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Technical Memorandum

Date: July 8, 2011 Project Number: 1882.01

Prepared by: Dudley W. Reiser, Ph.D.

Subject: Review and evaluation of wetted perimeter analysis as presented in the report titled: Interim minimum flow recommendations for maintenance of juvenile steelhead rearing habitat on the Big Sur River, Monterey County, California; California Department of Fish and Game, May 17, 2011.

Introduction and Questions Addressed

On June 1, 2011 I was requested by the law office of Duane Morris LLP to complete an independent review of the subject document that presented the results of a wetted perimeter (WP) analysis completed by the California Department of Fish and Game (CDFG) pertaining to the Big Sur River, in California. I learned that a water rights application on the Big Sur River had been filed by the El Sur Ranch, and that the CDFG report had been submitted by the State to support their recommendations for interim minimum flows for fish habitat in the Big Sur River. The interim minimum flows were based on the data and analysis presented in the report.

As background, I was provided a copy of the report, as well as copies of two sets of field notes that I was told contained data used in the wetted perimeter analysis. The first set of data consisted of 25 pages and covered the period September 17, 1992 through June 9, 1993. The second set of data consisted of 38 pages and spanned the period June 10, 1993 through August 3, 1995. I was also provided an excel file (BSR_wetted perimeter_PRA) that ostensibly contained electronic data that had been entered from the field books that were used in generating the wetted perimeter vs. flow relationships found in the report.

I was therefore specifically requested to complete the following two assignments:

1. Review the CDFG (2011) report and its conclusions, and all of the supporting field data (data from September 17, 1992 through August 3, 1995) and electronic data (Excel files BSR_Wetted_ Perimeter_PRA); and
2. Evaluate whether the data and methods used in the report are reliable, were appropriately used, and support the conclusions reached concerning the interim flow needs of the Big Sur River.

This Technical Memorandum (TM) presents the results of my review and evaluation. The TM is a companion to a series of numbered PowerPoint (PPT) slides that describe the results of my evaluation; these slides were used during my oral testimony presented on July 8, 2011 and where appropriate, are cross-referenced in this TM (**PPT slides 1 and 2** restate the two assignments noted above). Copies of all of the PPT slides are appended to this TM.

Qualifications for Making this Evaluation

I am a Senior Fisheries Scientist with and President of R2 Resource Consultants, a company that specializes in environmental and engineering consulting with a special focus on fish and aquatic ecology, instream flow assessments, habitat assessments, fisheries engineering, and habitat restoration. The company also provides technical expertise to clients relative to issues involving the federal Endangered Species Act (ESA). My qualifications for completing this assignment are presented in my vitae, a copy of which I have appended to the TM. In summary, I have more than 30 years experience in working on instream flow related issues and have applied a variety of instream flow needs assessment tools for defining flow requirements, including the wetted perimeter method which is at issue in this proceeding.

In completing my review and analysis, I directed and received technical support from Dr. Stuart Beck, P.E., one of R2's hydraulic and hydrologic engineers who has worked extensively on instream flow issues and in the application of hydraulic models.

Methods Used

My approach in completing this evaluation was to first complete a detailed review of the CDFG (2011) report and the associated field data, and a comparison of the field data with the electronic data files. This was done to gain an understanding of the methods that were used in developing the WP-flow relationships for the Big Sur River, and the rationale for selecting specific flows that were considered as "interim minimum flow recommendations". The review of the field data and field notes provided insight into the data collection methods that were used and the purpose for which the data had been originally collected. The comparison of the electronic data files with the field data was done to check whether the field data had been used in deriving the WP-flow relationships depicted in the CDFG (2011) report.

Based on my review of the above information, I conducted additional analyses that included 1) a general review of the wetted perimeter methodology as described by a number of technical references **(PPT slides 5-8);** 2) a comparison of the methods employed by the CDFG with WP-flow methods described in the technical references that included consideration of transect

permanency, transect placement relative to length of habitat unit measured, and consistency in transect measurement techniques **(PPT slides 4, 9 and 10);** 3) plotting all five individual transect WP-flow relationships for each of the ten sites on the same figure rather than plotting an average of the five transects as was done by the CDFG (2011) **(PPT slides 11-20);** and 4) a review of the range of flow conditions measured for each site, and a comparison of the shapes of the WP-flow relationships based on transects defined by a low flow measurement, with transects that were defined without a low flow measurement **(PPT slides 21-23).**

Conclusions

Based on my review of the CDFG (2011) report and associated data, I concluded that although the data are reliable for making inferences relative to general habitat characteristics of each habitat unit during the different survey dates, the data were not intended to be used and were not collected in a fashion that they could be used in developing accurate WP-flow relationships. Therefore, I conclude that the data are unreliable for developing accurate WP-flow relationships and therefore the results presented in CDFG (2011) should not be relied upon or used for determining interim minimum flow recommendations. The bases for these conclusions are presented below.

1. My review of the field notes suggested that the data used in deriving the WP-flow relationships were not originally intended for that purpose, but were rather collected as ancillary information to characterize habitats during fish surveys taken under different flow conditions. The survey protocol used involved a single depth and velocity measurement taken at the thalweg, and a width measurement of the channel at each sampled cross-section. This protocol is similar to other general macro-habitat characterization methods such as those described in Bain and Stevenson (1999). Had the surveys been focused on instream flow, I would have expected a more robust survey approach that involved multiple measurements of depth and velocity across each transect that would serve to better define wetted perimeter, and as well provide for a measurement of flow at each location. There was no indication in the field notes I reviewed that flow measurements had been taken at any of the cross-sections, which is apparently why the CDFG related the WP – flow relationships to the USGS gage, rather than to local hydrology.

2. The methods the CDFG (2011) applied for deriving WP-flow relationships do not conform to standard practices for developing these types of relationships. My review of salient literature (Annear et al. 2004; EA Engineering, Science and Technology 1986; Wesche and Rechard 1980; Stalnaker and Arnette 1976; and others) served to identify the

major elements of these practices which I listed in **PPT slides 5-8**. As noted in **PPT slide 8**, there are two general approaches to developing WP-flow relationships – an empirical approach which involves the establishment of fixed cross-sectional transects and repeated measurements of depths at numerous intervals across the channel, channel widths, and measurement of flows **(PPT slides 6 and 7)** are schematics that define WP and illustrate its' calculation). This allows the determination of WP at a specific transect under different flows. Numerous measurements (Annear et al. 2004 suggest 10 or more) of each transect than allow for the plotting of WP versus flow. The second approach involves less field time but still requires establishment of fixed cross-sections across each transect and then measurements of depth and channel width, along with water surface elevations. This information can then be used in computer programs that compute stage – discharge relationships for a given transect. Using this relationship, WP can then be determined for a variety of different flows leading to development of a WP-flow relationship.

3. Fundamentally, I would have expected for there to have been "fixed" (i.e., marked by a wooden stake or piece of steel rebar) headpins established **(see PPT slide 5)** on each side of the channel to clearly define the channel transect and ensure that the same exact locations are measured during subsequent surveys. This is extremely important for developing an accurate WP-flow relationship. However, I did not find any indication that "fixed" transects were used for any of the measurements, and therefore I conclude that the same locations and cross-sections were not measured during each of the surveys.

4. I also noted during my review of the field notes that different lengths of stream, which were classified as different habitat units (e.g., C7, C8, through M25) were measured during different surveys and provided an example of this in **PPT slide 10**. The figure includes a table that shows the reach lengths measured on each survey date. The table indicates that 5 transects were measured on each survey date. The schematic of the stream is to scale and shows the distribution of the five transects based on field notes that occurred on October 13, 1992 when 92.1 ft of stream were surveyed, compared with the distribution on November 3, 1993 when 210 ft of stream were surveyed. With the exception of the uppermost transect, which I assumed would be the common starting point for all surveys, there is essentially no overlap in the cross-sections between the different sampling dates. Only 3 of the 7 survey dates used the same reach lengths (186 ft) and ostensibly would therefore have transects aligned at the same relative locations. However, there would be variation even for those transects since the actual measurement locations were not fixed (i.e., no fixed transects were used). Related to this, it is important to note that there can be substantial change in channel morphologies in

relatively short distances of stream that would result in differences in WP-flow relationships. And yet, the CDFG (2011) apparently ignored these differences and simply incorporated measurements from all five transects (computed as averages) for each of the different survey periods to generate WP-flow relationships.

5. The appropriate method for developing these relationships would have been to first establish fixed transect locations, and then complete repeated measurements of water depth at various intervals across the stream, as well as measurements of stream width, along with a flow measurement at each location, and to do this over a wide range of flows - as noted by Annear et al. (2004), perhaps as many as 10 flows. This would have resulted in a valid and accurate WP-Q relationship for each transect. These relationships could then be averaged or weighted (based on habitat distributions) to allow further analysis. The approach CDFG applied is a clear case of mixing apples (i.e. measurements taken from one location(s)) and oranges (i.e. measurements taken from different locations), and will not result in accurate WP - flow relationships. The pooling of transect information collected from different channel locations as was done by the CDFG is not a reliable approach for developing accurate WP-flow relationships.

6. This is clearly demonstrated in the series of ten slides **(PPT slides 11-20)** that we developed that display WP vs. flow relationships of each of the five transects for each of ten habitat units (C7 through M25) based on measurements made during the different survey dates. These are the same data that were used by CDFG (2011) in developing the WP-flow relationships displayed in their report (see Figures 3 and 4 of CDFG 2011). In every instance, there is at least one or more transects that exhibit an anomalous behavior pattern in which WP is shown to decrease with increasing flow that is often followed by an increase. In some instances **(see PPT slide 11)**, this pattern occurs several times. These patterns simply cannot occur under normal circumstances if the same transect is measured at the same locations across the stream under different flow conditions. The figure in **PPT slide 6** can be used to illustrate this. As flows increase or decrease at a given cross-section (transect), the wetted perimeter will always correspondingly increase or decrease. Unless there are major changes in channel morphologies (which would negate the ability to develop accurate WP – flow relationships at any site), there will never be a condition when an increase in flow will result in a decrease in WP, or conversely a decrease in flow would result in an increase in WP. The patterns of WP-flow relationships displayed in the figures are likely the result of a combination of; a) not having "fixed transects" from which to ensure measurement of the same cross-section during each field survey, and; b) the measurement of different lengths of stream being

surveyed at different times resulting in measurements from disparate transect locations **(see PPT slide 10)**.

7. Rather than displaying individual transect WP-flow relationships as in **PPT slides 11-20**, which is the most appropriate way since WP-flow relationships are location-specific, the CDFG (2011) averaged the WP values across all five transects for a given survey date and related that to the flow occurring on that date based on the USGS gage. They did this for each survey date and then plotted the average WP values against the respective flows per the USGS gage for the respective dates. This averaging process ignores the inherent differences in the WP-flow relationships that occur at specific locations, and reduces the overall validity and reliability of the relationships for use in determining instream flow needs. Moreover, this process results in the development of a WP – flow relationship that includes values that were not consistently measured from the same location.

8. I also noted that there was no consistency in the flow conditions measured at each location and that there were five sites that included the low flow measurement in September 1994, while the other five sites did not include the low flow measurement **(PPT slide 21).** Inspection of the WP-flow relationships presented in Figures 3 and 4 of CDFG (2011) indicate that the initial inflection point was largely defined by the lowest measured flow at that site. Thus, the inflection points for the five sites for which low flow measurements were made, consistently occur at lower flows than the other five sites for which low flow measurements were not made.

9. To illustrate this, I plotted each of the site relationships depicted in Figures 3 and 4 of CDFG (2011), but normalized the curves so that WP is expressed as a percentage of the maximum wetted perimeter that could occur for each curve **(PPT slides 22 and 23).** I also computed a WP-flow curve that represents the median of the five curves that included the low flow measurement (I did this for only four curves for the non-low flow measured sites; I omitted site M20 from the analysis due to the absence of any lower flow measurements (the lowest flow for which measurements were made was around 20 cfs)). I then imposed lines originating from 50%, 70%, and 80% of the maximum WP that intersected with the median line and noted the resulting flows. This process clearly indicated that when low flow measurements were included in the data set, the inflection points (and the percentage of maximum WP intersection points) occurred at lower flows than indicated by the relationships that lacked a low flow measurement **(compare PPT slide 22 with PPT slide 23).** For example, 70% of the maximum WP would occur at a flow of 3.9 cfs when low flow measurements were included in the data set, and the same level of WP would occur at a flow of 9.0 cfs when low flow measurements were not

included in the data set. Notwithstanding the other problems with the analysis and data noted above, this indicates that the number and range of flows measured were insufficient to accurately define WP – flow relationships for the sites. This further demonstrates the unreliability of the data for developing WP – flow relationships and affirms my earlier statement that the information should not be used in defining instream flow needs.

References

Annear, T., I. Chisholm, H. Beecher, A. Locke, P. Aarrestad, C. Coomer, C. Estes, J. Hunt, R. Jacobson, G. Jobsis, J. Kauffman, J. Marshall, K. Mayes, G. Smith, R. Wentworth, and C. Stalnaker. 2004. Instream Flows for Riverine Resource Stewardship - Revised Edition. Instream Flow Council, Cheyenne, WY.

Bain, M. B. and N. J. Stevenson.(eds). 1999. Aquatic Habitat Assessment: Common Methods. American Fisheries Society, Bethesda, Maryland.

EA Engineering, Science and Technology. 1986. Instream flow methodologies. Electric Power Research Institute. EA-4819, Research Project 2194-2.

Nelson, F. (Unpub). Guidelines for using the wetted perimeter (WETP) computer program of the Montana Department of Fish, Wildlife and Parks. (1984). 104 pp.

Stalnaker, C.B., and J.L. Arnette. 1976. Methodologies for the determination of stream resource maintenance flow requirements: An assessment. Wester Water Association, Office of Biological Service. U.S. Fish and Wildlife Service. U.S. Dept. of the Interior, Washington, D.C.

Wesche, T.A. and P.A. Rechard. 1980. A summary of instream flow methods for fisheries and related research needs. Wyoming Water Resources Research Institute. Eisenhower Consortium Bulletin 9.

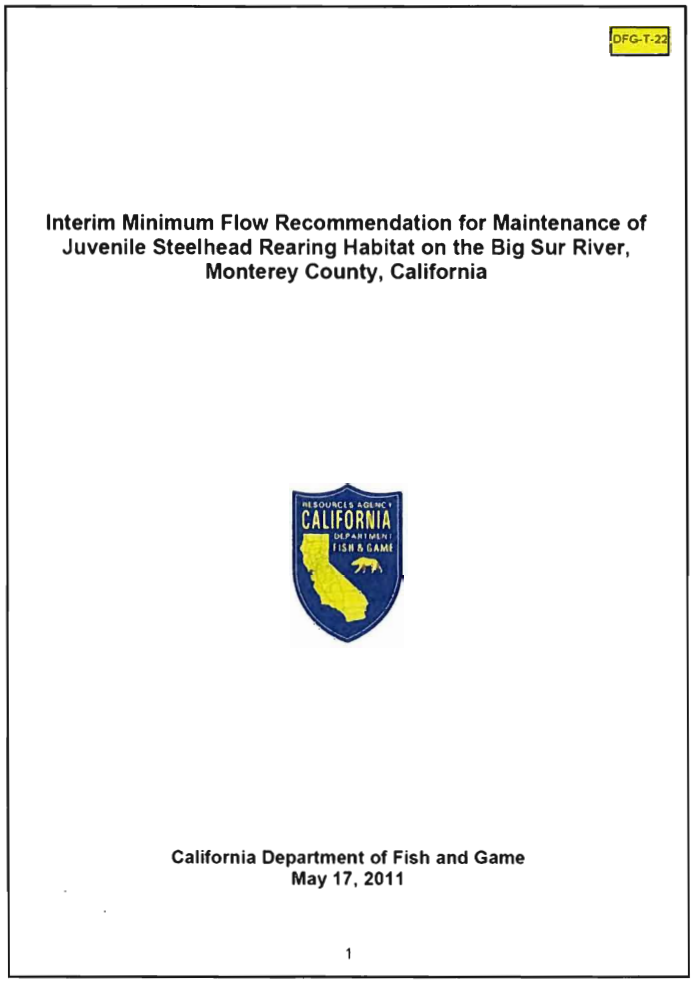
APPENDIX A

PowerPoint Slides

Assignment

1

1. Review CDFG (2011) report and its conclusions, and supporting field data (data from September 17, 1992 through August 3, 1995) and electronic data (Excel files (BSR_Wetted_ Perimeter_PRA).



DFG-T-22

Interim Minimum Flow Recommendation for Maintenance of Juvenile Steelhead Rearing Habitat on the Big Sur River, Monterey County, California

California Department of Fish and Game
May 17, 2011

1

Assignment

2

2. Evaluate whether the data and methods used in the report are reliable, were appropriately used, and support the conclusions reached concerning the interim flow needs of the Big Sur River.

Conclusions

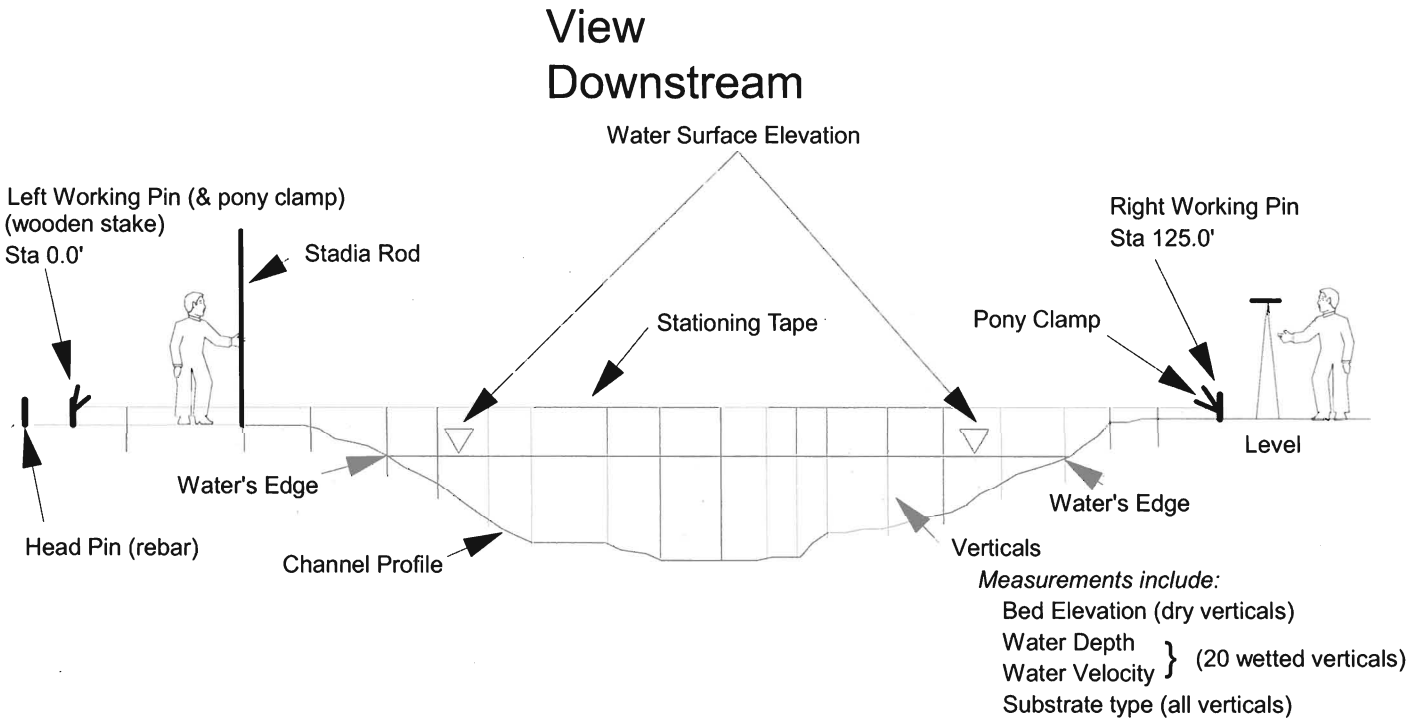
- The data used in the report are RELIABLE *for habitat characterization purposes.*
- The data are NOT RELIABLE for deriving accurate Wetted Perimeter vs Flow relationships for the Big Sur River.

Basis for Conclusions

- Data were not collected specifically for use in a WP-Q analysis but rather a general habitat characterization.
- Data collection methods did not conform to standard practices for defining WP-Q analysis.

General methods to determine WP-Flow relationships (Annear et al. 2004)

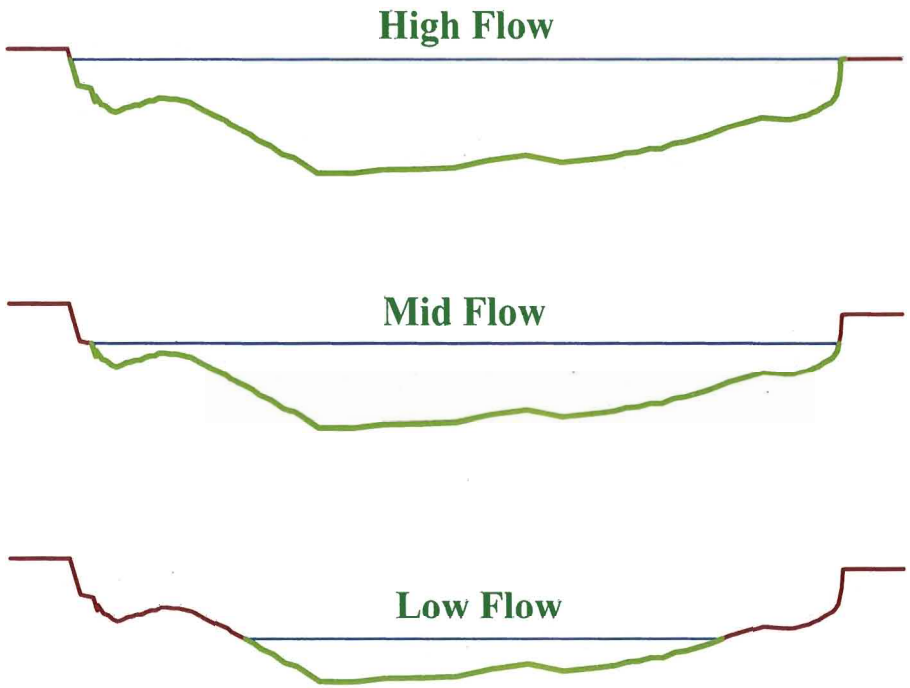
- Establish 1 or more fixed Cross-channel transects at locations representative of riffle



Wetted Perimeter Definition

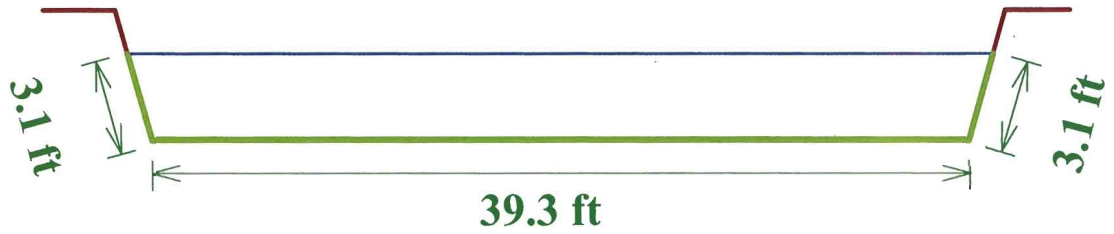
Total length of wetted portion of cross-section

Wetted perimeter shown as green line in illustration



Wetted Perimeter Calculation

Simple Trapezoidal Cross-Section Shape



Wetted Perimeter = 3.1 ft + 39.3 ft + 3.1 ft = 45.5 ft

WP-Flow Relationships

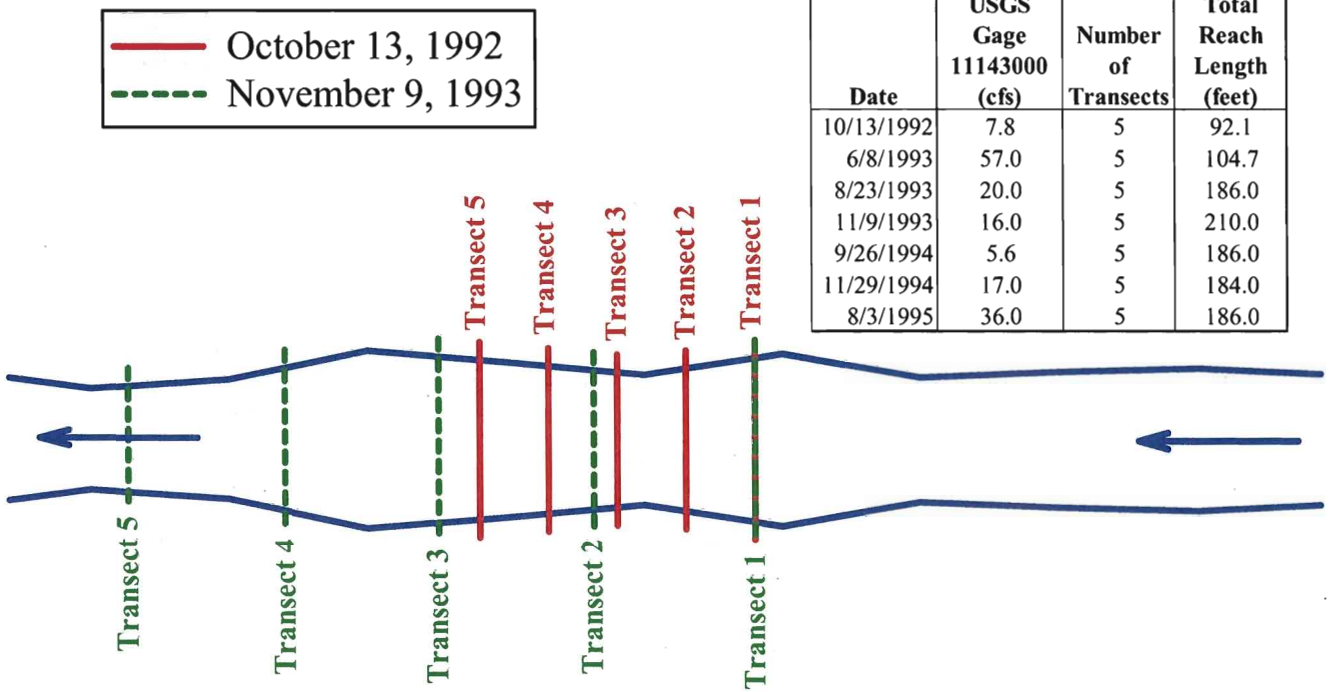
- Empirical Derivation
  - Measurements of water depth and widths at numerous intervals (verticals) across "fixed" transects.
  - Same locations and intervals measured under numerous different flows (Annear et al. 2004 suggest 10 or more flows should be measured).
  - Plot WP vs Flow.
- Computer generation
  - Single set of field measurements that includes Water Surface elevation.
  - Synthesize stage-discharge relationships that

Basis for Conclusions (cont)

- CDFG 2011 Analysis
  - No "fixed" transects used - same locations not sampled each time.
  - Different lengths of stream surveyed at different times – same locations not sampled each time.
  - Included thalweg depths and channel widths that appear to have been measured at different locations, within the same data set used in developing WP-flow relationships for a given location.

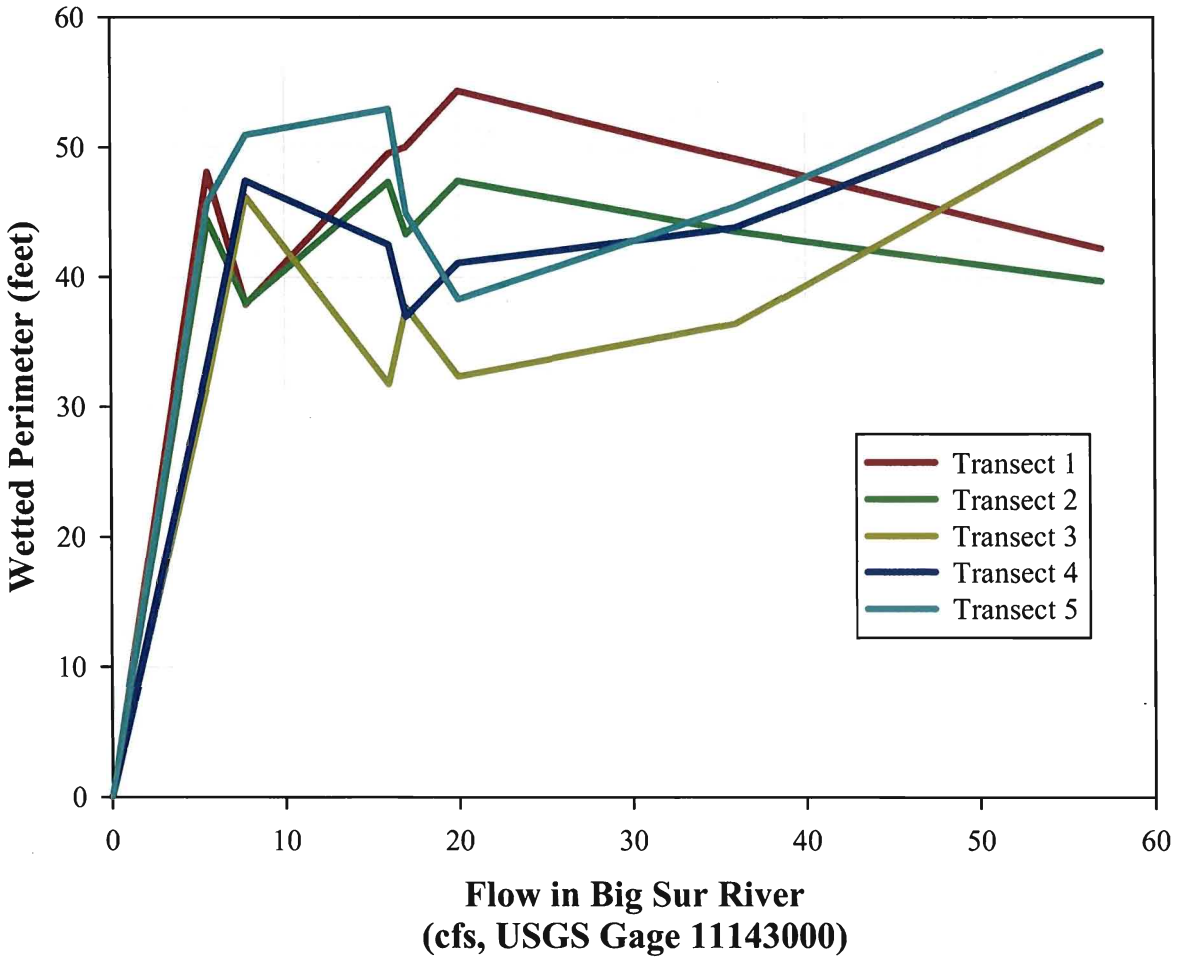
Transect Locations on Two Different Dates at Site C7

10

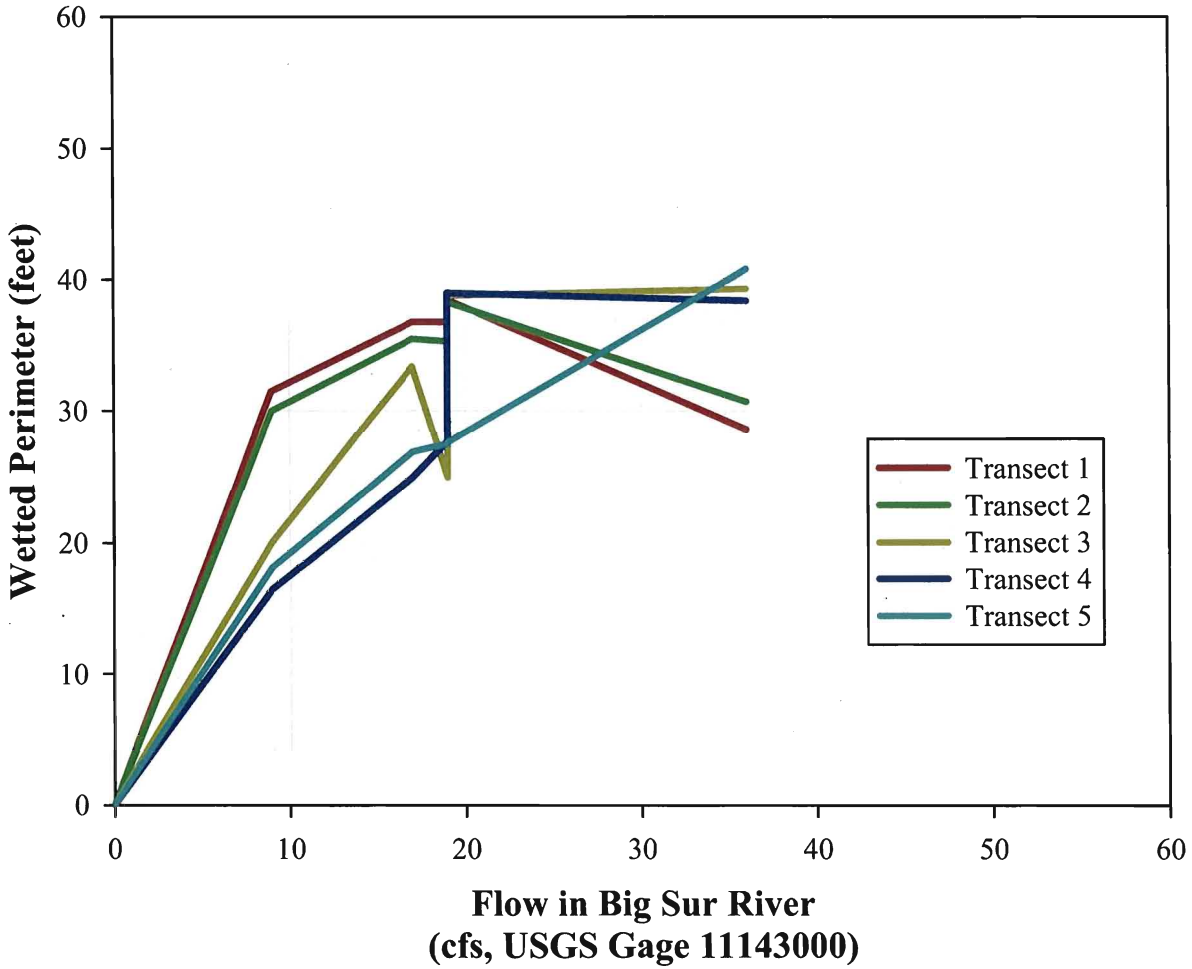


Date	Flow at USGS Gage 11143000 (cfs)	Number of Transects	Total Reach Length (feet)
10/13/1992	7.8	5	92.1
6/8/1993	57.0	5	104.7
8/23/1993	20.0	5	186.0
11/9/1993	16.0	5	210.0
9/26/1994	5.6	5	186.0
11/29/1994	17.0	5	184.0
8/3/1995	36.0	5	186.0

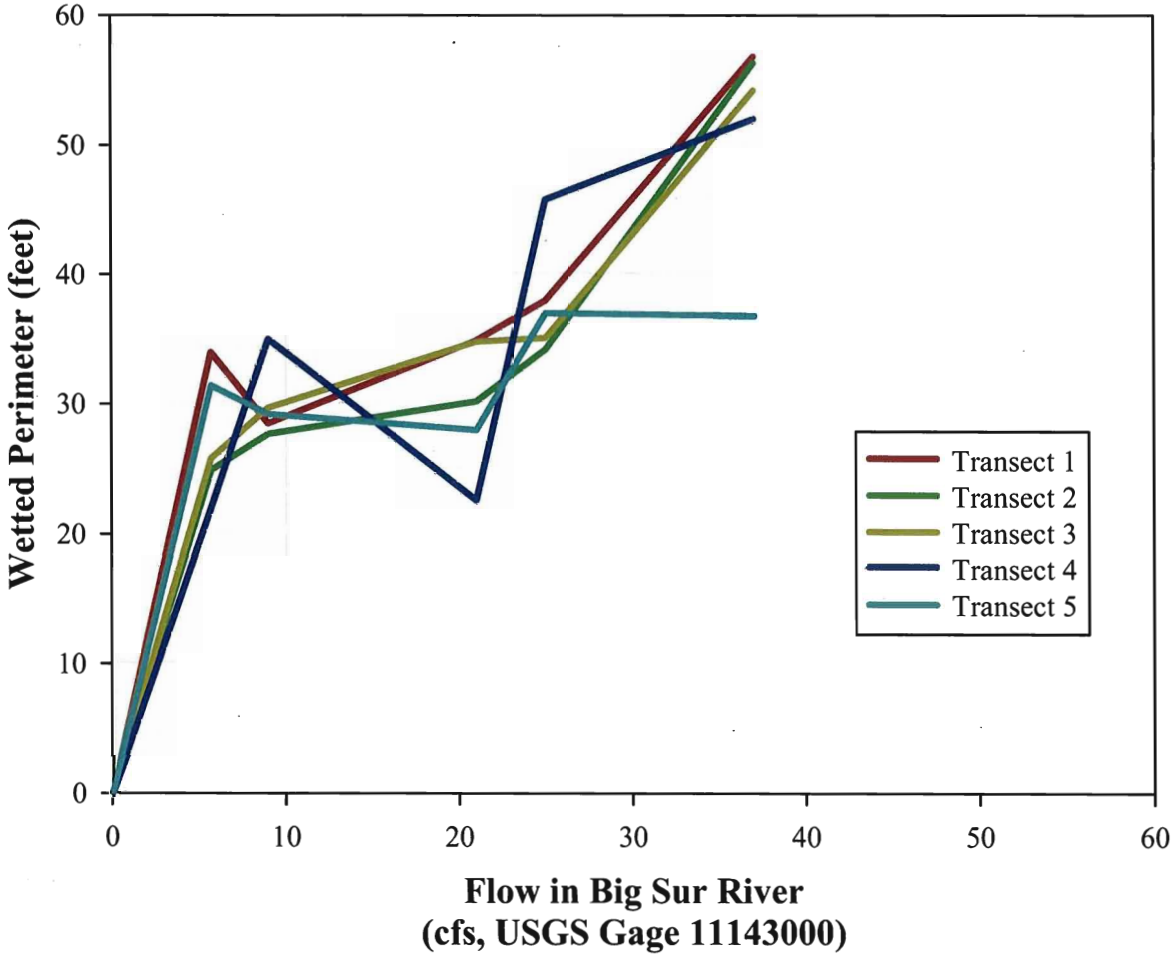
Wetted Perimeter/Flow Relationships for Each Transect at Site C7



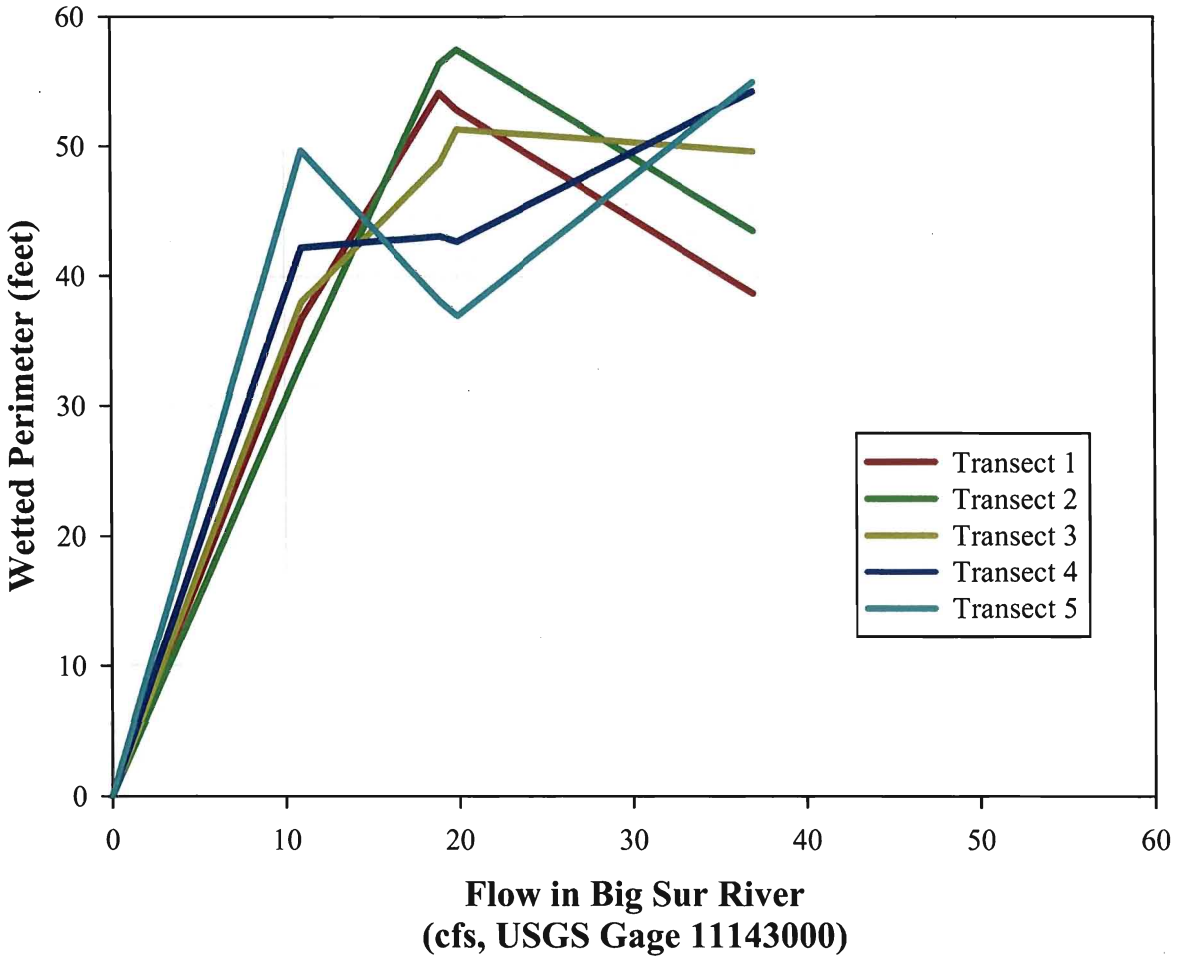
Wetted Perimeter/Flow Relationships for Each Transect at Site C14



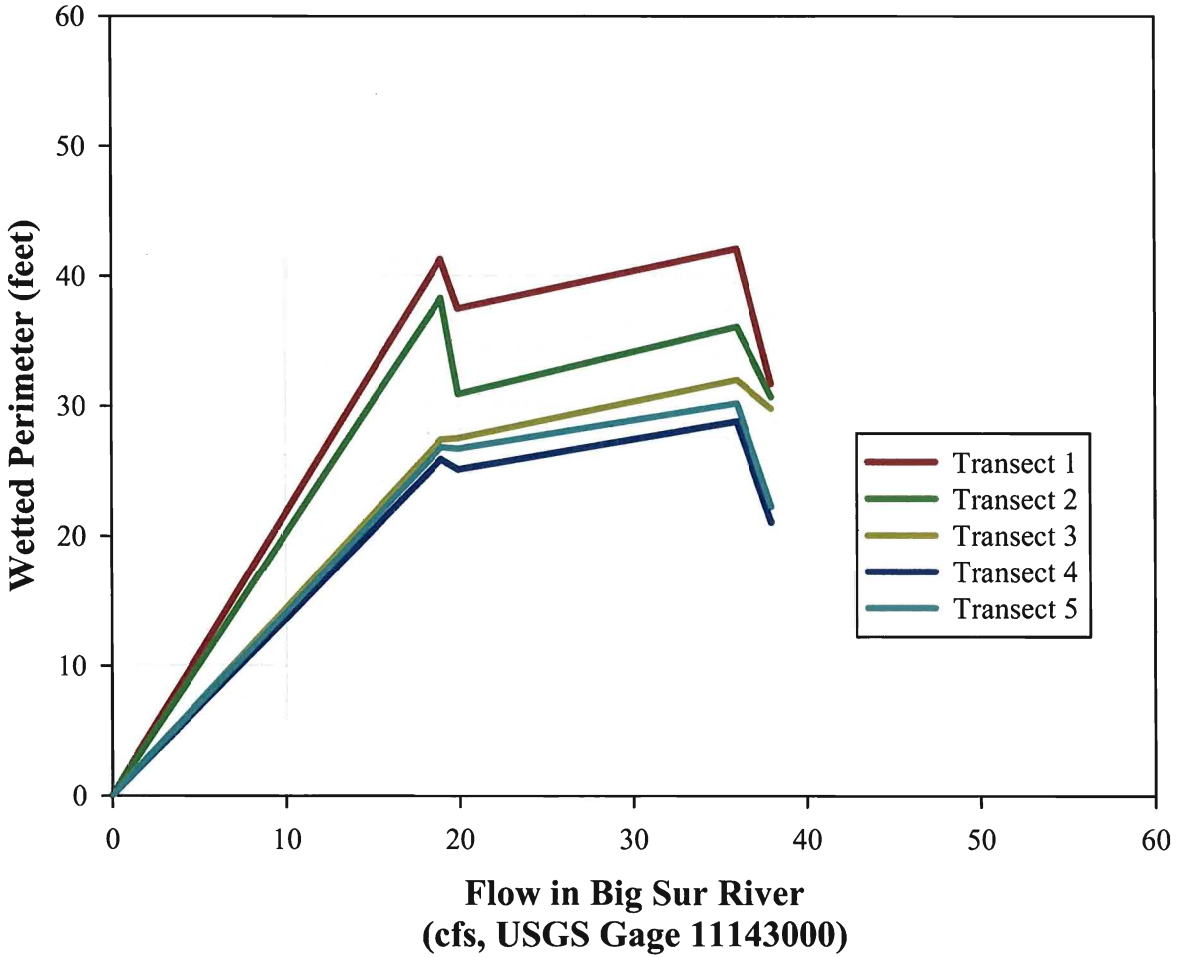
Wetted Perimeter/Flow Relationships for Each Transect at Site M16



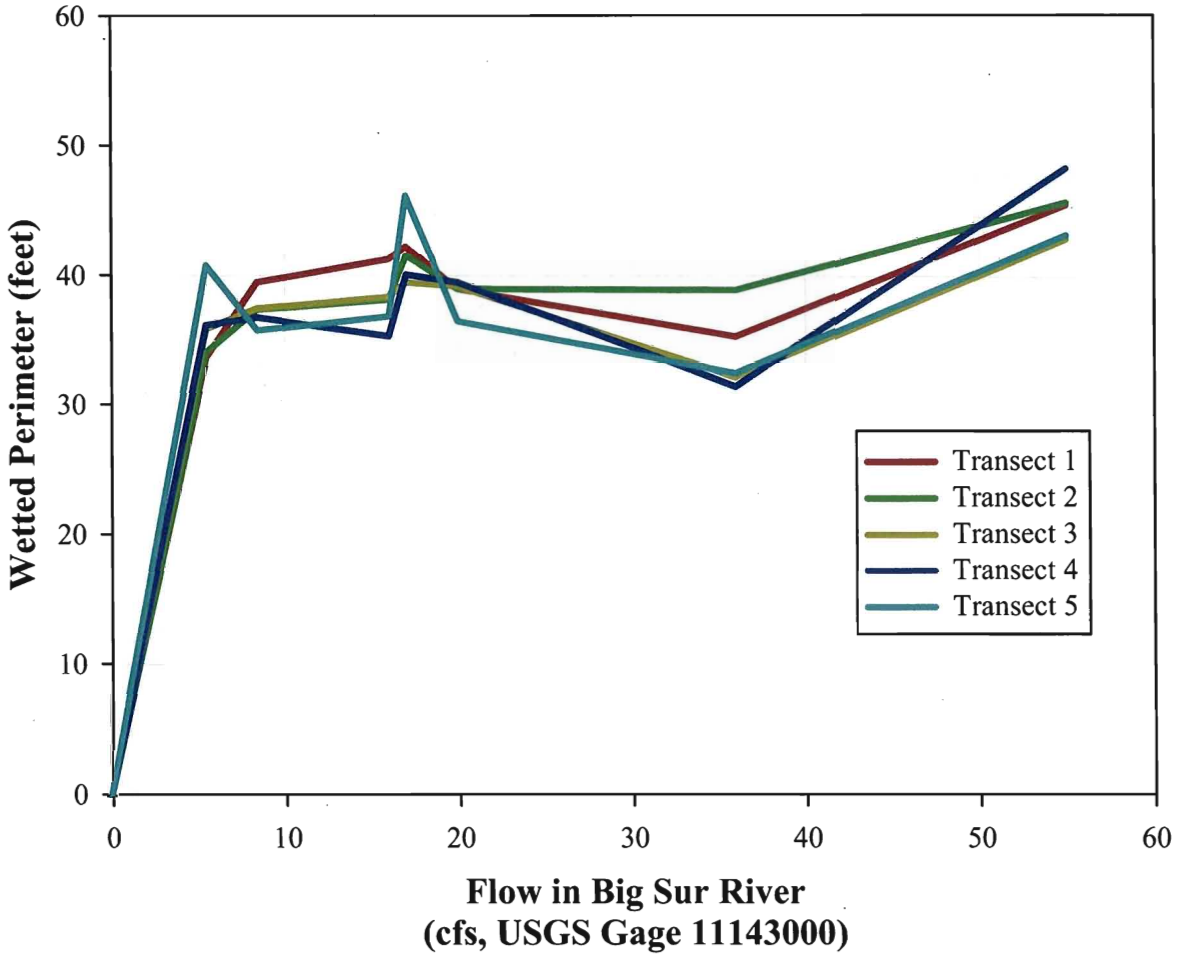
Wetted Perimeter/Flow Relationships for Each Transect at Site M18



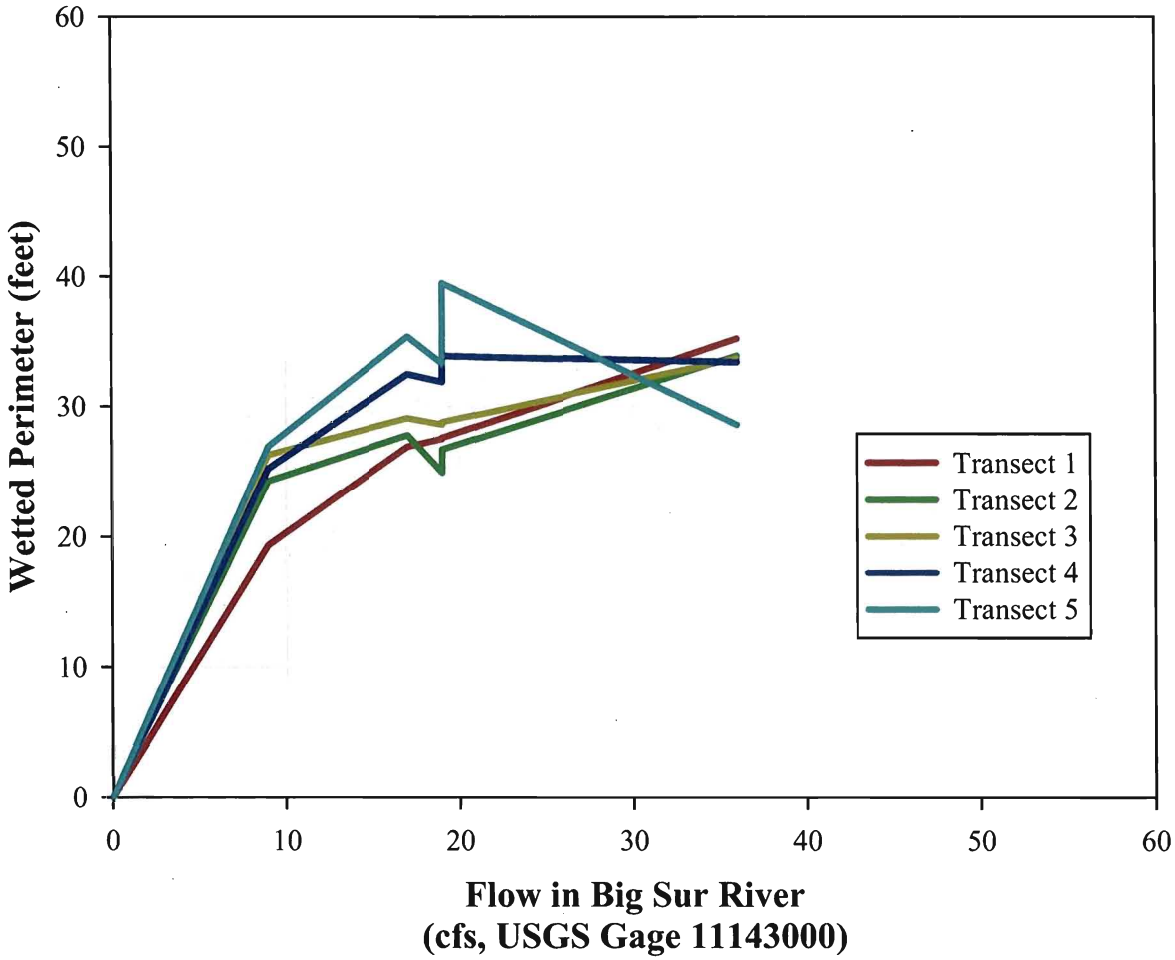
Wetted Perimeter/Flow Relationships for Each Transect at Site M20



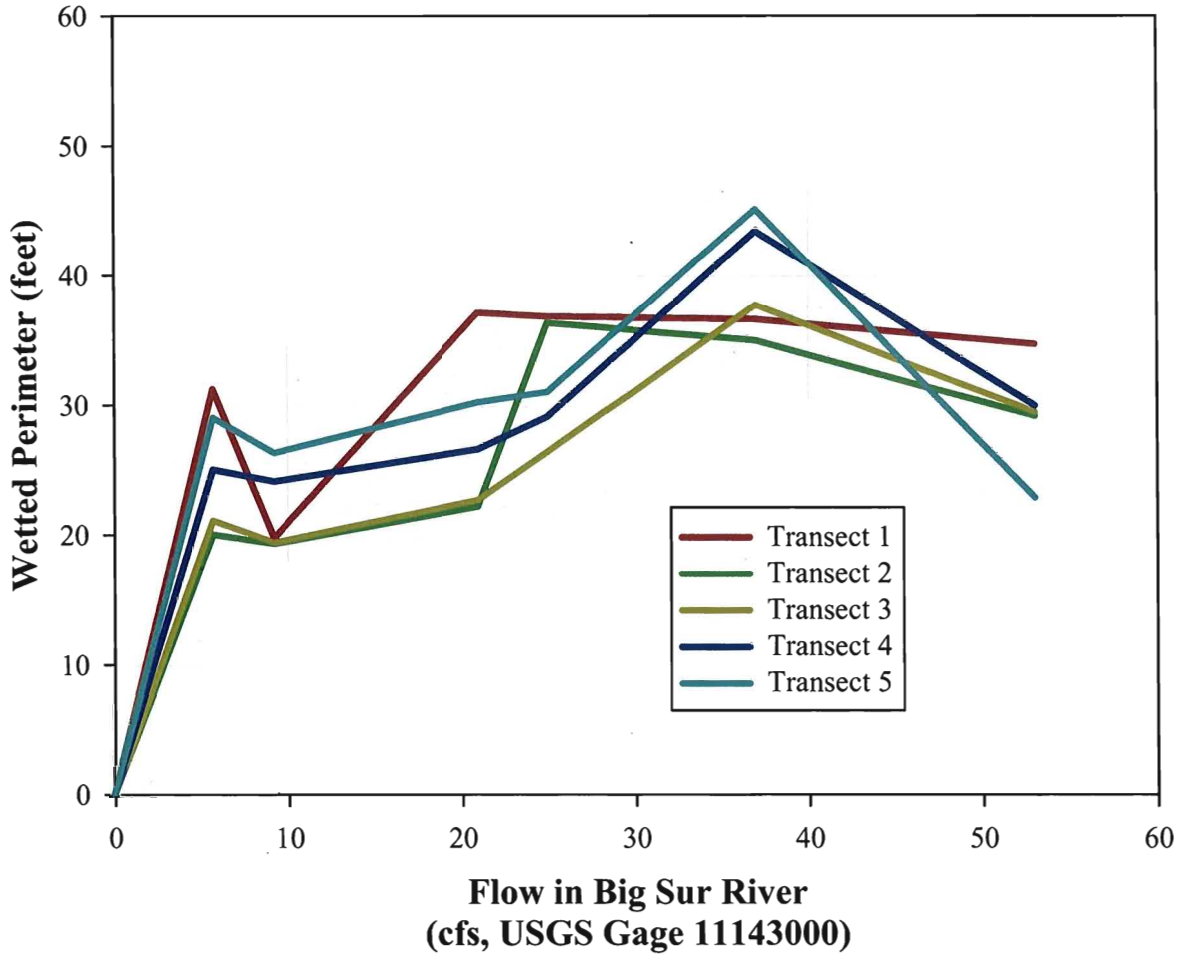
Wetted Perimeter/Flow Relationships for Each Transect at Site C9



Wetted Perimeter/Flow Relationships for Each Transect at Site C15

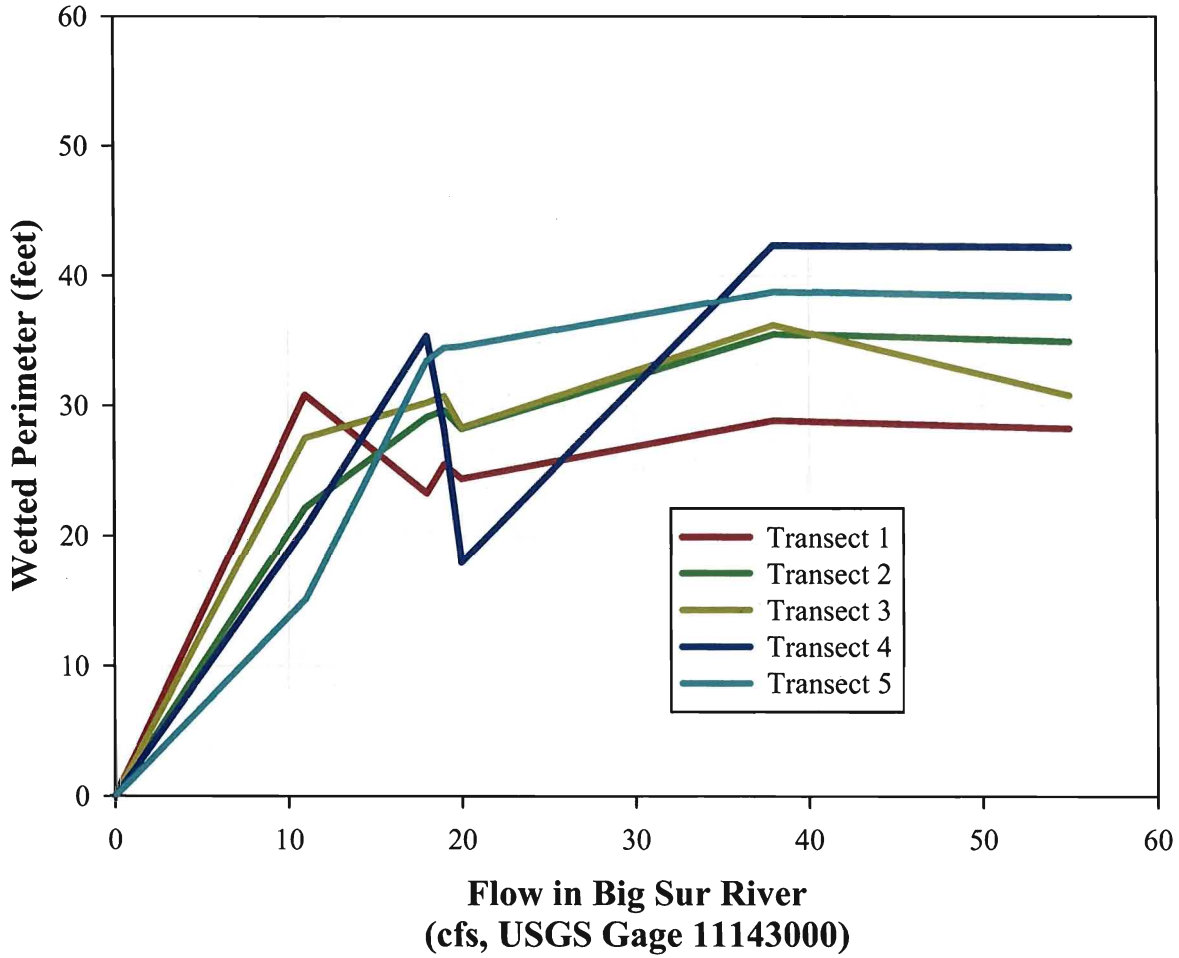


Wetted Perimeter/Flow Relationships for Each Transect at Site M17

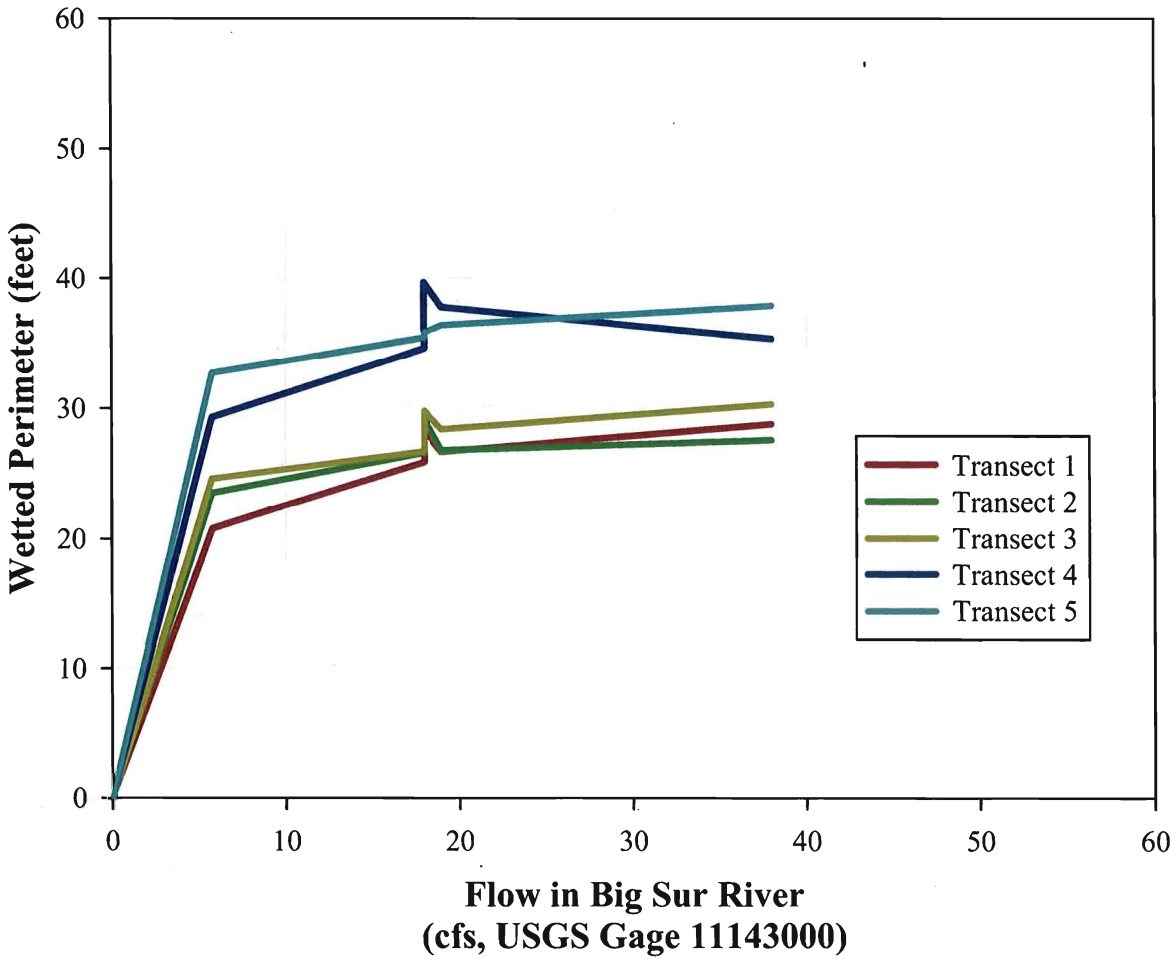


Wetted Perimeter/Flow Relationships for Each Transect at Site M23

19



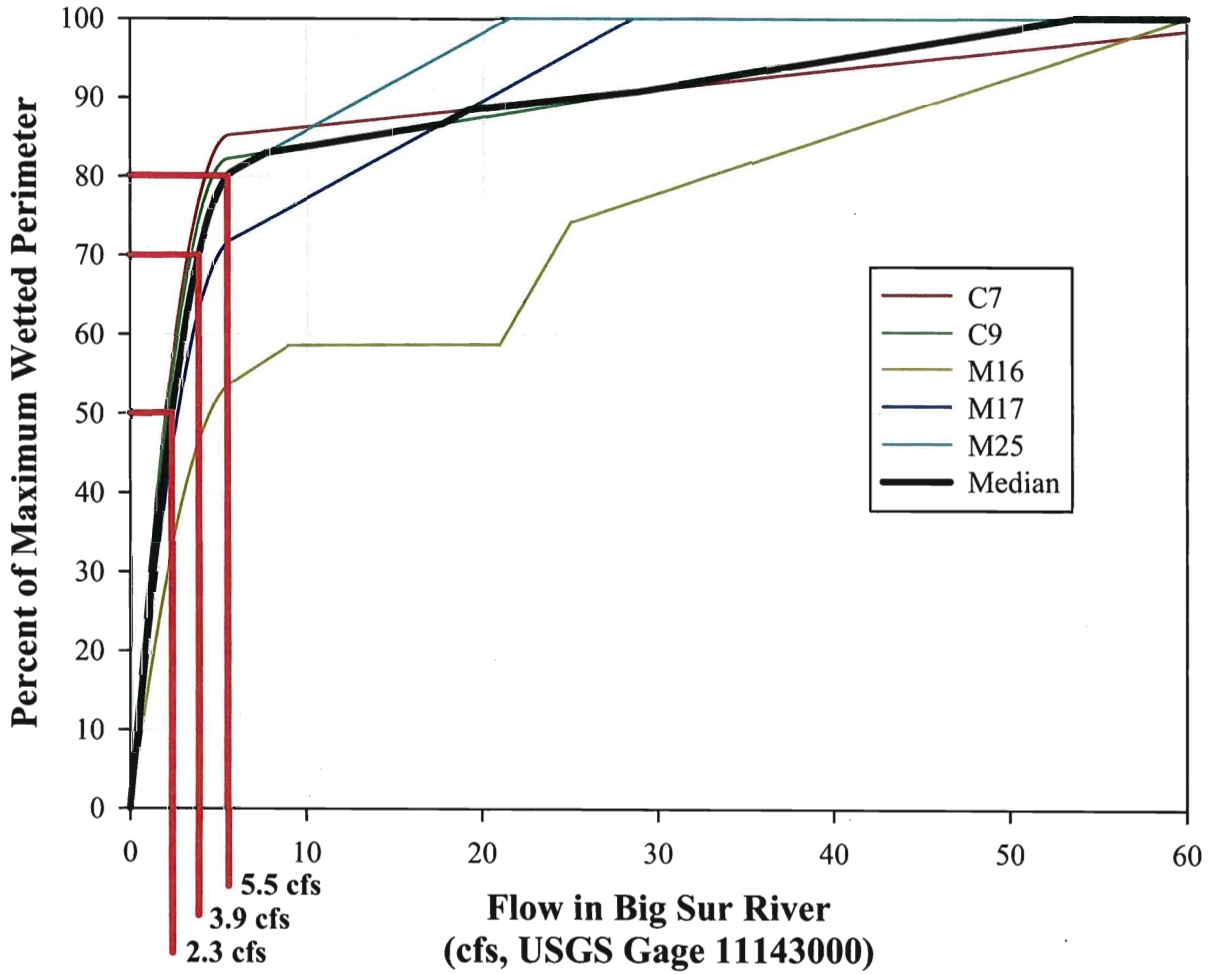
Wetted Perimeter/Flow Relationships for Each Transect at Site M25



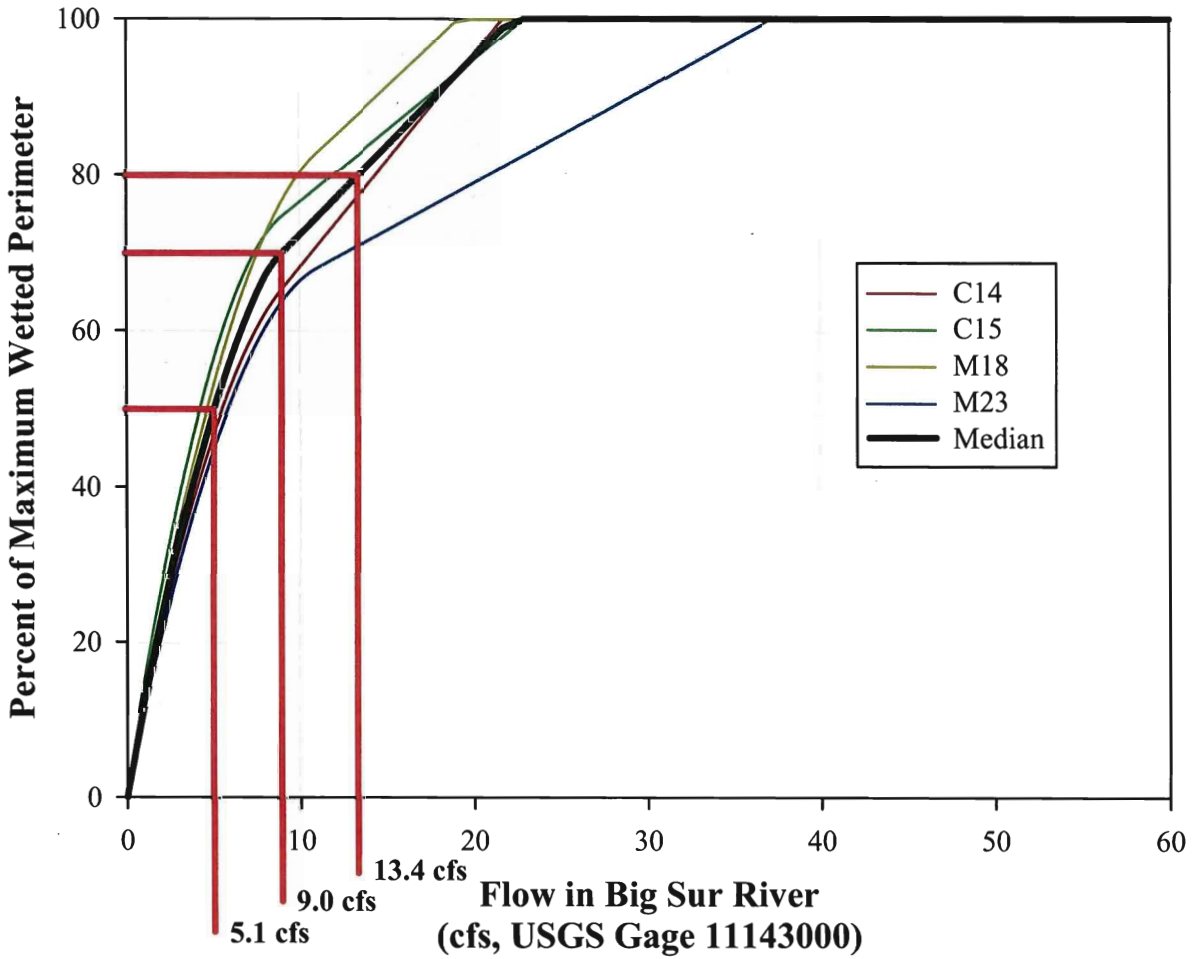
Basis for Conclusions (cont)

- CDFG 2011 Analysis
  - No consistency in the flow conditions measured at the different locations; five locations included "low flow measurements in September 94"; the other five did not.
  - Inflection points largely determined by "lowest" flow measured.

Sites Visited Under Low Flow Conditions (September 1994)



Sites Not Visited Under Low Flow Conditions



Conclusions - Restated

- The data used in the report are RELIABLE *for habitat characterization purposes.*
- The data are NOT RELIABLE for deriving accurate Wetted Perimeter vs Flow relationships for the Big Sur River.

APPENDIX B

Vitae – D. Reiser

DUDLEY W. REISER, Ph.D. – PRESIDENT
Senior Fisheries Scientist

Dr. Reiser is a fisheries scientist and the President of R2 Resource Consultants, and has more than 30 years experience designing, implementing, and managing fisheries and aquatic ecology projects, and habitat and instream flow assessments. His particular areas of expertise include fish ecology (anadromous and resident species), habitat assessments and criteria development, endangered species evaluations, assessments of flow regulation on fish populations and habitats, fisheries habitat enhancement, fisheries engineering, instream flow studies, assessments of sedimentation impacts on aquatic ecosystems, and flushing flow studies (related to sediment deposition).

EDUCATION

Ph.D. (Forestry, Wildlife and Range Sciences – major in fishery resources) University of Idaho, 1981
M.S. (Water Resources) University of Wyoming, 1976
B.A. (Zoology) Miami University, Ohio, 1972

PROFESSIONAL AFFILIATIONS AND CERTIFICATIONS

Certified USFWS IFIM Course - Computer Modeling (201), IFIM:IFG210, SNTEMP (310)
Certified USFWS Course - Expert Witness Seminar
Certified SCUBA DIVER - PADI and YMCA
American Fisheries Society (AFS), Certified Fisheries Scientist (No. 1447), Re-Certified (No. 2463)
Society of Environmental Toxicology and Chemistry
Co-editor, Sustainable Fisheries – Pacific Salmon, Lewis Publishers.
Past Member, Editorial Board, "Rivers: Studies in the Science, Environmental Policy, and Law of Flowing Waters" (ongoing member since 1992)
Member, Independent Science Panel (ISP) – Washington State – appointed by Governor Gary Locke to serve on Salmon Recovery Science Panel, Term: 1999-2003; reappointed by Governor Gregoire through 2006.

EMPLOYMENT HISTORY

R2 Resource Consultants, Inc., Redmond, Washington, President, Senior Fisheries Scientist, 1992-Present
EA Engineering, Science, and Technology, Redmond, Washington, Vice President, Senior Fisheries Scientist, 1987-1992
Bechtel Corporation, San Francisco, California, Senior Fisheries Scientist, 1982-1987
Camp Dresser and McKee Inc., Denver, Colorado, Senior Fisheries Scientist, 1980-1982
Idaho Cooperative Fishery Research Unit, Moscow, Idaho, 1977-1980
Wyoming Water Resources Research Institute, Laramie, Wyoming, 1974-1977

EXPERIENCE

Habitat Modeling, Instream Flow and Flushing Flow Determinations: Extensive experience in the area of habitat and instream flow assessments in Alaska, California, Colorado, Idaho, Montana, New York, Vermont, North Carolina, Oregon, Washington, and Wyoming. Has applied a variety of IF methods including the USFWS IFIM/PHABSIM, Tennant (Montana) Method, Wetted Perimeter (WP), Trout Cover Rating (TCR), Toe-width, R-2 Cross Method, and the New England Method. Project Manager and Principal-in-charge of one of the largest instream flow studies conducted in North America; the study was conducted as part of the Snake River Basin Adjudication and included over 1100 basins within the Salmon and Clearwater basins of Idaho. Other ongoing and recent instream flow projects directed by Dr. Reiser include: instream flow and lake level recommendations related to the Klamath River Basin Adjudication (for the BIA), determination of flow recommendations for the Duck Valley Indian Reservation, Nevada and Idaho (for the BIA), instream flow studies related to a large mine in Alaska, an assessment of instream flow requirements below Madison Dam, Montana (conducted for the Montana Power Company), and instream flow studies on Ward Creek below Connell Dam and Whitman Creek below Whitman Dam near Ketchikan, Alaska (conducted for Ketchikan Public Utility). Dr Reiser is also the Project Manager of a national instream flow support contract to the U.S. Forest Service to provide technical assistance related to instream flow issues associated with hydroelectric relicensing. He was also involved in a study for the Chelan PUD evaluating instream flow and passage flows within a bypass reach below Lake Chelan.

Habitat Assessments and Habitat Suitability Curve Development: Principal investigator of a comparative habitat study evaluating limiting factors within the Clark Fork River, Montana. Applied a variety of habitat quantification methods including IFIM, Habitat Quality Index (HQI), Habitat Suitability Index system (HSI), and Trout Cover Rating (TCR). Project Manager of a comprehensive aquatic ecosystem assessment (conducted for the U.S. Fish and Wildlife Service) of the South Fork Coeur d'Alene River watershed, focused on evaluating factors controlling wild trout production. Collected, analyzed, and developed habitat suitability (Category II) curves for brown and brook trout, bull trout, Chinook salmon, pink salmon, chum salmon, and steelhead trout. Invited participant in bull trout experts meeting to develop Habitat Suitability Curves (Category I) for bull trout spawning, juvenile rearing, adult holding, and fry. Organized and conducted three habitat suitability curve workshops designed to review and develop Category I curves for anadromous and resident salmonid species for drainages in Oregon and Idaho. Principal investigator of a microhabitat study to define habitat utilization of coho and Chinook salmon, and steelhead trout in the White River, Washington; data were collected by direct observation using snorkeling techniques.

Endangered Species Issues: Direct experience in working on endangered species issues related to resource developments, including those that influence streamflow, temperature, habitat quality and quantity. Project Manager of technical studies on bull trout for Seattle Water Department (SWD); assisted in coordination of studies for integration into SWD Habitat Conservation Plan (HCP). Invited member of Independent Scientific Review Panel by USFWS to evaluate the current risk of extinction of Lost River and shortnose suckers in the Klamath Basin, Oregon. Project Manager for Tri-County Urban Issues ESA response project focused on evaluating restoration options for listed Chinook salmon within urban watersheds. Project Manager of an HCP developed for the J.L. Storedahl & Sons Daybreak Mine located near the East Fork Lewis River, Washington, and more recently an HCP for the City of Kent's

water supply. Project Manager for development of restoration plans for reintroducing the federally listed endangered Snake River Chinook salmon into the Panther Creek drainage in Idaho. Project Manager for a bull trout evaluation for the Seattle City Light in connection with the Boundary Hydroelectric Project and Ross Lake Project. Appointed by Washington Governor Gary Locke and re-appointed by Governor Gregoire to serve on a five member Independent Science Panel focused on salmon recovery in the State of Washington.

Fish Population Assessments: Directed numerous studies focused on determining fish population abundance and dynamics in streams and rivers. These have most recently included fish studies conducted for the City of Kent pertaining to the Green River Natural Resources Area, and streams that may be influenced by the revised Critical Areas Ordinance; General Electric (Housatonic River, Massachusetts), the Seattle Water Department (Lake Chester Morse and Cedar watershed), Montana Power Company (Holter and Hauser reservoirs; Missouri River), Atlantic Richfield Company (Clark Fork River and tributaries), U.S. Fish and Wildlife Service (Coeur d'Alene basin and St. Regis Rivers), J.L. Storedahl Company (series of gravel ponds adjacent to the East Fork Lewis River), and Ketchikan Public Utilities (Whitman and Connell lakes, and tributaries). Dr. Reiser has recently initiated a study for the City of Seattle evaluating the effects of reservoir management on bull trout redds and egg survival. Fishery surveys often include use of a variety of gear types including electrofishing, seining, gill netting, trapping, hook and line, and snorkeling.

Fisheries Habitat Enhancement: Project manager for a mine reclamation fishery habitat enhancement project for the Bonneville Power Administration (BPA) for Panther Creek, Idaho; a fisheries engineering habitat enhancement project on the Yankee Fork of the Salmon River, Idaho, for the Shoshone-Bannock Indian Tribes; a habitat enhancement project on the East Fork Salmon River Idaho for the Shoshone-Bannock Tribes, a tributary improvement study for Pacific Gas and Electric Company (PG&E) in California; a feasibility study for developing an artificial spawning channel in Montana; a gravel supplementation study to evaluate options for increasing brown and rainbow trout spawning success within the Madison River below Madison Dam (for Montana Power Company); and most recently, development of habitat restoration options designed to restore runs of Chinook salmon back to Panther Creek (conducted for NMFS). Enhancement measures included instream structures, bank stabilization, spawning channel development, spawning gravel supplementation, rearing pond development (low-technology and natural), and barrier removal, mine tailings pond stabilization, and dam removal. Project Manager of biomonitoring studies of the Mill-Willow Bypass channel in Montana, a channel that was completely reconstructed following the removal of mine tailings and floodplain construction. The studies have included assessments of habitat, monitoring of invertebrate communities, water quality and fish recolonization.

Natural Resource Damage Assessments (Aquatic Studies): Principal investigator of four investigations directly related to NRDAs and litigation. These have included a comprehensive nine (9) year study of the upper Clark Fork River, Montana for the Atlantic Richfield Company. Dr. Reiser provided expert testimony in trial (State of Montana v. Atlantic Richfield Company; U.S. District Court of Montana) concerning his work and his critique of the plaintiff's application of a reference stream analysis. For the U.S. Fish and Wildlife Service, Dr. Reiser conducted detailed studies in the Coeur d'Alene Basin, including a reference stream analysis, and provided expert testimony during depositions and trial in U.S. District Court of Idaho. Dr. Reiser also directed the preparation of a Biological Compensation and

Restoration Plan for the reintroduction of Chinook salmon into Panther Creek. That work was part of an NRDA investigation on behalf of the National Marine Fisheries Service. Dr. Reiser was also the principal investigator of a two year largemouth bass reproductive study conducted for General Electric Company in Pittsfield, Massachusetts that was related to EPA clean-up actions on the Housatonic River.

Fish Passage: Awarded Outstanding Technical Paper award (Bechtel) for work involving the development of a procedure for assessing fish passage problems at low head hydro projects. Evaluated passage problems and barrier potential (Chinook salmon and steelhead) of the Lake Redding project in California. Developed conceptual designs of fish passage facilities for salmon (Atlantic salmon) at two hydro projects in Connecticut. Assessed barrier potential (Chinook salmon and steelhead) of falls in two Idaho streams, and formulated plans for removal of an abandoned power dam in the East Fork Salmon River drainage in Idaho. Designed barrier analysis study for potential flow-dependent barriers located in Ward Creek, below Connell Dam near Ketchikan, Alaska. Involved in the development of concepts for upstream and downstream fish passage (steelhead trout) on the Carmel River in California. Reviewed and assessed suitability of upstream and downstream passage facilities for the Milford Dam on the Penobscot River.

Hydroelectric Project Licensing Studies: Dr. Reiser has worked on licensing/relicensing studies on over 20 hydroelectric projects. These have included most recently, the Henry M. Jackson Hydroelectric Project (Washington), Boundary Hydroelectric Project (Washington), Skagit Project (Washington), White River (Washington), Clackamas (Oregon), Deschutes (Oregon), Carmen-Smith (Oregon), Connell and Whitman (Alaska), Cooper Lake (Alaska), Upper American River (California), Big Creek (California), Tapoco (North Carolina), Natahala (North Carolina), and Missouri-Madison (Montana). He has provided both technical and strategic support on many of these projects and has worked from the utility, stakeholder, and the FERC perspective. His working experience on these projects has involved the traditional, ALP, and ILP relicensing procedures. In addition, for the Clackamas Project, he served as the aquatic and fisheries resource lead for a 3rd party DEIS prepared for the FERC. Dr. Reiser also recently served as the Project Manager of a national technical support contract with the U.S. Forest Service where he participated in instream flow related studies associated with hydroelectric relicensing involving a number of resource issues including fish flows, impacts of flow fluctuations, impacts of whitewater flows on aquatic biota, and sediment transport issues. Most recently, he is directing three studies being completed as part of the ILP process for the Jackson Hydroelectric Project.

Book and Manuscript Reviews: Technical manuscript reviewer for Fisheries, Rivers, Transactions of the American Fisheries Society, North American Journal of Fisheries Management, and Environmental Management. Has reviewed technical reports for the U.S. Fish and Wildlife Service, U.S. Geological Survey, the U.S. Forest Service, National Marine Fisheries Service, and various State resource agencies. Member of the Editorial Board for "Rivers," a journal focused on addressing instream flow issues. Published several formal reviews of books in "Rivers" and "Fisheries."

TESTIMONY AT HEARINGS, TRIAL AND DEPOSITIONS

Klamath Basin Adjudication (before the Office of Administrative Hearings, State of Oregon)

1. Provided Affidavit and Direct Testimony for Cases 277, 279, 280 and 281 related to the Determination of the relative rights of the waters of the Klamath River, a tributary to the Pacific Ocean; submitted on behalf of the Bureau of Indian Affairs, 2010.
2. Provided Rebuttal Testimony for Cases 277, 279, 280 and 281, 2010.

Klamath Basin Adjudication (before the Water Resources Director of Oregon)

1) Provided Affidavit in support of instream flow claims for Klamath River; submitted on behalf of Bureau of Indian Affairs, 2006.
2) Provided Affidavit in support of instream flow claims for streams in the Upper Klamath River Basin, submitted on behalf of Bureau of Indian Affairs, 2006.
3) Provided Affidavit in support of instream flow claims developed on behalf of the Bureau of Indian Affairs, 1997.

State of Washington, Shoreline Hearings Board; Daybreak Mining and Habitat Enhancement Project; Provided testimony on behalf of the J.L. Storedahl Company, August 2005.

Clark County, Washington, Public Land Use Hearings regarding Daybreak Mining and Habitat Enhancement; Case No. REZ98-011; CUP20004-00002. Provided testimony on behalf of the J.L. Storedahl Company, May and June 2004.

United States of America vs. ASARCO Inc. et al. (Case No. 96-0122-N-EJL and Case No. 91-9342-N-EJL) (District of Idaho) (Testimony provided on behalf of the United States, Department of Justice, U.S. Fish and Wildlife Service).

1) Provided testimony during depositions – (Seattle, Washington) (December 15-16, 1999).
2) Provided testimony during trial in United States District Court, District of Idaho, Boise Idaho, February 28-March 1, 2001.

State of Montana vs. Atlantic Richfield Company (No. CF-83-317-HLN-PGH) (District of Montana) (Testimony provided on behalf of Atlantic Richfield Company)

1) Provided testimony during depositions – (Seattle, Washington) (January 18-20, 1996).
2) Provided testimony during trial (United States District Court, District of Montana – Great Falls, Montana) (April 21-24, 1997).

Snake River Basin Adjudication (Case No. 39576) (District Court of the Fifth Judicial District of the State of Idaho, in and for the County of Twin Falls) (Testimony provided on behalf of the United States, Department of Justice, Bureau of Indian Affairs).

1) Provided testimony during depositions – (Lynnwood, Washington) (April 27-30, 1999).
2) Provided Declarations/Affidavits in support of instream flow claims developed on behalf of the Bureau of Indian Affairs, June 1995 and April 1998.

Puget Sound Energy, Inc. – Federal Energy Regulatory Commission (White River Project No. 2494-002)

1) Provided Declaration in support of Puget's request for a license order stay (March 13, 1998).

California State Water Resources Control Board – 1995.

1) Provided oral testimony regarding proposed Salinity standards for San Francisco Bay – Delta, California.

SELECTED PUBLICATIONS AND TECHNICAL REPORTS

Reiser, D. W. 2008. Enhancing Salmonid Populations via Spawning Habitat Restorative Actions. 2008. Pages 349-376 *in* D. Sear and P. DeVries, editors. Salmonid Spawning Habitat in Rivers: Physical Controls, Biological Responses, and Approaches to Remediation. American Fisheries Society, Symposium Publication No. 365. Bethesda, Maryland.

Reiser, D. W., M. Gagner, C. Huang, T. Sullivan, S. Beck, T. Nightengale, and C. Morello. 2008. Determination and evaluation of habitat – flow relationships in the Sultan River, Washington. Sultan River Instream Flow Study. Prepared by R2 Resource Consultants, for Public Utility District No. 1 of Shohomish County and City of Everett.

T. J. Sullivan, D. W. Reiser, M. Gagner, and S. M. Beck. 2008. Penny Creek fish passage feasibility study: Phase 2 – assessment of Penny Creek anadromous salmonid production potential and fish passage technical considerations. Report prepared for U.S. Fish and Wildlife Service, under contract to MWH Americas.

Reiser, D. W, T. Nightengale, N. Hendrix, and S. Beck. 2008. Effects of pulse-type flows resulting from hydroelectric operations on aquatic biota. Hydro Review. May Issue.

Reiser, D. W. 2007. Species distributions, life history strategies and habitat-flow requirements of anadromous salmonid populations in the Yukon River Basin, Alaska. Report prepared for the Native American Rights Fund. Anchorage, Alaska.

DeVries, P., D. Reiser, C. Huang, S. Beck, M. Ramey, A. Olson, N. Hendrix, K. Oliver, T. Nightengale, J. Reilly, T. Kenward, and M. Palmer. 2007. North Coast instream flow policy: scientific basis and development of alternatives protecting anadromous salmonids. Task 3 Report – Administrative Draft. Prepared for California State Water Resources Control Board.

Souchon, Y., C. Sabaton, R. Deibel, D. Reiser, J. Kershner, M.l Gard, C. Katopodis, P. Leonard, N. Poff, W. Miller, and B. Lamb. 2007. Detecting biological responses to flow management: missed opportunities: future directions. River Research and Applications, 24: 506-518.

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DeVries, P., D. Reiser, and N. Hendrix. 2006. Tests of regional Habitat Suitability Index curves: validation of Snake River Basin Adjudication curves with empirical data and comparison of curves developed independently for the Big Creek and Upper American River projects, Sierra Nevada,

California. Technical Memorandum No. 2. Prepared for U.S. Forest Service, Fort Collins, Colorado.

Reiser, D. W., C. Morello, M. Gagner, and T. Nightengale. 2006. Fish, habitat, and benthic macroinvertebrate surveys of selected streams within the City of Kent, Washington. Technical Report prepared for City of Kent, Washington.

Reiser, D. W., C. Huang, S. Beck, M. Gagner, and E. Jeanes. 2006. Defining flow windows for upstream passage of adult anadromous salmonids at cascades and falls. Transactions of the American Fisheries Society; 135:668-679.

Beck, S. and D. Reiser. 2006. Monitoring of gravel quality in the Sultan River, Washington. Report prepared by R2 Resource Consultants for Snohomish County Public Utility District.

Reiser, D. W, T. Nightengale, N. Hendrix, and S. Beck. 2005. Effects of pulse-type flows on benthic macroinvertebrates and fish: a review and synthesis of information. Report prepared by R2 Resource Consultants for Pacific Gas and Electric Company, San Ramon, California.

Harvey, B., S. McBain, D. Reiser, L. Rempel, and L. Sklar. 2005. Key uncertainties in gravel augmentation: geomorphological and biological research needs for effective river restoration. Prepared by CALFED Science Program and Ecosystem Restoration Program and Gravel Augmentation Panel, Sacramento, California.

Nightengale, T., and D. Reiser. 2005. Comparison of benthic macroinvertebrates in spring- vs run-off dominated streams in the Upper Klamath Basin, Oregon. Report prepared by R2 Resource Consultants for Bureau of Indian Affairs, Portland, Oregon.

Nightengale, T., N. Hendrix, S. Beck, and D. Reiser. 2005. Macroinvertebrate data analysis for Tule River and Rock Creek-Cresta (FERC No. 1962) Projects. Prepared for Pacific Gas and Electric Company, San Ramon, California. Prepared by R2 Resource Consultants, Inc. Redmond, Washington.

Reiser, D. W. 2005. Instream flows for fish and aquatic biota: a review of technical considerations and commonly applied methodologies. Technical Paper, R2 Resource Consultants, prepared for Seattle City Light and Seattle Public Utilities.

Reiser, D. W., C. Morello, M. Appy, E. Jeanes, and A. Olson. 2005. Monitoring the Green River Natural Resource Area for salmonid utilization. Report prepared by R2 Resource Consultants for City of Kent, Washington.

Loftus, M. E., and D. Reiser. 2004. Evidence of Repetitive Spawning Activity of Lost River and Shortnose Suckers from USBR Radio-telemetry Studies, 1993 – 1999, Technical Memorandum; in R2 Resource Consultants. 2004. A compendium of technical memoranda related to water quality and shortnose (*Chasmistes brevirostris*) and Lost River (*Delistes luxatus*) suckers population demographics in Upper Klamath Lake, Oregon. Prepared for Bureau of Indian Affairs, Portland, Oregon.

Helser, T., M. Loftus, and D. Reiser. 2004. A Statistical Model of Upper Klamath Lake Adult Sucker Depth Utilization; Technical Memorandum; in R2 Resource Consultants. 2004. A compendium of technical memoranda related to water quality and shortnose (*Chasmistes brevirostris*) and Lost River (*Delistes luxatus*) suckers population demographics in Upper Klamath Lake, Oregon. Prepared for Bureau of Indian Affairs, Portland, Oregon.

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REPORTS AND TECHNICAL MEMORANDUM PREPARED AS A MEMBER OF WASHINGTON'S INDEPENDENT SCIENCE PANEL

Currens, K., H. Li, J. McIntyre, W. Megahan, and D. Reiser. 2003. Review of Stormwater Management Manual for Western Washington. August 2001. Washington Independent Science Panel. Report 2003-1. Olympia, Washington.

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Bechtel Civil and Minerals. 1984. Preliminary review of fish passage structures for application to the Collinsville Hydroelectric Projects. Prepared for Metropolitan District Commission, Connecticut.

Bechtel Civil and Minerals and Bechtel Group, Inc. 1982. Lake Redding power project – report on the dam as fish migration barrier. Prepared for the City of Redding, California.

PRESENTATIONS/SEMINARS/WORKSHOPS

Reiser, D. W., T. Nightengale, N. Hendrix, and S. Beck. 2006. Effects of pulse-type flows resulting from hydroelectric operations on aquatic biota. Paper presented at 2006 Hydrovision, Portland, Oregon.

Reiser, D. W. and N. Hendrix. 2006. Translation of incremental changes in flow/habitat to changes in population size/viability – What new science process understanding is open for development. Invited Keynote speaker at U.S. Geological Survey workshop on – Analysis Of Flow And Habitat For Instream Flow Aquatic Communities: Tools And Approaches For Decision-Making And Resource Management. April 18-19, 2006, Fort Collins, Colorado.

Reiser, D. W., M. E. Loftus, T. Helser, and N. Hendrix. 2005. Relationship of adult Lost River and Shortnose Sucker habitat in Upper Klamath Lake to changes in lake level elevation. Paper presented at American Fisheries Society 135th Annual Meeting, Anchorage, Alaska.

Reiser, D. W. E. Jeanes, D. Woodward, and A. Farag. 2004. A reference stream approach for identifying resource injury in the South Fork Coeur d'Alene River, Idaho. Paper presented at Fourth SETAC World Congress. Portland, Oregon.

Reiser, D. W., P. DeVries, P. Sampson, and M. Ramey. 2004. Development of basin-wide instream flow recommendations using statistical and extrapolation techniques. Paper presented at Annual Meeting of North Pacific International Chapter of the American Fisheries Society.

Reiser, D. W., D. Chapin, P. DeVries, and M. Ramey. 2003. Flow regime and ecosystem interactions in spring dominated streams: implications for selecting instream flow methods. Paper presented at International IFIM Conference, June 2003, Fort Collins, Colorado.

Reiser, D. W., E. Jeanes, M. Ramey, and S. Beck. 2003. Comparison of salmonid spawning habitat quality, quantity and utilization before and after channel reconstruction at a Superfund site. Presented at American Fisheries Society 133rd Annual Meeting, Quebec City, Quebec, Canada.

Reiser, D. W. 2003. Streamflows and salmonids. Invited paper presented at specialty conference - Instream Flow Science and Management: Developing a Comprehensive, Ecosystem Based Approach, May 28-29, 2003, University of Washington, Seattle, Washington.

Reiser, D. W., C. Huang, M. Gagner, E. Jeanes, and M. Ramey. 2003. Assessing the passage potential of five natural falls in Ward Creek, Alaska, under varying flow conditions. Presented at Western Division American Fisheries Society Annual Meeting, San Diego, California.

Reiser, D. W. 2002. Instream flows: what do fish need? Invited paper presented at the Ninth Annual Regional Conference on The Endangered Species Act. January 24-25, 2002, Seattle, Washington.

Reiser, D. W., and E. Greenberg. 2002. Largemouth bass reproduction and population dynamics in the Housatonic River, Massachusetts. Society of Environmental Toxicology and Chemistry, Annual Meeting, Salt Lake City, Utah. November 17-20, 2002.

DeVries, P., D. W. Reiser, S. Beck, M. Ramey, and B. Kvam. 2002. Effects of ramping rates on fish stranding and invertebrate density in Lower Flathead River, below Kerr Dam, Montana. Presented at American Fisheries Society 132nd Annual Meeting, Baltimore, Maryland.

Reiser, D. W. 2002. Instream flow requirements: finding methods that work. Presented at Instream Flow Needs specialty conference, HydroVision 2002, Portland, Oregon.

Reiser, D. W., and E. Jeanes. 2002. Defining salmonid carrying capacity in a newly constructed stream channel. Presented at Western Division American Fisheries Society Annual Meeting, Spokane, Washington.

Reiser, D. W. 2001. Invited Participant. USDA Forest Service Workshop on Amphibian Habitat Modeling and Instream Flow Incremental Methodology Advanced Technology Concepts, April 11-12, 2001, Sacramento, California.

Reiser, D. W. 2001. Invited Panel Member. Society for Ecological Restoration, Northwest Chapter. Restoration Objectives. April 5-6, 2001, Bellevue, Washington.

Reiser, D. W. 2000. Biological and ecological considerations in river restoration. Short course seminar presented at American Society of Civil Engineers national meeting – short course – Planning for

River Restoration, October 2000. Seattle, Washington. (Co-instructors, Peter Klingeman and Jeff Bradley).

Grant, G., and D. W. Reiser. 2000. Identification of geomorphology issues relative to the Clackamas River Hydroelectric Project. Presentation to Clackamas Fish and Aquatics Group, Portland, Oregon.

Reiser, D. W., and D. Jepsen. 2000. Review of fish passage alternatives for the Clackamas Hydroelectric Project, and a review of existing information on fish passage studies. Presentation to Fish Passage Sub-group, Clackamas Fish and Aquatics Group, Portland, Oregon.

Reiser, D. W. 2000. Overview of the Tri-County ESA urban issues study. Presentation to Tri-County Executive Committee, Seattle, Washington.

Reiser, D. W. 2000. Summary of the Tri-County ESA urban issues study. Presentation to Puget Sound Business Coalition, Seattle, Washington.

Reiser, D. W., E. Jeanes, and E. Connor. 2000. Defining The Determinants Limiting Wild Trout Production in the South Fork Coeur d'Alene Basin, Idaho; using a Reference Stream Approach. Paper presented at Idaho Chapter American Fisheries Society Meeting. Coeur d'Alene, Idaho.

Greenberg, E., M. Gagner, and D. W. Reiser. 1999. Application of the Urban Stream Baseline Evaluation Method for assessing stream habitats in urban settings. Paper presented at Annual meeting of the American Water Resources Association. Seattle, Washington.

Reiser, D. W. 1999. Development of instream flow claims for the Salmon and Clearwater basins of Idaho, an ecosystem based approach. Invited paper presented at BC Hydro specialty conference on instream flow methods, June 1999, New Westminster, B.C.

Reiser, D. W. 1999. Development of instream flow claims for streams in the Upper Klamath Basin, Oregon. Presentation to Oregon Water Resources Department, Salem, Oregon. July 1999.

Reiser, D. W., E. Greenberg, and M. Gagner. 1999. Urban Issues Study Habitat Assessment Workshop; Review of Urban Stream Baseline Evaluation Method. July 19, 1999. Mercer Island, Washington.

DeVries, P. and D. W. Reiser. 1998. Sediment intrusion within the streambed of the Clark Fork River, a potential factor controlling trout production. Paper presented at Annual Meeting of the Western Division of the American Fisheries Society, Anchorage, Alaska.

Reiser, D. W. 1997. Determining basin wide instream flow needs of anadromous and resident salmonid stocks in the Salmon and Clearwater drainages of Idaho. Paper presented at 127th Annual Meeting of the American Fisheries Society, Monterey, California.

DeVries, P., D. W. Reiser, and M. Loftus. 1997. Evaluating carrying capacity and habitat limitations with data envelopes. Paper presented at 127th Annual meeting of the American Fisheries Society. Monterey, California.

Reiser, D. W., P. DeVries, and M. Loftus. 1997. Defining scientifically defensible and rational baselines for quantifying injury in freshwater ecosystems for NRD assessments. Invited paper presented at 18th Annual Meeting of the Society of Environmental Toxicology and Chemistry. San Francisco, California.

Reiser, D. W. 1997. Application of PHABSIM in evaluating the effects of spawning gravel supplementation in the Madison River, Montana. Paper presented at the Annual Meeting of the North Pacific Division of the American Fisheries Society. Everett, Washington.

Reiser, D. W. 1996. Presentation on "instream flows," technical session presented to a group of Japanese engineers and hydrologists. Washington Department of Fish and Wildlife, December 6, 1996.

Reiser, D. W. 1996. Characteristics of bull trout spawning habitat in the upper Cedar Watershed. Invited Paper presented at the Salvelinus Confluentus Curiosity Society meeting. October 17, 1996. Eugene, Oregon.

Reiser, D. W. 1996. Presentation to the State of Idaho and other water user groups on the development of instream flow recommendations/claims for the Salmon and Clearwater Basins, Idaho, on behalf of the Department of Justice and Bureau of Indian Affairs.

Reiser, D. W. 1996. Review of the "Alberta IFN Method" for determining instream flows in Alberta. Presentation to Alberta Environment, Calgary, Alberta.

Reiser, D. W. 1996. Presentation to Trout Unlimited (Montana Chapter) regarding factors influencing trout populations in the Clark Fork River, Montana.

Reiser, D. W. 1995. Hazardous substance impacts on fish resources: problems in quantifying injuries on fisheries. Session chair and presenter at Law Seminars International, Natural Resource Damages Conference, Bellevue, Washington, September 21-22, 1995.

Reiser, D. W. 1995. Presentation on flushing flow requirements in the Madison River, Montana; presentation to agencies and stakeholders; work conducted in support of the relicensing of the Madison – Missouri Hydroelectric Project, Montana Power Company.

Reiser, D. W. 1994. Provided testimony to California State Water Resources Control Board regarding "other factors" influencing aquatic ecosystem of San Francisco Bay – Delta system. Testimony prepared on behalf of California Urban Water Agencies.

Reiser, D. W. 1994. Served as technical representative of California Urban Water Agencies on interagency committee to review technical basis of proposed EPA salinity standard for the San Francisco Bay – Delta system.

Reiser, D. W. 1994. Served as technical representative of California Urban Water Agencies on interagency committee to evaluate and develop monitoring programs for San Francisco Bay – Delta system.

Reiser, D. W., and E. Connor. 1994. Invited presenters at Cedar River watershed – Bull trout workshop. Seattle Water Department. November 18, 1994.

Reiser, D. W., E. Connor, K. Binkley, K. Lynch, and D. Paige. 1994. An evaluation of spawning habitat used by bull trout in the Cedar River watershed, Washington. Paper presented at "Friends of the Bull Trout" conference, Calgary, Alberta.

Connor, E., D. W. Reiser, K. Binkley, K. Lynch, and D. Paige. 1994. Life history and ecology of an unexploited bull trout population in the Cedar River watershed, Washington. Paper presented at "Friends of the Bull Trout" conference, Calgary, Alberta.

Reiser, D. W., and J. B. Bradley. 1993. Fine sediment intrusion and salmonid habitat. Paper presented at Advances in Hydroscience and Engineering; Symposium Sponsored by ASCE, Washington, D.C. June 1993.

Reiser, D. W., and A. Olson. 1992. Sediment Deposition within fry emergence traps: a confounding factor in estimating survival to emergence (STE). Paper presented at the Annual Meeting of the Western Division of the American Fisheries Society, Fort Collins, Colorado.

Reiser, D. W. 1992. Sedimentation Impacts on the Aquatic Ecosystems; Instructor for Short Course for state and federal agencies, and industry. Bellevue, Washington.

Reiser, D. W. 1992. Instream flow needs (IFN) practices in North America. Invited paper presented at the IFN Special Session sponsored by Alberta Environment, Edmonton, Alberta.

Reiser, D. W. 1992. Technical considerations related to Natural Resource Damage Assessments. Paper presented to Tacoma Chamber of Commerce, Environmental Concerns Committee. Tacoma, Washington.

Gift, J. J., D. F. Ludwig, and D. W. Reiser. 1991. Key issues related to Natural Resource Damage Assessments. Paper presented at short course sponsored by Preston, Thorgrimson, Shindler, Gates and Ellis, Seattle, Washington.

Reiser, D. W. 1991. Impacts of sedimentation on salmonid ecology. Instructor for Short Course presented to the Tongass National Forest, Alaska.

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