

USACE WALLA WALLA DISTRICT BIOLOGICAL SERVICES: TEMPERATURE MONITORING PROGRAM AT MCNARY DAM

Prepared By:	Kathleen Carter, Mainstem Fish Research; Douglas Long, Aerotek	Date:	June 20, 2016
		Report Period:	June 10 to 16, 2016
Report No.	MCN TEMP 3-16		

Fish Collection

Daily datasets run from 0700 of the previous day to 0700 of the reporting day. Data for this week's report were collected from 0700 on June 9 to 0700 on June 16 and reported each day from June 10 to June 16. An estimated 113,583 juvenile salmonids bypassed the McNary Juvenile Fish Facility (JFF) and consisted of 98% subyearling Chinook salmon, 0.7% yearling Chinook salmon, 0.5% subyearling Chinook fry, 0.4% steelhead, and 0.4% sockeye salmon (Table 1). There were total of 20 juvenile system mortalities, comprised of 1 sample mortality and 19 facility mortalities (Figure 1).

River Conditions

Average river flow for this reporting period was 201,400 cubic feet per second (201.4 kcfs), with an average spill of 81.6 kcfs. The average powerhouse flow was 115.1 kcfs.

Weather Conditions

The weekly average daytime temperature for June 9 to June 16 was 65.3 °F. The weekly average nighttime temperature was 57.2 °F. Temperatures ranged from a maximum of 79.6 °F at 1630 on June 9 to a minimum of 47.9 °F from 0330 to 0430 on June 15.

Winds averaged 3.9 mph this week. The wind was highest from 1900 to 2200 on June 9, with winds averaging 17.1 mph and gusts up to 37 mph.

Probe Operations

Probes in spillbays 22, 17, 12, and 7 were removed for debris clearing. The probe at spillbay 22 was taken out of service from 0800 on June 8 to 0730 on June 9. Probes at spillbays 17, 12, and 7 were taken out of service from 0930 to 1200 on June 9.

The spillbay 22 probe malfunctioned over several days. The probe failed to record data from 0700 on June 9 to 0830 on June 11. The probe had a small amount of corrosion on the circuit board, and the battery may have been loose. At 0815 on June 11, the battery was replaced and data recording resumed.

Temperature probes at JFF (separator, sample tank A, and recovery raceway 9W) and the collection channel (at Units 1, 8, and 12) were taken out of service from 0830 on June 14 to 1300 on June 15. The collection channel and JFF were dewatered to repair a malfunctioning sidebrush in the collection channel at Unit 1.

Water Temperatures

Temperature data were collected every half hour. Temperature averages are expressed as either as an average temperature during a half hour or the entire week. For the large portion of the week, water temperatures through the powerhouse and into the JFF trended with air temperatures (Figures 2 and 3). Generally, the water temperature cooled slightly during the week. The average gatewell temperature (weekly average 64.6 °F) was generally higher than the average temperatures in the forebay (weekly average 63.9 °F), collection channel (weekly average 63.7 °F), and JFF (weekly average 63.1°F). The average forebay and collection channel were similar during the majority of the week. JFF and tailwater 14 had the lowest temperatures.

Water temperatures increased markedly from approximately 1030 to 2000 on June 9 and again at approximately 0830 on June 12 to approximately 1130 on June 13. The increase in temperatures did not trend with air temperatures. Warmer water was detected in the forebay, gatewells, collection channel, and JFF, but not in the tailwater or wing wall areas.

The influx of warmer water affected the temperature differentials across the dam. The difference between minimum and maximum temperatures across the forebay, gatewells, collection channel, and JFF increased with the warmer waters (Figure 4). The forebay saw the largest increase in differential temperatures. Average weekly difference between

minimum and maximum temperature in the forebay was 5.9 °F. The maximum differential across the forebay detected in one half-hour period was 12.1 °F and lasted from 1700 to 1800 on June 12. Average weekly differential for the gatewells was 4.9 °F. The maximum half-hour differential was 8.8 °F at 1800 on June 12.

The warmer waters had a smaller effect on water temperatures through the dam (Figures 5 and 6). The average weekly absolute differential between the gatewell and forebay was 1.7 °F. The average differential temperature generally showed the gatewell to be warmer than the forebay, except for Units 1, 3, 6, 7, 8, and 14. The largest half-hour differential was 5.4 °F at Unit 2 at 1800 on June 12, with the forebay being warmer than the gatewell. The average weekly absolute differential between the gatewell and collection channel was 1.4 °F, with the average differential temperature showing the gatewell being warmer at all three locations. The largest half-hour differential was 4.5 °F at Unit 1 from 1900 to 1930 on June 12, with the gatewell being warmer than the collection channel.

The spillway temperatures followed the same trends as seen in the powerhouse (Figure 7). Spillbay 1 had the highest average weekly temperature, at 66.1 °F. Spillbays 22 and 12 had the lowest weekly temperatures, at 61.5 °F and 62.0 °F, respectively. The wing wall closely resembled the temperature profile of spillbay 17 throughout the week.

Table 1
Bypass, Mortality, and River and Weather Conditions

Date	Fish Bypass	Mortality		Avg. River Flow	Avg. Turbine Flow	Avg. Spill	Air Temperature		Wind Speed	
		Sample	Facility				Avg.	Max	Avg.	Max
Jun 9–10	36,881	0	19	213.9	123.4	85.8	66.2	79.6	3.0	37.0
Jun 10–11	--	--	--	218.8	126.4	87.8	61.1	72.1	4.1	23.0
Jun 11–12	32,000	0	0	202.8	116.3	81.7	62.6	73.0	1.9	24.0
Jun 12–13	--	--	--	189.3	108.5	76.2	66.5	78.6	0.8	13.0
Jun 13–14	6,703	0	0	202.8	116.9	81.2	63.5	72.5	7.7	30.0
Jun 14–15	--	--	--	191.4	109.9	76.8	59.1	67.4	3.4	27.0
Jun 15–16	37,999	1	0	190.8	104.3	81.8	54.2	56.5	2.7	20.0
Weekly Average	113,583	1	19	201.4	115.1	81.6	62.4		3.4	

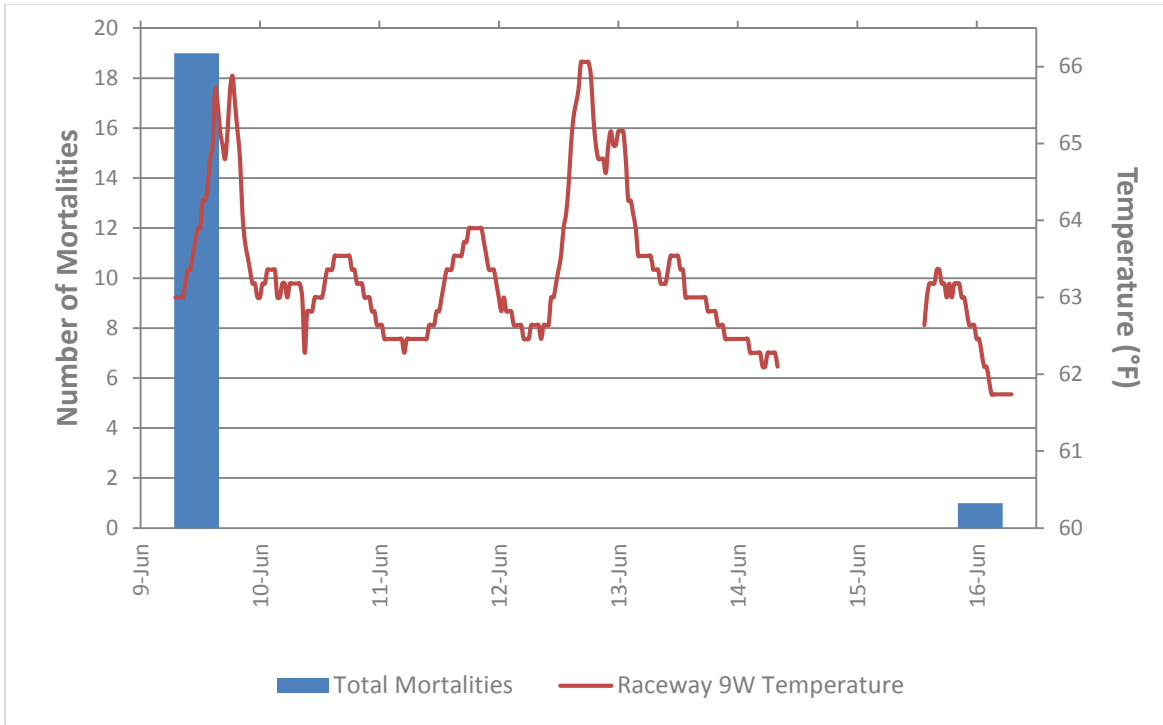


Figure 1
Juvenile Fish Facility Total System Mortalities and Raceway 9W Temperatures

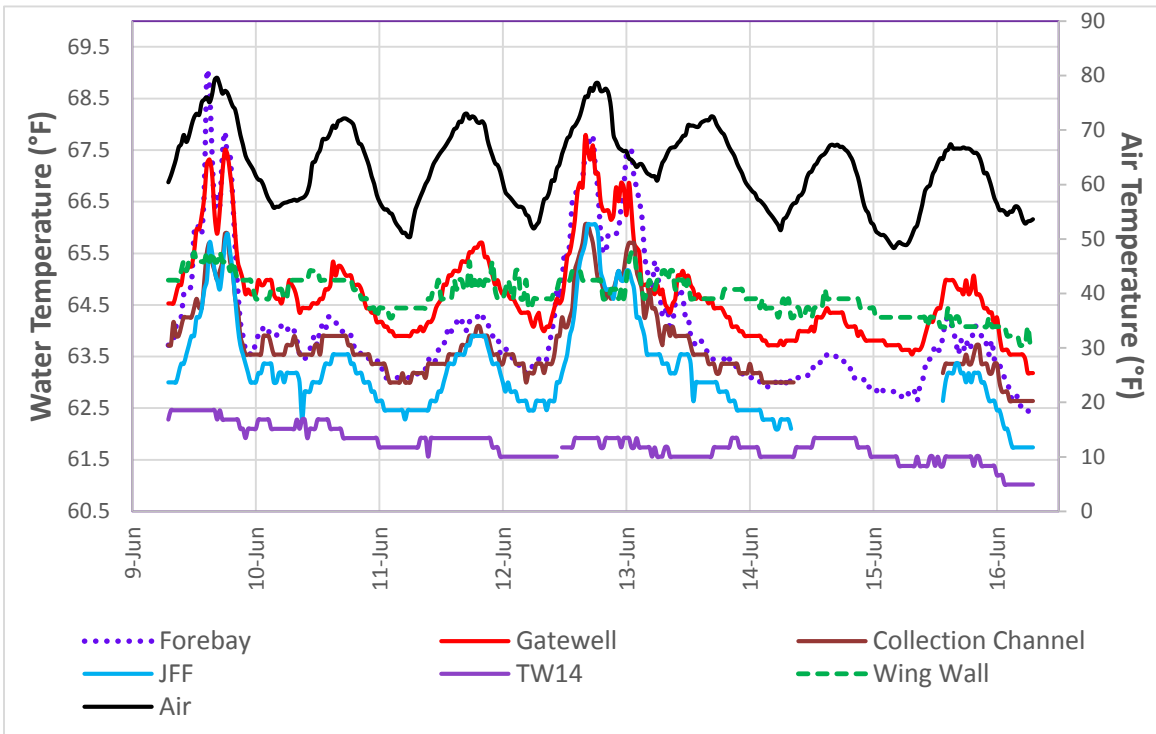


Figure 2
Average Air and Water Temperatures for Six Dam Locations for 0700 on June 9 to 0700 on June 16

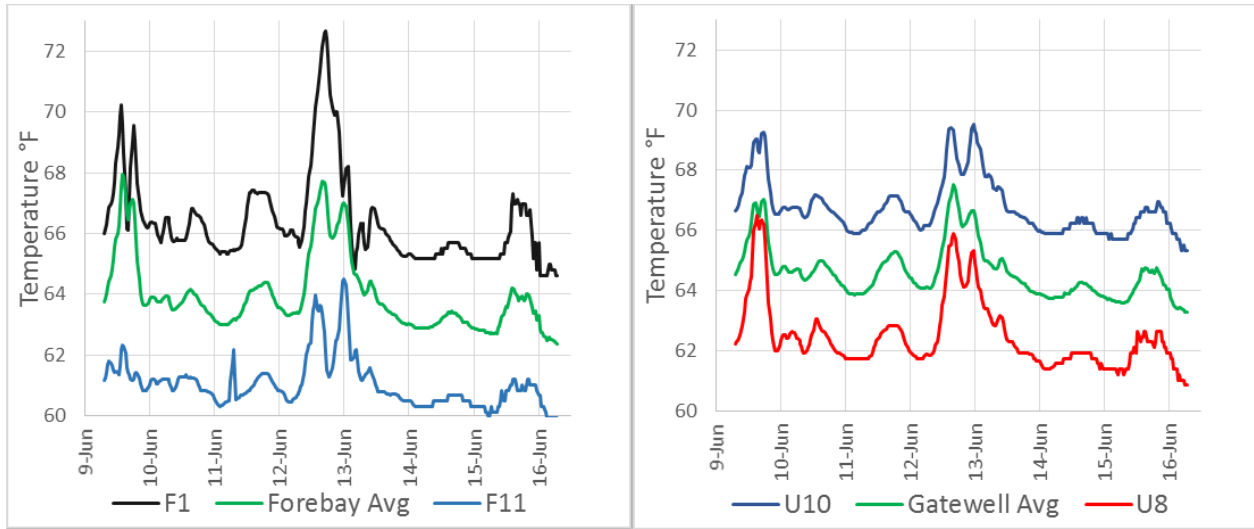


Figure 3
High, Average, and Low Forebay and Gatewell Temperatures

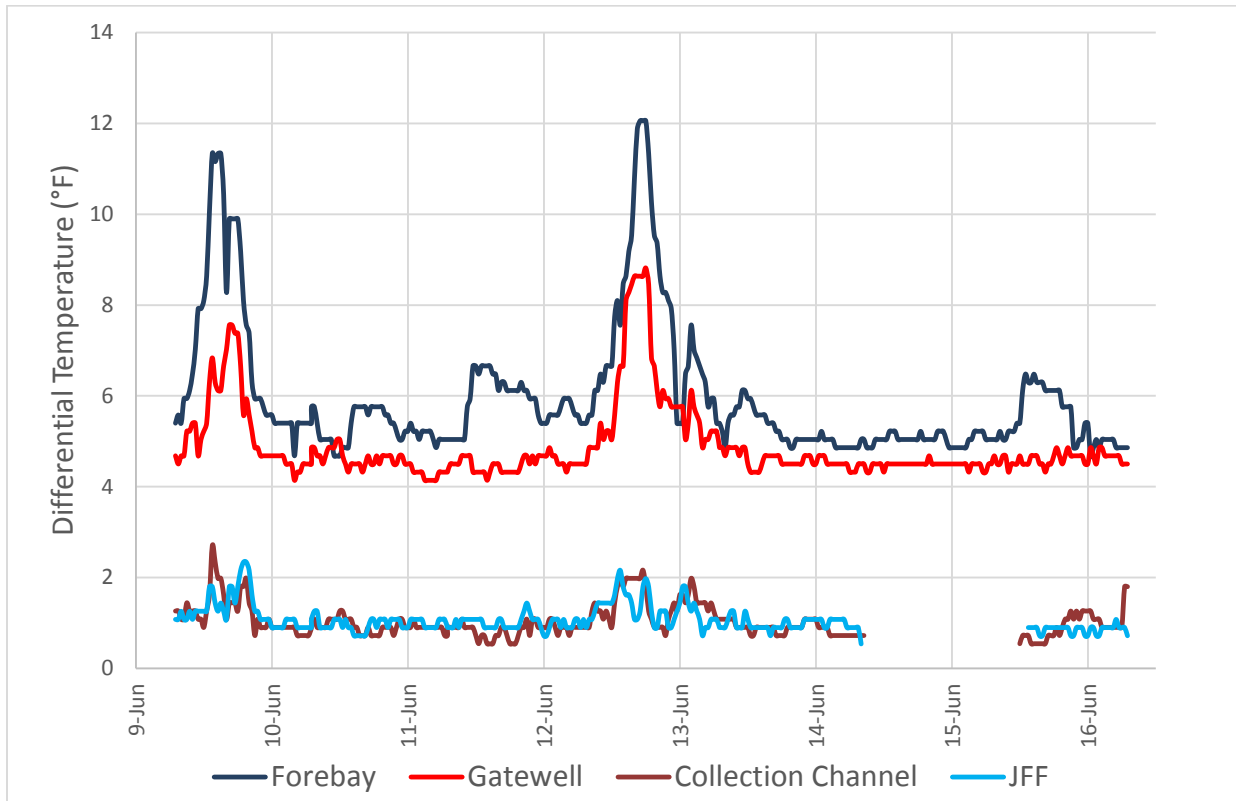


Figure 4
Average Differential Temperatures within Four Dam Locations

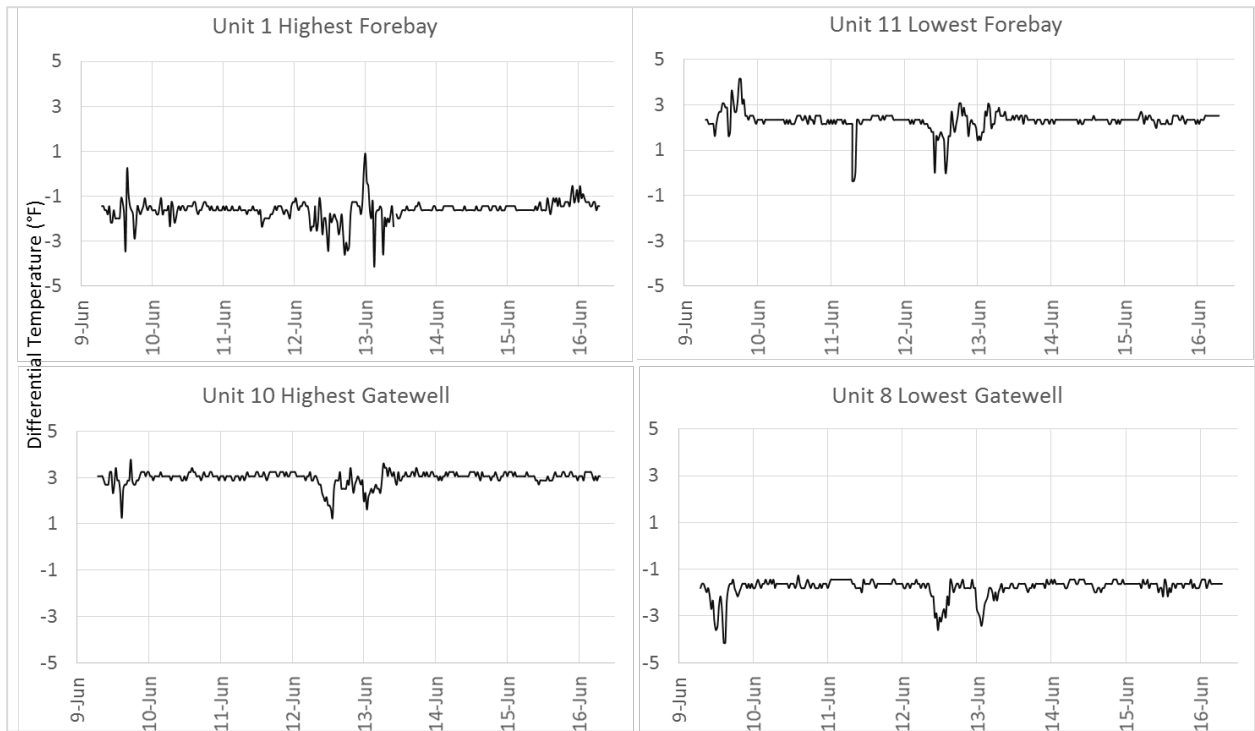


Figure 5

Gatewell and Forebay Differential Temperatures (Gatewell minus Forebay) for Units with the Highest and Lowest Weekly Average Temperature

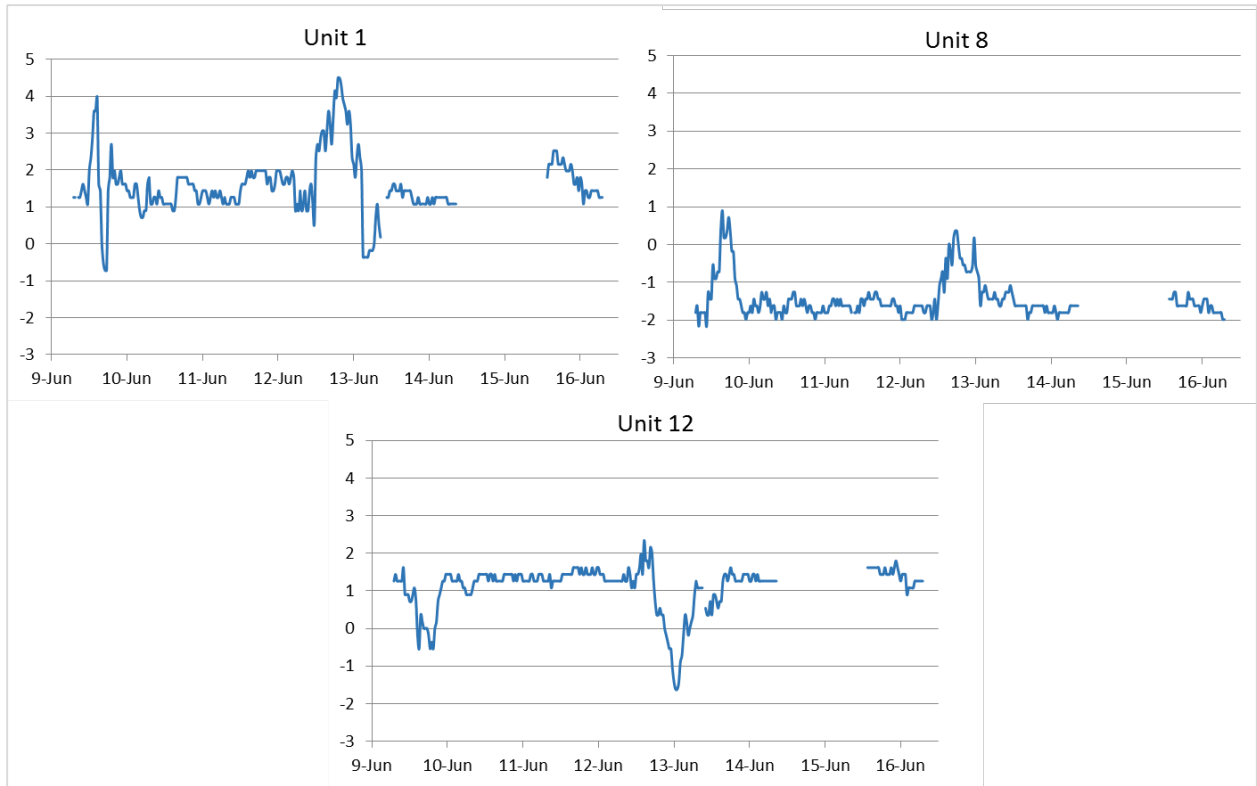


Figure 6
Gatewell and Collection Channel Differential Temperatures (Gatewell minus Collection Channel) for
Units 1, 8, and 12

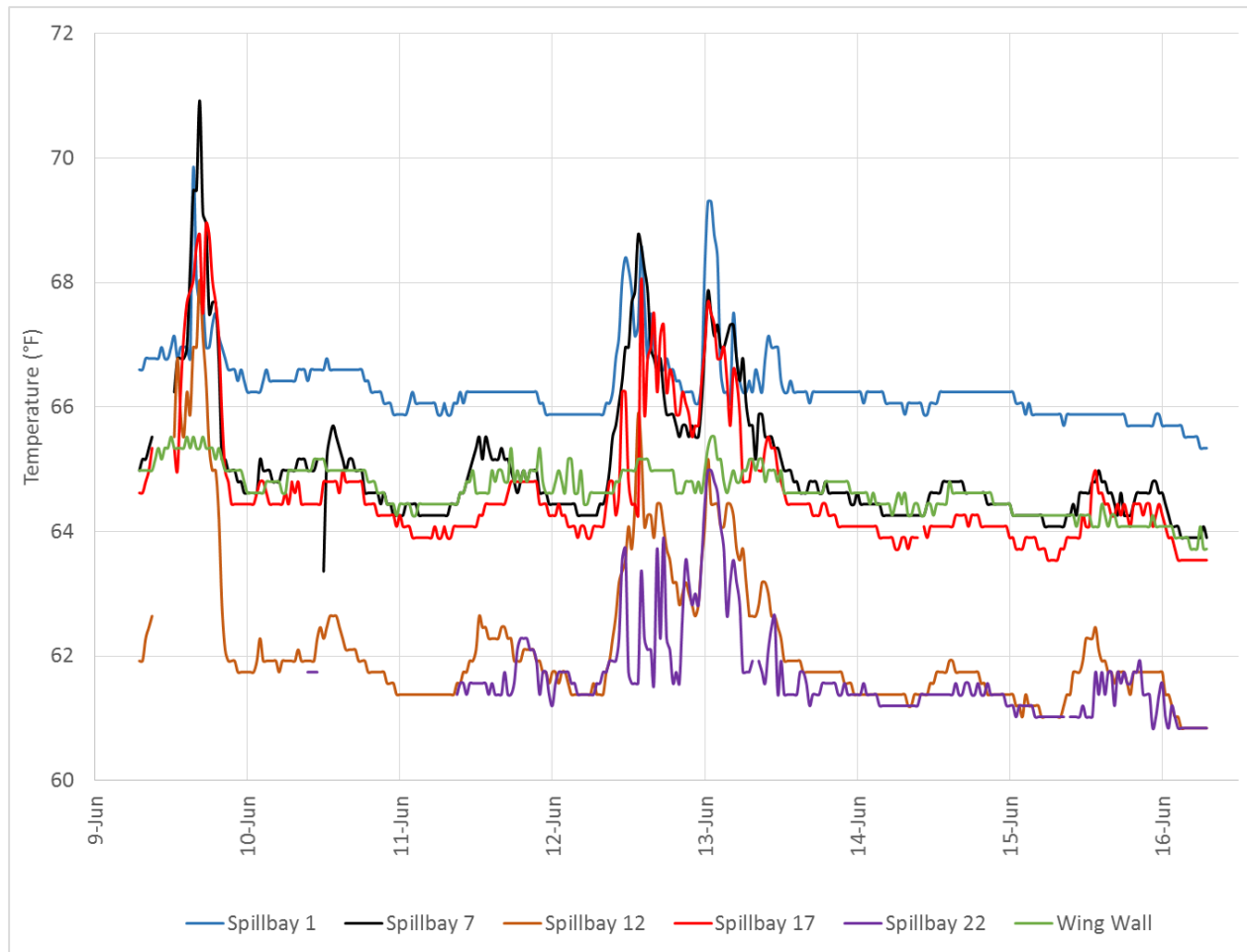


Figure 7
Temperatures for Five Spillbays and the Wing Wall from 0700 on June 9 to 0700 on June 16