Study 19

Two-Dimensional Temperature Modeling of Gravel Pits in Reach 1A

Public Draft
2013 Monitoring and Analysis Plan

SAN JOAQUIN RIVER
RESTORATION PROGRAM

September 2012

August 10, 2012

San Joaquin River Restoration Program

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Two-Dimensional Temperature Modeling of Gravel Pits in Reach 1A

1. Statement of Need

Understanding the spatial and temporal variations in temperature along the San Joaquin River and adjacent gravel pits is necessary to determine the most efficient strategies for managing water quality in Reach 1 and its influence on habitat for juvenile salmonids.

2. Background

Gravel pits are currently present and connected to the San Joaquin River in several locations of Reach 1, which is located just downstream from the Friant Dam. The gravel pits are remnants of areas where gravels were historically mined from the channel. The San Joaquin River Restoration Program (SJRRP) seeks a tool to help guide management decisions related to the impacts of gravel pits on the water quality of Reach 1 with respect to temperature.

Adequate temperatures within the San Joaquin River are critical to the survival of Chinook salmon. Temperatures approaching or above thresholds considered to be dangerous or lethal to key life stages of salmonids may be exacerbated by the presence of gravel pits. A temperature model of Reach 1 (or any part therein) may improve understanding of the spatial and temporal variations in temperature resulting from gravel pits within the river, which could facilitate selection of potential restoration actions.

Uncertainties associated with the influence of gravel pits on river temperatures create a need to investigate the use of a two-dimensional temperature model. Hypotheses to be addressed as part of this modeling effort include:

- Gravel pits influence the spatial and temporal variations in temperature along the San Joaquin River.
- A 2D unsteady temperature model can be used to quantify the effects of gravel pits on the river temperature.

Recent studies in the Lower Tuolumne River indicate that velocity and water temperature may influence rates of predation by bass on Chinook salmon (Stillwater Sciences and McBain & Trush, 2006). The 2D temperature model proposed for this study will produce depths and velocities within the study area that can be compared with documented preferred conditions of predators within the San Joaquin River to identify areas and flows that are favorable to different predator species. An improved understanding of the interactions between the river and gravel pit water temperatures may also help to identify the most effective mechanisms to reduce predation

potential. An assessment of predator abundance and distribution was conducted within gravel pits present in the study area in 2012 (SJRRP, 2012). In addition, ongoing temperature monitoring of the gravel pits and river within study area continued in 2012 and will likely continue in the future (SJRRP, 2012). Data collected from these studies can be combined with results from the 2D temperature model to examine interactions between hydraulic conditions, temperature and predation. The primary goal of the 2D temperature model is to offer insight for controlling water temperatures during critical life stages. In addition, the modeling effort may also assist in determining which gravel pits may be most favorable to certain predator species, and in evaluating restoration techniques to promote hydraulic and temperature conditions that would suppress specific predator species during critical life stages for juvenile salmonids.

3. Anticipated Outcomes

The outcome of this effort is a tool that can be utilized by Program managers to assist in identifying which gravel pits are most negatively influencing water temperature, which in turn impacts habitat suitability for juvenile salmonids. Results from the model may be combined with results from temperature monitoring and predation studies to discern the existence of patterns between temperature, hydraulic conditions, and predation.

4. Methods

To test the aforementioned hypotheses, a 2D hydraulic model was developed Reach 1A between Highway 41 and Sycamore Island last year using Reclamation's model, SRH-2D. Code for the temperature component is currently being developed and tested on another river system in Washington. Once validated, the temperature component will be applied to the Reach 1A model. The model will be evaluated to determine its potential in replicating existing measured temperature patterns. Temperature measurements within the gravel pits and river will be used for model calibration.

If the preliminary model is capable of reproducing measured temperatures within the test reach, the model may be extended to help prioritize which gravel pits have the greatest impacts to water temperature, and possibly to evaluate predation potential of juvenile salmonids. In addition, the model may be used to help evaluate possible restoration strategies, such as gravel pit isolation or segregation.

5. Schedule

6. Budget

	Staff Day Costs ($)					
Task List	SL1 $568/day	SL2 $776/day	SL3 $952/day	SD Total	Non-Labor ($)	Grand Total
Build in temperature component		$ 1,552	$ 7,616	$ 9,168	$ 500	
Calibrate temperature data		$ 2,328	$ 952	$ 3,280		
Develop maps and report		$ 6,208	$ 2,856	$ 9,064	$ 500	
Technology and Equipment Fee					$ 250	
Subtotals		**$10,088**	**$11,424**	**$21,512**	**$ 1,250**	**$ 22,762**

7. Deliverables

The deliverables associated with this study include a 2D temperature model from Highway 41 to Sycamore Island, a report of the model development, application, and preliminary results, and maps illustrating the spatial distributions of predicted temperatures and flow conditions of interest.

8. Point of Contact/Agency

Elaina Gordon, Bureau of Reclamation

Katrina Harrison, Bureau of Reclamation

9. References

San Joaquin River Restoration Program, SJRRP, 2012. Mid-Year Technical Report, July 2012.

Stillwater Sciences and McBain &Trush, 2006. Lower Tuolmne River Predation Assessment Final Report. Prepared for The Tuolmne River Technical Advisory Committee, June 2006.

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