Attachment A

Temperature

Applicable temperature licensing criteria

06-096 CMR Chapter 582, *Regulations Relating to Temperature* states in part:

SUMMARY: These rules provide safeguards for fresh and salt water fauna in lakes and rivers of the state, by establishing instream limits on temperature resulting from thermal discharges.

and

Sub-§5, *Tidal Water Thermal Discharges states* – "No discharge of pollutants shall cause the monthly mean of the daily maximum ambient temperatures in any tidal body of water, as measured outside the mixing zone, to be raised more than 4 degrees Fahrenheit nor more than 1.5 degrees Fahrenheit from June 1 to September 1. In no event shall any discharge cause the temperature of any tidal waters to exceed 85 degrees Fahrenheit at any point outside a mixing zone established by the Board."

Department Review and Analysis of Temperature

Department staff have reviewed and analyzed the applicant's proposal from the standpoint of applicable temperature criteria and note the following:

Considering a worst-case scenario for the applicant's proposed discharge at the full flow of 7.7 MGD contemplated by the application as follows:

Using the highest discharge temperature 18°C (64.4°F). (The temperature of 18°C is the highest discharge temperature identified by the applicant in its application.)

Using the mean of the daily maximum ambient temperature – non summer 1.3°C (34.3°F), in the month of March. (Ambient temperatures are coldest in the month of March.)

Using the mean daily maximum ambient temperature - summer 10°C (50.0°F) in the month of June. (Ambient temperatures are warmest in the month of June.)

Given:

Acute near-field dilution factor 10:1 to be conservative ⇒ 9 parts ambient, 1 part effluent. An acute near-field dilution factor is most appropriate for this analysis as temperature impacts to the environment are greatest shortly after being discharged to the environment.

Effluent flow = 7.7 MGD (from the application)

Receiving water volume= 69.3 MG (calculated from the acute near-field dilution factor of 10:1)

Non-Summer (September 2 – May 31)

Ambient 34.3° F (1.3 °C)
Daily max effluent temperature of 64.4 °F (18° C)

Find the change in temperature (ΔT):

$$\frac{(64.4°F)(7.7\ MGD) + (34.3°F)(69.3\ MGD)}{77\ MGD} = 37.3°F$$

37.3°F -34.3°F = **3.0°F < 4°F** **Based on Department's staff review and analysis to date, this worst-case scenario for non-summer would be below, and thus meet the non-summer licensing criteria if permitted.**

Summer (June 1 – September 1)

Ambient 50.0 °F (10° C)
Daily max effluent temperature of 64.4 °F (18° C)

Find the change in temperature (ΔT):

$$\frac{(64.4°F)(7.7\ MGD) + (50.0°F)(69.3\ MGD)}{77\ MGD} = 51.4°F$$

51.4°F -50.0°F = **1.4°F < 1.5°F** **Based on Department's staff review and analysis to date, this worst-case scenario for summer would be below, and thus meet the summer licensing criteria if permitted.**

ANON. 2020a. *Belfast Sea Temperatures* [Online]. 2020. Available: https://www.seatemperature.org/north-america/united-states/belfast.htm [Accessed 9th January 2020].

Monthly average max / min water temperatures

The graph below shows the range of monthly Belfast water temperature derived from many years of historical sea surface temperature data.