Comments on Draft NPDES Permit for Merrimack Station, No. NH0001465
Applied Science Associates, Inc. Responses to
U.S. Environmental Protection Agency Review of its
Modeling Study of the Merrimack Station Thermal Discharge
February 2012

The U.S. Environmental Protection Agency issued draft permit 0001465 for the Merrimack Station in Bow, NH for its thermal discharge into the Merrimack River (USEPA, 2012). In its draft permit documentation, USEPA reviewed the thermal modeling report for the Station discharge prepared by Applied Science Associates (ASA) (Crowley, et al 2010) and made a series of comments which ASA believes fundamentally misinterpreted the purpose of the modeling study. Each comment is presented below followed by ASA's response. The comments are found in section 5.6.3.2d, Revised Thermal Model, beginning on page 83 (USEPA, 2012).

EPA Comment (pg. 83, para. 2)

On January 10, 2011, EPA received another thermal plume modeling study from PSNH. This report, dated December 21, 2010, was prepared by Applied Science Associates, Inc. (ASA). The study is largely based on data collected in 2009. According to the report's cover letter, the model developed by ASA predicts the thermal plume generated by Merrimack Station to be largely confined to the western side of Hooksett Pool, and to tend to stratify in the upper half of the water column. This prediction is inconsistent, however, with a five-year study in the 1970's that revealed that the thermal plume initially flows across to the east side of the river under summer low flow conditions and then disperses throughout the river by the time it reaches Station S-4 (See Section 5.6.3.2b). The cover letter for the new report further states, "These results are consistent with those reported by Normandeau Associates, Inc. ("NAI") in their 2007 report, *A probabilistic Thermal Model of Merrimack River Downstream of Merrimack Station.*" Yet, EPA rejected PSNH's 2007 model (See EPA's evaluation of the 2007 report in Section 5.6.3.2c, above).

ASA Response

The purpose of the modeling described in Crowley et al. (2010) was to document model calibration and verification of a three-dimensional, hydrothermal computer model applied to the Hooksett Pool in the Merrimack River. A significant field program conducted by Normandeau Associates, Inc. in 2009 acquired an extensive data set which provided the most complete information on the thermal structure of the River. For that reason the 2009 period was chosen for model calibration and verification. Before any hydrothermal model can be used to predict extreme events it must be shown to accurately reflect observations, which the 2010 report successfully showed. Additional model runs using the validated model for average and extreme

years (higher water temperature, lower river flow) for different periods of combined biological and environmental significance were subsequently performed (Crowley, et al., 2012). Furthermore EPA's rejection of NAIs 2007 report was in reference to the use of A0 as a monitoring station, not a rejection of the thermal characterization of the Hooksett Pool which was the subject of the ASA statement of agreement between ASA's 2010 report and Normandeau's 2007 report.

EPA Comment (pg. 84, para. 1)

According to the 2010 model predictions, the thermal plume is only significant in the immediate area where the cooling canal discharges into the river (Station S-0 West). PSNH defines "significant" as temperatures of 2°C (3.6°F) above ambient, or higher. EPA reviewed the temperature data collected during the periods in July and August 2009 that supported the modeling effort, and compared them to 20 years of temperature data collected by PSNH as part of the monitoring requirements under its NPDES permit. The ASA report only provided 2009 temperature data in graphic form so EPA had to pull the data points off the graph, but expects them to be within 0.2°C of the actual value. The ASA report refers to the study period from July 11-21, 2009, as the "validation" timeframe (ASA 2010). During this period, both units were operating, as were the power spray modules. The period from August 5-15 is referred to by the report as the "calibration" time frame. During this period, Unit 2 and the power spray modules were not operational; only Unit I was operating. Table 5-18 provides a comparison of the July 2009 data – the period when both units were operating - with data collected during the same period (July 11-21) from 1984-2004.

Table 5-18 Comparison of the July 11-21, 2009 mean temperature with data collected by PSNH on the same days from 1984-2004.

Monitoring Period	Station N-10[1]	Station S-0[1]	Station S-4[1]	Delta-T (N-10 > S-0)	Delta-T (N-10 > S-4)
July[2] (ASA)	21.5°C/70.7°F	27.3°C/81.1°F	22.3°C/72.1°F	5.8°C /10.4°F	0.8°C/1.4°F
July[3] (PSNH)	23.9°C/75.1°F	33.1°C/91.6°F	27.1°C/80.7°F	9.2°C/16.2°F	3.2°C/5.8°F

Notes:

[1]Temperatures reflect data collected on west-side, near-surface monitoring stations

[2]Temperatures collected from July 11-21, 2009

[3]Temperatures reflect the 11-day average (7/11-7/21) of mean temperatures reported by PSNH for the years 1984-2004.

ASA Response

USEPA fundamentally misinterpreted the purpose of the 2009 model simulations. As stated in the previous response, the purpose of the modeling described in Crowley et al. (2010) was to document successful model calibration and verification of a three-dimensional, hydrothermal

computer model applied to the Hooksett Pool in the Merrimack River using the most extensive data set available (2009). ASA did not propose that the 2009 period was typical, only that the most extensive data set available for model calibration and verification was taken in 2009. Additional model runs for average and extreme years were subsequently performed (Crowley et al., 2012).

EPA Comment (pg. 84, para. 2)

The ASA report indicates that the model was calibrated and validated for summer conditions since this period corresponds with lower river flows, and higher air and water temperatures. Based on EPA's review of the two temperature data sets, it appears that ambient river temperatures, as represented by data collected at Station N-10, were significantly cooler (2.4°C/4.4°F) during the July 2009 study period than during the 21-year period from 1984-2004 for the same dates reviewed (July 11-21). This suggests that the ambient river temperatures used in the model did not reflect typical summer conditions in Hooksett Pool.

ASA Response

Again, USEPA misinterpreted the purpose of using the 2009 data set, i.e., to successfully calibrate and verify the model. ASA did not propose that the 2009 period was typical, only that an extensive data set was available for model calibration and verification. Again, average and extreme years were subsequently modeled.

EPA Comment (pg. 85, para. 1)

There were other notable differences in the data sets, as well. Based on the new model, PSNH predicts that "significant" temperatures would be restricted to the area of the river closest to the mouth of the cooling canal (as represented by Station S-0), but the 21-year data set for these periods in July and August indicates that temperature effects have been both more extreme and more extensive than the new model predicts. EPA's review of the two data sets revealed temperature differences between ambient (Station N-10) and Station S-0 to average 9.2°C (16.2°F) for July 11-21 period (21-year data set) compared to only 5.8°C (10.4°F) for the ASA data (Table 5-18). The differences were also notable in the two data sets when comparing ambient temperatures with temperatures recorded at Station S-4. The average delta-T for the July 11-21 period, based on the 21-year data set, was 3.2°C (5.8°F), while the average delta-T between Stations N-10 and S-4 was only 0.8°C(1.4°F) using the ASA data (Table 5-18).

ASA Response

ASA did not imply that the 2009 period was the warmest period only that the most extensive data set was used, typical of good modeling practice. In 2009 the plume was somewhat smaller and typically was oriented more to the west side of the Pool. As above, the purpose of the

modeling described in Crowley et al. (2010) was to document model calibration and verification. A joint probability analysis was subsequently conducted to identify average and extreme years based on river temperature and flow (Crowley et al., 2012).

EPA Comment (pg. 85, para. 2)

EPA also reviewed river flow data in order to assess if flows in the summer of 2009 were comparable to typical summer flows. Using an existing 15-year river flow data set covering the years 1993 through 2007 for Garvins Falls Dam, EPA compared the mean river flow values of this data set with river flow data from the months of July and August in 2009. Based on this analysis, the mean river flow during July 2009 was more than three times (3.4) as high as the average flow in July, from 1993 to 2007 (see Table 5-19). The difference in mean flow during August 2009 was even higher (3.7 times higher) as compared to the August mean flow from 1993 to 2007. With river flows being more than three times greater in 2009 than the 15-year average (1993-2007), EPA cannot consider the flows in July and August 2009 used in ASA's model to be typical of summer flow conditions in Hooksett Pool.

ASA Response

USEPA fundamentally misinterpreted the goal of the study as noted above. The subsequent study analyzed environmental conditions to determine years with typical and extreme periods.

EPA Comment (pg. 85, para. 3)

Following its review of ASA's plume study, EPA has concluded that data collected in 2009 does not reflect typical thermal or flow conditions in Hooksett Pool during summer months, nor do they capture the magnitude of temperature change, or the spatial extent of the plume's influence that is reflected in 20 years of temperature data collected by PSNH. Therefore, ASA's report does not alter EPA's assessment of Merrimack Station's thermal impact on the Hooksett Pool.

ASA Response

ASA's modeling successfully captured the magnitude of temperature change and spatial extent of the plume's influence in 2009 as documented by its report. ASA did not seek to imply that 2009 period was a typical year, as stated above. Additional model runs using the validated model for average and extreme years for different periods of combined biological and environmental significance were subsequently performed (Crowley, et al., 2012).

References

Crowley, D., C. Swanson, L. Decker, and N. Cohn, 2010. Modeling the Thermal Plume in the Merrimack River from the Merrimack Station Discharge. ASA Project 10-011. Prepared for Public Service New Hampshire, Bow, NH, December 2010.

Crowley, D., C. Swanson, and L. Decker, 2012. Modeling the Thermal Structure in the Hooksett Pool of the Merrimack River During Periods of Biological Significance. ASA Project 10-011. Prepared for Public Service New Hampshire, Bow, NH, February 2012.

USEPA, 2012. Clean Water Act NPDES Permitting Determinations for the Thermal Discharge and Cooling Water Intake Structures at Merrimack Station in Bow, New Hampshire, NPDES Permit No. NH 0001465. EPA – New England, Boston, MA.