SUPPLEMENTAL EXPERT REPORT OF DONALD J. SMITH

1. Introduction and Summary of Opinions:

I, Donald J. Smith have been identified as an expert by the U.S. Department of Justice to provide testimony in *NRDC v. Rodgers*. I have been asked to express my opinions regarding preliminary flow and water temperature modeling of the San Joaquin River from downstream of the Friant Dam to the confluence of the Merced River. My opinion was summarized in "Expert Report of Donald J. Smith", August 18, 2005.

My expert report was based in part on preliminary results from the HEC-5Q model of the San Joaquin River system between of the confluence with the Merced River and Millerton Lake. My expert report contained an analysis of the thermal response of the river-reservoir system to incremental increases in releases from Friant Dam with a corresponding decrease in diversions (Madera and Friant-Kern Canals) from Millerton Lake. The incremental release approach was used since I did not have a proposed river restoration flow Friant Dam release schedule. Upon review of the NDRC expert reports (Expert Report of Professor G. Mathigs Kondolf, Ph.D., August 11, 2005), a proposed restoration Friant Dam release schedule is now available. Additionally, the HEC-5Q model is currently under development and has been refined since August 18, 2005.

This supplement report describes the current status of the HEC-5Q model and the results of the analysis of the Kondolf based hydrograph.

1.a Summary of HEC-5Q model status

1. Meteorology: Meteorological data of four CIMIS stations are now being utilized. The CIMIS stations and model components are summarized below. (Note that there has been no change in the meteorological data for the system above Mendota Pool, therefore, the calibration results presented in the August 18 report are unaffected.)
   a. Fresno: Millerton and San Joaquin River above Mendota Pool
   b. Firebaugh: Mendota Pool and San Joaquin River and Bypass to Bear Creek
   c. Kesterson: San Joaquin River and Bear Creek to below the Merced Confluence
   d. Madera: Merced River inflow temperature

2. Mendota Pool: Operation of the Mendota Pool has been changed to reflect annual Mendota Dam inspection requirements. The Mendota Pool is assumed drained between December and January of next year of each year. The reservoir is approximated as a stream and Mendota Pool diversions are discontinued.

3. Stream and Mendota Pool inflow temperature: The inflows temperature relations for tributary streams below Mendota Dam have been refined and Delta Mendota Canal (DMC) inflow temperatures have defended as the daily average computed as the average temperature in the DMC at Check 21 (CDEC – DM3). These changes do not impact the calibration results of the August 18 report

4. Millerton Lake inflow Temperature: Additional ambient temperature data for the 1960 – 1974 period at the Kerckhoff PH #1 were obtained. These temperature data along with the average for each day of the year are shown in Figure 1. I believe that this temperature record provides the best indication of the long-term inflow temperatures to Millerton Lake. The average seasonal temperature distribution computed from these data was used to refine the algorithm used to compute the Millerton Lake inflow temperature. The algorithm computed the inflow temperature at 6-hour intervals from the seasonal distribution, inflow rate and meteorology. These changes result in a slight increase in the Friant Dam release temperatures reported in the calibration results of the August 18 report. The increase can be seen in Table 2, which is a modified version of equivalent table of the August 18 report. These small changes do not impact the conclusions regarding river temperature dynamics expressed in that report. Table 2 also includes the computed temperature statistics for the Kondolf hydrograph based operation.

5. Channel cross sections: The cross sections data developed for the Bypass between Sand Slough and Owens Creek were in error and have been corrected. This error does not impact the calibration results of the August 18 report.

6. Flow Routing: Flow routing has been implemented to better represent attenuation of flow as it transits the San Joaquin River and Bypass system. Figure 2 shows the observed Friant Dam Release rate and the computed and observed flow in the San Joaquin River at Stevinson for the first six months of 2000. This plot shows that the model represents the flow trends at Stevinson. It also shows that the flow at Stevinson is somewhat independent of Friant Dam release rates during periods of elevated tributary inflow. Flow routing in the San Joaquin River between Friant Dam and Mendota pool result in a slight change in the temperatures reported in the calibration results of the August 18 report. The net temperature change due to flow routing and changes in Friant Dam release temperature can be seen in Table 2.

7. The model calibration has been refined but additional calibration is anticipated. Figure 3 shows the computed and observed (CDEC temperature data) San Joaquin River temperature at Stevinson. This figure shows that the model captures the seasonal variation in the lower river during the 5-year hydrograph analysis period of 2000 through 2004.

Table 1. Flow Volume Statistics for Millerton Lake for Historical and Revised Operation to Meet Restoration Flow Requirements per Kondolf hydrographs

Year	Year type	Volume (TAF)	Historical Volume (TAF)		Kondolf Volume (TAF)	
		Diverted	canals	river	canals	river
2000	normal-wet	291	1,543	183	1,252	474
2001	dry	173	966	129	792	302
2002	dry	187	984	114	795	301
2003	normal-dry	240	1,304	131	1,063	371
2004	dry	180	967	130	786	310

Table 2. Average Flow and Computed and Observed Temperatures in the San Joaquin River between Friant Dam and Gravelly Ford for the period of July 1 through August 31, 2002

	Friant Bridge	Willow Unit	Sportsman Club	Milburn Unit	Donny Bridge	Skaggs Park	Gravelly Ford
Distance below Dam, miles	<1	8	11	20	25	34	38
Average observed Flow, cfs	216	na	na	na	92	69	10
Computed temperature, F	47.6	60.9	68.1	78.4	81.2	81.7	81.6
Observed temperature, F (CDF&G)	49.5	60.3	67.1	79.0	na	82.0	na
Computed temperature, F (Kondolf)	48.9	58.5	63.9	72.2		77.1	78.7

1.b **Assumptions made in the analysis of temperature impacts of river restoration flows**

1. The Kondolf expert report was reviewed by Ms. Claire Hsu of Reclamation and yearly hydrographs for various water year types were developed. I used selected restoration flow requirements and the historical record for the 2000 – 2005 analysis periods to develop the hypothetical Friant Dam release sequence. The following assumptions were made.
    a. Historical inflows and channel depletions above Gravelly Ford were assumed.
    b. Kondolf channel depletion below Gravelly Ford were assumed.
    c. Kondolf Friant Dam releases were assumed subject to the minimum flow requirement in Reach 3 (above Mendota Pool). Small increases in the Friant Dam release rate were required during periods when observed depletion above Gravelly Ford exceeded the Kondolf estimates.

d. Historical DMC flows were increased during two short periods when the historical inflow to Mendota Pool from the San Joaquin exceeded the Kondolf flows.

e. Historical diversions to the Eastside Bypass were assumed. The San Joaquin River channel was assumed to convey all pulse flows without regard to present channel capacity restrictions.

f. Historical inflows and diversions below Gravelly Ford were assumed.

g. The Kondolf flow at the Merced River confluence was not considered due to the complexities resulting from tributary inflows and travel time delays. Flow routing results in the pulse flows lag of approximately 10 days between Friant Dam and the Merced River Confluence.

h. The Madera Canal and Friant-Kern Canal diversion rates were reduced by a uniform percentage to equal the increased Friant Dam release to the river. Table 1 summarizes the flow volumes by year.

i. The 2000 – 2004 historical and revised Friant Dam release to the San Joaquin River is shown in Figure 4. The resulting historical and revised Millerton Lake volume and water surface elevation is shown in Figures 5 and 6 respectively.

1.c **Results of the analysis of temperature impacts of river restoration flows**

1. The HEC-5Q model represents the reservoir in the vertical dimension. The reservoir inflow temperature is computed as a function of seasonal tendencies, inflow rate and meteorology. The inflow is distributed within the reservoir water column based on reservoir and inflow densities. Vertical mixing within the reservoir and source of withdrawal waters is computed as a function of reservoir density and geometry. The model calibration exercise relies on ambient temperature data in the form of temperature profiles within the reservoir and at the outlets to assess the models accuracy. Ambient reservoir temperature data consist of several monitoring events when temperature at various depths and locations were measured in Millerton Lake. Reservoir release temperatures (release to the river and canals) are available in 2004 and early 2005 and were discussed in my August 18, 2005 report.

   The computed impacts on temperature released to the river of restoration flows proposed by Kondolf suggest that the maximum thermal impact would occur in mid November of each year. Six water temperature profile plots are included for two purposed. First, the computed temperature profiles for historical and Kondolf hydrograph based operation show the computed impact of the two operating conditions. Plots are provided for mid-year and mid November of 2002, 2003 and 2004. Four of the plots include the observed temperature and provide some measure of model accuracy. The calibration variables and inflow computation algorithm are constant for all years, therefore I believe that the variation seen in the short calibration period is representative of the accuracy of the alternative evaluation period (i.e., 2000 – 2004)

   j. Figure 7: July, 1, 2002 – this is a typical mid summer profile. The sharp density gradient near elevation 540 results from atmospheric induced surface heating. Mid-summer inflow temperatures that are approximately 60^{o}F (see Figure 1) flow beneath the warm surface layer. The steeper thermal gradient in the vicinity of elevation 450 feet results from water from above being drawn down to the canal outlets. The increased temperature below elevation 440 computed for the Kondolf hydrograph based operation results from a larger amount of water being drawn down to the river outlet.

k. Figure 8; November 15, 2002 – This profile is within a week of the maximum increase in the computed river temperature associated with the Kondolf hydrograph based operation. It shows the impact of the increased flow to the river and associated depletion of the available cold water. The observed data shows that the model accurately represents thermal conditions at depth but over estimates the near surface waters. The computed surface water reached 62^{o}F approximately 2 weeks later.

l. Figure 9: July 3, 2003 – this profile is similar to the July 2003 profile. The observed data exhibit the same general shape as the computed but the mid elevation temperatures deviate from the computed by as much as 5^{o}F. I believe that much of this discrepancy results from the inflow temperature approximation.

m. Figure 10: November 16, 2003 - this profile is similar in shape to the November 2003 profile. The surface temperature is cooler and more inline with the previously years temperature on the same date.

n. Figure 11: July 3, 2003 – this profile is similar to the other two mid-summer profiles. The observed temperatures indicate that the model represents the thermal structure throughout the entire depth.

o. Figure 12: November 16, 2004 - this profile is similar in shape to the other November profile. The surface temperature is also warmer than the observed but the computed and observed profiles have the same shape.

Based on these and similar results of the calibration effort, it is my opinion that the model provides a reasonable approximation of the thermal dynamics of Millerton Lake and the temperature of the water released to the river. The tendency to compute warmer near surface waters in November may result in higher predicted river release temperatures towards the end of November.

2. In my report of August 18, 2005, I concluded the following regarding temperature responses in the San Joaquin River between Friant Dam and the confluence with the Merced River. These opinions were based on my experience with other river systems, the preliminary model calibration results and simulations that examined the temperature response to increased Friant Dam release rates.

a. Water released from Friant Dam to the San Joaquin River during the summer months warms rapidly due to the relatively warm meteorology. The rate of rise is dependant on the river flow rate. As flow rates increase, the depth of water increases and the rate of temperature raise decreases. River velocities increase and travel time decreases with higher flows, therefore the water reaches a downstream location more quickly. At any downstream location the rate of temperature change decreases with increased flow

b. Under current summertime operation, little flow originating from Millerton Lake reaches Mendota Pool. Therefore, waters continuing down the San Joaquin River below Mendota Dam reflect the thermal characteristics of the Delta-Mendota Canal.

c. Summertime San Joaquin water temperatures at the Merced confluence reflect the thermal characteristics of the agricultural drainage. Summertime flows in the San Joaquin River at Stevinson are currently small. Agricultural drainage flows enter the River via Salt and Mud Sloughs downstream of Stevinson and constitute the major component of the San Joaquin River at the Merced confluence. (Note that the term agricultural drainage in this context includes flow from the wildlife refuges that contribute a major component of Salt and Mud Slough flows.)

d. During periods of moderate flow (500 cfs), water released from Friant Dam would approach thermal equilibrium with the atmosphere before arriving at the confluence. Once thermal equilibrium is reached, the rate of change in temperature is controlled solely by atmospheric, channel and hydraulic conditions and is independent of the temperature at the source of the water.

3. The modeling work performed since August 18, 2005 including the evaluation of the thermal impacts of the Kondolf based hydrograph has not changed these opinions. Rather the analysis of the Kondolf based hydrograph operation has refined and quantified the response of San Joaquin River temperature to Friant Dam operation. The computed daily average river temperature for the 5-year analysis period (2000 – 2004) period under historical flow conditions and Kondolf based hydrograph operation flows are shown in Figures 13 through 22. Table 3 lists the computed San Joaquin River temperature averaged by month over the 5-year evaluation period for historical and Kondolf hydrograph based operation. Table 3 also includes the monthly average incremental change in temperature between the two operating assumptions.

   a. Figure 13: Friant Dam release – Diverting flows from the Madera and Friant-Kern Canals to the river results in higher river temperatures as the year progresses. The increase is due to the limited capacity of Millerton Lake cold-water pool. The maximum outflow temperature of approximately 57^{o}F occurs in late November of each year. Referring to Figure 1, the lake inflow is also approximately the same temperature indicating to me that the inflow, which is cooler than the lake surface, will pass through the lake to the outlet with little change in temperature during the late fall and early winter. The temperature profile plots (Figures 8, 10 and 12) are consistent with this observation. The typical mid-November temperature increase is approximately 7^{o}F. The flows to the fish hatchery would experience a similar increase in temperature during this period.

b. Figure 14: San Joaquin River at Lost Lake – The reduced rate of summertime heating associated with increased flow is seen in this plot. The summertime temperature variation for historical flows are greater due to meteorological variations. Higher historical flow events (refer to Figure 4) contribute to this variation. The mid-November temperature increase associated with the Kondolf based hydrograph operation persist since higher flow also result in less rapid cooling during cold weather.

c. Figure 15: San Joaquin River at Willow Unit – The variable nature of the historical flow temperatures is extenuated in response to weather conditions and lower flows. The low temperatures seen early June, 2003 is a response to the flow pulse. (Note that unlike the actual operation that resulted in spilling of warm surface waters, the flow pulse was assumed to pass the low level outlet.) The Kondolf based hydrograph operation temperatures are generally cooler in the spring and summer while the warmer mid-November temperatures remain warmer. The maximum mid-November increase is approximately 4^{o}F.

d. Figure 16: San Joaquin River at Sportsman Club – The summertime temperatures are more variable for both flow conditions as the distance from Friant Dam increases. The Kondolf based hydrograph operation temperatures continue to be cooler in the spring and summer (by approximately 3-5^{o}F) while the warmer mid-November temperatures remain warmer. The maximum mid-November increase was approximately 3^{o}F.

e. Figure 17: San Joaquin River at Milburn Unit – The mid summer temperature exceed 75^{o}F and 80^{o}F for the historical and Kondolf based hydrograph operation flows respectively. The mid-November temperature are essential the same for both operation assumptions.

f. Figure 18: San Joaquin River at Skaggs Park – The mid summer temperature exceed 80^{o}F and 85^{o}F for the historical and Kondolf based hydrograph operation flows respectively. Temperature variations are greater for both operation assumptions as the river temperature approaches equilibrium and the influence of weather becomes more dominant.

g. Figure 19: San Joaquin River at Gravelly Ford – The mid summer temperature exceed 85^{o}F for both operation assumptions as the river temperature approaches equilibrium. The reduced temperature (up to 15^{o}F) associated with the spring pulse of the Kondolf hydrograph is the only significant difference in the computed temperatures.

h. Figure 20: San Joaquin River above Mendota Pool – Temperatures are essentially the same for both flow conditions except during the spring pulse flow of the Kondolf hydrograph. There is very little change in the computed temperature between Gravelly Ford and the Mendota Pool.

i. Figure 21: San Joaquin River below Mendota Pool – Temperatures are essentially the same for both flow conditions except during the spring pulse flow of the Kondolf hydrograph. The temperature reduction during the pulse flow varies from approximately 3^{o}F to 10^{o}F. The maximum and variability of the temperature is less due to the influence of the DMC inflow that is generally cooler than the San Joaquin River. The daily average DMC temperature at check 21 (CDEC station DM3 data) are included on this plot.

j. Figure 22: San Joaquin River at Sack Dam – Temperatures are nearly identical to those computed below Mendota Dam indicating that equilibrium has been approached except during the spring pulse flow event.

k. Figure 23: San Joaquin River at Stevinson – Temperatures are nearly identical for both flow conditions. The higher spring pulse flows (normal-wet and normal-dry years) of 2000 and 2003 result in slightly larger temperature differences.

l. Figure 23: San Joaquin River above the Merced River – Temperatures are nearly identical throughout the simulation period indicating that the river is at equilibrium with the atmosphere.

Table 3. Computed San Joaquin River temperature in degrees Fahrenheit averaged by month over the 5-year evaluation period for historical and Kondolf hydrograph based operation

Month	Friant Dam	Lost Lake	Willow Unit	Sports-man Club	Milburn Unit	Skaggs Park	Gravelly Ford	Above Mendota Pool	Below Mendota Dam	At Sack Dam	Stev-inson	Above the Merced
Historical Operation												
January	47.8	48.4	48.8	49.2	49.5	49.0	48.8	48.8	49.5	49.6	50.0	50.0
February	46.8	48.8	50.2	51.7	53.3	53.8	53.9	54.3	53.0	53.4	56.0	54.7
March	47.0	50.6	53.1	56.5	59.5	60.6	60.8	61.2	61.3	60.9	63.9	63.0
April	47.3	52.5	56.3	61.0	66.3	67.5	67.5	67.2	66.6	66.6	69.4	67.8
May	47.8	54.7	59.8	65.6	72.6	74.3	74.0	72.8	69.2	69.7	75.3	73.7
June	47.9	54.4	59.7	65.7	74.2	77.5	78.0	78.1	75.4	75.3	80.8	78.8
July	48.3	55.4	61.3	68.2	78.3	81.9	82.2	81.3	79.5	79.2	83.4	80.8
August	48.6	55.0	60.4	66.8	76.7	80.6	81.0	80.5	79.7	79.1	82.2	79.4
September	49.0	53.7	57.9	62.9	71.5	75.8	76.6	77.0	77.4	76.9	78.9	75.7
October	49.6	52.5	55.2	58.7	65.4	68.8	69.3	69.8	69.9	70.0	70.3	66.8
November	50.4	51.3	52.1	53.4	56.4	57.2	57.3	58.0	58.5	59.8	58.4	55.0
December	50.4	50.2	50.0	49.8	49.9	49.1	48.8	49.2	49.6	50.3	50.3	49.6
Kondolf hydrograph based operation												
January	48.7	49.0	49.1	49.4	49.7	49.7	49.6	49.6	49.6	49.7	49.8	50.0
February	47.2	48.0	48.8	49.7	50.9	51.8	52.1	53.3	53.1	53.3	55.4	54.9
March	47.1	48.0	49.0	50.5	52.4	54.1	54.9	57.6	59.0	59.4	62.6	63.1
April	47.6	49.5	51.3	53.5	56.5	58.7	59.7	62.2	63.2	63.3	66.7	67.6
May	48.4	52.2	55.7	59.7	65.4	69.0	70.2	72.3	69.6	69.6	74.3	73.7
June	49.0	53.7	58.0	62.9	70.4	75.0	76.4	78.4	75.9	75.7	80.7	79.1
July	49.7	54.7	59.3	64.6	72.9	77.7	79.3	81.1	79.7	79.4	83.4	81.1
August	50.5	54.9	59.1	64.0	71.8	76.5	78.1	80.1	79.8	79.2	82.4	79.7
September	51.7	54.9	58.0	61.6	68.0	72.3	73.8	76.5	77.5	77.0	79.0	76.1
October	53.9	55.4	56.8	58.7	62.1	64.7	65.7	68.4	69.4	69.8	70.7	67.5
November	56.7	56.6	56.6	56.7	56.9	56.8	56.8	56.9	57.6	58.6	58.9	56.1
December	52.7	52.6	52.4	52.2	52.0	51.4	51.0	50.1	49.8	50.2	50.2	49.7
Temperature change (Kondolf hydrograph based - historical)												
January	0.9	0.6	0.4	0.1	0.2	0.7	0.9	0.7	0.1	0.1	(0.2)	(0.0)
February	0.4	(0.8)	(1.4)	(2.1)	(2.4)	(2.0)	(1.8)	(1.0)	0.1	(0.1)	(0.6)	0.2
March	0.1	(2.6)	(4.2)	(6.0)	(7.1)	(6.6)	(5.9)	(3.6)	(2.3)	(1.4)	(1.2)	0.1
April	0.3	(3.0)	(5.0)	(7.5)	(9.8)	(8.8)	(7.9)	(5.1)	(3.4)	(3.2)	(2.8)	(0.2)
May	0.6	(2.5)	(4.1)	(5.9)	(7.2)	(5.4)	(3.8)	(0.5)	0.4	(0.0)	(1.0)	0.1
June	1.1	(0.7)	(1.6)	(2.7)	(3.8)	(2.6)	(1.6)	0.3	0.5	0.4	(0.1)	0.2
July	1.4	(0.7)	(2.0)	(3.6)	(5.5)	(4.1)	(2.9)	(0.2)	0.2	0.2	0.0	0.3
August	1.9	(0.0)	(1.3)	(2.8)	(5.0)	(4.1)	(3.0)	(0.4)	0.1	0.2	0.2	0.3
September	2.8	1.2	0.1	(1.3)	(3.6)	(3.6)	(2.9)	(0.4)	0.1	0.2	0.1	0.4
October	4.4	2.8	1.6	(0.1)	(3.3)	(4.1)	(3.6)	(1.5)	(0.4)	(0.2)	0.4	0.7
November	6.3	5.4	4.5	3.3	0.5	(0.4)	(0.5)	(1.1)	(0.9)	(1.2)	0.6	1.1
December	2.4	2.4	2.5	2.4	2.1	2.2	2.2	0.9	0.2	(0.1)	(0.0)	0.1

2. Professional Qualifications (no change from August 18, 2005 report)

3. Data and Other Information Considered by the Witness in Forming Opinions:

In forming the opinions set forth herein and in preparing this expert report, I reviewed the following materials:

1) Restoration hydrographs that are proposed in Dr. Kondolf's report. The flow schedule is developed for five different water year types which are consistent with those used by Dr. Moyle and Dr. Deas in their expert reports.

2) In Kondolf's report, he defines the water year types as wet year, normal wet, normal-dry and dry. The wet year encompasses the wettest 20% of years (as ranked by total discharge for the year), normal-wet year encompasses 50-80th the percentiles years, and normal-dry encompasses 20-50th percentile years, and dry encompasses the driest 5th to 20th percentile years.

3) The application of the hydrographs includes the geographical area from the Friant Dam to the confluence of the Merced River. The calculation of gain and loss are also applied for Reach 2 and the sections of the Salt and Mud Slough. The flow release periods coincides with the fisheries needs for incubation flow, fall run attraction flow, pulse flows and spawning flows.

4) Daily average water temperatures at the Kerckhoff powerhouse #1 for years 1960 through 1974.

5) Hourly meteorological data from 1999 through August, 2005 for the Firebaugh, Kesterson and Madera stations.

4. Discussion:

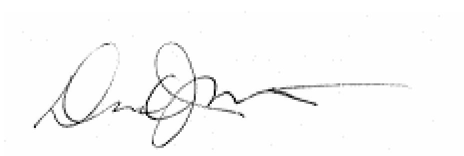
Diverting flows from the Madera and Friant-Kern canals to the river outlet results in more water being drawn to the level of the river outlet. Since the cold water storage volume is limited (approximately 90,000 acre-feet between the Madera Canal intake and river outlet elevations) some warming of the reservoir release water is inevitable. The reservoir modeling results have been summarized in section 1. These results suggest a maximum increase (relative to historical operating conditions) of approximately 7^{o}F in the reservoir release temperature can be expected in mid to late November of each year. The fish hatchery supply will also experience a comparable raise in temperature late in the year.

The rate of heating in the river is a function of meteorology coupled with hydraulic conditions related to flow. Table 3 provides an overview of the computed temperatures and the relative differences between the two operation scenarios. Although the computed Friant outflow temperatures for the

Kondolf based hydrograph operation scenario are higher than those computed for historical operation, the increased flow rate results in less rapid heating due to increased depth and decreased travel time. During the spring and summer months, the increased release temperatures are offset by the less rapid heating within a few miles of the dam (upstream of Lost Lake). The monthly average spring and summertime temperatures in the river between Lost Lake and the Mendota Pool are cooler by up to approximately 10^{o}F (Milburn Unit in April). Below the Mendota Dam, the higher Friant release rates during the summer months result in a slight increase in river temperature since the river above the Mendota Pool is warmer than the DMC that contribute to the flow below Mendota Dam. During November when the temperature increase associated with the Kondolf based hydrograph operation is the highest, the warmer river water condition persists to near the Highway 145 Bridge, approximately 32 miles below Friant Dam. During the spring pulse flow, slightly cooler water reaches down to Stevinson (up to 2.8^{o}F increase in the average April temperature). The additional travel distance of approximately 15 miles from Stevinson to the Merced River confluence plus the influence of the inflows from Mud and Salt Sloughs reduces the impacts of the modified flow regime to less than 1^{o}F.

5. **Conclusion:**

This HEC-5Q model evaluation of the Kondolf based hydrograph operation provides a more realistic assessment of the potential thermal impacts of river enhancement flows. The addition calibration, improved meteorology and tributary inflow characterization has added to the reliability and accuracy of the model. None of these developments have alter my perception of the thermal characteristics of the Millerton Lake and San Joaquin and Bypass system between Friant Dam ant the Merced River confluence that were expressed in my August 18, 2005 expert report.



Donald J. Smith
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All figures are contained in the “SJR_temperature_091505_Figures.pdf”