A-4

Water Quality Monitoring METHODS
Summer 1993, Dallas Aronson (Science Intern)
(see file c:\wp51\h2odata\methods)

Purpose of Data Collection

We have been monitoring streamflow and water quality at six sites along Silver Creek and its tributaries. Each site is visited once a month to measure stream discharge and the water quality parameters described below. A summary of the sampling schedule is included (Table 1).

Site Locations (See enclosed map)

Site 1, Stalker Creek, Fraser Cabin Site (StFr) - is located on Stalker Creek, approximately 100 meters upstream of Fraser cabin. A faint trail that leads to the right bank stake can be picked up at the water's edge just beyond the fence on the west side of the cabin. On the Gannett topographic map(T1S, R19E), the site is located in the NW quarter of the SE quarter of the NW quarter of Section 27.

Site 2, Chaney Creek Site, (Chan) - is located on Cain and Chaney Creeks. It is reached by crossing the footbridge over the rock dam on Stalker (about 1/4 mile East of Fraser cabin) then following the edge of the field west to the first bend in Chaney creek. It is located in the SE quarter of the NE quarter of the NW quarter of section 27. It is south of the confluence of Cain and Chaney Creeks and about 80 meters north of the confluence of Cain and Stalker Creeks.

Site 3, Stalker Bridge Site, (StBr) - is located on Stalker Creek. It is reached by crossing the fence on the north side of Stalker Creek bridge and walking up Stalker Creek 10 to 12 meters. It is located in the NW quarter of the SE quarter of the NW quarter of Section 26.

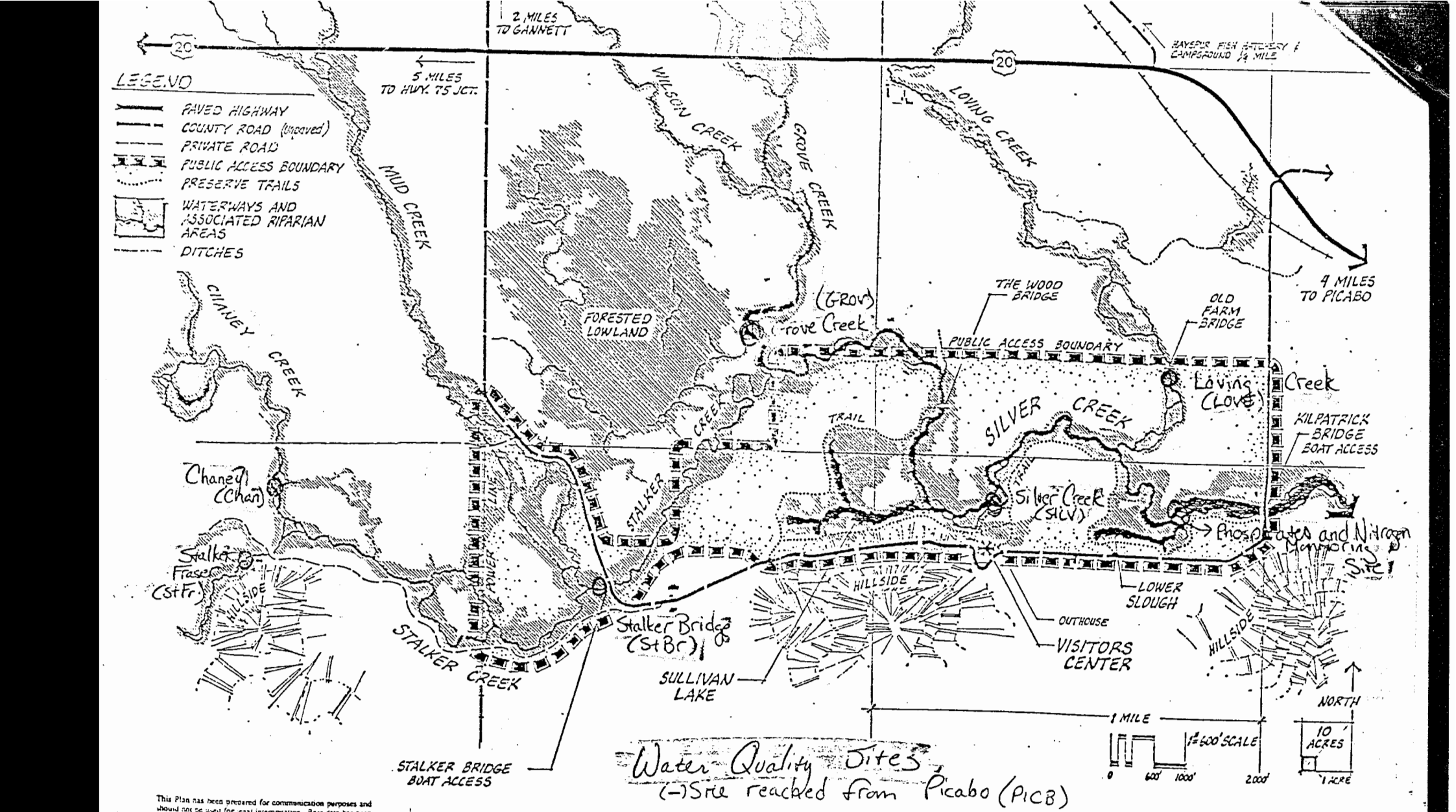
Site 4, Silver Creek Site, (Silv) - is located on Silver Creek below the Visitor Center. It is reached by walking down the nature trail NE of the Visitor Center. After crossing the last set of boards and coming out of the shrubs, turn left and walk toward the stream. The right bank stake and stream gauge will be visible to the right. On the Gannett topographic map the site is in the NW quarter of the NE quarter of the NW quarter of Section 25.

Site 5, Grove Creek Site, (Grov) - is on the Kennedy ranch property north of the preserve. The site is reached by taking Highway 20 to the Loving Creek/Silver Creek ranch gate. From the parking area at the owner's house on Silver Creek ranch, one walks west across a horse pasture. The transect stakes are in the open and the tops wrapped with white rags to protect the horses. The site is in the SE quarter of the NW quarter of the SE quarter of Section 23.

Site 6, Loving Creek Site, (Love) - is downstream of the

SCHEDULE.XLS

A Schedule for Water Quality Monitoring - prepared 10/1993												
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Flow, CFS	X	X	X	X	X	X	X	X	X	X	X	X
Staff Gauge	X	X	X	X	X	X	X	X	X	X	X	X
Sediment					X	X	X	X	X			
Bottom Cover					X	X	X	X	X			
Turbidity	X	X	X	X	X	X	X	X	X	X	X	X
Water Temp.	X	X	X	X	X	X	X	X	X	X	X	X
Air Temp.	X	X	X	X	X	X	X	X	X	X	X	X
pH					X	X	X	X	X			
Conductivity					X	X	X	X	X			
Dissolved O2	X	X	X	X	X	X	X	X	X	X	X	X
Nitrate	X		X		X	X	X	X	X		X	
Nitrite	X		X		X		X		X		X	
Ammonia	X						X				X	
Ortho Phosph.	X		X		X		X		X		X	
Total Phosph.	X		X		X		X		X		X	
Dredge Sites									X			



This Plan has been prepared for communication purposes and should not be used for legal interpretation. Base data has been enlarged from U.S.G.S. Gannett Quadrangle 1979 and aerial photogrammetry 5-10-99.

Created by:

PUBLIC ACCESS MAP

SILVER CREEK PRESERVE

BLAINE COUNTY, IDAHO

The Nature Conservancy

bridge below the property boundary of the Worthington ranch. The Worthington property is found 1/2 mile north of Kilpatrick Bridge. Park at the old corral. There is an old track along a wire fence that leads to the willows on the left bank of Loving Creek. Go through the willows to the old farm bridge and look south to find the transect stakes.

Site 7, Picabo Bridge Site, (Picb) - This is a new site added in the summer of 1993. Drive east along route 20 to the Picabo General Store. Make a left turn and drive about 1/2 mile to the first bridge. Samples are collected on the east side of the bridge and access is from the NE side of the stream (on the Tick Tock Ranch conservation easement property). No discharge or bottom cover/sediment measurements are made here.

Site 8, Lower S Turns, Silver Creek (STRN) - This site is used to collect samples for water quality parameters measured by Alchem Laboratories. It is accessed by parking on Kilpatrick Bridge Road east of the visitors center at the area used by fishermen to reach the lower slough. Walk through the split rail fence, turn east and follow the trail until Silver Creek is directly in front of you (about 400 yds). Walk into the stream about 30 feet and collect the water sample.

Parameter Measurements AT THE STREAM -
Read all instrument manuals carefully before using any equipment.

A. Staff Gauge - Staff gauges are installed at each site. The height of water on the staff gauge is optimally recorded every week and at the time of the monthly water quality visit.

B. Water and Air Temperature -

1. Measure air temperature first in the shade of a tree or shrub.
2. Measure water temperature next in the middle of the fastest flowing part of the stream. Water temperature is measured after air temperature as water evaporating from the glass will cool the thermometer.

C. Dissolved Oxygen - All data collected using the ICM meter up until May 1993 has an error associated with it due to incorrect calibration of the meter. The numbers collected previously were corrected as to water temperature however the atmospheric pressure was unknown. A uniform value of 760 mm Hg was used to calculate the calibration value. These numbers can not be published. A new YSI meter was purchased in september 1993 and the method outlined below is for this meter.

1. Set the meter to the altitude compensation value for 4800 feet (use the arrows to set the machine at 48). Salinity should be entered (~0.2mg/L) as part of the calibration procedure.
2. The calibration chamber in the machine should be

saturated with dH2O, allowing the meter to calibrate itself.

3. Move to the fastest flowing part of the stream.
4. Place the probe in the water and allow the LCD reading to stabilize. Record this number.
5. Remove the probe from the water, shake it to remove excess water and place it back in the water. Allow the LCD reading to stabilize and record this number.
6. Repeat step 5. These three readings are then averaged.
7. Rinse the probe with dH2O and place it back in the calibration chamber.
8. Turn the meter off.

The probe membrane should be changed every month. Directions are found in the instruction manual. These should be read thoroughly before use of the instrument.

D. Discharge Measurements -

Read the Hydrologic Monitoring Manual by Brian Richter, 1992

1. Setting up the transect

   The transect is set up using a steel cable tagline. At each stream site there is a pair of stakes. Hook the tagline to the stake at the right edge of water (facing upstream the bank to your left) so that the first pair of beads are at the stake. These beads represent the "0" point on the transect. Unreel the tagline, walk across the stream to the left edge of water and secure it to the stake found there. Beads are spaced along the tagline every 2 feet along the wire from 0 to 50 feet with two beads every 10 feet and beads are found every 5 feet from 50 to 100+ feet. There are also yellow spots painted every 2 feet from 50 to 100+ feet. Make sure that the cable is pulled tautly so that it does not hang in the water.

2. Velocity measurements will be made for 20-25 points across the transect. At Stalker Fraser the stream is only 10-11 feet wide and fewer readings are obtained. Readings are taken at six inch intervals here. Distance between readings depends on total length of the transect and on characteristics of the flow at different places across the stream. If velocity measurements for one section are greatly different from measurements on either side, the middle section should be broken down into two or three sections and velocity measurements taken for each new section. You are trying to get a <u>representative measurement</u> of the flow across the stream, including deep holes, slow water, and the main channel

3. Velocity Measurements -
   a. At each measurement point along the transect the depth of the water is read from the scale on the wading rod.
   b. The moveable section of the rod, at the top, is

F. Macrophyte Coverage

The percent bottom cover of macrophyte, sediment, sand, or gravel is estimated visually by percent for every ten foot section along the transect.

G. Collection of Water Samples

There are three polyethylene bottles labelled with the name of each stream site. The water collected in these bottles is used to measure turbidity, conductivity, and pH in the laboratory. Collect water samples from the fastest flowing area in the stream.

1. Face upstream above the transect in the water and let resuspended sediment wash away. Be careful not to stir up too much sediment, especially at Chaney Creek.
2. Rinse the bottles once in the stream. Submerge the closed bottle, remove the lid, fill the bottle with water, and replace the lid, all under the water. This will keep debris from getting into the bottle from the surface.
3. Collect the water sample using the same procedure as in step 2. Collect the water entirely from the middle of the water column.
4. Water quality parameters measured from water samples should be measured within a few hours of collection. pH values will vary significantly if allowed to warm to room stream temperatures. Warm water holds less HCO_3^- resulting in a lower pH reading than that found in the stream. Optimally, a small cooler should be used to hold samples for one to two hours while another site is completed.
5. Samples can not be frozen and thawed.

Water quality measurements IN THE LABORATORY

Turbidity should be measured first, conductivity second, and pH last. The pH measurement requires adding chemicals which will affect conductivity readings. **All measurements must be made within a few hours at the most after collection of the water samples.**

A. Turbidity -

The Lamotte turbidity meter is used in the lab to measure turbidity in NTU.

1. Turn the meter on and make sure that the red recharge light is not on.
2. Calibrate the meter using the 0.5 and 5.0 NTU standards. Use the 0-20 NTU scale. Both should calibrate within a few points. If there is a gross difference the machine should be serviced.
3. Shake the water sample bottle gently to resuspend any settled material and pour a sample into a glass vial. The vial should be filled to the neck. Each creek site has its own vial. A list of the vial for each site is posted in the lab.
4. Wipe the outside of the vial with a clean old t-shirt

should be within a few hundredths of each other. If not, remeasure the samples to check your numbers.

7. An inability to calibrate the meter with two buffers suggests that you might need a new electrode. The last one was purchased in June 1993.

Phosphorus and Nitrogen Monitoring

1. A container is obtained through Alchem.

   Alchem Laboratories
   104 West 31st Street
   Boise, ID 83714
   (208)336-1172

2. A sample is taken from site eight on Silver Creek below the "S"-turns.
3. The sample is mailed back to Alchem in a container plus a freeze-pack. This is done IMMEDIATELY! The sample must be received in Boise within two days so mail it priority post.
4. In 1993 we measured ammonia, nitrate, nitrite, ortho phosphate, and total phosphate in July and dropped the ammonia measurement for the months of August and September.
5. Monitoring of these chemicals is summarized in the water quality schedule (Table 1).
6. After one year of data is collected this procedure should be reassessed and measurement for chemicals which are a problem should be continued with others dropped or measured once or twice a year.

Data Management

Data is stored in Excel under the main directory of H2ODATA. Within H2ODATA there are subdirectories for bottom, datasum, dredge, flowcalc, h2ografs, sediment, and sedjunk. **Bottom** holds the information from the 10 foot bottom cover estimates. **Datasum** is the final repository for all water quality data. **Dredge** holds the information from the nine transects across Chaney Creek. **Flowcalc** holds the worksheets and program necessary to calculate discharge in CFS from the depth and velocity measurements taken across the stream site. **Sediment** holds the worksheets and program used to determine the amount of sediment on the bottom of the stream.

Bottom	contains spreadsheets botcalc.xls, botsum.xls
Datasum	contains a spreadsheet h2odata.xls and a backup copy
Flowcalc	contains flowcalc.xls, and all data spreadsheets for flow.
Sediment	contains sedcalc.xls, sedsum.xls, and all data spreadsheets for sediment calculations.

Backup copies of these spreadsheet programs and the data summary spreadsheet are kept at the main office and in the laboratory. Please update the information on the backup discs every three or four months.

SILVER CREEK PRESERVE
STREAM QUALITY MONITORING SUMMARY
May 1993 through October 1993

by Dallas Aronson, Science Intern
Silver Creek Preserve
The Nature Conservancy
P.O. Box 624
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A long term stream quality monitoring program was instituted in upper Silver Creek and its four major tributaries in June 1991 by The Nature Conservancy of Idaho. The information obtained in this program is being used to track long term changes in stream and water quality. Stream restoration and protection projects are also being driven in part by this information. Parameters are monitored once per month and include data on turbidity, pH, temperature, conductivity, dissolved oxygen, stream flow/discharge, sediment depth, and aquatic plant composition and cover. The most useful information from this monitoring will be in identifying dramatic long term trends in stream flow, water quality, and sedimentation.

Study Area

Silver Creek is considered a premier and rare example of a desert cold springs aquatic ecosystem. Its slow flows (< 1% gradient), alkaline chemistry (pH approximately 8.5) and relatively cool, constant temperatures (40-60 degrees Fahrenheit) make the system biologically unique and diverse. The springs that form Silver Creek originate within 5 miles of Gannett, ID. Four major tributary streams converge in the core of Silver Creek Preserve to form Silver Creek proper (Figure 1).

Because the water in upper Silver Creek is close to its origin, the water quality is generally high. However, due to decades of intensive ranching and farming, much of the Silver Creek watershed has been heavily impacted by field runoff, eroding banks, grazing, and deteriorating riparian tree and shrub communities. Since The Nature Conservancy first purchased the core preserve area in 1975, cooperative work has been completed with farmers and ranchers to protect Silver Creek and its tributaries. Projects include the establishment of buffer strips in agricultural areas, voluntary restrictions on aerial spraying of pesticides in stream corridors, fencing of riparian areas to prevent grazing disturbances, and removal of accumulated sediments. The Conservancy cooperatively protects over 4,200 acres through conservation easements and management agreements and owns 825 acres with a total of over 22 miles of protected spring creek.

Methods

Six stream monitoring sites were placed permanently in Silver Creek and four major tributaries (Figure 1). The sites were chosen to best represent upper Silver Creek's major drainage basins. Each site was marked with steel posts, a staff gauge was installed and photo monitoring points were established. Monitoring is conducted year round, once per month, and will continue indefinitely.

Dissolved oxygen (ppm) was measured using an ICM Oxygen Meter from June 1991 through July 1993. We are now using a YSI digital field unit. Electrolytic conductivity (mS/cm) is measured with a Hach conductivity meter. pH is measured with a Hach pH meter and water temperature (degrees fahrenheit) using a mercury thermometer. Turbidity (in NTU) is measured with a LaMotte turbidity meter. Stream discharge (in CFS) is measured using a Marsh-McBirney flow meter. Sediment depth (in inches) is measured with a yardstick along a stream transect. Aquatic plant cover (in percent) is measured visually along the same transect. Turbidity, pH, and conductivity are measured in a laboratory at the preserve. The other parameters are measured in the field.

Water quality and discharge measurements are conducted for each site at the same time of day throughout the study (three in the morning, three in the afternoon) to minimize variation in parameter sampling due to temperature changes (pH, dissolved oxygen, water temperature will be affected). In both 1991 and 1992 dissolved oxygen was measured through one 24 hour cycle. This was not completed in the summer of 1993 due to equipment failure.

A detailed description of these methods are included with this report.