Appendix D.
Cleanup Action Alternative Calculations

Alternative 1 - Volumes and Weights

		Prjct #	33764085.00001		
Job	IP Tacoma Metals	Des'd	Melanie Young	Date	June 8, 2015
Description	Alt 1 Volumes & Weights	Check'd	Debbie Rodenhizer	Date	June 10, 2015

A	B	C	D	E	F	G	H	I	J	K	L	M

1.0 PROJECT INPUT

PROJECT	IP Tacoma Metals	**Client:**	IP
Engineer	Debbie Rodenhizer, PE	**City:**	Tacoma
Project No.	33764085.00001	**State:**	Washington

2.0 DESIGN OBJECTIVE

The objective of this analysis is to estimate the volumes of overburden and contaminated soils being excavated at the Simpson Property

3.0 REFERENCES

1 Figure 1-3 Soil Sampling Results B36 Area, Tacoma Metals Site
2 Figure 2-1 Alternative 1-Soil Excavation and Disposal

4.0 GENERAL ASSUMPTIONS

1 1 CY of soil weighs 1.65 tons or 3,300 pounds
2 The JJ Port and Simpson properties will be excavated to a depth of 15 feet
3 The upper 4 feet of soil will be segregated for reuse in the two areas with shallow contamination
4 The upper 7.5 feet of soil will be segregated for reuse at the remainder of the site
5 Soil removal bulking factor is 15%

4.1 SPREADSHEET USE

The speadsheet uses the following color convention for cells used for the analysis in the spreadsheet

User input values

Calculated or referenced values input from another cell

Alternative 1 - Volumes and Weights

		Prjct #	33764085.00001		
Job	IP Tacoma Metals	Des'd	Melanie Young	Date	June 8, 2015
Description	Alt 1 Volumes & Weights	Check'd	Debbie Rodenhizer	Date	June 10, 2015

A	B	C	D	E	F	G	H	I	J	K	L	M

5.0 DATA and SPECIFIC ASSUMPTIONS

5.1 AREA & VOLUME - Overburden Excavation in Areas with Shallow Contamination

Area of Overburden Excavation	=	2800	ft^2
Average Depth of Excavation	=	4	ft
In Place Volume of Excavation (Overburden)	=	420	CY
Bulking Factor	=	15	%
Volume of Excavated Soil (Overburden)		480	CY
Soil Density	=	1.65	TN/CY
Total Weight of Soil	=	700	TN

5.2 AREA & VOLUME - Overburden Excavation in All Other Areas

Area of Overburden Excavation	=	6800	ft^2
Average Depth of Excavation	=	7.5	ft
In Place Volume of Excavation (Overburden)	=	1900	CY
Bulking Factor	=	15	%
Volume of Excavated Soil (Overburden)		2200	CY
Soil Density	=	1.65	TN/CY
Total Weight of Soil	=	3200	TN

5.3 AREA & VOLUME - Sidewall Material Excavation (Overburden & Contaminated Soil)

Area of Excavation with 1:1 Slope	=	5900	ft^2
Depth of Excavation	=	15	ft
Total In-Place Volume of Excavation	=	1700	CY
Bulking Factor	=	15	%
Total Volume of Excavated Soil		2000	CY
Soil Density	=	1.65	TN/CY
Total Weight of Soil	=	2900	TN
Depth of Contaminated Soil	=	11	ft
In-Place Volume of Excavation (Contaminated Soil)	=	900	CY
Bulking Factor	=	15	%
Volume of Excavated Soil (Contaminated Soil)	=	1000	CY
Soil Density	=	1.65	TN/CY
Weight of Contaminated Soil	=	1500	TN
In-Place Volume of Excavation (Overburden)	=	800	CY
Bulking Factor	=	15	%
Volume of Excavated Soil (Overburden)	=	920	CY
Soil Density	=	1.65	TN/CY
Weight of Overburden	=	1320	TN

Alternative 1 - Volumes and Weights

		Prjct #	33764085.00001		
Job	IP Tacoma Metals	Des'd	Melanie Young	Date	June 8, 2015
Description	Alt 1 Volumes & Weights	Check'd	Debbie Rodenhizer	Date	June 10, 2015

A	B	C	D	E	F	G	H	I	J	K	L	M

5.4 AREA & VOLUME - Contaminated Soil Excavation in Areas with Shallow Contamination

Area of Contaminated Soil Excavation	=	2800	ft^2
Depth of Excavation	=	11	ft
In-Place Volume of Excavation (Contaminated Soil)	=	1200	CY
Bulking Factor	=	15	%
Volume of Excavated Soil (Contaminated Soil)		1400	CY
Soil Density	=	1.65	TN/CY
Total Weight of Soil	=	2000	TN

5.5 AREA & VOLUME - Contaminated Soil Excavation in All Other Areas

Area of Contaminated Soil Excavation	=	6800	ft^2
Depth of Excavation	=	7.5	ft
In-Place Volume of Excavation (Contaminated Soil)	=	1900	CY
Bulking Factor	=	15	%
Volume of Excavated Soil (Contaminated Soil)		2200	CY
Soil Density	=	1.65	TN/CY
Total Weight of Soil	=	3200	TN

5.6 TOTAL VOLUMES & WEIGHTS

Total Volume of In Place Overburden Excavated	=	3200	CY
Total Volume of In Place Contaminated Soil Excavated	=	4000	CY
Total In Place Volume	=	7200	CY
Total Volume of Overburden for Reuse	=	3600	CY
Total Volume of Contaminated Soil for Disposal	=	4600	CY
Total Weight of Overburden	=	5220	TN
Total Weight of Contaminated Soil	=	6700	TN

Alternative 1 - Material Volumes

		Prjct #	33764085.00001		
Job	IP Tacoma Metals	Des'd	Melanie Young	Date	June 8, 2015
Description	Alt 1 Material Volumes	Check'd	Debbie Rodenhizer	Date	June 10, 2015

A	B	C	D	E	F	G	H	I	J	K	L	M

1.0 PROJECT INPUT

PROJECT	IP Tacoma Metals	**Client:**	IP
Engineer	Debbie Rodenhizer, PE	**City:**	Tacoma
Project No.	33764085.00001	**State:**	Washington

2.0 DESIGN OBJECTIVE

The objective of this analysis is to estimate the volumes of material needed to implement Alternative #1. Specificially the material volumes for new import material to backfill and compact the excavation.

3.0 REFERENCES

1 Figure 1-3 Soil Sampling Results B36 Area, Tacoma Metals Site
2 Figure 2-1 Alternative 1-Soil Excavation and Disposal

4.0 GENERAL ASSUMPTIONS

1 Import material has a 15% bulking factor

4.1 SPREADSHEET USE

The speadsheet uses the following color convention for cells used for the analysis in the spreadsheet

User input values

Calculated or referenced values input from another cell

5.0 DATA and SPECIFIC ASSUMPTIONS

5.1 VOLUME - Import Clean Fill

In Place Volume of Excavation	=	7200	CY
In Place Volume of Material for Reuse	=	3200	CY
Bulking factor	=	15	%
Volume of Import Clean Fill Needed	=	4600	CY

Alternative 2 - Volumes and Weights

		Prjct #	33764085.00001		
Job	IP Tacoma Metals	Des'd	Melanie Young	Date	June 9, 2015
Description	Alt 2 Volumes & Weights	Check'd	Debbie Rodenhizer	Date	June 11, 2015

A	B	C	D	E	F	G	H	I	J	K	L	M

1.0 PROJECT INPUT

PROJECT	IP Tacoma Metals	**Client:**	IP
Engineer	Debbie Rodenhizer, PE	**City:**	Tacoma
Project No.	33764085.00001	**State:**	Washington

2.0 DESIGN OBJECTIVE

The objective of this analysis is to estimate the volumes of overburden and contaminated soils being excavated or solidified at the Simpson Property

3.0 REFERENCES

1. Figure 1-3 Soil Sampling Results B36 Area, Tacoma Metals Site
2. Figure 2-2 Alternative 2- *In Situ* Solidification

4.0 GENERAL ASSUMPTIONS

1. 1 CY of soil weighs 1.65 tons or 3,300 pounds
2. The JJ Port property will be excavated to a depth of 7.5 feet
3. The upper 4 feet of soil will be excavated and segregated for reuse
4. Soil between 7.5 and 15 feet below ground surface will be solidified on the JJ Port property
5. Soil between 4 and 15 feet below ground surface will be solidified on the Simpson property
6. Soil removal bulking factor is 15%
7. Solidification volumetric expansion is 35%
8. Solidification area extends 1.5 feet beyond limits of contaminated material

4.1 SPREADSHEET USE

The speadsheet uses the following color convention for cells used for the analysis in the spreadsheet

User input values

Calculated or referenced values input from another cell

Alternative 2 - Volumes and Weights

		Prjct #	33764085.00001		
Job	IP Tacoma Metals	Des'd	Melanie Young	Date	June 9, 2015
Description	Alt 2 Volumes & Weights	Check'd	Debbie Rodenhizer	Date	June 11, 2015

A	B	C	D	E	F	G	H	I	J	K	L	M

5.0 DATA and SPECIFIC ASSUMPTIONS

5.1 AREA & VOLUME - Overburden Excavation

Area of Overburden Excavation	=	10,000	ft^2
Average Depth of Excavation	=	4	ft
In Place Volume of Excavation (Overburden)	=	1,500	CY
Bulking Factor	=	15	%
Volume of Excavated Soil (Overburden)		1,700	CY
Soil Density	=	1.65	TN/CY
Total Weight of Soil	=	2,500	TN

5.2 AREA & VOLUME - Contaminated Soil Excavation on JJ Port Property

Area of Contaminated Soil Excavation	=	650	ft^2
Depth of Excavation	=	3.5	ft
In-Place Volume of Excavation (Contaminated Soil)	=	90	CY
Bulking Factor	=	15	%
Volume of Excavated Soil (Contaminated Soil)		100	CY
Soil Density	=	1.65	TN/CY
Total Weight of Soil	=	150	TN

5.3 AREA & VOLUME - Soil Solidification on JJ Port Property

Area of Soil Solidification	=	480	ft^2
Depth of Solidification	=	7.5	ft
Volume of Soil to be Solidified (Contaminated Soil)	=	140	CY
Solidification Volumetric Expansion Factor	=	35	%
Volume of Solidified Soil	=	190	CY

5.4 AREA & VOLUME - Soil Solidification on Simpson Property

Area of Soil Solidification	=	8800	ft^2
Depth of Solidification	=	11	ft
Volume of Soil to be Solidified (Contaminated Soil)	=	3,600	CY
Solidification Volumetric Expansion Factor	=	35	%
Volume of Solidified Soil	=	4,900	CY

Alternative 2 - Volumes and Weights

		Prjct #	33764085.00001		
Job	IP Tacoma Metals	Des'd	Melanie Young	Date	June 9, 2015
Description	Alt 2 Volumes & Weights	Check'd	Debbie Rodenhizer	Date	June 11, 2015

A	B	C	D	E	F	G	H	I	J	K	L	M

5.5 AREA & VOLUME - Solidification Overlap Volume

Depth of Solidification	=	11	ft
Solidification Perimeter	=	420	ft
Estimated Overlap (Outside of Target Treatment Zone)	=	1.5	ft
Volume of Solidified Overlap Soil (Not Contaminated)	=	260	CY
Solidification Volumetric Expansion Factor	=	35	%
Volume of Solidified Soil	=	360	CY

5.6 TOTAL VOLUMES & WEIGHTS

Total Volume of In Place Overburden Excavated	=	1,500	CY
Total Volume of In Place Contaminated Soil Excavated	=	90	CY
Total Volume of Soil Excavated	=	1,600	CY
Total Volume of In Place Contaminated Soil Solidified	=	3,900	CY
Total Volume of Solidified Overlap Volume	=	260	CY
Total In Place Volume of Soil Solidified	=	4,200	CY
Total In Place Volume	=	5,700	CY
Total Volume of Overburden for Reuse	=	1,700	CY
Total Volume of Contaminated Soil Relocated	=	100	CY
Total Volume of Solidified Soil	=	5,700	CY
Total Weight of Overburden	=	2,500	TN
Total Weight of Contaminated Soil Excavated/Relocated	=	150	TN

Alternative 2 - Material Volumes

		Prjct #	33764085.00001		
Job	IP Tacoma Metals	Des'd	Melanie Young	Date	June 9, 2015
Description	Alt 2 Material Volumes	Check'd	Debbie Rodenhizer	Date	June 11, 2015

A	B	C	D	E	F	G	H	I	J	K	L	M

1.0 PROJECT INPUT

PROJECT	IP Tacoma Metals	**Client:**	IP
Engineer	Debbie Rodenhizer, PE	**City:**	Tacoma
Project No.	33764085.00001	**State:**	Washington

2.0 DESIGN OBJECTIVE

The objective of this analysis is to estimate the volumes of material needed to implement Alternative #2. Specificially the material volumes needed for implementation of solidification, and the volumes of import material needed, if any.

3.0 REFERENCES

1. Figure 1-3 Soil Sampling Results B36 Area, Tacoma Metals Site
2. Figure 2-2 Alternative 2- *In Situ* Solidification

4.0 GENERAL ASSUMPTIONS

1. Solidification material consists of 8% newslag cement, 2% bentonite grout and 0.5% caustic soda
2. 1 CY of newslag cement weighs 1.8 tons
3. 1 CY of bentonite grout weighs 1.6 tons
4. 1 CY of caustic soda weighs 1.5 tons
5. Import material has a 15% bulking factor
6. Solidification volumetric expansion is 35%
7. Miminum 2 feet of clean fill required above solidifed material

4.1 SPREADSHEET USE

The speadsheet uses the following color convention for cells used for the analysis in the spreadsheet

User input values

Calculated or referenced values input from another cell

Alternative 2 - Material Volumes

		Prjct #	33764085.00001		
Job	IP Tacoma Metals	Des'd	Melanie Young	Date	June 9, 2015
Description	Alt 2 Material Volumes	Check'd	Debbie Rodenhizer	Date	June 11, 2015

A	B	C	D	E	F	G	H	I	J	K	L	M

5.0 DATA and SPECIFIC ASSUMPTIONS

5.1 VOLUME - Import NewSlag Cement

Volume of Treatment Area	=	4200	CY
NewSlag Cement Density	=	1.8	TN/CY
Percent of NewSlag Cement	=	8%	
Weight of Material Needed	=	610	TN

5.2 VOLUME - Import Bentonite Grout

Volume of Treatment Area	=	4200	CY
Bentonite Grout Density	=	1.6	TN/CY
Percent of NewSlag Cement	=	2%	
Weight of Material Needed	=	140	TN

5.3 VOLUME - Import Caustic Soda

Volume of Treatment Area	=	4200	CY
Caustic Soda Density	=	1.5	TN/CY
Percent of NewSlag Cement	=	0.5%	
Weight of Material Needed	=	40	TN

5.4 VOLUME - Import Clean Fill

Height of Fill above Solidified Soil on JJ Port Property	=	5.0	FT
Height of Fill above Solidified Soil on Simpson Property	=	3.40	FT
Total In-Place Volume of Fill Above Solidified Soil	=	1,300	CY
Solidification Volumetric Expansion Factor	=	35	%
Depth Interval of Solidification	=	11	FT
Depth Interval of Overburden Excavation	=	4	FT
Height of Solidified Soil Area Above Existing Grade	=	3.3	FT
Area of Sloped Transition Area (4:1 Slope)	=	3,600	SF
Volume of Sloped Transition Area	=	220	CY
Total Volume of In Place Fill Required	=	1,520	CY
Bulking factor	=	15	%
Total Volume of Fill Required	=	1,700	CY
Volume of Import Clean Fill Needed	=	0	CY

Alternative 3 - Volumes and Weights

		Prjct #	33764085.00001		
Job	IP Tacoma Metals	Des'd	Debbie Rodenhizer	Date	April 22, 2015
Description	Alt 3 Volumes & Weights	Check'd	Melanie Young	Date	April 27, 2015

A	B	C	D	E	F	G	H	I	J	K	L	M

1.0 PROJECT INPUT

PROJECT	IP Tacoma Metals	**Client:**	IP
Engineer	Debbie Rodenhizer, PE	**City:**	Tacoma
Project No.	33764085.00001	**State:**	Washington

2.0 DESIGN OBJECTIVE

The objective of this analysis is to estimate the volumes of clean and contaminated soils being excavated at the Simpson Property.

3.0 REFERENCES

1 Figure 1-2 Soil Sampling Results B36 Area, Simpson Property, Tacoma Metals Site
2 Figure 2-3 Alternative 3-Multi-Component Alternative

4.0 GENERAL ASSUMPTIONS

1 1 CY of soil weighs 1.65 tons or 3,300 pounds
2 The upper 4 feet of soil will be segregated for reuse
3 Contaminated soil above 7.5 ft bgs on the Simpson property will be excavated for disposal
4 Contaminated soil above 15 ft bgs on the JJ Port property will be excavated for disposal
5 Soil removal bulking factor is 15%

4.1 SPREADSHEET USE

The speadsheet uses the following color convention for cells used for the analysis in the spreadsheet

User input values

Calculated or referenced values input from another cell

Alternative 3 - Volumes and Weights

		Prjct #	33764085.00001		
Job	IP Tacoma Metals	Des'd	Debbie Rodenhizer	Date	April 22, 2015
Description	Alt 3 Volumes & Weights	Check'd	Melanie Young	Date	April 27, 2015

A	B	C	D	E	F	G	H	I	J	K	L	M

5.0 DATA and SPECIFIC ASSUMPTIONS

5.1 AREA & VOLUME - Overburden Excavation

Area of Overburden Excavation	=	2800	ft^2
Average Depth of Excavation	=	4	ft
In Place Volume of Excavation (Overburden)	=	420	CY
Bulking Factor	=	15	%
Volume of Excavated Soil (Overburden)		480	CY
Soil Density	=	1.65	TN/CY
Total Weight of Soil	=	700	TN

5.2 AREA & VOLUME - Sidewall Material Excavation

Area of Excavation with 1:1 Slope	=	1600	ft^2
Depth of Excavation	=	7.5	ft
Total In-Place Volume of Excavation	=	230	CY
Bulking Factor	=	15	%
Total Volume of Excavated Soil		260	CY
Soil Density	=	1.65	TN/CY
Total Weight of Soil	=	380	TN
Depth of Contaminated Soil	=	3.5	ft
In-Place Volume of Excavation (Contaminated Soil)	=	50	CY
Bulking Factor	=	15	%
Volume of Excavated Soil (Contaminated Soil)	=	60	CY
Soil Density	=	1.65	TN/CY
Weight of Contaminated Soil	=	90	TN
In-Place Volume of Excavation (Overburden)	=	180	CY
Bulking Factor	=	15	%
Volume of Excavated Soil (Overburden)	=	210	CY
Soil Density	=	1.65	TN/CY
Weight of Overburden	=	300	TN

5.3 AREA & VOLUME - Contaminated Soil Excavation JJ Port Property

Area of Contaminated Soil Excavation	=	480	ft^2
Depth of Excavation	=	11	ft
In-Place Volume of Excavation (Contaminated Soil)	=	200	CY
Bulking Factor	=	15	%
Volume of Excavated Soil (Contaminated Soil)		230	CY
Soil Density	=	1.65	TN/CY
Total Weight of Soil	=	330	TN

Alternative 3 - Volumes and Weights

		Prjct #	33764085.00001		
Job	IP Tacoma Metals	Des'd	Debbie Rodenhizer	Date	April 22, 2015
Description	Alt 3 Volumes & Weights	Check'd	Melanie Young	Date	April 27, 2015

A	B	C	D	E	F	G	H	I	J	K	L	M

5.4 AREA & VOLUME - Contaminated Soil Excavation Simpson Property

Area of Contaminated Soil Excavation	=	2300	ft^2
Depth of Excavation	=	3.5	ft
In-Place Volume of Excavation (Contaminated Soil)	=	300	CY
Bulking Factor	=	15	%
Volume of Excavated Soil (Contaminated Soil)		350	CY
Soil Density	=	1.65	TN/CY
Total Weight of Soil	=	500	TN

5.5 AREA & VOLUME - Contaminated Soil Capped Simpson Property

Area of Contaminated Soil Excavation	=	8800	ft^2
Depth Interval Capped	=	7.5	ft
In-Place Volume of Capped Soil (Contaminated Soil Only)	=	2500	CY

5.5 TOTAL VOLUMES & WEIGHTS

Total Volume of In Place Overburden Excavated	=	600	CY
Total Volume of In Place Contaminated Soil Excavated	=	550	CY
Total In Place Volume	=	1200	CY
Total Volume of Overburden for Reuse	=	690	CY
Total Volume of Contaminated Soil for Disposal	=	640	CY
Total Weight of Overburden	=	1000	TN
Total Weight of Contaminated Soil	=	1000	TN

Alternative 3 - Material Volumes and Quantities

		Prjct #	33764085.00001		
Job	IP Tacoma Metals	Des'd	Debbie Rodenhizer	Date	April 22, 2015
Description	Alt 3 Material Volumes	Check'd	Melanie Young	Date	April 27, 2015

A	B	C	D	E	F	G	H	I	J	K	L	M

1.0 PROJECT INPUT

PROJECT	IP Tacoma Metals	**Client:**	IP
Engineer	Debbie Rodenhizer, PE	**City:**	Tacoma
Project No.	33764085.00001	**State:**	Washington

2.0 DESIGN OBJECTIVE

The objective of this analysis is to estimate the volumes of material needed to implement Alternative #3. Specificially the material volumes for new import material to backfill the excavation and cap the site.

3.0 REFERENCES

1 Figure 1-2 Soil Sampling Results B36 Area, Simpson Property, Tacoma Metals Site
2 Figure 2-3 Alternative 3-Multi-Component Alternative

4.0 GENERAL ASSUMPTIONS

1 1 CY of soil weighs 1.65 tons or 3,300 pounds
2 Import material has a 15% bulking factor
3 Cap consists of 6.5 feet of fill, 8 inches of gravel, and 4 inches of asphalt.
4
5

4.1 SPREADSHEET USE

The speadsheet uses the following color convention for cells used for the analysis in the spreadsheet

User input values

Calculated or referenced values input from another cell

Alternative 3 - Material Volumes and Quantities

		Prjct #	33764085.00001		
Job	IP Tacoma Metals	Des'd	Debbie Rodenhizer	Date	April 22, 2015
Description	Alt 3 Material Volumes	Check'd	Melanie Young	Date	April 27, 2015

A	B	C	D	E	F	G	H	I	J	K	L	M

5.0 DATA and SPECIFIC ASSUMPTIONS

5.1 VOLUME - Import Clean Fill for Excavation Areas

In Place Volume of Excavation	=	1200	CY
In Place Volume of Material for Reuse	=	600	CY
Bulking factor	=	15	%
Volume of Import Clean Fill Needed for Excavation Areas	=	690	CY

5.2 VOLUME - Import Clean Fill for Cap

Cap Area	=	8800	SF
Height of Capped Lift	=	6.5	FT
Bulking factor	=	15	%
Volume of Import Clean Fill for Cap	=	2500	CY

5.3 VOLUME - Import Clean Fill for 4:1 Slope for Cap

Area of Sloped Transition Area (4:1 Slope)	=	9100	ft^2
Height of Soil Cap	=	6.5	ft
In-Place Volume of Transition Sloped Area	=	1100	CY
Bulking Factor	=	15	%
Volume of Transtiion Soil (Clean Fill)		1270	CY

5.4 Volume - Import Gravel for Base Course

Total Asphalt Cap Area	=	17900	SF
Depth of Gravel	=	0.7	FT
Volume of Gravel for Cap	=	450	CY

5.5 Total Volumes of Import Materials

Total Volume of Clean Fill	=	4500	CY
Total Volume of Gravel	=	450	CY

AVERAGE CONCENTRATION CALCULATIONS

		Prjct #	33764085.00010		
Job	IP Tacoma Metals	Des'd	Shelby Nerison	Date	May 27, 2015
Description	Average Concentration Calcs	Check'd	Debbie Rodenhizer	Date	June 10, 2015

										Reference		Row
A	B	C	D	E	F	G	H	I	J	K	L	M

1.0 PROJECT INPUT

PROJECT	IP Tacoma Metals	**Client:**	IP
Engineer	Shelby Nerison	**City:**	Tacoma
Project No.	33764085.00010	**State:**	Washington

2.0 DESIGN OBJECTIVE

The objective of this analysis is to estimate the average concentrations of contaminants in four combinations of areas/depths at the Simpson and JJ Port Properties.

3.0 REFERENCES

1. Figure 1-3 Soil Sampling Results B36 Area, Tacoma Metals Site, Tacoma, Washington
2. Figure 2-1 Alternative 1 Soil Excavation and Disposal
3. Figure 2-2 Alternative 2 *In Situ* Solidifaction
4. Figure 2-3 Alternative 3 Multi-Component Alternative

4.0 GENERAL ASSUMPTIONS

1. 1 CY of soil weighs 1.65 tons or 3,300 pounds
2. 1 ton equals 907.185 kg
3. Non-detected concentrations are not included in the average concentration calculation
4. A = JJ Port Property (4-7.5 ft bgs)
5. B = JJ Port Property (7.5-15 ft bgs)
6. C = Simpson Property (4-7.5 ft bgs)
7. D = Simpson Property (7.5-15 ft bgs)
8. Areas estimated by CAD

4.1 SPREADSHEET USE

The speadsheet uses the following color convention for cells used for the analysis in the spreadsheet

User input values

Calculated or referenced values input from another cell

AVERAGE CONCENTRATION CALCULATIONS

		Prjct #	33764085.00010		
Job	IP Tacoma Metals	Des'd	Shelby Nerison	Date	May 27, 2015
Description	Average Concentration Calcs	Check'd	Debbie Rodenhizer	Date	June 10, 2015

Reference	Row

A	B	C	D	E	F	G	H	I	J	K	L	M

5.0 DATA and SPECIFIC ASSUMPTIONS

5.1 AREAS AND VOLUMES OF CONTAMINATED SOIL

Soil Density	1.65	TN/CY
Conversion Factor	907.185	KG/TN

Alternatives 1, 2, 3	A	B	C	D
Area (sq ft)	480	480	2,300	8,800
Depth Interval (ft)	3.5	7.5	3.5	7.5
Volume of Soil (cy)	70	140	300	2,500
Mass of Soil (kg)	100,000	210,000	450,000	3,700,000
Borings	B53	B60	B58	B36
	B60		B64	B49
			B65	B50
			B68	B51
			B69	B55
			B72	B56
				B57
				B58
				B64
				B65
				B68
				B69
				B72

5.2 AVERAGE CONCENTRATIONS OF CONTAMINATED SOIL

A	Depth (ft bgs)	cPAH (mg/kg)	TPHd (mg/kg)	TPHo (mg/kg)
B53	4-5	**45.6**	497	**2,640**
B60	4.5-5	9.48	385	857
Average	4-7.5	28	440	1,700

B	Depth (ft bgs)	cPAH (mg/kg)	TPHd (mg/kg)	TPHo (mg/kg)
B60	9-15	**29.6**	**2,910**	1,330
Average	7.5-15	30	2,900	1,300

C	Depth (ft bgs)	cPAH (mg/kg)	TPHd (mg/kg)	TPHo (mg/kg)
B58	4-5	NA	687	**3,030**
B64	All samples too deep			
B65	3.5-4.5	**20.6**	137	910
B68	4-5	**87.5**	452	**2,620**
B69	3.5-4.5	NA	1,560	**3,570**
B72	4-5	**14**	93.2	484
Average	4-7.5	41	590	2,100

AVERAGE CONCENTRATION CALCULATIONS

		Prjct #	33764085.00010		
Job	IP Tacoma Metals	Des'd	Shelby Nerison	Date	May 27, 2015
Description	Average Concentration Calcs	Check'd	Debbie Rodenhizer	Date	June 10, 2015

										Reference		Row
A	B	C	D	E	F	G	H	I	J	K	L	M

D	Depth (ft bgs)	cPAH (mg/kg)	TPHd (mg/kg)	TPHo (mg/kg)
B36	8-10	**118**	1,060	1,690
B49	8-10	**385**	**31,800**	**40,600**
B50	**7-8**	**47.0**	1,150	949
	8-9	0.194	104	50 U
B51	8.5-10	0.151	58.9	73.2
B55	7.5-9	**24.7**	419	750
	10-12	14.1	661	631
B56	7-8.5	**62.0**	266	1,560
	13-14	2.83	156	184
B57	7.5-8.5	**2,033**	**4,440**	**20,200**
	9-12	**283**	**13,200**	**3,510**
B58	7.5-8.5	**118**	920	1,460
B64	7.5-8.5	**30.6**	325	847
	14-15	0.323	58.5	19.2
B65	8-9	14.2	358	456
B68	13.5-15	0.033 U	10 U	50 U
B69	8.5-9.5	**265**	**18,300**	**3,830**
	12.5-13.5	**72.6**	**6,970**	**2,160**
B72	8-9	0.033 U	10 U	50 U
	13-14	0.033 U	10 U	50 U
B76	8-9	**102**	1,480	**3,200**
	12-14	10.2	300	494
B77	7.5-8.5	**411**	**21,200**	**13,600**
B78	7.5-9	**118**	1,410	**3,310**
	14-15	4.38	365	233
B80	8-9	**39.8**	101	522
	12-13	7.53	33.0	210
Average	7.5-15	170	4,400	4,400

SOIL CONTAMINANT MASS CALCULATIONS FOR ALTERNATIVE 1

		Prjct #	33764085.00010		
Job	IP Tacoma Metals	Des'd	Shelby Nerison	Date	April 23, 2015
Description	Mass Calcs for Alt 1	Check'd	Debbie Rodenhizer	Date	April 24, 2015

										Reference		Row
A	B	C	D	E	F	G	H	I	J	K	L	M

1.0 PROJECT INPUT

PROJECT	IP Tacoma Metals	Client:	IP
Engineer	Shelby Nerison	City:	Tacoma
Project No.	33764085.00010	State:	Washington

2.0 DESIGN OBJECTIVE

The objective of this analysis is to estimate the mass of contaminants removed from the Simposon and JJ Port Properties by excavation in Alternative 1.

3.0 REFERENCES

1. Table 1-2 Soil Analytical Results
2. Figure 1-3 Soil Sampling Results B36 Area, Tacoma Metals Site, Tacoma, Washington
3. Figure 2-1 Alternative 1 Soil Excavation and Disposal

4.0 GENERAL ASSUMPTIONS

1. A = JJ Port Property (4-7.5 ft bgs)
2. B = JJ Port Property (7.5-15 ft bgs)
3. C = Simpson Property (4-7.5 ft bgs)
4. D = Simpson Property (7.5-15 ft bgs)
5. Soil in Areas/Volumes A, B, C, and D will be excavated
6. 1 lb is equal to 453,592 mg

4.1 SPREADSHEET USE

The speadsheet uses the following color convention for cells used for the analysis in the spreadsheet

User input values

Calculated or referenced values input from another cell

SOIL CONTAMINANT MASS CALCULATIONS FOR ALTERNATIVE 1

		Prjct #	33764085.00010		
Job	IP Tacoma Metals	Des'd	Shelby Nerison	Date	April 23, 2015
Description	Mass Calcs for Alt 1	Check'd	Debbie Rodenhizer	Date	April 24, 2015

										Reference		Row
A	B	C	D	E	F	G	H	I	J	K	L	M

5.0 DATA and SPECIFIC ASSUMPTIONS

5.1 TOTAL MASS EXCAVATED IN ALTERNATIVE 1

Conversion Factor: 453,592 MG/LB

Alternative 1	cPAH	TPHd	TPHo
Mass in Area/Volume A (lbs)	6.2	97	370
Mass in Area/Volume B (lbs)	14	1,300	600
Mass in Area/Volume C (lbs)	41	590	2,100
Mass in Area/Volume D (lbs)	1,400	36,000	36,000
Total Mass (lbs)	1,500	38,000	39,000

SOIL CONTAMINANT MASS CALCULATIONS FOR ALTERNATIVE 2

		Prjct #	33764085.00001		
Job	IP Tacoma Metals	Des'd	Shelby Nerison	Date	May 27, 2015
Description	Mass Calcs for Alt 2	Check'd	Debbie Rodenhizer	Date	June 10, 2015

										Reference		Row
A	B	C	D	E	F	G	H	I	J	K	L	M

1.0 PROJECT INPUT

PROJECT	IP Tacoma Metals	**Client:**	IP
Engineer	Shelby Nerison	**City:**	Tacoma
Project No.	33764085.00010	**State:**	Washington

2.0 DESIGN OBJECTIVE

The objective of this analysis is to estimate the mass of contaminants solidified at the Simpson and JJ Port Properties in Alternative 2.

3.0 REFERENCES

1. Table 1-2 Soil Analytical Results
2. Figure 1-3 Soil Sampling Results B36 Area, Tacoma Metals Site, Tacoma, Washington
3. Figure 2-2 Alternative 2 *In Situ* Solidification

4.0 GENERAL ASSUMPTIONS

1. A = JJ Port Property (4-7.5 ft bgs)
2. B = JJ Port Property (7.5-15 ft bgs)
3. C= Simpson Property (4-7.5 ft bgs)
4. D = Simpson Property (7.5-15 ft bgs)
5. Soil in Areas/Volumes A, B, C, D will be solidified
6. 1 lb is equal to 453,592 mg

4.1 SPREADSHEET USE

The speadsheet uses the following color convention for cells used for the analysis in the spreadsheet

User input values

Calculated or referenced values input from another cell

SOIL CONTAMINANT MASS CALCULATIONS FOR ALTERNATIVE 2

		Prjct #	33764085.00001		
Job	IP Tacoma Metals	Des'd	Shelby Nerison	Date	May 27, 2015
Description	Mass Calcs for Alt 2	Check'd	Debbie Rodenhizer	Date	June 10, 2015

										Reference		Row
A	B	C	D	E	F	G	H	I	J	K	L	M

5.0 DATA and SPECIFIC ASSUMPTIONS

5.1 TOTAL MASS SOLIDIFIED IN ALTERNATIVE 2

Conversion Factor: 453,592 MG/LB

Alt 2	cPAH	TPHd	TPHo
Mass in Area/Volume A (lbs)	6.2	97	370
Mass in Area/Volume B (lbs)	14	1,300	600
Mass in Area/Volume C (lbs)	41	590	2,100
Mass in Area/Volume D (lbs)	1,400	36,000	36,000
Total Mass (lbs)	1,500	38,000	39,000

SOIL CONTAMINANT MASS CALCULATIONS FOR ALTERNATIVE 3

		Prjct #	33764085.00001		
Job	IP Tacoma Metals	Des'd	Shelby Nerison	Date	April 23, 2015
Description	Mass Calcs for Alt 3	Check'd	Debbie Rodenhizer	Date	April 24, 2015

										Reference		Row
A	B	C	D	E	F	G	H	I	J	K	L	M

1.0 PROJECT INPUT

PROJECT	IP Tacoma Metals	**Client:**	IP
Engineer	Shelby Nerison	**City:**	Tacoma
Project No.	33764085.00010	**State:**	Washington

2.0 DESIGN OBJECTIVE

The objective of this analysis is to estimate the mass of contaminants removed from and contained at the Simpson and JJ Port Properties in Alternative 3.

3.0 REFERENCES

1 Table 1-2 Soil Analytical Results
2 Figure 1-3 Soil Sampling Results B36 Area, Tacoma Metals Site, Tacoma, Washington
3 Figure 2-3 Alternative 3 Multi-Component Alternative

4.0 GENERAL ASSUMPTIONS

1 A = JJ Port Property (4-7.5 ft bgs)
2 B = JJ Port Property (7.5-15 ft bgs)
3 C = Simpson Property (4-7.5 ft bgs)
4 D = Simpson Property (7.5-15 ft bgs)
5 Soils in Areas/Volumes A, B, and C will be excavated
6 Soils in Area/Volume D will be capped
7 1 lb is equal to 453,592 mg

4.1 SPREADSHEET USE

The speadsheet uses the following color convention for cells used for the analysis in the spreadsheet

User input values

Calculated or referenced values input from another cell

SOIL CONTAMINANT MASS CALCULATIONS FOR ALTERNATIVE 3

		Prjct #	33764085.00001		
Job	IP Tacoma Metals	Des'd	Shelby Nerison	Date	April 23, 2015
Description	Mass Calcs for Alt 3	Check'd	Debbie Rodenhizer	Date	April 24, 2015

										Reference		Row
A	B	C	D	E	F	G	H	I	J	K	L	M

5.0 DATA and SPECIFIC ASSUMPTIONS

5.1 TOTAL MASS EXCAVATED IN ALTERNATIVE 3 (AREAS/VOLUMES A, B, AND C)

Conversion Factor: 453,592 MG/LB

Alt 3 - Excavated	cPAH	TPHd	TPHo
Mass in Area/Volume A (lbs)	6.2	97	370
Mass in Area/Volume B (lbs)	14	1,300	600
Mass in Area/Volume C (lbs)	41	590	2,100
Total Mass (lbs)	60	2,000	3,100

5.2 TOTAL MASS CONTAINED IN PLACE IN ALTERNATIVE 3 (AREA/VOLUME D ONLY)

Alt 3 - Capped	cPAH	TPHd	TPHo
Mass in Area/Volume D (lbs)	1,400	36,000	36,000
Total Mass (lbs)	1,400	36,000	36,000

Figure B-1
Alternative 1 CALCULATIONS
Soil Excavation and Disposal

AECOM

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Tacoma Metals Site
Tacoma, Washington

Figure B-2
Alternative 2 CALCULATIONS
***In Situ* Solidification**

AECOM

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Tacoma Metals Site
Tacoma, Washington

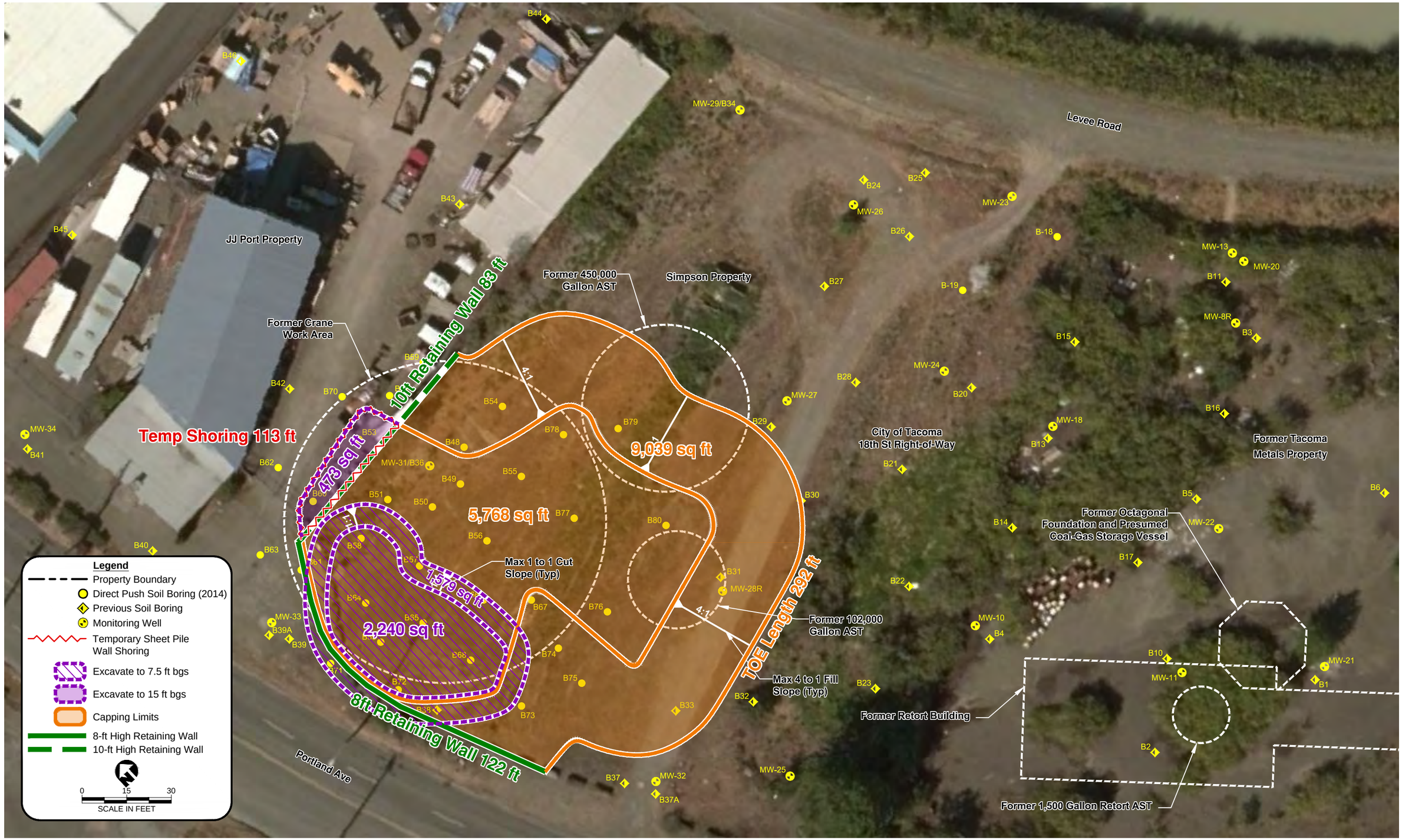

Figure B-3
Alternative 3 CALCULATIONS
Multi-Component Alternative

AECOM

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Tacoma Metals Site
Tacoma, Washington

Appendix E.
Cleanup Action Alternative Cost Estimates

Alternative 1 **EXCAVATION WITH OFF-SITE DISPOSAL**
Former Tacoma Metals Site, Simpson and JJ Port Properties

Client	International Paper		**Estimator**	Cary Brown, AECOM	
Location	Tacoma, Washington		**Report Date**	NA	
Project	Former Tacoma Metals Site Remediation		**Last Updated**	6/9/2015	
Document	FS Addendum		**Source of Costs**	Engineers Estimate	
Soil Removal	YES	SIMPSON PROPERTY-B36	**Groundwater Treatment**	No	
Soil Treatment Area	9,600	SF	**Treatment Depth**	4-15	FT bgs
In-Place Soil Volume	4,000	CY			
Soil Disposal Volume	4,600	CY (assumes 15% bulking)			

Alternative Specific Assumptions

1. The JJ Port and Simpson properties soil impacted area is approximately 9,300 SF and has contaminated soil from 4 to 15 feet bgs in areas of shallow contamination and 7.5 to 15 feet bgs elsewhere.
2. Contaminated soil will be excavated over 9,600 SF area, 16,000 SF footprint including clean sidewall areas
3. The maximum depth of excavation will be approximately 15 feet bgs
4. The top 4 feet in areas of shallow contamination is below CUL and can be reused on site and the top 7.5 feet can be reused elsewhere on site.
5. The excavation sidewalls will be sloped at 1:1 to access the contaminated soil
6. A portion of the excavated sidewalls (800 CY in place) are below CUL and can be reused on site
7. Pre-design soil sampling will be conducted on the JJ Port property in 6-10 locations.
8. Non-DNAPL contaminated soil above Method C will be landfilled as CAMU-eligible waste in Arlington, OR
9. All soil with DNAPL will be incinerated and transported by rail to an incinerator in Utah
10. Ten (10) Percent of excavated soil will have DNAPL and need incineration
11. Ninety (90) Percent of excavated soil will be disposed at a Subtitle C landfill
12. No soil excavated can be disposed at a Subtitle D landfill
13. Soil Density is 1.65 TN/CY, Soil Removal Bulking is 15%, and Soil Import Bulking is 15%
14. Temporary shoring will be required along the northern excavation boundary near JJ Port property (approx. 100 LF) and will be installed to a depth of 30 ft bgs.
15. The work will be done independent from other Tacoma Metals Remediation areas

Category	Task #	Task Description	Quantity	Unit	Unit Cost	Total Cost
CONTRACTOR COSTS (CAPITAL DIRECT)						
Remedial Action Construction						
$796,020	1	Mobilization/Demobilization	1	LS	$67,000	$67,000
	2	Contractor Work Plans	240	HR	$90	$21,600
	3	Decommission Wells in the Soil Removal Area	3	EA	$920	$2,760
	4	Specialty Subcontractors (surveyor, utility locate)	1	LS	$8,000	$8,000
	5	TESC (Silt Fence, Construction Entrance, and Dust Control)	1	LS	$10,000	$10,000
	6	Install Temporary Sheet Pile Wall Shoring	3,000	SF	$45	$135,000
	7	Excavation and Stockpiling of Clean Overburden	2,680	CY	$24	$64,320
	8	Excavation and Stockpiling of Clean Sidewalls 1:1 slope	920	CY	$27	$24,840
	9	Excavation and Stockpiling of Contaminated Soil	4,600	CY	$28	$128,800
	10	Analytical Testing Services (Mobile Laboratory)	10	Day	$2,250	$22,500
	11	Loading of Contaminated Soil	6,700	TN	$6	$40,200
	12	Import of Clean Fill to the Site (with 15% bulking)	4,600	CY	$22	$101,200
	13	Contaminated Water Handling and Environmental Protection	1	LS	$60,000	$60,000
	14	Backfill and Compaction of Excavation	8,200	CY	$9	$73,800
	15	Monitoring Well Installation	3	EA	$5,400	$16,200
	16	Site Restoration (hydroseeding)	18,000	SF	$0.10	$1,800
	17	Contractor Reporting and Closeout Submittals	200	HR	$90	$18,000
Contaminated Waste Disposal and Transportation						
$1,708,300	1	NAPL Contaminated Soil Disposal Costs (Incinerator)	670	TN	$460	$308,200
	2	Transportation Costs to Incinerator	670	TN	$180	$120,600
	3	Liquid NAPL Material Disposal Costs (Incinerator)	900	GAL	$10	$9,000
	4	Liquid NAPL Transportation Costs to Incinerator	18	DRUM	$250	$4,500
	5	CAMU-Eligible Material Disposal Costs (Subtitle C Landfill)	6,030	TN	$130	$783,900
	6	Transportation Costs to Subtitle C Landfill	6,030	TN	$70	$422,100
	7	Non-Hazardous Material Disposal Costs (Subtitle D)	0	TN	$51	$0
	8	Transportation Costs to Subtitle D Landfill	0	TN	$41	$0
	9	Contaminated Water Treatment and Disposal	300,000	GAL	$0.20	$60,000
	10	Non-Hazardous Material Disposal Costs (Concrete Recycling)	0	TN	$8	$0
	11	Transportation Costs to Asphalt Recycler	0	TN	$9	$0
Subtotal Contractor Costs						**$2,504,320**
Contractor Contingency (%)			**30**	%	$2,504,320	$751,296
Total Contractor Costs						**$3,255,616**
Contractor Markup (%)			**10**	%	$3,255,616	$325,562
Total Contractor Costs with Markup						**$3,581,178**

Category	Task #	Task Description	Quantity	Unit	Unit Cost	Total Cost
ENGINEERING COSTS (CAPITAL INDIRECT)						
	1	General Coordination, Meetings, and Planning	1	LS	$30,000	$30,000
	2	Regulatory Review, Coordination, and Meetings	1	LS	$15,000	$15,000
	3	Pre-Design Soil Sampling on JJ Port Property	1	LS	$25,000	$25,000
	4	Engineering Design (% DCC)	2.5	%	$3,255,616	$81,390
	5	Bid & RFI Support	60	HR	$135	$8,100
	6	Construction Oversight and QA (% DCC)	3	%	$3,255,616	$97,668
	7	Confirmational Sample Collection and Reporting	1	LS	$50,000	$50,000
	8	Overburden Sample Collection and Reporting	1	LS	$20,000	$20,000
	9	Closure Documentation & Reporting	300	HR	$110	$33,000
Subtotal Engineering Costs						**$360,159**
Engineering Contingency (%)			**15**	%	$360,159	$54,024
Total Engineering Costs						**$414,183**

Category	Task #	Task Description	Quantity	Unit	Unit Cost	Total Cost
ANNUAL O&M and / or LONG-TERM MONITORING COSTS						
Annual LTM Cost (Annual GW Sampling of 6 wells for 5 years)			***5***	***Years of Annual LTM***		
$19,550	1	Mob/Demob for Sampling	1	Event	$750	$750
	2	Sampling Labor and Supplies (2 people for 1 day)	2	Day	$2,000	$4,000
	3	Analytical Testing	6	Samples	$800	$4,800
	4	Annual Reporting	1	LS	$10,000	$10,000
Subtotal Annual O&M and LTM Cost						$19,550
O&M Contingency			25%	%	$19,550	$4,888
Total Annual O&M and LTM Cost						$24,438
Total Non-Routine O&M Cost		Estimated to be 0% of Construction Costs				$0
Total O&M and LTM Cost		***Years till project completion***	***5***			$122,188
Present-Worth O&M Cost		***Presumed Interest Rate***	***3%***			**$105,400**

ALTERNATIVE COST SUMMARY			**Rounded Total**	**Cumulative Total**
TOTAL CAPITAL COSTS (DIRECT & INDIRECT)			$3,995,000	**$3,995,000**
TOTAL O&M COSTS (PRESENT WORTH)			$105,000	**$4,100,000**
SALES TAX (Washington State)	Percentage of Direct Capital Costs	9.5%	$340,000	**$4,440,000**
AGENCY OVERSIGHT (Ecology)	Percentage of Capital Costs	2.0%	$80,000	**$4,520,000**
TOTAL PRESENT-WORTH COST				**$4,500,000**

Alternative 2 ***IN SITU*** **SOLIDIFICATION**

Former Tacoma Metals Site, Simpson and JJ Port Properties

Client	International Paper		**Estimator**	Cary Brown, AECOM	
Location	Tacoma, Washington		**Report Date**	NA	
Project	Former Tacoma Metals Site Remediation		**Last Updated**	6/9/2015	
Document	FS Addendum		**Source of Costs**	Engineers Estimate	
Soil Removal	YES	SIMPSON PROPERTY-B36	**Groundwater Treatment**	No	
Soil Treatment Area	9,300	SF	**Treatment Depth**	4-15	FT bgs
In-Place Soil Volume	4,200	CY			
Soil Disposal Volume	0	CY (assumes 15% bulking)			

Alternative Specific Assumptions

1 The JJ Port and Simpson properties soil impacted area is approximately 9,300 SF and has contaminated soil from 4 to 15 feet bgs in areas of shallow contamination and 7.5 to 15 feet bgs elsewhere.
2 Contaminated soil will be solidified over 9,300 SF area
3 The maximum depth of solidification will be approximately 15 feet bgs
4 The top 4 feet of soil (1,500 CY in place) is below CUL and will be temporarily removed and reused on site
5 All soil between 4 and 15 feet bgs will be solidified
6 Some hidden obstacles will need to be removed by excavation to complete solidification
7 Pre-design soil sampling will be conducted on the JJ Port property in 6-10 locations.
8 Pilot testing of solidification will be completed on a 400 SF area prior to the remedial action construction
9 Soil Density is 1.65 TN/CY and Soil Removal Bulking is 15%
10 The northern and western limits of the fill placement over solidified soil will have 8 ft and 5 ft high, respectively, retaining wall installed.
11 The work will be done independent from other Tacoma Metals Remediation areas

Category	Task #	Task Description	Quantity	Unit	Unit Cost	Total Cost
CONTRACTOR COSTS (CAPITAL DIRECT)						
Remedial Action Construction						
$1,223,084	1	Mobilization/Demobilization	1	LS	$225,000	$225,000
	2	Contractor Work Plans	300	HR	$90	$27,000
	3	Decommission Wells in the Solidification Area	3	EA	$920	$2,760
	4	Bench Scale Mix Designs	1	LS	$60,000	$60,000
	5	Solidification Pilot Test of Selected Mix Design (10%)	190	CY	$300	$57,000
	6	Specialty Subcontractors (surveyor, utility locate)	1	LS	$8,000	$8,000
	7	TESC (Silt Fence, Construction Entrance, and Dust Control)	1	LS	$10,000	$10,000
	8	Trench Box for Excavation of JJ Port Soils to Depth of 7.5 ft bgs	1	LS	$5,000	$5,000
	9	Excavation and Stockpiling of Clean Overburden 0 to 4 ft bgs	1,700	CY	$24	$40,800
	10	Excavation and Relocation of JJ Port Soils to 7.5 ft bgs	100	CY	$32	$3,200
	11	Solidification Materials (8% NewCem Slag Cement)	610	TN	$84	$51,240
	12	Solidification Materials (2% Bentonite Grout - Hydrogel 90)	140	TN	$120.96	$16,934
	13	Solidification Materials (0.5% Caustic Soda)	40	TN	$1,260	$50,400
	14	Solidification Labor and Equipment	4,200	CY	$131	$551,250
	15	Removal of Hidden Obstacles During Solidification	1	LS	$25,000	$25,000
	16	Backfill and Compaction of Fill Above Solidified Soil	1,700	CY	$9	$15,300
	17	Materials and Installation of Retaining Wall and Rail/Fence	1,100	SF	$35	$38,500
	18	Monitoring Well Installation	3	EA	$5,400	$16,200
	19	Site Restoration (hydroseeding)	15,000	SF	$0.10	$1,500
	20	Contractor Reporting and Closeout Submittals	200	HR	$90	$18,000
Contaminated Waste Disposal and Transportation						
$0	1	NAPL Contaminated Soil Disposal Costs (Incinerator)	0	TN	$460	$0
	2	Transportation Costs to Incinerator	0	TN	$180	$0
	3	Liquid NAPL Material Disposal Costs (Incinerator)	0	GAL	$10	$0
	4	Liquid NAPL Transportation Costs to Incinerator	0	DRUM	$250	$0
	5	CAMU-Eligible Material Disposal Costs (Subtitle C Landfill)	0	TN	$130	$0
	6	Transportation Costs to Subtitle C Landfill	0	TN	$70	$0
	7	Non-Hazardous Material Disposal Costs (Subtitle D)	0	TN	$51	$0
	8	Transportation Costs to Subtitle D Landfill	0	TN	$41	$0
	9	Contaminated Water Treatment and Disposal	0	GAL	$0.20	$0
	10	Non-Hazardous Material Disposal Costs (Asphalt Recycling)	0	TN	$8	$0
	11	Transportation Costs to Asphalt Recycler	0	TN	$9	$0
Subtotal Contractor Costs						**$1,223,085**
Contractor Contingency (%)			**30**	%	$1,223,085	$366,925
Total Contractor Costs						**$1,590,010**
Contractor Markup (%)			**10**	%	$1,590,010	$159,001
Total Contractor Costs with Markup						**$1,749,011**

Alternative 2 ***IN SITU*** **SOLIDIFICATION** **(CONTINUED)**

Category	Task #	Task Description	Quantity	Unit	Unit Cost	Total Cost
ENGINEERING COSTS (CAPITAL INDIRECT)						
	1	General Coordination, Meetings, and Planning	1	LS	$30,000	$30,000
	2	Regulatory Review, Coordination, and Meetings	1	LS	$15,000	$15,000
	3	Pre-Design Soil Sampling on JJ Port Property	1	LS	$25,000	$25,000
	4	Engineering Design (% DCC)	7	%	$1,590,010	$111,301
	5	Bid & RFI Support	80	HR	$135	$10,800
	6	Construction Oversight and QA (% DCC)	3.0	%	$1,590,010	$47,700
	7	Solidified soil leachability and strength testing	1	LS	$10,000	$10,000
	8	Overburden Sample Collection and Reporting	1	LS	$20,000	$20,000
	9	Closure Documentation & Reporting	400	HR	$110	$44,000
Subtotal Engineering Costs						**$313,801**
Engineering Contingency (%)			**15**	%	$313,801	$47,070
Total Engineering Costs						**$360,871**

Category	Task #	Task Description	Quantity	Unit	Unit Cost	Total Cost
ANNUAL O&M and / or LONG-TERM MONITORING COSTS						
Annual LTM Cost (Annual GW Sampling of 6 wells for 5 years)			***5***	***Years of Annual LTM***		
$19,550	1	Mob/Demob for Sampling	1	Event	$750	$750
	2	Sampling Labor and Supplies (2 people for 1 day)	2	Day	$2,000	$4,000
	3	Analytical Testing	6	Samples	$800	$4,800
	4	Annual Reporting	1	LS	$10,000	$10,000
Subtotal Annual O&M and LTM Cost						$19,550
O&M Contingency			25%	%	$19,550	$4,888
Total Annual O&M and LTM Cost						$24,438
Total Non-Routine O&M Cost		Estimated to be 0% of Construction Costs				$0
Total O&M and LTM Cost		***Years till project completion***	***5***			$122,188
Present-Worth O&M Cost		***Presumed Interest Rate***	***3%***			**$105,400**

ALTERNATIVE COST SUMMARY			**Rounded Total**	**Cumulative Total**
TOTAL CAPITAL COSTS (DIRECT & INDIRECT)			$2,110,000	**$2,110,000**
TOTAL O&M COSTS (PRESENT WORTH)			$105,000	**$2,215,000**
SALES TAX (Washington State)	Percentage of Direct Capital Costs	9.5%	$166,000	**$2,381,000**
AGENCY OVERSIGHT (Ecology)	Percentage of Capital Costs	2.0%	$42,000	**$2,423,000**
TOTAL PRESENT-WORTH COST				**$2,400,000**

Alternative 3 **MULTI-COMPONENT ALTERNATIVE (SOIL CAPPING AND EXCAVATION)**
Former Tacoma Metals Site, Simpson and JJ Port Properties

Client	International Paper		**Estimator**	Cary Brown, AECOM	
Location	Tacoma, Washington		**Report Date**	NA	
Project	Former Tacoma Metals Site Remediation		**Last Updated**	5/6/2015	
Document	FS Addendum		**Source of Costs**	Engineers Estimate	
Soil Removal	YES	SIMPSON PROPERTY-B36	**Groundwater Treatment**	No	
Soil Treatment Area	9,300	SF	**Treatment Depth**	4 to 7.5	FT bgs
Excavation Volume	550	CY			
Soil Disposal Volume	640	CY (assumes 15% bulking)			

Alternative Specific Assumptions	1	The JJ Port and Simpson properties soil impacted area is approximately 9,300 SF and has contaminated soil from 4 to 15 feet bgs in areas of shallow contamination and 7.5 to 15 feet bgs elsewhere.
	2	Contaminated soil above 7.5 feet below existing ground surface will be removed over a 2,800 SF area
	3	Clean fill will be placed 7.5 feet thick above the entire area to create a 15 feet thick barrier of clean material
	4	Pre-design soil sampling will be conducted on the JJ Port property in 6-10 locations.
	5	The maximum depth of excavation on the Simpson property will be approximately 7.5 feet bgs in a 2,300 SF area
	6	The maximum depth of excavation on the JJ Port property will be approximately 15 feet bgs in a 480 SF area
	7	The Simpson excavation will be sloped at 1:1.
	8	Temporary shoring will be required along JJ Port excavation boundary (approx. 120 LF)
	9	Non DNAPL contaminated soil above Method C will be landfilled as CAMU-eligible waste in Arlington, OR
	10	All soil with DNAPL will be incinerated and transported by rail to an incinerator in Utah
	11	Ten (10) Percent of excavated soil will have DNAPL and need incineration
	12	Ninety (90) Percent of excavated soil will be disposed at a Subtitle C landfill
	13	No soil excavated can be disposed at a Subtitle D landfill
	14	Soil Density is 1.65 TN/CY, Soil Removal Bulking is 15%, and Soil Import Bulking is 15%
	15	Additional soil will be imported to transition from existing ground surface at a 4:1 slope
	16	The northern and western limits of the fill placement will have 10 ft and 8 ft high, respectively, retaining wall installed.
	17	The work will be done independent from other Tacoma Metals Remediation areas

Category	Task #	Task Description	Quantity	Unit	Unit Cost	Total Cost
CONTRACTOR COSTS (CAPITAL DIRECT)						
Remedial Action Construction						
$709,345	1	Mobilization/Demobilization	1	LS	$75,000	$75,000
	2	Contractor Work Plans	240	HR	$90	$21,600
	3	Decommission Wells in the Soil Removal/Capping Area	3	EA	$920	$2,760
	4	Specialty Subcontractors (surveyor, utility locate)	1	LS	$8,000	$8,000
	5	TESC (Silt Fence, Construction Entrance, and Dust Control)	1	LS	$10,000	$10,000
	6	Install Temporary Sheet Pile Wall Shoring	3,600	SF	$45	$162,000
	7	Excavation and Stockpiling of Clean overburden 0 to 4 ft bgs	480	CY	$24	$11,520
	8	Excavation and Stockpiling of Clean Sidewalls 1:1 slope	210	CY	$27	$5,670
	9	Excavation and Stockpiling of Contaminated Soil 4 to 15 ft bgs	640	CY	$28	$17,920
	10	Loading of Contaminated Soil	1,000	TN	$6	$6,000
	11	Import of Clean Fill to Raise the Site (w/ 15% bulking)	3,200	CY	$22	$70,400
	12	Import of Clean Fill to Grade to 4:1 Slope (w/ 15% bulking)	1,270	CY	$22	$27,940
	13	Materials and Installation of Retaining Wall and Rail/Fence	1,800	SF	$35	$63,000
	14	Contaminated Water Handling and Environmental Protection	1	LS	$40,000	$40,000
	15	Backfill and Compaction of Excavated Overburden	690	CY	$9	$6,210
	16	Fill Placement and Compaction Raised Area and Side Slopes	4,500	CY	$9	$40,500
	17	Imported Base Course Under Asphalt Pavement	450	CY	$28	$12,600
	18	Low Perm Asphalt paving (4-inches) of site	17,900	SF	$4.75	$85,025
	19	Keyed-in Toe of Paved Area (300 LF)	600	SF	$15	$9,000
	20	Monitoring Well Installation	3	EA	$5,400	$16,200
	21	Contractor Reporting and Closeout Submittals	200	HR	$90	$18,000
Contaminated Waste Disposal and Transportation						
$252,250	1	NAPL Contaminated Soil Disposal Costs (Incinerator)	100	TN	$460	$46,000
	2	Transportation Costs to Incinerator	100	TN	$180	$18,000
	3	Liquid NAPL Material Disposal Costs (Incinerator)	150	GAL	$10	$1,500
	4	Liquid NAPL Transportation Costs to Incinerator	3	DRUM	$250	$750
	5	CAMU-Eligible Material Disposal Costs (Subtitle C Landfill)	900	TN	$130	$117,000
	6	Transportation Costs to Subtitle C Landfill	900	TN	$70	$63,000
	7	Non-Hazardous Material Disposal Costs (Subtitle D)	0	TN	$51	$0
	8	Transportation Costs to Subtitle D Landfill	0	TN	$41	$0
	9	Contaminated Water Treatment and Disposal	30,000	GAL	$0.20	$6,000
	10	Non-Hazardous Material Disposal Costs (Concrete Recycling)	0	TN	$8	$0
	11	Transportation Costs to Asphalt Recycler	0	TN	$9	$0
Subtotal Contractor Costs						**$961,595**
Contractor Contingency (%)			**25**	%	$961,595	$240,399
Total Contractor Costs						**$1,201,994**
Contractor Markup (%)			**10**	%	$1,201,994	$120,199
Total Contractor Costs with Markup						**$1,322,193**

Category	Task #	Task Description	Quantity	Unit	Unit Cost	Total Cost
ENGINEERING COSTS (CAPITAL INDIRECT)						
	1	General Coordination, Meetings, and Planning	1	LS	$30,000	$30,000
	2	Regulatory Review, Coordination, and Meetings	1	LS	$15,000	$15,000
	3	Pre-Design Soil Sampling on JJ Port Property	1	LS	$25,000	$25,000
	4	Engineering Design (% DCC)	8	%	$1,201,994	$96,160
	5	Bid & RFI Support	60	HR	$135	$8,100
	6	Construction Oversight and QA (% DCC)	7	%	$1,201,994	$84,140
	7	Confirmational Sample Collection and Reporting	1	LS	$20,000	$20,000
	8	Overburden Sample Collection and Reporting	1	LS	$20,000	$20,000
	9	Closure Documentation & Reporting	300	HR	$110	$33,000
Subtotal Engineering Costs						**$331,399**
Engineering Contingency (%)			**15**	%	$331,399	$49,710
Total Engineering Costs						**$381,109**

Category	Task #	Task Description	Quantity	Unit	Unit Cost	Total Cost
ANNUAL O&M and / or LONG-TERM MONITORING COSTS						
Annual O&M Cost (Asphalt Inspection/Repair as Needed)			***5***	***Years of Annual O&M***		
$5,612	1	Prorated Cost for Asphalt Repairs (6.6% of install per year)	1	LS	$5,612	$5,612
O&M Contingency			25%	%	$5,612	$1,403
Total Annual O&M Cost						$7,015
Annual LTM Cost (Annual GW Sampling of 6 wells for 5 years)			***5***	***Years of Annual LTM***		
$19,550	1	Mob/Demob for Sampling	1	Event	$750	$750
	2	Sampling Labor and Supplies (2 people for 1 day)	2	Day	$2,000	$4,000
	3	Analytical Testing	6	Samples	$800	$4,800
	4	Annual Reporting	1	LS	$10,000	$10,000
Subtotal Annual LTM Cost						$19,550
LTM Contingency			25%	%	$19,550	$4,888
Total Annual LTM Cost						$24,438
Total Non-Routine O&M Cost		Estimated to be 0% of Construction Costs				$0
Total O&M and LTM Cost		***Years till project completion***	***5***			$157,260
Present-Worth O&M Cost		***Presumed Interest Rate***	***3%***			**$135,654**

ALTERNATIVE COST SUMMARY			**Rounded Total**	**Cumulative Total**
TOTAL CAPITAL COSTS (DIRECT & INDIRECT)			$1,703,000	**$1,703,000**
TOTAL O&M COSTS (PRESENT WORTH)			$136,000	**$1,839,000**
SALES TAX (Washington State)	Percentage of Direct Capital Costs	9.5%	$126,000	**$1,965,000**
AGENCY OVERSIGHT (Ecology)	Percentage of Capital Costs	2.0%	$34,000	**$1,999,000**
TOTAL PRESENT-WORTH COST				**$2,000,000**