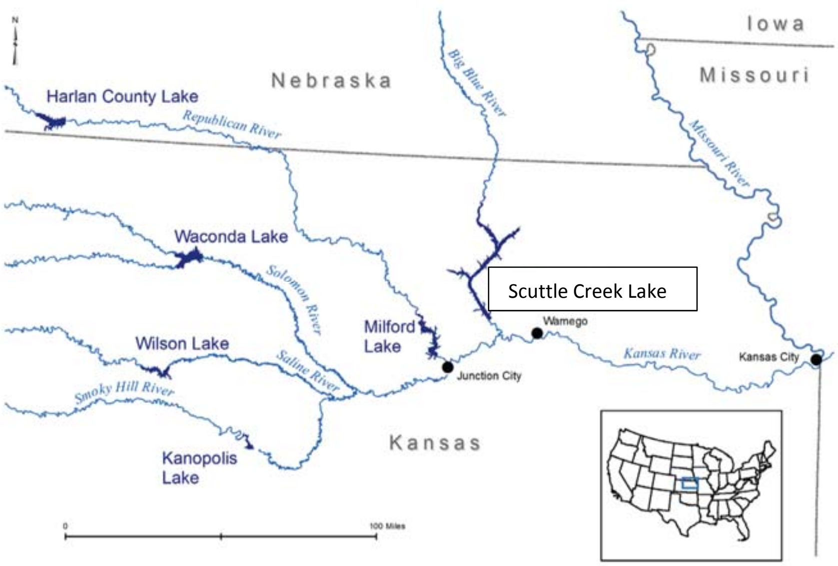
Note: While loosely based on a real reservoir in order to be realistic, the following is a simplified classroom exercise.

Scenario: Scuttle Creek Lake

Background

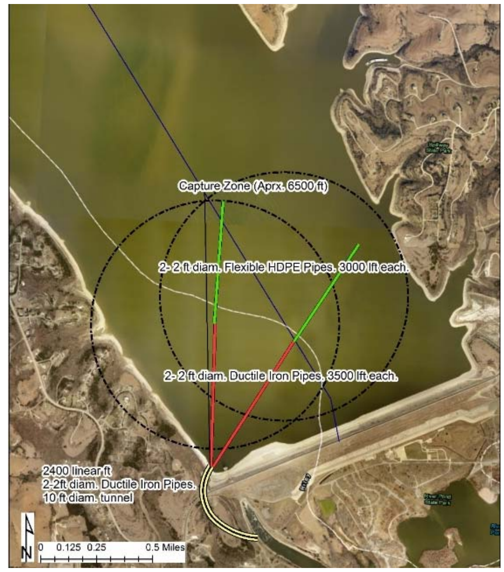
Scuttle Creek Lake is a large, multi-purpose reservoir with significant water supply, recreation, navigation support, and flood control functions. The lake up to the level of the multi-purpose pool is 40% full of sediment. The coarse sediment delta is approximately 14 miles away from the dam. No management is proposed for this coarse sediment. The lower 14 miles of reservoir is full of very fine sediment, predominantly clay. The clay is very erodible and non-contaminated with levels of phosphorous that are typical for soils in the watershed.



Right now, Scuttle Creek Lake traps 98% of the incoming sediment load. Downstream from Scuttle Creek Lake is the last 10 miles of the Big Blue River, which drains to the Kansas River. Due to the discharge of clear "hungry" water, the downstream Big Blue River channel bed has dropped 3 - 14 ft and has widened up to 200 ft.

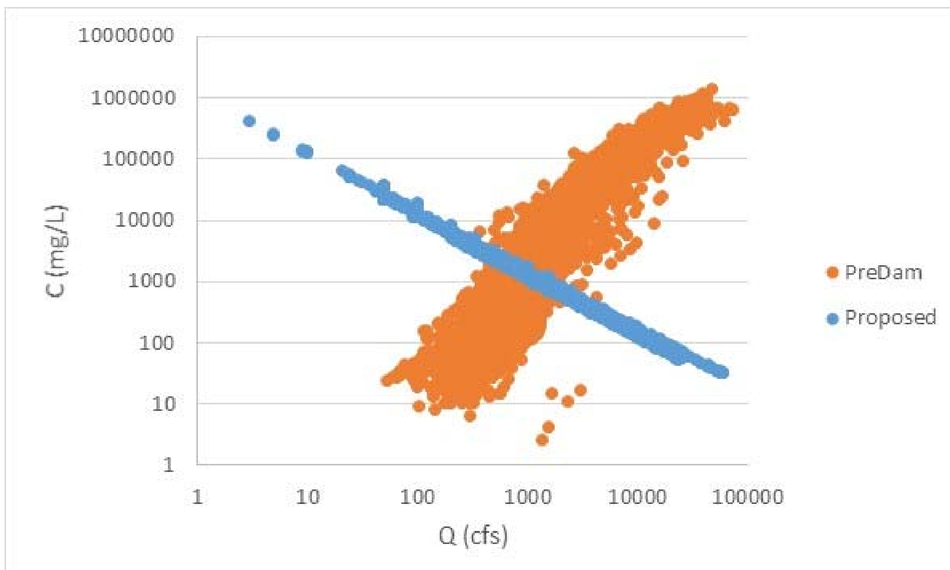
No ecological assessments have been done on the small stretch of the Big Blue River downstream of the dam. Reports on the downstream Kansas River indicate no endangered species, but do indicate a 70% reduction in fish species over the last several decades. Several native fish have been identified as imperiled due to lack of turbidity which causes predation or competition by non-native, sight-feeding fish. There has been no systematic assessment of macroinvertebrates.

Proposed Action



Water providers in the basin have banded together to propose a fix for Scuttle Creek Lake. This proposal is to install two pipes to suck fine sediment from the reservoir bottom and discharge the sediment into the Big Blue River downstream of the dam. These pipes will run by hydrosuction initially, but are configured so additional power via a dredge can be added in future years to either increase the sediment discharge or capture sediment from further upstream. The sediment concentration of the effluent is expected to be 6% solids in about 20 cfs of discharge. The median daily release of clear water through the existing service gates is 900 cfs—but it has ranged historically from 200 cfs to a maximum of 60,000 cfs. As proposed, the new sediment discharge would raise the sediment concentration in the Big Blue River to about 0.6% solids (6,000 mg/L) at low discharge, 1,390 mg/L at median discharge. Median flow in the Kansas River downstream is 2,400 cfs, but has ranged from 242 cfs to 179,000 cfs.

During 20 years of measurement, the pre-dam concentrations on the Big Blue River ranged from 3 mg/L at very low flows to 1,360,000 mg/L with a median concentration of 469 mg/L. Compared to pre-dam conditions, the new discharge from the Big Blue River would have higher sediment concentrations at low flows and lower sediment concentrations at high flows. Analysis shows that with 24/7 operation, these hydrosuction pipes could remove sufficient sediment to transport 52% of the incoming load downstream.



1- Is a federal permit needed here? Why or why not?

2- What information do you want to know before permitting this action (and how will that information be used to inform the permit)?

3- What permit conditions (including monitoring) will you impose?

Note: While loosely based on a real reservoir in order to be realistic, the following is a simplified classroom exercise.

Scenario: Smithfield Lake

Background

Smithfield Lake is a large, multi-purpose reservoir with significant flood control, fish and wildlife, hydropower, navigation, and recreation benefits. The lake up to the level of the flood control pool is 35% full of sediment. The coarse sediment delta is approximately 15 miles away from the dam. It consists of mostly fine and very fine sand, and the sand fraction makes up approximately 60% of the total volume of sediment trapped by the reservoir. The lower 15 miles of reservoir is covered in a thin layer of very fine sediment, predominantly silt. There are no know sediment or water quality issues associated with metals or water chemistry.

Right now, Smithfield Lake traps 100% of the incoming sediment load. Downstream of the lake the river channel is highly degraded, up to 14 feet for nearly 100 miles. This degradation has resulted in vertical banks, perched riparian zones, and a biological disconnect with the floodplain. It has also significantly increased the channel capacity, to nearly 100,000 cfs within the channel banks. Approximately 75 miles downstream is the start of a shallow draft navigation channel.

Endangered fish are found both above and below the dam, as well as populations of threatened and endangered shore birds, who use sandbars developed by the historic high floods on the river.

Proposed Action

The managing agency proposes an annual drawdown flush of the reservoir to provide multiple sustainable benefits to the reservoir, delta, and the downstream river. Benefits will include:

- Increase in water storage in all pools as a result of transporting sediment into the downstream reach, extending the life of the reservoir
- Development and re-nourishment of inter-channel sandbars used by endangered shore birds

The proposed flush would occur annually, after the end of the navigation season, likely in early November, using 60,000 cfs for seven days, and drawing down the reservoir to the lowest point possible. Using flushing will require a coffer dam to be permanently installed below the water surface near the dam to prevent sediment from entering the hydropower penstocks. This will result in the loss of hydropower production for approximately two weeks annually, and the loss of water use for recreation and municipal water supply.

Due to the nature of the discharge gates at the reservoir, the first years of flushing will be highly Inefficient, effectively filling in the bottom of the lake before sediment can build up to the height of the spillway. Extensive modeling has been done on the reservoir and downstream reach, and this analysis has shown that it will be approximately 30 years of annual flushes before any significant amount of sand is moved to the reach below.

Downstream aggradation will occur from silt during the first 30 years and will be minor. When sand begins to move downstream, the long term equilibrium will likely result in an increase in water surface elevation of approximately 10 feet over the coming decades.

4- Is a federal permit needed here? Why or why not?

5- What information do you want to know before permitting this action (and how will that information be used to inform the permit)?

6- What permit conditions (including monitoring) will you impose?

NOTE: While loosely based on a real reservoir in order to be realistic, the following is a simplified classroom exercise.

Scenario: Fauxchiti Reservoir Density Current Venting

Background

Fauxchiti Lake is a US Army Corp of Engineers managed lake located in Sandoval County, New Mexico and within the boundaries of the Pueblo de Fauxchiti Nation on the Rio Grande about 50 miles upstream of Albuquerque. Fauxchiti Dam is one of the four Corps of Engineer projects for flood and sediment control on the Rio Grande, operating in conjuction with Abiquiu, Gallsteo and Jemez Canyon Dams.

The 2011 Las Conchas Wildfire burned more than 600 km² of forested land in the Jemez Mountains. Burn severity was greatest in the mountainous headwaters of some 15 streams that drain directly to the Rio Grande and into USACE's Fauxchiti Lake (see Figure 1). The affected basins have shed sediment at rates far above their historic quantities. Recovery of these watersheds is decades away, creating an ongoing sediment management problem at Fauxchiti Lake.

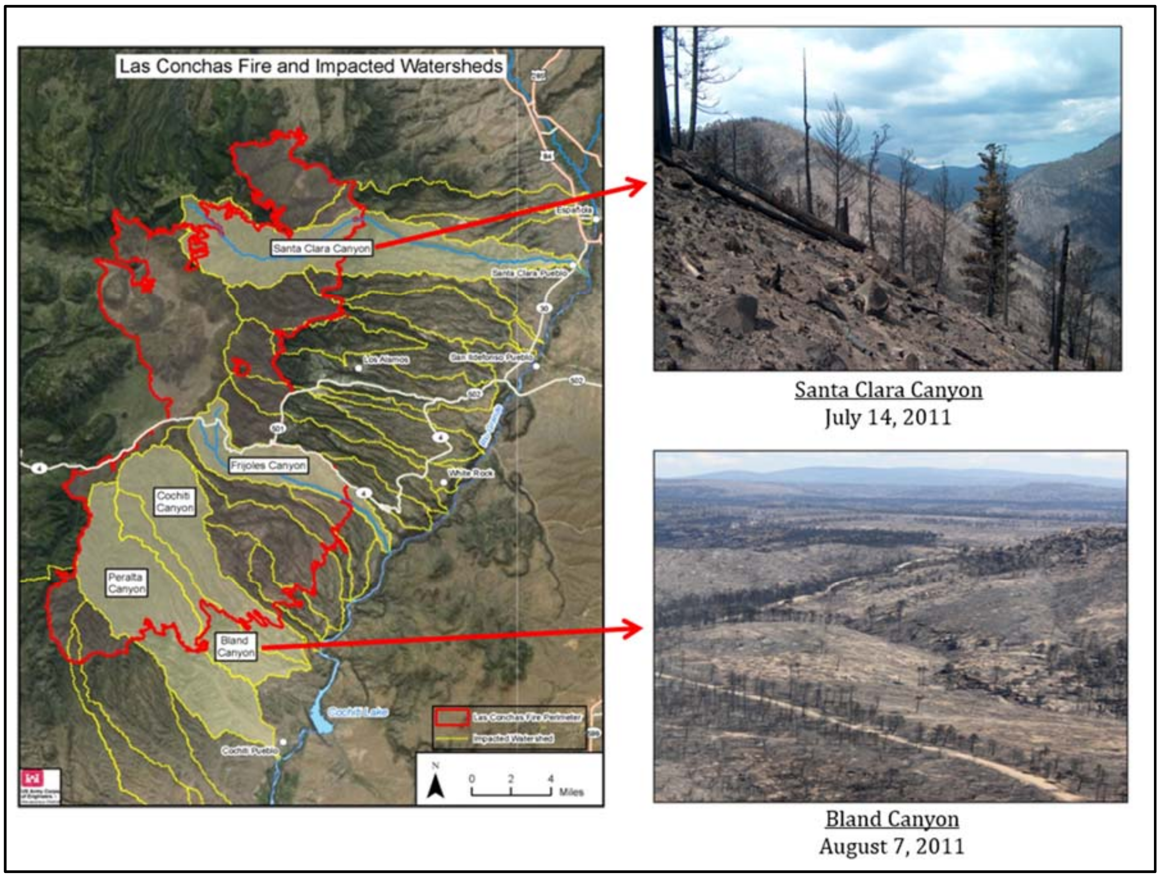
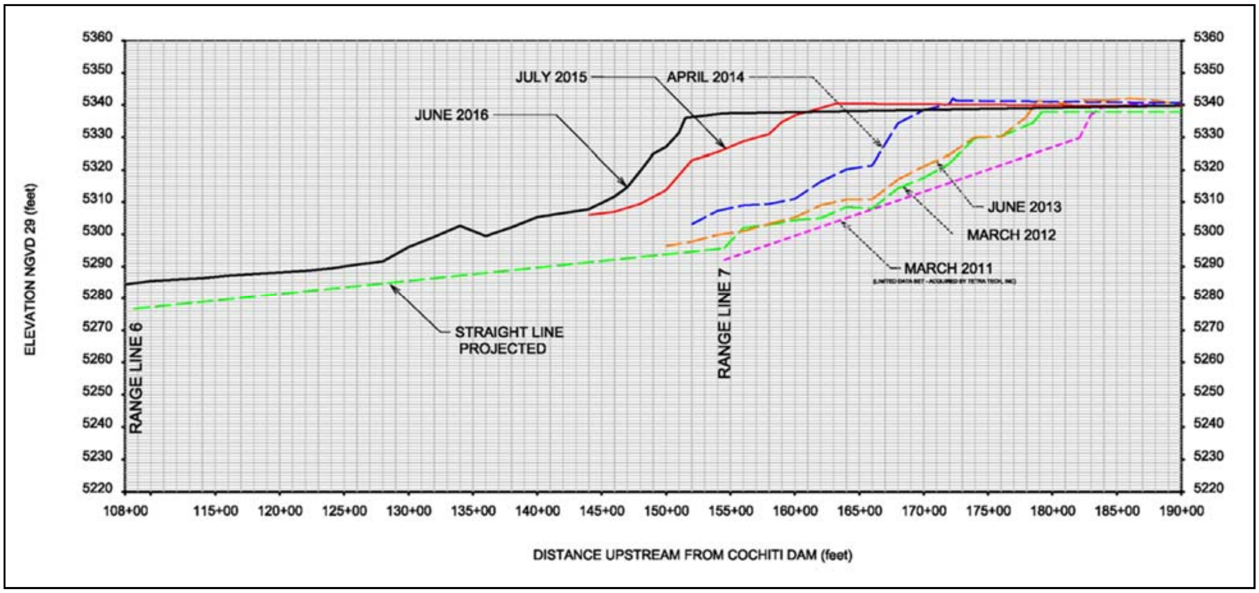


Figure 1. Las Conchas wildfire burn scar and impacted watersheds, with post-fire photographs of Santa Clara and Bland watershed.

A broad coalition of federal and non-federal partners have invested in aiding communities to recover from post-fire flooding, including FEMA, the Bureau of Reclamation, and the Bureau of Indian Affairs. The increased sediment loading, which has negatively impacted natural resources on agency lands along the Rio Grande and at the upper end of Fauxchiti Lake (see Figure 2), has not yet been addressed but desperately needs to be, especially the long-term sediment impacts. At Fauxchiti Lake, USACE has a direct need to understand sediment movement downstream of a burn scar, as USACE owns, operates and manages Fauxchiti Lake. Ecological assessments have been conducted frequently for two endangered species, the willow fly catcher and silver minnow.



Proposed Action

Reservoir management and operators and Fauxchiti de Pueblo Tribe have grouped to propose to actively manage sediment within the lake. Dredging is not an authorized mitigation approach due to upstream contaminants from Los Alamos. The proposal is to annually conduct turbidity current venting to actively route fine sediments (via density currents) through the Dams low outflow structure. Density currents are prevalent and a common yearly phenomena as a result of high fine sediment load and temperature variations.

1) Is a federal permit needed here? Why or why not?

2) What information do you want to know before permitting this action (and how will that information be used to inform the permit)?

3) What permit conditions (including monitoring) will you impose?