



METEOROLOGICAL CHARACTERIZATION STUDY OF THE WHARF BOSTON EXPANSION PROJECT

REVISION 2 TOPICAL REPORT RSI-3139



PREPARED FOR

Wharf Resources (USA), Inc.
10928 Wharf Road
Lead, South Dakota 57754

APRIL 2022





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1.0 INTRODUCTION

Wharf Resources (USA), Inc. (Wharf) is proposing to expand its existing gold mine operations in the area known as the Boston Expansion, which is located on the southern edge of the Wharf Mine along the Portland Ridgeline. This area is approximately four miles west of Lead, South Dakota, in Lawrence County. The proposed permit area consists of approximately 47.4 acres of private land located in Sections 2 and 3, Township 4 North, Range 2 East. Figure 1-1 shows the Boston Expansion Project study area. The blue outline represents the current permitted mine boundaries for Wharf and Golden Reward, the red outline represents the proposed Boston Expansion permit area, and the red dots are meteorological stations.

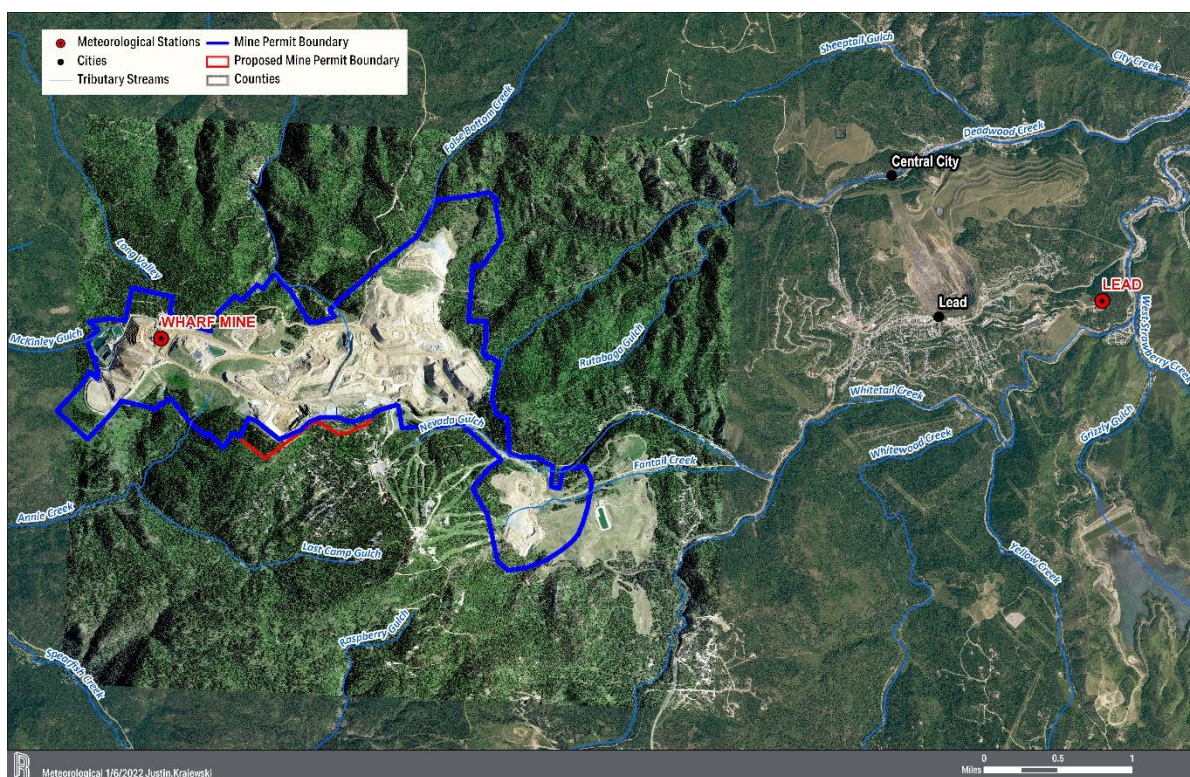


Figure 1-1. Expansion Baseline Study Area and the Wharf Mine and Lead Meteorological Stations Map.

The Wharf Mine and proposed Boston Expansion Area are located in the north-central portion of the Black Hills uplift in western South Dakota. The area topography is mountainous within a forested ridge system. Land elevations of the Boston Expansion Area range from 6,320 feet to 6,560 feet above mean sea level, and the geology consists of Precambrian metamorphic rocks overlain by sediments of the Cambrian Deadwood Formation.

The objective of this study was to satisfy the South Dakota Department of Agriculture and Natural Resources (SD DANR) meteorological characterization requirement of developing a meteorological monitoring plan (Administrative Rules of South Dakota, 74:29:02:11(8)) [South Dakota Legislature Administrative Rules, 2021]. This study aimed to summarize meteorological data for the Wharf Mine and the Boston Expansion Area. This report is organized to optimize available information and understand



including temperature, precipitation, and wind patterns. Conclusions and recommendations are provided in Chapter 3.0, and cited references are provided in Chapter 4.0. The report concludes with statistical meteorological data for the Lead Station and Wharf Mine in Appendices A and B, respectively.

2.0 SITE ANALYSIS

The meteorological site analyses were performed using data from the Wharf Mine and Lead meteorological stations. One year of recent data (January 1, 2020, to December 31, 2020) and 6 years of historical meteorological data (January 1, 2015, through December 31, 2020) were summarized as part of this report. Also, seasons are defined as winter (December, January, February), spring (March, April, May), summer (June, July, August), and fall (September, October, November) for this report.

The Wharf meteorological station (44.3518°N, 103.8799°W) is located at the Wharf Mine and is approximately 0.9 mile northwest of the Boston Expansion Area. The Lead meteorological station (44.3544°N, -103.7431°W) is located at Lead, South Dakota, is approximately 5.0 miles east of the Boston Expansion Area and part of the National Weather Service (NWS) Cooperative Observer Program (COOP) and Global Historical Climatology Network (GHCN). The Lead meteorological station identifiers are COOP 394834 and GHCN USC0039483.

On-site meteorological monitoring data at the Wharf meteorological station for temperature and precipitation were obtained from Wharf [Allen, 2021]. In addition to the on-site Wharf meteorological station data, available temperature, precipitation, and snowfall data for the Lead meteorological station were obtained from the High Plains Regional Climate Center (HPRCC) "Daily Data Listing" webpage (<http://climod.unl.edu/>) [HPRCC, 2021].

Wind speed and wind gust data are not recorded at the Wharf Mine and Lead meteorological stations [Allen, 2021; HPRCC, 2021]. The nearest meteorological station to the site with available wind data is the Spearfish meteorological station, which is located 10–11 miles north of the Wharf Mine and Boston Expansion Area. Therefore, RESPEC downloaded a 7.5-mile (12-kilometer) gridded dataset that provides hourly meteorological data for the Wharf Mine and Boston Expansion Area from the North American Land Data Assimilation System (NLDAS) [NLDAS, 2021]. The NLDAS includes quality controlled, spatially and temporally consistent, land-surface model datasets from the best available observations and is available online on the NLDAS website (<https://ldas.gsfc.nasa.gov/nldas/nldas-get-data>).

2.1 TEMPERATURE

Temperature data from 2015 through 2020 were obtained from the HPRCC for the Lead meteorological station. The 6-year average historical temperature for the Lead station was 46.4 degrees Fahrenheit (°F), as shown in Table 2-1. Historical maximum, average, and minimum monthly temperatures from January 1, 2015, through December 31, 2020, are shown in Table 2-1 and Figure 2-1. The warmest months historically occur during the summer months. Historically, the months with the highest and lowest average monthly temperature were July (81.8°F) and February (15.7°F), respectively.

Table 2-1. Maximum, Average, and Minimum Monthly Average Temperatures at the Lead Meteorological Station (2015–2020)

Lead Historical Temperature (°F)	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Maximum	39.2	37.3	48.6	53.6	62.0	77.2	81.8	79.7	71.8	55.8	47.2	36.8	57.6
Average	28.9	26.5	37.3	42.4	51.2	64.9	69.3	66.8	59.7	44.9	37.2	27.9	46.4
Minimum	18.6	15.7	26.1	31.2	40.4	52.5	56.8	53.9	47.7	34.0	27.2	18.9	35.3

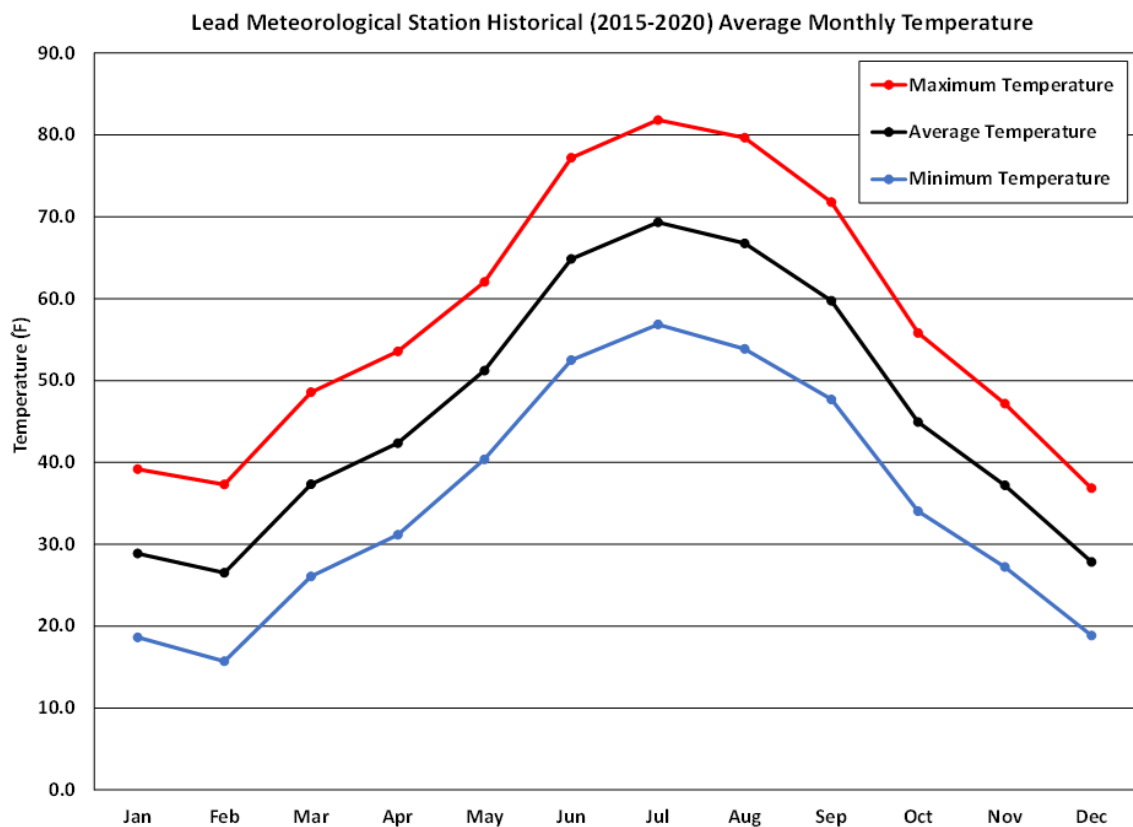


Figure 2-1. Maximum, Average, and Minimum Monthly Average Temperatures From January 2015 Through December 2020 at the Lead Meteorological Station.

In addition to the temperature data obtained for the Lead meteorological station, temperature data were obtained from the Wharf Mine for the observed temperatures that were measured at 7 a.m. daily at the Wharf meteorological station [Allen, 2021]. The 6-year average historical temperature for the Wharf station was 36.8°F, as shown in Table 2-2. Historical maximum, average, and minimum monthly temperatures from January 1, 2015, through December 31, 2020, are shown in Table 2-2 and Figure 2-2. The warmest observed temperatures historically occurred during the summer months. Historically, the months with the highest average and lowest average monthly observed temperatures were July (65.0°F) and February (9.2°F), respectively.

Table 2-2. Maximum, Average, and Minimum Monthly Average Temperatures Taken at 7 a.m. at the Wharf Mine (2015–2020)

Wharf Historical 7 a.m. Temperature (°F)	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Maximum	22.8	26.2	30.4	33.8	45.5	59.8	65.0	61.2	52.1	39.8	35.2	26.2	41.5
Average	20.4	18.5	26.3	30.6	42.1	54.0	59.3	55.9	49.9	34.0	29.7	20.4	36.8
Minimum	15.9	9.2	20.9	27.6	34.6	48.5	54.2	53.7	46.8	27.6	24.2	11.5	31.2

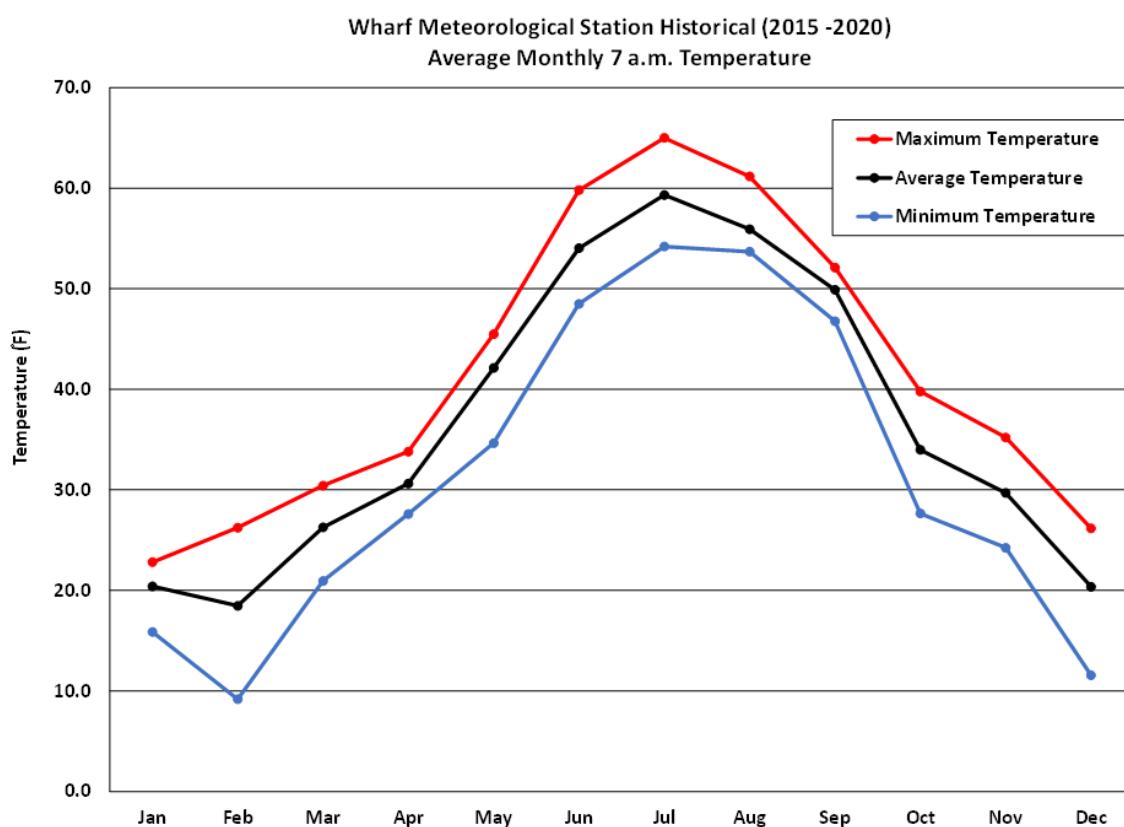


Figure 2-2. Maximum, Average, and Minimum Monthly Average 7 a.m. Temperatures From January 2015 Through December 2020 at the Wharf Meteorological Station.

Table 2-3 and Figure 2-3 compares the maximum and minimum monthly temperatures at the Wharf and Lead meteorological stations from January 2015 through December 2020. The Wharf and Lead stations' maximum and minimum monthly temperatures from 2015 through 2020 track closely to one another with slight variances but confirm the similarities of meteorological conditions at both stations. Figure 2-4 compares the maximum and minimum monthly temperatures at the Wharf and Lead meteorological stations from January 2020 through December 2020. As with the 2015–2020 temperatures in Figure 2-3, the Wharf Mine and Lead meteorological stations' maximum and minimum monthly temperatures during 2020 were similar with some differences in the fall and winter months.

Table 2-3. Maximum and Minimum Monthly Temperatures at the Wharf and Lead Meteorological Stations (2015–2020) (Page 1 of 2)

Year	Month	Wharf Maximum Temperature (°F)	Wharf Minimum Temperature (°F)	Lead Maximum Temperature (°F)	Lead Minimum Temperature (°F)
2015	Jan	54.0	–1.0	66.0	–6.0
	Feb	48.0	–10.0	66.0	–5.0
	Mar	62.0	–7.0	79.0	0.0
	Apr	70.0	16.0	81.0	23.0
	May	66.0	22.0	77.0	27.0
	Jun	82.0	42.0	92.0	48.0
	Jul	86.0	43.0	91.0	49.0
	Aug	90.0	34.0	93.0	41.0
	Sep	87.0	36.0	91.0	38.0
	Oct	76.0	19.0	82.0	23.0
	Nov	68.0	–2.0	68.0	3.0
	Dec	50.0	–2.0	57.0	0.0
2016	Jan	53.0	–2.0	56.0	–3.0
	Feb	58.0	9.0	64.0	14.0
	Mar	66.0	9.0	71.0	15.0
	Apr	74.0	14.0	79.0	18.0
	May	76.0	18.0	79.0	24.0
	Jun	92.0	40.0	96.0	42.0
	Jul	98.0	46.0	96.0	48.0
	Aug	87.0	36.0	92.0	41.0
	Sep	81.0	30.0	89.0	36.0
	Oct	73.0	14.0	80.0	20.0
	Nov	72.0	12.0	76.0	11.0
	Dec	43.0	–24.0	48.0	–18.0
2017	Jan	72.0	–14.0	65.0	–7.0
	Feb	65.0	–12.0	69.0	–3.0
	Mar	62.0	–12.0	73.0	5.0
	Apr	67.0	12.0	70.0	15.0
	May	79.0	27.0	82.0	30.0
	Jun	90.0	36.0	87.0	39.0
	Jul	94.0	42.0	94.0	47.0
	Aug	84.0	42.0	88.0	44.0
	Sep	83.0	30.0	88.0	34.0
	Oct	70.0	6.0	78.0	13.0
	Nov	61.0	8.0	66.0	10.0
	Dec	53.0	–10.0	55.0	–16.0

Table 2-3. Maximum and Minimum Monthly Temperatures at the Wharf and Lead Meteorological Stations (2015–2020) (Page 2 of 2)

Year	Month	Wharf Maximum Temperature (°F)	Wharf Minimum Temperature (°F)	Lead Maximum Temperature (°F)	Lead Minimum Temperature (°F)
2018	Jan	54.0	–10.0	60.0	–12.0
	Feb	43.0	–14.0	50.0	–11.0
	Mar	57.0	10.0	62.0	7.0
	Apr	72.0	0.0	75.0	3.0
	May	88.0	31.0	88.0	32.0
	Jun	92.0	38.0	94.0	41.0
	Jul	94.0	40.0	93.0	45.0
	Aug	94.0	32.0	94.0	38.0
	Sep	85.0	27.0	88.0	30.0
	Oct	74.0	0.0	77.0	14.0
	Nov	65.0	–4.0	60.0	–7.0
	Dec	55.0	–2.0	56.0	–2.0
2019	Jan	49.0	–4.0	55.0	–6.0
	Feb	36.0	–12.0	58.0	–18.0
	Mar	50.0	–8.0	58.0	–17.0
	Apr	70.0	8.0	71.0	8.0
	May	74.0	14.0	75.0	24.0
	Jun	88.0	28.0	87.0	37.0
	Jul	87.0	38.0	88.0	49.0
	Aug	90.0	0.0	86.0	40.0
	Sep	90.0	36.0	89.0	38.0
	Oct	69.0	–4.0	76.0	–1.0
	Nov	58.0	–8.0	60.0	–4.0
	Dec	53.0	2.0	55.0	5.0
2020	Jan	51.0	1.0	54.0	–3.0
	Feb	51.0	–4.0	58.0	–6.0
	Mar	62.0	3.0	64.0	1.0
	Apr	74.0	–3.0	72.0	1.0
	May	90.0	26.0	87.0	27.0
	Jun	91.0	40.0	90.0	42.0
	Jul	92.0	45.0	91.0	46.0
	Aug	93.0	39.0	93.0	39.0
	Sep	91.0	25.0	94.0	23.0
	Oct	79.0	–4.0	80.0	3.0
	Nov	77.0	12.0	71.0	11.0
	Dec	58.0	10.0	65.0	8.0

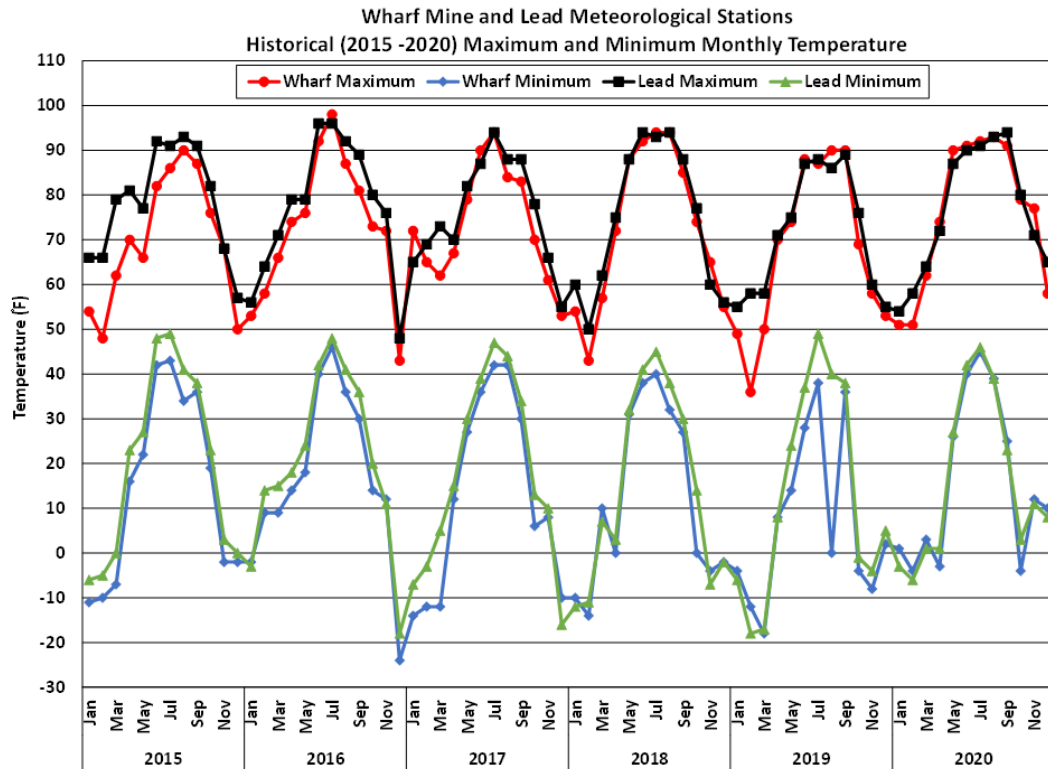


Figure 2-3. Comparison of Maximum and Minimum Monthly Temperatures From January 2015 Through December 2020 at the Wharf and Lead Meteorological Stations.

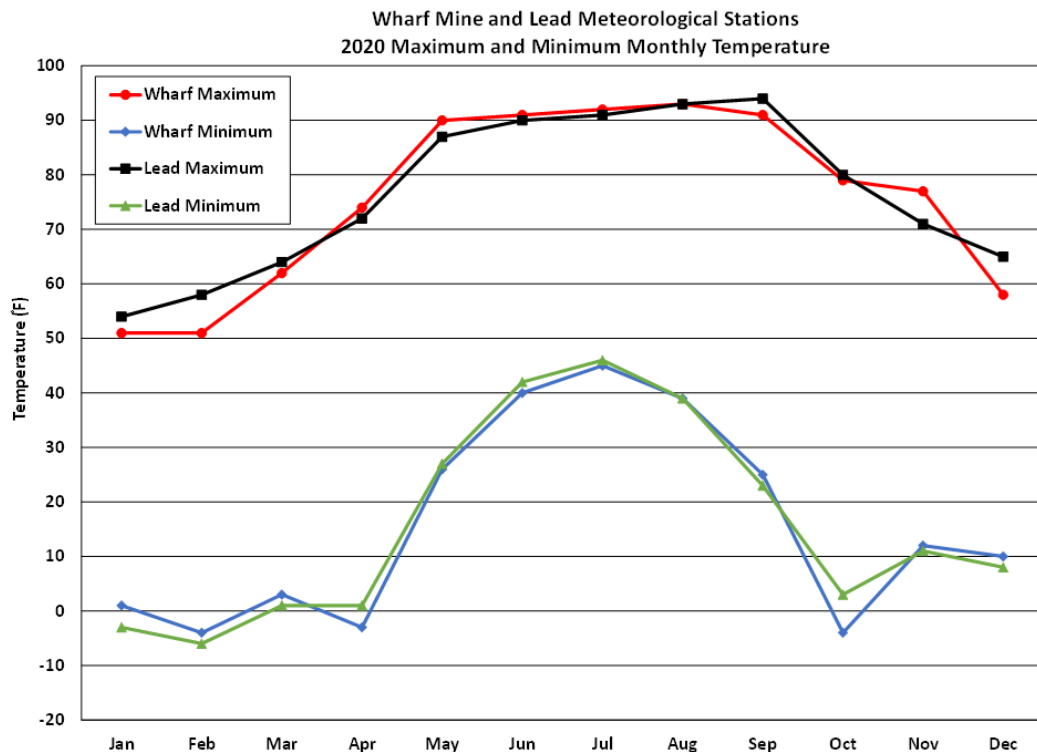


Figure 2-4. Comparison of Maximum and Minimum Monthly Temperatures From January 2020 Through December 2020 at the Wharf and Lead Meteorological Stations.

2.2 PRECIPITATION

Precipitation data from 2015 through 2020 were obtained from the HPRCC for the Lead meteorological station. The 6-year average historical annual precipitation for the Lead station was 28.8 inches, as shown in Table 2-4. Historical maximum, average, and minimum monthly precipitation from January 1, 2015, through December 31, 2020, are also shown in Table 2-4 and Figure 2-5. The highest average monthly total precipitation amounts occurred during May, June, and July, and the lowest amounts occurred during February, March, and November. Figure 2-6 shows the total monthly precipitation at the Lead meteorological station during 2020.

Table 2-4. Maximum, Average, and Minimum Monthly Average Precipitation at the Lead Meteorological Station (2015–2020)

Lead Historical Precipitation (inches)	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Maximum	1.9	3.0	2.5	3.1	9.2	6.2	8.8	4.2	2.3	3.8	2.0	1.7	48.7
Average	1.3	1.6	1.5	2.7	5.0	3.8	4.0	2.5	1.8	2.1	1.1	1.4	28.8
Minimum	1.1	0.7	0.5	2.5	1.6	0.9	1.6	1.0	1.2	1.0	0.2	0.9	13.2

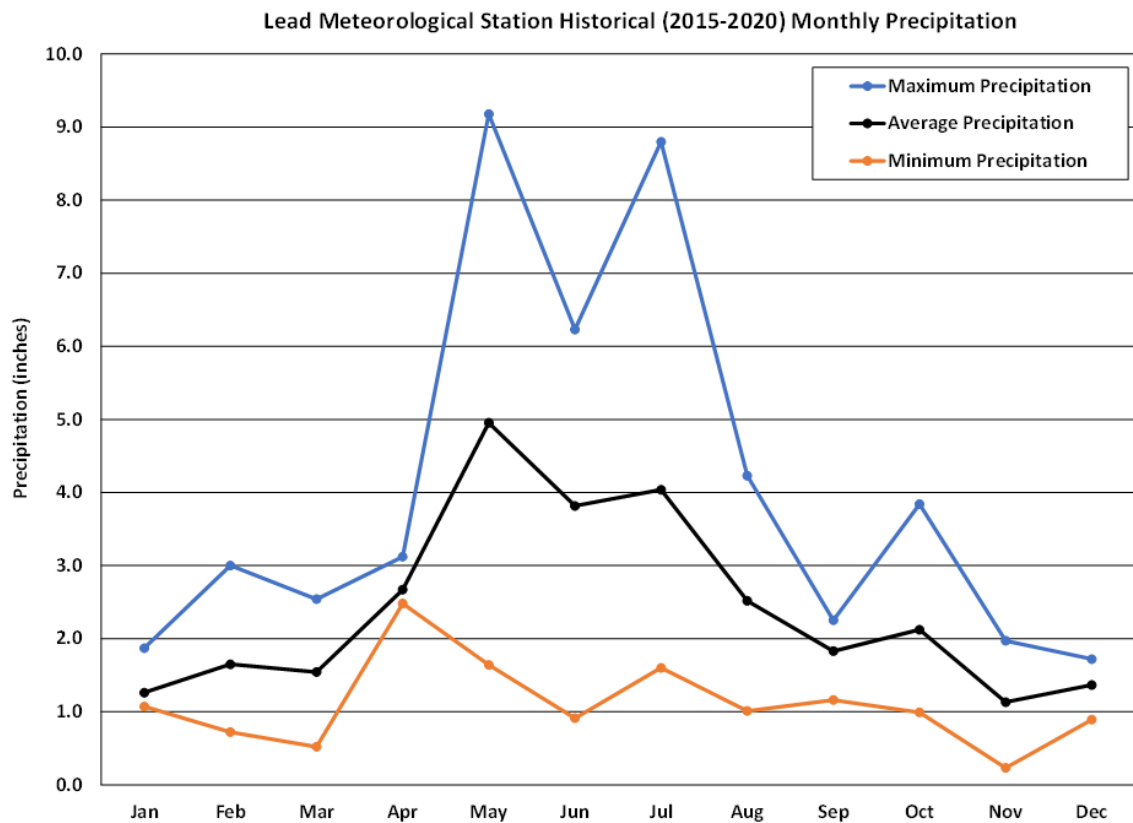


Figure 2-5. Maximum, Average, and Minimum Monthly Precipitation Measured From January 2015 Through December 2020 at the Lead Meteorological Station.

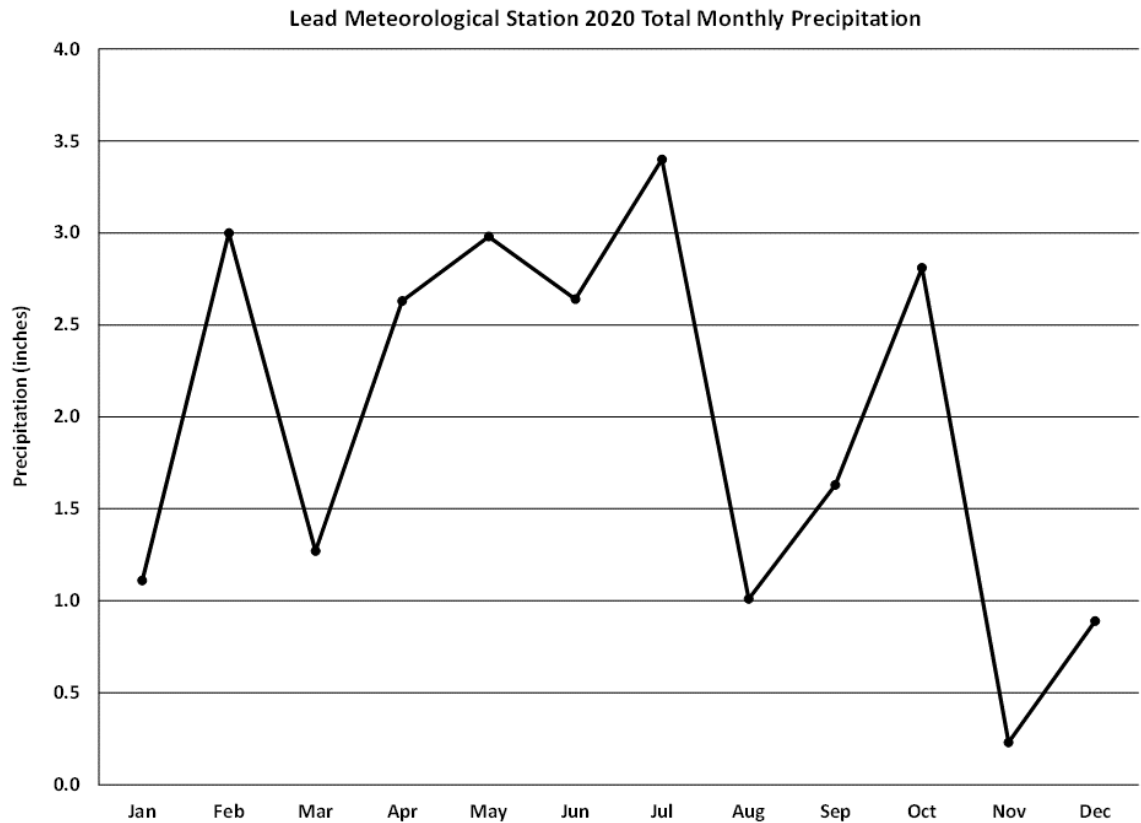


Figure 2-6. Total Monthly Precipitation Measured From January 2020 Through December 2020 at the Lead Meteorological Station.

Precipitation data from 2015 through 2020 were obtained from Wharf for the Wharf meteorological station at the mine. The 6-year average historical annual precipitation for the Wharf station was 30.1 inches, as shown in Table 2-5. Historical maximum, average, and minimum monthly precipitation from January 1, 2015, through December 31, 2020, are also shown in Table 2-5 and Figure 2-7. The highest average monthly total precipitation amounts occurred during May, June, and July, and the lowest amounts occurred during March, November, and December. Figure 2-8 shows the total monthly precipitation at the Wharf meteorological station during 2020.

Table 2-5. Maximum, Average, and Minimum Monthly Average Precipitation at the Wharf Mine (2015–2020)

Wharf Historical Precipitation (in)	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Maximum	2.2	4.9	3.8	3.4	8.5	7.0	6.2	3.0	2.4	3.8	1.8	2.2	49.2
Average	1.6	2.1	1.9	2.8	4.9	3.7	4.2	2.1	1.8	2.3	1.1	1.6	30.1
Minimum	0.9	1.0	0.6	1.7	1.8	0.7	1.8	0.7	1.2	1.0	0.0	0.6	12.0

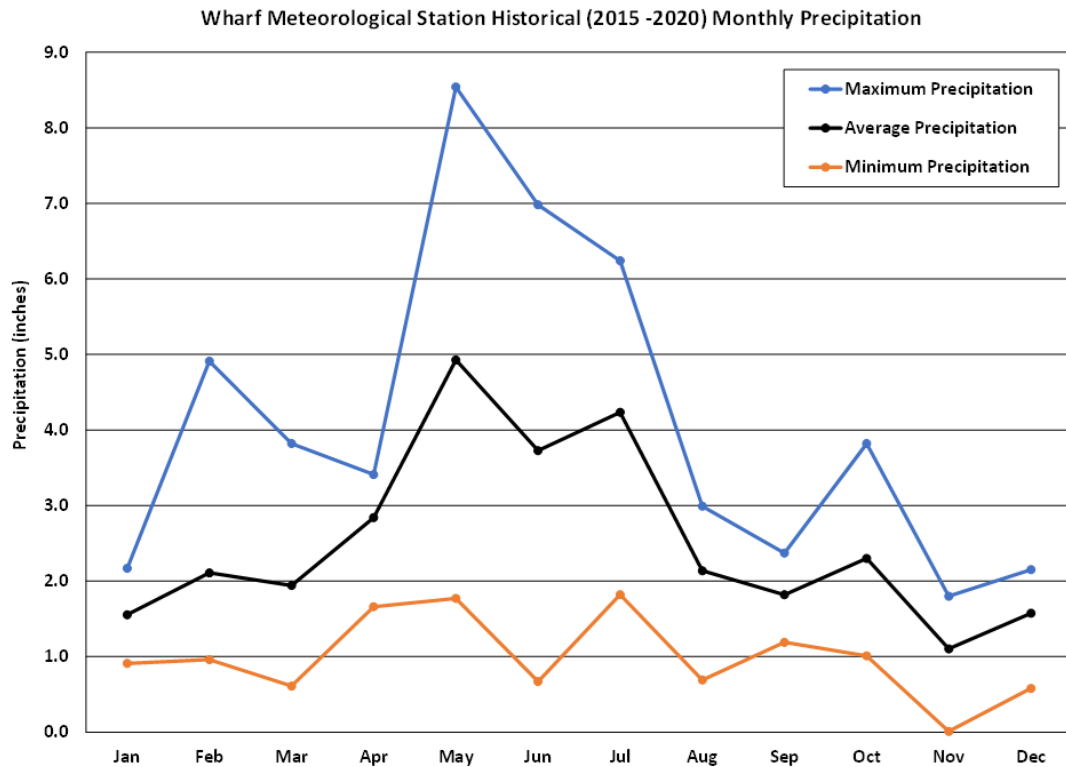


Figure 2-7. Maximum, Average, and Minimum Monthly Precipitation Measured From January 2015 Through December 2020 at the Wharf Meteorological Site.

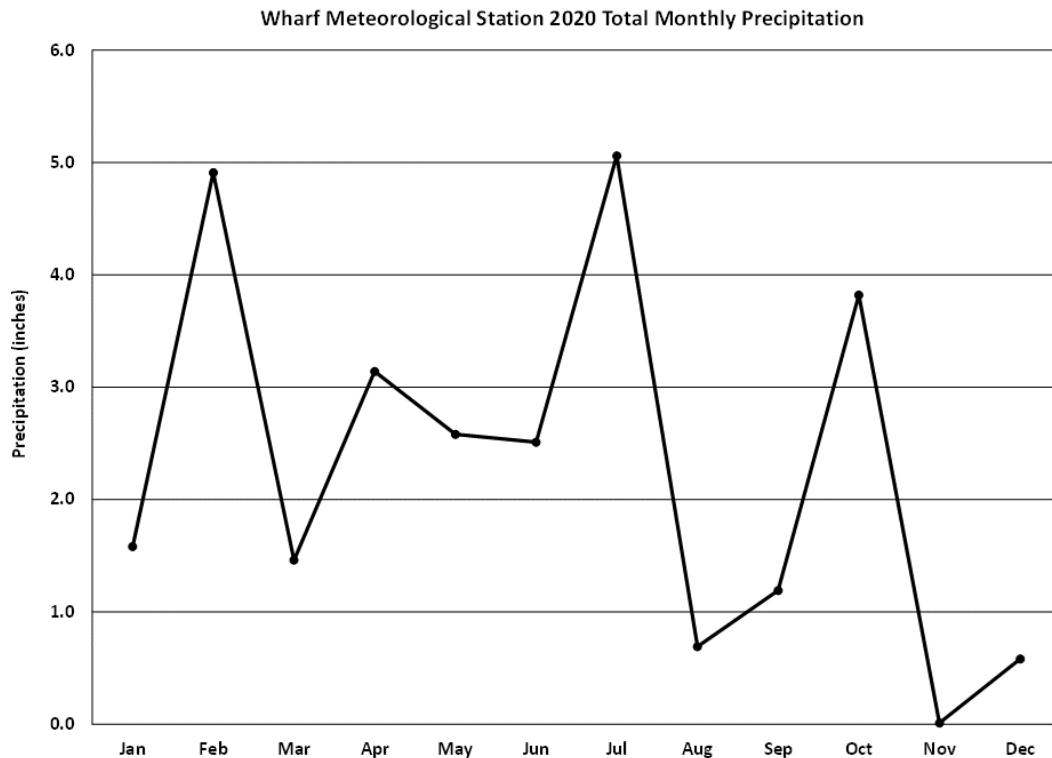


Figure 2-8. Total Monthly Precipitation Measured From January 2020 through December 2020 at the Wharf Meteorological Site.

Snowfall data from 2015 through 2020 were obtained from the HPRCC for the Lead meteorological station. The 6-year average historical snowfall for the Lead station was 127.2 inches, as shown in Table 2-6. Total monthly snowfall received at the Lead station from January 1, 2015, through December 31, 2020, are shown in Table 2-6 and Figure 2-9. The highest average monthly total snowfall amounts occurred during January, February, and December. No snowfall was received at the Lead station during June, July, and August. Table 2-6 and Figure 2-10 show the total monthly snowfall received at the Lead meteorological station during 2020. The Lead meteorological station received an average of 152.1 inches of snowfall in 2020, as shown in Figure 2-11.

Table 2-6. Total Monthly Snowfall Received at the Lead Meteorological Station From 2015 Through 2020 and During 2020

Lead Snowfall (inches)	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Average 2015–2020 Snowfall	17.3	23.3	14.7	16.2	8.6	0.0	0.0	0.0	1.4	11.1	12.2	22.4	127.2
Total 2020 Snowfall	15.6	51.5	12.5	28.2	2.0	0.0	0.0	0.0	7.0	18.0	3.7	13.6	152.1

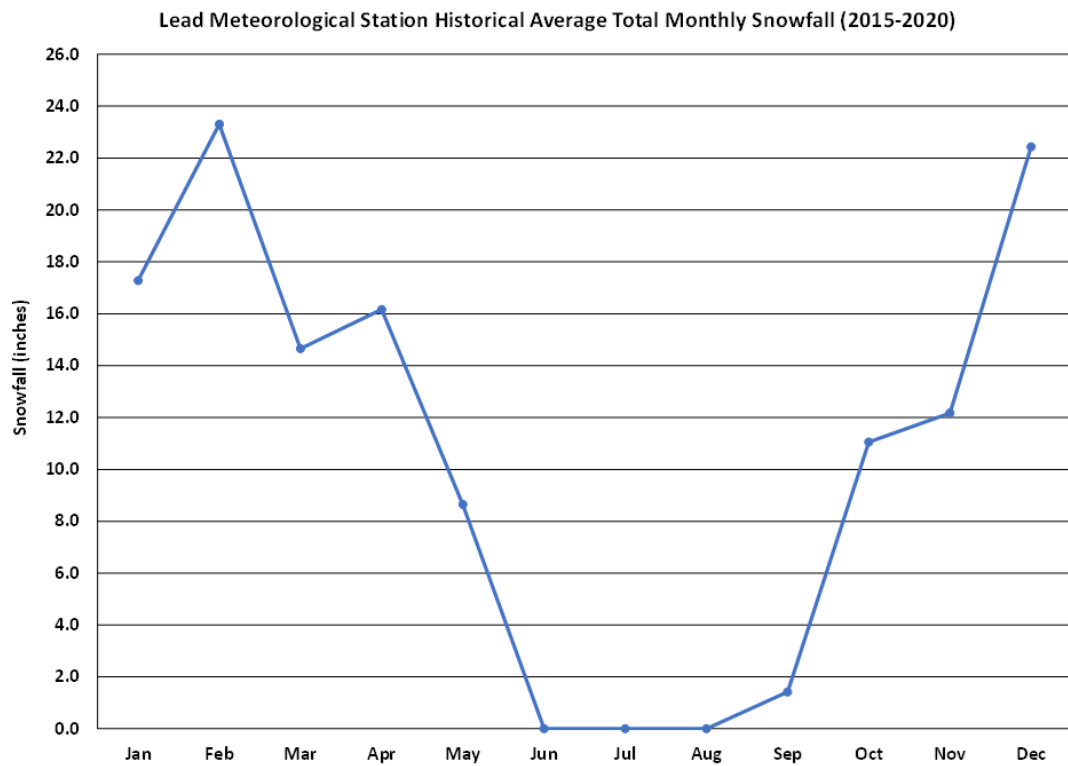


Figure 2-9. Average of the Total Monthly Snowfall Measured From 2015 Through 2020 at the Lead Meteorological Station.

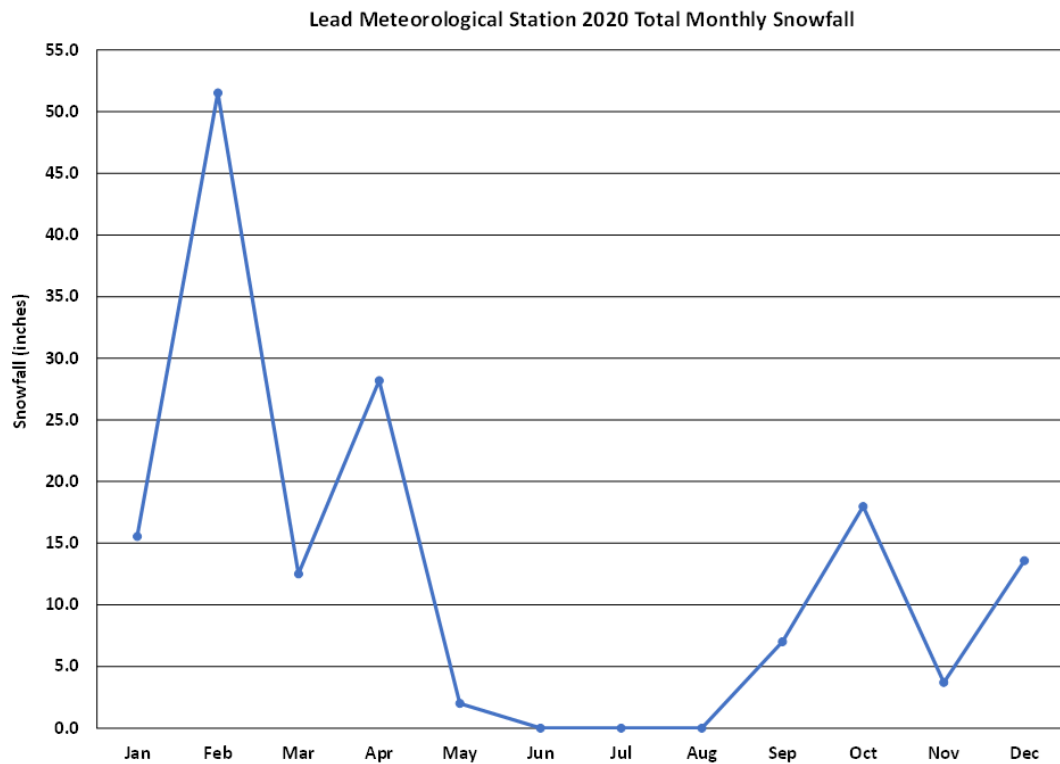


Figure 2-10. Total Monthly Snowfall Measured During 2020 at the Lead Meteorological Station.

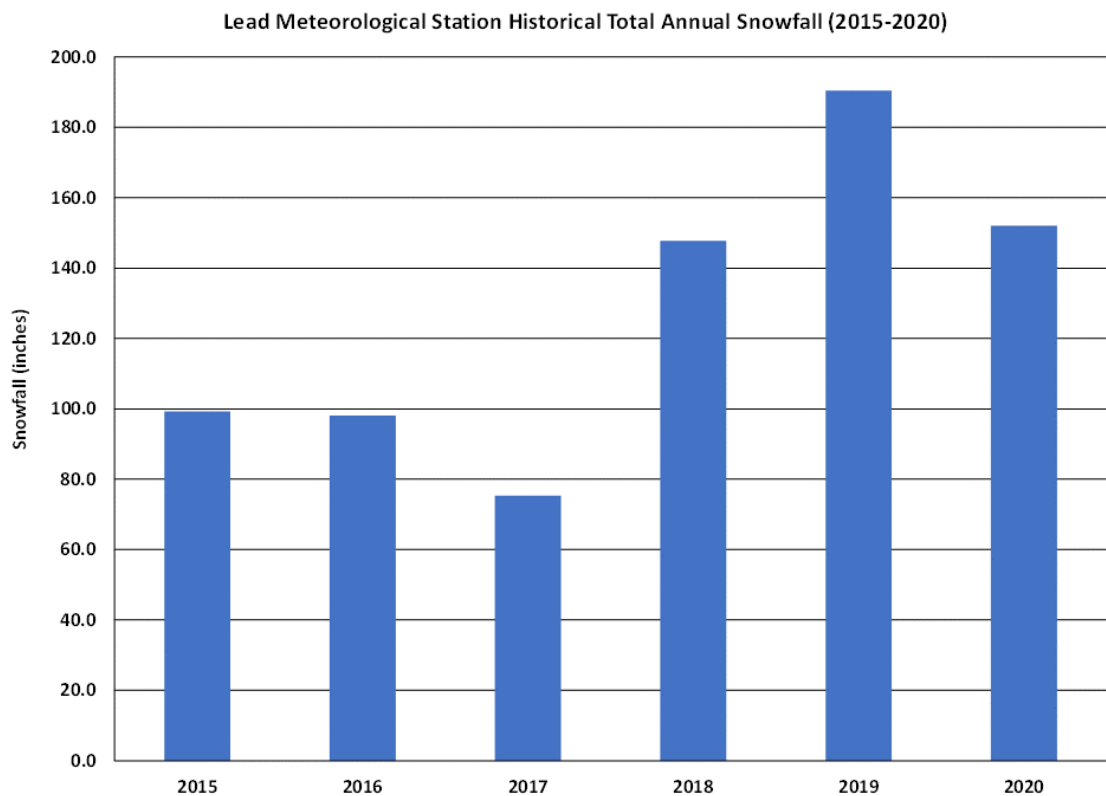


Figure 2-11. Total Annual Snowfall Measured From 2015 Through 2020 at the Lead Meteorological Station.

2.3 WIND PATTERNS

Historical wind speed data for the 7.5-mile grid containing the Wharf Mine and Boston Expansion Area were obtained from the NLDAS and analyzed to show wind speed patterns. Gridded wind vector data were also available from the NLDAS, and wind direction was calculated from wind vector data. As shown in Table 2-7 and Figure 2-12, December and October were the windiest months at the Wharf Mine with an average wind speed of 11.4 miles per hour (mph) and 11.1 mph, respectively, from 2015 through 2020; July was the calmest month with an average wind speed of 8.0 mph. The historical yearly average wind speed was 9.9 mph from 2015 through 2020.

Table 2-7. NLDAS Gridded Maximum, Average, and Minimum Monthly Wind Speed at the Wharf Mine (2015–2020)

Wind Speed (mph)	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Maximum	33.5	34.9	36.7	33.1	30.3	29.9	25.3	32.0	32.0	33.5	43.5	36.2	33.4
Average	10.5	10.1	10.4	10.5	10.0	9.0	8.0	8.3	9.2	11.1	10.8	11.4	9.9
Minimum	0.1	0.3	0.2	0.1	0.1	0.2	0.1	0.1	0.1	0.2	0.3	0.0	0.0

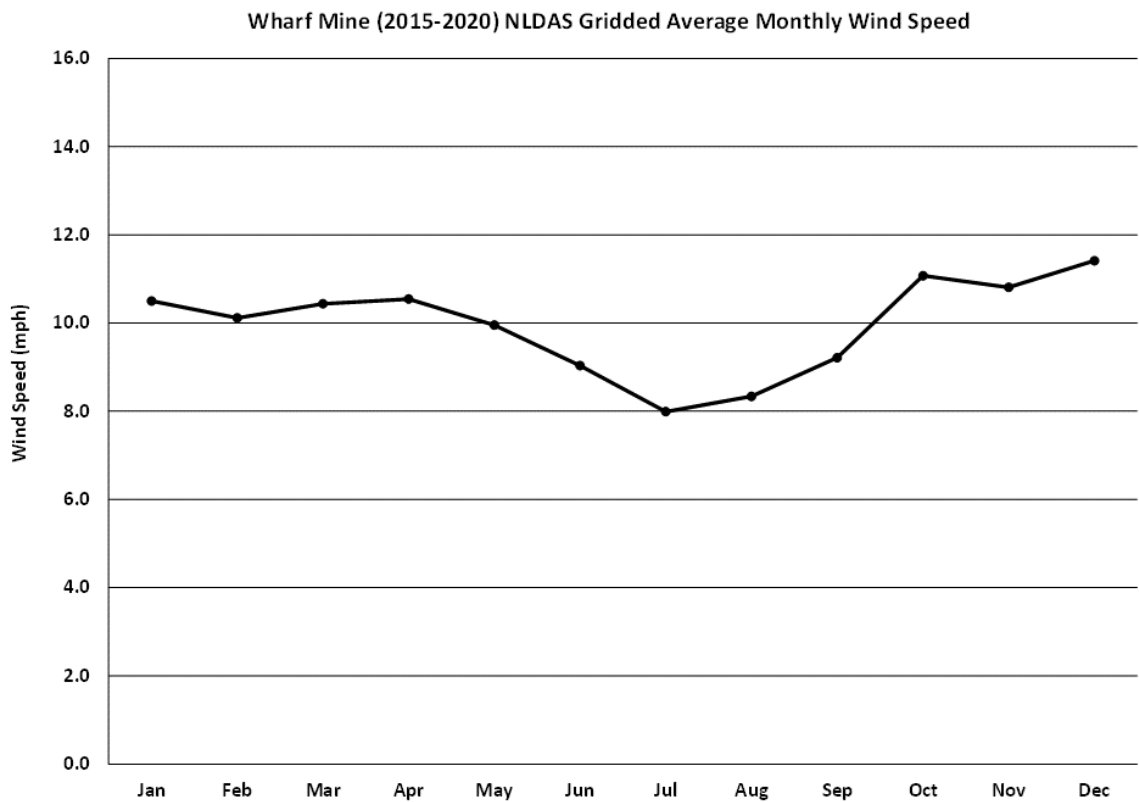


Figure 2-12. Monthly NLDAS Gridded Average Wind Speed From 2015 Through 2020 at the Wharf Mine.

Table 2-8 and Figure 2-13 show the historical NLDAS wind speed data of the 7.5-mile grid containing the Wharf Mine and Boston Expansion Area during 2020. April was the windiest month with an average wind speed of 11.1 mph during 2020; July was the calmest month with an average wind speed of 7.4 mph. The average wind speed in 2020 was 10.0 mph. Wind conditions appear to be similar between the period from 2015 through 2020 and during 2020.

Table 2-8. NLDAS Gridded Maximum, Average, and Minimum Monthly Wind Speed at the Wharf Mine (2020)

Wind Speed (mph)	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Maximum	33.2	22.7	26.0	31.4	30.3	29.9	23.4	24.5	29.7	33.5	29.4	36.2	29.2
Average	9.9	10.1	9.6	11.1	10.5	10.5	7.4	8.4	9.3	11.0	11.0	10.9	10.0
Minimum	0.6	0.3	0.4	0.6	0.5	0.8	0.1	0.1	0.6	0.3	2.0	0.0	0.5

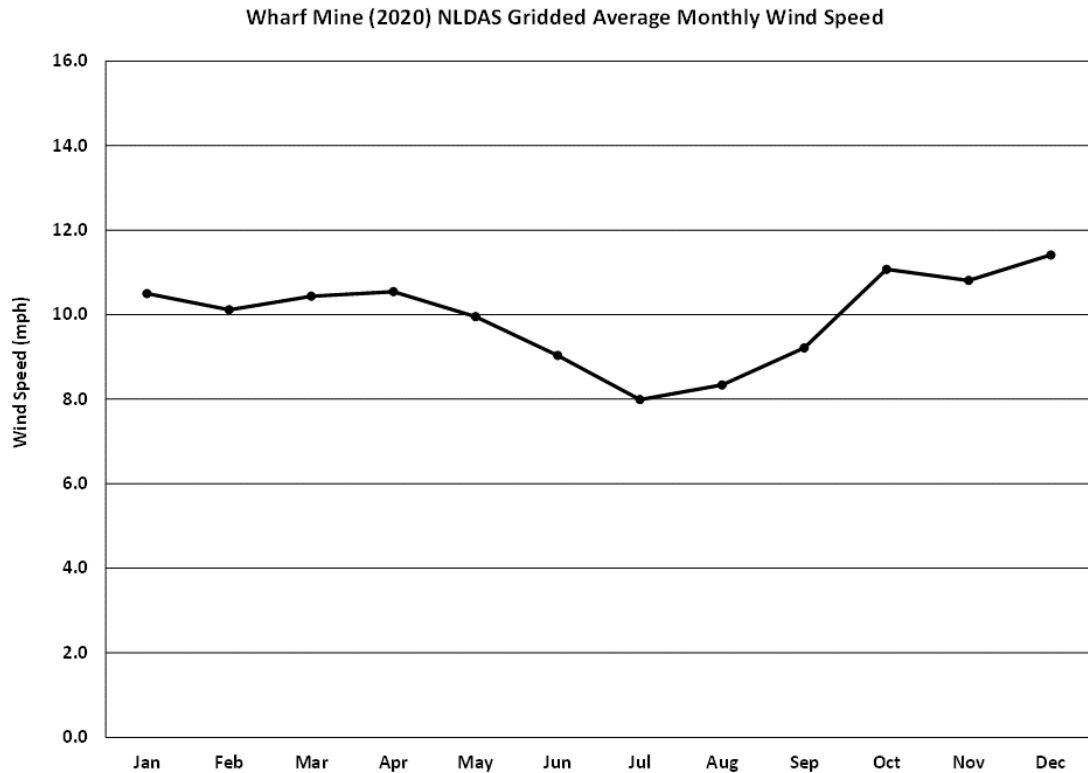


Figure 2-13. Monthly NLDAS Gridded Average Wind Speed During 2020 at the Wharf Mine.

Wind roses summarize recorded wind speeds and directions by depicting the frequency of wind occurrence in each of the specified direction sectors and speed classes for a given location and time. Statistical analysis and visualization of the NLDAS wind speed and vector data were performed using WRPLOT View Version 8.0.2 distributed by Lakes Environmental Inc. [2018]. WRPLOT View generates wind rose statistics based on meteorological data.

An overall 2015–2020 wind rose for the 7.5-mile grid containing the Wharf Mine and Boston Expansion Area is shown in Figure 2-14 and depicts that most winds were from the northwest. Figure 2-15 displays the overall wind class frequency distribution and indicates that the 12.7–19.7 mph wind class is the most prevalent. The next most prevalent overall wind class is the ≥ 24.8 mph wind class.

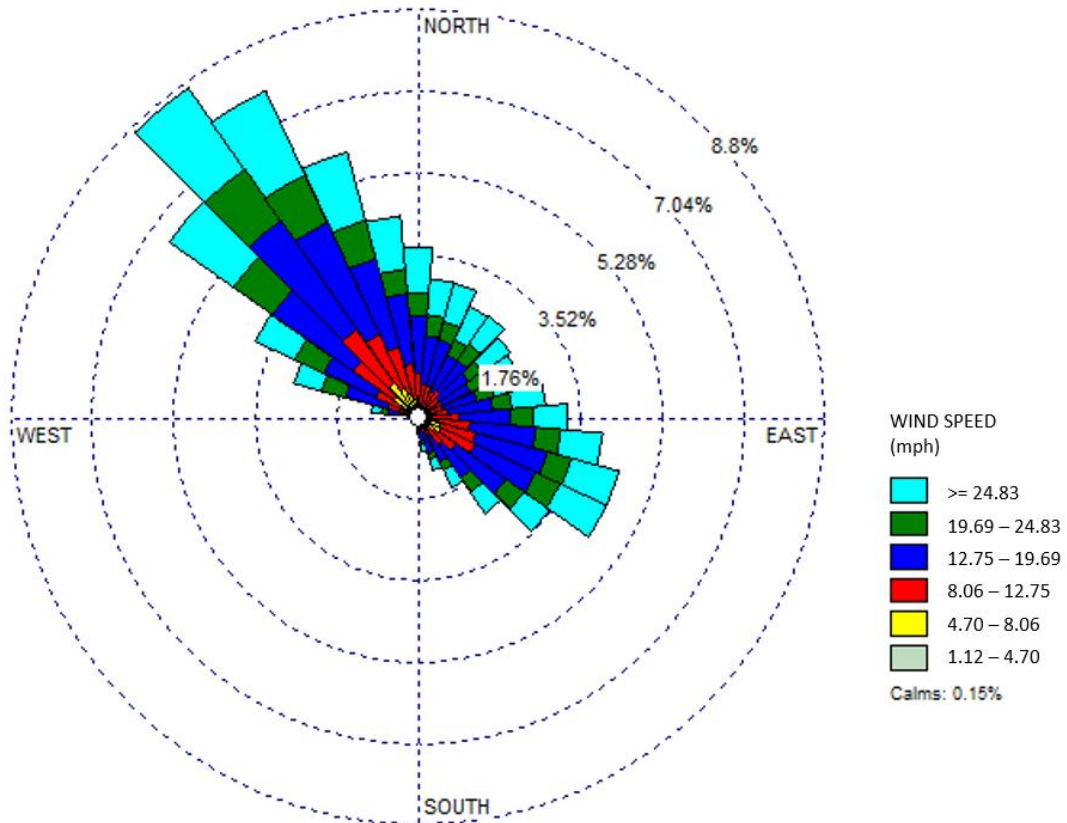


Figure 2-14. Wind Rose of NLDAS Gridded Wind Speed and Wind Vector From 2015 Through 2020 for the Wharf Mine.

Seasonal wind roses were also constructed from the NLDAS gridded wind data from 2015 through 2020. Figure 2-16 shows that the winter winds were most prevalent from the northwest, summer winds were prevalent from the southeast, and spring and fall were from mixed directions. Figure 2-17 includes the wind class frequency distributions for winter, spring, summer, and fall seasons and indicates that the 12.7–19.7 mph wind class to be the most prevalent through the seasons. The next most prevalent seasonal wind class is the ≥ 24.8 mph wind class.

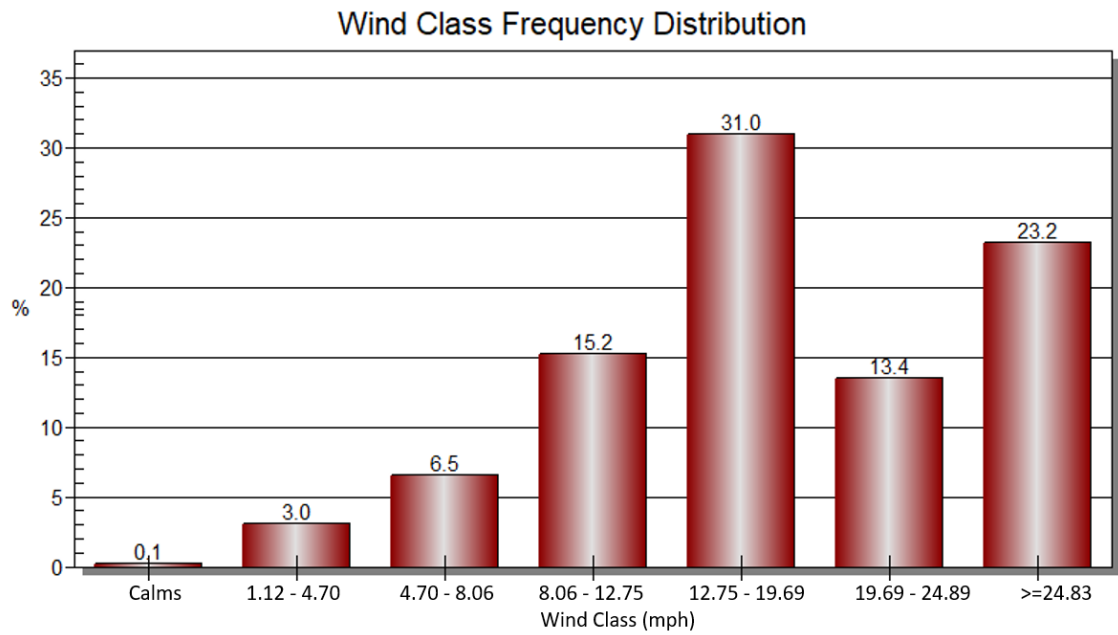


Figure 2-15. Frequency Distribution by Wind Class of NLDAS Gridded Wind Speed From 2015 Through 2020 for the Wharf Mine.

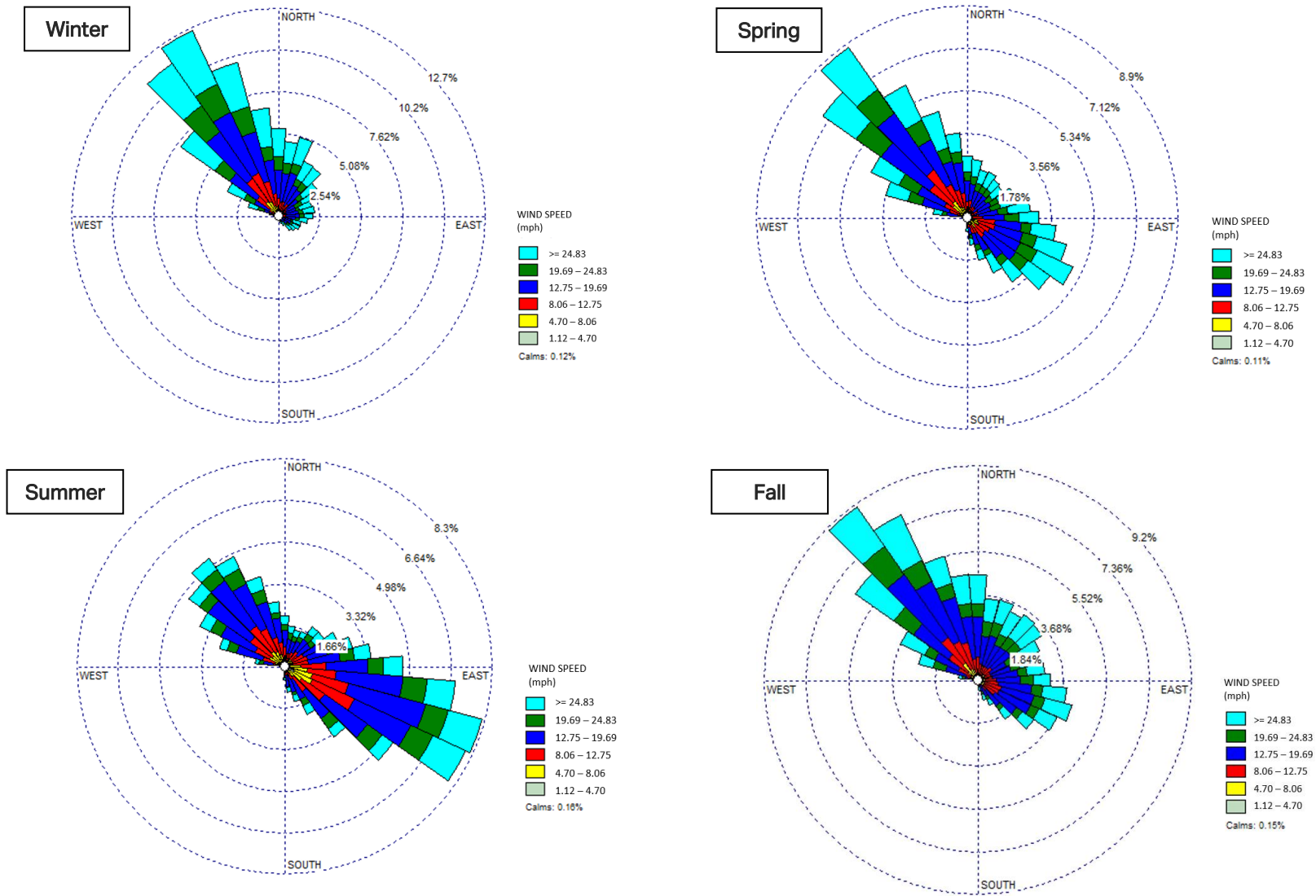


Figure 2-16. Winter, Spring, Summer, and Fall Seasonal Wind Roses of NLDAS Gridded Wind Speed and Wind Vector From 2015 Through 2020 for the Wharf Mine.

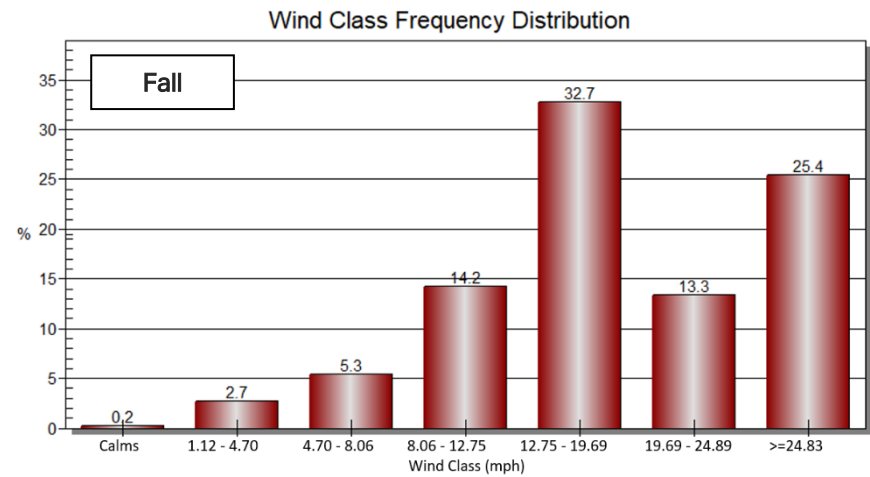
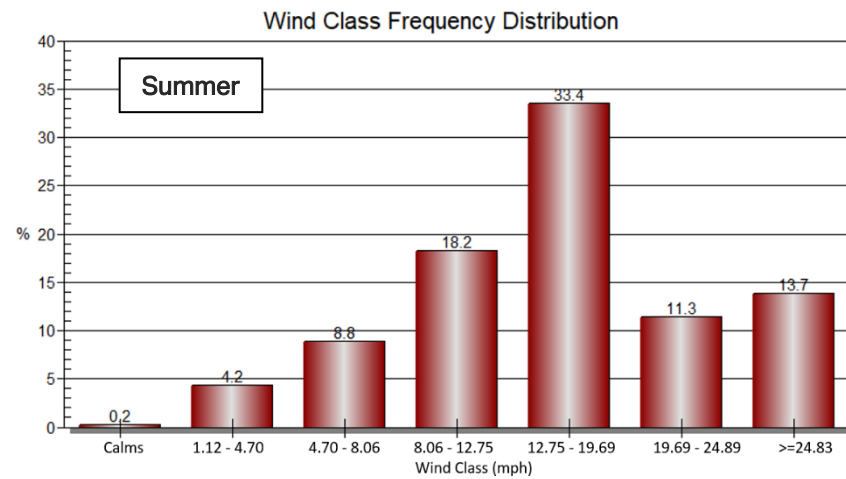
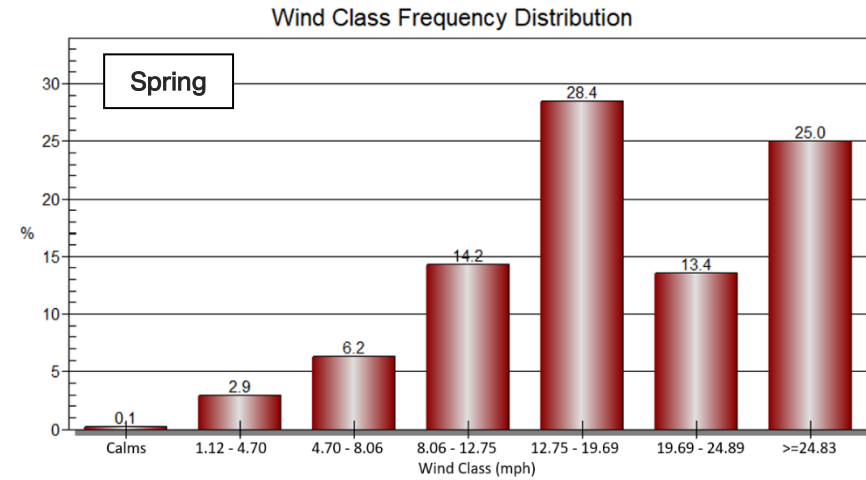
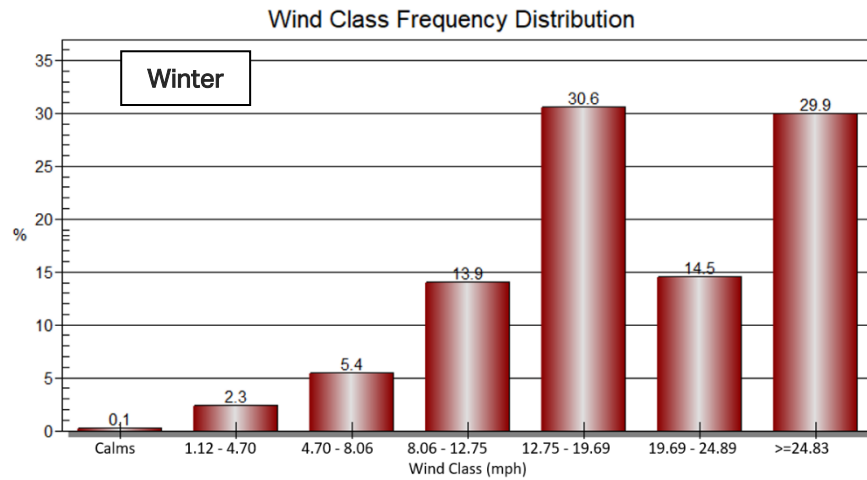


Figure 2-17. Winter, Spring, Summer, and Fall Seasonal Frequency Distributions by Wind Class of NLDAS Gridded Wind Speed for the Wharf Mine From 2015 Through 2020.

3.0 CONCLUSIONS AND RECOMMENDATIONS

The objective of this report was to satisfy the SD DANR mining meteorological characterization requirements of describing the site meteorology and developing a meteorological monitoring plan (Administrative Rules of South Dakota 74:29:02:11(8)) [South Dakota Legislature Administrative Rules, 2021]. This characterization of the meteorological conditions occurring near the Boston Expansion Area will assist Wharf in understanding trends in temperature, precipitation, and wind patterns. This baseline analysis included data from the Lead meteorological station (temperature, precipitation, and snow), the Wharf meteorological station (temperature and precipitation), and the NLDAS gridded dataset (wind speed and direction) from 2015 through 2020. Based on the proximity and close representativeness of the data from the Lead meteorological station and the availability of gridded data through the NLDAS, no additional meteorological monitoring is recommended for the Boston Expansion Area. Continued on-site precipitation and temperature data collection at the Wharf meteorological station is recommended.

4.0 REFERENCES


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Lakes Environmental, Inc., 2018. "WRPLOT View v.8.0.2. Freeware Wind Rose Plots for Meteorological Data," accessed March 11, 2021, <http://www.weblakes.com/products/wrplot/index.html>


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South Dakota Legislature Administrative Rules, 2021. "Chapter 74:29:02:11, Effect on Hydrologic Balance and on Surface Water and Groundwater," accessed June 16, 2021, from <https://sdlegislature.gov/Rules/Administrative/27584>



APPENDIX A

STATISTICAL METEOROLOGICAL REPORTS FOR THE LEAD STATION



APPENDIX A: STATISTICAL METEOROLOGICAL REPORTS FOR THE LEAD STATION

Table A-1. 2015–2020 Temperatures (°F) for the Lead Meteorological Station

Month	<i>N</i>	Maximum	Average	StdDev	Minimum
January	186	39.3	29.0	11.0	18.7
February	170	37.3	26.5	14.1	15.8
March	186	48.6	37.3	11.0	26.1
April	180	53.6	42.4	10.8	31.2
May	186	62.0	51.2	9.6	40.4
June	180	77.2	64.9	7.4	52.5
July	186	81.8	69.3	5.5	56.8
August	186	79.7	66.8	6.4	53.9
September	180	71.8	59.7	9.6	47.7
October	186	55.8	44.9	12.5	34.0
November	180	47.2	37.2	11.2	27.2
December	185	36.8	27.8	12.7	18.8
Total	2,191	57.6	46.4	10.2	35.3

*F = degrees Fahrenheit.

Table A-2. 2015–2020 Monthly Precipitation for the
Lead Meteorological Station (Page 1 of 3)

Month	<i>N</i>	Sum of Precipitation
<i>2015</i>		
January	31	1.1
February	28	1.8
March	31	0.5
April	30	2.7
May	31	9.2
June	30	6.2
July	31	3.9
August	31	4.2
September	30	1.2
October	31	2.5
November	30	0.6
December	31	1.5
Total	365	35.4
<i>2016</i>		
January	31	1.2
February	29	1.7
March	31	2.5
April	30	2.5
May	31	1.6
June	30	0.9
July	31	2.5
August	31	2.8
September	30	2.1
October	31	1.0
November	30	1.4
December	31	1.3
Total	366	21.5

Table A-2. 2015–2020 Monthly Precipitation for the
Lead Meteorological Station (Page 2 of 3)

Month	<i>N</i>	Sum of Precipitation
<i>2017</i>		
January	31	1.1
February	28	0.7
March	31	1.2
April	30	2.5
May	31	3.3
June	30	3.3
July	31	1.6
August	31	1.1
September	30	2.3
October	31	1.3
November	30	0.9
December	31	1.7
Total	365	21.0
<i>2018</i>		
January	31	1.2
February	28	2.0
March	31	2.0
April	30	2.6
May	31	5.3
June	30	6.1
July	31	4.0
August	31	2.3
September	30	1.7
October	31	1.3
November	30	1.6
December	31	1.6
Total	365	31.7

Table A-2. 2015–2020 Monthly Precipitation for the
Lead Meteorological Station (Page 3 of 3)

Month	<i>N</i>	Sum of Precipitation
<i>2019</i>		
January	31	1.9
February	28	0.8
March	31	1.8
April	30	3.1
May	31	7.3
June	30	3.8
July	31	8.8
August	31	3.7
September	30	2.2
October	31	3.8
November	30	2.0
December	31	1.2
Total	365	40.4
<i>2020</i>		
January	31	1.1
February	29	3.0
March	31	1.3
April	30	2.6
May	31	3.0
June	30	2.6
July	31	3.4
August	31	1.0
September	30	1.6
October	31	2.8
November	30	0.2
December	31	0.9
Total	366	23.5
2015–2020 Total	2,192	173.5

Table A-3. 2015–2020 Average Monthly Precipitation for the Lead Meteorological Station

Month	<i>N</i>	Average	StdDev
January	6	1.3	0.3
February	6	1.6	0.8
March	6	1.5	0.7
April	6	2.7	0.2
May	6	5.0	2.9
June	6	3.8	2.1
July	6	4.0	2.5
August	6	2.5	1.3
September	6	1.8	0.4
October	6	2.1	1.1
November	6	1.1	0.7
December	6	1.4	0.3
Total	72	2.4	1.8

Table A-4. 2015–2020 Monthly Snowfall for Lead Meteorological Station (Page 1 of 3)

Month	<i>N</i>	Sum of Snowfall (inches)
<i>2015</i>		
January	31	13.04
February	28	25.07
March	31	5.00
April	30	0.51
May	31	20.83
June	30	0
July	31	0
August	31	0
September	30	0
October	31	0
November	30	10.12
December	31	24.74
Total	365	99.31
<i>2016</i>		
January	31	15.70
February	29	16.93
March	31	15.98
April	30	10.45
May	31	0
June	30	0
July	31	0
August	31	0
September	30	0
October	31	0
November	30	22.01
December	31	16.96
Total	366	98.03

Table A-4. 2015–2020 Monthly Snowfall for Lead Meteorological Station (Page 2 of 3)

Month	<i>N</i>	Sum of Snowfall (inches)
<i>2017</i>		
January	31	20.87
February	28	8.97
March	31	4.48
April	30	11.03
May	31	0
June	30	0
July	31	0
August	31	0
September	30	0
October	31	1.22
November	30	2.99
December	31	25.73
Total	365	75.29
<i>2018</i>		
January	31	18.46
February	28	29.33
March	31	22.99
April	30	24.84
May	31	0
June	30	0
July	31	0
August	31	0
September	30	1.5
October	31	9.01
November	30	13.74
December	31	27.86
Total	365	147.73

Table A-4. 2015–2020 Monthly Snowfall for Lead Meteorological Station (Page 3 of 3)

Month	<i>N</i>	Sum of Snowfall (inches)
<i>2019</i>		
January	31	20.07
February	28	8.02
March	31	26.97
April	30	21.96
May	31	29.05
June	30	0
July	31	0
August	31	0
September	30	0
October	31	38.11
November	30	20.47
December	31	25.78
Total	365	190.43
<i>2020</i>		
January	31	15.55
February	29	51.53
March	31	12.51
April	30	28.19
May	31	2
June	30	0
July	31	0
August	31	0
September	30	7.01
October	31	17.98
November	30	3.7
December	31	13.58
Total	366	152.05
2015–2020 Total	2,192	762.84



APPENDIX B

STATISTICAL METEOROLOGICAL REPORTS FOR THE WHARF MINE



APPENDIX B: STATISTICAL METEOROLOGICAL REPORTS FOR THE WHARF MINE

Table B-1. 2015–2020 7 a.m. Temperatures (°F) for the Wharf Mine

Month	<i>N</i>	Maximum	Average	StdDev	Minimum
January	186	54	21	12	–14
February	170	48	19	15	–18
March	186	55	26	12	–18
April	179	54	31	11	–1
May	186	84	42	10	21
June	179	76	55	8	28
July	178	76	59	7	42
August	186	73	56	9	0
September	180	74	50	11	0
October	186	61	35	13	–4
November	180	57	29	12	–4
December	186	51	20	13	–24
Total	2,182	84	37	18	–24

°F = degrees Fahrenheit.

Table B-2. 2015–2020 Monthly Precipitation for the Wharf Mine (Page 1 of 3)

Month	<i>N</i>	Sum of Precipitation
<i>2015</i>		
January	31	1.1
February	28	1.9
March	31	0.6
April	30	1.7
May	31	8.5
June	30	6.6
July	30	3.7
August	31	3.0
September	30	2.1
October	31	2.4
November	30	0.8
December	31	1.6
Total	364	34.0
<i>2016</i>		
January	31	1.1
February	29	1.9
March	31	0.6
April	30	1.7
May	31	8.5
June	30	6.6
July	31	3.7
August	31	3.0
September	30	2.1
October	31	2.4
November	30	0.8
December	31	1.6
Total	366	34.0

Table B-2. 2015–2020 Monthly Precipitation for the Wharf Mine (Page 2 of 3)

Month	<i>N</i>	Sum of Precipitation
<i>2017</i>		
January	31	0.9
February	28	1.0
March	31	1.7
April	30	2.9
May	31	2.2
June	30	3.3
July	31	2.9
August	31	1.9
September	30	2.2
October	31	1.0
November	30	1.1
December	31	2.2
Total	365	23.3
<i>2018</i>		
January	31	1.9
February	28	2.0
March	31	1.7
April	30	2.9
May	31	6.6
June	30	7.0
July	31	6.2
August	31	2.2
September	30	1.3
October	31	2.1
November	30	1.2
December	31	1.9
Total	365	37.0

Table B-2. 2015–2020 Monthly Precipitation for the Wharf Mine (Page 3 of 3)

Month	<i>N</i>	Sum of Precipitation
<i>2019</i>		
January	31	2.2
February	28	1.0
March	31	2.4
April	30	3.1
May	31	7.9
June	30	2.3
July	31	5.7
August	31	2.3
September	30	1.7
October	31	3.3
November	30	1.7
December	31	1.4
Total	365	35.0
<i>2020</i>		
January	31	2.2
February	29	1.0
March	31	2.4
April	30	3.1
May	31	7.9
June	30	2.3
July	31	5.7
August	31	2.3
September	30	1.7
October	31	3.3
November	30	1.7
December	31	1.4
Total	366	35.0
2015–2020 Total	2,191	198.30

Table B-3. 2015–2020 Average Monthly Precipitation for the Wharf Mine

Month	<i>N</i>	Average	StdDev
January	6	1.6	0.5
February	6	2.1	1.5
March	6	1.9	1.1
April	6	2.8	0.6
May	6	4.9	3.1
June	6	3.7	2.5
July	6	4.2	1.7
August	6	2.1	0.8
September	6	1.8	0.5
October	6	2.3	1.1
November	6	1.1	0.7
December	6	1.6	0.6
Total	72	2.5	1.8