRM: TIME:
RECEIVED BY: DATE:
PRINT NAME: FIRM: TIME:

ADDITIONAL REMARKS: TOC METHOD 9060 - NORMAL T.A.T.
NWTPH-Dx RUSH (3 DAY)

TEMP: 3.5

PAGE 1 OF

COC REV 09/04

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2000 W International Airport Rd Ste A10, Anchorage, AK 99502-1119 907-563-9200 FAX 563-9210

CHAIN OF CUSTODY REPORT

Work Order #: B5L0547

NCA CLIENT: BNSF
REPORT TO: Stephen Howard
ADDRESS: The Retec Group Inc. – Seattle, WA
PHONE: 206-624-9349 FAX: 206-624-2839
INVOICE TO: BRUCE SHEPPARD THE BNSF Railway Company Inc.
P.O. NUMBER: TT0100-E07
PROJECT NAME: SKYKOMISH
PROJECT NUMBER: BN050-16423-522
SAMPLED BY: Vlado Arsov

TURNAROUND REQUEST in Business Days *
Organic & Inorganic Analyses: 10 STD, 7, 5, 4, 3, 2, 1, <1
Petroleum Hydrocarbon Analyses: 5 STD, 4, 3, 2, 1, <1
OTHER Specify:
* Turnaround Requests less than standard may incur Rush Charges.

PRESERVATIVE: / /

REQUESTED ANALYSES

CLIENT SAMPLE IDENTIFICATION	SAMPLING DATE/TIME	NWTPH-DX	TOC	MATRIX (W, S, O)	# OF CONT.	LOCATION / COMMENTS	NCA WO ID
1 LEV8B-17.5'	12/20/05 11:30	X		S	1		-11
2 LEV8B-20'		X		S	1		-12
3 LEV8B-22.5'		X		S	1		-13
4 LEV8B-25'		X		S	1		-14
5 LEV8B-27.5'		X		S	1		-15
6 LEV8B-30'		X		S	1		-16
7 LEV8B-32.5'		X		S	1		-17
8 LEV8B-35'		X	X	S	2		-18
9 LEV7A-10'	12/20/05 16:00	X	X	S	1		-19
10 LEV7A-15'	-11-	X		S	1		-20

RELEASED BY: Vlado Arsov DATE: 12/22/05
PRINT NAME: Vlado Arsov FIRM: RETEC TIME: 1655
RECEIVED BY: [signature] DATE: 12/22/05
PRINT NAME: PANY TOATS FIRM: NCA TIME: 1658

RELEASED BY: DATE:
PRINT NAME: FIRM: TIME:
RECEIVED BY: DATE:
PRINT NAME: FIRM: TIME:

ADDITIONAL REMARKS: TOC METHOD 9060 – NORMAL TAT
NWTPH-Dx RUSH (3 day)

TEMP: 3.5

PAGE 2 OF

COC REV 09/04

nca

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2000 W International Airport Rd Ste A10, Anchorage, AK 99502-1119 907-563-9200 FAX 563-9210

CHAIN OF CUSTODY REPORT

Work Order #: B5L0547

NCA CLIENT: BNSF
REPORT TO: STEPHEN HOWARD
ADDRESS: THE RETEC GROUP, INC - Seattle
PHONE: 206-624-9349 FAX: 206-624-2839
PROJECT NAME: SKYKOMISH
PROJECT NUMBER: BN050-16423-522
SAMPLED BY: VLADO ARSOV

INVOICE TO: BRUCE SHEPPARD THE BNSF RAILWAY COMPANY INC.
P.O. NUMBER: TT0100-F07

TURNAROUND REQUEST in Business Days*
Organic & Inorganic Analyses: 10 STD, 7, 5, 4, 3, 2, 1, <1
Petroleum Hydrocarbon Analyses: 5 STD, 4, 3 (X), 2, 1, <1
OTHER Specify:
*Turnaround Requests less than standard may incur Rush Charges.

PRESERVATIVE / REQUESTED ANALYSES

Revised Chain of Custody

CLIENT SAMPLE IDENTIFICATION	SAMPLING DATE/TIME	NWTPH-DX	TOC	MATRIX (W, S, O)	# OF CONT.	LOCATION / COMMENTS	NCA WO ID
1 LEV7A-17.5'	12/20/05 16:00	X		S	1		-21
2 LEV7A-20'		X		S	1		-22
3 LEV7A-22.5'		X		S	1		-23
4 LEV7A-25'		X		S	1		-24
5 LEV7A-27.5		X		S	1		-25
6 LEV7A-30'		X		S	1		-26
7 LEV7A-32.5'		X		S	1		-27
8 LEV7A-35'		X	X	S	2		-28
9 LEV6A-10'	12/21/05 10:30	X		S			-29
10 LEV6A-15'		X		S			-30

RELEASED BY: Vlado Arsov	DATE: 12/22/05	RECEIVED BY: [signature]	DATE: 12/22/05
PRINT NAME: VLADO ARSOV FIRM: RETEC	TIME: 1655	PRINT NAME: PRANY TONG FIRM: NCA	TIME: 1655
RELEASED BY:	DATE:	RECEIVED BY:	DATE:
PRINT NAME: FIRM:	TIME:	PRINT NAME: FIRM:	TIME:

ADDITIONAL REMARKS: TOC METHOD 9060 - NORMAL TAT
NWTPH-DX RUSH (3 DAY)
(X) Analysis per S. Howard 12/27/05 (KW)

TEMP: 3.5
PAGE 3 OF

COC REV 09/04

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20332 Empire Ave, Ste F1, Bend, OR 97701-5712 541-383-9310 FAX 382-7588
2000 W International Airport Rd Ste A10, Anchorage, AK 99502-1119 907-563-9200 FAX 563-9210

CHAIN OF CUSTODY REPORT

Work Order #: B5L0547

NCA CLIENT: BNSF
REPORT TO: STEPHEN HOWARD
ADDRESS: THE RETEC GROUP, INC - Seattle
PHONE: 206-624-9349 FAX: 206-624-2839
INVOICE TO: BRUCE SHEPPARD THE BNSF RAILWAY COMPANY INC
P.O. NUMBER: TT0100 - F07
PROJECT NAME: SKYKOMISH
PROJECT NUMBER: BN050-16423-522
SAMPLED BY: VLADO ARSOV

TURNAROUND REQUEST in Business Days*
Organic & Inorganic Analyses: 10 7 5 4 3 2 1 <1 (STD. 10)
Petroleum Hydrocarbon Analyses: 5 4 ~~3~~ 2 1 <1 (STD. 5)
OTHER Specify:

PRESERVATIVE: / /

REQUESTED ANALYSES

	CLIENT SAMPLE IDENTIFICATION	SAMPLING DATE/TIME	NWTPH-DX	TOC	MATRIX (W, S, O)	# OF CONT.	LOCATION / COMMENTS	NCA WO ID
1	LEV7A-17.5'	12/20/05 16:00	X		S	1		-21
2	LEV7A-20'	↓	X		S	1		-22
3	LEV7A-22.5'	↓	X		S	1		-23
4	LEV7A-25'	↓	X		S	1		-24
5	LEV7A-27.5	↓	X		S	1		-25
6	LEV7A-30'	↓	X		S	1		-26
7	LEV7A-32.5'	↓	X		S	1		-27
8	LEV7A-35'	↓	X	X	S	2		-28
9	LEV6A-10'	12/21/05 10:30			S			-29
10	LEV6A-15'				S			-30

RELEASED BY: Vlado Arsov DATE: 12/22/05
PRINT NAME: VLADO ARSOV FIRM: RETEC TIME: 1655
RECEIVED BY: [signature] DATE: 12/22/05
PRINT NAME: PRANY TONG FIRM: NCA TIME: 1655

RELEASED BY: DATE:
PRINT NAME: FIRM: TIME:
RECEIVED BY: DATE:
PRINT NAME: FIRM: TIME:

ADDITIONAL REMARKS: TOC METHOD 9060 - NORMAL TAT
NWTPH - DX RUSH (3 DAY)

TEMP: 4.5
PAGE 3 OF

COC REV 09/04

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2000 W International Airport Rd Ste A10, Anchorage, AK 99502-1119 907-563-9200 FAX 563-9210

CHAIN OF CUSTODY REPORT

Work Order #: B5L0547

NCA CLIENT: BNSF

REPORT TO: STEPHEN HOWARD
ADDRESS: THE RETEC Group, Inc Seattle

PHONE: 206-624-9349 FAX: 206-624-2839

INVOICE TO: BRUCE SHEPPARD
THE BNSF RAILWAY COMPANY INC.

P.O. NUMBER: TT0100-F07

PROJECT NAME: Skykomish

PROJECT NUMBER: BN050-16423-522

SAMPLED BY: Vlado Arsov

TURNAROUND REQUEST
In Business Days *
Organic & Inorganic Analyses
10 STD 7 5 4 3 2 1 <1
Petroleum Hydrocarbon Analyses
5 STD 4 3 2 1 <1
OTHER Specify:
* Turnaround Requests less than standard may incur Rush Charges.

PRESERVATIVE: / /

REQUESTED ANALYSES

	CLIENT SAMPLE IDENTIFICATION	SAMPLING DATE/TIME	NWTPH DX	TOC	MATRIX (W, S, O)	# OF CONT.	LOCATION / COMMENTS	NCA WO ID
1	LEV6A-17.5'	12/21/05 10:30	X		S	1		-31
2	LEV6A-20'	↓	X		↓	1		-32
3	LEV6A-22.5'		X			1		-33
4	LEV6A-25'		X			1		-34
5	LEV6A-27.5'		X			1		-35
6	LEV6A-30'		X			1		-36
7	LEV6A-32.5'		X			1		-37
8	LEV6A-35'		X			1		-38
9	LEV6A-37.5'		X			1		-39
10	LEV6A-40'		X	X		2		-40

RELEASED BY: Vlado Arsov DATE: 12/22/05
PRINT NAME: Vlado Arsov FIRM: RETEC TIME: 1655

RECEIVED BY: [signature] DATE: 12/22/05
PRINT NAME: FRANY TONG FIRM: NCA TIME: 1655

RELEASED BY: DATE:
PRINT NAME: FIRM: TIME:

RECEIVED BY: DATE:
PRINT NAME: FIRM: TIME:

ADDITIONAL REMARKS: TOC METHOD 9060 - NORMAL TAT
NWTPH-Dx RUSH (3 DAY)

TEMP: 3.5

PAGE 4 OF

COC REV 09/04

Chain of Custody Record

№ 101321

The RETEC Group, Inc.
1011 S.W. Klickitat Way, Suite 207 • Seattle, WA 98134-1162
(206) 624-9349 Phone • (206) 624-2639 Fax
www.retec.com

B5L0547

RETEC

Project Name: BNSF	Project Number: BN050-16423-522		Page 5 of ___
Send Report To: STEPHEN HOWARD	Sampler (Print Name): VLADO ARSOV		
Address: THE RETEC GROUP Seattle, WA	Sampler (Print Name):		TOC METHOD 9060 - normal TAT
	Shipment Method:		NWTPH-DX RUSH (3 day)
	Airbill Number:		Purchase Order #: TT0100-F07
Phone: 206-624-9349	Laboratory Receiving:		
Fax: 206-624-2839			

Analysis Requested: NWTPH-DX, TOC

Field Sample ID	Sample Date	Sample Time	Sample Matrix	Number of Containers	NWTPH-DX	TOC	Comments, Special Instructions, etc.	Lab Sample ID (to be completed by lab)
LEV6A - 42.5'	12/21/05	10:30	S	1	X			B5L0547-41
LEV6A - 45'		10:30		1	X			-42
LEV 5C - 10'		14:30		1	X	X		-43
LEV 5C - 15'				1	X			-44
LEV5C - 17.5'				1	X			-45
LEV5C - 20'				1	X			-46
LEV5C - 22.5'				1	X			-47
LEV5C - 25'				1	X			-48
LEV5C - 27.5'				1	X			-49
LEV5C - 30'				1	X			-50
LEV 5C - 32.5'				1	X			-51
LEV5C - 35'				1	X			-52
LEV 4A - 10'	12/22/05	10:15		1	X	X		-53
LEV 4A - 15'				1	X			-54
LEV 4A - 17.5'				1	X			-55
LEV 4A - 20'				1	X			-56
LEV 4A - 22.5				1	X			-57

Relinquished by: (Signature)	Received by: (Signature)	Date:	Time:
Vlado Arsov	[signature]	12/22/05	1655
Relinquished by: (Signature)	Received by: (Signature)	Date:	Time:
Relinquished by: (Signature)	Received by: (Signature)	Date:	Time:

Sample Custodian Remarks (Completed By Laboratory):

QA/QC Level	Turnaround	Sample Receipt	
Level I ☐	Routine ☐	Total # Containers Received?	
Level II ☐	24 Hour ☐	COC Seals Present?	
Level III ☐	1 Week ☐	COC Seals Intact?	
Other ☐	Other ___	Received Containers Intact?	
		Temperature?	9.5

White: Lab Copy   Yellow: PM Copy   Pink: Field Copy   Gold: PM/QA/QC Copy

Chain of Custody Record

№ 101323

The RETEC Group, Inc.
1011 S.W. Klickitat Way, Suite 207 • Seattle, WA 98134-1162
(206) 624-9349 Phone • (206) 624-2839 Fax
www.retec.com

RETEC

Project Name: BNSF
Project Number: BN050-16423-522
Send Report To: STEPHEN HOWARD
Sampler (Print Name): VLADO ARSOV
Address: THE RETEC Group Seattle, WA
Sampler (Print Name):
Shipment Method:
Airbill Number:
Phone: 206-624-9349
Laboratory Receiving:
Fax: 206-624-2839

Page 6 of ____

TOC METHOD 9060 - Normal TAT
NWTPH-Dx Rush (3 day)
Purchase Order #: TT0100-F07

Analysis Requested: NWTPH-DX, TOC

Field Sample ID	Sample Date	Sample Time	Sample Matrix	Number of Containers	NWTPH-DX	TOC	Comments, Special Instructions, etc.	Lab Sample ID (to be completed by lab)
LEV4A - ~~20'~~ 25' (NA)	12/22/05	10:15	S	1	X			B5L0547-58
LEV4A - 27.5'				1	X			-59
LEV 4A - 30'				1	X			-60
LEV 4A - 32.5'				1	X			-61
LEV 4A - 35'				2	X	X		-62
LEV 2A - 10'		13:15		1	X	X		-63
LEV 2A - 15'				1	X			-64
LEV 2A - 17.5'				1	X			-65
LEV 2A - 20'				1	X			-66
LEV 2A - 22.5'				1	X			-67
LEV 2A - 25'				1	X			-68
~~LEV 2A - 27.5'~~				~~1~~	~~X~~		(NA)	~~-69~~ (ory)
LEV 2A - 30'				1	X			-69
LEV 2A - 32.5'				1	X			-70
LEV 2A - 35'				2	X	X		-71
LEV 2A - 37.5'				1	X			-72
LEV 2A - 40'				1	X			-73

Relinquished by: (Signature)	Received by: (Signature)	Date:	Time:
Vlado Arsov	Jenny Tate	12/22/05	1653
Relinquished by: (Signature)	Received by: (Signature)	Date:	Time:
Relinquished by: (Signature)	Received by: (Signature)	Date:	Time:

Sample Custodian Remarks (Completed By Laboratory):

QA/QC Level	Turnaround	Sample Receipt	
Level I ☐	Routine ☐	Total # Containers Received?	
Level II ☐	24 Hour ☐	COC Seals Present?	
Level III ☐	1 Week ☐	COC Seals Intact?	
Other ☐	Other ____	Received Containers Intact?	
		Temperature?	3.5

White: Lab Copy   Yellow: PM Copy   Pink: Field Copy   Gold: PM/QA/QC Copy

nca

Revised Chain of Custody

11720 North Creek Pkwy N Suite 400, Bothell, WA 98011-8244 425-420-9200 FAX 420-9210
11922 E 1st Ave, Spokane, WA 99206-5302 509-924-9200 FAX 924-9290
9405 SW Nimbus Ave, Beaverton, OR 97008-7145 503-906-9200 FAX 906-9210
20332 Empire Ave, Ste F1, Bend, OR 97701-5712 541-383-9310 FAX 382-7588
2000 W International Airport Rd Ste A10, Anchorage, AK 99502-1119 907-563-9200 FAX 563-9210

CHAIN OF CUSTODY REPORT

Work Order #: B5L0547

NCA CLIENT: BNSF

REPORT TO: STEPHEN HOWARD

ADDRESS: The RETEC group, Inc - Seattle

PHONE: (206) 624-9349 FAX: (206) 624-2839

INVOICE TO: Bruce Sheppard
The BNSF Railway Company, Inc.

P.O. NUMBER: TT0100 - F07

PROJECT NAME: Sky Komish

PROJECT NUMBER: BN050 - 16423 - 522

SAMPLED BY: VLADO ARSON

PRESERVATIVE: none

REQUESTED ANALYSES: NWTPH-Dx

TURNAROUND REQUEST in Business Days *

Organic & Inorganic Analyses: 10 7 5 4 3 2 1 <1 (STD.)

Petroleum Hydrocarbon Analyses: 5 4 3 2 1 <1 (STD.)

OTHER Specify:

* Turnaround Requests less than standard may incur Rush Charges.

CLIENT SAMPLE IDENTIFICATION	SAMPLING DATE/TIME	NWTPH-Dx	MATRIX (W, S, O)	# OF CONT.	LOCATION / COMMENTS	NCA WO ID
1 LEV8A-17.5' Dup	12/19/05 1630	X	S			-74
2 LEV8B-20' Dup	12/20/05 1130	X	S			-75
3 LEV7A-20' Dup	12/20/05 1600	X	S			-76
4 LEV6A-20' Dup	12/21/05 1030	X	S			-77
5 LEV5C-22.5' Dup	12/21/05 1430	X	S			-78
6 LEV4A-15' Dup	12/22/05 1015	X	S			-79
7 LEV2A-22.5' Dup	12/22/05 1315	X	S			-80
8						
9						
10						

RELEASED BY: DATE:
PRINT NAME: FIRM: TIME:

RECEIVED BY: DATE:
PRINT NAME: FIRM: TIME:

RELEASED BY: DATE:
PRINT NAME: FIRM: TIME:

RECEIVED BY: DATE:
PRINT NAME: FIRM: TIME:

ADDITIONAL REMARKS: X analysis + samples added as duplicates ~~12/28/0~~ 12/29/05 by. S. Howard. Ku on Standard TAT.

TEMP: 3.5

PAGE 7 OF

COC REV 09/04

Kate Haney B5L0547

From: Steve Howard [showard@retec.com]
Sent: Thursday, December 29, 2005 10:03 AM
To: Kate Haney
Cc: Halah Voges
Subject: BNSF Skykomish - Duplicate Samples

Hi Kate,

As discussed, we would like duplicate samples run for NWTPH-Dx from a subset of the soil samples we delivered to you on December 22. These samples can be run with standard turnaround time, rather than the 3-day rush for the original samples.

Please analyze duplicates from the following seven samples:

LEV8A-17.5' Dup B5L0547-74
LEV8B-20' Dup B5L0547-75
LEV7A-20' Dup B5L0547-76
LEV6A-20' Dup B5L0547-77
LEV5C-22.5' Dup B5L0547-78
LEV4A-15' Dup B5L0547-79
LEV2A-22.5' Dup B5L0547-80

In addition, we will be sending you approximately 20 additional samples (including dups) for NWTPH-Dx analysis on Wednesday January 4. We will also like to have these analyzed on a 3-day rush basis.

Thanks
Stephen Howard
The RETEC Group, Inc.
1011 S.W. Klickitat Way, Suite 207
Seattle, WA. 98134-1162
(206) 624-9349
(206) 890-7481 (cell)

Appendix C

South Fork Skykomish River
Mean Discharge Ranking in Summer

MEMORANDUM

TO: Halah Voges, Steve Howard, Mike Byers

DATE: 10 January 2006

FROM: Joe Scott

RE: South Fork Skykomish River Mean Discharge Ranking in Summer

---

There is a need to know the summer stages of the South Fork of the Skykomish River to determine if construction of levee remediation can proceed safely in the summer of 2006 and how high the crest of the cofferdam needs to be to prevent overtopping during construction. River stages of the South Fork of the Skykomish River are measured by a sonic gage on the 5th Street Bridge. Mean monthly stage statistics are available for the years 2000 through 2004 (see Table 1), a total of only 5 years. Do these stages represent the typical range of river stages?

Mean monthly discharges of the South Fork of the Skykomish River at Gold Bar are available for the years 1929 through 2004, or 76 years. To address the above question, the 2000-2004 discharges of the South Fork of the Skykomish River at Gold Bar for June through September are compared to the 1929-2004 record to determine the summer normalcy of the last 5 years.

The mean monthly discharges for June through September for 1929-2004 are graphed and listed separately from the rest of the record (see Attachment A). For each of these months individually, the discharges are ordered in ascending order. The place in the order for the last five years is then noted on the listing.

The results indicate that the last five years are scattered in the record comparison over 76 years; but in general, three of the years are always near the low end of record and two years are always near the high end. For June, 2001, 2003 and 2004 flows ranked 17th, 18th, and 23rd, respectively; whereas 2000 and 2002 flows ranked 62nd and 74th, respectively. For July, 2003, 2004 and 2001 flows ranked 7th, 10th, and 20th, respectively; whereas 2000 and 2002 ranked 49th and 63rd, respectively. For August, 2003 flow ranked 1st; whereas 2001, 2000, 2002 and 2004 flows ranked 31st, 49th, 50th and 59th, respectively. For September, 2001, 2003 and 2002 ranked 6th, 12th, and 18th, respectively; whereas 2000 and 2004 ranked 58th and 75th, respectively.

This means that the years 2001 and 2003 represent relatively dry years. 2000 and 2002 represent fairly wet years for June and July; but 2000 and 2004 represent wet years for August and September.

I recommend that the maximum stage statistics for 2000 be used to guide the planning as to the safety of construction and for setting the crest of the cofferdam. The 2000 monthly stage statistics represent stages associated with slightly above average mean monthly river discharges.

This means that a water elevation of less than (914.2 + 8.2) 922.4 feet (NAXD88) be set for the beginning of construction and that the crest of the cofferdam be no lower than elevation (914.2 + 7.6) 921.8 feet (NAVD88).

Table 1 Mean Monthly Stages (ft) of the South Fork of the Skykomish River at the 5th Street Bridge

Year and Month	Minimum	Mean	Maximum
2000 June	5.8	6.6	8.2
2001 June	4.7	5.2	6.0
2002 June	5.9	7.2	8.7
2003 June	4.4	5.4	6.8
2004 June	4.4	5.4	6.4
2000 July	4.2	4.9	6.0
2001 July	3.6	4.1	4.9
2002 July	4.2	5.5	6.7
2003 July	3.2	4.0	4.8
2004 July	3.4	4.0	4.7
2000 August	3.2	3.8	4.4
2001 August	3.2	3.5	3.9
2002 August	3.3	3.9	4.6
2003 August	2.9	3.3	3.6
2004 August	3.2	3.8	5.9
2000 September	2.9	3.7	7.6
2001 September	2.7	3.2	3.5
2002 September	2.9	3.4	3.9
2003 September	2.7	3.2	3.8
2004 September	3.5	4.6	7.0

Attachment A

Skykomish River Mean Monthly Discharges – June through September, 1929-2004

Attachment A – Mean Montly Discharge (cfs) of the Skykomish River at Gold Bar
September Ordered Data

USGS	12134500	9	1998	465	
USGS	12134500	9	1987	489	
USGS	12134500	9	1940	515	
USGS	12134500	9	1938	535	
USGS	12134500	9	1989	560	
USGS	12134500	9	2001	579	6
USGS	12134500	9	1929	594	
USGS	12134500	9	1993	597	
USGS	12134500	9	1942	612	
USGS	12134500	9	1957	635	
USGS	12134500	9	1952	646	
USGS	12134500	9	2003	651	12
USGS	12134500	9	1930	662	
USGS	12134500	9	1966	680	
USGS	12134500	9	1991	680	
USGS	12134500	9	1937	719	
USGS	12134500	9	1995	725	
USGS	12134500	9	2002	733	18
USGS	12134500	9	1990	739	
USGS	12134500	9	1967	769	
USGS	12134500	9	1943	773	
USGS	12134500	9	1946	806	
USGS	12134500	9	1939	830	
USGS	12134500	9	1979	855	
USGS	12134500	9	1986	886	
USGS	12134500	9	1935	917	
USGS	12134500	9	1936	926	
USGS	12134500	9	1994	927	
USGS	12134500	9	1934	976	
USGS	12134500	9	1951	1015	
USGS	12134500	9	1963	1056	
USGS	12134500	9	1960	1064	
USGS	12134500	9	1973	1073	
USGS	12134500	9	1953	1121	
USGS	12134500	9	1961	1121	
USGS	12134500	9	1999	1129	
USGS	12134500	9	1932	1137	
USGS	12134500	9	1996	1145	
USGS	12134500	9	1955	1150	
USGS	12134500	9	1931	1153	
USGS	12134500	9	1947	1176	
USGS	12134500	9	1975	1193	
USGS	12134500	9	1981	1200	
USGS	12134500	9	1988	1223	
USGS	12134500	9	1958	1226	
USGS	12134500	9	1965	1252	
USGS	12134500	9	1984	1253	
USGS	12134500	9	1950	1274	
USGS	12134500	9	1985	1311	
USGS	12134500	9	1962	1333	
USGS	12134500	9	1974	1350	
USGS	12134500	9	1982	1439	
USGS	12134500	9	1971	1486	
USGS	12134500	9	1992	1506	
USGS	12134500	9	1976	1525	
USGS	12134500	9	1956	1586	
USGS	12134500	9	1949	1691	
USGS	12134500	9	2000	1703	58
USGS	12134500	9	1948	1765	
USGS	12134500	9	1970	1774	
USGS	12134500	9	1945	1777	
USGS	12134500	9	1977	1779	
USGS	12134500	9	1983	1784	
USGS	12134500	9	1969	1998	
USGS	12134500	9	1980	2004	
USGS	12134500	9	1944	2147	
USGS	12134500	9	1954	2220	
USGS	12134500	9	1964	2450	
USGS	12134500	9	1997	2522	
USGS	12134500	9	1941	2542	
USGS	12134500	9	1972	2881	
USGS	12134500	9	1968	2985	
USGS	12134500	9	1978	2995	
USGS	12134500	9	1933	3366	
USGS	12134500	9	2004	3537	75
USGS	12134500	9	1959	4942	

Attachment A – Mean Montly Discharge (cfs) of the Skykomish River at Gold Bar
August Ordered Data

USGS	12134500	8	2003	535	1
USGS	12134500	8	1992	589	
USGS	12134500	8	1941	612	
USGS	12134500	8	1987	627	
USGS	12134500	8	1958	654	
USGS	12134500	8	1940	659	
USGS	12134500	8	1994	662	
USGS	12134500	8	1938	690	
USGS	12134500	8	1944	696	
USGS	12134500	8	1986	707	
USGS	12134500	8	1931	712	
USGS	12134500	8	1998	717	
USGS	12134500	8	1930	722	
USGS	12134500	8	1934	754	
USGS	12134500	8	1985	827	
USGS	12134500	8	1951	843	
USGS	12134500	8	1945	849	
USGS	12134500	8	1970	855	
USGS	12134500	8	1988	858	
USGS	12134500	8	1981	862	
USGS	12134500	8	1979	879	
USGS	12134500	8	1973	886	
USGS	12134500	8	1936	888	
USGS	12134500	8	1961	891	
USGS	12134500	8	1942	918	
USGS	12134500	8	1969	947	
USGS	12134500	8	1929	983	
USGS	12134500	8	1963	986	
USGS	12134500	8	1952	991	
USGS	12134500	8	1957	1006	
USGS	12134500	8	2001	1006	31
USGS	12134500	8	1947	1039	
USGS	12134500	8	1989	1041	
USGS	12134500	8	1993	1086	
USGS	12134500	8	1996	1088	
USGS	12134500	8	1990	1132	
USGS	12134500	8	1937	1136	
USGS	12134500	8	1980	1142	
USGS	12134500	8	1967	1165	
USGS	12134500	8	1960	1215	
USGS	12134500	8	1935	1235	
USGS	12134500	8	1966	1236	
USGS	12134500	8	1984	1243	
USGS	12134500	8	1939	1260	
USGS	12134500	8	1983	1260	
USGS	12134500	8	1978	1282	
USGS	12134500	8	1991	1293	
USGS	12134500	8	1946	1310	
USGS	12134500	8	2000	1316	49
USGS	12134500	8	2002	1318	50
USGS	12134500	8	1977	1321	
USGS	12134500	8	1943	1346	
USGS	12134500	8	1995	1388	
USGS	12134500	8	1959	1422	
USGS	12134500	8	1968	1459	
USGS	12134500	8	1965	1470	
USGS	12134500	8	1982	1487	
USGS	12134500	8	1932	1518	
USGS	12134500	8	2004	1553	59
USGS	12134500	8	1953	1608	
USGS	12134500	8	1956	1620	
USGS	12134500	8	1997	1652	
USGS	12134500	8	1962	1810	
USGS	12134500	8	1948	1882	
USGS	12134500	8	1949	1971	
USGS	12134500	8	1975	2082	
USGS	12134500	8	1971	2615	
USGS	12134500	8	1972	2660	
USGS	12134500	8	1955	2741	
USGS	12134500	8	1950	2844	
USGS	12134500	8	1933	2989	
USGS	12134500	8	1976	3106	
USGS	12134500	8	1999	3126	
USGS	12134500	8	1954	3304	
USGS	12134500	8	1974	3389	
USGS	12134500	8	1964	3605	

Attachment A – Mean Montly Discharge (cfs) of the Skykomish River at Gold Bar
July Ordered Data

USGS	12134500	7	1941	971	
USGS	12134500	7	1940	990	
USGS	12134500	7	1992	1027	
USGS	12134500	7	1987	1267	
USGS	12134500	7	1977	1279	
USGS	12134500	7	1958	1291	
USGS	12134500	7	2003	1381	7
USGS	12134500	7	1944	1388	
USGS	12134500	7	1934	1391	
USGS	12134500	7	2004	1429	10
USGS	12134500	7	1931	1645	
USGS	12134500	7	1986	1719	
USGS	12134500	7	1930	1736	
USGS	12134500	7	1994	1779	
USGS	12134500	7	1963	1811	
USGS	12134500	7	1938	1848	
USGS	12134500	7	1995	1867	
USGS	12134500	7	1945	1896	
USGS	12134500	7	1993	1903	
USGS	12134500	7	2001	1937	20
USGS	12134500	7	1973	1949	
USGS	12134500	7	1998	2033	
USGS	12134500	7	1996	2106	
USGS	12134500	7	1957	2127	
USGS	12134500	7	1951	2132	
USGS	12134500	7	1981	2136	
USGS	12134500	7	1980	2162	
USGS	12134500	7	1970	2316	
USGS	12134500	7	1936	2339	
USGS	12134500	7	1969	2345	
USGS	12134500	7	1989	2394	
USGS	12134500	7	1978	2397	
USGS	12134500	7	1961	2431	
USGS	12134500	7	1985	2444	
USGS	12134500	7	1942	2511	
USGS	12134500	7	1960	2547	
USGS	12134500	7	1947	2567	
USGS	12134500	7	1979	2674	
USGS	12134500	7	1929	2725	
USGS	12134500	7	1968	2759	
USGS	12134500	7	1988	2794	
USGS	12134500	7	1952	2849	
USGS	12134500	7	1965	3140	
USGS	12134500	7	1937	3242	
USGS	12134500	7	1990	3281	
USGS	12134500	7	1935	3385	
USGS	12134500	7	1962	3405	
USGS	12134500	7	1948	3594	
USGS	12134500	7	2000	3703	49
USGS	12134500	7	1966	3711	
USGS	12134500	7	1967	3869	
USGS	12134500	7	1939	3948	
USGS	12134500	7	1991	4003	
USGS	12134500	7	1984	4072	
USGS	12134500	7	1983	4115	
USGS	12134500	7	1932	4293	
USGS	12134500	7	1946	4403	
USGS	12134500	7	1982	4618	
USGS	12134500	7	1949	4666	
USGS	12134500	7	1959	5034	
USGS	12134500	7	1943	5090	
USGS	12134500	7	1953	5090	
USGS	12134500	7	2002	5191	63
USGS	12134500	7	1975	5934	
USGS	12134500	7	1997	6243	
USGS	12134500	7	1956	6326	
USGS	12134500	7	1976	6415	
USGS	12134500	7	1955	7304	
USGS	12134500	7	1950	7671	
USGS	12134500	7	1999	7764	
USGS	12134500	7	1954	7841	
USGS	12134500	7	1933	8080	
USGS	12134500	7	1971	8199	
USGS	12134500	7	1972	8209	
USGS	12134500	7	1964	8364	
USGS	12134500	7	1974	8413	

Attachment A – Mean Montly Discharge (cfs) of the Skykomish River at Gold Bar
June Ordered Data

USGS	12134500	6	1992	1955	
USGS	12134500	6	1941	2169	
USGS	12134500	6	1940	2595	
USGS	12134500	6	1934	2600	
USGS	12134500	6	1987	3630	
USGS	12134500	6	1963	3689	
USGS	12134500	6	1994	3920	
USGS	12134500	6	1930	3941	
USGS	12134500	6	1944	4029	
USGS	12134500	6	1996	4029	
USGS	12134500	6	1995	4112	
USGS	12134500	6	1986	4115	
USGS	12134500	6	1977	4152	
USGS	12134500	6	1958	4237	
USGS	12134500	6	1993	4238	
USGS	12134500	6	1980	4300	
USGS	12134500	6	2001	4377	17
USGS	12134500	6	2003	4580	18
USGS	12134500	6	1973	4607	
USGS	12134500	6	1983	4630	
USGS	12134500	6	1931	4846	
USGS	12134500	6	1945	4903	
USGS	12134500	6	2004	4942	23
USGS	12134500	6	1938	5188	
USGS	12134500	6	1979	5351	
USGS	12134500	6	1952	5430	
USGS	12134500	6	1998	5433	
USGS	12134500	6	1951	5558	
USGS	12134500	6	1991	5578	
USGS	12134500	6	1988	5580	
USGS	12134500	6	1947	5617	
USGS	12134500	6	1957	5737	
USGS	12134500	6	1978	5760	
USGS	12134500	6	1981	5850	
USGS	12134500	6	1942	5931	
USGS	12134500	6	1953	6020	
USGS	12134500	6	1939	6089	
USGS	12134500	6	1965	6152	
USGS	12134500	6	1962	6252	
USGS	12134500	6	1989	6351	
USGS	12134500	6	1966	6452	
USGS	12134500	6	1960	6627	
USGS	12134500	6	1968	6721	
USGS	12134500	6	1935	6753	
USGS	12134500	6	1976	7141	
USGS	12134500	6	1990	7269	
USGS	12134500	6	1929	7329	
USGS	12134500	6	1943	7498	
USGS	12134500	6	1949	7549	
USGS	12134500	6	1970	7603	
USGS	12134500	6	1984	7683	
USGS	12134500	6	1961	7693	
USGS	12134500	6	1985	7759	
USGS	12134500	6	1936	7776	
USGS	12134500	6	1932	7984	
USGS	12134500	6	1954	8428	
USGS	12134500	6	1971	8491	
USGS	12134500	6	1969	8537	
USGS	12134500	6	1946	8551	
USGS	12134500	6	1975	8808	
USGS	12134500	6	1959	8835	
USGS	12134500	6	2000	9062	62
USGS	12134500	6	1982	9291	
USGS	12134500	6	1956	9534	
USGS	12134500	6	1937	9627	
USGS	12134500	6	1967	9655	
USGS	12134500	6	1997	9704	
USGS	12134500	6	1999	10240	
USGS	12134500	6	1955	10590	
USGS	12134500	6	1933	10960	
USGS	12134500	6	1972	11000	
USGS	12134500	6	1948	11060	
USGS	12134500	6	1964	11190	
USGS	12134500	6	2002	11350	74
USGS	12134500	6	1950	11900	
USGS	12134500	6	1974	13610	

Appendix D

Scour Hydraulic Analysis

Purpose

These calculations assess the potential scour in the South Fork of the Skykomish River during construction of the levee remediation. The summer construction window, due to fish closure on the river, is from 1 July to 15 September of any year.

Given

Based on the topographic and hydrographic surveys of the river done by Bush, Roed & Hitchings (BRH) in May 2005, the river bed in front of the levee has an average slope of 0.0028 (0.16º) between the bridge and the west end of the levee.

Assumptions

Using data from the FEMA (2001) Flood Insurance Study and the survey data for the river, the flow characteristics of the river during construction and during flood events are assumed to be as given in Table 1.

Table 1. Skykomish River Flow Characteristics about 300 Feet Downstream of the 5th Street Bridge.

Flood Frequency	Elevation, ft NAVD88	Discharge cfs	Average Flow Area ft^2	Average Velocity ft/sec
Summer Low	917.2	6,000	325 249*	18.5 24.1*
Summer High	921.2	12,000	1,147 743*	10.5 16.2*
1-yr	924.2	20,500	1,804	11.4
2-yr	925.0	24,000	1,984	12.1
5-yr	926.0	30,000	2,211	13.6
10-yr	926.8	32,200	2,396	13.4
50-yr	928.6	47,400	2,818	16.8
100-yr	929.4	54,300	3,009	18.0

* With cofferdam installed on river bar.

The elevations and discharges as a function of recurrence intervals are from the calculations of river flow (RETEC, 1 February 2005). The cross-sectional areas are from a section cut across the river 300 feet downstream of the bridge and based on the BRH May 2005 survey data.

The river bed is composed of sand, gravel, and cobbles. Based on a visual inspection of the river bed, the estimated median grain size (D_{50}) is 2 inches (50 mm, 0.17 feet).

Assume a grain size distribution as presented in Table 2. While boulders can be found in the river, it is assumed they are not present on the surface of the river bed or, if so, are too big to move.

Table 2. Skykomish River Sediment Distribution.

Grain Size Description	Median Grain Size mm	Size Distribution %
Sand	0.074 – 2.0	10
Gravel	2.0 - 76	60
Cobbles	76 - 300	30
Boulders	300+	0

Calculations

Localized scour may occur in the river bed due to flood flows or concentrated flows, like that between the cofferdam and north bank during construction.

The ASCE (2005) methods, which are derived from the work of Lagasse et (2001), are used to assess scour potential. First, the critical conditions (incipient motion) are calculated. Under critical conditions, the hydrodynamic forces on a grain are just balanced by the resisting forces. Sediment grains smaller than the critical sediment size will be transported downstream and grains equal to or larger will remain in place.

The critical conditions are assessed using a calculation spreadsheet (Attachment A) based on the ASCE methods. The calculation results need to be assessed with caution. The methods upon which the calculations are based are empirical approximations. The results are order of magnitude only, but they can be used in a qualitative sense.

The river cross-sectional areas reported in Table 1 are much less than those used in the flood study. For example, the cross-sectional area for section AT (about 300 feet downstream of the bridge) is 4,576 ft^2 at the 100-year flood elevation as measured by photogrammetric means in 1993. At the same 100-year flood elevation, the CADD measured cross-sectional area is 3,006

ft^2 as surveyed in 2005. This is a difference (decrease) of about 35%. It is assumed that as the river bed elevation increased, the river water level increased accordingly for the various freshet recurrence intervals. In other words, the flood elevations may be higher than shown in Table 1 and the average velocities may be less than shown. This means that the scour velocity, shear stress, and critical sediment diameter are conservatively high. Calculation results, however, suggest that the river has been aggrading (depositing sediment) more than degrading (scouring), given the input parameters.

Blodgett (1986) provides a less sophisticated relationship of scour depth to median size of bed material in the channel. The relationship is expressed as:

$$d_s = 1.42\ D_{50}^{-0.115},$$

where d_s is the mean depth of scour. Calculations [$1.42(2/12)^{-0.115} = 1.7$ feet] indicate that the local scour during flood flows may be on the order of 2 feet.

Discussion

The coarse, cohesionless nature of the river bed material suggests that the river bed may scour locally based on the river velocity and carrying capacity of the river. The river bed load is assumed to be subject to some transport during flood stages of the river and the distribution of the bed load is assumed to change seasonally in response to river flow. The calculations suggest that the river has been aggrading more than degrading.

Given the calculation results, during normal flow (less than flood flow) the river bed aggrades as material is transported downstream of the steep valleys in the Cascade Mountains. During flood flows, the river bed is scoured in places to a depth of about 2 feet. But as the flood flows recede, sediment is deposited and the elevation of the river bed returns to its pre-flood elevation or higher.

References

ASCE. **Predicting Bed Scour for Toe Protection Design for Bank Stabilization Projects**. American Society of Civil Engineers Continuing Education Seminar, 2005.

Blodgett, J.C, and C.E. McConaughy. **Rock Riprap Design for Protection of Stream Channels Near Highway Structures, Volume 2 – Evaluation of Riprap Design Procedures**. U.S. Geological Survey, Water-Resources Investigations Report 86-4127, Sacramento, CA, 1986.

FEMA. **Flood Insurance Study, King County Washington and Incorporated Areas**. 3 Volumes, Revised: December 6, 2001

Lagasse, P.F., J.D Schall, and V.E. Richardson. **Stream Stability at Highway Structures**. Third Edition, Report FHWA NHI 01-002, Federal Highway Administration, Hydraulic Engineering Circular No. 20, U.S. Department of Transportation, Washington, D.C., 2001.

Stream Channel Equilibrium Slope Calculations
Per Lagasse et (2001)*

Step	Item/Description	Symbol	Units	Calculations				
1	Calculation Identification	-	-	H w/o	H w	L w/o	L w	100-Yr
2	Specific weight of water	g	lbf/ft^3	62.4	62.4	62.4	62.4	62.4
3	Specific weight of sediment	g_s	lbf/ft^3	167	167	167	167	167
4	Mannings roughness coefficient	n	-	0.03	0.03	0.03	0.03	0.03
5	Median sediment diameter	D_{50}	mm	50	50	50	50	50
6	Average channel discharge	Q	ft^3/sec	12,000	12,000	6,000	6,000	54,300
7	Wetted channel cross-sectional area	A	ft^2	1,147	743	325	249	3,009
8	Wetted channel perimeter	P	ft	215	122	200	118	248
9	Average channel width at average channel discharge	W	ft	213	120	197	115	240
10	Existing channel slope	S_{ex}	-	0.00280	0.00280	0.00280	0.00280	0.00280
11	Distance upstream of base level control	L	ft	600	600	600	600	600
12	Hydraulic radius of channel	R	ft	5.3	6.1	1.6	2.1	12.1
13	Average channel velocity	V	ft/sec	10.5	16.2	18.5	24.1	18.0
14	Shields parameter	K_s	-	0.03	0.03	0.03	0.03	0.03
15	Sediment roughness	k_s	ft	0.851	0.851	0.851	0.851	0.851
16	Boundary shear stress	t_o	lbf/ft^2	1.80	4.05	10.65	15.47	3.79
17	Diameter of Sediment at incipient motion	D_c	mm	175.17	393.12	1034.09	1502.47	368.53
18	Channel discharge per unit width	q	ft^2/sec	56.3	100.0	30.5	52.2	226.3
19	Channel slope for stable D_c with no upstream sediment supply	S_{eq}	-	0.01098	0.02130	0.23498	0.25261	0.00965
20	Sediment supply coefficient	a	-	0.000003	0.000003	0.000003	0.000003	0.000003
21	Sediment supply exponent	b	-	3.67276	3.67276	3.67276	3.67276	3.67276
22	Sediment supply exponent	c	-	0.64433	0.64433	0.64433	0.64433	0.64433
23	Sediment transport capacity per unit width	q_s	ft^2/sec	0.04638	0.25004	0.17426	0.55229	0.59211
24	Channel slope for stable D_c with upstream sediment supply	S_{eq}	-	0.00473	0.00935	0.07126	0.08448	0.00456
25	Ultimate degradation at distance L with no sediment supply	Y_s	ft	-4.91	-11.10	-139.31	-149.89	-4.11
26	Ultimate degradation at distance L with sediment supply	Y_s	ft	-1.16	-3.93	-41.08	-49.01	-1.05

* Lagasse, P.F., J.D Schall, and V.E. Richardson. *Stream Stability at Highway Structures* . Third Edition, Report FHWA NHI 01-002, Federal Highway Administration, Hydraulic Engineering Circular No. 20, U.S. Department of Transportation, Washington, D.C., 2001.

1-11	User input calculation identification, specific weight of water, specific weight of sediment, Mannings roughness coefficient, median sediment diameter, average discharge, average wetted channel cross-sectional area, wetted channel perimeter, average channel width, existing channel slope, and distance upstream of base level control.
12	$R = A/P$
13	$V = Q/A$
14	$K_s = 0.047$ for $D_{50} < 2$ mm; $K_s = 0.03$ for $D_{50} > 2$ mm.
15	$k_s = 3.5D_{84} = 3.5D_{50}e^{[0.01157(84)-0.5785]}$
16	$t_o = (gn^2V^2)/(2.208R^{1/3})$ for $D_{50} < 2$ mm; $t_o = (gV^2/g)/[5.75\log(12.27R/k_s)]^2$
17	$D_c = t_o/[K_s(g_s-g)]$
18	$q = Q/W$
19	$S_{eq} = \{K_s(D_ce^{[0.01157(90)-0.5785]})[(g_s-g)/g]\}^{(10/7)}[1.486/qn]^{(6/7)}$
20	$a = 0.025n^{[2.39-0.8\log(D50)]}(D_{50}-0.07)^{-1.4}$
21	$b = 4.93-0.74\log(D_{50})$
22	$c = -0.46+0.65\log(D_{50})$
23	$q_s = aV^b(A/W)^c$
24	$S_{eq} = \{a/q_s\}^{[10/3(c-b)]}q^{[2(2b+3c)/3(c-b)]}(n/1.486)^2$
25-26	$Y_s = L(S_{ex}-S_{eq})$

Appendix E

Dewatering Calculations

The RETEC Group, Inc.
1011 SW Klickitat Way, Suite 207
Seattle, WA 98134-1162

MEMORANDUM

206.624. 9349 Phone
206.624. 2839 Fax
www.retec.com

TO: Mike Byers
FROM: Cliff Baines, Stephen Howard
DATE: 2/21/06
CLIENT: BNSF, BN050-19390
TASK: Interim Action for Levee Cleanup
RE: Dewatering Modeling

Introduction

This memo is intended to document methods of fluid management within the excavation. It includes an additional estimate of the volume of water produced by dewatering to effect a negative hydraulic gradient into the excavation, methods to contain NAPL within the excavation and a brief summary of contingency actions to implement in the event that fluid from the excavation is migrating into the South Fork Skykomish River.

Description of the Remedial Action

The proposed interim action will consist of excavating petroleum-contaminated soil from beneath the flood control levee west of the 5th Street Bridge in Skykomish and from beneath adjacent portions of the South Fork Skykomish River to the north and the Town of Skykomish to the south. Excavation below the ordinary high water mark will be conducted within the regulatory fish window[1].

The base of the excavation will be below the water table for much of the duration of the excavation. In addition, the river level is expected to be higher than the undisturbed riverbed in the excavation area for most of the construction period. Inner and outer coffer dams will be installed on the river bed around the excavation in the river to protect the excavation from rises in the river level and to help prevent water from flowing out of the excavation and into the river. The total length of the coffer dam along the river is roughly 700 feet. Further details of the coffer dam construction are provided in the EDR. In addition, one to two interior north-south trending coffer dams will be placed across the interior of the excavation as described in the EDR to further reduce the anticipated volume of water pumped to maintain hydraulic control of the excavations.

The physical properties of the site have been described in the EDR and previous documents[2]. In addition, a recent soil and sediment investigation was conducted in the Skykomish River and the levee; details of this investigation are included in the EDR (Appendix B).

[1] July 1 to September 15, 2006.
[2] The most comprehensive descriptions are included in the Supplemental Remedial Investigation Report (RETEC, 2001) and the Feasibility Study (RETEC, 2004).

Purpose of the Dewatering

Most of the excavation will probably be performed under wet conditions, however dewatering is proposed to create a hydraulic gradient towards the excavation pit and away from the river. An inward hydraulic gradient is required to keep water from the inside of the excavation from flowing through the subsurface under the coffer dams and into the river.

Groundwater Modeling to Estimate Dewatering Volumes

Groundwater flow modeling was conducted using SEEP2D. The model was constructed using known site characteristics and construction design drawings contained in the EDR.

Model Objective

The model objective was to estimate whether construction dewatering activities can maintain an inward gradient from the river without exceeding the maximum permitted surface water discharge rate (1,000 gpm). The model met the objective by calculating the volume of groundwater inflow into the planned excavation area for a given dewatering water elevation. The inflow volume was then directly compared to permit discharge limits.

Model Methods

Groundwater inflow was estimated using a computer software program called SEEP2D. SEEP2D is a two-dimensional steady state finite element groundwater flow program. The software program was developed by the US Army Corps of Engineers and is commonly applied to two-dimensional, cross sectional groundwater flow problems involving engineered structures such as dams, dikes, and sheet piles. These features can be modeled more efficiently and accurately using a finite element solution method rather than a finite difference solution method such as the one used in the software program MODFLOW.

Model Geometry

The model was constructed along the South-North cross-sectional line shown on Figure 1. This cross section line is located in the easternmost third of the excavation planned for the levee remediation. The cross section location was selected to represent a typical section of the excavation area. The basic model geometry is shown on Figure 2. The geometry is based on interpretation of engineering design drawings and ground surface/river bed topographic data.

The upland (south) boundary of the model is set at 200 feet south of the southern limit of the planned excavation area, approximately 30 feet north of with Railroad Avenue . The 200-foot distance represents the estimated distance where water table drawdown caused by excavation dewatering is zero. The northern model boundary is set in the middle portion of the Skykomish River where the riverbed has an elevation of approximately 914 feet above mean sea level (MSL).

The initial upper boundary of the model varies with location. Between the southern model boundary and the proposed southern limit of the excavation area the upper boundary drops uniformly between monitor well MW-37 (approximately 931 feet above mean sea level (ft-msl)) and the southern limit of the excavation area along the cross section line (approximately 926 ft-msl. The upper boundary then follows the surface slope of the excavation area to an elevation of 918 feet. The upper boundary remains at the 918 foot elevation until it intersects the coffer dams where the boundary follows the shape of the coffer dams with surface water in between the two dams. North of the coffer dams the upper boundary is a constant elevation of 919.1 feet, representing the assumed water level elevation in the Skykomish River.

The simulated model bottom represents an elevation of 855 feet, approximately 50 feet deeper than the deepest planned portion of the excavation area. This depth is probably great enough such that the depth of the model bottom will not affect the model results.

Model Mesh

The SEEP2D software program contains a finite element algorithm to solve groundwater flow equations. The algorithm uses a network of nodes and connecting lines known as a mesh to solve partial differential equations describing the flow of groundwater. The mesh can be modified to conform to the shape of geometric features. The density of nodes in the mesh can be varied to provide finer or coarser solutions to groundwater flow problems depending on the needs of the model. For example, the mesh at the excavation borders and near the excavation bottom is finer because finer meshes provide more accurate solutions to groundwater flow problems in areas of steep gradients or groundwater sinks and sources. Conversely, the mesh is coarser in areas further from and deeper beneath the excavation area because the accuracy of the solution is not affected by the mesh density in these areas. The initially constructed mesh is shown on Figure 3.

As previously discussed the mesh can be modified to conform to the shape of geometric features. This feature of the finite element method conforms to the shape of the mesh boundaries to the slope of the water table calculated by the model. The conforming of the mesh to the water table surface occurs when the water table is modeled as unconfined. The conformed mesh is automatically calculated by the model. The groundwater flow system in the excavation area is modeled as unconfined, consistent with the current site conceptual model. The water table modified mesh is shown on Figure 4.

Material Properties and Boundary Conditions

Three material properties are specified in the model. These three properties represent native alluvium, sheet piles/coffer dam, and surface water. Native alluvium is assigned a uniform isotropic hydraulic conductivity value of 64 feet per day[3]. Although actual native alluvium stratigraphy and corresponding material properties are variable, the native alluvium was assigned

---

[3] This hydraulic conductivity is the average hydraulic conductivity determined from slug tests performed in the upland sand and gravel. Further details are included in the Supplemental Remedial Investigation Report (RETEC, 2001).

a uniform hydraulic conductivity value to simplify the modeling process and maintain flexibility for any future modeling. Sheet piles and the coffer dam are assigned hydraulic conductivity values of 0.1 feet per day. Sheet pile and coffer dam locations are shown on Figures 1 and 2.

Surface water areas are simulated by assigning a hydraulic conductivity value of 10,000 feet per day. This value creates negligible resistance to groundwater flow and facilitates the simulation of surface water using the finite element method. Three areas of surface water are simulated: the area between the northern model boundary to the northern-most coffer dam, the area between the two coffer dams, and the area between the southern-most coffer dam and the planned location of the temporary sheet pile wall.

The southern (upland) model boundary is simulated as a constant head boundary with a value of 922.15 feet. This value is the average water level elevation near July 1 between the years 2002 and 2005 at monitor well MW-37, located on Railroad Avenue. The boundary condition assumes no vertical component to the groundwater flow gradient at MW-37. The northern model boundary is simulated as a constant head boundary with a value of 919.1, the mean river stage elevation during July 2000. The 919.1 foot value is also assigned to all upper boundary nodes north of the coffer dams. Upper boundary nodes between the coffer dams and the sheet pile are assigned a constant head value of 918 feet. The 918 foot elevation represents a head potential difference of about 1 foot between the river and the excavation area.

Six sheet pile and south excavation wall boundary nodes at elevations between 918 and 922.15 feet are assigned as exit face nodes. The exit face nodes allow the model to calculate the configuration of the water table across the plane of the sheet pile.

Model Results

The SEEP2D program software automatically calculates the net flow of groundwater through the model. In the model domain described in this memo, groundwater enters and exits the model through constant head nodes. Nodes where groundwater enters the model include the southern and northern boundary nodes as well as the upper boundary constant head nodes north of the coffer dams. Groundwater exits the model through all 918 foot constant head nodes, simulating pumping from the interior of the excavation necessary to maintain a 1 foot head difference across the coffer dams. Model calculated groundwater elevation contours and flow lines are shown on Figure 5. Most of the groundwater flowing into the excavation area comes from the river.

The net flow calculated by the model is about 0.9 gallons per minute per linear foot of excavation parallel to the river. The estimated flow rate is the combined flow of groundwater flowing into the excavation area from the south (upland) and the north (the river). The 0.9 gallons per minute flow rate represents the flow rate of water required to be removed from the excavation area to maintain a constant head elevation of 918 feet. This volume does not account for groundwater inflow across the western and eastern excavation boundaries. However, based on preliminary model results, this volume is less than 0.5 gallons per minute per foot of distance along the north/south sides. Therefore, to maintain hydraulic control over the entire excavation area (700 lineal feet east/west and the east and west ends), a pumping rate of around 930 gallons per minute (gpm) is predicted. To maintain control over a smaller excavation that would be the result of placing a single interior cofferdam, a pumping rate slightly over 600 gpm is predicted. For the scenario of utilization of two interior cofferdams, the excavation size is approximately 230 in the east-west direction and 300 feet in the north-south direction, and the predicted pumping rate to maintain the one foot head difference across the cofferdam is slightly greater than 500 gpm.

Model Sensitivity

The model was constructed using engineering design documents, historic groundwater and surface water elevations, and existing knowledge of site characteristics. Parameters that could be varied to evaluate their affect on calculated discharge rates include constant head values, hydraulic conductivity values, and the geometry of the excavation area.

If constant head values are not changed, there will be a direct linear correlation between a change in hydraulic conductivity and a change in groundwater flow rate. This correlation is more important if the modeled hydraulic conductivity is increased rather than decreased. However, hydraulic conductivity would have to be increased approximately three times to create groundwater flow rates that may be greater than what ordinary dewatering measures can accommodate. This is unrealistic given the nature of the sediments present in the excavation area.

Sensitivity analysis for the modeling described in this memo consists of varying the geometry of the excavation area, and the associated constant head node values. The first sensitivity analysis scenario simulates dewatering to an elevation of 916 feet-msl within an open excavation (i.e an approximate drawdown of 3 feet). The model calculated flow based on this scenario is about 1.9 gpm per linear foot of excavation parallel to the river. The second sensitivity scenario simulates dewatering to an elevation of 910 feet-msl within an open excavation (i.e. an approximate drawdown of nine feet). The model calculated flow for the second sensitivity scenario is 3.4 gpm per linear foot of excavation parallel to the river.

A third sensitivity scenario simulates an upland constant head of 924.15, two feet greater than the original constant head boundary value of 922.15. The 924.15 head value is 1 foot greater than the highest documented summer-time water level at well MW-37. The model predicted groundwater inflow rate for this scenario is 1.1 gpm, about 0.2 gpm greater than the initial model configuration.

Changing the constant head value of the river will not affect the simulated flow rates because in practice the dewatering heads in the excavation area will be adjusted to maintain a minimum head differential required to maintain flow from the river toward the excavation area.

NAPL Control

Diesel and Bunker C will be excavated during the cleanup action. Since some of this will be present as NAPL in soil beneath the water table, it is probable that free-phase petroleum hydrocarbons (NAPL) will be released into the excavation during the remedial activities. The

NAPL will potentially be present as a layer floating on the water surface as well as a lesser volume in small discrete bodies beneath the water table. Water will be present within the excavation; therefore, engineering measures will be taken to ensure that NAPL does not spread across the entire water surface in the excavation. These measures will include the following:

Booms

Booms will be placed around the inside of the coffer dam, these boom will consist of booms with skirts of oil-absorbent material. This type of boom should be effective at controlling the spread of oil across the water surface as will as preventing oil from passing beneath the boom.

A line of booms will also be emplaced outside the coffer dams for added assurance that small releases of NAPL be captured before they flow down the Skykomish River.

Skimmer pumps

Skimmer pumps will be employed inside the booms to remove oil from the water in the excavation, and to reduce the probability of oil escaping the booms. In addition, skimmer pumps will be used throughout the excavation as required to reduce the migration of NAPL across the excavation pit.

Absorbent Pads

Oil absorbent pads will be used as necessary to remove floating oil from the excavation. These will be used to remove oil from heavy seeps and to contain the oil closer to the excavation face. They may also be used behind the booms, as required.

Contingencies

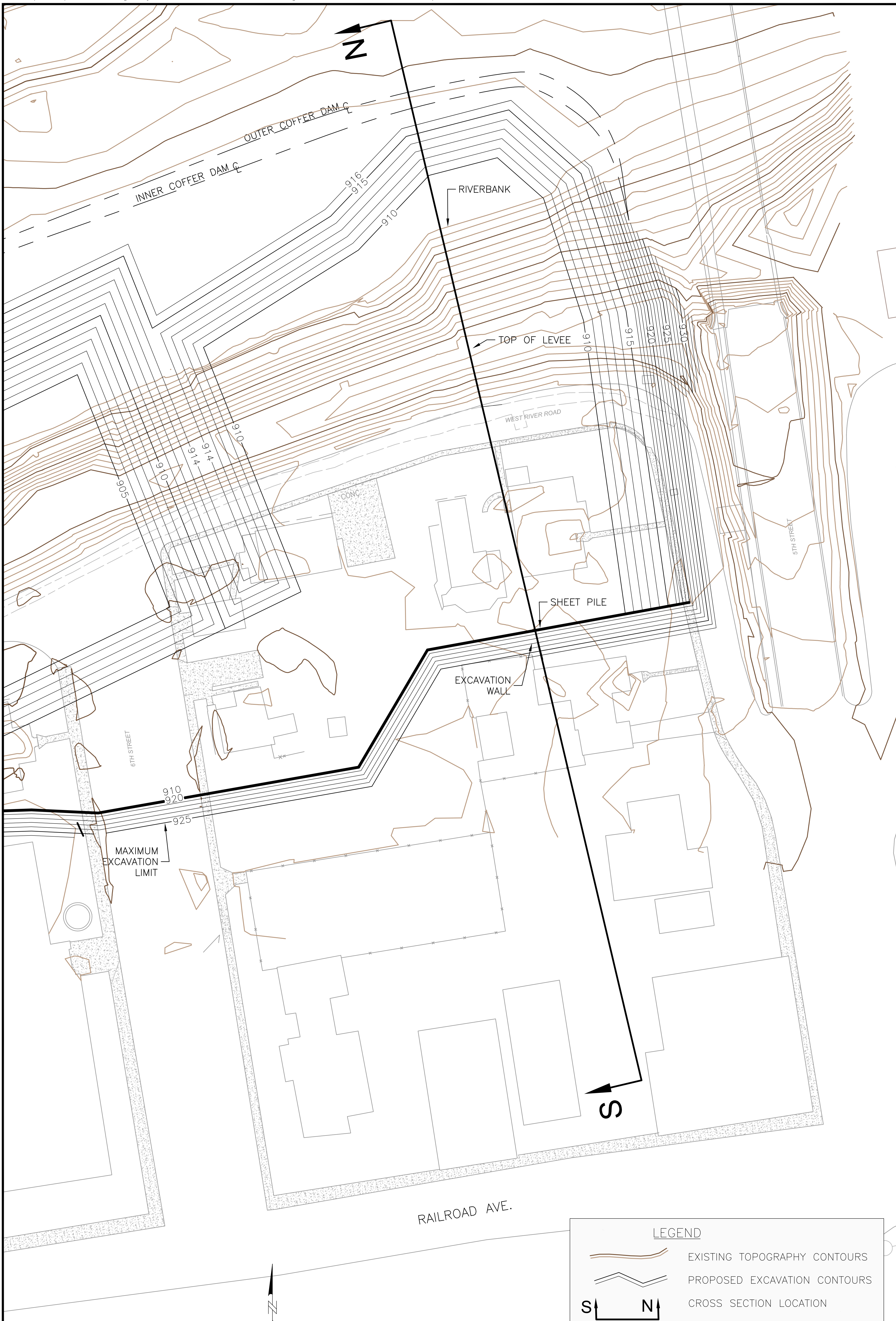
Contingency measures will be available to prevent the migration of oil and reduce the possibility that contaminants are released into the Skykomish River. These measures may be used if the dewatering pumps are ineffective in containing fluids (especially NAPL) within the excavation or if the coffer dam is breached by flood waters.

The effectiveness of the dewatering system at maintaining flow into the excavation will be monitored by collecting frequent measurements of the water levels around the outer perimeter of the coffer dams (in the Skykomish River) and within the excavation pit, using automatic water level data loggers. These water level data will be supplemented by visual observations looking for the presence of sheen or some other indication of contamination outside the coffer dams. If the monitoring indicates that the dewatering system is ineffective, contingency measures will be undertaken. These will consist of additional containment of NAPL within the excavation pit by use of additional booms, adsorbent pads and skimmer pumps.

Two coffer dams will be constructed on the river bed around the excavation area. The second coffer dam will be constructed as a contingency measure to protect the river if the outer dam fails. These coffer dams will be lined with impermeable flexible sheeting to prevent excavation water from seeping into the river through the dams. As described in the EDR, should a breach in either coffer dam occur, work will immediately stop and measures will be taken to repair the dam. The on-call Spill Response contractor will be called in as needed to recover any substances that have accidentally been released.

In addition to the two coffer dams, an outer line of booms will be emplaced outside the coffer dams for added assurance that small releases of NAPL are captured before they flow down the Skykomish River.

File: H:\16423\16423S415.dwg Layout: ANSI_BVI-CP User: astenberg Plotted: Feb 21, 2006 - 4:02pm Xref's: BN050-16423-CE-ST-B003, BRH-TOPO_BATH_EXCAV-E



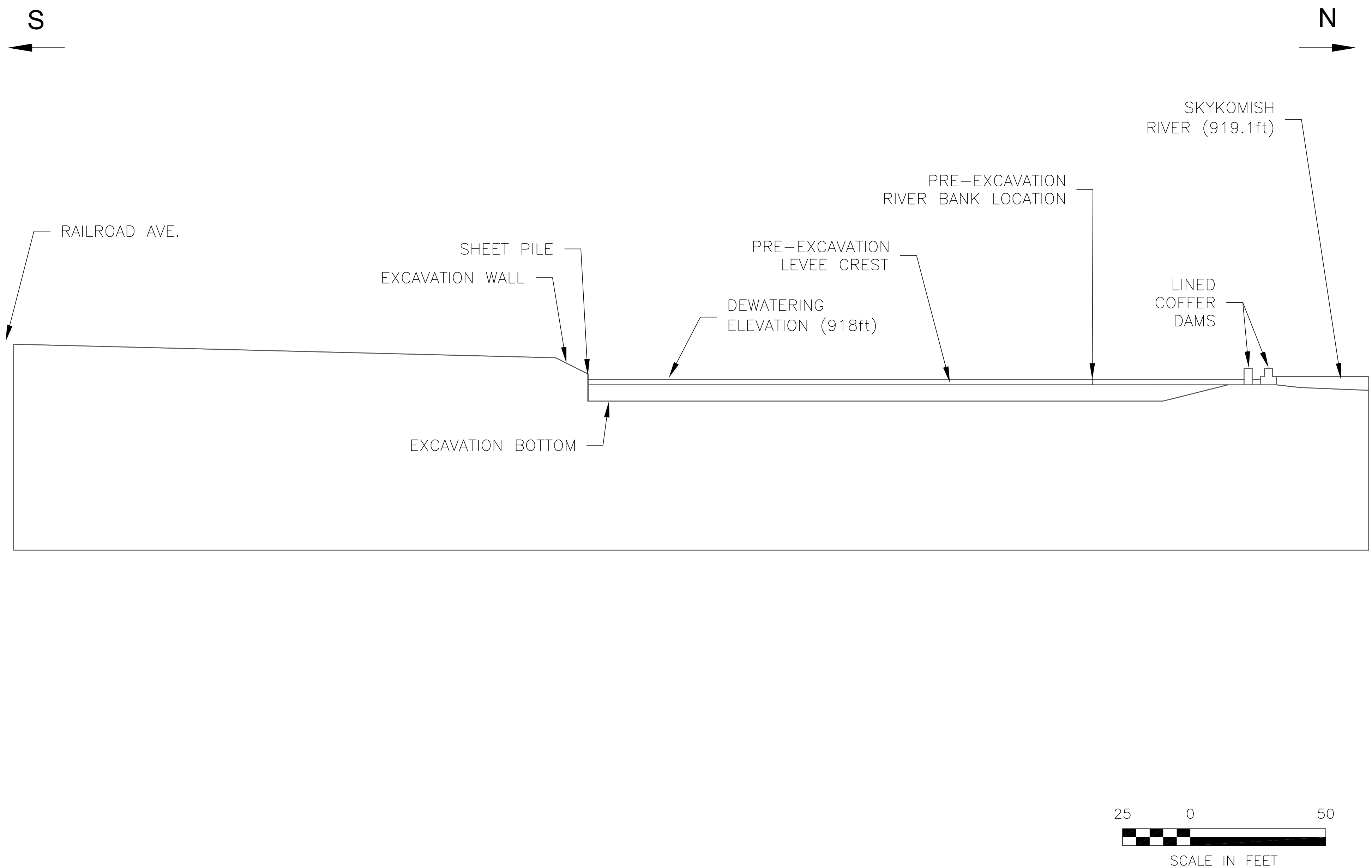
THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON

BN050-16423-

DATE: 02/20/06 DRWN: A.S./SEA

CROSS-SECTION MODEL LOCATION

FIGURE 1



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THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON

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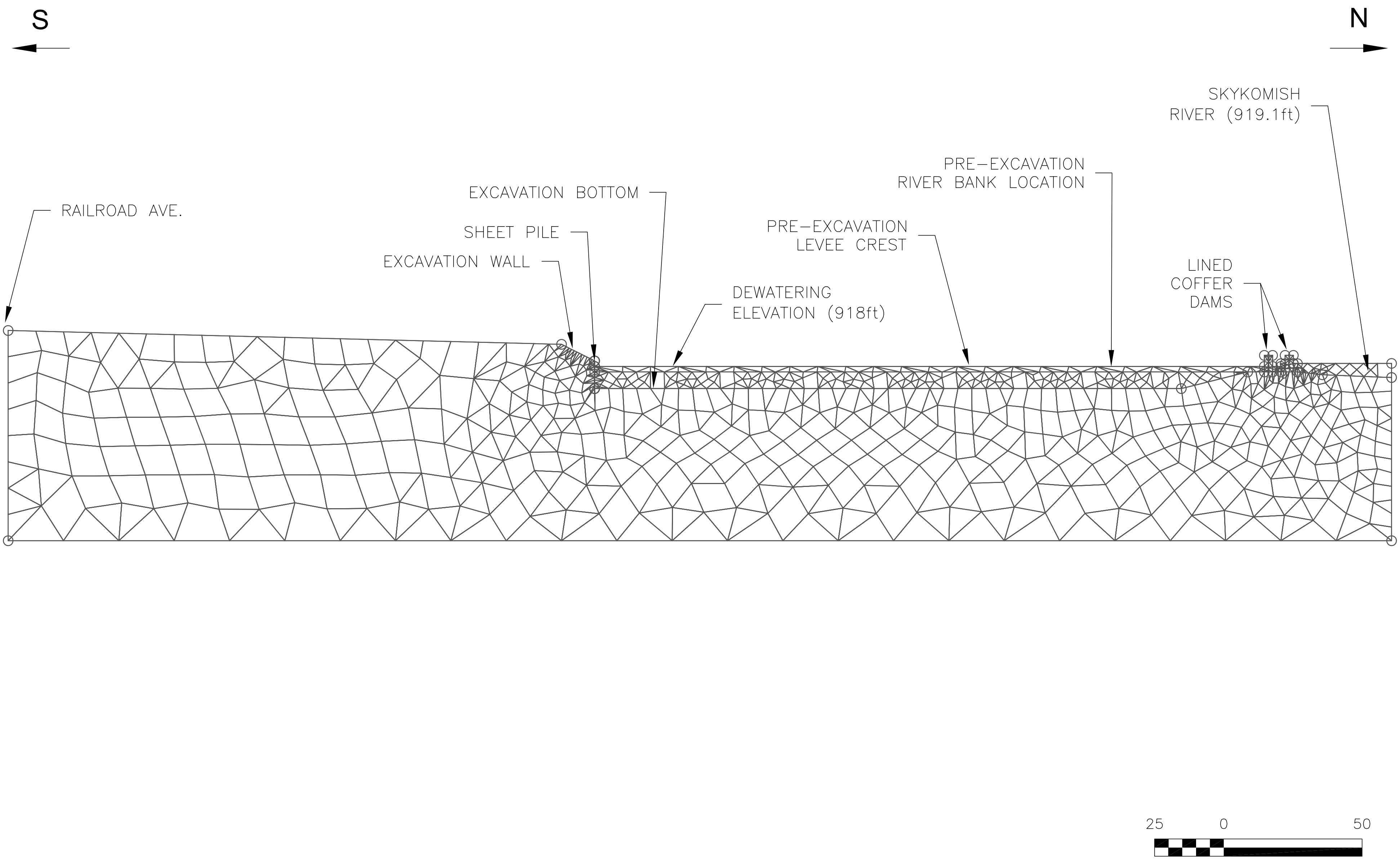
DATE: 02/20/06 | DRWN: A.S./SEA

BASIC GEOMETRY

FIGURE 2



RETEC

THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON

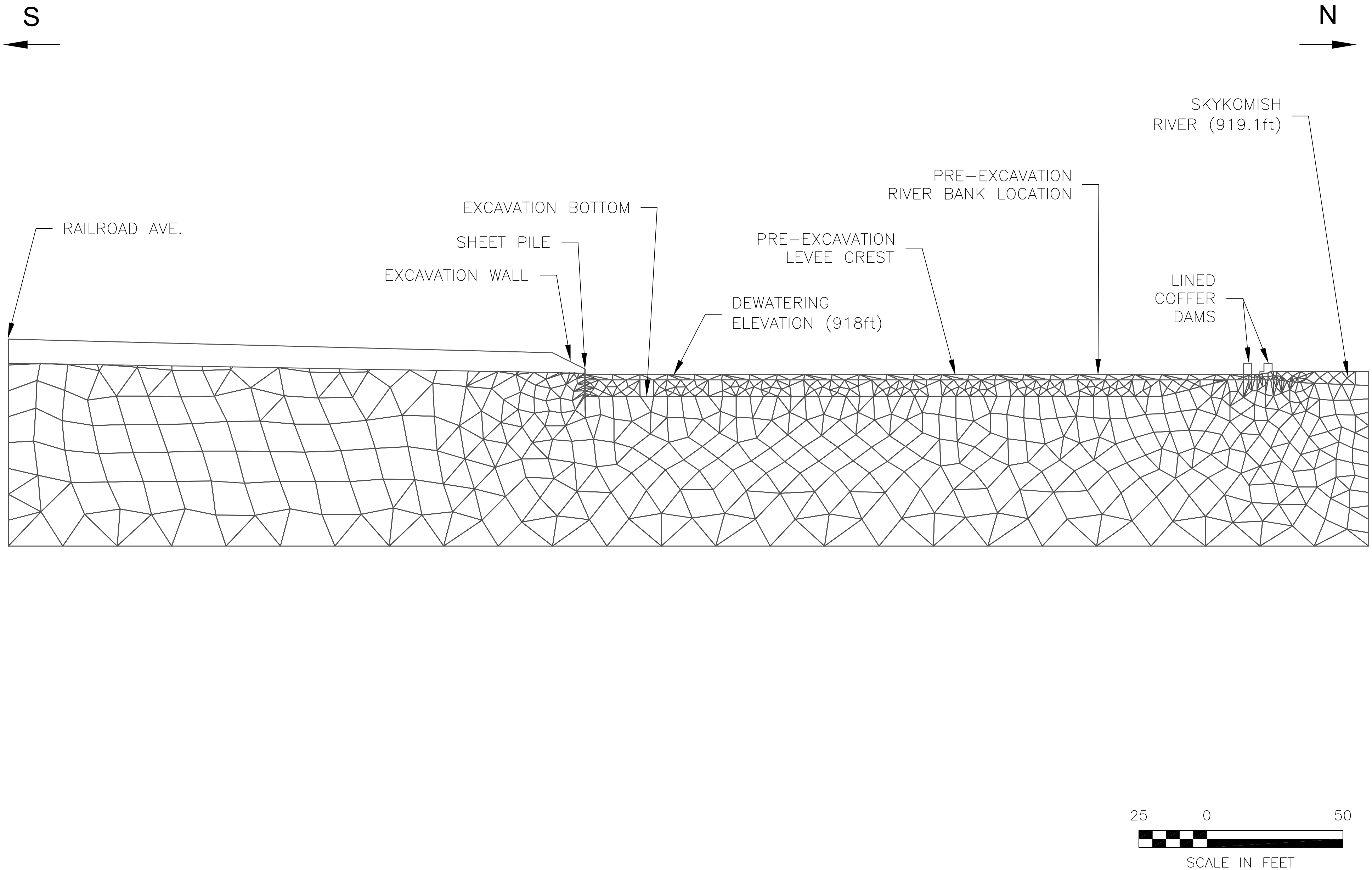
BN050-16423-

INITIAL MODEL MESH

DATE: 02/20/06 | DRWN: A.S./SEA

FIGURE 3

File: H:\16423\EMAIL\FROM CLIFF\Cell 1 N-S model mesh WT.dwg Layout: ANSI_AI-CP User: astenberg Plotted: Feb 21, 2006 - 3:58pm Xref's:



RETEC

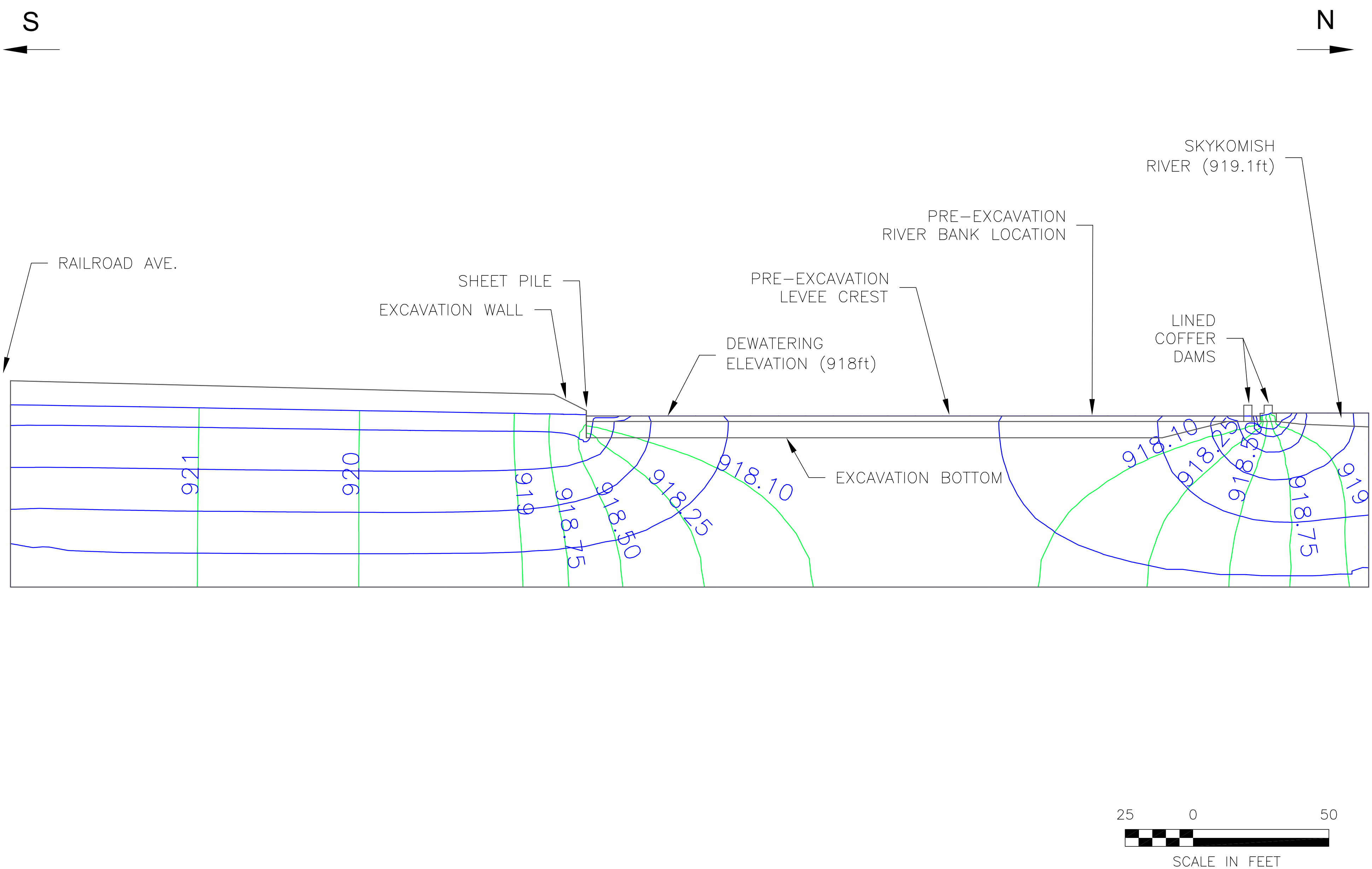
THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON

BN050-16423-

MODIFIED MODEL MESH

DATE: 02/20/06 | DRWN: A.S./SEA

FIGURE 4



RETEC

THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON

BN050-16423

MODEL PREDICTED GROUNDWATER FLOW LINES AND CONTOURS

DATE: 02/17/06	DRWN: A.S./SEA		**FIGURE 5**

Appendix F

EDR Amendment Form

Engineering Design Report/ Sampling and Analysis Plan
MINOR SITE MODIFICATION

Site: Skykomish Levee
Modification Number:
Relevant EDR/SAP Section and Page Number:

Date:

Issue:
Describe problem resulting from current plan or document vs. field or other encountered conditions.

Recommended Resolution:

Resolution Approved by Ecology:

Requested by: ____________________ ____________________
RETEC personnel P.E. License No. and Seal

Approved by: ____________________
Louise Bardy
Site Manager
Department of Ecology

See other side for instructions regarding use of this form.

Instructions for Use

1. Use this form to document and obtain approval for approval for significant changes to the EDR or SAP. Significant changes constitute changes in remedial goals, sampling protocol, schedule, deviations from the Order or any issues that arise that are not resolved by agreement between PLP representatives and Ecology.

2. In the case of significant changes, described above, the form on the other side should be completed. The issue section should include a specific reference to the section of the Order, EDR or document that is in dispute. If the issue requires rapid resolution, the requestor may call Louise Bardy at (425) 649-7209 or her designated representative before completing and FAXing the form.

3. After the form is filled out and signed by the requestor, FAX the completed form to Louise Bardy at 425-649-7098.

4. All completed forms should be copied in duplicate, with one copy remaining with the EDR/SAP and one copy sent to Louise Bardy.

Sampling and Analysis Plan – Environmental Sampling and Monitoring for Levee Zone Interim Cleanup Action

Former Maintenance and Fueling Facility
Skykomish, Washington

Prepared by:

The RETEC Group, Inc.
1011 SW Klickitat Way, Suite 207
Seattle, WA 98134-1162

RETEC Project Number: BN050-16423-520

Prepared for:

The BNSF Railway Company
2454 Occidental Street, Suite 1A
Seattle, Washington 98134

May 3, 2006

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1 Introduction

This sampling and analysis plan (SAP) presents the project organization, objectives, and specific Quality Assurance (QA) and Quality Control (QC) activities associated with the collection and evaluation of environmental soil and sediment samples during the levee cleanup zone interim action for cleanup at the BNSF Railway Company's former maintenance and fueling facility in Skykomish, Washington. This SAP meets the requirements of the Model Toxics Control Act (WAC 173-340-820) and WAC 173-204, sediment management standards. All QA/QC procedures detailed in this SAP are in accordance with applicable professional technical standards, Washington Department of Ecology guidelines (Ecology, 1991, 1995), and project-specific goals. This SAP describes the procedures that will be implemented to ensure that the precision, accuracy, representativeness and completeness of the project data are sufficient to satisfy the project objectives.

This SAP pertains to soil and sediment samples that are collected as part of the performance monitoring (as defined in WAC 173-340410 (1) (a)) and stockpile characterization for the levee zone interim action for cleanup. Additional sampling for the National Pollutant Discharge Elimination System (NPDES) permit, compliance monitoring, and air monitoring will be detailed in other documents.

This SAP is an appendix to the Engineering Design Report Levee Zone Interim Action for Cleanup (EDR, RETEC, 2006). The EDR outlines remedial actions to which this SAP applies and presents a project schedule as required in WAC 173-340-820.

2 Project Organization

2.1 Project Structure

The organizational structure for the levee remediation phase of the project will consist of several RETEC staff. They include: a Client Service Manager, Project Manager, Regional Health and Safety Officer, Levee Remediation Chief Engineer, Site Safety Officer, Data Validator, and Support Staff. Additional members of the project team include, but are not limited to the laboratory coordinator, public relations officer, and Contractors.

2.2 Responsibilities of Project Personnel

The responsibilities of project personnel are described in the following paragraphs. In some cases one person may assume more than one role.

2.2.1 Client Service Manager

The Client Service Manager will be an alternate point of contact and will have responsibility for the overall success of the project. The Client Service Manager's duties will include:

- Project oversight and strategy development with project team. Provision of resources to allow completion of project
- Assist Project team as needed in negotiations, strategy development, and project deliverables.

2.2.2 Project Manager

The Project Manager (PM) will be the primary point of contact and will have responsibility for technical, financial, and scheduling matters. The PM's responsibilities will include:

- Ecology contact
- Assignment of duties to the project staff and orientation of the staff to the needs and requirements of the project
- Supervision of the performance of project team members
- Monitoring all aspects of the project to verify that all work is being completed in accordance with this SAP
- Budget and schedule control
- Establishment of a project record-keeping system.

2.2.3 Regional Health and Safety Officer

The Regional Health and Safety Officer (HSO) has the following responsibilities:

- Interface with the Project Manager as required in matters of health and safety
- Approve the site-specific Health and Safety Plan (HASP) for the project
- Amend the approved HASP as site conditions warrant
- Appoint or approve a Site Safety Officer (SSO) to assist in implementing the HASP
- Monitor compliance with the approved HASP
- Assist the Project Manager in ensuring that proper health and safety equipment is available for the project
- Approve personnel to work on the site with regard to medical examinations and health and safety training.

2.2.4 Levee Remediation Chief Engineer

The Levee Remediation Chief Engineer has the following responsibilities:

- Review all technical documents associated with the project for technical accuracy and feasibility
- Interface with the Project Manager as required in all technical matters
- Appoint or approve a Project Engineer to assist in approving invoices and working with the contractors
- Act as point contact for design work that has been subcontracted out, such as infrastructure and utilities and water management, and the general contractor (who will be a BNSF direct contract).

2.2.5 Project Engineer

The Project Engineer is responsible for assisting the Levee Remediation Chief Engineer.

- Reviewing subcontractors' work and approving all subcontractor invoices.

- Working with the subcontractors and analytical laboratories to ensure that all field activities are conducted appropriately and that field activities are properly documented.
- Coordinating the sampling operations to verify that the sampling team members adhere to this SAP.
- Providing daily schedules for field personnel including subcontractors.
- Maintaining a log for all work completed on site.
- Preparing the field investigation data and information for reports.
- Sending the analytical laboratory deliverables of performance sampling results to Ecology via electronic mail, or if the Ecology representative is on-site without electronic mail access, in hard copy. These deliverables will be sent immediately to Ecology if a timely response is to be requested of Ecology.

Note that it is not necessary for the Project Engineer to be present on-site during all sampling activities or field operations. Thorough coordination and communication with the sampling team members will ensure compliance with this SAP.

2.2.6 Public Relations Officer

The public relations officer will be an EnviroIssues employee. This officer will be the main contact for the public for the project. All comments, requests, questions and complaints should be directed to the Public Relations officer. If the Public Relations officer needs technical support, RETEC will be contacted and a member of the project team, likely the Project Manager, will provide technical input.

2.2.7 Quality Assurance Officer

The Quality Assurance (QA) Officer will be responsible for audits and monitoring adherence to the project QA objectives. The QA Officer reports directly to the Levee Remediation Chief Engineer. The QA Officer has the following responsibilities:

- Reviewing laboratory analytical data
- Coordinating QA/QC operation with the Laboratory Coordinator
- Providing the Data Validator with the laboratory analytical data and sampling field notes

- Informing the Levee Remediation Chief Engineer of whether soil excavation is complete in a given area per compliance monitoring data or whether additional excavation is required.

2.2.8 Site Safety Officer

The Site Safety Officer (SSO) will be responsible for verifying that project personnel adhere to the site safety requirements outlined in the HASP. These responsibilities will include:

- Conducting the health and safety training for project personnel as appropriate
- Modifying health and safety equipment or procedure requirements based on data gathered during the site work
- Determining the posting locations and routes to medical facilities, including poison-control centers, and arranging for emergency transportation to medical facilities
- Posting the telephone numbers of local public emergency services and facilities
- Performing site audits to verify adherence to the requirements of the HASP.

The SSO has authority to stop any operation that threatens the health or safety of the work team or surrounding populace. The daily health and safety activities may be conducted by the SSO or a designated replacement.

2.2.9 Laboratory Coordinator

The laboratory coordinator will be an employee at the analytical laboratory. Responsibilities of the Laboratory Coordinator will include:

- Collaborating with the Project Engineer in establishing sampling and analysis programs
- Serving as liaison between the laboratory and Project Engineer or QA Officer
- Serving as the “focal point” for laboratory activities
- Coordinating laboratory and data activities by the analytical services staff
- Notifying the laboratory and QA Officer of specific laboratory nonconformances and changes
- Maintaining a complete set of laboratory data

- Releasing testing data and results to the Project Engineer.

2.2.10 Data Validator

Responsibilities of the Data Validator will include:

- Identifying data to be classified as questionable or qualitative
- Comparing actual sampling and laboratory procedures to those outlined in this plan
- Reporting the validation results to the Project Engineer and QA Officer.

3 Excavation Performance Samples

3.1 Purpose

Excavation performance sampling will be performed at the limits of the excavation (with the exception of the southern side) to confirm that cleanup has been achieved in accordance with the compliance monitoring requirements in WAC 173-340-740, and WAC 173-204. The south side of the excavation will not be sampled since remediation will continue to the south at a future date. As discussed below (see 3.2: Sampling Locations), one discrete grab sample will be analyzed for excavation bottom and sidewall areas not to exceed 625 square feet.

Sediment is typically defined either as the upper 10 centimeters (the biologically active zone) or material below the ordinary high water mark, for the purposes of this SAP, sediments are defined as the solids which directly underlie the area beneath and waterward of the ordinary high water mark (OHWM). The OHWM was determined using a vegetation survey. The OHWM was staked and surveyed in the field. The OHWM elevation varies with distance along the river.

Excavations waterward of the OHWM will remove material exceeding the sediment cleanup level of 40.9 mg/kg NWTPH-Dx or extend at least 10 feet below the river bottom. If concentrations exceed 40.9 mg/kg NWTPH-Dx at the 10 foot depth below the river bottom, Ecology will be consulted regarding whether backfilling can be done or whether additional excavation is required. The uplands excavation less than 25 feet landward from the OHWM will remove material exceeding the soil cleanup level of 22 mg/kg NWTPH-Dx to a depth of at least 10 feet below the river bottom. NWPTH-Dx concentrations in material more than 25 feet landward of the OHWM must be less than or equal to the remediation level of 3,400 mg/kg NWTPH-Dx and excavations will be backfilled with clean material

3.2 Sampling Locations

Both exterior sidewalls and excavation bottoms will be sampled during the Levee Interim Action for Cleanup. Sidewalls and excavation bottoms will be sampled separately. For either sidewall or excavation bottom sampling, one discrete grab sample will be collected per 625 square foot area (25’ x 25’) or fraction thereof. Areas larger than 625 square feet must be subdivided into areas less than or equal to 625 square feet and one discrete grab sample will be collected from each of the smaller areas.

Grab samples will be collected from approximately the center of each area. Additional grab samples will be collected from any visually-impacted areas and analyzed separately.

Samples will be named in a systematic fashion. For example, sample "SKY-SOIL-A1" would be collected from row A, column 1 and any subsequent samples from the same location due to re-excavation based on the results of the previous sampling would be named "SKY-SOIL-A1-2," etc. Sediment samples would be named with SED (such as "SKY-SED-A2") if the sample is intended to meet sediment cleanup levels. This includes material waterward of the OHWM.

The location of the discrete grab samples will be determined as accurately as possible given the conditions present in the field at the time of the sampling and the surveying technique used (i.e., accuracy within a few feet is desired). For example, if the bottom of the excavation at the approximate location of a proposed sample is relatively dry, the location can be located relatively accurately using a hand-help global positioning system device at the time of sampling. On the other hand, if soil removal at a sample location involves removing soil in 8 feet of water so that it is not physically possible to stand on the proposed sample location, the sample location will be determined by measuring as accurately as possible with the surveying techniques at hand from existing features or from known benchmarks. Stakes will be placed at the perimeter of the excavation to mark the 25 foot grids. It will not be possible to obtain the same accuracy of a sample location where the sample is taken in standing water as compared to a sample location where the sample is taken on dry ground. The GPS survey will be used to map all samples collected in locations where the sample point can be logged by the GPS unit.

3.3 Environmental Sampling Procedures

Environmental sampling procedures for soil and sediment will be identical. These samples will confirm that the extents of the excavation have been achieved. Soil and sediment samples at the limits of the excavation will be collected as discrete grab samples from the excavation using a clean stainless steel trowel or shovel or may be collected directly from the excavator bucket during excavation. Should sampling from the bucket be impractical, for example, if a clamshell bucket is to be used, material from the bucket will be placed on a clean plastic liner and the sample will be collected from the pile using a clean stainless steel spoon or trowel or by hand using disposable gloves. If the sample can be collected directly from the excavation, the sample will be collected from the floor of the excavation to be representative of the material left in place. Surface materials that are not to be included in the sample (such as rocks, twigs, and leaves) will be removed before the sample is collected.

Sampling containers will be filled to minimize head space, and will be appropriately labeled and stored prior to shipment or delivery to the laboratory. Reusable sampling equipment such as stainless steel trowels and shovels shall be decontaminated between sample locations as described below. Sampling procedures will comply with RETEC Standard Operating

Procedure (SOP) 210 (Attachment A). Decontamination processes will comply with SOP 120 (Attachment A).

The water in the excavation may be allowed to clear prior to sampling, depending on the length of time it takes for this to occur. Any visible sheen and/or petroleum product will be removed by a skimming system and water will be removed by pumping water from within the excavation area to the National Pollutant Discharge Elimination System-permitted treatment system.

3.4 Chemical Analysis and Turn-Around Times

Excavation performance monitoring samples will be analyzed by NWTPH-Dx. Although other indicator hazardous substances exist for the Site, NWTPH-Dx has been selected as the surrogate analysis in consultation with Ecology as outlined in the Feasibility Study (RETEC, 2005). The upland area consists of all material landward of the OHWM. Sediment, as defined above, includes all material waterward of the OHWM.

Performance samples within the sediment area must meet the sediment cleanup level of 40.9 mg/kg NWTPH-Dx. If excavation within the sediment area reaches a depth of 10 feet below the river bottom and the 40.9 mg/kg NWTPH-Dx cleanup level is not met, Ecology will be consulted and the area may be backfilled as it may be protective of sediment.

Material less than 25 feet landward from the OHWM must meet upland soil cleanup standards to a depth of 10 feet below the river bottom. Beyond 25 feet landward, upland areas where soil remediation levels are applicable that are represented by samples with concentrations less than or equal to 3,400 mg/kg NWTPH-Dx will be backfilled following Ecology approval. If the concentration exceeds 3,400 mg/kg NWTPH-Dx, the 2,500 square foot area may be re-excavated an additional 2 feet and re-sampled. If the depth of the excavation prevents the 625 square foot area from being re-excavated, Ecology will be consulted and contingencies such as soil mixing may be used.

Rush turn-around times, such as 24-hours, may be requested for some of the samples collected depending on the staging of work within the Project Area. Once Ecology receives analytical data, they will have 24 hours (on a weekday basis) to respond with approval for backfill or selection of BNSF’s proposed contingency actions. It may be necessary to perform work on weekends to meet the project schedule. If Ecology review of performance sample data and backfill approval will be needed on a weekend day, RETEC will make every effort to give Ecology 48 hours notice. RETEC will submit performance sampling data to Ecology upon receipt from the laboratory for portions of the excavation for which we are requesting approval to backfill.

4 Stockpile Sampling

4.1 Purpose

Excavated material will be field-screened and segregated based on final disposal or placement location. Clean overburden material will be classified as appropriate for backfill or designated for waste disposal off-site. Stockpiles will be separated to prevent cross-contamination. Stockpiles will be sampled before the material is used for backfill and as required by the waste management facility for disposal. The final sampling procedure for the backfill material will be established when the contractor provides a plan for filling and maintaining stockpiles and through coordination with the waste disposal facility. The sampling frequency and testing requirements of the stockpiles of impacted materials designated for disposal are set by the disposal company. Those details will be worked out with the disposal company at a later date.

4.2 Locations

Overburden stockpiles will be divided into volumes of 200 cubic yards as the material is stockpiled and the sections will be named sequentially (for example, the first 200 cubic yards would be referred to and labeled as Stockpile A, the second 200 cubic yards would be referred to and labeled as Stockpile B). A plan for filling and maintaining stockpiles will be developed with the contractor. Samples will be named based on the name of the stockpile (for example, "SKY-STOCK-A" will represent the first 200 cubic yards, "SKY-STOCK-B" the second 200 cubic yards).

4.3 Stockpile Environmental Sampling Procedures

Based on existing analytical data for the site, overburden material will consist of material removed from the levee above the road elevation and the upper four feet of the uplands. Four grab samples will be collected from each 200 cubic yard division of the stockpile and composited into one sample for laboratory analysis. An excavator will be used to cut a trench 3 feet normal to the pile surface at four locations equally spaced around the pile and the grab sample will be collected from the vertical mid-point within the trench.

Samples will be collected using equipment appropriate to the depth from which collection is to occur. The grab samples will be of equal volume and will be collected using a clean, stainless steel trowel of spoon. Samples may be collected directly from piles or from a shovel or excavator bucket. The grab samples will be homogenized in a decontaminated stainless steel bowl or in a disposable zip-lock type bag. Sampling containers will be filled to minimize headspace, and will be appropriately labeled and stored prior to delivery to the laboratory.

4.4 Overburden Stockpile Chemical Analysis and Turn-Around Times

Overburden stockpile samples will be analyzed for total petroleum hydrocarbons by NWTPH-Dx. Standard turn-around times will be requested since material will likely be suitable for backfill.

4.5 Disposal or Reuse as Backfill

In order to be considered clean, the concentration must be less than or equal to cleanup level, i.e., 22 mg/kg NWTPH-Dx in soil or 40.9 mg/kg NWTPH-Dx in sediment, or the laboratory's Practical Quantitation Limit (PQL) estimated to be approximately 35 mg/kg for NWTPH-Dx. If a sample concentration is clean, the volume represented by that sample can be used anywhere within the Project Area as backfill except as sediment in reconstruction of the river bed. If a sample concentration is clean, the volume represented by that sample may be stockpiled in a long-term stockpile area for use as backfill on the railyard during subsequent phases of remediation. Alternatively, excavated soils and sediments whose NWTPH-Dx concentrations are not clean may be screened and materials that are less than 1 inch in diameter will be designated under WAC 173-303 and disposed of at an appropriate facility. The screening operation is expected to remove most of the finer grained soil that may cling to oversized material, leaving the oversized fraction relatively free of impacts. The 1.0 inch and greater size material must pass visual inspection as having no visible contamination and be approved by Ecology for use as backfill in areas of the excavation greater than 25 feet landward of the OHWM.

Over-sized boulders & rip-rap will be reused in reconstruction of the levee if they pass visual inspection as having no visible contamination and are approved for reuse by Ecology. Rip-rap and boulders with visual contamination may be reused after steam cleaning. Photo-documentation of materials passing visual inspections will be maintained in the project records.

5 Sample Handling

5.1 Sample Handling

Analytical methods and requirements for soil and sediment are summarized in Table 6-1. Soil and sediment samples will be analyzed for the following constituents:

- Total Petroleum Hydrocarbons (NWTPH-diesel extended).

Table 5-1 Sample Handling and Preservation Requirements for Soil and Sediment

Parameter	Method	Container	Preservation	Holding Time Soil
TPH	NWTPH-Dx	8 oz. WMG	Cool to 4º C	14 days

Notes:
Container
WMG = wide mouth glass

5.2 Sample Packing and Labeling Procedures

Samples must be packed to prevent damage to the sample container and labeled to allow sample identification. All samples must be packaged so that they do not leak, break, vaporize or cause cross-contamination of other samples. Waste samples and environmental samples (e.g., soil, etc.) should not be placed in the same container. Each individual sample must be properly labeled and identified. A chain-of-custody record must accompany each shipping container. When refrigeration is required for sample preservation, samples must be kept cool during the time between collection and final packaging.

All samples must be clearly identified immediately upon collection. Each sample bottle label will include the following information:

- Client and project name
- A unique sample description (such as SKY-SOIL-A1 or SKY-STOCK-A)
- Sample collection date and time.

Additionally, the sample bottle label may include:

- Sampler's name or initials
- Indication of addition of preservative, if applicable
- Analyses to be performed.

After collection, the samples will be maintained under chain-of-custody procedures as described below.

5.3 Chain of Custody

Chain-of-custody procedures are intended to document sample possession from the time of collection to disposal. Chain-of-custody forms must document transfers of sample custody. A sample is considered to be under custody if it is in one's possession, view, or in a designated secure area. The chain-of-custody record will include, at a minimum, the following information:

- Client and project name
- Sample collector's name
- Company's (RETEC) mailing address and telephone number
- Designated recipient of data (name and telephone number)
- Analytical laboratory's name and city
- Description of each sample (i.e., unique identifier and matrix)
- Date and time of collection
- Quantity of each sample or number of containers
- Type of analysis required
- Addition of preservative, if applicable
- Requested turn-around times
- Date and method of shipment.

Additional information may include type of sample containers, shipping identification air bill numbers, etc.

When transferring custody, both the individual(s) relinquishing custody of samples and the individual(s) receiving custody of samples will sign, date, and note the time on the form. If samples are to leave the collector's possession for shipment to the laboratory, the subsequent packaging procedures will be followed. If an on-site lab is being used, a chain-of-custody must be completed but the following packing procedures do not apply. All samples will be stored appropriately by the lab.

5.3.1 Packing for Shipment

Packing of samples for shipment will comply with RETEC Standard Operating Procedure 110 (Attachment A). To prepare a cooler for shipment, the sample bottles will be inventoried and logged on the chain-of-custody form. At least one layer of protective material will be placed in the bottom of the container. As each sample bottle is logged on the chain-of-custody form, it should be wrapped with protective material (e.g., bubble wrap, matting, plastic gridding, or similar material) to prevent breakage. Each sample bottle should be placed upright in the shipping container. Each sample bottle cap should be checked during wrapping and tightened if needed. Avoid over tightening, which may cause bottle cap to crack and allow leakage. Additional packaging material such as bubble wrap or Styrofoam pellets should be spread throughout the voids between the sample bottles.

Most samples require refrigeration as a minimum preservative. If needed, reusable cold packs or ice placed in heavy-duty zip-lock type bags should be distributed over the top of the samples. Two or more cold packs or bags should be used to cool the samples to 4 to 6 degrees Celsius. Additional packing material should then be placed to fill the balance of the cooler or container.

Place the original completed chain-of-custody record in a zip-lock type plastic bag and place the bag on the top of the contents within the cooler or shipping container. Alternatively, the bag may be taped to the underside of the container lid. Retain a copy of the chain-of-custody record with the field records.

Close the top or lid of the cooler or shipping container and rotate/shake the container to verify that the contents are packed so that they do not move. Add additional packaging if needed and reseal. Place signed and dated chain-of-custody seal at two different locations (front and back) on the cooler or container lid and overlap with transparent packaging tape. The chain-of-custody tape should be placed on the container in such a way that opening the container will destroy the tape. Packaging tape should encircle each end of the cooler at the hinges.

Sample shipment should be sent via courier or an overnight express service that can guarantee 24-hour delivery. Retain copies of all shipment records as provided by the shipper.

Chain-of-custody records will be maintained in an appropriate file with the Project Manager. Copies of these records will be submitted in an appendix to the final report. Chain-of-custody information will also be recorded in field notebooks.

5.4 Sample Log-In

Upon receipt of samples (which will be accompanied by a completed chain-of-custody record detailing requested analyses), the Laboratory Coordinator(s) or his/her delegate will:

- Verify all paperwork, chain-of-custody records, and similar documentation
- Log-in samples, assign unique laboratory sample numbers, and attach the numbers to the sample container(s)
- Store samples in a refrigerated sample bank
- Record temperature upon receipt.

6 Analytical Procedures

The laboratories utilized for analysis of samples collected under the SAP shall perform all analysis according to EPA/Ecology-accepted methods. Accepted EPA methods consist of those methods that are documented in the "Contract Lab Program Statement of Work for Organic Analysis" or any alternative method that has been approved by EPA/Ecology for use during this project. The analytical method procedures are detailed in the laboratory QA manual.

6.1 Analytical Laboratories

A laboratory accredited by Ecology will perform analysis on all soil and sediment samples collected as described in this SAP.

6.2 General Requirements

In general, the laboratory will adhere to those recommendations as promulgated in 21 CFR Part 58, "Good Laboratory Practices" and procedures described in SW-846 Test Methods for Evaluating Solid Waste-Physical/Chemical Methods, Third Edition, 1994; and those criteria presented in 40 CFR 136.

6.3 Analytical Data Review

The QA Officer will perform a review of the data received from the analytical laboratory to ensure that all of the project QC criteria have been met. Every component of the data package will be inspected. A series of QC forms will be supplied by the laboratory with the analytical data package and will be used as part of the data review process.

The results of all environmental sampling will be sent to the Data Validator for validation. A report containing the results of the validation will be submitted to the QA Officer.

7 Quality Control and Quality Assurance

7.1 Quality Control of Soil and Sediment Sample Collection

At least one soil/sediment sample in every 20 will be field split for pseudoreplicated chemical analysis. Split samples will be collected by filling two sets of sample containers with the soils collected. Field splits will not be identified as splits on the sample labels or chain-of-custody forms but will be identified as such in the field notebook and the sample logs. A summary of the QA samples to be collected is summarized in Table 7-1.

Table 7-1 Summary of Quality-Assurance Soil and Sediment Samples

Matrix	Parameter	Equipment Rinseate Samples	Field Duplicates	Matrix Spikes
Soil	A	1 per 20 samples	1 per 20 samples	1 per 20 samples
Sediment	A	1 per 20 samples	1 per 20 samples	1 per 20 samples
Stockpiles for re-use as backfill	A	As required by waste management facility	1 per 20 samples	1 per 20 samples

Notes:
A –Field duplicate and equipment rinseate samples will be analyzed for the same parameters as the investigative samples.

7.1.1 Documentation

Various documents will be completed and maintained as a part of soil and sediment sample collection. These documents will provide a summary of the sample collection procedures and conditions, shipment method, analyses requested, and the custody history. These documents may include:

- Field books
- Soil sampling forms
- Sample labels
- Chain-of-custody forms
- Shipping receipts.

All documentation will be stored in the project files.

7.1.2 Decontamination

Decontamination is performed as a quality control measure and as a safety precaution. It prevents cross-contamination between samples and also helps maintain a clean working environment. All equipment which could potentially contact samples requires decontamination. This includes hand tools, monitoring and testing equipment, personal protective equipment, or heavy equipment (e.g., loaders, backhoes, drill rigs, etc.). All decontamination will comply with RETEC Standard Operating Procedure 120 (Attachment A).

Decontamination will be achieved by rinsing with liquids that may include: soap and/or detergent solutions, tap water, distilled water and methanol. Equipment may be allowed to air dry after being cleaned or may be wiped dry with paper towels or chemical-free cloths.

All sampling equipment will be decontaminated prior to use and between each sample collection point as outlined in SOP 120 (Attachment A). Waste products produced by the decontamination procedures such as rinse liquids, solids, rags, gloves, etc. will be collected and disposed of properly at an off-site licensed facility and shipment will comply with RETEC SOP 430 (Attachment A). Any materials and equipment that will be reused must be decontaminated or placed in plastic bags before being taken off-site.

All soil sample collection apparatus will be fully decontaminated before sampling and between sampling points. At least one equipment rinseate sample will be collected after decontamination for every 20 soil grab samples collected. Duplicate and equipment rinsate samples will be analyzed for the same constituents as the environmental samples. Excavator buckets will be rinsed out to the extent possible. Soil grab samples will be collected away from the walls of the excavator buckets to reduce possible cross-contamination.

The following are decontamination procedures for sampling equipment:

1) Remove gross visible solids from the equipment by brushing and then rinse with tap water.

2) Wash with detergent or soap solution (e.g., Alconox® and tap water).

3) Rinse with tap or distilled water.

4) Repeat entire procedure or any parts of the procedure if solids appear to still be present on the sampling equipment.

5) Rinse with distilled water.

6) After decontamination procedure is completed, avoid placing equipment directly on ground surface where recontamination is

possible. Spoons and trowel will be placed in clean plastic bags or wrapped in foil.

No additional decontamination procedures will be required if the equipment appears to be visually clean. If impacts are visible after hot water/steam cleaning, then a detergent wash solution with brushes (if necessary) will be used.

7.2 Quality Assurance Objectives

Quality assurance objectives help to achieve the data quality requirements required by the project. Soil and sediment samples will be collected for NWTPH-Dx analysis as described above in order to meet the objectives of the interim action for cleanup. To help achieve the data quality requirements, the following quality-control parameters will be evaluated throughout the course of this project:

- Detection limits
- Practical Quantitation Limits
- Data precision
- Data accuracy
- Representativeness
- Comparability and completeness.

These quality-assessment parameters are described in greater detail in the following paragraphs.

7.2.1 Detection Limits

The method detection limit for a given parameter is determined by procedures specified in the analytical method. Detection limits will be observed for all laboratory analyses performed during this project, except where matrix interferences and high concentrations of target and non-target compounds increase the reporting detection limits. Method detection limits for NWTPH-Dx at Test America Laboratories, the laboratory selected for this work, are listed in Table 7-2. Samples that are highly impacted visually in the field will be flagged for the laboratory to minimize dilution of the entire set of samples.

Table 7-2 NWTPH-Dx Method Detection and Practical Quantitation Limits

	Method Detection Limit (mg/kg)	Estimated Practical Quantitation Limit / Reporting Limit (mg/kg)
Diesel Range Hydrocarbons	1.60	10.0
Lube Oil Range Hydrocarbons	3.19	25.0

7.2.2 Practical Quantitation Limits

Practical quantitation limits are the lowest concentrations that can be reliably measured within specified limits of precision, accuracy, representativeness, completeness, and comparability during routine laboratory operation conditions (WAC 173-340-200). At Test America, practical quantitation limits are equivalent to reporting limits. The NWTPH-Dx method detection limits are below the cleanup and remediation levels for this site, but the reporting limits do vary during routine analyses. When the lab cannot meet the cleanup levels or remediation levels with the reporting limits, appropriate analytical QA/QC will be provided to Ecology to justify use of that reporting limit. The reporting limit may typically be 10.0 mg/kg for diesel range hydrocarbons and 25.0 mg/kg for lube oil range hydrocarbons, i.e., 35 mg/kg NWTPH-Dx, but needs to be approved by Ecology upon review of the QA/QC information.

7.2.3 Precision

Precision will be determined for field split samples by examining sample results for degree of variance.

Precision is a measure of agreement among individual measurements of the same parameter, usually under prescribed similar conditions. Precision is best expressed in terms of the relative percent difference. The relative percent difference (RPD) parameter will be calculated to define the precision between duplicate analyses.

The RPD for each component is calculated using the following equation:

$$\%\,\mathrm{RPD} = \frac{(X_2 - X_1)}{[(X_1 + X_2)/2]} \times 100$$

where:

X_1 = parent sample value

X_2 = duplicate sample value

The laboratory objective for precision is to generate RPD values that fall within the established control limits for the method employed. The field objective for precision is to generate RPD values that are between 0 and 50 percent for soil and sediment samples (USEPA, 1996). If the criteria are not met, the data reviewer will examine other quality-control criteria to determine the need for some qualification of the data.

7.2.4 Accuracy

Accuracy is defined as the degree of agreement between a measurement and an accepted reference of true concentration and is an indication of any bias that exists during sampling, handling, matrix interference, and analysis. Accuracy is determined by spiking samples with a known concentration of standard compounds and comparing the analytical results with the known value. Data accuracy will be assessed by determining the percent recovery of a spiked compound. Percent recovery (%R) is determined by the equation:

$$\%\,R = \frac{(C_1 - C_0)}{C_S} \times 100$$

where:

C_1	=	measured concentration in the spiked sample
C_0	=	measured concentration in the unspiked sample
C_s	=	concentration at which the sample was spiked

The concentration at which the sample was spiked (C_s) is calculated, using the following equation:

$$C_S = \frac{(C_{spike} \times V_{spike})}{V_{sample} + V_{spike}}$$

where:

C_s	=	concentration at which the sample was spiked
C_{spike}	=	spike concentration
V_{spike}	=	volume of spike
V_{sample}	=	volume of sample

The laboratory objective for accuracy is to generate $\%R_s$ that fall within established control limits for the method employed. These control limits are the more conservative of laboratory control charts that consider 9-12 months of laboratory quality control data and method specifications.

Surrogate and matrix spiking compounds and sample selection for spiking are determined by current SW-846 methodologies. Percent recoveries indicate the actual performance of the analytical method on real world samples. Surrogate spikes, matrix spikes, matrix spike duplicates, and QC spikes will be conducted using standard laboratory methods.

7.2.5 Representativeness

Representativeness is the degree to which data accurately and precisely represent a characteristic population, a process control or an environmental condition. Taking the following steps will ensure representativeness of the data:

- Performing sampling procedures as described in this SAP and recording any deviations from these methods in the project field book
- Using only standard USEPA analytical procedures with well established quality assurance/quality control criteria
- Using a contract lab with a well established performance record
- Subjecting all data to validation process.

Appropriate sampling procedures will be implemented so that the samples are representative of the environmental matrices from which they were obtained as specified above.

7.2.6 Comparability and Completeness

Comparability is achieved through the use of the same analytical methods that were used previously, through use of trained personnel and through following procedures in this SAP. Extraction or analytical procedures performed by the laboratory for the project will be in compliance with USEPA standard methods and references for these methods will be included with the analytical report. Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. The completeness goal will be at least 90 percent.

7.3 Data Management and Assessment

The data collected and validated as part of the project scope of work will be combined with the data already compiled for the facility. This section discusses the management of data generated as part of the field effort.

7.3.1 Data Management

Reporting

After receipt of the analytical results, the QA Officer will review all raw data, including QA/QC data from the sample analyses.

Periodic reports will include a summary of data reduction results and a discussion of any inconsistencies that exist from a data-use standpoint. All field data sheets will be included as an appendix in the reports. All raw data will be appropriately identified in reports and included in a separate appendix of the report. Raw data will be submitted to Ecology following the schedule and format specified in the Agreed Order for this project.

Representativeness

The determination of the representativeness of the data will be performed by:

- Comparing actual sampling procedures to those delineated in this plan.
- Examining the results of QC samples for evidence of cross-contamination; such evidence may be cause for invalidations or qualification of the affected samples.
- Invalidating non-representative data or identifying data to be classified as questionable or qualitative. Only representative data will be used in subsequent data reduction, validation activities and facility characterization.

The analytical results of the equipment rinseate samples (cross-contamination) will be compared to the results of the field samples to determine if the level of impact is significant. The rule of 5x will be used when chemicals are measured in a QC sample. This rule states that if a sample concentration is less than five times (5x) the QC sample, the sample should be qualified as non-detectable (EPA, 1988).

Data Review

The objective of the data review is to identify any qualitative, unreliable or invalid laboratory measurements. Data review entails a review of the laboratory-provided QC data to verify that the laboratory is properly performing the QC program and is operating within the required control limits. As a result, it will be possible to determine which samples, if any, are related to out-of-control laboratory QC samples. Laboratory data will be screened for inclusion of and frequency of the necessary QC supporting information, such as detection limit verification, duplicates, spikes and method blanks. QC supporting information will be screened to determine whether any data are outside established control limits. Any out-of-control data without appropriate corrective action will be cause to qualify the affected measurement data. Missing or infrequent QC information will be cause to contact the laboratory concerning affected measurement data and to request additional QC supporting information for re-analysis.

7.3.2 Data Assessment

Data assessment will be conducted in accordance with RETEC Standard Operating Procedure 410 (Attachment A).

Laboratory Procedures

Following the assessment of laboratory data for the inclusion of required QC data, the QC data will be analyzed for accuracy and precision. If quality control audits result in the detection of unacceptable data, the QA Officer will be responsible for initiating corrective action, which may include:

- Reanalyzing samples if holding-time criteria permit
- Resampling and analyzing
- Evaluating and amending sampling and analytical procedures
- Accepting data and acknowledging the level of uncertainty.

Accuracy

The accuracy of the data will be determined as follows:

- Computing percent recoveries for spiked samples
- Calculating the standard deviation in the overall average recovery value
- Determining the range of uncertainty at a given level of confidence.

The accuracy of the data will be used to determine any bias in the analytical methods. The field sample results will not be adjusted for bias, but the bias will be considered in the interpretation of the data.

Precision

The determination of the precision of the data will be performed by examining duplicate samples for degree of variance and by determining if sampling error has occurred by the variance of duplicates. The precision values calculated from the field duplicates will be used in the data interpretations to determine how sensitive the site characterizations are to the variances in the data.

Specific precision targets cannot be formulated without baseline precision data. However, the precision data will be summarized into the following categories. For each compound or element, the number of field duplicates with variance in the following ranges will be evaluated:

- Less than 10 percent
- 10 to 25 percent
- 25 to 50 percent
- Greater than 50 percent.

This will provide qualitative information to the individuals interpreting the data as to the range of variances and will also allow the proper planning for QC samples in future sampling episodes..

7.3.3 Data Validation

After reviewing the laboratory analytical data, the QA officer will provide the Data Validator with the data and field notes from the applicable sampling activities. The Data Validator will compare the actual sampling and laboratory procedures to those explained in this plan, identify any questionable or qualitative data, and report the validation results to the QA Officer.

8 Review and Reporting of Laboratory Data

Data quality and utility depends on many factors, including sampling methods, sample preparation, analytical methods, quality control and documentation. Physical and chemical data have been divided into five categories (EPA Region V Model Quality Assurance Project Plan, 1991), as follows:

- **Level V B Nonstandard Methods.** Analyses by nonstandard protocols, such as ultra-low detection limits or analysis of an unusual chemical compound. These analyses often require method modification and/or development. CLP (Contract Laboratory Program) Special Analytical Services (SAS) projects are considered Level V.

- **Level IV B CLP Routine Analytical Services (RAS).** This level is characterized by rigorous QA/QC protocols and documentation, and it provides qualitative and quantitative analytical data. Some EPA regions have obtained similar support via their own regional laboratories, university laboratories or other commercial laboratories.

- **Level III B Laboratory Analysis (using methods other than the CLP RAS).** This level is used primarily in support of engineering studies, using standard EPA-approved procedures. Some procedures may be equivalent to CLP RAS, without the CLP document requirements.

- **Level II B Field Analysis.** This level is characterized by the use of portable analytical instruments that can be used on-site or in mobile laboratories stationed near a site (close-support labs). Depending upon the types of impacts, sample matrix and personnel skills, qualitative and quantitative data can be obtained.

- **Level I B Field Screening.** This level is characterized by the use of portable instruments that can provide real-time data to assist in the optimization of sampling point locations and for health and safety support. The types of data included are those generated on site through the use of PID, pH, conductivity, or other real-time monitoring equipment. Data can be generated regarding the presence or absence of certain materials (especially volatiles) at sampling locations.

The data generated in this project will be prepared and reviewed for Level III validation. The laboratory will use EPA methods to identify analytical values that do not meet the required ranges for surrogate recoveries and matrix spike recoveries. If such values are identified, then the analysis must be repeated. If the re-analyzed values are within required limits and holding times, they will be reported as true values. If, in the repeated analysis, the values are still outside required limits, the data are considered to be invalid, and matrix effects are considered to have caused the values to be outside of the acceptable recovery limits.

8.1 Analytical Data

The laboratory will submit results that are supported by sufficient backup data and QA/QC results to enable the quality of the data to be determined conclusively. Prior to release of data, the laboratory coordinator(s) will: review the data package for reasonableness; review QC data results; verify that calculation checks were properly performed; review chain-of-custody record(s), sample preservation, and holding-time requirements; and write a project narrative. Data that are not acceptable will be held until the problems are resolved. Section 3 of this SAP describes the procedures that are employed to evaluate the precision, accuracy, representativeness, and completeness of the analytical test data generated during this project. It is the responsibility of the QA Officer to review these parameters. Validity of all data will be determined based on the criteria described in Section 3.

8.2 Final Reporting and Archiving of Laboratory Documents

Upon successful completion of the data validation process, all data generated at the site will be tabulated and stored on computer disk in a format suitable for import to a relational database. Data summaries and results will be submitted in final report form as a completion report. This report will consist of all pertinent sample and project information. It will also identify analytical procedures.

Copies of all analytical data and/or final reports will be retained in the laboratory files, and at the discretion of the Laboratory Coordinator(s), the data will be stored on computer disks for a minimum of 1 year.

After one year, or whenever the data become inactive, the files will be transferred to archives in accordance with standard laboratory procedure. Data may be retrieved from archives upon request.

9 References

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.

Attachment A

RETEC Standard Operating Procedures (SOPs)

RETEC Standard Operating Procedure (SOP) 120
Decontamination

1.0 Purpose and Applicability

The RETEC Group, Inc. (RETEC) SOP 120 describes the methods to be used for the decontamination of items that may become contaminated during field operations. Decontamination is performed as a quality assurance measure, and as a safety and health precaution. It prevents cross-contamination between samples and also helps maintain a clean working environment. Equipment requiring decontamination may include hand tools, monitoring and testing equipment, personal protective equipment (PPE), or heavy equipment (e.g., loaders, backhoes, drill rigs, etc.).

Decontamination is achieved mainly by rinsing with liquids, which may include soap and/or detergent solutions, tap water, distilled water, and methanol or isopropyl alcohol. Equipment may be allowed to air dry after being cleaned or may be wiped dry with paper towels or chemical-free cloths.

All sampling equipment will be decontaminated prior to use and between each sample collection point. Waste products produced by the decontamination procedures, such as rinse liquids, solids, rags, gloves, etc., will be collected and disposed of properly, based on the nature of contamination and site protocols. Any materials and equipment that will be reused must be decontaminated or properly protected before being taken off site.

Specific project requirements as described in an approved Work Plan, Sampling Plan, Quality Assurance Project Plan, the RETEC Corporate Environment, Health, and Safety (EHS) Manual, Job Hazard Analysis (JHA), Safety Task Analysis Review (STAR), or Site-Specific Health and Safety Plan (HASP) will take precedence over the procedures described in this document.

2.0 Responsibilities

It is the responsibility of the field sampling coordinator to ensure that proper decontamination procedures are followed and that all waste materials produced by decontamination are properly managed. It is the responsibility of any subcontractors (e.g., drilling or sampling contractors) to follow the designated decontamination procedures that are stated in their contracts and outlined in the project HASP. It is the responsibility of all personnel involved with sample collection or decontamination to maintain a clean working environment and to ensure that no contaminants are inadvertently introduced into the environment, tracked out of the contamination reduction zone (CRZ), or passed from one sample point to another.

3.0 Health and Safety

This section presents the generic hazards associated with decontamination and is intended to provide general guidance in preparing site-specific health and safety documents. The Site-Specific HASP, JHAs, and STARs will address additional requirements and will take precedence over this document. Note that decontamination usually requires Level D personal protection unless there is a potential for airborne exposures to site contaminants. Under circumstances where potential airborne exposure is possible respiratory protective equipment may be required based on personal air monitoring results. Upgrades to Level C will be coordinated with your Site Safety and Health Officer (SSHO) or EHS Coordinator.

Health and safety hazards potentially involved decontamination include the following:

- Skin contact with decontamination solvents. Wear solvent impervious gloves when decontaminating equipment. Methanol and isopropanol are approved but use the solvents sparingly and dispense only from pre-labeled polypropylene solvent wash bottles. Whenever possible use an aqueous based non-toxic cleaning agents in lieu of solvents. **Hexane is prohibited from use for decontamination.**

- Avoid contact with site contaminants. Exposure to contaminated media is possible when either removing contaminated personal protective equipment (PPE) or decontaminating heavy equipment. Take care to prevent slips and falls when scrubbing over boots in the CRZ and remove PPE using proper “inside-out” techniques to minimize airborne exposure to potentially contaminated particulate. In addition to Level D PPE, wear a face shield when brushing off heavy equipment or using a pressure washer. Consult the Corporate EHS Manual for additional precautions.

- Decontamination pad liquids. If large volumes of rinsates are generated, wash water must be properly characterized prior to disposal. Avoid contact and wear PPE during liquids transfer.

4.0 Supporting Materials

The following materials should be on hand in sufficient quantity to ensure that proper decontamination methods and procedures are followed:

- Cleaning liquids and dispensers (phosphate-free soap and/or detergent solutions, tap water, distilled water, deionized water, reagent grade methanol or isopropyl, etc.)

- PPE, as defined in the project HASP

- Paper towels or chemical-free cloths

- Disposable chemically impervious gloves
- Waste-storage containers (e.g., drums, boxes, plastic bags)
- Drum labels, if necessary
- Cleaning containers (e.g., plastic and/or galvanized steel pans or buckets)
- Cleaning brushes
- Plastic sheeting
- Material Safety Data Sheets (MSDSs) for any chemicals or site-specific contaminants and decontamination solvents
- A copy of the Site-Specific HASP (consult for heavy equipment decontamination)

5.0 Methods and Procedures

The extent of known contamination will determine the degree of decontamination required. When the extent of contamination cannot be readily determined, cleaning should be done according to the assumption that the equipment is highly contaminated.

Standard operating procedures listed below describe the method for full field decontamination. If different technical procedures are required for a specific project, they will be spelled out in the project plans.

Such variations in decontamination may include all or an expanded scope of these decontamination procedures:

- Remove gross contamination from the equipment by brushing and then rinse with tap water.
- Wash with detergent or soap solution (e.g., Alconox and tap water).
- Rinse with tap water or distilled water.
- Rinse with reagent grade methanol or isopropyl alcohol.
- Rinse with deionized water (distilled water is an acceptable substitute if deionized water is unavailable).
- Repeat entire procedure or any parts of the procedure as necessary.

- After decontamination procedure is completed, avoid placing equipment directly on ground surface to avoid re-contamination.

Downhole drilling equipment, such as augers, split spoons, Shelby tubes, and sand lines, will be decontaminated with pressurized hot water or steam wash, followed by a fresh water rinse. No additional decontamination procedures will be required if the equipment appears to be visually clean. If contamination is visible after hot water/steam cleaning, then a detergent wash solution with brushes (if necessary) will be used. Items heavily contaminated with product may require more aggressive decontamination techniques. If the items cannot be discarded, consult your EHS coordinator to obtain guidance in this regard.

6.0 Quality Assurance/Quality Control

To assess the adequacy of decontamination procedures, rinsate blanks should be collected and analyzed for the same parameters as the field samples. Specific number of blanks will be defined in the project-specific sampling plan. In general, one rinsate blank will be collected per 20 samples.

7.0 Documentation

Field notes describing procedures used to decontaminate equipment/personnel and for collection of the rinsate blanks will be documented by on-site personnel. Field notes will be retained in the project files.

RETEC Standard Operating Procedure (SOP) 210 Soil Sample Collection

1.0 Purpose and Applicability

The RETEC Group, Inc. (RETEC) SOP 210 describes methods used to obtain soil samples for physical testing, stratigraphic correlations, and chemical analysis. Soil samples are obtained in conjunction with surface sampling, test pit excavation, soil boring, and monitoring well installation programs. These procedures provide specific information for determining the physical makeup of the surface and subsurface environment, as well as how to estimate the extent and magnitude of soil contamination, if present. RETEC SOP 210 will discuss sampling of the surface material with hand tools and sampling of the subsurface material by augers and split spoons, and within test pits by backhoes and hand tools.

Specific project requirements as described in an approved Work Plan, Sampling Plan, Quality Assurance Project Plan, Job Hazard Analysis, Safety Task Analysis Review, or Site-Specific Health & Safety Plan will take precedence over the procedures described in this document.

2.0 Responsibilities

The project geologist/engineer will be responsible for the proper use and maintenance of all types of equipment used for obtaining soil samples. The geologist/engineer will determine the location, total depth, and overall size of each surface sample collection point and test pit, and the location and depth of all subsurface borings based on the project specific sampling plan. The project geologist/engineer will be responsible for locating any subsurface utilities or structures, and disseminating this information to the contractor prior to commencing the sampling program. The location of overhead utilities and obstructions relative to the sampling locations will also be noted. In addition, a Safety Task Analysis Review will be conducted to assess any other potential health and safety hazards associated with soil sample collection.

It shall be the responsibility of the project geologist/engineer to observe all activities pertaining to soil sampling and subsurface investigations to ensure that all the standard procedures are followed properly, and to record all pertinent data on a field log or field book. The collection, handling, and storage of all samples will be the responsibility of the geologist/engineer.

It is the responsibility of the contractor to provide safe and well-maintained equipment for obtaining subsurface samples in borings and for decontamination of the equipment. Test pit construction, split-spoon sampling, and subsurface augering will be conducted by the contractor. In addition, the contractor will be responsible for containment of cuttings, if required.

3.0 Health and Safety

This section presents the generic hazards associated with soil sampling techniques and is intended to provide general guidance in preparing site-specific health and safety documents. The Site-Specific Health & Safety Plan, Job Hazard Analyses, and Safety Task Analysis Reviews will address additional requirements and will take precedence over this document. Note that sample collection usually requires Level D personal protection unless there is a potential for airborne exposures to site contaminants.

Health and safety hazards include but are not limited to the following:

Test Pit Excavation

- Heavy equipment operation
- Cave-in (trench/excavation work)
- Hazardous materials (exposure and/or release)
- Utilities (underground)
- High noise levels
- Air quality (i.e., chemical, dust, explosive conditions)
- Uneven walking/working surfaces

Hollow Stem Auger Drilling

- Heavy equipment operation
- Pinch points
- Rotating parts
- Loose clothing
- Heavy lifting
- Air quality (i.e., chemical, dust, explosive conditions)
- Hazardous materials (exposure and release)
- Pressurized lines
- High noise levels
- Utilities (underground or overhead)
- Hoisting
- Overhead hazards
- Hand hazards

Rotary Drilling (Mud/Air)

- Same as above
- Increased noise hazard
- Increased dust hazard (air rotary)

- Cyclones/Diverters (pressurized lines should be anchored with whip-stops)
- Investigation derived waste containment
- Blow protect inspection/replacement
- Sample collection (i.e., there are increased hazards when taking samples from air rotary rigs resulting from overhead hazards (cyclones), pressurized lines, increased noise, and air quality at sample collection outlets. Field personnel must be aware of these hazards and initiate engineered controls to limit these hazards.)

If site/project conditions warrant the use of other drilling techniques, hazards associated with these techniques will be evaluated by amendment in the site-specific Health & Safety Plan, Job Hazard Analyses, or Safety Task Analysis Reviews. Drill rig inspections, if applicable, will be completed prior to initiating soil sampling.

4.0 Supporting Materials

In addition to materials provided by the contractor, the geologist/engineer will provide:

- Sample bottles/containers and labels
- Boring or test pit logs
- Field notebook
- Chain-of-custody forms
- Depth-measurement device
- Stakes and fluorescent flagging tape
- Decontamination solution
- Camera for photographing sections
- Sampling equipment (e.g., knives, trowels, shovels, hand augers, aluminum foil, etc.)
- Plastic garbage bags
- Material Safety Data Sheets (MSDSs) for any chemicals or site specific contaminants
- A copy of the site-specific Health and Safety Plan

5.0 Methods and Procedures

Specific sampling equipment and methodology will be dictated by characteristics of the soil to be sampled, type of soil samples required, and by the analytical procedures to be employed. Soil samples obtained at the surface may be collected using a shovel, trowel, or hand auger. A hand auger can be used to extract shallow soil samples up to 10 feet below the surface. Sampling to obtain uniform coverage within a specified area will often require the use of an area grid. These considerations will be followed based upon project specific requirements.

There are two types of samples that may be required by the project sampling plan, grab or composite. A grab sample is collected from a specific location or depth and placing it in the appropriate sample container. A composite sample consists of several discrete locations (or depths) mixed to provide a homogeneous, representative sample. To ensure that the sample is representative, the soil volume and collection method from each discrete location should be as identical as possible. It should be noted that samples analyzed for volatile organic compounds cannot be composited since it is necessary to expose the soil to the atmosphere prior to transfer into the sample container.

The sampling depth interval in borings is typically one sample for every five feet with additional samples taken at the discretion of the project geologist/engineer when significant color, textural, or odor changes are encountered. Deviations in the standard operating procedure will be covered in the project specific sampling plans.

Most subsurface explorations by RETEC will be on privately owned land, often an industrial facility. Prior to commencing subsurface exploration, RETEC will work with the facility manager to locate any subsurface utilities or structures and discuss any pertinent health and safety issues. Utility companies, (electric, gas, water, phone, sewer, etc.) who may have equipment or transmission lines buried in the vicinity, will also be notified. Many regions have organizations, which represent all utilities for these notification purposes. Allow enough time after notification (typically three working days) for the utilities to respond and provide locations of any equipment, which may be buried on site. Overhead lines must also be kept in consideration when a drilling rig is used. As a rule of thumb, the rig and derrick should be at least 25 feet away from overhead lines unless special shielding and grounding are provided. In addition, consult the site-specific health and safety documentation.

5.1 General Applications

General locations shall be mapped by the field geologist/engineer using a stationary structure as the reference point. Specific locations for test pits and sampling locations will be documented by survey or by using topographic maps and/or plans. A preliminary log of the test pit, or boring shall be prepared in the field by the field geologist/engineer. A sketch of the test pit may be necessary to depict the strata encountered. Before measuring the depth to groundwater, if encountered, the field geologist/engineer will allow sufficient time for stabilization of the water table in the excavation or boring. All information shall be recorded on the field log or the field book.

5.2 Surface Sampling

Prior to surface sampling, remove all surface materials that are not to be included in the sample such as rocks, twigs, and leaves. For sample collection taken within the upper two to three feet, use a shovel or trowel. A hand auger may be used for depths of up to 10 feet. When using the hand auger, auger the hole to the required depth, then slowly remove the auger and collect the soil sample from the auger flight or auger bucket at the point corresponding to the required depth. A tube sampler can be attached to the auger rods after augering to the desired depth, inserted into the open borehole, and then advanced into the soil at the base of the boring. If sampling is in sandy or non-cohesive soil, a shovel may be necessary to collect samples. Sample logging is described in Section 5.5.

Photographs of specific geologic features or sample location may be required for documentation purposes. A scale or item providing a size perspective should be placed in each photograph. The frame number and picture location shall also be documented in the field book. All equipment shall be decontaminated following RETEC SOP 120 between sample locations unless otherwise specified in the project specific sampling plan.

5.3 Test Pit Excavation and Sampling

Test pits shall be excavated in compliance with applicable safety regulations. Walls should be cut as near vertical as possible to facilitate stratigraphic logging. Field personnel will not enter an open test pit deeper than four feet without shoring or benching present. Samples shall be collected from the backhoe bucket with a trowel or from the side of the test pit wall (depending upon the depth of the test pit and the safety precautions in place). The size, depth, and orientation of the test pit shall be recorded on the test pit log (Figure 1). Sample logging is described in Section 5.5.

Photographs of specific geologic features or sample location may be required for documentation purposes. A scale or item providing a size perspective should be placed in each photograph. Frame numbers and picture locations shall also be documented in the field book.

The test pit shall be inspected and the test pit log reviewed to ensure that all the appropriate and/or required data and samples have been collected. All test pits will be backfilled to original grade and compacted. All equipment shall be decontaminated following RETEC SOP 120 and guidance provided in the Health and Safety Plan between sample locations unless otherwise specified in the project specific sampling plan. Avoid using flammable liquids for decontamination purposes.

5.4 Subsurface Sampling

Note: RETEC employees conducting these operations must have completed a drilling safety course.

Borings are typically advanced by two methods: rotary drilling and augering. The casing shall be of the flush-joint or flush-couple type and of sufficient size to allow for soil sampling, coring, and/or well installation. All casing sections shall be straight and free of any obstructions. Hollow-stem augers or solid-flight augers with casing may be used according to specific project requirements. Rotary drilling with water, mud, or air may be used in dense or indurated formations to advance to the required sample depth where a split spoon sampler or a coring device will be used to obtain the sample. Re-circulated water shall not be used when casing is being driven unless specified in project specific sampling plans and/or directed and properly documented by the field geologist/engineer. If re-circulated water is used, all loose material within the casing shall be removed by washing to the required sampling depth using a minimum amount of water. Care should be taken to limit re-circulation of the wash water to those times when the water supply is extremely limited or unavailable. The amount of water used should be documented in the project field book or on the field form.

Generally subsurface soil samples shall be obtained using a split-tube type sampler (split spoon), however, other devices (Shelby tubes, continuous samples, core, etc.) may be used as specified in the project specific sampling plan. Split-spoons come in a variety of sizes with the most standard having a 2-inch OD, a 1 3/8-inch ID and a 24-inch long barrel with an 18-inch sample capacity. Split spoons shall be equipped with a check valve at the top and a flap valve or basket-type retainer at the bottom. Samples shall be obtained using the standard penetration test (SPT), which allows for qualitative determination of mechanical properties and aids in identification of material type. The number of hammer blows shall be recorded on the boring log (Figure 2) for each six-inch drive distance.

The soil sampler shall be opened immediately upon removal from the casing. If the recovery is inadequate (i.e., most of the penetrated material was not retained inside the soil sampler), a note will be made on the boring log stating that “no recovery” was possible at that depth. In the event that gravels or other material prevent penetration by the split spoon, samples may be collected from the auger flights. Slowly remove the auger and collect the sample at the point corresponding to the required depth. Samples collected in this manner must be documented on the boring log. Sample logging is described in Section 5.5.

Photographs of specific geologic features or sample location may be required for documentation purposes. A scale or item providing a size perspective should be placed in each photograph. The frame number and picture location shall also be documented in the field book. All equipment will be decontaminated following RETEC SOP 120 between sample locations and sample depths unless otherwise specified in the project specific sampling plan.

Upon completion of the boring, backfill may be required. The backfill may consist of native material, hydrated bentonite chips/pellets, Portland cement/bentonite grout, or other low permeability material as specified in the project specific sampling plan. All applicable state/federal regulations concerning plugging of boreholes should be reviewed prior to the commencement of field activities.

5.5 Sample Logging

To ensure consistent descriptions of soil or rock material, the following criteria should be included on the sampling logs:

- Soil or rock type
- Depth ranges, recorded in feet
- Grain size
- Roundness
- Sorting
- Moisture
- Color
- Degree of oil contamination
- Remarks

Examples of soil types would be gravel, sand, silt, or clay. Soil types should be based on the Unified Soil Classification System (USCS). Figure 3 shows the USCS table. Examples of rock types include limestone, shale, claystone, siltstone, and sandstone. Soil/rock classifications determined in the field may be subject to change based upon laboratory tests. Factors to consider before changing a field determination include the expertise of the field geologist/engineer and laboratory personnel, representative character of the tested sampling, labeling errors, etc. Any changes made after this consideration shall be discussed and incorporated in the project report.

Grain size, roundness, and degree of sorting should also be included on the log if they are discernable. In addition to composition, blow counts and the length of the sample recovered should also be recorded on the sampling log. The degree of sample moisture should be described as dry, moist, and wet.

The color(s) or range of color(s) of the soil or rock type should be defined. If a Munsell color chart is used, the number designation of the color will also be recorded in the description. A notation of the degree of oil contamination should be included on the sample log. The contamination should be noted as high (30 %), medium (10-30 %), low (1-10 %), or none. Other classifiers may include odor (low to high) and mottling (low to high).

Remarks should include anything pertinent to the sample description or sample collection that is not described above. Other information to be placed on the logs as appropriate is:

- PID readings (with associated calibration information)

- Appearance of contamination (consistency)

- Degree of fracturing or cementation in the rock

- Drilling equipment used (rod size, bit type, pump type, rig manufacturer and model, etc.)

- Special problems and their resolution (hole caving, recurring problems at a particular depth, sudden tool drops, excessive grout takes, drilling fluid losses, lost casing, etc.)

Dates for start and completion of borings

- Depth of first encountered free water
- Definitions of special abbreviations used on log

5.6 Sample Handling

Specific procedures pertaining to the handling and shipment of samples shall be in accordance with RETEC SOP 110. A clean pair of gloves and decontaminated sampling tools will be used when handling the samples during collection to prevent cross contamination. A representative sample will be placed in the sampling container. Sample containers (jars or bags) shall be labeled with the following information:

- Client or project name, or unique identifier, if confidential
- Unique sample description (i.e., test pit, boring, or sampling point number and horizontal/vertical location)
- Sample collection date and time
- Sampler's name or initials
- Analyses to be performed

These data shall be recorded on the field logs and/or field book. Larger bulk samples shall be placed in cloth bags with plastic liners or plastic five-gallon buckets. Sample bags shall be marked with the information listed above.

6.0 Quality Assurance/Quality Control

Quality Assurance/Quality Control (QA/QC) requirements include, but are not limited to, blind field duplicates, blind rinsate blanks, and blind field blanks. These samples will be collected on a frequency of one QA/QC sample per 20 field samples or a minimum of one QA/QC sample per day unless otherwise specified in the project specific sampling plan.

7.0 Documentation

Documentation may consist of all or part of the following:

- Test pit or boring log
- Sample log sheets

- Field log book
- Chain-of-custody forms
- Shipping receipts
- Health & Safety forms (Job Hazard Analysis, Safety Task Analysis Review, and/or Site Specific Health & Safety Plan amendments)
- PID calibration records

All documentation shall be placed in the project files and retained following completion of the project.

8.0 References

Handbook of Suggested Practices for the Design and Installation of Ground-Water Monitoring Wells, EPA/600/4-89/034, published by National Water Well Association, 1991.

RCRA Ground Water Monitoring Technical Enforcement Guidance Document, published by National Water Well Association, 1986.

A Compendium of Superfund Field Operations, EPA 540/P-87/001, published by the Office of Emergency and Remedial Response, Office of Waste Programs Enforcement, US EPA, 1987.

Preparation of Soil Sampling Protocols: Sampling Techniques and Strategies, EPA/600/R-92/128, published by the Environmental Research Center, 1992.

The RETEC Group
Test Pit Log

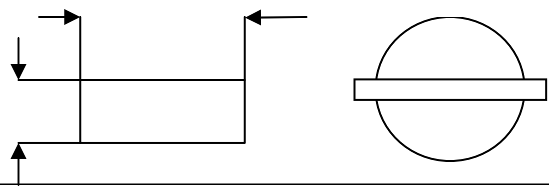
TEST PIT: TP-
SHEET:

PROJECT:			**LOCATION:**	**CONTRACTOR:**
PROJECT NO.:			**EQUIPMENT USED:**	
DATE:			**TOTAL DEPTH (ft.):**	
START TIME:		**FINISH TIME:**	**LOGGED BY:**	

Depth Range	Sample Type and Number	USCS	Depth (ft.)	Soil and Rock Description and Comments
			1	
			2	
			3	
			4	
			5	
			6	
			7	
			8	
			9	

TEST PIT PLAN

NORTH



Groundwater		
Date	Time (hours after completion)	Depth (ft.)

Comments:

The RETEC Group	**BORING LOG**	BORING SHEET OF
PROJECT	CONTRACTOR	MONUMENT
PROJECT #	DRILLER	RISER
LOCATION	RIG TYPE	SCREEN
TOTAL DEPTH	METHOD	FILTER PACK
DATE	CASING ID	SEAL
START / FINISH	BORING ID	GROUT
LOGGED BY DMS	BIT TYPE	GROUND ELEV.

SAMPLE TYPE AND NUMBER	**BLOWS PER 6 INCH**	**DEPTH RANGE**	**% REC**	**DEPTH FEET**	**SAMPLE DESCRIPTION** **CLASSIFICATION SCHEME**______________________

GROUNDWATER DEPTH (FT)	DATE/TIME
REMARKS	

FIELD GUIDE AND USCS CLASSIFICATION TABLE

SAND

SOIL TYPE	SPT, N Blows/ft.	Relative Density, %	FIELD TEST
VERY LOOSE SAND	4	0 – 15	Easily penetrated with ½ " reinforcing rod pushed by hand.
LOOSE SAND	4 – 10	15 – 35	Easily penetrated with ½ " reinforcing rod pushed by hand.
MEDIUM DENSE SAND	10 – 30	35 – 65	Penetrated a foot with ½ " reinforcing rod driven with 5-lb hammer.
DENSE SAND	30 – 50	65 – 85	Penetrated a foot with ½ " reinforcing rod driven with 5-lb hammer.
VERY DENSE SAND	50	85 – 100	Penetrated only a few inches with ½ " reinforcing rod driven with 5-lb hammer.

CLAY

CLAY CONSISTENCY	THUMB PENETRATION	SPT, N BLOWS/ FT.	Undrained Shear Strength c (PSF) TORVANE	Unconfined Compressive Strength (PSF) Pocket Penetrometer
VERY SOFT	Easily penetrated several inches by thumb. Exudes between thumb and fingers when squeezed in hand.	<2	250	500
SOFT	Easily penetrated one inch by thumb. Molded by light finger pressure.	2 – 4	250 – 500	500 – 1000
MEDIUM STIFF	Can be penetrated over ¼ " by thumb with moderate effort. Molded by strong finger pressure.	4 – 8	500 – 1000	1000 – 2000
STIFF	Indented about ¼ " by thumb but penetrated only with great effort.	8 – 15	1000 – 2000	2000 – 4000
VERY STIFF	Readily indented by thumbnail.	15 – 30	2000 – 4000	4000 – 8000
HARD	Indented with difficulty by thumbnail.	>30	>4000	>8000

Unified Soil Classification System (USCS)

		MILLIMETERS	INCHES	SIEVE SIZES
BOULDERS		> 300	> 11.8	-
COBBLES		75 – 300	2.9 – 11.8	-
GRAVEL	COARSE	75 – 19	2.9 - .75	-
	FINE	19 – 4.8	.75 - .19	¾ " – No. 4
SAND	COARSE	4.8 – 2.0	.19 - .08	No. 4 – No. 10
	MEDIUM	2.0 - .43	.08 - .02	No. 10 – No. 40
	FINE	.43 - .08	.08 - .003	No. 40 – No. 200
FINES	SILTS	< .08	< .003	< No. 200
	CLAYS	< .08	< .003	< No. 200

Table Title

MAJOR DIVISIONS			LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL – GRADED GRAVELS, GRAVEL – SAND MIXTURES, LITTLE OR NO FINES.
			GP	POORLY – GRADED GRAVELS, GRAVEL – SAND MIXTURES, LITTLE OR NOT FINES.
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND – SILT MIXTURES.
			GC	CLAYEY GRAVELS, GRAVEL – SAND – CLAY MIXTURES.
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	CLEAN SAND (LITTLE OR NO FINES)	SW	WELL – GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES.
			SP	POORLY – GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES.
		SANDS WITH FINES APPRECIABLE AMOUNT OF FINES)	SM	SILTY – SANDS, SAND – SILT MIXTURES
			SC	CLAYEY SANDS, SAND – CLAY MIXTURES.
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY.
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY, CLAYS, LEAN CLAYS.
			OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY.
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50	MH	INORGANIC SITLS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS.
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS.
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS.
HIGHLY ORGANIC SOILS			PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS.

RETEC Standard Operating Procedure (SOP) 430
Hazardous Waste Management & Shipping

1.0 Purpose and Applicability

The RETEC Group, Inc. (RETEC) SOP 430 details the proper management and shipping of hazardous wastes. Specific project requirements as described in an approved Work Plan, Sampling Plan, Quality Assurance Project Plan, Job Hazard Analysis (JHA), Safety Task Analysis (STAR), or Site-Specific Health and Safety Plan (HASP) will take precedence over the procedures described in this document.

The Resource Conservation and Recovery Act (RCRA) regulates hazardous waste from the point of its generation through its point of final disposal. EPA has developed generator standards that address on-site accumulation of hazardous waste in 40 CFR 262. Additional waste accumulation and handling procedures may be required by your local state agency.

2.0 Responsibilities

Hazardous waste management is an essential component of many RETEC projects. Everyone who handles hazardous waste is responsible for ensuring that the waste is properly managed. Improperly managing waste can result in violations and fines, and criminal penalties.

3.0 Health and Safety

Although there are no specific health and safety hazards associated with this task, always remember to work safe.

4.0 Supporting Materials

Supporting materials for the management of hazardous waste are as follows:

- Copy of RCRA regulations (40 CFR 261 and 262)
- Copy of applicable state regulations
- Waste management labels

5.0 Methods and Procedures

The RCRA regulations establish a comprehensive hazardous waste management system under the authority of RCRA Subtitle C. RCRA regulates hazardous waste from the point of its generation through its point of final disposal. Hazardous waste generators are subject to varying degrees of regulation depending on the amount of hazardous waste produced. These methods and procedures define the three classifications of generators, details the varying degree of regulation that applies to each, and explains hazardous waste manifesting and shipping requirements.

5.1 Generator Status

A generator can be thought of as any entity whose process produces hazardous waste or whose action causes a hazardous waste to be subject to regulation (40 CFR 260.10). On RETEC jobsites, our clients are almost always considered the generator. If a hazardous waste was generated in one of our offices, however, we would likely be considered the generator.

Generators fall into one of three types of generator status categories according to the amount of waste generated in a calendar month. These three classes of generators are described in Table 1: conditionally exempt small quantity generators (CESQGs), small quantity generators (SQGs), and large quantity generators (LQGs). Regulatory requirements for each become increasingly stringent as the volume of waste generated grows. Section 4.2 details the regulatory requirements for each type of generator.

Generators sometimes periodically exceed or fall below their normal generation limits in a generator month. If the amount of waste generated in that calendar month exceeds the limits of their generator status, the generator is responsible for complying with additional regulatory requirements of the new status. For example, if a generator produces 300 kilograms (kg) of hazardous waste in March, the waste must be managed in accordance with the SQG regulations; if the same generator produces 1,500 kg of hazardous waste in April, the waste must be managed in accordance with the LQG regulations (50 Federal Register (FR) 10153; March 24, 1986).

Table 1 Generator Status and Applicable Regulations

Generator Status	Quantity of Waste Generated	Accumulation Limit	Applicable Regulations
Conditionally Exempt Small Quantity (CESQG)	≤ 100 kg / month ≤1 kg acute ≤ 100 kg acute residue or contaminated soil	1,000 kg	§261.5
Small Quantity (SQG)	Between 100-1,000 kg / month (approx. 220 – 2200 lbs)	6,000 kg	Part 262, Subparts A, B, C (§262.34(d) is specific to SQGs); and Subparts E, F, G, H if applicable; and portions of Subpart D as specified in §262.44
Large Quantity (LQG)	≥ 1,000 kg / month (approx. 2,200 lbs) > 1 kg / month acute (approx. 2.2 lbs) > 100 kg acute residue or contaminated soil	NA	All Part 262 Requirements

5.2 Hazardous Waste Management Requirements by Generator Status

5.2.1 Conditionally Exempt Small Quantity Generator Requirements

Hazardous waste generated by CESQG is not subject to specific management standards under the federal hazardous waste regulations. Care must be taken that a client who maintains a CESQG does not generate more than 100 kg of hazardous waste (or more than 1 kg of acute hazardous waste, or more than 100 kg of spill residue from an acute hazardous waste) on site in one month or greater than 1,000 kg total at any time. If the client exceeds the 1,000 kg limit for hazardous waste, their site is subject to the SQG requirements in §262.34(d) and discussed in Section 5.2.2 of this SOP (§261.5(g)). If a client exceeds any of the limits set for acute hazardous waste, then they are subject to Large Quantity Generator requirements discussed in Section 5.2.3 of this SOP (§261.5(f)).

If your client is a CESQG, then you must ensure that the following waste management requirements are met:

- Maintain the client's generator status by accumulating only a maximum 1,000 kg of hazardous waste, or 1 kg of acute hazardous waste, or 100 kg of acute spill residue onsite at any time (§261.5).
- Place the waste in a container that is compatible with its properties, and is in good condition (Best Management Practice (BMP))
- Label all waste with content and hazard information (OSHA HazCom)
- Inspect the waste container frequent enough to determine that the container is not leaking and is in good condition (BMP)
- Minimize potential spills by inspecting the container at regular intervals, by placing containers away from stormwater drains, and by placing waste in secondary containment, if possible (BMP).
- Ensure that personnel shipping the waste is trained in DOT hazardous materials transport, and ship the waste in accordance with DOT regulatory requirements (See Section 4.4)
- Dispose of hazardous waste at a permitted or authorized disposal facility (§261.5(f)(3) and §261.5(g)(3)).

5.2.1 Small Quantity Generator Requirements

Generally, SQGs must comply with only some of the regulations that apply to LQGs. Care must be taken that a client who maintains an SQG does not accumulate more than 6,000 kg of hazardous waste on site at any time, and that waste is shipped offsite within 180 days of generation (or 270 days if shipped 200 miles or more). If the client exceeds the 6,000 kg limit for hazardous waste or the accumulation time limit, then their site is subject to LQG or requirements detailed in Section 4.2.3 of this SOP (§261.5(f)).

If your client is an SQG, then you must ensure that the following waste management requirements are met:

- Maintain the client's generator status by generating between 100 and 1,000 kg per month and accumulating only 6,000 kg of hazardous waste onsite at any one time (§262.34).
- Read and understand your role in relation to the facility's preparedness and prevention procedures, which are required by RCRA (§262.34(d)(4)).
- Ensure that RETEC staff handling hazardous waste are trained in accordance with the facility's RCRA personnel training program (§262.34(d)(5)(iii)).
- Accumulate waste in tanks or containers only (§262.34).
- Place the waste in a container that is compatible with its properties (§260.10), is in good condition (§§264 / 265.171), and is closed, except when waste is being added or removed (§264 / 265.173).
- Ensure that hazardous waste is not mixed with any other type of waste or any materials that the waste may react with (BMP, §260.10).
- Place containers holding ignitable or reactive wastes at least 50 feet from the property line (§264 / 265.173).
- Label all waste with content and hazard information (OSHA HazCom)
- Inspect the containers for leaking and deterioration at least once a week (§§264/265.174), and retain records of inspection in a log as detailed in §§264/265.15(d).
- Minimize potential spills by inspecting the container at regular intervals , by placing containers away from stormwater drains, and by placing waste in secondary containment, if possible (BMP).
- Prepare a manifest in accordance with the instructions found in the Appendix of §262, and sign the manifest only if a legal agreement has been reached with the client (see Section 4.3).
- Ensure that personnel shipping the waste and preparing the manifest are trained in DOT hazardous materials transport, and ship the waste in accordance with DOT regulatory requirements (See Section 4.4).
- Ensure that the waste is shipped offsite at 180 days or less, or before 270 days if the waste will be shipped 200 miles or more to the disposal facility (§262.34(e)).
- Dispose of hazardous waste at a permitted or authorized disposal facility (§261.5(f)(3) and §261.5(g)(3)).

5.2.2 Large Quantity Generator Requirements

LQG are the most heavily regulated of all generators. If your client is an LQG, then you must ensure that the following waste management requirements are met:

- Read and understand your role in relation to the facility's preparedness and prevention procedures, which are required by RCRA (§262.34(d)(4)).
- Review the facility's RCRA contingency plan (§262.34(a)(4)), and understand your role should an emergency occur.
- Ensure that RETEC staff handling hazardous waste are trained in accordance with the facility's RCRA personnel training program (§262.34(d)(5)(iii)).
- Accumulate hazardous waste only in containers, tanks, containment buildings, or on drip pads (§262.34), and meet the air emission control requirements for accumulation tanks and containers (§§262.34(a)(l)(i) and (ii)).
- Place the waste in a container that is compatible with its properties (§260.10), is in good condition (§§264/265.171), and is closed, except when waste is being added or removed (§264/265.173).
- Ensure that hazardous waste is not mixed with any other type of waste (BMP) or any materials that the waste may react with (§260.10).
- Place containers holding ignitable or reactive wastes at least 50 feet from the property line (§264/265.173).
- Label all waste with content and hazard information (OSHA HazCom).
- Inspect the containers for leaking and deterioration at least once a week (§§264/265.174), and retain records of inspection in a log as detailed in §§264/265.15(d).
- Minimize potential spills by inspecting the container at regular intervals, by placing containers away from stormwater drains, and by placing waste in secondary containment, if possible (BMP).
- Prepare a manifest in accordance with the instructions found in the Appendix of §262, and sign the manifest only if a legal agreement has been reached with the client (see Section 4.3).
- Ensure that personnel shipping the waste and preparing the manifest are trained in DOT hazardous materials transport, and ship the waste in accordance with DOT regulatory requirements (Section 4.4)
- Ensure that the waste is shipped offsite at 90 days (§264.34).
- Dispose of hazardous waste at a permitted or authorized disposal facility (§261.5(f)(3) and §261.5(g)(3)).

5.3 Department of Transportation Requirements

The Hazardous Material Regulations (HMR) state that all hazardous wastes are hazardous materials because they are capable of posing an unreasonable risk to health, safety, and property when transported in commerce (49 CFR Parts 172-179). Preparation of hazardous materials for transportation is the responsibility of RETEC when we offer the material for transportation. A DOT-trained individual may offer a hazardous material for transportation if it is in an approved packing or container and is:

- Properly classed
- Properly described
- In a properly manufactured and tested packaging or container
- In a packing marked in accordance with the HMR
- The package is in full compliance with Part 178 (173.22)(a)(1)-(4))

Attachment B provides shipping information for wastes that are commonly shipped from client sites. Always review the HMR to ensure that the shipping information associated with the waste is complete and accurate. Remember that only DOT trained individuals may ship hazardous waste or prepare hazardous waste for shipment.

5.4 Manifests

A generator who transports, or offers for transportation, hazardous waste for off-site treatment, storage, or disposal must prepare a Uniform Hazardous Waste Manifest. The manifest is a multiple-copy tracking document that tracks the chain of custody for the waste from the point it leaves the generator to final disposition at a hazardous waste disposal or recycling facility (Part 262, Subpart B). Once the chain is complete, the receiving facility returns a signed copy of the manifest to the generator. CESQG are not required to use a manifest when shipping their waste offsite, but may use a bill of lading for internal tracking purposes. A copy of the manifest form and instructions for completion are found in the Appendix to Part 262.

In general, client manifests should not be prepared or signed by RETEC employees. In some cases, a client may want a RETEC employee to act as their agent and sign a manifest. RETEC employees may only sign client manifests upon completion of a letter agreement with the client authorizing RETEC and RETEC employees to act as the client's agent in arranging for waste disposal or transportation . The client must agree to, sign, and return the letter before RETEC employees act as the client's agent or signing any documents on behalf of the client. Attachment A provides a template that may be used to meet the requirements of the authorization letter; you may call RETEC's Shared Services Risk Management for more assistance in preparation of the letter.

RETEC employees who prepare or sign a manifest as an agent for the client must have received Department of Transportation (DOT) hazardous materials shipping training in the last three years (49 CFR 172 -179). In no case may a RETEC employee prepare or sign a manifest without having received DOT training.

5.5 Land Disposal Restriction Forms

In addition to a manifest, you must complete a Land Disposal Restriction (LDR) Form to accompany a hazardous waste manifest. LDR forms communicate to the waste vendor that the hazardous waste doesn't meet the treatment standard required by the LDR regulations. It is the waste vendor's responsibility to ensure that after treatment the waste meets the standard before land disposal. A list of the LDR treatment standards is found in 40 CFR

268.40.

6.0 Quality Assurance/Quality Control

Every manifest signed as an agent for the client must be reviewed for accuracy by an experienced co-worker or supervisor. If additional questions arise, contact a RETEC EH&S coordinator for assistance with finding an internal RETEC expert.

7.0 Documentation

Copies of manifests that are signed as an agent for the client must be returned to the client for their records; copies should be retained in the project file for at least 5 years.

Attachment A

Conditions for Acting as Agent to Sign Manifests

Conditions for RETEC Acting as Agent to Sign Waste Manifests

The following information and indemnity provisions must be covered in a letter agreement with the Client authorizing RETEC and RETEC employees to act as the Client's agent in arranging for waste disposal or transportation. It is not sufficient merely to send the letter to the Client. The Client must agree to, sign, and return the letter before RETEC will commence to act as the Client's agent or sign any documents on behalf of the Client. The order that the information is presented is not as important, but the content of the letter is critical to limit RETEC's liability and protect the Client. Please feel free to have Corporate Risk Management (Charlotte Lawson (904) 726-8379) proofread any authorization letter you are preparing. Attached is a sample authorization letter.

Prior to undertaking to act as agent for a Client to arrange for and sign waste manifests and other documents relating to the transport and disposal of wastes, the following conditions and procedures must be followed:

1. **Document the phone telephone conversation, meeting, proposal, letter or situation upon which you will base the client authorization.**

2. **Detail the scope of work including the 1) origination site, 2) disposal site and 3) period of authorization, if any.**

EXAMPLE:

Per our conversation on Tuesday this letter is to confirm <u>ABC Industries, Inc.'s (ABC)</u> authorization to have RETEC Consulting Corporation (RETEC) act as agent for <u>ABC Industries, Inc.</u> for the purpose of arranging for the transport and disposal of hazardous wastes and other materials from the <u>Green Acres MGP</u> site to the <u>Landsend Landfill</u> for the period of <u>March 3 through August 1, 2001</u>, and signing on behalf of <u>ABC</u> waste manifests and other documents required for the transport and disposal of such materials.

3. **Expressly state the indemnification (Very Important!)**

It is recognized that <u>ABC</u> may assert that certain third persons or parties may rightfully bear the ultimate legal responsibility for any and all hazardous or nonhazardous substances, wastes, pollutants or contaminants which may currently be present on or have originated from <u>the Green Acres MGP site</u>. For the transport and disposal activities to be undertaken by RETEC as described above, it is agreed that RETEC shall under no circumstances be considered the generator of any hazardous or nonhazardous substances, wastes, pollutants or contaminants which may currently be present on or have originated from <u>the Green Acres MGP site</u> for the purposes of any environmental or other law or regulation. It is agreed that any hazardous materials, pollutants or contaminants generated or encountered in the performance of such activities by RETEC shall remain the property of <u>ABC</u>, shall remain the responsibility of <u>ABC</u> and shall be disposed of under a RCRA hazardous waste Generator Number obtained by and carried in name of <u>ABC</u>.

ABC agrees to defend, hold harmless and indemnify RETEC and its affiliates, and their officers, directors, employees, agents and subcontractors from and against any and all claims, actions, causes of action, liability, judgments, fines, penalties and costs (including attorney's fees) incurred by or to which any of them are subjected and which arise out of or related to the materials, wastes, pollutants or contaminants generated, originating from or transported from ABC's properties.

4. Ask for formal authorization (We cannot sign manifests or bills of lading at risk.)

If these conditions are acceptable, please sign and fax this authorization letter to my attention at [RETEC's office fax number].

Add signature, title & date lines at the bottom of letter.

5. Add deadline or schedule information, if applicable.

In order to schedule the waste disposal by March 3, 2001, we request a fax authorization by February 25.

6. Request an immediate call if there has been a misunderstanding.

If you have any questions or require more information about the planned waste disposal, please call me immediately at [RETEC's office phone number]. RETEC appreciates this opportunity to be of continued service to ABC Industries, Inc.

7. Remember that when signing any waste manifests or related documents to do so as agent for the Client.

For example, [your name], agent for ABC Industries, Inc.

HARD DATE

Mr. John Brown
ABC Industries, Inc.
1234 West Industrial Drive
Anytown, MO 17345

Dear Mr. Brown:

Per our conversation on Tuesday, this letter is to confirm ABC Industries, Inc.'s (ABC) authorization to have RETEC Consulting Corporation (RETEC) act as agent for ABC Industries, Inc. for the purpose of arranging for the transport and disposal of hazardous wastes and other materials from the Green Acres MGP site to the Landsend Landfill for the period of March 3 through August 1, 2001, and signing on behalf of ABC waste manifests and other documents required for the transport and disposal of such materials.

It is recognized that ABC may assert that certain third persons or parties may rightfully bear the ultimate legal responsibility for any and all hazardous or nonhazardous substances, wastes, pollutants or contaminants which may currently be present on or have originated from the Green Acres MGP site. For the transport and disposal activities to be undertaken by RETEC as described above, it is agreed that RETEC shall under no circumstances be considered the generator of any hazardous or nonhazardous substances, wastes, pollutants or contaminants which may currently be present on or have originated from the Green Acres MGP site for the purposes of any environmental or other law or regulation. It is agreed that any hazardous materials, pollutants or contaminants generated or encountered in the performance of such activities by RETEC shall remain the property of ABC, shall remain the responsibility of ABC and shall be disposed of under a RCRA hazardous waste Generator Number obtained by and carried in name of ABC.

ABC agrees to defend, hold harmless, and indemnify RETEC and its affiliates, and their officers, directors, employees, agents, and subcontractors from and against any and all claims, actions, causes of action, liability, judgments, fines, penalties and costs (including attorney's fees) incurred by or to which any of them are subjected and which arise out of or related to the materials, wastes, pollutants or contaminants generated, originating from or transported from ABC's properties.

If these conditions are acceptable, please sign and fax this authorization letter to my attention at (978) 369-2979. In order to schedule the waste disposal by March 3, 2001, we request a fax authorization by February 25. If you have any questions or require more information about the planned waste disposal, please call me immediately at (978) 371-1422. RETEC appreciates this opportunity to be of continued service to ABC Industries, Inc.

Sincerely,

The RETEC Group, Inc.

Richard Manager
Project Manager

____
Authorizing Signature for ABC Industries, Inc

____
Name, Title (print)

____
Date

Attachment B

Waste Shipping Information for Common Wastes

Air Stripper Packing
Packaging, Marking, Labeling and Shipping

Example Waste	RCRA Regulated	DOT Regulated	Shipping Paper (49 CFR Subpart C)	Shipping Name (49 CFR 172.101)	LDR Form (40 CFR 268.7)	RCRA Label (40 CFR 262.34)	DOT Marking (49 CFR 172 Subpart D)	DOT Label (49 CFR 172 Subpart E)	Placard (49 CFR 172 Subpart F)
Air Stripper Packing TCLP Benzene > 0.5 mg/L, Lead > 5 mg/L	Yes	Yes	Haz Waste Manifest	Hazardous Waste Solid, N.O.S., 9, NA3077, PGIII (Lead, Benzene)	Yes	Yes	Yes	Yes	Yes*
Air Stripper Packing TCLP Lead < 5 mg/L Benzene < 0.5 mg/L	No	No	Straight Bill of Lading	Non-Regulated Material	No	No	No	No	No

* With Exceptions

Fuel Oil

Packaging, Marking, Labeling and Shipping

Example Waste	RCRA Regulated	DOT Regulated	Shipping Paper (49 CFR Subpart C)	Shipping Name (49 CFR 172.101)	LDR Form (40 CFR 268.7)	RCRA Label (40 CFR 262.34)	DOT Marking (49 CFR 172 Subpart D)	DOT Label (49 CFR 172 Subpart E)	Placard (49 CFR 172 Subpart F)
Fuel Oil for Disposal Flashpoint < 140F, TCLP Benzene < 0.5 mg/L	Yes	Yes	Haz Waste Manifest	Waste Fuel Oil Mixture, 3, NA1993 PGlll	Yes	Yes	Yes	Yes	Yes*
Fuel Oil for Recycling Flashpoint > 200F, TCLP Benzene, <0.5 mg/L	No	Yes	Haz Materials of Lading	Fuel Oil Mixture, 3, NA1993, PGlll (Benzene)	No	No	Yes	No*	Yes*
Fuel Oil Flashpoint > 200F, TCLP Benzene < 0.5 mg/L	No	No	Straight Bill of Lading	Non-Regulated Material	No	No	No	No	No

* With Exceptions

Fuel Oil and Water Mixtures
Packaging, Marking, Labeling and Shipping

Example Waste	RCRA Regulated	DOT Regulated	Shipping Paper (49 CFR Subpart C)	Shipping Name (49 CFR 172.101)	LDR Form (40 CFR 268.7)	RCRA Label (40 CFR 262,34)	DOT Marking (49 CFR 172 Subpart D)	DOT Label (49 CFR 172 Subpart E)	Placard (49 CFR 172 Subpart F)
Mostly Fuel Oil Flashpoint < 140F, TCLP Benzene > 0.5 mg/L	Yes	Yes	Haz Waste Manifest	Waste Fuel Oil Mixture, 3, NA1993, PGII (Benzene)	Yes	Yes	Yes	Yes	Yes*
Mostly Water, (Fuel Oil portion recycled) Flashpoint 141-200F, TCLP Benzene > 0.5 mg/L	No	Yes	Haz Materials Bill of Lading	Combustible Liquid, N.O.S., NA1993 PGIII (Fuel Oil)	No	No	Yes	No	Yes*
Mostly Water Flashpoint > 200F, TCLP Benzene < 0.5 mg/L	No	No	Straight Bill of Lading	Non-Regulated Material	No	No	No	No	No

* With Exceptions

Gasoline

Packaging, Marking, Labeling and Shipping

Example Waste	RCRA Regulated	DOT Regulated	Shipping Paper (49 CFR Subpart C)	Shipping Name (49 CFR 172.101)	LDR Form (40 CFR 268.7)	RCRA Label (40 CFR 262,34)	DOT Marking (49 CFR 172 Subpart D)	DOT Label (49 CFR 172 Subpart E)	Placard (49 CFR 172 Subpart F)
Gasoline for Disposal Flashpoint < 140F TCLP Benzene > 0.5 mg/L	Yes	Yes	Haz Waste Manifest	Waste Gasoline Mixture, 3, UN1203, PGII (Benzene)	Yes	Yes	Yes	Yes	Yes*
Gasoline for Recycling Flashpoint < 140F, TCLP Benzene > 0.5 mg/L	No	Yes	Haz Materials Bill of Lading	Gasoline Mixture, 3, UN1203, PGII	No	No	Yes	Yes*	Yes*

* With Exceptions

Gasoline and Water Mixtures

Packaging, Marking, Labeling and Shipping

Example Waste	RCRA Regulated	DOT Regulated	Shipping Paper (49 CFR Subpart C)	Shipping Name (49 CFR 172.101)	LDR Form (40 CFR 268.7)	RCRA Label (40 CFR 262,34)	DOT Marking (49 CFR 172 Subpart D)	DOT Label (49 CFR 172 Subpart E)	Placard (49 CFR 172 Subpart F)
Mostly Gasoline Flashpoint >140F, TCLP Benzene > 0.5 mg/L	Yes	Yes	Haz Waste Manifest	Waste Gasoline Mixture, 3, UN1203, PGII (Benzene)	Yes	Yes	Yes	Yes	Yes*
Mostly Water with Gasoline Flashpoint < 140F, TCLP Benzene < 0.5 mg/L, TCLP Lead > 5.0 mg/L	No	Yes	Haz Waste Manifest	Waste Flammable Liquid, N.O.S., 3, UN1993, PGIII (Lead, Benzene)	Yes	Yes	Yes	Yes	Yes*
Mostly Water Flashpoint 141-200F, TCLP Benzene < 0.5 gm/l	No	Yes	Haz Materials Bill of Lading	Combustible Liquid, N.O.S., NA1993 PGIII (Gasoline)	No	No	Yes	No*	Yes*
Mostly Water Flashpoint > 200F, TCLP Lead > 5.0 mg/L, TCLP Benzene > 0.5 mg/L	No	No	Straight Bill of Lading	Non-Regulated Material	No	No	No	No	No

* With Exceptions

Oil/Water Separator Sludge
Packaging, Marking, Labeling and Shipping

Example Waste	RCRA Regulated	DOT Regulated	Shipping Paper (49 CFR Subpart C)	Shipping Name (49 CFR 172.101)	LDR Form (40 CFR 268.7)	RCRA Label (40 CFR 262,34)	DOT Marking (49 CFR 172 Subpart D)	DOT Label (49 CFR 172 Subpart E)	Placard (49 CFR 172 Subpart F)
O/W separator sludge TCLP Benzene < 0.5 mg/L TCLP Cresol >200 mg/L, TCLP Lead > 5 mg/L, Flashpoint >200F	Yes	Yes	Haz Waste Manifest	Hazardous Waste Liquid, N.O.S., 9, NA3082, PGlll (Lead, Cresol)	Yes	Yes	Yes	Yes	Yes*
O/W separator sludge Flashpoint 141-200F, TCLP Benzene < 0.5 mg/L TCLP Lead < 5 mg/L	No	Yes	Haz Materials Bill of Lading	Combustible Liquid N.O.S., NA1993 PGlll (Oil)	No	No	Yes	No*	Yes*
O/W separator sludge Flashpoint > 200F TCLP Lead < 5 mg/L, TCLP Benzene < 0.5 mg/L	No	No	Straight Bill of Lading	Non-Regulated Material	No	No	No	No	No

* With Exceptions

PPE, Sorbents, Trash
Packaging, Marking, Labeling and Shipping

Example Waste	RCRA Regulated	DOT Regulated	Shipping Paper (49 CFR Subpart C)	Shipping Name (49 CFR 172.101)	LDR Form (40 CFR 268.7)	RCRA Label (40 CFR 262.34)	DOT Marking (49 CFR 172 Subpart D)	DOT Label (49 CFR 172 Subpart E)	Placard (49 CFR 172 Subpart F)
PPE and Trash TCLP Benzene > 0.5 mg/L,TCLP Lead < 5.0 mg/L	Yes	Yes	Haz Waste Manifest	Hazardous Waste Solid, N.O.S., 9, NA3077, PGlll (Benzene)	Yes	Yes	Yes	Yes	Yes*
PPE and Trash TCLP Lead < 5.0 mg/L, TCLP Benzene < 0.5 mg/L	No	No	Straight Bill of Lading	Non-Regulated Material	No	No	No	No	No

* With Exceptions

Soil and Debris

Packaging, Marking, Labeling and Shipping

Example Waste	RCRA Regulated	DOT Regulated	Shipping Paper (49 CFR Subpart C)	Shipping Name (49 CFR 172.101)	LDR Form (40 CFR 268.7)	RCRA Label (40 CFR 262.34)	DOT Marking (49 CFR 172 Subpart D)	DOT Label (49 CFR 172 Subpart E)	Placard (49 CFR 172 Subpart F)
AST gasoline spill/release clean-up (soil and debris) Benzene > 0.5 mg/L	Yes	Yes	Haz Waste Manifest	Hazardous Waste Solid, N.O.S., 9, NA3077, PGIII (Benzene)	Yes	Yes	Yes	Yes	Yes*
UST gasoline spill/release clean up (soil and debris) Benzene > 10 mg/L	No	Yes	Haz Materials Bill of Lading	Environmentally Hazardous Substances, Solid, N.O.S., 9, UN3077, PGIII (Benzene)	No	No	Yes	Yes	Yes*
UST gasoline spill/ TCLP Benzene < 5 mg/L, TCLP Lead = 2 mg/L	No	No	Straight Bill of Lading	Non-Regulated Material	No	No	No	No	No

* With Exceptions

Spent Acid

Packaging, Marking, Labeling and Shipping

Example Waste	RCRA Regulated	DOT Regulated	Shipping Paper (49 CFR Subpart C)	Shipping Name (49 CFR 172.101)	LDR Form (40 CFR 268.7)	RCRA Label (40 CFR 262,34)	DOT Marking (49 CFR 172 Subpart D)	DOT Label (49 CFR 172 Subpart E)	Placard (49 CFR 172 Subpart F)
Spent Acid (HCL) pH=1, TCLP Benzene < 0.5 mg/L TCLP Lead < 5 mg/L	Yes	Yes	Haz Waste Manifest	Waste Hydrochloric Acid Solution, 8, UN1789, PGII	Yes	Yes	Yes	Yes	Yes*
Spent Acid (HCL) pH=3, TCLP Benzene < 0.5 mg/L TCLP Lead < 5 mg/L	No	No	Haz Materials Bill of Lading	Hydrochloric Acid Solution, 8, UN1789 PGIII	No	No	Yes	Yes	Yes*

* With Exceptions

Spent Carbon

Packaging, Marking, Labeling and Shipping

Example Waste	RCRA Regulated	DOT Regulated	Shipping Paper (49 CFR Subpart C)	Shipping Name (49 CFR 172.101)	LDR Form (40 CFR 268.7)	RCRA Label (40 CFR 262,34)	DOT Marking (49 CFR 172 Subpart D)	DOT Label (49 CFR 172 Subpart E)	Placard (49 CFR 172 Subpart F)
Spent Carbon TCLP Benzene > 0.5 mg/L	Yes	Yes	Haz Waste Manifest	Hazardous Waste Solid, N.O.S., 9, NA3077, PGlll (Benzene)	Yes	Yes	Yes	Yes	Yes*
Spent Carbon TCLP Benzene < 0.5 mg/L Flashpoint >141- < 200F	No	Yes	Haz Materials Bill of Lading	Combustible liquid, N.O.S., NA1993, PGlll (Gasoline) Domestic Transport	No	No	Yes	No*	Yes*
Spent Carbon TCLP Benzene - ND, Flashpoint > 200F	No	No	Straight Bill of Lading	Non-Regulated Material	No	No	No	No	No

* With Exceptions

Waste Oil

Packaging, Marking, Labeling and Shipping

Example Waste	RCRA Regulated	DOT Regulated	Shipping Paper (49 CFR Subpart C)	Shipping Name (49 CFR 172.101)	LDR Form (40 CFR 268.7)	RCRA Label (40 CFR 262,34)	DOT Marking (49 CFR 172 Subpart D)	DOT Label (49 CFR 172 Subpart E)	Placard (49 CFR 172 Subpart F)
Waste Oil TCLP Benzene > 0.5 mg/L, Flashpoint > 200F	Yes	Yes	Haz Waste Manifest	Hazardous Waste Liquid, N.O.S., 9, NA3082, PGIII (Oil, Benzene)	Yes	Yes	Yes	Yes	Yes*
Waste Oil for Disposal or Recycling Flashpoint 141-200F	No	Yes	Haz Materials Bill of Lading	Combustible Liquid, N.O.S., NA1993, PGIII (Oil)	No	No	Yes	No*	Yes*
Waste Oil for Recycling Flashpoint >200F, TCLP Lead > 5.0 mg/L	No	No	Straight Bill of Lading	Non-Regulated Material	No	No	No	No	No

* With Exceptions

WASTE OIL AND WATER MIXTURES

Packaging, Marking, Labeling and Shipping

Example Waste	RCRA Regulated	DOT Regulated	Shipping Paper (49 CFR Subpart C)	Shipping Name (49 CFR 172.101)	LDR Form (40 CFR 268.7)	RCRA Label (40 CFR 262,34)	DOT Marking (49 CFR 172 Subpart D)	DOT Label (49 CFR 172 Subpart E)	Placard (49 CFR 172 Subpart F)
Waste oil/water TCLP Benzene > 5 mg/L, Flashpoint > 200F	Yes	Yes	Haz Waste Manifest	Hazardous Waste Liquid, N.O.S., 9, NA3082, PGIll (Oil, Benzene)	Yes	Yes	Yes	Yes	Yes*
Waste oil/water for disposal or recycling FP 141-200F	No	Yes	Haz Materials Bill of Lading	Combustible Liquid, N.O.S., NA1993 PGIll (Oil)	No	No	Yes	No*	Yes*
Waste Oil-recycled Flashpoint > 200F TCLP Lead > 5.0 mg/L	No	No	Straight Bill of Lading	Non-Regulated Material	No	No	No	No	No

* With Exceptions

Well Purge /Development Water

Packaging, Marking, Labeling and Shipping

Example Waste	RCRA Regulated	DOT Regulated	Shipping Paper (49 CFR Subpart C)	Shipping Name (49 CFR 172.101)	LDR Form (40 CFR 268.7)	RCRA Label (40 CFR 262,34)	DOT Marking (49 CFR 172 Subpart D)	DOT Label (49 CFR 172 Subpart E)	Placard (49 CFR 172 Subpart F)
UST Groundwater TCLP Lead > 5 ppm	Yes	Yes	Haz Waste Manifest	Hazardous Waste Liquid, N.O.S., 9, NA3082, PGII (Lead)	Yes	Yes	Yes	Yes	Yes*
UST Groundwater TCLP Benzene > 10 mg/L	No	Yes	Haz Materials Bill of Lading	Environmentally Hazardous Waste Substance, 9, UN3082 PGIII (Benzene)	No	No	Yes	Yes	Yes*
UST Groundwater TCLP Benzene < 0.5 mg/L Flash Point > 200F	No	No	Straight Bill of Lading	Non-Regulated Material	No	No	No	No	No

* With Exceptions

Appendix H

Stormwater System Design

Purpose

The purpose of this calculation is to provide a preliminary analysis of piping size and headloss for the new (proposed) drainage system to be installed as part of the Skykomish Levee Remediation. These calculations address a drainage system for an area that is encompassed by the railroad line to the south, the levee crest on the north, 5th Street to the east, and McCowen's house on West River Road on the west. The area west of McCowen's house is drained by a drainage ditch and the Town does not plan to include this area in the proposed drainage system (Personal communication, Gary West, 15 December 2005).

The layout of a preliminary system is given in plan and profile in Figure 1. The analysis concentrates on verifying the pipe sizes and headlosses in the outfall and trunk line to be installed under West River Road.

Given

Per the Town's Resolution, the analysis and the preliminary design is in general conformance with the *King County, Washington, Surface Water Design Manual* (**SWDM**, King County, Department of Natural Resources and Parks, 2005) and the *King County Road Standards 1993* (**KCRS**, King County, Department of Transportation, 1993).

Per the calculation of runoff (Calculation by RETEC of Stormwater Runoff to Drainge System, 21 December 2005), the peak runoff for the 25-year return frequency storm event, and the design flow for the conveyance system, is 7.0 cfs (3,140 gpm).

The components of the drainage conveyance system are discussed below. Where applicable, the appropriate SWDM or KCRS design criteria are referenced.

Catch Basins

Per KCRS (7.04A), a catch basin shall be spaced no more than 150 feet apart. Catch Basins Type 1 (per King County Standard Drawing No. 2-003) are to be installed adjacent to the curb at the toe of the retaining wall. While KCRS (7.04B) prefers that catch basins be used for road surfaces, it does not rule out the use of curb inlets.

Catch Basin Drain (Lateral) Pipe

Each catch basin is to be connected by an 8-inch lateral to a nearby manhole or an adjacent catch basin. If two adjacent catch basins are interconnected by an 8-inch lateral pipe, the downstream catch basin will be connected by a 12-inch lateral pipe to a nearby manhole.

SWDM (4.2.1.1, Pg. 4-11) requires a minimum of 2 feet of cover over drain pipe. The lateral drain pipes will be subjected to snowplow loads (assumed H20) periodically. Therefore, the IE of the exiting drain pipe from the catch basin will be at least 32 inches below the structure rim elevation.

Manholes

The manholes are to be 48-inch diameter King County Standard Manholes Type 1 (Drawing No. 2-007).

Manhole-to-Manhole (Trunk) Drain Pipe

The trunk drain line is to run between, and interconnect, manholes. It is to run parallel to the levee for 630 feet and needs to carry increasing flows from 0.83 cfs at 5th Street to 7.00 cfs at the outfall.

Oil/Water Separator

To help maintain surface water quality in the river, an oil/water separator is to be located between the first manhole and the outfall. The simplest structure is the 72-inch diameter baffle type (FROP-B) flow restrictor/oil pollution control device in a manhole per King County Standard Drawing No. 2-027.

Check Valve

To prevent backflow in the conveyance system, a check valve is to be located between the oil/water separator and the outfall. The check valve is to be a Red Valve duck-billed Series 39 valve, or equivalent. For easy maintenance and replacement, the valve will be installed in an assessable underground concrete vault.

Outfall

The outfall is to be a tightline pipe from the oil/water separator, through the check valve, and under the levee, to an energy dissipating rock pad near the toe of the levee into the South Fork of the Skykomish River. To prevent large debris and children from entering the outfall pipe, a metal grating will be installed over the end of the outfall pipe. To prevent floating debris from damaging the end of the outfall, large guardian rocks will be placed around the end of the outfall.

Assumptions

A number of options are available to the design of the drainage system. These include two configurations (a four-manhole and a six-manhole configuration), six pipe sizes (from 12 to 30 inches), and two trunk line slopes (0.2 % to 0.5 %). The plan is to optimize the drainage system design in the analysis.

Using KCRS criteria, seven catch basins are needed to intercept surface drainage along the levee. One catch basin (CB) each is assumed to be located at the north end of 5th Street Arterial CB6), one at the bend midway between the north ends of 5th and 6th Streets (CB5), one at the north end of 6th Street (CB4), three evenly spaced between the north end of 6th Street and the west end of the levee retaining wall (CBs 3, 2, and 1), and one at the end of the temporary road traversing Lyderson's property (CB0).

The flow into each catch basin is assumed to be proportional to the areas of the subsections of the total drainage area. The sub-areas and resulting flows to the individual catch basins is presented in Table 1.

Table 1. The Apportioned Catch Basin Flows Based on Percentage of Drainage Area.

Catch Basin Number	Portion of Total Area (%)	Apportioned Flow to CB (cfs)
CB0	15	1.05
CB1	12	0.84
CB2	13	0.91
CB3	13	0.91
CB4	19	1.33
CB5	16	1.12
CB6	12	0.84

The Town has expressed a preference (Personal Communication, Gary West, 15 December 2005) that all pipe material be HDPE pipe, corrugated on the outside and smooth on the inside (King County's designation of LCPE pipe per SWDM, Section 4.2.1.1). The calculations assume this material in subsequent calculations.

The main drainage trunk pipe will be analyzed for minimum slope down to the west of 0.2% and a maximum of 0.5%. The 0.2% slope is the SWDM (4.2.1, Pg. 4-11) and KCRS minimum allowable slope. The maximum slope of 0.5% conforms to the topography. West River Road drops 3 feet (927.2 feet to 924.2 feet) in the 640 feet along the length of the levee. This is a slope of 0.5% (0.0047 to be more precise).

The levee remediation will require removal of the existing conveyance system up to about 100 feet south of the levee and installation of a new drainage system with reconstruction of the levee. The existing drainage system, within the confines of the levee remediation zone and intercepted by the barrier wall, is assumed to consist of the following:

- A 12-inch concrete pipe with an invert elevation (IE per NAVD88) of 924.76 feet from a catch basin in 5th Street Arterial extending north about 140 feet through the existing levee to an 18-inch CMP outfall with an IE of 919.68 feet;
- A 6-inch concrete pipe with an IE of 923.20 feet from a catch basin in 6th Street extending north through the existing levee, but with no visible outfall;
- An 8-inch concrete pipe with an IE of 923.60 feet from the same 6th Street catch basin as above extending northwest about 100 feet through the existing levee to an 8-inch CMP outfall with an IE of 918.26 feet;
- An 8-inch concrete pipe with an IE of 924.76 feet from a different catch basin in 6th Street extending north about 60 feet to a catch basin at the end of 6th Street and West River Road and an IE of 923.44 feet;
- An 8-inch concrete pipe coming into the above catch basin (at the end of 6th Street and West River Road) from the southeast with an IE of 923.49 feet;
- A 12-inch CMP with an IE of 923.54 feet from the same 6th Street and West River Road catch basin as above extending north about 50 feet through the existing levee to an 18-inch CMP outfall with an IE of 921.39 feet.

Construction of the new surface water drainage system is anticipated to include the following steps:

- Intercepting existing pipe and conveying them to manholes;
- Installing seven catch basins along West River Road at the Town-side toe of the levee;
- Installing additional catch basins south of the levee as the limits of the excavation require;
- Installing 8-inch to 12-inch lateral pipe from each inlet/catch basin to a manhole;
- Installing four or six 48-inch manholes along West River Road;
- Installing 12-inch to 24-inch trunk pipe connecting the manholes;
- Installing a 72-inch manhole-type oil/water separator upstream between the last manhole and the outfall;
- Installing a check valve between the oil/water separator and the outfall;

- Installing an 18-inch to 30-inch outfall pipe through the levee and into the South Fork of the Skykomish River.

The four-manhole configuration is assumed to consist of the following consecutive elements:

- 42-foot long outfall with an in-line check valve,
- 6-foot diameter oil/water separator,
- 10-foot long trunk pipeline,
- 4-foot diameter manhole (MH1),
- 364-foot long trunk pipeline,
- 4-foot diameter manhole (MH2),
- 164-foot long trunk pipeline,
- 4-foot diameter manhole (MH3),
- 100-foot long trunk pipeline,
- 4-foot diameter manhole (MH4).

The six-manhole configuration is assumed to consist of the following consecutive elements:

- 42-foot long outfall with an in-line check valve,
- 6-foot diameter oil/water separator,
- 10-foot long trunk pipeline,
- 4-foot diameter manhole (MH1),
- 160-foot long trunk pipeline,
- 4-foot diameter manhole (MH2),
- 118-foot long trunk pipeline,
- 4-foot diameter manhole (MH3),
- 78-foot long trunk pipeline,
- 4-foot diameter manhole (MH4),
- 164-foot long trunk pipeline,
- 4-foot diameter manhole (MH5),
- 100-foot long trunk pipeline,
- 4-foot diameter manhole (MH6).

The proposed rim elevations of the structures for each configuration are presented in Table 2. The four-manhole configuration is presented schematically in Figure 2 and the six-manhole configuration in Figure 3.

For calculation purposes, the water elevation in the river is assumed to have an annual high water level of 922.8 feet (NAVD88) and may drop below elevation 919.0 feet.

Table 2. Proposed Rim Elevations (in Feet, NAVD) of Oil/Water Separator and Manholes Along West River Road.

Structure	4-Manhole Option	6-Manhole Option
Oil/Water Separator	925.00*	925.00*
Manhole 1	924.20	924.20
Manhole 2	925.20	924.40
Manhole 3	926.50	925.00
Manhole 4	927.20	925.40
Manhole 5	-	926.40
Manhole 6	-	927.20

* Baffle elevation is 923.50 feet.

Calculations

Per SWDM (4.2.1.1, Pg 4-11), the minimum full pipe flow velocity shall be 3 feet per second (fps), the minimum pipe slope shall be 0.2% for 12-inch pipe and larger (0.5% for 8-inch pipe), and the maximum length between structures shall be 300 feet, and 150 feet for grades less than 1% (KCRS, 7.04.A).

Using the above restrictions and the uniform flow analysis method, a preliminary analysis (pipe sizes, invert elevations, and backwater levels) of the trunk pipes between manholes and the outfall are calculated. Analyses are performed for pipes flowing full, associated with a river level higher than 921.0 feet, and for pipes flowing partially full, associated with river level lower than 919.0 feet.

The initial screening of pipe sizes, invert elevations, and backwater levels is analyzed using the Darcy-Weisbach methods for backwater calculations. The calculations for pipes flowing full, along with their sources and the equations upon which they are based, are presented on spreadsheets in Attachment A for the outfall to MH1, in Attachment B for the four-manhole configuration, and in Attachment C for the six-manhole configuration.

The differential headwater elevations and slope elevations for each run of pipe are summarized in Tables 3 and 4 for the four-manhole and six-manhole configurations, respectively. The differential headwater elevations are obtained by adding the minor headlosses, and pipe friction for each run of pipe between structures.

The elevation of the hydraulic grade line (headwater level) at each structure is obtained by adding the respective differential headwater elevations and slope elevations to the tailwater elevation of the river. An optimum trunk pipeline configuration is obtained by selecting the pipe sizes and slopes whose sequential addition of differential headwater elevations and slope elevations do not exceed the sequential manhole rim elevations.

Table 3. Differential Headwater Elevations (in Feet) and Slope Elevations (in Feet) for Each Run of Pipe for the Four-Manhole Configuration.

Pipe Run	12"	15"	18"	21"	24"	30"	0.2% Slope	0.5% Slope
Outfall to Oil/Water Separator			1.67	0.89	0.53	0.30	0.09	0.22
Oil/Water Separator Baffle Orifice	1.23	0.51	0.24	0.13	0.08	0.03	-	-
Oil/Water Separator to Manhole 1			0.37	0.19	0.12	0.04	0.03	0.08
Manhole 1 to Manhole 2	3.06	1.08	0.44				0.74	1.84
Manhole 2 to Manhole 3	0.40	0.14					0.34	0.84
Manhole 3 to Manhole 4	0.06						0.21	0.52

To keep from overflowing at the manhole lids (see Table 2 for rim elevations) during an annual high river flow (elevation 922.7 feet NAVD), an optimum four-manhole configuration has the following trunk pipeline sizes:

- 24-inch diameter outfall with an IE of 919.0 feet at a slope of 0.2% from the river to manhole 1 (MH1). This includes a 24-inch diameter in-line check valve and the oil/water separator.
- 18-inch diameter trunk pipe at a slope of 0.2% from MH1 to MH2,
- 12-inch diameter trunk pipe at a slope of 0.5% from MH2 to MH3,
- 12-inch diameter trunk pipe at a slope of 0.5% from MH3 to MH4.

Table 4. Differential Headwater Elevations (In Feet) and Slope Elevations (in Feet) for Each Run of Pipe for the Six-Manhole Configuration.

Pipe Run	12"	15"	18"	21"	24"	30"	0.2% Slope	0.5% Slope
Outfall to Oil/Water Separator			1.67	0.89	0.53	0.30	0.09	0.22
Oil/Water Separator Baffle Orifice	1.23	0.51	0.24	0.13	0.08	0.03	-	-
Oil/Water Separator to Manhole 1			0.37	0.19	0.12	0.04	0.03	0.08
Manhole 1 to Manhole 2	2.41	0.89	0.40	0.19	0.10		0.33	0.82
Manhole 2 to Manhole 3	1.42	0.51	0.23	0.12			0.24	0.61
Manhole 3 to Manhole 4	0.70	0.26	0.12				0.16	0.41
Manhole 4 to Manhole 5	0.41	0.14	0.07				0.34	0.84
Manhole 5 to Manhole 6	0.07	0.02					0.21	0.52

To keep from overflowing at the manhole lids (see Table 2 for rim elevations) during an annual high river flow (elevation 922.7 feet NAVD), an optimum six-manhole configuration has the following trunk pipeline sizes:

- 24-inch diameter outfall with an IE of 919.0 feet at a slope of 0.2% from the river to manhole 1 (MH1). This includes a 24-inch diameter in-line check valve and the oil/water separator.
- 18-inch diameter trunk pipe at a slope of 0.2% from MH1 to MH2,
- 18-inch diameter trunk pipe at a slope of 0.2% from MH2 to MH3,
- 18-inch diameter trunk pipe at a slope of 0.2% from MH3 to MH4,
- 12-inch diameter trunk pipe at a slope of 0.5% from MH4 to MH5,
- 12-inch diameter trunk pipe at a slope of 0.5% from MH5 to MH6.

For comparison, the SWDM backwater analysis method was applied to both configurations. The analyses are presented on spreadsheets in Attachments D and E for the four-manhole and six-manhole configurations, respectively. The resulting headwater elevations are about 15% higher (~0.30 feet) than those calculated by the Darcy-Weisbach methods above. This indicates that the SWDM backwater analysis method is the more conservative method of calculation. It also indicates that the water level in the river can rise to an elevation of 923.5 feet for either configuration before it starts to overflow the rims of the manholes on West River Road.

For river levels below 919.0 feet (NAVD), the outfall and portions of the trunk pipelines flow only partially full. This means that the analysis needs to use culvert flow methods to evaluate. Partial flow culvert analysis is not exact and requires the use of SWDM nomographs and empirical curves in a series of trial-and-error calculations. For each pipe segment, the tailwater elevation is calculated using the critical depth from Figure 4.3.1.F (Pg. 4-49). The tailwater elevation results are presented in Table 5. Again, the SWDM backwater analysis method was applied to both configurations. The calculations are presented in Attachments F and G. In all cases, the hydraulic grade line is below the crown of the pipe at the outlet, or exit end, and just above the crown at the inlet, or entrance, end. This means that all the pipe segments flow partially full and the outlet end of the pipe and flow full at the inlet end.

Table 5. Tailwater Elevation Calculations for both Configurations.

Segment		Pipe Diameter [D] (in)	Pipe Discharge [Q] (cfs)	Critical Depth-Diameter Ratio	Critical Depth [d_c] (ft)	Outlet Invert Elevation (ft)	Tailwater Elevation* (ft)
4-MH Config.	Outfall - O/W Separator	24	7.00	0.47	0.94	919.00	920.47
	O/W Separator - MH1	24	7.00	0.47	0.94	919.09	920.56
	MH1 – MH2	18	4.20	0.39	0.58	919.12	920.16
	MH2 – MH3	12	1.96	0.58	0.58	919.86	920.65
	MH3 – MH4	12	0.84	0.37	0.37	920.70	921.38
6-MH Configuration	Outfall - O/W Separator	24	7.00	0.47	0.94	919.00	920.47
	O/W Separator - MH1	24	7.00	0.47	0.94	919.09	920.56
	MH1 – MH2	18	5.11	0.59	0.88	919.12	920.31
	MH2 – MH3	18	4.20	0.51	0.76	919.45	920.58
	MH3 – MH4	18	3.29	0.46	0.69	919.69	920.78
	MH4 – MH5	12	1.96	0.58	0.58	919.85	920.64
	MH5 – MH6	12	0.84	0.37	0.37	920.69	921.38

* Tailwater elevation = Invert elevation + $(D+d_c)/2$.

Discussion

The preliminary details of the structures and pipelines are given in Tables 6 and 7, respectively. These details will cause some revision to Figure 1 before it is incorporated into the final drawing set.

There is a potential to eliminate two manholes along the levee by interconnecting two sets of catch basins. CB4 could be interconnected to CB3 with an 8-inch lateral pile and CB5 could be interconnected to CB6 with an 8-inch lateral. Then CBs 3 and 6 could be connected to here adjacent manholes by 12-inch lateral pipes.

Ecology may determine that the manhole-type oil/water separator is insufficient, in which case a larger vault-type baffle oil/water separator or coalescing plate separator will be required.

Table 6. Preliminary Structure Details for the Skykomish Drainage System.

Structure		Rim Elevation (ft)	Invert Elevation In (ft)	Invert Elevation Out (ft)
Four-Manhole Configuration	O/W Separator	925.00	919.10	919.09
	CB0	923.50		920.50
	MH 1	924.20	919.13	919.12
	CB 1	924.40		921.40
	CB2	924.44		921.44
	MH 2	925.20	919.87	919.86
	CB3	924.96		921.96
	CB4	925.51		922.51
	MH 3	926.50	920.71	920.70
	CB5	926.38		923.38
	MH 4	927.20	912.23	921.22
	CB6	927.10		924.10
Six-Manhole Configuration	O/W Separator	925.00	919.10	919.09
	CB0	923.50		920.50
	MH 1	924.20	919.13	919.12
	CB 1	924.40		921.40
	MH 2	924.40	923.02	922.98
	CB 2	924.44		921.44
	MH 3	925.00	921.32	921.28
	CB 3	924.96		921.96
	MH 4	925.40	920.91	920.89
	CB 4	925.51		922.51
	MH 5	926.40	920.31	920.29
	CB 5	926.38		923.38
	MH 6	927.20	919.51	919.49
	CB 6	927.10		924.10

Table 7. Preliminary Pipe Details for the Skykomish Drainage system.

Pipe Segment		Invert Elevation In (ft)	Invert Elevation Out (ft)	Inside Diameter (in)	Length (ft)	Slope (%)
Four-Manhole Configuration	O/W Separator - Outfall	919.09	919.00	24	42	0.2
	MH1 - O/W Separator	919.12	919.10	24	10	0.2
	CB0 - MH1	920.50	919.20	8	130	1
	CB1 - MH1	919.90	919.75	8	15	1
	CB2 - CB1	921.44	919.94	12	150	1
	MH2 - MH1	919.86	919.13	18	364	0.2
	CB3 - CB4	921.96	920.80	8	116	1
	CB4 - MH2	920.75	920.40	12	35	1
	MH3 - MH2	920.70	919.87	12	164	0.5
	CB5 - MH3	923.38	923.32	8	6	1
	MH4 - MH3	921.22	920.71	12	100	0.5
	CB6 - MH4	924.10	924.02	8	8	1
Six-Manhole Configuration	O/W Separator - Outfall	919.09	919.00	24	42	0.2
	MH1 - O/W Separator	919.12	919.10	24	10	0.2
	CB0 - MH1	920.50	919.20	8	130	1
	CB1 - MH1	919.90	919.75	8	15	1
	MH2 - MH1	919.45	919.13	18	160	0.2
	CB2 - MH2	921.44	921.38	8	6	1
	MH3 - MH2	919.69	919.46	18	118	0.2
	CB3 - MH3	921.96	921.90	8	6	1
	MH4 - MH3	919.85	919.70	18	78	0.2
	CB4 - MH4	920.75	920.40	8	35	1
	MH5 - MH4	920.69	919.86	12	164	0.5
	CB5 - MH5	923.38	923.32	8	6	1
	MH6 - MH5	921.21	920.70	12	100	0.5
	CB6 - MH6	924.10	924.02	8	8	1

References

King County. *King County Road Standards 1993*. King County Department of Transportation, Road Services Division, King County, Washington.

King County. *King County, Washington, Surface Water Design Manual*. King County Department of Natural Resources and Parks, King County, Washington, January 24, 2005.

Skykomish Levee Drainage System

Pipe Headloss from Outfall from Discharge to O/W Separator:

Step	Item/Description	Symbol	Unit	Calculations			
1	Calculation Identification	-	-	Outfall-O/W	Outfall-O/W	Outfall-O/W	Outfall-O/W
2	Flow rate	Q	cfs	7.00	7.00	7.00	7.00
3	Pipe diameter	d	in	18	21	24	30
4	Pipe length	L	ft	42	42	42	42
5	Pipe area	A	ft^2	1.767	2.405	3.142	4.909
6	Average flow velocity	v	ft/sec	3.96	2.91	2.23	1.43
7	Kinematic viscosity	n	ft^2/sec	0.0000190	0.0000190	0.0000190	0.0000190
8	Reynold's number	N_{Re}	-	312726	268050	234544	187635
9	Friction factor	f	-	0.016	0.017	0.017	0.018
10	Pipe headloss	h_L	ft	0.11	0.05	0.03	0.01

1-4	User input of calculation identification, flow rate, pipe diameter, and pile length.
5	$A = pd^2/4$; note that if diameter is in inches, then d = diameter/12.
6	$v = Q/A$
7	For kinematic viscosity, see Tuma Table A.60, or equivalent.
8	$N_{Re} = dv/n$
9	For friction factor, see Tuma Table A.65, or equivalent.
10	$h_L = fLv^2/2gd$

Tuma, Jan J. *Handbook of Physical Calculations*. Second Edition, McGraw-Hill Book Company, New York, 1983.

Minor Headloss from Outfall from Discharge to O/W Separator:

Step	Item/Description	Symbol	Unit	Calculations					
1	Calculation Identification	-	-	Outfall Out	CV	O/W Out	Outfall Out	CV	O/W Out
2	Flow rate	Q	cfs	7.00	7.00	7.00	7.00	7.00	7.00
3	Pipe diameter	d	in	18	18	18	21	21	21
4	Pipe area	A	ft^2	1.767	1.767	1.767	2.405	2.405	2.405
5	Average flow velocity	v	ft/sec	3.96	3.96	3.96	2.91	2.91	2.91
6	Minor loss coefficient	K	-	1.00	5.00	0.42	1.00	5.00	0.38
7	Pipe headloss	h_L	ft	0.24	1.22	0.10	0.13	0.66	0.05

1-3	User input of calculation identification, flow rate, pipe diameter, and pile length.
4	$A = pd^2/4$; note that if diameter is in inches, then d = diameter/12.
5	$v = Q/A$
6	For minor loss coefficient, see Tuma Pages 188-189, or equivalent.
7	$h_L = Kv^2/2g$

Minor Headloss from Outfall from Discharge to O/W Separator (Cont.):

Step	Item/Description	Symbol	Unit	Calculations					
1	Calculation Identification	-	-	Outfall Out	CV	O/W Out	Outfall Out	CV	O/W Out
2	Flow rate	Q	cfs	7.00	7.00	7.00	7.00	7.00	7.00
3	Pipe diameter	d	in	24	24	24	30	30	30
4	Pipe area	A	ft^2	3.142	3.142	3.142	4.909	4.909	4.909
5	Average flow velocity	v	ft/sec	2.23	2.23	2.23	1.43	1.43	1.43
6	Minor loss coefficient	K	-	1.00	5.00	0.36	1.00	5.00	0.34
7	Pipe headloss	h_L	ft	0.08	0.39	0.03	0.03	0.16	0.01

Minor Headloss at Oil/Water Separator:

Step	Item/Description	Symbol	Unit	Calculations					
1	Calculation Identification	-	-	Orifice	Orifice	Orifice	Orifice	Orifice	Orifice
2	Flow rate	Q	cfs	7.00	7.00	7.00	7.00	7.00	7.00
3	Pipe diameter	d	in	12	15	18	21	24	30
4	Pipe area	A	ft^2	0.785	1.227	1.767	2.405	3.142	4.909
5	Average flow velocity	v	ft/sec	8.91	5.70	3.96	2.91	2.23	1.43
6	Minor loss coefficient	K	-	1.00	1.00	1.00	1.00	1.00	1.00
7	Pipe headloss	h_L	ft	1.23	0.51	0.24	0.13	0.08	0.03

Pipe Headloss from O/W Separator to MH1:

Step	Item/Description	Symbol	Unit	Calculations			
1	Calculation Identification	-	-	O/W-MH1	O/W-MH2	O/W-MH3	O/W-MH4
2	Flow rate	Q	cfs	7.00	7.00	7.00	7.00
3	Pipe diameter	d	in	18	21	24	30
4	Pipe length	L	ft	10	10	10	10
5	Pipe area	A	ft^2	1.767	2.405	3.142	4.909
6	Average flow velocity	v	ft/sec	3.96	2.91	2.23	1.43
7	Kinematic viscosity	n	ft^2/sec	0.0000190	0.0000190	0.0000190	0.0000190
8	Reynold's number	N_{Re}	-	312726	268050	234544	187635
9	Friction factor	f	-	0.016	0.017	0.017	0.018
10	Pipe headloss	h_L	ft	0.03	0.01	0.01	0.00

Minor Headloss from O/W Separator to MH1:

Step	Item/Description	Symbol	Unit	Calculations							
1	Calculation Identification	-	-	O/W In	MH1 Out	O/W In	MH1 Out	O/W In	MH1 Out	O/W In	MH1 Out
2	Flow rate	Q	cfs	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
3	Pipe diameter	d	in	18	18	21	21	24	24	30	30
4	Pipe area	A	ft^2	1.767	1.767	2.405	2.405	3.142	3.142	4.909	4.909
5	Average flow velocity	v	ft/sec	3.96	3.96	2.91	2.91	2.23	2.23	1.43	1.43
6	Minor loss coefficient	K	-	1.00	0.42	1.00	0.38	1.00	0.36	1.00	0.34
7	Pipe headloss	h_L	ft	0.24	0.10	0.13	0.05	0.08	0.03	0.03	0.01

Skykomish Levee Drainage System

Pipe Headloss from MH1 to MH4:

Step	Item/Description	Symbol	Unit	Calculations					
1	Calculation Identification	-	-	MH1-MH2	MH1-MH2	MH1-MH2	MH2-MH3	MH2-MH3	MH3-MH4
2	Flow rate	Q	cfs	4.20	4.20	4.20	1.96	1.96	0.84
3	Pipe diameter	d	in	12	15	18	12	15	12
4	Pipe length	L	ft	369	369	369	165	165	100
5	Pipe area	A	ft^2	0.785	1.227	1.767	0.785	1.227	0.785
6	Average flow velocity	v	ft/sec	5.35	3.42	2.38	2.50	1.60	1.07
7	Kinematic viscosity	n	ft^2/sec	0.0000190	0.0000190	0.0000190	0.0000190	0.0000190	0.0000190
8	Reynold's number	N_{Re}	-	281453	225162	187635	131345	105076	56291
9	Friction factor	f	-	0.015	0.016	0.016	0.017	0.018	0.019
10	Pipe headloss	h_L	ft	2.46	0.86	0.35	0.27	0.09	0.03

1-4	User input of calculation identification, flow rate, pipe diameter, and pile length.
5	$A = pd^2/4$; note that if diameter is in inches, then d = diameter/12.
6	$v = Q/A$
7	For kinematic viscosity, see Tuma Table A.60, or equivalent.
8	$N_{Re} = dv/n$
9	For friction factor, see Tuma Table A.65, or equivalent.
10	$h_L = fLv^2/2gd$

Tuma, Jan J. *Handbook of Physical Calculations*. Second Edition, McGraw-Hill Book Company, New York, 1983.

Minor Headloss from MH1 to MH2:

Step	Item/Description	Symbol	Unit	Calculations					
1	Calculation Identification	-	-	MH1-In	MH2-Out	MH1-In	MH2-Out	MH1-In	MH2-Out
2	Flow rate	Q	cfs	4.20	4.20	4.20	4.20	4.20	4.20
3	Pipe diameter	d	in	12	12	15	15	18	18
4	Pipe area	A	ft^2	0.785	0.785	1.227	1.227	1.767	1.767
5	Average flow velocity	v	ft/sec	5.35	5.35	3.42	3.42	2.38	2.38
6	Minor loss coefficient	K	-	0.92	0.42	0.81	0.38	0.70	0.36
7	Pipe headloss	h_L	ft	0.41	0.19	0.15	0.07	0.06	0.03

1-3	User input of calculation identification, flow rate, pipe diameter, and pile length.
4	$A = pd^2/4$; note that if diameter is in inches, then d = diameter/12.
5	$v = Q/A$
6	For minor loss coefficient, see Tuma Pages 188-189, or equivalent.
7	$h_L = Kv^2/2g$

Minor Headloss from MH2 to MH4:

Step	Item/Description	Symbol	Unit	Calculations					
1	Calculation Identification	-	-	MH2-In	MH3-Out	MH2-In	MH3-Out	MH3-In	MH4-Out
2	Flow rate	Q	cfs	1.96	1.96	1.96	1.96	0.84	0.84
3	Pipe diameter	d	in	12	12	15	15	12	12
4	Pipe area	A	ft^2	0.785	0.785	1.227	1.227	0.785	0.785
5	Average flow velocity	v	ft/sec	2.50	2.50	1.60	1.60	1.07	1.07
6	Minor loss coefficient	K	-	0.92	0.42	0.81	0.38	0.92	0.42
7	Pipe headloss	h_L	ft	0.09	0.04	0.03	0.02	0.02	0.01

Skykomish Levee Drainage System

Pipe Headloss from MH1 to MH2:

Step	Item/Description	Symbol	Unit	Calculations				
1	Calculation Identification	-	-	MH1-MH2	MH1-MH2	MH1-MH2	MH1-MH2	MH1-MH2
2	Flow rate	Q	cfs	5.11	5.11	5.11	5.11	5.11
3	Pipe diameter	d	in	12	15	18	21	24
4	Pipe length	L	ft	160	160	160	160	160
5	Pipe area	A	ft^2	0.785	1.227	1.767	2.405	3.142
6	Average flow velocity	v	ft/sec	6.51	4.16	2.89	2.12	1.63
7	Kinematic viscosity	n	ft^2/sec	0.0000190	0.0000190	0.0000190	0.0000190	0.0000190
8	Reynold's number	N_{Re}	-	342434	273948	228290	195677	171217
9	Friction factor	f	-	0.014	0.015	0.016	0.016	0.016
10	Pipe headloss	h_L	ft	1.47	0.52	0.22	0.10	0.05

1-4	User input of calculation identification, flow rate, pipe diameter, and pile length.
5	$A = pd^2/4$; note that if diameter is in inches, then d = diameter/12.
6	$v = Q/A$
7	For kinematic viscosity, see Tuma Table A.60, or equivalent.
8	$N_{Re} = dv/n$
9	For friction factor, see Tuma Table A.65, or equivalent.
10	$h_L = fLv^2/2gd$

Tuma, Jan J. *Handbook of Physical Calculations*. Second Edition, McGraw-Hill Book Company, New York, 1983.

Minor Headloss from MH1 to MH2:

Step	Item/Description	Symbol	Unit	Calculations							
1	Calculation Identification	-	-	MH1-In	MH2-Out	MH1-In	MH2-Out	MH1-In	MH2-Out	MH1-In	MH2-Out
2	Flow rate	Q	cfs	5.11	5.11	5.11	5.11	5.11	5.11	5.11	5.11
3	Pipe diameter	d	in	12	12	15	15	18	18	21	21
4	Pipe area	A	ft^2	0.785	0.785	1.227	1.227	1.767	1.767	2.405	2.405
5	Average flow velocity	v	ft/sec	6.51	6.51	4.16	4.16	2.89	2.89	2.12	2.12
6	Minor loss coefficient	K	-	1.00	0.42	1.00	0.37	1.00	0.35	1.00	0.34
7	Pipe headloss	h_L	ft	0.66	0.28	0.27	0.10	0.13	0.05	0.07	0.02

1-3	User input of calculation identification, flow rate, pipe diameter, and pile length.
4	$A = pd^2/4$; note that if diameter is in inches, then d = diameter/12.
5	v = Q/A
6	For minor loss coefficient, see Tuma Pages 188-189, or equivalent.
7	$h_L = Kv^2/2g$

Minor Headloss from MH1 to MH2 (Cont.):

Step	Item/Description	Symbol	Unit	Calculations	
1	Calculation Identification	-	-	MH1-In	MH2-Out
2	Flow rate	Q	cfs	5.11	5.11
3	Pipe diameter	d	in	24	24
4	Pipe area	A	ft^2	3.142	3.142
5	Average flow velocity	v	ft/sec	1.63	1.63
6	Minor loss coefficient	K	-	1.00	0.33
7	Pipe headloss	h_L	ft	0.04	0.01

Pipe Headloss from MH2 to MH4:

Step	Item/Description	Symbol	Unit	Calculations						
1	Calculation Identification	-	-	MH2-MH3	MH3-MH2	MH2-MH3	MH2-MH3	MH3-MH4	MH3-MH4	MH3-MH4
2	Flow rate	Q	cfs	4.20	4.20	4.20	4.20	3.29	3.29	3.29
3	Pipe diameter	d	in	12	15	18	21	12	15	18
4	Pipe length	L	ft	118	118	118	118	78	78	78
5	Pipe area	A	ft^2	0.785	1.227	1.767	2.405	0.785	1.227	1.767
6	Average flow velocity	v	ft/sec	5.35	3.42	2.38	1.75	4.19	2.68	1.86
7	Kinematic viscosity	n	ft^2/sec	0.0000190	0.0000190	0.0000190	0.0000190	0.0000190	0.0000190	0.0000190
8	Reynold's number	N_{Re}	-	281453	225162	187635	160830	220471	176377	146981
9	Friction factor	f	-	0.015	0.015	0.016	0.016	0.015	0.016	0.017
10	Pipe headloss	h_L	ft	0.79	0.26	0.11	0.05	0.32	0.11	0.05

Pipe Headloss from MH4 to MH6:

Step	Item/Description	Symbol	Unit	Calculations				
1	Calculation Identification	-	-	MH4-MH5	MH4-MH5	MH4-MH5	MH5-MH6	MH5-MH6
2	Flow rate	Q	cfs	1.96	1.96	1.96	0.84	0.84
3	Pipe diameter	d	in	12	15	18	12	15
4	Pipe length	L	ft	164	164	164	100	100
5	Pipe area	A	ft^2	0.785	1.227	1.767	0.785	1.227
6	Average flow velocity	v	ft/sec	2.50	1.60	1.11	1.07	0.68
7	Kinematic viscosity	n	ft^2/sec	0.0000190	0.0000190	0.0000190	0.0000190	0.0000190
8	Reynold's number	N_{Re}	-	131345	105076	87563	56291	45032
9	Friction factor	f	-	0.017	0.018	0.018	0.020	0.020
10	Pipe headloss	h_L	ft	0.27	0.09	0.04	0.04	0.01

Minor Headloss from MH2 to MH3:

Step	Item/Description	Symbol	Unit	Calculations							
1	Calculation Identification	-	-	MH2-In	MH3-Out	MH2-In	MH3-Out	MH2-In	MH3-Out	MH2-In	MH3-Out
2	Flow rate	Q	cfs	4.20	4.20	4.20	4.20	4.20	4.20	4.20	4.20
3	Pipe diameter	d	in	12	12	15	15	18	18	21	21
4	Pipe area	A	ft^2	0.785	0.785	1.227	1.227	1.767	1.767	2.405	2.405
5	Average flow velocity	v	ft/sec	5.35	5.35	3.42	3.42	2.38	2.38	1.75	1.75
6	Minor loss coefficient	K	-	1.00	0.42	1.00	0.36	1.00	0.35	1.00	0.34
7	Pipe headloss	h_L	ft	0.44	0.19	0.18	0.07	0.09	0.03	0.05	0.02

Minor Headloss from MH3 to MH5:

Step	Item/Description	Symbol	Unit	Calculations							
1	Calculation Identification	-	-	MH3-In	MH4-Out	MH3-In	MH4-Out	MH3-In	MH4-Out	MH4-In	MH5-Out
2	Flow rate	Q	cfs	3.29	3.29	3.29	3.29	3.29	3.29	1.96	1.96
3	Pipe diameter	d	in	12	12	15	15	18	18	12	12
4	Pipe area	A	ft^2	0.785	0.785	1.227	1.227	1.767	1.767	0.785	0.785
5	Average flow velocity	v	ft/sec	4.19	4.19	2.68	2.68	1.86	1.86	2.50	2.50
6	Minor loss coefficient	K	-	1.00	0.42	1.00	0.36	1.00	0.35	1.00	0.42
7	Pipe headloss	h_L	ft	0.27	0.11	0.11	0.04	0.05	0.02	0.10	0.04

Minor Headloss from MH4 to MH6:

Step	Item/Description	Symbol	Unit	Calculations							
1	Calculation Identification	-	-	MH4-In	MH5-Out	MH4-In	MH5-Out	MH5-In	MH6-Out	MH5-In	MH6-Out
2	Flow rate	Q	cfs	1.96	1.96	1.96	1.96	0.84	0.84	0.84	0.84
3	Pipe diameter	d	in	15	15	18	18	12	12	15	15
4	Pipe area	A	ft^2	1.227	1.227	1.767	1.767	0.785	0.785	1.227	1.227
5	Average flow velocity	v	ft/sec	1.60	1.60	1.11	1.11	1.07	1.07	0.68	0.68
6	Minor loss coefficient	K	-	1.00	0.36	1.00	0.35	1.00	0.42	1.00	0.36
7	Pipe headloss	h_L	ft	0.04	0.01	0.02	0.01	0.02	0.01	0.01	0.00

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Step	Item/Description	Symbol	Unit	Calculations				
1	Pipe Segment - Outlet Structure	-	-	Outfall	O/W Sep	MH1	MH2	MH3
2	Pipe Segment - Inlet Structure	-	-	O/W Sep	MH1	MH2	MH3	MH4
3	Discharge	Q	cfs	7.00	7.00	4.20	1.96	0.84
4	Pipe Length	L	ft	42.00	10.00	364.00	164.00	100.00
5	Pipe Diameter	D	in	24	24	18	12	12
6	Manning "n" Value	n	-	0.012	0.012	0.012	0.012	0.012
7	Outlet Elevation	El_{out}	ft	919.00	919.09	919.12	919.86	920.70
8	Inlet Elevation	El_{in}	ft	919.09	919.12	919.86	920.70	921.22
9	Barrel Area	A	ft^2	3.14	3.14	1.77	0.79	0.79
10	Barrel Velocity	V	ft/sec	2.23	2.23	2.38	2.50	1.07
11	Barrel Velocity Head	h_V	ft	0.08	0.08	0.09	0.10	0.02
12	Tailwater Elevation	El_{TW}	ft	922.70	923.24	923.36	923.98	924.55
13	Friction Loss	h_f	ft	0.03	0.01	0.49	0.42	0.05
14	Entrance Hydraulic Grade Elevation	El_{entHGL}	ft	922.73	923.25	923.85	924.40	924.60
15	Entrance Loss Coefficient	K_{ent}	-	0.50	0.50	0.50	0.50	0.50
16	Entrance Head Loss	h_{ent}	ft	0.04	0.04	0.04	0.05	0.01
17	Exit Loss Coefficient	K_{ex}	-	1.00	1.00	1.00	1.00	1.00
18	Exit Head Loss	h_{ex}	ft	0.08	0.08	0.09	0.10	0.02
19	Other Loss Coefficient	K_o	-	5.00	0.00	0.00	0.00	0.00
20	Other Head Loss	h_o	ft	0.39	0.00	0.00	0.00	0.00
21	Outlet Control Elevation	$El_{outcont}$	ft	923.24	923.36	923.98	924.55	924.62
22	Inlet Control Elevation	El_{incont}	ft	921.09	921.12	921.36	921.70	922.22
23	Approach Velocity Head	h_{AV}	ft	0.00	0.00	0.00	0.00	0.00
24	Bend Loss Coefficient	K_b	-	0.00	0.00	0.00	0.00	0.00
25	Bend Head Loss	h_b	ft	0.00	0.00	0.00	0.00	0.00
26	Upstream Trunkline Discharge	Q_1	cfs	7.00	7.00	4.20	1.96	0.84
27	Upstream Lateral Discharge	Q_3	cfs	0.00	0.00	2.80	2.24	0.00
28	Junction Loss Coefficient	K_j	-	0.00	0.00	0.42	0.60	0.00
29	Junction Head Loss	h_j	ft	0.00	0.00	0.00	0.00	0.00
30	Headwater Elevation	El_{HW}	ft	923.24	923.36	923.98	924.55	924.62

* *King County, Washington, Surface Water Design Manual*. King County Department of Natural Resources, January 24, 2005.

1-8	User input of pipe segment, discharge (Q), pipe length (L), pipe diameter (D), roughness coefficient (n), outlet elevation (El_{out}), inlet elevation (El_{in}).
9	$A = p(D/12)^2/4$
10	$V = Q/A$
11	$h_V = V^2/2g$
12	User input of tailwater elevation (El_{TW}); or $(D+d_c)/2$, whichever is greater.
13	$h_F = L(nV)^2(D/48)^{-4/3}/2.22$
14	$El_{entHGL} = El_{TW} + h_F$
15	User input of entrance headloss coefficient (K_{ent}).
16	$h_{ent} = K_{ent}V^2/2g$
17	User input of exit headloss coefficient (K_{ex}).
18	$h_{exit} = K_{ex}V^2/2g$
19	User input of other headloss coefficient (K_o).
20	$h_o = K_oV^2/2g$
21	$El_{outcont} = El_{entHGL} + h_{ent} + h_{exit}$
22	User input of inlet control elevation (El_{incon}).
23	User input of approach velocity head, $h_{AV} = h_V$ in upstream segment.
24	User input of bend headloss coefficient.
25	$h_b = K_bh_{AV}$
26	User input of upstream trunkline discharge (Q_3).
27	User input of upstream lateral discharge (Q_1).
28	$Kj = (Q_3/Q_1)/[1.18+0.63(Q_3/Q_1)]$
29	$h_j = K_jh_{AV}$
30	El_{HW} = greater of $El_{outcont}$ or $El_{incont} - h_{AV} + h_b + h_j$

King County *Surface Water Design Manual* (2005)* Backwater Calculation

Step	Item/Description	Symbol	Unit	Calculations						
1	Pipe Segment - Outlet Structure	-	-	Outfall	O/W Sep	MH1	MH2	MH3	MH4	MH5
2	Pipe Segment - Inlet Structure	-	-	O/W Sep	MH1	MH2	MH3	MH4	MH5	MH6
3	Discharge	Q	cfs	7.00	7.00	5.11	4.20	3.29	1.96	0.84
4	Pipe Length	L	ft	42.00	10.00	160.00	118.00	78.00	164.00	100.00
5	Pipe Diameter	D	in	24	24	18	18	18	12	12
6	Manning "n" Value	n	-	0.012	0.012	0.012	0.012	0.012	0.012	0.012
7	Outlet Elevation	El_{out}	ft	919.00	919.09	919.12	919.45	919.69	919.85	920.69
8	Inlet Elevation	El_{in}	ft	919.09	919.12	919.45	919.69	919.85	920.69	921.21
9	Barrel Area	A	ft^2	3.14	3.14	1.77	1.77	1.77	0.79	0.79
10	Barrel Velocity	V	ft/sec	2.23	2.23	2.89	2.38	1.86	2.50	1.07
11	Barrel Velocity Head	h_V	ft	0.08	0.08	0.13	0.09	0.05	0.10	0.02
12	Tailwater Elevation	El_{TW}	ft	922.70	923.24	923.36	923.88	924.17	924.32	925.08
13	Friction Loss	h_f	ft	0.03	0.01	0.32	0.16	0.06	0.42	0.05
14	Entrance Hydraulic Grade Elevation	El_{entHGL}	ft	922.73	923.25	923.68	924.04	924.23	924.74	925.13
15	Entrance Loss Coefficient	K_{ent}	-	0.50	0.50	0.50	0.50	0.50	1.50	2.50
16	Entrance Head Loss	h_{ent}	ft	0.04	0.04	0.06	0.04	0.03	0.15	0.04
17	Exit Loss Coefficient	K_{ex}	-	1.00	1.00	1.00	1.00	1.00	2.00	3.00
18	Exit Head Loss	h_{ex}	ft	0.08	0.08	0.13	0.09	0.05	0.19	0.05
19	Other Loss Coefficient	K_o	-	5.00	0.00	0.00	0.00	0.00	0.00	0.00
20	Other Head Loss	h_o	ft	0.39	0.00	0.00	0.00	0.00	0.00	0.00
21	Outlet Control Elevation	$El_{outcont}$	ft	923.24	923.36	923.88	924.17	924.32	925.08	925.22
22	Inlet Control Elevation	El_{incont}	ft	921.09	921.12	920.95	921.19	922.35	921.69	922.21
23	Approach Velocity Head	h_{AV}	ft	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24	Bend Loss Coefficient	K_b	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	Bend Head Loss	h_b	ft	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26	Upstream Trunkline Discharge	Q_1	cfs	7.00	5.11	4.20	3.29	1.96	0.84	0.84
27	Upstream Lateral Discharge	Q_3	cfs	0.00	1.89	0.91	0.91	1.33	1.12	0.00
28	Junction Loss Coefficient	K_j	-	0.00	0.26	0.16	0.20	0.42	0.66	0.00
29	Junction Head Loss	h_j	ft	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	Headwater Elevation	El_{HW}	ft	923.24	923.36	923.88	924.17	924.32	925.08	925.22

* *King County, Washington, Surface Water Design Manual*. King County Department of Natural Resources, January 24, 2005.

1-8	User input of pipe segment, discharge (Q), pipe length (L), pipe diameter (D), roughness coefficient (n), outlet elevation (El_{out}), inlet elevation (El_{in}).
9	$A = p(D/12)^2/4$
10	$V = Q/A$
11	$h_V = V^2/2g$
12	User input of tailwater elevation (El_{TW}); or $(D+d_c)/2$, whichever is greater.
13	$h_F = L(nV)^2(D/48)^{-4/3}/2.22$
14	$El_{entHGL} = El_{TW} + h_F$
15	User input of entrance headloss coefficient (K_{ent}).
16	$h_{ent} = K_{ent}V^2/2g$
17	User input of exit headloss coefficient (K_{ex}).
18	$h_{exit} = K_{ex}V^2/2g$
19	User input of other headloss coefficient (K_o).
20	$h_o = K_oV^2/2g$
21	$El_{outcont} = El_{entHGL} + h_{ent} + h_{exit}$
22	User input of inlet control elevation (El_{incon}).
23	User input of approach velocity head, $h_{AV} = h_V$ in upstream segment.
24	User input of bend headloss coefficient.
25	$h_b = K_bh_{AV}$
26	User input of upstream trunkline discharge (Q_3).
27	User input of upstream lateral discharge (Q_1).
28	$Kj = (Q_3/Q_1)/[1.18+0.63(Q_3/Q_1)]$
29	$h_j = K_jh_{AV}$
30	El_{HW} = greater of $El_{outcont}$ or $El_{incont} - h_{AV} + h_b + h_j$

King County *Surface Water Design Manual* (2005)* Backwater Calculation

Step	Item/Description	Symbol	Unit	Calculations				
1	Pipe Segment - Outlet Structure	-	-	Outfall	O/W Sep	MH1	MH2	MH3
2	Pipe Segment - Inlet Structure	-	-	O/W Sep	MH1	MH2	MH3	MH4
3	Discharge	Q	cfs	7.00	7.00	4.20	1.96	0.84
4	Pipe Length	L	ft	42.00	10.00	364.00	164.00	100.00
5	Pipe Diameter	D	in	24	24	18	12	12
6	Manning "n" Value	n	-	0.012	0.012	0.012	0.012	0.012
7	Outlet Elevation	El_{out}	ft	919.00	919.09	919.12	919.86	920.70
8	Inlet Elevation	El_{in}	ft	919.09	919.12	919.86	920.70	921.22
9	Barrel Area	A	ft^2	3.14	3.14	1.77	0.79	0.79
10	Barrel Velocity	V	ft/sec	2.23	2.23	2.38	2.50	1.07
11	Barrel Velocity Head	h_V	ft	0.08	0.08	0.09	0.10	0.02
12	Tailwater Elevation	El_{TW}	ft	920.47	920.56	920.16	920.65	921.38
13	Friction Loss	h_f	ft	0.03	0.01	0.49	0.42	0.05
14	Entrance Hydraulic Grade Elevation	El_{entHGL}	ft	921.09	921.12	921.36	921.70	922.22
15	Entrance Loss Coefficient	K_{ent}	-	0.50	0.50	0.50	0.50	0.50
16	Entrance Head Loss	h_{ent}	ft	0.04	0.04	0.04	0.05	0.01
17	Exit Loss Coefficient	K_{ex}	-	1.00	1.00	1.00	1.00	1.00
18	Exit Head Loss	h_{ex}	ft	0.08	0.08	0.09	0.10	0.02
19	Other Loss Coefficient	K_o	-	5.00	0.00	0.00	0.00	0.00
20	Other Head Loss	h_o	ft	0.39	0.00	0.00	0.00	0.00
21	Outlet Control Elevation	$El_{outcont}$	ft	921.59	921.24	921.49	921.85	922.25
22	Inlet Control Elevation	El_{incont}	ft	920.44	920.07	921.00	921.35	921.77
23	Approach Velocity Head	h_{AV}	ft	0.00	0.00	0.00	0.00	0.00
24	Bend Loss Coefficient	K_b	-	0.00	0.00	0.00	0.00	0.00
25	Bend Head Loss	h_b	ft	0.00	0.00	0.00	0.00	0.00
26	Upstream Trunkline Discharge	Q_1	cfs	7.00	7.00	4.20	1.96	0.84
27	Upstream Lateral Discharge	Q_3	cfs	0.00	0.00	2.80	2.24	0.00
28	Junction Loss Coefficient	K_j	-	0.00	0.00	0.42	0.60	0.00
29	Junction Head Loss	h_j	ft	0.00	0.00	0.00	0.00	0.00
30	Headwater Elevation	El_{HW}	ft	921.59	921.24	921.49	921.85	922.25

* *King County, Washington, Surface Water Design Manual*. King County Department of Natural Resources, January 24, 2005.

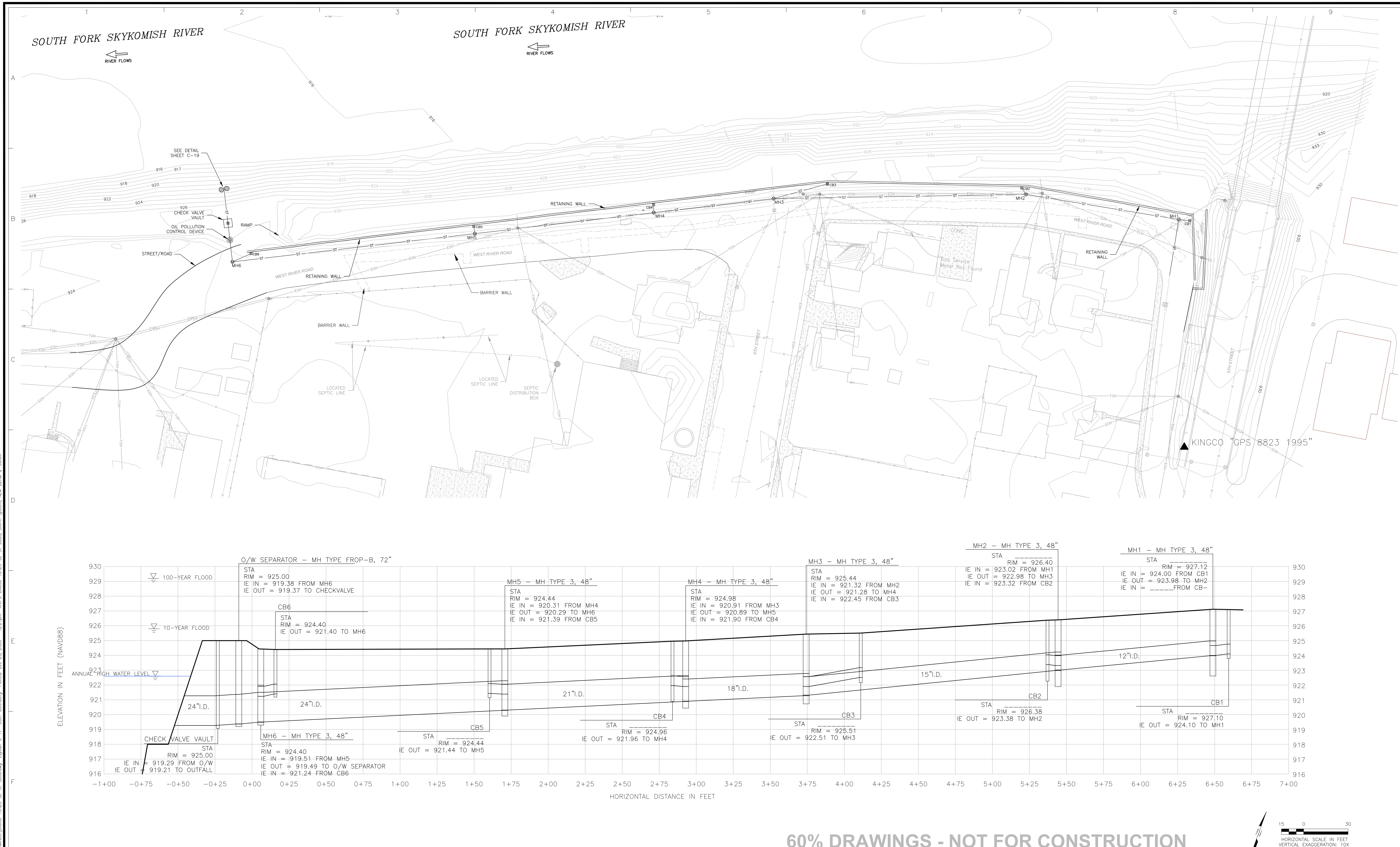
1-8	User input of pipe segment, discharge (Q), pipe length (L), pipe diameter (D), roughness coefficient (n), outlet elevation (El_{out}), inlet elevation (El_{in}).
9	$A = p(D/12)^2/4$
10	$V = Q/A$
11	$h_V = V^2/2g$
12	User input of tailwater elevation (El_{TW}); or $(D+d_c)/2$, whichever is greater.
13	$h_F = L(nV)^2(D/48)^{-4/3}/2.22$
14	$El_{entHGL} = El_{TW} + h_F$
15	User input of entrance headloss coefficient (K_{ent}).
16	$h_{ent} = K_{ent}V^2/2g$
17	User input of exit headloss coefficient (K_{ex}).
18	$h_{exit} = K_{ex}V^2/2g$
19	User input of other headloss coefficient (K_o).
20	$h_o = K_oV^2/2g$
21	$El_{outcont} = El_{entHGL} + h_{ent} + h_{exit}$
22	User input of inlet control elevation (El_{incon}).
23	User input of approach velocity head, $h_{AV} = h_V$ in upstream segment.
24	User input of bend headloss coefficient.
25	$h_b = K_bh_{AV}$
26	User input of upstream trunkline discharge (Q_3).
27	User input of upstream lateral discharge (Q_1).
28	$Kj = (Q_3/Q_1)/[1.18+0.63(Q_3/Q_1)]$
29	$h_j = K_jh_{AV}$
30	El_{HW} = greater of $El_{outcont}$ or $El_{incont} - h_{AV} + h_b + h_j$

King County *Surface Water Design Manual* (2005)* Backwater Calculation

Step	Item/Description	Symbol	Unit	Calculations						
1	Pipe Segment - Outlet Structure	-	-	Outfall	O/W Sep	MH1	MH2	MH3	MH4	MH5
2	Pipe Segment - Inlet Structure	-	-	O/W Sep	MH1	MH2	MH3	MH4	MH5	MH6
3	Discharge	Q	cfs	7.00	7.00	5.11	4.20	3.29	1.96	0.84
4	Pipe Length	L	ft	42.00	10.00	160.00	118.00	78.00	164.00	100.00
5	Pipe Diameter	D	in	24	24	18	18	18	12	12
6	Manning "n" Value	n	-	0.012	0.012	0.012	0.012	0.012	0.012	0.012
7	Outlet Elevation	El_{out}	ft	919.00	919.09	919.12	919.45	919.69	919.85	920.69
8	Inlet Elevation	El_{in}	ft	919.09	919.12	919.45	919.69	919.85	920.69	921.21
9	Barrel Area	A	ft^2	3.14	3.14	1.77	1.77	1.77	0.79	0.79
10	Barrel Velocity	V	ft/sec	2.23	2.23	2.89	2.38	1.86	2.50	1.07
11	Barrel Velocity Head	h_V	ft	0.08	0.08	0.13	0.09	0.05	0.10	0.02
12	Tailwater Elevation	El_{TW}	ft	920.47	920.56	920.31	920.58	920.78	920.64	921.38
13	Friction Loss	h_f	ft	0.03	0.01	0.32	0.16	0.06	0.42	0.05
14	Entrance Hydraulic Grade Elevation	El_{entHGL}	ft	921.09	921.12	920.95	921.19	921.35	921.69	922.21
15	Entrance Loss Coefficient	K_{ent}	-	0.50	0.50	0.50	0.50	0.50	1.50	2.50
16	Entrance Head Loss	h_{ent}	ft	0.04	0.04	0.06	0.04	0.03	0.15	0.04
17	Exit Loss Coefficient	K_{ex}	-	1.00	1.00	1.00	1.00	1.00	2.00	3.00
18	Exit Head Loss	h_{ex}	ft	0.08	0.08	0.13	0.09	0.05	0.19	0.05
19	Other Loss Coefficient	K_o	-	5.00	0.00	0.00	0.00	0.00	0.00	0.00
20	Other Head Loss	h_o	ft	0.39	0.00	0.00	0.00	0.00	0.00	0.00
21	Outlet Control Elevation	$El_{outcont}$	ft	921.59	921.24	921.14	921.32	921.43	922.03	922.31
22	Inlet Control Elevation	El_{incont}	ft	921.09	921.12	920.95	921.19	922.35	921.69	922.21
23	Approach Velocity Head	h_{AV}	ft	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24	Bend Loss Coefficient	K_b	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	Bend Head Loss	h_b	ft	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26	Upstream Trunkline Discharge	Q_1	cfs	7.00	5.11	4.20	3.29	1.96	0.84	0.84
27	Upstream Lateral Discharge	Q_3	cfs	0.00	1.89	0.91	0.91	1.33	1.12	0.00
28	Junction Loss Coefficient	K_j	-	0.00	0.26	0.16	0.20	0.42	0.66	0.00
29	Junction Head Loss	h_j	ft	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	Headwater Elevation	El_{HW}	ft	921.59	921.24	921.14	921.32	922.35	922.03	922.31

* *King County, Washington, Surface Water Design Manual*. King County Department of Natural Resources, January 24, 2005.

1-8	User input of pipe segment, discharge (Q), pipe length (L), pipe diameter (D), roughness coefficient (n), outlet elevation (El_{out}), inlet elevation (El_{in}).
9	$A = p(D/12)^2/4$
10	$V = Q/A$
11	$h_V = V^2/2g$
12	User input of tailwater elevation (El_{TW}); or $(D+d_c)/2$, whichever is greater.
13	$h_F = L(nV)^2(D/48)^{-4/3}/2.22$
14	$El_{entHGL} = El_{TW} + h_F$
15	User input of entrance headloss coefficient (K_{ent}).
16	$h_{ent} = K_{ent}V^2/2g$
17	User input of exit headloss coefficient (K_{ex}).
18	$h_{exit} = K_{ex}V^2/2g$
19	User input of other headloss coefficient (K_o).
20	$h_o = K_oV^2/2g$
21	$El_{outcont} = El_{entHGL} + h_{ent} + h_{exit}$
22	User input of inlet control elevation (El_{incon}).
23	User input of approach velocity head, $h_{AV} = h_V$ in upstream segment.
24	User input of bend headloss coefficient.
25	$h_b = K_bh_{AV}$
26	User input of upstream trunkline discharge (Q_3).
27	User input of upstream lateral discharge (Q_1).
28	$Kj = (Q_3/Q_1)/[1.18+0.63(Q_3/Q_1)]$
29	$h_j = K_jh_{AV}$
30	El_{HW} = greater of $El_{outcont}$ or El_{incont} - $h_{AV} + h_b + h_j$



RETEC

NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE
5							
4							
3							
2							
1	A.S.	8/9/05	60% DRAWINGS	J.S.	8/9/05		
0	A.S.	2/23/05	30% DRAWINGS	J.S.	2/23/05	J.S.	2/23/05

THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON
BN050-16423-520

CURRENT DATE 12/20/05

SKYKOMISH LEVEE REMEDIATION

FINAL STORM SEWER PROFILE

DRAWING NO. FIGURE 1

REVISION

File: H:\16423\DESIGN SET\60% DRAWINGS\BN050-16423-CE-ST-5030.dwg Layout: C-17 User: astenberg Plotted: Dec 23, 2005 - 12:21pm Xref's: BN050-16423-CE-ST-B003, storm-system, NEW-BERM-2-CONST

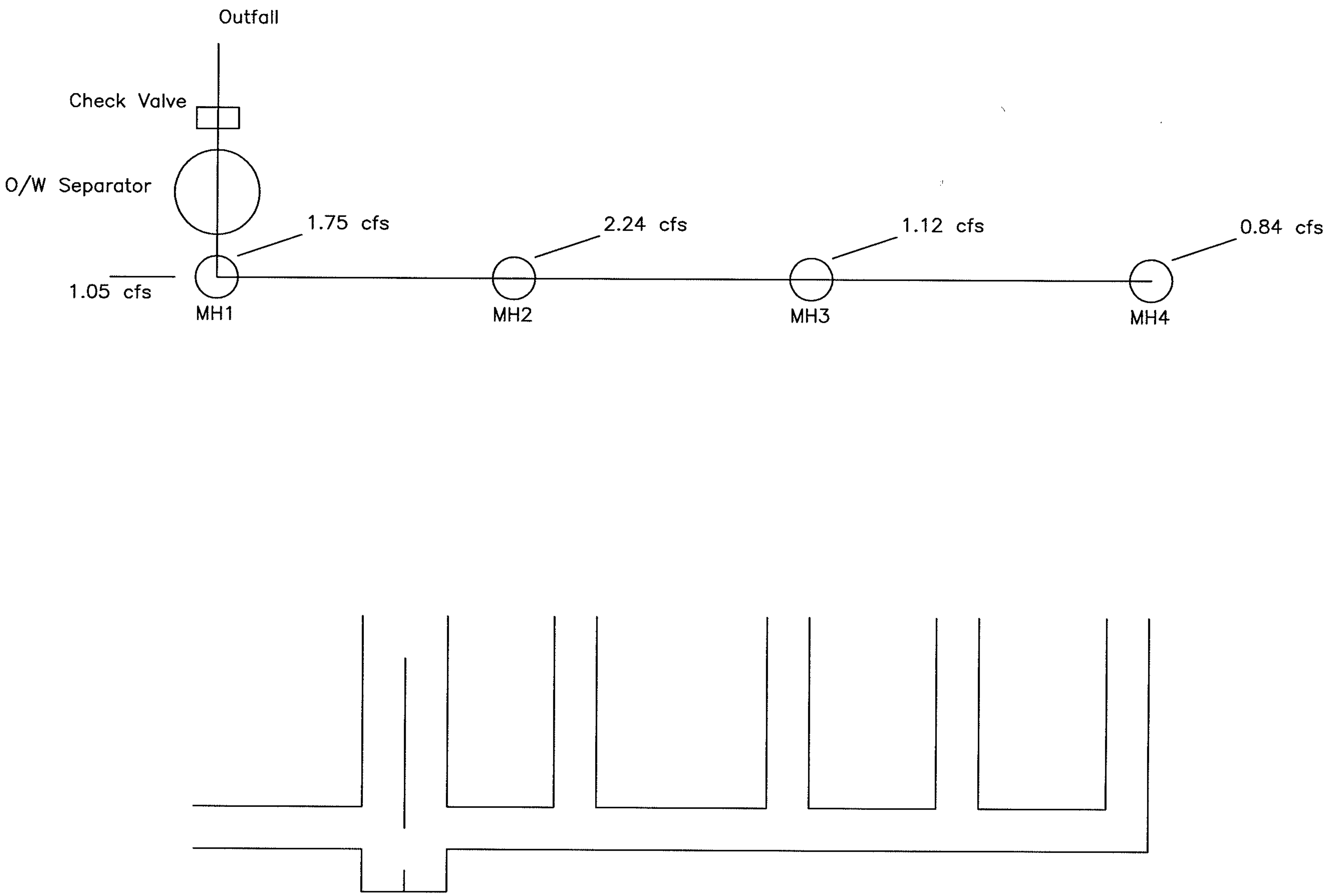


Figure 2. Schematic Plan and Profile of the Four-Manhole Configuration.

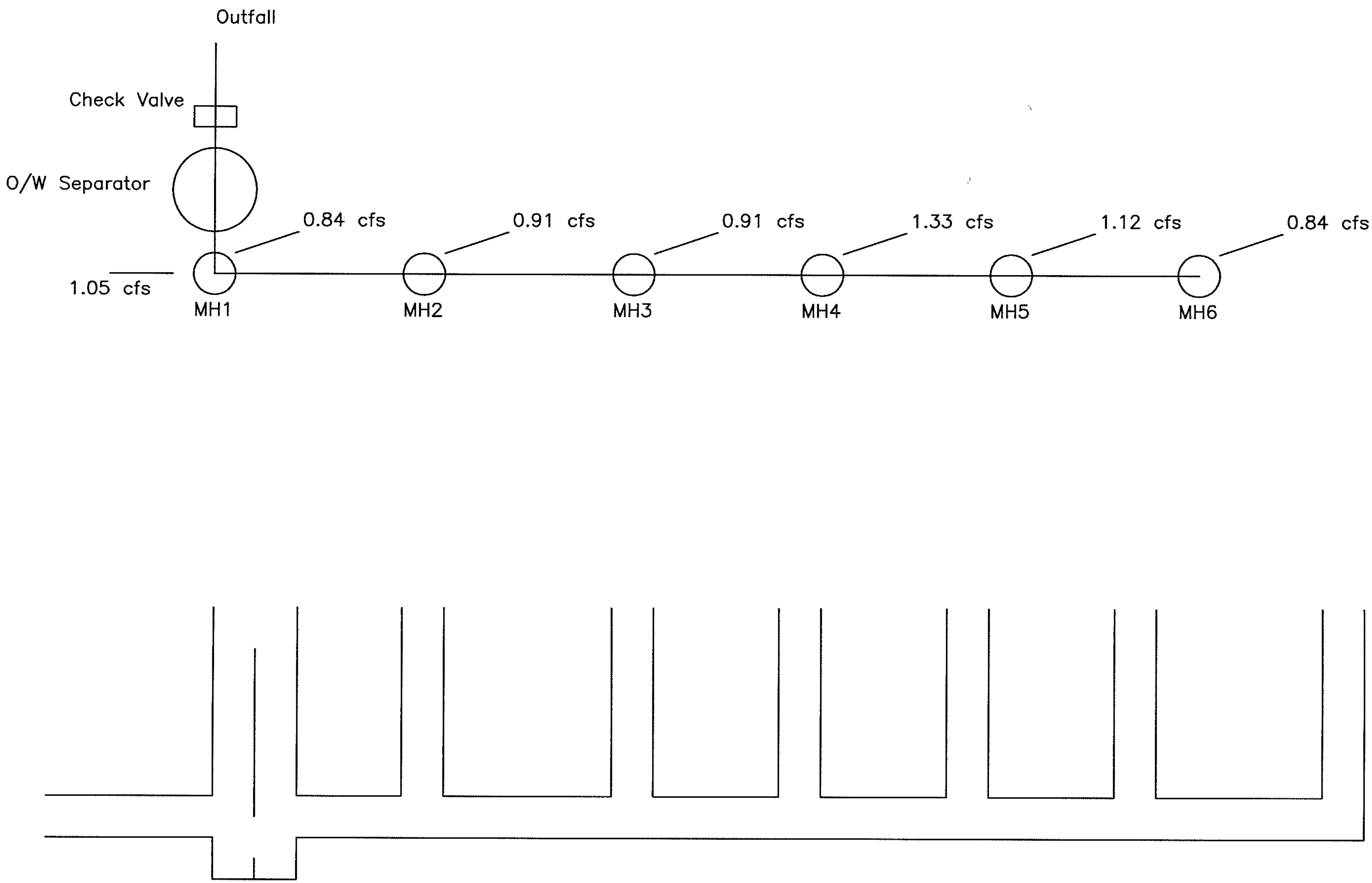
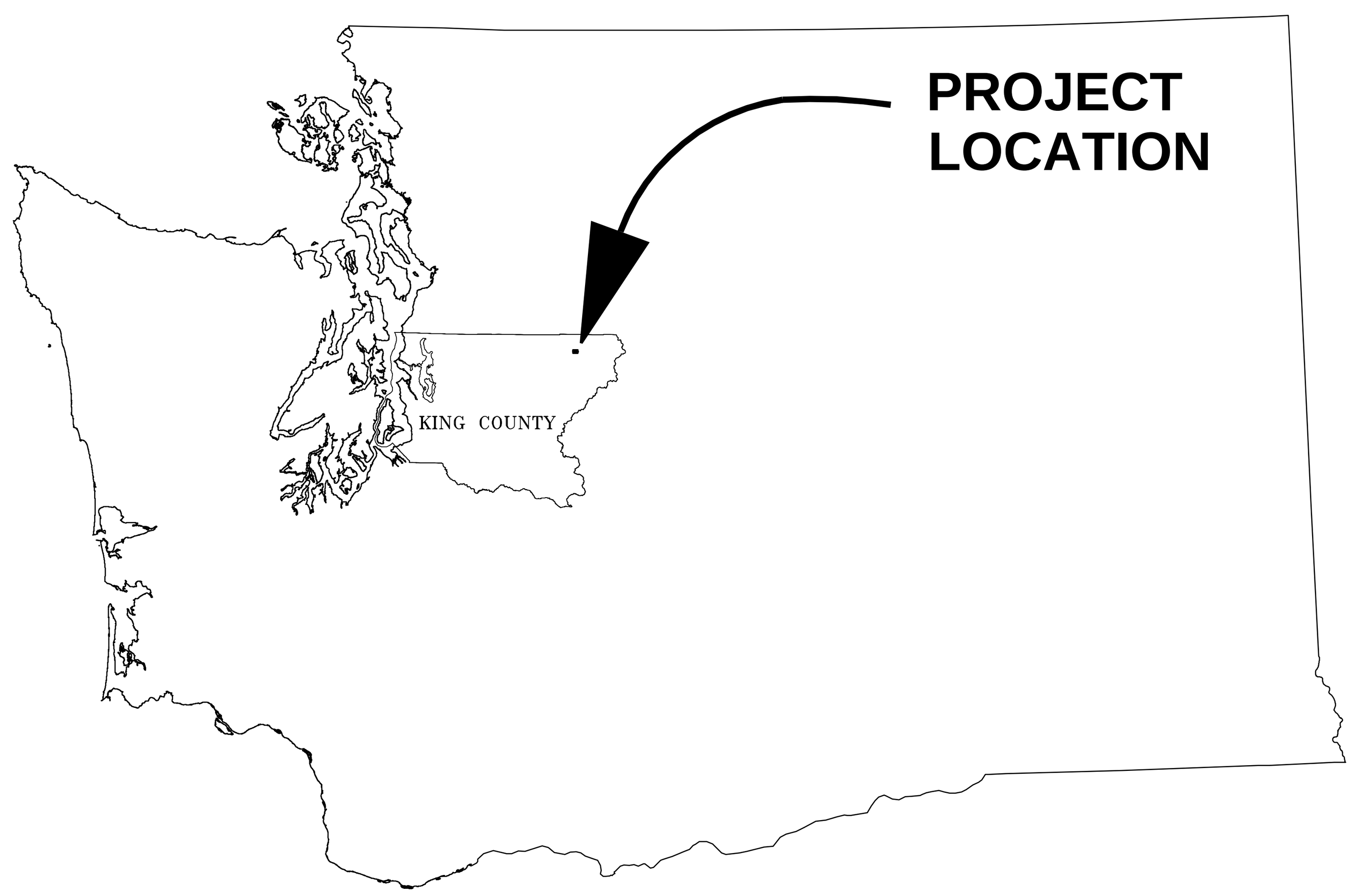


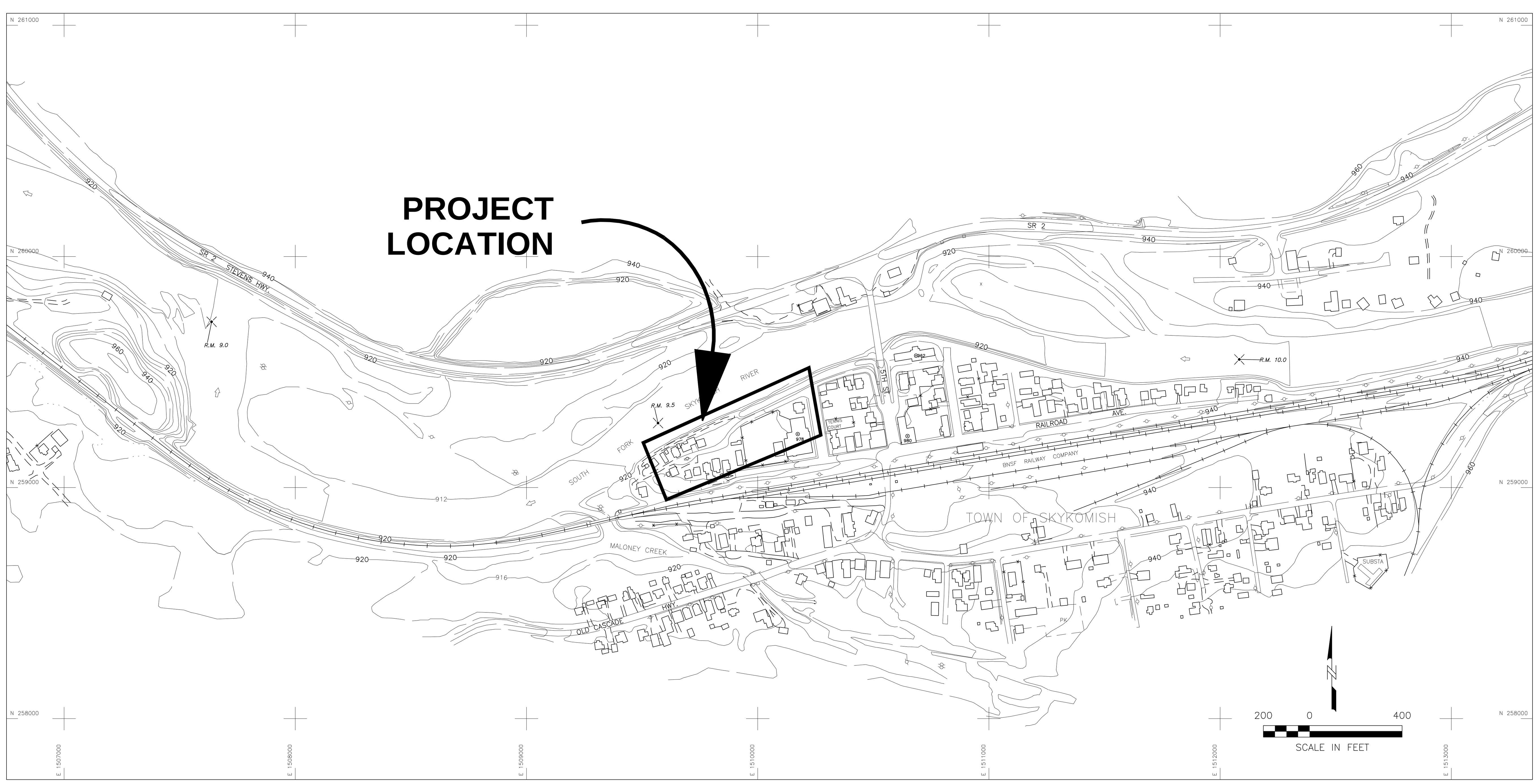
Figure 3. Schematic Plan and Profile of the Six–Manhole Configuration.

SKYKOMISH LEVEE REMEDIATION

THE BNSF RAILWAY COMPANY
2454 OCCIDENTAL AVE. S. Suite #1A
SEATTLE, WASHINGTON
206-625-6298



PREPARED BY:
THE RETEC GROUP, INC.
1011 SW KLICKITAT WAY, SUITE 107
SEATTLE, WASHINGTON
206-624-9349



DRAWING NO.	DESCRIPTION
C–1	TITLE SHEET
C–2	LEGEND AND GENERAL NOTES
C–3	EXISTING SITE PLAN INDEX AND SURVEY CONTROL
C–4	EXISTING SITE PLAN WEST
C–5	EXISTING SITE PLAN EAST
C–6	EXISTING LEVEE SECTIONS
C–7	DEMOLITION PLAN
C–8	CONSTRUCTION LAYOUT PLAN
C–9	SCHOOL YARD CONSTRUCTION AND RESTORATION PLAN
C–10	SEDIMENT AND EROSION CONTROL PLAN
C–11	SEDIMENT AND EROSION CONTROL DETAILS SHEET 1 OF 3
C–12	SEDIMENT AND EROSION CONTROL DETAILS SHEET 2 OF 3
C–13	SEDIMENT AND EROSION CONTROL DETAILS SHEET 3 OF 3
C–14	EXCAVATION PLAN WEST
C–15	EXCAVATION PLAN EAST
C–16	EXCAVATION SECTIONS
C–17	EXCAVATION DETAILS
C–18	FINAL GRADING PLAN WEST
C–19	FINAL GRADING PLAN EAST
C–20	FINAL LEVEE SECTIONS
C–21	RESTORATION PLAN
C–22	FINAL STORM SEWER PROFILE SHEET 1 OF 2
C–23	FINAL STORM SEWER PROFILE SHEET 2 OF 2
C–24	LANDSCAPE DETAILS/PLANT PLACEMENT
C–25	CROSS SECTIONS
C–26	FINAL LEVEE DETAILS
C–27	FINAL DETAILS SHEET 1 OF 2
C–28	FINAL DETAILS SHEET 2 OF 2
P–1	CONSTRUCTION WATER TREATMENT SYSTEM P&ID

DRAFT BID SET

RETEC

NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE
B	RCW	2/--/06	ISSUED FOR PRELIMINARY BID				
A	A.S.	1/13/06	60% DRAWINGS – NOT FOR CONSTRUCTION	J.S.	1/13/06		

THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON
BN050-19390-200

SKYKOMISH LEVEE REMEDIATION

TITLE SHEET, INDEX AND SITE LOCATION MAPS

CURRENT DATE 2/--/06 | DRAWING NO. C-1 | REVISION 0

GENERAL NOTES:

1. HORIZONTAL DATUM IS WASHINGTON STATE PLANE (WASP) NORTH ZONE, BASED ON NORTH AMERICAN DATUM 1983/1991 (NAD83/91)

2. VERTICAL DATUM IS NORTH AMERICAN VERTICAL DATUM 1988 (NAVD88)

3. ALL DISTANCES ARE U.S. SURVEY FEET.

4. MATERIAL IN THE RIVER IS REFERRED TO AS SEDIMENT. ALL OTHER MATERIAL IS REFERRED TO AS SOIL.

5. SEDIMENT WITH NWTPH–Dx CONCENTRATIONS LESS THAN 22mg/kg WILL BE USED AS BACKFILL AND IS REFERRED TO AS "UNCONTAMINATED RECYCLED SEDIMENT".

6. SOIL WITH NWTPH–Dx CONCENTRATIONS LESS THAN 22mg/kg WILL BE USED AS BACKFILL AND IS REFERRED TO AS "UNCONTAMINATED RECYCLED SOIL".

EROSION AND SEDIMENT CONTROL NOTES:

1. APPROVAL OF THIS EROSION/SEDIMENTATION CONTROL (ESC) PLAN DOES NOT CONSTITUTE AN APPROVAL OF PERMANENT ROAD OR DRAINAGE DESIGN (E.G. SIZE AND LOCATION OF ROADS, PIPES, RESTRICTORS, CHANNELS, RETENTION FACILITIES, UTILITIES, ETC.).

2. THE IMPLEMENTATION OF THESE ESC PLANS AND THE CONSTRUCTION, MAINTENANCE, REPLACEMENT, AND UPGRADING OF THESE ESC FACILITIES IS THE RESPONSIBILITY OF THE CONTRACTOR UNTIL ALL CONSTRUCTION IS COMPLETED AND APPROVED AND VEGETATION/LANDSCAPING IS ESTABLISHED.

3. THE BOUNDARIES OF THE CLEARING LIMITS SHOWN ON THIS PLAN SHALL BE CLEARLY FLAGGED IN THE FIELD PRIOR TO CONSTRUCTION. DURING THE CONSTRUCTION PERIOD, NO DISTURBANCE BEYOND THE FLAGGED CLEARING LIMITS SHALL BE PERMITTED. THE FLAGGING SHALL BE MAINTAINED BY THE CONTRACTOR FOR THE DURATION OF CONSTRUCTION.

4. THE ESC FACILITIES SHOWN ON THIS PLAN MUST BE CONSTRUCTED IN CONJUNCTION WITH ALL CLEARING AND GRADING ACTIVITIES, AND IN SUCH A MANNER AS TO INSURE THAT SEDIMENT AND SEDIMENT LADEN WATER DO NOT ENTER THE DRAINAGE SYSTEM, ROADWAYS, OR VIOLATE APPLICABLE WATER STANDARDS.

5. THE ESC FACILITIES SHOWN ON THIS PLAN ARE THE MINIMUM REQUIREMENTS FOR ANTICIPATED SITE CONDITIONS. DURING THE CONSTRUCTION PERIOD, THESE ESC FACILITIES SHALL BE UPGRADED AS NEEDED FOR UNEXPECTED STORM EVENTS AND TO ENSURE THAT SEDIMENT AND SEDIMENT–LADEN WATER DO NOT LEAVE THE SITE.

6. THE ESC FACILITIES SHALL BE INSPECTED DAILY BY THE CONTRACTOR AND MAINTAINED AS NECESSARY TO ENSURE THEIR CONTINUED FUNCTIONING.

7. THE ESC FACILITIES ON INACTIVE SITES SHALL BE INSPECTED AND MAINTAINED A MINIMUM OF ONCE A MONTH OR WITHIN THE 48 HOURS FOLLOWING A MAJOR STORM EVENT.

8. AT NO TIME SHALL MORE THAN ONE FOOT OF SEDIMENT BE ALLOWED TO ACCUMULATE WITHIN A TRAPPED CATCH BASIN. ALL CATCH BASINS AND CONVEYANCE LINES SHALL BE CLEANED PRIOR TO PAVING. THE CLEANING OPERATION SHALL NOT FLUSH SEDIMENT LADEN WATER INTO THE DOWNSTREAM SYSTEM.

9. ALL PAVED AREAS SHALL BE KEPT CLEAN FOR THE DURATION OF THE PROJECT. CONTRACTOR SHALL HAVE A STREET CLEANING TRUCK ON SITE SO THAT LOCAL ROADWAYS USED AS HAUL ROUTES CAN BE CLEANED IMMEDIATELY WHEN ANY SOIL IS DROPPED ON THE ROADWAY,

10. TO THE EXTENT PRACTICABLE, NATURAL VEGETATION SHALL BE PRESERVED.

11. TO CONTROL DUST, TRUCKS SHALL BE COVERED WHEN TRANSPORTING MATERIAL, WHEN THE ENGINEER DETERMINES THAT DUSTY CONDITIONS EXIST.

DEMOLITION NOTES:

1. VEGETATION WITHIN LIMITS OF DISTURBANCE TO BE CLEARED AND GRUBBED.

2. SOD AND TOPSOIL WITHIN LIMITS OF DISTURBANCE SHALL BE STRIPPED PRIOR TO EXCAVATION.

3. REMOVAL OF PAVEMENT OF 5TH STREET, 6TH STREET AND WEST RIVER ROAD TO BE PERFORMED WITH EXCAVATION TO EXTENT POSSIBLE. EXISTING ROADS SHALL BE USED AS CLEAN CONSTRUCTION ROADS.

4. OVERHEAD ELECTRICAL AND TELEPHONE LINES WILL BE RELOCATED OUTSIDE THE LIMITS OF DISTURBANCE BY OTHERS BEFORE WORK BEGINS.

5. EXISTING WATER LINES AND STORM DRAINS WITHIN THE LIMITS OF DISTURBANCE TO BE DECOMMISSIONED AND REMOVED BY CONTRACTOR.

6. ALL BUILDINGS, UTILITIES, SEPTIC SYSTEMS, WELLS, PIEZOMETERS AND OTHER STRUCTURES OUTSIDE THE LIMITS OF DISTURBANCE SHALL BE PROTECTED.

SITE RESTORATION NOTES:

1. LANDSCAPE PLAN FOR DISTURBED AREAS SOUTH OF THE LEVEE CREST, INCLUDING TOPSOILING AND PERMANENT RESEEDING, TO BE DEVELOPED BY ENGINEER WITH EACH PROPERTY OWNER.

2. LANDSCAPE PLAN FOR DISTURBED AREAS NORTH OF THE LEVEE CREST SHOWN ON DRAWING C–XX.

LEGEND:

SURFACE FEATURES:

	BUILDING FOOTPRINT
	CONCRETE (EXISTING)
	STREAMBED/WATER CHANNEL
	FENCE (EXISTING)
	RAILROAD TRACK
	CURB/PAVEMENT/SIDEWALK (EXISTING)
	CURB/PAVEMENT/SIDEWALK (PROPOSED)
925	CONTOUR (EXISTING)
925	CONTOUR (PROPOSED)
	VEGETATION
	BNSF PROPERTY LINE
	HIGH VISIBILITY METAL FENCE (PROPOSED TEMPORARY)
SF	SILT FENCE
	DIRECTION OF SURFACE WATER FLOW
	TREES

UTILITY FEATURES:

EOH	DATA SUBSURFACE
EOH	ELECTRIC OVERHEAD
TOH	TELEPHONE OVERHEAD
W	WATER
ST	STORM SEWER (EXISTING)
ST	STORM SEWER (PROPOSED)
S	SEPTIC LINE
	CATCH BASIN (EXISTING)
	CATCH BASIN (PROPOSED)
M	MANHOLE (PROPOSED)
GW	GREY WATER TANK
BW	BLACK WATER TANK
GBW	GREY/BLACK WATER TANK

WELL SYMBOLS:

	MONITOR WELL LOCATION
	RECOVERY WELL LOCATION
▲ ●	SOIL BORING LOCATION
	PIEZOMETER LOCATION
	MARKER LOCATION
	MONITORING WELL TO BE ABANDONED BY OTHERS

ABBREVIATIONS:

C.P.B – CONTROL PANEL BOX

DRAFT BID SET

RETEC

NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE
B	RCW	2/––/06	ISSUED FOR PRELIMINARY BID				
A	A.S.	1/13/06	60% DRAWINGS – NOT FOR CONSTRUCTION	J.S.	2/––/06		

THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON
BN050-19390-200

CURRENT DATE 2/––/06

SKYKOMISH LEVEE REMEDIATION

LEGEND AND GENERAL NOTES

DRAWING NO. C-2 REVISION B

DATUM \ MARKER		NGS Z58 1934	KING CO GPS 8823 1995	WSDOT2761	TBM ML1	TBM ML2	TBM ML3	TBM SK1	TBM SK2	TBM SK3	TBM SK4	TBM SK5
NORTHING	WASP NAD83/91 FEET	259122.02	259378.63	259970.33	258775.43	258698.76	258771.24	259357.43	259496.40	259514.77	259104.51	259193.58
EASTING	WASP NAD83/91 FEET	1510709.89	1510539.74	1507599.36	1511358.83	1511048.71	1510540.64	1511778.32	1511078.48	1510584.17	1510285.59	1509864.28
ELEVATION	NAVD 88	935.50	931.74	930.70	935.28	936.43	932.92	933.92	936.62	928.46	926.81	923.43

200 100 0 200 400 600

SCALE OF FEET

N

SOUTH FORK SKYKOMISH RIVER
KING COUNTY, WASHINGTON

DATE OF PHOTOGRAPHY 4-19-93

CONTOUR INTERVAL 4' DERIVED FROM PHOTOGRAMMETRY BY DAVID C. SMITH & ASSOCIATES, INC.

DASHED CONTOURS DO NOT MEET NATIONAL MAP ACCURACY STANDARDS AND MAY NOT BE RELIABLE.

HORIZONTAL DATUM NAD '83-91
VERTICAL DATUM NAVD '88

LEGEND

▲ BRONZE DISK MARKER

PK NAIL MARKER

DRAFT BID SET

RETEC

NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE
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THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON

BN050-19390-200

CURRENT DATE 2/--/06

SKYKOMISH LEVEE REMEDIATION

EXISTING SITE PLAN INDEX
AND SURVEY CONTROL

DRAWING NO. C-3

REVISION B

DRAFT BID SET

RETEC

NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE
B	RCW	2/--/06	ISSUED PRELIMINARY FOR BID				
A	A.S.	1/13/06	60% DRAWINGS – NOT FOR CONSTRUCTION	J.S.	1/13/06		

THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON
BN050-19390-200

CURRENT DATE 2/--/06

SKYKOMISH LEVEE REMEDIATION

EXISTING SITE PLAN WEST

DRAWING NO. C-4

REVISION B

DRAFT BID SET

NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE
B	RCW	2/--/06	ISSUED FOR PRELIMINARY BID				
A	A.S.	1/13/06	60% DRAWINGS – NOT FOR CONSTRUCTION	J.S.	1/13/06		

RETEC

THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON
BN050-19390-200

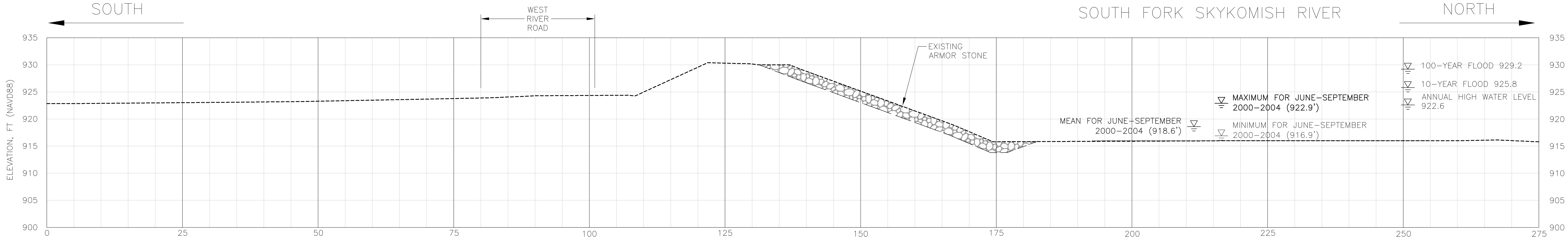
CURRENT DATE 2/--/06

SKYKOMISH LEVEE REMEDIATION

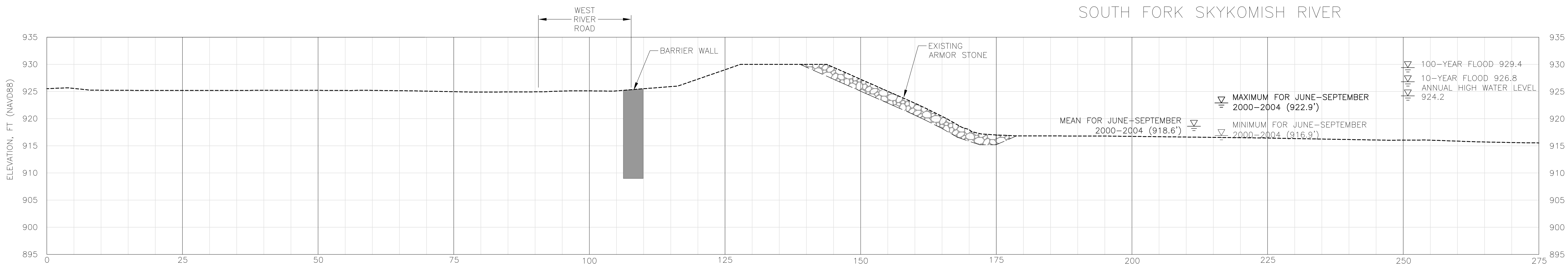
EXISTING SITE PLAN EAST

DRAWING NO. C-5

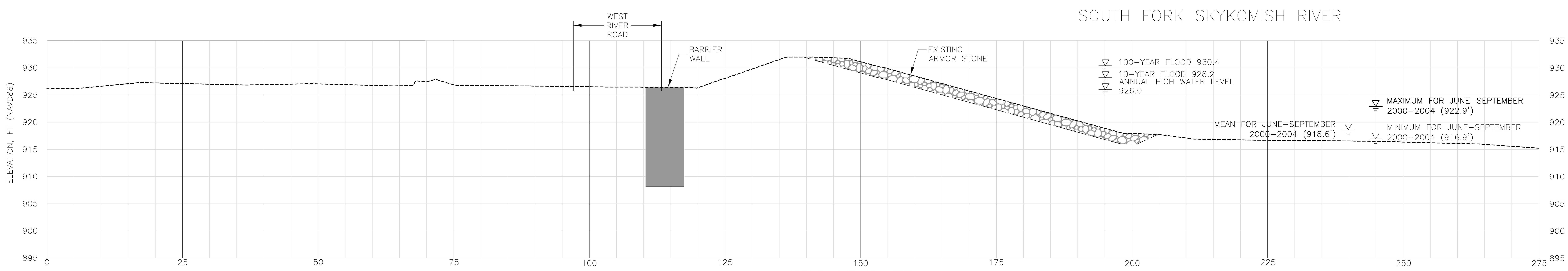
REVISION B



1 C-5 CROSS-SECTION
SCALE: 1"=10'



2 C-6 CROSS-SECTION
SCALE: 1"=10'



3 C-6 CROSS-SECTION
SCALE: 1"=10'

5 0 10
SCALE IN FEET

DRAFT BID SET

RETEC

NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE
B	RCW	2/--/06	ISSUED FOR PRELIMINARY BID				
A	A.S.	1/13/06	60% DRAWINGS - NOT FOR CONSTRUCTION	J.S.	1/13/06	J.S.	

THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON
BN050-19390-200

CURRENT DATE 2/--/06

SKYKOMISH LEVEE REMEDIATION

EXISTING LEVEE SECTIONS

DRAWING NO. C-6

REVISION B

NOTES:
1. VEGETATION WITHIN LIMIT OF DISTURBANCE TO BE CLEARED AND GRUBBED.

2. DEMOLITION OF 5TH STREET, 6TH STREET AND WEST RIVER ROAD TO BE PERFORMED WITH EXCAVATION TO EXTENT POSSIBLE. EXISTING ROADS SHALL BE USED AS CLEAN CONSTRUCTION ROADS.

LEGEND

LIMIT OF DISTURBANCE

15 0 30
SCALE IN FEET

DRAFT BID SET

RETEC

NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE
B	RCW	2/--/06	ISSUED FOR PRELIMINARY BID				
A	RCW	1/17/06	60% DRAWINGS – NOT FOR CONSTRUCTION				

THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON
BN050-19390-200

CURRENT DATE 2/--/06

SKYKOMISH LEVEE REMEDIATION

DEMOLITION PLAN

DRAWING NO. C-7

REVISION B

LEGEND

PROPOSED STAGING AREAS	BNSF PROPERTY LINE
PROPOSED PORTABLE EQUIPMENT STORAGE AREA	LIMIT OF DISTURBANCE
DESIGNATED CONSTRUCTION TRAFFIC ROUTE	HIGH VISIBILITY METAL FENCE
	SILT FENCE
	FEMA FLOODWAY BOUNDARY
	FEMA 100 YEAR FLOOD PLAIN

50 0 100
SCALE IN FEET

DRAFT BID SET

RETEC

NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE
B	RCW	2/--/06	ISSUED FOR PRELIMINARY BID				
A	RCW	1/17/06	60% DRAWINGS – NOT FOR CONSTRUCTION				

THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON
BN050-19390-200

CURRENT DATE 2/--/06

SKYKOMISH LEVEE REMEDIATION

CONSTRUCTION LAYOUT PLAN

DRAWING NO. C-8 REVISION B

RETEC

NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE
B	RCW	2/--/06	ISSUED FOR PRELIMINARY BID				
A	RCW	1/24/06	60% DRAWINGS – NOT FOR CONSTRUCTION				

THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON

BN050-19390-200

CURRENT DATE 2/--/06

SKYKOMISH LEVEE REMEDIATION

SCHOOLYARD CONSTRUCTION AND RESTORATION PLAN

DRAWING NO. C-9 REVISION B

LEGEND

LIMIT OF DISTURBANCE

FEMA FLOODWAY BOUNDARY

STORMWATER FLOW DIRECTION

NOTES:

1. SEDIMENT AND EROSION CONTROLS FOR STAGING AREAS SHOWN ON DRAWING C-8
2. ALL AREAS SHOWN ON THIS DRAWING ARE WITHIN THE 100-YEAR FLOODPLAIN AND THE SHORELINE MANAGEMENT BOUNDARY.

15 0 30
SCALE IN FEET

DRAFT BID SET

RETEC

NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE
B	RCW	2/--/06	ISSUED FOR PRELIMINARY BID				
A	RCW	1/17/06	60% DRAWINGS – NOT FOR CONSTRUCTION				

THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON

BN050-19390-200

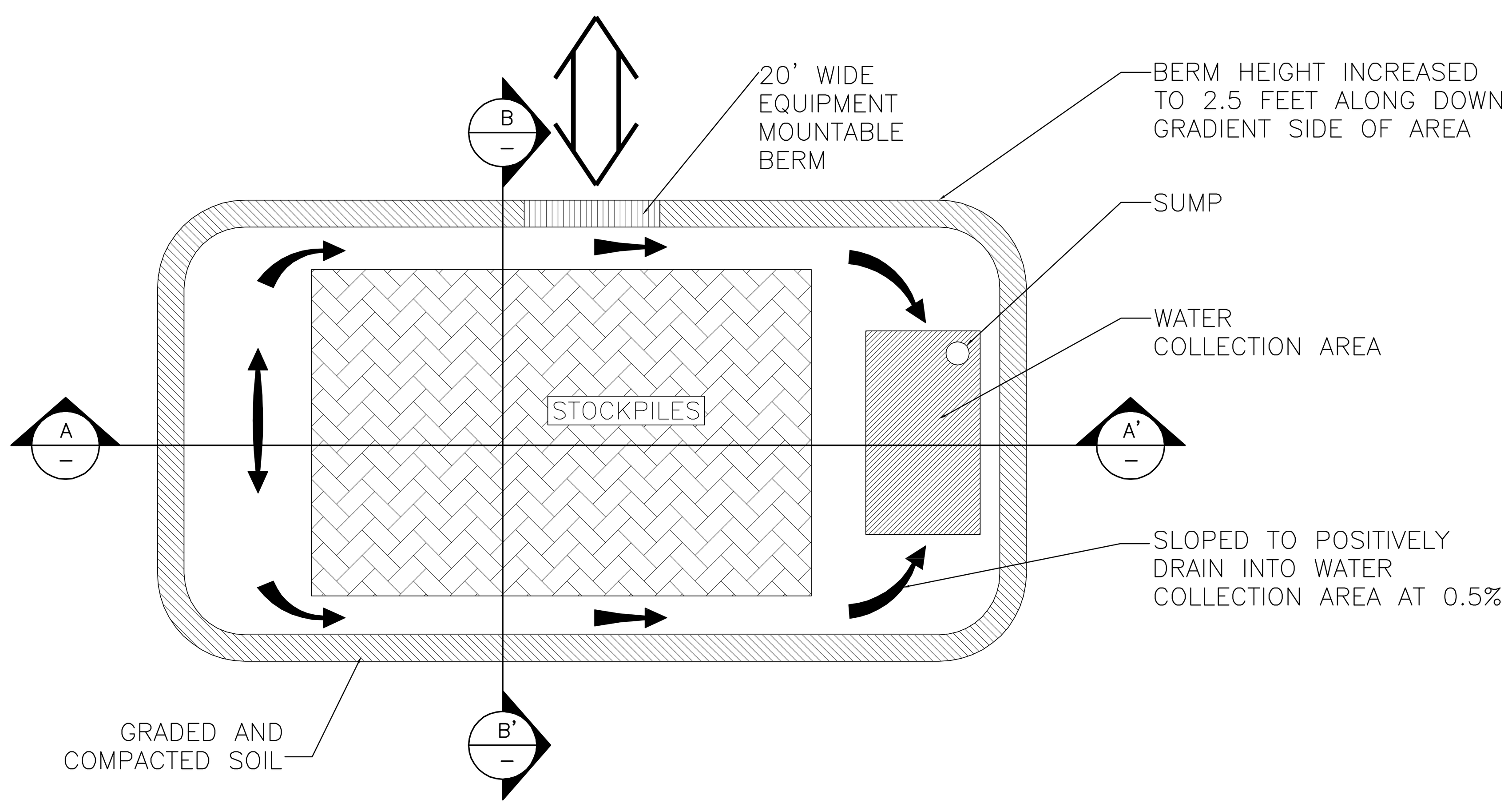
CURRENT DATE 2/--/06

SKYKOMISH LEVEE REMEDIATION

SEDIMENT AND EROSION CONTROL PLAN

DRAWING NO. C-10

REVISION B



NOTES:

1. STOCKPILE AREA DIMENSIONS AND SHAPE MAY VARY. ACTUAL SIZE WILL BE DETERMINED BASED ON SITE CONDITIONS AND REQUIRED STORAGE AREA. CONTRACTOR SHALL DETERMINE FINAL SIZE OF AREA WITH APPROVAL BY SITE ENGINEER.

2. EXISTING SUBGRADE SHALL BE FREE OF ANGULAR PROTRUSIONS. A TWO TO SIX INCH LAYER OF CLEAN STRUCTURAL BACKFILL SHALL BE PLACED, GRADED TO DRAIN AND COMPACTED TO A FIRM UNYIELDING SURFACE PRIOR TO PLACEMENT OF LINER.

3. STOCKPILE AREA IS TO BE GRADED TO POSITIVELY DRAIN TOWARDS THE WATER COLLECTION AREA.

4. CONTAINMENT BERMS SHALL BE CONSTRUCTED OF IMPORTED CLEAN SOIL. NO ON SITE BORROW WILL BE AVAILABLE. PLACE WATER CONTAINMENT BERM SOILS IN MAXIMUM OF 12" LIFTS.

5. WATER CONTAINMENT BERMS ARE TO BE MOISTURE CONDITIONED AND COMPACTED TO A FIRM, UNYIELDING CONDITION, AS DIRECTED BY THE SITE ENGINEER.

6. INITIAL PLACEMENT OF EXCAVATED MATERIALS SHALL BE CAREFULLY PLACED IN A 12" LIFT SO THAT EQUIPMENT DOES NOT DAMAGE LINER.

7. DAILY INSPECTION AND MAINTENANCE OF THE WATER CONTAINMENT BERMS IS REQUIRED FOR THE DURATION OF THE PROJECT.

8. CONTRACTOR SHALL REMOVE WATER FROM COLLECTION SUMP, FILTER IT FOR DISPOSAL AT THE SITE WATER TREATMENT SYSTEM, AND HAUL IT TO THE WATER TREATMENT SYSTEM VIA TRUCK.

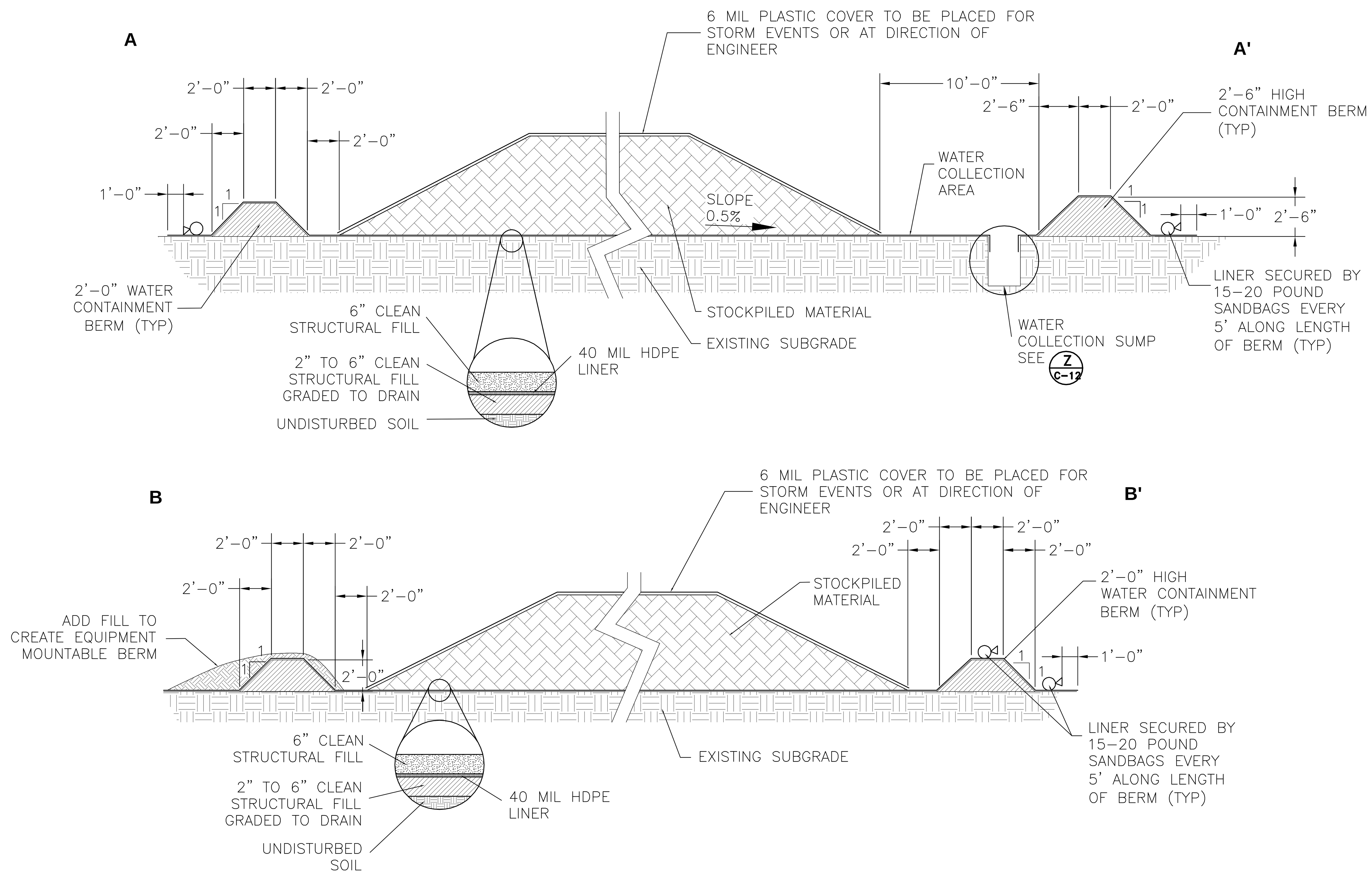
9. SOLIDS ACCUMULATED IN THE SUMP SHALL BE EXCAVATED PERIODICALLY AND PLACED ON THE STOCKPILE.

10. UPON COMPLETION OF THE WORK, THE WASTE MANAGEMENT AREA SHALL BE REMOVED, AND THE AREA GRADED.

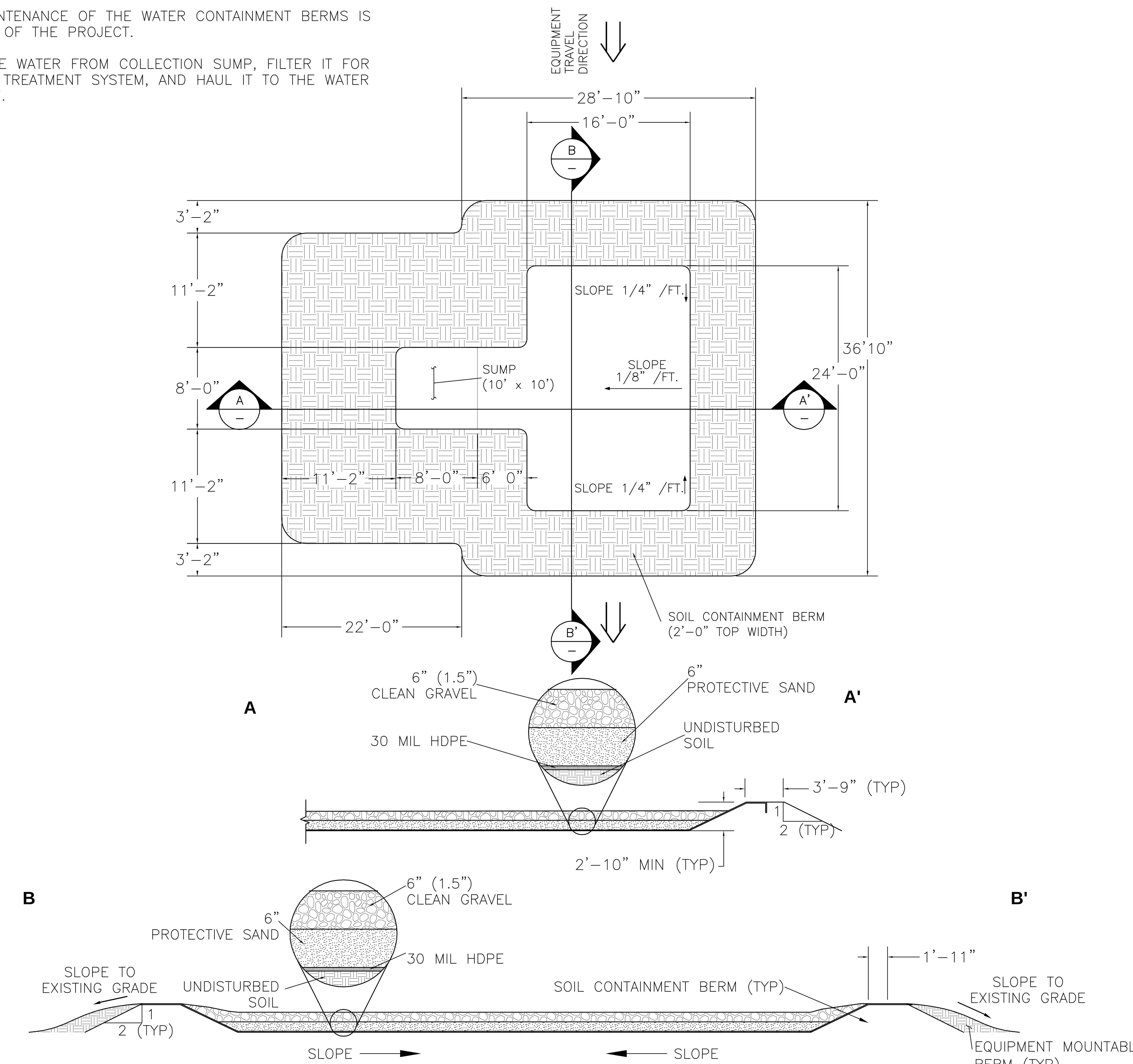
11. ANY DAMAGE TO WASTE MANAGEMENT AREA MUST BE REPORTED TO THE SITE ENGINEER IMMEDIATELY.

12. LINER SHALL BE 40 MIL HDPE ONE SOLID SHEET OR SHALL HAVE SEAMS WELDED PER MANUFACTURER'S RECOMMENDATIONS. NO OVERLAP WILL BE ACCEPTED.

13. ALL WELLS TO BE PROTECTED DURING INSTALLATION AND REMOVAL OF STOCKPILE AREA.



1 C-8 CONTAMINATED MATERIAL STOCKPILE AREA DETAIL
SCALE: NTS



2 C-8 DECONTAMINATION AREA DETAIL
SCALE: NTS

DRAFT BID SET

RETEC

NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE
B	RCW	2/--/06	ISSUED FOR PRELIMINARY BID				
A	RCW	1/17/06	60% DRAWINGS – NOT FOR CONSTRUCTION				

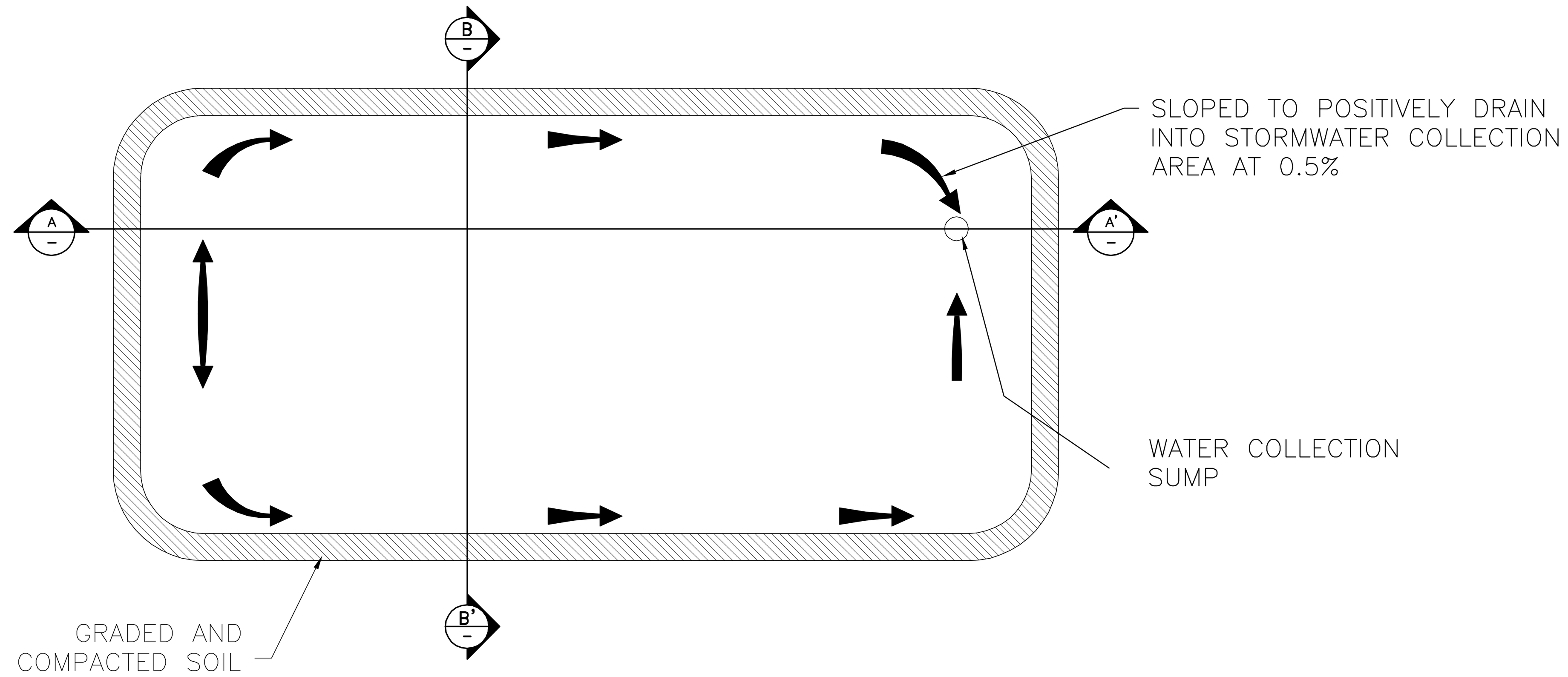
THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON
BN050-19390-200

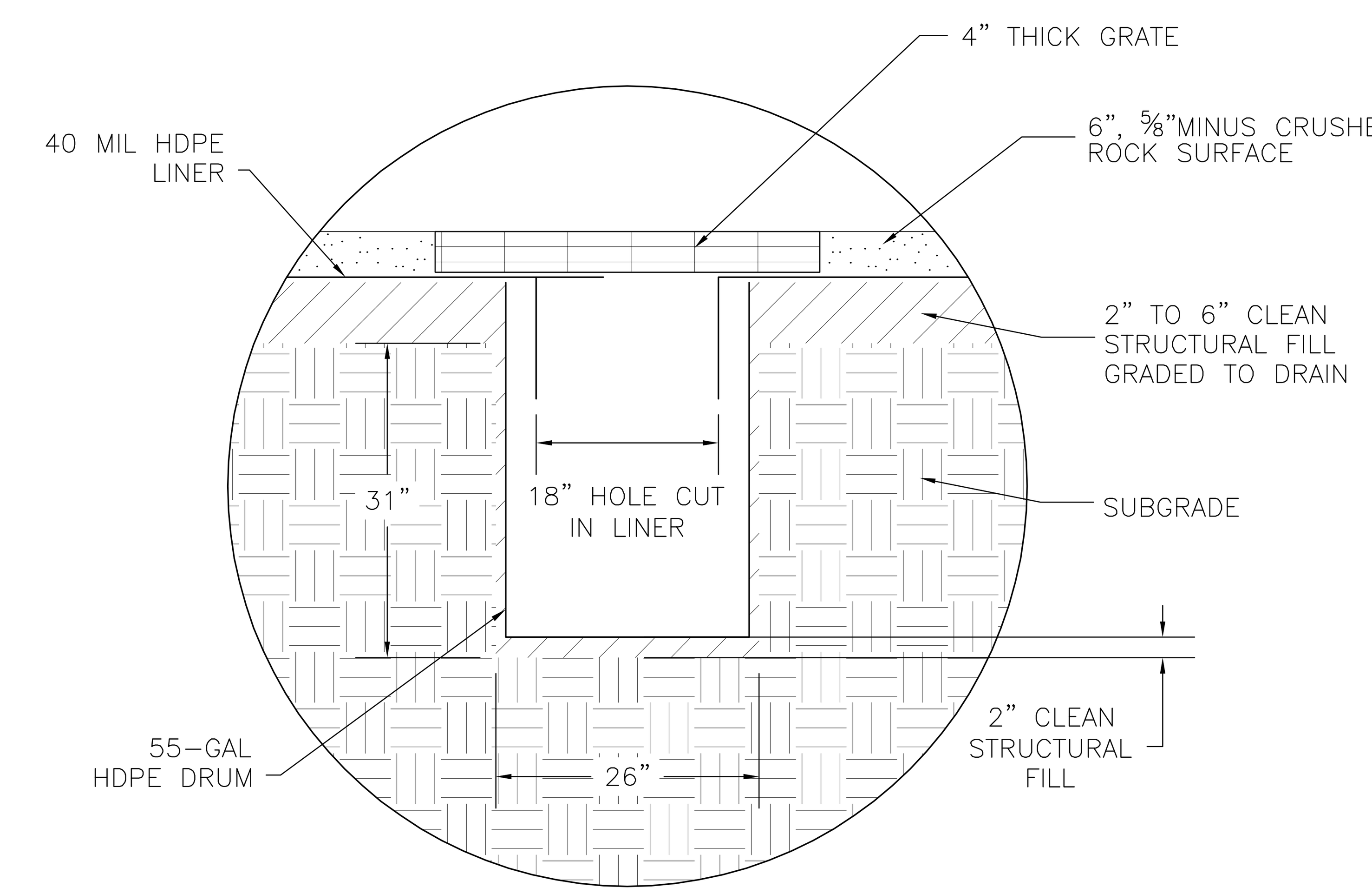
CURRENT DATE 2/--/06

SKYKOMISH LEVEE REMEDIATION

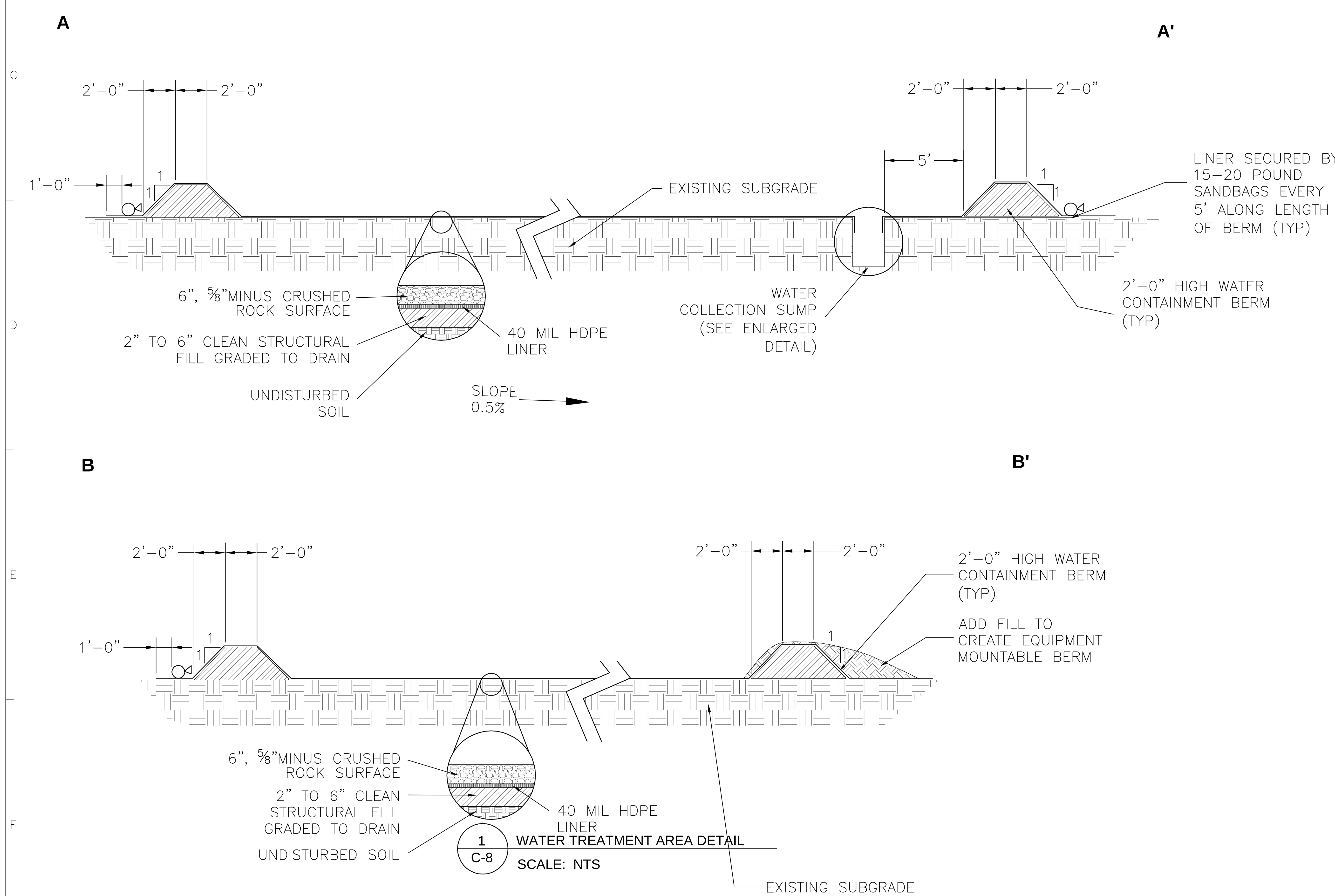
SEDIMENT AND EROSION CONTROL DETAILS
SHEET 1 OF 3

DRAWING NO. C-11 REVISION B





ENLARGED SUMP DETAIL



1 / C-8 WATER TREATMENT AREA DETAIL

SCALE: NTS

NOTES:

1. EXISTING SUBGRADE SHALL BE FREE OF ANGULAR PROTRUSIONS. A TWO TO SIX-INCH LAYER OF CLEAN STRUCTURAL BACKFILL SHALL BE PLACED, GRADED TO DRAIN AND COMPACTED TO A FIRM UNYIELDING SURFACE PRIOR TO PLACEMENT OF LINER.

2. WATER TREATMENT PLANT AREA IS TO BE GRADED TO POSITIVELY DRAIN TOWARDS THE WATER COLLECTION SUMP.

3. CONTAINMENT BERMS SHALL BE CONSTRUCTED OF IMPORTED CLEAN SOIL. NO ON SITE BORROW WILL BE AVAILABLE. PLACE CONTAINMENT BERM SOILS IN MAXIMUM OF 12" LIFTS. CONTAINMENT BERMS ARE TO BE MOISTURE CONDITIONED AND COMPACTED TO A FIRM, UNYIELDING CONDITION, AS DIRECTED BY THE SITE ENGINEER.

4. DAILY INSPECTION AND MAINTENANCE OF THE CONTAINMENT BERMS IS REQUIRED FOR THE DURATION OF THE PROJECT.

5. SOLIDS ACCUMULATED IN THE SUMP SHALL BE EXCAVATED PERIODICALLY AND PLACED ON THE WASTE MATERIAL STOCKPILE.

6. ANY DAMAGE TO WATER TREATMENT AREA MUST BE REPORTED TO THE SITE ENGINEER IMMEDIATELY.

7. LINER SHALL BE 40 MIL HDPE ONE SOLID SHEET OR SEAMS SHALL BE WELDED PER SPECIFICATIONS AND MANUFACTURER'S RECOMMENDATIONS. NO OVERLAP IS ALLOWED.

8. SUMP SHALL BE A 55-GALLON HDPE DRUM. A HOLE SHALL BE CUT IN THE LINER CENTERED OVER THE DRUM TO ALLOW WATER TO DRAIN INTO THE DRUM.

9. GRATE OVER SUMP SHALL BE OF SUFFICIENT STRENGTH TO WITHSTAND VEHICLE TRAFFIC AND EXTEND AT LEAST 6 INCHES PAST THE SUMP EXCAVATION ON ALL SIDES. SLOPES SHALL BE GRADED TO THE SUMP.

10. SIZE OF THE WATER TREATMENT AREA SHALL BE DETERMINED BY THE CONTRACTOR AND SHALL INCLUDE FRAC AND WEIR TANKS.

DRAFT BID SET

RETEC

NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE
B	RCW	2/--/06	ISSUED FOR PRELIMINARY BID				
A	RCW	1/17/06	60% DRAWINGS – NOT FOR CONSTRUCTION				

THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON

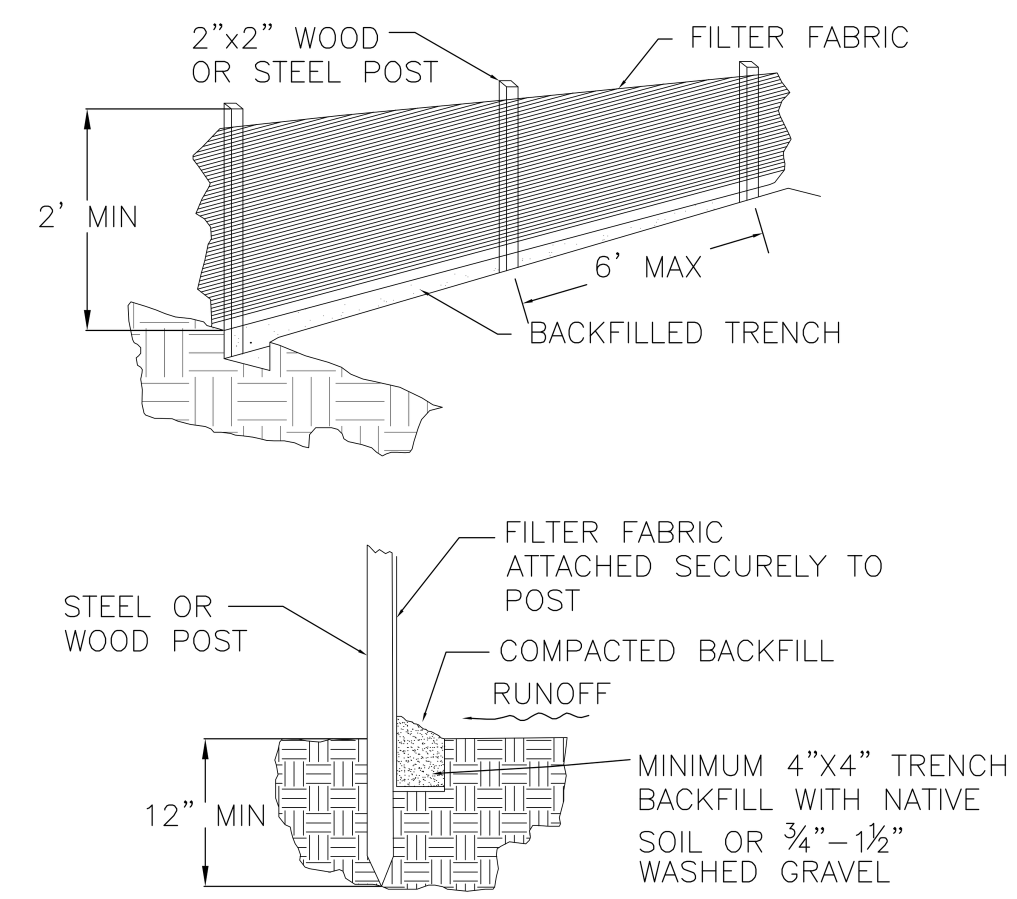
BN050-19390-200

CURRENT DATE 2/--/06

SKYKOMISH LEVEE REMEDIATION

SEDIMENT AND EROSION CONTROL DETAILS
SHEET 2 OF 3

DRAWING NO. C-12 REVISION B



GENERAL NOTES:

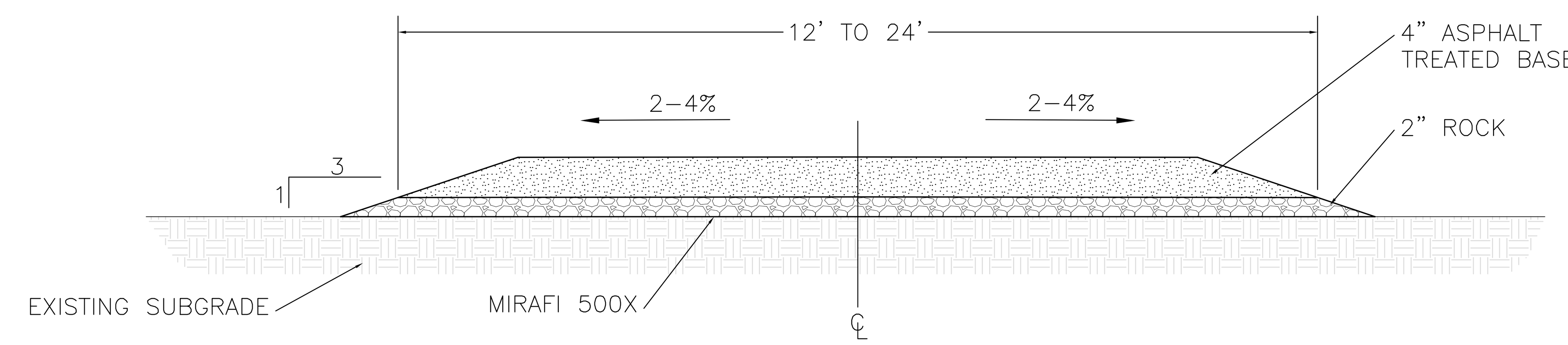
1. BACK FILTER FABRIC WITH 2"x2"x14 GAUGE WIRE OR EQUIVALENT, IF STANDARD STRENGTH FABRIC IS USED. POST SPACING MAY BE INCREASED TO 8' IF WIRE BACKING IS USED.

2. JOINTS IN FILTER FABRIC SHALL BE SPLICED AT POSTS. USE STAPLES, WIRE RINGS OR EQUIVALENT TO ATTACH FABRIC TO POSTS.

3. THE MAXIMUM TRIBUTARY AREA IS LIMITED TO 0.25 ACRES PER 100 FEET OF FENCE.

4. INSPECT AND REPAIR FENCE EVERY 7 CALENDAR DAYS AND AFTER EACH STORM EVENT. REMOVE SEDIMENT WHEN ONE HALF THE HEIGHT OF THE FENCE HAS BEEN FILLED. REMOVED SEDIMENT SHALL BE DEPOSITED IN STOCKPILE AREA FOR DISPOSAL.

1 / C-9 SILT FENCE
SCALE: NTS



2 / C-8 TEMPORARY ACCESS ROAD
SCALE: NTS

NOTES:

1. TEMPORARY ROAD WIDTH SHALL BE 12'–0" FOR ONE–WAY LOOP AND 24"–0" FOR SITE ACCESS ROAD. ACTUAL PLACEMENT WILL BE DETERMINED BASED ON SITE CONDITIONS. CONTRACTOR SHALL DETERMINE FINAL LOCATION OF ROADWAY WITH APPROVAL BY SITE ENGINEER.

2. EXISTING SUBGRADE SHALL BE FREE OF ANGULAR PROTRUSIONS AND COMPACTED TO A FIRM UNYIELDING SURFACE PRIOR TO PLACEMENT OF GEOTEXTILE.

3. GEOTEXTILE SHALL BE WOVEN AS DETAILED IN SPECIFICATIONS PLACED WITH MINIMUM 18"–24" OVERLAPPING SECTIONS PER MANUFACTURER'S RECOMMENDATIONS.

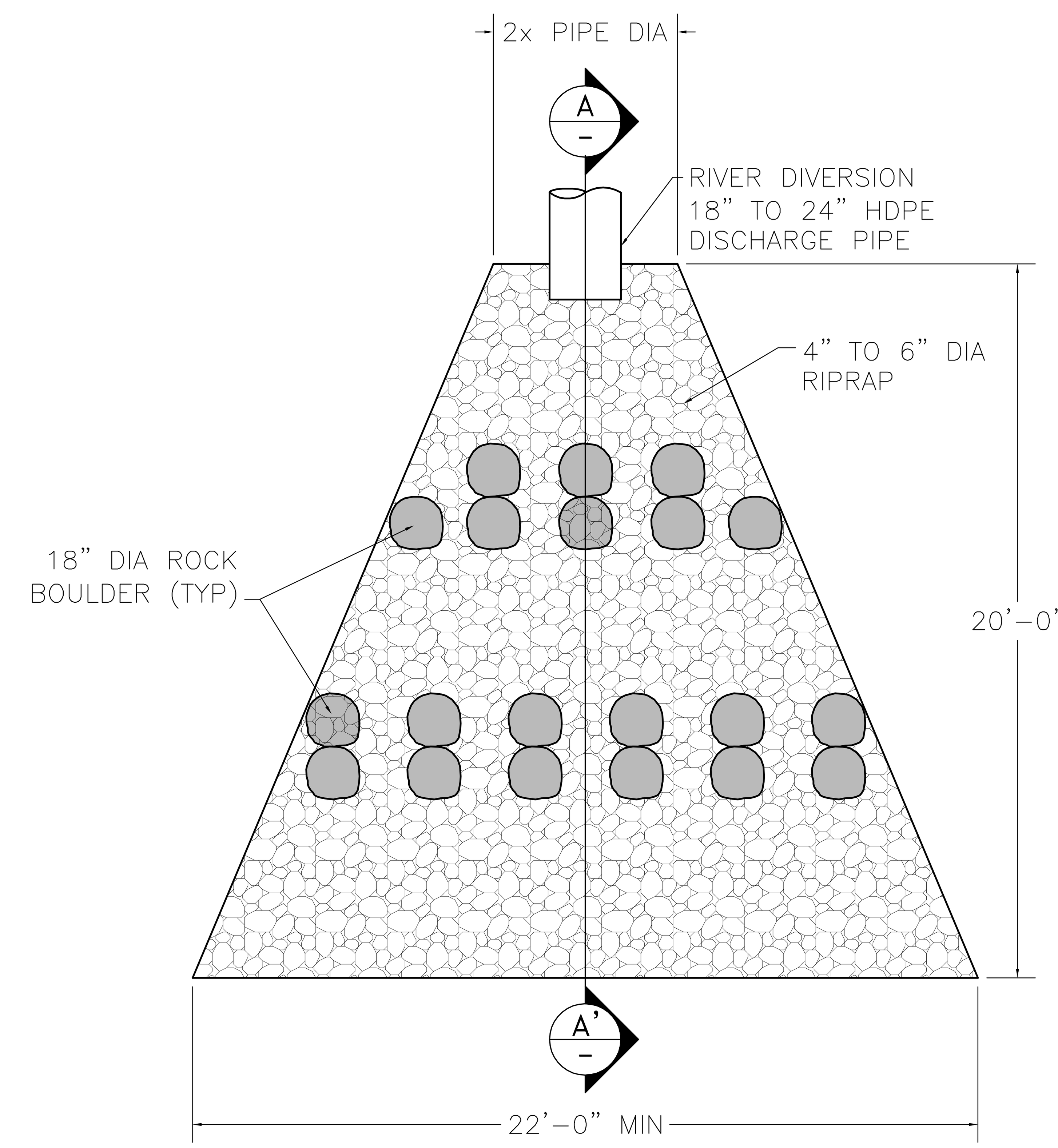
4. ROADBASE SHALL BE A FREE DRAINING, EASILY COMPACTED AGGREGATE (GRAVEL OR CRUSHED STONE).

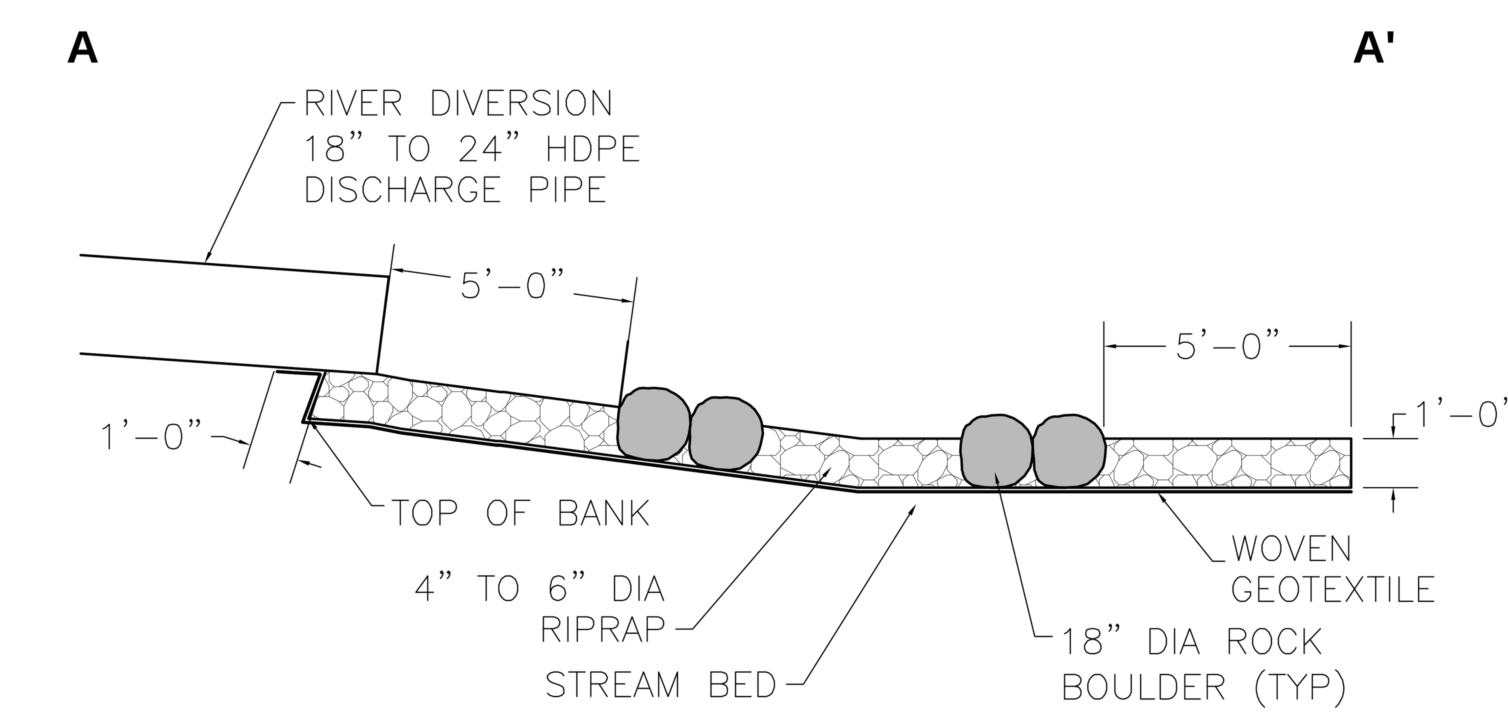
5. TEMPORARY ROAD SHALL BE GRADED TO POSITIVELY DRAIN FROM THE CENTERLINE AT A 2% TO 4% SLOPE.

6. TEMPORARY ROAD SHALL BE INSPECTED REGULARLY. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL MAINTENANCE TO BE PERFORMED FOR THE DURATION OF THE PROJECT.

7. IN AREAS WHERE THE TEMPORARY ACCCESS ROAD RUNS WITHIN THE DRIPLINE OF TREES, 4" OF MULCH SHALL BE PLACED BENEATH THE WOVEN GEOTEXTILE.

8. AS PART OF SITE RESTORATION, REMOVE AND RESTORE TO EXISTING CONDITIONS.





3 / C-9 TEMPORARY ENERGY DISSIPATION STRUCTURE
SCALE: NTS

DRAFT BID SET

RETEC

NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE
B	RCW	2/--/06	ISSUED FOR PRELIMINARY BID				
A	RCW	1/17/06	60% DRAWINGS – NOT FOR CONSTRUCTION				

THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON

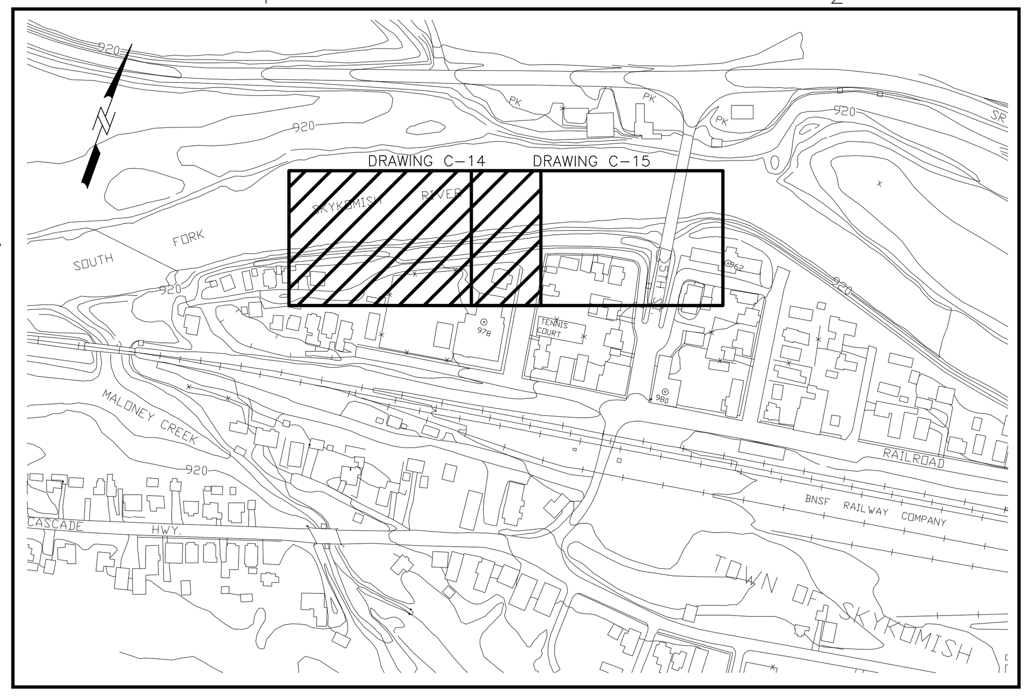
BN050-19390-200

CURRENT DATE 2/--/06

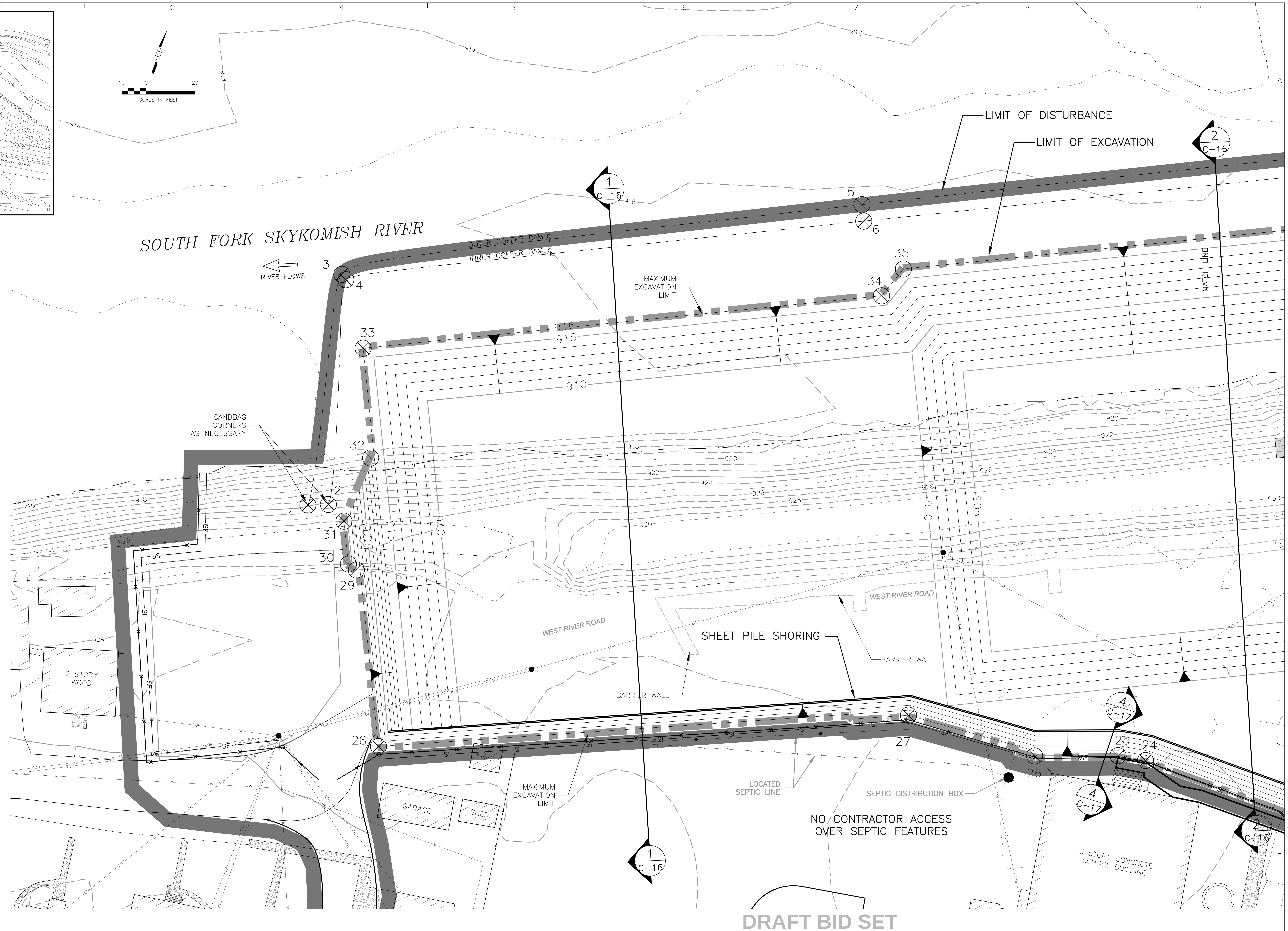
SKYKOMISH LEVEE REMEDIATION

SEDIMENT AND EROSION CONTROL DETAILS
SHEET 3 OF 3

DRAWING NO. C-13 REVISION B



DRAWING LOCATION



POINT LOCATION TABLE

POINT ID	NORTHING	EASTING
1	259293.17	1509815.68
2	259296.24	1509823.45
3	259386.45	1509796.48
4	259384.94	1509798.73
5	259485.85	1509986.39
6	259479.77	1509989.34
7	259597.02	1510225.61
8	259590.09	1510228.07
9	259658.02	1510420.73
10	259651.30	1510421.06
11	259649.10	1510448.89
12	259643.39	1510444.04
13	259633.10	1510463.69
14	259628.74	1510460.40
15	259589.95	1510474.01
16	259545.74	1510502.82
17	259518.67	1510506.68
18	259508.59	1510500.54
19	259402.17	1510514.19
20	259392.41	1510460.47
21	259383.18	1510387.35
22	259329.16	1510355.62
23	259312.35	1510260.12
24	259312.15	1510172.82
25	259310.15	1510161.63
26	259298.42	1510129.62
27	259296.40	1510075.53
28	259210.35	1509876.49
29	259275.03	1509843.36
30	259276.18	1509839.46
31	259292.00	1509831.77
32	259319.99	1509833.17
33	259361.07	1509814.98
34	259453.59	1510006.63
35	259466.94	1510011.29
36	259578.96	1510243.31
37	259546.12	1510256.40
38	259594.90	1510334.06
39	259632.13	1510369.28
40	259645.19	1510419.71
41	259614.56	1510456.73

RETEC

NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE
B	RCW	2/--/06	ISSUED FOR PRELIMINARY BID				
A	A.S.	1/13/06	60% DRAWINGS – NOT FOR CONSTRUCTION	J.S.	1/13/06		

THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON
BN050-19390-200

CURRENT DATE 2/--/06

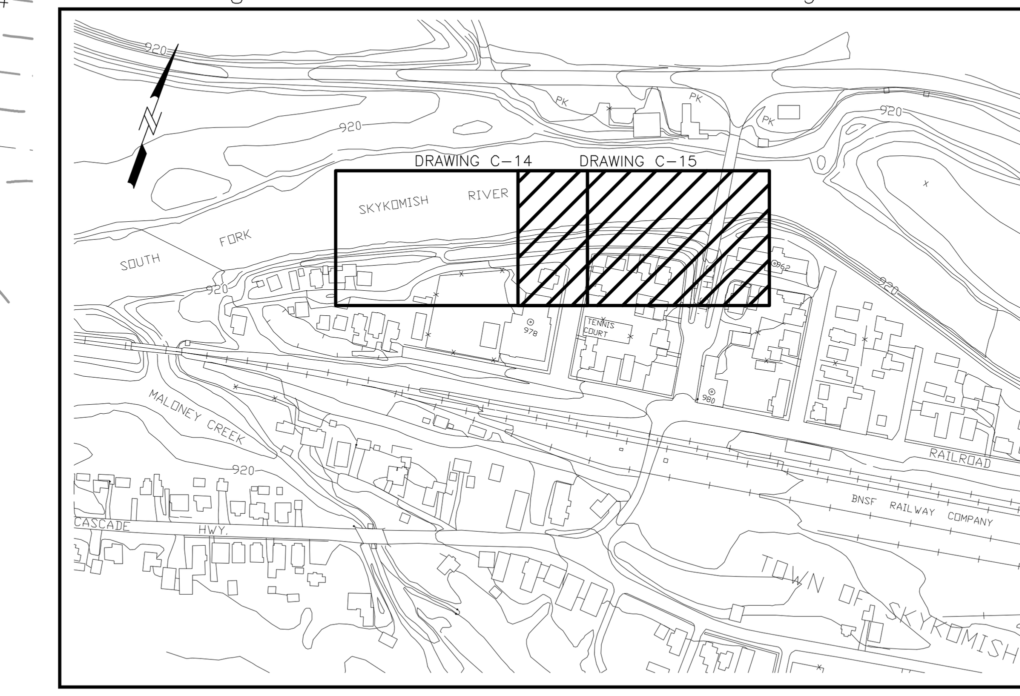
SKYKOMISH LEVEE REMEDIATION

EXCAVATION PLAN WEST

DRAWING NO. C-14 REVISION B

NOTES:

1. INSTALL ROW OF 36-INCH ROCK TO FORM 2-FOOT TOE LEDGE. ROCKS WILL BE STAGGERED SUCH THAT EVERY THREE ARE SHIFTED ONE FOOT IN OR OUT FROM THE ADJACENT THREE, FORMING A SIMIANS SHORELINE. (SEE DETAIL C-18).



DRAWING LOCATION

POINT LOCATION TABLE

POINT ID	NORTHING	EASTING
1	259293.17	1509815.68
2	259296.24	1509823.45
3	259386.45	1509796.48
4	259384.94	1509798.73
5	259485.85	1509986.39
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9	259658.02	1510420.73
10	259651.30	1510421.06
11	259649.10	1510448.89
12	259643.39	1510444.04
13	259633.10	1510463.69
14	259628.74	1510460.40
15	259589.95	1510474.01
16	259545.74	1510502.82
17	259518.67	1510506.68
18	259508.59	1510500.54
19	259402.17	1510514.19
20	259392.41	1510460.47
21	259383.18	1510387.35
22	259329.16	1510355.62
23	259312.35	1510260.12
24	259312.15	1510172.82
25	259310.15	1510161.63
26	259298.42	1510129.62
27	259296.40	1510075.53
28	259210.35	1509876.49
29	259275.03	1509843.36
30	259276.18	1509839.46
31	259292.00	1509831.77
32	259319.99	1509833.17
33	259361.07	1509814.98
34	259453.59	1510006.63
35	259466.94	1510011.29
36	259578.96	1510243.31
37	259546.12	1510256.40
38	259594.90	1510334.06
39	259632.13	1510369.28
40	259645.19	1510419.71
41	259614.56	1510456.73

DRAFT BID SET

RETEC

NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE
B	RCW	2/--/06	ISSUED FOR PRELIMINARY BID				
A	A.S.	1/13/06	60% DRAWINGS - NOT FOR CONSTRUCTION	J.S.	1/13/06		

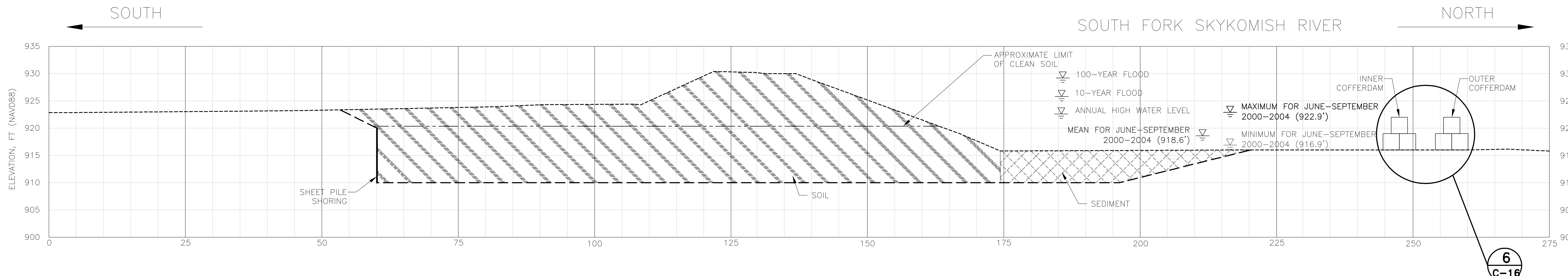
THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON
BN050-19390-200

CURRENT DATE 2/--/06

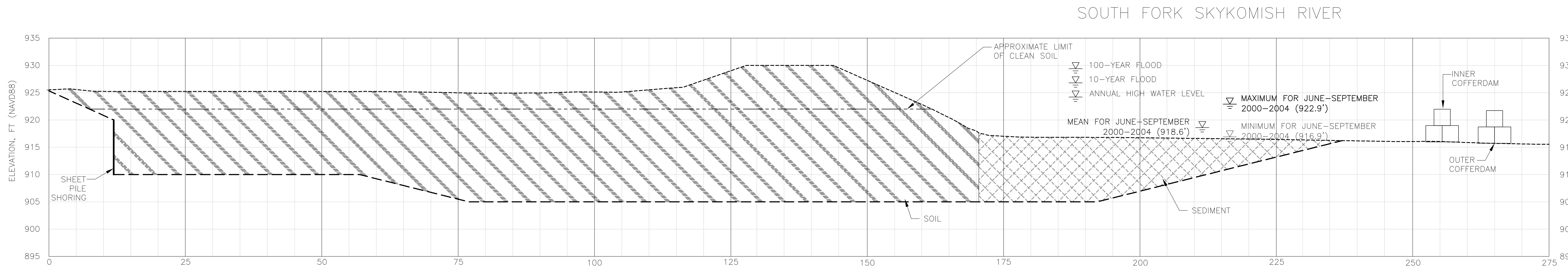
SKYKOMISH LEVEE REMEDIATION

EXCAVATION PLAN EAST

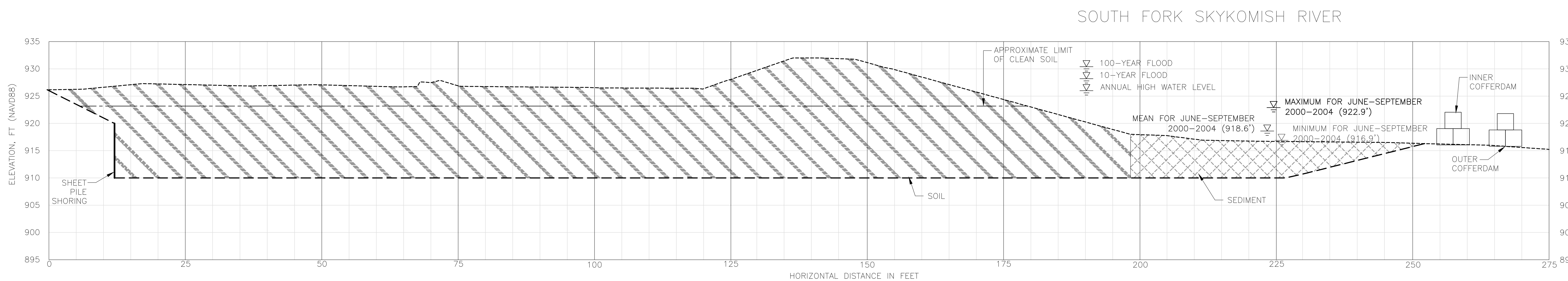
DRAWING NO. C-15 REVISION B



1 C-14 CROSS-SECTION
SCALE: 1"=10'



2 C-15 CROSS-SECTION
SCALE: 1"=10'



3 C-15 CROSS-SECTION
SCALE: 1"=10'

SOIL

SEDIMENT

NOTES:

1. SOIL IS MATERIAL EXCAVATED FROM UNDER LEVEE
2. SEDIMENT IS MATERIAL EXCAVATED FROM UNDER RIVER

5 0 10
SCALE IN FEET

DRAFT BID SET

RETEC

NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE
B	RCW	2/--/06	ISSUED FOR PRELIMINARY BID				
A	A.S.	1/13/06	60% DRAWINGS - NOT FOR CONSTRUCTION	J.S.	1/13/06		

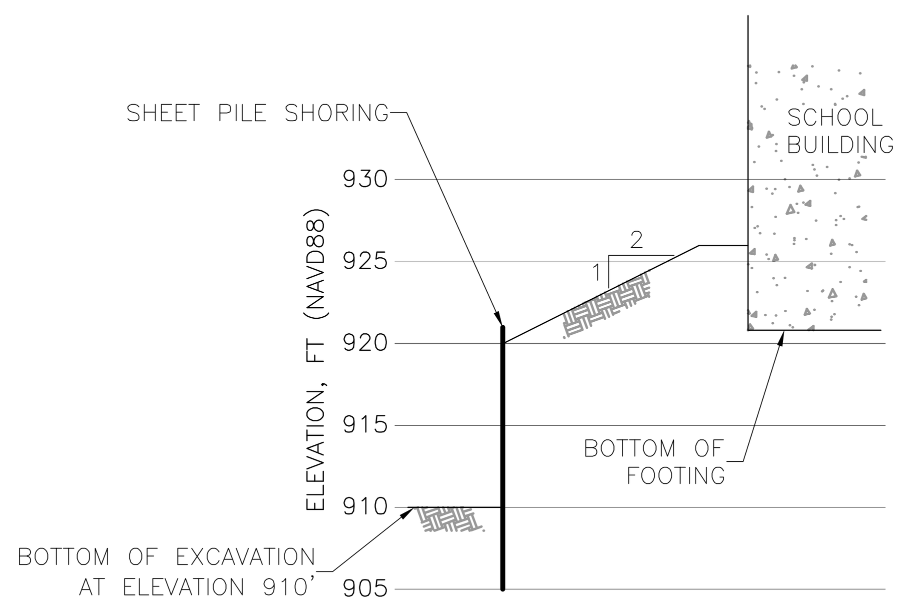
THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON
BN050-19390-200

CURRENT DATE 2/--/06

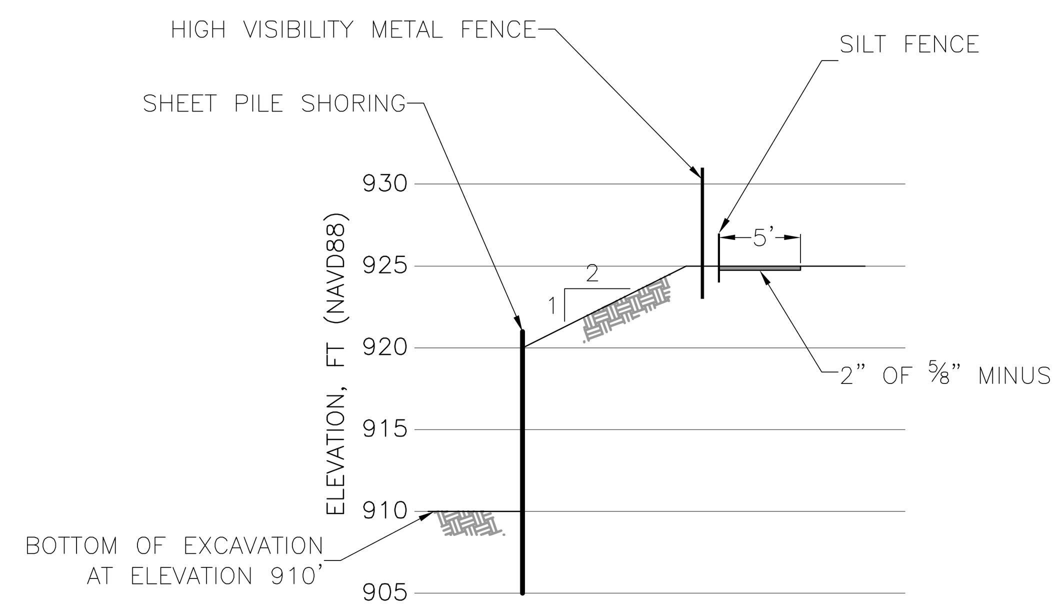
SKYKOMISH LEVEE REMEDIATION

EXCAVATION SECTIONS

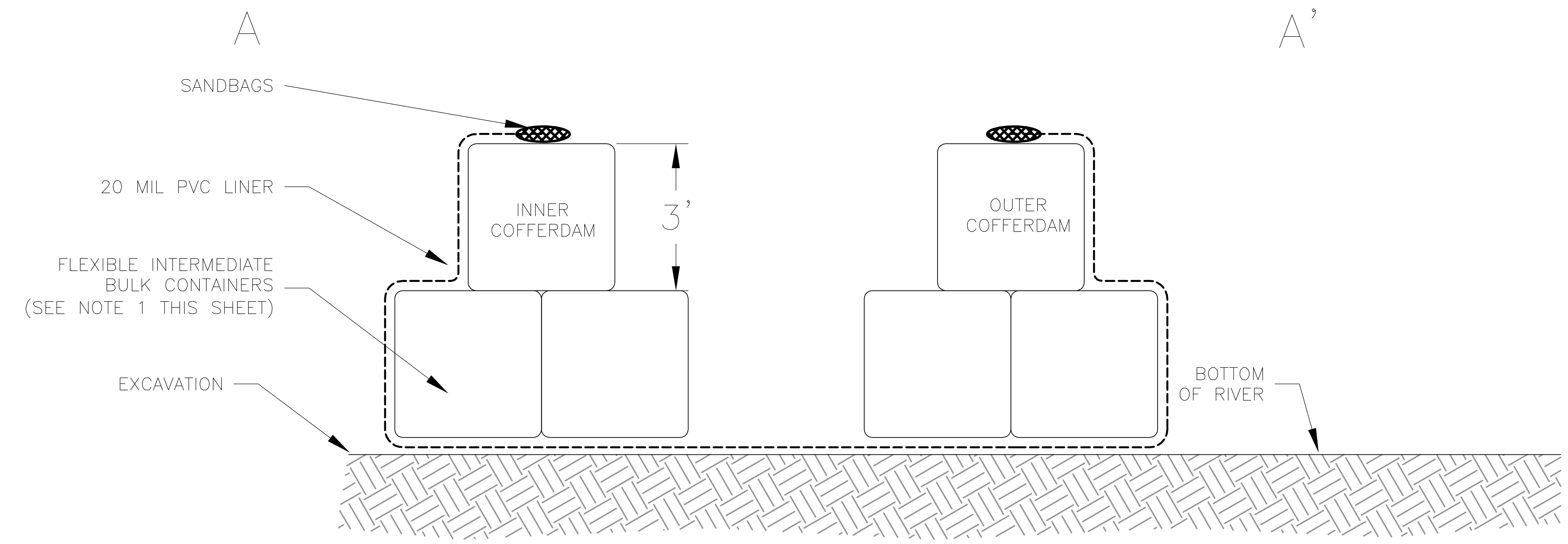
DRAWING NO. C-16 REVISION B



4 / C-15 SHEET PILE SHORING DETAIL
SCALE: 1'=10'



5 / C-15 SHEET PILE SHORING DETAIL
SCALE: 1'=10'



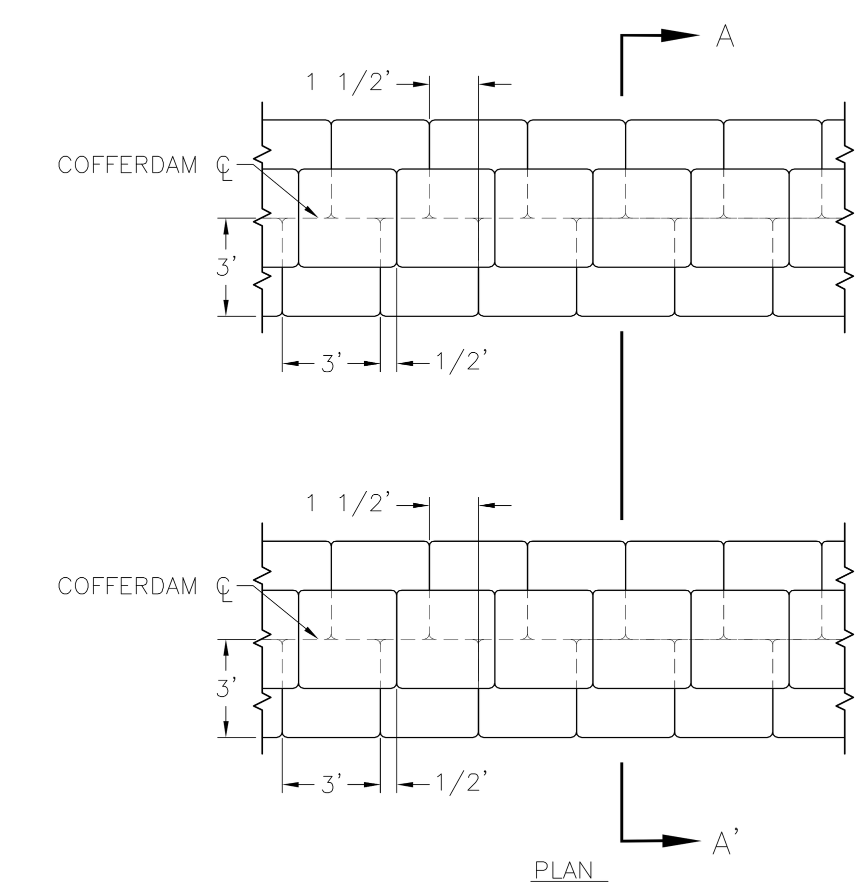
6 / C-16 GEOMEMBRANE DETAIL
SCALE: 1"=2'

SHORING NOTES:

1. SHEET PILE SHORING SHALL BE CONTRACTOR DESIGNED.

2. SHORING WILL REMAIN IN PLACE AFTER THIS PHASE OF CONSTRUCTION AS A BARRIER TO LIMIT RECONTAMINATION OF NEWLY PLACED FILL UNTIL SUBSEQUENT PHASES OF CONSTRUCTION OCCUR.

3. WHERE SHORING CANNOT BE DRIVEN IN PLACE DUE TO SUBSURFACE OBSTRUCTIONS, OBSTRUCTION SHALL BE REMOVED TO ALLOW ADVANCEMENT OF SHORING TO THE DESIGN DEPTHS.



6 / C-16 COFFERDAM DETAIL
SCALE: 1"=5'

COFFERDAM NOTES:

1. 35"X35"X42" (EMPTY) FLEXIBLE INTERMEDIATE BULK CONTAINERS (FIBC) SHALL BE CONSTRUCTED FROM COATED FABRIC WITH A SKIRT TOP AND AN IMPERMEABLE LINER. OVERALL CAPACITY SHALL BE 4,000 POUNDS WITH A 5:1 MINIMUM SAFETY RATING. FILL FIBC WITH SAND AND GRAVEL. (4) LIFTING LOOPS SHALL HAVE A HARNESS FOR CENTER POINT PICK-UP.

2. SANDBAG GAP BETWEEN SHORING AND RIVER BANK AS REQUIRED.

3. STAGGER BASE TWO ROWS OF COFFERDAM ONE-HALF FIBC APART. PLACE FIBC'S TIGHTLY TOGETHER TO FORM A TIGHT SEAM. STAGGER CAP ROW ONE-HALF FOOT TO COVER BASE ROW SEAMS.

DRAFT BID SET

RETEC

NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE
B	RCW	2/--/06	ISSUED FOR PRELIMINARY BID				
A	A.S.	1/13/06	60% DRAWINGS - NOT FOR CONSTRUCTION	J.S.	1/13/06		

THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON
BN050-19390-200

CURRENT DATE 2/--/06

SKYKOMISH LEVEE REMEDIATION

EXCAVATION DETAILS

DRAWING NO. C-17 REVISION B

NOTES:

1. INSTALL ROW OF 36-INCH ROCK TO FORM 2-FOOT TOE LEDGE. ROCKS WILL BE STAGGERED SUCH THAT EVERY THREE ARE SHIFTED ONE FOOT IN OR OUT FROM THE ADJACENT THREE, FORMING A SIMIANS SHORELINE. (SEE DETAIL C-18).

DRAFT BID SET

RETEC

NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE
B	RCW	2/--/06	ISSUED FOR PRELIMINARY BID				
A	A.S.	1/13/06	60% DRAWINGS – NOT FOR CONSTRUCTION	J.S.	1/13/06		

THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON

BN050-19390-200

CURRENT DATE 2/--/06

SKYKOMISH LEVEE REMEDIATION

FINAL GRADING PLAN WEST

DRAWING NO. C-18

REVISION B

NOTES:

1. INSTALL ROW OF 36-INCH ROCK TO FORM 2-FOOT TOE LEDGE. ROCKS WILL BE STAGGERED SUCH THAT EVERY THREE ARE SHIFTED ONE FOOT IN OR OUT FROM THE ADJACENT THREE, FORMING A SIMIANS SHORELINE. (SEE DETAIL C-18).

DRAFT BID SET

RETEC

NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE
B	RCW	2/--/06	ISSUED FOR PRELIMINARY BID				
A	A.S.	1/13/06	60% DRAWINGS – NOT FOR CONSTRUCTION	J.S.	1/13/06		

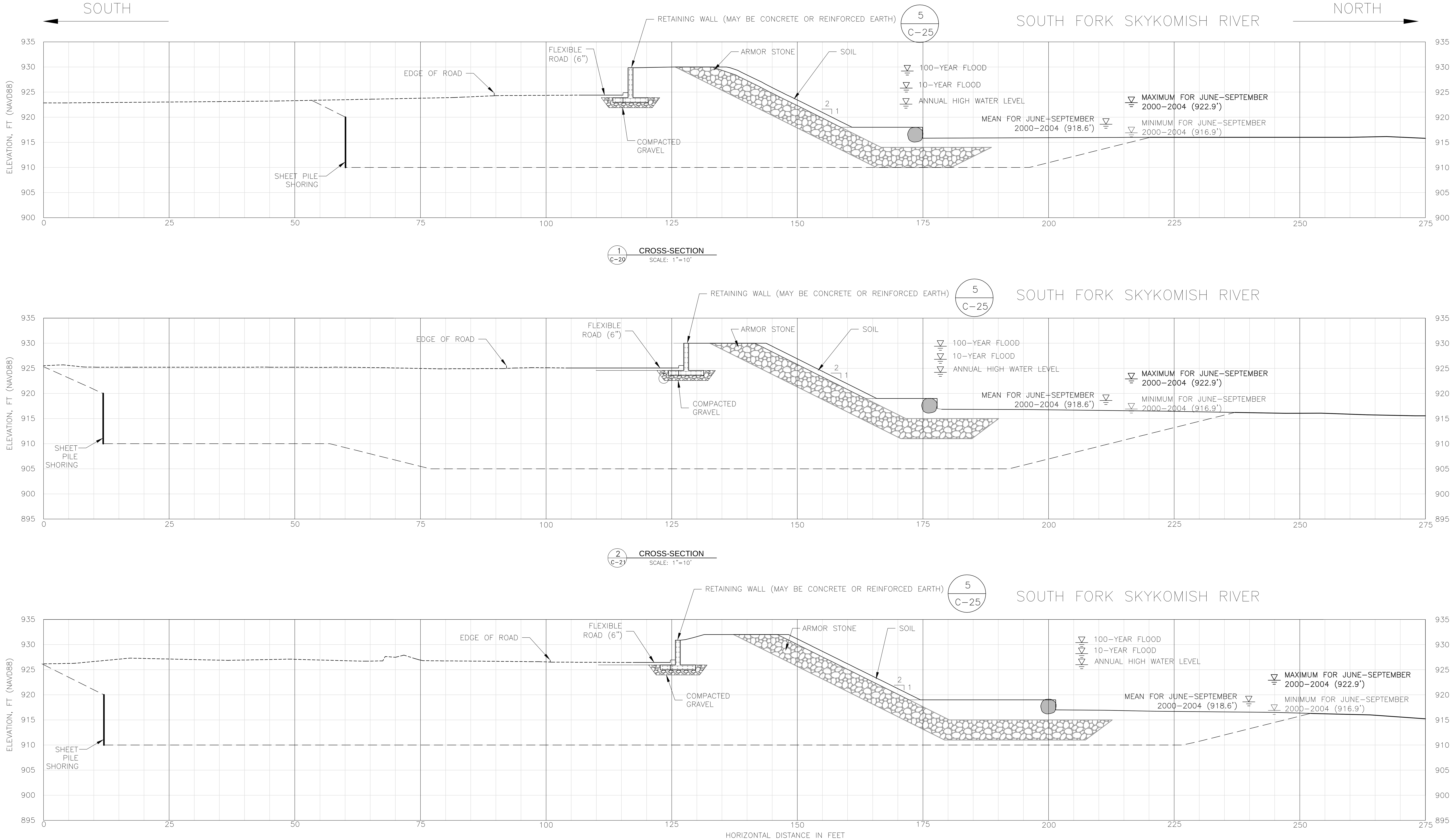
THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON
BN050-19390-200

CURRENT DATE 2/--/06

SKYKOMISH LEVEE REMEDIATION

FINAL GRADING PLAN EAST

DRAWING NO. C-19 REVISION B



1 C-20 CROSS-SECTION
SCALE: 1"=10'

2 C-21 CROSS-SECTION
SCALE: 1"=10'

3 C-21 CROSS-SECTION
SCALE: 1"=10'

NOTES:

1. SOIL IS MATERIAL EXCAVATED FROM UNDER LEVEE
2. SEDIMENT IS MATERIAL EXCAVATED FROM UNDER RIVER

DRAFT BID SET

5 0 10
SCALE IN FEET

RETEC

NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE
B	RCW	2/--/06	ISSUED FOR PRELIMINARY BID				
A	A.S.	1/13/06	60% DRAWINGS – NOT FOR CONSTRUCTION	J.S.	1/13/06		

THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON
BN050-19390-200

SKYKOMISH LEVEE REMEDIATION

FINAL LEVEE SECTIONS

CURRENT DATE 2/--/06

DRAWING NO. C-20

REVISION B

LEGEND

LIMIT OF DISTURBANCE

15 0 30
SCALE IN FEET

DRAFT BID SET

RETEC

NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE
B	RCW	2/--/06	ISSUED FOR PRELIMINARY BID				
A	RCW	1/17/06	60% DRAWINGS – NOT FOR CONSTRUCTION				

THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON

BN050-19390-200

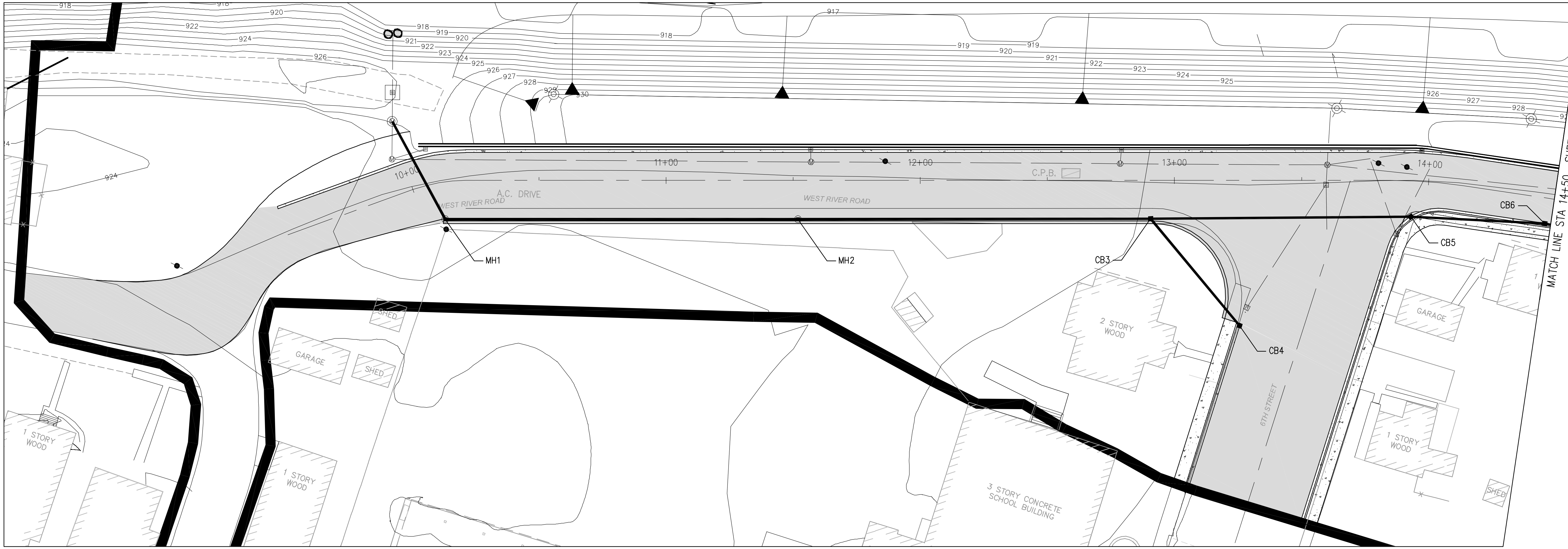
CURRENT DATE 2/--/06

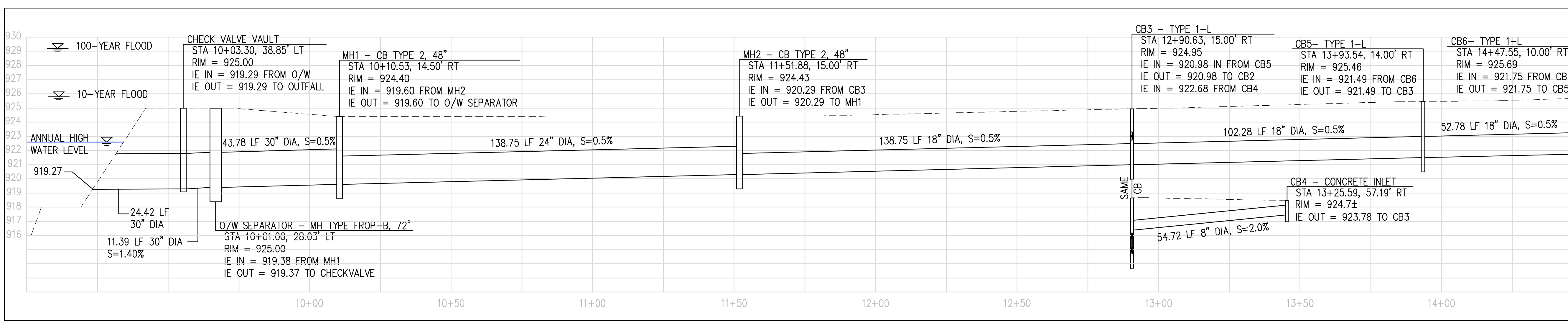
SKYKOMISH LEVEE REMEDIATION

RESTORATION PLAN

DRAWING NO. C-21

REVISION B





60% DRAWINGS - ISSUED FOR BID

NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE
B	RCW	2/--/06	60% DRAWINGS - ISSUED FOR BID				
A	A.S.	1/13/06	60% DRAWINGS - NOT FOR CONSTRUCTION	J.S.	1/13/06		

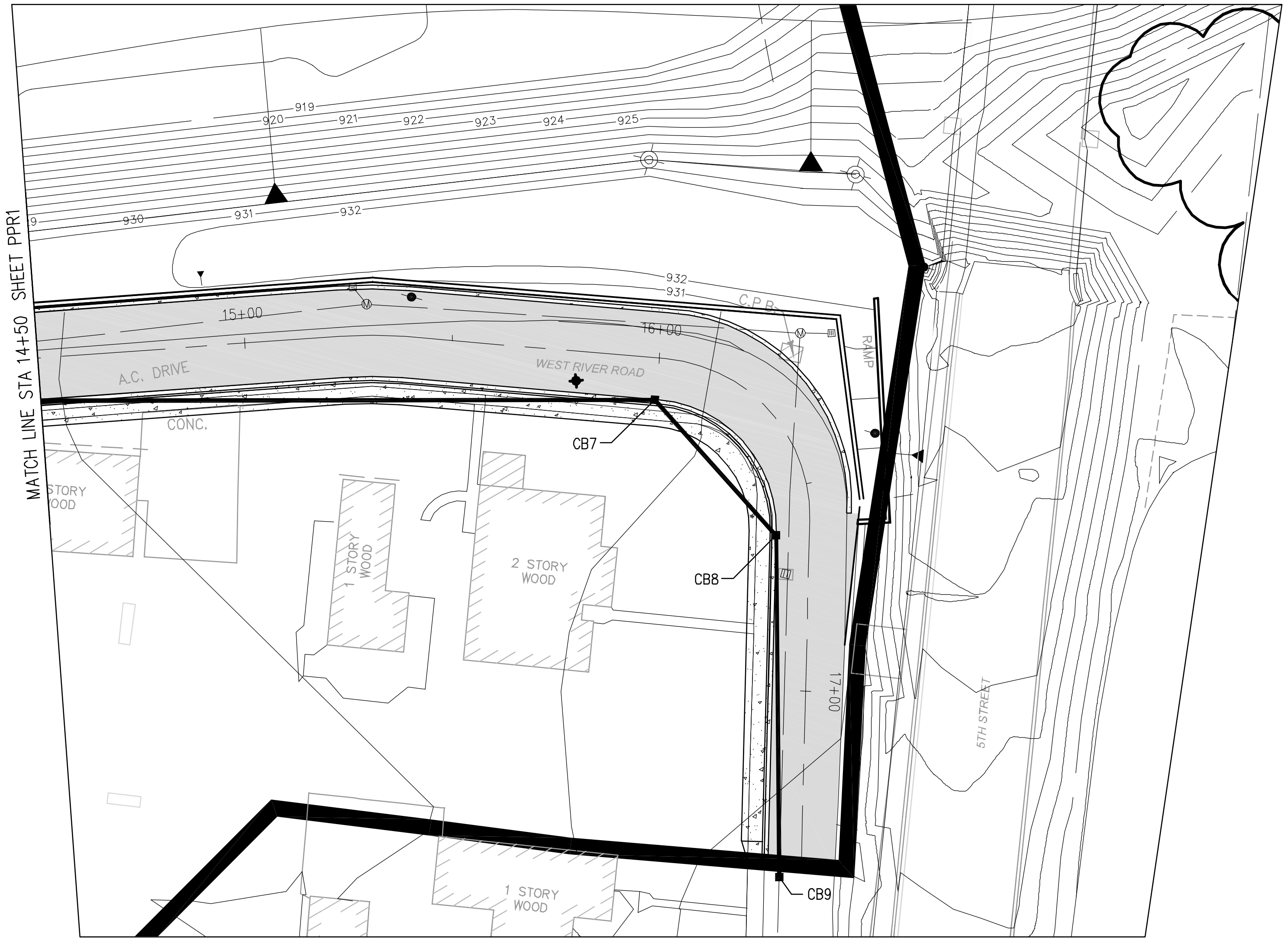
THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON
BN050-16423-520

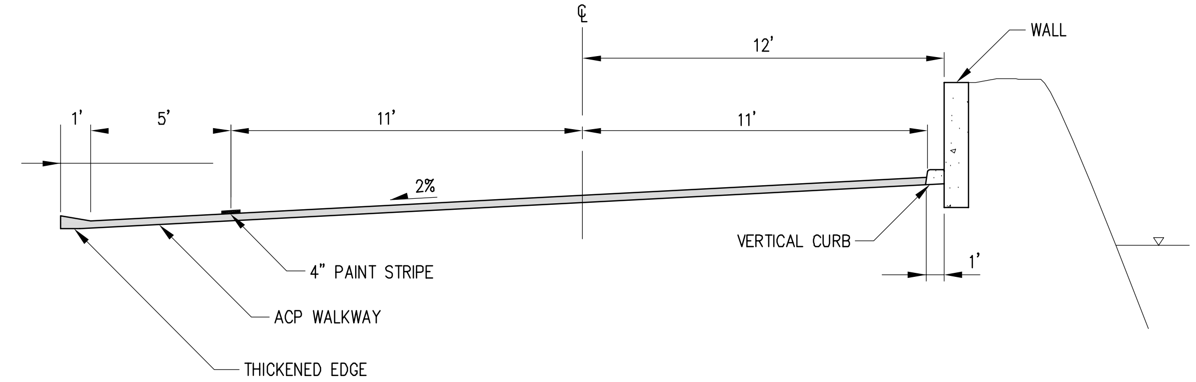
CURRENT DATE 2/14/06

SKYKOMISH LEVEE REMEDIATION

STORM SEWER PROFILE

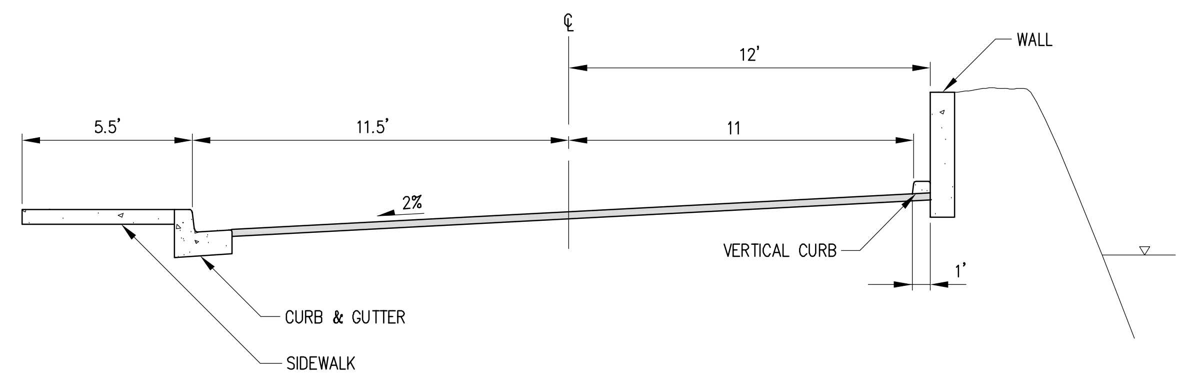
DRAWING NO. C-22 REVISION B





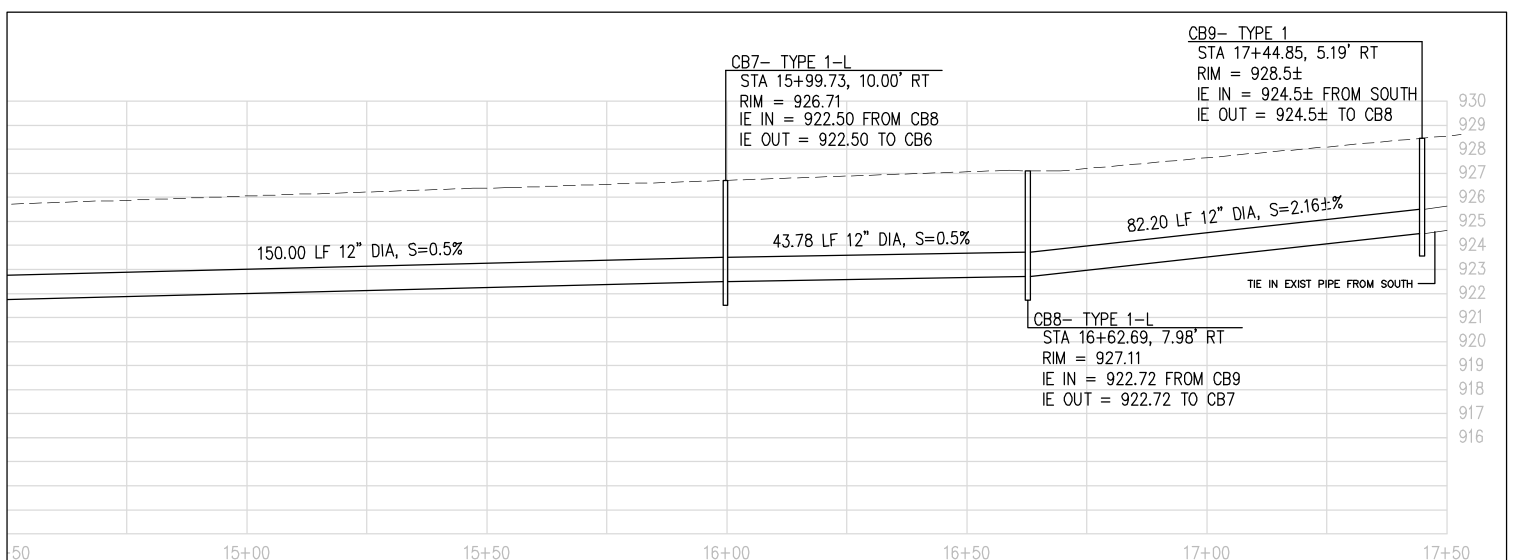
TYPICAL SECTION X

STA 10+00 TO STA 14+00



TYPICAL SECTION A

STA 14+00 TO STA 17+50



STORM DRAIN PROFILE 1:1 H, 1:5 V

60% DRAWINGS - ISSUED FOR BID

RETEC

NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE
B	RCW	2/--/06	60% DRAWINGS – ISSUED FOR BID				
A	A.S.	1/13/06	60% DRAWINGS – NOT FOR CONSTRUCTION	J.S.	1/13/06		

THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON

BN050-16423-520

SKYKOMISH LEVEE REMEDIATION

STORM SEWER PROFILE

CURRENT DATE 2/14/06

DRAWING NO. C-22

REVISION B

TREES	COMMON NAME	SCIENTIFIC NAME	PLANT SIZE	QUANTITY
PN	Pacific ninebark	Physocarpus capitatus	cuttings	24
PW	Pacific willow	Salix lucida var. lucida	cuttings	45
SW	Sitka willow	Salix sitchensis	cuttings	23
BM	Bigleaf maple	Acer macrophyllum	2-gal	18
PD	Pacific dogwood	Cornus nuttalli	2-gal	36
WH	Western hemlock	Tsuga heterophylla	2-gal	15

SHRUBS	COMMON NAME	SCIENTIFIC NAME	PLANT SIZE	QUANTITY
•	Red-Osier Dogwood	Cornus stolonifera	cuttings	29
◂	Salmonberry	Rubus spectabilis	cuttings	95
⋆	Oregon grape	Mahonia nervosa	1-gal	53
○	Sword fern	Polystichum munitum var. munitum	1-gal	147
•	Snowberry	Symphoricarpos albus	1-gal	79

NOTE:

TOTAL NUMBER OF BIG LEAF MAPLE AND WESTERN HEMLOCK MAY BE DECREASED BASED ON REQUESTS FROM THE TOWN OF SKYKOMISH TO ALLOW FOR VIEW CORRIDORS. THESE TWO SPECIES WILL NOT BE DECREASED BY MORE THAN HALF OF THE TOTAL QUANTITY PROPOSED. FINAL LOCATIONS MAY ALSO DIFFER FROM PROPOSED LOCATIONS BASED ON REQUESTS FROM THE TOWN.

15 0 30
SCALE IN FEET

DRAFT BID SET

RETEC

NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE
B	RCW	2/--/06	ISSUED FOR PRELIMINARY BID				
A	A.S.	1/16/06	60% DRAWINGS – NOT FOR CONSTRUCTION	S.A.	1/16/06		

THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON
BN050-19390-200

LANDSCAPE DETAILS/PLANT PLACEMENT

CURRENT DATE 2/--/06 | DRAWING NO. C-24 | REVISION B

DRAFT BID SET

RETEC

NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE
B	RCW	2/--/06	ISSUED FOR PRELIMINARY BID				
A	A.F.	1/27/06	60% DRAWINGS – NOT FOR CONSTRUCTION				

THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON

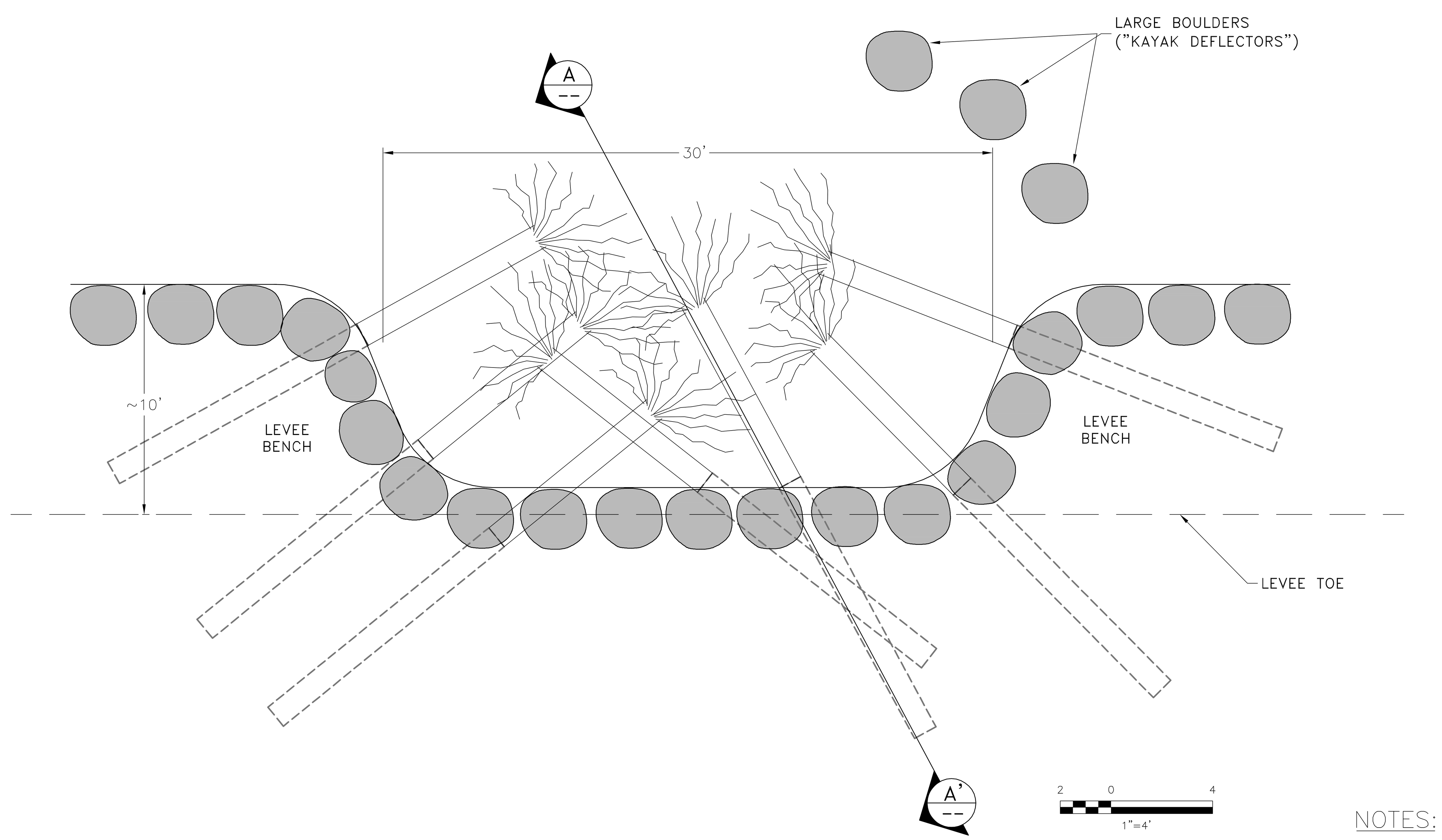
BN050-19390-200

CURRENT DATE 2/--/06

SKYKOMISH LEVEE REMEDIATION

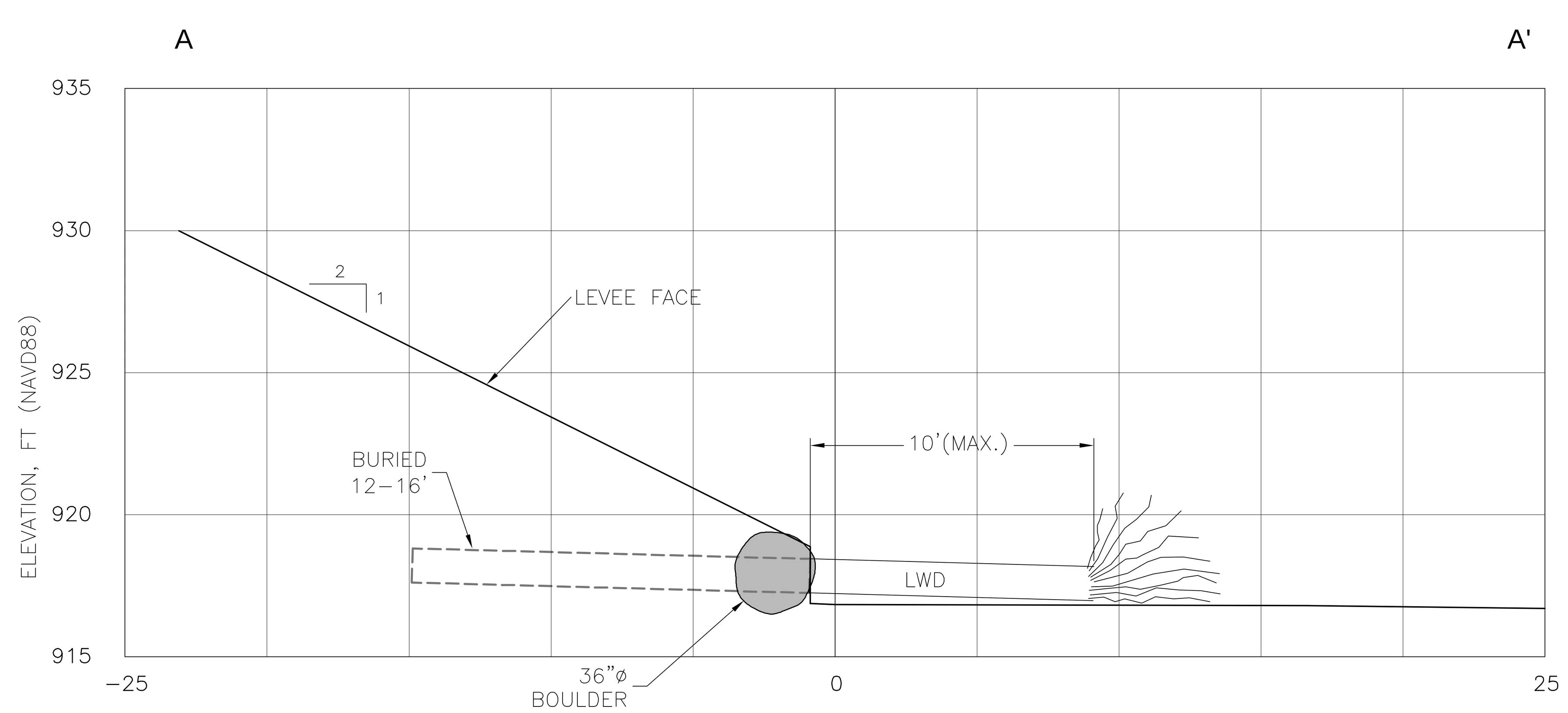
CROSS SECTIONS

DRAWING NO. C-25 REVISION B



NOTES:
1. BOULDER CLUSTER PLACED ONLY ON UPSTREAM LWD CLUSTER.

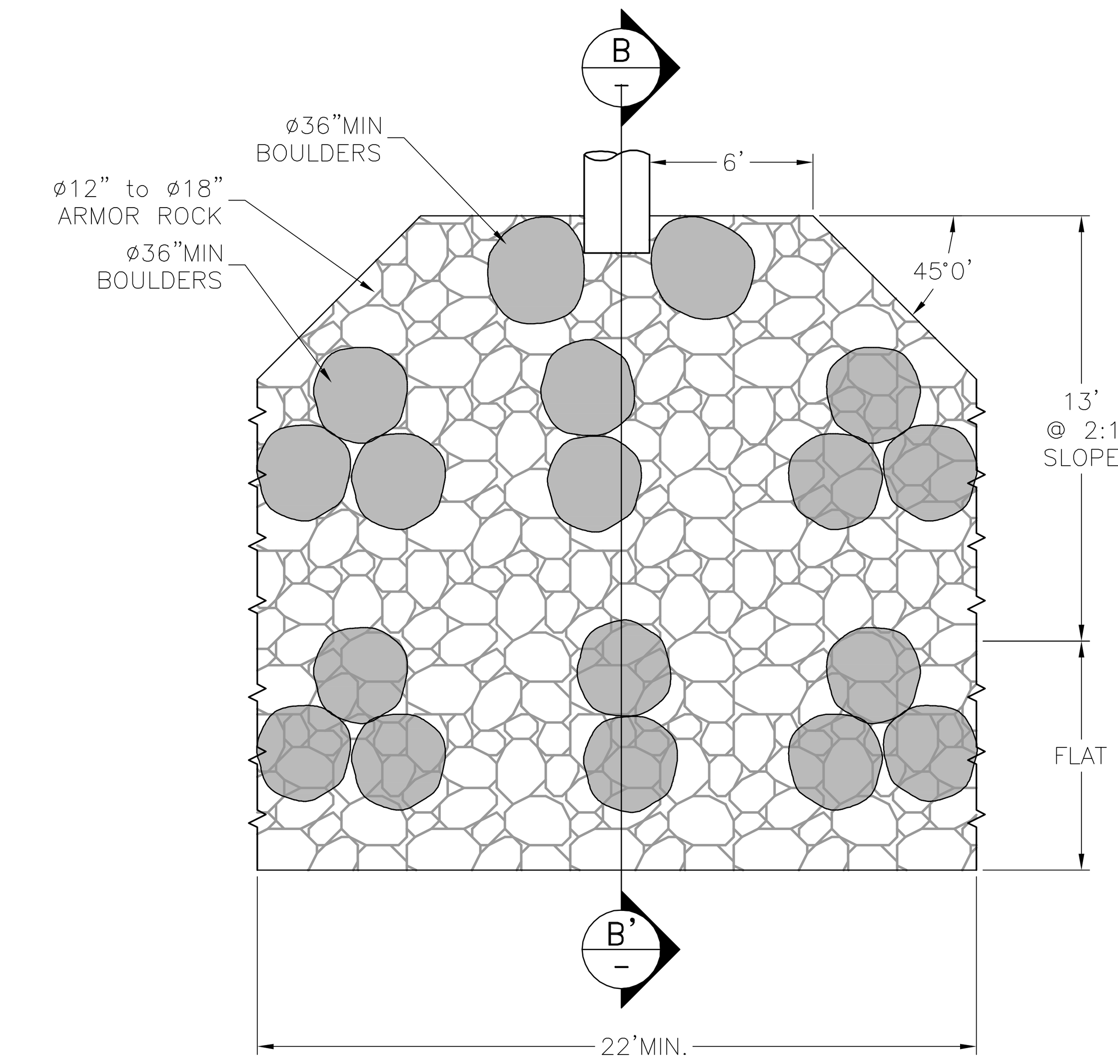
PLAN VIEW



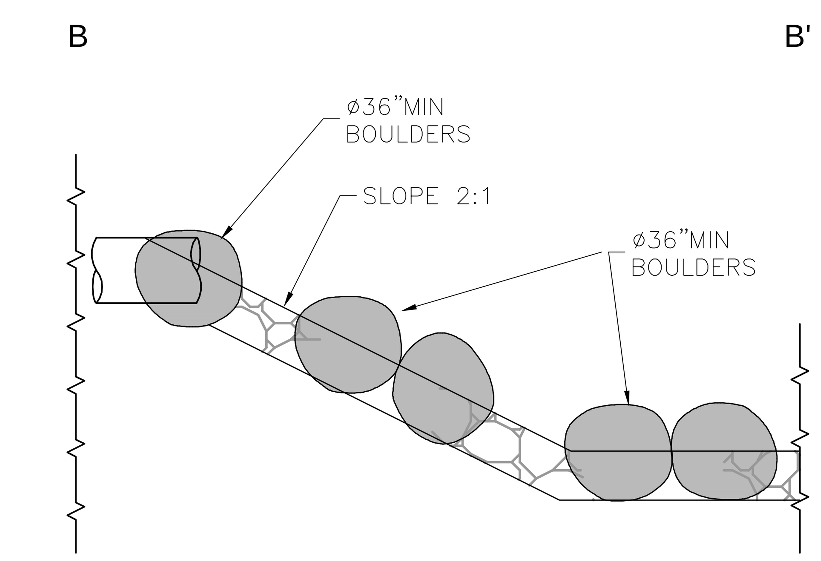
SECTION A–A'

1 C–21 LWD CLUSTER (TYP.)

SCALE 1"=4'



PLAN VIEW



SECTION B–B'

2 C–20 OUTFALL PIPE END

N.T.S.

DRAFT BID SET

RETEC

NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE
B	RCW	2/--/06	ISSUED FOR PRELIMINARY BID				
A	A.S.	1/13/06	60% DRAWINGS – NOT FOR CONSTRUCTION	J.S.	1/13/06		

THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON

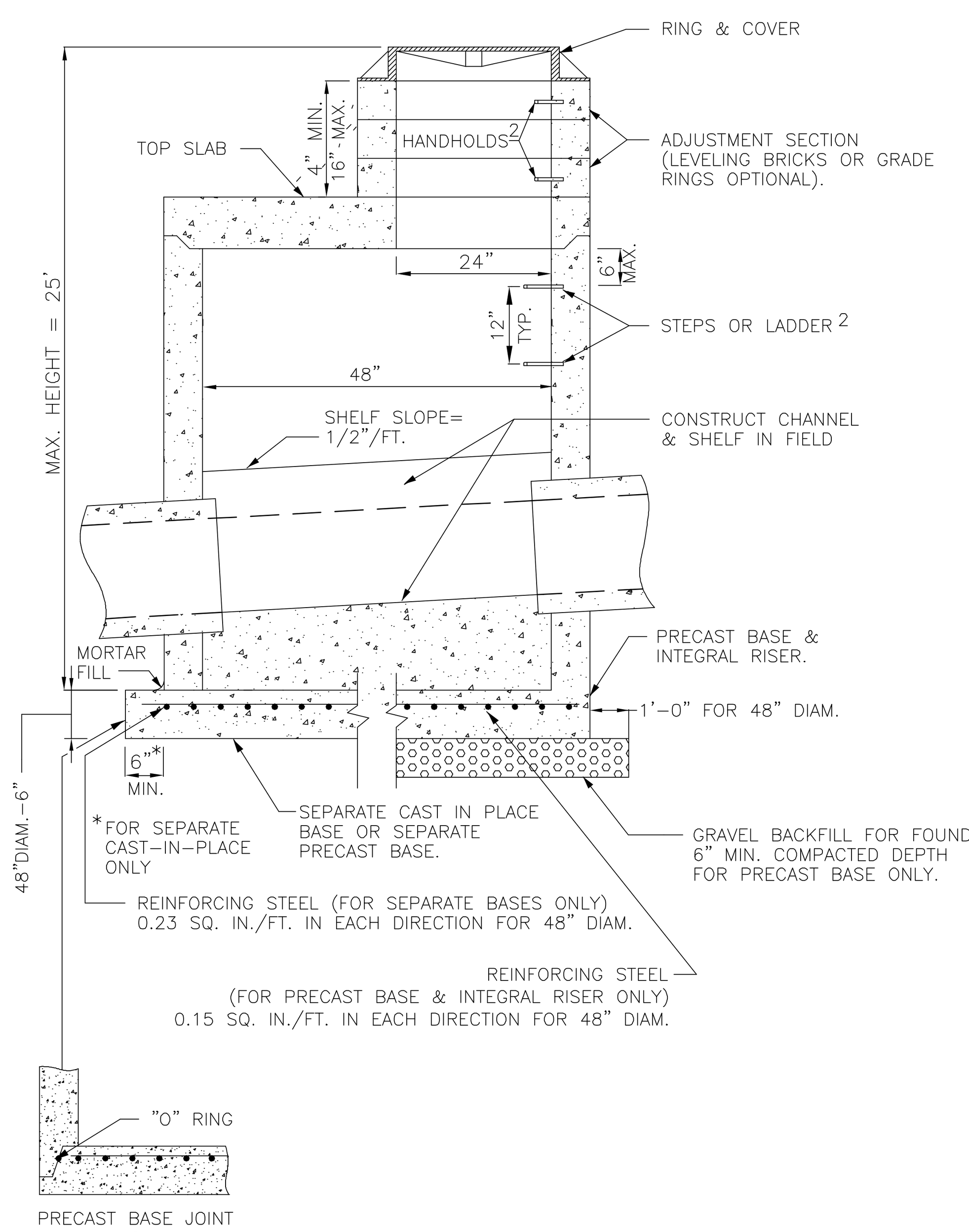
BN050-19390-200

CURRENT DATE 2/--/06

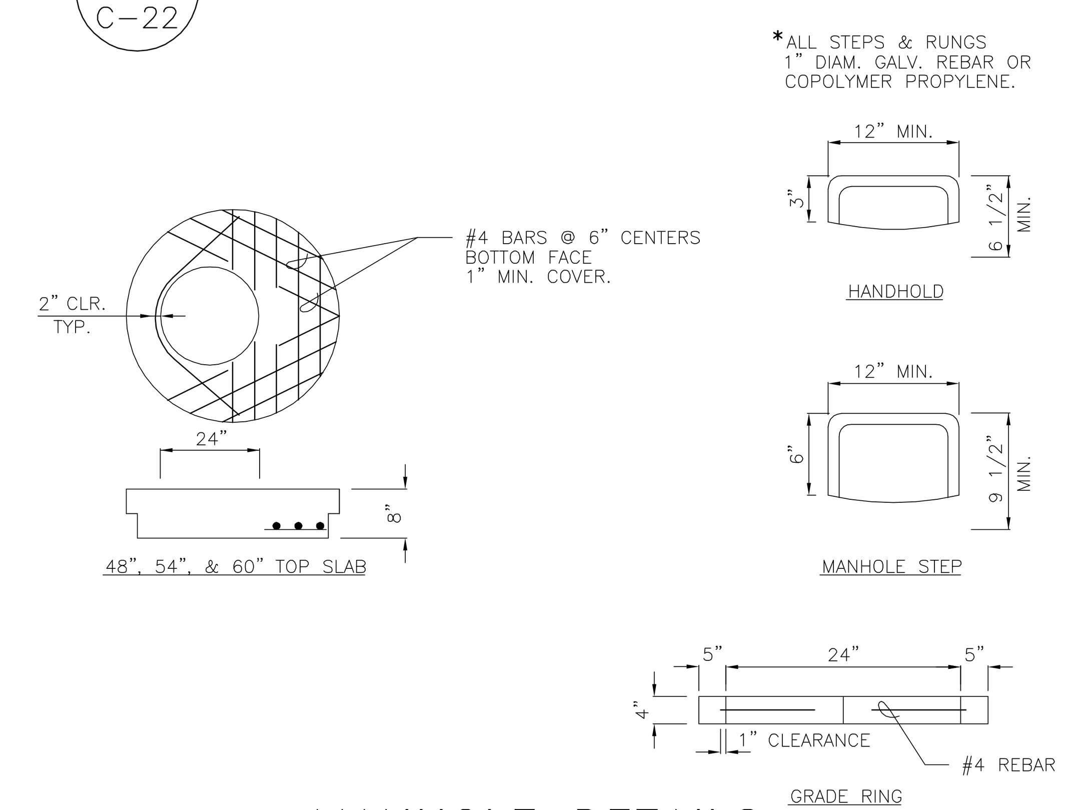
SKYKOMISH LEVEE REMEDIATION

FINAL LEVEE DETAILS

DRAWING NO. C-26 REVISION B



1 C-22 MANHOLE TYPE 3 (48")



MANHOLE DETAILS

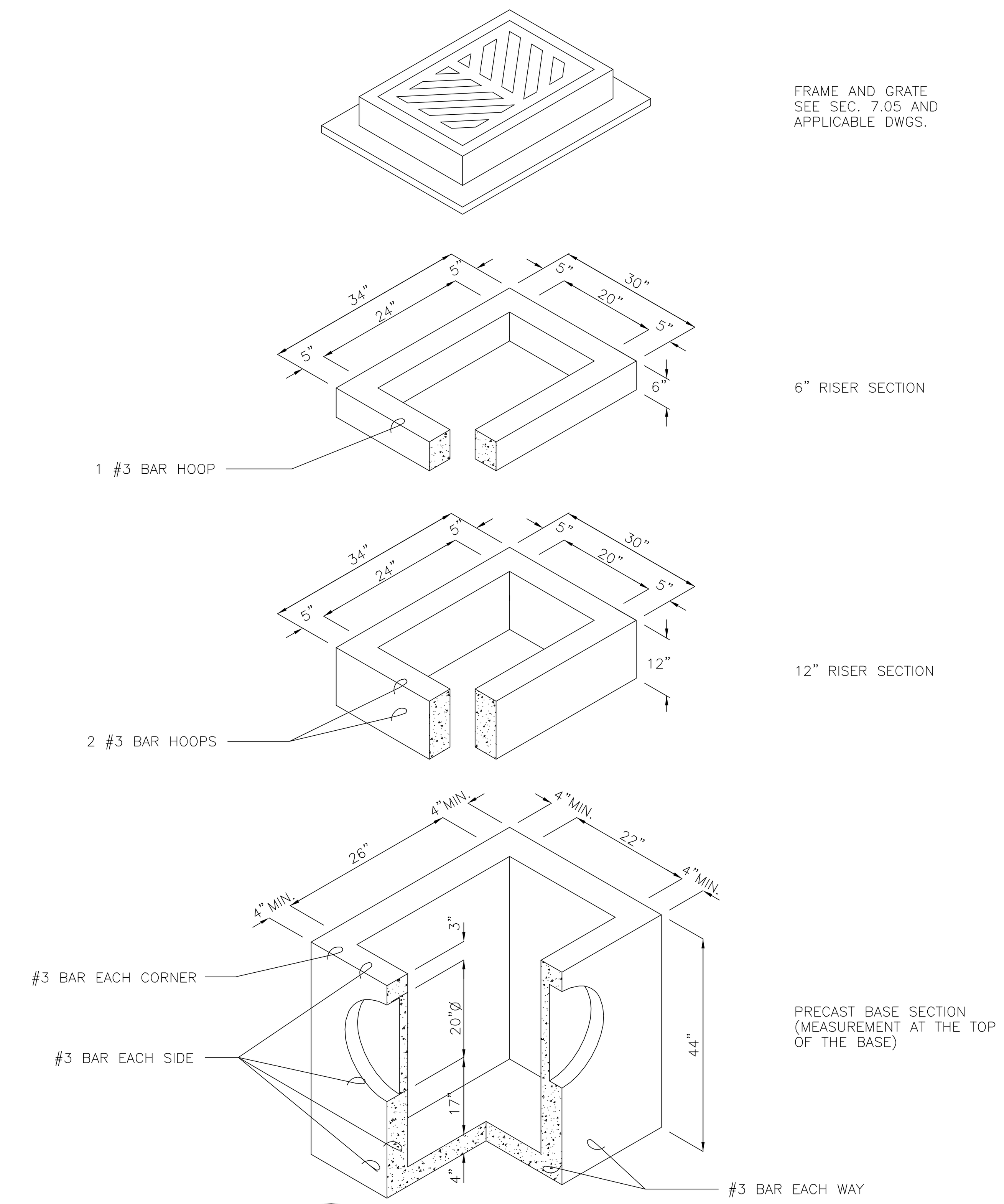
MANHOLE:

1. MANHOLES SHALL BE CONSTRUCTED IN ACCORDANCE WITH AASHTO M199 UNLESS OTHERWISE SHOWN ON PLANS OR NOTED IN THE WSDOT/APWA STANDARD SPECIFICATIONS.
2. HANDHOLDS IN ADJUSTMENT SECTION SHALL HAVE 3" MIN. CLEARANCE. STEPS IN MANHOLE SHALL HAVE 6" MIN. CLEARANCE. HANDHOLDS SHALL BE PLACED IN ALTERNATING GRADE RINGS OR LEVELING BRICK COURSE WITH A MIN. OF ONE HANDHOLD BETWEEN THE LAST STEP AND THE TOP OF THE MANHOLE.
3. PROPRIETARY MANHOLE HANDHOLDS AND STEPS ARE ACCEPTABLE, PROVIDED THAT THEY CONFORM TO SEC. R, ASTM C478, AASHTO M199 AND MEET ALL WISHA REQUIREMENTS.
4. MANHOLE STEP/HANDHOLD LEGS SHALL BE PARALLEL OR APPROXIMATELY RADIAL AT THE OPTION OF THE MANUFACTURER, EXCEPT THAT ALL STEPS IN ANY MANHOLE SHALL BE SIMILAR. PENETRATION OF OUTER WALL BY A LEG IS PROHIBITED.
5. HANDHOLDS AND STOPS SHALL HAVE "DROP" RUNGS OR PROTUBERANCES TO PREVENT SIDEWAYS SLIP.
6. LADDERS OR STEPS SHALL EXTEND TO WITHIN 16" OF BOTTOM OF MANHOLE.
7. ALL REINFORCED CAST-IN-PLACE CONCRETE SHALL BE CLASS 4000. NON-REINFORCED CONCRETE IN CHANNEL AND SHELF SHALL BE CLASS 3000. ALL PRECAST CONCRETE SHALL BE CLASS 4000.
8. PRECAST BASES SHALL BE FURNISHED WITH CUTOUTS OR KNOCKOUTS. KNOCKOUTS SHALL HAVE WALL THICKNESS OF 2" MIN. UNUSED KNOCKOUTS NEED NOT BE GROUTED IF WALL IS LEFT INTACT. PIPES SHALL BE INSTALLED IN FACTORY KNOCKOUTS UNLESS OTHERWISE APPROVED BY THE ENGINEER.
9. KNOCKOUT OR CUTOUT HOLE SIZE SHALL EQUAL PIPE OUTER DIAM. PLUS MANHOLE WALL THICKNESS. MAX. HOLE SIZE SHALL BE 36" FOR 48" M.H., 42" FOR 54" M.H., 48" FOR 60" M.H., 60" FOR 72" M.H., 84" FOR 96" M.H. MIN. DISTANCE BETWEEN HOLES SHALL BE 8" FOR 48", 54", AND 60" M.H., 12" FOR 72" AND 96" M.H.
10. MANHOLE RINGS AND COVERS SHALL BE IN ACCORDANCE WITH SEC. 7.05 AND MEET THE STRENGTH REQUIREMENTS OF FEDERAL SPECIFICATION RR-F-621D. MATING SURFACES SHALL BE FINISHED TO ASSURE NON-ROCKING FIT WITH ANY COVER POSITION.
11. ALL BASE REINFORCING STEEL SHALL HAVE A MIN. YIELD STRENGTH OF 60,000 PSI AND BE PLACED IN THE UPPER HALF OF THE BASE WITH 1" MIN. CLEARANCE.
12. FOR HEIGHTS OF 12' OR LESS, MIN. SOIL BEARING VALUE SHALL EQUAL 3,300 POUNDS PER SQUARE FOOT. FOR HEIGHTS OVER 12', MIN. SOIL BEARING VALUE SHALL EQUAL 3,800 POUNDS PER SQUARE FOOT.
13. SEE THE WSDOT/APWA STANDARD SPECIFICATIONS SEC. 7-05.3 FOR JOINT REQUIREMENTS.

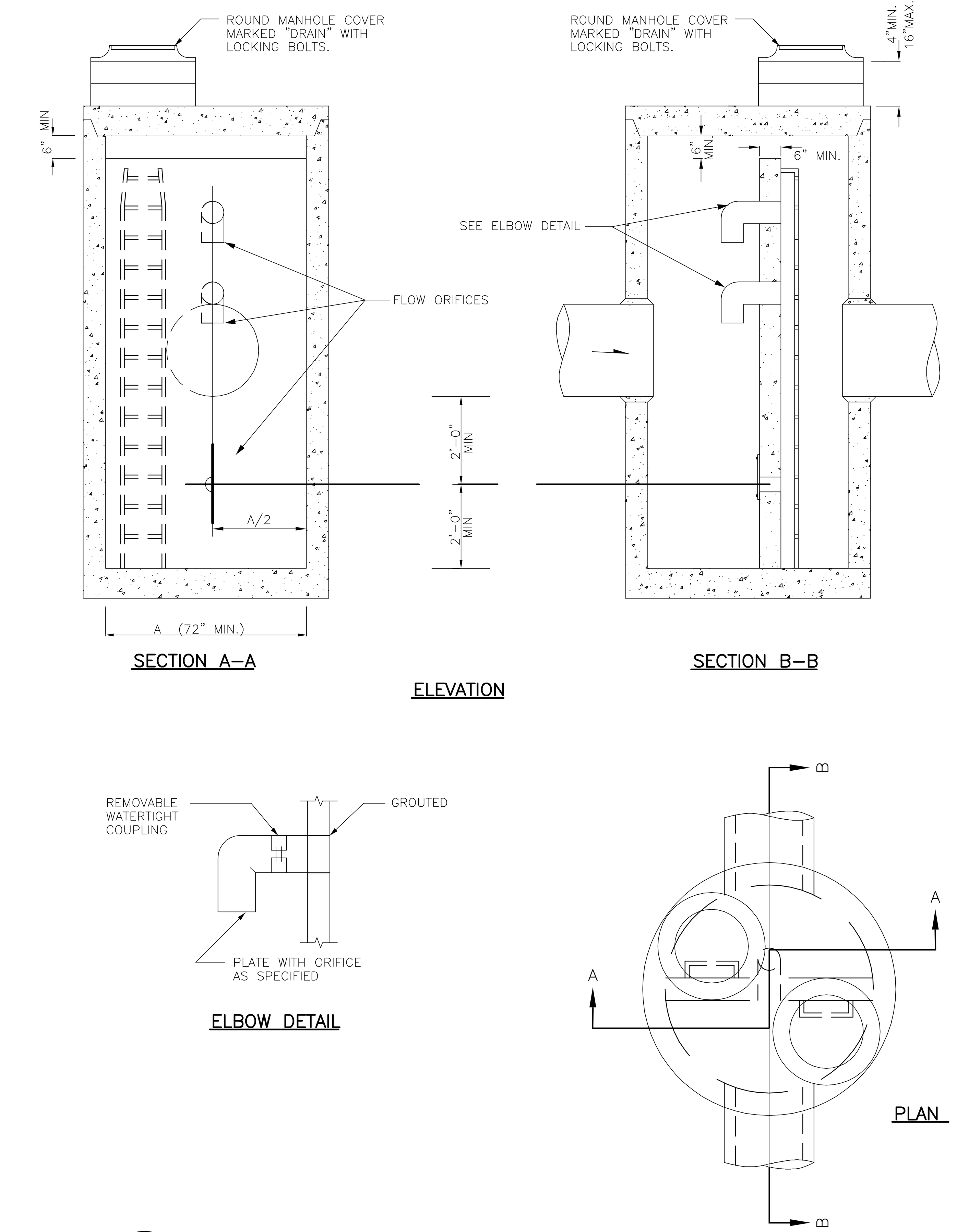
CATCH BASIN:

1. CATCH BASINS SHALL BE CONSTRUCTED IN ACCORDANCE WITH ASTM C478 (AASHTO M 199) & C890 UNLESS OTHERWISE SHOWN ON PLANS OR NOTED IN THE WSDOT/APWA STANDARD SPECIFICATIONS.
2. AS AN ACCEPTABLE ALTERNATIVE TO REBAR, WELDED WIRE FABRIC HAVING A MIN. AREA OF 0.12 SQUARE INCHES PER FOOT MAY BE USED. WELDED WIRE FABRIC SHALL COMPLY TO ASTM A497 (AASHTO M 221). WIRE FABRIC SHALL NOT BE PLACED IN KNOCKOUTS.
3. ALL REINFORCED CAST-IN-PLACE CONCRETE SHALL BE CLASS 4000.
4. PRECAST BASES SHALL BE FURNISHED WITH CUTOUTS OR KNOCKOUTS. KNOCKOUTS SHALL HAVE A WALL THICKNESS OF 2" MIN. ALL PIPE SHALL BE INSTALLED IN FACTORY PROVIDED KNOCKOUTS. UNUSED KNOCKOUTS NEED NOT BE GROUTED IF WALL IS LEFT INTACT.
5. KNOCKOUT OR CUTOUT HOLE SIZE IS EQUAL TO PIPE OUTER DIAM. PLUS CATCH BASIN WALL THICKNESS.
6. ROUND KNOCKOUTS MAY BE ON ALL 4 SIDES, WITH MAX. DIAM. OF 20". KNOCKOUTS MAY BE EITHER ROUND OR "D" SHAPE.
7. THE MAX. DEPTH FROM THE FINISHED GRADE TO THE PIPE INVERT IS 5'-0".
8. THE TAPER ON THE SIDES OF THE PRECAST BASE SECTION AND RISER SECTION SHALL NOT EXCEED 1/2"/FT.
9. CATCH BASIN FRAME AND GRATE SHALL BE IN ACCORDANCE WITH STANDARD SPECIFICATIONS AND MEET THE STRENGTH REQUIREMENTS OF FEDERAL SPECIFICATION RR-F-621D. MATING SURFACES SHALL BE FINISHED TO ASSURE NON-ROCKING FIT WITH ANY COVER POSITION.
10. FRAME AND GRATE MAY BE INSTALLED WITH FLANGE DOWN OR CAST INTO RISER.
11. EDGE OF RISER OR BRICK SHALL NOT BE MORE THAN 2" FROM VERTICAL EDGE OF CATCH BASIN WALL.

KING COUNTY STANDARDS, 2005



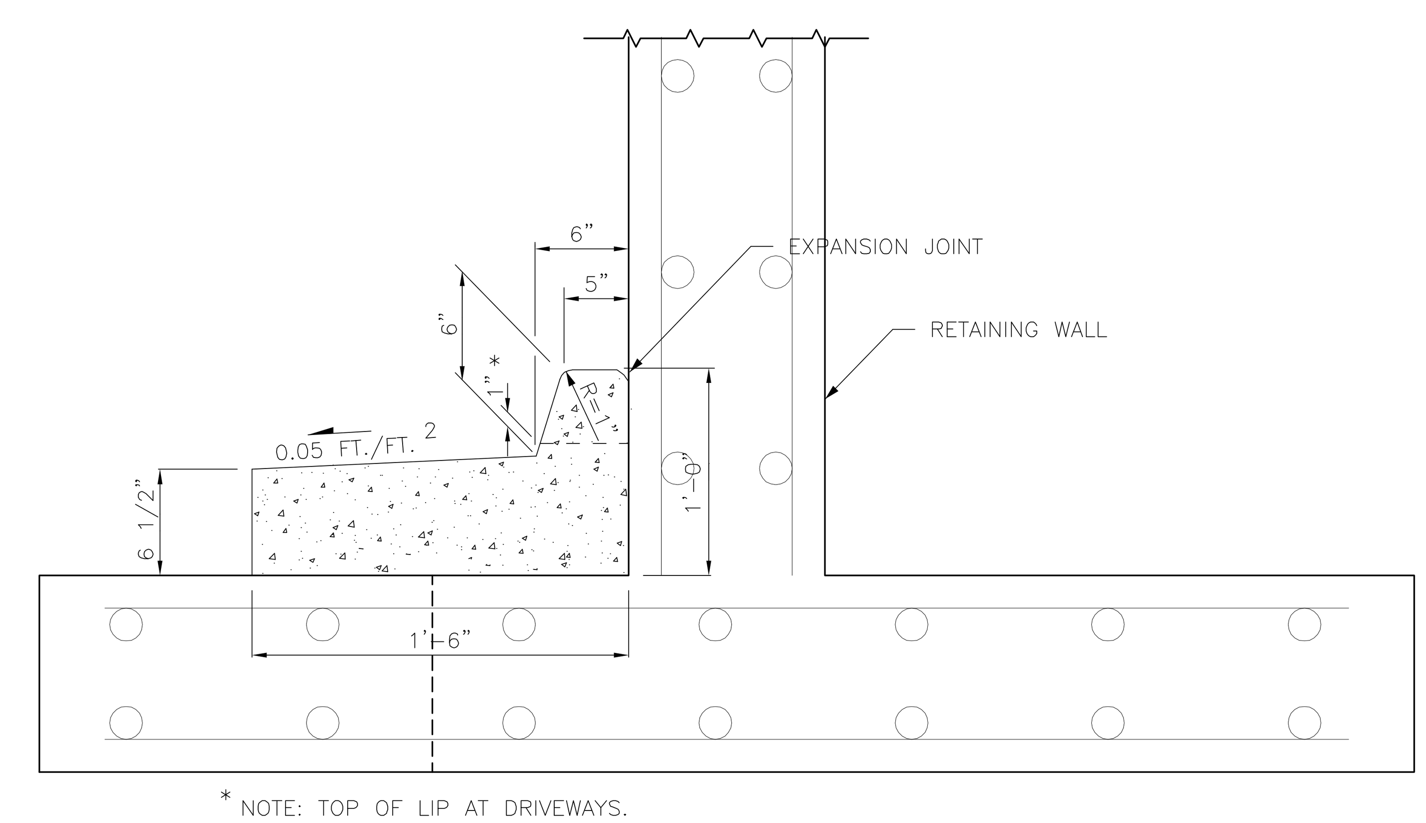
2 C-22 CATCH BASIN



4 C-22 FLOW RESTRICTOR / OIL POLLUTION CONTROL DEVICE, BAFFLE TYPE (FROP-B)

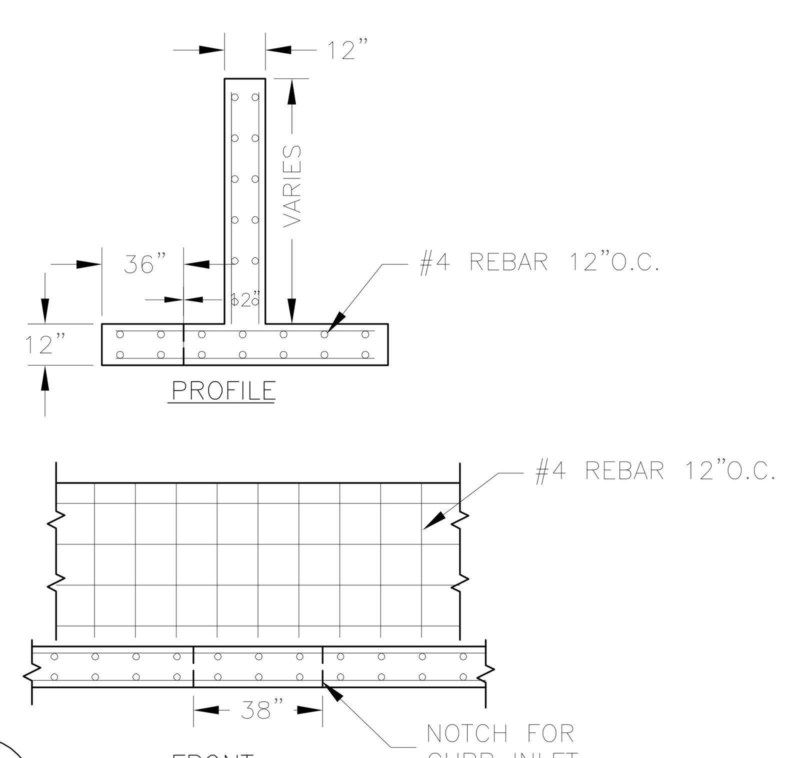
FLOW RESTRICTOR / OIL POLLUTION CONTROL DEVICE, BAFFLE TYPE (FROP-B):

1. PIPE SIZE, SLOPES AND ALL ELEVATIONS: PER PLANS.
2. OUTLET CAPACITY: NOT LESS THAN COMBINED INLETS.
3. CATCH BASIN: TYPE 2, TO BE CONSTRUCTED IN ACCORDANCE WITH DWG. NO. 2-005 AND AASHTO M199 UNLESS OTHERWISE SPECIFIED.
4. COVERS: ROUND, SOLID MARKED "DRAIN," WITH LOCKING BOLTS SEE DWG. NO. 2-022 & 2-023.
5. ORIFICES: SIZED AND LOCATED AS REQUIRED, WITH LOWEST ORIFICE MIN. 2' FROM BASE.
6. BAFFLE WALL SHALL HAVE #4 BAR AT 12" SPACING EACH WAY.
7. PRECAST BAFFLE WALL SHALL BE KEYED AND GROUTED IN PLACE.
8. BOTTOM ORIFICE PLATE TO BE 1/4" MIN. GALVANIZED STEEL AND ATTACHED WITH 1/2" STAINLESS STEEL BOLTS. OMIT ORIFICE PLATE IF ONLY FOR OIL SEPARATION.
9. UPPER FLOW ORIFICE SHALL BE ALUMINUM, ALUMINIZED STEEL OR GALVANIZED STEEL. SEE DWG. NO. 2-025. GALVANIZED STEEL SHALL HAVE TREATMENT 1.



3 C-22 CURB DETAILS

NOTE: DETAILS WOULD DIFFER FOR A REINFORCED EARTH WALL



5 C-23 RETAINING WALL (TYPICAL FOR REINFORCED CONCRETE WALL)

DRAFT BID SET

RETEC

NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE
B	RCW	2/--/06	ISSUED FOR PRELIMINARY BID				
A	A.S.	1/13/06	60% DRAWINGS – NOT FOR CONSTRUCTION	J.S.	1/13/06		

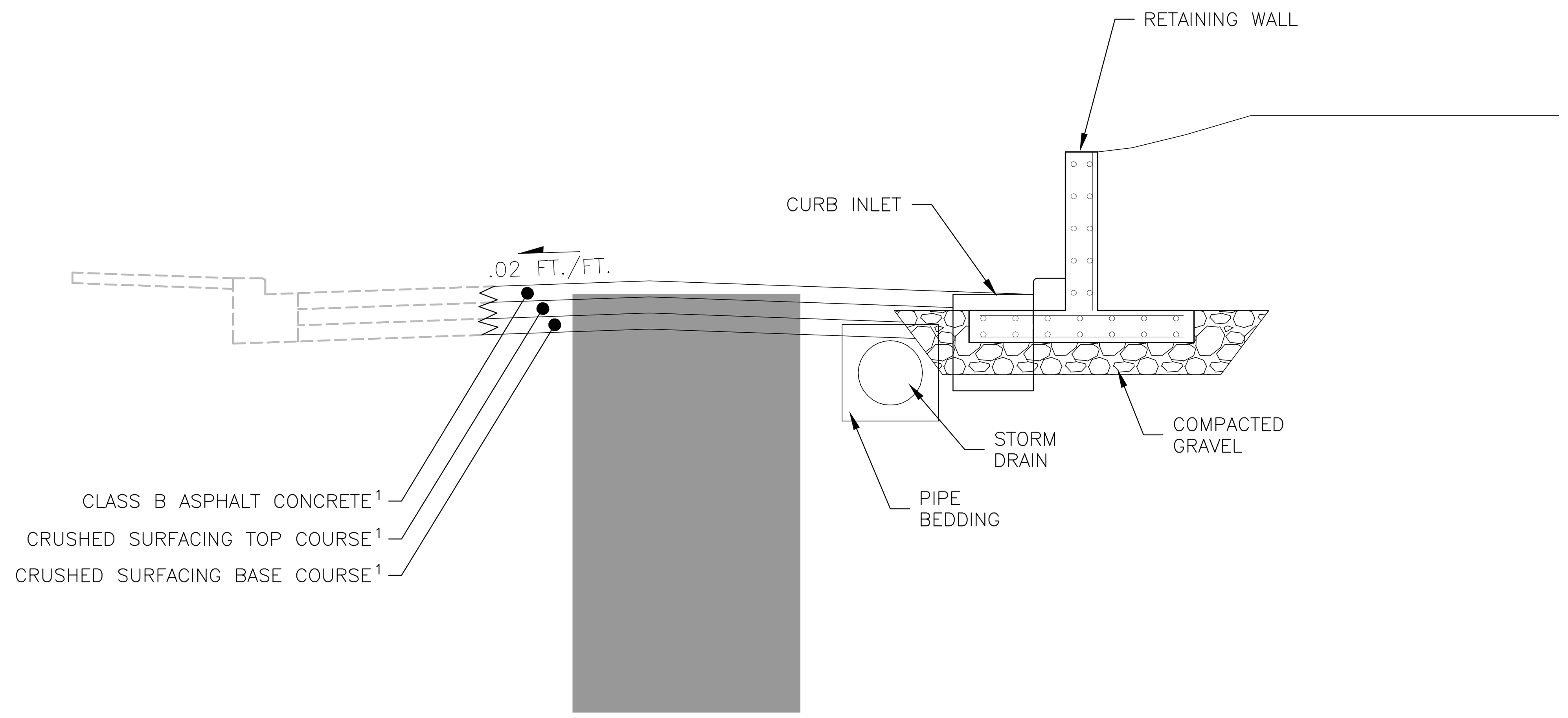
THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON
BN050-19390-200

CURRENT DATE 2/--/06

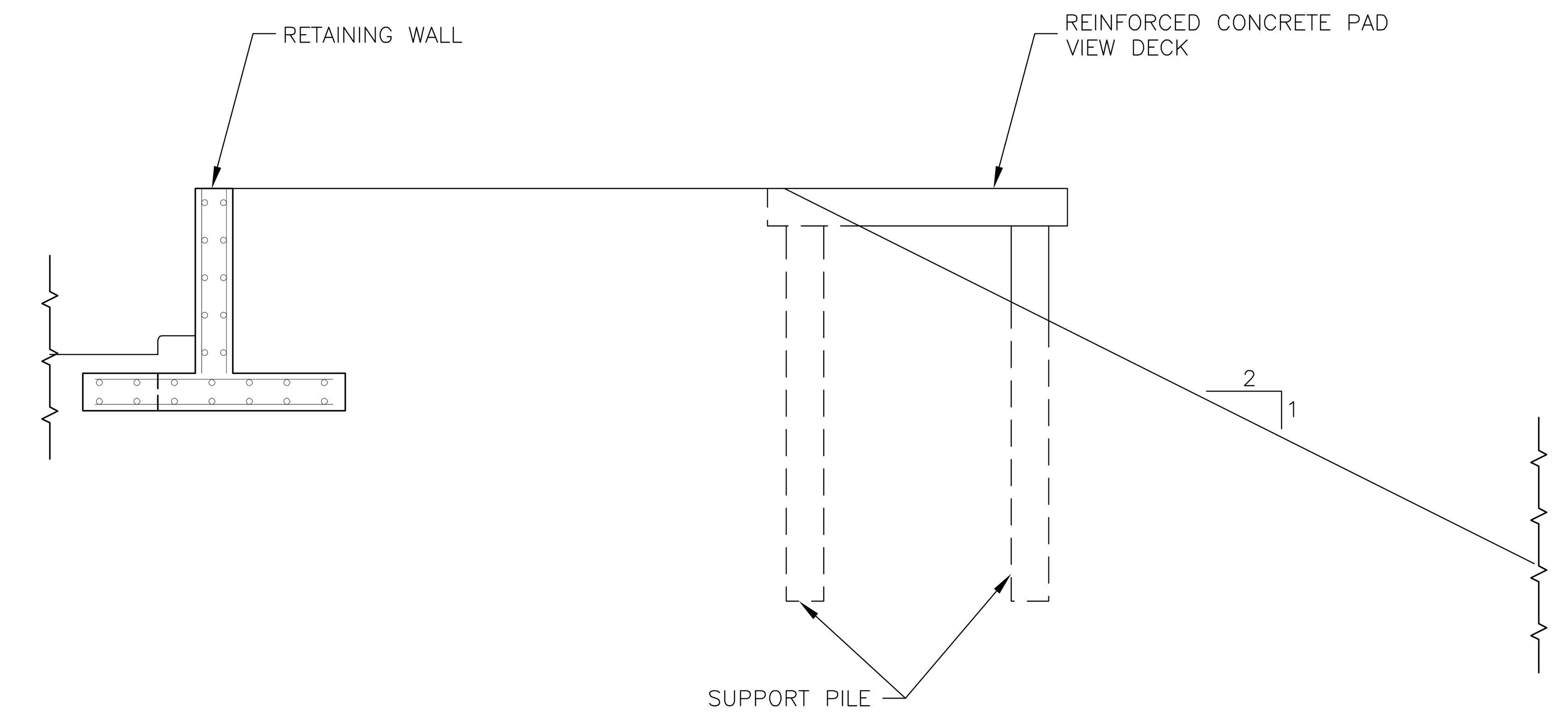
SKYKOMISH LEVEE REMEDIATION

FINAL DETAILS
SHEET 1 OF 2

DRAWING NO. C-27 REVISION B



1 / C-21 VERTICAL CURB TYPE ROADWAY



2 / C-21 VIEW DECK CROSS-SECTION

NOTES:

1. THIS DRAWING ILLUSTRATES A TYPICAL ASPHALT CONCRETE ROAD SECTION, ALTERNATIVE II. ACTUAL SURFACING DESIGN FOR ARTERIALS AND COMMERCIAL ACCESS STREETS SHALL BE BASED ON SOILS AND TRAFFIC ANALYSIS PER SEC. 4.03.
2. GRADES:
   - MINIMUM 0.5%
   - MAXIMUM SEE KING COUNTY ROAD STANDARDS, SECS. 2.02, 2.03, 2.04, AND 2.11.
3. FOR WIDTHS OF PAVEMENT, SHOULDER, AND RIGHT-OF-WAY, SEE KING COUNTY ROAD STANDARDS, SECS. 2.02, 2.03, AND 2.04.
4. FOR CLEARANCE OF UTILITY POLES SEE SEC. 8.02G AND DWG. NO. 5-001.
5. SEE KING COUNTY ROAD STANDARDS, CHAPTER 7 FOR CATCH BASIN AND STORM SEWER LOCATIONS.
6. NOTCH TOE OF RETAINING WALL AS NECESSARY TO INSTALL CURB INLET.

7 / C-16

3. SIDEWALKS SHALL BE 8 FT. WIDE IN BUSINESS DISTRICTS AND 6.5 FT. WIDE ON ARTERIALS IF NEXT TO TRAFFIC LANE, 5 FT. WIDE IF NEXT TO PARKING OR BIKE LANE, OR BEHIND PLANTING STRIP SEE SECTION 3.02B.

DRAFT BID SET

RETEC

NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE
B	RCW	2/--/06	ISSUED FOR PRELIMINARY BID				
A	A.S.	1/13/06	60% DRAWINGS - NOT FOR CONSTRUCTION	J.S.	1/13/06		

THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON
BN050-19390-200

CURRENT DATE 2/--/06

SKYKOMISH LEVEE REMEDIATION

FINAL DETAILS
SHEET 2 OF 2

DRAWING NO. C-28 REVISION B

P-1	P-2	D-1	P-3A/B	D-2&3 A/B	P-4&5 A/B	T-1A/B	T-2A/B	T-3A/B	P-6A	F-01	P-7	T-4	F-02A/B
DECON AREA SUMP PUMP	CONSTRUCTION PIT SUMP PUMP TRASH PUMP 500 GPM GAS POWERED	DE-EMULSIFIER 55 GAL DRUM	DE-EMULSIFIER METERING PUMP	FLOCCULANT 55 GAL DRUM	CHITOSAN METERING PUMP	WEIR TANK 18,000 GAL CARBON STEEL	FRAC TANK 21,000 GAL CARBON STEEL	SURGE TANK 21,000 GAL CARBON STEEL	DISCHARGE PUMP 25 HP, 3Ø, 460 VAC CENTRIFUGAL 500 GPM @ 110' TDH (CHANGE AT 1,000 GPM)	SAND FILTER UNIT VENDOR PACKAGE 2 PAIRS @ 500 GPM PER PAIR	SUBMERSIBLE TRANSFER PUMP 30 GPM, 115 VAC, ½ HP	BACKWASH HOLDING TANK 20,000 GAL CARBON STEEL	LIQUID PHASE GRANULAR ACTIVATED CARBON 10,000 LBS MAX PSIG 150

Tie Point	Description	Interface Type	Size	Comment
1	Filter inlet	Pipe	6" 150#RF	Flanged steel
2	Filter outlet	Pipe	6" 150#RF	Flanged steel
3	Filter backwash	Pipe	6" 150#RF	Flanged steel
4	Filter high DP	Electrical	5A 115 VAC	SPDT Dry contact
5	Collection Permissive	Electrical	5A 115 VAC	SPDT Dry contact

ABBREVIATIONS

AI	ANALOG IN
AO	ANALOG OUT
DI	DIGITAL IN
DO	DIGITAL OUT
FQI	FLOW TOTALIZING INDICATOR
HSS	HAND SELECTOR SWITCH
LAS	LEVEL ALARM SWITCH
LAH	LEVEL ALARM HIGH
LHY	LEVEL HIGH RADIO RECIEVER OR TRANSMITTER
LSH	LEVEL SWITCH HIGH
LSHH	LEVEL SWITCH HIGH-HIGH
LSHL	LEVEL SWITCH HIGH/LOW
MC	MOTOR CONTACT

LEGEND

- INDICATES FLUID LEVEL
- INTERMITTANT FLOW
- SIGNAL LINE
- RADIO COMMUNICATIONS LINE
- ADDITIONAL EQUIPMENT FOR 1,000 GPM
- PI A — PRESSURE INDICATOR 0-15 PSIG
- PI B — PRESSURE INDICATOR 0-60 PSIG
- AUTO DIALER
- TP ## — EQUIPMENT TIE POINT
- DO — DIGITAL INTERFACE I/O

NOTES:

1. PRELIMINARY MOBILIZATION FOR TREATING 500 GALLONS PER MINUTE. PHANTOMED (— —) EQUIPMENT NEEDED FOR 1,000 GALLONS PER MINUTE.
2. ALL MAJOR PIPING FLEXIBLE HOSE WITH CAM-LOCK FITTINGS.
3. SPARE PUMP FOR TRANSFER OR DISCHARGE TO BE ONSITE.
4. TYPICAL OF 2 SYSTEMS.
5. SYSTEM SCHEMATIC REPRESENTS CONSTRUCTION PHASE TREATMENT SYSTEM.
6. SYSTEM TO INCLUDE HOSES AND FITTINGS NEEDED FOR BACKWASH.
7. DEWATERING CONTRACTOR TO PROVIDE DRY CONTACT (5 AMP) TO DISABLE DEWATERING PUMPS DURING ALARM EVENTS.

DRAFT BID SET

RETEC

NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE
5							
4							
3							
C							
B	RCW	2/--/06	ISSUED FOR PRELIMINARY BID				
A	RCW	1/17/06	60% DRAWINGS – NOT FOR CONSTRUCTION				

THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON

BN050-19390-200

CURRENT DATE 2/__/06

CONSTRUCTION WATER TREATMENT SYSTEM
PIPING & INSTRUMENTATION DIAGRAM

DRAWING NO. P-1 REVISION B