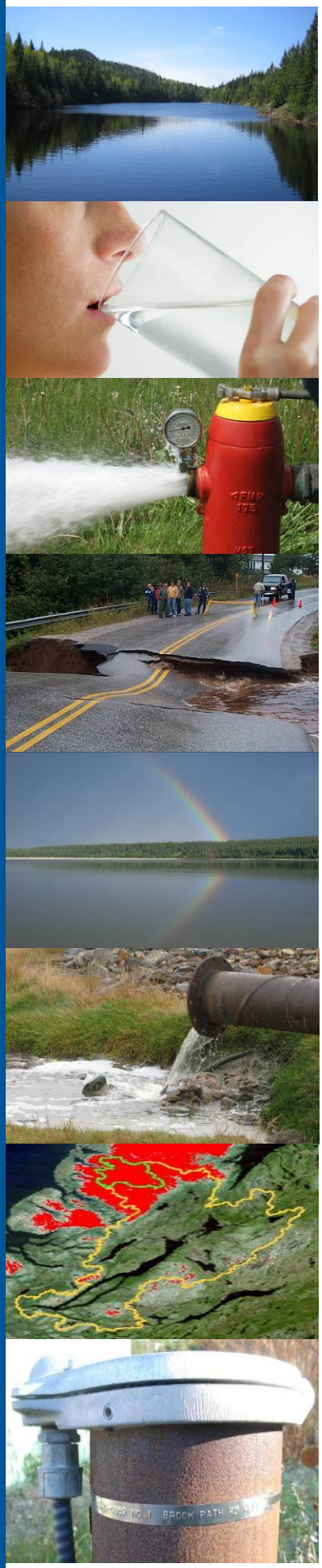


Waterford River @ Kilbride

NF02ZM0009

July to August 2011

Government of Newfoundland & Labrador
Department of Environment and Conservation
Water Resources Management Division
St. John's, NL, A1B 4J6 Canada

Real Time Water Quality Monthly Report
Waterford River - St. John's NL
July – August 2011

General

- Data from the Waterford River real-time station is monitored by the Water Resources Management Division staff regularly.

- The instrument used for the deployment period from June 15th until June 22nd was a Minisonde which continuously monitors water temperature; pH; specific conductivity; and dissolved oxygen. This particular instrument is not capable of monitoring turbidity. From July 22nd to August 26th, the original Minisonde was replaced with an YSI multiprobe which possesses the capability to measure turbidity.

Maintenance and Calibration of Instrumentation

- The following table (**Table 1**) displays the dates when the Waterford River water quality probe was installed and removed during this deployment period for routine cleaning, maintenance and calibration.

Table 1: Table of Water Quality Probe Installation and Removal

Date Installed	**Date Removed**
July 22nd, 2011	August 26th, 2011

- Water quality readings were taken with a second freshly cleaned and calibrated water quality instrument at the time of installation and removal for QAQC comparison. The QAQC instrument was calibrated prior to each use.

Quality Assurance and Quality Control

- Deployment and removal comparison rankings for the Waterford River deployment from July 22nd to August 26th are summarized in **Table 2**.

- The absence of turbidity ranking can be attributed to the QA/QC probe lacking a turbidity sensor.

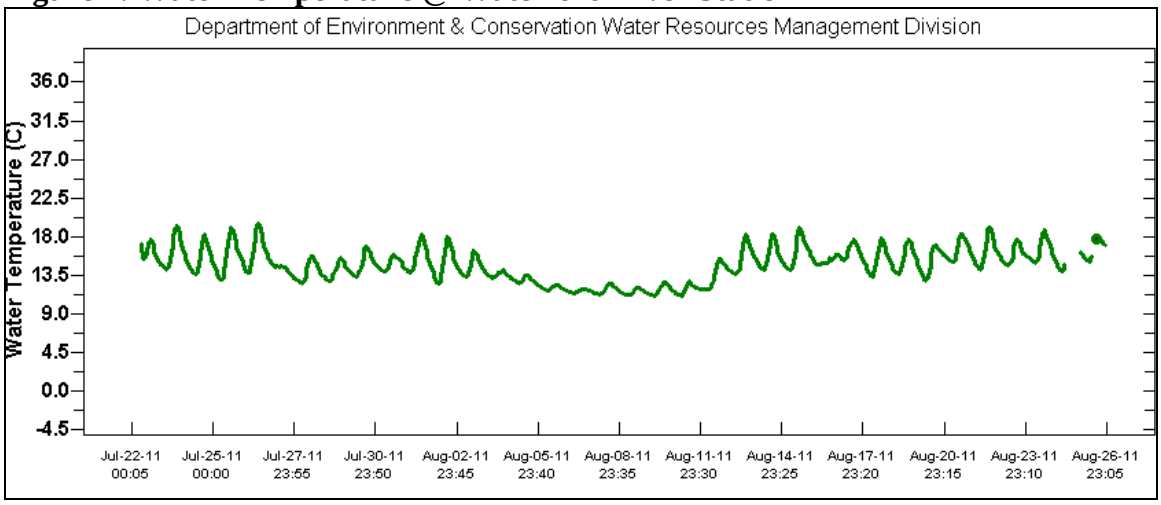
Table 2: Comparison rankings for Waterford @ Kilbride station, July 22nd – August 26th, 2011

Station	Date	Action	Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
Waterford @ Kilbride	July 22nd, 2011	Deployment	Fair	Fair	Excellent	Excellent	Excellent
	August 26th 2011	Removal	Excellent	Excellent	Marginal	Excellent	Poor

Data Interpretation

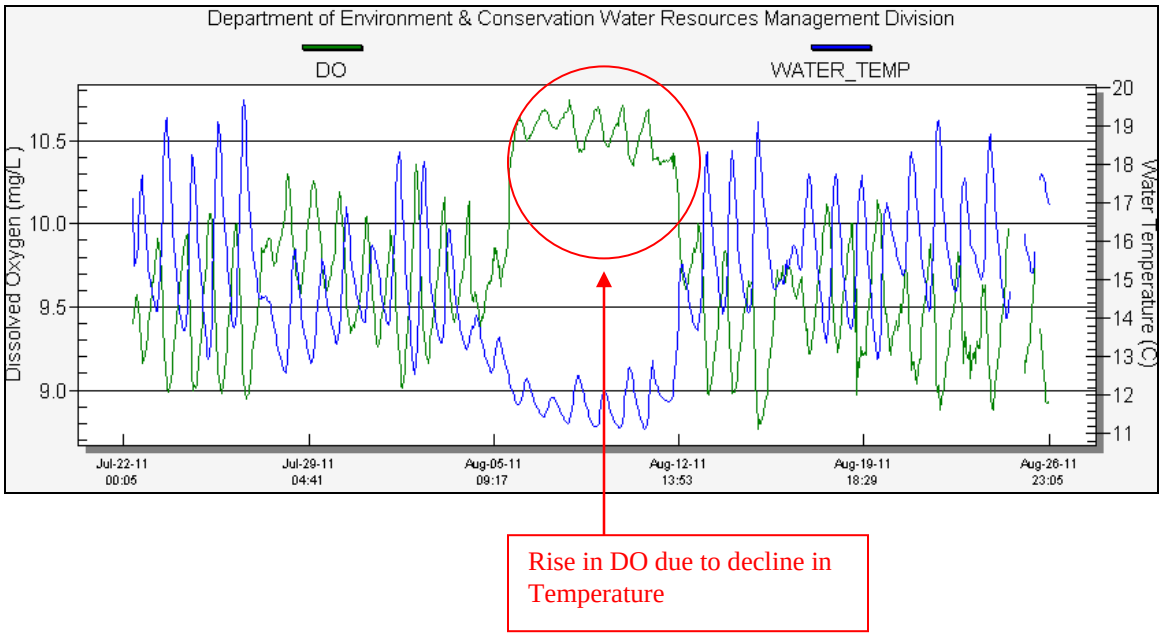
- **Water temperatures** were fairly constant and increasing slightly during this deployment, ranging between 11.14 and 19.65°C, which is within the expected temperature range for this time of year. Water temperature data is shown in **Figure 1** below.

Figure 1: Water Temperature @ Waterford River Station



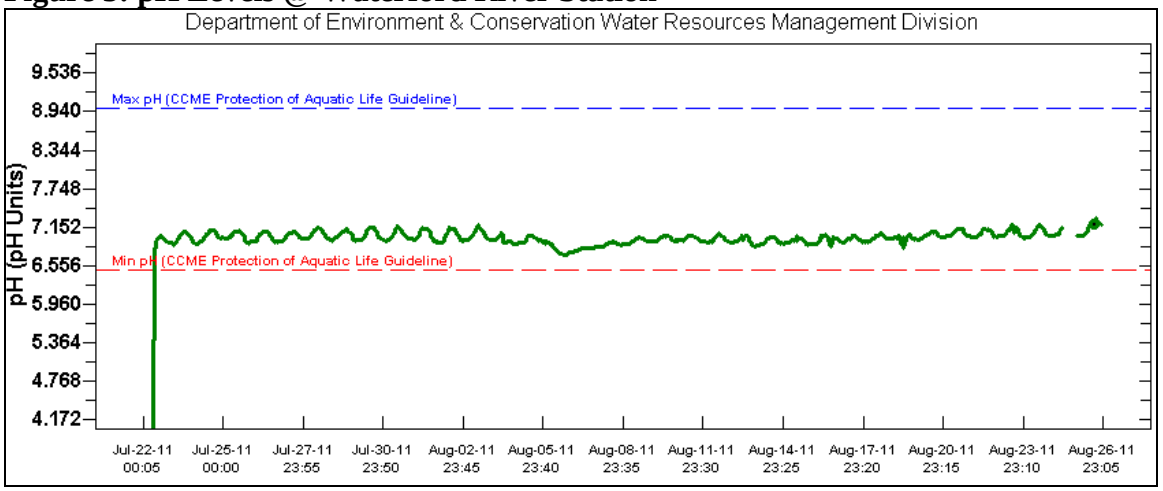
- **Dissolved oxygen (DO)** has an inverse relationship with water temperature whereby DO levels decrease as water temperature increases. Dissolved oxygen is shown in green and water temperature is shown in blue in **Figure 2**, below. The graph indicates that dissolved oxygen levels peaked at 10.74 mg/L on August 8th, the same day that water temperature reached one of its lowest level of 11.39°C. DO plummeted to its lowest level of 8.77 mg/L on August 15th, corresponding to the day one of the highest water temperatures during the deployment period were reached at 18.87°C.

Figure 2: Dissolved Oxygen and Water Temperature @ Waterford River Station



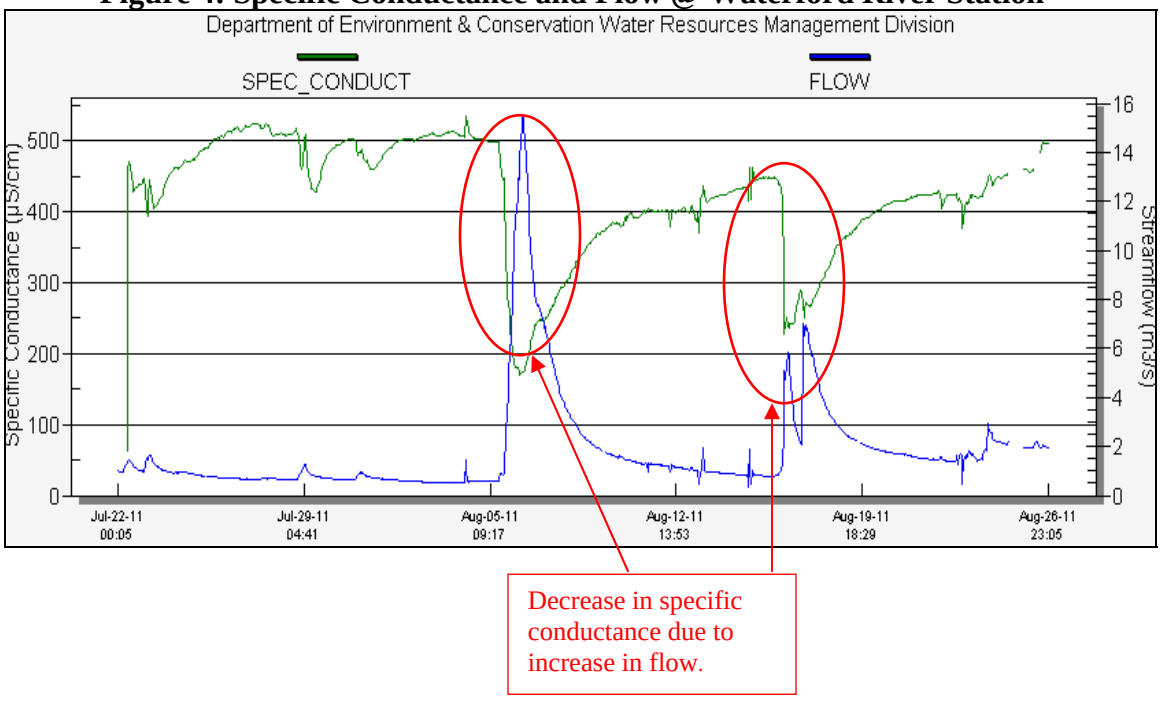
- **pH** levels were fairly constant and within the expected range for this station, with pH values ranging from of 6.72 - 7.29. There was no sudden surges or drops in pH during the specified time frame, except during servicing of the instrument which caused a slight decrease in pH on July 22nd. pH data is shown in **Figure 3** below.

Figure 3: pH Levels @ Waterford River Station



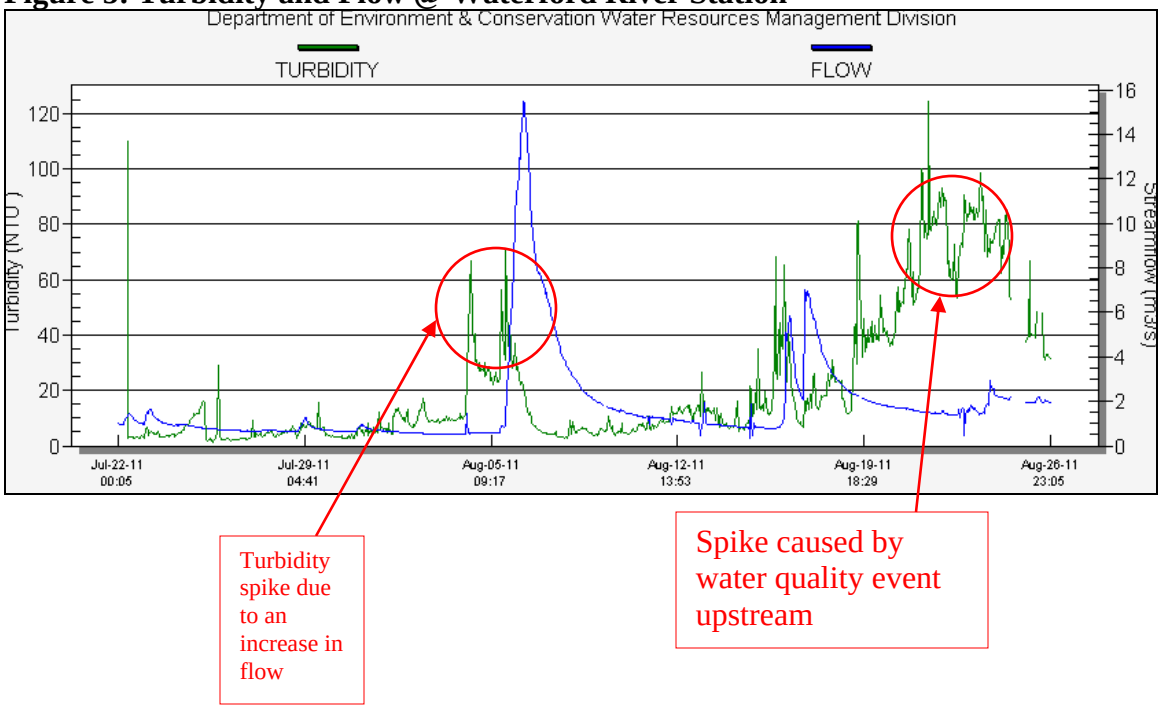
- **Specific conductivity** levels were within the expected range for Waterford River during this deployment. Specific conductivity levels ranged between 170.0-535.0 µS/cm and showed sudden increases, generally in response to the aftermath of significant precipitation events. The specific conductivity data for this deployment is shown in **Figure 4** below. The Environment Canada Daily Climate Data for August, for the St. John's region, shown below in **Appendix 2,** indicates that there was significant precipitation events during August 6th (33mm) and 16th (30mm), which resulted in an increased runoff, which in turn caused the specific conductivity to spike.

Figure 4: Specific Conductance and Flow @ Waterford River Station



- **Turbidity** levels shown in green in **Figure 5** were within the expected range for Waterford River during this deployment, up until August 10th. During this time there were numerous turbidity spikes. These turbidity spikes can be attributed to a water quality event upstream. As can be seen in **Appendix 2**, there was no significant precipitation events to account for these spikes. It is determined not to be a sensor malfunction, as turbidity returned to background levels without intervention soon after the spikes. Since these spikes occurred over a few days, it can be concluded that these spikes were caused by a water quality event upstream.

Figure 5: Turbidity and Flow @ Waterford River Station



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APPENDIX 1: Weather information for St. John's, NL provided by Environment Canada for July 2011:

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
Sum				81.0	5.6	150.2	0.0	150.2			
Avg	20.0	11.1	15.6								
Xtrm	25.1	6.3								24	93
01†	18.4	7.6	13.0	5.0	0.0	0.6	0.0	0.6		13	32
02†	21.1	10.6	15.9	2.1	0.0	T	0.0	T		27	44
03†	21.9	11.6	16.8	1.2	0.0	0.0	0.0	0.0		29	48

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
04†	23.8	12.9	18.4	0.0	0.4	0.0	0.0	0.0			<31
05†	22.2	15.3	18.8	0.0	0.8	7.2	0.0	7.2		27	37
06†	25.1	13.9	19.5	0.0	1.5	0.0	0.0	0.0		27	41
07†	25.0	12.9	19.0	0.0	1.0	T	0.0	T		26	48
08†	22.8	10.6	16.7	1.3	0.0	0.0	0.0	0.0		27	48
09†	20.4	9.8	15.1	2.9	0.0	15.8	0.0	15.8		20	50
10†	17.8	10.4	14.1	3.9	0.0	2.4	0.0	2.4		24	93
11†	23.1	10.6	16.9	1.1	0.0	0.0	0.0	0.0		26	50
12†	22.3	15.0	18.7	0.0	0.7	T	0.0	T		24	52
13†	18.4	6.8	12.6	5.4	0.0	5.6	0.0	5.6		24	50
14†	8.0	6.3	7.2	10.8	0.0	31.4	0.0	31.4		7	37
15†	20.2	7.1	13.7	4.3	0.0	23.0	0.0	23.0		19	70
16†	23.8	13.8	18.8	0.0	0.8	12.4	0.0	12.4		19	46
17†	18.8	11.4	15.1	2.9	0.0	0.6	0.0	0.6		26	52
18†	23.0	11.4	17.2	0.8	0.0	6.6	0.0	6.6		25	57
19†	20.2	13.6	16.9	1.1	0.0	6.6	0.0	6.6		19	44
20†	21.5	15.2	18.4	0.0	0.4	0.2	0.0	0.2		23	35
21†	19.3	14.2	16.8	1.2	0.0	0.2	0.0	0.2		26	48
22†	20.0	12.7	16.4	1.6	0.0	7.2	0.0	7.2		25	63
23†	19.0	9.0	14.0	4.0	0.0	0.8	0.0	0.8			<31
24†	20.5	9.1	14.8	3.2	0.0	5.4	0.0	5.4		26	59
25†	23.1	9.8	16.5	1.5	0.0	0.0	0.0	0.0		27	32
26†	23.6	12.1	17.9	0.1	0.0	T	0.0	T		20	35
27†	13.4	9.6	11.5	6.5	0.0	2.4	0.0	2.4		8	37
28†	12.1	9.2	10.7	7.3	0.0	9.8	0.0	9.8			<31
29†	15.4	9.3	12.4	5.6	0.0	6.6	0.0	6.6			<31
30†	18.2	10.8	14.5	3.5	0.0	T	0.0	T			<31
31†	17.5	11.0	14.3	3.7	0.0	5.4	0.0	5.4		26	35

APPENDIX 2: Weather information for St. John's, NL provided by Environment Canada for August 2011:

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
Sum				100.1*	6.7*	91.6*	0.0*	91.6*			
Avg	18.4*	11.1*	14.8*								
Xtrm	26.6*	5.8*								23*	70*
01†	18.4	7.4	12.9	5.1	0.0	T	0.0	T		31	32
02†	13.9	5.8	9.9	8.1	0.0	0.6	0.0	0.6			<31
03†	13.3	9.6	11.5	6.5	0.0	1.4	0.0	1.4			<31
04†	12.0	10.1	11.1	6.9	0.0	0.8	0.0	0.8			<31
05†	11.0	10.1	10.6	7.4	0.0	7.4	0.0	7.4		8	44
06†	10.3	9.5	9.9	8.1	0.0	33.6	0.0	33.6		5	65

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
07†	10.1	9.0	9.6	8.4	0.0	5.8	0.0	5.8		3	61
08†	11.7	8.4	10.1	7.9	0.0	1.6	0.0	1.6			<31
09†	10.7	8.2	9.5	8.5	0.0	0.4	0.0	0.4			<31
10†	10.7	8.0	9.4	8.6	0.0	0.2	0.0	0.2			<31
11†	11.6	8.3	10.0	8.0	0.0	1.4	0.0	1.4		11	33
12†	19.9	11.4	15.7	2.3	0.0	T	0.0	T		27	32
13†	21.9	12.2	17.1	0.9	0.0	T	0.0	T		28	32
14†	18.3	10.9	14.6	3.4	0.0	0.0	0.0	0.0			<31
15†	23.7	13.0	18.4	0.0	0.4	0.0	0.0	0.0		27	44
16†	21.3	13.5	17.4	0.6	0.0	30.4	0.0	30.4		16	44
17†	23.3	12.2	17.8	0.2	0.0	4.4	0.0	4.4		26	54
18†	21.9	11.4	16.7	1.3	0.0	0.0	0.0	0.0		27	56
19†	22.5	11.8	17.2	0.8	0.0	0.0	0.0	0.0		26	44
20†	22.0	10.2	16.1	1.9	0.0	T	0.0	T			<31
21†	22.3	14.2	18.3	0.0	0.3	T	0.0	T			<31
22†	20.4	12.1	16.3	1.7	0.0	0.0	0.0	0.0			<31
23†	18.7	12.5	15.6	2.4	0.0	2.8	0.0	2.8		27	41
24†	21.8	12.6	17.2	0.8	0.0	0.0	0.0	0.0		28	41
25†	23.3	12.1	17.7	0.3	0.0	0.0	0.0	0.0		27E	52E
26†	23.3	16.7	20.0	0.0	2.0	0.8	0.0	0.8		23E	61E
27†	22.2	14.2	18.2	0.0	0.2	0.0	0.0	0.0		28	46
28†	26.0	10.0	18.0	0.0	0.0	0.0	0.0	0.0			<31
29†	26.6	17.0	21.8	0.0	3.8	T	0.0	T		23	70
30											
31											