# Waterford River
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# NF02ZM0009

**May 2013**

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**
**April 30 – May 24, 2013**

## General

- Data from the Waterford River real-time station is regularly monitored by the Water Resources Management Division (WRMD) staff.
- The instrument used for the deployment period from April 30 to May 24, 2013 was a YSI 6600 series multi-probe, which continuously measured water temperature, dissolved oxygen, pH, specific conductivity and turbidity. The duration of the deployment was 24 days.

## Maintenance and Calibration of Instrumentation

- **Table 1** displays the dates when routine cleaning, maintenance and calibration were performed on the water quality probe during this deployment.

**Table 1**: **Table of Water Quality Probe Installation and Removal**

| Date Deployed | Date Removed |
|---|---|
| April 30, 2013 | May 24, 2013 |

- Water quality readings were taken with a second freshly cleaned and calibrated water quality instrument at the time of deployment and removal, in compliance with WRMD quality assurance and quality control protocol.

## Deployment

- Deployment comparison rankings between the field instrument and the QAQC instrument are summarized in **Table 2**.

**Table 2: Field sonde to QAQC sonde comparison rankings for deployment of the RTWQ instrument on April 30, 2013**

| Parameter | Field Sonde | QAQC Sonde | Difference / % Difference | Ranking |
|---|---|---|---|---|
| Temperature ('C) | 10.52 | 10.55 | 0.03 | Excellent |
| pH | 7.22 | 7.38 | 0.16 | Excellent |
| Specific Conductivity (µS/cm) | 522.0 | 518.0 | 0.8 | Excellent |
| Total Dissolved Solids (g/l) | 0.3390 | 0.3370 | 0.0020 | |
| Dissolved Oxygen (%-Sat) | 105.6 | 107.1 | 1.5 | |
| Dissolved Oxygen (mg/l) | 11.76 | 11.91 | 0.15 | Excellent |
| Turbidity (NTU) | 1.6 | 1.6 | 0.0 | Excellent |

- **Deployment rankings** of “excellent” for water temperature, pH, specific conductivity, dissolved oxygen and turbidity indicate successful cleaning and calibration, which enable these sensors to produce reliable data during the deployment period.

## Removal

- Removal comparison rankings between the field instrument and the QAQC instrument are summarized in **Table 3**.

**Table 3: Field sonde to QAQC sonde comparison rankings for removal of the RTWQ instrument on May 24, 2013**

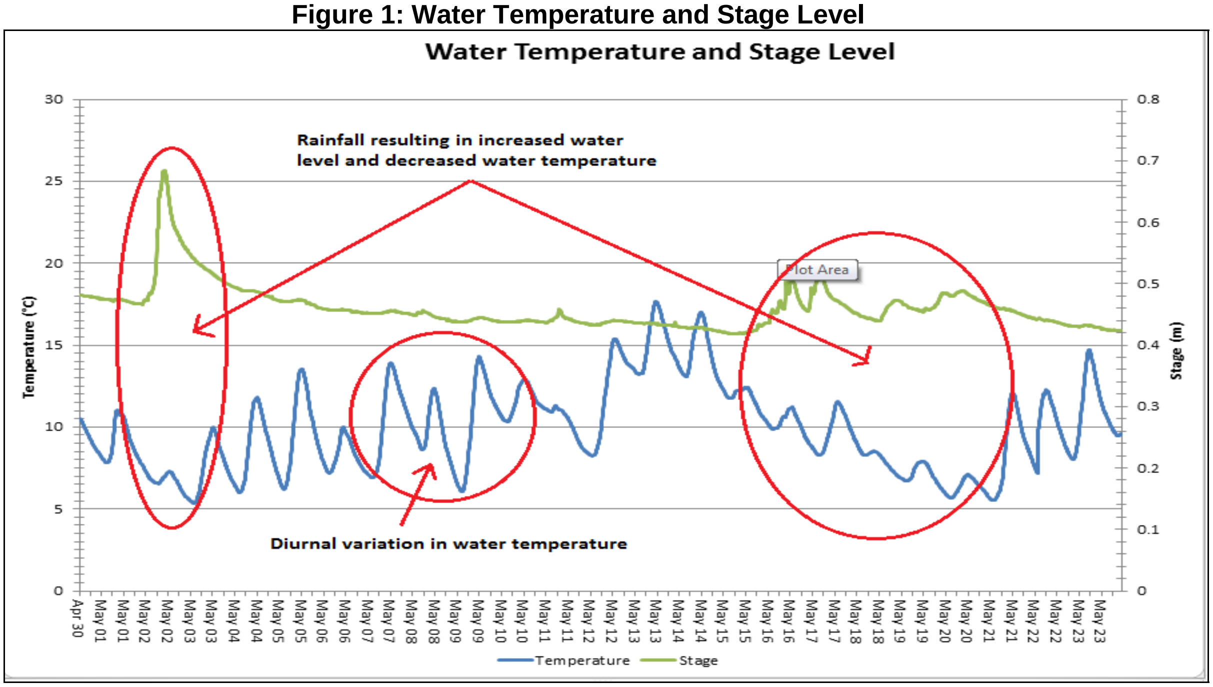
| Parameter | Field Sonde | QAQC Sonde | Difference / % Difference | Ranking |
|---|---|---|---|---|
| Temperature ('C) | 9.59 | 9.64 | 0.05 | Excellent |
| pH | 6.87 | 7.04 | 0.17 | Excellent |
| Specific Conductivity (µS/cm) | 616.0 | 622.0 | 1.0 | Excellent |
| Total Dissolved Solids (g/l) | 0.4000 | 0.4040 | 0.0040 | |
| Dissolved Oxygen (%-Sat) | 103.6 | 105.6 | 2.0 | |
| Dissolved Oxygen (mg/l) | 11.82 | 11.99 | 0.17 | Excellent |
| Turbidity (NTU) | 8.3 | 1.1 | 7.2 | Fair |

- **Removal rankings** of “excellent” for water temperature, pH and specific conductivity increase confidence that the data collected for these parameters over the duration of this deployment are reliable. A ranking of “fair” for turbidity indicates that all turbidity data are acceptable and meet QAQC standards; however, the sensor was showing signs of mild fouling.

## Data Interpretation

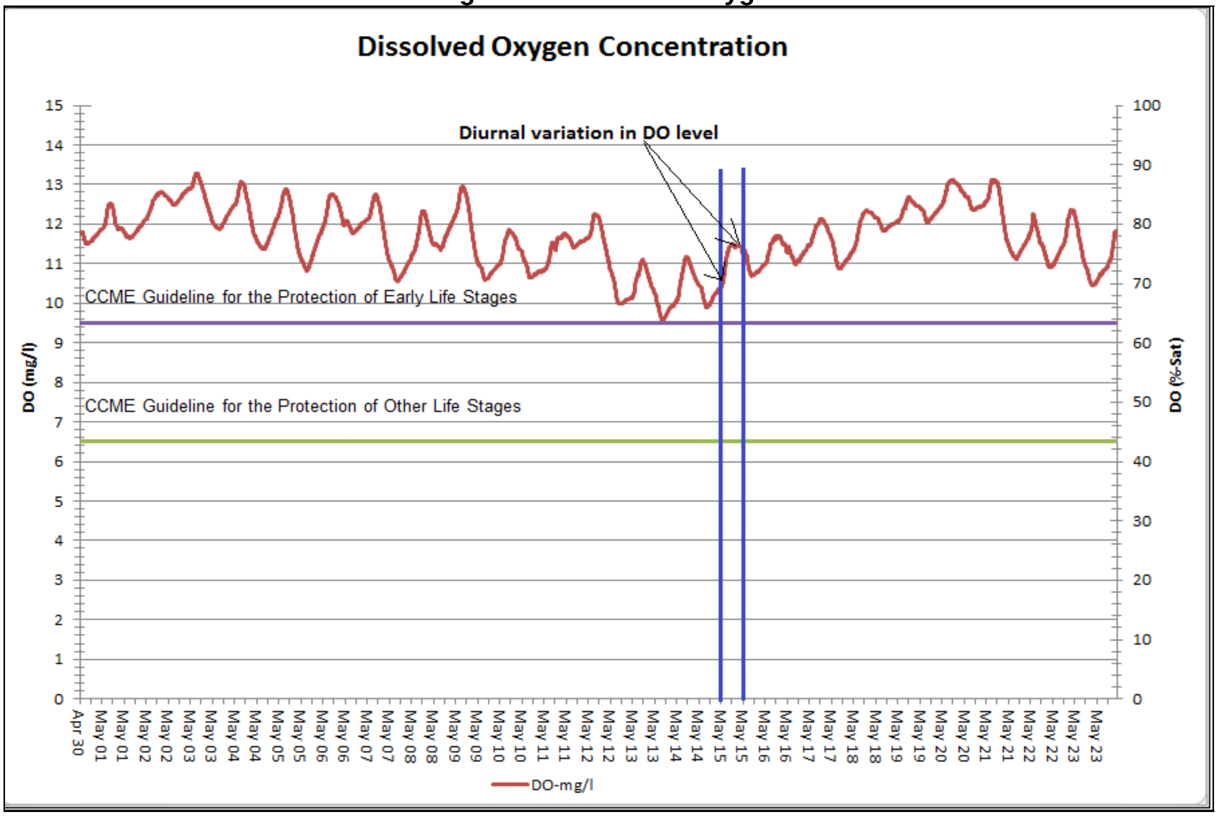
- A graph of **water temperature,** which fluctuated between 5.35 and 17.68$^{o}$C during this deployment period, is shown in blue ink in Figure 1, below. Water level (stage) is depicted in green ink. Diurnal variation in water temperature is clearly seen with colder temperatures occurring at night and warmer temperatures occurring during the day, corresponding with cooler nightly air and warmer daily air temperatures. Rainfall, seen in the graph as spikes in water level, appeared to have a cooling effect on water temperature during this deployment, as water temperatures plummeted in association with rainfall on May 2, and May 15 -18. Daily rainfall amounts during the month of May are shown in Environment Canada’s Climate Data in **Appendix 1,** at the end of this report.

**Figure 1: Water Temperature and Stage Level**



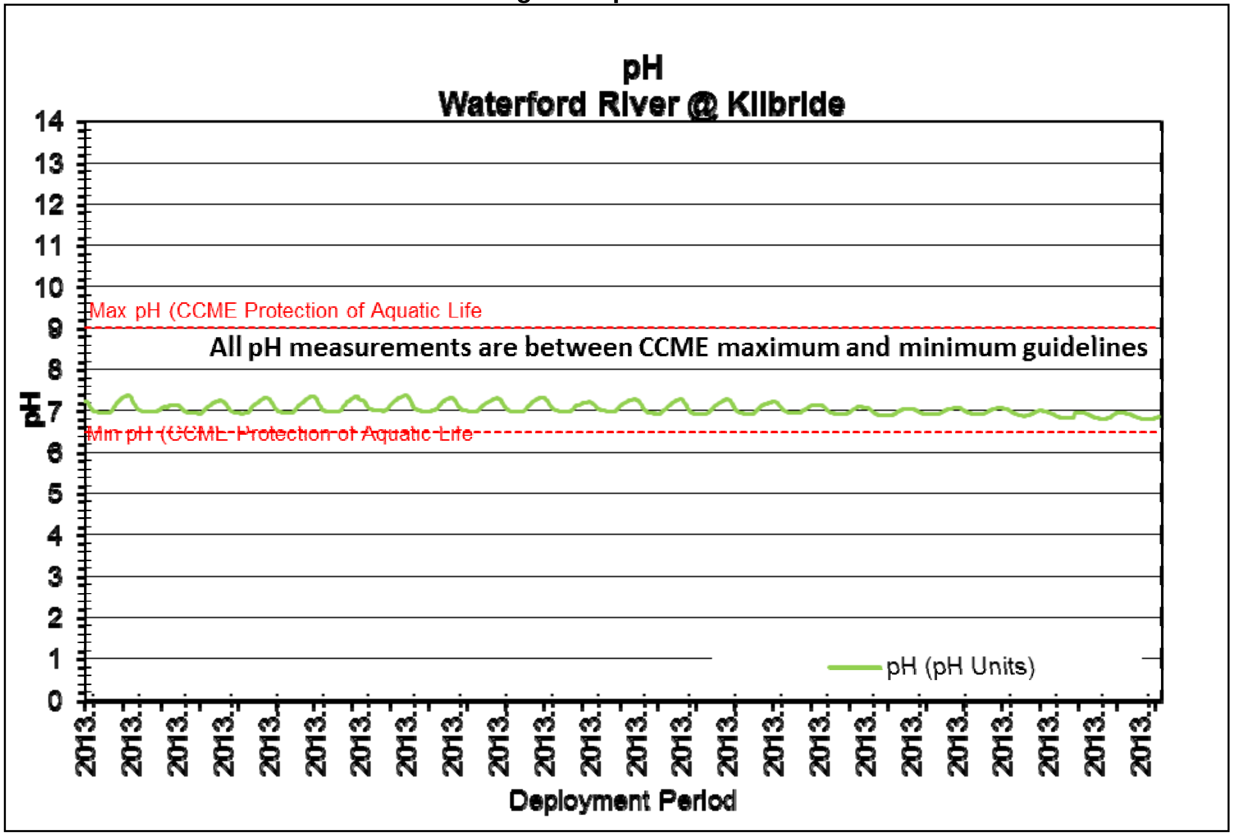
▪ Dissolved Oxygen (DO) measurements during this deployment ranged between 9.57 and 13.28 mg/l. All DO measurements were above the minimum guidelines recommended by the CCME for the protection of freshwater aquatic life, of 9.5 mg/L for early life stages and 6.5 mg/L for other life stages in cold water systems. Diurnal variation in DO is clearly seen in Figure 2, where DO is shown in red ink. DO levels were lower during the warmer daylight hours and higher at night, corresponding to warmer water temperatures during the daytime and cooler water temperatures at night. This inverse relationship is based on the fact that the solubility of oxygen is greater in colder water than in warmer water, thus as water temperatures decrease DO levels increase.

**Figure 2: Dissolved Oxygen**



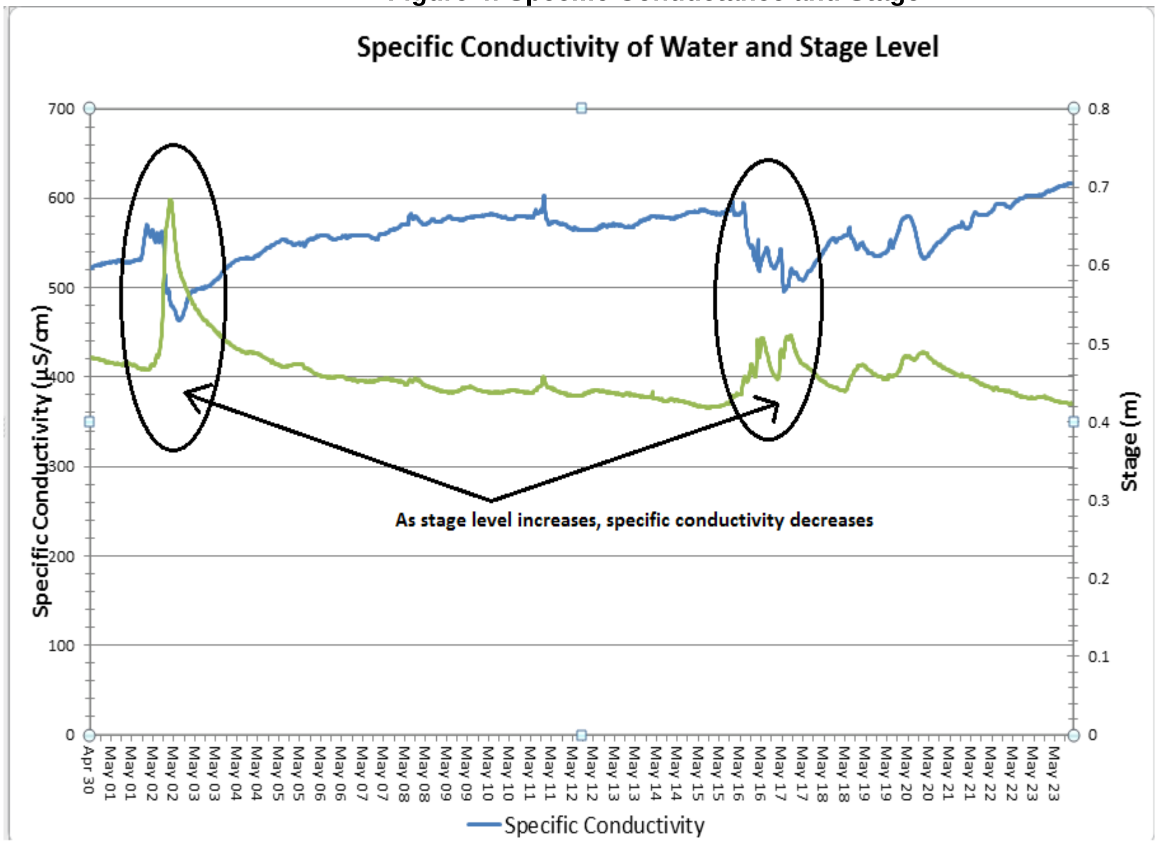

▪ **pH** values during this deployment period were quite stable, ranging from 6.5 to 7.38 pH units. All pH measurements were within the CCME recommended guideline range for the protection of aquatic life, of 6.5 - 9.0 pH units. pH values for this deployment are shown below in Figure 3.

**Figure 3: pH**



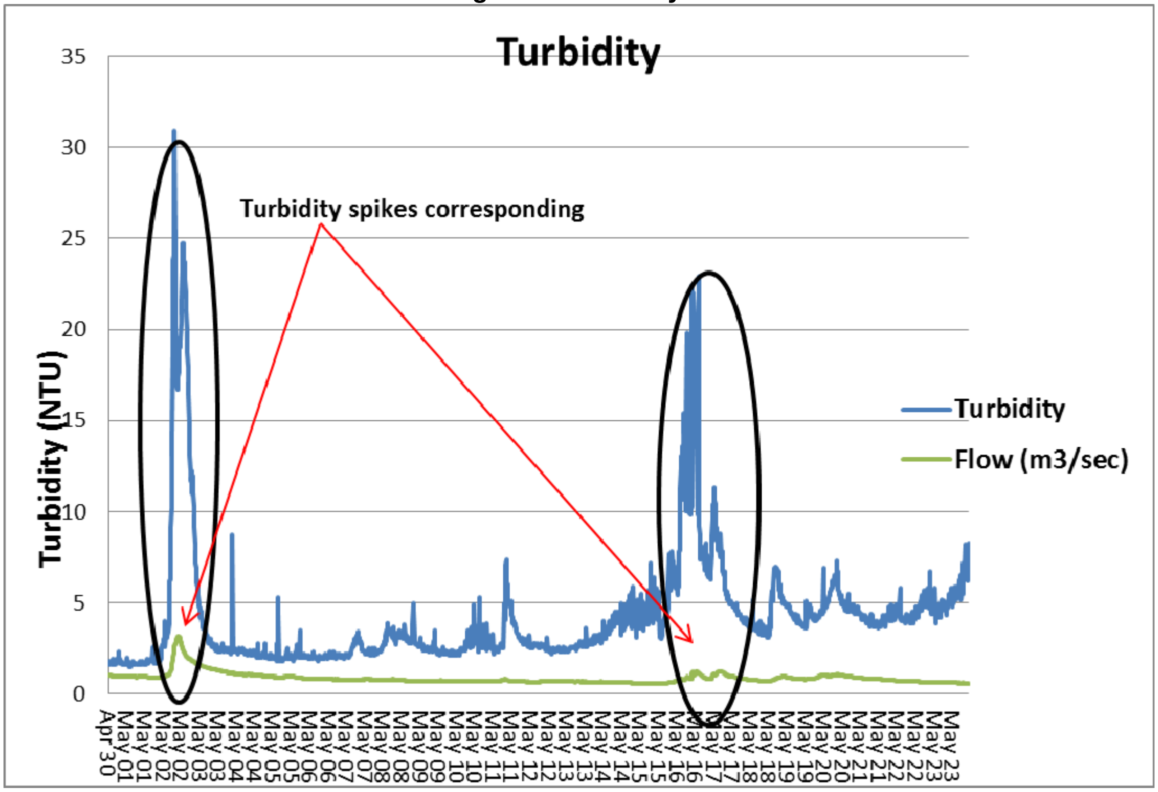

- **Specific conductivity (SpC)** measures the ability of water to pass an electrical current. Conductivity in streams and rivers is affected by the geology of the area through which the water flows. Streams that run through granite bedrock tend to have lower conductivity than those that flow through limestone and clay soils. High specific conductance readings are often influenced by urban run-off. The effects of urban run-off are dependent upon the season. During warmer temperatures, when road salt is not being used for ice control, rainfall and urban run-off can have a dilution effect, causing specific conductivity levels to decrease as stage level increases. However, during the winter months when road salting operations are in effect, urban run-off can result in spikes in specific conductivity. In **Figure 4,** below, increased stage height appears to have a dilution effect on conductivity, as spikes in stage, shown in green, correspond with drops in conductivity, shown in blue. This observation is supported by Environment Canada Daily Climate Data, presented in **Appendix 1,** at the end of this report. The climate data indicate significant precipitation occurred on May 2 and May 15-18, which coincides with the concurrent spikes in stage height and dips in conductivity that are circled in black in **Figure 4**. The climate data also indicate that air temperatures were above zero degrees Celsius for almost the entire deployment period, suggesting that road salting operations were minimal. Specific conductance values in Waterford River during this deployment period were within the expected range for this river at this time of year, ranging between 463 and 617µS/cm.

**Figure 4: Specific Conductance and Stage**




- **Turbidity** is a measure of water clarity, and the degree to which material suspended in water decreases the passage of light through the water. Suspended materials include soil particles (clay, silt, and sand), algae, plankton, microbes, and other substances. **Turbidity** often increases as flow increases, due to the presence of higher levels of suspended particles and entrapped air in the water column. Increased flow can be caused by precipitation and/or a sudden rise in winter air temperatures that results in snowmelt. Turbidity spikes that occur in the absence of increased flow often indicate land based activity occurring upstream that is resulting in water quality impairment. Turbidity remained within expected background levels of less than 8 NTU for much of this deployment, with the exception of two spikes that occurred on May 2 and May 15-18. These spikes are shown in blue ink in **Figure 5** below, and they coincide with increased flow that is shown in green ink. Environment Canada Daily Climate Data, shown in **Appendix 1,** indicates that significant rainfall occurred on these dates, resulting in increased flow and turbidity. Turbidity measurements during this deployment period were within the range of 1.5 and 30.9 NTU, with a mean of 4.2 NTU and a median of 3.3 NTU.

**Figure 5: Turbidity and Flow**




## Appendix 1: Environment Canada Climate Data (May 2013), St. John's West

Daily Data Report for May 2013

| DAY | Max Temp °C | Min Temp °C | Mean Temp °C | Total Precip mm |
|---|---|---|---|---|
| 01 | 11.9 | 1.0 | 6.5 | 0.0 |
| 02 | 5.4 | 2.4 | 3.9 | **10.2** |
| 03 | 8.2 | -0.3 | 4.0 | 0.0 |
| 04 | 10.3 | -1.1 | 4.6 | 0.0 |
| 05 | 18.4 | -0.7 | 8.9 | 0.0 |
| 06 | 8.2 | 0.0 | 4.1 | 0.0 |
| 07 | 17.4 | 4.7 | 11.1 | 0.0 |
| 08 | 7.1 | -2.5 | 2.3 | 0.4 |
| 09 | 17.2 | -0.4 | 8.4 | 0.0 |
| 10 | 16.6 | 8.5 | 12.6 | 0.0 |
| 11 | 14.3 | 2.8 | 8.6 | 0.2 |
| 12 | 20.6 | 5.4 | 13.0 | 0.0 |
| 13 | 20.0 | 13.3 | 16.7 | 0.0 |
| 14 | 17.8 | 8.9 | 13.4 | 0.0 |
| 15 | 11.0 | 6.4 | 8.7 | **1.4** |
| 16 | 10.6 | 3.7 | 7.2 | **9.4** |
| 17 | 14.0 | 2.9 | 8.5 | **2.9** |
| 18 | 4.0 | 2.3 | 3.2 | **0.9** |

| | | | | |
|---|---|---|---|---|
| 19 | 4.7 | 1.1 | 2.9 | TRACE |
| 20 | 2.8 | -0.3 | 1.3 | 0.0 |
| 21 | 10.6 | -0.2 | 5.2 | 0.0 |
| 22 | 13.2 | -0.2 | 6.5 | 0.0 |
| 23 | 13.8 | 0.7 | 7.3 | 0.0 |
| 24 | 21.1 | 5.8 | 13.5 | 0.0 |

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