PROJECT REPORT

EMPSi, Inc. > Burning Man Event EIS

Revised Baseline Technical Report – Air Resources

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LIST OF ACRONYMS AND ABBREVIATIONS

AQRV	Air Quality Related Values
BAPC	Bureau of Air Pollution Control
BLM	Bureau of Land Management
CAMD	Clean Air Markets Division
CASTNET	Clean Air Status and Trends Network
CFR	Code of Federal Regulations
CO	Carbon Monoxide
CRI	Coeur Rochester, Inc.
EIS	Environmental Impact Statement
FLAG	Federal Land Manager's Air Quality Related Values Work Group
FR	Federal Register
GHG	Green House Gas
HAP	Hazardous Air Pollutant
H2O	Water
IPCC	Intergovernmental Panel on Climate Change
km	kilometers
NAAQS	National Ambient Air Quality Standards
NCDC	National Climatic Data Center
NDEP	Nevada Department of Environmental Protection
NEI	National Emission Inventory
NEPA	National Environmental Policy Act
NOx	Nitrogen Dioxide
NPS	National Park Service
O3	Ozone
Pb	Lead
PM10	Particulate Matter
SIP	State Implementation Plan
SNOTEL	Snowpack Telemetry
SO2	Sulfur Dioxide
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
VOC	Volatile Organic Compound
WRCC	Western Regional Climate Center

1. INTRODUCTION

Burning Man is an annual event held in the western United States at Black Rock City – a temporary city erected on a dry lake bed known as the Black Rock Playa within the Black Rock Desert of northwest Nevada. The event site is located approximately 100 miles (160 km) north-northeast of Reno in the northwest corner of Pershing County.

The event is attended by approximately 70,000 ticketed attendees as well as support and logistical staff. The event includes dispersed art installations, interactive artistic performances and the infrastructure for event attendees.

The event site is located on public lands managed by the Winnemucca District Office of the U.S. Department of the Interior (USDI), Bureau of Land Management (BLM). The event is permitted through use of a BLM Special Recreation Permit (SRP).

The event site has an approximate center point of 40.786432°/ -119.206695° (WGS84 Datum) and occurs at a median elevation of 3,900 feet above mean sea level. Primary site access occurs off of County Road 34 located to the west of the Black Rock Playa. The region surrounding the event is currently designated as attainment/unclassifiable for all pollutants in accordance with 40 CFR 81.329. The event is located within a high desert environment, characterized by arid and semiarid conditions, minimal annual precipitation and large temperature ranges. The Sierra Nevada mountain range dictates the regional climate. **Figure 1-1** provides a regional view of the event location.

This report has been developed in support of a revision to the event's SRP that will require review under the National Environmental Policy Act (NEPA). This report is meant to document the current baseline conditions of air resources within the Study Area boundary described in **Section 2.1** and depicted on **Figure 1-2**. Specifically, this report addresses the following:

- Ambient Air Quality;
- Air Emissions; and
- Climatology and Meteorology.

Figure 1-1
Air Quality Assessment Area, Aerial

Air quality assesment area

Burning Man Event

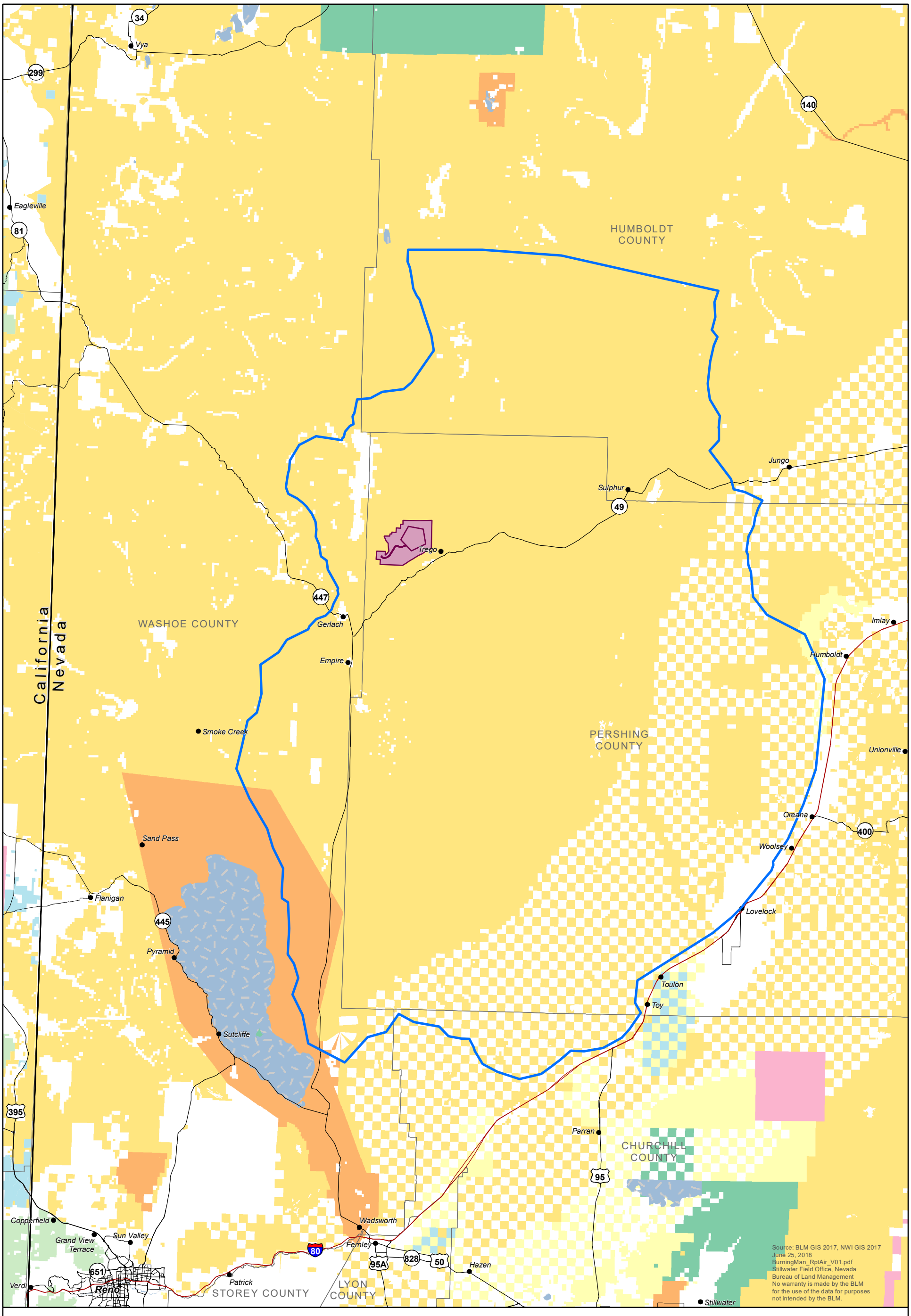


Figure 1-2
Air Quality Assessment Area

2. METHODS

BRC is proposing to modify their SRP to allow for an extended permit term and revisions to total bodies on playa within the event closure area. BRC is proposing to increase the total number of people allowed on the playa to 100,000. Depending on the number of participates and volunteers for recent events, this is an approximately 20% increase in the total bodies on playa. As a result, this Air Quality Baseline has been designed to assess both current event air quality impacts as well as the air quality environment within which the event exists. BRC and the BLM have supplied environmental evaluations and regional data for use in the development of this report. External meteorological data, onsite air quality and meteorological data, permitting information from the Nevada Department of Environmental Protection and publicly available ambient air quality data were also utilized. The following sections are drafted based on all data and information stated above.

2.1. STUDY AREA

The Study Area for air quality includes the event closure area and the surrounding airshed within which event emissions would be released and dispersed. The airshed is approximately bounded on the west by the Granite Range, to the east by the Jackson Mountains, to the south by the Trinity Range, and to the north by the Black Rock Range. The site lies within the Black Rock Desert and is surround on all sides by peaks between 500 and 2000 feet above the Playa floor. Lovelock, the nearest city with National Weather Service data within Pershing County, lies approximately 50 miles southwest of the event site and has been included in the analysis region because of it housing the nearest NWS station within the county.

2.2. REVIEW OF EXISTING DATA

The following information was reviewed to identify and characterize ambient air quality, emissions, climatology, and meteorology within the Study Area:

- Onsite Meteorological and Air Quality Data
- National Emissions Inventory
- Class I Area Reports
- Significant Permitted Air Quality Facilities Permits within 25 km of the Event
- Clean Air Status and Trends Network (CASTNET) Data
- MesoWest Climate and Meteorology Data
- Snow Telemetry (SNOTEL) Data
- National Climatic Data Center (NCDC) Data
- Western Regional Climate Center (WRCC) Data

2.3. ON-SITE DATA COLLECTION

Air quality and meteorological monitoring were completed in association with the baseline assessment for the Burning Man Event. Monitoring was completed during and prior to the event at a location on the playa and adjacent to the main event site. The monitoring location was selected to be co-located with the Operation Center for the BLM and law enforcement. This location allowed for adequate power for the monitoring equipment, a location near the event activities (near proximity to the edge of the city perimeter) and in range of communications for review of onsite data in a continuous manner. The monitoring was completed in keeping with a BLM approved monitoring protocol (attached as Appendix D). The protocol detailed monitoring methods, monitor siting analyses as well as data quality assurance and validation methods to be used.

The continuous (on-playa) monitoring commenced after the closure of the area for the event but prior to the event, although this period did not include event attendees, it did include event infrastructure construction and the activities completed by event staff. The permit closure period began on July 31. 2017 and continued until September 7, 2017. The Burning Man event occurred from August 27, 2017 – September 4, 2017. Onsite monitoring data was collected from August 15, 2017 to September 6, 2017. A detailed chronology of the monitoring effort follows below. Additionally, **Figure 2-1** depicts the monitoring location for the onsite monitors.

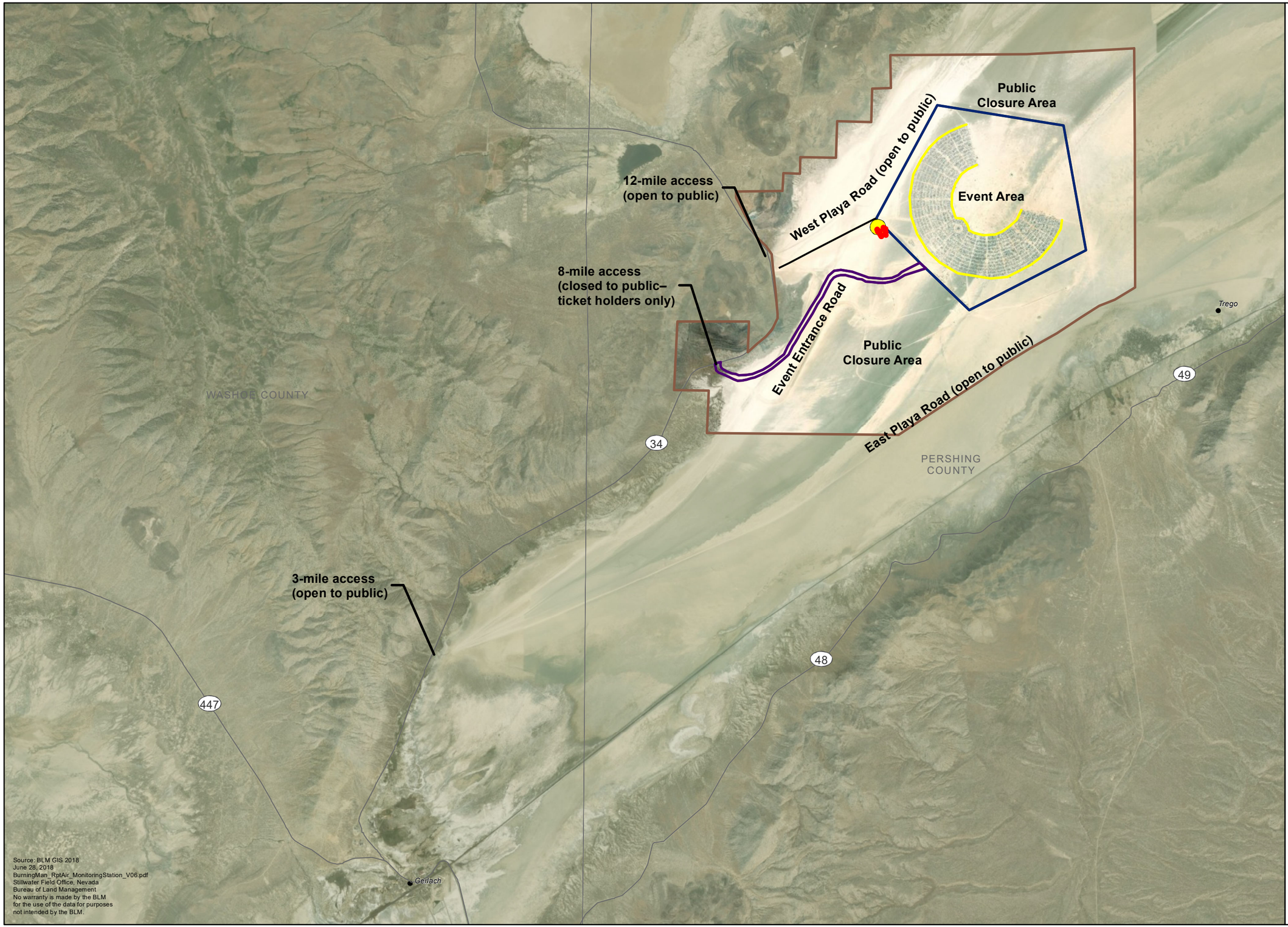
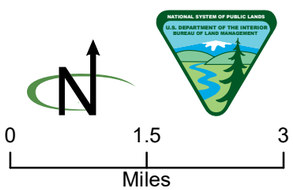


Figure 2-1
Air Monitoring Stations

- Air monitoring stations
- Public closure area
- Event area
- Event entrance road
- Operations center
- City
- Service road



Trinity staff arrived at the BLM Operation Center on the Black Rock Playa on August 10th, 2017. Staff deployed a trailer mounted monitoring system that included a continuous PM_{10} monitor (Met One BAM-1020 PM_{10}), a continuous $PM_{2.5}$ monitor (Met One BAM-1020 $PM_{2.5}$) and a three-meter autonomous meteorological tower (Met One Automet) that included wind speed, wind direction, temperature, dew point and ambient pressure. The BAM 1020 represent EPA Federal Equivalent Methods (FEM) for monitoring of PM_{10} and $PM_{2.5}$. The BAM monitors operate on continuous one hour cycles and record mass concentrations using the following steps:

- At the beginning of the hour, a small Carbon 14 element emits beta rays through a clean spot of filter tape to determine a zero reading
- The BAM advances this exact spot to the sample nozzle where air containing particulate is sampled onto the filter tape.
- • At the end of the hour, the dirty spot is placed back at the source where it is re-measured with beta rays.
- The particulate laden spot attenuates the beta rays more than the clean spot did. The difference between the two measurements is related to the mass of the particulate by a variation of Beer's Law
- This calculation is completed by the machine each hour and a final mass is recorded.

The installation was completed on the 10th of August and staff left the Playa. A photo of the installed continuous monitoring system is provided below. The two BAM monitors are visible on the left side of the trailer the MET-One Automet is visible on the right side of the trailer. **Figure 2-2** depicts the monitoring installation for all onsite monitors.

Figure 2-2. On Site Monitoring Installation

The monitoring system was left in a calibrated state awaiting electrical power. Power was supplied to the system on August 14th, 2017. Staff worked remotely with BLM and BRC staff on the 14th to ensure the system was operational. Following initial startup, the electrical distribution to the $PM_{2.5}$ monitor was interrupted on August 21st due to an issue with the internal shelter circuit breaker. Trinity staff worked remotely with BLM and BRC staff to rewire the enclosure power distribution and reestablished monitoring on August 24th. Additionally, on August 23rd, it was noted that the fin on the wind vane had become detached. It was reinstalled by BLM staff and the data was invalidated during the period that it was missing.

In addition to the continuous playa monitoring, Trinity staff deployed filter based monitors at both the BLM Winnemucca Field Office and the playa (visible behind the trailer mounted continuous monitors in the previous photo). On August 29th staff traveled to Winnemucca and deployed two BGI PQ-200 PM_{10} monitors at the BLM Winnemucca Field Office. BLM staff assisted with access for the monitoring. The monitors operated for 24hr periods on August 30th and August 31st. On September 1st staff traveled to the BLM Operation Center on the playa and deployed the two PQ-200's to operate from September 2nd through the 4th.

The deployment of the filter based PQ-200 monitors was done at the request of the BLM for future speciation of recovered filters. Speciation is still ongoing and the results of any speciation data will be disclosed during the

EIS development process. Additionally, the PQ-200 monitors allowed for use of an EPA Federal Reference Method (FRM) monitor to corroborate the data monitored using the continuous FEM monitors (BAM 1020). At each deployment, Trinity staff cleaned and recalibrated the PQ-200 monitors to ensure accurate measurements. The deployment of the PQ-200 monitors at the Winnemucca District Office were included in the monitoring assessment to allow monitoring at the nearest downwind population center during and after the burning man event to investigate if direct emissions impacts could be observed. The site also acts as a regional control during the same time of year in the Northern Nevada region.

While onsite on the playa, Trinity staff interacted with BLM and BRC staff to maintain and troubleshoot any monitor issues. The extreme (at or exceeding 10 times the NAAQS) particulate loading on the playa caused operational difficulties but the data requirements for monitoring were maintained for the majority of the monitoring period. While onsite, Trinity staff also observed emissions generating processes on the playa. Site photos were documented to clarify emissions generating locations and extent and have been included in Appendix B. The majority of emissions generation resulted from vehicular and human traffic on the playa which liberated material for wind erosion.

On September 5th, Trinity Staff traveled back to Winnemucca and deployed the PQ-200 PM_{10} monitors for sampling dates on September 6th and 7th. Separate Trinity staff recovered the continuous monitoring system from the BLM playa Operation Center on September 7th. The final data record was downloaded prior to equipment recovery. During the recovery it was discovered that the $PM_{2.5}$ monitor experienced a power loss event on September 5th, resulting in loss of $PM_{2.5}$ data on September 5th and 6th. The staff who recovered the Playa monitoring system then recovered the PQ-200 monitors from the Winnemucca Field Office with the assistance of BLM staff on September 8th.

Upon completion of the monitoring, all continuous air quality and meteorological data was downloaded and quality assured. Data analysis suggests that the particulate concentrations were extreme for both PM10 and $PM_{2.5}$. These concentrations are consistent with onsite observations and were monitored well above the National Ambient Air Quality Standards (NAAQS) for the majority of the event period. The Environmental Protection Agency has established the NAAQS as allowable concentration limits applicable to ambient air. They represent health based standards that indicate the potential for negative impacts on public health if exceeded. In many periods, the concentrations were extreme (at or exceeding 10 times the NAAQS) and they exceeded the monitor's maximum concentration threshold of 1000 micrograms/cubic meter (based on factory default). These data are still considered valid but may suppress the total concentration impacts. Monitoring data for the continuous Playa monitors is included in **Table 2-1** below. The data has been color coded for NAAQS compliance with periods above the NAAQS being colored red, periods below the NAAQS being colored green and periods of lost data being colored yellow. The data indicated that with respect to the PM_{10} and $PM_{2.5}$ NAAQS, the event site was above the health based thresholds for all event periods when the monitors were operating.

Table 2-1. Onsite Particulate Monitoring Data (24-Hr Average Concentrations per NAAQS)

Date Monitored	PM_{10} (Microgram/Cubic Meter) MetOne BAM-1020	$PM_{2.5}$ (Microgram/Cubic Meter) MetOne BAM-1020
8/14/2017	-999[b]	-999.0[b]
8/15/2017	72[c]	20.0[c]
8/16/2017	93[c]	20.1[c]
8/17/2017	55[c]	13.5[c]
8/18/2017	127[c]	27.4[c]
8/19/2017	194[a]	48.6
8/20/2017	164[a]	45.5
8/21/2017	338[a]	-999.0[b]
8/22/2017	481[a]	-999.0[b]
8/23/2017	281[a]	-999.0[b]
8/24/2017	290[a]	-999.0[b]
8/25/2017	418[a]	78.8[a]
8/26/2017	499[a]	192.0[a]
8/27/2017	539[a]	196.0[a]
8/28/2017	803[a]	285.6[a]
8/29/2017	572[a]	237.2[a]
8/30/2017	653[a]	276.8[a]
8/31/2017	602[a]	245.6[a]
9/1/2017	672[a]	302.8[a]
9/2/2017	680[a]	296.8[a]
9/3/2017	762[a]	367.7[a]
9/4/2017	638[a]	176.1[a]
9/5/2017	497[a]	-999.0[b]
9/6/2017	342[a]	-999.0[b]

[a] RED Color Coding (and note a) indicates concentration exceeding the NAAQS numerical value.
[b] YELLOW Color Coding (and note b) and -999 indicates missing or invalidated data.
[c] GREEN Color Coding (and note c) indicates concentrations below the NAAQS numerical value.

Table 2-2. Onsite Filter Based Particulate Monitoring Data (Monitor 1) - (24-Hr Average Concentrations per NAAQS)

PM_{10} Sampler Summary

August 1, 2017 - October 10, 2017

Network: **Trinity Consultants**
Site: BLM-Black Rock City
Sampler ID: BRC1 **AQS ID:**
Sampler Type: BGI FRM Single

Date	Filter ID	Concentration (µg/m3) LTP	Concentration (µg/m3) STP	Sample Period (hr:min)	Sample Volume (m3)	Std Volume (m3)	Tare (mg)	Mass Gross (mg)	Net (mg)	Flag	Comments
08/30/17	P2943783	**51.0**	**60.4**[c]	24:00	24.0	20.3	373.545	374.773	1.228	HT	Winnemucca BLM
09/03/17	P2943786	**1882.8**	**2180.0**[a]	24:00	24.0	20.8	379.928	425.191	45.263	HT	BM Playa
09/04/17	P2943787	**1155.3**	**1344.2**[a]	24:00	24.0	20.7	381.007	408.770	27.763	HT	BM Playa
09/07/17	P2943789	**26.7**	**31.3**[c]	24:00	24.0	20.5	382.008	382.650	0.642	HT	Winnemucca BLM
08/29/17	P2943782	**Field Blank**					379.427	379.438	0.011	-	-

[a] RED Color Coding (and note a) indicates concentration exceeding the NAAQS numerical value.
[b] YELLOW Color Coding (and note b) indicates missing data.
[c] GREEN Color Coding (and note c) indicates concentrations below the NAAQS numerical value.

Table 2-3. Onsite Filter Based Particulate Monitoring Data (Monitor 2) - (24-Hr Average Concentrations per NAAQS)

PM_{10} Sampler Summary

August 1, 2017 - October 10, 2017

Network: **Trinity Consultants**
Site: BLM-Black Rock City
Sampler ID: BRC2 **AQS ID:**
Sampler Type: BGI FRM Single

Date	Filter ID	Concentration (µg/m3) LTP	Concentration (µg/m3) STP	Sample Period (hr:min)	Sample Volume (m3)	Std Volume (m3)	Mass Tare (mg)	Mass Gross (mg)	Mass Net (mg)	Flag	Comments
08/31/17	P2943784	**25.8**	**30.1**[c]	24:00	24.0	20.6	372.626	373.248	0.622	HT	Winnemucca BLM
09/02/17	P2943785	**1331.5**	**1532.5**[a]	24:00	24.0	20.9	373.313	405.284	31.971	HT	BM Playa
09/06/17	P2943788	**110.7**	**129.9**[c]	24:00	24.0	20.5	372.567	375.230	2.663	HT	Winnemucca BLM
08/29/17	P2943790	**Field Blank**					372.077	372.071	-0.006	-	-

[a] RED Color Coding (and note a) indicates concentration exceeding the NAAQS numerical value.
[b] YELLOW Color Coding (and note b) indicates missing data.
[c] GREEN Color Coding (and note c) indicates concentrations below the NAAQS numerical value.

The results reported from the continuous playa monitors were confirmed by the laboratory analysis (filter mass analysis) of the filters collected from the PQ-200 monitors deployed at both the playa and the Winnemucca District Office (**Tables 2-2 and 2-3** above for monitors 1 and 2). Monitoring at the Winnemucca District office during and after the event (8/30-8/31 and 9/6-9/7) did not indicate any exceedance of the PM_{10} NAAQS, however elevated levels were noted on September 6th due to regional wild fire smoke. The monitoring completed on the playa however did indicate extreme exceedance of the PM_{10} NAAQS with monitored 24-hr concentrations between 1300 and 2200 $\mu g/m^3$or approximately 8.6 to 14.6 times above the NAAQS threshold. These monitoring results speak to the extreme levels of atmospheric particulate being generated and dispersed at the event site.

The ambient monitoring for both the Winnemucca and Playa location describe the total ambient particulate from all sources that are emitted to the atmosphere and are dispersed to the monitor locations. This included, Burning Man Event Sources, regional dispersed sources including motor vehicles and residential activities, permitted stationary sources and regional wildland fire impacts. During the event monitoring, a large regional wildfire, southwest of the event site was ignited on August 29th by lightning strike near Nixon, NV. The Tohakum 2 Fire burned until approximately September 15th and burned more than 94,221 acres. The influence of wild fire smoke was evidenced by elevated PM_{10} concentrations in the Winnemucca monitoring data and may have had an impact on playa particulate concentrations. The mass of crustal playa material on the recovered monitoring filters (photos of filters included in Appendix B) do however suggest that the main contributor to playa concentrations were on-playa anthropogenic activities. Site photos were documented to clarify emissions generating processes and have been included in Appendix B. The majority of emissions generation resulted from vehicular and human traffic on the playa which liberated material for wind erosion.

In addition to particulate concentrations, the chemical constituents of the monitor filters were analyzed for two of the filters collected on the Black Rock Playa. The filters were analyzed utilizing two testing methods. The first was a traditional destructive wet test for metals composition. The filter sample was analyzed for the amount of the following metals present in the total filter sample mass. The metals tested included: Arsenic, Aluminum, Beryllium, Cadmium, Chromium, Cobalt, Lead, Manganese, Nickel. Metals testing was completed by Intermountain Laboratory in Sheridan Wyoming. The sample tested was Filter P2943785 which was collected at the Playa monitoring site on 9/2/17. The average 24-hr sample concentration was 1331.5 micrograms/cubic meter and the filter content weight was 31.971 mg. Testing was completed utilizing the following reference methods and procedures:

> Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition; 40 CFR Parts 136 and 141; 40 CFR Part 50, Appendices B, J, L, and O; Methods indicated in the Methods Update Rule published in the Federal Register Friday, May 18, 2012; ASTM approved and recognized standards

Per the laboratory test results, "All quality control parameters met the acceptance criteria defined by EPA and Inter-Mountain Laboratories…". The two primary constituents found in the sample were Aluminum and Manganese. Both are species that are consistent with the makeup of Playa soils. The testing was below the detection limit for Beryllium, Cadmium, Chromium and Nickle. Other than Aluminum all other metals remained less than 1% of the filter content by weight. Table 2-4 details the results of the metals testing.

Table 2-4. Playa Filter Speciation (Metals – Intermountain Labs Test)

Analyses	Result (ng/filter)	Reporting Limit	Percent Filter Content
Aluminum	560000	10000	1.75%
Arsenic	450	50	0.00%
Beryllium	ND	150	
Cadmium	ND	1000	
Chromium	ND	1500	
Cobalt	328	125	0.00%
Lead	440	50	0.00%
Manganese	18500	600	0.06%
Nickel	ND	1300	

The full test report from Intermountain Labs is provided in Appendix C of this Baseline Document.

Concurrent to the traditional wet testing by Intermountain Labs, testing was completed on a separate Playa filter utilizing X-ray fluorescence (XRF) to assess both metal and oxide constituents. XRF is a non-destructive analytical technique used to determine the elemental composition of materials. XRF analyzers determine the chemistry of a sample by measuring the fluorescent (or secondary) X-ray emitted from a sample when it is excited by a primary X-ray source. XRF testing was completed by Chester Labs in Tigard, OR. Testing was completed for Filter P2943786 collected on 9/3/17 at the Playa monitoring site. The average 24-hr sample concentration was 1886 micrograms/cubic meter (as tested) and the filter content weight was 45.263 mg. The test report included comments that the filter included heavy deposits with some flaking that could lead to the potential for under prediction of concentrations. Additionally, because of the heavy loading, the layer may not be considered a thin film, so uncertainties were elevated particularly for lower weight elements. All quality assurance and control review metrics were met or exceeded. The XRF tests indicated that Silicon, Iron, Calcium, Potassium and Aluminum were the most common constituents. All of these constituents (with the exception of Aluminum) exceeded 1% of the sample weight with Silicon approaching 3.25% of the sample weight. This finding is consistent with the material on the filter being primarily made up of native Playa soils. Table 2-5 details the findings of the XRF testing. No explicit regulatory threshold exist for the acceptable percentage of oxides or metals in ambient samples. However, the EPA has defined some metals and oxides as Hazardous Air Pollutants (HAPS) and provides additional regulations on their emissions from permitted sources. A list of all HAPS is available from EPA's website (https://www.epa.gov/haps).

1 **Table 2-5. Playa Filter Speciation (XRF – Chester Labs Test)**

Analyses	ug/m3	ng/m3	% Filter Content
Si	60.83	60830	3.23%
Fe	50.24	50240	2.66%
Ca	45.80	45800	2.43%
K	20.24	20240	1.07%
Al	18.16	18160	0.96%
Mg	5.22	5217	0.28%
Ti	3.66	3660	0.19%
Na	2.41	2409	0.13%
Cl	1.24	1235	0.07%
Mn	0.90	904	0.05%
Sr	0.70	697	0.04%
Ba	0.69	688	0.04%
Zr	0.25	247	0.01%
Zn	0.19	191	0.01%
Rb	0.18	185	0.01%
V	0.14	142	0.01%
S	0.11	110	0.01%
Cu	0.06	59	0.00%
Cr	0.06	58	0.00%
As	0.05	46	0.00%
Y	0.04	44	0.00%
Ni	0.03	34	0.00%
Ga	0.02	25	0.00%
Br	0.02	19	0.00%
Mo	0.00	2	0.00%
Pd	0.00	1	0.00%
Cd	0.00	0	0.00%
P	0.00	0	0.00%
Co	0.00	0	0.00%
Ge	0.00	0	0.00%
Se	0.00	0	0.00%
Ag	0.00	0	0.00%
In	0.00	0	0.00%
Sn	0.00	0	0.00%
Sb	0.00	0	0.00%
La	0.00	0	0.00%
Hg	0.00	0	0.00%
Pb	0.00	0	0.00%

2

3. REGIONAL AMBIENT AIR QUALITY

Potential emissions from the event include criteria air pollutants. The criteria air pollutants which are regulated under Nevada law are carbon monoxide (CO), lead (Pb), sulfur dioxide (SO_2), particulate matter less than or equal in diameter to 10 microns (PM_{10}), particulate matter less than or equal in diameter to 2.5 microns ($PM_{2.5}$), ozone (O3), and nitrogen dioxide (NO_2). The Environmental Protection Agency has established NAAQs for these pollutants; the NAAQS are allowable concentration limits applied at the public access boundary. Nevada has adopted some of these standards for use in the Rules for the Control of Air Pollution in Nevada. The NAAQs which have been adopted by Nevada are shown in **Table 3-1.**

Table 3-1. National Ambient Air Quality Standards (NAAQS)

Pollutant	Averaging Time	Concentration
Carbon Monoxide (CO)	8-hr	10,000 µg/m^3 (9 ppm)
	1-hr	40,000 µg/m^3 (35 ppm)
Lead	Rolling 3-Month Average	0.15 µg/m^3
Nitrogen Dioxide (NO_x)	Annual	53 ppb
	1-hr	100 ppb
Ozone	8-hr	0.075 ppm
Sulfur Dioxide (SO_2)	Annual	0.03 ppm
	24-hr	0.14 ppm
	3-hr	0.5 ppm
	1-hr	75 ppb
PM_{10}	24-hr	150 µg/m^3
$PM_{2.5}$	Annual	12 µg/m^3
	24-hr	35 µg/m^3

3.1. BAPC AIR QUALITY MONITORING DATA SUMMARY

The Bureau of Air Pollution Control (BAPC) does not currently conduct any ambient air quality monitoring within the air basin in which the event is located. The region is however designated as in attainment/unclassifiable for all NAAQS and NvAAQS.

Additionally, there was a special PM_{10} monitoring project conducted by BAPC in Lovelock during the 1990's. The purpose was to determine the potential impacts from agriculture burning, which typically occurs to the south of the monitoring site located at the Post Office. Ambient monitoring was conducted from 1992 through 1997. Data is summarized below in Table 3-2. The highest values were collected on days with generally low average wind speeds, which is indicative of stable atmospheric conditions.

Table 3-2. Annual Average PM_{10} Monitoring Data from Lovelock, Nevada Post Office 1992-1997 (Enviroscientists, 2010)

Year	Annual PM_{10} Concentration ($\mu g/m^3$)			
	# of Samples	First High	Second High	Mean
1992	53	44	44	22
1993	51	67	59	31
1994	43	56	53	25
1995	27	55	55	24
1996	56	69	62	26
1997	27	47	42	24
Average	46	58.2	54.6	25.6

3.2. CLASS I AREAS

Class I areas typically include wilderness areas and National Parks. Within 300 km of the event, the Federal Mandatory Class I areas include:

- Jarbidge Wilderness
- South Warner Wildness
- Thousand Lakes Wilderness
- Caribou Wilderness
- Lassen Volcanic National Park
- Desolation Wilderness
- Lavabeds
- Gearhart Mountain
- Mokelumne Wilderness
- Yosemite National Park
- Emigrant Wilderness
- Hoover Wilderness
- Ansel Adams Wilderness

Publically available data and reports for data for each Class I area listed above were reviewed as part of this baseline study. Pertinent monitoring data was available for Lassen Volcanic National Park and Yosemite National Park. The remainder of the Class I areas did not collect air quality or meteorological baseline data. The data available for both Parks is included below.

Yosemite National Park

Yosemite National Park is located in Mariposa County, California, approximately 170 miles southwest of the event site. The National Park Service monitors 8-hr ozone and hourly PM2.5 levels on a continual basis however only ozone data was available for the Yosemite site. The maximum 1-hr concentration of ozone between May, 2009 - April, 2013 was 98 ppb, with the average being 47.1 ppb. These finding are from CASTNET and represented the most recent data available. The Clean Air Status and Trends Network (CASTNET) is a regional long-term environmental monitoring program administered and operated by EPA's Clean Air Markets Division (CAMD) and functions as the primary monitoring network for measuring concentrations of air pollutants involved in acidic deposition affecting regional ecosystems and rural ambient ozone levels.

Lassen Volcanic National Park

Lassen Volcanic National Park is located in Shasta County, California, approximately 130 miles west of the event site. The National Park Service monitors 8-hr ozone and hourly PM2.5 levels on a continual basis however only ozone data was available for the Lassen site. As with Yosemite, data was reviewed via CASTNET and the maximum 1-hr concentration of ozone between April, 2009 - March, 2014 was 89 ppb, with the average being 40.4 ppb. This represented the most recent data available.

The majority of the Class 1 Areas identified will be unlikely to be impacted by the proposed project as they lie upwind (West) of the proposed event. The Jarbidge Wilderness area is the only Class I area that lies downwind of the event site within the study area.

The Jarbidge Wilderness is located in Elko County, Nevada, approximately 180 miles northeast of the event location. At these distances, atmospheric particulate or other pollutants are unlikely to produce meaningful impacts on the Class I area.

4. AIR EMISSIONS

4.1. STATIONARY SOURCES

State air quality permits for sources that reside within approximately 50 km of the event location were reviewed for emissions data. The region surrounding the event location is dominated by publicly controlled or managed land used for recreation and grazing. Limited private property with agricultural or ranching activities also exists. There are a very limited number of industrial facilities within 50km of the event site. Two facilities have been identified for inclusion in the regional baseline. Each is listed below with a full description of the facility. Both are considered minor sources and are expected to have minimal impact on the event area.

Hycroft Mining Company – The Hycroft Mine is located 25 miles east of the event site in the historic Sulfur Mining District. The Hycroft Mine currently has limited operations following a Chapter 11 reorganization in 2015. The facility is still being operated as a heap leach gold and silver mine while undergoing feasibility testing for milling operations. The mine is approximately 54 miles west of Winnemucca and straddles Humboldt and Pershing Counties. The mine encompasses approximately 72,000 acres, including both patented and unpatented claims. Emissions associated with surface mining are limited to the mine site and surrounds and are unlikely to influence baseline conditions at the event site. Baseline ambient data was once collected at the Hycroft Mine site, however, a limited chronological record of the data did not allow for its inclusion in this baseline assessment.

Empire Mine and Production Facility – The historic US Gypsum Empire Mine and production facility is located in Empire, Nevada approximately 20 miles southwest of the event site. The mine and production facility was closed in 2011. In 2016, the plant and mine were purchased by Empire Mining Company. No production is proposed at the plant site, but mining activities and commercial sale of Gypsum and Anhydrite Products is proposed. Emissions associated with surface mining are limited to the mine site and surrounds and are unlikely to influence baseline conditions at the event site.

4.2. NATIONAL EMISSIONS INVENTORTY

EPA's National Emission Inventory (NEI) database contains information about sources that emit criteria air pollutants and their precursors, and hazardous air pollutants. The database includes estimates of annual air pollutant emissions from point, nonpoint, and mobile sources in the 50 States, the District of Columbia, Puerto Rico, and the Virgin Islands. EPA collects information about sources and releases an updated version of the NEI database every three years; the latest update is the 2014 NEI. Data from the 2014 NEI was downloaded from the EPA website (https://www.epa.gov/air-emissions-inventories/2014-national-emissions-inventory-nei-data) for Pershing County, Nevada.

Annual criteria pollutant emissions reported in the 2014 NEI for all of Pershing County, NV for mobile sources, fuel combustion and industrial processes combined are 1,949.69 tpy NO_x, 3,150.36 tpy CO, 885.05 tpy PM_{10}, 189.95 tpy $PM_{2.5}$, 45.92 tpy SO_2, and 458.02 tpy VOC. Please note that PM_{10} includes both filterable and condensable.

5. CLIMATOLOGY AND METEOROLOGY

Extensive surface and upper air data surrounding the proposed project area were analyzed to develop an assessment of regional climatology and meteorological conditions and links to the data reviewed are included in Appendix A. The resulting assessment is presented in the following subsections.

5.1. CLIMATOLOGY

Nevada is predominately an elevated plateau with basin and range geologic characteristics. The eastern part has an average elevation of between 5,000 and 6,000 feet. The western part is between 3,800 and 5,000 feet, the lower limit being in the vicinity of Pyramid Lake and Carson Sink. The southern part is generally between 2,000 and 3,000 feet. From the lower elevations of the western portion there is a fairly rapid rise westward toward the summits of the Sierra Nevada. The southwestern part slopes down toward Death Valley, California; the southern portion slopes toward the channel of the Colorado River, which is less than 1,000 feet above sea level. The northeastern part slopes toward the north, draining into the Snake River and thence into the Columbia River Basin.

The Nevada plateau has several mountain ranges, most of them 50 to 100 miles long, running generally north-south. The only east-west range is in the northeast where it forms the southern limit of the Columbia River Basin. Except for this small drainage area and another limited region in the southeast which drains into the Colorado River, the State lies within the Great Basin, and the waters of its streams disappear into sinks or flow into lakes with no outlets. Nevada has great climatic diversity, ranging from scorching lowland desert in the south to cool mountain forests in the north. Its varied and rugged topography, mountain ranges, and narrow valleys range in elevation from about 1,500 to more than 10,000 feet above sea level. Wide local variations of temperature and rainfall are common. The principal climatic features are bright sunshine, small annual precipitation, (averaging nine inches in the valleys and deserts) heavy snowfall in the higher mountains, clean, dry air, and exceptionally large daily ranges of temperature.

The Burning Man event site is located within Pershing County, Nevada. The county receives only 7 inches of rain annually, 8 inches of snow and approximately 38 days with measurable precipitation. Generally mountainous terrain with a major north-south axis surrounds the flat Playa that makes up the Black Rock Desert and event site. The region is comprised of a mix of high alpine forest and sagebrush vegetation at higher elevations and barren Playa's at low elevations.

Nevada lies on the eastern, lee side of the Sierra Nevada Range, a massive mountain barrier that markedly influences the climate of the State. One of the greatest contrasts in precipitation found within a short distance in the United States occurs between the western slopes of the Sierras in California and the valleys just to the east of this range. The prevailing winds are from the west, and as the warm moist air from the Pacific Ocean ascends the western slopes of the Sierra Range, the air cools, condensation takes place and most of the moisture falls as precipitation. As the air descends the eastern slope, it is warmed by compression, and very little precipitation occurs. The effects of this mountain barrier are felt not only in the west but throughout the State, with the result that the lowlands of Nevada are largely desert or steppes.

Long-term climatological data was obtained from the National Oceanic and Atmospheric Administration (NOAA) for the division of northwestern Nevada. While regionally representative, the climatology data can be assumed to differ slightly from that at the mine site. This is due to the NOAA data being an average of several weather stations that encompass six counties, one of which is Pershing. **Table 5-1** below depicts the average climatological variables for the regional calculated over a period of 31 years from 1980 to 2017.

Table 5-1. Average Northwestern Nevada Climate Data from 1980 to 2017

Data Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	41.5	46.4	53.5	60.0	69.0	79.4	89.0	87.4	78.3	65.1	50.3	41.0	63.4
Average Min. Temperature (F)	21.4	24.8	29.2	33.2	41.0	48.4	56.0	53.9	46.1	36.1	26.9	20.6	36.5
Average Total Precipitation (in.)	1.24	1.06	1.11	0.97	1.13	0.68	0.29	0.25	0.46	0.79	1.12	1.34	0.87

Source: NOAA Divisional Northwestern Nevada data. http://www7.ncdc.noaa.gov/CDO/CDODivisionalSelect.jsp#

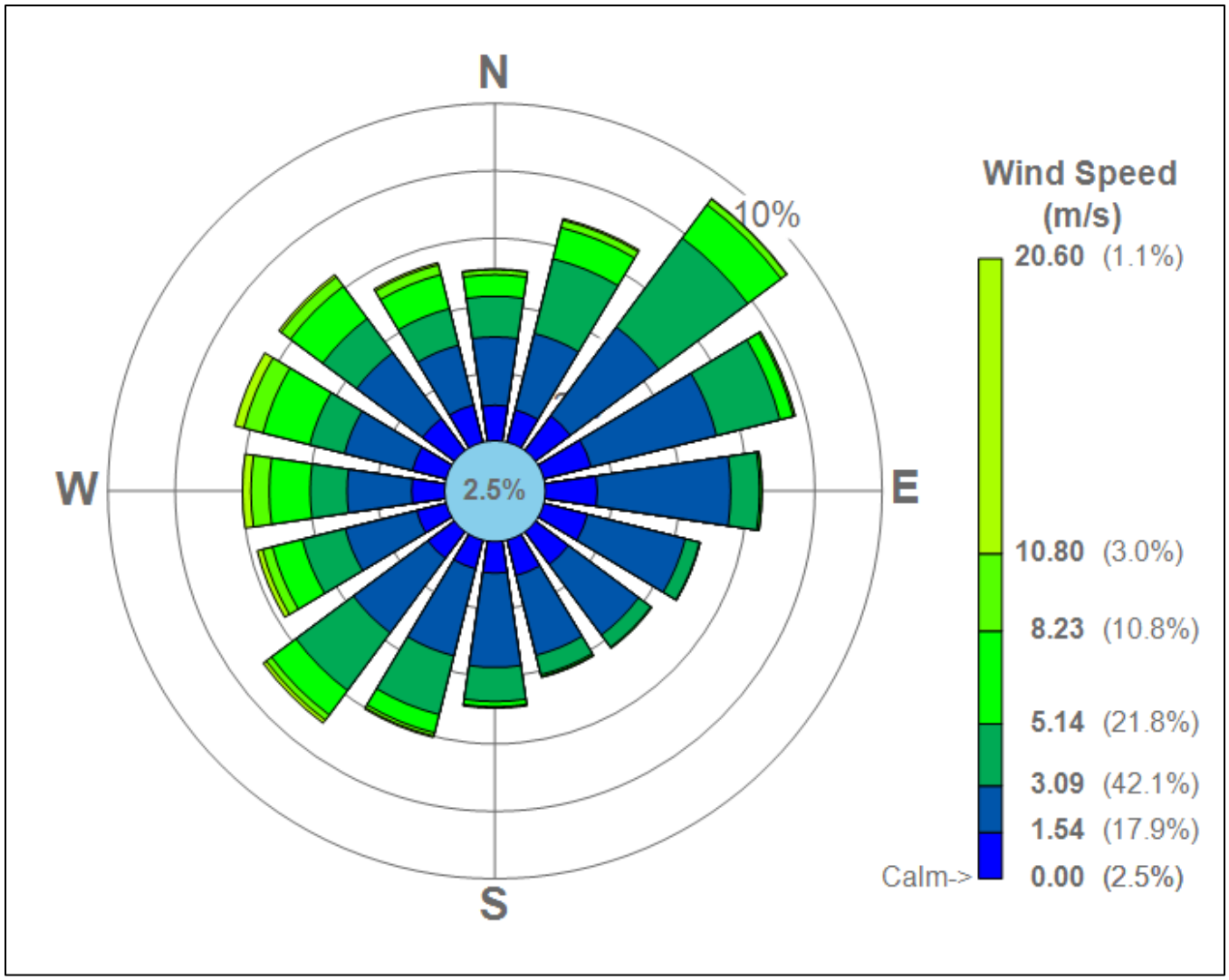
5.2. METEOROLOGICAL CHARACTERIZATION

In order to assess the regional meteorological conditions for Pershing County and the event site, National Weather Service Automated Data (ASOS) data from the nearest NWS airport location was identified and reviewed. The data site selected was KLOL, the Lovelock Airport. Data was reviewed for the time period of 2012-2016.

5.2.1. Wind Speed and Direction

Hourly average wind speed and direction data for the Lovelock station were reviewed for 2012-2016. Annualized plots were developed to analyze patterns in the wind speed and direction from the data. The aggregated annual data is graphically presented in a single wind rose format below for review. As witnessed by the data, wind directions had a strong tendency toward northeast/southwest directionality. Speeds varied somewhat but tended to be strongest from the southwest and northeast. These findings are consistent with the terrain channeling effects that occur in regions, such as the event site, with topography that run in a generally northeast-southwest direction. **Figures 5-1** on the following page depicts the annualized wind rose plots for the Derby Field Lovelock Airport.

Figure 5-1. Derby Field Wind Rose 2012-2016



5.2.2. Temperatures

Temperature data was obtained from Derby Field weather station in Lovelock, nearest NWS ASOS station in Pershing County. Maximum annual high temperatures occurred each year during July or August while the minimum annual low temperature occurred at various dates through the December to February timeframe. Maximum and minimum annual temperature extremes have been included below in **Table 5-2.**

Table 5-2. Maximum and Minimum Annual Temperatures at Derby Field

Temperature	Derby Field				
	2012	2013	2014	2015	2016
Maximum Temp (˚F)	106	106	108	104	105
Minimum Temp (˚F)	-5.1	-16.1	3.92	-4.0	-9.9

Source: Derby Field data from https://www.ncdc.noaa.gov/cdo-web/datasets#LCD for Station ID: WBAN:24172, Lovelock Derby Field Nevada US.

5.2.3. Total Precipitation and Snowpack

Total precipitation and snowpack were analyzed at the Summit Lake SNOTEL site. The SNOTEL site approximates the snow pack and precipitation characteristics of the high terrain surrounding the event sire. The snowpack depths are measured based on calendar year and represent the maximum snow pack depths that occurred throughout the year listed. The precipitation data are annual totals based on the snow water year which runs from October of the preceding year through September of the following year. Snow water year precipitation data from the onsite weather station is shown as well. The totals for the site have been tabulated in **Table 5-3** below.

Table 5-3. Maximum Snowpack Depth and Total Precipitation at Summit Lake

Inches	Summit Lake					
	2012	2013	2014	2015	2016	2017
Max Snow Depth (inches)	27.0	40.0	28.0	32.0	34.0	48
Total Precipitation (inches)	16.4	21.0	16.3	20.2	22.4	26.8

Source: Summit Lake data from Nevada (PST) SNOTEL Site Summit Lk - NRCS National Water and Climate Center - Provisional Data (https://www.wcc.nrcs.usda.gov/snow/).

APPENDIX A: SUPPORTING DATA ACCESS

DATA UTILIZED

All data utilized in the development of the air quality baseline document is available in the public domain. Hard copies of the data reviewed have not been included due to the quantity of data involved. Electronic copies of supporting data will be made available upon request from interested stakeholders. Additionally, electronic data portals where study related data was collected have been included below.

DATA ACCESS PORTALS

http://mesowest.utah.edu/index.html - Online regional meteorological database

http://www.epa.gov/ttn/airs/airsaqs/ - EPA Monitoring Database

http://www.epa.gov/oar/data/neidb.html - EPA National Emissions Inventory

http://java.epa.gov/castnet/ - EPA CASTNET Monitoring Data

http://www.ncdc.noaa.gov/oa/ncdc.html - National Climatic Data Center

http://www.wcc.nrcs.usda.gov/snow/ - Snotel USDA – National Resources Conservation Service

APPENDIX B: ONSITE PHOTOS OF EMISSIONS GENERATION AND DISPERSION

Photograph 1

Photograph 2

Photograph 3

Photograph 4

Photograph 5

Photograph 6

Photograph 7

Photograph 8

Photograph 9

APPENDIX C: FILTER SPECIATION LABORATORY REPORTS

Inter-Mountain Labs
1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Your Environmental Monitoring Partner

Date: 6/13/2018

CLIENT: Trinity Consultants
Project: Burning Man
Lab Order: S1806162

CASE NARRATIVE

Report ID: S1806162001

Sample P2943785 Sample ID 036 was received on October 9, 2017.

All samples were received and analyzed within the EPA recommended holding times, except those noted below in this case narrative. Samples were analyzed using the methods outlined in the following references:

"Standard Methods For The Examination of Water and Wastewater", approved method versions
Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition
40 CFR Parts 136 and 141
40 CFR Part 50, Appendices B, J, L, and O
Methods indicated in the Methods Update Rule published in the Federal Register Friday, May 18, 2012
ASTM approved and recognized standards

All Quality Control parameters met the acceptance criteria defined by EPA and Inter-Mountain Laboratories except as indicated in this case narrative.

Reviewed by: John M. Jacobs
John Jacobs, Project Manager

Inter-Mountain Labs
1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Your Environmental Monitoring Partner

Sample Analysis Report

CLIENT: Trinity Consultants
4525 Wasatch Blvd.
Suite 200
Salt Lake City, UT 84124

Date Reported: 6/13/2018
Report ID: S1806162001

Work Order: S1806162
Collection Date: 9/2/2017
Date Received: 10/9/2017 8:50:00 AM
Sampler:
Matrix: Filter
COC: 173413

Project: Burning Man
Lab ID: S1806162-001
Client Sample ID: P2943785 Sample ID 036
Comment: BM Playa

Analyses	Result	RL	Qual	Units	Date Analyzed/Init	Method
IO-3.5 Teflon Filters						
Aluminum	560000	10000		ng/filter	06/13/2018 0141 MS	IO-3.5
Arsenic	450	50		ng/filter	06/13/2018 0102 MS	IO-3.5
Beryllium	ND	150		ng/filter	06/13/2018 0102 MS	IO-3.5
Cadmium	ND	1000		ng/filter	06/13/2018 0102 MS	IO-3.5
Chromium	ND	1500		ng/filter	06/13/2018 0102 MS	IO-3.5
Cobalt	328	125		ng/filter	06/13/2018 0102 MS	IO-3.5
Lead	440	50		ng/filter	06/13/2018 0102 MS	IO-3.5
Manganese	18500	600		ng/filter	06/13/2018 0102 MS	IO-3.5
Nickel	ND	1300		ng/filter	06/13/2018 0102 MS	IO-3.5

These results apply only to the samples tested.

Qualifiers:

B	Analyte detected in the associated Method Blank
E	Value above quantitation range
H	Holding times for preparation or analysis exceeded
L	Analyzed by another laboratory
ND	Not Detected at the Reporting Limit
S	Spike Recovery outside accepted recovery limits
X	Matrix Effect

RL - Reporting Limit

C	Calculated Value
G	Analyzed at IML Gillette laboratory
J	Analyte detected below quantitation limits
M	Value exceeds Monthly Ave or MCL or is less than LCL
O	Outside the Range of Dilutions
U	Analysis reported under the reporting limit

Reviewed by: John M. Jacobs
John Jacobs, Project Manager

Inter-Mountain Labs

Sheridan, WY and Gillette, WY

- CHAIN OF CUSTODY RECORD -

Page of

All shaded fields must be completed.
This is a legal document: any misrepresentation may be construed as fraud.

173413

Client Name	Project Identification	Sampler (Signature/Attestation of Authenticity)	Telephone #
TRINITY CONSULTANTS	BURNING MAN		

Report Address	Contact Name
702 W. IDAHO ST SUITE 1100 BOISE IDAHO 83702	DAVID STROHM
	Email: dstrohm@TrinityConsultants.com
	Phone: 208-999-2327

Invoice Address	Purchase Order #	Quote #
Same AS above		

ITEM	LAB ID (Lab Use Only)	DATE SAMPLED	TIME SAMPLED	SAMPLE IDENTIFICATION	Matrix	# of Containers	ANALYSES / PARAMETERS: PM10 Concentration	ANALYSES / PARAMETERS: metals	REMARKS
1	P2H3783	8/30	24Hr	Sample ID 033	FT		X		WINNEMUCCA BLM
2	P2H3784	8/31	24HR	Sample ID 034			X		WINNEMUCCA BLM
3	P2H3785	9/2	24HR	Sample ID 036			X	X	BM Playa
4	P2H3786	9/3	24 HR	Sample ID 037			X		BM Playa
5	P2H3787	9/4	24HR	Sample ID 038			X		BM Playa
6	P2H3788	9/6	24 hr	Sample ID 039			X		Winnemucca BLM
7	P2H3789	9/7	24 hr	Sample ID 040			X		Winnemucca BLM
8									
9									
10									
11									
12									
13									
14									

LAB COMMENTS	Relinquished By (Signature/Printed)	DATE	TIME	Received By (Signature/Printed)	DATE	TIME
	Adam Lenkowski	[illegible]	ASL	Monique Moore IML	10/09/17	08:50 MST
		10/5/17	1700			
	Mary Hannigan IML	6/11/18	0922	Kathy Bapp	6.11.18	9:23

SHIPPING INFO	MATRIX CODES		TURNAROUND TIMES	COMPLIANCE INFORMATION		ADDITIONAL REMARKS
X UPS	Water	WT	Check desired service	Compliance Monitoring?	Y / N	3.6 ≈ 2.6ᶜ ≈ 3ᵉ
☐ Fed Express	Soil	SL	X Standard turnaround	Program (SDWA, NPDES,...)		
☐ US Mail	Solid	SD	☐ RUSH - 5 Working Days	PWSID / Permit #		
☐ Hand Carried	Filter	FT	☐ URGENT - < 2 Working Days	Chlorinated?	Y / N	
☐ Other _____	Other	OT	*Rush & Urgent Surcharges will be applied*	Sample Disposal: Lab	Client	3 soft ice packs 2056

Rush for Client

INTER-MOUNTAIN LABS

Survey Meter # Model 2241-2; SN 182115
pH strip lot # HC7302G9
Thermometer SN# 27130475

Condition Upon Receipt (Attach to COC)

Sample Receipt

1 Number of ice chests/packages received: OTC ROI? Yes (No)

Note as "OTC" if samples are received over the counter, unpackaged

2 Temperature of cooler/samples. *(If more than 8 coolers, please write on back)*

Temps Observed (°C):								
Temps Corrected (°C):								

***Acceptable is: 0.1° to 10°C** for Bacteria; and 0.1° to 6°C for most other water parameters. Samples may not have had adequate time to cool following collection. Indicate ROI (Received on Ice) for iced samples received on the same day as sampled, in addition to temperature at receipt.*

Client contact for temperatures outside method criteria must be documented below.

3 Emission rate of samples for radiochemical analyses < 0.5mR/hr?	Yes	No	(N/A)
4 COC Number (If applicable): 17343			
5 Do the number of bottles agree with the COC?	(Yes)	No	N/A
6 Were the samples received intact? *(no broken bottles, leaks, etc.)*	(Yes)	No	N/A
7 Were the sample custody seals intact?	(Yes)	No	N/A
8 Is the COC properly completed, legible, and signed?	(Yes)	No	

Sample Verification, Labeling & Distribution

1 Were all requested analyses understood and appropriate?	Yes	(No)	
2 Did the bottle labels correspond with the COC information?	(Yes)	No	
3 Samples collected in method-prescribed containers?	Yes	(No)	

4 Sample Preservation:

pH at Receipt:	Final pH (if added in lab):	Preservative/Lot#	Date/Time Added:
_____ Total Metals	_____ Total Metals	HNO_3 _____	_____
_____ Diss Metals	_____ Diss Metals	*Filtered and preserved in metals*	*Filtered and preserved in metals*
_____ Nutrient	_____ Nutrient	H_2SO_4 _____	
_____ Cyanide	_____ Cyanide	NaOH _____	
_____ Sulfide	_____ Sulfide	ZnAcet _____	
_____ Phenol	_____ Phenol	H_2SO_4 _____	
_____ SDWA Rads	_____ SDWA Rads	HNO_3 _____	_____

Preserved samples for Rad analysis accompanied by Field Blank?	Yes	No	
5 VOA vials have <6mm headspace?	Yes	No	(N/A)
6 Were all analyses within holding time at the time of receipt?	(Yes)	No	
7 Specially requested detection limits (RLs) assigned?	Yes	No	(N/A)
8 Have rush or project due dates been checked and accepted?	Yes	No	(N/A)
9 Do samples require subcontracted analyses?	Yes	(No)	

If "Yes", which type of subcontracting is required? General Customer-Specified Certified

Sample Receipt, Verification, Login, Labeling & Distribution completed by *(initials)*: KB

Set ID: S1806162

Discrepancy Documentation *(use back of sheet for notes on discrepancies)*

Any items listed above with a response of "No" or do not meet specifications must be resolved.

Person Contacted: _____ Method of Contact: __ Phone: _____

Initiated By: _____ Date/Time: _____ __ Email: _____

Problem:

Resolution:

IML Air Science

Project: Trinity Consultants

Client # I003
Report # 18-237

Submitted By:
CHESTER LabNet
12242 S.W. Garden Place
Tigard, OR 97223
(503)624-2183/Fax (503)624-2653
www.ChesterLab.Net

CHESTER LabNet

12242 SW Garden Place ❖ Tigard, OR 97223-8246 ❖ USA
Telephone 503-624-2183 ❖ Fax 503-624-2653 ❖ www.chesterlab.net

Case Narrative

Date: June 12, 2018

General Information

Client:	IML Air Science
Client Number:	I003
Report Number:	18-237
Sample Description:	47mm Teflon filter
Sample Numbers:	18-X669

Analysis

Analytes:	XRF Metals (Na – Pb)
Analytical Protocols:	X-Ray Fluorescence by EPA IO 3.3
Analytical Notes:	The sample was heavily loaded and some of the deposit was flaking off of the filter. The XRF results may be biased low because of the lost deposit. The deposit was so thick that the sample cannot be considered thin film. As a result, the uncertainties are elevated, especially for the lower weight elements. Results have **not** been blank corrected.
QA/QC Review:	All of the data have been reviewed by the analysts performing the analyses and the project manager. All of the quality control and sample-specific information in this package is complete and meets or exceeds the minimum requirements for acceptability.
Comments:	If you have any questions or concerns regarding this analysis, please feel free to contact the project manager.
Disclaimer:	This report shall not be reproduced, except in full, without the written approval of the laboratory. The results only represent that of the samples as received into the laboratory.

Paul Duda 6/12/18

Project Manager Date
Paul Duda

Client: I003 - Inter-Mountain Labs
Report Number: 18-237

Lab ID: 18-X669
Client ID: 037
Filter ID: P2943786
Site: BM Playa
Sample Date: 9/ 3/17
Volume: 24.00 ± 1.200 m³
Deposit Area: 11.3 cm²
Size Fraction: PM10
Mass: 45263. ± 15. µg
Suspended Particulates: 1886. ± 94.30 µg/m³
Comments: Heavy deposit. Flaking off of filter

Analyte	µg/filter	percent	µg/m³
XRF			
* Na	57.81 ±217.4	0.1277 ± 0.4803	2.409 ± 9.060
* Mg	125.2 ±180.1	0.2766 ± 0.3979	5.217 ± 7.510
* Al	435.7 ±318.5	0.9627 ± 0.7038	18.16 ± 13.30
* Si	1460. ±674.7	3.226 ± 1.491	60.83 ± 28.28
* P	0.0000 ± 0.8554	0.0000 ± 0.0019	0.0000 ± 0.0356
* S	2.632 ± 0.8837	0.0058 ± 0.0020	0.1097 ± 0.0372
Cl	29.64 ± 3.853	0.0655 ± 0.0085	1.2350 ± 0.1720
K	485.8 ± 43.03	1.073 ± 0.0951	20.2411 ± 2.0588
Ca	1099. ± 89.55	2.428 ± 0.1979	45.7980 ± 4.3780
Ti	87.85 ± 5.204	0.1941 ± 0.0115	3.6603 ± 0.2837
V	3.397 ± 0.1887	0.0075 ± 0.0004	0.1415 ± 0.0106
Cr	1.382 ± 0.0881	0.0031 ± 0.0002	0.0576 ± 0.0047
Mn	21.68 ± 1.087	0.0479 ± 0.0024	0.9035 ± 0.0640
Fe	1206. ± 60.27	2.664 ± 0.1332	50.2379 ± 3.5520
* Co	0.0000 ± 1.513	0.0000 ± 0.0033	0.0000 ± 0.0630
Ni	0.8147 ± 0.0429	0.0018 ± 0.0001	0.0339 ± 0.0025
Cu	1.403 ± 0.0712	0.0031 ± 0.0002	0.0585 ± 0.0042
Zn	4.584 ± 0.2294	0.0101 ± 0.0005	0.1910 ± 0.0135
Ga	0.5978 ± 0.0316	0.0013 ± 0.0001	0.0249 ± 0.0018
* Ge	0.0000 ± 0.0113	0.0000 ± 0.0000	0.0000 ± 0.0005
As	1.095 ± 0.0565	0.0024 ± 0.0001	0.0456 ± 0.0033
* Se	0.0000 ± 0.0068	0.0000 ± 0.0000	0.0000 ± 0.0003
Br	0.4633 ± 0.0249	0.0010 ± 0.0001	0.0193 ± 0.0014
Rb	4.439 ± 0.2226	0.0098 ± 0.0005	0.1849 ± 0.0131
Sr	16.72 ± 0.8362	0.0369 ± 0.0018	0.6968 ± 0.0493
Y	1.058 ± 0.0565	0.0023 ± 0.0001	0.0441 ± 0.0032
Zr	5.936 ± 0.2983	0.0131 ± 0.0007	0.2473 ± 0.0175
* Mo	0.0396 ± 0.0350	0.0001 ± 0.0001	0.0016 ± 0.0015
* Pd	0.0226 ± 0.0316	0.0000 ± 0.0001	0.0009 ± 0.0013
* Ag	0.0000 ± 0.0441	0.0000 ± 0.0001	0.0000 ± 0.0018
* Cd	0.0102 ± 0.0463	0.0000 ± 0.0001	0.0004 ± 0.0019
* In	0.0000 ± 0.0497	0.0000 ± 0.0001	0.0000 ± 0.0021
* Sn	0.0000 ± 0.0802	0.0000 ± 0.0002	0.0000 ± 0.0033
* Sb	0.0000 ± 0.1141	0.0000 ± 0.0003	0.0000 ± 0.0048
Ba	16.51 ± 1.306	0.0365 ± 0.0029	0.6879 ± 0.0644
* La	0.0000 ± 0.3040	0.0000 ± 0.0007	0.0000 ± 0.0127
* Hg	0.0000 ± 0.0294	0.0000 ± 0.0001	0.0000 ± 0.0012
* Pb	0.0000 ± 0.0396	0.0000 ± 0.0001	0.0000 ± 0.0016

* - XRF Concentration is less than three times the uncertainty

Client: Inter-Mountain Labs
Report: 18-237
Analysis Period: June 12, 2018
Number of Samples: 1

1. Precision Data

Micromatter Multi-elemental Quality Control Standard: QS285

QC Standard Results

Analyte	n	micrograms per square centimeter			c.v.	%E
		Calib.	Meas.	S.D.		
Si	1	7.70	7.38	na	na	-4.16
Ti	1	10.61	10.46	na	na	-1.43
Fe	1	11.05	10.85	na	na	-1.79
Se	1	5.17	5.08	na	na	-1.74
Cd	1	6.59	6.71	na	na	1.76
Pb	1	12.58	12.51	na	na	-0.57

2. Accuracy Data

NIST Standard Reference Materials: SRM 2783

Analyte/ SRM	n	Certified Value(µg/cm²)	Measured Value (µg/cm²)			% Rec.
			High	Low	Average	
K 2783	4	0.5301	0.4722	0.4604	0.4656 +/- 0.0044	87.8
Ca 2783	4	1.3253	1.0998	1.0747	1.0893 +/- 0.0095	82.2
Ti 2783	4	0.1496	0.1382	0.1318	0.1356 +/- 0.0025	90.6
Fe 2783	4	2.6606	2.5085	2.4565	2.4788 +/- 0.0199	93.2
Cu 2783	4	0.0406	0.0378	0.0344	0.0363 +/- 0.0012	89.3
Zn 2783	4	0.1797	0.1690	0.1661	0.1670 +/- 0.0012	92.9
Pb 2783	4	0.0318	0.0345	0.0314	0.0330 +/- 0.0015	103.6

3. Addendum

Micromatter Certified Reference Materials

CRM	Analytes	Certified Value(µg/cm²)	Measured Value(µg/cm²)	% Rec.
39149	Cr	53.7	52.6	98.0
39150	Cu	49.4	50.5	102.2
39151	Zn, Te	49.9	50.9	101.9
39152	Ga, As	50.9	50.5	99.3
39153	Se, Cd	47.1	48.2	102.3
39154	Pb	47.9	48.4	101.0

NIST: National Institute of Standards and Technology
% Rec: Percent Recovery = (Experimental/Given) x 100
n: Number of Observations
S.D.: Standard Deviation
c.v.: Coefficient of Variation = (S.D./Measured) x 100
% E: Percent Error = [(Measured-Calibrated)/Calibrated] x 100

QUANT'X 1020 REPLICATE REPORT

3.45

Original ID: 18X669

Replicate ID: RX669

Element	Original ug/cm2		Replicate ug/cm2		Difference ug/cm2		RPD	
Na	5.1162 +- 19.2379		5.6263 +- 22.1039		-0.5101 +- 29.3032			
Mg	11.0767 +- 15.9397		11.5065 +- 17.5183		-0.4298 +- 23.6846			
Al	38.5601 +- 28.1914		39.2300 +- 30.2474		-0.6699 +- 41.3480	+	-1.7	+- 106.3
Si	129.1950 +- 59.7075		132.4150 +- 64.1571		-3.2200 +- 87.6420	+	-2.5	+- 67.0
P	0.0000 +- 0.0757		0.0000 +- 0.0798		0.0000 +- 0.1100			
S	0.2329 +- 0.0782		0.1589 +- 0.0628		0.0740 +- 0.1003	+	37.8	+- 51.2
Cl	2.6225 +- 0.3410		2.6415 +- 0.3522		-0.0190 +- 0.4902	+	-0.7	+- 18.6
K	42.9890 +- 3.8084		44.6390 +- 4.0155		-1.6500 +- 5.5343	+	-3.8	+- 12.6
Ca	97.2685 +- 7.9248		100.7385 +- 8.3189		-3.4700 +- 11.4895	+	-3.5	+- 11.6
Ti	7.7742 +- 0.4605		7.9332 +- 0.4734		-0.1590 +- 0.6604	+	-2.0	+- 8.4
V	0.3006 +- 0.0167		0.3276 +- 0.0181		-0.0270 +- 0.0247	0	-8.6	+- 7.9
Cr	0.1223 +- 0.0078		0.1263 +- 0.0081		-0.0040 +- 0.0113	+	-3.2	+- 9.1
Mn	1.9195 +- 0.0962		1.9915 +- 0.0997		-0.0720 +- 0.1385	+	-3.7	+- 7.1
Fe	106.6758 +- 5.3338		110.0958 +- 5.5048		-3.4200 +- 7.6650	+	-3.2	+- 7.1
Co	0.0000 +- 0.1339		0.0000 +- 0.1382		0.0000 +- 0.1925			
Ni	0.0721 +- 0.0038		0.0767 +- 0.0040		-0.0046 +- 0.0055	+	-6.2	+- 7.4
Cu	0.1242 +- 0.0063		0.1387 +- 0.0070		-0.0145 +- 0.0095	0	-11.0	+- 7.2
Zn	0.4057 +- 0.0203		0.4162 +- 0.0208		-0.0105 +- 0.0291	+	-2.6	+- 7.1
Ga	0.0529 +- 0.0028		0.0530 +- 0.0028		-0.0001 +- 0.0039	+	-0.2	+- 7.4
Ge	0.0000 +- 0.0010		0.0000 +- 0.0010		0.0000 +- 0.0014			
As	0.0969 +- 0.0050		0.1035 +- 0.0053		-0.0066 +- 0.0072	+	-6.6	+- 7.2
Se	0.0000 +- 0.0006		0.0000 +- 0.0006		0.0000 +- 0.0009			
Br	0.0410 +- 0.0022		0.0445 +- 0.0024		-0.0035 +- 0.0032	0	-8.2	+- 7.6
Rb	0.3928 +- 0.0197		0.4054 +- 0.0203		-0.0126 +- 0.0282	+	-3.2	+- 7.1
Sr	1.4802 +- 0.0740		1.5282 +- 0.0764		-0.0480 +- 0.1064	+	-3.2	+- 7.1
Y	0.0937 +- 0.0050		0.0959 +- 0.0051		-0.0022 +- 0.0072	+	-2.3	+- 7.6
Zr	0.5253 +- 0.0264		0.5653 +- 0.0284		-0.0400 +- 0.0388	0	-7.3	+- 7.1
Mo	0.0035 +- 0.0031		0.0026 +- 0.0031		0.0009 +- 0.0044			
Pd	0.0020 +- 0.0028		0.0000 +- 0.0040		0.0020 +- 0.0049			
Ag	0.0000 +- 0.0039		0.0000 +- 0.0039		0.0000 +- 0.0056			
Cd	0.0009 +- 0.0041		0.0000 +- 0.0040		0.0009 +- 0.0057			
In	0.0000 +- 0.0044		0.0035 +- 0.0053		-0.0035 +- 0.0069			
Sn	0.0000 +- 0.0071		0.0000 +- 0.0071		0.0000 +- 0.0100			
Sb	0.0000 +- 0.0101		0.0000 +- 0.0101		0.0000 +- 0.0143			
Ba	1.4608 +- 0.1156		1.5478 +- 0.1210		-0.0870 +- 0.1674	+	-5.8	+- 11.1
La	0.0000 +- 0.0269		0.0000 +- 0.0275		0.0000 +- 0.0385			
Hg	0.0000 +- 0.0026		0.0000 +- 0.0027		0.0000 +- 0.0037			
Pb	0.0000 +- 0.0035		0.0000 +- 0.0036		0.0000 +- 0.0050			

RPD: Relative Percent Difference (X1-X2)/[(X1+X2)/2]*100. RPD is calculated when original value is greater than three times its uncertainty.

Inter-Mountain Labs
Sheridan, WY and Gillette, WY

- CHAIN OF CUSTODY RECORD -

Page of

All shaded fields must be completed.
This is a legal document: any misrepresentation may be construed as fraud.

173413

Client Name	Project Identification	Sampler (Signature/Attestation of Authenticity)	Telephone #
TRINITY CONSULTANTS	BURNING MAN		

Report Address	Contact Name	Invoice Address	Purchase Order #	Quote #
702 W. IDAHO ST SUITE 1100 BOISE IDAHO 83702	DAVID STROHM Email dstrohm@trinityconsultants.com Phone 208-999-2327	same as above		

ANALYSES / PARAMETERS

ITEM	LAB ID (Lab Use Only)	DATE SAMPLED	TIME SAMPLED	SAMPLE IDENTIFICATION	Matrix	# of Containers	PM10 Concentration	metals	XRF						REMARKS
1	P24137483	8/30	24 HR	Sample ID 033	FT		X								WINNEMUCCA BLM
2	P24137484	8/31	24 HR	Sample ID 034			X								WINNEMUCCA BLM
3	P24137485	9/2	24 HR	Sample ID 036			X	X							BM Playa
4	P24137486	9/3	24 HR	Sample ID 037 18-X669			X		X						BM Playa
5	P24137487	9/4	24 HR	Sample ID 038			X								BM Playa
6	P24137488	9/6	24 hr	Sample ID 039			X								Winnemucca BLM
7	P24137489	9/7	24 hr	Sample ID 040			X								Winnemucca BLM
8															
9															
10															
11															
12															
13															
14															

Report # 18-237

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LAB COMMENTS	Relinquished By (Signature/Printed)	DATE	TIME	Received By (Signature/Printed)	DATE	TIME
	Adam Lenkowski	10/5/17	ASL			
		10/5/17	1700			
	Mary Hennings IML	6/11/18	0932	Kathi Bay	6.11.18	9:23
	Mary Hennings IML	6/11/18	1600		6/12/18	9:50

SHIPPING INFO	MATRIX CODES		TURNAROUND TIMES	COMPLIANCE INFORMATION	ADDITIONAL REMARKS
☒ UPS	Water	WT	**Check desired service**	Compliance Monitoring? Y / N	
☐ Fed Express	Soil	SL	☒ Standard turnaround	Program (SDWA, NPDES,...)	
☐ US Mail	Solid	SD	☐ **RUSH - 5 Working Days**	PWSID / Permit #	
☐ Hand Carried	Filter	FT	☐ **URGENT** - < 2 Working Days	Chlorinated? Y / N	
☐ Other _____	Other	OT	***Rush & Urgent Surcharges will be applied***	Sample Disposal: Lab / Client	Soft copies 7056

RAW DATA

Available upon request

APPENDIX D: AIR QUALITY MONITORING PROTOCOL

PROJECT REPORT

EMPSi, Inc. > Burning Man Event EIS

AERMOD Modeling Protocol to Assess Ambient Air Quality Impacts

Prepared By:

David E.B. Strohm II – Managing Consultant

TRINITY CONSULTANTS
702 W. Idaho Street
Suite 1100
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208.472.8837

June 2018

Project 171301.0026

Trinity Consultants

Environmental solutions delivered uncommonly well

TABLE OF CONTENTS

ACRONYMS

AMS	American Meteorological Society
AMSL	Above Mean Sea Level
BAPC	Bureau of Air Pollution Control
BRC	Black Rock City, LLC
BLM	Bureau of Land Management
EPA	Environmental Protection Agency
HAPs	Hazardous Air Pollutants
km	kilometers
m	meters
MDBM	Mount Diablo Base and Meridian
NAAQS	National Ambient Air Quality Standards
NBAPC	NDEP, Bureau of Air Pollution Control
NDEP	Nevada Division of Environmental Protection
NED	National Elevation Dataset
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
NRS	Nevada Revised Statutes
NWS	National Weather Service
OLM	Ozone Limiting Method
PAB	Project Area Boundary
PSD	Prevention of Significant Deterioration
SRP	Special Recreation Permit
TPY	Tons per Year
TSD	Technical Support Document
VMT	Vehicle Miles Traveled
WRAP	Western Regional Air Partnership

1. EXECUTIVE SUMMARY

This document, "AERMOD Air Quality Modeling Protocol to Assess Ambient Air Quality Impacts," is being submitted to the U.S. Bureau of Land Management, Winnemucca District Office, Humboldt River Field Office (BLM), on behalf of Black Rock City, LLC (BRC). Pursuant to the National Environmental Policy Act (NEPA), the BLM is the lead agency preparing the NEPA analysis for the proposed revision to BRC's Special Recreation Permit (SRP) for the Burning Man Festival. The purpose of this air quality modeling protocol is to outline proposed modeling procedures that will be used to appropriately and thoroughly assess ambient air quality impacts from the implementation of the proposed components of BRC's revised SRP and its alternatives. After modeling is completed, an air quality modeling Technical Support Document (TSD) will be developed for inclusion in the NEPA analysis.

A. FACILITY DESCRIPTION AND PROJECT OVERVIEW

Burning Man is an annual event held in the western United States at Black Rock City – a temporary city erected on a dry lake bed known as the Black Rock Playa within the Black Rock Desert of northwest Nevada. The event site is located approximately 100 miles (160 km) north-northeast of Reno in the northwest corner of Pershing County.

The event is attended by approximately 70,000 ticketed attendees as well as support and logistical staff. The event includes dispersed art installations, interactive artistic performances and the infrastructure for event attendees.

The event site is located on public lands managed by the Winnemucca District Office of the BLM. The event is permitted through use of a BLM SRP. The event site has an approximate center point of 40.786432°/ -119.206695° (WGS84 Datum) and occurs at a median elevation of 3,900 feet above mean sea level. Primary site access occurs off of County Road 34 located to the west of the Black Rock Playa.

BRC is proposing to modify their SRP to allow for an extended permit term and revisions to total bodies on playa within the event closure area. BRC is proposing to increase the total number of people allowed on the playa to 100,000. Depending on the number of participates and volunteers for recent events, this is an approximately 20% increase in the total bodies on playa. As a result, this Air Quality Modeling Protocol has been designed to assess both current event air quality dispersion and the impact of the proposed SRP revisions and its alternatives.

B. PURPOSE OF AERMOD MODELING AND SUBMITTAL OF MODELING PROTOCOL

Both installation of the Burning Man festival site infrastructure and the onsite activities of the festival participants will increase fugitive air emissions in the area surrounding the Black Rock Desert Therefore, air quality modeling is being performed to identify, to the extent feasible, what impact those emissions would have on ambient air quality. The BLM requested that an air impact analysis be submitted as part of the NEPA process in order to demonstrate that the National Ambient Air Quality Standards (NAAQS) will be protected during the expansion of the SRP.

This document presents the protocol that will be followed for the AERMOD modeling as requested by the BLM and cooperating agencies.

The modeling protocol presented herein will be followed to assess ambient air quality impacts from the proposed project and its alternatives. This protocol has been developed following recommendations of the BLM and cooperating agencies and taking into consideration the precedents set forth in the Nevada Division of Environmental Protection (NDEP) guidance document "General Air Dispersion Modeling Guidelines" (NDEP, Bureau of Air Pollution Control (BAPC) Guidance, September 2008) and the Environmental Protection Agency (EPA) Guideline on Air Quality Models (Guidelines, 40 CFR Part 51, Appendix W, January 2017). Additional references taken into consideration include EPA's Meteorological Monitoring Guidance for Regulatory Modeling Applications (February 2000) and guidance documents available through EPA's Technology Transfer Network (TTN) Support Center for Regulatory Atmospheric Modeling (SCRAM) website at http://www.epa.gov/ttn/scram/.

The objective of this modeling effort is to provide an assessment of pollutant concentrations in ambient air and the resulting potential impacts on the public. These impacts will be assessed at the SRP public closure boundary, which corresponds with the limit of short term public access during the event activities.

C. SITE DESCRIPTION

The event site has an approximate center point of 40.786432°/ -119.206695° (WGS84 Datum) and occurs at a median elevation of 3,900 feet above mean sea level. Primary site access occurs off of County Road 34 located to the west of the Black Rock Playa. The region surrounding the event is currently designated as attainment/unclassifiable for all pollutants in accordance with 40 CFR 81.329. The event is located within a high desert environment, characterized by arid and semiarid conditions, minimal annual precipitation and large temperature ranges. **Figure 1-1** provides a regional view of the event location.

Festival activities and infrastructure are located primarily on a central portion of the Black Rock Playa. Onsite activities include operational vehicle activity for BLM and BRC personnel, foot, bicycle and vehicle traffic of event participants, combustion for artistic and event purposes and enhanced fugitive dust emissions associated with the erosion of playa surface material during wind events. The event site and permit closure area are closed to the general permit (not inclusive of ticket festival attendees or event employees/invitees). During the event infrastructure installation and the event, these areas will not be accessible to the general public and the boundaries will be formally and legally established through the NEPA process. The proposed boundary for model impacts assessment will begin at outside of the pick area identified on **Figure 1-1.**

Figure 1-1
Air Quality Assessment Area, Aerial

Air quality assesment area

Burning Man Event

A. PROJECT AREA AIR QUALITY CLASSIFICATIONS

EPA classifies air quality regions as "nonattainment" for a given pollutant if ambient air concentrations exceed the NAAQS. NAAQS are established separately for each of the "criteria" pollutants and these NAAQS have been promulgated under Title 40 of the Code of Federal Regulations (40 CFR) Part 50 (see http://www.epa.gov/air/criteria.html for more information). Areas that are not nonattainment are either "attainment" if the NAAQS have not been exceeded, or the area is deemed unclassifiable/attainment if sufficient data does not exist to make a determination. Attainment status is based on the results of ambient air quality monitoring, typically performed over a three year period.

According to EPA's green book of non-attainment areas and the NDEP, BAPC (see 40 CFR §81.303 for the promulgated attainment status of all areas in Nevada, or http://www.epa.gov/oaqps001/greenbk/ for maps identifying nonattainment areas throughout Nevada and the United States), Pershing County has been designated as in attainment for all criteria air pollutants that have a National Ambient Air Quality Standard/Ambient Air Quality Standard.

B. FACILITY DESIGNATION AND FEDERAL PERMITTING FRAMEWORK

New point sources located in attainment areas are subject to air quality permitting under Prevention of Significant Deterioration (PSD), as promulgated under 40 CFR Part 52, if the potential to emit of PM_{10}, $PM_{2.5}$, NO_2, SO_2, or CO exceed 250 tons per year (tpy). PSD permitting involves a number of requirements, one of which is an air quality impact analysis involving dispersion modeling. PSD and other air quality permitting components under the Clean Air Act (CAA) do not apply to the BRC festival as it does not fulfill the definition of a Stationary Source under those regulations. However, the PSD program does provide a long-standing, nationally-standardized framework for performing ambient air quality monitoring and dispersion modeling. As a result, the PSD methodologies will generally be applied for BRC project modeling.

Dispersion modeling will be performed, at the request of the BLM, to identify the potential impacts of emissions from the expansion of the BRC SRP on air quality.

C. STATE AIR QUALITY REGULATORY AUTHORITY

The NDEP, Bureau of Air Pollution Control (, BAPC or NBAPC) permits and regulates stationary sources of emissions located within the state, as provided in §445(B) of the Nevada Revised Statutes (NRS).

The BRC event is not required obtain State of Nevada air quality permits as it does not represent a stationary source of emissions.

4. DISPERSION MODELING INPUT DATA AND DEFAULTS

The dispersion modeling proposed for this project will be conducted using the PSD regulatory guideline dispersion model developed by the EPA in conjunction with the American Meteorological Society (AMS). However, as previously stated, the Project is not subject to PSD requirements. The model is called the AMS/EPA Regulatory Model, or AERMOD. Evaluation of the maximum ambient air quality impacts from the proposed BRC SRP expansion will be conducted using the latest version of AERMOD (User's Guide for the AMS/EPA Regulatory Model – AERMOD, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Emissions, Monitoring, and Analysis Division, Research Triangle Park, North Carolina, EPA-454/B-03-001, September 2004), version 16216r. Trinity Consultants, Inc. (Trinity) uses the commercial version of AERMOD from BREEZE (a division of Trinity).

Federal Class I areas, such as national parks, national wilderness areas, and national monuments, are granted special air quality protections under Section 162(a) of the federal Clean Air Act. No Federal Class I areas are located within 100 kilometers (km) of the Project Area. As a result, a Class I "Far-Field" analysis will not be completed.

EPA's *Guideline on Air Quality Models* (herein after referred to as *Guideline*) addresses the regulatory application of air quality models for assessing criteria pollutants under the Clean Air Act[1]. Appendix A of the Guideline identifies AERMOD as the preferred model for near-field (within 50 km) regulatory applications. The AERMOD modeling system consists of one main program (AERMOD) and two pre-processors (AERMET and AERMAP). The major purpose of AERMET is to calculate boundary layer parameters for use by AERMOD. The major purpose of AERMAP is to calculate terrain heights and receptor grids for AERMOD. Both AERMET and AERMAP require observational data to parameterize the growth and structure of the atmospheric boundary layer. AERMOD uses terrain, boundary layer and source data to model pollutant transport and dispersion for calculating temporally averaged air pollution concentrations.

AERMOD's three models, and required model inputs, are described as follows:

- AERMET: calculates boundary layer parameters for input to AERMOD
  - Model inputs: wind speed; wind direction; cloud cover; ambient temperature; morning sounding; albedo; surface roughness; Bowen ratio
  - Model outputs for AERMOD: wind speed; wind direction; ambient temperature; lateral turbulence; vertical turbulence; sensible heat flux; friction velocity; Monin-Obukhov Length
- AERMAP: calculates terrain heights and receptor grids for input to AERMOD
  - Model inputs: DEM data [x,y,z]; design of receptor grid (pol., cart., disc.)
  - Model outputs for AERMOD: [x,y,z] and hill height scale for each receptor

[1] "Revision to the Guideline on Air Quality Models: Enhancements to the AERMOD Dispersion Modeling System and Incorporation of Approaches to Address Ozone and Fine Particulate Matter (Final Rule)." Federal Register 82:10 (17 January 2017) p. 5182

- AERMOD: calculates temporally-averaged air pollution concentrations at receptor locations for comparison to the NAAQS

    - Model inputs: source parameters; boundary layer meteorology (from AERMET); receptor data (from AERMAP)
    - Model outputs: temporally averaged air pollutant concentrations

A. RECOMMENDED REGULATORY DEFAULT OPTIONS

The following recommended regulatory default options for AERMOD, as stated in the Guideline, will be used for the model runs: stack-tip downwash; incorporation of the effects of elevated terrain; and calms and missing data processing routines.

B. MISSING DATA PROCESSING ROUTINES

The missing data processing routines that are included in AERMOD allow the model to handle missing meteorological data in the processing of short term averages. The model treats missing meteorological data in the same way as the calms processing routine (i.e., it sets the concentration values to zero for that hour and calculates the short term averages according to EPA's calms policy, as set forth in the *Guideline*). Calms and missing values are tracked separately for the purpose of flagging the short term averages. An average that includes a calm hour is flagged with a 'c'; an average that includes a missing hour is flagged with an 'm'; and an average that includes both calm and missing hours is flagged with a 'b'. If the number of hours of missing meteorological data exceeds ten percent of the total number of hours for a given model run, a cautionary message is written to the main output file, and the user is referred to Section 5.3.2 of *Meteorological Program Guidance for Regulatory Modeling Applications* (EPA, 2000).

C. REGIONAL TOPOGRAPHY

The regional topography of Pershing County generally consists of alternating, linear mountains between broad flat valleys characteristic of the Basin and Range Province. The Project Area is located on the Black Rock Playa, a large dry lake bed located with the Black Rock Desert and is surrounded by elevated topography. The region consists of groups of mostly topographically closed valleys with internal drainage.

D. RURAL/URBAN CLASSIFICATION

For modeling purposes, the rural/urban classification of an area is determined by either the dominance of a specific land use or by population data in the study area. Generally, if the sum of heavy industrial, light-moderate industrial, commercial, and compact residential (single and multiple family) land uses within a three km radius from the facility are greater than 50 percent, the area is classified as urban. Conversely, if the sum of common residential, estate residential, metropolitan natural, agricultural rural, undeveloped (grasses), undeveloped (heavily wooded) and water surfaces land uses within a three km radius from the facility are greater than 50 percent, the area is classified as rural. Alternatively, if the population is greater than 750 persons per km^2, the area is also classified as urban.

Rural land use in the area surrounding the Project Area is much greater than 50 percent. Thus, the rural classification will be used in the modeling.

E. REGIONAL CLIMATOLOGY

The Burning Man event site is located within Pershing County, Nevada. The county receives only 7 inches of rain annually, 8 inches of snow and approximately 38 days with measurable precipitation. Generally mountainous terrain with a major north-south axis surrounds the flat Playa that makes up the Black Rock Desert and event site. The region is comprised of a mix of high alpine forest and sagebrush vegetation at higher elevations and barren Playa's at low elevations.

Nevada lies on the eastern, lee side of the Sierra Nevada Range, a massive mountain barrier that markedly influences the climate of the State. One of the greatest contrasts in precipitation found within a short distance in the United States occurs between the western slopes of the Sierra Nevada Range in California and the valleys just to the east of this range. The prevailing winds are from the west. As the warm moist air from the Pacific Ocean ascends the western slopes of the Sierra Nevada Range, the air cools, and condensation takes place and most of the moisture falls as precipitation. As the air descends the eastern slope, it is warmed by compression, and very little precipitation occurs. The effects of this mountain barrier are felt not only in the west but throughout the State, with the result that the lowlands of Nevada are largely desert or steppes.

Long-term climatological data was obtained from the National Oceanic and Atmospheric Administration (NOAA) for the division of northwestern Nevada. While regionally representative, the climatology data can be assumed to differ slightly from that at the Project Area. This is due to the NOAA data being an average of several weather stations that encompass six counties, one of which is Pershing. **Table 4-1** below depicts the average climatological variables for the region calculated over a period of 36 years from 1980 through 2017.

Table 4-1. Average Northwestern Nevada Climate Data, 1980 through 2017

Title	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	41.5	46.4	53.5	60.0	69.0	79.4	89.0	87.4	78.3	65.1	50.3	41.0	63.4
Average Min. Temperature (F)	21.4	24.8	29.2	33.2	41.0	48.4	56.0	53.9	46.1	36.1	26.9	20.6	36.5
Average Total Precipitation (in)	1.24	1.06	1.11	0.97	1.13	0.68	0.29	0.25	0.46	0.79	1.12	1.34	0.87

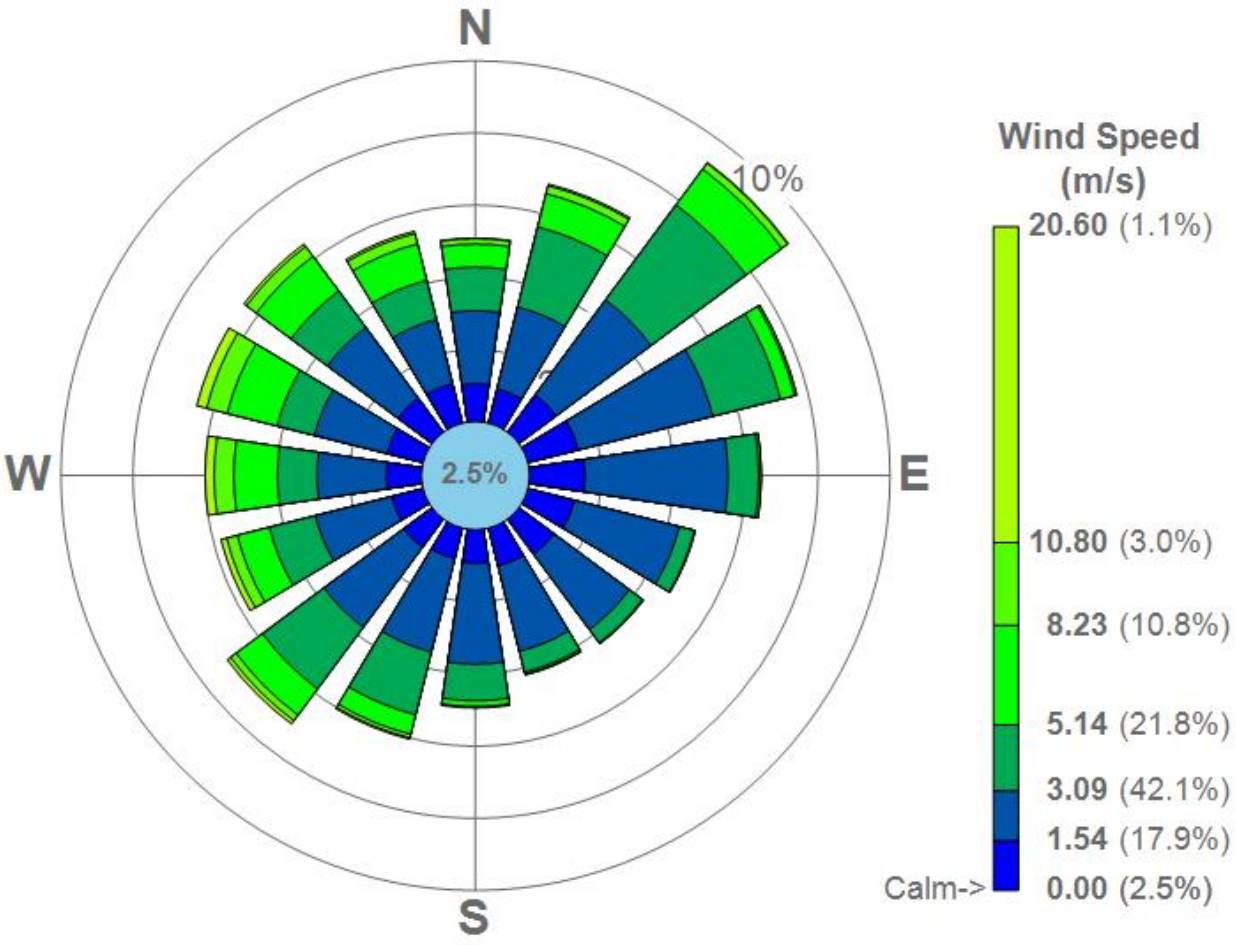
Source: NOAA Divisional Northwestern Nevada data.
http://www7.ncdc.noaa.gov/CDO/CDODivisionalSelect.jsp#

F. METEOROLOGICAL DATA AND PROCESSING FOR AERMOD

Five complete calendar years of National Weather Service (NWS) meteorological monitoring data (2010-2014), provided by NDEP will be used for this modeling analysis. A wind rose of the data collected from January 1, 2010 through December 31, 2014 is presented in **Figure 4-1**. A year-to-year data comparison shows consistency in the average wind speeds and directions and also indicates that meteorological data was consistently collected. Winds had no strong tendency toward directionality with only slight preference for the south/southwest. Wind speeds varied somewhat and tended to be strongest from the southwest and west.

Meteorological data will be combined into AERMOD-ready surface and upper air input files using AERMET. As a regulatory component of the AERMOD modeling system, the AERMET program serves as the meteorological preprocessor for AERMOD. AERMET is designed to combine and quality control NWS surface and upper air data for use by AERMOD. All data processed for this project meets or exceeds the EPA requirements for meteorological monitoring for dispersion modeling.

Figure 4-1. Wind Rose for the Proposed Lovelock AERMET Data for the Time Period January 1, 2010 – December 31, 2014



G. SKY COVER DATA

AERMOD requires parameters for determining boundary layer conditions, which include opaque sky cover (or total sky cover). Per EPA's AERMET guidance, the concurrent sky cover data for surface meteorological data is to be obtained from the nearest NWS site. The Lovelock, Nevada NWS site surface measurement data includes sky cover data, which will be used for the analysis.

H. UPPER AIR AND SURFACE METEOROLOGICAL DATA

AERMOD requires upper air and surface characteristic data. Twice-daily upper air sounding data will be obtained from the upper air monitoring station most geographically proximate to the surface station site. The nearest upper air data collection site, relative to the Project Area, is the Reno, NV station (REV, WMO 72489). Archived upper air radiosonde data will be acquired from the NOAA/ESRL radiosonde database and used in AERMET processing.

Hourly surface meteorological data will be utilized for AERMET processing. Data from the Lovelock, Nevada NWS station will be used for surface meteorological data.

I. SURFACE CHARACTERISTICS

Surface characteristics influence the boundary layer parameter estimates generated by AERMOD. Obstacles to the wind flow, the amount of moisture at the surface, and reflectivity of the surface all affect the boundary layer estimates. These influences are quantified through the surface albedo, Bowen ratio and roughness length, and are introduced into AERMOD through the files generated by AERMET.

The albedo is the fraction of total incident solar radiation reflected by the surface back to space without absorption. Typical values range from 0.1 for thick deciduous forests to 0.90 for fresh snow. The daytime Bowen ratio, an indicator of surface moisture, is the ratio of the sensible heat flux to the latent heat flux and is used for determining planetary boundary layer parameters for convective conditions. While the diurnal variation of the Bowen ratio may be significant, the Bowen ratio usually attains a fairly constant value during the day. Midday values of the Bowen ratio range from 0.1 over water to 10.0 over desert. The surface roughness length is related to the height of obstacles to the wind flow and is, in principle, the height at which the mean horizontal wind speed is zero. Values range from less than 0.001 m over a calm water surface to 1 m or more over a forest or urban area. The values for surface albedo, Bowen ratio and roughness length can be entered into the AERMET preprocessor based on frequency and sector.

The frequency defines how often these characteristics change, or alternatively, the period of time over which these characteristics remain constant. The frequency can be annual, seasonal (winter [December, January, February], spring [March, April, May], summer [June, July, August], fall [September, October, November]), or monthly, corresponding to one, four, or 12 periods, respectively. Sectors refer to the number of non-overlapping sectors into which the 360 degree compass is divided.

A minimum of one and a maximum of 12 sectors can be specified (i.e., one sector of 360 degrees, up to 12 non-overlapping sectors of 30 degrees). Thus, AERMET allows the values for surface albedo, Bowen ratio and roughness length to be entered annually, seasonally or monthly for each sector, the number of which can range between one and 12. The area surrounding the Project Area is undeveloped, desert scrub terrain in all directions. Consequently, surface characteristics will be entered for a single sector.

The EPA has developed a computer program called AERSURFACE to aid users in obtaining realistic and reproducible surface characteristic values for the albedo, Bowen ratio, and surface roughness length for input to AERMET. The program uses publicly available national land cover datasets and look-up tables of surface characteristics that vary by land cover type and season. Land cover data (not partitioned) from the USGS NLCD92 will be used for the modeling as recommended by the AERSURFACE user guide.

J. ADJUST U-STAR PROCESSING

EPA has introduced options into AERMET to allow adjustment of friction velocity for low wind stable conditions. The option, known as "Adjust U*" allows for more accurate assessment of concentrations during low wind and stable atmospheric conditions. Adjust U* will be utilized for the AERMET processing for the BRC modeling.

5. BACKGROUND CONCENTRATIONS

To evaluate the potential impacts of emissions from the BRC SRP expansion on the public, the dispersion modeling evaluation must consider the existing background concentrations of pollutants in the area where impacts are being evaluated. The background concentration of a given pollutant is added to the modeled impact from the BRC SRP expansion, and the result is compared to the NAAQs. The NAAQS are allowable concentration limits applied at the public access boundary.

Only criteria air pollutant impacts will be assessed as part of the modeling analysis. The criteria air pollutants which are regulated under Nevada law are carbon monoxide (CO), lead (Pb), sulfur dioxide (SO_2), particulate matter less than or equal in diameter to ten microns (PM_{10}), particulate matter less than or equal in diameter to 2.5 microns ($PM_{2.5}$), ozone (O_3), and nitrogen dioxide (NO_2). Pollutants directly emitted by operations from BRC SRP activities, and under evaluation for dispersion modeling purposes, are PM_{10}, $PM_{2.5}$, NO_2, CO, and SO_2. O_3 will not be analyzed as part of this modeling effort due to the photochemical formation of O_3. Atmospheric chemistry is not able to be modeled in a steady state Gaussian plume model such as AERMOD.

The NBAPC recommended the use of statewide "pristine" background concentrations for state permitting analyses. The background values to be used for this analysis are tabulated, below in **Table 5-1**. The values included in the table were provided via electronic mail from Andrew Tucker, dispersion modeler at NBAPC.

Table 5-1. Background Concentration Values to Be Used for the Modeling Analysis

Pollutant	Averaging Period	Background Concentration ($\mu g/m^3$)
$PM_{2.5}$	24-hr	8.0
	Annual	2.3
PM_{10}	24-hr	10.2
	Annual	N/A
SO_2	1-hr	0
	3-hr	0
	24-hr	0
	Annual	0
NO_2	1-hr	0
	Annual	0
CO	1-hr	0
	8-hr	0

Source: Background values provided by NBAPC. PM10 background from monitor in Great Basin National Park; PM2.5 backgrounds from monitor in Jarbridge Wilderness Area.

A. OZONE LIMITING METHOD (OLM) FOR EVALUATING NO_2 IMPACTS

The Ozone Limiting method (OLM), which was incorporated as a regulatory default in AERMOD in the December 2016 Appendix W updates, may be used to evaluate the impact of NO_2 in the near vicinity of the Project Area if appropriate data can be developed for its use.

OLM involves an initial comparison of the estimated maximum NO_x concentration and the ambient ozone concentration to determine the limiting factor in the formation of NO_2. If the ozone concentration is greater than the maximum NO_x concentration, total conversion is assumed. If the NO_x concentration is greater than the ozone concentration, the formation of NO_2 is limited by the ambient ozone concentration. The method also uses a correction factor to account for in-stack conversion of NO_x to NO_2.

Currently, background ozone and NO_2 data does not currently exist near the Project Area so OLM cannot be run with local data. As a result, an initial modeling analysis will be completed using a default ambient ratio (ARM 1 and 2) to conduct a Tier I and Tier II analysis for one hour NO_2. Should this analysis fail to comply with the onehour NO_2 NAAQS, background ozone and NO_2 data from a representative region will be sought in consultation with BLM. This data will be used to complete a third tier one hour NO_2 analysis using OLM.

B. RECEPTOR NETWORK

The receptor grid will consist of the following:

- Receptors spaced at 100 meters along the Permit Closure Boundary (PAB) large pink region in Figure 1-1 ;
- Receptors spaced at 250* meters from the PAB to one kilometer; and
- Receptors spaced at 500* meters from one kilometer to five kilometers.
- The receptors will begin at the proposed PAB.

*Should maximum impacts occur at the 100 or 500 m grid, and concentrations are close to the NAAQS, an additional modeling run will be conducted using tighter (50 m) spacing around that concentration in order to ensure that the maximum modeled location is captured.

C. RECEPTOR ELEVATIONS

Receptor elevations will be determined from the National Elevation Dataset (NED) distributed by the USGS, which are based on North American Datum 1927 (NAD27). This dataset has a resolution of 1/3 arc-second (or approximately ten meters).

The NED data will be processed with AERMAP. AERMAP, like AERMET, is a preprocessor program which was developed to process terrain data in conjunction with a layout of receptors and sources to be used in AERMOD. For complex terrain situations, AERMOD captures the essential physics of dispersion in complex terrain and therefore, needs elevation data that convey the features of the surrounding terrain. In response to this need, AERMAP first determines the base elevation at each receptor. AERMAP then searches for the terrain height and location that has the greatest influence on dispersion for each individual receptor. This height is referred to as

the hill height scale. Both the base elevation and hill height scale data are produced by AERMAP as a file or files which are then inserted into an AERMOD input control file.

D. MODELING DOMAIN

The AERMAP terrain preprocessor requires the user to define a modeling domain. The modeling domain is defined as the area that contains all the receptors and sources being modeled with a buffer to accommodate any significant terrain elevations. Significant terrain elevations include all the terrain that is at or above a ten percent slope from each and every receptor. The proposed modeling domain extends five kilometers in all directions from the PAB. The calculated modeling domain is then used to develop a NED file that sufficiently incorporates the geographic area.

E. PLUME DEPLETION

One other option in the AERMOD model requires particle size data. This option is known as DDEP, which specifies that dry deposition flux values will be calculated. If this option is selected, dry removal (depletion) mechanisms (known as dry plume depletion (DRYDPLT) in the old ISC modeling program and earlier versions of AERMOD) are automatically included in the calculated concentrations. This option will be selected in the proposed modeling for receptors exhibiting high particulate impacts in initial modeling runs. Dry plume depletion will be utilized only if initial particulate modeling suggests impacts may exceed the NAAQS. Particle size distribution values for various categories are provided in Appendix A. Detailed background information on the selected particle size values will be included in the final modeling report, should they be used in the modeling effort.

F. BUILDING DOWNWASH

Building downwash effects are not likely to influence the impacts associated with festival emissions. As such, building downwash will not be evaluated as part of the project modeling.

7. EMISSIONS MODELED AND SOURCE CHARACTERIZATION

A detailed emissions inventory will be generated in keeping with the new and modified sources of ambient emissions associated with the BRC SRP expansion and the associated alternatives. All emissions calculations will be developed following standard NEPA quantification methodologies and will be based on proposed reasonable foreseeable maximum activity rates. An electronic version of the emissions inventory will be provided to BLM for review. All emissions calculations are proposed to follow EPA and NDEP guidance, where available, and utilize the best available information for all calculation inputs. Emissions for criteria pollutants, hazardous air pollutants (HAPs), and greenhouse gasses will be calculated. Fugitive dust and tailpipe emissions will be approximated for existing festival activities as well as each SRP expansion alternative. HAPs emissions will be quantified however, A detailed HAPs health risk modeling analysis is not proposed as part of this assessment. The emissions inventory will be based on best estimates of activity rates and locations available throughout the analysis.

Where appropriate, model emissions input data will directly match the proposed SRP. For all averaging periods, maximum hourly emission rates from the emission inventory will be used to ensure conservatism. This procedure will be used for all pollutants modeled and therefore should ensure that the maximum and most conservative impact is modeled.

Each source will be assumed to emit continuously at the emissions rates and proposed operating hours indicted developed as part of the SRP alternatives analysis. Emission sources will be modeled as either volume or surface area sources, depending on source characteristics.

A preliminary plan view map depicting the event area layout is presented in **Figure 7-1**.

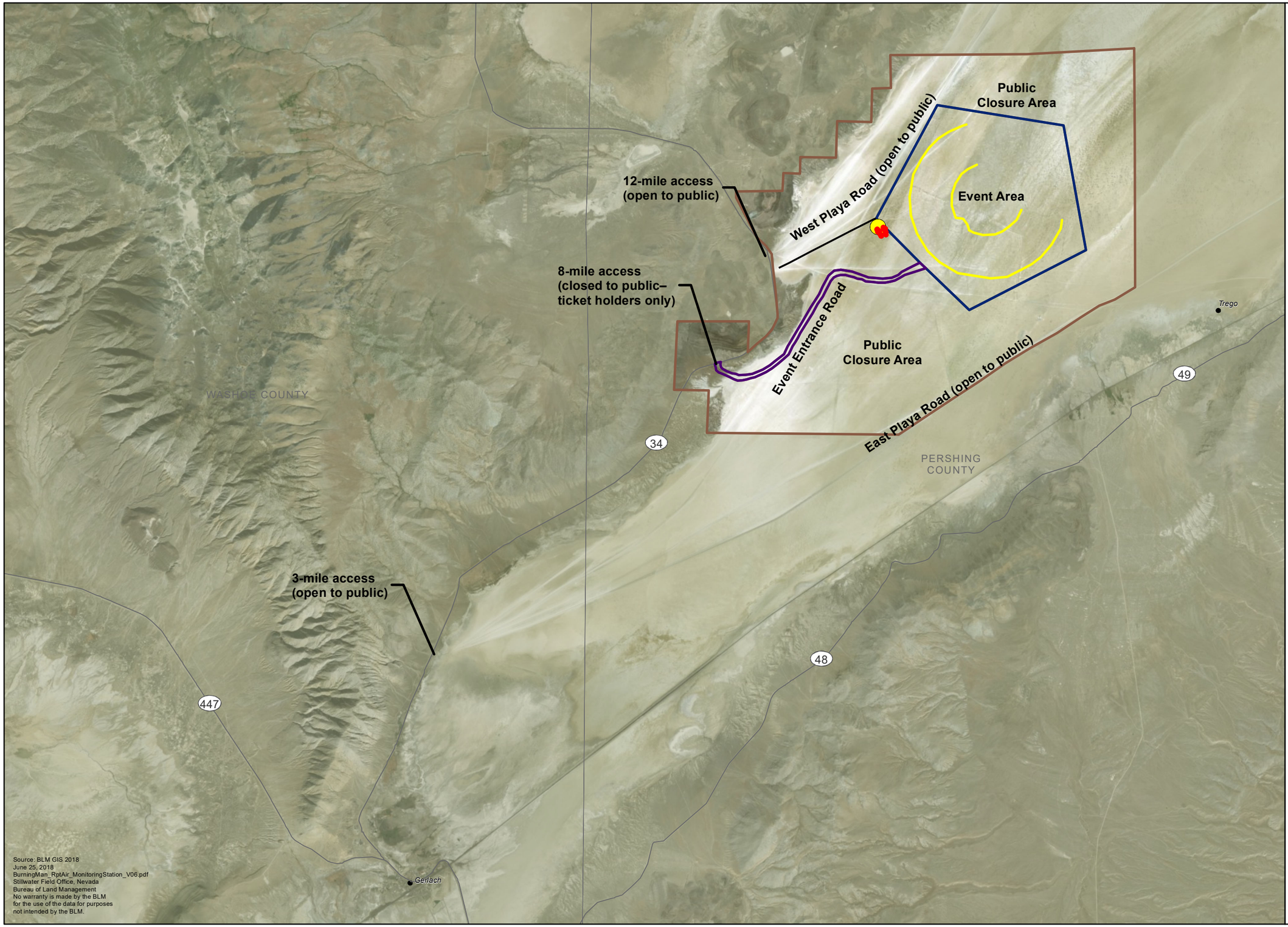
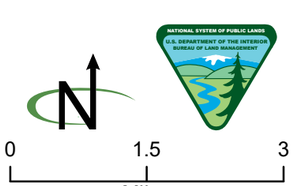


Figure 1-3
Air Monitoring Stations

- Air monitoring stations
- Public closure area
- Event area
- Event entrance road
- Operations center
- City
- Service road



A. OPERATING SCENARIOS TO BE MODELED

A single modeling simulation will be used for each SRP action alternative as appropriate. Additionally, emissions groups will be used within the AERMOD model file. Groups will separate current activity emissions from proposed future activities where appropriate.

Emissions from the BRC SRP expansion will result in expanded festival logistical construction emissions and festival activity emissions. Modeling for all sources of emissions will be modeled in this analysis.

7.A.1. Annual Criteria Pollutant Emissions Modeling

Annual impacts of particulate and gaseous emissions will be based upon emissions calculated using the average daily process rates during the festival periods. The emissions will also be set to zero outside of the event activity periods to accurately assess long term annual impacts.

7.A.2. Short-Term Criteria Pollutant Emissions Modeling

Short-term impacts (one hour and 24-hour) will be based upon the emissions calculated using the maximum daily process rates for the period. Short- term impacts are affected by peak emission rates. These are better determined using the expected maximum daily process rates rather than the average daily process rates.

A general description of how each source type will be assessed is presented below.

B. AREA POLYGON SOURCES

Fugitive emissions due to wind erosion from the disturbed event region will be represented by area polygon sources. The release height will be set to 3 meters to account for low level turbulent mixing. The emissions calculations for disturbed ground will utilize the 10/98 version of AP-42 Chapter 11.9 of 0.38t/ac-year and a particle size fraction from AP-42 13.2.5 of 0.5 for PM_{10} and 0.075 for $PM_{2.5}$..

C. VOLUME SOURCES

Volume sources will be utilized to model event road and fugitive particulate emissions sources. Volume source parameters will be developed by Trinity, in consultation with BRC/BLM or provided directly by BRC, depending on the source. For sources without provided parameters, Trinity will calculate volume source parameters in accordance with EPA guidance and the AERMOD user's guide. Initial vertical dimensions will be calculated as source height divided by 4.3. Initial lateral dimensions will be calculated as source width divided by 4.3. Source release heights will be set at the center of the volume. A description of the various volume sources and modeling methodologies is described below.

7.C.1. Event Road Sources

A refined road network will be developed to depict the anticipated vehicle routes with the estimated greatest emissions, which will be the basis of the emissions inventory that will be used for all of the modeling. Emissions due to event vehicle travel on unpaved playa roads will be modeled as volume sources. The modeling parameters will be based on guidance from NBAPC and the EPA Haul Roads workgroup report: "Haul Road Workgroup Final Report Submission to EPA- OAQPS." If dry plume depletion is utilized, as outlined in Section 6.5, all road emissions will be modeled using the particle size distribution shown in Table A.1 of Appendix A.

7.C.2. Tail Pipe Emissions

Tail pipe emissions from event participant and support vehicles will be distributed the on playa road network emissions sources. The amount of emissions assigned to each individual road segment, will be based upon an evaluation of the vehicle miles travelled (VMT) estimates for each vehicle type along each road segment associated with each SRP alternative analysis. All tailpipe particulate emissions will be modeled as $PM_{2.5}$.

8. DISPERSION MODELING IMPACT ANALYSIS

The purpose of the dispersion modeling outlined in this protocol is to demonstrate that emissions from the BRC SRP expansion will not cause exceedances of the applicable NAAQS. Since no Class I federal lands are located within 100 km of the Project Area, a Class I "Far-Field" analysis will not be completed. The final impact analysis will include all the information necessary for this demonstration including: (a) a project and meteorological station location map; (b) a complete list of source parameters; (c) complete modeling input and output file, including emissions calculation spreadsheets; and (d) graphic presentations of the modeling results for each pollutant showing the magnitude and location of the maximum ambient impacts. Impacts for atmospherically formed pollutants will not be included in this analysis.

9. REFERENCES

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United States Government Publishing Office, Electronic Code of Federal Regulations. T*itle 40, Chapter I, Subpart C, Part 50 – National Primary and Secondary Ambient Air Quality Standards.* Retrieved from https://www.ecfr.gov/cgi-bin/text-idx?tpl=/ecfrbrowse/Title40/40cfr50_main_02.tpl.

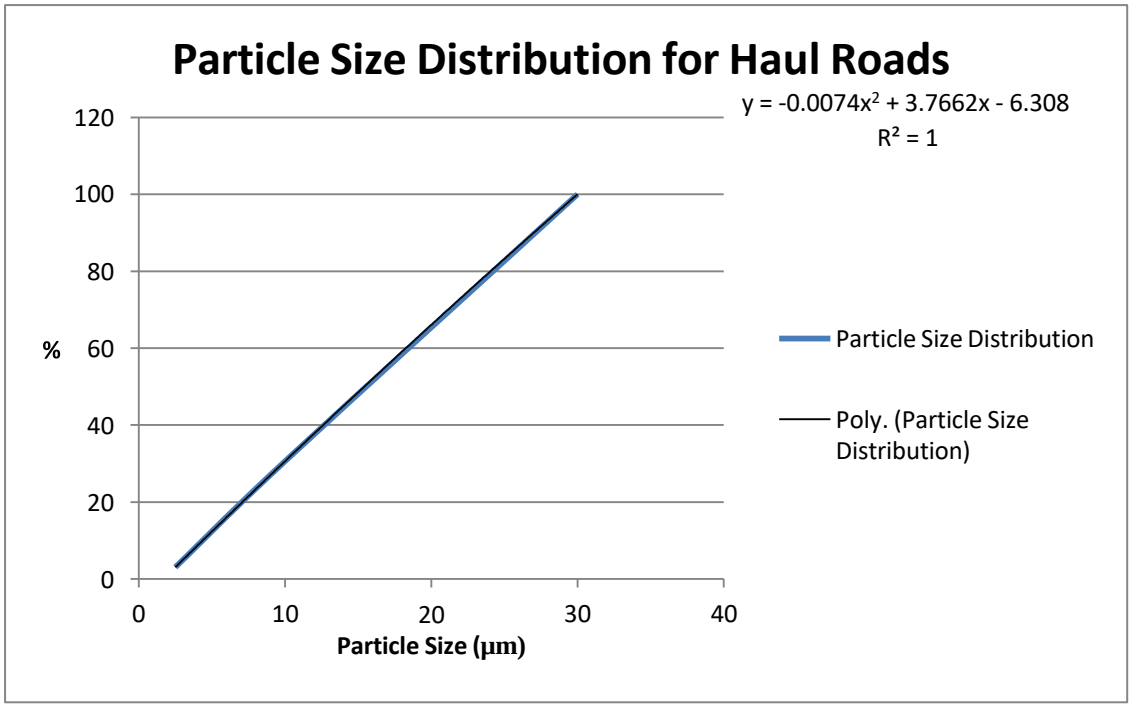
A.1 Particle Size Distributions

The following section describe the methodology used to estimate the particle size distributions for various emission sources. These values will be utilized only if dry plume depletion is determined to be necessary for the modeling of particulate emissions.

A.1.1 Fugitive Dust and Vehicle Emissions

Section 13.2.4 of AP 42 lists the emission factors for emissions from unpaved roads. These emission factors were used to determine the distribution of emissions for particles with nominal diameters less than 30, 10 and 2.5 µm. **Figure A-1** shows the distribution.

Appendix Figure A-1. Average size distribution for airborne dust generated by haul trucks for entire study period.



A second degree polynomial equation was used to fit the data and determine particle size distributions for use with fugitive dust and road emissions for BRC's SRP expansion. **Table A-1** shows the calculated particle size distribution that will be used for haul road emissions.

Appendix Table A-1. Particle Size Distribution – Haul Road Emissions

Diameter (microns)	Mass Fraction	Density (g/cm^3)
2.2	0.069	2.44
3.17	0.128	2.44
6.1	0.385	2.44
7.82	0.224	2.44
9.32	0.194	2.44