Draft 1 Meeting Notes

LESSONS LEARNED SEDIMENT MANAGEMENT WORKSHOP

September 16, 2015

Weaverville Fire Hall, 125 Bremer, Weaverville, CA

Attendees: Robert Stewart, Dave Gaeuman, Robin Schrock, Brandt Gutermuth, Michelle Gallagher, Eric Peterson, Todd Buxton (Trinity River Restoration Program); Tyrell DeWeber (Oregon State Univ, Fisheries); Gil Saliba, Ed Duggan, Emelia Berol, Tom Stokely (TAMWG members); Phil Fishella, Bill Brock (USFS), Tony LaBanca Steve Cannata, Wade Sinnen (Ca Dept of Fish and Wildlife) Dave Hillemeier, Aaron Martin, Kyle DeJuilio, Andreas Krause (Yurok Tribe); Dave Wellock, Chester Anderson (residents); Teresa Connor, Travis Moore, and Scott Lawrence (Ca Dept. of Water Resources); Vina Frye, Joe Polos, Josh Bryce (USFWS); Wes Smith (OIA/NMFS); Seth Naman (NMFS); Robert Franklin, Andreas Krause, Sean Ledwin, George Kautsky, James Lee (Hoopa Valley Tribe); Debra Curry, Jenny Curtis (USGS); Jodi Durrett (Burleson Consulting).

Notes: Kim Mattson (ENW).

Meeting Notes

1. Welcome and Introduction, Joe Polos and Robin Schrock

Joe Polos, Interim Science Coordinator for the Trinity River Restoration Program (TRRP), opened the meeting and welcomed the attendees. He invited everyone to a barbeque dinner that evening at Lowden Park. He asked the attendees to introduce themselves.

Robin Schrock, Executive Director of the TRRP provided opening comments and gave a brief introduction to the Trinity River Restoration Program (TRRP) and its operations and participating partners.

2. Intro to the Sediment Management Program (TRFES/CSMP), Robert Franklin

Robert Franklin of the Hoopa Valley Tribe provided a background and context for the workshop by presenting the rationale of the creation of the TRRP and specifically the concepts of a healthy alluvial river that incorporates change.

Franklin passed out a copy of Appendix H of the Trinity Flow Evaluation Study (TRFES) "Attributes of Alluvial River Ecosystems." It was pointed out that this document and other foundation documents are available on the TRRP website data portal. Franklin noted how Luna Leopold was instrumental in developing the concept of river health as the foundation of the restoration and is a fundamental objective of the TRRP. Attributes of a healthy river include formation of meanders and formation of active gravel bars that are mobile over time, a balanced gravel budget and infrequent floods forming complex channel morphology. He suggested that all partner scientists should answer the question of how their particular project contributes to moving the Trinity River towards a more healthy, functioning alluvial river.

3. Coarse Sediment Transport, Andreas Krause

Andreas Krause explained the development of the Record of Decision (ROD) recommendations for high flows and gravel augmentation. Critical to their recommendations was the 1997 rating curve at Lewiston showing bedload transport as a function of discharge. This graph showed expected coarse sediment (> 8mm) as a function of flow. They only had 3 data points at that time.

Since then the TRRP has collected an abundance of data and the new data show an order of magnitude lower transport than the original relationship. Krause noted that a lower transport relationship was also observed at Douglas City.

Potential explanations for an order of magnitude lower transport is not known but there could be many possible reasons (change in sand content, flows, river morphology). The management implications are that these reduced gravel transport relationships need to be incorporated into the considerations of how to balance the coarse sediment budget. He noted that Dave Gaeuman will be speaking on this topic.

Questions

Wes Smith noted that 1997 was a high-flow year and that may explain the differences. Also the three points may be within the error ranges for the more recent data points.

There were several questions about whether the Program should consider decreasing gravel inputs. Robert Franklin suggested another way to look at this would be to increase flows.

Wade Sinnen asked about the consequences of not having the high flows (e.g., 30,000 or 100,000 cubic feet per second [cfs] events) post-dam. Krause acknowledged that, now, certain geomorphic thresholds cannot be crossed. Today the river is scaled down and they must manage within the 11,000 (cfs) cap. They do have a lot of options but there are limits to what they can do.

4. **Gravel Budgets, Dave Gaeuman**

Dave Gaeuman referenced his 2012 report on sediment budgeting that was the basis of his presentation. He reviewed that a sediment budget is a measure of sediment storage over time. It can be calculated as inputs minus outputs similar to a bank checkbook. He noted that the TRFES and ROD objectives are focused on recent budgets and focus on the area upstream of Rush Creek, whereas the Coarse Sediment Management Plan focuses on a slightly larger area—the area upstream of Indian Creek. He described four budget "cells" that define reaches from the dam to Douglas City.

Sediment export is measured out on the river as sediment leaving a cell annually. Inputs include that from upstream cells, estimates of tributary inputs, bank erosion, and measured gravel augmentations. He noted that 2006 and 2011 were the big flow years since 2000 and that they have added 70,000 tons of gravel since 2005.

Graphs of sediment budgets show increases over time except the cell furthest downstream at Douglas City. Gaeuman thought this cell seems to be losing excess sediment that had been stored from an earlier period. The others are storing sediment.

He commented there is less known about historic budgets but concluded that all cells were pretty close to being balanced and were close to pre-dam budgets. He suggested the Program should focus more on long-term objectives than short-term objectives.

Questions

Ed Duggan asked if Rush Creek or Indian Creek were producing a lot of sediment and if gravel should be added there. Gaeuman said no gravel is being added at those sites and most is added upstream of Rush Creek.

Seth Naman asked if sediment storage may be lower post-dam since the flows are lower. Gaeuman said not really.

George Kautsky asked about sampling frequency and if annual sampling is necessary. Gaeuman responded that sampling is needed for annual flows as transport can be so variable and seems to be storm dependent and sometimes shows hysteresis.

Gil Saliba and Aaron Martin asked how do you know how much storage is needed? Gaeuman acknowledged this is a very good question and while they have some historic data, they really don't know.

5. **System-wide Geomorphic Change, Dave Gaeuman and Jenny Curtis**

Pool Depth Change, Dave Gaeuman

Gaeuman reviewed that about three years ago, stakeholders became concerned that the gravel augmentation was filling in fishing pools. The Program decided to investigate using sonar surveys in 2009, 2010, and 2011. They were able to grid the depths to 3' grids in ArcView and develop assessments of changes in depth over the entire pool. He showed depth data as "cumulative depth profiles" which were graphs of percent of pool area versus depth. He could compare the profiles for the three years at specific pools to look for patterns or shifts in deeper or shallower depths. This showed not only if depths were changing but what parts of the pool (e.g., specific depths) may have changed.

He showed that some pools had deepened and others shallowed but most did not change more than 1 foot. Those that showed filling were at Trinity House Gulch, the 299 Bridge, and Sky Ranch. Specific filling occurred at these pools: Burner Hole, Wellock Pool, Lower Bend, and Alcatraz. Gaeuman explained some ideas why these sites may have showed filling.

Burner Hole had additions of sediment in 2008 and 2009. In 2008, the sediment cleared out of the hole but did not go downstream. In 2009, the restoration lowered the floodplains and the added sediment did not scour out of the hole because of this work.

Wellock Hole had no pool in 1980 but was dredged in 1988 as part of the Hamilton Ponds project to trap sediment coming out of Grass Valley Creek. In the large flow release of 2011, sediment filled the dredged pool and now it is similar to 1980.

At Lower Bend, there was terrace lowering as part of the Reading Creek project. And at Alcatraz there was terrace lowering and the flow was diverted away from the former pool. Gaeuman thinks the maximum depth is still there and it may be recovering.

Gaeuman noted some sites where the depth downstream of gravel augmentation (e.g., at Lowden) actually got deeper. He noted that typically, gravel doesn't stay in pools—it tends to go through the pool during scour events, unless they lower the terrace.

Gaeuman said a popular assumption is that pools are filling with gravel due to gravel augmentation. But the findings are that only a few pools have filled and many have deepened.

Questions

Ed Duggan noted the guides think the holes are getting smaller (e.g., narrower). Gaeuman noted they have not just looked at maximum depths but have measured depths over the entire pool.

Aaron Martin asked what is going on in Junction City. Gaeuman said it is shallower and this may be due to higher ROD flows. This area may be widening and that creates shallowing.

Dave Wellock noted that at his home in the 1940's, his parents had two dredges than dredged down to bedrock. The DWR put in holding ponds in 1982 and that pool stayed quite a while until it filled by Grass Valley Creek.

6. USGS geomorphic assessment, Jenny Curtis

Jenny Curtis presented on USGS assessment of geomorphic change in the Trinity River from 1980 to 2011. This assessment is the first post-ROD of geomorphic change. She referenced an open file report that contained the data and an interpretative report as the basis of her presentation and that these reports are available on line.

The USGS study used available data and had no new data collections. They developed a GIS data base that can be updated over time. They had six sets of aerial photos—only two in the pre ROD period and the rest post-ROD. Using these photos, they delineated geomorphic features such as bars, active channel, riparian and floodplain and then assessed changes over time.

Curtis said her take home message was that there have been geomorphic changes in the river, but these have been muted since the ROD, and there will be limited change in the future without management action.

Curtis described several trends of change. Riparian features dominated the landscape in 1980 and these have been converted into channel features caused by channel widening. She noted huge increases in channel expansion by 1997, especially downriver with tributary accretions. Active channel (active bars and wetted width) width increased from 28 m in 1980 to 34 m by 1997 and 35 m by 2011. She thought the recent (2011) increases occurred more in the upper river (where most restoration had occurred) whereas recently decreases occurred in the lower river.

Curtis noted other increased in features such as channel complexity (with active bars peaking in 2001), riparian diversity, and constructed features.

She concluded with five basic findings:

1) There were measurable increases in ecological characteristics both pre- and post-ROD periods. Post ROD changes were spatially limited.
2) There was a muted response that may have been related to expansion to active channel. 6,000 cfs did not produce scour mobility or meet channel maintenance targets.
3) There is limited potential to achieved desired future conditions. She noted that northwest California is experiencing the largest relative change in precipitation.
4) Controlling factor analysis was limited by lack of comprehensive monitoring data. Continuing model development will be helpful.
5) The data base can be updated and expanded. There are additional photos available that could be analyzed.

Questions

Tom Stokely asked about sediment input from tributaries and whether that was an indicator of an evolving system. Do we need more monitoring? Curtis said they are inferring sediment inputs from tributaries she cannot say if monitoring was the best use of funds. Modeling may be a better approach using a watershed approach.

Seth Naman asked if sediment inputs from tributaries were declining. Curtis said no, flow has been declining. Is lack of sediment from tributaries hurting the river? She could not say, because it is difficult to define the desired condition. We want a healthy alluvial system but how to quantify this?

Dave Hillemeier asked about active channel changes and recent increases in upper river but less in lower river. Is this suggestion of too little sediment? Curtis said it could be or it also could be too little flow. The lower river bars have either scoured or revegetated. The active channel width has not changed very much.

Lunch Break

7. Effects and Fate of Injected Gravel, Dave Gaeuman and Kyle DeJuilio

Fate of Gravel Augmentations, Dave Gaeuman

Gaeuman presented his understanding on where the gravel goes once it is injected to the river. He showed the primary gravel augmentation sites beings in the upper river near the dam, at Cableway, Diversion Pool, Sawmill, Lowden Ranch, and Grass Valley Creek. He next described the fate of gravel injections at these sites.

Near the dam, 6,000 cubic yards (cy) was placed in 2006 and 2007. There was not a lot of change after gravel placement. Gaeuman thought at least 1,000 cy of gravel did leave the site and may have deposited at Bear Island about 1,200 feet downstream. This was not considered to be a long distance of transport. During the 12,000 cfs release, the gravel appeared to only move another 300 feet downstream. Gaeuman thinks local hydraulics were the cause of these changes.

Diversion Pool gravel additions occurred 2009, 2010, and 2011. At least half of it stayed near the injection site. Some may have moved out into the channel, but it did not fill the pool downstream.

Cableway received 2,000 cy of gravel in 2003 with about 6,000 total cy added. The 2011 flow transported much of the mobile gravel out of the site. Monitoring indicates that 1.8 times the added gravel passed out under the bridge at the downstream of the site. Gaeuman thought the gravel may have gone ½ to 1 mile.

Burner Hole has not shown much movement. Gaeuman thought the Burner Hole is a sink.

Sawmill gravel was placed in 2009. By 2011 gravel moved about 300 to 400 feet. The site is considered a gravel sink.

Lowden Grass Valley injection site received 1530 cy in 2010. 900 cy exited the system. The gravel may have replaced some scoured sand. But some went downstream and they don't have data downstream.

Lowden Ranch and vicinity received 2050 cy in 2011. The gravel moved through the reach and picked up more gravel. The flux downstream was 4.7 times more that injected and filled Wellock Pool. Downstream, more gravel was picked up and at least twice as much gravel exited as added. The material may have gone a long way—maybe to Society Pool.

Gaeuman summarized the results seem to be a mixed bag of movement or not.

Initial assumptions were that gravel affects habitat far downstream and acts like a conveyor belt.

Findings were that a large portion remains close to inject site and downstream transport has been irregular and mediated by sinks where gravel can stall for long periods.

Management implications are that gravel should be placed close to sites where you want gravel. Channel modifications that reduce stream power such as widening can trap gravel.

Questions

Phil Fishella asked about transport of fines out of the system. Gaeuman noted that Krause would talk about fines later. Fishella asked about siltation in pools and would it recover. Gaeuman said he did not look at siltation but thought it could recover especially if you cut down the floodplain terrace.

Lowden Ranch, Kyle DeJuilio

Kyle DeJuilio presented on Fish to Substrate Relationships. He said the gravel augmentation is expected to have positive effects on fish. The TRFE found that Chinook used small cobble for spawning. More recently it appears that Chinook have shifted to large gravels as it has become more available.

Another goal for gravel injections is to create juvenile habitat. However, no studies have been designed to examine gravel injections on fish habitat. Most fish work has been done on channel restoration or flow management.

He showed surveys of habitat (e.g., depth and flow) changes pre- versus post-construction at several sites. Hoadly Gulch showed minimal change. Sawmill surveys showed increases in habitat but this ended up being loss of habitat by the third year. Mobilization helped to increase habitat after the 2011 flow, but in an unintended location. Lower Reading Creek also saw habitat increases but in an area intended to be a meander. Lowden Meadows showed increased habitat in a low-flow constructed area and this has persisted.

Regarding high-flow gravel augmentation, he showed a natural site at Hocker Flat that since construction, a mid-channel bar has persisted. Hocker Flat habitat increased, but more so at lower flows. Lewiston Cableway showed increases in habitat at all flows. He noted that construction allowed low flow water to get up on a lowered terrace. Upper Dark Gulch showed increased habitat at all flows. Upon resurvey at 2014 there was an increase in habitat with increasing flows. Gravel seemed to be the cause for change. The gravel mostly likely came from Rush Creek delta and constrained the low flow channel which then overtopped the lower floodplain.

DeJuilio listed these lessons learned:

1) Changes in sediment supply can cause a change spawning preferences for Chinook.
2) Gravel has had minimal impacts on rearing habitat.
3) The constructed habitat increases has not persisted.
4) Gravel placement can alter the flow to habitat relationship.
5) Habitat gains may occur at specific flows.

Questions

Tom Stokely asked why only measure fish habitat up to 2,000 cfs. Aaron Martin responded that they can't go higher because it gets difficult to have the river held at higher flows for the time required surveys.

Habitat, Dave Gaeuman

Gaeuman presented on gravel augmentation and channel change at Lowden Ranch. He reviewed the rationale for gravel was to create functional gravel bars. They do this via low flow gravel placement and during high flows to allow distribution. A new idea is dynamic injection at high flow for a specific design.

At Lowden Ranch the pre-project condition was a straight channel with a high terrace on the left bank. They constructed a meander and lowered the terrace. They injected gravel before the 2011

release. They modeled aggregation would occur near the injection site with additional deposition downstream to form a bar. The pre- and post-construction elevations showed that the model was accurately predicted deposition, but scour was deeper and a second middle zone scour also occurred. Total storage change was only 345 cy but a lot of bed change occurred that created more depth and flow habitat conducive for fish.

Furthermore, they did a study of moderation of stream temperature by bars. The naturally deposited bar showed greater temperature moderation because they had more hydraulic drop that drove the hyporheic flow through the bar.

These results demonstrated that the dynamic bar construction worked.

Questions

James Lee asked if the presence of coarse sediment sinks in the system suggests that there still is a sediment deficit? Gaeuman thought no, that natural systems will always have sinks.

LaBanca asked how the hydraulic head of natural bars helps to modulate temp. Gaeuman said it drives hyporheic flow better.

8. **Fine Sediment Management Efforts (Fine Sediment Reduction) Andreas Krause**

Andreas Krause defined fine sediment as grains less than 8 mm. They use this higher diameter due to the high amount of decomposed granite. Management objectives are reduced inputs of fine sediment to the mainstem and reduce fine sediment storage in the river.

The river was originally over-whelmed by fine sediment. He showed photos from 1975 with deposits of 1 m deep of sand. Early restoration efforts were to construct spawning gravel on top of sand. Another efforts tried were use of a riffle sifter, digging it up and allowing transport to move it, and dredging. Grass Valley Creek was restored with Buckhorn Dam, Hamilton Ponds and watershed work.

Post ROD they now have high flows and these are working to move sand as shown by photos of turbid water at the North Fork. Watershed restoration has been effective in reducing sediment from Grass Valley to the Hamilton Ponds. Bulk samples from the mainstem showed sand was 40 % in 1979 and 20 % in 2009. Other data show reduced fine sediment below Grass Valley Creek, but these data are preliminary. He showed photos from 1970s and 1980s versus today that showed reduced sand in some pools.

In summary Krause noted that fine sediment is less of an issue that it once was and this is a major accomplishment. The objectives have been met in Grass Valley but not necessarily at other sites. Storage reductions have some uncertainty but the trends are in the right directions. We need to have quantitative targets that relate to biology.

Questions

Tony LaBanca agreed that quantification of biological implications are important.

Seth Naman suggested they can conclude a reduction even if one doesn't know the biology. Krause said yes.

Phil Fishella asked if it is possible to sample sediment in pools. Krause said the sand in the bottom of the pool is not an issue as it is likely mobile. It is more important to monitor sand on riffles where there is spawning.

Bill Smith asked about surface versus subsurface sands. Krause said there is likely sand down deep.

Dave Wellock said there have been good improvements in sand reduction.

9. **Basis for WY 2015 Recommendation Dave Gaeuman**

Gaeuman presented analyses to support gravel recommendations for the Trinity River.

He reviewed short-term objective to mitigate for dam deficits and the long-term objective of additions of annual coarse sediment to help create habitat. He talked about how to define an unregulated gravel load for a regulated river. The ROD called for an average of 10,000 cy to be added per year. Later Gaeuman has revised this estimate down to 1900 cy per year. He explained how he arrived at this estimate.

He first asked how much gravel would be transported in a regulated river. He presumed that transport at Douglas City may represent an unregulated (unlimited) supply of gravel. He asked if the upstream sites had that much gravel could they transport it like Douglas City?

He showed a transport relationship via a graph showing transport versus discharge and also showed an equation that was calibrated for the Trinity. Using the expected flows, he calculated transport rates at different points on the river.

He calculated 1910 cy for all reaches above Indian Creek. He was able to suggest "practical" augmentation amount for each water year type of flow. These ranged from 0 in a critically dry year to 5000 cy in an extremely wet year.

Regarding short term gravel inputs, they may still have local deficits. He thinks the short term objectives should be biological not just storage.

Questions

Josh Bryce asked if the gravel is sorted before adding to the river. Gaeuman said it is sieved to remove 3/8 inch. The upper limit is sieved between 3 and 5 inches.

Ed Duggan asked if there has been surveys at the North Fork or South Fork regarding fine sediment. Gaeuman said not that he is aware of.

General Questions and Comments about All Presentations

Joe Polos opened the session up for general questions and discussion. He noted some of the findings. He noted Krause's points on the fine sediment changes and the historical changes presented by Jenny Curtis. He reiterated the flow constraints. He reviewed that pool depths are generally maintaining themselves except in some areas. He restated an unanswered question: What is the desired future conditions?

Ed Duggan asked about placing gravel closer to project sites. Gaeuman said it is better to augment target areas with closer injections. The volumes needs to be determined on a site by site basis.

Dave Wellock asked about what responsibility agencies accept for gravel building up on a private property. He thought the restoration agency has to accept for damages and they need to communicate with the downstream landowners. Seth Naman thought this is more of a policy question. In general they are seeking a dynamic river that incorporates change and these may incorporate an area where bars grows and declines. He agreed that the agency needs to make an

effort at communication. Robin Schrock said they are also work under California State law that covers these issues from road work etc.

Jim Smith asked about whether designer are looking at unintended effects. Gaeuman said there are a lot of places where they don't agree about the outcomes. Aaron Martin said it sometime takes time for the flows to engage the project. Brandt Gutermuth said designs generally try to keep the base flood elevations fairly constant.

Gil Saliba asked Andreas Krause how they are with the overall goals and the biological effects. Krause said at first, the objectives was to just reduce the sand. He acknowledged there is likely a lot of sand underneath the sediment. He thinks there is not much fine sediment upstream of Lewiston but there may be downstream. He acknowledged they still need to define the biological thresholds they wish to reach. Steve Cannata said there are thresholds for infiltration in sediment for spawning etc.

Kyle De Juilio asked where the dynamic injection might be implemented and how to incorporate tributary inputs. Gaeuman said if they have only done it at Lowden so far. He would like to incorporate it at Junction City but doesn't know if they will have the opportunity.

Dave Hillemeier asked if there will be a summary document and how the sediment results may be used in future planning. Joe Polos said they are working on a summary document and there will be an effort to address where to move forward and remaining questions.

Wes Smith asked about the fine sediment reduction objective and suggested that the river corridor concept may be helpful to answer questions.

Tyrell DeWeber asked what you are keeping track of to know if there is a healthy river. Attributes in Appendix H are not quantified. Can these be linked to habitat and fish? Robert Franklin said many attributes are laid out such as active bars but these may not be quantified. The IAP may have some more quantification help. It has been a problem to sell some of these ideas.

Tyrell DeWeber asked about quantified fine sediments? Krause mentioned fine percentages in bulk densities. Seth Naman said the question may be what are the benefits of a certain amount of fine sediment for species such as lamprey. DeWeber suggested they simply say the need fine sediment that is adequate for lamprey instead of setting a level for fine sediment. Steve Cannata said there are thresholds that are established. Todd Buxton noted that fine sediment has benefits.

Adjourn 3:30 PM