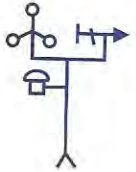




TECHNICAL ENVIRONMENTAL SERVICES, LLC



Mr. Jamie Foster
Department of Environmental Protection
Division of Solid Waste Services
16101 Frederick Road
Derwood, MD 20855

April 3, 2019

Dear Jamie:

GUDE DRIVE 2018 ANNUAL METEOROLOGICAL REPORT

Enclosed is the Gude Drive Annual Meteorological Report for 2018. This report summarizes the meteorological data collected at the Gude Drive landfill facility located in Rockville, Maryland. Data Collection for the year was very good averaging near 100% for all parameters. There were no major instrument problems during the year that resulted in data loss. There were a few time periods when the rain gauge was found to be clogged. Data from Dickerson was used during these time periods to replace the Gude data.

If you have any questions, please call or e-mail them to me.

Best regards,

Mark Abrams
President - TES

**GUDE DRIVE LANDFILL ANNUAL
METEOROLOGICAL REPORT
FOR 2018**

**Prepared for
THE MONTGOMERY COUNTY GOVERNMENT**

By

TECHNICAL ENVIRONMENTAL SERVICES, LLC

APRIL 2019

TABLE OF CONTENTS

	Page
TITLE PAGE	1
TABLE OF CONTENTS	2
1. INTRODUCTION	3
2. INPUT DATA	3
2.1 Meteorological Data	3
3. Summary of Gude Dr. 2018 Meteorological Data	4
4. REFERENCES	6

List of Tables

Table 1 Gude Dr. Meteorological Tower Data Recovery January-December 2018.....	7
Table 2 Hourly and Annual Average of Wind Speed, Temperature, Relative Humidity and Solar Radiation for 2018.....	8
Table 3 2018 Yearly Rainfall from Gude Dr. and Nearby Stations.....	9

List of Figures

Figure 1 Gude Dr. 10M Wind Rose 2018.....	10
Figure 2 Gude Dr. 10M Wind Rose Winter 2018	11
Figure 3 Gude Dr. 10M Wind Rose Spring 2018	12
Figure 4 Gude Dr. 10M Wind Rose Summer 2018.....	13
Figure 5 Gude Dr. 10M Wind Rose Fall 2018.....	14
Figure 6 Gude Dr. Daily Average, Minimum, and Maximum 2M Dry-Bulb Temperature 2018.....	15
Figure 7 Gude Dr. Daily Average, Minimum, and Maximum 2M Relative Humidity 2018	16

1. INTRODUCTION

The purpose of this report is to provide a summary of the 2018 meteorological data collection at the Gude Dr. Landfill Remission site. All the calculations used hourly meteorological data from the Gude Dr. meteorological tower. The hourly averaged data came from the onsite Campbell Scientific CR-300 data logger.

2. INPUT DATA

2.1 Meteorological Data

The meteorological data used in all calculations was generated by the onsite Campbell Scientific data logger. The data are hourly averages, except for the rainfall data that is the total rainfall for the hour. Technical Environmental Services collected this data via a cellular telephone interface and by downloading data to a laptop computer. Once the data was received it was reviewed and edited where necessary by a meteorologist. Periods of bad or missing data were left out of all calculations.

3.

SUMMARY OF GUDE DRIVE LANDFILL. 2018 METEOROLOGICAL DATA

The meteorological data collection at Gude Dr. was very good in 2018 with all parameters averaging near 100% for the year. All the data were collected using the onsite CR-300 data logger. The rainfall data was compared with data from the National Weather Service at Dulles Airport and other cooperative sites in Maryland. Table 1 summarizes the data collection for 2018. The year was highlighted by record rainfall.

There were no instrument problems during 2018. The meteorological instrumentation was calibrated during June and December.

Figures 1 through 5 show annual and seasonal wind roses from the 3m level. The predominant wind direction at Gude Dr. during 2018 was from the north-northwest. This was followed by secondary peak of winds from the northwest, north-northeast and the south-southwest. The winds vary with the season with winds predominantly from the northwest to the north-northwest and the south to south-southwest in the winter and the northwest to the north-northwest in spring months. During the summer winds were predominantly from the north-northeast to the northeast. The fall showed winds predominant winds from the northwest to the north-northwest and the northeast. The predominant wind direction for any given month is highly correlated to the weather pattern. During periods of cold weather, the winds are from the northwest to the north-north. During warm periods the winds are from the northeast. The average wind speed for the year was 4.7 mph and the highest hourly average was 27.9 mph on March 2, 2018. The average wind speed for the year was a little below the average wind speed (4.8 mph) over a previous 5-year period. Table 2 shows the average hourly wind speed for each hour of the day over the annual period of 2018.

Figures 6 and 7 show plots of the daily maximum, minimum and average temperatures and relative humidity. The temperatures for the year averaged about normal. Temperatures were below average for the first four months of the year and then mostly above average for the remainder of 2018. This resulted in an overall average temperature for the year of 56.2° F at Dulles airport, which was 1.0° F above the long-term average temperature of 55.2° F (at Dulles airport⁽¹⁾). The average temperature at Gude Dr. was 55.4° F, which was about average for the area. The maximum temperature in 2018 was 95.0° F. on July 2nd and the minimum temperature was 3.8° F. on January 3rd. Table 2 shows the average hourly temperature (55.4° F) at Gude Dr. over the annual 2018 period. Also, shown in Table 2 are hourly averages of relative humidity. The annual average relative humidity reading of 71.7% is above the long-term average of 70% from Dulles Airport. This was caused by the record rainfall which increased the overall moisture level for the year.

The rainfall total at Gude Dr. for 2018 was 62.23 inches. Rainfall in the Gude Dr. area during 2018 was record setting, well above the area annual average of 41 inches. Table 3 shows monthly and annual rainfall totals for the year from Gude Dr. and several other NWS and cooperative sites⁽²⁾ in the area. There was good agreement between Gude Dr. and Dulles airport and the cooperative stations, but there was less rainfall recorded at Gude Dr. than any other site. There were a couple of time periods when the rain gauge was found to be clogged with debris. This could have contributed to the slightly lower rainfall totals. Also, this rain gauge does not have a heater, so snowfall is for the most part not accounted for. During 2018

there were 8 days when more than one inch of rain fell. The maximum daily rainfall occurred on September 6 with 2.16 inches. There were several months, May, July, September and November with high precipitation totals. There were a few months, February and March with low rainfall amounts.

REFERENCES:

1. NOAA, NCDC, Local Climatological Data from Dulles Airport for 2018.
2. NOAA, NCDC, Cooperative Weather Stations, Maryland Stations of Sharpsburg, Damascus and Brighton Dam, for 2018.

<p style="text-align: center;">TABLE 1</p> <p style="text-align: center;">GUDE DRIVE METEOROLOGICAL TOWER DATA RECOVERY JANUARY-DECEMBER 2018</p>	
PARAMETER	RECOVERY (percent)
Wind Speed 3m	100.0
Wind Direction 3m	100.0
Temperature 2m	100.0
Relative Humidity 2m	100.0
Precipitation	100.0

Table 2

Hourly and Annual Average of Wind Speed,
Temperature and Relative Humidity for 2018

Time of day	Wind Speed (mph)	Temperature (°F)	Relative Humidity (%)
0	3.62	53.21	79.40
1	3.55	52.43	80.40
2	3.56	51.88	81.50
3	3.46	51.29	82.30
4	3.47	50.79	83.10
5	3.43	50.35	83.80
6	3.42	50.17	84.00
7	3.67	50.90	82.20
8	4.29	52.51	78.40
9	5.09	54.57	73.40
10	5.71	56.60	68.50
11	6.10	58.33	64.70
12	6.23	59.69	61.90
13	6.39	60.81	59.80
14	6.47	61.63	58.40
15	6.45	62.21	57.80
16	6.20	61.89	58.70
17	5.71	61.15	60.20
18	5.03	59.94	63.00
19	4.38	58.42	66.60
20	4.10	56.91	69.80
21	3.99	55.60	72.70
22	3.82	54.71	75.30
23	3.74	53.89	77.50
Annual Average	4.52	55.40	71.81

TABLE 3
2018 Yearly Rainfall

	Dickerson		Dulles		Gude Dr.		Sharpsburg	
January	1.48		1.79		1.45		*	
February	4.06		4.60		5.14		*	
March	1.99		1.79		1.63		2.24	
April	2.86		3.55		4.97		3.93	
May	6.51		8.93		7.10		12.91	
June	5.33		4.18		2.29		5.37	
July	9.74		11.21		8.55		8.24	
August	8.55		7.23		4.32		5.68	
September	11.00		7.36		10.47		10.47	
October	2.18		2.68		2.56		1.71	
November	7.69		7.68		7.77		7.57	
December	5.58		5.76		5.58		5.60	
Total	67.02		66.76		62.23		63.72+	

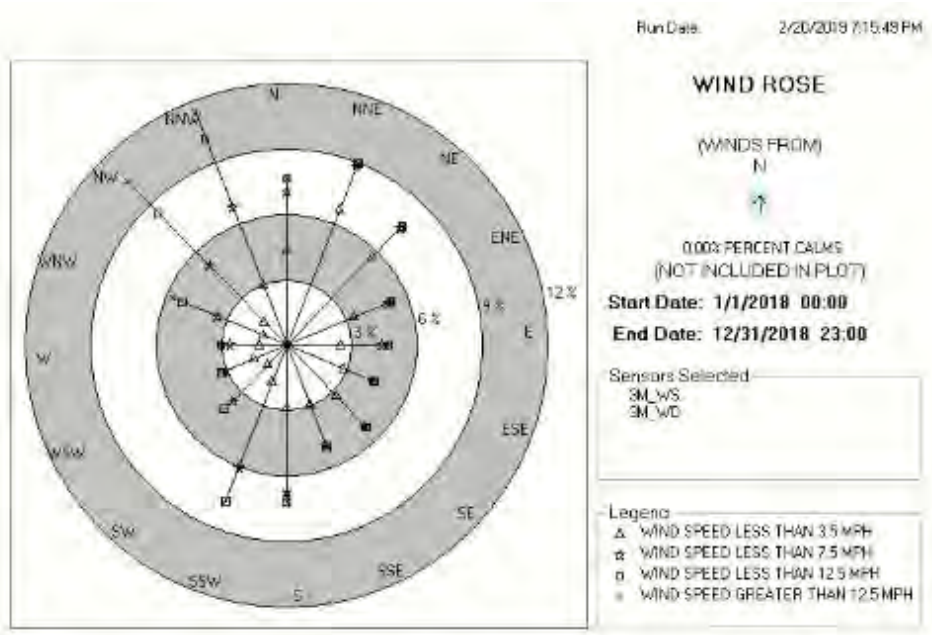


Figure 1 - Gude Dr. Annual Wind Rose for 2018

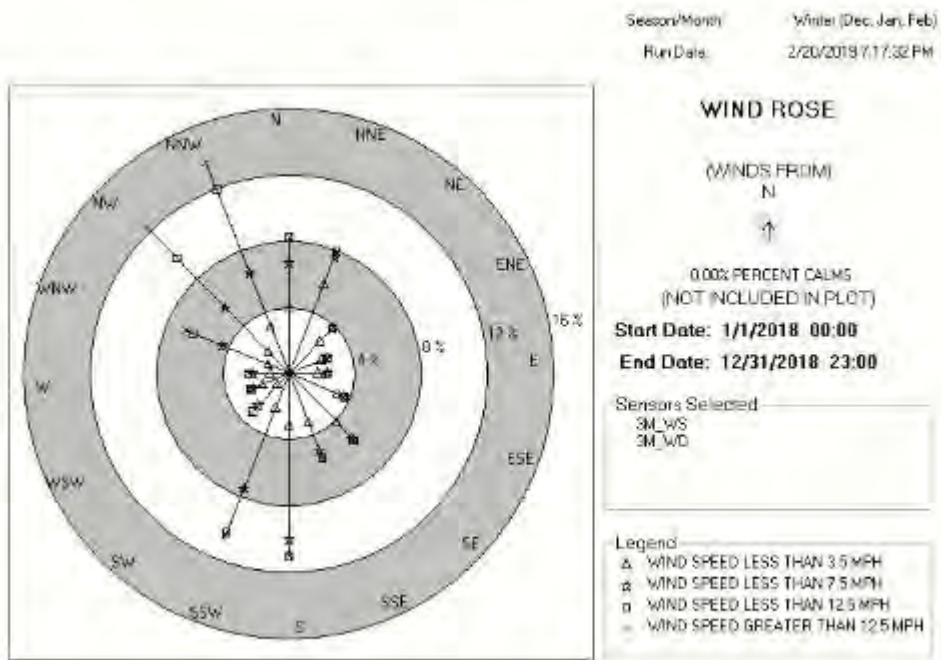


Figure 2 - Gude Dr. Winter Wind Rose for 2018

Season/Month: Spring (Mar, Apr, May)
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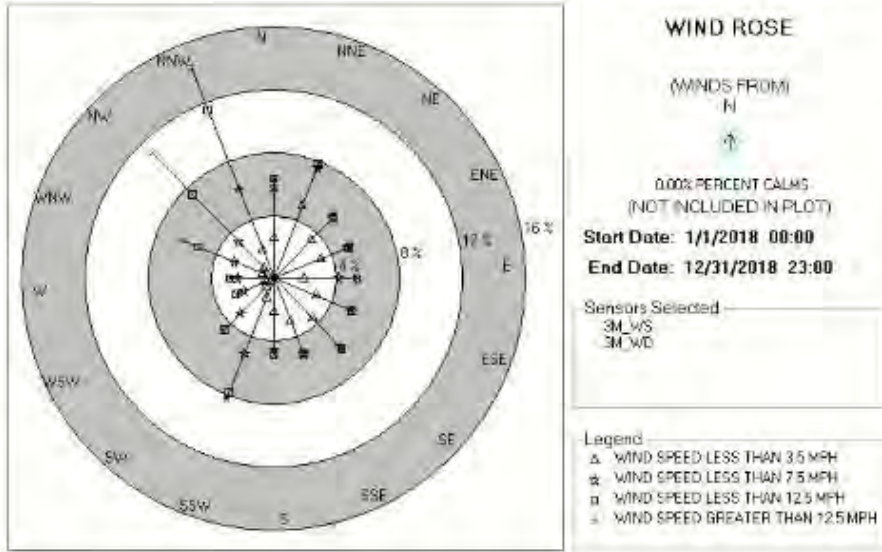


Figure 3 - Gude Dr. Spring Wind Rose for 2018

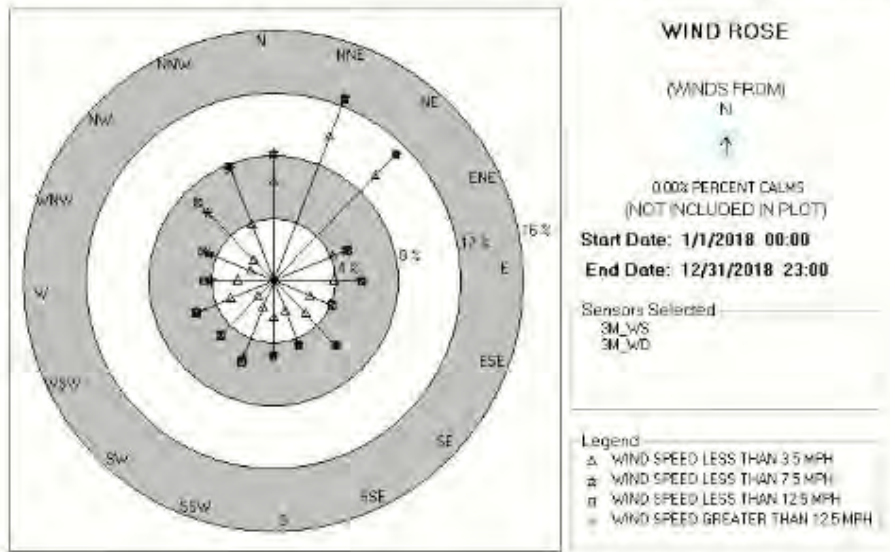


Figure 4 - Gude Dr. Summer Wind Rose for 2018

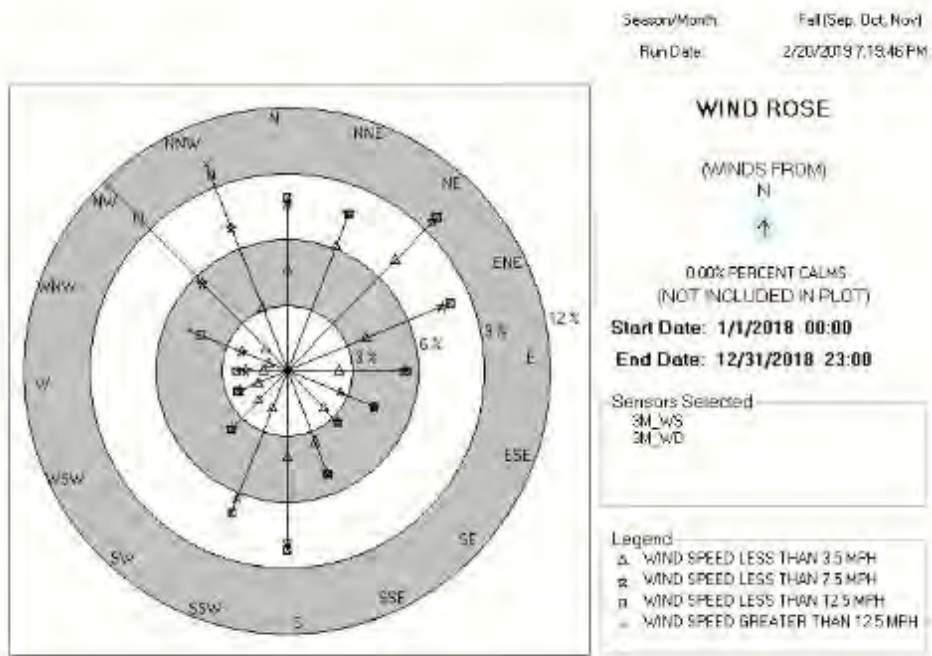


Figure 5 - Gude Dr. Fall Wind Rose for 2018

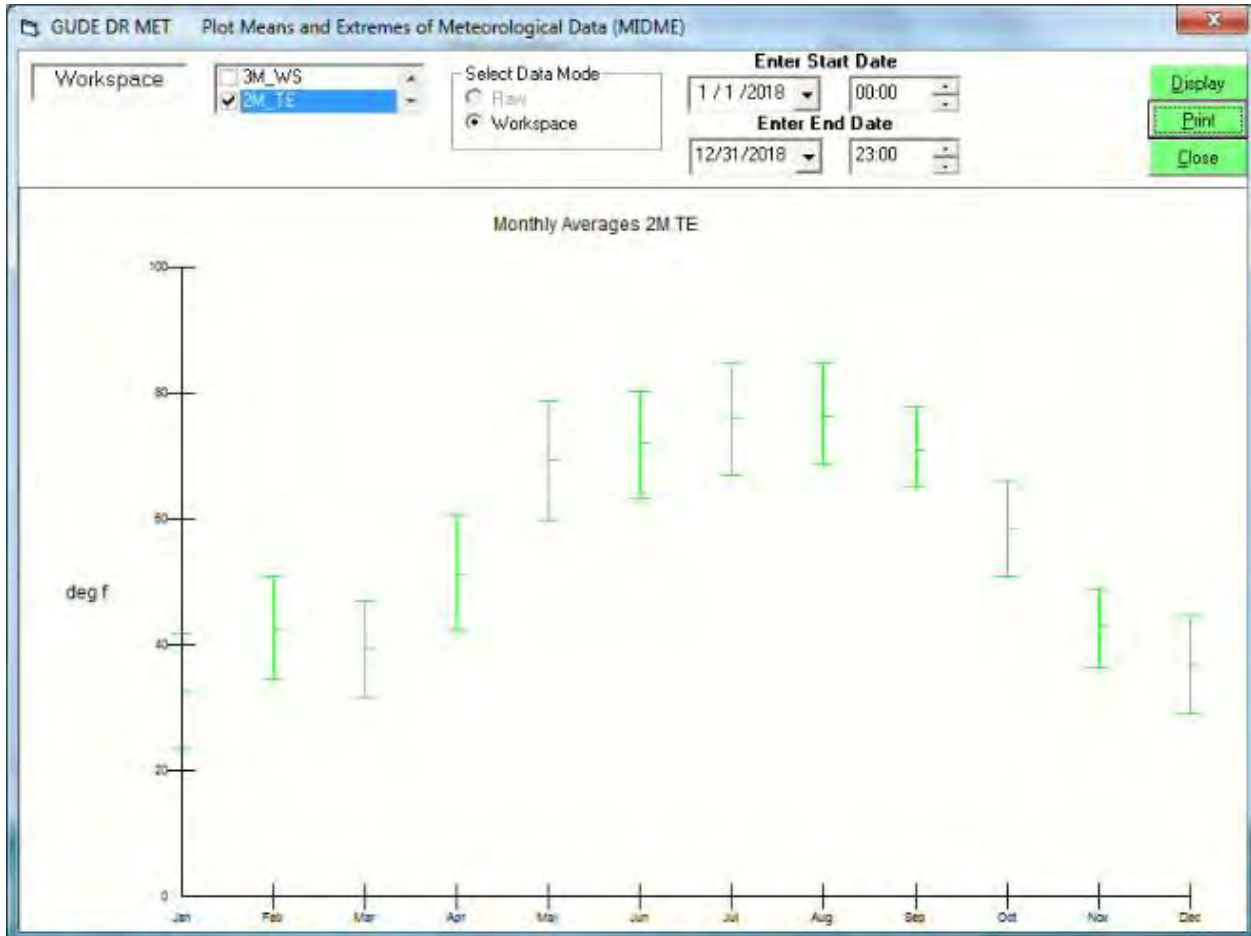


Figure 6 - Gude Dr. 2M Temperature Max. Avg. and Min. for 2018

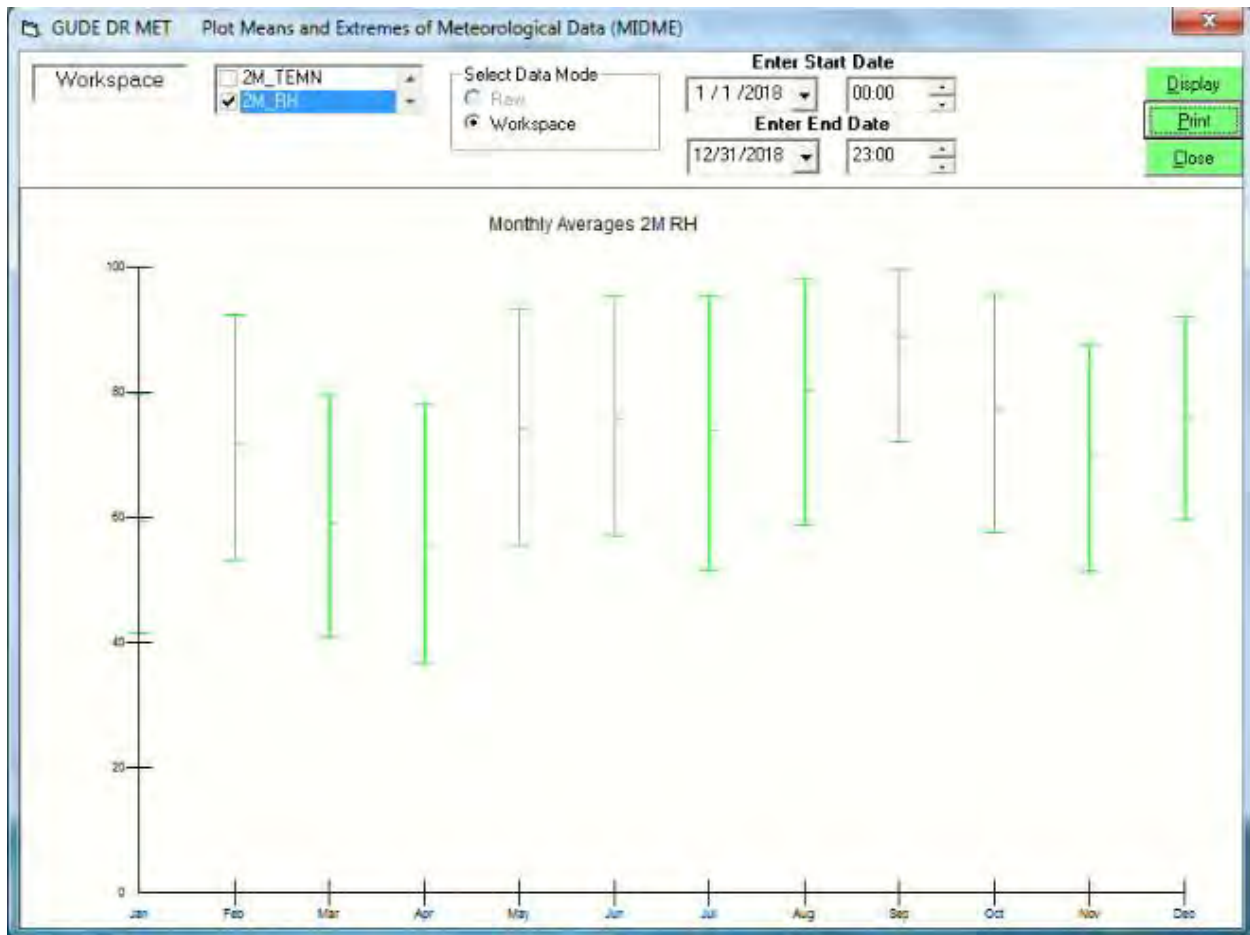


Figure 6 - Gude Dr. 2M Relative Humidity Max. Avg. and Min. for 2018