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June 27, 2018

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Oklahoma Water Resources Board

Matt Cogburn  
Oklahoma Water Resources Board  
3800 North Classen Blvd.  
Oklahoma City, OK 73118

Subject: Vulcan North Troy Annual Water Report Revisions

Mr. Cogburn,

Attached please find the revised annual water reports for the Vulcan North Troy mine site for 2015, 2016 and 2017. The revision are being submitted to update the actual precipitation watershed area for the mine. In addition the revisions account for stormwater storage from one calendar year to the next, the evaporation associated and clarify water augmented to the creek.

If you have further questions please feel free to contact us.

Sincerely,

*Eddie Saucedo*

Eddie Saucedo  
Environmental Services Manager  
Vulcan Materials Company

Revised: 6-26-2018

# 2016 ANNUAL REPORT

Report 2016  
North Troy Quarry  
Mill Creek, OK  
Vulcan Materials Company

## VMC North Troy 2016 Monitoring Report

All volumes are in acre-feet.

	Total Stormwater Entering Pit note(s)	Total Groundwater Diverted	Pit Water Sent To Holding Basin	Groundwater Augmentation	Streamwater Augmentation	Defined Elements of Consumptive Use of Pit Water	Streamwater Pumped From Mill Creek	Groundwater Pumped From Wells	Total Annual Groundwater Allocation, Ac-ft
January-16	331.82	329.27	53.08	241.05	0.00	6.28	0.00	0.00	219.50
February-16	331.65	310.07	51.53	263.89	0.00	10.76	0.00	0.00	219.50
March-16	294.34	43.12	251.22	348.12	0.00	13.68	0.00	1.48	219.50
1st QTR Totals	967.81	680.55	110.38	853.05	0.00	30.70	0.00	1.48	N/A
April-16	313.57	241.66	43.18	277.63	0.00	14.04	0.00	0.00	219.50
May-16	828.97	805.42	32.53	282.60	0.00	13.52	0.00	0.00	219.50
June-16	380.05	375.93	43.24	341.80	0.00	14.29	0.00	0.00	219.50
2nd QTR Totals	1522.59	1423.01	118.95	912.03	0.00	41.85	0.00	0.00	N/A
July-16	322.97	310.65	28.85	55.11	242.75	20.06	0.00	0.00	219.50
August-16	303.51	24.22	279.29	258.08	0.00	12.75	0.00	0.00	219.50
September-16	378.68	340.69	30.26	351.59	0.00	10.80	0.00	0.00	219.50
3rd QTR Totals	1008.16	930.64	107.29	684.78	242.75	43.61	0.00	0.00	N/A
October-16	342.43	313.40	0.00	251.36	96.06	11.68	0.00	0.00	219.50
November-16	205.90	275.14	32.78	220.26	35.14	6.04	0.00	0.00	219.50
December-16	297.59	290.53	29.55	270.50	1.78	5.41	0.00	0.00	219.50
4th QTR Totals	925.92	679.06	62.33	742.12	132.98	23.12	0.00	0.00	N/A
2016 Totals	4412.28	4123.26	398.98	3171.98	375.73	139.28	0.00	2.92	219.50
2016 Totals (adj)	4412.28	3866.05	398.98	3171.98	375.73	139.28	0.00	2.92	219.50

10 notes

Pit Meter replaced Mar 19th

20 notes

Onsite Rain Gauge damaged by hail

30 notes

Replaced

40 notes

Production Well electrical problem. Not operational

(a)

Total Stormwater = Volume of precipitation that falls into producing mine pit and volume of precipitation that falls onto producing mine and flows over the land surface into the mine pit.

(adj)

Annual total adjustment for stormwater carried over to next calendar year

Water Balance = -80.61

Total Net Reported Consumptive Use

Revisions:

06-2018

Stormwater watershed area revised based on actual pit area (adj) adjustment based on stored water streamwater augmentation totals revised to show actual augmentation credits added notes for definitions

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MILL CREEK 2016 AUGMENTATION and GAUGE DATA

Start Date	Start Time	Stop Date	Stop Time	Begin Reading	End Reading	Augmentation Ac - Ft pumped	Stormwater Pumped AF	Stream Gauge Reading	Time Read	Stream height	Stream flow
1/24/2016	9:30 AM	1/25/2016	5:30 PM				4.19	7331200	9:00 AM	7	28
1/28/2016	4:30 PM	2/1/2016	9:00 AM	1484749704	1496350000		35.60	7331200	4:00 PM	6.97	25
2/4/2016	6:20 AM	2/6/2016	2:50 PM	1509970000	1515980000		18.44	7331200	6:00 AM	6.89	19
2/11/2016	10:15 AM	2/12/2016	5:00 PM	1538940000	1542940000		12.28	7331200	9:30 AM	6.86	18
2/18/2016	2:45 PM	2/22/2016	6:10 AM	1570130000	1581520000		34.95	7331200	2:00 PM	6.79	12
3/2/2016	7:00 AM	3/5/2016	11:00 AM	1618660000	1658560000		122.45	7331200	6:30 AM	7.02	30
4/5/2016	3:55 PM	4/15/2016	2:00 PM	74760000	110100000		108.45	7331200	3:30 PM	6.74	15
5/10/2016	5:40 PM	5/17/2016	5:45 PM	224290000	245760000		65.89	7331200	5:00 PM	7.13	51
6/30/2016	1:00 PM	7/13/2016	5:31 PM	447260000	489160000	128.59		7331200	12:30 PM	6.53	4.9
7/20/2016	9:15 AM	8/1/2016	6:30 AM	515300000	552500000	114.16		7331200	8:30 AM	6.4	3.6
August 2016	No augmentation this month										
September 2016	No augmentation this month										
10/11/2016	10:14 AM	10/13/2016	3:39 PM	815710000	825080000	28.76		7331200	10:00 AM	6.36	4.07
10/13/2016	4:15 PM	10/20/2016	7:30 AM	825080000	847010000	67.30		7331200	4:00 PM	6.28	2.36
11/17/2016	11:40 AM	11/20/2016	7:40 AM	940850000	946490000	17.31		7331200	11:00 AM	6.14	0.83
11/21/2017	6:00 AM	11/23/2016	7:45 AM	946490000	952300000	17.83		7331200	5:30 AM	6.16	0.97
12/1/2016	8:20 AM	12/1/2016	1:05 PM	979860000	980440000	1.78		7331200	7:30 AM	6.16	0.97
Total							402.25				

777.98 Pumped to Mill Creek  
 375.73 Augmented to Mill Creek  
 546.23 Stormwater collected entering pit  
 402.25 Stormwater pumped to Mill Creek

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August Precipitation/Evaporation Data

PIT RUNOFF ASSUMPTIONS			
Hydrologic Soil Group	D	II (ave)	II (ave)
Land Use	gravel road	88	88
AMC Condition		100	100
CN (pt fringe)	area draining into pit	1,360,000	0
S (pt fringe)	area with direct interception	100.91	87.48
Pit - Direct Interception (>95 ft deep)	area with direct interception	100.91	87.48
Pit fringe (area drains to pit)	subject to refinement	87.48	87.48
Drainage to Pit (total area)	subject to refinement	188.39	188.39

Date	Quarry area fringe area		Daily
	Precip. in, Runoff, in	Runoff, in	
1-Aug	1.18	0.00	0.41
2-Aug	0.00	0.00	0.41
3-Aug	0.00	0.00	0.31
4-Aug	0.00	0.00	0.31
5-Aug	0.00	0.00	0.34
6-Aug	0.00	0.00	0.31
7-Aug	0.02	0.00	0.31
8-Aug	0.00	0.00	0.31
9-Aug	0.00	0.00	0.34
10-Aug	0.00	0.00	0.34
11-Aug	0.00	0.00	0.34
12-Aug	0.00	0.00	0.31
13-Aug	0.00	0.00	0.31
14-Aug	0.00	0.00	0.31
15-Aug	0.00	0.00	0.18
16-Aug	0.00	0.00	0.20
17-Aug	0.00	0.00	0.16
18-Aug	0.00	0.00	0.16
19-Aug	0.00	0.00	0.16
20-Aug	0.00	0.00	0.16
21-Aug	0.00	0.00	0.16
22-Aug	0.00	0.00	0.16
23-Aug	0.00	0.00	0.16
24-Aug	0.00	0.00	0.16
25-Aug	0.00	0.00	0.16
26-Aug	0.00	0.00	0.16
27-Aug	0.00	0.00	0.16
28-Aug	0.00	0.00	0.16
29-Aug	0.00	0.00	0.16
30-Aug	0.00	0.00	0.16
31-Aug	0.00	0.00	0.16
Sum	2.88	0.00	8.83
Volume, ac-ft	24.21	0.00	8.83
Total Vol, ac-ft	24.21	0.00	8.83

Pan Evaporation from Sulphur Mesonet

September Precipitation/Evaporation Data

PIT RUNOFF ASSUMPTIONS			
Hydrologic Soil Group	D	II (ave)	II (ave)
Land Use	gravel road	88	88
AMC Condition		100	100
CN (pt fringe)	area draining into pit	1,360,000	0
S (pt fringe)	area with direct interception	100.91	87.48
Pit - Direct Interception (>95 ft deep)	area with direct interception	100.91	87.48
Pit fringe (area drains to pit)	subject to refinement	87.48	87.48
Drainage to Pit (total area)	subject to refinement	188.39	188.39

Date	Quarry area fringe area		Daily
	Precip. in, Runoff, in	Runoff, in	
1-Sep	0.24	0.00	0.19
2-Sep	0.00	0.00	0.18
3-Sep	0.01	0.00	0.24
4-Sep	0.00	0.00	0.31
5-Sep	0.00	0.00	0.34
6-Sep	0.00	0.00	0.31
7-Sep	0.00	0.00	0.31
8-Sep	0.00	0.00	0.31
9-Sep	0.00	0.00	0.31
10-Sep	0.27	0.00	0.22
11-Sep	0.00	0.00	0.24
12-Sep	0.00	0.00	0.24
13-Sep	0.00	0.00	0.24
14-Sep	0.00	0.00	0.15
15-Sep	0.00	0.00	0.11
16-Sep	0.17	0.00	0.19
17-Sep	0.88	0.00	0.18
18-Sep	1.33	0.00	0.23
19-Sep	0.00	0.00	0.23
20-Sep	0.00	0.00	0.24
21-Sep	0.00	0.00	0.21
22-Sep	0.00	0.00	0.21
23-Sep	0.00	0.00	0.23
24-Sep	0.00	0.00	0.23
25-Sep	1.39	0.50	0.28
26-Sep	0.00	0.00	0.22
27-Sep	0.00	0.00	0.15
28-Sep	0.00	0.00	0.21
29-Sep	0.00	0.00	0.10
30-Sep	0.00	0.00	0.14
Sum	4.20	0.50	3.87
Volume, ac-ft	35.32	4.30	3.87
Total Vol, ac-ft	34.98	4.30	3.87

Pan Evaporation from Sulphur Mesonet

October Precipitation/Evaporation Data

PIT RUNOFF ASSUMPTIONS			
Hydrologic Soil Group	D	II (ave)	II (ave)
Land Use	gravel road	88	88
AMC Condition		100	100
CN (pt fringe)	area draining into pit	1,360,000	0
S (pt fringe)	area with direct interception	100.91	87.48
Pit - Direct Interception (>95 ft deep)	area with direct interception	100.91	87.48
Pit fringe (area drains to pit)	subject to refinement	87.48	87.48
Drainage to Pit (total area)	subject to refinement	188.39	188.39

Date	Quarry area fringe area		Daily
	Precip. in, Runoff, in	Runoff, in	
1-Oct	0.00	0.00	0.13
2-Oct	0.00	0.00	0.17
3-Oct	0.00	0.00	0.21
4-Oct	0.00	0.00	0.23
5-Oct	0.00	0.00	0.20
6-Oct	0.00	0.00	0.20
7-Oct	1.73	1.73	0.18
8-Oct	0.00	0.00	0.18
9-Oct	0.00	0.00	0.14
10-Oct	0.00	0.00	0.19
11-Oct	0.00	0.00	0.23
12-Oct	0.00	0.00	0.21
13-Oct	0.14	0.00	0.08
14-Oct	0.00	0.00	0.12
15-Oct	0.00	0.00	0.21
16-Oct	0.00	0.00	0.23
17-Oct	0.00	0.00	0.21
18-Oct	0.00	0.00	0.21
19-Oct	0.36	0.36	0.18
20-Oct	0.21	0.00	0.15
21-Oct	0.00	0.00	0.11
22-Oct	0.00	0.00	0.17
23-Oct	0.00	0.00	0.17
24-Oct	0.00	0.00	0.15
25-Oct	0.00	0.00	0.15
26-Oct	0.32	0.32	0.12
27-Oct	0.00	0.00	0.12
28-Oct	0.00	0.00	0.12
29-Oct	0.00	0.00	0.13
30-Oct	0.00	0.00	0.13
31-Oct	0.00	0.00	0.19
Sum	2.60	2.60	4.45
Volume, ac-ft	21.83	21.83	4.45
Total Vol, ac-ft	21.83	21.83	4.45

Pan Evaporation from Sulphur Mesonet

\* Used Mesonet Pan Evaporation - Sulphur

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November Precipitation/Evaporation Data

PIT RUNOFF ASSUMPTIONS			
Hydrologic Soil Group	D		
Land Use	gravel road		
AMC Condition	II (ave)		
CN (pit fringe)	88		area draining into pit
CN (pit fringe)	100		area with direct interception
S (pit fringe)	1363036		area draining into pit
S (pit fringe)	0		area with direct interception
Pit - Direct Interception (>95 ft deep)	100.91		subject to refinement
Pit fringe (area drains to pit)	87.48		subject to refinement
Drainage to Pit (total area)	188.39		subject to refinement

Date	Quarry area			Daily
	Precip. in.	Runoff. in.	Evaporation. in.	
1-Nov	0.00	0.00	0.17	Runoff formula
2-Nov	0.00	0.00	0.13	Pe = (P-0.2S)*2/(P+0.8S)
3-Nov	0.44	0.00	0.07	S = (1000/CN)-10
4-Nov	0.00	0.00	0.06	
5-Nov	0.00	0.00	0.11	
6-Nov	0.00	0.00	0.14	Blue cells contain formulas
7-Nov	0.16	0.00	0.05	
8-Nov	0.00	0.00	0.04	
9-Nov	0.00	0.00	0.11	
10-Nov	0.00	0.00	0.07	Nov. Precip
11-Nov	0.00	0.00	0.1	N. Troy Rain gauge
12-Nov	0.00	0.00	0.11	
13-Nov	0.00	0.00	0.1	
14-Nov	0.00	0.00	0.1	
15-Nov	0.00	0.00	0.06	
16-Nov	0.00	0.00	0.18	
17-Nov	0.00	0.00	0.12	
18-Nov	0.00	0.00	0.23	
19-Nov	0.00	0.00	0.07	
20-Nov	0.00	0.00	0.14	
21-Nov	0.00	0.00	0.17	
22-Nov	0.16	0.00	0.06	
23-Nov	0.00	0.00	0.06	
24-Nov	0.00	0.00	0.06	
25-Nov	0.00	0.00	0.06	
26-Nov	0.00	0.00	0.06	
27-Nov	0.00	0.00	0.06	
28-Nov	0.52	0.00	0.14	
29-Nov	0.00	0.00	0.14	
30-Nov	0.00	0.00	0.11	
sum	1.28	0.00	3.18	
Volume, ac-ft	1076	0.00		Pan Evaporation from Sulphur Mesonet
Total Vol, ac-ft	1076			

\* Used Mesonet Pan Evaporation - Sulphur

December Precipitation/Evaporation Data

PIT RUNOFF ASSUMPTIONS			
Hydrologic Soil Group	D		
Land Use	gravel road		
AMC Condition	II (ave)		
CN (pit fringe)	88		area draining into pit
CN (pit fringe)	100		area with direct interception
S (pit fringe)	1363036		area draining into pit
S (pit fringe)	0		area with direct interception
Pit - Direct Interception (>95 R deep)	100.91		subject to refinement
Pit fringe (area drains to pit)	87.48		subject to refinement
Drainage to Pit (total area)	188.39		subject to refinement

Date	Quarry area			Daily
	Precip. in.	Runoff. in.	Evaporation. in.	
1-Dec	0.00	0.00	0.12	Runoff formula
2-Dec	0.00	0.00	0.06	Pe = (P-0.2S)*2/(P+0.8S)
3-Dec	0.66	0.00	0.03	S = (1000/CN)-10
4-Dec	0.06	0.00	0.03	
5-Dec	0.00	0.00	0.03	Blue cells contain formulas
6-Dec	0.00	0.00	0.06	
7-Dec	0.00	0.00	0.07	
8-Dec	0.00	0.00	0.06	
9-Dec	0.00	0.00	0.05	Dec. Precip
10-Dec	0.00	0.00	0.11	N. Troy Rain gauge
11-Dec	0.00	0.00	0.15	
12-Dec	0.00	0.00	0.07	
13-Dec	0.00	0.00	0.05	
14-Dec	0.00	0.00	0.06	
15-Dec	0.00	0.00	0.06	
16-Dec	0.00	0.00	0.06	
17-Dec	0.00	0.00	0.13	
18-Dec	0.00	0.00	0.04	
19-Dec	0.00	0.00	0.05	
20-Dec	0.00	0.00	0.12	
21-Dec	0.00	0.00	0.16	
22-Dec	0.00	0.00	0.06	
23-Dec	0.06	0.00	0.03	
24-Dec	0.00	0.00	0.03	
25-Dec	0.12	0.00	0.03	
26-Dec	0.00	0.00	0.14	
27-Dec	0.00	0.00	0.11	
28-Dec	0.00	0.00	0.18	
29-Dec	0.00	0.00	0.16	
30-Dec	0.00	0.00	0.16	
31-Dec	0.00	0.00	0.14	
sum	0.84	0.00	2.76	
Volume, ac-ft	7.06	0.00		Pan Evaporation from Sulphur Mesonet
Total Vol, ac-ft	7.06			

\* Used Mesonet Pan Evaporation - Sulphur

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Monthly Water Data, ac-ft

	Water Diverted From Pit	Storm Water Entering Pit	Net Sump Volume Change	Groundwater Sent To Holding Basin	Groundwater Sent To Infiltration Areas	Groundwater Used For Stream Augmentation	Evaporation	Moisture Content of Product Shipped	Water Truck Usage	Misc Pit Water Use On Site	Misc Pit Water Use Off Site	Production Well Permit 2002-502	North Well Permit 20060501A
January-16	33,872	2,35	1,00	53,00	238,77	3,94	1.43	0.00	0.00	0.00	0.00	0.00	0.00
February-16	331,63	21,50	-11,00	51,63	258,15	7,51	2,36	0.80	0.00	0.00	0.00	0.00	0.00
March-16	294,34	43,12	1,02	5,00	349,63	9,08	3,55	1,04	0.00	0.00	0.00	0.00	0.00
April-16	313,11	71,91	0,51	43,18	272,54	10,24	3,09	0,73	0.00	0.00	0.00	0.00	0.00
May-16	878,37	23,55	2,10	37,53	290,32	9,78	3,37	0,37	0.00	0.00	0.00	0.00	0.00
June-16	599,05	4,12	0,41	43,94	336,81	12,56	0,95	0,77	0.00	0.00	0.00	0.00	0.00
July-16	322,09	12,32	-2,18	28,85	83,37	16,14	2,70	1,22	0.00	0.00	0.00	1,44	0.00
August-16	303,57	24,22	2,42	30,18	253,34	8,00	3,91	0,85	0.00	0.00	0.00	0.00	0.00
September-16	378,00	36,99	2,40	30,38	349,43	6,16	3,74	0,90	0.00	0.00	0.00	0.00	0.00
October-16	342,43	29,03	0,23	0,00	248,17	4,94	2,96	3,78	0.00	0.00	0.00	0.00	0.00
November-16	265,60	10,76	-8,64	32,78	311,55	2,88	1,62	1,83	0.00	0.00	0.00	0.00	0.00
December-16	297,59	7,08	4,30	28,63	269,35	2,50	2,10	0,81	0.00	0.00	0.00	0.00	0.00

Pit Sump Volumes

	West Sump				S05 Sump				New Freshwater Pond				Pit area				
	Month End Depth-ic-Water, Ft	Width, Ft	Length, Ft	Sump Volume Change, Ac-ft	Evaporation, ac-ft	Month End Depth-ic-Water, Ft	Width, Ft	Length, Ft	Sump Volume Change, Ac-ft	Evaporation, ac-ft	Month End Depth-ic-Water, Ft	Width, Ft		Length, Ft	Evaporation, ac-ft	Total Evaporation, ac-ft	Acres
January-16	5,53	125	325	0,69	0,30	4	50	50	50	0,01	5,40	475	750	1,78	2,00	9,89	2,16
February-16	5,17	125	325	-11,00	0,30	4	50	50	50	0,00	5,01	475	750	3,42	3,61	9,89	4,11
March-16	7,13	125	325	3,83	0,47	4	50	50	50	0,00	6,81	475	750	4,43	4,61	9,89	4,97
April-16	12,337	125	325	0,83	0,50	4	50	50	50	0,00	4,484	475	750	11,116	4,46	9,89	5,32
May-16	10,20	125	325	2,10	0,42	4	50	50	50	0,00	4,42	475	750	0,03	4,21	9,89	5,08
June-16	9,8	125	325	0,45	0,61	4	50	50	50	0,00	3,55	475	750	15,91	5,38	9,89	6,52
July-16	13,12	125	325	-2,18	0,72	4	50	50	50	0,00	4,067	475	750	12,57	6,02	9,89	6,37
August-16	14,719	125	325	-2,42	0,81	4	50	50	50	0,00	3,832	475	750	2,25	6,02	9,89	1,25
September-16	17,11	125	325	2,40	0,53	4	50	50	50	0,00	4,84	475	750	2,00	4,83	9,89	0,96
October-16	11,903	125	325	0,23	0,42	4	50	50	50	0,00	4,335	475	750	1,54	3,71	9,89	0,77
November-16	19,024	125	325	-8,64	0,25	4	50	50	50	0,00	3,721	475	750	5,03	2,17	9,89	0,45
December-16	14,42	125	325	4,30	0,31	4	50	50	50	0,00	3,40	475	750	0,50	1,68	9,89	0,39

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September Shipments		October Shipments		November Shipments		December Shipments	
Tons Shipped	Ac-ft of water shipped	Tons Shipped	Ac-ft of water shipped	Tons Shipped	Ac-ft of water shipped	Tons Shipped	Ac-ft of water shipped
Base Products	900	2,505	0.061	1,339	0.033	5,671	0.136
Coarse Aggregates	107,339	165,535	2,350	114,021	1,370	120,520	1,449
Fine Aggregates	42,339	17,336	0.551	6,948	0.218	16,151	0.513
	240,578	215,376	2,962	122,268	1,621	142,342	2,101

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Oklahoma Natl. Resources Board