

Preliminary Report on Mercury and Methylmercury in Water, Sediment, Biota, and Placer Tailings, Hocker Flat Restoration Project Area, Trinity County, California

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Introduction

Historic placer gold mining has impacted the landscape of the lower Trinity River and introduced mercury into sedimentary environments within the watershed. The data presented in this preliminary report were collected to assess the impact of historic placer mining. Restoration project activities at Hocker Flat proposed by the Trinity River Restoration Program (TRRP) have the potential to release mercury and enhance mercury methylation. The USGS has collected sediments, tailings, and water samples in the Hocker Flat area in seven sampling events between October 2002 and June 2004. Mercury concentration in biota have also been assessed and a brief summary of biota results to date are presented. Only the results for mercury and methyl mercury c in placer tailings, sediment, and water are presented and discussed. Other physical and chemical variable that control mercury methylation, such as sulfate and total organic carbon concentration, are not evaluated because all analytical data have not been received.

The purposes of this project are to identify materials with elevated mercury concentrations, determine the speciation of mercury in such materials, and obtain preliminary information on ranges of mercury concentrations in all types of material and environments found on the site. The sampling scheme implemented so far has been designed for these purposes. It is not designed to determine spatial variations in mercury concentrations, and cannot be used reliably for this purpose.

Placer Mining Methods

Both dredge and hydraulic placer gold mining methods have been used in the lower Trinity watershed, and locally gold bearing gravels have been processed by both methods. In the Hocker Flat project area, the placer tailings are primarily derived from dredge operations. In placer dredge operations, gold bearing gravels were classified by size on the dredge such that coarse sediment was separated from finer sediment which was processed in sluices charged with mercury. Hydraulic operations used water cannons to dislodge gravels and to create a sediment slurry that was processed in either a surface or underground sluice charged with mercury. Thus in dredge operations only the finer grained gravels came in contact with mercury while in hydraulic operations all the sediment was exposed to mercury.

Dredges of various sizes were used to recover gold from gravels in the main stem of the lower Trinity River and some of the larger tributaries. Sediment was excavated by either bucket or dragline and classified by size on the dredge. The coarse sediment consisting of coarse gravel and cobbles was deposited away from the dredge by means of a conveyor belt on a swinging boom, called a stacker. Because stacker cobble tailings were not processed in a sluice, they are typically not contaminated with mercury. Fine-grained gravels (generally smaller than about 1 cm) were run through a mercury charged sluice on the dredge and released into the dredge pond after processing. The fine gravels, sands, and silts deposited in the dredge pond were enriched in mercury from processing in the sluice as well as from mercury that was spilled from the dredge. The fine-grained sluice sands were typically covered by stacker cobble tailings as the dredge moved

forward. Lenses of sluice sands are locally common at the base of the stacker cobble tailings.

Exposures of dredge stacker cobble tailings in the walls of the inactive Jim Smith gravel pit contain several beds of sluice sands. Sluice sands can be readily distinguished in the field from stacker cobble tailings by their grain size, sorting, and distinct bedding.

Stacker cobble tailings and underlying sluice sands have been a source of aggregate and stacker cobble tailings are presently being mined at Hocker Flat.

Background mercury concentration and speciation

The range of background concentration of mercury in gold enriched sedimentary rocks in the Trinity watershed has not been established because essentially all of these sediments have been mined at least once, and in many cases multiple times. In the adjacent Clear Creek watershed, gold-enriched sediments that have not been mined have relatively low Hg concentration 3-6 ppb (Ashley and others, 2002) and similar pre mining values would be expected for similar sediments in the Trinity watershed. Background values for this report are considered to 30 ppb. This value is based on mercury determinations from sand or finer size fractions at background stream sediment sites in the Trinity (Garden Valley Creek) and Clear Creek (Brandy Creek) drainage basins. This background value is adjusted to include mercury typically present in the silicate minerals of granitic rocks (about 5-10 ppb). In unmined gold-enriched sediments, mercury is primarily present within silicate minerals that are present.

During placer mining, elemental mercury, Hg^0 , was added and placer tailings were enriched in this form of mercury. Since its introduction into placer tailings and subsequently into sedimentary environments contaminated with tailings, Hg^0 has been transformed to other mercury species by biotic and abiotic processes. Various methods have been used to determine the mercury species present in tailings and contaminated sediments. These include sequential extraction (Bloom and others, 2003), X-ray absorption spectroscopy (Kim and others, 2000), pyrolysis (Biester and Scholz, 1997), and a combination of these techniques (Kim and others, 2004, Sladek and others, 2002). In the nearby Clear Creek watershed, sequential extraction has been used to determine the mercury species present in sand size sluice tailings that were enriched with Hg^0 .

Elemental mercury initially comprised most of the mercury in the tailings. Now Hg^0 comprises only 15-38% of the bulk mercury concentration. Much of the Hg^0 has been transformed to organic bound phases and mercury sulfide, HgS . The pre-mining mercury that is bound in silicate minerals comprises only 3% of the sample (Slowey and others, 2004). In the Trinity watershed, dredge sluice tailings exposed in the Jim Smith gravel pit at Hocker Flat show similar evidence for transformation of Hg^0 to other mercury species. Most of the mercury is present as mercury sulfide, 45%, and organic bound species, 35%, and only 20% remains as Hg^0 . Mercury present in sand in the active channel of the Trinity River just above the confluence with Canyon Creek at Hocker Flat is primarily present as organic bound species, 65%, and HgS , 15%, and only 15% is present as Hg^0 . Sand from the active channel of the Trinity River below Hocker Flat has somewhat higher Hg^0 , 25%, with most of the mercury present as organic bound species, 38%, and HgS , 35%.

Mercury in sedimentary and aquatic environments

Most sedimentary environments in the lower Trinity River watershed have been variably impacted by the release of mercury during placer mining and subsequent remobilization of placer tailings enriched in mercury. Sedimentary environments that have been sampled include: the main channel of the Trinity River; riparian berm and flood plain at Hocker Flat; tributaries; tributary deltas; and dredge and gravel pit ponds at Hocker Flat. Results of mercury and methylmercury analyses for solids are shown in Tables 1a and 1b and coordinates for the sample sites are shown in Table 2. The sample sites and selected analytical data are plotted on the aerial photograph provided by North State Resources, Inc. (Figure 1). Mercury and methylmercury, concentrations in water from the Hocker Flat project area and outside the project area are summarized in Table 3.

Sampling sites and sample numbering system for solids

Samples collected at Hocker Flat are grouped into two series. The “HF” series includes both wet and dry samples removed from various parts of the area through the study period by hand excavation methods. The “HFP” series includes samples removed from backhoe pits dug for installation of piezometers in 2003. The prefix (e.g. “3” or “03” or “23” for 2003) refers to the year of the sampling event. If samples were collected in more than one event during a year, the second event is “3A” (for 2003) the third event is “3B” etc. Letters following the locality number refer to various materials from the same site collected in the same sampling event, including various size fractions, replicates, or different materials visually identified in the field. In the results tables (Tables 1a and 1b) all subsamples are shown in separate columns or rows, with descriptions, so these suffixes can be ignored.

The list of coordinates for the sample sites in Table 2 is preliminary. A recent attempt to validate the GPS coordinates determined in the field, by plotting on the Junction City Quadrangle (1:24:000), revealed many discrepancies which will be revalidated in the August 2004 sampling event. Coordinates for about half the sites do not appear to fit the topographic map because they were recorded in NAD83 or WGS84 coordinate systems instead of NAD27. These have been corrected to NAD27. Sites HF8, HF9, and HF10 plot too far north and west on the topographic map but sources of errors are not completely resolved. Migration of the Trinity River channel and growth of the Canyon Creek delta at its confluence with the Trinity River probably accounts for some of the error for one or more of these three sites.

Locations were transferred to the aerial photographic base from North State Resources (Fig. 1) by scaling and overlaying the topographic map plot. This process reveals some distortion in the aerial photo base, which is a mosaic of parts of at least eight individual photographs. Distortion is particularly evident along the north and northwest edges of the mosaic. The two main roads in the area, traced from the topographic map, are shown on the annotation overlay to give an idea of unaccommodated errors between the photo and topo bases. Sites HF8, HF9, and HF10 have been replotted visually on the photo, ignoring the unresolved errors in reported coordinates.

Sampling protocols

At dry sites a shallow pit is dug with a shovel to remove surface material; sample material is removed from depths of 10-30 cm using a stainless steel trowel, and sieved over a plastic pan. If the pit reveals visually distinct strata, which was the case at all piezometer pits, material is removed separately from a vertical channel cut in each layer. Subsamples are loaded into Series 200 or 300 I-Chem Enviroclean glass jars. Bulk samples are removed and loaded directly into jars with minimal handling; no attempt is made to mix and split in the field.

At wet sites material is removed from the bottom 10-30 cm below the water surface, again using a stainless steel trowel, and transferred to an acid-rinsed 5-gallon plastic bucket. This process results in loss of some fines, especially in flowing water. Material from the bucket is wet-sieved, catching overflow in a plastic pan. Sieved fractions, both wet and dry, are loaded into Series 200 or 300 I-Chem Enviroclean glass jars. Subsamples for methylmercury determination (silt-clay or sand size fraction splits) are loaded in polycarbonate jars and quick-frozen on dry ice.

All operators wear site-dedicated disposable latex gloves while handling all sample materials, sampling tools, and containers. All sieves used are stainless steel.

Analytical procedures

High-precision analyses for total mercury and methylmercury were performed by Frontier Geosciences, Inc. (Frontier) or Brooks Rand LLC (BR) by standard EPA methods. Lower-precision total mercury analyses more suitable for larger samples (especially bulk samples) and coarser size fractions were performed by ALS Chemex, Inc. (Chemex). Duplicate analyses were performed. Selected samples from various types of environments were analyzed by two or more laboratories. For more information on the analytical procedures and differences between them, see Ashley and others (2002).

Mercury concentrations in sediments and placer tailings Results

The maximum total mercury concentration seen in any subsample from any sampling event at each site is shown in Figure 1. Mercury values are classified in three categories. The lowest, ≤ 30 ppb (parts per billion, ng/g) is considered background, based on stream sediment sites in the Trinity (Garden Valley Creek) and Clear Creek (Brandy Creek) drainage basins. The second category includes values above background but below the NOAA ERL of 150 ppb ("medium" values). This number has been applied to restoration activities in the Lower Clear Creek Restoration Area, as a level of concern criterion for sediments. See Ashley and others (2002) for further discussion of this criterion. The third category includes values exceeding the 150 ppb guideline ("high" values).

The type of subsample at each site that yielded the highest total mercury value is also reflected in Figure 1. If a silt-clay fraction yielded the highest value, that value is shown with the smallest symbol, because this fraction is likely to account for only a small proportion of the bulk material at the site. Values from sand-silt and sand-silt-clay fractions are given larger symbols because these fractions probably account for progressively larger proportions of the material at the site. The largest symbols represent values for bulk samples, because (ignoring sampling and analytical error) these values apply to all the material at the site.

The majority of sample sites have at least one fraction (size-range) with mercury levels above background (Fig. 1). Sediments in the active channel of the Trinity River generally show mercury values above background only in the silt-clay fraction. This appears to be the case also for waning-stage sands that cover the surfaces of the flood channels.

In dry dredge stacker tailings, medium values are most common, and these are restricted to the finer fractions (sand-silt-clay). Coarser fractions always show background values. Mercury concentrations in sand-silt-clay are highly variable, probably both within and between sites, but the sampling design does not allow quantitative estimation of sources of variability. Bulk values are also variable, depending upon mercury concentrations in fines and percentage of fines.

High bulk values in dredge stacker tailings are of particular interest. Sample HF15 is a bed of sluice sand interlayered with stacker cobble tailings, exposed in the west wall of the northern Jim Smith gravel pit (Fig. 2). As has been seen in the lower Clear Creek area, they usually have relatively high mercury concentrations in sand and finer size fractions (Ashley and others, 2002).

Presence of sluice sand may be the explanation for the high bulk mercury value at HF4, which is in stacker tailings. This sample contains considerable amounts of mercury-rich sand and fines. As a dredge moves forward, sluice sands may be deposited on top of previous stacker tailings, and eventually covered by later stacker tailings, resulting in zones of mixed sluice and stacker materials.

The bulk material at HF7 is fine black organic-rich mud from a perennial pond in the stacker tailings. The inorganic portion of this mud probably represents fines washed out of the surrounding stacker tailings.

Hocker Flat flood plain sediments

The mercury concentration in sediments within the Hocker Flat flood plain was evaluated by sampling sediments exposed in seven trenches cut during the installation of piezometers on April 30, 2003. The piezometers were located in the lower part of the Hocker Flat flood plain project area and are shown in Figure 1 (sample sites HFP1-7). The stratigraphic sequence of sediments exposed in each of the trenches is generally similar with an upper relatively thin section of sand, less than 0.5 m thick, and a lower unit of medium to coarse gravel. The exposures in the trenches provide an indication of the various types of sediments that are likely to be exposed during the proposed excavation and lowering of the Hocker Flat flood plain.

The upper-most sediment consists of gray to tan, well sorted, medium to coarse sand that has a maximum thickness of 0.5 m (Fig. 3). The sand has a variable thickness on a local scale, such as around the perimeter of each of the trenches. The upper sand unit is not present in trench 2 and was likely not deposited at this site because of its elevation and distance from the Trinity River. The unit is also absent in trench 7, site HFP7 (Fig. 1) because this site is located adjacent to the Trinity River and the sand has been removed by erosion. In trenches cut near the Trinity River, for example trench 3, site HFP3 (Fig. 1), the unit has been reworked and consists of a poorly sorted gravel. It is interpreted that this sand unit was deposited in the 1997 flood event. This sand has relatively low concentrations of mercury, 8-17 ng/g, and methylmercury, <.02 to .02 ng/g in bulk samples (Table 1a). These mercury and methylmercury concentration are comparable to

bulk sediment samples from the Trinity River (Table 1a). Sediment deposited in the Trinity River at Hocker Flat during the recent high flow events in May, 2004, have concentrations of mercury and methylmercury comparable to the upper sand unit (Table 1b); 15.3-17.3 ng/g Hg and .02-.029 methylmercury.

Below the upper sand unit in trench 5 (site HFP5 in Fig. 1), is a brown, well-sorted sand that is restricted to the area of this trench (Fig. 3). This trench is located adjacent to undisturbed stacker cobble tailings. The bulk mercury concentration, 166 ng/g, is relatively high and comparable to the concentration of mercury in sluice sands that are exposed in the Jim Smith gravel pit. On the basis of mercury concentration, grain size, sorting, and local distribution, and location adjacent to stacker cobble tailings, the sand unit is interpreted to be composed of sluice sand that was reworked in a post-mining flood event. The sluice sand has low methylmercury concentration similar to that present in other sluice sands in the Jim Smith gravel pit (tables 1a and 1b).

Poorly sorted, coarse pebble to cobble gravels underlie the upper sand units in all the trenches. These are interpreted to consist of dredge and hydraulic tailings transported and deposited during the 1955 flood event. However, the gravels in trench 2, which is located adjacent to stacker cobble tailings, display bedding and contain local thin beds of fine gravel that are characteristic of stacker cobble tailings. This bedding likely is original bedding formed during the dredge mining. The concentration of mercury in the coarse gravels ranges from 12 to 29 ng/g in bulk samples, and from 318 to 345 ng/g in the fine-grained fraction (<63 μm) (Table 1a). The concentration of methylmercury in bulk samples is very low and ranges from <.02 to .062 ng/g. The mercury and methylmercury concentrations are comparable to those in stacker cobble tailings that have not been remobilized by flood events (Table 1a).

Riparian berm sands at Hocker Flat have mercury concentrations that range from 11-13 ng/g, values that are similar to flood plain sands deposited from the 1997 flood event.

Methylmercury in sediments

Methylmercury levels in solids are generally in the normal range, which is less than one percent of total mercury. However, the concentration of methylmercury is relatively high, 0.41 ng/g, in one sample from the riparian berm that was taken in the area of abundant root material. Slightly elevated methylmercury levels occur primarily in ponds, including one of the Jim Smith quarry ponds and the pond at HF7.

Mercury in Trinity River water and tributaries as a function of flow regime

At low flow conditions (500 cfs), the Trinity River water in the Hocker Flat area has very low total mercury and methylmercury concentrations, ranging from 0.49 to 2.89 ng/L mercury, and from <0.025 to 0.07 ng/L methylmercury. The dissolved fraction of Hg, (filtered fraction < 0.45 μm) has a wide range in values and comprises from 25 to 80 % of the total mercury present. Total mercury and methylmercury concentrations in water released from Lewiston Lake, as measured at the Lewiston gage, are lower than most of the values measured in the Trinity River downstream from the dam, indicating that mercury is added to the water from the bed load as the river moves downstream.

Under high flow conditions, 3000, 4500, and 6000 cfs, the total mercury concentration in Trinity River water in the Hocker Flat area increases with higher flows,

the highest values occurring at the highest flow (Table 3). At each flow regime, total mercury concentration in Trinity River water increases downstream from the Junction City gage through the Hocker Flat area and reaches a maximum value just below the Hocker Flat project area (site HF 11). This increase in total mercury concentration reflects release of mercury from erosion of stacker cobble tailings near the confluence of the Canyon Creek with the Trinity River, and mercury added from the bed load of the river. Total mercury concentrations in Trinity River water within the Hocker Flat project area are higher at each flow regime than total mercury concentration in Trinity River water above the Hocker Flat project area, extending to the Lewiston gage (Table 3).

The dissolved component of mercury present in the Trinity River water measured during the 6000 cfs release is the same at all sites within the Hocker Flat project area. Methylmercury concentrations in Trinity River water are relatively low at all sites and under the three flow regimes measured except just below the Hocker Flat project area where methylmercury is slightly elevated in the 6000 cfs flow regime. Although the total mercury concentrations in Trinity River water are elevated at every flow regime in the Hocker Flat area, the values are relatively low in comparison to other watersheds impacted by placer mine tailings.

Waters from tributaries such as Canyon, Rush, Deadwood, Indian and Grass Valley Creeks at low flow conditions (Table 3) generally have very low total mercury concentrations that are typically lower than values in Trinity River water. However, unlike water from the Trinity River, most of the mercury, from 70-90%, is present as dissolved or colloidal species (filtered fraction $<0.45\mu\text{m}$) under low flow conditions. Concentrations of methylmercury in the tributary waters are low and comparable to those measured in the Trinity River.

Two small ponds have formed from ground water infiltration in the inactive Jim Smith gravel pit. The two ponds have different water chemistry and both are alkaline, pH 8.2 in the north pond and 7.4 in the south pond. Concentrations of Hg and methylmercury in water are low in both ponds. Sulfate concentrations are low, 1.9 and 3.3 ppm, but sufficient to allow sulfate reducing bacteria to methylate mercury if mercury is added to the ponds during restoration. The walls of the gravel pit consist of stacker cobble tailings with beds of sluice sands and silts (Fig. 2). The sluice sands consist of discontinuous beds and have elevated concentrations of mercury in bulk samples, up to 1019 ng/g but low methylmercury concentration. The natural pond developed at Hocker Flat on stacker cobble tailings provides an example of the relatively low levels of mercury, 1.09 ng/L and methylmercury, 0.23 ng/L, that may exist after wetlands become established at the Jim Smith gravel pit.

Mercury Concentrations in Aquatic Biota

To evaluate the distribution and occurrence of mercury in biota within the Trinity River watershed, fish, amphibians, and predaceous aquatic insects were sampled from sites in the Hocker Flat project area where both sediment and water were sampled (Fig. 1). These sites are primarily in the Trinity River channel but also included off-channel locations such as ponds in the Jim Smith gravel pits, and natural ponds established in stacker cobble tailings at Hocker Flat. Concentrations of total mercury (Hg_T) were determined in fish tissue (fillets) and amphibian carcasses. Composites of predaceous aquatic insects were analyzed for Hg_T and methylmercury.

Methyl mercury concentrations in biological samples collected from the Hocker Flat area in April 2002 and 2003 were similar to or lower than most sites sampled within the Trinity watershed. All biological samples sampled in the Hocker Flat project area are considerably lower than samples from the East Fork of the Trinity River, and the nearby Clear Creek watershed that has also been impacted by placer mine tailings. For example water striders from five of the sites within the Hocker Flat project area had concentrations of methylmercury of 0.042 µg/g, which is about one tenth the highest concentration measured in water striders in the East Fork of the Trinity River near the Altoona mercury mine. Dragonfly samples collected from seven Hocker Flat sites have methyl mercury concentrations that range from 0.017 to 0.048 µg/g. Dragonflies collected from ponds had similar methylmercury concentration and have only slightly higher concentration than those from river sites. The methylmercury concentrations in dragonflies at Hocker Flat are relatively low and significantly less than samples from the East Fork of the Trinity River and the highest values in the Clear Creek watershed. Other biota sampled, including amphibians and fish, show similar relationships.

Conclusions

Mercury concentration in sediments and placer tailings in the Hocker Flat project area is a function of grain size with the highest mercury concentrations occurring in the less than 63 µm size fraction. Sluice tailings have the highest mercury concentrations; up to 1019 ng/g. Dredge stacker cobble tailings have relatively low mercury and methylmercury concentrations in the less than 2 mm size range, but higher concentrations in the less than 63 µm size range. Trinity River bulk sediment samples typically have relatively low mercury, 2.5-19 ng/g, and methylmercury concentrations. The fine sediment fraction is highly variable, with mercury values ranging from 10 to 4540 ng/g, and methylmercury from .02 to 2.4 ng/g. Canyon Creek bulk sediments have mercury and methylmercury concentrations similar to Trinity River sediments.

Flood plain sediments at Hocker Flat deposited in the 1997 flood event are relatively thin and have mercury and methylmercury concentrations comparable to values in Trinity River bulk sediment samples. Gravels present below this sand unit consist of stacker cobble tailings, most of which have been reworked in post-mining flood events. Locally sluice sands with elevated mercury concentrations are present within the stacker cobble tailings. Riparian berm sediment mercury concentrations are generally low but can have moderately elevated methylmercury concentrations.

Under low flow conditions, mercury and methylmercury concentrations are relatively low in Trinity River and tributary waters but generally higher than water from Lewiston Reservoir as measured at the Lewiston gage. Mercury concentration in Trinity River water increases as flows increase, but even at highest flows, the concentration of mercury is relatively low. Mercury concentration in Trinity River water increases downstream from the Lewiston gage at a given flow regime, and is the highest just below the Hocker Flat project area.

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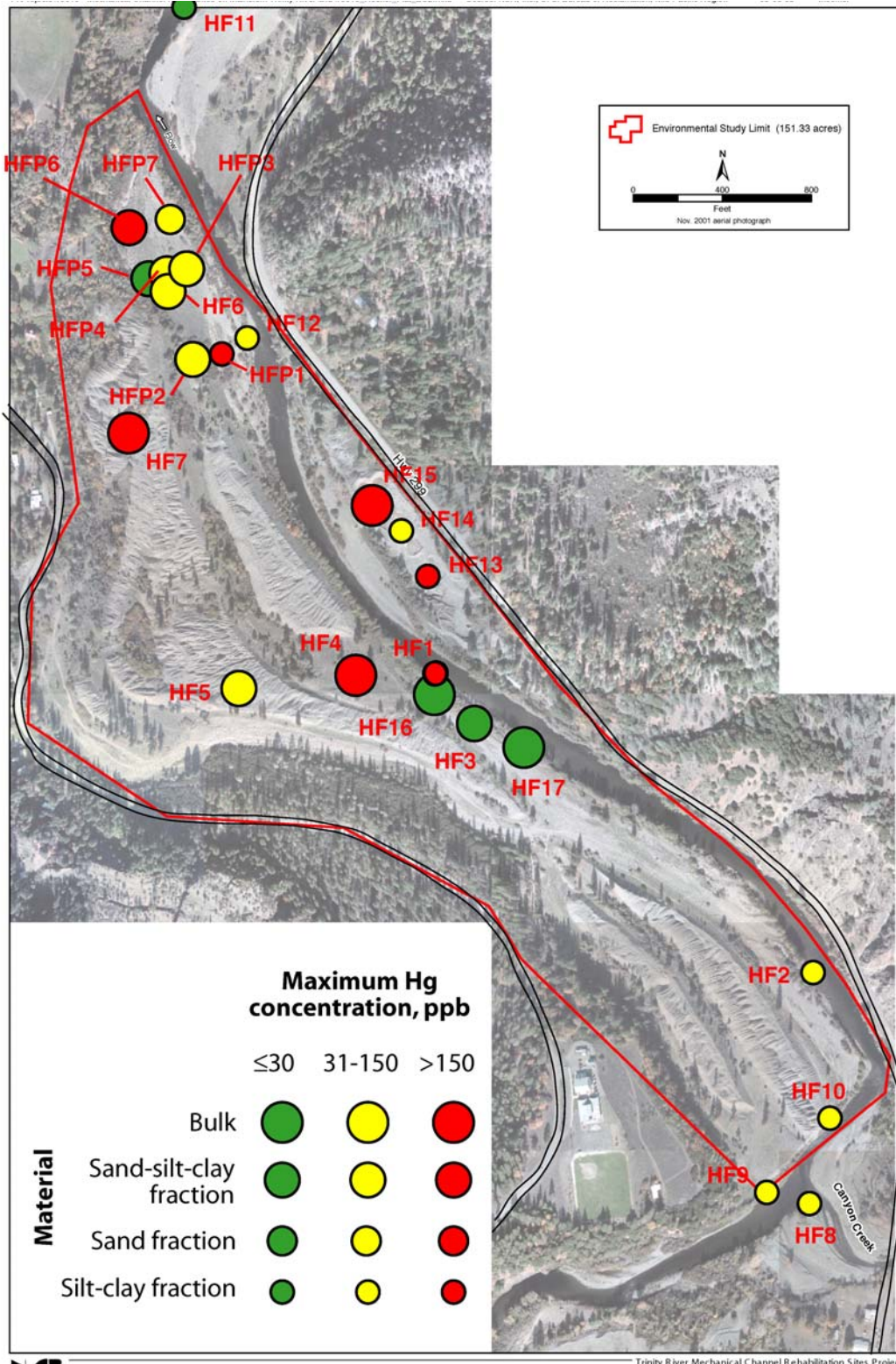


Figure 1. Aerial image showing sample site locations and maximum Hg concentrations in bulk, sand-silt-clay, sand, and silt-clay size fraction sediments.



Figure 2. Sluice sand exposed in wall of Jim Smith gravel pit is interbedded with stacker cobble tailings (site HF15 in fig. 1). Sluice sands are well sorted and range in grain size from silt to coarse sand.



Figure 3. Hocker Flat flood plain sediments: upper sand has variable thickness and mercury concentration ranging from 8 to 17 ng/g; reworked sluice sand is only present in trench 5 (site HFPS, fig. 1); and lower sediments consist of reworked stacker cobble tailings present in all trenches.

Table 2. Location of sample sites in figure 1, Hocker Flat

Sample Site	Latitude	Longitude
02HF01	40.73882	-123.06102
02HF02	40.73493	-123.05467
02HF03	40.73810	-123.06032
02HF04	40.73868	-123.06222
02HF05	40.73850	-123.06423
02HF06	40.74358	-123.06528
02HF07	40.74173	-123.06612
03HF08	40.73233	-123.05470
03HF09	40.73282	-123.05527
03HF10	40.73347	-123.05530
03HF11	40.74712	-123.06548
03HF12	40.74293	-123.06418
03HF13	40.74003	-123.06118
03HF14	40.74050	-123.06153
03HF15	40.74083	-123.06210
03HF16	40.73855	-123.06097
03HF17	40.73783	-123.05953
23HFP1	40.74278	-123.06438
23HFP2	40.74265	-123.06432
23HFP3	40.74382	-123.06502
23HFP4	40.74363	-123.06540
23HFP5	40.74358	-123.06582
23HFP6	40.74425	-123.06600
23HFP7	40.74442	-123.06533

Table 3. Mercury and methylmercury concentration of Trinity River and tributary waters as a function of flow regime

Field Number	Latitude	Longitude	Hg Total ng/L	Hg Filtered ng/L	Methyl Hg ng/L	T.S.S. mg/L	Flow cfs	Collection Date	Water Conductivity uS	Water pH	Water Temperatur deg C	Sample Source
Lewiston Lake at Mary Caompground west side												
04LL1	40.73387	-122.80693	0.887			2.27		5/13/2004	83.3	7.257	16.8	Lake
Trinity River below Lewiston Lake at gaging station established for high flow event												
04LW1-1	40.71102	-122.80544	1.26			0.5	3000	5/13/2004	70.4	6.59	9	Stream
04LW2			1.48		0.045	1.24	4500	5/15/2004	81	7.36	9.5	Stream
04LW3			1.16	0.614	0.045	1.72	6000	5/16/2004	81.4	6.59	8.7	Stream
Trinity West Side Salt Flat Bridge												
04SF1	40.70824	-122.80720	1.17			0.51	3000	5/13/2004	75.5	6.92	10.3	Stream
Trinity River at LimeKiln												
04LK1	40.67323	-122.91931	0.927	0.624	0.045	2.9	3000	5/13/2004	74	6.97	10.6	Stream
04LK-2			2.6	0.439	0.045	4.81	4500	5/13/2004	75.8	7.28	10.9	Stream
04LK-2B			0.927	0.621	0.064		4500	5/13/2004	75.8	7.28	10.9	Stream
04KL-2			1.86				4500	5/13/2004	75.8	7.28	10.9	Stream
04LK3			1.45	0.589	0.045	8.97	4500	5/15/2004	82.5	7.605	10.7	Stream
04LK3B			1.57	0.637		10.8	6000	5/16/2004	84	7.609	19.5	Stream
04LK4B			1.64	0.666		7.39	6000	5/16/2004	84	7.609	19.5	Stream
04LK4AA			2.03	0.623	0.045	7.39	6000	5/16/2004	84	7.609	19.5	Stream
04LK4A			1.33	0.536	0.045	13.6	6000					
Trinity River at Douglass City BLM Campground												
04DC1	40.64859	-122.95313	1.82			5.9	3000	5/13/2004	79.4	7.48	11.5	Stream
04DC2			1.61	0.876		14.6	4500	5/15/2004	84.5	7.36	11.3	Stream
04DC3			2.3	0.505	0.051	15.9	6000	5/16/2004	84	7.561	10.3	Stream
Trinity River at Junction City Gage												
04JC1-1	40.72860	-123.06080	2.35			22.7	3000	5/13/2004	82.8	7.78	12.1	Stream
04JC-2			2.48	0.646	0.058	18.7	4500	5/15/2004	102.8	6.6	9.2	Stream
04JC3			4.55	0.705	0.045	68.3	6000	5/16/2004	86	6.64	9.8	Stream
Hocker Flat area												
04HF10-1	40.73350	-123.05530	2.41				3000	5/13/2004	82.6	8.06	11.9	Stream
04HF10-2			2.23			40.9	4500	5/15/2004	88.8	7.28	10.9	Stream
04HF10-3			4.17	0.676	0.067	45.1	6000	5/16/2004	85	7.16	10.2	Stream
Trinity River middle Hocker Flat												
04HF1-1	40.73880	-123.06100	6.21				3000	5/13/2004	80.7	7.76	11.9	Stream
04HF1-2			2.06				4500	5/15/2004	86	7.411	10.8	Stream
04HF1-3			4.64	0.685	0.061	30	6000	5/16/2004	83.7	7.08	10.2	Stream
Hocker Flat lower part past tailings												
04HF12-3	40.74280	-123.06530	2.76			22.5		5/17/2004	89	7.08	12.2	Stream
Trinity River at Junction City BLM campground												
04HF11-1	40.74710	-123.06550	3.86			9.71	3000	5/13/2004	77.9	7.81	11.6	Stream
04HF11-2			3.33			32.8	4500	5/15/2004	97.6	7.11	9.9	Stream
04HF11-3			6.36	0.665	0.104	71.8	6000	5/16/2004	84	7.16	10.2	Stream

Table 3. (cont'd) Mercury and methylmercury concentration of Trinity River and tributary waters as a function of flow regime

Field Number	Latitude	Longitude	Hg Total ng/L	Hg Filtered ng/L	Methyl Hg ng/L	T.S.S. mg/L	Flow cfs	Collection Date	Water Conductivity uS	Water pH	Water Temperatur deg C	Sample Source
04HF18	40.73410	-123.06250	2.63	0.771				5/15/2004	102.8	7.583	18.7	Pond
	New Gravel Pit Pond Hocker Flat Tributaries to Trinity River Canyon Creek											
04HF8	40.73220	-123.05580	2.71	0.902	1.09			5/17/2004	26.6	7.44	12.01	Stream
	Grass Valley Creek at Gage											
04GV1	40.68670	-122.86061	0.853	0.259	1.29			5/17/2004	118.8	7.717	12.8	Stream
	Deadwood Creek below road culvert											
04DW1	40.71743	-122.80096	1.54	1.24	0.91			5/17/2004	297	7.94	11.7	Stream
	Indian Creek Up from Trinity 600 m											
04IC-1-3D	40.65786	-122.91196	0.613	0.49				5/18/2004	161	7.888	13.2	Stream
	Rush Creek Up from Trinity 500 m											
04RC1-3D	40.72197	-122.83360	2.32	1.04				5/18/2004	45	7.63	9.4	Stream