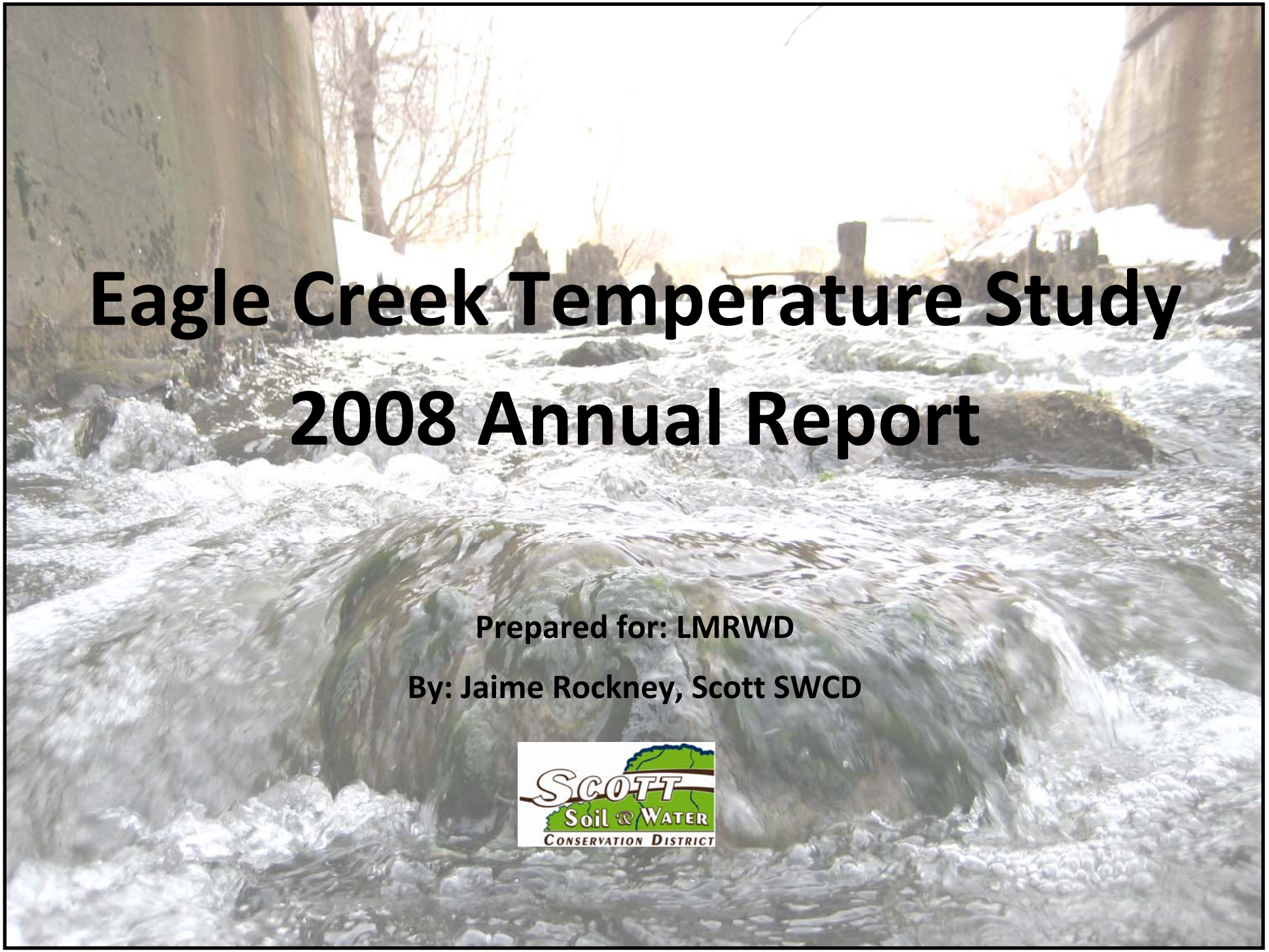

Eagle Creek Temperature Study
2008 Annual Report

Prepared for: LMRWD

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Scott Soil & Water Conservation District

Introduction

This study was initiated to evaluate the effect storm water runoff from Highway 101 has on temperature of Eagle Creek, a DNR designated trout stream. Because trout are sensitive to temperature, it is a critical variable to monitor. The optimal temperature range for adult brown trout is approximately 12.4 – 17.6° Celsius (Bell, 2006). Temperature loggers were placed upstream and downstream of Highway 101 by Bonestroo in June of 2006. The loggers record temperature in 15 minute intervals. Refer to the following report to see the relationship of temperature upstream and downstream of Highway 101 during 2008.

Figure 1. Location of Temperature Loggers

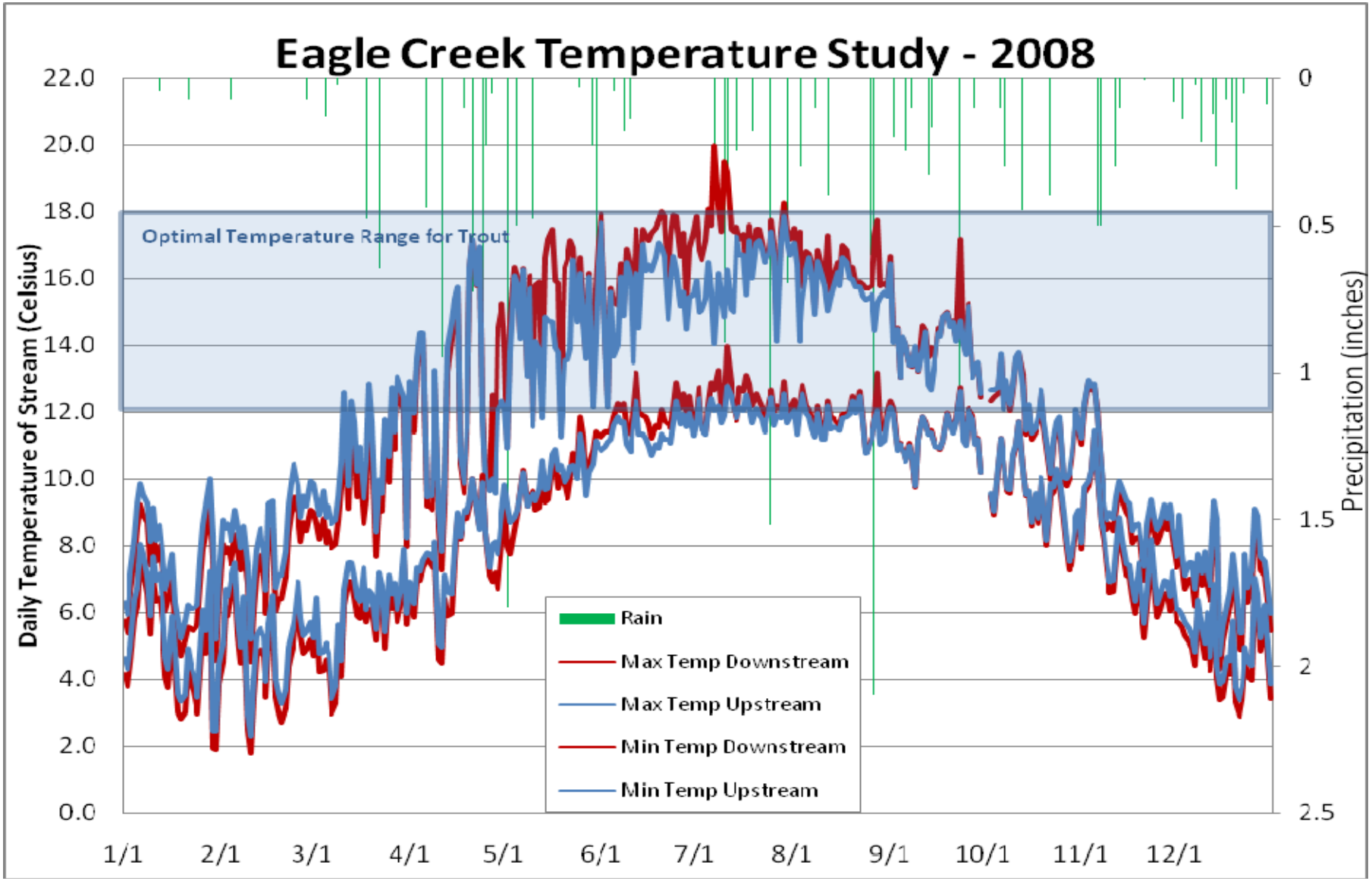

Figure 2. Daily maximum and minimum temperatures for 2008 (October 1 and 2 are missing)

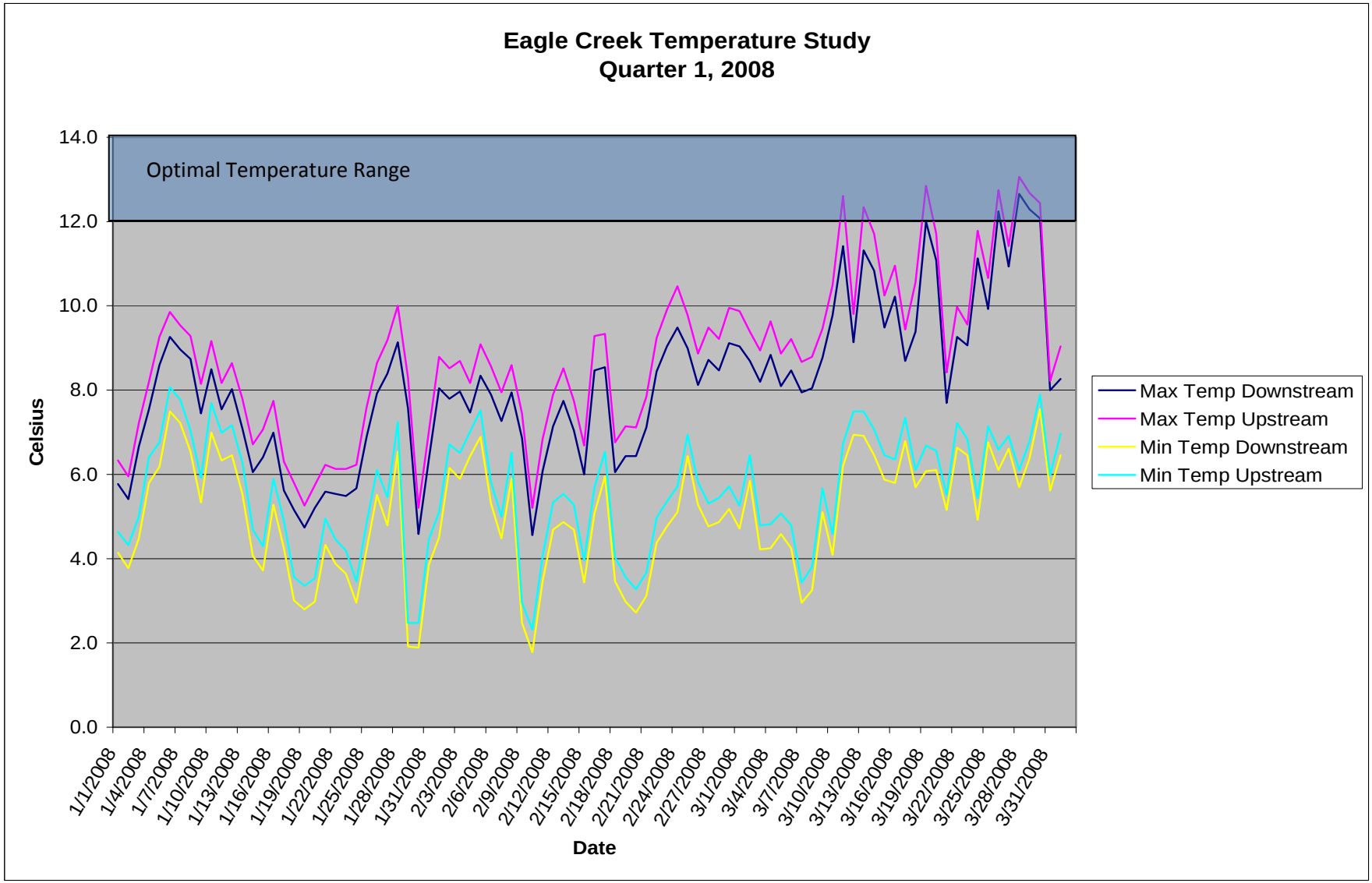

Figure 3. Quarter 1, 2008 – Maximum and Minimum Daily Temperature Ranges. Because of the cold air temperatures in quarter 1, all stream temperatures were at or below the optimal temperature range. The daily maximum and minimum temperatures are similar, but the upstream sight is consistently warmer than the downstream sight. This slight difference is likely due to atmospheric cooling of the stream, and indicates that groundwater inflows that would be warmer than the air temperature are not significant in this reach.

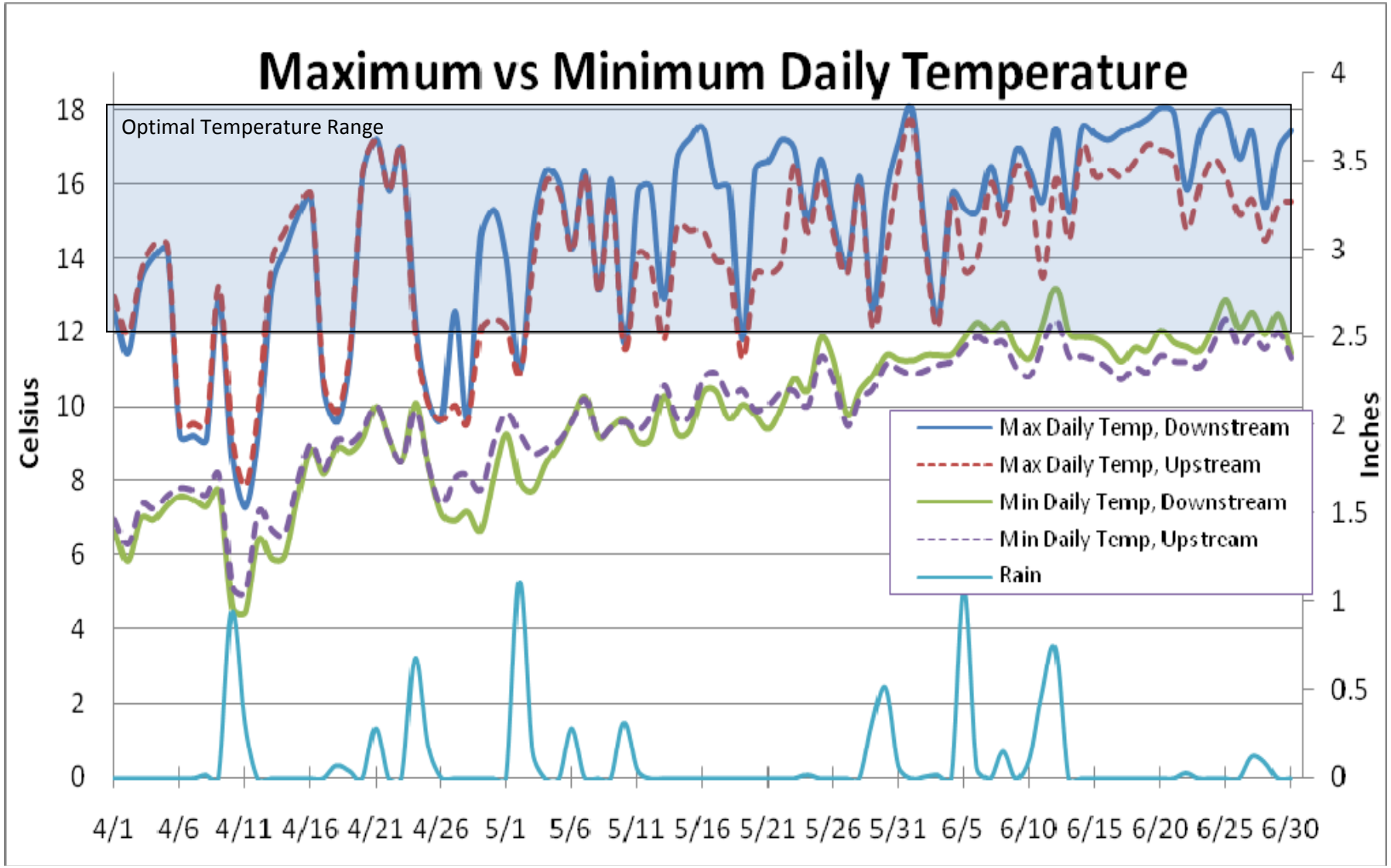

Figure 4. Quarter 2, 2008 – Maximum and Minimum Daily Temperature Ranges. All temperatures stay within or below the optimal range. During April, the temperatures seem to follow each other closely. May and June show several instances where the upstream and downstream temperatures deviate from each other and the downstream logger is consistently warmer than upstream. Some of the deviations appear directly linked to rainfall, while others do not. The cause of the fluctuations not linked to rainfall is unknown at this time and warrants further study.

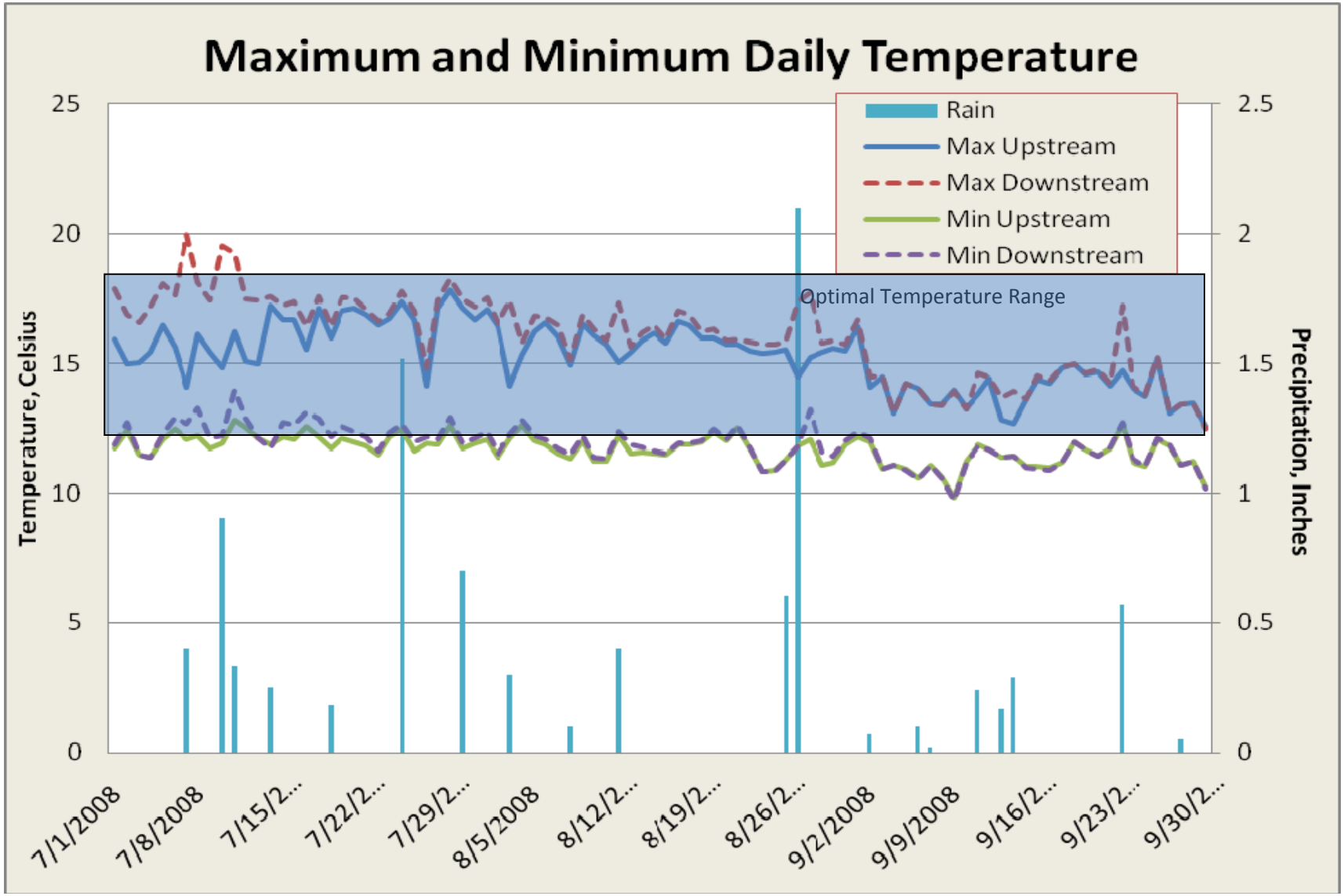

Figure 5. Quarter 3, 2008 – Maximum and Minimum Daily Temperature Ranges. During the beginning of July, a few instances exceed the optimal temperature range. By looking at Figure 6, those instances are broken down into a 48 hour period.

During July and August, a few times during rain events temperature decreases upstream while increasing downstream which doesn't appear to happen any other quarter. This could be due to the relatively cold rain water entering the river upstream, while water running off warm pavement could be heating the river downstream.

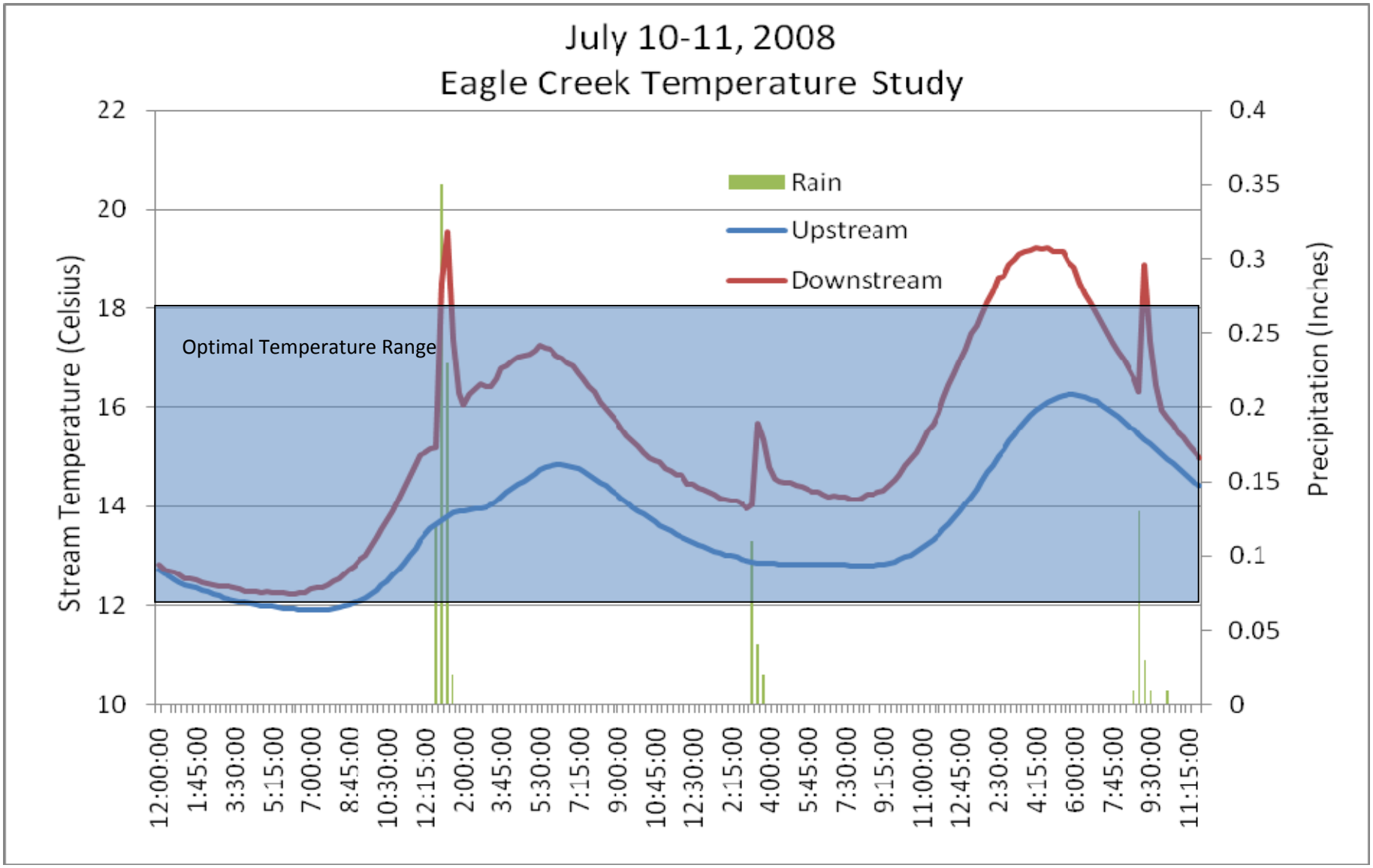

Figure 6. 15 minute temperature readings from July 10-11. This figure shows the immediate response of temperature from rain events over a 48 hour period. The optimal temperature range is exceeded for only a short amount of time. Although it is a short amount of time that the exceedance is surpassed, fish are relatively intolerant of drastic temperature fluctuations and may stress trout. This example shows a 5° C temperature spike between the two loggers, which are ~400 feet apart.

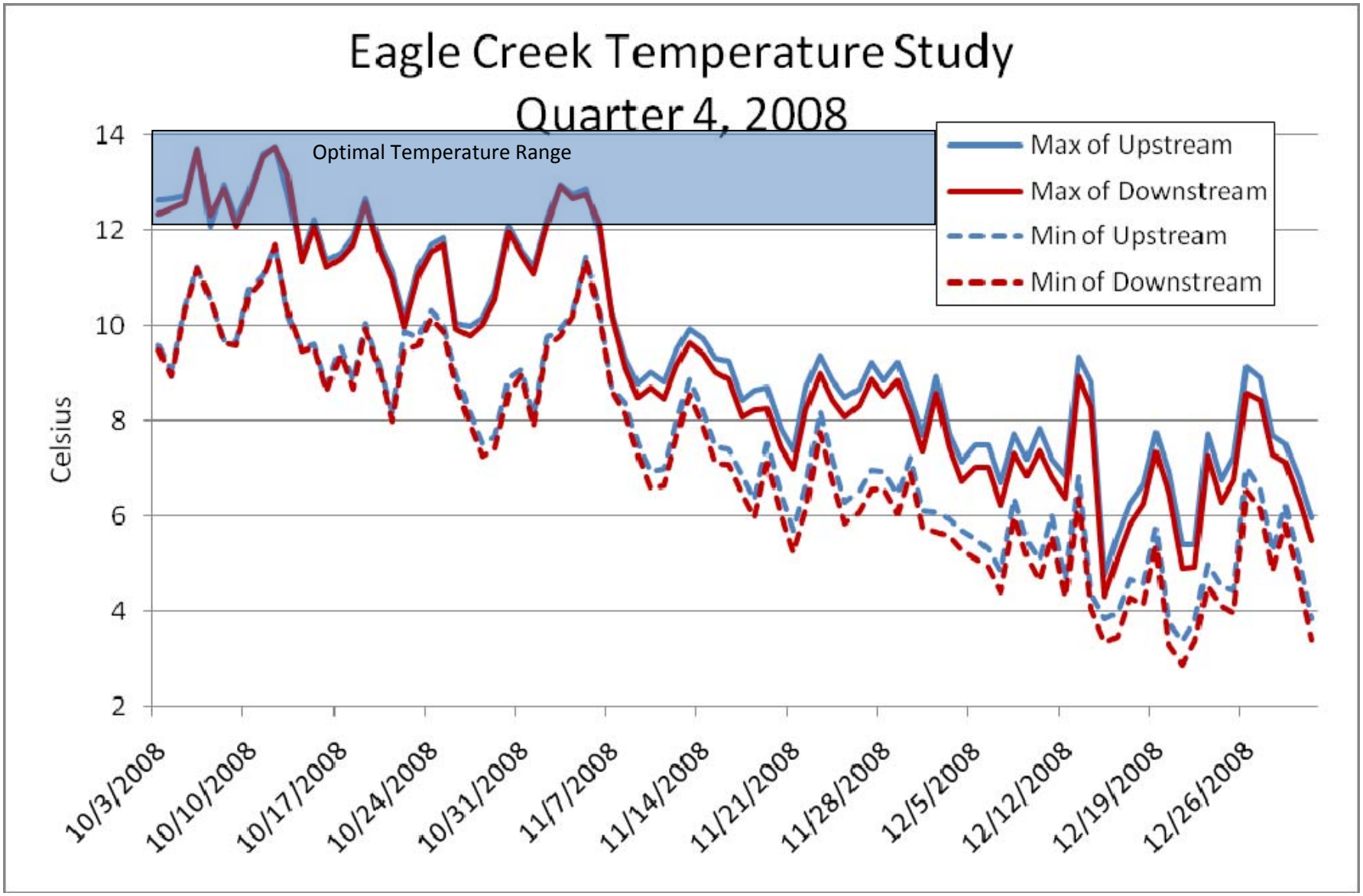

Figure 7. Quarter 4, 2008 – Maximum and Minimum Daily Temperature Ranges. Water temperatures mimic each other very closely. As air temperature cools, the downstream logger is also recording colder temperatures, most likely due to atmospheric cooling of the water.

Summary and Conclusions

During 2008, water temperatures rarely exceeded the optimal range for trout. However, during summer months there is a noticeable warming of water temperature downstream of highway 101 following rain events. This trend can likely be attributed to rain water heating up after landing on hot pavement and running off into cooler stream water. This increase greatly exceeds the small increase in temperature seen during dry periods that could be attributed to atmospheric warming of the stream. Even though the temperature exceeds the optimal range for trout by only a few degrees and for only a short period, the drastic temperature increase can be highly stressfulto fish.

Water temperature is an important factor influencing the health of trout streams. Overall, water quality of Eagle Creek appears good. Trout are making a comeback (Peterson, 2008), water temperatures rarely exceed optimal range, and most of the riparian area is in a natural state. However, the state water quality standard for Class 2A waters maintain that there shall be “no material increase” in temperature. Depending upon how the standard is interpreted, these data could possibly lead to an impairment listing and Total Maximum Daily Load Temperature Study on Eagle Creek if submitted to the the Minnesota Pollution Control Agency for review.

Another variable to consider is the pond located between Highway 101 and the railroad tracks, which empties into Eagle Creek from the west (see Figure 8). The downstream temperature logger is located approximately 30 feet downstream of this input. This pond holds water which is likely warmed by a combination of the sun and storm water runoff and may release large amounts of warm water during rain events as it overflows. The temperature spikes may not be due entirely to runoff from Highway 101, but rather a combination of the warm ponded water and runoff from Highway 101. This will be investigated further in 2009. Placing another temperature logger upstream of the tributary or taking instantaneous temperature measurements upstream, downstream, and directly in the tributary water during base flow and storm events would help determine the influence the pond has on temperature increase of Eagle Creek. The results of this analysis will be reported in the Eagle Creek Temperature Study, 2009 Annual Report.

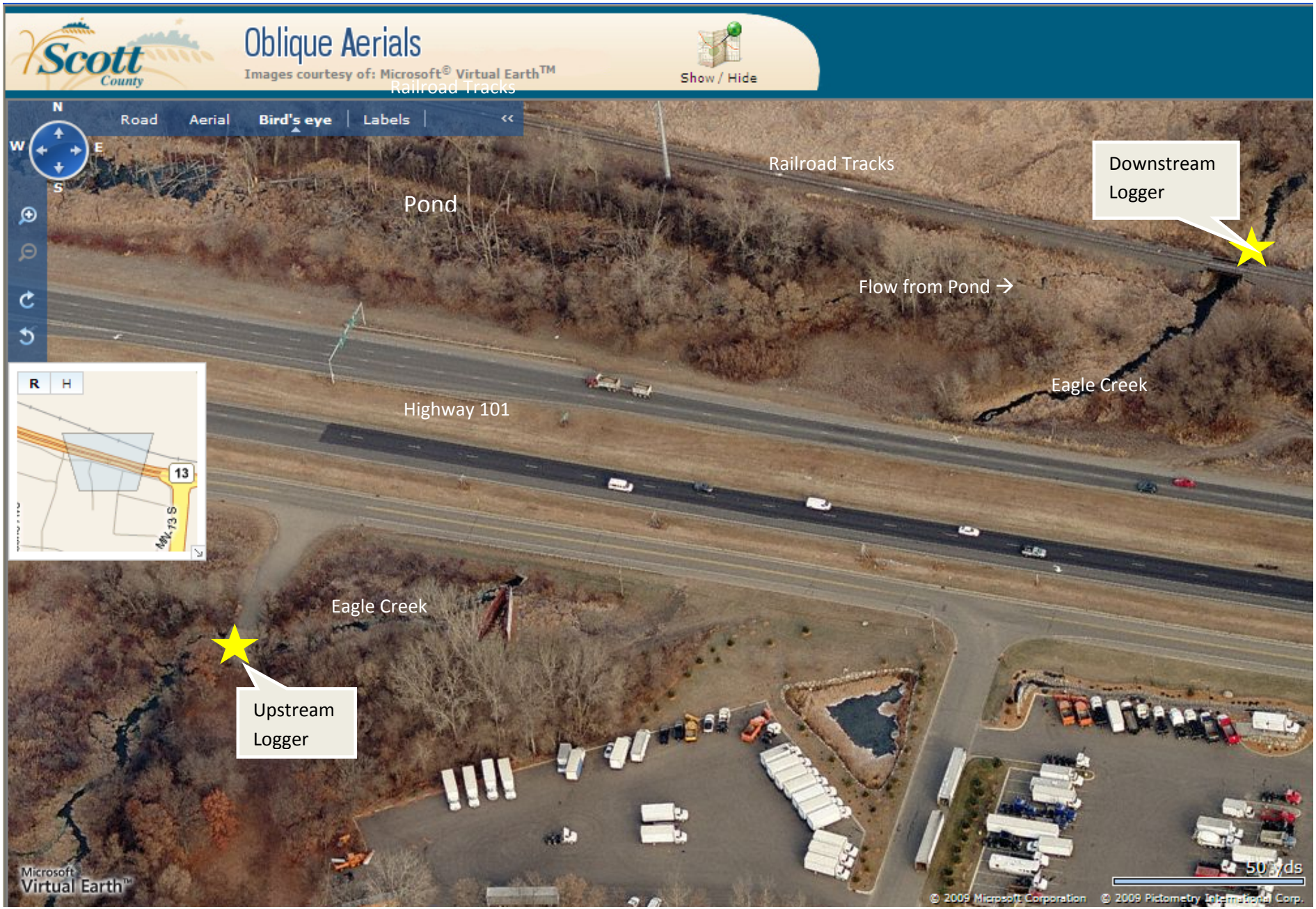

Figure 8. Pond influence. Birdseye View from South

Works Cited:

Bell J.M., 2006. The Assessment of Thermal Impacts on Habitat Selection, Growth, Reproduction, and Mortality in Brown Trout (*Salm trutta* L): A Review of the Literature. Prepared for the Vermillion River EPA Grant #WS 97512701-0 and the Vermillion River Joint Powers Board. Applied Ecological Services, Inc.

Peterson, David. (2008, October 1). "Without a doubt: More trout in Eagle Creek." *Star Tribune*. 2008. Star Tribune. 21 May 2009 [http://www.startribune.com/local/south/29842934.html?elr=KArksi8cyaiUo8cyaiUiD3aPc:_Yyc:aUU].