WATER QUALITY PROGRAMS DIVISION

Standard Operating Procedure for the Collection of Habitat Data in Streams

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Revised 2013

Draft Copy

OKLAHOMA WATER RESOURCES BOARD
WATER QUALITY PROGRAMS DIVISION
3800 NORTH CLASSEN
OKLAHOMA CITY, OK 73118

STANDARD OPERATING PROCEDURE FOR THE COLLECTION OF HABITAT DATA IN STREAMS
REVISED AND ADOPTED APRIL 2010
(PREVIOUS REVISION 2007)

1.0 General Information

An evaluation of habitat quality is critical to any assessment of ecological integrity. The habitat assessment measures the quality of the in stream and riparian zone habitat that influences the structure and function of the lotic aquatic community. Habitat directly influences the biotic community and can be used to discern the source of impairment. The habitat parameters evaluated during this process are related to the overall aquatic life use and are potential sources of limitations to the aquatic biota. Habitat, as structured by in stream and surrounding topographical features is a major determinant of the aquatic community potential. Both the quality and quantity of available habitat affect the structure and composition of resident biological communities.

The habitat assessment procedures follow a modified version of the EPA Rapid Bioassessment Protocol V (EPA 1999), the National Rivers and Streams Assessment Field Protocols (USEPA, 2008 and 2013), and other supplementary documents. The habitat assessment was designed to assess the physical habitat available to support the biological community. The assessment is based on particular parameters grouped into three principal categories. The first group represents parameters on the microscale habitat, for example bottom substrate, cover, and flow. The second group of parameters is designed to assess the macroscale habitat such as channel morphology, sediment deposition, and sinuosity. The third grouping evaluates the riparian and bank structure; for example, bank stability, vegetation, and streamside cover. A quantitative value or weight is assigned to each parameter so that biologically significant factors can be emphasized. These weighting values are then adjusted based on the quality of the parameter. Scores are then assigned as an evaluation of in-stream and riparian conditions. Measurements/scoring for each parameter are made on various intervals set at 4x, 2x, 0.4 times average wetted width, or reach length.

2.0 Definitions/Terms

- Team Leader—crew member of fish collection team who provides support, expertise, and opinions; gives instruction and has final say on how work will be done; must score a 95% on critical fish identification
- Team Member—crew member of fish collection team who provides support, expertise, and opinions; follows the instructions of the team leader
- Left and Right Bank—bank is determined by looking downstream with right bank to right and left bank to left

3.0 Safety

Upon reaching the sampling location, site safety determinations should be made before proceeding. Please refer to the OWRB safety manual for instructions.

4.0 Quality of the Measurement

4.1 Training

Principle investigators for the OWRB are required to have degrees and/or experience with biological or other applicable sciences. Principle investigators are defined as crew leaders, and this designation may be made upon the leader of a multi- or a one person crew. Training is required for all SOPs dealing with water quality and quantity collections and measurements as well as habitat assessments and biological collections. In-house training will be conducted for the use of all meters and digital titrators used for water quality or quantity measurements. Investigators must be familiar with OWRB SOP document and all training will follow the methods outlined in that document. Extra training will be provided when new SOPs are developed. Training of field crews will be done through dry run exercises in the laboratory to familiarize field crews with sample collection, sample preservation, instrument operation, calibration, and maintenance. In addition, when new personnel are hired or new methods developed, qualified staff will train on sample collection, measurement, and field analysis methods through side-by-side field trips. These trips will familiarize staff with SOP requirements. When training is considered adequate, a qualified staff member will check field staff for adherence to SOPs. Prior to collecting data, all staff should familiarize themselves with this SOP, OWRB Technical Report 99-3, and and the National Rivers and Streams Assessment Field Protocols (USEPA, 2008)..

4.2 Kinds of Quality Assurance Samples

4.2.1 Replicate Collections

Replicate habitat collections will be made when replicate fish collections are done and may include replicates for various habitat or stream order. The scope and number of replicates will be determined by the project Quality Assurance Project Plan. .

4.2.2 Certification of Personnel for Habitat Measurements

For habitat assessments, field QA sessions will be conducted annually and will include a side-by-side measurement of all metrics with all qualified personnel. Calculating a mean score for all team leaders creates a data standard for the assessment. Team leaders and other staff are then compared to the mean and a percent difference is calculated for each metric. An acceptable percent difference is ½ of the scoring category range. Remedial training will be performed when an investigator falls outside of the acceptable percent difference.

5.0 Personnel and Equipment

5.1 Personnel

Habitat measurement crews will consist of a team leader and one or two team member. The team leader is someone with one or more seasons of collection experience who has passed the annual QA described above. Collection experience in other programs may be substituted for that with the OWRB. The team leader will have the final say on all crew activities. A team member is someone trained on habitat measurement protocols. Team members will be expected to participate in the decision-making and follow the team leader's direction.

5.2 Equipment

All equipment should be consistently calibrated, cleaned, and treated with care. Training on the proper operation of each piece of equipment will be done by a team leader before use is allowed.

- **Auto Level and Tripod—**Used to measure slope.
- **Stadia Rod—**Used to measure height, depth, width, slope, and bank angle. The rod should be calibrated to tenths of a foot and made of a durable material.
- **Rangefinder—**Used to measure transects and width. It should not be used for widths less than or equal to 10 meters.
- **GPS Unit—**Used to mark beginning and ending point of a reach as well as transects on larger rivers. Will also be used on larger rivers to set points for thalweg measurement profiles.
- **Clinometer—**Used to measure bank angle and height and may be used to measure slope.
- **Convex Spherical Densiometer—**Used to measure canopy density.
- **Compass—**Used to measure bearing.

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6.0 Measurement of Habitat Data

The stream habitat assessment follows a modified version of the EPA Rapid Bioassessment Protocol V (EPA 1999), OWRB Technical Report 99-3, and the National Rivers and Streams Assessment Field Protocols (USEPA, 2008). The habitat assessment was designed to assess the physical habitat available to support a biological community and is based on particular parameters as they are observed in the field. A quantitative or qualitative value is recorded for each parameter at set intervals (4x, 2x, and 0.4x of average wetted width) along the stream reach depending on the type of parameter. The information is weighted and complied to generate an overall score.

Over the following pages are the various metadata and metrics that need to be accounted for in the assessment. The following paragraphs are divided into certain groups to allow for better explanation.

Because interpretation of the assessment parameters can be subjective from site to site and ecoregion to ecoregion, it is imperative that the field personnel be properly trained in quantitative evaluation and go through annual certification. Record all measurement data legibly and in the units and significant digits required.

6.1 Designation of Reach Length (All Biological Sampling Activities)

Before sampling begins, a waterbody should be classified based on size and accessibility. Average wetted width (AWW) and fish gear will be used to determine reach length and whether a site is wadeable or boatable. First, a total possible reach length will be established by using either detailed aerial photos or direct measurement at the site. A total of five representative widths are used to obtain the AWW and should represent the diversity of the site. It is important to measure areas of varying width including bends, large shallow runs, and riffles. Areas directly around a bridge should

be avoided. After the AWW is calculated, the reach length is set at 40x wetted width and rounded to the nearest "10". Second, fish gear accessibility is determined. If a reach is continuously wetted and greater than 50% of contiguous length can be safely and efficiently fished using a seine or pram/backpack electrofishing equipment, the site is classified as wadeable. Conversely, if a reach is continuously wetted and greater than 50% of contiguous length requires at least a 14-foot electrofishing boat to be efficiently fished and can be safely and efficiently accessed, the site is classified as boatable. Based on this information, the following rules should be used to determine reach length.

1. All sites will have a minimum reach length of 150 meters, regardless of wadeability.
2. Wadeable sites can be fished efficiently and effectively with pram or seine over greater than 50% of contiguous wetted length. Maximum reach length will be 2000 meters, regardless of calculated reach length.
3. Boatable sites can be fished efficiently and effectively with a boat over greater than 50% of contiguous wetted length. Maximum reach length will be 4000 meters, regardless of calculated reach length.
4. The reach length minimum and maximums can be adjusted under extremely unique circumstances, but only after prior consultation with the Monitoring Coordinator and Biological Team Leader and approval.

6.2 Wadeable Habitat Introduction

Following is a simplistic explanation of each set of measurements made. Please refer to the more detailed protocols for more in-depth explanation. For all forms, both front and back, please place site number, transect or sub-reach, and date.

6.2.1 Channel/Riparian Transect and Mid-Section Cross-Section Forms

These forms should be completed as the front and back of the same form. The information required is the same with the addition of several elements on the mid-section form that account for items unique to the rapid bioassessment protocol form. The measurements are made at the 2x AWW level and characterize the substrate, channel, bank, fish cover, riparian area, and human influence.

6.2.1.1 Substrate Cross-Sectional Information

Cross-section measurements include distance from left bank (100^{th} of a meter), depth (centimeter), size classification code, and embeddedness (percentage). Each measurement type is divided into 5 subcolumns (Left, LCtr, Ctr, RCtr, and Right).

- "Left" is depth at the left bank where water meets un-wetted bank.
- "LCtr" is depth of water midway between the center of the stream and the left bank. May be measured on dry land.
- "Ctr" is depth of water at the midway point between left and right bank and may be measured on dry land.
- "RCtr" is depth of water midway between the center of the stream and the right bank and may be measured on dry land.
- "Right" is depth at the right bank where water meets un-wetted bank.

The substrate measurement characterizes the physical benthic material and is collected in several ways. First, the dominant substrate immediately below the stadia rod at the 5 increments described above is recorded using the substrate codes on the form. Secondly, at the bottom of the form (in the comments section) is an additional measurement used to assist in completing the RBP form. This box requires that the primary, secondary, and tertiary dominant substrate at the transect be recorded. If a secondary or tertiary substrate is not present, please record the primary dominant substrate in all boxes.

Embeddedness (EMB) is the degree to which boulders, cobble and gravel have been surrounded by fine sediment and indicates suitability of the stream substrate as habitat. If there is no fine material surrounding the cobble and gravel, and there is at least some free space under the rocks, that is 0 percent embedded. If the free space under the rocks is filled but the sides are untouched, count that as 5 percent embedded. As the level of fines rises up the substrate sides, estimate the percentage of the total height of the cobbles that is covered. This is the embeddedness estimate. Often an "embeddedness line" is quite distinct if rocks are inspected out of the water. At least 5 rocks from bank to bank should be used in the estimate. Embeddedness should be determined for substrates at the 5 cross-section measurements. Please, note that some substrates are automatically classified as 0% embedded (bedrock and hardpan clay) or 100% embedded (sand an silt/clay/muck).

6.2.1.2 Bank Measurements

Bank measurements are made at a 2x interval for bank angle and undercut distance (meters) for both banks. Wetted, in-channel bar-width, and bankfull widths are measured across the transect to the nearest tenth of a meter. Similarly, bankfull and incised height as well as incised height are measured to the nearest tenth of a meter at the lowest point off the channel.

6.2.1.3 Canopy Cover Measurements

The spherical densitometer is used to measure canopy on the transect. The number of points intersected along a grid of 17 squares is counted at six locations including the left and right banks as well as in the center at points up, down, left and right.

6.2.1.4 Fish Cover Area

These are gross quantifications made across the sub-reach for each transect. For boulders include cobble and gravel in the estimate.

6.2.1.5 Visual Riparian Estimates

This section includes three different kinds of visual estimations. First, riparian vegetation cover is estimated in three cover classes (ground, understory, and canopy) over a 10X10 riparian plot set on both banks. Secondly, human influence is classified into four categories including not present, >10 meters from bank, < 10 meters from the bank, and on the bank.

Lastly, at each midpoint (4x wetted width), several measurements will be that are needed for the RBP habitat methodology. Measurements should be made on both the left and right bank, and include.

- **Bank Vegetative Cover (BVC)—**Record an estimate of the total area on both banks that is protected from erosion by well-established, **perennial** vegetation. Soil doesn't have to be covered as long as it is stable. If banks are covered with riprap or large gravel, they can still be stable. Remember to note this in the "Comments" section.
- **Dominant Vegetation (DV)—**Place an S (shrub), T (tree), or G (grasses and forbs) in the box indicating which type of vegetation is most dominant **ON THE BANKS** in terms of percent of ground protected. For our purposes, shrubs are any woody plant whose trunk and branches are <= 10 cm in diameter. If the vegetation is mixed but at least 2 of the three groups contribute at least 20% of the total put an M in the box.
- **Percent Eroded Banks (% ERODED BK)—**The column is divided into 2 subcolumns (LEFT and RIGHT). Record the average % of stream bank that is actively eroding for both the left bank and the right bank of the stream segment. Measure from the edge of the lower bank to the edge of the upper bank. The upper bank is usually the edge of the flood plain.
- **Average Height of the Eroding Banks (HT. ERODED BK)—**The column is divided into 2 subcolumns (LEFT and RIGHT). Record the average height of the eroding banks on either side of the stream segment just walked. Measure from the lower edge of the bank to the upper edge of the bank.

6.2.2 Thalweg Profile and Woody Debris Form

A thalweg profile will be taken between each transect at 0.4x wetted width. Measurements include depth (cm) and wetted width (tenth of a meter). Additionally, presence will be noted for of mid-channel and point bars, soft/small sediment (fines including gravel), side channels and backwater. Lastly, at each measurement point a channel unit code should be determined, and if the channel is pool, a pool-forming code should be included.

Throughout the sub-reach, the woody debris will be classified and tallied. Pieces are first classified into one of nine size categories based on large end diameter and length, and then classified as all/part of the bankfull channel or above bankfull channel. Minimum size is 0.1 meter large end diameter and 1.5 meter length

6.2.3 Slope and Bearing Form

Slope and bearing is calculated on all waterbodies with reach lengths of up to 1500 meters. For reaches greater than 2000 meters, maps may be used to determine both slope and bearing. For reaches projected at between 1500 – 2000 meters, maps should be used to predetermine if slope and bearing estimations can be a desktop exercise or if data will need to be collected in the field. The method is described in great detail in the NRSA Field Protocols (USEPA, 2008). Various methods may be used for direct site measurements. However, the transit method is preferred (auto

levels and stadia rod) because it is much more accurate and typically not difficult to accomplish.

6.2.4 Riparian Legacy Tree and Invasive Plant Species

For each main transect, please denote the largest, visible tree within the transect. Record the diameter at breast height (meters), height (meter), distance from wetted margin (meter), type of tree, and either taxonomic category or taxonomic name. Also, note the presence of any invasive species. If the species is not on the list, please list in the comments section. This list is nationally inclusive, and may not include plants currently in Oklahoma.

6.2.5 Reach-Wide Forms

Various forms will be completed that characterize the entire reach. The Channel Constraint Form classifies channel pattern, constraint and constraining feature. The Torrent evidence accounts for any recent events that may have had dramatic influence on channel characteristics. The visual assessment form classifies watershed activities and disturbances, accounts for the presence of beavers, and allows the sampling team to make a subjective determination of how pristine and appealing the site is. Additionally, comments should be made about the site that do not easily fit into any of the completed forms.

6.3 Boatable Habitat Introduction

Following is a simplistic explanation of each set of measurements made. Please refer to the more detailed protocols for more in-depth explanation For all forms, both front and back, please place site number, transect or sub-reach, and date.

6.3.1 Channel/Riparian Transect Forms

These forms should be completed as the front and back of the same form. The measurements are made at 4x wetted width and characterize the substrate, channel, bank, fish cover, riparian area, and human influence. Unless otherwise noted, all measurements are made with a 10x20 meter plot around the transect on a particular bank. The sample reach layout for boatable habitat is illustrated in Figure 1.

For each transect, several accounting measurements will need to be taken. The arrival/leave time as well as the chosen bank should be included. Transect GPS measurements will be taken at the mid-channel and shore. The intended transect spacing and the actual transect spacing will be recorded on the front page of the form. On the back of the form, the channel will be classified into one of four constraint categories—constrained, in broad valley but constrained by incision, narrow valley but not very constrained, and un-constrained. Also, note the distance from water's edge to riparian vegetation as well as the ability to readily see over the bank from water's edge.

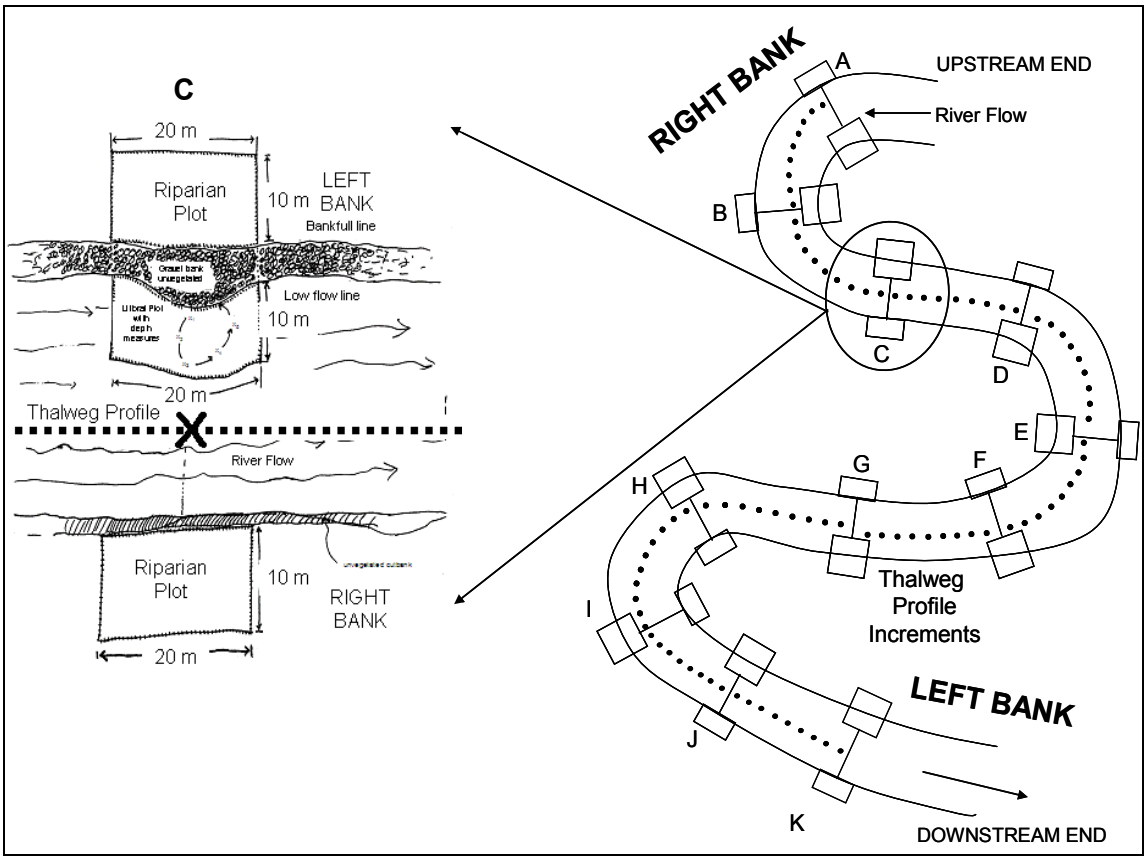

Figure 1. Illustration of sample reach layout and plot for Boatable Habitat.

6.3.1.1 Substrate, Bank and Depth Characteristics

The front page of the habitat form quantifies substrate, depths, and bank characteristics. When entering the 10x20 meter plot begin probing for depth to determine if a rapid dropoff exists. If a large depth difference exists between the edge of the littoral plot and the bank, please not in the comments section of the form. First, the littoral substrates are classified on both the shore and the bottom. Both the dominant and secondary substrates are classified either through judgment or observation (visual or with stadia rod). Second, depth is measured at five points within the 10x20 meter plot. To ensure consistency of measurement, these measurements should be made at five points around the boat. With the boat perpendicular to the shore, measurements should be at just off shore at both the left and right gunwales, left and right of stern, and aft of stern behind and away from the motor. Third, bank characteristics will be measured to the nearest centimeter including wetted, bar, and bankfull widths as well as bankfull and incised heights. When determining heights, the near (work) bank will be compared to the far bank, and the lowest height will be recorded. Also, bank angle will be determined only at the near bank using a gross estimation (pictured on the form) and classified as flat, gradual, steep, and near vertical/undercut.

6.3.1.2 Canopy Cover Measurements

The spherical densitometer is used to measure canopy in the 10x20 meter littoral plot. The number of points intersected along a grid of 17 squares is counted at four bank points including up, down, left and right.

6.3.1.3 Fish Cover Area

These are gross quantifications made within the littoral plot for each transect. For boulders include cobble and gravel in the estimate.

6.3.1.4 Visual Riparian Estimates

This section includes three different kinds of visual estimations. First, riparian vegetation cover is estimated in three cover classes (ground, understory, and canopy) over a 10X10 riparian plot on both banks. Secondly, human influence is classified into four categories including not present, >10 meters from bank, < 10 meters from the bank, and on the bank. For both sets of measurements, the far bank can be visualized and estimated from the near bank.

6.3.2 Woody Debris

Woody debris is tallied on the front page of the Channel/Riparian Form. It is classified and enumerated in two different areas of each sub-reach including the 10x20 littoral plot as well as over the entire sub-reach. For each group, pieces are first classified into one of nine size categories based on large end diameter and length, and then classified as "all/part in wetted channel" or "dry but all/part in bankfull channel". Minimum size is 0.3 meter large end diameter and 5 meter length. A separate form is

6.3.3 Thalweg Profile

A thalweg profile will be taken between each transect at 0.4x wetted width. At each point, depth will be measured to the nearest tenth of a meter using either a stadia rod or sonar. Also, presence will be noted for snags and off channel areas including backwaters. Lastly, at each measurement point, substrate should be classified and a channel habitat code should be determined.

6.3.4 Slope and Bearing Form

Slope and bearing is calculated on all waterbodies with reach lengths of up to 1500 meters. For reaches greater than 2000 meters, maps may be used to determine both slope and bearing. For reaches projected at between 1500 – 2000 meters, maps should be used to predetermine if slope and bearing estimations can be a desktop exercise or if data will need to be collected in the field. The method is described in great detail in the NRSA Field Protocols (USEPA, 2008). Various methods may be used for direct site measurements. However, the transit method is preferred (auto levels and stadia rod) because it is much more accurate and typically not difficult to accomplish.

At most boatable sites, field measurements will not be necessary for slope and bearing determinations. However, it may be determined during the desktop exercise prior to monitoring that additional waypoints may be necessary to verify bearing. The front

page of the Channel/Riparian Transect Form provides additional space for additional sub-reach waypoints.

6.3.5 Supplemental Sub-Reach Fish Habitat/Cover Form

Because the 10x20 meter plot is often not representative of the available fish cover within the sub-reach, an additional form will need to be completed at each of the 10 sub-reaches. Like littoral fish cover form, these are gross quantifications. For boulders include cobble and gravel in the estimate.

6.3.6 Riparian Legacy Tree and Invasive Plant Species

For each main transect, please denote the largest, visible tree within the transect. Record the diameter at breast height (meters), height (meter), distance from wetted margin (meter), type of tree, and either taxonomic category or taxonomic name. Also, note the presence of any invasive species. If the species is not on the list, please list in the comments section. This list is nationally inclusive, and may not include plants currently in Oklahoma.

6.3.7 Reach-Wide Forms

Various forms will be completed that characterize the entire reach. The Channel Constraint Form classifies channel pattern, constraint and constraining feature. The Torrent evidence accounts for any recent events that may have had dramatic influence on channel characteristics. The visual assessment form classifies watershed activities and disturbances, accounts for the presence of beavers, and allows the sampling team to make a subjective determination of how pristine and appealing the site is. Additionally, comments should be made about the site that do not easily fit into any of the completed forms.

7.0 Forms

7.1 Field Notes

Field notes are documents used to annotate and record information that is gathered at the project site. They are a data sheet and should be treated as such. Therefore, they should be written, legible, and complete. To avoid confusion and loss of data, a new sheet should be used at each new project site. Field notes should be initialed and dated by the collecting personnel and data entry personnel. For guidance on proper procedure to complete the field notes, refer to your supervisor and or FTE. Field notes can be found at S:\Monitoring\STREAMS\forms\.

8.0 Data Storage

All completed paper copies of forms and data sheets should be maintained with the appropriate station notebook. The data from the field notes and laboratory data sheets should be either entered into or uploaded to the Water Quality Biological Database and a provided electronic spreadsheet with automated habitat calculations. Each sample should be maintained electronically in the database under a unique sample number.

9.0 References

United States Environmental Protection Agency. 1999. Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers, 2nd Edition. EPA 841-B-99-002. Office of Water, Washington, D.C.

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Oklahoma Conservation Commission, Water Quality Division. 2001. Standard Operating Procedures Habitat Assessment. Oklahoma City, OK.

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Oklahoma Water Resources Board. 2005. Standard Operating Procedures for the Measurement of Stream Discharge. Oklahoma City, OK.