# SCOTT RIVER WATER TEMPERATURE ASSESSMENT

## 1.0 Study Goals and Objectives

The overall goal of the study element is to acquire sufficient water temperature and metrological data in the Scott River watershed to support the characterization of salmonid rearing habitat in the rivers and tributaries as a function of river flow, springs, channel hydraulics (width, depth, and velocity), and riparian shade. Because water temperature is likely a limiting factor for fish habitat quality, the connection between these variables will be an important factor in the successful implementation of fish habitat protection and restoration (McCullough 1999, Carter 2005). Once acquired, existing data will be reviewed and a determination made by reach that they are either adequate or inadequate for habitat characterization using either direct thermal patterns or water temperature modeling. If determined to be necessary, new data should be collected that would be compatible with either approach. Both approaches would create frameworks for predicting and interpreting the effects of potential restoration actions (e.g., altered instream flow or increased riparian shade) on water temperatures and aquatic habitat.

High water temperatures often occur under low flow conditions and are presumed to be major limitations for fish habitat in the Scott River basin. Scott River temperatures generally remain cooler in the shaded mountain tributary streams, but warm considerably in the valley reaches because of wider channels, diverted flows, lower water velocities, and lack of riparian shade.

The specific objectives of the study include:

- Acquiring and summarizing existing data on water temperatures over space and time,
- Developing empirical water temperature maps showing the presence and persistence of thermal refugia that may be used by rearing juvenile salmonids during seasons of high temperatures,
- Creating a database of all springs by location, temperature, flow, and known water rights,
- Acquiring physical and meteorological data sufficient for development and calibration of water temperature models, and
- Identifying specific water temperature models compatible with either existing or acquired data and capable of predicting thermal effects of restoration activities.

## 2.0 Review of Existing Information

Flows and water temperatures in the Scott River watershed have been of great interest for fisheries resources for many years. Staff reports were prepared by North Coast Regional Water Quality Control Board (NCRWQCB) for the Scott River temperature and sediment TMDL determinations (NCRWQCB 2006). Several previous surveys, investigations, and modeling studies of flow and water temperatures (and effects on fish habitat) have been conducted in the Scott River watershed (e.g., Watershed Sciences 2004; 2007, SRCD 2013). Optimal, sub-optimal, and detrimental water temperature thresholds for coho salmon have also been identified in the adjacent Shasta River watershed (Stenhouse et al. 2012).

The Scott River TMDL staff report (NCRWQCB 2006) provides an excellent analysis of the factors controlling water temperatures (e.g., flow, meteorology, stream geometry, shade, springs), and used the Heat Source model with extensive data collection to evaluate management alternatives for the 50 miles of the Scott River downstream of Fay Lane and selected tributaries. Results of recent efforts by the Karuk Tribe (Papadopulus 2012) and UC Davis (Foglia et al. 2013a, 2013b) to develop groundwater models for the Scott River basin (e.g., SVIHM, Scott Valley Integrated Hydrologic Model) also contribute to the understanding of surface flow water temperatures. These documents, literature cited below, and related sources of existing information should be obtained and reviewed as part of this water temperature assessment in the Scott River watershed.

## 3.0 Study Areas

The Scott River watershed is about 812 square miles at the confluence with the Klamath River, and about 650 square miles at the USGS streamflow measurement station (gage) at Fort Jones. During project scoping, the Scott River was segmented into study reaches using criteria such as hydrology, length, geomorphology, and others (Normandeau Associates 2013; Figures 1 and 2). Water temperature monitoring is currently being conducted within the Scott River basin (Table 1). There are few reaches of the Scott River or tributaries where there are known springs that could serve as thermal refugia. Table 2 identifies reaches to be surveyed to determine their potential suitability. All reaches of the watershed designated in the Potential Studies Matrix (http://www.normandeau.com/scottshasta/project_materials.asp) are identified as needing data for water temperature modeling (Table 3).

Table 1. Reaches of the Scott River and tributaries where water temperature monitoring has been conducted (see Table 4 for specific reaches).

| REACH DESCRIPTION | Reference(s) | Studies Status |
|---|---|---|
| **Mainstem Scott River** | NCRWQCB 2005, 2009, 2011; Quigley 2008; Quigley et al. 2001; Bowman 2009; SRWC 2006; Yokel 2009; Yokel 2013 | On-going |
| **Scott River Tributaries** | NCRWQCB 2005, 2009, 2011; Quigley 2008; Quigley et al. 2001; Bowman 2009; SRWC 2006; Yokel 2009; Yokel 2013 | On-going |

Table 2. Reaches of the Scott River and tributaries where areas of springs, groundwater accretion, and potential thermal refugia are to be identified and mapped.

| REACH DESCRIPTION | Reference(s) | Studies Status |
|---|---|---|
| **Mainstem Scott River** | CDFG 2003; NMFS 2012; SRWC 2006 | Needed |
| **Scott River Canyon Tributaries (Thompson, Canyon, Kelsey, Mill)** | CDFG 2003; NMFS 2012; SRWC 2006 | Needed |
| **East Fork Scott River** | NCRWQCB 2011 | Needed |
| **South Fork Scott River** | Sommarstrom 2015, Magranet 2015 | Needed |
| **Sugar Creek** | Sommarstrom 2015, Olswang 2012 | Needed |

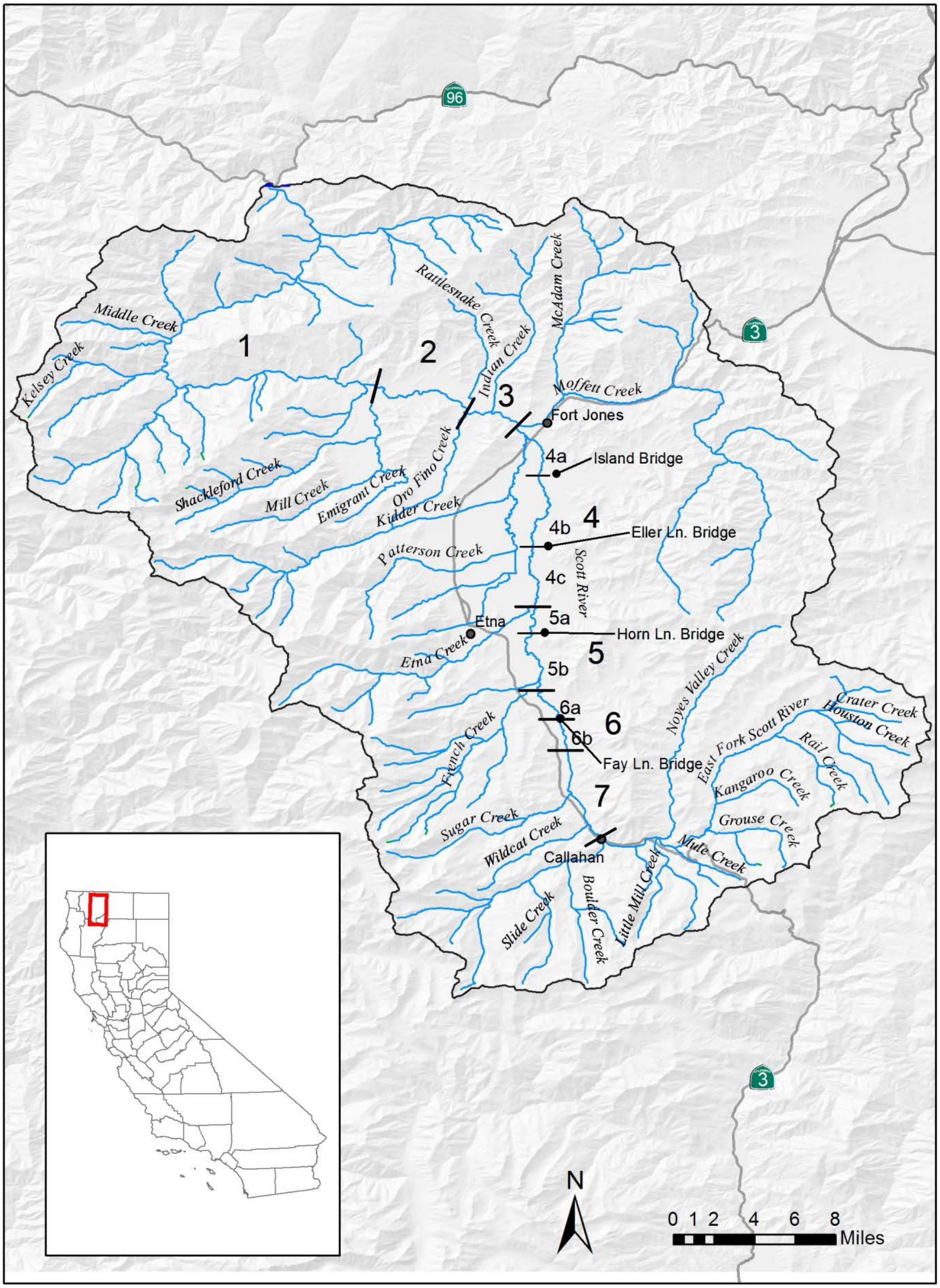

Figure 1. Scott River Mainstem Reaches.

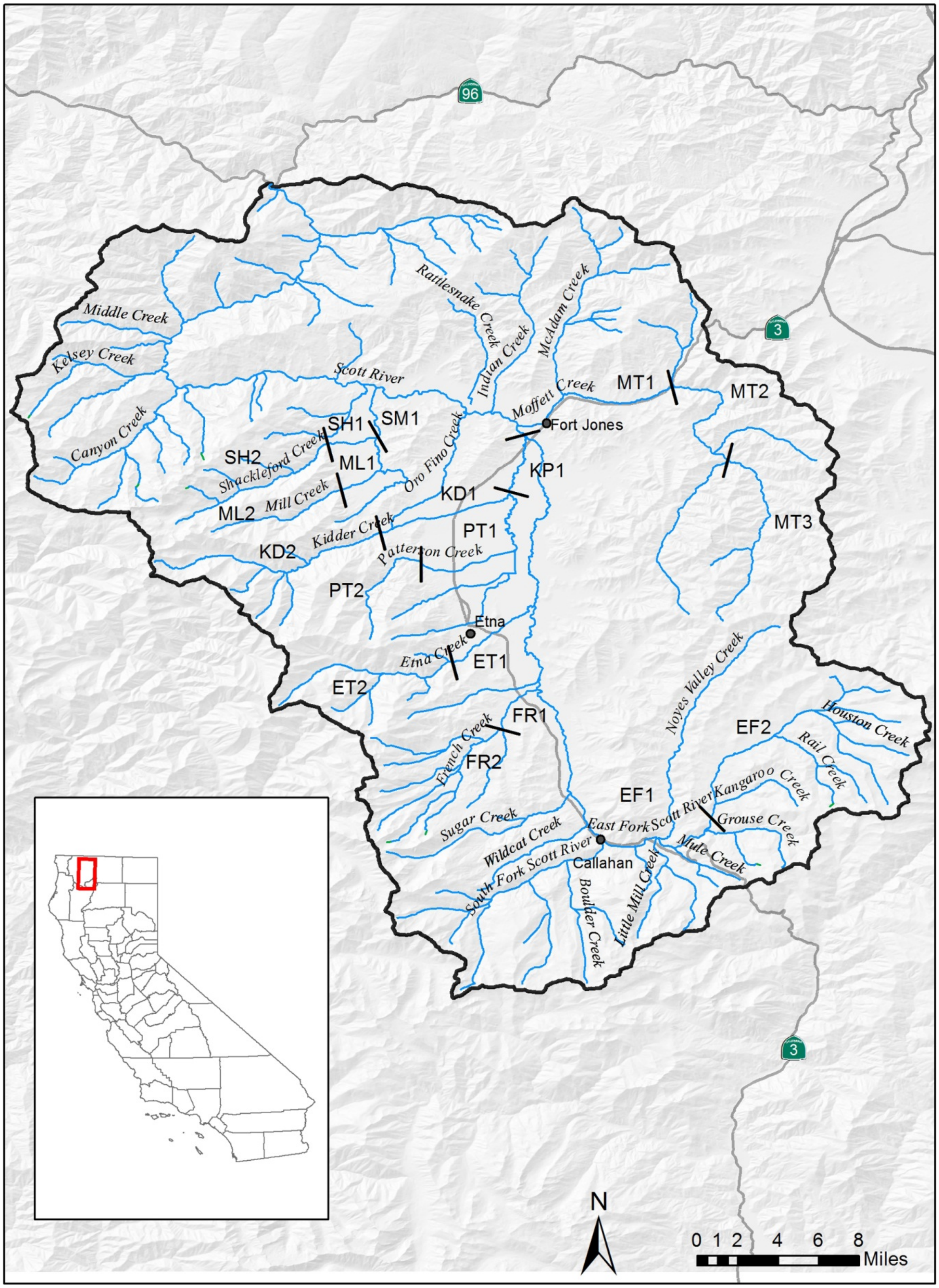

Figure 2. Scott River Tributary Reaches.

Table 3. Reaches of the Scott River and tributaries where data suitable for predictive water temperature modeling will be acquired.

| REACH DESCRIPTION | Reference(s) | Studies Status |
|---|---|---|
| **Mainstem Scott River** | CDFG 2009; SRWC 2006 | Needed |
| **Scott River Tributaries** | CDFG 2009; SRWC 2006 | Needed |

## 4.0 Study Methods

The thermal relationships in the Scott River and tributaries between streamflow, spring inflow, and potential thermal refugia for rearing salmonids are to be assessed with three basic approaches:

1. Collect (compile) all previous water temperature measurements. Prepare watershed map(s) with stream reaches, spring locations, and riparian vegetation
2. Conduct multiple FLIR thermal overflights to locate sources of spring inflow and evaluate patterns of mixing or cool water retention in relation to streamflow
3. Validate the level of effectiveness of FLIR images at locating small seeps and springs by comparison to existing and new field measurements
4. Investigate the application of distributed temperature sensing (DTS) fiber optic technology for collecting water temperature data.
5. Collect physical and meteorological data sufficient for developing and calibrating water temperature models capable of predicting thermal effects of restoration activities.

All aspects of this study plan should be closely coordinated with the California Department of Fish and Wildlife (CDFW), the NCRWQCB, their specified contractors who work on the Scott River TMDL, and the Siskiyou County Scott Valley Groundwater Advisory Committee, and with other studies related to water temperature such as the *Scott River Hydrology and Integrated Surface Water/Groundwater Modeling* study plan.

### 4.1 Water Temperature Data Compilation

All known sources of water temperature data for the Scott River and tributaries are to be compiled and the data itself collated, analyzed, and summarized in a searchable electronic database. Water temperatures have been measured at many locations in the Scott River watershed as an important variable to suitable fish habitat. Several agencies have established measurement stations, and numerous evaluations, monitoring programs, and modeling studies have already been undertaken. Table 4 identifies temperature measurements in the Scott River since 1994, although not all of these stations have been consistently active.

Table 4. Water temperature sampling locations in the Scott River and tributaries.

| | | |
|---|---|---|
| Scott River above Canyon Ck | Alder Creek near 123 deg long. | Kelsey Creek (295) |
| Scott River above mouth of Etna | Boulder Creek - high | Kelsey Creek d/s 44N41 bridge |
| Scott River below French | Boulder Creek - lower | Kelsey Creek, Upper SF 9.4 |
| Scott River above French | Boulder Creek - mid | Kidder Creek at Scott River |
| Scott River at Alexander's | Boulder Creek - near mouth | Kidder Creek-d/s of FGS ownership |
| Scott River at Buker Br (d/s of | Boulder Creek (SF) near mouth | Kidder Creek-u/s Clendenning |

| | | |
|---|---|---|
| Canyon Ck) | | Fk |
| Scott River at Deep Creek | Cabin Meadows Creek at rd 41N04 | Little Houston Creek @ Houston Ck |
| Scott River d/s of Moffett Ck (Eiler Ranch) | Cabin Meadows Creek d/s of rd 41N03 | Meamber Creek -FGS |
| Scott River at Fay Lane | Canyon Creek 500ft d/s of Canyon Ck Br | Middle Creek at mouth |
| Scott River at Horn Lane | Canyon Creek- d/s of deep lake ck | Mill Creek 24.1 |
| Scott River at Hwy 3 -1 | Canyon Creek near mouth | Mill Creek - Lower (near confl w/ shackleford) |
| Scott River at Hwy 3 -2 | Clarks Creek - Lower (at diversion) | Mill Creek - Scott Bar u/s Coats Ck |
| Scott River at Jones Beach | Clarks Creek - Upper (at forks) | Mill Creek (shack) u/s of Mill Ck ditch |
| Scott River at McGuffy Cr | Crater Creek at rd 41N03 | Mill Creek at Etna Ck |
| Scott River at Meamber Br. | Crater Creek at Houston Ck | Mill Creek -Scott Bar d/s new barn gulch |
| Scott River at Meamber Cr. | Deep Creek at mouth | Miners Creek appx 100m u/s of French Ck |
| Scott River at mouth of Boulder Creek | EF Scott River at Callahan | Moffett Creek -betw Skookum Glch & Spring Br |
| Scott River at mouth of Canyon Creek | EF Scott River at Upper Masterson Rd | NF French Creek (appx 0.6 km u/s of French Ck) |
| Scott River at mouth of Kelsey Creek | EF Scott River d/s Houston Ck | NF French Creek, Upper (u/s of Meeks Meadow Ck) |
| Scott River at mouth of McGuffy Creek | Etna Creek - Lower (d/s of Mill Ck) | Patterson Creek nr middle Sec 7, R9W, T42N |
| Scott River at mouth of Tompkins creek | Etna Creek at Mouth | Rail Creek near KNF bndry |
| Scott River at Red Bridge | Etna Creek d/s Ruffey Ck | SF Scott River - u/s of SF Rd |
| Scott River at Serpa Lane | Fox Creek at mouth | SF Scott River at Boulder Ck |
| Scott River at Steelhead Bridge | French Creek u/s Miner's Rd Br. | SF Scott River u/s 40N21Y |
| Scott River at Steelhead Bridge | French Creek - Headwaters | SF ScottRiver u/s Blue Jay Ck |
| Scott River at Townsend Gulch | French Creek near Miner's Rd Br | Shackleford Creek - Lower |
| Scott River at USGS Gage | French Creek near mouth | Shackleford Creek at Trailhead |
| Scott River below Black Bridge | French Creek d/s NF | Shackleford Cr-near Alder Gulch |
| Scott River below mouth of Etna | Grouse Creek at Rd 40N03 | Shackleford Creek-Near Shackleford falls |
| Scott River u/s of Sugar Creek | Grouse Creek u/s Hayes gulch | Sissel Gulch near mouth |
| Scott River at Meamber Creek | Houston Creek at EF Scott | Sniktaw Creek near 123 deg |
| Scott River between Kidder and Moffett Cks | Houston Creek u/s of L. Houston | Snow Creek 21.3 |
| Scott River at Roxbury Br. | Jackson Creek at Cecilville Rd | Sugar Creek - u/s HW3 |
| Scott River at Sweazey's Bridge | Kangaroo Creek - at 40N08 xing | Sugar Creek near KNF bndry |
| | Kangaroo Creek - EF, u/s of Facey Mine | Tompkins Creek at mouth |
| | Kangaroo Creek - EF at rd 40N08 xing | Wildcat Creek near KNF bndry |
| | Kangaroo Creek - WF, 100m u/s 40N08 | |

Additional water temperature information in the form of raw data files associated with the Maximum Weekly Average Temperatures (MWAT) values in NCRWQCB (2011) are available from the North Coast Regional Board (NCRWQCB 2015).

## 4.2 Thermal Refugia Monitoring and Evaluation

Aerial thermal infrared imaging will be conducted using the latest available technology along each reach of the Scott River and tributaries identified in Table 2. Image collection and data processing methods should be substantially the same as those used in previous surveys of the watershed by Watershed Sciences (2004) as part of the NCRWQCB TMDL process. The NCRWQCB funded a thermal infrared remote radiometry (TIR) survey of the Scott River and select tributaries. As described in the TMDL report (NCRWQCB 2011), "on July 25 & 26, 2003, Watershed Sciences, LLC conducted aerial TIR surveys of the Scott River, East Fork Scott River, South Fork Scott River, Shackleford Creek, and the lower reaches of Kidder Creek. The imagery was collected using side-by-side video and infrared cameras. The survey yielded temperature measurements of approximately half-meter resolution, in images that captured an area approximately 140 m – 193 m (459ft - 635ft) on the ground, depending on flight altitude. The accuracy of TIR data was better than +/- 0.5ºC (0.9ºF), based on temperatures measured at the time of the flight. Watershed Sciences subsequently processed the thermal information into longitudinal profiles, a GIS database, and other data products." A similar aerial infrared survey was conducted by Watershed Sciences in 2006 on the Scott River and Shackleford Creek (Watershed Sciences 2007) on behalf of the Quartz Valley Indian Tribe.

These two surveys should be repeated on two successive years under different summer flow and meteorological conditions to validate the results and confirm the conclusions that thermal refugia are present and persistent. Evaluation should consist of mapping colder water pockets within springs, where spring runs join and merge with tributaries or the main stream, and where springs emerge from the stream bed or along stream banks, then relating the existence and areal extent of the pockets to stream flow. With six TIR surveys in three different years (two completed and four planned), it should be possible to assess whether and what flows disrupt or disperse the pockets, and whether higher or lower net stream temperatures result. If higher flows increase instead of decrease stream temperatures in specific areas used as thermal refugia by rearing juvenile salmonids, riparian shade management might be preferred over flow enhancement in potential habitat restoration scenarios.

The cold water springs identified through a review of existing information and TIR imagery should be compiled into a searchable data base and series of maps documenting where the springs are located, along with discharge, temperature, ownership, and water right. If no data on discharge or temperature is located, they should be added to the field data monitoring sites needed to meet the requirements of water temperature modeling in the following section.

## 4.3 Water Temperature Data Collection for Modeling

In reaches of the Scott River identified in Table 3 as needing a water temperature model capable of predicting thermal effects of restoration activities, sufficient physical and meteorological data should be collected for developing and calibrating such a model (or models). For any given reach, most water temperature models require continuous records of inflow, outflow, flow accretion (point or diffuse), starting and ending water temperatures, flow accretion water temperatures, air temperature, relative humidity, wind speed, and percent sun (or solar radiation). The continuous data may be in daily, hourly, or sub-hourly form, depending on the time-step requirements of the model. Model input requirements also include physical data on upstream and downstream topographic elevation, wetted channel widths in relation to streamflow, stream channel aspect by distance (coarse or fine scales), ground temperature, ground reflectivity, thermal gradient, dust coefficients, channel roughness (Manning's n), east and west topographic altitude, and riparian vegetation height, width, density, and offset.

Existing data compiled under study element 4.1 will need to be evaluated to determine if any reaches of the Scott River and tributaries have sufficient information to populate a model, and if so, what type of model. Daily time-step models that calculate average, maximum, and minimum water temperatures can use daily average data and approximations of the physical input data, while more sophisticated, shorter time-step models need more detail, since they will be sensitive to short-term variability (afternoon thunderstorms, or diurnal snowmelt change, for example). A single year's data between May 1 and September 30 (the warmest part of the year coinciding with the juvenile salmonid rearing period) is less preferable than two or more years of data, because models are typically calibrated with one season or year and validated against another season or year. If the validation statistics (mean error, maximum error, bias, etc.) approximate the calibration statistics, the model would be suitable for simulation of restoration activities such as flow change or riparian vegetation enhancement.

For any reach that does not meet these data requirements, field data collection will be necessary and could be fairly elaborate, depending on the complexity of conditions within the reach. A simple reach with virtually the same rates of inflow and outflow and no diversions or irrigations returns would only require temperature recording devices at the upstream and downstream ends, along with a continuous stream gage recorder. Any significant change from these characteristics will require additional continuous monitoring data on both water temperature and flow volume by location, whether point or diffuse. Two years of comprehensive data suitable for detailed, seasonal water temperature modeling will be required. The feasibility of collecting water temperature data through the use of DTS technology should also be investigated (e.g. Hausner et al. 2011).

The most suitable meteorological station is an hourly CIMIS station, used throughout California for irrigation management (tracking of evaporation and crop transpiration) based on soil moisture and crop needs. The direct measurements of solar radiation are particularly valuable for hourly water temperature estimates from heat transfer equations (and water depth). A CIMIS station (CI225) has recently been established just south of Ft. Jones at elevation 2,733 feet, and two other active stations are located at McArthur in northern Shasta County at elevation 3310 feet, and Tulelake in Siskiyou County at elevation 4,035 feet. Data from these stations, in combination with the hourly weather stations at Callahan (no solar radiation) in Scott Valley and Weed (includes solar radiation) in Shasta Valley will likely be adequate for accurate water temperature modeling.

## 4.4 Water Temperature Model Selection

A water temperature model should be recommended by reach as part of the Scott River water temperature assessment. There are several water temperature modeling packages available, such as SNTEMP (Bartholow 1999) developed by USGS, Heat Source (Boyd and Kasper 2003) currently maintained and used by the Oregon Department of Environmental Quality (http://www.deq.state.or.us/wq/tmdls/heatsource.htm), RQUAL from the Tennessee Valley Authority (Hauser and Walters 1995), CE-QUAL-W2 from the Corps of Engineers (Cole and Wells 2006), QUAL2K or QUALKw from the Environmental Protection Agency (Brown and Barnwell 1987, Chapra et al. 2008), TEMP (ICFI 2014), and W3T (Watercourse Engineering 2013) among others. The pros and cons of each model considered for application to the Scott River watershed should be clearly described and the recommended model or models justified by accuracy, professional acceptability, data requirements, and the objectives of this study plan.

Determining the relationships between surface flow, groundwater inputs, riparian shade, channel geometry, and downstream water temperatures are the most important results from the water temperature modeling. There are sufficient historical temperatures for identifying tributary reaches that remain relatively cool (higher elevations with shade and higher flows or springs) and those valley reaches that warm to above suitable water temperatures for fish rearing (lower elevations with less shade and lower flows). Increased flows will likely provide more suitable habitat and will moderate the temperature warming in the valley sections of the tributaries. The water temperature model could be applied to determine minimum flows below each major diversion or to assess the effect of riparian vegetation enhancement that would maintain more suitable water temperatures for fish habitat.

## 5.0 Deliverables

The main products from the *Scott River Water Temperature Assessment* Study Plan will be:

1) A searchable electronic data base containing all known water temperature data for the Scott River and tributaries, along with sourcing and collection methods.
2) Four new thermal image maps for identified reaches showing the location and persistence of potential thermal refugia, along with evaluation,
3) A searchable electronic data base and series of maps documenting where all springs are located in the watershed, along with discharge, temperature, ownership, and water right.
4) Two complete years of continuous data on water temperature and flow suitable for predictive water temperature modeling, and
5) A recommendation for a water temperature model capable of assessing the potential effect of surface flow and riparian vegetation enhancements.

## 6.0 Literature Cited

Bartholow, J.M. 1999. SSTEMP Version 1.1.0: As retrieved from USGS, Midcontinent Ecological Science Center website: .http://www.mesc.usgs.gov/ rsm/rsm_software.html

Bowman, C. 2009. Quartz Valley Indian Reservation Water Quality Monitoring and Assessment Report 2008. Quartz Valley Tribal Environmental Program Report. 65 pp.

Boyd, M.S. 1996. Heat Source: stream temperature prediction: Master's Thesis, Departments of Civil and Bioresource Engineering, Oregon State University, Corvallis, Oregon.

Boyd, M., and Kasper, B. 2003. Analytical methods for dynamic open channel heat and mass transfer: Methodology for heat source model Version 7.0, 193 pp.

Brown, L.C., and Barnwell, T.O. 1987. The Enhanced Stream Water Quality Models QUAL2E and QUAL2E-UNCAS, EPA/600/3-87-007, U.S. Environmental Protection Agency, Athens, GA, 189 pp.

California Department of Fish and Game (CDFG). 2003. Shasta and Scott River Pilot for Coho Salmon Recovery: with recommendations relating to Agriculture and Agricultural Water Use. Prepared by The Shasta-Scott Coho Recovery Team. 125 pp.

California Department of Fish and Game (CDFG). 2004. Recovery Strategy for California Coho Salmon. Report to the California Fish and Game Commission, Species Recovery

Strategy 2004-1. California Department of Fish and Game, Native Anadromous Fish and Watershed Branch. Sacramento, CA.

California Department of Fish and Game (CDFG). 2009. Scott River Watershed-Wide Permitting Program. Final Environmental Impact Report. FEIR Volume I: Revisions to the Draft EIR Text. 632 pp.

Carter, K. 2005. The effects of temperature on steelhead trout, coho salmon, and Chinook salmon biology and function by life stage: implications for Klamath basin TMDLs: NCRWQCB, August, 2005.

Chapra, S.C., Pelletier, G.J. and Tao, H. 2008. QUAL2K: A Modeling Framework for Simulating River and Stream Water Quality, Version 2.11: Documentation and Users Manual. Civil and Environmental Engineering Dept., Tufts University, Medford, MA

Cole, T.M., and S.A. Wells. 2006. CE-QUAL-W2: A two-dimensional, laterally averaged, Hydrodynamic and Water Quality Model, Version 3.5, Instruction Report EL-06-1, US Army Engineering and Research Development Center, Vicksburg, MS.

Foglia, L., A. McNally, and T. Harter. 2013a. Coupling a spatiotemporally distributed soil water budget with stream depletion functions to inform stakeholder-driven management of groundwater-dependent ecosystems, Water Resources Research, 49, 7292–7310, doi:10.1002/wrcr.20555.

Foglia, L., A. McNally, C. Hall, L. Ledesma, R. J. Hines, and T. Harter. 2013b. Scott Valley Integrated Hydrologic Model: Data Collection, Analysis, and Water Budget, Final Report. University of California, Davis. April 2013. 101 p. Available at: http://groundwater.ucdavis.edu.

Hauser, G.E. and Walters, M. 1995. User's Manual for One- Dimensional Unsteady Flow and Water Quality Modeling in River Systems with Dynamic Tributaries. WR28-3-590-135. TVA Engineering Laboratory. Norris, Tennessee. July, 1995.

Hausner, M.B., F. Suárez, K.E. Glander, N. van de Giesen, J.S. Selker, and S.W. Tyler. 2011. Calibrating Single-Ended Fiber-Optic Raman Spectra Distributed Temperature Sensing Data. Sensors 2011(11)10859-10879; doi:10.3390/s111110859.

ICF International. 2014. TEMP (Temperature Evaluation for Management and Protection): Development and assumptions for the Battle Creek daily hydrology and hourly water temperature model. ICF International, Sacramento, California.

Magranet, L. 2015. Scott River juvenile coho rescue and relocation monitoring: 2014 drought emergency. Siskiyou County Resource Conservation District, Etna, CA.

McCullough, D.A. 1999. A review and synthesis of effects of alterations to the water temperature regime on freshwater life stages of salmonids, with special reference to Chinook salmon: prepared for the U.S. Environmental Protection Agency, Region 10, Seattle, Wash., EPA 910-R-99-010, 279 p. Available online at: http://www.critfc.org/tech/EPAreport.htm

National Marine Fisheries Service (NMFS). 2012. Recovery Plan for the Southern Oregon Northern California Coast Evolutionary Significant Unit of Coho Salmon (Oncorhynchus kisutch). Volume II, Chapter 36, Scott River Population.

National Research Council. 2004. Endangered and Threatened Fishes in the Klamath River Basin. Available online at: http://www.krisweb.com/biblio/klamath_nsa_nrc_2003.pdf

Normandeau Associates, Inc. 2013. Scott River and Shasta River study reaches. 1 October 2013 final report submitted to California Department of Fish and Wildlife, Yreka, CA. 30 pp.

North Coast Regional Water Quality Control Board. (NCRWQCB). 2005. Staff Report for the Action Plan for the Scott River Watershed Sediment and Temperature Total Maximum Daily Loads. 472 pp.

North Coast Regional Water Quality Control Board. 2006. Action Plan for the Scott River Sediment and Temperature Total Maximum Daily Loads, September 2006. http://www.swrcb.ca.gov/northcoast/water_issues/programs/tmdls/scott_river/staff_report.shtml

North Coast Regional Water Quality Control Board (NCRWQCB). 2009. Draft Scott River Watershed Water Quality Compliance and Trend Monitoring Plan. Prepared by NCRWB Staff. 33 pp.

North Coast Regional Water Quality Control Board (NCRWQCB). 2011. Scott River Watershed Water Quality Compliance and Trend Monitoring Plan. http://www.waterboards.ca.gov/northcoast/water_issues/programs/tmdls/scott_river/pdf/Compliance_and_Trend_Monitoring_FINAL.pdf. Version dated July 12, 2011.

North Coast Regional Water Quality Control Board (NCRWQCB). 2015. Comment letter on the Scott River Water Temperature Assessment Draft Study Plan by Brian McFadin, NCRWQCB staff, dated May 11, 2015. 6 pp.

Olswang, M. 2012. Sugar Creek beaver pond juvenile salmonid habitat, 2011-12. California Department of Fish and Game, Yreka, CA.

Papadopulos & Associates. 2012. Groundwater conditions in Scott Valley. Report prepared by S.S. Papadopulos & Associates, Boulder, Colorado, for the Karuk Tribe, March 2012.

Quigley, D. 2008. Scott River Watershed Monitoring Program - Water Quality. Water Temperature Monitoring and Sediment Sampling Analysis 2005, 2006 & 2007. Prepared by Siskiyou Resource Conservation District.

Quigley, D., Farber, S., Conner, K., Power, J., and L. Bundy. 2001. Water Temperatures in the Scott River Watershed in Northern California. Prepared for U.S. Fish and Wildlife Service. 67 pp.

Scott River Watershed Council (SRWC). 2006. Initial Phase of the Scott River Watershed Council Strategic Action Plan. October 2005 Update. 5/2/2006. 249 pp.

Siskiyou Resource Conservation District (SRWC). 2013. Scott River water quality and water quantity monitoring, 2011-2013, Final Report. Prepared for the California Department of Fish and Wildlife, dated December 2013. 51 pp.

Sommarstrom, S. 2015. Comment letter on the Scott River Water Temperature Assessment Draft Study Plan by Sari Sommarstrom, Etna, CA, dated May 15, 2015. 3 pp.

Stenhouse, S.A., C.E. Bean, W.R. Chesney, and M.S. Pisano. 2012. Water temperature thresholds for coho salmon in a spring-fed river, Siskiyou County, California. California Fish and Game 98(1):19-37.

Sullivan, Kathleen, Martin, D.J., Cardwell, R.D., Toll, J.E., and Duke, Stephen. 2000. An analysis of the effects of temperature on salmonids of the Pacific Northwest with implications for selecting temperature criteria: Sustainable Ecosystems Institute, Portland, OR. 147 pp. Available online at: http://www.sei.org/pub.html#reports

Theurer, F.D., K.A. Voos, and W.J. Miller. 1984. Instream water temperature model. Instream flow information paper 16. United States Fish and Wildlife Service. Washington D.C. 316 pp.

Torgersen, C.E., D.M. Price, H.W. Li, and B.A. McIntosh. 1999. Multiscale thermal refugia and stream habitat associations of Chinook salmon in northeastern Oregon. Ecological Applications 9:301–319.

Watercourse Engineering, Inc. 2004. Shasta River Field Monitoring Report 2001-2002. Napa, CA. 44pp + appendices.

Watercourse Engineering, Inc. 2013. Water Temperature Transaction Tool (W3T): Technical and User's Guide (V1.0). A report for National Fish and Wildlife Foundation (NFWF) prepared by Watercourse Engineering, Inc., Davis, CA. Dated September 2013. 19 pp. + apps.

Watershed Sciences. 2004. Aerial surveys using thermal infrared and color videography: Scott River and Shasta River sub-basins. 26 February 2004 final report to the California North Coast Regional Water Quality Control Board and University of California at Davis Department of Environmental Science and Policy. 59 pp.

Watershed Sciences, Inc. 2007. Airborne thermal infrared remote sensing, Scott River Basin, CA. Report to Quartz Valley Indian Reservation, Ft. Jones, CA, by Watershed Sciences, Inc., Corvallis, OR. Revised report dated June 1, 2007. 31 pp.

Yokel, D. 2013. 2011 Monitoring Report for the Scott River Water Trust. Siskiyou Resource Conservation District, Etna, CA. 27 pp.

Yokel, E. 2009. Monitoring Report – 2008 for the Scott River Water Trust. Siskiyou Resource Conservation District, Etna, CA. 48 pp.