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June 30, 2017

Brian Sato
Toxics Cleanup Program
Dept. of Ecology
3190 160th AVE SE
Bellevue, WA 98008-5452

**RE: Final 2016 As-Built Completion Report Transmittal**
**Consent Decree No. 07-2-33672-9 SEA:**
**Site Name: BNSF Former Maintenance and Fueling Facility**
**Site Address: Skykomish, WA**
**Facility/Site ID No.: 2104**
**Cleanup Site ID No.: 34**

Dear Mr. Sato:

Enclosed is the Final 2016 As-Built Completion Report. Changes to this report were based on your comments received April 19, 2017. A matrix with responses to the agency's comments for ease of tracking is included in Appendix A.

Sincerely,

Shane C. DeGross, LG
Manager of Environmental Remediation, BNSF Railway

cc: Mr. Craig Trueblood, K&L Gates
Ms. Amy Essig Desai, Farallon Consulting

# 2016 AS-BUILT COMPLETION REPORT

# BNSF FORMER MAINTENANCE AND FUELING FACILITY
# SKYKOMISH, WASHINGTON
# CONSENT DECREE NO. 07-2-33672-9 SEA

**Submitted by:**
**Farallon Consulting, L.L.C.**
**975 5th Avenue Northwest**
**Issaquah, Washington 98027**

**Farallon PN: 683-057**

**For:**

**605 Puyallup Avenue**
**Tacoma, Washington**

June 2017

Prepared by:

Andrew Vining, P.E.
Project Engineer

Reviewed by:

Gerald J. Portele
Principal

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## FIGURES



## APPENDICES

# ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| 2015 CPS | *Technical Specifications – Skykomish School HWF Remediation, Skykomish, Washington*, Issued for Bid, Volume 1 of 2 dated January 16, 2015, prepared by Farallon Consulting, L.L.C. |
| AECOM | AECOM Environment |
| Air Sparge Site | 312 Railroad Avenue at the BNSF Former Maintenance and Fueling Facility in Skykomish, Washington |
| As-Built Report | *2016 As-Built Completion Report, BNSF Former Maintenance and Fueling Facility, Skykomish, Washington* dated February 23, 2017 prepared by Farallon Consulting, L.L.C. (this report) |
| BNSF | BNSF Railway Company |
| CAP | *Cleanup Action Plan for BNSF Former Maintenance and Fueling Facility, Skykomish, Washington* dated October 18, 2007 prepared by the Washington State Department of Ecology |
| Ecology | Washington State Department of Ecology |
| Farallon | Farallon Consulting, L.L.C. |
| GAC | granular activated carbon |
| Glacier | Glacier Environmental Services, Inc. |
| HCC | Hydraulic Control and Containment |
| Holocene | Holocene Drilling Inc. |
| Holt | Holt Services, Inc. |
| HWF | hot water flushing |
| NAPL | nonaqueous-phase liquid |
| NWTPH-Dx | cumulatively, total petroleum hydrocarbons as diesel-range organics and as oil-range organics |
| School Site | the area beneath and adjacent to all sides of the Skykomish School building within the sheet pile barrier wall |

| | |
|---|---|
| Site | BNSF Former Maintenance and Fueling Facility in Skykomish, Washington |
| SVE | soil vapor extraction |
| Town | Town of Skykomish in King County, Washington |

# 1.0 INTRODUCTION

This 2016 As-Built Completion Report (As-Built Report) describes the remediation construction activities completed during 2016 for the BNSF Railway Company (BNSF) as part of the remedial action underway at the BNSF Former Maintenance and Fueling Facility in Skykomish, Washington (herein referred to as the Site). The Site includes BNSF property and public and private properties within the Town of Skykomish in King County, Washington (Town), and encompasses an area of approximately 40 acres (Figure 1).

This As-Built Report has been prepared to meet the requirements of Section 400 of Chapter 173-340 of the Washington Administrative Code, and in accordance with the *Cleanup Action Plan for BNSF Former Maintenance and Fueling Facility, Skykomish, Washington* dated October 18, 2007 prepared by the Washington State Department of Ecology (Ecology) (2007) (CAP). The remediation activities completed at the Site in 2016 were approved by Ecology and undertaken by BNSF pursuant to Consent Decree No. 07-2-33672-9 SEA between BNSF and Ecology, and are part of an integrated and comprehensive remedial action for the Site. The overall cleanup approach for the Site is described in the Master Engineering Design Report (The RETEC Group, Inc. 2008). This document has been revised based on comments received from Ecology on April 19, 2017 on the draft version submitted on March 30, 2017. The comments received and the responses to the comments are presented in Appendix A, Response to Comments.

Locations of the remedial construction activities performed at the Site during 2016 are shown on Figure 1. Construction activities performed include removal and replacement of carbon at the West Gate of the Hydraulic Control and Containment (HCC) system; decommissioning of the air sparge system located at 312 Railroad Avenue on the Site (Air Sparge Site); and installation of hot water flushing (HWF) equipment at the School Site. The School Site is defined as the area beneath and adjacent to all sides of the Skykomish School building within the sheet pile barrier wall, as shown on Figure 2. These remedial construction activities performed during 2016 were in support of the ongoing remediation system operations described below.

## 1.1 HWF REMEDIATION AT SCHOOL SITE

HWF remediation is the agreed-upon remedy for reducing the amount of petroleum nonaqueous-phase liquid (NAPL) from beneath the School Site. HWF construction activities were performed in accordance with the School Hot Water Flushing Remediation Construction Plans and Specifications (2015 CPS) (Farallon 2015). The subsurface HWF system was installed during the 2015 construction season, with remaining aboveground equipment fabricated, and installed during the 2016 season. Following completion of equipment installation and testing, the HWF system began operating in June 2016, and will be operated annually during the summer and autumn seasons. Operation of the HWF system is summarized in the 2016 Hot Water Flushing Performance Report (Farallon & Trihydro Corporation 2017).

## 1.2 HCC SYSTEM OPERATIONS ACROSS THE SITE

The primary objective of the HCC system described in the CAP (Ecology 2007), HCC System Special Design Report (ENSR Corporation 2008), and Operation and Maintenance Manual for the HCC System (AECOM Environment 2011), is to prevent the migration of NAPL and contaminated groundwater from the BNSF railyard, and this objective has been achieved. The HCC system also had an operational objective of creating a hydraulic gradient reversal across the barrier wall gates. This operational objective has not been achieved, due to the high permeability of the coarse aggregate fill material that was placed within the barrier wall recovery trench and in the remedial excavation areas north of the barrier wall. This fill material was placed after the HCC system design was completed, and exhibits a substantially greater hydraulic conductivity than assumed in the groundwater modeling that informed the system design. BNSF will continue to pursue HCC system optimization efforts during 2017.

Installation of the carbon treatment vaults/gates and containment wall was performed during the 2008 construction season, documented in the 2008 Skykomish Remediation – As-Built Completion Report (AECOM 2009). The West Gate is one of four gate installations that are components of the HCC barrier wall. The West Gate consists of two separate vaults, each containing an oil-water separator followed by chambers containing a granular activated carbon (GAC)/pea gravel mixture. The GAC/pea gravel mixture was replaced in the east vault of the West Gate during the summer of 2016, the first carbon media change-out performed on the HCC gates since system installation in 2008.

## 1.3 AIR SPARGE SYSTEM OPERATIONS

The air sparge system was operated from 2009 until May 2013. In September 2015, confirmation soil sampling was performed to verify that the concentrations of total petroleum hydrocarbons as diesel-range organics and as oil-range organics (herein referred to cumulatively as NWTPH-Dx) in soil were less than the remediation level of 3,400 milligrams per kilogram (Farallon 2016). The air sparge system was successful in reducing concentrations of NWTPH-Dx at the Site, and a request to proceed with decommissioning of the air sparge system was presented to Ecology (Farallon 2016). With the concurrence from Ecology, the air sparge system and all related components were decommissioned and removed from the Air Sparge Site in the summer of 2016.

## 1.4 OVERVIEW OF 2016 CONSTRUCTION ACTIVITIES

The remainder of this As-Built Report is organized into the following sections:

- **Section 2, Project Management and Organization,** describes the roles and responsibilities of the general contractor, and of the consultants and contractors to BNSF, Farallon, the Town of Skykomish, and the Skykomish School District for the completion of the 2016 remediation activities. This section also includes a schedule describing the work completed in 2016.

- **Section 3, Temporary Facilities and Utilities,** describes general Site preparation activities completed prior to the start of construction, including establishment of temporary facilities and controls, and utility location.
- **Section 4, Hot Water Flushing System Construction Activities,** describes the preparation of the treatment compound, and installation of equipment for the HWF system at the School Site.
- **Section 5**, **Air Sparge System Decommissioning**, describes the vault and well decommissioning activities performed at the Air Sparge Site.
- **Section 6, HCC System Maintenance Activities,** describes the carbon change-out conducted at the east vault of the West Gate of the HCC system, and West Gate restoration.
- **Section 7, Site Improvement Activities,** describes the improvements to the Town Sewer system in Sixth Street, and restoration of the basement floor in the School building.
- **Section 8, Work to be Completed After 2016,** describes the remaining remediation activities presented in the planning documents that will be completed after 2016, including cleanup beneath the School building, operation of the HCC system, and final restoration of the School Site and Town.
- **Section 9, Summary,** provides an overview of the 2016 remediation activities conducted at the Site.
- **Section 10, Bibliography,** provides a list of the documents used in preparing this 2016 As-Built Report.

# 2.0 PROJECT MANAGEMENT AND ORGANIZATION

## 2.1 GENERAL CONTRACTOR

Glacier Environmental Services, Inc. (Glacier) performed the construction activities related to the HWF system and the Sixth Street sewer installation in accordance with the 2015 CPS, HCC maintenance activities, and air sparge system decommissioning.

Subcontractors to Glacier and the services they provided were as follows:

- Pacific Surveying & Engineering, Inc. of Bellingham, Washington: land surveying;
- National Construction Rentals of Pacific, Washington: installation of temporary site security fencing;
- Lakeside Paving of Monroe, Washington: Sixth Street paving;
- Marine Vacuum Services, Inc. of Seattle, Washington: oil recovery;
- GeoTest Services, Inc. of Arlington, Washington: compaction testing;
- Applied Professional Services of North Bend, Washington: utility location; and
- Superior Custom Controls of Seattle, Washington: installation of HWF and SVE system programming and controls.

## 2.2 CONSULTANTS AND CONTRACTORS TO BNSF

The following firms provided the services indicated below under contract to BNSF in support of this project:

- Farallon: project management; construction management; and BNSF liaison activities with contractors, the Town, and local stakeholders; and
- TestAmerica Laboratories, Inc.: laboratory analysis of soil samples.

## 2.3 SUBCONSULTANTS AND SUBCONTRACTORS TO FARALLON

The following firms provided the services indicated below under contract to Farallon in support of this project:

- Trihydro Corporation: design, construction observation and support, and submittal review services for the HWF system;
- Washington State licensed drilling contractors
    - Holt Services, Inc. (Holt): well decommissioning; and
    - Holocene Drilling Inc. (Holocene): well installation and decommissioning.

## 2.4 CONSULTANTS TO TOWN OF SKYKOMISH

Gray & Osborne, Inc. provided engineering design and construction observation services for the sanitary sewer installations.

## 2.5 2016 CONSTRUCTION SCHEDULE

The 2016 construction schedule is summarized in the table below. Final HWF system installation activities occurred prior to June 1, 2016 to allow system start-up to immediately follow the end of the 2016 school year. The Sixth Street sewer work and the HCC carbon change-out occurred in late August during Site seasonal low groundwater conditions.

| 2016 Dates | Construction Activity |
|---|---|
| March 15 – June 1 | HWF system installation |
| August 8 – August 16 | Sixth Street sewer upgrade |
| August 15 – September 15 | Air sparge system decommissioning |
| August 22 – September 9 | Carbon replacement in east vault of HCC system West Gate |

NOTES:
HCC = Hydraulic Control and Containment
HWF = hot water flushing

# 3.0 TEMPORARY FACILITIES AND UTILITIES

This section describes the temporary facilities provided and utility locating activities conducted prior to the start of 2016 construction work.

## 3.1 TEMPORARY FACILITIES AND CONTROLS

### 3.1.1 Construction Water Storage Facilities

A 20,000-gallon temporary storage tank was set up adjacent to the HCC Treatment Building for storage of dewatered groundwater pumped from the West Gate during carbon change-out activities. The water in the storage tank was pumped at a controlled rate to the HCC Treatment Building for treatment and discharge under the existing National Pollutant Discharge Elimination System Permit.

### 3.1.2 Temporary Site Security

A 6-foot-high temporary fence was installed around Sixth Street and around the west vault to maintain security throughout the duration of the project. All Site visitors were briefed via a Site orientation and safety meeting prior to obtaining access to the fenced area.

### 3.1.3 Temporary Traffic Control

During Sixth Street sewer installation, described in Section 7.1, Town Sewer Improvements, Sixth Street was closed. Emergency access was maintained along Railroad Avenue by placement of steel plates. Railroad Avenue access was not impacted by the carbon replacement at the HCC system's West Gate, the air sparge system decommissioning at the Air Sparge Site, or by the HWF system installation at the School Site.

### 3.1.4 Temporary Erosion and Sediment Control

Stormwater catch basins within 100 feet of the work areas were protected using sandbags and filter socks to ensure that no sediment-laden runoff from the work area entered the stormwater system. A fully stocked spill kit, plastic sheeting, and sandbags for additional stormwater protection were available on the Site through the project duration. The paved work areas were swept clean of loose soil with a street sweeper to clean tracked dirt.

## 3.2 UTILITY LOCATING

A one-call utility locate was conducted at the Air Sparge Site, at the HWF system treatment equipment compound, in Sixth Street, and at West Gate locations prior to commencement of construction activities to locate utilities. In addition, Applied Professional Services conducted a private locate at each of these locations prior to commencement of construction.

# 4.0 HOT WATER FLUSHING SYSTEM CONSTRUCTION ACTIVITIES

The majority of the subsurface infrastructure for the HWF system at the School Site was installed during the 2015 construction season including the sheet pile barrier wall around the School Site. Aboveground equipment was fabricated off-site and installed at the beginning of the 2016 construction season. The HWF system began operating in June 2016 following equipment installation and testing. The 2016 installation activities included:

- Site work and preparation of a treatment equipment pad;
- An upgrade to the treatment compound sewer system;
- Installation of soil vapor extraction (SVE) condensation sumps;
- Installation of equipment in the treatment compound; and
- Installation of equipment at the School Site.

Photographs of these installation activities are provided in Appendix B.

## 4.1 PREPARATION OF TREATMENT COMPOUND

Installation of HWF system equipment in the treatment compound were completed in March and April 2016. These activities are described in greater detail in the following sections.

### 4.1.1 Treatment Equipment Pad Preparation

The gravel pad in the treatment equipment compound was improved with additional grading and compaction. The layout of the treatment equipment compound was confirmed, and concrete footing pads were placed at the locations of the SVE container, water treatment container, emergency generator, air-water heat exchanger, and transformer (Figure 2). An electrical service feed and a transformer were installed at the western end of the treatment compound, and associated electrical services were routed to the generator, water treatment container, SVE container, and recovery sumps at the School Site.

An ecology block wall and a 6-foot-high temporary fence were installed around the treatment compound to provide site security during HWF activities. Signage that included pertinent emergency contact information was installed at the treatment compound.

### 4.1.2 Treatment Compound Sewer System Upgrade

A sanitary sewer connection was added in the vicinity of the boiler/chiller area to allow for discharge of boiler blowdown water. The sewer connection was coordinated with the Town's consultant Gray & Osborne, Inc. Less than 20 gallons of blowdown water is produced daily from the boiler; the water was collected in a storage tank prior to discharge to the sanitary sewer.

### 4.1.3 Soil Vapor Extraction Condensation Sumps Installation

Five condensation sumps were installed adjacent to the northern side of the SVE container to drain condensation from SVE header piping. The condensation sumps were installed to a depth of 7 feet below ground surface, and include a tee approximately 5 feet below ground surface that connects the condensation sump to existing SVE header piping. Photographs of the SVE condensation sumps and installation are provided in Appendix B.

## 4.2 EQUIPMENT INSTALLATION

Following preparation of the treatment compound pad, HWF system equipment was installed in April and May 2016, as described in the following sections.

### 4.2.1 Treatment Compound Equipment Installation

Equipment installed at the treatment compound included all piping, valves, fittings, enclosures, control panels, conduit, and other equipment necessary for the operation of the water treatment container, SVE container, boiler, and chiller.

The water treatment container was equipped with lighting, sound insulation, an oil-water separator, an equalization tank, a transfer pump, and bag filter housing. The SVE container was equipped with lighting, sound insulation, control manifolds and instrumentation, an air-to-air heat exchanger, a moisture separator, transfer pumps, and control panels.

Following placement of the water treatment and SVE containers, liquid- and vapor-phase carbon vessels were placed and connected in-line with flexible hosing. The air-to-water heat exchanger was installed and connected to the water treatment container with steel piping. All remaining aboveground piping, including connections to existing injection and extraction header piping and temporary connections for the boiler and chiller, was installed at the treatment compound. All remaining electrical connections were made, including connection of the SVE container to the backup power generator.

### 4.2.2 School Site Equipment Installation

Equipment installed at the School Site included all piping, valves, fittings, instrumentation, control panels, conduit, and other equipment necessary for operation of the hot water injection wells and the groundwater extraction recovery pumps.

The hot water injection well vaults were equipped with flowmeters and pressure gauges. All interior vaults were equipped with level float switches and foam-gasket sealed lids. The groundwater extraction recovery sumps were equipped with pumps, oil skimmers, flowmeters, pressure gauges, temperature transmitters, down-well extraction piping, and foot valves. All electrical equipment was connected using quick-disconnect pigtail plugs for removal during seasonal winterization. Prior to operation, all recovery wells were cleared of sediment and debris using a vactor truck.

Following equipment installation, Superior Custom Controls of Seattle, Washington installed and tested system programming and control logic at the programable logic controller. All system alarm functions were tested and verified.

# 5.0 AIR SPARGE SYSTEM DECOMISSIONING ACTIVITIES

The air sparge system consisted of a network of 16 air sparge wells, 3 vapor monitoring wells, and 3 groundwater monitoring wells strategically placed on and adjacent to the Air Sparge Site to monitor system effectiveness in removing petroleum hydrocarbons from soil and groundwater (Figure 3). Photographs of the air sparge system decommissioning activities are provided in Appendix B.

Operation of the air sparge system began in 2009 and was shut down with concurrence from Ecology in May 2013. Based on results from groundwater monitoring and confirmation soil sampling conducted in September 2015, it was confirmed that the 4.5-year operation of the air sparge system was successful in reducing concentrations of NWTPH-Dx in soil to less than the remediation level established in the CAP. In February 2016, Ecology concurred with the request from BNSF to decommission the air sparge system (Ecology 2016).

## 5.1 AIR SPARGE SYSTEM VAULT DECOMISSIONING

When in operation, influent air for the air sparge wells was obtained from an air compressor in the HCC system water treatment building and piped to an in-ground utility vault at the Air Sparge Site. As part of system decommissioning, Glacier removed the flowmeters, pressure gauges, valves, and manifold piping from inside the air sparge system vault. The buried horizontal piping from the manifold to the individual air sparge wells was capped below ground in the area adjacent to the vault location, and abandoned in-place. The air sparge system vault and the vault lid were removed, and the remaining void was backfilled with soil and graded. The vault area disturbed during decommissioning is scheduled to be backfilled with top soil and reseeded during spring of 2017.

## 5.2 WELL DECOMISSIONING

Each of the individual air sparge and vapor monitoring wells were located at the Air Sparge Site using a combination of survey data acquired during installation, and geophysical utility locating equipment. The air sparge well collars and skirts and any associated concrete were removed and buried air sparge well heads were exposed using hand tools. A total of 15 of the 16 air sparge wells and the three vapor monitoring wells were exposed, decommissioned in-place, and backfilled with bentonite grout by Holt. Air sparge well AS-09 in the east-central portion of the Air Sparge Site could not initially be located because the metal plate that had been installed at each of the remaining locations had not been placed for this well. Air sparge well AS-09 was subsequently located by tracing the air supply line from the air sparge system vault, and was abandoned by Holocene in the same manner used for the other wells. Disturbed pavement at the property was patched to match existing cover, and disturbed landscaping was graded. The well installation areas disturbed during decommissioning are scheduled to be backfilled with top soil and reseeded during spring of 2017.

# 6.0 HCC SYSTEM MAINTENANCE ACTIVITIES

This section describes the maintenance activities performed by Glacier at the West Gate of the HCC System. The maintenance activities at this location are described in detail in the Technical Memorandum regarding Carbon Replacement in East Vault of West Gate of HCC System (Farallon 2017a), provided in Appendix C. The maintenance activities performed included the following:

- Excavation to the top of the vault, removal of sentry wells S2-BU and S2-BD, and lid removal;
- Removal of the GAC/pea gravel media, including vault dewatering;
- GAC/pea gravel media replacement;
- Sentry well reinstallation; and
- Restoration of the area.

## 6.1 WEST GATE EAST VAULT CARBON REMOVAL AND REPLACEMENT

To access the east vault of the West Gate, the area was excavated through approximately 5 feet of overburden material to expose the concrete lid of the vault. Excavated material was stockpiled adjacent to the excavation area, and reused as backfill during restoration. Each of the three approximately 10-ton concrete lid sections were removed using an excavator, and staged adjacent to the vault in the work zone. A detailed description of the vault lid removal process is provided in Appendix C.

Following removal of the lid sections, groundwater dewatering equipment was installed. Dewatering equipment included two water-resistant plywood and inflatable plastic barriers that placed along the up- and down-gradient sides of the vault to limit groundwater seepage. Groundwater remaining in the vault was evacuated using a combination of a vacuum truck and a submersible pump. Pumped groundwater was conveyed to a temporary water storage tank located adjacent to the HCC water treatment building, and ultimately treated for discharge using the HCC water treatment system. The GAC/pea gravel media was removed sequentially from the two in-series media chambers in the vault using the same vacuum truck in tandem with dewatering operations. The GAC/pea gravel removal was conducted in sequence to ensure that adsorptive media was present in the vault at all times during the media removal and replacement process. Material from the up-gradient chamber was removed and replaced with new media to a level above the groundwater level, before work proceeded in the down-gradient chamber. Extracted GAC/pea gravel media was stockpiled in the soil-handling facility on the southern portion of the BNSF railyard, and covered with plastic sheeting. The GAC/pea gravel media was hauled to the Republic Services, Inc. transfer facility in Seattle, Washington and transported to a Subtitle D waste disposal facility in Roosevelt, Washington under special waste profile No. 4178133228. This waste profile was established to support routine GAC change-outs for the carbon treatment vessels at the HCC water treatment plant, and was re-certified in October 2016 for disposal of the GAC/pea gravel media.

The media was replaced in-kind with a 70:30 GAC/pea gravel ratio by volume mixture. The media mixture was mixed on the site using an excavator bucket, and placed into the vault to match the previous fill depth. A total of 12.5 tons of GAC and approximately 23 tons of pea gravel were placed in the east vault of the West Gate.

## 6.2 WEST GATE RESTORATION

Following the GAC/pea gravel media replacement and final inspection of the vault, the lids to the vault were replaced using the existing gaskets on the top of the concrete vault walls. Before the lids were replaced, the original rebar dowel set pins, which had been installed on the top of the concrete vault walls during construction to guide and secure the vault lids during placement, were removed because they were deemed unnecessary given the configuration and bulk of the lids. The lid post holes for the set pins and the vault lid seams were grouted.

The final step taken in the GAC/pea gravel media replacement was reinstallation of sentry wells S2-BU and S2-BD in the vault by Holocene using a truck-mounted direct-push drill rig. The wells were constructed using 2-inch stainless steel screen and riser materials.

Following completion of the vault restoration, the excavation was fully backfilled and regraded. The vault area disturbed during decommissioning is scheduled for top soil placement and reseeding during spring of 2017.

# 7.0 SITE IMPROVEMENT ACTIVITIES

## 7.1 TOWN SEWER IMPROVEMENTS

As part of the 2015 CPS, the Town's sanitary sewer system was scheduled to be upgraded with a sanitary sewer pipe extension down Sixth Street to connect with the Teacherage, and private residences on Sixth Street. The Town's consultant, Gray & Osborne, Inc., provided the engineering design for the sewer system upgrades. During 2015 construction activities, it was discovered that portions of the sewer main that were thought to exist in Sixth Street had not been constructed, and that construction of the anticipated sewer improvements was not possible without redesign of the system. Gray & Osborne, Inc. provided updated design plan Sheet C-121 dated September 10, 2015, which took into account the existing sewer layout. The updated Gray & Osborne, Inc. design is provided on the Supplemental Sewer Plan in Appendix D.

A pre-construction meeting was held at the Skykomish Community Center on August 9, 2016 prior to mobilization to the Site for the Sixth Street sewer construction activities. Meeting attendees included representatives of BNSF; Farallon; Glacier; Gray & Osborne, Inc.; the Skykomish School District; the Town; and Ecology.

During the week of August 9, 2016, Glacier installed approximately 250 linear feet of 4-inch-diameter polyvinyl chloride sanitary sewer main in Sixth Street. The existing side sewer laterals connecting the mainline sewer in Sixth Street to the private residences were verified to be operational. The Town adjusted existing valves at each of the private residences on Sixth Street to redirect sanitary sewer discharge from existing drain fields to the new, improved Sixth Street sewer main. Prior to construction, effluent from the Teacherage septic tank discharged to the School building's septic system, which discharged to the Town sanitary sewer main located on Railroad Avenue. Glacier disconnected Teacherage septic tank effluent piping from the School building and connected it to a previously installed sewer lateral dedicated to the Teacherage. This lateral was installed during 2015 construction activities in anticipation of future connection with the Sixth Street system. Sanitary sewer improvements performed during 2016 construction activities are shown on the Supplemental Sewer Plan provided in Appendix D.

Following placement of sewer pipeline, the trench excavation was backfilled with existing aggregate fill material, and compacted using a hydraulic plate compactor. Compaction testing was performed by GeoTest Service, Inc. in accordance with the 2015 CPS. Asphalt pavement was placed along the trench in Sixth Street to match the existing road grade. Crosswalk striping was added to the Sixth Street road surface at the intersection with Railroad Avenue.

Pacific Surveying & Engineering, Inc. of Bellingham, Washington conducted an as-built survey of the Sixth Street sewer following installation and prior to backfilling activities. The as-built survey has been incorporated into the Supplemental Sewer Plan prepared by Gray & Osborne, Inc. provided in Appendix D.

## 7.2 SCHOOL BUILDING BASEMENT FLOOR IMPROVEMENTS

During the spring of 2016, Glacier restored the School building basement floor to provide a clean finish along the interior HWF conveyance piping trench locations. Gap filler material along the trench edges was removed with an electric grinder, and replaced with an epoxy-grout mixture. Seams were ground flush, and painted to match existing floor paint. These School building basement floor improvements were performed during school spring break to avoid impacting school operations.

# 8.0 WORK TO BE COMPLETED AFTER 2016

## 8.1 CLEANUP BENEATH THE SCHOOL BUILDING

The final phase of cleanup in the Town involves remediation of petroleum-contaminated soil and groundwater beneath the School building. This final phase of cleanup will be accomplished through operation of the HWF remediation system to reduce the amount of petroleum beneath the School building to the extent technically possible.

The first season of HWF system operation began with start-up in June 2016 and operation continued through August 2016. Ambient water flushing was performed from August 2016 until October 31, 2016. The system was shut down after weekly NAPL recovery rates had reached zero to protect equipment from freezing temperatures and high groundwater events during winter months. Additional information of the HWF operation is presented in the 2016 Hot Water Flushing Annual Remediation Performance Report (Farallon 2017c). The HWF system is scheduled to be restarted in June 2017 to prepare for the second season of HWF remediation.

## 8.2 HYDRAULIC CONTROL AND CONTAINMENT SYSTEM OPERATION

The HCC system operational objective of creating a hydraulic gradient reversal across the HCC system barrier wall gates has not been achieved, due to the high permeability of the coarse aggregate fill material that was placed within the barrier wall recovery trench and in the remedial excavation areas north of the barrier wall. BNSF will continue to pursue HCC system optimization efforts during 2017. The 2016 Annual HCC System Operations Report covering the period from January 1 through December 31, 2016 prepared by Farallon (2017b) on behalf of BNSF has been submitted to Ecology under separate cover.

## 8.3 SCHOOL SITE AND TOWN FINAL RESTORATION

Final Town right-of-way restoration was completed east of Sixth Street during the 2011 construction season. Final restoration of the School Site, the Sixth Street right-of-way, and the Railroad Avenue right-of-way south of the School Site will be completed following completion of the remedial work at the School Site, which will likely include equipment removal, well decommissioning, School Site cap removal, sheet pile removal, basement School floor restoration, and exterior restoration west of the eastern side of Sixth Street.

# 9.0 SUMMARY

Remediation system installation, maintenance, and decommissioning activities were conducted at the Site during 2016 on behalf of BNSF. Based on testing and inspections conducted during the 2016 HWF installation and startup, it is the opinion of the Project Professional Engineer that the work was completed in substantial compliance with the plans, specifications, and design quality objectives pertaining to the cleanup action. Gray and Osborne, Inc. provided design and construction oversight services related to the Sixth Street sewer installation on behalf of the Town of Skykomish. The record drawing prepared by Gray and Osborne, Inc. for the Sixth Street sewer installation is provided in Appendix D.

The only petroleum-contaminated soil and groundwater remaining at the Site north of the HCC barrier wall that requires further remediation is beneath the School building. Remediation will continue in the spring and summer of 2017. Ambient water-flushing operations may be performed during the fall of 2017 until NAPL recovery rates approach zero.

# 10.0 BIBLIOGRAPHY


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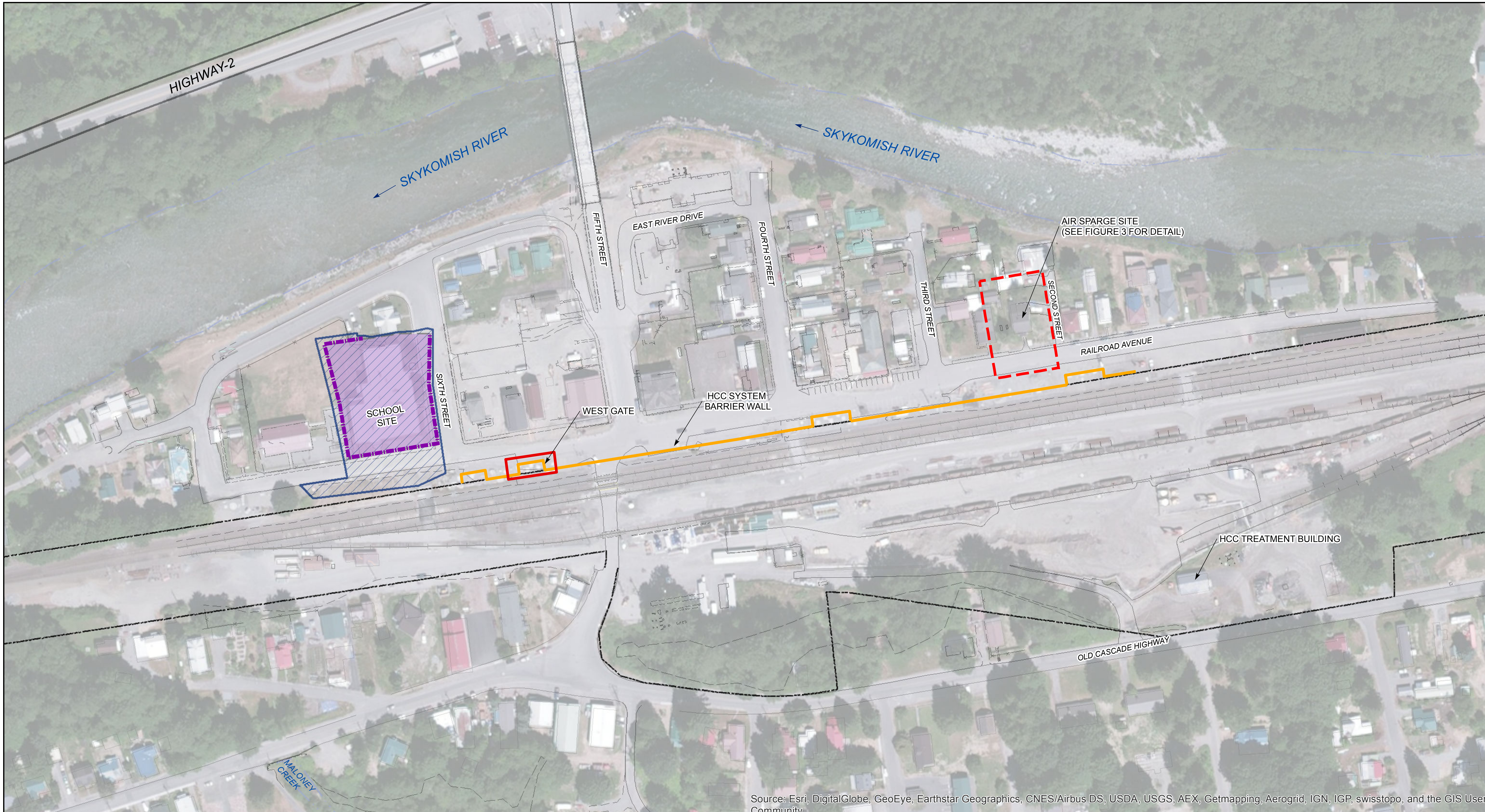
# FIGURES

2016 AS-BUILT COMPLETION REPORT
BNSF Former Maintenance and Fueling Facility
Skykomish, Washington

Farallon PN: 683-057




## LEGEND

- SCHOOL SITE
- HOT WATER FLUSHING (HWF) SYSTEM AT THE SCHOOL SITE
- AIR SPARGE SITE
- WEST GATE OF HCC SYSTEM
- HCC SYSTEM BARRIER WALL
- BNSF RAILYARD
- HWF SYSTEM BARRIER WALL

HCC = HYDRAULIC CONTROL AND CONTAINMENT SYSTEM

IMAGERY SOURCE: USDA FARM SERVICE AGENCY(FSA)
NATIONAL AGRICULTURE IMAGERY PROGRAM (NAIP) 2015

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SCALE IN FEET

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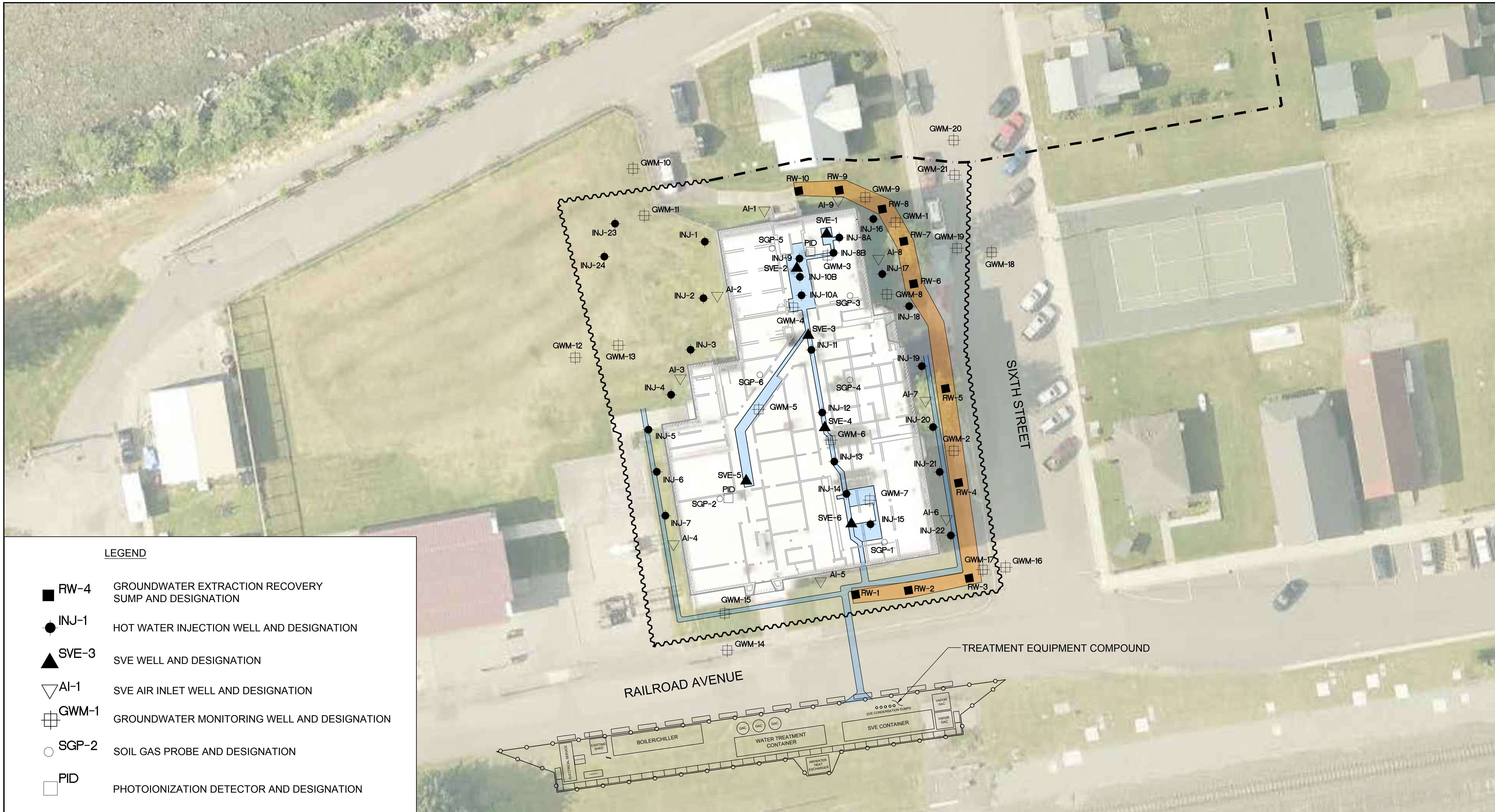
FIGURE 1
SITE LAYOUT
2016 AS-BUILT COMPLETION REPORT
BNSF FORMER MAINTENANCE AND FUELING FACILITY
SKYKOMISH, WASHINGTON
FARALLON PN: 683-057

Drawn By: tperrin | Checked By: AV | Date: 3/23/2017 | Disc Reference:
Document Path: G:\Projects\683 BNSF\683043 Skykomish Ongoing Cleanup Activities\GIS\FIGURE1_683057_site.mxd




LEGEND

| | |
|---|---|
| RW-4 | GROUNDWATER EXTRACTION RECOVERY SUMP AND DESIGNATION |
| INJ-1 | HOT WATER INJECTION WELL AND DESIGNATION |
| SVE-3 | SVE WELL AND DESIGNATION |
| AI-1 | SVE AIR INLET WELL AND DESIGNATION |
| GWM-1 | GROUNDWATER MONITORING WELL AND DESIGNATION |
| SGP-2 | SOIL GAS PROBE AND DESIGNATION |
| PID | PHOTOIONIZATION DETECTOR AND DESIGNATION |
| | 2006 MSE WALL |
| | SHEET PILE BARRIER WALL |
| | GROUNDWATER AND LNAPL RECOVERY TRENCH |
| | TREATMENT PIPING CORRIDOR |

0 40
Scale in feet

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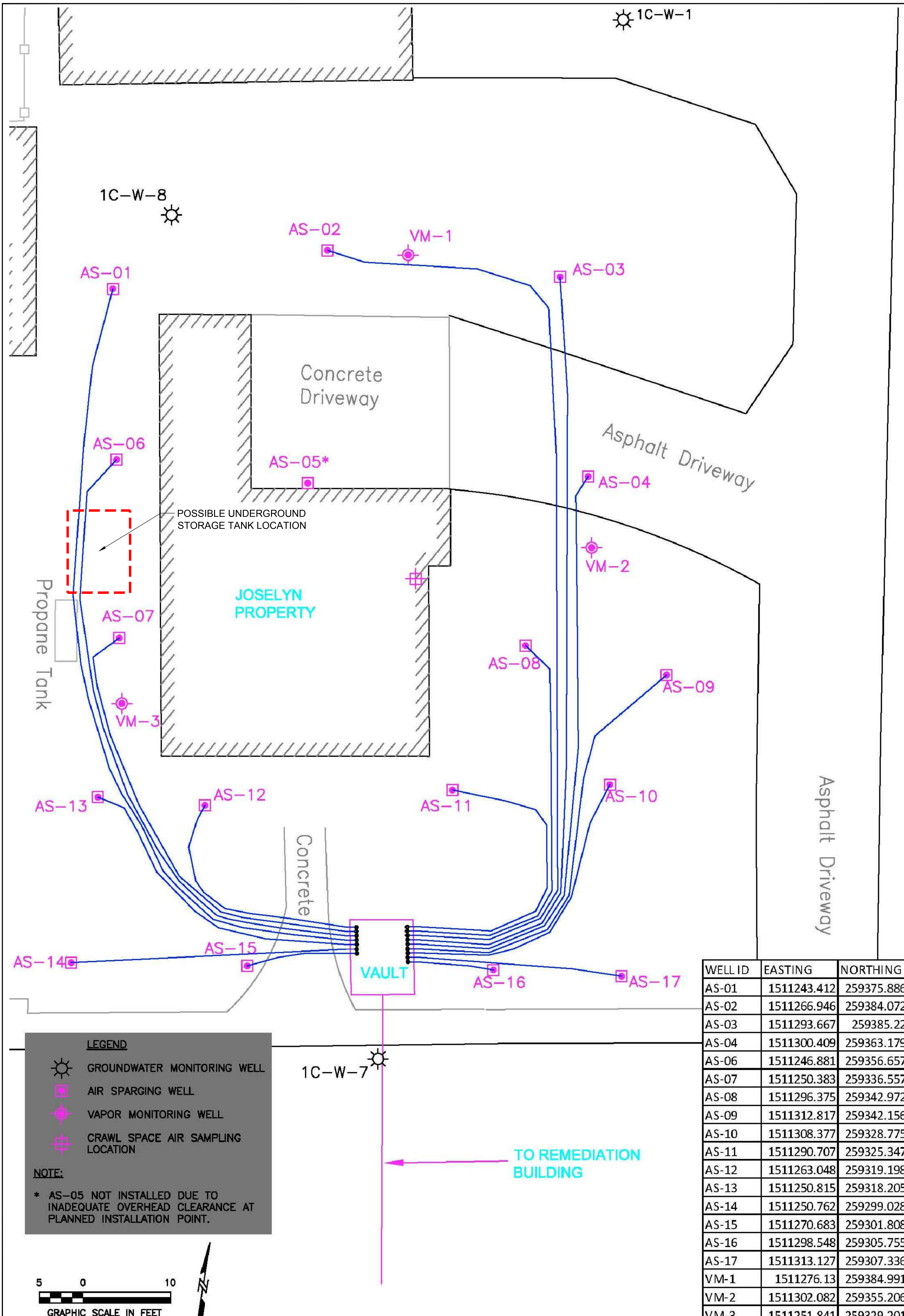
# FIGURE 2

HOT WATER FLUSHING SYSTEM LAYOUT
2016 AS-BUILT COMPLETION REPORT
BNSF FORMER MAINTENANCE
AND FUELING FACILITY
SKYKOMISH, WASHINGTON

FARALLON PN: 683-057

Drawn By: JS | Checked By: AV | Date: 2/13/2017 | File: FIGURE 2




| WELL ID | EASTING | NORTHING |
|---|---|---|
| AS-01 | 1511243.412 | 259375.886 |
| AS-02 | 1511266.946 | 259384.072 |
| AS-03 | 1511293.667 | 259385.22 |
| AS-04 | 1511300.409 | 259363.179 |
| AS-06 | 1511246.881 | 259356.657 |
| AS-07 | 1511250.383 | 259336.557 |
| AS-08 | 1511296.375 | 259342.972 |
| AS-09 | 1511312.817 | 259342.156 |
| AS-10 | 1511308.377 | 259328.775 |
| AS-11 | 1511290.707 | 259325.347 |
| AS-12 | 1511263.048 | 259319.198 |
| AS-13 | 1511250.815 | 259318.205 |
| AS-14 | 1511250.762 | 259299.028 |
| AS-15 | 1511270.683 | 259301.808 |
| AS-16 | 1511298.548 | 259305.755 |
| AS-17 | 1511313.127 | 259307.336 |
| VM-1 | 1511276.13 | 259384.991 |
| VM-2 | 1511302.082 | 259355.206 |
| VM-3 | 1511251.841 | 259329.201 |

SOURCE: 2011 ANNUAL SPARGING SYSTEM REPORT, BNSF FORMER MAINTENANCE AND FUELING FACILITY SKYKOMISH, WASHINGTON. PREPARED BY AECOM ENVIRONMENTAL. DATED FEBRUARY 2012.

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FIGURE 3

AIR SPARGE SITE
2016 AS-BUILT COMPLETION REPORT
BNSF FORMER MAINTENANCE AND FUELING FACILITY
SKYKOMISH, WASHINGTON

FARALLON PN: 683-057

Drawn By: AEV | Checked By: JTH | Date: 2/13/2017 | Disk Reference: AIR.dwg

**APPENDIX A**
**RESPONSE TO COMMENTS**

2016 AS-BUILT COMPLETION REPORT
BNSF Former Maintenance and Fueling Facility
Skykomish, Washington

Farallon PN: 683-057

**RESPONSE TO COMMENTS**
**2016 AS-BUILT COMPLETION REPORT**
**FARALLON PN: 683-057**

| Draft 2016 As-Built Completion Report | Ecology Comment | BNSF Response |
|---|---|---|
| Draft—Issued for Ecology Review dated March 2017<br><br>Table of Contents | Revise or add section to address the following:<br><br>Add the final version of Response to Comments matrix as an appendix to the final report and revise the Table of Contents accordingly. | The Table of Contents, page ii, and the attached appendices have been revised to include a new appendix, designated Appendix A, Response to Comments. The remaining three appendices have been renamed Appendices B through D, and the in-text references revised accordingly. Reference to Appendix A and the comments received from Ecology have been included in Section 1.0, Introduction, on page 1-1. |
| **Section 1.2 HCC System Operations Across the Site, page 1-2**<br><br>*Since initial start-up in 2008, the HCC system has been operated in accordance with the 2011 Operation and Maintenance Manual for the Hydraulic Control and Containment System (AECOM Environment [AECOM] 2011).* | The O&M Manual makes clear the groundwater recovery operations are to pump sufficient volumes to create an artificial gradient at the gates from the northern (downgradient) to southern (upgradient) side of the barrier wall to achieve hydraulic control.<br><br>Monitoring data confirms the HCC system has not achieved hydraulic control.<br><br>Delete italicized text and revise section to explain the HCC system is not operating in accordance with the 2011 O&M Manual and will undergo optimization efforts in 2017. | The italicized text has been deleted and the following text has been added as the first paragraph of Section 1.2, HCC System Operations Across the Site:<br><br>*The primary objective of the HCC system described in the CAP (Ecology 2007), HCC System Special Design Report (ENSR Corporation 2008), and Operation and Maintenance Manual for the HCC System (AECOM Environment 2011), is to prevent the migration of NAPL and contaminated groundwater from the BNSF railyard, and this objective has been achieved. The HCC system also had an operational objective of creating a hydraulic gradient reversal across the barrier wall gates, this has not been achieved, due to the high permeability of the coarse aggregate fill material that was placed within the barrier wall recovery trench and in the remedial excavation areas north of the barrier wall. This fill material was placed after the HCC system design was completed, and exhibits a substantially greater hydraulic conductivity than assumed in the groundwater modeling that informed the system design. BNSF will continue to pursue HCC system optimization efforts during 2017.*<br><br>The reference to the HCC System Special Design Report has been added to Section 10.0, Bibliography. |
| **Section 8.2 School Site and Town Final Restoration, page 8-1**<br><br>*The HCC system is operated in accordance with the Operation and Maintenance Manual for the Hydraulic Control and Containment System (AECOM 2011).* | See previous comment.<br><br>Delete italicized text and revise section to explain the HCC system is not operating in accordance with the 2011 O&M Manual and will undergo optimization efforts in 2017. | The italicized text has been deleted and the following text has been added as the first paragraph of Section 8.2, Hydraulic Control and Containment System Operation:<br><br>*The HCC system operational objective of creating a hydraulic gradient reversal across the barrier wall gates has not been achieved, due to the high permeability of the coarse aggregate fill material that was placed within the barrier wall recovery trench and in the remedial excavation areas north of the barrier wall. BNSF will continue to pursue HCC system optimization efforts during 2017.*<br><br>The reference to the 2016 Annual HCC System Operations Report at the end of the first paragraph of Section 8.2, Hydraulic Control and Containment System Operation, has also been revised to cite the correct full title of the document. |

| Draft 2016 As-Built Completion Report | Ecology Comment | BNSF Response |
|---|---|---|
| **Section 9.0 Summary, page 9-1** | Revise section to include opinion from the engineer, based on testing results and inspections, as to whether the 2016 cleanup actions have been constructed in substantial compliance with the plans and specifications and related documents [see WAC 173-340 400(6)(b)(ii)]. | The text of the first paragraph of Section 9.0, Summary, has been augmented to include the following:<br><br>*Based on testing and inspections conducted during the 2016 HWF installation and startup, it is the opinion of the Project Professional Engineer that the work was completed in substantial compliance with the plans, specifications, and design quality objectives pertaining to the cleanup action. Gray and Osborne, Inc. provided design and construction oversight services related to the Sixth Street sewer installation on behalf of the Town of Skykomish. The record drawing prepared by Gray and Osborne, Inc. for the Sixth Street sewer installation is provided in Appendix D.* |

**APPENDIX B**
**SITE PHOTOGRAPHS**

2016 AS-BUILT COMPLETION REPORT
BNSF Former Maintenance and Fueling Facility
Skykomish, Washington

Farallon PN: 683-057

# SITE PHOTOGRAPHS
# 2016 As-Built Completion Report
# BNSF Former Maintenance and Fueling Facility
# Skykomish, Washington
# Farallon PN: 683-057

## AIR SPARGE

Photograph 1: Air sparge system vault prior to decommissioning activities.

Photograph 2: Backfill following removal of the air sparge system vault.

Photograph 3: Exposed air sparge well prior to decommissioning.

Photograph 4: Exposed air sparge well prior to decommissioning.

Photograph 5: Holt drilling decommissioning air sparge well with bentonite chips.

Photograph 6: Joslyn property following decommissioning, looking west.

## HOT WATER FLUSHING INSTALLATION

Photograph 7: Pad for the hot water flushing (HWF) treatment compound, looking west.

Photograph 8: Electrical panel and concrete pad for generator at the HWF treatment compound, looking west.

Photograph 9: Glacier installing condensation sumps for the soil vapor extraction (SVE) system.

Photograph 10: Piping connecting the SVE condensation sumps to the SVE container.

Photograph 11: Air-to-water heat exchanger installed adjacent to the HWF treatment compound.

Photograph 12: Boiler staged at the HWF treatment compound, looking east.

Photograph 13: HWF electrical panel and transformer, looking east.

Photograph 14: Temporary fuel storage tank for the HWF system.

Photograph 15: Liquid-phase granular activated carbon treatment vessels at the HWF treatment compound.

Photograph 16: Vapor-phase granular activated carbon treatment vessels at the HWF treatment compound.

Photograph 17: Groundwater recovery sump at the School Site following pump installation.

# SEWER

Photograph 18: Traffic control and fencing, looking west across Railroad Avenue.

Photograph 19: Steel plates placed across trench for emergency access at Railroad Avenue.

Photograph 20: Installed sewer cleanout south of Railroad Avenue, looking south.

Photograph 21: Sewer installation activities at Railroad Avenue and Sixth Street.

Photograph 22: Backfill and compaction activities south of Railroad Avenue.

Photograph 23: New wye of teacherage side sewer adjacent to existing capped side sewer.

Photograph 24: Sewer cleanout installed southwest of the teacherage.

Photograph 25: Sixth Street following backfill and compaction, looking north along Sixth Street.

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**Photograph 4**: Exposed air sparge well prior to decommissioning.


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# HOT WATER FLUSHING INSTALLATION

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## SEWER


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**Photograph 24**: Sewer cleanout installed southwest of the teacherage.

**Photograph 25**: Sixth Street following backfill and compaction, looking north.

# APPENDIX C
# CARBON REPLACEMENT TECHNICAL MEMORANDUM

2016 AS-BUILT COMPLETION REPORT
BNSF Former Maintenance and Fueling Facility
Skykomish, Washington

Farallon PN: 683-057

# T E C H N I C A L M E M O R A N D U M

**TO:** Brian Sato, P.E. – Washington State Department of Ecology

**cc:** Shane DeGross – BNSF Railway Company

**FROM:** Gerald Portele, Principal
Jason Shrope, P.E., Senior Engineer

**DATE:** January 4, 2017

**RE:** **CARBON REPLACEMENT IN EAST VAULT OF WEST GATE OF HCC SYSTEM**
**BNSF FORMER MAINTENANCE AND FUELING FACILITY**
**SKYKOMISH, WASHINGTON**
**FARALLON PN: 683-043**

Farallon Consulting, L.L.C. (Farallon) has prepared this technical memorandum on behalf of BNSF Railway Company (BNSF) to summarize the methods implemented for removal and replacement of the granular activated carbon (GAC)/pea gravel media in the east vault of the West Gate of the hydraulic control and containment (HCC) system in September 2016 at the BNSF Former Maintenance and Fueling Facility in Skykomish, Washington (herein referred to as the Site). This technical memorandum also provides recommendations for implementation of the GAC/pea gravel media removal and replacement process as part of future HCC system operation and maintenance activities conducted at the Site.

The West Gate is one of four gate installations that are part of the HCC system at the Site constructed in 2008. A detailed description of GAC/pea gravel removal and replacement was provided in the technical memorandum regarding Revised Work Plan for Carbon Replacement at East Vault of West Gate of HCC System dated August 12, 2016.

The West Gate consists of two separate vaults, each containing an oil-water separator followed by two partitioned chambers containing a GAC and pea gravel mix at a 70:30 ratio by volume. Each vault in the West Gate is covered by three lids that are oriented in a north-south direction, perpendicular to the oil-water separator and the GAC/pea gravel media chambers. The plan set in Attachment A depicts the gate and vault configurations in plan view and in cross-section.

Farallon provided project coordination, design support services, and technical guidance for replacement of the GAC/pea gravel media in the two chambers comprising the east vault of the West Gate. Construction support services were provided by Glacier Environmental Services, Inc. of Mukilteo, Washington (Glacier). A description of the work undertaken to complete the GAC/pea gravel media replacement is provided below. Photographs showing the GAC/pea gravel media replacement process are provided in Attachment B.

## GAC/PEA GRAVEL MEDIA REPLACEMENT

The methods for conducting the GAC/pea gravel media replacement are described in the following sections:

- Obtaining required permits;
- Groundwater elevation monitoring;
- Temporary erosion and sediment control;
- Asphalt and concrete gutter protection;
- Excavation to the top of the vault and lid removal;
- Removal of the GAC/pea gravel media, including vault dewatering;
- GAC/pea gravel media replacement; and
- Restoration of the area.

### Permitting

Prior to the GAC/pea gravel media replacement, a Street Use Permit was obtained by Glacier from the Town of Skykomish for the work to be conducted in the right-of-way of Railroad Avenue in Skykomish.

### Groundwater Elevation Monitoring

Prior to the GAC/pea gravel media replacement, groundwater elevations were monitored in the piezometers, sentry wells, and the gate well proximate to the West Gate. A second set of groundwater elevation data was obtained from the same locations following completion of the GAC/pea gravel media replacement. The groundwater elevation data were evaluated to assess flow conditions at and proximate to the West Gate before and after the GAC/pea gravel media replacement. There were no discernible indications of changes in flow conditions or the transmissivity of groundwater through the vault as a result of the GAC/pea gravel replacement. Between the initial set of water level measurements on August 17, 2016 and the second measurements on September 19, 2016, the seven wells and piezometers monitored increased in elevation by an average of 0.6 foot while the elevation of the Skykomish River increased by 0.8 foot. These measurements are consistent with the trends typically observed at the Site.

### Temporary Erosion and Sediment Control

Work zones, stockpile areas, and contractor lay-down areas were cordoned off using traffic cones and temporary fencing. Stormwater catch basins within 100 feet of the work areas were protected using sandbags and filter socks to ensure that no runoff from the work area entered the stormwater system. A fully stocked spill kit, plastic sheeting, and sandbags for additional stormwater protection were available on the Site throughout the project duration, although not needed. The work area was swept clean of loose soil before workers left the Site, and a street sweeper was used to clean tracked dirt.

### Asphalt and Concrete Gutter Protection

The northern outside face of the vault is approximately 2 feet from the southern side of the adjacent concrete gutter in Railroad Avenue. It was not necessary to remove any portion of the concrete gutter or the asphalt concrete pavement during construction due to the installation of construction shoring south-adjacent to Railroad Avenue on the northern side of the vault. Metal plates were placed over the concrete gutter and the asphalt concrete where needed to prevent damage by construction equipment (see photographs in Attachment B).

**Excavation to Vault Top and Lid Removal**

Approximately 5 feet of soil was removed from the top of the vault lids. Excavators worked around the access risers that had been placed to provide access to the oil-water separator and the GAC/pea gravel media chambers (Attachment A), and shoring was installed along the northern and southern sides of the vault. Vault lids were exposed, and excavated material was stockpiled adjacent to the excavation area and reused as backfill during restoration.

Following removal of the overburden, the access lids and risers were removed from the top of the vault. The two sentry wells that had been installed through the risers at the center access point also were removed. Risers and access lids south-adjacent to the excavation were temporarily shored to prevent impact from construction activities.

Once the three vault lids were exposed, several unexpected conditions were encountered:

- The lift loops identified on the as-built drawings and used to originally place each of the vault lids had been removed. Installation of new lift anchor bolts was required to remove each of the vault lids. The vaults were originally constructed by Concrete Technology Corporation of Tacoma, Washington. Farallon contacted Concrete Technology Corporation to determine the size, strength, and installation location for new lift anchor bolts. Hilti brand adhesive and anchor rods were specified by Farallon and installed by Glacier at the same locations as the original lift loops.
- The seams between the vault lids had been sealed using an epoxy grout, which had to be removed before the vault lids could be lifted.
- The rebar dowel posts used to secure the vault to the lids had been grouted in-place with high-strength, non-shrink grout. Two additional rebar dowel posts not shown on the as-built plans were present on each of the narrow ends of the vaults. The rebar dowel post connections were core-drilled to enable removal of the lids from the vault.

The three approximately 10-ton lid sections were removed using an excavator, and were staged adjacent to the vault in the work zone before the GAC/pea gravel media was removed and replaced.

**GAC/Pea Gravel Media Removal**

The GAC/pea gravel media is contained in up-gradient and down-gradient chambers inside the vault. GAC/pea gravel media removal and replacement were completed sequentially in each of the chambers to ensure that GAC/pea gravel media was present in the east vault of the West Gate at all times. No personnel were required to enter the vault during the GAC/pea gravel media removal and replacement effort.

Approximately 3 feet of groundwater was present in the vault prior to dewatering. A vacuum truck with a positive displacement pump and high vacuum capacity was used initially to remove the GAC/pea gravel media present above the groundwater table from the up- and down-gradient chambers using an overhead stinger. When the unsaturated material had been removed, GAC chamber dewatering was instituted as described below.

**Vault Dewatering and Water Management**

The chambers containing the GAC/pea gravel media are enclosed by metal mesh with an internal support framework. Gaps are present between the oil-water separator baffle on the up-gradient side of the vault and the first GAC/pea gravel chamber, and on the down-gradient side of the vault between the down-gradient side of the second GAC/pea gravel media chamber and the down-gradient concrete face of the vault. The presence of these gaps enabled installation of temporary water-resistant barriers to impede groundwater flow into the vault.

Two water-resistant barriers were constructed to limit the flow of water into both the up-gradient and down-gradient sides of the east vault. The water barriers were constructed of plywood, with a continuous 2-inch-diameter hose along the bottom and two sides. Once the barrier was lowered into place, the hose was inflated with air in an effort to create a water-tight seal. The presence of loose imported aggregate material along the bottom of the vault prevented attaining a water-tight seal at both barrier locations, so groundwater flow into the vault was reduced, but not eliminated.

The water in the vault was then pumped to lower the water level in the GAC/pea gravel media chambers. A submersible pump was used to continuously pump water from the vault in the area up-gradient of the metal mesh enclosure at a rate of approximately 100 gallons per minute. The pumped water was conveyed through an existing unused 3-inch-diameter pipe to a 500-barrel weir settling tank near the HCC system groundwater treatment building on the southern side of the railyard. The water removed during the GAC/pea gravel media replacement process subsequently was treated by the HCC treatment system. The dewatering process had limited influence, lowering the water level to a total depth of approximately 2 feet in the east vault.

During the GAC/pea gravel media replacement process, the up-gradient portion of the oil-water separator was monitored for the presence of light nonaqueous-phase liquid (LNAPL). A heavy trace of LNAPL was observed and recorded. Approximately 20 gallons of an LNAPL-water mix was removed using a vacuum-equipped liquid-transfer trailer, and was transported for treatment using the HCC treatment system.

When the removal of the unsaturated GAC/pea gravel media was complete and the dewatering procedure had been initiated, a vacuum truck was operated in tandem with the 6,000-gallon-capacity vacuum-equipped liquid-transfer truck and trailer to facilitate removal of the saturated GAC/pea gravel media from the up-gradient chamber. Because the GAC/pea gravel media chamber could not be fully dewatered, the vacuum truck was used to extract a GAC/pea gravel media-water mix once the saturated material was encountered. Water that accumulated in the vacuum truck was decanted, using the vacuum-equipped liquid-transfer truck and trailer for additional water storage. This tandem system was capable of operating for approximately 1.5 hours before the vacuum truck required emptying. The extracted GAC/pea gravel media was then transported and placed into the containment area near the HCC water treatment building pending transport for disposal off the Site. After approximately 4.5 hours of operation, water in the vacuum-equipped liquid-transfer truck and trailer was transferred to two 20,000-gallon settling tanks that had been staged in the containment area on the southern portion of the railyard. Residual water collected in the sump in the containment area subsequently was transferred to the settling tanks for treatment. The excess water pumped and transported to the HCC water treatment building during the GAC/pea gravel media removal process was temporarily stored in the settling tanks before being discharged to the treatment facility at a rate that allowed for treatment of the influent water from the HCC system and the stored water consistent with the design capacity of the treatment system.

Material from the up-gradient chamber was removed and then refilled with new media to a level above the groundwater level before proceeding to the down-gradient chamber. The tandem operation of the vacuum truck and the vacuum-equipped liquid-transfer truck and trailer continued for the removal of saturated GAC/pea gravel media from the down-gradient chamber.

**GAC/Pea Gravel Media Replacement**

The GAC/pea gravel media used for replacement of the extracted material was blended to match the existing media mix at a 70:30 ratio by volume in small 3- to 5-cubic-yard batches using the excavator and a small dump truck. Care was taken to gently mix the materials using the excavator bucket to ensure that the integrity of the GAC in the mixture was maintained throughout the mixing and placement process. Following mixing, the excavator was used to place the new GAC/pea gravel media into the up-gradient and down-gradient vault chambers. The new material was added until it was approximately 12 inches from the top of the metal framework, matching the previous volume. The quantities of material placed in the GAC/pea gravel media chambers in the east vault of the West Gate were 12.5 tons of GAC and approximately 23 tons of pea gravel.

**Restoration**

Following the GAC/pea gravel media replacement and final inspection of the vault, the lids to the vault were replaced using the existing gaskets on the top of the concrete vault walls. Before the lids were replaced, the rebar dowel set pins, originally installed on the top of the concrete vault walls during construction to guide and secure the vault lids during placement, were removed because they were deemed to be unnecessary given the configuration and bulk of the lids. The lid post holes for the set pins and the vault lid seams were grouted. Following placement of the vault lids, the risers and access lids were replaced on top of the vault lids, and the aggregate material and topsoil removed at the outset of the process were reused as backfill. Following backfilling and compacting, mulch and seed were applied to the excavation area and to surrounding areas where vegetation had been disturbed. The final step taken was reinstallation of the two sentry wells in the vault using direct-push drilling equipment. The sentry wells were reinstalled by Holocene Drilling, Inc. of Puyallup, Washington using a truck-mounted direct-push drill rig. The wells were constructed using 2-inch stainless steel screen and riser materials.

**RECOMMENDATIONS**

Based on the conditions encountered during the September 2016 GAC/pea gravel media replacement process, the following recommendations are provided for future replacement actions:

- A crane with appropriate lift rigging should be used to lift and remove the vault lids to provide added stability and improve safety during lifting.
- The contractor should be prepared to install new lift anchor bolts to replace several that required removal for secure placement of the vault risers, and in the event that existing lift anchor bolts exhibit indication of corrosion.
- GAC/pea gravel media removal and replacement should be implemented during the low-groundwater season, typically from late August through September.
- Use of a dredge-style pump in combination with a sludge dewatering box lined with filter fabric is anticipated to be more expeditious and efficient for removal of saturated GAC/pea gravel media below the water level than the combined use of a vacuum truck and vacuum-equipped liquid-transfer truck and trailer.
- Care should be taken during installation of the replacement GAC/pea gravel media to avoid over-mixing and pulverizing the GAC, thereby reducing its effectiveness in absorbing contaminants.

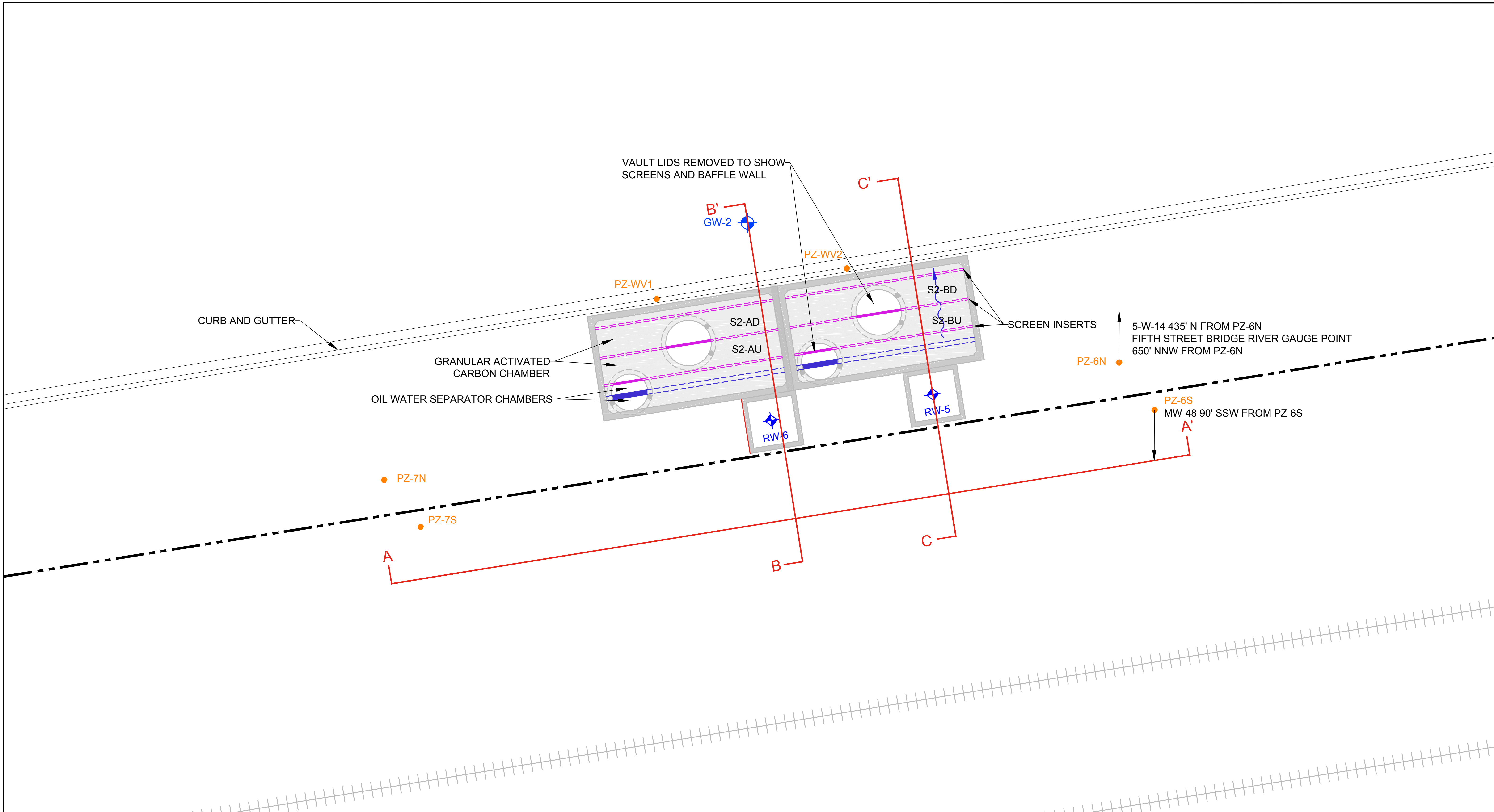
Attachments: Attachment A, West Gate Figures
Attachment B, Construction Photographs

JS/GJP:bjj

# ATTACHMENT A
# WEST GATE FIGURES

CARBON REPLACEMENT AT EAST VAULT OF
WEST GATE OF HCC SYSTEM
BNSF Former Maintenance and Fueling Facility
Skykomish, Washington

Farallon PN: 683-043




LEGEND

WATER FLOW DIRECTION

RAILROAD TRACKS

GW-2 MONITORING WELL

RW-5 RECOVERY WELL

PZ-7N PIEZMOMETER

A A' LINE OF CROSS-SECTION

ALL LOCATIONS APPROXIMATE

0' SCALE IN FEET 10'

N

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Washington
Issaquah | Bellingham | Seattle

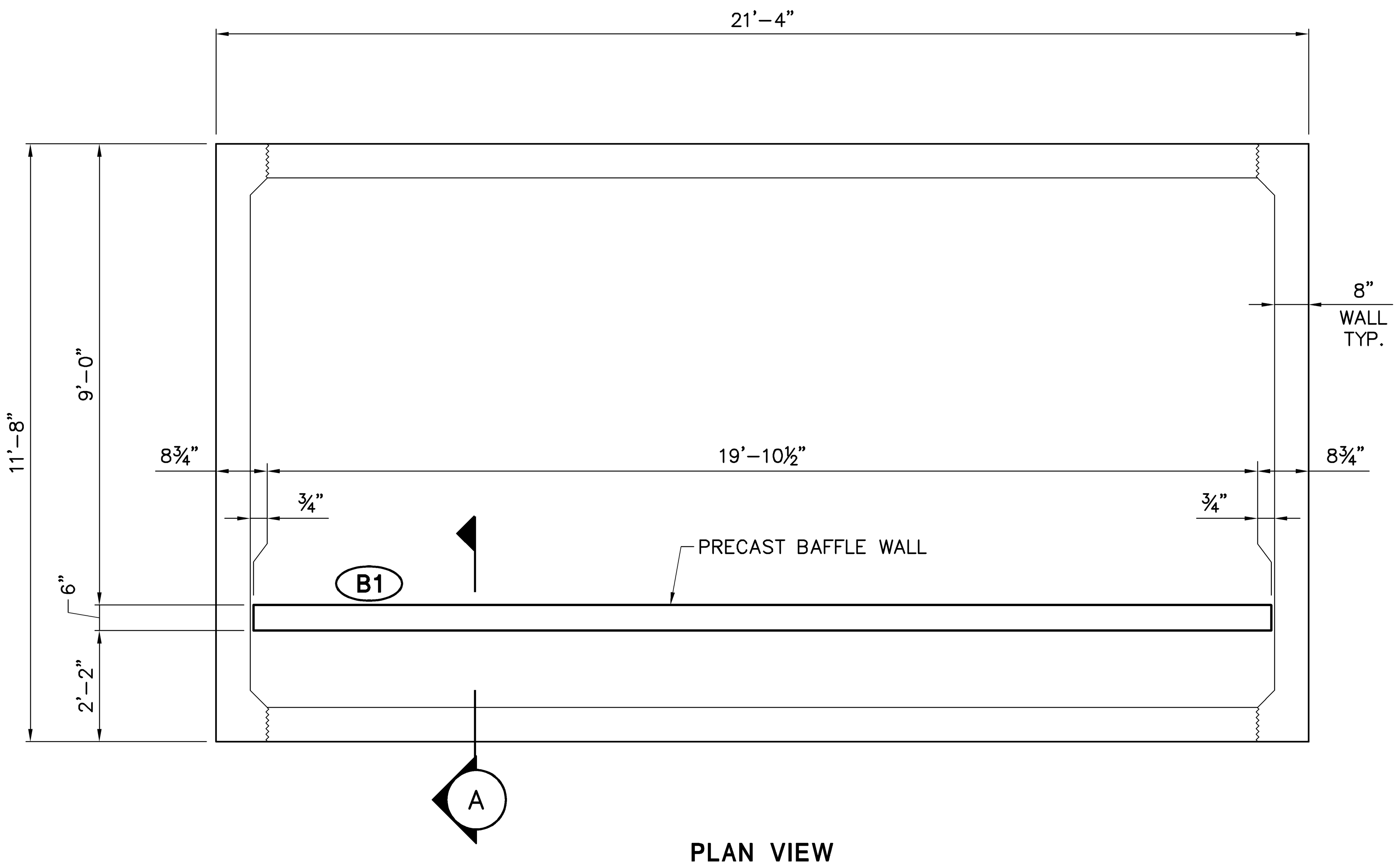
Oregon
Portland | Bend | Baker City

California
Oakland | Sacramento | Irvine

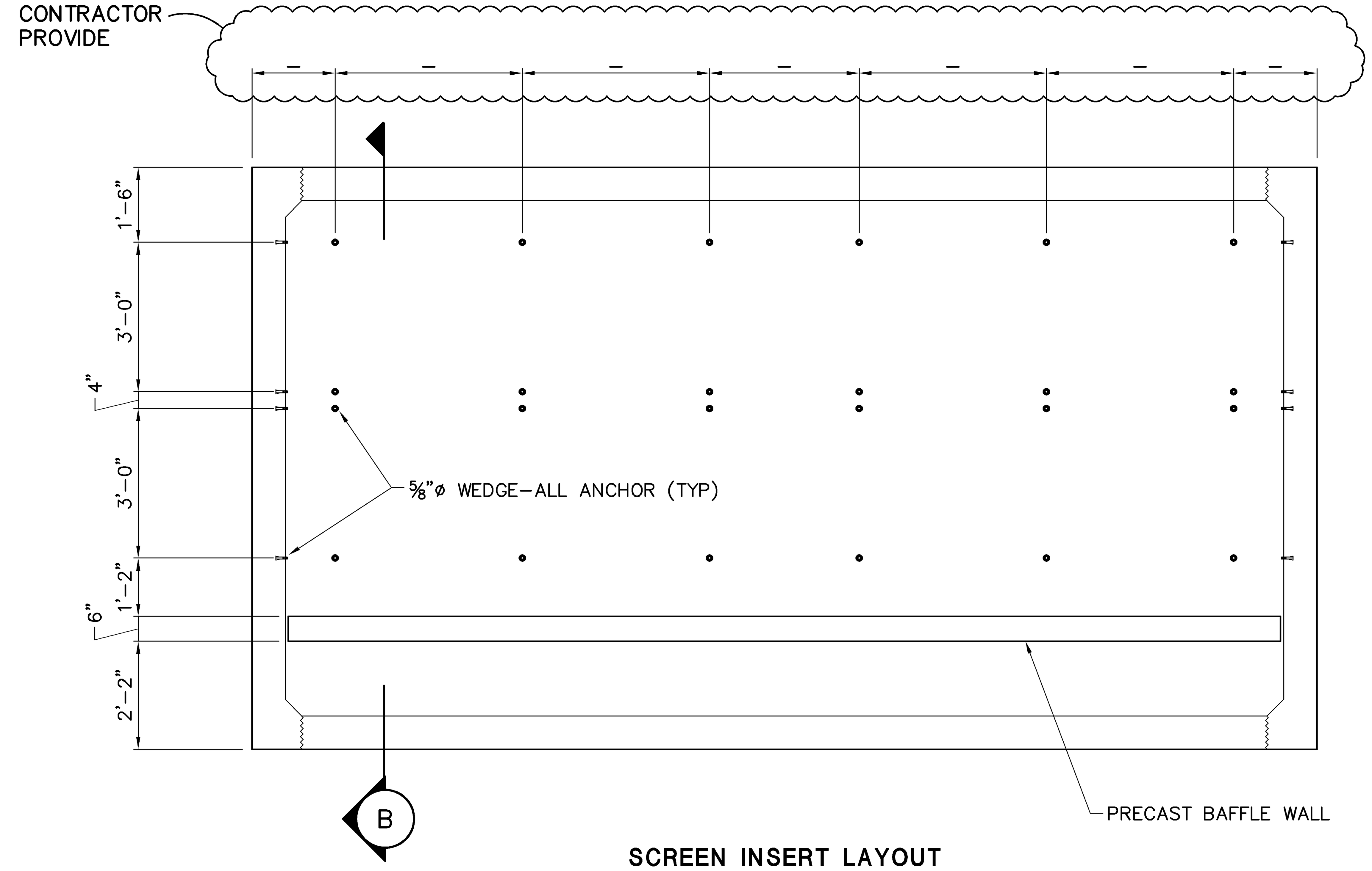
PLAN VIEW OF HCC SYSTEM WEST GATE
BNSF FORMER MAINTENANCE AND FUELING FACILITY
SKYKOMISH, WASHINGTON

FARALLON PN: 683-043

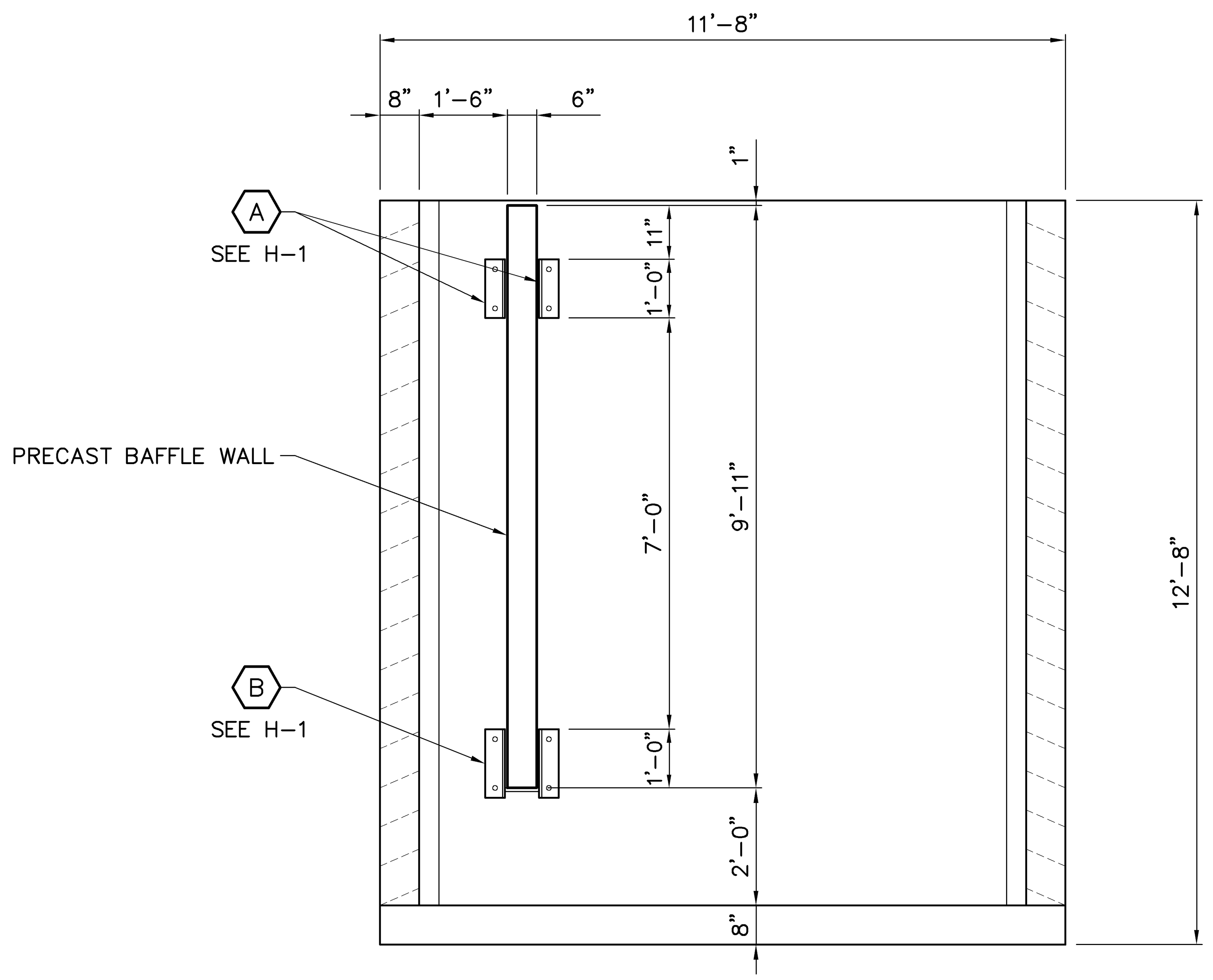
Drawn By: DJR | Checked By: DEW | Date: 12/29/2015 | Disk Reference: 683-043-028D.dwg



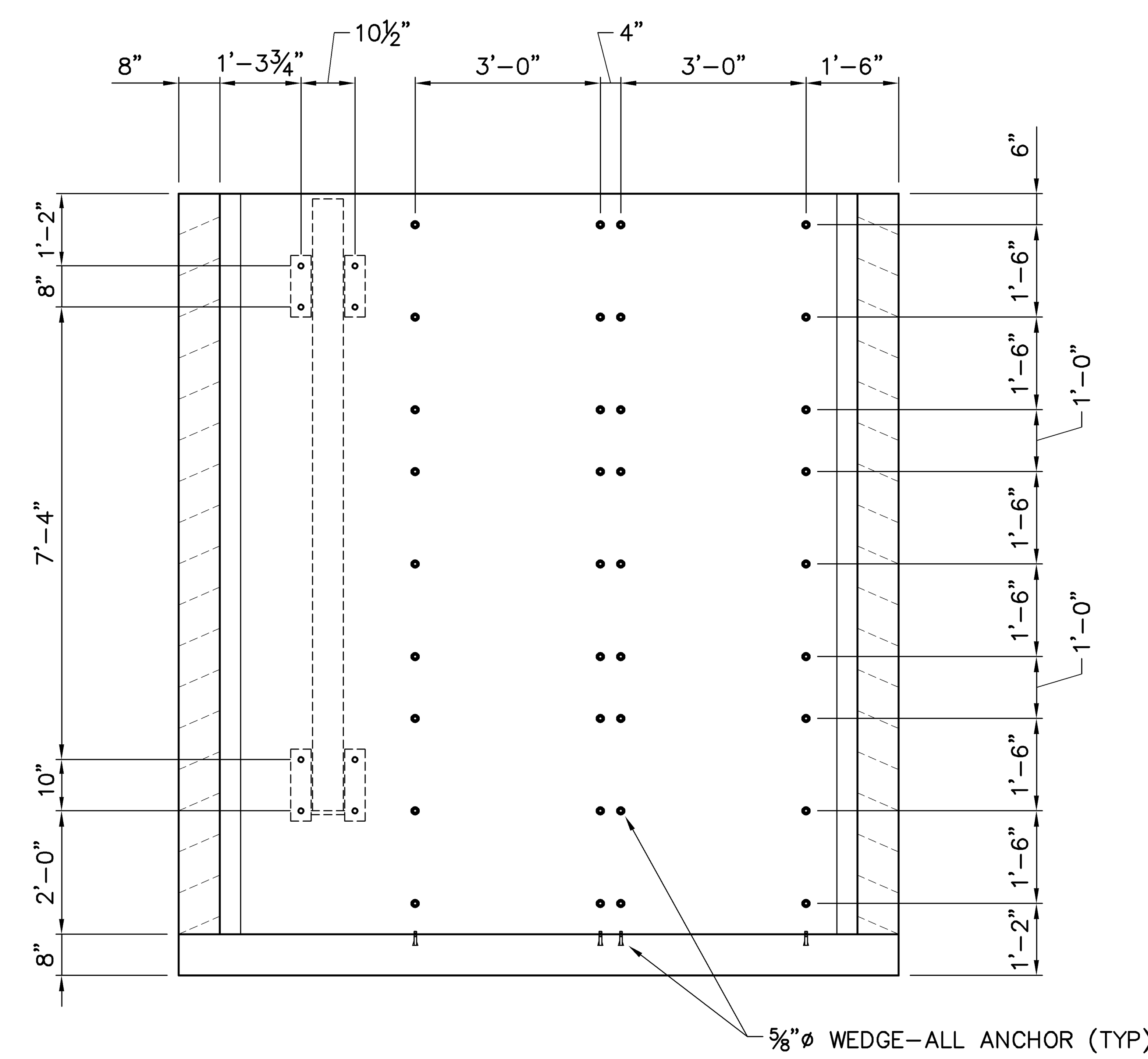

PLAN VIEW




SCREEN INSERT LAYOUT
PLAN VIEW




SECTION A




ELEVATION B

C.T.C.
FOR APPROVAL
05/16/2008
IMPORTANT
Production and/or delivery
may be re-scheduled
unless drawings are
RETURNED APPROVED
by
MAY 30, 2008



| No. | Revisions | By | App'd | Date |
|---|---|---|---|---|
| | | | | |

CONTRACTOR : (206) 625–6298
BNSF
2454 OCCIDENTAL AVE. S., SUITE 1A
SEATTLE, WA 98134

Design
Drawn PDT
Checked CW
Approved

DO NOT SCALE

CONCRETE TECHNOLOGY CORP.
MANUFACTURERS OF PRESTRESSED CONCRETE
1123 PORT OF TACOMA ROAD
TACOMA, WASHINGTON 98421

BNSF - SKYKOMISH GATES
SKYKOMISH, WASHINGTON

PRECAST BAFFLE WALL

Date MAY 2008
Sh. No. of
Dwg. No. P–3
Job. No. 08042C

**ATTACHMENT B**
**CONSTRUCTION PHOTOGRAPHS**

CARBON REPLACEMENT AT EAST VAULT OF
WEST GATE OF HCC SYSTEM
BNSF Former Maintenance and Fueling Facility
Skykomish, Washington

Farallon PN: 683-043

# SITE PHOTOGRAPHS

**Carbon Replacement in East Vault of West Gate of HCC System**
**BNSF Former Maintenance and Fueling Facility**
**Skykomish, Washington**
**Farallon PN: 683-043**

Photograph 1: Preconstruction Site conditions.

Photograph 2: Beginning excavation.

Photograph 3: Excavation to vault top.

Photograph 4: Removal of Vault Access Hatch

Photograph 5: Coring rebar dowel post connections.

Photograph 6: Removal of vault access lid and risers.

Photograph 7: Hilti adhesive for installation of new anchor bolts for lifting.

Photograph 8: New anchor bolts installed.

Photograph 9: Exposed vault lid.

Photograph 10: Lifting concrete vault lid.

Photograph 11: Removal of concrete vault lid.

Photograph 12: Exposed vault.

Photograph 13: Exposed vault.

Photograph 14: Removal of final concrete lid.

Photograph 15: Exposed vault.

Photograph 16: Beginning to vactor dry material in the up-gradient vault chamber.

Photograph 17: Installation of water barriers.

Photograph 18: Installation of water barriers.

Photograph 19: Water barrier detail.

Photograph 20: Water barrier detail.

Photograph 21: Dewatering vault.

Photograph 22: Removal of saturated material with vactor.

Photograph 23: Mixing GAC/pea gravel materials.

Photograph 24: Mixing GAV/pea gravel materials.

Photograph 25: Mixing GAC/pea gravel materials.

Photograph 26: Placement of GAC/pea gravel materials.

Photograph 27: Replaced material.

Photograph 28: Reinstallation of vault lid.

Photograph 29: Reinstallation of vault lids.

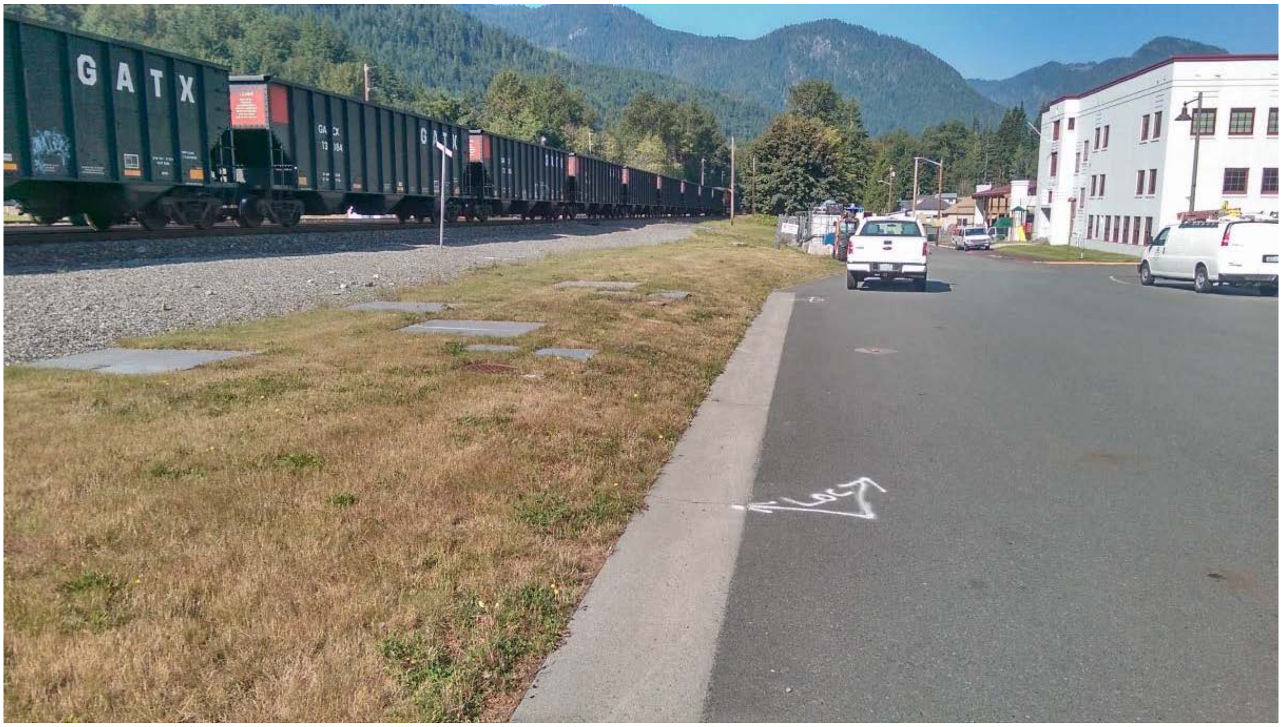
Photograph 30: Replacement of risers and access lids.

Photograph 31: Replacement of access riser.

Photograph 32: Grouting rebar dowel holes and vault seam.

Photograph 33: Backfill and compaction.

Photograph 34: Backfill and compaction.

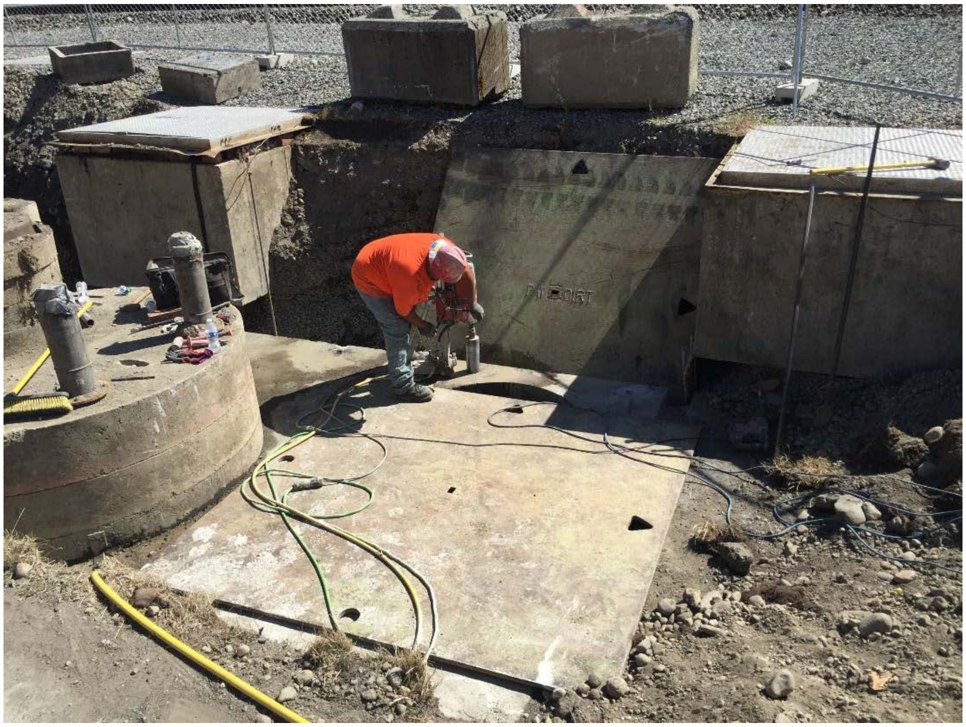



**Photograph 1**: Preconstruction Site conditions.

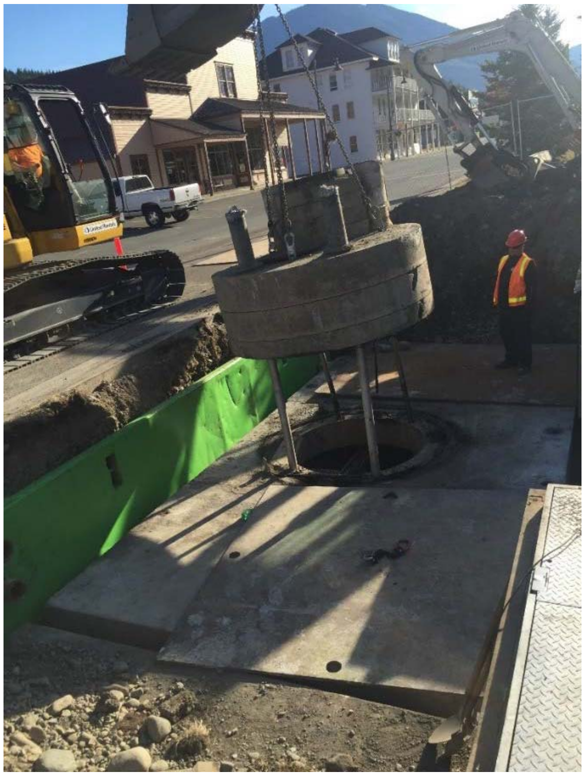

**Photograph 2**: Beginning excavation.

**Photograph 3**: Excavation to vault top.

**Photograph 4**: Removal of Vault Access Hatch



**Photograph 5**: Coring rebar dowel post connections.



**Photograph 6**: Removal of vault access lid and risers.


**Photograph 7**: Hilti adhesive for installation of new anchor bolts for lifting.

**Photograph 8**: New anchor bolts installed.

**Photograph 9**: Exposed vault lid.

**Photograph 10**: Lifting concrete vault lid.

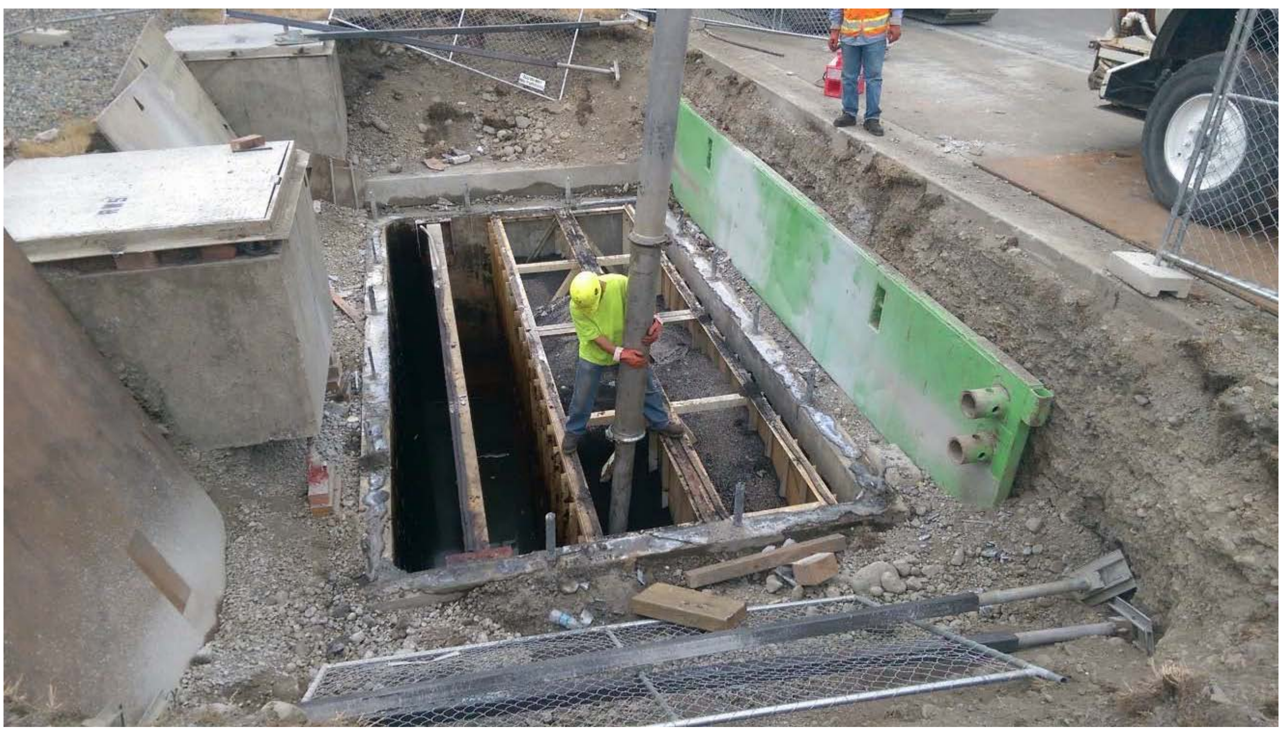
**Photograph 11**: Removal of concrete vault lid.

**Photograph 12**: Exposed vault.

**Photograph 13**: Exposed vault.

**Photograph 14**: Removal of final concrete lid.

**Photograph 15**: Exposed vault.



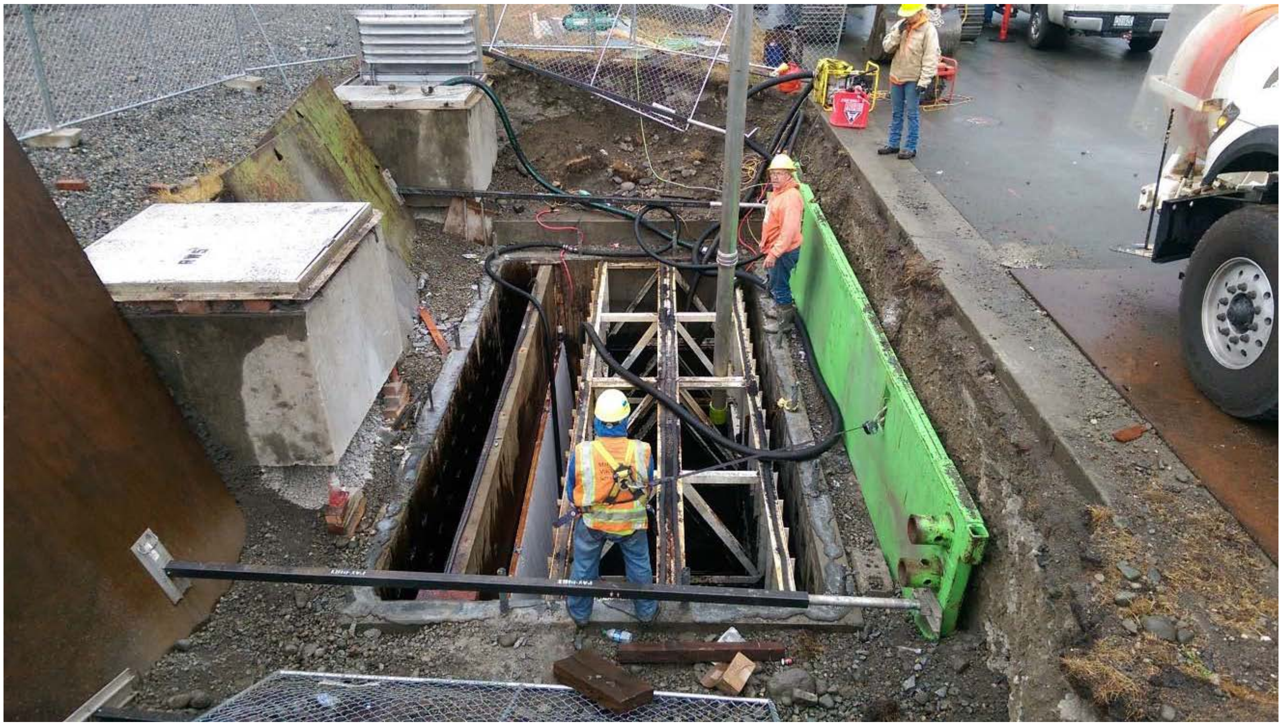
**Photograph 16**: Beginning to vactor dry material in the up-gradient vault chamber.

**Photograph 17**: Installation of water barriers.

**Photograph 18**: Installation of water barriers.

**Photograph 19**: Water barrier detail.

**Photograph 20**: Water barrier detail.

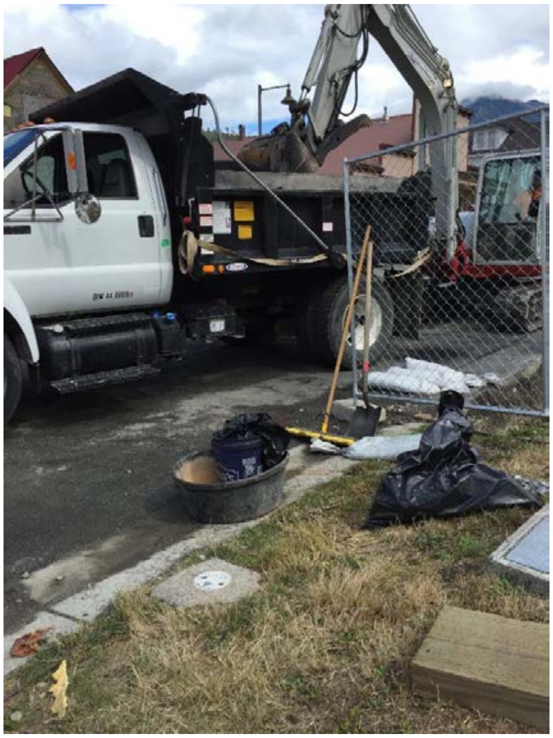


**Photograph 21**: Dewatering vault.

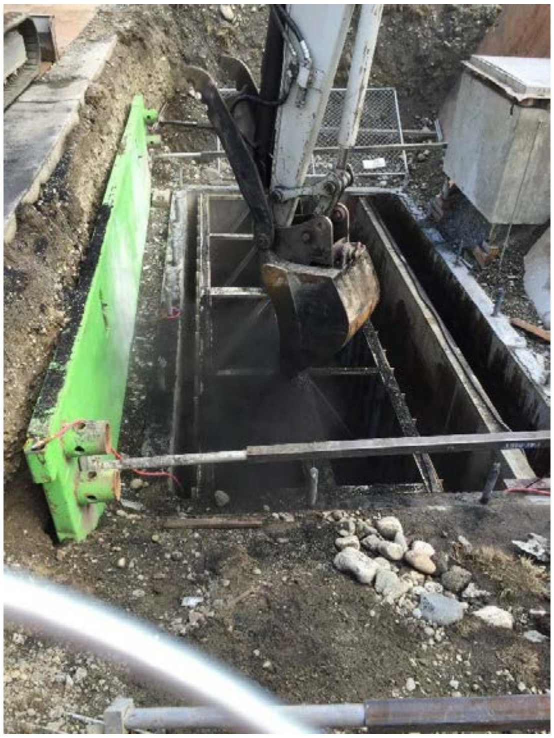
**Photograph 22**: Removal of saturated material with vactor.


**Photograph 23**: Mixing GAC/pea gravel materials.


**Photograph 24**: Mixing GAV/pea gravel materials.



**Photograph 25**: Mixing GAC/pea gravel materials.



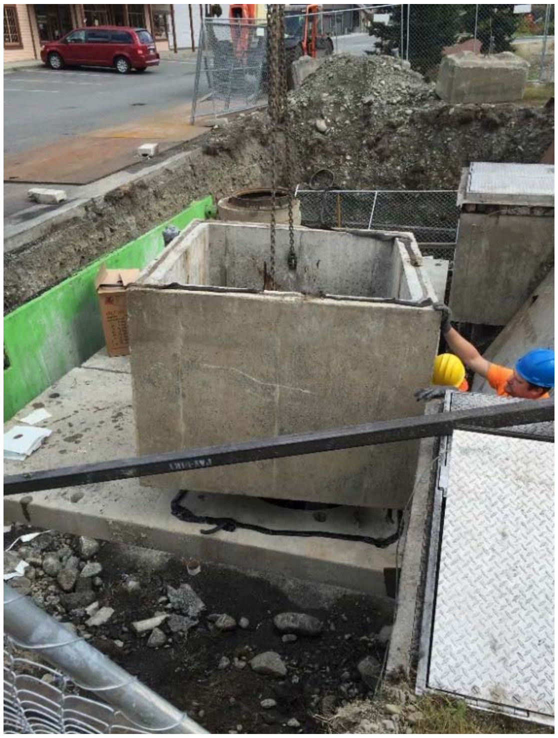
**Photograph 26**: Placement of GAC/pea gravel materials.

**Photograph 27**: Replaced material.

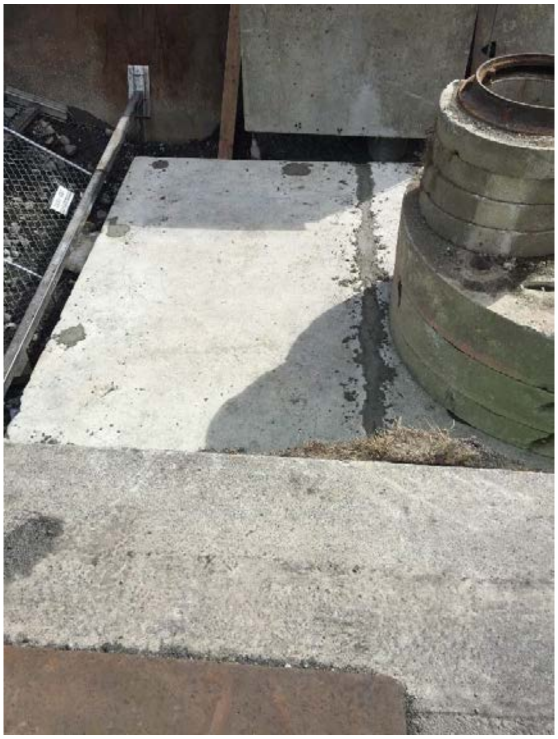
**Photograph 28**: Reinstallation of vault lid.

**Photograph 29**: Reinstallation of vault lids.

**Photograph 30**: Replacement of risers and access lids.



**Photograph 31**: Replacement of access riser.



**Photograph 32**: Grouting rebar dowel holes and vault seam.

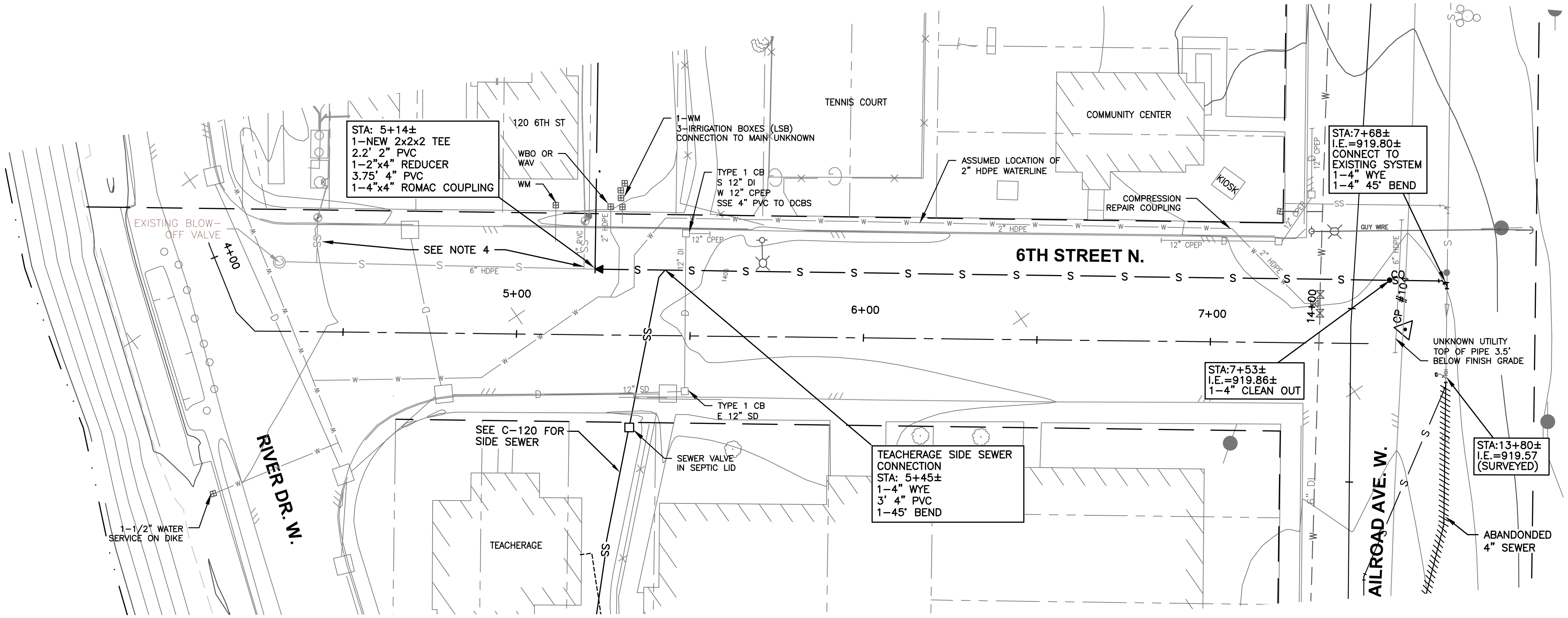
**Photograph 33**: Backfill and compaction.

**Photograph 34**: Backfill and compaction.

**APPENDIX D**
**SUPPLEMENTAL SEWER PLAN – $6^{TH}$ STREET, RECORD DRAWING**

2016 AS-BUILT COMPLETION REPORT
BNSF Former Maintenance and Fueling Facility
Skykomish, Washington

Farallon PN: 683-057



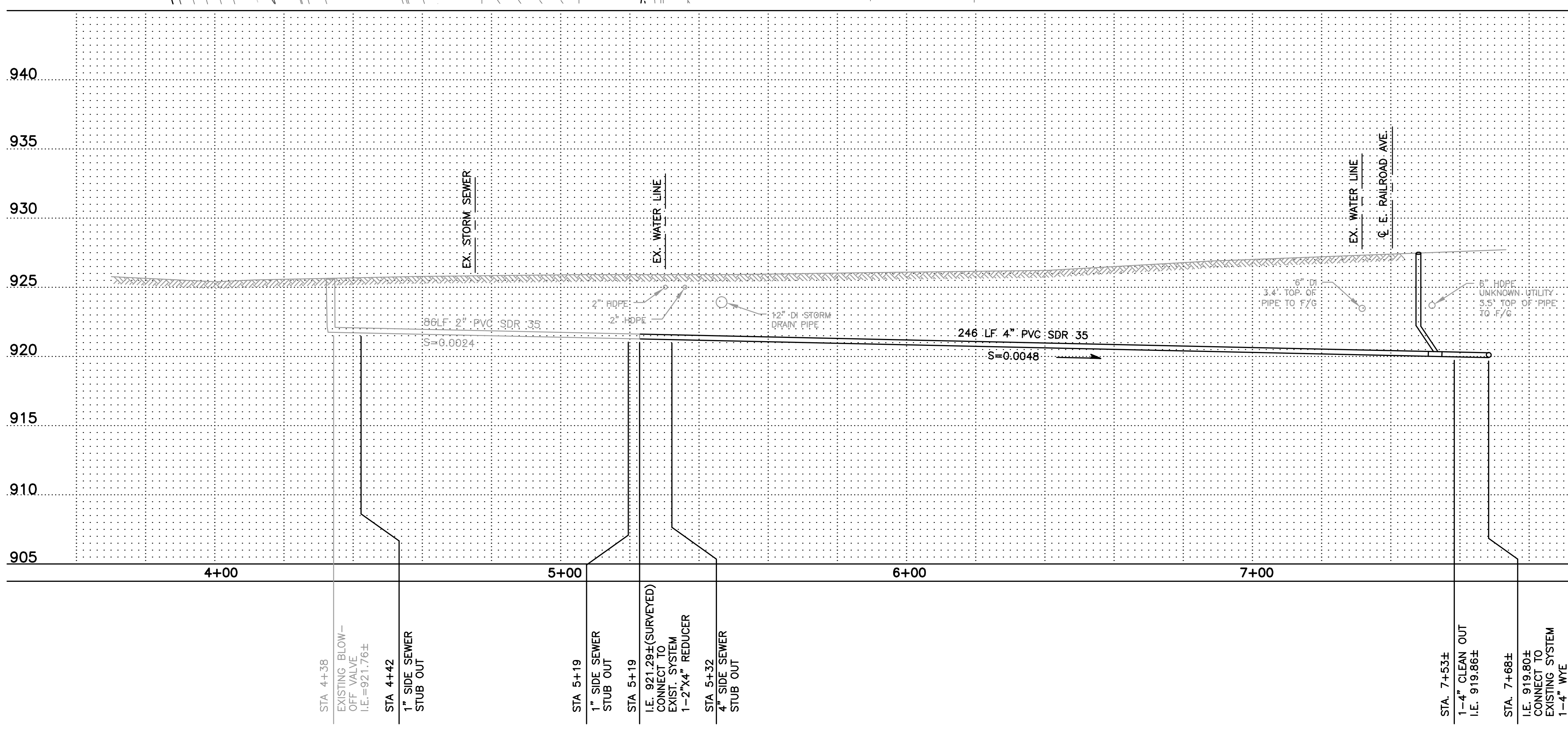

SCALE: HORIZONTAL 1"=20'
VERTICAL 1"=5'

CONSTRUCTION NOTES:

1. REMOVE EXISTING SIDE SEWER PIPE AND INSTALL NEW PIPE IN THE SAME LOCATION AS SHOWN. VERIFY EXACT LOCATION OF EXISTING SEPTIC TANKS, PIPING, AND BUILDING CONNECTIONS PRIOR TO CONSTRUCTION. PROVIDE 2% MINIMUM SLOPE ON NEW PVC SIDE SEWER PIPE TO SEPTIC TANK.
2. MAINTAIN MINIMUM SLOPE OF 1% ON ANY NEW PVC SIDE SEWER FROM SEPTIC TANK TO MAINLINE CONNECTION.
3. REMOVE EXISTING PVC PIPE AND EXISTING D-BOX. REPLACE SHORT SECTION OF PIPE FROM EXISTING SCHOOL SEPTIC TANK TO EXISTING SIDE SEWER.

**RIGHT-OF-WAY DISCLAIMER**

The right-of-way and/or property lines shown hereon are based on available information, not on a surveyed location and are only approximate.




BACKGROUND INFORMATION:

ATTEMPTS TO LOCATE SEWER ON 6TH STREET WERE MADE VIA POTHOLING AT STA. 6+42±. NO SEWER WAS LOCATED. IT IS ASSUMED THAT THE PIPE WAS NOT INSTALLED AS SHOWN IN AS-BULTS. POTHOLING AT WYE CONNECTION ON RAILROAD AVENUE WEST (STA. 7+68) REVEALED A PLUG ON THE 6TH STREET CONNECTION. POT HOLING AND SURVEYING AT NORTH 6TH STREET CONNECTION VERIFIED LOCATION OF 2" SEWER LINE.

(3) CONSTRUCTION NOTE REVISION:

4. CONTRACTOR SHALL VERIFY EXISTING SIDE SEWER CONNECTIONS ARE COMPLETE FROM MAINLINE TO BUILDING PLUMBING.

**RECORD DRAWING**

Based upon best available information obtained during construction.

Date: 8/18/2016
By: B.S.
Checked By: B.S.

CALL 2 DAYS BEFORE YOU DIG
1-800-424-5555

TWO INCHES AT FULL SCALE. IF NOT, SCALE ACCORDINGLY

**Gray & Osborne, Inc.**
CONSULTING ENGINEERS
701 DEXTER AVENUE NORTH SUITE 200
SEATTLE, WASHINGTON 98109 • (206) 284-0860

| DATE: APRIL 2015 | SCALE: NOTED | DRAWN: P.G.M. | CHECKED: A.J.M. | APPROVED: A.J.M. |
|---|---|---|---|---|

| No. | REVISION | DATE | APPD |
|---|---|---|---|
| 3 | CHANGE ORDER/ LOCATE REVISIONS | 9/10/2015 | W.R.K |
| 2 | REVISED SEWER | 4/19/2015 | A.J.M. |
| 1 | ISSUED FOR BID | 1/16/2015 | A.J.M. |

ADAM J. MILLER — STATE OF WASHINGTON — 38603 — REGISTERED PROFESSIONAL ENGINEER

**TOWN OF SKYKOMISH**
KING COUNTY WASHINGTON
SKYKOMISH SCHOOL HOT WATER FLUSHING REMEDIATION, FORMER MAINTENANCE AND FUELING FACILITY

SUPPLEMENTAL SEWER PLAN - 6TH STREET

SHEET: C-121
OF: X

JOB NO.: 07479
DWG: C-121_ RECORD