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BNSF Wishram Railyard, Wishram, Washington

Sediment Remedial Investigation Work Plan

Ecology Site Name: BNSF Wishram Track Switching Facility
Ecology Facility/Site ID: 1625461
Cleanup Site ID: 230

Final

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BNSF Railway Company

BNSF Wishram Railyard, Wishram, Washington

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Contents

Appendices

Tables

Figures

Acronyms and Abbreviations

µg/kg	microgram(s) per kilogram
%RE	percent of the reference emitted
AO	Agreed Order
AST	aboveground storage tank
BAZ	biologically active zone
bgs	below ground surface
BNSF	BNSF Railway Company
bss	below sediment surface
COPC	contaminant of potential concern
CSL	cleanup screening level
CSM	conceptual site model
CUL	cleanup level
DPT	direct-push technology
EC	Electrical Conductivity Dipole Array
Ecology	Washington State Department of Ecology
EIM	Environmental Information Management System
FS	feasibility study
LIF	laser-induced fluorescence
LNAPL	light nonaqueous petroleum liquid
mg/kg	milligram(s) per kilogram
MTCA	Model Toxics Control Act
NAPL	nonaqueous petroleum liquid
NAVD88	North American Vertical Datum of 1988
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCC	State of Washington Pollution Control Commission
QA	quality assurance
QC	quality control
RI	remedial investigation
SAP	sampling and analysis plan
SCO	sediment cleanup objective
SCUM	Sediment Cleanup User's Manual

SMS	Sediment Management Standards
SOP	standard operating procedure
SP&S	Spokane, Portland, and Seattle Railway
SPI	Sediment Profile Imaging
SVE	soil vapor extraction
TarGOST	Tar-specific Green Optical Screening Tool
TPH	total petroleum hydrocarbons
TPH-diesel	total petroleum hydrocarbons as diesel range organics
TPH-residual	total petroleum hydrocarbons as residual/oil range organics
USACE	U.S. Army Corps of Engineers
UST	underground storage tank
WAC	Washington Administrative Code

1. Introduction

This remedial investigation (RI) work plan presents the scope of work for sediment investigation activities in the aquatic lands adjacent to the BNSF Railway Company (BNSF) Wishram Railyard (aka BNSF Track Switching Facility) in Wishram, Washington (site) (Figure 1-1).

Petroleum sheening and nonaqueous phase liquid (NAPL) droplets have been observed occasionally along an approximately 350-foot stretch of the Columbia River adjacent to the railyard (Ecology 2017a). This stretch of the Columbia River is separated from the uplands area by a berm armored with riprap. The area where the sheening has been observed was inundated when the area behind The Dalles Dam was flooded in 1957.

Initial investigation activities within the vicinity of the observed sheens identified a NAPL-impacted organic-rich fill layer between 0.5 and 2.5 feet below the sediment surface between 40 and 130 feet south of the current riprap shoreline (CH2M 2019). The sheens intermittently observed along the shoreline were shown to be the result of ebullition-driven transport of NAPL from this isolated layer to the water column. Selected individual samples of the overlying surface sediments were found to exceed the Sediment Management Standards (SMS) Sediment Cleanup Objectives (SCOs) (Washington Administrative Code [WAC] 173-204-563). As required by the Washington State Department of Ecology (Ecology) in its letter dated August 13, 2020, BNSF will collect additional data to meet the requirements of an RI, as discussed in the Sediment Cleanup User's Manual II (SCUM II) (Ecology 2019). The RI work plan has been developed to collect the additional data needed to characterize the site and identify all potential contaminants of concern, establish sediment cleanup standards, and select a cleanup action, as well as to determine the vertical and lateral extent of NAPL. This RI for the sediments adjacent to the BNSF Wishram facility will be performed in accordance with the Ecology Model Toxics Control Act (MTCA) regulations published under WAC 173-340 (Ecology 2017b) and the SMS under WAC 173-204, as described in the SCUM II (Ecology 2019).

1.1 General Site Information and Legal Description

The BNSF railyard is located in the town of Wishram in Klickitat County, Washington, approximately 13 miles northeast of The Dalles, Oregon, and 0.75 mile south of Washington State Route 14, within the southwestern quarter of Section 17, Township 2 north, Range 15, east of the Willamette Meridian. Figure 1-1 shows the site location.

The uplands portion of the railyard under investigation is approximately 2,000 feet long and ranges from 150 to 720 feet wide. The uplands investigation area is bounded by the town of Wishram to the north, mainline and switching tracks to the east, Lake Celilo to the south and southwest, and the railroad right-of-way to the west. Existing structures on the railyard include storage buildings, a maintenance shop (office and tool storage), two mainline tracks, and active yard tracks. Figure 1-2 shows the railyard and study area.

Reported locations and uses of former buildings and structures, former fueling areas, and former fuel storage in aboveground and underground storage tanks (ASTs and USTs) were identified using past reports, historical maps and aerial photographs, and historical documents including a summary of the Wishram Railyard presented in The Northwest's Own Railway Fall 2014 publication (NWOR 2014) and correspondences between Spokane, Portland, and Seattle Railway (SP&S) Railway personnel including design plans and drawings for now-former site features. The historical documents were transmitted from BNSF to Ecology on September 27, 2017 (BNSF 2017).

Based on historical photos and plans, areas to the south of the current railyard consisted of vegetated areas and bedrock outcrops with some areas of sandy beachfront. Limited structures included a former pump house and a feature identified on historical maps as a 24-foot-diameter structure with an associated manhole that was associated with former processes for obtaining railyard and drinking water from the Columbia River in the early 1900s (Figure 1-3). Use of the water from the Columbia River was discontinued after installation of water supply wells located on the railyard. The river water supply piping, which extended from a pump shaft on the railyard to the pump house, well, and river intake lines, was removed or abandoned in place in 1920. According to correspondences between SP&S personnel in the 1950s, numerous small shacks occupied by employees of SP&S were also located south of the current railyard. Several roofed structures are visible in the aerial photograph circa 1951 (obtained by Kennedy Jenks from USACE in 2017) (Figure 1-3). It is unknown if these "shacks" were still present when this area was inundated by the construction of The Dalles Dam in March 1957.

As illustrated on Figure 1-3, the study area associated with this work represents an expansion from the 2018 initial investigation area and consists of the aquatic lands inundated during the filling of Lake Celilo in 1957 and historic shoreline areas that were adjacent to past industrial activities and discharges associated with the railyard. This aquatic area extends approximately 1,850 feet along the shoreline and extends approximately 500 feet south of the riprap shoreline. Prior to 1957, the bulk of this area consisted of uplands adjacent to a free-flowing Columbia River that was 40 to 50 feet lower than railyard property. Following the construction of the Dalles Dam in 1957, the river was impounded and Lake Celilo was formed. Following this, the aquatic area received discharges from the industrial areas through outfalls. The former and current shorelines and prominent site features believed to have existed during some portions of the time between 1910 (when the railyard began operations) and the present are shown on Figure 1-3.

1.2 Regulatory Framework

Remedial work on the uplands portion of the site is being performed pursuant to an Agreed Order (AO) (No. DE 12897) between Ecology and BNSF, dated October 7, 2015. The scope of work in the AO is mainly focused on the uplands investigation, with limited actions related to shoreline conditions.

On March 3, 2017, Ecology directed BNSF to initiate the following:

> *Ecology has determined that these limited actions (do not comprise sufficient investigation to address potential shoreline and/or surface water impacts. We believe on the basis of several lines of evidence that further investigation is warranted beyond what has already been proposed in the current RI Work Plan.*
>
> *One item in particular that has to be more fully investigated is the groundwater/surface water interface including whether the process of ebullition is occurring. Other mechanisms that may produce a sheen are 1) NAPL seepage due to NAPL drainage and mobility at low water, 2) NAPL wicking along the capillary fringe; and 3) erosion leading to redistribution of NAPL from the riverbank to sediments.*
>
> *Based on these environmental concerns, Ecology requires BNSF to produce a supplemental work plan that will fully address the shoreline component of the RI.*

Figure 1-2 shows the area identified by Ecology in the March 3, 2017 letter. This area was identified for the nearshore initial investigation.

BNSF subsequently developed an initial investigation work plan to investigate the potential presence of NAPL in the identified area, characterize the nature and extent of NAPL, if present, and evaluate nearshore sediment against applicable sediment cleanup standards (CH2M 2018). The work plan was approved by Ecology on February 7, 2018, and field work was performed in June and August 2018.

The draft Inundated Lands Initial Investigation Report (draft Initial Investigation report) and the draft Initial Investigation Work Plan Addendum (IIWP addendum) for additional investigation were submitted to Ecology on May 30, 2019. Ecology provided comments separately on the draft IIWP addendum in a letter to BNSF dated August 5, 2019, and on the draft Initial Investigation report in a letter to BNSF dated October 11, 2019. Ecology provided additional comments on the draft Initial Investigation report and IIWP addendum from the Ecology Sediment Policy Program and the Yakama Nation in a letter dated April 21, 2020. In a letter dated August 13, 2020, Ecology determined that the inundated land adjacent to the BNSF railyard is a sediment site, based on the results of the initial investigation, and required that BNSF perform an RI. In the August 13, 2020 letter, Ecology included the statement "the RI shall include analysis of the full suite of SMS constituents, as reflected in Table VI (WAC 173-204-563(2)) as well as carcinogenic polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyl (PCB) congeners."

On September 15, 2020, BNSF responded to the August 13, 2020 letter from Ecology, agreeing to perform a sediment (inundated lands) RI for the site, and proposed to prepare a draft Sediment (Inundated Lands) RI Work Plan for submittal to Ecology within 90 days of the Ecology acceptance of the proposal. The letter also stated that BNSF disagreed that a full suite of SMS constituents was appropriate for the site. In a letter dated September 30, 2020, Ecology accepted this proposal but reaffirmed the requested contaminants of potential concern (COPCs) in the August 13, 2020 letter.

BNSF submitted the draft Sediment RI Work Plan (draft Work Plan) to Ecology on December 28, 2020. Ecology provided initial comments and redlined markup of the draft Work Plan and sampling and analysis plan to BNSF on February 12, 2021. Ecology and BNSF discussed those comments during a conference call on March 11, 2021, then provided Ecology the presentation slides from that meeting along with a summary of the discussion topics and proposed path forward in an email on March 23, 2021. On April 6, 2021, Ecology provided a letter dated April 5, 2021 and a memorandum dated April 4, 2021, providing further comments on specific proposed scope items. BNSF submitted a response letter and matrix to Ecology on May 14, 2021 that responded to Ecology's specific comments in the April 5, 2021 letter and April 4, 2021 technical memorandum, and general responses to the February 12, 2021 letter. On June 11, 2021 Ecology provided an email response and marked up flowchart.

1.3 Hazard Assessment

The August 13, 2020 letter from Ecology references WAC 173-204-563(2) – Freshwater Sediment Chemical Criteria as a prescribed analytical list for Sediment RI.

Section 3.3.6 (Contaminants of Potential Concern) of the SCUM II (Ecology 2019) states:

> *A screening evaluation should be conducted to identify CoPCs that should be investigated during the RI. At the RI Work Plan stage, identification of CoPCs is based on existing data and information (e.g., type of facility, sources, releases, pathways, and receptors). The process used to identify the CoPCs will vary depending on the amount, quality, recency, and representativeness of the sediment data for the site.*

The criteria for sites with little or no sediment data are described in Section 3.3.6.1 of SCUM II (Ecology 2021):

> *Preliminary CoPCs for a site may be based on analytical groups (e.g., semi-volatiles, standard metals, butyltins, PCBs/pesticides, dioxins/furans) that are known or suspected to be:*
>
> - *Used or manufactured in processes at the site with known or suspected releases*
> - *Present or elevated in sediment, surface soil, bank soil, or groundwater (especially near the shoreline)*
> - *Chemicals that may be elevated in sediment due to adjacent sites/sediment cleanup units or major sources*

Section 3.3.6.1 of SCUM II goes on to clarify that:

> *When there is no or very little data for the sediment at a site, the CoPCs should err on the side of inclusiveness for the initial phase of sampling. All standard SMS benthic chemicals (Table 8-1) should be measured, along with any additional analytes associated with processes at the site…*
>
> *Based on the sediment regional background studies conducted by Ecology (SCUM Chapter 10), the most widespread bioaccumulative chemicals above natural background are cPAHs, PCB congeners and dioxin/furan congeners. Most sites will have sources of PAHs and historical sources of PCBs, and therefore these groups should be included among the CoPCs.*

In accordance with WAC 173-204-520 (2) and SCUM II, the list of COPCs for the RI was developed using a hazard assessment screening process. The assessment looks at each constituent in WAC 173-204-563(2) Table VI as well as the most widespread bioaccumulative chemicals above natural background as listed in Section 3.3.6.1 of SCUM II (PCB congeners, dioxin/furan congeners, and carcinogenic polycyclic aromatic hydrocarbons). Table 1-1 provides a list of chemicals considered as part of this assessment. Consideration was given to whether each constituent listed in Table 1-1 could be associated with any known or suspected use at the facility, as well as whether they were analyzed for in upland surface or subsurface soil samples, and how detections (and detection limits) compare to sediment management standards protective of benthic and human receptors. The assessment also considers whether constituents can bioaccumulate and the likelihood of their presence regionally. The hazard assessment places each of the chemicals listed in Table 1-1 in one of the following six Screening Result Categories:

Included (I)

- Category I1 – Analyzed for and detected in upland soil and sediment within initial study area above sediment criteria; component of known release; may also have potential for accumulation in wider sediment environment.
- Category I2 – Analyzed for in upland soil or sediment within the initial study area and present above sediment criteria; constituent also has potential for accumulation in wider sediment environment.
- Category I3 – Not analyzed for in upland soil or analyzed and not detected, but some samples may not have had detection limits at or below the lowest sediment criteria; constituent may also have potential for accumulation in wider sediment environment; use at the facility cannot be ruled out at this time; includes "conventional chemicals".
- Category I4 – May or may not have been analyzed for in upland soil and while its use at the facility is not suspected, constituent is considered one of the most widespread bioaccumulative chemicals above natural background based on the sediment regional background studies conducted by Ecology and referenced in SCUM II Chapter 10.

Table 1-1. Hazard Assessment Screening of Constituents

Chemical Parameter	Freshwater Benthic		Freshwater Human Health and Higher Trophic Level Receptors				Upland Soil Analysis			Excluded as COPC for Step 1 of Sediment RI (Y/N)	Screening Result Category [c]	Rationale for Inclusion or Exclusion
	WAC 173-204-563 Table VI/ SCUM II Table 8-1		SCUM II Table 9-2 [b]			Programmatic PQLs SCUM II Table 11-1						
	Dry Weight Sediment Cleanup Objective (SCO)	Dry Weight Cleanup Screening Level (CSL)	Beach Play (Child)	Subsistence Clam Digging (Adult)	Subsistence Net Fishing (Adult)	Consumption of Fish/Shellfish by Human and Higher Trophic Level Receptors	Performed (Y/N)	Exceeds (Y/N)	Notes			
Conventional Chemicals (mg/kg)												
Ammonia	230	300					N	--		**N**	**I3**	Conventional chemical
Total sulfides	39	61					N	--		**N**	**I3**	Conventional chemical
Metals (mg/kg)												
Arsenic	14	120	4.8	0.96	3	0.3	Y	Y	Detected in 31 of 128 samples; All detections and DLs below SCO and CSL, but above lowest human health criteria	**N**	**I2**	Detections in railyard soils in excess of sediment criteria; potential for accumulation in wider sediment environment as a result of upstream sources.
Cadmium	2.1	5.4	610	1,300	4400	0.07	Y	N	Detected in 1 of 128 samples; All detections and DLs below SCO, CSL and human health criteria in ALL samples	**N**	**I3**	Potential for accumulation in wider sediment environment as a result of upstream sources. Detection limits appropriate; not detected in soil samples from across railyard above sediment criteria
Chromium	72	88				0.2	Y	N	Detected in 128 of 128 samples; All detections below SCO and CSL (max of 28.8 mg/kg). Hexavalent chromium not detected in 4 of 4 samples at or above 10 mg/kg	**N**	**I3**	Potential for accumulation in wider sediment environment as a result of upstream sources. Detection limits appropriate; not detected in soil samples from across railyard above sediment criteria
Copper	400	1,200				0.1	N	--		**N**	**I3**	Not analyzed for; metal that cannot be ruled out at this time. Potential for accumulation in wider sediment environment as a result of upstream sources.

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Chemical Parameter	Freshwater Benthic		Freshwater Human Health and Higher Trophic Level Receptors				Upland Soil Analysis			Excluded as COPC for Step 1 of Sediment RI (Y/N)	Screening Result Category [c]	Rationale for Inclusion or Exclusion
	WAC 173-204-563 Table VI/ SCUM II Table 8-1		SCUM II Table 9-2 [b]			Programmatic PQLs SCUM II Table 11-1						
	Dry Weight Sediment Cleanup Objective (SCO)	Dry Weight Cleanup Screening Level (CSL)	Beach Play (Child)	Subsistence Clam Digging (Adult)	Subsistence Net Fishing (Adult)	Consumption of Fish/Shellfish by Human and Higher Trophic Level Receptors	Performed (Y/N)	Exceeds (Y/N)	Notes			
Lead	360	> 1,300				0.1	Y	Y	Detected in 133 of 133 samples; Detected below SCO in 132 of 133 samples and below CSL in ALL samples	**N**	**I2**	Potential for accumulation in wider sediment environment as a result of upstream sources. Detection limits appropriate; not detected above sediment criteria in >99% of soil samples collected from across railyard
Mercury	0.66	0.8				0.02	Y	N	Detected in 18 of 128 samples; All detections and DLs below SCO and CSL	**N**	**I3**	Potential for accumulation in wider sediment environment as a result of upstream sources. Detection limits appropriate; not detected in soil samples from across railyard above sediment criteria
Nickel	26	110				0.2	N	--		**N**	**I3**	Not analyzed for; metal that cannot be ruled out at this time
Selenium	11	> 20					Y	N	Detected in 3 of 128 samples; All detections and DLs below SCO and CSL	**N**	**I3**	Potential for accumulation in wider sediment environment as a result of upstream sources. Detection limits appropriate; not detected in soil samples from across railyard above sediment criteria
Silver	0.57	1.7				0.1	Y	N	ND in all samples; DL below SCO in 8 of 128 samples and below CSL in ALL samples	**N**	**I3**	Not detected but DLs above SCO in more than 50% of samples; metal that cannot be ruled out at this time
Zinc	3,200	> 4,200				1	N	--		**N**	**I3**	Not analyzed for; metal that cannot be ruled out at this time
Organometallics (µg/kg)												
Monobutyltin	540	> 4,800					N	--		**Y**	**E1**	Organotin compound used only in specialty manufacturing of products (stabilizers, coatings, anti-biofouling agents) and marine paints with no known or suspected use at railyard

Table 1-1. Hazard Assessment Screening of Constituents

Chemical Parameter	Freshwater Benthic		Freshwater Human Health and Higher Trophic Level Receptors				Upland Soil Analysis			Excluded as COPC for Step 1 of Sediment RI (Y/N)	Screening Result Category [c]	Rationale for Inclusion or Exclusion
	WAC 173-204-563 Table VI/ SCUM II Table 8-1		SCUM II Table 9-2 [b]			Programmatic PQLs SCUM II Table 11-1						
	Dry Weight Sediment Cleanup Objective (SCO)	Dry Weight Cleanup Screening Level (CSL)	Beach Play (Child)	Subsistence Clam Digging (Adult)	Subsistence Net Fishing (Adult)	Consumption of Fish/Shellfish by Human and Higher Trophic Level Receptors	Performed (Y/N)	Exceeds (Y/N)	Notes			
Dibutyltin	910	130,000					N	--		**Y**	**E1**	Organotin compound used only in specialty manufacturing of products (stabilizers, coatings, anti-biofouling agents) and marine paints with no known or suspected use at railyard
Tributyltin	47	320	160,000	230,000	1,200,000		N	--		**Y**	**E1**	Organotin compound used only in specialty manufacturing of products (stabilizers, coatings, anti-biofouling agents) and marine paints with no known or suspected use at railyard
Tetrabutyltin	97	> 97					N	--		**Y**	**E1**	Organotin compound used only in specialty manufacturing of products (stabilizers, coatings, anti-biofouling agents) and marine paints with no known or suspected use at railyard
Pesticides (µg/kg)												
Beta-Hexachlorocyclohexane	7.2	11					N	--		**Y**	**E1**	Insecticide or insecticide byproduct with no known or suspected use at railyard
Dieldrin	4.9	9.3					N	--		**Y**	**E1**	Insecticide or insecticide byproduct with no known or suspected use at railyard
Endrin Ketone	8.5	> 8.5					N	--		**Y**	**E1**	Insecticide or insecticide byproduct with no known or suspected use at railyard
Total DDDs	310	860					N	--		**Y**	**E1**	Insecticide or insecticide byproduct with no known or suspected use at railyard
Total DDEs	21	33					N	--		**Y**	**E1**	Insecticide or insecticide byproduct with no known or suspected use at railyard

Table 1-1. Hazard Assessment Screening of Constituents

Chemical Parameter	Freshwater Benthic		Freshwater Human Health and Higher Trophic Level Receptors				Upland Soil Analysis			Excluded as COPC for Step 1 of Sediment RI (Y/N)	Screening Result Category [c]	Rationale for Inclusion or Exclusion
	WAC 173-204-563 Table VI/ SCUM II Table 8-1		SCUM II Table 9-2 [b]			Programmatic PQLs SCUM II Table 11-1						
	Dry Weight Sediment Cleanup Objective (SCO)	Dry Weight Cleanup Screening Level (CSL)	Beach Play (Child)	Subsistence Clam Digging (Adult)	Subsistence Net Fishing (Adult)	Consumption of Fish/Shellfish by Human and Higher Trophic Level Receptors	Performed (Y/N)	Exceeds (Y/N)	Notes			
Total DDTs	100	8,100	21,000	4,300	13,000		N	--		**Y**	**E1**	Insecticide or insecticide byproduct with no known or suspected use at railyard
PCBs and Dioxins/Furans (see units below)												
Total PCB Aroclors (µg/kg)	110	2,500					Y	N	ND in all samples; DL below SCO and CSL in ALL samples	**N**	**I4**	Potential for accumulation in wider sediment environment as a result of upstream sources. Detection limits appropriate; not detected in 8 upland samples collected from suspected use areas and 5 samples of on-site NAPL.
Dioxin-like PCB Congeners[a] (ng/kg)			89	15	55	0.7	N	--		**N**	**I4**	Potential for accumulation in wider sediment environment as a result of upstream sources.
Dioxan/Furan Congeners[a] (ng/kg)						5	N	--		**N**	**I4**	Potential for accumulation in wider sediment environment as a result of upstream sources.
Organic Chemicals (µg/kg)												
4-Methylphenol	260	2,000					Y	N	ND in all samples; DL below SCO in 0 of 7 samples and below CSL in 2 of 7 samples	**N**	**I3**	Derivative of phenol; intermediate in the production of numerous chemicals; no known or suspected use at railyard
Pentachlorophenol	1,200	> 1,200					Y	N	ND in all samples; DL below SCO and CSL in 4 of 10 samples	**N**	**I3**	Not detected but DLs above SCO in more than 50% of samples; wood preservative that cannot be ruled out at this time
Phenol	120	210					Y	N	ND in all samples; DL below SCO and CSL in 0 of 10 samples	**N**	**I3**	Component of coal tar, precursor for plastics, epoxies and other chemicals; no known or suspected use at railyard

Table 1-1. Hazard Assessment Screening of Constituents

Chemical Parameter	Freshwater Benthic		Freshwater Human Health and Higher Trophic Level Receptors				Upland Soil Analysis			Excluded as COPC for Step 1 of Sediment RI (Y/N)	Screening Result Category [c]	Rationale for Inclusion or Exclusion
	WAC 173-204-563 Table VI/ SCUM II Table 8-1		SCUM II Table 9-2 [b]			Programmatic PQLs SCUM II Table 11-1						
	Dry Weight Sediment Cleanup Objective (SCO)	Dry Weight Cleanup Screening Level (CSL)	Beach Play (Child)	Subsistence Clam Digging (Adult)	Subsistence Net Fishing (Adult)	Consumption of Fish/Shellfish by Human and Higher Trophic Level Receptors	Performed (Y/N)	Exceeds (Y/N)	Notes			
Benzoic acid	2,900	3,800					Y	N	ND in all samples; DL below SCO and CSL in 0 of 1 sample	**N**	**I3**	Precursor for plasticizers and food preservatives; occurs naturally in many plants; no known or suspected use at railyard
Bis(2-ethylhexyl) phthalate	500	22,000					Y	N	ND in all samples; DL below SCO in 3 of 10 samples and below CSL in 7 of 10 samples	**N**	**I3**	Plasticizer; used as a hydraulic fluid and as a dielectric fluid in capacitors; no known or suspected use at railyard
Di-n-butyl phthalate	380	1,000					Y	N	ND in all samples; DL below SCO in 0 of 10 samples and below CSL in 4 of 10 samples	**N**	**I3**	Plasticizer used in manufacturing; no known or suspected use at railyard
Di-n-octyl phthalate	39	> 1,100					Y	N	ND in all samples; DL below SCO in 0 of 10 samples and below CSL in 4 of 10 samples	**N**	**I3**	Plasticizer used in manufacturing; no known or suspected use at railyard
Carbazole	900	1,100					N	--		**N**	**I3**	Polycyclic aromatic hydrocarbon that cannot be ruled out at this time
Dibenzofuran	200	680					N	--		**N**	**I3**	polycyclic aromatic hydrocarbon that cannot be ruled out at this time
Total PAHs	17,000	30,000					Y	Y	Component of petroleum-related impacts; exceeds SCO and CSL in upland source area soil samples	**N**	**I1**	Components of known fuel releases; have been detected in upland soils in excess sediment criteria; potential for accumulation in wider sediment environment as a result of upstream sources.
Carcinogenic PAHs[a] (cPAH)			900	320	680	9	Y	Y	Component of petroleum-related impacts; exceeds SCO and CSL in upland source area soil samples	**N**	**I1**	Components of known fuel releases; have been detected in upland soils in excess sediment criteria; potential for accumulation in wider sediment environment as a result of upstream sources.

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Chemical Parameter	Freshwater Benthic		Freshwater Human Health and Higher Trophic Level Receptors				Upland Soil Analysis			Excluded as COPC for Step 1 of Sediment RI (Y/N)	Screening Result Category [c]	Rationale for Inclusion or Exclusion
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Bulk Petroleum Hydrocarbons (mg/kg)												
Total Petroleum Hydrocarbons as diesel-range organics	340	510					Y	Y	Component of petroleum-related impacts; exceeds SCO and CSL in upland source area soil samples	**N**	**I1**	Components of known fuel releases; have been detected in upland soils and sediment within initial study area in excess sediment criteria
Total Petroleum Hydrocarbons as residual/oil-range organics	3,600	4,400					Y	Y	Component of petroleum-related impacts; exceeds SCO and CSL in upland source area soil samples	**N**	**I1**	Components of known fuel releases; have been detected in upland soils and sediment within initial study area in excess sediment criteria

Notes:

[a] Not a WAC 173-204-563 Table VI constituent but represents one of the most widespread bioaccumulative chemical classes based on sediment regional background studies conducted by Ecology (SCUM II Chapter 10).
[b] Human health risk-based sediment concentrations for ingestion of sediment and direct contact with sediment from Chapter 9 of SCUM II (calculated using the spreadsheets in Appendix K and the recommended exposure parameters in Table 9-1).
[c] Screening Result Category
I1: Analyzed for and detected in upland soil and sediment within initial study area in excess sediment criteria; component of known release; may also have potential for accumulation in wider sediment environment.
I2: Analyzed for in upland soil or sediment and present in excess sediment criteria; constituent also has potential for accumulation in wider sediment environment
I3: Not analyzed for in upland soil or analyzed and not detected, but some samples may not have had detection limits at or below the lowest sediment criteria; constituent may also have potential for accumulation in wider sediment environment; use at the facility cannot be ruled out at this time; includes "conventional chemicals"
I4: May or may not have been analyzed for in upland soil and while its use at the facility is not suspected, constituent is considered one of the most widespread bioaccumulative chemicals above natural background based on the sediment regional background studies conducted by Ecology and referenced in SCUM II Chapter 10.
E1: Analyzed for in upland soil and not detected; detection limits are at or below the lowest sediment criteria; determined with certainty there was no known or suspected use at railyard and is not a ubiquitous or widespread chemical
E2: Not analyzed for in upland soil; determined with certainty there was no known or suspected use at railyard and is not a ubiquitous or widespread chemical
µg/kg = microgram(s) per kilogram
cPAH = carcinogenic polycyclic aromatic hydrocarbon
CSL = cleanup screening level
DDD = dichlorodiphenyldichloroethane
DDE = dichlorodiphenyldichloroethene
DL = detection limit
DDT = dichlorodiphenyltrichloroethane
mg/kg = milligram(s) per kilogram
ND = not detected
ng/kg = nanogram(s) per kilogram

Excluded (E)

- Category E1 – Analyzed for in upland soil and not detected; detection limits are at or below the lowest sediment criteria and determined with certainty there was no known or suspected use at the railyard and is not a ubiquitous or widespread chemical.
- Category E2 – Not analyzed for in upland soil; determined with certainty there was no known or suspected use at railyard and is not a ubiquitous or widespread chemical.

Table 1-1 lists the Table VI chemicals and indicates the rationale for whether they have been included or excluded as COPCs for the RI sediment sampling and which of the above categories they fall within.

Chemicals included as COPCs for the RI sediment sampling include chemicals in the SMS Table VI (with the exception of pesticides and butyltins), carcinogenic PAH congeners, PCB congeners, and dioxin/furan congeners. Organometallics (butyltins),[1] and insecticides were excluded as COPCs for the site as it has been determined with certainty there was no known or suspected use at the railyard and these constituents are not ubiquitous or widespread. While there was no known use of PCBs at the railyard (BNSF 2020) and PCBs have not been detected in any soil, groundwater, or NAPL samples collected during uplands investigation activities (KJ 2020), However, PCBs (congeners) and dioxin/furans congeners have been included as initial COPCs due to their ubiquitous presence in the wider sediment environment as well as their ability to bioaccumulate. Furthermore, select metals as well as phthalates and phenols that also have no identified or suspected use at the railyard have also been included as COPCs for the initial stages of the sediment RI.

1.4 Remedial Investigation Work Plan Requirements

The requirements for a remedial investigation work plan are listed in WAC 173-204-550(4) and include:

> *(a) Public participation plan;*
>
> *(b) A summary of available information regarding the site and data gaps needing to be addressed by the remedial investigation;*
>
> *(c) A conceptual site model, including current and potential human and ecological receptors and exposure pathways;*
>
> *(d) Cleanup action alternatives that are likely to be considered in the feasibility study;*
>
> *(e) Sampling plan and recordkeeping in compliance with WAC 173-204-600 through 173-204-610. Analytical methods and limits shall be sufficiently sensitive to measure concentrations at levels of potential regulatory concern. Proposed sampling locations should consider the movement and deposition patterns of sediments;*
>
> *(f) Site safety plan to meet the requirements of the Occupational Safety and Health Act of 1970 (29 U.S.C. Sec. 651 et seq.) and the Washington Industrial Safety and Health Act (chapter 49.17 RCW), and regulations promulgated pursuant thereto. These requirements are subject to enforcement by the designated federal and state agencies. Actions taken by the*

[1] Butyltins were used as antifoulant components in marine paints and can be associated with harbors and shipyards.

department under this part do not constitute an exercise of statutory authority within the meaning of section (4)(b)(1) of the Occupational Safety and Health Act;

(g) A proposed schedule for completion of the remedial investigation/feasibility study; and

(h) Other information as required by the department. In the case of this site, this would include coordination with the Yakama Nation regarding various fish runs during the year.

This work plan provides the requested information. Fulfillment of the public participation requirement will rely on the existing plan developed by Ecology (Ecology 2015).

1.5 Objectives of the Remedial Investigation

The objectives of the sediment RI are to collect, develop, and evaluate sufficient information to characterize the inundated lands portion of the site, further develop the conceptual site model (CSM), evaluate the nature and extent of impacts, establish cleanup standards, and develop cleanup alternatives. The objectives of this RI work plan include:

- Characterize the sediments within the biological active zone (BAZ) across an expanded study area from the initial investigation that includes the post-1957 inundated lands and adjacent areas potentially impacted by historical discharges, activities in the uplands and inundated land, and activities along the historic shoreline (for example, historical outfalls, drainage channels, and low-lying areas)
- Provide additional characterization of sediments in the initial investigation area adjacent to uplands where groundwater concentrations in berm wells exceed MTCA cleanup levels (CULs) and in the area of known NAPL impacts
- Characterize the vertical and lateral extent of NAPL-impacted materials and refine the understanding as to the source of observed sheens
- Determine sediment cleanup unit boundaries and appropriate cleanup standards (which may include CULs and points of compliance), as applicable

As part of the Sediment RI report, the sediment CSM, provided in Section 3, will be updated based on the information collected, and conclusions will be provided that support the evaluation of potential remedial alternatives for the site.

1.6 Work Plan Organization

This RI work plan is organized as follows, and includes the following components:

- **Section 1 – Introduction.** This section states the objective of the investigation and includes general site information.
- **Section 2 – Site Information**. This section includes a summary of available information of the site, including site history, past and present potential sources of impacts at the site (including a list of owners and operators), and previous investigations.
- **Section 3 – Preliminary Conceptual Site Model**. This section provides discussion on the preliminary CSM, including site physical characteristics, COPCs, sources, transport pathways, exposure pathways, and data gaps including where data quality and completeness could be improved.

- **Section 4 – Remedial Investigation**. This section includes details of the sediment investigation field scope, laboratory analyses, and data evaluation.
- **Section 5 – Data Management and Data Quality**. This section includes project quality assurance and quality control (QC), data validation, and data management for the project.
- **Section 6 – Development of Proposed Cleanup Standards and Site Clusters and Boundaries**. This section provides the proposed cleanup standards (that is, cleanup levels and points of compliance) for the RI and development of sediment management areas and site boundaries.
- **Section 7 – Schedule and Likely Remedial Alternatives**. This section provides the tentative project schedule for the RI and presents likely remedial alternatives.
- **Section 8 – References**. This section provides references used in the development of this document.

A public participation plan has been developed by Ecology and is currently in use for the uplands. It will be used for the Sediment RI as well. Appendix A contains the sampling and analysis (SAP) plan. Appendix B contains the health and safety plan.

2. Site Information

2.1 Site History

The site occupies a flat bench along the northern side of the Columbia River at the eastern edge of the Columbia River Gorge. The site was originally developed by the Spokane, Portland, and Seattle Railway between 1910 and 1912. The Spokane, Portland, and Seattle Railway merged with other railroads in 1970 to become the Burlington Northern Railroad, which merged with the Santa Fe Railroad in 1995 to become what is now BNSF. The primary historical use of the railyard was railcar switching. Historically, locomotive operations involving fueling/watering and repairs also occurred at Wishram within the western portion of the railyard. Bunker C and diesel were the primary fuels historically used to fuel locomotives at this yard. Most track spurs, early structures, and infrastructure no longer remain. Prominent site features believed to have been present during some portions of the time between 1910 and the present are shown on Figure 1-3.

At the time the railyard was constructed, the Columbia River was free-flowing and occupied a channel approximately 300 feet south of and 40 to 50 feet lower than the current railyard. Construction of The Dalles Dam in 1957 impounded the Columbia River to create Lake Celilo. As a result, the lands along the southern portion of the railyard were inundated and remain submerged today. The main area for the sediment RI is the inundated lands adjacent to the railyard operational areas and associated outfalls. The approximate extent of the investigation area is shown on Figures 1-2 and 1-3. The extent of these inundated lands areas was used to inform the proposed sampling locations.

2.2 Summary of Previous Investigations

BNSF performed a series of voluntary and AO-required investigations to characterize the nature and extent of impacted soil and groundwater in the uplands portion of the site. In addition, BNSF implemented voluntary independent remediation activities in the uplands portion of the site.

Results from past investigations indicate the primary COPCs for the uplands are petroleum hydrocarbons, specifically diesel- and oil-range hydrocarbons, with gasoline-range hydrocarbons in localized areas. PAHs, related to the petroleum hydrocarbons, have been reported in a small subset of samples above applicable MTCA CULs. Reported concentrations of metals in soil were below applicable MTCA CULs in 126 of 127 samples. Metals reported in groundwater samples above applicable MTCA CULs were limited to total and dissolved arsenic, total barium (in 1 of 73 groundwater samples), dissolved iron, and dissolved manganese. Per Ecology's letter dated 10 December 2020, geochemical conditions influencing metals concentrations in groundwater will be further evaluated as part of future groundwater monitoring efforts once the Cleanup Action Plan is approved.

Inundated lands initial investigation activities identified total petroleum hydrocarbons (TPH) as diesel range organics (TPH-diesel) and TPH as residual/oil range organics (TPH-residual) as COPCs in study area sediment. The following subsections briefly summarize past investigation and remediation activities that have occurred at the site.

2.2.1 Uplands Investigations and Remedial Activities

- **2002** – Removed a 30,000-gallon, steel, single-walled UST adjacent to the western side of a former boiler house, collected soil samples, and removed petroleum-containing soils to the top of bedrock (16 feet below ground surface [bgs] at this location). Confirmation sampling indicated a thin layer of

soil containing diesel- and oil-range hydrocarbons at concentrations above MTCA Method A soil CULs for industrial properties remaining in place just above bedrock to the north, east, and south of the excavation.

- **2003** – Conducted UST site assessment to evaluate site hydrogeologic conditions and determine the extent of petroleum-containing soil south and potentially hydraulic downgradient of the former 30,000-gallon UST (KJ 2004a). Soil samples from two borings and groundwater samples from four monitoring wells were above MTCA Method A CULs.
- **2004** – Conducted an overall site assessment (KJ 2004b) to locate and evaluate potential primary sources of petroleum at the site. These potential primary sources, which are shown on Figure 1-3, included:
  - Former 30,000-barrel oil AST
  - Former 600-gallon fuel oil and 10,000-gallon gasoline/oil USTs
  - Former 5,000-gallon oil UST at Depot
  - Former 1,000-gallon gasoline UST and Oil House
  - Former Transformer Storage Area
  - Former Engine House and Turntable
  - Former Power House
  - Former 100,000-gallon diesel ASTs, Pump House, and former 500-gallon gasoline USTs
  - Former Fueling Island and 5,000-gallon lubricating oil AST

  Petroleum-containing soil and groundwater were identified at several possible petroleum storage and use locations.
- **2005** – Used results of 2004 site assessment to guide additional remediation activities in the uplands portion of the site. These activities included removal and offsite disposal of approximately 3,600 tons of petroleum-containing soil and debris, removal and recycling of approximately 1,800 gallons of petroleum from the former 5,000-gallon lube oil UST and associated piping, and removal and recycling of 10 tons of metal (KJ 2007). Excavation depths extended to the water table, typically encountered around 10 to 12 feet bgs. Confirmation sampling in excavation areas west of the current Maintenance Shop indicated some soil containing diesel-range petroleum hydrocarbons at concentrations above the MTCA Method A industrial soil CUL was left in place below the water table.
- **2010** – Performed supplemental investigation to identify potential primary sources of residual NAPL in the vicinity of the Maintenance Shop (KJ 2010b). The source of the NAPL appeared to be petroleum-saturated soil submerged beneath the present-day water table and likely related to historical releases from the former 30,000-gallon diesel UST. Additionally, debris and petroleum-containing soil in the vicinity of the former 28,500-gallon oil service AST were removed and disposed of offsite. Confirmation soil samples collected following the excavation activities confirmed residual hydrocarbon concentrations in the excavation area were below MTCA Method A soil CULs for unrestricted land use (KJ 2010a).
- **2012** – Conducted soil and groundwater investigations focused on the southern side of the mainline tracks near the former fueling island and Former Power House (KJ 2012). Diesel-impacted soil and groundwater were found along the length of the former fueling platform south of the mainline tracks, but the source was thought to be migration of NAPL from the area north and upgradient of the mainline tracks and former fueling platform. An air sparging system and a soil-vapor extraction (SVE) system were installed north of the mainline tracks to address the NAPL. However, air sparging was discontinued in June 2012 due to the sporadic presence of NAPL in monitoring wells in the area. The SVE system was also modified to operate in bioventing mode (injecting, rather than pulling air through the SVE wells). Bioventing with ambient air through the SVE wells operated in continuous mode

(24 hours a day, 7 days a week) between June 2012 and April 2017, when the system blower failed. The system blower was replaced on November 28, 2017, and the bioventing system was restarted, operating again in continuous mode. Operation of the system continued until July 24, 2019, when the system was shut down to perform a respirometry test and to evaluate future system operation.

- **2013** – Conducted a laser-induced fluorescence (LIF) survey to further delineate the heavy oil-impacted areas in the uplands portion of the site. The LIF survey was conducted by Dakota Technologies, of Fargo, North Dakota, using the Tar-specific Green Optical Screening Tool LIF system, developed specifically for coal tar and heavy oil detection (Dakota Technologies 2013). The LIF survey included 102 sample points at approximately 12.5- to 50-foot centers, but mostly spaced on 30- to 40-foot centers. The LIF tooling was advanced to refusal (the top of bedrock surface) using a Geoprobe direct-push rig. Soil samples were collected to qualitatively correlate the LIF signal response to laboratory soil analytical concentrations for petroleum hydrocarbons. The LIF and analytical data were used to delineate the approximate distribution of light nonaqueous petroleum liquid (LNAPL) in subsurface soils at the site.

  During the LIF survey on July 13, 2013, oil droplets and an associated sheen were observed offshore but near the site in the Columbia River. BNSF reported the occurrence of the oil and sheen in surface water to the National Response Center and Ecology on the same date. Monthly inspections for possible sheen began in December 2013.

  The LIF data and additional laboratory data collected during the uplands RI were provided as part of the uplands RI report (KJ 2020).

- **2014** – Conducted additional investigations near the Former Power House to evaluate potential mobility of the submerged oil LNAPL in the saturated zone and to select locations for oil head monitoring and deep riverside monitoring wells. Additionally, petroleum sheens[2] were observed near the shoreline in July 2014.

- **2016 - 2020** – Conducted RI work planning, data collection activities, and reporting pursuant to AO No. DE 12897, dated October 7, 2015, to investigate the nature and extent of site-related constituents in soil and groundwater at the railyard and evaluate related fate and transport mechanisms across the approximately 6-acre area at the railyard where industrial activities (e.g., fuel storage, engine refueling, engine maintenance) historically occurred. This work culminated in Ecology's acceptance of the uplands RI report (KJ 2020) (Ecology 2021).

2.2.2 Shoreline and Sediment Investigations

- **2013** – During the uplands LIF survey on July 13, 2013, oil droplets and an associated sheen were observed offshore and near the site in the Columbia River. BNSF reported the occurrence of the oil and sheen in surface water to the National Response Center and Ecology on the same date. Monthly inspections for sheen began in December 2013.
- **2014** – Petroleum sheens were observed near the shoreline in July 2014.
- **2015** – Petroleum sheen was observed near the shoreline in June 2015.
- **2016** – Petroleum sheen was observed near the shoreline in August and October 2016.

[2] Sheen is a very thin layer of oil (less than 0.0002 inch or 0.005 millimeter) floating on the water surface and is the most common form of oil seen in the later stages of a spill. According to their thickness, sheens vary in color from rainbows for the thicker layers, to silver/gray for thinner layers, to almost transparent for the thinnest layers (NOAA 2016).

- **2018** – An initial investigation was conducted in June and August 2018 to evaluate the potential presence of NAPL in the inundated lands that might be the source of the observed sheens. During the investigation, 30 Darts[3] were advanced in June, 5 surface sediment grab samples were collected in August, and 1 sediment core sample was collected in the nearshore and 7 sediment cores were advanced in the offshore in August. Submerged NAPL, approximately 2- to 4-feet thick, was observed in a disturbed layer 0.5 to 2.5 feet beneath the surface sediments at four sampling locations in the offshore area. Concentrations of TPH-diesel and TPH-residual exceeded the Washington Freshwater SCOs in offshore sediment at one location in the vicinity of the NAPL. Closer to the shoreline where NAPL was not observed to be present, a second sediment sample had a concentration of TPH-diesel just above the SCO. While the general location of the submerged NAPL has been identified, additional data are needed to refine the extent of NAPL and SCO exceedances. (CH2M 2019).

[3] Darts are a sampling method developed by Dakota Technologies. Darts quickly screen for polycyclic aromatic hydrocarbons (PAHs) in sediments and similar soft soils. The Dart sampler consists of a continuous rod made coated with solid-phase extraction (SPE) media – the same type of materials used in laboratories for U.S. Environmental Protection Agency-approved cleanup and pre-concentration of PAHs in traditional grab samples. PAHs are attracted to and absorb into the SPE media. Once they've migrated into the Dart, they're held in solid solution and remain trapped there until analyzed.

3. Preliminary Conceptual Site Model

This section describes the preliminary CSM based on the SCUM II guidance. The following informs the details of the CSM:

- The historical uplands use of the facility including associated outfalls and drainage patterns from railyard operations documented in the approved Uplands RI report (KJ 2020).
- Potential release and transport mechanisms (for example, erosion and stormwater runoff and direct discharges) going from the uplands to the sediment, thus the Uplands RI results help inform the sediment CSM.
- Historical photos and drawings of the railyard before the formation of Lake Celilo and bathymetry data collected by the U.S. Army Corps of Engineers (USACE) (2008) and CH2M HILL Engineers, Inc. (CH2M 2017) that show the current bathymetry aligns closely with the shoreline before inundation. Combining the historical aerial photograph and bathymetry shows historical drainage pathways and low-lying areas now in sediment.
- Initial Investigation results that include NAPL screening, coring, and surface sediment analytical data from the portion of the inundated lands where sheens have been observed. The initial investigation identified the presence of submerged NAPL within the inundated lands and informed the potential NAPL transport mechanisms.

This preliminary model will be refined and updated during the RI/Feasibility Study (FS) process.

3.1 Physical Characteristics

3.1.1 Geologic and Hydrogeologic Conditions

The local geology at the site, as determined by soil borings completed in the uplands area, consists of varying thickness of surface fill (sand and gravel reportedly sourced from nearby sand dunes and river deposits), followed by 10- to 95-foot-thick sequences of glaciofluvial sediment (and silt) deposited on eroded Columbia River Basalt Group bedrock during ice-age floods.

The uppermost hydrogeologic unit at the railyard is the glaciofluvial aquifer, consisting of unconsolidated sand and silt with gravel lenses deposited during the Missoula Floods. The aquifer is unconfined. Numerous monitoring wells have been installed at the railyard, screened in the sand/silt deposits, which can be up to 95 feet thick in the western section of the railyard where locomotive operations involving fueling/watering and repairs occurred and a glaciofluvial sediment-filled erosional feature in the basalt bedrock is believed to be present. Based on local topography and historical aerial photographs taken before creation of Lake Celilo, which show exposed bedrock along some portions of the historical Columbia River shoreline adjacent to the railyard, the sediment-filled depression is expected to be limited in areal extent. The glaciofluvial deposits are generally homogeneous, and, in some areas, the sand and silt overlie a thin layer of gravel just above bedrock (KJ 2016). Given the presence of exposed bedrock surfaces east and west of the initial sediment study, as shown on historical aerial photographs and local bathymetry, the glaciofluvial aquifer likely pinches out to the south just beyond the former shoreline of the Columbia River (Figure 1-3), approximately 350 feet from the current shoreline (CH2M 2018).

Groundwater occurs in the unconfined sand/silt alluvial aquifer at 10 to 12 feet below grade at the railyard. Before construction of the dam and creation of Lake Celilo, the unconfined water table was likely at least 30 to 40 feet deeper. While groundwater flow across the railyard is generally south toward the lake

at a very shallow gradient, it has been estimated that during 10 months of the year, the nearshore portions of Lake Celilo in the vicinity of the railyard is a losing water body where flow directions and periods of groundwater discharge toward the railyard are controlled by the lake level. Daily oscillations in the Columbia River stage (typically 1 to 2 feet) occur because of variable discharge rates from The Dalles Dam (KJ 2020).

Within approximately 100 feet of the current shoreline, Lake Celilo water depths extend up to 15 feet as the riverbed dips to the south at a slope of approximately 8 percent. Beyond this distance, steeper slopes of approximately 20 percent are present, and water depths increase to over 30 feet within approximately 160 feet of the current shoreline. Historical aerial photographs indicate the former shoreline of the river was approximately 300 feet farther south of where it is today and consisted primarily of bedrock with the exception of an 800-foot sandy section where the bedrock erosional feature is believed to extend. Overlying the glaciofluvial deposits within the river and beyond the toe of the riprap embankment, are surface sediments consisting of micaceous fine sand to silty fine sand with varying amounts of organics that have been observed at thicknesses of up to approximately 5 feet. In select locations farther from the current shoreline, a 2- to 3.5-foot interval of highly plastic silty sand fill containing wood, roots, and limited amounts of miscellaneous litter[4] is present at depths of 0.5 to 2.5 feet below sediment surface (bss).

3.1.2 Bathymetry

A detailed bathymetric survey of the inundated lands adjacent to the railyard and around the initial study area was completed in 2017. The bathymetry survey indicated surface water depth gradually increases to 15 feet at approximately 100 feet from the current shoreline, before increasing to depths of over 30 feet at approximately 160 feet from the current shoreline, as the sediment surface transitions from approximately an 8-percent grade to 20-percent grade slope. Elevation of the sediment surface ranged from approximately 150 feet North American Vertical Datum of 1988 (NAVD88) to 130 feet NAVD88 within the study area. The current stage of the Columbia River ranges from 158.3 to 163.3 feet NAVD88. New bathymetry data will be collected for the expanded study area using the same methodology as the 2017 survey, to provide for detailed subsurface information.

The bathymetry outside this initial investigation study area is available from a larger-scale 2008 USACE bathymetry survey of Lake Celilo. The combined data are shown on Figure 1-3 and indicate the depths within the RI study area extend up to 40 feet below the water surface across the inundated lands and to as deep as 60 feet in some localized areas farther south beyond the former shoreline. Both the 2008 and the 2017 bathymetry data were used to help select sampling locations in the investigation study area.

3.2 Sources

The preliminary CSM is illustrated on Figure 3-1 and described in the following subsections. It includes the sources and potential sources of impacts, release and transport mechanisms, impacted media, exposure routes, and receptors as described in Sections 1 and 2.

The primary sources of constituents related to the historical uplands railyard operations are detailed in the uplands RI report (KJ 2020). These sources included various historical ASTs, USTs, and underground fuel and steam lines associated with fueling and maintenance operations and onsite utilities (including power generation) (Section 2.2.1). COPCs detected above MTCA CULs in the uplands area include TPH-related compounds (primarily TPH-diesel and TPH-residual, but also TPH as gasoline range organics in localized

[4] A partially intact glass mason jar with its metal lid was observed in one core sample.

areas), and PAHs (reported in a small subset of samples above the applicable CULs). Total and dissolved arsenic are also present in groundwater at concentrations above screening levels.

Suspected legacy sources of petroleum hydrocarbons have been decommissioned and/or removed from the site and shallow impacted soil (down to the water table or bedrock) has been removed and disposed of offsite as part of interim remedial activities. LNAPL that remains within the uplands area includes diesel LNAPL, which is predominantly observed in the shallow water table zone to the south of the former fueling island, and highly viscous oil-based Bunker C LNAPL, which is predominantly observed in the submerged zone in the vicinity of former underground fuel oil supply piping and the former oil sump. LNAPL south of the mainline (near former underground piping) is classified as mobile, as defined by Interstate Technology and Regulatory Council (ITRC), as evidenced by observations of measurable LNAPL in three wells. LNAPL was not observed in TarGOST LIF borings south of the LNAPL body nor in the river berm monitoring wells, indicating that the LNAPL body is not migrating. Dissolved phase fractions of TPH-diesel, and to a lesser extent TPH-residual, are present in the samples collected from the uplands groundwater wells adjacent to the initial investigation area. However, sufficient data has not been collected to conclude the absence of NAPL within inundated nearshore areas.

Within the inundated lands, a separate occurrence of viscous NAPL consistent with Bunker C has been identified in the offshore area within a submerged layer approximately 40 to 130 feet from the shoreline. COPCs associated with these impacts include TPH-diesel, TPH-residual, and Bunker C-related PAHs. The absence of bedding structure and disturbed nature of these materials indicates that the NAPL was discharged to the surface and subsequently inundated by the construction of The Dalles Dam in 1957, and is not related to those LNAPL bodies identified within the uplands portion of the site. This is also supported by the lack of LNAPL in borings along the berm (KJ 2020), and the NAPL mobility observed in cores taken from the most impacted intervals/areas during the 2018 investigation (CH2M 2019). While the primary sources associated with the submerged NAPL present in offshore sediment are unknown, the uplands RI Work Plan Addendum (KJ 2018) included a summary of 1950 and 1951 correspondences between SP&S personnel and the State of Washington Pollution Control Commission (PCC), as well as internal SP&S communications related to potential releases of petroleum hydrocarbons at the railyard that may have impacted the inundated lands (BNSF 2017). These include:

- A release described in a November 20, 1950 letter from SP&S to PCC and in an internal December 1, 1950 SP&S document as an accidental spill due to a broken valve on the service tank while fueling a locomotive that had occurred some years prior to 1950. The oil was trenched across the track to accumulate in a swamp and allowed to dry to the consistency of asphalt. The December 1, 1950 letter also notes evidence of a new oil spill just upstream from the Power House since the November 20, 1950 letter (KJ 2018).
- A PCC Field Engineer, Mr. Alfred Neale, visited the railyard and in a letter dated February 26, 1951, noted three sewer outfalls that discharged wastes to the Columbia River. The documents show that Mr. Neale inspected the facility and observed waste oils on the banks of the Columbia River in the vicinity of the outfall (potentially Former Pump House #2 location) nearest to the oil-water separator. He also observed an open ditch a short distance downstream that had an outfall that terminated over 100 feet from the river.

While the exact locations of the oil releases are not known, the presence of highly viscous NAPL within an organic-rich fill layer observed during the Initial Investigation is consistent with the descriptions provided. The historical communications, drawings, and aerial photographs suggest that other potential sources related to historical outfalls and stormwater runoff from operational areas may have impacted sediment within and adjacent to the inundated lands as shown on Figure 1-3.

The following historical outfalls, underdrains, and surface drainage features have been identified as potential sources:

- Former Pump House #1 Outfall - This easternmost historical outfall was used for treated municipal sewage and stormwater discharged from the onsite septic drainage field from the early 1960s through the 1970s. Inputs to the septic drainage field included the railyard Wash and Locker Room (south of the former Engine House), as well as wastewater generated by the City of Wishram (single-family homes, a hotel, restaurant, etc.). A 1959 Existing and Proposed Sewers and Disposal System drawing (revised 1961) shows discharge lines from Pump House #1 to the Columbia River and to the onsite leaching field immediately north and east. If the proposed sewers and disposal systems were installed as designed, the waste from the former Wash and Locker Room would have been discharged to the leach field and not the river (KJ 2020).
- Former Pump House #2 - A 4-foot by 4-foot concrete box culvert extended from north to south beneath the railyard (first appears in a 1917 blueprint) with an outfall to the Columbia River. Early blueprints and station plats show sewer connection lines from houses in Wishram, north of the railyard, to the culvert along with roof drains and sewer drains from the railyard Storehouse and Engine House (KJ 2020). The box culvert was cut off just north of the railyard sometime in the 1960s and 1970s and replaced with a subsurface line (corrugated metal) that connects to Pump House #2. The 2017 bathymetry shown on Figure 1-3 indicates a low-lying area to the south-southwest of this outfall that may be the remnants of a topographic feature that once conveyed discharges in this area to the former shoreline.
- Corrugated Pipe Outfalls – A 1959 Existing and Proposed Sewers and Disposal System drawing (revised 1961) shows an "Oil Drain" existing between the former Engine House and where corrugated pipes have been identified along the current shoreline. This line, that appears to have previously discharged directly to the river, is shown in the historical design drawings to be connected to a sump pump (cutting off the direct discharge) to pump fluid to an oil-water separator farther west and discharged through a 12-inch concrete pipe to a location near the Former Pump House #2 concrete box culvert. Per November 6, 1950 SP&S correspondence, the oil-water separator had not been used for its intended purpose since being constructed, but rather as a booster cistern for pumping water into a water tank SP&S 1950.
- Historical drainage discharge feature and outfall pipe south of Former Pump House #2 – The 1951 aerial photograph that shows the pre-inundation shoreline indicates a north-south trending linear erosional feature and an adjacent pipe at the edge of the former shoreline where discharges from farther upgradient could have been conveyed to the river.
- Historical drainage discharge feature – The 1951 aerial photograph also shows a north-south trending erosional feature at the former shoreline located south of the corrugated pipe outfalls that have been observed along the current shoreline south of the vicinity of the Former Engine House.

In addition to the potential site-related sources, the concentrations of COPCs in sediment at the site may be impacted by upstream offsite sources. As discussed in Section 4.2, background values will be established for the BNSF site.

3.3 Nature and Extent

3.3.1 Nonaqueous Phase Liquid

The extent of NAPL in the uplands has been fully characterized and is defined in the Ecology-approved Uplands RI Report (KJ 2020). The extent of this NAPL does not extend to the current shoreline.

The draft Initial Investigation report identified locations where NAPL was observed in offshore sediment, and where sheen was observed on the water surface. Figure 3-2 shows the sediment characterization sample locations from the 2018 investigation. The data set includes:

- Shoreline surface locations
- Shoreline core locations
- Shoreline Dart locations. The Darts were installed as close to the shoreline as possible by probing the riprap edge. The inner set of the Darts follow the edge of riprap
- Offshore sheen observations
- Offshore core locations with NAPL impacts identified

These data form the basis of the known sediment NAPL impacts. Based on the Initial Investigation, additional exploration of the nature and extent of the NAPL is needed. The extent of NAPL within the expanded study area will be assessed during this RI investigation following the approach presented in Section 4.

3.3.2 Uplands Soil, Groundwater, and Sediment Chemical Impacts

The nature and extent of site-related constituents in soil and groundwater across the uplands are detailed in the Uplands RI Report (KJ 2020). Dissolved-phase TPH-diesel and TPH-residual exceeding MTCA Method A CULs in groundwater within the uplands extend to the berm just upgradient of the current shoreline in western portions of the site north of the initial investigation area. Total and dissolved arsenic are also present above its MTCA Method CUL in select nearshore wells across the site.

During the initial investigation of the inundated lands, sediment samples were collected for petroleum-related constituents only (TPH and PAHs). Of the seven samples collected within the nearshore area and analyzed for TPH-diesel, TPH-residual, and PAHs, only one location had a detection above the SCO. This was for TPH-diesel in the non-silica gel treatment/cleanup sample at location D200. TPH-residual and total PAHs were below their respective benthic SCOs and benthic cleanup screening levels (CSLs) in the surface sediment samples collected from the nearshore area.

Farther offshore near the localized NAPL body, concentrations of TPH-diesel and TPH-residual were found at core location J260 in excess of the benthic SCO for both TPH-diesel (340 milligrams per kilogram [mg/kg]) and TPH-residual (3,600 mg/kg) in the 0- to 0.5-foot bss sample. Location J260 was immediately adjacent to the NAPL-impacted fill layer that was observed to extend from 0.5 foot to 4 feet. Concentrations of TPH-diesel and TPH-residual exceeding the benthic SCO observed in surface sediment at location J260 require further lateral delineation, particularly south and east.

The initial investigation also found that total PAH concentrations in surface sediment sample locations across the offshore area were below the benthic SCO of 17,000 micrograms per kilogram (µg/kg) and the benthic CSL of 30,000 µg/kg. The maximum total PAH concentration of 6,055 µg/kg was detected in the surface sediment sample from core location J260 (CH2M 2019).

A discussion of additional COPCs that will be considered for the site, given the nature and extent of the uplands impacts and the identified potential sources to the sediments, is presented in Section 4.2.

3.4 Release and Transport Mechanisms

The transport mechanisms that may be associated with distribution of COPCs in sediment can include:

- **Erosion and Stormwater Runoff**. Soil erosion and transport from the uplands and bank areas to the sediments through stormwater runoff. This potentially includes historical bank erosion in drainage channels to the Columbia River (historical aerial photographs appear to indicate these types of drainage areas). The riprap-armored shoreline and stormwater systems prevent this from being a current transport mechanism.
- **Stormwater and Wastewater Discharge**. Direct discharge of stormwater and historical wastewater through outfalls and drainage channels (direct discharge to the Columbia River/Lake Celilo have been conducted under permits from the appropriate state and federal agencies). Currently, there are no active discharges associated with the railyard.
- **Sediment Suspension and Deposition**. Sediment suspension and deposition through river flow and recirculation.
- **Groundwater Flow**. Transport of dissolved constituents through vertical and horizontal groundwater flow. Seeps are usually associated with daylighting of groundwater flow. The Columbia River is a losing river for most of the year in the vicinity of the railyard. Discharge of dissolved-phase constituents detected in groundwater at the shoreline would only occur during periods when the river is a gaining water body (typically of limited duration during spring).
- **NAPL Transport**.

  In 2020 and 2021, ASTM released several guides on the topic of NAPL mobility and migration in sediment. **ASTM E3248-20 NAPL Mobility and Migration in Sediment – Conceptual Models for Emplacement and Advection** (ASTM 2020) presents different conceptual models for NAPL emplacement and advective NAPL transport. The guide states that "there are two primary physical processes that emplace NAPL within sediments: (1) advective flow, and (2) deposition." These two processes are discussed below with relevant site data.

  – **Advection from Upland – Unconfined LNAPL Discharge to Surface Water Along the Current Bank/Shoreline**

    The absence of NAPL in the nearshore areas adjacent to the riprap embankment and physical separation of the defined extent of uplands NAPL (KJ 2020) and the shoreline to the south (Figure 1-2) indicates that advection of NAPL from the uplands portions of the site is not contributing to the observed sheens at the shoreline. Furthermore, the armoring provided by the heavy riprap shoreline limits erosion that could result in the redistribution of shoreline NAPL if it were present. Additional data collection to confirm the absence of a connection between the uplands NAPL and that observed within the inundated lands is being proposed as part of the RI.

  – **Advection from Upland - Unconfined LNAPL Migration Through Sediment to Historic Shoreline**

    Similar to emplacement by advection to the current shoreline, this NAPL emplacement mechanism is not supported by the current data set because of the absence of NAPL in the nearshore areas adjacent to the riprap embankment and the physical separation of the defined extent of uplands NAPL. However, Ecology has requested additional data to confirm. This potential NAPL-Sediment interface interaction is identified as a data gap in Section 4.

  – **Direct LNAPL Discharge Between Current and Historic Shorelines.** This NAPL release mechanism is not covered in the ASTM guidance, likely due to its infrequent occurrence. The separation of the known offshore NAPL impact to the current shoreline is a data gap presented in Section 4.

– **Gas Ebullition**. ASTM E3248-20 did not address gas ebullition because it is not an NAPL emplacement mechanism, but a transport NAPL emplaced by other methods. Future ASTM guides will discuss gas ebullition.

  Gas ebullition potential in sediment samples collected from across the study area was evaluated in the 2018 Initial Investigation. Ebullition rates estimated at the site ranged between 6.5 and 6.8 liters per square meter per day with little spatial variability (CH2M 2019). These rates are indicative of high gas production resulting from the abundance of total organic carbon observed in deeper sediment and more labile carbon substrate observed at shallow depths. This is further validated by field observations of ebullition during the 2018 sediment sampling event. The depth of the NAPL occurrence offshore coincides with the ebullition active zone of 0 to 5 feet bss (Viana et al. 2012; Costello and Talsma 2003), suggesting that gas ebullition is responsible for the mobilization of free phase NAPL and contributes to NAPL transport to the water column.

  Based on the data and observations collected to date, the source of the sheens observed along the shoreline area identified by Ecology in the March 3, 2017 letter (Figure 1-2) may be the isolated NAPL found 0.5 to 2.5 feet beneath the river sediment within the submerged fill layer (Ecology 2017a). The intermittent sheening observed is the result of ebullition, with the gases developed by the decaying organic matter associated with the submerged fill. A greater abundance of gas bubbles and sheening occurs during periods of low water when the pressure from the overlying water column is reduced, and during hot periods when the temperature of the sediment rises. A combination of the winds and current carry the sheens toward the shoreline where they are seen most often from the shoreline and where globules have been observed to accumulate during relatively warm and calm weather conditions.

3.5 Potential Exposure Pathways and Receptors

Potentially impacted media are surface water and sediment in areas near and adjacent to the BNSF facility. Exposure pathways and potential receptors associated with the offshore area have not been evaluated to date but could include those related to Washington state-designated uses (WAC 173-201A-200) as shown in Table 3-1 and indicated on Figure 3-1.

Table 3-1. Columbia River Designated Uses

Aquatic Life Use	Recreation Use	Water Supply Use	Miscellaneous Use
Spawning/Rearing	Primary Contact	Domestic	Wildlife Habitat
Salmonid Migration		Industrial	Harvesting/Fishing
		Agricultural	Commerce/Navigation
		Stock	Boating
			Aesthetics

3.5.1 Ecological

Ecological receptors identified on Figure 3-1 include fish, birds, and benthic organisms as potentially impacted media could be a source of exposure to different trophic levels in the river ecosystem. Specifically, ecological receptors could be exposed through the following pathways:

- Direct exposure of benthic organisms, to contaminants via direct contact, ingestion, or filtration of sediment particles
- Direct exposure of benthic organisms to contaminants in porewater or surface water via direct contact or ingestion.
- Exposure of demersal fish to contaminants in sediment or surface water through direct contact exposure or through exposure via ingestion of prey organisms.
- Exposure of higher trophic level receptors including pelagic fish, aquatic birds, and mammals through ingestion of fish and benthic prey organisms.

The Columbia River provides federally designated critical habitat for Chinook salmon, steelhead, and bull trout. Threatened or endangered species, including those identified to be present near or to pass through the Columbia River adjacent to the railyard, include:

- Federally Threatened
  - Middle Columbia River bull trout
  - Middle Columbia River steelhead
  - Snake River fall, spring, and summer Chinook salmon
  - Columbia River chum salmon
  - Upper Columbia River bull trout
  - Snake River bull trout
  - Snake River basin steelhead
  - Upper Columbia River steelhead
- Federally Endangered
  - Upper Columbia River spring Chinook salmon
  - Snake River sockeye salmon

3.5.2 Human Health

Recreational- and tribal-related uses along the Columbia River adjacent to the site are included as potential human exposure pathways. The offshore area is in a treaty-defined usual and accustomed fishing area of the Confederated Tribes and Bands of the Yakama Nation. Yakama tribal members exercise treaty-reserved fishing rights for ceremonial, subsistence, and commercial purposes on the shores of or in the Columbia River in the vicinity of the railyard (Ecology 2020a).

Potentially impacted sediment could be a source of exposure to humans along this stretch of the river. Generally, humans could be exposed to COPCs in sediment through the following pathways:

- Direct contact with impacted sediment or surface water during shoreline recreational activities including fishing, clamming, swimming, or wading
- Incidental ingestion of sediments or surface water that occurs during shoreline recreational activities such as fishing, clamming, swimming, or wading
- Food chain exposure to site impacts by ingestion of fish and shellfish

As part of the initial remedial investigation, the assumed CSM will be verified and each pathway will be evaluated at the site to confirm that they are complete pathways. Site-specific information that will be considered will include where and if COPCs are detected, habitat type and fish species present, physical access to these areas, whether direct contact with the sediment is likely, and the type of fishing and recreational activities that occur in these areas.

As part of the developing the Reasonable Maximum Exposure scenario, both the current and potential future use (e.g., tribal fishing) from the general vicinity of the site will be included in the CSM [WAC 173-204-561(2)(b)(i)(A)].

4. Remedial Investigation

The purpose of this sediment RI is to collect, develop, and evaluate sufficient information and data to characterize the nature and extent of identified impacts, establish cleanup standards, and develop cleanup alternatives. RI data collection activities have been developed to address the RI objectives as outlined in Section 1.5 and in consideration of the CSM. The specific RI data gaps identified in Section 4.1 were used to develop the work scope components described in the remainder of Section 4. Data collection activities will be performed in two steps to optimize the field efforts and characterization.

4.1 Remedial Investigation Data Gaps

The following data gaps have been identified:

- Depth of the BAZ.
- COPCs within the BAZ in areas potentially impacted by historical discharges and activities within inundated lands.
- The lateral distribution of COPCs in surface sediments, and whether constituents represent an adverse risk to benthic organisms or human health.
- The lateral and vertical extent of submerged NAPL in sediment, sediment and soil lithology, and determination that the known NAPL in sediment is isolated from the NAPL in the upland areas.

4.2 Remedial Investigation Approach

Data collection activities associated with this RI have been developed to address the data gaps. The work will be conducted in two steps. A summary of the sampling and analysis and the phasing of the work is provided in Table 4-1.

Step 1 will involve determination of the biologically active zone (BAZ), surface sediment sampling in areas of known and potential sources, and background surface sediment collection. The initial work for Step 1 includes using a Sediment Profile Imaging (SPI) camera with dissolved oxygen readings to determine the depth of the BAZ. Following the determination of the BAZ, surface and background sediment samples will be collected to the depth of the BAZ. Samples will be analyzed for the COPCs listed in Table 4-2, along with dioxin/furans, PCB congeners, grain size, and total organic carbon. Analysis on surface samples will be conducted per Figure 4-1. The proposed sediment characterization sample locations are shown on Figure 4-2A.

Step 2 will be conducted following receipt of the analytical data from Step 1. Analytical results from Step 1 will be evaluated and locations where the SCOs and background values are exceeded will be selected for conducting a second round of surface sampling. Step 2 surface samples may be collected for bioassay tests to override the chemical results where benthic criteria and background values are exceeded, in accordance with Chapter 8 of SCUM II. In order to have comparable analytical chemistry results, samples collected for bioassay will also be analyzed for the relevant COPCs.

Table 4-1. Sampling and Analysis Summary

Work Plan Element	Number of Locations	Number of Analyses	Target Depth (bss unless noted otherwise)	Analyses	Sample Station IDs	Rationale by location
Step 1 of RI Field Work						
Determine the BAZ	6	6	Up to 30 cm	SPI Camera; Dissolved oxygen levels in sediment	Primary sample locations: SG11, SG19, SG29, SG21, SG04, SG31	To obtain samples representative of the various historical and geologic conditions, as well as spatial distribution.
Surface Sediment – Primary samples	26	26	Sample to the depth of the BAZ	COPCs listed in Table 4-2 Grain size Total organic carbon	a) SG11, SG18, SG19, and SG32 b) SG12, SG14, SG20, and SG29 c) SG15 and SG21 d) SG04, SG09, SG25, and SG31 e) I120 f) SG01, SG02, SG03, SG17, SG22, SG34, D160, D100, E460 g) SG05, SG08 See Figure 4-2a	a) Current nearshore areas in vicinity of historical outfalls b) Locations south of former outfalls c) End of former drainage ditches d) Other former nearshore locations (prior to inundation) e) Area of submerged NAPL f) Areas of potential impacts near historical shoreline g) Potential depositional areas in river (“holes” in bathymetry)
Surface Sediment – Secondary samples	18	18	Sample to the depth of the BAZ	COPCs listed in Table 4-2; as per flowchart (Figure 4-1) Grain size Total organic carbon	a) SG30, and SG33 b) SG06 c) SG07, SG16, SG27, and SG28 d) SG10 e) SG13, SG23, SG24, and SG26 f) D240, E320, and E380 g) H260, H360, and L320 See Figure 4-2A	a) Former deposition area b) Historical sandy shoreline south of submerged NAPL c) Former nearshore areas (prior to inundation) downstream of historical outfalls and submerged NAPL d) Deeper low-lying areas south of the inundated lands and former outfalls e) Scattered locations to provide samples in other areas of inundated lands f) Current nearshore area adjacent to uplands groundwater impacts exceeding MTCA Method A CULs and between shoreline and the suspected northern extent of submerged NAPL g) Area of submerged NAPL
Surface Sediment - Background	12	12	Sample to the depth of the BAZ	COPCs that are bioaccumulative as well as any non-bioaccumulative chemicals that exceed the SMS listed in Table 4-2 [a] Grain size Total organic carbon	See Figure 4-4. Sample locations: BG01 through BG12	Spatial distribution of sample locations downstream of the John Day Dam, but upgradient of the site
Step 2 of RI Field Work						
Bioassays	TBD [b]	TBD [b]	Need for, quantity, and depth depends on BAZ results and chemical results from Step 1	Bioassays only need to be run for stations that exceed the benthic criteria. Total PAHs, TPH-diesel, TPH-residual, metals and additional chemicals that exceeded the SCO benthic criteria and background values in surface sediment samples.[b]	Locations will be based on the results of the sediment chemistry from Step 1. Selected locations will be reacquired.	Bioassays may be conducted on samples that exceed the benthic SCOs.
LIF Profiling	18+	Up to 30 feet	TarGOST Profiling	Continuous	Establish lateral and vertical extent of NAPL See Figure 4-2B.	Areas of known or suspected NAPL.

Table 4-1. Sampling and Analysis Summary

Work Plan Element	Number of Locations	Number of Analyses	Target Depth (bss unless noted otherwise)	Analyses	Sample Station IDs	Rationale by location
Sediment Cores	6	2 samples from each core within the NAPL footprint – one sample will be collected from just above and one sample collected from just below the NAPL impacted zone.	Up to 30 feet or refusal (bedrock) Samples to be collect above and below the NAPL impacted areas as defined by the TarGOST.	Core logging, field observation and screening Total PAHs, TPH-diesel, TPH-residual, metals and additional chemicals that exceeded the SCO benthic criteria or background in surface sediment samples Grain size Total organic carbon	G160, K240, I320, G320, E360, E280. (The final core locations will be based on the actual TarGOST screening results and the resulting NAPL footprint) See Figure 4-2B.	NAPL delineation confirmation Characterization of subsurface lithology Vertical delineation of constituents of potential concern
	3	2 samples from cores south of the NAPL footprint – samples will be collected at zones with a visual change in stratigraphy.			Cores will also be conducted at SG06, SG07, SG08, which are south of the known NAPL area. See Figure 4-2B.	

Notes:

a. Although benthic criteria are typically greater than background values, any non-bioaccumulative chemicals that exceed benthic criteria will also be analyzed for in background samples to confirm this assumption.

b. Per Chapter 8 of SCUM II bioassays may be conducted to override the chemistry results for samples where one or more contaminants of potential concern exceed the benthic criteria. While benthic criteria are typically in excess of background values, all non-bioaccumulative chemicals exceeding benthic criteria will be tested for in background samples. If background levels of these constituents are found to be higher than those measured in site sediment, then bioassay override may not be performed. It is estimated that a maximum of 6 bioassay analyses would be performed. A hold time of 2 weeks will apply unless samples are preserved in a nitrogen environment at 4° C in which case the hold time may be extended up to 8 weeks.

bss = below sediment surface

Table 4-2. List of COPCs for Remedial Investigation Step 1 Sediment Sampling

BNSF Track Switching Facility, Wishram, Washington

Chemical Parameter	Freshwater Benthic		Freshwater Human Health			
	(WAC 173-204-563 Table VI)		(SCUM II Table 9-2)			Programmatic PQLs (SCUM II Table 11-1)
	Dry Weight Sediment Cleanup Objective (SCO)	Dry Weight Cleanup Screening Level (CSL)	Beach Play (Child)	Subsistence Clam Digging (Adult)	Subsistence Net Fishing (Adult)	Consumption of Fish/Shellfish by Human and Higher Trophic Level Receptors
Conventional chemicals (mg/kg)						
Ammonia	230	300				
Total sulfides	39	61				
Metals (mg/kg)						
Arsenic	14	120	4.8	0.96	3	0.3
Cadmium	2.1	5.4	610	1300	4400	0.07
Chromium	72	88				0.2
Copper	400	1200				0.1
Lead	360	> 1300				0.1
Mercury	0.66	0.8				0.02
Nickel	26	110				0.2
Selenium	11	> 20				
Silver	0.57	1.7				0.1
Zinc	3,200	> 4,200				1
Organic chemicals (µg/kg)						
4-Methylphenol	260	2,000				
Benzoic acid	2,900	3,800				
Bis(2-ethylhexyl) phthalate	500	22,000				
Carbazole	900	1,100				
Dibenzofuran	200	680				
Di-n-butyl phthalate	380	1,000				
Di-n-octyl phthalate	39	> 1,100				
Pentachlorophenol	1,200	> 1,200				
Phenol	120	210				
Total PAHs	17,000	30,000				
Carcinogenic PAHs[a] (sum TEQ)			900	320	680	9

Table 4-2. List of COPCs for Remedial Investigation Step 1 Sediment Sampling

BNSF Track Switching Facility, Wishram, Washington

Chemical Parameter	Freshwater Benthic		Freshwater Human Health			
	(WAC 173-204-563 Table VI)		(SCUM II Table 9-2)			Programmatic PQLs (SCUM II Table 11-1)
	Dry Weight Sediment Cleanup Objective (SCO)	Dry Weight Cleanup Screening Level (CSL)	Beach Play (Child)	Subsistence Clam Digging (Adult)	Subsistence Net Fishing (Adult)	Consumption of Fish/Shellfish by Human and Higher Trophic Level Receptors
PCBs and Dioxan/Furans (ng/kg)						
Dioxins/Furans Congeners[b] (sum TEQ)			89	15	55	5
Dioxin-like PCB Congeners[c] (sum TEQ)						0.7
Bulk Petroleum Hydrocarbons (mg/kg)						
TPH-diesel	340	510				
TPH-residual	3,600	4,400				

Notes:

[a] Table 6-1, Chapter 6 of SCUMII contains the specific carcinogenic PAHs (cPAHs) and TEFs used for calculations. The cPAHs are: benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene. These seven cPAHs are appropriate for calculating the sum TEQ.

[b] Chlorinated dibenzo-p-dioxins and chlorinated dibenzofurans congeners. Table 6-2 in Chapter 6 of SCUM II contains the specific congeners and TEFs used for calculations

[c] Table 6-3 in Chapter 6 of SCUMII contains the specific dioxin-like PCB congeners and TEFs used for calculations

mg/kg =milligram(s) per kilogram

ng/kg = nanogram(s) per kilogram

TEF = toxicity equivalency factor

TEQ= toxicity equivalent

The Step 2 investigation will include LIF profiling using Tar-specific Green Optical Screening Tool (TarGOST) to determine the depth of NAPL in the inundated lands. Locations for TarGOST are shown on Figure 4-2B. Additional TarGOST profiling may be conducted at locations in the expanded study area if needed. These additional areas would have TarGOST profiling along with confirmatory subsurface cores with subsurface sediment sampling and analytical testing. The TarGOST profiling will include measurement of electrical conductivity, as described in Section 4.3.

Confirmatory subsurface cores will be advanced in up to 6 locations based on the results of the TarGOST profiling, as outlined in Table 4-1. An additional 3 locations (SG06, SG07, and SG08) will have subsurface sediment sampling.

The locations of Step 1 surface sediment samples are shown on Figure 4-2A relative to the historical 1951 pre-inundation aerial photo. Figure 4-2B shows the proposed LIF profiling/ TarGOST and the 3 additional sediment core locations located south of the expanded study area. Figure 4-3 shows the surface sediment sample locations relative to the current bathymetry. A new bathymetry survey will be conducted to improve the understanding of the subsurface. The proposed background surface sample locations are presented on Figure 4-4.

4.3 Field Activities

RI field activities will be conducted in two steps. Table 4-1 provides a summary of the sampling and analysis to be performed as part of the RI. Additional details related to this work are provided in the SAP (Appendix A).

4.3.1 Step 1

Step 1 of the remedial investigation is outlined below.

4.3.1.1 Determine Biological Active Zone

Based on guidance (EPA 2015) a site-specific BAZ will be established. The BAZ thickness will be confirmed with multiple lines of evidence to support the establishment of a consistent surface sediment sampling depth for this portion of the river. The primary lines of evidence will be visual observations made using SPI combined with measurements of oxygen levels in the shallow sediment. SPI provides a visual record of the in situ sediment column avoiding disturbance of the sediment caused by some sampling techniques.

The SPI system uses a specially designed camera that is inserted into the sediment up to a depth of 12 inches. The camera head includes a clear plastic viewing plate with the camera behind the plate. Once inserted into the sediment, the camera takes a picture as a cross section of the sediment profile. The cross section photographs provide important visual information used to establish the BAZ including:

- The Redox Potential Discontinuity or the zone where the sediment changes from oxic to anoxic which can be observed as a color change from brown to black.
- Sediment texture, grain type and size, and color allowing identification of sediment as sand, gravel, silt, or mud.
- Evidence of biological activity by depth and the type of benthic infauna community present.
- Evidence of strongly reducing conditions such as methane pockets

In addition, oxygen profile readings will be collected in sediment column samples co-located with the SPI samples to verify oxygen levels at depth in the sediment. The SPI and oxygen data will be collected from six locations within the study area as an initial survey of sediment characteristics. After a review of the collected data, the BAZ will be established for the future sediment sampling events.

4.3.1.2 Surface Sediment Samples

Surface sediment samples will be collected to the depth determined from the BAZ investigation. The surface sediments samples will be collected and processed in accordance with the standard operating procedure (SOP) for Surface Sediment Sampling (Attachment 3 of the SAP [Appendix A]). The samples will be analyzed for the COPCs listed in Table 4-2 using the methods listed in Table 3-2 of the SAP (Appendix A). Samples will be collected using a Van Veen or similar device deployed from a boat. Collecting surface sediment using a Van Veen or similar device will cause minimal disturbance to the surficial layer while providing enough capacity for collecting necessary volumes of sediment from the BAZ.

A total of 26 primary and 18 secondary surface sediment sample locations have been identified in the investigation area (Figure 4-2A). Samples are planned for the areas listed in Table 4-1, with the analysis flowchart presented in Figure 4-1

The samples will be collected and processed in accordance with the SOP for Surface Sediment Sampling (Attachment 3 of the SAP [Appendix A]). The sediment CSM for the inundated lands identifies direct contact and ingestion of fish as the primary potential human exposure routes.

A total of 12 additional surface samples, as shown on Figure 4-4, will be collected to establish background concentrations for the COPCs that exceed the criteria listed in Table 4-2. Samples for determining background will be collected upstream of the site to establish natural background conditions in the Columbia River near the site. Twelve samples will be collected starting at a distance approximately 1 mile upstream of the site and extending up to and adjacent to the downstream end of Miller Island. Samples will primarily be located away from identifiable sources downstream of the confluence of the Deschutes River with the Columbia River. One sample will be located upstream of the Deschutes River confluence. Background samples will be collected from areas of the river with a comparable depth and flow conditions to the site study area. Considering flow within Columbia River, the upstream samples locations will not be influenced by site impacts but will be representative of natural conditions in the river including influence from the Deschutes River.

4.3.2 Step 2

Step 2 may include the collection of bioassay samples from those areas where Step 1 surface sediment results indicate an exceedance of the applicable benthic criteria (Table 4-2) in accordance with Chapter 8 of SCUM II (Ecology, 2019). The exception to this will be if background levels of these constituents are found to be consistent with, or higher than the levels measured in site sediment. In this scenario the constituent will be considered related to background and thus bioassay override will not be required. If bioassay samples are collected sediment chemistry results will also be generated for these samples for the relevant COPCs. During Step 2 the extent of NAPL will be characterized using TarGOST profiling and confirmatory sediment cores. Additional sediment cores will be advanced in the area south of the known NAPL extent to determine if impacts extend to that area.

4.3.2.1 Bioassay

Because the NAPL area represents a source of sheens that will require remediation, bioassay data will not be performed on sediment overlying these NAPL impacts. Descriptions of bioassay sampling and testing protocols are provided in the SAP (Appendix A).

For Step 1 areas that exceed the SCO for chemistry and are inconsistent with natural background conditions, Step 2 surface samples may be collected for bioassay tests. Bioassays will not be conducted in Step 1 due to the time needed to evaluate the data. Instead, the Step 1 locations will be reacquired in Step 2, and surface samples will be collected at that time for potential bioassays. Bioassay analysis will be conducted within 2 weeks of sample collection, unless samples are preserved in a nitrogen environment at 4° C, in which case the hold time may be extended up to 8 weeks. To have synoptic results for the assessment of the bioassay results Step 2 surface sediment samples to be analyzed for bioassay will also be analyzed for the constituents at that location that exceeded the SCO in Step 1.

Potential risks to the benthic community will be assessed using a weight-of-evidence approach that integrates whole sediment toxicity tests and compares constituent concentrations to the Sediment Management Standards benthic chemical criteria.

4.3.2.2 TarGOST Profiling

To characterize the vertical and lateral extents of the submerged NAPL observed in the offshore area, continuous sediment profiling will be conducted at a minimum of 18 locations across the known NAPL impact area using the Dakota Technologies TarGOST. The locations are shown on Figure 4-2B.

TarGOST is a LIF tool developed specifically for the detection of higher molecular weight NAPL (both free and residual phase). TarGOST is used as an in-situ evaluation tool that is advanced using a direct-push technology (DPT) drilling rig and provides real-time, semiquantitative graphical data of the vertical distribution of NAPL saturation in the subsurface. Fluorescence responses are recorded as a percentage of a fixed calibration standard or reference emitter.

TarGOST was successfully used in uplands portions of the railyard. In addition, NAPL-containing sediment cores collected from within the inundated lands area during the initial sediment investigation were scanned at the Dakota Technologies facility using TarGOST. The results of these scans generated approximately 100 readings per sample from which indicated peak TarGOST fluorescence responses of between 55 and 229 percent of the reference emitted (%RE) for sediment where NAPL saturations were measured to range between 3 and 42 percent pore volume (%PV) (CH2M 2019). For samples where NAPL saturations were less than 0.1 %PV maximum TarGOST responses ranged from 30.6 to 39.2 %PV. This work demonstrated the effectiveness of TarGOST at identifying the NAPL present in the offshore area.

Dakota Technologies couples TarGOST with Electrical Conductivity Dipole Array (EC) to provide general stratigraphic information. EC emits a current through the subsurface formation in between the two probe contacts. This current and the resulting voltage is measured, and sediment type can be determined by its conductivity.

The TarGOST/EC-equipped DPT unit will be mounted on a spudded barge and the investigation will begin at locations of known NAPL impacts (for example, G200 and G260). Up to 6 planned TarGOST borings will be extended to a depth of 30 feet bss or refusal, whichever occurs first. These locations will include select locations along the northernmost line of proposed borings as well as locations farther offshore within the known NAPL area. Once the elevation of the base of the NAPL-impacted interval has been established, the

remaining borings may be shortened to depths that are equivalent to the deepest observed TarGOST response, indicating the presence of NAPL plus 5 feet. The work will progress from the inside/out to cover and extend beyond the area of observed NAPL. The six primary locations on the E grid line shown on Figure 4-2B will serve to confirm the absence of nearshore NAPL and isolation of the submerged NAPL that is present farther offshore within the inundated lands.

If needed, and if practicable, additional TarGOST profiles beyond those shown on Figure 4-2B may be completed at a spacing of approximately 40 feet to establish the lateral and vertical extents of NAPL. The grid shown on Figure 4-2B will be used as a guide to assist in identifying step-out locations. The need for further step-outs will be based on a weight-of-evidence approach following the completion of the initial 18 locations within and adjacent to areas of known NAPL, and the acquisition and visual interpretation of up to 4 confirmatory cores (Section 4.3.2.3). The emitter response, fluorescence waveforms, thickness of elevated/suspect response intervals, will be assessed relative visual observations from collocated confirmatory cores to determine fluorescence response and waveforms that are indicative of NAPL presence versus those that are the result of naturally occurring materials (e.g. peat, wood, limestone). This information will be used to assess the need for further step outs along the periphery.. Samples with potential interfering materials (peats and natural organics) from cores may be sent to Dakota Technologies to confirm the waveform observed in the collocated TarGOST boring. If NAPL is observed in surface samples collected in Step 1 in the expanded study area, additional TarGOST may be attempted at those locations.

4.3.2.3 Confirmatory Sediment Cores

Following review of the results of the TarGOST profiling, up to six sediment cores will be advanced using DPT or vibracore to confirm TarGOST results, including potential interferences, and allow for the characterization of stratigraphy across the study area. Cores will be advanced adjacent to TarGOST locations where NAPL is suspected (up to four locations) as well as those where it is not suspected (up to two locations). In general, cores will be advanced to 5 feet below the base of the NAPL impacts as indicated in the collocated TarGOST, or to 15 feet bss (where suspected impacts are not present). However, at two locations where deeper TarGOST profiles are advanced, a final sediment core depth of up to 30 feet bss will also be targeted to allow for the characterization of deeper stratigraphy. Three additional sediment cores will be advanced south of the known NAPL footprint to a depth of 15 feet bss, with samples collected at visual stratigraphic changes. Additional sediment cores may be added to the south dependent on the analytical and TarGOST profiling results.

Cores will be continuously logged and screened using visual, olfactory, and photoionization detector. Visual observations will be used to confirm NAPL presence or absence at each location. At each core location, sediment samples will be collected for chemical analysis from intervals 6 to 12 inches above and below where NAPL is visually observed. Chemical analysis will include TPH (diesel and residual), PAHs, and other constituents exceeding an SCO during the Step 1 sediment sampling. Samples will also be collected from each distinct stratigraphic unit for grain size analysis (assumed that on average two samples will be collected from each core). Advancement, logging, and screening of the sediment borings will be performed in accordance with the SOPs provided as Attachment 2 of the SAP (Appendix A).

4.4 Laboratory Analyses

Sediment and other media samples will be submitted under chain-of-custody protocols to the subcontracted laboratories and will be analyzed on a standard turnaround basis. Bioassay analysis will be conducted within 2 weeks of sample collection, unless samples are preserved in a nitrogen environment at 4° C, in which case the hold time may be extended up to 8 weeks. Sample handling, packing, shipping

procedures, and data validation procedures are identified in the SAP (Appendix A). Analytical methods, containers, and holding times are provided in updated SAP Table 3-2 (Appendix A).

4.5 Data Evaluation and Reporting

4.5.1 Surface Sediment Data Evaluation

The Step 1 surface sediment sampling will be conducted across the sediment study area, along the former shoreline, and in areas where discharges and deposition may have occurred. The Step 1 surface sediment sampling will also provide additional characterization of sediments adjacent to uplands nearshore groundwater impacts and in the area of known NAPL impacts.

The Step 1 sample results will be evaluated using a point-by-point comparison initially by comparing them to the SMS Freshwater sediment SCOs and CSLs, SCUM II Table 9-3 human health risk-based sediment concentrations for beach play and subsistence fishing, and with the site-specific sediment natural background values. In addition, each bioaccumulative chemical will be analyzed using a Surface Weighted Average Concentration (SWAC) for the area to compare to SCUM Table 9-3 and natural background values. A summary of the Step 1 data and associated figures will be prepared and submitted to Ecology within 60 days of receipt of data for discussion to inform the Step 2 effort.

Any Step 2 supplemental surface sediment data will be used to update and refine the surface sediment evaluation and CSM.

4.5.2 NAPL Extent, Subsurface Sediments, and Bioassays

The sediment cores will be evaluated to confirm the TarGOST results in the NAPL area, characterize the stratigraphy, and determine the vertical extent of the NAPL and other areas where vertical characterization might be required.

Bioassays will be conducted in Step 2 to allow for evaluation of the initial surface sediment analytical results from Step 1. As previously noted, surface chemistry will be included in the analysis of Step 2 surface sediment samples when bioassay tests are conducted.

4.5.3 Report

The Sediment RI Report will document the investigative approach, data, and conclusions based on the data from the investigation, and relevant data from prior investigations, as discussed in Chapter 6 of the SCUM II. This process is illustrated generally on Figure 4-4.

The Sediment RI Report will also present an updated characterization stage CSM, updated COPCs and proposed CULs, potential sediment cleanup unit boundaries, and an outline for the approach for satisfying remaining reporting requirements for completing an RI/FS for the sediment in accordance with Chapters 3 and 6 of the SCUM II (WAC 173-204-510 and 173-204-520).

5. Data Management and Data Quality

5.1 Quality Assurance and Quality Controls

The integrity and validity of analytical results requires the implementation of an internal quality assurance (QA) program. The program will meet the requirements set forth in the SCUM II guidance. QA and QC requirements, including field QC samples, data validation, and corrective actions are included in the SAP (Appendix A).

5.2 Data Validation

The analytical results of the data collection effort will be validated using the QC limits established by the laboratory, method-specific criteria, and the latest versions of the U.S. Environmental Protection Agency *National Functional Guidelines for Inorganic Superfunds Methods Data Review* (EPA 2017) as guidance. SCUM II data validation requirements as discussed in Chapter 5 of that document. Details of the data validation procedures for the project are included in the SAP (Appendix A).

5.3 Data Management and Submittal to Ecology

An RI report will be prepared following the sediment sampling and will describe the sampling results. The report will describe sample locations and depths, sampling handling and analytical methods, QA/QC, data results, and copies of field logs and laboratory data packages. In addition, valid data will be compiled and uploaded into the Ecology Environmental Information Management (EIM) System. EC data will be submitted with the raw data for the LIF.

6. Development of Proposed Cleanup Standards and Boundaries

The RI will focus on the evaluation of sediment chemistry and bioassays consistent with the Washington State SMS. The preliminary CSM identifies preliminary ecological and human health exposure pathways for sediment, including direct contact and fish consumption as the primary potential exposure routes. For this reason, the RI work effort will focus on collection of representative surface sediment chemistry data for the BAZ and extent of the offshore NAPL.

The analytical data for site chemicals (for example, PAHs) or other chemicals found in sediment will be evaluated to determine if there is a potential ecological and/or human health risk. The data will be screened as discussed in the SCUM II (Ecology 2019). The SCUM II serves as guidance for implementing the cleanup provisions of the Washington State SMS. Risk-based sediment concentrations protective of human health will be initially evaluated using the "sediment only" approach outlined in SCUM II. The sediment data collected will be compared against the SMS screening levels, SCUM human health risk-based sediment concentrations, and site-specific natural background concentrations, as discussed in Section 4. Following evaluation of the RI data, sediment cleanup unit boundaries will be established based on the comparison values discussed in the RI report. A supplemental work plan addendum for risk evaluation will be prepared if chemicals are present above the SCOs (both benthic and natural background).

7. Schedule

WAC 173-204-550(4)(g) requires a schedule for the RI and FS be provided in the RI work plan. The project schedule will be coordinated once the RI work plan is approved. The actual field schedule may vary depending on field conditions (including weather), subcontractor availability, and a variety of other factors. Table 7-1 provides a tentative project schedule.

Table 7-1. Tentative Project Schedule

Date	Task	
August 2021	Submit Draft Final RI Work Plan and SAP to Ecology	
4th Quarter 2021	Work Plan approval	
4th Quarter 2021 and 1st Quarter 2022	Step 1:	Determine BAZ Depth
		Conduct Surface Sediment Characterization – chemistry
		Establish Background Values
	Step 2:	LIF Profiling – TarGOST Profiling and Analysis
		Subsurface Sediment Characterization
		Conduct Surface Sediment Sampling – chemistry and bioassay
2nd and 3rd Quarter 2022	Complete Laboratory Analysis and Prepare RI Report	
3rd Quarter 2022	Submit Draft RI Report to Ecology	

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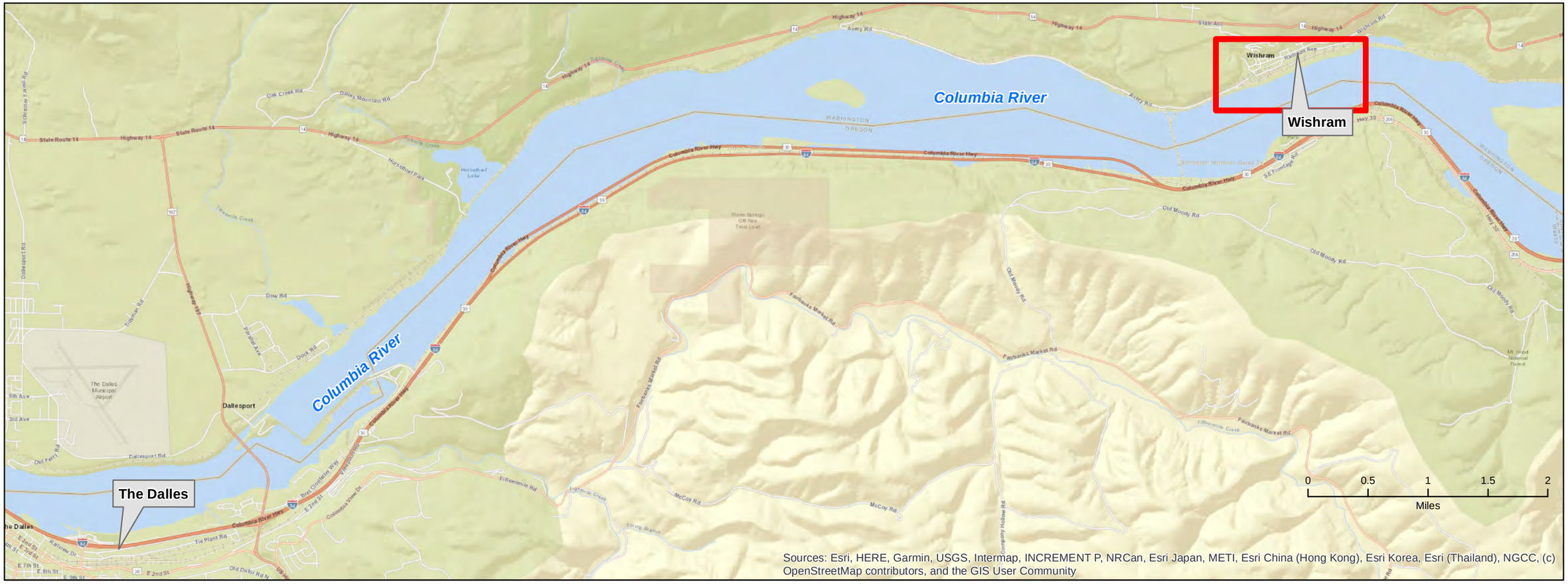
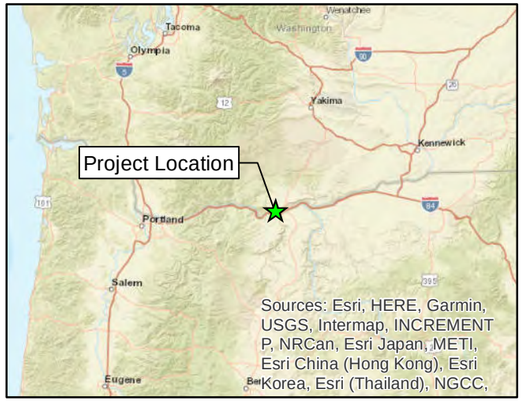
Figures



Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community



N

0 375 750 1,500
Feet

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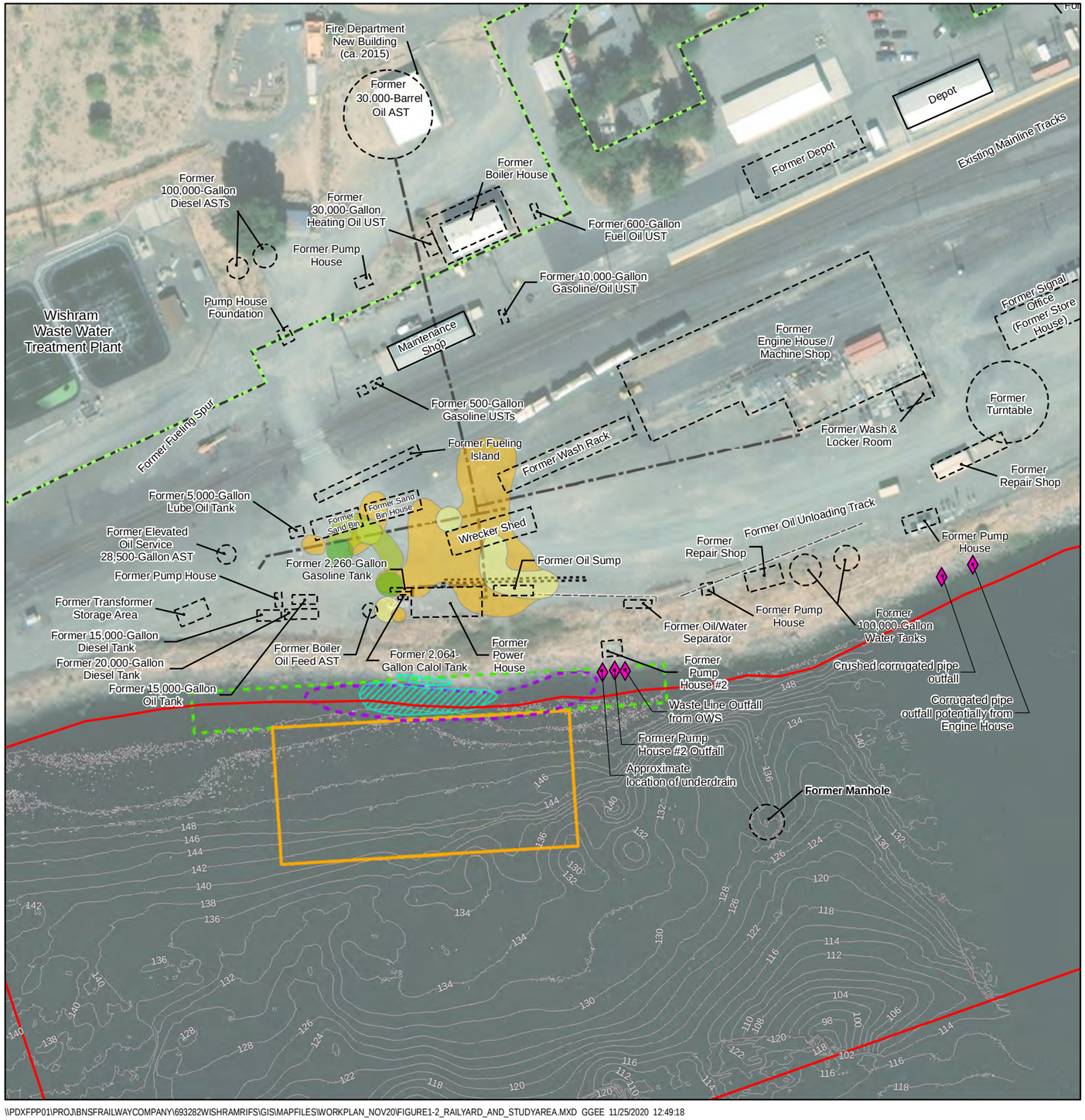
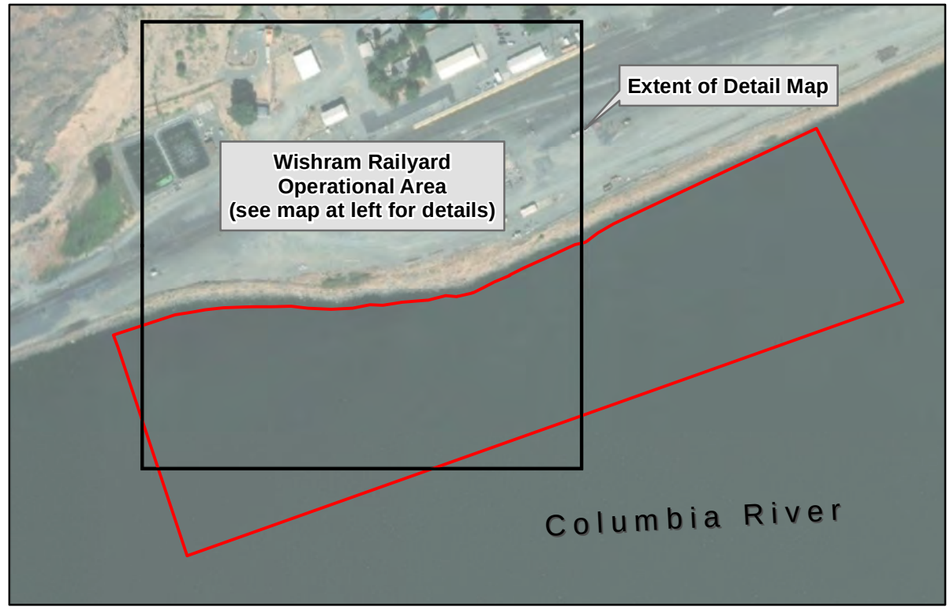
Figure 1-1. Site Location Map
BNSF Track Switching Facility
Wishram, Washington

Jacobs





LEGEND

- Proposed RI Area
- WA Ecology Initial Investigation Area
- 2018 Initial Investigation Area
- Approximate BNSF Property Line
- Existing Site Feature
- Former Site Feature
- Former Bunker Fuel / Oil Pipeline
- Former Oil Drain
- Former Oil Trough
- Former Sewer Line (Potential)
- Stormwater Underdrain (A portion removed from service circa 1960)
- Stormwater Underdrain (Rerouted portion circa 1960)
- Former Outfall Location
- Area of Intermittent NAPL Sheening
- Small-extent NAPL Sheens Observed (Ecology, 2017)
- Bathymetric Contour (ft NAVD88, 2 ft Contour Interval)

Upland Area[1]

- Inferred Lateral Extent of Smear Zone Diesel Impacts
- Inferred Lateral Extent of Submerged Diesel Impacts
- Inferred Lateral Extent of Smear Zone Oil Impacts
- Inferred Lateral Extent of Submerged Oil Impacts

0 200 400 800
Feet

N

0 62.5 125 250
Feet

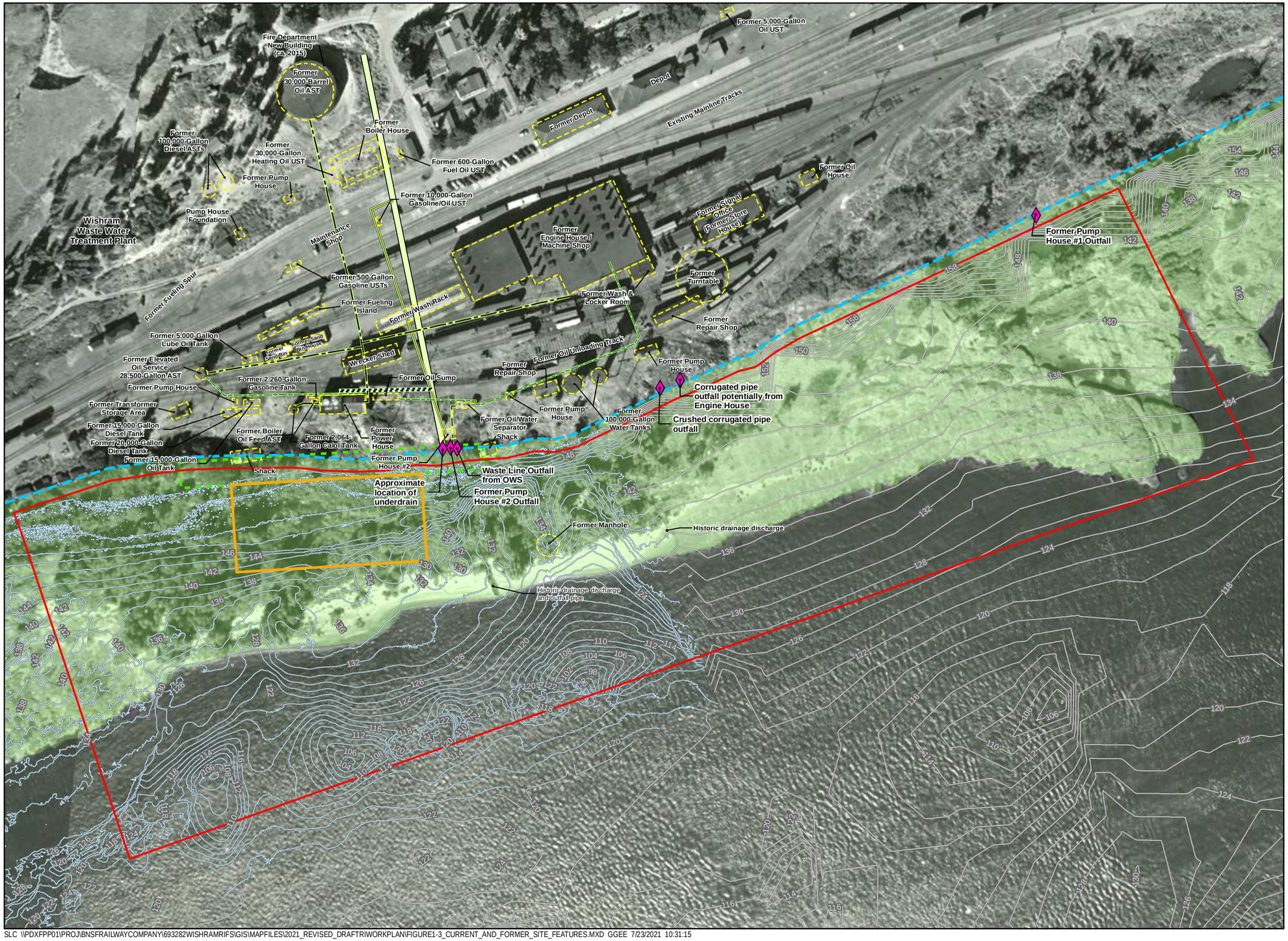
N

Notes:
[1]Inferred lateral extent of Diesel- or Oil-Like LNAPL based on interpretation of LIF waveforms (July 2013) and soil boring logs (KJ, 2019).
ft = feet
NAPL = nonaqueous phase liquid
NAVD88 = North American Vertical Datum 1988

Figure 1-2. Wishram Railyard and Study Area
BNSF Track Switching Facility
Wishram, Washington

Jacobs

\\PDXFPP01\PROJ\BNSFRAILWAYCOMPANY\693282WISHRAMRIFS\GIS\MAPFILES\WORKPLAN_NOV20\FIGURE1-2_RAILYARD_AND_STUDYAREA.MXD GGEE 11/25/2020 12:49:18



LEGEND

- Former Site Feature
- Former Bunker Fuel / Oil Pipeline
- Former Oil Drain
- Former Oil Trough
- Former Sewer Line (Potential)
- Stormwater Underdrain (A portion removed from service circa 1960)
- Stormwater Underdrain (Rerouted portion circa 1960)
- Former Outfall Location
- Proposed RI Area
- WA Ecology Initial Investigation Area
- 2018 Initial Investigation Area
- Current Shoreline
- Bathymetric Contour (ft NAVD88, 2 ft Contour Interval, [US Army Corps of Engineers, 2008])
- Bathymetric Contour (ft NAVD88, 2 ft Contour Interval, [2017])
- Inundated Lands

N

0 75 150 300
Feet

Figure 1-3. Former Site Features
BNSF Track Switching Facility
Wishram, Washington

Jacobs

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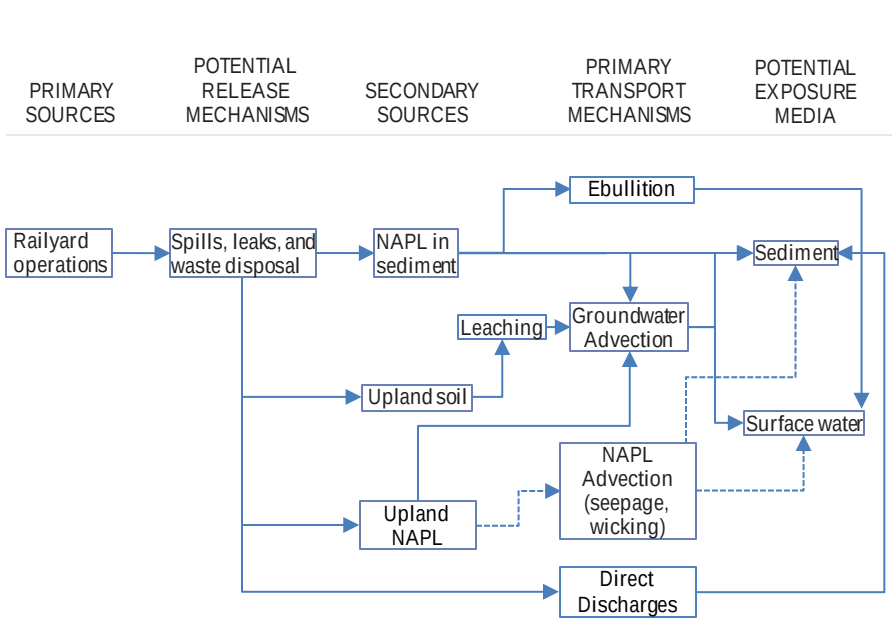


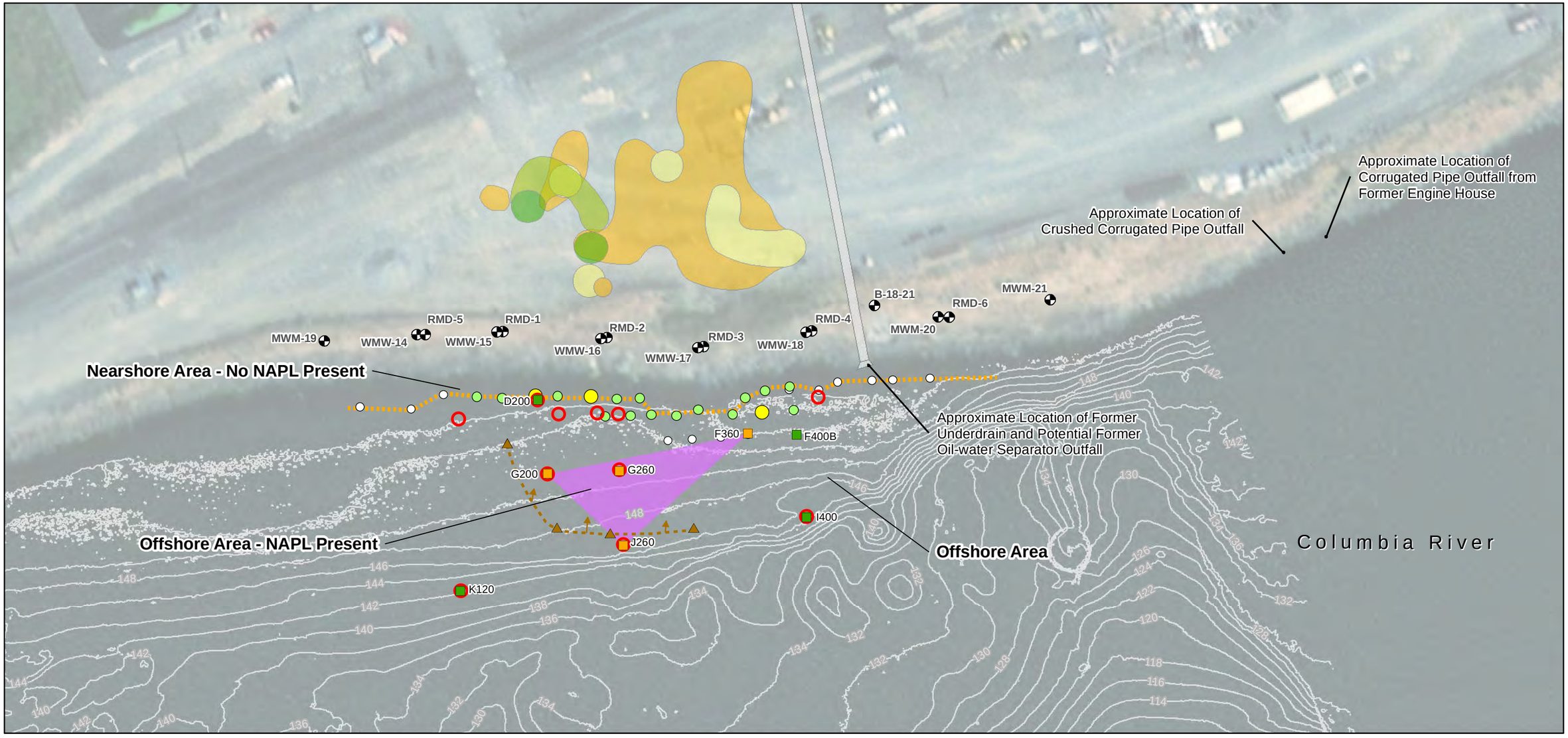
Note: Dashed lines indicate transport mechanism or impacts on potential exposure media are not believed to have occurred, but are being further assessed as part of the Remedial Investigation

EXPOSURE ROUTES	*Ecological Receptors*			*Human Receptors*		
	Fish	Benthos	Birds	Tribal/ Recreational Fisherman	Recreation/ Boating/ Swimming	Drinking
Ingestion of fish/benthos	■	□	■	■	□	□
Incidental ingestion of sediment	■	■	□	□	■	□
Dermal contact with sediment	■	■	■	■	■	□
Ingestion of surface water	■	■	■	□	■	■
Dermal contact with surface water	■	■	■	■	■	□

□ Incomplete pathway ■ Potentially Complete pathway

Figure 3-1. Preliminary Sediment Conceptual Site Model
BNSF Track Switching Facility
Wishram, Washington

Jacobs



LEGEND

- Core Location with NAPL Observed (2018)
- Core Location with no NAPL Observed (2018)
- Location of Surface Sediment Chemical Data (2018)
- Location of Farthest Offshore Sheens Observed (August 7, 2018)
- Very Low Level Response Consistent with Background
- Very Low Level Response (Generally <10% RE Maximum) with Blue-green Waveform that is Inconsistent with Background
- Low Level Response (Maximum Response Between 10 and 18%RE) with Blue-green Waveform that is Inconsistent with Background
- Toe of Exposed Riprap during 2018 Sampling Event
- Southernmost Extent of Sheens Observed August 7, 2018 (Arrows Represent the Observed General Direction of Sheen Movement)
- Bathymetric Contour (ft NAVD88, 2 ft Contour Interval)
- Groundwater Monitoring Well
- Offshore Area - NAPL Observed

Uplands Area

- Inferred Lateral Extent of Smear Zone Diesel Impacts
- Inferred Lateral Extent of Submerged Diesel Impacts
- Inferred Lateral Extent of Smear Zone Oil Impacts
- Inferred Lateral Extent of Submerged Oil Impacts

Notes:
ft = feet; NAPL = nonaqueous phase liquid

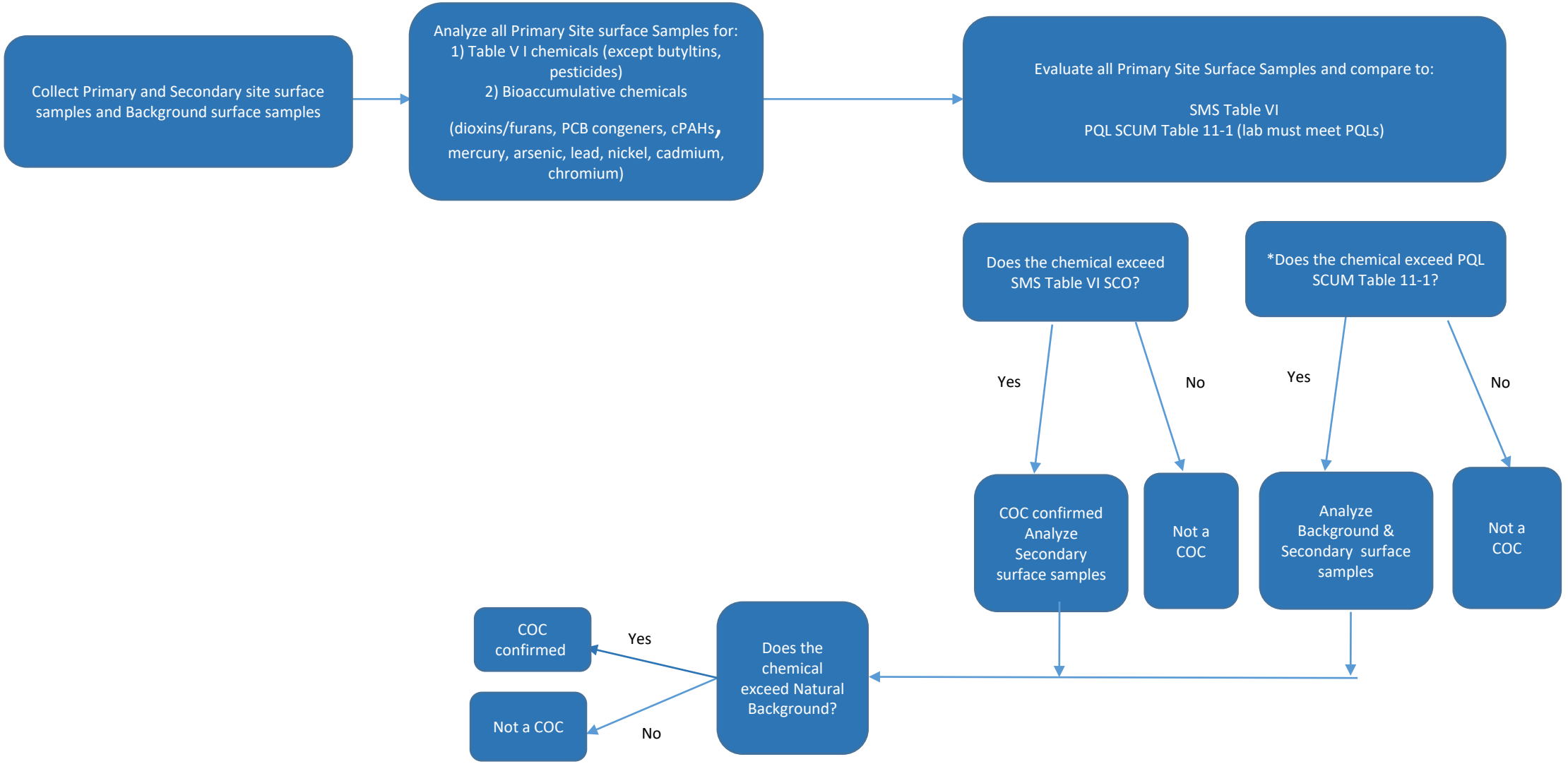
N

0 40 80 160
Feet
1:964 1 inch = 80.32 feet

Figure 3-2. Initial Investigation Sediment Characterization Summary
BNSF Track Switching Facility
Wishram, Washington

Jacobs

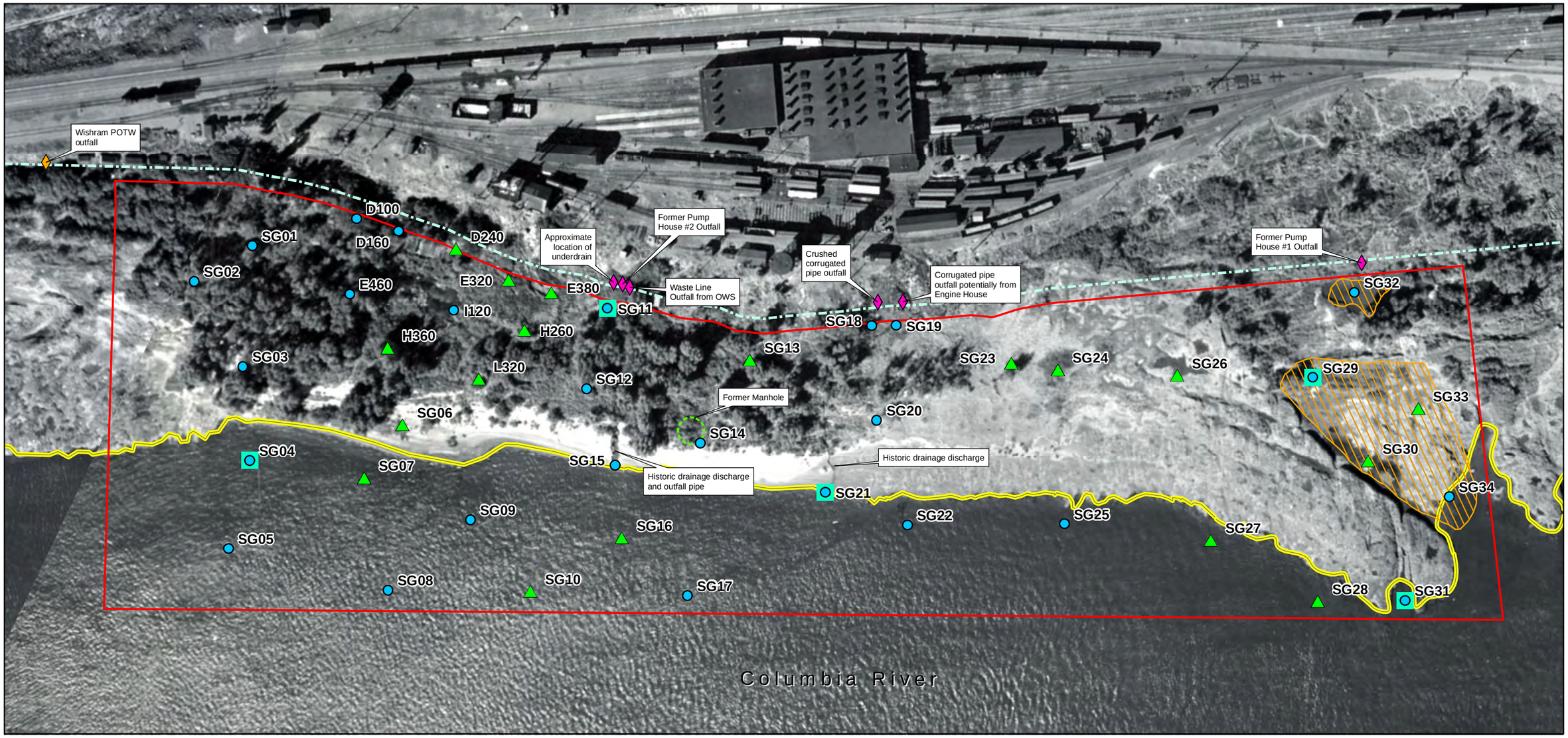
\\PDXFPP01\PROJ\BNSFRAILWAYCOMPANY\693282WISHRAMRIFS\GIS\MAPFILES\2021_REVISED_DRAFTRIWORKPLAN\FIGURE3-2_INVESTIGATIONRESULTS.MXD GGEE 7/26/2021 16:00:17



*Alternative: Analyze Natural Background and compare at this step

Figure 4-1. Process for Identifying COCs
BNSF Track Switching Facility
Wishram, Washington

Jacobs



LEGEND

- Primary Surface Sample Location
- Secondary Surface Sample Location
- Sample Location for SPI Camera Survey
- Current Outfall Location
- Former Outfall Location
- Proposed RI Area
- Potential Sediment
- Current Shoreline
- Historic Shoreline

Notes:
Base map is 1951 aerial photo.
OWS = oil/water separator
POTW = publicly owned treatment works

0 100 200 400
Feet

Figure 4-2A. Proposed Sediment Characterization Locations shown with 1951 Aerial Photo
BNSF Track Switching Facility
Wishram, Washington

\\PDXFPP01\PROJ\BNSFRAILWAYCOMPANY\693282WISHRAMRIFS\GIS\MAPFILES\2021_REVISED_DRAFTRIWORKPLAN\FIGURE4-2A_LOCATIONS.MXD GGEE 7/22/2021 13:46:11

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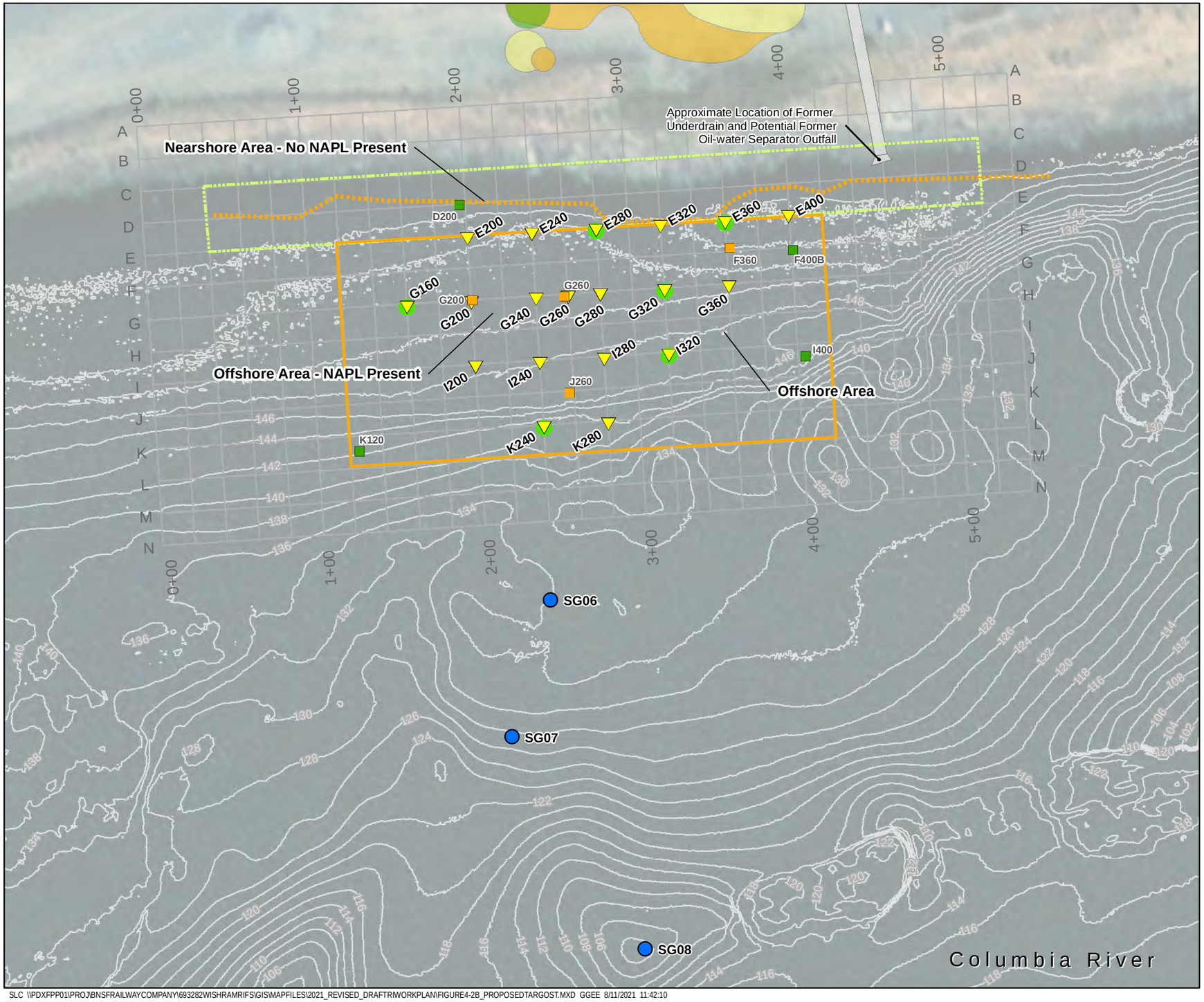


LEGEND

- Proposed Primary TarGOST Locations
- Potential Core Location Pending TarGOST Result
- Proposed Core Location Further Offshore of Known NAPL
- Core Location with NAPL Observed (2018)
- Core Location with no NAPL Observed (2018)
- Initial Study Area
- Expanded Study Area
- Sampling Grid (20 ft x 20 ft)
- Stormwater Underdrain (Portion Removed from Service Circa 1960)
- Toe of Exposed Riprap during 2018 Sampling Event
- Bathymetric Contour (ft NAVD88, 2 ft Contour Interval)

Uplands Area

- Inferred Lateral Extent of Smear Zone Diesel Impacts
- Inferred Lateral Extent of Submerged Diesel Impacts
- Inferred Lateral Extent of Smear Zone Oil Impacts
- Inferred Lateral Extent of Submerged Oil Impacts

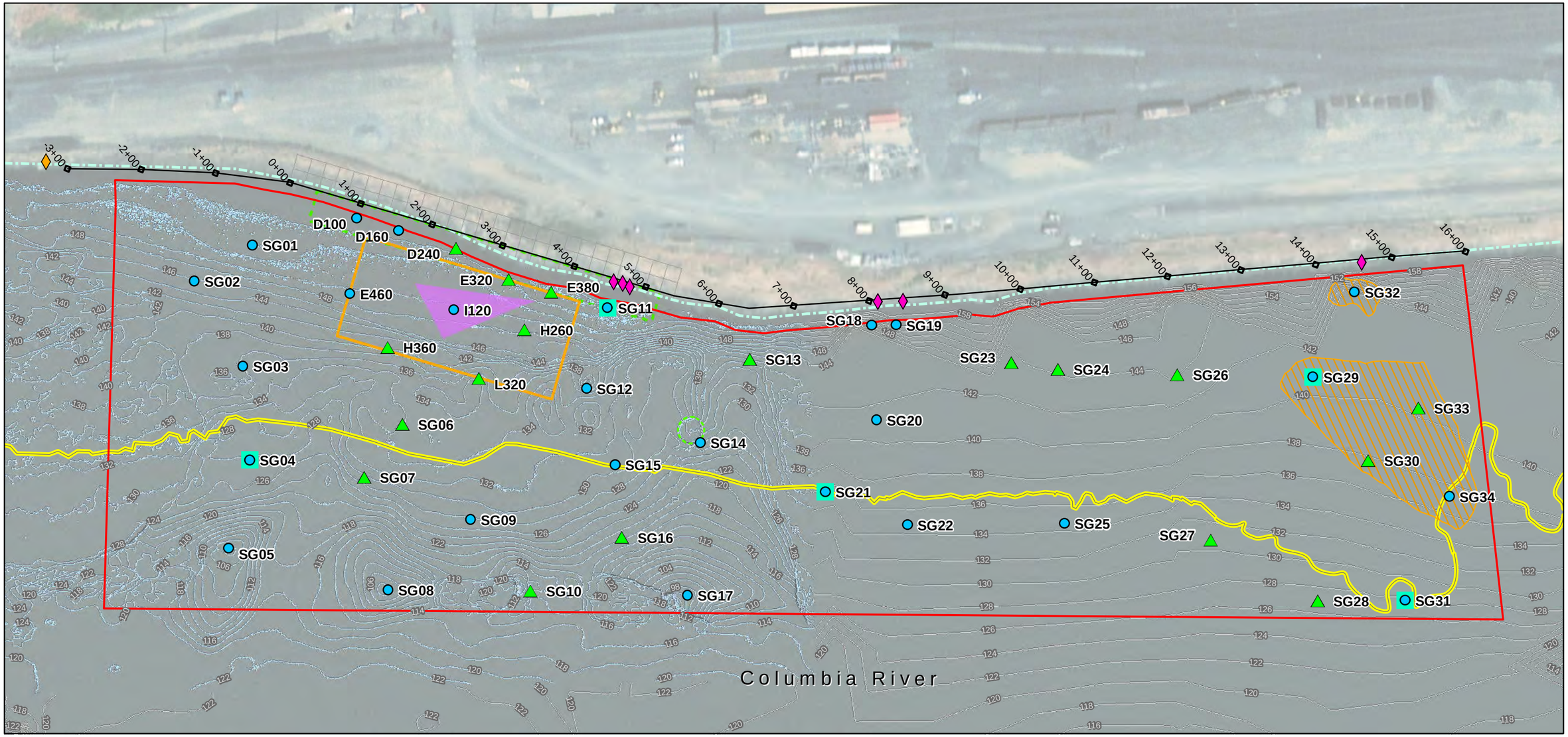
Notes:
NAPL = nonaqueous phase liquid
µg/L = microgram(s) per liter
MTCA = Model Toxics Control Act
ft = feet
NAVD88 = North American Vertical Datum 1988

N
0 25 50 100
Feet
1:780
1 inch = 65 feet

SLC \\PDXFPP01\PROJ\BNSFRAILWAYCOMPANY\693282WISHRAMRIFS\GIS\MAPFILES\2021_REVISED_DRAFTRIWORKPLAN\FIGURE4-2B_PROPOSEDTARGOST.MXD GGEE 8/11/2021 11:42:10

Figure 4-2B. Proposed Primary TarGOST Locations and Surface Sediment Characterization Approach
BNSF Track Switching Facility
Wishram, Washington

Jacobs



LEGEND

- Primary Surface Sample Location
- Secondary Surface Sample Location
- Sample Location for SPI Camera Survey
- Current Outfall Location
- Former Outfall Location
- Proposed RI Area
- Potential Sediment
- Shoreline Stationing
- WA Ecology Initial Investigation Area
- 2018 Initial Investigation Area
- Offshore Area - NAPL Present
- 2018 Initial Investigation Area Sampling Grid
- Bathymetric Contour (ft NAVD88, 2 ft Contour Interval, [US Army Corps of Engineers, 2008])
- Bathymetric Contour (ft NAVD88, 2 ft Contour Interval, [2017])
- Current Shoreline
- Historic Shoreline

Notes:
ft = feet
NAPL = nonaqueous phase liquid

0 100 200 400
Feet

Figure 4-3. Proposed Sediment Characterization Locations shown with Bathymetry
BNSF Track Switching Facility
Wishram, Washington

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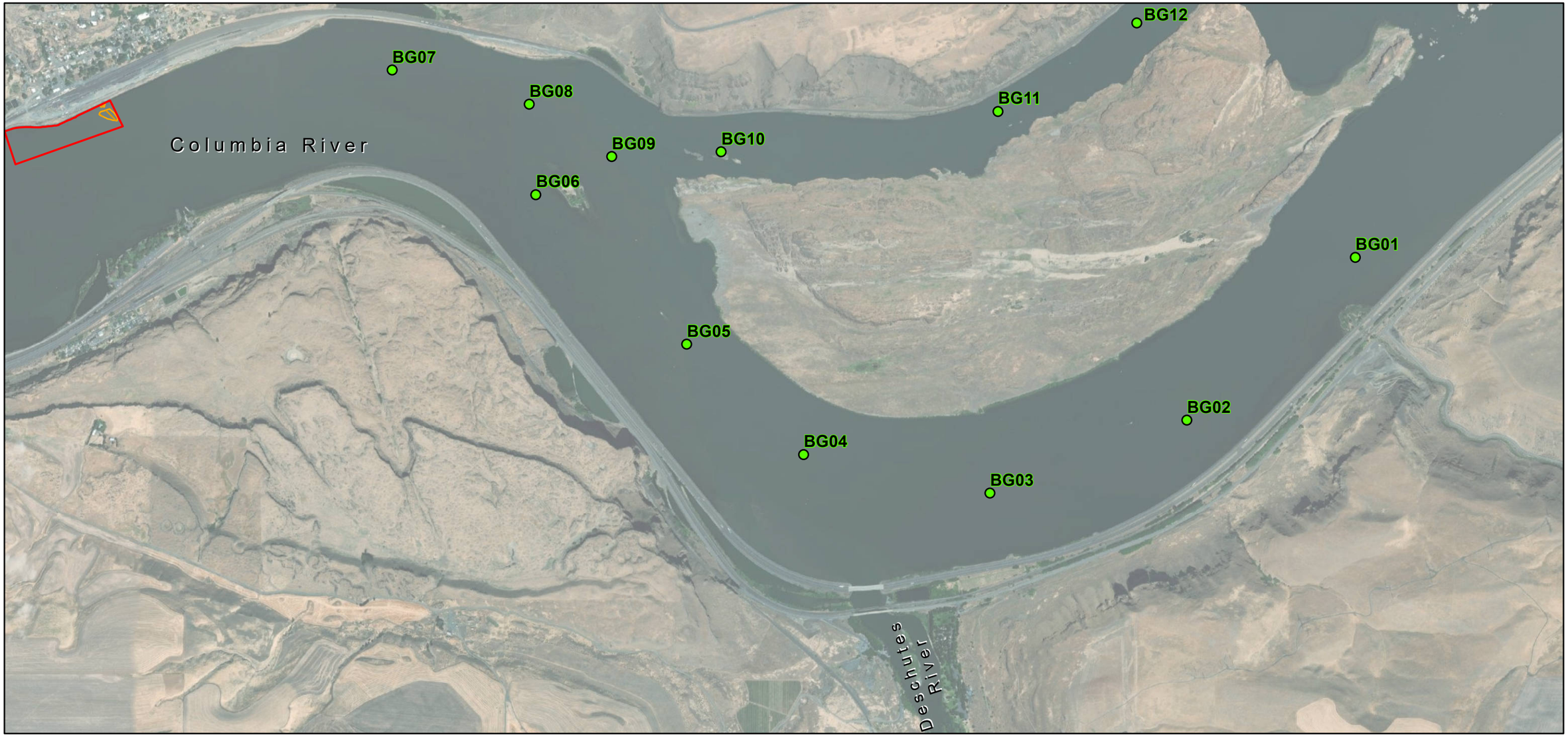

LEGEND

- Proposed Background Sample Locations
- Proposed RI Area
- Potential Sediment

N

0 0.125 0.25 0.5
Miles

Figure 4-4. Proposed Background Sample Locations
BNSF Track Switching Facility
Wishram, Washington

\\PDXFPP01\PROJ\BNSFRAILWAYCOMPANY\693282WISHRAMRIFS\GIS\MAPFILES\2021_REVISED_DRAFTRIWORKPLAN\FIGURE4-4_PROPOSEDBACKGROUNDSAMPLELOCATIONS.MXD GGEE 10/21/2021 16:42:32

Jacobs

Appendix A
Sampling and Analysis Plan

Jacobs

BNSF Wishram Railyard, Wishram, Washington (BNSF Track Switching Facility)

Sediment Remedial Investigation Sampling and Analysis Plan

Final

November 2021

BNSF Railway Company

BNSF Wishram Railyard, Wishram, Washington

Project No: D3367100
Document Title: Sediment Remedial Investigation Sampling and Analysis Plan
Document No.: FES1203201440PDX
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Document History and Status

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Contents

Attachments

Tables

Figures

Acronyms and Abbreviations

AO	Agreed Order
BAZ	biologically active zone
BNSF	BNSF Railway Company
bss	below sediment surface
C/T	conductivity and temperature
COPC	contaminant of potential concern
CSL	cleanup screening level
CUL	cleanup level
DOT	U.S. Department of Transportation
DPT	direct-push technology
Ecology	Washington State Department of Ecology
FS	feasibility study
GSI	groundwater-surface water interface
LIF	laser-induced fluorescence
LNAPL	light nonaqueous phase liquid
mg/kg	milligram(s) per kilogram
MRL	mean reporting limit
MTCA	Model Toxics Control Act
NAPL	nonaqueous phase liquid
NAVD88	North American Vertical Datum of 1988
PAH	polycyclic aromatic hydrocarbon
QA	quality assurance
QC	quality control
RI	remedial investigation
SAP	sampling and analysis plan
SCO	sediment cleanup objective
SCUM	Sediment Cleanup User's Manual
SMS	Sediment Management Standards
SOP	standard operating procedure
TarGOST	Tar-specific Green Optical Screening Tool
TPH	total petroleum hydrocarbons
TPH-diesel	total petroleum hydrocarbons as diesel range organics
TPH-residual	total petroleum hydrocarbons as residual/oil range organics
WAC	Washington Administrative Code

1. Introduction

This sampling and analysis plan (SAP) has been prepared in support of the *Wishram Railyard Sediment Remedial Investigation Work Plan* for the sediments in the Columbia River adjacent to the BNSF Railway Company (BNSF) Wishram Railyard (site), located in Wishram, Washington (Figure 1-1 Site Map). Petroleum sheening and nonaqueous phase liquid (NAPL) gas bubbles have been observed along an approximately 300-foot stretch of the Columbia River known as Lake Celilo adjacent to the railyard (Figure 1-2 Study Area) (Ecology 2017).

The purpose of the sediment remedial investigation (RI) is to characterize the nature and extent of NAPL in the nearshore environment and evaluate chemicals of potential concern (COPCs) potentially present in nearshore sediment against applicable sediment cleanup standards.

1.1 Regulatory Framework

Remedial work at the railyard is being performed pursuant to an Agreed Order (AO) (No. DE 12897) between the Washington Department of Ecology (Ecology) and BNSF, dated October 7, 2015. The scope of work in the AO is mainly focused on the upland investigation, with limited actions related to shoreline conditions. As discussed in the Sediment RI Work Plan, Ecology directed BNSF to investigate sheens that had been observed along the shoreline.

The Sediment RI will be performed in accordance with the Ecology Model Toxics Control Act (MTCA) regulations published in Washington Administrative Code (WAC) 173-340 (Ecology 2017) and the cleanup provisions of the Sediment Management Standards (SMS) under WAC 173-204, as described in the *Sediment Cleanup User's Manual: Guidance for Implementing the Cleanup Provisions of the Sediment Management Standards, Chapter 173-204 WAC* (SCUM) (Ecology 2019).

1.2 Site History

The BNSF railyard is located in the town of Wishram in Klickitat County, Washington, approximately 13 miles northeast of The Dalles, Oregon, and 0.75 mile south of Washington State Route 14, within the southwestern quarter of Section 17, Township 2 north, Range 15, east of the Willamette Meridian. The location of petroleum sheening and approximate area of interest for the Inundated Lands RI are shown on Figure 1-2.

The study area associated with this work represents an expansion from the 2018 initial investigation area and includes the lands inundated during the filling of Lake Celilo in 1957 that are adjacent to past industrial activities and discharges associated with the railyard. This area extends approximately 1,850 feet along the shoreline and extends approximately 500 feet south of the riprap shoreline. Prior to 1957, the bulk of the study area consisted of exposed lands adjacent to a free-flowing Columbia River that was 40 to 50 feet lower than the railyard. No identified industrial activity occurred in this area, but the area did receive discharges associated with drains and outfalls. Construction of The Dalles Dam in 1957 impounded the river and formed Lake Celilo. The former and current shorelines and prominent site features believed to have existed during some portions of the time between 1910 (when the railyard began operations) and the present are shown on Figure 1-3.

Additional details regarding historical site activities, including historical plat maps, are presented in the report *Site Investigation, Wishram Railyard, Wishram, Washington* (KJ 2012) and the *Nearshore Sediment RI Workplan* (CH2M 2018).

1.3 Project Personnel and Responsibilities

Table 1-1 lists the project personnel with their associated company/agency and responsibility.

Table 1-1. Project Personnel and Responsibilities

Company/Agency	Personnel	Responsibility
BNSF	Shane DeGross	Manager Environmental Remediation
Washington Department of Ecology	John Mefford	Cleanup Project Manager
	Chance Asher	Sediment Lead
Kennedy/Jenks	Ryan Hultgren	Project Manager
	Todd Miller	Program Manager
	Alice Robinson	Field Lead/Site Safety Coordinator
	Scott Larew	Senior Technical Consultant/Subject Matter Expert
Jacobs	Carrie Andrews	Senior Project Manager
	Jeff Gentry, PE	Senior Technical Consultant
	Kris Ivarson	Task Lead and Assistant Project Manager
	Marilyn Gauthier, PG	Subject Matter Expert, Geology and Sediment
	David Finney	Subject Matter Expert, NAPL
	Elizabeth Luecker, PE	Senior Technical Consultant
	Andrew Hopton	Subject Matter Expert, Ecological Risk/Bioassay
	Jennifer Ulrich	Field Sampling Lead/Site Safety Coordinator
	Bernice Kidd	Project Chemist/Data Validation

Note:

NAPL = nonaqueous phase liquid

1.4 Document Organization

This SAP is organized in the following sections:

- **Section 1 – Introduction.** This section includes the site history, regulatory framework for the project, and project personnel.
- **Section 2 – Sampling Design.** This section outlines the scope of sampling for the project.
- **Section 3 – Sampling Collection and Handling Methods**. This section includes sample collection protocols, equipment needs, and sampling handling procedures.
- **Section 4 – Laboratory Analytical Methods and Test Conditions.**
- **Section 5 – Quality Assurance Project Plan.** This section provides data quality objectives and project quality controls.
- **Section 6 – Data Analysis, Record Keeping, and Reporting.**
- **Section 7 – Health and Safety Plan.** The site-specific health and safety plan is discussed in this section.
- **Section 8 – References.** Report references are provided in Section 8.

2. Sampling Design

The objectives of the sediment RI are to collect, develop, and evaluate sufficient information to characterize the inundated lands portion of the site, further develop the conceptual site model (CSM), evaluate the nature and extent of impacts, establish sediment cleanup standards, and develop cleanup alternatives. The approach for the investigation includes the following components:

- Characterize the sediments within the biological active zone (BAZ) across an expanded study area from the initial investigation that includes the post-1957 inundated lands and adjacent areas potentially impacted by historical discharges, activities in the uplands and inundated land, and activities along the former shoreline (for example, historical outfalls, drainage channels, and low-lying areas)
- Provide additional characterization of sediments in the initial investigation area adjacent to uplands where groundwater concentrations in berm wells exceed MTCA cleanup levels (CULs) and in the area of known NAPL impacts
- Characterize the vertical and lateral extent of NAPL-impacted materials and refine the understanding as to the source of observed sheens
- Determine sediment cleanup unit boundaries and appropriate cleanup standards (which may include CULs and points of compliance), as applicable

Details of the activities included in the remedial investigation are provided in the following sections.

3. Sampling Collection and Handling Methods

Sampling stations will be located in the field using a Global Positioning System (GPS) unit within ± 2 to 3-meter accuracy. Actual latitude-longitude of sampling stations will be recorded at the time of sample collection. Horizontal data will be presented in North American Datum of 1983 (NAD83). Vertical data will be presented in North American Vertical Datum of 1988 in units of United States (U.S.) survey feet (NAVD88). GPS coordinates will be recorded in decimal degrees. The vertical elevation of the top of the water column and the top of the sediment (mudline) will be obtained concurrently. Sampling will be conducted from a research vessel and or spud barge anchored to the bottom of the Columbia River.

RI field activities will be conducted in two steps. A summary of the sampling and analysis to be performed as part of the RI is provided in Table 3-1.

Table 3-1. Sampling and Analysis Summary

Work Plan Element	Number of Locations	Number of Analyses	Target Depth (bss unless noted otherwise)	Analyses	Sample Station IDs	Rationale by location
Step 1 of RI Field Work						
Determine the biologically active zone (BAZ)	6	6	Up to 30 cm	SPI Camera; Dissolved oxygen levels in sediment	Primary sample locations: SG11, SG19, SG29, SG21, SG04, SG31	To obtain samples representative of the various historical and geologic conditions, as well as spatial distribution.
Surface Sediment – Primary samples	26	26	Sample to the depth of the BAZ	COPCs listed in Table 3-2 Grain size Total organic carbon	a) SG11, SG18, SG19, and SG32 b) SG12, SG14, SG20, and SG29 c) SG15 and SG21 d) SG04, SG09, SG25, and SG31 e) I120 f) SG01, SG02, SG03, SG17, SG22, SG34, D160, D100, E460 g) SG05, SG08 See Figure 3-1	a) Current nearshore areas in vicinity of historical outfalls b) Locations south of former outfalls c) End of former drainage ditches d) Other former nearshore locations (prior to inundation) e) Area of submerged NAPL f) Areas of potential impacts near historical shoreline g) Potential depositional areas in river (“holes” in bathymetry)
Surface Sediment – Secondary samples	18	18	Sample to the depth of the BAZ	COPCs listed in Table 3-2; as per flowchart (Figure 3-2) Grain size Total organic carbon	a) SG30, and SG33 b) SG06 c) SG07, SG16, SG27, and SG28 d) SG10 e) SG13, SG23, SG24, and SG26 f) D240, E320, and E380 g) H260, H360, and L320 See Figure 3-1	a) Former deposition area b) Historical sandy shoreline south of submerged NAPL c) Former nearshore areas (prior to inundation) downstream of historical outfalls and submerged NAPL d) Deeper low-lying areas south of the inundated lands and former outfalls e) Scattered locations to provide samples in other areas of inundated lands f) Current nearshore area adjacent to uplands groundwater impacts exceeding MTCA Method A CULs and between shoreline and the suspected northern extent of submerged NAPL g) Area of submerged NAPL
Surface Sediment - Background	12	12	Sample to the depth of the BAZ	COPCs that are bioaccumulative as well as any non-bioaccumulative chemicals that exceed the SMS listed in Table 3-2[a] Grain size Total organic carbon	See Figure 3-3. Sample locations: BG01 through BG12	Spatial distribution of sample locations downstream of the John Day dam, but upgradient of the site.
Step 2 of RI Field Work						
Bioassays	TBD	TBD[a]	Need for, quantity, and depth dependent on BAZ results and chemical results	Bioassays only need to be run for stations that exceed the benthic criteria. Total PAHs, TPH-diesel, TPH-residual, metals and additional chemicals that exceeded the SCO benthic criteria and background values in surface sediment samples[b].	TBD. Locations will be based on the results of the sediment chemistry from Step 1. Selected locations will be reacquired.	Bioassays will be conducted on samples that exceed the benthic SCOs in Step 1.
LIF Profiling	18+	Up to 30 feet	TarGOST Profiling	Continuous	Establish lateral and vertical extent of NAPL	Areas of known or suspected NAPL.

Table 3-1. Sampling and Analysis Summary

Work Plan Element	Number of Locations	Number of Analyses	Target Depth (bss unless noted otherwise)	Analyses	Sample Station IDs	Rationale by location
					See Figure 3-4.	
Sediment Cores	6	2 samples from each core within the NAPL footprint – one sample will be collected from just above and one sample collected from just below the NAPL impacted zone.	Up to 30 feet or refusal (bedrock) Samples to be collect above and below the NAPL impacted areas as defined by the TarGOST	Core logging, field observation and screening Total PAHs, TPH-diesel, TPH-residual, metals and additional chemicals that exceeded the SCO benthic criteria or background in surface sediment samples. Grain size Total organic carbon	G160, K240, I320, G320, E360, E280. (The final core locations will be based on the actual TarGOST screening results and the resulting NAPL footprint) See Figure 3-4.	NAPL delineation confirmation Characterization of subsurface lithology Vertical delineation of constituents of potential concern
	3	2 samples from cores south of the NAPL footprint – samples will be collected at zones with a visual change in stratigraphy.			Cores will also be conducted at SG06, SG07, SG08, which are south of the known NAPL area. See Figure 3-4.	

Notes:

a. Although benthic criteria are typically greater than background values, any non-bioaccumulative chemicals that exceed benthic criteria will also be analyzed for in background samples to confirm this assumption.

b. Per Chapter 8 of SCUM II bioassays may be conducted to override the chemistry results for samples where one or more contaminants of potential concern exceed the benthic criteria. While benthic criteria are typically in excess of background values, all non-bioaccumulative chemicals exceeding benthic criteria will be tested for in background samples. If background levels of these constituents are found to be higher than those measured in site sediment, then bioassay override may not be performed. It is estimated that a maximum of 6 bioassay analyses would be performed. A hold time of 2 weeks will apply unless samples are preserved in a nitrogen environment at 4° C in which case the hold time may be extended up to 8 weeks.

bss = below sediment surface

3.1 Step 1 Sample Collection

Step 1 of the remedial investigation is outlined below.

3.1.1 Determine Biologically Active Zone (BAZ)

Based on guidance (EPA 2015) a site-specific BAZ will be established. The BAZ thickness will be confirmed with multiple lines of evidence to support the establishment of a consistent surface sediment sampling depth for this portion of the river. The primary lines of evidence will be visual observations made using Sediment Profile Imaging (SPI) combined with measurements of oxygen levels in the shallow sediment. SPI provides a visual record of the in situ sediment column avoiding disturbance of the sediment caused by some sampling techniques.

The SPI system uses a specially designed camera that is inserted into the sediment up to a depth of 12 inches. The camera head includes a clear plastic viewing plate with the camera behind the plate. Once inserted into the sediment the camera takes a picture as a cross-section of the sediment profile. The cross-section photographs provide important visual information used to establish the BAZ including:

- The Redox Potential Discontinuity (RPD) or the zone where the sediment changes from oxic to anoxic which can be observed as a color change from brown to black.
- Sediment texture, grain type and size, and color allowing identification of sediment as sand, gravel, silt, or mud.
- Evidence of biological activity by depth and the type of benthic infauna community present.
- Evidence of strongly reducing conditions such as methane pockets

In addition, oxygen profile readings will be collected in sediment column samples co-located with the SPI samples to verify oxygen levels at depth in the sediment. The SPI and oxygen data will be collected from 5 locations within the study area as an initial survey of sediment characteristics. After a review of the collected data the BAZ will be established at the deepest depth identified for the future sediment sampling events.

3.1.2 Surface Sediment Samples

Surface sediment samples will be collected to the depth determined from the BAZ investigation. The surface sediments samples will be collected and processed in accordance with the standard operating procedure (SOP) for Surface Sediment Sampling (Attachment 3).

A total of 26 primary and 18 secondary surface sediment sample locations have been identified in the investigation area (Figure 3-1). Samples are planned for the areas listed in Table 3-1. The samples will be analyzed for the COPCs listed in Table 3-2, in accordance with the analysis flowchart presented in Figure 3-2, using the methods listed in Table 3-3.

Surface sediment samples will be collected using a Van Veen grab or power grab sampler deployed from a vessel. Collecting surface sediment using a Van Veen or similar device will cause minimal disturbance to the surficial layer while providing enough capacity for collecting necessary volumes of sediment from the BAZ. Samples will be collected to avoid contamination from known contaminated areas and any suspended sediment upstream. This will be done by working upstream and towards the areas with highest concentrations based on past sampling events.

The samples will be collected and processed in accordance with the SOP for Surface Sediment Sampling (Attachment 3). The sediment CSM for the inundated lands identifies direct contact with sediment and surface water, and ingestion of fish as the primary potential human exposure routes.

A total of 12 additional surface samples, as shown on Figure 3-3, will be collected to establish background concentrations for the bioaccumulative COPCs that exceed the programmatic PQL criteria listed in Table 3-2. For COPCs that do not have a listed programmatic PQL, the lower value will be used. Although benthic criteria are typically greater than background values, any non-bioaccumulative chemicals that exceed benthic criteria will also be analyzed for in background samples to confirm this assumption.

Table 3-2. List of COPCs for Remedial Investigation

	Freshwater Benthic (WAC 173-204-563 Table VI)		Freshwater Human Health (SCUM II Table 9-2)			Programmatic PQLs (SCUM II Table 11-1)
Chemical Parameter	Dry Weight Sediment Cleanup Objective (SCO)	Dry Weight Cleanup Screening Level (CSL)	Beach Play (Child)	Subsistence Clam Digging (Adult)	Subsistence Net Fishing (Adult)	Consumption of Fish/Shellfish by Human and Higher Trophic Level Receptors
Conventional Chemicals (mg/kg)						
Ammonia	230	300				
Total sulfides	39	61				
Metals (mg/kg)						
Arsenic	14	120	4.8	0.96	3	0.3
Cadmium	2.1	5.4	610	1300	4400	0.07
Chromium	72	88				0.2
Copper	400	1,200				0.1
Lead	360	> 1300				0.1
Mercury	0.66	0.8				0.02
Nickel	26	110				0.2
Selenium	11	> 20				
Silver	0.57	1.7				0.1
Zinc	3,200	> 4,200				1
Organic Chemicals (µg/kg)						
3&4-Methylphenol	260	2,000				
Benzoic acid	2,900	3,800				
Bis(2-ethylhexyl) phthalate	500	22,000				
Carbazole	900	1,100				
Dibenzofuran	200	680				
Di-n-butyl phthalate	380	1,000				
Di-n-octyl phthalate	39	> 1,100				
Pentachlorophenol	1,200	> 1,200				
Phenol	120	210				

Table 3-2. List of COPCs for Remedial Investigation

Chemical Parameter	Freshwater Benthic (WAC 173-204-563 Table VI)		Freshwater Human Health (SCUM II Table 9-2)			Programmatic PQLs (SCUM II Table 11-1)
	Dry Weight Sediment Cleanup Objective (SCO)	Dry Weight Cleanup Screening Level (CSL)	Beach Play (Child)	Subsistence Clam Digging (Adult)	Subsistence Net Fishing (Adult)	Consumption of Fish/Shellfish by Human and Higher Trophic Level Receptors
Total PAHs	17,000	30,000				
Carcinogenic PAHs[a] (sum TEQ)			900	320	680	9
PCBs and Dioxin/Furans (ng/kg)						
Dioxin/Furan Congeners[b] (sum TEQ)			89	15	55	5
PCB Congeners[c] (sum TEQ)						0.7
Bulk Petroleum Hydrocarbons (mg/kg)						
TPH-diesel	340	510				
TPH-residual	3,600	4,400				

[a] Table 6-1, Chapter 6 of SCUM II contains the specific carcinogenic PAHs and TEFs used for calculations

[b] Chlorinated dibenzo-p-dioxins and chlorinated dibenzofurans congeners. Table 6-2 in Chapter 6 of SCUM II contains the specific congeners and TEFs used for calculations

[c] Table 6-3 in Chapter 6 of SCUM II contains the specific dioxin-like PCB congeners and TEFs used for calculations

mg/kg =milligram(s) per kilogram

ng/kg = nanogram(s) per kilogram

TEF = toxicity equivalency factor

TEQ= toxicity equivalent

3.1.3 Surface Sediment Sample Collection and Handling

Before collecting sediment samples, a clean plastic workspace will be laid out on the bow of the boat that is anchored with the motor off. Sample bottles will remain covered in plastic bags inside the plastic-lined ice chests until ready to be filled.

Sediment samples collected with the grab sampler will be rejected if the following acceptability criteria are not met:

- The sampler is not over-filled so the sediment surface is not pressed against the top of the sampler.
- Overlying water is present (indicates minimal leakage).
- The overlying water is not excessively turbid (indicates minimal sample disturbance).
- The sediment surface is relatively flat (indicates minimal disturbance or winnowing).
- The necessary penetration depth is achieved (e.g., several centimeters more than the targeted sample depth).
- The material collected is smaller than cobble.

Up to three attempts will be made to collect a sample from the identified location. Sample compositing may be necessary if the grab sampler contains an insufficient volume of sediment for the required analyses. Composites must be from the same station but can be from different grab attempts. Discrete samples will be collected and transferred to a single, decontaminated, clean stainless steel compositing bowl and unrepresentative material removed (e.g., woody debris), then thoroughly homogenized to a uniform appearance using a decontaminated, clean, stainless steel spoon. The discrete samples will be collected away from the surfaces of the sampler to avoid potential residual contamination from previous station grabs. Sampling will first be conducted from known areas with lower concentrations and working upstream to avoid cross contamination.

Sediment samples for analysis of potentially volatile chemicals (i.e., naphthalene) will be placed immediately into sample containers and will not be composited or homogenized. Field observations will include sediment characteristics and the presence of debris and biota. Additional information related to surface sediment collection protocol is provided in SOP provided in the Attachments.

Water depths will also be measured to the nearest 0.1 foot using a hand-held acoustic sounder. Sampling locations will be referenced horizontally using easting and northing coordinates in NAD83 State Plane coordinate system measured in U.S. survey feet. The as-sampled coordinates of each location will be captured by the subcontractor and recorded at the time of sampling with the Trimble GPS.

3.2 Step 2

Step 2 may include the collection of bioassay samples from those areas where Step 1 surface sediment results indicate an exceedance of the applicable benthic criteria (Table 4-2) in accordance with Chapter 8 of SCUM II (Ecology, 2019). The exception to this will be if background levels of these constituents are found to be consistent with, or higher than the levels measured in site sediment. In this scenario the constituent will be considered related to background and thus bioassay override will not be required. If bioassay samples are collected sediment chemistry results will also be generated for these samples for the relevant COPCs. During Step 2, the extent of NAPL will be characterized using Tar-specific Green Optical Screening Tool (TarGOST) profiling and advancing confirmatory sediment cores. Three additional sediment cores will be advanced in the area south of the known NAPL extent in low lying areas according to the bathymetry maps to determine if impacts extend to that area. Additional sediment cores may be added, dependent on the analytical and TarGOST profiling results.

3.2.1 Bioassay

Because the NAPL area represents a source of sheens that will require remediation, bioassay data will not be performed on sediment overlying the NAPL impacted area(s).

For Step 1 locations that exceed the SMS benthic SCO for chemistry, Step 2 surface samples may be collected for bioassay tests. Bioassays will not be collected in Step 1 due to the time needed to evaluate the data and determine if additional areas need sampling. Instead, Step 1 locations will be reacquired in Step 2, and surface samples will be collected at that time for potential bioassays. Bioassays will be preferentially conducted within 2 weeks of sample collection, unless preserved in a nitrogen environment at 4° C, in which case the hold time may be extended up to 8 weeks. These Step 2 surface sediment samples will also be analyzed for constituents that exceed the SCO in order to have synoptic sample results.

By completing the bioassay work as a second phase, the study can be designed to address the data gaps related to benthic risk.

The proposed assessment approach for the benthic community will be designed to address potential risk and uncertainties by focusing the data collection and analysis to further:

- Characterize the bioavailability/toxicity of site-related chemicals and identify chemicals causing risk to benthic organisms
- Characterize the spatial extent and pattern of site-related risks to benthic organisms

Potential risks to the benthic community will be assessed using a weight-of-evidence approach that integrates whole sediment toxicity tests and compares constituent concentrations in bulk sediment with SMS benthic chemical criteria. A separate work plan for this task would be prepared prior to the Step 2 evaluation.

3.2.2 TarGOST

To characterize the vertical and lateral extents of the submerged NAPL that has been observed in the offshore area, continuous sediment profiling will be conducted at a minimum of 18 locations across the study area using Dakota Technologies' TarGOST. Locations are shown on Figure 3-4.

TarGOST is a laser-induced fluorescence (LIF) tool developed specifically for the detection of higher molecular weight NAPL (both free- and residual phase). The TarGOST system is used as an in-situ evaluation tool that is advanced using a direct-push technology (DPT) drilling rig and provides real-time, semi-quantitative graphical data of the vertical distribution of NAPL saturation in the subsurface. Fluorescence responses are recorded as a percentage of a fixed calibration standard or reference emitter.

TarGOST was successfully used in uplands portions of the railyard. In addition, NAPL-containing sediment cores collected from within the inundated lands area during the initial sediment investigation were scanned at the Dakota Technologies facility using TarGOST. The results of these scans generated approximately 100 readings per sample from which indicated peak TarGOST fluorescence responses of between 55 and 229 percent of the reference emitted (%RE) for sediment where NAPL saturations were measured to range between 3 and 42 percent pore volume (%PV) (CH2M 2019). For samples where NAPL saturations were less than 0.1 %PV maximum TarGOST responses ranged from 30.6 to 39.2 %PV. This work demonstrated the effectiveness of TarGOST at identifying the NAPL present in the offshore area.

Dakota Technologies couples TarGOST with Electrical Conductivity Dipole Array (EC) to provide general stratigraphic information. EC emits a current through the subsurface formation in between the two probe contacts. This current and the resulting voltage is measured, and sediment type can be determined by its conductivity.

The TarGOST/EC-equipped DPT unit will be mounted on a spudded barge and the investigation will begin at locations of known NAPL impacts (for example, G200 and G260). Up to 6 planned TarGOST borings will be extended to a depth of 30 feet bss or refusal, whichever occurs first. These locations will include select locations along the northernmost line of proposed borings as well as locations farther offshore within the known NAPL area. Once the elevation of the base of the NAPL-impacted interval has been established, the remaining borings may be shortened to depths that are equivalent to the deepest observed TarGOST response, indicating the presence of NAPL plus 5 feet. The work will progress from the inside/out to cover and extend beyond the area of observed NAPL. The six primary locations on the E grid line shown on Figure 3-4, will serve to confirm the absence of nearshore NAPL and isolation of the submerged NAPL that is present farther offshore within the inundated lands.

If needed, and if practicable, additional TarGOST profiles beyond those shown on Figure 3-4, may be completed at a spacing of approximately 40 feet to establish the lateral and vertical extents of NAPL. The grid shown on Figure 3-4 will be used as a guide to assist in identifying step-out locations. The need for

further step-outs will be based on a weight-of-evidence approach following the completion of the initial 18 locations within and adjacent to areas of known NAPL, and the acquisition and visual interpretation of up to 4 confirmatory cores (Section 4.3.2.3). The emitter response, fluorescence waveforms, thickness of elevated/suspect response intervals, will be assessed relative visual observations from collocated confirmatory cores to determine fluorescence response and waveforms that are indicative of NAPL presence versus those that are the result of naturally occurring materials (e.g. peat, wood, limestone). This information will be used to assess the need for further step outs along the periphery. Samples with potential interfering materials (peats and natural organics) from cores may be sent to Dakota Technologies to confirm the waveform observed in the collocated TarGOST boring. If NAPL is observed in surface samples collected in Step 1 in the expanded study area, additional TarGOST may be attempted at those locations. These additional areas would have TarGOST profiling along with confirmatory subsurface cores with subsurface sediment sampling and analytical testing.

3.2.3 Confirmatory Sediment Cores

Following review of the results of the TarGOST profiling, six sediment cores will be advanced using DPT or vibracore to confirm TarGOST results, including potential interferences, and allow for the characterization of stratigraphy across the study area. Cores will be advanced adjacent to TarGOST locations where NAPL is suspected (four locations) as wells as those where it is not suspected (two locations), pending the results of the TarGOST analysis. An additional three locations south of the known NAPL area will also be advanced in low lying areas based on bathymetry maps. Up to three attempts will be made to collect core material from the identified target locations (Figure 3-4). In general, cores will be advanced to 5 feet below the base of the NAPL impacts as indicated in the collocated TarGOST, or to 15 feet bss (where suspected impacts are not present). However, at two locations where deeper TarGOST profiles are advanced (up to 30 feet bss), a final sediment core depth of 30 feet bss will also be targeted to allow for the characterization of deeper stratigraphy. Three additional sediment cores (for a total of nine cores) will be advanced south of the known NAPL footprint to a depth of 15 feet bss, with samples collected at visual stratigraphic changes.

Cores will be continuously logged and screened using visual, olfactory, and photoionization detector. Visual observations will be used to confirm NAPL presence or absence at each location. At each core location, sediment samples will be collected for chemical analysis from intervals 6 to 12 inches above and below where NAPL is visually observed. Chemical analysis will include TPH (diesel and residual), PAHs, and other constituents exceeding an SCO during the Step 1 sediment sampling. Samples will also be collected from each distinct stratigraphic unit for grain size analysis (assumed that on average two samples will be collected from each core). Advancement, logging, and screening of the borings will be performed in accordance with the SOPs provided in Attachment 2. Cores will also be collected to inform cleanup alternatives by calculating volume of impacted sediment and sedimentation rates.

3.3 Sampling Equipment

The following sampling equipment may be required for collection of sediment samples:

- MacroCore Sampler
- Vibracore
- van Veen grab sampler (stainless steel) – Surface sampling only
- large plastic tub
- Laboratory-supplied sample containers (jars)
- Tape Measure
- Plastic sheeting
- Plastic sheeting clamps
- Sample table
- Ziploc-type bags
- Camera
- Deionized water
- Paper towels
- Duct tape
- Large garbage bags
- Chain-of-custody forms and seals
- Sample labels
- Lithology identification guide
- Pens (water-resistant pen, permanent pens, paint marker, etc.)

- Whiteboard and marker
- GPS unit
- Decontaminated stainless steel tablespoons
- Disposable gloves (non-talc)
- Safety glasses
- Water-resistant field notebooks
- Sample data sheets and field log sheets
- Toolbox (wrench, field knife, etc.)
- Ice

3.4 Equipment Decontamination

Decontamination of sampling equipment must be conducted consistently to minimize the potential for cross-contamination. Re-usable equipment that comes into contact with potentially contaminated materials will be decontaminated. Non-disposable sampling equipment will be decontaminated before each use (i.e., between each sampling station). The decontamination procedure will consist of the following steps:

- Physically remove visible debris, to the extent practicable
- Nonionic detergent wash (phosphate free)
- Potable water rinse
- Acetone or hexane solvent rinse
- Triple rinse with distilled/deionized water
- Air dry
- Wrap equipment in new aluminum foil

Disposable equipment intended for one-time use that is factory wrapped generally does not need to be decontaminated before use (if evidence of contamination is present the disposable equipment will be discarded and not used). One-time use, disposable, sampling equipment and accessories will be discarded once used and a new set of equipment will be used for each subsequent sample. Disposable sampling equipment will be used as much as practical including nitrile gloves. Decontamination liquids and solids will be collected and disposed on-land in an approved wastewater receptacle.

3.5 Sample Containers and Labels

During the field investigation, a consistent sample identification system will be employed to ensure uniqueness and clarity in sample labeling. This section describes the protocol that will be followed in labeling samples that are submitted to the analytical laboratory. This section does not apply to those samples that will be collected but not retained for laboratory analysis.

Each sample collected during the fieldwork will be assigned a unique ID number that includes the following information:

- Site Identifier (BNSF)
- Sediment Sample type (e.g., SD = Sediment core, SG = sediment grab, FD = field duplicate)
- Sample core/grab number
- Date and time sample was taken
- Top of sample depth (in feet bss)
- Bottom of sample depth (in feet bss)

A complete sample name will consist of the components listed above, using the following format:

(sample type)(sample core or grab number)-(sample date)(top of sample depth)-(bottom of sample depth)

For example, "BNSF-SG01-112220-01-02" would represent the first surface grab sample #01, collected on November 22, 2020, from 1 to 2 feet bss.

The above sample naming format will be modified for field duplicates as follows:

(FD)(duplicate core number)-(top of sample depth)-(bottom of sample depth)

For example, "FD01-112220-01-02" would represent the field duplicate of the first sample collected for surface grab #01.

Matrix spike/matrix spike duplicate (MS/MSD) samples will be named the same as their parent sample except with the "MS" and "MSD" designation at the end of the sample ID (e.g., SG01-112220-MS and SG01-112220-MSD).

The sample labeling program for trip blanks and equipment blanks will be as follows:

- Trip blanks – TB (6-digit date)-(blank number)
- Equipment blanks – EB (6-digit date)-(blank number)

For example, "*TB0101520-01*" is a trip blank #1 submitted for analysis on 15-October-20.

TarGOST/LIF samples will be named by the grid location where they are collected. For example, K150.

3.6 Field Documentation

A written record of sampling activities and field observations will be maintained in a bound, water-resistant field notebook with consecutively numbered pages. Entries will be legibly written in black or blue, indelible ink. Entry errors will be corrected by drawing one solid line through the incorrect entry, followed by the user's initials and date. The end of each workday or task will be signed and dated by the individual making the entries. Factual and objective language will be used. Entries will be complete and accurate enough to allow reconstruction of each field activity. Activities should be recorded contemporaneously. When not in use, the logbook will be stored in the permanent project file. After completion of the sampling activities, the field notebooks will be in the custody of the Jacobs project manager.

Daily entries of the following minimum information will be recorded in the logbook, when applicable.

- Date and time, expressed in 24-hour format
- Time of arrival and departure from the site
- Meteorological and water conditions (including tidal conditions)
- Project personnel and subcontractor personnel onsite
- Any visitors onsite, their representative company and their level of protection
- Health and safety hazards and precautions
- Level of personal protection
- Field observations
- Task start/stop times
- Time of each entry
- Duration of sampling activities
- Site identification (visual sketches where appropriate)
- Location of sampling points (visual sketches where appropriate)
- Description of sample
- Sample ID and analyses to be completed
- Number of samples taken

- Time of sample collection
- Quality assurance and quality control (QA/QC) samples taken
- Type of field instrumentation (if any)
- Names of people collecting samples
- Water depth per station location
- Comments on sampling (for example, equipment or sampling difficulties)
- Volume of sample return
- Decontamination procedures
- Equipment calibration records and all calibrations done
- Any other field instruments, general observations, or notes
- Any deviations from the sampling plan or sampling protocol, if any
- Health and safety observations
- Signature of recorder

3.6.1 Photographic Log

Digital photographs will be taken in the field to document sampling locations, collected samples, site conditions, and any other site-related observations. A photographic log will be kept in which the date, location, photo ID number, brief photographic description, and direction the photographer is facing (if appropriate), and if sheen was produced. Photographs and relevant log information will be downloaded onto a field computer on a regular basis.

3.6.2 Subsurface Sediment Core Logs

Core logs will be recorded in the field for the following observations and information:

- Sampling depth for each sample
- Gross characteristics of the sediment, such as texture, color, biological structures, presence of debris, presence of oily sheen, and presence of an odor
- Comments on sample cohesiveness

3.7 Investigation-Derived Waste Management

Waste generated during fieldwork includes personal protective equipment, disposable sampling items sediment cuttings, decontamination wash water, and other wastes generated during general sampling activities and decontamination. To the extent possible, any excess water or sediment remaining after sediment core collection and sectioning on the vessel will be returned to the collection site. The coring and grab sampling equipment, as well as the deck of the sampling vessel will be washed down using site water before moving to the next station; this water will not be containerized. Excess sediment containing significant sheen or NAPL, if encountered, will be containerized and managed as waste. Investigation-derived waste will be managed consistent with upland activities as described in the *Remedial Investigation Work Plan, Wishram, Washington* (KJ 2016).

3.8 Sampling Handling Procedures

After samples are collected, they will be stored and transported under chain-of-custody as described in this section.

3.8.1 Sample Storage Requirements

The sampling container, preservation, and holding time requirements for each sample are listed below in Tables 3-3 and 3-4. Precleaned containers will be procured from the analytical laboratory. Samples will be held at or below 6 degrees Celsius (°C) in a cooler until delivery to the laboratory.

Table 3-3. Sediment Sample Containers, Preservation, and Holding Time Requirements

Parameter	Analytical Method	Container	Preservation	Maximum Holding Time
Ammonia	Plumb 1981	4-oz glass jar	Cool, ≤ 6°C	7 days to analysis
Grain Size (particle size including hydrometer)	ASTM D422	4-oz glass jar	Cool, ≤ 6°C	6 months
Total organic carbon	SW9060A (with guidance from the SCUM II Manual)	4-oz glass jar	Cool, ≤ 6°C	14 days to analysis
Total Sulfides	Plumb 1981	4-oz glass jar (a 250 ml sample for 5 ml of 2 N zinc acetate)	Cool, ≤ 6°C zero headspace	7 days to analysis
Metals	SW6020B/SW7471B	4-oz glass jar	Cool, ≤ 6°C	6 months (28 days for mercury) to extraction and analysis
Semi-volatile Organic Compounds and Polycyclic aromatic hydrocarbons (standard and carcinogenic)	SW8270E/SW8270E-SIM	4-oz glass jar	Cool, ≤ 6°C	14 days to extraction, 40 days to analysis
Polychlorinated biphenyl congeners	EPA 1668C	4-oz glass jar	Cool, ≤ 6°C	1 year to extraction, 1 year to analysis
Dioxins/Furans	EPA 1613B	8-oz amber glass jar	Cool, ≤ 6°C	1 year to extraction, 1 year to analysis
Total petroleum hydrocarbons-diesel and oil ranges (speciation may be requested)	NWTPH-Dx	4-oz glass jar	Cool, ≤ 6°C	14 days to extraction, 40 days to analysis
Freshwater Bioassay (if needed)[c] *Hyalella azteca* 28-day test	EPA Method 100.4[b] Survival (Chronic endpoint) Growth as Dry Weight (Sublethal endpoint)	1 x 5-gallon bucket[a]	Cool, ≤ 6°C, nitrogen	2 to 8-weeks
Chironomus dilutus 10-day test	EPA Method 100.2[b] Survival (meets the "Acute" endpoint requirement)			

a Samples will be collected and held by the laboratory without further action until it is determined if bioassays are necessary. A two week holding time is preferred. The maximum holding time allowed for sediment samples held at 4°C in the dark and under a nitrogen atmosphere is up to 8 weeks for bioassay testing.

Table 3-3. Sediment Sample Containers, Preservation, and Holding Time Requirements

Parameter	Analytical Method	Container	Preservation	Maximum Holding Time

b. Testing will adhere to the QA/QC criteria specified in SCUM, Chapter 5. The above paradigm meets the SCUM objectives of: Testing of two species: Hyalella and Chironomus. The accumulation of three endpoints of data: Acute (10d Survival), Chronic (28d Survival), and Sublethal (28d growth).

c. The primary method guidance for the freshwater sediment bioassays is from: *Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates. Second Edition. EPA 600/R-99/064. MARCH 2000.*

Notes:

°C = degree(s) Celsius
DPT = direct-push technology
EPA = U.S. Environmental Protection Agency
N/A = Not applicable
NAPL = nonaqueous phase liquid
oz = ounce

Table 3-4. Aqueous Sample Containers, Preservation, and Holding Time Requirements

Parameter	Analytical Method	Container	Preservation	Maximum Holding Time
Metals	SW6020B/SW7470A	1 x 500 ml poly	Cool, ≤ 6°C, HNO3 to pH<2	6 months (28 days for mercury) to extraction and analysis
Semi-volatile Organic Compounds	SW8270E	2 x 1-liter amber glass	Cool, ≤ 6°C	7 days to extraction, 40 days to analysis
Polycyclic aromatic hydrocarbons (standard and carcinogenic)	SW8270E-SIM	2 x 1-liter amber glass	Cool, ≤ 6°C	7 days to extraction, 40 days to analysis
Polychlorinated biphenyl congeners	EPA1668C	2 x 1-liter amber glass	Cool, ≤ 6°C	1 year to extraction, 1 year to analysis
Dioxins/Furans	EPA1613B	2 x 1-liter amber glass	Cool, ≤ 6°C	1 year to extraction, 1 year to analysis
Total petroleum hydrocarbons (diesel and oil ranges)	NWTPH-Dx	2 x 1-liter amber glass	Cool, ≤ 6°C, HCl to pH<2	7 days to extraction, 40 days to analysis

Notes:

C = Celsius
HCl = hydrochloric acid
HNO3 = nitric acid
pH = hydrogen (ion) concentration

3.8.2 Chain-of-Custody Procedures

Procedures must be taken to preserve and ensure the integrity of samples from the time of collection through analysis. Records of the custody of samples must be maintained both in the field and in the laboratory. A sample is considered to be in someone's custody if it is in his or her physical possession or view, locked up, or kept in a secured and restricted area. Until the samples are shipped, their custody will be the responsibility of the sampling team leader.

Chain-of-custody records document sample collection and shipment to the laboratory. A chain-of-custody form will be completed in duplicate, as a minimum, for each sampling day. The original chain-of-custody form will be delivered with the sample shipping cooler, and the copy will be retained in the field documentation files. The chain-of-custody form will identify the contents of each shipment and maintain the custodial integrity of the samples. All chain-of-custody forms will be signed and dated by the responsible sampling team personnel. The "relinquished by" box will be signed by the responsible sampling team personnel, and the date, time, and air bill number (if applicable) will be noted on the chain-of-custody form.

The following information must be documented on the chain-of-custody form as a minimum:

- Project name, project number, and project manager's name and contact information
- Unique sample identification (no dashes, spaces, or commas)
- Date and time of sample collection
- Matrix
- Number of sample containers
- Analyses required
- Designation of matrix spike/matrix spike duplicate (MS/MSD) samples
- Preservative used
- Name and signature of sampler, receiver
- Bill of lading or transporter tracking number (if applicable)
- Requested turnaround time

Custody seals will be placed across the front and sides of each sample cooler lid to maintain its integrity until it is opened by the laboratory. The shipping coolers containing the samples will be sealed with a custody seal any time they are not in someone's possession or view before shipping. All custody seals will be signed and dated by the responsible sampling team personnel.

When transferring the samples, the individuals relinquishing and receiving the samples will sign, date, and note the time on the chain-of-custody form. If the samples are required to be shipped, the primary or QA laboratory coordinators will be notified of when and how samples were sent. Notification will include the following information:

- Date of shipment
- Name of shipping company
- Air bill number
- Number of coolers
- Name, phone number, and facsimile number of point of contact
- Estimated date of shipment arrival
- Type of samples (water, sediment)

On receipt of each sample cooler and after verification of the chain-of-custody records, the primary or QA laboratory will provide a cooler receipt form documenting any discrepancies such as, but not limited to, the following:

- Inappropriate sample containers or preservation
- Broken sample containers
- Cooler temperature outside range of 0°C to 6°C (where applicable)
- Missing chain-of-custody form or QA sample form
- Errors on chain-of-custody or QA sample form
- Missing custody seals

The laboratory will notify Jacobs of any such discrepancies immediately of its receipt of the samples.

The chain-of-custody forms then become part of the permanent record of the project file and serve as a future reference for sample documentation.

Custody must be maintained at the laboratory once samples are received until all tests are completed. This will be accomplished using an internal custody system that requires samples to be kept in a secured and restricted area when not in use, and to be checked out and checked back in by the analysts who use them. Internal custody records must be maintained by the laboratory as part of the documentation file for each sample.

3.8.3 Sample Transport Requirements

Sample transport requirements are described below.

- **Sediment Samples.** Sediment (grab samples and core samples will be shipped to Pace Analytical, Test America, or other Washington State accredited laboratory for analysis). To minimize the potential for sample degradation and to maintain a temperature at or below 4°C, sediment samples will be chilled in a cooler with an ice substitute (for example, blue ice) or ice in resealable plastic bags. The chain-of-custody form, and a QA sample form, if required, will be filled out in indelible ink, placed in a resealable plastic bag, and taped to the inside lid of the shipping cooler. It is anticipated that most project samples will be environmental samples in small volumes. Environmental samples are samples with contaminant concentrations significantly reduced by normal environmental weathering processes such as volatilization to the air, degradation caused by exposure to sunlight and microbes, or simple mixing with soil or groundwater. As such, the samples present little shipping hazard in terms of corrosiveness, flammability, and explosiveness.
- **Aqueous Samples (for investigation derived waste characterization).** Aqueous samples will be shipped to Pace Analytical, Test America, or other Washington State accredited laboratory for analysis. To minimize the potential for sample degradation and to maintain a temperature at or below 4°C, sediment samples will be chilled in a cooler with an ice substitute (for example, blue ice) or ice in a resealable plastic bag. The chain-of-custody form and a QA sample form, if required, will be filled out in indelible ink, placed in a resealable plastic bag, and taped to the inside lid of the shipping cooler. It is anticipated that most project samples will be environmental samples in small volumes. Environmental samples are samples with contaminant concentrations significantly reduced by normal environmental weathering processes such as volatilization to the air, degradation caused by exposure to sunlight and microbes, or simple mixing with soil or groundwater. As such, the samples present little shipping hazard in terms of corrosiveness, flammability, and explosiveness.

The following procedures will be implemented in packing environmental samples:

- Check the sample container caps to make sure they are tightened properly. (Samples for volatile components must be discarded and recollected if the cap is loose.)
- Tape over the drain hole on the inside of the cooler.
- Place a layer of cushioning material in the bottom of the cooler.
- Line the cooler with a large plastic bag (heavy duty garbage bag or bag provided by the laboratory).
- Enclose each bottle in separate packing material so that they will not touch against each other and place inside a clear, plastic bag. Multiple bottles from the same location may be included in one bag as long as it can be properly sealed.
- Place the bottles upright in the cooler during shipment. Place additional cushioning material around sample bottles, and fill voids between bottles.

- Transfer ice into plastic bags that can be sealed, and double wrap (ie. place inside of another sealable plastic bag). Place ice between samples and over the containers to preserve them at or below 4°C. (Note: Loose bagged ice is not acceptable if coolers are transported by commercial aircraft.)
- Add a temperature blank to the inside of the large plastic bag.
- Ensure the plastic bag is closed using a zip tie or other method.
- Fill the cooler with cushioning material.
- Tape the cooler drain shut from the outside of the cooler.
- Place completed chain-of-custody form inside a resealable bag and tape the bag to the inside lid of the cooler.
- Close and latch the cooler. Wrap a strong adhesive tape around the ends of the cooler to secure it, making sure to cover the spigots at the bottom and any open space between the lid and the cooler. Tape the cooler latch closed with strapping tape.
- Seal the cooler with custody seals on the front and the sides and seal the cooler with strapping tape. The signature on the custody seals should match the signature on the chain-of-custody form.
- Attach the completed shipping label to the top of the cooler; print "Laboratory Samples" and "This End Up" on the top of the cooler; and put upward-pointing arrows on all four sides. Place "Fragile" and "Chill, Do Not Freeze" labels on at least one side.

Samples will be packaged for shipment according to DOT regulations. Marking and labeling procedures will be consistent with DOT regulations. The method of shipment, courier name(s), and other pertinent information will be entered on the chain-of-custody form. Air bills will be properly completed, and copies will be retained and placed in the project file.

For environmental samples, no DOT marking, labeling, or shipping papers are required, and there are no DOT restrictions on the mode of transportation. DOT regulations do not apply to transport by government-owned vehicles, including aircraft.

While not anticipated, if hazardous samples are encountered, the following procedures will be implemented:

- Place the sample container inside a 1-quart or 1-gallon paint can. Fill the void space with vermiculite. Place the paint can in a cooler and pack as described above.
- Complete a carrier-approved air bill or shipper's certification for restricted articles, providing the following information in the order listed:
  - "Flammable Liquid, No. UN 1993" or "Flammable Solid, No. UN 1325"
  - "Limited Quantity" (or "Ltd. Qty.")
  - Net weight or net volume of total sample material in cooler
  - "Laboratory Samples"
  - "Cargo Aircraft Only"

4. Laboratory Analytical Methods and Test Conditions

Sediment samples will be sent to Pace Analytical or TestAmerica for chemistry analysis, and to EcoAnalysts, Inc. for bioassay analysis. Tables 4-1 lists the laboratory analytical methods, quality objectives, and method detection limits for chemical characterization analyses. Table 4-2 lists the freshwater sediment toxicity test conditions for *Hyalelle azteca* and *Chironomus dilutes.* Sampling results will be uploaded into Ecology's Environmental Information Management System database (EIM).

Table 4-1. Laboratory Methods and Target Detection Limits- Sediment

Analyte	Preparation Method	Analytical Method	Method Detection Limit
General Chemistry Compounds (mg/kg)			
Ammonia	Per the analytical method	Plumb 1981	7
Total Sulfides	Per the analytical method	Plumb 1981	7.63
Total organic carbon	Per the analytical method	SW9060A	3.33
Semi-volatile Organic Compounds and Polycyclic Aromatic Hydrocarbons (µg/kg)			
3&4-Methylphenol	SW3550B	SW8270E	1.04
Benzoic acid	SW3550B	SW8270E	118
Bis(2-ethylhexyl) phthalate	SW3550B	SW8270E	42.2
Carbazole	SW3550B	SW8270E	10.3
Dibenzofuran	SW3550B	SW8270E	10.9
Di-n-butyl phthalate	SW3550B	SW8270E	11.4
Di-n-octyl phthalate	SW3550B	SW8270E	22.5
Pentachlorophenol	SW3550B	SW8270E	8.96
Phenol	SW3550B	SW8270E	13.4
1-Methylnaphthalene	SW3550B	SW8270E	4.26
2-Methylnaphthalene	SW3550B	SW8270E	4.32
Acenaphthene	SW3550B	SW8270E	5.39
Acenaphthylene	SW3550B	SW8270E	4.69
Anthracene	SW3550B	SW8270E	5.93
Benz(a)anthracene	SW3550B	SW8270E	5.87
Benzo(a)pyrene	SW3550B	SW8270E	6.19
Benzo(ghi)perylene	SW3550B	SW8270E	6.09
Chrysene	SW3550B	SW8270E	1.3
Dibenz(ah)anthracene	SW3550B	SW8270E	1.2
Fluoranthene	SW3550B	SW8270E	1.2
Fluorene	SW3550B	SW8270E	0.50
Indeno(123-cd)pyrene	SW3550B	SW8270E	1.2

Table 4-1. Laboratory Methods and Target Detection Limits- Sediment

Analyte	Preparation Method	Analytical Method	Method Detection Limit
Naphthalene	SW3550B	SW8270E	0.50
Phenanthrene	SW3550B	SW8270E	0.58
Pyrene	SW3550B	SW8270E	1.3
Benzo(b)fluoranthene	SW3550B	SW8270E	6.21
Benzo(k)fluoranthene	SW3550B	SW8270E	5.92
Metals (mg/kg)			
Arsenic	SW3050B	SW6020B	0.518
Cadmium	SW3050B	SW6020B	0.0471
Chromium	SW3050B	SW6020B	0.133
Copper	SW3050B	SW6020B	0.4
Lead	SW3050B	SW6020B	0.208
Mercury	SW7471B	SW7471B	0.018
Nickel	SW3050B	SW6020B	0.132
Selenium	SW3050B	SW6020B	0.764
Silver	SW3050B	SW6020B	0.127
Zinc	SW3050B	SW6020B	0.832
PCB Congeners and Dioxins/Furans (ng/kg)			
Polychlorinated biphenyls congeners	HRMS_Soxhlet	EPA1668C	varies 2.0 - 117
Dioxin/Furan	HRMS_Soxhlet	EPA1613B	varies 0.2 – 2.0
Bulk Petroleum Hydrocarbons (mg/kg) (speciation may be required for some samples)			
TPH-Dx (Diesel)	SW3630C, SW3546	NW-TPH-Dx	2
TPH-Dx (Residual)	SW3630C, SW3546	NW-TPH-Dx	5
Grain size (particle size including hydrometer)	N/A	ASTM D422	N/A

Notes:
NWTPH-Dx Analysis to be run with and without silica gel cleanup as a sample preparation method
Practical quantitation limits will meet SCUM Chapter 11, Table 11.1 requirements for bioaccumulative chemicals.

LIF = laser-induced fluorescence
mg/kg = milligram(s) per kilogram
mg/L = milligram(s) per liter
N/A = not applicable
M = Mortality
mg = milligram(s)
NAPL = nonaqueous phase liquid
PAH = polycyclic aromatic hydrocarbon
TPH = total petroleum hydrocarbon
MIG = Mean Individual Growth at time final
pH = hydrogen (ion) concentration
R = Reference

Table 4-2. Bioassay Test Conditions: *Hyalella azteca and Chironomus dilutus*

Biological Test Endpoint	Performance Standard		Control Samples		Control Limits		Water Quality Monitoring Frequency	
	Control[a]	Reference	Negative	Positive	Temp[b] °C	DO[c]	Temp/DO	Hardness, Alkalinity, Conductivity, Sulfides, Ammonia
Hyalella azteca								
10-day mortality	MC < 20%	MR < 25%	Clean sediment	Reference toxicant in freshwater	23 ± 1	40–100	Daily	pH = Daily Others at start/end of test
28-day mortality	MC < 20%	MR < 30%						
28-day growth	MIG_C > 0.15 mg/ individual	MIG_R > 0.15 mg/ individual						
Chironomus dilutus								
10-Day mortality	MC < 30%	MR < 30%	Clean sediment	Reference toxicant in freshwater	23 ± 1	40–100	Daily	pH = Daily Others at start/end of test
10-Day growth	MIG_C > 0.48 mg/ individual	RF / CF > 0.8						
20-Day mortality	MC < 32%	MR < 35%						
20-Day growth	MIG_C ≥ 0.60 mg/ individual[c]	MIG_R/ MIG_C ≥ 0.8						

[a] These tests and parameters were developed based on the most updated American Society for Testing and Materials (ASTM International) protocols.

[b] Water bath or exposure chamber temperature should be continuously monitored. The daily mean temperature should be within ±1°C of the desired temperature. The instantaneous temperature should be within ±3°C of the desire temperature.

[c] Percent saturation

Notes:

C = Control
DO = dissolved oxygen
F = Final
M = Mortality
mg = milligram(s)
MIG = Mean Individual Growth at time final
pH = hydrogen (ion) concentration
R = Reference

5. Quality Assurance Project Plan

This section describes for the QA/QC requirements for data quality objectives, field quality control samples, data validation, and corrective actions.

5.1 Data Quality Objectives

Data quality objectives are used to describe data requirements necessary to meet the project objectives (Ecology 2019). Typical data quality objectives, described below, include precision, accuracy, representativeness, completeness, and comparability:

Precision. Precision is the measure of agreement among repeated measurements. It is evaluated using the relative percent difference (RPD) between the duplicate sample results. Precision is calculated with the following formula:

$$RPD = [(ABS(R1-R2))/((R1+R2)/2)] \times 100$$

Where:

ABS = Absolute difference between values (meaning no negative values)
R1 = measured concentration for matrix spike or duplicate #1
R2 = measured concentration for matrix spike duplicate or duplicate #2

Bias and Accuracy. Bias is the systematic or persistent distortion of a measurement process that causes error in one direction, while accuracy is the measure of the overall agreement of a measurement to a known value. Accuracy is evaluated using the percent recovery, using the following equation:

$$\text{Percent Recovery} = ((SSR-SR) / SA) \times 100$$

Where:

SSR = spiked sample result
SR = sample result
SA = spike added

Representativeness. Representativeness is the degree to which data accurately and precisely represents a particular characteristic of the environmental matrix being tested. It is ensured by adhering to standard field sampling protocols and evaluating whether measurements are made in such a manner that the resulting data appropriately reflects the environment or condition being measured.

Completeness. Completeness is the percentage of valid results compared to the total number of samples for each parameter. Completeness is calculated using the following equation:

$$\text{Percent Completeness} = ((\text{Number of valid results}) / (\text{Number of samples taken})) \times 100$$

Comparability. Comparability is a measurement that expresses the measure of confidence that one data set can be compared to another, by using the same matrix, sampling location, techniques, and analytical methodologies.

5.2 Quality Control

QC samples will be collected to monitor accuracy, precision, and the presence of field contamination for definitive analytical methods to be performed by the contracted primary laboratory. Field QC samples are not required for biological analyses.

5.2.1 Field Duplicate Samples

A field duplicate is an independent sample collected as close as possible to the original sample from the same source under identical conditions. Field duplicates are used to document sampling and analytical precision. They are collected at a minimum frequency of 1 per 10 samples (10 percent) for each matrix and for each type of analysis. The sampling locations of the field duplicate sample will be recorded in the field logbook. All field QC samples will be sent blind to the laboratory along with regular field samples. They will be labeled similar to regular field samples for disguise.

5.2.2 Matrix Spike/Matrix Spike Duplicate

The MS/MSD is a duplicate pair of samples collected along with an investigatory sample, to which the laboratory adds a spike containing target analytes specified for each method at known concentrations. The purpose is to assess the effect of the sample matrix on the extraction and analysis method.

For every 20 field samples of each matrix collected from each site, one location will have sample volume collected in triplicate for each analysis required and designated on the chain-of-custody form as an MS/MSD. MS/MSD samples may involve obtaining an independent pair of samples collected as close as possible to the original (parent) sample from the same source under identical conditions or prepared by the laboratory as part of their QA program and subsampled from an investigatory sample. The sampling locations for the MS/MSD will be documented in the field logbook.

5.2.3 Equipment Blanks

Equipment rinsate blanks may be collected to evaluate field sampling and decontamination procedures by pouring deionized water over the decontaminated equipment and capturing that water in laboratory-supplied containers. If required, equipment blanks will be collected for each matrix sampled and will be collected at a rate of 1 in 20 for each field crew. The equipment blanks will be analyzed for the same parameters specified for the corresponding matrix. Equipment blanks are not required where disposable or dedicated sampling equipment is used.

5.3 Data Validation

5.3.1 Laboratory Data Review

The integrity and validity of all analytical results requires the implementation of an internal QA program. The program will meet the requirements set forth in the SCUM II guidance.

Analyses not meeting test validation criteria will be described in the case narrative. If the laboratory does not expect to be able to meet any of the limits, the sampling contractor project manager will be notified in writing (email or fax) as soon as any failure is noted by the laboratory. Any variances must be approved by appropriate laboratory personnel and the sample contractor project manager before the laboratory proceeds with sample analysis.

5.3.2 Data Validation Data Review

The analytical results of the data collection effort will be validated. Data will be validated using the QC limits established by the laboratory, method-specific criteria, and the latest versions of the U.S. Environmental Protection Agency *National Functional Guidelines for Inorganic and Organic Superfunds Methods Data Review* as guidance. SCUM II data validation requirements as discussed in Chapter 5 of that document will also be met.

Data collected during the project will be subjected to a level III data validation that will include the following items:

- Review of the data set narrative to identify any issues that the lab reported in the data deliverable
- Check of sample integrity (sample collection, preservation, and holding times)
- Evaluation of basic QC measurements used to assess the accuracy, precision and representativeness of data including QC blanks, laboratory control samples, MS/MSD, surrogate recovery when applicable, and field or laboratory duplicate results
- Review of sample results, target compound lists, and detection limits to verify that project analytical requirements are met
- Initiation of corrective actions, as necessary, based on the data review findings
- Qualification of the data using appropriate qualifier flags, as necessary, to reflect data usability limitations
- Evaluation of calibration and internal standard summary results against the project requirements.
- Other method-specific QC requirements

In addition to the data review conducted by the laboratory, this data validation process will involve a detailed review of the raw analytical data, if deemed necessary, to include the following:

- Review of sample chromatograms
- Verification of analyte identification and calculations for at least 10 percent of the data

The results of this data validation process will describe whether the reported data are considered to be from valid, representative samples, and therefore acceptable for the data endpoints for which they were intended as set forth in the project SAP. Data QA/QC and validation summaries for each sample delivery group will be included in a technical appendix to the final report.

5.4 Corrective Actions

Laboratory results that do not meet specified method criteria or the laboratory's internal QC requirements will be reanalyzed by the laboratory unless directed otherwise by the project manager.

The laboratory will review the data generated to verify that samples have been run as specified in the procedure. Laboratory personnel are alerted that corrective actions may be necessary under the following conditions:

- QC data are outside the warning or acceptable windows for precision and accuracy established for laboratory samples.
- Test validation criteria are not met as identified in the respective procedure.
- Deficiencies are detected by the laboratory QA director during internal or external audits, or from the results of performance evaluation samples.
- Reporting limits for non-detects are greater than the freshwater SMS criteria.

Corrective actions are implemented immediately when non-conformances in QC or sample results are identified. If the problem persists, cannot be identified, or cannot be remedied, the project manager must be notified about the nonconformance. All laboratory QC problems that will impact the final data must be documented. Once resolved, full documentation of the corrective action will be filed for inclusion in the project file, if data are affected. A copy of the corrective action report must be included in the laboratory data package deliverable.

Corrective actions may include the following actions:

- Reanalyzing the samples, if holding time criteria permit
- Resampling and reanalysis
- Evaluating and amending sampling and analytical procedures
- Accepting data and acknowledging level of uncertainty or inaccuracy by flagging the data and providing an explanation for their qualification

6. Data Analysis, Record Keeping, and Reporting

Chemical concentrations in the analytical results of this sediment evaluation will be compared to the numeric SMS criteria for freshwater sediment developed by Ecology (Ecology 2019), Human Health screening values, and site-specific natural background values.

An RI report will be prepared following the completion of sediment sampling and will describe sampling results. The report will describe sample locations and depths, sampling handling and analytical methods, QA/QC, data results, and copies of field logs and laboratory data packages. In addition, valid data will be compiled and uploaded into the Ecology Environmental Information Management (EIM) System.

The Sediment RI Report will also present an updated characterization stage CSM, updated COPCs and proposed CULs, potential sediment cleanup unit boundaries sediment management, and an outline for the approach for satisfying remaining reporting requirements for completing an RI/FS for the sediment in accordance with Chapters 3 and 6 of the SCUM II (WAC 173-204-510 and 173-204-520).

7. Health and Safety Plan

Sediment sampling activities will be conducted according to Jacobs's Health, Safety, and Environment program requirements, which include project-specific field safety instructions (FSI). In accordance with Jacobs' policy, all Jacobs field team members and subcontractors must successfully satisfy all Jacobs and site-specific health and safety requirements before working on the site, including Drug-Free Workplace training, wearing required personal protective equipment, and other requirements of the FSI. Employees working over or near water will be provided with U.S. Coast Guard-approved life jacket or buoyant work vests. Staff working on shore at the Railyard will have credentials from railroad and BNSF specific training.

The site-specific Health and Safety Plan is included in Appendix B of the RI Work Plan.

8. References

CH2M HILL Engineers, Inc. (CH2M). 2018. *Initial Nearshore Sediment Investigation Work Plan, BNSF Wishram Track Switching Facility, Wishram, Washington.*

CH2M HILL Engineers, Inc. (CH2M). 2019. *Inundated Lands Initial Nearshore Sediment Investigation Report, BNSF Wishram Track Switching Facility, Wishram, Washington.*

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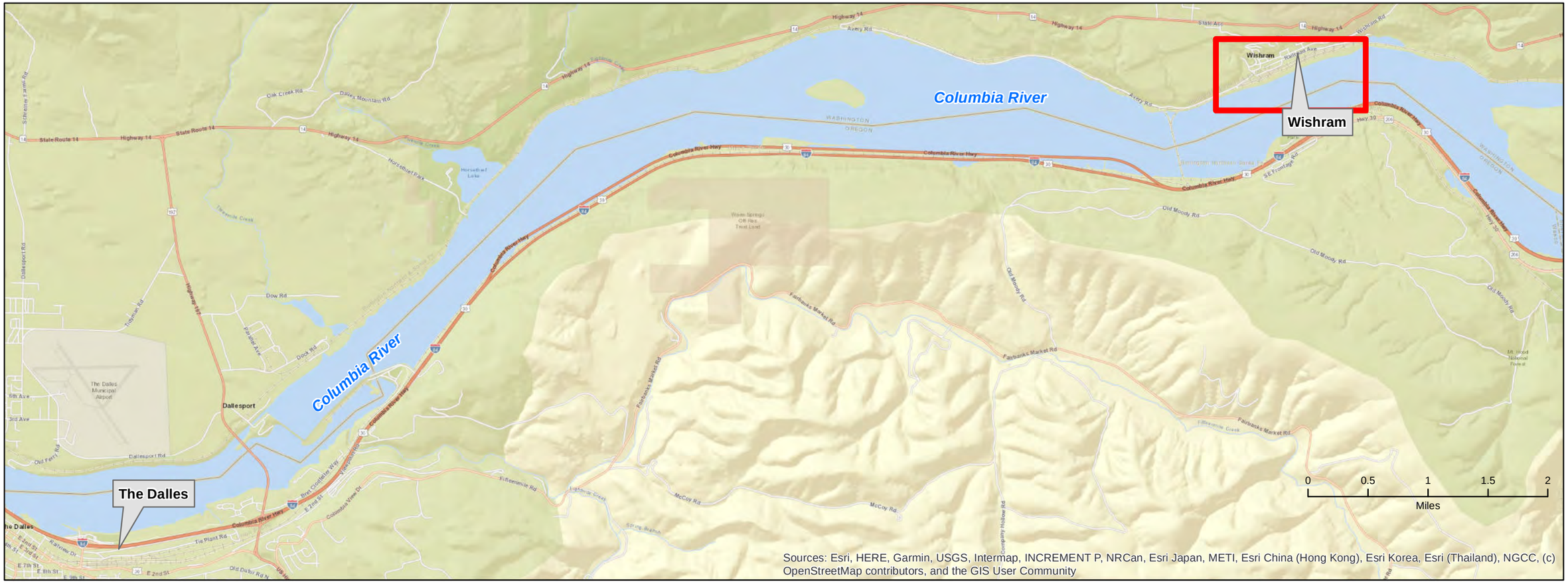
Kennedy/Jenks Consultants (KJ). 2020. *Uplands Remedial Investigation Report BNSF Wishram Railyard.* Prepared for BNSF Railway Company. October.

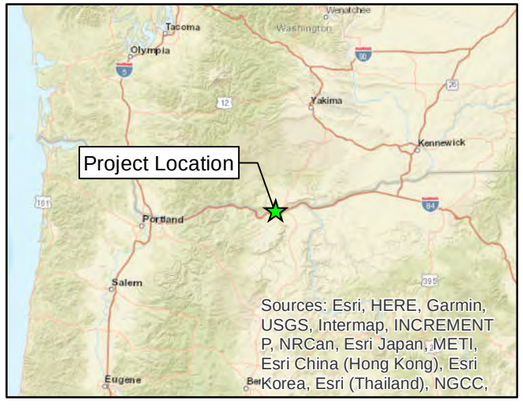
Washington State Department of Ecology (Ecology). 2017. Letter regarding *Data Gaps Investigation, BNSF Track Switching Facility aka Wishram Railyard*. March 3.

Washington State Department of Ecology (Ecology). 2019. *Sediment Cleanup User's Manual II: Guidance for Implementing the Cleanup Provisions of the Sediment Management Standards, Chapter 173-204 WAC.* Publication No. 12-09-057. March.

Figures



Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community



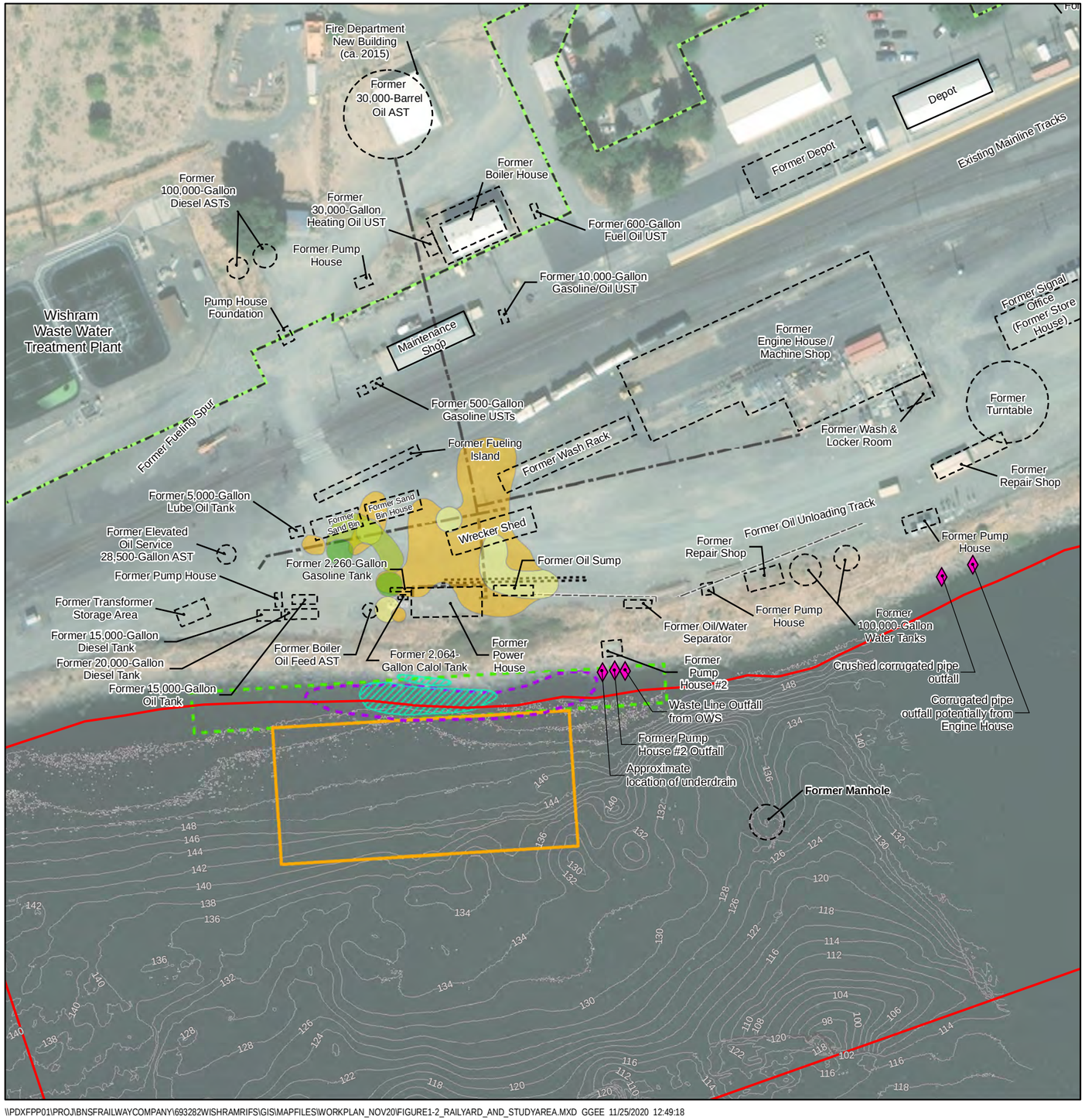
N

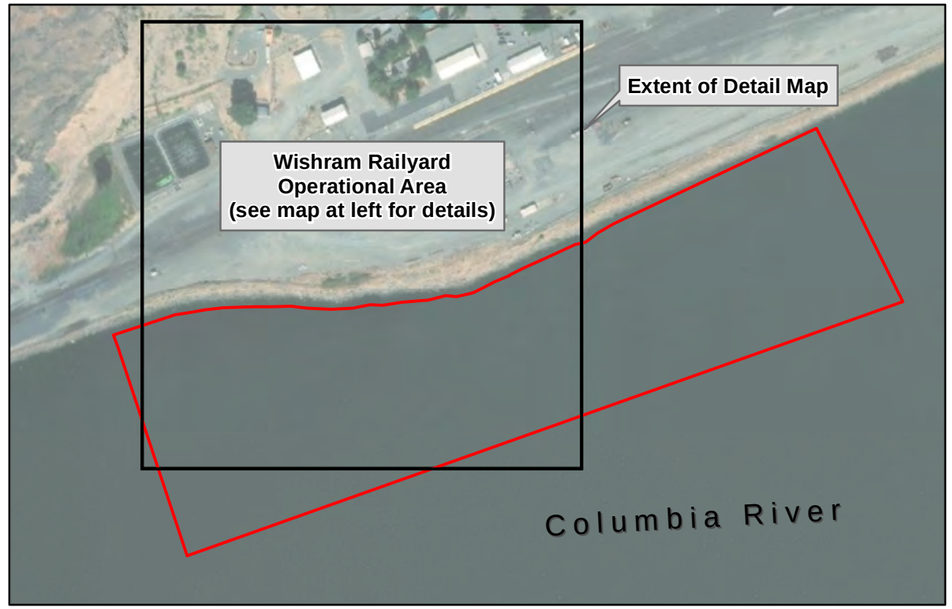
0 375 750 1,500
Feet

\\PDXFPP01\PROJ\BNSFRAILWAYCOMPANY\693282WISHRAMRIFS\GIS\MAPFILES\2021_REVISED_DRAFTRIWORKPLAN\FIGURE1-1_SITEMAP.MXD GGEE 7/22/2021 09:37:59

Figure 1-1. Site Location Map
BNSF Track Switching Facility
Wishram, Washington

Jacobs





LEGEND

- Proposed RI Area
- WA Ecology Initial Investigation Area
- 2018 Initial Investigation Area
- Approximate BNSF Property Line
- Existing Site Feature
- Former Site Feature
- Former Bunker Fuel / Oil Pipeline
- Former Oil Drain
- Former Oil Trough
- Former Sewer Line (Potential)
- Stormwater Underdrain (A portion removed from service circa 1960)
- Stormwater Underdrain (Rerouted portion circa 1960)
- Former Outfall Location
- Area of Intermittent NAPL Sheening
- Small-extent NAPL Sheens Observed (Ecology, 2017)
- Bathymetric Contour (ft NAVD88, 2 ft Contour Interval)

Upland Area[1]

- Inferred Lateral Extent of Smear Zone Diesel Impacts
- Inferred Lateral Extent of Submerged Diesel Impacts
- Inferred Lateral Extent of Smear Zone Oil Impacts
- Inferred Lateral Extent of Submerged Oil Impacts

0 200 400 800
Feet

N

0 62.5 125 250
Feet

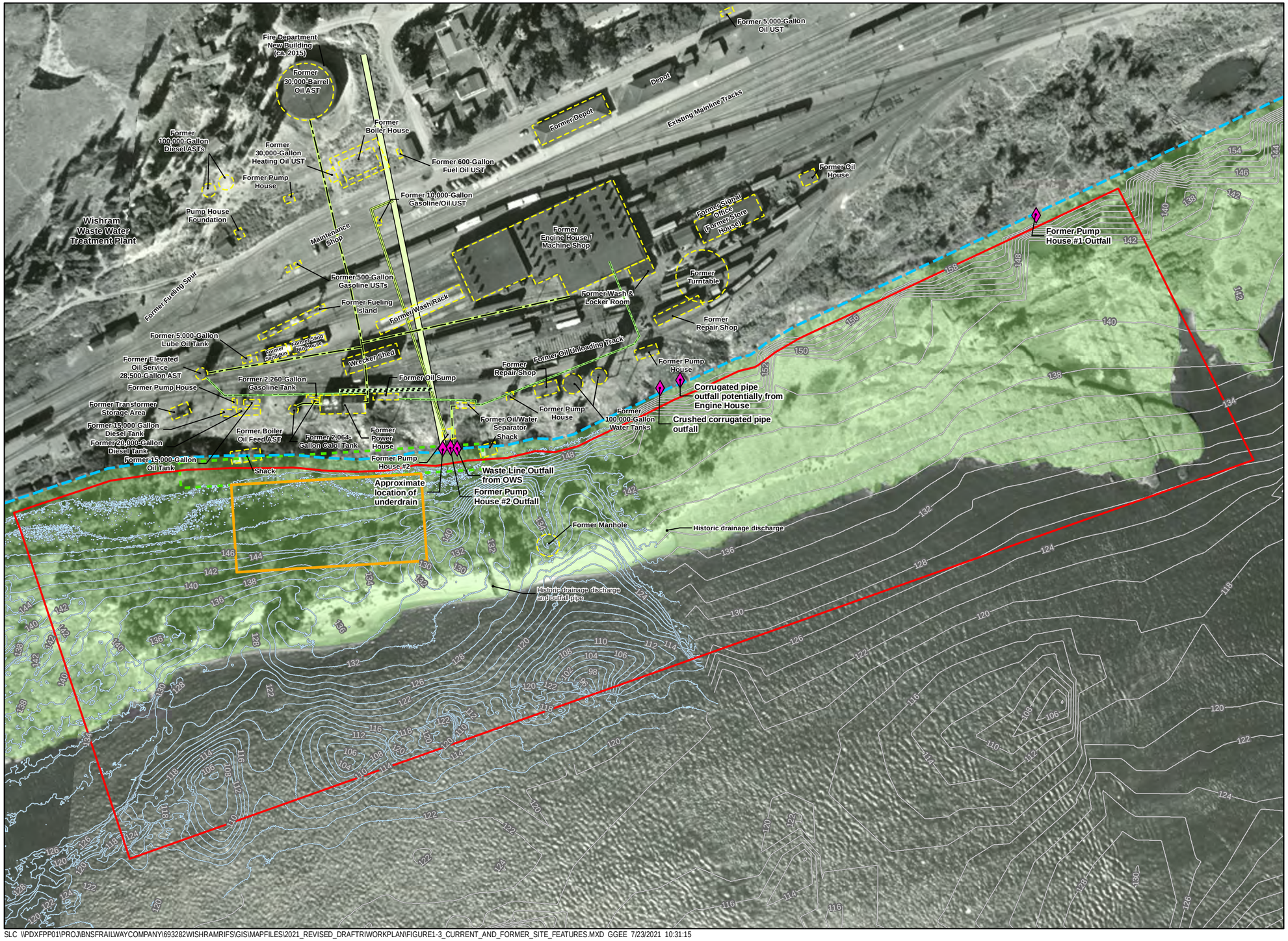
N

Notes:
[1]Inferred lateral extent of Diesel- or Oil-Like LNAPL based on interpretation of LIF waveforms (July 2013) and soil boring logs (KJ, 2019).
ft = feet
NAPL = nonaqueous phase liquid
NAVD88 = North American Vertical Datum 1988

Figure 1-2. Wishram Railyard and Study Area
BNSF Track Switching Facility
Wishram, Washington

Jacobs

\\PDXFPP01\PROJ\BNSFRAILWAYCOMPANY\693282WISHRAMRIFS\GIS\MAPFILES\WORKPLAN_NOV20\FIGURE1-2_RAILYARD_AND_STUDYAREA.MXD GGEE 11/25/2020 12:49:18



LEGEND

- Former Site Feature
- Former Bunker Fuel / Oil Pipeline
- Former Oil Drain
- Former Oil Trough
- Former Sewer Line (Potential)
- Stormwater Underdrain (A portion removed from service circa 1960)
- Stormwater Underdrain (Rerouted portion circa 1960)
- Former Outfall Location
- Proposed RI Area
- WA Ecology Initial Investigation Area
- 2018 Initial Investigation Area
- Current Shoreline
- Bathymetric Contour (ft NAVD88, 2 ft Contour Interval, [US Army Corps of Engineers, 2008])
- Bathymetric Contour (ft NAVD88, 2 ft Contour Interval, [2017])
- Inundated Lands

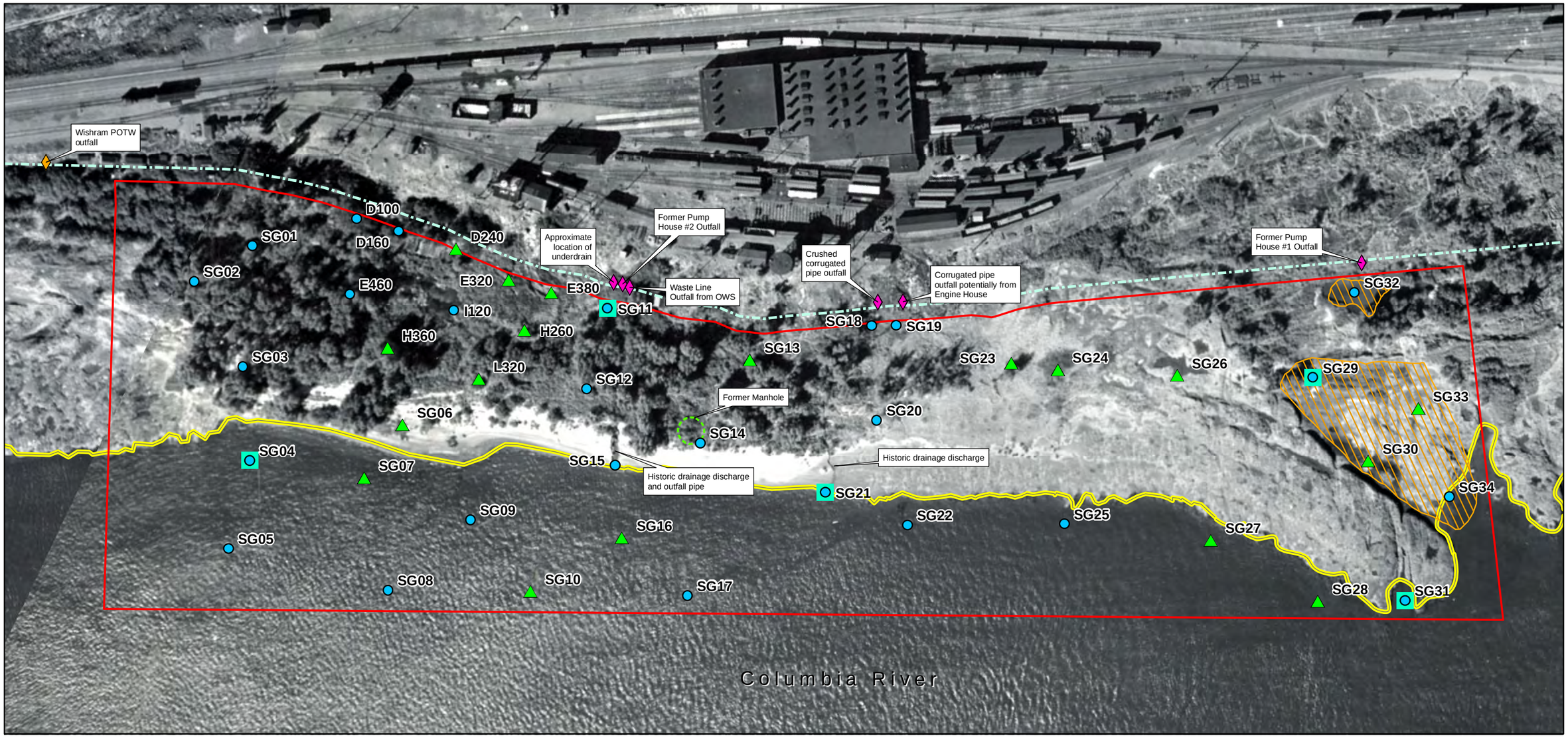
N

0 75 150 300
Feet

Figure 1-3. Former Site Features
BNSF Track Switching Facility
Wishram, Washington

Jacobs

SLC \\PDXFPP01\PROJ\BNSFRAILWAYCOMPANY\693282WISHRAMRIFS\GIS\MAPFILES\2021_REVISED_DRAFTRIWORKPLAN\FIGURE1-3_CURRENT_AND_FORMER_SITE_FEATURES.MXD GGEE 7/23/2021 10:31:15



LEGEND

- Primary Surface Sample Location
- Secondary Surface Sample Location
- Sample Location for SPI Camera Survey
- Current Outfall Location
- Former Outfall Location
- Proposed RI Area
- Potential Sediment
- Current Shoreline
- Historic Shoreline

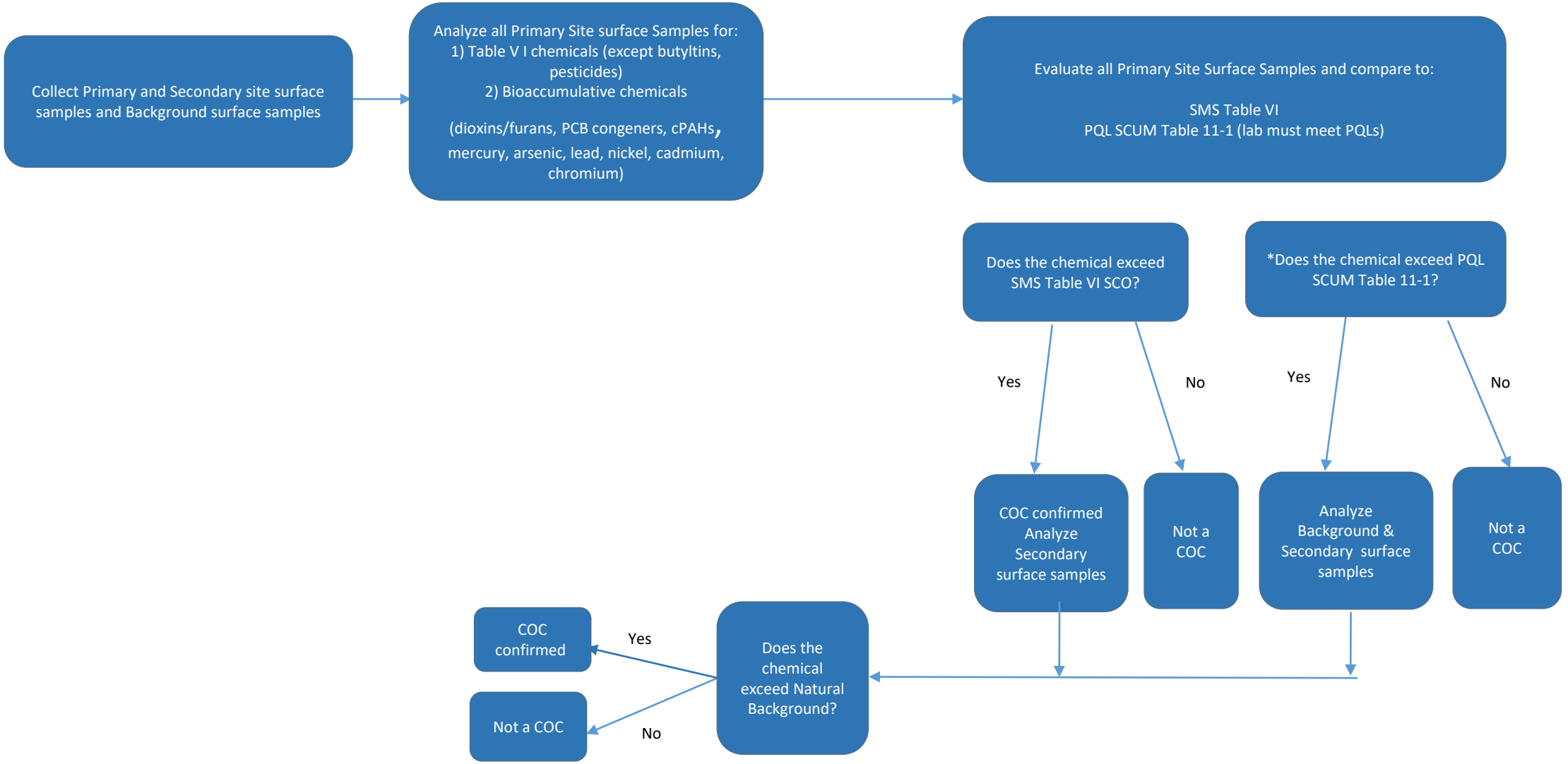
Notes:
Base map is 1951 aerial photo.
OWS = oil/water separator
POTW = publicly owned treatment works

0 100 200 400
Feet

Figure **3-1**. Proposed Sediment Characterization Locations shown with 1951 Aerial Photo
BNSF Track Switching Facility
Wishram, Washington

\\PDXFPP01\PROJ\BNSFRAILWAYCOMPANY\693282WISHRAMRIFS\GIS\MAPFILES\2021_REVISED_DRAFTRIWORKPLAN\FIGURE4-2A_LOCATIONS.MXD GGEE 7/22/2021 13:46:11

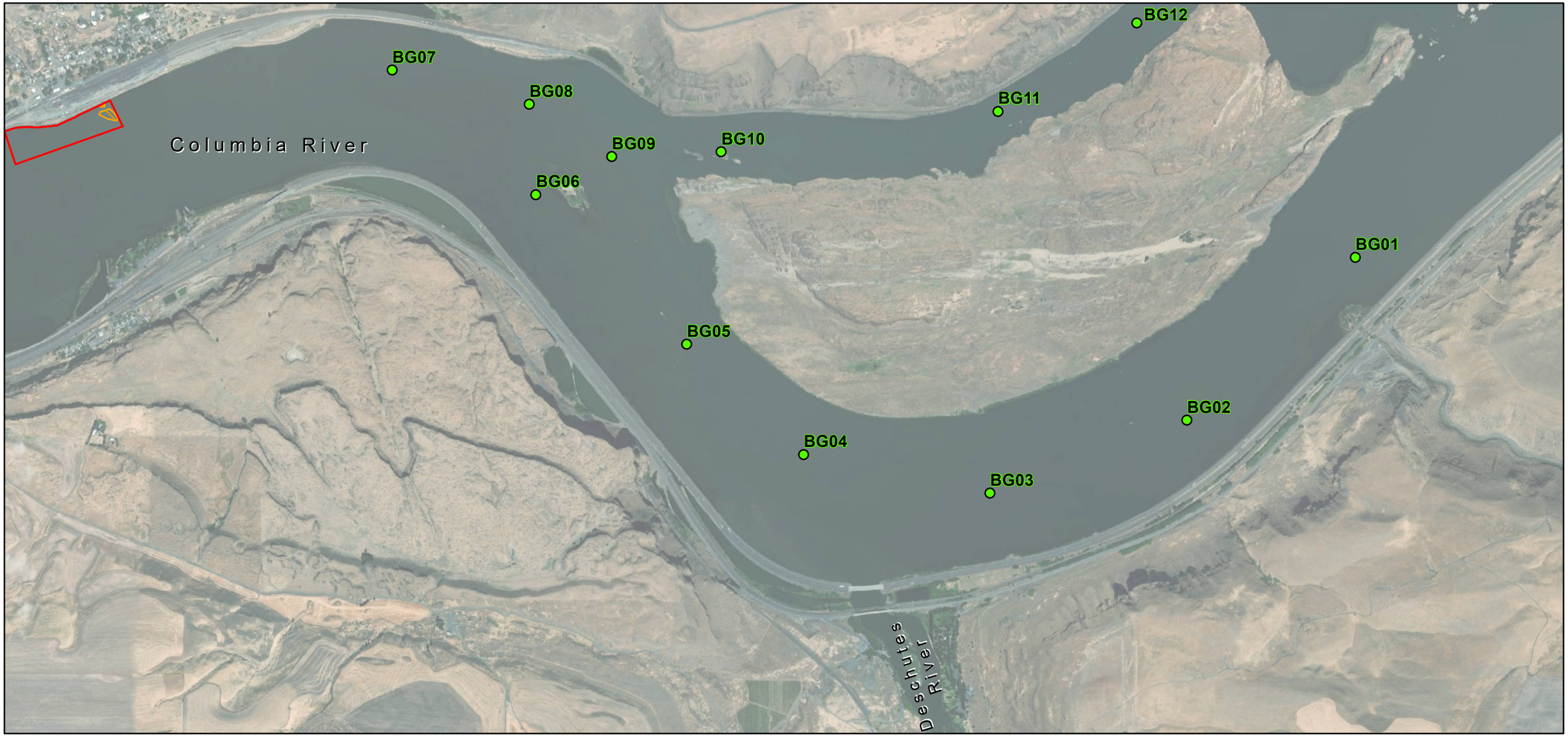
Jacobs



*Alternative: Analyze Natural Background and compare at this step

Figure 3-2. Process for Identifying COCs
BNSF Track Switching Facility
Wishram, Washington

Jacobs



LEGEND

- Proposed Background Sample Locations
- Proposed RI Area
- Potential Sediment

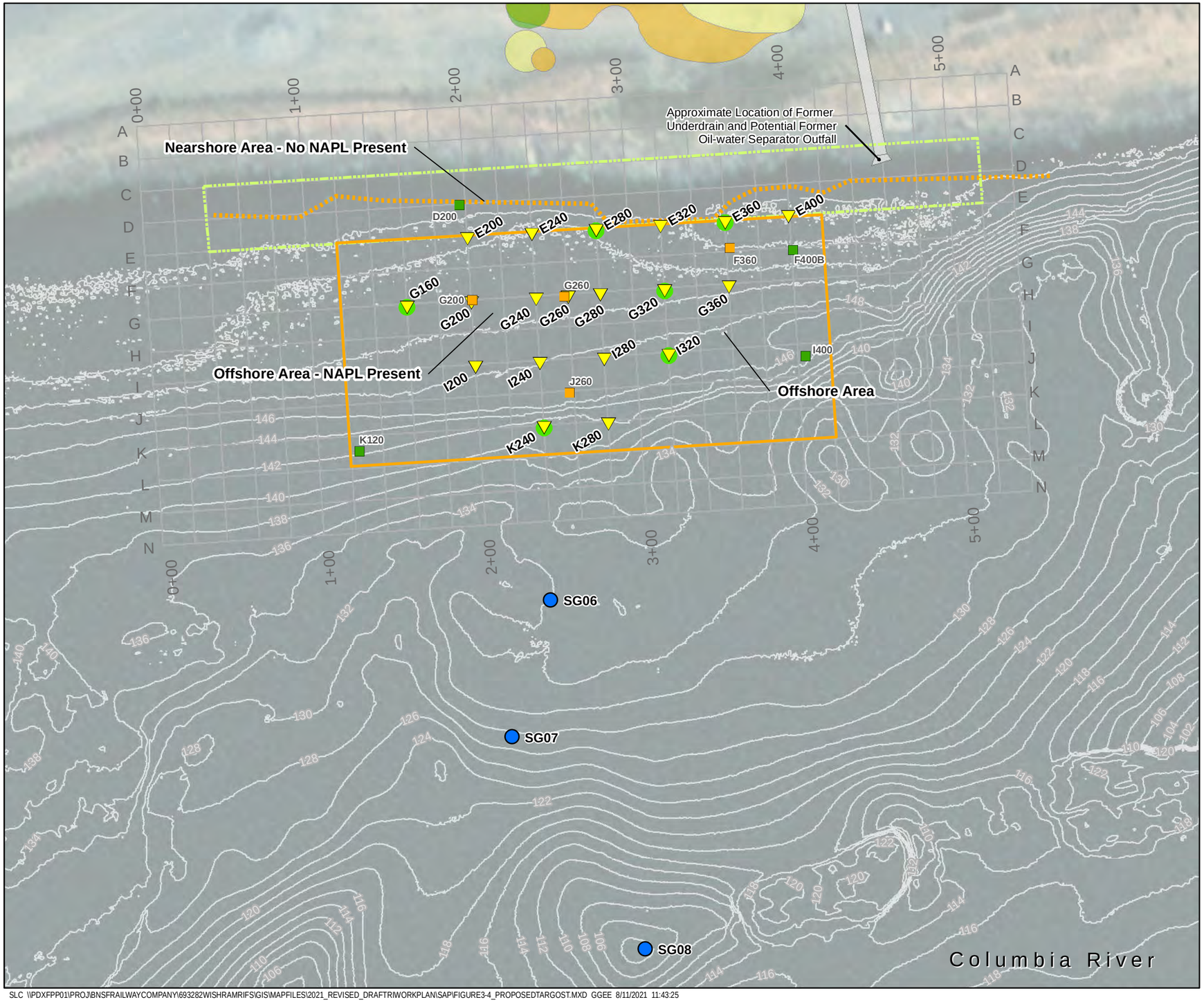
N

0 0.125 0.25 0.5
Miles

Figure 3-3. Proposed Background Sample Locations
BNSF Track Switching Facility
Wishram, Washington

\\PDXFPP01\PROJ\BNSFRAILWAYCOMPANY\693282WISHRAMRIFS\GIS\MAPFILES\2021_REVISED_DRAFTRIWORKPLAN\FIGURE4-4_PROPOSEDBACKGROUNDSAMPLELOCATIONS.MXD GGEE 10/21/2021 16:42:32

Jacobs



LEGEND

- Proposed Primary TarGOST Locations
- Potential Core Location Pending TarGOST Result
- Proposed Core Location Further Offshore of Known NAPL
- Core Location with NAPL Observed (2018)
- Core Location with no NAPL Observed (2018)
- Initial Study Area
- Expanded Study Area
- Sampling Grid (20 ft x 20 ft)
- Stormwater Underdrain (Portion Removed from Service Circa 1960)
- Toe of Exposed Riprap during 2018 Sampling Event
- Bathymetric Contour (ft NAVD88, 2 ft Contour Interval)

Uplands Area

- Inferred Lateral Extent of Smear Zone Diesel Impacts
- Inferred Lateral Extent of Submerged Diesel Impacts
- Inferred Lateral Extent of Smear Zone Oil Impacts
- Inferred Lateral Extent of Submerged Oil Impacts

Notes:
NAPL = nonaqueous phase liquid
µg/L = microgram(s) per liter
MTCA = Model Toxics Control Act
ft = feet
NAVD88 = North American Vertical Datum 1988

N
0 25 50 100
Feet
1:780
1 inch = 65 feet

SLC \\PDXFPP01\PROJ\BNSFRAILWAYCOMPANY\693282WISHRAMRIFS\GIS\MAPFILES\2021_REVISED_DRAFTRIWORKPLAN\SAP\FIGURE3-4_PROPOSEDTARGOST.MXD GGEE 8/11/2021 11:43:25

Figure 3-4. Proposed Primary TarGOST Locations and Surface Sediment Characterization Approach
BNSF Track Switching Facility
Wishram, Washington

Jacobs

Attachment A
Standard Operating Procedures for Surface Sediment Sampling

Surface Sediment Sampling

1.0 Purpose

The purpose of this Standard Operating Procedure (SOP) is to describe the collecting and handling of surface sediment samples using a sediment grab sampler. This SOP is applicable to collecting representative surficial sediment samples using a sediment grab sampler.

2.0 Equipment and Materials

The following materials are required to undertake this procedure:

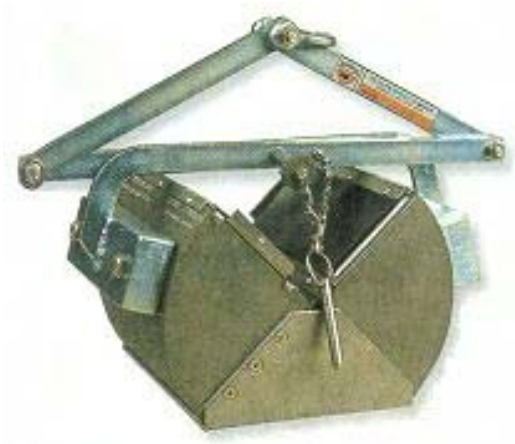
- Suitable work platform
- Sediment Sampler (e.g., van Veen, Petite Ponar, Wildco Hard Corer or Dormer Piston Sampler) and required lengths of rope
- Large plastic tub
- Stainless-steel pan
- Stainless-steel spatula
- Sample containers
- Cooler with ice
- Tape measure
- GPS unit

3.0 Procedures and Guidelines

3.1 Hand-Operated Dredge Samplers

Grab sediment samplers are best used from, but are not limited to, boats or piers in water bodies 3 feet (ft) or deeper. The dredge sampler is lowered using a rope and embedded 6 to 15 centimeters (cm) into the sediment, depending on sediment firmness.

Most samplers are activated once the tension has been removed from the rope or by a messenger trigger sent down the rope. This method is preferred when large amounts of surface sediment are required and sediment profiles are not important. It is very difficult not to disturb fine-grained materials of the sediment/water interface when using this method. The most common dredge sampling devices for sub-aqueous surficial sediments are the modified van Veen bottom grab, the Ekman grab, and the Ponar grab.

	**Ponar Dredge Sampler** For sampling hard bottoms such as sands, gravel and clays Widely used for quantitative samplings of benthic macro organisms in sand, gravel and clays. The self-tripping sampler features center hinged jaws and a spring-loaded pin that releases when the sampler makes impact with the bottom. Features include an underlip attachment that cleans gravel from the jaws that would normally prevent closing and removable side plates that prevent lateral loss of sample. The top is covered with a stainless steel screen with neoprene rubber flaps which allows water to flow through for a controlled descent and less interference with the sample. The standard Ponar is 230 mm x 230 mm and weighs 20 kg, and should be used with a winch and cable. Sample volume 8200 mL. Petite Ponar is 150 mm x 150 mm and weighs 11 kg. Sample volume 2400 mL.
	**Wilco Hand Corer** For sampling softer sediments A relatively undisturbed sample is captured within polyethylene liner. Sample is held in place with polyethylene core catchers which prevent sample loss. Samples can be retrieved from approximately 6.0 m with the use of extensions. Corer can take a 50 mm diameter sample which measures 500 mm long. The unit weighs 7 kg.
	**Ponar Dredge Sampler** For sampling softer sediments A relatively undisturbed sample is captured within the stainless steel casing. Sample is held in place with polyethylene core catchers and suction which prevent sample loss. Samples can be retrieved from approximately 9.0 m with the use of extensions. Corer can take a 50 mm diameter sample which measures 1 m long. The unit weighs 15 kg.

	**Ekman Bottom Grab Sampler** For sampling lakes, streams and rivers Designed for sampling in soft, finely divided bottoms that are free from vegetation and other coarse debris. Each sampler features machined jaws and hinged overlapping lids that open easily during descent to let water pass through and close during retrieval to reduce sample washout. The patented Two-Pin release mechanism has few moving parts and is very reliable. Each sampler is constructed of 316 stainless steel, including the springs, cables and fasteners. Sampler measures 150 mm x 150 mm x 150 mm. The Ekman sampler is light weight and has difficulty penetrating to depth. It is triggered by a messenger weight that travels down the rope and triggers the jaws closed. If the bottom is not flat, it can be difficult to trigger the Ekman sampler.
	**Van Veen Grab Sampler** Simple design for taking composite samples: The stainless steel Van Veen grab samplers are used for the taking of disturbed samples from the bottom of lakes, rivers etc. The jaws are pushed open at the surface, and kept open by a fastened hook. Then, after being lowered slowly, the jaws touch the bottom, and the hook loosens its grip, so that the jaws shut tight as its hoisted back up.

The jaws of these two samplers are held open until they reach the bottom and are tripped when the rope goes slack. Both have greater penetration and can collect more volume than the Ekman sampler, but overfilling may become an issue. Both of these samplers have removable weights on the outside of the sampler to help alleviate over penetration or if the sediment is very fine. Most samplers have open upper faces that are fitted with flaps.

Upon descent, the flaps are forced open by the water to minimize the bow wake, whereas upon ascent, the flaps are forced closed to prevent sample winnowing.

3.2 Collection of Minimally-disturbed Sediment Samples

The collection of minimally-disturbed sediment requires the field personnel to:

- Create a minimal bow wake when descending;
- Form a leak-proof seal when the sediment sample is taken;
- Prevent winnowing and excessive sample disturbance when ascending; and
- Allow easy access to the sample surface.

The dredge sampler should be lowered through the water column at a controlled speed of approximately 30 cm per second. Under no circumstances should the sampler be allowed to ‘free fall’ to the bottom, as this may result in premature triggering, excessive bow wake, or improper orientation upon contact with the bottom. The sampler should contact the bottom gently and only its weight or piston mechanism should be used to force it into the sediment.

3.3 Raising Sediment Sampler

After the sediment sample is taken, the sampler should be raised slowly off the bottom and then retrieved at a control speed of approximately 30 cm per second. Before the sampler breaks the water surface, the sampling vessel should head into the waves (if present) to minimise vessel rolling. The manoeuvre will minimise the swinging of the sampler after is breaks the water surface. If excessive swinging occurs or if the sampler strikes the vessel during retrieval, extra attention should be paid to evaluating sample disturbance when judging sample acceptability.

3.4 Sample Acceptability

The sampler should be secured immediately after it is brought on board the vessel. It is recommended that the sampler be placed in a large plastic tub to assist in securing the unit, and to prevent contaminating the vessel with sediments. If the sampler tips or slides around before being secured, extra attention should be paid to evaluating sample disturbance.

Once the sampler is secured on board the vessel, the surface of the sample must be made accessible without disturbing the sample. For characterising biological analytes in surficial sediments, it is recommended that the upper 10 cm be used.

After the sampler is secured on the vessel, the sediment sample should be inspected carefully before being accepted. The following criteria should be used to assess sample acceptability:

- The sampler must not be overfilled with sample so that the sediment surface is pressed against the top of the sampler
- Overlying water must be present (indicated minimal leakage)
- Overlying water must not be excessively turbid (indicated minimal sample disturbance)
- Sediment surface must be relatively flat (indicated minimal disturbance or winnowing)
- Desired penetration depth must be achieved

If a sample does not meet all the above criteria, it should be rejected and another sample collected.

3.5 Sampling Procedure

- Verify and mark sample locations.
- Start downstream and work upstream to prevent contamination of unsampled areas.
- After the vessel is anchored or dynamically located at the sampling location, measure and record the water depth to the stream / lake bottom using a survey rod attached to a 30-cm metal plate.
- Collect the sediment sample using the procedures detailed above. Make sure that the sampling location is a sufficient distance from the water depth and soft sediment location to provide a minimally-disturbed sample.
- Before samples of the sediment can be taken, the overlying water must be removed by carefully siphoning it off while tilting the sampler. Care must be taken to avoid disturbance of the sediment sample.
- Once the overlying water has been removed, the sediment can be sampled. Unrepresentative material should be removed.

- Handling of samples.
  - Samples for VOC analysis should be sampled first and placed directly into the sample container.
  - Samples for non-volatile analysis can be removed from the sampling device and homogenized in the stainless-steel pan.
  - Sample containers should be labelled with a unique identifier and stored at 4^{o}C until shipped to the laboratory.

3.6 Documentation

Observations and quantitative data collected during the implementation of this sampling procedure should be recorded in the field logbook. The following information should be recorded:

- Location;
- Date;
- Time;
- Personnel;
- Weather;
- Latitude / Longitude;
- Water Surface Elevation (ft NGVD 88)
- Water Depth;
- Sediment Surface (Mudline) Elevation (Calculated)
- Soft Sediment Thickness; and
- Sediment Recovery.

4.0 Attachments

None.

5.0 Key Checks and Preventative Maintenance

- Overlying water present when assessing sample suitability.
- Lower and raise sampler at constant and slow speed.

Attachment B
Standard Operating Procedure for Sediment Core Collection and Characterization

Sediment Core Collection, Characterization and Processing

1.0 Purpose

The purpose of this Standard Operating Procedure (SOP) is to describe protocols for collecting, characterizing, and processing sediment cores, including sample collection.

2.0 Collection Procedure

Sediment core collection is generally performed by a qualified subcontractor. The vessel maneuvering, positioning, and sediment core collection will be performed by the qualified subcontractor in accordance with their standard procedures and specifications noted in a Scope of Work.

The minimum following information must be recorded in the field log book by the project team representative on the vessel:

- Time and date of core collection
- Location coordinates (as-sampled)
- Surface water elevation (ft NGVD 88)
- Water depth
- Calculated sediment surface (mudline) elevation (ft NGVD 88)
- Core recovery
- Note any problems with core collection (e.g., number of attempts needed)
- Make note of any debris in area
- Note where signs of NAPL begin and end (include olfactory, visual, and multi-rae/PID observations)
- Any other pertinent information

If continuous vibracores are collected they will be segmented into manageable lengths (e.g., 4-5 feet) capped, tapped, labeled (location ID, a top/bottom designator, and indication of upper, middle, or lower core segment). This designation will be determined in the field by the field team leader. Cores will be retained upright on the sampling vessel until transfer to the shore-based processing crew.

Cores collected in stainless steel tubes will be sealed, frozen on dry ice, and shipped to the laboratory.

3.0 Materials

The following materials are needed for core characterization, processing and subsampling:

- Plastic sheeting and duct tape
- Field table
- Coolers (to accommodate shipping of NAPL mobility core sections
- Dry Ice (for storage and shipment of NAPL mobility cores only)
- Standard coolers (for shipment of all other samples)
- Ice (for shipment of all other samples)
- Electric double cut shears

- Straight bladed knife and cut resistant gloves
- Measuring tape (engineering scale)
- Dry erase board and marker
- Digital camera
- Core logging form
- Munsell color chart
- Bottleware for samples
- PPE – gloves, safety glasses, face shields
- Disposable, dedicated single-use pans and scoops (either stainless steel bowls and utensils, or aluminum pans and high-density polyethylene (HDPE) scoops)
- PID

3.1 Opening the Core

Prepare the processing tables by covering with plastic sheeting and securing with heavy duty tape (e.g. duct tape). Place the bulk core segments on the table so that the top of the core is to the left and the bottom is to the right.

Once the core segments are arranged, cut slits in the taped caps approximately 0.75 inches wide on opposite sides of the liner and cut away a small triangular portion of the cap (enough to allow the shears to access the liner).

Make two parallel cuts for each segment on opposite sides of the core and then open the core so that it splits into two separate halves that lie flat on the processing table, with the fresh sediment surfaces exposed.

Arrange tape measure next to core so that it will be visible in photos.

The contact between the accumulated soft sediment and the underlying native sediment should be identified. Composite sample intervals should be delineated prior to the collection of PID readings and samples for chemical analysis.

3.2 Field screening

Photoionization detector (PID) readings will be collected from each 2-foot interval. The readings will be collected from the mid-point of the sampling interval unless there is an area within the interval with a notable odor or staining. Note on the core log the interval from which the reading was collected. The reading will be taken from the headspace of a sealed plastic bag that is allowed to equilibrate for several minutes prior to obtaining the reading.

3.3 Sediment Core Characterization

The sediment cores will be visually characterized for sediment type, color, moisture content, texture, grain size and shape, consistency, visible evidence of staining, and any other observations. ***The observations recorded must be factual and accurate and must not contain any subjective conclusions about product type (i.e., NAPL observations will consist of a description of the physical properties of the material including a description of odor as standardized below).***

The Core Log Key (attached) is to be used for this characterization. The sediment will be described using the Unified Soil Classification System (USCS) (modified slightly for sediment characterization) based visual-manual identification in accordance with the American Society for Testing and Materials (ASTM) ASTM-2488 standard practice.

The colors will be designated using a Munsell color chart. Sediment logs will be recorded on the Core Log Field Form (attached).

Digital photographs of each core segment will be taken in order to visually document the undisturbed core structure. Each photograph will include a scale (i.e., tape measure), station ID, indication of depth interval, indication of top orientation, and date of core collection.

Odor: Use the descriptors ***none, strong, moderate, or faint*** *to characterize odor.*

Odor will be **only** be categorized as follows:

- **No Odor**
- **Unclassified Odor (UNC)** – used when a distinct odor is present but it cannot be classified into any of the identified categories
- **Sulfur-like Odor (S)** – used to describe a distinct rotten-egg-like odor
- **Petroleum hydrocarbon-like Odor (PHC)** – used to describe odors similar to petroleum products such as gasoline, kerosene, diesel, and fuel oil
- **Tar-like Odor (T)** – used to describe the distinctive odor of coal tar products similar to an asphalt/paving odor

Evidence of contamination: The following descriptors should be used to characterize any visible evidence of non-aqueous phase liquid (NAPL) impact:

- **NAPL** – Any free phase NAPL observed in cores should be described in terms of color, distribution, and viscosity (if determinable) as described further below. Free phase product should be described as NAPL in the "Comments" column on the core logs. ***Do not draw any conclusions about the type of product (e.g., oil, tar, fuel, coal tar, etc.)***
- **Sheen** – iridescent petroleum-like sheen. Free product is not present but a distinct film is evident.
- **Stained** – used w/ color (i.e., black or brown stained) to indicate that the soil matrix is stained a color other than the natural (unimpacted) color of the soil.
- **Coated** – sediment grains are coated with product – there is not sufficient free-phase material present to saturate the pore spaces.
- **Blebs** – observed discrete spheres of NAPL – but for the most part the sediment matrix is not visibly contaminated or saturated with NAPL.
- **Saturated** – the entirety of the pore space for a sample is saturated with free product. Care should be taken to ensure that the pore spaces are saturated with NAPL rather than water if this term is used.

3.4 Ebullition Sample Collection

Upon completion of the physical characterization, the cores will be sub-sampled for ebullition potential in the subsurface. Samples will be collected from specified elevations within the native sediment based on results of the DART survey and observations from the NAPL confirmation sediment cores.

Sediment samples will be collected at subsurface (greater than 6 inches) depths determined in the field.

The target analytes, as well as the containers, preservation requirements, and holding times, are listed in Table 3-1 of the SAP. Samples will be placed in a cooler with ice, along with the applicable COC, and shipped to the laboratory for analysis.

Sample collection times assigned will be the date/time that the core is processed and sub-sampled.

Any reusable equipment used during the core processing or for the collection of the samples will be decontaminated between samples in accordance with procedures described in the decontamination SOP. Sediment samples will be packaged and handled in accordance Section 3 of the SAP.

3.5 NAPL Mobility Sample Collection

Five undisturbed samples will be collected in stainless steel tubes at an adjacent location to the original five NAPL confirmation sediment cores. Samples will be labeled and prepared for shipment as described in Section 5.0 with no sub-sampling activities.

4.0 Maintenance

The blades on the electric shears used for opening the cores should be changed when there is a noticeable difference in the amount of force required to advance the shears through the liner. These blades typically need to be changed after opening approximately 80 to 100' of core liner. Wear rates with different liner materials will vary. If too much time lapses between blade changes, the bearings within the cutting head of the shears will begin to wear very quickly and will result in quite a bit of additional vibration. The shears should also be lubricated per manufacturers' directions when the blades are changed.

4.1 Stainless Steel Tube Handling/Shipping

The stainless steel tubes will be properly sealed before deposit at the on-shore processing facility. Undisturbed cores collected in tubes shall be wiped clean with paper towels upon receipt at on-shore processing facility. The top and bottom sample interval depths and orientation will be labeled on the cores along with the sampling location. The labeled cores will be placed in a cooler sufficiently large to hold the tubes in a flat horizontal position. For NAPL mobility cores, sufficient dry ice will be added to the cooler to keep samples frozen during shipment. No more than 3 layers of tubes shall be placed in each cooler and cushioning material should be placed between each layer of tubes. Approximately 50 pounds of dry ice shall be used per cooler. Due to the dry ice, coolers containing NAPL mobility tubes shall be shipped as Dangerous Goods following proper CH2M policies.

5.0 Precautions

There are several precautions that should be taken when handling, opening, and processing the sediment cores:

- When opening the cores, knives and/or other cutting instruments must be used. Cut resistant gloves should be worn under nitrile gloves when cores are opened.
- Staff opening cores should wear face shields; very wet sediment can spatter from the notched ends of the cores.
- The cut edges of the core liner can be very sharp and splinter like. Caution should be used and gloves should be worn when handling cut pieces of core liners.
- Sediment cores can be very heavy and due the shape of the core can be very awkward to move. The core collection team on the vessel will cut the cores to manageable lengths to the extent possible, but proper lifting technique and team lifting should be used when handling heavy cores.

- Do not transport dry ice or coolers containing dry ice in the cabin space of a vehicle due to danger of asphyxiation.
- Do not place liquid samples of groundwater and/or NAPL in the cooler with dry ice as the samples will freeze.

6.0 Attachments

- Sediment core characterization form and key

Site Name: BNSF Track Switching Facility
Project Number: 693282
Project Location: Wishram, WA
Survey Duration:

Station ID:	Latitude:		Attempt 1	Refusal? Y/N	
Sampling	Longitude:	Penetration (ft):			
Crew/Company	Datum:	Recovery (ft)			
	Depth (ft):	Date/Time:			
	Water Surface Elevation				
	St. Arrival:		Attempt 2	Refusal? Y/N	
Vessel:	St.Depart:	Penetration (ft):			
Collection:	Logged by:	Recovery (ft)			
Collector Information:		Date/Time:			

	Depth below mudline (ft)	Lithology	Type	Color (Munsell)	Consistency/ Density	Cementation/ Plasticity	Structure	Moisture Content	Maximum particle size	Odor	% gravel	% Sand	% fines	PID Reading (ppm)	Sample IDs (Single Letter)	Evidence of Contamination	Comments
1																	
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	

Additional Notes/Comments:

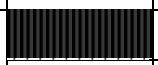
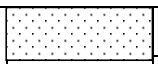
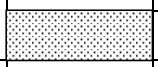
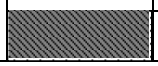
Depth below mudline (ft)	Lithology	Type	Color (Munsell)	Consistency/ Density	Cementation/ Plasticity	Structure	Moisture Content	Maximum particle size	Odor	% gravel	% sand	% fines	PID Reading (ppm)	Sample IDs (Single Letter)	Evidence of Contamination	Comments
11																
12																
13																
14																
15																
16																
17																
18																
19																
20																

Sample Summary (check boxes for analysis):

Sample ID	Sample Type (N/FD/MSD)	Sample Date/Time	Depth Interval (ft)													
A																
B																
C																
D																
E																
F																
G																
H																
I																
J																
K																
L																
M																
N																
O																
P																
Q																
R																
S																
T																
U																

Reviewed by: Date:

Sediment Core Log Key

MAJOR DIVISIONS			GRAPHIC SYMBOL	GROUP SYMBOL	DESCRIPTION
COARSE-GRAINED MATERIAL	GRAVELS	CLEAN GRAVELS		GW	Well-graded gravel Well-graded gravel with sand
				GP	Poorly graded gravel Poorly graded gravel with sand
		GRAVELS WITH FINES		GW-GM	Well-graded gravel with silt Well-graded gravel with silt and sand
				GW-GC	Well-graded gravel with clay Well graded gravel with clay and sand
				GP-GM	Poorly graded gravel with silt Poorly graded gravel with silt and sand
				GP-GC	Poorly graded gravel with clay Poorly graded gravel with clay and sand
				GM	Silty gravel Silty gravel with sand
				GC	Clayey gravel Clayey gravel with sand
	SANDS	CLEAN SANDS		SW	Well-graded sands Well-graded sand and gravel
				SP	Poorly-graded sands Poorly graded sand with gravel
		SANDS WITH FINES		SW-SM	Well-graded sand with silt Well-graded sand with silt and gravel
				SW-SC	Well-graded sand with clay Well-graded sand with clay and gravel
				SP-SM	Poorly-graded sand with silt Poorly-graded sand with silt and gravel
				SP-SC	Poorly-graded sand with clay Poorly-graded sand with clay and gravel
				SM	Silty sand Silty sand and with gravel
				SC	Clayey sand Clayey sand and with gravel
FINE-GRAINED MATERIALS	SILTS AND CLAYS			CL	Lean clay * Lean clay with sand or gravel * Sandy lean clay * Sandy lean clay with gravel * Gravelly lean clay * Gravelly lean clay with sand
				ML	Silt * Silty with sand or gravel * Sandy silt * Sandy silt with gravel * Gravelly silt * Gravelly silt with sand
				CH	Fat clay * Fat clay with sand or gravel * Sandy fat clay * Gravelly fat clay * Gravelly fat clay with sand
				MH	Elastic silt * Elastic silt with sand or gravel * Sandy elastic silt * Sandy elastic silt with gravel * Gravelly elastic silt * Gravelly elastic silt with sand
				OL/OH	Organic silt * Organic silt with sand or gravel * Sandy organic silt * Sandy organic soil with gravel * Gravelly organic soil * Gravelly organic soil with sand

Well Graded (Engineering) = Poorly Sorted (Geological) = grains of all different sizes mixed together

Poorly Graded (Engineering) = Well Sorted (Geological) = grains are all same size

∩ Shell hash

λλλλ Peat/organic matter

CONSISTENCY

Penetration of thumb:
<0.25 cm = hard (H)
0.25 - 2.0 cm = firm (F)
2.0 - 4.0 cm = soft (S)
>4.0 cm = very soft (VS)

CEMENTATION

N = not cemented
W = weakly cemented
M = Moderately cemented
S = Strongly cemented

STRUCTURE

H = Homogeneous
S = Stratified
L = Laminated
M = Mottled

COLOR

from Munsell chart

MAXIMUM PARTICLE SIZE

SC = Small Cobble
CP = Coarse Pebble
MP = Medium Pebble
SP = Small Pebble
CS = Coarse Sand
MS = Medium Sand
FS = Fine Sand
VFS = Very Fine Sand
Z = Silt

SA = Sub-angular
VA = Very angular

ODOR

N = None
UNC = Unclassified
S = Sulfur-like
T = Tar-like
PHC = Petroleum hydrocarbon-like

Quantifying Descriptors

Strong
Moderate
Faint

Moisture Content

Wet
Moist
Dry

VISIBLE CONTAMINATION DESCRIPTORS

Sheen - iridescent petroleum-like sheen. Free product is not present but a distinct film is evident. Not to be used to describe a “bacterial sheen” which can be distinguished by its tendency to break up on the water surface at angles whereas petroleum sheen will be continuous and will not break up.

Stained - used w/ color (i.e. black or brown stained) to indicate that the soil matrix is stained a color other than the natural (unimpacted) color of the soil.

Coated - soil grains are coated with free product – there is not sufficient free-phase material present to saturate the pore spaces.

Blebs - observed discrete sphericals of tar/free product - but for the most part the soil matrix was not visibly contaminated or saturated. Typically this is residual product.

Saturated - the entirety of the pore space for a sample is saturated with NAPL. Care should be taken to ensure that you’re not observing water saturating the pore spaces if you use this term. Depending on viscosity, free-phase saturated materials may freely drain from a soil sample.

Attachment C
Standard Operating Procedure for Sediment Profile Imaging

STANDARD OPERATING PROCEDURE (SOP)

Sediment Profile Imaging

1 SCOPE AND APPLICATION

The following standard operating procedure (SOP) details the steps involved in the use of a Sediment Profile Imaging camera (SPI).

Although sediment profile imagery (SPI) is a photographic technique, its use bears more similarity to other point-sampling techniques (e.g. grabs and cores) used in benthic sampling than to video techniques. The SPI (Figure 1) acts like an inverted periscope, driving a mirrored prism into the sediment through which a photograph is taken of the sediment profile. Resulting images can be used for qualitative and quantitative analysis. Its utility in habitat mapping is mainly to provide information on the nature of sediments, which can be used to characterize and indicate the quality of the habitat.

2 EQUIPMENT

The following equipment is necessary sampling surface sediments:

- Sediment Profile Camera
- Sufficient line to lower instrument to sea floor and retrieve
- Decontamination equipment for cleaning between stations such as Alconox detergent, cleaning brushes, distilled or deionized water
- Vessel with crane capacity of 100kg
- DGPS for station positioning
- Field Note Book/ Field Log Sheets

3 Imagery Collection

Sediment Profile Images will be collected from a vessel at predefined sampling locations. The vessel should be equipped with the necessary equipment to safely operate and navigate and complete the required sampling tasks. Additionally, the proper vessel should be selected for stations in shallow areas which may preclude larger vessels due to draft limitations.

4 Positioning & Coordinates

A differential global positioning system (DGPS) will be used aboard the sampling vessel for accurate station positioning. Once the vessel is anchored in place, the actual position will we recorded for each grab sample taken and/or attempted. Horizontal coordinates should be recorded in either latitude and longitude (WGS 1984, decimal degrees) or x and y coordinates in WGS1984 UTM Zone 10 North (meters). Water depths will be recorded in meters from the vessel sonar if applicable, or with the use of a lead line.

5 Sample Deployment & Retrieval

Once the vessel has navigated to position and been securely anchored, the SPI will be deployed over the side of the vessel. The SPI will be advanced by gravity into the sediment until full penetration or refusal. A remote monitor on the vessel will be used to evaluate the quality of the image. If acceptable the camera will be remotely triggered to collect multiple captures. Once SPI has been recovered to the vessel, the camera will be inspected and cleaned.

6 Image Documentation and Processing

Each successful image from the SPI will be noted in the field logs. The images will then be reviewd for geotechnical and biological attributes and recorded in the SPI log sheet. Information to be recorded includes:

- Station ID
- Vessel
- Name of SPI specialist
- Station Coordinates (coordinate datum)
- Weather conditions
- Image time and date
- Image number (if multiple taken)
- Water depth
- Estimated SPI penetration (cm)
- Sediment type (surface, subsurface)
- Sediment color (surface, subsurface)
- Presence of sheen
- Observed debris (wood debris, shell hash…etc)
- Observed biological activity

7 DATA QA/QC

The quality of the images can be checked as soon as they are downloaded from the camera. Check the images are in focus and that the flash has operated correctly. Remedy any faults prior to the next deployment. Images may be unusable if the prism has not penetrated the sediment far enough or has penetrated too far. The sediment-water interface should always be visible in the image, and ideally should be captured about three-quarters of the way up the photograph. If the sediment-water interface cannot be seen, adjustments should be made to the weight of the SPI and the samples repeated.

The scale of the image will be calibrated by etching a scale rule (usually divided into 1 cm sections) vertically on the glass faceplate of the prism. This scale can be used to determine the penetration depth in each photograph.

8 Reporting

Field notes will be taken during all sediment sampling activities in a field note book which will be kept with the lead sampler. Included in the field notes will be the following information:

- Names of persons collecting and logging images
- Names of persons operating vessel and/or equipment
- Weather conditions (and/or any changes in weather)
- Mudline elevation of each sampling station
- Date and time of collection of each sample
- Sample station number and actual coordinates
- Brief description of sediments
- Any deviations from the approved sampling plan

Field notes will be kept in a single, bound, weatherproof notebook. Additionally, information from each sample location will be recorded on the field log sheet.

Following each day of sampling, a daily summary report should be completed and sent electronically to the onshore survey manager. Report should include summary of sampling events, stations completed, and a brief summary of sediments observed. Additionally, log sheets from the day and field notes from the day should be scanned and sent electronically each night if possible.

Appendix B
Health and Safety Plan

BNSF Wishram Railyard, Sediment Sampling Klickitat County, Washington

Project HSE Plan

October 2020

Client – BNSF Railway Company

Approval

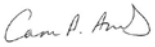
This Project Health, Safety, and Environmental (PHSE) Plan has been written for use by Jacobs only. Jacobs claims no responsibility for its use by others unless that use has been specified and defined in project or contract documents. The plan is written for the specific project and site conditions and identified scope(s) of work and must be amended if those conditions or scope(s) of work change.

By approving this PHSE Plan, the Health and Safety Manager (RHSM) certifies that the personal protective equipment has been selected based on the project-specific hazard assessment.

ORIGINAL PLAN

Original Plan Written by: Eric Hamm **Date**: October 22, 2020

HSM Approval: Eric Hamm  **Date**: October 22, 2020

Project Manager Approval:  **Date**: Noveber 6, 2020

Revision 1

Revisions Made By: **Date**:

Description of Revisions to Plan:

Revisions Approved By: **Date:**

Revision 2

Revisions Made By: **Date:**

Description of Revisions to Plan:

Revisions Approved By: **Date:**

Contents

Attachment 8 Stop Work Order Form
Attachment 9 Beyond Zero Safety Tools
Attachment 10 Completed JACOBS AHAs
Attachment 11 Safety Data Sheets
Attachment 12 COVID-19 Guidance Document

Project Emergency Contacts

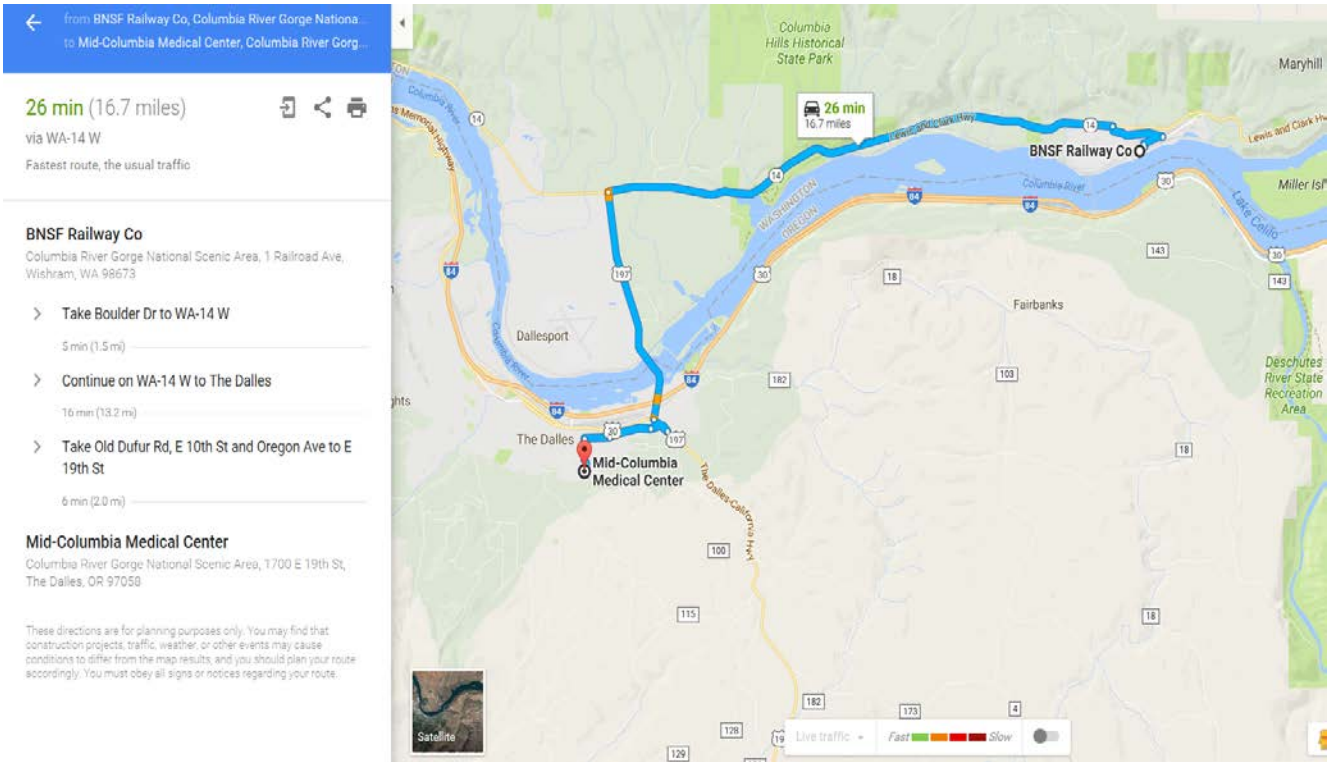
WorkCare 24-hour Injury Care – 1-888-449-7787

Medical Emergency—911 See local hospital information and route to hospital below	**Non-Emergency medical Injuries** (no matter how minor) WorkCare: 1-888-449-7787 (call as soon as injury occurs)
Fire/Spill Emergency—911 Facility Fire Response #: Local Fire Department #: **Security & Police—911** Local Police #:	**Utilities Emergency Phone Numbers 911** Water: 811 Gas: 811 Electric: 811 Other:
Jacobs Project Manager (PM) Name: Andrews, Carrie/PDX Phone: 503-736-4270; cell 503-348-9500	**Jacobs Responsible Health and Safety Manager (RHSM)** Name: Eric Hamm Phone: cell 626-644-2563
Jacobs Safety Liaison (SL) Name: Jennifer Ulrich/PDX Phone: (907) 762-3818 x53818	**Jacobs Responsible Environmental Manager (EM)** Name: Liz Luecker Phone: (425) 453-5005 x25585; cell 425-647-6073
Human Resources Department Submit a request through Global People Services on Jacobs Connect Workman's Compensation Claims WCClaims@jacobs.com	**Automobile Accidents** **Rental**: Vehicle Accident Form required to be sent to AutoClaims@jacobs.com (see Vehicle Accident Guidance attached to this plan) **Fleet Vehicle**: Karyna Zarate 281-721-8634
Federal Express Dangerous Goods Shipping Phone: 800/238-5355 **CHEMTEL (hazardous material spills)** Phone: 800-255-3924	**Media Inquiries Corporate Strategic Communications** Name: Lorrie Paul Crum Phone: 720-286-0255
Facility/Site Alarms: TBD at each location	**Evacuation Assembly Areas(s)** TBD at each location
Facility/Site Evacuation Route(s): TBD at each location	

Directions and Map to Local Hospital

Local Hospital **Mid-Columbia Medical Center** Columbia River Gorge National Scenic Area, 1620 E 12th St, The Dalles, OR 97058	**Local Occupational Clinic (Consult with WorkCare prior to any clinic visit)** **WorkCare**: 1-888-449-7787 (call as soon as injury occurs) Phone Number: Address:

DO NOT SKIP THIS STEP – THE CONTACT INFORMATION AND DIRECTIONS TO THE NEAREST HOSPITAL MUST BE DISCUSSED AT EACH MORNING TAILBOARD MEETING AND INCLUDED ON THE PTSP.



1 Introduction

1.1 Use, Purpose and Scope of PHSE Plan

The objective of this PHSE Plan is to ensure that project risks are eliminated or mitigated through the identification of hazards, assessment of risk and the application of effective control measures and to achieve a safe and healthy workplace for ourselves and Sub-consultants to whom we have a legal and moral duty of care. Further, there is a requirement to ensure that our activities and that of our Sub-consultants/Subcontractors are conducted in an environmentally responsible manner.

Jacobs has undertaken structured hazard identification and risk assessment process and will develop and implement safe working procedures for this project.

1.2 Applicability

This PHSE Plan applies to:

- All Jacobs staff, including subcontractors and tiered subcontractors of Jacobs working on the site;
- All visitors to Jacobs construction or remediation sites in the custody of Jacobs (including, but not limited to, visitors from the Client, the Government, or the public,).

In addition, Subcontractors and tiered subcontractors shall also follow any of their company HSE programs, and site-specific HSE Plans and AHAs.

This PHSE Plan does not apply to the third-party contractors, their workers, their subcontractors, their visitors, or any other persons not under the direct control or custody of Jacobs.

This PHSE Plan defines the procedures and requirements for the health and safety of staff and visitors when they are physically on the work site. The work site includes the project area (as defined by the contract documents) and the project offices, trailers, and facilities thereon.

This PHSE Plan will be kept onsite during field activities and will be reviewed as necessary. The PHSE Plan will be revised as project activities or conditions change or when supplemental information becomes available.

1.3 Organisations involved in the Project

Client (Owner):	BNSF Railway – Shane DeGross; phone 253.591.2567
Jacobs' Client:	BNSF
Principal Subcontractors:	TBD
Facility Contact:	NA

1.4 Jacobs' Personnel involved in the Project

Role	Name	Contact number
Project Manager:	Andrews, Carrie/PDX	503-736-4270; cell 503-348-9500
Health and Safety Manager	Eric Hamm	626-644-2563
SL/FTL	Jennifer Ulrich/PDX	(907) 792-9633

1.5 Project Background

On March 27, 2017, BNSF contacted CH2M to develop a scope of work to meet the requirements of the agreed order for the river sections of the site with the first deliverable being a remedial investigation work plan. Non aqueous phase liquid (NAPL) impacts have been reported in the river.

The site is approximately 2,000 feet long, ranges from 150 to 720 feet wide, and encompasses approximately 20 acres, including land no longer occupied by BNSF (Kennedy/Jenks Consultants 2004b). The site is bounded by the town of Wishram to the north, the vacant portion of the railyard to the east, the Columbia River to the south and southwest, and railroad right-of-way to the west.

The site hydrology was significantly altered in 1957 when The Dalles dam began operation forming Lake Celilo which submerged the river in the Wishram area.

1.6 Project Location

Project/Site Name: BNSF Wishram Sediment Sampling

Site Address: 1 Railroad Ave, Wishram, WA 98673

1.7 Identifying HSE Objectives Targets & Indicators

All project personnel and its visitors are to strive to meet the project-specific HSE goals outlined below.

- Project management to demonstrate a top-down commitment to HSE
- Create an incident-free environment
- Establish and share the BeyondZero® culture
- Accomplish zero loss incidents (e.g., injuries, spills, vehicle incidents property damage)
- Reduce risks to our health and the environment by identifying, assessing, and mitigating hazards and environmental impacts.
- Continually improve project environmental performance (e.g, reduce number of spills, achieve compliance with any applicable environmental permit)
- Ensure 100% participation in training programs, conformance to company requirements and HSE compliance
- 100% participation in safety meetings
- 100% on-schedule completion of environmental, safety and security corrective actions from audits or incidents
- Achieve recognition from the client for outstanding performance
- Participate in the BZO process and strive for recognition in the BZO of the month awards.
- Recognize project and subcontractor HSE excellence through project or corporate reward and recognition programs.

1.8 Identifying Legal and Other Requirements

This PHSEP applies to:

All Jacobs staff, including subcontractors and tiered subcontractors of Jacobs working on the site;

- All visitors to Jacobs construction or remediation sites in the custody of Jacobs (including, but not limited to, visitors from the Client, the Government, or the public,).
- In addition, Subcontractors and tiered subcontractors shall also follow any of their company HSE programs, and site-specific PHSEPs and AHAs.

This PHSEP does not apply to the third-party contractors, their workers, their subcontractors, their visitors, or any other persons not under the direct control or custody of Jacobs.

The objective of this PHSEP is to ensure that project hazards and environmental risks are eliminated or mitigated through the identification of hazards, assessment of risk and the application of effective control measures and to achieve a safe and healthy workplace for ourselves and subcontractor to whom we have a legal and moral duty of care. Further, there is a requirement to ensure that our activities are conducted in an environmentally friendly responsible manner.

Jacobs has undertaken structured hazard identification and risk assessment process and shall implement a Safe System of Work (SSoW) for delivery of our services on this project. This PHSEP defines the procedures and requirements for the health and safety of staff and visitors when they are physically on the work site. The work

site includes the project area (as defined by the contract documents) and the project offices, trailers, and facilities thereon.

This PHSEP will be kept onsite during field activities and will be reviewed as necessary. The PHSEP will be revised as project activities or conditions change or when supplemental information becomes available or at minimum, annually. The PHSEP adopts, by reference, the Jacobs Business Management System Global Health, Safety and Environment (HSE) and People and Places Solutions (P&PS) HSE Procedures and Work Instructions, as appropriate. In addition, applicable requirements contained in the Jacobs Federal and Environmental Services (F&ES) Field Handbook (Handbook) will be implemented. The Handbook is available as a stand-alone Handbook at the project site. The PHSEP may adopt procedures from the project Work Plan and any governing regulations. If there is a contradiction between this PHSEP and any governing regulation, the more stringent and protective requirement shall apply.

All staff and subcontractors must sign the employee sign-off form (Attached to this PHSEP) to acknowledge review of this document. Copies of the signature page will be maintained onsite by the Safety Liaison (SL).

SITE MAP


WISHRAM
HEIGHTS
Lewis and Clark Hwy
Boulder Dr
Bluff Rd
Wishram Rd
Main St
Railroad Ave
Park Pl
BNSF Railway Co
Wishram Post Office
Wishram
Satellite
Google

2 Project Scope and Schedule

2.1 Description of Work

Below is a description of the tasks covered by this plan. Any additions or changes in scope will require a revision to this PHSEP; see Change Management below.

- Mobilization/Demobilization
- Utility locates
- Vessel-mounted ponar/power grab for surface sediment sampling
- Vessel-mounted vibracore
- Decontamination of equipment and/or personnel
- Preparation of samples for shipment to laboratory
- IDW Management

Employee Responsibilities
Jacobs employees responsible for field work at this project site, include:

Project Manager:	
PM Name:	Andrews, Carrie
Office:	PDX
Telephone number:	503-736-4270
Cellular Number:	503-348-9500

Environmental Manager:	
EM Name:	Liz Luecker
fice:	SEA
Telephone number:	(425) 453-5005 x25585
Cellular Number:	425-647-6073

Responsible Health and Safety Manager:	
RHSM Name:	Eric Hamm
Office:	SCO
Telephone number:	NA
Cellular Number:	626-644-2563

Safety Coordinator:	
SC Name:	Jennifer Ulrich
Office:	PDX
Telephone number:	NA
Cellular Number:	907-792-9633

Subcontractors

Subcontractor: TBD	
Contact Name:	
Telephone	
Cellular Number:	

Subcontractor: TBD	
Contact Name:	
Telephone	
Cellular Number:	

2.2 Contract Indemnification

This Project Health, and Safety, and Environment Plan (PHSEP) has been written for use by Jacobs only. Jacobs claims no responsibility for its use by others unless that use has been specified and defined in project or contract documents. The plan is written for the specific project and site conditions and identified scope(s) of work and must be amended if those conditions or scope(s) of work change.

3 HSE Roles and Responsibilities

3.1 Project HSE Activities

Actions by Jacobs Project/Site Manager:	• Support the implementation of this HSE Plan, communicate it to the Jacobs employees working at the field or site workplace, monitor their compliance with it, and hold the Jacobs employees and our subcontractors accountable for its proper execution • Ensure safe systems of work are in place for all Jacobs employees and our subcontractors and implemented in accordance with this HSE Plan • Ensure that task/location-specific risk assessments are prepared for hazards potentially affecting Jacobs' employees or our subcontractors and for hazards created by the activities of Jacobs' employees or our subcontractors that potentially affect others. • Ensure adequate welfare arrangements are available. • Provide or arrange HSE induction and training for the Jacobs team • Obtain written evidence of inductions and briefings held in compliance with this HSE Plan • Ensure HSE monitoring is carried out • Report all HSE incidents • Ensure prompt and adequate treatment for injured employees and subcontractor personnel; • Ensure adequate investigation and analysis of accidents (non-injury and injury); • Manage subcontractor HSE • Give recognition for good HSE performance/working practice • Take a leadership position on HSE issues where there are clearly unacceptable HSE standards or practices being employed at any workplace where our employees are present • Ensure application of these requirements to Jacobs subcontractors • Demonstrate leadership of and commitment to HSE, setting a personal example at all times
Actions by Jacobs Construction Supervisor:	• Implement the HSE program; • Effectively communicate the Company's HSE goals, objectives, policies and procedures to each member of your work group; • Establish an environment of "zero tolerance" for safety non-compliance and promote a positive atmosphere for HSE excellence; • Plan each task with HSE as an integral part, and conduct pre-job risk assessments of all work activities; • Orient the worker with respect to: o The work group (the new worker), o The work area and hazards that may exist, o General and specific safety hazards, o Accident (non-injury and injury) reporting requirements, and o The employee's HSE responsibilities;

	• Assign employees only to tasks for which they are trained and qualified;
	• Monitor worker and work group performance for quality and safe work practices;
	• Correct any deficiencies noted and educate the worker to improve work methods;
	• Report and investigate all non-injury and injury incidents and
	  o Secure incident scene,
	  o Actively participate in the investigation, and
	  o Implement corrective actions;
	• Assure good housekeeping at all times;
	• Encourage crew members to actively participate in the HSE program; and
	• Enforce Company and project HSE policies and procedures at all times.

Actions by Corporate HSE Manager:	• Provide HSE advice and guidance to the Jacobs project team. • Carry out HSE inspections and audits for compliance with this Project HSE Plan as required by the Project Manager and Corporate.
Actions by all Jacobs' project employees:	• Comply with procedures established for their safety and health and for preservation of the environment • Apply Jacobs mandatory StepBack Process and Safety Observation Report (SOR) process to site or fieldwork carried out by Jacobs employees or our subcontractors. • Promptly report incidents involving personnel or property to your supervisor, no matter how minor. • Inspect, use, and maintain personal protective equipment provided for you; • Plan your work and try to anticipate any hazards you might encounter; and • ***Intervene whenever imminent danger situations are observed.*** As construction professionals, we are expected to recognise and take prompt action whenever imminent danger situations are observed on any project we are working on. We have defined imminent danger as "any condition where there is reasonable certainty that a danger exists that can be expected to cause death or serious physical harm immediately." Typically, such conditions would include; electrocution hazards, falls from heights, improperly shored excavations, and crush hazards by heavy equipment. Once appropriate actions are taken to remove any exposed persons from harm's way, the unsafe condition/act and our actions should be documented in writing to the Client.

4 Project Hazard/Impact Identification and Risk Assessment

(See People and Places Solutions Work Instruction IB-HS-WI-0101-IB, P&PS Risk Assessment and Safety System of Work)

As part of the SSoW, a hazard identification and environmental impact assessment must be undertaken for all tasks performed by Jacobs and their subcontractors. A project Hazard Identification (Table 1) has been completed for this project. Specific project tasks are listed in Table 1 with a designation of the hazards associated with the task. Initial risk and residual risk associated with the hazards identified below shall be documented in the AHA/Hazard Identification and Risk Assessment form (see attachments for form). Members of the public or visitors that enter the work area must be escorted briefed on the hazards they may be exposed to by reviewing applicable portions of the PHSEP and AHAs.

The Safe System of Work to mitigate these hazards include the hazard control sections listed in this plan (or referred to in the Handbook) along with the Activity Hazard Analysis (AHA)/Hazard Identification and Risk Assessment for each project task listed in Table 4-1. **The HSE Handbook included in the Attachment E-1, must be utilized to reference information for the topics covered in Table 4-1.**

Jacobs project-specific AHAs for the tasks below are attached to this plan. Jacobs subcontractors are required to provide AHAs specific to their scope of work on the project for acceptance by Jacobs prior to the start of work. Each subcontractor shall submit AHAs for their field activities, as defined in their scope of work, along with their project-specific safety plan and procedures. Additions or changes in field activities, equipment, tools, or material used to perform work or hazards not addressed in existing AHAs requires either a new AHA to be prepared or an existing AHA to be revised.

Table 4-1: Project Tasks and Associated Hazards

Associated Hazard Section	Project Activity	Daily Mobilization/ Demobilization	Vessel-mounted submersible sledge for video survey	LIF profiler deployed from a vessel	Decontamination of Personnel and/or Equipment	IDW Management	Preparation of Samples for Shipment to Laboratory	Utility Survey
General Hazards – Refer to General Hazards and Controls in HSSE Handbook, Section 7.								
Blood Borne Pathogens		X	X	X	X	X	X	X
Chemical Storage					X	X		
Driving Safety		X						
Electrical Safety					X			
Extended Work Hours and Fatigue Management		X	X	X	X	X	X	X
Field Ergonomics and Manual Lifting		X	X	X	X	X	X	X
Field Vehicles		X	X	X	X	X	X	X
Fire Prevention		X	X	X	X	X	X	X
General Practices and Housekeeping		X	X	X	X	X	X	X
Hazard Communication			X	X	X	X		

Associated Hazard Section	Project Activity	Daily Mobilization/ Demobilization	Vessel-mounted submersible sledge for video survey	LIF profiler deployed from a vessel	Decontamination of Personnel and/or Equipment	IDW Management	Preparation of Samples for Shipment to Laboratory	Utility Survey
Knife Use		Open bladed knives are not allowed; any changes to this policy must be discussed with HSM						
Lighting			X	X				
Personal Hygiene		X	X	X	X	X	X	X
Personal Security		X	X	X	X	X	X	X
Shipping and Transportation of Hazardous Waste						X		X
Substance Abuse		X	X	X	X	X	X	X
Project-Specific Hazards – Refer to HSSE Handbook, Section 8, and the additional project-specific controls in this plan when specified.								
Benzene			X	X	X			
Boating Safety			X	X	X			
Hand & Power Tools			X	X	X	X	X	X
Slips, Trips and Falls			X	X	X	X	X	X
Utilities (Underground)			X	X				
Utilities (Overhead)			X	X				
Working Alone		X				X	X	X
Physical Hazards – Refer to Physical Hazards in HSSE Handbook, Section 9, and the additional project-specific controls in this plan when specified.								
Noise			X	X				
Ultraviolet Light exposure (sunburn)		X	X	X	X	X	X	X
Temperature Extremes		X	X	X	X	X	X	X
Biological Hazards – Refer to Biological Hazards in HSSE Handbook, Section 10, and the additional project-specific controls in this plan when specified.								
Bees and Other Stinging Insects			X	X	X	X	X	X
Feral Dogs			X	X	X	X	X	X
Fire Ants			X	X	X	X	X	X
Mosquito Bites			X	X	X	X	X	X
Poison Ivy, Oak and Sumac			X	X	X	X	X	X

Associated Hazard Section	Project Activity	Daily Mobilization/ Demobilization	Vessel-mounted submersible sledge for video survey	LIF profiler deployed from a vessel	Decontamination of Personnel and/or Equipment	IDW Management	Preparation of Samples for Shipment to Laboratory	Utility Survey
Snakes			X	X	X	X	X	X
Spiders – Brown Recluse and Black Widow			X	X	X	X	X	X
Ticks			X	X	X	X	X	X

J – Hazard identification applicable to Jacobs personnel
S – Hazard identification applicable to Subcontractor personnel

4.1 Critical Risk Management

(See Jacobs Global Work Instruction JJ-HS-WI-0303-JJ, Critical Risk Management)

Incidents involving one of the Jacobs' nine Critical Risks often result in more severe injuries, death or other devastating impact. The nine Critical Risks include:

Additional critical risks may be identified based on risk assessments that could pose the potential for more severe outcomes of incidents (e.g., working with explosives, working on sites with MPPEH, working on water, working remotely). Heightened project awareness, training, monitoring and pre-planning is expected among tasks involving critical risks. Refer to the Critical Risk Awareness Booklet **(Appendix E, Attachment 5)** and the Critical Risk Awareness Guide for Managers and Supervisors.

Project tasks with associated critical risks have been identified in Table 1 above.

- Critical Risk Universal Requirements include:
- Perform a Risk Assessment - work must not be conducted without addressing the risks and controls measures. Ensure the AHA/Hazard Identification/Risk Assessment includes controls for work with critical risks.
- Verify Competency - all personnel must be trained and competent for the work to which they are assigned.
- Wear PPE - PPE must be worn in accordance with the requirements identified in the AHA/Hazard Identification/Risk Assessment for that task.
- Emergency Preparedness - suitable emergency response must be in place before work commences. These shall be addressed in the AHA/Hazard Identification and Risk Assessment.
- Stop Work Authority - if anyone has any questions or concerns about performing the work in a safe manner, they shall stop work and raise those concerns immediately.

4.2 StepBack

(Reference BIAF Global Guide, BIAF-350-G-01, HSE StepBack Process)

The StepBack process applies to all Jacobs employees and subcontractors that are performing tasks in an office or at a site location. It is a critical thinking process to supplement HSE planning tools such as the Pre-Task Safety Plan, AHAs, and HSPs and should be applied at the start of shift, after a break, when the task or location change, when adjacent work may present additional hazards, or any other hazard or change to task is identified. Training for initial roll-out will be provided via 8-hour HAZWOPER refreshers or a briefing from the RHSM.

The process is comprised of three key steps:

Identify: Prior to and while executing the task, "StepBack" and identify any new hazards or changes to the environment, including reviewing personal physical and mental preparedness. Ask the questions on the card (see wallet card or the form attached to this plan); if "yes" is the answer to all questions, the task may proceed. If you answer "no" to any of the questions, STOP work and contact your HSM/EM. Together you will work through the following steps to identify corrective actions.

Evaluate: Assess the risk associated with the new hazard or change to the environment to understand the level of risk.

Act: Take appropriate action. Engage with project management or supervisors as necessary to identify the risk mitigation measures. Mitigation measures (changes to means/methods, use of different PPE than specified in the AHA, or similar) would require RHSM involvement and potentially revision to the AHA and or HSP.

Completion: After the job has finished ask:

Did you feel safe doing the job?

Were others nearby working safely?

Can any improvements be made next time?

If any of these questions yield a "no" response, follow up with feedback to the PM, RHSM, or your supervisor.

4.3 Daily Safety Meetings and Point of Work Risk Assessments

Daily safety meetings are a means to coordinate project HSE activities and review HSE performance on a regular basis. Daily safety meetings are to be held with all project personnel in attendance, including subcontractors, to review the hazards, controls, and required procedures/AHAs that apply for each day's activities, as well as any environmental issues, requirements and/or best management practices.

Site supervisors/Field Team Leads shall lead the daily safety meeting. Everyone involved in the day's work needs to participate and to sign a sign-in form to show they've had a briefing/attended at the meeting.

Point of Work Risk Assessments (POWRAs) known as Safe Plan of Action (SPA) or Pre-Task Safety Plans (PTSPs) serve the same purpose as general safety meetings, but the PTSPs shall be completed by individual crews to focus on those hazards posed by their specific work, taking into account field conditions and/or hazards at the point of work and associated risks. If a POWRA shows an unacceptable level of risk, field crew shall contact the PM and HSM.

5 Hazards and Controls

(See People and Places Solutions Work Instruction IB-HS-WI-0101-IB, P&PS Risk Assessment and Safety System of Work)

Safe work practices and hazard control measures to reduce or eliminate potential hazards as identified in Table 4-1 are stated in the Handbook, Sections 7-10, the associated Jacobs procedure, Work Instruction, or Guideline, and/or are addressed in project-specific AHAs. Any additional project-specific control measures, or those hazards requiring additional emphasis, are identified in the following sections.

Always consult the appropriate procedures or work instruction referenced in the hazard sections to ensure all requirements are implemented. All employees and subcontractors must remain aware of the hazards affecting them regardless of who is responsible for controlling the hazards. Jacobs employees and subcontractors who do not understand any of these provisions should contact the RHSM for clarification.

A POWRA (either a Safe Plan of Action or PTSP) shall be performed at the start of each shift or when conditions significantly change. Implement the StepBack process throughout the duration of the task.

5.1 General Hazards and Controls

5.1.1 Driving Safety

Follow the guidelines below when operating a vehicle:

- **Note: Schlumberger requires that vehicles are backed into parking areas or use pull-through spots to eliminate property damage and facility emergency escape.**
- All vehicles have blind spots to the side and the rear.
- **Backing up — safe practices:**
    - Walk around your vehicle prior to moving
    - Try to position your vehicle so that you don't have to back up.
    - Back into the space if possible when you're parking.
    - Back to the left if possible so that you can see objects on the driver's side.
    - Have a spotter guide your vehicle when you're backing up

Get
Out
And
Look

- Refrain from using a cellular phone or GPS while driving. Pull completely off the road in an area with a solid shoulder, put the vehicle in park and turn on flashers before talking on a cellular phone, looking at maps or GPS systems and performing paper work; Stay in the vehicle;
- Never operate a personal digital assistant (PDA), or other device with e-mail, internet, or text messaging function while driving a vehicle;
- Obey speed limits; be aware of blind spots or other hazards associated with low visibility. Practice defensive driving techniques, such as leaving plenty of room between your vehicle and the one ahead of you;
- Always maintain your focus and continuously scanning for hazards, e.g., debris on the road, trucks hauling rock, unsecure loads, drunk, and drowsy or aggressive drivers to avoid possible accidents or your vehicle be struck by air borne objects (e.g., rocks). Maintain a safe following distance of 1 car length for

every 10 mph of speed. Increase this distance to 300 feet if you are following a truck that is hauling rock or a similar loose material. Double the following distance in inclement weather.

- Do no drive while drowsy. Drowsiness can occur at any time, but is most likely after 18 hours or more without sleep;
- Do not swerve to avoid hitting biological resources, but instead use steady braking to try to stop short of hitting the biological resource.
- Maintain focus on driving. Eating, drinking, smoking, adjusting controls can divert attention from the road. Take the time to park and perform these tasks when parked rather than while driving; and
- Ensure vehicle drivers are familiar with the safe operation of vehicles of the type and size to be operated. Large vehicles such as full size vans and pick-ups have different vision challenges and handling characteristics than smaller vehicles.

5.1.2 Fatigue and Journey Management

Managing fatigue and the journey to remote locations is of concern. When travel takes longer than expected due to conditions that require slow speeds, it can make a long day longer. JACOBS has prepared a Journey Management Process, attached to this HSP, to mitigate hazards associated with travel.

In addition, workers need to consciously assess themselves as to their personal "fitness for duty" for completing field work during the day. Terrain during this field effort can be demanding and may take much focus and effort. A short checklist is included as an attachment to the HSP that asks simple questions to engage the worker and to help them decide when to keep working and when not to and should be completed twice a day—once before field work, and once after lunch.

As a rule of thumb, field work shall not be scheduled for more than 10 hours a day and workers shall not be conducting field work before dawn or after dusk. Make sure you leave plenty of time when on foot or on UTV to get back to the field vehicle before it gets dark. Work days should not exceed 12 hours per day when commute time is added in. If work hours are exceeding these times, contact the PM and RHSM. Additional fatigue management measures may be required.

See also the Extended Work Hours and Fatigue Management section of the Private Client Sector HSE Handbook for fatigue information.

Definition of Fatigue

Fatigue is defined as a state of being tired. It can be caused by long hours of work, long hours of physical or mental activity, inadequate rest, excessive stress, or combinations of these factors. The signs, symptoms, and affect fatigue has on workers varies from one person to the next, however fatigue may affect the individual worker's ability to perform mental and physical tasks, including driving and working with tool and equipment. The resultant fatigue can lead to any of the following hazardous conditions, effects, or behaviors:

- Inability to see properly;
- Slower reflexes and reactions;
- Micro sleeps (up to 60 seconds where the brain goes to sleep and worker blacks out no matter what they are doing);
- Automatic behavior (where worker does routine tasks but is not having any conscious thoughts);
- Inability to make good decisions or plans;
- Inability to solve problems;
- Inability to concentrate, including wandering thoughts;
- Decreased alertness and watchfulness;
- Inability to remember things just done, seen, or heard;
- Inability to notice things the worker usually would notice;
- More mistakes than usual;

- Failure to respond to changes in surroundings or situation;
- Poor logic and judgment, including taking risks the worker usually would not take;
- Inability to respond quickly or correctly to changes;
- Inability to communicate well;
- Inability to handle stress;
- Moodiness (example -irritable, restlessness, depression, giddiness, grouchiness, and impatience).

All JACOBS workers, supervisors, and management by way of this HSP, will be trained to recognize and respond to fatigue issues at the workplace. It is the responsibility of the supervisor to make corresponding changes to work requirements if fatigue impairment signs are evident. All concerns should be communicated to management and corresponding changes should be documented for review and follow-up.

Responsibilities of Management

- To ensure fatigue management is implemented throughout the project;
- Ensure crews are strategically positioned for work the following day;
- Communicate expectations to the workers;
- Monitor the effects of extended work hours;
- Monitor expected weather conditions for suitability of travel;
- Support workers who are experiencing concerns with fatigue;
- Investigate any problems and/or concerns;
- Review the HSP.

Responsibilities of Supervisors

- Scheduling of work and rest days;
- Ensure all crewmembers understand signs and symptoms of fatigue;
- Conduct safety meetings discussing fatigue management;
- Solicit short-term help to minimize the need for extended hours;
- Ensure tasks are performed in safe and healthy manner;
- Be aware of the possible risks associated with extended hours and/or consecutive days of work;
- Give workers as much notice as possible if extended hours are anticipated;
- Account for workers returning from sickness, absences and/or modified work;
- In conjunction with workers, identify health problems which may affect a workers ability to work extended hours i.e. diabetes;
- Consider travel time to and from work;
- Observe and record how individuals respond to extended hours;
- Recognize individual and crew fatigue;
- Get feedback from individual crewmembers and the crew as a whole;
- Assess and control hazards and risks and take prompt action if a risk develops;
- Relay information to and from management & workers;
- Report any FMP problems, concerns and/or issues.

Responsibilities of Workers

- Actively participate in fatigue management training by way of this HSP;
- Take short and frequent breaks;
- Recognize symptoms of fatigue;
- Promptly report any fatigue related concerns;
- Report any individual medical or personal situations, which may have an effect on fatigue;
- To get proper rest during time off;
- Identify personal stress and seek assistance if required.
- Rotate and perform various functions of short duration during extended hours;
- Perform complex tasks earlier in the shift, if possible.

5.1.3 Inclement Weather

Sudden inclement weather can rapidly encroach upon field personnel. Preparedness and caution are the best defenses. Field crew members performing work outdoors should carry clothing appropriate for inclement weather. Personnel are to take heed of the weather forecast for the day and pay attention for signs of changing weather that indicate an impending storm. Signs include towering thunderheads, darkening skies, or a sudden increase in wind. If stormy weather ensues, field personnel should discontinue work and seek shelter until the storm has passed.

5.1.3.1 Lightning

Lightning can strike more than 10 miles away from the center of a thunderstorm - well beyond the audible range of thunder. Therefore, if you hear thunder, you're already within striking range of a storm and should seek shelter immediately, especially if in an open area.

Protective measures during a lightning storm include seeking shelter; avoiding projecting above the surrounding landscape (don't stand on a hilltop—seek low areas); staying away from open water, metal equipment, railroad tracks, wire fences, and metal pipes; and positioning people several yards apart. Some other general precautions include:

- Avoid close contact with others. Spread out at least 50 feet apart in order to minimize the chance of everyone in a group being struck.
- Know where to go and how long it will take to get there. If possible, take refuge in a large building or vehicle. Do not go into a shed in an open area;
- With no other options, use the field vehicle or take shelter under a group of shorter trees among larger trees. A thick forest is far better than a lone tree or a small group of trees. Do not go under a large tree that is standing alone. Likewise, avoid poles, antennae, and towers;
- If the area is wide open, go to a valley or ravine, but be aware of flash flooding;
- If you are caught in a level open area during an electrical storm and you feel your hair stand on end, drop to your knees, bend forward and put your hands on your knees or crouch. The idea is to make yourself less vulnerable by being as low to the ground as possible and taking up as little ground space as possible. Lying down is dangerous, since the wet earth can conduct electricity. Do not touch the ground with your hands; and
- Do not use telephones during electrical storms, except in the case of emergency.

Remember that lightning may strike several miles from the parent cloud, so work should be stopped and restarted accordingly. Seek refuge when THUNDER sounds, regardless of lightening flash; and do not resume activity until 30 minutes after the last THUNDER clap. When you hear THUNDER, look for shelter.

5.1.3.2 Flash Flooding

Flash flooding is a result of heavy localized rainfall such as that from slow moving intense thunderstorms. Flash floods often result from small creeks and streams overflowing during heavy rainfall. These floods often become raging torrents of water which rip through river beds, city streets, and valleys or canyons, sweeping everything with them. Flash Flooding usually occurs within 6 hours of a heavy rain event.

- In hilly or mountainous terrain, flash floods can strike with little or no advance warning. Distant rain may be channeled into gullies and ravines, turning a quiet stream into a rampaging torrent in minutes. Never set up base camp or park on low ground next to streams.
- Do not cross flowing stream on foot where water is above your ankles.
- If you are driving, don't try to cross water-filled areas of unknown depths. If your vehicle stalls, abandon it immediately and go to higher ground. Rapidly rising water may sweep the vehicle and its occupants away. Many deaths have been caused by attempts to move stalled vehicles.

- Don't try to outrace a flood on foot. If you see or hear it coming, move to higher ground immediately.
- Be familiar with the land features and watch for drainage ditches or small streams.
- Stay tuned to weather forecasts and NOAA Weather Radio for the latest statements, watches and warnings concerning heavy rain and flash flooding in your area. The National Weather Service will issue a Flash Flood Watch when heavy rains may result in flash flooding in a specific area. In this case you should be alert and prepare for the possibility of a flood emergency which will require immediate action. A Flash Flood Warning will be issued when flash flooding is occurring or is imminent in a specified area. If your locale is placed under a warning, you should move to safe ground immediately.

5.1.3.3 Windy Conditions

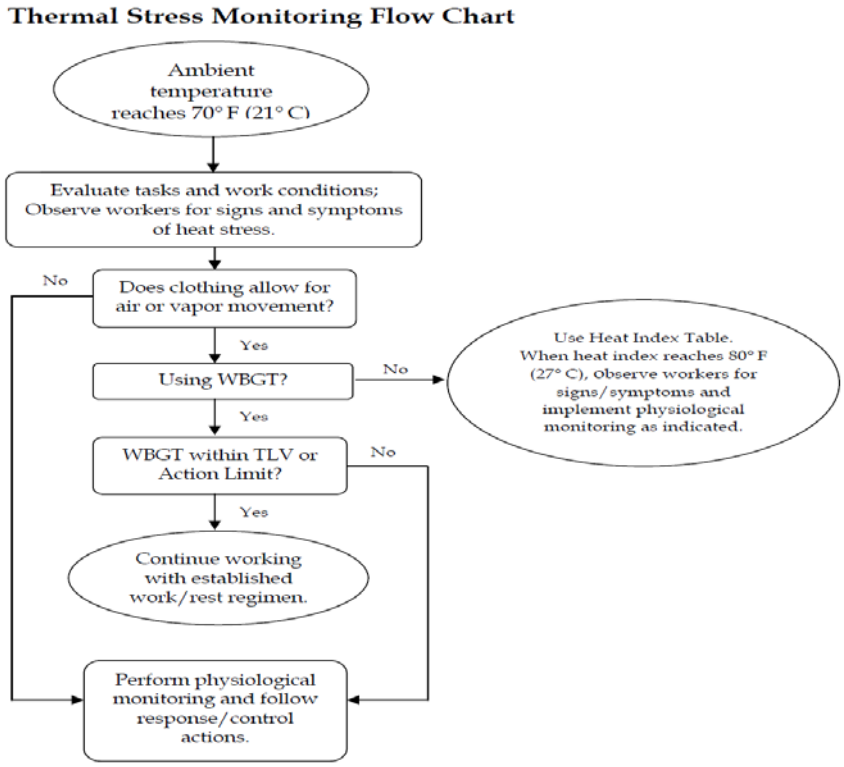
High winds can cause unsafe conditions, and activities should be halted until wind dies down. High winds can also knock over trees, so walking through forested areas during high-wind situations should be avoided. If winds increase, seek shelter or evacuate the area. Proper body protection should be worn in case the winds hit suddenly, because body temperature can decrease rapidly. If wind kicks up potentially impacted soils at claim sites, suspend work and move upwind. Do not commence work unless wind is not causing dust to be airborne.

5.1.3.4 Winter Weather

Work will not commence if winter weather is forecasted. Contact the PM.

5.2 Heat Stress Monitoring Flow Chart

Use the flow chart below and refer to the applicable protocol in Section 9 of the Handbook for heat stress monitoring.



- Heat stress monitoring must be instituted at 80F and the team must utilize the "Heat Stress Physiological Monitoring Form" in Attachment 4, to track breaks, fluid intake, pulse and rest in shade or AC.

- Each JACOBS employee and subcontractor must have and utilize the following equipment and additional items of PPE to reduce heat stress:
    - Personal ice chest, ice, water and electrolyte replacement fluids
    - Personal hydration pack (while hiking) (Note: Packs used to carry supplies, equipment and hydration bladders must have 2 shoulder straps and a hip belt)
    - Water mister bottle
    - Cooling neck bandana with gel
    - Wide brim hard hat with extension or wide brim hat
    - Neck capes
    - Lightweight long sleeve shirts

5.3 Heat Stress Prevention and Precautions

- Drink 16 ounces of water before beginning work. Try to maintain water at 50ºFahrenheit (10 degrees Celsius [C]) to 60ºFahrenheit (F) (15.6 degrees C). This can be accomplished by filling up "hydration packs" or other water containers with ice and filling the void with cold water. Have a chest of ice for keeping water cool (and can also be used for first aid treatment). Under severe conditions, drink 1 to 2 cups every 20 minutes, for a total of 1 to 2 gallons (7.5 liters) per day. Remind employees to drink water throughout their work shift.
- Most of the time water is the best hydration source; however, certain situations may contribute to electrolyte losses, in which case proper replacement becomes important. Electrolytes are lost from the body through sweat. Sodium and potassium are lost in the greatest amounts via sweat, while magnesium and chloride are lost in only small amounts. The more you sweat, the more electrolytes you may be losing. If you sweat a lot and/or you seem to be caked with salt, you're losing a fair amount of electrolytes and need to pay special attention to replacing them. Water is not necessarily always sufficient to ensure hydration. CH2M's occupational medicine provider recommends a mixture of 50:50 water: electrolyte fluids. The 50:50 can be achieved either by alternating of mixing electrolyte fluid and water
- Sports drinks contain supplement electrolyte replacement, but the usual foods we eat contain far more electrolytes than sports drinks. For example, a medium banana contains about 450 mg of potassium, whereas Gatorade provides 30 mg per 8-ounce serving. After a long field day, a meal consisting of 8 ounces of yogurt and a can of chicken noodle soup would adequately replace lost electrolytes (potassium and sodium). If using foods for electrolyte replacement, it's important to continue to hydrate completely.
- Begin physiological monitoring for heat stress when temperatures reach 80 degrees Fahrenheit, even if that means simply taking a baseline measurement.
- Engage occupational health (ICE) to provide guidance when symptoms are observed; occupational health should be engaged whenever possible in decisions to seek medical assistance.
- If an employee's condition is in question, do not have them operate a vehicle or be alone. These are judgment calls in the field, but generally a person exhibiting heat stress symptoms should not be operating heavy equipment nor alone.

5.4 Cold Stress Monitoring

General

Low ambient temperatures increase the heat lost from the body to the environment by radiation and convection. In cases where the worker is standing on frozen ground, the heat loss is also due to conduction.

Wet skin and clothing, whether because of water or perspiration, may conduct heat away from the body through evaporative heat loss and conduction. Thus, the body cools suddenly when chemical protective clothing is removed if the clothing underneath is perspiration soaked.

Movement of air across the skin reduces the insulating layer of still air just at the skin's surface. Reducing this insulating layer of air increases heat loss by convection.

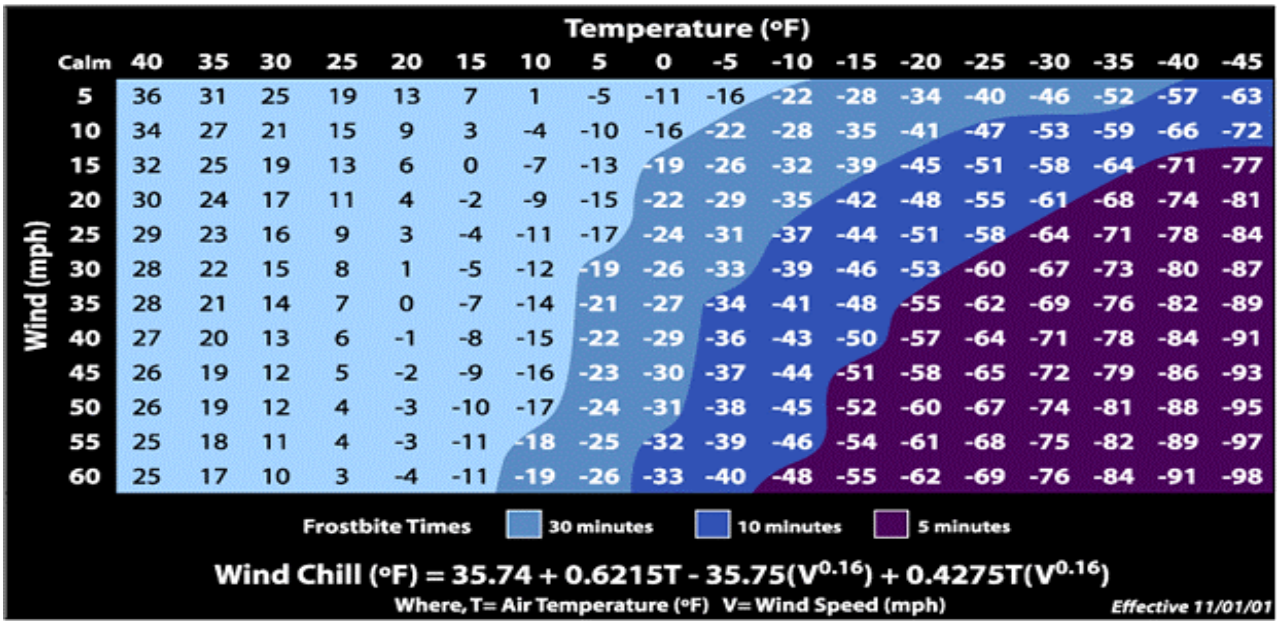
Non-insulating materials in contact or near-contact with the skin, such as boots constructed with a metal toe or shank, conduct heat rapidly away from the body.

Certain common drugs, such as alcohol, caffeine, or nicotine, may exacerbate the effects of cold, especially on the extremities. These chemicals reduce the blood flow to peripheral parts of the body, which are already high-risk areas because of their large surface area to volume ratios. These substances may also aggravate an already hypothermic condition.

Precautions

- Be aware of the symptoms of cold-related disorders, and wear proper, layered clothing for the anticipated fieldwork. Appropriate rain gear is a must in wet weather.
- Consider monitoring the work conditions and adjusting the work schedule using guidelines developed by the U.S. Army (wind-cindex) and the National Safety Council (NSC).
- Wind-CIndex (below) is used to estimate the combined effect of wind and low air temperatures on exposed skin. The wind-cindex does not take into account the body part that is exposed, the level of activity, or the amount or type of clothing worn. For those reasons, it should only be used as a guideline to warn workers when they are in a situation that can cause cold-related illnesses.
- NSC Guidelines for Work and Warm-Up Schedules can be used with the wind-cindex to estimate work and warm-up schedules for fieldwork. The guidelines are not absolute; workers should be monitored for symptoms of cold-related illnesses. If symptoms are not observed, the work duration can be increased.
- Persons who experience initial signs of immersion foot, frostbite, and/or hypothermia should report it immediately to their supervisor/PM to avoid progression of cold-related illness.
- Observe one another for initial signs of cold-related disorders.
- Obtain and review weather forecast – be aware of predicted weather systems along with sudden drops in temperature, increase in winds, and precipitation.

SYMPTOMS AND TREATMENT OF COLD STRESS			
	Immersion (Trench) Foot	**Frostbite**	**Hypothermia**
Signs and Symptoms	Feet discoloured and painful; infection and swelling present.	Blanched, white, waxy skin, but tissue resilient; tissue cold and pale.	Shivering, apathy, sleepiness; rapid drop in body temperature; glassy stare; slow pulse; slow respiration.
Treatment	Seek medical treatment immediately.	Remove victim to a warm place. Re-warm area quickly in warm–but **not** hot–water. Have victim drink warm fluids, but **not** coffee or alcohol. Do not break blisters. Elevate the injured area, and get medical attention.	Remove victim to a warm place. Have victim drink warm fluids, but **not** coffee or alcohol. Get medical attention.



5.5 Physical Hazards and Controls

5.5.1 Infectious Disease/Coronavirus

Coronavirus disease 2019 (COVID-19) is a respiratory illness that can spread rapidly from person to person. Field personnel can potentially be exposed to COVID-19 while mobilizing/demobilizing to and from the project site, while working in areas with ongoing spread of the virus, and while working in close proximity to other field staff that have been previously exposed to the virus.

COVID-19 is thought to spread mainly between people who are in close contact with one another (within about 6 feet) through respiratory droplets produced when an infected person talks, coughs, or sneezes. It also may be possible that a person can get COVID-19 by touching a surface or object that has the virus on it and then touching their own mouth, nose, or possibly their eyes. Symptoms can include, but are not limited to, Fever, Cough, Shortness of breath or difficulty breathing, Chills, Repeated shaking with chills, Muscle pain, Headache, Sore throat, and New loss of taste or smell. The following control measures should be implemented to reduce the risk of contracting, and further spreading of, COVID-19:

- Review and follow Jacobs Global Security Companywide Travel Restriction, Preparedness Pamphlet and FAQ and attached Pandemic Management Strategy and Precautions for COVID-19 Precautions on Field Project Sites.
- Review signs and symptoms of Coronavirus with all field staff. Use CDC guidance document to review COVID-19 awareness information.
- If project team member has specific COVID-19 concerns (e.g. in high risk category, high risk locations), speak with PM and supervisor. Accommodations shall be made by the PM and supervisor.
- If showing signs of COVID-19 (fever, cough, shortness of breath) in CDC guidance (attached); do not report to project site for work. Contact project Safety Liaison, WorkCare, supervisor, PM, HSM and HR.

- Contact personal care physician. WorkCare can be contacted at this link, however they will not diagnose you, but will refer you to your personal physician.

Additional COVID-19 field project control measures:

- Jacobs is requiring that all individuals performing work will wear cloth face coverings when they cannot maintain 6 feet of social distance in public areas or work centers.
- On project sites, where possible, undertake site work such as inspections during quieter times (early mornings, scheduled breaks, and lunch) to reduce interaction with other employees and maintain social distancing of at least 6 ft or more from all persons at all times.
- Where close contact or contact with individuals is unavoidable but critical, the tasks must be risk assessed with the support of an HSE professional (and if necessary, industrial hygienist or medical professional). The principles of prevention must be applied, and if necessary, as a last resort, PPE must be provided such as disposable coveralls, safety glasses, face-masks, nitrile gloves, and any other protective clothing deemed necessary. However, where work presents a risk that cannot be mitigated, the work shall not continue. If there is a need to provide the disposable coveralls and nitrile gloves, ensure an appropriate disposal receptacle is provided. Garbage must be double bagged.
- Work in the smallest groups possible (e.g., alone where it makes sense for low-risk activities while staying in communication). Consider keeping similar teams together on shift or in working groups. This will limit the chance of cross-infection across multiple groups and limiting contact across groups can help reduce risk of large percentage of staff needing to be quarantined.
- Monitor local public health agencies communications. Follow all local agency guidance and restrictions.
- Ensure Field Team Lead and Safety Liaison has cell phone number of all field staff for communication to project teams.
- Refrain from person to person contact (e.g., handshakes, high-fives, etc.). Refrain from sharing personal items such as pens, glasses/mugs, cell phone, etc.
- Identify project specific telework opportunities where feasible (e.g. work from hotel room).
- Frequent hand washing is required. Hand wash facilities are typically required at temporary job locations (e.g. at port-a-potty at field office). If a handwashing sink is not feasible (e.g. mobile staff), use disinfectant hand wipes.
- Provide hand sanitizer at all field project locations.
- Use disinfectant to frequently clean shared surfaces including, but not limited to rental cars; hotel room touch points; temporary office trailer touch points (e.g. door handles, workstations).
- If entering residential project site locations – ask occupants if they have signs of illness prior to entry. Do not enter residential locations with occupants that have signs/symptoms.
- Note: All references are frequently updated. Check Jacobs and CDC COVID-19 webpages frequently for updates.

See Jacobs Novel Coronavirus Preparedness Pamphlet and the Center for Disease Control Guidance Document, attached to project safety plan, for further precautions and controls measures for COVID-19. If showing signs of COVID-19, do not report to project site for work. Contact the project RHSM with questions, and immediately report any suspicious symptoms to your supervisor, PM, and contact the occupational nurse at 1-888-449-7787.

6 Hazard Communication

As indicated in Section 7 of the Handbook, under "Hazard Communication," the hazard communication (HazCom) Liaison (the SL or qualified designee) must perform the following (additional HazCom duties are outlined in the Handbook):

- Complete an inventory of chemicals brought on site by JACOBS using the chemical inventory form included as an attachment to this HSP;
- Confirm that an inventory of chemicals brought on site by JACOBS subcontractors is available;
- Before or as the chemicals arrive on site, obtain a Safety Data Sheet (SDS) for each hazardous chemical and include on the chemical inventory sheet (attached to this HSP) and add the SDS to the SDS attachment section of this HSP;
- Give employees required chemical-specific HazCom training using the chemical-specific training form included as an attachment to this HSP.

7 Contaminants of Concern

The table below summarizes the potential contaminants of concern (COC) and their occupational exposure limit and signs and symptoms of exposure. The table also includes the maximum concentration of each COC and the associated location and media that was sampled (groundwater, soil boring, surface soil). These concentrations were used to determine engineering and administrative controls described in the "Project-Specific Hazard Controls" section of this HSP, as well as PPE and site monitoring requirements.

Table 7-1. Contaminants of Concern

Contaminant	Location and Maximum[a] Concentration	Exposure Limit[b]	IDLH[c]	Symptoms and Effects of Exposure	PIP[d] (eV)
Benzene	GW: UK SB: UK	0.5 ppm	500 Ca	Eye, nose, skin, and respiratory irritation; headache; nausea; dermatitis; fatigue; giddiness; staggered gait; bone marrow depression	9.24
Diesel Range Organics	GW: UK SB: UK	100 mg/m^3 (REL)	NL	Primary system effect is CHS depression. Inhalation of vapors may cause nausea, confusion, drowsiness, convulsions, and coma. Liquid may cause skin and eye irritation.	UK
Ethyl Benzene	GW: UK SB: UK	100 ppm	800	Eye, skin, and mucous membrane irritation; headache; dermatitis; narcotic; coma	8.76
PNAs (Limits as Coal Tar Pitch)	GW: UK SB: UK	0.2 mg/m^3	80 Ca	Dermatitis and bronchitis	UK
Toluene	GW: UK SB: UK	20 ppm	500	Eye and nose irritation, fatigue, weakness, confusion, dizziness, headache, dilated pupils, excessive tearing, nervousness, muscle fatigue, paresthesia, dermatitis, liver and kidney damage	8.82
Xylene	GW: UK SB: UK	100 ppm	900 ppm	irritation eyes, skin, nose, throat; dizziness, excitement, drowsiness, loss of coordination, staggering gait; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis	8,56

Notes:
[a]Specify sample-designation and media: SB (Soil Boring), A (Air), D (Drums), GW (Groundwater), L (Lagoon), TK (Tank), SS (Surface Soil), SL (Sludge), SW (Surface Water).
[b]Appropriate value of permissible exposure limit (PEL), recommended exposure limit (REL), or threshold limit value (TLV) listed.
[c]IDLH = immediately dangerous to life and health (units are the same as specified "Exposure Limit" units for that contaminant); NL = No limit found in reference materials; CA = Potential occupational carcinogen.
[d]PIP = photoionization potential; NA = Not applicable; UK = Unknown.

eV = electron volt
mg/kg = milligram per kilogram
mg/m^3 = milligrams per cubic meter
µg/m^3 = micrograms per cubic meter

Table 7-1. Contaminants of Concern

Potential Routes of Exposure		
Dermal: Contact with contaminated media. This route of exposure is minimized through use of engineering controls, administrative controls and proper use of PPE.	Inhalation: Vapors and contaminated particulates. This route of exposure is minimized through use of engineering controls, administrative controls and proper use of respiratory protection when other forms of control do not reduce the potential for exposure.	Other: Inadvertent ingestion of contaminated media. This route should not present a concern if good hygiene practices are followed (e.g., wash hands and face before drinking or smoking).

8 Site Monitoring

(Reference Exposure Monitoring for Airborne Chemical Hazards)

For each task listed in the table below, perform the associated monitoring ensuring the equipment is calibrated daily according to the manufacturer's recommendations. Use the Daily Site Monitoring Form (or equivalent) to document the calibration and the readings taken. Retain area monitoring readings with project records.

Exposure records (breathing zone and personal air sampling) must be preserved for the duration of employment plus thirty years. Copies of all project exposure records (e.g., copies of Daily Site Monitoring form or field logbook pages where breathing zone readings are recorded along with associated calibration) shall be sent to the Sector Safety Program Assistant (SPA) for retention and also maintained in the project files.

Subcontractors are responsible for monitoring and performing integrated personal sampling for their employees as documented in their HSP or, if permitted, according to the table below.

8.1 Direct Reading Monitoring Specifications

Table 8-1. Direct Reading Monitoring Specifications

Instrument	Tasks	Action Levels[a]	Action to be Taken when Action Level Reached	Frequency[b]	Calibration
Toxic Gas Monitor: MultiRAE Plus with 11.6 eV lamp (VOCs, O_2, LEL)	Groundwater Sampling; Drilling	1 ppm 1-5 ppm >5 ppm	Level D Level C Stop work, let the area ventilate	Initially at well head and periodically during tasks	Daily
		0-10% : 10-25% LEL: >25% LEL:	No explosion hazard Potential explosion hazard Explosion hazard; evacuate or vent		
		20.9%[c] O_2: <19.5%[c] >23.5 %	Normal O_2 O_2 deficient; False LEL reading O_2 rich; Explosion hazard; evacuate or vent		
Detector Tube: Synsidine Benzene specific 118 SD 0.1 – 75 ppm range	Drilling and Sampling	<1 ppm 1-5 ppm >5 ppm	Level D Level C (must be approved by RHSM) Level B (must be approved by RHSM)	Initially and periodically when PID >1 ppm	Not applicable

[a]Action levels apply to sustained breathing-zone measurements above background.

[b]The exact frequency of monitoring depends on field conditions and is to be determined by the SC; generally, every 5 to 15 minutes if acceptable; more frequently may be appropriate.

[c]If the measured percent of O_2 is less than 10, an accurate LEL reading will not be obtained. Percent LEL and percent O_2 action levels apply only to ambient working atmospheres, and not to confined-space entry. More-stringent percent LEL and O_2 action levels are required for confined-space entry.

[d]Noise monitoring and audiometric testing also required.

9 Training and Competency

9.1 Jacobs Personnel Training

The following training is required for Jacobs personnel working onsite. Copies of training will either be available onsite, or readily available from the Jacobs Learning Management System (LMS) training database. The Project Manager shall ensure that all employees, including subcontractors/subconsultants have the correct training, skills and experience to undertake the tasks they are engaged on. All project staff will have the necessary licences to drive vehicles, operate equipment and undertake specialised work as required by law.

Jacobs Required Worker Training

Required JACOBS Worker Training	JACOBS Task or Equipment-Specific Training (if performing task)
☒ 40-hour HAZWOPER Training	☒ 8-hour HAZWOPER Refresher
☒ JACOBS HSP Training	☒ JACOBS AHAs
☒ JACOBS HSE Handbook	☒ First Aid/CPR/BBP
☒ At least one SC-HW (refer to worker category for all applicable training needed)	☐ Other (specify):
☐ Other (specify)	
Project-Specific Required (VO) Training - personnel must check their training records on the HandS database to make sure that the following training courses on the VO are current	
☒ Behavior Based-Loss Prevention System (BBLPS) Training (take one time, no expiration)	☒ Hand Safety Training (take one time, no expiration)
☒ Blood Borne Pathogens (annual requirement)	☒ Manual Lifting Training (take one time, no expiration)
☐ Drum Handling Training (take one time, no expiration)	☒ Noise Training (annual requirement)
☒ Fire Extinguisher Training (annual requirement)	☒ PPE (take one time, no expiration)
☒ Waste Management (annual requirement)	☒ Safe Behavior Observations (take one time, no expiration)

9.2 Subcontractor Worker Training

The following training is required for Subcontractor personnel working onsite. Copies of training shall be available onsite.

Required Subcontractor Worker Training	Subcontractor Task or Equipment-Specific Training (required if performing this work)
☒ 40-hour HAZWOPER Training	☒ 8-hour HAZWOPER Refresher
☒ JACOBS HSP Training	☒ Subcontractor HSP
☒ Subcontractor AHAs	☒ JACOBS HSE Handbook
☒ Asbestos certifications (abatement and oversight subs)	☒ First Aid/CPR/BBP
☐ Other:	

10 Medical Surveillance and Qualification

(Reference Medical Surveillance, Section 13 of the Handbook)

The following medical surveillance is required for JACOBS and subcontractor personnel working onsite. Copies of physician's medical opinion will either be available onsite, or for JACOBS staff, readily available from the JACOBS HandS training database system. Refer to Section 13 of the Handbook for a description of HAZWOPER, respirator user, and hearing conservation medical surveillance.

General Required Medical Surveillance	Job or Activity-Specific Medical Surveillance (required if performing this work)
☒ HAZWOPER Medical Clearance	☒ Asbestos physicals (subcontractors)
☒ Respirator Medical Clearance	☐ Baseline Blood Lead
Personnel or Tasks Not Requiring Medical Surveillance, When Outside Exclusion Zones	
Access Agreement and Notifications	Brief on hazards, limits of access, and emergency procedures.
Site Walkthrough	Post areas of contamination as appropriate.
Daily mobilization/demobilization	Perform air sampling/monitoring as specified in this HSP.
Preparing samples for shipment to laboratory	
Utility Clearance and Surveying	

11 Site-Control Plan

(Reference Hazardous Waste Operations, Section 14 of the Handbook)

Site control is established to prevent the spread of contamination throughout the site and to ensure that only authorized individuals are permitted into potentially hazardous areas. Task-specific control measures are listed below. **Use of the Buddy System will be implemented unless a Working Alone protocol has been established and approved as indicated in Sections 5 and 6 above.**

Site Control for General Work Area(s)			
☒ Perimeter fencing	Location:	☐ Barricades	Location:
☒ Signage	Location: label all drums	☒ Other: traffic cones	Location: Identify EZ/CRZ
☐ Traffic control devices	Location:	☐ Other:	Location:

Location	Site Control Procedure (discuss important elements such as signs, barricades, briefings, qualifications, required supplies and equipment, sign-in/out logs, etc.)
Support Zone	NA
Contamination Reduction Zone	Traffic Cones and caution tape
Exclusion Zone	Traffic Cones and caution tape

12 Personal Protective Equipment

Personal Protective Equipment (PPE) must be worn by employees when actual or potential hazards exist and engineering controls or administrative practices cannot adequately control those hazards.

A PPE assessment has been conducted by the HSM based on project tasks (see PPE specifications below). Verification and certification of assigned PPE by task is completed by the HSM that approved this plan. Refer to *IB-HS-WI-0310-IB PPE Minimum Standards*) for requirements on the use, care, and maintenance of PPE.

The table below outlines PPE to be used according to task based on project-specific hazard assessment. If a task other than the tasks described in this table needs to be performed, contact the HSM so this table can be updated.

Table 12-1. Personal Protective Equipment

Project-Specific Personal Protective Equipment Requirements[a]				
Task	**Level**	**Body**	**Head**	**Respirator[b]**
Site Walkthrough; Surveying; Ground Maintenance	D	☒ Work clothes (sleeved shirt, long pants) ☐ Cotton Coveralls ☒ Safety-toed Boots ☐ Gloves (leather) ☒ ANSI/ISEA 107-2010 high visibility vest ☐ Other: (specify)	☒ ANSI Z89.1 Hardhat[c] ☒ ANSI Z87.1 Safety glasses ☒ Hearing protection[d] – ground maintenance	None required
Sampling	Modified D	☒ Work clothes ☐ Cotton coveralls ☒ ANSI/ISEA visibility vest ☒ Safety-toed boots ☒ Inner surgical-style nitrile ☒ Outer chemical-resistant nitrile gloves. ☒ PFD while working from vessel	☒ ANSI Z89.1 Hardhat[c] ☒ ANSI Z87.1 Safety glasses ☒ Hearing protection[d]	None required unless indicated by dust monitoring; must discuss with HSM
Drum sampling and IDW Management	Modified D with splash protection	☒ Work clothes ☐ Cotton coveralls ☒ ANSI/ISEA high visibility vest ☒ Safety-toed boots ☐ Safety-toed rubber boots (can be deconned in a boot wash) ☐ Outer boot covers ☒ Outer chemical-resistant nitrile gloves. ☒ Chemical protective suit when there will be contact with COC	☒ ANSI Z89.1 Hardhat[c] ☒ ANSI Z87.1 Safety glasses ☒ Hearing protection[d] ☒ Face shield – splash protection	None required unless indicated by dust monitoring; must discuss with HSM

Table 12-1. Personal Protective Equipment

Project-Specific Personal Protective Equipment Requirements[a]				
Task	**Level**	**Body**	**Head**	**Respirator[b]**
Tick and/or poisonous plant infested area		Use clothing treated with insect repellent and/or Tyvek coveralls that are taped at the ankles and wrists with double sided tape. (NOTE: The use of Tyvek is for biological hazards are only required, if there are biological hazards present that require this PPE.)		

Reasons for Upgrading or Downgrading Level of Protection (with approval of the RHSM)	
Upgrade[f]	**Downgrade**
• Request from individual performing tasks. • Change in work tasks that will increase contact or potential contact with hazardous materials. • Occurrence or likely occurrence of gas or vapor emission. • Known or suspected presence of dermal hazards. • Instrument action levels in the "Site Monitoring" section exceeded.	• New information indicating that situation is less hazardous than originally thought. • Change in site conditions that decrease the hazard. • Change in work task that will reduce contact with hazardous materials.

[a]Modifications are as indicated. CH2M will provide PPE only to CH2M employees.

[b]No facial hair that would interfere with respirator fit is permitted.

[c]Hardhat and splash-shield areas are to be determined by the SC.

[d]Ear protection should be worn when conversations cannot be held at distances of 3 feet (1 meter) or less without shouting.

[e]See cartridge change-out schedule.

[f]Performing a task that requires an upgrade to a higher level of protection (e.g., Level D to Level C) is permitted only when the PPE requirements have been approved by the RHSM, and an SC qualified at that level is present.

12.1 Respiratory Protection

Reference *Respiratory Protection, HSE Handbook*

Implement the following when using respiratory protection:

- Respirator users must have completed appropriate respirator training within the past 12 months. Level C training is required for air-purifying respirators (APR) use and Level B training is required for supplied-air respirators (SAR) and self-contained breathing apparatus (SCBA) use. Specific training is required for the use of powered air-purifying respirators (PAPR);
- Respirator users must complete the respirator medical monitoring protocol and been approved for the specific type of respirator to be used;
- Tight-fitting face piece respirator (negative or positive pressure) users must have passed an appropriate fit test within past 12 months;
- Respirator use shall be limited to those activities identified in this plan. If site conditions change that alters the effectiveness of the specified respiratory protection, the RHSM shall be notified to amend the written plan;
- Tight-fitting face piece respirator users shall be clean-shaven and shall perform a user seal check before each use;

- Canisters/cartridges shall be replaced according to the change-out schedule specified in this plan. Respirator users shall notify the SC or RHSM of any detection of vapor or gas breakthrough. The SC shall report any breakthrough events to the RHSM for schedule upgrade;
- Respirators in regular use shall be inspected before each use and during cleaning;
- Respirators in regular use shall be cleaned and disinfected as often as necessary to ensure they are maintained in a clean and sanitary condition;
- Respirators shall be properly stored to protect against contamination and deformation;
- Field repair of respirators shall be limited to routine maintenance. Defective respirators shall be removed from service;
- When breathing air is supplied by cylinder or compressor, the SC or RHSM shall verify the air meets Grade D air specifications; and
- The SC or designee shall complete the Self-Assessment Checklist – Respiratory Protection included in as attachment to this plan to verify compliance with CH2M HILL's respiratory protection program.

Table 10-2. Respirator Change-Out Schedule

Contaminant	Change-Out Schedule
Benzene	End-of-service life or end of shift (whichever occurs first)

13 Decontamination

(Reference CH2M SOP HSE-218, Hazardous Waste Operations, and Section 15 of the Handbook)

Refer to the Handbook, Section 15, "Decontamination," for a complete description of decontamination activities and diagrams of typical decontamination areas. Decontamination areas will be established for work in potentially contaminated areas to prevent the spread of contamination. Decontamination areas should be located upwind of the exclusion zone where possible and should consider any adjacent or nearby projects and personnel. No eating, drinking, or smoking is permitted in contaminated areas and in exclusion or decontamination zones.

All contaminated material generated through the personnel and equipment decontamination processes (e.g., contaminated disposable items, gross debris, liquids, sludges) will be properly containerized and labeled, stored at a secure location, and disposed in accordance with project plans.

Type of Decon	Activity	Equipment	Process/Protocol
Personnel	☒ Oversight	☐ Tubs/brushes for boot/glove wash ☒ Solids disposal bag or drum (used PPE) ☒ Liquid disposal drum (decon water)	☐ Boot wash/rinse ☒ PPE disposal (no decon) ☒ PPE waste area identified ☐ Other: _____
Equipment	☒ Oversight	☒ Table for equipment decon/staging ☐ Pressure Washer ☒ PPE used during decon ☒ Decon supplies (brushes, brooms) ☒ Containers/method to capture decon water and or sludge	☐ Equipment wiped/cleaned before leaving CRZ ☐ Vehicle tires dry deconned prior to leaving site ☐ Vehicle tires washed prior to leaving site ☒ Sampling equipment decon supplies

13.1 Decontamination During Medical Emergencies

Standard personnel decontamination practices will be followed whenever possible. For emergency life saving first aid and/or medical treatment, normal decontamination procedures may need to be abbreviated or omitted. In this situation, site personnel shall accompany contaminated victims to advise emergency response personnel on potential contamination present and proper decontamination procedures.

Outer garments may be removed if they do not cause delays, interfere with treatment, or aggravate the problem. Protective clothing can be cut away. If the outer garments cannot be safely removed, a plastic barrier between the individual and clean surfaces should be used to help prevent contaminating the inside of ambulances or medical personnel. Outer garments can then be removed at the medical facility.

14 HSE Program

14.1 Permits to Work

(See Jacobs Global Work Instruction JJ-HS-WI-0305-JJ, Safe Work Permits)
Safe work permits are used as a work control process for defined hazardous activities. The use of work permits may be required by clients or as a result of task risk assessment. Safe work permits are mandatory for the following types of operations (others based on client or other requirements may be needed as well):

- Confined Space Entry
- Excavations
- Energized Electrical Work
- LO/TO

14.2 Project Activity Self-Assessment Checklists and Permits

The following self-assessment checklists and permits are required when the task or exposure is possible. The checklists and permits shall be completed by the SL or other JACOBS representative and maintained in project files.

- Biological safety
- Boating Safety
- Hand and Power Tools
- Hazardous Materials Handling
- Heat stress physiological monitoring form
- Manual Lifting
- Personal Protective Equipment

Coordinate work with the project team and client's operations representative (if required) as necessary to ensure that:

A properly filled out work permit is issued and includes relevant supporting information:

- The hazards and limitations at the site are assessed
- All precautions are taken and safe practices followed
- A work area review is conducted prior to signing and authorizing work
- Verify by means of a signature that the work permit has been reviewed and limitations and controls measures understood

Inspect the permit and tasks to ensure the permit requirements are still being met. Immediately stop work and notify supervision if any changes in job conditions or hazards take place. Ensure the permit is closed out where required.

14.3 Site Access and Control

- Security clearance or security pass requirements – a base pass or government escort is required.
- Vehicle inspection requirements – All vehicles subject to inspection at any time.
- Policy regarding contraband or other devices (e.g., mobile phones, cameras, computers, etc.) - Confirm with base before each site visit

14.4 Fatigue Management Plan

A normal work shift is considered to be eight consecutive hours during the day, five days a week, with at least an eight-hour rest period. Any shift that incorporates more continuous hours, requires more consecutive days of work, or requires work during the evening should be considered extended or unusual.

Extended or unusual work shifts are typically more stressful for workers physically, mentally, and emotionally, and can lead to increased fatigue, stress, and lack of concentration. These effects can lead to an increased risk of worker error, incidents, and injuries.

If field work exceeds either criteria listed below, you must consult with your PM and HSM for approval of the extended hours/days, and fatigue management requirements must be addressed in this plan or a project-specific Fatigue Management Plan (FMP):

- Planning field work or vehicle operation for more than 10 hours per day, up to 14 hours total including commute time.

  Note: Working over 12 field hours in one day should be for emergency situations only and would require Project Manager and RHSM approval.
- Working more than 10 consecutive days.

14.5 Security Measures

Describe the security procedures for the site with consideration for:

- Security clearance or security pass requirements – a base pass or government escort is required.
- Vehicle inspection requirements – All vehicles subject to inspection at any time.
- Policy regarding contraband or other devices (e.g., mobile phones, cameras, computers, etc.) - Confirm with base before each site visit

14.6 Traffic Management Plan and Vehicle Safety

NOT APPLICABLE to Jacobs site work.

14.7 Facilities

(See P&PS Procedure, IB-HS-PR-0600-IB, Health and Well Being)

The following facilities and equipment are required and used for safe completion of work:

Emergency Equipment and Supplies	Location
Hand washing basin or hand sanitizer	Field Vehicle
Fire extinguisher (2A:10B:C)	Field Vehicle
First aid kit	Field Vehicle
Eye wash	Field Vehicle
Potable water (ice chest, ice, water and electrolytes; warm fluids during cold weather)	Field Vehicle
Bloodborne-pathogen kit	Field Vehicle
Additional Equipment: cell phone, sun screen, clothing and emergency supplies for extreme weather conditions	Field Vehicle

15 Communication, Consultation & Reporting

15.1 Communication

A primary and backup means of communication for field crews have been established as described below:

Type of Communication	Primary Means	Backup Means
Communication between field crew	☒ Voice ☐ Radio ☐ Phone	☐ Voice ☐ Radio ☒ Phone
Communication with Office crew	☐ Radio ☒ Cell Phone	☐ Radio ☒ Phone
Communication with Fire and Emergency Services	☐ Radio ☒ Cell Phone	☐ Radio ☐ Phone

16 Monitoring

16.1 Operational Project Reviews

HSE performance of the Jacobs project team on projects will be reviewed by the DPEs at Operational Project Reviews (OPRs). Evidence will be required to be presented by the Jacobs PM to demonstrate that:

- A Project HSE plan is in place that is reviewed, approved and current
- Safe systems of work are in place for any field activity
- Competent people are engaged on the Project team
- Competent subcontractors are engaged to carry out work on our behalf
- SORs are being raised
- StepBack is being used effectively
- Any incidents have been reported, investigated and the lessons learned communicated
- Deficiencies and recommendations arising from Project audits by the Corporate HSE Team have been actioned and closed out

16.2 Audits and Inspections

Audits and inspections will be undertaken as determined with the project risk profile (ref) and an audit schedule will be set and monitored.

16.3 BeyondZero Observation (BZO)

(Reference Jacobs Business Management System Work Instruction, JJ-HS-WI-0306-JJ, Beyond Zero Observations (BZO))

BZOs are a tool to document both safe and at-risk observations whether you are in the office or in the field. BZOs are a required element of our BeyondZero Culture of Caring. The project shall attempt to perform and submit at least one BZO per week.

BZOs are a tool to document both safe and at-risk observations whether you are in the office or in the field

- It is a tool that can be used for both a planned or an unplanned observation of behaviors or conditions in the work area
- It's a tool for improving leadership, workforce behaviors, and peer to peer communication
- It's a tool to provide positive reinforcement, correct unsafe behaviors or unsafe conditions
- You can also use the SOR tool to document something you witness outside of work hours that others can learn from

BZOs are a required element of our BeyondZero Culture of Caring. As a general rule, the BZO program will be used in place of the legacy JACOBS Safe Behavior or Work Observation (SBO/SWO) programs.

Performing an BZO is something that everyone should be considering both in the workplace and outside of the workplace as often as possible. The minimum frequency for submitting an BZO is once per week.

Everyone is asked to participate: all office staff, management, Project Managers, supervisors, Safety Coordinators, and field staff whether in an office, travelling, at a project site or anywhere in between.

After you've discussed the observation with the affected parties (see **note*** below), use the BZO app on your phone or tablet, or use your computer to log onto JacobsConnect and enter the SOR into the system. Once

submitted, parts of the BZO cannot be changed, so reach out to your HSSM/EM if you need help entering an Observation. Once submitted, the BZO will be routed to your supervisor (and Project manager if you entered the project number). A feature to this system is you can attach photos.

*** Note**: Entering the correct Worst Potential Severity (WPS) code is important! The WPS code is a way of rating an event based on the likelihood of what could have happened versus what actually happened. **When a WPS of 3, 4, or 5 is indicated, the BZO form is elevated to higher levels of management so please be sure you've notified your HSM, Supervisor, and/or PM of the event prior to submitting an BZO with a WPS of 3 or greater. Likewise, if any follow-up action is needed, regardless of WPS, notify the HSM and/or PM and supervisor.**

Worst Potential Severity Table

WPS	Injury -Illness	Environment	Property Damage
5	Fatality or total permanent disability	Serious offsite impact, significant remediation required	USD$> 3 million
4	Partial disability; life changing; intensive care	Significant offsite impact, some remediation required	USD$ 300K-3 million
3	Urgent treatment, surgery	Release significantly above reportable limit of some local impact	USD$ 30K-300K
2	Medical treatment to prevent deterioration	Release above reportable limit or minor impact	USD$ 3K-30k
1	Simple, immediate treatment	Small release contained onsite and no impact	USD$ less than 3K

How do I complete an BZO?

- **Access Intelex**: Beginning February 17th all Jacobs' employees can access the system through the Intelex portal with Single Sign On (SSO) capability. Additional instructions, including off network access, can be found in the Intelex Getting Started Guide .
- Use the hard copy form attached to this plan.
- BZOs can be chosen by the Center of Excellence (COE) as a winner of the "BZO of the Month."

17 Incident Reporting and Investigation

(See P&PS Work Instruction IB-HS-WI-0400-IB, P&PS Incident Reporting and Investigation)

17.1 Incident Notification

All employees and subcontractors' employees shall immediately report any incident (including "near misses,") in which they are involved or witness to their supervisor.

The Jacobs or Subcontractor supervisor, upon receiving an incident report, shall inform his immediate supervisor and the Jacobs SL (see incident notification flowchart at the end of this section).

The SL shall immediately verbally report the following information to the RHSM and PM by phone and e-mail (an incident reporting form is available as an attachment to this HSE Plan):

- Project Name and Site Manager;
- Date and time of incident;
- Description of incident;
- Extent of known injuries or damage;
- Level of medical attention; and
- Preliminary root cause/corrective actions

If the incident was an environmental permit issue (potential permit non-compliance, other situation that result in a notice of violation) or a spill or release, contact the Project EM immediately so evaluation of reportable quantity requirements and subsequent agency notification is required.

17.2 Drug and Alcohol Testing for Jacobs Employees

Employees are subject to post-incident and reasonable suspicion drug and alcohol testing. The Employee must submit to drug and alcohol testing if the supervisor has a reasonable suspicion, and when any of the following occur:

- Work-related injury in which the Company reasonably believes that drug and/or alcohol use is a contributing factor;
- Injury on or in Company Property/Workplace (to Employee or third parties) involving the Employee's use of heavy machinery as determined by the Company;
- Incident considered to be a serious near-miss injury that occurs in the field or in the office as determined by the Company and where the Company reasonably believes that drug and/or alcohol use is a contributing factor to the serious near miss injury;
- Other circumstances as dictated by Human Resources; or
- An Employee contributes to any of the above.

The drug and alcohol testing requirements stated above apply to subcontractors when required by the subcontract.

17.3 Intelex and Incident Report Form

The RHSM or EM shall complete an entry into the Intelex system located on JacobsConnect. The SL shall summarize or use the hard copy incident reporting form (attached to this plan) and forward it to the RHSM within 24 hours.

17.4 WorkCare Injury Management and Return to Work (for U.S./Puerto Rico-based P&PS Jacobs Staff Only)

In the event of an injury, or potential injury (i.e., involvement in motor vehicle collision with no apparent injury; a puncture wound with no bleeding or apparent infection, etc.), the following actions shall be taken:

- Employee informs their supervisor.
- Employee calls the Injury Management Program toll free number 1-888-449-7787 immediately and speaks with the Occupational Injury Nurse. This number is operable 24 hours per day, 7 days a week. **Employees are encouraged to enter this phone number into their cell phones prior to starting field work.**
- Supervisor ensures employee immediately calls the Injury Management Program number. Supervisor makes the call with the injured worker or for the injured worker, if needed.
- Nurse assists employee with obtaining appropriate medical treatment, as necessary schedules clinic visit for employee (calls ahead and assists with any necessary follow up treatment). The supervisor or SL accompanies the employee if a clinic visit is necessary to ensure that employees receive appropriate and timely care.
- SL or designee shall verbally notify the RHSM and PM. The SL or designee may use the hardcopy Incident Report attached to this plan to forward to the RHSM for Intelex entry. RHSM completes the Intelex entry within 24 hours.
- Nurse notifies appropriate Jacobs staff by e-mail (supervisor, Health & Safety, Human Resources, Workers' Compensation).
- Nurse communicates and coordinates with and for employee on treatment through recovery.
- Supervisor and/or PM ensures suitable duties are identified and available for injured or ill workers who are determined to be medically fit to return to work on transitional duty (temporary and progressive).
- Supervisor and/or PM ensures medical limitations prescribed (if any) by physician are followed until the worker is released to full duty.

17.5 Serious Incident Reporting Requirements

Serious incidents include the following:

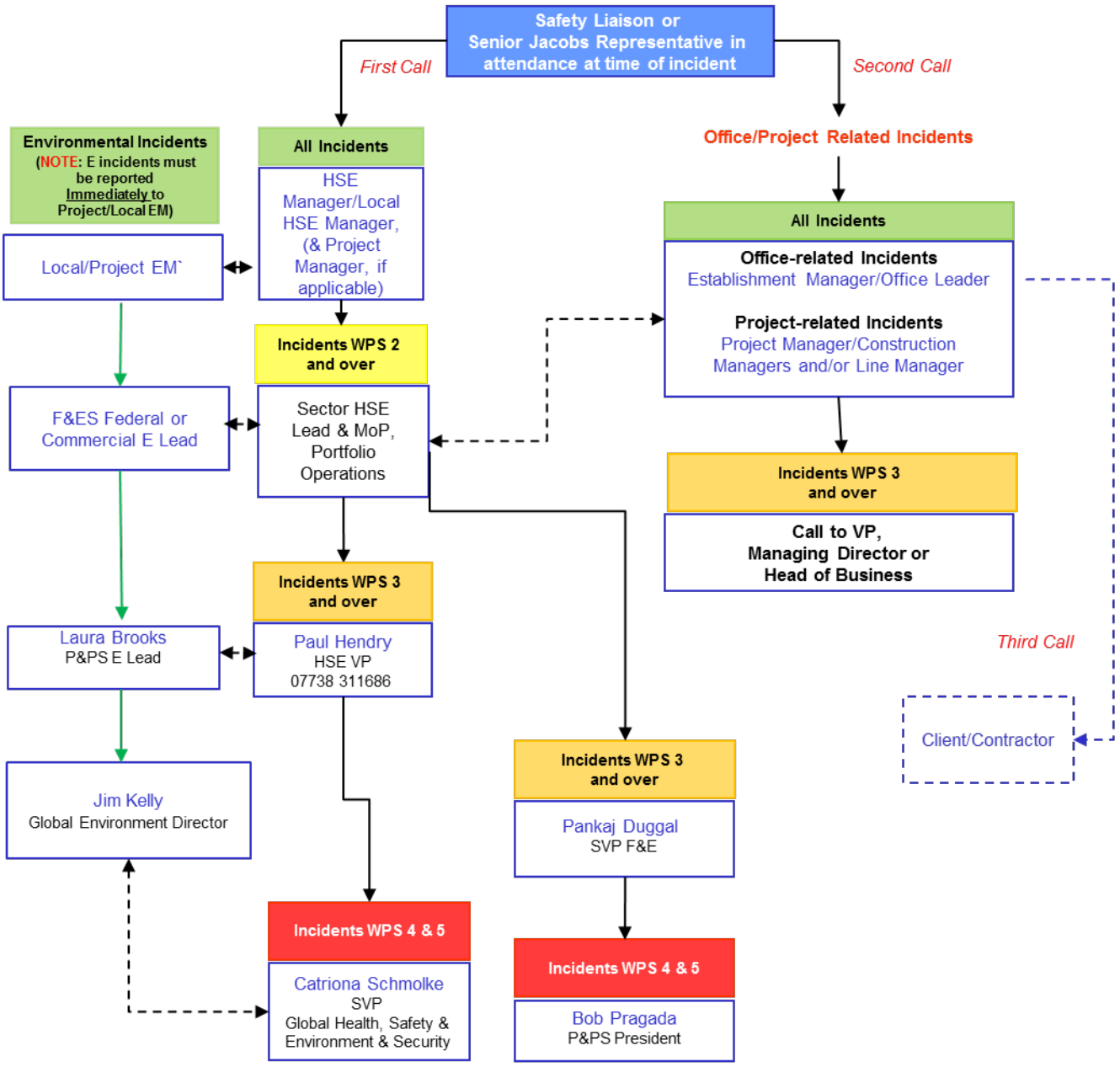
- Work related death, or life-threatening injury or illness of a Jacobs employee, subcontractor, or member of the public;
- Kidnap or missing person;
- Acts or threats of terrorism;
- Event that involves a fire, explosion, or property damage that requires a site evacuation or is estimated to result in greater than $ 500,000 in damage; or
- Spill or release of hazardous materials or substances that involves a significant threat of imminent harm to site workers, neighboring facilities, the community or the environment.

If an incident meets the "Serious Incident" criteria, the Project Manager is to immediately contact the Global Assistance and Response Hotline 443-221-6281, then follow the standard incident reporting procedure

Verbal incident notification is made to both the HSE and the Operations chains to the indicated group depending on the severity, and any project, geographic, or client specific notification and reporting requirements as shown below (Refer to P&PS Work Instruction IB-HS-WI-0400-IB, Incident Reporting and Investigation). The RHSM will complete an Intelex report.

Updated January 2020

P&PS Verbal Chain for Reporting all Incidents



Notes:

1. **Each Project/Region shall provide their own Verbal Reporting Chain- customised as required.**
2. Worst Potential Severity (WPS) definitions are to be found in Global Work Instruction JJ-HS-WI-0400-JJ, HSE&S Incident Mgmg.
3. Actual 4 and 5 must be communicated to Legal and Communications by the HSE VP or GVP
4. All incidents involving Jacobs employees or a sub-consultant or subcontractor under Jacobs control (including motor vehicle accidents, injuries, environmental incidents and near-misses) shall be reported as soon as possible **in person or by telephone**.
5. If your Project Manager is not your Line Manager it is essential that a call is made to both.
6. Calls must be made to both the relevant Corporate HSE Representative and the Establishment Manager/Office Leader or Project Manager/Construction Managers and/or Line Manager (as appropriate). These are not alternatives
7. Security and Sustainability Directors / VP's will be notified where appropriate by HSE&S VP / HSE VP
8. Where required by legislation, a Jacobs HSES&S Manger will make the necessary report to the enforcing authorities.

18 Emergency Preparedness

18.1 Emergency Notification List

If an emergency situation develops which requires evacuation of the work area, the following steps shall be implemented.

Evacuation Step	Methods and comments:
Notify affected workers	SL/PM to tell effected workers
Evacuate to safe location	Depending on emergency, SL/PM to determine rally points during Daily Safety Briefing (PTSP)
Assemble and account for workers	SL/PM to use PTSP or Safety Briefing sign-in sheet
Notify Supervisor/Manager	SL/PM notifies using cell phone
Complete incident report	Contact HSM

Potential emergency situations and response actions are identified below.

In case of:	Response actions:
Injury or illness	Major Medical: FA/CPR trained personnel respond. If additional response required, contact local emergency responders and 911. Have a designee assist with guiding ambulance service to site if needed. If Jacobs BIAF employee, call WorkCare at 888-449-7787. Minor Medical: FA/CPR trained personnel respond. If Jacobs BIAF employee, call WorkCare at 888-449-7787. Transport to occupational health clinic if advised to do so.
Chemical exposure	Decon affected employee, seek medical treatment if necessary. Utilize eyewash and shower if needed. If additional response required, contact local emergency responders. If Jacobs BIAF employee, call WorkCare at 888-449-7787.
Fire or explosion	Evacuate site to designated location, call 911. Provide necessary first aid, seek treatment if necessary. For small fires, only respond to trash can size fires with site fire extinguishers.
Adverse weather	Call supervisor, and HSM if non-emergency.
Heat Stroke	Call 911, have a designee give location and directions to ambulance service if needed. If Jacobs BIAF employee, call WorkCare at 888-449-7787.
Material spill or release	Appropriate spill response materials for all chemicals must be present at the job site. Only qualified (by training and previous experience) who have proper PPE and equipment available shall provide spill response operations, when safe to do so.
Active Shooter	Have a plan when working on client premises—look for at least 2 evacuation routes/points. Program emergency numbers in your phone (client emergency service numbers, RHSM, PM, Supervisor, WorkCare, Global Assistance and Response number). If an active shooter is on the premises follow Run, Hide, Fight: • Run: Leave belonging behind. Try to get out of the building or danger area if possible using exits. Call 911 when in a safe area and then call the Global Assistance and Response Hotline (443-221-6281) PM and RHSM. • Hide: Act quickly - Find a place, closet or office, or something to hide behind out of the vision of shooter. Lock or barricade or otherwise secure the spot if possible. Turn off lights, silence cell phones. Stay calm and quiet

	• Fight: Last resort! If your life is at risk—work alone as or as a group. Use improvised weapons, act aggressively, disarm or injure the shooter, commit to your actions. When law enforcement arrives – stay calm—show hands, spreading fingers. Avoid sudden movements, yelling or pointing. Allow law enforcement to do their job to control the area. Their first priority is finding the shooter. Once you are safe – be sure to notify your supervisor, the PM, and HSM of your status. The PM/Supervisor shall follow the incident reporting process, including notification in accordance with the incident reporting flowchart. RHSM will complete an Intelex report.

Evacuation Signals:	Meaning:
Grasping throat with hand	Emergency-help me.
Thumbs up	OK; understood.
Grasping buddy's wrist	Leave area now.
Continuous sounding of horn	Emergency; leave site now.

In the event of a **large quantity spill** notify emergency services. Personnel discovering a spill shall (only if safe to do so):

- Stop or contain the spill immediately (if possible) or note source. Shut off the source (e.g., pump, treatment system) if possible. If unsafe conditions exist, then leave the area, call emergency services, inform nearby personnel, notify the site supervisors, and initiate incident reporting process. The SC shall be notified immediately;
- Extinguish sources of ignition (flames, sparks, hot surfaces, cigarettes);
- Clear personnel from the spill location and barricade the area;
- Use available spill control equipment in an effort to ensure that fires, explosions, and releases do not occur, recur, or spread;
- Use sorbent materials to control the spill at the source;
- Construct a temporary containment dike of sorbent materials, cinder blocks, bricks or other suitable materials to help contain the spill;
- Attempt to identify the character, exact source, amount, and extent of the released materials. Identification of the spilled material should be made as soon as possible so that the appropriate clean-up procedure can be identified;
- Contact the RHSM and Project EM in the event of a spill or release immediately so evaluation of reportable quantity requirements and whether agency reporting is required;
- Assess possible hazards to human health or the environment as a result of the release, fire or explosion; and
- Follow incident notification, reporting, and investigation section of this plan.

Appendix A: Project Hazard/Impact Identification and Risk Assessment / AHAs

JACOBS

ACTIVITY HAZARD ANALYSIS

Date: October 2020	Task Risk Assessment Code (RAC): M – L
Project: BNSF – Wishram	L = Low
Site Supervisor:	E = Extremely High Risk
Site Safety Coordinator:	H = High Risk
HSM Review/Approval: Eric Hamm	M = Moderate Risk
Job/Activity: Boating **Description of the work**: Observing sample practices from a boat. Drilling and sediment sampling.	

Severity \ Probability	Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

TYPES OF POTENTIAL ENERGY:

									
1	2	3	4	5	6	7	8	9	10
BIOLOGICAL	CHEMICAL	ELECTRICAL	GRAVITY	MECHANICAL	MOTION	PRESSURE	RADIATION	SOUND	TEMPERATURE

Work Task Sequence (List steps you need to take to complete the activity.)	Potential Health and Safety Hazards (How can you be harmed? Cut, struck, exposed…)	Potential Energy(ies) Associated with Task	Hazard Controls (List the specific controls for each potential hazard. Refer to HSE Handbook for required controls)
Review emergency procedures	Delays/Inadequate response to emergency situations		Review PHSEP, AHA, Communication Plan, Pre-Task Safety Plan, & Safety Fact Sheet; daily completion of boat safety checklist

Work Task Sequence (List steps you need to take to complete the activity.)	Potential Health and Safety Hazards (How can you be harmed? Cut, struck, exposed…)	Potential Energy(ies) Associated with Task	Hazard Controls (List the specific controls for each potential hazard. Refer to HSE Handbook for required controls)
Stage equipment at boat, boarding (and leaving)	Slips & Trips Poisonous plants/insects Fires	  	Ensure safe footing, keep area around boat clear of obstructions. Maintain good housekeeping inside and outside of boat. Observe surroundings – able to identify poison ivy. Wear protective clothing that covers exposed skin. If skin contacts a plant, wash area with soap and water immediately. Maintain an operational (inspected prior to launch…fully charged, tamper seal affixed, etc.) fire extinguisher on the boat. Ensure all boat occupants have had fire extinguisher training.
Check communication equipment	Delays/Inadequate response to emergency response		Ensure cell phones are fully charged. Air horn on the boat and functional.
Don PPE	General hazards such as drowning, overhead (DPT rig), etc.		Employees are required to wear the following PPE: personal flotation devices (PFD's with adequate reflective material for night operations), safety shoes and glasses
Boat use	Injuries and illnesses Struck-by hazard, run into equipment or debris Drowning		Boating team must include at least one person qualified in First Aid. First aid kit required in boat. All operations will be directed by a qualified and experienced boater as the team leader Aware of proper

Work Task Sequence (List steps you need to take to complete the activity.)	Potential Health and Safety Hazards (How can you be harmed? Cut, struck, exposed…)	Potential Energy(ies) Associated with Task	Hazard Controls (List the specific controls for each potential hazard. Refer to HSE Handbook for required controls)
			boat operation (who has right-a-way), drive defensively, keep wide berth from other boats/equipment, Bowman watch out for floating debris, etc. Observe and comply with safety markers. Boat must be operated in accordance with U.S. Coast Guard regulations for: speed, lighting, right-a-way, etc.
Boat use at night	Poor visibility		PRIOR TO ANY BOAT ACTIVITY CONDUCTED AT NIGHT, CH2M Hill SAFETY MUST AGREE TO ACTIVITY. Flashlights required for employees (dawn/dusk). PFD must have reflective material
	Inclement Weather		Any “observable” lightning or thunder – stop work and return to shore. Team leader must monitor appropriate sources to track developing potential for lightning, high winds, tornado’s, etc. Sustained wind speeds of 20 mph or wind gusts of 25 mph will cease boat operations – return to shore. Tornado warnings in the general area will require work to stop and return to shore.

Equipment to be used (List equipment to be used in the work activity)	Inspection Requirements (List inspection requirements for the work activity)	Training Requirements (List training requirements including hazard communication)
Boat	Inspect boat for damage; Utilize self-assessment checklist for boating safety	Qualified/Experienced boat operator
PPE plus PFD	PFD that meets Coast Guard requirements	Individual training for use and proper fit
First Aid Kit	Inspect contents to ensure all supplies are available	At least one person first aid trained
Cell Phone	Ensure fully charged	
Fire Extinguisher	Inspect prior to boat launch	Must have fire extinguisher training per 29 CFR1910.157 requirements

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ACTIVITY HAZARD ANALYSIS

	PRINT NAME	SIGNATURE	
Supervisor Name:			**Date/Time:**
Safety Coordinator Name:			**Date/Time:**
Employee Name(s):			**Date/Time:**
			Date/Time:
			Date/Time:
			Date/Time:
			Date/Time:
			Date/Time:
			Date/Time:
			Date/Time:
			Date/Time:

JACOBS

ACTIVITY HAZARD ANALYSIS

Date: October 2020	Task Risk Assessment Code (RAC): **Moderate/Low**
Job/Activity: Daily mobilization/demobilization; site reconnaissance and general support	L = Low
Project: BNSF - Wishram	E = Extremely High Risk
Prepared by: Eric Hamm	H = High Risk
Reviewed by (PM/Site Supervisor/H&S): Eric Hamm	M = Moderate Risk
Description of the work: Daily mobilization/demobilization; site reconnaissance and general support for utility locates and cultural surveys	

Severity \ Probability	Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

TYPES OF POTENTIAL ENERGY:

1	2	3	4	5	6	7	8	9	10
BIOLOGICAL	CHEMICAL	ELECTRICAL	GRAVITY	MECHANICAL	MOTION	PRESSURE	RADIATION	SOUND	TEMPERATURE

Work Task Sequence (List steps you need to take to complete the activity.)	Potential Health and Safety Hazards (How can you be harmed? Cut, struck, exposed…)	Potential Energy(ies) Associated with Task	Hazard Controls (List the specific controls for each potential hazard. Refer to HSE Handbook for required controls)
General preparation	Forgotten safety equipment, no cell phone coverage, lack of emergency preparedness, untimely reporting of an injury or other incident	NA	• Complete PHSEP, AHA review • Complete PTSP, daily safety meeting. • Check for cell phone coverage. • Designate rally point and evacuation point (daily if working in new locations each day). • Check daily weather report and plan activities around severe weather. • Review, inspect and locate safety equipment including fire extinguisher, first aid kit, insect repellant, PPE, water, food, spill kits, etc.

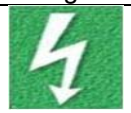
Work Task Sequence (List steps you need to take to complete the activity.)	Potential Health and Safety Hazards (How can you be harmed? Cut, struck, exposed…)	Potential Energy(ies) Associated with Task	Hazard Controls (List the specific controls for each potential hazard. Refer to HSE Handbook for required controls)
			• Be sure to review the requirements for incident notification, reporting and investigation section of the PHSEP. Report all injuries, no matter how minor. If you are unsure whether an event should be reported, contact your RHSM. Be sure to report near misses.
Operating Vehicles - General	Break-downs; Flat Tires; Collisions, etc.		Make sure vehicle is current on preventive maintenance. Conduct vehicle walk around prior to leaving for the field to check for low tires, fluid leaks, debris and operating hazards. Check lights, windshield wipers, fluid levels, seat belts. Make sure emergency flashers are functional.
Operating Vehicles -Travel to and from site. Travel on Secondary Roads, Gravel Roads and Trails	Collision with other vehicles; Collision with animals or objects; Running or skidding off road; wet and/or muddy roads; Poor visibility; Backing; Vehicle wear/tear, etc.	 Motion	• Inspect the vehicle prior to departure. • If driving a rental car, become familiar with the safe operation of vehicles of the type and size to be operated. Large vehicles such as full-size vans and pick-ups have different vision challenges and handling characteristics than smaller vehicles. • Exercise caution – “Drive Defensively” • Observe all laws and regulations • Drive defensively and safely, watch ahead for oncoming traffic. Maintain 1 car length (approximately 10 feet) for every 10 mph of highway speed. • Watch for debris on the road or materials falling from other vehicles. Stay back 300 feet from trucks hauling rock or similar materials. • Do not drive off-road if it has rained in the past 48 hours • Do not drive or park over tall brush. • Do not drive on soft gravel shoulders. Pull over to use a cell phone, GPS unit or map. • Park at pull-through parking spaces. • When descending steep grades, use lower gears to control speed, rather than the brakes or riding the clutch. • Drivers shall not use cellular phones, or other two-way communication devices while driving (including hands-free devices). Pull over and park the car to make or take phone calls, text, or e-mail.

Work Task Sequence (List steps you need to take to complete the activity.)	Potential Health and Safety Hazards (How can you be harmed? Cut, struck, exposed…)	Potential Energy(ies) Associated with Task	Hazard Controls (List the specific controls for each potential hazard. Refer to HSE Handbook for required controls)
			• Be sure to take adequate rest breaks when driving, especially on long distance trips. • Obey speed limits; be aware of blind spots or other hazards associated with low visibility. Practice defensive driving techniques, such as leaving plenty of room between your vehicle and the one ahead of you. • If vehicle is malfunctioning, don't pull over off the road suddenly. Give the traffic behind you notice that you are pulling off. • Always wear seatbelt in vehicle, regardless of length of drive. • Apply Get Out and Look (GOAL) when returning to the vehicle to prevent property damage and injury by looking for obstructions, personnel or other items. Back slowly and use a spotter when view is obstructed.
Vehicle Parking	Pedestrian accidents and vehicle fires	 Motion	• Vehicles should be parked off road in areas where access to from vehicles is safe and avoids active roadways. • Do not park vehicle over grassed areas due to the potential fire hazard from the catalytic converter. Park on gravel or paved areas whenever possible that are designated as pull outs. • Do not block any property access roads. • Wear reflective orange vests when near traffic. • Know the location and operation of the fire extinguisher carried in the field vehicle or near treatment system.
Walking / Site Survey	Traffic Snakes Barbed wire fences Slips/trips/falls Sunburn	 Gravity  Motion	• Wear high-visibility safety vests, hard hats and safety glasses. Wear gloves as appropriate. • Do not handle or harass any harmful wildlife including venomous snakes. • If a venomous snake is encountered, stop and retreat in the opposite direction/same path taken. Do not harass wildlife. Wear snake chaps if walking in grassy areas or brush where you cannot see venomous snakes.

Work Task Sequence (List steps you need to take to complete the activity.)	Potential Health and Safety Hazards (How can you be harmed? Cut, struck, exposed…)	Potential Energy(ies) Associated with Task	Hazard Controls (List the specific controls for each potential hazard. Refer to HSE Handbook for required controls)
			• Do not climb any fences. Cross fences through gates. • Apply sunscreen as-needed and wear light-colored clothing. If feasible, wear long sleeved shirts, and always wear long pants. Large-brimmed hardhat will offer extra protection against UV. • Always be on the lookout while walking the sites. Avoid using mobile devices while walking so you can be on the lookout for holes, depressions, uneven terrain that can cause sprains or other injury. Be vigilant for hazards as surveys can take place in remote areas where people have not been. • Use proper auger/shovel form when sampling soils, inspecting ground conditions, or otherwise as appropriate.
Hazards and controls applicable to all steps of field work.	Temperature Extremes **(heat)**	 Temperature	• Acclimatize to work in hot weather by working in heat and taking more frequent breaks, systematically building up tolerance to heat. • Conduct field activities in the early morning if possible to avoid heat or inclement weather. • Having enough water onsite so that each worker can consume at a minimum, one quart per hour per shift. • Frequent reminders and/or water breaks shall be taken so that each person can consume enough water. • Access to shade (i.e., blockage from direct sunlight) shall be provided at all times and shall be reasonably close to the work area. Keep in mind that a vehicle or other enclosed are with no air conditioning is NOT considered shade. • Workers suffering from heat illness-related symptoms OR if needed for preventative recovery shall be provided access to shade for at least 5 minutes, or longer, for recovery. (if heat related symptoms are occurring, contact the RHSM). • Training on risk factors, signs and symptoms of heat illness, importance of hydration and acclimatization, and importance of reporting symptoms and what to do in case of heat illness emergency, and contacting emergency medical services (see HSP, Temperature Extremes section).

Work Task Sequence (List steps you need to take to complete the activity.)	Potential Health and Safety Hazards (How can you be harmed? Cut, struck, exposed…)	Potential Energy(ies) Associated with Task	Hazard Controls (List the specific controls for each potential hazard. Refer to HSE Handbook for required controls)
			• Read and follow heat stress precautions specified in the HSP. • Follow the requirements for physiological monitoring as stated in the HSP (e.g., During work in temperatures above 80 degrees, perform physiological monitoring—see safety plan if wearing Tyvek for when to start monitoring) and document on the heat stress physiological monitoring form. • Be conscious of your individual tolerance to work in hot weather and monitor yourself for signs and symptoms of heat stress. • Take breaks as necessary in shady or cool areas and drink plenty of liquids. • Take regular breaks in an air-conditioned truck during warm weather. Use a wide-brim hat or an umbrella when working under direct sun for extended periods. • Persons who experience signs of heat or cold stress should contact the SL, PM and RHSM. Call the occupational nurse first if symptoms are severe at **1-888-449-7787**.
	Ticks	 Biological	• Wear light colored long sleeve shirts and pants. Use repellent on exposed skin (with at least 35% DEET) if ticks/other biting insects are suspected in the area. Whenever you use an insecticide or insect repellent, be sure to read and follow the manufacturer's DIRECTIONS FOR USE, as printed on the product. Tape bottoms of pant legs or tuck pants into socks. Use double sided tape around ankles, waist and wrists. • Wear protective clothing such as Tyvek or Bug-out suits if ticks are abundant in addition to controls above. • Have tick removal kits accessible. If ticks were not planned to be encountered and are observed, do not continue field work until these controls can be implemented. • See Tick Fact Sheet attached to the HSP for further precautions and controls to implement when ticks are present. If bitten by a tick, follow the removal procedures found in the tick fact sheet.

Work Task Sequence (List steps you need to take to complete the activity.)	Potential Health and Safety Hazards (How can you be harmed? Cut, struck, exposed…)	Potential Energy(ies) Associated with Task	Hazard Controls (List the specific controls for each potential hazard. Refer to HSE Handbook for required controls)
	Stinging insects	 Biological	• Keep exposed skin to a minimum. • Carry a kit if you have had allergic reactions in the past, and inform your supervisor and/or a buddy or client contact. When working at a remote location, ensure that first-aid kits contain over-the-counter allergy and itch medication (e.g., Benadryl, Claritin, etc) as well as other over-the-counter (OTC) medications that may not be available to aid in symptom treatment. WARNING: Some OTC medications will cause drowsiness. Do not operate equipment or vehicles if you feel drowsy. • If bees or other stinging insects are known to be present, determine whether additional protective clothing should be donned before entering/working in brushy areas. • Use insect repellent on clothing. Wear light-colored clothing and remove bright reflective safety-colored clothing if not working near a roadway as these may attract the wasps. • Wear fragrance-free or lightly-scented sunscreen, and body lotions. Bees are attracted to sweet scents. Avoid using floral scented soaps, shampoos, or conditioners. • If you encounter a wasp, back away slowly and calmly, do not run or swat at the insect. Wait for it to leave, or gently move or brush it off gently with a piece of paper or other light object. Do not use your hand. • If you are stung, notify your supervisor, no matter how minor it may seem. If a stinger is present, remove it as soon as possible using something with a thin, hard edge (e.g., credit card) to scrape the stinger out. Be sure to sanitize the object first with hand sanitizer, alcohol or soap and water. Wash and disinfect the wound, cover it, and apply ice. Watch for an allergic reaction if you have never been stung before. Call 911 if the reaction is severe. • Use wasp/bee spray if necessary in accordance with manufacturer's labeling and direction for use.

Work Task Sequence (List steps you need to take to complete the activity.)	Potential Health and Safety Hazards (How can you be harmed? Cut, struck, exposed…)	Potential Energy(ies) Associated with Task	Hazard Controls (List the specific controls for each potential hazard. Refer to HSE Handbook for required controls)
	Other biological hazards	 Biological	• Refer to the HSP for controls on other biological hazards possibly present dependent on season/location, including snakes, spiders, and poisonous plants.
	Inclement weather	 Electrical	• Sudden inclement weather can rapidly encroach upon field personnel. Preparedness and caution are the best defenses. Carry clothing appropriate for inclement weather. • Take heed of the weather forecast for the day and pay attention for signs of changing weather that indicate an impending storm. Signs include towering thunderheads, darkening skies, or a sudden increase in wind. If stormy weather ensues, field personnel should discontinue work and seek shelter until the storm has passed. • When YOU HEAR THUNDER, TAKE COVER. • If caught in one, seek shelter. • Avoid lone trees as shelter and open, bare areas. • If caught in open area, place feet close together and crouch down as small as possible, without lying on the ground. • Ground strikes are known to be initiated by “leaders”, or charges, from the earth making a connection to the charge in the clouds. This may cause your hair to stand up, and since you do not want to be part of a leader that makes the connection to form a cloud-to-ground strike, immediately crouch as described above. • Avoid low lying areas such as washes after rain as they can flood. • Take time to review where the closest structure that can be used when severe weather occurs and what route will be used to get there. Listen to weather reports and plan for severe weather. Designate an emergency evacuation assembly area and evacuation routes for non-weather related emergencies (fire, etc.). Keep a copy of the Emergency Contact page from the HSP accessible.

Work Task Sequence (List steps you need to take to complete the activity.)	Potential Health and Safety Hazards (How can you be harmed? Cut, struck, exposed…)	Potential Energy(ies) Associated with Task	Hazard Controls (List the specific controls for each potential hazard. Refer to HSE Handbook for required controls)
	Injury from lifting and moving heavy or awkward loads; injury from working in awkward or static positions for extended periods of time (field ergonomics)	 Gravity  Motion	• Use proper lifting techniques such as keeping back straight, lifting with legs, limiting twisting and keep the load close to your body. • All backpacks utilized to carry hydration bladders, supplies and equipment must have 2 shoulder straps and hip belt for proper weight distribution. • Contact the RHSM to determine hazard control measures your task involves: – Lifting and carrying items over long distances or on steep or sloped terrain; – Heavy lifting;
	Feral Dogs	 Biological	• Avoid all dogs • If approached by a dog, stay still, avoid eye contact – if you say anything, speak calmly and firmly • Do not turn away, do not run – if dog does not leave back away slowly • If attacked retreat to vehicle or attempt to place something between you and the dog; if you fall curl into a ball with your hands over your head and neck and protect your face • If bitten, call nurse 1-888-449-7787.
	Mosquito Bites	 Biological	• Mosquitoes can carry West Nile Virus and other types of encephalitis • Avoid outdoor activities at dawn, dusk and early evening • Wear long sleeved shirts • Use insect repellent – be sure to read directions for use • Symptoms of West Nile Virus can be found in Section 10.13

Equipment to be used (List equipment to be used in the work activity)	Inspection Requirements (List inspection requirements for the work activity)	Training Requirements (List training requirements including hazard communication)
• Portable eye wash (eye wash bottles) • First Aid/Bloodborne pathogen kit • PPE as noted above, including safety glasses, safety-toed boots, work gloves, as needed, high visibility vests, • Biological hazard precautions (insect spray, tick removal kit, duct tape, Tyvek or bug-out suit, wasp spray if needed, Benadryl) • Sunscreen	• Inspect all vehicles, equipment, tools, and PPE prior to each use (remove from service any defective equipment) • Ensure cell phone has coverage and have fully charged. • Determine daily rally point/evacuation route.	• Training on Jacobs PHSEP • Hazard Communication training (see PHSEP for how to document) as applicable

PRINT NAME **SIGNATURE**

Supervisor Name: _____ _____ **Date/Time:** _____

Safety Coordinator Name: _____ _____ **Date/Time:** _____

Employee Name(s): _____ _____ **Date/Time:** _____

_____ _____ **Date/Time:** _____

_____ _____ **Date/Time:** _____

_____ _____ **Date/Time:** _____

_____ _____ **Date/Time:** _____

Activity Hazard Analysis (AHA)

ACTIVITY/WORK TASK:	**COVID-19 Virus Prevention**	AHA #	**1**
Project Location:	Wishram, WA	Overall Risk Assessment Code (RAC) (Use highest code)	**L**
CONTRACT NUMBER:			
DATE Prepared			
Prepared by (Name/Title):			
Reviewed by (Name/Title):			
Notes: (Field Notes, Review Comments, etc.)			

Risk Assessment Code (RAC) Matrix

RAC Chart	Severity	Probability				
		Frequent	Likely	Occasional	Seldom	Unlikely
E = EXTREMELY HIGH	Catastrophic	**E**	**E**	**H**	**H**	**M**
H = HIGH RISK	Critical	**E**	**H**	**H**	**M**	**L**
M = MODERATE RISK	Marginal	**H**	**M**	**M**	**L**	**L**
L = LOW RISK	Negligible	**M**	**L**	**L**	**L**	**L**

Step 1: Review each “Hazard” with identified safety “Controls”. Determine RAC (See above)

Probability: likelihood the activity will cause a Mishap (near miss, incident or accident). Identify as Frequent, Likely, Occasional, Seldom or Unlikely.

Severity: the outcome if a mishap occurred. Identify as Catastrophic, Critical, Marginal, or Negligible

Step 2: Identify the RAC (probability vs. severity) as E, H, M, or L for each “Hazard” on AHA. Annotate the overall highest RAC at the top of AHA.

Job Steps	Hazards	Controls	RAC
COVID-19 Virus Prevention	General	• Review the COVID-19 Virus (Field Change Request Form, CDC Factsheet, Jacobs Preparedness Pamphlet, WorkCare Guidance) information sent out by Jacobs prior to returning to operations at the facility. • Monitor local public health agency communications. Follow all local agency guidance and restrictions. • Inspect stores periodically for additional disinfectant supplies (disinfectant wipes, disinfectant sprays, etc.) • Contact local hospital to ensure no issue with treatment in the event of an emergency. • Avoid touching your eyes, nose, and mouth. • Maintain social distancing from other (6-foot distance from others). • Frequent hand washing is required.	**L**

		• Ensure hand sanitizer is provided to employees when away from wash facilities. • Where nitrile gloves if unable to wash hands or use hand sanitizer, ensuring not to touch your face when wearing gloves. • Do not come to work if you feel sick or have the symptoms of the virus (fever, dry cough, shortness of breath). • Do not come to work and notify Site Manager if you have come into contact with someone who is known to have the COVID-19 virus within the last 14 days or have come into contact with someone exhibiting severe respiratory illness. • Notify Site Manager if you become sick with COVID-19 symptoms during work. • Important to note, that tasks may take longer than usual. Take your time to ensure we are complying with requirements of this AHA.	
	Working Inside Facilities	• Ensure all buildings will be thoroughly cleaned with disinfectant products. Clean surfaces regularly touched by staff (door handles, drawer handles, computer keyboard/mouse, toilet handles, faucet handles, refrigerator handles, etc.). • Surfaces (door handles, toilet handle, faucet handles, etc.) within the bathroom will be disinfected after each use. • The general office surfaces such as main door handles will be disinfected initially upon arriving at site and when leaving the site for the day.	**L**
	Driving to and from Site	• Employees are only permitted to drive alone when conducting work on site. • The vehicle will be disinfected each day prior to use and when exiting the vehicle after leaving a public area. Clean all surfaces that are typically touched (door handles, steering wheel, thermostat controls, radio controls, etc.). • If using a rental, thoroughly clean prior to use. Se above cleaning protocol. • In the unlikely event others would use a vehicle after others, then each vehicle will be disinfected with the approach discussed above before allowing another individual to operate the vehicle.	**L**
	Conducting Work Activities	• Comply with Lone Worker Procedure requirements.	**L**

		• Nitrile gloves will be worn, anyways, during task where there are potential exposure to contaminants which will also assist prevent transmission of the virus. • Even though it isn't anticipated, if someone would be present in the area around the treatment building (parking lot, monitoring wells, etc.) maintain social distancing from others. • Any surface that could be touched (valves, handles of electrical panels, etc.) without protective nitrile gloves during task, should be disinfected afterwards in the event someone will conduct the work the next trip.	

Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements
• Disinfectant Supplies • Hand Sanitizer • Nitrile Gloves • Face Covers	• Review safety plans by new site personnel. • 1st Aid/CPR (minimum of 2 personnel per site) when access to a medical facility or physician is more than 5 minutes away • Competent Person Requirement & Name: NA	• Visual Inspections of designated work areas identify and address hazardous conditions. • Equipment/Supplies inspections and maintenance. • Emergency Response equipment Inspections • (Fire Extinguishers, Eye wash First Aid/CPR etc.) • Ensure all inspections are recorded on the Daily Contractor Production Report or Daily Contractor Quality Control Report.

	PRINT NAME	**SIGNATURE**	
Supervisor Name:	_____	_____	**Date/Time:** _____
Safety Officer Name:	_____	_____	**Date/Time:** _____
Employee Name(s):	_____	_____	**Date/Time:** _____
	_____	_____	**Date/Time:** _____
	_____	_____	**Date/Time:** _____
	_____	_____	**Date/Time:** _____
	_____	_____	**Date/Time:** _____
	_____	_____	**Date/Time:** _____
	_____	_____	**Date/Time:** _____
	_____	_____	**Date/Time:** _____
	_____	_____	Date/Time: _____

Appendix B: HSE Legislative Compliance

ID	Legislation Reference (SI= Statutory Instruction)	Legislation Title	Summary	Compliance (Full, Partial, Non-compliant)	Evidence to support compliance	Hyperlink
OSHA	29 CFR 1910	General Industry	US Safety Regulations	Full	PHSEP	
OSHA	29 CFR 1926	Construction	US Safety Regulations	Full	PHSEP	

Appendix C: HSE Induction Record

Project Health, Safety, Security, Environment & Community Induction Record		
Note: Inducted Persons are to TICK YES or NO to each question BELOW.		
Questions:	**Employee**	
I have been instructed by the Project Manager (or their nominee) in the following safety and environmental requirements:	**YES**	**No**
a) HSE Plan.	☐	☐
b) Safe Work Methods	☐	☐
c) General Workplace Hazards.	☐	☐
I have been trained in the use of Personnel Protective Equipment	☐	☐
I am aware of the Project Emergency Procedure requirements.	☐	☐
I have been introduced to scope of works and general locations	☐	☐
I have completed an orientation of my work area with my team Leader.	☐	☐

Project Manager name (print): _____ Signature: _____ Date: _____	Personnel name (print): _____ Signature: _____ Company: _____ Date: _____

Appendix D: Site Rules

Based on best practice and experience, Jacobs has defined a minimum set of control measures (site rules) that are mandatory for all Jacobs employees and our subcontractors at all field and site workplaces irrespective of whether Jacobs has control of the workplace.

Personal Protective Equipment (PPE) requirements

1. Safety helmets shall always be worn when on a construction site or process plant, and elsewhere when an overhead hazard exists.
2. Safety glasses (wrap around or with rigid side shields) shall always be worn on a construction site, and elsewhere when an eye hazard exists. Dark tinted safety glasses shall not be worn indoors, inside closed structures, or at night.
3. Hearing protection shall be worn when noise levels exceed 85 decibels (dB) or when normal speech cannot be heard at a distance of two metres.
4. Work gloves appropriate for the hazard and shirts with sleeves and long trousers (or coveralls) shall be worn on all field and construction sites.
5. High visibility clothing shall be worn on all construction sites, and elsewhere when there is a risk of being struck by vehicles or mobile plant.
6. Safety boots (not trainers) with toe and mid-sole protection shall be worn on all construction sites, and elsewhere when there is a risk of foot injuries.

Other Requirements

7. Working at height will only take place where there are no other reasonably practicable means of avoiding it. Where it is unavoidable work must be properly planned, supervised and executed following risk assessment by a competent person to eliminate or minimise any risks involved. Control measures must be identified and applied following a hierarchy that seeks to eliminate risk in the first instance. Consideration must also be given to the wider working area and protection for people not directly involved in the activity for example other workers, visitors and members of the public. Harnesses and lanyards can only be used by trained and competent persons with fall prevention lanyards being selected over fall arrest where reasonably practicable to do so. Where fall arrest is used there will be a potential for a person to be suspended in a harness and a suitable rescue procedure must be in place. Advice on how to satisfy these requirements can be obtained from your Health and Safety department.
8. Scaffolding shall be used only if inspected by a competent person prior to initial use, once per week and after any event that could affect its structural integrity.
9. No straight ladder shall be climbed unless it is securely fastened at the top or footed at the base.
10. If using a work platform is not reasonably practical and work from a stepladder is required, then it shall be of appropriate height and type for the task. The top rung of the steps must be kept at or above waist height.
11. No excavation or trench shall be entered unless it is adequately battered, shored or supported, barricaded and with suitable access and egress and inspected by a competent person.
12. All applicable Permit-to-Work systems shall be followed e.g. ground disturbance greater than 300mm, unit entry, hot work, confined space entry, electrical isolation, etc.
13. No confined space shall be entered without a risk assessment and method statement, a permit authorising entry and training.
14. Good “housekeeping” shall be maintained continually, “a clean site is a safe site”.
15. Report all incidents immediately to your Line Manager

Appendix E: HSE Attachments

JACOBS Health and Safety Plan

Attachment 1

HSE Handbook

JACOBS Health, Safety, and Environment Field Handbook

May 2020

Jacobs

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Contents

ATTACHMENTS:
Employee Sign-Off Form
Subcontractor Sign-Off Form

1. Introduction

1.1 JACOBS Health, Safety, and Environment Policy Commitment and Goals

1.1.1 Health, Safety, and Environment Policy Commitment

Protection of people and the environment is a JACOBS core value. It is our vision to create a culture that empowers employees to drive this value into all global operations and achieve excellence in health, safety, and environment (HSE) performance. JACOBS deploys an integrated, enterprise-wide behavior based HSE management system to fulfill our mission and the expectations of our clients, staff, and communities based on the following principles:

- We require all management and supervisory personnel to provide the leadership and resources to inspire and empower our employees to take responsibility for their actions and for their fellow employees to prevent injuries, illnesses, and adverse environmental impacts, and create a safe, healthy, and environmentally-responsible workplace.
- We provide value to clients by tailoring HSE processes to customer needs and requiring JACOBS employees and subcontractors to deliver projects that identify HSE requirements and commit to compliance with applicable HSE laws and regulations, company standards, and external requirements.
- We are committed to pollution prevention in conjunction with our Sustainability Policy and by offering our clients sustainable solutions.
- We aspire to continually improve our performance and influence others to redefine world-class HSE excellence.
- We evaluate our design engineering and physical work environment to verify safe work conditions and practices are established, followed, and corrected as needed.
- We assess and continually improve our HSE program to achieve and maintain world-class performance by setting and reviewing objectives and targets, reporting performance metrics, and routinely evaluating our program.
- We expect all employees to embrace our Target Zero culture, share our core value for the protection of people and the environment, understand their obligations, actively participate, take responsibility, and “walk the talk” on and off the job.

1.1.2 Project-Specific Health, Safety, and the Environment Goals

All management and employees are to strive to meet the project-specific Health, Safety, and the Environment (HSE) goals outlined below. The team will be successful only if everyone makes a concerted effort to accomplish these goals. The goals allow the project to stay focused on optimizing the health and safety of all project personnel and, therefore, making the project a great success.

JACOBS has established eleven specific goals and objectives:

- Create an injury-free environment;
- Have zero injuries or incidents;
- Provide management leadership for HSE by communicating performance expectations, reviewing and tracking performance, and leading by example;
- Ensure effective implementation of the project safety plan, environmental plan (or equivalent) through education, delegation, and team work;

- Ensure 100 percent participation in HSE compliance;
- Continuously improve our safety and environmental performance;
- Maintain free and open lines of communication;
- Make a personal commitment to safety as a value;
- Focus safety improvements on high-risk groups;
- Continue strong employee involvement initiatives; and
- Achieve health, safety, and environmental excellence.

2. Applicability

This JACOBS Health, Safety, and Environment Field Handbook (Handbook) applies to:

- All JACOBS staff supporting projects globally, including subcontractors and tiered subcontractors of JACOBS working on the site; and
- All visitors to the construction or remediation site in the custody of JACOBS (including visitors from the Client, the Government, the public, and other staff of any JACOBS company).

This Handbook does not apply to the third-party contractors, their workers, their subcontractors, their visitors, or any other persons not under the direct control or custody of JACOBS. This document does not apply to LLC companies within JACOBS.

This Handbook defines the procedures and requirements for the health and safety of JACOBS staff and visitors when they are physically on the work site. The work site includes the project area (as defined by the contract documents) and the project offices, trailers, and facilities thereon.

This Handbook will be kept onsite during field activities and will be reviewed as necessary. The Handbook will be amended or revised as project activities or conditions change or when supplemental information becomes available. The Handbook adopts, by reference, the Enterprise-wide Core Standards and Standards of Practice (SOPs), as appropriate. In addition, the Handbook may adopt procedures from the project Work Plan and any governing regulations. If there is a contradiction between this Handbook and any governing regulation, the more stringent and protective requirement shall apply.

For those working in the state of California in the United States, this Handbook incorporates the regulatory requirements described in the State of California OSHA agency – Cal/OSHA Title 8 CCR, Section 3203, Injury and Illness Prevention Program (IIPP), and section 1509, Construction Injury and Illness Prevention Program. The current version of JACOBS Cal/OSHA IIPP written program can be accessed on the HSE website under HSE Programs.

When this Handbook is used to supplement the project health and safety plan, all JACOBS staff and subcontractors must sign the employee sign-off form included at the end of this Handbook to acknowledge review of the document. JACOBS employees will send a signed copy of the sign-off form to their SPA or will maintain it in project files. The subcontractor sign-off form will be maintained on site by the project Safety Liaison (SC).

3. Roles and Responsibilities

The sections below describe the roles and responsibilities of personnel referred to in the project-specific safety plan.

3.1 JACOBS Line Management (Program/Project Managers)

Line management safely manages and executes overall program, project, or site work. The Program or Project Manager (PM) may explicitly delegate specific tasks to other staff, but retains ultimate responsibility for HSE related responsibilities including:

- Coordinate and lead Subcontractor HSE Chartering meetings prior to the start of field work;
- Designate a qualified Safety Liaison in conjunction with the RHSM/EM;
- Ensure JACOBS safety plan (and environmental plan, if applicable) is current and provide approval alongside the HSE Manager/RHSM or EM, if applicable;
- Ensure JACOBS Activity Hazard Analyses (AHAs) or AHA/Environmental Impact Assessment (EIA) are in place and verify HSE Manager/RHSM has reviewed and approved;
- Notify HSE staff if changes to scope have an effect on HSE plans, documents, or requirements; review and approve any field change requests (FCRs) to the safety plan.
- Ensure copies of training and medical monitoring records, and site-specific safety procedures are being maintained in the project file accessible to site personnel;
- Provide oversight of subcontractor HSE practices per the site-specific safety plans and procedures;
- Manage the site and interfacing with 3rd parties in a manner consistent with the contract and subcontract agreements and the applicable standard of reasonable care;
- Ensure that the overall, job-specific, HSE goals are fully and continuously implemented;
- Perform a Management Inspection at least once during short-term projects or once a month on long-term projects;
- Set an example for safe work practices, attitudes, and culture through personal action and participation in the HSE program, including HSE programs, rules, procedures, processes, and training
- Intervene or stop work when an unsafe condition or behavior is observed, and/or when an environmentally compromising condition is encountered;
- Consistently and even-handedly enforce HSE rules, procedures, and requirements at the office and/or on project work sites;
- Promptly report all work-related HSE incidents or near misses;
- Conduct, cooperate, or assist with HSE incident investigations;
- Wear any required personal protective equipment when visiting project site;
- Consult with the Human Resources Delivery Partner before taking any disciplinary action (other than verbal counseling) associated with JACOBS Policy 203, HSE Accountability, and/or HSE programs rules, procedures, processes and training;
- Has the overall responsibility for implementing the Drug-Free Workplace Program (Policy 810) on his/her project; and

- Coordinate HSE needs of contingent labor as required by the Contingent Worker Core Standard and Policy 809, Contingent Worker Policy.

3.2 JACOBS Responsible Health and Safety Manager

The Responsible Health and Safety Manager (RHSM) is assigned by the client sector HSE Lead or designee to provide ongoing health and safety technical guidance and support to the project, program or facility. The RHSM is responsible for the following:

- Develop or review and approve JACOBS safety plan(s) and revisions or amendments as well as AHAs or AHA/EIA;
- Review and accept subcontractor training and medical monitoring records prior to start of field operations;
- Review subcontractor statements of work to include project H&S requirements before they are sent to potential subcontractors ;
- Review and accept subcontractor site-specific safety procedures (including safety plans and AHAs or AHA/EIAs) for adequacy prior to start of subcontractor's field operations;
- Provide input to the PM on the selection of the SC;
- Support the oversight (or SC's direct oversight) of subcontractor and tiered subcontractor HSE practices;
- Permit upgrades and downgrades in personal protective equipment (PPE), including respiratory protection, in accordance with the site safety plan;
- Conduct audits as determined by project schedule and coordination with PM; and
- Participate in incident investigations, lessons learned, loss and near loss reporting.

3.3 JACOBS Project Environmental Manager

The Responsible Project EM (REM), also referred to as the Program or Project EM, is assigned by the client sector HSE Manager or sector EM to provide ongoing environmental protection and compliance guidance and support the project, program or facility. The REM is responsible for the following:

- Provide project/task-specific environmental compliance input to include in statements of work before they are sent to potential subcontractors (when requested by the project team);
- Provide environmental program support in areas such as training, auditing, planning, permit tracking, and subcontractor oversight as needed or as specified in the project environmental plan or equivalent plan;
- Assist the PM to identify environmental requirements, including those described in the JACOBS Target Zero Management System Manual, environmental risks, environmental permits and similar documents that JACOBS is responsible for complying with (e.g., notices, approvals or other documents that legally bind CH2M);
- Verify that a Field Project Start-up Form (FPSF) has been submitted and that an Environmental Plan or equivalent document is available;
- Assist the PM in preparing or coordinating the preparation of regulatory-required environmental plans (e.g., SPCC, SWPPP) and contract-required environmental plans (e.g., Environmental Protection Plan);
- Review revised scopes of work and changes in project conditions to identify new environmental issues and requirements;
- Review/approve waste characterizations and client waste profiles, or engage the project Waste Coordinator to review and approve;

- Evaluate any spills, releases, or environmental permit incidents for appropriate follow-up actions, notifications, and recordkeeping requirements; and
- Provide environmental compliance and environmental management expertise, advice, and training to the project team as needed during the course of the project.

3.4 JACOBS Safety Liaison

The SL is responsible for verifying that the project is conducted in a safe manner including the following specific obligations:

- Participate in Subcontractor HSE Chartering meetings prior to the start of field work;
- Verify the project safety plan, and environmental plan, if applicable, is current and amended when project activities or conditions change;
- Verify JACOBS site personnel and subcontractor personnel read this Handbook, the project safety plan, and applicable AHAs or AHA/EIA and sign the accompanying sign-off forms for each, prior to commencing field activities;
- Verify JACOBS site personnel have completed any required specialty training (for example, fall protection, confined space entry, among others) and medical surveillance as identified in the project safety plan;
- Verify that project files include copies of accepted subcontractor training and medical monitoring records, and accepted site-specific safety procedures prior to start of subcontractor's field operations;
- Act as the project "Hazard Communication Coordinator" and perform the responsibilities outlined in the project safety plan;
- Act as the project "Emergency Response Coordinator" and perform the responsibilities outlined in the project safety plan;
- Post the required workplace labor posters. In the US, post the Occupational Safety and Health Administration (OSHA) job-site poster. The poster is required at sites where project field offices, trailers, or equipment-storage boxes are established. If you work in the US in a state with an OSHA State Plan, make sure the State Plan poster is posted, if required. In Canada, check the provincial Ministry of Labour website to determine which posters are required;
- Hold and/or verify that safety meetings are conducted and documented in the project file initially and as needed throughout the course of the project (as tasks or hazards change);
- Assist in implementing environmental plan requirements at the project as assigned by the PM or project EM;
- Verify that project health and safety forms and permits are being used as outlined in the project safety plan;
- Perform oversight and assessments of subcontractor HSE practices per the site-specific safety plan and verify that project activity self-assessment checklists are being used as outlined in the project safety plan;
- Ensure that deficiencies identified in self-assessment checklists are tracked through completion and closed out;
- Coordinate with the RHSM regarding JACOBS and subcontractor operational performance, and 3rd party interfaces;
- Verify appropriate personal protective equipment (PPE) use, availability, and training;
- Ensure that the overall, job-specific, HSE goals are fully and continuously implemented;
- Calibrate and conduct air monitoring in accordance with the project safety plan; maintain all air monitoring records in project file;

- Maintain HSE records and documentation at the project site;
- Facilitate government agency inspections (e.g., OSHA, Occupational Health and Safety [OH&S]) including accompanying inspector and providing all necessary documentation and follow-up;
- Deliver field HSE training as needed based on project-specific hazards and activities;
- Consistently and even-handedly enforce HSE rules, procedures, and requirements at the office and/or on project work sites;
- Wear any required personal protective equipment;
- Contact the RHSM and PM in the event of an incident;
- Contact the RHSM and Project EM in the event of a spill or release immediately so evaluation of reportable quantity requirements and whether agency reporting is required;
- Conduct, cooperate, or assist with HSE incident investigations;
- Contact the PM and RHSM when standards of conduct or JACOBS Policy 203 has been violated by a JACOBS employee;
- When an apparent imminent danger exists, immediately remove all affected JACOBS employees and subcontractors, notify subcontractor safety representative, stop affected work until adequate corrective measures are implemented, and notify the PM and RHSM as appropriate; and
- Document all verbal health and safety-related communications in project field logbook, daily reports, or other records.

3.5 JACOBS Employees

All personnel have the responsibility for performing work in a safe manner and to:

- Understand and abide by JACOBS and client HSE programs, rules, procedures, processes, and training, including any that are project-specific;
- Complete all required HSE training made available and accessible within established timelines;
- Always wear any required personal protective equipment;
- Intervene or stop JACOBS work when an unsafe condition or behavior is encountered or observed, and/or when an environmentally compromising condition exists;
- Promptly pause work and notify a supervisor, PM, SL, or RHSM when an unsafe condition or behavior is observed, and/or when an environmentally compromising condition exists;
- Promptly report to supervisor, PM, SL, or HSE Manager/RHSM/EM all work-related health, safety and environmental incidents or near misses;
- Attend required project HSE pre-task briefings and meeting prior to performing work;
- Cooperate or assist with HSE incident investigations; and
- Encourage safe work practices and attitudes by setting a personal example and participate in the site HSE program and meetings.

3.5.1 Employee Authority

Each employee on the project has the obligation and authority to shut down any perceived unsafe work and during employee orientation, each employee will be informed of their authority to do so.

3.6 JACOBS Subcontractors

Subcontractors must comply with the following activities, and are responsible to:

- Participate in Subcontractor HSE Chartering meetings;
- Implement and comply with all HSE requirements in their subcontract;
- Comply with all local, state, provincial, and federal safety standards;
- Comply with project and owner safety requirements;
- Maintain up-to-date health and safety training, medical, and competent person qualification records at the project site, readily available for inspection;
- Assign a competent site HSE representative who has the appropriate level of authority to act on HSE issues;
- Actively participate in the project safety program and either hold or attend and participate in all required safety meetings;
- Develop and implement site- and activity-specific HSE plans and/or procedures for work they will be performing;
- Maintain safety equipment and PPE for their employees;
- Determine and implement necessary controls and corrective actions to correct unsafe conditions;
- Maintain and replace safety protection systems damaged or removed by the subcontractor's operations;
- Notify the SL of any incidents including, injury, spills or releases, environmental permit issues, near misses or property damage immediately and submit report to JACOBS within 24 hours;
- Install contractually required general conditions for safety (for example, handrail, fencing, fall protection systems, floor opening covers);
- Conduct site-specific and job-specific training for all subcontractor employees, including review of the JACOBS safety plan, subcontractor safety plans, and subcontractor AHAs or AHA/EIA, and sign appropriate sign-off forms;
- Provide subcontractor staff with the appropriate HSE training, qualifications, PPE, supplies and equipment necessary to safely complete assigned work; and
- Provides reports and maintains records of HSE-related activities in accordance with contract requirements and HSE Plans.

Subcontractors may be required to submit their own site-specific safety plan and other plans such as lead or asbestos abatement compliance plans. Subcontractors are responsible for the HSE procedures specific to their work, and are required to submit their plans to JACOBS for review and acceptance before the start of field work.

Subcontractors are also required to prepare AHAs or AHA/EIAs before beginning each activity posing hazards to their personnel. The AHA or AHA/EIA shall identify the principle steps of the activity, potential HSE hazards or impacts for each step and recommended control measures for each identified hazard. In addition, a listing of the equipment to be used to perform the activity, inspection requirements, and training requirements for the safe operation of the equipment listed must be identified.

3.7 Client Contractors

JACOBS project safety plans do not cover contractors that are contracted directly to the client or the owner. JACOBS is not responsible for the health and safety or means and methods of the contractor's work, and we must

never assume such responsibility through our actions (such as advising on health and safety issues). In addition to these instructions, JACOBS team members should review contractor safety plans so that we remain aware of appropriate precautions that apply to us. Self-assessment checklists are to be used by the SL and JACOBS team members to review the contractor's performance only as it pertains to evaluating JACOBS exposure and safety. The RHSM is the only person who is authorized to comment on or accept contractor safety procedures.

Health and safety-related communications with contractors should be conducted as follows:

- Request the contractor to brief JACOBS team members on the precautions related to the contractor's work;
- When an apparent contractor non-compliance or unsafe condition or practice poses a risk to JACOBS team members:
    - Notify the contractor safety representative;
    - Request that the contractor determine and implement corrective actions;
    - If necessary, stop affected JACOBS work until contractor corrects the condition or practice; and
    - Notify the client, PM, and RHSM as appropriate.

If apparent contractor non-compliance or unsafe conditions or practices are observed, inform the contractor safety representative (CH2M's obligation is limited strictly to informing the contractor of the observation; the contractor is solely responsible for determining and implementing necessary controls and corrective actions).

If an apparent imminent danger is observed, immediately warn the contractor employee(s) in danger and notify the contractor safety representative (CH2M's obligation is limited strictly to immediately warning the affected individual(s) and informing the contractor of the observation; the contractor is solely responsible for determining and implementing necessary controls and corrective actions).

All verbal health and safety-related communications will be documented in project field logbook, daily reports, or other records.

4. Standards of Conduct

All individuals associated with this project must strive to work injury-free and must work drug-free and comply with the following standards of conduct, and the safety requirements of JACOBS. Commonly accepted standards of conduct help maintain good relationships between people. They promote responsibility and self-development. Misunderstandings, frictions, and disciplinary action can be avoided by refraining from thoughtless or wrongful acts.

4.1 HSE Accountability

4.1.1 Prohibited Behaviors and Actions

Managers, supervisors, and employees who openly or recklessly exhibit a disregard, defiance, or disrespect for CH2M's HSE programs, rules, procedures, processes, and training, or who violate established HSE programs, rules, procedures, processes or training endangering themselves or other employees, will be subject to disciplinary actions. Without limitation, behaviors and actions that warrant disciplinary action include the following:

- Requiring, requesting, demanding, asking, or threatening another person in any manner to entice the person to engage in or work around a patently unsafe or environmentally compromising act or condition.
- Condoning or knowingly allowing a person to engage in or work around a patently unsafe or environmentally compromising act or condition.
- Recklessly, knowingly, or purposely failing to wear required PPE.
- Failing to successfully complete any required HSE training that is scheduled and made available for completion.
- Failing to promptly notify a supervisor, project safety manager, coordinator, lead, or the project manager when an unsafe condition or behavior is observed, and/or when an environmentally compromising condition is encountered.
- Failing to promptly report to a supervisor, project safety manager, coordinator, lead, or the project manager, a work-related HSE incident or near miss.
- If required of the position, failing to maintain as active and in good standing necessary health, safety, and/or environmental licenses or permits needed to support JACOBS work and projects.
- Knowingly falsifying any HSE record or investigative document (whether internal to JACOBS or external), or providing false testimony, during an HSE or outside agency incident investigation.
- Refusing to cooperate in an HSE incident investigation.
- Knowingly falsifying any inspection or sampling records (whether internal to JACOBS or external).
- Performing field work without the required site HSE plan approved by a HSE manager.
- Engaging in any form of workplace violence described in Policy 201 Workplace Violence Awareness and Prevention, including physical encounters, destruction of property, and verbal threats of violence, harm, or mayhem.
- Failing to comply with any HSE procedures contained in any contract, subcontract, site health safety and environment plan, or any federal, state, provincial, or local health, safety, or environmental laws and regulations creating actual or potential significant risk for JACOBS (whether monetary or otherwise).

In addition, no individual may have in his or her possession, bring to the project site, or maintain on JACOBS property, concealed or otherwise, any weapon, explosive device or substance, firearm, ammunition or instrument that could be used as a weapon. All weapons, explosive devices or substances, firearms, and ammunition are banned from all project sites, properties, vehicles and/or any JACOBS activities or events.

4.1.2 Disciplinary Actions

When JACOBS employees neglect to fulfill their responsibilities and/or project-specific HSE requirements, JACOBS may discipline its employees. All JACOBS employees, including management and supervisory employees, are equally subject to disciplinary action for failing to meet the expectations associated with this Policy and/or HSE programs, rules, procedures, processes, and training. JACOBS reserves the right in its sole discretion to determine the appropriateness of any discipline imposed, but such disciplinary action may include, without limitation, denial of access to the worksite, verbal and/or written warnings/reprimands, and termination of employment.

4.2 Subcontractor Safety Performance

JACOBS should continuously endeavor to observe subcontractors' safety performance and adherence to their plans and AHAs or AHA/EIAs. This endeavor should be reasonable, and include observing for hazards or unsafe practices that are both readily observable and occur in common work areas. JACOBS oversight does not relieve subcontractors of their responsibility for effective implementation and compliance with the established plan(s).

4.2.1 Observed Hazard Form

When apparent non-compliance or unsafe conditions or practices are observed, notify the subcontractor's supervisor or safety representative verbally, and document using the Observed Hazard Form, included as an attachment to the project safety plan, and require corrective action.

If necessary, stop subcontractor's work using the Stop Work Order Form until corrective actions is implemented for observed serious hazards or conditions. Update the Observed Hazard Form to document corrective actions have been taken. The subcontractor is responsible for determining and implementing necessary controls and corrective actions.

4.2.2 Stop Work Order

JACOBS has the authority, as specified in the contract, and the responsibility to stop work in the event any JACOBS employee observes unsafe conditions or failure of the subcontractor to adhere to its safe-work practices, or observes a condition or practice that may result in a release or violation of an environmental requirement. This authority and action does not in any way relieve the subcontractor of its responsibilities for the means and methods of the work or, therefore, of any corrective actions. Failure to comply with safe work practices can be the basis for restriction or removal of the subcontractor staff from the job site, termination of the subcontract, restriction from future work, or all three.

When an apparent imminent danger is observed, immediately stop work and alert all affected individuals. Remove all affected JACOBS employees and subcontractor staff from the danger, notify the subcontractor's supervisor or safety representative, and do not allow work to resume until adequate corrective measures are implemented. Notify the PM, Buyer, and RHSM.

When repeated non-compliance or unsafe conditions are observed, notify the subcontractor's supervisor or safety representative and stop affected work by completing and delivering the Stop Work Order Form (attached to the project safety plan) until adequate corrective measures are implemented. Consult the Buyer to determine what the contract dictates for actions to pursue in event of subcontractor non-compliance including work stoppage, back charges, progress payments, removal of subcontractor manager, monetary penalties, or termination of subcontractor for cause.

4.3 Incentive Program

Each project is encouraged to implement a safety incentive program that rewards workers for exhibiting exemplary safety behaviors. Actions that qualify are those that go above and beyond what is expected. Actions that will be rewarded include spotting and correcting a hazard, bringing a hazard to the attention of your foreman, telling your foreman about an incident, coming up with a safer way to get the work done, or stopping a crew member from doing something unsafe. The program will operate throughout the project, covering all workers. The incentive program will be communicated to all employees during the project employee orientation and project safety meetings.

4.4 Reporting Unsafe Conditions/Practices

Responsibility for effective health and safety management extends to all levels of the project and requires good communication between employees, supervisors, and management. Incident prevention requires a proactive policy on near misses, close calls, unsafe conditions, and unsafe practices. All personnel must report any situation, practice, or condition which might jeopardize the safety of our projects. All unsafe conditions or unsafe practices will be corrected immediately. JACOBS has zero tolerance of unsafe conditions or unsafe practices.

No employee or supervisor will be disciplined for reporting unsafe conditions or practices. Individuals involved in reporting the unsafe conditions or practices will remain anonymous.

The following reporting procedures will be followed by all project employees:

- Upon detection of any unsafe condition or practice, the responsible employee will attempt to safely correct the condition;
- The unsafe condition or practice will be brought to the attention of the worker's direct supervisor, unless the unsafe condition or practice involves the employee's direct supervisor. If so, the SL needs to be notified at once by the responsible employee;
- Either the responsible employee or responsible employee's direct supervisor is responsible for immediately reporting the unsafe condition or practice to the SC;
- The SL will act promptly to correct the unsafe condition or practice; and
- Details of the incident or situation will be recorded by the SL in the field logbook or use the Observed Hazard Form if subcontractor was involved.

5. Safety Planning and Change Management

5.1 Subcontractor HSE Chartering Meeting

A subcontractor HSE chartering meeting shall be held with subcontractors performing field work on the project. The purpose of the meeting is to discuss and agree on key HSE requirements on a project, and to emphasize and reinforce JACOBS expectations for subcontractor HSE performance. The target audience includes key JACOBS project staff with HSE responsibilities (e.g., PM, RHSM, SL, Field Team Leader (FTL)) and key Subcontractor staff (e.g., project manager, supervisors, designated field HSE contact, drill team leads, foreman). For small scale projects (e.g., small drill crew and limited JACOBS staff), all the subcontractor crew members should attend if available. The meeting should be held prior to mobilization with enough time to ensure that HSE issues identified can be addressed prior to the start of work. The meeting can be held over the phone or in person depending on project needs. An example agenda can be found at following link Program Element Guideline, "Subcontractor HSE Chartering Meeting."

5.2 Daily Safety Meetings and Pre-Task Safety Plans

Daily safety meetings are to be held with all project personnel in attendance to review the hazards posed and required HSE procedures and AHAs or AHA/EIAs that apply for each day's project activities. The Pre-Task Safety Plans (PTSPs) serve to supplement these general assembly safety meetings; the PTSPs are held between the crew supervisor and their work crews to focus on those hazards posed to individual work crews.

At the start of each day's activities, the crew supervisor completes the PTSP, provided as an attachment to the project safety plan, with input from the work crew. The day's tasks, personnel, tools and equipment that will be used to perform these tasks are listed, along with the hazards posed and required HSE procedures, as identified in this Handbook and AHA or AHA/EIA. The use of PTSPs promotes worker participation in the hazard recognition and control process while reinforcing the task-specific hazard and required HSE procedures with the crew each day. The PTSP can be completed either with the daily safety meeting or, if there are multiple crews, separately with each crew and their supervisor after the general daily safety meeting.

5.3 Change Management

This Handbook and the project safety plan address known activities and associated hazards. As work progresses, if significant changes are identified which could affect health, safety, or environmental conditions at the site, coordinate with the RHSM or EM to determine whether an update to the safety plan and/or environmental plan are necessary. Follow the change management protocol in the safety plan.

The following are examples of changes that may require a revision to the plan:

- Change in JACOBS staff;
- New subcontractor to perform work;
- New chemicals brought to site for use;
- Change in scope or addition of new tasks;
- Change in contaminants of concern (COCs) or change in concentrations of COCs; and
- New hazards or hazards not previously identified that are not addressed in this Handbook or the project safety plan.

5.4 Agency Inspection Guidance

Agency inspections (e.g., OSHA, EPA, Federal Aviation Administration (FAA), and in Canada, Workplace Health and Safety, Provincial Ministry of Labour, Provincial Ministry of the Environment) are on the rise. JACOBS implements safety and environmental programs in order to ensure safety to workers, the public, and the environment. Field personnel need to contact the RHSM to update the project safety plan if hazards are encountered that are not addressed.

It is critical to make immediate notification to the RHSM if an inspector arrives (and EM if it is environmental-related); they can help facilitate and make additional notifications.

Review the SOP and make it a topic at a safety meeting and keep it readily available in the event of an inspection.

6. Project Hazard Analysis

A health and safety risk analysis is performed for each task of a given project. In the order listed below, the RHSM considers the various methods for mitigating the hazards. Employees are trained on this hierarchy of controls during their hazardous waste training and reminded of them throughout the execution of projects:

- Elimination of the hazards (use remote sampling methodology to avoid going into a confined space);
- Substitution (reduce exposure to vapors by using a geoprobe instead of test pitting);
- Engineering controls (ventilate a confined space to improve air quality);
- Warnings (establish exclusion zones to keep untrained people away from hazardous waste work);
- Administrative controls (implement a work-rest schedule to reduce chance of heat stress); or
- Use of PPE (use of respirators when action levels are exceeded).

Employees are trained on the hierarchy of controls during their hazardous waste training and reminded of them throughout the execution of projects.

6.1 Hazard Identification and Control – The 10 Energies

Hazards are created when an object interacts with a type of energy or combination of energies. The first step in incident prevention is recognizing the energy source(s) and the potential for an uncontrolled release of, or contact with, that energy source. Identifying potential energy sources associated with a piece of equipment or a task allows us to mitigate the hazard correctly.

The 10 types of energy to consider are:

- Chemical
- Electrical
- Gravity
- Mechanical
- Motion
- Pressure
- Sound
- Radiation
- Temperature
- Biological

As described in the hierarchy of controls above, there are four basic options available to prevent unwanted exposure of the energy or energies:

- Eliminate the energy,
- Control the energy,
- Provide a protective barrier or,
- Use stop work authority

When possible, plan or do work that does not require exposure to an energy source. Take action to remove or control the energy source, or be sure that barriers are adequate to mitigate the resulting hazard (engineering controls, PPE, etc.). Use safe work observations to look for body position and placement and use of safety equipment with respect to energy sources present and the potential for an uncontrolled release or contact (line of fire incidents!).

Identify the energy source(s) in the safety plan and AHA or AHA/EIA or during the pre-task safety briefing and **verify** controls are in place for each task or STOP work until they are.

6.2 Activity Hazard Analysis

An AHA must be developed for each JACOBS field activity. The AHA or AHA/EIA shall define the work tasks required to perform each activity, along with potential HSE hazards and recommended control measures for each hazard, incorporating the hazardous energies described above. In addition, a listing of the equipment to be used to perform the activity, inspection requirements to be performed and training requirements for the safe operation of the equipment listed must be identified. Workers are briefed on the AHA or AHA/EIA before performing the work and their input is solicited prior, during, and after the performance of work to further identify the hazards posed and control measures required.

6.3 Subcontractor Activity Hazard Analysis

JACOBS subcontractors are required to provide AHAs or AHA/EIAs specific to their scope of work on the project for acceptance by JACOBS. Each subcontractor shall submit AHAs or AHA/EIA for their field activities, as defined in their scope of work, along with their project safety plan and procedures. Additions or changes in field activities, equipment, tools, or material used to perform work or hazards not addressed in existing AHAs or AHA/EIAs requires either a new AHA or AHA/EIA to be prepared or an existing one to be revised.

7. General Hazards and Controls

This section provides safe work practices and control measures used to reduce or eliminate potential hazards. It is a summarized list of requirements. Always consult the appropriate JACOBS Core Standard and/or SOP to ensure all requirements are implemented.

7.1 Bloodborne Pathogens

Exposure to bloodborne pathogens may occur when rendering first aid or cardiopulmonary resuscitation (CPR), or when coming into contact with landfill waste or waste streams containing potentially infectious material (PIM).

Employees trained in first-aid/CPR or those exposed to PIM must complete CH2M's 1-hour bloodborne pathogens computer-based training module annually. When performing first-aid/CPR the following shall apply:

- Observe universal precautions to prevent contact with blood or other PIMs. Where differentiation between body fluid types is difficult or impossible, consider all body fluids to be potentially infectious materials;
- Always wash your hands and face with soap and running water after contacting PIMs. If washing facilities are unavailable, use an antiseptic cleanser with clean paper towels or moist towelettes; and
- If necessary, decontaminate all potentially contaminated equipment and surfaces with chlorine bleach as soon as possible. Use one part chlorine bleach (5.25 percent sodium hypochlorite solution) diluted with 10 parts water for decontaminating equipment or surfaces after initially removing blood or other PIMs. Remove contaminated PPE as soon as possible before leaving a work area.

JACOBS will provide exposed employees with a confidential medical examination should an exposure to PIM occur. This examination includes the following procedures:

- Documenting the exposure;
- Testing the exposed employee's and the source individual's blood (with consent); and
- Administering post-exposure prophylaxis.

7.2 Chemical Storage

The following is general guidance for storing chemicals and other hazardous materials:

- Keep acids away from bases;
- Keep oxidizers (nitric acid, nitrates, peroxides, chlorates) and organics away from inorganic reducing agents (metals);
- Keep flammables and corrosives in appropriate storage cabinets;
- Do not store paper or other combustibles near flammables;
- Use secondary containment and lipped shelving that is secured; and
- Have a fire suppression system available.

7.2.1 Storage of Flammable/Combustible Liquids

- Only approved containers and portable tanks shall be used for storage and handling of flammable and combustible liquids.
- Approved safety cans shall be used for the handling and use of flammable liquids in quantities of 5 gallons (19 liters) or less. Do not use plastic gas cans. In Canada, use only the appropriate and approved gas cans for your specific province. In addition, the client may have specific requirements.

- For quantities of 1 gallon (3.78 liters) or less, the original container may be used for storage and use of flammable liquids.
- Flammable or combustible liquids shall not be stored in areas used for stairways or normally used for the passage of people.

7.2.2 Indoor Storage of Flammable/Combustible Liquids

- No more than 25 gallons (95 liters) of flammable or combustible liquids shall be stored in a room outside of an approved storage cabinet.
- Quantities of flammable and combustible liquids in excess of 25 gallons (95 liters) shall be stored in an acceptable or approved cabinet.
- Cabinets shall be conspicuously lettered: "FLAMMABLE: KEEP FIRE AWAY."
- Not more than 60 gallons (228 liters) of flammable or 120 gallons (456 liters) of combustible liquids shall be stored in any one storage cabinet. Not more than three such cabinets may be located in a single storage area.

7.2.3 Outside Storage of Flammable/Combustible Liquids

- Storage of containers (not more than 60 gallons [228 liters] each) shall not exceed 1,100 gallons (4,180 liters) in any one area. No area shall be within 20 feet (6.1 meters) of any building.
- Storage areas shall be graded to divert spills away from buildings and surrounded by an earthen dike.
- Storage areas may not be located near a storm drain. Overflow and spills must be diverted away from storm drains or surface waters.
- Storage areas shall be free from weeds, debris, and other combustible materials.
- Outdoor portable tanks shall be provided with emergency vent devices and shall not be closer than 20 feet (6.1 meters) to any building.
- Signs indicating no smoking shall be posted around the storage area.

7.2.4 Storage of Hazardous Waste

- All facilities storing ignitable and combustible liquids and hazardous wastes must be designed, constructed, maintained, and operated to minimize the possibility of a fire, explosion, or any release of hazardous constituents.
- Flammable wastes should be stored more than 50 feet from the property line.

7.2.5 Storage of Chemical Injection Chemicals/Materials

- When chemical injection remediation technologies are being used at a site, the following storage guidelines must be followed:
- Some injection chemicals, such as strong oxidizers, may have stringent storage requirements per local or National Fire Codes. Verify that appropriate storage provisions are in place prior to starting work.
- NOTE: Counties and cities may have requirements specific to storing these chemicals. Also, storage and use of certain chemicals such as potassium permanganate and hydrogen peroxide may be subject to state, provincial, or federal regulations (e.g., the Chemical Facility Anti-Terrorism Standards of the Department of Homeland Security in the United States). The applicability depends on the chemical, quantity/concentration, and type of facility. Please contact the project EM to determine whether chemicals are subject to these standards.

- Injection chemicals must be stored in a designated, secured area with spill prevention capabilities. Review Safety Data Sheet (SDS) or other information to determine potential incompatible materials. Incompatible materials shall not be stored together. Ensure all containers are labeled.

7.3 Driving Safety

All JACOBS employees are prohibited from using wireless devices while operating a motor vehicle when conducting company business regardless of the location or vehicle ownership and whether or not during regular working hours.

All JACOBS contractors and subcontractors are prohibited from using wireless devices while operating a JACOBS - or JACOBS client-owned, leased, or rented motor vehicle, or while operating any other motor vehicle on the project site.

Motorcycles, motorbikes, or other motorized devices with two or three wheels, all-terrain vehicles (ATVs) or quads are not allowed to be used for company related business. See the all-terrain vehicle (ATV)/utility-type vehicle (UTV) section of this Handbook for more information on ATVs/UTVs.

Avoid distractions from wireless devices (e.g., mobile phones, smartphones, voice recognition systems, PDAs, notebook, tablets, or laptops) by turning off or silencing the wireless devices before operating a motor vehicle.

- Prohibited use includes the following:
    - Dialing or speed dialing
    - Using a hands-free or voice recognition (blue tooth) device to dial or speed dial
    - Engaging in conversation or listening to a conversation using a wireless device
    - Checking emails or surfing the internet using a wireless device
    - Texting or e-mailing (reading, sending, or screening) with a wireless device
    - Programming or entering coordinates into a global positioning system (GPS) device (following directions by a GPS is permitted)
    - Using a wireless device for voice recording or dictation
    - Employees, contractors, and subcontractors who need to use a wireless device must pull off the road to a safe location, with the vehicle securely stopped and emergency flashers on, or wait until they reach their destination.

Follow the guidance below when operating a vehicle:

- All vehicles have blind spots to the side and the rear. Follow these safe practices for backing up:
    - Walk around your vehicle prior to moving
    - Try to position your vehicle so that you don’t have to back up
    - Back into the space if possible when you’re parking
    - Back to the left, if possible, so that you can see objects on the driver’s side
    - Have a spotter guide your vehicle when you’re backing up
    - Apply GOAL (Get Out And Look)

- Obey speed limits; be aware of blind spots or other hazards associated with low visibility. Practice defensive driving techniques, such as leaving plenty of room between your vehicle and the one ahead of you;
- Do no drive while drowsy. Drowsiness can occur at any time, but is most likely after 18 hours or more without sleep;
- Ensure seatbelts are worn at all times, and by all passengers
- Maintain focus on driving. Eating, drinking, smoking, adjusting controls can divert attention from the road. Take the time to park and perform these tasks when parked rather than while driving; and
- Ensure vehicle drivers are familiar with the safe operation of vehicles of the type and size to be operated. Large vehicles such as full size vans and pick-ups have different vision challenges and handling characteristics than smaller vehicles.

Driving in Areas with Tall Grass/Brush

- Driving in areas with tall grass/brush can present a potential fire hazard if the grass/brush gets caught under and/or remains in contact with the vehicle exhaust system. Employees should exercise the following precautions:
- When stopping vehicle, ensure it is in an area where grass is not tall.
- Do not leave vehicle idling once stopped.
- When possible, try to drive through areas where grass is not tall or grass has been beaten down.
- Ensure that a fire extinguisher is available for each vehicle.
- Keep fire extinguisher readily available in passenger area of vehicle while driving.
- Keep fire extinguisher outside of vehicle upon stopping.
- Address fire hazards and controls in daily safety briefings as appropriate.

7.4 Electrical Safety

Below are the hazard controls and safe work practices to follow when using electrical tools, extension cords, and/or other electrical-powered equipment or when exposed to electrical hazards. Ensure the requirements of the referenced SOP are followed:

- Only qualified personnel are permitted to work on unprotected energized electrical systems;
- Only authorized personnel are permitted to enter high-voltage areas;
- JACOBS employees who might from time to time work in an environment influenced by the presence of electrical energy must complete Awareness Level Electrical Safety Training located on the JACOBS Virtual Office;
- Do not tamper with electrical wiring and equipment unless qualified to do so. All electrical wiring and equipment must be considered energized until lockout/tagout procedures are implemented;
- Inspect electrical equipment, power tools, and extension cords for damage prior to use. Do not use defective electrical equipment, remove from service;
- JACOBS has selected Ground Fault Circuit Interrupters (GFCIs) as the standard method for protecting employees from the hazards associated with electric shock;

  - GFCIs shall be used on all 120-volt, single phase 15 and 20-amphere receptacle outlets which are not part of the permanent wiring of the building or structure.

- An assured equipment grounding conductor program may be used on construction projects under the following scenarios:
  - GFCIs cannot be utilized;
  - Client requires such a program to be implemented; or
  - Business group decides to implement program in addition to GFCI protection.
- Extension cords must be equipped with third-wire grounding. Cords passing through work areas must be covered, elevated or protected from damage. Cords should not be routed through doorways unless protected from pinching. Cords should not be fastened with staples, hung from nails, or suspended with wire;
- Electrical power tools and equipment must be effectively grounded or double-insulated and Underwriters Laboratory (UL) approved;
- Operate and maintain electric power tools and equipment according to manufacturers' instructions;
- Maintain safe clearance distances between overhead power lines and any electrical conducting material unless the power lines have been de-energized and grounded, or where insulating barriers have been installed to prevent physical contact. Maintain at least 10 feet (3 meters) from overhead power lines for voltages of 50 kV or less, and 10 feet (3 meters) plus 0.4 inches (1.0 cm) for every 1 kV over 50 kV;
- Temporary lights shall not be suspended by their electric cord unless designed for suspension. Lights shall be protected from accidental contact or breakage; and
- Protect all electrical equipment, tools, switches, and outlets from environmental elements.

7.5 Extended Work Hours and Fatigue Management

(Reference JACOBS Core Standard, *Fatigue Management*)

A normal work shift is considered to be eight consecutive hours during the day, five days a week, with at least an eight hour rest period. Any shift that incorporates more continuous hours, requires more consecutive days of work, or requires work during the evening should be considered extended or unusual.

Extended or unusual work shifts are typically more stressful for workers physically, mentally, and emotionally, and can lead to increased fatigue, stress, and lack of concentration. These effects can lead to an increased risk of worker error, incidents, and injuries.

If field work exceeds either criteria listed below, you must consult with your PM and HSM for approval of the extended hours/days, and fatigue management requirements must be addressed in the project Health and Safety Plan (HASP), Field Safety Instruction, or project-specific Fatigue Management Plan (FMP):

- Planning field work or vehicle operation for more than 10 hours per day, up to 14 hours total including commute time.

  Note: Working over 12 field hours in one day should be for emergency situations only and would require Project Manager and RHSM approval.

- Working more than 10 consecutive days.
- A Fatigue Management Evaluation Form can be on found on the Enterprise HSE Website under Forms & Templates.

7.6 Field Ergonomics and Manual Lifting

Some of the most common injuries during field work are the result of performing work in an awkward body position (poor ergonomics) or pushing the body beyond its natural limits. Workers who have to lift, stoop, kneel, twist, grip, stretch, reach overhead, or work in other awkward positions regularly are at risk of developing discomfort or even an injury. Additionally, back injuries are one of the leading causes of work disability and most back injuries are the result of improper lifting techniques or overexertion.

Contact the RHSM to determine hazard control measures if your task involves:

- Repetitive motions;
- Lifting and carrying items over long distances (100 feet) or on uneven, steep, or sloped terrain;
- Heavy lifting;
- Use of vibrating tools or equipment; or
- Being in a static position for extended periods of time;

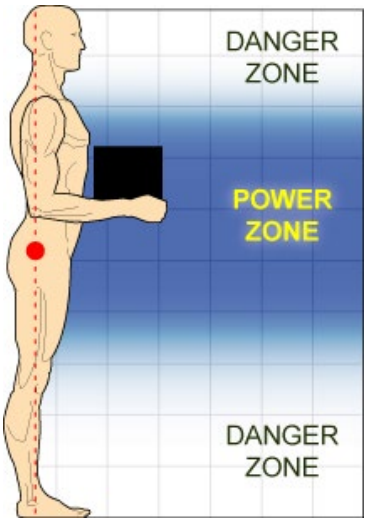
There are a variety of ergonomically designed tools and work practices that can reduce the potential for discomfort and injury. Following are requirements ("must" or "shall") and recommendations ("should") to aid in the prevention of discomfort or injuries while working in the field.

Fitness for Duty

If manual lifting and repetitive activities are not part of your normal work duties, contact your PM and/or RHSM to help determine if you have the physical capability to perform the work. In many cases adding lifting or repetitive tasks to a subcontractor's scope of work is desirable to prevent injury. If the work task causes any pain or discomfort stop and get assistance.

Manual Lifting

- All JACOBS workers must have training in proper manual lifting either through New Employee Orientation or through the Manual Lifting module located on the VO;
- When possible, the task should be modified to minimize manual lifting hazards or awkward body positions;
- Lifting occasional loads weighing more than 40 pounds (18 kilograms) should be evaluated by the SL using the Lifting Evaluation Form contained in SOP HSE-112;
- When performing repetitive lifting tasks with loads over 40 pounds, the Lifting Evaluation Form contained in SOP HSE-112 shall be used, and mechanical means used where possible;
- Personnel shall seek assistance when performing manual lifting tasks that appear beyond their physical capabilities;
- Using mechanical lifting devices such as forklifts; cranes, hoists, and rigging; hand trucks; and trolleys; is the preferred means of lifting heavy objects;
- Lift and Work in the Power Zone - The power zone for lifting or working is close to the body, between mid-thigh and mid-chest height. This zone is where arms and back can lift the most with the least amount of effort. This is zone is sometimes refered to as the "strike zone";
- Work near elbow height to avoid excessive bending (avoid working above the shoul knees);



Source: OSHA

- Plan before carrying:
  - Wear appropriate shoes to avoid slips, trips or falls
  - If you wear gloves, wear gloves that fit. Tight-fitting gloves can put pressure on the hands, while loose-fitting gloves reduce grip strength and pose other safety hazards.
  - Avoid carrying large or bulky loads that limit or obstruct your vision
  - Slide, push, or roll instead of carrying when appropriate
  - When there is a choice, push instead of pull
  - Carry only as much as you can safely handle
  - Try to avoid slopes, stairs, or other obstacles that make carrying materials more difficult
  - Beware of and try to avoid slippery floors (e.g., liquids, ice, oil, and fine powders)
  - Use extra caution when moving loads that may be unstable
- In general, the following steps must be practiced when planning and performing manual lifts:
  - Examine the load and the surrounding area
  - Bend knees when lifting a load
  - Look forward to keep back straight
  - Position the load close to the body
  - Maintain a firm grip on the load
  - Test the load for stability and weight prior to lifting
  - Use smooth, controlled movements
  - Keep arms in front of body
  - Turn feet in direction of movement to avoid twisting
- Avoid carrying objects more than 100 feet;

<u>Ergonomic Work Practices</u>

- Avoid repetitive motions, overhead reaching, and kneeling when possible;
- If prolonged awkward postures are unavoidable, use a “supported” posture to compensate; a supported posture uses part of your body to support the weight of another body segment that is in an awkward position;
- Watch your pace—attempting to do something faster can cause you to lose proper form;
- Use a table or move work to a location where you don’t have to be in a bent-over position to do your work; and
- Where awkward postures or repetitive motions are unavoidable, rotate with another worker, change tasks, stretch, and take short breaks frequently.

7.7 Field Trailer/Office Setup and Maintenance

- Determine trailer placement by considering all potential hazards that could impact “office” work. Trailers usually are placed in the support zone and out of construction zones. Think about what type of PPE will be necessary when exiting the trailer, parking needs, biological hazards or other hazards that could impact location.
- Check utility configuration prior to placement, including electrical, water, and sewer.
- Use spotters when placing trailer.
- Set on flat ground.
- Be sure trailer wheels are chocked.
- When disconnecting trailer from hitch—watch pinch points and wear leather gloves.

- Carefully jack trailer using the appropriately rated jacks and following manufacturer's recommendations.
- Secure and anchor trailer to protect from wind or other severe weather.
- Place cones in front of hitch.
- Ensure proper stairs and secure stairs next to doors. Ensure stairs are "no slip" and that the platform or landing of the stairs is flush the door threshold.
- Use only qualified electricians to establish electrical service.
- Consider ergonomics when furnishing trailer with desks and chairs.
- Place fire extinguishers near doors, and place signage.
- Put up emergency contacts, evacuation and rally point map, and route to the hospital
- Place right to know posters (e.g., OSHA, Workplace, Wage and Hour, Family Medical Leave).
- Place signage on exit doors.
- Never place porta-johns at HVAC intake (usually HVAC is located at the front of trailer).
- Have capability to properly store food—temporary field offices can quickly develop rodent issues if food is not stored properly or the trailer isn't cleaned regularly.

7.8 Field Vehicles

- Field vehicles may be personal vehicles, rental vehicles, fleet vehicles, or project vehicles.
- Maintain a first aid kit and bloodborne pathogen kit in the field vehicle.
- Assess whether maintaining a fire extinguisher in the field vehicle is feasible. If fire extinguishers are readily available, for example on heavy equipment, or if the project is short duration, a fire extinguisher would not be necessary. Fire extinguishers in field vehicles need to be properly secured and inspected on a monthly basis.
- The following precautions should be implemented if work involves stopping or parking along roadways:
  - Freeways and limited access – no stopping/parking allowed
- The following applies in Canada:
  - Roads with speed limits 80 km/hr (50 mph) or higher – flashing beacon required on top of the vehicle.
  - Roads with speed limits 55 km/hr (35 mph) or higher with no/limited shoulder (not able to get fully off the road at least 12 inches from the fog line or road edge) - flashing beacon required
  - Roads with speed limits 55 km/hr (35 mph) or higher with full shoulder (are able to get fully off the road at least 12 inches from the fog line or road edge) - flashers required
  - Roads with speed limits under 55 km/hr (35 mph) - flashers required
- Familiarize yourself with rental vehicle features prior to operating the vehicle:
  - Vision Fields and Blind Spots
  - Vehicle Size
  - Mirror adjustments
  - Seat adjustments
  - Cruise control features, if offered
  - Pre-program radio stations and Global Positioning System (GPS), if equipped
- Always wear seatbelt while operating vehicle.
- Adjust headrest to proper position.

- Tie down loose items if utilizing a van or pick-up truck. If supplies/equipment is being transported inside the vehicle, be sure to tie down or secure to prevent movement within the vehicle.
- Close car doors slowly and carefully. Fingers can get pinched in doors.
- Park vehicle in a location where it can be accessed easily in the event of an emergency. If not possible, carry a phone.
- Have a designated place for storing the field vehicle keys when not in use.
- Ensure back-up alarms are functioning, if equipped. Before backing a vehicle, take a walk around the vehicle to identify obstructions or hazards. Use a spotter when necessary to back into or out of an area.
- See the Vehicle Incident Guidance attached to the project safety plan, if a vehicle incident is experienced in a rental or fleet vehicle.

7.9 Fire Prevention

Follow the fire prevention and control procedures listed below.

7.9.1 Fire Extinguishers and General Fire Prevention Practices

- Fire extinguishers shall be provided so that the travel distance from any work area to the nearest extinguisher is less than 100 feet (30.5 meters). When 5 gallons (19 liters) or more of a flammable or combustible liquid is being used, an extinguisher must be within 50 feet (15.2 meters). Extinguishers must:
  - be maintained in a fully charged and operable condition;
  - be visually inspected each month; and
  - undergo a maintenance check each year.
- The area in front of extinguishers must be kept clear.
- Post “Exit” signs over exiting doors, and post “Fire Extinguisher” signs over extinguisher locations.
- Combustible materials stored outside should be at least 10 feet (3 meters) from any building.
- Solvent waste and oily rags must be kept in a fire resistant, covered container until removed from the site.
- Keep areas neat. Housekeeping is important.

7.9.2 Dispensing of Flammable/Combustible Liquids

- Areas in which flammable or combustible liquids are dispensed in quantities greater than 5 gallons (22.7 liters) (shall be separated from other operations by at least 25 feet (7.6 meters).
- Drainage away from storm drains or surface waters or other means of containment shall be provided to control spills.
- Adequate natural or mechanical ventilation shall be provided to maintain the concentration of flammable vapor at or below 10 percent of the lower flammable limit.
- Dispensing of flammable liquids from one container to another shall be done only when containers are electrically interconnected (bonded).
- Dispensing flammable or combustible liquids by means of air pressure on the container or portable tanks is prohibited.
- Dispensing devices and nozzles for flammable liquids shall be of an approved type.

7.10 General Practices and Housekeeping

The following are general requirements applicable to all portions of the work:

- Site work should be performed during daylight hours whenever possible;
- Good housekeeping must be maintained at all times in all project work areas;
- Common paths of travel should be established and kept free from the accumulation of materials;
- Keep access to aisles, exits, ladders, stairways, scaffolding, and emergency equipment free from obstructions;
- Provide slip-resistant surfaces, ropes, or other devices to be used;
- Specific areas should be designated for the proper storage of materials;
- Tools, equipment, materials, and supplies shall be stored in an orderly manner;
- As work progresses, scrap and unessential materials must be neatly stored or removed from the work area;
- Containers should be provided for collecting trash and other debris and shall be removed at regular intervals;
- All spills shall be quickly cleaned up; oil and grease shall be cleaned from walking and working surfaces;
- Review the safety requirements of each job you are assigned to with your supervisor. You are not expected to perform a job that may result in injury or illness to yourself or to others;
- Familiarize yourself with, understand, and follow jobsite emergency procedures;
- Do not fight or horseplay while conducting the firm's business;
- Do not use or possess firearms or other weapons while conducting the firm's business;
- Report unsafe conditions or unsafe acts to your supervisor immediately;
- Report emergencies, occupational illnesses, injuries, motor vehicle incidents, and near misses immediately;
- Do not remove or make ineffective safeguards or safety devices attached to any piece of equipment;
- Report unsafe equipment, defective or frayed electrical cords, and unguarded machinery to your supervisor;
- Shut down and lock out machinery and equipment before cleaning, adjustment, or repair. Do not lubricate or repair moving parts of machinery while the parts are in motion;
- Do not run in the workplace;
- When ascending or descending stairways, use the handrail and take one step at a time;
- Do not apply compressed air to any person or clothing;
- Do not wear steel taps or shoes with metal exposed to the sole at any JACOBS project location;
- Do not wear finger rings, loose clothing, wristwatches, and other loose accessories when within arm's reach of moving machinery;
- Remove waste and debris from the workplace and dispose of in accordance with federal, state, provincial, and local regulations;
- Note the correct way to lift heavy objects (secure footing, firm grip, straight back, lift with legs), and get help if needed. Use mechanical lifting devices whenever possible; and

- Check the work area to determine what problems or hazards may exist.

7.11 Hazard Communication

For work in the US, the governing regulation is OSHA's Hazard Communication regulation, 29 CFR 1910.1200. In Canada, the national hazard communication standard is the Workplace Hazardous Materials Information System (WHMIS).

The hazard communication (HazCom) coordinator is to perform the following:

- Complete an inventory of chemicals brought on site by JACOBS using the chemical inventory form included as an attachment to the project safety plan;
- Confirm that an inventory of chemicals brought on site by JACOBS subcontractors is available;
- Request or confirm locations of Globally Harmonized System (GHS) compliant (i.e., consisting of 16 sections that appear in the same order and contain uniform information regarding the chemical) safety data sheets (SDSs) from the client, contractors, and subcontractors for chemicals to which JACOBS employees potentially are exposed;
- For chemicals used by JACOBS workers, before or as the chemicals arrive on site, obtain an SDS for each hazardous chemical and include on the chemical inventory sheet (attached to the project safety plan) and add the SDS to the SDS onsite notebook. Ensure everyone knows where SDSs are kept;
- The six required elements of the GHS label must include the product identifier, pictograms, signal word, hazard statements, precautionary statements, and the name, address, and telephone number of the chemical manufacturer, importer or other responsible party;
- The manufacturer's original label on any incoming regulated product must not be removed or defaced. The manufacturer's label and markings must be retained on the package or container until it is sufficiently cleaned of residue and purged of vapors to remove any potential hazards;
- Ensure all secondary containers are labeled in compliance with GHS labeling requirements. If GHS compliant information has not yet been provided by the manufacturer or chemical distributor, the HCC must contact the manufacturer or chemical distributor and document in the chemical inventory when the GHS labeling information will be available, until the labeling requirement is fulfilled;
- In the United States, the container label shall be in English, although labels in other languages may be kept as well. Container labels in other languages for non-speaking English speaking workers will be made available when specified by the client for their project site or facility;
- Give employees required chemical-specific HazCom training using the chemical-specific training form included as an attachment to the project safety plan and ensure that the GHS supplemental VO module has been completed; and
- Store all materials properly, giving consideration to compatibility, quantity limits, secondary containment, fire prevention, and environmental conditions.

The following are general guidelines for storing chemicals and other hazardous materials:

- Keep acids away from bases;
- Keep oxidizers (nitric acid, nitrates, peroxides, chlorates) and organics away from inorganic reducing agents (metals);
- Keep flammables and corrosives in appropriate storage cabinets;
- Do not store paper or other combustibles near flammables;

- Use secondary containment and lipped shelving that is secured; and
- Have a fire suppression system available.

7.12 Knife Use

Open-bladed knives (for example, box cutters, utility knives, pocket knives, machetes, and multi-purpose tools with fixed blades such as a Leatherman™) are prohibited at worksites except where the following three conditions are met:

- The open-bladed knife is determined to be the best tool for the job;
- An approved Activity Hazard Analysis (AHA) or written procedure is in place that covers the necessary safety precautions (work practices, PPE, and training); and
- Knife users have been trained and follow the AHA.

Specific precautions for knife use include:

- Employees are responsible for using cutting tools in the way they are intended, maintaining them in good working order and reporting faulty or unusable items. PPE as specified in the AHA is to be used;
- Those engaging and supervising subcontractors are to ensure that the requirements of this policy are communicated;
- The most appropriate gloves shall be identified within the AHA. In general, cut resistant gloves (e.g., Kevlar) are to be worn when using a knife in an occupational setting. Other types of gloves may be required and will be identified within the AHA. An example may be leather gloves may be worn when using the acetate sleeve cutter;
- All employees that will use a cutting tool must be trained in the proper use;
- Position the item to be cut on a stable surface. Secure it to prevent slippage, wherever possible. Select a work location which does not put your body in the line of fire of a knife slippage or failure;
- When using a knife do not cut towards yourself;
- When cutting, make the force of the cut carry the blade away from any part of your body. If you have a situation where this is not possible, protect yourself with a leather apron, or other material placed between you and the blade. Consider putting the material to be cut in a vise, or other holding device;
- Many tasks using a utility knife require a knife edge but not a sharp point. For these tasks you can add protection against puncture wounds by using a rounded-tip blade;
- In general, a pocket knife if not the preferred tool of choice as there are alternatives (e.g., retracting safety blade).
- If you use a folding knife, it must be a locking blade type.
- Never use a knife that will fold under pressure.
- If you use a fixed blade knife, make sure there is a handle guard to keep your hand from slipping forward. Also, make sure the handle is dry and non- greasy/slippery to assure a better grip. If you carry a fixed blade knife, use a sheath or holder.
- Store utility knives safely, retract the blade or sheath an open blade before storing. Never, leave a knife with the blade exposed on the floor, on a pallet, on a work surface, or in a drawer or cabinet.
- Keep your knife sharp. A dull blade requires you to use more force to cut, and consequently increases the risk of slip or mistake.

- Knives used on the job, but not carried with you, must be properly stored when not in use;
- Never use a defective knife;
- Utility knife blades are brittle and can snap easily. Don't bend them or apply side loads to them by using them to open cans or pry loose objects. Use the knife only to cut. It was not designed to work as a pry bar, screwdriver, or hole punch.

7.13 Lighting

Lighting shall be evaluated when conducting work inside buildings, confined spaces, or other areas/instances where supplemental light may be needed (e.g., work before sunrise or after sunset). A light meter can be used to evaluate the adequacy of lighting. The following are common requirements for lighting and the conditions/type of work being performed:

- While work is in progress outside construction areas shall have at least 33 lux (lx);
- Construction work conducted inside buildings should be provided with at least 55 lux light;
- The means of egress shall be illuminated with emergency and non-emergency lighting to provide a minimum 11 lx measured at the floor. Egress illumination shall be arranged so that the failure of any single lighting unit, including the burning out of an electric bulb will not leave any area in total darkness.

7.14 Personal Hygiene

Good hygiene is essential for personal health and to reduce the potential of cross-contamination when working on a hazardous waste site. Implement the following:

- Keep hands away from nose, mouth, and eyes during work;
- Keep areas of broken skin (chapped, burned, etc.) covered; and
- Wash hands with soap and water prior to eating, smoking, or applying cosmetics.

7.15 Personal Security

Follow the guidelines below for personal security measures. The RHSM and Firm-Wide Security Office can be contacted if additional, specific measures are needed (e.g., such as evaluating the needs for security service).

General Safety and Security Guidelines

JACOBS Corporate Security Department recommends the following guidelines for workers in the United States:

- Stay alert and be aware of your surroundings. Avoid pre-occupations with mobile devices, while in an unfamiliar area.
- Whenever possible use the buddy system with another employee or client or subcontractor employee.
- Trust your intuition; if a situation appears strange or wrong, it probably is.
- Be confident in your walk or stride; do not give the appearance you are new in town.
- Avoid carrying and displaying large sums of cash.
- If you sense or see dangerous situations along your route, change your route and depart the area quickly. If you feel that you are being followed, go to the nearest police station or safe location and file a complaint with the police. Provide a description of the person, their vehicle, license plate number and any other useful information.
- Only walk short distances that are safe and secure while visiting an unfamiliar city or location.

- Take host approved transportation for long distances.
- "Fight or Flight?" Leaving the possible or dangerous area is always better than staying to fight.
- Always report suspicious activity to the nearest local law enforcement agency.
- Locate emergency exits in your hotel or where you are staying to ensure you know where to go in case of a fire or a natural or man-made disaster.
- Secure your electronic devices when left in your room or take them with you if you are not able to secure them properly.
- If you feel your life is in danger, call 911. Be sure to speak clearly, concisely and give the dispatcher a good description of where you are physically located.

Operating or Riding in Vehicles

- When waiting for public transportation or a taxi, remain in a store or restaurant as long as possible before catching your ride and never wait by yourself in an isolated area.
- Approach your vehicle with keys firmly in your hand and ready to unlock the car.
- Quickly check your car before entering it to determine damage or presence of an intruder.
- Vulnerable times can be stopping to find your keys to enter your vehicle or stepping out of your vehicle in an isolated area. Be aware of your surroundings before you perform these activities.
- Always keep your doors locked during transit and when the vehicle is parked.
- Never leave your vehicle unlocked, even when to performing a quick task such as checking in a hotel, getting gas or going picking up food.
- If confronted by an individual inside a vehicle pointing a weapon at you, run the opposite way from where the vehicle is facing and scream as loud as you can. This evasive action will probably cause the individual to drive away.
- If an individual in a passing car points at your tires or engine to indicate a malfunction, only pull over in a well-lit and populated gas or rest stop. Never pull over in an isolated or dimly lit area. You may have a malfunction or the passing motorist may be attempting to rob you.
- Always park your vehicle is a well-lit and secure area. If your vehicle is parked in a dimly lit or isolated area in a parking garage; ask an attendant or friend to accompany you to your vehicle.
- Secure your valuables in the trunk, or place them out of sight or cover them with a blanket or coat if there is no secure storage area in the vehicle. The would-be-perpetrator likes to see what to steal and not knowing what you have concealed will normally prevent a break in.

Riding in a Taxi

- Have your host or a designated travel agent suggest or reserve a reputable taxi service for you during your stay.
- Only use a taxi service that was vetted for safety and reliability.
- If possible, place luggage, laptop and personal belongings inside the taxi.
- When you first enter the taxi, check the driver photo identification card, normally located on the driver's visor with the driver to ensure they match.

Walking

- If you experience automotive trouble, remain inside the locked vehicle and call for assistance.
- If you can't reach assistance via a mobile phone, only walk for help in a safe area facing the traffic.
- If while walking, you are shadowed or followed by a vehicle, run back in the direction of your vehicle and enter the vehicle if possible. File a police report on the incident as soon as practicable.
- Be aware of your surroundings and those around you while walking and do not be distracted by using electronic devices.
- Regularly change your route if you are walking to and from meetings or conferences and choose only well-lit areas to walk in at night.
- If walking long distances, identify a "safe house, shop, store or restaurant" to duck into if confronted by a perpetrator.

Jogging or Running

- Always jog or run in an area that is safe, secure, and used for exercising.
- Avoid running along busy roads or highways.
- If you chose to venture out on a jog or run, check the route by vehicle prior to beginning to exercise.
- Let the host or a friend know when you leave, when you plan to return, and the route you will take during exercising.
- Take a photo identification and mobile phone with you for emergencies.
- Avoid physically over-extending yourself since reflexes and decision-making ability can be impaired.

Clothing and Jewelry

- Dress to blend in with locals, maintain a low profile and avoid drawing attention to yourself.
- Travel with inexpensive clothing and jewelry.
- Avoid wearing JACOBS distinctive clothing or using JACOBS logos on luggage or laptops.

Emergency Numbers and Information

- Leave your itinerary and emergency contact numbers where you can be reached with family members and only those that have a need to know.
- Pre-program emergency numbers in the mobile device you are traveling with.
- Carry a list of current medications and specific doses in your purse or wallet.
- Record medical emergency information on a document that can be readily available if you are unable to speak or unconscious.
- Have a photo copy of your driver's license, passport, and credit card information separately in case your wallet or purse is stolen.

7.16 Shipping and Transportation of Hazardous Materials

Chemicals brought to the site might be defined as hazardous materials or dangerous goods by the U.S DOT, Canadian Transportation of Dangerous Goods (TDG) Regulations, or other local or country norms. This can include calibration gases used in personal exposure monitoring or field instruments. Hazardous wastes that may be shipped offsite are also defined as hazardous materials by U.S. DOT, Canadian TDG. Other wastes may also be considered hazardous materials. To confirm whether a material or a waste is a hazardous material under applicable

regulations, check with the Waste Coordinator, the project EM, or the JACOBS Dangerous Goods Shipping Coordinator (Rob Strehlow/MKW).

All staff who affect shipment of hazardous materials, including receiving hazardous materials, preparing profiles or manifests, packaging hazardous wastes, labeling, or transporting hazardous materials by road, are called HazMat employees (note JACOBS cannot transport hazardous wastes by public road). HazMat employees must receive JACOBS online training in shipping dangerous goods. CH2M's online Dangerous Goods Shipping course can be found on the JACOBS HSE website.

All hazardous materials that are shipped (e.g., via Federal Express) or are transported by road must be properly identified, labeled, packed, and documented by trained staff. If the material is a product that is being shipped (e.g., calibration gas), use the HazMat ShipRight tool on the JACOBS virtual office (under Company Resources – Online Shipping). Contact the Dangerous Goods Shipping coordinators, the Waste Coordinator or the project EM for additional information.

It is important that employees be aware of potential transportation security concerns and regulations. In the US, 49 CFR 172 requires that all hazmat employees be aware of potential transportation security concerns. Hazardous materials security is addressed in CH2M's Hazardous Materials SOP (HSE-403). The following points are provided as an overview of security measures to increase awareness of this important matter:

- Do not to ship calibration gas back to JACOBS warehouses. See the Calibration Gas Cylinder Disposal section of this Handbook;
- It is essential that each employee understand the security risks involved with transporting hazardous materials;
- All transporters of hazardous materials must be prequalified by a Contracts Administrator who evaluate the carrier's safety rating, security measures, and employee screening procedures;
- When shipping hazardous materials, check driver credentials and ask about shipping details;
- When receiving a hazardous materials shipment, inspect packages for signs of tampering or damage to the contents. Verify the drivers and company information on the form with the driver; and
- If there is suspicious or unusual behavior (e.g., driver without credentials, evasive answers) or any discrepancies identified, do not offer or accept the shipment, and immediately notify the project manager or the RHSM.

Employees responsible for shipping hazard materials must also review the JACOBS Transportation Security Plan.

7.17 Substance Abuse

Employees who work under the influence of controlled substances, drugs, or alcohol may prove to be dangerous or otherwise harmful to themselves, other employees, clients, the company, the company's assets and interests, or the public. JACOBS does not tolerate illegal drug use, or any use of drugs, controlled substances, or alcohol that impairs an employee's work performance or behavior.

Prohibitions onsite include:

- Use or possession of intoxicating beverages while performing JACOBS work;
- Abuse of prescription or nonprescription drugs;
- Use or possession of illegal drugs or drugs obtained illegally;
- Sale, purchase, or transfer of legal, illegal or illegally obtained drugs; and
- Arrival at work under the influence of legal or illegal drugs or alcohol.

Drug and/or alcohol testing is applicable under Policy 810 in the United States. In addition, employees may be required to submit to drug and/or alcohol testing as required by clients. In the US, this testing is performed in accordance with Policy 810, Drug-Free Workplace. Contact the Drug-Free Workplace administrator, Mary Beth Thomas/DEN, if testing is necessary.

Employees who are enrolled in drug or alcohol testing are required to complete annual training located on the JACOBS Virtual Office (VO).

In Canada, drug and/or alcohol testing is not applicable in Ontario, but employees may be required to submit to drug and/or alcohol testing as required by clients, or in the event of specific incidents/accidents. When required, employees will be contacted by Human Resources with forms and this testing is performed in accordance with JACOBS Canadian Operations Alcohol and Drug Free Workplace Policy. Employees who are enrolled in drug or alcohol testing are required to complete annual training located on the JACOBS Virtual Office (VO).
When drug testing is required outside of the US and Canada, follow applicable regulations or policy.

7.18 Unknown or Suspect Objects/Materials

If unknown or suspect objects/materials are encountered (i.e., exposed or partially buried drums, biological waste, cylinders, glass containers, munitions of explosive concern, unexpected stained/discolored soil) are encountered during site operations, ongoing activities shall be immediately suspended. JACOBS or subcontractor personnel encountering unknown or suspect objects or materials shall:

- Secure the area and identify the location of the object/material to the extent possible, without causing bodily injury to yourself or others and without disturbing the object.
- Evacuate the work area.
- Immediately notify the PM and RHSM of the encountered condition.
- Do not further disturb or otherwise handle the suspect object or material.

The site supervisor or SL shall contact the Project Manager and the RHSM to evaluate potential hazards associated with the specific situation encountered. The project team will then address the need for the use of special procedures, engineering controls, PPE or specialized subcontract personnel to safely mitigate the situation.

7.19 Workplace Hazardous Materials Information System

Hazardous Material Handling; in Canada, also refer to Provincial Workplace Hazardous Materials Information System (WHMIS) Regulation)

- WHMIS is the governing regulation for hazard communication in Canada. For work in the US, the governing regulation is OSHA's Hazard Communication regulation, 29 CFR 1910.1200).
- By May 2017, requirements of WHMIS 2015 must be implemented.

The hazard communication (HazCom) coordinator is to perform the following:

- Complete an inventory of chemicals brought on site by JACOBS using the chemical inventory form included as an attachment to this HSP;
- Confirm that an inventory of chemicals brought on site by JACOBS subcontractors is available;
- Request or confirm locations safety data sheets (SDSs) from the client, contractors, and subcontractors for chemicals to which JACOBS employees potentially are exposed;
- For chemicals used by JACOBS workers, before or as the chemicals arrive onsite, obtain a SDS for each hazardous chemical and include on the chemical inventory sheet (attached to this HSP) and add the SDS to

the SDS attachment section of this HSP (or maintain in an accessible binder onsite). Ensure everyone knows where SDSs are kept. SDS shall be in English and French;

- Country-specific workplace-secondary container labeling systems, such as required by Canada for Workplace Hazard Materials Identification System (WHMIS), must be used. In Canada, the label must be in English and French.
- Ensure all secondary containers are labeled in compliance with WHMIS 2015 requirements;
- Give employees required chemical-specific training using the chemical-specific training form included as an attachment to this HSP and ensure that the GHS supplemental VO module has been completed (if applicable).Store all materials properly, giving consideration to compatibility, quantity limits, secondary containment, fire prevention, and environmental conditions.

The following are general guidelines for storing chemicals and other hazardous materials:

- Keep acids away from bases;
- Keep oxidizers (nitric acid, nitrates, peroxides, chlorates) and organics away from inorganic reducing agents (metals);
- Keep flammables and corrosives in appropriate storage cabinets;
- Do not store paper or other combustibles near flammables;
- Use secondary containment and lipped shelving that is secured; and
- Have a fire suppression system available.

8. Project-Specific Hazard Controls

This section provides safe work practices and control measures used to reduce or eliminate potential hazards. These practices and controls are to be implemented by the party in control of either the work or the particular hazard. Each person onsite is required to abide by the hazard controls. Always consult the appropriate JACOBS SOP to ensure all requirements are implemented. JACOBS employees and subcontractors must remain aware of the hazards affecting them regardless of who is responsible for controlling the hazards. JACOBS employees and subcontractors who do not understand any of these provisions should contact the RHSM for clarification.

8.1 Abrasive Blasting

Abrasive blasting is the cleaning or preparing of a surface by forcibly propelling a stream of abrasive material against the surface using sand, glass bead, aluminum oxide, grit, garnet, steel shot, slag, walnut shells, and others. Below are the hazard controls and safe work practices to follow when overseeing or performing abrasive blasting.

- JACOBS employees who work on projects with abrasive blasting operations are required to complete the JACOBS 10-Hour Construction Safety Awareness training and waste management training.
- Abrasives and the surface coatings on the materials blasted are shattered and pulverized during blasting operations and the dust formed will contain particles of respirable size. The composition and toxicity of the dust from these sources shall be considered in making an evaluation of the potential health hazards. Air monitoring instruments shall be provided if the potential for a hazardous atmosphere exists.
- Personnel shall remain a safe distance from the abrasive blasting area to reduce exposure to hazardous airborne contaminants.
- Abrasive blasting equipment shall be inspected each day, before use, to ensure safe operational condition.
- Non-silica containing abrasive blasting materials must be used to the extent possible.
- Blast nozzles must be equipped with an operating valve that must be held open manually.
- Eating, drinking, and smoking shall be prohibited in areas where blasting is performed. Employees shall wash their face and hands before eating, drinking or smoking.
- Abrasive blasting debris shall be cleaned up by using dust-free methods. Wet clean-up methods and vacuum cleaners with High Efficiency Particulate Air (HEPA) filters are recommended.
- Fugitive dust must be controlled during abrasive blasting operations by using water sprays or other methods.
- Noise must be monitored and controlled as required by state, provincial, or local regulations.
- Complete the abrasive blasting self-assessment checklist when performing or when subcontractors perform this operation.

See also *Crystalline Silica* for requirements regarding silica hazards.

8.2 Aerial Lifts

Below are the hazard controls and safe work practices to follow when working around or operating aerial lifts. Ensure the requirements in the referenced SOP are followed:

- Operate aerial lifts only if you are authorized and trained to do so;
- Inspect aerial lifts and test lift controls prior to use;

- Wear a full-body harness, with a lanyard attached to the boom or platform (see also SOP HSE-308, *Fall Protection*). When working within a standard guardrail system with scissors lifts, the full-body harness and lanyard are not required;
- Do not attach lanyard to any adjacent structures or equipment while working from an aerial lift;
- Stand firmly on the floor of the platform and do not sit or climb on the railings of the platform, or use planks, ladders, or other devices to increase working height;
- Remain on the platform at all times and do not leave the platform to climb to adjacent structures;
- Position aerial lifts on firm, level surfaces when possible, with the brakes set. Use wheel chocks on inclines. If outriggers are provided, position them on solid surfaces or cribbing;
- Maintain safe clearance distances between overhead power lines and any part of the aerial lift or conducting material, unless the power lines have been de-energized and grounded, or insulating barriers have been installed to prevent physical contact. Maintain at least 10 feet (3 meters) from overhead power lines for voltages of 50 kilovolts (kV) or less, and 10 feet (3 meters) plus 0.4 inches (1.0 cm) for every 1 kV over 50 kV;
- Do not exceed the boom and basket load limits;
- Do not use aerial lifts as cranes, unless specifically designed and approved by the lift manufacturer;
- Do not work or stand below aerial lift operations;
- Do not use aerial lifts when winds exceed 30 miles per hour (48 km per hour) or per manufacturers recommendations; and
- Complete the self-assessment checklist for aerial lifts whenever aerial lifts are being used.

8.3 All-Terrain Vehicles and Utility-Type Vehicle Safety

An all-terrain vehicle (ATV) means any recreational vehicle with three or more tires, has handlebar steering, and a seat designed to be straddled by the operator and are not intended for use on paved roads. The only type of ATV permitted for use is the Polaris Ace model which is the only model known to have rollover protection.

Utility-type vehicle (UTV) means any recreational motor vehicle other than an ATV, motorbike, or snowmobile designed for and capable of travel over designated roads, traveling on four (4) or more tires.

Motorcycles, motorbikes, or other motorized devices with two or three wheels, ATVs or quads are not allowed to be used for company related business.

Four-wheeled, cabbed vehicles and vehicles with rollover protection structures (ROPS), with seatbelts for all passengers such, as Yamaha Mules and Polaris Rangers (and similarly designed vehicles including golf carts) are allowed for use.

Doors (plastic, metal or net) supplied by the manufacturer at the time of purchase must be utilized.

Operators shall have the proper safety training and must follow all facility, and client rules for safe operation of the vehicle.

ATVs/UTVs shall not be operated on site unless determined to be the most appropriate vehicle(s) to use and their use is pre-approved by the PM and RHSM.

Operators shall be trained and qualified before operation of the ATV or UTV onsite and will possess a valid driver's license.

ATV/UTV operators are prohibited from using any wireless device while operating ATVs/UTVs. Equipment must be stopped before using devices such as two way radios or cell phones. If a wireless device is required for a certain

operation, the PM and RHSM must authorize the wireless use on a case by case basis and make sure limitations are addressed in the project safety plan.

Training shall consist of manufacturer's operating manual, hands-on training by a competent person, a demonstration of basic skills, and when required by the state or province, completion of an ATV/UTV safety course. An AHA shall also be developed for the use of ATVs/UTVs and operators shall be trained on the AHA. All individuals are required meet all training aspects before ATV/UTV use and documentation of training shall be maintained at the site.

Some states and provinces may require an ATV/UTV license or even a motorcycle endorsement on the operator's current driver's license. Be sure to contact the local division of motor vehicles (DMV) office for details. (In the United States, the following states require a specialized driver's license: Arizona, Oregon, Georgia, and Illinois. New Hampshire's and Montana's requirements vary by city. Check your state for new local requirements.)

Keep in mind that states and provinces may still:

- Impose age restrictions for operating ATVs/UTVs;
- Require an ATV/UTV safety or education course certification (even if you're older than 18);
- Require ATV/UTV insurance.

Daily inspections of vehicles for safety and maintenance are required.

Minimum PPE required for operators and passengers on ATVs/UTVs include:

- Safety glasses, goggles, or face-shield at all times when moving;
- Leather boots or shoes (if safety-toed boots are not required by the project safety plan); and
- A properly fitted DOT/ANSI/SNELL-approved helmet (check with client, local requirements, and the project safety plan for helmet requirements when operating or riding in a golf cart or UTV with roll-over protection).

Other safety requirements include:

- ATVs and UTVs shall be operated in accordance with the manufacturer's operating manual, any state, province, or client requirements, and task-specific AHA;
- Speed is not to exceed 32 km/hr (20 mph). Keep all parts of your body inside any roll over protection;
- Always use the seat belt on ATVs/UTVs;
- Make sure the engine is turned off before dismounting the vehicle;
- Avoid driving over any extremely large obstacles (i.e., wood/logs, fences, boulders, etc);
- When using trailers, watch your turning radius;
- Shut engine down prior to refueling;
- ATVs/UTVs must have fenders;
- Utilize high visibility flag and wear high visibility vest when operating adjacent to heavy equipment or haul vehicles.

8.4 Arsenic

(In Canada, provincial occupational regulations may apply and should be implemented as required.)

Arsenic is considered a "Confirmed Human Carcinogen." JACOBS is required to control employee exposure to arsenic when exposures are at or above 5.0 micrograms per cubic meter ($\mu g/m^3$), or lower if the local regulations

are more stringent, or if there is the possibility of skin or eye irritation from arsenic. The elements of the JACOBS arsenic program include the following:

Exposure monitoring;

- Methods of control, including PPE and respirators;
- Medical surveillance;
- Training on hazards of arsenic and control measures (includes project-specific training and the computer-based training on CH2M's Virtual Office, *Arsenic Exposure);* and
- Recordkeeping requirements.

If air monitoring indicates there is potential exposure at the action level concentrations, notify the RHSM to ensure the above have been adequately addressed. Full implementation of SOP HSE-501, Arsenic, will be required. Other exposure control measures include:

- Do not enter regulated work areas unless training, medical monitoring, and PPE requirements established by the competent person have been met;
- Do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in regulated areas;
- Avoid skin and eye contact with liquid and particulate arsenic or arsenic trichloride;
- Respiratory protection and other exposure controls selection shall be based on the most recent exposure monitoring results obtained from the competent person; and
- Review the fact sheet included as an attachment to the SOP.

8.5 Asbestos

Asbestos is a cancer-causing mineral that was included in many building materials. When disturbed harmful asbestos fibers can be released and inhaled and ingested by workers. Materials suspected of containing asbestos shall be treated as asbestos unless documentation and testing results indicate otherwise. Where the presence of asbestos is suspected, if at all possible, design all operations to avoid contact.

When there is a risk of disturbing asbestos and making it friable (able to release fibers when the materials are crushed, abraded or cut) the activity becomes regulated. The asbestos standard for construction regulates asbestos exposure for the following activities:

- Demolishing or salvaging structures where asbestos is present in concentrations greater than 1 percent;
- Removing or encapsulating asbestos-containing materials (1 percent or greater asbestos content);
- Constructing, altering, repairing, maintaining, or renovating asbestos-containing structures or substrates;
- Installing asbestos containing products;
- Cleaning up asbestos spills/emergencies; and
- Transporting, disposing, storing, containing and housekeeping involving asbestos or asbestos containing products on a construction site.

JACOBS is required to control employee exposure to asbestos when exposures are at or above 0.1 fibers per cc (f/cc) by implementing a program that meets the requirements of the applicable regulatory agency (OSHA Asbestos standard, 29 Code of Federal Regulations (CFR) 1926.1101, Canadian Provincial OH&S Code/Regulations, etc.). The elements of the JACOBS asbestos program include the following:

- Exposure monitoring;
- Methods of control, including PPE and respirators;

- Medical Surveillance;
- Training on hazards of asbestos and control measures; and
- Record keeping requirements.

If air monitoring indicates there is potential exposure at the action level concentrations, notify the RHSM to ensure the above have been adequately addressed. Other exposure control measures include:

- Do not enter regulated work areas unless training, medical monitoring, and PPE requirements established by the competent person have been met;
- Do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in regulated areas;
- Avoid skin and eye contact asbestos;
- Respiratory protection and other exposure controls selection shall be based on the most recent exposure monitoring results obtained from the competent person;
- Review the fact sheet included as an attachment to the SOP; and
- Do not disturb waste or other materials labeled “Danger - Asbestos Fibers.”

Subcontractors performing asbestos abatement activities are required to obtain state or special licenses and permits and have a written compliance/abatement plan that has been reviewed and accepted by JACOBS before work begins. Subcontractors are required to provide proof that all asbestos workers medically qualified, training and a competent person has been appointed before work begins.

8.6 Barbed Wire Fences

Crossing barbed wire fences shall be avoided, in general, when performing field work. Use gates or other entryways within a reasonable walking distance whenever possible and permitted by fence owner.

In some circumstances, barbed wire fences may have to be crossed during pre-construction surveys or other similar tasks through open country. JACOBS and subcontractor personnel shall follow the requirements in the safety plan which may include determining whether personnel should go over or in between the strings of barbed wire fence based on height and ability (e.g., if the fence is 3-feet high or less, most personnel may prefer to go over the fence). If going over the top string of barbed wire, use a split section of foam pipe insulation to cover the barbs while crossing over the fence. Use a buddy to hold the fence down while crossing. If personnel will be going in between two strings of barbed wire, use the buddy system to perform a step-through technique to cross through the fence. Each worker will need to take turns spreading the top and middle sections of wire, so that the second person can step through the fence. PPE shall include leather gloves and foam pipe insulation to cover the barbs.

8.7 Benzene

(In Canada, provincial occupational regulations may apply and should be implemented as required.)

Benzene is considered a “Confirmed Human Carcinogen.” JACOBS is required to control employee workplace exposure to benzene when personal exposures is at or above 0.5 parts per million (ppm) as an 8-hour time-weighted average (TWA) or above 5.0 ppm short term exposure limit (STEL), by implementing a program that meets the requirements of the local regulatory agency (OSHA Benzene standard, 29 CFR 1910.1028, Provincial OH&S Code/Regulations, etc.). [Note: Alberta, British Columbia, and Ontario state a more conservative STEL of 2.5 ppm for benzene.) The elements of the JACOBS benzene program include the following:

- Exposure monitoring;
- Methods of control, including personal protective equipment (PPE) and respirators;
- Medical surveillance;

- Training on hazards of benzene and control measures (includes project-specific training and the computer-based training on CH2M's Virtual Office, *Benzene);* and
- Record keeping requirements.

If air monitoring indicates there is potential exposure at the action level concentrations above, notify the RHSM to ensure the above have been adequately addressed. Other exposure control measures include:

- Do not enter regulated work areas unless training, medical monitoring, and PPE requirements established by the competent person have been met;
- Do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in regulated areas;
- Respiratory protection and other exposure controls selection shall be based on the most recent exposure monitoring results obtained from the competent person; and
- Review the fact sheet included as an attachment to the SOP.

8.8 Blasting / Explosives

- A (safety) Opportunity Risk Evaluation (ORE) must be conducted with the Munitions Response (MR) Safety/Quality Officer prior to the Go/No Go decision making opportunity for all projects involving the use of explosives or work to be performed on a MR site.
- Only authorized, trained and qualified personnel shall handle, use and transfer explosives.
- Blasting subcontractors are responsible for providing a competent person to oversee blasting operations.
- Personnel who will be handling explosives will not wear outer or inner garments having static electricity-generating characteristics. These include clothing made of 100 percent polyester, nylon, silk, and wool, which are all highly static producing.
- Protective shoes worn by personnel performing explosives operations should be constructed of nonferrous materials (e.g., fiberglass) to prevent interference with sensitive geophysical instruments.
- Expose the minimum number of people to the minimum amount of explosives for the minimum amount of time. Project-specific explosives safety precautions shall be developed prior to field activities and must be reviewed and approved by the MR Safety/Quality Officer and the MR Operations Manager.
- Details of explosives management and safety requirements are developed and included in a site-specific Explosives Management Plan (EMP).
- Security of explosives shall conform to the requirements set forth by federal, state, provincial, and local jurisdictions. Project site and overnight explosives security will conform to any local transportation security requirements.
- In Canada, **Type-20 Manufacturer of High Explosives License/Permit** issued by the country ATF&E is required to purchase, store, and use high explosives including on-site use of binary explosives in support of MR operations, construction projects, and demolition and deactivation (D&D) projects.
- State, Provincial and/or local explosives permits may be required for JACOBS and individuals to purchase, store, and use explosives in support of MR operations, CDC operations, construction projects, and D&D projects. In addition there may be local requirements.

8.9 Boating Safety

Personnel who will operate a boat during the course of a project shall first demonstrate to the site manager that they are experienced in operating boats similar to those used for the project and that they are knowledgeable of local boating safety requirements (e.g., the National Coast Guard, Canadian Coast Guard, etc.). Project boats shall

be operated by experienced boat operators in possession of a current operator's license only. Boat operators shall also possess basic mechanical knowledge necessary to troubleshoot common mechanical problems that can and do occur. The boat operator shall be responsible for the safety of all personnel on board the boat he or she is operating and for the integrity of all boat and safety equipment.

Each designated boat operator shall give a safety briefing to all occupants of the boat prior to leaving the shore. Boats are to be occupied during use by not less than one qualified operator plus one additional person.

The boat captain has the final authority with regard to boat safety and navigational safety.

Boat Requirements

All project boats will meet or exceed US, Canada, or local Coast Guard requirements for safety equipment, as applicable to the operation and type of boat. These requirements are summarized below for small craft (less than forty feet [12 meters] in length).

Flame Arresters

All gasoline engines, except outboard motors, installed in a boat must have an approved flame arrestor (backfire preventer) fitted to the carburetor.

Sound Signaling Devices

Boats shall carry at least one air horn or similar sound-signaling device. Radio or cell-phone communication must be in place as well.

Personal Flotation Devices

All personnel and passengers shall wear an approved personal flotation device (PFD) at all times when operating or being transported in a boat. A positively buoyant wet suit or dry suit may be substituted for a PFD. PFDs shall be Type II or higher (capable of turning its wearer in a vertical or slightly backward position in the water). In addition, each boat shall be equipped with at least one Type IV PFD, designed to be thrown to a person in the water and grasped and held by the user until rescued. A buoyant boat cushion equipped with straps and a float ring are two common examples of a Type IV PFD.

Fire Extinguishers

Each boat shall carry at least one Type B-I or B-II fire extinguisher (for use in gasoline, oil and grease fires) approved by Underwriters Laboratories (UL). Each fire extinguisher shall be inspected to ensure that it is sufficiently charged and that the nozzles are free and clear. Discharged fire extinguishers shall be replaced or recharged immediately.

Emergency Planning

As part of the project HSP and AHAs, emergencies and response actions must be addressed for potential emergencies such at fire, sinking, flooding, severe weather, man over-board, hazardous material incidents, etc.

Load Capacity

Boats shall not be loaded (passengers and gear) beyond the weight capacity printed on the Coast Guard information plate attached to the stern. In addition, several factors must be considered when loading a boat: distribute the load evenly, keep the load low, do not stand up in a small boat or canoe, and do not overload the boat.

Tool Kit

All motorized boats shall carry a tool kit sufficient for the boat operator to troubleshoot common mechanical problems such as fouled spark plugs, flooded carburetor, electrical shorts, etc. Boats operated in remote areas

shall also carry appropriate spare parts (propellers, shear pins, patch kits, air pumps, etc). The tool kit shall be maintained by the boat operator and supplies used up shall be replaced immediately.

Communications

All boats operated shall carry a two-way radio or cellular telephone that enables communication back to the field camp or other pre-established location.

Good Housekeeping

Personnel using a boat shall properly stow and secure all gear and equipment against unexpected shifts when underway. Decks and open spaces must be kept clear and free from clutter and trash to minimize slip, trip, and fall hazards.

Fuel Management

Personnel shall utilize the "one-third rule" in boating fuel management. Use one-third of the fuel to get to the destination, one-third to return, and keep one-third in reserve.

No smoking is permitted on board vessels or during refueling operations.

Pollution Control

The Clean Water Act prohibits the discharge of oil, hazardous substances, or other materials or wastes in quantities that may be harmful into Canadian navigable waters. No person may intentionally drain oil or oily wastes from any source into the bilge of any vessel. Larger vessels equipped with toilet facilities must be equipped with a Canadian Coast Guard-approved marine sanitation device.

Employees shall report any significant oil spills to water to the SL and/or supervisor and the RHSM. The procedure for incident reporting and investigation shall be followed when reporting the spill.

Training

All operators and passengers shall be trained on the requirements outlined above, as well as trained on the HSP/AHA(s), including emergency response actions.

8.10 Cadmium

(In Canada, provincial occupational regulations may apply and should be implemented as required.)

Cadmium is considered a “Suspected Human Carcinogen.” JACOBS is required to control employee workplace exposure to cadmium when personal exposure is at or above 2.5 micrograms per cubic meter ($\mu g/m^3$) by implementing a program that meets the requirements of the OSHA Cadmium standard, 29 *Code of Federal Regulations* (CFR) 1926.1127, the Provincial OH&A Code/Regulation, or other (more stringent) local regulation. The elements of the JACOBS cadmium program include the following:

- Exposure monitoring;
- Methods of control, including PPE and respirators;
- Medical surveillance;
- Training on hazards of cadmium and control measures (includes project-specific training and the computer-based training on CH2M’s Virtual Office, *Cadmium);* and
- Recordkeeping requirements.

If air monitoring indicates there is potential exposure at the action level concentrations above, notify the RHSM to ensure the above have been adequately addressed. Other exposure control measures include:

- Do not enter regulated work areas unless training, medical monitoring, and PPE requirements established by the competent person have been met;
- Do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in regulated areas;
- Respiratory protection and other exposure controls selection shall be based on the most recent exposure monitoring results obtained from the competent person; and
- Review the fact sheet included as an attachment to the SOP.

8.11 Chainsaws

Below are the hazard controls and safe work practices to follow when working around or operating chainsaws. Ensure the requirements in the referenced SOP are followed.

8.11.1 Equipment

Only chainsaws equipped with a spark arrestor and fully functioning chain brake or "safety chain" shall be used. The following safety equipment shall be readily available while operating a chainsaw:

- Chainsaw operator's manual;
- Fully stocked first aid kit;
- Multipurpose fire extinguisher;
- Grounded extension cord approved for outdoor use and ground fault circuit interrupter (GFCI) for electrical-powered chainsaws;
- Approved safety gasoline container and funnel or flexible nozzle for refueling gasoline-powered chainsaws; and
- Sledge hammer and non-metallic wedges when necessary to prevent pinching of the chain.

8.11.2 PPE Requirements

The following personal protective equipment shall be worn while operating chainsaws:

- Safety glasses with side shields and face shield to prevent injury from wood chips, sawdust, or other flying objects;
- Hard hat with properly fitted suspension to prevent head injury from falling debris;
- Steel-toed safety shoes or boots to prevent foot injury from falling objects and accidental contact with the moving chain;
- Hearing protection to prevent permanent damage to hearing. Ear muffs or plugs will have a decibel noise reduction rating (NRR) assigned to them. The higher the rating, the greater the protection offered;
- Non-leather, fabric work gloves to prevent hand injury from abrasions, splinters and cuts;
- Clothing that is well-fitted and free of loose edges that could become entangled in the saw; and
- Protective chaps or leggings that cover the area from the groin to about 2 inches (5.08 cm) above the ankles should be used. These chaps are made from synthetic fabrics that are designed to prevent the running saw chain from coming in contact with your legs.

8.11.3 Safe Operation

The following safe operation guidelines shall be followed regardless of the purpose for using a chainsaw:

- Inspect the chainsaw prior to use;
- Chainsaws shall be held firmly with both hands, with thumbs and fingers encircling both chain saw handles;

- Stand slightly to the left side of the saw, out of the plane of the cutting chain and guide bar to reduce the risk of injury in the event of a kickback;
- Position saw so that it is between the waist and mid-chest level. Overreaching or cutting above the mid-chest height shall be avoided;
- Maintain a full throttle setting while cutting. Chainsaws are designed to be run at full speed;
- Always be aware of what is in the saw's downward path after the cut;
- Do not attempt to cut material that is larger than the guide bar of the saw;
- Avoid cuts that will cause the chainsaw to jam. Always cut into the compression wood first until the cut starts to close; then cut from the other side toward the compression cut;
- Use a non-metallic wedge to prevent the compression cut jamming on the blade;
- Chainsaws are designed to feed themselves into the wood and require only light pressure to cut efficiently. If extra force is required to keep cutting, the chain requires sharpening. Additional signs of a dull chain include a saw that is cutting crooked, results in fine sawdust instead of chips, or the smell of burnt wood. Do not use a dull chain;
- Bystanders and helpers shall be kept at a safe distance from operation;
- Do not operate a chainsaw when fatigued; take frequent breaks;
- Work slowly; don't rush; and
- A fire extinguisher shall be present at all times when operating the chainsaw in forest or brushy areas.

8.11.4 Refueling the Engine

The fuel for gasoline-powered chainsaws shall be mixed in accordance with the manufacturer's recommendations as outlined in the chainsaw operator's manual. Fuel shall be stored and transported in an approved safety container. The following precautions should also be followed:

- The engine shall be shut off and allowed to cool before refueling; never refuel a hot engine;
- A fire extinguisher shall be present during fueling and refueling;
- Smoking around fueling or refueling operations shall be prohibited; and
- A funnel or a flexible nozzle shall be used to avoid spilling fuel on the engine.

8.12 Chemical Injections

When the remedial action objectives for a project include subsurface injection of chemicals, the procedures and handling practices identified below must be implemented.

Pre-Injection

Review the Safety Data Sheets (SDSs) for the materials which are expected to be utilized in the chemical injection processes for this contract task order and:

- Document training in accordance with the Hazard Communication section of this Handbook.
- Ensure that appropriate spill response materials are present (e.g., absorbent media for oil, neutralizing agents for potassium permanganate, secondary containment for larger chemical tanks).

Evaluate potential for "daylighting" of chemical injection in the work area:

- Evaluation should identify known or potential pathways such as existing monitoring wells screened at the same depth interval as the planned injection, wells that were not properly abandoned, and utility corridors.

- Identify potential surface release areas such as nearby sensitive areas (e.g., wetlands) storm drains, ditches, or streams, and ensure that mitigation measures are in place (e.g., temporarily blocking storm sewer drains).
- Contact the project Environmental Manager for assistance in identifying release scenarios and mitigation measures.

Injection Operations

- Operate and maintain pressure vessels, pumps and hosing in accordance with the manufacturer's recommendations.
- Do not exceed the rated pressure of the vessels and associated piping or hoses of the system.
- The system must be provided with a pressure relief valve/controller that safely reduces the system pressure to within the system rated pressure.
- The pressure relief valve must be rated at no more than 110 percent the rated pressure of the system and must be tested at regular intervals.
- Each vessel must be equipped with a functioning pressure gauge to monitor pressure.
- For PPE and air monitoring requirements, refer to the PPE section and Site Monitoring section of the project safety plan. PPE shall be used to minimize potential exposure to identified site contaminants of concern and injection solutions during site injection operations. In addition, good personal hygiene practices and procedures must be practiced.
- Use face shields in combination with safety glasses or goggles when the potential for exposure to chemical splashes may exist.
- If repairs to injection delivery system components are necessary after the subsurface injection operations have been initiated, the injection lines must be relieved of pressure and drained before conducting repair work. See also the Lockout/Tagout section of this Handbook.
- Drums/containers of injection material shall be moved using a drum "dolly" or other appropriate material handling equipment where the weight of the drum can be properly managed and secured during the movement.
- Empty containers may require special preparation/rinsing prior to disposal. Verify requirements with the project EM.
- Only qualified personnel, by prior training or experience, may operate the injection system delivery components/array(s).
- Appropriate spill response materials for all chemicals must be present at the job site. Only qualified (by training and previous experience) who have proper PPE and equipment available shall provide spill response operations.
- Station a portable eye wash in the immediate work area where chemical injections are occurring, along with wash facilities for hygienic practices and PPE decontamination.
- If PPE becomes saturated and may potentially impact work clothing, dermal surfaces, or mucous membranes, change PPE immediately.
- Verify the competency and integrity of the chemical injection hoses/piping and connection points
- Confirm hose/piping rated for 100 psi.

- Verify the any cam-lock fitting on the injection hose/piping, well head, or direct push technology (DPT) rods are structurally sound and free of defects. Where hoses are used, ensure fittings have been secured to the hose surface via mechanical banding equipment to prevent whipping.
- When injecting under pressure, stand at a sufficient distance (i.e., ~ 20 feet) from the injection well head/point. Keep unessential project personnel away from the injection system, array, and well head(s) during injection operations.
- Remove/stow all unnecessary equipment and material in the area.
- The injection system/array must be monitored/attended at all times during the injection process and when not in use, components must be properly secured, de-energized, or stowed. If the system will operate without an attendant, plans for operating unattended must be in place an approved by the PM an RHSM/EM.
- All pressured lines and fittings should be 'tethered' or otherwise secured to minimize whipping or 'launching' of lines in the event of an equipment failure. Any "quick connect" type fittings (compressed air or fluid) should be secured with appropriate pins, clips to prevent accidental disengagement of the fitting during operation.
- Inspect all equipment, hoses, pressure lines, and fittings daily and prior to pressurizing.

Chemical Storage

- Some injection chemicals, such as strong oxidizers, may have stringent storage requirements per local or National Fire Codes. Verify that appropriate storage provisions are in place prior to starting work.
- NOTE: Counties and cities may have requirements specific to storing these chemicals. Also, storage and use of certain chemicals such as potassium permanganate and hydrogen peroxide may be subject to the new Chemical Facility Anti-Terrorism Standards of the Department of Homeland Security – the applicability depends on the chemical, quantity/concentration, and type of facility. Please contact the project Environmental Manager to determine whether chemicals are subject to these standards.
- Chemicals must be stored in a designated, secured area with spill prevention capabilities. Review SDS or other information to determine potential incompatible materials. Incompatible materials shall not be stored together. Ensure all containers are labeled.

Substrates That Create Reducing Conditions to Facilitate Bioremediation

Materials such as Emulsified vegetable oil (EVO) or emulsified oil substrate (EOS), lactate, and cheese whey are commonly used as the electron donors or "fuel" during enhanced reductive dechlorination (ERD) treatment. ERD can be an effective method for degrading various chlorinated solvents dissolved in groundwater.

Addition of these "electron donors" can also cause changes that need to be recognized and monitored, such as production of gases such as methane and hydrogen sulfide, and increases in carcinogenic byproducts, such as vinyl chloride, in groundwater or in the vadose zone. These gases or byproducts are not yet formed during the injection work, but are observed weeks following the injections as the biological process take place. These hazards must be considered during subsequent groundwater sampling activities. The air monitoring protocol and action levels, as well as required PPE, are discussed in later sections of this HSP.

Although EVO is food-grade material, SDSs for the material must be kept onsite, as well as added to the chemical inventory, and specific training on hazards conducted and documented in the Attachments in this HSP.

The Clean Water Act requires a Spill Prevention, Control, and Countermeasures (SPCC) Plan for storage of more than 1320 gallons of oil (including EVO and EOS) in ≥55 gallon aboveground containers. Additionally, spill kits/materials capable of stopping the spread of a leak/spill must be available and accessible. Involve your

Environmental Manager for assistance to determine whether a plan is required, to prepare an SPCC Plan, or to plan for spill control if EVO or other oils will be used around a body of water.

The following hazards must be acknowledged and addressed in the injection AHA or AHA/EIA:

- Slips/falls resulting from spilled EVO/EOS
- Slips/trips/falls from hoses transporting EVO/EOS and water
- Pressure in the injection lines (<20 psi)
- Potential for oil to spray on face/body if there's a breach or leak (refer to bullets above for mitigation measures)
- Hazards associated with the mixing and injection process such as electrical hazards associated with the pump, hand contact hazards during the mixing process, spills, etc.
- Other hazards applicable to the injection process.

Potassium Permanganate

- This in situ treatment technology uses potassium permanganate (KMnO4) to destroy [insert COCs, i.e., DNAPL] through an oxidative reaction. The KMnO4 reacts with the carbon-carbon double bonds found in chloroethenes to produce primarily carbon dioxide, chloride ions, and manganese dioxide as byproducts.
- Potassium permanganate (KMnO4) is considered to be an irritant to the respiratory system affecting the nose, throat, and the lungs. Engineering controls should be employed to minimize dust generation during use (pouring). The best protection is to enclose the operation or to provide local exhaust ventilation at the site of dust generation. KMnO4 also is a skin irritant and can severely burn the eyes and skin. Caution should be used to prevent the generation of dust which can contact the eyes or skin. It should be mixed with water before use. Aqueous solutions of KMnO4 are much less dangerous, especially when diluted.
- Solid KMnO4 is a very strong oxidizer. Keep in a tightly closed, labeled container, in a cool, dry, ventilated area. Protect against physical damage and moisture. Isolate from any source of heat or ignition. Avoid storage on wood floors. Separate from incompatibles, combustibles, organic or other readily oxidizable materials. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product.
- Potassium permanganate stains the hand and clothing and should be handled with care. It causes corrosive burns on the skin, and swallowing it may lead to gastroenteritis.
- When handling, wear chemical splash-type goggles, impervious clothing, such as Polycoated-tyvek, rubber or nitrile gloves and rubber or neoprene gloves and shoe covers. Should clothing become contaminated, it should be immediately decontaminated or removed to prevent injury.
- Respiratory protection should be worn during pouring if dust cannot be controlled; follow the action levels in the Site Monitoring section of this HSP. Strict adherence to dust control measures and monitoring must be performed during the execution of this task.

Hydrogen Peroxide

- Hydrogen peroxide is an oxidizer and will release oxygen when decomposed adding to combustion. It can be corrosive to eyes, nose, throat, lungs and gastrointestinal tract.
- When handling hydrogen peroxide, wear chemical splash-type goggles and full-face shield, impervious clothing, such as Polycoated-Tyvek, rubber or nitrile gloves and rubber or neoprene gloves and shoe covers (avoid cotton, wool and leather).

- Avoid excessive heat and contamination (meaning other material getting in the container). Contamination may cause decomposition and generation of oxygen gas which could result in high pressures and possible container rupture. Hydrogen peroxide should be stored only in vented containers and transferred only in a prescribed manner (refer to the SDS). Never return unused hydrogen peroxide to original container, empty drums should be triple rinsed with water before discarding. Utensils used for handling hydrogen peroxide should only be made of glass, stainless steel, aluminum or plastic.
- Store drums in cool areas away from direct sunlight and incompatible materials such as reducing agents, wood, paper and other combustibles, iron and other heavy metals, copper alloys and caustic. Provide mechanical general and/or local exhaust ventilation to prevent release of vapor or mist into the work environment.

Sodium Permanganate

- Sodium Permanganate (NaMnO4) is considered to be an irritant to the respiratory system affecting the nose, throat, and the lungs. Since solution is in a liquid form, all spraying, misting, and splashing should be minimized. If used, this liquid form should alleviate the potential for dust exposure which can occur during the mixing of the potassium permanganate described above.
- Engineering controls should be implemented to prevent or minimize the potential for spraying, misting, or splashing. In addition to wearing appropriate PPE (see below), an emergency eye wash/shower facilities shall be provided in the immediate area.
- Should clothing become contaminated, it should be immediately decontaminated or removed to prevent injury. While handling, the following PPE should be worn: Face shield & chemical goggles, coveralls, rubber protective gloves (shoulder length), and a rubber apron.

Hydrogen Release Compound (HRC)

- HRC is a controlled release, electron donor material, that when hydrated is specifically designed to produce a controlled release of lactic acid. The lactic acid is critical for the production of hydrogen to fuel anaerobic biodegradation processes in soil and groundwater.
- Refer to the SDS for HRC for specific handling and storage protocol.
- HRC is considered to be a skin irritant. Should clothing become contaminated, it should be immediately decontaminated or removed to prevent injury.
- HRC is a skin irritant and can burn the eyes and skin. Caution should be used to prevent the generation of misting, spraying, or splashing. While handling, the following PPE should be worn: Face shield & safety glasses, rubber protective gloves (shoulder length) along with a rubber apron.
- Spills of HRC should be cleaned up immediately to prevent slips and falls. Adequate spill containment and clean-up material must be provided in areas of chemical use. Dry absorbent material must be maintained on hand and ready to be immediately employed should a spill occur.

8.13 Compressed Gas Cylinders

8.13.1 General

Below are the hazard controls and safe work practices to follow when working around or using compressed gas cylinders. Ensure the requirements in the referenced SOP are followed.

- Cylinders and pressure-controlling apparatus shall be inspected for defects and leakage prior to use. Damaged or defective items shall not be used. If a cylinder is found to be defective, the gas distributor shall be notified and subsequent instructions followed. If a leak should develop at a fuse plug or other safety device, the cylinder shall be removed from the work area.

- Cylinders shall be labeled with the identity of the contents. Cylinders not labeled shall be sent back to the cylinder distributor. The color of the cylinder shall not be used exclusively to identify cylinder contents.
- Valve caps must be in place when cylinders are transported, moved, or stored.
- Cylinders must be secured in an upright position at all times.
- Cylinder valves must be closed when cylinders are not being used and when cylinders are being moved.
- Cylinders must be secured on a cradle, basket, or pallet when hoisted; they may not be hoisted by choker slings.
- Eye protection (safety glasses or goggles) shall be worn when using cylinders.
- Cylinders must be shielded from welding and cutting operations and positioned to avoid being struck or knocked over; contacting electrical circuits; or exposed to extreme heat sources.
- Cylinders inside buildings shall be stored in dry, well-ventilated locations at least 20 feet (6.1 meters) from highly combustible materials. Cylinders should be stored in definitely assigned places away from elevators, stairs, or gangways. Assigned storage areas shall be located where cylinders will not be knocked over or damaged.
- Oxygen cylinders in storage shall be separated from fuel gas cylinders or combustible materials by a minimum of 20 feet (6.1 meters) or by a noncombustible barrier at least 5 feet (1.5 meters) high, having a fire resistance rating of at least 0.5 hour.
- Signs indicating no smoking shall be provided for storage areas containing flammable gas cylinders.
- Complete the self-assessment checklist for compressed gas cylinders are being used.

8.13.2 Calibration Gas Cylinder Disposal

Calibration gas for field instruments is usually shipped in non-refillable DOT-39 specification cylinders. They can be identified by a code stamped into the cylinder that begins with “DOT-39, NRC” followed by a series of other numbers and letters. These cylinders cannot be refilled and are intended to be disposed of by the end user once the contents are consumed. Because of the high cost of shipping partially full cylinders to a JACOBS warehouse, equipment rental company, or the manufacturer, most calibration gas cylinders should be disposed of locally using this procedure.

Applicability

This procedure applies only to non-refillable DOT-39 specification cylinders containing calibration gas that is classified by DOT as a Division 2.2 nonflammable gas. The cylinder will display the green nonflammable gas label. Calibration gas usually contains parts per million (ppm)-range concentrations of compounds such as isobutylene, hexane, or methane. This procedure does not apply to Division 2.1 flammable gasses, Division 2.3 poison gasses, corrosive gasses, or oxidizing gasses. It also does not apply to gasses contained in larger refillable DOT-specification cylinders.

Disposal Procedure

1. Review the cylinder labeling and material safety data sheet (SDS) to verify that the material in question is calibration gas containing ppm-range concentrations of materials such as isobutylene, hexane, or methane, and that the gas is classified as a Division 2.2 nonflammable gas. If the material is a flammable gas (Division 2.1), poison gas (Division 2.3) corrosive gas, oxidizing gas, or contains toxic air contaminants such as trichloroethylene, DO NOT FOLLOW THIS PROCEDURE. Contact a dangerous goods advisor or the project EM for assistance.
2. Attach the appropriate regulator or valve to the cylinder, open the valve, and allow the gas to vent slowly to the atmosphere in an unconfined, well ventilated area outdoors.

3. If a regulator is not available, depress the valve with a non-sparking tool (e.g., pencil, stick). Be sure that the cylinder is pointed away from you at all times. The valve operates the same way as the valve on a car or bicycle tire.
4. Wear leather work gloves and keep your hands away from the flow of gas.
5. Leave the valve open until all gas is discharged from the cylinder.
6. If the cylinder has a permanently attached valve, leave it open. If a removable regulator or valve was used, remove it from the cylinder.
7. Mark the cylinder as “EMPTY” or “MT.”
8. Recycle the empty cylinder as scrap metal or dispose as solid waste after verifying that the solid waste collection company will accept this material in the trash.
9. If required to puncture the empty cylinder before disposal or recycling, do not attempt to do so using hand tools such as a hammer and nail or punch. Contact a dangerous goods advisor, the project EM, or health and safety manager for assistance.

8.14 Concrete Work and Masonry Construction Activities (Including well pad construction)

Below are the hazard controls and safe work practices to follow when working around or performing concrete and masonry activities. Ensure the requirements in the referenced SOP are followed.

- Wear PPE to avoid contact with concrete including gloves, mud boots, hard hat, safety glasses, long sleeved shirt and long pants.
- Consult the glove supplier or the cement manufacturer’s SDS for help in choosing the proper gloves. Butyl or nitrile gloves (rather than cotton or leather gloves) are frequently recommended for caustic materials such as Portland cement.
- Use only well-fitting gloves. Loose-fitting gloves let cement in. Often the use of gloves and clothing makes exposure worse when cement gets inside or soaks through the garment. Use glove liners for added comfort.
- Wash your hands before putting on gloves. Wash your hands every time that you remove your gloves.
- Dry your hands with a clean cloth or paper towel before putting on gloves.
- Protect your arms and hands by wearing a long sleeve shirt with the sleeves duct-taped to your gloves to prevent wet cement from getting inside the gloves.
- Follow proper procedures for removing gloves, whether reusing or disposing them.
- Clean reusable gloves after use. Before removing gloves, clean the outside by rinsing or wiping off any wet cement. Follow the manufacturer’s instructions for glove cleaning. Place clean and dry gloves in a plastic storage bag and store them in a cool, dry place away from tools.
- Throw out grossly contaminated or worn-out gloves.
- Keep the inside of gloves clean and dry.
- Wear waterproof boots when necessary to prevent wet cement from coming into contact with your skin. It is as important to protect your legs, ankles, and feet from skin contact with wet cement as it is to protect your hands.
- Boots need to be high enough to prevent wet cement from getting inside. Tuck pants inside and wrap duct tape around the top of the boots to prevent wet cement from entering.

- Change protective boots if they become ineffective or contaminated on the inside with wet cement while in use.
- Change out of any work clothes that become contaminated with wet cement and keep contaminated work clothes separate from your street clothes.
- When kneeling on wet cement use waterproof kneepads or dry kneeboards to prevent the knees from coming into contact with the cement.
- Wear proper eye protection when working with Portland cement.
- Perform hazard communication training for concrete. Read SDSs heed the manufacturers' recommendations for safety precautions.
- Protruding reinforcing steel (rebar), onto which personnel could fall, must be guarded to eliminate the hazard of impalement
- During post-tensioning, only those personnel essential to the operation are permitted behind the tensioning jacks.
- Personnel shall not ride concrete buckets nor position themselves in areas where buckets are lifted overhead.
- Personnel shall maintain a safe distance from formwork and shoring being removed from concrete structures.
- Personnel shall maintain a safe distance from precast and lift-slab concrete being lifted into position until physically secured.
- Personnel shall not enter limited access zones during masonry wall construction.
- When JACOBS is in control of concrete and masonry operations, a lift slab competent person will oversee all the concrete and masonry operations.
- See also SOP HSE-511, Crystalline Silica.
- Complete the self-assessment checklist for concrete and masonry activities whenever those activities are being performed.

8.15 Concrete Core Drilling

Below are the hazard controls and safe work practices to follow when working around or performing concrete core drilling.

- Operators must read and understand the Operators Manual(s) for the equipment that will be used.
- Follow all manufacturers' operating instructions and comply with all warning labels on the equipment.
- Inspect equipment to ensure it is in proper operating condition prior to use. Equipment damage or missing parts must be corrected prior to operation.
- Follow all requirements for use of PPE. Minimum PPE includes hearing protection, safety glasses with side shields, safety toed boots. A face shield over safety glasses or liquid splash goggles may be required for wet coring.
- Inspect areas to be cored to ensure there are no obstructions, for example utilities on the opposite side of a wall to be cored through. Follow utility locate procedures for when coring slab on grade.
- Provide dust control (wet coring or local exhaust for dry coring) to avoid potential silica exposure.
- Make sure that all electrical wiring is grounded.

- The power supply line (electric cord, pneumatic or hydraulic line) must be protected from damage and routed to prevent it becoming a tripping hazard.
- When hydraulic coring equipment is uses, all workers must be aware of hydraulic lines running to the coring equipment. Preparations must be made for containment/clean up in the event of a ruptured hydraulic line.
- All workers must keep their hands and body away from the cutting saw/cable.
- The power supply must be disconnected when changing bits or conducting other maintenance on the equipment.
- Slippery conditions may exist in wet coring operations. Water needs to be controlled during cutting and proper safety toed footwear used to minimize slip potential.
- The dust created by the concrete coring needs to be controlled using the application of water or local exhaust ventilation (i.e., removing dust at the source) to reduce the amount of airborne dust generated. Contact the RHSM to determine if air monitoring/respiratory protection will be necessary. See also SOP HSE-511, *Crystalline Silica.*
- Use the Drilling Self-Assessment checklist to evaluate coring operations.

8.16 Concrete Saw Cutting

- Ensure operators are trained and familiar with the equipment are operating the saw. Operators must read and understand the Operators Manual(s) for the equipment that will be used.
- Inspect equipment to ensure it is in proper operating condition prior to use. Equipment damage or missing parts must be corrected prior to operation.
- Cutting blades shall be the correct size, installed properly, guarded at all times, and speed should not exceed the manufacturer's suggested operating speed.
- Workers shall use the correct blade for the job and inspect it for defects before each use.
- Saws shall be maintained and kept clean from dust build-up. Workers shall not push against the saw during operation to avoid the blade jumping out of the cutting path and loss of operator control.
- Inspect areas to be sawed to ensure there are no obstructions, for example rocks or other debris. Follow utility locate procedures prior to cutting.
- Personal protective equipment (PPE) saw use shall include hard hats, safety-toed boots, safety glasses and face shields, hearing protection, and leather gloves.
- The dust created by the concrete saw needs to be controlled using the application of water or local exhaust ventilation (i.e., removes dust at the source) to reduce the amount of airborne dust generated. Contact the RHSM to determine if air monitoring/respiratory protection will be necessary. See also SOP HSE-511, *Crystalline Silica.*
- If equipped, the power supply line (electric cord, pneumatic or hydraulic line) must be protected from damage and routed to prevent it becoming a tripping hazard. The power supply must be disconnected when changing blades or conducting other maintenance on the equipment.
- Ensure all utilities have been marked and located in accordance with the underground utilities section of this Handbook.
- Slippery conditions may exist in wet cutting operations. Water needs to be controlled during cutting and proper safety toed footwear used to minimize slip potential.

8.17 Confined Space Entry Activities

OSHA and JACOBS define a confined space as a space that has all of the following characteristics:

- Large enough to allow personnel to enter the space with their entire body;
- Limited openings for entry and exit; and
- Not designed for continuous human occupancy;

Examples of possible confined spaces include underground vaults, pipelines, ducts, tunnels, storage tanks, sewers, process vessels, and pits. Entry into a confined space is defined as breaking the plane of a confined space with any part of the body.

A Permit-required Confined Space (PRCS) is defined as a confined space that has one or more of the following characteristics:

- Contains or has the potential to contain a hazardous atmosphere
- Contains a material that has the potential for engulfing an entrant
- Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor that slopes downward and tapers to a smaller cross-section, or
- Contains any other recognized serious safety or health hazard

In Canada, some individual Provinces have different definitions of confined spaces; refer to the specific Canadian Provincial code.

The following requirements apply when entering a permit-required confined space (PRCS), an Alternate Procedure Confined Space, or a PRCS reclassified as a non-permit confined space (NCS). Ensure the requirements in the referenced SOP are followed.

- Entrants, Attendants, and the Entry Supervisor shall have successfully completed Confined Space Entry training.
- The appropriate confined space entry permit shall be completed as outlined in JACOBS SOP HSE-203, *Confined Space Entry*.
- The completed permit or certificate shall be posted for review near the space entrance point.
- The Entry Supervisor shall conduct a pre-entry briefing with all Authorized Entrants and Attendants prior to entry in accordance with SOP HSE-203.
- Entrants and Attendants shall verify that the Entry Supervisor has authorized entry and that all requirements of the permit or certificate have been satisfied prior to each entry.
- Atmospheric monitoring for oxygen, combustible gases, and potential toxic air contaminants shall be conducted at the frequency provided on the permit or certificate. Entry shall not be permitted if an atmospheric hazard is detected above acceptable safe levels. Atmospheric monitoring shall be performed in accordance with the Site Monitoring Section of the project safety plan and SOP HSE-203.
- Entrants shall evacuate the space upon orders of the Attendant or Entry Supervisor, when an alarm is sounded, or when a prohibited condition or dangerous situation is recognized.
- Entrants and Attendants shall inform the Entry Supervisor of any hazards confronted or created in the space, or any problems encountered during entry. The Entry Supervisor shall inform the owner of such issues.
- The Entry Supervisor shall provide a copy of the canceled permit or certificate to the SL for review and maintain it in the project file.

- Complete the self-assessment checklist for confined space entry whenever entries are being performed.

8.18 Cranes

Below are the hazard controls and safe work practices to follow when working around or operating cranes. Ensure the requirements in the referenced SOP are followed.

- Crane operators are prohibited from using any wireless device while operating a crane. Equipment must be stopped before using devices such as two way radios or cell phones. If a wireless device is required for a certain operation, the PM and RHSM must authorize the wireless use on a case by case basis and make sure limitations are addressed in the project safety plan.
- Cranes shall be operated by a certified crane operator. After November 10, 2014, only operators possessing a certificate from a nationally accredited testing organization, an audited employer training program, or U.S. military, or state- or provincial-issuing agency will be authorized to operate cranes.
- The crane's operations manual and load chart specifically designed for the crane shall be in the crane at all times.
- The crane must have a current annual inspection to include load test certification (within the last 12 months) that meets all state and provincial and federal safety standards. Documentation of this inspection must be available for review.
- A competent person will inspect the crane daily to ensure it is in safe operating condition. The daily crane inspection log provided within the crane manufacturer's operations manual shall be used. See also the requirements for monthly inspections, among others, in SOP HSE-303.
- All rigging equipment must be inspected by a competent person prior to use for signs of excessive wear; equipment found to be damaged will be tagged and removed from service.
- A qualified and competent Assembly/Disassembly (A/D) Director shall be assigned when cranes must be assembled onsite. The A/D Director is responsible for ensuring the crane is assembled and disassembled according to manufacturer requirements; performing training for the A/D crew; and ensuring sufficient ground conditions exist for crane placement; among other responsibilities (see SOP HSE-303).
- The assembly/disassembly process must comply with requirements in HSE-303, including having an AHA for the task.
- A critical lift plan shall be prepared when the lift is estimated to be greater than 75 percent of the crane capacity or when two cranes will be used to make a lift.
- A pre-lift meeting will be conducted to include all parties involved in that day's crane operation.
- Only one qualified person shall be designated to signal the crane operator. This person shall be thoroughly familiar with the ANSI standard method of hand signals and an illustration of these signals shall be posted at the job site.
- No personnel shall be permitted under the load at any time.
- Tag lines shall be attached to every load being made by the crane.
- The swing radius of the rear rotating superstructure (counterweight) of the crane shall be barricaded and no entrance allowed.
- Suspended loads shall not pass over workers or occupied buildings at any time.
- Complete the self-assessment checklist for crane-suspended personnel platforms whenever they are being used.

- JACOBS employees exposed to hazards posed by crane operations, must be trained in hazards awareness and control procedures. See requirements for training in HSE-303.

Power Line Safety

It must be determined whether equipment operations including assembly/disassembly, positioning, and crane operation (including traveling with a load) will occur in proximity to power lines within 20 feet (6.1 meters) for line voltage up to 350 kilo volts (kV), and within 50 feet (15.2 meters) for line voltage between 350 kV to 1000 kV. For power lines over 1000 kV, the distance must be determined by the utility/operator or qualified registered professional engineer in electrical power transmission and distribution.

If equipment operations are within proximity of aforementioned distances to power lines, one of the following options must be implemented to prevent encroachment and electrocution:

- Option 1: Deenergize and ground the power. Confirm from the utility/operator that the power line has been deenergized and visibly grounded at the worksite
- Option 2: If the voltage is not determined, ensure that no part of the equipment, load line, or load (including rigging and lifting accessories), gets closer than 20 feet (6.1m) by:
  - Conduct a planning meeting with the operator and other workers in the area to review the actions that will be taken to prevent encroachment and electrocution. Training requirements for working around energized power lines are described in Section 6.0, Training.
  - Use non-conductive tag lines.
  - Erect and maintain an elevated warning line, barricade or line of signs in view of the operator, either with flags or other high-visibility markings at 20 feet (1.6m) from the power line. A spotter must be used when the operator does not have clear line of sight to the elevated warning line.
  - To prevent encroachment, the operator can use a proximity alarm, or position a dedicated spotter with visual aids to demarcate the encroachment and constant communication access to the operator.

If the line voltage can be determined, and if any part of the equipment, line load or load (including rigging and lifting accessories) would encroach within that specified distance listed in Table 1, then the requirements listed in Option 2 must be implemented.

TABLE 1
Minimum Clearance Distances

Voltage (nominal, kV, alternating current)	Minimum Clearance – Feet (meters)
Up to 50	10
Over 50 to 200	15
Over 200 to 350	20
Over 350 to 500	25
Over 500 to 750	35
Over 750 to 1000	45
Over 1000	Established by the utility owner/operator or by a qualified registered professional engineer in electrical power transmission and distribution

For equipment traveling within 20 feet (6.1m), under or near power lines without a load, the clearance distances described in Table 2 must be maintained and the following actions implemented.

- A dedicated spotter is assigned during equipment travel, positioned to effectively gauge the clearance distance, and is in continuous communication with the operator.
- During equipment travel, the boom/mast and support system are sufficiently lowered to ensure clearance distances are maintained, along with taking into consideration of the effects of speed and terrain.

TABLE 2
Minimum Clearance Distances While Traveling With No Load

Voltage (nominal, kV, alternating current)	Minimum Clearance – Feet (meters)
Up to 0.75	4
Over 0.75 to 50	6
Over 50 to 345	10
Over 345 to 750	16
Over 750 to 1000	20
Over 1000	Established by the utility owner/operator or by a qualified registered professional engineer in electrical power transmission and distribution

8.19 Crystalline Silica

Crystalline silica can be a hazard during concrete cutting, jackhammering, well completion, building demolition or using impact or rotary drills on concrete surfaces.

JACOBS and its subcontractors shall control employee exposure to crystalline silica when exposures are at or above the ACGIH TLV and the OSHA action level of 0.025 mg/m^3 by submitting for review and approval a crystalline silica exposure monitoring plan. The elements of an exposure monitoring plan include, but are not limited to the following:

- A bulk sample representative of the material to be demolished must be sent with the air monitoring sample media for analysis;
- Initial monitoring and personal air sampling must be conducted to determine the potential worker exposure to respirable crystalline silica;
- Real-time particulate monitors with a 10 micron respirable size fraction attachment may be used as part of the initial and ongoing monitoring plan to evaluate the potential worker exposure. This must include an action level established by their corporate or site health and safety professional and include actions required (e.g., implement engineering, administrative controls, respiratory protection);

Other exposure control measures include:

- Follow the engineering controls and PPE requirements for tasks called out under 29 CFR 1926.1153, Table 1 (e.g., use of jackhammers, walk behind or hand-held saws, hand-held and rig-mounted core saws or drills, among others);
- Workers shall use power tools with dust suppression controls such as a water spray or local exhaust ventilation connected to a HEPA vacuum system when cutting concrete;
- When using handheld and stand-mounted drills (including impact and rotary hammer drills) (e.g., for soil vapor probe installation):

  - Use a drill equipped with commercially available shroud or cowling with dust collection system
  - Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions
  - The dust collector must provide the air flow recommended by the tool manufacturer, or greater, and have a filter with 99% or greater efficiency and a filter-cleaning mechanism
  - Use a HEPA-filtered vacuum when cleaning holes
- Maintaining surfaces as clean as practicable to minimize accumulation of crystalline silica containing particulate material;
- Apply dust control products or water on dry, dusty roads or piles of materials;
- Utilize heavy equipment with pressurized cabs and HEPA filter systems;
- Clean surfaces with a HEPA-filter vacuum or equivalent method;
- Implement dust suppression during demolition;
- An area on the worksite must be designated to be free of crystalline silica for workers to consume food or beverages;
- Restricting access to the work area where crystalline silica exposure may exist to only those authorized to perform work or enter the area;
- Do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in these areas; and
- Respiratory protection and other exposure controls selection shall be based on the most recent exposure monitoring results obtained from the competent person.

8.20 Demolition

This section is applicable to all forms of demolition. Demolition is defined as the removal or dismantling of structures or equipment by disassembly.

An engineering survey shall be completed prior to start of demolition operations. The survey shall determine the condition of the structure framing, floors, and walls; the presence of asbestos, polychlorinated biphenyls (PCBs), lead paint, or other regulated hazardous substances; the presence of hazardous materials in tanks, pipes, and equipment; and the possibility of unplanned collapse of any portion of the structure. Any adjacent structure where personnel may be exposed shall also be similarly evaluated. The survey shall be conducted by a competent person and a written record of the survey findings shall be maintained at the project site.

The demolition contractor working on this project will provide JACOBS with a demolition safety plan prior to the start of work. JACOBS will use this plan to verify that the subcontractor is implementing the necessary safety precautions during this activity. In addition, the following safety precautions shall be implemented by JACOBS personnel. Below are the hazard controls and safe work practices to follow when working around or performing demolition. Ensure the requirements in the referenced SOP are followed.

- Appropriate warning and instructional safety signs shall be conspicuously posted where necessary.
- Fugitive dust must be controlled during demolition by using water spray or other methods.
- Remain a safe distance from the demolition zone to reduce exposure to fragmentation of glass, steel, masonry, and other debris during demolition operations.
- Do not enter the demolition zone unless completely necessary, and only after the competent person has assessed the condition of the structure and has authorized entry.

- Follow all requirements established by the competent person. The competent person shall inform personnel of the areas that are safe to enter and the areas where entry is prohibited. When possible, the competent person should escort JACOBS personnel while in the demolition zone.
- All demolition activities that may affect the integrity of the structure or safety of personnel must cease until personnel have exited the demolition zone.
- During the course of demolition, work areas, passageways, stairs, ladders, and exits shall be kept free of demolition debris.
- Stay as clear as possible of all hoisting operations. Loads shall not be hoisted overhead of personnel
- Proper control measures shall be in place before welding or cutting on surfaces covered by coatings containing flammable or hazardous materials such as lead, cadmium, zinc, etc. Highly flammable or toxic coatings may require stripping of the coating a sufficient distance from the area to be heated. Welding and cutting shall be performed in accordance with the applicable governing provisions (e.g., in the US: OSHA 1926, Subpart J, "Welding and Cutting"; in Canada: provincial code, etc.). Follow "Welding and Cutting" SOP HSE-314.

The following lead-exposure-control procedures will be implemented during demolition operations involving potential exposure to lead:

- Site personnel will be provided lead-awareness training;
- Site personnel will be provided with hand-washing facilities and will wash their hands daily;
- An excavator equipped with hydraulic shears will be used only to cut painted wooden, concrete, and metal structures;
- Neither hand-held band/chop saws nor torch cutting equipment will be used on painted surfaces without proper PPE and engineering controls in place or removal of paint prior to cutting;
- During all demolition operations to control potential exposures to LBP, wet methods using water mist will be used;
- A direct-reading dust monitor will be used to monitor demolition operations that pose a potential lead-exposure hazard (that is, those with an action level requiring that additional dust control measures be employed and/or that respiratory protection be used.);
- Personal air samples will be collected and analyzed for lead to confirm that no personnel are exposed to levels above the lead action level of 30 micrograms per cubic meter ($\mu g/m^3$); and
- The selection of respiratory protection and other exposure controls will be based on the most recent exposure monitoring results obtained from the lead-exposure-competent person.
- For more information see JACOBS SOP HSE-508, Lead.

8.21 Diving

Diving operations must be conducted in accordance with the JACOBS Commercial Diving Safe Practices Manual. Requirements in the manual include:

- Dive team members must have the experience and/or training in the use of tools, equipment and systems relevant to assigned tasks; techniques of the assigned diving mode; diving operations; and emergency procedures;
- Dive team members must be trained in cardiopulmonary resuscitation and standard first aid;

- Dive team members who are exposed to or control the exposure of others to hyperbaric conditions shall be trained in diving-related physics and physiology; and
- A "designated person-in-charge" must be at the dive location and in charge of all aspects of the diving operation affecting the safety and health of dive team members. The designated person-in-charge shall have experience and training in the conduct of the assigned diving operation.

8.22 Drilling Safety

Below are the hazard controls and safe work practices to follow when working around or performing drilling. Ensure the requirements in the referenced SOP are followed.

- When considering drilling at sites with nearby monitoring wells, particularly in cases where drilling methods utilize pressurized fluids (air or water), consider the potential risk of hydraulic communication between the drilling location and the adjacent wells and/or other subsurface conduits.
- The drill rig is not to be operated in inclement weather.
- The driller is to verify that the rig is properly leveled and stabilized before raising the mast.
- Personnel should be cleared from the sides and rear of the rig before the mast is raised.
- The driller is not to drive the rig with the mast in the raised position.
- The driller must check for overhead power lines before raising the mast. Maintain a minimum distance of 10 feet (3 meters) between mast and overhead lines (<50 kV) and an additional 0.4 inches for every 1 kV over 50kV. Verify the voltage of nearby overhead power lines to determine the minimum distance.
- If the project site is suspected of munitions or explosives of concern (MEC) contamination, requirements of the *Explosives Usage and Munitions Response (MR)* SOP HSE-610 shall be followed. MECs include material potentially presenting an explosive hazard (MPPEH), discarded military munitions, materials that present a potential explosive hazard, chemical warfare materials, munitions constituents, and contaminated soil or groundwater. "Down-hole" avoidance support may be required to prevent accidental contact with MPPEH. Safety requirements will be based on the risk assessment identified within the MR (safety) ORE (Opportunity Risk Evaluation).
- All drilling sites must be evaluated for potential contamination by consulting with the client, reviewing historic data related to properties' past owners and uses, prior investigation reports or through vendor services.
- If unexpected contamination is discovered during drilling operations, all activities must immediately stop and the JACOBS Safety Liaison or Project Manager shall be immediately notified. Work shall not recommence until authorized by the JACOBS Project Manager.
- If contamination is suspected or confirmed at the drilling site, the following must be implemented:
    - The standard hazardous materials/hazardous waste clause is included in our contract with the client and in our subcontract agreements
    - The drilling subcontract work plans address appropriate disclosure of potential contamination, any required training (e.g., HAZWOPER) and the requirement to plan for unexpected contamination. The subcontractor work plan and submittals are reviewed for appropriate licenses, certifications, permits, training, sampling and analytical, waste characterization, and waste management, including accumulation, transport and disposal.
- Personnel should stand clear before rig startup.
- The driller is to verify that the rig is in neutral when the operator is not at the controls.

- Become familiar with the hazards associated with the drilling method used (cable tool, air rotary, hollow-stem auger, etc.).
- Do not wear loose-fitting clothing, watches, etc., that could get caught in moving parts.
- Do not smoke or permit other spark-producing equipment around the drill rig.
- The drill rig must be equipped with a kill wire or switch, and all personnel are to be informed of its location.
- Be aware and stand clear of heavy objects that are hoisted overhead. Ensure any components subject to load bearing are rated and not shop-made.
- The driller is to verify that the rig is properly maintained in accordance with the drilling company's maintenance program.
- The driller is to verify that all machine guards are in place while the rig is in operation.
- The driller is responsible for housekeeping (maintaining a clean work area).
- The drill rig should be equipped with at least one fire extinguisher.
- If the drill rig comes into contact with electrical wires and becomes electrically energized, do not touch any part of the rig or any person in contact with the rig, and stay as far away as possible. Notify emergency personnel immediately.
- Use the drilling self-assessment checklist to evaluate drilling operations.

8.22.1 Air Rotary Drilling

- When a hydraulic communication hazard may exist, do not perform work at an adjacent structure or conduit when drilling, and be mindful of potential line-of-fire hazards. Evaluate the possibility of:
  - Increasing the distance between the proposed drilling site and the existing structure(s);
  - Abandon the adjacent structure(s)/conduit(s);
  - Consider use of an alternative drilling technology that minimizes propagation of pressures in the borehole to the adjacent formation (e.g., casing methods, continuous override methods, rotosonic); and
  - Ensure that hydraulic communication risks are addressed in your AHA or AHA/EIA.
- If drilling near a previously installed well, remove or loosen the well cap of that well to relieve pressure that may build during drilling.
- Stay clear of nearby wells that aren't protected by a secured steel casing/monument as a steel casing should provide protection from the inner well in the event of a pressure buildup.
- When opening a well in the vicinity of where air rotary drilling is being performed, or when opening a newly installed well via air rotary methods, remove the cap slowly to relieve pressure, keeping your head away from the line of fire in case the cap does pop off.

8.22.2 Cold Weather Drilling

- When possible, secure a tarp or plastic sheeting on the ground of the drilling work area overnight to reduce buildup of ice/snow.
- Place non-slip pads near work area and clean off regularly.
- Keep the drilling area clear of soil or cuttings at the surface, especially if soil is very wet, to prevent freezing and slipping/tripping hazards.
- Work at a slower pace to avoid slips

- Evaluate alternate methods for extreme conditions with PM/HSM.

8.23 Drum and Portable Tank Handling

Below are the hazard controls and safe work practices to follow when overseeing the movement of drums or when handling drums:

- Ensure that personnel are trained in proper lifting and moving techniques to prevent back injuries;
- Ensure drum or tank bungs and lids are secured and are labeled prior to moving;
- Ensure that drums and tanks remain covered except when removing or adding material or waste. Covers and/or lids will be properly secured at the end of each workday;
- Provide equipment to keep the operator removed from the drums to lessen the likelihood of injury. Such equipment might include: a drum grappler attached to a hydraulic excavator; a small front-end loader, which can be either loaded manually or equipped with a bucket sling; a rough terrain forklift; Roller conveyor equipped with solid rollers; drum carts designed specifically for drum handling;
- Make sure the vehicle selected has sufficient rated load capacity to handle the anticipated loads, and make sure the vehicle can operate smoothly on the available road surface;
- Ensure there are appropriately designed Plexiglas cab shields on loaders, backhoes, etc., when handling drums containing potentially explosive materials;
- Equipment cabs should be supplied with fire extinguishers, and should be air-conditioned to increase operator efficiency;
- Supply operators with appropriate respiratory protective equipment when needed;
- Ensure that drums are secure and are not in the operator's view of the roadway;
- Prior to handling, all personnel should be warned about hazards of handling;
- Before moving anything, determine the most appropriate sequence in which the various drums, portable tanks, and other containers should be moved (e.g., small containers may have to be removed first to permit heavy equipment to enter and move the drums;
- Overpack drums and an adequate volume of absorbent should be kept near areas where minor spills may occur;
- Use containers or overpacks that are compatible with the waste or materials;
- Drums containing liquids or hazardous waste will be provided with secondary containment and may not be located near a storm water inlet or conveyance;
- Allow enough aisle space between drum pallets and between drums and other equipment that the drums can be easily accessed (at least 2 to 3 feet) by fire control equipment and similar equipment.; and
- Make sure that a spill kit is available in drum or tank storage areas (or where liquids are transferred from one vessel to another).

8.24 Drum Sampling Safety

Personnel are permitted to handle and/or sample drums containing certain types of waste (drilling waste, investigation-derived waste, and waste from known sources) only. Handling or sampling drums with unknown contents requires a plan revision or amendment approved by the RHSM. The following control measures will be taken when sampling drums:

- Minimize transportation of drums;

- Sample only labeled drums or drums from a known waste stream;
- Do not sample bulging or swollen drums. Contact the RHSM;
- If drums contain, or potentially contain, flammable materials, use non-sparking tools to open;
- Use the proper tools to open and seal drums;
- Reseal bung holes or plugs whenever possible;
- Avoid mixing incompatible drum contents;
- Sample drums without leaning over the drum opening;
- Transfer/sample the content of drums using a method that minimizes contact with material;
- Use the PPE and perform air monitoring as specified in the PPE and Site Monitoring sections of the project safety plan;
- Take precautions to prevent contaminated media from contacting the floor or ground, such as having plastic under the sampling area, having a spill kit accessible during sampling activities; and
- If transferring/sampling drums containing flammable or combustible liquids, drums and liquid transfer equipment should be grounded and bonded to reduce the potential of a static discharge.

8.25 Earthmoving/Heavy Equipment

Below are the hazard controls and safe work practices to follow when working around or operating heavy equipment. Ensure the requirements in the referenced SOP are followed.

- JACOBS authorizes only those employees qualified by training or previous experience to operate material handling equipment.
- JACOBS employees must be evaluated prior to operating earthmoving equipment by a JACOBS earthmoving equipment operator evaluation designated person. This evaluation will be documented according to SOP HSE-306, Earthmoving Equipment.
- Heavy equipment operators are prohibited from using any wireless device while operating equipment. Equipment must be stopped before using devices such as two way radios or cell phones. If a wireless device is required for a certain operation, the PM and RHSM must authorize the wireless use on a case by case basis and make sure limitations are addressed in the project safety plan.
- Equipment must be checked at the beginning of each shift to ensure the equipment is in safe operating condition and free of apparent damage. The check should include: service brakes, parking brakes, emergency brakes, tires, horn, back-up alarm, steering mechanism, coupling devices, seat belts and operating controls. All defects shall be corrected before the equipment is placed in service. Documentation of this inspection must be maintained onsite at all times (use the Earthmoving Equipment Inspection form if operated by CH2M).
- Equipment must be on a stable foundation such as solid ground or cribbing; outriggers are to be fully extended.
- Equipment must not be used to lift personnel; loads must not be lifted over the heads of personnel.
- Equipment, or parts thereof, which are suspended must be substantially blocked or cribbed to prevent shifting before personnel are permitted to work under or between them. All controls shall be in a neutral position, with the motors stopped and brakes set.
- Equipment which is operating in reverse must have a reverse signal alarm distinguishable from the surrounding noise or a signal person when the operators view is obstructed.

- When equipment is used near energized power lines, the closest part of the equipment must be at least 10 feet (3 meters) from the power lines less than 50 kilovolts (kV). Provide an additional 4 feet (1.2 meters) for every 10 kV over 50 kV. A person must be designated to observe clearances and give timely warning for all operations where it is difficult for the operator to maintain the desired clearance by visual means. All overhead power lines must be considered to be an energized until the electrical utility authorities indicate that it is not an energized line and it has been visibly grounded.
- Underground utility lines must be located before excavation begins; refer to the Utilities (underground) section.
- Operators loading and unloading from vehicles are responsible for seeing that vehicle drivers are in the vehicle cab or in a safe area.
- The parking brake shall be set whenever equipment is parked; wheels must be chocked when parked on inclines.
- When not in operation, the blade or bucket must be blocked or grounded; the master clutch must be disengaged when the operator leaves the cab. When equipment is unattended, power must be shut off, brakes set, blades or buckets landed and shift lever in neutral.

8.26 Elemental Sulphur

- Do not enter regulated work area unless training, medical monitoring and PPE requirements established by the competent person have been met.
- Do not eat, drink, smoke, chew tobacco or gum or apply cosmetics in regulated areas.
- Respiratory protection and other exposure controls selection shall be based on the most recent exposure monitoring results obtained from the competent person.
- Exposure to elemental sulphur dust may irritate eyes, skin and respiratory tract.
- Avoid breathing dust and keep clothing from dust as possible.
- If dusty conditions, wear dust mask, safety goggles and Tyvek.

8.27 Energized Electrical Work

(Reference JACOBS SOP HSE-221, *Energized Electrical*)

All electrical systems shall be considered energized unless lockout/tagout procedures are implemented and zero energy verified in accordance with the Lockout/Tagout section of this Handbook.

Energized electrical work is defined as work performed on or near energized electrical systems or equipment with exposed components operating at 50 volts AC (or 100 volts DC) or greater. Working near energized live parts is any activity inside a Limited Approach Boundary.

Evaluate the use remote testing device for troubleshooting (e.g., Fluke 233 Remote Display Multimeter or equivalent). This type of testing device eliminates the exposure to unprotected energized electrical parts.

Electrical wiring and equipment shall be de-energized prior to conducting work unless it can be demonstrated that de-energizing introduces additional or increased hazards or is unfeasible due to equipment design or operational limitations. When energized electrical work is the only means that work can be performed (e.g., for voltage testing or troubleshooting), all requirements of SOP HSE-221 must be implemented including the following:

- Only qualified personnel are permitted to work on unprotected energized electrical systems. To be a JACOBS qualified person, an employee must meet all of the following bulleted requirements:

- The employee must be assigned one of the two worker categories and up-to-date on the requirements:
  - Energized Electrical Trained Worker Limited (EETW-L) which is restricted to working on electrical systems 480 VAC and below or working in the Limited Approach Boundary of systems that have a designated Arc Flash PPE Category of ≤ 2, which **does not** require First Aid/CPR or AED training or the buddy system.
  - Energized Electrical Trained Worker (EETW) allows individuals to work on equipment rated at Arc Flash PPE category 2, which requires the individual to complete First Aid/CPR or AED, and implement the buddy system.
- Possess credentials, electrical educations, training and task specific knowledge, experience and capability (i.e., a qualified person may be qualified for one type of system or task, but not another).
- Attachment 4 of the Energized Electrical SOP, "Energized Electrical Qualified Person Assessment" must be completed annually by the RHSM or applicable operations lead/supervisor which requires a skill demonstration performed by the qualified person while wearing the necessary PPE and using the required tools. This form must be submitted to the SPA and maintained with the project files.
- Employees shall complete the JACOBS energized electrical refresher safety training every 3 years.
- First Aid/CPR and AED training (EETW only), release of victim, completed annually (Release of victim refresher available on the VO). For annual the First Aid, CPR and AED requirement, an employee may retake the course through a certified provider (including local organizations), conduct a drill where CPR and AED skills are demonstrated, or complete the American Red Cross CPR/AED Refresher course.

- If JACOBS personnel are only overseeing a qualified subcontractor performing energized electrical work and not entering the Limited Approach Boundary or tasked to perform troubleshooting near unprotected energized parts, then the '2015 NFPA 70E Awareness for Oversight of Work' VO training is required (i.e., the above training requirements would not apply).
- The client sector HSE Lead must approve any energized electrical work that is above an Arc Flash PPE Category 2 or an incident energy greater than 8 calories/cm^2.
- An Electrical Hazard Analysis must be performed to identify energized electrical safe work practices before any person approaches exposed live parts within the Limited Approach Boundary (as determined by the shock hazard analysis), by performing both shock hazard analysis and flash hazard analysis, which comprise the electrical analysis.
- The Energized Electrical Work Permit must be completed prior to working on unprotected energized electrical systems.
- Provisions for first responder equipment, such as a first aid kit, AED, communication devices, and non-conductive release equipment (when disconnect means is not in the immediate vicinity of the work) shall be made available. If an AED is available at the host employer's facility, the location of the AED must be determined and personnel trained in its use.
- JACOBS employees designated as qualified persons working on live parts of energized electrical systems 480 volts and above shall implement the buddy system. This means that two EEQPs must be engaged in this work. Working on live parts of energized electrical systems 480 volts and above means actual contact with live parts or working within the Prohibited Approach Boundary, which is one inch (2.54 cm) for 480 volt systems.
- The buddy system requires the presence of an additional EEQP who shall stand by and render assistance, or summon help for the first person, in the event the first person is inadvertently shocked while performing

the work. The second person shall not be assigned to additional distracting duties or tasks while the energized electrical work is being performed and shall know the location of the isolation device(s) for the equipment being worked on.

- Workers designated as qualified persons shall wear the required electric shock and arc-flash PPE, as specified by the qualified person responsible for the energized electrical operations.
- Safety signs, safety symbols or incident prevention tags, meeting applicable American National Standards Institute (ANSI) Standards, shall be used where necessary to warn employees about electrical hazards.
- Barricades shall be used in conjunction with safety signs where it is necessary to prevent or limit employee access to work areas containing live parts. Conductive barricades shall not be used where it may cause an electrical hazard. Barricades shall be placed no closer than the Limited Approach Boundary.
- If signs and barricades do not provide sufficient warning and protection from electrical hazards, an attendant shall be stationed to warn and protect unqualified employees. The primary duty and responsibility of an attendant providing manual signaling and alerting shall be to keep unqualified employees outside a work area where the unqualified employee might be exposed to electrical hazards. An attendant shall remain in the area as long as there is a potential for employees to be exposed to the electrical hazards.
- Employees shall not perform tasks near exposed energized parts where lack of illumination or an obstruction precludes observation of the work. Employees shall not reach blindly into areas that may contain energized parts.
- Work shall be performed in accordance with National Fire Protection Association (NFPA) 70E requirements (2015 edition).
- Follow all control measures and procedures identified on the Energized Electrical Work Permit and the AHA. Complete the self-assessment checklist for energized electrical work.

8.28 Electrofishing Safety

Below are the hazard controls and safe work practices to be followed when overseeing or performing electrofishing.

- At least one member of the crew must have current first aid and CPR cards.
- Make sure every member of your crew knows where the nearest hospital is and how to get there or where to go to get help.
- All members of the crew shall have completed an electrofishing safety course.
- Before loading up equipment and heading into the field, make sure every member of the crew know the evacuation routes in case of an accident.
- Check the equipment for damaged or missing parts and for proper operation. Never use an electrofisher that is in poor condition or not working correctly as it can present a severe shock hazard.
- Check the cathodes cable for wear and burrs that may cause injury or tear holes in protective clothing. Check the insulation for damage. Replace the cathode as necessary.
- Check the anode pole for cracks in the fiberglass and handle assembly. Replace as necessary.
- Check the curl cord for cracks and abrasion. Do not use a cracked pole or a pole with a damaged curl cord.
- Check your boots and high voltage gloves for holes. Boots and gloves must be water tight without any holes. Repair as necessary.

- If you are using chest waders you should use a wading belt. A wading belt around your chest will trap air in your waders if you step or fall into a hole.
- Check all batteries for damage. Never use a damaged battery as the gelled electrolyte in these batteries is a strong acid and can cause severe chemical burns and damage clothing and the electrofisher.
- Use only dip nets with non-conductive handles. Never use an anode as a net, as it is extremely dangerous to other members of the crew and can cause severe injury to any fish caught with it.
- Never electrofish alone.
- Never electrofish if you are tired.
- Use only dip nets with insulated handles.
- Wear lineman's gloves, rated 5,000V minimum.
- Never try to reach into deeper pools with the electrodes. If you can't safely wade in an area it cannot be electrofished with a backpack electrofisher.
- Only one person on a crew can order the power for the electrofisher to be turned on, and that person is the crew leader. The crew leader is responsible for the safety of everyone on the crew.
- Any member of the crew can call for or turn off the power to the electrofisher.
- If an accident occurs, stop electrofishing and turn off the power to the unit. The person wearing the backpack unit should leave the water and take the unit to shore. The remaining members of the crew should help or attend to the accident victim. Get help for the injured person if necessary. Evaluate what happened and make the necessary procedural or equipment changes before proceeding.
- Never electrofish with spectators on shore. Electric fields can travel large distances through buried pipes, metal culverts, and metal sheet piling. If spectators show up during electrofishing, stop the operation and go explain what you are doing. Explain the risks to them being there and ask them to please leave for their own safety. If they refuse to leave, stop electrofishing, load your equipment and leave the area.

8.28.1 Safe Fishing

Electrofishing equipment uses voltages and currents that can be lethal to humans. The operators must always keep in mind that the chance of receiving an electrical shock is multiplied in or near water. Using an electrofisher is like using a firearm: if used properly and with good judgment it is perfectly safe; lose respect for it and you can lose your life.

Electrical equipment used in a moist field environment is always subject to deterioration that could lead to dangerous electrical shock. Field equipment is also subjected to vibration and impact during transporting and while in operation. Often equipment shared by different crews does not receive proper maintenance or a complete checkout. Follow the safety guidelines, and use good common sense to handle unforeseen circumstances.

All personnel involved in electrofishing should be taught the fundamentals of electricity, and have an understanding of the safety requirements.

8.28.2 Electrical Shock

It is the current that passes through the human body that does the damage. The voltage is relevant, because it is the force that "pushes" the current through the body. Experiments show that 20 to 500 HZ AC current is more dangerous than DC, or higher frequencies of AC.

The voltage used by electrofishing gear cause death by one of the following three means:

Ventricular Fibrillation – is uncoordinated contraction of the muscles of the heart. The heart quivers rather than beats. Electrical current through the chest can cause this condition,. Once a person goes into ventricular fibrillation, the only way to stop the quivering is to use a defibrillator that applies a pulse shock to the chest to restore heart rhythm. Cardiopulmonary resuscitation may help to keep a victim alive until he can be defibrillated.

Respiratory Arrest – The respiratory center is at the base of the skull. Thus, shock to the head can cause the breathing to stop. Artificial respiratory by the mouth-to-mouth method should be used in this case.

Asphyxia – is caused by contraction of the chest muscles. When current is above a certain level, a person cannot let go of an electrically hot wire. Currents above this level may not cause ventricular fibrillation, but may be enough to cause contraction of the chest muscles. If the current is not stopped, or the victim is not removed from the point of electrical contact, asphyxia will result. Artificial respiration or cardiopulmonary resuscitation may be necessary.

8.28.3 Preventing Electrical Shock

Electricity needs to have a complete electrical circuit in order for current to flow. The only way that you can get shocked is if you become the electrical conductor to complete the circuit. The current flows from the cathode to the anode through the water. The water is the electrical conductor. If you touched both the anode and the cathode you would become an electrical conductor and complete the circuit path and get a severe electrical shock. If you were to touch only one of the electrodes, you would not complete the electrical circuit and not get shocked.

WARNING: Touching any electrode is not recommended. Unless all conductive objects you come into contact with are connected to the same electrode, you will be shocked to find a current path that is not obvious, (e.g., the water or the boat).

Preventing electrical shock means preventing electrical current from entering and flowing through parts of the body. The skin is a partial but variable barrier, because it offers resistance to the passage of electrical current. Tough skin has more resistance that tender skin, and dry skin more than wet skin. But tough dry skin alone does not offer enough protection for electrofishing. Rubber lineman's gloves, rated 5,000V minimum should always be worn.

Even while wearing rubber gloves and waders, never touch an electrode while the circuit is energized. Do not work on electrical system while the generator is running. Do not enter the water while the current is on during boom shocking operations.

A severe electrical shock from electrofishing gear may result in the need for artificial respiration; therefore it is imperative that no one ever works alone.

8.28.4 Backpack Safety

- Before each operation, check that the frame emergency release is in working order and check that the tilt switch shuts off power if the unit is tipped more than 55 degrees forward.
- Wear hip boots or chest-high waders, with non-skid soles.
- Wear polarized sunglasses to help you detect sub-surface hazards and obstacles. Beware of turbid water that can hide unseen subsurface obstacles and sudden drop-offs.
- Shut off your electrofisher before entering or leaving a stream.
- Do not operate an anode pole when carrying a backpack unit weighing more than 20 pounds (9 kg) when in hazardous conditions.
- If you get water in your boots, waders, or gloves, stop work immediately and get dry clothing.

- Operate slowly and carefully. Footing in most streams is poor, and most falls often occur when operators are in a hurry.

8.29 Excavation Activities

The requirements in this section shall be followed whenever excavation is being performed. Refer to the Earthmoving Equipment section and SOP for additional requirements applicable to operating/oversight of earthmoving equipment. Below are the hazard controls and safe work practices to follow when working around or performing excavation. Ensure the requirements in the referenced SOP are followed.

- If the project site is suspected of munitions or explosives of concern (MEC) contamination, requirements of the *Explosives Usage and Munitions Response (MR)* SOP HSE-610 shall be followed. MECs include material potentially presenting an explosive hazard (MPPEH), discarded military munitions, materials that present a potential explosive hazard, chemical warfare materials, munitions constituents, and contaminated soil or groundwater. “Down-hole” avoidance support may be required to prevent accidental contact with MPPEH. Safety requirements will be based on the risk assessment identified within the MR (safety) ORE (Opportunity Risk Evaluation).
- Do not enter the excavations unless completely necessary, and only after the excavation competent person has completed their daily inspection and has authorized entry. An inspection shall be conducted by the competent person prior to the start of work, as needed throughout the shift, after every rainstorm, and after any hazard increasing occurrence. Documentation of the inspection must be maintained onsite at all times.
- Follow all excavation entry requirements established by the excavation competent person and any excavation permit being used.
- Sloping, benching, shoring, shielding, or other protective systems are required to protect personnel from cave-ins except when the excavation is made entirely in stable rock or is less than 5 feet deep (1.5 meters) and there is no indication of possible cave-in, as determined by the excavation competent person. Protective systems for excavations deeper than 20 feet (6.1 meters) must be designed or approved by a registered professional engineer.
- Trenches greater than 4 feet (1.2 meters) deep shall be provided with a ladder, stairway, or ramp positioned so that the maximum lateral travel distance is no more than 25 feet (7.6 meters).
- The atmosphere of excavations greater than 4 feet (1.2 meters) deep shall be tested prior to entry when a hazardous atmosphere exists or could reasonably be expected to exist, such as excavating landfills, hazardous waste dumps; or areas containing sewer or gas utility systems, petroleum distillates, or areas where hazardous substances are stored nearby.
- Spoil piles, material, and equipment must be kept at least 2 feet (61 centimeters) from the edge of the excavation, or a retaining device must be used to prevent the material from falling into the excavation.
- Excavations shall not be entered when:
  - Protective systems are damaged or unstable;
  - Objects or structures above the work location may become unstable and fall into the excavation;
  - The potential for a hazardous atmosphere exists, unless the air has been tested and found to be at safe levels; or
  - Accumulated water exists in the excavation, unless precautions have been taken to prevent excavation cave-in.
- The excavation self-assessment checklist shall be used to evaluate excavations prior to entry.

Excavation Operations

Refer to the Excavation Entry section when entering excavations controlled by other parties. When JACOBS performs the excavating, a JACOBS excavation competent person will oversee all excavation operations and entry into excavations. The competent person shall:

- Complete the JACOBS Excavation Permit to ensure HSE requirements have be satisfied during excavation activities;
- Complete the JACOBS Daily Excavation Inspection Checklist to ensure HSE requirements have be satisfied, document that an inspection has been conducted, and to authorize entry into the excavation. A new Checklist shall be completed each day, authorizing excavation entry. Inspections should be continued as needed throughout the work shift, and after any event that could increase the potential for cave-in (e.g., rainfall); and
- Conduct daily safety briefings prior to excavation entry.

8.30 Fall Protection Activities

Below are the hazard controls and safe work practices to follow when personnel or subcontractors are exposed to unprotected heights. Ensure the requirements in the referenced SOP are followed.

- Fall protection systems must be used to eliminate fall hazards when performing construction activities at a height of 6 feet (1.8 meters) or greater and when performing general industry activities at a height of 4 feet (1.2 meters) or greater.
- JACOBS staff exposed to fall hazards must complete initial fall protection training by completing either the JACOBS 10-Hour Construction Safety Awareness training course or the Fall Protection computer-based training module. Staff must also and receive project-specific fall protection training using the fall protection evaluation form attached to the project safety plan. Staff shall not use fall protection systems for which they have not been trained.
- The SL or designee must complete the Project Fall Protection Evaluation Form and provide project-specific fall protection training to all JACOBS staff exposed to fall hazards.
- The company responsible for the fall protection system shall provide a fall protection competent person to inspect and oversee the use of fall protection system. JACOBS staff shall be aware of and follow all requirements established by the fall protection competent person for the use and limitation of the fall protection system.
- When JACOBS designs or installs fall protection systems, staff shall be qualified as fall protection competent persons or work directly under the supervision of a JACOBS fall protection competent person.
- When horizontal lifelines are used, the company responsible for the lifeline system shall provide a fall protection qualified person to oversee the design, installation, and use of the horizontal lifeline.
- Inspect personal fall arrest system components prior to each use. Do not use damaged fall protection system components at any time, or for any reason. Fall protection equipment and components shall be used only to protect against falls, not to hoist materials. Personal fall arrest systems that have been subjected to impact loading shall not be used. SL shall periodically inspect JACOBS fall protection equipment using the Fall Protection Inspection Log form.
- Personal fall arrest systems shall be configured so that individuals can neither free-fall more than 6 feet (1.8 meters) or contact any lower level.
- Only attach personal fall arrest systems to anchorage points capable of supporting at least 5,000 pounds (2,268 kg). Do not attach personal fall arrest systems to guardrail systems or hoists.

- Rescue support shall be provided when personnel are not capable of rescuing themselves in the event of a fall. The emergency rescue requirements will be included in the Activity Hazard Analysis (AHA) for associated task(s) requiring the fall arrest system.
- Remain within the guardrail system when provided. Leaning over or stepping across a guardrail system is not permitted. Do not stand on objects (boxes, buckets, bricks, blocks, etc.) or ladders to increase working height on top of platforms protected by guardrails.
- Only one person shall be simultaneously attached to a vertical lifeline and shall also be attached to a separate independent lifeline.

8.31 Flight Line Safety

Always assume that the airfield is active. An active airfield means there is the possibility, even if an area is "closed", that aircraft or other vehicles will need access on or through a work area. There is always the potential for an incursion. If in an area of the airfield where radio contact with the control tower is required, the potential for miscommunication exists. Any mistake in communication has the potential to cause a problem with Air Operations. When maneuvering on the airfield, there are fuel trucks, helicopter rotors, jet blast, etc., all of which are potential hazards for workers. Pilots of aircraft do not expect workers to be on the airfield. If equipment is not properly marked, it may go unnoticed by pilots and present the potential for an incursion.

An aircraft always has the right of way. When working in a confined area that is "closed" to traffic, outline the work area with traffic cones or barricades that will provide a warning to other airfield traffic. This will also serve to keep vehicles from running through wet paint. Have one person designated as the point of contact who will be responsible for monitoring the radio and communicating with the control tower. That person shall be properly trained in the use of the radio, and check in daily with Air Operations to confirm work areas. Properly train workers to be aware of airfield operations going on around them, to give way to all moving aircraft, to allow great distances from aircraft, parked or running, when maneuvering on airfield.

It is inherent upon the contractor to be visible to everyone operating on the airfield. Orange and white checkered flags, flashing amber beacons, cones and/or barricades should be in good condition and clearly visible.

Speed limits on airfield area are enforced. Speed limits on an airfield are very low relative to speeds on the roads. Speeding on the airfield can lead to a possible incursion. Restricted areas, particularly on a military installation, must be strictly enforced. They are usually outlined with a red line and often have certain "Entry Control Points" painted along the red line where entry into the area is permitted. Entry into the restricted area without permission may subject the workers to arrest.

There are safety areas around runways on the airfield. All equipment and materials must be stored behind these areas. If a crew working on the runway is instructed to clear the runway, all workers and equipment must be moved beyond the safety area until given clearance by the control tower to return to the runway.

8.32 Forklift Operations

Below are the hazard controls and safe work practices to follow when working around or operating forklifts. Ensure the requirements in the referenced SOP are followed.

- Forklift operators are prohibited from using any wireless device while operating forklifts. If a wireless device is required for a certain operation, the PM and RHSM must authorize the wireless use on a case by case basis and make sure limitations are addressed in the project safety plan.
- A rated lifting capacity must be posted in a location readily visible to the operator.
- A forklift truck must not be used to elevate employees unless a platform with guardrails, a back guard, and a kill switch is provided on the vehicle. When guardrails are not possible, fall arrest protection is required.
- The subcontractor operating the forklift must post and enforce a set of operating rules for forklift trucks.

- Only certified forklift operators shall operate forklifts.
- Stunt driving and horseplay are prohibited.
- Employees must not ride on the forks.
- Employees must never be permitted under the forks (unless forks are blocked).
- The driver must inspect the forklift once a shift and document this inspection.
- The operator must look in the direction of travel and must not move the vehicle until all persons are clear of the vehicle.
- Forks must be carried as low as possible.
- The operator must lower the forks, shut off the engine, and set the brakes (or block the wheels) before leaving the forklift operator's position unless maintenance or safety inspections require the forklift to be running.
- Trucks must be blocked and have brakes set when forklifts are driven onto their beds.
- Extreme care must be taken when tilting elevated loads.
- Every forklift must have operable brakes capable of safely stopping it when fully loaded.
- Forklifts must have parking brakes and an operable horn.
- When the operator is exposed to possible falling objects, industrial trucks must be equipped with overhead protection (canopy).
- If using certified JACOBS forklift operators—forklifts must be inspected and documented daily using the forklift inspection form.

8.33 Groundwater Sampling/Water Level Measurements

Below are the hazard controls and safe work practices to follow when personnel or subcontractors are performing groundwater sampling and/or water level measurements.

- Full coolers are heavy. Plan in advance to have two people available at the end of the sampling effort to load full coolers into vehicles. If two people won't be available use several smaller coolers instead of fewer large ones.
- Wear the appropriate PPE when sampling, including safety glasses, nitrile gloves, and steel toe boots (see PPE section of the project safety plan).
- Monitor headspace of wells prior to sampling to minimize any vapor inhalation (refer to the "Site Monitoring" section of the project safety plan).
- Use caution when opening well lids. Wells may contain poisonous spiders and hornet or wasp nests.
- Use the appropriate lifting procedures (see JACOBS SOP HSE-112) when unloading equipment and sampling at each well.
- Avoid sharp edges on well casings.
- If dermal contact occurs with groundwater or the acid used in sample preservation, immediately wash all affected skin thoroughly with soap and water.
- Avoid eating and drinking on site and during sampling.
- Use ear plugs during sampling if sampling involves a generator.
- Containerize all purge water and transport to the appropriate storage area.

- Use two people to transport full coolers/containers whenever possible. If two people are not available use a dolly to move coolers. If the coolers weigh more than 40 pounds Attachment 1 of the HSE-112, *Manual Lifting,* shall be completed by the SC. If the coolers weigh more than 50 pounds they should never be lifted by one person.

8.34 Hand and Power Tools

Hands are one of the most complex parts of the body. Every employee uses their hands to help them make a living. There are more on-the-job injuries to hands than any other body part.

Below are the hazard controls and safe work practices to follow when personnel or subcontractors are using hand and power tools. Ensure the requirements in the referenced SOP are followed.

General

- Always select the right tool for the job;
- Keep cutting tools sharp—less force will be needed for the cut. Do not use pocket knives—only safety cutting tools and if using these be sure to comply with the "Knife Use" section of this Handbook;
- Carry and store tools correctly and never put sharp or pointed tools in your pocket or belt;
- Tools shall be inspected prior to use and damaged tools will be tagged and removed from service;
- Store tools properly in a place where they will not be damaged or come in contact with hazardous materials; and
- Tools used in an explosive environment must be rated for work in that environment (that is, intrinsically safe, spark-proof, etc.).
- Employees shall be trained on the "line of fire" hazards associated with operating power tools, how to look after their hands and body, and avoid pinch points or crush points. This may be accomplished by completing the Hand Safety training on the VO and reviewing the task-specific hazards and control measures in the Activity Hazard Analysis (AHA).

Hand and Power Tools

- Hand and power tools will be used for their intended use and operated in accordance with manufacturer's instructions and design limitations;
- Screwdrivers are one of the most used and abused tools, never:
  - Hammer with a screwdriver
  - Use as a pry bar
  - Use with a broken handle
  - Use with worn out tips
- Maintain all hand and power tools in a safe condition;
- When possible, use power tools over hand tools. Powered tools tend to require less exertion and reduce repetitive motion. Be sure that the weight of a powered tool (and cording) does not create additional force issues.
- Whenever possible, select tools that use a full-hand power grip rather than a precision finger grip. The greater the efforts to maintain control of a hand tool, the higher the potential for injury. A compressible gripping surface rather than hard plastic should be used.

- Avoid repetitive trigger-finger actions. Select tools with large switches that can be operated with all four fingers.
- When possible, use tools with extension handles that let you stand up while performing a floor-level task (extension handles must be manufacturer-approved)
- To lessen vibration:
  - Pad tool handles with a soft compressible surface
  - Use vibration damping (gel filled) gloves
  - Select tools (hammers and chippers) with built in damping systems (springs/hydraulics)
- Maintain straight wrists. Avoid bending or rotating the wrists; a variety of bent-handle tools are commercially available.
- Avoid static muscle loading. Reduce both the weight and size of the tool. Do not raise or extend elbows when working with heavy tools.
- Use PPE (such as gloves, safety glasses, earplugs, and face shields) when exposed to a hazard from a tool;
- Do not carry or lower a power tool by its cord or hose;
- Portable power tools will be plugged into GFCI protected outlets;
- Portable power tools will be Underwriters Laboratories (UL) listed and have a three-wire grounded plug or be double insulated;
- Disconnect tools from energy sources when they are not in use, before servicing and cleaning them, and when changing accessories (such as blades, bits, and cutters);
- Safety guards on tools must remain installed while the tool is in use and must be promptly replaced after repair or maintenance has been performed;
- If a cordless tool is connected to its recharge unit, both pieces of equipment must conform strictly with electrical standards and manufacturer's specifications; and

Machine Guarding

- Ensure that all machine guards are in place to prevent contact with drive lines, belts, chains, pinch points or any other sources of mechanical injury;
- Unplugging jammed equipment will only be performed when equipment has been shut down, all sources of energy have been isolated and equipment has been locked/tagged and tested; and
- Maintenance and repair of equipment that results in the removal of guards or would otherwise put anyone at risk requires lockout of that equipment prior to work.

8.35 Haul Trucks

Below are the hazard controls and safe work practices to follow when working around or operating haul trucks:

- Haul truck operators are prohibited from using any wireless device while operating trucks on site. Trucks must be stopped before using devices such as two way radios or cell phones. If a wireless device is required for a certain operation, the PM and RHSM must authorize the wireless use on a case by case basis and make sure limitations are addressed in the project safety plan.
- Haul truck operators should be familiar with their equipment and inspect all equipment before use;

- Haul truck operators should ensure all persons are clear before operating truck or equipment. Before moving operators should sound horn or alarm, all equipment should be equipped with a working back up alarm;
- Haulage trucks or equipment with restricted visibility should be equipped with devices that eliminate blind spots;
- Employees should stay off haul roads. When approaching a haul area, employees should make eye contact and communicate their intentions directly with the equipment operator;
- If possible minimize steep grades on haul roads;
- Where grades are steep provide signage indicating the actual grade as well as measures for a runaway truck;
- Trucks are to be operated within the manufacturer's recommendations (for example- retarder charts indicate the combination of loads, grades and speeds that should not be exceeded if the truck's retarder is to work properly – to ensure the truck does not descend grade at speeds greater than listed);
- Haul roads should be well lit, sufficiently wide (at least 50 percent of the width of the equipment on both sides of road) and equipped with reflectors to indicate access points;
- Haul roads should have adequate right-of-way signs indicating haul directions;
- Haul trucks will follow designated haul roads; and
- Haul trucks will comply with posted speed limits.

8.36 Hoists

- Below are the hazard controls and safe work practices to follow when working around or operating hoists. Ensure the requirements in the referenced SOP are followed.
- Manufacturer's specifications and limitations applicable to the operation of material hoists shall be followed. Where manufacturer's specifications are not available, the limitations assigned to the equipment shall be based on the determinations of a professional engineer competent in the field.
- Rated load capacities, recommended operating speeds, and special hazard warnings or instructions shall be posted on hoists.
- Hoisting ropes shall be installed in accordance with the wire rope manufacturer's recommendations.
- The installation of live booms on hoists is prohibited.
- Operating rules shall be established and posted at the operator's station of on hoists.
- No person shall be allowed to ride on material hoists except for the purposes of inspection and maintenance.
- All entrances of the hoistways shall be protected by substantial gates or bars, which guard the full width of the landing entrance.
- Overhead protective coverings of 2-inch planking, ¾-inch plywood, or other solid material of equivalent strength, shall be provided on the top of every material host cage or platform.
- All hoistway entrance bars and gates shall be painted with diagonal contrasting colors, such as black and yellow.

- A qualified hoist operator will operate, inspect, maintain and oversee all hoist operations. The SL or designee shall verify hoist operator qualifications (e.g., operator to provide for the type of hoist being operated—years of experience, training, background).
- JACOBS employees who are required to operate hoists shall read the hoist manufacturer's operations and maintenance manual, be evaluated and approved as qualified hoist operators. The JACOBS may require operators to complete separate hoist operations training, provided by commercial training specialists.

8.37 Hydrogen Sulfide

Hydrogen sulfide (H2S) is a colorless, toxic, and flammable gas responsible for the odor of rotten eggs. It often results from the bacterial break down of organic matter in the absence of oxygen, such as in sewers. It also occurs in gases, natural gas and in well waters. H2S may be produced during the biological process when biological substrates are used to expedite the remediation process.

Chemical Properties

Hydrogen sulfide is heavier than air and may travel along the ground. It collects in low-lying and enclosed, poorly-ventilated areas such as basements, manholes, sewer lines, and underground telephone vaults. For work within confined spaces, use appropriate procedures for identifying hazards, monitoring and entering confined spaces (see Confined Space Entry section of this Handbook or the project safety plan). Additionally, H2S is a highly flammable gas and gas/air mixtures can be explosive. It may travel to sources of ignition and flash back. If ignited, the gas burns to produce toxic vapors and gases, such as sulfur dioxide.

Routes of Exposure and Exposure Limit

The primary route of exposure to H2S is inhalation, and the gas is rapidly absorbed by the lungs. Absorption through the skin is minimal. People can smell the "rotten egg" odor of H2S at low concentrations in air. However, with continuous low-level exposure, or at high concentrations, a person loses his/her ability to smell the gas even though it is still present; this is called olfactory fatigue. This can happen very rapidly and at high concentrations, the ability to smell the gas can be lost instantaneously. Therefore, DO NOT rely on your sense of smell to indicate the continuing presence of H2S or to warn of hazardous concentrations.

About half of the population can smell H2S at concentrations as low as 0.5 parts per billion (ppb) in air, and more than 90 percent can smell it at levels of 50 ppb. At higher concentrations H2S rapidly deadens the sense of smell. For most people, this occurs at approximately 150 ppm.

The American Conference of Governmental Industrial Hygienists (ACGIH) 8-hr time-weighted average (TWA) exposure limit for H2S is 1 ppm; the 15-minute short term exposure limit (STEL) is 5 ppm.

The Immediately Dangerous to Life or Health (IDLH) in air is 100 ppm. Exposure to 500 ppm can be fatal in a few breaths. Exposure to 1000 ppm is fatal.

Effects on the Body

Hydrogen sulfide is both an irritant and a chemical asphyxiant with effects on both oxygen utilization and the central nervous system. Its health effects can vary depending on the level and duration of exposure. Low concentrations irritate the eyes, nose, throat and respiratory system (e.g., burning/tearing of eyes, cough, shortness of breath). Asthmatics may experience breathing difficulties. The effects can be delayed for several hours, or sometimes several days, when working in low-level concentrations. Repeated or prolonged exposures may cause eye inflammation, headache, fatigue, irritability, insomnia, digestive disturbances and weight loss.

Moderate concentrations can cause more severe eye and respiratory irritation (including coughing, difficulty breathing, and accumulation of fluid in the lungs), headache, dizziness, nausea, vomiting, staggering and excitability.

High concentrations can cause shock, convulsions, inability to breathe, extremely rapid unconsciousness, coma and death.

H_2S as a Project Hazard

Elevated levels of H2S have not been reported during normal drilling activities, but experience has shown that high levels of H2S may be present in the well space and in the breathing zone following the injection of emulsified oil, once the biological process has had time to progress. Engineering controls shall be considered to bring the concentrations of H2S down to an acceptable level in the breathing zone, followed by administrative controls, and respiratory protection.

All employees will receive orientation on the emergency contingency plan for the specific actions to follow when there is an H_2S release from equipment, fire involving H_2S, or medical emergency involving exposure to H_2S.

Air Monitoring

Follow the air monitoring action levels in the project safety plan. If elevated levels of H2S are encountered, first implement engineering controls to reduce exposures to allowable levels. If that is not possible, then an upgrade in PPE may be required; refer to the PPE section of the project safety plan.

8.38 Ionizing Radiation

In addition to the general requirements below, refer to Section 2.4 “Radiological Hazards and Control” for project-specific information.

- JACOBS Policy approval may be required for activities involving radiation; check with the project EM in the project planning stages.
- JACOBS employees working onsite must complete the JACOBS online Ionizing Radiation Training module available through the Virtual Office.
- Do not enter restricted work areas unless training, medical monitoring, personal monitoring equipment, and PPE requirements established by the radiation protection competent person have been met.
- Know your quarterly dose margin and do not exceed your personal limits.
- Assure personal monitoring devices are worn properly. Always calibrate pocket dosimeters prior to entering and exiting restricted areas.
- Plan activities to minimize exposure (ALARA) and waste generation.
- Limit the amount of potential waste (e.g., packaging, boxes, paperwork, etc.) brought into restricted areas.
- Do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in restricted areas.
- Promptly report any condition which may lead to or cause a violation of radiation protection standards.
- Assure radioactive sources, containers, and the area are properly labeled and posted.
- Protective clothing and other exposure controls shall be based on the most recent survey results obtained from the radiation protection competent person.
- Know the emergency evacuation warning signals and be prepared to respond.
- Do not leave radioactive source materials and equipment unattended.

8.39 Lead

(In Canada, provincial occupational regulations may apply and should be implemented as required.)

JACOBS is required to control employee exposure to lead when exposures are at or above 30 $\mu g/m^3$ by implementing a program that meets the requirements of the OSHA Lead standard, 29 CFR 1910.1025 and 29 CFR 1926.62, or lower if the local regulations are more stringent. The elements of the JACOBS lead program include the following:

- Exposure monitoring;
- Methods of control, including personal protective equipment (PPE) and respirators;
- Medical surveillance;
- Training on hazards of lead and control measures (includes project-specific training and the computer-based training on CH2M's Virtual Office, *Lead Exposure Training);* and
- Record keeping requirements.

If air monitoring indicates there is potential exposure at the action level concentrations above, notify the RHSM to ensure the above have been adequately addressed. Other exposure control measures include:

- Do not enter regulated work areas unless training, medical monitoring, and PPE requirements established by the competent person have been met;
- Do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in regulated areas;
- Respiratory protection and other exposure controls selection shall be based on the most recent exposure monitoring results obtained from the competent person; and
- Review the fact sheet included as an attachment to the SOP.

8.40 Lockout/Tagout Activities

Lockout/tagout (LO/TO) shall be performed whenever service or maintenance is necessary on equipment that could cause injury to personnel from the unexpected equipment energizing or start-up or unexpected release of stored energy. Energy sources requiring lockout/tagout may include electrical, pneumatic, kinetic, and potential.

If work on energized electrical systems is necessary—contact the RHSM. Specific training and procedures are required to be followed before any work on energized electrical systems can be performed and are NOT covered in this section. Energized electrical work is defined as work performed **on or near** energized electrical systems or equipment with exposed components operating at 50 volts or greater. Working near energized live parts is any activity inside a Limited Approach Boundary (anywhere from 3.5 feet to 24 feet [1 meter 7.3 meters] depending on voltage). Examples of energized electrical work include using a voltmeter to troubleshoot electrical systems and changing out controllers.

When lockout/tagout is necessary to perform maintenance/repair of a system, all the requirements of SOP HSE-310, Lockout and Tagout, shall be met including the following bulleted items:

- When JACOBS controls the work, JACOBS must verify that subcontractors affected by the unexpected operation of equipment develop a written lockout/tagout program, provide training on lockout/tagout procedures and coordinate its program with other affected subcontractors. This may include compliance with the owner or facility lockout/tagout program.
- When JACOBS personnel are affected by the unexpected operation of equipment they must complete the electrical safety awareness module on the VO. Authorized personnel shall inform the affected personnel of the LO/TO. Affected personnel shall not tamper with LO/TO devices.

- Standard lockout/tagout procedures include the following six steps: 1) notify all personnel in the affected area of the lockout/tagout, 2) shut down the equipment using normal operating controls, 3) isolate all energy sources, 4) apply individual lock and tag to each energy isolating device, 5) relieve or restrain all potentially hazardous stored or residual energy, and 6) verify that isolation and deenergization of the equipment has been accomplished. Once verified that the equipment is at the zero energy state, work may begin.
- All safe guards must be put back in place, all affected personnel notified that lockout has been removed and controls positioned in the safe mode prior to lockout removal. Only the individual who applied the lock and tag may remove them.
- JACOBS authorized employees shall complete the LO/TO training module on the VO and either the electrical safety training module on the VO or 10-hour construction training. The authorized employee must also be trained and qualified on the system they are working on (e.g., qualified electrician for working on electrical components of a system).
- When equipment-specific LO/TO procedures are not available or when existing procedures are determined to be insufficient, JACOBS authorized employees shall also complete the Equipment-Specific LO/TO Procedure Development Form, provided as an attachment to the SOP, to create an equipment-specific lockout/tagout procedure. Each lockout/tagout event shall be recorded on the Logout/Tagout Log (Attachment 4 of SOP HSE-310) to manage work and identify every point where locks and tags are applied.

8.41 Avoidance of Munitions and Explosives of Concern (MEC) and/or Materials Potentially Presenting an Explosive Hazard (MPPEH)

If work will be conducted on a government/military facility or ex-government/military facility; area currently or previously used as a range; or if military munitions, MEC, or material potentially presenting an explosive hazard (MPPEH) are associated with the scope of work or location immediately contact the JACOBS Central Point of Contact for Explosives Usage and Munitions Response. The following will be required prior to any field work:

- Setting up a conference call with all required personnel to conduct a basic safety risk assessment over the phone.
- Providing written directions detailing job-specific requirements and what actions to take to ensure safety during the work.
- “3R Training” will be required for all affected project personnel. This training teaches personnel to Recognize, Retreat, and Report.

8.42 Marijuana Cultivation Sites

Marijuana grow sites are illegal on public lands, but are becoming more common. These sites may be encountered when working in undeveloped or “back country” areas. These sites pose risks to workers, the public, and the environment and are most often associated with organized crime. The potential for violent confrontations is high.

Most marijuana grow sites have someone always watching the site. Even unattended sites pose a significant risk. Recognize the signs of marijuana cultivation sites, and if you think you are near one, be quiet and leave the area immediately.

How to recognize a cultivation site:

- Sometimes marijuana smells like a skunk on hot days.
- Hoses or drip lines (made of black or white PVC piping or rubber hose) located in unusual or unexpected places.

- Discarded containers of herbicides, pesticides or other chemicals. A variety of chemicals for pest and animal control, including chemicals that may be so hazardous they are illegal in the United States are sometimes encountered.
- A well-used trail where there shouldn't be one.
- People standing along roads without vehicles present, or in areas where loitering appears unusual.
- Grow sites are usually found in isolated locations, in rough steep terrain. Look for signs of cultivation, cleared vegetation, soil disturbance.
- Food cached near trailheads or alongside roads.
- Sights or sounds of human activity in remote forest areas.
- Camps containing cooking and sleeping areas with food, fertilizer, weapons, garbage, rat poison, and/or dead animals.
- Small propane bottles, used to avoid the detection of wood smoke.
- Individuals armed with rifles outside of hunting season.
- Paper cups, chicken wire or plastic sheets used for starting and protecting plants.

As soon as you become aware that you have come upon a cultivation site, leave the way you came in immediately and make as little noise as possible. Never engage the growers as these are extremely dangerous people. If you can identify a landmark or it is helpful for authorities, but put your own safety first. The growers may be present and may or may not know that you have found their grow site. Get to a safe place and report as much detail about the location and incident as you can recall to authorities. Ensure you contact the RHSM and Project Manager as soon as possible.

Other precautions to take include:

- Check with local law enforcement officers to see whether they know of any dangers or concerns in the area where you will be working.
- Establish and follow check-in and checkout procedures every day.
- Make sure your supervisor and the dispatch office know where you will be working.
- If necessary, agree on a phrase that you would use to let your co-workers (SL, RHSM, or PM) know you are in danger and need law enforcement assistance immediately at your last known location.
- Make sure you have a working communication device.
- Use the buddy system. Work in pairs.
- Park your vehicle so it's pointing in the direction of escape.

8.43 Methane (as a Product of Injection Activities)

Methane is a colorless, odorless gas with a wide distribution in nature. Methane is created when organic matter decomposes (rots) without any oxygen present ("anaerobic" decomposition) and is common in landfills, marshes, septic systems and sewers.

Methane may be produced as a by-product of the biological process when biological additives are used in a remediation process (such as when emulsified oil is injected to enhance dechlorination of contaminated groundwater).

Experience has shown that methane may be present in the well space following the injection of emulsified oil, once the biological process has had time to progress. This needs to be considered when returning to collect ground

water samples. Although methane degrades Engineering controls shall be considered to bring the concentrations of methane down to an acceptable level in the breathing zone.

Methane is a “simple asphyxiant,” which means that it can displace available oxygen. Methane is combustible and mixtures of methane with air are explosive within the range 5-15 percent by volume of methane (the lower and upper explosive limits). At room temperature, methane is lighter than air, so in an outdoor environment, it tends to dissipate.

Methane is not toxic when inhaled, but it can produce suffocation by reducing the concentration of oxygen inhaled. When exposed to concentrations high enough to displace oxygen, you may experience dizziness, deeper breathing, possible nausea and eventual unconsciousness.

The primary danger is from fire and explosion, so ensure that you work in a well-ventilated area, and that there is no source of ignition present. Use spark-proof tools and intrinsically safe equipment, if necessary. If working in a confined space, make sure that appropriate controls are in place and follow an approved permit-required confined space entry plan.

8.44 Methane (as Landfill Gas or Shale Formations)

Landfill gas is normally made up of 50 percent methane and 50percent carbon dioxide

Shale formations can produce methane that has the potential to be released during drilling or groundwater sampling.

Other constituents have been found in the landfill gas. These may include hydrogen sulfide, tetrachloroethene, ethyl benzene, toluene, and xylenes. Refer to the project health and safety plan for additional information on these constituents when this hazard is part of your work.

- Continuous monitoring is required when performing intrusive activities (e.g., excavation, drilling) in a methane area. This includes refuse and any cover material.
- Monitoring will be conducted with oxygen/combustible gas meters.
- All instruments will be calibrated according to manufacturer’s specifications. Instruments will be calibrated at the frequency specified by the manufacturer.
- Ventilation is the primary control to reduce the fire potential from methane. The action required for ventilation include:
- Natural Ventilation – If the wind speed across the bore hole or sampling apparatus is over 5 mph (8 kph) then natural ventilation is sufficient. Equipment and personnel must be located upwind of the potential methane source to prevent any ignition source from contacting methane in air.
- Forced Ventilation – If the wind speed across the bore hole or sampling apparatus is less than 5 mph (8 kph) then forced ventilation is required. Large air movers are preferable but standard ventilation fans may be used if the air flow is directed to the bore hole or the location in the sampling apparatus where the methane first encounters open air.

8.45 Methylene Chloride

(In Canada, provincial occupational regulations may apply and should be implemented as required.)

Methylene chloride has a faint, sweet odor which is not noticeable at dangerous concentrations. Methylene chloride is shipped as liquefied compressed gas and will cause frostbite on contact.

JACOBS is required to control employee workplace exposure to methylene chloride when personal exposures are at or above 12.5 parts per million (ppm) as an 8-hour time-weighted average (TWA) or above 125 ppm short-term exposure limit (STEL) by implementing a program that meets the requirements of SOP HSE-509, the OSHA

Methylene Chloride standard, 29 *Code of Federal Regulations* (CFR) 1910.1052, or local regulation if more stringent The elements of the JACOBS methylene chloride program include the following:

- Exposure monitoring;
- Methods of control, including personal protective equipment (PPE) and respirators;
- Medical surveillance;
- Training on hazards of methylene chloride and control measures (includes project-specific training and the computer-based training on CH2M's Virtual Office, *Methylene Chloride)* and*;*
- Recordkeeping requirements.

If air monitoring indicates there is potential exposure at the action level concentrations above, notify the RHSM to ensure the above have been adequately addressed. Other exposure control measures include:

- Do not enter regulated work areas unless training, medical monitoring, and PPE requirements established by the competent person have been met;
- Do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in regulated areas;
- Respiratory protection and other exposure controls selection shall be based on the most recent exposure monitoring results obtained from the competent person;
- Appropriate air-supplied respirators must be used when methylene chloride exposures exceed PEL or STEL;
- Air supplied to respirators must meet Grade D breathing air requirements; and
- Review the fact sheet included as an attachment to the SOP.

8.46 Naturally Occurring Radiation Materials (NORM)

Naturally Occurring Radiation Materials (NORM) is found in the earth's crust, soil, plants and many living organisms. The geologic formations that contain oil and gas deposits also contain NORM, commonly consisting of the elements of uranium, radium, thorium and their associated decay products. If present, these radio nuclides dissolve in water and can be bound into the scale deposited in production equipment handling produced water. Radon gas follows the propane/ethane streams of produced (natural) gas and the radon gas byproducts (radon daughters) can be deposited on the inside surfaces of gas handling equipment. Land can be contaminated with NORM from descaling operations, contaminated sludges, and/or residual from produced water.

Equipment that can contain NORM-contaminated scale includes equipment associated with the separators (separate gas from the oil and water) and heater treaters (divide the oil and water phases) such as flowlines, pumps, valves, and piping (especially transition pieces such as elbows and reducer) and filters.

Gas processing equipment can also be contaminated with NORM (radon daughters). This contamination, unlike scales, can be in the form of an invisible film inside gas equipment and can only be detected by internal surveying with appropriate instrumentation.

Natural gas liquid equipment can also be contaminated by radon in the gas. Sludges accumulated in this equipment may contain the heavy metal radon daughters that have attached to dust and other particles that become part of the sludge.

While NORM has generally been associated with exploration and production activities, there is some industry experience to indicate that some refinery process equipment can also be contaminated with NORM, including natural gas stream equipment, crude tank bottoms, desalters, overhead atmospheric pipestill equipment, and exchanger deposits/sludge.

Hazards of NORM

NORM generally does not present an external radiation (Gamma) hazard to employees working around closed process equipment. This is particularly the case with NORM associated with scale inside equipment handling production water due to attenuation by the scale and steel pipe wall. Recent field experience, however, indicates that some in-service gas processing equipment, particularly valves, elbows, or transition piping pieces, may have fairly high external Gamma radiation levels. If gas-processing equipment is out of service for more than 4 hours, external Gamma measurements will not detect internal accumulation of the radon daughters.

Work procedures are recommended when maintaining NORM contaminated equipment such as pipelines, filters, pumps, lines, sludge or wellhead equipment. The exposure risk is highest when grinding, cutting, polishing, or performing other work that may generate dust. These dusts present inhalation hazards that result in internal exposures to radioactive material.

- Radium, radon, and their decay products are radioactive elements of concern in petroleum production and gas processing. Exposure may occur when contaminated dusts and sludge are inhaled or ingested (internal exposure) or when radiation from surrounding equipment strikes the body (external exposure).
- Radium is found in most oil and gas fields in the world in varying concentrations. There is potential to find radium in significant amounts in almost all types of equipment. Radon is found in most natural gas deposits in the world.
- Radon itself does not present a health hazard because it is not easily absorbed into the body and is quickly cleared when absorbed.
- Radon's radioactive breakdown products, called radon "daughters," may be hazardous. Radon naturally breaks down into radioactive metals before becoming non-radioactive lead.
- Radon daughters may be inhaled or ingested when attached to scale or dust generated during equipment inspection and repair. Radon daughter overexposure has been associated with an increased risk of lung cancer.

NORM Hazard Control Measures

- For operations where NORM is a potential hazard, a qualified individual (s) will be assigned for implementing radiological protection of employees, members of the public, and the environment.
- Surveys and monitoring must be conducted to evaluate the potential radiological hazards. The surveys must include measurements for radiation levels based on the concentrations or quantities of radioactive material, along with any other measurements or evaluations necessary to characterize the potential radiological hazards that could be present.
- Equipment contaminated with NORM must be labeled.
- Gas processing equipment should be opened to allow gas to escape, and allowed to stand idle for at least 4 hours prior to any entry.
- Water washing of any equipment prior to entry is recommended when practical.
- Personal protective equipment (PPE) must be selected based on the hazards (both radiological and non-radiological) work activities to be conducted, and the contamination levels in the work area,
    - Level D PPE must be worn to minimize skin contact with NORM such as gloves and appropriate body protection. Disposable clothing such as TYVEK is preferred since NORM contaminated clothing should be laundered.
    - Level C PPE using full-face air-purifying respirator with high efficiency particulate air (HEPA filters) must be worn if dust exposure is expected.

- Do not sand, grind, cut, or weld on surfaces contaminated with NORM without appropriate cleaning. Equipment should be resurveyed after cleaning prior to these activities.
- NORM-contaminated equipment or material should not be shipped offsite for repair or disposal without first contacting the designated NORM coordinator (may be the RHSM and/or REM)

8.47 Mower, Brush Hog and Weed Trimmer Safety

Below are hazard controls and safe work practices to follow when personnel or subcontractors are working near or using mowers, brush hogs and weed trimmers. The brush hog is a dangerous machine that will throw rocks and debris long distances at speeds that can and have caused significant injury. It can also become entangled in rope, wire or other objects that can endanger workers in the vicinity.

Ensure that the following requirements are followed

Mower/Brush Hog

- Meet with the brush hog or mower crew during the safety tailgate meeting and immediately prior to operations to ensure all personnel understand the signal that indicates when the operator will operate the brush hog.
- Conduct a sweep of the area where the brush hog or mower is scheduled to cut vegetation and 100-foot buffer prior to mower, brush hog, masticator and trimmer operations for loose debris, rocks, logs, foreign objects, wire, rope, fencing, etc. that could present a safety hazard.
- Restrict other workers and oversight activities to 300 feet outside the staked limits of the work area while brush clearing equipment is operating.
- Workers should position themselves 180 degrees towards the rear of the mower, always maintaining >300 feet from the edge the area being cleared by the mower.
- Minimum PPE Requirements – leather boots with safety toes, safety glasses, leather gloves, hard hat, long pants, and high visibility vest.
- The equipment operator must read the owner's manual prior to operating the equipment.
- Make all necessary adjustment prior to turning on the equipment.
- Practice operation in an open area.
- Make sure all protective guards are in place. Never remove guards.
- Determine that steering is responsive before beginning a job.
- Test the brakes.
- Clean the steps and operating platform to prevent slipping.
- Ensure that tires are properly inflated.
- Only the operator should be riding on the equipment, no passengers are allowed.
- When leaving the seat, the operator should disengage the Power Take Off (PTO), engage the brake, stop the engine, and wait for all parts to stop before dismounting.
- The operator should not adjust any mechanism of the equipment while the mower is running, making sure all parts have stopped moving prior to making any adjustments.
- When driving between mowing jobs, crossing a road, path or sidewalk, or when not using the mower, the operator should disengage the PTO to stop the mower blade.
- Operators should not mow in conditions where traction or stability is questionable. If uncertain, test drive a section with the PTO off.
- Never refuel equipment while the engine is running or extremely hot. A fire or explosion could result.

- Maintain a fire extinguisher nearby.
- When mowing on uneven ground follow these rules:
    - Reduce the travel speed so that you can see and react to hazards in your path. Overturns are four times more likely to occur when the speed is doubled.
    - Be on the alert for holes and ditches covered by grass or debris. A wheel may drop and cause an overturn.
    - Drive up and down a hill, not across.
    - Do not stop when going uphill or downhill. If the mower stops going uphill, turn off the PTO and back down slowly.
    - Do not try to stabilize the mower by putting your foot on the ground.

Weed Trimmer

- Wear snug, tight-fitting equipment while operating the weed trimmer or tri-blade. Retain long hair or any other loose items or clothing.
- Inspect guard/shield and ensure it is securely in place.
- Do not change string with equipment running. Turn off equipment before removing any jams.
- When cutting, keep spinning string low and maintain control.
- Never operate the weed trimmer one handed; hold with both hands with thumbs opposed to direction of other fingers, using a firm grip to prevent loosing grip if the tool kicks back or bucks.
- Start cutting in a position so that it is off to the side of your body, so that if the tool bucks it doesn't come back up into your body.
- Inspect brush/weeds for any objects that could become a harmful projectile.
- Clear area of people and vehicles; minimum of 100 feet safe zone.

8.48 Off-Road Driving Safety

- Whenever possible, use only paved roads when there is a choice between un-improved roads and paved roads.
- On a project by project basis, conduct an assessment based on the degree of hazard, driving route, and location, determine whether an In Vehicle Monitoring System (IVMS) is required when driving alone in remote areas (Refer to Working Alone Core Standard). Also consider what will be used for communication when in remote areas (e.g., satellite phone, InReach device).
- When four-wheel drive (off-road) roads are used, personnel shall be experienced in off-road driving.
- Plan access routes prior to setting out. Obtain the most current maps if traveling on federal lands.
- Prepare an emergency kit with extra clothes, food, water, batteries, flashlight, and other items that may be needed if you become stranded.
- Roads can become slick with mud, may be along cliff sides with no protection, have soft shoulders/erosion, may be narrow, have blind curves, have damage or obstructions in the road. Do not attempt to drive routes you are not comfortable with. Have potential alternate routes identified wherever possible so if a road becomes more dangerous than when you used it before, you can take another road.
- Carry a compass and/or GPS when traveling to remote areas on rural roads.
- Before going off-road, inspect the vehicle. Make sure the tires (including the spare) are in good condition and inflated properly. Look under the vehicle for any leaks or mechanical problems. Make sure all fluids are topped off. Check the condition of your steering and brakes.

- Fill fuel tank before leaving populated areas. Fuel stations may be unavailable for long distances. Carry extra fuel in an approved gas can if you will be a long way from populated areas.
- Know how the 4x4 system works and how to use the controls before they are needed. Practice using the low ratio gearbox. If the vehicle is equipped with manual locking hubs, test them to ensure they are working properly.
- Know where the spare tire and jack are located and how to use them.
- Know and understand the vehicle's dimensions - height, width, length, approach angle, departure angle and ramp angle. Also know where the lowest point of clearance is - usually the differential casing.
- Keep track of preventative maintenance schedule and keep vehicle up-to-date if being used long-term.
- Pay attention to how the vehicle is loaded. Loads should be distributed evenly within the vehicle if possible. Loads behind the rear axle will sag the rear of the vehicle, limiting your departure angle and clearance. Excessive loads will change the center-of-gravity, thus making the vehicle less stable.
- Be time-conscious. What may look like a short trip on the map may take many hours in 4-wheel drive; allow enough time for safe travel.
- Drive within your ability. If you are not comfortable, do not proceed.
- Avoid surprises by surveying the road ahead before it is driven, when needed. Get a good idea where to place the tires and have a plan of approach. Follow through beyond the obstacle.
- Driving diagonally can lead to a rollover. Always drive straight down hills or steep terrain.
- Avoid driving over obstacles that may cause the vehicle to become stuck. Cross ditches or logs at an angle so that one wheel at a time goes over the obstacle; the other three help the one wheel to climb over. Dropping the tire into a ditch or crack in a rock can put you and your truck in a vulnerable position.
- When driving on narrow roads and there is no shoulder available for either vehicle to pull over safely, stop. One vehicle should back up until a safe spot is reached. By custom the vehicle closest to the safe shoulder will reverse or, on a steep hill, the vehicle traveling downhill.
- Do not expect logging trucks, cars with trailers, or other large vehicles to make room for you. Pull over early when you see them coming.
- Slow down when traversing blind curves, washboard roads, or roads with loose surfaces. Make turns and brake gently to avoid sliding or loss of control.

8.49 PCB/Ballast Handling

Fluorescent lighting used in many older buildings use ballast resistors that contain polychlorinated biphenyl (PCB) oil. PCB is colorless to light-colored, viscous liquid with a mild, hydrocarbon odor.

PCB has been found to cause, irritation eyes; chloracne; liver damage; reproductive effects; and has shown to cause cancer in lab animals.

When work requires the handling or removal of fluorescent ballast resistors, extra care and attention needs to be taken. While ballasts are usually well sealed, it is not uncommon to find a ballast resistor that has leaked. Below are the hazard controls and safe work practices to be followed when PCBs are present.

- A survey must be made to determine whether ballast resistors contain PCB fill.
- Leaking resistors must be identified and handled with appropriated PPE.
- Exposure Routes are inhalation, skin absorption, ingestion, skin and/or eye contact

- Prevent skin contact by using chemical resistant gloves, wear eye protection, and thoroughly wash hands before eating or smoking.
- Ensure eyewash is available.
- In the event of exposure, follow the following First Aid procedures:
  Eyes: Irrigate immediately
  Skin: Soap wash immediately
  Ingestion: Seek medical attention immediately
- Dispose of PCB ballast resistors in accordance with Federal, State and Local environmental regulations.

8.50 Portable Generator Hazards

- Portable generators are useful when temporary or remote electric power is needed, but they also can be hazardous. The primary hazards to avoid when using a generator are carbon monoxide (CO) poisoning from the toxic engine exhaust, electric shock or electrocution, and fire.
- NEVER use a generator indoors or in similar enclosed or partially-enclosed spaces. Generators can produce high levels of carbon monoxide (CO) very quickly. When you use a portable generator, remember that you cannot smell or see CO. Even if you can't smell exhaust fumes, you may still be exposed to CO.
- If you start to feel sick, dizzy, or weak while using a generator, get to fresh air RIGHT AWAY. DO NOT DELAY. The CO from generators can rapidly lead to full incapacitation and death.
- If you experience serious symptoms, get medical attention immediately. Inform project staff that CO poisoning is suspected. If you experienced symptoms while indoors have someone call the fire department to determine when it is safe to re-enter the building.
- Follow the instructions that come with your generator. Locate the unit outdoors and away from doors, windows, and vents that could allow CO to come indoors.
- Generators rated greater than 5 kilowatts that are not vehicle- mounted need to be grounded in accordance with regulatory and manufacturer requirements. Always refer to the manufacturer grounding requirements for any generator used on site.
- Keep the generator dry and do not use in rain or wet conditions. To protect from moisture, operate it on a dry surface under an open, canopy-like structure. Dry your hands if wet before touching the generator.
- Plug appliances directly into the generator. Or, use a heavy duty, outdoor-rated extension cord that is rated (in watts or amps) at least equal to the sum of the connected appliance loads. Check that the entire cord is free of cuts or tears and that the plug has all three prongs, especially a grounding pin.
- Most generators come with Ground Fault Circuit Interrupters (GFCI). Test the GFCIs daily to determine whether they are working
- If the generator is not equipped with GFCI protected circuits plug a portable GFCI into the generator and plug appliances, tools and lights into the portable GFCI.
- Never store fuel near the generator or near any sources of ignition.
- Before refueling the generator, turn it off and let it cool down. Gasoline spilled on hot engine parts could ignite.

8.51 Powder-Actuated Tools

Below are the hazard controls and safe work practices to follow when working around or using powder-actuated tools. Ensure the requirements in the referenced SOP are followed.

- Only trained personnel are permitted to operate powder-actuated tools. JACOBS employees using powder-actuated tools must be trained in the operation of the particular tool in use. Training and certification are provided by the tool manufacturer.
- Inspect and test powder-actuated tools each day before they are loaded per manufacturer's instruction. Remove from service any tool that is not in proper working order.
- Wear appropriate personal protective equipment (eye, face, and hearing protection) when using powder-actuated tools.
- Never point powder-actuated tools at other workers, whether empty or loaded. Tools shall not be loaded until just before use. Never leave loaded tools unattended.
- Do not drive fasteners into very hard or brittle materials such as, cast iron, glazed tile, surface-hardened steel, glass block, live rock, face brick, or hollow tile.
- Avoid driving fasteners into easily penetrable materials unless backing is provided. Pins or fasteners can otherwise become flying missiles when they pass right through such materials.
- Use powder-actuated tools with the manufacturer's specified guard, shield, or other attachment.
- Do not use powder-actuated tools in explosive or flammable atmospheres.

8.52 Pressure Line/Vessel Systems

- Operate and maintain pressure vessels, pumps and hosing in accordance with the manufacturer's recommendations.
- Do not exceed the rated pressure of the vessels and hosing of the system.
- The system must be provided with a pressure relief valve/controller that safely reduces the system pressure to within the system rated pressure.
- The pressure relief valve must be rated at no more than 110 percent the rated pressure of the system and must be tested at regular intervals.
- Each vessel must be equipped with a functioning pressure gauge to monitor pressure.

8.53 Pressure Washing Operations

Below are the hazard controls and safe work practices to follow when working around or performing pressure washing.

- Only trained, authorized personnel may operate the high-pressure washer.
- Follow manufacturer's safety and operating instructions.
- Inspect pressure washer before use and confirm deadman trigger is fully operational
- The wand must always be pointed at the work area.
- The trigger should never be tied down
- Never point the wand at yourself or another worker.
- The wand must be at least 42 inches (1.1 meter) from the trigger to the tip and utilize greater than 10 degree tips.
- The operator must maintain good footing.
- Non-operators must remain a safe distance from the operator.

- No unauthorized attachment may be made to the unit.
- Do not modify the wand.
- All leaks or malfunctioning equipment must be repaired immediately or the unit taken out-of-service.
- Polycoated Tyvek or equivalent, 16-inch-high steel-toed rubber boots, safety glasses, hard hat with face shield, and inner and outer nitrile gloves will be worn, at a minimum.

8.54 Process Safety Management

- All JACOBS projects require a systematic evaluation of processes to prevent, or minimize the consequences of, catastrophic releases of toxic, reactive, flammable, or explosive chemicals at or above the specified threshold quantities. In the US, these are listed in Appendix A, List of Highly Hazardous Chemicals, Toxics, and Reactives in OSHA Standard 29 CFR 1910.119, Process Safety Management.
- A Process Hazard Analysis (PHA) is required of all processes covered by PSM.
- Operating procedures shall be developed and implemented that provide clear operating instructions consistent with the process safety information.
- Contractors, whether considered to be JACOBS or a subcontractor of CH2M, performing maintenance or repair, turnaround, major renovation, or specialty work on or adjacent to a covered process shall be informed by the client of the known potential fire, explosion, and toxic release hazards related to the contractor work and the provisions of the emergency action plan.
- JACOBS projects shall develop and implement the written procedure requirements to maintain the mechanical integrity of pressure vessels, storage tanks, piping systems, relief and vent systems, emergency shutdown systems, and controls and pumps process systems.
- A hot work permit shall be completed for any JACOBS work involving welding, cutting, brazing, or similar flame- or spark-producing operations conducted near a covered process.
- Written procedures shall be developed, updated, and implemented to manage changes in chemicals, technology, equipment, and facilities.
- An incident report form (IRF) shall be completed within 24 hours of a PSM-related incident. Incidents involving a release of highly hazardous chemicals shall be reported following the Serious Incident Reporting section of SOP HSE-111.
- An investigation shall be initiated as soon as possible, but no later than 48 hours following an incident that resulted in, or could reasonably have resulted in, a catastrophic release of a highly hazardous chemical.
- An emergency action plan shall be developed and implemented for the entire plant, including procedures for handling small releases.
- A facility or process audit shall be performed every three years to certify compliance with the PSM standard.
- All information regarding compliance with PSM requirements shall be made available to affected personnel without regard to possible trade secret status.
- JACOBS employees shall be trained before operating a newly assigned process or when involved in maintaining equipment. Refresher training shall be provided at least every three years and more often if necessary to assure the employee understands and adheres to the current operating procedures of the process.

8.55 Radar Hazards

Airports and all branches of the military use radar of significant power for buildings, towers, aircraft, ships, armor vehicles, and installations in general. Radar devices may emit harmful microwave radiation emissions. Microwave radiation is absorbed by the body and dissipated in the tissue as heat.

The penetration ability of the radiation depends on the wavelength. Microwave wavelengths of 25-200 centimeters have the ability to reach the internal organs with potentially damaging effects. Wavelengths less than 25 centimeters are absorbed and dissipated by the skin and the human body is thought to be transparent to microwave wavelengths greater than 200 centimeters. The health effects of microwave radiation include deep burns and thermal damage to any organ or organ system with low blood flow, most notably the lenses of the eyes. If adequate time has elapsed between exposures, the repair mechanisms of the lens seem to limit damage. Microwave radiation cannot be seen and its effects cannot be felt until serious damage has already occurred.

The OSHA exposure limit is 10 milliwatts per square centimeter (10 mW/cm^2) averaged over any 6-minute period.

Warning signs must be posted in areas where potentially damaging microwave radiation exists.

The prevention method for microwave radiation exposure is to not be in the path of radar or other microwave emitting devices by either ensuring that the device is not operating or ensuring that there is sufficient shielding between you and the microwave source.

8.56 Rail Road Safety

Careful observation of railroad safety requirements is essential and in the US is governed by the Federal Railroad Administration (FRA). For railroads involving Union Pacific Railroads (UPRR), refer to the “Minimum Safety Requirements for Engineering Department Contractors,” of the HSE SharePoint site which addresses training, minimum PPE, and safety requirements.

Permission to enter railroad property must be obtained from the local railroad. Working alone is not anticipated for this work. Contact the RHSM if working alone in the vicinity of railroads becomes necessary. Additional hazard controls will be evaluated by the RHSM and incorporated into the project safety plan.

If required by the client or railroad, all employees must participate in and comply with any job briefings conducted by the railroad’s employee in charge (EIC). During these briefings, the railroad’s EIC will specify safe work procedures, the potential hazards of the job, and emergency response procedures.

The following PPE must be worn when working around trains and rail-yards.

- Reflective/high-visibility safety vests (orange or green-yellow);
- ANSI Z87.1-approved safety glasses shall be worn to protect from flying debris;
- ANSI-approved hard hat;
- Safety-toed boots (ANSI, CSA, or country/region equivalent);
- Hearing protection is required when employees are within 100 feet of locomotive or roadway/work equipment; 15 feet of power operated tools 150 feet of jet blowers or pile drivers 150 feet of retarders in use (when within 10 feet, employees must wear dual ear protection – plugs and muffs); and
- Any other PPE as required by the PPE section of the project safety plan.

Other general safety requirements include:

- Any work conducted within 25 feet of active tracks must first be approved by the client and any EIC requirements addressed (preferably in an AHA). Training (i.e., On-track Railroad Safety Training) is required

in the US Federal Railroad Administration in these instances and may be required in other countries/localities. Coordinate this training with the RHSM or Safety Program Assistant (SPA).

- Attend client's safety training courses, as required, and carry or maintain proof of training as required by the client;
- Always pay attention to moving trains – never assume they are looking out for you;
- Work as far from traveled way as possible to avoid creating confusion for trains;
- Use the "buddy system" when work does not face the direction in which trains are coming from;
- The railroad must be promptly notified of any reportable injury;
- The railroad must be promptly notified of any damage to railroad property;
- All waste must be properly disposed of. No fires are permitted;
- All contractor's vehicles stop at all railroad crossings to ascertain the way is clear;
- Always be on alert for moving equipment in either direction on the tracks. Do not stop or walk on the top of rail, frog, switches, guard rails, or other track components;
- When walking around a standing rail car, stay at least 20 feet behind it. Do not walk between rail cars unless there is a 50 feet clearance between cars. Do not sit on, lie under, or cross between cars; and
- No tools or materials are to be left close to the track when trains are passing.

8.57 Rigging

Below are the hazard controls and safe work practices to follow when personnel are overseeing or performing rigging. Ensure the requirements in the referenced SOP are followed.

8.57.1 General

- All rigging equipment shall be used only for its intended purpose, inspected by a competent person prior to use, and shall not be loaded in excess of its capacity rating. Defective rigging shall be removed from service.
- When JACOBS is in control of rigging operations, JACOBS shall provide a rigging competent person that will inspect, maintain oversee all rigging operations. The competent person shall use the appropriate rigging inspection log form to inspect wire rope, synthetic slings and/or shackles.
- Tag lines shall be attached to every load being lifted by a crane.
- Rigging equipment shall be protected from flame cutting and electric welding operations, and or contact avoided with solvents and chemicals.
- Rigging equipment, when not in use, shall be stored in an area free from damage caused by environmental elements, hazardous substances, and other factors that may compromise equipment integrity and performance.
- No modification or addition, which that could affect the capacity and or safe operation of the equipment, shall be made without the manufacturer's written approval.
- Rigging equipment shall not be shortened with knots, bolts or other makeshift devices.
- The manufacturer's recommendations shall be followed in determining the safe working loads of the various sizes and types of specific and identifiable hooks. All hooks for which applicable manufacturer's recommendations are available shall be tested to twice the intended safe working load before they are initially put into their initial use. Venders or suppliers will provide documentation of proof testing documentation.

- Special hoisting devices, slings, chokers, hooks, clamps, or other lifting accessories shall be marked to indicate the safe working loads and shall be proof -tested prior to initial use to 125 percent of their rated load. Vendors or suppliers will provide documentation of proof testing documentation.

8.57.2 Equipment

- Protruding end strands of wire rope shall be covered or blunted.
- Wire rope shall not be used, if in any length of eight diameters, the number of total number of visible broken wires exceeds 10 percent of the total number of wires, or if the rope shows other signs of excessive wear, corrosion, or defect.
- When inspecting the end fittings of wire rope slings, if more than one wire in a lay is broken in the fitting, do not use the sling.
- Synthetic web slings shall be immediately removed from service if any of the following conditions are present:
  - acid or caustic burns; melting or charring of any part of the sling
  - surface; snags, punctures, tears or cuts; broken or worn stitches; distortion of fittings;
  - discoloration of or rotting; red warning line showing.
- Never use makeshift hooks, links or other fasteners. Job or shop hooks and links, or makeshift fasteners, formed from bolts, rods, etc., or other such attachments, shall not be used.
- Alloy steel chains shall have permanently affixed identification stating size, grade, rated capacity and reach.
- Shackles and hooks shall be constructed of forged alloy steel with the identifiable load rating on the shackle or hook.

8.57.3 Rigging Use

- Rigging shall not be pulled from under a load when the load is resting on the rigging.
- Place sling(s) in center bowl of hook.
- When attaching slings to the load hoist hook, corners and sharp edges should be “packed” to prevent cutting or damaging the rope or slings.
- Never use nylon, polyester, or polypropylene web slings, or web slings with aluminum fittings shall not be used where fumes, vapors, sprays, mists or liquids of acids, caustics or phenolics are present.
- Natural and synthetic fiber rope slings, except for wet frozen slings, may be used in a temperature range form from minus 20º F to plus 180º F without decreasing the working load limit. For operations outside this temperature range, and for wet frozen slings, the sling manufacturer’s recommendations shall be followed.
- When used for eye splices, the U-bolt shall be installed so that the “U” section is in contact with the dead end of the rope.

8.58 Scaffolds

Below are the hazard controls and safe work practices to follow when personnel or subcontractor personnel are using scaffolds. Ensure the requirements in the referenced SOP are followed.

8.58.1 Working from Scaffolds

- All scaffolds must be designed by a qualified person and installed under the supervision of a competent person.
- Do not access scaffolds until the competent person has completed the work shift inspection and has authorized access.

- Follow all requirements established by the competent person or as identified on the scaffold tag.
- Do not access scaffolds until authorized by the competent person.
- Do not access scaffolds that are damaged or unstable at any time and for any reason.
- Only access scaffolds by means of a ladder, stair tower, ladder stand, ramp, integral prefabricated scaffold access, or other equivalent safe means of access. Scaffold cross-bracing shall not be used to access scaffold platforms.
- Remain within the scaffold guardrail system when provided. Leaning over or stepping across a guardrail system is not permitted.
- Use personal fall arrest systems when required by the competent person and when working from suspension scaffolds or boatswains' chairs.
- Do not stand on objects (boxes, buckets, bricks, blocks, etc.) or ladders on top of scaffold platforms to increase working height unless the platform covers the entire floor area of the room.
- Do not work on scaffolds covered with snow, ice, or other slippery material or work on scaffolds during storms or high winds unless personal fall arrest systems or wind screens are provided and the competent person determines it is safe to remain on the scaffold.
- Do not overload scaffold planks over their rated weight bearing capacity. When feasible, place loads directly over the scaffolds vertical weight bearing structures.

8.58.2 Supported Scaffolds

This section covers the erection, use, and dismantling of supported scaffolds. Supported scaffolds consist of one or more platforms supported by outrigger beams, brackets, poles, legs, uprights, posts, frames, or similar rigid support. Supported scaffolds include frame, fabricated frame, tube and coupler, pole, bricklayer's, and step platform. The common requirements for all supported scaffolds are addressed here; the competent person shall ensure scaffold type specific requirements are included as applicable.

- JACOBS staff erecting, dismantling, or working on scaffolds must complete the JACOBS 10-Hour Construction Safety Awareness training course. Staff must also and receive project-specific scaffold training from a qualified person. Staff shall not use scaffold systems for which they have not been trained.
- A JACOBS scaffold competent person shall be assigned to direct and oversee the erection, dismantling, and use of scaffolds. Additionally, they must inspect scaffolds each day prior to use.
- Scaffolds shall be designed by a qualified person and shall be constructed and loaded in accordance with that design.
- Stationary scaffolds over 125 feet (38.1 meters) in height and rolling scaffolds over 60 feet (18.3 meters) in height must be designed by a professional engineer.
- A tag and permit system shall be used to inform personnel of the construction status of the scaffold. At a minimum, the system used shall inform users when a scaffold is complete and safe to be used and when a scaffold is under construction and is not ready to be used. When additional precautions are required to use the scaffold safely, for example, the use of fall protection systems, the system shall identify the precautions to be taken. The tag or permit shall be placed at each means of access to the scaffold. The competent shall be responsible for the tag and permit system.
- A daily safety briefing shall be conducted with all scaffold personnel to discuss the work planned for the day and the HSE requirements to be followed.
- Scaffolds and scaffold components must be capable of supporting, without failure, their own weight and at least 4 times their maximum intended load.

- The site must be inspected to determine ground conditions, strength of supporting structure, and for proximity of electric power lines, overhead obstructions, wind conditions, the need for overhead protection or weather protection coverings.
- Supported scaffolds must be set on base plates, mudsills, or other adequate firm foundation.
- Frame spacing and mudsill size can only be determined after the total loads to be imposed on the scaffold and the strength of the supporting soil or structure are calculated and considered. This analysis must be done by a qualified person.
- Base plates or screwjacks with base plates must be in firm contact with both the sills and the legs of the scaffolding. Compensate for uneven ground with screwjacks with base plates. DO NOT USE unstable objects such as blocks, loose bricks, etc.
- Scaffolds and scaffold components must be inspected for visible defects before each shift by a competent person, and after each occurrence that could affect a scaffold's integrity (such as being struck by a crane).
- Maintain scaffolding and materials (e.g., paint roller extensions, building material) at least 10 feet (3 meters) from overhead power lines for voltages of 50 kV or less, and 10 feet (3 meters) plus 0.4 inch (1.0 cm) for every 1 kV over 50 kV.
- All portable electric equipment must be protected by ground-fault circuit interrupters (GFCIs) or an assured equipment grounding conductor program.

8.58.3 Suspended Scaffolding

Suspension scaffolds consist of one or more platforms suspended by ropes or other non-rigid means from an overhead structure(s). The common requirements for suspended scaffolds are addressed here; the competent person shall ensure scaffold type specific requirements are included as applicable.

- JACOBS staff erecting, dismantling, or working on scaffolds must complete the JACOBS 10-Hour Construction Safety Awareness training course. Staff must also and receive project-specific scaffold training from a qualified person. Staff shall not use scaffold systems for which they have not been trained.
- A JACOBS scaffold competent person shall be assigned to direct and oversee the erection, dismantling, and use of scaffolds. Additionally, they must inspect scaffolds each day prior to use.
- Scaffolds shall be designed by a qualified person and shall be constructed and loaded in accordance with that design.
- A tag and permit system shall be used to inform personnel of the construction status of the scaffold. At a minimum, the system used shall inform users when a scaffold is complete and safe to be used and when a scaffold is under construction and is not ready to be used. When additional precautions are required to use the scaffold safely, for example, the use of fall protection systems, the system shall identify the precautions to be taken. The tag or permit shall be placed at each means of access to the scaffold. The competent shall be responsible for the tag and permit system.
- A daily safety briefing shall be conducted with all scaffold personnel to discuss the work planned for the day and the HSE requirements to be followed.
- Scaffolds and scaffold components must be capable of supporting, without failure, their own weight and at least 4 times their maximum intended load.
- The site must be inspected to determine the strength of supporting structure, and for proximity of electric power lines, overhead obstructions, wind conditions, the need for overhead protection or weather protection coverings.
- Scaffolds and scaffold components must be inspected for visible defects before each shift by a competent person, and after each occurrence that could affect a scaffold's integrity (such as being struck by a crane).

- Maintain scaffolding and materials (e.g., paint roller extensions, building material) at least 10 feet (3 meters) from overhead power lines for voltages of 50 kV or less, and 10 feet (3 meters) plus 0.4 inch (1.0 cm) for every 1 kV over 50 kV.
- All portable electric equipment must be protected by ground-fault circuit interrupters (GFCIs) or an assured equipment grounding conductor program.

8.58.4 Fall Protection on Suspended Scaffolds

- Each employee on a multi-point or two-point adjustable suspension scaffold must be protected by both a guardrail system and a personal fall arrest system.
- Personal fall-arrest systems used on scaffolds shall be attached by lanyard to a vertical lifeline, horizontal lifeline, or scaffold structural member.
- Guardrail systems must be installed along all open sides and ends of platforms, and must be in place before the scaffold is released for use by employees other than erection/dismantling crews.

8.59 Spotters during Vehicle Backing Operations and Heavy Equipment Tasks

Spotters should be used for these tasks as indicated below.

- Evaluate vehicle operations prior to performing the task to assess the following:
  - Can the distance of reversing the vehicle be eliminated or minimized?
  - Are there any hazards along the route that would interfere with the safe completion of the job including any points along the path of travel where the spotter may be placed in a dangerous position or line of fire?
  - Can the route be modified to make the task safer?
  - Can the route be cleared of workers (pedestrians) within 8 feet (2.5m) of the moving vehicle? If not, do not proceed. Contact HSM and PM.
- In additional to verbal communications, the driver/operator and spotter must agree to communicate via one of the following: hand signals, two-way radio, lights, handheld air horn or other (specify in daily safety briefings, PTSP, etc.).
- Only one spotter should be used at a time.
- Spotters responsibilities are:
  - Position to enable the driver to maintain visual contact with me
  - Never cross the path of travel of a **moving** vehicle
  - Maintain a minimum 8 feet (2.5 m) distance from **moving** vehicle
  - Wear a high visibility vest
  - Wear the PPE requirements for the area
  - Communicate to the driver to **STOP** immediately if any unexpected hazards are observed
  - Never ride on the vehicle while it is moving
  - Keep the route free of people that don't need to be there
- Driver responsibilities include:
  - STOP immediately if visual contact with the spotter is lost
  - STOP immediately if instructed by the spotter
  - STOP immediately if anyone comes within 8 feet (2.5 m) of the vehicle
  - Operate the vehicle so speed does not exceed the walking pace of the spotter
  - Communicate the blind spots of the vehicle to the spotter
  - Turn radio and any other distractions off in the cab of vehicle
  - Make sure window(s) are open to receive spotter communications

- Make sure windows and mirrors are clear to ensure good visibility

8.60 Stairways and Ladders

Below are the hazard controls and safe work practices to follow when using stairways and ladders. Ensure the requirements in the referenced SOP are followed.

- Stairway or ladder is generally required when a break in elevation of 19 inches (48.3 cm) or greater exists.
- Personnel should avoid using both hands to carry objects while on stairways; if unavoidable, use extra precautions.
- Personnel must not use pan and skeleton metal stairs until permanent or temporary treads and landings are provided the full width and depth of each step and landing.
- Ladders must be inspected by a competent person for visible defects prior to each day's use. Defective ladders must be tagged and removed from service.
- Always obey and pay attention to warning labels or stickers on the specific ladder being used.
- Ladders must be used only for the purpose for which they were designed and shall not be loaded beyond their rated capacity.
- Ladder safety training on safe use (take the Stairways and Ladders safety training module located on the VO).
- Only one person at a time shall climb on or work from an individual ladder.
- User must face the ladder when climbing; keep belt buckle between side rails.
- Ladders shall not be moved, shifted, or extended while in use.
- User must use both hands to climb; use rope to raise and lower equipment and materials.
- Straight and extension ladders must be tied off to prevent displacement.
- Ladders that may be displaced by work activities or traffic must be secured or barricaded.
- Personnel climbing ladders shall face the ladder and maintain 3 points of contact with the ladder.
- Portable ladders must extend at least 3 feet (91.5 cm) above landing surface.
- Straight and extension ladders must be positioned at such an angle that the ladder base to the wall is one-fourth of the working length of the ladder.
- Stepladders are to be used in the fully opened and locked position.
- Users are not to stand on the top two steps of a stepladder; nor are users to sit on top or straddle a stepladder.
- Fixed ladders $\geq$ 24 feet (7.3 meters) in height must be provided with fall protection devices.
- Fall protection should be considered when working from extension, straight, or fixed ladders greater than six feet (1.8 meters) from lower levels and both hands are needed to perform the work, or when reaching or working outside of the plane of ladder side rails.

8.61 Steel Erection

Below are the hazard controls and safe work practices to follow when working around or performing steel erection activities. Ensure the requirements in the referenced SOP are followed.

- Protruding reinforcing steel (rebar), onto which personnel could fall, must be guarded to eliminate the hazard of impalement.
- Structural steel loads shall not be released from the hoisting line until the members are secured with at least two bolts, or the equivalent at each connection and drawn up wrench tight.
- Tag lines shall be used for controlling loads.
- Containers shall be provided for storing or carrying rivets, bolts, and drift pins, and secured against accidental displacement when aloft.
- Air line hose sections shall be secured together, except when quick disconnect couplers are used to join sections.
- Impact wrenches used for bolting shall be provided with a locking device for retaining the socket.
- Turnbuckles shall be secured to prevent unwinding while under stress.
- Plumbing-up guys shall be removed only under the supervision of a competent person.
- Metal decking of sufficient strength shall be laid tight and secured to prevent movement.
- Provisions shall be made to secure temporary flooring against displacement. Planks shall overlap the bearing on each end by a minimum of 12 inches (30.5 cm). Wire mesh, exterior plywood, or equivalent, shall be used around columns where planks do not fit tightly.
- All unused openings in floors, temporary or permanent, shall be completely planked over or guarded.

8.62 Slips, Trips and Falls

General

- Institute and maintain good housekeeping practices.
- Designate foot traffic paths in and out of sites, when necessary, to ensure paths are kept free from slip, trip, and fall hazards or to deter personnel from taking “shortcuts” where slip, trip, hazards may be.
- Mitigate icy conditions by keeping foot traffic paths clear of ice and snow.
- Watch footing as you walk to avoid trip hazards, animal holes, or other obstacles, especially in tall grassy areas.

Muddy Conditions

- Muddy conditions present a slipping hazard. Use mats or other similar surface to work from if footing cannot be stabilized.
- Take shortened steps across muddy areas.
- Use a walking staff or other similar means to assist with balance.

Steep Slopes/Uneven Ground/Rock and Vertical Slopes

- Be aware that escarpments can slough. Avoid these areas.
- Exercise caution in relying on rocks and trees/tree stumps to support yourself – many times they are loose.
- Whenever possible, switchback your way up/down steep areas, and maintain a slow pace with firm footing.
- Employees walking in ditches, swales and other drainage structures adjacent to roads or across undeveloped land must use caution to prevent slips and falls which can result in twisted or sprained ankles, knees, and backs.

- Whenever possible observe the conditions from a flat surface and do not enter a steep ditch or side of a steep road bed.
- If steep terrain must be negotiated coordinate with RHSM to evaluate the need for ladders or ropes to provide stability.

Snow and Ice on Walking/Working Surfaces

Housekeeping and Preparedness

- Evaluate whether the work can be postponed until site conditions improve for both our work and our subcontractors.
- Remove snow from walkways regularly and use ice-melt or sand, when necessary.
- Notify those responsible for clearing walkways and work areas when we observe a potentially hazardous location. At our project sites, be sure someone is responsible for maintaining walkways.
- Don't assume that the walk path is not slippery if it has been plowed and sanded already.
- Mark potential hazards (e.g., holes, rebar, plastic, etc.) prior to snowfall. Designate walkways that avoid such hazards.
- Avoid any ice or snow-covered location where a hazard may exist; use a vehicle rather than walking, when possible.
- If you cannot avoid the area, wear shoes or boots that provide traction on snow and ice or use YakTrax™, ice cleats, or similar product (see links below). *Note* - Additional hazards could be introduced if these types of footwear are worn inside, on stairs, etc. Be sure appropriate donning and doffing areas are established.
- Inspect your footwear before wearing it.
- Ensure that your safety plan or Activity Hazard Analysis is up to date and adequately addresses hazards of winter work environments.

How to Walk in Icy Conditions

- Give yourself sufficient time and plan your route.
- Keep your eyes on where you are stepping and GO S-L-O-W-L-Y!! This will help your reaction time to changes in traction.
- Be aware of hazards you might have missed such as black ice and ice covered by snow.
- Keep both hands free for balance --NOT in your pockets.
- When handrails are available – USE THEM!
- Wear gloves to keep hands warm and readily available to hold snow-covered handrails.
- Take short steps or shuffle for stability, bend slightly, and walk flat-footed. Keep your center of gravity directly over your feet as much as possible. Keep your eyes on where you are going. Remember the "Walk like a penguin" method.
- Don't carry too much or block your line of vision.
- Be prepared to fall!

How to Fall

Have you ever practiced falling? In the event that you slip and fall while walking in the office, to your car, or on a project site try and remember the following:

- Do not try to break your fall by sticking out your arm, elbow or wrist due to potential for fractures or ligament damage.
- Try instead to create a large surface area by either outstretching your arm and landing on your side or tucking your arm and curling to a ball and landing on your back.

Getting in and out of Vehicles on Icy or Snowy Surfaces

Use special care when entering and exiting vehicles:

- Use the vehicle for support
- Step out planting foot firmly on the ground
- Have hands free for support

8.63 Stream Crossing

Traversing streams present significant hazards, including drowning, hypothermia, and abrasions. When crossing streams, be sure to implement the bulleted items below.

- When walking in streams, first plan the route. Look ahead for exits should there be any difficulty during the crossing, and "read" the water for spots to avoid such as drop offs, sunken logs, and tricky currents.
- Do seek out the safest route – narrow, low flow, shallow. Evaluate deeper and faster moving sections with caution. Backtracking is often dangerous or impossible once committed.
- If streams to be crossed are deeper than "knee deep", find an alternate crossing location that is less deep.
- Streams should be crossed while facing upstream, stepping side to side, and using a sturdy walking stick. When possible, wade a stream diagonally, moving downstream. Move slowly, keeping the foot on the upstream side in the lead and pointed forward. Your rear, or anchor, foot should point downstream and be at right angles to the lead foot. Move the lead foot forward about half a step, feeling for a solid hold. Next, move the anchor foot forward the same distance – shuffle across so that your anchor foot never passes the lead. This way both feet are always in position to lend support. If you must turn around, do so toward the upstream direction.
- Don't attempt to cross above rocky rapids or a cascade. Step on submersed rocks with great care.
- If you are working in streams, algae covered rocks should be assumed slippery until tested. Always be alert for unstable and extremely slippery rocks.
- Rocks with green moss or attached plants offer better traction or even better, look for gravel and sand pockets among the stream boulders, which are much more stable, and use a wading staff (if not carrying one, find a suitable one nearby) to steady your balance while crossing. Use a solid wading staff instead of the collapsible type.
- Be cautious of areas where there are submerged or partially submerged trees/tree branches – these can create entanglement hazards during a crossing or a "swim".
- If streams are crossed that are deeper than "crotch deep", personnel must use either ropes and/or wear chest waders.
- Choose the right waders (with RHSM/SL involvement).
- Footwear with felt-bottom soles are ideal for rocky bottom streams. The rough texture cuts through algae growing on the rocks and grips well. For very slippery conditions, consider studded felt soles or a slipover, studded sandal. However, felt soles do not provide good traction on muddy, slippery banks. Cleated soles work well for mud or sand bottom streams (a hard molded tread pattern similar to a hiking boot).
- Wear a wading belt with chest waiters to keep your waders from billowing out like a parachute; the currents will carry you and move you in ways you don't want to move.
- Never wade alone.

- If the wader fills with water, don't panic. Waders full of water weigh less in water than on land and the water inside doesn't add any weight as long as you are in the water. Also a common fear is that air trapped in the waders will raise the feet higher than the head and force the face underwater is unfounded. Waders do streamline your legs and kicking is useless. Follow these steps if the waders fill with water:
  - Don't try to take them off in the water
  - In calm water, wade or swim to shore
  - In fast-moving water, ride the current:
  - Pull your feet up in front of you, bend your knees
  - Point your feet downstream (so the feet, not the head will bounce off the rocks)
  - Sculling with your hands will help direct to the nearest shallow area
  - When you reach calm water, go ashore and empty your waders
  - Don't waste energy in the vertical position going for the bottom. This position is virtually impossible to maintain and leads quickly to exhaustion (the major cause of drowning).
  - Concentrate on getting out of the water and not saving the equipment.
- The higher the elevation you are at, the steeper the stream gradient is. This means the stream can rise quicker and return to lower flow more quickly.
- Always wait out a swollen stream if at all possible.
- If you do slip into the water and are being swept downstream, don't panic. Cold water will be a shock for 2-3 seconds. Pull your knees up, face your feet downstream and lean back, using your hands as best you can to navigate and get to the bank. Keep your head up; you don't want your head underwater banging into rocks. If you stay calm, you can reach water where you can stand up or swim to the bank.
- When walking along stream banks and not entering streams, wear work boots.

8.64 Traffic Control

The following precautions must be taken when working around traffic, and in or near an area where traffic controls have been established by a subcontractor. Ensure the requirements in the referenced SOP are followed.

- JACOBS employees must never perform traffic control activities for 3rd party subcontractors.
- Exercise caution when exiting traveled way or parking along street – avoid sudden stops, use flashers, etc.
- Park in a manner that will allow for safe exit from vehicle, and where practicable, park vehicle so that it can serve as a barrier.
- All staff working adjacent to traveled way or within work area must wear reflective/high-visibility safety vests.
- Eye protection should be worn to protect from flying debris.
- Remain aware of factors that influence traffic related hazards and required controls – sun glare, rain, wind, flash flooding, limited sight-distance, hills, curves, guardrails, width of shoulder (i.e., breakdown lane), etc.
- Always remain aware of an escape route (e.g., behind an established barrier, parked vehicle, guardrail, etc).
- Always pay attention to moving traffic – never assume drivers are looking out for you.
- Work as far from traveled way as possible to avoid creating confusion for drivers.

- When workers must face away from traffic, a “buddy system” should be used, where one worker is looking towards traffic.
- When working on highway projects, obtain a copy of the contractor’s traffic control plan.
- Work area should be protected by a physical barrier – such as a K-rail or Jersey barrier.
- Review traffic control devices to ensure that they are adequate to protect your work area. Traffic control devices should: 1) convey a clear meaning, 2) command respect of road users, and 3) give adequate time for proper traffic response. The adequacy of these devices are dependent on limited sight distance, proximity to ramps or intersections, restrictive width, duration of job, and traffic volume, speed, and proximity.
- Either a barrier or shadow vehicle should be positioned a considerable distance ahead of the work area. The vehicle should be equipped with a flashing arrow sign and truck-mounted crash cushion (TMCC). All vehicles within 40 feet (12.2 meters) of traffic should have an orange flashing hazard light atop the vehicle.
- Except on highways, flaggers should be used when 1) two-way traffic is reduced to using one common lane, 2) driver visibility is impaired or limited, 3) project vehicles enter or exit traffic in an unexpected manner, or 4) the use of a flagger enhances established traffic warning systems.
- Lookouts should be used when physical barriers are not available or practical. The lookout continually watches approaching traffic for signs of erratic driver behavior and warns workers.
- Vehicles should be parked at least 40 feet (12.2 meters) away from the work zone and traffic. Minimize the amount of time that you will have your back to oncoming traffic.
- Traffic control training module on the VO shall be completed when JACOBS workers who work in and around roadways and who exposed to public vehicular traffic.

8.65 Utilities (underground)

An assessment for underground utilities must be conducted where there is a potential to contact underground utilities or similar subsurface obstructions during intrusive activities. Intrusive activities include excavation, trenching, drilling, hand augering, soil sampling, or similar activities.

The assessment must be conducted before any intrusive subsurface activity and must include at least the following elements:

- A background and records assessment of known utilities or other subsurface obstructions.
- Contacting and using the designated local utility locating service.
- Conducting an independent field survey to identify, locate, and mark potential underground utilities or subsurface obstructions. *Note: This is independent of, and in addition to, any utility survey conducted by the designated local utility locating service above.*
- A visual survey of the area to validate the chosen location.
- When required by the project-specific safety plan, using the Utility Verification Checklist.

When any of these steps identifies an underground utility within 5 feet (1.5 meters) of intrusive work, then non-aggressive means must be used to physically locate the utility before a drill rig, backhoe, excavator or other aggressive method is used.

Aggressive methods are never allowed within 2 feet of an identified high risk utility (see paragraph below).

Any deviation from these requirements must be approved by the Responsible HS Manager and the Project Manager.

Background and Records Assessment of Known Utilities

Identify any client- or location-specific permit and/or procedural requirements (e.g., dig permit or intrusive work permit) for subsurface activities. For military installations, contact the Base Civil Engineer and obtain the appropriate form to begin the clearance process.

Obtain available utility diagrams and/or as-built drawings for the facility.

Review locations of possible subsurface utilities including sanitary and storm sewers, electrical lines, water supply lines, natural gas lines, fuel tanks and lines, communication lines, lighting protection systems, etc. Note: Use caution in relying on as-built drawings as they are rarely 100 percent accurate.

Request that a facility contact with knowledge of utility locations review and approve proposed locations of intrusive work.

Designated Local Utility Locating Service

Contact your designated local utility locating service (e.g., Dig-Safe, Blue Stake, One Call) to identify and mark the location of utilities. In the US, call 811 in the go to www.call811.com to identify the appropriate local service group. Contacting the local utility locating service is a legal requirement in most jurisdictions. (Some US states, [e.g., Washington] require that the entity performing the intrusive work be the responsible for contacting the local service.) Where subcontractors are responsible for the intrusive work, JACOBS personnel shall verify the subcontractor has contacted the designated local utility locating service.

Independent Field Survey (Utility Locate)

The organization conducting the intrusive work (JACOBS or subcontractor) shall arrange for an independent field survey to identify, locate, and mark any potential subsurface utilities in the work area. This survey is in addition to any utility survey conducted by the designated local utility locating service.

The independent field survey provider shall determine the most appropriate instrumentation/technique or combinations of instrumentation/techniques to identify subsurface utilities based on their experience and expertise, types of utilities anticipated to be present, and specific site conditions.

A JACOBS or subcontractor representative must be present during the independent field survey to observe the utility locate and verify that the work area and utilities have been properly identified and marked. If there is any question that the survey was not performed adequately or the individual was not qualified, then arrangements must be made to obtain a qualified utility locate service to re-survey the area. Obtain documentation of the survey and clearances in writing and signed by the party conducting the clearance. Maintain all documentation in the project file.

If the site owner (military installation or client) can provide the independent field survey, JACOBS or the subcontractor shall ensure that the survey includes:

- Physically walking the area to verify the work location and identify, locate, and mark underground utility locations:
- Having qualified staff available and instrumentation to conduct the locate;
- Agreeing to document the survey and clearances in writing.
- Should any of the above criteria not be met, JACOBS or subcontractor must arrange for an alternate independent utility locate service to perform the survey.
- The markings from utility surveys must be protected and preserved until the markings are no longer required. If the utility location markings are destroyed or removed before intrusive work commences or is completed, the PM, SL, or designee must notify the independent utility locate service or the designated local utility locating service to resurvey and remark the area.

Visual Assessment before and during Intrusive Activities

Perform a "360 degree" assessment. Walk the area and inspect for utility-related items such as valve caps, previous linear cuts, patchwork in pavement, hydrants, manholes, utility vaults, drains, and vent risers in and around the dig area.

The visual survey shall include all surface landmarks, including manholes, previous liner cuts, patchwork in pavement, pad-mounted transformers, utility poles with risers, storm sewer drains, utility vaults, and fire hydrants.

If any unanticipated items are found, conduct further research before initiating intrusive activities and implement any actions needed to avoid striking the utility or obstruction.

Completion of the Utility Verification Checklist

When required by the safety plan, the utility verification checklist shall be completed by the SL and submitted to the PM and HSM for review and signature. Follow the instructions on the form and keep it accessible in the field during intrusive operations. Evaluate intrusive activities for changed conditions and contact the PM and HSM to ensure hazards are addressed and whether a new checklist needs to be completed.

Subsurface Activities within 5 feet of an Underground Utility or if there is Uncertainty

When aggressive intrusive activities will be conducted within 5 feet (1.5 meters) of an underground utility or when there is uncertainty about utility locations, locations must be physically verified by non-aggressive means such as air or water knifing, hand digging, or human powered hand augering. Non-conductive tools must be used if electrical hazards may be present. If intrusive activities are within 5 feet (1.5 meters) and parallel to a marked existing utility, the utility location must be exposed and verified by non-aggressive methods every 100 feet (30.5 meters). Check to see if the utility can be isolated during intrusive work.

Intrusive Activities within 2 feet of an Underground Utility

Use non-aggressive methods (hand digging, vacuum excavation, etc.) to perform intrusive activities within 2 feet of a high risk utility (i.e., a utility that cannot be de-energized or would cause significant impacts to repair/replace). Hazardous utilities shall be de-energized whenever possible.

Spotter

A spotter shall be used to monitor for signs of utilities during advancement of intrusive work (e.g., sudden change in advancement of auger or split spoon, presence of pea gravel or sand in soils, presence of concrete or other debris in soils, refusal of auger or excavating equipment). If any suspicious conditions are encountered stop work immediately and contact the PM or RHSM to evaluate the situation. The spotter must have a method to alert an operator to stop the intrusive activity (e.g., air horn, hand signals).

8.66 Utilities (overhead)

Proximity to Power Lines

It must be determined whether equipment operations including, positioning, and traveling will occur in proximity to power lines within 20 feet (6.1 meters) for line voltage up to 350 kilo volts (kV), and within 50 feet (15.2 meters) for line voltage between 350 kV to 1000 kV. For power lines over 1000 kV, the distance must be determined by the utility/operator or qualified registered professional engineer in electrical power transmission and distribution.

Operations adjacent to overhead power lines are PROHIBITED unless one of the following conditions is satisfied:

- Power has been shut off, positive means (such as lockout) have been taken to prevent the lines from being energized, lines have been tested to confirm the outage, and the utility company has provided a signed certification of the outage.
- The minimum clearance from energized overhead lines is as shown in the tables below, or the equipment will be repositioned and blocked to ensure that no part, including cables, can come within the minimum

clearances shown in the table. [NOTE: Outside of the US, check with local and provincial code for more stringent requirements. The more stringent requirement will be followed.]

- The power line(s) has been isolated through the use of insulating blankets which have been properly placed by the utility. If insulating blankets are used, the utility will determine the minimum safe operating distance; get this determination in writing with the utility representative's signature.
- All inquiries regarding electric utilities must be made in writing and a written confirmation of the outage/isolation must be received by the PM prior to the start of work.

MINIMUM DISTANCES FROM POWERLINES - US

Powerlines Nominal System Kv	Minimum Required Distance, Feet (Meters)
0-50	10 (3.0)
50-200	15 (4.6)
201-350	20 (6.1)
351-500	25 (7.6)
501-750	35 (10.7)
751-1000	45 (13.7)
Over 1000	Established by utility owner/operator or by a professional engineer in electrical power transmission/distribution

(These distances have been determined to eliminate the potential for arcing based on the line voltage.)

MINIMUM DISTANCES FROM POWERLINES – ALBERTA

Operating voltage between conductors of overhead powerline	Safe limit of approach distance for persons and equipment
0-750 volts (insulated or polyethylene covered conductors – entire length)	300 millimetres
0-750 volts (bare, uninsulated)	1.0 metre
Above 750 volts (insulated conductors – entire length, rated and tested)	1.0 metre
750 volts to 40 kilovolts	3.0 metres
69 kilovolts, 72 kilovolts	3.5 metres
138 kilovolts, 144 kilovolts	4.0 metres
230 kilovolts, 260 kilovolts	5.0 metres
500 kilovolts	7.0 metres

(These distances have been determined to eliminate the potential for arcing based on the line voltage.)

MINIMUM DISTANCES FROM POWERLINES – British Columbia, Manitoba, NWT, Ontario, Saskatchewan, and Yukon

Voltage of live Powerlines	Minimum Required Distance, Metres (Feet)
750 to 75,000 volts	3 (10)
75,000 to 250,000 volts	4.5 (15)
250,000 to 550,000 volts	6 (20)

(These distances have been determined to eliminate the potential for arcing based on the line voltage.)

8.67 Vacuum Trucks

When JACOBS personnel are exposed to vacuum truck operations, the following safe work practices/hazard controls shall be implemented.

- A pre-operational check should be performed on the vacuum truck before use. Operators must be familiar with the operator's manual.
- Operators of vacuum trucks should be trained and familiar with the equipment. At least one person should be operating the boom and one person signaling and assisting the boom operator.
- Before use the hoses and lines should be checked for fraying and connections checked for leakage. Proper selection of hose diameter and type of hose (smooth bore hose vs. corrugated hose) is vital before the job is performed.
- The amount of force produced by a vacuum truck can kill hose operators. If an eight-inch hose gets stuck to your body at 27 inches Hg, it can be fatal. All trucks should be equipped with an emergency release the hose operator or assistant can initiate if a worker gets sucked into a hose. A remote release, manual release near the truck and an inline "T" should be present on the truck. The inline "T" should be installed between the very last section of hose and the working section of hose. The cord that releases the in-line relief should be tethered to the hose handler's belt or a watch buddy should be nearby holding the cord and ready to relieve in the event of an emergency. Operators should never attempt to vacuum hose with any part of their body to check for suction.
- Tanks on vacuum trucks are a confined space. Before the tank is opened and anyone enters a confined space assessment should be performed.
- The truck should always be grounded before use. The static electricity produced when sucking materials into the system can produce a spark and ignite anything in the tank or hose. Use of a grounding wire will prevent static electric explosions. Vacuum trucks should not be used to pump mixtures with a flash point less than 140 degrees or less - this is an accepted industry standard - refer to the operators manual for more information.
- When positioning truck to work, be extra cautions of personnel and other equipment located next to truck.
- Wet and dry material should not be mixed in the tank.
- When swinging the boom, change directions slowly.
- Do not load dump body beyond rated capacity. Be aware of possible load surge when turning or braking.

8.68 Vinyl Chloride

Vinyl Chloride is considered a "Confirmed Human Carcinogen." Vinyl Chloride has a mild, sweet, chloroform-like odor.

JACOBS is required to control employee workplace exposure to vinyl chloride when personal exposures are at or above 1.0 ppm as an 8-hour time-weighted average (TWA) or above 5.0 ppm short term exposure limit (STEL), by implementing a program that meets the requirements of the governing regulatory agency (e.g., in the US: Occupational Safety and Health Administration (OSHA) Vinyl Chloride standard, 29 CFR 1910.1017; in Canada: Provincial OH&S Code/Regulation, etc.). The elements of the JACOBS vinyl chloride program include the following:

- Exposure monitoring
- Methods of control, including personal protective equipment (PPE) and respirators

- Medical surveillance
- Training on hazards of vinyl chloride and control measures (includes project-specific training and the computer-based training on CH2M's Virtual Office, *Vinyl Chloride)*
- Record keeping requirements

If air monitoring indicates there is potential exposure at the action level concentrations above, notify the RHSM to ensure the above have been adequately addressed. Other exposure control measures include:

- Do not enter regulated work areas unless training, medical monitoring, and PPE requirements established by the competent person have been met.
- Do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in regulated areas.
- Respiratory protection and other exposure controls selection shall be based on the most recent exposure monitoring results obtained from the competent person.
- Review the fact sheet included as an attachment to the SOP.

8.69 Welding and Cutting

Below are the hazard controls and safe work practices to follow when working around or performing welding and cutting.

- Workers designated to operate welding and cutting equipment shall have been properly instructed and qualified to operate such equipment.
- Before welding or cutting is permitted, the area shall be inspected by the individual responsible for authorizing the welding or cutting operation. The authorization, preferably in the form of a written permit, shall detail precautions to be taken before work is to begin.
- Suitable fire extinguishing equipment shall be immediately available in the work area.
- Flame-resistant blankets shall be used to control sparks produced by welding and cutting operations from traveling to lower levels or adjacent surfaces.
- If the valve on a fuel-gas cylinder is found to leak around the valve stem, the valve shall be closed and the gland nut tightened. If this does not stop the leak, the cylinder is to be tagged and removed from service.
- Nothing should be placed on top of a cylinder or manifold that will damage it or interfere with the quick closing of the valve.
- Flow gages and regulators shall be inspected prior to use and removed from cylinders when not in use.
- Hoses, leads, and cables shall be not be routed through doorways and walkways unless covered, elevated, or protected from damage. Where hoses, leads, and cables pass through wall openings, adequate protection shall be provided to prevent damage.
- Flash arresters shall be installed at the torch handle.
- Arc welding electrodes shall not be struck against compressed gas cylinders to strike an arc.
- All arc welding or cutting operations shall be shielded by noncombustible or flame resistant screens to protect employees or other persons in the vicinity from the direct rays of the arc.
- Proper ventilation shall be provided so as to maintain the level of contaminants in the breathing zone of welders below applicable permissible exposure limits.

- When the potential for an explosive atmosphere exists in the immediate area of welding or cutting operations, air monitoring instruments shall be used to verify that no explosive atmosphere is present before or during welding or cutting operations.
- An assigned Fire Watch shall be maintained at least a half an hour after the welding or cutting operation was completed. The fire watch must be identifiable with a distinguishable hard hat and/or vest.
- Minimum personal protective equipment includes the following:
  - Safety-toed shoes or boots, hard hats, and safety glasses
  - Body protection (such as gloves, coveralls, or Tyvek) when chemical hazards exist
  - Hearing protection when working in close proximity to loud equipment and machinery
  - Protective clothing and gloves to prevent burns
  - Suitable eye protective equipment for the type of welding or cutting performed
  - Opaque screens to block arc flash from arc welding and cutting operations
  - Mechanical ventilation systems for welding and cutting operations conducted in enclosed or confined spaces
  - Air monitoring or sampling equipment to evaluate airborne concentrations of welding and cutting contaminants
  - Respiratory protection when airborne concentrations of contaminants exceed regulatory limits

8.69.1 Compressed Gas Cylinders

- Cylinders being transported, moved, or stored shall have valve protection caps installed. When transported by motor vehicle, hoisted, or carried, cylinders shall be in the vertical position.
- Oxygen cylinders in storage shall be separated from fuel-gas cylinders or combustible materials by a minimum of 20 feet (6.1 meters) or by a noncombustible barrier at least 5 feet (1.5 meters) high having a fire resistant rating of at least one half hour.
- Inside of buildings, cylinders shall be stored in well-ventilated, dry locations at least 20 feet (6.1 meters) from highly combustible materials. Cylinders should be stored in definitely assigned places away from elevators, stairs, or gangways. Assigned storage areas shall be located where cylinders will not be knocked over or damaged.
- During use, cylinders shall be kept far enough away from the actual welding and cutting operations to prevent sparks, hot slag, or flames from reaching them. When impractical, fire resistant shields shall be provided.
- Cylinders containing oxygen or fuel-gas shall not be taken into confined spaces.
- If cylinders are frozen, warm (not boiling) water shall be used to thaw them.

8.69.2 Welding and Cutting Equipment

- Fuel-gas and oxygen hoses shall be easily distinguishable from each other and shall not be interchangeable between fuel-gas and oxygen.
- Hoses shall be inspected at the beginning of each shift. Defective hoses shall be removed from service.
- Hose couplings shall be designed to be disconnected with a rotary motion, not by straight pull.

- Torches shall be inspected at the beginning of each shift for leaking valves, connections, and couplings. Defective torches shall be removed from service.
- Torches shall be ignited with friction lighters, not open flames or hot work.

8.69.3 Arc Welding and Cutting

- Only manual electrode holders that are designed for arc welding or cutting and are capable of safely handling the maximum rated current shall be used.
- Only cable that is free from repair or splices for a minimum distance of 10 feet (3 meters) from the cable's attachment to the electrode holder shall be used.
- Any current-carrying part that arc welders or cutters grip in their hand, as well as the outer surfaces of the jaws of the holder, shall be fully insulated against the maximum voltage encountered to ground.
- The frames of arc welding or cutting machines shall be grounded. Grounding circuits, other than by means of the structure, shall be checked to ensure that the circuit between the ground and the grounded power conductor has resistance low enough to permit sufficient current flow to cause the fuse or circuit breaker to interrupt the current.
- When electrode holders are left unattended, the electrode shall be removed and the holder placed where it cannot harm employees.
- Hot electrode holders shall not be dipped in water to cool them.
- When welding or cutting is stopped for any appreciable length of time, or before the welding or cutting machine is moved, the power shall be shut off.
- Before starting welding or cutting operations, all connections to the machine shall be checked.

8.69.4 Toxic Fumes and Gases

- General mechanical or local exhaust ventilation shall be provided when welding or cutting in a confined space.
- Contaminated air exhausted from the work area shall be discharged into the open air or otherwise clear of the intake air.
- Other employees exposed to the same atmosphere as the welder or cutter shall be protected in the same manner as the welder or cutter.
- In enclosed spaces, all surfaces covered with toxic preservative coatings shall be stripped to a distance of at least four inches from the area to be heated, or the worker shall be protected with an air-line respirator.
- Welding or cutting in an enclosed space shall be performed with local exhaust ventilation or air-line respirators when the following metal bases, fillers, or coatings are involved: lead, cadmium, mercury, zinc, stainless steel, or beryllium.
- Employees welding or cutting in the open air and who are exposed to the metals noted above shall be protected with filter-type respirators; however, when working with beryllium, the employee shall be protected with an air-line respirator.

8.69.5 Fire Prevention

- When the potential for an explosive atmosphere exists in the immediate area of welding or cutting operations, air monitoring instruments shall be used to verify that no explosive atmosphere is present before or during welding or cutting operations.
- When welding or cutting on walls, floors, or ceilings, the same precautions shall be taken on the opposite side as for the welding or cutting side.

- Whenever openings or cracks in the floor, walls, or doorways cannot be closed, precautions shall be taken to prevent combustible materials in other areas from coming in contact with sparks.
- To prevent fire in enclosed spaces, the gas supply to the torch shall be shut off at some point outside the enclosed space whenever the torch is not in use or is left unattended.
- Drums or hollow structures that have contained toxic or flammable substances shall be filled with water or thoroughly cleaned, ventilated, and tested before welding or cutting on them.
- Before heat is applied to a drum, container, or structure, a vent or opening shall be provided to release built-up pressure during the application of heat.
- Before welding or cutting on any surface covered by a preservative coating whose flammability is unknown, a competent person shall test to determine its flammability.
- Preservative coatings shall be considered highly flammable when scrapings burn rapidly.
- When preservative coatings are determined to be highly flammable, they shall be stripped from the area to be heated.

8.70 Working Around Material Handling Equipment

When JACOBS personnel are exposed to material handling equipment, the following safe work practices/hazard controls shall be implemented:

- Never approach operating equipment from the rear. Always make positive contact with the operator, and confirm that the operator has stopped the motion of the equipment.
- Never approach the side of operating equipment; remain outside of the swing and turning radius.
- Maintain distance from pinch points of operating equipment.
- Never turn your back on any operating equipment.
- Never climb onto operating equipment or operate contractor/subcontractor equipment.
- Never ride contractor/subcontractor equipment unless it is designed to accommodate passengers and equipped with firmly attached passenger seat.
- Never work or walk under a suspended load.
- Never use equipment as a personnel lift; do not ride excavator buckets or crane hooks.
- Always stay alert and maintain a safe distance from operating equipment, especially equipment on cross slopes and unstable terrain.
- Wear a high visibility safety vest or high visibility clothing.

8.71 Working Alone

Personnel can only be tasked to work alone by the Project Manager who shall assess potential hazards and appropriate control measures, with assistance from the Responsible Health and Safety Manager (RHSM).

“Lone workers” with an accountability system in place is permitted, depending on the hazards presented during the execution of the task. Reference the “Lone Worker Protocol” included as an attachment to the project safety plan.

Only limited operations task are permitted to be performed alone. Activities that are not permitted to be performed by a lone worker include the following:

- Working at heights (e.g., on ladders, lifts, scaffolding);
- Energy isolation (e.g., lockout/tagout);

- Any entry into a confined space; and
- Work involving electricity or other hazardous equipment (e.g., chainsaws);
- Work over or near water; and
- Working in an area where there is an increased potential for violence.

An AHA shall be developed that shall include:

- Type or nature of work to be conducted by the lone worker;
- Location of the work
- Length of time the worker will be working alone; and
- Any characteristics of the individual working alone which may increase the risk to the worker (e.g., medical conditions).

The employee working alone shall at all times be equipped with a working voice communication device such as a cellular phone, satellite phone, personal alarms, or two-way radio to check-in to their project contact (s) at pre-determined times. For some work, a satellite-based communication system may be appropriate (i.e., a "SPOT" device).

Call-In System for Lone Worker Accountability

The employee working alone shall at all times be equipped with a working voice communication device such as a cellular phone, satellite phone, personal alarms, or two-way radio to check-in to their project contact (s) at pre-determined times.

Each time before going into the field, a "Call in contact Form" shall be completed by the lone worker and given to the call-in office worker contact prior to going into the field.

During field work, a copy of "The Lone Worker Call-In Contact Form" should be maintained by both the "Office Contact Worker" and the field-worker ("Lone Worker"). Lone Worker and Office Contact Worker must both have cell phones and each other's phone number, plus one other alternate phone number.

Lone worker shall call the office contact worker when he/she has arrived on-site, before exiting his/her vehicle. On this phone call, a time shall be arranged for a "check-in" call to be made by the field worker, based on duration of task. On each "check-in" call a time should be arranged for the next "check-in" call. Document these times on the form.

Lone Worker shall carry his or her cell-phone throughout the field event and put the ringer on its loudest setting as wind or other noise can muffle the sound. If, for any reason the cell-phone becomes inoperable, the field-worker shall immediately stop work, leave the site and find an alternative method of contacting the Office Contact Worker to verify their safety and to inform them of the issue.

Work shall not proceed in the field until the Lone Worker has a working device that provides communication with the Office Contact Worker.

Upon completion of work activities, Lone Worker should pack up all materials and prepare to leave site. Then, before starting the engine of the vehicle to leave site, the Lone Worker should contact the office-worker and inform him or her that work is complete and that he or she is leaving the site. A final call shall be made by the lone work to the office worker to confirm he/she has reached their destination.

If at any time, the Office Contact Worker does not receive a "check-in" call at the scheduled time he/she should attempt to contact Lone Worker. If no contact is made then the Office Contact Worker should contact the facility contact person to check on the Lone Worker.

If no contact is made with the Lone Worker, then the Office Contact Worker shall contact the PM and/or RHSM to let them know they are going to inform emergency services inform that there is a possible emergency and instruct them to go to the field location and assist the Lone Worker. The Office Contact Worker will provide to emergency services the Lone Worker's name, their last known location, vehicle description and their contact information.

Call in contact Form shall be completed by lone worker and given to call in contact prior to going into the field. Refer to the "Lone Worker Protocol" attached to the project safety plan.

8.72 Working Over Water

If any activities pose a risk to drowning implement the following during the activity:

- Fall protection should be provided to prevent personnel from falling into water. Where fall protection systems are not provided and the danger of drowning exists, Coast Guard-approved personal flotation devices (PFDs), or a life jacket, shall be worn.
- Provide employees with an approved life jacket or buoyant work vest (USCG for U.S. operations).
    - Employees should inspect life jackets or work vests daily before use for defects. Do not use defective jackets or vests.
- Post ring buoys with at least 90 feet (27.4 meters) of 3/8-inch solid-braid polypropylene (or equal) line next to the work area. If the work area is large, post extra buoys 200 feet (61 meters) or less from each other.
- Provide at least one life saving skiff, immediately available at locations where employees are working over or adjacent to water.
    - Ensure the skiff is in the water and capable of being launched by one person and is equipped with both motor and oars.
- Designate at least one employee on site to respond to water emergencies and operate the skiff at times when there are employees above water.
    - If the designated skiff operator is not within visual range of the water, provide him or her with a radio or provide some form of communication to inform them of an emergency.
    - Designated employee should be able to reach a victim in the water within three to four minutes.
- Ensure at least one employee trained in CPR and first aid is on site during work activities.

9. Physical Hazards and Controls

Physical hazards include exposure to temperature extremes, sun, noise, and radiation. If you encounter a physical hazard that has not been identified in this Handbook or the project safety plan, contact the RHSM so hazard controls can be addressed.

9.1 Noise

JACOBS is required to control employee exposure to occupational noise levels of 85 decibels, A-weighted, (dBA) and above by implementing a hearing conservation program that meets the requirements of the OSHA Occupational Noise Exposure standard, 29 CFR 1910.95 (in Canada: Provincial OH&S Code/Regulations). A noise assessment may be conducted by the RHSM or designee based on potential to emit noise above 85 dBA and also considering the frequency and duration of the task.

- Areas or equipment emitting noise at or above 90dBA shall be evaluated to determine feasible engineering controls. When engineering controls are not feasible, administrative controls can be developed and appropriate hearing protection will be provided.
- Areas or equipment emitting noise levels at or above 85 dBA, hearing protection must be worn.
- Employees exposed to 85 dBA or a noise dose of 50 percent must participate in the Hearing Conservation program including initial and annual (as required) audiograms.
- The RHSM will evaluate appropriate controls measures and work practices for employees who have experienced a standard threshold shift (STS) in their hearing.
- Employees who are exposed at or above the action level of 85 dBA are required to complete the online Noise Training Module located on CH2M's virtual office.
- Hearing protection will be maintained in a clean and reliable condition, inspected prior to use and after any occurrence to identify any deterioration or damage, and damaged or deteriorated hearing protection repaired or discarded.
- In work areas where actual or potential high noise levels are present at any time, hearing protection must be worn by employees working or walking through the area.
- Areas where tasks requiring hearing protection are taking place may become hearing protection required areas as long as that specific task is taking place.
- High noise areas requiring hearing protection should be posted or employees must be informed of the requirements in an equivalent manner and a copy of the OSHA standard (29 CFR 1910.95), Provincial OH&S Code/Regulation, or other governing regulation shall be posted in the workplace.

9.2 Ultraviolet Radiation (sun exposure)

Health effects regarding ultraviolet (UV) radiation are confined to the skin and eyes. Overexposure can result in many skin conditions, including erythema (redness or sunburn), photoallergy (skin rash), phototoxicity (extreme sunburn acquired during short exposures to UV radiation while on certain medications), premature skin aging, and numerous types of skin cancer. Implement the following controls to avoid sunburn.

Limit Exposure Time

- Rotate staff so the same personnel are not exposed all of the time.
- Limit exposure time when UV radiation is at peak levels (approximately 2 hours before and after the sun is at its highest point in the sky).
- Avoid exposure to the sun, or take extra precautions when the UV index rating is high.

Provide Shade

- Take lunch and breaks in shaded areas.
- Create shade or shelter through the use of umbrellas, tents, and canopies.
- Fabrics such as canvas, sailcloth, awning material and synthetic shade cloth create good UV radiation protection.
- Check the UV protection of the materials before buying them. Seek protection levels of 95 percent or greater, and check the protection levels for different colors.

Clothing

- Reduce UV radiation damage by wearing proper clothing; for example, long sleeved shirts with collars, and long pants. The fabric should be closely woven and should not let light through.
- Head protection should be worn to protect the face, ears, and neck. Wide-brimmed hats with a neck flap or "Foreign Legion" style caps offer added protection.
- Wear UV-protective sunglasses or safety glasses. These should fit closely to the face. Wrap-around style glasses provide the best protection.

Sunscreen

- Apply sunscreen generously to all exposed skin surfaces at least 20 minutes before exposure, allowing time for it to adhere to the skin.
- Re-apply sunscreen at least every 2 hours, and more frequently when sweating or performing activities where sunscreen may be wiped off.
- Choose a sunscreen with a high sun protection factor (SPF). Most dermatologists advocate SPF 30 or higher for significant sun exposure.
- Waterproof sunscreens should be selected for use in or near water, and by those who perspire sufficiently to wash off non-waterproof products.
- Check for expiration dates, because most sunscreens are only good for about 3 years. Store in a cool place out of the sun.
- No sunscreen provides 100 percent protection against UV radiation. Other precautions must be taken to avoid overexposure.

9.3 Temperature Extremes

Each employee is responsible for the following:

- Recognizing the symptoms of heat or cold stress;
- Taking appropriate precautionary measures to minimize their risk of exposure to temperature extremes (see following sections); and
- Communicating any concerns regarding heat and cold stress to their supervisor or SC.

9.3.1 Heat

Heat-related illnesses are caused by more than just temperature and humidity factors.

Physical fitness influences a person's ability to perform work under heat loads. At a given level of work, the more fit a person is, the less the physiological strain, the lower the heart rate, the lower the body temperature (indicates less retrained body heat—a rise in internal temperature precipitates heat injury), and the more efficient the sweating mechanism.

Acclimatization is a gradual physiological adaptation that improves an individual's ability to tolerate heat stress. Acclimatization requires physical activity under heat-stress conditions similar to those anticipated for the work. With a recent history of heat-stress exposures of at least two continuous hours per day for 5 of the last 7 days to 10 of the last 14 days, a worker can be considered acclimatized. Its loss begins when the activity under those heat-stress conditions is discontinued, and a noticeable loss occurs after 4 days and may be completely lost in three to four weeks. Because acclimatization is to the level of the heat-stress exposure, a person will not be fully acclimatized to a sudden higher level; such as during a heat wave.

Dehydration reduces body water volume. This reduces the body's sweating capacity and directly affects its ability to dissipate excess heat.

The ability of a body to dissipate heat depends on the ratio of its surface area to its mass (surface area/weight). **Heat dissipation** is a function of surface area, while heat production depends on body mass. Therefore, overweight individuals (those with a low ratio) are more susceptible to heat-related illnesses because they produce more heat per unit of surface area than if they were thinner. Monitor these persons carefully if heat stress is likely.

When wearing **impermeable clothing**, the weight of an individual is not as important in determining the ability to dissipate excess heat because the primary heat dissipation mechanism, evaporation of sweat, is ineffective.

SYMPTOMS AND TREATMENT OF HEAT STRESS

	Heat Syncope	Heat Rash	Heat Cramps	Heat Exhaustion	Heat Stroke
Signs and Symptoms	Sluggishness or fainting while standing erect or immobile in heat.	Profuse tiny raised red blister-like vesicles on affected areas, along with prickling sensations during heat exposure.	Painful spasms in muscles used during work (arms, legs, or abdomen); onset during or after work hours.	Fatigue, nausea, headache, giddiness; skin clammy and moist; complexion pale, muddy, or flushed; may faint on standing; rapid thready pulse and low blood pressure; oral temperature normal or low	Red, hot, dry skin; dizziness; confusion; rapid breathing and pulse; high oral temperature.
Treatment	Remove to cooler area. Rest lying down. Increase fluid intake. Recovery usually is prompt and complete.	Use mild drying lotions and powders, and keep skin clean for drying skin and preventing infection.	Remove to cooler area. Rest lying down. Increase fluid intake.	Remove to cooler area. Rest lying down, with head in low position. Administer fluids by mouth. Seek medical attention.	Cool rapidly by soaking in cool– but not cold– water. Call ambulance, and get medical attention immediately!

Precautions

- Drink 16 ounces of water before beginning work. Disposable cups and water maintained at 50°Fahrenheit (10 degrees Celsius [C]) to 60°Fahrenheit (F) (15.6 degrees C) should be available. Under severe conditions, drink 1 to 2 cups every 20 minutes, for a total of 1 to 2 gallons (7.5 liters) per day. Remind employees to drink water throughout their work shift.
- Alternating water consumption with a sports drinks (e.g., Gatorade, Powerade, Sqwincher) to help maintain electrolyte balance, especially when working in hot conditions for more than 2 hours, may be necessary. The recommended hydration protocol is alternating water with a sports drink at a one-to-one ratio. Also eating regular meals and salt-containing snacks can also replace electrolytes lost during sweating.
- Do not use alcohol in place of water or other nonalcoholic fluids. Decrease your intake of coffee and caffeinated soft drinks during working hours.
- Acclimate to site work conditions by slowly increasing workloads; for example, do not begin site work with extremely demanding activities. Closely monitor employees during their first 14 days of work in the field.

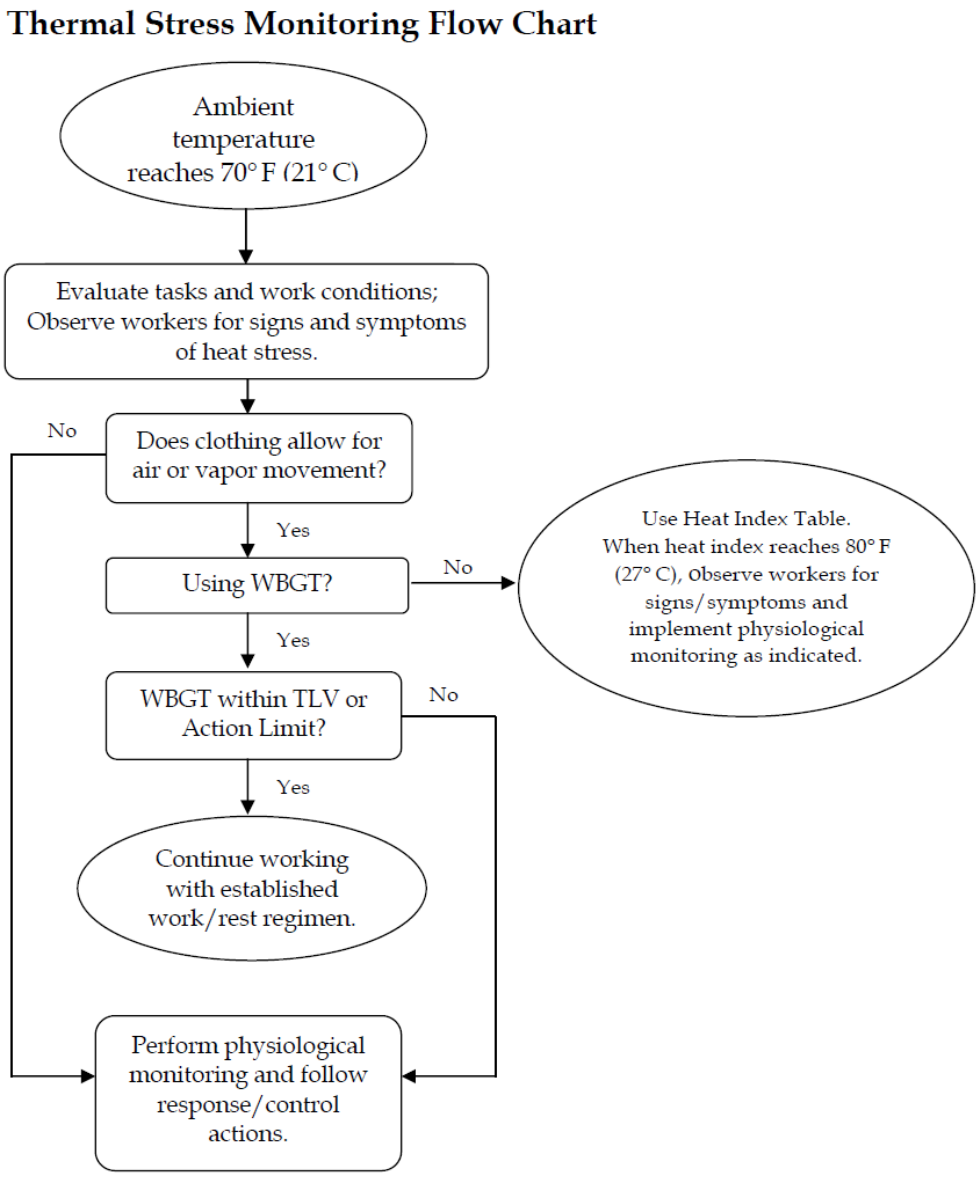
- Supervisors and SCs must continually observe employees throughout the work shift for signs and symptoms of heat stress or illness. Employees must monitor themselves for heat stress as well as observe their co-workers.
- Effective communication must be maintained with employees throughout the work shift either by voice, observation, or electronic device.
- Use cooling devices, such as cooling vests, to aid natural body ventilation. These devices add weight, so their use should be balanced against efficiency.
- Use mobile showers or hose-down facilities to reduce body temperature and cool protective clothing.
- Conduct field activities in the early morning or evening and rotate shifts of workers, if possible.
- Avoid direct sun whenever possible, which can decrease physical efficiency and increase the probability of heat stress. Take regular breaks in a cool, shaded area. Use a wide-brim hat or an umbrella when working under direct sun for extended periods.
- Provide adequate shade to protect personnel against radiant heat (sun, flames, hot metal).

- Use portable fans for convection cooling or in extreme heat conditions, an air-conditioned rest area when needed.
- In hot weather, rotate shifts of workers.
- Maintain good hygiene standards by frequent changes of clothing and showering. Clothing should be permitted to dry during rest periods. Persons who notice skin problems should consult medical personnel.
    - Brief employees initially before the project work begins and routinely as part of the daily safety briefing, on the signs and symptoms of heat-relatedness illnesses, precautions and emergency procedures to follow as described in the project safety plan.
    - Observe one another for signs of heat stress. PREVENTION and communication is key.

California has a specific heat illness prevention regulation that must be implemented. This includes,

- Having enough water onsite so that each worker can consume at a minimum, one quart per hour per shift.
- Frequent reminders and/or water breaks shall be taken so that each person can consume enough water.
- Access to shade (i.e., blockage from direct sunlight) shall be provided at all times and shall be reasonably close to the work area. Keep in mind that a vehicle or other enclosed are with no air conditioning is NOT considered shade. Must be a well ventilated area or have air conditioning.
- Workers shall be allowed to take a work-free cool-down rest/recovery period in the shade for a minimum of five minutes at any time when they feel the need to do so to protect themselves from overheating, or at the first sign of heat illness-related symptoms. (NOTE: If heat related symptoms are occurring, contact the RHSM).
- Training on risk factors, signs and symptoms of heat illness, importance of hydration and acclimatization, and importance of reporting symptoms and what to do in case of heat illness emergency, and contacting emergency medical services.

Thermal Stress Monitoring



Permeable Clothing – Monitoring Using WBGT

A Wet Bulb Globe Thermometer (WBGT) is the established and preferred means of measuring the environmental factors associated with heat stress and for providing indication of when physiological monitoring or rest regimens should be incorporated into the work schedule. The WBGT is the composite temperature used to estimate the effect of temperature, humidity, wind speed, and solar radiation on the human body.

When permeable work clothes are worn (street clothes or clothing ensembles over modesty clothes), physiological monitoring may be required based on the outcome of the WBGT measurements, taking into account the clothing adjustment factors. Use of the WBGT should generally begin when the heat index reaches 80° F (27° C) as indicated in the Heat Index Table below, or when workers exhibit symptoms of heat stress as indicated above.

If the WBGT is within the TLV (acclimatized workers) or Action Limit (unacclimatized workers) per the tables below, then work may continue while maintaining the established work/rest regimen. If the WBGT reading meets or exceeds either the TLV or Action Level for a work/rest regimen of 15 minutes work and 45 minutes rest, then physiological monitoring will be implemented.

Screening Criteria for TLV and Action Limit for Heat Stress Exposure

Allocation of work in a cycle of work and recovery	TLV (WBGT Values in ˚F/˚C˚) (Acclimatized Workers)				Action Limit (WBGT Values in ˚F/˚C˚) (Unacclimatized Workers)			
	Light	Moderate	Heavy	Very Heavy	Light	Moderate	Heavy	Very Heavy
75-100%	88/31	82/28	—	—	82/28	77/25	—	—
50-75%	88/31	84/29	82/28	—	83/29	79/26	75/24	—
25-50%	90/32	86/30	84/29	82/28	85/30	81/27	78/26	76/25
0-25%	91/33	89/32	87/31	86/30	86/30	84/29	82/28	81/27

Work Category Descriptions:

Light	Sitting or standing with light manual work using hands or arms; occasional walking.
Moderate	Sustained moderate hand, arm, and leg work; light pushing and pulling; normal walking.
Heavy	Intense arm and trunk work, carrying, shoveling, manually sawing, pushing and pulling heavy loads, walking at a fast pace.
Very Heavy	Very intense activity at fast to maximum pace.

Notes:
WBGT values are expressed to the nearest degree.
"—"Dashes indicate the need for physiological monitoring because screening criteria are not recommended for this type of work.

Clothing Adjustment Factors for Some Clothing Ensembles*

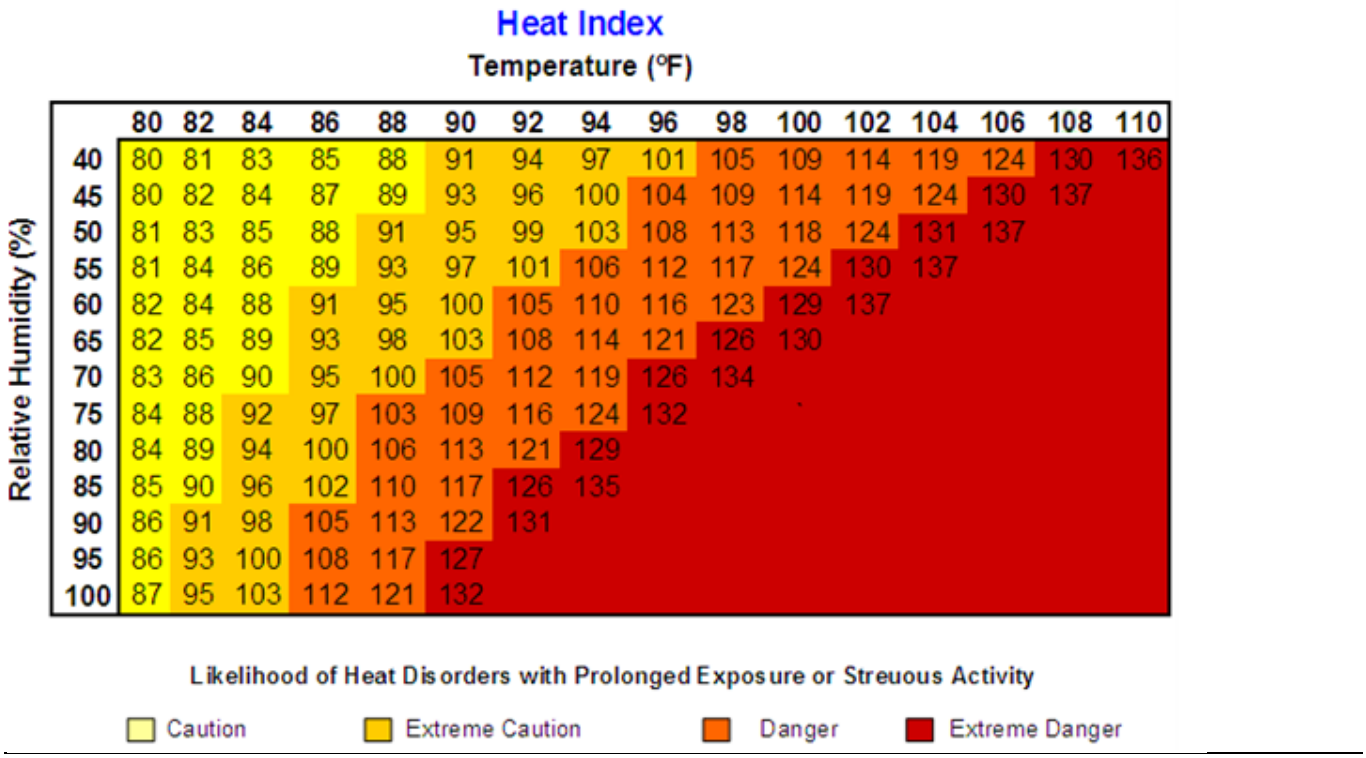
Clothing Type	Addition to WBGT ˚F/˚C˚
Work Clothes (sleeved shirt and pants)	0/0
Cloth (woven material) coveralls	0/0
Double-layer woven clothing	5.4/3
Polypropylene coveralls	0.9/0.5
Limited Use Vapor barrier coveralls	19.8/11

* These values must not be used for completely encapsulating (impermeable) coveralls/suits. Coveralls assume that only modesty clothing is worn beneath.

Thermal Stress Monitoring – Permeable or Impermeable Clothing

When **permeable work clothes** are worn (street clothes or clothing ensembles over street clothes), regularly observe workers for signs and symptoms of heat stress and implement physiological monitoring as indicated below. This should start when the heat index reaches 80° F (27° C) [see Heat Index Table below], or sooner if workers exhibit symptoms of heat stress indicated in the table above. These heat index values were devised for shady, light wind conditions; exposure to full sunshine can increase the values by up to 15°F (8°C). Also, strong winds, particularly with very hot, dry air, can be extremely hazardous.

When wearing **impermeable clothing** (e.g., clothing doesn't allow for air or water vapor movement such as Tyvek), physiological monitoring as described below shall be conducted when the ambient temperature reaches 70° F (21° C) or sooner when climatic conditions may present greater risk of heat stress combined with wearing unique variations of impermeable clothing, or workers exhibit symptoms of heat stress



Heat Index	Possible Heat Disorders	Minimum Frequency of Physiological Monitoring
80°F - 90°F (27°C - 32°C)	Fatigue possible with prolonged exposure and/or physical activity	Conduct initial monitoring as baseline and observe workers for signs of heat stress and implement physiological monitoring if warranted.
90°F - 105°F (32°C - 41°C)	Sunstroke, heat cramps, or heat exhaustion possible with prolonged exposure and/or physical activity	Conduct initial monitoring as baseline, then at least every hour, or sooner, if signs of heat stress are observed.
105°F - 130°F (41°C - 54°C)	Sunstroke, heat cramps, or heat exhaustion likely, and heat stroke possible with prolonged exposure and/or physical activity.	Conduct initial monitoring as baseline, then every 30 minutes or sooner if signs of heat stress are observed.
130°F or Higher (54°C or Higher)	Heat/Sunstroke highly likely with continued exposure.	Conduct initial monitoring as baseline, then every 15 minutes or sooner if signs of heat stress are observed.

Source: National Weather Service

Physiological Monitoring and Associated Actions

For employees wearing permeable clothing, follow the minimum frequency of physiological monitoring listed in the Heat Index Table.

For employees wearing impermeable clothing, physiological monitoring should begin initially at a 15 minute interval, then if the employee's heart rate or body temperature is within acceptable limits, conduct the subsequent physiological monitoring at 30 minutes, and follow the established regimen protocol below.

When physiological monitoring is required, use either radial pulse or aural temperature and follow actions below:

- The sustained heart rate during the work cycle should remain below 180 beats per minute (bpm) minus the individual's age (e.g., 180 – 35 year old person = 145 bpm). The sustained heart rate can be estimated by measuring the heart rate at the radial pulse for 30 seconds as quickly as possible prior to starting the rest period.

- The heart rate after one minute rest period should not exceed 120 beats per minute (bpm).
- If the heart rate is higher than 120 bpm after the FIRST minute into the rest period, the next work period should be shortened by 33 percent, while the length of the rest period stays the same.
- If the pulse rate still exceeds 120 bpm at the beginning of the next rest period, the following work cycle should be further shortened by 33 percent.
- Continue this procedure until the rate is maintained below 120 bpm after the FIRST minute into the rest period.

Alternately, the body temperature can be measured, either oral or aural (ear), before the workers have something to drink.

- If the oral or aural temperature exceeds 99.6° F (37.6 ° F) at the beginning of the rest period, the following work cycle should be shortened by 33 percent.
- Continue this procedure until the oral or aural (ear) temperature is maintained below 99.6 ° F (37.6° C). While an accurate indication of heat stress, oral temperature is difficult to measure in the field, however, a digital aural (aural) thermometer is easy to obtain and inexpensive to purchase.

Procedures for when Heat Illness Symptoms are Experienced

- Always contact the RHSM when any heat illness related symptom is experienced so that controls can be evaluated and modified, if needed.
- In the case of cramps, reduce activity, increase fluid intake, move to shade until recovered.
- In the case of all other heat-related symptoms (fainting, heat rash, heat exhaustion), and if the worker is a JACOBS worker, contact the occupational physician at 1-866-893-2514 and immediate supervisor.
- In the case of heat stroke symptoms, call 911, have a designee give location and directions to ambulance service if needed, follow emergency medical treatment section of the project safety plan.
- Follow the Incident Notification, Reporting, and Investigation section of this Handbook.

9.3.2 Cold

General

Low ambient temperatures increase the heat lost from the body to the environment by radiation and convection. In cases where the worker is standing on frozen ground, the heat loss is also due to conduction.

Wet skin and clothing, whether because of water or perspiration, may conduct heat away from the body through evaporative heat loss and conduction. Thus, the body cools suddenly when chemical protective clothing is removed if the clothing underneath is perspiration soaked.

Movement of air across the skin reduces the insulating layer of still air just at the skin's surface. Reducing this insulating layer of air increases heat loss by convection.

Non-insulating materials in contact or near-contact with the skin, such as boots constructed with a metal toe or shank, conduct heat rapidly away from the body.

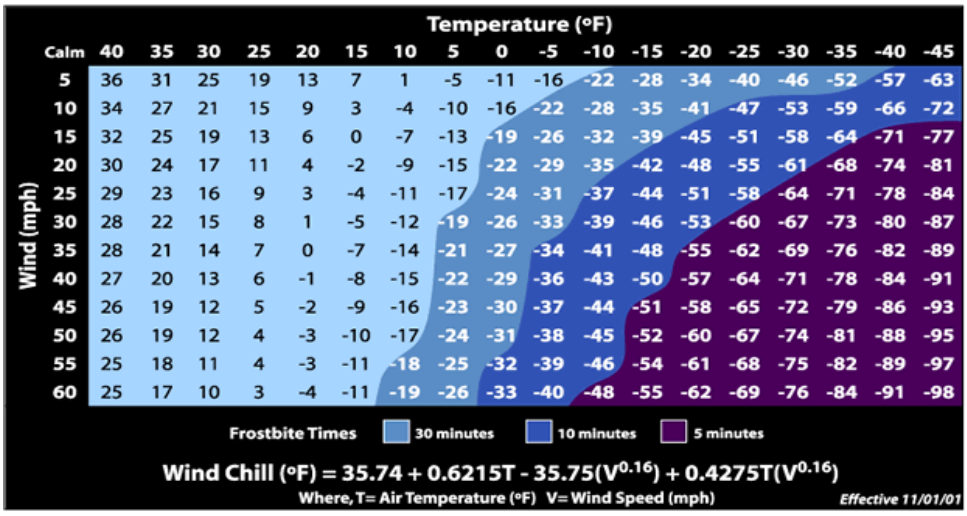
Certain common drugs, such as alcohol, caffeine, or nicotine, may exacerbate the effects of cold, especially on the extremities. These chemicals reduce the blood flow to peripheral parts of the body, which are already high-risk areas because of their large surface area to volume ratios. These substances may also aggravate an already hypothermic condition.

Precautions

- Be aware of the symptoms of cold-related disorders, and wear proper, layered clothing for the anticipated fieldwork. Appropriate rain gear is a must in wet weather.
- Consider monitoring the work conditions and adjusting the work schedule using guidelines developed by the U.S. Army wind-chill index and the National Safety Council (NSC) [in Canada: Environment Canada Will Chill Chart].
- Wind-Chill Index (below) is used to estimate the combined effect of wind and low air temperatures on exposed skin. The wind-chill index does not take into account the body part that is exposed, the level of activity, or the amount or type of clothing worn. For those reasons, it should only be used as a guideline to warn workers when they are in a situation that can cause cold-related illnesses.
- Persons who experience initial signs of immersion foot, frostbite, and/or hypothermia should report it immediately to their supervisor/PM to avoid progression of cold-related illness.
- Observe one another for initial signs of cold-related disorders.
- Obtain and review weather forecast – be aware of predicted weather systems along with sudden drops in temperature, increase in winds, and precipitation.

SYMPTOMS AND TREATMENT OF COLD STRESS

	Immersion (Trench) Foot	Frostbite	Hypothermia
Signs and Symptoms	Feet discolored and painful; infection and swelling present.	Blanched, white, waxy skin, but tissue resilient; tissue cold and pale.	Shivering, apathy, sleepiness; rapid drop in body temperature; glassy stare; slow pulse; slow respiration.
Treatment	Seek medical treatment immediately.	Remove victim to a warm place. Re-warm area quickly in warm–but **not** hot–water. Have victim drink warm fluids, but **not** coffee or alcohol. Do not break blisters. Elevate the injured area, and get medical attention.	Remove victim to a warm place. Have victim drink warm fluids, but **not** coffee or alcohol. Get medical attention.



Environment Canada Wind Chill Chart

Actual Air Temperature T_{air} (°C)

T_{air} (°C) / V10 (km/h)	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45	-50
5	4	-2	-7	-13	-19	-24	-30	-36	-41	-47	-53	**-58**
10	3	-3	-9	-15	-21	-27	-33	-39	-45	-51	**-57**	**-63**
15	2	-4	-11	-17	-23	-29	-35	-41	-48	-54	**-60**	**-66**
20	1	-5	-12	-18	-24	-30	-37	-43	-49	**-56**	**-62**	**-68**
25	1	-6	-12	-19	-25	-32	-38	-44	-51	**-57**	**-64**	**-70**
30	0	-6	-13	-20	-26	-33	-39	-46	-52	**-59**	**-65**	**-72**
35	0	-7	-14	-20	-27	-33	-40	-47	-53	**-60**	**-66**	**-73**
40	-1	-7	-14	-21	-27	-34	-41	-48	-54	**-61**	**-68**	**-74**
45	-1	-8	-15	-21	-28	-35	-42	-48	**-55**	**-62**	**-69**	**-75**
50	-1	-8	-15	-22	-29	-35	-42	-49	**-56**	**-63**	**-69**	**-76**
55	-2	-8	-15	-22	-29	-36	-43	-50	**-57**	**-63**	**-70**	**-77**
60	-2	-9	-16	-23	-30	-36	-43	-50	**-57**	**-64**	**-71**	**-78**
65	-2	-9	-16	-23	-30	-37	-44	-51	**-58**	**-65**	**-72**	**-79**
70	-2	-9	-16	-23	-30	-37	-44	-51	**-58**	**-65**	**-72**	**-80**
75	-3	-10	-17	-24	-31	-38	-45	-52	**-59**	**-66**	**-73**	**-80**
80	-3	-10	-17	-24	-31	-38	-45	-52	**-60**	**-67**	**-74**	**-81**

where
T_{air} = Actual Air Temperature in °C
$V_{10\,m}$ = Wind Speed at 10 metres in km/h (as reported in weather observations)

Notes:

1. For a given combination of temperature and wind speed, the wind chill index corresponds roughly to the temperature that one would feel in a very light wind. For example, a temperature of -25°C and a wind speed of 20 km/h give a wind chill index of -37. This means that, with a wind of 20 km/h and a temperature of -25°C, one would feel as if it were -37°C in a very light wind.
2. Wind chill does *not* affect objects and does *not* lower the actual temperature. It only describe how a human being would feel in the wind at the ambient temperature.
3. The wind chill index does *not* take into account the effect of sunshine. Bright sunshine may reduce the effect of wind chill (make it feel warmer) by 6 to 10 units.

10. Biological Hazards and Controls

Biological hazards are everywhere and change with the region and season. During project planning stages, ask the site Point of Contact if there are insect or other biological hazards have been noted in any of the work sites.

Biological hazards are everywhere and change with the region and season. If you encounter a biological hazard that has not been identified in the project safety plan or in this Handbook, contact the RHSM so that hazard controls can be addressed. Whether it is contact with a poisonous plant, a poisonous snake, or a bug bite, do not take bites or stings lightly. If there is a chance of an allergic reaction or infection, or to seek medical advice on how to properly care for the injury, contact the occupational nurse at 1-866-893-2514.

10.1 Black Bears

Bears may inhabit wooded areas where there is scarce continuous human presence. Make your presence known-especially when vegetation and terrain make it hard to see. Make noise, sing, or talk loudly. Avoid thick brush. Try to walk with the wind at your back so your scent will warn bears of your presence.

Give bears plenty of room. Every bear has a “personal space” - the distance within which a bear feels threatened – that can be from a few feet to a few hundred feet. If you stray within that zone, a bear may act aggressively. Never approach bears, even if only out of curiosity, and never attempt to feed bears.

If a bear cannot recognize you, he may come closer or stand on his hind legs for a better view. You may try to back away slowly diagonally, but if the bear follows, stop and stand your ground. If the bear moves closer or acts aggressively, stay close together and wave your arms and shout.

Do not climb a tree – black bears are good climbers.

Do not run. Bears have been clocked at speeds of up to 35 mph, and like dogs, will chase fleeing animals. Bears often make bluff charges, sometimes up to 10 feet away without making contact. Continue waving your arms and shouting. Never imitate bears sounds or use high-pitched squeals.

If attacked, do not run. Clasp your hands tightly over the back of your neck or if you are carrying a backpack use it to protect your head and neck and remain still.

For Black bears, if the attack lasts for more than a few seconds, respond aggressively - use sticks, rocks, your fists or noise. Black bears will sometimes back off if they are challenged.

10.2 Bees and Other Stinging Insects

Bees and other stinging insects may be encountered almost anywhere and may present a serious hazard, particularly to people who are allergic.

Precautions include:

- Watching for and avoiding nests.
- Keep exposed skin to a minimum.
- Carry a kit if you have had allergic reactions in the past, and inform your supervisor and/or a buddy. When working at a remote location, ensure that first-aid kits contain over-the-counter allergy and itch medication (e.g., Benadryl, Claritin, etc.) as well as other over-the-counter medications that may not be available to aid in symptom treatment.
- If bees or other stinging insects are known to be present, determine whether additional protective clothing should be donned before entering/working in brushy areas.

- Before entering a heavily vegetated or brushy area, observe the area for several minutes to see if bees or other stinging insects may be present. If nests or individual insects are observed, retreat and inquire whether a specialist or a client service can be contacted to clear the area before work proceeds.
- Consider if heavy-weight clothing or tyvek, or head netting would provide additional protection in areas where wasps/bees are known or suspected. Be aware of heat stress conditions additional clothing may cause.
- Use insect repellent on clothing. Wear light-colored clothing and remove bright reflective safety-colored clothing if not working near a roadway as these may attract the wasps.
- Wear fragrance-free or lightly-scented sunscreen, and body lotions. Bees are attracted to sweet scents. Avoid using floral scented soaps, shampoos, or conditioners.
- Move slowly and calmly through vegetated areas and try to avoid major disturbance of vegetation as wasps/bees often react to aggressive movement.
- If you encounter a wasp, back away slowly and calmly, do not run or swat at the insect. Wait for it to leave, or gently move or brush it off gently with a piece of paper or other light object. Do not use your hand.

If you are stung, contact the occupational nurse at 1-866-893-2514, no matter how minor it may seem. If a stinger is present, remove it as soon as possible using something with a thin, hard edge (e.g., credit card) to scrape the stinger out. Be sure to sanitize the object first with hand sanitizer, alcohol or soap and water. Wash and disinfect the wound, cover it, and apply ice. Watch for an allergic reaction if you have never been stung before. Call 911 if the reaction is severe.

10.3 Bird Droppings

Large amounts of bird droppings may present a disease risk. The best way to prevent exposure to fungus spores in bird droppings is to avoid disturbing it. A brief inhalation exposure to highly contaminated dust may be all that is needed to cause infection and subsequent development of fungal disease.

If disturbing the droppings or if removal is necessary to perform work, follow these controls:

- Use dust control measures (wetting with water or HEPA vacuuming) for all activities that may generate dust from the accumulated droppings.
- Wear Tyvek with hoods, disposable gloves and booties, and air-purifying respirators with a minimum N95 rating.
- Put droppings into plastic/poly bags and preferably into a 55-gallon drum to prevent bag from ripping.

10.4 Cactus

Contact with cacti can result in dermatitis as well as causing immunologic and infectious reactions. The spines can scratch the skin or induce wounds and multiple abrasions. Some cacti have glochids (hair-like spines or short prickles, generally barbed). Glochids can induce more troublesome, more persistent, dermatological manifestations such as papules or nodules.

Set up the work area to ensure avoidance of cacti. Wear leather glove if working near cacti. Keep any clothing such as jackets away from cacti as spines can become lodged into the clothing and can be contacted by the skin later. Contact the occupational nurse if cactus contact occurs.

10.1 Canada Geese

If Canadian geese are present at the worksite, do not attempt to feed or go near geese or nesting areas. Canada Geese can be extremely aggressive during mating and nesting periods. If the project work requires staff to work in areas where geese may be nesting, please contact the SL and/or client site supervisor to determine the correct

course of action to be taken. Minimize direct contact with goose droppings, remove shoes prior to entering home or work following contact and wash hands thoroughly with antibacterial soap

10.2 Cougars/Mountain Lions

Like bears, cougars will often retreat if given the opportunity. Walking in groups and making noise will give the cougar the chance to retreat and reduce the likelihood of a sudden encounter. Be especially cautious during dusk and dawn.

If you see a cougar—do not play dead, do not run. Running may trigger an attack. Face the cougar and retreat slowly maintaining eye contact. If the cougar continues advancing, raise your arms above your head to make yourself look larger than normal. This may help to intimidate the cougar. Sometimes aggressive yelling and rock throwing may scare it off.

If attacked, fight back with whatever is at hand (without turning your back)—people have utilized rocks, jackets, garden tools, tree branches, and even bare hands to turn away cougars.

10.3 Coyotes

While far from domesticated, coyotes show little fear of humans and have become comfortable living in close proximity to our communities. Although they tend to do most of their hunting after dusk, coyotes can be active at any time. Under normal circumstances, a coyote is not a danger to humans. They are, however, territorial and will respond aggressively if they or their family are threatened.

If you encounter a coyote that behaves aggressively, you have probably gotten too close to its prey or its family. Try to scare the coyote by yelling and waving your arms. Throw rocks, sticks or other objects. Do not turn away and run.

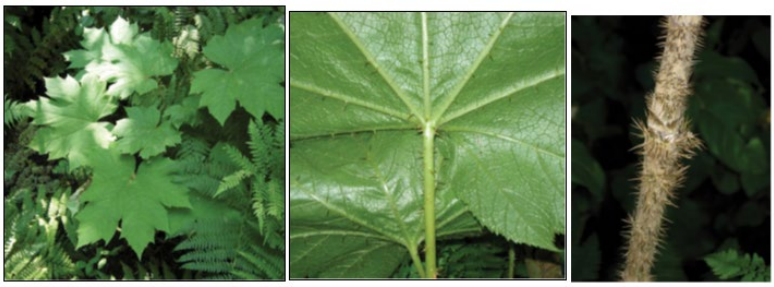
10.4 Devil's Club

Devil's Club (scientific name: Oplopanax horridus) is a large plant which thrives in moist woods and along streams. The plant is native to British Columbia and found all along the Pacific coast from Alaska to southern Oregon. Devil's Club grows up to 19 feet (6 meters) tall and has large 7 to 15 inch (20 to 40 centimeters), maple-shaped leaves. It produces small white flowers in spring and bright red fruit (clustered berries) in summer. The fruit is considered poisonous to humans but is eaten by bears.

Both the stem and leaves are covered with sharp thorns that are up to over a half an in (2 centimeters) long. In addition to physical damage to the eyes and skin, there is evidence that the spiny thorns can cause serious allergic reactions in some individuals.

Wear long-sleeved shirts and long pants when working in areas where Devil's Club is growing. Protective goggles or safety glasses with side shields are recommended when walking through patches of brush that exceed shoulder height. Wear heavy, leather or canvas gloves when handling the plants. When cutting devil's club with a chainsaw make sure the hand protection is in place to protect the operators knuckles

Avoid devil's club if possible. The thorns are barbed and cannot be fully removed. Wounds from devil's club thorns often become infected and fester from the imbedded barbs. If skin contacts occurs, immediately remove any thorns with tweezers and wash the skin carefully with soap and water. Application of an anti-inflammatory cream (e.g., a 0.5% hydrocortisone cream) may reduce skin irritation. Seek medical assistance and contact the Injury Management hotline at 1-866-893-2514.



10.5 Feral Dogs and Cats

Below are hazard controls when dogs or cats are encountered.

- Do not attempt to handle or capture a stray dog or cat.
- Avoid all dogs – both leashed and stray. Do not disturb a dog while it is sleeping, eating, or caring for puppies.
- If a dog approaches to sniff you, stay still. An aggressive dog has a tight mouth, flattened ears and a direct stare.
- If you are threatened by a dog, remain calm, do not scream and avoid eye contact. If you say anything, speak calmly and firmly. Do not turn and run, try to stay still until the dog leaves, or back away slowly until the dog is out of sight or you have reached safety (e.g., vehicle).
- If attacked, retreat to vehicle or attempt to place something between you and the dog. If you fall or are knocked to the ground, curl into a ball with your hands over your head and neck and protect your face.
- If bitten, contact the occupational nurse at 1-866-893-2514. Report the incident to the local authorities.

10.6 Fire Ants

There are several types of fire ants in the United States that can cause painful bites and allergic reactions. Fire ants aggressively defend their nests by stinging several times after climbing on their victims. Large ant mounds are easily visible, but there can be smaller mounds or nests with little “worked” soil that can be stepped on inadvertently. They can also be under rocks, wood or other debris. Implement the following when fire ants are observed:

- Be aware of fire ants and take care not to stand on ant nests;
- Use insect repellents on clothing and footwear to temporarily discourage ants from climbing; and
- Tuck pants into socks.

If stung, get away from the area you are standing on, briskly brush off ants—wash affected area with soap. Call your Supervisor and HSM and contact Injury Care for Employees hotline at 1-866-893-2514.

10.7 Giant Hogweed

Giant hogweed is a noxious weed that has become established in the US and Canada.

Its sap, in combination with moisture and sunlight, can cause phytophotodermatitis—a serious skin inflammation and severe eye irritation leading to blindness. Contact between the skin and the sap of this plant occurs either through brushing against the bristles on the stem or breaking the stem or leaves. Eye exposure to the sap can occur during the breaking of the stems (during clearing/grubbing). Heat, sunlight, and moisture worsen the skin reaction.

Giant hogweed is a biennial or perennial which can grow up to 12 feet (approximately 3.5 meters) or more. Its hollow, ridged stems grow 2-4 inches (5-10 cm) in diameter and have dark reddish-purple blotches. Its large

compound leaves can grow up to five feet (1.5 meters) wide. Its white flower heads can grow up to 2.5 feet (approximately 1 meter) in diameter.

Symptoms of exposure include initial itching and redness, then painful blisters form within 48 hours with the area becoming dark and pigmented. Long-term effects include scarring, sensitivity of the affected area to sunlight, temporary or permanent blindness if it gets into the eyes.

As with all hazardous plants, recognition and avoidance is key. Do not touch any portion of the plant. Become familiar with the identity of these plants (see below). Wear protective clothing that covers exposed skin and clothes. Avoid contact with plants and the outside of protective clothing. If skin contacts a plant, wash the area with soap and cold water immediately. Keep exposed area away from sunlight for 48 hours. Contact your supervisor, RHSM and the Injury Care for Employees hotline at 1-866-893-2514.

10.8 Hantavirus

Hantavirus pulmonary syndrome (HPS) is a disease caused by a virus which can be transmitted from certain rodents to humans and is prevalent throughout North America. Avoid disturbing rodent nests. Contact is most likely to occur when there is a current rodent infestation in things like control boxes, storage sheds, wellheads, remediation equipment, or trailers. Once excreted into the environment by the rodent, hantaviruses can survive in the environment and remain infectious for a period of 2-3 days. Ultraviolet rays in sunlight inactivate hantaviruses.

Nesting material and droppings must be removed if work is necessary in a rodent-infested area. PPE for removal shall include:

- Tyvek coveralls;
- Rubber boots or disposable shoe covers;
- Rubber, latex, or vinyl gloves;
- Respiratory protection such as a full face or half-mask air-purifying respirator with a high-efficiency particulate air (HEPA) filter; and
- Protective goggles if wearing a half-mask respirator.

Spray any urine, droppings, and nesting materials with either a bleach and water solution (1 parts bleach to 9 parts water) or a household disinfectant prepared according to the label instructions for dilution and disinfection time. Soak well and let stand for 15 minutes. Use a paper towel or rag to pick up the materials and dispose of them.

Mop floors after spraying them using bleach and water solution or a disinfectant. Dirt floors can be sprayed with either bleach and water solution or a disinfectant.

Personal protective gear shall be decontaminated upon removal at the end of the day. All potentially infective waste material (including respirator filters) from clean-up operations shall be double-bagged in plastic bags.

Symptoms of HPS

Symptoms develop between 14 and 31 days after exposure to infected rodents and include fatigue, fever, and muscle aches, especially the large muscle groups—thighs, hips, back and sometimes shoulders. About half of all HPS patients also experience headaches, dizziness, chills and/or abdominal pain. Four to 10 days after the initial phase of the illness, late symptoms of HPS may appear. These include coughing and shortness of breath. If you develop symptoms suggestive of HPS, call the occupational nurse at 1-866-893-2514.

10.9 Hazards during Hunting Seasons

Various times of the year can be particularly hazardous for personnel working in the field. The danger is highest for our teams doing cross-country surveys of pipelines and transmission lines, but everyone doing field work should be aware of the hunting seasons that are active where you are working.

Big game hunting can be very dangerous, but also be aware of water fowl seasons and hunting seasons for less common game in your area. Work in wetlands can bring us in close proximity to these types of hunters.

If possible consider postponing field surveys so they do not coincide with hunting seasons but if you must be in the field be as visible as possible at all times.

(In the US, this site gives all the different hunting seasons by state: www.huntinfo.org/)

Implement the following if hunting may be a hazard:

- Do not wear kaki, brown or tan clothing, wear high visibility colors including hats and vests;
- Avoid wearing white or light colored scarves, gloves, handkerchiefs (a woman wearing white mittens hanging laundry was shot and killed as bad hunter shot at flash of white);
- When carrying white plans, field data sheets etc keep them in binder or backpack;
- Wear your safety vest at all times including standing by car/truck;
- Wear a safety hat/cap or put florescent markers on hard hats;
- Be alert particularly in early mornings and at end of day when most hunters are present;
- Avoid being in field altogether at dawn or dusk - start a little later in the morning and make sure you get out of the field earlier;
- Stop at local hardware or convenience market and pick up hunter safety gloves, caps, rolls of tape etc. All the stores carry them and they are cheap visual protection.
- Make your presence known, such as slamming car doors, honk horn, talk loudly when getting out to a field site; and
- Stop and survey your surroundings. Many hunters are up in tree stands.

10.10 Leeches

Leeches are bloodsucking aquatic or terrestrial worms. They can crawl through or over your socks or brush onto you from shrubbery. They carry no disease and there is low risk of significant blood loss. Leech bites do not hurt since they release an anesthetic, but they can bleed profusely due to an anticoagulant they release to facilitate the flow of blood.

Possible Complications

- Some people suffer allergic reaction from leech bites and require urgent medical care. Symptoms include an ulcer infection, itchy rash, red blotches or an itchy rash over the body, swelling around the lips or eyes, feeling faint or dizzy, and difficulty breathing. If you experience any of these symptoms, seek medical attention immediately.

Prevention options

- The best protection against leeches is covering up and using tropical strength insect repellent on socks and clothing.
- Use anti leech socks and fit over outer garments which served as a barrier.
- Various reports suggest applying salt, dettol spray, bath soap, eucalyptus oil or lemon juice to your skin.
- Inspect your body after leaving leech-infested waters or area, removing them promptly.

First Aid

- Locate the head with a sucker attached to the wound. It will be the narrow end of leech's body.
- Use your fingernail or other flat, blunt object to break the seal of the oral sucker at which point the leech's jaws will detach. Repeat with the posterior end.
- Quickly flick the leech away before it bites you again and reattaches.
- Treat the wound with soap and water and antiseptic wipes; then bandage to stop bleeding.
- Do not just pull off the leech as this may cause a severe wound and the jaws may stay imbedded in the skin
- If the leech has attached to an orifice such ear, nose or mouth use salt or strong (drinkable) alcohol to cause it to release before it expands.
- Apply pressure to the area and a cold pack to reduce pain or swelling.
- The wound normally itches as it heals, but should not be scratched, as this may complicate healing and introduce other infections. Apply an antihistamine if necessary to reduce itching.
- If assisting a bitten person, use the usual protective universal precautions to protect against blood borne pathogens
- Call the RHSM, Workers Supervisor and Injury Management hotline at 1-866-893-2514 (as necessary).

10.11 Mosquitos and Dengue, Chikungunya, Zika, and West Nile Viruses

(Source: Centers for Disease Control)

Aside from being itchy and annoying, the bite of an infected female mosquito (Aedes aegypti or Aedes albopictus) can spread dengue, chikungunya, or Zika viruses. People become infected with dengue, chikungunya, or Zika after being bitten by an infected mosquito.

- Female mosquitoes lay several hundred eggs on the walls of waterfilled containers. Eggs stick to containers like glue and remain attached until they are scrubbed off. When water covers the eggs, they hatch and become adults in about a week.
- Adult mosquitoes live inside and outside.
- They prefer to bite during the day.
- A few infected mosquitoes can produce large outbreaks in a community and put your family at risk of becoming sick.

Protect Yourself, Your Family, and Community from Mosquitoes

1. Eliminate standing water in and around your home:

- Once a week, empty and scrub, turn over, cover, or throw out items that hold water, such as tires, buckets, planters, toys, pools, birdbaths, flowerpots, or trash containers. Check inside and outside your home.
- Tightly cover water storage containers (buckets, cisterns, rain barrels) so that mosquitoes cannot get inside to lay eggs.
- For containers without lids, use wire mesh with holes smaller than an adult mosquito.

2. If you have a septic tank, follow these steps:

- Repair cracks or gaps.

- Cover open vent or plumbing pipes. Use wire mesh with holes smaller than an adult mosquito.

3. Keep mosquitoes out of your home:

- Use screens on windows and doors.
- Repair holes in screens.
- Use air conditioning when available.
- Put plants in soil, not in water.
- Drain water from pools when not in use.
- Recycle used tires or keep them protected from rain.
- Drain & dump any standing water.
- Weekly, scrub vases & containers to remove mosquito eggs.

4. Prevent mosquito bites:

- Use an Environmental Protection Agency (EPA)-registered insect repellent with one of the following active ingredients. All EPA-registered insect repellents are evaluated to make sure they are safe and effective.

Active ingredient Higher percentages of active ingredient provide longer protection	**Some brand name examples***
DEET	Off!, Cutter, Sawyer, Ultrathon
Picaridin, also known as **KBR 3023, Bayrepel**, and **icaridin**	Cutter Advanced, Skin So Soft Bug Guard Plus, Autan (outside the United States)
IR3535	Skin So Soft Bug Guard Plus Expedition, SkinSmart
Oil of lemon eucalyptus (OLE) or **para-menthane-diol** (PMD)	Repel
* Insect repellent brand names are provided for your information only. The Centers for Disease Control and Prevention and the U.S. Department of Health and Human Services cannot recommend or endorse any name brand products.	

  - Always follow the product label instructions.
  - Reapply insect repellent every few hours, depending on which product and strength you choose.
  - Do not spray repellent on the skin under clothing.
  - If you are also using sunscreen, apply sunscreen first and insect repellent second.

- Treat clothing and gear (such as boots, pants, socks, and tents) with permethrin or purchase permethrin-treated clothing and gear.
  - Treated clothing remains protective after multiple washings. See product information to find out how long the protection will last.
  - If treating items yourself, follow the product instructions carefully.
  - Do not use permethrin products, intended to treat clothing, directly on skin.
- Wear long-sleeved shirts and long pants.

- Use BugOut Suits™ or equivalent as necessary.

Signs and symptoms of common mosquito-borne diseases

Below are signs and symptoms of common mosquito-borne diseases.

Contact the project RHSM with questions, and immediately report any suspicious symptoms to your supervisor, PM, and contact the occupational nurse at 1-866-893-2514.

Signs and symptoms of chikungunya virus disease (chikungunya)

Common symptoms include fever and severe joint pain. Other symptoms may include headache, muscle pain, joint swelling, or rash.

Symptoms usually begin 3—7 days after being bitten by an infected mosquito.

Most patients will feel better within a week. In some people, the joint pain may persist for months. Death is rare.

People at risk for more severe disease include newborns infected around the time of birth, older adults (≥65 years), and people with medical conditions such as high blood pressure, diabetes, or heart disease.

Signs and symptoms of Dengue

The principal symptoms of dengue are:

- High fever and at least two of the following:
  - Severe headache
  - Severe eye pain (behind eyes)
  - Joint pain
  - Muscle and/or bone pain
  - Rash
  - Mild bleeding manifestation (e.g., nose or gum bleed, petechiae, or easy bruising)
  - Low white cell count

Generally, younger children and those with their first dengue infection have a milder illness than older children and adults.

Watch for warning signs as temperature declines 3 to 7 days after symptoms began. Seek immediate medical attention if any of the following warning signs appear:

- Severe abdominal pain or persistent vomiting
- Red spots or patches on the skin
- Bleeding from nose or gums
- Vomiting blood
- Black, tarry stools (feces, excrement)
- Drowsiness or irritability
- Pale, cold, or clammy skin
- Difficulty breathing

Signs and symptoms of Zika

About 1 in 5 people infected with Zika virus become ill (i.e., develop Zika). The most common symptoms of Zika are:

- Fever, rash, joint pain, or conjunctivitis (red eyes).
- Other common symptoms include muscle pain and headache.

The incubation period (the time from exposure to symptoms) for Zika virus disease is not known, but is likely to be a few days to a week. The illness is usually mild with symptoms lasting for several days to a week.

People usually don't get sick enough to go to the hospital, and they very rarely die of Zika.

Zika virus usually remains in the blood of an infected person for about a week but it can be found longer in some people.

Signs and symptoms of West Nile Virus

Most infections are mild, and symptoms include fever, headache, and body aches, occasionally with skin rash and swollen lymph glands. More severe infection may be marked by headache, high fever, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness, paralysis, and, rarely, death.

The West Nile Virus incubation period is from 3 to 15 days.

Contact the project RHSM with questions, and immediately report any suspicious symptoms to your supervisor, PM, and contact the Injury Care for Employees hotline at 1-866-893-2514.

10.12 Poison Ivy, Poison Oak, and Poison Sumac

Poison ivy, poison oak, and poison sumac typically are found in brush or wooded areas. They are more commonly found in moist areas or along the edges of wooded areas. Shrubs are usually 12 to 30 inches high, or can also be a tree-climbing vine, with triple leaflets and short, smooth hair underneath. Plants are red and dark green in spring and summer, with yellowing leaves anytime especially in dry areas. Leaves may achieve bright reds in fall, but plants lose its (yellowed, then brown) leaves in winter, leaving toxic stems. All parts of the plant remain toxic throughout the seasons. These plants contain urushiol a colorless or pale yellow oil that oozes from any cut or crushed part of the plant, including the roots, stems and leaves and causes allergic skin reactions when contacted. The oil is active year round.

Become familiar with the identity of these plants (see below). Wear protective clothing that covers exposed skin and clothes. Avoid contact with plants and the outside of protective clothing. If skin contacts a plant, wash the area with soap and water immediately. If the reaction is severe or worsens, seek medical attention.

Poison Ivy

Poison Sumac

Poison Oak

Contamination with poison ivy, sumac or oak can happen through several pathways, including:

- Direct skin contact with any part of the plant (even roots once above ground foliage has been removed).
- Contact with clothing that has been contaminated with the oil.
- Contact from removing shoes that have been contaminated (shoes are coated with urishol oil).
- Sitting in a vehicle that has become contaminated.
- Contact with any objects or tools that have become contaminated.
- Inhalation of particles generated by weed whacking, chipping, vegetation clearing.

If you must work on a site with poison ivy, sumac or oak the following precautions are necessary:

- Do not drive vehicles onto the site where it will come into contact with poison ivy, sumac or oak. Vehicles which need to work in the area, such as drill rigs or heavy equipment must be washed as soon as possible after leaving the site.

- All tools used in the poison ivy, sumac or oak area, including those used to cut back poison oak, surveying instruments used in the area, air monitoring equipment or other test apparatus must be decontaminated before they are placed back into the site vehicle. If on-site decontamination is not possible, use plastic to wrap any tools or equipment until they can be decontaminated.
- Personal protective equipment, including Tyvek coveralls, gloves, and boot covers must be worn. PPE must be placed into plastic bags and sealed if they are not disposed immediately into a trash receptacle.
- As soon as possible following the work, shower to remove any potential contamination. Any body part with suspected or actual exposure should be washed with Zanfel, Tecnu or other product designed for removing urishiol. If you do not have Zanfel or Tecnu wash with cold water. Do not take a bath, as the oils can form and invisible film on top of the water and contaminate your entire body upon exiting the bath.
- Tecnu may also be used to decontaminate equipment.
- Use IvyBlock or similar products to prevent poison oak, ivy and sumac contamination. Check with a local drug sotre the closest JACOBS warehouse to see if these products are available. Follow all directions for application.
- If you do come into contact with one of these poisonous plants and a reaction develops, contact your supervisor and the occupational nurse 1-866-893-2514. Be aware that in some instances, there can be a delay between contact with poisonous plants and the symptoms. If you are working near poison ivy or other poisonous plants and feel a mild skin irritation, apply Zanfel/Technu immediately and contact the occupational nurse.

10.13 Scorpions

Scorpions usually hide during the day and are active at night. They may be hiding under rocks, wood, or anything else lying on the ground. Some species may also burrow into the ground. Most scorpions live in dry, desert areas; however, some species can be found in grasslands, forests, and inside caves.

When entering an area that has the potential to contain scorpions, the following PPE is recommended: long pants, long sleeved shirts with collars, leather work gloves and leather work boots. Reaching into enclosures or recesses without prior visual inspection is not recommended. Thoroughly inspect each area before accessing. Shake out clothing, jackets, shoes or boots prior to putting them on.

If you are stung by a scorpion, call the Injury Care for Employees hotline 1-866-893-2514 and try to note the description of the scorpion. Cleanse the sting area and apply ice.

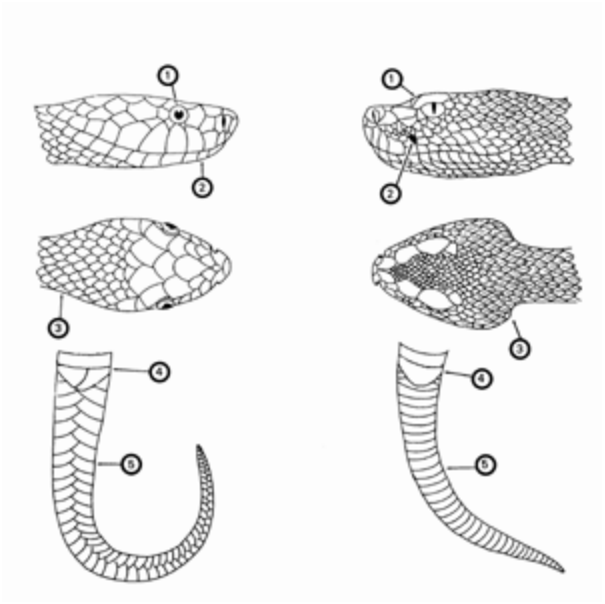
10.14 Snakes

Snakes typically are found in underbrush and tall grassy areas. If you encounter a snake, stay calm and look around; there may be other snakes. Turn around and walk away on the same path you used to approach the area. If bitten by a snake, wash and immobilize the injured area, keeping it lower than the heart if possible. Call the occupational nurse at 1-866-893-2514 immediately. Do not apply ice, cut the wound, or apply a tourniquet. Try to identify the type of snake: note color, size, patterns, and markings. Below is a guide to identifying poisonous snakes from non-poisonous snakes.

Ontario’s only venomous snake is the Eastern Massassauga rattlesnake, which only occurs in four isolated areas: Southern Georgian Bay, the Bruce Peninsula, Wainfleet Bog near Port Colborne, and Ojibway Prairie near Windsor. The chances of encountering this rattlesnake outside of these areas is very low.

Identification of Poisonous Snakes

Major Identification Features Non-venomous Snake	Major Identification Features Venomous Snake
1. Round pupils 2. No sensing pit 3. Head slightly wider than neck 4. Divided anal plate 5. Double row of scales on the underside of the tail	1. Elliptical pupils 2. Sensing pit between eye and nostril 3. Head much wider than neck 4. Single anal plate 5. Single scales on the underside of the tail



10.15 Spiders - Brown Recluse and Widow

The Brown Recluse spider can be found most anywhere in North America. It varies in size in shape, but the distinguishing mark is the violin shape on its body. They are typically non-aggressive. Keep an eye out for irregular, pattern-less webs that sometimes appear almost tubular built in a protected area such as in a crevice or between two rocks. The spider will retreat to this area of the web when threatened.

The Black Widow, Red Widow and the Brown Widow are all poisonous. Most have globose, shiny abdomens that are predominantly black with red markings (although some may be pale or have lateral stripes), with moderately long, slender legs. These spiders are nocturnal and build a three-dimensional tangled web, often with a conical tent of dense silk in a corner where the spider hides during the day.

Hazard Controls

- Inspect or shake out any clothing, shoes, towels, or equipment before use.
- Wear protective clothing such as a long-sleeved shirt and long pants, hat, gloves, and boots when handling stacked or undisturbed piles of materials.
- Minimize the empty spaces between stacked materials.
- Remove and reduce debris and rubble from around the outdoor work areas.
- Trim or eliminate tall grasses from around outdoor work areas.
- Store apparel and outdoor equipment in tightly closed plastic bags.

- Keep your tetanus boosters up-to-date (every 10 years). Spider bites can become infected with tetanus spores.

If you think you have been bit by a poisonous spider, immediately call the Injury Care for Employees number at 1-866-893-2514 and follow the guidance below:

- Remain calm. Too much excitement or movement will increase the flow of venom into the blood;
- Apply a cool, wet cloth to the bite or cover the bite with a cloth and apply an ice bag to the bite;
- Elevate the bitten area, if possible;
- Do not apply a tourniquet, do not try to remove venom; and
- Try to positively identify the spider to confirm its type. If the spider has been killed, collect it in a plastic bag or jar for identification purposes. Do not try to capture a live spider—especially if you think it is a poisonous spider.

Black Widow

Brown Recluse

10.16 Ticks

Every year employees are exposed to tick bites at work and at home putting them at risk of illness. Ticks typically are in wooded areas, bushes, tall grass, and brush. Ticks are black, black and red, or brown and can be up to one-quarter inch (6.4 mm) in size.

In some geographic areas exposure is not easily avoided. Wear tightly woven light-colored clothing with long sleeves and pant legs tucked into boots; spray only outside of clothing with permethrin or permanone and spray skin with only DEET; and check yourself frequently for ticks.

Where site conditions (vegetation above knee height, tick endemic area) or when tasks (having to sit or kneel in vegetation) diminish the effectiveness of the other controls mentioned above, bug-out suits (check with your local or regional warehouse) or Tyvek shall be used. Bug-out suits are more breathable than Tyvek.

Take precautions to avoid exposure by including pre-planning measures for biological hazards prior to starting field work. Avoid habitats where possible, reduce the abundance through habitat disruption or application of acracide. If these controls aren't feasible, contact your local or regional warehouse for preventative equipment such as repellants, protective clothing and tick removal kits. Use the buddy system and perform tick inspections prior to entering the field vehicle. If ticks were not planned to be encountered and are observed, do not continue field work until these controls can be implemented.

See Tick Fact Sheet attached to project safety plan for further precautions and controls to implement when ticks are present. If bitten by a tick, follow the removal procedures found in the tick fact sheet, and call the occupational nurse at 1-866-893-2514.

Be aware of the symptoms of Lyme disease or Rocky Mountain spotted fever (RMSF). Lyme disease is a rash that might appear that looks like a bull's eye with a small welt in the center. RMSF is a rash of red spots under the skin 3 to 10 days after the tick bite. In both RMSF and Lyme disease, chills, fever, headache, fatigue, stiff neck, and bone pain may develop. If symptoms appear, again contact the occupational nurse at 1-866-893-2514.

Be sure to complete an Incident Report (either use the Hours and Incident Tracking System [HITS] system on the VO) if you do come in contact with a tick.

11. Personal Protective Equipment

11.1 Required Personal Protective Equipment

PPE must be worn by employees when actual or potential hazards exist and engineering controls or administrative practices cannot adequately control those hazards.

A PPE assessment has been conducted by the RHSM based on project tasks (see PPE specifications below). Verification and certification of assigned PPE by task is completed by the RHSM in each project safety plan. Below are items that need to be followed when using any form of PPE:

- Employees must be trained to properly wear and maintain the PPE; if you are unsure of how to use or maintain your PPE, ask your RHSM for guidance.
- Employees must be trained in the limitations of the PPE; if you are unsure, ask your RHSM for guidance.
- In work areas where actual or potential hazards are present at any time, PPE must be worn by employees working or walking through the area;
- Areas requiring PPE should be posted or employees must be informed of the requirements in an equivalent manner;
- PPE must be inspected prior to use and after any occurrence to identify any deterioration or damage;
- PPE must be maintained in a clean and reliable condition;
- Damaged PPE shall not be used and must either be repaired or discarded; and
- PPE shall not be modified, tampered with, or repaired beyond routine maintenance.

Each project safety plan will outlines PPE to be used according to task based on project-specific hazard assessment. Long pants and short-sleeve shirts that cover the shoulders, with a minimum three-inch sleeve length, are required to be worn for all field project sites. The minimum PPE typically required for field project sites is: hard hat, safety glasses and safety footwear. The minimum PPE required on construction, operations and maintenance project sites is: hard hat, safety glasses, high visibility vest (when exposed to heavy equipment operations or vehicular traffic), safety footwear and appropriate work gloves.

11.2 Respiratory Protection

Implement the following when using respiratory protection:

- Respirator users must have completed appropriate respirator training within the past 12 months. Level C training is required for air-purifying respirators (APR) use and Level B training is required for supplied-air respirators (SAR) and self-contained breathing apparatus (SCBA) use. Specific training is required for the use of powered air-purifying respirators (PAPR);
- Respirator users must complete the respirator medical monitoring protocol and been approved for the specific type of respirator to be used;
- Tight-fitting facepiece respirator (negative or positive pressure) users must have passed an appropriate fit test within past 12 months;
- Respirator use shall be limited to those activities identified in the safety plan. If site conditions change that alters the effectiveness of the specified respiratory protection, the RHSM shall be notified to amend the written plan;

- Tight-fitting facepiece respirator users shall be clean-shaven and shall perform a user seal check before each use;
- Canisters/cartridges shall be replaced according to the change-out schedule specified in the safety plan. Respirator users shall notify the SL or RHSM of any detection of vapor or gas breakthrough. The SL shall report any breakthrough events to the RHSM for schedule upgrade;
- Respirators in regular use shall be inspected before each use and during cleaning;
- Respirators in regular use shall be cleaned and disinfected as often as necessary to ensure they are maintained in a clean and sanitary condition;
- Respirators shall be properly stored to protect against contamination and deformation;
- Field repair of respirators shall be limited to routine maintenance. Defective respirators shall be removed from service;
- When breathing air is supplied by cylinder or compressor, the SL or RHSM shall verify the air meets Grade D air specifications; and
- The SL or designee shall complete the Self-Assessment Checklist – Respiratory Protection included in the SOP and/or in the safety plan to verify compliance with CH2M's respiratory protection program.

12. Worker Training and Qualification

12.1 JACOBS Worker Training

12.1.1 JACOBS Worker Category Training

All employees shall be assigned a worker category by their supervisor with assistance from the RHSM or SPA based on the type of work activities they are anticipated to perform throughout the year. It is JACOBS policy to require an appropriate level of HSE training for all employees, including contingent workers or contractors under JACOBS supervision, so they can recognize and mitigate workplace hazards and perform their jobs in a safe and environmentally sound manner, and to comply with applicable regulations.

An employee's Worker Category may change based on changing work assignments, and/or the employee may have more than one Worker Category based on assigned work scope or location. If an employee falls into more than one category listed below, or works on a site with multiple hazards (e.g., construction and hazardous waste), they must meet the training requirements for each category.

12.1.2 Hazardous Waste Operations Training

All employees engaging in hazardous waste operations and emergency response (HAZWOPER) activities, as well as site investigations, characterization, remedial action, shall receive appropriate training as required by US regulations 29 CFR 1910.120/29 CFR 1926.65. At a minimum, the training shall have consisted of instruction in the topics outlined in 29 CFR 1910.120/29 CFR 1926.65. JACOBS International Regions will provide HAZWOPER-equivalent training, with concurrence from the Enterprise HSE Training Manager, and to meet any country-specific training related to hazardous waste operations or emergency response. Personnel who have not met these training requirements shall not be allowed to engage in hazardous waste operations or emergency response activities.

12.1.2.1 Initial Training

General site workers engaged in hazardous waste operations shall, at the time of job assignment, have received a minimum of 40 hours of initial health and safety training for hazardous waste site operations, unless otherwise noted in the above-referenced standards.

Employees who may be exposed to health hazards or hazardous substances at treatment, storage, and disposal (TSD) operations shall receive a minimum of 24 hours of initial training to enable the employee to perform their assigned duties and functions in a safe and healthful manner.

Employees engaged in emergency response operations shall be trained to the level of required competence in accordance with the US regulation 29 CFR 1910.120.

12.1.2.2 Three-Day Actual Field Experience

General site workers for hazardous waste operations shall have received three days of actual experience (on-the-job training) under the direct supervision of a trained, qualified supervisor and shall be documented. If the field experience has not already been received and documented at a similar site, this supervised experience shall be accomplished and documented at the beginning of the assignment of the project.

12.1.2.3 Refresher Training

General site workers and TSD workers shall receive 8-hours of refresher training annually (within the previous 12-month period) to maintain qualifications for fieldwork. Employees engaged in emergency response operations shall receive annual refresher training of sufficient content and duration to maintain their competencies or shall demonstrate competency in those areas at least annually.

12.1.2.4 Eight-Hour Supervisory Training

On site management or supervisors who will be directly responsible for, or supervise employees engaged in hazardous waste site operations, will have received at least 8 hours of additional specialized training on managing

such operations. Employees designated as Safety Liaison – Hazardous Waste are considered 8-hour HAZWOPER Site Safety Supervisor trained.

12.1.3 Competent Person

The term "Competent Person" is used in many US (OSHA) and International standards and documents. Generally, a "competent person" is defined as one who, by way of training and/or experience, is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them. Some standards add additional specific requirements which must be met by the competent person.

CH2M's practice is that the employer responsible for directing the means and methods of an activity (typically the employer responsible for actually performing the work) is responsible for designating the qualified competent person for that activity. This is typically a subcontractor or a third party contractor, unless JACOBS is actually self-performing the work. The RHSM will review and accept subcontractor competent persons.

Should JACOBS self-perform work and an employee needs to be designated as a competent person, the JACOBS site or project manager and/or supervisor shall coordinate with the client sector HSE Lead or RHSM to verify that the employee has the requisite training and experience to be identified as the competent person. A competent person designation form must be completed and kept with the project files, along with any accompanying documentation (training, experience) in accordance with SOP HSE-110, Training.

12.1.4 First Aid/Cardiopulmonary Resuscitation

First aid and CPR training consistent with the requirements of a nationally recognized organization such as the Red Cross Association, National Safety Council, or equivalent country organization shall be administered by a certified trainer. A minimum of two personnel per active field operation will have first aid and CPR training. Bloodborne pathogen training located on CH2M's Virtual Office is also required for those designated as first aid/CPR trained.

12.1.5 Safety Liaison Training

SCs are trained to implement the HSE program on JACOBS field projects. A qualified SL is required to be identified in the project safety plan for JACOBS field projects. SCs must also meet the requirements of the worker category appropriate to the type of field project (construction or hazardous waste). In addition, the SCs shall have completed additional safety training required by the specific work activity on the project that qualifies them to implement the HSE program (for example, fall protection, excavation).

12.1.6 Site-Specific Training

Site-specific training will be addressed in the project safety plan. Prior to commencement of field activities, all field personnel assigned to a project will have completed site-specific training that will address the contents of applicable project safety plans, including the activities, procedures, monitoring, and equipment used in the site operations. Site-specific training will also include site and facility layout, potential hazards, risks associated with identified emergency response actions, and available emergency services. This training allows field workers to clarify anything they do not understand and to reinforce their responsibilities regarding safety and work operations for their particular activity.

13. Medical Surveillance and Qualification

All site workers participating in HAZWOPER work will maintain an adequate medical surveillance program in accordance with the Medical Surveillance Enterprise Standard Operating Procedure HSE-113, 29 CFR 1910.120/29 CFR 1926.65 and other applicable OSHA standards or provincial requirements. Documentation of employee medical qualification (e.g., physician's written opinion) will be maintained in the project files and made available for inspection.

13.1 Hazardous Waste Operations and Emergency Response

JACOBS personnel expected to participate in on site HAZWOPER tasks are required to have a current medical qualification for performing this work. Medical qualification shall consist of a qualified physician's written opinion regarding fitness for duty at a hazardous waste site, including any recommended limitations on the employee's assigned work. The physician's written opinion shall state whether the employee has any detected medical conditions that would place the employee at increased risk of material impairment of the employee's health from work in hazardous waste operations or emergency response, or from respirator use.

13.2 Respirator User Qualification

Personnel required to wear respirators must have a current medical qualification to wear respirators. Medical qualification shall consist of a qualified physician's written opinion regarding the employee's ability to safely wear a respirator in accordance with 29 CFR 1910.134 or provincial requirement.

13.3 Hearing Conservation

Personnel working in hazardous waste operations or operations that fall under 29 CFR 1910.95 (in the US), Provincial OH&S Code/Regulations (in Canada) or other country norms, and exposed to noise levels in excess of the 85dBA time-weighted average shall be included in a hearing conservation program that includes annual audiometric testing.

14. Site-Control Plan

14.1 Site-Control Procedures

Site control is established to prevent the spread of contamination throughout the site and to ensure that only authorized individuals are permitted into potentially hazardous areas.

The SL will implement site control procedures including the following bulleted items.

- Establish support, contamination reduction, and exclusion zones. Delineate with flags or cones as appropriate. Support zone should be upwind of the site. Use access control at entry and exit from each work zone.
- Establish onsite communication consisting of the following:
  - Line-of-sight and hand signals;
  - Air horn; and
  - Two-way radio or cellular telephone if available.
- Establish offsite communication.
- Establish and maintain the “buddy system.”

14.2 Remediation Work Area Zones

A three-zone approach will be used to control areas where site contaminants exist. Access will be allowed only after verification of appropriate training and medical qualification. The three-zone approach shall include an EZ, Contamination Reduction Zone (CRZ) and a Support Zone (SZ). The three-zone approach is not required for construction work performed outside contaminated areas where control of site contamination is not a concern.

Specific work control zones shall be established as necessary during task planning. Site work zones should be modified in the field as necessary, based on such factors as equipment used, air monitoring results, environmental conditions, or alteration of work plans. The following guidelines shall be used for establishing and revising these preliminary zone designations.

14.2.1 Support Zone

The SZ is an uncontaminated area (trailers, offices, field vehicles, etc.) that will serve as the field support area for most operations. The SZ provides field team communications and staging for emergency response. Appropriate sanitary facilities and safety and emergency response equipment will be located in this zone. Potentially contaminated personnel/materials are not allowed in this zone. The only exception will be appropriately packaged and decontaminated materials, or personnel with medical emergencies that cannot be decontaminated.

14.2.2 Contamination Reduction Zone

The CRZ is established between the EZ and the SZ, upwind of the contaminated area where possible. The CRZ provides an area for decontamination of personnel, portable handheld equipment and tools, and heavy equipment. In addition, the CRZ serves as access for heavy equipment and emergency support services.

14.2.3 Exclusion Zone

The EZ is where activities take place that may involve exposure to site contaminants and/or hazardous materials or conditions. This zone shall be demarcated to prevent unauthorized entry. More than one EZ may be established if there are different levels of protection to be employed or different hazards that exist in the same work area. The EZ shall be large enough to allow adequate space for the activity to be completed, including field personnel and equipment, as well as necessary emergency equipment.

The EZ shall be demarcated with some form of physical barrier or signage. The physical barrier or signage shall be placed so that they are visible to personnel approaching or working in the area. Barriers and boundary markers shall be removed when no longer needed.

14.2.4 Other Controlled Areas

Other work areas may need to be controlled due to the presence of an uncontrolled hazard, to warn workers of requirements, or to prevent unauthorized entry. Examples include general construction work areas, open excavations, high noise areas, vehicle access areas, and similar activities or limited access locations. These areas shall be clearly demarcated with physical barriers (fencing, cones, reinforced caution tape or rope) as necessary and posted with appropriate signage.

15. Decontamination

Decontamination areas will be established for work in potentially contaminated areas to prevent the spread of contamination. Decontamination areas should be located upwind of the exclusion zone where possible and should consider any adjacent or nearby projects and personnel. The SL must establish and monitor the decontamination procedures and their effectiveness. Decontamination procedures found to be ineffective will be modified by the SC. The SL must ensure that procedures are established for disposing of materials generated on the site.

No eating, drinking, or smoking is permitted in contaminated areas and in exclusion or decontamination zones. The SL should establish areas for eating, drinking, and smoking.

15.1 Contamination Prevention

Preventing or avoiding contamination of personnel, tools, and equipment will be considered in planning work activities at all field locations. Good contamination prevention and avoidance practices will assist in preventing worker exposure and result in a more efficient decontamination process. Procedures for contamination prevention and avoidance include the following:

- Do not walk through areas of obvious or known contamination;
- Do not directly handle or touch contaminated materials;
- Make sure there are no cuts or tears in PPE;
- Fasten all closures in suits and cover them with duct tape, if appropriate;
- Take particular care to protect any skin injuries;
- Stay upwind of airborne contamination, where possible;
- Do not eat or drink in contaminated work areas;
- Do not carry food, beverages, tobacco, or flame-producing equipment into contaminated work areas;
- Minimize the number of personnel and amount of equipment in contaminated areas to that necessary for accomplishing the work;
- Choose tools and equipment with nonporous exterior surfaces that can be easily cleaned and decontaminated;
- Cover monitoring and sampling equipment with clear plastic, leaving openings for the sampling ports, as necessary; and
- Minimize the amount of tools and equipment necessary in contaminated areas.

15.2 Personnel and Equipment Decontamination

Personnel exiting an EZ must ensure that they are not spreading potential contamination into clean areas or increasing their potential for ingesting or inhaling potential contaminants. Personal decontamination may range from removing outer gloves as exiting the EZ, to proceeding through an outer layer doffing station including a boot and glove wash and rinse, washing equipment, etc. Equipment that has come into contact with contaminated media must also be cleaned/decontaminated when it is brought out of the EZ.

15.3 Decontamination During Medical Emergencies

Standard personnel decontamination practices will be followed whenever possible. For emergency life-saving first aid and/or medical treatment, normal decontamination procedures may need to be abbreviated or omitted. In this

situation, site personnel shall accompany contaminated victims to advise emergency response personnel on potential contamination present and proper decontamination procedures.

Outer garments may be removed if they do not cause delays, interfere with treatment, or aggravate the problem. Protective clothing can be cut away. If the outer garments cannot be safely removed, a plastic barrier between the individual and clean surfaces should be used to help prevent contaminating the inside of ambulances or medical personnel. Outer garments can then be removed at the medical facility.

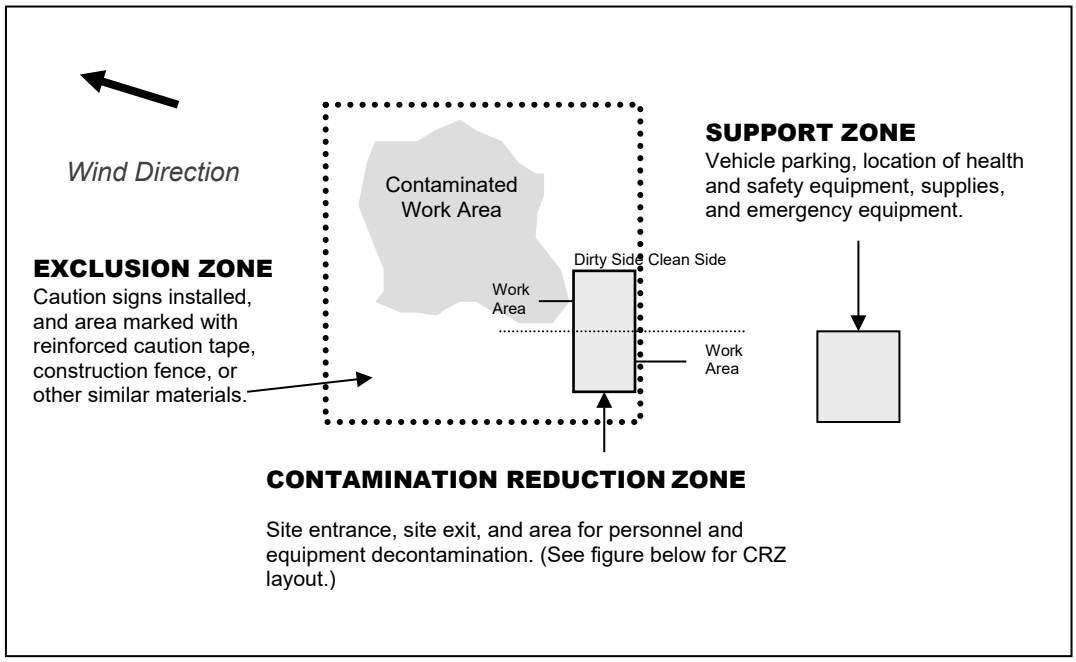
15.4 Waste Collection and Disposal

All contaminated material generated through the personnel and equipment decontamination processes (e.g., contaminated disposable items, gross debris, liquids, sludges) will be properly containerized and labeled, stored at a secure location, and disposed in accordance with the project plans.

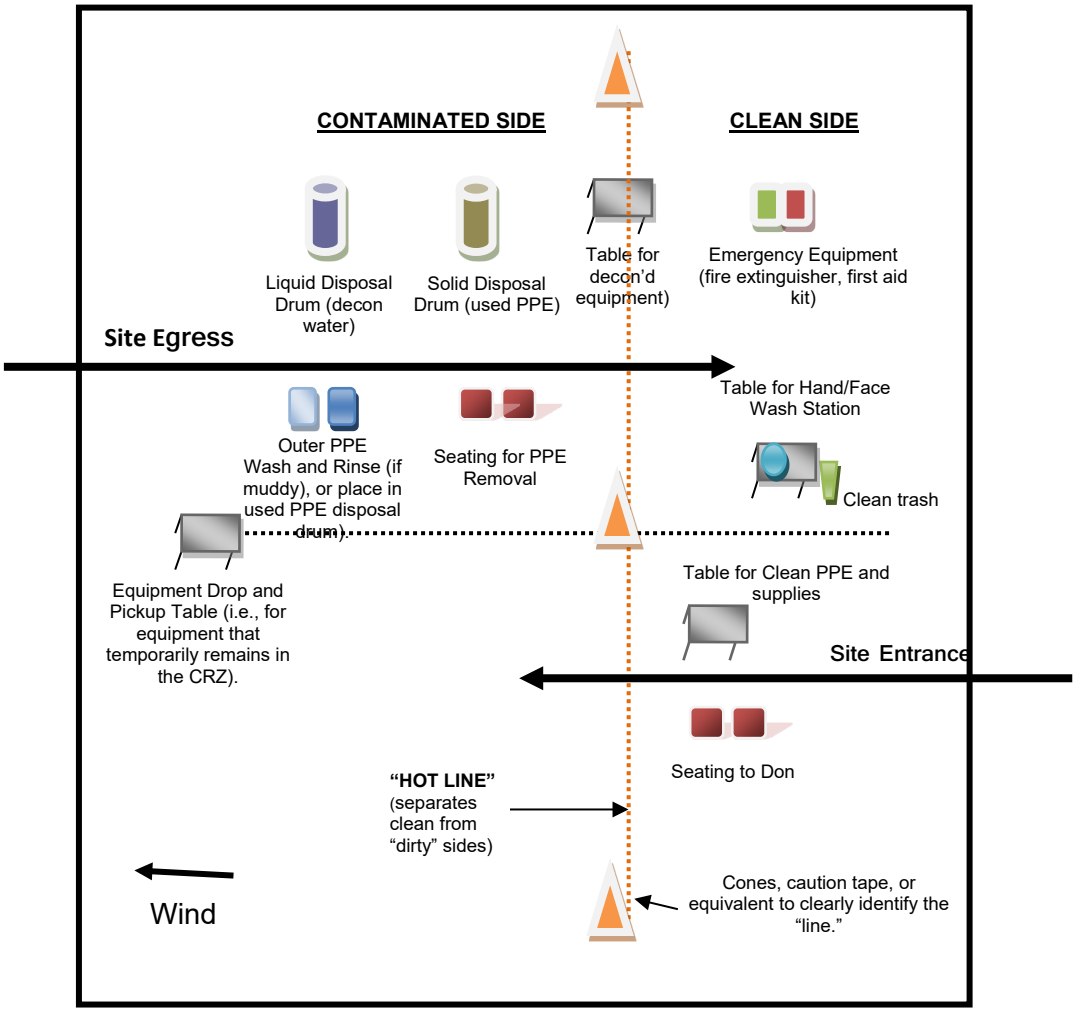
15.5 Diagram of Personnel-Decontamination Line

The following figure illustrates a conceptual establishment of work zones, including the decontamination line. Work zones are to be modified by the SL to accommodate task-specific requirements.

Work Area - Set up appropriately based on wind direction



Typical Contamination Reduction Zone



16. Emergency Preparedness

16.1 Pre-Emergency Planning

The Emergency Response Coordinator (ERC), typically the SL or their designee, performs the applicable pre-emergency planning tasks before starting field activities and coordinates emergency response with JACOBS onsite parties, the facility, and local emergency-service providers as appropriate. Pre-Emergency Planning activities performed by the ERC include:

- Review the facility emergency and contingency plans where applicable;
- Determine what onsite communication equipment is available (two-way radio, air horn);
- Determine what offsite communication equipment is needed (nearest telephone, cell phone);
- Confirm and post the "Emergency Contacts" page and route to the hospital located in this section in project trailer(s) and keep a copy in field vehicles along with evacuation routes and assembly areas. Communicate the information to onsite personnel and keep it updated;
- Field Trailers: Post "Exit" signs above exit doors, and post "Fire Extinguisher" signs above locations of extinguishers. Keep areas near exits and extinguishers clear;
- Review changed site conditions, onsite operations, and personnel availability in relation to emergency response procedures;
- Where appropriate and acceptable to the client, inform emergency room and ambulance and emergency response teams of anticipated types of site emergencies;
- Inventory and check site emergency equipment, supplies, and potable water;
- Communicate emergency procedures for personnel injury, exposures, fires, explosions, and releases;
- Rehearse the emergency response plan before site activities begin. This may include a "tabletop" exercise or an actual drill depending on the nature and complexity of the project. Drills should take place periodically but no less than once a year;
- Brief new workers on the emergency response plan; and
- The ERC will evaluate emergency response actions and initiate appropriate follow-up actions.

16.2 Incident Response

In fires, explosions, or chemical releases, actions to be taken include the following:

- Notify appropriate response personnel;
- Shut down JACOBS operations and evacuate the immediate work area;
- Account for personnel at the designated assembly area(s);
- Assess the need for site evacuation, and evacuate the site as warranted;
- Implement HSE-111, Incident Notification, Reporting and Investigation; and
- Notify and submit reports to clients as required in contract.

Small fires or spills posing minimal safety or health hazards may be controlled with onsite spill kits or fire extinguishers without evacuating the site. When in doubt evacuate. Follow the incident reporting procedures in the "Incident Notification, Reporting, and Investigation" section of this Handbook.

16.3 Emergency Medical Treatment

Emergency medical treatment is needed when there is a life-threatening injury (such as severe bleeding, loss of consciousness, breathing or heart has stopped). When in doubt if an injury is life-threatening or not, treat it as needing emergency medical treatment.

- Notify 911 or other appropriate emergency response authorities as listed in the "Emergency Contacts" page located in this section.
- The ERC will assume charge during a medical emergency until the ambulance arrives or until the injured person is admitted to the emergency room.
- Prevent further injury, perform decontamination (if applicable) where feasible; lifesaving and first aid or medical treatment takes priority.
- Initiate first aid and CPR where feasible.
- Notify supervisor and if the injured person is a JACOBS employee, the supervisor will call the occupational nurse at 1-866-893-2514 and make other notifications as required by HSE SOP-111, *Incident Notification, Reporting and Investigation*.
- Make certain that the injured person is accompanied to the emergency room.
- Follow the Serious Incident Reporting process in HSE SOP-111, Incident Notification, Reporting and Investigation, and complete incident report using the HITS system on the VO or if not feasible, use the hard copy forms provided as an attachment to the project safety plan.
- Notify and submit reports to client as required in contract.

16.4 Evacuation

- Evacuation routes, assembly areas, and severe weather shelters (and alternative routes and assembly areas) are to be specified on the site map.
- Evacuation route(s) and assembly area(s) will be designated by the ERC or designee before work begins.
- Personnel will assemble at the assembly area(s) upon hearing the emergency signal for evacuation.
- The ERC and a "buddy" will remain on the site after the site has been evacuated (if safe) to assist local responders and advise them of the nature and location of the incident.
- The ERC will account for all personnel in the onsite assembly area.
- A designated person will account for personnel at alternate assembly area(s).
- The ERC will follow the incident reporting procedures in the "Incident Notification, Reporting and Investigation" section of this Handbook.

16.5 Evacuation Signals

Signal	Meaning
Grasping throat with hand	Emergency-help me.
Thumbs up	OK; understood.
Grasping buddy's wrist	Leave area now.
Continuous sounding of horn	Emergency; leave site now.

16.6 Inclement Weather

Sudden inclement weather can rapidly encroach upon field personnel. Preparedness and caution are the best defenses. Field crew members performing work outdoors should carry clothing appropriate for inclement weather. Personnel are to take heed of the weather forecast for the day and pay attention for signs of changing weather that indicate an impending storm. Signs include towering thunderheads, darkening skies, or a sudden increase in wind. If stormy weather ensues, field personnel should discontinue work and seek shelter until the storm has passed.

Protective measures during a lightning storm include seeking shelter; avoiding projecting above the surrounding landscape (don't stand on a hilltop—seek low areas); staying away from open water, metal equipment, railroad tracks, wire fences, and metal pipes; and positioning people several yards apart. Some other general precautions include:

- Know where to go and how long it will take to get there. If possible, take refuge in a large building or vehicle. Do not go into a shed in an open area;
- The inclination to see trees as enormous umbrellas is the most frequent and most deadly mistake. Do not go under a large tree that is standing alone. Likewise, avoid poles, antennae, and towers;
- If the area is wide open, go to a valley or ravine, but be aware of flash flooding;
- If you are caught in a level open area during an electrical storm and you feel your hair stand on end, drop to your knees, bend forward and put your hands on your knees or crouch. The idea is to make yourself less vulnerable by being as low to the ground as possible and taking up as little ground space as possible. Lying down is dangerous, since the wet earth can conduct electricity. Do not touch the ground with your hands; and
- Do not use telephones during electrical storms, except in the case of emergency.

Remember that lightning may strike several miles from the parent cloud, so work should be stopped and restarted accordingly. The lightning safety recommendation is 30-30: Seek refuge when thunder sounds within 30 seconds after a lightning flash; and do not resume activity until 30 minutes after the last thunder clap.

High winds can cause unsafe conditions, and activities should be halted until wind dies down. High winds can also knock over trees, so walking through forested areas during high-wind situations should be avoided. If winds increase, seek shelter or evacuate the area. Proper body protection should be worn in case the winds hit suddenly, because body temperature can decrease rapidly.

16.6.1 Tornado Safety

Recognizing imminent tornado signs include seeing an unusually dark sky, possibly with some green or yellow clouds. You may hear a roaring or rumbling sound like a train, or a whistling sound like a jet. Large hail may also be falling. You may be able to see funnels, or they may be hidden by rain or hail.

Listen to your radio for tornado warnings during bad thunderstorms. If a tornado warning is issued, don't panic. Instead, listen and look. Quickly but calmly follow directions for getting to shelter.

Take cover. Indoors you should go down into the basement and crouch down under the stairs, away from windows. Do not take an elevator. If you can't get to a basement, go into a closet or bathroom and pull a mattress over you or sit underneath a sturdy piece of furniture on the ground floor near the center of the building. Pull your knees up under you and protect your head with your hands.

A bad place to be in a tornado is in a building with a large freestanding roof such as a gymnasium, arena, auditorium, church or shopping mall. If you are caught in such a building, take cover under something sturdy.

More than half of tornado deaths occur in mobile homes. If a tornado threatens, get out and go to a building with a good foundation, or lay down in a ditch away from vehicles and other objects.

If you are driving, get to a shelter, lie down in a ditch or seek cover up under the girders of an overpass or bridge. Stay as close to the ground as you can. Protect your head and duck flying debris.

Stay away from metal and electrical equipment because lightning accompanies tornadoes.

If you have time before the tornado strikes, secure objects such as garbage cans and lawn furniture which can injure people. While most tornado damage is a result of the violent winds, most injuries and deaths actually result from flying debris.

16.1 International Travel

It is the employee's responsibility to:

- Book ALL international travel (all modes of transportation and all accommodations) through your local CH2M-approved travel agent. This is essential to keep track of international travelers in times of crisis, and allows for the Travel Department to provide international travelers with up-to-date information regarding safety and security risks associated with their intended destination.
- Advise the in country JACOBS office of your travel arrangements, including local hotel details and itinerary changes. Make changes through the approved travel agency.
- If the country you are visiting is categorized as a high or extreme risk country, complete the high/extreme risk travel form and notify the cognizant Regional Security Manager (RSM).
- Should JACOBS not have an office in the country you are traveling to, advise your home HR contact of your travel arrangements, including your contact details.

If working on an international project site, ensure the HSM and Enterprise Security is involved and has had input into the safety plan, including any precautions for emergency planning and evacuation. Ensure that International SOS (ISOS) contact numbers and instructions are included with the safety plan. A separate security asset protection plan may be advised by Enterprise Security depending on country threat level.

17. Inspections

17.1 Management/Leadership Health, Safety, Security, and Environment Inspections

Management Leadership is an integral part of CH2M's HSE culture. The Management Inspection Checklist is intended to facilitate PM leadership, provide an opportunity for PM's to mentor field staff on HSE and identify any big picture actions that need to be addressed. Observations that would improve global HSE program should also be included on the form. This Checklist does NOT take the place of a formal HSE audit. The PM shall:

- Complete one checklist per month during field work when visiting the site. The PM may delegate completion to the task lead, field team leader, or construction manager if the project is short duration and a visit is not planned for.
- Complete applicable sections of the checklist (can by typed or hand-written). Address issues with the field team, taking the opportunity to mentor staff by identifying the "root cause" of observation (e.g., why are SBOs not being completed, had this hazard been noted by any other team members?).
- E-mail the completed form to the address listed at the bottom of the form, and courtesy copy the Project Delivery Manager, Sector HSE Lead, and RHSM for tracking and review. Original should be kept in the project files.

The results of the site visit should be communicated with the site or project team during the visit. Other forms may be used to document management/leadership site visits.

17.2 Project Activity Self-Assessment Checklists

In addition to the hazard controls specified in this document, Project Activity Self-Assessment Checklists are contained as an attachment to the project safety plan. The Project-Activity Self–Assessment Checklists are based upon minimum regulatory compliance and some site-specific requirements may be more stringent. The objective of the self-assessment process is to identify gaps in project safety performance, and prompt for corrective actions in addressing these gaps. The self-assessment checklists, including documented corrective actions, shall be made part of the permanent project records and maintained by the SC.

The self-assessment checklists will also be used by the SL in evaluating the subcontractors and any client contractors' compliance on site.

17.3 Beyond Zero Observations

(Reference Jacobs Business Management System Work Instruction, JJ-HS-WI-0306-JJ, Beyond Zero Observations (BZO))

BZOs are a tool to document both safe and at-risk observations whether you are in the office or in the field

- It is a tool that can be used for both a planned or an unplanned observation of behaviors or conditions in the work area
- It's a tool for improving leadership, workforce behaviors, and peer to peer communication
- It's a tool to provide positive reinforcement, correct unsafe behaviors or unsafe conditions
- You can also use the SOR tool to document something you witness outside of work hours that others can learn from

BZOs are a required element of our BeyondZero Culture of Caring. As a general rule, the BZO program will be used in place of the legacy CH2M Safe Behavior or Work Observation (SBO/SWO) programs.

Performing an BZO is something that everyone should be considering both in the workplace and outside of the workplace as often as possible. The minimum frequency for submitting an BZO is once per week.

Everyone is asked to participate: all office staff, management, Project Managers, supervisors, Safety Coordinators, and field staff whether in an office, travelling, at a project site or anywhere in between.

After you've discussed the observation with the affected parties (see **note*** below), use the BZO app on your phone or tablet, or use your computer to log onto JacobsConnect and enter the SOR into the system. Once submitted, parts of the BZO cannot be changed, so reach out to your HSSM/EM if you need help entering an Observation. Once submitted, the BZO will be routed to your supervisor (and Project manager if you entered the project number). A feature to this system is you can attach photos.

*** Note**: Entering the correct Worst Potential Severity (WPS) code is important! The WPS code is a way of rating an event based on the likelihood of what could have happened versus what actually happened. **When a WPS of 3, 4, or 5 is indicated, the BZO form is elevated to higher levels of management so please be sure you've notified your HSM, Supervisor, and/or PM of the event prior to submitting an BZO with a WPS of 3 or greater. Likewise, if any follow-up action is needed, regardless of WPS, notify the HSM and/or PM and supervisor.**

Worst Potential Severity Table

WPS	Injury -Illness	Environment	Property Damage
5	Fatality or total permanent disability	Serious offsite impact, significant remediation required	USD$> 3 million
4	Partial disability; life changing; intensive care	Significant offsite impact, some remediation required	USD$ 300K-3 million
3	Urgent treatment, surgery	Release significantly above reportable limit of some local impact	USD$ 30K-300K
2	Medical treatment to prevent deterioration	Release above reportable limit or minor impact	USD$ 3K-30k
1	Simple, immediate treatment	Small release contained onsite and no impact	USD$ less than 3K

How do I complete an BZO?

- **Access Intelex**: Beginning February 17th all Jacobs' employees can access the system through the Intelex portal with Single Sign On (SSO) capability. Additional instructions, including off network access, can be found in the Intelex Getting Started Guide .
- Use the hard copy form attached to this plan.
- BZOs can be chosen by the Center of Excellence (COE) as a winner of the "BZO of the Month."

18. Incident Notification, Reporting, and Investigation

18.1 General Information

This section applies to the following:

- All injuries involving employees, third parties, or members of the public;
- Damage to property or equipment;
- Interruptions to work or public service (hitting a utility);
- Incidents which attract negative media coverage;
- Near misses;
- Spills, leaks, or regulatory violations; and
- Motor vehicle incidents.

Documentation, including incident reports, investigation, analysis and corrective measure taken, shall be kept by the SL and maintained onsite for the duration of the project.

18.2 Section Definitions

Incident: An incident is an event that causes or could have caused undesired consequences. An incident may be caused by natural forces, employees, subcontractors, or third parties in any location associated with JACOBS operations, including offices, warehouses, project sites, private property, or public spaces. Incidents include:

- Injury or illness to a JACOBS employee or subcontractor employee
- Property damage
- Spill or release of hazardous or regulated material
- Environmental or permit violation
- A “near-miss”
- A “near serious injury”
- Other such as a Worker Welfare issue, fire, explosion, bomb threat, workplace violence, or threats

Near Miss: A near-miss occurs when an intervening factor prevented an injury or illness, property damage, spill or release, permit violation or other event from occurring. Examples of near-miss situations include: a hard hat or other personal protective equipment (PPE) prevented an injury; secondary containment or emergency shutoff prevented a spill; or an alert co-worker prevented an incident.

Near Serious Injury Incident: A near serious injury is an incident that could have resulted in a serious injury (as described below) if not for an intervening factor that reduced or eliminated the severity.

Serious Incident

A Serious Incident must be immediately reported to senior management includes:

- Work related death, or life threatening injury or illness of a JACOBS employee, subcontractor, or member of the public;
- Kidnap/missing person;
- Acts or threats of terrorism;
- Event that involves a fire, explosion, or property damage that requires a site evacuation or is estimated to result in greater than $ 500,000 in damage; or

- Spill or release of hazardous materials or substances that involves a significant threat of imminent harm to site workers, neighboring facilities, the community or the environment.

18.3 Incident Notification and Reporting Requirements

All employees and subcontractors' employees shall immediately report any incident in which they are involved or witness verbally to the SL or HS Manager and Field Team Leader/Site Supervisor or PM (including "near misses").

Incident notification is made verbally through both the HSE and the Operations chain of command. Upon notification of an incident, the SL or HS Manager initiates the HSE notification chain, and the Field Team Leader or Supervisor initiates the Operations notification chain.

All recordable incidents and regulatory agency actions are reported up to the Sector President and the HSE Director. Other incident notification is made up the chains to the indicated group depending on the severity, and any project, geographic, or client specific notification and reporting requirements.

For serious injury and near serious injury incidents (JACOBS or JACOBS Subcontractor), the Sector HSE Manager must notify the HSE Director as soon as practical but within two hours of knowledge of the injury, and ensure that a rigorous incident investigation/root cause analysis process is implemented in a timely manner. Also, the incident cause analysis must identify the Plan, Do, Check, Act classification in accordance with Attachment 5 of SOP HSE-111.

If the incident was an environmental permit issue (potential permit non-compliance, other situation that result in a notice of violation) or a spill or release, contact the Project EM immediately so evaluation of reportable quantity requirements and whether agency reporting is required. Spills and releases must be reported without delay because "immediately" has been interpreted in many jurisdictions to mean 15 minutes.

The JACOBS team shall comply with all applicable statutory incident reporting requirements (e.g., OSHA, OH&S (MOL, MOE) the police, or state or Federal environmental agency).

For all Worker Welfare incidents (listed in Policy 113, Worker Welfare, Section 3, Figure 1, The Division of Worker Welfare Issues), JACOBS project worker, subcontractor worker, and third party contractor worker (when JACOBS has health and safety oversight) will be reported to the PM and RHSM, who will contact the Regional Managing Director.

JACOBS project workers, subcontractor workers, and third party Contractor workers when JACOBS has health and safety oversight may submit a confidential concern regarding a Worker Welfare issue through the The Guideline. The issue will be assigned to the RHSM and/or Region HSM.

18.4 Drug and Alcohol Testing for JACOBS Employees

As required by JACOBS Policy 810, employees may be subject to post-incident and reasonable suspicion drug and alcohol testing. The Employee must submit to drug and alcohol testing if the supervisor has a reasonable suspicion, and when any of the following occur:

- Work-related injury in which the Company reasonably believes (under the Reasonable Suspicion provisions in the Policy) that drug and/or alcohol use is a contributing factor;
- Incident resulting in property damage over USD$500 as determined by the Company;
- Injury on or in Company Property/Workplace (to Employee or third parties) involving the Employee's use of heavy machinery as determined by the Company;
- Incident considered to be a serious near-miss injury that occurs in the field or in the office as determined by the Company and where the Company reasonably believes (under the Reasonable Suspicion provisions in the Policy) that drug and/or alcohol use is a contributing factor to the serious near miss injury;
- Other circumstances as dictated by Employee Relations; or

- An Employee contributes to any of the above.

Except in emergencies, the employee must remain available for testing. Failure to remain available will be considered as a refusal to submit to the testing, which will result in disciplinary action. Following the test, if there is no reasonable suspicion, the Employee returns to work. The employee will not be allowed to operate any company vehicle or company equipment, or work in any designated areas, pending the result of the drug and/or alcohol test.

Employees who are required to submit to reasonable suspicion testing are prohibited from transporting themselves to or from the collection site. The supervisor will arrange for transportation; the employee will be transported by a JACOBS staff member. The employee must remain under the direct observation of the supervisor until turned over to the transporter. The employee will not be allowed to eat or drink unless instructed by the collector as this may hinder or decrease the company's ability to obtain a valid sample once the drug and/or alcohol test is administered.

After returning from the collection site, the employee must make arrangements to be transported home or to his/her residence. Supervisors must contact local authorities if an employee insists on driving a vehicle. Pending receipt of the drug and alcohol test results, the employee may not return to work.

18.5 Drug and Alcohol Testing for Subcontractors

The drug and alcohol testing requirements stated above apply to subcontractors when required by the subcontract.

18.6 Intelex System and Incident Report Form

The RHSM or EM shall complete an entry into the Intelex system located on JacobsConnect. The SL shall summarize or use the hard copy Incident Report Form and Root Cause Analysis Form (attached to this plan) and forward it to the RHSM within 24 hours.

18.7 Injury Management/Return-to-Work (for US/Puerto Rico based BIAF Jacobs Staff Only)

18.7.1 Background

The Injury Management Program has been established to provide orderly, effective and timely medical treatment and return-to-work transition for an employee who sustains a work-related injury or illness. It also provides guidance and assistance with obtaining appropriate treatment to aid recovery, keep supervisors informed of employee status, and to quickly report and investigate work-related injury/illnesses to prevent recurrence.

To implement the Injury Management Program successfully, supervisors and/or SL should:

- Ensure employees are informed of the Program;
- Become familiar with the Notification Process (detailed below); and
- Post the Injury Management Program Poster.

18.7.2 The Injury Care for Employees Notification Process:

In the event of an injury, or potential injury (i.e., involvement in motor vehicle collision with no apparent injury; a puncture wound with no bleeding or apparent infection, etc.), the following actions shall be taken:

- Employee informs their supervisor.
- Employee calls the Injury Management Program toll free number 1-888-449-7787 immediately and speaks with the Occupational Injury Nurse. This number is operable 24 hours per day, 7 days a week. **Employees are encouraged to enter this phone number into their cell phones prior to starting field work.**
- Supervisor ensures employee immediately calls the Injury Management Program number. Supervisor makes the call with the injured worker or for the injured worker, if needed.

- Nurse assists employee with obtaining appropriate medical treatment, as necessary schedules clinic visit for employee (calls ahead, and assists with any necessary follow up treatment). The supervisor or SL accompanies the employee if a clinic visit is necessary to ensure that employees receive appropriate and timely care.
- SL or designee shall verbally notify the RHSM and PM. The SL or designee may use the hardcopy Incident Report attached to this plan to forward to the RHSM for Intelex entry. RHSM completes the Intelex entry within 24 hours.
- Nurse notifies appropriate Jacobs staff by e-mail (supervisor, Health & Safety, Human Resources, Workers' Compensation).
- Nurse communicates and coordinates with and for employee on treatment through recovery.
- Supervisor and/or PM ensures suitable duties are identified and available for injured or ill workers who are determined to be medically fit to return to work on transitional duty (temporary and progressive).
- Supervisor and/or PM ensures medical limitations prescribed (if any) by physician are followed until the worker is released to full duty.

18.8 Serious Incident Reporting Requirements

The serious incident reporting requirements ensures timely notification and allows for positive control over flow of information so that the incident is handled effectively, efficiently, and in conjunction with appropriate corporate entities. This standard notification process integrates HSE and Firm Wide Security Operations requirements for the consistent reporting of and managing of serious events throughout our operations.

18.8.1 Serious Incident Determination

The following are general criteria for determining whether an incident on JACOBS owned or managed facilities or program sites is considered serious and must be immediately reported up to Group President level through the reporting/notification process:

- Work related death, or life threatening injury or illness of a JACOBS employee, subcontractor, or member of the public;
- Kidnap or missing person;
- Acts or threats of terrorism;
- Event that involves a fire, explosion, or property damage that requires a site evacuation or is estimated to result in greater than $ 500,000 in damage; or
- Spill or release of hazardous materials or substances that involves a significant threat of imminent harm to site workers, neighboring facilities, the community or the environment.

18.8.2 Serious Incident Reporting

If an incident meets the "Serious Incident" criteria, the Project Manager is to immediately contact the Crisis Manager at 443-221-6281, then follow the standard incident reporting procedure.

For all serious incidents this standard reporting process is implemented immediately so as to ultimately achieve notification to the Business Group President within 2 hours of incident onset or discovery, and notification to appropriate corporate Crisis Management Support Team.

Ontario and Alberta have additional serious incident reporting requirements; refer to your health and safety plan for details or speak to your health and safety manager.

18.9 Cause Analysis/Incident Investigation

The sector conducts incident investigations to determine how an incident happened, to identify the root causes, and to prevent recurrence by implementing corrective actions.

All incidents must be investigated, and the investigation must be based on facts that clearly identify the sequence of events and the factors that contributed to the incident to determine the immediate and basic causes.

In accordance with the SOP, a Root Cause Analysis (RCA) is completed for all recordable incidents, serious injuries/near serious injuries, property damage incidents in excess of $5,000.00 (U.S.), environmental permit violations, spills and releases, which are required to be reported to regulatory agencies, and any other incident, including near misses, where the HSE Manager/RHSM or PM determines a RCA is appropriate.

A RCA must be completed using the process or equivalent described in Attachment 5 of the SOP. The incident investigation team should include the HSE Manager/RHSM or designee, the involved party(ies), a responsible operations representative (e.g. PM, construction Manager, crew supervisor, etc.), and an independent management representative not associated with the incident.

During the incident investigation phase, one of the tools that can be used is the Det Norske Veritas (DNV) Systematic Cause Analysis Technique (SCAT) chart. The chart consistently identifies direct and root causes and facilitates tracking and trending areas for improvement. By using a consistent cause analysis system, trending can be performed for individual projects, programs, Sectors or regions as needed. The SCAT chart can be used along with any client-required cause analysis system, or other common cause analysis techniques such as the “5-WHYS.”

Recordable injury and near serious injury incidents must include identifying the Plan, Do, Check, Act incident cause(s).

The HSE Manager/RHSM/REM makes certain that an investigation is complete and results are entered into HITS.

Investigation information, including the results of a RCA, is entered into the applicable evaluation sections in HITS, such as the immediate cause(s), root cause(s), and corrective action(s). When corrective actions are verified as completed, the HITS should be closed by the HSE Manager/RHSM/EM. Non-crisis investigations will be documented by updating the HITS incident report and describing the investigation facts in the Evaluation sections.

19. Records and Reports

An organized project filing system is essential for good documentation and recordkeeping. There are many benefits to an organized filing system:

- Other JACOBS employees can easily and quickly find documents;
- Records are readily available for review;
- Records may be needed during regulatory agency investigations, audits, or other legal matters;
- Records may be needed on short notice in case of an injury, illness or other emergency; and
- Systematic recordkeeping aids in overall project organization.

The project filing system shall be established at the beginning of the project and maintained throughout all phases of construction and archived in accordance with JACOBS's Records Retention Policy. The information contained in the filing system shall be updated regularly and/or as specified in this document. The PM and SL are responsible for collecting documentation, including subcontractor documentation, and maintaining a complete and organized filing system.

Below are examples of records that must be maintained as the project progresses:

- Exposure records includes air monitoring data (including calibration records), SDSs, exposure modeling results;
- Physical hazard exposure records include noise, ionizing radiation, non-ionizing radiation, vibration, and lasers exposure assessments and measurements;
- Respiratory fit test records;
- Training records;
- Incident reports, investigations and associated back-up information such as agency notifications, calculations, and corrective actions taken;
- Federal, provincial, or state agency inspection records;
- Waste analytical data;
- Waste profiles;
- Manifests;
- Permit inspection records;
- Agency submittals and reports;
- Certifications [such as Notice(s) of Intent, state-required erosion and sediment control inspector certifications, Stormwater Pollution Prevention Plan (if permit requires certification), and discharge, wastewater, and monitoring data];
- Other Records:
    - Ergonomic evaluations;
    - HSE audits and assessments;
    - Project-specific HSE plans;
    - Confined space entry permits;
    - Equipment inspections;

  - Equipment maintenance;
  - Emergency equipment inspection records;
  - SBOs;
  - Self-assessment checklists

- The RHSM shall coordinate with the PM or designee to ensure that final project-specific HSE records described in this section, including negative exposure determinations, are maintained with the project files in accordance with the JACOBS records retention schedule, or forwarded to the Medical Surveillance Program Administrator, as appropriate.

JACOBS Employee Sign-Off

I hereby acknowledge that I have received, read, understand, and will comply with this Handbook.

Name (printed):_____

Signature: _____

Employee Number (GEN):_____

Date:_____

Make a photo copy or scan and send this completed sign-off page to your JACOBS Safety Program Assistant (SPA).

Subcontractor Sign-Off

JACOBS HSE FIELD HANDBOOK

The JACOBS subcontractors listed below have been provided with this Handbook, have read and understand it, and agree to abide by its provisions.

This sign-off sheet shall be maintained with the project safety plan.

Project Name: **Project Number:**

EMPLOYEE NAME (Please print)	**EMPLOYEE SIGNATURE**	**COMPANY**	**DATE**

JACOBS Health and Safety Plan

Attachment 2

Chemical Inventory/Register Form

JACOBS

CHEMICAL INVENTORY/REGISTER FORM

Refer to SOP HSE-107, Attachment 1, for instructions on completing this form.

Location:

HCC:

☐ Office ☐ Warehouse ☐ Laboratory ☐ Project:

Project No.:

Regulated Product	Location	Container labeled (✓if yes)	SDS available (✓if yes)

SDS for the listed products will be maintained at:

JACOBS Health and Safety Plan

Attachment 3

Chemical-Specific Training Form

JACOBS

CHEMICAL-SPECIFIC TRAINING FORM

Refer to SOP HSE-107 Attachment 1 for instructions on completing this form.

Location:	Project # :
HCC:	Trainer:

TRAINING PARTICIPANTS:

NAME	SIGNATURE	NAME	SIGNATURE

REGULATED PRODUCTS/TASKS COVERED BY THIS TRAINING:

The HCC shall use the product SDS to provide the following information concerning each of the products listed above.

☐ Physical and health hazards

☐ Control measures that can be used to provide protection (including appropriate work practices, emergency procedures, and personal protective equipment to be used)

☐ Methods and observations used to detect the presence or release of the regulated product in the workplace (including periodic monitoring, continuous monitoring devices, visual appearance or odor of regulated product when being released, etc.)

Training participants shall have the opportunity to ask questions concerning these products and, upon completion of this training, will understand the product hazards and appropriate control measures available for their protection.

Copies of SDSs, chemical inventories, and CH2M written hazard communication program shall be made available for employee review in the facility/project hazard communication file.

JACOBS Health and Safety Plan

Attachment 4

Project Activity Self-Assessment Checklists/Permits/Forms

Biological Safety

Boat Safety Checklist

Hand and Power Tools

Heat stress physiological monitoring form

Hazardous Material Handling

Manual Lifting

Personal Protective Equipment

HS&E Self-Assessment Checklist—Biological Prevention Measures

JACOBS

HS&E Self-Assessment Checklist

This checklist shall be used by personnel and shall be completed by each crew entering the work area at the frequency of one per day or otherwise specified in the project's Health and Safety Plan/Field Safety Instruction (HSP/FSI). The checklist should be completed prior to entry and at the end of the day to document that appropriate checks have been completed.

This checklist is to be used at locations where the possibility exists that contact with biological hazards is possible.

Site Safety Coordinator (SSC) will request any JACOBS subcontractor to take necessary precautions in eliminating the exposure to biological hazards, but shall not direct the means and methods.

Project Name: _____ Project No.: _____
Location: _____ PM: _____
Auditor: _____ Title: _____ Date: _____

- Check "Yes" if an assessment item is complete or correct.
- Check "No" if an item is incomplete or deficient. Section 2 must be completed for all items checked "No."
- Check "N/A" if an item is not applicable.
- Check "N/O" if an item is applicable but was not observed during the assessment.

SECTION 1 – PRE-ENTRY	Yes	No	N/A	N/O
SITE HAZARD EVALUATION				
1. Inform field members of hazards (types, symptoms)	☐	☐	☐	☐
2. Can work be completed without entering the work zone	☐	☐	☐	☐
3. Have controls been implemented where possible (clearing vegetation, spraying)	☐	☐	☐	☐
4. Has an inspection been made to identify nests, hives or areas where insects may concentrate	☐	☐	☐	☐
5. Will working at different time will reduce exposure	☐	☐	☐	☐
SENSATIVITIES				
6. Does any staff have existing reactions to stings or bites	☐	☐	☐	☐
7. If yes to #6, is special required and medication available on site (epi-pen)	☐	☐	☐	☐
8. Has anyone with an existing condition briefed other team members about symptoms and first aid which may be required	☐	☐	☐	☐
EMERGENCY RESPONSE				
9. Are first aid kits, along with tick removal kits, readily available to all staff	☐	☐	☐	☐
10. Does each member of the field staff have ability to communicate (phone, radios, and visual)	☐	☐	☐	☐
11. Are emergency contacts available (base emergency, local police, or local EMT	☐	☐	☐	☐
12. If working in remote areas, is transport readily available (less than 5 minutes)	☐	☐	☐	☐
13. Have you planned an emergency exit from the site in the event of a swarm	☐	☐	☐	☐

SECTION 2 - PPE	Yes	No	N/A	N/O
SELECTION OF PPE				
14. Will weather (heat, rain, ice) impact the safety of workers wearing protective suits	☐	☐	☐	☐
15. Will visibility be limited to unacceptable levels if a hood is worn	☐	☐	☐	☐
16. Will the use of equipment be difficult if a suit is worn	☐	☐	☐	☐
17. Will heavy vegetation be encountered that could rip or damage a suit	☐	☐	☐	☐
18. Will a Bug-Out suit or Tyvek suit be used by staff (if not, please give additional rationale in writing in Section 4)	☐	☐	☐	☐
TYPE OF PPE USED OTHER THAN BUG-OUT OR TYVEK SUIT				
19. Is staff wearing light-colored clothes	☐	☐	☐	☐
20. Is staff wearing long sleeve shirts	☐	☐	☐	☐
21. Are pant legs tucked into socks	☐	☐	☐	☐
22. Are shirts tucked into pants	☐	☐	☐	☐
23. Has tape been placed around sock/pant leg line and around waist	☐	☐	☐	☐
24. Have hand and wrist areas been sealed	☐	☐	☐	☐
25. Are hats being worn	☐	☐	☐	☐
26. Have clothes been pre treated with Permethrin	☐	☐	☐	☐
27. Has team member inspected coworker's suits or clothing to ensure no spaces exist for insects to penetrate	☐	☐	☐	☐

SECTION 3 – CHECKS AND DECONTAMINATION	Yes	No	N/A	N/O
DAILY CHECKS (TO BE COMPLETED DURING AND AT END OF DAY)				
28. Were tick/insect checks performed during the day (if not, please provide reason in Section 4)	☐	☐	☐	☐
29. Was one unclothed tick check completed	☐	☐	☐	☐
30. Were ticks found on the outerwear (if yes, please note the number in Section 4)	☐	☐	☐	☐
31. Were ticks found inside the Bug-Out, Tyvek, or personal clothing	☐	☐	☐	☐
32. Were suits turned inside out and inspected prior to putting away	☐	☐	☐	☐
33. Were showers taken by field staff immediately upon arrive from the field	☐	☐	☐	☐
34. Were clothing placed in a garbage bag and sealed to prevent any insects from spreading	☐	☐	☐	☐
35. If ticks were found embedding in skin, were they properly removed and saved	☐	☐	☐	☐
36. Have vehicles been inspected for ticks on a daily basis and before the vehicle is turned in	☐	☐	☐	☐
REPORTING				
37. If a tick was found on your skin, could you tell where it entered so that it could be addressed	☐	☐	☐	☐
38. If a tick was found embedded, did you contact the PM, complete a HITS form and contact the Occupational Physician at 1-866-893-2514	☐	☐	☐	☐
39. Did you contact field staff on the project to provide potential corrective measures	☐	☐	☐	☐
40. Did you follow the IM/RTW procedure to ensure you received the proper medical attention (if not, provide an explanation in Section 4)	☐	☐	☐	☐

SECTION 4

Complete this section for all items where further information was requested in the previous sections.

Item #	Rationale	Corrected (either next day or intended on future projects)

Auditor: ______________________________ Project Manager: ___________________________

JACOBS

Health and Safety Self Assessment Checklist-BOATS

This self assessment is only to be used at locations where JACOBS controls the work. It is not to be used at locations where others control the work.

Project Name: _____ Project No.: _____

Location: _____ PM: _____

Auditor: _____ Title: _____ Date: _____

If an assessment item is complete/correct the "Yes" box should be checked. If an item is incomplete or deficient the "No" box should be checked. Items that are considered to be imminently dangerous must be corrected immediately or all exposed personnel must be removed from the hazard. All deficiencies shall be brought to the attention of the appropriate party that is responsible for correcting the deficiency. If an item is not applicable, the "N/A" box should be checked. If an item is applicable but was not observed during the assessment, the "N/O" box should be checked.

	Yes	No	NA	N/O
GENERAL				
1. Weather forecast checked.	☐	☐	☐	☐
2. At Least one Team Member is trained in First Aid/CPR.	☐	☐	☐	☐
3. Lights, horn, battery, fuel, steering, bilge pump, anchor & propeller checked.	☐	☐	☐	☐
4. Daily safety briefing/meeting conducted with crew	☐	☐	☐	☐
5. Personal Floatation Devices (PFD's) inspected daily.	☐	☐	☐	☐
6. Fire extinguisher available, charged and accessible.	☐	☐	☐	☐
7. First aid kit available	☐	☐	☐	☐
8. Project Instructions and H&S Plan available	☐	☐	☐	☐
9. Potable water available	☐	☐	☐	☐
10. Sunscreen & Bug Spray available	☐	☐	☐	☐
11. Distress communications available (flare gun, air horn, Cell phone, CB)	☐	☐	☐	☐
12. An oar is available on board the boat in the event of mechanical failure	☐	☐	☐	☐
BOAT TRANSPORT				
13. Boat motor secured prior to boat transport	☐	☐	☐	☐
14. Turn signals and brake lights verified as operable.	☐	☐	☐	☐
15. Safety chains available on trailer and secured in a criss-cross fashion	☐	☐	☐	☐
16. Trailer winch engaged	☐	☐	☐	☐
17. Ball hitch seated and latch pin installed	☐	☐	☐	☐
18 Tools and equipment secured prior to boat movement	☐	☐	☐	☐
19 Personnel not allowed ride on boat as it is being towed	☐	☐	☐	☐
20. Safe distance is maintained with traveling around power lines	☐	☐	☐	☐
21. Backup alarm or spotter used when backing boat	☐	☐	☐	☐
22. Boat is unhitched on a level and stabile surface	☐	☐	☐	☐
BOAT OPERATION				
23. Boat holds appropriate size load	☐	☐	☐	☐
24. Personnel cleared during boat start-up	☐	☐	☐	☐
25. Kill switch clearly identified and operational	☐	☐	☐	☐
26. Personnel wearing appropriate PPE	☐	☐	☐	☐
27. All personnel wearing PFD's	☐	☐	☐	☐
28. Boat will not be used for recreational purposes	☐	☐	☐	☐

JACOBS

Attachment 1: Subcontractor Safety Procedure Criteria-Hand and Power Tools

The following criteria are not intended to be all-inclusive, but are provided as a tool to facilitate development and review of subcontractor hand and power tool procedures. Subcontractors are expected to address the following items in their safety procedures.

Minimum Acceptable Criteria for Subcontractor Hand and Power Tool Safety Procedures:

1. Describe the method of training and qualifying personnel in the use of powder-actuated tools if such tools are to be used on the project.
2. Provide safe work practice guidelines on use and limitations for the types of hand and power tools to be used.
3. Provide a list of the types, work areas, and activities where special hand and power tools will be used.
4. Describe plans for the inspection of hand and power tools prior to introducing such tools to the work environment (i.e., tools brought on site by equipment rental vendors, home office storage facilities/yards, new purchases, employee supplied, etc.).
5. Provide a description of hand and power tool inspection criteria or procedures (frequency of inspections and items that are inspected).

The following safety procedures criteria, specifically applies to chain saw operations:

6. Provide qualifications of chainsaw operators (training, years and type of experience, etc.)
7. Describe personal protective equipment to be used by chain saw operators.
8. Describe safety equipment to be provided to ensure safe chain saw operation.
9. Describe inspection criteria or procedures (frequency of inspections per work shift, as needed throughout day; visual versus written inspections; items that are inspected).
10. Describe safe work practices (safe operation, refueling, maintenance, transport).
11. Describe methods of avoiding contact with overhead power-lines (contacting utilities, de-energizing and grounding, insulating, safe clearance distances).
12. Describe methods of protecting the public and others onsite (barricading, danger zone established, traffic control, etc.).
13. Describe safe work practices or procedures for the specific work to be performed (tree feeling, limbing standing trees, limbing fallen trees, bucking trees, etc.).

JACOBS

Attachment 2 - HSE Self-Assessment Checklist—HAND AND POWER TOOLS Page 1 of 4

This checklist shall be used by JACOBS personnel **only** and shall be completed at the frequency specified in the project's HSP/FSI.

This checklist is to be used at locations where: (1) JACOBS employees are exposed to hand and power tool hazards and/or (2) JACOBS provides oversight of subcontractor personnel who are exposed to hand and power tool hazards.

SC may consult with subcontractors when completing this checklist, but shall not direct the means and methods of hand and power tool use nor direct the details of corrective actions. Subcontractors shall determine how to correct deficiencies and we must carefully rely on their expertise. Items considered being imminently dangerous (possibility of serious injury or death) shall be corrected immediately or all exposed personnel shall be removed from the hazard until corrected.

Project Name: _____ Project No.: _____

Location: _____ PM: _____

Auditor: _____ Title: _____ Date: _____

This specific checklist has been completed to:

☐ Evaluate JACOBS employee exposure to hand and power tool hazards.
☐ Evaluate a JACOBS subcontractor's compliance with hand and power tool requirements.
Subcontractors Name: _____

- Check "Yes" if an assessment item is complete/correct.
- Check "No" if an item is incomplete/deficient. Deficiencies shall be brought to the immediate attention of the subcontractor. Section 3 must be completed for all items checked "No."
- Check "N/A" if an item is not applicable.
- Check "N/O" if an item is applicable but was not observed during the assessment.

Numbers in parentheses indicate where a description of this assessment item can be found in Standard Operating Procedure HSE-210.

SECTION 1

	Yes	No	N/A	N/O
SAFE WORK PRACTICES (5.1)				
1. All tools operated according to manufacturer's instructions and design limitations.	☐	☐	☐	☐
2. All hand and power tools maintained in a safe condition and inspected and tested before use.	☐	☐	☐	☐
3. Defective tools are tagged and removed from service until repaired.	☐	☐	☐	☐
4. PPE is selected and used according to tool-specific hazards anticipated.	☐	☐	☐	☐
5. Power tools are not carried or lowered by their cord or hose.	☐	☐	☐	☐
6. Tools are disconnected from energy sources when not in use, servicing, cleaning, etc.	☐	☐	☐	☐
7. Safety guards remain installed or are promptly replaced after repair.	☐	☐	☐	☐
8. Tools are stored properly.	☐	☐	☐	☐
9. Cordless tools and recharging units both conform to electrical standards and specifications.	☐	☐	☐	☐
10. Tools used in explosive environments are rated for such use.	☐	☐	☐	☐
11. Knives/open blade tools only used when approved with written precautions, PPE, and training	☐	☐	☐	☐
12. Consider controls to avoid muscular skeletal, repetitive motion, and cumulative trauma stressors.	☐	☐	☐	☐

SECTION 2	Yes	No	N/A	N/O
GENERAL (5.2.2)				
13. PPE is selected and used according to tool-specific hazards anticipated.	☐	☐	☐	☐
14. Tools are tested daily to assure safety devices are operating properly.	☐	☐	☐	☐
15. Damaged tools are removed from service until repaired.	☐	☐	☐	☐
16. Power operated tools designed to accommodate guards have guards installed.	☐	☐	☐	☐
17. Rotating or moving parts on tools are properly guarded.	☐	☐	☐	☐
18. Machines designed for fixed locations are secured or anchored.	☐	☐	☐	☐
19. Floor and bench-mounted grinders are provided with properly positioned work rests.	☐	☐	☐	☐
20. Guards are provided at point of operation, nip points, rotating parts, etc.	☐	☐	☐	☐
21. Fluid used in hydraulic-powered tools is approved fire-resistant fluid.	☐	☐	☐	☐
ELECTRIC-POWERED TOOLS (5.2.3)				
22. Electric tools are approved double insulated or grounded and used according to SOP HSE-206.	☐	☐	☐	☐
23. Electric cords are not used for hoisting or lowering tools.	☐	☐	☐	☐
24. Electric tools are used in damp/ wet locations are approved for such locations or GFCI installed.	☐	☐	☐	☐
25. Hand-held tools are equipped with appropriate on/off controls appropriate for the tool.	☐	☐	☐	☐
26. Portable, power-driven circular saws are equipped with proper guards.	☐	☐	☐	☐
ABRASIVE WHEEL TOOLS (5.2.4)				
27. All employees using abrasive wheel tools are wearing eye protection.	☐	☐	☐	☐
28. All grinding machines are supplied with sufficient power to maintain spindle speed.	☐	☐	☐	☐
29. Abrasive wheels are closely inspected and ring-tested before use.	☐	☐	☐	☐
30. Grinding wheels are properly installed.	☐	☐	☐	☐
31. Cup-type wheels for external grinding are protected by the proper guard or flanges.	☐	☐	☐	☐
32. Portable abrasive wheels used for internal grinding are protected by safety flanges.	☐	☐	☐	☐
33. Safety flanges are used only with wheels designed to fit the flanges.	☐	☐	☐	☐
34. Safety guards on abrasive wheel tools are mounted properly and of sufficient strength.	☐	☐	☐	☐
PNEUMATIC-POWERED TOOLS (5.2.5)				
35. Tools are secured to hoses or whip by positive means to prevent disconnection.	☐	☐	☐	☐
36. Safety clips or retainers are installed to prevent attachments being expelled.	☐	☐	☐	☐
37. Safety devices are installed on automatic fastener feed tools as required.	☐	☐	☐	☐
38. Compressed air is not used for cleaning unless reduced to < 30 psi, with PPE, and guarded.	☐	☐	☐	☐
39. Manufacturer's safe operating pressure for hoses, pipes, valves, etc. are not exceeded.	☐	☐	☐	☐
40. Hoses are not used for hoisting or lowering tools.	☐	☐	☐	☐
41. All hoses >1/2-inch diameter have safety device at source to reduce pressure upon hose failure.	☐	☐	☐	☐
42. Airless spray guns have required safety devices installed.	☐	☐	☐	☐
43. Blast cleaning nozzles are equipped with operating valves, which are held open manually.	☐	☐	☐	☐
44. Supports are provided for mounting nozzles when not in use.	☐	☐	☐	☐
45. Air receiver drains, handholes, and manholes are easily accessible.	☐	☐	☐	☐
46. Air receivers are equipped with drainpipes and valves for removal of accumulated oil and water.	☐	☐	☐	☐
47. Air receivers are completely drained at required intervals.	☐	☐	☐	☐
48. Air receivers are equipped with indicating pressure gauges.	☐	☐	☐	☐
49. Safety, indicating, and controlling devices are installed as required.	☐	☐	☐	☐
50. Safety valves are tested frequently and at regular intervals to assure good operating condition.	☐	☐	☐	☐

SECTION 2 (continued)

	Yes	No	N/A	N/O
LIQUID FUEL-POWERED TOOLS (5.2.6)				
51. Liquid fuel-powered tools are stopped when refueling, servicing, or maintaining.	☐	☐	☐	☐
52. Liquid fuels are stored, handled, and transported in accordance with SOP HSE-403	☐	☐	☐	☐
53. Liquid fuel-powered tools are used in confined spaces in accordance with SOP HSE-203.	☐	☐	☐	☐
54. Safe operating pressures of hoses, valves, pipes, filters, and other fittings are not exceeded.	☐	☐	☐	☐
POWDER-ACTUATED TOOLS (5.2.7)				
55. Only trained employee operates powder-actuated tools.	☐	☐	☐	☐
56. Powder-actuated tools are not loaded until just prior to intended firing time.	☐	☐	☐	☐
57. Tools are not pointed at any employee at any time.	☐	☐	☐	☐
58. Hands are kept clear of open barrel end.	☐	☐	☐	☐
59. Loaded tools are not left unattended.	☐	☐	☐	☐
60. Fasteners are not driven into very hard or brittle materials.	☐	☐	☐	☐
61. Fasteners are not driven into easily penetrated materials unless suitable backing is provided.	☐	☐	☐	☐
62. Fasteners are not driven into spalled areas.	☐	☐	☐	☐
63. Powder-actuated tools are not used in an explosive or flammable atmosphere.	☐	☐	☐	☐
64. All tools are used with correct shields, guards, or attachments recommended by manufacturer.	☐	☐	☐	☐
JACKING TOOLS (5.2.8)				
65. Rated capacities are legibly marked on jacks and not exceeded.	☐	☐	☐	☐
66. Jacks have a positive stop to prevent over-travel.	☐	☐	☐	☐
67. The base of jacks are blocked or cribbed to provide a firm foundation, when required.	☐	☐	☐	☐
68. Wood blocks are place between the cap and load to prevent slippage, when required.	☐	☐	☐	☐
69. After load is raised, it is cribbed, blocked, or otherwise secured immediately.	☐	☐	☐	☐
70. Antifreeze is used when hydraulic jacks are exposed to freezing temperatures.	☐	☐	☐	☐
71. All jacks are properly lubricated.	☐	☐	☐	☐
72. Jacks are inspected as required.	☐	☐	☐	☐
73. Repair or replacement parts are examined for possible defects.	☐	☐	☐	☐
74. Jacks not working properly are removed from service and repaired or replaced.	☐	☐	☐	☐
75. Wrenches are not used when jaws are sprung to the point of slippage.	☐	☐	☐	☐
76. Impact tools are kept free of mushroomed heads.	☐	☐	☐	☐
77. Wooden handles of tools are kept free of splinters or cracks and are tightly fitted in tool.	☐	☐	☐	☐
78. Cutting tools maintained and used following requirements in AHA or procedure	☐	☐	☐	☐
CHAIN SAWS (5.2.10)				
79. Chainsaw equipped with spark arrestor and fully functioning chain brake	☐	☐	☐	☐
80. Chainsaw operator's manual readily available	☐	☐	☐	☐
81. Fully stocked first aid kit and multipurpose fire extinguisher available	☐	☐	☐	☐
82. Appropriate personal protective equipment available and worn	☐	☐	☐	☐
83. Clothing free of loose edges that could become entangled in the saw	☐	☐	☐	☐
84. Chainsaw handles kept dry, clean, and free of oil or fuel mixture	☐	☐	☐	☐
85. Chainsaws held firmly with both hands and used right-handed	☐	☐	☐	☐
86. Operator standing to the left of the saw out of the plane of the chain	☐	☐	☐	☐
87. Saw used between the waist and mid-chest level	☐	☐	☐	☐
88. Full throttle maintained while cutting	☐	☐	☐	☐
89. Operator aware of position of guide bar tip, does not contact tip with anything being cut	☐	☐	☐	☐
90. Bumper spikes maintained as close to the object as possible	☐	☐	☐	☐
91. Operator aware of what is in the saw's downward path after the cut	☐	☐	☐	☐
92. No attempt made to cut material that is larger than the guide bar of the saw	☐	☐	☐	☐
93. Cuts avoided that will cause chain to jam	☐	☐	☐	☐
94. Non-metallic wedges used to prevent compression cuts from jamming the blade	☐	☐	☐	☐
95. Bystanders and helpers kept at a safe distance from operation	☐	☐	☐	☐
96. Chainsaw not operated when fatigued	☐	☐	☐	☐
96. Fire extinguisher present when operating the chainsaw in forest or brushy areas	☐	☐	☐	☐

SECTION 3

Complete this section for all items checked "No" in Sections 1 or 2. Deficient items must be corrected in a timely manner.

Item #	Corrective Action Planned/Taken	Date Corrected

Auditor: _____ Project Manager: _____

JACOBS

HSE Self-Assessment Checklist: HAZARDOUS MATERIALS HANDLING

This checklist is provided as a method of verifying compliance with regulations pertaining to the handling of hazardous materials. It shall be used at locations where JACOBS employees handle hazardous materials, or are required to perform oversight of subcontractor personnel handling hazardous materials, or both.

JACOBS staff shall not direct the means and methods of subcontractor operations nor direct the details of corrective actions. The subcontractor must determine how to correct deficiencies, and JACOBS staff must carefully rely on the subcontractor's expertise. Items considered imminently dangerous (possibility of serious injury or death) must be corrected immediately, or all exposed personnel must be removed from the hazard until it is corrected.

Project Name: _____ Project No.: _____
Location: _____ PM: _____
Auditor: _____ Title: _____ Date: _____

This specific checklist has been completed to (check only one of the boxes below):

☐ Evaluate JACOBS compliance with hazardous material handling requirements (SOP HSE-403)
☐ Evaluate a JACOBS subcontractor's compliance with hazardous material requirements
Subcontractor's Name: _____

- Check "Yes" if an assessment item is complete or correct.
- Check "N/A" if an item is not applicable.
- Check "N/O" if an item is applicable but was not observed during the assessment.

Numbers in parentheses indicate where a description of this assessment item can be found in Standard Operating Procedure HSE-403.

SECTION 1	Yes	No	N/A	N/O
GENERAL GUIDELINES (5.2)				
1. Acids are stored away from bases.	☐	☐	☐	☐
2. Oxidizers and organics are stored away from inorganic reducing agents.	☐	☐	☐	☐
3. Flammables and corrosives are stored in appropriate storage cabinets.	☐	☐	☐	☐
4. Paper and other combustibles are not stored near flammables.	☐	☐	☐	☐
5. Secondary containment and lipped shelving are in place in storage areas.	☐	☐	☐	☐
6. A fire suppression system is available.	☐	☐	☐	☐
FLAMMABLE AND COMBUSTIBLE LIQUIDS (5.3)				
GENERAL STORAGE (5.3.1)				
7. Only approved containers/portable tanks used to store flammable and combustible liquids.	☐	☐	☐	☐
8. Approved safety cans used for handling flammable liquids in quantities 1-5 gallons.	☐	☐	☐	☐
9. For quantities of one gallon or less, the original container must be used for storage.	☐	☐	☐	☐
10. Flammable or combustible liquids are not stored in stairways or personnel passageways.	☐	☐	☐	☐

SECTION 1 (continued)	Yes	No	N/A	N/O
INDOOR STORAGE (5.3.2)				
11. Quantities of flammable or combustible liquids > 25 gallons stored in approved storage cabinet.	☐	☐	☐	☐
12. No more than 25 gallons of flamm. or comb. liquids can be stored outside an approved cabinet.	☐	☐	☐	☐
13. Cabinets are labeled with "'FLAMMABLE: KEEP FIRE AWAY."	☐	☐	☐	☐
14 No more than 60 gallons of flamm. or 120 gallons of comb. liquids stored in one storage cabinet.	☐	☐	☐	☐
15. Not more than three cabinets located in a single storage area.	☐	☐	☐	☐
OUTSIDE STORAGE (5.3.3)				
16. Storage of containers (not more than 60 gallons each) do not exceed 1,100 gallons in any area.	☐	☐	☐	☐
17. Storage areas are not within 20 feet of any building.	☐	☐	☐	☐
18. Storage areas graded to divert spills away from buildings and surrounded by an earth dike.	☐	☐	☐	☐
19. Storage areas are free from weeds, debris, and other combustible materials.	☐	☐	☐	☐
20. Outdoor portable tanks are provided with emergency vent devices.	☐	☐	☐	☐
21. Outdoor portable tanks are no closer than 20 feet from any building.	☐	☐	☐	☐
22. Signs indicating no smoking are posted around the storage area.	☐	☐	☐	☐
DISPENSING (5.3.4)				
23. Areas where liquids are dispensed in >5-gal quantities are separated from other operations by 25'.	☐	☐	☐	☐
24. Drainage or other means provided to control spills.	☐	☐	☐	☐
25. Adequate natural or mechanical ventilation provided to maintain concentration of flammable vapor < 10% of the lower flammable limit.	☐	☐	☐	☐
26. Dispensing of flammable liquids from one container to another is done only when containers are electrically interconnected (bonded).	☐	☐	☐	☐
27. Dispensing flammable or combustible liquids by means of air pressure on the container or portable tanks prohibited.	☐	☐	☐	☐
28. Dispensing devices and nozzles for flammable liquids are of an approved type.	☐	☐	☐	☐
USE (5.3.5)				
29. Flammable liquids are kept in closed containers when not in actual use.	☐	☐	☐	☐
30. Leakage or spillage of flammable or combustible liquids is disposed of promptly and safely.	☐	☐	☐	☐
31. Sources of ignition are kept at least 50 feet from flammable liquids.	☐	☐	☐	☐
LIQUID PETROLEUM GAS (5.4)				
32. LPG containers meet DOT requirements.	☐	☐	☐	☐
33. Each container or system has a safety relief device or valve in good working order.	☐	☐	☐	☐
34. Portable heaters using LPG have an automatic shutoff device in the event of flame failure.	☐	☐	☐	☐
35. Storage of LPG within buildings is prohibited.	☐	☐	☐	☐
36. LPG storage location has at least one portable fire extinguisher rated not less than 20-B:C.	☐	☐	☐	☐
COMPRESSED GAS CYLINDERS (5.5) **GENERAL (5.5.1)**				
37. Cylinders and apparatus inspected for defects and leakage prior to use. Damaged items not used.	☐	☐	☐	☐
38. Gas distributor notified and subsequent instructions followed for defective cylinders.	☐	☐	☐	☐
39. Leaking cylinders removed from the work area.	☐	☐	☐	☐
40. Cylinder users do not modify, tamper, or attempt repair on cylinders or apparatus.	☐	☐	☐	☐
41. Only cylinder owners or authorized agent refill cylinders or attempt to mix gases in a cylinder.	☐	☐	☐	☐
42. Cylinders labeled with the identity of the contents.	☐	☐	☐	☐

SECTION 1 (continued)	Yes	No	N/A	N/O
TRANSPORTING (5.5.2)				
43. Cylinders not rolled in the horizontal position or dragged; suitable material-handling device used.	☐	☐	☐	☐
44. Cylinders being transported have valve protection caps installed.	☐	☐	☐	☐
45. Cylinders in vertical position when transported by motor vehicle, hoisted, or carried.	☐	☐	☐	☐
46. Cylinders hoisted by a cradle or pallet designed for such use, and not by magnets, slings, or their valve protection caps.	☐	☐	☐	☐
STORAGE (5.5.3)				
47. Cylinders are stored in the vertical position with valve protection caps installed.	☐	☐	☐	☐
48. Cylinders are secured from being knocked over by a chain or other stabilizing device.	☐	☐	☐	☐
49. Cylinders are stored away from readily ignitable substances.	☐	☐	☐	☐
50. Cylinders are protected from exposure to temperature extremes.	☐	☐	☐	☐
51. Oxygen cylinders in storage are separated from fuel gas cylinders or combustible materials > 20' or by a ½-hour fire-resistant barrier at least 5' high.	☐	☐	☐	☐
52. Cylinders inside buildings are stored in dry, well-ventilated locations > 20' from comb. materials.	☐	☐	☐	☐
53. Cylinders are stored in definitely assigned places away from elevators, stairs, or gangways.	☐	☐	☐	☐
54. Signs indicating no smoking are provided for storage areas containing flammable gas cylinders.	☐	☐	☐	☐
PLACEMENT FOR USAGE (5.5.4)				
55. Cylinders are located where they will not be knocked over or damaged.	☐	☐	☐	☐
56. Cylinders are secured in the vertical position.	☐	☐	☐	☐
57. Cylinders are not placed where they can become part of an electrical circuit.	☐	☐	☐	☐
58. Cylinders are kept far enough away from welding and cutting operations to prevent sparks, hot slag, or flames from reaching them. When impractical, fire resistant shields are provided.	☐	☐	☐	☐
59. Cylinders are not taken into confined spaces.	☐	☐	☐	☐
CYLINDER CONNECTIONS (5.5.5)				
60. Pressure-controlling apparatus is compatible with the particular gas used.	☐	☐	☐	☐
61. Cylinders and pressure-controlling apparatus are kept free of oil and grease.	☐	☐	☐	☐
62. Pressure-controlling apparatus is kept gastight to prevent leakage.	☐	☐	☐	☐
63. Cylinders not attached to process where backflow could occur unless check valves or traps used.	☐	☐	☐	☐
64. Manifolds designed for product used at the appropriate temperatures, pressures, and flow rates.	☐	☐	☐	☐
65. Manifolds are labeled and placed in well-ventilated and accessible locations.	☐	☐	☐	☐
66. Cylinders are not cross-connected with plant air lines.	☐	☐	☐	☐
67. Flash arrestors or reverse flow check valves are installed on all flammable gas cylinders.	☐	☐	☐	☐
USAGE (5.5.6)				
68. Eye protection (safety glasses or goggles) is worn when using cylinders.	☐	☐	☐	☐
69. Cylinder valve and regulator are inspected for foreign material before connecting.	☐	☐	☐	☐
70. If cylinders are frozen, warm (not boiling) water is used to thaw cylinders.	☐	☐	☐	☐
71. Cylinder valve remains closed except when the cylinder is in use.	☐	☐	☐	☐
72. Fuel gas cylinder valves are not opened more than 1½ turns, for quick closing.	☐	☐	☐	☐
73. If a special wrench is used to open a cylinder valve, it is left in position on the valve.	☐	☐	☐	☐
74. Acetylene cylinders are used in the vertical position.	☐	☐	☐	☐
75. Acetylene cylinders are not used > 15 psig or > 30 psia.	☐	☐	☐	☐
76. Copper pipe or fittings are not used with acetylene systems.	☐	☐	☐	☐
77. Compressed gas is not used to dust off clothing.	☐	☐	☐	☐
78. Cylinder valve closed and regulator relieved of internal pressure before regulators are removed.	☐	☐	☐	☐

HEAT STRESS PHYSIOLOGICAL MONITORING FORM

Project Name:

Date: | Company:

1. Record start and stop time for break, pulse at the beginning of your break and a second pulse 60 seconds later, fluid intake (water or electrolyte replacement), shade (Y/N) and A/C (Y/N).
2. Follow the Physiological Monitoring Protocol in the attached safety bulletin or FSI.
3. Never continue work if you are experiencing sudden and severe fatigue, nausea, dizziness, or lightheadedness, immediately call your Field Lead/Safety Coordinator/RHSM.

Employee:

Describe action taken if heart rate measurements are exceeded:

Time	Start	Stop	Start	Stop	Start	Stop	Start	Stop
Pulse								
Fuilds								
Shade								
A/C								

Employee:

Describe action taken if heart rate measurements are exceeded:

Time	Start	Stop	Start	Stop	Start	Stop	Start	Stop
Pulse								
Fuilds								
Shade								
A/C								

Employee:

Describe action taken if heart rate measurements are exceeded:

Time	Start	Stop	Start	Stop	Start	Stop	Start	Stop
Pulse								
Fuilds								
Shade								
A/C								

Employee:

Describe action taken if heart rate measurements are exceeded:

Time	Start	Stop	Start	Stop	Start	Stop	Start	Stop
Pulse								
Fuilds								
Shade								
A/C								

JACOBS

HSE Self-Assessment Checklist: HAZARDOUS MATERIALS HANDLING

This checklist is provided as a method of verifying compliance with regulations pertaining to the handling of hazardous materials. It shall be used at locations where JACOBS employees handle hazardous materials, or are required to perform oversight of subcontractor personnel handling hazardous materials, or both.

JACOBS staff shall not direct the means and methods of subcontractor operations nor direct the details of corrective actions. The subcontractor must determine how to correct deficiencies, and JACOBS staff must carefully rely on the subcontractor's expertise. Items considered imminently dangerous (possibility of serious injury or death) must be corrected immediately, or all exposed personnel must be removed from the hazard until it is corrected.

Project Name: _____ Project No.: _____
Location: _____ PM: _____
Auditor: _____ Title: _____ Date: _____

This specific checklist has been completed to (check only one of the boxes below):

☐ Evaluate JACOBS compliance with hazardous material handling requirements (SOP HSE-403)
☐ Evaluate a JACOBS subcontractor's compliance with hazardous material requirements
Subcontractor's Name: _____

- Check "Yes" if an assessment item is complete or correct.
- Check "N/A" if an item is not applicable.
- Check "N/O" if an item is applicable but was not observed during the assessment.

Numbers in parentheses indicate where a description of this assessment item can be found in Standard Operating Procedure HSE-403.

SECTION 1	Yes	No	N/A	N/O
GENERAL GUIDELINES (5.2)				
1. Acids are stored away from bases.	☐	☐	☐	☐
2. Oxidizers and organics are stored away from inorganic reducing agents.	☐	☐	☐	☐
3. Flammables and corrosives are stored in appropriate storage cabinets.	☐	☐	☐	☐
4. Paper and other combustibles are not stored near flammables.	☐	☐	☐	☐
5. Secondary containment and lipped shelving are in place in storage areas.	☐	☐	☐	☐
6. A fire suppression system is available.	☐	☐	☐	☐
FLAMMABLE AND COMBUSTIBLE LIQUIDS (5.3)				
GENERAL STORAGE (5.3.1)				
7. Only approved containers/portable tanks used to store flammable and combustible liquids.	☐	☐	☐	☐
8. Approved safety cans used for handling flammable liquids in quantities 1-5 gallons.	☐	☐	☐	☐
9. For quantities of one gallon or less, the original container must be used for storage.	☐	☐	☐	☐
10. Flammable or combustible liquids are not stored in stairways or personnel passageways.	☐	☐	☐	☐

SECTION 1 (continued)	Yes	No	N/A	N/O
INDOOR STORAGE (5.3.2)				
11. Quantities of flammable or combustible liquids > 25 gallons stored in approved storage cabinet.	☐	☐	☐	☐
12. No more than 25 gallons of flamm. or comb. liquids can be stored outside an approved cabinet.	☐	☐	☐	☐
13. Cabinets are labeled with "'FLAMMABLE: KEEP FIRE AWAY."	☐	☐	☐	☐
14 No more than 60 gallons of flamm. or 120 gallons of comb. liquids stored in one storage cabinet.	☐	☐	☐	☐
15. Not more than three cabinets located in a single storage area.	☐	☐	☐	☐
OUTSIDE STORAGE (5.3.3)				
16. Storage of containers (not more than 60 gallons each) do not exceed 1,100 gallons in any area.	☐	☐	☐	☐
17. Storage areas are not within 20 feet of any building.	☐	☐	☐	☐
18. Storage areas graded to divert spills away from buildings and surrounded by an earth dike.	☐	☐	☐	☐
19. Storage areas are free from weeds, debris, and other combustible materials.	☐	☐	☐	☐
20. Outdoor portable tanks are provided with emergency vent devices.	☐	☐	☐	☐
21. Outdoor portable tanks are no closer than 20 feet from any building.	☐	☐	☐	☐
22. Signs indicating no smoking are posted around the storage area.	☐	☐	☐	☐
DISPENSING (5.3.4)				
23. Areas where liquids are dispensed in >5-gal quantities are separated from other operations by 25'.	☐	☐	☐	☐
24. Drainage or other means provided to control spills.	☐	☐	☐	☐
25. Adequate natural or mechanical ventilation provided to maintain concentration of flammable vapor < 10% of the lower flammable limit.	☐	☐	☐	☐
26. Dispensing of flammable liquids from one container to another is done only when containers are electrically interconnected (bonded).	☐	☐	☐	☐
27. Dispensing flammable or combustible liquids by means of air pressure on the container or portable tanks prohibited.	☐	☐	☐	☐
28. Dispensing devices and nozzles for flammable liquids are of an approved type.	☐	☐	☐	☐
USE (5.3.5)				
29. Flammable liquids are kept in closed containers when not in actual use.	☐	☐	☐	☐
30. Leakage or spillage of flammable or combustible liquids is disposed of promptly and safely.	☐	☐	☐	☐
31. Sources of ignition are kept at least 50 feet from flammable liquids.	☐	☐	☐	☐
LIQUID PETROLEUM GAS (5.4)				
32. LPG containers meet DOT requirements.	☐	☐	☐	☐
33. Each container or system has a safety relief device or valve in good working order.	☐	☐	☐	☐
34. Portable heaters using LPG have an automatic shutoff device in the event of flame failure.	☐	☐	☐	☐
35. Storage of LPG within buildings is prohibited.	☐	☐	☐	☐
36. LPG storage location has at least one portable fire extinguisher rated not less than 20-B:C.	☐	☐	☐	☐
COMPRESSED GAS CYLINDERS (5.5) **GENERAL (5.5.1)**				
37. Cylinders and apparatus inspected for defects and leakage prior to use. Damaged items not used.	☐	☐	☐	☐
38. Gas distributor notified and subsequent instructions followed for defective cylinders.	☐	☐	☐	☐
39. Leaking cylinders removed from the work area.	☐	☐	☐	☐
40. Cylinder users do not modify, tamper, or attempt repair on cylinders or apparatus.	☐	☐	☐	☐
41. Only cylinder owners or authorized agent refill cylinders or attempt to mix gases in a cylinder.	☐	☐	☐	☐
42. Cylinders labeled with the identity of the contents.	☐	☐	☐	☐

SECTION 1 (continued)	Yes	No	N/A	N/O
TRANSPORTING (5.5.2)				
43. Cylinders not rolled in the horizontal position or dragged; suitable material-handling device used.	☐	☐	☐	☐
44. Cylinders being transported have valve protection caps installed.	☐	☐	☐	☐
45. Cylinders in vertical position when transported by motor vehicle, hoisted, or carried.	☐	☐	☐	☐
46. Cylinders hoisted by a cradle or pallet designed for such use, and not by magnets, slings, or their valve protection caps.	☐	☐	☐	☐
STORAGE (5.5.3)				
47. Cylinders are stored in the vertical position with valve protection caps installed.	☐	☐	☐	☐
48. Cylinders are secured from being knocked over by a chain or other stabilizing device.	☐	☐	☐	☐
49. Cylinders are stored away from readily ignitable substances.	☐	☐	☐	☐
50. Cylinders are protected from exposure to temperature extremes.	☐	☐	☐	☐
51. Oxygen cylinders in storage are separated from fuel gas cylinders or combustible materials > 20' or by a ½-hour fire-resistant barrier at least 5' high.	☐	☐	☐	☐
52. Cylinders inside buildings are stored in dry, well-ventilated locations > 20' from comb. materials.	☐	☐	☐	☐
53. Cylinders are stored in definitely assigned places away from elevators, stairs, or gangways.	☐	☐	☐	☐
54. Signs indicating no smoking are provided for storage areas containing flammable gas cylinders.	☐	☐	☐	☐
PLACEMENT FOR USAGE (5.5.4)				
55. Cylinders are located where they will not be knocked over or damaged.	☐	☐	☐	☐
56. Cylinders are secured in the vertical position.	☐	☐	☐	☐
57. Cylinders are not placed where they can become part of an electrical circuit.	☐	☐	☐	☐
58. Cylinders are kept far enough away from welding and cutting operations to prevent sparks, hot slag, or flames from reaching them. When impractical, fire resistant shields are provided.	☐	☐	☐	☐
59. Cylinders are not taken into confined spaces.	☐	☐	☐	☐
CYLINDER CONNECTIONS (5.5.5)				
60. Pressure-controlling apparatus is compatible with the particular gas used.	☐	☐	☐	☐
61. Cylinders and pressure-controlling apparatus are kept free of oil and grease.	☐	☐	☐	☐
62. Pressure-controlling apparatus is kept gastight to prevent leakage.	☐	☐	☐	☐
63. Cylinders not attached to process where backflow could occur unless check valves or traps used.	☐	☐	☐	☐
64. Manifolds designed for product used at the appropriate temperatures, pressures, and flow rates.	☐	☐	☐	☐
65. Manifolds are labeled and placed in well-ventilated and accessible locations.	☐	☐	☐	☐
66. Cylinders are not cross-connected with plant air lines.	☐	☐	☐	☐
67. Flash arrestors or reverse flow check valves are installed on all flammable gas cylinders.	☐	☐	☐	☐
USAGE (5.5.6)				
68. Eye protection (safety glasses or goggles) is worn when using cylinders.	☐	☐	☐	☐
69. Cylinder valve and regulator are inspected for foreign material before connecting.	☐	☐	☐	☐
70. If cylinders are frozen, warm (not boiling) water is used to thaw cylinders.	☐	☐	☐	☐
71. Cylinder valve remains closed except when the cylinder is in use.	☐	☐	☐	☐
72. Fuel gas cylinder valves are not opened more than 1½ turns, for quick closing.	☐	☐	☐	☐
73. If a special wrench is used to open a cylinder valve, it is left in position on the valve.	☐	☐	☐	☐
74. Acetylene cylinders are used in the vertical position.	☐	☐	☐	☐
75. Acetylene cylinders are not used > 15 psig or > 30 psia.	☐	☐	☐	☐
76. Copper pipe or fittings are not used with acetylene systems.	☐	☐	☐	☐
77. Compressed gas is not used to dust off clothing.	☐	☐	☐	☐
78. Cylinder valve closed and regulator relieved of internal pressure before regulators are removed.	☐	☐	☐	☐

JACOBS

HSE Self-Assessment Checklist—Lifting

This checklist shall be used **only** by JACOBS personnel and shall be completed at the frequency specified in the project's HSP/FSI.

This checklist is to be used at locations where: (1) JACOBS employees perform manual lifting activities (office or projects), and/or (2) JACOBS provides oversight of a subcontractor performing manual lifting activities. SC or Office Safety Coordinators/Committee members may consult with subcontractors (if applicable) when completing this checklist but shall not direct the means and methods of activities nor direct the details of corrective actions. Subcontractors shall determine how to correct deficiencies, and we must carefully rely on their expertise. Conditions considered imminently dangerous (possibility of serious injury or death) shall be corrected immediately or all exposed personnel shall be removed from the hazardous area until corrected.
Complete the appropriate project or office information:

Project Information
Project Name: _____ Project No.: _____

Location: _____ PM: _____

Auditor: _____ Title: _____ Date: _____

Office Information
Office Location: _____
Auditor: _____ Title: _____ Date: _____

This specific checklist has been completed to:
☐ Evaluate JACOBS employee manual lifting activities.
☐ Evaluate a JACOBS subcontractor's manual lifting activities.
Subcontractor Name: _____

- Check "Yes" if an assessment item is complete/correct.
- Check "No" if an item is incomplete/deficient. Deficiencies shall be brought to the immediate attention of the subcontractor.
- Check "N/A" if an item is not applicable.
- Check "N/O" if an item is applicable but was not observed during the assessment.

Numbers in parentheses indicate where a description of this assessment item can be found in Standard Operating Procedure HSE-112.

Planning Activities	**Yes**	**No**	**N/A**	**N/O**
1. Efforts have been made to inquire about receiving equipment or supplies in containers weighting less than 50 pounds (23 kilograms).	o	o	o	o
2. Equipment or supplies are being delivered as close as possible to their use point.	o	o	o	o
3. Heavy equipment or supplies are being stored off the ground and no lower than knee height.	o	o	o	o
4. Adequate space has been provided to access and lift equipment or supplies without reaching or twisting.	o	o	o	o
Safe Work Practices (5.1)	**Yes**	**No**	**N/A**	**N/O**
5. Tasks or activities have been modified to reduce or minimize manual lifting.	o	o	o	o
6. All employees performing manual lifting have received training on how to lift safely.	o	o	o	o
7. Manual lifting control measures are evaluated during assessments.	o	o	o	o

8. Manual lifting incidents are reviewed as part of the HSE Program reviews.	o	o	o	o
9. Manual lifting incidents are reviewed as part of the HSE Program reviews.	o	o	o	o
Office Environments (5.1.1)	**Yes**	**No**	**N/A**	**N/O**
10. Employees have received lifting training.	o	o	o	o
11. Mechanical devices are readily available to employees handling equipment or supplies weighing more than 40 pounds (18 kilograms).	o	o	o	o
Field Projects (5.1.2)	**Yes**	**No**	**N/A**	**N/O**
12. All manual lifting tasks or activities have been addressed in the written site safety plan.	o	o	o	o
13. Employees have received safe lifting training as required by the written site safety plan.	o	o	o	o
Mechanical Lifting (5.2)	**Yes**	**No**	**N/A**	**N/O**
14. Hand trucks and trolleys are visually inspected before use.	o	o	o	o
15. Hand trucks and trolleys do not have any broken or damaged parts.	o	o	o	o
16. Hand truck and trolley paths are free of uneven surfaces, water, oil, or cracks and holes.	o	o	o	o
17. Loads carried by hand trucks are balanced and sturdy.	o	o	o	o
18. Hand trucks or dollies are being pushed when on level ground.	o	o	o	o
19. When going up or down a slope using a hand truck or trolley, the load is downslope of the person.	o	o	o	o
20. Employees using hand trucks or dollies are moving slowly and cautiously.	o	o	o	o
21. Employees using hand trucks or trolleys are able to see over the load.	o	o	o	o
Assisted Lifting (5.3)	**Yes**	**No**	**N/A**	**N/O**
22. Personnel are not performing manual lifting beyond their physical capabilities.	o	o	o	o
23. Loads are evenly distributed when being handled by multiple people.	o	o	o	o
Manual Lifting (5.4)	**Yes**	**No**	**N/A**	**N/O**
24. Before the lift, the load and path was assessed.	o	o	o	o
25. Loads being lifted are free of sharp edges, slivers, or wet or greasy spots.	o	o	o	o
26. Gloves are used for manual lifts of loads with sharp or splintered edges.	o	o	o	o
27. Employees performing manual lifts use the proper lifting techniques.	o	o	o	o
28. Special tools fabricated for lifting grates or manhole covers are used.	o	o	o	o

Item #	Corrective Action Planned/Taken	Date Corrected

Auditor: _____ Project Manager: _____

JACOBS

HSE Self-Assessment Checklist—Lifting

This checklist shall be used **only** by JACOBS personnel and shall be completed at the frequency specified in the project's HSP/FSI.

This checklist is to be used at locations where: (1) JACOBS employees perform manual lifting activities (office or projects), and/or (2) JACOBS provides oversight of a subcontractor performing manual lifting activities. SC or Office Safety Coordinators/Committee members may consult with subcontractors (if applicable) when completing this checklist but shall not direct the means and methods of activities nor direct the details of corrective actions. Subcontractors shall determine how to correct deficiencies, and we must carefully rely on their expertise. Conditions considered imminently dangerous (possibility of serious injury or death) shall be corrected immediately or all exposed personnel shall be removed from the hazardous area until corrected.
Complete the appropriate project or office information:

Project Information
Project Name: _____ Project No.: _____

Location: _____ PM: _____

Auditor: _____ Title: _____ Date: _____

Office Information
Office Location: _____
Auditor: _____ Title: _____ Date: _____

This specific checklist has been completed to:
☐ Evaluate JACOBS employee manual lifting activities.
☐ Evaluate a JACOBS subcontractor's manual lifting activities.
Subcontractor Name: _____

- Check "Yes" if an assessment item is complete/correct.
- Check "No" if an item is incomplete/deficient. Deficiencies shall be brought to the immediate attention of the subcontractor.
- Check "N/A" if an item is not applicable.
- Check "N/O" if an item is applicable but was not observed during the assessment.

Numbers in parentheses indicate where a description of this assessment item can be found in Standard Operating Procedure HSE-112.

Planning Activities	**Yes**	**No**	**N/A**	**N/O**
1. Efforts have been made to inquire about receiving equipment or supplies in containers weighting less than 50 pounds (23 kilograms).	o	o	o	o
2. Equipment or supplies are being delivered as close as possible to their use point.	o	o	o	o
3. Heavy equipment or supplies are being stored off the ground and no lower than knee height.	o	o	o	o
4. Adequate space has been provided to access and lift equipment or supplies without reaching or twisting.	o	o	o	o
Safe Work Practices (5.1)	**Yes**	**No**	**N/A**	**N/O**
5. Tasks or activities have been modified to reduce or minimize manual lifting.	o	o	o	o
6. All employees performing manual lifting have received training on how to lift safely.	o	o	o	o
7. Manual lifting control measures are evaluated during assessments.	o	o	o	o

8. Manual lifting incidents are reviewed as part of the HSE Program reviews.	o	o	o	o
9. Manual lifting incidents are reviewed as part of the HSE Program reviews.	o	o	o	o
Office Environments (5.1.1)	**Yes**	**No**	**N/A**	**N/O**
10. Employees have received lifting training.	o	o	o	o
11. Mechanical devices are readily available to employees handling equipment or supplies weighing more than 40 pounds (18 kilograms).	o	o	o	o
Field Projects (5.1.2)	**Yes**	**No**	**N/A**	**N/O**
12. All manual lifting tasks or activities have been addressed in the written site safety plan.	o	o	o	o
13. Employees have received safe lifting training as required by the written site safety plan.	o	o	o	o
Mechanical Lifting (5.2)	**Yes**	**No**	**N/A**	**N/O**
14. Hand trucks and trolleys are visually inspected before use.	o	o	o	o
15. Hand trucks and trolleys do not have any broken or damaged parts.	o	o	o	o
16. Hand truck and trolley paths are free of uneven surfaces, water, oil, or cracks and holes.	o	o	o	o
17. Loads carried by hand trucks are balanced and sturdy.	o	o	o	o
18. Hand trucks or dollies are being pushed when on level ground.	o	o	o	o
19. When going up or down a slope using a hand truck or trolley, the load is downslope of the person.	o	o	o	o
20. Employees using hand trucks or dollies are moving slowly and cautiously.	o	o	o	o
21. Employees using hand trucks or trolleys are able to see over the load.	o	o	o	o
Assisted Lifting (5.3)	**Yes**	**No**	**N/A**	**N/O**
22. Personnel are not performing manual lifting beyond their physical capabilities.	o	o	o	o
23. Loads are evenly distributed when being handled by multiple people.	o	o	o	o
Manual Lifting (5.4)	**Yes**	**No**	**N/A**	**N/O**
24. Before the lift, the load and path was assessed.	o	o	o	o
25. Loads being lifted are free of sharp edges, slivers, or wet or greasy spots.	o	o	o	o
26. Gloves are used for manual lifts of loads with sharp or splintered edges.	o	o	o	o
27. Employees performing manual lifts use the proper lifting techniques.	o	o	o	o
28. Special tools fabricated for lifting grates or manhole covers are used.	o	o	o	o

Item #	Corrective Action Planned/Taken	Date Corrected

Auditor: _____ Project Manager: _____

HSE Self-Assessment Checklist: PERSONAL PROTECTIVE EQUIPMENT

This checklist shall be used by JACOBS personnel **only** and shall be completed at the frequency specified in the project's HSP/FSI.

This checklist is to be used at locations where JACOBS employees are required to wear PPE or are required to perform oversight of a subcontractor using PPE or both.

JACOBS staff shall not direct the means and methods of subcontractor use of PPE nor direct the details of corrective actions. The subcontractor must determine how to correct deficiencies and JACOBS staff must carefully rely on their expertise. Conditions considered to be imminently dangerous (possibility of serious injury or death) must be corrected immediately or all exposed personnel must be removed from the hazard until corrected.

Project Name: _____ Project No.: _____

Location: _____ PM: _____

Auditor: _____ Title: _____ Date: _____

This specific checklist has been completed to (check only one of the boxes below):

☐ Evaluate JACOBS compliance with its PPE program (SOP HSE-117)
☐ Evaluate a JACOBS subcontractor's compliance with its PPE program
Subcontractor's Name: _____

Check the appropriate box, as follows:

- Check "Yes" if an assessment item is complete or correct.
- Check "No" if an item is incomplete or deficient. Section 2 must be completed for all items checked "No."
- Check "N/A" if an item is not applicable.
- Check "N/O" if an item is applicable but was not observed during the assessment.

Numbers in parentheses indicate where a description of this assessment item can be found in Standard Operating Procedure HSE-117.

SECTION 1	**Yes**	**No**	**N/A**	**N/O**
GENERAL				
1. Required PPE listed in HSP FSI or AHA.	☐	☐	☐	☐
2. PPE available for use by employees.	☐	☐	☐	☐
3. PPE cleaning supplies available for use.	☐	☐	☐	☐
4. PPE stored appropriately to prevent deformation or distortion.	☐	☐	☐	☐
5. PPE written certification has been completed.	☐	☐	☐	☐
EYEWEAR (Glasses/Goggles/Face Shields)				
6 Eyewear cleaning supplies available.	☐	☐	☐	☐
7 Safety glasses in good condition and lenses free of scratches.	☐	☐	☐	☐
8 Goggles adjustment strap not cracked or frayed, not deformed, or lenses not scratched.	☐	☐	☐	☐
9. Face shields in good condition, including adjustment band, and free of scratches or chips.	☐	☐	☐	☐

SECTION 1 (Continued)	**Yes**	**No**	**N/A**	**N/O**
HEAD PROTECTION				
10. Hard hat bill and suspension attached as allowed by manufacturer.	☐	☐	☐	☐
11. Shell is pliable, free of dents, cracks, nicks, or any damage due to impact.	☐	☐	☐	☐
12. Suspension maintained at 1.25 inches from inside of shell.	☐	☐	☐	☐
13. Suspension free of cuts or fraying, torn headband, adjustment strap workable.	☐	☐	☐	☐
14. Electrical hard hat matched to hazard classification.	☐	☐	☐	☐
15. Dated to determine whether within manufacturer's allowable 5-year use time period.	☐	☐	☐	☐
HAND PROTECTION				
16. Available in sizes matched to employee.	☐	☐	☐	☐
17. Gloves free of rips tears, abrasions, or holes.	☐	☐	☐	☐
18. Matched to manufacturer's specification for chemicals used onsite.	☐	☐	☐	☐
19. Electrical gloves matched to hazard and periodically inspected for insulating rating.	☐	☐	☐	☐
20. Maintained in a clean and sanitary condition, decontaminated or disposed properly.	☐	☐	☐	☐
BODY PROTECTION				
21. Available in sizes matched to employee.	☐	☐	☐	☐
22. Maintained in a clean and sanitary condition, decontaminated or disposed properly.	☐	☐	☐	☐
23. Vapor-tight fully encapsulated suits tested at required periodic intervals.	☐	☐	☐	☐
24. Flame-resistant clothing matched to electrical hazard and arc flash rating.	☐	☐	☐	☐
25 Welding gear matched to degree of hazard and free of cuts, tears or burn holes.	☐	☐	☐	☐
26 Flotation gear available for work near or on water and in good condition.	☐	☐	☐	☐
HOT AND COLD BODY PROTECTION				
27 Cooling gear available based on degree of heat stress hazard.	☐	☐	☐	☐
28 Cooling gear in operable, clean, and sanitary condition.	☐	☐	☐	☐
29 Cold-weather gear provided based on needs assessment.	☐	☐	☐	☐
30. Cold-weather gear available in sizes to match employees.	☐	☐	☐	☐
31 Cold-weather gear is in free of tears, rips, or holes and in maintained in a clean condition.	☐	☐	☐	☐
TRAINING				
32 Initial PPE training completed by employees.	☐	☐	☐	☐
33 Training conducted when new types or styles of PPE are issued.	☐	☐	☐	☐
34 PPE selection, use, and maintenance reviewed at daily safety briefings.	☐	☐	☐	☐

SECTION 2

Complete this section for all items checked “No” in Section 1. Deficient items must be corrected in a timely manner.

Item #	Corrective Action Planned or Taken	Date Corrected

Auditor: _________________________________ Project Manager: ____________________________________

JACOBS Health and Safety Plan

Attachment 5

Key Target Zero Program Elements
(Blank forms for field use)

Critical Risk Awareness Booklet

Project Health and Safety Field Change Request Log

Management Health, Safety, Security and Environment

Inspection Activity Hazard Analysis

Pre-Task Safety Plans

Safe Behavior Observation

Incident Report and Investigation
(use electronic form when possible)

Lessons Learned Template

Air Monitoring Form

JACOBS®

CRITICAL RISK AWARENESS

CRITICAL RISK AWARENESS

Raising awareness of Critical Risks to help avoid workplace injuries.

This document is intended to raise awareness of key elements of our existing HSE processes for nine critical risk activities. These critical risk awareness elements are intended to reinforce existing Corporate, Regional and local policies, systems and procedures and do not cover all operational risks.

It is important that you make yourself aware of all appropriate safety protocol contained in the project HSE Plan and local procedures. Planning and supervision for critical risk activities should consider ALL appropriate risk control requirements.

This booklet can be used as a tool to raise awareness of critical risks and support task planning for critical risk activities.

The following fundamental requirements must always be considered:

- Work must not be conducted without a pre-job risk assessment and safety discussion, appropriate to the level of risk.
- All personnel must be trained and competent for the work that they are assigned.
- Personal Protective Equipment (PPE) must be worn in accordance with the requirements identified by the risk assessment and work procedures.
- Suitable emergency response plans must be in place before work commences.
- If anyone has any questions or concerns about performing the work in a safe manner they should stop work and raise those concerns immediately.

TABLE OF CONTENTS

For further Health, Safety and Environment information, including access to the Jacobs' Health and Safety procedures, visit Jacobs Safety Pages: JacobsConnect > Company > Safety

WORK AT ELEVATION

Work at elevation 1.8 meters (6 feet) or higher above the ground or working surface must not proceed unless properly managed so as to eliminate or mitigate the risk of falling, or dropped objects. In addition, floor and roof openings must be properly managed to eliminate the risk of people falling through them.

Key Elements:

- Utilize design and engineering controls to minimize the need to work at elevation.
- Plan tasks to minimize fall hazards.
- Provide a secure working area to prevent personnel or tools and materials from falling when work at elevation is unavoidable.
- Use appropriate personal fall arrest or restraint when fall prevention is not reasonably practicable, taking into consideration the following:
  - Personnel are trained in use of all necessary equipment
  - Equipment is suitable, inspected and certified for use
  - Proper and adequate anchor points are selected
  - Double lanyards are used to enable 100% tie-off
  - Shock absorbing lanyards are selected to limit fall distance
- Do not work alone when working at elevation.
- Have an appropriate emergency response plan for rescue and recovery.
- Wear personal fall restraint/arrest attached to a suitable anchor point when working in Mobile Elevated Work Platforms or suspended work baskets.
- Complete a risk assessment for work off ladders.
- Protect from objects dropped or dislodged while working at height by using barricades, warning signs and tool lanyards/tethers.
- Provide proper barricades or covers for all floor and roof openings.

For additional requirements refer to HSEP 13.8, Fall Protection, or appropriate local procedures.

LIFTING OPERATIONS

Lifting operations must be planned and performed by trained, authorized and Competent Personnel using lifting equipment designed, certified and appropriate to the lift activity.

Key Elements:

- Assess the lift and determine the lift method and equipment required. The assessment must be performed by a Competent Person*.
- Do not operate powered lifting devices unless trained and certified to do so.
- Rigging of the load shall be carried out by a trained and Competent Person.
- Do not use lifting devices and equipment unless they are certified and visually inspected before each lift by a Competent Person.
- Do not exceed the load capacities of lifting equipment.
- Verify that safety devices installed on lifting equipment are operational.
- Establish and maintain clear communication between everyone involved in the lift.
- Assess weather, light and ground conditions to ensure they are suitable to undertake the lift safely.
- Incorporate measures to prevent or mitigate the risk of dropped objects.
- Do not allow people to be under a suspended load or between a suspended load and fixed objects.
- Utilize appropriate barriers and signs to prevent unauthorized entry into work zones
- Do not use cranes or personnel baskets for any purpose other than those for which they are certified.
- Use tag lines to control loads at all times.

For additional requirements refer to HSEP 17.1, Mobile Cranes; HSEP 17.6, Rigging; and HSEP 17.7, Critical Lifts; and HSEP 17.9, Overhead Cranes, or appropriate local procedures.

*Competent Person - a person having the knowledge, skills and experience to complete a task effectively and safely. For certain prescribed activities and occupations a Competent Person must also possess recognized certificates, licenses or similar documentation that verifies competency to do the task.

MOBILE EQUIPMENT

Mobile equipment must be selected, equipped, operated and maintained in a safe manner to protect personnel from harm. Never operate vehicles or mobile equipment while distracted or otherwise impaired.

Key Elements:

- Operate mobile equipment only if you are experienced, trained and authorized to do so.
- Use mobile equipment only for its intended purpose and in accordance with the manufacturer's safe limits and recommendations.
- Operate mobile equipment so that it is visible and easy to identify at a safe distance by other vehicles and pedestrians, through the use of markings, warning devices, flags, etc.
- Inspect mobile equipment prior to operation and take appropriate action if defects are observed.
- Be aware of safe access and egress, including emergency egress, from mobile equipment.
- Provide safe access to equipment for maintenance, inspection and material handling to prevent fall exposure.
- Wear seat belts in all mobile equipment.
- Do not use mobile phones or two-way radios when operating mobile equipment. Before engaging in the use of these devices, mobile equipment must be stopped and in a safe location.
- Implement safeguards to prevent uncontrolled movement of vehicles and mobile equipment.
- Use spotters (banksman or flagger) when moving mobile equipment and to control interaction between vehicles, mobile equipment and pedestrians.
- Reverse park mobile equipment at all times when it is safe to do so.

For additional requirements refer to HSEP 8.3, Excavation Equipment Use; HSEP 17.1, Mobile Cranes; HSEP 17.4, Forklifts; and HSEP 17.9, Aerial and Scissor Lifts, or appropriate local procedures.

ENERGY ISOLATION

Isolation separates you from dangerous energy, such as electricity, pressure, hazardous materials, hot liquids, moving parts and stored energy. Potential sources of hazardous energy must be identified and isolated prior to starting work.

Key Elements:

- Work requiring energy isolation must be authorized by a permit.
- Identify potential sources of hazardous energy. Common forms of hazardous energy include, but are not limited to, electrical, mechanical, pressure, motion, gravity, and chemical energy.
- Coordinate and confirm energy isolation method with all involved work groups.
- De-energize and isolate all energy sources and discharge any stored energy. Use a system of locks and tags at the energy isolation points.
- Test the isolation system to confirm the isolation is effective.
- Periodically monitor and evaluate the isolation system for effectiveness.
- Communicate details regarding energy isolations between crews and shifts.
- Develop a procedure to mitigate risk when a zero energy state cannot be achieved, a test of positive isolation is not possible, or the use of a locking device is not possible.
- Locks must only be removed by the persons who placed them.

For additional requirements refer to HSEP 8.5, Line and Equipment Opening, and HSEP 15.1, Lock-out/Tag-out, or appropriate local procedures.

CONFINED SPACES

A confined space, such as a tank, vessel, or pipe can contain explosive, toxic or oxygen deficient atmospheres or other hazards. Wherever possible, eliminate the need to work in confined spaces. If it is necessary to work in confined spaces, a permit is required and precautions must be taken to protect the safety of people who enter.

Key Elements:

- Confined space work must be authorized by a permit.
- Identify and isolate potential sources of hazardous energy that could be present in, or enter into, the confined space.
- Test the confined space atmosphere prior to entry to determine if it safe for entry. Testing should be conducted by a Competent Person* using calibrated equipment.
- Wherever possible, ventilate confined spaces.
- Establish continuous monitoring of the confined space as required.
- Prior to commencing work in a confined space, access controls must be in place and the confined space entry supervisor and attendant must be in attendance.
- Establish agreed-upon controls for communications between confined space workers and attendants.
- Develop a rescue plan and have appropriate rescue equipment in place prior to work. Only enter a confined space if trained and fit to do so.

For additional requirements refer to HSEP 7.2, Confined Space Entry, or appropriate local procedures.

*Competent Person - a person having the knowledge, skills and experience to complete a task effectively and safely. For certain prescribed activities and occupations a Competent Person must also possess recognized certificates, licenses or similar documentation that verifies competency to do the task.

ELECTRICAL WORK

Working around energized electrical equipment can be dangerous due to the potential for electric shock and arc flash. Work on energized or potentially energized equipment must only be performed by qualified personnel.

Key Elements:

- Electrical work must be authorized by a permit.
- Do not work on energized or potentially energized electrical equipment unless trained, qualified and authorized to do so.
- Wherever possible, identify and isolate potential sources of electrical energy prior to work.
- Ground (earth) all power supply systems, electrical circuits and equipment and all exposed metal parts of equipment prior to work.
- Only use appropriate and well-maintained equipment and tools.
- Use protective equipment (including arc flash protective clothing and equipment) that are appropriate to the task.
- Place appropriate barricades and warning devices to prevent others from exposure to electrical energy.
- Do not work alone when working on energized or potentially energized equipment.

For additional requirements refer to HSEP 19.1, Electrical Safety, or appropriate local procedures.

EXCAVATIONS

Always obtain authorization before starting excavation activities, as you may encounter hazards such as electrical cables, confined spaces, collapse of walls or excavated material.

Key Elements:

- Excavation and ground-breaking work must be authorized by a permit.
- Identify and locate overhead and underground services and hazards including, pipelines, electric and telecom cables. Wherever necessary, remove or isolate them.
- Place appropriate barriers and warning signs to restrict access to excavation sites.
- Position appropriate barriers or other controls at a suitable distance to prevent equipment falling into the excavation and to prevent cave-in or collapse.
- Enter an excavation only after:
  - Confined space entry controls are applied, if the area is assessed as being a confined space.
  - Ground movement is controlled to prevent collapse (e.g. shoring, sloping, benching).
  - Ground stability is assessed before work and after adverse weather conditions.
  - Suitable entry, exit and escape methods, and equipment and routes are established.
  - An emergency response plan is in place.

For additional requirements refer to HSEP 18.4, Excavations, or appropriate local procedures.

HAZARDOUS MATERIALS

Hazardous Materials are any substances or compounds that may produce adverse effects on the health and safety of people if not properly managed. Management of hazardous materials includes storage, handling, use and disposal.

Key Elements:

- A program for the handling of hazardous materials must be in place and address the following:
  - Approval process for the selection and use of hazardous materials
  - A register of hazardous materials used at the site, including readily accessible material safety data (Safety Data Sheet (SDS) or equivalent)
  - An appropriate method for labeling and storage of hazardous materials
  - Appropriate information and instructions to workers on the hazardous materials they may be exposed to and safe handling precautions, including appropriate PPE.
- Exposure of personnel to hazardous materials must be kept below relevant exposure standards and to levels as low as reasonably practicable.
- Personnel undertaking critical roles in the management and assessment of hazardous materials must be Competent* .
- Develop and implement a program for monitoring exposure to hazardous materials and a health surveillance program where required, either by legislation or as part of a Health Hazard Assessment.
- Develop and implement an Exposure Management Plan when carcinogens and highly toxic chemicals are present.
- Implement engineering and organizational controls for hazardous materials in preference to reliance on PPE.

For additional requirements refer to HSEP 1.3, Chemical Hazard Communication; HSEP 11.1, Biological Hazard Control; and HSEP 12.1, Health Hazard Evaluation, or appropriate local procedures.

*Competent Person - a person having the knowledge, skills and experience to complete a task effectively and safely. For certain prescribed activities and occupations a Competent Person must also possess recognized certificates, licenses or similar documentation that verifies competency to do the task.

DRIVING

A Safe Plan of Action (SPA) can assist you in traveling and arriving at your destination safely. Speeding or using your phone while driving increases your risk of losing control of your vehicle. Using a seat belt minimizes your risk of injury in the event of an accident.

Key Elements:

- Inspect and maintain your vehicle regularly.
- Inspect your vehicle prior to starting any journey.
- Prepare a Journey Safe Plan of Action as required, including route details, driving and rest hours, and communication controls.
- Only drive if you are appropriately licensed, competent and medically fit to operate the class of vehicle being used.
- Develop and communicate site specific traffic management plans.
- Do not drive if you are under the influence of alcohol or drugs or are fatigued.
- Use seat belts or restraints when in a vehicle (driver and all occupants).
- Do not exceed the number of passengers for which the vehicle is rated.
- Properly secure loads so that they do not interfere with the driver's vision or ability to operate the vehicle safely.
- Do not operate mobile phones or two-way radios (hands-free or not) while driving.
- Reverse park vehicles at all times when it is safe to do so.

For additional requirements refer to HSEP 21.2, Motor Vehicle Safety, or appropriate local procedures.

Project Health and Safety Field Change Request Log

INSERT PROJECT NAME

FCR Number	Description of changes	Date of issue
	.	

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Management Health, Safety, Security and Environment Inspection

Program/Project Name: _____ **Work Being Performed:** _____

Management Inspector: _____ **Project Number:** _____

Date: _____ **Sector:** _____

1. Job Information/Postings	A	C	I	N/A	Comments/Corrective Action(s)
a. Required postings in place (OSHA/State/Country)					
b. Emergency Contacts and Phone list posted					
c. Directions and map to hospital posted					
d. Incident Reporting Flow Chart posted					
2. HSSE Documentation					
a. HASP current (within 1 year), onsite, and signed					
b. AHAs available for all work and reviewed/signed					
c. Daily Pre-Task Safety Plan/Meeting completed					
d. SBO's completed weekly and emailed					
e. Self-Assessment checklists completed per HASP					
f. Environmental Plan available					
g. Emergency drill completed and documented					
h. E Permit compliance assurance measures documented					
i. HSE training up to date and documented					
3. Housekeeping/First Aid					
a. Work areas clean and organized					
b. Fire extinguisher, eye wash, 1st aid/BBP kit in place					
c. Materials and waste labeled and in closed containers					
4. PPE and Air Monitoring					
a. PPE being worn as specified in HASP/AHA					
b. Air monitoring done per HASP and documented					
5. Heavy Equipment and Construction Operations					
a. Documentation of Competent/Qualified Operators					
b. Back-up alarms audible & no cell phone use					
c. High-visibility vests on ground personnel					
d. Daily inspections completed and documented					
e. Windshields/mirrors OK and seat belts worn					
6. Excavation, Trenching, and Land Disturbing Activities					
a. Competent person identified					
b. Daily inspection completed prior to entry					
c. Proper setup (sloping, shoring, exits, spoils)					
d. 3rd party Utility Locate service used					
d. Storm water PPP and inspections/sampling conducted					
d. Erosion/sediment controls and dust controls in place					
7. Hand Tools					
a. Hand tools inspected prior to use					
b. Guards in place on tools					
c. Right tool for the job at hand					
8. Electrical					
a. All electrical cords, prongs, receptacles OK					
b. GFCI used on all circuits					
c. No energized electrical work incl. voltage testing					
d. Written Lockout Tagout system in use					

(Column - A=Adequate, C=Needs Consideration, I=Needs Immediate Action, N/A= Not Applicable or Not Assessed)

9. Ladders and Scaffolds	A	C	I	N/A	Comments/Corrective Action(s)
a. Ladders extend 36" above the landing and secured					
b. Ladders selected and used properly					
c. Scaffold planked, unaltered, and in good condition					
d. Scaffold/ladder users trained in inspection and use					
10. Hot Work					
a. Gas cylinders stored upright and secured					
b. Minimum 20' distance between fuels and oxygen					
c. PPE in use per HASP/AHA					
d. Fire watch in place w/adequate fire extinguishers					
11. Cranes					
a. Outriggers extended, swing radius protected					
b. Operator CCO licensed, competent person for rigging					
c. Annual certified crane inspection					
d. Chains and slings inspected, have rating tag					
e. Suspended load tag lines - no one underneath					
12. Drill Rigs					
a. Overhead electrical clearance adequate					
b. Daily inspections completed and available					
c. Emergency shut off functioning					
d. 3rd party Utility Locate service used					
13. Hazard Communication and Chemical Use					
a. MSDS's present for all chemicals					
b. Chemical Inventory current and in HSP or on file					
c. Hazard communication briefing for all chemicals					
d. All chemicals labeled/stored as required					
e. SPCC Plan implemented for >1320 gals fuels/oils on site					
14. Fall Protection					
a. Full body harness worn properly, workers tied off over 6'					
b. Guard rails 42" high					
15. Material Handling					
a. Proper body positioning					
b. Objects less than 40 lbs. for one person lift					
16. Site Control					
a. Work Zones delineated, necessary signage in place					
b. Decontamination method is adequate					
17. Waste and Hazardous Materials Management					
a. Waste Tracking Log					
b. Hazardous waste onsite for <90 days					
c. Containers labeled, inspections conducted/documented					
d. HW manifests signed, tracked, copies kept on site					
e. HW Transporters trained and licensed, placards used					
18. Security and Emergency Planning					
a. Emergency coordinator designated					
b. Severe weather plans/controls in place					
c. Security plan/measures adequate					
19. Demolition					
a. ACM and Hazardous Materials Survey					
b. Asbestos/Lead based paint work approved per policy					

(Column - A=Adequate, C=Needs Consideration, I=Needs Immediate Action, N/A= Not Applicable or Not Assessed)

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ACTIVITY HAZARD ANALYSIS

Date:	Task Risk Assessment Code (RAC):
Project:	L = Low E = Extremely High Risk H = High Risk M = Moderate Risk
Site Supervisor:	
Site Safety Coordinator:	
HSM Review/Approval:	
Job/Activity: **Description of the work**:	

		Probability				
		Frequent	Likely	Occasional	Seldom	Unlikely
Severity	**Catastrophic**	E	E	H	H	M
	Critical	E	H	H	M	L
	Marginal	H	M	M	L	L
	Negligible	M	L	L	L	L

TYPES OF POTENTIAL ENERGY:									
									
1	2	3	4	5	6	7	8	9	10
BIOLOGICAL	CHEMICAL	ELECTRICAL	GRAVITY	MECHANICAL	MOTION	PRESSURE	RADIATION	SOUND	TEMPERATURE

Work Task Sequence (List steps you need to take to complete the activity.)	Potential Health and Safety Hazards (How can you be harmed? Cut, struck, exposed…)	Potential Energy(ies) Associated with Task	Hazard Controls (List the specific controls for each potential hazard. Refer to HSE Handbook for required controls)

Work Task Sequence (List steps you need to take to complete the activity.)	Potential Health and Safety Hazards (How can you be harmed? Cut, struck, exposed…)	Potential Energy(ies) Associated with Task	Hazard Controls (List the specific controls for each potential hazard. Refer to EN&N Market HSSE Handbook for required controls)

Equipment to be used (List equipment to be used in the work activity)	Inspection Requirements (List inspection requirements for the work activity)	Training Requirements (List training requirements including hazard communication)

ACTIVITY HAZARD ANALYSIS

	PRINT NAME	SIGNATURE	
Supervisor Name:	_____	_____	**Date/Time:** _____
Safety Officer Name:	_____	_____	**Date/Time:** _____
Employee Name(s):	_____	_____	**Date/Time:** _____
	_____	_____	**Date/Time:** _____
	_____	_____	**Date/Time:** _____
	_____	_____	**Date/Time:** _____
	_____	_____	**Date/Time:** _____
	_____	_____	**Date/Time:** _____
	_____	_____	**Date/Time:** _____
	_____	_____	**Date/Time:** _____
	_____	_____	**Date/Time:** _____

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Pre-Task Safety Plan (PTSP) and Safety Meeting Sign-in Sheet

Project:_____ Location: _____ Date:_____

Supervisor: _____ Job Activity:_____

_____

Attendees: Print Name Sign Name

_____

_____

_____

_____

_____

_____

_____

List Tasks and verify that applicable AHAs have been reviewed:

_____

_____

_____

Tools/Equipment Required for Tasks (ladders, scaffolds, fall protection, cranes/rigging, heavy equipment, power tools):

_____

_____

_____

Potential H&S Hazards, including chemical, physical, safety, biological and environmental (check all that apply):

__ Chemical burns/contact	__ Trench, excavations, cave-ins	__ Ergonomics
__ Pressurized lines/equipment	__ Overexertion	__ Chemical splash
__ Thermal burns	__ Pinch points	__ Poisonous plants/insects
__ Electrical	__ Cuts/abrasions	__ Eye hazards/flying projectile
__ Weather conditions	__ Spills	__ Inhalation hazard
__ Heights/fall > 6 feet	__ Overhead Electrical hazards	__ Heat/cold stress
__ Noise	__ Elevated loads	__ Water/drowning hazard
__ Explosion/fire	__ Slips, trip and falls	__ Heavy equipment
__ Radiation	__ Manual lifting	__ Aerial lifts/platforms
__ Confined space entry	__ Welding/cutting	__ Demolition
__Underground Utilities	__ Security	__ Poor communications

Other Potential Hazards (Describe):

_____

_____

_____

Hazard Control Measures (Check All That Apply):			
PPE __ Thermal/lined __ Eye __ Dermal/hand __ Hearing __ Respiratory __ Reflective vests __ Flotation device __ Hard Hat __ Safety-Toed Boots	Protective Systems __ Sloping __ Shoring __ Trench box __ Barricades __ Competent person __ Locate buried utilities __ Daily inspections __ Entry Permits/notification	Fire Protection __ Fire extinguishers __ Fire watch __ Non-spark tools __ Grounding/bonding __ Intrinsically safe equipment	Electrical __ Lockout/tagout __ Grounded __ Panels covered __ GFCI/extension cords __ Power tools/cord inspected __ Overhead line clearance __ Underground utils ID'd
Fall Protection __ Harness/lanyards __ Adequate anchorage __ Guardrail system __ Covered opening __ Fixed barricades __ Warning system	Air Monitoring __ PID/FID __ Detector tubes __ Radiation __ Personnel sampling __ LEL/O2 __ No visible dust __ Other	Proper Equipment __ Aerial lift/ladders/scaffolds __ Forklift/heavy equipment __ Backup alarms __ Hand/power tools __ Crane with current inspection __ Proper rigging __ Operator qualified	Welding & Cutting __ Cylinders secured/capped __ Cylinders separated/upright __ Flash-back arrestors __ No cylinders in CSE __ Flame retardant clothing __ Appropriate goggles
Confined Space Entry __ Isolation __ Air monitoring __ Trained personnel __ Permit completed __ Rescue	Medical/ER __ First-aid kit __ Eye wash __ FA-CPR trained personnel __ Route to hospital	Heat/Cold Stress __ Work/rest regime __ Rest area __ Liquids available __ Monitoring __ Training	Vehicle/Traffic __ Traffic control __ Barricades __ Flags __ Signs
Permits __ Hot work __ Confined space __ Lockout/tagout __ Excavation __ Demolition __ Energized work	Demolition __ Pre-demolition survey __ Structure condition __ Isolate area/utilities __ Competent person __ Hazmat present	Inspections: __ Ladders/aerial lifts __ Lanyards/harness __ Scaffolds __ Heavy equipment __ Drill rigs/geoprobe rigs __ Cranes and rigging __ Utilities marked	Training: __ Hazwaste (current) __ Construction __ Competent person __ Task-specific __ FA/CPR __ Confined Space __ Hazcom
Underground Utilities __Dig alert called __3rd Party locater __As-builts reviewed __Interview site staff __Client review __soft locate necessary?	Incident Communications __Work stops until cleared by TM/CM __Immediate calls to TM/CM __Client notification __24 hour notification setup __Clear communications	AHA' s __reviewed and approved by HSM __on site and current __applicable for this day's work __Communication and incident processes included?	
Field Notes (including observations from prior day, etc.): _____ _____ _____			

Name (Print): _____
Signature:_____ Date:_____

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SAFE WORK OBSERVATION

Project Information							
Program:		**Portfolio:**	Choose an item.	**PG&E EnvRem PM Name:**	Choose an item.		
Project Name:		**Project #:**		**Project Location:**			
Observation Information							
Observer Name:		**Company:**		**Date:**	Click here to enter a date.		
Position/Title of worker observed:		**Company:**		**Type:**	Supervisor to Employee If Other:		
Work or Task Observed:				**Activity**	**Other**		
Positive Observations/Safe Work Practices:							

Observation Category	Observation (choose one)	At- Risk Observation	Corrected (Y or N)	Root Cause #
1. Work Environment *(Perform a 360 degree observation of the area surrounding the worksite; are there potential uncontrolled hazards that could impact the worker or work area?)*	☐ Not Observed ☐ Safe ☐ At-Risk	*Look at housekeeping, electrical, overhead, confined space or fall hazards, and site control issues.* Choose an item.		
2. Work Behaviors *(Are there any at-risk behaviors observed such as trigger states, focus on the work at hand, and situational awareness?)*	☐ Not Observed ☐ Safe ☐ At-Risk	*Look at trigger states (rushing, fatigue, complacency, frustration), eyes on task, awareness.* Choose an item.		
3. Body Use and Positioning *(Are there any at-risk motions or body positions that need to be corrected?)*	☐ Not Observed ☐ Safe ☐ At-Risk	*Look at at-risk carrying/lifting/twisting, repetitive motion, excessive standing/sitting/kneeling, line of fire.* Choose an item.		
4. Personal Protective Equipment *(Is PPE selected, used, inspected, maintained and stored in accordance with work needs and plans?)*	☐ Not Observed ☐ Safe ☐ At-Risk	*Look at head, foot, body, hand, hearing protection, safety vest, and condition of PPE.* Choose an item.		
5. Tools and Equipment *(Are the tools and equipment at the site selected, inspected, used and maintained in accordance with plans and requirements?)*	☐ Not Observed ☐ Safe ☐ At-Risk	*Look at hand tools, power tools, portable equipment, open-bladed knife use, ladders, scaffolds, fall protection.* Choose an item.		

6. Environmental Conditions *(Are environmental conditions and risks, e.g., heat, cold, noise, lighting, and biological hazards identified and controlled?)*	☐ Not Observed ☐ Safe ☐ At-Risk	*Also look at work/rest breaks, ice/snow removal, tick/insect, poison ivy/oak, dust/vapor/odor control.* Choose an item.		
7. Environmental Protection Measures *(Have environmental issues [e.g., waste, hazardous materials, stormwater] been identified and mitigation measures in place?)*	☐ Not Observed ☐ Safe ☐ At-Risk	*Look at proximity to waterways, waste or hazmat containers/ labeling/storage/spill control, nesting birds* Choose an item.		
8. Emergency Planning and Response *(Are the emergency planning and response measures adequate for the anticipated emergency situations?)*	☐ Not Observed ☐ Safe ☐ At-Risk	*Look at emergency alarms, communications, assembly area, fire extinguisher, eye-wash, first aid kit, signs.* Choose an item.		
9. Motor Vehicles and Heavy Equipment *(Observe site vehicle and heavy equipment use, observe work in the vicinity of operating equipment. Are there at-risk behaviors or conditions? [E.g., spotters not used, seatbelts not used, 3 points of contact not used to enter/exit, etc.])*	☐ Not Observed ☐ Safe ☐ At-Risk	*Also look at distracted driving/equipment use, eye contact with operator, weather conditions considered, vehicles inspected prior to use.* Choose an item.		
10. Work Planning, Hazard Identification and Control *(Ask the observed worker(s) about the work planning process they used. Were the risks identified in the HSE plan(s) and AHAs, and controlled before work began, and on-going as the work progressed?*	☐ Not Observed ☐ Safe ☐ At-Risk	*Look at journey management/work hours, working alone, PTSP/Daily safety meetings, permits in place, self-assessment checklists used, HazCom, HSE records.* Choose an item.		
Percent Safe	**%**	% Safe = **#** of Safe Observations / (**#** of Safe Observations + **#** of At-Risk Observations)		
11. Action plan notes for any uncorrected deficiencies: Click here to enter text.				
12. Other notes or comments regarding this safety observation: Click here to enter text.				

Root Cause Codes:

1. Lack of skill or knowledge
2. Lack of or inadequate operational procedures or work standards
3. Not following procedure
4. Inadequate communication of expectations regarding procedures or work standards
5. Inadequate tools or equipment
6. Correct way takes more time and/or requires more effort
7. Short-cutting standard procedures is positively enforced or tolerated
8. Engineering/design deficiency
9. Uncontrollable

INTELEX Incident Report Hardcopy (Phase 1 – Initial Entry) Phase 1 – Initial Entry

Type of Incident (May select more than one)

☐	Injury/Illness	☐	Spill/Release	☐	Near Miss
☐	Property Damage	☐	Environment/Permit	☐	Other

General Information Section

Preparer's Name: _____ **Preparer's Phone Number:** _____

Date of Incident: _____ **Time of Incident**: _____ AM / PM

What Business Group is accountable for this incident: _____

What Business Group SubGroup is accountable for this incident: _____

What CH2M HILL Company is accountable for this incident: _____

Where did the Incident occur?

- ☐ United States, Geographic Region: _____
- ☐ Canada, Province/Territory: _____
- ☐ International, County: _____

Location of Incident?

- ☐ Company Premises, JACOBS Office (use 3 letter office code if available): _____
- ☐ Project, Project name: _____
- ☐ In Transit
  - Traveling from: _____
  - Traveling to: _____
- ☐ At Home
- ☐ Other, Specify: _____

Describe the incident: _____

_____

_____

Describe how this event could have been prevented: _____

_____

Provide Witness Information:

Name: _____ Phone: _____

Name: _____ Phone: _____

Name: _____ Phone: _____

Personnel Notified of Incident (Provide name, date and time):

JACOBS Personnel: _____

Client Personnel: _____

Additional Comments:

_____

_____

Injury/Illness Section [Complete only if Injury/Illness Incident type selected]

Who was injured?

- ☐ CH2M Employee or CH2M Temp Employee
- ☐ Subcontractor to CH2M (Non-LLC Joint Venture Project)
- ☐ LLC Joint Venture Partner Employee
- ☐ LLC Joint Venture Project Subcontractor/Contractor
- ☐ Other

Name of Injured: _____ **Job Title:** _____

Employer Name: _____ **Supervisor of Employee:** _____ Complete for CH2M Employee Injuries

Business Group of Injured Employee: _____

Has the employee called the Injury Management Administrator (1-855-328-6547)?

☐ Yes ☐ No ☐ Not Sure

Has the injured employee's supervisor been notified of this incident?

☐ Yes ☐ No ☐ Not Sure

Complete for Non-CH2M HILL Employee Injuries

Has the project safety coordinator been notified of this incident?

☐ Yes ☐ No ☐ Not Sure

Project Safety Coordinator: _____

Body Part Affected: _____

Injury/Illness (Result): _____

Describe treatment provided (if medication provided, identify whether over-the-counter or prescription): _____

_____

Describe any work restriction prescribed (include dates and number of days): _____

_____

Physician/Health Care Provider Information

Name: _____ Phone: _____

Was treatment provided away from the worksite?

☐ No

☐ Yes

Facility Name:

_____

Address:

_____

City: _____ Phone Number:

_____

Was injured treated in an emergency room?

☐ No ☐ Yes

Was injured hospitalized overnight as an in-patient?

☐ No ☐ Yes

General Information Environmental Section **[Complete only if Environment/Permit or Spill/Release Incident type selected]**

Who had control of the area during the incident?

☐ CH2M HILL, Company: _____

☐ Subcontractor, Company: _____

☐ Joint Venture Partner/Contractor/Subcontractor, Company: _____

☐ Other, Company: _____

Relationship to CH2M HILL: _____

Property Damage Section **[Complete only if Property Damage Incident type selected]**

Property Damaged: _____

Property Owner: _____

Damage Description: _____

Estimated US Dollar Amount: _____

Spill or Release Section **[Complete only if Spill/Release Incident type selected]**

Substance: _____

Estimated Quantity: _____

Did the spill/release move off the property?: _____

Spill/Release From: _____

Spill/Release To: _____

Environment/Permit Section **[Complete only if Environment/Permit Incident type selected]**

Describe Environmental or Permit Issue: _____

Permit Type: _____

Permitted Level or Criteria (e.g., discharge limit): _____

Permit Name and Number (e.g., NPDES No. ST1234): _____

Substance and Estimated Quantity: _____

Duration of Permit Exceedence: _____

HSSE Lessons Learned

[Date] ESBG LL-11-xx

Subject	**[Insert Descriptive Name of Lessons Learned]**
CH2M HILL Project?	[Yes or No]
Situation	[Describe incident or situation that occurred in general terms. Try to be brief and avoid unnecessary details such as names of people or projects, business groups, divisions, dates, location, etc.]
Lessons Learned (Recommendations and Comments)	• Bullet out any lessons learned, recommendations or other important "take away" information that would benefit others. Tie the recommendations to the incident or event, and avoid including information that is not directly tied to the event.
Submitted By	[Name/Office Location/Phone]
Additional Information Contact	[Name/Office Location/Phone]
Keywords/Categories	[Insert any keywords or incident categories that would aid in a search for this lessons learned]

JACOBS Health and Safety Plan

Attachment 6

Fact Sheets

Tick Fact Sheet

Vehicle Accident

Guidance Working Alone

Ticks and Tick-borne Pathogens Fact Sheet

Jacobs

Tick-Borne Pathogens

Most of us have heard of Lyme disease or Rocky Mountain Spotted Fever (RMSF), but there are several notifiable tick-borne pathogens that present a significant field hazard. In some areas, these account for more than half of our serious field incidents. The following procedures should be applied during any field activity, even in places that are predominantly paved with bordering vegetation.

Hazard Recognition

An important step in controlling tick related hazards is understanding how to identify ticks, their habitats, their geographical locations, and signs and symptoms of tick-borne illnesses.

Tick Identification

There are five varieties of hard-bodied ticks that have been associated with tick-borne pathogens. These include:

- Deer (Black Legged) Tick (eastern and pacific varieties)
- Lone Star Tick
- Dog Tick
- Rocky Mountain Wood Tick

These varieties and their geographical locations are illustrated on the following page. See also the 'TickEncounter' Resource Center website for photos of each variety of tick including photos of larvae, nymph, adult male and female, and partially fed and fully fed females ticks. It also shows the geographic location, their activity cycle over the year, and what diseases they can carry.

Tick Habitat

In eastern states, ticks are associated with deciduous forest, grasslands, and habitat containing leaf litter. Leaf litter provides a moist cover from wind, snow, and other elements. In the north-central states, is generally found in heavily wooded areas often surrounded by broad tracts of land cleared for agriculture.

On the Pacific Coast, the bacteria are transmitted to humans by the western black-legged (deer) tick and habitats are more diverse. For this region, ticks have been found in habitats with forest, north coastal scrub, high brush, and open grasslands. Coastal tick populations thrive in areas of high rainfall, but ticks are also found at inland locations.

Illnesses and Signs & Symptoms

There are several notifiable tick-borne pathogens that cause human illness in the United States. These pathogens may be transmitted during a tick bite—normally hours after attachment. The illnesses include:

- Lyme (bacteria)
- RMSF (bacteria)
- Colorado Tick Fever (virus)
- Powassan (virus)
- Ehrlichiosis (bacteria)
- STARI (Southern Tick-Associated Rash Illness) (bacteria)
- Tularemia (Rabbit Fever) (bacteria)
- Babesia (protozoan parasite)

Symptoms will vary based on the illness, and may develop in infected individuals typically between 3 and 30 days after transmission. Some infected individuals will not become ill or may develop only mild symptoms. These illnesses present with some or all the following signs & symptoms: fever, headache, muscle aches, stiff neck, joint aches, nausea, vomiting, abdominal pain, diarrhea, malaise, weakness, small solid, ring-like, or spotted rashes. The bite site may be red, swollen, or develop ulceration or lesions. For Lyme disease, the bite area will sometimes resemble a target pattern. A variety of long-term symptoms may result if the illness is left untreated, including debilitating effects and death.

Ticks and Tick-borne Pathogens Fact Sheet

Deer Tick

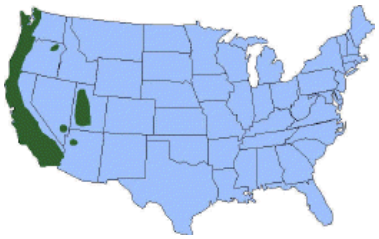
From Left: adult female, adult male, nymph, and larvae Deer Tick (cm scale)

Lone Star Tick

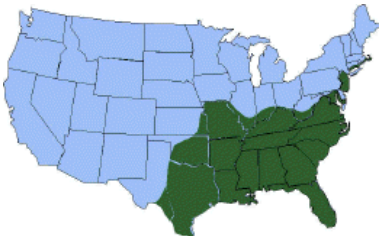
Dog Tick

Rocky Mountain Wood Tick

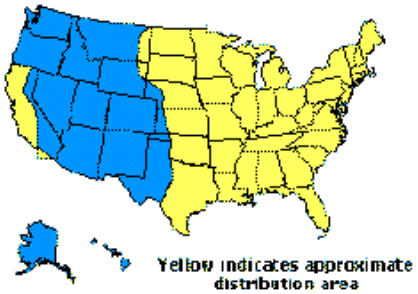
Distribution of Deer Tick (dark green)

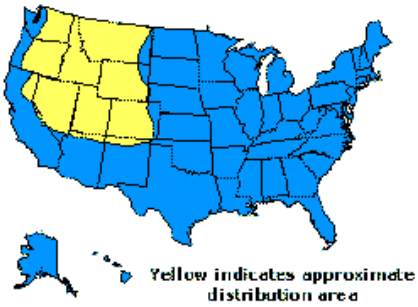


Distribution of Pacific Deer Tick (dark green)



Distribution of Lone Star Tick (Green)





Hazard Control

The methods for controlling exposure to ticks include, in order of most- to least-preferred:

- Avoiding tick habitats and ceasing operations in heavily infested areas
- Reducing tick abundance through habitat disruption or application of acracide
- Personal protection through use of repellants and protective clothing
- Frequent tick inspections and proper hygiene

Vaccinations are not available and preventative antibiotic treatment after a bite is generally not recommended.

Avoidance and Reduction of Ticks

To the extent practical, tick habitats should be avoided. In areas with significant tick infestation, consider stopping work and withdrawing from area until adequate tick population control can be achieved. Stopping and withdrawing should be considered as seriously as entering an area without proper energy control or with elevated airborne contaminants—tick-borne pathogens present risk of serious illness!

In areas where significant population density or infestation exists, tick reduction should be considered. Tick reduction can be achieved by disrupting tick habitats and/or direct population reduction using tick-toxic pesticides (Damminix, Dursban, Sevin, etc.).

Habitat disruption may include only simple vegetative reduction such as removing leaf litter and trimming grass and brush. Trim/clear walking paths and specific work locations or request facility mow areas prior to field work. Often, projects schedule subcontractors to assist with vegetation reduction tasks prior to field work. Tick populations can be reduced by between 72 and 100 percent when leaf litter alone is removed. In more heavily infested areas, habitat disruption may include grubbing, tree trimming or removal, and pesticide application (Damminix, Dursban, Sevin, etc.). This approach is practical in smaller, localized areas or perimeter areas that require occasional access. Habitat controls are to be implemented with appropriate health and safety controls, in compliance with applicable environmental requirements, and may be best left to the property owner or tenant or to a licensed pesticide vendor. Caution should be exercised when using chemical repellents or pesticides in or around areas where environmental or industrial media samples will be collected for analysis.

Personal Protection

After other prevention and controls are implemented, personal protection is still necessary to control exposure to ticks. Personal protection must include all of the following steps:

- So that ticks may be easily seen, wear light-colored clothing. Full-body New Tyvek (paper-like disposable coveralls) may also be used.
- To prevent ticks from getting underneath clothing tuck pant legs into socks or tape to boots and/or use tick gaiters (available through the warehouses). Tuck shirt into pants.
- Wear long-sleeved shirts, a hat, and high boots. Carry a tick removal kit (available through the warehouses).
- Apply DEET or Picradin repellent to exposed skin or clothing per product label. CDC recommended natural repellents may be used on a case-by-case basis for project staff sensitive to DEET or Picradin. Repellant is required when walking in vegetated areas with potential tick habitat.
- Apply permethrin repellent to the outside of boots, clothing and cloth field equipment (e.g. backpacks, snake chaps) before wearing, per product label. Consult this video, SDS, FAQ and label instructions for information on one of the available permethrin products that includes how to properly treat clothing and gear. Reapply Permethrin spray per the instructions (typically every six washings or six weeks). Insect Shield clothing is an alternative to spray Permethrin, and lasts up to sixty washes. Permethrin treated or Insect Shield clothing is required when walking in vegetated areas with potential tick habitat.

- Carry a lint roller. Frequently check for ticks and remove from clothing. Use lint roller, especially in the areas you can't see (back, back of the legs), the white roller body of the lint roller makes it much easier to identify and remove the very small ticks.
- At the end of the day, search your entire body for ticks (particularly groin, armpits, neck, and head) and shower.
- To prevent pathogen transmission through mucous membranes or broken/cut skin, wash or disinfect hands and/or wear surgical-style nitrile gloves any time ticks are handled.

Pregnant individuals and individuals using prescription medications should consult with their physician and/or pharmacists before using chemical repellents. Because human health effects may not be fully known, use of chemical repellents should be kept to a minimum frequency and quantity. Always follow manufacturers' use instructions and precautions. Wash hands after handling, applying, or removing protective gear and clothing. Avoid situations such as hand-to-face contact, eating, drinking, and smoking when applying or using repellents. Remove and wash clothes per repellent product label.

Vaccinations are generally not available for tick-borne pathogens. Although production of the LYMErix™ Lyme disease vaccination has been ceased, vaccination may still be considered under specific circumstances and with concurrence from the consulting physician.

In summary, if vegetation removal or insecticide to eliminate ticks is not feasible, the requirements are broken down into "**the three I's": Insecticide** (apply permethrin on clothing, DEET/repellant on skin), **Isolation** (wear long pants/sleeves, taping/tucking) and **Inspection** (frequent lint roller and visual checks, before entering vehicle checks, end of day check). You need all three I's to successfully protect yourself from ticks.

Tick Check

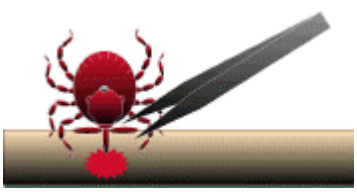
A tick check should be performed after field survey and each time before entering the field vehicle (you do not want to infest your field vehicle with ticks). Use a lint roller to check your clothes, small ticks are much easier to see on the white lint roller body, or if you don't have a lint roller, have your field partner check your back; the backs of your legs, arms, and neck; and your hairline. Shake off clothing as thorough as possible before entering the vehicle. Once the field day is complete, repeat this procedure and perform a thorough self-check. Notify the Responsible Health and Safety Manager (RHSM), Project Manager (PM), and you supervisor if ticks are found on clothing and alert the entire field crew.

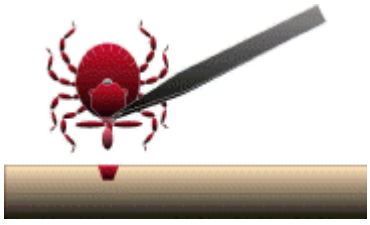
If a tick has embedded itself into the skin, remove the tick as described below and notify the RHSM, PM and your supervisor.

Tick Removal

1. Use a tick removal kit (obtained through one of the CH2M warehouses), or a fine-tipped tweezers or shield your fingers with a tissue, paper towel, or nitrile gloves.

2. Grasp the tick as close to the skin surface as possible and pull upward with steady, even pressure. Do not twist or jerk the tick; this may cause the mouthparts to break off and remain in the skin. If this happens, remove mouthparts with tweezers. Notify the PM, RHSM, and your supervisor if a tick bite is experienced.





3. Avoid squeezing, crushing or puncturing the body of the tick because its fluids (saliva, hemolymph, gut contents) may contain infectious organisms. Releasing these organisms to the outside of the tick's body or into the bite area may increase the chance of infectious organism transmission.

4. Do not handle the tick with bare hands because infectious agents may enter through mucous membranes or breaks in the skin. This precaution is particularly directed to individuals who remove ticks from domestic animals with unprotected fingers. Children, elderly persons, and immunocompromised persons may be at greater risk of infection and should avoid this procedure.

5. After removing the tick, thoroughly disinfect the bite site and wash your hands with soap and water.

6. Should you wish to save the tick for identification, place it in a plastic bag, with the date of the tick bite, and place in your freezer. It may be used at a later date to assist a physician with making an accurate diagnosis (if you become ill).

Note: Folklore remedies such as petroleum jelly or hot matches do little to encourage a tick to detach from skin. In fact, they may make matters worse by irritating the tick and stimulating it to release additional saliva, increasing the chances of transmitting the pathogen. These methods of tick removal should be avoided. In addition, many tick removal devices have been marketed, but none are better than a plain set of fine tipped tweezers.

First-Aid and Medical Treatment

Tick bites should always be treated with first aid. Clean and wash hands and disinfect the bite site after removing embedded tick. Individuals previously infected with Lyme disease does not confer immunity—re-infection from future tick bites can occur even after a person has contracted a tick-borne disease.

If you experience a tick bite, be sure to:

- ✓ **Notify your supervisor, PM, and RHSM**
- ✓ **Call WorkCare (U.S. including, Puerto Rico, Hawaii and AK) at 1-888-449-7787**

  For all other locations:
  - Canada, contact your supervisor and your HSE representative and call the Nurse Triage number at 1-877-424-5256
  - For International, contact your supervisor, HSE representative and HR
  - HKA (contingent) workers use the WorkCare number above

Jacobs

US & CANADA
VEHICLE ACCIDENT REPORTING & INTAKE FORM

VEHICLE ACCIDENT INSTRUCTIONS (US & Canada)

Jacobs Owned or Leased Vehicle Damage only:

You are not required to submit the Vehicle Incident Report to Risk Management for incidents involving ONLY damage to Jacobs personnel or property. (Example: owned/leased/rental vehicles where single vehicle runs off road). In these instances:

- Notify your supervisor, HSE representative and Fleet Management (JacobsUSAFleet@Jacobs.com)
- If our employee is injured, follow procedures for reporting a workers' compensation claim
- If you have questions, contact your Risk Management representative.

Vehicle Damage or Injury to Members of the Public:

- Complete and submit the attached Vehicle Intake Form
- If necessary, move vehicles to a safe location and wait for police.
- Aid the Injured - Do not move injured individuals unless absolutely necessary. Warn other drivers.
- Call the Police – Give exact location and advise if medical help is needed.
- Don't Comment – Do not make/sign any statement concerning who was at fault. Give out only information required by authorities.
- Notification – Report the accident to your Department Manager, your HSE Representative and Global Risk Management.
- Serious accidents and accidents with injuries: Report as soon as possible, immediately following the accident. Do not wait for a copy of the police report to notify Global Risk Management of the incident.
- Accidents without injuries: Report within twenty-four (24) hours of the accident.
- Vehicle Accident Report – The Jacobs Vehicle Accident Report must be completed and sent to your HSE Representative and AutoClaims@Jacobs.com

Rental Car Incidents:

- For incidents involving a rental car that was rented through BCD Travel or Concur Travel for approved work business, you must file an auto claim directly with the rental car company.
- For incidents involving Rental Vehicles with injuries to Members of the Public, complete and submit the attached Intake Form to Global Risk Management.

Questions

Contact: Zane Wilson (Zane.Wilson@Jacobs.com), Global Risk Management Department
Phone: 214 583-8417
Email: AutoClaims@Jacobs.com

Jacobs

US & CANADA
VEHICLE ACCIDENT REPORTING & INTAKE FORM

Email Completed form to: AutoClaims@Jacobs.com For Questions Contact: 214 583-8417

Location Code: _____

Company/Subsidiary Name: _____

Line of Business: People & Places Solutions ☐ Critical Mission Solutions ☐ Corporate Functions☐

Incident Location

Date of Accident: _____ Time of Accident: ☐ a.m. ☐ p.m.

Location of Accident: Client Facility/Project Site ☐ Highway ☐ Other (specify)☐ _____

Address: _____

Nearest Intersection: City _____ State _____

Company Vehicle Information

Company Vehicle Driver: _____ Driver Date of Birth: _____

Office/Project Assigned to: _____

Name of Passenger(s): _____

Work Address: _____

Home Address: _____ Home/Cell Phone: _____

Supervisor Name: _____ Supervisor Phone: _____

Vehicle Owner: _____ Company Owned ☐ Leased ☐ Rental ☐ Personal ☐

If rental vehicle, name of agency: _____

If rental, reservation through: BCD Travel ☐ Concur ☐ Rental Desk ☐

If leased vehicle, name of agency: _____

Vehicle Number: _____ Make & Model: _____

Vehicle License Number: _____ Vehicle ID Number _____

Has Driver Completed Jacobs Recognized Driver Training: Yes ☐ No ☐ Unknown ☐

Other Driver(s) Information

Other Driver(s) Name: _____

Home Address: _____

Phone Number: Home/Cell: _____ Work: _____

Vehicle Owner: _____ Relation to Driver: _____

Vehicle Make & Model _____

Insurance Company _____

Insurance Agent: _____ Agent Phone Number: _____

Policy Number: _____

Jacobs

US & CANADA
VEHICLE ACCIDENT REPORTING & INTAKE FORM

Incident Description

Contact with: Other Vehicle(s) ☐ Fixed Object ☐ Pedestrian ☐ Other ☐

Details: _____

_____

_____

_____

_____

Witnesses: _____

Citations Issued: Jacobs Driver: Yes ☐ No ☐ Other Driver: Yes ☐ No ☐

Police Contacted: Yes ☐ No ☐ Agency: _____

Officer name/badge: _____

Injuries

Jacobs Employee Yes ☐ No ☐ Other Driver/Passengers: Yes ☐ No ☐

If yes, describe _____

Other Driver/Passengers: Yes ☐ No ☐

If yes, describe _____

Vehicle Damages

Company Vehicle: _____

Location of Company Vehicle _____

Other Vehicle Damage: _____

Location of Other Vehicle: _____

Property Damage (Do not include vehicle damages listed above)

Property Owner: _____

Describe Damages: _____

Contact info for Owner: _____

Comments: _____

_____

_____

_____

_____

_____

Diagram of Incident (attach additional documents if needed):

Report Submitted by: _____ Date: _____

Reporter's Email Address: _____ Phone: _____

JACOBS

WORKING ALONE PROTOCOL
CALL – IN CONTACT FORM

Date of site work:_____ Expected start time:_____
Name of JACOBS employee in the field:_____
Name of JACOBS employee responsible to receive contact:
Client Emergency Contact (if any):
JACOBS employee's contact numbers:
Radio #_____
Cell Phone #_____
Address and Location of work:_____
Directions/Map:

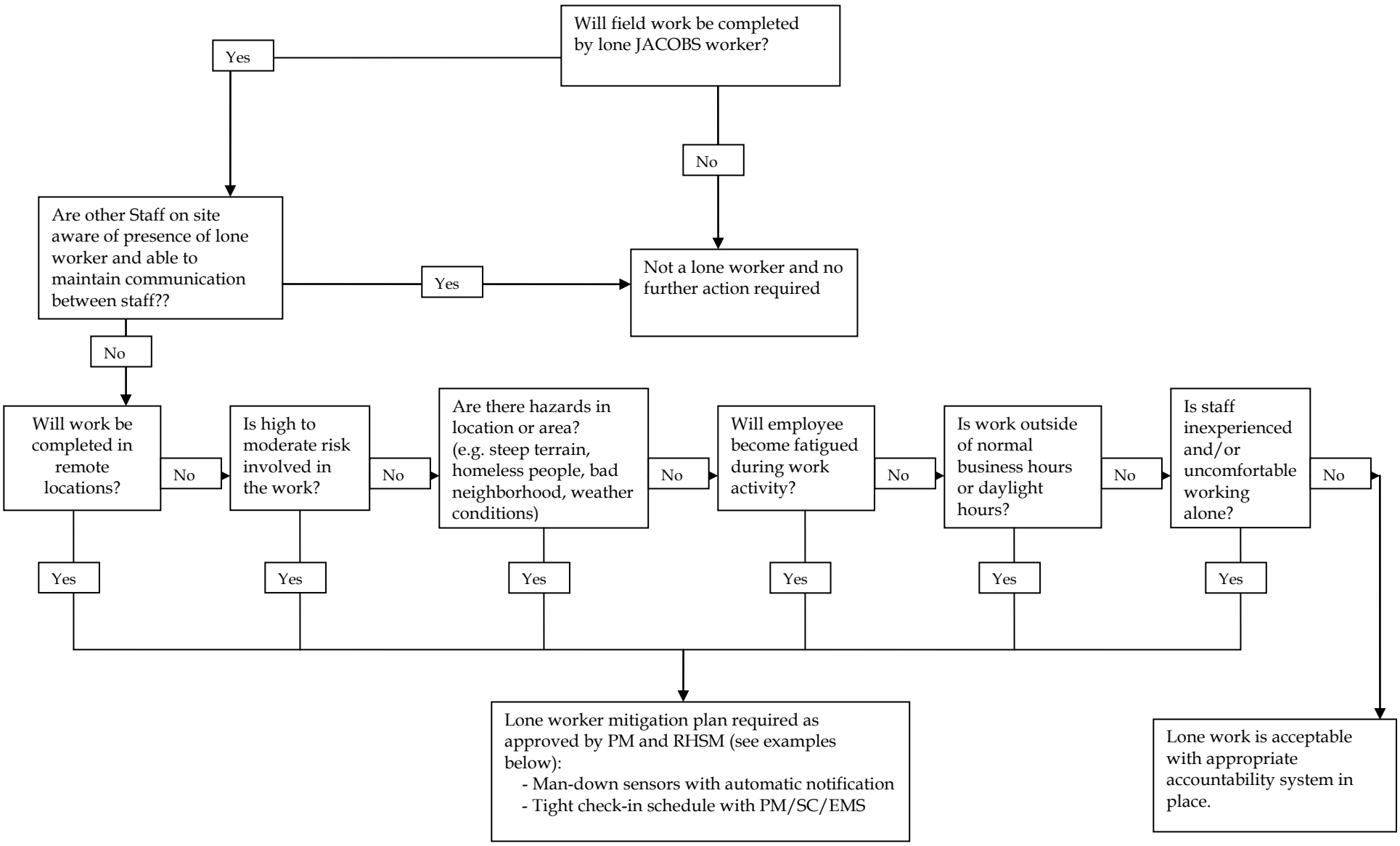
Planned Activity:_____
Specified Frequency and time for call in:_____

Time	Verified	Location

If lone worker fails to call in at specified frequency/time:

1) Call worker's radio and cell to determine if an emergency exists.
2) If no reply, immediately call Client security/emergency service if there is one at the site.
3) If there is no client security call Emergency Services (911). Inform the dispatcher there is a lone worker that cannot be contacted and there may be an emergency on site. Provide the lone worker's name, their last known location, and your contact information.
4) After Emergency Services have been contacted, call the other emergency contacts, Project Manager, and Responsible Health and Safety Manager.

Lone Worker Protocol



JACOBS HEALTH AND SAFETY PLAN

Attachment 7

Observed Hazard Form

JACOBS

OBSERVED HAZARD FORM

Name/Company of Observer (*optional*):

Date reported:_____

Time reported:_____

Contractor/s performing unsafe act or creating unsafe condition:

1. _____

2. _____

3. _____

Unsafe Act or Condition:

_____

_____

_____

_____

_____

_____

_____

_____

_____

Location of Unsafe Act or Condition:

Name of CH2M HILL Representative:

_____

Corrective Actions Taken: Date: _____

_____

_____

_____

_____

_____

Project Safety Committee Evaluation: Date: _____

_____

_____

_____

_____

JACOBS HEALTH AND SAFETY PLAN

Attachment 8

Stop Work Order Form

JACOBS

Stop Work Order

REPORT PREPARED BY:

Name:	**Title:**	**Signature:**	**Date:**

ISSUE OF NONPERFORMANCE:

Description:	Date of Nonperformance:

SUBCONTRACTOR SIGNATURE OF NOTIFICATION:

Name:	**Title:**	**Signature:**	**Date:**

**** Corrective action is to be taken immediately. Note below the action taken, sign and return to CCI.* Work may not resume until authorization is granted by CH2M HILL Constructors, Inc. Representative,***

SUBCONTRACTOR'S CORRECTIVE ACTION

Description:	Date of Nonperformance:

SUBCONTRACTOR SIGNATURE OF CORRECTION

Name:	**Title:**	**Signature:**	**Date:**

JACOBS HEALTH AND SAFETY PLAN

Attachment 9

Beyond Zero Safety Tools

JACOBS

StepBack

What are the hazards?
What is the risk?
What can we do about it?

StepBack Risk Questions.	**YES**	**NO**
Is there enough time to complete the task safely and are people focused (not fatigued, distracted)?		
Is the right person(s) completing the task? (experience/training)		
Are adequate support and resources available?		
Are the correct tools, equipment, and PPE in place and are they in good operating condition?		
Are control measures in place to protect people/the environment (barriers, LOTO, adjacent activities)?		
Have environmental issues (waste, hazardous materials, stormwater) been identified and mitigated?		
Are there safe access and egress to and from the work area?		
Are emergency planning/response measures adequate, including spills/releases?		
Are conditions the same since the task was last assessed?		
Is there a pre-task plan developed and approved for the task?		
If you answer '**NO**' to any of the above, **STOP** work, and contact your HSM or EM.		

JACOBS

Beyond Zero Observations

Project Observation Information					
Project Name:			**Project Manager:**		
Project #:			**Health & Safety Mgr.:**		
Office Observation Information					
Office:					
Observation Information					
Observer Name:		**Company:**		**Date & Time:**	
Position/Title of worker observed:		**Company:**			
Observation Type:	☐ Safe Behavior ☐ Safe Condition ☐ Unsafe Behavior ☐ Unsafe Condition ☐ Opportunity for Improvement ☐ Other (specify):				
Work or Task Observed:					
Describe Observation:					
Type of incident prevented?					
WPS (*see table below):	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5				
Remedial Action Taken?	☐ Not Applicable ☐ No ☐ Yes (describe):				
Further Action Needed?	☐ No Action ☐ Outstanding Action ☐ Urgent Action (describe action needed):				

***For any incident with a WPS greater than 3, or when futher action is necessary, notify your HSM/EM and PM/Supervisor as soon as possible.**

Worst Potential Severity Table

WPS	Injury -Illness	Environment	Property Damage
5	Fatality or total permanent disability	Serious offsite impact, significant remediation required	USD$> 3 million
4	Partial disability; life changing; intensive care	Significant offsite impact, some remediation required	USD$ 300K-3 million
3	Urgent treatment, surgery	Release significantly above reportable limit of some local impact	USD$ 30K-300K
2	Medical treatment to prevent deterioration	Release above reportable limit or minor impact	USD$ 3K-30k
1	Simple, immediate treatment	Small release contained onsite and no impact	USD$ less than 3K

JACOBS HEALTH AND SAFETY PLAN

Attachment 10

Completed JACOBS AHAs

JACOBS HEALTH AND SAFETY PLAN

Attachment 11

Safety Data Sheets

JACOBS Health and Safety Plan

Attachment 12

COVID-19 Pandemic Management Strategy

Jacobs

COVID-19 Pandemic Management Strategy

April 9, 2020

Document history and status

Revision	Date	Description	Author	Reviewed	Approved
0	4/9/20	Original Document	J. Painter	M. Orman, T. Doerr, C. West	S. DeWitt

Contents

Executive Summary

On March 11, the World Health Organization (WHO) officially declared the outbreak of COVID-19 a pandemic as the number of people who have been diagnosed continues to increase. From the beginning of the outbreak of COVID-19, our top priority has been the safety and well-being of our people and the continuity of our business operations in support of our clients around the globe. Jacobs has taken steps to ensure we can deliver on that objective.

We have adopted mitigation strategies and protocols from the WHO and the United States Center for Disease Control (CDC), as well as the equivalent health authorities from respective countries where we operate. Recognizing that world standards and guidelines from the WHO and the CDC may change, the Jacobs guidelines are also subject to revision as the situation dictates. We continue to receive the most up-to-date information and will adjust our protocols in response to this rapidly evolving situation.

Key elements of the actions we have taken to date include:

1) Leadership – Our response to the COVID-19 outbreak is being coordinated by a cross-functional Global Crisis Management Team (CMT), that regularly reports into the office of the Chair and CEO and is connected to our regional CMTs in place in North America, Europe/Middle East/Africa, and Asia Pacific. These teams are comprised of senior representatives from our Health, Safety & Security, Legal, HR, IT, Real Estate, Operations, and Communications organizations, operating in an integrated manner.

2) Communications – Keeping our employees informed through our Global and Regional CMTs is critical. We have established a Coronavirus Update page on our global intranet which provides employees direct access to WHO and CDC information, as well as briefings, FAQs, travel advisories, and health information from Jacobs global leadership team and our CMTs. The information is updated real-time as major developments occur.

3) Travel Restrictions and Travel – A travel restriction is in place for all employees. (Refer to the Jacobs COVID-19 page; the FAQ also includes information on travel restrictions.) All non-client travel is currently cancelled. All client-related travel requires the approval of a Senior Vice President. Any international travel, including client-related, now requires the approval of an Executive Vice President. We are watching the situation closely and we will evaluate the restriction on an ongoing basis.

   We are enforcing due diligence around pre-trip planning, starting with evaluating whether an in-person trip is required or could be covered virtually. For approved client-related travel – or even personal travel – the planning extends to assessment of the threat level of the coronavirus at the travel destination, preventative measures during travel, and understanding the rules and guidelines for re-entry to the home location, including requirements for quarantine that align with the requirements of the WHO/CDC.

   As more states and local governments throughout the United States implement shelter in place or stay home orders to prevent the spread of COVID-19, our ability to work in our offices and other sites in these locations depends on whether we are exempt under the applicable orders. Where our work activities at a location meets the requisite definition of an Essential Business or Service under the order and where such work can't be performed remotely, the Company will issue to impacted employees a COVID-19 travel authorization document (TAD). This TAD, along with a client letter (where applicable), serves as an indication that the individual is exempt from certain restrictions under the executive or judicial order. Please note that this TAD only serves as our good faith belief that our work is exempt under the applicable order(s) and may not be honored by authorities.

   We have established return protocols for both client and personal travel from or through high-risk countries. This includes self-imposed isolation for a minimum of 14 days and requires an employee to be cleared before returning to work to ensure the safety and well-being of others.

For approved travel, please review the air, vehicle, and lodging recommendations included in Appendix I.

4) Meetings and Visitors – We are limiting face-to-face meetings as much as possible and are confirming that visitors have not travelled to/from any high-risk countries identified by the WHO/CDC. When meetings and visitors are required, we are adhering to WHO/CDC's guidelines around social proximity.

5) Exposure and Quarantine – We have implemented a global Real Estate Operations protocol for mitigating the spread of COVID-19 into our office environments through good office preparation/cleaning – as well as protocols for an office that does become infected. Please visit the REO - Facilities FAQs, Staging Area Detail and Visitor Management Signage page. We have also established and cascaded protocols to employees regarding actions to take whether at home or at work when there is a potential or real exposure, when symptoms present, or when there is a confirmed case.

6) Contingency Planning – The situation is very fluid. Like businesses all around the world, we are making contingency plans for remote working in the event of office closures or restrictions on project sites that do not allow our people to gain access. Our project teams will work closely with their client counterparts to establish project-specific plans tailored to each situation.

   Our focus during this challenging time remains on keeping our employees safe and honoring our commitments to our clients.

Refer to the Appendices at the back of this Plan for additional information on COVID-19 and how we can prepare and protect ourselves, our coworkers, and our clients, and help stop the spread of the COVID-19 virus.

1. COVID-19 Precautions on Jacobs Project Sites

The COVID-19 virus is thought to spread mainly from person-to-person contact (e.g., coughs, sneezes, contact with contaminated surfaces [e.g., equipment/tools]); therefore, when conducting work activities at Jacobs project site locations, the following COVID-19 protection protocols shall be implemented until further notice. Because the situation related to COVID-19 is so fluid, no one document or set of documents can cover all risks associated with this outbreak. This is an evolving situation, and your teams will need to check and adjust. Due to the wide spectrum of various field work activities that are being conducted, use the following guidance as it relates to your specific site location (i.e., 10-person groundwater treatment plant, 2-person field team conducting soil/air/groundwater sampling, conducting a pre-mob site walkthrough, etc.). Note: All references are frequently updated. Check Jacobs and CDC COVID-19 webpages frequently for updates.

We are now asking that the following precautions are fully implemented across all our project sites.

1. General Requirements:

- Review and follow Jacobs Global Security Companywide Travel Restriction, Preparedness Pamphlet and FAQ on the Jacobs COVID-19 Page.
- Review signs and symptoms of Coronavirus with all field staff. Refer to the CDC guidance document to review COVID-19 awareness information – fever, cough, shortness of breath, etc.
- Monitor local public health agency communications. Follow all local agency guidance and restrictions.
- If project team member has specific COVID-19 concerns (e.g., in high risk category, high risk locations), speak with PM and supervisor, and engage HR as necessary. Accommodations shall be made.
- If showing signs of COVID-19 or any flu-like symptoms, do not report to project site for work. Contact project Safety Liaison (SL), supervisor, PM, HR, and HSM. Contact your personal care physician.
- If clients or state/local governments require employers to perform temperature scans of Jacobs staff, contact the project Safety Liaison (SL), supervisor, PM, HR, and HSM for information on proper protocols.
- In office settings, wipe down your desk, keyboard, mouse, and telephone at least daily with a disinfectant. Do not clean up after others, especially in common areas. At smaller field sites (e.g., trailer setting), work surfaces such as desks, keyboards, mouse pointers, cell phones, telephones, radios, and copiers should be wiped down at least once a day with disinfecting wipes or solution. Periodically throughout the day, disinfect surfaces or tools being used such as pens, staplers, clipboards, door handles/knobs, coffee pot handles, etc.
- Refrain from person to person contact (e.g., handshakes, high-fives, etc.).
- Refrain from sharing personal items such as pens, glasses/mugs, cellphone, etc.
- Practice social distancing by maintaining a distance of 6 feet from each other unless essential to complete a job task.
- Eliminate group meetings to the maximum extent possible and limit attendance to essential personnel. If in-person meetings are necessary, maintain distance from each other (~6 feet). Utilize other means of communication for group-wide messages (phone, skype, radio, message boards, written communications, etc.).
- Work in the smallest groups possible (e.g., alone where it makes sense for low-risk activities while staying in communication). Consider keeping similar teams together on shift or in working groups. This will limit the chance of cross-infection across multiple groups and limiting contact across groups can help reduce risk of large percentage of staff needing to be quarantined.
- Use disposable gloves whenever feasible for all tasks (do not reuse gloves once removed).

- Coughing or sneezing should be done into a tissue and immediately placed into a trash receptacle. If a tissue is not available, then sneeze into the inside of your elbow/shirt sleeve (launder potentially contaminated clothing as soon as feasible). If nothing else, cover your nose and mouth with your hand, then immediately wash your hands or use hand sanitizer.
- Clean hands often with soap and water for at least 20 seconds. Soap and water should be used preferentially if hands are visibly dirty. If soap and water are not available, then use an alcohol-based hand sanitizer that contains at least 60% alcohol.
- Avoid touching your face – eyes, nose, mouth - throughout the day.
- If you are wearing gloves, remove them immediately after coughing or sneezing and discard in a waste receptacle.
- Do not come to work or to the site if you are sick or exhibiting any symptoms of the flu or COVID-19.
- If another person on site comes to work site exhibiting signs/symptoms of COVID-19 (fever, cough, shortness of breath) isolate them and send them home, unless and until they can provide a medical clearance from their personal physician.
- Use the Jacobs StepBack Card. We have developed a COVID-19 specific StepBack card (see Appendix F). You can find a short presentation on how to use the card here – StepBack COVID-19 Tool – and the card template is available here on Jacobs Connect. The COVID-19 StepBack tool does not replace the requirement to undertake a robust risk assessment of the workplace and the implementation of controls measures, but assists in maintaining an awareness of the work environment and recognizing any change in conditions or circumstances.
- Use of face coverings. The CDC recommends wearing cloth face coverings when people have to go out in public, for example to the grocery store or to pick up other necessities, especially in areas of significant community-based transmission. The need to wear a face covering on your project should be based upon a risk-assessment performed with your PM and HSM (the use of face coverings should be addressed in project HSE documents), unless working under client or local municipality mandates (see "NOTE" below).
    - The cloth face cover is meant to protect other people in case you are infected and may not know it.
    - Cloth face coverings can be fashioned from household items or made at home from common materials at low cost. Visit this link for directions on how to make a face covering. This information is also included as Appendix G of this Plan.
    - It is strongly recommended that employees use different masks for work and for home. It is also recommended you wash the cloth covering with laundry detergent and warm or hot water after each use.
    - Continue to keep about 6 feet between yourself and others. The cloth face cover is not a substitute for social distancing.
    - Do not use a facemask meant for a healthcare worker (N-95 respirators) unless specifically called for in your project HSE Plan - these are critical supplies that must continue to be reserved for healthcare workers and other medical first responders.
    - The face covering should be absent insignia, graphics or any other communication that is inconsistent with our Core Values or could be construed as disrespectful.
    - Face coverings should not be worn if they create more of a hazard, such as blocking vision, potential for contacting moving equipment, impeding critical communication, etc.

  NOTE: Some U.S. Agencies, such as the Department of the Defense (DoD), are requiring that all individuals on DoD property, installations, and facilities wear cloth face coverings when they cannot

maintain 6 feet of social distance in public areas or work centers. Other clients or facilities may have the same requirements. Verify with your PM and HSE manager what the requirements are on your site.

2. Business Resilience: To ensure business continuity we are currently ensuring isolation between our operations, therefore as far as is reasonably practicable we are avoiding physical interaction between each project, as well between our main offices and project sites (and vice versa).

   At your project sites consider measures that you can take to ensure project resilience such as:

   - Split shifts – For example into three teams, those that work remotely, and two other teams, A and B, working rotating shifts.
   - Split offices/sites – Consider having teams working in different parts of the project with zero cross over.
   - Shut down considerations – Ensure that you have everyone take home laptops, chargers, and any other important work documents in case of a shutdown of work sites. Refer to HSSE COVID-19 Temporary Field Project Shutdown Guidance.

3. Vulnerable Groups: Identify any higher risk individuals, such as those with underlying health conditions, that are pregnant, or Jacobs staff that are 60 years and older and make arrangements for these employees to work from home. If this is not possible, for client or project reasons, consider risk reduction such as part time options. We would also recommend that those that have partners working in higher risk professions such as care workers, doctors and nurses consider working from home if in an area of widespread community transmission.

   There will also be some staff that are genuinely concerned or unable to work on site at this time (such as care givers of parents), in line with our culture of caring we must assess each case individually and discuss the concerns and do everything we can to allow that colleague to work remotely, where this is not possible, this should be raised to the project management, DO/Ops and HSE representative for support.

4. Visitor Management: Take steps to reduce the number of visitors coming to the site office. Require visitors to book their appointment 24 hours minimum in advance and only allow visitors that are critical to the operation of the site/office. Approval of visitors must be approved by PM or another senior project team member. Maintain clear signage at reception informing visitors of additional control measures and requesting that they disclose where they have travelled in the last 14 days and if they are displaying any COVID-19 symptoms. Refer to Real Estate Operations' guidance issued on establishing signs/protocols for visitors. Any such case would be denied access to the site office and be asked to leave. Also make available hand sanitizer for visitors. On larger sites where project offices are shared, consider infrared cameras to monitor the temperature of those arriving to work.

5. Meetings: Make use of technology for meetings with clients and contractors where possible in order to avoid the need for in person meetings altogether. Where meetings are required or essential, ensure number of attendees is kept to a minimum (i.e., one essential team member) and social distancing is maintained (2 m or more). Some projects are considering holding meetings outside where they have more space, however ultimately what is important is avoiding the need for in person meetings, reducing the number of staff in attendance and ensuring distancing between participants.

6. Hard Copy Transmittals: Conduct an assessment and determine methods to stop the submission of all hard copies of documents (drawings, method statements, letters, etc.) and request the contractor to make all submissions electronically. Where hard copies must be kept for contractual reasons, request that they are sent electronically to Jacobs and have the Contractor retain the hard copy on their premises to submit later as a hard copy submittal. We understand that a number of projects have raised concerns around physical servers being located on site and inaccessible to staff working from outside the project, we ask project teams to follow IT guidance and utilize, Jacobs file sharing tools, ProjectWise, SharePoint, and TEAMS and other

communication tools, where there is an issue and requirement on your project please raise a ticket to IT for support.

7. Travel, Site Surveys and Inspections: Traveling in a car by yourself or with a colleague and then being outdoors is a relatively low-risk activity, although overnight accommodation in a hotel may be required. Assess your tasks and travel arrangements to site and on site, limit the number of passengers in vehicles to maintain social distancing, consider lone working risks if you're travelling alone and if overnight stays are required. Colleagues should maintain good personal hygiene at all times and avoid crowded places such as restaurants. Also, buy food or takeaways to be eaten in rooms. Refer to Appendix H for additional travel recommendations and guidance.
8. Jacobs Site Work: Site work is an integral part of our business and the continuation of site work is considered business critical (Business Continuity) and should continue unless directed by the government authorities, the client, or Jacobs leadership. The following measures are suggested:
    - On project sites, where possible, undertake site work such as inspections during quieter times (early mornings, scheduled breaks, and lunch) to reduce interaction with construction workers and maintain social distancing of at least 6 ft or more from all persons at all times.
    - Carry personal hand sanitizers and use to ensure hands remain clean when soap and water are not available.
    - No one on site should be at work if they are unwell or displaying any of the symptoms (coughing, fever, fatigue, shortness of breath). If employee begins to have symptoms, they should isolate immediately and notify their PM verbally (phone) or electronically. If this is noticed by another worker, they must notify their Supervisor or PM.
    - Everyone is empowered and expected to stop work if they believe their work, or the work of their team or others is unsafe or is putting others at increased risk.
    - Where close contact or contact with individuals is unavoidable but critical, the tasks must be risk assessed with the support of an HSE professional (and if necessary, industrial hygienist or medical professional). The principles of prevention must be applied, and if necessary, as a last resort, PPE must be provided such as disposable coveralls, safety glasses, face-masks, nitrile gloves, and any other protective clothing deemed necessary. However where work presents a risk that cannot be mitigated, the work shall not continue. If there is a need to provide the disposable coveralls and nitrile gloves, ensure an appropriate disposal receptacle is provided. Garbage must be double bagged.
    - Watch out for your team members, it is normal to feel down, low, anxious at this time and many will be distracted and may be complacent about other project safety risks, ensure we look out for one another and stay safe.
    - Make use of down-time by undertaking any outstanding training or updating documents such as HSE plans, Risk Assessment (RA) method statements and other documents.
    - Ensure that there is an adequate supply of running water along with soap and disposable hand towels or alcohol-based hand wipes in each of the wash facilities. Keep hand sanitizers in the office in easily accessible areas (motion operated are preferred), outside toilets, break rooms, office entrance and encourage staff to use it frequently. Maintain extra vigilance around cleaning in the office and on site.
    - Use the COVID-19 Field Checklist in Appendix D as necessary to ensure COVID-19 measures are addressed.
    - For projects that require temporary shut-down due to the COVID-19, refer to the Checklist in Appendix E.
    - If health screening becomes necessary (e.g., temperature screening), follow the "COVID-19 Working Onsite During a Pandemic" guidance, posted here. The need and protocol for health screening will be

based upon a risk assessment performed with your PM and HSM, unless working under a client- or municipality mandate, and will be addressed in HSE Plans. This document includes other measures for protecting staff and preventing the spread of the COVID-19 virus.

- Use of face coverings (repeated here purposefully). The CDC recommends wearing cloth face coverings when you have to go out in public, for example to the grocery store or to pick up other necessities, especially in areas of significant community-based transmission. The need to wear a face covering on your project should be based upon a risk-assessment performed with your PM and HSM (the use of face coverings should be addressed in project HSE documents), unless working under client- or local municipality mandates (see "NOTE" below).
  - The cloth face cover is meant to protect other people in case you are infected and may not know it.
  - Cloth face coverings can be fashioned from household items or made at home from common materials at low cost. Visit this link for directions on how to make a face covering. This information is also included as Appendix G of this Plan.
  - It is strongly recommended that employees use different coverings for work and for home. It is also recommended you wash the cloth covering with laundry detergent and warm or hot water after each use.
  - Once you place your face covering on your face, do not touch it again until ready to remove. When removing the mask, be careful not to touch your eyes, nose, and mouth and wash your hands immediately after removing.
  - Continue to keep about 6 feet between yourself and others. The cloth face cover is not a substitute for social distancing.
  - Do not use a facemask meant for a healthcare worker (surgical masks or N-95 respirators) unless specifically called for in your project HSE Plan - these are critical supplies that must continue to be reserved for healthcare workers and other medical first responders.
  - The face covering should be absent insignia, graphics or any other communication that is inconsistent with our Core Values or could be construed as disrespectful.
  - Face coverings should not be worn if they create more of a hazard, such as blocking vision, potential for contacting moving equipment, impeding critical communication, etc.

  NOTE: Some U.S. Agencies, such as the Department of the Defense (DoD), are requiring that all individuals on DoD property, installations, and facilities wear cloth face coverings when they cannot maintain 6 feet of social distance in public areas or work centers. Other clients or facilities may have the same requirements. Verify with your PM and HSE manager what the requirements are on your site. .

9. Vigilance and Incident Notification: We would like everyone to remain vigilant and look out for one another. Ensure prompt notification of any confirmed or potential case from our staff or non-controlled contractor in order to ensure that the correct measures are taken in line with local government and company direction. However, we must also ensure that we avoid rumors and panic unnecessarily. Please ensure that there is a method for both our staff and contractors to promptly notify you as the PD or PM on your project of any confirmed or potential case and then follow the process below to notify our regional management team of the incident:
   - The incident must be verbally reported immediately by your established Verbal Reporting Chain.
   - If the matter is triaged and the person is asked to go into self-isolation, advise HR.

   Due to the fact our staffing levels may be lower, pay extra care to personnel not authorized to be on site. Any security concerns should be reported immediately to Security, HSE, or management.

10. Temporary Field Project Shutdown: In the event a COVID-19 outbreak forces a temporary shutdown of a field project, PMs should work with the HSE Leads and Environmental Managers to conduct a risk assessment to determine site specific considerations and actions to take. Appendix E provides HSSE considerations that should be discussed. Refer to Office Reduced Attendance Protocols on Jacobs Connect for considerations of reduced staffing of an office.

2. COVID-19 Return to the Workplace Post Isolation Quarantine Guideline

The purpose of this guideline is to provide a process that protects the rights and health of the returning employee, but also the health of other employees, client employees, and Jacobs team mates. This protection extends to ensuring the mental health and wellbeing of all stakeholders.

The scope of this guideline is for any employee who has been in a period of isolation or quarantine due to precautionary measures, or had COVID-19-like illness (unconfirmed), or had an actual presumptive or confirmed positive COVID-19 illness, and that period has ended with either no illness or recovery from illness, and the employee is looking to return to the workplace.

A 'workplace' in the context of this guideline means a Jacobs workplace such as a Jacobs office or project site, or any other workplace excluding the home environment (WFH) where the person is conducting work on behalf of Jacobs.

Regardless of this guidance, the decision by an employee to discontinue home isolation after illness and return to the workplace should be made in consultation with their healthcare provider and state and/or local health departments. Local decisions depend on local circumstances.

Notification of intent to return to a workplace

No employee is to return to a workplace after a period of isolation/quarantine if they or someone in their household has been ill with any of the following symptoms in the 14 days prior to the date of return:

- Fever
- Cough
- Shortness of breath

Where the employee, or someone in their household, has been ill, they are to notify their line manager or HR partner of their intent to return to a workplace, but not do so until either assessed (see below) or have a clearance/written advice from a medical practitioner. If an employee or anyone in their household was not ill, they may return to the workplace.

COVID-19 Return to Workplace Assessment

The employee's line manager or HR, with HSE support, are to identify if there are specific local health agency requirements regarding the discontinuance of isolation or additional transmission-based precautions. Where no local requirements are stipulated and the employee has not been provided written advice by a medical practitioner, Jacobs' guidance for assessing an employee to return to the workplace is based on the CDC's time-since-illness-onset and time-since-recovery strategy (non-test-based strategy).

The employee's line manager or HR is to conduct the following assessment with the employee who has indicated that themselves or someone in their household has been ill in the 14 days prior to the intended date of return.

- Determine if the employee was ill
    - If YES, on what date did they first show signs of symptoms?
        - Has it been 7 days or greater since symptoms first appeared?
            - If NO they are to be reassessed after the minimum 7-day period has passed
        - If YES, have at least 3 days (72 hours) passed since recovery defined as resolution of fever without the use of fever-reducing medications and improvement in respiratory symptoms (e.g., cough, shortness of breath)
            - If NO, they are to be reassessed after they have had 3 days since recovery
            - If YES, they can return to the workplace
            - Note: A cough may still persist for several weeks after illness recovery.

    - o If NO, it wasn't the employee who was ill, continue assessment

- On what date did the first person in the employee's household become ill?
    - Determine if isolation period has been achieved in accordance with the assessment notes* (see below).
        - If they haven't, they are to finish isolation period and be reassessed on completion of the isolation period.
        - If they have, they can return to the workplace.

* Assessment notes (based on UK Government advice)

1. The 14-day period starts from the day illness began in the first person to become ill. Fourteen days is the incubation period for coronavirus; people who remain well after 14 days are unlikely to be infectious.
2. Should a household member (not the employee) develop coronavirus symptoms late in the 14-day household-isolation period (for example, on day 13 or day 14) the isolation period does not need to be extended.

General Requirements

Employees who have returned to the workplace post isolation/quarantine where neither themselves nor their household members were ill during the period, but they or a household member have later become ill are to notify their line manager, supervisor or HR as soon as possible and refer to WHO, CDC, or specific country guidance for how to conduct a self-assessment of their symptoms.

Responsibility

All employees are responsible for complying with this guideline to ensure that we protect the health, safety, and wellness of the Jacobs workplace.

If you have any questions regarding this guideline, please contact the local HR office or the Global Security & Resilience team via Global.Security@jacobs.com. The Company will continue to monitor the latest CDC and WHO bulletins for guidance and to update this guideline as appropriate. Within the U.S, requirements set forth by the Occupational Safety and Health Administration (OSHA) will apply. For Jacobs' international operations, compliance with country-specific health and safety regulations will apply. In implementing the processes set forth herein, Jacobs will comply with applicable country specific local employment and labor laws.

Appendix A. CDC, What You Need to Know

COVID 19 CORONAVIRUS DISEASE

What you need to know about coronavirus disease 2019 (COVID-19)

What is coronavirus disease 2019 (COVID-19)?

Coronavirus disease 2019 (COVID-19) is a respiratory illness that can spread from person to person. The virus that causes COVID-19 is a novel coronavirus that was first identified during an investigation into an outbreak in Wuhan, China.

Can people in the U.S. get COVID-19?

Yes. COVID-19 is spreading from person to person in parts of the United States. Risk of infection with COVID-19 is higher for people who are close contacts of someone known to have COVID-19, for example healthcare workers, or household members. Other people at higher risk for infection are those who live in or have recently been in an area with ongoing spread of COVID-19. Learn more about places with ongoing spread at https://www.cdc.gov/coronavirus/2019-ncov/about/transmission.html#geographic.

Have there been cases of COVID-19 in the U.S.?

Yes. The first case of COVID-19 in the United States was reported on January 21, 2020. The current count of cases of COVID-19 in the United States is available on CDC's webpage at https://www.cdc.gov/coronavirus/2019-ncov/cases-in-us.html.

How does COVID-19 spread?

The virus that causes COVID-19 probably emerged from an animal source, but is now spreading from person to person. The virus is thought to spread mainly between people who are in close contact with one another (within about 6 feet) through respiratory droplets produced when an infected person coughs or sneezes. It also may be possible that a person can get COVID-19 by touching a surface or object that has the virus on it and then touching their own mouth, nose, or possibly their eyes, but this is not thought to be the main way the virus spreads. Learn what is known about the spread of newly emerged coronaviruses at https://www.cdc.gov/coronavirus/2019-ncov/about/transmission.html.

What are the symptoms of COVID-19?

Patients with COVID-19 have had mild to severe respiratory illness with symptoms of

- fever
- cough
- shortness of breath

What are severe complications from this virus?

Some patients have pneumonia in both lungs, multi-organ failure and in some cases death.

How can I help protect myself?

People can help protect themselves from respiratory illness with everyday preventive actions.

- Avoid close contact with people who are sick.
- Avoid touching your eyes, nose, and mouth with unwashed hands.
- Wash your hands often with soap and water for at least 20 seconds. Use an alcohol-based hand sanitizer that contains at least 60% alcohol if soap and water are not available.

If you are sick, to keep from spreading respiratory illness to others, you should

- Stay home when you are sick.
- Cover your cough or sneeze with a tissue, then throw the tissue in the trash.
- Clean and disinfect frequently touched objects and surfaces.

What should I do if I recently traveled from an area with ongoing spread of COVID-19?

If you have traveled from an affected area, there may be restrictions on your movements for up to 2 weeks. If you develop symptoms during that period (fever, cough, trouble breathing), seek medical advice. Call the office of your health care provider before you go, and tell them about your travel and your symptoms. They will give you instructions on how to get care without exposing other people to your illness. While sick, avoid contact with people, don't go out and delay any travel to reduce the possibility of spreading illness to others.

Is there a vaccine?

There is currently no vaccine to protect against COVID-19. The best way to prevent infection is to take everyday preventive actions, like avoiding close contact with people who are sick and washing your hands often.

Is there a treatment?

There is no specific antiviral treatment for COVID-19. People with COVID-19 can seek medical care to help relieve symptoms.

CDC

CS 314937-A 03/03/2020

For more information: **www.cdc.gov/COVID19**

Appendix B. Jacobs COVID-19 Preparedness

Jacobs Novel Coronavirus (2019-nCoV) Preparedness

Jacobs has a pandemic preparedness guide within our Emergency Response Plan which includes specified actions at certain trigger points (phases). As the situation progresses, we will keep you informed via email, JacobsConnect, office HSE and facilities communications.

Our travel locator service allows us to identify business travellers in affected regions and to provide them with specific advice.

If you are not feeling well, stay home and seek medical care. For further guidance, employee can also contact the Global Assistance & Response hotline at **+1-443-221-6281**.

For additional information, reach out to the Operational Centers of Excellence HSE or Global Security & Resilience contacts at global.security@jacobs.com.

BeyondZero

Jacobs

Appendix C. Jacobs – Global Assistance and Response

What is a Coronavirus?

The 2019 novel (new) coronoavirus (2019-nCoV) is an ongoing outbreak of pneumonia first identified in Wuhan, China and can spread from person-to-person. Common signs of infection include:

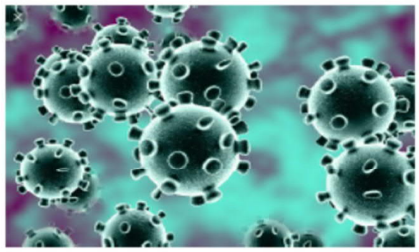
Healthy adults can infect others beginning three days after exposure to the virus, one day before symptoms develop, and up to five days after becoming sick. The total incubation period can be up to 14 days. This means you can pass the disease to someone else before you know you are sick, as well as while you are sick.

Currently, there is no specific treatment or vaccine to protect against 2019-nCoV.

Pandemic influenza phases

The World Health Organisation (WHO) uses the following classifications:

Phases 1 - 3	Predominantly animal infections. Few human infections.
Phase 4	Sustained human to human transmission.
Phases 5 – 6 PANDEMIC	Widespread human infection
Post Peak	Possibility of recurrent events
Post Pandemic	Disease activity at seasonal level



Healthy people either inhale the virus or pick it up by touching contaminated surfaces, then touching their nose, eyes, or mouth. Reduce transmission by covering your cough or sneeze.

What you can do

- Practice good personal hygiene – cover your mouth and nose with a tissue while coughing or sneezing.
- Wash hands frequently with soap and water or hand sanitizer that contains at least 60% alcohol – especially after coughing or sneeze.
- Avoid crowds and stay at least one to two meters away from obviously sick people. Stay at least one to two meters away from them.
- Avoid contact with wild animals or farm animals (live or dead) and their environment. This includes "wet markets" with live animals.
- Clean your environment often.
- Do not touch surfaces that may be contaminated with animal droppings.
- Avoid touching your face. If you must touch, ensure your hands are clean first.
- Do not travel if you are sick.
- Always check travel advisories before travelling.
- If travelling from an affected area or after contact with anyone from an affected area, monitor your health for at least fourteen days after your return and seek medical attention immediately if you become ill.
- Thoroughly cook meat and eggs to the recommended temperatures.

Up-to-date information on the 2019-nCoV can be found through the following:

- World Health Organization (WHO) Novel Coronvirus
- Center for Disease Control and Prevention (CDC)

Keeping your hands clean can reduce the spread of infection and protect yourself and others from getting sick.

Workplace Measures & Frequently Asked Questions

To protect our employees, Jacobs has deployed several measures:

- We are providing timely communications and guidance through JacobsConnect, network groups and HSE and real estate partners.
- Each country has specific guidelines around time off and time recording. Reach out to your local HR and line manager for guidance.
- Inform your manager if you are feeling unwell and discuss time off decisions.
- Visit your local doctor for further assessment and treatment.
- Local offices should look to procure containment kits which may include nitrile gloves, surgical masks, and hand sanitizers containing at least 60% alcohol.
- The Global Security & Resilience (GS&R) and Health, Safety and Environmental (HSE) team will continue to monitor the situation closely and provide updates as they develop.

Travel is temporarily banned to Mainland China at this time (excluding Hong Kong). Exceptions will require completion of TRiP consultation with and assessment by Global Security & Resilience team and final approval by the President, COO and/or CFO.

Reference: Global Security & Resilience JacobsConnect page for the latest travel status

- Global Assistance and Response World Cue Planner
- The Center for Systems Science and Engineering (CSSE) – Mapping the Wuhan Coronavirus

The use of surgical face masks can help protect you and others. If you are ill, face masks also help prevent the spread of disease.

Emergency preparedness

Circulate the pamphlet to your teams, direct any employee inquiry or travel concerns to GS&R, and refer employees to the Coronavirus mitigation protocol.

All Emergency Management Teams (EMTs) should continue to monitor the situation and follow guidance from the Operational Centers of Excellence.

All EMTs should review and update their Emergency Response Plan (ERP) and refer to the Pandemic guide to action for response advice on Page 95.

The EMT Incident Commander or Coordinator should seek guidance and coordinate with the GS&R team and Operational Centers of Excellence HSE leads as needed.

Educate yourself and your family. Learn about possible dangers and become familiar with your local office emergency plan for handling pandemics and your local community health response plan.

Jacobs Global Assistance & Response is available 24/7 for any security or medical enquiries.

Appendix D. COVID-19 Field Checklist

Below is a checklist for field projects working during the COVID-19 (C-19) pandemic. Please engage your project Health and Safety Manager (HSM) to ensure that appropriate hazard mitigation measures for C-19 are addressed in project HSE plans.

As a reminder, all employees are to advise their line manager, HR or their HSE representative if they have any C-19 related symptoms, and either not present for work or remove themselves from the workplace immediately until symptoms are assessed.

COVID-19 Field Checklist	
Business Resilience: At your project sites consider measures that you can take to ensure project resilience such as:	
☐	Where possible, split shifts – for example into three teams, those that work remotely, and two other teams A and B working rotating shifts.
☐	Split offices / sites - Consider having teams working in different parts of the project with zero cross over
☐	Shut down considerations - Ensure that you have everyone take home laptops, chargers and any other important work documents in case of a shutdown of work sites. Refer to HSSE COVID-19 Temporary Field Project Shutdown Guidance
Visitor management: Take steps to reduce the number of visitors coming to the site office. Require visitors to book their appointment 24 hours minimum in advance and only allow visitors that are critical to the operation of the site / office. Approval of visitors must be approved by PM or other senior project team member.	
☐	Maintain clear signage at reception informing visitors of additional control measures and requesting that they disclose where they have travelled in the last fourteen (14) days and if they are displaying any COVID-19 symptoms. Any such case would be denied access to the site office and be asked to leave.
☐	Also make available hand sanitizer for visitors.
Meetings: Make use of technology for meetings with clients and contractors where possible in order to avoid the need for in person meetings altogether.	
☐	Where meetings are required or essential, ensure number of attendees is kept to a minimum (i.e. one essential team member) and physical distancing is maintained (6'/2m or more).
Hard Copy Transmittals: Conduct an assessment and determine methods to stop the submission of all hard copies of documents (drawings, method statements, letters, etc.) and request the contractor to make all submissions electronically.	

☐	Where hard copies must be kept for contractual reasons, request that they are sent electronically to Jacobs and have the Contractor retain the hard copy on their premises to submit later as a hard copy submittal.
Travel, Site Surveys and Inspections: Traveling in a car by yourself or with a colleague and then being outdoors is a relatively low-risk activity, although overnight accommodation in a hotel may be required. Refer to Appendix I of the F&ES COVID-19 Pandemic Plan for additional travel guidelines.	
☐	Assess your tasks and travel arrangements to site and on site, limit the number of passengers in vehicles to reduce contact.
☐	Consider lone working risks if you're travelling alone and if overnight stays are required.
☐	If staying in a hotel, ensure they have C-19 cleaning protocols in place and take antiseptic wipes to clean items such as the TV remote, phone, light switches, and bathroom handles, etc.
☐	Ensure that hotels have restaurants in the near vicinity that you can order take-away to eat in your room.
☐	Avoid crowded places such as restaurants. Preference is to buy food or takeaways to be eaten in rooms. Refer to Appendix I of the F&ES COVID-19 Pandemic Plan for additional travel guidelines.
☐	Use your own vehicle when possible for local travel. Whether driving your own vehicle or a field vehicle, ensure that the inside of vehicles are cleaned thoroughly before you drive them using an EPA-approved cleaning agent. If others have been in the car who are exhibiting symptoms of C-19, let the vehicle set for a day or two with windows down to allow for natural ventilation. Wear gloves when cleaning. • Check out this article from Kelley Blue Book: How to Clean Your Car to Reduce the Spread of the Coronavirus. • View the EPA's registered list of antimicrobial products for use against novel Coronavirus SARS-CoV-2, the cause of COVID-19.
Jacobs site work: Site work is an integral part of our business and the continuation of site work is considered business critical (Business Continuity) and should continue unless directed by the government authorities, the client or Jacobs leadership. The following measures are suggested:	
☐	On project sites, where possible undertake site work such as inspections during quieter times (early mornings, scheduled breaks and lunch) to reduce interaction with construction workers and maintain physical distancing of at least 6 feet (2 meters) or more from all persons at all times.
☐	Reduce the need for individuals to touch potentially contaminated surfaces. For example, by signing documents, picking up passes, etc.
☐	Carry personal hand sanitizers and use this to ensure hands remain clean where soap and water are not available.
☐	No one on site should be at work if they are unwell or displaying any of the symptoms (coughing, fever, fatigue, shortness of breath). If employee begins to have symptoms, they should isolate

	immediately and notify their PM electronically. If this is noticed by another worker, they must notify their PM or HSE.
☐	Everyone is empowered expected to directly stop work if they believe their work, or the work of their team or others is unsafe or is putting others at increased risk.
☐	Where close contact or contact with individuals that are unavoidable, but critical, the tasks must be risk assessed with the support of a HSE professional (and if necessary industrial hygienist or medical professional). The principles of prevention must be applied, and if necessary, as a last resort PPE must be provided such as disposable coveralls, safety glasses, face-masks, nitrile gloves and any other protective clothing deemed necessary; however, where work presents a risk that cannot be mitigated, the work shall not continue. If there is a need to provide the disposable coveralls and nitrile gloves, ensure appropriate disposal receptacle is provided ensuring all PPE waste is double bagged.
☐	Watch out for your team members, its normal to feel down, low, anxious at this time and many will be distracted and may be complacent about other project safety risks, ensure we look out for one another and stay safe.
☐	Ensure that there is an adequate supply of hot/cold water along with soap and disposable hand towels in each of the wash facilities, or adequate alcohol-based hand sanitizers. Keep hand sanitizers in the office in easily accessible areas (motion operated are preferred), outside toilets, break rooms, office entrance and encourage staff to use it frequently. Maintain extra vigilance around cleaning in the office and on site.
Contractor site and facilities: Ask contractors to ensure that they have instilled appropriate preventative measures on site and to submit an outline of measures taken or to be taken. This must include ensuring the following as a minimum:	
☐	There is an adequate supply of hot/cold water along with soap and disposable hand towels in each of the wash facilities.
☐	Hand sanitizer must be available in the office in easily accessible areas, outside toilets, break rooms, office entrance and encourage staff to use it frequently.
☐	Regular cleaning regimes in the office.
☐	Physical distancing measures, such as reduced meeting and visitor attendance, site transportation, canteen protocol etc.
☐	Measures to reduce the risks of workers on site
☐	Deep cleaning and disinfection regime of site / offices
☐	Incident / suspected COVID-19 case management protocol.
☐	Please note that this is a non-exhaustive list of considerations and the contractor should assess their operations and mitigate risk accordingly

Vigilance and incident notification: We would like everyone to remain vigilant and look out for one another. Ensure prompt notification of any confirmed or potential case from our staff or subcontractor in order to ensure that the correct measures are taken in line with local government and company direction. However, we must also ensure that we avoid rumors and panic unnecessarily. Please ensure that there is a method for both our staff and contractors to promptly notify the PM or designee on your project of any confirmed or potential case and then follow the below process to notify our regional management team of the incident:	
☐	The incident must be verbally reported immediately by your established Verbal Reporting Chain
☐	If the matter is triaged and the person is asked to go into self-isolation, advise HR and HSE
☐	Due to the fact our staffing levels may be lower, pay extra care to personnel not authorized to be on site. Any security concerns should be reported immediately to Security, HSE or management.
Personal Hygiene	
☐	Do not touch your face!
☐	Avoid touching surfaces and equipment that you don't need to touch or clean them thoroughly before touching them. Wear gloves to prevent contact if cleaning supplies aren't available. Remove gloves by peeling them off inside-out to reduce potential spread of the virus. Double bag them and dispose of them in normal sanitary trash.
☐	Wash your hands or use hand sanitizer frequently throughout the day.

Appendix E. COVID-19 Temporary Field Project Shutdown Guidance

The purpose of this guidance is to equip project teams with Health, Safety, Security and Environment (HSSE) considerations in the event a COVID-19 outbreak forces a temporary shutdown of a field project. Refer to Office Reduced Attendance Protocols for considerations of reduced staffing of an office. Our most important consideration is the health, safety and well-being of those affected. *Project Managers should work with the HSE Leads and Environmental Managers to conduct risk assessments to determine site specific considerations and actions to take*. Below are some HSSE considerations that should be discussed at the project:

Health and Safety

- ☐ Direct staff to Jacobs COVID-19 information on JacobsConnect
- ☐ Direct contractors to COVID-19 resources (e.g., CDC, WHO, local health authority)
- ☐ Provide instructions to staff and contractors to notify Project Management of changes in health status and ability to return to work
- ☐ Annotate last work day in individual employee medical monitoring records
- ☐ Secure hazardous chemicals and flammable materials in an approved chemical storage cabinet
- ☐ Remove combustible material from site if long-term site storage is not available
- ☐ Remove equipment or supplies that are sensitive to temperature extremes or weather, and store all equipment in appropriate location (e.g., eyewash units, fire extinguishers, hand tools)
- ☐ Verify that any potentially contaminated equipment leaving the site is cleaned/decontaminated
- ☐ Ensure all exposed supplemental electrical cables and cords are tagged and made safe
- ☐ Define and manage processes for energy isolation including existing lockout-tagout
- ☐ Follow appropriate crane shutdown procedures
- ☐ Properly band brick stacks to prevent accidental collapse
- ☐ Chock or wedge pipes to prevent rolling
- ☐ Store all material away from site perimeter fence
- ☐ Remove and store/secure ladders to prevent unauthorized usage
- ☐ Secure, cover or barricade all excavations and post warning signs
- ☐ Ensure edges are protected; use barricades and signs on leading edges and drop-off points
- ☐ Protect exposed reinforcing steel with rebar caps, etc.
- ☐ Maintain good housekeeping in trailers, work areas, and walkways prior to leaving the site
- ☐ Log key hazards associated with unfinished work that need to be considered for restart

Environment

- ☐ Ensure emergency response plan includes spill/release protocols and Environmental Manager and alternate contact information
- ☐ Coordinate environmental permit status with issuing authority to determine if permit conditions can be suspended (e.g., site stabilization, inspections and reporting)
- ☐ Stabilize the site by replacing temporary dust, stormwater and erosion control measures with more permanent controls (e.g., reseeding, crushed concrete, gravel, cover or seed soil stockpiles), in coordination with government authorities if necessary.

- ☐ Assess potential weather impacts based on long range forecasts, especially in cyclone/hurricane and tornado risk areas
- ☐ Determine if temporary control measures should be removed to prevent creating a nuisance if not maintained (i.e., silt fencing, erosion control matting, sediment wattles, mulch)
- ☐ Remove storm drain inlet barriers if disturbed areas have been stabilized as needed to prevent local flooding
- ☐ Consider removing sediment basins or traps if disturbed areas are stabilized and cannot be secured (these may become attractive to children and standing water can attract mosquitoes)
- ☐ Inspect site control measures (silt fences, covers) and material/waste containers and note shutdown dates on inspection forms
- ☐ Coordinate the removal of any waste prior to shut down
- ☐ Secure containers of hazardous materials or waste that will remain onsite during shutdown, making sure they are closed, labeled and inventoried
- ☐ Place drums of liquid materials/oils (e.g., form oil) in secondary containment or under a protective covering
- ☐ Remove portable fuel tanks from the site. Secure tanks (fuel, materials) that will remain onsite to prevent discharge or unauthorized usage and verify that valves are closed and locked
- ☐ Stabilize any ongoing hazardous material abatement projects and consider additional postings and security measures if work cannot be completed before shutdown
- ☐ Remove or secure heavy equipment, storage containers (e.g., Conex boxes) and portable toilets away from storm drains and water bodies. Consider placing drip pans under equipment
- ☐ Stabilize/secure soil and material stockpiles with covers and anchors

Security

- ☐ Use the Business Continuity Plan Template to plan for project disruptions.
- ☐ Post “NO TRESPASSING” signs at entrance gates and on all perimeter fence every 100 feet
- ☐ Nominate standby persons at all levels (client, contractors) to respond to emergency situations
- ☐ Display emergency numbers on site
- ☐ Confirm and distribute emergency standby list to relevant persons
- ☐ Arrange after-hours security
- ☐ Check security lighting and alarms to be fully operational
- ☐ Inspect all perimeter fences, gates and barricades to be sure they are in good condition and prevent unauthorized access
- ☐ Prevent unauthorized access to equipment (e.g., earthmoving equipment, cranes, scaffolding) by removing or boarding up access ladders, and posting “No Unauthorized Access” signs
- ☐ Store and lock up all material/tools safely in containers
- ☐ Lock doors and containers and remove keys
- ☐ Lock away or remove all computers, copiers, scanners etc.
- ☐ Lock all vehicles and critical equipment and secure keys in a lockable safe or other secure place
- ☐ Park all vehicles in safe designated areas with drip trays under engine, wheels chocked, batteries disconnected
- ☐ Restrict travel to Client Critical Needs, defined as critical sales pursuits or critical client imperatives that cannot be done virtually. SVP approval must be included in your TRiP request.

Please consult your HSE representative or Region Security lead to evaluate other HSSE and local requirements applicable to your field project during temporary shutdown.

Appendix F. COVID-19 StepBack Card

Why use StepBack	StepBack assists in maintaining an awareness of the work environment, and recognizing any change in conditions or circumstances.
When to use StepBack	○ At the start of shift, ○ Every 2 hours ○ After a welfare break, ○ When the task changes ○ When location changes or ○ any time when circumstances change throughout the working day.
How to use this card	Review the questions on the next page, if the answer to any of the questions is **NO**, talk to your supervisor and discuss additional controls or protocols.

Step Back & Consider:		**Decision**	
1.	Am I free from COVID-19 symptoms?	Yes	No
2.	Does my task or office risk assessment/SPA include COVID-19 controls?	Yes	No
3.	Have I been briefed on the site or office COVID-19 control measures?	Yes	No
4.	Can I maintain a 2m (6ft) safe distance from my co-workers in the field, welfare facilities or office ?	Yes	No
5.	Do I have ready access to hand sanitizer or soap and running water?	Yes	No
6.	Am I able to avoid potentially contaminated surfaces?	Yes	No
7.	Do I have suitable PPE to avoid potential exposure to COVID-19?	Yes	No
8.	Can I dispose of potentially contaminated PPE/cleaning materials safely?	Yes	No
9.	Are the mess / wash room / kitchen / office facilities cleaned regularly?	Yes	No

If you answered "No" to any question, stop work and discuss with your supervisor

COVID-19 Symptoms:

Jacobs COVID-19 Resources:

If you develop symptoms contact your **Supervisor** or **Line Manager**, who will assist you and help inform your;

1.	HSE representative
2.	Local HR representative
3.	GSR (Global, Security & Resilience)

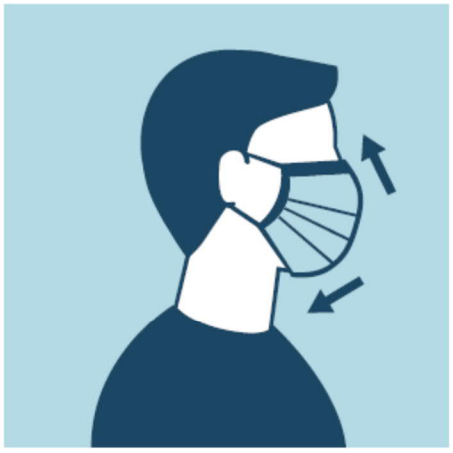
Appendix G. CDC DIY Cloth Face Coverings

Use of Cloth Face Coverings to Help Slow the Spread of COVID-19

How to Wear Cloth Face Coverings

Cloth face coverings should—

- fit snugly but comfortably against the side of the face
- be secured with ties or ear loops
- include multiple layers of fabric
- allow for breathing without restriction
- be able to be laundered and machine dried without damage or change to shape



CDC on Homemade Cloth Face Coverings

CDC recommends wearing cloth face coverings in public settings where other social distancing measures are difficult to maintain (e.g., grocery stores and pharmacies), **especially** in areas of significant community-based transmission.

CDC also advises the use of simple cloth face coverings to slow the spread of the virus and help people who may have the virus and do not know it from transmitting it to others. Cloth face coverings fashioned from household items or made at home from common materials at low cost can be used as an additional, voluntary public health measure.

Cloth face coverings should not be placed on young children under age 2, anyone who has trouble breathing, or is unconscious, incapacitated or otherwise unable to remove the cloth face covering without assistance.

The cloth face coverings recommended are not surgical masks or N-95 respirators. Those are critical supplies that must continue to be reserved for healthcare workers and other medical first responders, as recommended by current CDC guidance.

Should cloth face coverings be washed or otherwise cleaned regularly? How regularly?

Yes. They should be routinely washed depending on the frequency of use.

How does one safely sterilize/clean a cloth face covering?

A washing machine should suffice in properly washing a cloth face covering.

How does one safely remove a used cloth face covering?

Individuals should be careful not to touch their eyes, nose, and mouth when removing their cloth face covering and wash hands immediately after removing.

CDC

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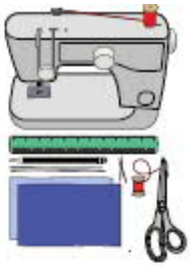
cdc.gov/coronavirus

Sewn Cloth Face Covering

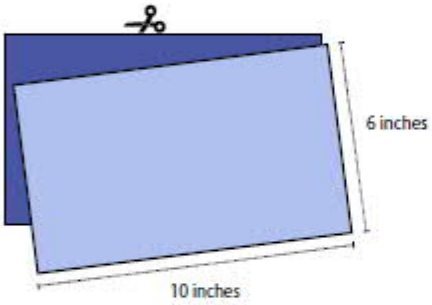


Materials

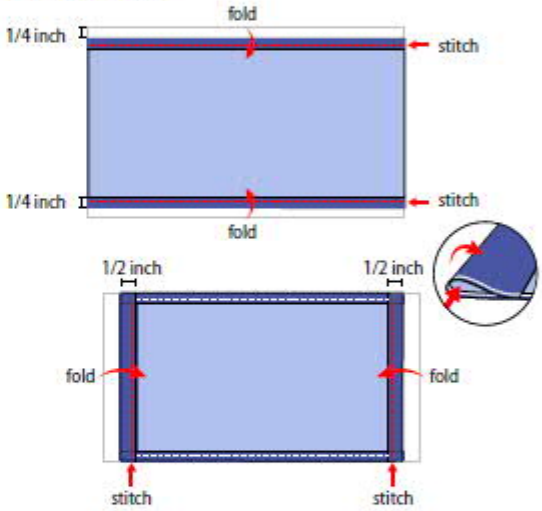
- Two 10"x6" rectangles of cotton fabric
- Two 6" pieces of elastic (or rubber bands, string, cloth strips, or hair ties)
- Needle and thread (or bobby pin)
- Scissors
- Sewing machine

Tutorial

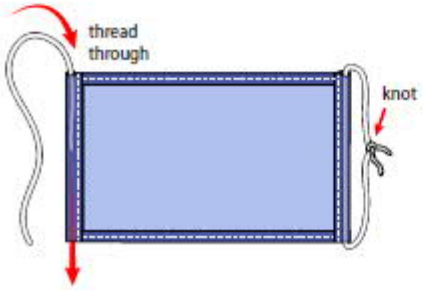
1. Cut out two 10-by-6-inch rectangles of cotton fabric. Use tightly woven cotton, such as quilting fabric or cotton sheets. T-shirt fabric will work in a pinch. Stack the two rectangles; you will sew the cloth face covering as if it was a single piece of fabric.



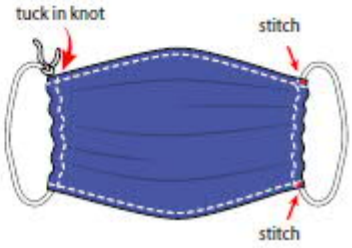
2. Fold over the long sides ¼ inch and hem. Then fold the double layer of fabric over ½ inch along the short sides and stitch down.



3. Run a 6-inch length of 1/8-inch wide elastic through the wider hem on each side of the cloth face covering. These will be the ear loops. Use a large needle or a bobby pin to thread it through. Tie the ends tight.
Don't have elastic? Use hair ties or elastic head bands. If you only have string, you can make the ties longer and tie the cloth face covering behind your head.



4. Gently pull on the elastic so that the knots are tucked inside the hem.
Gather the sides of the cloth face covering on the elastic and adjust so the cloth face covering fits your face. Then securely stitch the elastic in place to keep it from slipping.

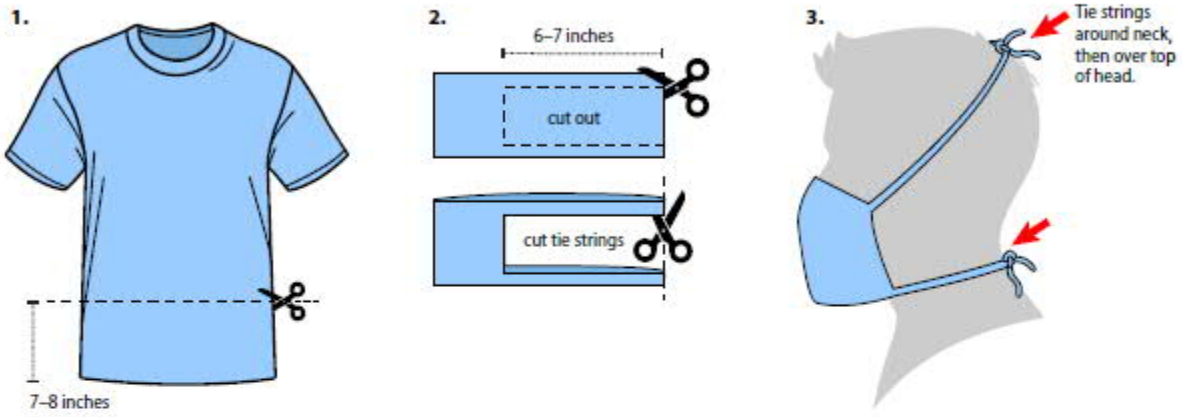


Quick Cut T-shirt Cloth Face Covering (no sew method)

Materials

- T-shirt
- Scissors

Tutorial

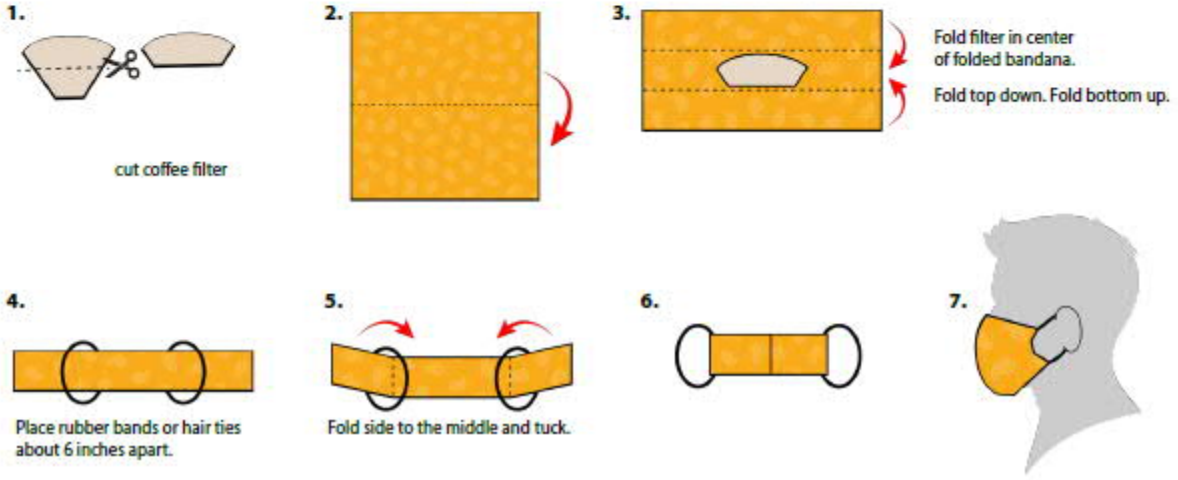


Bandana Cloth Face Covering (no sew method)

Materials

- Bandana (or square cotton cloth approximately 20"x20")
- Coffee filter
- Rubber bands (or hair ties)
- Scissors (if you are cutting your own cloth)

Tutorial



How to Safely Remove and Dispose of Face Coverings

Safely Removing Face Coverings

Wash your hands with soap and water or use hand sanitizer before touching the face covering. Avoid touching the front of the covering because it may be contaminated.

Only touch the ear loops, ties, or band. Follow the instructions below for the type of covering you are using.

- Covering with Ear Loops: Hold both ear loops and gently lift and remove.
- Covering with Ties: Untie the bottom bow then untie the top and pull the covering away from you as the ties are loosened.
- Covering with Bands: Lift the bottom strap over your head first then pull the top strap over your head.

Wash your hands with soap and running water or use hand sanitizer if soap and water is not available.

Safe Disposal

Disposable coverings must be thrown away immediately once removed.

- Reminder - Wash your hands with soap and water or use hand sanitizer before and after.
- Do not take off the face covering and place it on any surface.
- Refer to any local guidance for disposal location or instructions.
- Disposable coverings do not work well if they are damp, soiled, or damaged. Replace when this occurs.

Cloth face coverings (homemade or purchased) do not require disposal after use but following requirements must be followed:

- Reminder: Wash your hands with soap and water or use hand sanitizer before and after handling your cloth face covering.
- Do not take off the covering and place it on any surface.
- When removed in the work environment (such as needed to eat or drink), place the cloth face covering in a sealed plastic baggie upon removal from users' face.
- Face covering must be laundered with detergent at home each night
- Do not sanitize by microwave unless you are certain no metal clips were used when making the cloth face covering.

Appendix H. Travel Recommendations

Employees who will be traveling for work must take necessary precautions to reduce their risk to COVID-19. Discuss travel details with your supervisor, PM and HSM to assist with identification of local health requirements and proper planning. Below are recommendations to protect you during travel.

General Considerations During Travel

- Ensure that necessary approvals are in place prior to planning travel.
- Make every effort to maintain 6' spacing from others. If you must provide items (identification, payment, keys, etc.), provide item and step back until item is being returned. Wipe/clean items that have been handled by others.
- Acquire supplies for traveling safely. This includes hand sanitizer and disinfectant wipes. If feasible, bring food, snacks and beverages from home to minimize the need to acquire during travel. Many restaurants will be closed. Use automated services when feasible (on-line or credit-card payments) to minimize person-to-person interactions. If staying in a hotel, use one that has refrigerators and microwaves in the room.

Traveling to your Destination

Driving

- If feasible, use your personal vehicle for travel
- If using a rental car, wipe down steering wheel, dash, seatbelt, door inside, center console, shift lever, keys, etc., with a disinfectant wipe.
- Only stop for fuel and pay at the pump. If available use disposable gloves or ensure that hands are disinfected after pumping gas.
- If stopping for food, use drive-thrus and try not to pay with cash. Use hand sanitizer after paying.
- Avoid the use of uber/taxi/etc. if possible. If you must use them, it is imperative that you wipe down the door handles and seatbelt. If this can't be done, ensure that you don't touch your face or eat/drink in the vehicle. Wash hands thoroughly after getting out of vehicle or use hand sanitizer. Sit as far away from driver as possible.
- To the extent possible, limit the number of people in a vehicle to one. If it's necessary for two people to be in the car, the second person should sit in the back seat on the passenger side to maintain physical distancing. Roll the windows down for ventilation where possible.

Air Travel

Air travel should be used as a last resort and requires SVP approval at a minimum.

- Use hand sanitizer after using airline check-in kiosks
- Maintain 6' spacing when going through security checkpoints. Kindly ask travelers behind/around you to do the same
- Use hand sanitizer after clearing security

- Use hand sanitizer after using computer charging stations
- Wipe down airline seats, trays, armrest, seatback displays, seatback pocket. If read airline magazines, use hand sanitizer afterwards.
- Refrain from using inflight restrooms if possible
- If possible, walk instead of using the train between concourses; maintain 6' distancing from others.
- Airport shuttles: If you need to use one of the grab bars or straps, ensure you disinfect your hands when departing shuttle

Lodging

- Prior to booking, inquire about the hotel's procedures and processes for addressing COVID-19 concerns (cleaning, check-in, etc.).
- Wash hands immediately after entering room.
- Use disinfectant wipes for wiping down tv remote, door knobs, light switches, suitcase handles, telephones, desk surfaces, information booklets, etc.
- Request for room service to be suspended, especially for short-duration stays. If you must get new linens or towels, don't allow housekeepers to enter room. Have them delivered outside of door or pick them up, but limit amount of interaction with hotel staff.
- Bring your own pillowcases. Remove decorative pillows from bed for the duration of your stay.
- If clothes need to be cleaned and you do not have access to controlled laundry equipment, send out to be laundered.
- Choose a room on the first floor if possible. If you must access another level take the stairwell and sanitize your hands immediately after exiting the stairwell.
- If elevator must be used, try to ride it alone. Wash hands with sanitizer immediately after touching elevator floor buttons
- Travel with a personal water bottle or mug to limit use of room glassware. If dish washing equipment is available wash all dishes prior to use.
- Don't use the hotel exercise equipment – workout in your room or outside.
- Don't use the pool.
- Do not eat at buffet style meals in the hotel.
- Avoid eating out as much as possible, if necessary, use the drive through and use hand sanitizer after paying.
- Once you arrive at your destination, purchase necessary food for the duration of your stay so that meals can be prepared in your room (if possible).
- Avoid using community grills.