

# **Boise River Side Channel Project at Harris Ranch Monitoring Plan**

Monitoring of the Boise River Side Channel Project at Harris Ranch will focus on habitat and fishery monitoring to evaluate the establishment of the channel as spawning and rearing habitat for salmonids.

Habitat monitoring will be done using an approach adapted from the state of Idaho's Department of Environmental Quality Beneficial Use Reconnaissance Program protocol for wadeable streams. This monitoring plan gives an overall picture of stream integrity as well as direct measurement of fish populations.

The habitat associated with the Boise River Side Channel at Harris Ranch will take time to establish and this monitoring will help project coordinators determine both if project objectives are being met and whether additional channel improvements need to be implemented.

## **Objectives**

1. Determine if project objectives for spawning and rearing habitat are met
2. Track habitat and fishery trends
3. Identify further channel improvements that need to be made

## **Rational for Selected Variables**

### **Flow**

Minshall (1993) noted that flow was one of the principal abiotic factors shaping stream ecosystems. Nelson et al. (1992) found flow to be one of the physical attributes that distinguished streams from different geologic regions. Flow is one of a series of measurements taken by both Oregon and Washington in very similar bioassessment projects (Mulvey et al. 1992, Plotnikoff 1992). Flow patterns affect habitat characteristics such as erosion (in part), distribution of aquatic assemblages, and movement of suspended materials (Rankin 1995). Flow measurements will ensure that the expected discharge of 10-20 cfs is being met and water is not subbing out into the gravels.

### **Width and Depth**

Width and depth measurements along with discharge data provide meaningful information about stream size and habitat characteristics. These variables have significant impact on the distribution of the aquatic community. Further, grouping rivers by width and depth may be useful for data comparison purposes (IDHW 1996).

## **Shade**

Canopy cover can be a surrogate for water temperature since vegetation can influence the amount of sunlight reaching the stream (Platts et al. 1987). Canopy cover was found to be an important variable in studies by Mulvey et al. (1992) and Overton et al. (1993). Temperature and canopy cover helped explain differences in fish occurrence and abundance in these studies as well as in the Robinson and Minshall (1992, 1994) ecoregion studies.

## **Substrate**

Fine sediment and its accumulation is detrimental to salmonid spawning since it limits the quality and quantity of the inter-gravel spaces that are critical for egg incubation (Maret et al. 1993, Young et al. 1991, and Scrivener and Brownlee 1989). Fine sediment and availability of living space have direct affect on both fish and insects (Marcus et al. 1990, Minshall 1984). Several studies and state projects have found relative substrate size to be important indicators of water quality effects due to activities in the watershed (Overton et al. 1993, McIntyre 1993, Skille 1991).

## **Habitat Types**

An evaluation of habitat diversity is critical to any assessment of ecological integrity. Water velocity, in conjunction with depth, has been demonstrated to have a direct influence on the structure of benthic (Osborne and Hendricks 1983; as cited in Plafkin et al. 1989) and fish (Oswood and Barber 1982) communities. Chapman (1966) stated the physical habitat regulates fish abundance. Researchers have correlated various components of the physical habitat with fish abundance and denoted habitat type as an important factor (Hunt 1969, Graham et al. 1980, Fraley et al. 1981, Shepard et al. 1982, Shepard 1983, Pratt 1984, Irving 1987, Hoelscher and Bjornn 1989, Moore and Gregory 1989). Gorman and Karr (1978) took this relation one step further and found fish diversity, as well as abundance, increased with habitat diversity.

## **Bank Stability**

The removal of stream bank vegetation and soils reduces the structural stability of the stream channel and negatively affects fish productivity (Platts, 1990; Platts & Nelson, 1989). Banks stabilized by deeply rooted vegetation, rocks, logs, or other resistant materials are less susceptible to flow related erosion, reduce water velocity along the stream perimeter, and aid in beneficial sedimentation (Bauer & Burton, 1993).

## **Riparian Vegetation**

The presence and condition of the riparian vegetation is important to the overall ecological health of the river and its floodplain. Healthy stands of riparian vegetation provide habitat for aquatic and terrestrial animals, as well as perform important physical functions (e.g. erosion control, sediment catchment). Stands of naturally occurring riparian vegetation can vary from river to river depending on climate and geomorphology. Monitoring the riparian vegetation in the side channel will provide valuable information on the time it takes for vegetation to establish itself and reach optimal shading characteristics. Also, monitoring information will be used to determine

if further riparian management is necessary to either increase shading or diversity of riparian plants for wildlife and fish habitat.

### **Pool Complexity**

Pool complexity is a measure of pool quality and pool to riffle ratio is a measure of pool quantity. In a study of streams that differed by the amount of management in their watersheds, Overton et al. (1993) found pools in the less impacted watersheds were more frequent, had higher volumes, and were of greater depth than those in the more impacted watersheds. Beschta and Platts (1986) suggested that pool quality is equally as important as the number of pools in describing a healthy stream from a fisheries standpoint.

### **Large Woody Debris**

Large Woody Debris (LWD), sometimes referred to as "large organic debris", has been found important in smaller sized streams where the riparian zone consists of evergreens, i.e., forested areas (Everest et al. 1987). Large organic debris has been found to be important for the complexity it adds to stream habitats, retention of allochthonous matter and sediment, and stability it imparts to streams under high flow conditions. Some species of salmonids show a high affinity for LWD (Rieman and McIntyre 1993).

### **Photo Documentation and Diagrammatic Mapping**

Photographic records provide visual details concerning riparian conditions and river geomorphology. Diagrammatic mapping is a representative map of the sampling reach. The map provides visual information and an approximate scale of important stream characteristics such as land use, geomorphic channel units, habitat features, and bank conditions (Meador et al. 1993).

Such visual details compliment field notes and habitat measurements. This type of documentation may also provide baseline information concerning qualitative changes of riparian conditions, land use and river channel modifications.

### **Stream Channel Classification**

Streams in Idaho exhibit considerable variability in climates, hydrology, geology, land forms, and soils. Rosgen's (1996) Stream Classification System, Level I, is a means of organizing and stratifying streams for comparison.

### **Conductivity**

Conductivity, or specific conductance, refers to the ability of water to conduct an electrical current. It is an indication of the concentration of dissolved solids. Conductivity is a necessary measurement in order to electrofish a site but also Royer and Minshall (1996) found sites designated as degraded generally had higher conductivities. Maret et al. (1997) reported conductivity is one environmental factor determining the distribution of fishes.

### **Temperature and Oxygen**

These variables are critical to salmonid spawning and rearing. If dissolved oxygen and temperature requirements are not met, egg emergence and fry survival are decreased. Adequate dissolved oxygen concentrations in the spawning gravel are crucial for egg viability.

### **Macroinvertebrates**

Macroinvertebrates are an essential part of the monitoring process. This biological community reflects a stream's overall ecological integrity. Because most streams are monitored infrequently, chemical monitoring is not always representative of the long term condition of the stream.

Biological monitoring provides an integrated representation of water conditions and provides better classification of the stream's condition and support status because the biological community is exposed to the stream's condition over a long period of time. This biological assemblage is a useful assessment tool because it is ubiquitous, includes numerous species, and responds to physical and chemical impacts in the water column (Rosenberg and Resh 1993). Additionally, macroinvertebrates with certain environmental tolerances may provide some insight of pollutants (Johnson et al. 1993).

### **Fish**

The Boise River Side Channel Project at Harris Ranch is designed to provide rearing and spawning habitat. The direct measurement of the fish community will provide valuable information on the success of the project as well as trend monitoring over time. This measurement will be done both by electroshocking and snorkel surveys. Snorkel surveys will be done by Timberline High School biology students and a protocol will be submitted at the time of the survey.

## **Description of Methods and Modifications**

### **Site Selection**

Three 100 meter transects will be monitored in the side channel. These transects will all incorporate spawning habitat (i.e. riffles) and will be determined in a site visit with project coordinators prior to monitoring.

### **Monitoring Periods**

Habitat parameters (shade, bank stability, substrate, width/depth, riparian, pool complexity, large woody debris) will be evaluated annually). Macroinvertebrate, periphyton and fish will also be evaluated on an annual basis. Temperature will be measured on an ongoing basis. Flow, dissolved oxygen and conductivity will be measured several times throughout the spawning period.

### **Flow**

Locate a straight non-braided stretch of your sampling reach. Place a measuring tape across the stream perpendicular to the flow. Take evenly spaced velocity measurements from wetted bank to wetted bank so that no more than 5% of the total discharge is in each (partial cross-section) (Harrelson et al., 1994). Record the horizontal distance measured from the tape and record depth and velocity from the top-setting wading rod and electromagnetic velocity meter. On very narrow streams with homogenous depth and substrate, >10% of the total discharge in any partial cross-section, or cell, is acceptable for reconnaissance level monitoring purposes. Also note: for depths >2.5 feet, two velocity measurements are taken for each partial cross-section; one at 20% of total depth and a second at 80% of total depth.

### **Width/Depth**

Although high accuracy using measurement methods for streams < 100 feet wetted width has been reported (Platts et al., 1983) the following protocol was developed to provide meaningful resolution without the encumbrance of multiple measurements.

At each BURP site a transect is established 10 meters upstream of each macroinvertebrate collection location. Procedure is conducted from the left bank to the right bank while facing upstream.

- Stretch, secure, and level tape across bank full (BF) width.
- Measure and record BF width.
- Measure and record the vertical distance from the tape at BF elevation to the left wetted edge (LWE).
- Measure and record wetted width (WW).
- Measure and record wetted depth (WD) from the water surface to the channel bottom at evenly spaced increments across the wetted width according to the following guideline: (intervals calculated by WW divided by n+1)

WW # measurements(n)

- < 1 meter 3
- > 1 but < 4 meters 5
- > 4 meters 7

- Calculate and record average wetted depth (AWD).

When a width/depth transect is measured in a split channel, there are two ways to make the measurement. Bankfull measurements should be taken in the channel with the most discharge if the area between the channel is above the ordinary high water level. Bankfull measurements should be taken across both of the channels if the area between the channels is below the ordinary high water level. Bankfull stage will be identified using, in part, Leopold et al. (1995).

### **Shade**

Use a concave spherical densiometer to determine canopy cover. The number of densiometer grid intersections obstructed by overhead vegetation is recorded. Densiometer readings are taken at three riffle habitat units. Densiometer measurements

should be taken on the riffle relative to where the macroinvertebrate samples were taken. For stream orders 1-4 the following four readings are taken per cross section; right bank, left bank, from the center of the stream facing upstream, and from the center of the stream facing downstream. The densiometer should be held one foot above the water surface for all measurements and one foot in from the banks when taking right and left bank measurements.

### **Stream Bank Cover and Stability**

Using a modified version of Bauer & Burton (1993), the stream bank is categorized as covered and stable, covered and unstable, uncovered and stable, or uncovered and unstable. Banks are defined as covered if they are typified by a 50% coverage of perennial vegetation or their roots, rocks of cobble size or larger, or logs greater than four inches in diameter (Bauer & Burton, 1993). Banks are defined as unstable if they are typified by fractured banks, bank slumping, or vertical and eroding banks (Bauer & Burton, 1993).

Stream bank condition is determined on the left bank and the right bank of the waterbody. Using a two meter stick or a tape, the field crew measures the total number of meters of stream bank that fall into each of the four categories. These values are used to calculate what percent of the reach is characterized by each of the four bank conditions.

### **Substrate**

Both a modified Wolman Pebble Count (Wolman 1954) and a MacNeil Corer sample will be used to quantify substrate size distribution in riffle habitats. The Wolman pebble count method relies on surface fines (defined as material <6.35 mm Chapman and McLeod 1987) as an index of sedimentation and beneficial use impairment.

#### *Wolman Pebble Count*

Pebble counts (substrate measurements) are conducted at the same three transects in the riffle habitat units where macroinvertebrates were sampled. Begin at the bank full level on one stream bank and proceed across the riffle to the bank full level on the opposite stream bank. Select pebbles at equal distant intervals (heel to toe, one pace, each foot on a tape, etc.). At each interval, reach to the stream bottom, pick up the first particle touched, and measure the intermediate axis. Record on the Field Form the size class of the particle and whether the particle was chosen from within the wetted stream channel. Replace the particle down stream of the transect line. Conduct the pebble count with as little bottom disturbance as possible.

A minimum of 150 particles measured from three riffles (50 per riffle) is required. Record measurements until the bank full streambank is reached, even if the 50 counts are reached before a transect is completed. Each successive pass must be upstream from the previous pass if multiple passes are required to reach the minimum 50 pebbles per riffle.

### *McNeil Sediment Core*

McNeil Sediment Core samples are collected to describe size composition of bottom materials in salmonid spawning beds of streams. Research has shown that subsurface fine sediment composition is important to egg and fry survival (Hall 1986); (Reiser and White 1988)

Sample sites selected displayed characteristics of gravel size, depth, and velocity required by salmonids to spawn. Samples are collected during periods of low discharge to minimize loss of silt in suspension within the core sampling tube.

A 12-inch stainless steel open cylinder is worked manually as far as possible, at least 4 inches, into spawning substrate without allowing flowing water to top the core sampling tube. Samples of bottom materials are removed by hand, using a stainless steel mixing bowl, to a depth of at least 4 inches and placed into buckets. After solids are removed from the core sampling tube and placed into buckets, the remaining suspended material is discarded. It is felt that this fine material would be removed through the physical action of excavating a redd and would not be a significant factor with regard to egg to fry survival. Additionally, rinsing of sieves to process the sample results in some loss of the fraction below the smallest (0.053 mm) mesh size.

Samples are placed wet into a stack of sieves and separated into 10 size classes by washing and shaking them through nine standard Tyler sieves having the following square mesh openings (in mm): 63, 25, 12.5, 6.3, 4.75, 2.36, .85, .212, .053.

Silt passing the finest screen is discarded. The volume of solids retained by each sieve was measured after the excess water drained off. The contents of each of the sieves are placed in a bucket filled with water to the level of a spigot for measurement by displacement. The water displaced by solids is collected in a plastic bucket and transferred to a 2,000 ml graduated cylinder and measured directly. Water displaced by solids retained by the smaller diameter sieves is also collected in a plastic bucket and measured in a 250 ml graduated cylinder. All sample fractions are expressed as a percentage of the sample with and without the 63 mm fraction.

Three sediment core samples are collected at each sample site and grouped together by fractions 6.3 mm and greater and 4.75 mm to 0.53 mm. The results for a particular site are the percentage of 4.75 mm to 0.53 mm as a percent of the total sample. Standard deviation is calculated for estimates including and excluding particles 63 mm and above.

### **Habitat Typing**

A variety of habitats occur in wadable streams. Visual determination of habitat units can be subjective with poor precision because they are not clearly defined (Platts 1982). The Western Division of the American Fisheries Society formed a committee to standardize definitions related to habitat evaluations (Helm et al. 1985). Others have combined types into macrohabitat units thereby improving observer recognition and the ability to

replicate surveys in the future (Schuett-Hames et al. 1992). Macrohabitat units have equivalent structure, function, and responses to disturbance.

Oswood and Barber (1982) proposed four general categories or macrohabitat units based on velocity and depth relations: slow and deep, slow and shallow, fast and deep, and fast and shallow. These correspond to pools, glides, runs, and riffles. These habitat types will be differentiated by the following characteristics.

**Pool-**A portion of the stream with reduced water velocity, water deeper than the surrounding areas, the bottom often concave in shape forming a depression in the profile of the stream's thalweg, and that would retain water if there were no flow. Pools usually occur at outside bends (e.g. lateral scour) and around large obstructions (e.g. plunge pool). Pocket water pools refer to groups of small pools often in areas of otherwise fast or turbulent flow, usually caused by eddies behind boulders or other obstructions. Eddies are also associated with backwater pools. Water impounded upstream from channel blockage, typically caused by a log jam or beaver dam, is classed a dammed pool. Flats are actually a wide shallow pool often confused with a glide. Pools end where the stream bottom approaches the water surface, also known as the pool tailout.

**Glide-** A portion of the stream with slow moving, relatively shallow water. The water surface has little or no turbulence and the stream bottom is flat or slightly convex in shape lacking the scour associated with the pool. Glides are typically situated downstream of pools in the transition between the pool and the crest of the riffle. The riffle crest restricts water flow and slows the water in glides. Glides also occur where the channel widens allowing the stream to shallow and slow. Glides are most commonly found in low gradient streams associated with elongated pools.

**Riffle-** A portion of the stream with swiftly flowing, shallow water. The water's surface is turbulent. The turbulence is caused by completely or partially submerged obstructions, often the stream bottom. Cascades are one class of riffle characterized by swift current, exposed rocks and boulders, considerable turbulence, and consisting of stepped drops over steep slopes. Riffles that are swift, relatively deep, and have considerable surface turbulence, sometimes represented by standing waves, are called rapids. Rapids at high flow may be confused with runs.

**Run-** A portion of the stream with swiftly flowing, relatively deep water, which approximates uniform flow. There are no major flow obstructions downstream of causing little or no surface turbulence. Runs tend to occur immediately upstream of riffles. Pool tailouts are typically classed as runs in small, high gradient streams. A narrow, confined channel through which water flows rapidly and smoothly, usually with a bedrock substrate, is called a chute. Chutes are a class of runs.

### **Pool Complexity**

Pool complexity is measured at a minimum of four pools if pools are present at the site. Pool length, substrate, overhead cover, submerged cover, bank cover, maximum pool depth, maximum pool width, and depth at pool tailout are measured at each pool.

### **Large Woody Debris**

All LWD greater than ten centimeters in diameter and one meter in length is counted within the bankfull channel throughout the site. The requirements for minimum diameter and length are provided on the field form. This parameter only applies to streams in forested situations.

Occasionally, sites will be encountered with large accumulations of LWD. At these sites, it is acceptable to count up to 100 pieces then estimate thereafter, i.e., <100 pieces of LWD in site, count individually, >100 pieces in site, count by tens. When dealing with large amounts of LWD each piece counted must meet the minimum size requirement.

### **Photo Documentation**

Each crew is supplied with slide film, date back cameras, and compasses. Two photos are taken of the stream site from the lower end of the site. One photo is taken facing upstream and one facing downstream. Recording the azimuth in which each photo is taken is optional.

### **Stream Channel Classification**

Determine the Rosgen stream type to Level I only. Determine the following:

- Latitude
- Longitude
- Elevation
- Slope
- Stream Order
- Valley Type

Additional descriptive items that may be collected in the field or in the office before and after the assessment is made.

- Aspect
- Lithology

### **Conductivity**

The crew is to measure conductivity at transect 1 using a calibrated conductivity-temperature system.

### **Temperature and Oxygen**

A stowaway hobo temp logger will be installed to measure temperature every hour and 12 minutes. These measurements will allow project coordinators to track daily temperature swings and determine the maximum average daily temperature.

Dissolved oxygen will be measured using a hydrolab Quanta at the interface between the spawning gravels and water during spawning periods to determine if DO levels are above 6 mg/L.

### **Macroinvertebrates**

Macroinvertebrate samples are collected from three separate riffle habitat units following Clark and Maret (1993). Using a Hess sampler take an invertebrate sample by stirring substrate and brushing rocks for a minimum of two minutes (strive for a consistent time of 3-5 minutes per sample). Place the sample into a container, label inside and out, and preserve with 70% ethanol (container should be filled to shoulder). If container is greater than 50% full of sample material, contents should be divided into two containers of fresh alcohol or rinsed with 70% ethanol three times within 24 hours. Each of the three samples will be preserved separately for laboratory compositing. The first 500 individuals will be counted and identified.

### **Fish**

Obtain fish collection permit or cooperate electrofishing effort with permitted personnel. The site surveyed for fish should include all habitat types present in the reach if different than the BURP site.

Electrofish the site. Electrofish after macroinvertebrates have been collected and before habitat measurements are taken if a BURP site. The survey should include one upstream pass without block nets as a minimum reconnaissance level effort. Proceed up the thalweg of the channel for streams less than five meters wetted width and in a zig-zag pattern on larger streams.

- Sample all habitat types.
- Collect all fishes.
- Identify all fish to species.
- Prepare equipment to measure length (weight scales optional) and recovery chamber prior to applying anesthesia.
- Apply anesthesia as recommended in Chandler et al. (1993).
- Measure total length of all fish including the family Salmonidae.

If hundreds of young-of-the-year are collected, a random subsample of the total catch of each salmonid species may be measured for total length. All young-of-the-year should be counted.

- Count and measure each fish of non-Salmonidae families collected.
- Voucher up to six (6) specimens of each species as the fish collection permit allows. This is especially important for any fish that cannot be identified to species in the field. Voucher according to Appendix IV. Make a one inch incision along the right side of fish greater than 250 mm.
- Tag each vouchered fish and mark field form for tracking purposes.
- Record the amount of electrofishing effort (time) spent on the site. Record the effort (time) for each pass if multiple passes are made.
- Measure and record the conductivity.

- Measure and record the water temperature.
- Record water clarity (clear, stained, lightly turbid or highly turbid).
- Record the proportion of habitat types within the site on the fish data sheet
- Record stream length and average width (minimum of three transect measurements) of the site electrofished
- Electrofish a minimum of 100 meters of stream and strive for all habitat types present.

## **Periphyton**

Samples are collected from three separate riffle habitats using a modified 30cc syringe and a small, stiff bristled brush. Collection should occur in the same habitats as the macroinvertebrate samples. Randomly choose a stone from the wetted stream channel and carry it to the bank, making sure that the portion of the stone that is exposed to the sun remains on top. Firmly press the modified syringe over the stone and add a small amount of water using an aspirator or eye dropper. Place the brush into the syringe and scrub the surface of the stone until the attached algae are loose. When the algae have been sufficiently dislodged from the rock, use the aspirator to remove the mixture and place it into a 15ml scintillation vial. Combine the samples from all three riffles into one composite sample, fill the sample to the top and preserve with 7-10 drops of 2% formalin for a 15 ml vial collection (see Appendix XI) solution.