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4 March 2010

Mr. Mark Engdahl
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Subject: Groundwater Monitoring Report
BNSF Railway Company
Wishram, Washington, Railyard
K/J 036026.03

Dear Mr. Engdahl:

Kennedy/Jenks Consultants has prepared this report on behalf of BNSF Railway Company (BNSF) to summarize results of groundwater monitoring conducted at the BNSF Wishram, Washington, railyard (site) since completion of a remedial action in 2005. The site, remediation areas, and groundwater sampling locations are shown on Figures 1 and 2 (attached).

BACKGROUND

In 2003 and 2004, Kennedy/Jenks Consultants conducted a remedial investigation at the site and presented the results to BNSF and the Washington State Department of Ecology (Ecology) in *Site Assessment Report, Wishram Railyard*, dated August 2004. In October/November 2005, approximately 3,600 tons of petroleum-containing soil and abandoned fuel piping were excavated and removed from former diesel and bunker C oil fueling areas (Figure 2) as described in *Remediation Documentation Report, Wishram, Washington*, provided to BNSF in March 2007.

Since completion of soil remediation in 2005, groundwater samples have been collected periodically to evaluate petroleum hydrocarbon concentrations in groundwater. Groundwater sampling locations have included monitoring well WMW-7, located west of the maintenance shop building, wells WMW-3 and WMW-5 located south and southeast of a former fueling platform (removed in 2005), and well WMW-1 located near the Columbia River shoreline.

Other wells shown on Figure 2 were removed during the 2005 excavation or have been buried or destroyed during site road grading operations. Wells WMW-2 and WMW-6 were located in remediation areas where soil (including saturated soil) was removed and replaced to depths near or below the well bottoms. Ecology was notified and approved of the well abandonment procedure during the remediation planning process in 2005. Monitoring well WMW-4 appears to have been destroyed or buried under road grading spoils sidecast from the adjacent gravel driveway shown on Figure 2. Kennedy/Jenks Consultants has attempted several times, without success, to locate WMW-4 using metal detectors and/or by scraping away surface materials to reveal the monument.

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HYDROGEOLOGIC CONDITIONS

Hydrogeologic conditions at the site are dominated by the effects of historical, large-scale, geoenvironmental projects in the area including filling to create the railyard in the late 1800s and construction of The Dalles Dam, with subsequent upstream flooding of the Columbia River Gorge in the 1950s. The town of Wishram is located on a basalt bench at the base of an approximately 500-foot-high cliff which descends nearly vertically from the Columbia Plateau into the Columbia River Gorge. Early photographs indicate that prior to construction of the railyard and the Dalles Dam, barren basalt bedrock sloped southward from the town site to the pre-dam era Columbia River channel, which was approximately 40 feet lower and up to several hundred feet farther south of the current shoreline. When the Wishram Railyard was constructed, sand excavated from large dunes at the western end of the town was reportedly used to fill over a portion of the basalt slope to create flat areas for track and maintenance buildings. After completion of The Dalles Dam in 1957, the river stage rose to a level approximately 15 feet below the elevation of the site, creating Lake Celilo, and, through loss from the lake, produced an artificial saturated zone within the sandy fill beneath the railyard.

During the 2003/2004 site investigations, localized perched groundwater zones were observed just above bedrock [at approximately 15 feet below ground surface (bgs)] in some soil borings advanced along the site's northern boundary (i.e., the boundary of the railyard fill and native basalt bench beneath the town site). In wells and borings advanced within the railyard fill, groundwater has been observed year-round at depths typically ranging from approximately 10 to 12 feet bgs, with one anomalous period in September 2003 when some of the wells, including those next to the river shoreline, were almost dry. Groundwater depths and relative elevations measured in site monitoring wells since 2003 are presented in Table 1. The elevations are based on an arbitrary datum of 100 feet, which was established at a temporary benchmark, located northwest of the equipment maintenance building, near the Wishram post office.

Groundwater elevations measured in borings and wells during the 2003/2004 site investigations were initially interpreted to suggest a south/southwesterly groundwater flow direction toward the river. However, since 2004, additional groundwater level data have indicated gradients of various directions toward, away from, or parallel to the river/lake shoreline. Based on these observations and a limited review of available elevation data for adjacent Lake Celilo, it appears that groundwater in site fill responds primarily to changes in the lake stage, which is artificially controlled at the Dalles Dam and, like site groundwater, typically varies in elevation by approximately 1 to 2 feet. Extensive monitoring and analysis could be conducted to evaluate the interaction of the lake and site groundwater; however, such monitoring would not necessarily contribute to achieving project objectives.

GROUNDWATER SAMPLING AND ANALYSIS

Groundwater sampling has been conducted at the site using low-flow purging techniques as described in the *Remediation Work Plan, Wishram, Washington*, prepared by Kennedy/Jenks Consultants and presented to BNSF in June 2005. The groundwater samples have been submitted to TestAmerica (formerly North Creek Analytical) of Bothell, Washington, for analysis of gasoline-, diesel-, and oil-range hydrocarbons using Northwest Total Petroleum Hydrocarbon as gasoline (NWTPH-Gx) and as diesel (NWTPH-Dx) methods and benzene, toluene,

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ethylbenzene, and xylenes using EPA Method 8021B. Field forms documenting well purging and sampling are provided in Attachment A.

ANALYTICAL RESULTS

Laboratory analytical results for post-remediation groundwater samples are summarized in Table 2 and discussed below according to their relative locations at the site (north to south). Table 2 also includes data for pre-remediation samples, including analytical results for polynuclear aromatic hydrocarbons (PAHs) and metals. Post-remediation analyses did not include these analytes, because they were either dismissed as chemicals of concern for the site prior to remediation or, in the case of monitoring well WMW-2, were localized within debris in a buried concrete basement (former powerhouse), which was removed in 2005.

Maintenance Shop Area

Groundwater samples collected from well WMW-7 prior to excavation contained gasoline-range hydrocarbons at concentrations ranging from 316 to 1,790 micrograms per liter ($\mu\text{g/L}$). Since 2005, samples from this well have contained gasoline-range hydrocarbon concentrations ranging from 284 to 454 $\mu\text{g/L}$. Because no benzene has been detected in site groundwater, the Ecology Model Toxics Control Act (MTCA) Method A Cleanup Level for gasoline in groundwater is 1,000 $\mu\text{g/L}$. Therefore, none of the post-excavation gasoline concentrations has exceeded the MTCA Method A Cleanup Level.

Prior to excavation, groundwater samples collected from well WMW-7 contained diesel-range hydrocarbons at concentrations ranging from 677 to 1,220 $\mu\text{g/L}$. Since 2005, diesel-range hydrocarbons have ranged from 548 to 1,900 $\mu\text{g/L}$, with all sample concentrations exceeding the MTCA Method A Cleanup Level for diesel of 500 $\mu\text{g/L}$.

During each monitoring event since 2005, up to 0.10 foot of light non-aqueous phase liquid (LNAPL) has been measured in well WMW-7. This LNAPL appears to be localized within a few feet of the well, given that much of the soil west of the maintenance shop building was excavated and replaced to below the depth of groundwater in 2005 and LNAPL has not been encountered in other nearby soil boring locations

Former Fueling Area

Gasoline-range hydrocarbon concentrations detected in groundwater samples collected from well WMW-3, before and after excavation, have ranged from 190 to 291 $\mu\text{g/L}$. None of the gasoline-range concentrations has exceeded the MTCA Method A Cleanup Level. Diesel-range hydrocarbon concentrations have ranged from below a laboratory reporting limit of 250 $\mu\text{g/L}$ to 3,180 $\mu\text{g/L}$. Half of the samples collected from this well have exceeded the MTCA Method A Cleanup Level of 500 $\mu\text{g/L}$, without an apparent trend (i.e., increasing or decreasing) since excavation.

Monitoring well WMW-5 is located approximately 150 feet east of well WMW-3, in an area where petroleum hydrocarbons were not detected in soil and groundwater during the 2003/2004 site characterization. Since 2005, only one sample, collected in September 2009, contained gasoline-range hydrocarbons at a concentration of 63 $\mu\text{g/L}$.

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Downgradient Well

Monitoring well WMW-1 is located south of the former fueling platform, near the Columbia River shoreline. Prior to excavation, two samples collected from well WMW-1 contained gasoline-range hydrocarbons at concentrations ranging from 306 to 329 µg/L. Since excavation, gasoline-range hydrocarbons have ranged from below the laboratory reporting limit to 350 µg/L. Neither pre- nor post-excavation groundwater samples from this well have exceeded the MTCA Method A Cleanup Level for gasoline-range hydrocarbons.

Diesel-range hydrocarbons detected in samples from well WMW-1 prior to excavation ranged from 411 to 593 µg/L. Since excavation, diesel-range hydrocarbon concentrations have ranged from below the laboratory reporting limit to 5,960 µg/L. Concentrations in four of the seven post-excavation samples have exceeded the MTCA Method A Cleanup Level of 500 µg/L. Oil-range petroleum hydrocarbons were detected in the July 2007 sample collected from this well at a concentration of 523 µg/L (greater than the MTCA Method A Cleanup Level of 500 µg/L). Oil-range concentrations in all other pre- and post-excavation samples collected from this well have been below the laboratory reporting limit.

SUMMARY

As discussed above and as shown in Table 2, seven groundwater monitoring events, using various monitoring wells, have been conducted at the site since remediation was completed in 2005. Since remediation, gasoline-range hydrocarbons have not been detected in samples from any well at concentrations exceeding the MTCA Method A Cleanup Level for gasoline. Diesel-range hydrocarbon concentrations have exceeded the MTCA Method A Cleanup Level sporadically in samples collected from wells WMW-1, WMW-3, and WMW-7. Up to 0.10 foot of LNAPL has been measured in well WMW-7 during each monitoring event, yet the LNAPL appears to be localized to within a few feet of the well. LNAPL has not been encountered since 2005 in any of the other wells monitored.

Very truly yours,

KENNEDY/JENKS CONSULTANTS



Galen Davis
Geologist

Attachments

Tables

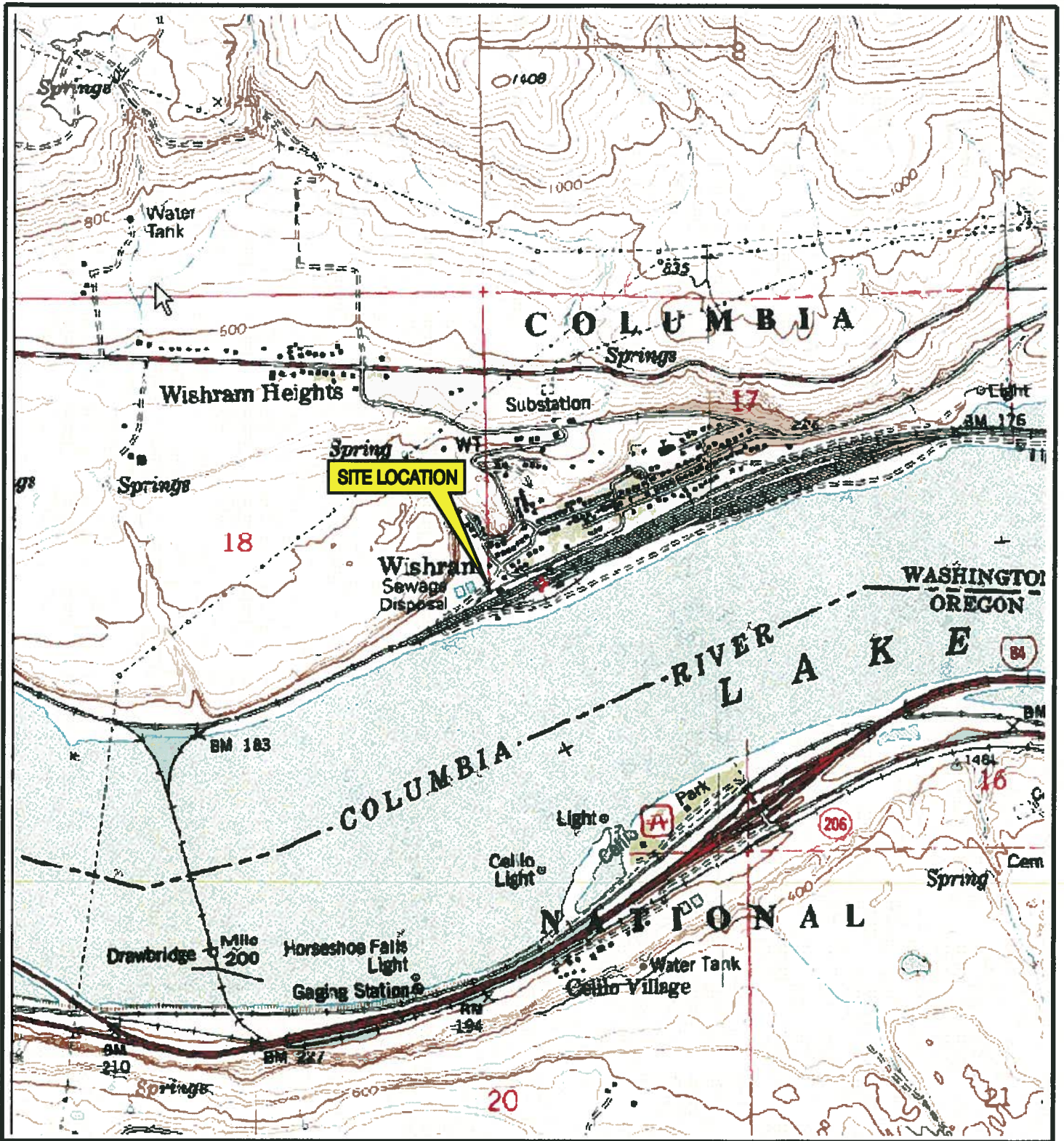
TABLE 1
RELATIVE GROUNDWATER ELEVATIONS IN SITE MONITORING WELLS
BNSF Wishram Rail yard

Well ID (Casing Elevation)	WMW-1 (94.35)										WMW-2 ^(d) (94.96)			WMW-3 (94.87)							
	Date	9/17/03	4/15/04	7/13/04	11/9/06	7/3/07	8/16/07	4/16/08	8/21/08	3/12/09	9/10/09	9/18/03	4/15/04	7/13/04	9/17/03	4/16/04	7/13/04	11/9/06	7/3/07	8/16/07	4/16/08
Depth to Groundwater	15.88	10.46	10.78	9.60	9.85	10.55	10.10	10.59	10.15	10.44	20.00	10.81	11.08	16.37	10.32	10.65	10.20	10.08	10.65	10.14	10.89
Groundwater Elevation ^(b)	78.47	83.89	83.57	84.75	84.50	83.80	84.25	83.76	84.20	83.91	74.96	84.15	83.88	78.50	84.55	84.22	84.67	84.79	84.22	84.73	83.98

Well ID	WMW-4 ^(c) (95.02)			WMW-5 (94.44)									WMW-6 ^(d) (94.92)		WMW-7 (95.95)							
	Date	9/18/03	4/15/04	7/13/04	4/16/04	7/13/04	11/9/06	7/3/07	8/16/07	4/16/08	8/21/08	3/12/09	9/10/09	4/16/04	7/13/04	4/16/04	7/13/04	7/3/07	8/16/07	4/16/08	8/21/08	3/12/09
Depth to Groundwater	20.00	11.10	11.40	10.12	10.40	11.00	9.79	10.35	9.91	10.53	10.09	10.62	10.46	10.83	10.43	11.04	10.58	11.00	10.66	12.19	11.45	13.60
Groundwater Elevation ^(b)	75.02	83.92	83.62	84.32	84.04	83.44	84.65	84.09	84.53	83.91	84.35	83.82	84.46	84.09	85.52	84.91	85.37	84.95	85.29	83.76	84.50	82.35

- Notes:
- (a) Monitoring well WMW-2 was removed during excavation in November 2005.
 - (b) Groundwater elevations are based on a wellhead top-of-casing survey relative to an arbitrary vertical datum of 100 feet, which was established at a temporary benchmark located near the Wishram Post Office.
 - (c) Monitoring well WMW-4 appears to have been destroyed in summer 2006.
 - (d) Monitoring well WMW-6 was removed during excavation and removal of the adjacent lubricating oil underground storage tank (UST) in 2006.

Figures



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THE BURLINGTON NORTHERN AND
SANTA FE RAILWAY CO.
WISHRAM, WA

SITE LOCATION MAP

036026.00/FIG_1.CDR

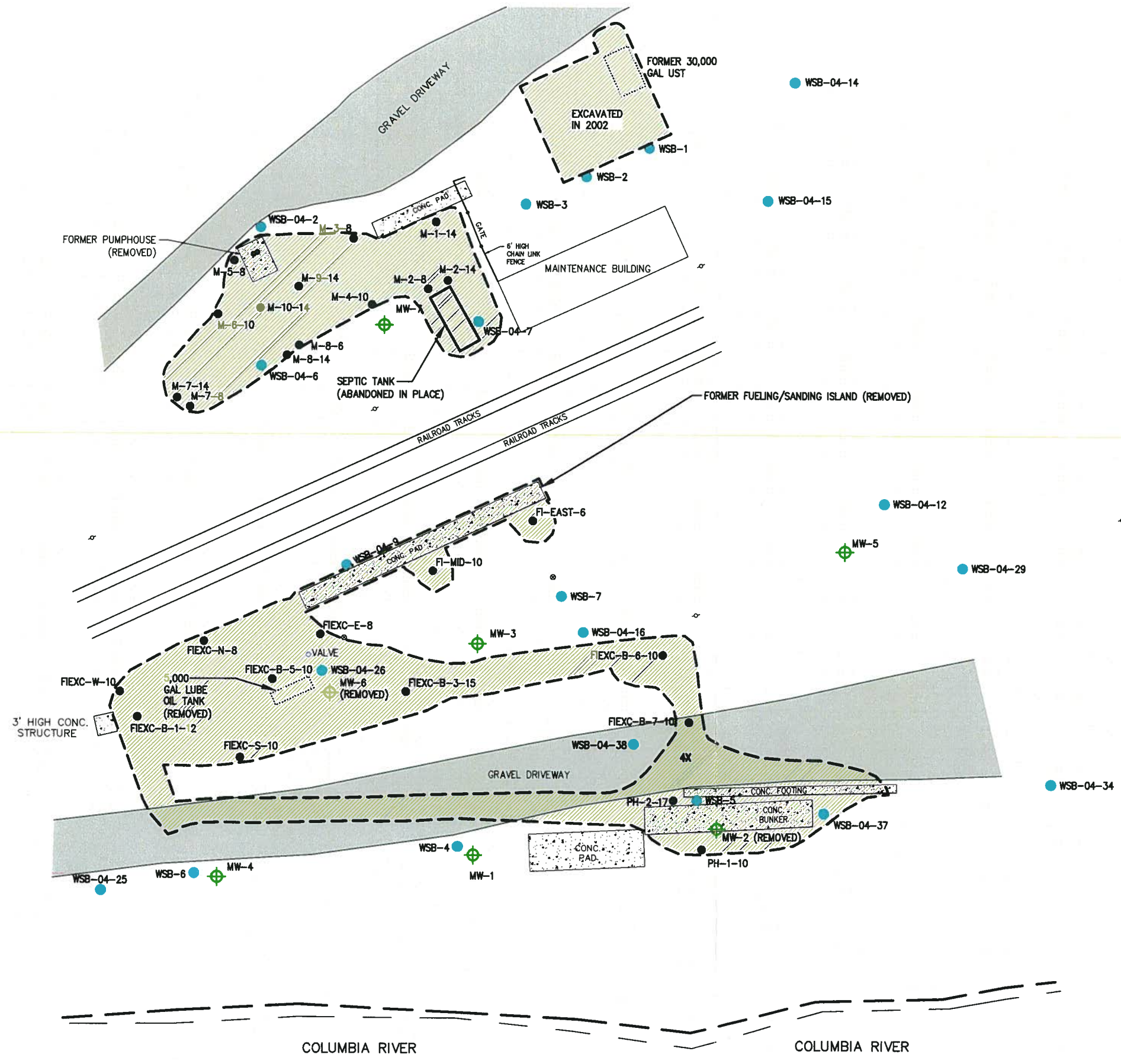
FIGURE 1



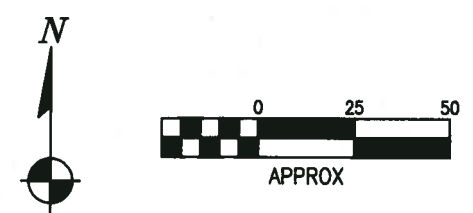
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APPROXIMATE SCALE IN FEET



- LEGEND**
- POWER POLE
 - ⊕ MW-4 MONITORING WELL
 - WSB-7 SOIL BORING LOCATION
 - M-9-14 EXCAVATION CONFIRMATION SAMPLE
 - ▭ EXCAVATION BOUNDARY



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BNSF RAILWAY COMPANY
WISHRAM, WA

**MONITORING WELL LOCATIONS
AND REMEDIATION AREA**

036026.02-Wishram\FIG-02

FIGURE 2