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REPORT 5554
Scarification Update

Date: May 29, 2017

To: Rich Marovich, Streamkeeper

Subject: Post 2017 Floods - Scarification Still Necessary

Preliminary Report

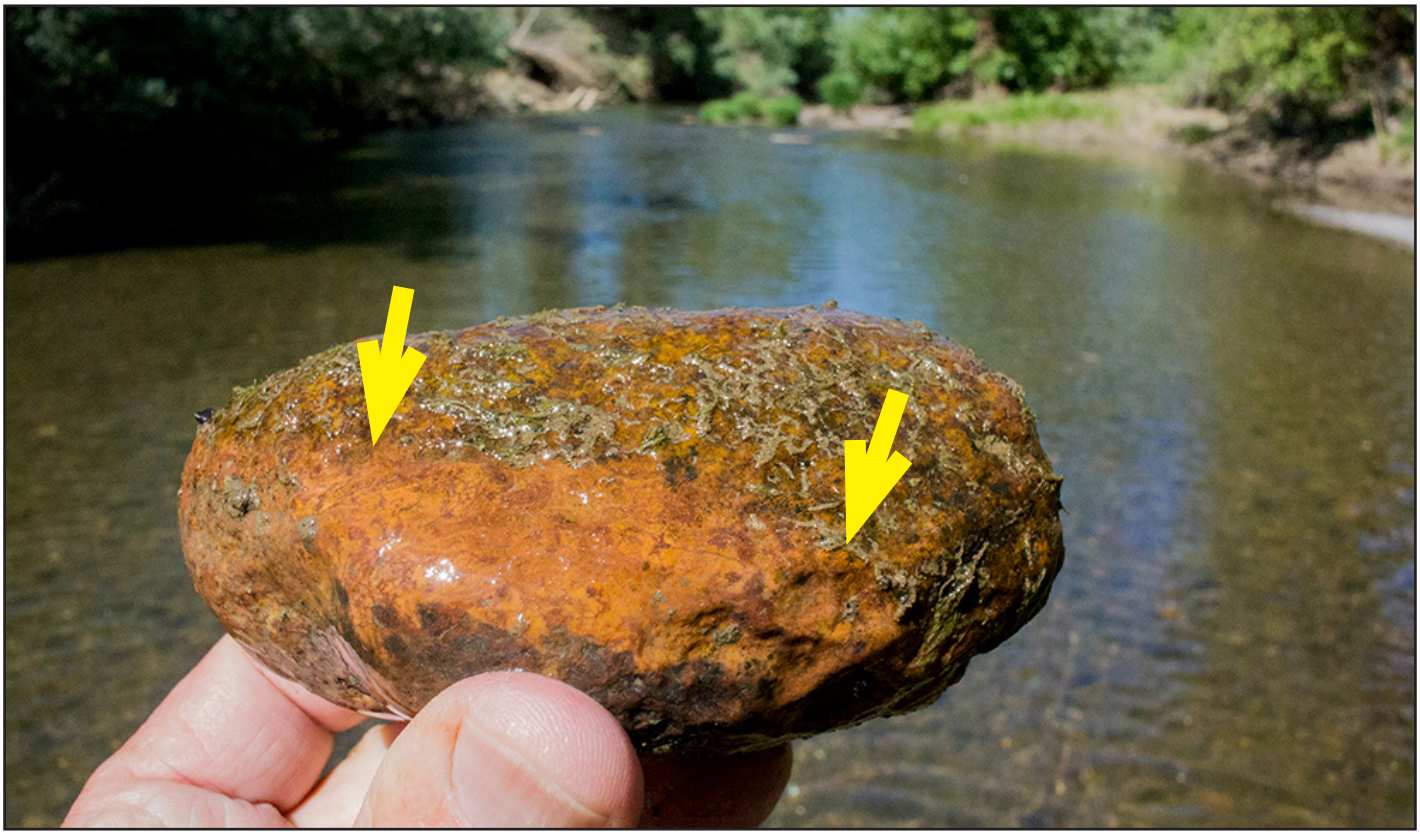
Due to the 2017 floods, it was impossible - until recently - to evaluate the status of salmon redds mapped during the 2016 Chinook salmon spawning period, the success of the Scarification Project sites, and evaluation of potential 2017 Scarification Sites. This report is preliminary and will be updated. After close examination of several Scarification Sites to evaluate the impact of the 2017 floods, I submit the following for your review:

1. Available Gravel in Lower Putah Creek:

Gravel in Lower Putah Creek is plentiful and readily available, although much is buried and in some areas remains embedded. That opinion (mine) is contrary to the report *"Chinook Salmon in Putah Creek, Spring 2004: Report to the Lower Putah Creek Coordinating Committee"* (Small 2004), which states:

> *"Gravel is a limiting resource in Putah Creek for salmon; it occurs in only small patches and is often only a thin veneer over the underlying clay."*

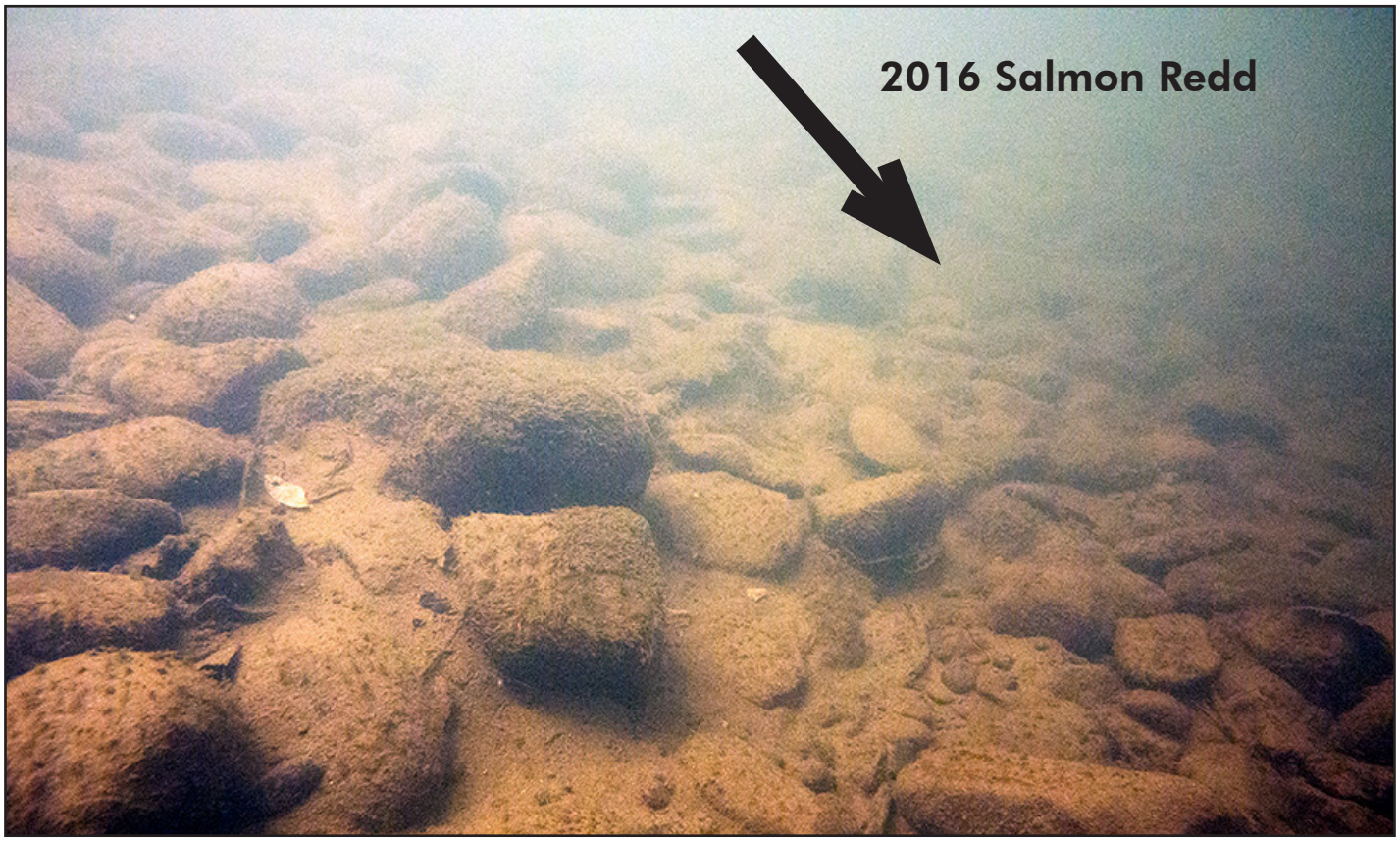
I am not certain how that report was developed, but it certainly is misleading and appears to have driven policy for managing Lower Putah Creek resources. The phrasing is similar to the Yates Report (2003). However, native cobble resources are readily available within much of the existing channel and nearby riparian areas. (Personal observation and communication with Rick Fowler and several landowners).



Embedded cobble at the Parker Riffles. The lower (cleaner) area was the embedded (buried) section. The upper section is covered with algae and sediment tubes (Chironomid Midges). 5/23/2017

2. Status of 2016 Chinook Salmon redds:

The redd survey is incomplete and ongoing. Many scarification spawning sites that were mapped in 2016 have intact redds. Many of the redds are still visible, most with some mobilized sand (see image below). Despite the sand, the individual cobble particles were free (not embedded). With the cobble in this condition, spawning salmon will easily move the cobble and develop healthy (deep) redds. All mapped spawning sites will be surveyed with results reported to the Streamkeeper.



2016 Chinook Salmon redd after the 2017 high-water events. This site was used by spawning salmon in 2014, 2015, and 2016. Cobble remains essentially free (not embedded). Some sand was mobilized by the flood waters. Scarification Control Site Harris C-2. Subsurface image taken on 5/23/2017.

3. Flood Scour:

Although the flood water (scouring flows) certainly scoured certain areas and mobilized significant amounts sand and some cobble, the main channel was not “scoured”. In some areas, deep pools were filled with sand.

4. Benthic Macroinvertebrate (BMI) Response:

Several 2016 Scarification sites and potential scarification sites (2017) have been checked for invertebrate communities. These surveys are simple measures of Benthic Macroinvertebrate (BMIs) species and density that are retained on embedded cobble. The survey is conducted while measuring cobble cementation. While diversity is limited due to the embeddedness, the BMI density is what I would expect on embedded rocks after a prolonged flood event. The image below of a cobble is characteristic of one that was embedded. The benthic macroinvertebrates are restricted to the non-embedded section and characterized by Chironomids (midges) and several species of caddisflies that are protected from fish in self-constucted cases.

Embedded rock (75%) showing algae and significant numbers of Midge (Chironomid) tubes on the top surface of the cobble. Harris Control Site. Image taken on 5-23-2017

5. Gravel size for Salmon Spawning:

Field experience of observing and filming spawning salmon in Lower Putah Creek and numerous other waterways has convinced me that the recommended size of cobble necessary for successful Chinook salmon spawning in Lower Putah Creek is on the small side. For example, redds that survived flood events in 2014 and 2016 had large cobble (15-25 cm. range) which the female used to armor the upstream edge of the redd. It appeared that the redd was developed to protect the "pot" or interior of the nest where the eggs were deposited. Other redds in areas with smaller gravel (and no larger cobble) were buried by flood-mobilized gravel.

2016 Spawn: Male salmon over a redd dug by the female (in background). The "spawning gravel" in the middle of the redd is consistent with the size of rock recommended for restored sites. The rocks used by the female to armor the redd are more in the 15-25 cm. range. 2016 Scarification Site #12.

NAWCA access road after 2017 flood. Image shows copious amount of rock that was revealed by the flood waters. Note: My understanding is that this rock is native and was not placed during the NAWCA project. The main channel Lower Putah Creek is on the far left of the image (see arrow). 5/20/2017

6. Comments on Gus Yates "Gravel & Temperature Surveys in Lower Putah Creek" (2003):

Because many Benthic Macroinvertebrates require the same environmental conditions necessary for spawning salmonids, I wanted to review the above report from Yates (2003). The Yates report is apparently one source of erroneous information concerning the gravel resources in Lower Putah Creek. My in-stream observations are contrary to the report. The process of collecting Benthic Macroinvertebrates "by hand" using a EPA-approved "D" net quickly reveals the condition of the benthos regarding embeddedness. Most species of BMIs cannot survive a condition of closed interstitial spaces within a bed of cobble. The Yates Report is replete with comments that exhibit the common misrepresentation of gravel resources in Lower Putah Creek. I offer a few examples from the report:

EXAMPLE 1: From Yates Executive Summary (Page ES3): *"Overall, gravel is not scarce along lower Putah Creek, but its texture is too fine for optimal spawning by some native fish, especially large salmonids."*

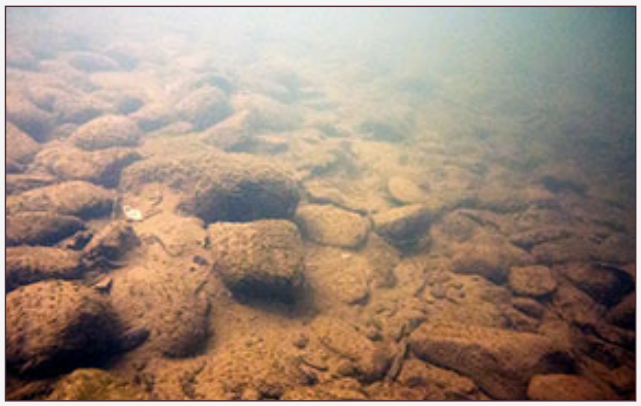
My Comment: That sentence explains some of the misunderstandings, especially when you consider he sampled the gravel no deeper than 6 inches. In many areas, the best gravel / cobble is buried by small materials and frequently embedded.

EXAMPLE 2: From Yates - Survey Methods (Page 13):
"Two gravel samples were collected at each site from locations that appeared representative of typical conditions at that site. The samples were collected by inserting a 12-inch diameter plastic cylinder ("bottomless" 5-gallon bucket) approximately 6 inches into the creekbed and scooping out the enclosed core of material."

My Comment: Survey was limited to a depth of 6 inches.

EXAMPLE 3: Yates Conclusions (Page 29): *"In terms of quality, gravel deposits are commonly too thin and too fine-grained to be optimal for spawning for most species. However, fish may be able to successfully spawn under suboptimal conditions if no better alternative is available."*

My Comment: See images! The sites in images shown below are examples of scarification areas completed by Rick Fowler. Both sites had copious amounts of prime spawning materials beneath the surface.



From Yates: Embeddedness (Page 13): *At many locations, creekbed gravels were densely packed and filled in with finer material to at least 50% of the diameter of the surface gravel grains. In addition to sand and silt, the gravel surface in some areas had a thin coating of a dark slimy algae. No systematic or quantitative measurements of embeddedness were made during the surveys. However, the feasibility of loosening the gravels was tested at a number of locations. The tests consisted of a hydrographer firmly swishing his hand (fingers pointed down) back and forth close to the gravel surface,mimicking the hydraulic effect of a fish tail. It was generally found that 5-10 seconds of this procedure would clear off the surficial fines and begin to loosen the gravels and that further loosening and cleaning became increasingly easy. This test obviously does not prove that a fish would choose such a site for spawning, but it does suggest that at least the larger fish (salmon and steelhead) would probably be physically capable of constructing a redd in the material.*

My Comment: The survey did not involve any investigation of the gravel beds deeper than approximately six inches.

RECOMMENDATIONS / PLANS:

1. I will work with Rick Fowler, and a couple of interested landowners, to develop a list of proposed gravelbed scarification sites for the 2017 Phase of the Scarification Project.

2. Per the **2016 Lower Putah Creek Streambed Gravel Scarification Monitoring & Construction Plan**, a complete survey of the existing scarification sites, salmon redds, benthic macroinvertebrate response, and proposed 2017 Scarification Sites will be submitted.

Report submitted via e-mail on 5/29/2017 - 10:30 PM.

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References:

Small, K.M., P.K. Crain and P.B. Moyle, 2004. *Chinook Salmon in Putah Creek: Report to Lower Putah Creek Coordinating Committee.* 10pg.

Yates, Gus. 2003. *Gravel and Temperature Surveys of Lower Putah Creek.* Report to the Lower Putah Creek Coordinating Committee. 34 pgs.