

## **APPENDIX B**

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### *Air Quality and Greenhouse Gas Emission Calculations*

Carnegie State Vehicle Recreation Area General Plan/Draft EIR Emissions Estimates

		HC	CO	NOX	PM10	PM2.5	CO2	CO2e
		(tons/year)					(metric tons/year)	
2001	OHMC	18.2	46.7	0.8	0.1	0.1	111.7	117.5
	ATV	1.3	4.1	0.1	0.0	0.0	17.3	18.2
	4X4	0.0	0.1	0.0	0.0	0.0	7.7	8.1
	Fugitive Dust	-	-	-	127.1	12.5	-	-
	On-Road Vehicles	0.7	20.6	2.4	0.0	0.0	2017.1	2123.3
	Total (tons/year)	20.2	71.4	3.3	127.3	12.6	2153.8	2267.1
	Total (lb/day)	110.9	391.2	18.1	697.5	69.1	13008.9	13693.6
2010	OHMC	3.4	20.4	0.4	0.1	0.0	48.7	51.3
	ATV	0.2	1.4	0.0	0.1	0.0	4.8	5.0
	4X4	0.0	0.0	0.0	0.0	0.0	3.4	3.6
	Fugitive Dust	-	-	-	55.5	5.4	-	-
	On-Road Vehicles	0.3	8.5	1.0	0.0	0.0	892.6	939.6
	Total (tons/year)	4.0	30.3	1.4	55.6	5.5	949.5	999.5
	Total (lb/day)	21.8	166.2	7.7	304.7	30.1	5735.3	6037.2
2030	OHMC	8.50	49.05	1.19	0.18	0.14	150.19	158.10
	ATV	0.60	3.48	0.07	0.01	0.01	14.69	15.46
	4X4	0.00	0.02	0.00	0.00	0.00	7.15	7.52
	Fugitive Dust	-	-	-	170.97	16.78	-	-
	On-Road Vehicles	0.10	5.34	0.57	0.01	0.01	1879.03	1977.93
	Total (tons/year)	9.20	57.89	1.83	171.18	16.94	2051.06	2159.01
	Total (lb/day)	50.42	317.20	10.04	937.95	92.80	12388.53	13040.55
	<b>2001-2030 Net Change (tons/year)</b>	-11	-14	-1	44	4	-103	-108
	<b>2001-2030 Net Change (lb/day)</b>	-60	-74	-8	240	24	-620	-653
	<b>2010-2030 Net Change (tons/year)</b>	5	28	0.4	116	11	1102	1159
	<b>2010-2030 Net Change (lb/day)</b>	29	151	2	633	63	6653	7003

Carnegie State Vehicle Recreation Area General Plan/Draft EIR Emissions Estimates

Base Year (2001)

													Emission Factors (g/mile)						Emissions																	
																			(lb/year)						(tons/year)				(metric tons/year)							
													Tech Group	HC	CO	NOX	Total PM	PM2.5	CO2	HC	CO	NOX	PM10	PM2.5	CO2	HC	CO	NOX	PM10	PM2.5	CO2	CO2e				
On-Site OHV Activity	Vehicles	Visitors	OHVs	OHV Counts			Avg Activity Distance		Avg Activity Time		Avg Speed		VMT		Vehicle Type	G2	34.2	54.1	0.01	0.42	-	79.58	31741	16737	3.1	117	88	24619	15.87	8.37	0.00	0.06	0.04	11.17	11.75	
				94,338			14.9	miles	3.4	hours	4.366	mi/hr	1,403,285	mi/yr		OHMC	G4 Pre-1998	3.59	39.1	0.49	0.06	-	79.58	3887	43546	546	60	45	88630	1.94	21.77	0.27	0.03	0.02	40.20	42.32
																OHMC	G4 1998+	0.68	19.8	0.64	0.06	-	79.58	736	33077	1069	90	68	132945	0.37	16.54	0.53	0.05	0.03	60.30	63.48
				ATVs										G2	34.2	54.1	0.01	0.42	-	109.63	2253	1188	0.22	8	6	2408	1.13	0.59	0.00	0.00	0.00	1.09	1.15			
				11,068			9	miles	3.2	hours	2.8	mi/hr	99,615	mi/yr	ATV	G4 Pre-1998	3.59	39.1	0.64	0.06	-	109.63	276	3091	51	4.3	3.2	14325	0.14	1.55	0.03	0.00	0.00	6.50	6.84	
														G4 1998+	0.68	19.8	0.49	0.06	-	109.63	86	3881	96	6.4	4.8	21488	0.04	1.94	0.05	0.00	0.00	9.75	10.26			
				4X4s										LDT1	0.238939	5.930207	0.582716	0.007333	0.006588	398.3067	3	80	8	0.1	0.1	5373	0.00	0.04	0.00	0.00	0.00	2.44	2.57			
				3,816			4.5	miles	1.2	hours	3.857	mi/hr	17,174	mi/yr	4X4	LDT2	0.101579	3.133506	0.433065	0.003391	0.003081	473.6537	2	76	11	0.1	0.1	11544	0.00	0.04	0.01	0.00	0.00	5.24	5.51	

													Emission Factors (lb/VMT)						Emissions																	
																			(lb/year)						(tons/year)				(metric tons/year)							
													HC	CO	NOX	PM10	PM2.5	CO2	HC	CO	NOX	PM10	PM2.5	CO2	HC	CO	NOX	PM10	PM2.5	CO2	CO2e					
On-Site Fugitive Dust	OHVs	Mean Vehicle Weight			Mean OHV Weight		Mean OHV Speed		Mean OHV VMT								-	-	-	0.167255	0.016413	-	-	-	254240.6	24948.28	-	-	-	-	127.1203	12.47414	-	-		
		OHMC			0.11 tons		0.185		4.2		13.9								-	-	-	0.167255	0.016413	-	-	-	254240.6	24948.28	-	-	-	-	127.1203	12.47414	-	-
		ATV			0.18 tons		4.2		13.9								-	-	-	0.167255	0.016413	-	-	-	254240.6	24948.28	-	-	-	-	127.1203	12.47414	-	-		
		4X4			1.98 tons		4.2		13.9								-	-	-	0.167255	0.016413	-	-	-	254240.6	24948.28	-	-	-	-	127.1203	12.47414	-	-		

													Emission Factors (g/mile)						Emissions												
																			(lb/year)						(tons/year)				(metric tons/year)		
													ROG RUN	CO RUN	NOX RUN	PM10 RUN	PM2.5 RUN	CO2 RUN	HC	CO	NOX	PM10	PM2.5	CO2	HC	CO	NOX	PM10	PM2.5	CO2	CO2e
On-Road Vehicles	Vehicles	Average Miles Driven Roundtrip	VMT		Vehicles								847.3067	21029.27	2066.386	26.00399	23.36347	1412446	0.42	10.51	1.03	0.01	0.01	640.68	674.40						
			Light-Duty Trucks (0-3750 lbs)										0.238939	5.930207	0.582716	0.007333	0.006588	398.3067	650.7698	20074.93	2774.447	21.72577	19.74095	3034481	0.33	10.04	1.39	0.01	0.01	1376.42	1448.86
			Light-Duty Trucks (3751-5750 lbs)										0.101579	3.133506	0.433065	0.003391	0.003081	473.6537	650.7698	20074.93	2774.447	21.72577	19.74095	3034481	0.33	10.04	1.39	0.01	0.01	1376.42	1448.86

Total OHMC Emissions =	18.18	46.68	0.81	0.13	0.10	111.67	117.55
Total ATV Emissions =	1.31	4.08	0.07	0.01	0.01	17.34	18.25
Total 4x4 Emissions =	0.00	0.08	0.01	0.00	0.00	7.67	8.08
On-Site Fugitive Dust Emissions =	-	-	-	127.12	12.47	-	-
On-Road Vehicle Emissions =	0.75	20.55	2.42	0.02	0.02	2017.09	2123.26
OHV Emissions (tons/year) =	19.5	50.8	0.89	0.14	0.11	137	144
Fugitive Dust Emissions (tons/year) =	-	-	-	127	12.5	-	-
On-Road Vehicle Emissions (tons/year) =	0.75	20.6	2.42	0.02	0.02	2017	2123
2030 Total Emissions (tons/year) =	20.2	71.4	3.31	127	12.6	2154	2267
OHV Emissions (lb/day) =	107	279	4.89	0.78	0.59	749	788
Fugitive Dust Emissions (lb/day) =	-	-	-	697	68.4	-	-
On-Road Vehicle Emissions (lb/day) =	4.1	113	13.3	0.13	0.12	11053	11634
2030 Total Emissions (lb/day) =	111	391	18.1	697	69.1	13008.93	13693.61

Base Year (2010)

													Emission Factors (g/mile)						Emissions																	
																			(lb/year)						(tons/year)				(metric tons/year)							
													Tech Group	HC	CO	NOX	Total PM	PM2.5	CO2	HC	CO	NOX	PM10	PM2.5	CO2	HC	CO	NOX	PM10	PM2.5	CO2	CO2e				
On-Site OHV Activity	Vehicles	Visitors	OHVs	OHV Counts			Avg Activity Distance		Avg Activity Time		Avg Speed		VMT		Vehicle Type	G2	34.2	54.1	0.01	0.42	-	79.58	4618	7306	1.4	51	39	10746	2.31	3.65	0.00	0.03	0.02	4.87	5.13	
				41,179			14.9	miles	3.4	hours	4.366	mi/hr	612,539	mi/yr		OHMC	G4 Pre-1998	3.59	39.1	0.49	0.06	-	79.58	1745	19008	238	26	20	38687	0.87	9.50	0.12	0.01	0.01	17.55	18.47
																OHMC	G4 1998+	0.68	19.8	0.64	0.06	-	79.58	496	14438	467	39	30	58031	0.25	7.22	0.23	0.02	0.01	26.32	27.71
				ATV										G2	34.2	54.1	0.01	0.42	-	109.63	328	519	0.10	51	3	1051	0.16	0.26	0.00	0.03	0.00	0.48	0.50			
				4,831			9	miles	3.2	hours	2.8	mi/hr	43,482	mi/yr	ATV	G4 Pre-1998	3.59	39.1	0.64	0.06	-	109.63	124	1349	22	26.3	1.4	3783	0.06	0.67	0.01	0.01	0.00	1.72	1.81	
														G4 1998+	0.68	19.8	0.49	0.06	-	109.63	35	1025	25	39.4	2.1	5675	0.02	0.51	0.01	0.02	0.00	2.57	2.71			
				4X4										LDT1	0.238939	5.930207	0.582716	0.007333	0.006588	398.3067	1	27	3	0.0	0.0	1806	0.00	0.01	0.00	0.00	0.00	0.82	0.86			
				1,666			4.5	miles	1.2	hours	3.857	mi/hr	7,497	mi/yr	4X4	LDT2	0.101579	3.133506	0.433065	0.003391	0.003081	473.6537	1	38	5	0.0	0.0	5681	0.00	0.02	0.00	0.00	0.00	2.58	2.71	

													Emission Factors (lb/VMT)						Emissions															
																			(lb/year)						(tons/year)				(metric tons/year)					
													HC	CO	NOX	PM10	PM2.5	CO2	HC	CO	NOX	PM10	PM2.5	CO2	HC	CO	NOX	PM10	PM2.5	CO2	CO2e			
On-Site Fugitive Dust	OHVs	Mean Vehicle Weight			Mean OHV Weight		Mean OHV Speed		Mean OHV VMT								-	-	-	0.167255	0.016413	-	-	-	110976.9	10890.01	-	-	-	-	55.48846	5.445005	-	-
		OHMC			0.11 tons		4.2		13.9								-	-	-	0.167255	0.016413	-	-	-	110976.9	10890.01	-	-	-	-	55.48846	5.445005	-	-
		ATV			0.18 tons		4.2		13.9								-	-	-	0.167255	0.016413	-	-	-	110976.9	10890.01	-	-	-	-	55.48846	5.445005	-	-
		4X4			1.98 tons		4.2		13.9								-	-	-	0.167255	0.016413	-	-	-	110976.9	10890.01	-	-	-	-	55.48846	5.445005	-	-

					Emission Factors (g/mile)						Emissions																		
											(lb/year)			(tons/year)				(metric tons/year)											
Vehicles	Average Miles Driven Roundtrip	VMT	Vehicles		ROG_RUN	CO_RUNE	NOX_RUN	PM10_RU	PM2_5_R	CO2_RUN	HC	CO	NOX	PM10	PM2.5	CO2	HC	CO	NOX	PM10	PM2.5	CO2	CO2e						
On-Road Vehicles	31,784	62	1,970,608	mi/yr	Light-Duty Trucks (0-3750 lbs)						0.238939	5.930207	0.582716	0.007333	0.006588	398.3067	284.7486	7067.162	694.4362	8.738984	7.851603	474671.1	0.14	3.53	0.35	0.00	0.00	215.31	226.64
					Light-Duty Trucks (3751-5750 lbs)						0.101579	3.133506	0.433065	0.003391	0.003081	473.6537	320.2431	9878.851	1365.302	10.69122	9.7145	1493265	0.16	4.94	0.68	0.01	0.00	677.33	712.98

Total OHMC Emissions =	3.43	20.38	0.35	0.06	0.04	48.75	51.31
Total ATV Emissions =	0.24	1.45	0.02	0.06	0.00	4.77	5.02
Total 4x4 Emissions =	0.00	0.03	0.00	0.00	0.00	3.40	3.57
On-Site Fugitive Dust Emissions =	-	-	-	55.49	5.45	-	-
On-Road Vehicle Emissions =	0.30	8.47	1.03	0.01	0.01	892.64	939.62
OHV Emissions (tons/year) =	3.67	21.9	0.38	0.12	0.05	56.9	59.9
Fugitive Dust Emissions (tons/year) =	-	-	-	55.5	5.45	-	-
On-Road Vehicle Emissions (tons/year) =	0.30	8.5	1.03	0.01	0.01	893	940
2030 Total Emissions (tons/year) =	3.98	30.3	1.41	55.6	5.50	950	1000
OHV Emissions (lb/day) =	20.1	120	2.09	0.64	0.26	312	328
Fugitive Dust Emissions (lb/day) =	-	-	-	304	29.8	-	-
On-Road Vehicle Emissions (lb/day) =	1.7	46	5.6	0.05	0.05	4891	5149
2030 Total Emissions (lb/day) =	21.8	166	7.7	305	30.1	5735.331	6037.191

Projected Future Year (2030)

											Emission Factors (g/mile)						Emissions																
																	(lb/year)			(tons/year)				(metric tons/year)									
Vehicles	Vistors	OHVs	OHV Counts	Avg Activity Distance	Avg Activity Time	Avg Speed	Total VMT	Vehicle Type	Tech Group	HC	CO	NOX	Total PM	PM2.5	CO2	HC	CO	NOX	PM10	PM2.5	CO2	HC	CO	NOX	PM10	PM2.5	CO2	CO2e					
On-Site OHV Activity	97,932	195,863	146,898	OHMC						G2	34.2	54.1	0.01	0.42	-	79.58	14230	22510	4.2	157	118.8324	33112	7.11	11.25	0.00	0.08	0.06	15.02	15.81				
				126,879	14.9	miles	3.4	hours	4.366	mi/hr	1,887,338	mi/yr	OHMC	G4 Pre-1998	3.59	39.1	0.49	0.06	-	79.58	269	2928	37	4	3.05569	5960	0.13	1.46	0.02	0.00	0.00	2.70	2.85
														G4 1998+	0.68	19.8	0.64	0.06	-	79.58	2495	72663	2349	198	149.7288	292045	1.25	36.33	1.17	0.10	0.07	132.47	139.44
				ATV						G2	34.2	54.1	0.01	0.42	-	109.63	1010	1598	0.30	11	8.435577	3238	0.51	0.80	0.00	0.01	0.00	1.47	1.55				
				14,886	9	miles	3.2	hours	2.8	mi/hr	133,977	mi/yr	ATV	G4 Pre-1998	3.59	39.1	0.64	0.06	-	109.63	19	208	3	0.3	0.216915	583	0.01	0.10	0.00	0.00	0.00	0.26	0.28
														G4 1998+	0.68	19.8	0.49	0.06	-	109.63	177	5158	128	14.1	10.62883	28560	0.09	2.58	0.06	0.01	0.01	12.95	13.64
				4X4						LDT1	0.018711	0.94561	0.096813	0.002352	0.002182	258.7942	0	13	1	0.0	0.03025	3588	0.00	0.01	0.00	0.00	0.00	1.63	1.71				
				5,133	4.5	miles	1.2	hours	3.857	mi/hr	23,098	mi/yr	4X4	LDT2	0.013763	0.741741	0.080754	0.00209	0.001939	328.4338	1	27	3	0.1	0.071861	12171	0.00	0.01	0.00	0.00	0.00	5.52	5.81

								Emission Factors (lb/VMT)						Emissions														
														(lb/year)			(tons/year)				(metric tons/year)							
OHVs	Mean Vehicle Weight	Mean OHV Weight	Mean OHV Speed	Mean OHV VMT	HC	CO	NOX	PM10	PM2.5	CO2	HC	CO	NOX	PM10	PM2.5	CO2	HC	CO	NOX	PM10	PM2.5	CO2	CO2e					
On-Site Fugitive Dust	146,898	OHMC 0.11 tons	0.185	tons	4.2	mi/hr	13.9	miles			-	-	-	0.167255	0.016413	-	-	-	-	341939.1	33554	-	-	-	170.9695	16.777	-	-
		ATV 0.18 tons																										
		4X4 1.98 tons																										

					Emission Factors (g/mile)						Emissions																		
											(lb/year)			(tons/year)				(metric tons/year)											
Vehicles	Average Miles Driven Roundtrip	VMT	Vehicles		ROG_RUN	CO_RUNE	NOX_RUN	PM10_RU	PM2_5_R	CO2_RUN	HC	CO	NOX	PM10	PM2.5	CO2	HC	CO	NOX	PM10	PM2.5	CO2	CO2e						
On-Road Vehicles	97,932	62	6,071,784	mi/yr	Light-Duty Trucks (0-3750 lbs)						0.018711	0.94561	0.096813	0.002352	0.002182	258.7942	68.18791	3446.012	352.8089	8.570109	7.951648	943103.2	0.03	1.72	0.18	0.00	0.00	427.78	450.30
					Light-Duty Trucks (3751-5750 lbs)						0.013763	0.741741	0.080754	0.00209	0.001939	328.4338	134.0701	7225.71	786.6718	20.35918	18.88996	3199453	0.07	3.61	0.39	0.01	0.01	1451.25	1527.63

Total OHMC Emissions =	8.50	49.1	1.19	0.18	0.14	150.2	158.1
Total ATV Emissions =	0.60	3.48	0.07	0.01	0.01	14.69	15.46
Total 4x4 Emissions =	0.00	0.02	0.00	0.00	0.00	7.15	7.52
On-Site Fugitive Dust Emissions =	-	-	-	171.0	16.8	-	-
On-Road Vehicle Emissions =	0.10	5.34	0.57	0.01	0.01	1879	1978
OHV Emissions (tons/year) =	9.10	52.6	1.26	0.19	0.15	172.0	181.1
Fugitive Dust Emissions (tons/year) =	-	-	-	171	16.8	-	-
On-Road Vehicle Emissions (tons/year) =	0.10	5.34	0.57	0.01	0.01	1879	1978
2030 Total Emissions (tons/year) =	9.20	57.9	1.83	171	16.9	2051	2159
OHV Emissions (lb/day) =	49.9	288	6.92	1.06	0.80	943	992
Fugitive Dust Emissions (lb/day) =	-	-	-	937	91.9	-	-
On-Road Vehicle Emissions (lb/day) =	0.55	29.2	3.12	0.08	0.07	10296	10838
2030 Total Emissions (lb/day) =	50.4	317	10.0	938	92.79958	12388.53	13040.55

Conversion Factors and Assumptions:

1 pound =	453.6 grams
1 ton =	2000 pounds
1 metric ton =	2204.62 pounds
% of G2 vehicles in 2001 =	30%
% of G4 Pre-1998 vehicles in 2001 =	35%
% of G4 1998+ vehicles in 2001 =	35%
% of G2 vehicles in 2010 =	10%
% of G4 Pre-1998 vehicles in 2010 =	36%
% of G4 1998+ vehicles in 2010 =	54%
% of G2 vehicles in 2030 =	10%
% of G4 Pre-1998 vehicles in 2030 =	2% * Estimated based on the very old age of pre-1998 vehicles in 2030
% of G4 1998+ vehicles in 2030 =	88%
% of LDT1 in 2001 =	36%
% of LDT2 in 2001 =	64%
% of LDT1 in 2010 =	27%
% of LDT2 in 2010 =	73%
% of LDT1 in 2030 =	27%
% of LDT2 in 2030 =	73%

AP-42, Section 13.2.2 - Unpaved Road Fugitive Dust Equation Inputs

surface material silt content - public (%) =	5
surface material silt content - industrial (%) =	13.5
surface material moisture content (%) =	6.515
emission factor for 1980's vehicle fleet exhaust, brake wear and tire wear (PM2.5) =	0.00036 lb/VMT
emission factor for 1980's vehicle fleet exhaust, brake wear and tire wear (PM10) =	0.00047 lb/VMT
fugitive dust constant k (PM2.5) =	0.18 lb/VMT
fugitive dust constant k (PM10) =	1.8 lb/VMT
fugitive dust constant a =	1
fugitive dust constant c =	0.2
fugitive dust constant d =	0.5