



August 3, 2015

To: Rich Marovich
Chris Lee

Subject: Mechanical Scarification of Cemented Gravelbeds in Lower Putah Creek

Background:

Considering all the actions available to improve aquatic habitat within the Lower Putah Creek (LPC) watershed, I believe we can document that there is one remedy - benthic scarification - which will significantly improve benthic habitat and food resources for native fish and riparian wildlife. Dramatic improvements in the benthic invertebrate (BMI) community, trout spawning, and salmon spawning can be tracked to the establishment of the Pickerel Weir in 2009. Natural scour occurred immediately below the weir and the results are showing. Some sections of the lower creek are cemented to a degree that I do not think a flood of the magnitude seen in 2006 would mobilize existing gravel deposits.

Benthic Macroinvertebrates: The aquatic food web, and a significant portion of the riparian food web, is driven by the BMI community. The aquatic phase of BMI species are a primary food source for native fish, including trout and juvenile salmon. The adult phase of aquatic BMIs are a major food source for several avian species that nest along the banks of Putah Creek.

Salmon and Trout Spawning: Benthic scarification will also dramatically improve salmon and trout spawning areas as documented in December 2014. Spawning improved dramatically without additional water releases or other significant cost.

Recommendation: I strongly suggest that SCWA do everything possible to submit a permit request to DFW to allow a scarification study to continue prior to the 2015 salmon and trout spawning season. Considering other restoration options, the scarification action appears to be highly effective at a relatively low cost. Using talented excavator operators, the process will have minimal environmental impact such as released sediment and damage to riparian vegetation. Using a streamside long-reach excavator to scarify highly cemented sections of Lower Putah Creek will improve the habitat conditions (open interstitial spaces) required for a healthy BMI community and salmon spawning areas.



Female rainbow trout above her redd in Lower Putah Creek. December 2014



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Scarification Benefits



Female tree swallow with mayflies.

It has been well documented that several bird species prey heavily on the adult phase of aquatic insects for their own subsistence and feeding their chicks. This female Tree Swallow repeatedly brought beak-fulls of adult mayflies to her chicks in the cavity nest.



Female blue bird with an adult *Hexagenia*, a large mayfly.

Blue birds take advantage of adult aquatic invertebrates, even large species such as *Hexagenia*, one of the largest mayflies on the West Coast (Image left). The adults feed directly on the mayflies and feed same to their chicks.



Report 5030

Scarification Benefits



Salmon spawning in control section (nonscarified) of Lower Putah Creek. December 2014



Salmon above redd in scarified section of Lower Putah Creek. December 2015



Salmon spawning in scarified section of Lower Putah Creek.

Non-scarified Areas: We know that salmon can marginally spawn in non-scarified areas. The rate of success is unknown. The depth of the redds is severely limited, typically a few inches. The eggs tend to wash downstream per documentation in 2004 near Yolo Housing.

Scarified Areas: The sections scarified in Lower Putah Creek (2014) were the first to be used by spawning salmon and rainbow trout. Per the image on the left, the gravel was loose and easily dug by female Chinooks.

Spawning in Scarified Areas: Same redd as image above. All of the scarified areas were utilized by spawning salmon and trout. It also appears that the scarification enhanced the Benthic Macroinvertebrate community and decreased the New Zealand Mudsail density (Survey ongoing).



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Pair spawning rainbow trout near the Harris property (2014)



Failed spawning area near Yolo Housing. December 2004



Embedded rocks in Lower Putah Creek.

Sent via e-mail on August 3, 2015

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Aquatic biologist
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Rainbow Trout Spawning in LPC: For the first time, rainbow trout were documented to spawn in areas below the Putah Diversion Dam (2014). They spawned in areas scarified in 2014 and in the north side channel. The trout were more sensitive to human disturbance (streamside viewers) than the salmon. The trout spawned in the same vicinity as the Chinook Salmon.

Failed Spawning: It appeared that the salmon redds shown on the left (2004) failed as I was picking up salmon eggs in a drift net several yards below the redds. The gravel was not deep enough for spawning and was primarily one layer just on top of the claypan.

Embedded Cobble: Embedded, highly cemented cobble dominated the Pickerel Weir section prior to natural scour caused by the weir. The embedded condition limits the diversity and density of benthic macro-invertebrates. The only invertebrate species that can survive this condition are primarily those that construct protective cases such as *Glossosoma* sp. A small caddisfly, *Glossosoma* larval cases are shown on the top of the cobble (image left).