Nevada Division of Environmental Protection

Soil Closures

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Presented by

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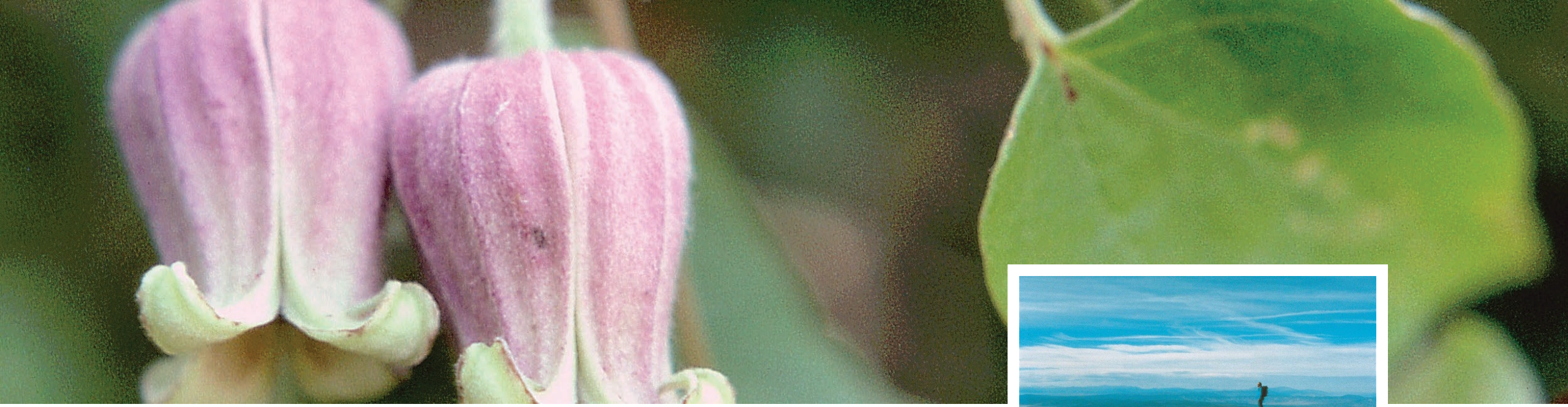
Nevada Department of CONSERVATION & NATURAL RESOURCES

NEVADA DIVISION OF ENVIRONMENTAL PROTECTION



Our Mission

Make informed decisions with a high level of consistency to promote efficient and protective cleanups.

Soil Closure Checklists

Designed to promote consistency on:

- Abatement, Characterization/Delineation, Analytical Requirements, Sensitive Receptor Evaluation, NAPL Migration, Engineering Controls for Backfilling, Soil & Groundwater Management Plans, Environmental Covenants.

Common Releases

- LUSTs, ASTs, Mobile Releases, Phase II Discoveries, Transformers, Generators, and Fuel Terminals

Soil Closure Checklists

- Clean Closure
- Analyte-Specific Closure
- A thru K Closure
- ASTM RBCA Closure

Clean Closure

Clean Closure Checklist All Requirements In Grey Must Be Met
____ Proper field sample collection procedures used
Confirmation samples are taken as discrete samples and are collected and preserved using appropriate procedures to minimize loss of volatile constituents prior to analysis.
____ Proper laboratory analytical method used
All confirmation samples are analyzed using EPA Method 8015 Modified for Petroleum Hydrocarbons
____ Proper laboratory sample preparation procedure used
The laboratory preparation procedure is appropriate for the type of petroleum product released: Gasoline—Purge and Trap Diesel and other mid-range products—Purge and Trap + Solvent Extraction Oil and other high-range products—Solvent Extraction Unknown—Purge and Trap + Solvent Extraction
____ Appropriate detection limit achieved
The reported detection limit from the laboratory is less than 100 mg/kg for total petroleum hydrocarbons for all confirmation samples.
____ Action level for clean closure met in all confirmation samples
All confirmation samples are below 100 mg/kg for Total Petroleum Hydrocarbons.
____ Destruction certificates or disposal certificates provided for all excavated soil
All soil above 100 mg/kg TPH that was excavated as a result of corrective action or abatement actions and that has been taken off-site for treatment or disposal has been accounted for with disposal or destruction certificates. If soil has been treated on-site and remains on-site in accordance with an approved corrective action plan, this requirement may be marked N/A and considered satisfied.

Clean Closure

- >100 mg/kg TPH via EPA Method 8015
- Remove the soil, take confirmation samples
- <100 mg/kg TPH via EPA Method 8015

Analyte-Specific Closure

Analyte-Specific Closure Checklist All Requirements In Grey Must Be Met
____ Proper field sample collection procedures used
Confirmation samples are taken as discrete samples and are collected and preserved using appropriate procedures to minimize loss of volatile constituents prior to analysis.
____ All contaminants of potential concern have been analyzed
Confirmation samples contain analytical results for all contaminants of potential concern associated with the petroleum product released. The contaminants of potential concern are identified on Table 1 of Appendix B. If the petroleum product has not been identified, all constituents on the Table should be analyzed.
____ Proper laboratory analytical methods used
All confirmation samples are analyzed using the appropriate laboratory method identified on Table 1 of Appendix B, and the laboratory has employed an appropriate sample preparation for the analytical method.
____ Appropriate detection limit achieved
The reported detection limit from the laboratory is below the screening level for all constituents. (This may require the use of Selected Ion Monitoring for polynuclear aromatic hydrocarbons for sites where they are a contaminant of potential concern.)
____ Action levels for Analyte-Specific Closure have been met
All concentrations are below the action levels for analyte-specific closure in all confirmation samples.
____ Residual TPH concentrations are not indicative of NAPL migration
All concentrations of TPH are below the levels indicative of NAPL migration for the soil type at the site as published by the American Petroleum Institute in Appendix C
____ Land use assumptions are supported and protective
If the higher action levels for industrial or commercial exposure scenarios are used at the site, information presented by the facility owner or operator should demonstrate that future land use will remain industrial/commercial or is controlled through an environmental covenant.
____ Environmental Covenant discussed when residual petroleum contamination exceeds 100 yds^3
If greater than 100 yds^3 of petroleum impacted soil is to remain on the site, an environmental covenant should be considered and discussed with a supervisor to determine whether future management of petroleum contaminated soils needs to be controlled.
____ Destruction certificates or disposal certificates provided for all excavated soil
All soil above 100 mg/kg TPH that was excavated as a result of corrective action or abatement actions and that has been taken off-site for treatment or disposal has been accounted for with disposal or destruction certificates. If soil has been treated on-site and remains on-site in accordance with an approved corrective action plan, this requirement may be marked N/A and considered satisfied.

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Analyte-Specific Closure

- >100 mg/kg TPH via EPA Method 8015
- Unable to remove all the impacted soil
- Perform additional analysis for VOCs and PAHs via EPA Method 8260 and 8270
- COCs < residential/industrial standards and COCs are < than NAPL Migration standards

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A Thru K Closure

A thru K Closure Checklist All Requirements In Grey Must Be Met
____ "A Thru K" closure request presented in an acceptable format
The "A Thru K" presents a coherent, defensible argument for closing the site with contamination above action levels, and it includes all supporting data, figures, and calculations relied on in the argument.
____ Data quality is sufficient to make defensible determinations about protectiveness
The "A thru K" analysis is based on data of sufficient quality as determined either by adherence to an approved quality assurance project plan or to generally accepted standard operating procedures for data collection and analysis.
____ All constituents of concern have been identified and properly addressed
The "A thru K" closure request addresses all constituents of concern at the site. Constituents of potential concern include all the constituents associated with the petroleum product that has been released; constituents of concern include all the constituents of potential concern that exceed health-based standards (Table 1 of Appendix B).
____ All exposure pathways have been examined and properly addressed
The "A thru K" closure request examines all exposure pathways and determine whether they are incomplete, potentially complete, or complete at the site.
____ The direct contact exposure pathway is demonstrated to be incomplete
Contamination in the top 6 feet at a site must be below analyte-specific action levels (Table 1 of Appendix B) or demonstrated to be inaccessible both to excavation/treatment and to direct contact by receptors.
____ Petroleum saturated soils have been remediated or removed to a reasonable extent
The facility owner or operator must make reasonable efforts to treat or remove soils that are indicative of NAPL formation or migration (API, Appendix C) as a step to minimize further degradation of subsurface soils or potential impacts to groundwater. The reasonableness of efforts may consider the vicinity of structures, depths of contamination, or remoteness of the location. If petroleum concentrations above screening levels for NAPL migration remain at the site, vadose zone modeling or calculations must demonstrate that groundwater impacts will not occur or will be sufficiently controlled.
____ Environmental Covenant discussed when residual petroleum contamination exceeds 100 yds^3
If greater than 100 yds^3 of petroleum impacted soil is to remain on the site, an environmental covenant should be considered and discussed with a supervisor to determine whether future management of petroleum contaminated soils needs to be controlled through a covenant. The covenant may also stipulate specific land use practices, engineering controls, and periodic review and reporting to NDEP to affirm maintenance of the engineering and institutional controls.

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A Thru K Closure

- >100 mg/kg TPH via EPA Method 8015
- Unable to remove all the impacted soil
- Perform additional analysis for VOCs and PAHs via EPA Method 8260 and 8270
- COCs > residential/industrial standards and COCs are > than NAPL Migration standards
- Perform vadose zone modeling/calculations to demonstrate no impact to groundwater
- Perform an exposure pathway evaluation

TABLE 1 Appendix B

NDEP Petroleum In Soils Closure
Table 1: "Analyte-Specific Closure" Levels[a]

Analyte Name	Preparation/ Analytical Method[b]	Gasoline	Diesel	Heating oil	Jet Fuel[f]	Residential[c] (mg/kg)	Industrial/ Commercial[d] (mg/kg)
Acenaphthene	3540[e]/8270C or D			X		3600	45000
Anthracene	3540/8270C or D		X	X		18000	230000
Benzene	5035/8260B	X	X	X	4	1.2	5.1
Benzo(a)anthracene	3540/8270C or D[g]		X	X		1.1	21
Benzo(a)pyrene	3540/8270C or D[g]		X	X		0.11	2.1
Benzo(b)fluoranthene	3540/8270C or D[g]		X	X		1.1	21
Benzo(k)fluoranthene	3540/8270C or D[g]		X	X		11	210
Chrysene	3540/8270C or D		X	X		110	2100
Dibenz(a,h)anthracene	3540/8270C or D[g]		X	X		0.11	2.1
Ethylbenzene	5035/8260B	X	X	X	4	5.8	25
Fluoranthene	3540/8270C or D		X	X		2400	30000
Fluorene	3540/8270C or D		X	X		2400	30000
Ideno(1,2,3-c,d)pyrene	3540/8270C or D[g]		X	X		1.1	21
Methyl t-butyl ether (MTBE)	5035/8260B	X[h]				47	210
1-Methylnaphthalene	3540/8270E		X	X	X	18	73
2-Methylnaphthalene	3540/8270C or D		X	X	X	240	3000
Naphthalene	5035/8260B or 3540/8270C or D		X	X	X	2.0	8.6
Pyrene	3540/8270C or D		X	X		1800	23000
Styrene	5035/8260B		X			6000	35000
Toluene	5035/8260B	X	X	X	4	4900	47000
1,2,4-Trimethylbenzene	5035/8260B		X		X	300	1800
1,3,5-Trimethylbenzene	5035/8260B		X		4	270	1500
Xylene (mixture)	5035/8260B	X	X		X	580	2500

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NAPL Migration

Name	Ref	S_r residual NAPL in the void fraction (cm^3/cm^3)	$C_{res,soil}$ residual NAPL concentration in soil (mg/kg)	$C_{sat,soil}$ soil saturation limit (mg/kg)	ρ_o liquid chemical density (g/cm^3)	MW molecular weight (g/g-mol)	S aqueous solubility (mg/L)	P_{vap} vapor pressure (mm Hg)
trichloroethylene (TCE)	a	0.2	70,000	1,045	1.46	131	1,100	75
benzene	b	0.24	53,000	444	0.88	78	1,750	95
o-xylene	c	0.01	2,000	143	0.88	106	178	6.6
gasoline	d,e	0.02 to 0.6	3,400 to 80,000	106	0.78	99	164	102
diesel	d,f	0.04 to 0.2	7,700 to 34,000	18	0.94	207	3.9	0.79
fuel oil	d,f	0.08 to 0.2	17,000 to 50,000	18	0.94	207	3.9	0.79
mineral oil	g	0.1 to 0.5	20,000 to 150,000	3	0.81	244	0.36	0.035

ASTM RBCA Closure

ASTM RBCA Closure Checklist All Requirements In Grey Must Be Met
____ ASTM RBCA conducted in accordance with Method E1739-95
The facility owner/operator and their consultant have submitted sufficient information to the NDEP and in a format that allows the NDEP to determine whether the Method was followed appropriately.
____ Data quality is sufficient to make defensible determinations about protectiveness
The analyses in the ASTM RBCA are based on data of sufficient quality as determined either by adherence to an approved quality assurance project plan or to generally accepted standard operating procedures for data collection and analysis.
____ All constituents of concern have been properly addressed in the RBCA analysis
Procedures in the ASTM RBCA method are followed for the identification of contaminants of concern. Site Specific Target Levels are developed for all contaminants of concern.
____ All exposure pathways have been examined and properly addressed
Procedures in the ASTM RBCA method are followed for the identification of completed exposure pathways and the Site Specific Target Levels are established based on the most conservative exposure pathway calculation for the site.
____ Confirmation sampling shows constituents of concern to be below Site Specific Target Levels
Samples show that residual contamination is below Site Specific Target Levels developed for the site. The density and quality of samples is sufficient to demonstrate achievement of Site Specific Target Levels.
____ Residual TPH contamination addressed either directly or indirectly in the ASTM RBCA
Residual TPH contamination is shown to be unlikely to further degrade subsurface soils or groundwater through either the development of SSTLs for TPH or through the excavation and treatment of soils above screening levels for NAPL migration published by the API in their June 2000 “Soil and Groundwater Research Bulletin” (Appendix C).
____ Environmental Covenant discussed when residual petroleum contamination exceeds 100 yds^3
If greater than 100 yds^3 of petroleum impacted soil is to remain on the site, an environmental covenant should be considered and discussed with a supervisor to determine whether future management of petroleum contaminated soils needs to be controlled through a covenant. The covenant may also stipulate specific land use practices, engineering controls, and periodic review and reporting to NDEP to affirm maintenance of the engineering and institutional controls.

ASTM RBCA Closure

- Follow ASTM Method E1739-95
- Establish SSTLs
- Perform an exposure pathway evaluation
- COCs < SSTLs
- NAPL Migration demonstrates no further soil degradation or impact to groundwater

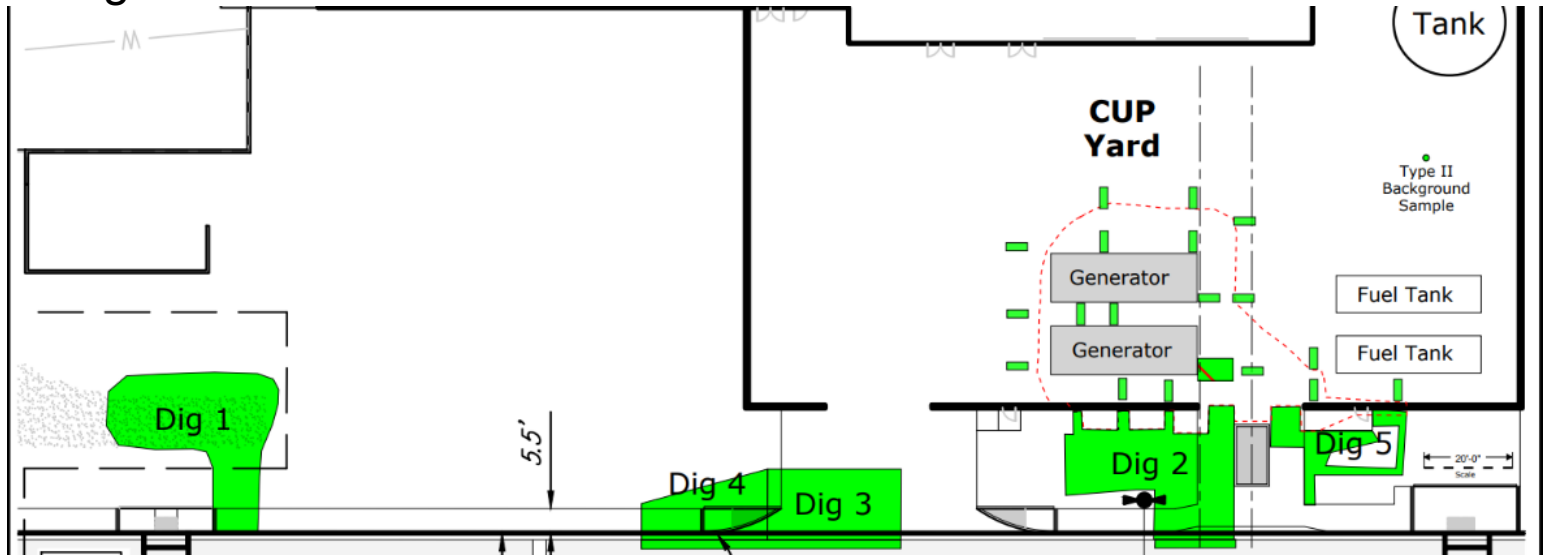
Soil Closure Breakout Session

- “Do I need to Run EPA 8270 to get an Analyte-Specific Closure”
- ‘We can’t get to it”
- Potential to impact groundwater (NAPL Migration)
- Do I need a Soil Management Plan?
- Recommending type of soil closure to receive NFA, Who’s responsibility???
- Interactive Case Studies

Case Study # 1

Diesel Fuel, 4,000 gallons, max. conc. of remaining TPH 45,100 mg/kg w/ DRO of 31,000 mg/kg in the Central Utility Plant (CUP), ALL PAH and VOC below RCs, DTW 200 FT.

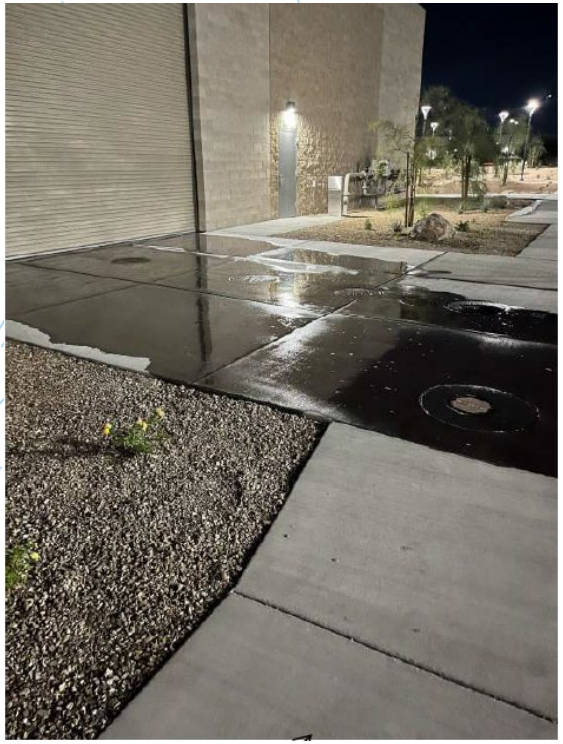
- Do you need to consider NAPL Migration?
- Do you need a Soil Management Plan?
- Type of Closure Recommended?
- Engineering Controls?
- " We can't get to it"

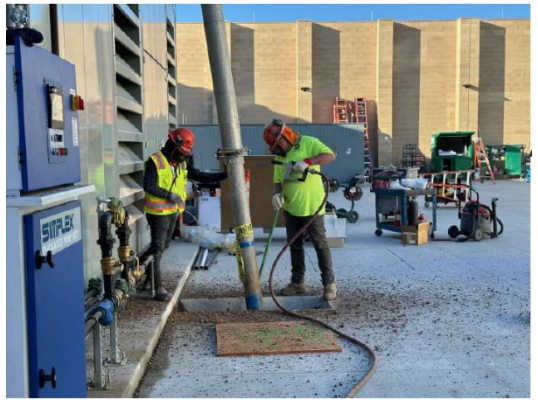


Soil Management Plans

- Short and simple
- Identify the potentially impacted soil in plan view.
- Identify the applicable range of depths.
- Note that excavated soil may need to be disposed of offsite. Sampling should be done in accordance with disposal profile.
- Prohibition against offsite direct reuse of untreated soil.

Case Study # 1

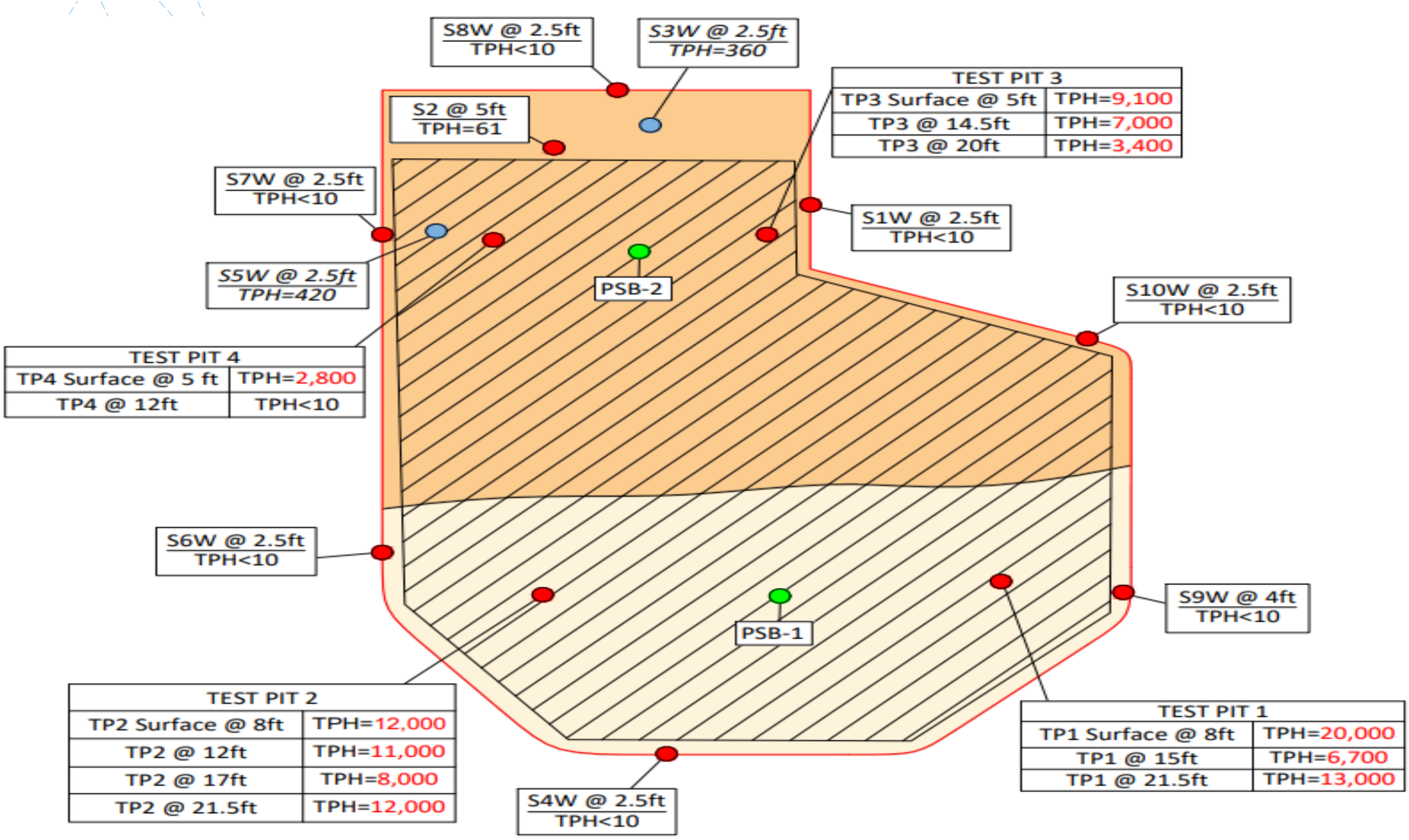


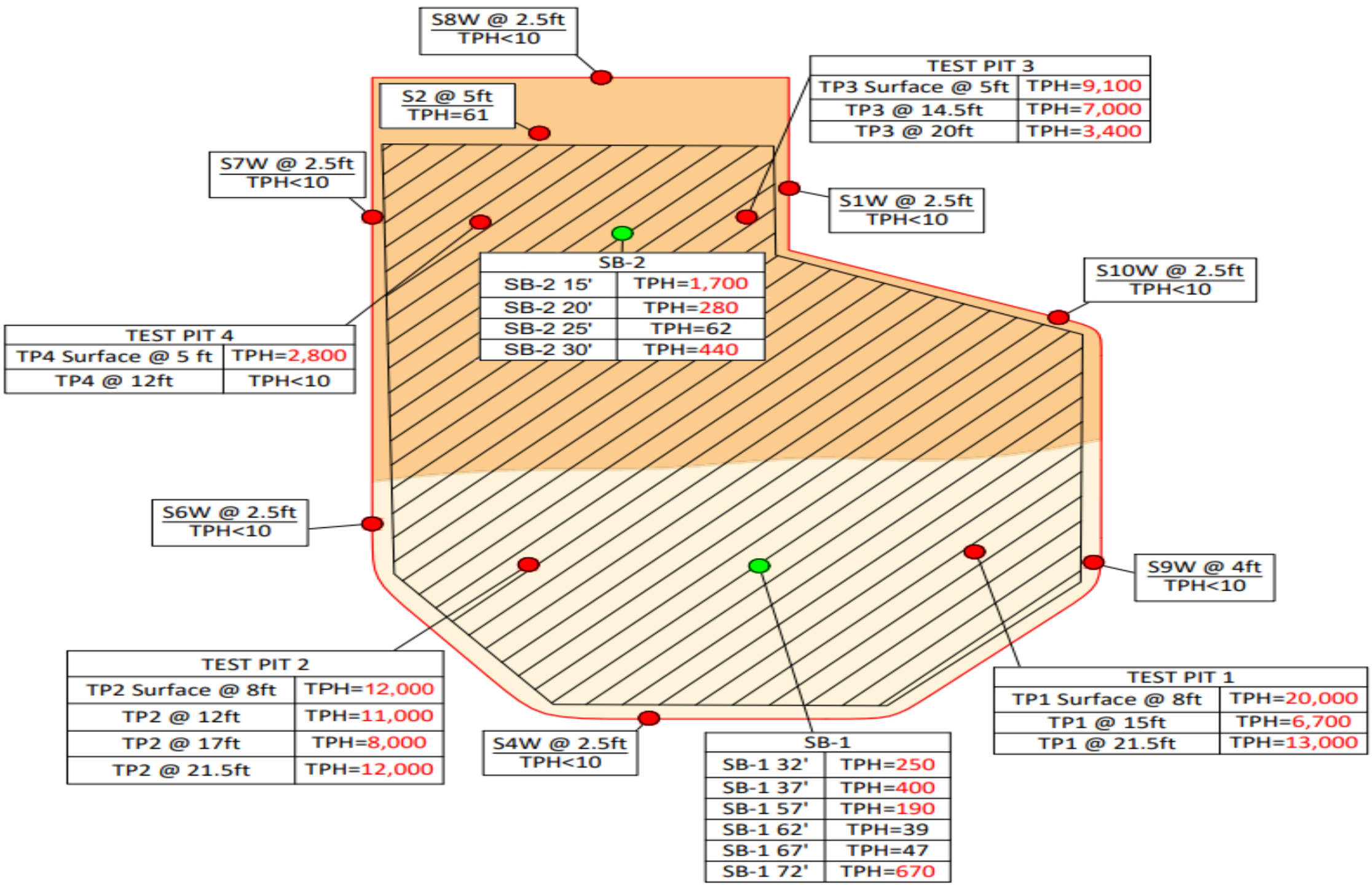


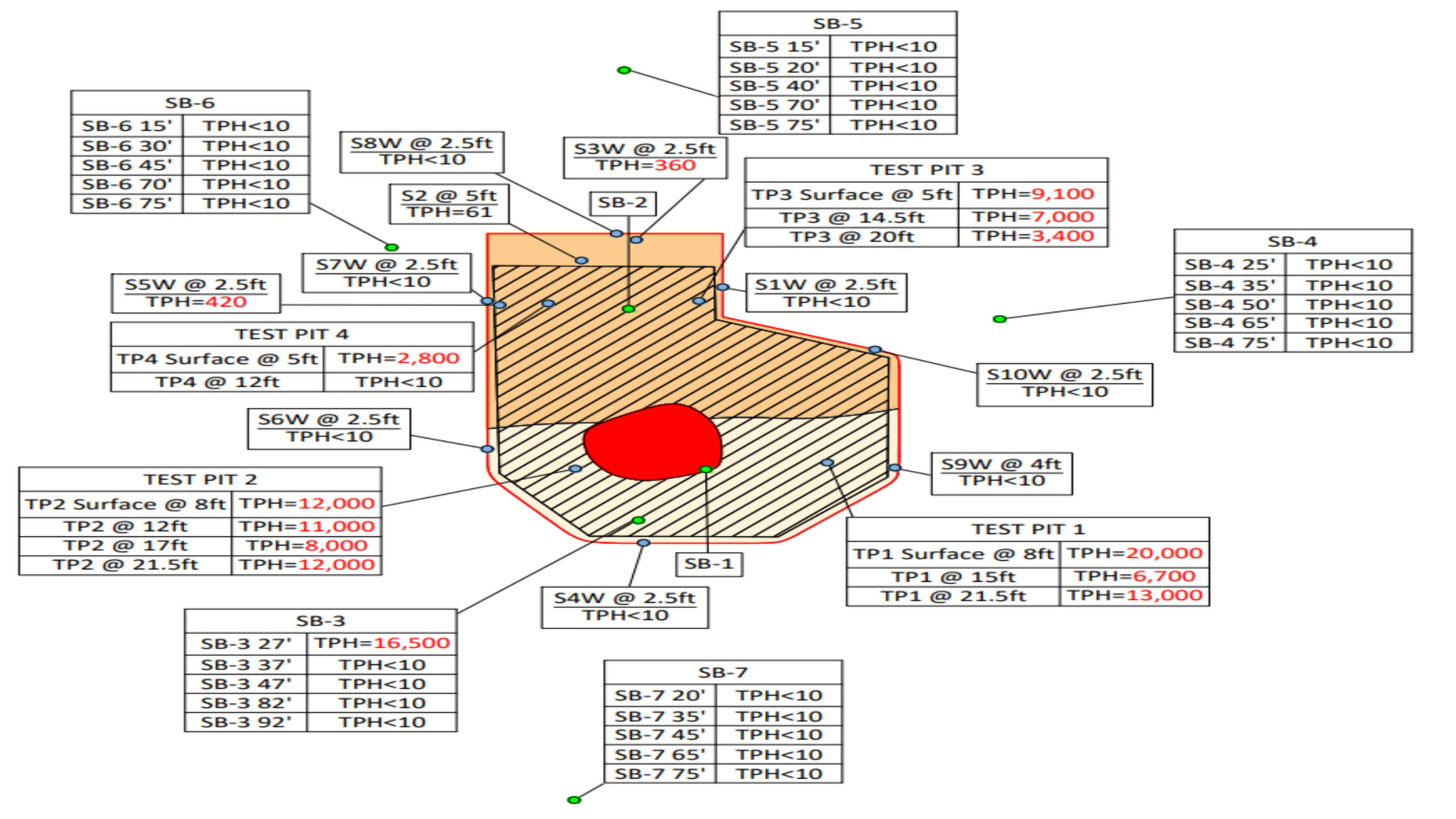
Case Study # 2

Diesel Fuel, Unknown Quantity, Naphthalene exceeding Industrial Standard, 10-8 mg/kg, DTW 400 FT

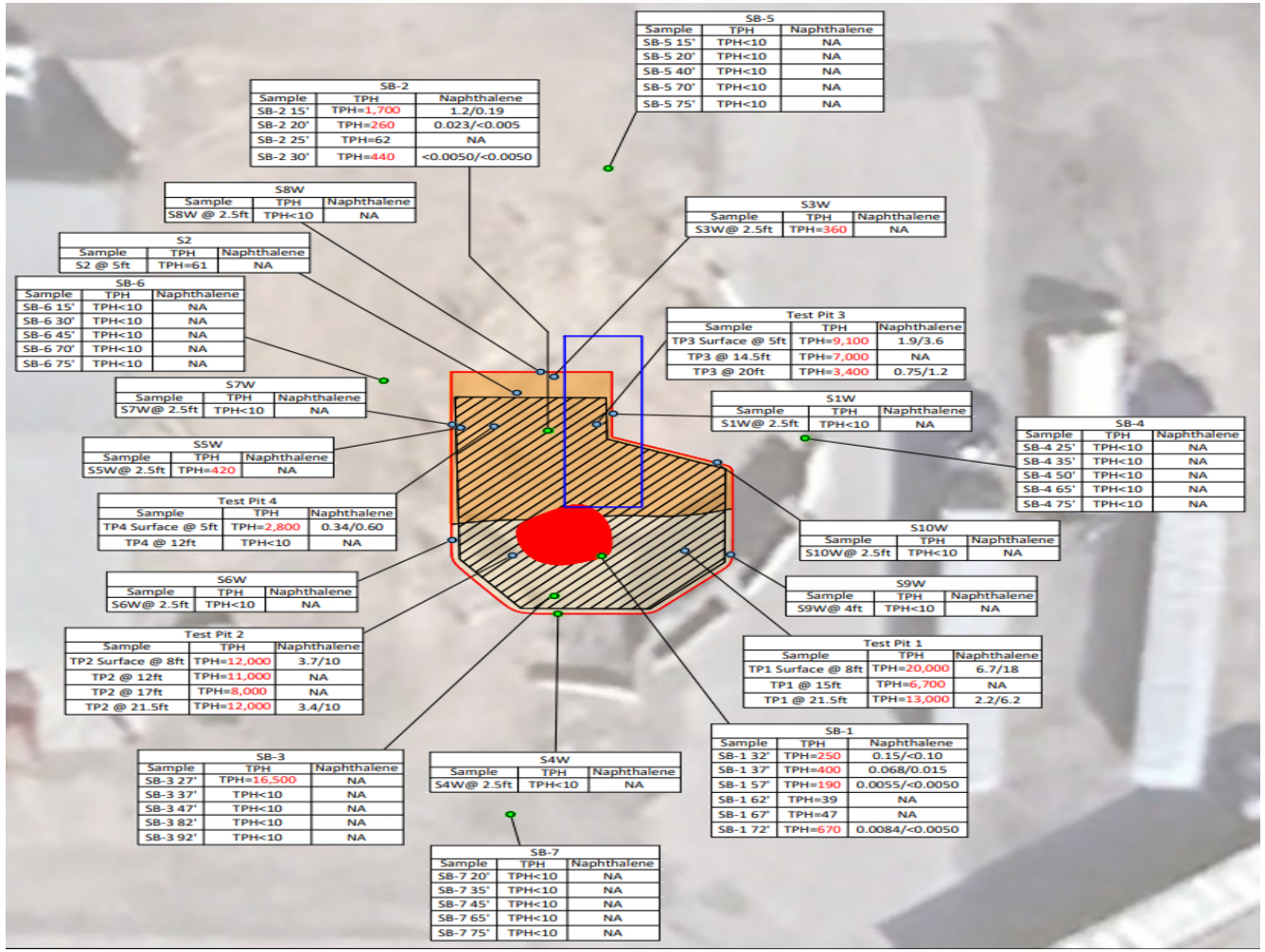
- Do we need to delineate further?


S8W @ 2.5ft
TPH<10
S3W @ 2.5ft
TPH=360
S2 @ 5ft
TPH=61
S7W @ 2.5ft
TPH<10
S5W @ 2.5ft
TPH=420
PSB-2
S1W @ 2.5ft
TPH<10
S10W @ 2.5ft
TPH<10
S6W @ 2.5ft
TPH<10
PSB-1
S9W @ 4ft
TPH<10
S4W @ 2.5ft
TPH<10
TEST PIT 3
TP3 Surface @ 5ft TPH=9,100
TP3 @ 14.5ft TPH=7,000
TP3 @ 20ft TPH=3,400
TEST PIT 4
TP4 Surface @ 5 ft TPH=2,800
TP4 @ 12ft TPH<10
TEST PIT 2
TP2 Surface @ 8ft TPH=12,000
TP2 @ 12ft TPH=11,000
TP2 @ 17ft TPH=8,000
TP2 @ 21.5ft TPH=12,000
TEST PIT 1
TP1 Surface @ 8ft TPH=20,000
TP1 @ 15ft TPH=6,700
TP1 @ 21.5ft TPH=13,000


S8W @ 2.5ft
TPH<10
S2 @ 5ft
TPH=61
S7W @ 2.5ft
TPH<10
TEST PIT 3
TP3 Surface @ 5ft | TPH=9,100
TP3 @ 14.5ft | TPH=7,000
TP3 @ 20ft | TPH=3,400
S1W @ 2.5ft
TPH<10
SB-2
SB-2 15' | TPH=1,700
SB-2 20' | TPH=280
SB-2 25' | TPH=62
SB-2 30' | TPH=440
S10W @ 2.5ft
TPH<10
TEST PIT 4
TP4 Surface @ 5 ft | TPH=2,800
TP4 @ 12ft | TPH<10
S6W @ 2.5ft
TPH<10
S9W @ 4ft
TPH<10
TEST PIT 2
TP2 Surface @ 8ft | TPH=12,000
TP2 @ 12ft | TPH=11,000
TP2 @ 17ft | TPH=8,000
TP2 @ 21.5ft | TPH=12,000
S4W @ 2.5ft
TPH<10
SB-1
SB-1 32' | TPH=250
SB-1 37' | TPH=400
SB-1 57' | TPH=190
SB-1 62' | TPH=39
SB-1 67' | TPH=47
SB-1 72' | TPH=670
TEST PIT 1
TP1 Surface @ 8ft | TPH=20,000
TP1 @ 15ft | TPH=6,700
TP1 @ 21.5ft | TPH=13,000


SB-5
SB-5 15' TPH<10
SB-5 20' TPH<10
SB-5 40' TPH<10
SB-5 70' TPH<10
SB-5 75' TPH<10
SB-6
SB-6 15' TPH<10
SB-6 30' TPH<10
SB-6 45' TPH<10
SB-6 70' TPH<10
SB-6 75' TPH<10
S8W @ 2.5ft TPH<10
S3W @ 2.5ft TPH=360
S2 @ 5ft TPH=61
SB-2
TEST PIT 3
TP3 Surface @ 5ft TPH=9,100
TP3 @ 14.5ft TPH=7,000
TP3 @ 20ft TPH=3,400
SB-4
SB-4 25' TPH<10
SB-4 35' TPH<10
SB-4 50' TPH<10
SB-4 65' TPH<10
SB-4 75' TPH<10
S7W @ 2.5ft TPH<10
S5W @ 2.5ft TPH=420
S1W @ 2.5ft TPH<10
TEST PIT 4
TP4 Surface @ 5ft TPH=2,800
TP4 @ 12ft TPH<10
S10W @ 2.5ft TPH<10
S6W @ 2.5ft TPH<10
TEST PIT 2
TP2 Surface @ 8ft TPH=12,000
TP2 @ 12ft TPH=11,000
TP2 @ 17ft TPH=8,000
TP2 @ 21.5ft TPH=12,000
S9W @ 4ft TPH<10
TEST PIT 1
TP1 Surface @ 8ft TPH=20,000
TP1 @ 15ft TPH=6,700
TP1 @ 21.5ft TPH=13,000
SB-1
S4W @ 2.5ft TPH<10
SB-3
SB-3 27' TPH=16,500
SB-3 37' TPH<10
SB-3 47' TPH<10
SB-3 82' TPH<10
SB-3 92' TPH<10
SB-7
SB-7 20' TPH<10
SB-7 35' TPH<10
SB-7 45' TPH<10
SB-7 65' TPH<10
SB-7 75' TPH<10

Case Study # 2


SB-5
Sample | TPH | Naphthalene
SB-5 15' | TPH<10 | NA
SB-5 20' | TPH<10 | NA
SB-5 40' | TPH<10 | NA
SB-5 70' | TPH<10 | NA
SB-5 75' | TPH<10 | NA
SB-2
Sample | TPH | Naphthalene
SB-2 15' | TPH=1,700 | 1.2/0.19
SB-2 20' | TPH=260 | 0.023/<0.005
SB-2 25' | TPH=62 | NA
SB-2 30' | TPH=440 | <0.0050/<0.0050
S8W
Sample | TPH | Naphthalene
S8W @ 2.5ft | TPH<10 | NA
S3W
Sample | TPH | Naphthalene
S3W@ 2.5ft | TPH=360 | NA
S2
Sample | TPH | Naphthalene
S2 @ 5ft | TPH=61 | NA
SB-6
Sample | TPH | Naphthalene
SB-6 15' | TPH<10 | NA
SB-6 30' | TPH<10 | NA
SB-6 45' | TPH<10 | NA
SB-6 70' | TPH<10 | NA
SB-6 75' | TPH<10 | NA
Test Pit 3
Sample | TPH | Naphthalene
TP3 Surface @ 5ft | TPH=9,100 | 1.9/3.6
TP3 @ 14.5ft | TPH=7,000 | NA
TP3 @ 20ft | TPH=3,400 | 0.75/1.2
S7W
Sample | TPH | Naphthalene
S7W@ 2.5ft | TPH<10 | NA
S1W
Sample | TPH | Naphthalene
S1W@ 2.5ft | TPH<10 | NA
SB-4
Sample | TPH | Naphthalene
SB-4 25' | TPH<10 | NA
SB-4 35' | TPH<10 | NA
SB-4 50' | TPH<10 | NA
SB-4 65' | TPH<10 | NA
SB-4 75' | TPH<10 | NA
S5W
Sample | TPH | Naphthalene
S5W@ 2.5ft | TPH=420 | NA
Test Pit 4
Sample | TPH | Naphthalene
TP4 Surface @ 5ft | TPH=2,800 | 0.34/0.60
TP4 @ 12ft | TPH<10 | NA
S10W
Sample | TPH | Naphthalene
S10W@ 2.5ft | TPH<10 | NA
S6W
Sample | TPH | Naphthalene
S6W@ 2.5ft | TPH<10 | NA
S9W
Sample | TPH | Naphthalene
S9W@ 4ft | TPH<10 | NA
Test Pit 2
Sample | TPH | Naphthalene
TP2 Surface @ 8ft | TPH=12,000 | 3.7/10
TP2 @ 12ft | TPH=11,000 | NA
TP2 @ 17ft | TPH=8,000 | NA
TP2 @ 21.5ft | TPH=12,000 | 3.4/10
Test Pit 1
Sample | TPH | Naphthalene
TP1 Surface @ 8ft | TPH=20,000 | 6.7/18
TP1 @ 15ft | TPH=6,700 | NA
TP1 @ 21.5ft | TPH=13,000 | 2.2/6.2
SB-1
Sample | TPH | Naphthalene
SB-1 32' | TPH=250 | 0.15/<0.10
SB-1 37' | TPH=400 | 0.068/0.015
SB-1 57' | TPH=190 | 0.0055/<0.0050
SB-1 62' | TPH=39 | NA
SB-1 67' | TPH=47 | NA
SB-1 72' | TPH=670 | 0.0084/<0.0050
SB-3
Sample | TPH | Naphthalene
SB-3 27' | TPH=16,500 | NA
SB-3 37' | TPH<10 | NA
SB-3 47' | TPH<10 | NA
SB-3 82' | TPH<10 | NA
SB-3 92' | TPH<10 | NA
S4W
Sample | TPH | Naphthalene
S4W@ 2.5ft | TPH<10 | NA
SB-7
Sample | TPH | Naphthalene
SB-7 20' | TPH<10 | NA
SB-7 35' | TPH<10 | NA
SB-7 45' | TPH<10 | NA
SB-7 65' | TPH<10 | NA
SB-7 75' | TPH<10 | NA

Thank You!

Questions?

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