Government of Newfoundland and Labrador

Real Time Water Quality Monthly Report for Voisey's Bay Nickel Company Ltd. July 2006

General

- The Water Resources Management Division staff monitors the real-time web page on a daily basis.
- Voisey's Bay Nickel Company Ltd. will continue to be informed of any significant water quality events in the future in the form of a monthly report.

Maintenance and Calibration of Instrumentation

- As noted in the previous monthly report, it was anticipated that the Environment Canada staff and Department of Environment and Conservation staff would be on-site in early July with a helicopter available to perform the necessary maintenance/calibrations on the real-time water quality monitoring equipment.
- The Environment Canada staff and Department of Environment and Conservation staff arrived on-site July 5th and assisted the VBNC staff in removing the two instruments that were deployed in Camp Pond Brook and Lower Reid Brook.
- These two instruments were cleaned/calibrated and deployed back in Camp Pond Brook and Lower Reid Brook on July 6th, 2006.
- Upon removal and redeployment at both stations, Minisonde readings were taken for QA/QC purposes. The results from comparing the Minisonde values to the Datasonde values can be seen in **Table 1**. As was expected due to the extended deployment period from May 26th – July 5th, the pH and dissolved oxygen values drifted at the Lower Reid Brook station resulting in a "marginal" and "poor" ranking respectively upon removal. At Camp Pond Brook, it appears as though the temperature and dissolved oxygen probes were fouled causing a drift in values resulting in two "fair" rankings upon removal. When both instruments were reinstalled after having been calibrated, the comparisons ranked "good" and "excellent" in most cases. It appears as though the conductivity probe on the Minisonde was not functioning properly leading to "poor" and "fair" rankings. Additionally, the dissolved oxygen readings only compared as a "fair" ranking at the Lower Reid Brook station. In all likelihood, the Minisonde could not establish an accurate dissolved oxygen reading due to the silty bottom.

Table 1: QA/QC Data Comparison Rankings (Lr. Reid Brook & Camp Pond Brook)

Station	Date	Action	Minisonde vs. Datasonde Comparison Ranking			
			Temperature	pH	Conductivity	Dissolved Oxygen
Lower Reid Brook	July 5th, 2006	Removal	Excellent	Marginal	Good	Poor
	July 6th, 2006	Installation	Excellent	Good	Poor	Fair
Camp Pond Brook	July 5th, 2006	Removal	Fair	Good	Good	Fair
	July 6th, 2006	Installation	Good	Good	Fair	Excellent

- The Upper Reid Brook could not be deployed in early July because the communication cable (needed to replace the damaged cable) had not arrived from the manufacturer.
- On July 6th, 2006 there was a new instrument deployed at the Tributary to Lower Reid Brook station. The instrument deployed was on loan to VBNC from the Department of Environment and Conservation because VBNC was still awaiting the arrival of the new instrument from the manufacturer. Upon deployment at this new station, Minisonde readings were taken for QA/QC

purposes. The results from comparing the Minisonde values to the Datasonde values can be seen in **Table 2**. In this case, all comparison rankings for all parameters fell within the "excellent" and "good" categories.

Table 2: QA/QC Data Comparison Rankings (Tributary to Lr. Reid Brook)

Station	Date	Action	Minisonde vs. Datasonde Comparison Ranking			
			Temperature	pH	Conductivity	Dissolved Oxygen
Tributary to Lower Reid Brook	July 6th, 2006	Installation	Excellent	Good	Good	Excellent

- On July 6th, 2006, there was also a new instrument (Quanta) deployed in a groundwater well located near the tailings dam between Headwater Pond and Otter Pond.
- All surface water stations were deployed from July 6th – August 11th, 2006 (37 days). Normally a 30 day maintenance/calibration schedule is followed, however, the weather was poor so VBNC staff could not fly in the helicopter to retrieve the instruments until the weather improved (mid-Aug).
- **Table 3** compares the Minisonde values to that of the Datasonde values when the instruments were removed from each station. Even with the slightly extended deployment period, none of the parameters ranked in the "poor" categories (with most parameters ranking in the "excellent" and "good" categories) upon removal. It appears as though dissolved oxygen was the only parameter that may have drifted slightly over the 37 day deployment period.

Table 3: QA/QC Data Comparison Rankings (Lr. Reid Bk; Camp Pond Bk & Trib. to Lr. Reid Bk)

Station	Date	Action	Minisonde vs. Datasonde Comparison Ranking			
			Temperature	pH	Conductivity	Dissolved Oxygen
Lower Reid Brook	August 11th, 2006	Removal	NA*	NA*	NA*	NA*
Camp Pond Brook	August 11th, 2006	Removal	Excellent	Good	Good	Fair
Tributary to Lower Reid Brook	August 11th, 2006	Removal	Excellent	Excellent	Excellent	Fair

* The QA/QC rankings for Lower Reid Brook can not be completed at this time due to the fact that the Lower Reid Brook station is not transmitting data (since July11th); when logged data is available, the rankings will be updated.

- The groundwater station was deployed on July 7th and will remain in the water until September when the Environment Canada and the Department of Environment and Conservation staff return for a site visit; this instrument can be deployed for a longer period of time due to the parameters being monitored (rugged sensors) and the fact that it is a groundwater well with very little change in water quality at this point in time.

Data Interpretation

- As noted previously, the Upper Reid Brook station was unable to be deployed due to damage to the communication cable, therefore there is no data to report for this control station.

- The data from the Lower Reid Brook station cannot be interpreted in this monthly report. On July 11th, 2006 (only 6 days after being deployed) the station stopped transmitting data; VBNC staff investigated the station and learned that a black bear pulled the antenna cable off the roof leaving the station unable to transmit data (**Figure 1**). This problem can only be fixed by Environment Canada staff when they visit the site in September. However, there is a good possibility that the data logger is still recording the data.

- Throughout the deployment period, most of the water quality parameters remained fairly consistent at Camp Pond Brook. As can be seen in **Figures 2 and 3**, the water temperature and dissolved oxygen levels remained constant with only slight fluctuations. Even with warm water temperatures, the dissolved oxygen levels remained well within the acceptable limits to support aquatic life.

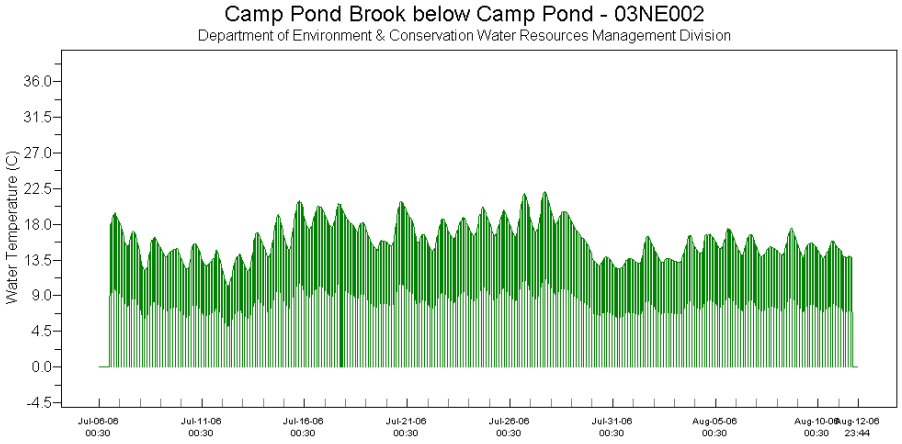
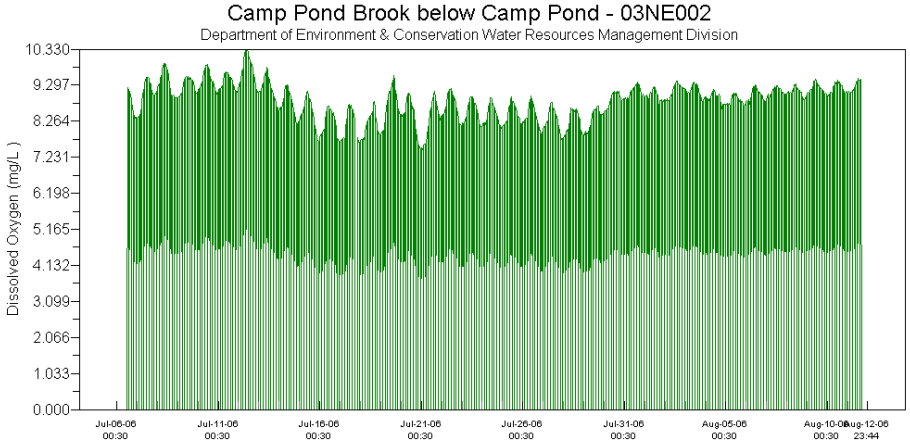


Figure 2

Figure 3



- The conductivity and total dissolved solids values at Camp Pond Brook remained fairly consistent over the deployment period with only two spikes occurring on July 21st and July 30th, 2006 (**Figures 4a & 4b**). The maximum specific conductivity value on each occasion was 35.3 uS/cm and 42.7 uS/cm respectively. The greater of these events (July 30th) may be associated with the increase in stage (increased rainfall – see Appendix A) at that particular time (**Figure 5**).

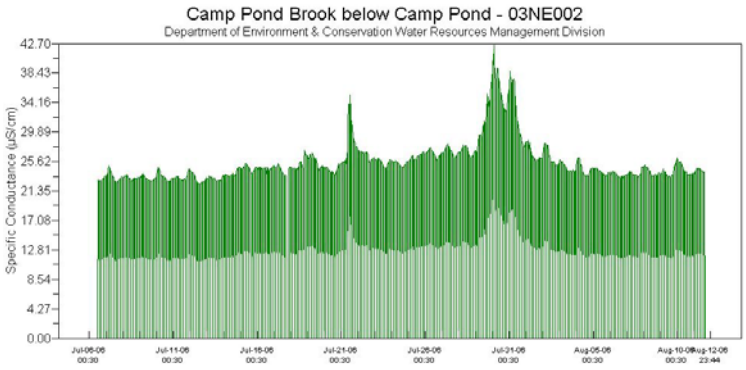


Figure 4a

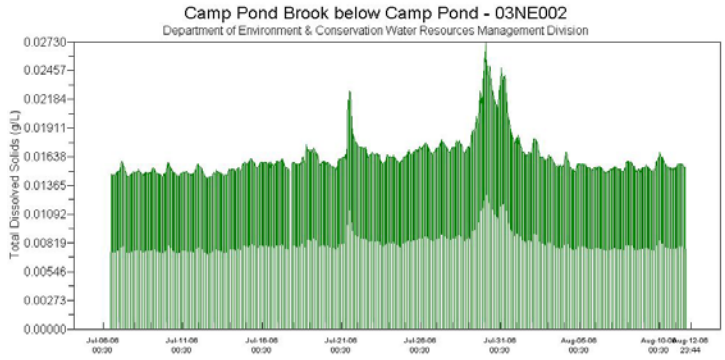


Figure 4b

Total dissolved solids is a calculated reading using the conductivity and water temperature values

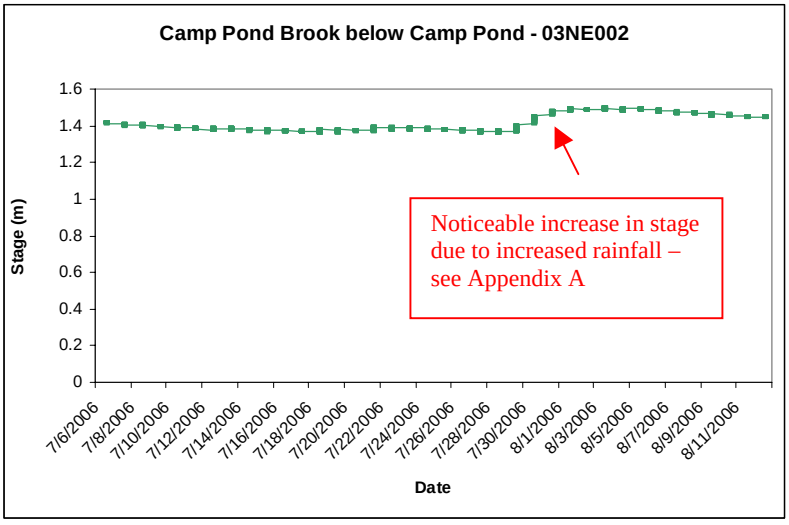


Figure 5

- The turbidity values at Camp Pond Brook remained relatively consistent throughout the month of July but began to fluctuate in early August (**Figure 6**). Again, the increases in turbidity values may be attributed to the significant amount of rainfall in late July (see Appendix A) (**Figure 5**). Of particular note, on July 31st, 2006, there was a point when the turbidity values spiked to a maximum reading of 57 NTU. This increase in turbidity values was caused by sediment-laden water from Sedimentation Pond B being pumped directly into the environment only about 100m from Camp Pond Brook. Some weeks before the incident, the pipeline that allows water to be pumped from Sedimentation Pond B to Sedimentation Pond A was disconnected to allow the pumping down of Sedimentation Pond B using a submersible pump. It was because this pipeline was disconnected that the water accidentally got pumped into the environment. The water flowed over ~50m of exposed material prior to reaching the buffer zone. When the incident was discovered by VBNC staff, the central control room was contacted and the pump was immediately shut down. Additionally, the VBNC staff on-site promptly contacted the Water Resources Management Division (along with other government departments) to report the incident.

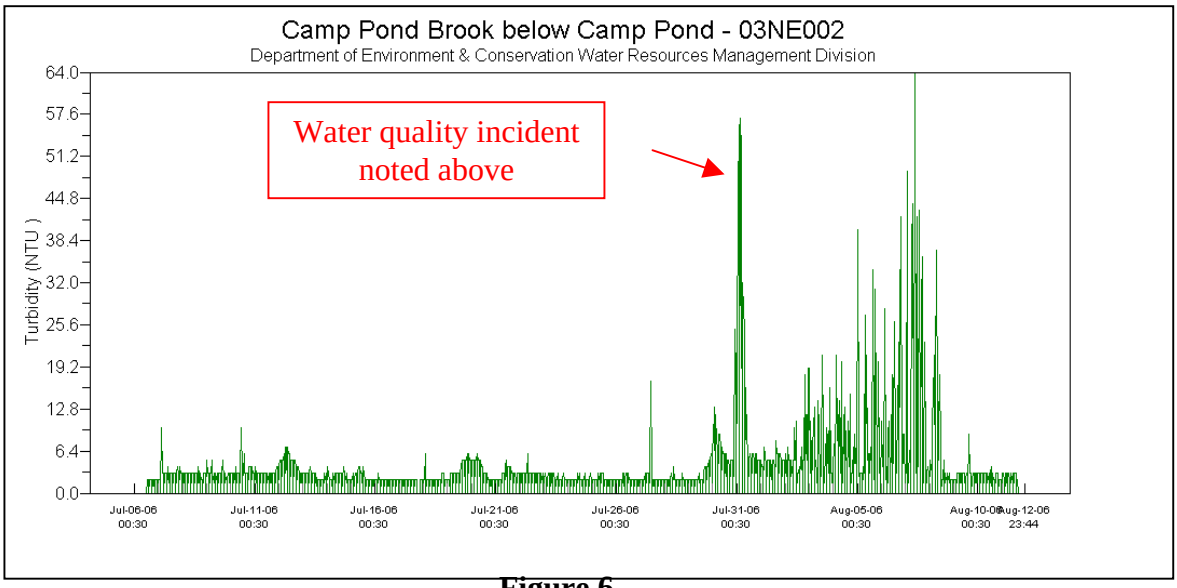


Figure 6

- The pH values at Camp Pond Brook remained very consistent over the deployment period (**Figure 7**). It appears as though the water quality event that occurred on July 31st as noted above did not have a significant impact on the pH values, however, there is a slight decrease in the pH values at that time.

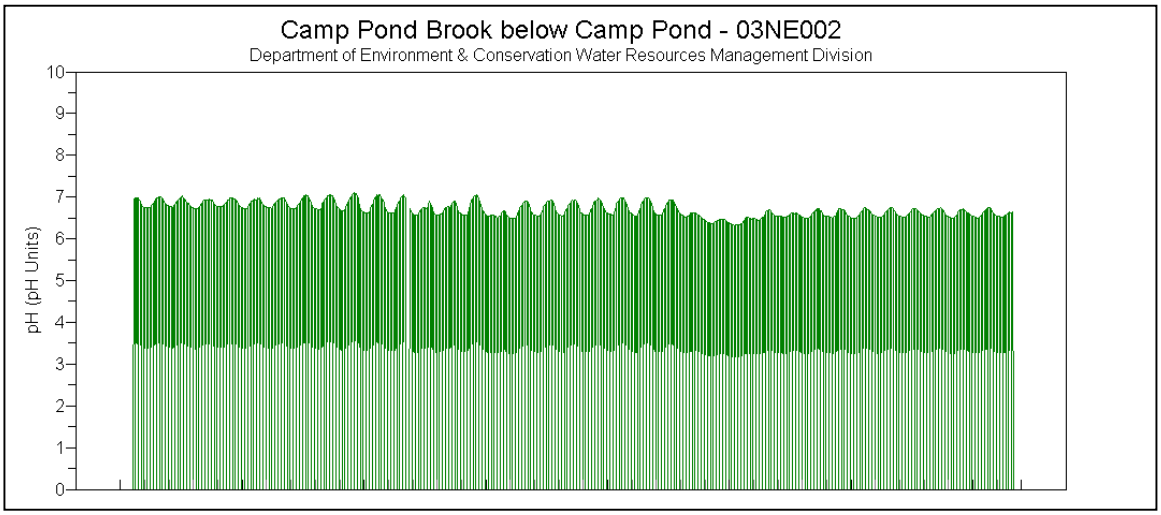


Figure 7

- The new surface water monitoring station on the Tributary to Lower Reid Brook logged and transmitted data without any issues encountered throughout the deployment period. As can be seen in Figures 8 – 12, it appears as though the significant amount of rainfall (as seen on the stage graph – **Figure 8**) in late July and early August (see Appendix A) significantly impacted many parameters. The pH values decreased (**Figure 9**) while the conductivity (**Figure 10**), total dissolved solids (**Figure 11**) and turbidity (**Figure 12**) values all increased at that point in time.

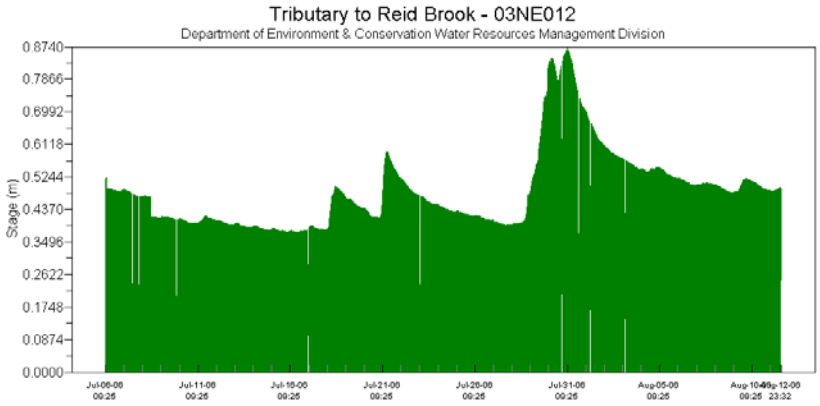


Figure 8

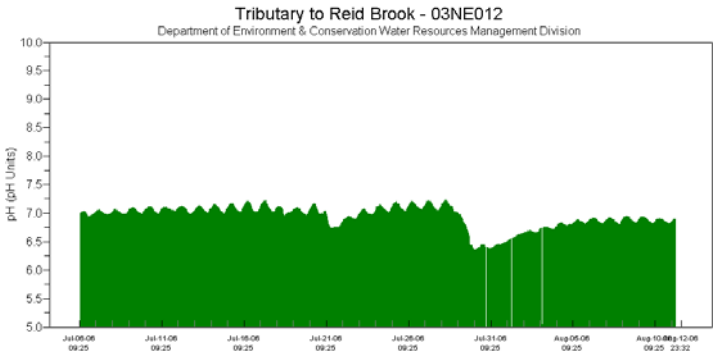


Figure 9

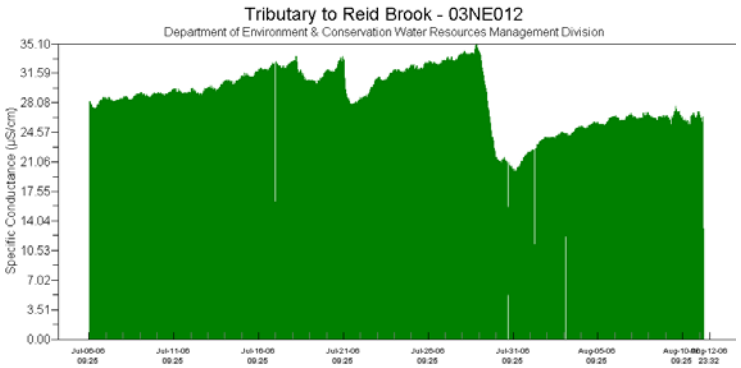


Figure 10

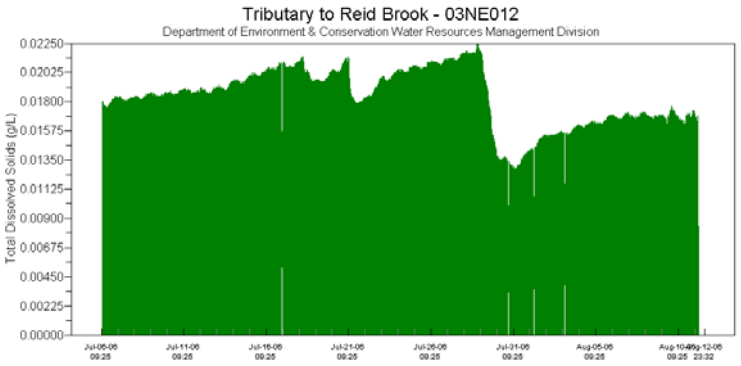


Figure 11

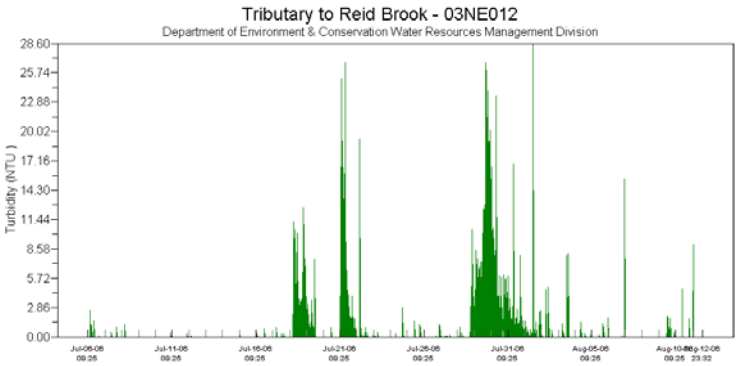


Figure 12

- The dissolved oxygen values at the Tributary to Lower Reid Brook station remained very consistent throughout the deployment period and did not appear to be affected by the increase in rainfall amounts as noted with the other parameters (**Figure 13**).

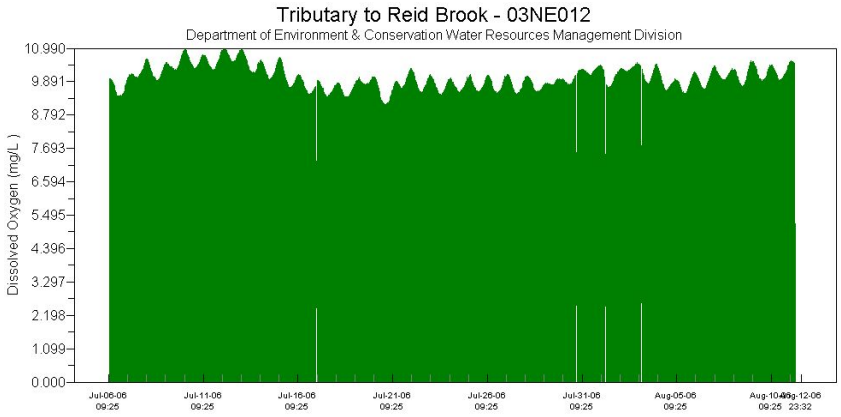


Figure 13

- As noted previously, the groundwater monitoring station was also deployed for the first time in early July. This instrument is due to be taken out for cleaning/calibration in September. It is at that point in time that the data will be processed and interpreted.

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Appendix A – Climate Data for Nain, Labrador (July & August 2006)

Daily Data Report for July 2006											
Day	Max Temp °C	Min Temp °C	Mean Temp °C	Heat Deg Days C	Cool Deg Days C	Total Rain mm	Total Snow cm	Total Precip mm	Snow on Grnd cm	Dir of Max Gust 10's Deg	Spd of Max Gust km/h
01†	10.1	4.9	7.5	10.5	0.0	M	M	24.9		6	46
02†	10.1	4.3	7.2	10.8	0.0	M	M	0.0		9	37
03†	10.5	3.8	7.2	10.8	0.0	M	M	0.7			<31
04†	14.6	3.7	9.2	8.8	0.0	M	M	0.0		9	32
05†	17.7	5.0	11.4	6.6	0.0	M	M	0.0			<31
06†	20.3	7.3	13.8	4.2	0.0	M	M	0.0		30	72
07†	14.5	7.3	10.9	7.1	0.0	M	M	2.5		31	76
08†	15.6	5.4	10.5	7.5	0.0	M	M	0.0		30	44
09†	10.9	6.7	8.8	9.2	0.0	M	M	0.6			<31
10†	16.3	7.8	12.1	5.9	0.0	M	M	0.0		30	63
11†	17.0	8.3	12.7	5.3	0.0	M	M	1.9		29	78
12†	15.1	6.4	10.8	7.2	0.0	M	M	0.0		30	72
13†	20.0	6.8	13.4	4.6	0.0	M	M	0.0		30	44
14†	15.6	5.8	10.7	7.3	0.0	M	M	0.0			<31
15†	18.8	5.1	12.0	6.0	0.0	M	M	0.0		16	52
16†	24.0	11.0	17.5	0.5	0.0	M	M	0.6			<31
17†	23.1	11.0	17.1	0.9	0.0	M	M	4.8		30	46
18†	20.8	11.4	16.1	1.9	0.0	M	M	12.4		25	50
19†	20.8	12.8	16.8	1.2	0.0	M	M	1.5		28	83
20†	29.4	13.0	21.2	0.0	3.2	M	M	0.0		27	50
21†	19.5	7.1	13.3	4.7	0.0	M	M	13.1		8	37
22†	19.2	6.5	12.9	5.1	0.0	M	M	0.0			<31
23†	19.1	7.3	13.2	4.8	0.0	M	M	0.6		30	35
24†	20.4	8.6	14.5	3.5	0.0	M	M	0.0		8	35
25†	15.9	8.0	12.0	6.0	0.0	M	M	0.0		8	33
26†	12.4	5.6	9.0	9.0	0.0	M	M	0.0		8	39
27†	13.8	6.0	9.9	8.1	0.0	M	M	0.0		8	33
28†	14.5	7.0	10.8	7.2	0.0	M	M	3.1			<31
29†	9.3	7.5	8.4	9.6	0.0	M	M	18.9			<31
30†	9.0	6.9	8.0	10.0	0.0	M	M	41.2		32	50
31†	10.1	7.6	8.9	9.1	0.0	M	M	M		32E	35E
Sum				**193.4**	**3.2**	**M**	**M**	**126.8***			
Avg	**16.4**	**7.3**	**11.8**								
Xtrm	**29.4**	**3.7**								**28**	**83**

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01†	12.6	6.3	9.5	8.5	0.0	M	M	0.0		32	41
02†	9.9	6.6	8.3	9.7	0.0	M	M	0.0			<31
03†	14.4	7.4	10.9	7.1	0.0	M	M	0.0		13	32
04†	18.8	7.8	13.3	4.7	0.0	M	M	1.4		14	41
05†	17.9	7.1	12.5	5.5	0.0	M	M	0.0		31	41
06†	18.7	9.3	14.0	4.0	0.0	M	M	0.0		28	46
07†	12.8	8.0	10.4	7.6	0.0	M	M	0.0			<31
08†	18.3	5.4	11.9	6.1	0.0	M	M	0.0		30	44
09†	16.8	5.6	11.2	6.8	0.0	M	M	6.6		14	43
10†	15.8	7.7	11.8	6.2	0.0	M	M	0.0		23	33
11†	9.2	7.0	8.1	9.9	0.0	M	M	8.8		3	37
12†	9.7	7.1	8.4	9.6	0.0	M	M	10.5		30	50
13†	9.6	6.7	8.2	9.8	0.0	M	M	52.1		1	70
14†	8.2	6.4	7.3	10.7	0.0	M	M	1.4			<31
15†	12.3	6.8	9.6	8.4	0.0	M	M	9.0		31	33
16†	21.1	8.9	15.0	3.0	0.0	M	M	0.0		30	50
17†	19.0	10.7	14.9	3.1	0.0	M	M	0.0		31	46
Sum				120.7*	0.0*	M	M	89.8*			
Avg	14.4*	7.3*	10.9*								
Xtrm	21.1*	5.4*								1*	70*