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Prepared for:
BNSF Railway Company
Seattle, Washington

2008 Engineering Design Report

BNSF Former Maintenance and Fueling Facility – Skykomish, WA

The RETEC Group, Inc.
February 2008
Document No.: 01140-204-0270

Merged with ENSR in 2007
RETEC

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Professional Certification

February 4, 2008

This Master Engineering Design Report (EDR) was prepared for the Site by ENSR on behalf of the BNSF Railway Company (BNSF) pursuant to a Consent Decree (CD, *State of WA v. BNSF Railway Company*, King County Case No. 07-2-33672-9SEA) between BNSF and Washington State Department of Ecology. The EDR is required under the Model Toxics Control Act (MTCA; Revised Code of Washington 70.105D; Washington Administration Code 173-340) and as such was prepared under the supervision of the Professional Engineer whose seal and signature appear hereon.

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Michael G. Byers, P.E.
Registered Professional Engineer
Washington State #30698

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List of Acronyms and Abbreviations

ACGIH	American Conference of Governmental Industrial Hygienists
AMP	Air Monitoring Plan
ANSI	American National Standards Institute
AS	Air Sparging
AST	Aboveground storage tank
BE	Biological Evaluation
BMP	Best Management Practice
CAO	Critical Area Ordinance
CD	Consent Decree
CDC	Centers for Disease Control
CDW	Construction Demolition Waste
CMP	Compliance Monitoring Plan
CPS	Construction Plans and Specifications
CSL	Cleanup Screening Level
CUL	Cleanup Level
CWA	Clean Water Act
DAHP	Department of Archaeological Historic Preservation
DCAP	Draft Cleanup Action Plan
DFW	Department of Fish and Wildlife
DHHS	United States Department of Health and Human Services
DNS	Determination of Non-significance
DS	Determination of Significance
Ecology	State of Washington Department of Ecology
EDR	Engineering Design Report
EIS	Environmental Impact Statement
ESA	Endangered Species Act
Facility	BNSF Railway Company's Former Maintenance and Fueling Facility
FEMA	Federal Emergency Management Act
FMCZ	Former Maloney Creek Zone
FS	Feasibility Study
GMA	Growth Management Act
HABS/HAER	Historic American Buildings Survey/Historic American Engineering Record
HASP	Health and Safety Plan
HCC	Hydraulic Control and Containment
HDPE	High-Density Polyethylene
HPA	Hydraulic Project Approval
JARPA	Joint Aquatic Resource Permit Application
LNAPL	Light Non-Aqueous Phase Liquid
MTCA	Model Toxics Cleanup Act

NEDZ	Northeast Developed Zone
NFIP	National Flood Insurance Program
NFPA	National Fire Protection Association
NGS	National Geodetic Survey
NIOSH	National Institute for Occupational Safety and Health
NPDES	National Pollutant Discharge Elimination System
NWAA	Northwest Archaeological Associates
NWDZ	Northwest Developed Zone
OHWM	Ordinary High Water Mark
OSHA	Occupational Safety and Health Administration
P.E.	Professional Engineer
PCB	polychlorinated bi-phenyl
PHS	Public Health Services
PSCAA	Puget Sound Clean Air Agency
PSE	Puget Sound Energy
R.G.	Registered Geologist
RCW	Revised Code of Washington
RI	Remedial Investigation
RL	Remediation Level
ROW	Right of Way
RYZ	Railyard Zone
SDZ	South Developed Zone
SEPA	State Environmental Policy Act
SHF	Soil Handling Facility
SQS	sediment quality standards
SWPPP	Stormwater Pollution Prevention Plan
Town	Town of Skykomish
UBC	Uniform Building Code
UIC	Underground Injection Control
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
UST	Underground Storage Tank
WAC	State of Washington Administrative Code
WISHA	Washington Industrial Safety and Health Act
WSDOT	State of Washington Departments of Transportation

1.0 Introduction

This document presents the *2008 Engineering Design Report* (2008 EDR) for the BNSF Railway Company's Former Maintenance and Fueling Facility (facility) and surrounding area located within the Town of Skykomish (Town), Washington (Site). The Site location is shown on Drawing C-1 and a Site Plan is included as Drawing C-3.

This 2008 EDR was prepared for the Site by ENSR on behalf of the BNSF Railway Company (BNSF). EDRs are part of the 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 major documents that define the criteria and scope of remediation activities for the Site are described below.

- **Remedial Investigation and Feasibility Studies.** 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 *Final Feasibility Study* (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 FSs pursuant to Agreed Order No. DE 91TC-N213.
- **Cleanup Action Plan.** The Cleanup Action Plan for BNSF Former Maintenance and Fueling Facility, Skykomish, Washington (CAP) describes the cleanup action to be taken at the Site. The CAP is Exhibit B of the CD and is an integral and enforceable part of the CD. As part of the Draft Consent Decree (CD), the Washington State Department of Ecology (Ecology) prepared a site-wide *Draft Cleanup Action Plan* (DCAP; Ecology, 2007a) that guides all remediation activities at the site. The Draft CD and Draft CAP underwent a public comment period which concluded on July 14, 2007. The CAP and CD (CAP and CD; Ecology, 2007b and c) were finalized on October 18, 2007 and entered into court on October 19, 2007. *Department of Ecology v. BNSF Railway Company*, King County Superior Court Cause No. 07-2-33672-9 SEA.
- **Environmental Impact Statement.** The Final Environmental Impact Statement from BNSF Former Maintenance and Fueling Facility, Skykomish, Washington (Ecology, 2007d) describes the existing environmental conditions, environmental impacts, and mitigation measures associated with the proposed cleanup action.
- **Master EDR.** The Master EDR (ENSR, 2008) provides an overview of cleanup activities that will be conducted in 2008 through 2011 and beyond throughout the Town of Skykomish.
- **2008 EDR.** Design, construction, and operation of the cleanup actions conducted in calendar year 2008 will be described in this 2008 EDR, with appropriate references to the Master EDR.
- **Subsequent Annual EDRs.** Additional details of the design, construction, and operation of the cleanup actions conducted in each calendar year will be described in subsequent annual EDRs and drawings.

1.1 Scope

The Master EDR and 2008 EDR are interdependent and together, along with subsequent annual EDRs, will provide all of the information outlined in WAC 173-340-400(a) for the work to be completed through 2008. The Master EDR includes background and general site-wide information that will not be included in the annual EDRs and addresses all phases of the work required by the CD through at least 2012. The 2008 EDR includes information that is specific to 2008 remediation activities and not presented in the Master EDR. The 2008 EDR is not intended to be a stand-alone document, but includes sufficient information for the development and review of construction plans and specifications (CPS) and documents engineering concepts and design criteria used for design of the cleanup action activities scheduled for

2008. CPS will be submitted to Ecology separately, as specified in CD Exhibit C. Table 1-1 summarizes the scopes of the Master EDR and the 2008 EDR (including supporting work plans and design documents) as they pertain to the requirements of WAC 173-340-400(a).

Table 1-1 Master EDR and Annual EDR Scopes

Information required per WAC 173-340-400(a)	Included in	
	Master EDR	Annual EDR
(i) Cleanup Action Goals		
Overall goals of the cleanup action including all specific cleanup and performance requirements	X	
Goals of the cleanup action to be implemented in the time period covered by the Annual EDR, including the cleanup and performance requirements specific to those actions		X
(ii) Site Information		
General Site information and a summary of information in the remedial investigation/feasibility study	X	
A summary of Site information pertinent to the cleanup action to be implemented in the time period covered by the Annual EDR, including an updated summary of investigation findings, as necessary to reflect the current condition within the target year work area.		X
(iii) Owner, Operator, Maintenance Responsibilities		
Identification of who will generally own, operate, and maintain the cleanup action during and following construction	X	
(iv) Facility Maps		
Facility maps showing existing Site conditions and proposed location of the cleanup action	X	
Facility maps showing updated Site conditions (if necessary) and the proposed location of the cleanup action in the time period covered by the Annual EDR		X
(v) Hazardous Substances Treatment and Management		
Characteristics, quantity, and location of materials to be treated or otherwise managed, including ground water containing hazardous substances.	X	
Characteristics, quantity, and location of materials to be treated or otherwise managed in the time period covered by the Annual EDR, including ground water containing hazardous substances.		X
(vi) Schedule		
A general schedule for the overall cleanup action	X	
A schedule for final design and construction for the time period covered by the Annual EDR		X

Information required per WAC 173-340-400(a)	Included in	
	Master EDR	Annual EDR
(viii) Engineering justification for design and operation parameters		
A. A summary of the general design criteria for components of the cleanup action	X	
Design criteria, assumptions, and calculations for the cleanup action components that will conducted through the duration of the cleanup action (e.g. construction water treatment)	X	
Design criteria, assumptions and calculations for cleanup action components that will be completed within the time period covered by the Annual EDR		X
B. Expected treatment, destruction, immobilization, or containment efficiencies for cleanup action components that will conducted through the duration of the cleanup action (e.g. construction water treatment), and documentation on how that degree of effectiveness is determined	X	
Expected treatment, destruction, immobilization, or containment efficiencies for the cleanup action components that will be completed within the time period covered by the Annual EDR, and documentation on how that degree of effectiveness is determined		X
C. Demonstration that the cleanup action components that will conducted through the duration of the cleanup action (e.g. construction water treatment), will achieve compliance with cleanup requirements by citing pilot or treatability test data, results from similar operations, or scientific evidence from the literature.	X	
Demonstration that the cleanup action components that will be completed within the time period covered by the Annual EDR will achieve compliance with cleanup requirements by citing pilot or treatability test data, results from similar operations, or scientific evidence from the literature.		X
(ix) Spill Control		
A general description of the spill control and response measures that will be implemented throughout the cleanup action	X	
Design features for control of hazardous materials spills and accidental discharges (for example, containment structures, leak detection devices, run-on and runoff controls)		X
(x) Public and Worker Safety		
A general description of the public and worker safety measures that will be implemented throughout the cleanup action	X	
Design features to assure long-term safety of workers and local residences (for example, hazardous substances monitoring devices, pressure valves, bypass systems, safety cutoffs)		X

Information required per WAC 173-340-400(a)	Included in	
	Master EDR	Annual EDR
(xi) Waste Management		
A discussion of general methods for management or disposal of any treatment residual and other waste materials containing hazardous substances generated as a result of the cleanup action	X	
A discussion of waste management methods to be implemented during the cleanup action time period covered by the Annual EDR, if different from the general methods.		X
(xii) Facility Specific Characteristics		
Facility specific characteristics that may affect design, construction, or operation of the selected cleanup action, including:		
A. The general relationship of the proposed cleanup action to existing facility operations	X	
Relationship of the proposed cleanup action to be implemented during the cleanup action time period covered by the Annual EDR to existing facility operations, if different from the general relationship described in the Master EDR		X
B. General probability of flooding, probability of seismic activity, temperature extremes, local planning and development issues; and	X	
Probability of flooding, probability of seismic activity, temperature extremes, local planning and development issues during the cleanup action time period covered by the Annual EDR, if different from general conditions described in the Master EDR.		X
C. General soil characteristics and ground water system characteristics	X	
Soil characteristics and ground water system characteristics specific to the cleanup action to be completed within time period covered by the Annual EDR, if different from general characteristics described in the Master EDR.		X
(xiii) Quality Control		
A general description of the overall approach to quality control.	X	
A description of construction testing that will be used to demonstrate adequate quality control within time period covered by the Annual EDR		X
(xiv) Compliance Monitoring		
A general description of compliance monitoring that will be performed during and after construction to meet the requirements of WAC 173-340-410	X	
A description of compliance monitoring that will be performed during and after construction activities specified in the Annual EDR to meet the requirements of WAC 173-340-410		X[1]

Information required per WAC 173-340-400(a)	Included in	
	Master EDR	Annual EDR
(xv) Health and Safety A general description of construction procedures proposed to assure that the safety and health requirements of WAC 173-340-810 are met	X	
A general description of construction procedures proposed to be completed during and after construction activities specified in the Annual EDR in order to assure that the safety and health requirements of WAC 173-340-810 are met		X[2]
(xvi) SEPA Requirements Any information not provided in the remedial investigation/feasibility study needed to fulfill the applicable requirements of the State Environmental Policy Act (chapter 43.21C RCW)		X
(xvii) Permitting Any additional information needed to address the applicable state, federal and local requirements including the substantive requirements for any exempted permits; and property access issues which need to be resolved to implement the cleanup action		X
(xviii) Financial Assurance For sites requiring financial assurance and where not already incorporated into the order or decree or other previously submitted document, preliminary cost calculations and financial information describing the basis for the amount and form of financial assurance and, a draft financial assurance document	3	
(xix) Institutional Controls For sites using institutional controls as part of the cleanup action and where not already incorporated into the order or decree or other previously submitted documents, copies of draft restrictive covenants and/or other draft documents establishing these institutional controls	3	
(xx) Other Other information as required by the department.	4	

Notes:

1. Will be described in Annual Compliance Monitoring Plans
2. Will be described in Annual Health and Safety Plans
3. Will be included as separate documents
4. Will be included, as needed, in separate documents

1.2 Overview of 2008 Cleanup Activities

The 2008 cleanup activities include activities described in the CD for three of the six remediation zones. The actions for each zone are interdependent. Achieving cleanup in one zone depends not only upon the actions to be taken in that zone, but also upon the actions to be taken in other zones. Permitting activities will be completed as outlined in the Master EDR (ENSR, 2008).

1.2.1 Railyard Zone

Depot Relocation: The existing Railyard Depot Building will be relocated from the NWDZ to facilitate excavation and construction of the HCC system. Pending discussions with the Town, following completion of the HCC the depot will either be placed back in its original location or placed at another location acceptable to the Town and BNSF.

Utility Crossing Construction: A new utility crossing of the mainline tracks will be constructed within the RYZ in anticipation of installing new Town sanitary sewer conveyance piping.[1] Construction will consist of a crossing beneath the existing mainline rail and installing a casing. Close coordination with the Town will be required in order to provide a crossing suitable for the grade and location requirements of the overall sewer system design. The crossing is contingent on successful negotiation of the required easements and related agreements between the Town and BNSF. A second crossing will be constructed to provide a conduit for remediation systems – this second crossing will be used by the remediation systems and controls only and is not available for other utilities.

Hydraulic Control and Containment (HCC) System: An HCC system consisting of a redundant groundwater barrier and a groundwater interception trench will be constructed near the north RYZ boundary with Railroad Avenue.

HCC Water Treatment System: An HCC water treatment system will be constructed to treat groundwater recovered via the HCC system. A remediation utility corridor will be constructed in the RYZ. A conduit will be installed within the corridor underneath the railroad tracks in anticipation of installing conveyance piping for transferring HCC water to the treatment system and from the treatment system to permitted surface discharge points, injection wells, surface waters, and/or the Town stormwater system.

HCC System Treated Groundwater Injection: Treated groundwater from the HCC system will be reintroduced into the railyard subsurface at appropriate locations and by appropriate means in order to flush petroleum contamination toward the HCC system.

HCC Treated Groundwater Discharge: Treated groundwater from the HCC system may be 1) discharged to the ground surface; 2) discharged to surface water; and/or 3) discharged to the Town storm water system consistent with applicable state and local substantive requirements and with applicable permits.

Construction Water Treatment: A temporary system will be constructed in the RYZ to treat water generated from construction activities.

Treated Construction Water Discharge: Treated construction water may be 1) discharged to the ground surface; 2) discharged to surface water; and/or 3) discharged to the Town storm water

[1] This work is not required by the CD but will occur on the railyard during 2008 and therefore needs to be coordinated with other activities required by the CD.

system consistent with applicable state and local substantive requirements and with applicable permits.

Air Sparging (AS) System Construction: An AS system, including sparging wells, underground piping, and blowers will be installed to treat impacted soil and groundwater in the NEDZ. Sparging wells and underground piping will be installed in the NEDZ. A mechanical building will be constructed in the RYZ to house AS system blowers and controls. AS system piping will be installed in trenches in the NEDZ and in the conduit installed in the remediation utility corridor to supply pressurized air from the blowers to the sparging wells.

Remediation Equipment Building Construction: One or more mechanical building(s) will be constructed in the RYZ to house equipment and controls for the HCC, water treatment, and AS systems.

Demolition of Operations Building: The existing Operations Building on the railyard may be demolished to allow construction of a new operations Building.[2]

New Operations Building Construction: A new Operations Building may be constructed on the railyard to replace the office space currently provided by the Depot. [3]

Groundwater Well Installation: Groundwater monitoring wells will be installed to support monitoring of the HCC system. Details will be provided in the *HCC Special Design Report*.

Compliance Monitoring: The following compliance monitoring activities will be conducted during and after remediation activities. These activities will be described in the *Compliance Monitoring Plan* (CMP).

- Protection monitoring to confirm that human health and the environment are adequately protected during remediation activities.
- Performance monitoring to assess whether or not the cleanup action has attained the designated Cleanup Levels (CULs), RLs, and other performance standards.

Right-of-Way (ROW) Restoration – ROWs that are excavated as part of remediation activities will be restored to meet current applicable King County standards as adopted by the Town, or as agreed by BNSF and the Town.

Utilities Construction and Restoration – Electrical and telecommunications services may be reconfigured as necessary to maintain these services to residences and businesses that remain inhabitable/operational during remediation activities. New permanent electrical, communications, and potable water utilities that are removed as part of remediation activities will be restored in-kind, or redeveloped as agreed by BNSF, property owners and the Town.

Soil Handling Facility Structure – A soil handling facility (SHF) structure could be constructed in the soil handling area in the RYZ.

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[2] This work is not required by the CD but will occur on the railyard during 2008 and therefore needs to be coordinated with other activities required by the CD.

[3] This work is not required by the CD but will occur on the railyard during 2008 and therefore needs to be coordinated with other activities required by the CD.

1.2.2 NWDZ

The following cleanup activities are planned for the NWDZ:

Building Relocation: The McEvoy house and the Whistling Post Tavern will be temporarily relocated to facilitate excavation of impacted soil. Building relocation will be contingent upon obtaining access from the owners.

- **Excavation:** Free product and soil with concentrations of lead exceeding 250 mg/kg and arsenic exceeding 20 mg/kg, and all free product and/or soil with concentrations of petroleum hydrocarbons exceeding 3,400 mg/kg NWTPH-Dx. The proposed excavation extents have been determined based on investigation results. Actual extents could vary and will be verified based on field observations and performance monitoring.

Containment Structures: Excavation of impacted soil may not occur under some buildings if access is denied or if temporary relocation of the building is not feasible. Containment structures will be constructed on adjacent excavated properties as necessary to prevent recontamination. Design of these containment structures will be addressed on a case-by-case basis in consultation with Ecology and affected property owners. Containment structure design for buildings to which BNSF is denied access by owners within the 2008 excavation area will be described in the 2009 EDR, however, at this time BNSF does not expect that any such containment structures will be required.

Temporary Containment Structures: A temporary barrier wall will be installed at the north and west 2008 excavation limits to delineate the limits of the excavation and prevent clean backfill from contacting LNAPL and impacted soils that will be remediated in subsequent years..

Compliance Monitoring: The following compliance monitoring activities will be conducted during and after remediation activities. These activities will be described in the *CMP*.

- Protection monitoring to confirm that human health and the environment are adequately protected during remediation activities.
- Performance monitoring to assess whether or not the cleanup action has attained the designated CULs, RLs, and other performance standards.

Municipal Wastewater Treatment System Construction: Infrastructure to connect to the community wastewater collection system will be constructed at the McEvoy house and the Whistling Post Tavern properties if, as anticipated, access is granted to these properties.

Right-of-Way Restoration: ROWs that are excavated as part of remediation activities will be restored to meet current applicable King County standards as adopted by the Town, or as agreed by BNSF and the Town.

Utilities Construction and Restoration: Electrical and telecommunications services will be reconfigured as necessary to maintain these services to residences and businesses that remain inhabitable/operational during remediation activities. New permanent electrical, communications, and potable water utilities that are removed as part of remediation activities will be restored in-kind, or constructed as agreed by BNSF and the Town.

Vapor Mitigation: It is anticipated that vapor mitigation will not be required in the RYZ because no buildings or structures will remain in place or will be built over petroleum contamination exceeding 3,400 mg/kg NWTPH-Dx.

1.2.3 NEDZ

The following cleanup activities are planned for the NEDZ:

Excavation: Free product and soil with petroleum concentrations exceeding 30,000 mg/kg NWTPH-Dx, as identified during previous investigations, will be removed from the area shown on Drawing C-6. Shallow soils on the Johnson property will be sampled more extensively to determine the need for and extents of excavation to remove soil within 2 feet of the surface with concentrations of lead exceeding 250 mg/kg and/or arsenic exceeding 20 mg/kg. Soil sampling and possible excavation will not require temporary relocation of buildings located on the Johnson property.

Air Sparging (AS) System Construction: An AS system will be installed and operated in the area where petroleum concentrations remain above 3,400 mg/kg NWTPH-Dx following excavation, as identified during previous investigations.

Compliance Monitoring: The following compliance monitoring activities will be conducted during and after remediation activities. These activities will be described in the *CMP*.

- Protection monitoring to confirm that human health and the environment are adequately protected during remediation activities.
- Performance monitoring to assess whether or not the cleanup action has attained the designated CULs, RLs, and other performance standards.

Vapor Mitigation: Protective measures will be designed and implemented for buildings, structures, and enclosed spaces that remain in place or are built over petroleum contamination exceeding 3,400 mg/kg NWTPH-Dx if the concentration of total petroleum hydrocarbons in indoor air exceeds the cleanup level of 1,346 $\mu g/m^3$.

Right-of-Way Restoration: ROWs that are excavated as part of remediation activities will be restored to meet current applicable King County standards as adopted by the Town, or as agreed by BNSF and the Town.

Utilities Construction and Restoration – Electrical and telecommunications services may be reconfigured as necessary to maintain these services to residences and businesses that remain inhabitable/operational during remediation activities. New permanent electrical, communications, and potable water utilities that are removed as part of remediation activities will be restored in-kind, or constructed as agreed by BNSF and the Town.

1.3 Associated Plans

A number of follow-on documents are necessary to complete each phase of cleanup work and required by regulation. These include engineering design reports, CPS, operation and maintenance plans, permits and substantive permit requirements, compliance monitoring plans; and as-built reports. The Project Document Control Matrix (see Master EDR Appendix E) summarizes the plans that are associated with the cleanup. Several of these plans are referenced in the Master EDR.

CAP Section 6.2 specifies that the following special design investigation work plans be in this 2008 EDR:

- The *Hydraulic Control and Containment System Special Design Report Work Plan* (RETEC, 2007)(see Appendix A) documents the overall strategy for evaluating the design of the HCC. The design criteria, excavation extents, and details for the HCC will be presented in the *Hydraulic Control and Containment System Special Design Report.*

- The *School Alternatives Evaluation Work Plan* (Farallon, 2007)(see Appendix B) describes the investigation for determining how to clean up contamination beneath the school to the degree

technically possible. The results of the site investigation will be documented in a *School Alternatives Evaluation Report* (or similarly titled document).

The *Hotel Structural Survey Report Work Plan* will describe how the structural condition of the hotel will be evaluated to determine whether the structural condition of the hotel will permit moving it or supporting it so that remediation can occur beneath it. Development of this work plan has been deferred to the 2009 EDR due to the lack of timely access to the Hotel. Access negotiations between the property owner are ongoing. A work plan will be completed only after access has been granted.

2.0 Regulatory Framework

The regulatory framework for 2008 cleanup activities is described in Master EDR (ENSR, 2008), Section 2.0, and the CD, Exhibit D and E. These include 1) MTCA design requirements; 2) applicable or relevant and appropriate substantive requirements established by state, and local governments to protect public health and the environment; and 3) permitting requirements established by federal law. The regulatory framework presented in the Master EDR was established with the understanding that the referenced regulatory requirements and guidelines are subject to change over the anticipated duration of the remediation activities and that changing site condition could warrant revision of this framework. No apparent changes to applicable regulatory requirements or guidelines have been made since the submittal date of the Master EDR, and there have been no apparent significant changes to site conditions. The regulatory framework presented in the Master EDR is therefore applicable to the 2008 cleanup activities with no revision.

3.0 Design Criteria

3.1 Design Criteria Described in the Master EDR

This section lists references to the site-wide and zone-specific design requirements that were originally presented in the Master EDR and are pertinent to 2008 site activities. These criteria are explicit goals that the remediation activities must achieve in order to be successful. The zone-specific design criteria in the Master EDR were established with the understanding that they could be revised in future annual EDRs as the scope of work was further clarified or re-defined. The overall design criteria presented in the Master EDR therefore requires no revision.

3.1.1 Site-Wide Design Requirements

Table 3-1 provides citations to the site-wide design requirements described in Master EDR Section 3.1 which are applicable to the 2008 cleanup activities.

Table 3-1 Master EDR Site-Wide Design Requirements Citations

2008 Site-Wide Design Requirement	Master EDR Section
Codes	3.1.1
Standards and Guidelines	3.1.2
Shoring and Excavation Stabilization	3.1.3
Excavation Dewatering	3.1.4
Product Recovery	3.1.5
Impacted Soil Handling and Disposal	3.1.6
Clean Overburden Handling and Onsite Reuse	3.1.7
Construction Dewatering Treatment	3.1.8
Construction Treated Water Discharge	3.1.9
Compliance Monitoring	3.1.10
Spill Control and Response	3.1.11
Building Relocation	3.1.12
Access/Haul Roads	3.1.13
Public ROW Restoration	3.1.14
Utilities Restoration	3.1.15
Cleanup Standards	3.1.16
Vapor Mitigation	3.1.17
Construction Safety	3.1.18
Traffic Routing and Pedestrian Access	3.1.19
Survey Control	3.1.20

3.1.2 2008 Cleanup Activities Zone-Specific Design Requirements

Table 3-2 provides citations to the zone-specific design requirements described in Master EDR Section 3.2 which are applicable to the 2008 cleanup activities.

Table 3-2 Master EDR Zone-Specific Design Requirements Citations

2008 Zone-Specific Design Requirement	Master EDR Section
Railyard Zone	**3.2.1**
Cleanup Levels (CULs)	3.2.1.2 (Table 3-1)
Excavation Extents	3.2.1.3
Hydraulic Control and Containment (HCC) System	3.2.1.4
HCC Water Treatment System	3.2.1.5
HCC Treated Water Disposal	3.2.1.6
Northwest Developed Zone	**3.2.3**
CULs	3.2.3.2 (Table 3-1)
Relocate Hotel/other Buildings	3.2.3.3
Excavation Extents	3.2.3.4
Compliance Monitoring	3.2.3.8
Northeast Developed Zone	**3.2.4**
CULs	3.2.4.2 (Table 3-1)
Excavation Extents	3.2.4.3
Air Sparging System	3.2.4.4
Compliance Monitoring	3.2.4.5

3.2 Supplemental 2008 Cleanup Activities Design Criteria

This section presents supplemental design criteria information with respect to the 2008 cleanup activities:

- Construction Dewatering Treatment
- Excavation
- Utility Corridor Construction
- Air Sparging System.

3.2.1 Construction Water Treatment

A temporary treatment system will be constructed upon a lined pad within a secured/isolated facility, located in the RYZ. The treatment system will remove petroleum from water generated from construction activities, except decontamination water, and treat the water to achieve required treatment levels described in the NPDES permits applicable to the system using the processes outlined in the *Water Treatment Engineering Report-Levee Remediation Process Water Treatment and Discharge* (Retec, July 2008). The nominal capacity of the

treatment system is 500 gpm, with a maximum flow of 1,000 gpm, in accordance with the NPDES permit issued for the project.

3.2.2 Excavation

Excavation will occur in much the same manner as it was completed in 2006. Full excavation dewatering is not anticipated given the extents of required removal and the general high permeability of the sand and gravel soils being removed. Excavation below the water table will be completed in the wet and excavated materials will be allowed to drain to facilitate transfer and disposal. Some screening of the excavated soils may occur on the railyard if sufficient oversized material is encountered.

Excavation Extents

The 2008 excavation limits include the following: 1) the HCC system (including the area under the Depot's current location); 2) the Railroad Avenue ROW adjacent to the north side of the HCC; 3) the majority of the Whistling Post Tavern property; 4) the McEvoy House property; 5) a portion of the church property; 6) the south end of the 4th Street ROW; and potentially 7) NEDZ metals hot spots on the Johnson property. These limits were developed based on the results of previous investigations and the following criteria:

- Remediation construction phasing requested by the Town
- Preliminary design criteria for the HCC system
- Maintaining a vehicle and pedestrian traffic corridor in the Railroad Avenue ROW
- The number of buildings that could be relocated within the construction window
- Property boundaries
- RLs and CULs described in the CD and Master EDR.

The approximate excavation limits are shown on Drawings C-6 through C-14. The limits shown on the drawings were determined based on observations during sampling and the laboratory analytical results. Observations are summarized in boring logs, which will be submitted with the 2007 Investigation Report. Laboratory analytical results will also be included in the 2007 Investigation Report. The report will be submitted in the first quarter of 2008. The actual excavation extents within the 2008 remediation boundary will be determined in the field based on excavation confirmation sampling.

Additional sampling of shallow soils on the Johnson property will be performed in early 2008 to define the need for and extent of excavation of metals hot spots. The Johnson property soils will be excavated in 2008 if necessary. Other potential metals areas in the NWDZ will also be sampled in 2008 but they will not be excavated in 2008.

HCC System. The Town requested that remediation construction be phased such that Railroad Avenue is restored to the maximum extent practicable prior to the Town centennial celebration in 2009. To satisfy this request, the HCC system excavation and the adjacent Railroad Avenue ROW excavation will be completed in 2008. The HCC system must be designed as an adequate collection system and it must be designed to maintain stability of the adjacent railroad tracks. The Depot is being relocated to allow for the excavation for installation of the HCC system. The predicted lateral and vertical extents of the excavation required to construct the HCC were determined based on the preliminary design criteria for the HCC system and are shown on Drawings C-6 through C-14. The anticipated depth of the HCC excavation is 15 to 35 feet bgs. It is anticipated that the HCC system excavation could be accommodated in a stable manner using slopes of 1.5 horizontal:1 vertical above the groundwater table, and from 1.5H:1V up to 2.5H:1V below the groundwater table. The deeper portions of the HCC system may be installed using drilling or grouting techniques so that stability of the main line tracks can be maintained.

The design criteria, excavation extents, and details for the HCC will be presented in the *Hydraulic Control and Containment System Special Design Report*. The lateral and vertical extents of the HCC system excavation could change and will be revised (if necessary) in subsequent design plans. The excavation extents could also be changed based on the results of ongoing field investigations and the results of performance monitoring

Railroad Avenue ROW. The adjacent Railroad Avenue ROW excavation extents were based on the results of previous investigations and the applicable RLs for petroleum. The section of the Railroad Avenue ROW adjacent to the HCC system excavation is located within the NWDZ and NEDZ. The anticipated vertical extent of the Railroad Avenue ROW excavation is based on observations during sampling and the depth at which soil analytical results indicate that TPH concentrations exceed 3,400 mg/kg NWTPH-Dx (in the NWDZ) and 30,000 mg/kg NWTPH-Dx or where free product occurs (in the NEDZ). The anticipated maximum depth of the excavation to remove impacted soil is 22 feet bgs. The north excavation boundary will be located within the existing street and is based on the locations of buildings that can not be relocated in 2008. The east and west extents of the Railroad Avenue ROW excavation are the same as those for the HCC system excavation and could change if the east-west extents of the HCC system excavation change. The lateral and vertical extents are shown on Drawings C-6 through C-14. These excavation extents could change based on the results of ongoing field investigations and the results of performance monitoring. It is anticipated that the south side of the excavation could be accommodated in a stable manner using slopes of 1.5H:1V above the groundwater table, and from 1.5H:1V up to 2.5H:1V below the groundwater table.

Some level of disruption and inconvenience for local residents is inevitable. There will be times when vehicles will need to drive either east or west on Old Cascade Highway or Highway 2 to drive around the construction activities when the crossing is closed. It is also anticipated that there may be full closure of Railroad Avenue near 2nd Street for up to 3 months to allow removal of impacted soil. Postings of road closures will be provided early in the process so planning can occur, and individual notifications will be made prior to full lane closures. Individual resident's needs will be accommodated as much as possible. An important design criteria for the Railroad Avenue ROW excavation is that the excavation be phased and completed in such a way to accommodate both pedestrian and vehicle traffic to all portions of Town to the extent practicable. Emergency access will be provided at all times This requirement will be placed on the contractor at the time of the bid, but the general concept is that traffic will be routed around the active excavation area, or that excavations will be phased to facilitate access. Traffic routing and pedestrian access are discussed in more detail in Section 5.

Whistling Post Tavern, McEvoy House, and Church. The 2008 excavation extents will include the Whistling Post Tavern and McEvoy House properties. The Whistling Post Tavern and McEvoy buildings will be temporarily relocated to facilitate the excavation. A portion of the adjacent church property and 4th Street ROW will also be excavated. The anticipated vertical extent of this excavation is based on the depth at which soil analytical results indicate that TPH concentrations exceed 3,400 mg/kg NWTPH-Dx (the NWDZ petroleum RL). The anticipated maximum depth of the excavation to remove impacted soil is 20 feet bgs. The lateral excavation extents are based on property boundaries determined by the 2007 survey, the NWDZ petroleum RL, and slopes required to reach the anticipated vertical excavation extents. The lateral and vertical extents are shown on Drawings C-6 through C-14. The excavation extents could change based on the results of ongoing field investigations and the results of performance monitoring.

The excavation on the Whistling Post property will extend to the southern and eastern property boundaries. Excavation sloping and shoring on the northern and western property boundaries will require that additional excavation take place in 2009 when the adjacent properties are excavated. The 2009 excavation will not require relocation of the Whistling Post.

Metals Hot Spot. Additional sampling will be performed to determine the need for and extent of metals hot spot excavation. The lateral extents of the metals hot spot excavation on the Johnson property will be based on the lead CUL of 250 mg/kg and arsenic cleanup level of 20 mg/kg. All soil within 2 feet of the surface outside the building footprint containing lead and/or arsenic at concentrations above these CULs will be removed.

Shoring and Excavation Stabilization

Part of the 2008 northern excavation boundary will abut future excavation areas. Two primary concerns arise in these areas:

1. Minimize the potential for recontamination of the newly placed fill; and

2. Where practical and necessary, minimize the impacts of future excavation on property that is remediated in the current year.

Much evaluation was completed on this subject during the 2006 construction period, and the end result was a constructed in place shoring system that was built as backfill was placed and compacted in the excavation. A liner was also placed adjacent to the shoring to minimize the potential for recontamination. The shoring requirements for 2008 will continue to be developed but it is anticipated that the shoring will be similar to what was used in 2006 and will include a product barrier, if necessary. The shoring may also consist of steel sheetpiles. Shoring design will be completed by the contractor to federal and state standards. Shoring plans will be prepared by the contractor and will be stamped by a contractor-selected P.E. registered in the State of Washington. Shoring will be installed as close to the property boundaries as practicable to minimize the possible quantities of impacted soil remaining between the shoring and property boundaries, which will have to be excavated in future years.

3.2.3 Utility Corridor Construction

The basis of design for PSE, Verizon, and Town of Skykomish utilities is unchanged from the Master EDR. PSE, Verizon, and the Town are completing their own designs for power, telephone, and sanitary sewer. KPG will be designing the water system. These designs will be incorporated into the 2008 Construction Plans and Specifications, which will be submitted to Ecology in accordance with the schedule set forth in CD Exhibit C. The utility corridor will be designed to reduce potential impacts to the function and maintenance of the HCC. Containment structures will be included in utility corridor construction plans as necessary to reduce the potential for creating preferential flow paths.

Town of Skykomish Utilities

A utility corridor will be constructed at the approximate location shown on Drawing C-4 to accommodate Town utilities. The location was selected by the Town. The utility corridor will be designed and constructed in accordance with the BNSF Utility Accommodation Policy (Rev. May 5, 2007), which is included as Appendix D. The corridor will be formed by constructing of a trench of sufficient width and depth to accommodate two 30-inch diameter casings.

Hydraulic Control and Containment System/Air Sparging System/Construction Water Treatment System

A utility corridor will be constructed at the approximate location labeled “Proposed Remediation Systems Crossing” on Drawing C-4 to accommodate piping for the construction water treatment system, HCC water treatment system, and air sparging system. The utility corridor will be designed and constructed in accordance with the BNSF Utility Accommodation Policy (Rev. May 5, 2007), which is included as Appendix D. The corridor will be formed by constructing a trench of sufficient width and depth to accommodate a conduit. The conduit will be sized to accommodate piping and will likely be 30 or more inches in diameter.

Air Sparging System

The proposed AS system will consist of a blower system installed on BNSF property, underground piping, vertical injection wells, and soil vapor monitoring wells. The sparging system design basis and criteria for selecting air sparging system components are described below.

Cleanup Levels

Air sparging will be implemented in the NEDZ to meet the performance standards specified in the CD, including:

1. Reducing petroleum concentrations in soil to below the *in situ* RL of 3,400 mg/kg NWTPH-Dx after excavation to remove free product and soil containing petroleum at concentrations greater that 30,000 mg/kg NWTPH-Dx has been completed.

2. Reducing petroleum groundwater concentrations to the CUL of 208 µg/L NWTPH-Dx and absence of sheen or free product at the conditional point of compliance immediately (within 2 years where the conditional point of compliance is at the river)

3. Reducing petroleum groundwater concentrations to 477 µg/L NWTPH-Dx and absence of sheen or free product throughout the NEDZ within a restoration time frame of 10 years.

Air Sparging Area

Sparging wells will be installed within the sparging area shown on Drawing C-4 in the general configuration shown on Drawing C-19. The design of the AS system will allow for the system to be expanded, as necessary, based on the results of compliance monitoring. The sparging areas were determined based on the following:

- The excavation extents for removal of soil impacted with petroleum at concentrations that exceed the RL of 30,000 mg/kg NWTPH-Dx
- The predicted extents of NEDZ soil impacted with petroleum at concentrations that exceed the 3,400 mg/kg NWTPH-Dx following excavation
- The extents of NEDZ groundwater impacted with petroleum at concentrations that exceed the RL of 477 µg/L NWTPH-Dx
- The apparent localized groundwater flow pathway, as determined based on the results of previous investigations
- The relative location of the conditional point of compliance (South Fork Skykomish River) to NEDZ soil and groundwater impacted with petroleum at concentrations that exceed the respective RLs and CUL.

Soil and groundwater isoconcentration contours and the apparent groundwater flow pathway were developed based on previous investigations and are shown on Drawing C-19. The excavation extents were developed using the criteria described in Section 3.2.2.1 and are shown on Drawing C-6. Groundwater isoconcentration contours were developed using analytical data from the second quarter 2007 groundwater sampling event. The isoconcentration contours and the resulting excavation areas and sparging areas vary slightly from those presented in the CAP because they are based on data that has been collected since the CAP was issued. The data sets used to generate these isoconcentration contours are presented in the 2007 Investigation Report, which will be submitted to Ecology in the first quarter of 2008.

The air sparging area includes the areal extents of NEDZ soil impacted with petroleum at concentrations exceeding the RL of 3,400 mg/kg NWTPH-Dx. Sparging wells will be installed to reduce soil petroleum hydrocarbon concentrations where they are highest and to reduce groundwater petroleum concentrations that exceed 477 µg/L NWTPH-Dx.

Air Sparging Well Layout

The spacing of sparging wells is dependent upon the sparging well radius of influence (ROI), and the presence of aboveground and underground structures, such as buildings, septic tanks, and utilities.

The ROI is based on the hydrogeologic characteristics of the sparging area and describes the areal extent of the formation that is affected by air injected through an individual sparging well. Literature suggests that the ROI may be two to three times the depth of an injection well below the water table (Marley *et al*., 1992a; P.J. Ware, 1993; Marley *et al*., 1992b; Leonard and Brown, 1992; and Felten *et al*., 1992). This empirical information suggests that the ROI of an injection well is approximately 1.5 times the distance between the water table and the top of the screened section of the well.

The approximate depth of the water table within the sparging areas varies from approximately 10 to 14 feet bgs. The target zone for injection in the NEDZ is approximately 10 feet below the low water table, or approximately 24 feet bgs. The distance between the water table and the top of the screened interval is therefore 10 feet and the estimated ROI is 15 feet. ROI calculations are included in Appendix E. The anticipated sparging well configurations are shown in Drawing C-19. The wells are spaced at 24 feet such that the estimated ROI overlap by approximately 6 feet (40% of the ROI). These design criteria result in 18 sparging wells. The combined sparging well ROIs cover the entire areal extents of NEDZ soil impacted with petroleum at concentrations exceeding the RL of 3,400 mg/kg NWTPH-Dx, including soil beneath structures.

Sparging Air Injection

Air will be injected into each well at a design flow rate of 3-5 standard cubic feet per minute (scfm). The design flow rate was determined based on previous experience designing and operating similar AS systems and will be adjusted in the field during system optimization. The design flow rate will be sufficient to deliver oxygen to impacted groundwater at a concentration that typically exceeds the biological oxygen demand (BOD) of *in situ* aerobic microbes and mobilizes volatile components of impacted groundwater. Sparging air will be injected into each well at an estimated design pressure of 7-10 psig. The pressure is sufficient to overcome hydrostatic head and minor losses at the well screen, and head losses in air piping. Blower sizing calculations are included in Appendix E.

Sparging Equipment

Air sparging blowers will be located within the mechanical equipment building on the railyard. The building will be completely enclosed to reduce ambient noise and to protect the equipment from environmental exposure. Blowers will be selected based on rated flow and pressure. Sparging air will be conveyed from the blowers to a utility vault through two headers installed in the 30-inch casing constructed across the railyard. One header will be connected to a manifold installed in the vault. The manifold will be designed to control sparging air flow and pressure to each well through an individual supply line. The second header will be capped near the vault. All underground sparging air piping will be high-density polyethylene (HDPE). HDPE is selected based on ease of construction and corrosion resistance. Vaults and underground piping will be installed in public ROWs whenever practicable. Piping placed in vaults, including manifold piping, and piping located within the mechanical equipment building will be steel. Valves will be brass or steel body. Piping will be rated for a working pressure at least 2 times greater than the blower maximum operating pressure and will be sized to deliver air at the design flow rate and pressure, while allowing for potential increases to flow rates and pressures. The sparging piping will be configured to allow for potential supplementation of sparging air with pressurized oxygen.

Sparging Wells

Sparging wells will be constructed in accordance with the Minimum Standards for Construction and Maintenance of Wells (Chapter 173-160 WAC). Sparging wells will be constructed to deliver sparging air at a depth of approximately 10 feet below the seasonal low groundwater table at the design flow rate and pressure with minimal losses due to short circuiting. Sparging well construction and pipe sizing will allow for potential increases to flow rates and pressures.

Vapor Monitoring Wells

Vapor monitoring wells will be constructed in accordance with the Minimum Standards for Construction and Maintenance of Wells (Chapter 173-160 WAC). Vapor monitoring wells will be constructed to allow sampling of soil vapor at depths between the seasonal high and low groundwater table, and above the seasonal low groundwater table. Vapor samples will be analyzed to evaluate the performance of the AS system. Performance monitoring will be described in the CMP.

4.0 Scope of Work

4.1 Site-Wide Scope of Work Described in the Master EDR

This section lists references to the elements of the site-wide scope of work that were originally presented in the Master EDR and are pertinent to 2008 site activities. The site-wide scope of work was established with the understanding that it could be further clarified or re-defined over the anticipated duration of remediation activities. No changes to the scope of work have been identified since preparation of the Master EDR. Table 4-1 provides to the site-wide scope of work items described in Master EDR Section 4.1 which are applicable to the 2008 cleanup activities.

Table 4-1 Master EDR Site-Wide Scope of Work

2008 Site-Wide Scope of Work	Master EDR Section
Drawings	4.1.1
Solicitation Package and Procurement	4.1.2
Permits	4.1.3
Mobilization and Site Preparation	4.1.4
Utility Locate	4.1.4.1
Surveying	4.1.4.2
Clearing and Grubbing	4.1.4.3
Spill Response	4.1.4.4
Temporary Facilities Construction	4.1.5
Access Agreements	4.1.6
Building Relocation	4.1.7
Relocation of Landmark and Historic Buildings	4.1.7.1
Relocation of Other Buildings	4.1.7.2
Excavation	4.1.8
Product Recovery	4.1.8.1
Wildlife Exposure Mitigation	4.1.8.2
Historic Structure Monitoring	4.1.8.3
Dewatering	4.1.8.4
Transporting Excavated Soil Onsite	4.1.8.5
Stockpiling Impacted Soil	4.1.8.6
Stockpiling Clean Overburden for Potential onsite Re-Use	4.1.8.7
Excavation Performance Sampling	4.1.8.8
Stockpile Amendment	4.1.8.9
Transportation and Disposal of Impacted Soil	4.1.8.10
Backfilling	4.1.8.11

2008 Site-Wide Scope of Work	Master EDR Section
Grading and Compaction	4.1.8.12
Dust Suppression and Mitigation	4.1.8.13
Compliance Monitoring	4.1.9
Protection Monitoring	4.1.9.1
Performance Monitoring	4.1.9.2
Confirmational Monitoring	4.1.9.3
Replacement of Relocated Structures and Restoration of Remediated Properties	4.1.10
Electrical and Telecommunications Utilities Restoration	4.1.11
Stormwater Collection System Construction	4.1.12
Wastewater Collection and Treatment System Construction	4.1.13
ROW Restoration	4.1.14

4.2 2008 Scope of Work

The following description of the 2008 scope of work supplements the information provided in the Master EDR.

4.2.1 Access Agreements

BNSF is contacting property owners to negotiate access agreements for properties where excavation is required to meet CULs or air sparging equipment must be installed to meet CULs. As described in the Master EDR, property owners may elect to not relocate and have subsurface containment put in place. Properties that require access agreements for the 2008 work are:

- Parcel number 780780-0250 (McEvoy House property) for building relocation and excavation
- Parcel number 780780-0440 (Whistling Post Tavern property) for building relocation and partial excavation
- Parcel number 780780-0270 (Skykomish Community Church property) for partial excavation
- Parcel number 780780-0140 (Johnson property) for metals investigation and potential metals excavation
- Parcel number 780780-0085 (Joselyn property) for AS system construction.
- Right-of-ways within the 2008 Remediation Boundary shown in drawing C-4 for HCC installation and partial excavation.

The CD requires documentation that access agreements necessary for 2008 work are provided to Ecology on or before December 31, 2007.

Access to the McEvoy House and Whistling Post Tavern properties will be necessary to relocate the buildings and to complete excavation and restoration activities. These negotiations are in progress.

Access to the Church property will be necessary to complete excavation activities. These activities could include the placement of structural supports in order to facilitate removal of petroleum impacted soil in close proximity to the building foundation. Current data suggests that underpinning of the church building will not be required in order to complete the excavation. These negotiations are in progress.

Access to the Joselyn property will be necessary to install and operate the AS system. AS system installation will include constructing wells, trenching, and installing underground piping in the landscaped area surrounding the house. Vapor mitigation may also be required based on the long-term success of the AS system and subsequent air monitoring on this property. BNSF has an access agreement for this property.

Access to the Johnson property will be necessary to sample for metals in surface soil and, if necessary, remove contaminated surface soil. BNSF has an access agreement for this property.

Access to the Town right-of-ways will be necessary to complete excavation and restoration activities and to install the HCC system. These negotiations are in progress.

4.2.2 Building Relocation

Buildings that will be relocated during the 2008 work are:

- BNSF Depot
- McEvoy House
- Whistling Post Tavern (aka Olympia Building).

All three of these buildings are on the National Register of Historic Places and will be moved and restored in accordance with the procedures described in Master EDR Section 4.1.7.1. Historical and structural surveys have been completed for each building. A Preliminary Structural Assessment report for the three buildings is included in Appendix F. Potential temporary relocation areas for these three buildings are shown on the Construction Layout Plan (Figure C-4). Building relocation guidelines will be prepared by the contractor conducting historical and structural surveys. These guidelines will be incorporated into relocation scopes of work, plans, and specifications and will be followed during relocation. Structures will be monitored in accordance with the developed guidelines during the move to the temporary storage location. Security fences will be installed around the relocated buildings for the duration of their storage and will be monitored by security personnel. Relocation of these structures in 2008 is contingent on obtaining property access agreements for the work.

4.2.3 Resident Relocation

The required construction on the site will involve large equipment and significant truck traffic. Some level of noise, vibration and traffic congestion are unavoidable such that some residents in very close proximity to active construction areas may determine that the construction impacts and their unique living circumstances are such that relocation is desirable and warranted. These are properties where BNSF does not need access for purposes of completing the work. BNSF will consider these requests on a case-by-case basis in consultation with Ecology and will attempt to accommodate affected residents if, as and when necessary. As noted above, BNSF is negotiating access to the McEvoy House and Whistling Post Tavern and as part of those arrangements the residents will be relocated in order to facilitate remediation activities.

4.2.4 Church Services

Access to the church will be restricted during remediation activities, however, the work will be designed and staged in a way that accommodates regular church functions and alternative parking areas will be designated for use by church patrons and employees as necessary.

4.2.5 Temporary Facilities Construction

Access and Haul Roads

The main access and haul roads that will be used during the 2008 work are Railroad Avenue, 5th Street, and the Old Cascade Highway, as shown on Drawing C-4. It is anticipated that trucks will enter the railyard from 5th

Street and exit to Old Cascade Highway after transferring material to the soil handling facility. Other roads and/or alternate truck routing may be used at the discretion of the contractor. These changes will be proposed to Town officials and emergency personnel for approval prior to implementation.

Equipment Decontamination Area

A heavy equipment and truck decontamination area will be constructed in the RYZ at the location shown on Drawing C-4 or at another appropriate location at the recommendation of the contractor. Decontamination water will be temporarily stored on-site and taken to an off-site licensed facility for disposal or treatment.

Construction Offices

Temporary construction offices will be located on the railyard. A temporary engineering field office may be established in Maloney's General Store on Railroad Avenue.

Temporary Electric and Communications Utilities

Existing electric and communications services will be maintained for all Skykomish residences and businesses that remain occupied during the 2008 remediation activities. PSE and Verizon have developed plans to temporarily reconfigure overhead electric and telecommunications wiring in order to maintain these services. The temporary reconfiguration is shown on the 2008 Conceptual Restoration Plan (see Appendix G). Structures that are outside of the active construction zone but vacant due to relocation of residents will also continue to be serviced by all appropriate utilities.

Temporary Potable Water Utilities

Temporary potable water piping may be constructed in ROWs as necessary to maintain services during excavation activities.

Enclosures and Fencing

Temporary chain link fencing will be installed along the perimeter of the 2008 remediation area, as shown on Drawing C-4. Warning signs will be posted at every gated entrance and at approximate 50-foot intervals along the fence line to warn the public that the fenced area contains physical and chemical hazards and that access is forbidden to unauthorized personnel.

Sediment and Erosion Controls

Sediment and erosion control measures will be implemented as described in the Stormwater Pollution Prevention Plan and Temporary Erosion and Sediment Control Measures for Levee Cleanup Action (SWPPP; RETEC, 2006) and as shown in Drawings C-15 through C-17.

Construction Staging Areas

Construction staging areas will be established in the RYZ at the locations shown on Drawing C-4, at other RYZ locations as agreed to by BNSF and the Contractor, or at locations outside of the RYZ as agreed to by the Town, BNSF, and the Contractor. Staging may also occur on private properties that are in the excavation area. The McEvoy House will be temporarily stored at the east end of Railroad Avenue, the Whistling Post Tavern will be stored west of its current location, and the Depot will be stored southeast of the railyard on BNSF property along Old Cascade Highway.

Spill/Emergency Response Equipment

Spill response equipment will be located in the contractor staging area shown in Drawing C-4, or at a location determined by the contractor. Spill response equipment will include oil absorbent booms and pads, as described in the Spill Response Plan (part of the SWPPP, RETEC, 2006).

Construction Water Treatment System

A treatment system similar in function and performance to the one permitted under the existing NPDES permit and implemented for the levee remediation in 2006 will be operated during 2008 remediation activities. The water treatment system will be constructed in a lined facility located within the RYZ at the approximate location shown on Drawing C-4. Other locations on the railyard will be considered if the contractor suggests moving the location to facilitate work activities. The treatment system will remove petroleum from water generated from construction activities, except decontamination water, and treat the water to achieve required treatment levels described in the NPDES permit. Drawing C-18 presents the process and instrumentation diagram (P&ID). The water treatment system design is described in the *Engineering Report – Levee Remediation Process Water Treatment and Discharge* (RETEC, 2008). System operation and maintenance is described in the current *Draft Operations and Maintenance Manual for Water Treatment System* (RETEC, 2008).

4.2.6 Hydraulic Containment and Control

The HCC system will be constructed as part of the 2008 remediation activities. The HCC system design was developed in accordance with the *Hydraulic Control and Containment System Special Design Report Work Plan* (RETEC, 2007)(see Appendix A). The HCC system design will be submitted in the *Hydraulic Control and Containment Special Design Report*.

4.2.7 Excavation

Clearing and Grubbing

All surface objects, brush, roots, and other protruding obstructions, and all trees and stumps will be cleared and/or grubbed from the excavation limits as indicated on Drawing C-6. The removed vegetation and debris will be recycled or disposed of at an appropriate municipal landfill.

Demolition

Asphalt roads and concrete building foundations, slabs, and walkways located within the excavation area will be demolished and recycled or disposed of at an appropriate construction demolition waste (CDW) landfill.

Extents

Excavation will include removing soil as necessary to reach the estimated areal and vertical extents of impacted soil shown on Drawings C-6 through C-14. Based on these extents, an estimated 56,000 cubic yards of soil will be removed from the site in 2008. The excavation extents as well as the clean overburden and impacted soil volumes will be refined based on the results of ongoing field investigations and the results of performance monitoring.

Removing Utilities

At grade and underground stormwater and potable water utilities will be removed during the excavation activities and will be recycled or disposed of at an appropriate CDW landfill.

Shoring and Barriers

Shoring is anticipated to be used during the HCC excavation and Railroad Avenue ROW excavations to provide structural support at the north excavation boundary. Shoring is also anticipated to be used at the Whistling Post Tavern property for structural support and to prevent contamination of clean fill. Temporary shoring will be constructed in 2008 and surface improvements will be constructed over remediated areas adjacent to the shoring. The purposes of the shoring will be twofold: 1) provide temporary shoring of adjacent areas to facilitate 2008 excavations; and 2) to protect the surface improvements completed in 2008 when subsequent excavation occurs in the area. Some of the shoring design may be completed by the contractor, and some will be completed by the design team. It is anticipated that the shoring will consist of driven steel sheetpiles, and

reinforced earth walls that may or may not have lock blocks (large concrete blocks) facing the wall. Deeper portions of the wall may be constructed of controlled density fill and a combination of reinforced earth and blocks that would remain in place as permanent backfill. Where steel sheet piles are used, it is anticipated that they will be removed in subsequent years once adjacent excavations are backfilled. The shoring will be planned and designed so that future utility installation and maintenance are not adversely affected.

Impermeable barriers will be placed to prevent contamination of clean fill at the north, south, and west excavation boundaries. A barrier will not be necessary at the east excavation boundary because it does not border impacted soil. Construction of the HCC wall will prevent contamination of the clean fill placed north of the wall. Contamination of clean fill that is placed upgradient of areas slated for future excavation will be addressed through the use of a temporary liner similar to the one placed at the upgradient extent of the 2006 removal, or a sheet pile wall. Where steel sheet piles are used for temporary shoring, the sheet piles are considered to suffice for the barrier without special sealing of sheet pile joints. The barrier will be placed at the northern extent of the 2008 excavation area along areas where future excavation is planned. Barriers will be placed as close to the property boundaries as possible, thus minimizing the potential need for excavation to remove impacted soils in the years following 2008. However, excavation will occur on the northern edge of the Whistling Post Tavern property in a subsequent year. This future excavation is not anticipated to impact the relocated structure once the shoring is installed in 2008.

Backfilling

Excavations will be backfilled with both clean overburden material and imported aggregate material. Topsoil will be placed on residential properties and on Town properties that will be restored with landscaping.

Clean Overburden Material

Overburden material with petroleum concentrations less than 3,400 mg/kg NWTPH-Dx may be used as backfill on-site as outlined in Section 6.4 of the CAP. Overburden material will be used for either stabilization or structural fill as long as it meets the gradation requirements outlined below. Soil within two feet of final grade must meet the petroleum cleanup level of 1,870 mg/kg NWTPH-Dx. No soil with arsenic concentrations exceeding 20 mg/kg, lead concentrations exceeding 250 mg/kg, PCB concentrations exceeding 0.65 mg/kg, or dioxin/furan concentrations exceeding 6.67 ng/kg Total Toxicity Equivalent Concentration will be used as backfill on the site.

Imported Aggregate Material

Excavations will also be backfilled with imported aggregate material that is suitable for placement and compaction under the site conditions. The South Fork Skykomish River will be visually monitored daily to demonstrate that backfilling activities do not result in exceedences of water quality standards in surface water. If turbidity is detected visually, turbidity measurements will be taken upstream and downstream of the release to determine if the water exceeds water quality criteria.

Given that the excavations will not be fully dewatered, backfill placed below the water table will need to be relatively clean (little to no fines) granular material that goes in place relatively compact, and is relatively easy to compact in a thick layer when compaction equipment is placed on the fill once it extends above the water surface elevation. The water surface elevation is anticipated to change throughout the construction season as the water table drops into summer. Given that the material will be placed below the water table, compaction testing will not be possible. A large compaction effort will be required on the fill at the point where it protrudes above the water level. Material placed below the water table (stabilization aggregate) is to conform to the grain size specification listed in Table 4-2.

Table 4-2 Stabilization Aggregate Grain-Size Requirements

Sieve Size	Percent Passing
2 ½ square	100
2 square	65-100
¾ square	40-80
U.S. No. 4	5 (max.)
U.S. No. 100	0-2
% Fracture	75 (min.)

Backfill placed above the stabilization aggregate is called structural fill, and it will conform to the grain size requirements listed in Table 4-3.

Table 4-3 Structural Fill Grain-Size Requirements

U.S Standard Sieve Size	Allowable Percent Passing
4-inch square	100
2-inch square	75-100
No. 4	50-80
No. 40	30 max.
No. 200	15 max.
Sand Equivalent	50 min.

All percentages are by weight. Note that the quantity of fines (material passing the No. 200 sieve) may be decreased to a maximum of 5 percent if the fill is to be placed during wet weather conditions.

Sieve analyses for backfill material placed against the HCC will be specified in the *HCC Special Design Report.*

Prior to importing material to the Site, the contractor will be required to provide lab analyses indicating that imported aggregate materials do not contain potential contaminants with concentrations greater than those shown in Table 4-4.

Table 4-4 Chemical Criteria for Backfill

Hazardous Substance	Maximum Concentration
Arsenic	20 mg/kg
Cadmium	2 mg/kg
Chromium VI	19 mg/kg
Chromium III	2,000 mg/kg
Lead	250 mg/kg
Mercury	2 mg/kg
NWTPH-Dx	1,870 mg/kg

Topsoil

Topsoil will be placed in residential yards and public parks one (1) foot thick. Topsoil must meet the requirements listed in Table 4-5.

Table 4-5 Topsoil Requirements

Parameter	Requirements
Sieve Analysis	Screened using sieve no finer than 7/16" and no greater than ¾"
pH	5.5-7.5
Electrical Conductivity	< 3.0 mhos/cm
Carbon to Nitrogen Ratio	< 15:1
Process to Further Reduce Pathogens Certified for Hot Composting at Compost Facility as outlined in WAC 173-350-220	Yes
Manufactured Inerts	< 1 percent
Sharps	0
Arsenic	≤ 20 mg/kg
Cadmium	≤ 10 mg/kg
Copper	≤ 750 mg/kg
Lead	≤ 150 mg/kg
Mercury	≤ 8 mg/kg
Molybdenum[1]	≤ 9 mg/kg
Nickel	< 210 mg/kg
Selenium[1]	≤ 18 mg/kg
Zinc	≤ 1400 mg/kg
NWTPH-Dx	< 1,870 mg/kg

[1]If required under WAC 173-350-220

Grading

Excavated areas will be restored to their original grade or to a suitable grade to facilitate stormwater control, as agreed to by BNSF, the Town, and property owners (where applicable). Grading plans will be presented as part of subsequent design plans. Structural fill will be placed in lifts and compacted to a minimum density of 95 percent of the maximum proctor density as determined by ASTM D-1557, Modified Proctor.

4.2.8 Air Sparging System

Mechanical Equipment

Mechanical equipment will be installed in the remediation equipment building located on the railyard at the approximate location shown on Drawing C-4. Pressurized air will be supplied by a single blower capable of delivering 150 scfm at 10 psig. Pressurized air exiting the blower system will be cooled using a heat exchanger (if necessary). A sparging system process and instrumentation diagram is shown in Drawing C-22. The system will be designed so that capacity can be increased if necessary. The blower will be installed on a skid constructed to allow easy installation of a second blower.

Piping and Manifolds

Pressurized air will be conveyed from the remediation equipment building to the utility vault through 4-inch SDR 17 HDPE headers. The headers will run through the utility corridor on the railyard conduit and in underground trenches. Due to the likely presence of underground impediments, such as tree roots and boulders, trench locations will be determined in the field during construction. A manifold will be installed in the utility vault constructed at the approximate location shown on Drawing C-19. . Sparging air will be conveyed from the vault to sparging wells through 1-inch SDR 17 HDPE piping installed in a trench. A trench detail is included in Drawing C-20.

Injection Wells

Injection wells will be installed at the locations shown on Drawing C-19. The wells will be installed to a depth of approximately 24 feet bgs, which is approximately 10 feet below the seasonal low water table. A cross section showing well depths is included on Drawing C-20. Injection wells will be constructed using 2-inch diameter Schedule 40 PVC casing. A two-foot section of 0.010-inch slot well screen will be installed at the bottom of the casing. A 2-inch PVC end cap will be fitted to the bottom of each well screen. The screened interval will be backfilled with 10-20 silica sand. A 1-foot cement-bentonite seal will be constructed above the sand. The remaining well annulus will be filled with bentonite. The wellheads will be constructed below the ground surface. A typical well construction detail is provided in Drawing C-21.

Vapor Monitoring Wells

Vapor monitoring wells will be installed at the approximate locations shown on Drawing C-19. The wells will be installed to depths of approximately 7 and 12 feet bgs, which are above the seasonal low water table and between the seasonal low and high water tables, respectively. A cross section showing well depths is included on Drawing C-20. Vapor monitoring casings will be constructed using 0.375-inch diameter aluminum tubing. The bottom one-foot of each well casing will be hand slotted A plug or cap will be fitted to the bottom of each casing. The well will be backfilled with 10-20 silica sand. A 1-foot bentonite seal will be constructed above the sand. A concrete seal will be formed above the bentonite seal. The well will be finished with a monument fitted with a flush-to-grade secured well lid. A typical well construction detail is provided in Drawing C-21.

Electrical Service

It is anticipated that the blower motor and other equipment located in the remediation building will be supplied with electrical power from the existing overhead service located on the railyard or along Old Cascade Highway. Power requirements will be provided in construction specifications.

4.2.9 Vapor Mitigation

Based on the current excavation extents, and what is currently known about impacts in the area, the house located on Parcel #780780-0085 (Joselyn property) will remain in place in the NEDZ over soil contamination exceeding 3,400 mg/kg NWTPH-Dx. Soil and groundwater on this property will be treated using AS. As required in the Cleanup Action Plan, air monitoring described in the Air and Noise Monitoring Plan (AMP) will be conducted before and after AS system construction and startup. The AMP is part of the CMP, which will be submitted to Ecology in accordance with the schedule set forth in CD Exhibit C. It is anticipated that engineered controls, such as active venting using fans, would be implemented if total petroleum hydrocarbons concentrations in the crawl space exceed the CUL of 1,346 $\mu g/m^3$. These engineered controls will be designed based on monitoring results and site conditions and constraints. The engineered controls would remain in place until monitoring demonstrates that the groundwater CUL has been achieved. Design information, plans, and specifications would be provided to Ecology and the property owner before implementation.

4.2.10 Stormwater Collection System Construction

Stormwater catch basins and underground conveyance piping will be constructed in the Railroad Avenue and 4th Street ROWs, at the approximate locations shown in the 2008 Conceptual Restoration Plan (Appendix G). The sizes and locations of catch basins and conveyance piping will be based on the stormwater capture zone boundaries. Capture zone calculations are included in the Stormwater System Design Technical Memorandum (Appendix C). Capture zone boundaries, catch basin locations, and conveyance piping locations and sizes will be shown in 2008 construction plans, which will be submitted to Ecology in accordance with the schedule set forth in CD Exhibit C.

The existing stormwater conveyance system on 4th Street does not meet current King County standards. The system consists of two catch basins and a 6-inch-diameter outfall pipe that extends out into the Skykomish River at the northern terminus of 4th Street. The total length of the system on 4th Street is approximately 140 feet. Requirements to upgrade the street improvements to King County standards within the remediation area mean that additional stormwater flow will be added to the existing system from newly installed catch basins on Railroad Avenue and on the refurbished portions of 4th Street. Since the remediation area does not extend out to the river along 4th Street, replacement of the outfall structure and piping will not be completed. Because of this, and since the outfall pipe is currently a 6-inch-diameter pipe, some water ponding similar to what currently occurs, may occur during heavy rain events. Additional evaluations will be completed to further identify and define when and where ponding should be expected. The evaluation findings will be presented in 2008 construction plans, which will be submitted to Ecology in accordance with the schedule set forth in CD Exhibit C.

The existing stormwater conveyance system on 3rd Street consists of a single catch basin just south of Railroad Avenue, and a 10-inch-diameter pipeline that extends around 340 feet to the north to the Skykomish River. It is anticipated that this line will have a small addition of stormwater flows due to addition of curb, gutter, and catch basins on Railroad Avenue East of 3rd Street. In addition, it is currently anticipated that any water exiting the HCC water treatment system that cannot be re-injected on the railyard could discharge to the South Fork Skykomish River through the existing 3rd Street outfall. It is anticipated that the 10-inch-diameter line will be sufficient to handle the additional flows, but additional calculations and evaluations will be completed to verify that the outfall pipe will handle the flows. Alternatively, the HCC water treatment system could discharge to the South Fork Skykomish River via a different outfall, as approved by the Town and in conformance with the NPDES permit. Calculations and evaluation findings will be presented in 2008 construction plans, which will be submitted to Ecology in accordance with the schedule set forth in CD Exhibit C.

4.2.11 Wastewater Collection and Treatment System Construction

Sanitary sewer infrastructure for the community collection system will be installed at the McEvoy House and the Whistling Post Tavern, and in the excavated sections of the Railroad Avenue and 4th Street ROWs. Infrastructure may include the tanks, piping, pumps, vaults, and electrical appurtenances. Construction details will be included in subsequent design plans.

4.2.12 ROW Restoration

Town roads within the 2008 excavation area, as shown in the 2008 Conceptual Restoration Plan (Appendix G), will be restored to King County road standards, as adopted by the Town. Restoration will include backfilling and grading roadways, placing base material, asphalt paving, and installing curbs and gutters at select locations. The approximate locations of sidewalks, utilities, curbs and gutters have been determined based on the locations of existing curbs and gutters. As was the case with the 2006 restoration work, the actual locations of sidewalks, utilities, curbs and gutters will be determined based on Town comments and by agreement between the Town and BNSF and between the Town and affected landowners. Revised locations and construction details will be provided in 2008 construction plans, which will be submitted to Ecology in accordance with the schedule set forth in CD Exhibit C.

4.2.13 Utility Corridor Construction

Two utility corridors will be constructed across the RYZ at the approximate locations shown on Drawing C-4. One utility corridor will be provided for Town use and will consist of a 30-inch (or greater) diameter casing installed in a trench. This casing will be completed in access structures on both ends, and it may extend to the south to join up with the anticipated east-west sewer line location along the northern end of the railyard. BNSF will complete the casing and access manholes on both sides, or as agreed upon by BNSF and the Town.

The second utility corridor will provided for remediation use and will include 30-inch conduits for HCCS water, construction water, and air sparging piping. Geotechnical testing is being conducted to determine the best method for installation of the two conduits. Conduits will be installed in accordance with the BNSF Utility Accommodation Policy (BNSF, 2007).

4.2.14 Electrical and Telecommunications Utilities Restoration

BNSF is responsible for replacing utilities to their current or equivalent configuration (i.e., above ground) in accordance with applicable codes. It is the Town's desire to convert overhead electrical utilities to an underground system. Therefore, it is anticipated that the Town will enter into a Schedule 74 agreement with PSE for the conversion of overhead electrical utilities located within the 2008 remediation area and in additional areas, as shown in the 2008 Conceptual Restoration Plan (Appendix G). The conversion will include installing underground wiring and pad-mounted transformers in place of pole mounted equipment, installing wiring from transformers to residential meters, and providing stub-ups or junction boxes for connection to street lights and other appurtenances installed as part of the restoration. Per the agreement terms, 60% of design and construction costs to complete this scope of work will be paid for by PSE. Payment for the remaining 40% will be the responsibility of the Town. Design drawings for the conversion scope of work will be prepared by PSE and their contractor, Potelco, after the agreement has been established.

If BNSF and the Town come to an agreement on underground installation in lieu of overhead restoration (BNSF's current commitment for the work), then BNSF will install underground conduits for electrical services in a joint utility trench within the 2008 remediation area, as specified in PSE/Potelco plans. BNSF will also install conduit for telecommunications (telephone) and high speed internet in the same trench and concrete pads for above-ground transformers. Note that since there is no current high speed internet conduit in place in the Town, agreement between BNSF and the Town is required prior to installation of conduit for high speed internet. Trench details, conduit specifications, and transformer locations and pad specifications will be provided by PSE/Potelco after the Schedule 74 agreement has been established. Additional conversion scope of work items will be defined by PSE and the Town.

4.2.15 Replacement of Relocated Structures and Restoration of Remediated Properties

Replacement of relocated structures and restoration of remediated properties will be completed at the conclusion of excavation activities as outlined in Master EDR Section 4.1.10. A preliminary review of property surveys indicates that there is one property line issue in the 2008 construction area that may affect restoration activities. Parcel 780780-0440 contains the building called the Whistling Post Tavern. Property line surveys indicate that the eastern edge of the Whistling Post Tavern building is currently located on Town property. The encroachment distance is around 0.7 feet. While this distance does not pose a problem related to public improvements on Town property, BNSF cannot replace the privately owned building on Town property without an agreement between the owner of parcel 780780-0440 and the Town.

4.2.16 Demolition and Replacement of Section Building

If BNSF and the Town come to an agreement whereby the Town takes possession of the Depot building, then the existing Section Building on the railyard will be demolished and replaced with a new Section Building sized to accommodate all of the existing operations required at the yard, including those that occurred in the Depot building. This work is not required by the CD but would occur on the railyard during 2008 and therefore would need to be coordinated with other activities required by the CD. Licensed contractors would complete asbestos

and lead surveys and abatement, if necessary, prior to demolition. The demolition debris would be recycled or disposed of at an appropriate CDW landfill.

The new Section Building would be constructed on the railyard west of 5th Street and south of the tracks at the approximate location of the existing Section Building (see Drawing C-4). Construction would include forming a new foundation, installing septic system infrastructure to allow connection to the Town's community wastewater treatment system when it is available, erecting the building, and installing potable water and electrical services. The building is currently planned to be a modular pre-constructed building that will be brought onto the site and assembled in pieces.

The Section Building would remain in its current location if the Town does not take possession of the Depot building.

4.2.17 Soil Handling Facility Structure

A covered structure could be erected within the existing SHF to reduce the potential for stockpiles to contact precipitation and stormwater runoff and minimize the potential impacts of late season wet weather on soil stockpile prior to full load out. If a SHF structure is required, calculations will be performed to determine the possible size and location. In addition to possibly erecting the structure, other work within the SHF will include installation of temporary facilities. This installation will include marking out stockpile areas with ecology blocks, inspecting and repairing (if necessary) the water treatment area and asphalt pad, installing sediment and erosion control BMPs, and leveling of SHF as needed to alleviate significant standing water.

5.0 Construction Sequencing and Phasing

Construction sequencing and phasing will generally be determined by the general contractor subject to approval by the Professional Engineer (P.E.) of record (Engineer) approval. Some sequencing is time critical or affects pedestrian and vehicle access throughout the Town. These items are described below. The timing of the installation of the air sparging system and the HCC water treatment system are not time critical and will be determined by the general contractor subject to Engineer approval.

5.1 Depot Relocation

The Depot is directly in the pathway of the HCC construction, and therefore will be the first building requiring relocation. As such, preparation and relocation of the Depot may be completed ahead of the primary construction contract in order to prepare the site for HCC work as soon as possible. This decision will be made later in the design process.

5.2 Main Excavation Phasing

The current excavation plans call for removal of nearly all of Railroad Avenue and some areas that extend to the north of Railroad Avenue. Removal and reconstruction of this major arterial in Skykomish will require careful planning, and some inevitable street closures and inconveniences to the local residents. The construction method of the HCC is yet to be determined, but it will likely require significant time to build and potentially require concrete cure time if concrete is used in the barrier system. The HCC and excavation will also cross 5th Street, the major north-south arterial in the Town, requiring that 5th Street be closed at some point. While the details of this phasing will be left to the contractor to complete in the most effective and efficient way possible, certain restrictions on the work are anticipated. These restrictions include:

- Resident access must generally be maintained at all times to all occupied houses. No occupied house can be fully blocked off from all access for any significant period of time. Vehicle access may be restricted to single traffic lanes, or closed in some extremely short-term periods of time (less than one week), and pedestrian access may be guided through active construction zones for safety reasons.
- Emergency access must be maintained at all times to occupied houses.
- Fire access must be maintained to all remaining structures and to houses that are temporarily stored in staging areas.
- Minimize the time that the 5th Street railroad crossing will be closed to pedestrian and emergency traffic.
- Complete the restoration work prior to October 30.

A viable construction phasing approach was developed based on the stated restrictions. This approach may or may not be utilized by the contractor as they develop their approach to the work. However, any suggested work approach will need to follow the restrictions stated in this section to be considered a viable approach to the work. A viable approach consists of two phases of work. The first phase is completion of the HCC, completion of the southern portion of the excavation, and general site preparation activities. The second phase includes moving structures, completion of the remaining excavation, and site restoration. The following more detailed description of the phases is not intended to be all inclusive. It is intended to present the basic components of construction for each phase.

5.2.1 Phase 1

- Move the Depot to a temporary storage location if it has not already been moved.
- Prepare the McEvoy House and Whistling Post Tavern for moving: includes moving residents and contents, installation of support beams, disconnect all utilities, secure the structure so that it is ready to move.
- Install all temporary overhead utility services.
- Construct a temporary crossing of the railroad tracks to be used for emergency vehicles. Public access to the temporary crossing will be provided during limited hours and controlled by BNSF flaggers. The crossing will be secured after hours.
- Construct a temporary construction crossing of the mainline tracks so that excavated material can be moved to the soil handling facility while the 5th Street crossing is closed. Public access to the temporary crossing will not be allowed. The crossing will be controlled by BNSF flaggers and secured after hours.
- Construct the barrier portion of the HCC: includes closing the 5th Street railroad crossing for some time period while construction activities occur in the immediate vicinity of the crossing.
- Complete excavation north of the HCC while still maintaining a single lane of traffic on Railroad Avenue east of 4th Street. The 5th Street crossing will remain closed during excavation work on 5th Street. It is estimated that the crossing could be closed for several months (up to three).
- The Whistling Post Tavern may be moved to a temporary storage location (to the west a short distance from its current location) during this time period.
- Where additional future excavation to the north will be required (between 4th Street and Maloney's General Store), backfill the excavation as far north as possible while maintaining separation between the excavation and backfill faces.
- Install shoring along the north side of the backfill area between 4th Street and 5th Street, and in the backfill zone west of 5th Street and adjacent to Maloney's General Store. Note that this shoring may be installed prior to full excavation if sheet pile shoring is utilized.
- Backfill the area east of 4th Street.
- Open up 5th Street to traffic.

5.2.2 Phase 2

- Move the McEvoy House to a temporary storage location east of the construction activities on Railroad Avenue
- Establish a driving surface on the newly backfilled area adjacent to the HCC and move Railroad Avenue traffic to that surface
- Move the Whistling Post Tavern if it was not moved in Phase 1
- Complete the remaining excavation
- Install shoring where required
- Backfill the excavation area
- Complete restoration activities
- Completion of the remaining HCC features including the water treatment facility.

Phase 1 and 2 construction and traffic routing on the impacted section of Railroad Avenue are illustrated on Drawing C-23.

5.3 5th Street and Railroad Avenue Intersection

The intersection of 5th Street and Railroad Avenue may be closed for several months. During this time, traffic will be rerouted out to Highway 2 to access the Old Cascade Highway. Emergency vehicles will be given a temporary crossing west of the HCC construction area to be able to access people and property north of the tracks in the event of an emergency.

5.4 Traffic Routing and Pedestrian Access

A significant amount of construction will occur in Town during 2008. Construction will impact the two main arterials through Town: Railroad Avenue and 5th Street. Some disruption to daily traffic patterns will therefore be unavoidable ands some level of disruption and inconvenience for local residents is inevitable.

Excavation will occur on both Railroad Avenue and 5th Street, and the 5th Street railroad crossing will be closed for a period of time. There will be times when vehicles will need to travel east or west on Old Cascade Highway or Highway 2 to drive around the construction activities when the crossing is closed. We anticipate that the 5th Street RR crossing will be closed only when school is not in session, such that impacts to pedestrian and bus traffic that typically utilizes this crossing for school access are minimal.

Vehicle access will be maintained at all times for all occupied residential structures through Town with the exception of possible very short closures (anticipated to be one or two days)_of Railroad Avenue near 2nd Street. At all other times, at least one lane of travel will be provided along all the streets (except possibly along Railroad Avenue between 4th and 6th Streets) within the Town limits throughout the construction period. Alternate reasonable access for emergency personnel will be provided at all times.

Postings of road closures will be provided early in the process so planning can occur, and individual notifications will be made prior to full lane closures. Individual resident's needs will be accommodated as much as possible. Signage related to the project will be that typical of a road construction project with traffic routing and authorized personnel access.

Proposed traffic routing and pedestrian access during 2008 remediation activities is shown on Drawings C-24 and C-25. This drawing will be submitted for review by all affected agencies and persons, including the fire department, the police department (county and state), residents, and the school. This drawing will be submitted to the contractor during the bidding process, with the understanding that they will need to evaluate the drawing based on the restrictions presented in this EDR, and either accept the proposed traffic routing and pedestrian access as a viable method, or develop an alternative method that meets all requirements for approval by the Engineer. If the contractor requests revisions to the traffic routing figure to accommodate their construction schedule and approach, the revisions will be reviewed by the Engineer, the Town, Ecology, and local fire and emergency personnel.

5.5 Air Sparging System Construction

Air sparging system construction will occur in several phases. The vault, piping, and manifold located in the Railroad Avenue ROW will be installed concurrently with impacted soil excavation activities. Piping located within the RYZ utility corridor will be installed after the corridor has been instructed and the conduit has been installed. Piping and equipment located within the remediation systems equipment building will be installed after the building has been constructed. Air sparging wells and underground piping within the sparging area will be installed concurrently with well drilling operations for the school remediation technology evaluation.

It is anticipated that air sparging system construction will not impact traffic routing. Access to the sparging area will be maintained during the well and piping installation (intermittently for less than 3 weeks), and will be controlled by construction personnel during work hours.

6.0 Construction Quality Assurance

Construction quality assurance (CQA) includes practices to demonstrate that construction activities are completed in accordance with CPS and the regulatory framework described in this EDR. The goals of this section are to:

- Describe the quality program and organization to be implemented;
- Describe guidelines for inspection and documentation of construction activities;
- Provide reasonable assurance that the completed work will meet or exceed the CPS requirements; and
- Describe how any unexpected changes or conditions that could affect the construction quality will be detected, documented, and addressed during construction.

6.1 Quality Assurance Structure

The quality of construction activities will be demonstrated through an integrated system of quality assurance performed by the Engineer and his designee and quality control provided by the Contractor.

6.2 Construction Quality Assurance Responsibilities

BNSF

BNSF is responsible for implementing the remediation activities in accordance with the CD and for ensuring that its contractors and subcontractors perform construction in accordance with the CD, 2008 EDR, and CPS. BNSF is responsible for verifying that the Engineer it has retained effectively implements and manages the scope of work detailed in this 2008 EDR.

Engineer

The Engineer is responsible for providing design and engineering services in connection with the project. The Engineer is responsible for implementation of this CQA program. The Engineer will manage Contractors on behalf of BNSF and serve as the primary point of contact with the Contractor for all communications. The Engineer provides submittal review and resolution of design issues as they arise during construction. The Engineer will provide QA through daily monitoring and as-needed inspections to verify the effectiveness of the contractor's QC program and assure that the quality and CPS are met. The Engineer will assure that the contractor's QC is working effectively and that the resultant construction complies with the quality requirements. The Engineer is also responsible for formal communications with and submittals to Ecology.

Contractors

The Contractor is retained by BNSF to provide the labor, materials and equipment required to complete the scope of work detailed in the CPS. Contractors are responsible for quality control and completing the necessary inspections and tests to demonstrate that their work complies with the CPS and the regulatory framework described in this EDR.

6.3 Quality Assurance Monitoring Structure

Quality assurance monitoring includes the following:

- Submittals review;
- Protection monitoring
- Inspection and verification
- Construction deficiencies
- Documentation
- Ecology approvals
- QA/QC changes
- Completion reporting.

This section describes these monitoring practices in detail.

6.3.1 Submittals

Contractors will submit one copy of all testing results, quality control reports, other quality control documentation, and Daily Construction Reports to the Engineer. The Engineer will administer and control the processing of Contractor submittals. After being reviewed for completeness, submittal documents will be transmitted to the relevant project staff for review and verification for compliance with contract requirements. The submittal's disposition will be noted on the submittal, which will be signed, dated and returned to the Contractor. If required, the contractor will revise the submittal, incorporating the comments and will resubmit it for review and verification for compliance. Submittals will be logged and copies will be retained in the project files.

6.3.2 Protection Monitoring

The protection monitoring requirements applicable 2008 EDR scope of work include air and noise monitoring, as described in the AMP, and worker and public health and safety requirements, as described in the HASP. The CPS imposes these requirements on the Contractor. The Engineer will perform QA oversight of Contractor compliance and related work-area protection monitoring.

6.3.3 Inspection and Verification Activities

QC Inspection

The Contractor will perform QC inspections as necessary to control the Project work to the extent necessary to achieve specified quality and ensure conformance with the CPS and Contract Documents. These inspections could include the following.

The Contractor will document inspections in daily reports. The reports will identify inspections conducted, results of inspections, location and nature of defects found, causes for rejection, and remedial or corrective action taken or proposed.

QC Testing

The Contractor will perform QC testing necessary to control the Project work to the extent necessary to achieve specified quality and ensure conformance with the CPS and Contract Documents. The

Contractor will document QC testing in daily reports. The Contractor will review test results on a daily basis and identify any non-conforming test results for discussion and resolution with the Engineer.

QA Testing

QA testing will be completed to verify the adequacy and effectiveness of the Contractor QC testing. QA testing may will be performed by the Engineer, on an as-needed basis. In lieu of performing independent tests the Engineer may choose to witness QC testing or conduct tests on split samples from QC testing. Additional testing may be needed to validate the results when QA and QC test results do not compare or have wide variances. The Engineer will document QA testing in daily reports. The Engineer will review QA tests and maintain files for all field QA testing.

Construction Acceptance Criteria

Construction acceptance criteria for materials qualifications, inspection, and testing are established in the CPS. The criteria for materials and equipment have been set by the Engineer in accordance with the applicable codes and standards, and by manufacturers' recommendations. Contractor submittals will document conformance with the acceptance criteria.

Compliance with Handling, Storage, Packaging, Preservation, and Delivery Requirements

The Engineer will inspect the Contractor activities to demonstrate technical compliance in identification, handling, storage, packaging, preservation, and delivery of materials, parts, assemblies, and end products. Related quality records and documents will be maintained by the Contractor.

Material Identification and Traceability

The Engineer will monitor the Contractor to demonstrate that identification and traceability requirements are met. Products and materials shall be traced from receipt through all project stages to installation. Documentation such as project control checklists, material receipts, material tracking forms, procedures, sample and test documentation, and reports will be maintained by the Contractor to demonstrate that the applicable material item traceability is maintained. Product identification and traceability requirements are defined in the CPS.

6.3.4 Construction Deficiencies

A deficiency occurs when a material, performed work, or installation does not meet the plans and/or specifications for the project. When material, performed work, or installation is found deficient, the Contractor will demonstrate that the non-conforming material, work, or installation is identified and controlled to prevent unintended use or delivery.

Deficiency Notification

The Contractor will notify the Engineer of any minor deficiencies (items that do not require significant rework or repair work to correct, and will not result in significant deviations from required quality standard if corrected immediately) and major deficiencies (major deviations from the CPS and/or accepted standard of quality) immediately upon detection and note the deficiency in daily reports.

Deficiency Correction

Minor deficiencies can be corrected on the spot by agreement between the Contractor and the Engineer. Correction of major deficiencies could include removal and replacement of deficient work using methods approved by the Engineer. Deficiency correction will be documented in daily reports.

Deficiency Prevention

The Contractor will take preventive actions as necessary to eliminate the causes of potential deficiencies to prevent their occurrence. The Engineer will have the authority to improve the project's work processes to eliminate the causes of potential non-conformities.

6.3.5 Documentation

Daily Construction Report

The Contractor will prepare daily construction reports, which will include a summary of the Contractor daily construction activities.

Inspection and Testing Reporting Forms

The Contractor and the Engineer will prepare inspection and testing reporting forms. These forms will vary depending on inspection or test type.

Record Drawings

The Contractor will submit draft record drawings to the Engineer for review. The Engineer will prepare draft and final record drawings. The Engineer, working with the Contractor, will be responsible for assuring that red-line record drawings are maintained throughout the construction process. These red-line record drawings will be used to update the design drawings to as-built status at the completion of the work.

Preparation of As-Built Drawings

The Engineer, working with the Contractor, will be responsible for red-lining construction drawings in the field as preparation for as-built drawings. The as-built drawings will record approved actual field conditions upon completion of the work. The original design drawings will be marked up by the Contractor as the project progresses to indicate as-built conditions. Where there was a change to a specified material, dimension, location, or other feature, the as-built drawing will indicate the work performed.

Record Maintenance

The Engineer will maintain copies of all quality-related documentation onsite. The Contractor will provide electronic or paper copies (suitable for scanning) of QC documentation. The Contractor will maintain all original QC records onsite until the project is completed.

6.3.6 Field Changes

The Engineer or Contractor may propose changes to the QC/QA procedures if it becomes apparent that the procedures or controls are inadequate to support work being produced in conformance with the CPS or are deemed to be more excessive than required to support work being produced.

6.3.7 Completion Reporting

Upon completion of remedial activities, the Engineer will submit a final as-built report. The report 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.

7.0 References

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Appendix A

Hydraulic Control and Containment System Special Design Work Plan

Appendix B

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2008 Conceptual Restoration Plan

ENSR | AECOM

Prepared for:
BNSF Railway Company
Seattle, Washington

Hydraulic Control and Containment System Special Design Report Work Plan

The RETEC Group, Inc.
November 9, 2007
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Merged with ENSR in 2007
RETEC

ENSR | AECOM

Prepared for:
BNSF Railway Company
Seattle, Washington

Hydraulic Control and Containment System Special Design Report Work Plan

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The RETEC Group, Inc.
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1.0 Introduction

This *Hydraulic Control and Containment System Design Work Plan* (HCCWP) documents the overall strategy for evaluating the design of a hydraulic control and containment system (HCC) at the BNSF Railway Former Maintenance and Fueling Site in Skykomish, Washington. The HCCWP has been prepared on behalf of The BNSF Railway Company (BNSF) and is a deliverable under Consent Decree No. 07-2-33672-9SEA.

1.1 Purpose

The HCCWP provides the overall approach for design of the hydraulic control and containment system. The HCCWP contains plans and schedules for the tasks and sub-tasks to be performed in developing the conceptual design. The outcome of this process will be the Final HCC Design Report which will represent approximately a 30% design of the HCC and will include a discussion of the construction, operation, maintenance, and monitoring of the system. The development of construction plans and specifications, bid documents, operation and maintenance manuals, and monitoring plans will follow completion of the Final HCC Design Report. The objectives defined in this document are consistent with the *Cleanup Action Plan* (CAP; Ecology, 2007).

1.2 Background

The BNSF Railway Former Maintenance and Fueling Facility (site) in the east King County town of 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 and Ecology have agreed, subject to public comment and Court approval, to clean-up this historical contamination consistent with Model Toxics Control Act (MTCA; WAC 173-340) and the CAP.

The HCC discussed in this document is part of the selected remedial action in the CAP for the Railyard zone. The site has been divided into five cleanup zones (Figure 1-1) based on land use (railyard, commercial, residential), land type (wetland, levee, upland), exposure pathways, and distribution and chemical composition of the hazardous substances. The Railyard zone consists primarily of the rail transportation corridor owned by BNSF.

2.0 Design Requirements

2.1 CAP Requirements

The objective of the hydraulic control and containment system (HCC) is to ensure groundwater meets the appropriate remediation level as it leaves the BNSF property and to flush contamination underlying the railyard to collection points for treatment. For groundwater flowing immediately north from the railyard boundary, the remediation level is 477 µg/L NWTPH-Dx and the absence of sheen or free product This remediation level is based on protecting groundwater as a potential future source of drinking water. The cleanup level for groundwater is 208 µg/L NWTPH-Dx and absence of sheen or free product at the conditional point of compliance (CPOC; CAP Figure 6), including the point where groundwater enters surface water at the Skykomish River and Former Maloney Creek Channel (FMC). This cleanup level is based on protection of aquatic life in sediments.

CAP requirements for the HCC are given in CAP Section 4.1.6, and are incorporated in their entirety herein by reference. The key requirement is for a robust and reliable active HCC incorporating a redundant barrier system, groundwater pumping, and groundwater treatment. The redundant barrier system must be capable of detecting leaks of free product that may occur anywhere along the length of the barrier system. Contaminated water will be collected, treated, and reintroduced into the railyard subsurface at appropriate locations and by appropriate means in order to flush petroleum contamination toward the HCC trench. The treatment system will provide a means to aerate the water so it has a high dissolved oxygen content before being re-injected into the ground.

Cap requirements for the HCC design process, including this work plan and the HCC Design Report, are given in CAP Section 6.2, and are incorporated in their entirety herein by reference. The CAP provides that investigations and studies will be conducted to design the hydraulic control and containment system. The investigations and studies (see section 5.3.1) will include, but are not limited to, design, installation, operation, and maintenance of: the groundwater interception trench; the redundant barrier system capable of detecting leaks of free product that may occur anywhere along the length of the barrier system; groundwater pumping rates and volumes necessary to maintain hydraulic control and containment of both free product and dissolved contamination; water treatment requirements; water re-injection rates, volumes, and locations; surface water discharge rates, volumes, and locations; groundwater elevation and quality monitoring (including free product monitoring); means of optimizing system performance; and any other parameters necessary to fully design, operate, maintain, and assess the performance of the hydraulic control and containment system.

The hydraulic containment and control system will be installed along the north boundary of the BNSF property and it will extend laterally to intercept groundwater affected by soil with petroleum concentrations that exceed 3,400 mg/kg (Figure 2-1). In addition, a second hydraulic control and containment system may be required along the south boundary of the BNSF property between the Railyard and the FMC. The need for this additional hydraulic control and containment system will be determined during this design process.

The design will also define possible system failure mechanisms and redundancies to address these possible failure mechanisms.

2.2 Other Requirements

Several operations and maintenance issues will be considered in designing the system. The system must:

- Minimize maintenance
- Have adequate design life (see CAP Section 4.1.6 for review requirements)
- Be compatible with expected seismic forces
- Minimize impacts to the community (noise and aesthetics)
- Provide the flexibility to allow incremental shutdown of remediation/containment systems as remediation progresses and restore natural groundwater flow to the maximum extent possible
- Satisfy applicable state and local substantive requirements and comply with federal permits, as necessary.

In addition, system reliability and operability must be such that the time and effort to restart the system after any emergency shutdown will allow the system to continue to satisfy performance criteria.

2.3 Confirmational Monitoring

Confirmational monitoring wells will be installed to verify that concentrations of TPH meet the remediation level and cleanup levels at appropriate locations and that no leaks of free product are occurring. The monitoring wells will be installed downgradient from the HCC. In addition, two wells will be installed near each end of the trench to assess the groundwater quality of any flow around the trench. A groundwater monitoring approach will be presented in the Final HCC Special Design Report and a discussion of contingency actions will be prepared as part of the final design. A groundwater monitoring plan will be developed following the Final HCC Special Design Report.

3.0 Physical Site Conditions

This section summarizes the physical site conditions that will be considered during the design process.

3.1 Geology

The Town of Skykomish is primarily underlain by highly heterogeneous glaciofluvial sediments that have been locally reworked by the Skykomish River and Maloney Creek. These glaciofluvial sediments consist mainly of sand and gravel, and underlie a generally thin layer of topsoil and/or fill. Figures 3-1 and 3-2 present profiles along the HCC alignments that illustrate the variability of the soils underlying the site. Figure 3-1 illustrates the stratigraphy along the north railyard property boundary and Figure 3-2 indicates the stratigraphy along an alignment 25 feet north of the Former Maloney Creek Channel wetland.

Silty sand or fill is generally present along the HCC alignments at a thickness of 1.5 to 5 feet. West of 5th Street along Railroad Avenue, this unit is largely not present. The silty sand is loose to medium dense, is gravelly in places, and contains trace to abundant amounts of organic material ranging from leaf matter and twigs to logs. The fill has also been noted to contain brick fragments, broken glass, and nails.

Native soils underlie the sandy silt or fill. The native soils consist primarily of sand, gravel, cobbles, and boulders, with shallow discontinuous lenses of silt and clay. The ratio of sand to gravel varies greatly with depth and laterally throughout the site, and the grain size of the sand and gravel is also highly variable. The sand is generally medium to coarse-grained and the gravel is fine to coarse. There are frequent cobbles up to one foot in diameter and occasional boulders up to 3 feet across.

A layer of stiff to hard silt (ML) is present beneath the sand and gravel throughout the entire site. This layer is at least 4 feet thick and in places is greater than 10 feet in thickness. The upper surface of the silt generally rises gently from west to east but undulates substantially with what appears to be a deep trough between about 4th and 5th Streets along the northern railyard property boundary. A higher plasticity silt (MH) lens is present in this trough area at about 20 feet bgs (see Figure 3-1). As data is collected from the ongoing investigations, the discussion of site geology will be updated.

Previous site investigations have not reached bedrock; however, the base of the soils is estimated at an approximate depth of 200 to 250 feet according to local area well logs (GeoEngineers, 1993).

Areas that were excavated in 2006 and will be excavated in the future were and will be backfilled with sand and gravel or crushed rock. In the 2006 excavation area, all areas below the water table elevation of 917 feet NAVD88 were backfilled with a coarser crushed rock referred to as stabilization fill. Above 917 feet NAVD88, the backfill consisted of sand and gravel structural fill.

3.2 Hydrology

A shallow water table is present in the largely sand and gravel aquifer that underlies the site. Hydraulic conductivity values have been estimated using laboratory and field tests: these tests have provided hydraulic conductivities between 41 and 84 feet per day for the shallow sands and gravels.

Groundwater levels measured during several gauging events indicate that the overall flow directions within the site are relatively consistent with time. Figures 3-3 and 3-4 presents a groundwater surface elevation map. East of 4th Street, the groundwater generally flows from south to north, towards the Skykomish River with an average gradient of 0.014 feet per foot (that is 0.014 vertical feet per one horizontal foot). To the west of 4th Street, the groundwater flows from the southeast to the northwest with an average gradient of 0.01 feet per foot (RETEC, 2002a). The hydraulic gradient indicates that groundwater flows at an average

rate of 2.5 feet per day (ft/day) (RETEC, 2002a). Groundwater contour maps and additional details on groundwater flow are contained in the *Supplemental RI* (RETEC, 2002a).

Samples of backfill from past and future excavations will be collected for lab testing of hydraulic conductivity and grain size. These data will be incorporated into groundwater model scenarios for evaluation of HCC performance.

Groundwater elevations are the highest at the southeast corner of the Former Maintenance and Fueling Facility and decrease to the northwest towards the Skykomish River. The depth to groundwater ranges approximately from 3 to 17 feet below ground surface throughout most of the site. High and low water table elevations along the HCC profiles are illustrated in Figures 3-1 and 3-2.

The groundwater levels fluctuate seasonally. Figures 3-5, 3-6, and 3-7 show hydrographs with groundwater levels measured at various frequencies between 1995 and 2007. Groundwater elevations are generally higher during late fall, winter, and spring (November to April) and lower in the summer and early fall (June to early November) (RETEC, 2001). Hydrographs of two wells (MW-20 and MW-21) with measurable free product are shown on Figure 3-8 and Figure 3-9. These hydrographs were developed to see if any preferential free product lenses could be determined along the HCC profiles. The hydrographs indicate that free product thicknesses increase after rapid declines in water table elevations, regardless of the water table elevation. Based on these observations, preferential free product flow layers are not present. It is hypothesized that after a rapid drop in water level, the high viscosity free product preferentially drains into the well and annulus, then slowly re-equilibrates with the formation as free product moves into the formation and drains from the well and annulus.

The former Maloney Creek channel is a wetland fed primarily by stormwater runoff. The water table is located well below the bed of the channel during seasonal low groundwater levels. During measured seasonal high water levels the groundwater rises to a foot or less below the channel, and it is possible that at times groundwater surfaces in the former creek bed and feeds the channel. Interaction between groundwater and the former Maloney Creek channel is being evaluated as part of the Remedial Design Investigation.

3.3 Railyard Property

The railyard has an active main line (consisting of two tracks) with one siding and two other active sidings south of the main line area. Both passenger and cargo trains use the main line and sidings. The rail line is one of the main trans-continental rail transportations corridors; approximately one train per hour passes the site (Yates, 2003). The BNSF railyard continues to be used for track maintenance and other railroad operations such as snow removal. The BNSF Depot building, north of the main line area, is defined as a landmark of significance of Skykomish and King County and is listed on the National Register of Historic Places (NWAA, 2005). This building will be permanently relocated as part of the cleanup. The Railyard also has a paved soil handling area that was used for stockpiling soil and loading railcars during the 2000 levee cleanup work. This area is located to the south of the property between the rail lines and the wetland. Future cleanup work will require substantial activity on the site related to soil handling facility upgrades, excavation, grading and stormwater management, and structures and facilities associated with HCC water treatment and NE zone enhanced bioremediation.

3.4 Surrounding Properties

The hydraulic control and containment system will be installed on the north side of the BNSF railyard property and will extend into the Railroad Avenue right of way. On the north side of Railroad Avenue North, across the street from the BNSF railyard property, is a mix of commercial, residential, and public properties. The Maloney General Store, Manual Training Building (110 RR Ave), Skykomish Theater (adjacent to Maloney's General Store), Skykomish Hotel, Whistling Post Tavern, McEvoy House (200 RR

Ave.) and Hatley Hotel (210 RR Ave.) are defined as landmarks of significance of Skykomish and King County and are listed on the National Register of Historic Places (NW Arch. Assoc., 2005). None of these structures will be relocated to accommodate the HCC but several will be moved temporarily as part of the overall cleanup work. Fifth Street bisects the railyard property.

A hydraulic control and containment system may also be installed along a line 25 feet north of the FMC and Railyard Zone Boundary. The FMC channel and wetland are protected under the Critical Area Ordinance (CAO; Ordinance 269, 1998).

3.5 Utilities

Fiber optics, electrical, and signal lines are present near the Railroad Avenue HCC alignment. The people of Skykomish are served by two public water supply wells that are located about 1,100 feet east (upgradient) of Skykomish. A 6-inch water main is present along Railroad Avenue and 2-inch or smaller water service lines are present on 3rd, 4th, 5th, and 6th Streets and portions of Railroad Avenue. Overhead power is present on the north side of Railroad Avenue.

There is currently a series unpermitted municipal stormwater pipes and outfalls in Skykomish, but no sanitary sewer systems or wastewater treatment plants. Residents use septic systems consisting of tanks and leach fields to treat and dispose of sanitary waste. A new wastewater treatment system will be constructed in the Town during the same time period that the cleanup occurs. HCC construction will need to be coordinated with this construction, which will add sanitary sewer piping in public rights of way.

4.0 Chemical Site Conditions

This section summarizes the extent of contamination at the site and describes LNAPL characteristics. The predominant types of product used or stored at the railyard were Bunker C and diesel. Fortnite oil (a kerosene-like product) was reportedly used as a cleaning solution during repair activities that occurred at the maintenance yard from the 1890s to the mid-1940s. In addition, gasoline, and waste oil have been used and stored on the railyard. Bunker C is usually blended with lower-molecular-weight fractions, such as diesel or Fuel Oil No. 3, to decrease viscosity and improve flow characteristics. The types and distribution of contamination at the site are discussed below since they impact the lateral extent and depth of the HCC that will be required as well as other specific design considerations.

4.1 LNAPL Distribution

Several discrete areas of free product are present within the site. Figure 4-1 shows the estimated extent of free product throughout the site based on measured free product at any time since May 2005. The areas of free product are discontinuous and are present both on and off the railyard. The lateral extent and location of mobile product changes as a result of water table fluctuations in the smear zone expanding and contracting within a relatively constant overall area of residual product. This fluctuation also affects the product thickness measured in wells as LNAPL moves slowly with respect to water table changes.

The largest three free product plumes are present in the northwest part of the site, underlying residential and commercial properties. These plumes have migrated downgradient from the source areas on the railyard since the original releases, and extend to the northwest towards the Skykomish River. The rate of migration is slow, as part of the free product plume is still present within the railyard. These free product plumes consist primarily of Bunker C although there may be some diesel or Fuel Oil No. 3 from the diesel plume area or from cutting of the Bunker C with less viscous oil to allow pumping.

Three other small free product plumes are present based on measurable free product in one well during at least one gauging event since May 2005. Bunker C free product is present at 2A-W-11 near the Former Maloney Creek Channel likely due to collection of spillage in a low lying area. Bunker C free product is also present at MW-21 likely due to spillage or leakage from an oil column that was used for fueling steam locomotives. Diesel free product has been detected for the first time at 1B-W-1 in Railroad Avenue with measurable free product measurements recorded in July and August 2005.

4.2 LNAPL Properties

Product characteristics have been evaluated by laboratory analysis of four product samples collected at the site (RETEC, 1996: Tables 6-11 and 4-1). Samples were obtained from the river seep near SED-4/ SED-5 and from wells MW-22, MW-27, and MW-39, and analyzed for physical parameters including specific gravity, viscosity, surface tension, and interfacial tension. Samples from SED-4/SED-5 and MW-22 consist primarily of Bunker C that has migrated from the railyard source area to the Skykomish River and should be representative of three major free product plume areas and most impacts within the NW Zone. MW-39 consists of a heavily weathered Bunker C that was likely present in an old channel of the Former Maloney Creek Channel but has since been buried when the channel was relocated. Product in MW-27 is Bunker C that is most likely to be commingled with some diesel that has migrated over from the railyard diesel source areas. The test results are summarized below:

- Specific gravity for the Bunker C samples ranges between 0.9676 (MW-27) and 0.9922 (MW-39). This indicates that the specific gravity is relatively consistent, and that the specific gravity is slightly less than that of water (specific gravity = 1). The product will float on water but its buoyancy is very low, so droplets of oil may be present within the water column in a well.

- Viscosity at 7.5 ºC (45 ºF) ranges between 1,035 centipoise (cP) (MW-27) to 95,350 cP (MW-39). This indicates that the viscosity varies greatly, probably due to different product composition of the samples. These viscosity results for Bunker C are high compared to the viscosity of common hydrocarbons such as diesel that has a viscosity of about 1 to 4 cP. The result for the sample from MW-39 suggests that this is a highly weathered Bunker C. The lower measured viscosities are considered more typical of the Bunker C free product present on the Railyard.
- Surface tension ranges from 33 dynes/cm (MW-22) to 39 dynes/cm (the river seep). Surface tension describes the force required to break the surface of the liquid. The surface tensions of the product samples are relatively consistent and lower than water (72.8 dynes/cm at 20ºC).
- Interfacial tension ranges from 25 dynes/cm (MW-39) to 81 dynes/cm (MW-27). The other two samples contained interfacial tensions of 27 and 49 dynes/cm; this indicates that the value of 81 dynes/cm may be an overestimation since this number exceeds the surface tension of water and is disproportionately higher than the other sample results. Interfacial tension is the force required to rupture the interface between two liquids (in this case, the product sample and water. This varies considerably for the different samples; it indicates that the two liquids will remain fully separate rather than mixing.

4.3 Groundwater TPH Distribution

Groundwater samples were collected site-wide from select wells during May, August and November 2005 and February 2006. These results were reported in the *Annual Site-Wide Groundwater Monitoring Report* (RETEC, 2006). TPH in groundwater was analyzed using method NWTPH-Dx without silica gel cleanup. This method reports diesel range (TPH-D, C12–C25) and oil range (TPH-O, C25-C36) hydrocarbons. Since that time, site-wide groundwater sampling has been performed in May and November 2006.

Figures 4-2 through 4-5 show the extent of TPH (measured as NWTPH-Dx without silica gel cleanup) in groundwater for November 2005 and February, May and November 2006, respectively. Extractable and volatile petroleum hydrocarbon (EPH/VPH) data were collected during the first two of the events listed above. The data for February 2006 are presented in Figure 4-6 as detections were more widespread than in the November 2005 event. As discussed in the *Site-Wide Groundwater Report* (RETEC, 2006), the NWTPH-Dx (without silica gel cleanup) results were consistently higher than the EPH results while VPH results were low to non-detect. This discrepancy likely occurs since the EPH analysis uses silica gel cleanup.

In 2002 and 2003, some groundwater samples were collected for analysis for both NWTPH-Dx with and without silica gel cleanup (see EPA Method 3630 and Ecy Pub. 97-602). Table 4-2 presents a summary of these data. When contaminants are detected, the non-silica gel NWTPH-Dx analyses are from 360% to over 1000% greater than the corresponding silica gel result. The purpose of the silica gel cleanup is to remove non-petroleum organics that will generate a petroleum-like response in the NWTPH-Dx GC-FID analysis. While the presence of Bunker C presents complications, *Analytical Methods for Petroleum Hydrocarbons* (Ecology, 1997) indicates that silica gel will remove 10 to 20% of Bunker C petroleum suggesting that non-silica gel results should be no more than 25% higher due to the presence of Bunker C. In addition, the site-specific correlation between NWTPH-Dx without silica gel with Total EPH/VPH for soil indicated that non-silica gel results were about 35% higher with a correlation coefficient of 96% (RETEC, 1999). This discussion explains a minor portion of the discrepancy in the Bunker C areas, but it provides no explanation for discrepancies in the diesel area where non-silica gel results are 700 to 850% greater than the silica gel results and where it is not expected that the silica gel could be removing oil that is suspended (not dissolved) within the groundwater that is present in the wells. Some biogenic sources are present in Skykomish, including wood waste from when the railyard was cleared and filled as well as septic discharges. Other possible sources for the significant discrepancy between the silica gel and non-silica gel analyses for groundwater samples could include bacterial metabolites in groundwater that are not present in the soil sample correlation. The absence of these compounds in soil samples could be due to

the high solubility of these polar organics, such as alcohols, aldehydes, and acids, such that they would not likely adsorb to organics in soil or sediment.

This variance in analytical results has a significant impact on the estimated extent of groundwater impacts, the design of cleanup elements such as the HCC and enhanced bioremediation system, and compliance monitoring throughout the site. Specifically, the variance in analytical data has the potential to impact the following cleanup elements:

- Lateral extent of the HCC
- Type of HCC design selected to achieve the applicable groundwater remediation and cleanup levels
- Extent of the enhanced bioremediation system in the NE Zone
- Accuracy of groundwater compliance monitoring data and triggers for contingent remedies

This Work Plan provides a description of some tests that will be used in an attempt to resolve these issues.

4.4 Soil TPH Distribution

TPH is present in the surface, vadose and smear zones within the railyard (RETEC, 2002). The concentrations of TPH (diesel and oil) in vadose and saturated zone soil are presented in Figures 4-7 and 4-8 while smear zone soil concentrations are present in Figure 4-1. In general, vadose zone impacts coincide with historical railroad operational areas that acted as sources of contamination. These operational areas included the fueling station and diesel tank, and areas topographically downgradient from the oil unloader pits, timber oil sump and pump house.

TPH is more widespread in the smear zone. In the smear zone, TPH is generally located in areas coincident with the vadose zone impacts and hydraulically downgradient from those impacted areas. This reflects free product migration with groundwater downgradient from the former operational areas where downgradient is to the northwesterly for the primary Bunker C area and northerly in the diesel area. The maximum TPH concentrations found to date are 13,400 mg/kg, 30,700 mg/kg and 40,000 mg/kg in the surface zone, vadose zone and smear zone, respectively, based on the sum diesel and lube oil range hydrocarbons (RETEC, 2002a). The residual saturation in the vadose zone varies with differences in the lithology throughout the site. Data collected during the Supplemental RI indicate that the residual saturation on the railyard may be as high as 30,700 mg/kg (RETEC, 2002).

Samples collected from the saturated zone indicate that contamination has not been detected in soil more than 25 feet below ground surface (RETEC, 2003). In addition, groundwater samples collected from wells (DW-1 through DW-5), completed below the silt, have not contained detectable concentrations of hydrocarbons (RETEC, 1996). This indicates that soil TPH impacts are only present above the silt that underlies the site at approximately 15 to 25 feet below grade.

5.0 Design Process

This section discusses the concepts that will be considered during the design process and the pre-design and design activities that will be performed to determine the most appropriate design of the HCC to achieve the design criteria.

5.1 Design Concepts

The purpose of this section is to outline the possible remedial approaches and design concepts so that the appropriate pre-design (Section 5.3) and design (Section 5.4) activities will be performed to evaluate this range of HCC remedial approaches. Design concepts presented in the CAP (Ecology, 2007) will be examined as the design process proceeds in order to develop the most appropriate remedial approach.

5.1.1 Full Barrier

The conceptual HCC design, as shown on Section 4.1.6 of the CAP and as illustrated in Figure 5-1, includes the following components:

- Redundant barrier system keyed into silt.
- LNAPL recovery trench backfill, sumps, and skimmers upgradient of barrier.
- Groundwater pumping for hydraulic control with inward gradient from downgradient side of wall to upgradient side provides redundancy; could also place organoclay mat on downgradient side of physical barrier.
- Groundwater treatment with reinjection at an appropriate location to provide flushing of the source area and to provide hydraulic control to prevent gradient reversals to the FMC. Reinjection downgradient of the barrier may occur, particularly in the NE Zone, to maintain groundwater flow for the enhanced bioremediation system. The enhanced bioremediation system is discussed in Section 4.1.3 of the CAP. Some reinjection outside of the impacted areas, and/or a discharge to surface water following treatment consistent with an NPDES permit, will likely need to occur to allow the HCC to function effectively.

5.1.2 Bunker C Area Alternatives to Full Barrier

The Bunker C portion of the HCC stretches from about MW-19 to the west to just east of the Depot along the north property boundary of the railyard. Both NAPL and dissolved phase impacts are amenable to sorption on organoclay. However, to the extent that polar organic biodegradation metabolites are present in groundwater, these compounds will pass through the organoclay and may be picked up by the NWTPH-Dx analysis without the use of silica gel cleanup. As a result, the HCC design and the compliance monitoring program will need to account for this issue. The following sections provide brief description of various design concepts for the Bunker C Area.

5.1.2.1 Funnel and Gate Oil-Water Separation

This system is premised on the assumption that simple oil-water separation will remove petroleum hydrocarbons from groundwater to the extent necessary to achieve the groundwater remediation level of 477 µg/L at the railyard property boundary and the 208 µg/L cleanup level at the South Fork Skykomish River (see Figure 5-2). This approach includes the following components:

- Physical barrier keyed into silt
- LNAPL recovery trench backfill, sumps, and skimmers upgradient of barrier

- Groundwater flow through oil-water separation gates in the physical barrier such that no groundwater pumping is necessary
- Redundant organoclay reactive barrier downgradient of gates for treatment of any NAPL or dissolved phase impacts.

There are a few design concept options associated with this approach that will also be considered:

- Replacement of the physical barrier and recovery trench with a series of box culvert sections that would allow oil-water separation and oil recovery in an open vault
- Including a groundwater extraction system at the gates to address the initial high load of contaminant removal that can later be turned off to allow more natural groundwater flow once groundwater has achieved the remediation level
- Upgradient air sparging in source areas, along with source area excavation, to enhance biodegradation and reduce dissolved phase impacts to below the remediation level more rapidly.

Pilot testing of a thermal treatment system or other alternate technology that may be used in the future for cleanup under the school may occur in the Bunker source areas on the railyard.

5.1.2.2 Underflow Oil-Water Separation/Full Reactive Barrier

This system is based on the same assumption presented in Section 5.1.2.1, above, with a hanging physical barrier as opposed to gates (see Figure 5-3). This approach includes the following components:

- Hanging physical barrier (not keyed in to silt) to allow groundwater to pass while stopping oil flow such that no pumping is required
- LNAPL recovery trench backfill, sumps, and skimmers upgradient of barrier
- A full length organoclay reactive barrier downgradient of recovery trench and physical barrier
- Contingent groundwater pumping for hydraulic control.

5.1.3 Diesel Area Alternatives to Full Barrier

The diesel portion of the HCC stretches from just east of the Depot at the west end to about MW-34 to the east along the north property boundary of the railyard. NAPL along the property boundary and in Railroad Avenue will be excavated in 2008. Post-excavation diesel-only impacts will remain in the NE Zone and on the railyard upgradient of the NE Zone. Diesel impacts and the associated metabolites are amenable to biodegradation. Two options for replacement of the physical barrier in the diesel areas are as follows:

- Extending the NE Zone enhanced bioremediation system into the railyard to aggressively treat the diesel source areas, along with source area excavation on the railyard, and eliminate the long-term source to groundwater impacts
- Placing an enhanced bioremediation GAC reactive barrier at the property boundary to provide a longer retention time for biological treatment before groundwater leaves the railyard (see Figure 5-4).

5.1.4 FMC Channel Area Alternatives to Full Barrier

A portion of the HCC may be needed along the south side of the railyard along the FMC Channel to address possible gradient reversals that could discharge impacted groundwater to the FMC Channel. The hydrologic study will help evaluate the potential for gradient reversal to occur and the associated need for the HCC while the default full barrier system includes clean groundwater reinjection in this area to address the potential for gradient reversal. The Town has expressed an interest in relocating the wetland post-remediation to an

alternative location. In addition to impacting the rationale and extent of excavation on this area, moving the wetland allows for alternative means of addressing the potential for gradient reversal. These include:

- Raising the elevation of the base of the channel to eliminate the potential for drainage of groundwater into the channel and the associated gradient reversal
- Lining of the bottom of the channel to eliminate the potential for groundwater discharge to the channel.

5.2 Coordination Issues

There are numerous details related to the primary design activities. Some ongoing site activities related to the HCC design include:

- Soil and groundwater investigation that will occur in July through October 2007
- Hydrologic study near FMC Channel to determine if flow occurs toward the FMC Channel at any time
- Potential relocation of mitigated wetland away from FMC Channel and impacts on extent of cleanup and need for HCC in this area
- Detailed survey of site that will be completed in August 2007
- Depot relocation from Railroad Avenue
- Groundwater quality testing in the 2006 excavation area, downgradient of LNAPL-impacted areas, that may have implications for HCC design
- Installation of utility corridors under mainline to avoid breach of HCC and allow connection of HCC to treatment system
- Determination of treatment plant location and power service and sewer connection needs.

Other major coordination issues are:

- Coordinate NW and NE Zone excavations with HCC installation
- Coordinate NE Zone enhanced bioremediation system to ensure groundwater flow through the NE Zone
- Coordinate with railyard source removal activities
- Coordinate with FMC Channel excavation and restoration.

5.3 Pre-Design Activities

The timeframe for performing the design of the HCC is very aggressive. As a result, many pre-design activities are already underway. These pre-design activities are designed to answer questions such as the following:

1. What is the needed lateral extent of the HCC?
2. What is the depth to silt along the HCC? Is it continuous?
3. What is the soil grain size along the HCC?
4. What are the hydrologic properties along the HCC? Upgradient and fill downgradient?
5. What are the LNAPL properties along the HCC?
6. What is groundwater quality after oil removal?
7. What are the locations of the railroad tracks, roads, utilities, and property boundaries?

The results of these pre-design activities will be provided in the HCC Design Report.

5.3.1 Supplemental Site Investigation

The supplemental site investigation includes the installation of numerous borings and wells as described in the *Remedial Design Investigation Work Plan* (RETEC, 2007). These investigation activities will provide the following information related to the HCC design:

- Extent of and depth to silt along the HCC profiles
- Soil TPH concentrations to help define the extent of the HCC
- Refinement of the extent of free product along the HCC alignment
- Interaction between groundwater and the former Maloney Creek channel
- Groundwater TPH concentrations to help define the extent of the HCC.

5.3.2 Semiannual Groundwater Monitoring

With the excavation of the area along the River and the subsequent installation of monitoring wells in the clean backfill, this is the first opportunity to evaluate groundwater quality downgradient of Bunker C free product and NAPL. During the groundwater sampling event performed during the week of July 30, 2007 groundwater samples were collected from seven new wells 5-W-14 through 5-W-20. These samples will be analyzed for both NWTPH-Dx with and without silica gel. In addition, an EPA Method 8270 scan will be performed on a sample from each well to estimate the types and concentrations of compounds that are removed by the silica gel since little to no petroleum should be present at these well locations. Similar testing will likely be performed on other groundwater samples from the diesel or other areas to evaluate groundwater composition.

5.3.3 Railroad Avenue Alignment Test Pits

A few test pits will be excavated along the Railroad Avenue HCC alignment to collect soil samples for the following tests:

- Grain size data along barrier wall alignment for trench backfill filter design
- Corrosion potential evaluation due to possible use of steel sheetpiles
- Soil for column leach testing to better estimate water quality downgradient of NAPL or free product areas in conjunction with the groundwater sampling noted in Section 5.3.2.

5.3.4 Free Product Testing

Free product samples will be collected from MW-20, MW-8, and 2A-W-4. These samples will be analyzed for viscosity, specific gravity, and interfacial tension to obtain product information for samples close to the HCC alignment. Flash point will also be tested to address future storage and disposition of collected product. Additional future testing of free product may be performed to evaluate NAPL/product mobility with additional analyses and modeling.

5.3.5 Oil-Water Separation Jar Tests

Combined product and water samples will be collected from MW-20, MW-8, and 2A-W-4. Simple jar tests will be performed to evaluate water quality after simple gravity oil-water separation. Future testing may be performed to evaluate the performance of emulsification breakers and other advanced oil-water separation techniques such as dissolved air flotation.

5.3.6 Excavation Backfill Permeability Testing

Samples of backfill consistent with backfill used during the 2006 excavation activities will be collected from a gravel pit. Constant head permeability tests will be run on samples of the two types of backfill so that the hydraulic conductivity may be included in the groundwater model for the 2006 and future excavations. Stabilization fill was used below 917 feet NAVD88 in the 2006 excavation and will be used beneath the low water table in future excavations and possibly up to the high water table elevation. Structural fill was used above 917 feet NAVD during the 2006 excavation. This elevation will intercept the high water table in this location and structural fill may be used beneath the high water table in future excavations.

5.4 Design Activities

Following pre-design activities, the following activities will be performed to complete the design of the HCC. The results of these design activities will be provided in the HCC Design Report.

5.4.1 Bench Testing

Bench testing will be performed to help evaluate and design some of the elements of the HCC as follows:

- Mixtures of organoclay with sand and gravel will be tested for permeability to ensure that a mixture can be developed with sufficient hydraulic conductivity and sorptive capacity to be included in the HCC design and that sufficient hydraulic conductivity will be maintained as the organoclay expands
- Organoclay column studies will be performed with site groundwater and product to evaluate the sorptive capacity with site-specific contaminants, to evaluate water quality post-sorption, and to confirm that polar organic metabolites will pass through the organoclay without sorbing
- Soil column leaching studies will be performed on heavily-impacted soil samples collected from test pits along the HCC alignment to estimate effluent water quality after groundwater and product pass through a free product recovery trench
- Shaker flask studies will be performed on groundwater from both the diesel and Bunker C areas to help evaluate the biodegradability of dissolved groundwater contaminants (and an estimate of the biodegradation rate) and the presence and degradability of bacterial metabolites and their impact on water quality analysis with and without silica gel analysis, including analysis by 8270.

5.4.2 Pumping Test

A pumping test will be performed on a new well, likely installed in the vicinity of MW-20 and 2A-W-1, to provide:

- Data related to aquifer properties such as hydraulic conductivity and specific yield
- Water treatment system influent quality.

The flow rate and duration of the pumping test will be determined based on providing sufficient stress on the aquifer to obtain good hydrologic data and available space for temporary water storage tanks. Pumped water will be analyzed for NWTPH-Dx as well as other parameters for several rounds to assist with design of a water treatment system. These parameters include:

- Total Suspended Solids
- Oil and grease
- Iron
- Manganese

- pH
- Hardness
- Alkalinity
- Microbial count (total heterotrophs).

5.4.3 Groundwater Modeling

The existing three dimensional finite element groundwater model will be updated with the new stratigraphic data from the supplemental investigation work and with the new hydrologic data from the permeability testing of backfill and the pump test. Modeling will be used to evaluate the extent and depth of a physical barrier, groundwater extraction rates needed for hydraulic containment, and the size and location of gates in a funnel and gate system and associated flow rates. Modeling will also include and evaluation of the location and flow rates of groundwater reinjection to promote flushing. Groundwater modeling will include sensitivity analyses for changes in groundwater gradient, flow direction, and hydraulic conductivity.

5.5 Evaluation Criteria for Selection of Preferred HCC Approach

Based on of all the data collected to this point and all of the associated analysis, the most appropriate HCC approach will be selected and designed. At a minimum, each HCC approaches considered must provide the following:

- Compliance with applicable state and local substantive requirements and federal permits, as necessary
- Achieve groundwater remediation and cleanup levels
- Flush remaining TPH source area on the Railyard per the CAP
- Compatibility with expected seismic forces
- A redundant barrier system to address possible system failure
- A groundwater flow control and containment/treatment system in the event of a long-term (i.e. greater than 2 months) power shutdown due to a catastrophic event such as a large earthquake
- Groundwater compliance monitoring to identify possible breakthrough of the HCC

For those HCC approaches that satisfy the minimum requirements, the following evaluation criteria will be used to select the preferred HCC design approach:

- Constructability
- Ease of coordination with other site cleanup activities
- Likelihood of achieving groundwater cleanup and remediation levels prior to discharge from the HCC
- Likelihood of triggering contingent actions
- Community disturbance associated with HCC maintenance and possible contingent actions
- Design life and ease of design life extension through maintenance or replacement
- Extent of routine maintenance
- Flexibility to allow incremental shutdown of remediation/containment systems as remediation progresses and restoration of natural groundwater flow to the maximum extent possible
- Cost-effectiveness.

5.6 HCC Design Report

The basis of design and 30% design will be provided in the HCC Draft Design Report that is due to Ecology on December 5, 2007. The 30% design will include the conceptual design for some or all of the following elements:

- Extent, depth, and alignment of physical barrier
- LNAPL recovery trench
- Product skimming and groundwater extraction systems
- Enhanced bioremediation system, including possible GAC reactive barrier
- Organoclay reactive barrier
- Water treatment system and building
- Reinjection system.

Other related remedial actions that will be described to the extent necessary to coordinate the activities include:

- Railyard source excavation activities
- NE Zone excavation and enhanced bioremediation
- NW Zone excavation
- Former Maloney Creek Channel excavation and restoration
- Any pilot testing of a proposed school remedy on railyard.

A proposed operations, maintenance, and performance monitoring plan will also be included in the Design Report.

A Plexiglas scale model of the HCC or a computer visualization model will be constructed to assist in our design evaluation and communication of the design to Ecology, the Town, community members, and other stakeholders.

6.0 Schedule and Deliverables

Per the Draft CAP (Ecology, 2007), the following deliverables related to the HCC are due on the following dates:

- Final HCC Design Work Plan – October 5, 2007
- Draft HCC Design Report – December 5, 2007
- Final HCC Design Report – January 15, 2008.

As noted earlier in this Work Plan, the design schedule for the HCC is extremely tight. As a result, this Work Plan submittal has occurred prior to the CAP stated deadline, pre-design activities have commenced, and design activities will be commencing shortly. The pre-design and design activities and the need for early start of these activities have been discussed with Ecology. Early submittal of the Work Plan will allow more time to focus on the design process and allow timely submittal of the Draft Design Report. Figure 6-1 presents the proposed schedule for the HCC design activities. The proposed submittal dates for the Draft and Final HCC Design Work Plans have been accelerated to August 28 and September 28, respectively.

After completion of the Final Design Report, design and bid documents will be prepared, including plans and specifications.

7.0 References

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SKYKOMISH SCHOOL CLEANUP ALTERNATIVES EVALUATION WORK PLAN

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November 29, 2007

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APPENDIX

1.0 INTRODUCTION

1.1 PURPOSE

This Work Plan has been prepared on behalf of BNSF Railway Company (BNSF) to present the methodology that will be used to conduct an evaluation of technically feasible cleanup alternatives for cleanup of petroleum hydrocarbons in soil and groundwater beneath and 20 feet adjacent to all sides of the Skykomish School building located at 105 6th Street North in Skykomish, Washington. The Skykomish School property is herein referred to as the School. The School is within the BNSF Former Maintenance and Fueling Facility, herein referred to as the Site, as defined in the Consent Decree 07-2-33672-9 SEA. The location of the School is shown on Figures 1 and 2. The Site is segregated into zones, as shown on Ecology Figure 5 in Appendix A. The School is located within the Northwest Developed Zone.

The objectives of the cleanup action are to reduce the total quantity of petroleum hydrocarbons beneath the School; reduce the mobility of free-phase and soluble components, to the maximum extent practicable; and be as compatible as possible with ongoing School operations.

An interim cleanup action was conducted within the Levee and Northwest Developed Zones in 2006 that included a portion of the School property (RETEC Figure 4-1, Appendix B). Additional excavation and removal of contaminated soil within the Northwest Developed Zone will include portions of the School property adjacent to and outside of the School building. The cleanup alternatives to be evaluated in accordance with the methodology presented in this Work Plan address the area beneath the School building that will not be affected by the interim action in the Northwest Developed Zone.

This Work Plan provides the results of remedial technology screening to select technologies applicable to the School remediation. Technologies screened and determined applicable to the School were combined and augmented to develop cleanup alternatives. The Work Plan presents the criteria that will be used to evaluate the cleanup alternatives, and describes the process for selecting the cleanup alternatives that warrant comparative physical testing. As required by the Cleanup Action Plan (Ecology 2007), one of the cleanup alternatives selected for physical testing will be thermal treatment. The performance of thermal treatment will be established as the benchmark by which other tested technologies will be compared. The purpose of the comparative physical testing is to select a final cleanup action to address the contamination beneath the School building.

This Work Plan has been prepared as a deliverable required by the Cleanup Action Plan (Ecology 2007), attached as Exhibit B to Consent Decree 07-2-33672-9 SEA between Ecology and BNSF.

1.2 REPORT ORGANIZATION

The Work Plan is organized into seven sections:

Section 1—Introduction. This section presents the purpose and scope of the Work Plan.

Section 2—Site Background. This section presents:

- A description of the School building;
- A summary of previous investigations;
- The geology and hydrogeology of the area;
- A summary of the nature and extent of contamination beneath the School; and
- A schedule of Site cleanup activities.

Section 3—Remedial Technology Screening and Cleanup Alternatives Development. This section provides the results of the screening of remedial technologies and summarizes the cleanup alternatives that have been selected for further evaluation.

Section 4—Evaluation Components. This section presents the evaluation components that will be used to select the technically feasible cleanup alternatives.

Section 5—Cleanup Alternatives Evaluation. The process for conducting the comparative analysis that will be performed to evaluate the relative performance of each selected cleanup alternative in relation to the evaluation criteria is discussed in this section.

Section 6—Deliverables. This section presents the deliverables that will be prepared and submitted to Ecology.

Section 7—References. The documents cited in the Work Plan are listed in this section.

2.0 SITE BACKGROUND

The following subsections provide a description of the School, Site features, and history. A summary of previous investigations conducted at the School, a description of the geology and hydrogeology of the area, and the nature and extent of contamination also are included. Additional information provided is a summary of the cleanup action at adjoining properties, a schedule of Site cleanup activities, and a summary of the integration of School cleanup activities with other Site cleanup activities. The information summarized in this section was obtained from reports prepared for the Site, including the School, by RETEC/ENSR, and from observations made by Farallon Consulting, L.L.C. (Farallon).

2.1 SITE DESCRIPTION

The School property consists of 1.6 acres located at 105 6th Street North in the Town of Skykomish, King County, Washington. Buildings on the School property include the School building, a covered sport structure, a storage shed, and a Teacherage (Figure 2). The Teacherage is a 2,100 square foot wood frame structure built in 1920. The School is a masonry structure built in 1936. Both buildings are landmark structures that are part of the Skykomish Historic Commercial District.

North of the School is West River Road, and beyond is the south fork of the Skykomish River. East of the School is 6th Street, and beyond is the Skykomish Community Center and single-family residences West of the School are single-family residences, and south of the School, across Railroad Avenue, is the railyard (Figure 2).

The railyard was historically used to fuel and maintain locomotives, provide electricity for electric engines, store snow removal equipment, and provide a base of operations for local track repair and maintenance (RETEC 2002). Current activities at the railyard include the use of active tracks for freight and passenger trains. The railyard also is used to store snow removal equipment, and as a base of operations for the local track repair and maintenance crew (RETEC 2002).

The release of petroleum hydrocarbons from the railyard has impacted groundwater and soil beneath the Town of Skykomish, including the School. BNSF and Ecology (2007) have been investigating the railyard and surrounding area since 1993. The impacted area is defined as the Site that has been segregated into the Railyard Zone, the Northwest Developed Zone, the South Developed Zone, the Northeast Developed Zone, the Levee Zone, and the Former Maloney Creek Zone (Ecology Figure 5, Appendix A). The School is located within the Northwest Developed Zone, which is affected by petroleum contamination that consists primarily of Bunker C oil (Ecology 2007).

2.1.1 School Building Description

According to King County Tax Assessor's records, the School building is of masonry construction, was built in 1936, and consists of three stories encompassing a total of 42,072 square feet (King County, Washington 2007). The first floor of the School building

consists of an approximately 6-inch-thick concrete slab-on-grade. The slab appears to have been constructed in sections between bearing walls, and is penetrated by numerous utilities. Given the general construction practices of the time, it is unlikely that a vapor barrier was installed beneath the slab at the time the School building was constructed, and none was observed through existing floor penetrations. Historical and current design drawings show foundation footing walls extending approximately 6 feet below grade around the perimeter of the School building and beneath bearing walls.

2.1.2 School Usage

The School serves as the only classroom facility in the Skykomish School District for kindergarten through twelfth grade. The first floor is occupied by classrooms, a wood shop, a cafeteria, locker rooms, and a boiler room. The Skykomish school year extends from September through early June.

Other uses of the School include:

- Summer school;
- After-school events;
- Meetings;
- Sporting events; and
- Community events and gatherings.

2.2 PREVIOUS INVESTIGATION SUMMARY

Subsurface soil and groundwater investigation activities have been conducted at the School from approximately 1990 to the present. Farallon reviewed the following documents to gain an understanding of the Site history and conditions:

- *Remedial Investigation for the Former Maintenance and Fueling Facility in Skykomish, Washington* (RETEC 1996);
- *Supplemental Remedial Investigation* (RETEC 2002);
- *Bench-Scale Cleanup Technology Testing Report* (RETEC 2004);
- *Final Feasibility Study* (RETEC 2005);
- *River and Levee Supplemental Site Investigation Report* (RETEC 2006);
- *Draft Cleanup Action Plan* (Ecology 2007);
- Figure 3-2, *Baseline Groundwater Sampling Network, TPH-Dx* (RETEC 2007a);
- *Levee Zone Interim Action for Cleanup 2006 – As-Built Completion Report* (RETEC 2007b);
- Figure 4-1, *Interpolated TPH-Dx Distribution in Smear Zone Soil* (RETEC 2007c); and
- Figure 4-7, *Interpolated TPH-Dx Distribution in Vadose Zone Soil* (RETEC 2007d).

Work completed to date on or immediately adjacent to the School includes advancement of 13 soil borings to maximum depths ranging from 8 to 35 feet below ground surface (bgs); installation of 11 monitoring wells to maximum depths ranging from 15.5 to 44 feet bgs, and three recovery wells installed to a maximum depth of 21 feet bgs; and excavation of a single test pit to approximately 5 feet bgs. A total of 50 soil samples, groundwater samples from seven of the monitoring wells, and one test pit soil sample were collected at or adjacent to the School between 1990 and 2005 and analyzed for total petroleum hydrocarbons (TPH). Concentrations of TPH exceeded the remediation level for the Site established for soil of 3,400 milligrams per kilogram (mg/kg) in three of the 50 soil samples collected on or adjacent to the School. These soil samples were collected from 5 to 7.5 feet bgs in boring 5-W-4, located east of the School in 6th Street; from 8 feet bgs in boring 5-B-3, located near the center of the School; and from 4 to 5 feet bgs from a test pit located near the northern border of the School. Concentrations of TPH exceeded the cleanup level for the Site established for groundwater of 208 micrograms per liter (µg/l) in four of the monitoring wells sampled. Monitoring well MW-22, located east of the School in 6th Street, has contained measurable nonaqueous-phase liquid (NAPL) from 1991 to the present. Concentrations of TPH were not detected in the groundwater sample collected from monitoring well MW-38, located south of the School in Railroad Avenue, in 2006. Concentrations of TPH detected in the groundwater sample collected from monitoring well MW-45 exceeded the cleanup level in 2006, and concentrations of TPH detected in the groundwater samples collected from monitoring well 5-W-4, located east of the School in 6th Street, exceeded the cleanup level from 2002 to 2006. The location of the soil borings and monitoring wells are shown on the RETEC Figures 3-2 and 4-1 (Appendix B).

BNSF implemented an interim cleanup action in the Levee Zone and a portion of the Northwest Developed Zone that consisted of excavation of soil to a maximum depth of 16 feet bgs and placement of a temporary barrier along the up-gradient (south) boundary of the excavation from June through December 2006 (RETEC 2007d). The excavation extended approximately 55 feet into the northern portion of the School, including beneath the Teacherage, which was temporarily relocated during the cleanup action. The interim action cleanup area is shown on RETEC Figure 4-7 (Appendix B). Eight of the 11 monitoring wells and all three recovery wells on or adjacent to the School were decommissioned as part of the cleanup action. Additional information regarding the interim cleanup is provided in Section 2.5, Adjoining Properties' Interim Cleanup Action Summary.

2.3 GEOLOGY AND HYDROGEOLOGY

The School is located within the Skykomish Valley, a steep-sided bedrock valley that has been partially filled with glaciofluvial sediments. The bedrock in the area consists of marine metasedimentary and metaigneous rocks overlain by volcanic and sedimentary rocks that have relatively low permeability. The glaciofluvial sediments filling the valley consist mainly of poorly to moderately sorted sand, gravel, cobbles, and boulders (RETEC 1996).

The Town of Skykomish is underlain by highly heterogeneous glaciofluvial sediments. These glaciofluvial sediments consist of sand and gravel, and underlie a thin layer of topsoil and/or fill (RETEC 2005).

Silty sand and/or fill up to 2 feet thick are present throughout the residential and commercial areas of the Site. The silty sand is loose to medium dense, is gravelly in places, and contains varying amounts of organic material. The fill consists of a sandy silt containing brick fragments, broken glass, nails, and in some areas is underlain by a distinct orange burn horizon (RETEC 2005). Native soils underlie the topsoil, although in places the topsoil is underlain by fill. The native soils consist of sand and gravel, with shallow discontinuous lenses of silt and clay. The sand is medium- to coarse-grained, and the gravel is fine to coarse. There are frequent cobbles up to 1 foot in diameter, and occasional boulders up to 3 feet across (RETEC 2005).

The direction of regional groundwater flow is to the west (RETEC 1996). However, groundwater flow at the School and vicinity is to the north, toward the Skykomish River. Groundwater beneath the School has been encountered between 5 and 10 feet bgs during subsurface investigations.

2.4 CONTAMINATION NATURE AND EXTENT

Farallon reviewed data on the nature and extent of contamination at the School developed by ENSR from previous investigations, including Figure 3-2, *Baseline Groundwater Sampling Network TPH-Dx*, dated January 15, 2007 (RETEC 2007a); Figure 4-1, *Interpolated TPH-Dx Distribution in Smear Zone Soil*, dated August 1, 2007 (RETEC 2007c); and Figure 4-7, *Interpolated TPH-Dx Distribution in Vadose Zone Soil*, dated August 2, 2007 (RETEC 2007d). Copies of the figures are included in Appendix B.

The RETEC figures show the extent of TPH in soil and groundwater and the estimated extent of NAPL in the Town of Skykomish. The highest concentrations of TPH detected in soil are in the Railyard Zone located southeast of the School (RETEC Figure 4-7, Appendix B). The soil contamination, plume of NAPL, and TPH-contaminated groundwater originate from the railyard, and extend north to the south fork of the Skykomish River, encompassing several blocks in the Town of Skykomish (RETEC 2007d).

Investigations continue to be done at the Site. As new information on subsurface conditions and the nature and extent of contamination is developed it will be incorporated into the development of School cleanup alternatives.

2.4.1 Soil

Based on the limited number of soil samples collected from the vadose zone (approximately 0 to 8 feet bgs) at the School, concentrations of TPH exceeding the remediation level for the Site in the vadose zone have been detected in boring 5-B-3, near the center of the School, and in boring 5-W-4, adjacent to the School to the east, and adjacent to former monitoring well MW-45 to the north, up to the boundary of the cleanup action completed in 2006. Concentrations of TPH in soil samples collected from the vadose zone in the southwestern portion of the School have not exceeded the remediation level for the Site. A smear zone of NAPL is present at depths between 4 and 15 feet bgs.

2.4.2 NAPL

The estimated extent of the NAPL plume, which is composed primarily of Bunker C oil with some diesel fuel, is from the southeast portion of the School to the northwest and northeast portions of the School, up to the boundary of the cleanup action completed in 2006 (RETEC 2007c). The estimated area of the NAPL plume includes the area covered by the entire School building, with the exception of approximately 20 to 30 feet along the southern edge of the building (RETEC Figure 4-1, Appendix B). The thickness of the NAPL plume across the School ranges from approximately several inches to 2.5 feet.

2.4.3 Groundwater

The extent of TPH in groundwater at the School is based on analytical results from groundwater samples collected at monitoring wells on and adjacent to the School. The concentration of TPH above the remediation level for the Site in groundwater extends from the southeast corner to the north-central portion of the School, and is depicted as being smaller than the estimated NAPL plume (RETEC 2007a). However, there are no monitoring wells on the western edge of the plume. Therefore, it is likely that the dissolved phase of TPH in groundwater extends further west, similar to the NAPL plume (RETEC 2007c).

2.5 ADJOINING PROPERTIES' INTERIM ACTION CLEANUP SUMMARY

An interim action cleanup was conducted in the Levee Zone and a portion of the Northwest Developed Zone in 2006 by RETEC (2007b) on behalf of BNSF. The interim action cleanup included excavation of approximately 70,000 cubic yards of TPH-impacted soil from the Levee Zone and part of the Northwest Developed Zone, and removal and recycling of approximately 23,700 gallons of Bunker C oil. The excavation area extended west from the 5th Street Skykomish Bridge by approximately 750 feet, and included the levee, sediments along the levee, and soil approximately 135 feet landward of the levee (RETEC Figure 4-7, Appendix B). The excavation extended beneath the Teacherage that abuts the School building.

The excavation removed parts of the existing stormwater sewer system of West River Road, 5th and 6th Streets, and the existing septic systems serving four of the residences in the cleanup area (RETEC 2007b). A temporary NAPL barrier wall was installed as an interim cleanup measure. The purpose of the barrier wall is to limit impacts from up-gradient sources to re-contaminate the newly placed fill during and after levee reconstruction. Ongoing work in the Levee Zone will be completed in 2007 and documented in a separate as-built report to be prepared by RETEC.

3.0 REMEDIAL TECHNOLOGY SCREENING AND CLEANUP ALTERNATIVES DEVELOPMENT

3.1 REMEDIAL TECHNOLOGIES SCREENING

The Feasibility Study (RETEC 2005) employed a two-step process to develop Site cleanup alternatives that could meet cleanup standards. The first step in the process was to screen remedial technologies to identify the technologies that were implementable and effective. Using the results of the remedial technology screening, remedial technologies identified as implementable and effective at the Site were grouped into cleanup alternatives applicable to the Site Cleanup Zones shown on Ecology Figure 5 (Appendix A).

The results and methodology of the Feasibility Study technology screening were used for this Work Plan as a first step to identify remedial technologies applicable to the School (Table 1). Remedial technologies that were not applicable to the Site based on the results of the Feasibility Study were not considered applicable to the School. However, thermally enhanced soil vapor extraction was initially eliminated from consideration for the Site by the Feasibility Study due to questions regarding its effectiveness. Information obtained since preparation of the Feasibility Study (RETEC 2005) indicates that thermally enhanced soil vapor extraction may represent a feasible technology for remediation of TPH in soil beneath the School building, and has been retained herein for further consideration.

The remedial technologies identified in the first step as technically feasible for cleanup of contaminants beneath the School building were further screened using MTCA threshold requirements and other requirements for a cleanup action (Section 360 [2][a, b] of Chapter 173-340 of the Washington Administrative Code) (Table 1). These requirements include:

- Protection of human health and the environment;
- Compliance with cleanup standards;
- Compliance with state and federal laws;
- Provision for compliance monitoring;
- Provision for permanent solutions to the maximum extent practicable;
- Provision for a reasonable cleanup time frame; and
- Consideration of public concerns.

Protection of the School building structure and limited disruption of School operations were identified as significant public concerns to be used in this screening process.

Technologies that met the MTCA threshold requirements for a cleanup action for the area beneath the School building were used to develop cleanup alternatives that warrant further evaluation. The cleanup alternatives developed from the remedial technology screening are presented in Table 2.

3.2 CLEANUP ALTERNATIVES DEVELOPMENT

Remedial technologies determined to be implementable, effective, and meet MTCA threshold requirements were combined and supplemented to develop cleanup alternatives that are applicable to cleanup of TPH beneath the School building. Development of the cleanup alternatives considered:

- The use of commercially available methods to implement the remedial technologies;
- A combination of technologies to effectively meet the cleanup criteria;
- The ancillary equipment and infrastructure required for installation and operation of the technologies; and
- Impacts to the School and community.

3.3 CLEANUP ALTERNATIVES SELECTED FOR FURTHER EVALUATION

The cleanup alternatives selected using the remedial technologies identified as implementable, effective, and that meet MTCA threshold requirements are described below and summarized in Table 2. These cleanup alternatives will be evaluated using the methodology presented in this Work Plan to select cleanup alternatives that warrant comparative physical testing. The results of the comparative physical testing will be used to select a final cleanup action at the School.

3.3.1 Permeation Grouting

Permeation grouting consists of injecting grout into the subsurface soil to immobilize petroleum hydrocarbons. The immobilization is accomplished by formation of solidified grout matrix and a reduced soil porosity and hydraulic conductivity. By decreasing hydraulic conductivity, the migration of soluble, volatile, and NAPL components of the petroleum hydrocarbons is significantly reduced. Additives can be included in the grout to reduce contaminant mobility further, as described below:

- *Portland Cement Grout Injection*—Permeation grouting using Portland cement grout involves injection of the cement grout throughout the area of contaminated soil from borings installed beneath and around the perimeter of the School building. Injection points would be placed to ensure complete distribution of the grout throughout the petroleum hydrocarbon-impacted soil beneath the School building.
- *Portland Cement Grout with Additives Injection*—Additives, such as bentonite and/or potassium permanganate, can be added to Portland cement grout to further reduce the hydraulic conductivity of soil. Other additives, such as activated carbon and organophyllic clays, can be added to cement grout to bind petroleum hydrocarbons chemically in the cement matrix. Portland cement grout augmented with additives is injected as described in the prior paragraph.

  This alternative may affect the groundwater flow regime such that groundwater extraction and aboveground treatment may be necessary, at least on a temporary basis. The need for groundwater extraction will be evaluated by further research and analysis.

3.3.2 Chemical Flushing

Chemical flushing consists of flushing the soil with a solution that extracts petroleum hydrocarbons from the soil and transfers them to groundwater. Groundwater containing the petroleum hydrocarbons is extracted from a groundwater extraction trench or well system located down-gradient of the treatment area. The extracted groundwater is treated to capture the petroleum hydrocarbons. Flushing solutions applicable to the removal of TPH in soil and groundwater beneath the School building include industrial soap or cosolvents such as an alcohol/water solution. The use of surfactants and/or cosolvents will be evaluated in more detail using the methodology presented in this Work Plan.

3.3.3 Hot Water/Steam Flushing

Hot water/steam flushing uses hot water and/or steam injected directly into the ground beneath the School building to heat the soil and groundwater. The hot water/steam injection produces a turbulent flow of air and water in the ground and elevates ground temperature. Petroleum hydrocarbons can be released as vapor, solubilized into the groundwater, and released as free-phase NAPL.

Applying the hot water/steam flushing technology at the School would involve augmenting steam injection with vapor extraction and groundwater extraction. The petroleum hydrocarbon vapors that will be released will be collected in subsurface vent pipes as part of the vapor extraction system to capture soil vapors for aboveground treatment. The solubilized hydrocarbons in the groundwater and NAPL are extracted through a groundwater extraction trench or extraction wells located down-gradient of the steam injection area and treated above ground prior to discharge.

3.3.4 Pressure Pulse Technology

Pressure pulse technology is an injection technology that improves viscous fluid recovery. As applied to site cleanup, fluid pressure pulses would be applied to the soil/groundwater/NAPL system. The fluid pulse causes momentary elastic flexure of the soil pore structure and moves fluid into and out of void networks. This flexure of the pore structure and movement of fluid in the voids improves NAPL recovery.

Pressure pulse technology can be applied in conjunction with recovery wells alone, or applied in combination with enhanced recovery approaches such as hot water/steam flushing and chemical flushing. Pressure pulse technology increases NAPL recovery by optimizing the performance of these NAPL recovery methods.

3.3.5 In-Situ Oxidation

In-situ oxidation involves using a strong oxidant to chemically react with and destroy the petroleum hydrocarbons present in soil and groundwater beneath the School building. The reaction converts the petroleum hydrocarbons to carbon dioxide and water. In-situ oxidation would involve injecting an oxidant solution into the area of contaminated soil beneath the School until the petroleum hydrocarbons are destroyed. Specific chemical oxidants applicable to the School include sodium persulfate and Regenox®, described below.

- *Activated Sodium Persulfate*—This approach involves the use of activated sodium persulfate to react chemically with petroleum hydrocarbons in soil and groundwater beneath the School building. The sodium persulfate solution is introduced into soil and groundwater through injection wells. Several technologies can be used to activate the persulfate, including heat, hydrogen peroxide, and caustic solutions. The breakdown component of persulfate, sulfate, and the petroleum hydrocarbons solubilized by the application of heat to soil and groundwater will be collected in a groundwater extraction trench or well system located down-gradient of the injection area for aboveground treatment
- *Regenox®*—Regenox® is an in-situ remedial alternative that uses a proprietary slow-release, catalyzed sodium percarbonate solution to oxidize petroleum hydrocarbons in soil and groundwater that is introduced into soil and groundwater through injection wells. The reaction products from fully oxidized petroleum hydrocarbons are carbon dioxide and water. According to the manufacturer of Regenox®, the breakdown products of Regenox® are not detrimental to groundwater. Groundwater extraction and treatment may not be required using this approach.

3.3.6 Thermally Enhanced Soil Vapor Extraction

Thermally enhanced soil vapor extraction treatment consists of heating the soil and groundwater to drive off or destroy the petroleum hydrocarbons sorbed or dissolved in the soil and groundwater beneath the School building. The vapors generated by the process are captured by a soil vapor extraction system. The two commercially available approaches to heating the soil and groundwater are resistive thermal heating and conductive thermal heating, both of which would be coupled with soil vapor extraction. These alternatives are described below:

- *Resistive Thermal Heating with Vapor Extraction*—Resistive thermal treatment, also known as six-phase heating, heats the soil and groundwater by passing electrical current between the electrodes installed beneath the basement floor slab. Petroleum hydrocarbons present in soil and groundwater released to the soil vapors are collected by subsurface vent pipes installed as part of a vapor extraction system for aboveground treatment.
- *Conductive Thermal Heating with Vapor Extraction*—Conductive thermal treatment heats the soil and groundwater by conductive thermal heating that uses well points installed beneath the basement floor slab that are heated up to 1,000 degrees Fahrenheit using electric heaters. The heat migrates through soil and groundwater via conductive transport, vaporizing petroleum hydrocarbons. The petroleum hydrocarbons that are released to the soil vapors are collected in subsurface vent pipes installed as part of the vapor extraction system for aboveground treatment.

4.0 EVALUATION COMPONENTS

The cleanup alternatives that are applicable to the conditions beneath the School building will be evaluated based on criteria developed specific to the School. Each cleanup alternative will be researched in publicly available literature, and through expert and vendor input. The results of the research will be used to evaluate each cleanup alternative against the criteria developed for the School and relative to the other alternatives. The purpose of the evaluation is to identify two to three cleanup alternatives that are most applicable to the subsurface conditions at the School and warrant comparative physical testing. The methodology that will be used to evaluate the selected cleanup alternatives for further testing is discussed in Section 6, Alternatives Evaluation.

4.1 EVALUATION DATA SOURCES

4.1.1 Research Technical Literature

Each cleanup alternative will be researched through review of relevant literature available from federal and state agencies, published technical papers, and independent agencies and institutes. A summary will be prepared describing the results of the research of each cleanup alternative.

4.1.2 Expert, Vendor, and End User Input

Each cleanup alternative will be researched by soliciting information from technical experts in site remediation and from vendors experienced in applying technologies associated with the selected alternatives. Technical experts in the EPA Technical Support Centers and the ten EPA regional offices will be identified through the EPA Technical Support Project. Academic experts may also be identified through recent publications in the technical literature.

Identified technical experts will be contacted and information will be solicited on the technical aspects of implementing each cleanup alternative relative to the evaluation criteria. The information obtained will be documented, including the name of the expert, company or agency affiliation, area of expertise, credentials, years of experience in remedial technology applications, and specific input regarding the performance of the alternative.

Vendors experienced in application of technologies associated with each cleanup alternative will be identified through internet searches, discussions with technical experts, information developed in the Feasibility Study (RETEC 2005), and information obtained through subsequent investigations. A project data summary will be prepared and provided to vendors for review. The project data summary will include a history of the site, project cleanup standards, site maps, geologic cross-sections, copies of relevant boring logs, photographs, and summary analytical data. Vendors will be requested to review the project data summary and provide information on approach, expected performance. Vendors will also be asked for client references for projects where applications of their technology have been applied in similar conditions. The information obtained will be documented, including the name of the vendor, technical expertise, years of experience in applying application technologies, and specific input regarding the performance of the alternative.

4.2 EVALUATION CRITERIA

The criteria to be used to evaluate each of the selected cleanup alternatives have been established to specifically address the unique attributes of the School cleanup. The School maintains a special place in Skykomish as the community School, a central focus of community activities, and historic landmark. As such, the selected cleanup alternative must be implementable in a manner that allows the School to function with minimal impact to operations and the operating environment.

The criteria developed to help facilitate selection of a final cleanup action at the School are provided herein.

4.2.1 Performance

Performance criteria address the ability to remove, treat, or contain the contaminants to reduce risk of exposure. As applied to the area beneath the School building, the relative performance of a cleanup alternative will be determined by:

- Degree of overall contaminant control or mass removal;
- Degree of NAPL control or mass removal;
- Degree of soluble component control or mass removal;
- Degree of volatile component control or mass removal;
- Degree of soluble component immobilization;
- Potential for daughter product formation;
- Ability to meet established cleanup and/or remediation levels;
- Technical maturity;
- Ability to measure progress/success;
- Ability to resist recontamination;
- Risk of uncontrolled contaminant release;
- Risk of treatment failure;
- Safety risk during implementation; and
- Treatment system reliability.

4.2.2 Schedule

Acceptable cleanup alternatives must be able to be performed within a reasonable period of time, and implemented in a manner that minimizes disruption to School operations. Specific schedule evaluation criteria will include the duration of:

- Indoor construction;
- Indoor operation and maintenance;

- Outdoor construction;
- Outdoor operation and maintenance;
- Compatibility with School schedules;
- Overall time to meet the cleanup standards or performance criteria; and
- Long-term monitoring.

4.2.3 Physical Impacts

The physical impacts of each cleanup alternative on the School building, Teacherage, exterior portions of the School, and surrounding properties will be evaluated. Due to the importance of the School to the community and its location in the center of the community, it is important that the physical impacts of the selected cleanup alternative be minimized. Specific physical impacts will be evaluated relative to:

- School operation;
- Indoor air temperature and humidity;
- Odor or vapors;
- Indoor air quality;
- School structures;
- Aesthetic factors; and
- Off-Site factors.

4.2.4 Implementability

Implementability addresses the technical feasibility, availability of equipment and expertise, and administrative acceptance of each cleanup alternative. The unique attributes of the School and contaminant characteristics represent unique challenges to implementing the cleanup alternatives. Specific attributes of the School cleanup include:

- Construction implementability beneath the School building;
- Operational implementability with ongoing School functions;
- Acceptance by the community;
- Acceptance by users of the School; and
- Timing of activities.

5.0 CLEANUP ALTERNATIVES EVALUATION

A comparative analysis will be conducted to evaluate the relative performance of each selected cleanup alternative to determine which cleanup alternatives warrant physical testing to select a final cleanup action. The results of research for each selected cleanup alternative will be summarized and compared against the criteria identified in Section 5.0. Each cleanup alternative will be evaluated using the evaluation criteria in relation to the other cleanup alternatives to identify the technologies that meet most of the requirements for cleanup of the School. The comparative analysis will be performed in three steps:

Step 1: Individual Cleanup Alternative Analysis. Each cleanup alternative will be evaluated against the selection criteria identified in Section 5.

Step 2: Stakeholder Input. Stakeholder (i.e., Skykomish School Board, Town of Skykomish, Ecology, and BNSF) input will be solicited to determine the relative importance of each evaluation criterion.

Step 3: Comparative Analysis and Cleanup Alternative Selection. A comparative analysis will be conducted to evaluate the performance of each cleanup alternative in relation to the other cleanup alternatives based on the evaluation criteria and in consideration of stakeholder input. From this analysis, one to three alternatives will be selected for comparative physical testing against thermally enhanced soil vapor extraction.

As required by the Cleanup Action Plan (Ecology 2007), the alternatives that are selected for comparative physical testing will include thermal treatment. Further discussion of the above three-step comparative analysis is provided herein.

5.1 INDIVIDUAL CLEANUP ALTERNATIVE ANALYSIS

Each selected cleanup alternative will be evaluated with respect to the criteria defined in Section 5.0 using a comparative matrix. The matrix will present the relative ability of each cleanup alternative to meet the evaluation criteria. The matrix will provide a brief narrative of the assessment of each remedial alternative against each evaluation criterion. The assessment will focus on how and to what extent each evaluation criterion is met for each cleanup alternative, the uncertainties associated with the assessment, assumptions, and unknown conditions that could affect the evaluation.

5.2 STAKEHOLDER INPUT

Once the individual cleanup alternatives have been described and assessed against each criterion, stakeholder input will be solicited to determine the relative importance of the evaluation criteria. The stakeholders include the Skykomish School Board, Ecology, BNSF, and potentially other interested parties. Information on the relative importance of the evaluation criteria to each stakeholder will be incorporated into the comparative analysis to identify the relative advantages and disadvantages of each remedial alternative with respect to each other.

Meetings will be held with the stakeholders to discuss the cleanup alternatives under consideration, to provide a summary of the cleanup alternatives, and to discuss the selection criteria that will be used for evaluating the cleanup alternatives.

5.3 COMPARATIVE ANALYSIS AND CLEANUP ALTERNATIVE SELECTION

Once the cleanup alternatives have been individually assessed against the criteria and stakeholder input has been received on the relative importance of the evaluation criteria, a comparative analysis will be conducted. The comparative analysis will include evaluating the relative performance of each cleanup alternative to the other cleanup alternatives, based on the criteria and in consideration of stakeholder input. The purpose of this comparative analysis is to identify the advantages and disadvantages of each cleanup alternative relative to the others to identify the key advantages and disadvantages.

The comparative analysis will include a narrative discussion describing the strengths and weaknesses of the cleanup alternatives relative to one another with respect to each criterion. From this analysis, two or three cleanup alternatives that meet the project goals as measured by the evaluation criteria, and in consideration of stakeholder input, will be selected for comparative physical testing. Comparative physical testing will include thermal treatment unless the alternatives evaluation clearly demonstrates that thermal treatment is unlikely to accomplish project goals as effectively as other cleanup alternatives and Ecology approves the exclusion of thermal treatment from the comparative physical testing.

6.0 DELIVERABLES

6.1 SCHOOL TECHNOLOGY REVIEW REPORT

The results of the cleanup alternatives evaluation will be summarized in the School Technology Review Report, which will include a summary of the cleanup alternatives selected for further evaluation, a summary of the technical literature research, the results of expert, vendor, and user research, the results of the criteria evaluation, and a discussion of the cleanup alternatives selected for comparative physical testing. The draft School Technology Review Report is due to Ecology January 31, 2008. The draft report will be issued to Ecology and Stakeholders for review and comment at that time. Farallon will meet with Ecology and Stakeholders following submission of the School Technology Review Report to discuss the results and the cleanup alternatives selected for comparative physical testing.

6.2 SCHEDULE OF DELIVERABLES

The following table presents the schedule of deliverables associated with selection of the School cleanup alternative. These deliverables are required by Exhibit C of the Consent Decree 07-2-33672-9 SEA between Ecology and BNSF.

Deliverable	Due Date
Final School Alternatives Evaluation Work Plan	November 30, 2007
Draft School Technology Review Report	January 31, 2007
Draft Comparative Physical Testing Study Work Plan	February 29, 2007
Final School Technology Review	March 31, 2007
Final School Comparative Physical Testing Work Plan	April 30, 2007
Draft School Comparative Physical Testing Report	April 1, 2007
Final School Comparative Physical Testing Report	May 1, 2007
Draft School Alternatives Evaluation Report	June 1, 2007
Final School Alternatives Evaluation Report	July 1, 2007

7.0 REFERENCES

King County, Washington. King County Real Property Parcel Records. June 18, 2007. <http://www.metrokc.gov/gis/mapportal/PViewer_main.htm> (August 24, 2007.)

The RETEC Group (RETEC). 1996. *Remedial Investigation for the Former Maintenance and Fueling Facility in Skykomish, Washington.* Prepared for Burlington Northern Railway. January.

_____. 2002. *Supplemental Remedial Investigation, BNSF Former Maintenance and Fueling Facility, Skykomish, Washington. Volume 1.* Prepared for BNSF Railway Company. July 16.

_____. 2004. *Bench-Scale Cleanup Technology Testing Report, The BNSF Former Fueling and Maintenance Facility, Skykomish, Washington.* Prepared for The Burlington Northern and Sante Fe Railway Company. July 1.

_____. 2005. *Final Feasibility Study. Former Maintenance and Fueling Facility, Skykomish, Washington. Volumes 1 – 3.* Prepared for BNSF Railway Company. March 15.

_____. 2006. *River and Levee Supplemental Site Investigation Report, Former Maintenance and Fueling Facility, Skykomish, Washington.* Prepared for BNSF Railway Company. January 13.

_____. 2007a. Figure 3-2, *Baseline Groundwater Sampling Network, TPH-Dx, The BNSF Railway Company - Skykomish, Washington.* January 15.

_____. 2007b. *Levee Zone Interim Action for Cleanup 2006 – As-built Completion Report, Former Maintenance and Fueling Facility, Skykomish, Washington.* Prepared for BNSF Railway Company. July 2.

_____. 2007c. Figure 4-1, *Interpolated TPH-Dx Distribution in Smear Zone Soil, BNSF Railway - Skykomish, Washington.* August 1.

_____. 2007d. Figure 4-7, *Interpolated TPH-Dx Distribution in Vadose Zone Soil, FS/EIS, BNSF- Skykomish, Washington.* August 2.

Washington State Department of Ecology (Ecology). 2007. *Cleanup Action Plan for BNSF Railway Former Maintenance and Fueling Facility*, Skykomish, Washington. June 12.

FIGURES

SKYKOMISH SCHOOL CLEANUP ALTERNATIVES
EVALUATION WORK PLAN
Skykomish School
105 6th Street North
Skykomish, Washington

Farallon PN: 683-019


SCHOOL
U.S. HIGHWAY 2
SITE BOUNDARY

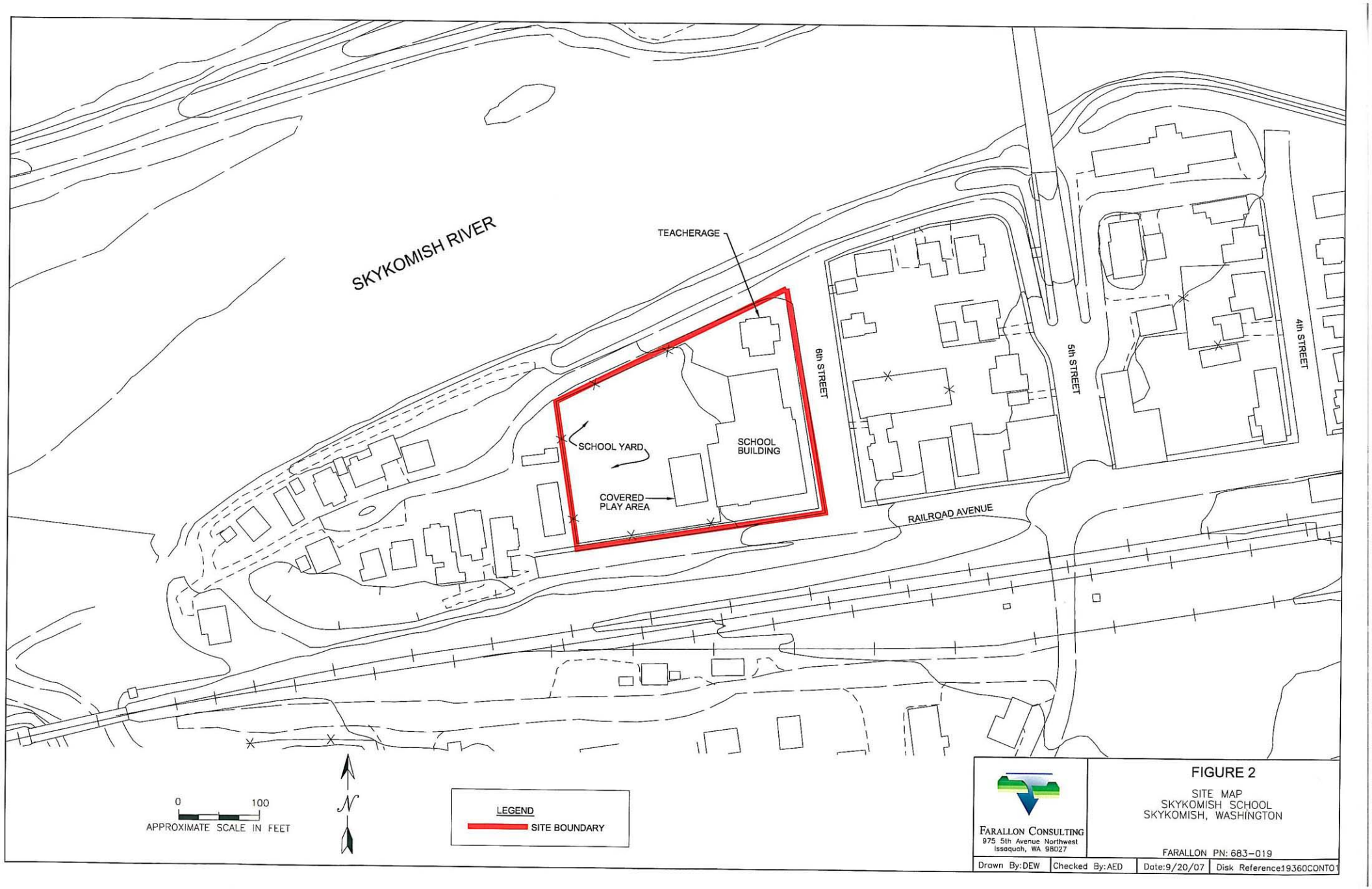


FIGURE 2

SITE MAP
SKYKOMISH SCHOOL
SKYKOMISH, WASHINGTON

FARALLON CONSULTING
975 5th Avenue Northwest
Issaquah, WA 98027

FARALLON PN: 683-019

Drawn By: DEW	Checked By: AED	Date: 9/20/07	Disk Reference 19360CONT01

TABLES

SKYKOMISH SCHOOL CLEANUP ALTERNATIVES
EVALUATION WORK PLAN
Skykomish School
105 6th Street North
Skykomish, Washington

Farallon PN: 683-019

Table 1
Technology Screening
Skykomish School
Skykomish, Washington
Farallon PN: 683-019

Screened Technologies[1]	MTCA Threshold or Other Requirements: Protect Human Health and the Environment	Comply With Cleanup Standards	Comply With Applicable State and Federal Laws	Provide for Compliance Monitoring	Provide a Permanent Solution to the Maximum Extent Practicable	Consider Public Concerns	Provide for a Reasonable Cleanup Time Frame	Retained for Further Evaluation?	Comments
Containment[2]									
Capping[3]	X	X	X	✓	X	✓	X	No	Does not reduce contaminant concentrations or mitigate migration.
Slurry Wall[4]	X	X	X	✓	X	✓	X	No	Does not reduce contaminant concentrations or mitigate potential exposure routes.
Permeation Grouting[4]	✓	✓	✓	✓	✓	✓	✓	Yes	
Removal[2]									
Excavation[3,4]	✓	✓	✓	✓	✓	X	✓	No	Excavation to the depths required would threaten the School structure.
Extraction[2]									
Skimming[4]	X	X	X	✓	X	✓	X	No	Would not meet cleanup standards within a reasonable time frame.
Recovery Trenches[4]	X	X	X	✓	X	✓	X	No	Would not meet cleanup standards within a reasonable time frame.
In Situ Treatment[2]									
Bioventing[3]	X	X	X	✓	✓	✓	X	No	Would not meet cleanup standards within a reasonable time frame.
Chemical Flushing[4]	✓	✓	✓	✓	✓	✓	✓	Yes	
Hot Water / Steam Flushing[4]	✓	✓	✓	✓	✓	✓	✓	Yes	
In-Situ Oxidation[4]	✓	✓	✓	✓	✓	✓	✓	Yes	
Enhanced Aerobic Biodegradation[5]	✓	✓	✓	✓	✓	✓	X	No	Would not meet cleanup standards within a reasonable time frame.
Natural Attenuation[5]	X	X	X	✓	X	✓	X	No	Would not meet cleanup standards within a reasonable time frame.
Thermally Enhanced Soil Vapor Extraction [4,6]	✓	✓	✓	✓	✓	✓	✓	Yes	
Ex Situ Treatment[2]									
Thermal Desorption[3]	✓	✓	✓	✓	✓	X	✓	No	Requires excavation that would threaten the School structure.
Cement Incorporation[3]	✓	✓	✓	✓	✓	X	✓	No	Requires excavation that would threaten the School structure.
Bioreactors[5]	X	X	X	✓	X	✓	X	No	These technologies are applicable to groundwater cleanup, and do not address contaminated soil or NAPL. They may be used individually or in combination to augment application of other technologies
Phase Separation[5]	X	X	X	✓	X	✓	X	No	
Precipitation[5]	X	X	X	✓	X	✓	X	No	
Filtration[5]	X	X	X	✓	X	✓	X	No	
Carbon Adsorption[5]	X	X	X	✓	X	✓	X	No	
Oxidation[5]	X	X	X	✓	X	✓	X	No	
Disposal[2]									
Commercial Landfills[3]	✓	✓	✓	✓	✓	X	✓	No	Requires excavation that would threaten the School structure.
Reuse[2]									
Recycling as Off Specification Fuel[4]	X	X	X	✓	X	✓	X	No	Applicable to NAPL, and does not address contaminated soil or groundwater. May be used to augment application of other technologies.
Discharge[2]									
NPDES Discharge[5]	X	X	X	✓	X	✓	X	No	Neither discharge nor reinjection is implementable as a primary remedial technology; however, either may be required to augment application of other technologies.
Reinjection[5]	X	X	X	✓	X	✓	X	No	

NOTES:

[1]Technologies identified and screened for use in developing remedial alternates in the Final Feasibility Study (RETEC 2005)

[2]Response action classification.

[3]Technology identified in Final Feasibility Study (RETEC 2005) as applicable to petroleum hydrocarbons in soil.

[4]Technology identified in Final Feasibility Study (RETEC 2005) as applicable to LNAPL.

[5]Technology identified in Final Feasibility Study (RETEC 2005) as applicable to Dissolved Petroleum Hydrocarbons in Groundwater

[6]Thermally enhanced soil vapor extraction eliminated from consideration in Final Feasibility Study (RETEC 2005) and retained for further consideration

NAPL = Nonaqueous-phase liquid

NPDES = National Pollutant Discharge Elimination System

RETEC = The RETEC Group, Inc

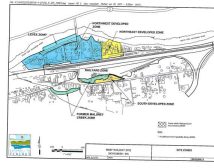
Shaded = Technology retained for further consideration

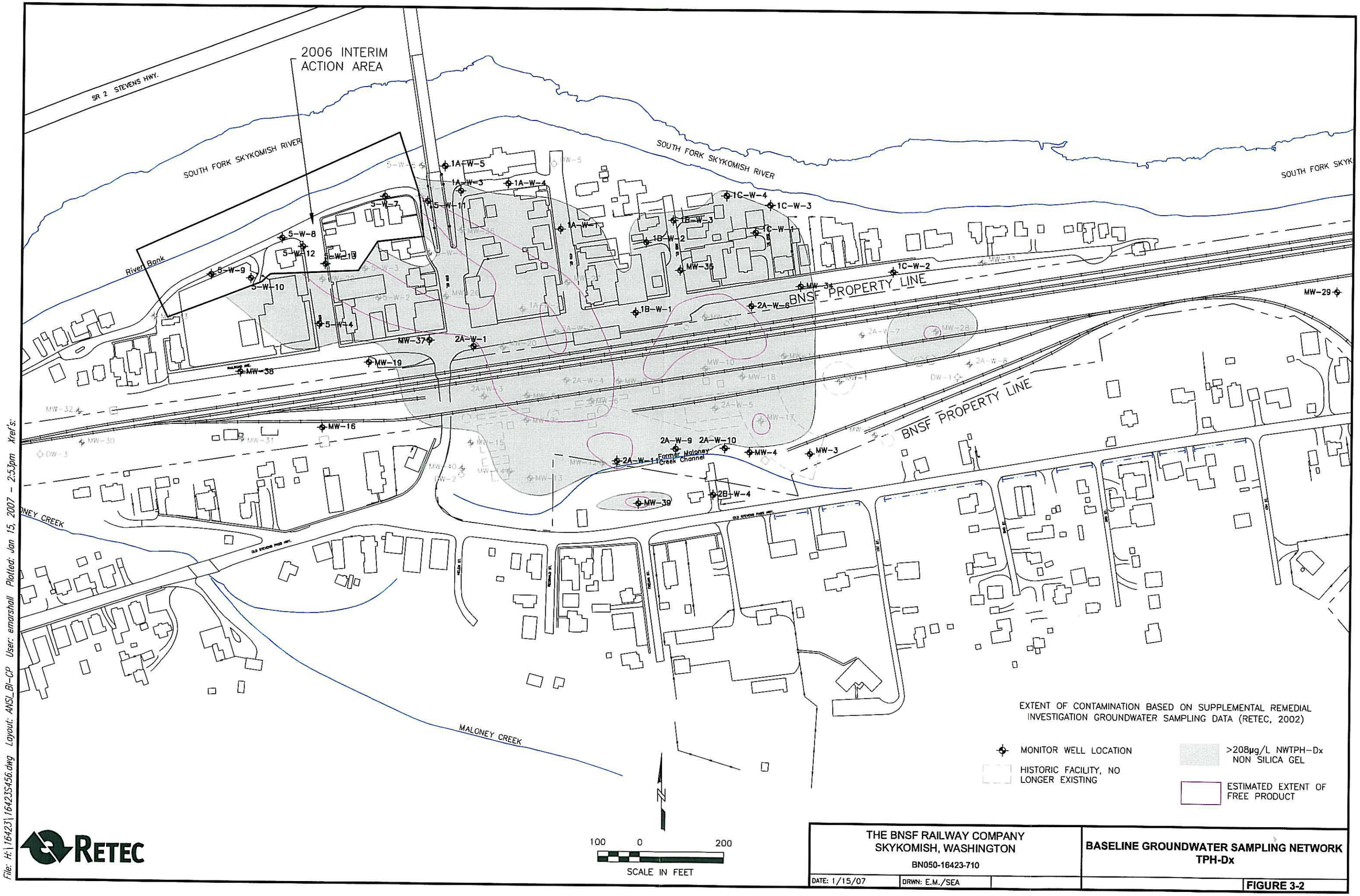
✓ = Meets criterion

X = Fails to meet criterion

Table 2
Summary of Applicable Cleanup Alternatives
Skykomish School
Skykomish, Washington
Farallon PN: 683-019

Remedial Technology	Cleanup Alternative Components
Permeation Grout	• Injection of Portland Cement **Or** • Injection of Portland Cement with Additives **And Possibly** • Groundwater Extraction
Chemical Flushing	• Injection of Soap Solution **Or** • Injection of Co-Solvent Solution **And** • Groundwater Extraction
Hot Water/Steam Flushing	• Injection of Hot Water **Or** • Injection of Steam **And** • Groundwater Extraction • Soil Vapor Extraction
In-Situ Oxidation	• Injection of Heated Sodium Persulfate **And** • Groundwater Extraction • Soil Vapor Extraction **Or** • Injection of Regenox®
Thermally Enhanced Soil Vapor Extraction	• Resistive Thermal Heating **Or** • Conductive Thermal Heating **And** • Soil Vapor Extraction

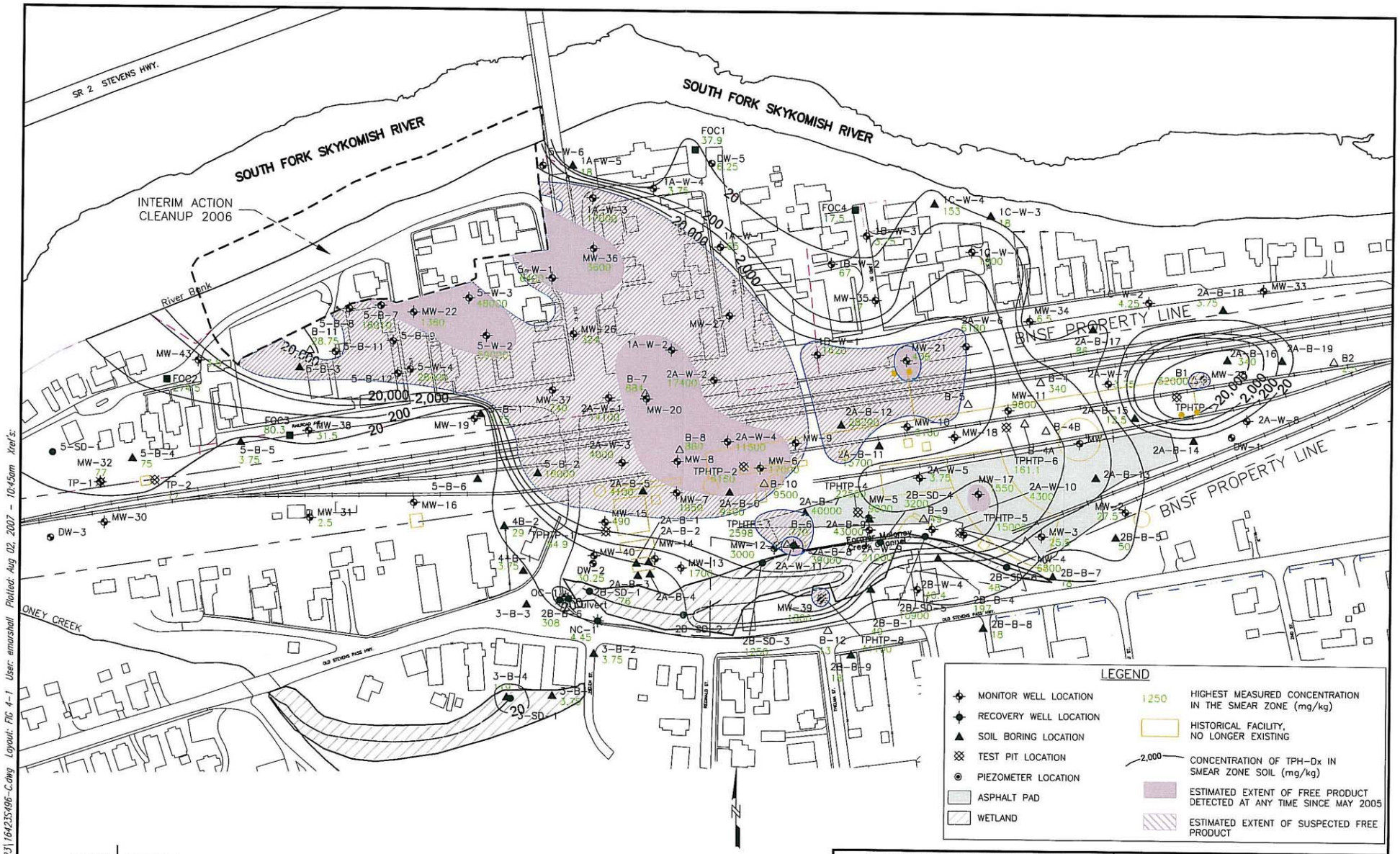

NORTHWEST DEVELOPED ZONE
LOCAL ZONE
NORTHEAST DEVELOPED ZONE
MULTIPLEX ZONE
SOUTH DEVELOPED ZONE
TOWER BLOCK ZONE
(NEW ZONE)
Area with Height Limit
Area without Height Limit
Title
Proposed Amendments to the Wan Chai OZP
WAN CHAI EAST (EN)
OUTLINE ZONING PLAN
PLAN No. S/H5/30
WAN CHAI
DRAWING 2



RETEC

THE BNSF RAILWAY COMPANY SKYKOMISH, WASHINGTON BN050-16423-710			**BASELINE GROUNDWATER SAMPLING NETWORK TPH-Dx**
DATE: 1/15/07	DRWN: E.M./SEA		**FIGURE 3-2**

File: H:\16423\16423456.dwg Layout: ANSL_BI-CP User: emarshall Plotted: Jan 15, 2007 - 2:53pm Xref's:



ENSR | AECOM

Merged with ENSR in 2007
RETEC

BNSF RAILWAY - SKYKOMISH, WA. FEASIBILITY STUDY BN050-16423-253			INTERPOLATED TPH-Dx DISTRIBUTION IN SMEAR ZONE SOIL
DATE: 8/1/07	DRWN: E.M./SEA		FIGURE 4-1

File: H:\16423\164235496-C.dwg Layout: Fig 4-1 User: amarshall Plotted: Aug 02, 2007 - 10:45am Xref's:

SOUTH FORK SKYKOMISH RIVER

SOUTH FORK SKYKOMISH RIVER

INTERIM ACTION CLEANUP 2006

River Bank

BNSF PROPERTY LINE

BNSF PROPERTY LINE

ONEY CREEK

Culvert

Former Channel Maloney Creek

DW-5 · 1A-W-3 · 1A-W-4 · 1A-W-1 125 · 1B-W-3 · 1C-W-1 · 1B-W-2 · 1C-W-2 · MW-33 45 · MW-36 · MW-36 6.5 · MW-27 775 · MW-34 · 2A-B-18 250 · 2A-B-17 900 · 2A-B-16 66 · 2A-B-19 3200 · B2 · B1 · MW-28 · TPHTP-7 25900 · MW-22 · 5-W-3 · 5-W-2 · MW-26 · 5-W-4 · B-11 · 5-B-11 98 · 5-B-3 3.75 · MW-43 · MW-37 · 2A-W-1 800 · B-7 · 2A-W-2 · 1A-W-2 · 1B-W-1 · MW-21 · 2A-W-6 77 · B-4 · 2A-W-7 · 2A-B-15 · 2A-W-8 18.5 · DW-1 18 · B-4A · B-4B · MW-1 1496 · 2A-B-14 580 · 2A-B-13 660 · MW-20 45.5 · MW-19 26.5 · 5-B-1 55.1 · 5-B-5 · MW-38 · 5-B-4 · MW-32 · TP-1 · TP-2 · 5-B-6 3.75 · 5-B-2 · 2A-W-3 55 · B-8 · 2A-W-4 1370 · MW-9 24.5 · 2A-B-12 · MW-10 · B-5 26 · MW-11 · 2A-B-11 31000 · MW-18 66.5 · TPHTP-6 2670 · 2A-W-5 9600 · MW-17 · MW-18 2950 · TPHTP-2 6420 · MW-6 · 2A-B-5 146 · MW-16 14.5 · MW-31 2.5 · MW-30 2.5 · DW-3 43 · MW-5 852.5 · TPHTP-1 40.5 · MW-40 6.5 · DW-2 18 · 2A-B-1 · MW-14 28.5 · 2A-B-2 · 4-B-1 · 2A-B-3 · OC-1 · NC-1 · 3-B-3 3.75 · 3-B-2 3.75 · 3-B-1 3.75 · MW-7 · 2A-B-6 78000 · 2A-B-7 22900 · TPHTP-4 36000 · MW-5 · B-9 · TPHTP-3 2553 · B-6 · 2A-B-9 · 2A-B-8 · MW-12 · MW-13 · 2A-W-11 · 2A-W-9 · 2B-B-4 · 2A-W-10 5900 · TPHTP-5 32.5 · MW-4 · MW-3 · MW-2 · 2B-B-5 · 2B-B-1 · TPHTP-8 181.5 · MW-39 · 2B-W-4 · B-12

LEGEND

- MONITOR WELL LOCATION
- RECOVERY WELL LOCATION
- SOIL BORING LOCATION
- TEST PIT LOCATION
- PIEZOMETER LOCATION
- WETLAND
- 200 — CONCENTRATION OF TPH-Dx IN VADOSE ZONE SOIL (mg/kg)
- 43 — HIGHEST MEASURED CONCENTRATIONS IN THE VADOSE ZONE (mg/kg)
- HISTORICAL FACILITY, NO LONGER EXISTING

N

80 0 160

SCALE IN FEET

ENSR | AECOM

Merged with ENSR in 2007

RETEC

FS/EIS
BNSF - SKYKOMISH, WASHINGTON
BN050-16423-250

DATE: 8/2/07 | DRWN: E.M./SEA

INTERPOLATED TPH-Dx DISTRIBUTION IN VADOSE ZONE SOIL

FIGURE 4-7

File: H:\16423\164235484-B.dwg Layout: FIG 4-7 User: emarshall Plotted: Aug 03, 2007 - 10:49am Xref's:

TECHNICAL MEMORANDUM

KPG 753 9th Avenue North
Seattle, WA 98109
SEATTLE • TACOMA Phone: 206.286.1640 Fax: 206.286.1639
ENGINEERS • ARCHITECTS • LANDSCAPE ARCHITECTS • SURVEYORS

Date: November 21, 2007

To: Winston Chen, P.E.
The RETEC Group Inc. – Merged with ENSR in 2007

From: Andrew Merges, P.E.

Re: Skykomish Existing Storm Sewer Basin and Conveyance Analysis

INTRODUCTION

This technical report analyzes a segment of the storm sewer conveyance system within the Town of Skykomish, Washington located within King County. The project area is approximately bounded by the Skykomish River, Fifth Street, BNSF Right-of-Way, and Second Street (Former Street Designation). The primary focus of this report identifies current deficiencies within the existing storm sewer infrastructure as well as impacts that future construction methods may pose during the 2008 restoration effort. Conclusions and recommendations are provided including additional field data that may be required to supplement the results of this report.

BASIN DELINEATION

Within the project area there are three drainage basins. Figure 1 in Appendix A delineates these boundaries, identifies the existing storm sewer system features, and notes ordinary high water elevations for the Skykomish River at each outfall location. Basin land use type and associated coverage used for calculations is summarized below (Based upon AutoCAD calculations):

BASIN A (3rd Street)
Impervious Area = 50,424 SF
Gravel Area = 10,354 SF
Lawn Area = 51,401 SF
Total Basin Acreage = 2.575 acres

BASIN B (4th Street)
Impervious Area = 29,396 SF
Gravel Area = 1,529 SF
Lawn Area = 1,529 SF
Total Bain Acreage = 1.476 acres

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BASIN C *Impervious Area = 42,755 SF*
(5th Street) *Gravel Area = 0 SF*
Lawn Area = 61,293 SF
Total Bain Acreage = 2.389 acres

Basin A storm water is conveyed through a 10-inch diameter reinforced concrete pipe system located on Third Street, with one catch basin upstream from the outfall at the Skykomish River. A low point within the center of the basin has been ignored due to its proximity with an adjacent structure and water is assumed to flow to the catch basin.

Basin B storm water is conveyed through an 8-inch diameter corrugated polyethylene pipe and then into a short 6-inch corrugated metal pipe. This system contains two catch basins located at the northern end of Fourth Street with an outfall at the Skykomish River.

Basin C storm water is conveyed through an 8-inch corrugated metal pipe system. There are two catch basins located at the west end of the alley from Fifth Street to Fourth Street with an unknown outfall at this time. This system could potentially tie into the existing 15-inch corrugated metal outfall located at the Skykomish River.

METHODS OF ANALYSIS

The Santa Barbra Unit Hydrograph (SBUH) method was used for hydrologic calculations to determine the capacity of existing drainage systems. SBUH is an appropriate methodology for determining peak flows in small to medium basins up to 1000 acres (Ref 2). StormSHED release 6.1.6.4 (Ref 3) was used to develop the SBUH peak flow rates for design storm events. Hydrologic calculations are based on a Type 1A storm distribution in accordance with KCSWDM (Ref 2) and WSDOTHM (Ref 1) requirements. The peak flow outputs and hydrographs are located in Appendix B of this report as well as copies of the isopluvial maps used to determine the rainfall intensities.

Capacity calculations for each basin were determined using backwater methods described in KCSWDM Section 4.2.1.2. Survey data obtained which illustrates the ordinary high water (OHW Ref 5) elevation of the Skykomish River at the various basin outfalls was used for the tail water elevations. Both the backwater analysis calculations and OHW survey points are located within Appendix C. The OHW survey points are also shown graphically on Figure 1 in Appendix A.

CONVEYANCE REQUIREMENTS FOR EXISTING SYSTEMS

Conveyance requirements for utilizing an existing storm sewer system are described in section 1.2.4.2 of the KCSWDM. In summary, an existing system that will experience a change in its flow characteristics due to proposed improvements or temporary construction methods must satisfy the following:

1) Capacity to convey and contain the 10-year peak flow for developed and existing conditions.
2) Demonstration that the 100-year peak flow will not create a severe flooding or erosion control problem.
3) Minor modifications can be made to the existing system as outlined in the KCSWDM to accommodate the required capacity.
4) Modifications that attenuate peak flows due to a detention system upstream cannot significantly increase downstream peak flows.

ANALYSIS RESULTS

The following table summarizes the peak flow rates and backwater results for each basin under design storm conditions. Detailed calculations are included in the report appendices.

The table includes the following design events to determine existing system capacity and capacity for anticipated construction and treatment flows:

- 1200 gpm construction flows and treatment excluding design storm events
- 10 Year, 24 Hour Design Storm
- 10 Year Design Storm and 200 gpm treatment flow
- 10 Year Design Storm and 1200 gpm construction flow and treatment flow
- 100 Year, 24 Hour Design Storm
- 100 Year Design Storm and 200 gpm treatment flow
- 100 Year Design Storm and 1200 gpm construction flow and treatment flow

It should be noted that all of the calculations performed assume that the existing storm sewer system infrastructure is in good operating condition. This provides the conjecture that there are no obstructions or damage within the conveyance pipes, adjacent structures, or at the outfall as well as consistency in conveyance pipe slope.

Basin Storm Sewer Analysis Result Summary							
	Dry	10-Year Design Storm Event			100-Year Design Storm Event		
BASIN	Construction and Treatment 1200 gpm (cfs)	Existing Conditions (cfs)	Existing + Treatment 200 gpm (cfs)	Existing + Construction and Treatment 1200 gpm (cfs)	Existing Conditions (cfs)	Existing + Treatment 200 gpm (cfs)	Existing + Construction and Treatment 1200 gpm (cfs)
A (3rd St)	2.67	1.80	2.25	4.26	2.84	3.29	5.29
Backwater Overflow Condition	YES	NO	YES	YES	YES	YES	YES
B (4th St)		1.07	N/A	N/A	1.55	N/A	N/A
Backwater Overflow Condition		YES	N/A	N/A	YES	N/A	N/A
C (5th St)		*1	N/A	N/A	*1	N/A	N/A
Backwater Overflow Condition		*1	N/A	N/A	*1	N/A	N/A

Note: *1 - Existing Storm Sewer System Survey for Basin C Incomplete

RECOMMENDATIONS AND CONCLUSIONS

Basin A (Third Street) Conveyance Capacity:
Analysis of the existing 10-inch storm sewer system located within Basin A (3rd Street) demonstrates that the system has adequate capacity for the 10 year flow, but is undersized for the 100 year design storm. Based on the backwater calculations included in the appendix, the maximum construction / treatment flow rate that could be added to the system during a 10-year storm event is approximately 0.40 cfs or 180 gpm before overtopping the catch basin grate. The HCCS peak treatment flows of 200 gpm will exceed the 10-inch pipe capacity during the 10 year design storm. Capacity upgrades, such as upsizing pipe diameter or providing detention storage, would be required in order to provide long term capacity for storm flows and HCCS treatment flows in Basin A.

Basin B (Fourth Street) Conveyance Capacity
The 6/8-inch outfall for Basin B (4th Street) does not provide capacity for existing drainage in either the 10 year or 100 year design storm. This system is not suitable for construction flows or treatment flows and will likely require upgrade or replacement for continued use with the proposed restoration project.

Basin C (Fifth Street) Conveyance Capacity
The outfall location and pipe routing is not clear based on current field survey information and no capacity calculations have been completed. It is likely that

Event
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uction

Basin C combines with the WSDOT bridge system, which will require further analysis of the additional drainage area.

Available Capacity for temporary construction flows

Given the fact that the 2008 HCCS and restoration construction activities will most likely occur during the summer season with less significant storm events, the Basin A, 10-inch storm sewer system could be used for permitted construction water (1000 gpm) and peak HCCS (200 gpm) conveyance of 1200 gpm. This system can handle approximately 2.2cfs or 985 gpm, which is slightly below the proposed 1200gpm HCCS and construction flow rates. This minor capacity issue can easily be resolved during construction with appropriately sized baker tanks or temporary ponds for storage of excess flows. During use of the existing pipe for construction flows, the water level of the Skykomish River should be at or below the Ordinary High Water elevation of 928.56.

If the Basin A storm sewer system is proposed for HCCS and construction use, the flowing conditions should be followed and continuously evaluated to ensure overflow and erosion problems do not arise:

1) Continuous monitoring of the Skykomish River surface water elevation in relation to the 10-inch outfall to ensure that high river stage does not create a backwater within the system.
2) Continuous monitoring of the 10-inch outfall area to ensure that there is no erosion control problems.
3) A Best Management Practice (BMP) Plan should be developed to account for on-site storage of HCCS and construction water during storm events. This plan should also indicate all erosion control, temporary and permanent, that will and could be used in the event that the 10-inch conveyance system can't be used or sediment and contaminants leave the construction limits. The plan should also consider the possibility that the construction activities could be extended past the proposed schedule and into historical recorded months where significant storm events and high river stages could be observed.

General

In conclusion, it is not recommended that the use of the existing storm sewer systems in Basins A and B (possibly C pending survey results) be utilized for the conveyance of proposed flows rates above the existing conditions unless there are modifications that demonstrate required capacities are reached for the 10-year and 100-year storm events per KCWSWDM requirements. If proposed storm sewer improvements are to utilize existing system features and outfalls, the Town of Skykomish should be aware and accept the potential associated implications. Last, all storm sewer structures and pipes should be inspected through video and visual methods to determine the system conditions prior to any proposed use.

We hope this information is sufficient to meet your current needs. Please feel free to contact either of us at (206) 206-1640 if you have questions or would like additional information.

Sincerely,

KPG

Andrew Merges, P.E.

Reviewed,
Nelson Davis, P.E.

REFERENCES

1) The Washington State Department of Transportation Hydraulics Manual, March 2007 (WSDOTHM)
2) King County, Washington, Surface Water Design Manual, 2005 (KCSWDM)
3) StormSHED release 6.1.6.4
4) True North Survey Certified Basemap, October 30, 2007
5) Ordinary High Water (OHW) elevations provided by RETEC/ENSR November 12, 2007

DRAFT

Burlington Northern Santa Fe

UTILITY ACCOMMODATION POLICY

Engineering Services
4515 Kansas Avenue
Kansas City, KS 66106

April 16, 2004
Revised May 5, 2007

TABLE OF CONTENTS

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PART 1

GENERAL POLICY

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PART 1 - GENERAL POLICY

A. Policy Application

1. Purpose

   This policy is to prescribe the accommodation, location and method of installation, adjustments, removal, relocation and maintenance of utility facilities within the property of Burlington Northern & Santa Fe Railway Company, referred to hereafter as BNSF. The policy was developed in the interest of safety, protection, utilization, and future development of BNSF with due consideration given to public and private service afforded by adequate and economical utility installations.

2. Application

   The policy concerning utility accommodations shall apply to all:

   a. New utility installations.

   b. Additions to existing utility installations.

   c. Adjustment and relocation of utilities.

   d. Existing or planned utility installations for which agreements with BNSF were entered prior to the date of the adoption of this policy.

   e. Existing utility installations that do not meet the license requirements may remain at the discretion of BNSF.

   Various types of utility lines not specifically discussed herein shall be considered within the provisions of this policy. It shall be the general practice to consider all lines carrying caustic, flammable or explosive materials under the provisions for high-pressure gas and liquid fuel lines.

3. Scope

   Utilities include lines, facilities and systems for producing, transmitting or distributing communications, power, electricity, light, heat, gas, oil, crude products, water, steam, waste, storm water and other similar commodities which are privately, publicly or cooperatively owned and which serve directly or indirectly the public or any part thereof.

   A Utility Agreement License allowing a Utility Owner the privilege of placing its facilities in or on railroad property does not constitute permanent right for such usage. Any removal, remodeling, maintenance or relocation of the facilities, whether or not required by BNSF, will be accomplished promptly by the Utility Owner at no cost to BNSF.

4. Exceptions

Exceptions to any design, location or methods of installation provisions contained in this policy must be authorized by BNSF. Requests for exceptions will be considered only where it is shown that extreme hardship and/or unusual conditions provide justification and where alternate measures can be prescribed in keeping with the intent of this policy. All requests for exceptions shall be fully documented including design data, cost comparisons and other pertinent information.

5. Liability

The Utility Owner, it successor, or assigns shall assume all risk and liability for accidents and damages that may occur to persons or property on account of this work, and shall indemnify and hold BNSF harmless from any and all costs, liabilities, expenses, suits, judgments or damages to persons or property or claims of any nature whatsoever arising out of or in connection with the permit, or the operation and performance thereunder by the utility, its agents, employees or subcontractors. In this regard, it is further understood and agreed that the utility may be required to obtain insurance coverage as determined by BNSF.

The Utility Owner agrees that if liability insurance is required, it will file with the designated office, prior to granting of the license, "Certificates of Insurance" or other evidence to show that the appropriate insurance is carried.

Insurance as may be required shall be maintained in force until the final release of the Utility Owner by BNSF from all obligations under the terms of the license. The insurance contract shall cover claims for such length of time as law permits said claims. The insurance document shall include a clause requiring the insurer to notify BNSF ten (10) days in advance of any cancellation or change in insurance contacts.

The Utility Owner is responsible for any subcontractor to be knowledgeable of the policy and to require all work to be in compliance with this policy. Subcontractors must carry a liability insurance policy unless the subcontractor is covered by the Utility Owner's insurance.

6. Replacement of Facility

Replacement of existing facility with the same facilities or facilities of a different type, or design, is to be considered as a new utility installation and all work shall adhere to this policy.

7. Change in Ownership

   It is the Utility Owner's responsibility to inform BNSF, in writing, of any name, ownership or address changes.

8. Noncompliance

   Noncompliance with any terms of this Utility Accommodation Policy or Utility License Agreements may be considered as cause for discontinuance of construction or operations until compliance is assured. Continued noncompliance will result in the revocation of the license. The cost of any work required by BNSF in the removal of non-complying construction will be assessed against the Utility Owner.

9. Discharge of Waste Material

   Applications for a Utility License Agreement for the installation of utility facilities which will discharge materials into the nation's waters, must comply with all applicable requirements of Corps of Engineers, and other federal, state or local environmental protection agencies. Identification of applicable requirements and administration of compliance procedures are the responsibility of the Utility Owner.

B. Utility License Agreement Requirements

1. General

   Utility License Agreements are required when utility facilities are installed, relocated, removed or maintained along or across all BNSF property.

   If liability insurance is required, then evidence of adequate liability insurance is to be on file with BNSF for each agreement.

2. Applications

   Approved requests to install, maintain, relocate or remove a utility within the property of BNSF shall be authorized by a Utility License Agreement. The applications for utility license agreements along with plans for the proposed installation shall be submitted to BNSF and approved before construction has commenced.

3. Location

   a. Utility lines shall be located to avoid or minimize the need for adjustments for future railroad improvements and to permit access to the utility lines for their maintenance with minimum interference to railroad traffic.

b. Pipelines shall be installed under tracks by boring, jacking, or in some cases, open-trenching. **WATER JETTING IS NOT PERMITTED.**

c. Where practical, pipelines carrying liquefied petroleum gas shall cross the railway where the tracks are carried on an embankment.

d. All high-pressure pipelines (greater than 60-psi internal pressure), except those in public roads, shall be prominently marked at the property line (on both sides of the track for under crossings) by signs which state the size of the line and its depth.

Example:

CAUTION: 30-inch diameter high-pressure Gas main 7 feet deep.

4. Design Considerations

a. The design of any utility installation will be the responsibility of the Utility Owner. An installation within the railroad property must be reviewed and approved by the railroad with regard to location and the manner of adjustment. This includes the measures to be taken to preserve the safety and flow of rail traffic, structural integrity of the roadway or structure, ease of maintenance and the integrity of the utility facility. Utility installations, on, over or under BNSF property shall conform with requirements contained herein and/or as a minimum, the appropriate requirements outlined in the following:

1) Safety Rules for the Installation and Maintenance of Electric Supply and Communication Lines-National Electric Safety Code.

2) Title 49 C.F.R. Part 192, Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards and Amendments.

3) Title 49 C.F.R. Part 195, Transportation of Liquids by Pipelines and Amendments.

4) American Society for Testing and Materials (ASTM) Specifications - latest edition.

5) Manual on Uniform Traffic Control Devices - with revisions.

6) Rules and Regulations for Public Water Systems - latest edition, published by the appropriate State Health Department.

b. All utility installations on, over or under BNSF property shall be of durable materials designed for long service life and relatively free from routine servicing and maintenance. Conformance with current applicable material specifications and codes is mandatory.

c. References given to any manual, publication or specification are intended to be the most current edition. If a conflict occurs between any publication and this manual, the most restrictive specification will be used.

d. For all boring and jacking installations under main and passing tracks, greater than 26 inches in diameter, and at a depth of between 5.5 and 10.0 feet below top of tie, a geotechnical study will need to be performed to determine the presence of granular material and/or high water table elevation, at the sole expense of the Permittee. The study will include recommendations and a plan for a procedure to prevent failure and a collapse of the bore. Generally, core samples are to be taken near the ends of tie at the proposed location, at least as deep as the bottom of the proposed horizontal bore. Test results must be reviewed and approved by BNSF, or its agent, prior to boring activities commencing. BNSF reserves the rights, based on test results, to require the Permittee to select an alternate location, or to require additional engineering specifications be implemented, at the sole expense of the Permittee, in order to utilize existing location.

C. Safety

1. A safety orientation course should be completed by all workers prior to entering BNSF property. It is the contractor's responsibility to conduct the safety training and implementation of a safety program for its employees. Training materials are available on the web site: www.contractororientation.com. The contractor must comply with all federal, state and local safety regulations.

2. Flagging

   When work is performed within twenty-five (25) feet of the centerline of the track, railroad flagging will be required.

   a. Railroad flagging will be required:

      1) During the period of construction when it is necessary for the Contractor to operate equipment in the vicinity of, or over, BNSF property which may endanger railroad operations, or

      2) Two or more railroad flagmen may be required at other times that the Railway Company Roadmaster's sole discretion shall deem necessary.

   b. Flagging services shall be performed by BNSF employees and the total cost borne by the Utility Owner.

   c. The Utility Owner will be billed monthly at a rate to be determined by BNSF to include labor and payroll associated costs plus any expenses incurred by BNSF for flagging services.

   d. A written request for flagging services will be required at least 72 hours prior to the time when such services are needed. This request is made to the BNSF Roadmaster, as noted in agreement.

3. Material Storage

   Storage of materials, parking of equipment and vehicles when not used in actual utility work will not be permitted on railroad property.

D. Maintenance and Servicing Utilities

1. Utility Owner's Responsibility

   a. Maintenance of the utility is the responsibility of the Utility Owner.

   b. Maintenance must be performed to keep the facility in an as-constructed condition, and in a good state of repair in accordance with the requirements of Federal, State and Local laws, regulatory standards and utility codes.

   c. It is the Utility Owner's responsibility to replace and stabilize all earth cover and vegetation when it has eroded over an underground utility facility where such erosion is due to, or caused by, the placement or existence of the underground utility facility.

   d. The Utility Owner shall be responsible for any settlement of backfill, fills, and embankments that may occur.

2. Emergency Maintenance

   a. Emergency maintenance of utilities located on railroad property is permissible without obtaining a Utility License Agreement if an emergency exists that is dangerous to the life, safety or welfare of the public and which requires immediate repair. The Utility Owner shall take all necessary and reasonable safety measures to protect the public and the railroad.

   b. The Utility Owner, in such and event, will advise the Railway Company's Roadmaster as soon as possible. Damage to the right-of-way and facilities will be restored to its original condition. A Utility License Agreement should be requested by the Utility Owner within the second working day provided the work is not covered under any previously granted license. Flagging requirements described earlier apply in all situations.

E. Preservation, Restoration and Cleanup

1. Disturbed Areas

   a. Areas of railroad property, disturbed by the installation, maintenance, removal and relocation of utilities shall be kept to a minimum.

   b. Disturbed areas shall be returned to normal grade and elevation, with compaction of backfill material, and all excess or undesirable material removed by the Utility Owner. The Utility Owner shall replace destroyed vegetation by sodding, or seeding, fertilizing and mulching, or a combination thereof.

   c. The Utility Owner shall provide protection against erosion in disturbed areas that are subject to erosion. Such protection may be in the form of rock riprap, wash checks, hay or straw cover, or other material that is approved and does not interfere with railroad maintenance.

2. Drainage Facilities

   Care shall be taken to avoid disturbing existing drainage facilities. Underground utility facilities shall be bedded with pervious material and outlets provided for entrapped water. Underdrains should be provided where necessary.

3. Cleanup

   Unused material or debris shall be removed from the work site area. At the end of every construction day, construction equipment and materials shall be removed as far from the operating railroad tracks as possible (minimum 25 feet from centerline).

F. Protection of Vegetation

1. Trimming, Clearing or Removal of Vegetation

   a. Consistent with the preservation of planted vegetation, consideration will be given to Utility Owners for the necessary trimming, clearing or removal of vegetation to provide adequate clearance of overhead wires. Such work will be done in accordance with established practices and standards; however, approval will not be granted for wasteful or wanton trimming, or removal in order to provide easy solutions to a difficult situation.

   b. No trees, shrubs, bushes, vines or ground cover on railroad property shall be sprayed, trimmed, cut down, rooted up, removed or mutilated in any manner unless a permit is granted by BNSF to do such work.

2. Chemical Brush Control

   a. Spraying brush and seedling tree growth to prevent re-sprouting may be permitted, and when permitted, shall be carried out with extreme caution and careful performance. The Utility Owner shall be responsible for the performance of their employees or contractors in the application of brush control and approved by BNSF Environmental Department.

   b. All spraying shall be done by a herbicide applicator that is licensed in the state where the work is to be performed.

   c. Permit applications for spraying shall list the kinds of chemical weed and brush killers that will be used. When liability insurance is required, it shall be provided by the herbicide applicator, or be insured under the liability insurance of the Utility Owner.

   d. Plants over five (5) feet in height should not be sprayed for control. Brush over five (5) feet in height, which is to be removed, should be cut and the stumps treated to prevent growth. Shrubbery type growth such as dogwood, sumac, redbud, plum, etc., should not be sprayed as a general rule. Steep slopes, where brushy growth is a major factor in preventing erosion, should not be sprayed.

3. Tree Pruning

   a. Tree pruning on railroad property for utility lines will utilize the best horticultural practices. All cut branches, dead limbs, etc., shall be removed. Such materials shall not be burned or disposed of on railroad property unless permission is granted by Utility License Agreement.

   b. Should burning be permitted, the Utility Owner will be held liable for any damage to grass, crops, native shrubs and trees arising from careless burning of such brush.

   c. Any and all limbs trimmed shall be removed with a clean cut and all limb scars over one (1) inch in diameter shall be treated with appropriate tree paint.

****

PART 2

UTILITIES PARALLELING

RAILROAD PROPERTY

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PART 2 - UTILITIES PARALLELING RAILROAD PROPERTY

A. General Provisions

This section of the policy applies to all public and private utilities, including electric power, telephone (including fiber optics), telegraph, cable television, water, gas, oil, petroleum products, steam, chemicals, sewage, drainage, irrigation and similar lines that are located, adjusted or relocated within the property under the jurisdiction of BNSF. Such utilities may involve underground, surface or overhead facilities.

Any utility line greater than five hundred (500) feet in length will be considered a parallel line and is to be located on uniform alignment, within ten (10) feet or less of the property line so as to provide a safe environment and to preserve space for future railroad improvements or other utility installations. BNSF Engineering must approve any installation over one mile.

Utilities will be located so as to provide a safe environment and shall conform to the current "National Electrical Safety Code," "American Waterworks Association Specifications," Federal Pipeline Safety Regulations," and "The American Railway Engineering and Maintenance Association Specifications." Where laws or orders of public authority prescribe a higher degree of protection, then the higher degree of protection prescribed shall supersede the provisions of this manual.

B. Overhead Installations

1. Minimum four feet clearance required above signal and communication lines.

2. Poles must be located 50 feet out from the centerline of railroad main, branch and running tracks, CTC sidings, and heavy tonnage spurs. Pole location adjacent to industry tracks; must provide at least a 10-foot clearance from the centerline of track, when measured at right angles. If located adjacent to curved track, then said clearance must be increased at a rate of 1-½ inches per degree of curved track.

3. Regardless of the voltage, unguyed poles shall be located a minimum distance from the centerline of any track, equal to the height of the pole above the ground-line plus 10 feet. If guying is required, the guys shall be placed in such a manner as to keep the pole from leaning/falling in the direction of the tracks.

4. Poles (including steel poles) must be located a minimum distance from the railroad signal and communication line equal to the height of the pole above the ground-line or else be guyed at right angles to the lines. High voltage towers (34.5kV and higher) must be located off railroad right of way.

5. For proposed electrical lines paralleling tracks, BNSF may request that an inductive interference study be performed at the expense of the utility owner. Inductive interference from certain lines have the potential to disrupt the signal system in the track causing failures in the track signals and highway grade crossing warning devices. The General Director of Signals will determine the need for a study on a case-by-case basis.

C. Underground Installations

1. Underground utility installations should be located on top of the back slope at the outer limits of the railroad property.

2. If the pipeline is located forty (40) feet or less from centerline of track, the pipeline shall be encased in a steel pipe subject to approval from BNSF. No pipe may be placed closer than twenty-five (25) feet from centerline of track. Pipe must be buried with a minimum cover of three (3) feet.

    a. If less than minimum depth is necessary because of existing utilities, water table, ordinance or similar reasons, the line shall be rerouted.

    b. Locations where it will be difficult to attain minimum depth due to wet or rocky terrain shall be avoided. Any location change from plan must be approved by BNSF.

3. The use of plastic carrier pipe for sewer, water, natural gas and other liquids is acceptable under specific circumstances. The use of plastic pipe is satisfactory if the pipe is designed to meet AREMA and all applicable federal and state codes, and if the carrier pipe is properly encased with a steel casing pipe for the entire length on BNSF right of way.

4. Manholes shall be limited to those necessary for installation and maintenance of underground lines. Manholes vary as to size and shape depending on the type of utility they serve. To conserve space, their dimensions should be minimally acceptable by good engineering and safety standards. In general, the only equipment to be installed in manholes located on railroad property is that which is essential to the normal flow of the utility, such as circuit reclosers, cable splices, relays, valves and regulators. Other equipment should be located outside the limits of the railroad property. Manholes shall not protrude above the surrounding ground nor be located in the shoulder, shoulder slope, ditch, backslope, or within twenty-five (25) feet of the centerline of track without approval of BNSF.

5. Electric Power Lines

    a. A minimum depth of 3.0 feet below natural grade (BNG) will be maintained for 750 volts and less, and 4.0 feet BNG for greater than 750 volts.

    b. A 6-inch wide warning tape will be installed, 1.0 foot BNG directly over the underground power line where located on Railroad right-of-way outside the track ballast sections.

6. Fiber Optic Lines

   a. A minimum depth of 4.0 feet BNG for fiber optic cable wirelines.

   b. Whenever feasible, all cable should be laid within 5 feet from property lines.

   c. A 6-inch wide warning tape will be installed, 1.0 foot BNG directly over the underground fiber optic line where located on Railroad right-of-way outside the track ballast sections.

D. Attachment to Bridges and Other Structures

The Utility Owner will not be permitted to attach to BNSF bridges or route facilities through drainage structures or cattle passes. Utilities are not to be attached to other railroad structures without the written approval of BNSF Structures Department. As a general rule, overhead power, communication and cable television line crossings at bridges must be avoided. Pipelines laid longitudinally on railroad property shall be located as far as practical from any tracks or other important structures. If located within forty (40) feet of the centerline of any track, the carrier pipe shall be encased or be of special design as approved by BNSF Engineering.

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PART 3

UTILITIES CROSSING

RAILROAD PROPERTY

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PART 3 - UTILITIES CROSSING RAILROAD PROPERTY

A. General Provisions

This section of the policy applies to all public and private utilities, including electric power, telephone (including fiber optics), telegraph, cable television, water, gas, oil, petroleum products, steam, chemicals, sewage, drainage, irrigation and similar lines that are located, adjusted or relocated within the property under the jurisdiction of BNSF. Such utilities may involve underground, surface or overhead facilities.

Installations crossing the property of the railroad, to the extent feasible and practical, are to be perpendicular to the railroad alignment and preferably at not less than forty-five (45) degrees to the centerline of the track. Utilities shall not be placed within culverts or under railroad bridges, buildings or other important structures.

Utilities will be located so as to provide a safe environment and shall conform to the current "National Electrical Safety Code," "American Waterworks Association Specifications," Federal Pipeline Safety Regulations," and "The American Railway Engineering and Maintenance Association Specifications." Where laws or orders of public authority prescribe a higher degree of protection, then the higher degree of protection prescribed shall supersede the provisions of this manual.

B. Overhead Installations

1. Minimum four feet clearance required above signal and communication lines.

2. Poles must be located 50 feet out from the centerline of railroad main, branch and running tracks, CTC sidings, and heavy tonnage spurs. Pole location adjacent to industry tracks; must provide at least a 10-foot clearance from the centerline of track, when measured at right angles. If located adjacent to curved track, then said clearance must be increased at a rate of 1-½ inches per degree of curved track.

3. Regardless of the voltage, unguyed poles shall be located a minimum distance from the centerline of any track, equal to the height of the pole above the ground-line plus 10 feet. If guying is required, the guys shall be placed in such a manner as to keep the pole from leaning/falling in the direction of the tracks.

4. Poles (including steel poles) must be located a minimum distance from the railroad signal and communication line equal to the height of the pole above the ground-line or else be guyed at right angles to the lines. High voltage towers (34.5kV and higher) must be located off railroad right of way.

5. Crossings will not be installed under or within 500 feet of the end of any railroad bridge, or 300 feet from the centerline of any culvert or switch area.

6. Complete spanning of the property is encouraged with supportive structures and appurtenances located outside railroad property. For electric supply lines, normally the crossing span shall not exceed 150 feet with adjacent span not exceeding 1-1/2 times the crossing span length. For communication lines, the crossing span shall not exceed 100 feet in heavy loading districts, 125 feet in medium loading districts, and 150 feet in light loading districts; and the adjacent span shall not exceed 1-1/2 times the crossing span length. For heavier type construction, longer spans will be considered.

7. Joint-use construction is encouraged at locations where more than one utility or type of facility is involved. However, electricity and petroleum, natural gas or flammable materials shall not be combined. Pipe truss design and layout will need to be reviewed and approved by BNSF Engineering.

8. To ensure that overhead wire crossings are clear from contact with any equipment passing under such wires, communication lines shall be constructed with a minimum clearance above top of rail of twenty-four (24) feet, and electric lines with a minimum clearance of twenty-six and one-half (26 1/2) feet or greater above top of rail when required by the "National Electric Safety Code" or state and local regulations. Electric lines must have a florescent ball marker on low wire over centerline of track.

9. The utility owner will label the posts closest to the crossing with the owner's name and telephone number for emergency contact.

10. All overhead flammable and hazardous material lines will need BNSF Engineering approval, but should be avoided if possible.

11. For proposed electrical lines crossing tracks, BNSF may request that an inductive interference study be performed at the expense of the utility owner. Inductive interference from certain lines have the potential to disrupt the signal system in the track causing failures in the track signals and highway grade crossing warning devices. The General Director of Signals will determine the need for a study on a case-by-case basis.

C. Underground Installations

1. General

    a. All underground utility crossings of railroad trackage shall be designed to carry Cooper's E-80 Railroad live loading with diesel impact (AREMA Cooper's loading Section 8-2-8). This 80,000-lb. axle load may be distributed laterally a distance of three (3) feet, plus a distance equal to the depth from structure grade line to base of rail, on each side of centerline of single tracks, or centerline of outer track where multiple tracks are to be crossed. In no case shall railroad loading design extend less than ten (10) feet laterally from centerline of track. Longitudinally, the load may be distributed between the five-foot axle spacing of the Cooper configuration. Railroad loading criteria will also apply

where future tracks on BNSF are contemplated, to the extent this information is available.

b. All utility crossings under ditches and railroad trackage should have a minimum depth of cover of three (3) feet below the flow line of the ditch or ground surface and five and one-half (5-1/2) feet from base of rail. In fill sections, the natural ground line at the toe of slope will be considered as ditch grade. The depth of cover shall not be less than that meeting applicable industry standards.

c. For all boring and jacking installations under main and passing tracks, greater than 26 inches in diameter, and at a depth of between 5.5 and 10.0 feet below top of tie, a geotechnical study will need to be performed to determine the presence of granular material and/or high water table elevation, at the sole expense of the Permittee. The study will include recommendations and a plan for a procedure to prevent failure and a collapse of the bore. Generally, core samples are to be taken near the ends of tie at the proposed location, at least as deep as the bottom of the proposed horizontal bore. Test results must be reviewed and approved by BNSF, or its agent, prior to boring activities commencing. BNSF reserves the rights, based on test results, to require the Permittee to select an alternate location, or to require additional engineering specifications be implemented, at the sole expense of the Permittee, in order to utilize existing location.

d. The use of plastic carrier pipe for sewer, water, natural gas and other liquids is acceptable under specific circumstances. The use of plastic pipe is satisfactory if the pipe is designed to meet all applicable federal and state codes, and if the carrier pipe is properly encased within a steel casing pipe per AREMA standards. This casing must extend the full width of the right of way. Casing may be omitted only for gaseous products if the carrier pipe is steel and is placed ten (10) feet minimum below the base of rail per AREMA standards.

2. General Design and Construction Requirements

a. If the minimum depth is not attainable because of existing utilities, water table, ordinances, or similar reasons, the line shall be rerouted.

b. Locations that are considered unsuitable or undesirable are to be avoided. These include deep cuts and in wet or rocky terrain or where it will be difficult to obtain minimum depth.

c. Underground installations may be made by open-trenching from the property line to the toe of the fill slope in fill sections and to the toe of the shoulder slope in cut sections but to no closer than thirty (30) feet of the centerline of track. The remainder will be tunneled, augured, jacked or directional-bored through the roadbed. Refer to the following sections for required encasement of utilities and boring requirements.

d. Manholes should be located outside railroad property, when possible. No manhole will be located in the shoulder, shoulder slope, ditch or backslope, or within twenty-five (25)

feet of the centerline of track, and shall not protrude above the surrounding ground without approval of BNSF.

e. Utilities will not be attached to or routed through drainage structures or cattle passes. Utilities are not to be attached to other railroad structures without written approval of the BNSF Structures Department.

f. Jacking pits shall be located a minimum of thirty (30) feet from the centerline of track.

3. Pipeline Requirements

a. Pipeline designs are to specify the type and class of material, maximum working pressures and test and design pressure. Pipelines which are not constructed, operated and maintained under regulations established under US Department of Transportation Hazardous Materials Regulations Board, shall upon revisions in the class of material or an increase in the maximum operating pressure, must obtain BNSF Engineering approval.

b. Pipelines carrying oil, liquefied petroleum gas, natural or manufactured gas and other flammable products shall conform to the requirements of the current AREMA, ANSI/ASME B 31.4 Code for pressure piping - Liquid Petroleum Transportation Piping Systems; ANSI B 31.8 Code for pressure piping - Gas Transmission and Distribution Piping Systems; other applicable ANSI codes and 49 C.F.R. Part 192 or Part 195 - Transportation of Hazardous Liquids by Pipeline, except that the maximum allowable stress of design of steel pipe shall not exceed the following percentages of the specified minimum yield strength (multiplied by longitudinal joint factor) of the pipe as defined in the ANSI codes.

c. Pipelines under railroad tracks and across railroad property shall be encased in a larger pipe or conduit called “casings.” Generally, casings shall extend from right-of-way line to right-of-way line, unless otherwise approved.

d. Pipelines and casing pipes shall be suitably insulated from underground conduits carrying electric wires on railroad property.

e. Reinforced concrete pipe will need to be encased for a distance as wide as the embankment at the utility crossing. This is to protect against track failure due to joint separation.

4. Encasement of Utilities

a. Casings are oversized load-bearing conduits or ducts through which a utility is inserted:

1) To protect the railroad from damages and to provide for repair, removal and replacement of the utility without interference to railway traffic.

2) To protect the carrier pipe from external loads or shock, either during or after construction.

3) To convey leaking fluids or gases away from the area directly beneath the railroad trackage to a point of venting at the railroad property line.

b. Casings may be omitted for **gaseous products only** under the following circumstances:

1) Carrier pipe must be steel and the wall thickness must conform to E-80 loading for casing pipe shown in the tables as included in the AREMA manual Chapter 1, Part 5 for Pipeline Crossings. The length of thicker-walled pipe shall extend from railroad right-of-way line to right-of-way line. This will generally result in thicker-walled pipe on railroad right-of-way.

2) All steel pipe shall be coated and cathodically protected.

3) The depth from base of rail to top of pipe shall not be less than ten (10) feet below base of rail. The depth from ditches or other low points on railroad right-of-way shall not be less than six (6) feet from ground line to top of pipe.

c. In circumstances where it is not feasible to install encasement from right-of-way line to right-of-way line, casing pipe under railroad tracks and across railroad property shall extend to the greater of the following distances, measured at right angles to the centerline of track:

1) Two (2) feet beyond toe of slope.

2) Three (3) feet beyond ditch line.

3) Twenty-five (25) feet from centerline of outside track when casing is sealed at both ends.

4) Forty-five (45) feet from centerline of outside track when casing is open at both ends.

5) If additional track is planned for future construction, casing must extend far enough to meet above distances given the additional track requirement.

d. Pipelines and casing pipe shall be suitably insulated from underground conduits carrying electric wires on railroad property.

e. Casing pipe and joints shall be made of metal, and of leakproof construction. Casings shall be capable of withstanding the railroad loadings and other loads superimposed upon them.

f. Wall thickness designations for steel casing pipe for E-80 loading (including impact) are:

Nominal Diameter, (Inches)	Min. Thickness for Coated (Inches)	Non Coated (Inches)
14 and Under	0.188	0.188
16	0.219	0.281
18	0.250	0.312
20 and 22	0.281	0.344
24	0.312	0.375
26	0.344	0.406
28	0.375	0.438
30	0.406	0.469
32	0.438	0.500
34 and 36	0.469	0.531
38, 40 and 42	0.500	0.563
44 and 46	0.531	0.594
48	0.563	0.625
50	0.594	0.656
52	0.625	0.688
54	0.656	0.719
56 and 58	0.688	0.750
60	0.719	0.781
62	0.750	0.813
64	0.718	0.844
66 and 68	0.813	0.875
70	0.844	0.906
72	0.875	0.938

1) Steel pipe shall have minimum yield strength of 35,000 pounds per square inch.

2) All metallic casing pipes are to be designed for effective corrosion control, long service life and relatively free from routine servicing and maintenance. Corrosion control measures must include cathodic protection.

3) Cast iron may be used for casing. It shall conform to ANSI A21. The pipe shall be connected with mechanical-type joints. Plain-end pipe shall be connected with compression-type couplings. The strength of the cast iron pipe to sustain external loads shall be computed in accordance with the most current ANSI A21.1 “Manual for the Computation of Strength and Thickness of Cast Iron Pipe.”

g. The inside diameter of the casing pipe shall be such that the carrier pipe can be removed without disturbing the casing. All joints or couplings, supports, insulators or centering devices for the carrier pipe shall be considered in the selection of the casing diameter.

h. For flexible casing pipe, a minimum vertical deflection clearance of the casing pipe shall be three percent (3%) of its diameter plus one-half (1/2) inch so that no loads from the roadbed, track, railroad traffic or casing pipe are transmitted to the carrier pipe. When insulators are used on the carrier pipe, the relationship of the casing size to the size of the carrier pipe is:

Diameter of Carrier Pipe	Inside Dia. of Casing Pipe Equals Outside Dia. of Carrier Pipe Plus
0" - 8"	2"
10" - 16"	3-1/4"
Over 16"	4-1/2"

5. Casing and Pipeline Installation

a. Casing and pipeline installations should be accomplished by directional boring, jack-and-bore, tunneling or other approved methods. Tunneling construction under tracks will be permitted only under direct supervision of a BNSF Engineer. Tunneling procedures and equipment, as well as structural design, must have BNSF Structures Department approval prior to starting any work on BNSF property. Generally, tunneling shall not be considered where less than six (6) feet of cover exists, or where excessively sandy, loose or rocky soils are anticipated.

Rail elevations over the work must be monitored at intervals prescribed by BNSF to detect any track movement. Movements of over one-quarter (1/4) inch vertically shall be immediately reported to the BNSF Roadmaster. Due to the danger to rail traffic that is caused by only small amounts of track movement, BNSF forces may have to be called to surface the track several times.

The following requirements shall apply to these construction methods:

1) The use of water under pressure jetting or puddling will not be permitted to facilitate boring, pushing or jacking operations. Some boring may require water to lubricate cutter and pipe, and under such conditions, is considered dry boring.

2) Where unstable soil conditions exist, boring or tunneling operations shall be conducted in such a manner as not to be detrimental to the railroad being crossed.

3) If excessive voids or too large a bored hole is produced during casing or pipeline installations, or if it is necessary to abandon a bored or tunneled hole, prompt remedial action should be taken by the Utility Owner.

4) All voids or abandoned holes caused by boring or jacking are to be filled by pressure grouting. The grout material should be sand cement slurry with a minimum of two (2) sacks of cement per cubic yard and a minimum of water to assure satisfactory placement.

5) The hole diameter resulting from bored or tunneled installations shall not exceed the outside diameter of the utility pipe, cable or casing (including coating) by more than one and one-half (1-1/2) inches for pipes with an inside diameter of twelve (12) inches or less, or two (2) inches on pipes with an inside diameter greater than twelve (12) inches.

6) Pits for boring, tunneling or jacking will not be permitted within thirty (30) feet of the centerline of track; or closer to the track than the toe of fill slopes in fill sections, or toe of shoulder slopes in ditch sections when pipes are allowed on the railroad property.

c. Vents. In casing pipe installations, vents are appurtenances by which fluids or gases between carrier and casing may be inspected, sampled, exhausted or evacuated.

1) Vents shall be located at the high end of short casings and at both ends of casing longer than one hundred fifty (150) feet.

2) Vent standpipes shall be located and constructed so as not to interfere with maintenance of the railroad or to be concealed by vegetation. Where possible, they shall be marked and located at the property line. The markers shall give the name and address of the owner, and a phone number to contact in case of emergency.

3) Casing pipe, when sealed, shall be properly vented. Vent pipes shall be of sufficient diameter, but in no case less than two (2) inches in diameter and shall be attached near each end of casing, projecting through ground surface at property lines.

4) Vent pipes shall extend not less than four (4) feet above ground surface. Top of vent pipes shall be fitted with a down-turned elbow, properly screened; or a relief valve.

5) For pipelines carrying flammable materials, vent pipes on casings shall be at least 16 feet (vertically) from aerial electric wires. Casings shall be suitably insulated from underground conduits carrying electric wires on Railroad right-of-way.

d. Shut-Off Valves

1) The Utility Owner shall install accessible emergency shut-off valves within effective distances on each side of the railroad. Where pipelines are provided with automatic control stations, no additional valves will be required.

2) Locating a shut-off valve on railroad property should be avoided. If approval is acquired, a guardrail must protect the shut-off valve.

3) When a guardrail is required, its height shall be four (4) feet above the ground line. All four corner posts shall be driven to a minimum depth of four (4) feet below ground line. There shall be a minimum clearance of two (2) feet from the valve to the

guardrail. The steel pipes for the four corner posts and guardrail shall have a minimum diameter of four (4) inches. All joints will be welded with a one-quarter (1/4) inch fillet weld all around.

6. Water Lines

   a. Where casing pipe is used, venting is not required; however, sealing will be required if the ends of the casing are not above high water.

   b. Where non-metallic pipe is permitted and installed, steel casings are required from right of way line to right of way line.

   c. Manholes should be located outside the railroad property. Manholes shall not be located within twenty-five (25) feet of railroad trackage, in the shoulder, shoulder slope, ditch or backslope; and shall not protrude above the surrounding ground without the approval of BNSF Engineering.

   d. The Utility Owner shall place a readily identifiable and suitable marker at each railroad property line where it is crossed by a water line.

7. Sewer Lines

   a. New and relocated sewer lines shall be constructed with satisfactory joints, materials and designs which will provide protection and resistance to damage from sulfide gases and other corrosive elements to which they may be exposed.

   b. Where casing pipe is used, venting and sealing of casing will be required.

   c. Where non-metallic pipe is permitted and installed, a durable metal wire shall be concurrently installed; or other means shall be provided for detection purposes.

   d. Manholes should be located outside the railroad property. Manholes shall not be located within twenty-five (25) feet of railroad trackage, in the shoulder, shoulder slope, ditch or backslope; and shall not protrude above the surrounding ground without the approval of BNSF Engineering.

8. Electric Power Lines

   a. A minimum depth of 5.5 feet below the base of rail (BBR) will be maintained.

   b. A minimum depth of 3.0 feet below natural grade (BNG) will be maintained for 750 volts and less, and 4.0 feet BNG for greater than 750 volts.

   c. The wireline must be encased completely across the Railroad right-of-way with a rigid metallic conduit.

d. Crossings will not be installed under or within 50 feet of the end of any Railroad bridge, centerline of any culvert or switch area.

e. A BNSF signal representative must be present during installation if railroad signals are in the vicinity of wireline crossings unless signal representative authorizes otherwise.

f. Markers that identify the Utility Owner shall be placed at both property lines for utilities crossing the railroad property. For parallel lines markers shall be placed above the cable at intervals no less than 300' apart. The markers should identify the owner, type of cable and emergency telephone number. A 6-inch wide warning tape will be installed, 1.0 foot BNG directly over the underground power line where located on Railroad right-of-way outside the track ballast sections.

g. Above-ground utility appurtenances installed as a part of an underground installation shall be located at or near the railroad property line and shall not be any closer than twenty-five (25) feet to the centerline of track.

9. Fiber Optic Lines.

a. The same requirements for electric power line crossings will apply for fiber optic line crossings except for the following:

b. A minimum depth of 4.0 feet BNG for fiber optic cable wirelines.

c. BNSF Engineering must approve any specialized equipment used to install cable. No rail plow will be allowed for installation purposes.

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PART 4

PLANS, APPROVALS AND PROCEDURES

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PART 4 - PLANS, APPROVALS AND PROCEDURES

A. Plans and Approvals

1. Design

   a. The design of all utility installations will be the responsibility of the Utility Owner.

   b. The plans for the proposed installation shall be submitted to and meet the approval of BNSF Engineering before construction is initiated.

   c. Plans shall be drawn to scale showing the relationship of the proposed utility line to the railroad tracks, the angle of crossing, location of valves and vents, the railroad mile post and engineering station, railroad property lines and general layout of tracks and other railroad facilities. The plans should include a cross-section (or sections) from the field survey that will show utility placement in relation to actual profile of ground and tracks. If tunneling is proposed, method of supporting tracks or driving of tunnel shall be shown. The geotechnical study, when required, should be included.

   d. The plans should contain the following data for carrier pipe and casing pipe:

      Contents to be carried
      Inside diameter
      Pipe material
      Specifications and grade of material
      Wall thickness
      Actual working pressure
      Type of joints
      Longitudinal joint factor
      Coating
      Method of installation
      Vents-Number, Size, Height above ground
      Seals-Both ends, One end
      Cover (top of tie to top of pipe or casing)
      Cover (other than under tracks)
      Cover (at ditches)
      Cathodic protection
      Type, Size and Spacing of insulators or supports

   e. When a geotechnical study is required, the findings and protection plan shall be prepared by a licensed civil engineer and included with the plans. The geotechnical crew will need to be properly permitted to enter BNSF right-of-way and a BNSF flagman will be required when working within 25 feet of the track.

2. Approvals

a. Approval of plans and application forms is required for all installations of utilities prior to initiation of work on railroad property.

b. If surveying is necessary for the completion of an application, a "Right of Entry" or "Release of Claim and Indemnity" must be executed and referenced.

B. License Procedures

1. Applications should be submitted to:

   Staubach Global Services
   Permits Department
   3017 Lou Menk Drive, Suite 100
   Fort Worth, TX 76131-2800

2. Upon receipt of the application, a letter will be forwarded acknowledging receipt and advising of the Permit & Contract file reference number that has been assigned and the person who should be contacted for further inquiries.

3. Office Hours: 8:00 A.M. to 5:00 P.M. Monday through Friday, CT
   Phone Number: (toll free) 866-498-6647.

4. Agreements will be required for all encroachments on railroad property.

5. Generally, agreement-processing time will be thirty to sixty days. Please allow sufficient lead-time for document handling prior to desired construction date. Before construction begins, agreements must be executed by Utility Owner and returned. Verbal authorizations will not be granted or permitted. A minimum of seventy-two (72) hours advance notice after execution of an agreement will be required prior to initiation of construction.

6. License fees must be submitted at the time the agreement is executed and returned.

7. Applications are to be made on the standard application form including an Exhibit "A."

C. Construction

1. The execution of the work on railroad property shall be subject to the inspection and direction of the Roadmaster or his representative.

2. A representative of BNSF Signal Department must be present during installation if railroad signals are in the vicinity of the construction.

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PART 5

APPENDIX

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REFERENCES

American National Standards Institute (ANSI) Codes, 1430 Broadway, NY, NY 10018.

American Railway Engineering and Maintenance of Way Association (AREMA) Specifications.

American Society for Testing and Materials (ASTM) Specifications.

American Water Works Association Standards and Specifications, AWWA, 2 Park Avenue, NY, NY 10016.

Manual on Uniform Traffic Control Devices - with revisions, US Department of Transportation, Federal Highway Administration.

National Electrical Safety Code, US Department of Commerce, National Bureau of Standards.

Pipeline Safety Regulations - Code of Federal Regulations, Tile 49 - Transportation, Parts 191-192-Natural Gas; Part 195-Liquid Petroleum Gas.

Rules and Regulations for Public Water Systems - latest edition, State Health Departments.

Rules and Regulations promulgated by the Hazardous Materials Regulation Board of the US Department of Transportation.

Statutory Provisions, 23 U.S.C. 109 and 111.

DEFINITION OF TERMS

The terminology used in this Policy strives for conventional meaning and to insure uniform interpretation. To this end, the following definitions apply:

ACCESS CONTROL: Restriction of access to and from abutting lands to railroad property.

AREMA: American Railroad Engineering and Maintenance of Way Association.

ANSI: American National Standard Institute.

ASTM: American Society for Testing and Materials.

BACKFILL: Replacement of soil around and over an underground utility facility.

BORING: Piercing a hole under the surface of the ground without disturbing the earth surrounding the hole. Boring may be accomplished by any approved manner. Water jetting or puddling will not be permitted. Holes may be mechanically bored and cased using a cutting head and continuous auger mounted inside of the casing. Small diameter holes may be augured and the casing or utility facility pushed in later.

BNSF: Burlington Northern and Santa Fe Railway Company.

BURY: Placement of the utility facility below grade of roadway, ditch or natural ground to a specified depth.

CARRIER: Pipe directly enclosing a transmitted fluid (liquid or gas).

CASING: A larger pipe enclosing a carrier.

CFR: Code of Federal Regulations.

COATING: Material applied to or wrapped around a pipe.

COMMUNICATION LINE: Fiber optic, telephone cable and similar lines, not exceeding four hundred (400) volts to ground or seven hundred fifty (750) volts between any two (2) points of the circuit, the transmittal power of which does not exceed one hundred fifty (150) watts.

CONDUIT OR DUCT: An enclosed tubular runway for protecting wires or cables.

COVER: The depth of material placed over a utility. Depth of cover is measured from top of utility casing or carrier pipe (if no casing is required) to the natural ground line or construction line above the utility.

DIRECT BURIAL: Installing a utility underground without encasement, by plowing or trenching. No rail plows will be permitted.

ELECTRIC SUPPLY: Electric light, power supply, and trolley lines, irrespective of voltage used for transmitting a supply of electrical energy.

ENCASEMENT: Structural element surrounding a pipe or cable.

FLEXIBLE PIPE: A plastic, fiberglass, or metallic pipe having a large ration of diameter to wall thickness that can be deformed without undue stress. Copper or aluminum pipe shall be considered as flexible pipe.

GROUNDED: Connected to the earth or to some extended conducting bodies which intentionally or accidentally is connected with the earth.

GROUT: A cement mortar or slurry of fine sand or clay as conditions govern.

JACK-AND-BORE: The installation method whereby the leading edge of the jacked pipe is well ahead of the cutting face of the auger bit. The auger is removing waste from inside the pipe as it is being jacked. This method greatly reduces the likelihood of subsidence of granular material during installation.

JACKING: The installation of small pipes by the use of hydraulic jacks or rams to push the pipe under the traveled surface of a road, railroad roadbed, or other facility.

LICENSE:

UTILITY LICENSE AGREEMENTS are executed for all utility facilities located on railroad property.

MANHOLE: An opening to an underground utility system which workmen or other may enter for the purpose of maintaining, inspecting, or making installations.

NATURAL GAS PIPELINES:

DISTRIBUTION SYSTEM - A pipeline other than a gathering or transmission line.

SERVICE LINE - A distribution line that transports gas from a common source of supply to a customer meter.

TRANSMISSION SYSTEM - A pipeline other than a gathering line that transports gas from a gathering line or storage facility to a distribution center or storage facility. It operates at a hoop stress of twenty percent (20%) or more of the Specified Minimum Yield Strength.

NORMAL: Crossing at a right angle.

PERMITS:

PERMIT TO BE ON BNSF PROPERTY FOR UTILITY SURVEY is to be executed prior to all survey work on railroad property.

PIPE: A tubular product made as a production item for sale as such. Cylinders formed from plate in the course of fabrication of auxiliary equipment are not pipes as defined here.

PRESSURE: Relative internal pressure in PSI (pounds per square inch) gauge.

PRIVATE LINES: Any privately owned facilities which convey or transmit the commodities outlined under the definition for Utilities but are devoted exclusively to private use.

PUBLIC LINES: Those facilities which convey or transmit the commodities outlined under the definition for Utilities and directly or indirectly serve the public or any part thereof.

RIGHT OF WAY: A general term denoting land, property of interest therein, usually in a strip, acquired for or devoted to railroad transportation purposes.

SEAL: A material placed between the carrier pipe and casing to prevent the intrusion of water, where ends of casing are below the ground surface.

SHOULDER: That portion of the roadbed outside the ballast.

TRENCHED: Installed in a narrow excavation.

TUNNELING: Excavating the earth ahead of a large diameter pipe by one or more of the following processes: 1) The earth ahead of the pipe will be excavated by men using hand tools while the pipe is pushed through the holes by means of jacks, rams or other mechanical devices, 2) The excavation is carried on simultaneously with the installation of tunnel liner plates, and/or 3) The tunnel liner plates are installed immediately behind the excavation as it progresses and are assembled completely away from the inside.

UTILITY OWNER: All privately, publicly or cooperatively owned lines, facilities and systems for producing, transmitting or distributing communications, power, electricity, light, heat, gas, oil, crude products, water, steam, waste, storm water and other similar commodities, including fire and police signal systems and street lighting systems which directly or indirectly serve the public.

APPLICANT'S PIPELINE CROSSING CHECKLIST

Installation must comply with Standard Specifications.

Installation is located at least fifty (50) feet from the end of any railroad bridge or centerline of any culvert.

Steel casing must extend completely across railroad property if carrier pipe is made of plastic.

Approval for installation may be given if pipeline is uncased and commodity is gaseous and the carrier pipe is made of steel, buried a minimum of ten (10) feet below base of rail and six (6) feet below ground line for its entire length across railroad property.

A BNSF Signal representative may be present during installation if railroad signals are in vicinity of installation, unless plans have been approved prior to installation.

Applications and Policy are available on-line at:

http://www.bnsf.com/tools/realestate/

Date: _____

APPLICATION FOR PIPE LINE CROSSING OR LONGITUDINAL

The Staubach Company
Permit Department
3017 Lou Menk Dr., Ste. 100
Fort Worth, TX 76131-2800

APPLICANT'S TAX I.D. NO./SS#_____

***ATTN**: Permit Specialist for _____(State)*

We submit for your approval the following specifications for a pipe line we propose to build across **THE BURLINGTON NORTHERN AND SANTA FE RAILWAY COMPANY** right-of-way, as shown on enclosed sketch.

Legal name of company or municipality who will own the pipeline _____
State in which incorporated _____
If not incorporated, correct name of owners or all partners: _____
Correct mailing address _____ Zip Code _____
Type of Encroachment: Crossing _____ Longitudinal _____ Telephone _____
Location of encroachment _____ 1/4 Sec _____ Twsp _____ Rng _____ MP _____ + _____
Name of nearest town on Railroad _____ County _____ State _____
Name of nearest roadway crossing Railroad _____
Within limits of public road or street ☐ Yes ☐ No **If yes, distance from center line of road or street** _____ **ft.**
Width of public road or street _____ **ft.**

	CARRIER	CASING
Contents to be handled through pipe		
Emergency Contact: _____ **Emergency Telephone:** _____		
Length of pipe on Railroad Co. property (Plastic pipe must be encased full width of right of way)	_____ ft.	_____ ft.
Inside diameter of pipe	_____ in.	_____ in.
Pipe Material		
Specification & grade (Min. yield strength casing 35,000 psi.)		
Wall Thickness (Min. wall thickness of casing pipe under 14 in.-0.188 in. E-80 Loading)	_____ in.	_____ in.
Actual working pressure	_____ psi	
Type of joint - (mechanical or welded type)		
Longitudinal Joint Factor		
Coating		
Distance Base of rail to top of pipe (Flammable, contents, steam, water or non-flammable - min. 5 1/2 ft. under main track.) (Uncased, gaseous products - min. 10' under track)		
Minimum ground cover on Railroad Co. property (min. 3 ft.)		
Cathodic protection casing-(flammable substance)		

Type of insulators or supports _____ Size _____ Space _____
Number of vents _____ Size _____ Height above ground _____
(Flammable substances require 2 vents)
Method of crossing: Jacking _____ Trench _____ Dry Bore Only _____
(If trenched - Railroad furnish flagman at applicant's expense.)
(If bored or jacked - Jacking Pit location minimum 30 ft. from centerline of nearest track.) Pit must not be open more than 48 hours. Also, it must be protected when not in use.
Does pipeline support oil or gas well? ☐ Yes ☐ No
If yes, advise distance the well is from Railway property - _____ ft. Name of well _____
Was this service requested by BNSF? Yes or No (circle one) If yes, who requested _____
Telephone # of Requestor _____.

Attached to this sheet is location plan and detail sketch. Sketch shows tie-down measurement to centerline of nearest road crossing, bridge or other railroad structure. Please authorize us to proceed with this installation or advise what changes are necessary to meet your specifications.

Signed: _____
Print Name: _____
Title: _____
Telephone: _____

April 16, 2004

Date: _____

APPLICATION FOR WIRE LINE CROSSING OR LONGITUDINAL

The Staubach Company
Permit Department
3017 Lou Menk Dr., Ste. 100
Fort Worth, TX 76131-2800

TAX I.D. NO./SS# _____

***ATTN**: Permit Specialist for _____(State)*

We submit for your approval the following specifications for a wire line we propose to build across **THE BURLINGTON NORTHERN AND SANTA FE RAILWAY COMPANY** Right-of-way, as shown on enclosed drawing.

Legal name of company or municipality who will own the wireline _____
State in which incorporated _____
If not incorporated, correct name of owners or all partners: _____
Correct mailing address _____ Zip Code _____
Telephone _____
Location of crossing _____ 1/4 Sec _____ Twsp _____ Rng _____
Name of nearest town on Railroad _____ State _____
Type of Encroachment: Crossing ____ Longitudinal ____ Railroad Mile Post _____
Name of nearest public roadway crossing Railroad _____ County _____
Within limits of public road or street? ☐ Yes ☐ No **If yes, distance from center line of road or street _____ ft.**
Width of public road or street ____ ft.
Kind of encroachment: Electric _____ Telephone _____ Other _____
No. of wires/cables _____ Type of wires/cable _____ Volts _____ Phase _____ Cycles _____
No. of conduits _____ No. of occupied conduits _____ No. of vacant conduits _____
Length of encroachment _____ Adjacent spans _____ ft. _____ ft.
Appurtenances on Ry. Co. Property _____
Wire clearance over or under top of rail _____ ft. _____ ft.
If under track, size & kind of conduit _____
Wire clearance over Ry. Co. wire lines ft. ft.
Was this service requested by BNSF? Yes or No (circle one)
If yes, who requested? _____ Telephone: _____

Attached to this sheet is a pole head diagram (if required) and location plan. Location plan shows tie-down measurement to centerline of nearest road crossing, bridge or other railroad structure. Please authorize us to proceed with construction of this encroachment as proposed or advise what changes are necessary to meet your specifications.

Signed: _____

Print Name: _____

Title: _____

Telephone: _____

April 16, 2004

POLE HEAD AND DATA SHEET

This completed form to accompany application to construct a wire line on THE BURLINGTON NORTHERN AND SANTA FE RAILWAY COMPANY right-of-way.

Name of Company _____

Location of encroachment _____ ft. Sec. _____ Twsp. _____ Rng. _____

Nearest Town _____ County _____

POLES
Kind _____ Size _____
Height _____
Class _____
Set-in Earth-Rock _____

GUY WIRES
Overhead _____ Down _____
Kind _____ Size _____

CROSS ARMS
Material _____
Size _____ X _____ X _____

FRONT ELEVATION

INSULATORS
Material _____
Type _____ Size _____

BRACKETS
Material _____
Type _____ Size _____

CONDUCTORS
Material _____
Kind _____ Size _____

LINE CHARACTERISTICS

Voltage _____
Phase _____ Cycle _____

SIDE ELEVATION

Project Name	**Skykomish**
Project/Task Number	**1140204/0360**
Calculation Title	**Air Sparging System Blower Sizing**
Prepared by	**D. Arcieri**
Reviewed by	**M. Havighorst**
Completion date	**11/4/2007**

ENSR | AECOM

Objective: To determine minimum blower operating pressure for Area 1 injection wells and future potential injection wells (aka Area 2 Well) based on system head losses and subsurface conditions.

Step 1. Determine Pressure Drop in Straight Runs of Pipe due to friction, h_f

PIPING RUN	FROM	TO	PIPE DIA (in)	PIPE DIA D (ft)	PIPE LENGTH L (ft)	DESIGN FLOW[b] *Q* (SCFM)	DESIGN FLOW[1] Q (ACFM)	DESIGN VEL.[2] v (fps)	TEMP (deg F)	Re[3] (dim)	RELATIVE ROUGHNESS[4] ε/D	FRICTION FACTOR[5] *f* (ft)	HEAD LOSS[6] h_f (ft)	PRESSURE DROP[7] p_{f1} (lbf/ft^2)	PRESSURE DROP[8] p_{f2} (psi)
Area 1															
	Mech. Bldg.	Vault 1	4	0.33	550	51	66	13	80	24921	1.50E-05	2.45E-02	100	8	0.05
	Vault 1	Area 1 Wells	1	0.08	140 [a]	3	4	12	80	5864	6.00E-05	3.62E-02	133	10	0.07
Total													234	18	0.12
Area 2 [b]															
	Mech. Bldg.	Vault 2	4	0.33	730	24	31	6	80	11727	1.50E-05	2.97E-02	36	3	0.02
	Vault 2	Area 2 Wells	1	0.08	180 [c]	3	4	12	80	5864	6.00E-05	3.62E-02	172	13	0.09
Total													207	16	0.11

Notes:

a Pipe length is to the Area 1 sparging well furthest from Vault 1. Length is based on 2008 EDR drawing C-17 takeoff.

b The locations of the Area 2 vault and sparging wells have not been determined, but would likely be located north of Area 1 and near the South Fork Skykomish River. Area 2 wells and piping would be constructed similarly to those installed in Area 1.

c Pipe length was estimated based on the predicted location of the future potential Area 2 sparging well furthest from the likely future potential location of Vault 2.

Calculations

1. $Q_{ACFM} = Q_{SCFM} [P_{std} / (P_{act} - P_{sat}\Phi)](T_{act} / T_{std})$ **where**
   ACFM = Actual Cubic Feet per Minute
   SCFM = Standard Cubic Feet per Minute
   Pstd = Standard absolute air pressure (psia)
   Pact = absolute pressure at the actual level (psia)
   Psat = Saturation pressure at the actual temperature (psi)
   Φ = Actual relative humidity
   Tact = Actual ambient air temperature (R)
   Tstd = Standard temperature (R)

   Assumptions:
   1. Pact = 13.66 psi at site elevation of 2000 ft above mean sea level
   2. Φ = 0.70
   3. Tact = 80°F, 540R

2. **$v = Q(\pi D^2/4)/(60$ sec/min)**

3. **$Re = Dv/\nu$ where**
   ν = kinematic viscosity(lbf-sec/ft^2)

Assumptions:

1. ν = 0.000169 lbf-sec/ft^2 at 80^{o}F

4. ε = 0.000005 ft where
ε = roughness factor for plastic pipe (Lindeburg, Table 17.2, p. 17-4)

5. $$f = \frac{0.25}{\left[\log_{10}\left(\frac{\frac{\varepsilon}{D}}{3.7}\right) + \frac{5.74}{\mathrm{Re}^{0.9}}\right]^2}$$ (Lindeburg, Eq. 17.21)

6. $h_f = fLv^2/(2Dg)$ (Lindeburg Eq. 17.28) where
g = acceleration of gravity, 32.2 ft/sec^2

7. $p_{f1} = h_f \rho g_{air}$ (Lindeburg, Eq. 17.29(a)) where
ρg_{air} = specific weight of air at STP, 0.0752 lbf/ft^3

8. $p_{f2} = p_f(144\ in^2/ft^2)$

Step 2. Determine Pressure Drop in Fittings, h_m

Fitting Type	K	No. of Fittings	HEAD LOSS[9] h_m (ft)	PRESSURE DROP[7] p_{m1} (lbf/ft^2)	PRESSURE DROP[8] p_{m2} (psi)
Area 1					
Mechanical Building					
gate valve (4-inch)	0.19	1	0.47	0.04	0.0002
check valve (4-inch)	2.3	1	5.70	0.43	0.0030
90 elbow (4-inch)	0.9	2	4.46	0.34	0.0023
flow meter	5	1	12.39	0.93	0.0065
Vault A					
gate valve (4-inch)	0.19	1	0.47	0.04	0.0002
tee (4-inch), stem flow	1.8	1	4.46	0.34	0.0023
gate valve (1-inch) 1/2 closed	5.6	1	12.30	0.92	0.0064
tee (1-inch), stem flow	1.8	1	3.95	0.30	0.0021
flow meter	5	1	10.98	0.83	0.0057
Area A Wellheads					
90 elbow (1-inch)	0.9	1	1.98	0.15	0.0010
Total			**57.17**	**4.30**	**0.03**

Project Name	**Skykomish**
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Area 2					
Mechanical Building					
gate valve (4-inch)	0.19	1	0.47	0.04	0.0002
check valve (4-inch)	2.3	1	5.70	0.43	0.0030
90 elbow (4-inch)	0.9	2	4.46	0.34	0.0023
flow meter	5	1	12.39	0.93	0.0065
Vault B					
gate valve (4-inch)	0.19	1	0.10	0.01	0.0001
tee (4-inch), stem flow	1.8	1	0.99	0.07	0.0005
gate valve (1-inch) 1/2 closed	5.6	1	12.30	0.92	0.0064
tee (1-inch), stem flow	1.8	1	3.95	0.30	0.0021
flow meter	5	1	10.98	0.83	0.0057
Area B Wellheads					
90 elbow (1-inch)	0.9	1	1.98	0.15	0.0010
Total			**53.32**	**4.01**	**0.03**

Calculations

9. $h_m = Kv^2/2g$ **(White, Eq. 6.109)**

Step 3. Determine Air Entry Pressure, p_e

Assume air entry pressure due to screen friction is 1 psi

p_e = 1psi

Step 4. Determine Total Head Losses Area 1 and 2 Wellheads located furthest from the blower system

$P_{TOTAL} = p_{f2} + p_{m2} + p_e$

Area 1	p_{TOTAL} = 0.12 psi + 0.03 psi + 1 psi =	**1.15 psi**
Area 2	p_{TOTAL} = 0.11 psi + 0.03 psi + 1 psi =	**1.14 psi**

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Step 5. Determine Overburden Pressure, p_o

Calculations

10. $p_o = p_h + p_s$ where **(USACE, Eq. 5-3)**

p_h = hydrostatic pressure from the water column = $\rho g_{water}(z_s - z_w)\phi$ (USACE, Eq. 5-2)

p_s = soil column pressure = $\rho g_{soil} z_s(1-\phi)$ (USACE, Eq. 5-1)

ρg_{water} = specific weight of water at STP, 62.4 lbf/ft^3

ρg_{soil} = specific weight of soil (lbf/ft$^{3)}$

z_s = depth to the top of the well screen (ft)

z_w = depth to high ground water table (ft)

ϕ = porosity

Assumptions:
1. ρg_{soil} = 100 lbf/ft^3
2. ϕ = .5

From Data:
1. z_s = 24 ft
2. z_w = 10 ft

p_o = 62.4 lbf/ft^3(24ft - 10ft)(0.5)+100 lbf/ft^3 (10ft)(0.5) =	937	lbf/ft^2
p_o = 937 lbf/ft^2 (144 in^2/ft^2) =	**6.1 psi**	

Step 6. Determine Range of Maximum Injection Pressure at Well, p_{max}

Calculations

11. $p_{max} = p_o$ (0.6 to 0.8) (USACE, Eq. 5-4)

p_{max} = 6.1 (0.6 to 0.8) = 3.7 to 4.9 psi

Step 7. Determine Minimum Blower Pressure, p_{BLOWER}, Based on Total Pressure Loss and Range of Maximum Injection Pressures

Calculations

12. $p_{BLOWER} > p_{max} + p_{TOTAL}$

Area 1	p_{BLOWER} > 4.9 psi+ 1.15 psi >	**6.05 psi**
Area 2	p_{BLOWER} > 4.9 psi+ 1.14 psi >	**6.04 psi**

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Conclusion: the minimum blower operating pressure is approximately 6.1 psi for each sparging area.

References

1. Lindeburg, Michael R., *Civil Engineering Reference Manual*, 8th Edition, 2001
2. White, F.M., *Fluid Mechanics*, 2nd Edition, 1986
3. United States Army Corps of Engineers (USACE) Engineering Manual (EM) 1110-1-4005 (1997)

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Structural Assessment
Depot, Olympia Building, McEvoy Residence
Skykomish, WA

January 10, 2007

1/10/08

EXPIRES 1/5/10

Introduction

The following report summarizes our findings with respect to the structural condition and suitability for lifting and temporarily relocating the Depot, Olympia Building, and McEvoy Residence all located in Skykomish, WA.

Our findings for the Depot and Olympia Building are based on our site visits, visual observations, and limited probing of the structures. As the owner has not granted access to the McEvoy Residence our findings are based on our visual exterior observations and review of the recent real estate appraisal dated 9/21/07 (prepared by Appraisal Group of the Northwest, LLP). No destructive testing has been performed and at this time is not required to form an opinion on the suitability for lifting and relocating the structures. None of the original construction drawings or soils reports were available for review.

It is anticipated that the relocation contractor will perform additional probing of the structures as required to confirm the as-built conditions.

While no significant wood rot was uncovered during our probing, the potential still exists in all three buildings. If found during lifting/relocation process it will need to be evaluated by a qualified structural engineer to determine if it must be repaired prior to lifting/relocating the structure.

This report is intended for the sole use of the owner and its consultants. The scope of services performed during the execution of this investigation may not be appropriate to satisfy the needs of other users, and any use or re-use of this document or the findings and recommendations presented herein is at the sole risk of the said user.

This evaluation does not represent a warranty or guarantee on the part of M.A. Wright, LLC that other problems do not exist. M.A. Wright, LLC's professional services are performed using the degree of skill and care ordinarily exercised under similar circumstances by structural engineers practicing in this or similar localities. No other warranty, expressed or implied, is made as to the professional opinions included in this report.

Depot Building

Building Description

The Depot is best described as a single story, wood framed structure over a crawl space that measures 24 feet 4 inches by 106 feet 4 inches in plan with a wall height of 11 feet 8 inches. The roof shape is a simple gable with a 6 in 12 pitch. The building is shown in photos below.

The majority of the western half of the structure is believed to have been originally constructed in the early 1900s on a different site and relocated to the current site in the 1920s. It was later expanded to the west with similar style of construction. Sometime in the 1940-1950 time frame the eastern half of the structure was added. It matches in form and exterior finishes the original eastern portion.

The exterior consists of clapboard siding over diagonal sheathing in the original portion of the structure with similar siding over straight sheathing at the addition. The doors and windows are of wood construction. The roof consists of asphalt shingles over plywood which was added over the original skip sheathing.

The walls and ceiling of the original portion of the building are covered with bead board with wood trim around the windows and doors. At some point in time, a suspended acoustic tile ceiling was added. In the eastern addition portion there is a mixture of bead board, plywood and exposed studs/joists typical of a

storage facility. The floors in the original portion are hardwood with the exception of the bathrooms which have concrete like topping. The floors in the addition are primarily exposed tongue and groove decking with the exception of the easternmost 10-12 feet (a vehicle garage) which consists of gravel over dirt.

The building is currently used for offices and work rooms in the original western portion and storage in the eastern addition.

Foundation

IBased on the limited probing the foundation appears to be wood shims/posts supporting longitudinal wood beams which in turn support wood floor joists. There does not appear to be concrete perimeter stem wall. The foundations are most likely spread footings as the structure is relatively light and there are no obvious soft soil conditions.

Primary Structure

The Depot is a wood bearing wall structure framed with typical platform framing details. The east/west running walls are the load bearing walls. The interior and exterior walls rest directly on the floor structure which is supported by a post and beam structure in the crawl space.

In the original portion of the building the roof structure consists of plywood sheathing over skip sheathing supported by 2x6 stick framed rafters and joists at 24 inches on center and supported by the interior and exterior walls. In the addition the roof structure consists of plywood over skip sheathing supported by 2x6 trusses at 24 inches on center that bear on the exterior walls.

The floor in the original portion consists of hardwood over diagonal sheathing supported by 2x10 joists at 16 inches on center supported by a series of longitudinal wood beams. There are 4 longitudinal beams, 2 exterior and one interior. The longitudinal beams appear to be supported by wood posts/shim resting on concrete pads.

The walls in both portions consist of 2x4 studs at 16 inches on center. The sheathing in the original portion was not observed due to interior finishes but given that the floor sheathing was laid in a diagonal pattern and this portion of the structure appears relatively straight and level it is most likely diagonal sheathing. The walls in the addition have straight sheathing at the exterior with some portions towards the eastern end covered with interior plywood. At this time no destructive investigation to determine the wall sheathing is required to form an opinion on lifting and relocating the structure.

Appendages

The only exterior appendage is a single bay window on the south side in the original portion. It was not clear if it was part of the original construction but is minor in nature and should not impact lifting and relocating the structure.

There is a single interior abandoned masonry chimney in the original boiler room. The portion above the roof line has been removed. The structure is independent of the chimney, which is supported by a concrete foundation.

Structural Condition

In general the building is in fair to good structural condition. There are signs of settlement as witnessed by the sloping clapboard siding and uneven floors. The settlement appears to be worse in the eastern addition with the original portion noticeably straighter and more level. This may be an indication of wood rot in the posts and beams that support the floor joists in the area of the addition though none was observed in our limited probing.

The roof, with the exception of the eaves, appears to be straight and level with no obvious sagging of the ridge line. The eaves appear to have some sag which could be an indication of rot in the edge board or rafter tails.

The floors in the original portion appear to be in relatively good condition given their age. The addition which mainly serves as a storage area shows signs of wear and abuse. There is a high potential for wood rot in the floor structure at the perimeter where the site soils rests directly against the structure to a height equal with the floor on the south side.

Suitability for Lifting/Relocating and Required Stabilization

Given the style of construction and the existence of a crawl space the structure is an excellent candidate for lifting and relocating. The structure could be lifted by installing steel beams in the north/south direction under the longitudinal wood beams with jacks at the exterior of the building. This will most likely require an access trench be constructed on the north and south sides of the structure. The limited height under the longitudinal beams may also require localized excavation to allow installation of the lifting beams.

The interior finishes are somewhat forgiving as no plaster or other brittle finishes exist, reducing the likelihood of damage during relocation. It is assumed that the masonry chimney, which is abandoned and does not project outside the roof, will be demolished as opposed to moving.

Any significant rot discovered in the longitudinal floor beams during installation of the lifting beams will need to be repaired before lifting the structure. The eastern most bay of the structure which does not contain a floor structure will also require localized strengthen (wall sheathing, cross ties, and hard lifting points) but should be well within the capabilities of a typical building mover.

West Elevation

Southeast Corner Looking West

East Elevation

North Elevation

Olympia Building

Building Description

The Olympia Building is best described as a wood framed structure over a crawl space. The building is divided into a single story portion and a two story attached addition. All portions of the structure have undergone significant modifications over their lifetimes. The structure as it now exists is shown in the photos below.

The original structure appears to have been constructed in the early 1900s and served as a bar. It consisted of a single story building roughly 16 feet by 40 feet in plan with a 6 foot wide porch along the full length of the West Elevation. The roof was a gable with a separate lower sloped porch roof. There was a false front (rectangular façade obscuring a gabled roof behind) on the South Elevation, which was removed in the 1970's and rebuilt in the 1980's. This portion of the structure remains and makes up the southern single story portion of the building.

The first addition (believed to be in the 1930's) was a single story addition, attached to the north of the original structure. It was roughly 29 feet 9 inches by 33 feet in plan and had a gable roof matching the portion to the south.

The next modifications appear to have occurred in the 1970s. They consisted of enclosing and expanding the covered porch on the west side of the 1900s construction. The porch was widened to match the width of the attached addition to the north. The original false front was removed and a new higher pitched roof covering the entire width of the structure was added. This new roof enclosed the original roof and can be observed in the attic of the single story portion.

In the 1980s a second story addition was added on top of the north addition. This was accomplished by removing the roof rafters but leaving the attic floor and ceiling joists in place. The new second floor was

then over-framed with 18 inch deep open-web joists spanning to the exterior walls. The roof structure consists of 2x stick framing spanning to the east/west bearing walls. A full width 10 foot deep deck (with storage rooms underneath) was added to the north of the building to complete this remodel.

Also in the 1980s the perimeter foundations were replaced with concrete stem walls and a new false front was added to the South Elevation.

The exterior siding is a combination of vertical board siding at the first story and T-111 sheathing at the second story addition. There is brick veneer at the bar entrance. Metal roofing is utilized at all the roofs. The interior finishes consist of hardwood floors and a combination of paneling, plaster and gypsum wallboard. The ceilings are a combination of plaster, gypsum wallboard, and suspended acoustic tile.

The building currently serves as a bar and the second floor is an apartment.

Foundation

The foundation consists of perimeter concrete stem walls and interior posts and beams supporting the floor joists. The beams run in the north south direction and occur under the original bearing walls as well as roughly mid span between the walls. The posts bear on a combination of spread footings and directly on earth.

Primary Structure

The Olympia Building is a wood bearing wall structure framed with a wide variety of details and styles which, given the number of modifications, is to be expected. The interior and exterior walls rest directly on the floor structure that is supported by the post and beam structure or perimeter concrete stem walls. The bearing lines run in the north/south direction.

The roof structure in the original single story portion consists of the original roof (sheathing supported by stick-framed rafters and ceiling joists) and the new over-framed roof (stick framed roof with plywood sheathing). The loads are transferred to the interior and exterior north/south running bearing walls. The floor in the single story portion consists of hardwood over diagonal sheathing supported by east/west running floor joists. The joists are supported by beams running in the north/south direction and perimeter concrete stem walls.

The roof at the two story addition utilizes plywood sheathing supported by 2x stick framing spanning to the east and west exterior load bearing walls. The upper floor consists of plywood spanning to 18 inch deep open web joists at 16 inches on center which span to the east and west exterior bearing walls. The first story ceiling is supported by the original ceiling joists (from the original one story addition) which clear span to the east and west exterior walls. The lower floor which is level with the floor of the original structure consists of hardwood flooring over sheathing spanning to 2x joists. The joists in turn are supported by a post and beam structure and the perimeter concrete foundation walls.

All the walls appear to be 2x4 stud walls. There is a combination of balloon, and platform framing details. The structural wall sheathing consists of a variety of straight, diagonal planking, plywood and non-structural panels. The sheathing at the various additions does not lap onto the adjacent structure creating weak planes at the interface. This is specifically the case at the second story addition where the exterior T-111 siding may not be adequately attached to the wall plates at the original roof.

Appendages

The south elevation contains the western front and covered porch. There is a bathroom single-story addition at the northwest corner of the single story portion. The deck (with storage rooms underneath) and stairs extend to the north of the original north addition.

There is a full height masonry chimney at the south side of the second floor addition that is supported by a concrete foundation in the crawl space.

Structural Condition

In general the building is in fair to good structural condition. The floors are reasonably flat and level. Most of the unevenness is a result of enclosing the former sloped porches. There were no obvious signs of wood rot in the structure in the crawl space.

The exterior roofs appear to be straight and level, with no signs of sagging in the ridgeline. The eaves on the north side of the second floor addition have exposed structure which is susceptible to wood rot. The exposed structure in the wood decks is also prone to rot.

Suitability for Lifting/Relocating and Required Stabilization

The Olympia Building can be lifted and temporarily relocated. However, the large number of modifications and additions will provide challenges to the lifting/relocation contractor. There is good access to install east/west lifting beams under the north/south running floor beams. Access holes will need to be created in the concrete stem walls to allow the installation of the beams.

The primary challenge is the lack of connection of the various additions to each other. At a minimum, the contractor should plan on strengthening the connection of the second floor addition to the first story exterior bearing walls by adding plywood spanning from the ceiling top plate to the second floor bottom plate (approximately 24 inches). Additionally a temporary wall in the first story at the south end of the second story addition may be required to stabilize the two story portion during movement.

The false front as well as the masonry chimney will most likely need to be temporarily braced to the roof during the relocation of the building. As an option it may be possible to replace the masonry chimney.

The brittle interior finishes may have minor cracking during the relocation; the amount is dependent on the skill of the moving contractor.

It is assumed that the deck to the north will be replaced as opposed to lifted and removed.

Due to the large size and configuration of the north addition, the contractor may decide it is more cost effective to move the structure in two pieces (the original single story portion and the two story addition). If this approach is taken additional temporary bracing of the two story addition at its connection to the single story original structure will be required. This bracing could take the form of a temporary wall.

South Elevation, looking northeast

East Elevation

West Elevation

Original roof, single story portion

McEvoy Residence

The following is based on our exterior observations of the structure and review of the real estate appraisal dated September 21, 2007. We have not been granted access by the home owner to either photograph the structure or observe the interior condition. As such we can not comment on the general condition and are using engineering judgment to predict the framing systems. All of our comments are subject to change once we have been granted access to the residence.

Building Description

The McEvoy Residence is best described as a single story wood framed structure originally constructed in 1897 with numerous remodels and single story additions over time. It is located in the National Historic District of Skykomish. The original structure appears to be T-shaped in plan with gable roofs. There is a bedroom addition in the NE corner of the T-shaped portion with a shed roof. A garage (with accessible attic) and utility room with gabled roofs were added directly north of the T-shaped portion, and a covered deck was added to the SE of the garage/utility room addition. See Figure 1 (taken from the real estate appraisal and modified to show the various areas).

The original 1897 structure is most likely a stick-framed structure over a crawl space. The exterior walls are most likely load- bearing. The composition roof is most likely attached to straight deck sheathing supported by 2x roof rafters in the open attic. The exterior is clapboard siding. The garage is most likely a stick-framed slab-on-grade structure with pre-engineered nail plate roof trusses. The utility room and bedroom addition are most likely stick-framed structures over a crawl space; they may, however, be slab-on-grade structures. The additions all appear to have clapboard siding and metal roofs. The covered deck is most likely a post-and-beam exposed wood structure.

The interior most likely contains a variety of brittle (plaster) and non-brittle (gypsum wall board, paneling) finishes.

The structure currently serves as a single family residence.

Foundation

The foundations have not been observed but are most likely concrete stem walls with timber post and beams in the crawl space areas. The garage most likely has concrete stem walls and slab on grade.

Primary Structure

The McEvoy Residence appears to have a wood bearing wall structure constructed with a variety of framing details. The bearing walls appear to run in both the north/south and east/west directions around the perimeter. Additional post and beam structure most likely supports the interior portion of the main floors.

Appendages

The exterior appendages consist primarily of the covered deck and the cantilevered covered porches on the south and west elevations.

There appears to be a single interior masonry chimney and fireplace in the original 1897 portion of the structure.

Structural Condition

As we have not been granted access we can not at this time comment on the structural condition of the residence.

Suitability for Lifting/Relocating and Required Stabilization

The McEvoy Residence can most likely be lifted and temporarily relocated. It will present several challenges to the lifting/relocation contractor.

The first challenge is the probable lack of floor structure in the garage. If the floor is found to be slab-on-grade, the walls may need to be sheathed and have lifting points and cross ties added. Cross ties will help to stabilize the bottom of the walls, preventing them from moving relative to each other. The garage door opening will need to be temporarily braced. Given the size and configuration of the residence it may make sense to move the garage as a separate structure.

The covered deck is most likely poorly connected to the residence with no perimeter walls In that case, bracing will be required and, in fact, it may be less expensive to demolish and replace this portion of the structure.

The original 1897 structure should be straight-forward to lift and relocate. The main challenge will be brittle finishes and the masonry chimney/fireplace. The cantilevered porches on the south and west elevations may also require additional bracing during the relocation. All of these are typical in a structure of this age and style of construction and should be within the capability of an experienced lifting/relocation contractor.

The utility room and bedroom additions, if located over crawl spaces, could be lifted and moved at the same time as the original 1897 structure. Temporary bracing to enhance the connection of these areas to the original house may be required.

Roof Plan

BUILDING SKETCH

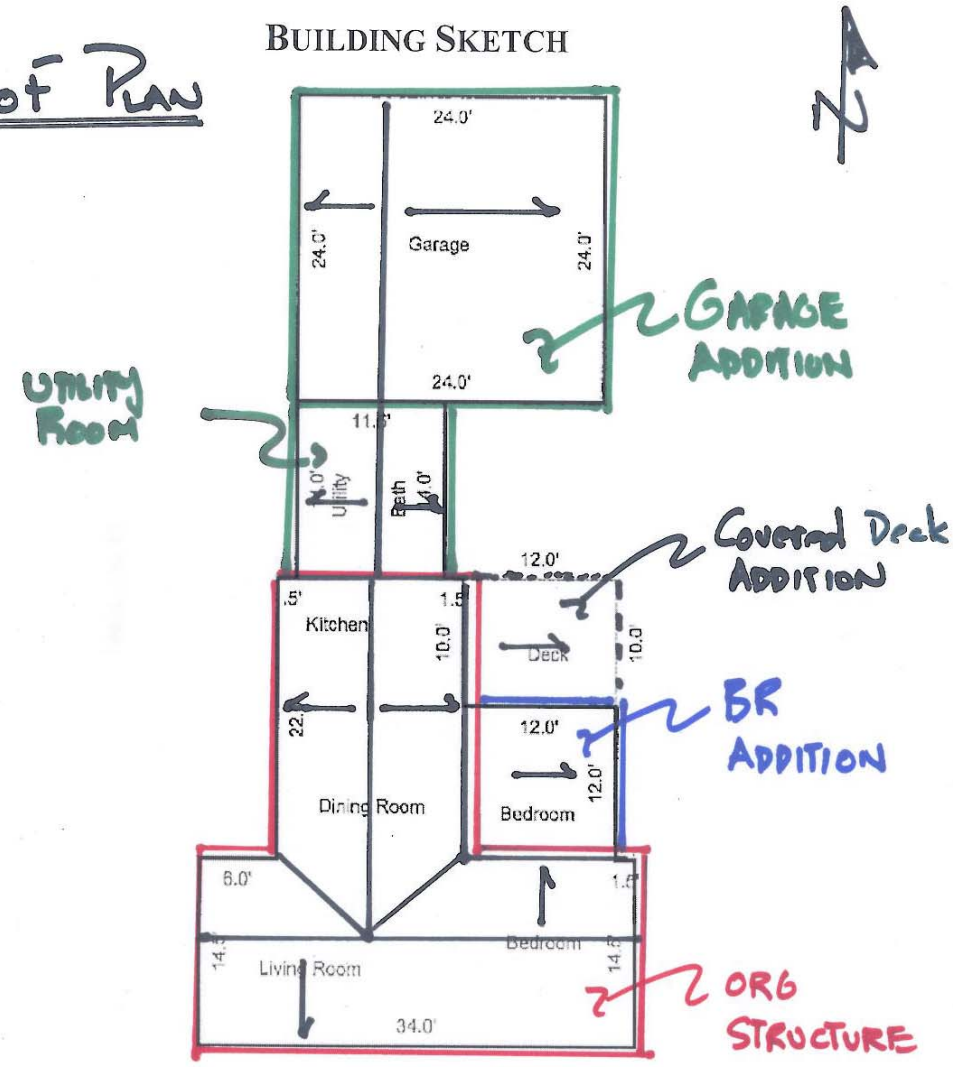
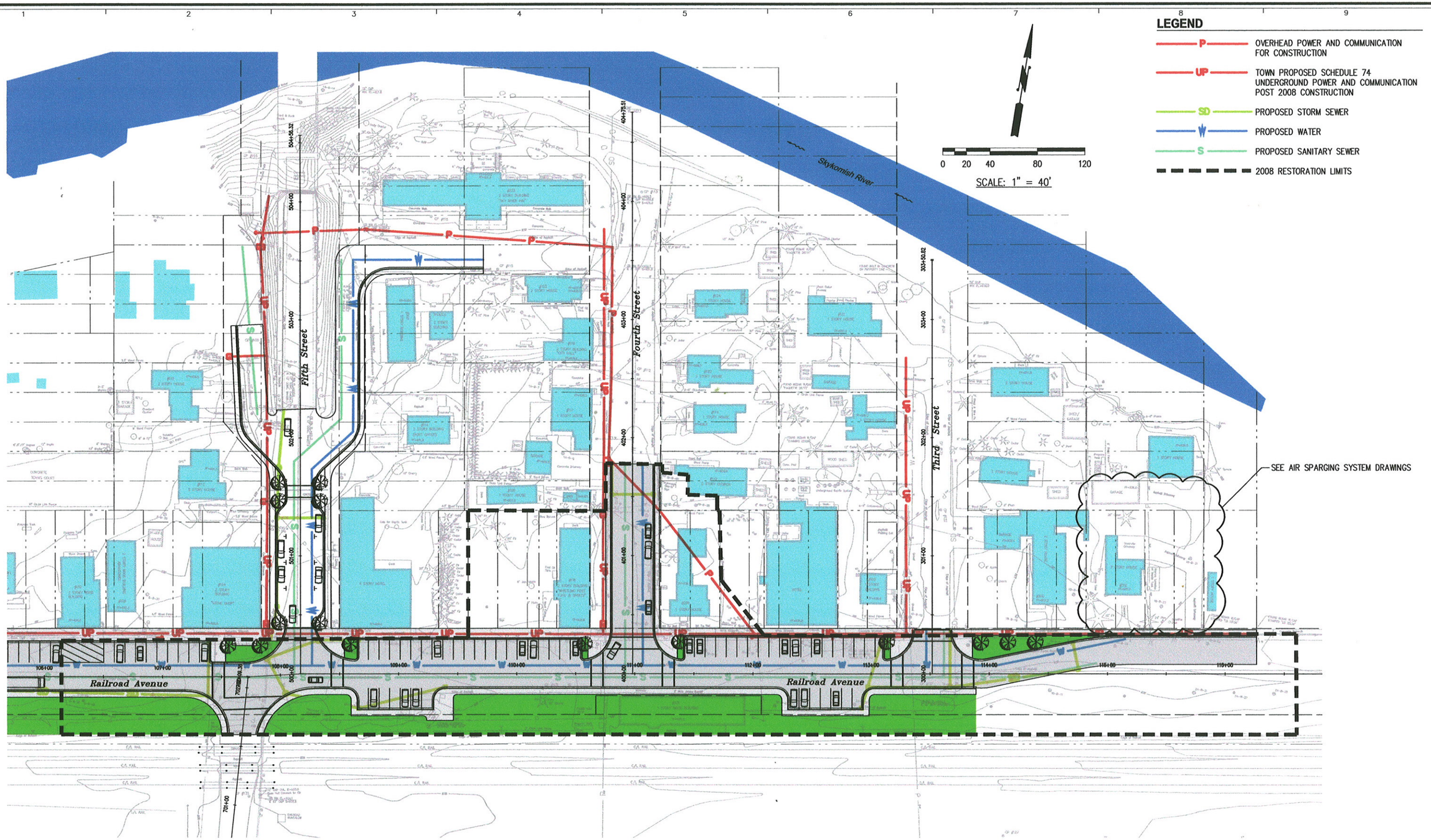


FIGURE 1

WRIGHT 11/6/07



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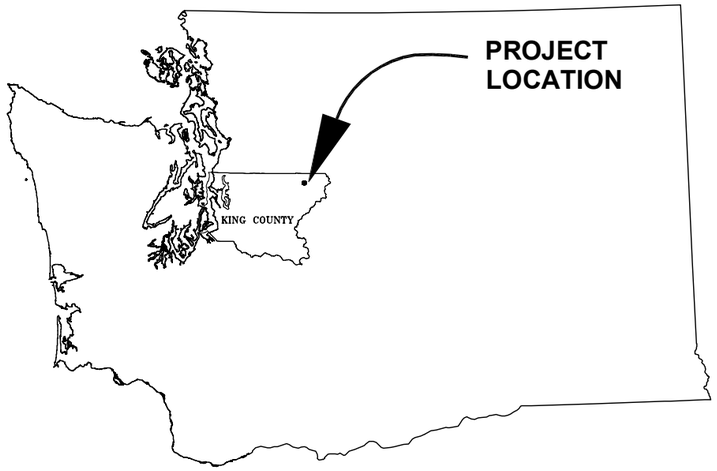
KPG
Architecture
Landscape Architecture
Civil Engineering
Urban Design
Surveying

BNSF SKYKOMISH
2008 CONCEPTUAL RESTORATION PLAN
PROJECT # 0559C

CURRENT DATE	NOVEMBER 2007	2008-30%EDR FIGURE.dwg	1 OF 1	REVISION

SKYKOMISH 2008 EDR



DRAWING NO.	DESCRIPTION
C-1	TITLE SHEET
C-2	LEGEND AND GENERAL NOTES
C-3	SITE PLAN AND SURVEY CONTROL
C-4	CONSTRUCTION LAYOUT PLAN
C-5	CLEARING, GRUBBING, AND DEMOLITION PLAN
C-6	INTERPOLATED TPH-Dx PLAN VIEW
C-7	EXCAVATION CROSS SECTION A-A'
C-8	EXCAVATION CROSS SECTION B-B'
C-9	EXCAVATION CROSS SECTION C-C'
C-10	EXCAVATION CROSS SECTION D-D'
C-11	EXCAVATION CROSS SECTION E-E'
C-12	EXCAVATION CROSS SECTION F-F'
C-13	EXCAVATION CROSS SECTION G-G'
C-14	EXCAVATION CROSS SECTION H-H'
C-15	SEDIMENT & EROSION CONTROL PLAN
C-16	SEDIMENT & EROSION CONTROL DETAILS
C-17	SEDIMENT & EROSION CONTROL DETAILS
C-18	CONSTRUCTION WATER TREATMENT SYSTEM PROCESS AND INSTRUMENTATION DIAGRAM
C-19	AIR SPARGING SYSTEM WELL LAYOUT
C-20	AIR SPARGING SYSTEM CROSS SECTION A-A'
C-21	AIR SPARGING SYSTEM DETAILS
C-22	AIR SPARGING SYSTEM PIPING AND INSTRUMENTATION DIAGRAM
C-23	PHASES 1 AND 2 RAILROAD AVENUE EXCAVATION
C-24	PHASE 1 TRAFFIC ROUTING AND PEDESTRIAN ACCESS
C-25	PHASE 2 TRAFFIC ROUTING AND PEDESTRIAN ACCESS

THE BNSF RAILWAY COMPANY
2454 OCCIDENTAL AVE. S. Suite #1A
SEATTLE, WASHINGTON
206-625-6298

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01140-204-270

CURRENT DATE 01/09/08

SKYKOMISH 2008 EDR
TITLE SHEET, LOCATION MAPS, SHEET INDEX

DRAWING NO. C-1 REVISION

LEGEND:

SURFACE FEATURES:

- BUILDING FOOTPRINT
- RAILROAD TRACK
- CURB/PAVEMENT/SIDEWALK (EXIST.)
- 925 CONTOUR (EXIST.)
- BNSF PROPERTY LINE
- CHAIN LINK FENCE
- SF SILT FENCE
- RIGHT OF WAY LINE
- PROPERTY LINE
- 2008 REMEDIATION BOUNDARY
- AIR SPARGING AREA
- BUILDING TO BE MOVED
- HCC AREA
- STORMWATER FLOW DIRECTION

SYMBOLS:

- MONITOR WELL LOCATION
- RECOVERY WELL LOCATION
- SOIL BORING LOCATION
- SURVEY CONTROL POINT
- MARKER LOCATION
- ABANDONED WELL
- TEST PIT

UTILITY FEATURES:

- FIRE DEPARTMENT CONNECTION
- FIRE HYDRANT
- WATER METER
- WATER VALVE
- HOSE BIB
- E ELECTRIC METER
- GAS VALVE
- OFC OIL FILLER CAP
- STORM DRAIN MANHOLE
- CATCH BASIN
- S SEWER MANHOLE
- CO SEWER CLEANOUT
- POWER POLE W/LUMINAIRE
- E ELECTRIC MANHOLE
- TRB TELEPHONE RISER BOX
- JUNCTION BOX

- W WATER LINE
- G GAS LINE
- SD STORM DRAIN LINE
- OHP OVERHEAD POWER
- UGP UNDERGROUND POWER
- OHC OVERHEAD COMMUNICATION
- UGC UNDERGROUND COMMUNICATION

ABBREVIATIONS:

C.P.B – CONTROL PANEL BOX

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.

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THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON
01140-204-0370

CURRENT DATE 12/20/07

SKYKOMISH 2008 EDR
LEGEND AND GENERAL NOTES

DRAWING NO. C-2 REVISION

File: H:\BNSF-Skykomish\2008 remediation\30% drawings\legend-notes(B).dwg Layout: C-2 User: emarshall Plotted: Dec 20, 2007 - 4:08pm Xref's:

TABLE OF PROJECT CONTROL POINTS

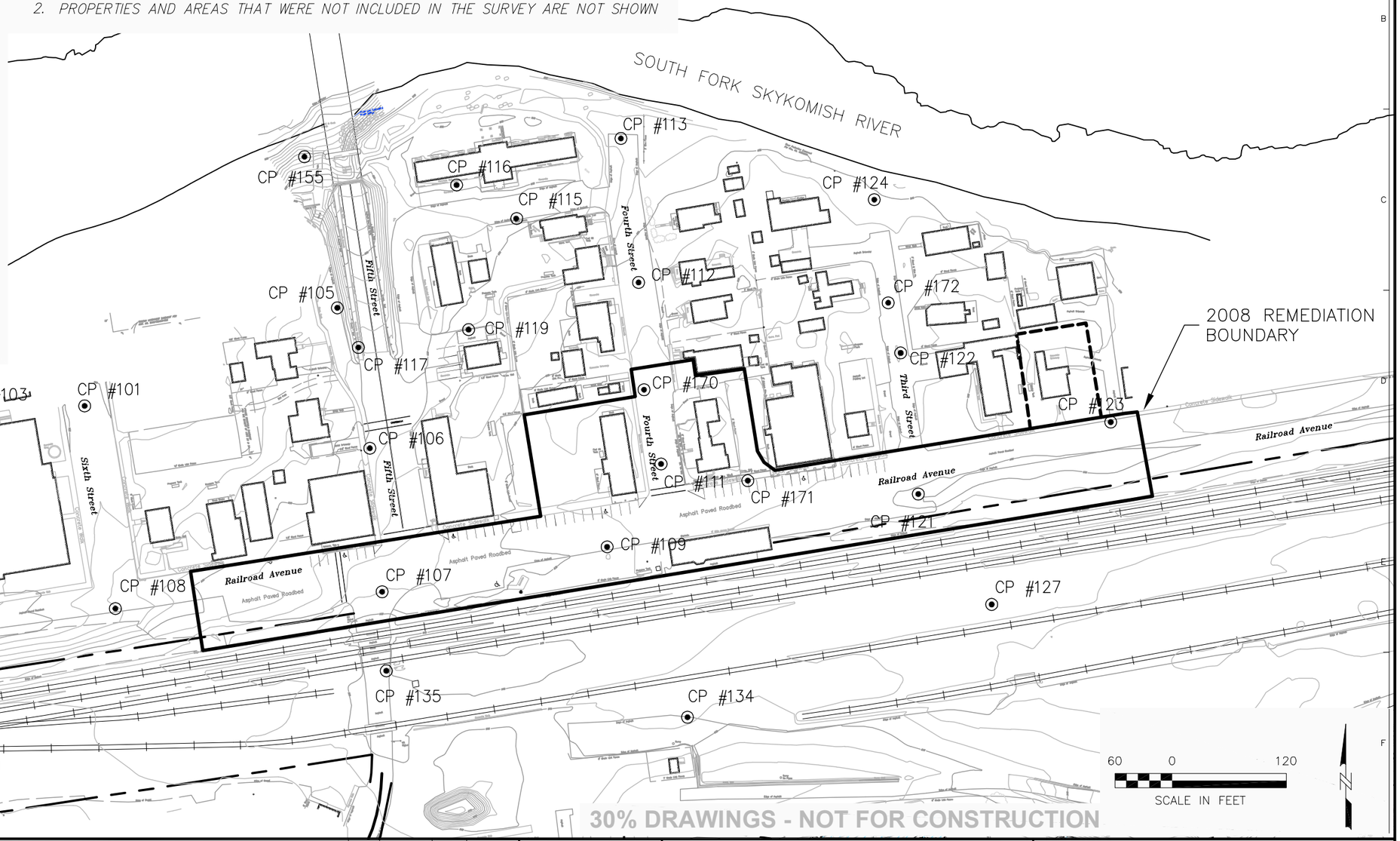
POINT #	NORTHING	EASTING	ELEVATION
101	259317.2666	1510252.1512	925.61
102	259066.6292	1509971.2047	921.75
103	259307.7987	1510120.3437	925.16
105	259420.2103	1510517.6074	928.37
106	259272.7849	1510551.7175	930.49
107	259122.0976	1510564.6601	
108	259104.5101	1510285.5817	
109	259169.2730	1510799.9373	935.51
111	259256.2817	1510857.6595	936.74
112	259446.8300	1510834.0072	935.49
113	259598.0336	1510815.4913	933.28
115	259513.9548	1510705.4390	929.32
116	259549.1949	1510642.8770	930.30
117	259378.6096	1510539.7420	931.73
119	259397.3358	1510655.4859	931.13
121	259224.6913	1511127.8968	934.86
122	259372.8530	1511108.2778	937.03
123	259300.2386	1511330.0063	935.49
124	259533.7780	1511081.6087	
127	259108.8291	1511204.5906	
134	258990.3948	1510884.3740	
135	259039.1543	1510569.0624	935.38
154	258739.3077	1511287.6759	935.24
155	259578.4946	1510482.2927	925.47
159	258509.6274	1510602.7187	
170	259334.2298	1510839.7728	936.41
171	259238.7620	1510948.7839	936.38
172	259425.4987	1511096.2824	936.95
177	259533.7608	1511081.6244	935.47
183	259271.2140	1509807.3229	927.85
185	259044.3825	1509875.1546	920.77

HORIZONTAL & VERTICAL CONTROL

1. HORIZONTAL DATUM: NAD 83/91
2. VERTICAL DATUM: NAVD 88
3. BENCHMARK: KING COUNTY MONUMENT STAMPED "1995 GPS 8823" WITH THE PUBLISHED ELEVATION OF 931.73.

NOTES

1. SITE PLAN IS BASED ON 2007 SURVEY DATA
2. PROPERTIES AND AREAS THAT WERE NOT INCLUDED IN THE SURVEY ARE NOT SHOWN



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01140-204-270

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SKYKOMISH 2008 EDR
SITE PLAN AND SURVEY CONTROL

DRAWING NO. C-3 REVISION

File: H:\BNSF-Skykomish\2008 remediation\30% drawings\siteplan_survey-control(0).dwg Layout: C-3 User: emarshall Plotted: Jan 09, 2008 - 11:51am Xref's:

BUILDING IDs

1. WHISTLING POST TAVERN
2. McEVOY HOUSE
3. COMMUNITY CHURCH
4. JOSELYN PROPERTY
5. DEPOT
6. SECTION BUILDING
7. MALONEY'S GENERAL STORE
8. JOHNSON PROPERTY
9. WHISTLING POST TEMPORARY LOCATION
10. McEVOY HOUSE TEMPORARY LOCATION
11. DEPOT TEMPORARY LOCATION

LEGEND

- 2008 REMEDIATION BOUNDARY
- AIR SPARGING SYSTEM AREA
- BNSF PROPERTY LINE
- PROPERTY LINE
- HCC AREA
- SOIL HANDLING AREA
- PROPOSED BUILDINGS TO BE RELOCATED
- PROPOSED STAGING AREAS
- PROPOSED PORTABLE EQUIPMENT STORAGE AREA

SOUTH FORK SKYKOMISH RIVER

Fourth Street

Fifth Street

Sixth Street

Third Street

Railroad Avenue

Asphalt Paved Roadbed

N.E. Old Cascade Highway

PROPOSED TOWN UTILITIES CROSSING

CONSTRUCTION WATER TREATMENT SYSTEM

GATES

PROPOSED REMEDIATION SYSTEMS CROSSING

STAGING AREA AND SOIL HANDLING AREA

BOUNDARIES WERE NOT SURVEYED IN 2007 AND HAVE BEEN APPROXIMATED BASED ON KING COUNTY RECORDS

PORTABLE EQUIPMENT STORAGE AREA AND CONTRACTOR TRAILERS

GATE

REMEDIATION EQUIPMENT BUILDING

SOIL HANDLING AREA EXIT ROAD

WHEEL WASH/ DECON AREA

75 0 150

SCALE IN FEET

N

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RETEC

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A	EM	11/14/07	30% DRAWINGS – NOT FOR CONSTRUCTION				

THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON

01140-204-270

CURRENT DATE 01/09/08

SKYKOMISH 2008 EDR
CONSTRUCTION LAYOUT PLAN

DRAWING NO. C-4

REVISION

NOTES

1. BREAK AND REMOVE ASPHALT/CONCRETE ROAD AND WALKWAYS IN EXCAVATION AREA, AS NECESSARY.
2. CLEAR AND GRUB WITHIN EXCAVATION AREA, AS NECESSARY.
3. REMOVE ABOVEGROUND STRUCTURES, INCLUDING FOUNDATIONS, OIL AND PROPANE TANKS, PIPING, AND ARCHITECTURAL ELEMENTS.
4. REMOVE UNDERGROUND STRUCTURES, SUCH AS SEPTIC TANKS, OIL AND PROPANE TANKS, PIPING, CATCH BASINS, MANHOLES AND FOUNDATIONS/FOOTINGS.
5. BREAK AND REMOVE ASPHALT AS REQUIRED FOR TRENCHING.
6. TEMPORARILY RELOCATE ABOVEGROUND TANKS, IF NECESSARY.
7. DEMOLISH EXISTING STRUCTURE.
8. REMOVE POWER POLES AND OVERHEAD UTILITIES, AS NECESSARY.

- FIRE DEPARTMENT CONNECTION
- FIRE HYDRANT
- WATER METER
- WATER VALVE
- HOSE BIB
- ELECTRIC METER
- GAS VALVE
- OFC OIL FILLER CAP
- STORM DRAIN MANHOLE
- CATCH BASIN
- SEWER MANHOLE
- SEWER CLEANOUT
- POWER POLE W/LUMINAIRE
- ELECTRIC MANHOLE
- TRB TELEPHONE RISER BOX
- JUNCTION BOX
- W WATER LINE
- G GAS LINE
- SD STORM DRAIN LINE
- OHP OVERHEAD POWER
- UGP UNDERGROUND POWER
- OHC OVERHEAD COMMUNICATION
- UGC UNDERGROUND COMMUNICATION
- BUILDING TO BE MOVED
- PROPERTY LINE
- BNSF PROPERTY LINE
- 2008 REMEDIATION BOUNDARY
- AIR SPARGING AREA
- HCC AREA

SWOMISH RIVER

RAILROAD AVENUE ① ② ④ ⑧

WHISTLING POST TAVERN ① ② ③ ④

4TH STREET ① ② ④ ⑧

AIR SPARGING AREA 1 ⑤ ⑥

McEVOY ① ② ③ ④

DEPOT ③

EXISTING SECTION BUILDING ② ③ ④ ⑦

Fifth Street · Sixth Street · Fourth Street · Third Street · Railroad Avenue · Asphalt Paved Roadbed · Concrete Sidewalk · Concrete Walk · Brick Sidewalk · Lids for Septic Tank

50 0 100

SCALE IN FEET

30% DRAWINGS - NOT FOR CONSTRUCTION

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RETEC

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THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON
01140-204-270

CURRENT DATE 01/09/08

SKYKOMISH 2008 EDR
CLEARING, GRUBBING, AND DEMOLITION PLAN

DRAWING NO. C-5 REVISION

File: H:\BNSF-Skykomish\2008 remediation\30% drawings\demolition_plan(h).dwg Layout: C-5 User: emarshall Plotted: Jan 09, 2008 - 12:09pm Xref's:

SKYKOMISH RIVER

NOTE:

APPROXIMATE EXCAVATION LIMITS WITHIN THE 2008 REMEDIATION BOUNDARY ARE BASED ON OBSERVATIONS DURING SAMPLING AND LABORATORY ANALYTICAL RESULTS. ACTUAL EXCAVATION EXTENTS WITHIN THE 2008 REMEDIATION BOUNDARY WILL BE DETERMINED BASED ON EXCAVATION CONFIRMATION SAMPLING.

LEGEND

- 2008 REMEDIATION BOUNDARY
- BNSF PROPERTY BOUNDARY
- APPROXIMATE HCC EXCAVATION LIMITS
- APPROXIMATE 2008 EXCAVATION LIMITS
- 3,400 — INTERPOLATED NWTPH-Dx IN SOIL ISOCONCENTRATION LINE WITHIN 2008 REMEDIATION BOUNDARY
- S — SHORING

SCALE IN FEET: 50 0 100

ENSR | AECOM

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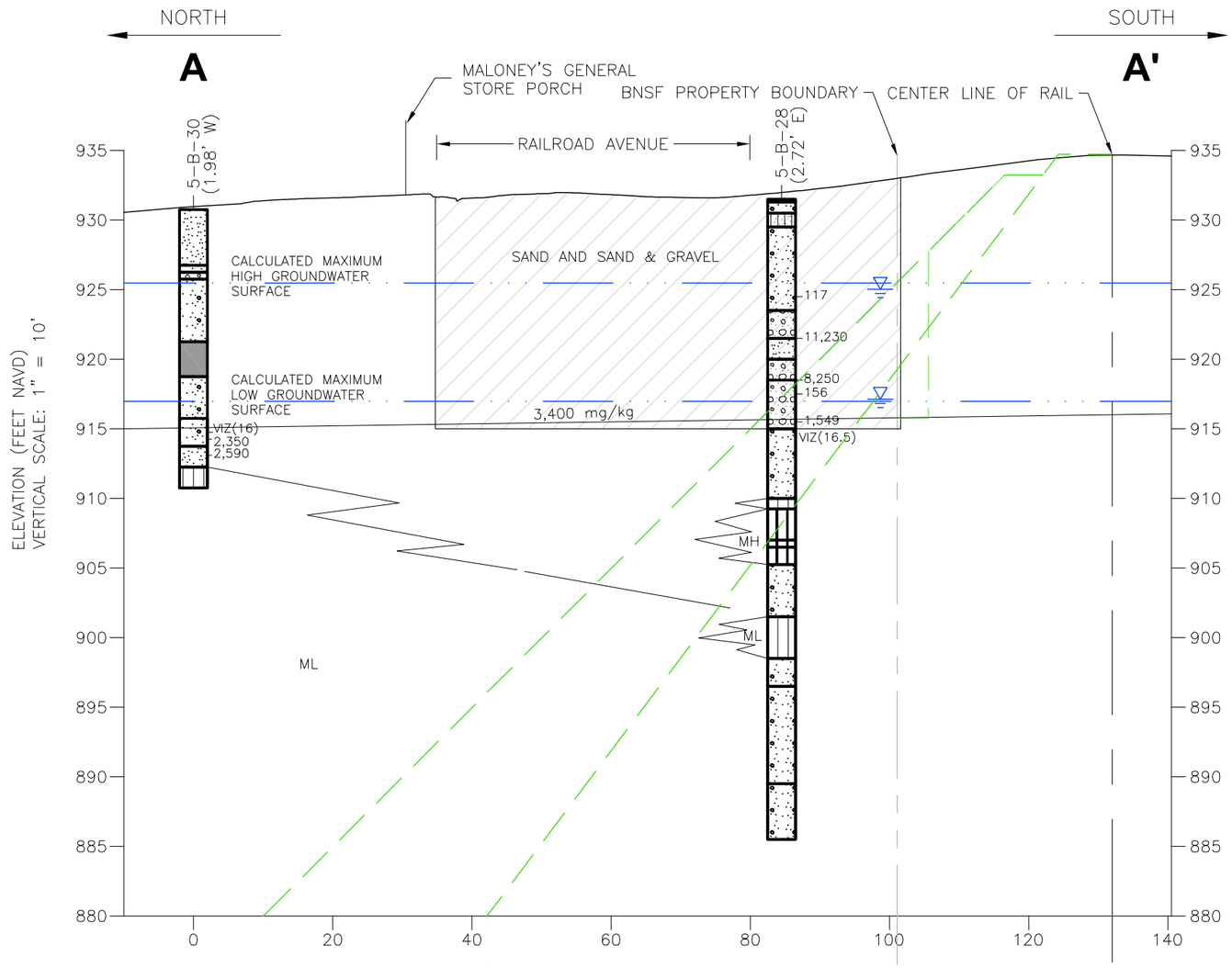
THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON
01140-204-0370

DATE: 01/09/08 | DRWN: E.M./SEA

SKYKOMISH 2008 EDR
INTERPOLATED TPH-Dx PLAN VIEW

DRAWING NO. C-6

File: H:\BNSF-Skykomish\2008 remediation\x-sects\plan view(C).dwg Layout: C-6 User: emarshall Plotted: Jan 09, 2008 - 12:13pm Xref's:



LEGEND

- Boulder
- MH
- ML
- SP
- GW
- SM
- SW

- Excavation Area
- Property Boundary
- 3,400 mg/kg — Interpolated NWTPH–Dx Isoconcentration Line
- 10,850 — NWTPH–Dx (mg/kg) concentration
- VIZ(20) — Visual contamination (depth in feet)
- NO VIZ — No Visual contamination
- Annual high and low water levels

NOTE: Section is projected NORTH to SOUTH

A–A' / C–6 CROSS–SECTION HORIZONTAL SCALE 1" = 20'

NOTE:

APPROXIMATE EXCAVATION LIMITS WITHIN THE 2008 REMEDIATION BOUNDARY ARE BASED ON OBSERVATIONS DURING SAMPLING AND LABORATORY ANALYTICAL RESULTS. ACTUAL EXCAVATION EXTENTS WITHIN THE 2008 REMEDIATION BOUNDARY WILL BE DETERMINED BASED ON EXCAVATION CONFIRMATION SAMPLING.

ENSR | AECOM

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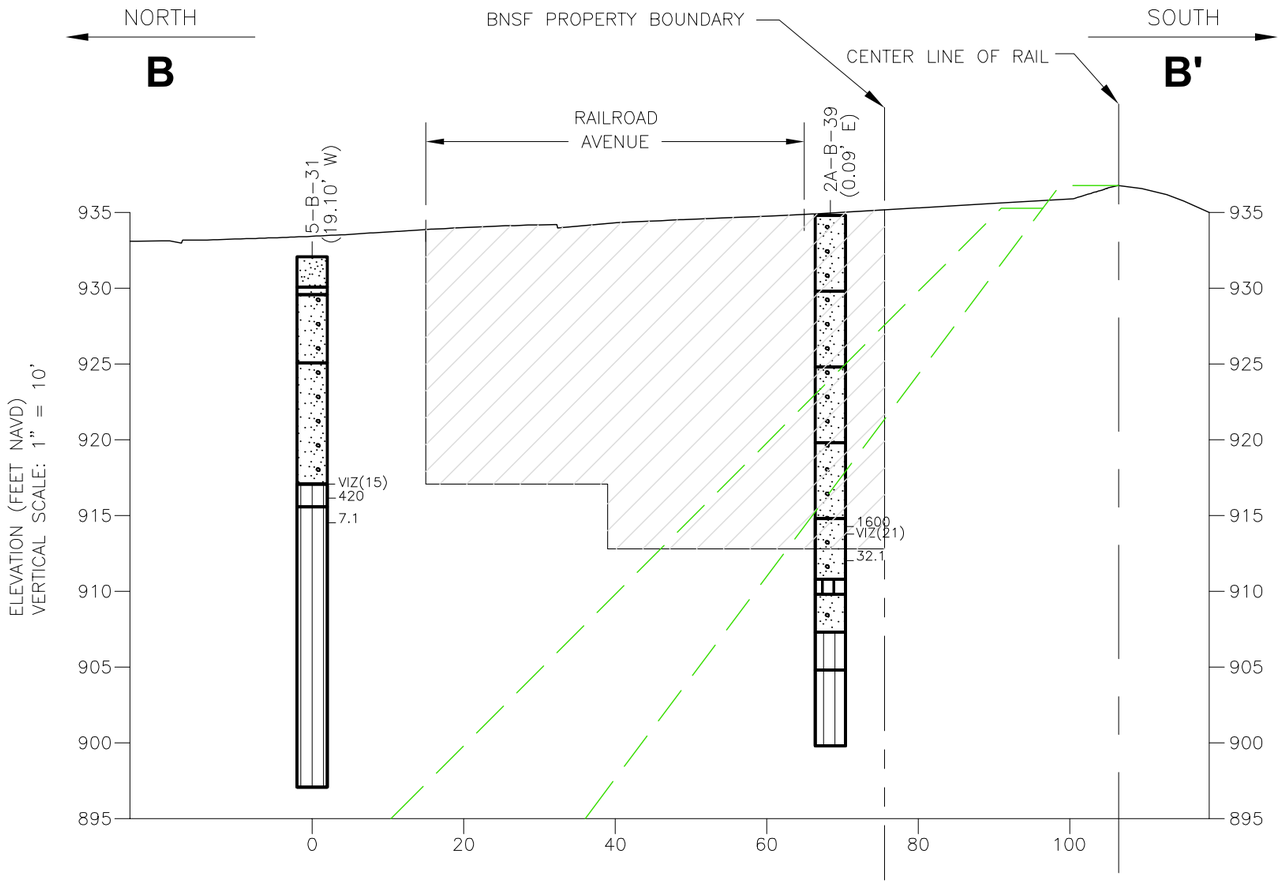
THE BNSF RAILWAY COMPANY SKYKOMISH, WASHINGTON 01140-204-0370			**SKYKOMISH 2008 EDR** **EXCAVATION CROSS SECTION A-A'**
DATE: 12/20/07	DRWN: E.M./SEA		**DRAWING NO. C-7**

File: H:\BNSF–Skykomish\2008 remediation\x–sects\profile A(3).dwg Layout: C–7 User: emarshall Plotted: Dec 21, 2007 – 8:55am Xref's:



LEGEND

SP
ML
MH
SW

Excavation Area

Property Boundary

3,400 mg/kg — Interpolated NWTPH-Dx Isoconcentration Line

10,850 — NWTPH-Dx (mg/kg) concentration

VIZ(20) — Visual contamination (depth in feet)

NO VIZ — No Visual contamination

Annual high and low water levels

NOTE: Section is projected NORTH to SOUTH

B-B' / C-6 CROSS-SECTION
HORIZONTAL SCALE 1" = 20'

NOTE:

APPROXIMATE EXCAVATION LIMITS WITHIN THE 2008 REMEDIATION BOUNDARY ARE BASED ON OBSERVATIONS DURING SAMPLING AND LABORATORY ANALYTICAL RESULTS. ACTUAL EXCAVATION EXTENTS WITHIN THE 2008 REMEDIATION BOUNDARY WILL BE DETERMINED BASED ON EXCAVATION CONFIRMATION SAMPLING.

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RETEC

THE BNSF RAILWAY COMPANY SKYKOMISH, WASHINGTON 01140-204-0360	**SKYKOMISH 2008 EDR** **EXCAVATION CROSS SECTION B-B'**
DATE: 12/20/07 | DRWN: E.M./SEA	**DRAWING NO. C-8**

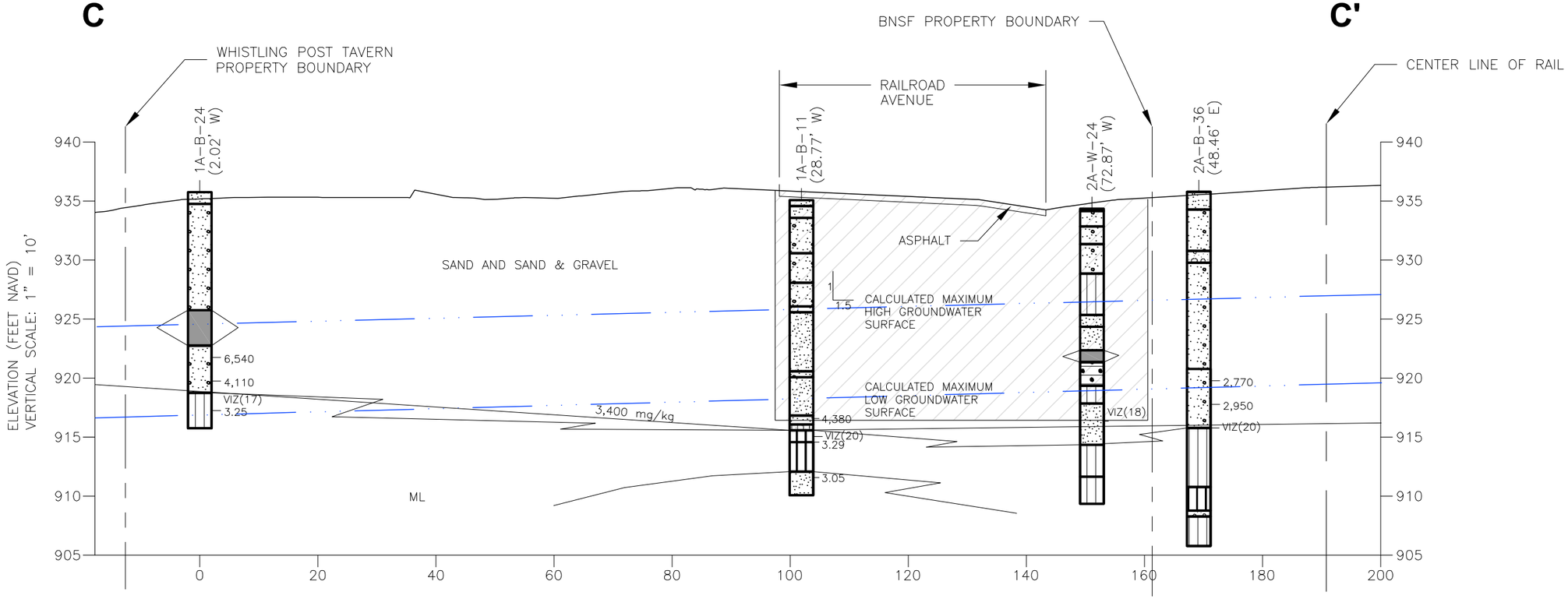
File: H:\BNSF-Skykomish\2008 remediation\x-sects\profile B(3).dwg Layout: C-8 User: emarshall Plotted: Dec 21, 2007 - 8:58am Xref's:

NORTH

C

SOUTH

C'



LEGEND

- SM
- GM
- Boulder
- Asphalt
- MH
- ML
- GW
- SW
- SP

- Excavation Area
- Property Boundary
- 3,400 mg/kg — Interpolated NWTPH–Dx Isoconcentration Line
- 10,850 — NWTPH–Dx (mg/kg) concentration
- VIZ(20) — Visual contamination (depth in feet)
- NO VIZ — No Visual contamination
- Annual high and low water levels

C–C' / C–6 — **CROSS–SECTION HORIZONTAL SCALE 1" = 20'**

NOTE: Section is projected NORTH to SOUTH

NOTE:

APPROXIMATE EXCAVATION LIMITS WITHIN THE 2008 REMEDIATION BOUNDARY ARE BASED ON OBSERVATIONS DURING SAMPLING AND LABORATORY ANALYTICAL RESULTS. ACTUAL EXCAVATION EXTENTS WITHIN THE 2008 REMEDIATION BOUNDARY WILL BE DETERMINED BASED ON EXCAVATION CONFIRMATION SAMPLING.

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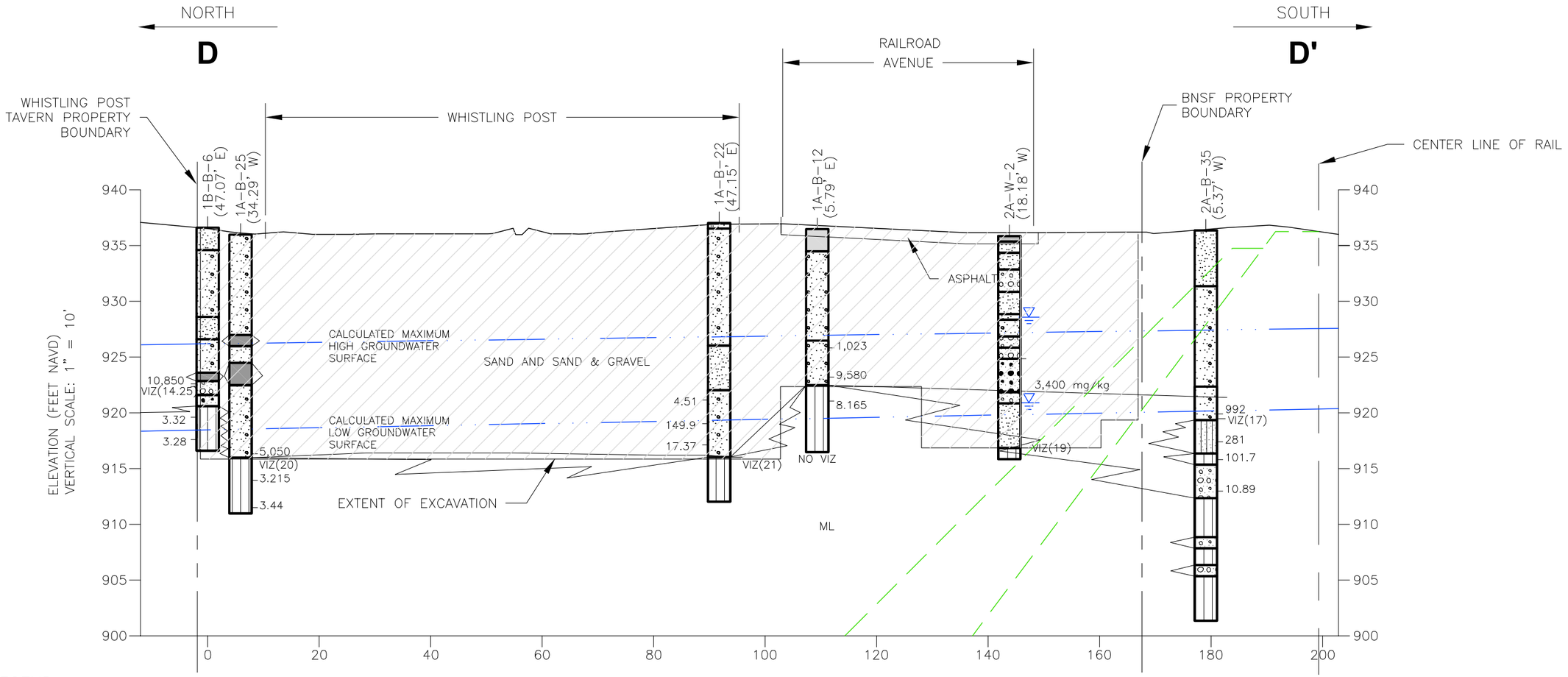
THE BNSF RAILWAY COMPANY SKYKOMISH, WASHINGTON 01140-204-0370			**SKYKOMISH 2008 EDR** **EXCAVATION CROSS SECTION C-C'**
DATE: 12/20/07	DRWN: E.M./SEA		**DRAWING NO. C-9**

File: H:\BNSF-Skykomish\2008 remediation\x-sects\profile C(3).dwg Layout: C-9 User: emarshall Plotted: Dec 21, 2007 - 9:04am Xref's:



LEGEND

- Asphalt
- Boulder
- GW
- ML
- SM
- SW
- SP
- Excavation Area
- Property Boundary
- 3,400 mg/kg — Interpolated NWTPH-Dx Isoconcentration Line
- 10,850 — NWTPH-Dx (mg/kg) concentration
- VIZ(20) — Visual contamination (depth in feet)
- NO VIZ — No Visual contamination
- Annual high and low water levels

D-D' / C-6

CROSS-SECTION
HORIZONTAL SCALE 1" = 20'

NOTE: Section is projected NORTH to SOUTH

NOTE:

APPROXIMATE EXCAVATION LIMITS WITHIN THE 2008 REMEDIATION BOUNDARY ARE BASED ON OBSERVATIONS DURING SAMPLING AND LABORATORY ANALYTICAL RESULTS. ACTUAL EXCAVATION EXTENTS WITHIN THE 2008 REMEDIATION BOUNDARY WILL BE DETERMINED BASED ON EXCAVATION CONFIRMATION SAMPLING.

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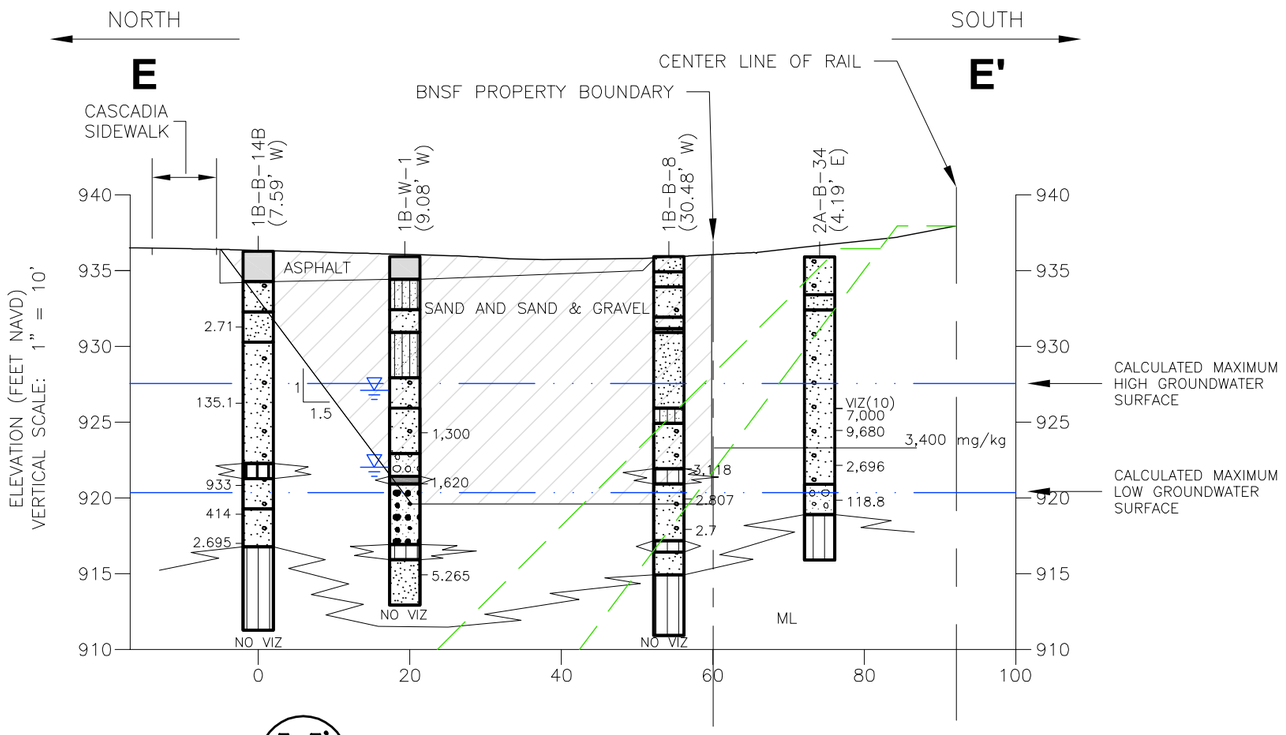
THE BNSF RAILWAY COMPANY SKYKOMISH, WASHINGTON 01140-204-0370			**SKYKOMISH 2008 EDR** **EXCAVATION CROSS SECTION D-D'**
DATE: 12/20/07	DRWN: E.M./SEA		**DRAWING NO.** C-10



E-E'
C-6

CROSS-SECTION
HORIZONTAL SCALE 1" = 20'

LEGEND

- MH
- GP
- Asphalt
- Boulder
- SM
- ML
- GW
- SP
- SW

- Excavation Area
- Property Boundary
- 3,400 mg/kg — Interpolated NWTPH-Dx Isoconcentration Line
- 10,850 — NWTPH-Dx (mg/kg) concentration
- VIZ(20) — Visual contamination (depth in feet)
- NO VIZ — No Visual contamination
- Annual high and low water levels

NOTE: Section is Pprojected NORTH to SOUTH

NOTE:

APPROXIMATE EXCAVATION LIMITS WITHIN THE 2008 REMEDIATION BOUNDARY ARE BASED ON OBSERVATIONS DURING SAMPLING AND LABORATORY ANALYTICAL RESULTS. ACTUAL EXCAVATION EXTENTS WITHIN THE 2008 REMEDIATION BOUNDARY WILL BE DETERMINED BASED ON EXCAVATION CONFIRMATION SAMPLING.

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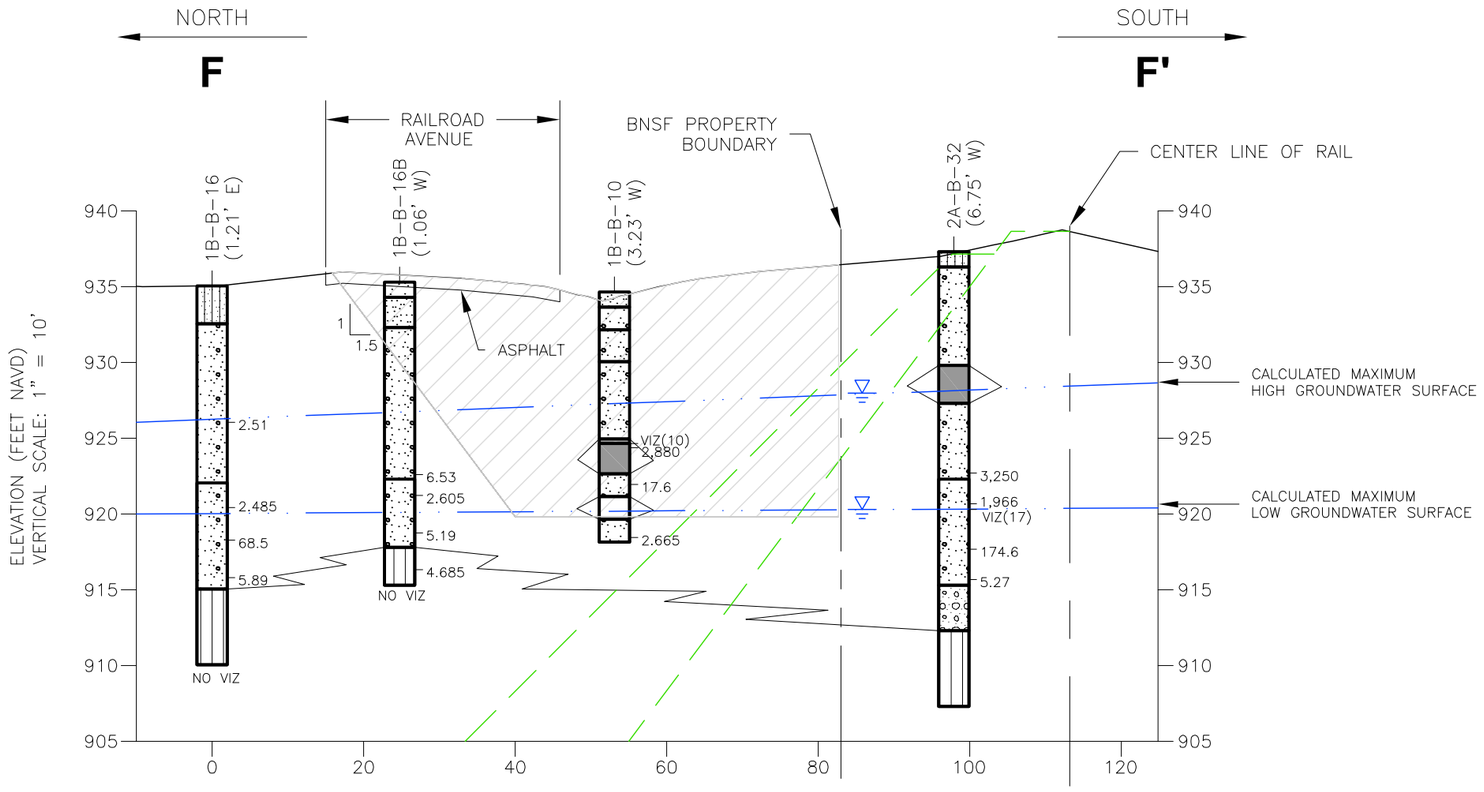
THE BNSF RAILWAY COMPANY SKYKOMISH, WASHINGTON 01140-204-0370			**SKYKOMISH 2008 EDR** **EXCAVATION CROSS SECTION E-E'**
DATE: 12/20/07	DRWN: E.M./SEA		**DRAWING NO.** C-11

File: H:\BNSF-Skykomish\2008 remediation\x-sects\profile E(3).dwg Layout: C-11 User: emarshall Plotted: Dec. 21, 2007 - 9:28am Xref's:



F-F'
C-6

CROSS-SECTION
HORIZONTAL SCALE 1" = 20'

LEGEND

- Boulder
- SP
- ML
- GW
- SW
- SM
- Excavation Area
- Property Boundary
- 3,400 mg/kg — Interpolated NWTPH-Dx Isoconcentration Line
- 10,850 — NWTPH-Dx (mg/kg) concentration
- VIZ(20) — Visual contamination (depth in feet)
- NO VIZ — No Visual contamination
- Annual high and low water levels

NOTE: Section is projected NORTH to SOUTH
All analytical data was below the Remediation Level of 3,400 mg/kg.

NOTE:

APPROXIMATE EXCAVATION LIMITS WITHIN THE 2008 REMEDIATION BOUNDARY ARE BASED ON OBSERVATIONS DURING SAMPLING AND LABORATORY ANALYTICAL RESULTS. ACTUAL EXCAVATION EXTENTS WITHIN THE 2008 REMEDIATION BOUNDARY WILL BE DETERMINED BASED ON EXCAVATION CONFIRMATION SAMPLING.

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Merged with ENSR in 2007
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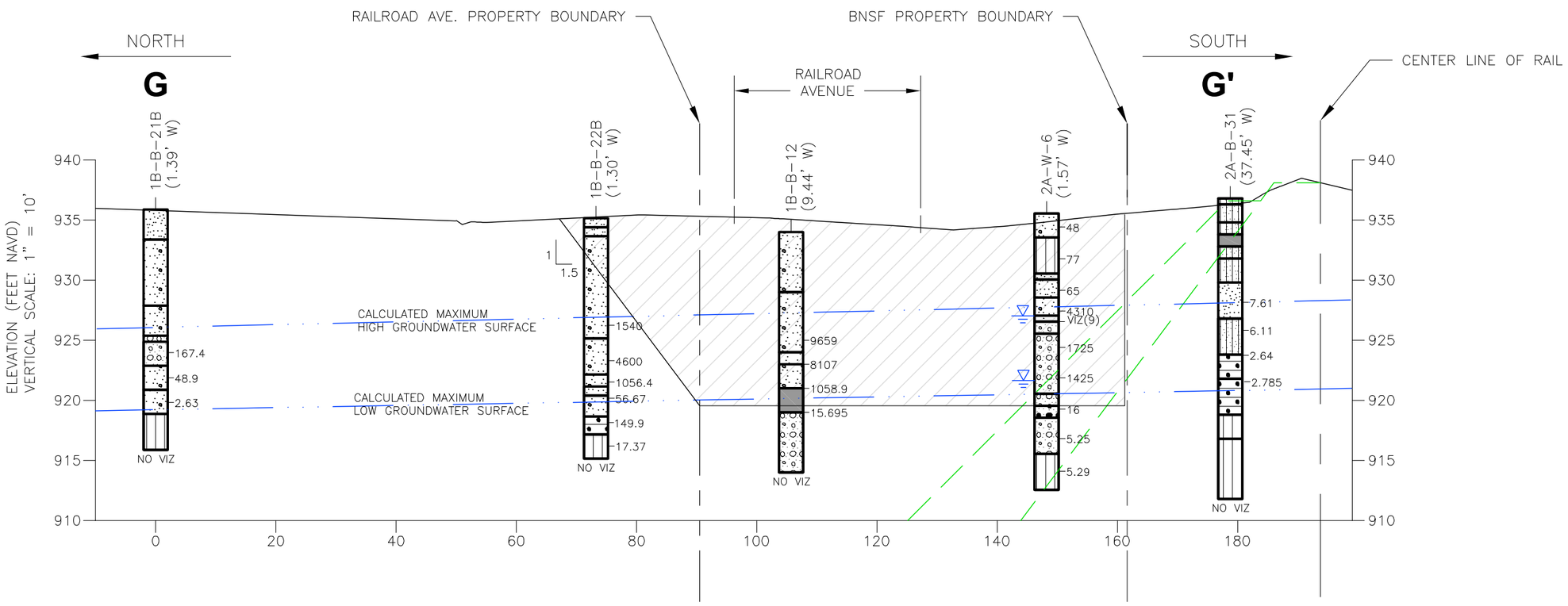
THE BNSF RAILWAY COMPANY SKYKOMISH, WASHINGTON 01140-204-0370			**SKYKOMISH 2008 EDR** **EXCAVATION CROSS SECTION F-F'**
DATE: 12/20/07	DRWN: E.M./SEA		**DRAWING NO. C-12**



LEGEND

SM
GM
Boulder
Asphalt
MH
ML
GW
SW
SP

Excavation Limits

Property Boundary

3,400 mg/kg — Interpolated NWTPH-Dx Isoconcentration Line

10,850 — NWTPH-Dx (mg/kg) concentration

VIZ(20) — Visual contamination (depth in feet)

NO VIZ — No Visual contamination

Annual high and low water levels

NOTE: Section is projected NORTH to SOUTH

G-G' / C-6 — **CROSS-SECTION**
HORIZONTAL SCALE 1" = 20'

NOTE:

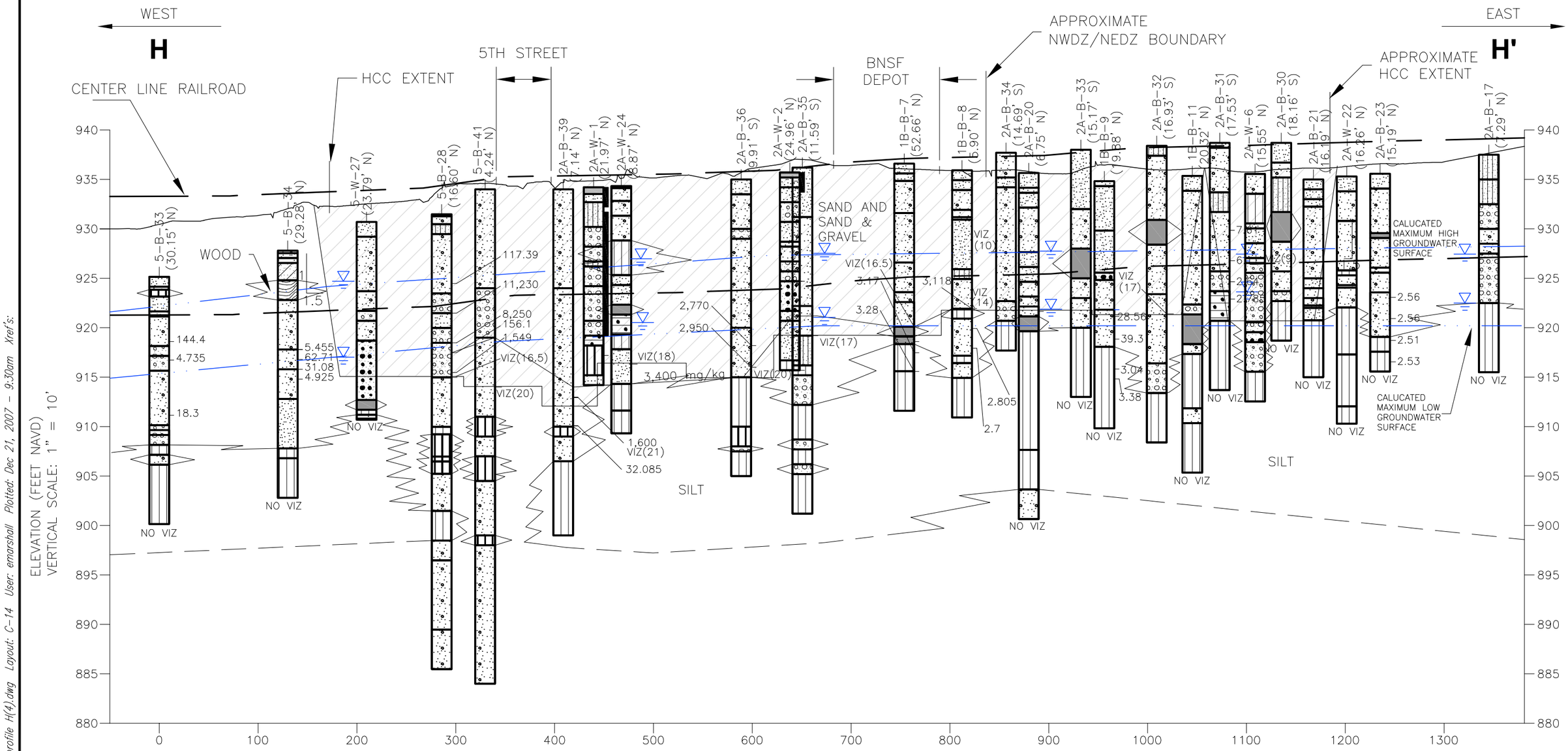
APPROXIMATE EXCAVATION LIMITS WITHIN THE 2008 REMEDIATION BOUNDARY ARE BASED ON OBSERVATIONS DURING SAMPLING AND LABORATORY ANALYTICAL RESULTS. ACTUAL EXCAVATION EXTENTS WITHIN THE 2008 REMEDIATION BOUNDARY WILL BE DETERMINED BASED ON EXCAVATION CONFIRMATION SAMPLING.

ENSR | AECOM

Merged with ENSR in 2007
RETEC

THE BNSF RAILWAY COMPANY SKYKOMISH, WASHINGTON 01140-204-0360			**SKYKKOMISH 2008 EDR** **EXCAVATION CROSS SECTION G-G'**
DATE: 12/20/07	DRWN: E.M./SEA		**DRAWING NO.** C-13

File: H:\BNSF-Skykomish\2008 remediation\x-sects\profile G(3).dwg Layout: C-13 User: emarshall Plotted: Dec 21, 2007 - 9:26am Xref's:



LEGEND

GM
Boulder
Wood
SM
SC
ML
GW
SW
GP
MH
SP

Excavation Area

Property Boundary

3,400 mg/kg Interpolated NWTPH–Dx Isoconcentration Line

10,850 NWTPH–Dx (mg/kg) concentration

VIZ(20) Visual contamination (depth in feet)

NO VIZ No Visual contamination

Annual high and low water levels

H–H' / C–6 CROSS–SECTION HORIZONTAL SCALE 1" = 100'

NOTE:

APPROXIMATE EXCAVATION LIMITS WITHIN THE 2008 REMEDIATION BOUNDARY ARE BASED ON OBSERVATIONS DURING SAMPLING AND LABORATORY ANALYTICAL RESULTS. ACTUAL EXCAVATION EXTENTS WITHIN THE 2008 REMEDIATION BOUNDARY WILL BE DETERMINED BASED ON EXCAVATION CONFIRMATION SAMPLING.

NOTE: Section is projected along BNSF Property Line
Data is truncated for presentation
All truncated data is less than 3,400 mg/kg

ENSR | AECOM

Merged with ENSR in 2007 RETEC

THE BNSF RAILWAY COMPANY SKYKOMISH, WASHINGTON 01140-204-0370			SKYKOMISH 2008 EDR EXCAVATION CROSS SECTION H-H'
DATE: 12/20/07	DRWN: E.M./SEA		DRAWING NO. C-14

File: H:\BNSF–Skykomish\2008 remediation\x–sects\profile H(4).dwg Layout: C–14 User: emarshall Plotted: Dec 21, 2007 – 9:30am Xref's:

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 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.

5. THE ESC FACILITIES SHALL BE INSPECTED DAILY BY THE CONTRACTOR AND MAINTAINED AS NECESSARY TO ENSURE THEIR CONTINUED FUNCTIONING.

6. 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.

7. 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.

8. ALL PAVED AREAS SHALL BE KEPT CLEAN FOR THE DURATION OF THE PROJECT.

9. TO THE EXTENT PRACTICABLE, NATURAL VEGETATION SHALL BE PRESERVED.

10. SEDIMENT AND EROSION CONTROL PLAN TEXT IS INCLUDED IN THE STORMWATER POLLUTION PREVENTION PLAN.

LEGEND

- SD — STORM DRAIN LINE
- STORM DRAIN MANHOLE
- CATCH BASIN
- STORMWATER FLOW DIRECTION
- 2008 REMEDIATION BOUNDARY
- BNSF PROPERTY LINE
- PROPERTY BOUNDARY
- AIR SPARGING AREA 1
- WIRE FENCE (INTERMITTANT)
- SF — SILT FENCE (INTERMITTANT)
- HCC AREA
- SOIL HANDLING AREA
- PROPOSED STAGING AREAS
- PROPOSED PORTABLE EQUIPMENT STORAGE AREA
- FEMA FLOODWAY BOUNDARY

BMPs

- BMP C101 – PRESERVING NATURAL VEGETATION
- BMP C103 – HIGH VISIBILITY FENCE
- BMP C106 – WHEEL WASH/DECONTAMINATION PAD
- BMP C120 – PERMANENT SEEDING
- BMP C123 – PLASTIC COVERING
- BMP C125 – TOPSOILING
- BMP C140 – DUST CONTROL
- BMP C220 – COVER CATCH BASINS
- BMP C223 – SILT FENCE
- BMP C250 – CONSTRUCTION WATER TREATMENT

50 0 100
SCALE IN FEET

N

BMP C223
BMP C120 AND BMP C125
SILT FENCE (BMP C223) AT PHASE 1/2 BOUNDARY
BMPC120 AND BMP C125
BMP C103
BMP C140
REMOVE AND REPLACE CATCH BASIN
CONSTRUCTION FENCE
GATES
SOIL HANDLING FACILITY 1 BMP C123 (1 C-16)
CONSTRUCTION WATER TREATMENT SYSTEM BMP C250 (3 C-17)
BMP C220
PORTABLE EQUIPMENT STORAGE AREA AND CONTRACTOR TRAILERS
GATE
WHEEL WASH/DECON AREA BMP C106 (2 C-16)
SOIL HANDLING AREA EXIT ROAD
Fifth Street
Fourth Street
Third Street
Railroad Avenue
N.E. Old Cascade Highway
Asphalt Paved Roadbed
Concrete Sidewalk

30% DRAWINGS - NOT FOR CONSTRUCTION

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RETEC

NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE
5							
4							
3							
2							
B	EM	01/09/08	REVISION				
A	EM	11/16/07	30% DRAWINGS – NOT FOR CONSTRUCTION				

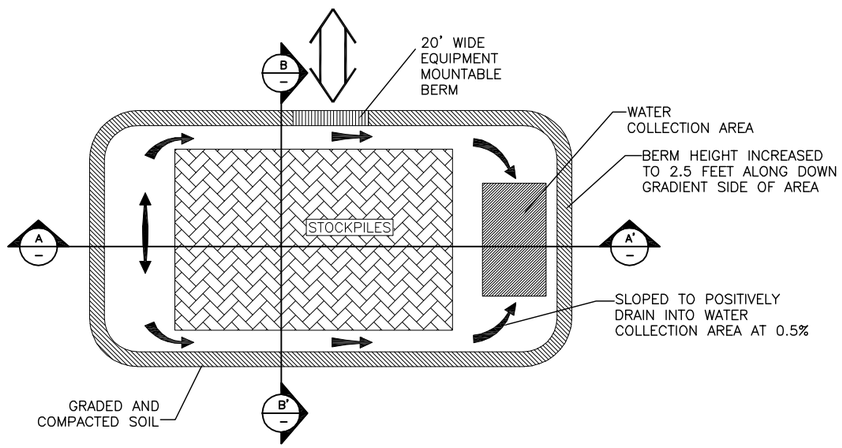
THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON
01140-204-270

CURRENT DATE 01/09/08

SKYKOMISH 2008 EDR
SEDIMENT AND EROSION CONTROL PLAN

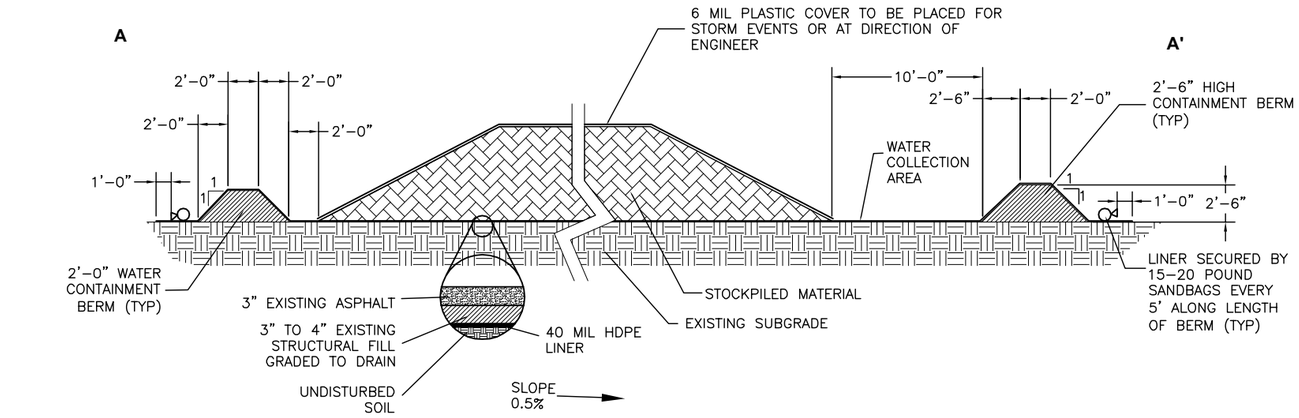
DRAWING NO. C-15 REVISION

File: H:\BNSF-Skykomish\2008 remediation\30% drawings\sediment_erosion_ctrl_plan(H).dwg Layout: C-15 User: emarshall Plotted: Jan 09, 2008 - 12:23pm Xref's:



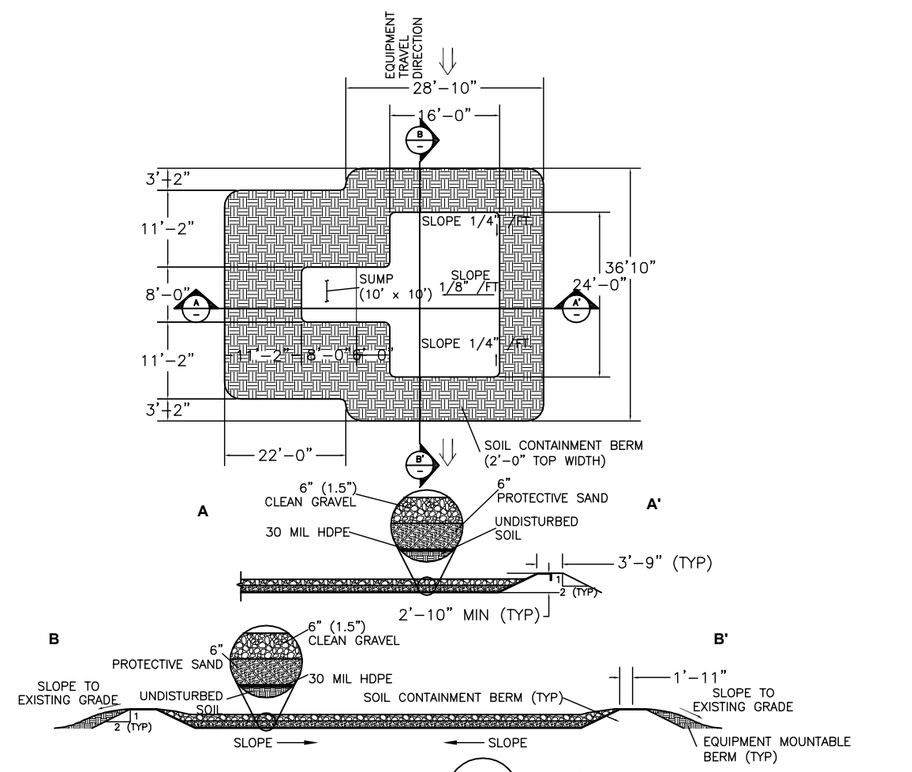
NOTES:

1. EXISTING STOCKPILE AREA DETAILS ARE SHOWN. THIS AREA WILL BE USED TO THE EXTENT PRACTICABLE. ALL CONSTRUCTION DETAILS AND SUBSEQUENT NOTES SHOWN WILL BE USED TO CONSTRUCT ADDITIONAL AREAS, IF REQUIRED.
2. 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.
3. STOCKPILE AREA IS TO BE GRADED TO POSITIVELY DRAIN TOWARDS THE WATER COLLECTION AREA.
4. CONTAINMENT BERMS SHALL BE CONSTRUCTED OF UNIMPACTED SOIL. 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. DAILY INSPECTION AND MAINTENANCE OF THE WATER CONTAINMENT BERMS IS REQUIRED DURING PERIODS OF PRECIPITATION.
7. CONTRACTOR SHALL REMOVE WATER FROM COLLECTION SUMP, FILTER IT FOR DISPOSAL AT THE CONSTRUCTION WATER TREATMENT SYSTEM, AND HAUL IT TO THE WATER TREATMENT SYSTEM VIA TRUCK.
8. SOLIDS ACCUMULATED IN THE SUMP WILL BE REMOVED PERIODICALLY AND PLACED ON THE STOCKPILE.
9. UPON COMPLETION OF THE WORK, THE CONTAMINATED MATERIAL STOCKPILE AREA SHALL BE REMOVED, AND THE AREA GRADED.
10. ANY DAMAGE TO CONTAMINATED MATERIAL STOCKPILE AREA MUST BE REPORTED TO THE SITE ENGINEER IMMEDIATELY.
11. ALL WELLS TO BE PROTECTED DURING INSTALLATION AND REMOVAL OF STOCKPILE AREA.
12. WATER COLLECTED FROM WHEEL WASH/DECON AREA SHOULD BE REMOVED AND DISPOSED OF OR RECYCLED AT A LICENSED FACILITY.



1 / C-15 CONTAMINATED MATERIAL STOCKPILE AREA DETAIL

SCALE: NTS



2 / C-15 DECONTAMINATION AREA DETAIL

SCALE: NTS

30% DRAWINGS - NOT FOR CONSTRUCTION

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Merged with ENSR in 2007 RETEC

NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE
5							
4							
3							
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B	EM	12/20/07	REVISION				
A	EM	11/15/07	30% DRAWINGS – NOT FOR CONSTRUCTION				

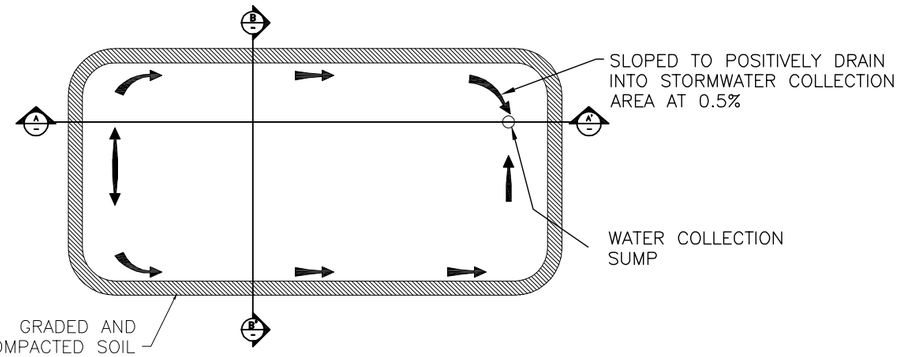
THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON
01140-204-270

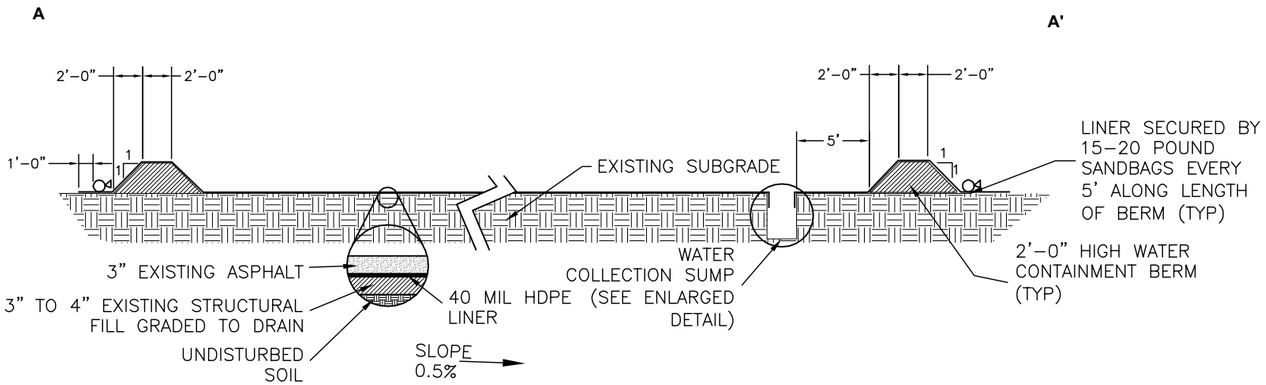
CURRENT DATE 12/20/07

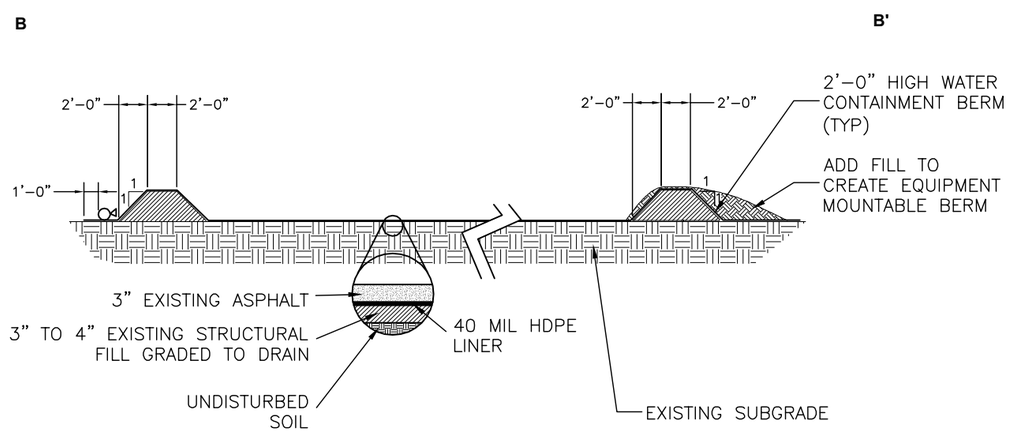
SKYKOMISH 2008 EDR
SEDIMENT AND EROSION CONTROL DETAILS
SHEET 1 OF 2

DRAWING NO. C-16 REVISION

File: H:\BNSF-Skykomish\2008 remediation\30% drawings\sediment-erosion_details(E).dwg Layout: C-16 User: emarshall Plotted: Jan 09, 2008 - 12:24pm Xref's:

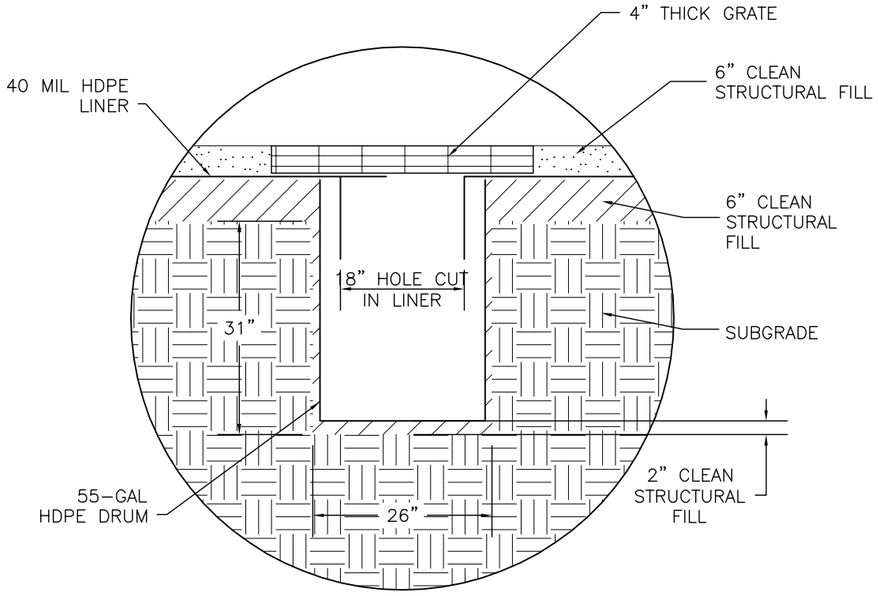






3 / C-15 WATER TREATMENT AREA DETAIL

SCALE: NTS



ENLARGED SUMP DETAIL

NOTES:

1. WATER TREATMENT PLANT AREA IS TO BE GRADED TO POSITIVELY DRAIN TOWARDS THE WATER COLLECTION SUMP.

2. CONTAINMENT BERMS SHALL BE CONSTRUCTED OF UNIMPACTED SOIL. 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.

3. PERIODIC INSPECTION AND MAINTENANCE OF THE CONTAINMENT BERMS IS REQUIRED FOR THE DURATION OF THE PROJECT.

4. SOLIDS ACCUMULATED IN THE SUMP WILL BE EXCAVATED PERIODICALLY BY THE SUBCONTRACTOR AND PLACED ON THE WASTE MATERIAL STOCKPILE.

5. ANY DAMAGE TO WATER TREATMENT AREA MUST BE REPORTED TO THE SITE ENGINEER IMMEDIATELY.

6. LINER SHALL BE 40 MIL HDPE ONE SOLID SHEET OR SEAMS SHALL BE WELDED PER SPECIFICATIONS AND MANUFACTURER'S RECOMMENDATIONS. NO OVERLAP IS ALLOWED.

7. 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.

8. GRATE OVER SUMP WILL BE OF SUFFICIENT STRENGTH TO WITHSTAND VEHICLE TRAFFIC AND EXTEND AT LEAST 6 INCHES PAST THE SUMP EXCAVATION ON ALL SIDES. SLOPES WILL BE GRADED TO THE SUMP.

30% DRAWINGS - NOT FOR CONSTRUCTION

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Merged with ENSR in 2007
RETEC

NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE
5							
4							
3							
2							
B	EM	12/20/07	REVISION				
A	EM	11/15/07	30% DRAWINGS – NOT FOR CONSTRUCTION				

THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON
01140-204-270

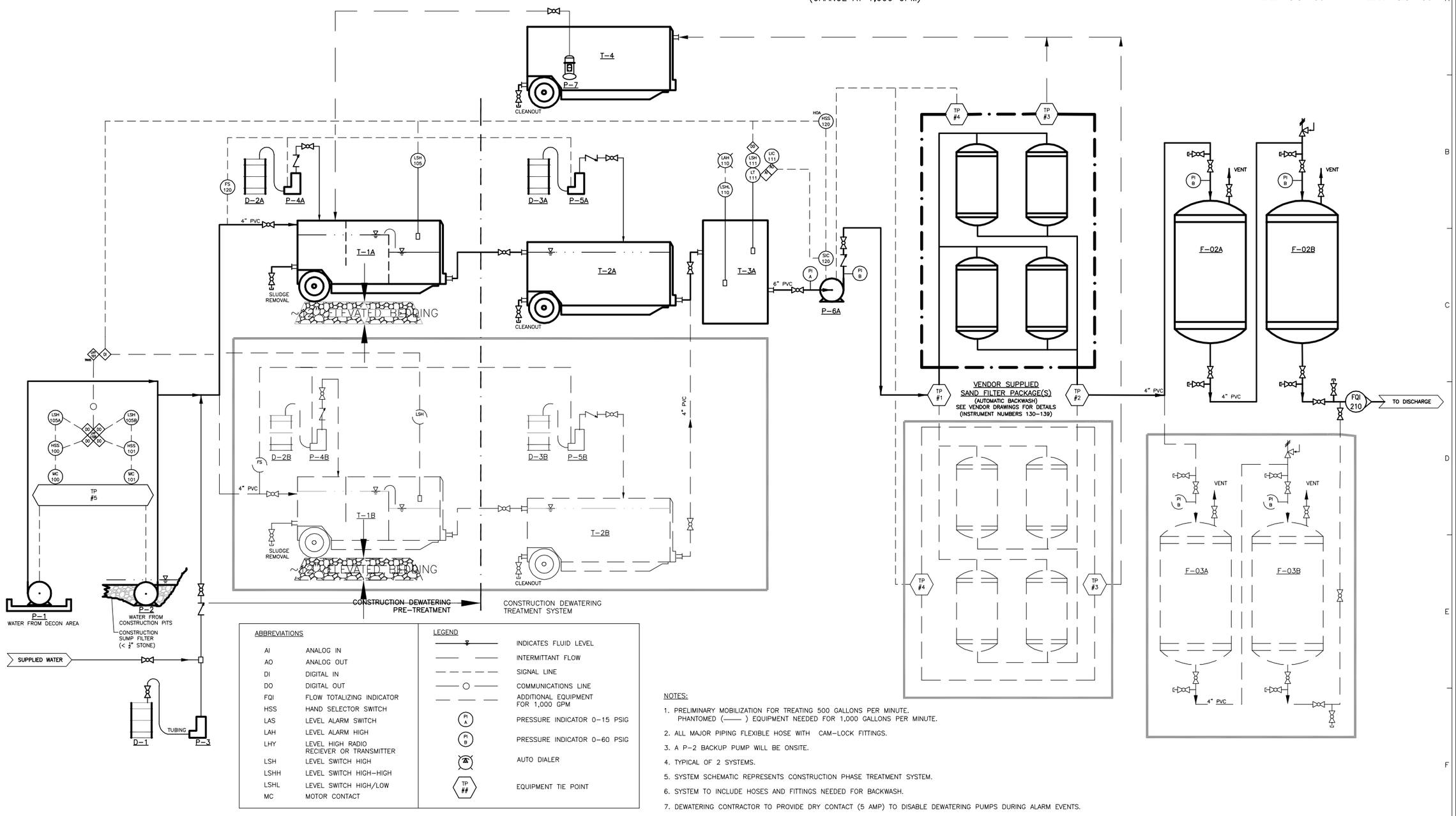
CURRENT DATE 12/20/07

SKYKOMISH 2008 EDR
SEDIMENT AND EROSION CONTROL DETAILS
SHEET 2 OF 2

DRAWING NO. C-17 REVISION

File: H:\BNSF-Skykomish\2008 remediation\30% drawings\sediment-erosion_details(D).dwg Layout: C-17 User: emarshall Plotted: Dec 21, 2007 - 9:37am Xref's:

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	F-03A/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 20,000 GAL CARBON STEEL	FRAC TANK 20,000 GAL CARBON STEEL	SURGE TANK TANK 20,000 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 SUMP 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	LIQUID PHASE GRANULAR ACTIVATED CARBON 10,000 LBS MAX PSIG 150



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
	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

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. A P-2 BACKUP PUMP WILL 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.

PIPING AND INSTRUMENTATION DIAGRAM

30% DRAWINGS - NOT FOR CONSTRUCTION

ENSR | AECOM

Merged with ENSR in 2007 RETEC

NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE
5							
4							
3							
2							
B	EM	12/20/07	REVISION				
A	EM	11/8/07	30% DRAWINGS – NOT FOR CONSTRUCTION				

THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON
01140-204-270

CURRENT DATE 12/20/07

SKYKOMISH 2008 EDR
CONSTRUCTION WATER TREATMENT SYSTEM
PROCESS AND INSTRUMENTATION DIAGRAM

DRAWING NO. C-18 REVISION

SOUTH FORK SKYKOMISH RIVER

208 µg/L

477 µg/L

477 µg/L

208 µg/L

DW-5
920.38

FOC4

1A-B-19B

1A-W-1

1A-B-8

1B-B-6D

1B-B-6B

1B-B-6C

1B-B-6

1B-B-14B
916.77
5.48

1B-W-3
921.34
918.02
3.32

1B-W-2
921.80
920.14
1.66

1B-W-1
922.39
916.94
5.45

2A-B-20
919.66

1B-B-14
918.35
3.90

1B-B-9
918.08
4.42

MW-21
922.54

1B-B-10
918.16

1B-B-11
917.35
5.15

MW-35
922.21

1B-B-15
919.89
2.36

1B-B-16
915.06
7.44

1B-B-4
917.92
4.58

1B-B-5

1B-B-12

1B-B-19
915.06
7.44

1B-B-22

1C-W-4
922.01
919.77
2.24

1C-W-3
912.61
921.5

1C-W-1
922.62
919.74
2.88

1B-B-21
918.91
3.84

1B-B-13
923.54
0.0

MW-34
923.18

2A-B-21
920.76
2.24

2A-W-22
924.75

2A-B-23
919.09
4.41

2A-B-17

2A-W-6
922.64
915.55
7.09

2A-W-7
927.42

B-4

3,400

A

A'

INFERRED GW DIRECTION

VAPOR MONITORING WELL DETAIL 2 / C-21

WELL CONSTRUCTION DETAIL 1 / C-21

TRENCH DETAIL 3 / C-21

VAULT DETAILS 4,5 / C-21

4"ø HDPE (2 TOTAL) IN CONDUIT

LEGEND

- 208 µg/L — CUL GROUNDWATER ISOCONCENTRATION LINE
- 477 µg/L — RL GROUNDWATER ISOCONCENTRATION LINE
- 3,400 — IN SITU SOIL RL ISOCONCENTRATION LINE
- X — APPROXIMATE SPARGING WELL LOCATION (FINAL LOCATIONS TO BE DETERMINED IN THE FIELD)
- SPARGE WELL ESTIMATED RADIUS OF INFLUENCE
- VAPOR MONITORING WELL

N

25 0 50

SCALE IN FEET

30% DRAWINGS - NOT FOR CONSTRUCTION

ENSR | AECOM

Merged with ENSR in 2007

RETEC

NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE
5							
4							
3							
2							
B	EM	01/09/08	REVISION				
A	EM	11/16/07	30% DRAWINGS – NOT FOR CONSTRUCTION				

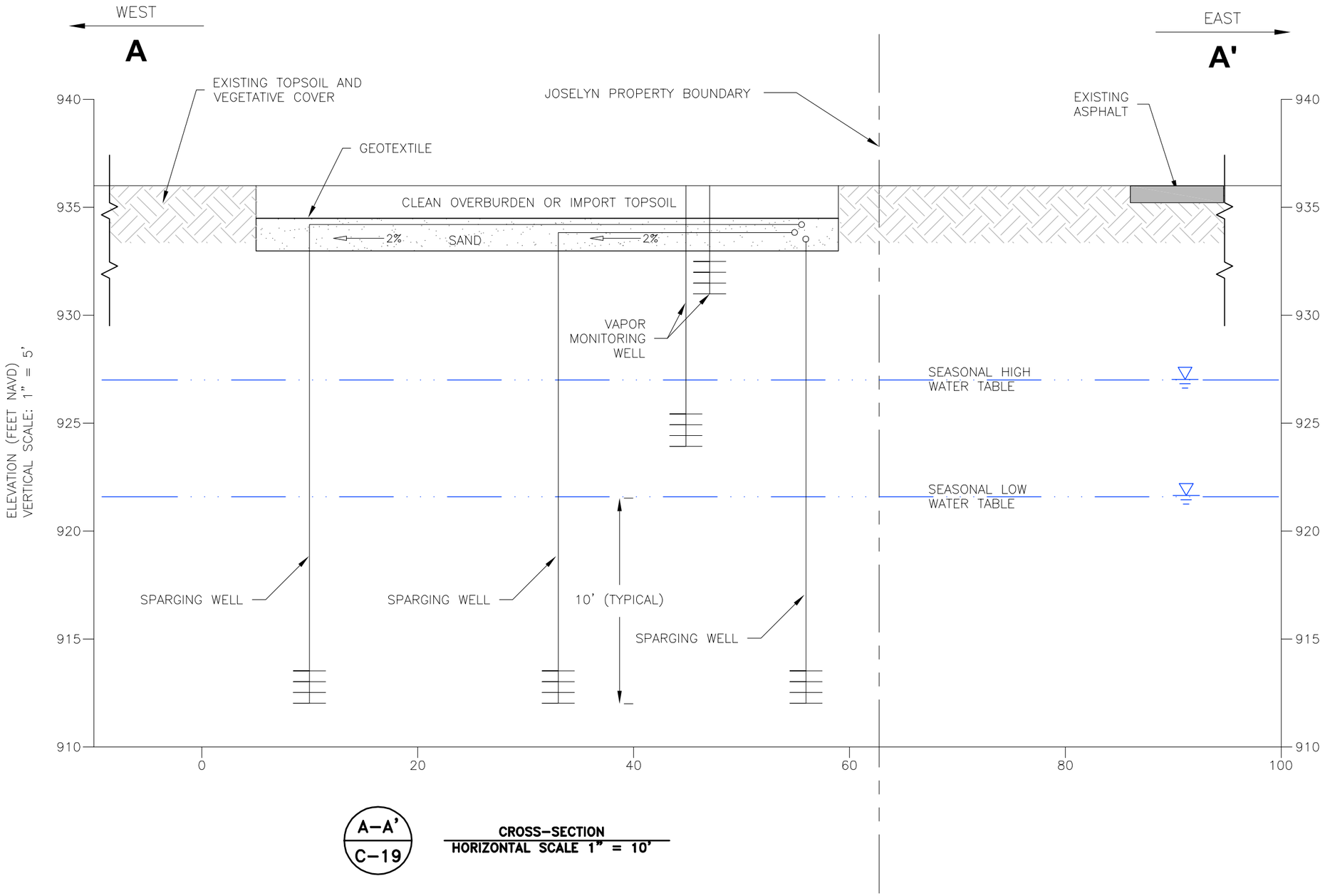
THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON
01140-204-270

CURRENT DATE 01/09/08

SKYKOMISH 2008 EDR
AIR SPARGING SYSTEM LAYOUT

DRAWING NO. C-19 REVISION

File: H:\BNSF-Skykomish\2008 remediation\30% drawings\air_sparging_layout(F).dwg Layout: C-19 User: emarshall Plotted: Jan 16, 2008 - 11:10am Xref's:



A–A'
C–19

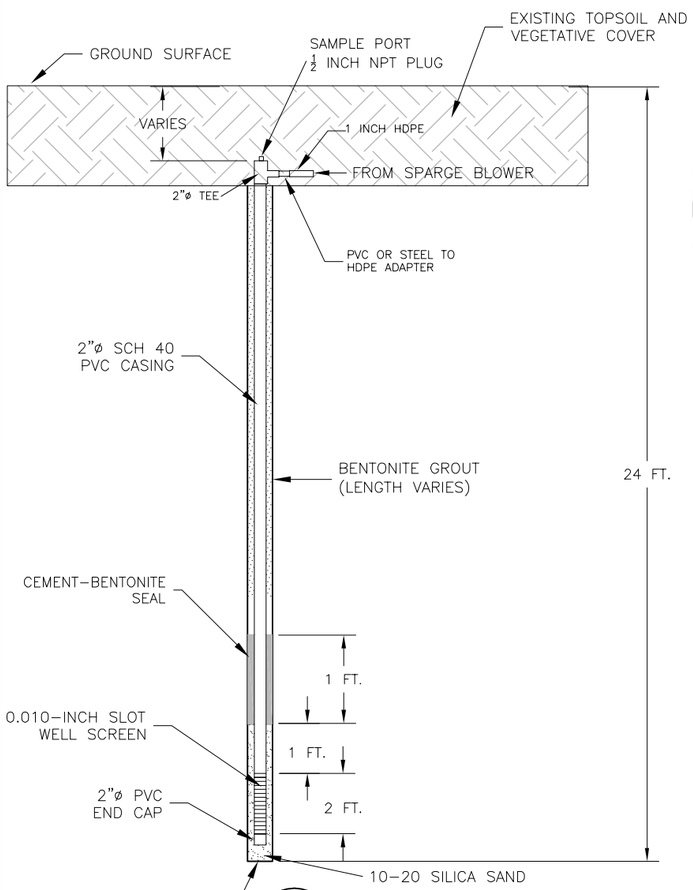
CROSS–SECTION
HORIZONTAL SCALE 1" = 10'

ENSR | AECOM

Merged with ENSR in 2007
RETEC

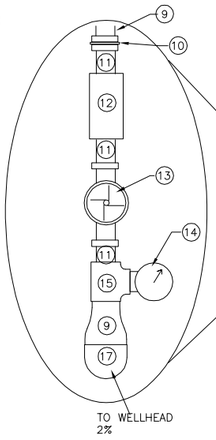
THE BNSF RAILWAY COMPANY SKYKOMISH, WASHINGTON 01140-204-0360			**SKYKKOMISH 2008 EDR** **AIR SPARGING SYSTEM** **CROSS SECTION A-A'**
DATE: 01/09/08	DRWN: E.M./SEA		**DRAWING NO.** C-20

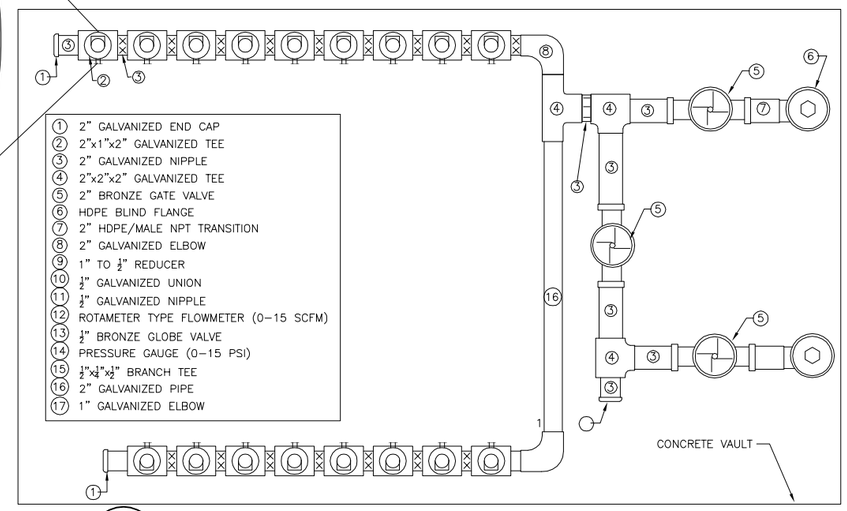
File: H:\BNSF-Skykomish\2008 remediation\30% drawings\air_sparging_x-sect.dwg Layout: C-20 User: emarshall Plotted: Jan 11, 2008 - 1:18pm Xref's:



1 C-20 SPARGING WELL CONSTRUCTION DETAIL

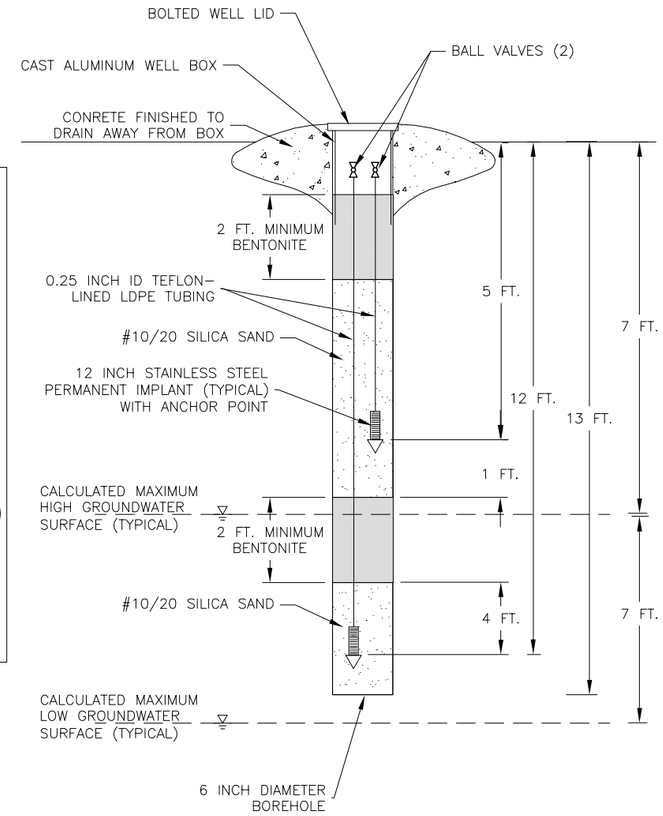
SCALE: NTS





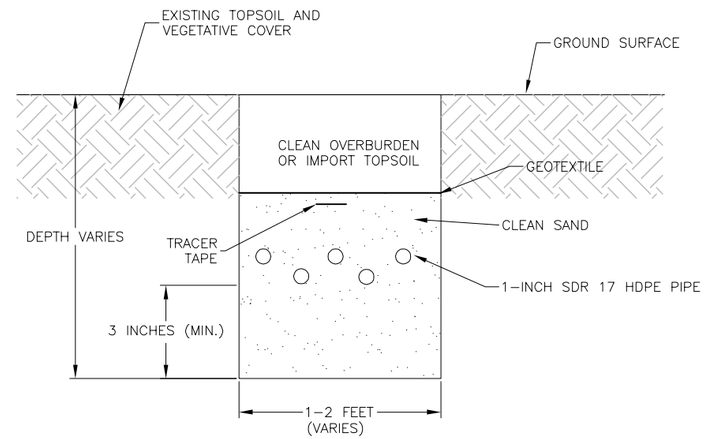
5 C-20 VAULT/MANIFOLD DETAIL

SCALE: NTS



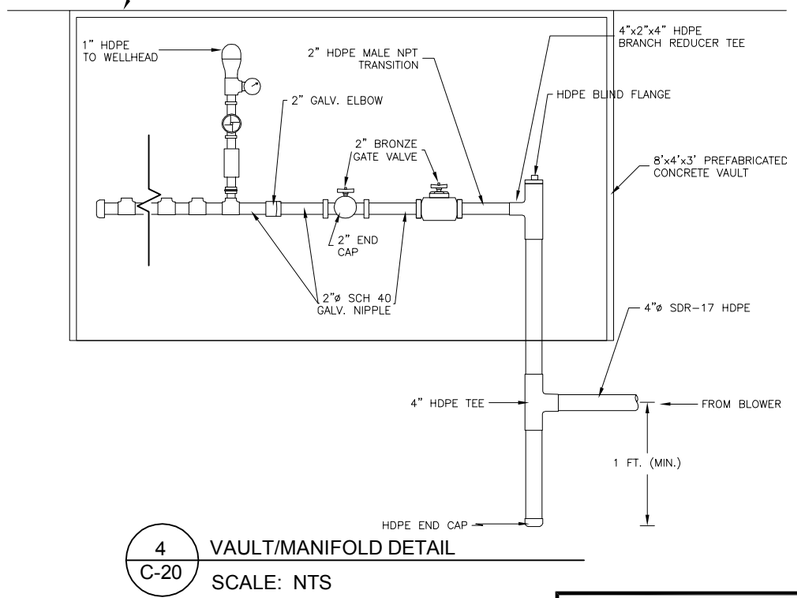
2 C-20 VAPOR MONITORING WELL DETAIL

SCALE: NTS



3 C-20 AIR SPARGING PIPING TRENCH DETAIL (TYP.)

SCALE: NTS



4 C-20 VAPOR MONITORING WELL DETAIL

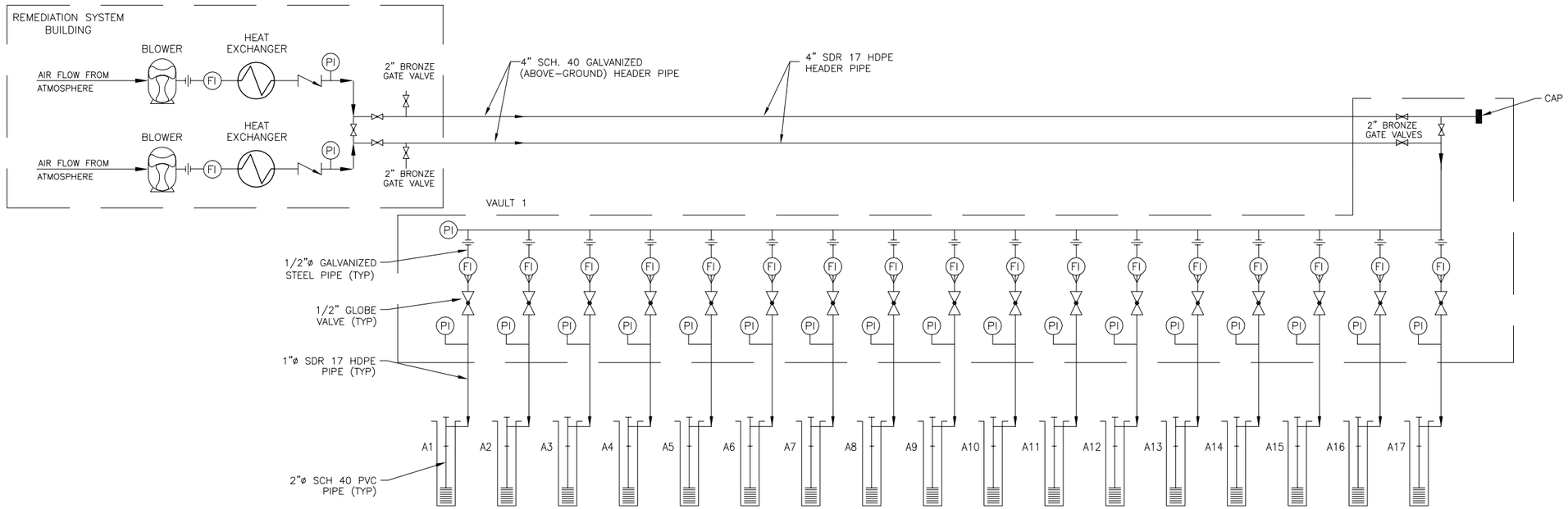
SCALE: NTS

ENSR | AECOM

Merged with ENSR in 2007
RETEC

THE BNSF RAILWAY COMPANY SKYKOMISH, WASHINGTON 01140-204-270			**SKYKOMISH 2008 EDR** **AIR SPARGING SYSTEM DETAILS**
DATE: 1/11/08	DRWN: E.M./SEA		**C-21**

File: H:\BNSF–Skykomish\2008 remediation\30% drawings\air_sparging_sys_details(C).dwg Layout: C–21 User: emarshall Plotted: Jan 16, 2008 – 12:06pm Xref's:



LEGEND

PI	PRESSURE INDICATOR
FI	FLOW INDICATOR
AI–A1	AIR INJECTION WELL (TYP.)
	CHECK VALVE
	GLOBE/GATE VALVE
	HEAT EXCHANGER
	BLOWER
	UNION

SCALE: NOT TO SCALE

30% DRAWINGS - NOT FOR CONSTRUCTION

ENSR | AECOM
Merged with ENSR in 2007
RETEC

NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE
5							
4							
3							
2							
B	EM	1/11/08	REVISION				
A	EM	11/16/07	30% DRAWINGS – NOT FOR CONSTRUCTION				

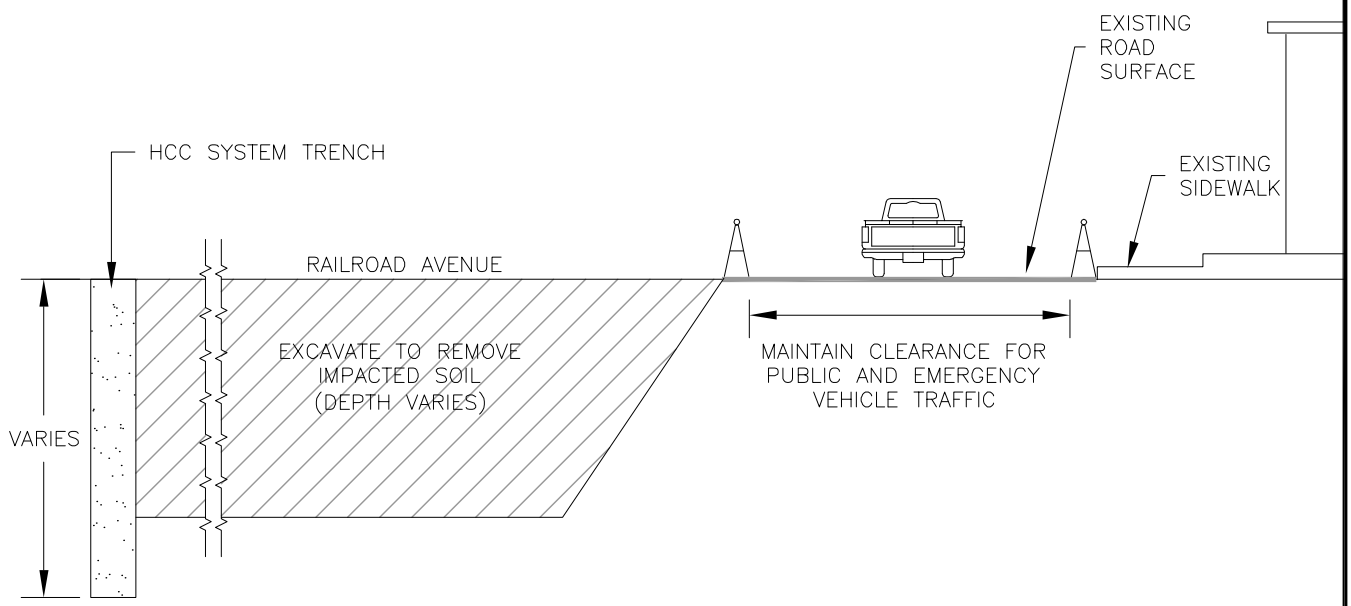
THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON
01140-204-270

SKYKOMISH 2008 EDR
AIR SPARGING SYSTEM PIPING
AND INSTRUMENTATION DIAGRAM

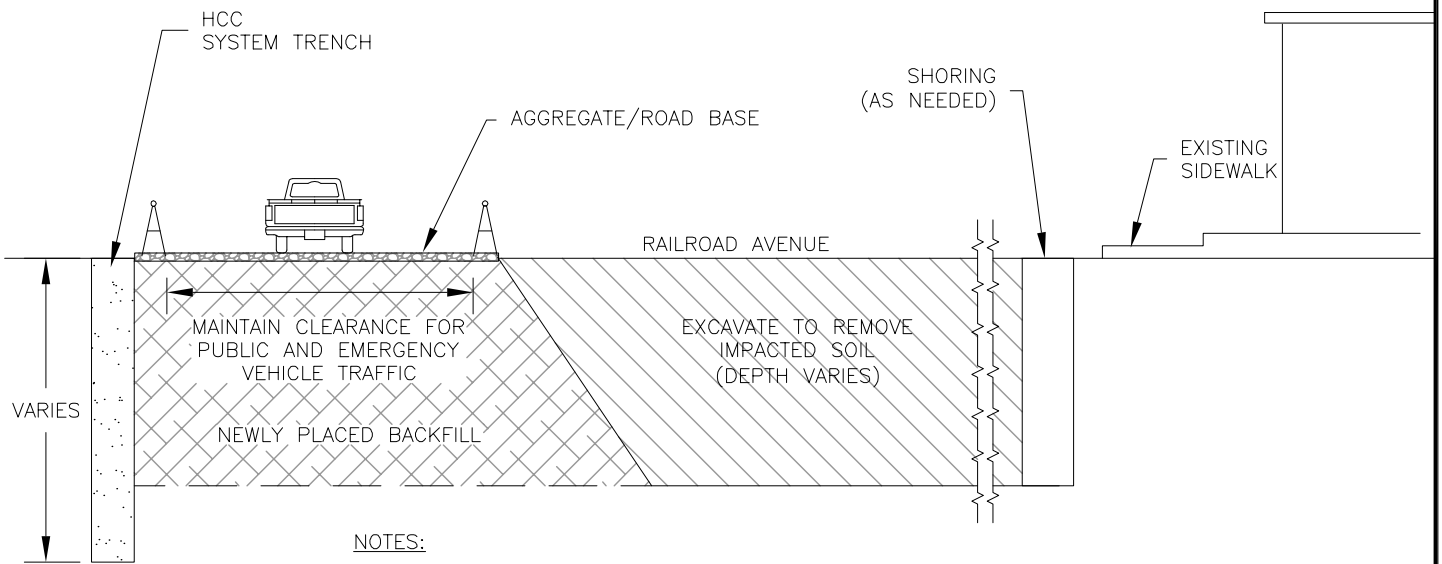
CURRENT DATE 1/11/08 | DRAWING NO. C-22 | REVISION

File: H:\BNSF-Skykomish\2008 remediation\30% drawings\air_sparging_diagram(F).dwg Layout: C-22 User: emarshall Plotted: Jan 14, 2008 - 2:21pm Xref's:

PHASE 1 – EXCAVATE SOUTH SIDE OF RAILROAD AVENUE



PHASE 2 – EXCAVATE NORTH SIDE OF RAILROAD AVENUE



NOTES:

NOT TO SCALE
LOCATIONS ARE APPROXIMATE
NOT FOR CONSTRUCTION

ENSR | AECOM

Merged with ENSR in 2007
RETEC

THE BNSF RAILWAY COMPANY SKYKOMISH, WASHINGTON 01140-204-270		**SKYKOMISH 2008 EDR PHASES 1 AND 2 RAILROAD AVENUE EXCAVATION**
DATE: 12/20/07	DRWN: E.M./SEA	**C-23**

File: H:\BNSF-Skykomish\2008 remediation\30% drawings\railroad_ave_excavation(b).dwg Layout: C-23 User: emarshall Plotted: Jan 11, 2008 - 10:17am Xref's:

ACCESS OLD CASCADE HIGHWAY
VIA HIGHWAY 2

SOUTH FORK SKYKOMISH RIVER

MOVE WHISTLING POST TAVERN

CHURCH

PREPARE McEVOY HOUSE FOR RELOCATION

EXCAVATION TO BE COMPLETED DURING LIMITED-TIME ROAD CLOSURES

APPROXIMATE PHASE 1/2 BOUNDARY

EXCAVATE AND RESTORE

MALONEY'S GENERAL STORE

TEMPORARY CONSTRUCTION CROSSING

GATES

GATE

MOVE DEPOT

GATES

CONSTRUCTION WATER TREATMENT SYSTEM

EMERGENCY VEHICLE ACCESS CROSSING

STAGING AREA AND SOIL HANDLING AREA

BOUNDARIES WERE NOT SURVEYED IN 2007 AND HAVE BEEN APPROXIMATED BASED ON KING COUNTY RECORDS

GATE

REMEDIATION EQUIPMENT BUILDING

PORTABLE EQUIPMENT STORAGE AREA AND CONTRACTOR TRAILERS

SOIL HANDLING AREA EXIT ROAD

HIGHWAY 2
APPROX. 3 MILES

ACCESS DOWNTOWN SKYKOMISH AND STATE HIGHWAY 2 VIA OLD CASCADE HIGHWAY

HIGHWAY 2
APPROX. 1.2 MILES

LEGEND

- ACTIVE EXCAVATION BOUNDARY FOR PHASE 1
- AIR SPARGING SYSTEM AREA
- BNSF PROPERTY LINE
- PROPERTY LINE
- WIRE FENCE
- SF — SILT FENCE
- DESIGNATED VEHICLE TRAFFIC ROUTE
- HCC AREA
- SOIL HANDLING AREA
- PROPOSED BUILDINGS TO BE RELOCATED
- PROPOSED STAGING AREAS
- PROPOSED PORTABLE EQUIPMENT STORAGE AREA

PEDESTRIAN ACCESS NOTES:

1. SIDEWALKS WILL REMAIN ACCESSIBLE TO PEDESTRIANS.
2. THE CHURCH WILL REMAIN ACCESSIBLE TO PEDESTRIANS AND VEHICLE TRAFFIC.
3. THE 5TH STREET RAILROAD CROSSING WILL BE CLOSED TO PEDESTRIANS DURING PART OF HCC CONSTRUCTION.

N

60 0 120

SCALE IN FEET

30% DRAWINGS - NOT FOR CONSTRUCTION

File: H:\BNSF-Skykomish\2008 remediation\30% drawings\traffic_plan-phase_1(C).dwg Layout: C-24 User: emarshall Plotted: Jan 14, 2008 - 2:22pm Xref's:

ENSR | AECOM
Merged with ENSR in 2007
RETEC

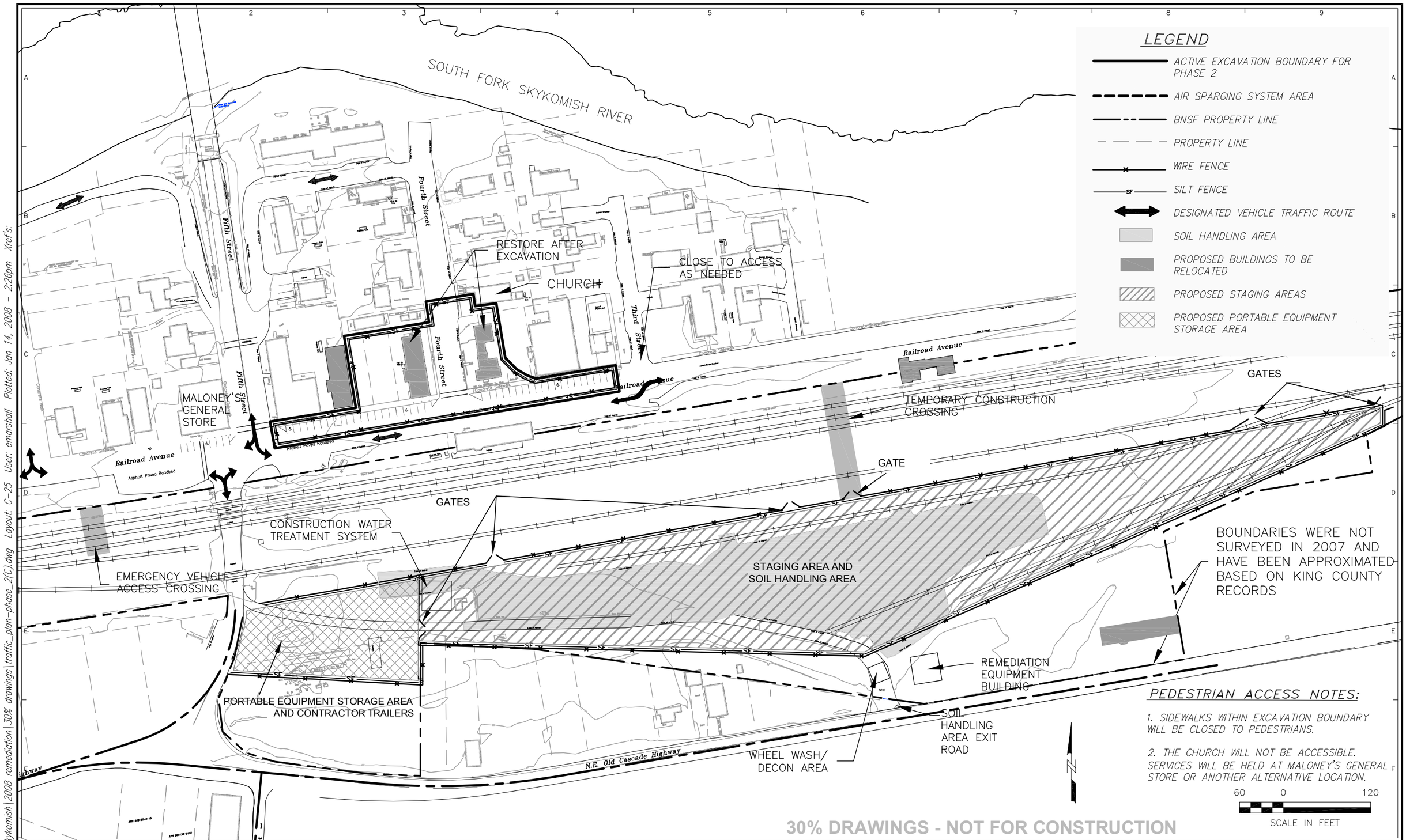
NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE
5							
4							
3							
2							
B	EM	12/20/07	REVISION				
A	EM	11/15/07	30% DRAWINGS – NOT FOR CONSTRUCTION				

THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON
01140-204-270

CURRENT DATE 12/20/07

SKYKOMISH 2008 EDR
PHASE 1 TRAFFIC ROUTING AND PEDESTRIAN ACCESS

DRAWING NO. C-24 REVISION



30% DRAWINGS - NOT FOR CONSTRUCTION

ENSR | AECOM
Merged with ENSR in 2007
RETEC

NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE
5							
4							
3							
2							
B	EM	12/20/07	REVISION				
A	EM	11/9/07	30% DRAWINGS – NOT FOR CONSTRUCTION				

THE BNSF RAILWAY COMPANY
SKYKOMISH, WASHINGTON
01140-204-270

CURRENT DATE 12/20/07

SKYKOMISH 2008 EDR
PHASE 2 TRAFFIC ROUTING AND PEDESTRIAN ACCESS

DRAWING NO. C-25 REVISION

File: H:\BNSF-Skykomish\2008 remediation\30% drawings\traffic_plan-phase_2(C).dwg Layout: C-25 User: emarshall Plotted: Jan 14, 2008 - 2:26pm Xref's: