

***** LIQUID SPILLS - VOLUME CALCULATIONS *****

Location of Spill: Bandit State #4 Tank Battery

Date of Spill: 02/02/2019

Site Soil Type: Caliche, Loam

Average Daily Production: 19 BBL Oil 74 BBL Water

Total Area Calculations						
Total Surface Area	Width	Length	Wet Soil Depth	Oil (%)	Soil Class.	Porosity%
Poly #1	5,482		4"	20	GM	15
Poly #2	875		6"	20	ML	21
Poly #3	484		2"	20	GM	15

<u>Saturated Soil Volume calculations:</u>			<u>H2O</u>	<u>OIL</u>
--	--	--	------------	------------

Polygon #1	1,827.33	39.05	9.76
Polygon #2	438	13.01	3.27
Polygon #3	80.7	1.72	0.40

Total Solid/ Liquid Volume:

<u>Estimated Volumes Spilled</u>	<u>H2O</u>	<u>OIL</u>
	53.78	13.43

Liquid Recovered:	17	5
-------------------	----	---

Total Spill Liquid:	36.78	8.43
---------------------	-------	------

Description	USCS	Porosity [-]			Reference
		min	max	Specific value	
Well graded gravel, sandy gravel, with little or no fines	GW	0.21	0.32		[1].
Poorly graded gravel, sandy gravel, with little or no fines	GP	0.21	0.32		[1].
Silty gravels, silty sandy gravels	GM	0.15	0.22		[1].
Gravel	(GW-GP)	0.23	0.38		[2].
Clayey gravels, clayey sandy gravels	GC	0.17	0.27		[1].
Glacial till, very mixed grained	(GC)	-	-	0.20	[4 cited in 5]
Well graded sands, gravelly sands, with little or no fines	SW	0.22	0.42		[1], [2].
Coarse sand	(SW)	0.26	0.43		[2].
Fine sand	(SW)	0.29	0.46		[2].
Poorly graded sands, gravelly sands, with little or no fines	SP	0.23	0.43		[1], [2].
Silty sands	SM	0.25	0.49		[1], [2].
Clayey sands	SC	0.15	0.37		[1].
Inorganic silts, silty or clayey fine sands, with slight plasticity	ML	0.21	0.56		[1].
Uniform inorganic silt	(ML)	0.29	0.52		[3].
Inorganic clays, silty clays, sandy clays of low plasticity	CL	0.29	0.41		[1].
Organic silts and organic silty clays of low plasticity	OL	0.42	0.68		[1], [3].
Silty or sandy clay	(CL-OL)	0.20	0.64		[3].
Inorganic silts of high plasticity	MH	0.53	0.68		[1].
Inorganic clays of high plasticity	CH	0.39	0.59		[1].
Soft glacial clay	-	-	-	0.55	[4 cited in 5]
Stiff glacial clay	-	-	-	0.38	[4 cited in 5]
Organic clays of high plasticity	OH	0.50	0.75		[1], [3].
Soft slightly organic clay	(OH-OL)	-	-	0.66	[4] cited in [5]
Peat and other highly organic soils	Pt	-	-		[4 cited in 5]
soft very organic clay	(Pt)	-	-	0.75	[4] cited in [5]

REFERENCES

1. Swiss Standard SN 670 010b, Characteristic Coefficients of soils, Association of Swiss Road and Traffic Engineers
2. Das, B., Advanced Soil Mechanics. Taylor & Francis, London & New York, 2008.
3. Hough, B., Basic soil engineering. Ronald Press Company, New York, 1969.
4. Terzaghi, K., Peck, R., and Mesri, G., Soil Mechanics in Engineering Practice. Wiley, New York, 1996.
5. Obrzud R. & Truty, A. THE HARDENING SOIL MODEL - A PRACTICAL GUIDEBOOK Z Soil.PC 100701 report, revised 31.01.2012

Citation :
Geotechdata.info, Soil void ratio, <http://geotechdata.info/parameter/soil-void-ratio.html> (as of November 16, 2013).