Water Quality Summary Report 34

A Recreational Suction Dredge Mining Water Quality Study on South Fork Clearwater River

Cover Photo by Daniel D. Stewart. July 26, 2001

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A Recreational Suction Dredge Mining Water Quality Study on South Fork Clearwater River Idaho County, Idaho

January 13, 2003

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Introduction

Recreational suction dredge mining operations were evaluated for potential impacts to water quality on South Fork Clearwater River during 2001. The Idaho Department of Environmental Quality (DEQ) monitored the short term water quality impacts of three suction dredges located east of Grangeville in Idaho County, Idaho, see Figures 1 and 2. Suction dredges operate by excavating streambed sediments down to bedrock, sorting the sediments to remove particles of gold, and re-depositing the streambed sediments back onto the surface substrate. On South Fork Clearwater River, recreational dredging is permitted to operate from July 1 through August 15 in order leave salmonid spawning beds undisturbed during spawning season.

Figure 1. Recreational Dredge Mining Locations.

The Idaho Department of Water Resources (IDWR) regulates recreational dredge mining by issuing annually-renewable permits. An IDWR permit is issued for small suction dredges with a nozzle 5 inches in diameter or less and with equipment rated at a maximum of 15 horsepower. Where operators have not been held responsible for water quality monitoring, local land management agencies such as the United States Forest Service or Bureau of Land Management frequently perform this function to determine if dredging or any similar activity has the potential to cause a significant disturbance to surface water quality. In order to provide additional information regarding the impacts of recreational dredge mining operations, DEQ implemented this study.

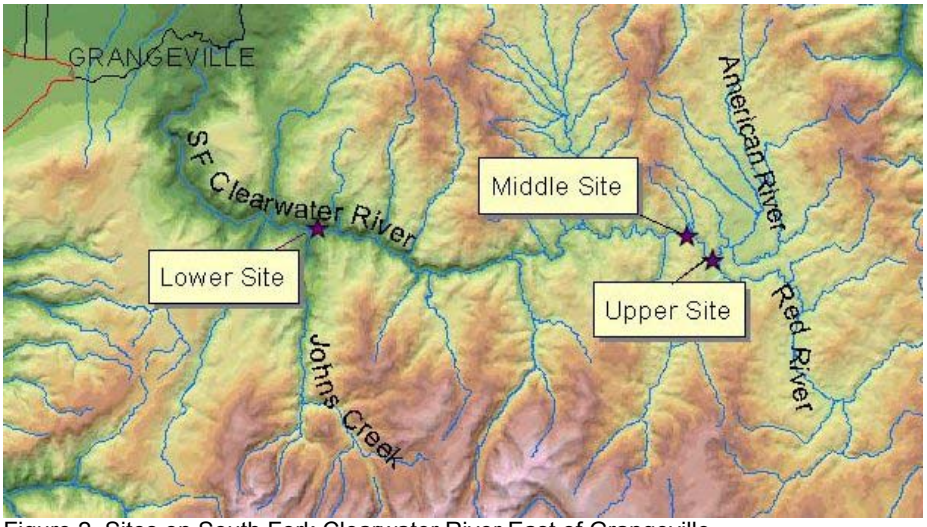

Figure 2. Sites on South Fork Clearwater River East of Grangeville.

Previous assessments include the suction dredge monitoring program performed by the Nez Perce National Forest from 1995 through 1999 in the South Fork Clearwater subbasin[1]. Analysis of the Nez Perce National Forest data has very limited use as the number of sampling events did not produce statistically viable data for demonstrating trends in water quality or long term effects. Furthermore, data and analysis should not be considered applicable to dredging operations which exceed the size and volume of operations evaluated by this study. Within these considerations, the Nez Perce National Forest study found that:

- within the short term, turbidity during suction dredge operations to process a very limited volume of material did not exceed state water quality standards; and
- surface fine sediment did not show habitat impairment in riffles and runs.

Objectives

The DEQ Lewiston Regional Office and the Nez Perce National Forest developed a cooperative study plan for the 2001 recreational dredge mining season to evaluate the short term impacts to water quality from recreational suction dredging. The following objectives were set:

- Identify a mixing zone for sediment plumes from suction dredge activity;
- Determine if turbidity violates Idaho's turbidity standard for cold water aquatic life use determination[2] by:
  - Sampling above and below ongoing suction dredge operations to determine average turbidity, and
  - Sampling directly below the dredge to measure maximum turbidity;
- Collect macroinvertebrates above and below suction dredge activity to determine its impact to cold water aquatic life[3]; and
- Collect surface fine sediment data above and below suction dredge activity.

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[1] DeRito, J. 2000. Draft Summary Report of the Suction Dredge Monitoring Program: 1995-1999, Nez Perce National Forest. 9 pp.

[2] **IDAPA 58.01.02 - Water Quality Standards and Wastewater Treatment Requirements**

250. SURFACE WATER QUALITY CRITERIA FOR AQUATIC LIFE USE DESIGNATIONS.

02. Cold Water. Waters designated for cold water aquatic life are not to vary from the following characteristics due to human activities: (3-15-02)

e. Turbidity, below any applicable mixing zone set by the Department, shall not exceed background turbidity by more than fifty (50) NTU instantaneously or more than twenty-five (25) NTU for more than ten (10) consecutive days. (8-24-94)

[3] **IDAPA 58.01.02 - Water Quality Standards and Wastewater Treatment Requirements**

100. SURFACE WATER USE DESIGNATIONS.

Waterbodies are designated in Idaho to protect water quality for existing or designated uses. The designated use of a waterbody does not imply any rights to access or ability to conduct any activity related to the use designation, nor does it imply that an activity is safe. For example, a designation of primary or secondary contact recreation may occur in areas where it is unsafe to enter the water due to water flows, depth or other hazardous conditions. Another example is that aquatic life uses may be designated in areas that are closed to fishing or access is not allowed by property owners. Wherever attainable, the designated beneficial uses for which the surface waters of the state are to be protected include: (3-15-02)

01. Aquatic Life. (7-1-93)

a. Cold water (COLD): water quality appropriate for the protection and maintenance of a viable aquatic life community for cold water species. (4-5-00)

Methods


Figure 3 Upper Site


Figure 4 Middle Site


Figure 5.Lower Site

Site Descriptions

The recreational suction dredge mining operations occurring on South Fork Clearwater River selected to be studied include:

-an upper site just below the confluence of the American and Red Rivers;

-a middle site about 200 yards above the confluence with South Fork Clearwater River of the conjoined Whiskey Creek and Maurice Creek; and

-a lower site about 1/4 mile above the confluence of Johns Creek with South Fork Clearwater River.

Field notes provide information about the recreational dredge mining study effort. Table 1 supplies the notes recorded during collection of turbidity, macroinvertebrate, and surface sediment samples[4].

	Upper Site 45 48 28 N -115 28 31 W Below American and Red Rivers 7-26-2001	**Middle Site** 45 49 31 N -115 30 11 W Above Whiskey/Maurice Creeks 7-27-2001	**Lower Site** 45 49 39 N -115 52 45 W Above Johns Creek 8-10-2001
Location			
Phase of Operation	– Established and working bedrock – Currently 4 - 5 feet down to bedrock	– Mining along the left bank looking upstream – Dredging in a slow run/glide – Dredging fairly shallow holes, operator does not have an air system	– Working approximately 3 weeks – Hole 4 feet deep, not to bedrock – Moved up river 20-30 feet
Dredge Specifications	– 8hp Precision 4 inch dredge running at 1/4 to 1/2 speed – Discharge rate of 600 gallons/minute – End of sluice is in the water, not above – Sluice 20" wide	– 5hp homemade dredge – 3-inch suction nozzle – Sluice is 18-inches wide – Discharge rate is 5 gallons/2 seconds	– Dredge width 35" – Discharge 2000 gallons/minute – Distance to water surface = 5"
Plume	– Plume is pulse-like, very dark, then nothing – Visible plume < 150 meters	– Plume dissipates at 40 meters – Very pulse-like, not a steady plume – Length of visible plume = 70 meters	Sporadic plume visible 125 meters downstream
Field Parameters	– Conductivity = 41.8 – Temperature = 9.8EC – 22 m wetted width (9-27-2001)	– Conductivity in the plume is 41.7; outside the plume is 41.7 – Temperature 19.0EC – 11m wetted width (7-27-2001)	– Conductivity = 40.7 – Temperature = 18.4EC – 26 m wetted width (8-10-2001)

Table 1. Field notes recorded during DEQ study of recreational dredge mining on South Fork Clearwater River.

[4] Stewart, D.D. 2002. Personal communications and notes. Idaho Department of Environmental Quality. Grangeville Satellite Office.

Mixing Zone Identification

The DEQ is responsible to set the applicable mixing zone for any turbidity measurements (IDAPA 58.01.02.250.02.e) to determine compliance with state water quality standards. For this project, the mixing zone was identified by visual estimations during dredge operation by DEQ and Nez Perce Forest Service staff. Downstream of the high-velocity, turbulent effluent from each of the suction dredges, there is a zone where the effluent reaches ambient stream velocity and the sediment plume begins to widen and mix with streamwater. This zone was identified visually as the mixing zone. At each site, the mixing zones were defined as follows:

- Upper Site--41 meters;
- Middle Site--40 meters; and
- Lower Site--110 meters

Turbidity

In order to demonstrate compliance with the instantaneous turbidity standard (50 Nephelometric turbidity units (NTU) above background), average and maximum turbidity were measured by collection of water samples. For average turbidity, depth-integrated water samples were collected above and below ongoing suction dredging. A cross section of the stream with relatively uniform, steady flow was selected. Samples were collected with a handheld DH-48 suspended sediment sampler. Sample bottles were stored in a cool, dark place until analysis by a Hach Model 2100A turbidimeter. For maximum turbidity, the samples were collected directly within the mixing zones of the sediment plumes created by the operation of suction dredges. Sample bottles were handled and analyzed in the same manner as the average turbidity samples.

In order to demonstrate compliance with the ten consecutive day turbidity standard (25 NTU), the sampling results were modeled using Cormix. Cormix is a mathematical model used to predict dissipation of the sediment plume after initial sediment emission into the river.

Macroinvertebrates

Macroinvertebrates were collected and identified for this study in accordance with the DEQ Beneficial Use Reconnaissance Program (BURP) protocol (DEQ 1999)[5]. South Fork Clearwater River is assessed as a wadeable stream because the macroinvertebrates were collected in accordance with wadeable stream protocols. Samples were collected immediately upstream and downstream of the suction dredging activity while operations were occurring. After suction dredging ceased for the year, the macroinvertebrate collections were duplicated at the same locations above and below the disturbance.

[5] DEQ. 1999. Beneficial Use Reconnaissance Project Workplan for Wadeable Streams. Prepared by the Beneficial Use Reconnaissance Project Technical Advisory Committee for the Idaho Division of Environmental Quality: Boise, ID. 100 pp.

Surface Fine Sediments

The substrate composition was determined using a pebble count as described by BURP protocol (DEQ 1999)[6]. Selected cross-sections were located upstream, immediately downstream, and well downstream of suction dredging activity. Cross-sections were chosen with similar discharge and gradient in low velocity glides or shallow pools. The cross-sections were marked with flagging and the wetted width was recorded to allow repeatable sampling. A minimum of 100 particles for each transect were sampled, measured, and recorded in the appropriate sediment size classes.

Results

Turbidity

None of the samples violated the water quality standards for turbidity by exceeding background turbidity by more than 50 NTU instantaneously or more than 25 NTU for more than ten consecutive days.

Instantaneous standard

The locations of turbidity samples and the results are presented below:

Upstream Site

Turbidity Samples	Results (NTU)
Background taken above dredge	1.1
Run/pool 0.3 meter below dredge	38
Run/pool 1 meter below	32
Run 21 meters below	7.3
Riffle 41 meters below	4.5
Riffle 61 meters below	4.0
Top of pool 81 meters below	2.9
Pool tailout 101 meters below	1.9
101 meters below, cross sectional composite	1.8

[6] DEQ. 1999. Beneficial Use Reconnaissance Project Workplan for Wadeable Streams. Prepared by the Beneficial Use Reconnaissance Project Technical Advisory Committee for the Idaho Division of Environmental Quality: Boise, ID. 100 pp.

Middle Site

Turbidity Samples	Results (NTU)
Background (lost sample)	Estimated at less than 2.0
0.3 meter below dredge (run)	21
1 meter below dredge (run)	39
10 meters below dredge (run)	8.5
20 meters below dredge (run)	2.5
40 meters below dredge (run)	1.2 (cross sectional composite)

Downstream Site

Turbidity Samples	Results (NTU)
Background	0.428
0.3 meter below dredge (run/riffle)	5.42
1 meter (run/riffle)	4.47
20 meters (run/riffle)	2.39
40 meters (riffle)	0.617
60 meters (riffle)	0.792
100 meters (riffle)	0.786
115 meters (riffle)	0.321
115 meters (cross sectional composite)	0.279

These results show that the instantaneous turbidity standard of 50 NTU was not violated within the sediment plumes of the suction dredges. See Figure 6 for the most opaque example of a sediment plume visually observed during the study.

Figure 6. Sediment Plume from Suction Dredging.

Ten consecutive day turbidity standard

In order to demonstrate compliance with the ten consecutive day turbidity standard of 25 NTU, the results of the turbidity sampling were entered into the Cormix mixing zone model to predict the size and extent of the sediment plumes. The model was established using a 100% mixing zone with no restriction on dilution. This is because the effluent from a suction dredge is not controllable by any means, so 100% of the streamflow is allowable for dilution of the effluent. The results of the modeling are given below:

Upstream Site

- Initial concentration equals 37 NTU above background.
- Concentration reaches 25 NTU at 2.28 meters downstream with a width of 1.08 meters and a thickness of 0.17 meters.
- Concentration reaches 10 NTU at about 14 meters downstream and slowly decreases from there.
- Concentration is still at 5 NTU after 500 meters.

Middle Site

- Initial concentration equals 39 NTU above background.
- Concentration reaches 25 NTU at 1.46 meters downstream with a width of 0.84 meters and a thickness of 0.09 meters.
- Concentration reaches 5 NTU at 12 meters.
- Concentration reaches 1 NTU at 500 meters.

Lower Site

- Initial concentration equals 5 NTU above background.
- Concentration reaches 1 NTU at 173 meters downstream.

These results show that the standard for "more than 25 NTU for more than ten consecutive days" is never exceeded for one day, according to modeling results. The 25 NTU is reached at a maximum of 2.28 meters downstream of the source of perturbation. It is highly unlikely for the 10-consecutive-day turbidity to exceed 25 NTU.

Macroinvertebrates

The macroinvertebrate communities do not indicate measurable short term impacts due to dredging operations at the upper site and lower site between July 15 and August 15, 2001. One of the samples from the middle site was lost in transit, so the middle site is not included in this analysis.

The macroinvertebrate samples were identified by certified taxonomists at EcoAnalysts, Inc. Staff from EcoAnalysts compiled a report, specifically assessing sediment impacts to the macroinvertebrate communities. The report is duplicated verbatim in Appendix A. The

conclusion from this evaluation is that the perturbation of substrates by suction dredging did not affect the macroinvertebrate communities in this study.

The samples were identified to family level and to species level if possible by certified taxonomists at EcoAnalysts, Inc. The laboratory assessed macroinvertebrate populations using the Stream Macroinvertebrate Index (SMI) described in the DEQ waterbody assessment guidance (Grafe et al. 2002)[7]. The SMI results are reported in Table 2. The results of the SMI are used to evaluate support of coldwater aquatic life. Although South Fork Clearwater River is a river according to guidance (Grafe et al. 2002), the stream metrics are applied because the sample collection and analysis procedures followed wadeable stream protocols.

Stream Macroinvertebrate Metric Scores										
	Upper Site		Upper Site		Lower Site			Lower Site		
	7-26-01 15m above dredge	7-27-01 100 m below dredge	9-27-01 33 m above dredge *	9-27-01 100 m below dredge	8-10-01 10 feet above dredge	8-10-01 40 m below dredge	8-10-01 115 m below dredge	9-26-01 10 feet above dredge	9-26-01 40 m below dredge	9-26-01 100 m below dredge
Scoring Parameters	Lab ID-1	Lab ID-2	Lab ID-9	Lab ID-10	Lab ID-3	Lab ID-4	Lab ID-5	Lab ID-6	Lab ID-7	Lab ID-8
Total taxa	59	62	52	53	48	44	51	46	53	51
Ephemeroptera taxa	8	11	8	10	6	8	8	8	8	8
Plecoptera taxa	9	10	3	9	4	1	4	4	6	9
Trichoptera taxa	9	10	3	9	11	9	7	7	7	6
% Plecoptera	8.96	10.2	0.53	4.04	1.64	0.34	2.12	2.05	2.09	3.24
HBI	4.61	4.30	5.42	4.22	4.65	4.47	4.49	4.21	4.02	4.00
% 5 dominant	48.92	48.84	56.14	58.08	60.03	53.45	49.47	61.30	37.57	40.96
Scraper taxa	10	8	9	10	8	7	6	6	9	7
Clinger taxa	28	31	16	25	22	21	20	22	27	27

*Transect originally 15 meters above dredge was moved 18 meters further upstream due to presence of active Chinook redds.

Table 2. Macroinvertebrate metrics

The SMI is scored according to the metric scoring formulas given in Table 3 for the northern mountains region and rated according to the rating categories shown in Table 4.

Metric	Metric Scoring Formula	5th or 95th percentiles as per formula—Northern Mountains
Total taxa	100*"Total taxa"/95th	39
Ephemeroptera taxa	100*"Ephemeroptera taxa"/95th	13
Plecoptera taxa	100*"Plecoptera taxa"/95th	10
Trichoptera taxa	100*"Trichoptera taxa"/95th	10
% Plecoptera	100*"%Plecoptera"/95th	40
HBI	100*"(10-"HBI")/(10-5th)	1.6
% 5 dominant	100*"(100-"%5 dominant")/(100-5th)	52
Scraper taxa	100*"Scraper taxa"/95th	8
Clinger taxa	100*"Clinger taxa"/95th	23

Table 3. Metric scoring formulas for Stream Macroinvertebrate Index.

[7] Grafe, C.S., C.A. Mebane, M.J. McIntyre, D.A. Essig, D.H. Brandt, D.T. Mosier. 2002. The Idaho Department of Environmental Quality waterbody assessment guidance, 2nd ed. Idaho Department of Environmental Quality: Boise, ID. 114 pp.

Rating	Northern Mountains
Very Good (midpoint between 25th percentile and maximum index score to maximum score)	84-100
Good (25th percentile to midpoint between 25th percentile and maximum score)	65-83
Fair (upper trisect of minimum score to 25th percentile)	44-64
Poor (middle trisect of minimum score to 25th percentile)	22-43
Very Poor (lower trisect of minimum score to 25th percentile)	0-21

Table 4. Rating categories based on 25th percentiles of least impacted Stream Macroinvertebrate Index scores.

When the scoring formulas in Table 3 and the ratings in Table 4 are applied to the data in Table 2, the assessment of integrity and health of macroinvertebrate populations is rated. Table 5 provides the calculations and ratings. In the DEQ rating and scoring system, 100 is the maximum rating, so any numbers exceeding that score are reset to 100.

Stream Macroinvertebrate Index Overall Rating										
	Upper Site		Upper Site		Lower Site			Lower Site		
	7-26-01 15m above dredge	7-27-01 100 m below dredge	9-27-01 33 m* above dredge	9-27-01 100 m below dredge	8-10-01 10 feet above dredge	8-10-01 40 m below dredge	8-10-01 115 m below dredge	9-26-01 10 feet above dredge	9-26-01 40 m below dredge	9-26-01 100 m below dredge
Scoring parameter	**Lab ID-1**	**Lab ID-2**	**Lab ID-9**	**Lab ID-10**	**Lab ID-3**	**Lab ID-4**	**Lab ID-5**	**Lab ID-6**	**Lab ID-7**	**Lab ID-8**
Total taxa	100	100	100	100	100	100	100	100	100	100
Ephemeroptera taxa	62	85	62	77	46	62	62	62	62	62
Plecoptera taxa	90	100	30	90	40	10	40	40	60	90
Trichoptera taxa	90	100	30	90	100	90	70	70	70	60
% Plecoptera	22.40	25.50	1.33	10.10	4.10	0.85	5.30	5.13	5.23	8.10
HBI	64.17	67.86	54.52	68.81	63.69	65.83	65.60	68.93	71.19	71.43
% 5 dominant	100	100	91	87	83	97	100	81	100	100
Scraper taxa	100	100	100	100	100	88	75	75	100	88
Clinger taxa	100	100	70	100	96	91	87	96	100	100
Average Score	80.95	86.48	59.87	80.32	70.31	67.19	67.21	66.45	74.27	75.50
Overall Rating	Good	Very Good	Fair	Good	Good	Good	Good	Good	Good	Good

*Transect originally 15 meters above dredge was moved 18 meters further upstream due to presence of active Chinook redds.

Table 5. South Fork Clearwater River macroinvertebrate communities rated according to DEQ waterbody assessment protocols.

For this study, samples collected upstream of the suction dredge activities are considered to reflect background conditions. Analysis of these samples document a 26% variation in the average Stream Macroinvertebrate Index scores (SMI). Samples collected at sites located below the suction dredge activities show a variation of less than 26% in the average SMI scores which may be interpreted as being within natural variation of background conditions. There are not enough data points to calculate a statistically significant comparison between above and below sample sites. Based on these limitations in data use, we believe the macroinvertebrate data are inconclusive and can not provide a determination of an impact to the macroinvertebrate community as a result of these suction dredge activities.

Surface Fine Sediments

Percent surface fine sediments measured using the pebble count is an accepted index of stream substrate condition. In this study these data proved inconclusive for indicating trends due to the natural variability.

The raw data for the surface sediment sampling results are provided in Table 6, along with the percentage of fine sediments. At the middle site, the water was too deep to perform a pebble count, so data for this site are absent.

Surface Fine Sediments								
	Upper Site			Lower Site				
	7/26/01	9/27/01	9/27/01	8/10/01	8/10/01	9/26/01	9/26/01	9/26/01
	BEFORE/ ABOVE	AFTER/ ABOVE	AFTER/ BELOW	BEFORE/ ABOVE	BEFORE/ BELOW	AFTER/ ABOVE	AFTER/ BELOW	AFTER/ BELOW
Particle Diameter Size	T-1 above dredge	T-1; duplicated W/D of T-1 7/26/01	T-2; 101 m below dredge site	T-1 above dredge	T-3 at 115 m below dredge	T-1; 10 m above dredge	T-2; 40 m below dredge	T-3; 115 m below dredge
silt/clay 0-1mm	0	10	0	0	0	2	6	10
sand 1.1-2.5 mm	26	22	10	6	3	8	40	10
very fine pebble 2.51-6 mm	2	5	0	1	0	5	2	1
Pebble 6.1-15 mm	2	7	0	0	1	19	8	9
coarse pebble 15.1-31 mm	9	10	4	3	2	10	14	7
very coarse pebble 31.1-64 mm	20	30	38	5	9	15	13	12
small cobble 64.1-128 mm	41	27	42	15	29	29	23	41
large cobble 128.1-256 mm	3	7	6	53	50	27	33	29
small boulder 256.1-512 mm	0	0	13	19	14	33	7	21
Medium boulder 512.1-1024 mm	0	0	0	0	0	11	0	2
large boulder 1024.1 mm & larger	0	0	1	13	0	5	1	0
Total # of particles	103	118	114	115	108	164	147	142
# of particles < 2.5 mm	26	32	10	6	3	10	46	20
# of particles < 6 mm	28	37	10	7	3	15	48	21
% fines < 2.5 mm	25.24	27.12	8.77	5.22	2.78	6.10	31.29	14.08
% fines < 6 mm	27.18	31.36	8.77	6.09	2.78	9.15	32.65	14.79

Table 6. Particle size distribution and percent surface fine sediments.

On the upper site (see Figure 7 for graphs), the surface fine sediment was significantly less below the perturbed area.

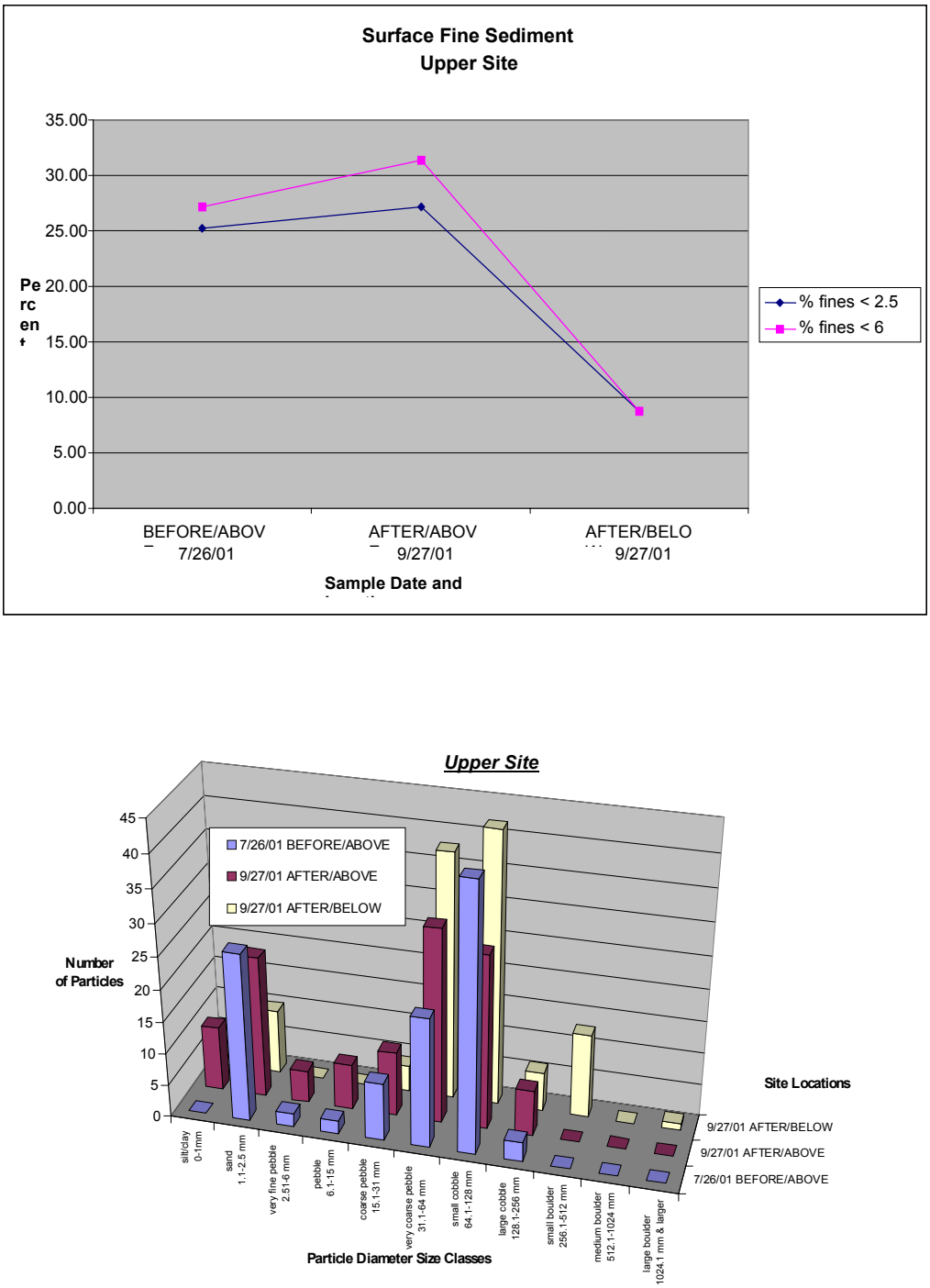
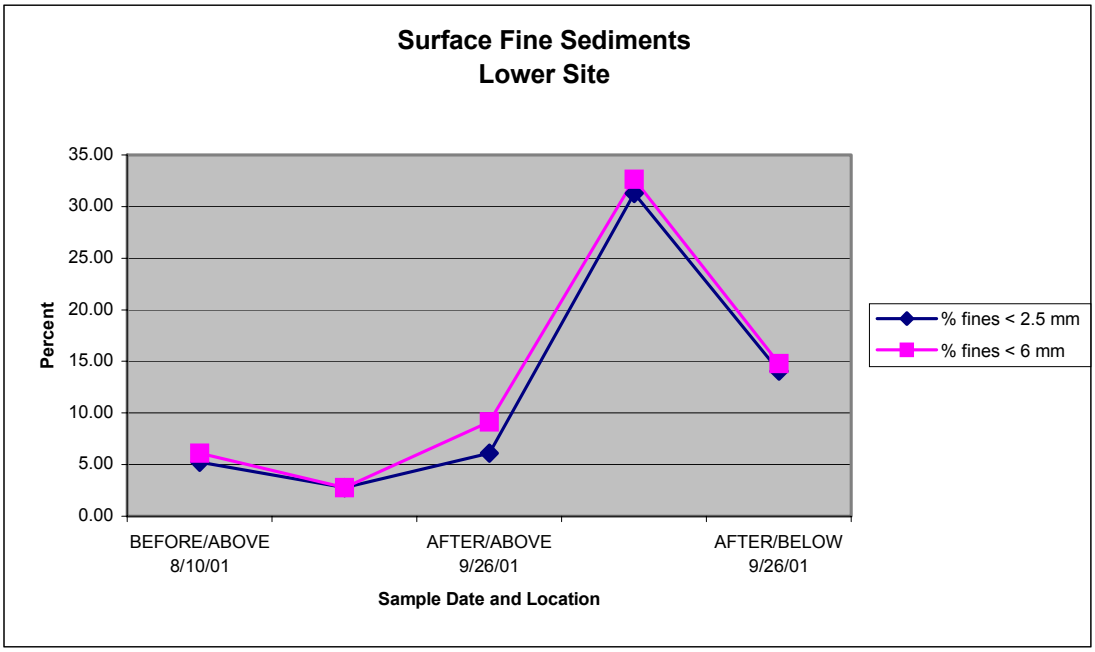


Figure 7. Percent Surface Fine Sediments and Partaicle Distribution at the Upper Site

For the lower site (see Figure 8 for graphs), the surface fine sediment does show some elevation below the perturbed area.



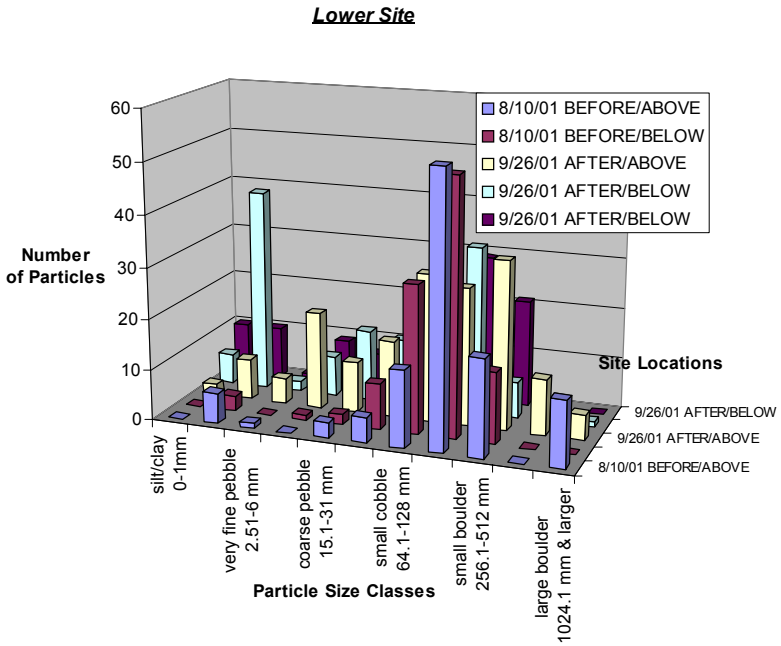


Figure 8. Percent Surface Fine Sediments and Particle Distribution at the Lower Site

Conclusions

The study plan implemented in 2001 had limited use in predicting recreational dredge mining impacts to water quality in South Fork Clearwater River. In order to determine long term impacts to water quality and habitat, a prolonged monitoring plan based on long term proposed plans of operation in each of the stream reaches would have to be developed and implemented. Within that study, additional habitats such as pools, which are important for overwintering, should be evaluated to determine if there is a significant loss in their volume. In addition, the volume and character of substrate dredged should be evaluated as different stream segments may deliver significantly different volumes of fines downstream during dredging operations.

Turbidity

The Idaho Water Quality Standards criteria for turbidity were not violated within the sediment plumes of active recreational suction dredges.

Macroinvertebrates

These short term recreational suction dredge mining activities monitored as part of this project do not appear to be impacting the benthic macroinvertebrate assemblages at the study sites. The seven metrics used in the Stream Macroinvertebrate Index score indicate the stream sites are in fair to very good condition. Improving macroinvertebrate assemblages at the downstream sites may be the result of temporary changes in substrate by the action of the suction dredges. Removing fine sediment from stream gravels creates interstitial spaces, which favor stoneflies and caddisflies, which are intolerant of fine sediment and indicators of good water quality. Large increases in Plecoptera (stonefly) and Trichoptera (caddisfly) Richness were seen at the downstream sites.

However, the score for each site may be interpreted as being within the natural variation of background conditions. Therefore, the macroinvertebrate data will not lend themselves to making any conclusions about impacts to water quality resulting from these recreational suction dredge mining activities to the macroinvertebrate populations present.

Surface Fine Sediments

Data collected for surface fine sediment was inconclusive. At one site, the surface fine sediments decreased, and at the other site, they increased below the perturbed area. These results could be due to background site variability or other parameters beyond the scope of the study. The surface fine sediment samples may not be representative of South Fork Clearwater River due to a small sample size. These data should not be interpreted as being representative of other waterbodies in the state.

As an overall conclusion, results from this study indicate that the limited recreational suction dredge mining activities occurring during 2001 on South Fork Clearwater River cause no measurable short term impairments on aquatic life beneficial uses.

References

DEQ. 1999. Beneficial Use Reconnaissance Project Workplan for Wadeable Streams. Prepared by the Beneficial Use Reconnaissance Project Technical Advisory Committee for the Idaho Division of Environmental Quality: Boise, ID. 100 pp.

DeRito, J. 2000. Summary Report of the Suction Dredge Monitoring Program: 1995-1999, Nez Perce National Forest. 9 pp.

Grafe, C.S., C.A. Mebane, M.J. McIntyre, D.A. Essig, D.H. Brandt, D.T. Mosier. 2002. The Idaho Department of Environmental Quality waterbody assessment guidance, 2nd ed. Idaho Department of Environmental Quality: Boise, ID. 114 pp.

Stewart, D.D. 2002. Personal communications and notes. Idaho Department of Environmental Quality. Grangeville Satellite Office.

Appendix A. Macroinvertebrate Data Analysis by EcoAnalysts, Inc.*

*typed verbatim from the narrative report

Michael Walters, 8 May 2002
Grangeville Dredge 2001-Narrative

(Upper Site)

Downstream comparison between 27 July and 27 September 2001
Percent dominant taxa looks good. Arrival of Acari as the third dominant taxon should be noted; though the water mites are diverse with regard to habitat requirements and stress response, a large proportion of mites in the community might indicate a stressed community.

Richness measures are lower in September than in July, however, similar changes occurred at the upstream site between the two sampling times.

Community composition looks good (note that I put less emphasis on these measures than the richness measures, which tend to be much more robust with regard to biological assessmen(t)). I see nothing here of concern.

Functional feeding group composition also looks good. Since these metrics tend to show a fair bit of variability, I only note the one that shows a large change and which is not reflected upstream. The percentage of shredders is higher in September sampling than in July, but this is an indicator of an improving community rather than one undergoing stress. 'Shredders' describes those organisms that utilize sources external to the stream system for food (e.g. leaf fall).

The HBI (Hilsenhoff Biotic Index) shows a slight decrease in September from July that is not reflected upstream. However, since higher numbers indicate stress, this certainly does not indicate a problem. The HBI is an abundance-weighted average of tolerance values for the organisms present in the sample, with a higher tolerance value indicative of a stress-tolerant organism. The values are intended for tolerance to organic enrichment, and are probably much less effective for indicating other stressors.

There are two other metrics which use tolerance values (again, the values are primarily used in response to organic enrichment). Intolerant taxa richness remains the same for July and September, so no problem indicated. Percent tolerant taxa does increase in September from July, but this is reflected upstream.

Long-lived taxa richness shows a reduction in September from July, however this is reflected at the upstream site.

In summary, most differences seen between July and September sampling were reflected upstream. Overall, there is no indication of impact due to dredging between the two sampling dates.

September upstream/downstream comparison
No problem indicated by identities of dominant taxa. Percent dominant taxa measures similar between upstream and downstream sites.

No decreases in the richness measures at the downstream site. In fact, large increases in Plecoptera and Trichoptera Richness are seen downstream.

No complaint with community composition measures.

The only functional feeding group measure that differs markedly is Percent Shredders, which does not indicate an impact at the downstream site.

HBI and Percent Tolerant Taxa decreased downstream, while intolerant taxa richness increased - therefore no problems indicated there either.

(Lower Site)

Comparison between 10 August and 26 September 2001
Percent dominant looks good, especially with the modest decrease between August and September (a high proportion of the dominant taxa indicates stress). Acari is not among the dominant taxa in September, and the three dominant taxa that are present are stress-intolerant. No problems indicated.

The only richness measure which shows a decrease is Trichoptera Richness. However, a similar decrease is reflected at T-1.

Differences in community composition between the two sampling dates are reflected upstream.

A strong increase in collector-filterers, which might otherwise indicate stress, is reflected upstream between the two sampling periods. Differences in functional feeding group composition otherwise do not indicate problems.

Other metrics look good.

September T-1/T-2 comparison
As stated above, the three dominant taxa present at T-2 in September are all stress-intolerant. Decreases in Percent Dominant Taxa measures at the downstream site certainly do not indicate impact.

Richness measures either were the same or increased at the downstream site. No problem indicated.

No complaints with community composition.

Increases in Percent Shredders and Percent Predators, with corresponding decreases in Percent Collector-filterers and Percent Collector-gatherers also are not indicative of impact.

Of the remaining metrics, only Percent Tolerant Taxa might be of concern if the difference between T-1 and T-2 were greater.

T-3 comparison between 10 August and 26 September 2001

Zaitzevia is moderately tolerant of stress, while the other two dominant taxa present in September are intolerant. Percent dominant taxa is reduced in all three cases between August and September. No problems indicated.

Except for Trichoptera Richness, the richness measures are the same or greater in September than in August. Reduced Trichoptera Richness is reflected at T-1 and T-2.

Community composition slightly improved between August and September.

Increases in Percent Shredders and Percent Predators, which accompanying reductions in Percent Collector-gatherers and Percent Collector-filterers indicate an improving community, but perhaps driven by seasonality.

Other metrics look good.

September T-1/T-3 comparison
Very similar results to September T-1/T-2 comparison.

Conclusion
The benthic invertebrate communities do not indicate impacts due to dredging operations at (Upper Site) and (Lower Site) between 15 July and 15 August 2001.