Instream Flow-Habitat Relationships in the Upper Rio Grande River Basin

Prepared for:

Senate Bill 3
Upper Rio Grande
Basin and Bay Expert Science Team

Prepared By:

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April, 2012

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Acknowledgements

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Table of Contents

List of Figures

List of Tables

1 Introduction

Trungale Engineering & Science (TES) is pleased to present this report in support of the efforts of the Upper Rio Grande Basin and Bay Expert Science Team (URGBBEST) in the development of Instream Flow-Habitat relationships supporting flow regime recommendations. This report documents analysis performed to develop predictive relationships that describe the instream available habitat over a range of flows. These relationships can be used to inform the flows that may be recommended by the BBEST as part of their charge under Senate Bill 3. The approach taken in this study employs a well-established methodology whereby site specific physical habitat data is collected at river cross sections and used to produce a one-dimensional physical habitat model. Species specific habitat suitability criteria were applied to the results of the physical habitat model to estimate the weighted usable area (WUA) for each species over a range of flows at all cross sections. Although the main body of this report focuses on a single cross section, this to done to provide an example which is used to explain the overall study appraoch. Appendix C at the end of the main report provides extensive results for all of the study sites, habitat types and individual cross sections.

2 Study Sites

Relationships between flow and instream habitat for focal species have been developed at 3 sites near U.S. Geological Survey (USGS) and International Boundary Water Commission (IBWC) gages for which the URGBBEST is developing recommended flow regimes. Table 2-1 identifies study site locations and associated gages.

Table 2-1 Study sites.

Agency	Number	Name	Latitude	Longitude	Study site location
USGS	08447020	Independence Ck nr Sheffield	30.45	-101.73	TNC preserve near hunting blind #14
IBWC	08449000	Devils Rv nr Juno	29.96	-101.15	TPWD SNA and TNC Preserve U/S of Dolan creek confluence
IBWC[1]	08447300	Pecos River nr Pandale	30.31	-101.74	approximately 5 to 6 miles upstream of the Pandale crossing

[1]The URGBBEST has been considering developing recommendations for this IBWC gage, however the gage at Brotherton Ranch, maintained by the USGS, is closer to the data collection site and therefore the rating curve for this USGS gages was use for the hydraulic models.

These sites are shown in Figure 2-1

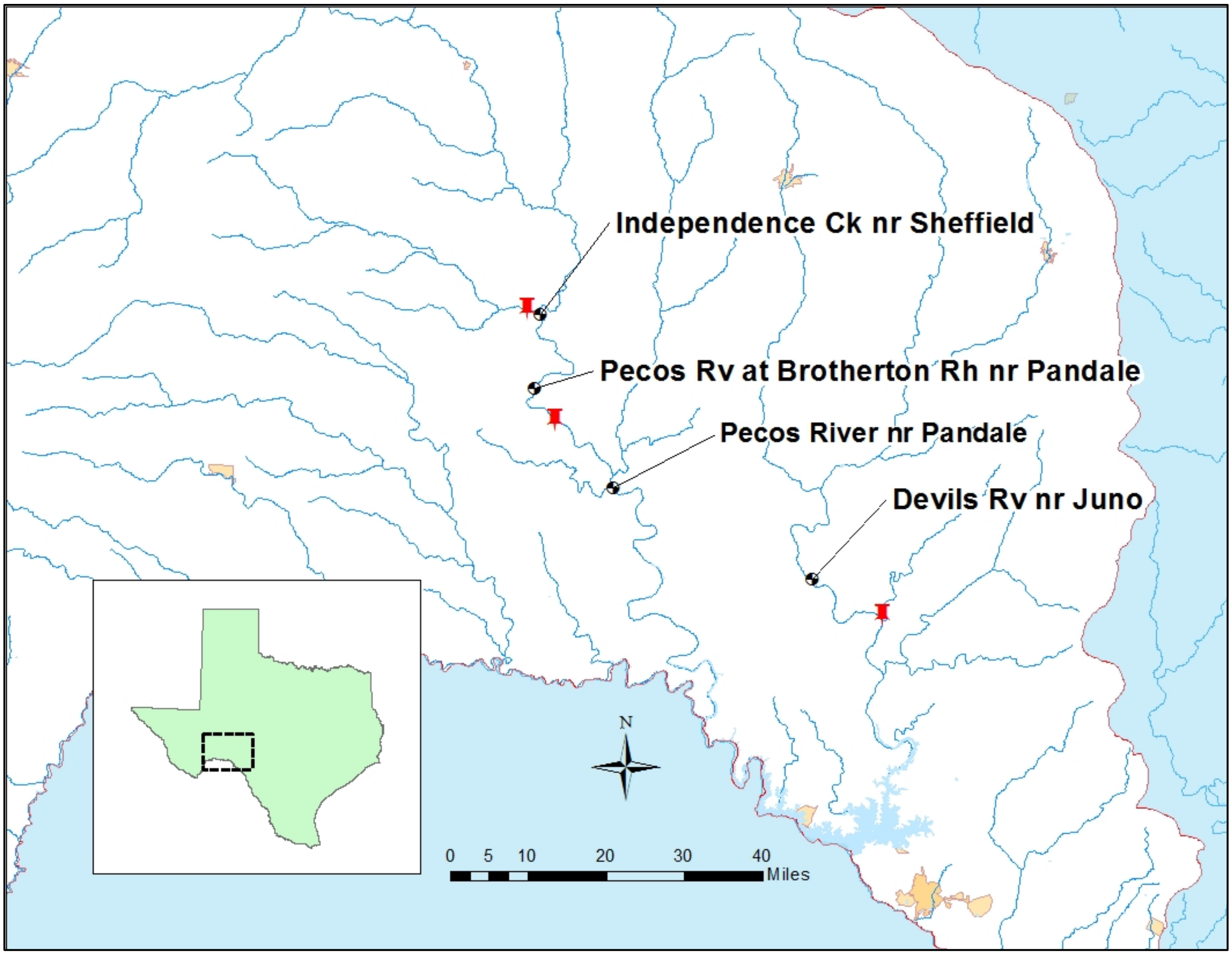


Figure 2-1 Map of study sites.

At each study site, 7 to 9 cross sections including replicates of riffles, runs and pools were identified. Figure 2-2 through Figure 2-4 show the layout of the cross sections at each study site. These figures represent the approximate locations of the cross sections determined based on a combination of GPS measurements and review of aerial photography.

At each cross section photographs were taken across the channel from the right and left banks and from the upstream and downstream ends of the mesohabitat feature towards the cross sections. These photos were georeferenced by TPWD and are included as part of the project deliverable on the URGBBEST ftp site in a Google Earth project file.

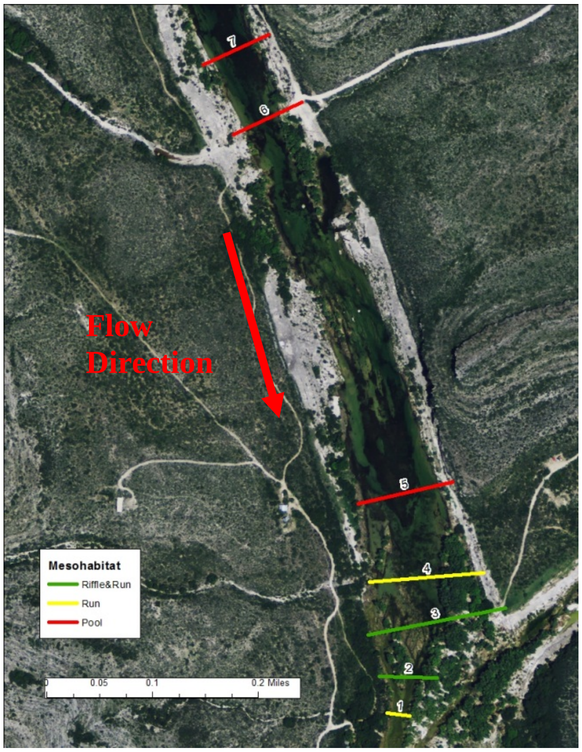


Figure 2-2 Devils River Cross Sections.

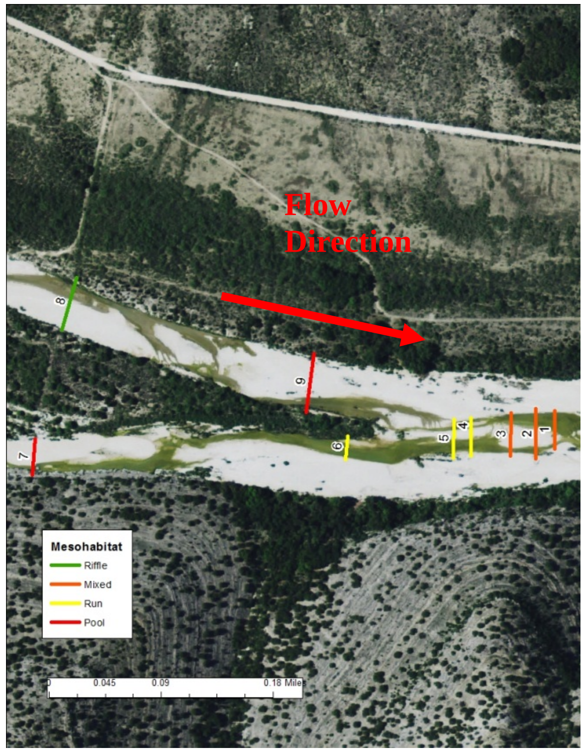


Figure 2-3 Independence Creek Cross Sections.

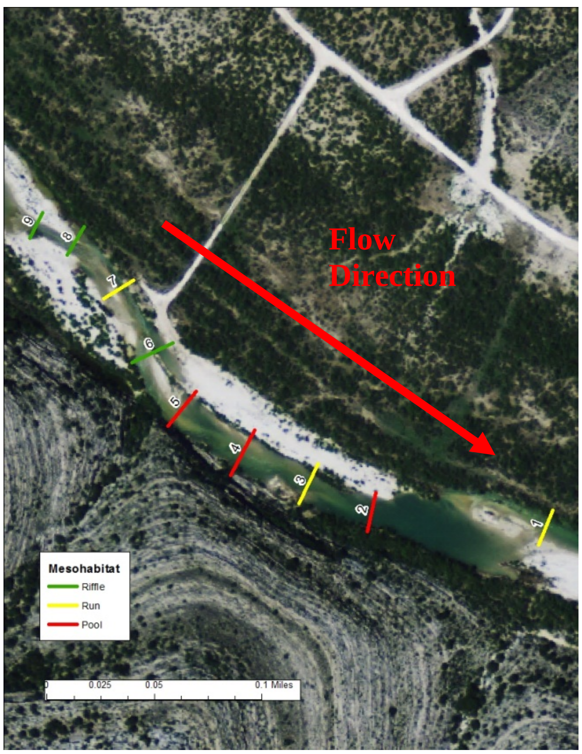


Figure 2-4 Pecos River Cross Sections.

3 Cross-Section Data Collection

Physical habitat data, collected at each of the study sites at 7 to 9 cross sections, included water surface elevations (WSE), channel bathymetry, velocity and dominate substrate type. It is important to point out that these measurements were made during low flow conditions and in some cases a significant portion of the base flow channel was dry. Recognizing the possibility that subsequent data may be desired as part of future adaptive management studies, benchmark monuments were established at each site using survey grade GPS. Headpins (river left facing downstream) and tailpins (river right facing downstream) were placed at each cross section by hammering rebar pins into the ground away from the channel and above base flow levels where possible. The elevations of these pins were tied to the benchmark via level surveying.

Within each study site, the cross-sections were established to describe physical and hydraulic conditions of individual mesohabitat types generally including at least three replicates for each mesohabitat type of interest (e.g., riffle, run and pool). The upper and lower boundaries of mesohabitat types were identified and the total stream length distances measured or determined based on review of aerial photographs. The water surface elevation at the top and bottom of each mesohabitat unit was also measured in order to calculate the slope of each mesohabitat feature. Figure 3-1 provides a generalized schematic of cross sections located within a study site.

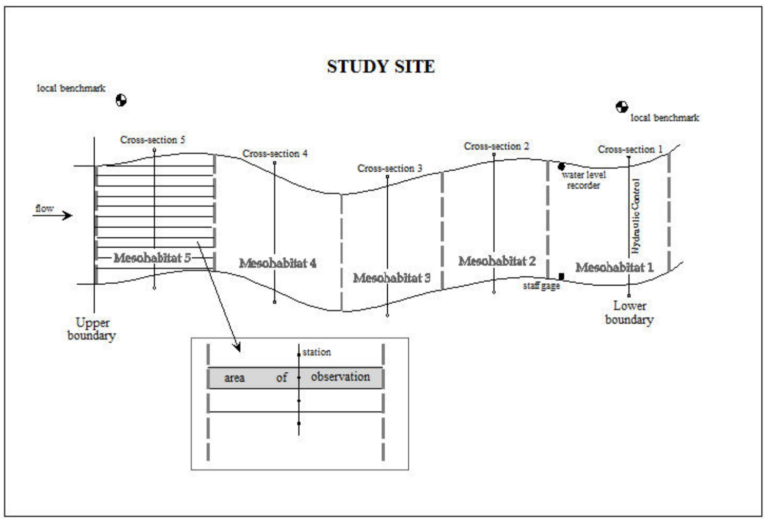


Figure 3-1 Generalized study site map.

Taglines were placed across the river, perpendicular to the channel, with zero located at the headpin. Measurements were taken at horizontal stations at breaks in topography (minimum of 20 stations in water) that, primarily, describe the streambed profile of the channel. The streambed profile was surveyed at each station from headpin to tailpin, with the horizontal distance of the right and left edge of water designated. Water surface elevations were surveyed at the right and left edge of water. A critical data point on the streambed profile is the deepest point on the cross-section, which is input as the stage of zero flow in the hydraulic models. Current velocity and depth were measured at each station within the wetted channel. Current velocity was measured at appropriate depths according to USGS protocol. At each station, primary substrate types were characterized according to a modified Wentworth substrate scale (Table 3-1). The presence of aquatic vegetation was also noted.

Table 3-1 Modified Wentworth substrate scale.

Code	Classification	Size (mm)
2	Clay/Silt	0 - 0.062
3	Sand	0.062 – 2
4	Gravel	2 – 32
6	Cobble/Rubble	32 – 256
7	Boulder	> 256
8	Bedrock	Solid substrate

All field data including pdf scans of field book notes and TWDB's GPS readings for benchmarks and pins are included as part of the project deliverable on the URGBBEST ftp site.

4 Hydraulic Modeling

Hydraulic models were developed to predict depths and velocities at each station across cross sections. The depths were calculated by subtracting measured channel bathymetry elevations from predicted water surface elevation (WSE) at each flow. Discharge measurements were made following USGS methods for each data set collected. Ideally stage - discharge datasets would have been collected at three flow levels that encompass the full range of base flows and from this a site specific rating curve could have been developed to predict WSE over the range of flows. The limited time frame for this project did not allow for this. Rating curves (Figure 4-1) were obtained from the USGS web site[1] for the Independence Creek and Pecos River Sites and from the IBWC via email for the Devils River site. It is worth noting that these relationships are used to evaluated base flow conditions which for these sites are generally less than about 200 cfs. Since WSE varies with flow someone differently from site to site, curves three rating curves predict elevations that may differ up to two tenths of a foot across the range of base flow. The tools developed as part of this project were used to perform sensitivity analysis to evaluate how change in the shape of this regression curve affects final habitat results (Appendix A). These regressions could be updated with additional measurements collected as part of a future adaptive management program.

At the Independence Creek site several of the cross sections traversed split channels and the water surface elevation in these split channels differed by 1-2 feet in some cases. For these situations the rating curve was used to predict water surface elevation in the main channel and an adjustment was applied to model water surface elevation in the side channel such that observed conditions were replicated and at higher flows, when the channels connect, they are at the same elevation.

[1] http://waterwatch.usgs.gov

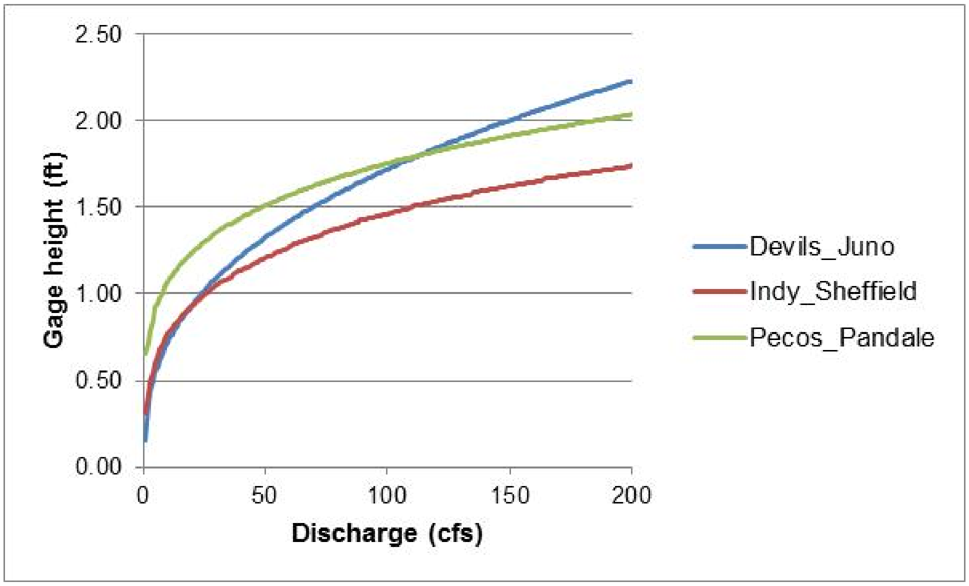


Figure 4-1 Rating curves for study sites in the upper Rio Grande basin.

While the lack of additional data points for these curves does introduce grater uncertainty, the data used to develop these curves is from nearby sites and presumably those locations share similar channel slopes, banks and substrates such that the transfer is reasonable.

Velocities were predicted by applying the Manning equation to calculate a velocity distribution parameter (N) based on the measured data. In the first step of the calibration this N value was applied to each station to simulate velocities across a range of flows (The models simulated flows from 1 to 500 cfs although base flows less than 200-300 cfs are the primary focus of this study.) The application of these "fixed" N values at high flow can result in very high N values in cells where observed depth is high and velocity is low and very low N values where observed depth is low and velocity is high. Simulations at higher flows can produce velocity estimates, in those cells with high N values, to remain near zero (contrary to expectation that the velocities would likely increase in these areas at higher flow rates). Similarly this model calibration can predict very high velocities in the cells in which a very low N value was calculated and thus predict velocity spikes of 7-10 ft/s which are probably unrealistic. To address this issue a traditional PHABSIM model uses a velocity-depth correction where the effect of roughness decreases as depth increases. A similar approach was implemented to calibrate the models in this study. The final calibrated models assume that at some high flow rate, the roughness effect becomes insignificant and velocity is simply a function of depth (described by Manning equation assuming an N value of 1). For simulations below and up to the observed flow, the N values calculated based on observed velocity (up to a maximum value of 1) are used. For simulations of flows between observed flow and 850 cfs, N value is interpolated between the N calculated at the observed flow and the values of 1 at 850 cfs. A review of simulations at all of these cross sections based on this calibration approach reproduced the observed velocities and produced what appear to be reasonable velocity distributions at higher flows (velocities increased in deeper areas as flows came up and there are no velocity spikes above about 3-4 ft/s).

Figure 4-2 shows WSE and velocity results from the hydraulic model for cross section 1 at the Devils River site.

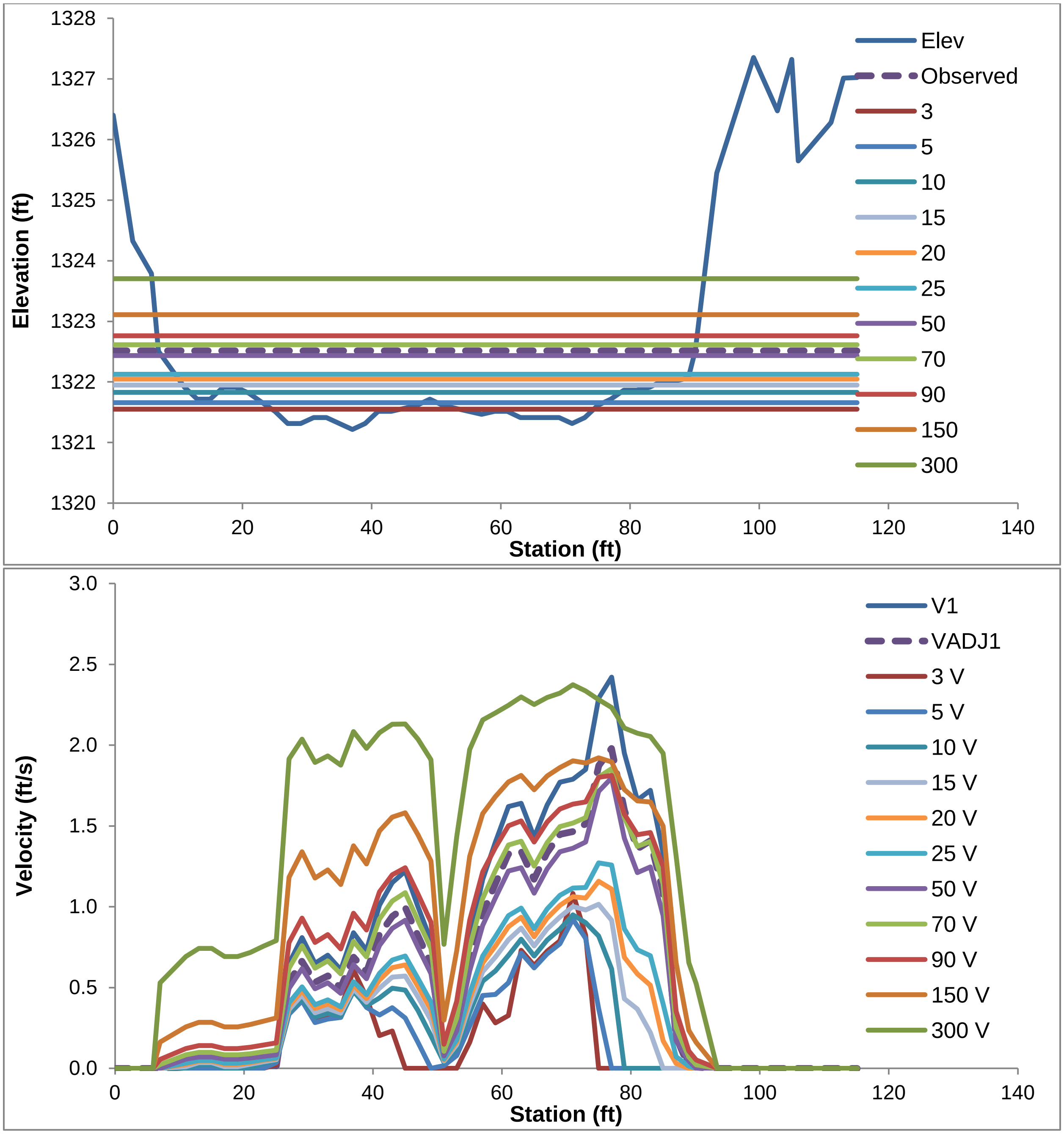


Figure 4-2 Water surface elevations (above) and velocities (below) predicted by hydraulic model for cross section 1 (run) at the Devils River.

5 Habitat Suitability Criteria

Habitat suitability criteria were developed for a total of 13 focal species. Site specific criteria were initially developed for 10 species at each site by applying a non-parametric tolerance limit model to data collected primarily at the individual sites (Bovee 1986). Subsequently the BBEST in consultation with TPWD developed regional criteria for each species. These regional criteria were based on all data from the Devils, Independence and Pecos sites and include modifications based on professional experience. Models were run using both site specific and regional criteria for each site although only the results from the regional criteria are included in this report. Table 5-1 listed the species considered for each set of criteria.

Table 5-1 Species for which habitat suitability criteria were developed for use in the physical habitat model.

Scientific Name	Common Name	Abbreviated (for figures)	Devils River	Indy Creek	Pecos River	URG Regional
Etheostoma grahami	Rio Grande darter	E. gra.	X	X	X	X
Cyprinella proserpina	proserpine shiner	C. pro.	X	X	X	X
Dionda argentosa	manantial roundnose minnow	D. arg.	X	X	X	X
Dionda diaboli	Devils River minnow	D. dia.	X			X
Notropis braytoni	Tamaulipas shiner	N. bra.			X	X
Notropis amabilis	Texas shiner	N. ama.	X	X	X	X
Ictalurus lupus	headwater catfish	I. lup.		X		X
Astyanax mexicanus	Mexican tetra	A. mex.	X	X	X	X
Notropis stramineus	sand shiner	N. str.	X			X
Moxostoma congestum[1]	gray redhorse	M. con.		X	X	X
Lepomis megalotis	longear sunfish	L. meg.	X	X	X	X
Micropterus salmoides[2]	largemouth bass	M. sal.	X	X	X	X
Cichlasoma cyanoguttatum[3]	Rio Grande cichlid	C. cya.	X	X	X	X

[1]Independence Creek, Pecos River criteria include data from Blanco and Pecos Rivers and Independence Creek. URG Regional criteria also include data from the Blanco River

[2]Independence Creek criteria include data from Pecos River. Pecos River criteria include data from the Devils River.

[3]Pecos River criteria include data from the Devils River.

Habitat suitability criteria describe suitability of hydrologic habitat parameters for specific species including depth, velocity and substrate. Figure 5-1 presents an example of these criteria. The x-axis is the habitat parameter, velocity depth or substrate (substrate codes correspond to values in Table 3-1) and the y-axis is the corresponding suitability index where 1 is most suitable and zero is unsuitable.

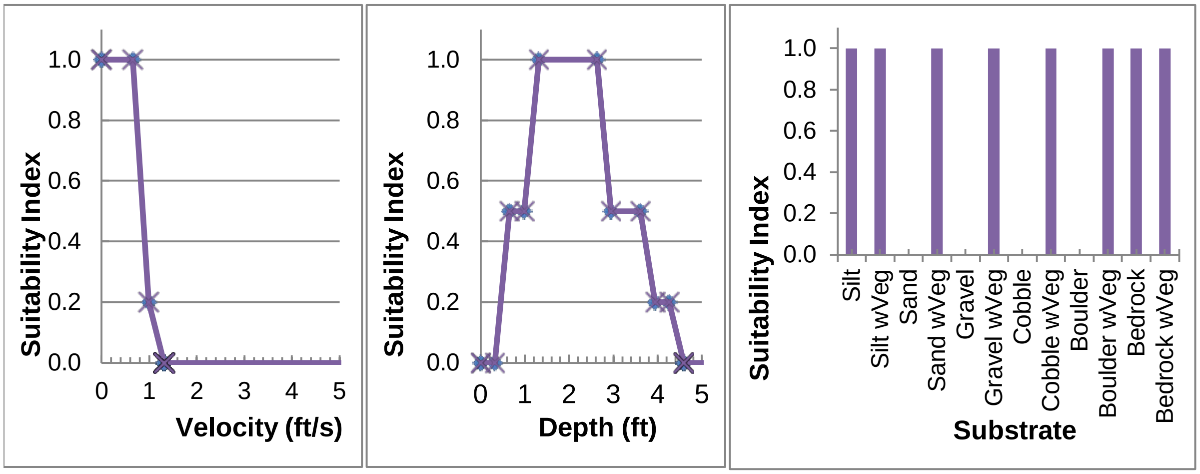


Figure 5-1 Habitat suitability criteria for the Devils River minnow (Dionda diaboli).

Habitat suitability criteria for all 13 species are included in Appendix B.

6 Physical Habitat Model

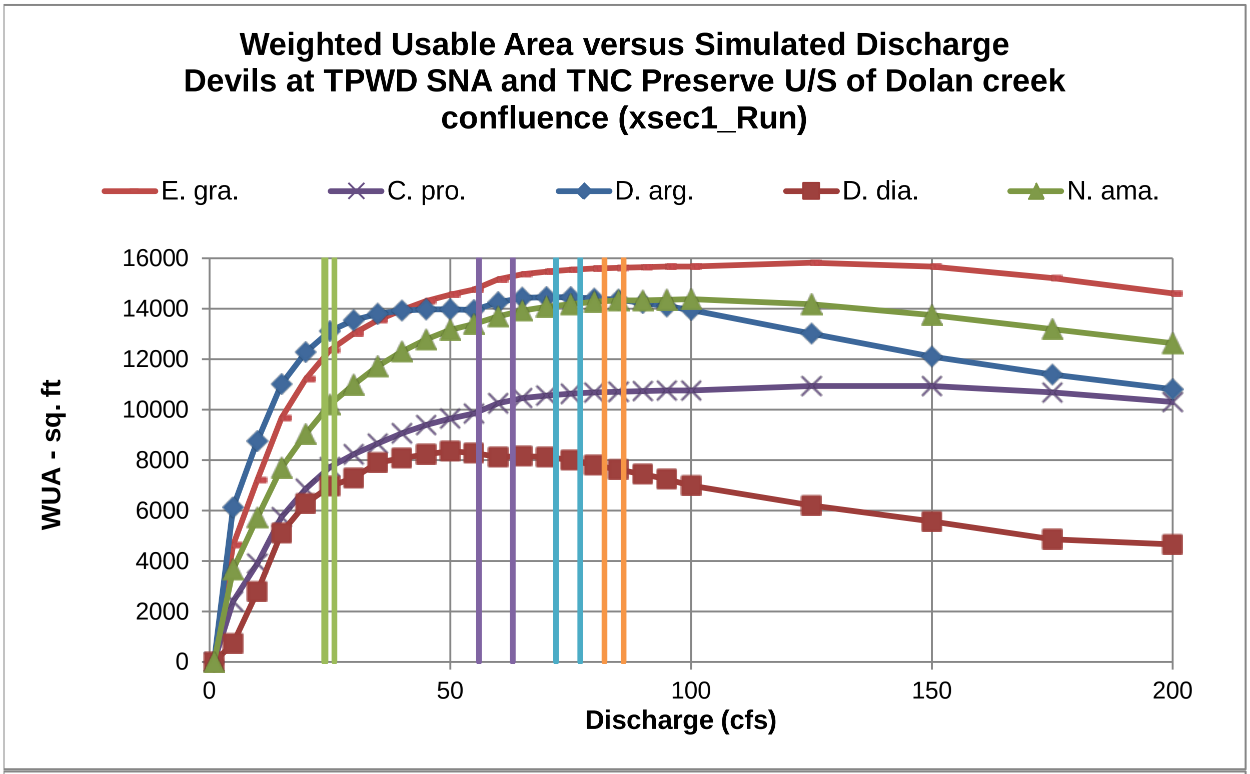
The calibrated hydraulic simulation models at each site were integrated with the habitat suitability criteria to generate available habitat as a function of discharge for each focal species. Physical habitat is reported as weighted usable area (WUA) and is derived by the combined suitability for depth, velocity and substrate based on the habitat suitability functions for each species times the area of the cell. The default combined suitability computation was based on the geometric mean of the component depth, velocity, and substrate suitability. Habitat results (WUA versus discharge) are provided for each species at each cross section, combined mesohabitat types, and for the reach level results that incorporate all mesohabitat types. These WUA curves include the full range of base flows (models include simulations from 1 - 500 cfs) and show the response of available habitat to different flow rates for each species. An Excel spreadsheet tool was developed for these analyses and permits detailed examination of each species, cross section, mesohabitats, and reach level results in terms of depth, velocity and substrate suitability, and combined suitability. In addition to the total quantity of available habitat (WUA) relationships, the analysis tool permits the evaluation of habitat quality by constraining the computed habitat area based on exceeding a user defined suitability threshold value.

6.1 Mesohabitat Scale Analysis (Cross Section Weighted Usable Area)

An example of the WUA (total quantity) versus discharge relationships for focal species at cross section 1 at the Devils River study site is illustrated in Figure 6-1. In this figure, the available habitat for Devils River Minnow (*D. dia.*) starts low, increases with flow to about 50 cfs, and gradually declines above about 70 cfs. The highest quantity of habitat for this species is produced by flows that result in depths between 1.3 and 2.6 feet and velocities less than 1 foot per second based on the habitat suitability criteria (Figure 5-1 above). This species is associated with vegetation over any substrate type and also with silt and bedrock substrate. This particular cross section is vegetated across most of the channel width. The vertical bars in Figure 6-1 represent the range of preliminary subsistence and base flow values produced by the HEFR[2] program.

The analysis conducted in this project produces outputs that allow for a direct evaluation of the WUA produced at user defined flow rates by examining where the vertical bars, representing the HEFR flows, intersect the habitat results. The run/riffle associated species displayed in this figure show that the range of base flows produce greater than 90 percent of the maximum WUA. For these five species at this particular cross section, 90 percent of the maximum habitat is produced by flow rates between 50 and 90 cfs. One species, Devils River Minnow, peaks below the base low value (56 cfs) at a flow of 50 cfs. The Rio Grande Darter, Proserpine Shiner and Roundnose minnow all peak near the base high flow value (86 cfs) and have maximum habitat areas up to about 150 cfs.

[2] HEFR stands for Hydrology-Based Environmental Flow Regime. It is a methodology widely used in the Texas Senate Bill 3 Environmental Flow planning process for analyzing historical flow data to develop preliminary environmental flow recommendations. (SAC 2009a)



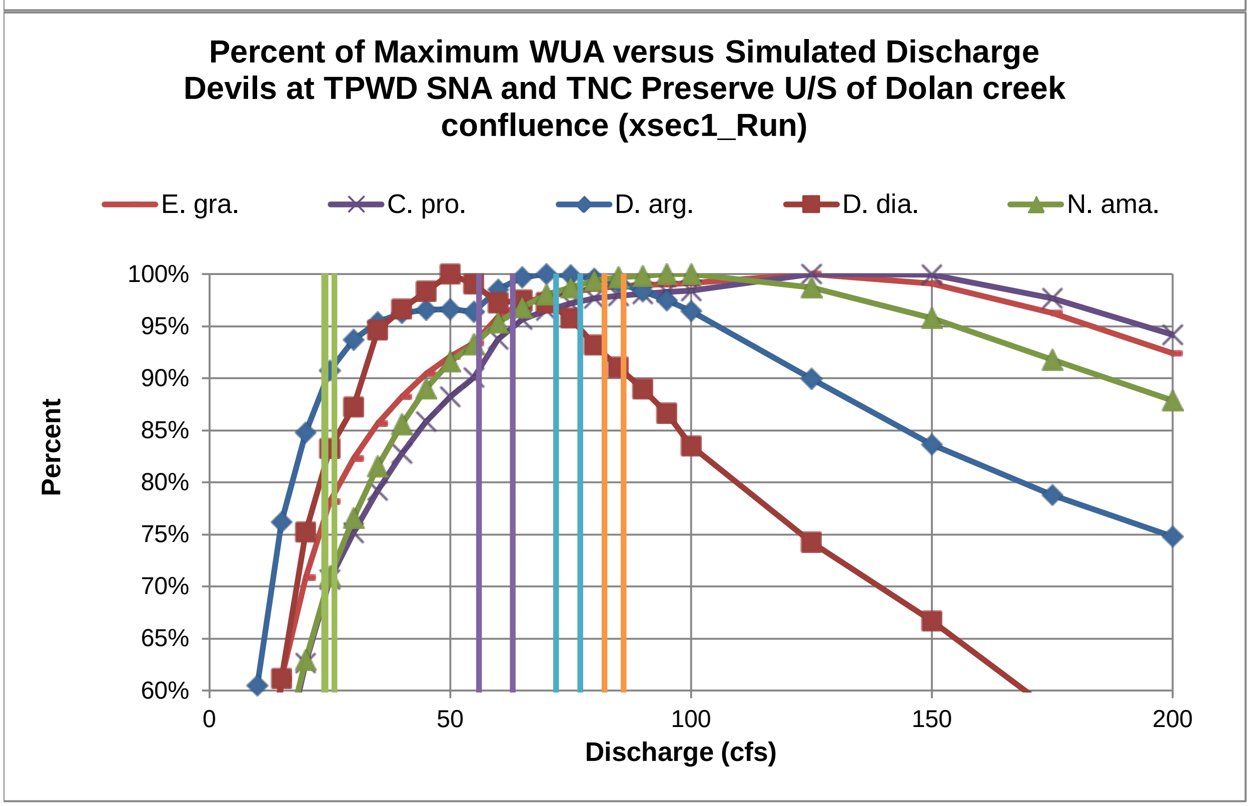


Figure 6-1 Flow versus weighted usable area (top) and percent of maximum WUA (bottom) for cross section 1 (Run) at the Devils River.

This information can also be viewed in tabular formats. Tables 4-7 (Devils River), 8-11 (Independence Creek) and 12-15 (Pecos River) show the percent of maximum habitat for all species summarized based on habitat type (Total, Riffle, Run, and Pool). Cells are colored coded based on the percent of the maximum habitat produced over the entire potential HEFR range (from zero to 200 cfs). Green indicates that the WUA produced at this flow rate is greater than 90 percent of that maximum, blue is greater than 75 percent, red greater than 50 percent and white is less than 50 percent. These thresholds are arbitrary and are solely to aid in display. These thresholds and the maximum range for base flows can be modified in the spreadsheet and the tables will update accordingly. The colored boxes approximate the HEFR base flows. Graphical and tabular results for all cross sections are included in Appendix C.

Table 6-1 Total habitat area - percent of maximum at Devils River.

Q	Min All	E. gra.	C. pro.	D. arg.	D. dia.	N. ama.	A. mex.	N. str.	L. meg.	M. sal.	C. cya.
1	58%	97%	95%	97%	85%	91%	71%	58%	96%	70%	80%
5	69%	94%	97%	96%	90%	95%	81%	69%	97%	76%	84%
10	72%	95%	98%	98%	94%	97%	84%	72%	97%	79%	87%
15	78%	97%	98%	99%	96%	97%	90%	78%	98%	81%	89%
20	81%	98%	98%	99%	97%	97%	91%	81%	99%	83%	90%
25	83%	99%	97%	100%	98%	98%	89%	83%	99%	85%	92%
30	85%	100%	96%	98%	98%	98%	88%	85%	100%	86%	93%
35	87%	100%	97%	99%	99%	100%	87%	88%	100%	87%	94%
40	86%	99%	97%	98%	99%	100%	86%	88%	99%	88%	94%
45	85%	99%	97%	97%	99%	100%	85%	88%	99%	88%	94%
50	84%	98%	96%	96%	99%	100%	84%	89%	99%	89%	94%
55	85%	97%	95%	95%	99%	99%	85%	91%	99%	90%	94%
60	90%	98%	97%	96%	99%	100%	90%	95%	98%	91%	96%
65	92%	98%	97%	95%	99%	99%	92%	97%	99%	92%	97%
70	93%	97%	97%	94%	100%	99%	94%	98%	99%	93%	97%
75	93%	97%	98%	93%	100%	98%	97%	99%	99%	93%	98%
80	92%	97%	98%	92%	100%	97%	98%	100%	99%	94%	98%
85	91%	96%	99%	91%	100%	97%	100%	100%	98%	94%	99%
90	89%	96%	98%	89%	99%	96%	100%	100%	98%	94%	99%
95	86%	95%	97%	86%	99%	95%	100%	99%	98%	95%	99%
100	85%	93%	97%	85%	99%	95%	100%	97%	96%	95%	99%
125	81%	89%	97%	81%	99%	92%	100%	93%	92%	98%	99%
150	78%	84%	99%	78%	98%	90%	99%	92%	87%	99%	100%
175	75%	79%	100%	75%	95%	86%	94%	87%	82%	100%	100%
200	72%	76%	101%	72%	92%	83%	89%	85%	80%	101%	100%
250	67%	71%	103%	67%	86%	76%	88%	87%	77%	102%	100%
300	63%	68%	101%	63%	82%	73%	88%	88%	73%	102%	99%
350	61%	64%	100%	61%	77%	69%	87%	90%	69%	103%	99%
400	58%	62%	104%	58%	70%	67%	89%	95%	66%	103%	100%
500	57%	60%	116%	57%	63%	65%	98%	111%	62%	105%	101%

Table 6-2 Riffle habitat - percent of maximum at Devils River.

Q	Min All	E. gra.	C. pro.	D. arg.	D. dia.	N. ama.	A. mex.	N. str.	L. meg.	M. sal.	C. cya.
1	3%	5%	11%	6%	4%	5%	13%	12%	4%	3%	4%
5	7%	17%	30%	21%	10%	15%	38%	33%	14%	7%	16%
10	13%	26%	41%	31%	18%	22%	50%	43%	20%	13%	23%
15	17%	33%	48%	40%	24%	29%	55%	49%	26%	17%	30%
20	22%	41%	52%	48%	30%	35%	58%	53%	31%	22%	36%
25	26%	47%	54%	55%	36%	41%	60%	56%	37%	26%	41%
30	32%	54%	59%	62%	42%	47%	64%	62%	43%	32%	47%
35	36%	60%	61%	69%	46%	52%	66%	64%	48%	36%	53%
40	40%	64%	62%	73%	50%	56%	68%	67%	52%	40%	57%
45	44%	67%	63%	75%	54%	60%	68%	69%	55%	44%	59%
50	47%	70%	63%	77%	57%	63%	69%	71%	58%	47%	62%
55	51%	72%	64%	79%	61%	65%	69%	71%	60%	51%	64%
60	55%	75%	66%	82%	65%	68%	71%	74%	63%	55%	67%
65	60%	78%	66%	84%	71%	71%	72%	74%	65%	60%	69%
70	63%	80%	68%	86%	74%	74%	76%	76%	69%	63%	72%
75	66%	83%	73%	89%	78%	77%	84%	81%	73%	66%	76%
80	68%	85%	75%	91%	80%	79%	87%	84%	75%	68%	78%
85	70%	88%	78%	94%	82%	82%	93%	87%	79%	70%	82%
90	72%	89%	80%	95%	83%	84%	95%	89%	81%	72%	84%
95	74%	90%	81%	96%	85%	85%	97%	90%	82%	74%	85%
100	76%	91%	83%	97%	86%	87%	98%	92%	84%	76%	87%
125	87%	95%	88%	98%	93%	93%	100%	94%	92%	87%	93%
150	95%	98%	95%	99%	98%	97%	100%	97%	97%	95%	97%
175	99%	100%	100%	100%	100%	100%	99%	100%	100%	100%	100%
200	99%	101%	105%	101%	101%	102%	99%	108%	104%	104%	103%
250	102%	104%	114%	103%	102%	109%	104%	123%	111%	112%	108%
300	102%	103%	120%	102%	102%	111%	106%	126%	113%	116%	110%
350	99%	100%	123%	99%	103%	111%	102%	126%	111%	119%	109%
400	95%	97%	127%	96%	102%	111%	95%	125%	109%	121%	108%
500	76%	91%	130%	89%	97%	110%	76%	129%	104%	122%	105%

Table 6-3 Run habitat - percent of maximum at Devils River.

Q	Min All	E. gra.	C. pro.	D. arg.	D. dia.	N. ama.	A. mex.	N. str.	L. meg.	M. sal.	C. cya.
1	33%	54%	42%	58%	43%	44%	56%	45%	43%	33%	47%
5	51%	71%	54%	76%	58%	61%	67%	62%	64%	51%	65%
10	58%	79%	58%	84%	65%	69%	71%	66%	73%	58%	74%
15	63%	84%	63%	88%	73%	74%	79%	74%	77%	63%	78%
20	66%	87%	66%	90%	78%	77%	82%	78%	80%	67%	81%
25	69%	89%	69%	91%	83%	80%	81%	80%	82%	71%	83%
30	71%	91%	71%	92%	85%	81%	79%	81%	83%	74%	85%
35	75%	95%	75%	95%	88%	86%	81%	87%	88%	78%	89%
40	77%	96%	77%	96%	89%	88%	80%	89%	89%	80%	91%
45	78%	96%	78%	95%	90%	89%	79%	89%	91%	82%	92%
50	79%	96%	79%	95%	90%	90%	79%	90%	92%	83%	92%
55	82%	98%	82%	96%	90%	92%	84%	95%	94%	85%	94%
60	85%	100%	85%	100%	90%	94%	89%	98%	97%	86%	97%
65	85%	100%	85%	100%	93%	96%	91%	99%	98%	88%	98%
70	86%	100%	86%	100%	95%	97%	91%	100%	99%	90%	98%
75	86%	100%	86%	100%	95%	97%	91%	100%	100%	91%	99%
80	86%	99%	86%	99%	96%	98%	91%	100%	100%	91%	99%
85	86%	99%	86%	99%	97%	98%	91%	98%	100%	92%	99%
90	86%	98%	86%	98%	97%	98%	90%	97%	100%	92%	99%
95	86%	98%	86%	97%	97%	98%	91%	95%	100%	92%	99%
100	86%	98%	86%	97%	98%	98%	91%	93%	99%	93%	99%
125	89%	98%	92%	95%	100%	99%	95%	89%	99%	98%	99%
150	88%	97%	98%	93%	99%	100%	100%	88%	98%	99%	100%
175	84%	95%	100%	90%	98%	100%	95%	84%	97%	100%	100%
200	80%	93%	102%	88%	97%	99%	88%	80%	94%	101%	100%
250	80%	89%	106%	84%	95%	96%	83%	80%	91%	103%	99%
300	77%	85%	106%	77%	93%	93%	84%	88%	88%	102%	97%
350	72%	81%	104%	72%	92%	89%	83%	93%	85%	102%	95%
400	68%	78%	109%	68%	90%	88%	94%	103%	80%	103%	97%
500	70%	78%	125%	70%	81%	88%	122%	124%	77%	106%	103%

Table 6-4 Pool habitat - percent of maximum at Devils River.

Q	Min All	E. gra.	C. pro.	D. arg.	D. dia.	N. ama.	A. mex.	N. str.	L. meg.	M. sal.	C. cya.
1	92%	100%	100%	100%	97%	100%	100%	97%	100%	92%	100%
5	89%	89%	90%	90%	99%	98%	90%	93%	93%	96%	98%
10	84%	85%	86%	87%	100%	97%	84%	89%	89%	98%	98%
15	83%	84%	83%	85%	100%	94%	88%	94%	88%	99%	98%
20	80%	82%	80%	81%	99%	91%	84%	93%	86%	99%	97%
25	76%	81%	76%	80%	98%	90%	80%	94%	85%	100%	98%
30	72%	79%	72%	76%	97%	88%	75%	95%	83%	100%	97%
35	70%	77%	72%	74%	96%	87%	70%	94%	81%	100%	96%
40	68%	74%	70%	71%	95%	86%	68%	93%	78%	99%	95%
45	65%	73%	69%	69%	94%	85%	65%	91%	77%	99%	94%
50	64%	71%	68%	67%	94%	84%	64%	91%	76%	99%	93%
55	63%	69%	65%	65%	93%	82%	63%	91%	75%	99%	93%
60	65%	68%	66%	65%	91%	81%	68%	97%	73%	99%	93%
65	63%	67%	65%	63%	91%	79%	69%	100%	72%	99%	94%
70	61%	66%	65%	61%	90%	78%	69%	100%	71%	99%	93%
75	60%	65%	65%	60%	90%	76%	68%	99%	70%	99%	93%
80	57%	64%	64%	57%	89%	74%	67%	98%	69%	99%	93%
85	55%	63%	63%	55%	88%	73%	66%	97%	67%	99%	93%
90	54%	62%	61%	54%	87%	71%	65%	95%	67%	99%	93%
95	49%	61%	60%	49%	87%	70%	63%	93%	66%	99%	92%
100	48%	59%	59%	48%	86%	69%	62%	90%	63%	99%	92%
125	43%	52%	55%	43%	85%	64%	57%	80%	57%	99%	90%
150	39%	46%	53%	39%	82%	60%	54%	76%	49%	99%	89%
175	36%	40%	51%	36%	78%	55%	46%	66%	43%	99%	89%
200	33%	37%	51%	33%	74%	50%	40%	56%	41%	99%	88%
250	28%	31%	49%	28%	67%	41%	38%	47%	35%	99%	87%
300	26%	28%	43%	26%	62%	37%	34%	43%	31%	98%	86%
350	25%	26%	41%	25%	56%	34%	36%	44%	27%	98%	87%
400	23%	26%	43%	23%	49%	31%	42%	51%	26%	98%	87%
500	24%	24%	51%	24%	42%	30%	60%	72%	24%	99%	89%

Table 6-5 Total habitat - percent of maximum at Independence Creek.

Q	Min All	E. gra.	C. pro.	D. arg.	N. ama.	I. lup.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	8%	21%	21%	28%	21%	16%	29%	8%	28%	13%	27%
5	28%	39%	39%	49%	38%	31%	49%	28%	45%	30%	45%
10	41%	50%	50%	59%	49%	41%	59%	44%	55%	45%	55%
15	48%	55%	55%	64%	55%	48%	64%	50%	61%	52%	60%
20	54%	60%	60%	68%	60%	54%	68%	56%	66%	60%	64%
25	59%	65%	65%	74%	66%	59%	74%	60%	73%	65%	70%
30	63%	69%	69%	77%	71%	64%	77%	63%	78%	70%	74%
35	67%	72%	71%	79%	73%	67%	79%	67%	80%	74%	76%
40	69%	74%	73%	81%	76%	69%	81%	69%	83%	78%	79%
45	71%	75%	75%	82%	78%	71%	82%	72%	84%	81%	80%
50	74%	78%	77%	84%	80%	74%	84%	74%	87%	84%	82%
55	75%	79%	78%	84%	81%	75%	85%	76%	88%	86%	83%
60	77%	80%	80%	85%	83%	77%	85%	80%	89%	90%	84%
65	79%	82%	81%	86%	84%	79%	86%	83%	90%	92%	85%
70	81%	83%	82%	86%	85%	81%	87%	85%	90%	93%	86%
75	82%	84%	83%	87%	86%	82%	87%	87%	91%	95%	87%
80	84%	85%	84%	87%	86%	84%	88%	89%	91%	96%	87%
85	86%	87%	86%	89%	88%	86%	90%	91%	92%	97%	89%
90	88%	89%	88%	91%	90%	88%	91%	92%	94%	99%	90%
95	88%	89%	88%	91%	91%	89%	92%	93%	94%	99%	91%
100	89%	90%	89%	91%	91%	90%	92%	93%	93%	98%	91%
125	94%	95%	94%	96%	96%	95%	96%	97%	96%	99%	95%
150	97%	97%	97%	98%	98%	97%	98%	99%	98%	100%	97%
175	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
200	101%	102%	102%	101%	102%	103%	101%	103%	101%	101%	101%
250	101%	104%	105%	102%	104%	107%	102%	104%	101%	101%	102%
300	100%	106%	107%	102%	105%	109%	102%	109%	100%	103%	102%
350	98%	106%	108%	102%	105%	112%	102%	110%	98%	102%	101%
400	97%	108%	109%	103%	105%	118%	103%	112%	97%	100%	100%
500	91%	109%	111%	101%	104%	124%	104%	112%	91%	95%	98%

Table 6-6 Riffle habitat - percent of maximum at Independence Creek.

Q	Min All	E. gra.	C. pro.	D. arg.	N. ama.	I. lup.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	1%	22%	22%	32%	21%	15%	33%	2%	23%	1%	25%
5	28%	43%	43%	53%	40%	35%	55%	35%	39%	28%	43%
10	45%	54%	54%	61%	51%	46%	62%	50%	47%	45%	52%
15	51%	58%	59%	66%	56%	51%	66%	54%	54%	52%	57%
20	57%	64%	64%	72%	63%	57%	73%	57%	65%	61%	64%
25	59%	69%	70%	79%	70%	62%	80%	59%	73%	66%	71%
30	60%	74%	74%	85%	75%	66%	86%	60%	80%	70%	77%
35	64%	76%	76%	86%	78%	69%	88%	64%	83%	75%	80%
40	67%	78%	78%	88%	80%	71%	89%	67%	86%	78%	82%
45	69%	79%	80%	89%	82%	73%	91%	69%	87%	80%	83%
50	72%	81%	81%	90%	83%	74%	92%	72%	89%	82%	85%
55	74%	82%	82%	91%	84%	75%	92%	74%	90%	83%	85%
60	77%	83%	83%	92%	85%	77%	93%	79%	90%	86%	86%
65	79%	84%	85%	92%	86%	79%	94%	85%	91%	90%	86%
70	81%	85%	86%	93%	87%	81%	94%	88%	91%	92%	87%
75	83%	86%	87%	93%	88%	83%	95%	91%	92%	94%	88%
80	85%	87%	88%	93%	88%	85%	95%	92%	92%	94%	88%
85	88%	90%	91%	96%	91%	88%	98%	95%	94%	96%	91%
90	90%	92%	92%	97%	92%	90%	99%	97%	96%	97%	92%
95	91%	92%	93%	97%	93%	91%	99%	98%	96%	97%	92%
100	92%	93%	93%	97%	93%	92%	100%	98%	96%	97%	93%
125	94%	95%	95%	97%	95%	96%	99%	100%	95%	98%	94%
150	97%	98%	98%	99%	98%	99%	100%	100%	98%	98%	97%
175	99%	100%	100%	100%	100%	100%	99%	100%	100%	100%	100%
200	98%	101%	102%	100%	101%	102%	98%	101%	101%	101%	102%
250	97%	104%	105%	100%	103%	103%	97%	100%	102%	101%	103%
300	97%	104%	107%	100%	104%	105%	97%	111%	103%	109%	103%
350	96%	105%	107%	100%	102%	110%	96%	115%	102%	110%	100%
400	96%	104%	107%	99%	101%	114%	96%	118%	99%	108%	98%
500	89%	105%	106%	95%	100%	117%	95%	118%	89%	106%	97%

Table 6-7 Run habitat - percent of maximum at Independence Creek.

Q	Min All	E. gra.	C. pro.	D. arg.	N. ama.	I. lup.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	9%	15%	14%	17%	14%	13%	20%	9%	24%	21%	23%
5	21%	31%	30%	36%	29%	25%	38%	21%	40%	30%	39%
10	34%	40%	40%	45%	38%	34%	46%	37%	46%	43%	46%
15	40%	45%	45%	48%	43%	40%	49%	43%	50%	50%	50%
20	44%	49%	48%	51%	47%	44%	52%	49%	54%	56%	53%
25	48%	54%	53%	56%	52%	48%	56%	53%	59%	62%	58%
30	52%	57%	56%	59%	56%	52%	60%	56%	64%	67%	62%
35	54%	59%	58%	61%	59%	54%	62%	59%	67%	71%	65%
40	56%	61%	61%	63%	62%	56%	64%	61%	70%	75%	68%
45	58%	63%	62%	64%	64%	58%	65%	63%	72%	77%	69%
50	60%	66%	65%	68%	68%	60%	69%	64%	76%	80%	72%
55	62%	67%	67%	69%	70%	62%	70%	65%	77%	81%	74%
60	64%	69%	68%	70%	71%	64%	71%	69%	79%	85%	75%
65	66%	70%	70%	72%	73%	66%	73%	71%	81%	87%	77%
70	67%	71%	71%	73%	74%	67%	74%	73%	82%	88%	78%
75	69%	73%	73%	74%	76%	69%	75%	75%	83%	90%	79%
80	71%	74%	74%	75%	77%	71%	76%	77%	83%	91%	80%
85	73%	76%	76%	77%	79%	73%	78%	79%	85%	92%	81%
90	76%	79%	79%	81%	82%	76%	82%	81%	88%	94%	84%
95	78%	80%	80%	81%	82%	78%	83%	82%	88%	94%	85%
100	79%	81%	80%	82%	83%	79%	83%	83%	88%	94%	85%
125	88%	90%	90%	92%	91%	88%	92%	91%	95%	97%	93%
150	94%	95%	95%	96%	96%	94%	96%	97%	97%	99%	96%
175	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
200	102%	104%	104%	102%	104%	104%	102%	105%	102%	104%	103%
250	107%	111%	112%	107%	111%	111%	107%	112%	107%	108%	107%
300	107%	115%	116%	108%	114%	117%	107%	120%	109%	115%	108%
350	107%	117%	118%	108%	116%	124%	107%	124%	108%	117%	108%
400	105%	119%	118%	108%	117%	132%	106%	128%	105%	116%	107%
500	99%	121%	121%	106%	118%	146%	106%	131%	99%	113%	103%

Table 6-8 Pool habitat - percent of maximum at Independence Creek.

Q	Min All	E. gra.	C. pro.	D. arg.	N. ama.	I. lup.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	9%	31%	31%	44%	32%	19%	41%	11%	37%	9%	37%
5	29%	49%	49%	65%	52%	34%	62%	32%	59%	29%	59%
10	46%	61%	62%	78%	66%	46%	76%	47%	75%	46%	73%
15	53%	68%	69%	85%	74%	56%	83%	53%	82%	53%	79%
20	61%	74%	75%	90%	81%	64%	89%	61%	87%	61%	84%
25	66%	80%	81%	96%	86%	71%	94%	67%	92%	66%	90%
30	71%	84%	85%	99%	91%	76%	98%	72%	95%	71%	93%
35	74%	86%	88%	99%	93%	80%	99%	76%	96%	74%	94%
40	77%	89%	90%	100%	94%	84%	100%	79%	97%	77%	95%
45	82%	90%	91%	100%	95%	86%	100%	84%	98%	82%	96%
50	86%	92%	93%	100%	97%	88%	100%	87%	99%	86%	97%
55	89%	93%	94%	99%	97%	90%	100%	90%	99%	89%	97%
60	92%	95%	95%	99%	98%	92%	99%	94%	100%	93%	98%
65	94%	96%	96%	98%	98%	94%	99%	96%	99%	95%	98%
70	95%	96%	96%	97%	98%	95%	98%	97%	99%	96%	98%
75	96%	97%	97%	97%	98%	96%	97%	98%	98%	98%	98%
80	96%	98%	97%	96%	98%	97%	97%	99%	97%	98%	98%
85	96%	99%	98%	97%	99%	99%	97%	99%	96%	99%	99%
90	96%	99%	99%	96%	100%	100%	97%	100%	96%	100%	99%
95	94%	100%	99%	96%	100%	100%	97%	100%	94%	100%	99%
100	92%	100%	99%	96%	100%	100%	96%	99%	92%	99%	99%
125	91%	100%	100%	93%	99%	98%	95%	97%	91%	96%	100%
150	89%	97%	98%	89%	94%	94%	93%	94%	89%	94%	97%
175	91%	97%	99%	91%	93%	94%	94%	92%	91%	91%	98%
200	88%	95%	97%	90%	91%	95%	95%	91%	89%	88%	97%
250	77%	91%	93%	86%	84%	96%	92%	86%	79%	77%	91%
300	67%	89%	93%	84%	82%	94%	91%	79%	71%	67%	89%
350	60%	86%	90%	81%	80%	89%	90%	72%	64%	60%	85%
400	56%	89%	94%	87%	77%	92%	95%	72%	68%	56%	88%
500	47%	90%	96%	88%	72%	91%	98%	65%	67%	47%	86%

Table 6-9 Total habitat - percent of maximum at Pecos River.

Q	Min All	E. gra.	C. pro.	D. arg.	N. bra.	N. ama.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	29%	45%	44%	53%	29%	56%	75%	40%	62%	58%	61%
5	40%	58%	57%	69%	40%	71%	87%	53%	79%	71%	74%
10	48%	65%	65%	77%	48%	79%	93%	64%	86%	79%	81%
15	55%	72%	71%	83%	55%	84%	94%	71%	90%	84%	85%
20	61%	77%	76%	89%	61%	87%	95%	76%	93%	88%	89%
25	65%	80%	80%	92%	65%	89%	96%	78%	96%	90%	92%
30	69%	83%	83%	94%	69%	92%	96%	82%	97%	92%	94%
35	72%	85%	84%	95%	72%	93%	95%	83%	97%	93%	94%
40	76%	86%	86%	95%	76%	94%	94%	87%	97%	94%	94%
45	78%	88%	88%	96%	78%	96%	94%	88%	97%	95%	95%
50	80%	91%	91%	99%	80%	98%	99%	89%	99%	96%	98%
55	84%	93%	93%	100%	84%	99%	100%	92%	100%	97%	99%
60	86%	94%	94%	100%	86%	100%	100%	93%	100%	98%	100%
65	88%	95%	95%	99%	88%	100%	100%	94%	99%	98%	100%
70	90%	96%	96%	99%	90%	100%	100%	95%	99%	99%	100%
75	92%	97%	96%	99%	92%	100%	99%	96%	98%	99%	100%
80	93%	97%	97%	98%	93%	100%	99%	97%	98%	99%	100%
85	94%	97%	97%	98%	94%	99%	98%	97%	97%	99%	99%
90	95%	98%	98%	97%	95%	99%	98%	97%	96%	99%	99%
95	95%	98%	98%	97%	95%	99%	97%	97%	95%	98%	99%
100	94%	98%	98%	96%	96%	98%	96%	97%	94%	98%	98%
125	91%	100%	100%	95%	100%	99%	98%	100%	91%	100%	98%
150	87%	99%	100%	92%	100%	96%	96%	100%	87%	99%	97%
175	82%	96%	96%	88%	100%	92%	93%	97%	82%	97%	95%
200	77%	93%	94%	83%	100%	87%	91%	93%	77%	94%	92%
250	69%	84%	87%	73%	95%	78%	85%	84%	69%	85%	84%
300	62%	74%	81%	64%	89%	70%	77%	76%	62%	79%	75%
350	57%	69%	76%	59%	82%	66%	75%	68%	57%	73%	69%
400	49%	63%	70%	52%	74%	62%	71%	60%	49%	67%	64%
500	39%	53%	57%	42%	59%	46%	62%	45%	39%	54%	55%

Table 6-10 Riffle habitat - percent of maximum at Pecos River

Q	Min All	E. gra.	C. pro.	D. arg.	N. bra.	N. ama.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	11%	21%	21%	29%	11%	38%	51%	18%	28%	19%	27%
5	21%	36%	37%	52%	21%	58%	68%	27%	55%	35%	49%
10	30%	46%	47%	63%	30%	71%	77%	42%	68%	50%	59%
15	38%	54%	54%	72%	38%	77%	83%	50%	76%	57%	66%
20	44%	62%	62%	82%	44%	80%	85%	57%	83%	61%	75%
25	48%	68%	69%	89%	48%	83%	88%	60%	90%	64%	82%
30	53%	74%	74%	95%	53%	88%	92%	65%	95%	68%	88%
35	55%	76%	77%	98%	55%	90%	93%	67%	98%	69%	90%
40	61%	79%	80%	99%	61%	91%	93%	72%	99%	75%	91%
45	64%	82%	82%	100%	64%	92%	93%	75%	100%	78%	92%
50	66%	83%	84%	100%	66%	92%	92%	76%	100%	79%	92%
55	74%	85%	86%	99%	74%	92%	91%	83%	99%	83%	92%
60	78%	86%	87%	98%	78%	91%	90%	85%	98%	85%	92%
65	80%	87%	88%	97%	80%	90%	88%	86%	97%	86%	93%
70	84%	89%	89%	96%	84%	90%	88%	89%	96%	88%	93%
75	87%	90%	91%	95%	87%	90%	88%	91%	95%	89%	94%
80	87%	91%	91%	94%	90%	89%	87%	92%	94%	90%	94%
85	86%	92%	92%	94%	92%	89%	86%	94%	93%	91%	94%
90	84%	93%	93%	94%	93%	88%	84%	95%	92%	92%	94%
95	83%	94%	93%	93%	94%	87%	83%	95%	90%	92%	93%
100	82%	94%	93%	92%	95%	86%	82%	95%	89%	93%	93%
125	92%	100%	100%	97%	100%	100%	100%	100%	92%	100%	99%
150	83%	97%	97%	96%	97%	98%	100%	98%	83%	97%	100%
175	76%	93%	93%	91%	97%	94%	99%	95%	76%	94%	97%
200	70%	88%	88%	86%	95%	89%	97%	89%	70%	87%	93%
250	59%	75%	81%	72%	90%	81%	95%	75%	59%	69%	78%
300	53%	63%	75%	59%	83%	79%	91%	65%	53%	59%	63%
350	46%	53%	65%	48%	76%	76%	88%	56%	46%	52%	51%
400	34%	46%	58%	40%	66%	73%	83%	47%	34%	45%	44%
500	26%	37%	45%	35%	53%	56%	70%	35%	26%	30%	36%

Table 6-11 Run habitat - percent of maximum at Pecos River.

Q	Min All	E. gra.	C. pro.	D. arg.	N. bra.	N. ama.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	36%	65%	61%	71%	36%	64%	78%	57%	73%	63%	70%
5	49%	75%	71%	80%	49%	75%	86%	71%	86%	78%	82%
10	58%	79%	77%	84%	58%	81%	90%	80%	92%	88%	88%
15	65%	83%	80%	89%	65%	85%	92%	84%	96%	93%	92%
20	71%	87%	84%	92%	71%	88%	93%	88%	99%	96%	96%
25	74%	88%	86%	93%	74%	90%	93%	89%	100%	98%	96%
30	79%	89%	87%	93%	79%	91%	92%	93%	100%	100%	96%
35	82%	89%	88%	92%	82%	92%	91%	94%	99%	100%	95%
40	84%	90%	89%	91%	84%	93%	89%	96%	97%	100%	94%
45	86%	91%	90%	92%	86%	94%	90%	97%	96%	99%	94%
50	87%	96%	95%	98%	87%	97%	96%	98%	99%	98%	98%
55	90%	98%	97%	100%	90%	99%	99%	100%	99%	98%	100%
60	92%	99%	98%	100%	92%	100%	100%	100%	98%	98%	100%
65	93%	100%	99%	100%	93%	100%	100%	100%	97%	97%	100%
70	94%	100%	100%	99%	94%	100%	100%	100%	96%	96%	99%
75	94%	100%	100%	98%	95%	100%	99%	100%	94%	95%	99%
80	93%	100%	100%	98%	96%	99%	98%	100%	93%	94%	98%
85	91%	100%	100%	97%	96%	98%	97%	99%	91%	93%	97%
90	90%	99%	100%	96%	97%	97%	96%	99%	90%	92%	96%
95	89%	99%	99%	94%	97%	96%	95%	99%	89%	91%	95%
100	87%	99%	99%	93%	97%	95%	94%	98%	87%	89%	95%
125	79%	96%	97%	86%	100%	89%	87%	97%	79%	87%	88%
150	75%	95%	98%	83%	100%	83%	82%	97%	75%	87%	85%
175	68%	92%	92%	77%	97%	76%	77%	92%	68%	81%	81%
200	62%	87%	89%	70%	95%	70%	73%	86%	62%	78%	76%
250	49%	75%	78%	60%	85%	58%	63%	75%	49%	66%	66%
300	41%	65%	68%	52%	78%	47%	55%	64%	41%	55%	56%
350	40%	63%	67%	53%	70%	43%	55%	56%	40%	46%	53%
400	33%	57%	60%	47%	62%	37%	52%	48%	33%	38%	46%
500	20%	44%	47%	33%	46%	24%	40%	30%	20%	24%	31%

Table 6-12 Pool habitat - percent of maximum at Pecos River.

Q	Min All	E. gra.	C. pro.	D. arg.	N. bra.	N. ama.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	39%	55%	53%	62%	39%	51%	81%	42%	73%	69%	72%
5	48%	68%	66%	76%	48%	65%	93%	56%	85%	78%	81%
10	54%	75%	72%	82%	54%	73%	97%	64%	89%	82%	85%
15	61%	81%	78%	88%	61%	76%	96%	72%	92%	86%	88%
20	65%	84%	81%	88%	65%	79%	96%	77%	92%	90%	90%
25	69%	85%	83%	90%	69%	82%	96%	79%	93%	92%	92%
30	72%	87%	84%	90%	72%	84%	96%	82%	94%	93%	92%
35	75%	87%	85%	91%	75%	86%	94%	83%	94%	94%	92%
40	78%	88%	86%	90%	78%	87%	92%	84%	93%	94%	92%
45	79%	89%	87%	91%	79%	89%	92%	84%	93%	94%	93%
50	82%	92%	90%	95%	82%	91%	98%	86%	97%	96%	97%
55	83%	93%	91%	96%	83%	93%	99%	86%	98%	97%	98%
60	85%	94%	92%	97%	85%	94%	100%	87%	99%	97%	99%
65	86%	94%	92%	98%	86%	94%	100%	88%	100%	98%	100%
70	87%	95%	93%	99%	87%	95%	100%	89%	100%	98%	100%
75	88%	95%	94%	99%	88%	96%	100%	90%	100%	99%	100%
80	89%	96%	94%	99%	89%	96%	100%	90%	100%	99%	100%
85	89%	96%	95%	100%	89%	96%	100%	91%	100%	99%	100%
90	90%	96%	95%	100%	90%	97%	100%	91%	100%	99%	100%
95	90%	96%	95%	100%	90%	97%	100%	91%	100%	99%	100%
100	91%	96%	96%	100%	91%	97%	100%	91%	100%	98%	100%
125	95%	97%	97%	98%	95%	98%	98%	97%	97%	100%	99%
150	94%	99%	99%	96%	98%	100%	97%	99%	94%	100%	98%
175	92%	100%	100%	94%	100%	100%	96%	100%	92%	99%	97%
200	89%	101%	102%	91%	102%	98%	94%	100%	89%	98%	96%
250	84%	102%	103%	88%	103%	92%	89%	101%	84%	96%	93%
300	79%	101%	102%	83%	100%	85%	81%	98%	79%	94%	90%
350	74%	98%	99%	78%	95%	82%	78%	92%	74%	91%	85%
400	66%	96%	96%	71%	89%	79%	74%	85%	66%	86%	83%
500	58%	87%	87%	64%	75%	63%	69%	73%	58%	76%	78%

6.2 Microhabitat Scale Analysis (Point Depth and Velocity Habitat Values)

Mesohabitat level responses described above can be more thoroughly understood by examining the hydrologic habitat parameters (depth, velocity and substrate) at the microhabitat level of points across the channel. The red bars in the following figures display the habitAt subsistence level flows (based on preliminary HEFR runs subsistence flows are estimated at about 25 cfs) habitat conditions are poor primarily because the depth for most of the channel is less than 1 foot, more shallow than preferred even for this small fish (Figure 6-2).

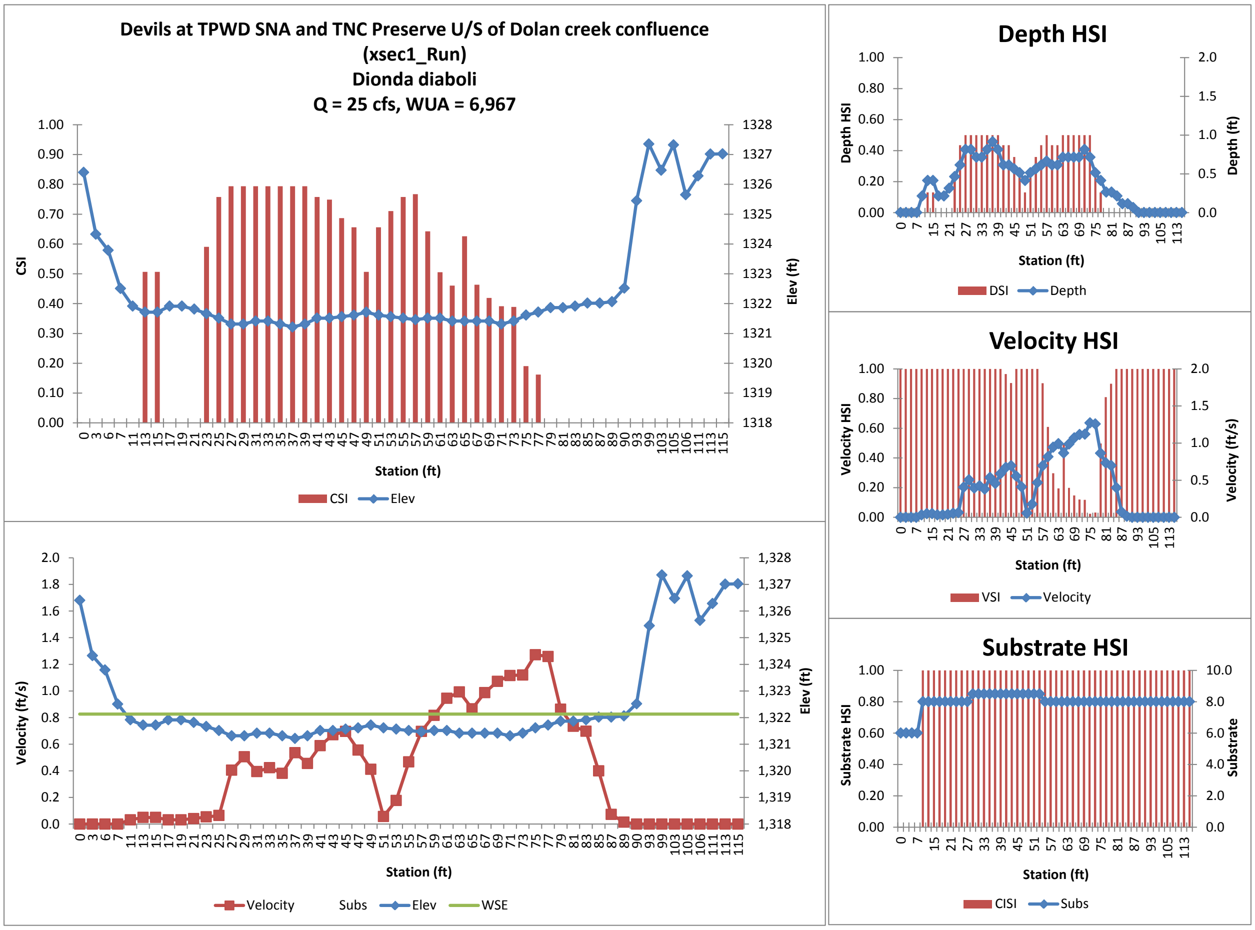


Figure 6-2 Devils River minnow habitat at 25 cfs at cross section 1 (run) at the Devils River.

As flows increase to 70 cfs (in the range of medium base flows), even though velocities are now too fast for most of the right side of the channel (the head pin for all sites was placed on the river left at station 0), significant portions of the left side of the channel are highly suitable for this species (Figure 6-3).

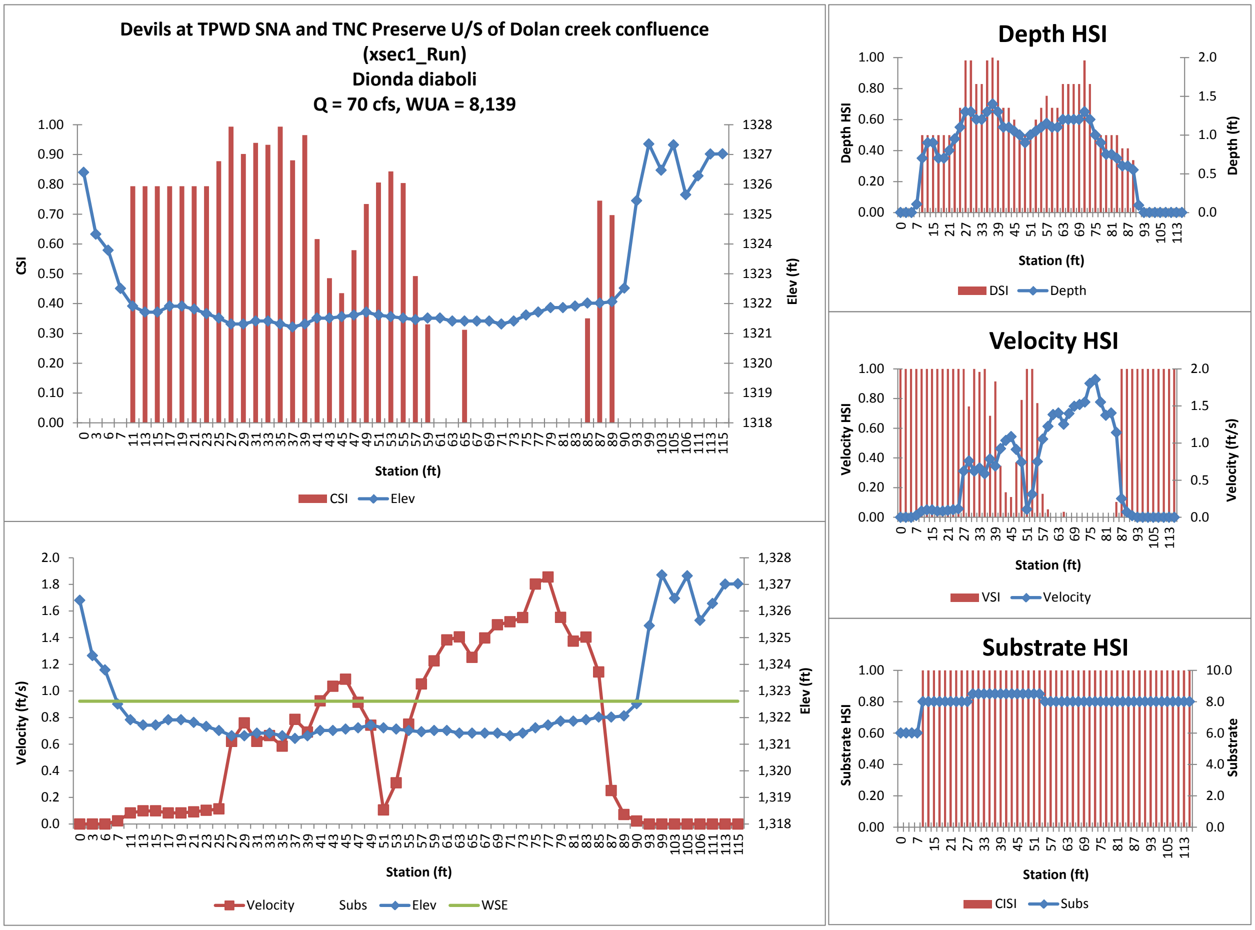


Figure 6-3 Devils River minnow habitat at 70 cfs at cross section 1 (run) at the Devils River.

Although somewhat higher than what would be considered for base flow recommendations, once the flow reaches 150 cfs at this cross section, high velocities result in most of the channel being unsuitable habitat for this species (Figure 6-4)

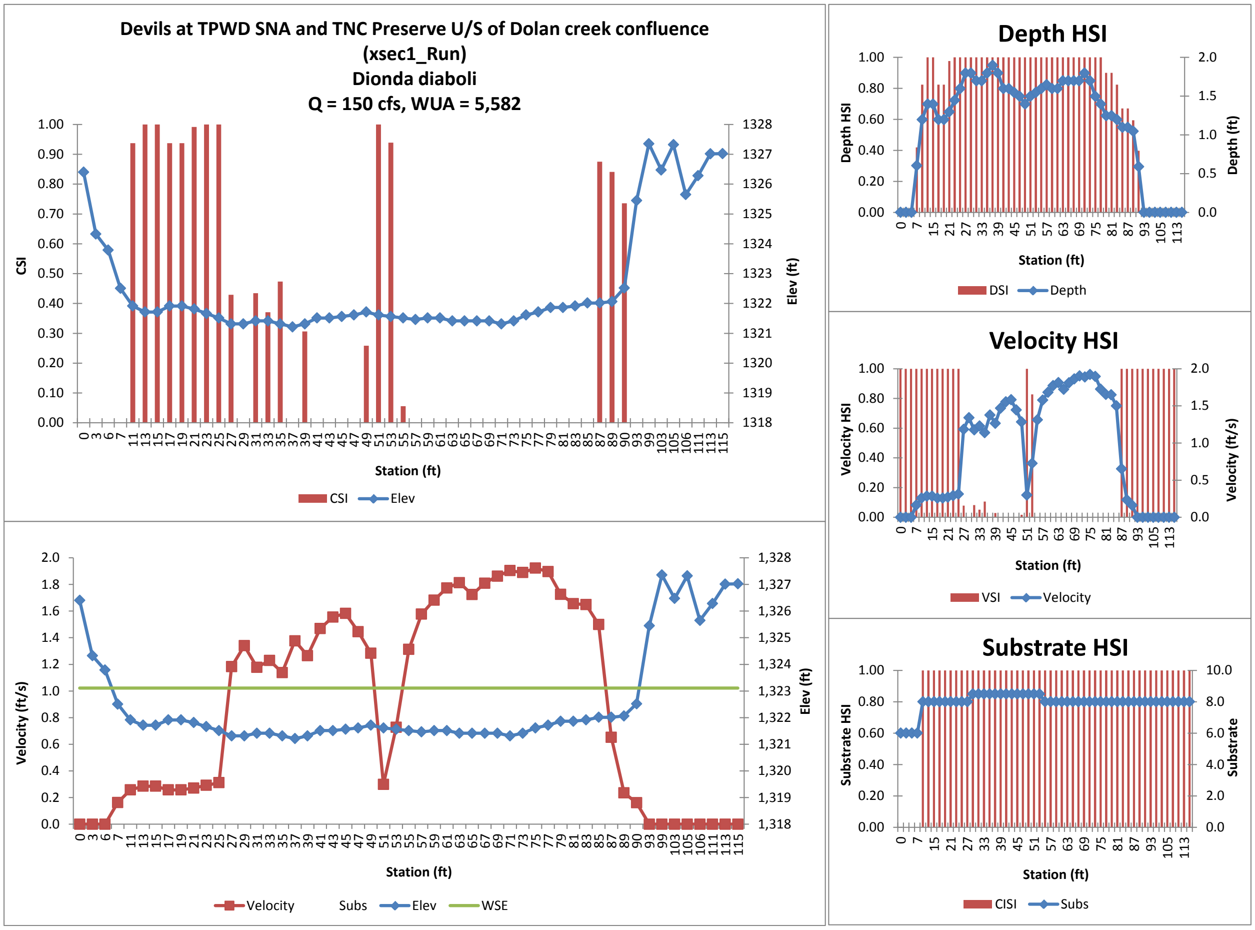


Figure 6-4 Devils River minnow habitat at 150 cfs at cross section 1 (run) at the Devils River.

The proceeding example demonstrates how the tool can be used to better understand how habitat conditions change with flows. This example not intended to make a recommendation for one flow rate over another, in fact this species at this cross section was selected because it shows a clear modal response over the range of base flows being considered, many of the species examined suggest less dramatic responses, especially when integrated over the entire study site and viewed at the reach scale. Typically, habitat area increases with increased flows as more edge area is inundated and, for some species, higher flows produce unsuitable depths and velocities in the middle of the channel. This highlights the importance of evaluating spatial issues. Suitable habitat for all species being limited to channel edges may suggest increased competition within that limited space. These results could also be used to evaluate habitat quality. While changes in habitat quality are not particularly significant for this species, habitat quality for some species may be an important factor to consider. For some species the total WUA at one flow may be the results of significant amounts of relatively poor quality habitat, while essentially the same total WUA may be produced by small areas of higher quality habitat. The relative value of large areas of poor quality habitat versus less area of higher-quality habitat is another factor that might be considered. The spreadsheet tool provides an option for excluding low quality habitat below a user defined value. Values used in other studies have been in the range of 0.7 and 0.8. The issue of habitat quality, at the reach level, is addressed in more detail in Section 6.3 below.

6.3 Assessing Quantity versus Quality Habitat at Reach level

One component in the evaluation of any instream flow regime is a consideration of the quantity versus quality aspects of available habitat. It is clear from simple observations across a wide array of aquatic species that individuals will occupy less than ideal habitats due to a variety of factors such as competition, linear dominance, community density, community structure (predator versus prey), etc. It is also known that if a more suitable location is made available, species will move to that “higher preferred” habitat location. This directly points out the subtle difference between pure quantities versus quality habitat in habitat selection by species. The analysis presented in this report is an estimate of the available habitat at each discharge, but does not consider these behavioral factors or species interactions. It is simply an estimated potential of locations having depth, velocity and substrate conditions that the biologist considers useable by each focal species. Given the type of habitat suitability criteria being employed in these studies, the calculation of physical habitat availability based on combinations of depth, velocity and substrate imply that, over some combination of their ranges, the combined suitability will range between 0.0 (totally unsuitable) to 1.0 (assumed to be ideal). What is assumed, however, is that any potential location having non-zero combined suitability is potentially inhabitable by the focal species and that a location having a combined suitability of 0.0 would not be occupied. The calculation of available habitat at any discharge is therefore the sum of all locations (cell areas) weighted by the combined suitability at each location. Clearly, if every location in the stream at given discharge had a combined suitability of 1.0, then the computed available habitat (Weighted Usable Area) would equal the stream surface area. Inherent in these calculations of total available habitat is that two identical values of available habitat at some discharge can be composed of two entirely different conditions of absolute suitability. If the river at some discharge contained 10 cells, each 1 square foot, and the combined suitability of each cell was 0.1 (poor quality) the total WUA would be estimated as 1 square foot. However, given this same discharge and 10 cells in which 9 cells had a 0.0 suitability and 1 cell had perfect suitability (i.e., 1.0) then the computed WUA would still be 1 square foot. At issue for the biologists then is making an informed decision between different flow rate ranges where one might be maximizing the total habitat area which may be composed mostly of poor quality suitability versus an alternative discharge in which more proportional area is composed of higher quality habitat areas.

In order to inform the BBEST, we have provided the capability in the assessment spreadsheets to examine both total quantity as well as quality of habitat available as a function of discharge. These results can be explored on a species by species basis at individual cross sections, by mesohabitat types derived from the replicate cross sections is these mesohabitat types, or at the reach level which integrates all habitat availability across all mesohabitat types. To further explore the implications of quantity versus quality, Figure 6-5 shows the relationships between total available habitat and discharge (top) versus only “high” quality habitat versus discharge (bottom) over the ranges of subsistence, low, medium and high base flow ranges. High quality habitat was assumed to be where the combined suitability for component depth, velocity, and substrate suitability were >= 0.75. The analysis tool can be used to set any arbitrary threshold for screen out "poor" habitat and the threshold of 0.75 was selected based on previous work by the TPWD and discussions with the Instream Subcommittee.

What is evident in Figure 6-5 is that while the total quantity of habitat (top) increases sharply from zero to the subsistence flow range, the rise is less sharp when considering only high quality habitat. Some species have no high quality habitat (or extremely low) within the subsistence flow ranges but have proportionally higher amounts within the base flow ranges of discharge. It is also evident that the amount of quality habitat is more sensitive to flows within the medium and high base flow seasonal discharge ranges but so not evident when only considering total habitat available. In some sense, these results support the underlying ethos of the Texas Instream Flow Program (TIFP 2008) and SAC guidance (SAC 2009b) where three levels of base flow regimes have been suggested as a starting point for evaluating environmental base flow regimes.

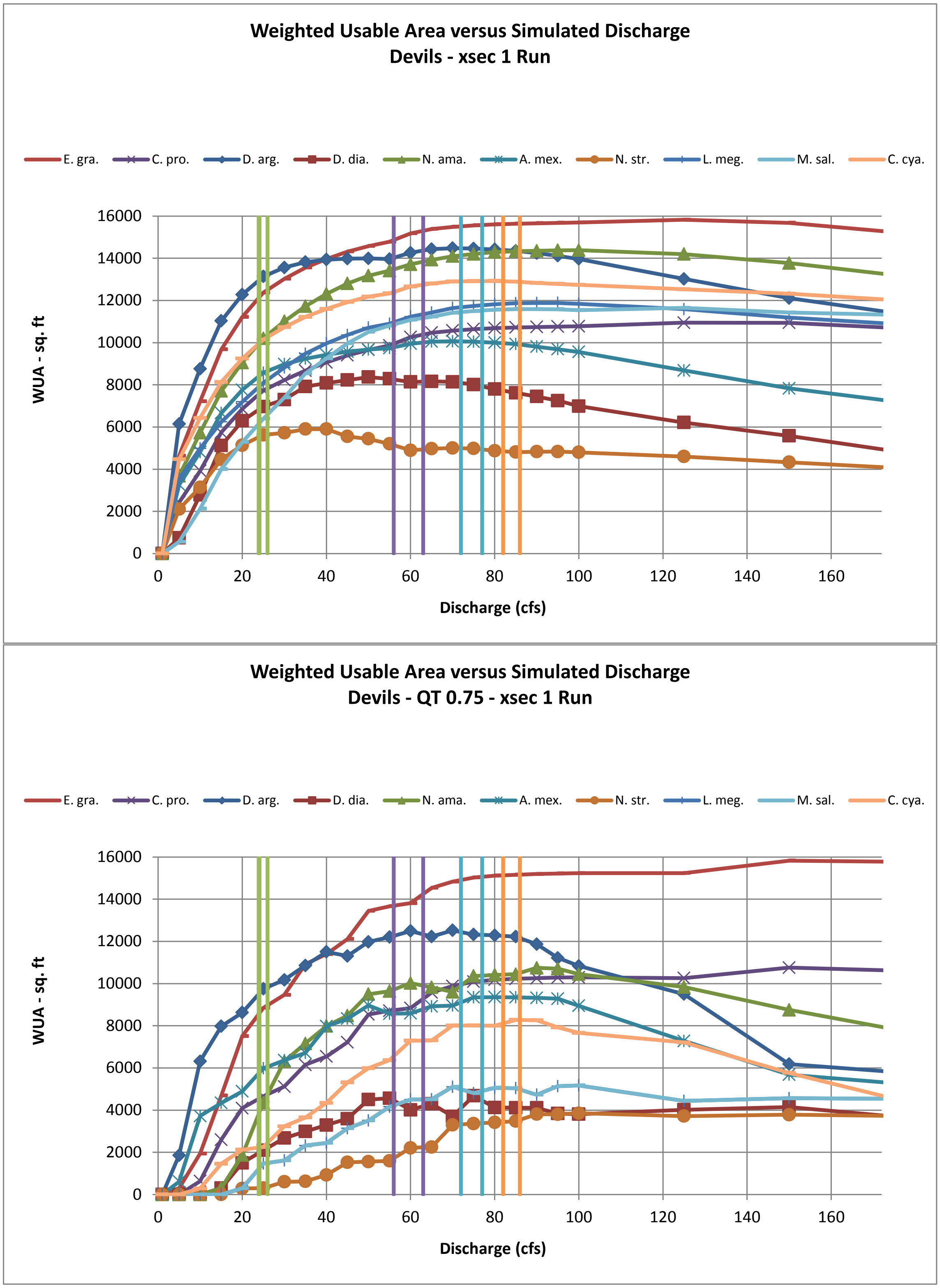


Figure 6-5 Quantity versus quality of available habitat at the Devils River study site.

7 Conclusions

The authors of this report recognize the task facing the BBEST, namely to develop scientifically defensible flow recommendations to maintain a sound ecological environment. A paucity of data, incomplete understanding of biological responses and time and resource constraints make this a particularly daunting task. The information developed as part of this project are intended to assist in the evaluation of the instream habitat response to different flow levels and support the decision process for recommended instream flow regimes. Physical habitat is an essential component of stream ecosystems. It is important to recognize, however, that this physical habitat based analysis does not consider water quality, sediment transport, or direct consequences of competition and predation.

8 References

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9 Appendix A Uncertainty

This study employed one dimensional habitat models, combined with habitat suitability criteria to predict the amount of suitable habitat (WUA – weighted usable area) produced over range of flows. It is intended that the WUA versus flow curves will be used to evaluate flow recommendations.

The assumption that habitat is an important precursor to establishing conditions in which native aquatic species will persist is fundamental to the science of instream flows however before addressing the uncertainties inherent within the specific hydraulic and habitat models used in this study, it is important to acknowledge some of the more significant uncertainties associated with instream flow studies and complex aquatic systems in general. Aquatic habitats are dynamic and are not completely understood, making them very difficult to sample comprehensively. The ecosystem processes and relationships between aquatic species and their environment and among species are complex and species populations can be influenced by other interactions, the nature and extent of which can be difficult to detect. Finally, this study does not addresses the many other issues related to community ecology or other disciplines such as water quality and geomorphology.

An important limitation of the analysis presented in this report is that the hydraulic models were developed based on field data collected at a single flow rate at each site. Ideally data would be collected over a range of flows to develop site (or cross section specific) rating curves to predict water surface elevation at different flows and to be able to calibrate the model roughness parameters to adequately predict velocity distributions across the channel over a range of flow conditions. Since data from other flow rates is not available rating curves available at the most proximate USGS/IBWC gage were used to estimate water surface elevation and calculate depths at each cross section (Figure 4-1 in the main body of this report). An iterative approach, described below, was employed to ensure that the model produced reasonable estimates of velocity.

A sensitivity analysis was performed for both depth and velocity. The objective of this analysis was to address the question "If the error resulting from the model assumptions is within a reasonably expected range, would the results suggest different conclusions.”

For the depth analysis the critical factor is the shape of the response of water surface elevation to flow. To evaluate a range of responses models were run for each site using ratings developed for the other sites. For example there is a model for the Devils site using the Devils rating curve (1) and also one of Devils using the Indy rating curve (2) and one of the Devils using the Pecos rating curve (3). The same is true for the other two sites. The resulting WUA versus flow curves produced by the application of these different shape rating curves were first compared visually, however detecting changes in curve response among 10 species X 7-9 cross sections X 3 alternative rating curves X 3 sites is difficult. One approach to focus on the most significant differences was to compare the flows that produce the maximum habitat for each rating curve application. For the Devil’s River site the most significant difference in peak habitat response within the base flow range of flows was at Cross Section 7, a Slow Run, were the application of the rating curve from Independence Creek predicts a continued increase WUA for sand shiner (*N. str.*) at flows above the HEFR base flows while the application of the Devils rating curve at the Devils site indicates that WUA for this species peaks within the range of HEFR base flows. (Figure 9-1)

This analysis provides an estimate of the range for the depth response over the range of flows that are being simulated. While some species show slightly different response due to the application one or another rating curve, in general the WUA response to selection of rating curve appears to be fairly minimal. It is worth noting that the rating curves developed by the USGS/IBWC were likely based on measurements at all three sites in runs. Depths in pools would likely respond more quickly to changes in flow and while depths in riffles may respond more slowly, thus it is possible that this analysis does not fully encompasses the range of response that might be observed at every cross section however an objective estimate of the extent this range is beyond the scope of this study. This analysis with graphs and tables showing the different WUA curves produced by each model are available in spreadsheet DepthCal_Results.xlsm.

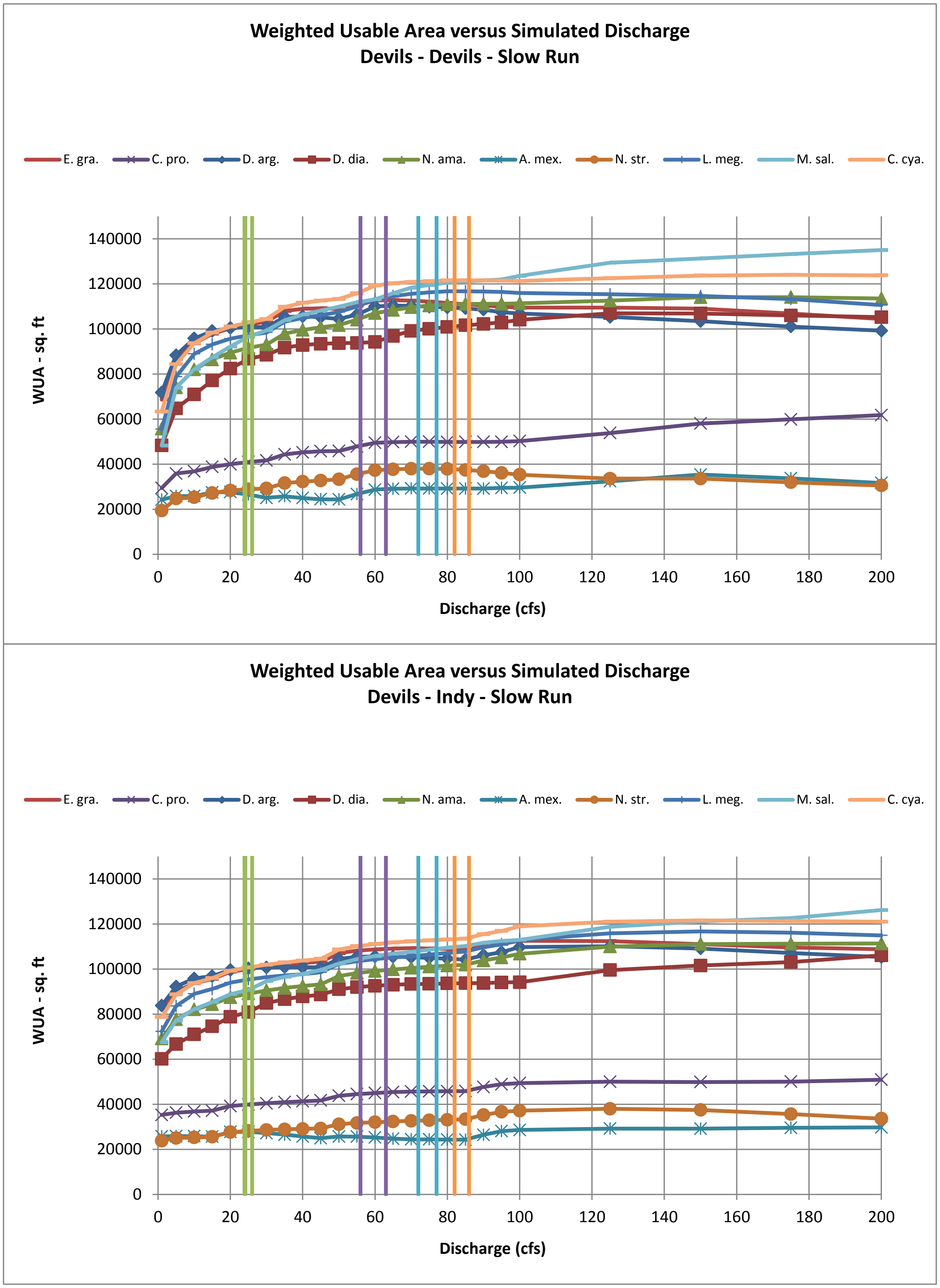

Figure 9-1 WUA response to flow Devils River cross section 7 based on application of Devils River rating curve to Devils River site (above) vs. application of Independence Creek River rating curve to Devils River site (below).

Velocity is equal to flow rate divided by cross sectional area which is a function of depth. Thus given a known depth and flow rate average velocity across the channel can be calculated directly. What is important from the stand point of one dimensional habitat modeling is how the velocity is distributed across the channel. In the first iteration of the hydraulic models, velocities were extrapolated down and up to simulate conditions at lower and higher flows based on the observed velocity distributions measured by TPWD and Sul Ross. A roughness coefficient (N), calculated for each cell using Manning's equation, served as a velocity distribution factor. In this first iteration of the models, these N values were held constant at all flows. The problem with this approach is that the model calculates very high N values in cells where observed depth is high and velocity is low and very low N values where observed depth is low and velocity is high. When the model simulates higher flows, the velocity in those cells with high N values remains very low or near zero (even though it is probably reasonable to expect velocities to increase in these areas). This approach also results in very high velocities in the cells in which a very low N value was calculated from the depths and velocities measured in the field. These velocity spikes of 7-10 ft/s are unrealistic expectations of what would occur at higher flows when velocity distributions across the channel would likely smooth out.

To address this issue the PHABSIM[3] model uses a velocity depth correction where the effect of roughness decreases as depth increases. Although implemented somewhat differently in the model spreadsheets used for this study, an approach was developed which has a similar effect. In what is now the final model calibration used for this study (results with the suffix var for "Variable"), the calculations assume that at some high flow rate, the roughness effect becomes insignificant and velocity is simply a function of depth (described by Manning equation but assuming an N value of 1). Up to the observed flow (which for all sites was relatively low) the N values were calculated based on observed velocity (with an maximum N value of 1) and between observed flow and a very high flow (850 cfs appeared to work well), the N value was interpolated between the values calculated at the observed flow and the value of 1 at 850 cfs. Velocity predictions at all cross sections were reviewed and appear to reasonably reproduced the observed velocities and produced what appear to be reasonable velocity distributions at higher flows (velocities increased in deeper, slower moving areas as flows came up and there are no velocity spikes above about 3 ft/s).

The uncertainty analysis compared two alternative approaches to developing velocity distributions across the channel with the calibration approach described in the paragraph above. The first alternative strictly applies N values calculated based on observed depths and velocities to all flows. The second alterative assumes uniform roughness were velocity is solely a function of depth. These alternatives are intended to provide reasonable bounds on the habitat response to the uncertainty of how velocities are distributed across the channel at flows that were not directly observed. Neither alternative should be interpreted as a replacement for the calibrated model. The former results in unrealistic velocity spikes while the later does not reproduce the velocity distributions that were observed during the field collections. The results of the velocity distribution sensitivity analysis were analyzed the same as the depth analysis presented above. Unlike the depth analysis which is independent of the velocity analysis, the velocity distributions are not independent of depths. This shortcoming is noted but no effort has been made to evaluate

[3] Physical HABitat SIMulation model (Stalnaker et al. 1995) developed by the USFWS at Fort Collins is the standard tool employed for 1 dimensional habitat modeling in the United States. This study preforms the basic PHABSIM calculations within an excel spreadsheet.

the potential compound effect of uncertainty associate with both depth and velocity. The velocity results suggest that uncertainty associated with velocity distributions are smaller than those associated with depth. The results of the velocity sensitivity analysis runs are available in VelCal_Results.xlsm.

While sensitivity analysis (to alternative rating curve shapes and velocity distributions across the channel) indicates some changes in magnitudes of WUA at different flow rates, in general the shape of the WUA response curves (especially within the range of flows that is of most interest to this evaluation) is very similar. This suggests that that error resulting from assumptions in model calibration would not likely effect the final conclusions regarding habitat response. The potential errors in the WUA response to depth appear to slightly higher than to velocity which suggest that collection of rating curve data could be more valuable in terms of reducing uncertainty that collection of velocity data.

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10 Appendix B Habitat Suitability Criteria

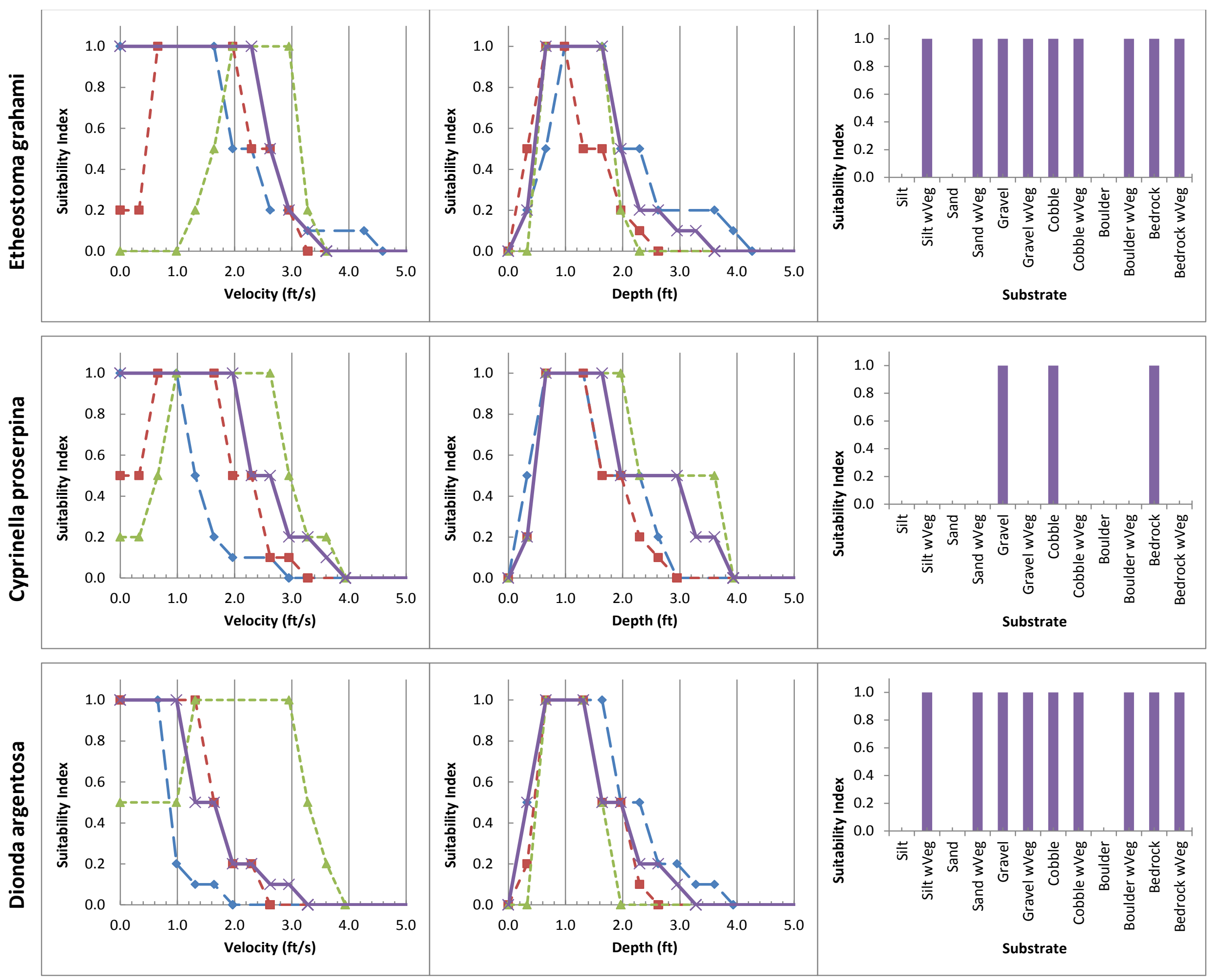
The following figures include site specific criteria developed for Devils River (blue diamond), Independence Creek (red square) and Pecos River (green triangle). As well as regional criteria based on data from all of the sites and application of professional experience to modify some of these criteria. The upper depth boundaries for gray redhorse, largemouth bass and Rio Grande cichlid were extended as there species are not know to be limited by deeper water and failure to collect them in deeper water is likely the result of sampling limitations. Specific modifications were made to proserpine shiner and Tamaulipas shiner per directions from the BBEST in consultation with TPWD.

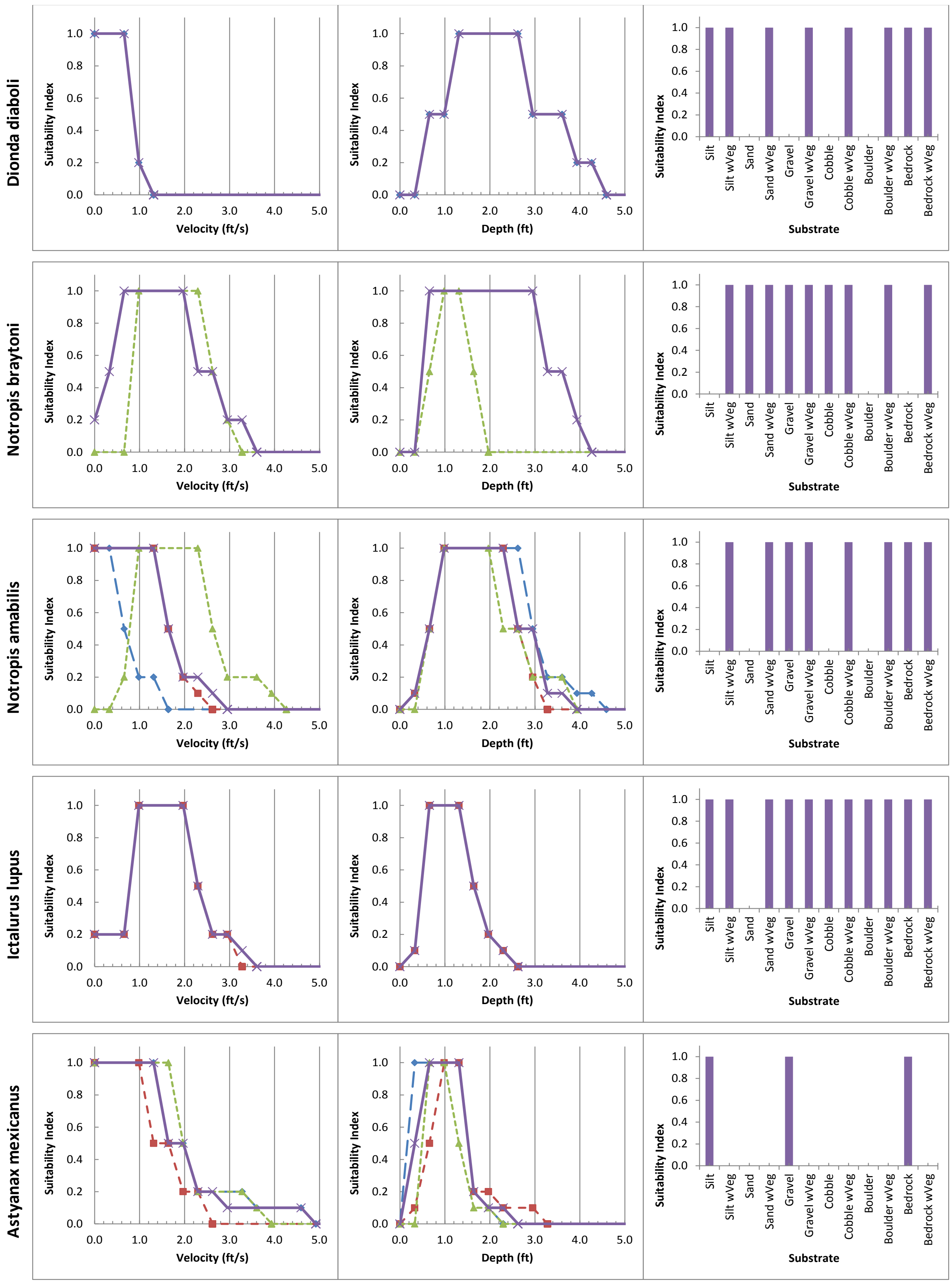
Cyprinella proserpina – velocity – extend suitability of 1 down to 0 ft/s (i.e., suitability of 1 for 0 to 2.0 ft/s)

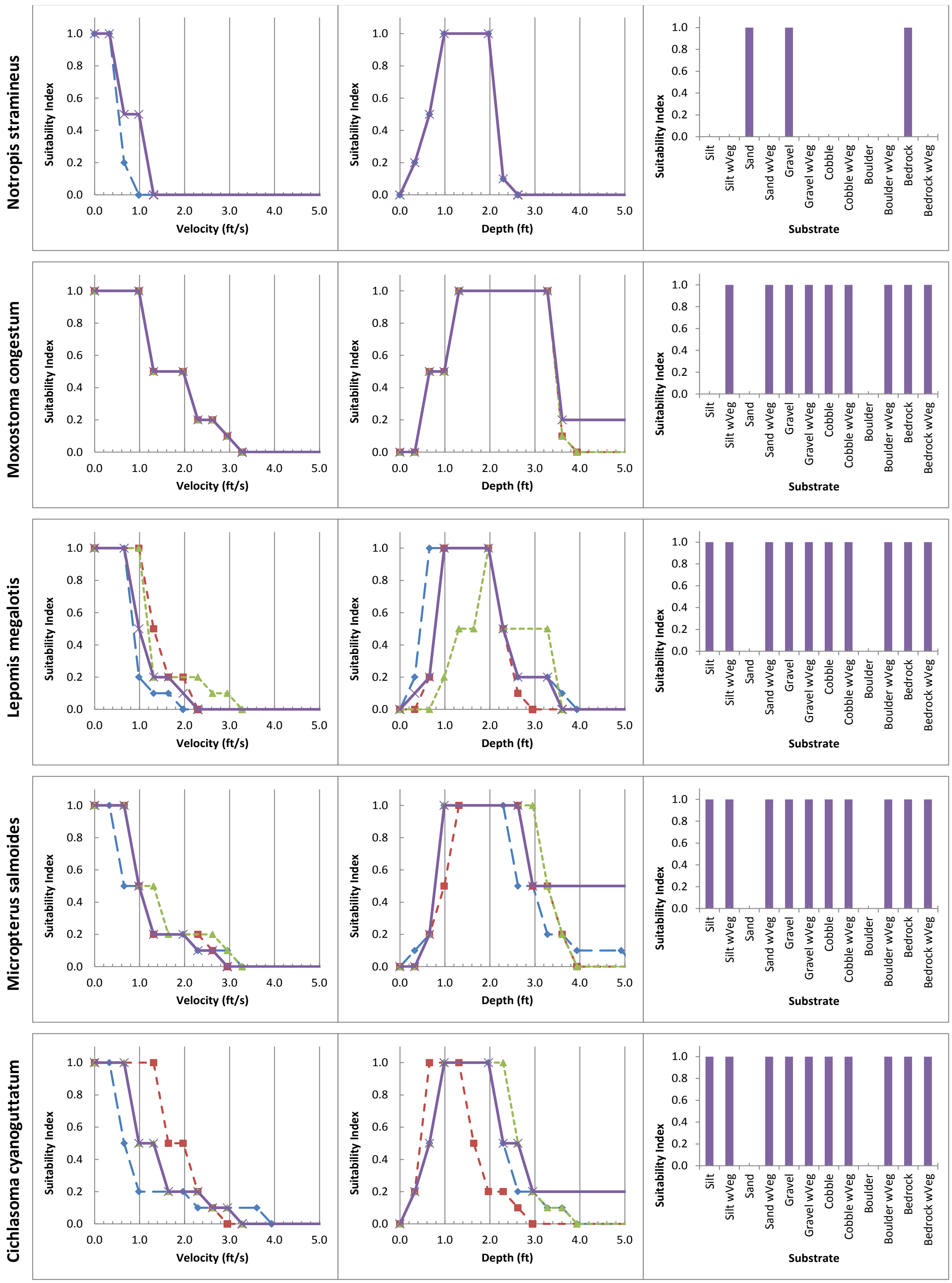
Cyprinella proserpina – depth – extend suitability of 0.5 up to 3ft (i.e., suitability of 0.5 for 2 to 3 ft)

Notropis braytoni – velocity – change to: 0 ft/s=0.2, 0.2 ft/s=0.5, 0.5-2 ft/s=1, 2.1-2.5 ft/s=0.5, 2.6-3 ft/s=0.2, >3ft/s=0

Notropis braytoni – depth – change to: 0-0.2 ft=0, 0.5-3 ft=1, 3.1-3.5 ft=0.5, 3.6-4 ft=0.2, >4 ft=0




Dionda diaboli
Notropis braytoni
Notropis amabilis
Ictalurus lupus
Astyanax mexicanus
Suitability Index
Velocity (ft/s)
Depth (ft)
Substrate
Silt
Silt wVeg
Sand
Sand wVeg
Gravel
Gravel wVeg
Cobble
Cobble wVeg
Boulder
Boulder wVeg
Bedrock
Bedrock wVeg


Notropis stramineus
Moxostoma congestum
Lepomis megalotis
Micropterus salmoides
Cichlasoma cyanoguttatum
Suitability Index
Velocity (ft/s)
Depth (ft)
Substrate
Silt
Silt wVeg
Sand
Sand wVeg
Gravel
Gravel wVeg
Cobble
Cobble wVeg
Boulder
Boulder wVeg
Bedrock
Bedrock wVeg

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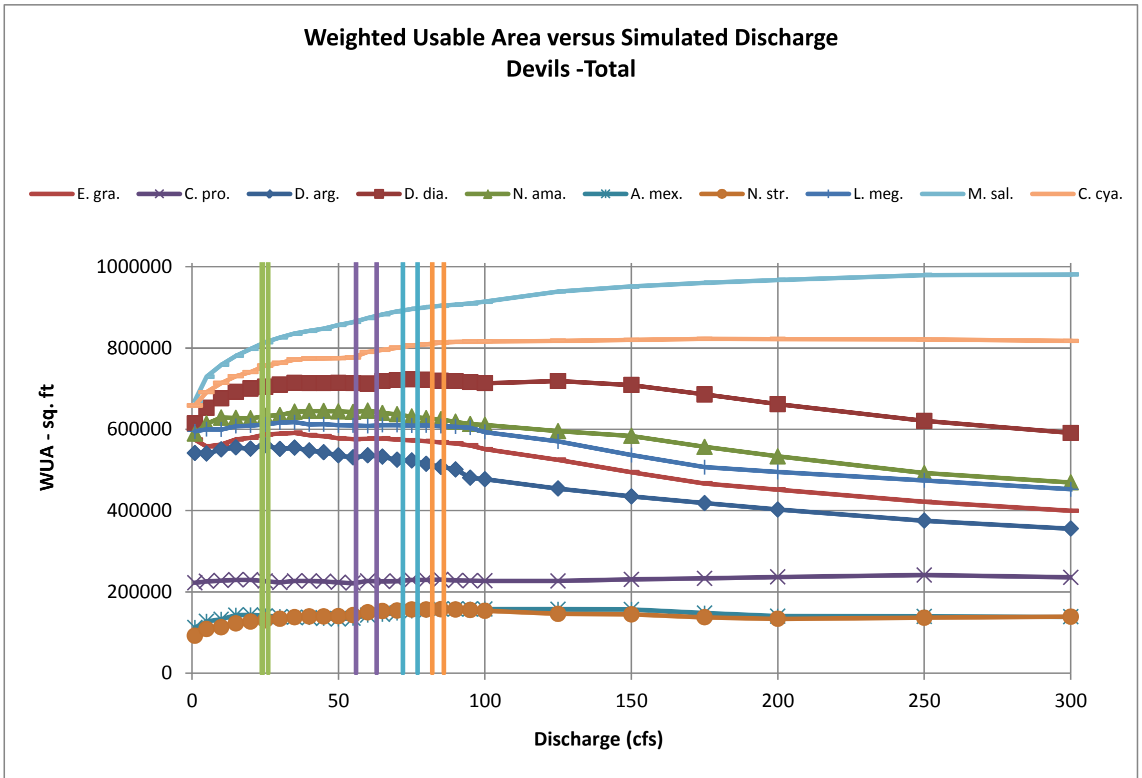
11 Appendix C Weighted Usable Area Results.



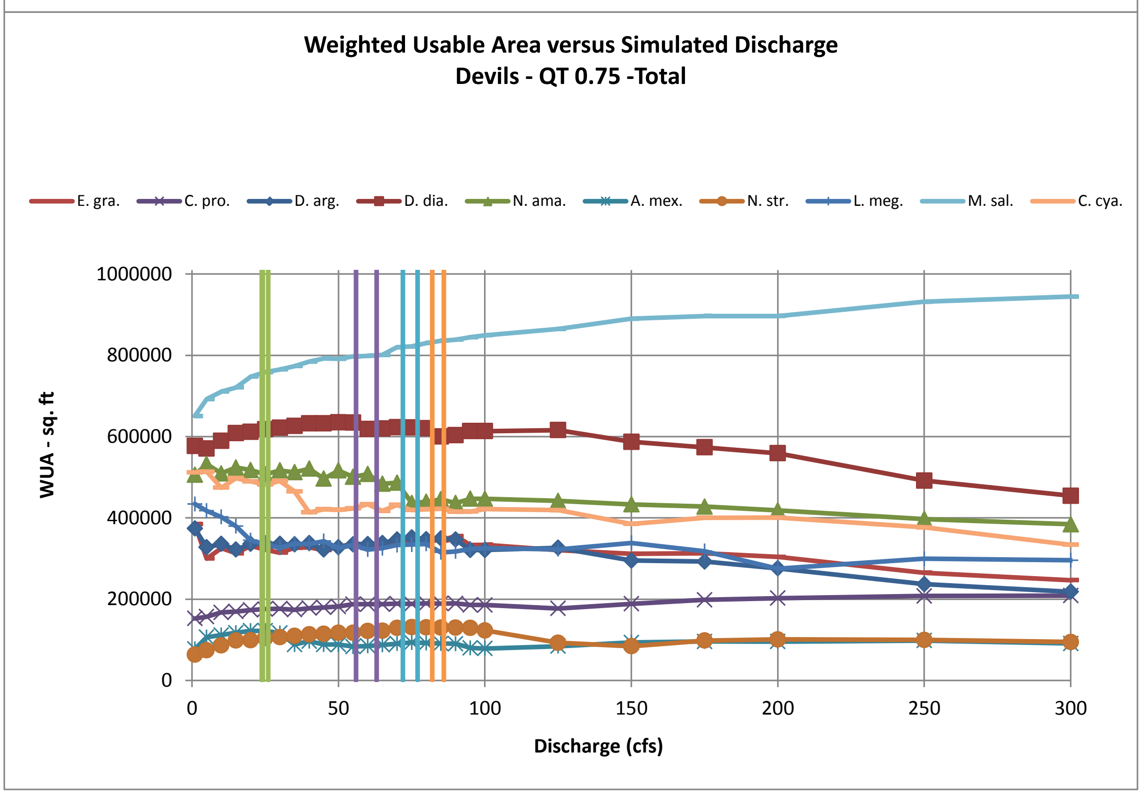


Figure 11-1 Weighted usable area versus simulated discharge at Devils River (Total).

Table 11-1 Percent of maximum WUA versus simulated discharge at Devils River (Total).

Devils -Total

Q	Min All	E. gra.	C. pro.	D. arg.	D. dia.	N. ama.	A. mex.	N. str.	L. meg.	M. sal.	C. cya.
1	58%	97%	95%	97%	85%	91%	71%	58%	96%	70%	80%
5	69%	94%	97%	96%	90%	95%	81%	69%	97%	76%	84%
10	72%	95%	98%	98%	94%	97%	84%	72%	97%	79%	87%
15	78%	97%	98%	99%	96%	97%	90%	78%	98%	81%	89%
20	81%	98%	98%	99%	97%	97%	91%	81%	99%	83%	90%
25	83%	99%	97%	100%	98%	98%	89%	83%	99%	85%	92%
30	85%	100%	96%	98%	98%	98%	88%	85%	100%	86%	93%
35	87%	100%	97%	99%	99%	100%	87%	88%	100%	87%	94%
40	86%	99%	97%	98%	99%	100%	86%	88%	99%	88%	94%
45	85%	99%	97%	97%	99%	100%	85%	88%	99%	88%	94%
50	84%	98%	96%	96%	99%	100%	84%	89%	99%	89%	94%
55	85%	97%	95%	95%	99%	99%	85%	91%	99%	90%	94%
60	90%	98%	97%	96%	99%	100%	90%	95%	98%	91%	96%
65	92%	98%	97%	95%	99%	99%	92%	97%	99%	92%	97%
70	93%	97%	97%	94%	100%	99%	94%	98%	99%	93%	97%
75	93%	97%	98%	93%	100%	98%	97%	99%	99%	93%	98%
80	92%	97%	98%	92%	100%	97%	98%	100%	99%	94%	98%
85	91%	96%	99%	91%	100%	97%	100%	100%	98%	94%	99%
90	89%	96%	98%	89%	99%	96%	100%	100%	98%	94%	99%
95	86%	95%	97%	86%	99%	95%	100%	99%	98%	95%	99%
100	85%	93%	97%	85%	99%	95%	100%	97%	96%	95%	99%
125	81%	89%	97%	81%	99%	92%	100%	93%	92%	98%	99%
150	78%	84%	99%	78%	98%	90%	99%	92%	87%	99%	100%
175	75%	79%	100%	75%	95%	86%	94%	87%	82%	100%	100%
200	72%	76%	101%	72%	92%	83%	89%	85%	80%	101%	100%
250	67%	71%	103%	67%	86%	76%	88%	87%	77%	102%	100%
300	63%	68%	101%	63%	82%	73%	88%	88%	73%	102%	99%
350	61%	64%	100%	61%	77%	69%	87%	90%	69%	103%	99%
400	58%	62%	104%	58%	70%	67%	89%	95%	66%	103%	100%
500	57%	60%	116%	57%	63%	65%	98%	111%	62%	105%	101%

Devils - QT 0.75 -Total

Q	Min All	E. gra.	C. pro.	D. arg.	D. dia.	N. ama.	A. mex.	N. str.	L. meg.	M. sal.	C. cya.
1	49%	100%	77%	100%	91%	95%	63%	49%	100%	73%	100%
5	57%	78%	79%	88%	90%	100%	87%	57%	96%	77%	100%
10	66%	85%	85%	90%	93%	96%	91%	66%	93%	79%	92%
15	75%	81%	86%	86%	96%	98%	96%	75%	87%	80%	97%
20	75%	86%	87%	90%	96%	97%	100%	75%	79%	83%	95%
25	77%	84%	89%	90%	97%	95%	100%	80%	77%	85%	94%
30	75%	82%	89%	90%	98%	97%	96%	81%	75%	85%	95%
35	72%	85%	88%	89%	99%	96%	72%	84%	78%	86%	91%
40	77%	85%	90%	90%	100%	98%	79%	86%	77%	88%	80%
45	72%	83%	91%	86%	100%	93%	72%	88%	79%	88%	82%
50	72%	86%	92%	88%	100%	97%	72%	89%	75%	88%	82%
55	68%	87%	95%	90%	100%	94%	68%	89%	77%	89%	82%
60	69%	86%	95%	90%	97%	95%	69%	93%	74%	89%	84%
65	72%	88%	95%	90%	98%	91%	72%	93%	75%	89%	81%
70	74%	89%	95%	93%	98%	91%	74%	98%	77%	91%	84%
75	76%	90%	95%	94%	98%	82%	76%	100%	77%	92%	82%
80	75%	90%	96%	93%	98%	83%	75%	100%	77%	93%	82%
85	73%	89%	95%	93%	95%	84%	74%	99%	73%	93%	82%
90	73%	92%	96%	93%	95%	82%	74%	99%	73%	94%	81%
95	66%	87%	94%	86%	97%	84%	66%	99%	75%	94%	81%
100	64%	87%	94%	86%	97%	84%	64%	94%	75%	95%	82%
125	69%	83%	89%	87%	97%	83%	69%	71%	74%	96%	82%
150	64%	81%	95%	79%	92%	81%	76%	64%	78%	99%	75%
175	73%	81%	100%	78%	90%	80%	79%	75%	73%	100%	78%
200	63%	79%	102%	74%	88%	79%	78%	77%	63%	100%	78%
250	63%	69%	105%	63%	77%	75%	80%	76%	69%	104%	73%
300	58%	64%	105%	58%	72%	72%	74%	72%	68%	105%	65%
350	54%	59%	92%	54%	68%	67%	76%	73%	58%	105%	64%
400	49%	51%	88%	49%	63%	58%	76%	78%	55%	105%	59%
500	43%	43%	86%	45%	55%	55%	71%	88%	48%	105%	51%

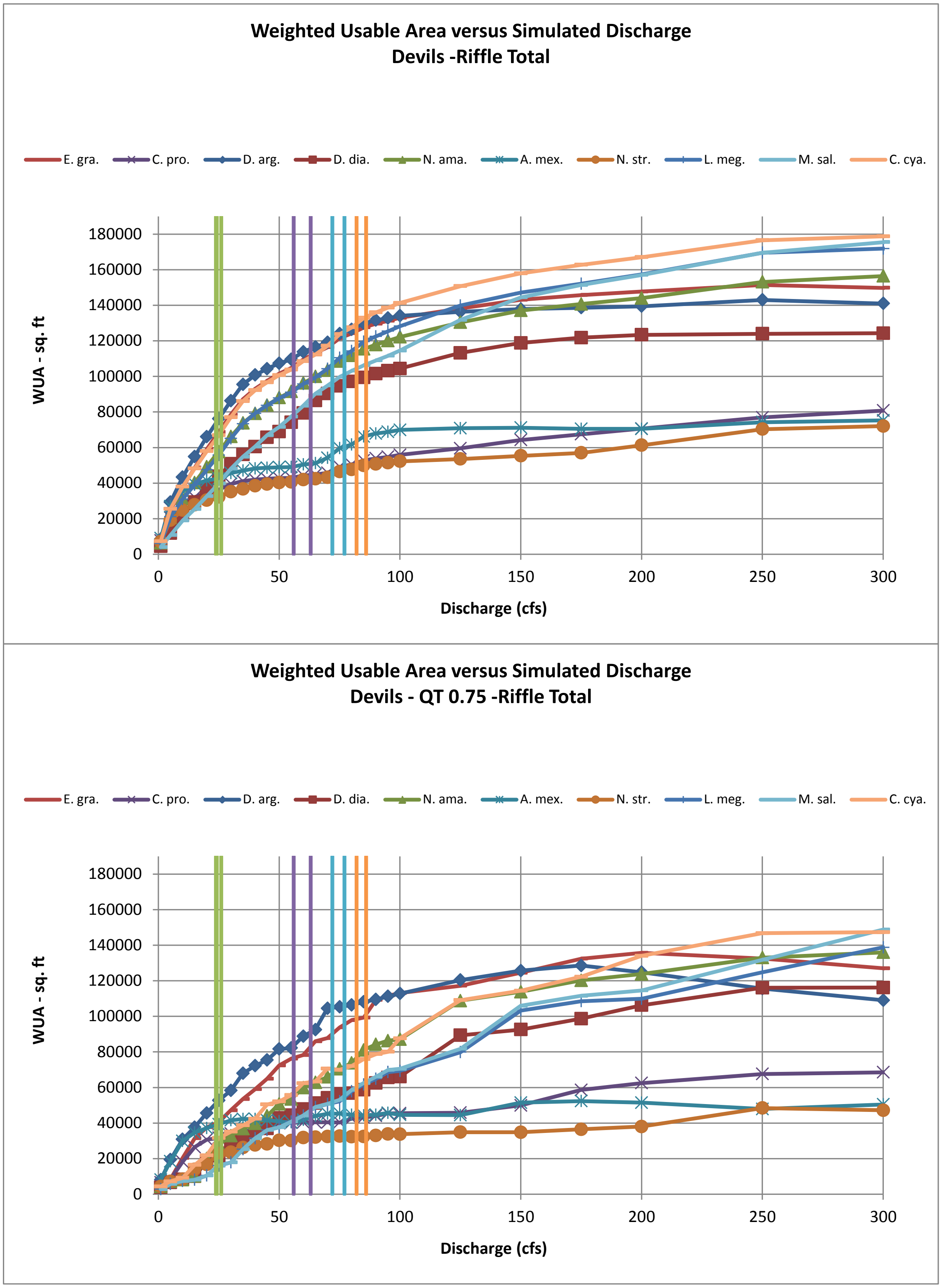


Figure 11-2 Weighted usable area versus simulated discharge at Devils River (Riffle Total).

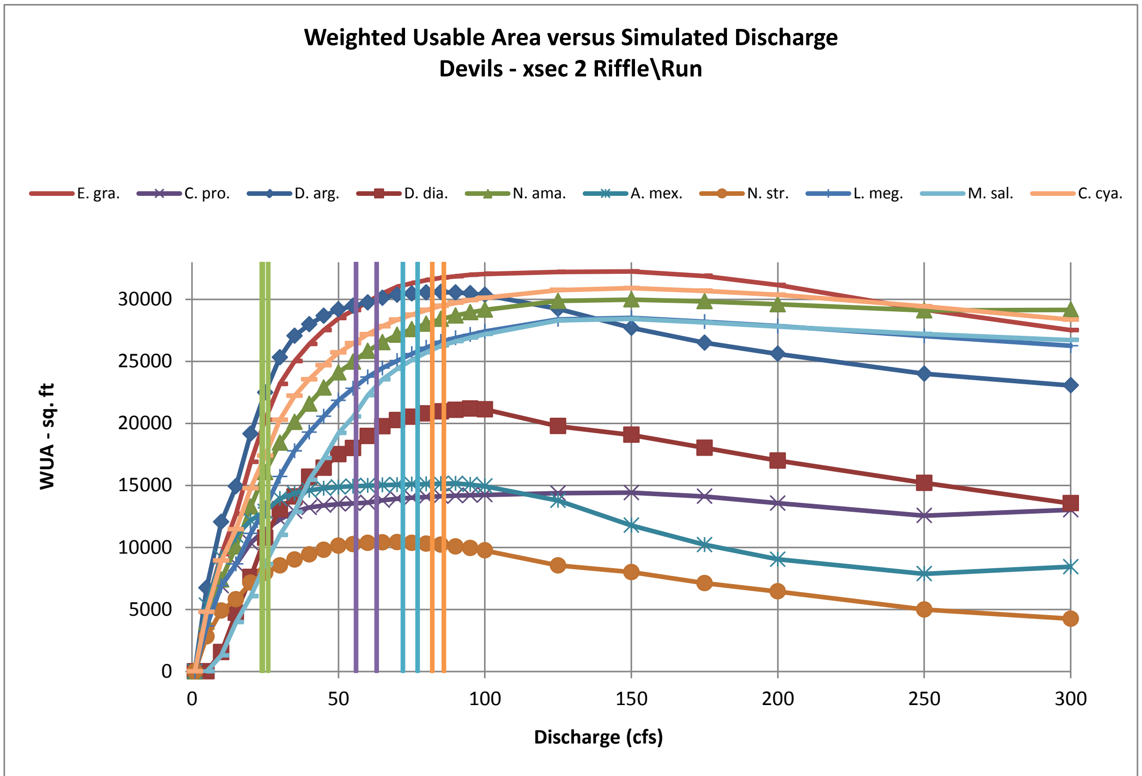
Table 11-2 Percent of maximum WUA versus simulated discharge at Devils River (Riffle Total).

Devils -Riffle Total

Q	Min All	E. gra.	C. pro.	D. arg.	D. dia.	N. ama.	A. mex.	N. str.	L. meg.	M. sal.	C. cya.
1	3%	5%	11%	6%	4%	5%	13%	12%	4%	3%	4%
5	7%	17%	30%	21%	10%	15%	38%	33%	14%	7%	16%
10	13%	26%	41%	31%	18%	22%	50%	43%	20%	13%	23%
15	17%	33%	48%	40%	24%	29%	55%	49%	26%	17%	30%
20	22%	41%	52%	48%	30%	35%	58%	53%	31%	22%	36%
25	26%	47%	54%	55%	36%	41%	60%	56%	37%	26%	41%
30	32%	54%	59%	62%	42%	47%	64%	62%	43%	32%	47%
35	36%	60%	61%	69%	46%	52%	66%	64%	48%	36%	53%
40	40%	64%	62%	73%	50%	56%	68%	67%	52%	40%	57%
45	44%	67%	63%	75%	54%	60%	68%	69%	55%	44%	59%
50	47%	70%	63%	77%	57%	63%	69%	71%	58%	47%	62%
55	51%	72%	64%	79%	61%	65%	69%	71%	60%	51%	64%
60	55%	75%	66%	82%	65%	68%	71%	74%	63%	55%	67%
65	60%	78%	66%	84%	71%	71%	72%	74%	65%	60%	69%
70	63%	80%	68%	86%	74%	74%	76%	76%	69%	63%	72%
75	66%	83%	73%	89%	78%	77%	84%	81%	73%	66%	76%
80	68%	85%	75%	91%	80%	79%	87%	84%	75%	68%	78%
85	70%	88%	78%	94%	82%	82%	93%	87%	79%	70%	82%
90	72%	89%	80%	95%	83%	84%	95%	89%	81%	72%	84%
95	74%	90%	81%	96%	85%	85%	97%	90%	82%	74%	85%
100	76%	91%	83%	97%	86%	87%	98%	92%	84%	76%	87%
125	87%	95%	88%	98%	93%	93%	100%	94%	92%	87%	93%
150	95%	98%	95%	99%	98%	97%	100%	97%	97%	95%	97%
175	99%	100%	100%	100%	100%	100%	99%	100%	100%	100%	100%
200	99%	101%	105%	101%	101%	102%	99%	108%	104%	104%	103%
250	102%	104%	114%	103%	102%	109%	104%	123%	111%	112%	108%
300	102%	103%	120%	102%	102%	111%	106%	126%	113%	116%	110%
350	99%	100%	123%	99%	103%	111%	102%	126%	111%	119%	109%
400	95%	97%	127%	96%	102%	111%	95%	125%	109%	121%	108%
500	76%	91%	130%	89%	97%	110%	76%	129%	104%	122%	105%

Devils - QT 0.75 -Riffle Total

Q	Min All	E. gra.	C. pro.	D. arg.	D. dia.	N. ama.	A. mex.	N. str.	L. meg.	M. sal.	C. cya.
1	3%	5%	11%	6%	4%	4%	15%	12%	3%	3%	4%
5	5%	6%	14%	15%	7%	6%	35%	20%	5%	5%	6%
10	7%	15%	31%	24%	9%	7%	57%	23%	7%	7%	8%
15	7%	24%	45%	29%	10%	8%	66%	38%	7%	7%	13%
20	9%	28%	52%	35%	19%	17%	71%	46%	10%	9%	18%
25	14%	31%	54%	41%	22%	23%	75%	62%	15%	14%	26%
30	16%	36%	58%	45%	30%	27%	79%	65%	16%	16%	29%
35	23%	40%	60%	53%	32%	31%	81%	72%	23%	23%	32%
40	28%	45%	62%	56%	35%	33%	81%	76%	29%	28%	35%
45	32%	49%	66%	59%	37%	37%	79%	77%	33%	32%	41%
50	34%	55%	68%	63%	43%	42%	78%	83%	35%	34%	43%
55	37%	58%	69%	64%	45%	44%	77%	83%	38%	37%	46%
60	40%	59%	69%	69%	49%	50%	80%	87%	41%	40%	51%
65	44%	65%	69%	72%	52%	52%	84%	88%	45%	44%	52%
70	46%	66%	69%	81%	55%	55%	86%	89%	47%	46%	58%
75	48%	71%	69%	82%	57%	59%	87%	89%	48%	48%	57%
80	53%	74%	72%	83%	58%	61%	85%	89%	53%	53%	59%
85	56%	75%	74%	84%	60%	67%	85%	89%	57%	56%	62%
90	59%	82%	75%	85%	63%	70%	85%	91%	60%	59%	64%
95	63%	84%	78%	87%	66%	72%	87%	93%	63%	63%	66%
100	63%	85%	78%	88%	67%	72%	85%	93%	64%	63%	72%
125	73%	88%	78%	94%	91%	91%	85%	96%	74%	73%	89%
150	85%	94%	85%	98%	94%	95%	98%	96%	95%	95%	94%
175	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
200	97%	102%	107%	97%	108%	103%	98%	104%	101%	103%	110%
250	90%	100%	115%	90%	118%	111%	91%	133%	115%	118%	120%
300	85%	96%	117%	85%	118%	113%	96%	129%	128%	133%	121%
350	79%	92%	124%	79%	116%	113%	97%	117%	122%	136%	120%
400	77%	84%	125%	77%	112%	107%	98%	132%	112%	137%	118%
500	60%	66%	130%	60%	110%	106%	87%	163%	102%	135%	111%



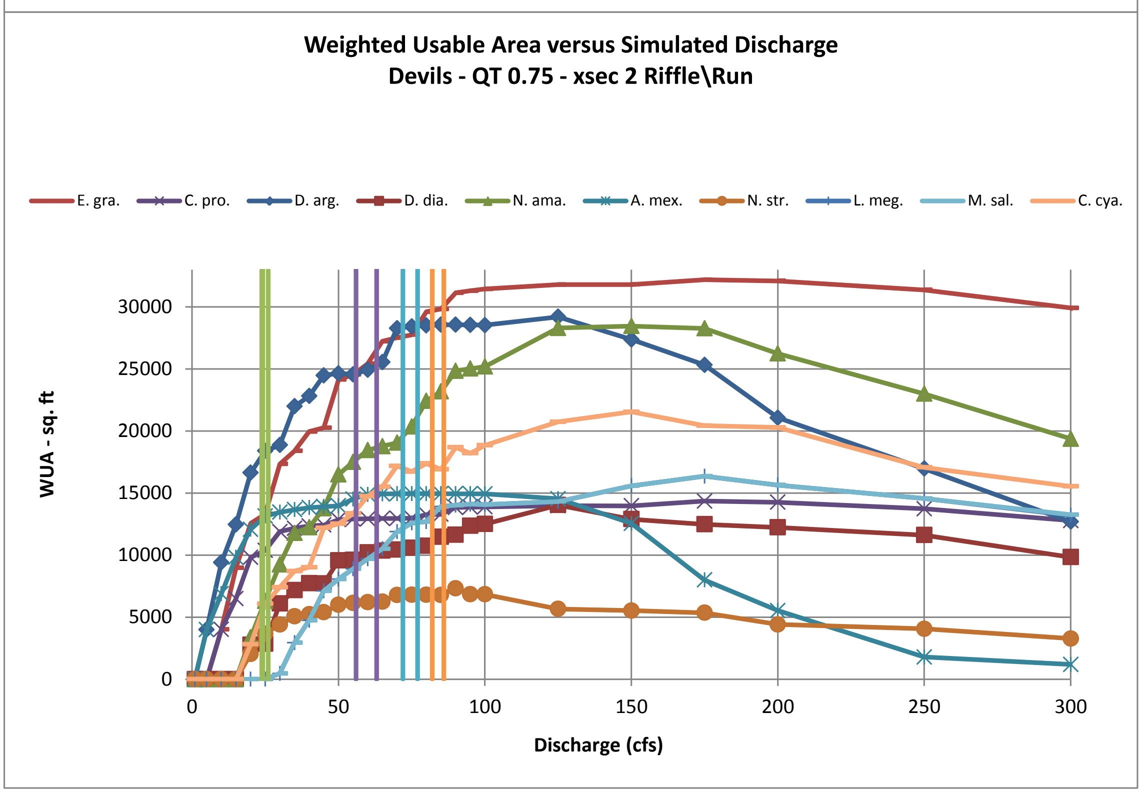


Figure 11-3 Weighted usable area versus simulated discharge at Devils River (Riffle 1).

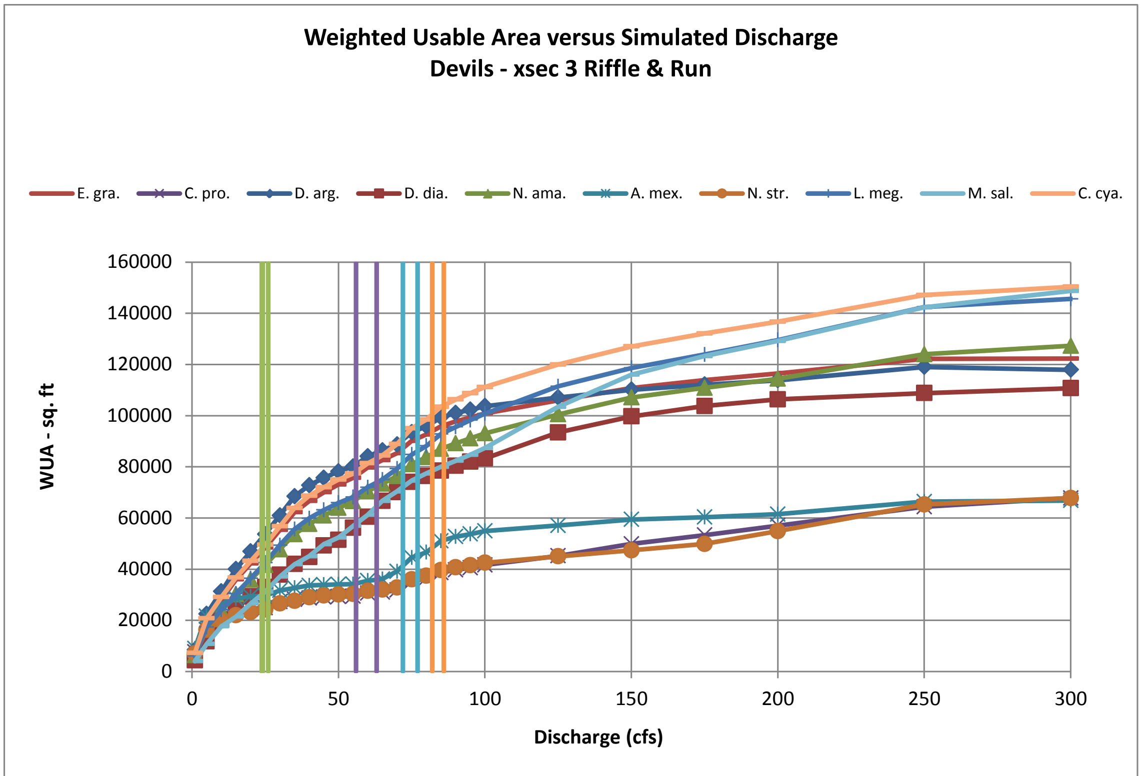
Table 11-3 Percent of maximum WUA versus simulated discharge at Devils River (Riffle 1).

Devils - xsec 2 Riffle\Run

Q	Min All	E. gra.	C. pro.	D. arg.	D. dia.	N. ama.	A. mex.	N. str.	L. meg.	M. sal.	C. cya.
1	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
5	0%	16%	29%	22%	0%	13%	35%	27%	13%	0%	16%
10	5%	29%	48%	39%	7%	25%	61%	47%	24%	5%	29%
15	14%	39%	60%	49%	22%	34%	72%	56%	30%	14%	37%
20	21%	52%	72%	63%	36%	44%	80%	69%	39%	21%	48%
25	30%	63%	79%	74%	51%	54%	85%	76%	46%	30%	56%
30	39%	72%	85%	83%	62%	61%	92%	82%	55%	39%	66%
35	45%	78%	89%	88%	67%	67%	95%	87%	62%	45%	72%
40	54%	82%	92%	91%	74%	72%	96%	91%	68%	54%	76%
45	60%	85%	93%	94%	77%	76%	97%	94%	72%	60%	80%
50	68%	88%	94%	95%	83%	80%	98%	97%	77%	68%	83%
55	72%	90%	94%	96%	85%	83%	99%	98%	80%	72%	86%
60	78%	92%	95%	97%	89%	86%	99%	99%	83%	78%	88%
65	83%	94%	96%	98%	93%	88%	99%	100%	86%	83%	90%
70	86%	96%	97%	99%	96%	90%	99%	100%	88%	86%	92%
75	88%	97%	97%	100%	97%	92%	100%	99%	90%	88%	93%
80	91%	98%	98%	100%	98%	93%	100%	99%	92%	91%	94%
85	92%	98%	98%	100%	99%	95%	100%	98%	93%	92%	95%
90	94%	99%	98%	100%	100%	96%	100%	97%	94%	94%	96%
95	95%	99%	99%	100%	100%	97%	99%	95%	95%	95%	97%
100	94%	99%	99%	99%	100%	97%	99%	94%	96%	96%	97%
125	82%	100%	100%	96%	93%	100%	91%	82%	100%	100%	100%
150	77%	100%	100%	91%	90%	100%	78%	77%	100%	100%	100%
175	67%	99%	98%	87%	85%	100%	67%	68%	99%	99%	99%
200	60%	97%	94%	84%	80%	99%	60%	62%	98%	98%	98%
250	48%	90%	87%	78%	72%	97%	52%	48%	95%	96%	95%
300	41%	85%	90%	75%	64%	97%	56%	41%	92%	94%	92%
350	33%	79%	94%	72%	57%	96%	57%	33%	86%	92%	86%
400	36%	78%	103%	73%	55%	94%	59%	36%	83%	95%	86%
500	39%	79%	124%	76%	39%	93%	61%	49%	77%	91%	85%

Devils - QT 0.75 - xsec 2 Riffle\Run

Q	Min All	E. gra.	C. pro.	D. arg.	D. dia.	N. ama.	A. mex.	N. str.	L. meg.	M. sal.	C. cya.
1	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
5	0%	0%	0%	14%	0%	0%	27%	0%	0%	0%	0%
10	0%	12%	28%	32%	0%	0%	46%	0%	0%	0%	0%
15	0%	28%	45%	43%	0%	0%	66%	0%	0%	0%	0%
20	0%	39%	68%	57%	20%	12%	81%	28%	0%	0%	13%
25	0%	41%	72%	63%	20%	22%	88%	50%	0%	0%	28%
30	3%	54%	83%	65%	43%	33%	90%	60%	3%	3%	34%
35	18%	57%	85%	75%	51%	41%	91%	69%	18%	18%	40%
40	29%	62%	86%	78%	55%	43%	92%	71%	29%	29%	42%
45	44%	63%	87%	84%	55%	48%	93%	74%	44%	44%	57%
50	49%	75%	90%	84%	68%	58%	93%	82%	49%	49%	58%
55	54%	76%	90%	84%	69%	62%	97%	84%	54%	54%	62%
60	59%	79%	90%	85%	73%	65%	100%	85%	59%	59%	68%
65	64%	85%	90%	87%	74%	66%	100%	85%	64%	64%	72%
70	67%	85%	90%	97%	74%	67%	100%	93%	73%	73%	80%
75	72%	86%	90%	97%	76%	72%	100%	93%	77%	77%	78%
80	77%	92%	92%	98%	77%	79%	100%	93%	78%	78%	81%
85	79%	93%	93%	98%	82%	82%	100%	93%	85%	85%	79%
90	83%	97%	96%	98%	83%	87%	100%	100%	86%	86%	87%
95	85%	97%	97%	98%	88%	88%	100%	93%	86%	86%	85%
100	86%	98%	97%	98%	89%	89%	100%	93%	86%	86%	87%
125	77%	99%	97%	100%	100%	99%	97%	77%	88%	88%	96%
150	75%	99%	97%	94%	92%	100%	84%	75%	95%	95%	100%
175	53%	100%	100%	87%	89%	99%	53%	73%	100%	100%	95%
200	37%	100%	99%	72%	87%	92%	37%	60%	96%	96%	94%
250	12%	97%	96%	58%	83%	81%	12%	55%	89%	89%	79%
300	8%	93%	89%	43%	70%	68%	8%	45%	81%	81%	72%
350	7%	77%	85%	23%	49%	59%	7%	7%	62%	68%	60%
400	0%	52%	83%	13%	17%	49%	0%	0%	42%	60%	34%
500	0%	32%	73%	15%	0%	35%	17%	0%	17%	17%	18%



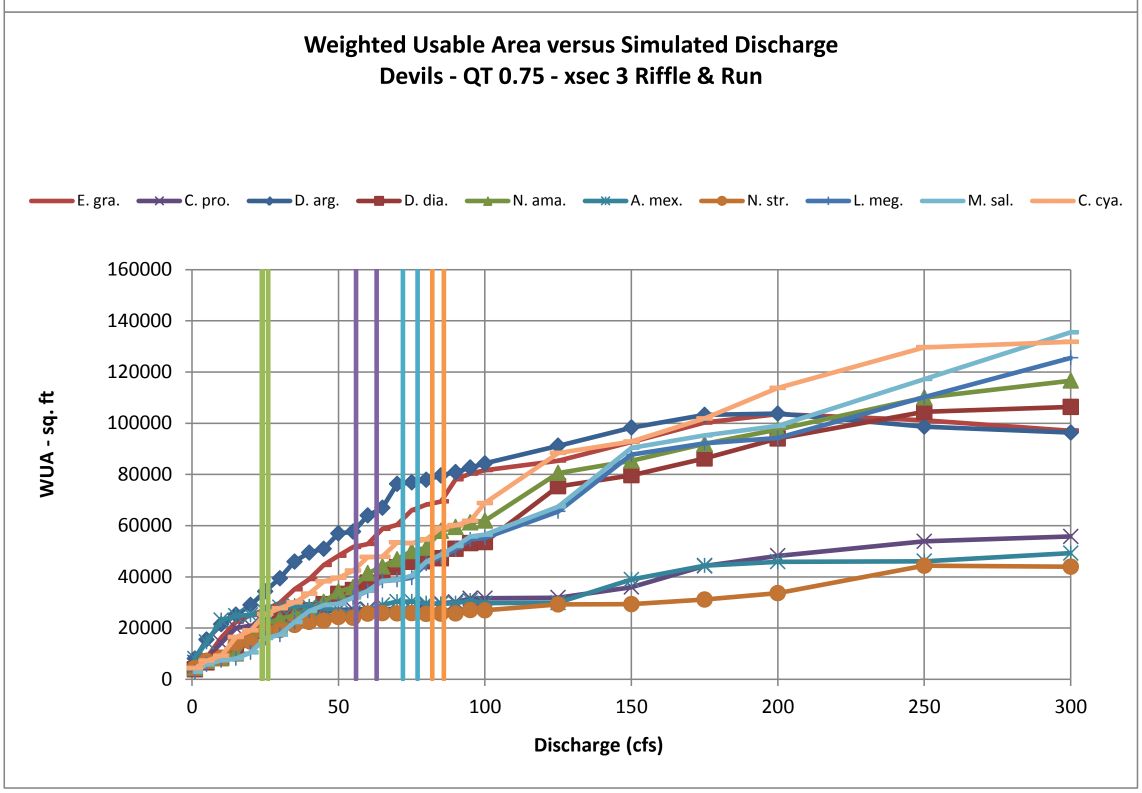


Figure 11-4 Weighted usable area versus simulated discharge at Devils River (Riffle 2).

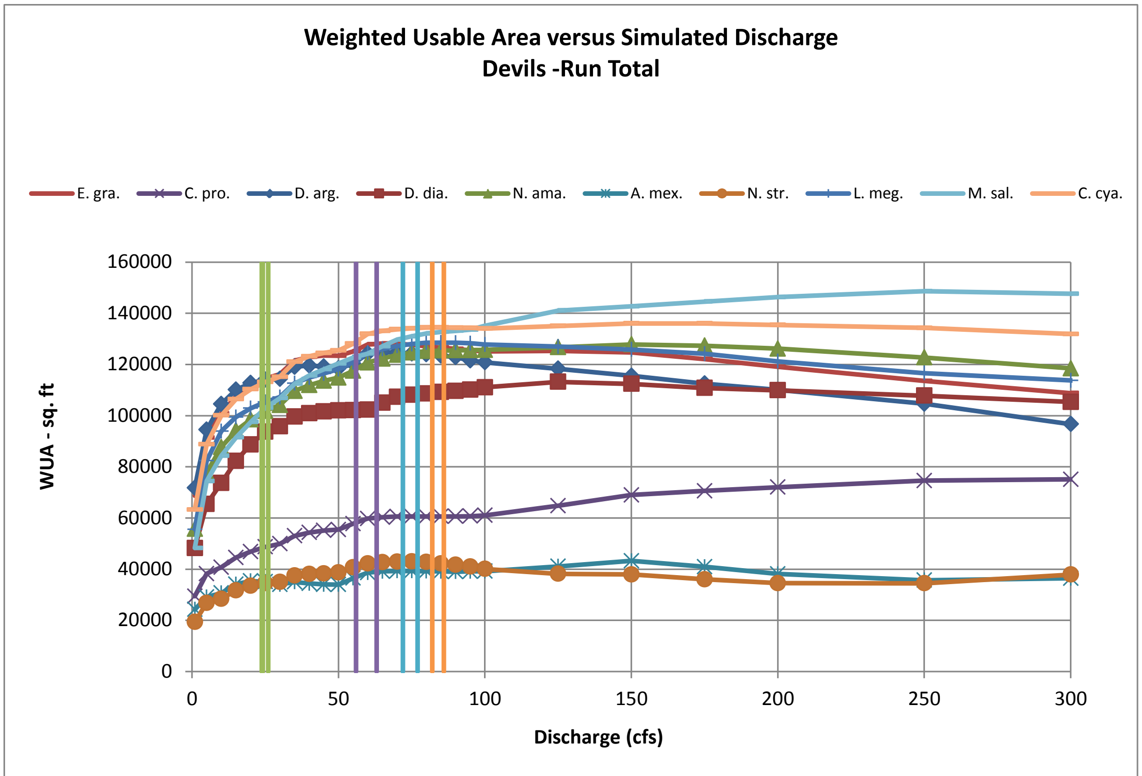
Table 11-4 Percent of maximum WUA versus simulated discharge at Devils River (Riffle 2).

Devils - xsec 3 Riffle & Run

Q	Min All	E. gra.	C. pro.	D. arg.	D. dia.	N. ama.	A. mex.	N. str.	L. meg.	M. sal.	C. cya.
1	3%	7%	14%	8%	4%	6%	15%	14%	5%	3%	5%
5	9%	17%	31%	20%	11%	15%	36%	33%	14%	9%	16%
10	14%	25%	39%	28%	20%	21%	44%	40%	19%	14%	22%
15	17%	32%	44%	36%	24%	27%	47%	44%	25%	17%	28%
20	22%	37%	46%	42%	28%	32%	49%	47%	29%	22%	33%
25	25%	43%	47%	48%	32%	38%	49%	49%	34%	25%	37%
30	30%	49%	51%	54%	36%	43%	53%	53%	40%	30%	43%
35	34%	55%	53%	61%	41%	48%	54%	55%	45%	34%	48%
40	37%	58%	54%	65%	43%	52%	56%	58%	48%	37%	52%
45	40%	62%	54%	67%	47%	55%	56%	59%	51%	40%	55%
50	42%	64%	55%	70%	50%	58%	56%	60%	53%	42%	57%
55	46%	66%	55%	71%	54%	60%	57%	61%	55%	46%	59%
60	50%	70%	57%	75%	58%	63%	59%	63%	58%	50%	62%
65	54%	73%	58%	77%	64%	66%	60%	64%	61%	54%	64%
70	57%	75%	60%	79%	68%	69%	65%	66%	64%	57%	67%
75	61%	79%	66%	83%	71%	73%	74%	72%	68%	61%	72%
80	63%	81%	68%	85%	74%	76%	77%	75%	71%	63%	75%
85	65%	84%	72%	89%	76%	78%	85%	79%	75%	65%	78%
90	67%	86%	74%	90%	78%	80%	87%	82%	77%	67%	80%
95	69%	87%	76%	91%	79%	82%	89%	83%	79%	69%	82%
100	71%	89%	78%	93%	80%	84%	91%	85%	81%	71%	84%
125	84%	93%	85%	96%	90%	91%	95%	90%	90%	84%	91%
150	93%	97%	93%	98%	96%	97%	98%	95%	96%	94%	96%
175	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
200	102%	102%	107%	102%	103%	103%	102%	110%	105%	105%	103%
250	105%	107%	121%	106%	105%	112%	110%	131%	115%	115%	111%
300	105%	107%	127%	105%	107%	115%	111%	136%	118%	121%	114%
350	103%	106%	130%	103%	109%	115%	106%	136%	116%	125%	114%
400	97%	102%	133%	99%	109%	116%	97%	135%	114%	127%	113%
500	75%	94%	132%	89%	106%	114%	75%	137%	110%	129%	109%

Devils - QT 0.75 - xsec 3 Riffle & Run

Q	Min All	E. gra.	C. pro.	D. arg.	D. dia.	N. ama.	A. mex.	N. str.	L. meg.	M. sal.	C. cya.
1	3%	7%	15%	8%	4%	5%	18%	14%	3%	3%	4%
5	6%	8%	19%	15%	8%	8%	33%	23%	6%	6%	7%
10	8%	16%	32%	21%	10%	9%	52%	27%	8%	8%	9%
15	9%	22%	45%	24%	12%	11%	56%	45%	9%	9%	16%
20	11%	25%	47%	28%	18%	18%	57%	47%	11%	11%	19%
25	17%	27%	48%	33%	22%	23%	59%	61%	17%	17%	25%
30	18%	30%	50%	38%	28%	26%	63%	62%	19%	18%	27%
35	23%	35%	52%	45%	29%	27%	65%	68%	24%	23%	29%
40	28%	39%	55%	48%	31%	30%	64%	72%	29%	28%	33%
45	30%	45%	60%	49%	34%	33%	62%	73%	31%	30%	38%
50	31%	48%	61%	55%	39%	37%	61%	78%	32%	31%	39%
55	34%	52%	62%	56%	40%	39%	58%	77%	35%	34%	42%
60	36%	53%	62%	62%	44%	45%	61%	82%	37%	36%	47%
65	40%	59%	62%	65%	47%	48%	65%	83%	42%	40%	47%
70	41%	60%	62%	74%	51%	51%	68%	82%	42%	41%	52%
75	43%	66%	62%	74%	53%	54%	68%	83%	43%	43%	52%
80	48%	68%	66%	75%	53%	56%	67%	82%	49%	48%	54%
85	51%	69%	67%	77%	55%	63%	66%	82%	52%	51%	58%
90	55%	78%	68%	78%	59%	65%	67%	83%	55%	55%	59%
95	59%	80%	71%	80%	62%	67%	69%	87%	59%	59%	61%
100	59%	81%	72%	82%	62%	67%	67%	87%	60%	59%	68%
125	67%	85%	72%	88%	87%	88%	67%	94%	71%	71%	87%
150	81%	92%	81%	95%	92%	93%	88%	94%	95%	95%	91%
175	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
200	101%	103%	109%	101%	109%	106%	103%	108%	102%	104%	112%
250	96%	101%	122%	96%	121%	120%	104%	143%	120%	123%	127%
300	93%	97%	126%	93%	123%	127%	111%	141%	136%	142%	129%
350	92%	96%	136%	92%	125%	129%	112%	135%	133%	148%	131%
400	92%	94%	139%	92%	125%	125%	115%	154%	125%	150%	134%
500	70%	77%	149%	70%	126%	128%	97%	192%	116%	155%	130%



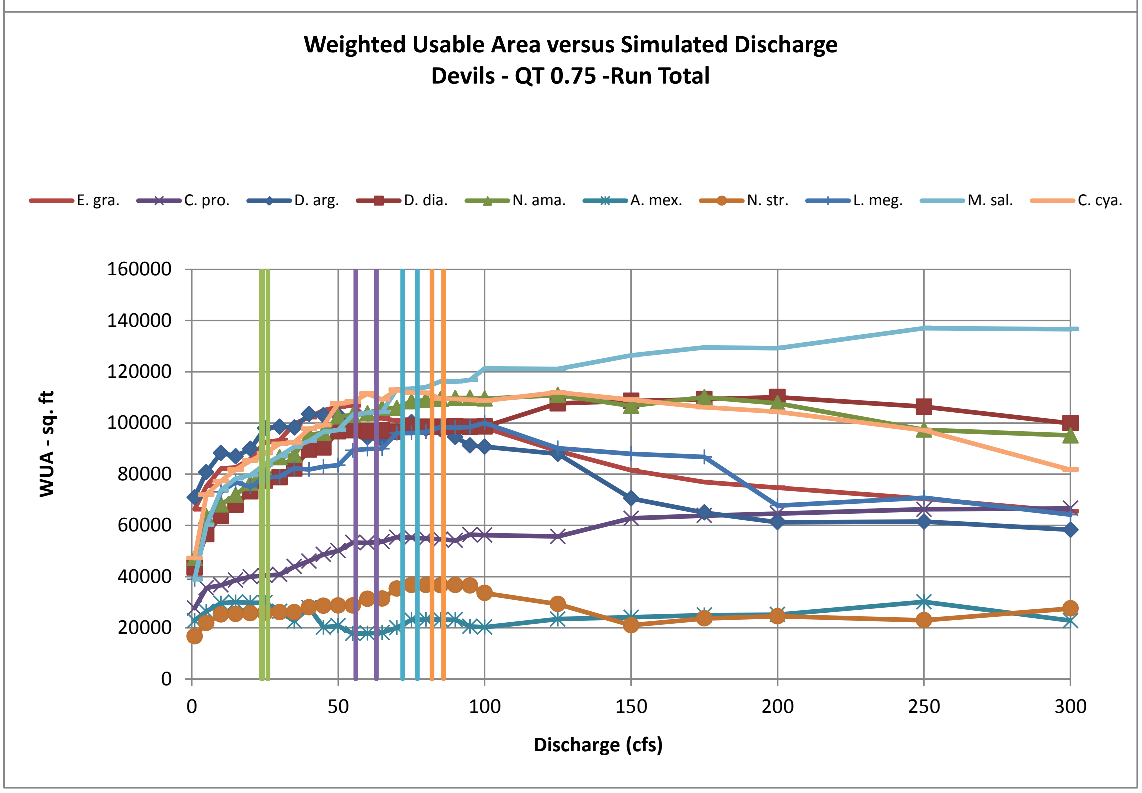


Figure 11-5 Weighted usable area versus simulated discharge at Devils River (Run Total).

Table 11-5 Percent of maximum WUA versus simulated discharge at Devils River (Run Total).

Devils -Run Total

Q	Min All	E. gra.	C. pro.	D. arg.	D. dia.	N. ama.	A. mex.	N. str.	L. meg.	M. sal.	C. cya.
1	33%	54%	42%	58%	43%	44%	56%	45%	43%	33%	47%
5	51%	71%	54%	76%	58%	61%	67%	62%	64%	51%	65%
10	58%	79%	58%	84%	65%	69%	71%	66%	73%	58%	74%
15	63%	84%	63%	88%	73%	74%	79%	74%	77%	63%	78%
20	66%	87%	66%	90%	78%	77%	82%	78%	80%	67%	81%
25	69%	89%	69%	91%	83%	80%	81%	80%	82%	71%	83%
30	71%	91%	71%	92%	85%	81%	79%	81%	83%	74%	85%
35	75%	95%	75%	95%	88%	86%	81%	87%	88%	78%	89%
40	77%	96%	77%	96%	89%	88%	80%	89%	89%	80%	91%
45	78%	96%	78%	95%	90%	89%	79%	89%	91%	82%	92%
50	79%	96%	79%	95%	90%	90%	79%	90%	92%	83%	92%
55	82%	98%	82%	96%	90%	92%	84%	95%	94%	85%	94%
60	85%	100%	85%	100%	90%	94%	89%	98%	97%	86%	97%
65	85%	100%	85%	100%	93%	96%	91%	99%	98%	88%	98%
70	86%	100%	86%	100%	95%	97%	91%	100%	99%	90%	98%
75	86%	100%	86%	100%	95%	97%	91%	100%	100%	91%	99%
80	86%	99%	86%	99%	96%	98%	91%	100%	100%	91%	99%
85	86%	99%	86%	99%	97%	98%	91%	98%	100%	92%	99%
90	86%	98%	86%	98%	97%	98%	90%	97%	100%	92%	99%
95	86%	98%	86%	97%	97%	98%	91%	95%	100%	92%	99%
100	86%	98%	86%	97%	98%	98%	91%	93%	99%	93%	99%
125	89%	98%	92%	95%	100%	99%	95%	89%	99%	98%	99%
150	88%	97%	98%	93%	99%	100%	100%	88%	98%	99%	100%
175	84%	95%	100%	90%	98%	100%	95%	84%	97%	100%	100%
200	80%	93%	102%	88%	97%	99%	88%	80%	94%	101%	100%
250	80%	89%	106%	84%	95%	96%	83%	80%	91%	103%	99%
300	77%	85%	106%	77%	93%	93%	84%	88%	88%	102%	97%
350	72%	81%	104%	72%	92%	89%	83%	93%	85%	102%	95%
400	68%	78%	109%	68%	90%	88%	94%	103%	80%	103%	97%
500	70%	78%	125%	70%	81%	88%	122%	124%	77%	106%	103%

Devils - QT 0.75 -Run Total

Q	Min All	E. gra.	C. pro.	D. arg.	D. dia.	N. ama.	A. mex.	N. str.	L. meg.	M. sal.	C. cya.
1	30%	62%	43%	69%	40%	43%	76%	46%	39%	30%	42%
5	46%	71%	56%	78%	52%	57%	88%	60%	60%	46%	64%
10	57%	77%	57%	85%	58%	61%	99%	69%	73%	57%	68%
15	60%	77%	60%	84%	62%	65%	100%	69%	77%	60%	72%
20	61%	80%	63%	87%	67%	69%	99%	70%	75%	61%	76%
25	63%	87%	63%	95%	71%	74%	99%	70%	79%	65%	78%
30	64%	87%	64%	95%	72%	78%	88%	71%	79%	67%	81%
35	69%	93%	69%	95%	75%	79%	75%	71%	82%	70%	82%
40	72%	96%	72%	100%	82%	86%	93%	76%	82%	72%	87%
45	67%	98%	76%	100%	83%	87%	67%	78%	83%	75%	88%
50	69%	99%	79%	100%	88%	92%	69%	78%	84%	75%	95%
55	59%	100%	83%	97%	89%	93%	59%	78%	89%	80%	96%
60	59%	95%	83%	91%	88%	94%	59%	85%	90%	80%	99%
65	60%	95%	84%	90%	89%	95%	60%	86%	90%	80%	97%
70	67%	94%	87%	93%	88%	95%	67%	96%	96%	87%	100%
75	77%	94%	86%	97%	90%	98%	77%	100%	96%	88%	99%
80	77%	91%	86%	94%	90%	98%	77%	100%	96%	88%	99%
85	77%	91%	85%	94%	90%	99%	77%	100%	99%	90%	97%
90	77%	92%	85%	91%	90%	99%	77%	100%	98%	90%	97%
95	68%	92%	88%	88%	90%	99%	68%	99%	98%	90%	97%
100	68%	92%	88%	88%	90%	99%	68%	91%	100%	94%	96%
125	78%	83%	87%	85%	99%	100%	78%	80%	90%	94%	99%
150	57%	76%	98%	68%	99%	96%	80%	57%	88%	98%	97%
175	63%	72%	100%	63%	100%	99%	83%	64%	87%	100%	94%
200	59%	70%	101%	59%	101%	97%	84%	67%	68%	100%	92%
250	59%	66%	104%	59%	97%	88%	100%	63%	71%	106%	86%
300	56%	61%	104%	56%	91%	86%	76%	75%	64%	106%	72%
350	49%	50%	94%	49%	85%	83%	81%	84%	57%	104%	69%
400	41%	42%	82%	41%	81%	71%	78%	86%	58%	106%	60%
500	36%	36%	71%	40%	74%	63%	80%	86%	49%	105%	55%

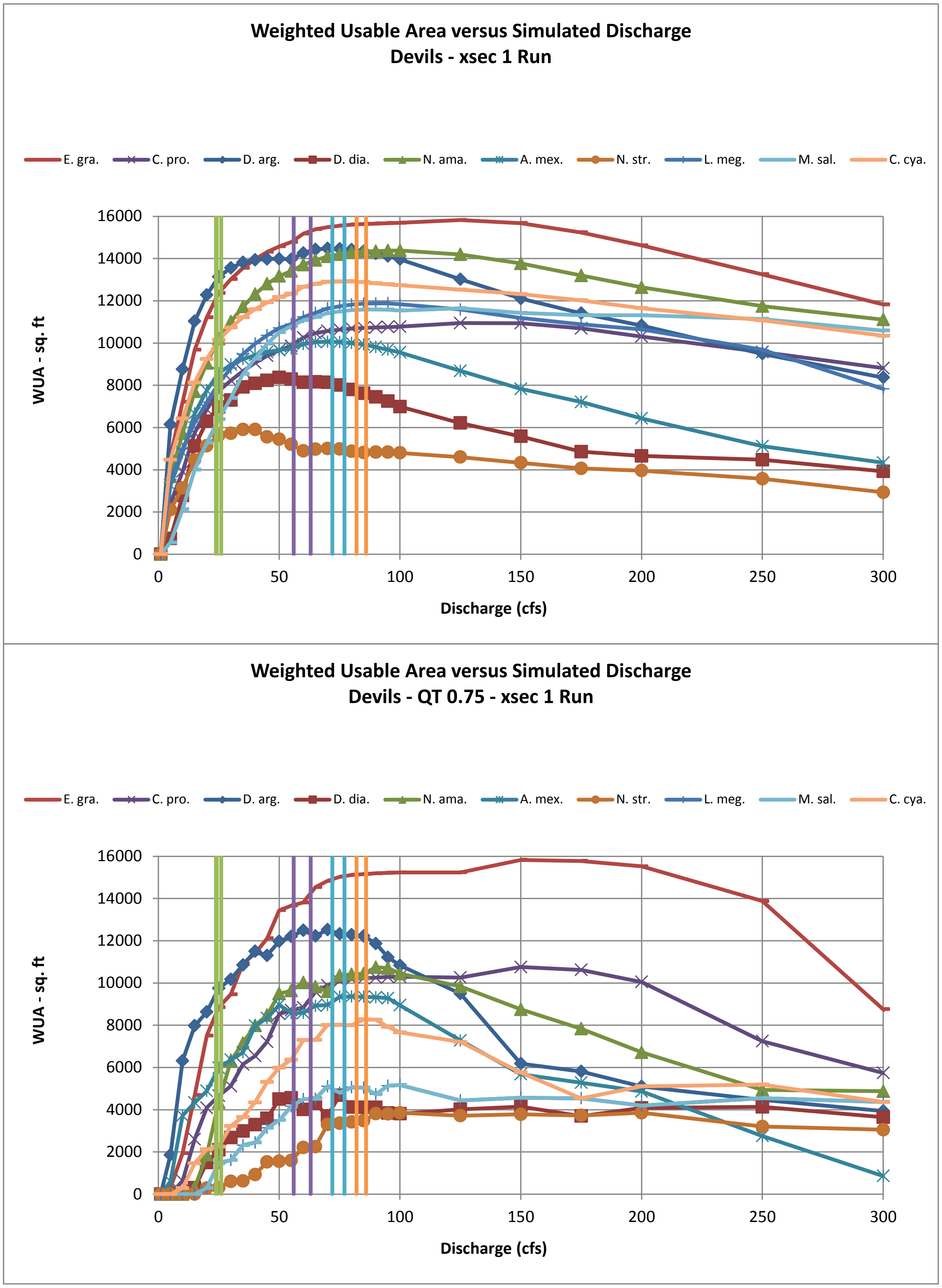


Figure 11-6 Weighted usable area versus simulated discharge at Devils River (Run 1).

Table 11-6 Percent of maximum WUA versus simulated discharge at Devils River (Run 1).

Devils - xsec 1 Run

Q	Min All	E. gra.	C. pro.	D. arg.	D. dia.	N. ama.	A. mex.	N. str.	L. meg.	M. sal.	C. cya.
1	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
5	5%	29%	22%	42%	9%	26%	32%	36%	30%	5%	35%
10	18%	46%	36%	61%	33%	40%	48%	53%	42%	18%	50%
15	34%	61%	53%	76%	61%	54%	66%	76%	53%	34%	63%
20	45%	71%	63%	85%	75%	63%	77%	87%	61%	45%	72%
25	55%	78%	71%	91%	83%	71%	85%	95%	68%	55%	78%
30	63%	82%	75%	94%	87%	77%	89%	97%	74%	63%	83%
35	73%	86%	79%	95%	95%	82%	92%	100%	80%	73%	87%
40	79%	88%	83%	96%	97%	86%	94%	100%	84%	79%	90%
45	86%	90%	86%	97%	98%	89%	95%	94%	87%	86%	92%
50	88%	92%	88%	97%	100%	92%	96%	92%	90%	90%	94%
55	88%	93%	90%	96%	99%	93%	97%	88%	92%	93%	95%
60	83%	96%	94%	99%	97%	95%	99%	83%	95%	95%	98%
65	84%	97%	96%	100%	98%	97%	100%	84%	96%	96%	99%
70	85%	98%	97%	100%	97%	98%	100%	85%	98%	98%	100%
75	84%	98%	97%	100%	96%	99%	100%	84%	99%	99%	100%
80	83%	99%	98%	100%	93%	99%	99%	83%	99%	99%	100%
85	82%	99%	98%	99%	91%	100%	99%	82%	100%	99%	100%
90	82%	99%	98%	98%	89%	100%	97%	82%	100%	99%	99%
95	82%	99%	98%	97%	87%	100%	96%	82%	100%	99%	99%
100	81%	99%	98%	96%	84%	100%	95%	81%	100%	99%	99%
125	74%	100%	100%	90%	74%	99%	86%	78%	98%	100%	97%
150	67%	99%	100%	84%	67%	96%	78%	73%	94%	98%	95%
175	58%	96%	98%	79%	58%	92%	72%	69%	92%	97%	93%
200	56%	92%	94%	75%	56%	88%	64%	67%	90%	97%	90%
250	51%	84%	87%	66%	53%	82%	51%	61%	81%	96%	86%
300	43%	75%	80%	58%	47%	77%	43%	50%	66%	91%	80%
350	37%	68%	76%	54%	38%	73%	37%	44%	51%	84%	73%
400	27%	63%	74%	49%	27%	68%	30%	33%	36%	77%	66%
500	1%	53%	73%	39%	1%	56%	17%	2%	21%	66%	54%

Devils - QT 0.75 - xsec 1 Run

Q	Min All	E. gra.	C. pro.	D. arg.	D. dia.	N. ama.	A. mex.	N. str.	L. meg.	M. sal.	C. cya.
1	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
5	0%	2%	0%	15%	0%	0%	7%	0%	0%	0%	0%
10	0%	12%	6%	50%	0%	0%	40%	0%	0%	0%	3%
15	0%	30%	24%	64%	6%	3%	46%	0%	0%	0%	18%
20	6%	47%	38%	69%	32%	17%	52%	7%	6%	6%	26%
25	8%	56%	43%	78%	45%	41%	64%	8%	28%	28%	27%
30	16%	60%	48%	81%	57%	59%	68%	16%	31%	31%	39%
35	16%	69%	57%	87%	64%	67%	72%	16%	45%	45%	44%
40	24%	72%	61%	92%	70%	74%	85%	24%	47%	47%	52%
45	40%	77%	67%	90%	77%	79%	89%	40%	61%	61%	64%
50	40%	85%	79%	96%	96%	88%	96%	40%	68%	68%	72%
55	41%	86%	81%	97%	97%	90%	92%	41%	80%	80%	77%
60	57%	87%	82%	100%	86%	93%	92%	57%	87%	87%	88%
65	58%	92%	89%	98%	92%	91%	95%	58%	87%	87%	88%
70	79%	94%	92%	100%	79%	89%	96%	85%	99%	99%	97%
75	87%	95%	94%	98%	100%	96%	100%	87%	93%	93%	97%
80	88%	96%	95%	98%	88%	97%	100%	89%	98%	98%	97%
85	88%	96%	95%	98%	88%	97%	100%	90%	98%	98%	100%
90	88%	96%	95%	95%	88%	100%	100%	99%	92%	92%	100%
95	82%	96%	96%	90%	82%	100%	99%	99%	99%	99%	96%
100	81%	96%	96%	87%	81%	97%	96%	100%	100%	100%	93%
125	76%	96%	95%	76%	86%	92%	78%	97%	86%	86%	87%
150	49%	100%	100%	49%	89%	81%	61%	98%	88%	88%	70%
175	46%	100%	99%	46%	79%	73%	56%	97%	88%	88%	55%
200	41%	98%	93%	41%	87%	63%	52%	100%	81%	81%	62%
250	29%	88%	67%	36%	88%	46%	29%	83%	88%	88%	63%
300	9%	55%	53%	31%	78%	45%	9%	79%	84%	85%	53%
350	3%	37%	45%	26%	10%	42%	3%	62%	64%	75%	44%
400	3%	22%	38%	8%	5%	39%	3%	6%	17%	17%	27%
500	0%	8%	33%	4%	0%	27%	2%	0%	0%	0%	7%

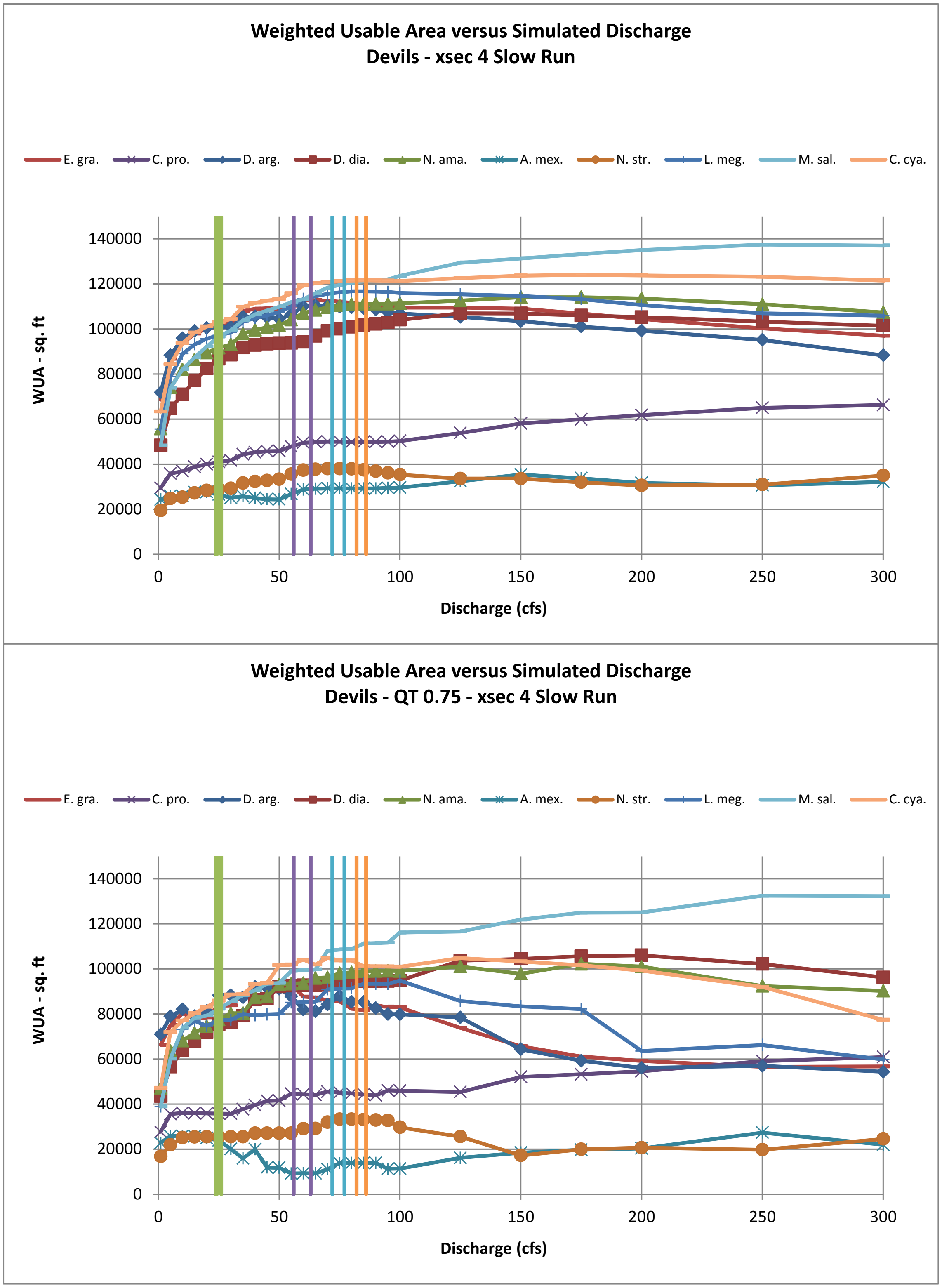


Figure 11-7 Weighted usable area versus simulated discharge at Devils River (Run 2).

Table 11-7 Percent of maximum WUA versus simulated discharge at Devils River (Run 2).

Devils - xsec 4 Slow Run

Q	Min All	E. gra.	C. pro.	D. arg.	D. dia.	N. ama.	A. mex.	N. str.	L. meg.	M. sal.	C. cya.
1	36%	61%	49%	65%	45%	49%	69%	51%	48%	36%	51%
5	55%	77%	60%	80%	60%	65%	73%	65%	68%	55%	68%
10	61%	83%	61%	87%	66%	72%	73%	67%	76%	62%	76%
15	65%	87%	65%	90%	72%	76%	78%	72%	80%	66%	79%
20	67%	89%	67%	91%	77%	78%	78%	74%	82%	69%	82%
25	68%	91%	68%	91%	81%	80%	75%	76%	83%	72%	83%
30	70%	91%	70%	91%	83%	82%	71%	77%	84%	75%	84%
35	73%	96%	74%	95%	86%	86%	73%	83%	88%	78%	89%
40	71%	97%	76%	96%	87%	87%	71%	85%	90%	80%	90%
45	69%	97%	76%	95%	87%	88%	69%	86%	91%	81%	91%
50	69%	96%	77%	95%	88%	89%	69%	87%	92%	82%	91%
55	76%	98%	80%	96%	88%	91%	76%	94%	94%	84%	93%
60	81%	100%	83%	100%	88%	94%	81%	98%	97%	85%	96%
65	82%	100%	83%	100%	91%	95%	82%	99%	98%	87%	97%
70	83%	100%	83%	100%	93%	96%	83%	100%	99%	89%	97%
75	83%	99%	83%	99%	94%	97%	83%	100%	100%	90%	98%
80	82%	99%	83%	99%	94%	97%	82%	100%	100%	90%	98%
85	82%	98%	83%	99%	95%	97%	82%	98%	100%	91%	98%
90	82%	98%	83%	98%	96%	97%	82%	97%	100%	91%	98%
95	83%	97%	83%	97%	96%	97%	83%	95%	100%	92%	98%
100	84%	97%	84%	97%	97%	98%	84%	93%	99%	93%	98%
125	88%	97%	90%	95%	100%	99%	92%	88%	99%	97%	99%
150	88%	97%	97%	94%	100%	100%	100%	88%	98%	99%	100%
175	84%	95%	100%	92%	99%	100%	95%	84%	97%	100%	100%
200	80%	93%	103%	90%	98%	100%	90%	80%	95%	101%	100%
250	81%	89%	109%	86%	97%	97%	86%	81%	92%	103%	99%
300	80%	86%	111%	80%	95%	94%	91%	92%	91%	103%	98%
350	74%	82%	109%	74%	94%	91%	91%	98%	88%	103%	97%
400	71%	80%	115%	71%	93%	90%	106%	111%	85%	105%	99%
500	74%	82%	133%	74%	86%	91%	144%	140%	83%	110%	107%

Devils - QT 0.75 - xsec 4 Slow Run

Q	Min All	E. gra.	C. pro.	D. arg.	D. dia.	N. ama.	A. mex.	N. str.	L. meg.	M. sal.	C. cya.
1	31%	71%	52%	77%	41%	46%	88%	50%	41%	31%	45%
5	48%	81%	67%	86%	54%	62%	100%	66%	63%	48%	69%
10	59%	86%	68%	89%	60%	67%	100%	75%	77%	59%	73%
15	63%	84%	68%	86%	64%	70%	99%	76%	81%	63%	77%
20	63%	84%	67%	88%	68%	73%	96%	76%	79%	63%	79%
25	66%	90%	67%	96%	71%	76%	92%	77%	81%	66%	82%
30	67%	90%	67%	96%	72%	79%	77%	77%	82%	68%	84%
35	61%	95%	71%	95%	75%	79%	61%	76%	84%	71%	85%
40	72%	97%	74%	100%	82%	85%	77%	81%	84%	72%	89%
45	46%	100%	78%	100%	82%	86%	46%	81%	84%	75%	89%
50	45%	100%	78%	99%	87%	91%	45%	81%	84%	75%	97%
55	35%	100%	84%	95%	88%	91%	35%	81%	90%	79%	97%
60	36%	94%	83%	89%	88%	92%	36%	87%	90%	80%	99%
65	36%	94%	83%	88%	88%	94%	36%	88%	90%	80%	97%
70	43%	92%	86%	92%	88%	94%	43%	96%	96%	86%	100%
75	53%	92%	85%	96%	89%	96%	53%	100%	96%	87%	99%
80	54%	88%	84%	93%	89%	96%	54%	100%	96%	87%	99%
85	54%	88%	83%	93%	89%	97%	54%	99%	99%	89%	96%
90	53%	90%	82%	90%	90%	97%	53%	99%	98%	89%	96%
95	43%	89%	87%	87%	90%	97%	43%	98%	98%	89%	96%
100	44%	89%	86%	87%	90%	97%	44%	89%	100%	93%	96%
125	62%	79%	85%	85%	98%	99%	62%	77%	90%	93%	100%
150	52%	70%	98%	70%	99%	96%	71%	52%	88%	98%	99%
175	60%	66%	100%	64%	100%	100%	76%	60%	87%	100%	97%
200	61%	63%	102%	61%	100%	99%	78%	62%	67%	100%	95%
250	59%	61%	111%	62%	97%	90%	106%	59%	70%	106%	88%
300	59%	61%	114%	59%	91%	88%	85%	74%	63%	106%	74%
350	51%	51%	104%	52%	87%	86%	92%	86%	57%	104%	71%
400	44%	44%	91%	45%	83%	73%	89%	94%	60%	109%	63%
500	40%	40%	79%	44%	77%	66%	92%	95%	51%	109%	59%

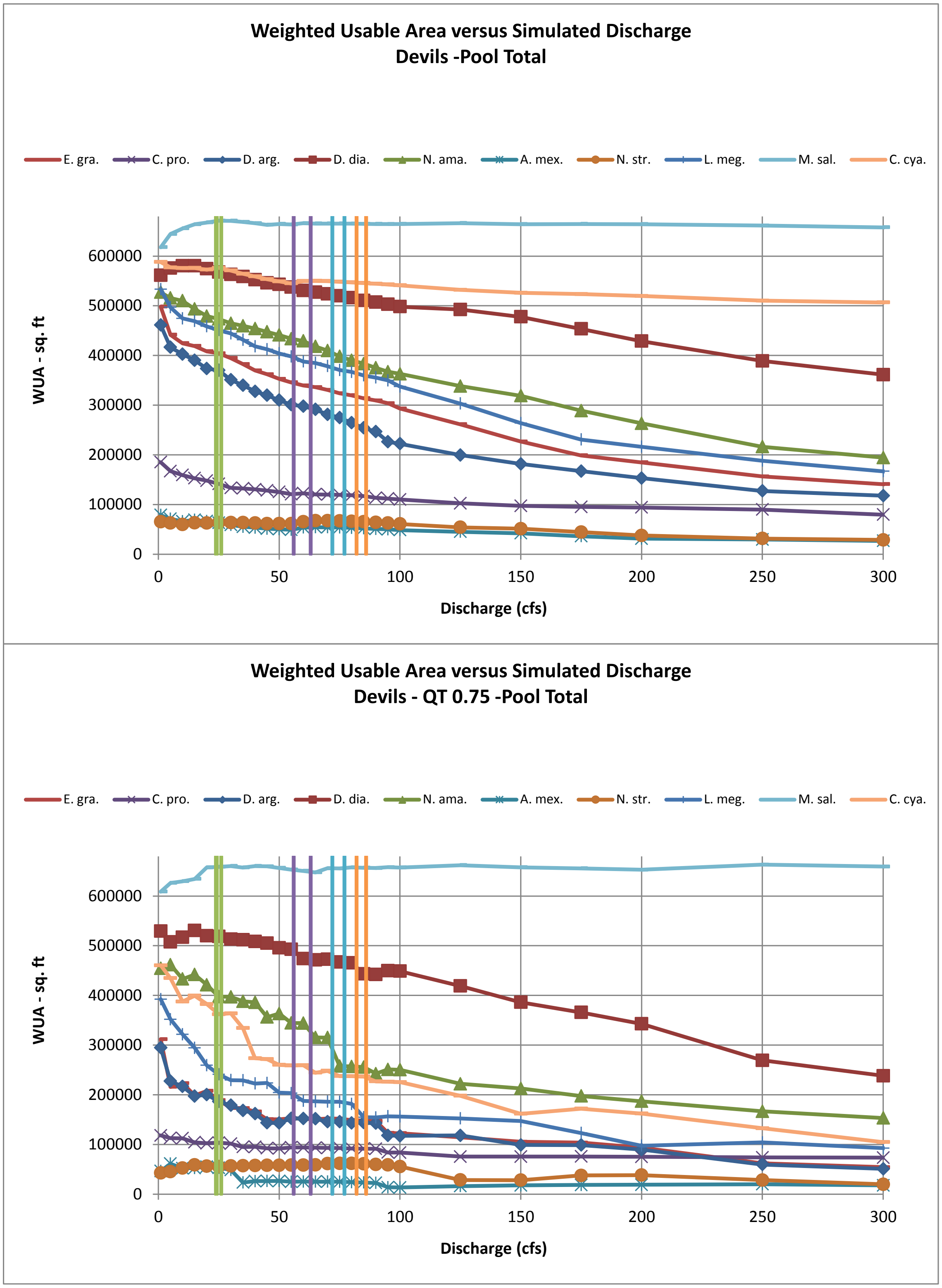


Figure 11-8 Weighted usable area versus simulated discharge at Devils River (Pool Total).

Table 11-8 Percent of maximum WUA versus simulated discharge at Devils River (Pool Total).

Devils -Pool Total

Q	Min All	E. gra.	C. pro.	D. arg.	D. dia.	N. ama.	A. mex.	N. str.	L. meg.	M. sal.	C. cya.
1	92%	100%	100%	100%	97%	100%	100%	97%	100%	92%	100%
5	89%	89%	90%	90%	99%	98%	90%	93%	93%	96%	98%
10	84%	85%	86%	87%	100%	97%	84%	89%	89%	98%	98%
15	83%	84%	83%	85%	100%	94%	88%	94%	88%	99%	98%
20	80%	82%	80%	81%	99%	91%	84%	93%	86%	99%	97%
25	76%	81%	76%	80%	98%	90%	80%	94%	85%	100%	98%
30	72%	79%	72%	76%	97%	88%	75%	95%	83%	100%	97%
35	70%	77%	72%	74%	96%	87%	70%	94%	81%	100%	96%
40	68%	74%	70%	71%	95%	86%	68%	93%	78%	99%	95%
45	65%	73%	69%	69%	94%	85%	65%	91%	77%	99%	94%
50	64%	71%	68%	67%	94%	84%	64%	91%	76%	99%	93%
55	63%	69%	65%	65%	93%	82%	63%	91%	75%	99%	93%
60	65%	68%	66%	65%	91%	81%	68%	97%	73%	99%	93%
65	63%	67%	65%	63%	91%	79%	69%	100%	72%	99%	94%
70	61%	66%	65%	61%	90%	78%	69%	100%	71%	99%	93%
75	60%	65%	65%	60%	90%	76%	68%	99%	70%	99%	93%
80	57%	64%	64%	57%	89%	74%	67%	98%	69%	99%	93%
85	55%	63%	63%	55%	88%	73%	66%	97%	67%	99%	93%
90	54%	62%	61%	54%	87%	71%	65%	95%	67%	99%	93%
95	49%	61%	60%	49%	87%	70%	63%	93%	66%	99%	92%
100	48%	59%	59%	48%	86%	69%	62%	90%	63%	99%	92%
125	43%	52%	55%	43%	85%	64%	57%	80%	57%	99%	90%
150	39%	46%	53%	39%	82%	60%	54%	76%	49%	99%	89%
175	36%	40%	51%	36%	78%	55%	46%	66%	43%	99%	89%
200	33%	37%	51%	33%	74%	50%	40%	56%	41%	99%	88%
250	28%	31%	49%	28%	67%	41%	38%	47%	35%	99%	87%
300	26%	28%	43%	26%	62%	37%	34%	43%	31%	98%	86%
350	25%	26%	41%	25%	56%	34%	36%	44%	27%	98%	87%
400	23%	26%	43%	23%	49%	31%	42%	51%	26%	98%	87%
500	24%	24%	51%	24%	42%	30%	60%	72%	24%	99%	89%

Devils - QT 0.75 -Pool Total

Q	Min All	E. gra.	C. pro.	D. arg.	D. dia.	N. ama.	A. mex.	N. str.	L. meg.	M. sal.	C. cya.
1	69%	100%	100%	100%	100%	98%	76%	69%	100%	92%	100%
5	69%	69%	95%	77%	96%	100%	100%	73%	90%	95%	94%
10	72%	72%	95%	73%	97%	94%	85%	85%	82%	95%	84%
15	64%	64%	88%	67%	100%	96%	86%	96%	75%	96%	87%
20	66%	67%	87%	68%	98%	91%	90%	91%	66%	99%	83%
25	61%	61%	88%	63%	98%	86%	86%	90%	61%	99%	79%
30	56%	56%	86%	61%	97%	86%	80%	92%	58%	100%	79%
35	38%	56%	80%	57%	96%	84%	38%	93%	58%	99%	73%
40	43%	53%	81%	55%	96%	84%	43%	93%	57%	100%	59%
45	43%	48%	78%	49%	95%	77%	43%	94%	57%	100%	59%
50	44%	48%	78%	49%	93%	79%	44%	94%	52%	99%	57%
55	41%	49%	80%	52%	93%	75%	41%	94%	52%	99%	56%
60	41%	49%	79%	52%	89%	75%	41%	95%	48%	98%	56%
65	41%	48%	79%	51%	89%	68%	41%	95%	48%	98%	53%
70	41%	49%	79%	49%	89%	68%	41%	99%	47%	99%	54%
75	41%	49%	79%	50%	88%	56%	41%	100%	47%	99%	52%
80	39%	48%	78%	49%	88%	56%	39%	100%	46%	99%	52%
85	38%	48%	77%	49%	84%	55%	38%	99%	39%	99%	51%
90	37%	47%	77%	48%	83%	53%	37%	97%	39%	99%	49%
95	23%	39%	71%	40%	85%	54%	23%	95%	40%	99%	49%
100	22%	39%	71%	40%	85%	54%	22%	90%	40%	99%	49%
125	27%	37%	64%	40%	79%	48%	27%	46%	39%	100%	43%
150	29%	34%	64%	34%	73%	46%	29%	46%	37%	99%	35%
175	30%	33%	64%	34%	69%	43%	30%	61%	31%	99%	37%
200	25%	30%	64%	30%	65%	40%	31%	62%	25%	99%	35%
250	20%	20%	63%	20%	51%	36%	33%	46%	27%	100%	29%
300	17%	17%	62%	17%	45%	33%	29%	32%	24%	100%	23%
350	16%	16%	42%	16%	43%	27%	30%	36%	16%	99%	22%
400	13%	13%	42%	14%	38%	22%	31%	38%	15%	99%	20%
500	12%	12%	41%	17%	31%	21%	28%	38%	13%	98%	14%

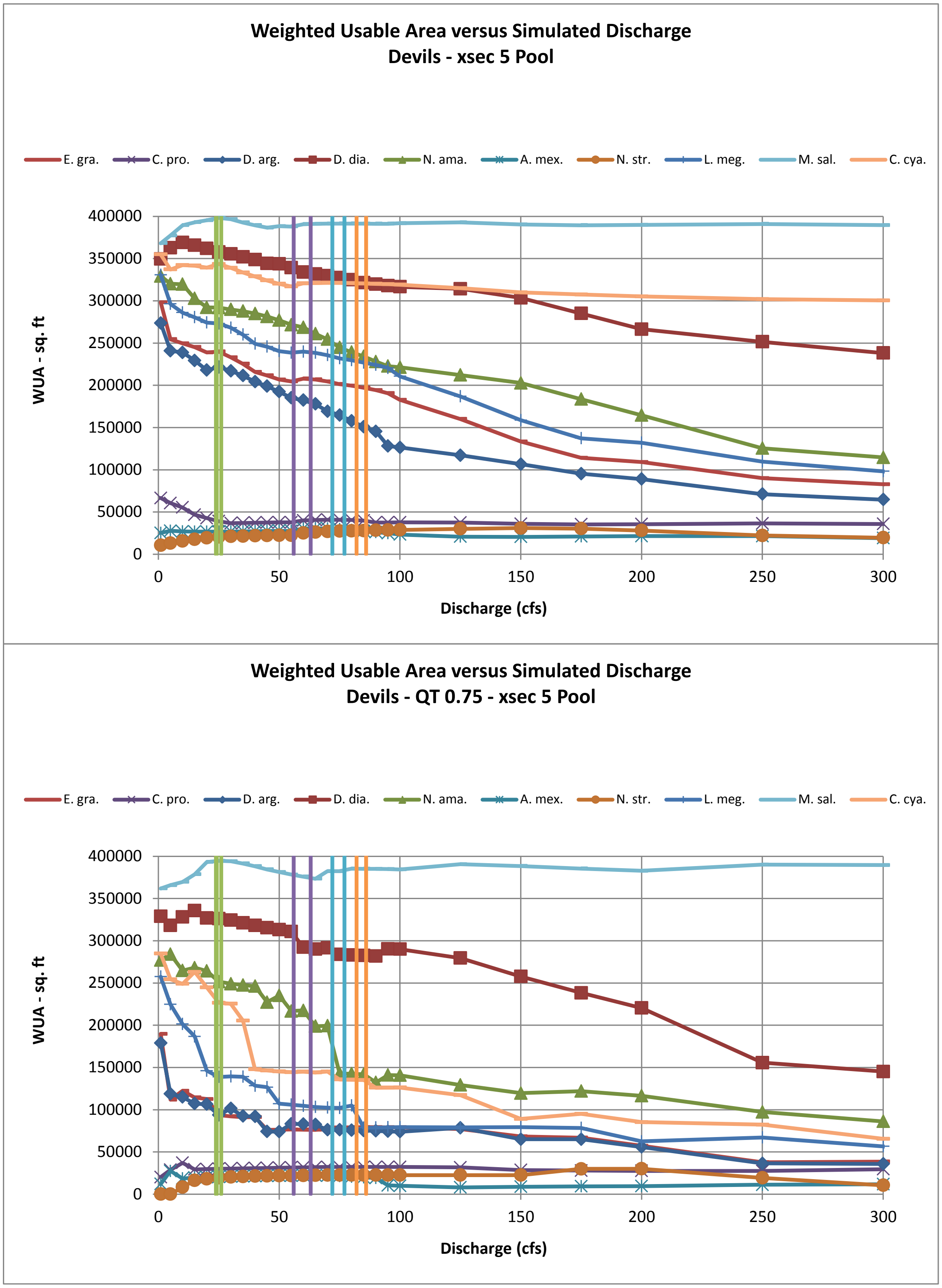


Figure 11-9 Weighted usable area versus simulated discharge at Devils River (Pool 1).

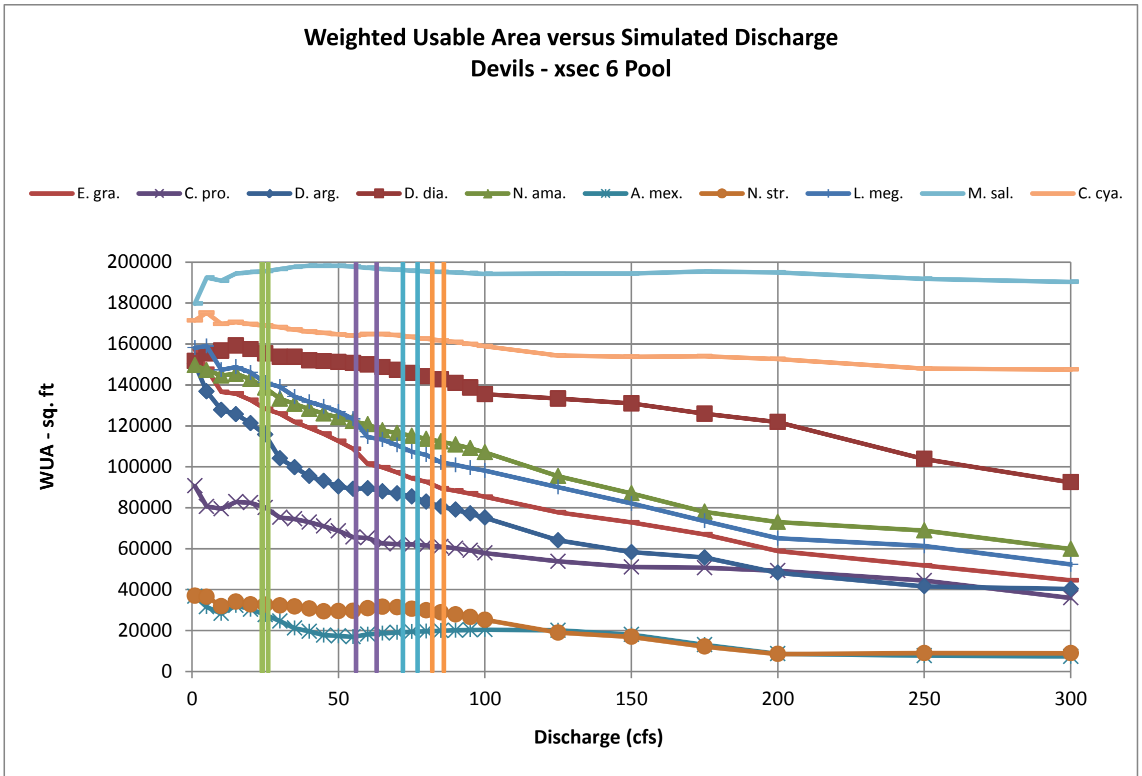
Table 11-9 Percent of maximum WUA versus simulated discharge at Devils River (Pool 1).

Devils - xsec 5 Pool

Q	Min All	E. gra.	C. pro.	D. arg.	D. dia.	N. ama.	A. mex.	N. str.	L. meg.	M. sal.	C. cya.
1	34%	100%	100%	100%	95%	100%	82%	34%	100%	92%	100%
5	43%	85%	91%	88%	98%	97%	90%	43%	90%	95%	95%
10	51%	84%	83%	87%	100%	97%	88%	51%	87%	98%	96%
15	57%	82%	70%	84%	99%	92%	87%	57%	85%	99%	96%
20	63%	80%	64%	80%	98%	89%	87%	63%	83%	99%	96%
25	59%	80%	59%	81%	97%	89%	87%	66%	83%	100%	97%
30	55%	78%	55%	79%	96%	88%	87%	69%	81%	100%	96%
35	56%	76%	56%	77%	95%	87%	88%	70%	79%	99%	94%
40	56%	72%	56%	75%	94%	87%	89%	70%	75%	98%	93%
45	57%	71%	57%	73%	93%	85%	90%	71%	74%	97%	91%
50	57%	69%	57%	70%	93%	84%	90%	72%	73%	98%	90%
55	57%	69%	57%	68%	92%	82%	90%	73%	72%	97%	89%
60	60%	70%	60%	67%	91%	82%	99%	81%	73%	98%	90%
65	61%	69%	61%	65%	90%	79%	100%	85%	72%	98%	91%
70	61%	69%	61%	62%	89%	77%	98%	87%	71%	98%	91%
75	60%	68%	61%	60%	89%	74%	96%	88%	70%	98%	91%
80	58%	67%	61%	58%	88%	73%	93%	90%	69%	98%	90%
85	55%	66%	60%	55%	87%	71%	89%	91%	69%	98%	90%
90	53%	65%	56%	53%	87%	69%	85%	92%	68%	98%	90%
95	47%	64%	57%	47%	86%	68%	81%	92%	67%	98%	90%
100	46%	61%	57%	46%	86%	67%	76%	93%	64%	98%	90%
125	43%	54%	56%	43%	85%	64%	68%	97%	56%	99%	89%
150	39%	45%	54%	39%	82%	62%	67%	100%	48%	98%	87%
175	35%	38%	53%	35%	77%	56%	68%	98%	42%	98%	87%
200	33%	37%	54%	33%	72%	50%	70%	91%	40%	98%	86%
250	26%	30%	55%	26%	68%	38%	70%	72%	33%	98%	85%
300	24%	28%	54%	24%	65%	35%	62%	64%	30%	98%	85%
350	23%	24%	49%	23%	58%	32%	48%	49%	23%	98%	84%
400	23%	23%	56%	23%	48%	31%	63%	66%	23%	97%	84%
500	22%	23%	65%	22%	37%	27%	84%	91%	22%	98%	85%

Devils - QT 0.75 - xsec 5 Pool

Q	Min All	E. gra.	C. pro.	D. arg.	D. dia.	N. ama.	A. mex.	N. str.	L. meg.	M. sal.	C. cya.
1	0%	100%	55%	100%	98%	98%	44%	0%	100%	92%	100%
5	0%	59%	78%	66%	95%	100%	100%	0%	87%	93%	89%
10	28%	64%	100%	64%	98%	93%	68%	28%	78%	94%	87%
15	55%	60%	79%	60%	100%	94%	72%	55%	73%	96%	92%
20	57%	59%	80%	60%	97%	93%	73%	60%	57%	100%	86%
25	49%	49%	81%	52%	97%	89%	74%	64%	54%	100%	80%
30	49%	49%	82%	57%	97%	88%	76%	68%	54%	100%	79%
35	48%	48%	83%	52%	96%	87%	77%	70%	54%	99%	72%
40	48%	48%	83%	51%	95%	87%	78%	71%	50%	98%	52%
45	40%	40%	84%	41%	94%	80%	78%	72%	49%	97%	51%
50	40%	40%	85%	41%	93%	83%	79%	73%	42%	97%	51%
55	40%	40%	85%	47%	93%	76%	80%	74%	41%	96%	51%
60	40%	40%	86%	46%	87%	77%	81%	74%	41%	95%	51%
65	40%	40%	86%	46%	86%	70%	80%	75%	40%	95%	51%
70	40%	42%	87%	43%	87%	70%	80%	75%	40%	97%	51%
75	40%	42%	87%	43%	85%	50%	78%	76%	40%	97%	48%
80	41%	42%	87%	42%	84%	50%	75%	76%	41%	98%	48%
85	31%	42%	87%	42%	84%	50%	72%	76%	31%	98%	47%
90	31%	42%	87%	42%	84%	47%	69%	76%	31%	98%	44%
95	31%	42%	87%	42%	87%	50%	38%	76%	31%	98%	44%
100	31%	42%	87%	41%	86%	50%	36%	76%	31%	97%	44%
125	29%	41%	86%	44%	83%	45%	29%	76%	31%	99%	41%
150	31%	36%	77%	36%	77%	42%	32%	76%	31%	98%	31%
175	30%	35%	75%	36%	71%	43%	34%	100%	30%	98%	33%
200	24%	30%	74%	31%	66%	41%	35%	101%	24%	97%	30%
250	20%	20%	74%	20%	46%	34%	41%	65%	26%	99%	29%
300	20%	20%	80%	20%	43%	30%	43%	35%	22%	99%	23%
350	15%	20%	82%	20%	40%	30%	46%	44%	15%	98%	24%
400	14%	15%	84%	14%	38%	24%	47%	46%	14%	98%	21%
500	12%	12%	85%	15%	28%	24%	38%	50%	15%	98%	14%



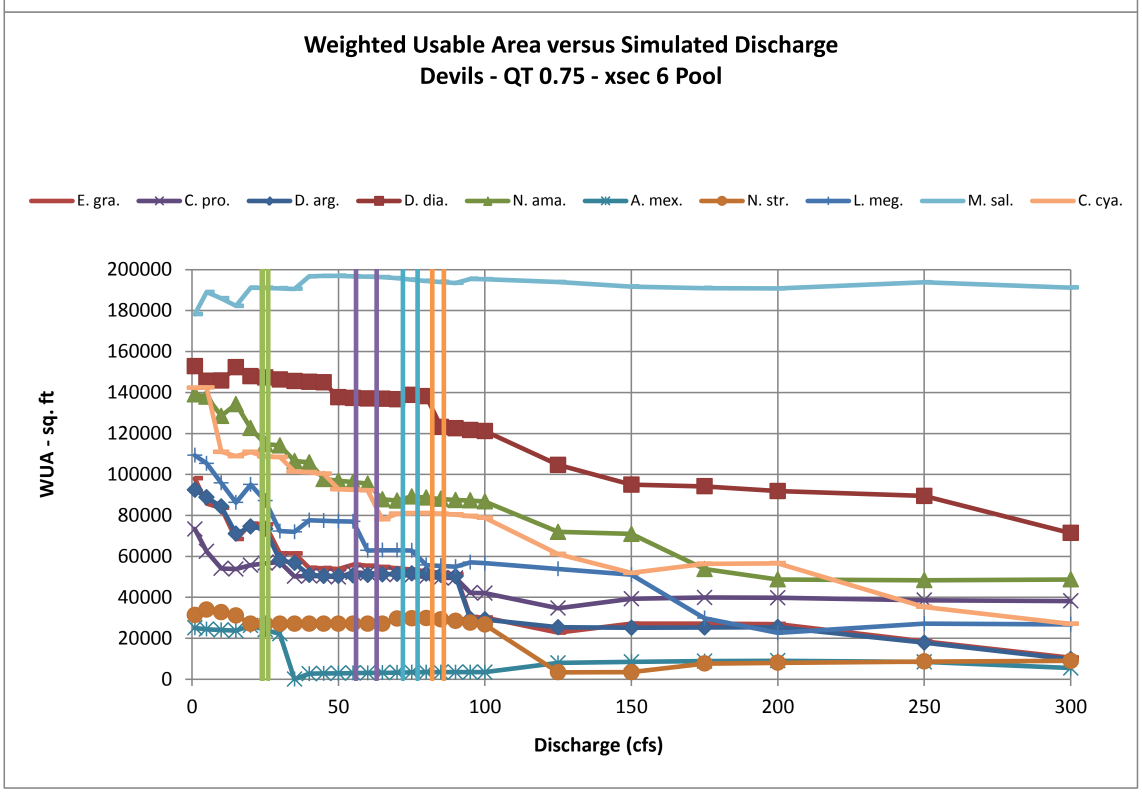


Figure 11-10 Weighted usable area versus simulated discharge at Devils River (Pool 2).

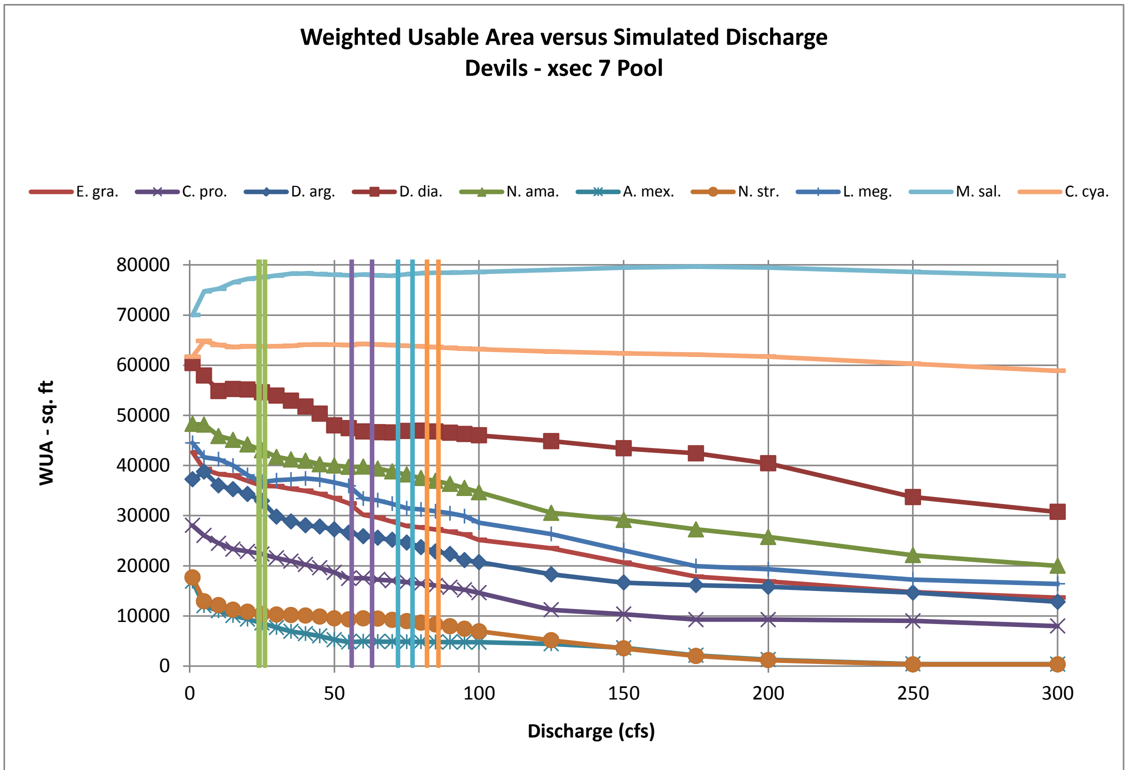
Table 11-10 Percent of maximum WUA versus simulated discharge at Devils River (Pool 2).

Devils - xsec 6 Pool

Q	Min All	E. gra.	C. pro.	D. arg.	D. dia.	N. ama.	A. mex.	N. str.	L. meg.	M. sal.	C. cya.
1	91%	100%	100%	100%	95%	100%	100%	100%	99%	91%	98%
5	86%	94%	89%	91%	98%	98%	86%	99%	100%	97%	100%
10	77%	87%	88%	85%	98%	97%	77%	86%	93%	96%	97%
15	84%	86%	91%	84%	100%	97%	88%	92%	94%	98%	97%
20	81%	84%	91%	81%	99%	95%	83%	89%	92%	98%	97%
25	76%	82%	88%	77%	98%	93%	76%	88%	89%	99%	96%
30	67%	80%	83%	69%	97%	89%	67%	87%	88%	99%	96%
35	58%	77%	82%	66%	97%	87%	58%	86%	84%	100%	95%
40	53%	76%	80%	63%	95%	86%	53%	83%	83%	100%	95%
45	48%	74%	78%	62%	95%	84%	48%	79%	81%	100%	94%
50	47%	72%	76%	60%	95%	83%	47%	80%	80%	100%	94%
55	46%	69%	72%	59%	95%	82%	46%	80%	78%	100%	94%
60	49%	64%	72%	60%	94%	81%	49%	83%	72%	100%	94%
65	51%	63%	69%	59%	93%	79%	51%	86%	71%	99%	94%
70	52%	62%	69%	58%	93%	78%	52%	85%	70%	99%	94%
75	53%	60%	68%	57%	92%	77%	53%	83%	68%	99%	93%
80	54%	59%	68%	55%	91%	76%	54%	80%	67%	99%	93%
85	54%	57%	67%	54%	90%	75%	54%	78%	64%	98%	92%
90	53%	56%	66%	53%	89%	74%	55%	75%	63%	98%	92%
95	51%	55%	65%	51%	87%	73%	55%	72%	63%	98%	91%
100	50%	54%	64%	50%	85%	72%	56%	68%	62%	98%	91%
125	43%	49%	59%	43%	84%	64%	55%	51%	57%	98%	88%
150	39%	46%	56%	39%	82%	58%	49%	46%	52%	98%	88%
175	33%	43%	56%	37%	79%	52%	35%	33%	46%	99%	88%
200	23%	37%	54%	32%	77%	49%	24%	23%	41%	98%	87%
250	21%	33%	49%	28%	65%	46%	21%	24%	39%	97%	84%
300	20%	28%	40%	27%	58%	40%	20%	24%	33%	96%	84%
350	24%	28%	38%	25%	54%	35%	24%	28%	31%	97%	86%
400	19%	27%	36%	19%	51%	29%	20%	25%	29%	97%	86%
500	23%	24%	43%	24%	50%	32%	38%	38%	23%	99%	89%

Devils - QT 0.75 - xsec 6 Pool

Q	Min All	E. gra.	C. pro.	D. arg.	D. dia.	N. ama.	A. mex.	N. str.	L. meg.	M. sal.	C. cya.
1	90%	100%	100%	100%	100%	100%	96%	92%	100%	90%	100%
5	85%	88%	85%	96%	95%	99%	93%	100%	96%	96%	100%
10	74%	85%	74%	91%	95%	92%	92%	97%	88%	94%	78%
15	70%	70%	73%	77%	100%	97%	91%	92%	79%	93%	76%
20	76%	78%	76%	81%	97%	88%	100%	80%	87%	97%	78%
25	76%	77%	77%	79%	96%	83%	93%	80%	80%	97%	76%
30	63%	63%	78%	63%	96%	82%	85%	80%	66%	97%	76%
35	0%	63%	68%	61%	95%	77%	0%	80%	66%	97%	71%
40	10%	55%	69%	55%	95%	76%	10%	80%	71%	100%	71%
45	11%	55%	69%	55%	95%	70%	11%	80%	71%	100%	70%
50	11%	55%	68%	55%	90%	70%	11%	80%	71%	100%	65%
55	12%	57%	71%	55%	90%	69%	12%	80%	70%	100%	65%
60	12%	57%	71%	55%	90%	69%	12%	80%	58%	100%	65%
65	12%	56%	70%	55%	90%	63%	12%	80%	58%	100%	55%
70	12%	55%	70%	56%	89%	63%	12%	87%	58%	99%	57%
75	13%	55%	69%	56%	91%	64%	13%	88%	58%	99%	57%
80	13%	54%	68%	56%	90%	64%	13%	88%	51%	99%	57%
85	13%	53%	68%	55%	81%	63%	13%	86%	51%	98%	57%
90	13%	52%	67%	54%	80%	63%	13%	84%	50%	98%	56%
95	13%	31%	58%	32%	80%	63%	13%	81%	52%	99%	56%
100	13%	31%	57%	32%	79%	62%	13%	79%	52%	99%	55%
125	10%	23%	47%	27%	68%	52%	31%	10%	49%	98%	43%
150	10%	28%	54%	27%	62%	51%	32%	10%	47%	97%	36%
175	23%	28%	54%	27%	62%	39%	34%	23%	27%	97%	40%
200	21%	27%	54%	28%	60%	35%	35%	24%	21%	97%	40%
250	19%	19%	53%	19%	59%	35%	32%	26%	25%	98%	25%
300	11%	11%	52%	11%	47%	35%	21%	26%	25%	97%	19%
350	11%	11%	22%	11%	46%	19%	21%	26%	17%	97%	18%
400	10%	10%	22%	15%	37%	13%	21%	27%	17%	97%	18%
500	1%	13%	22%	16%	31%	13%	1%	24%	10%	96%	16%



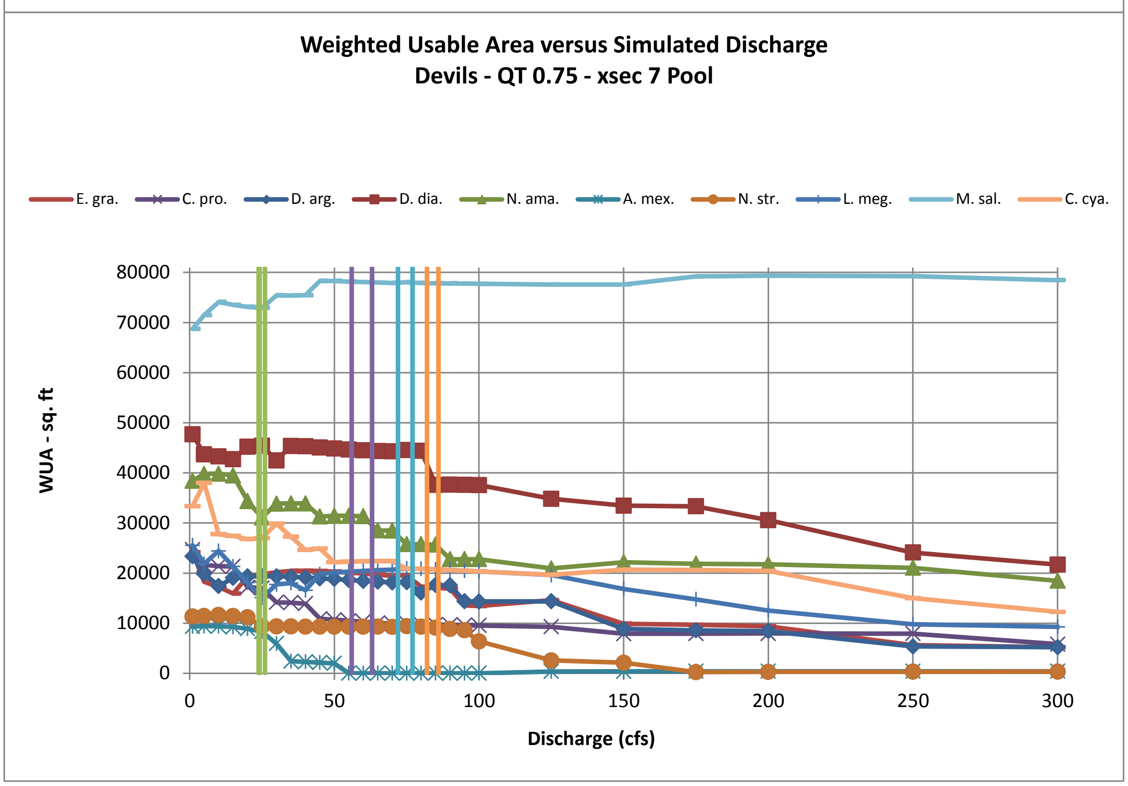


Figure 11-11 Weighted usable area versus simulated discharge at Devils River (Pool 3).

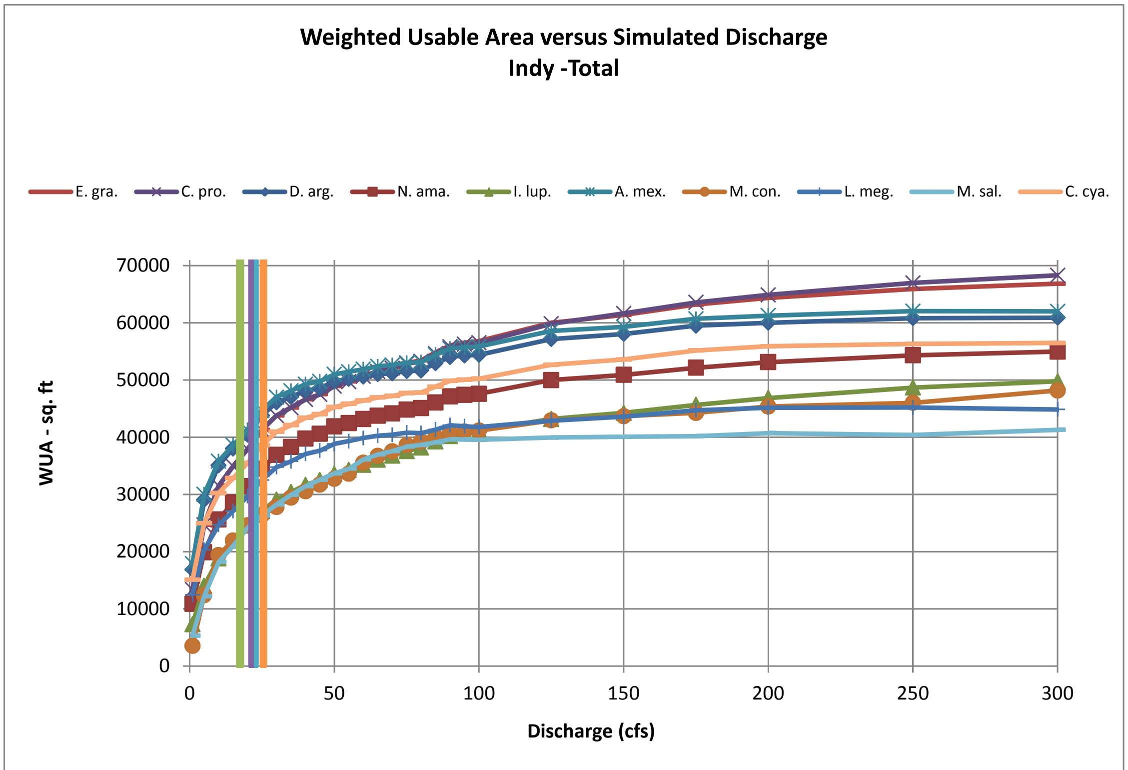
Table 11-11 Percent of maximum WUA versus simulated discharge at Devils River (Pool 3).

Devils - xsec 7 Pool

Q	Min All	E. gra.	C. pro.	D. arg.	D. dia.	N. ama.	A. mex.	N. str.	L. meg.	M. sal.	C. cya.
1	88%	100%	100%	96%	100%	100%	100%	100%	100%	88%	95%
5	71%	92%	93%	100%	96%	100%	71%	73%	93%	94%	100%
10	65%	90%	87%	93%	91%	95%	65%	69%	93%	94%	99%
15	59%	89%	83%	91%	91%	93%	59%	63%	90%	96%	98%
20	55%	87%	81%	88%	91%	91%	55%	61%	86%	97%	98%
25	51%	84%	80%	85%	90%	89%	51%	59%	83%	97%	98%
30	45%	84%	77%	77%	89%	86%	45%	58%	83%	98%	98%
35	41%	83%	75%	74%	88%	85%	41%	57%	84%	98%	99%
40	38%	82%	72%	72%	86%	85%	38%	57%	84%	98%	99%
45	35%	80%	70%	72%	83%	83%	35%	56%	83%	98%	99%
50	31%	79%	67%	70%	79%	83%	31%	54%	82%	98%	99%
55	28%	76%	62%	69%	79%	82%	28%	52%	81%	98%	99%
60	29%	71%	63%	67%	77%	82%	29%	54%	75%	98%	99%
65	29%	69%	62%	66%	77%	82%	29%	53%	74%	98%	99%
70	29%	68%	61%	65%	77%	80%	29%	52%	73%	98%	99%
75	29%	66%	60%	64%	78%	79%	29%	51%	71%	98%	99%
80	29%	65%	59%	61%	78%	78%	29%	49%	70%	98%	98%
85	28%	64%	57%	59%	77%	76%	28%	47%	69%	98%	98%
90	28%	63%	56%	58%	77%	75%	28%	45%	68%	98%	98%
95	28%	62%	54%	54%	77%	74%	28%	42%	67%	99%	98%
100	28%	59%	52%	53%	76%	72%	28%	39%	64%	99%	97%
125	26%	55%	40%	47%	74%	63%	26%	29%	59%	99%	97%
150	20%	48%	37%	43%	72%	60%	22%	20%	52%	100%	96%
175	11%	42%	33%	42%	70%	56%	13%	11%	45%	100%	96%
200	7%	40%	33%	41%	67%	53%	8%	7%	43%	100%	95%
250	2%	35%	32%	38%	56%	46%	2%	2%	39%	99%	93%
300	2%	32%	28%	33%	51%	41%	2%	2%	37%	98%	91%
350	21%	38%	35%	38%	46%	42%	30%	21%	41%	97%	95%
400	27%	39%	38%	38%	42%	41%	38%	27%	40%	97%	96%
500	33%	36%	44%	34%	42%	41%	45%	35%	33%	101%	97%

Devils - QT 0.75 - xsec 7 Pool

Q	Min All	E. gra.	C. pro.	D. arg.	D. dia.	N. ama.	A. mex.	N. str.	L. meg.	M. sal.	C. cya.
1	87%	100%	100%	100%	100%	96%	99%	97%	100%	87%	88%
5	75%	75%	88%	85%	92%	100%	100%	98%	86%	90%	100%
10	71%	71%	87%	75%	91%	100%	100%	100%	96%	94%	73%
15	66%	66%	86%	82%	90%	99%	98%	98%	83%	93%	72%
20	70%	80%	70%	83%	95%	86%	94%	96%	71%	92%	70%
25	59%	82%	69%	83%	95%	78%	88%	80%	59%	92%	71%
30	57%	83%	57%	83%	89%	85%	63%	80%	69%	95%	79%
35	26%	85%	57%	82%	95%	85%	26%	80%	70%	95%	72%
40	24%	85%	56%	82%	95%	85%	24%	80%	65%	95%	65%
45	23%	85%	44%	81%	94%	79%	23%	80%	77%	99%	65%
50	21%	84%	43%	81%	94%	79%	21%	80%	79%	99%	58%
55	0%	83%	43%	80%	94%	79%	0%	80%	79%	99%	59%
60	0%	82%	42%	79%	93%	79%	0%	80%	80%	99%	59%
65	0%	82%	41%	78%	93%	72%	0%	80%	81%	98%	59%
70	0%	81%	40%	78%	93%	72%	0%	79%	81%	98%	59%
75	0%	81%	40%	78%	93%	65%	0%	81%	82%	99%	55%
80	0%	71%	40%	69%	93%	65%	0%	80%	82%	98%	55%
85	0%	71%	39%	75%	79%	64%	0%	78%	81%	98%	55%
90	0%	70%	39%	75%	79%	57%	0%	76%	81%	98%	54%
95	0%	56%	39%	61%	79%	57%	0%	74%	80%	98%	54%
100	0%	56%	39%	61%	79%	57%	0%	55%	80%	98%	54%
125	4%	60%	38%	61%	73%	53%	4%	22%	77%	98%	52%
150	4%	41%	32%	38%	70%	56%	4%	18%	66%	98%	54%
175	2%	40%	32%	37%	70%	55%	4%	2%	58%	100%	54%
200	3%	39%	32%	36%	64%	55%	5%	3%	49%	100%	54%
250	3%	23%	32%	23%	51%	53%	4%	3%	38%	100%	39%
300	3%	22%	24%	22%	45%	46%	4%	3%	36%	99%	32%
350	3%	10%	10%	10%	44%	38%	4%	3%	22%	98%	23%
400	3%	10%	10%	9%	44%	31%	5%	3%	21%	98%	22%
500	2%	9%	2%	36%	43%	22%	69%	3%	10%	97%	14%



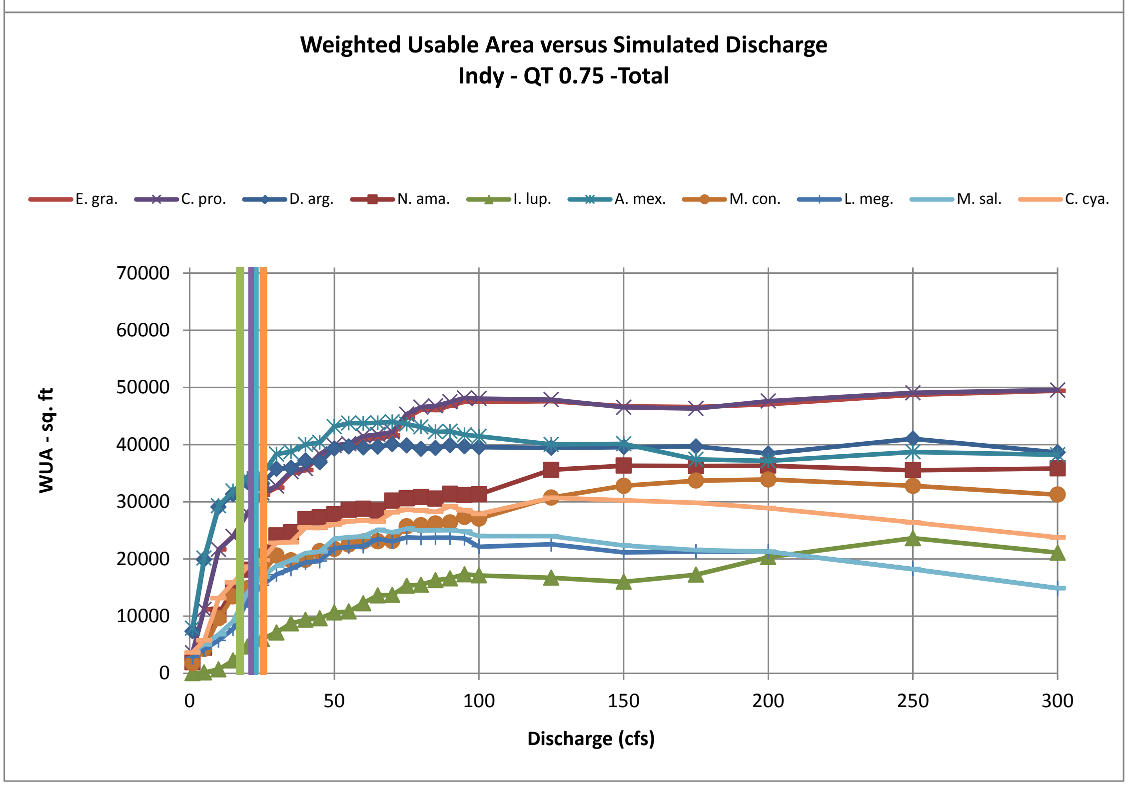


Figure 11-12 Weighted usable area versus simulated discharge at Independence Creek (Total).

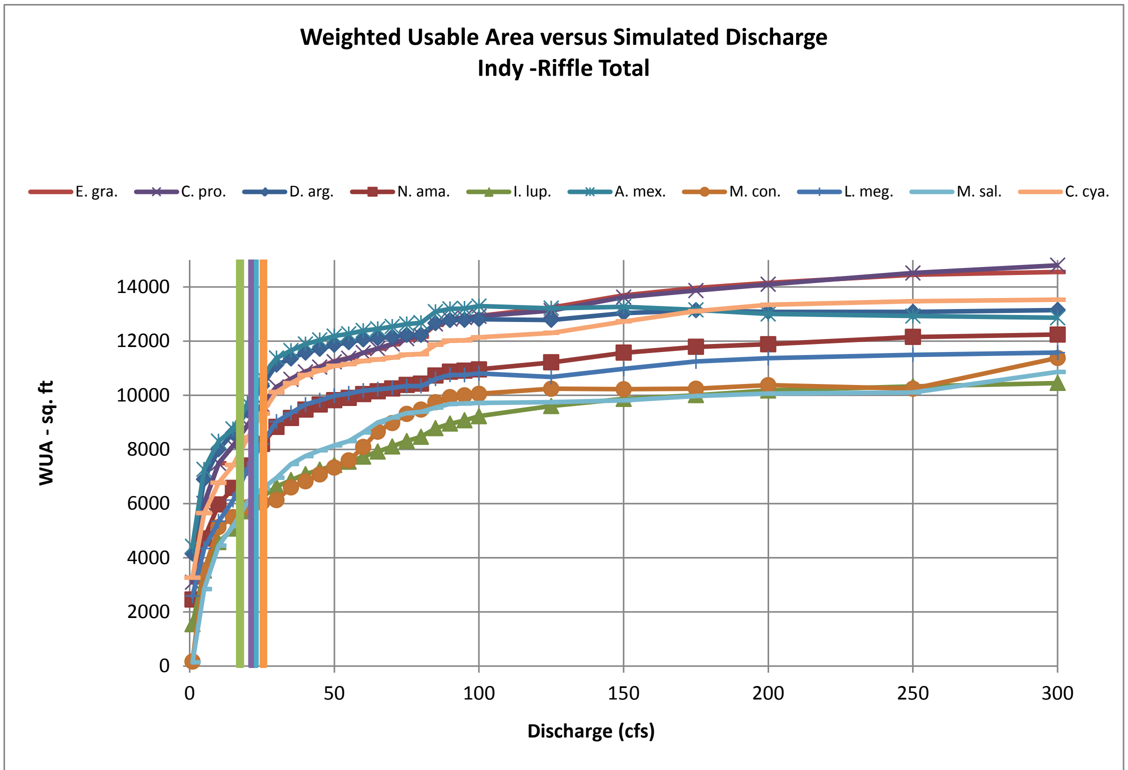
Table 11-12 Percent of maximum WUA versus simulated discharge at Indy Creek (Total).

Indy -Total

Q	Min All	E. gra.	C. pro.	D. arg.	N. ama.	I. lup.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	8%	21%	21%	28%	21%	16%	29%	8%	28%	13%	27%
5	28%	39%	39%	49%	38%	31%	49%	28%	45%	30%	45%
10	41%	50%	50%	59%	49%	41%	59%	44%	55%	45%	55%
15	48%	55%	55%	64%	55%	48%	64%	50%	61%	52%	60%
20	54%	60%	60%	68%	60%	54%	68%	56%	66%	60%	64%
25	59%	65%	65%	74%	66%	59%	74%	60%	73%	65%	70%
30	63%	69%	69%	77%	71%	64%	77%	63%	78%	70%	74%
35	67%	72%	71%	79%	73%	67%	79%	67%	80%	74%	76%
40	69%	74%	73%	81%	76%	69%	81%	69%	83%	78%	79%
45	71%	75%	75%	82%	78%	71%	82%	72%	84%	81%	80%
50	74%	78%	77%	84%	80%	74%	84%	74%	87%	84%	82%
55	75%	79%	78%	84%	81%	75%	85%	76%	88%	86%	83%
60	77%	80%	80%	85%	83%	77%	85%	80%	89%	90%	84%
65	79%	82%	81%	86%	84%	79%	86%	83%	90%	92%	85%
70	81%	83%	82%	86%	85%	81%	87%	85%	90%	93%	86%
75	82%	84%	83%	87%	86%	82%	87%	87%	91%	95%	87%
80	84%	85%	84%	87%	86%	84%	88%	89%	91%	96%	87%
85	86%	87%	86%	89%	88%	86%	90%	91%	92%	97%	89%
90	88%	89%	88%	91%	90%	88%	91%	92%	94%	99%	90%
95	88%	89%	88%	91%	91%	89%	92%	93%	94%	99%	91%
100	89%	90%	89%	91%	91%	90%	92%	93%	93%	98%	91%
125	94%	95%	94%	96%	96%	95%	96%	97%	96%	99%	95%
150	97%	97%	97%	98%	98%	97%	98%	99%	98%	100%	97%
175	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
200	101%	102%	102%	101%	102%	103%	101%	103%	101%	101%	101%
250	101%	104%	105%	102%	104%	107%	102%	104%	101%	101%	102%
300	100%	106%	107%	102%	105%	109%	102%	109%	100%	103%	102%
350	98%	106%	108%	102%	105%	112%	102%	110%	98%	102%	101%
400	97%	108%	109%	103%	105%	118%	103%	112%	97%	100%	100%
500	91%	109%	111%	101%	104%	124%	104%	112%	91%	95%	98%

Indy - QT 0.75 -Total

Q	Min All	E. gra.	C. pro.	D. arg.	N. ama.	I. lup.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	0%	8%	7%	18%	5%	0%	18%	5%	12%	15%	12%
5	1%	23%	23%	50%	12%	1%	46%	13%	18%	20%	19%
10	4%	45%	45%	73%	28%	4%	67%	29%	24%	27%	43%
15	13%	50%	50%	78%	41%	13%	72%	40%	33%	36%	52%
20	27%	59%	58%	84%	50%	27%	78%	44%	54%	56%	61%
25	35%	65%	65%	83%	56%	35%	79%	52%	65%	67%	65%
30	41%	68%	68%	89%	66%	41%	87%	61%	73%	74%	74%
35	50%	74%	73%	90%	68%	50%	88%	59%	77%	78%	75%
40	54%	75%	74%	93%	74%	54%	91%	59%	82%	83%	83%
45	56%	80%	80%	92%	75%	56%	92%	63%	83%	84%	83%
50	61%	82%	83%	98%	77%	61%	98%	65%	92%	93%	85%
55	62%	83%	83%	99%	79%	62%	100%	67%	93%	94%	87%
60	68%	86%	86%	99%	79%	71%	99%	68%	93%	95%	87%
65	68%	86%	87%	99%	78%	79%	100%	68%	99%	99%	86%
70	69%	87%	88%	100%	83%	79%	100%	69%	97%	98%	92%
75	76%	94%	94%	99%	84%	88%	99%	76%	100%	100%	93%
80	77%	97%	97%	98%	85%	89%	98%	77%	100%	99%	93%
85	78%	97%	97%	98%	84%	94%	96%	78%	100%	99%	92%
90	78%	98%	99%	100%	86%	96%	96%	78%	100%	99%	95%
95	81%	100%	100%	99%	86%	100%	95%	81%	99%	98%	93%
100	80%	100%	100%	99%	86%	99%	94%	80%	93%	95%	91%
125	91%	100%	99%	98%	98%	97%	91%	91%	95%	95%	100%
150	88%	98%	97%	99%	100%	92%	91%	97%	89%	88%	99%
175	85%	98%	96%	99%	100%	100%	85%	100%	89%	85%	97%
200	84%	99%	99%	96%	100%	117%	85%	101%	90%	84%	94%
250	72%	102%	102%	102%	98%	136%	88%	97%	77%	72%	86%
300	59%	104%	103%	96%	99%	122%	87%	93%	63%	59%	77%
350	50%	111%	111%	95%	98%	134%	85%	96%	53%	50%	68%
400	47%	109%	109%	95%	87%	139%	87%	94%	50%	47%	58%
500	29%	111%	108%	89%	90%	177%	88%	90%	31%	29%	55%



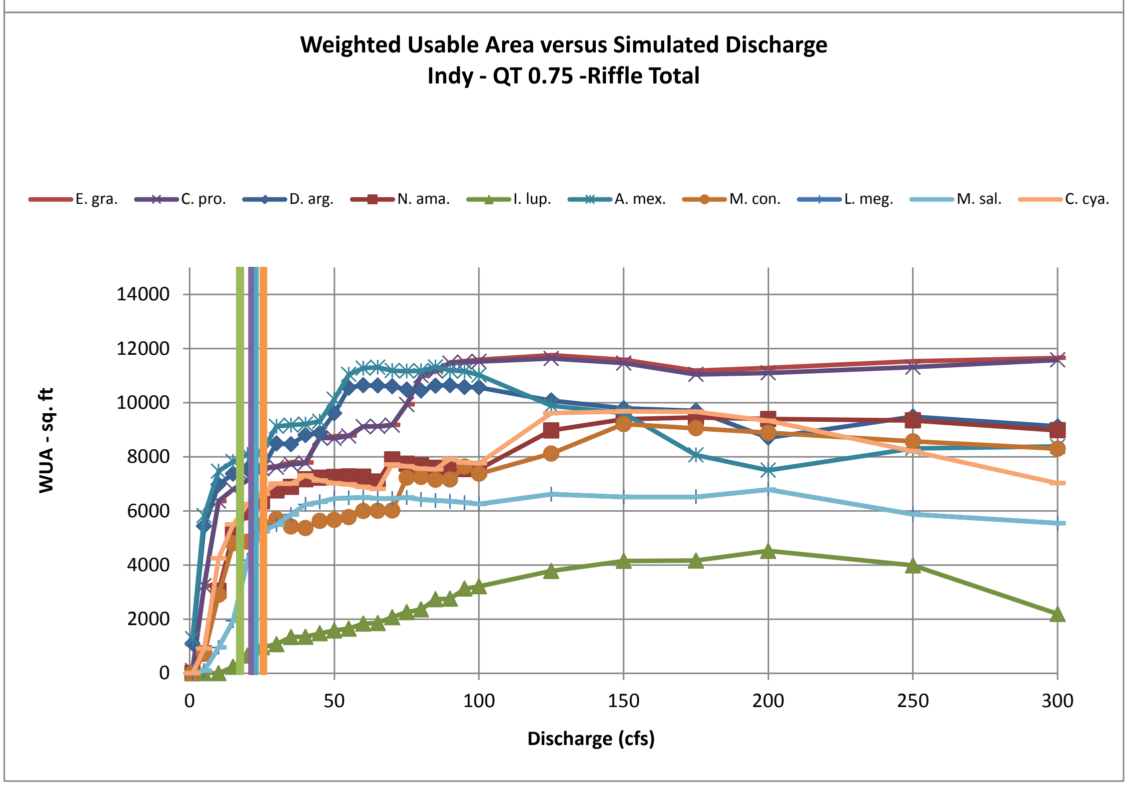


Figure 11-13 Weighted usable area versus simulated discharge at Indy Creek (Riffle Total).

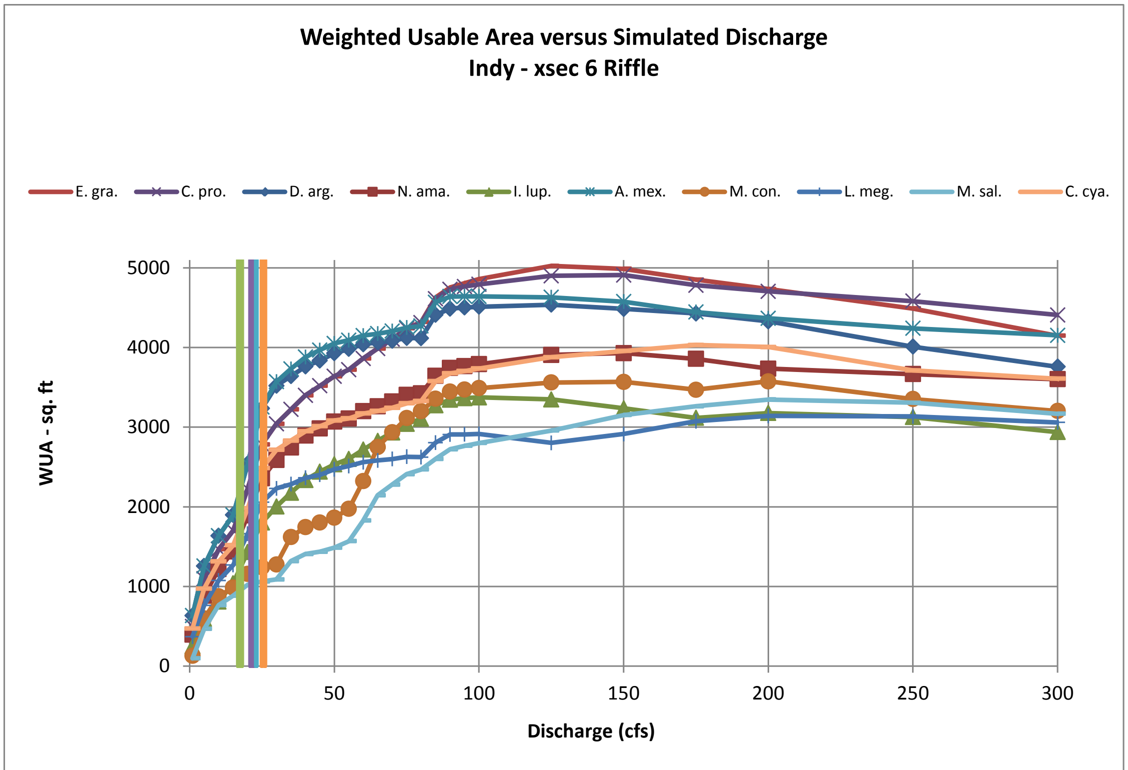
Table 11-13 Percent of maximum WUA versus simulated discharge at Indy Creek (Riffle Total).

Indy -Riffle Total

Q	Min All	E. gra.	C. pro.	D. arg.	N. ama.	I. lup.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	1%	22%	22%	32%	21%	15%	33%	2%	23%	1%	25%
5	28%	43%	43%	53%	40%	35%	55%	35%	39%	28%	43%
10	45%	54%	54%	61%	51%	46%	62%	50%	47%	45%	52%
15	51%	58%	59%	66%	56%	51%	66%	54%	54%	52%	57%
20	57%	64%	64%	72%	63%	57%	73%	57%	65%	61%	64%
25	59%	69%	70%	79%	70%	62%	80%	59%	73%	66%	71%
30	60%	74%	74%	85%	75%	66%	86%	60%	80%	70%	77%
35	64%	76%	76%	86%	78%	69%	88%	64%	83%	75%	80%
40	67%	78%	78%	88%	80%	71%	89%	67%	86%	78%	82%
45	69%	79%	80%	89%	82%	73%	91%	69%	87%	80%	83%
50	72%	81%	81%	90%	83%	74%	92%	72%	89%	82%	85%
55	74%	82%	82%	91%	84%	75%	92%	74%	90%	83%	85%
60	77%	83%	83%	92%	85%	77%	93%	79%	90%	86%	86%
65	79%	84%	85%	92%	86%	79%	94%	85%	91%	90%	86%
70	81%	85%	86%	93%	87%	81%	94%	88%	91%	92%	87%
75	83%	86%	87%	93%	88%	83%	95%	91%	92%	94%	88%
80	85%	87%	88%	93%	88%	85%	95%	92%	92%	94%	88%
85	88%	90%	91%	96%	91%	88%	98%	95%	94%	96%	91%
90	90%	92%	92%	97%	92%	90%	99%	97%	96%	97%	92%
95	91%	92%	93%	97%	93%	91%	99%	98%	96%	97%	92%
100	92%	93%	93%	97%	93%	92%	100%	98%	96%	97%	93%
125	94%	95%	95%	97%	95%	96%	99%	100%	95%	98%	94%
150	97%	98%	98%	99%	98%	99%	100%	100%	98%	98%	97%
175	99%	100%	100%	100%	100%	100%	99%	100%	100%	100%	100%
200	98%	101%	102%	100%	101%	102%	98%	101%	101%	101%	102%
250	97%	104%	105%	100%	103%	103%	97%	100%	102%	101%	103%
300	97%	104%	107%	100%	104%	105%	97%	111%	103%	109%	103%
350	96%	105%	107%	100%	102%	110%	96%	115%	102%	110%	100%
400	96%	104%	107%	99%	101%	114%	96%	118%	99%	108%	98%
500	89%	105%	106%	95%	100%	117%	95%	118%	89%	106%	97%

Indy - QT 0.75 -Riffle Total

Q	Min All	E. gra.	C. pro.	D. arg.	N. ama.	I. lup.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	0%	1%	1%	10%	0%	0%	11%	0%	0%	0%	0%
5	0%	28%	28%	51%	8%	0%	51%	8%	1%	1%	9%
10	0%	54%	55%	65%	32%	0%	66%	31%	14%	14%	44%
15	6%	58%	58%	69%	54%	6%	69%	52%	29%	29%	57%
20	16%	61%	61%	71%	63%	16%	71%	53%	63%	63%	65%
25	23%	65%	65%	71%	67%	23%	72%	59%	79%	79%	68%
30	26%	65%	65%	80%	71%	26%	81%	62%	83%	83%	72%
35	32%	66%	66%	79%	73%	32%	81%	59%	89%	89%	72%
40	32%	66%	67%	83%	76%	32%	81%	58%	94%	94%	75%
45	35%	74%	75%	83%	76%	35%	82%	61%	96%	96%	74%
50	38%	74%	75%	90%	77%	38%	89%	62%	98%	98%	72%
55	40%	75%	75%	99%	77%	40%	98%	63%	98%	98%	72%
60	44%	78%	78%	100%	77%	44%	100%	65%	98%	98%	71%
65	45%	78%	78%	100%	75%	45%	100%	65%	98%	98%	70%
70	50%	78%	79%	100%	84%	50%	99%	65%	98%	98%	80%
75	54%	85%	85%	99%	82%	54%	99%	78%	98%	98%	79%
80	57%	94%	95%	98%	81%	57%	99%	79%	97%	97%	78%
85	66%	95%	96%	100%	80%	66%	100%	78%	96%	96%	78%
90	66%	98%	99%	100%	80%	66%	99%	78%	96%	96%	82%
95	75%	98%	99%	99%	80%	75%	99%	83%	95%	95%	80%
100	77%	99%	99%	99%	80%	77%	97%	80%	94%	94%	80%
125	87%	100%	100%	95%	95%	91%	87%	88%	100%	100%	99%
150	85%	99%	99%	92%	99%	100%	85%	100%	98%	98%	100%
175	71%	95%	95%	91%	100%	100%	71%	98%	99%	99%	100%
200	66%	96%	95%	82%	99%	109%	66%	97%	103%	103%	96%
250	73%	98%	97%	89%	99%	96%	73%	93%	89%	89%	85%
300	53%	99%	100%	86%	95%	53%	74%	90%	84%	84%	73%
350	68%	113%	114%	87%	90%	87%	73%	98%	76%	76%	68%
400	67%	110%	116%	80%	73%	106%	74%	103%	73%	74%	67%
500	46%	104%	104%	79%	79%	126%	80%	100%	46%	48%	71%



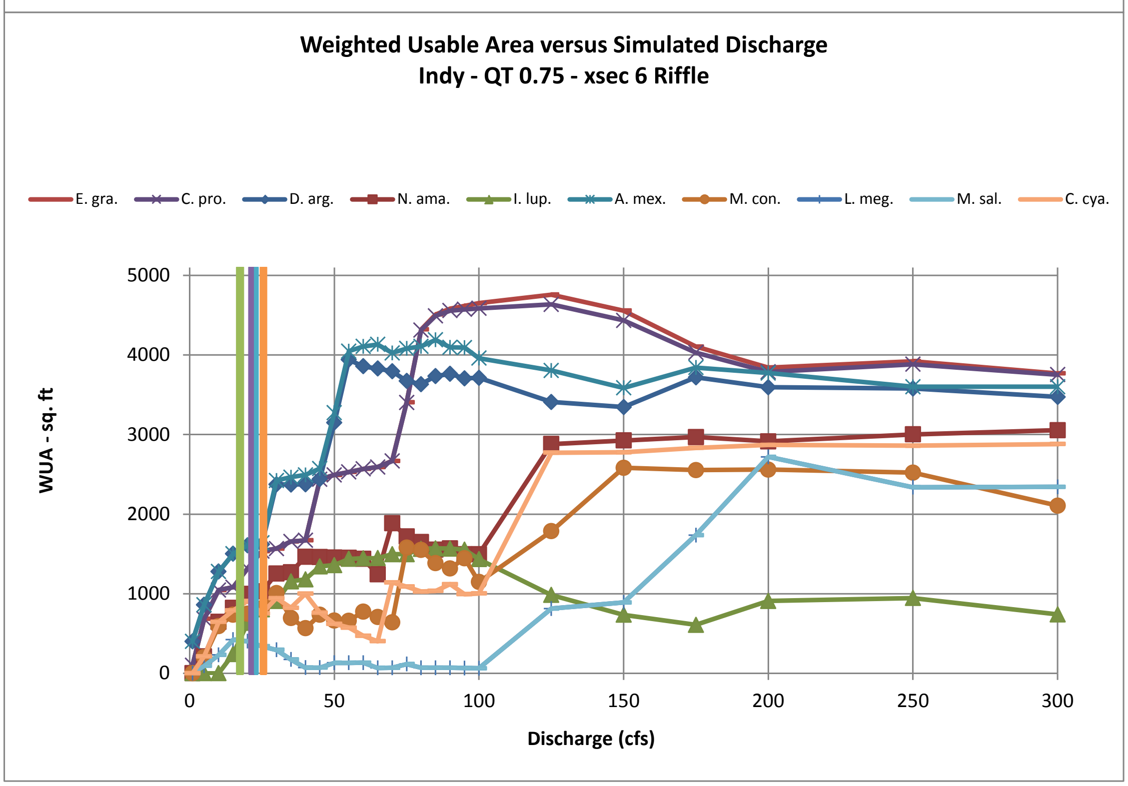


Figure 11-14 Weighted usable area versus simulated discharge at Indy Creek (Riffle 1).

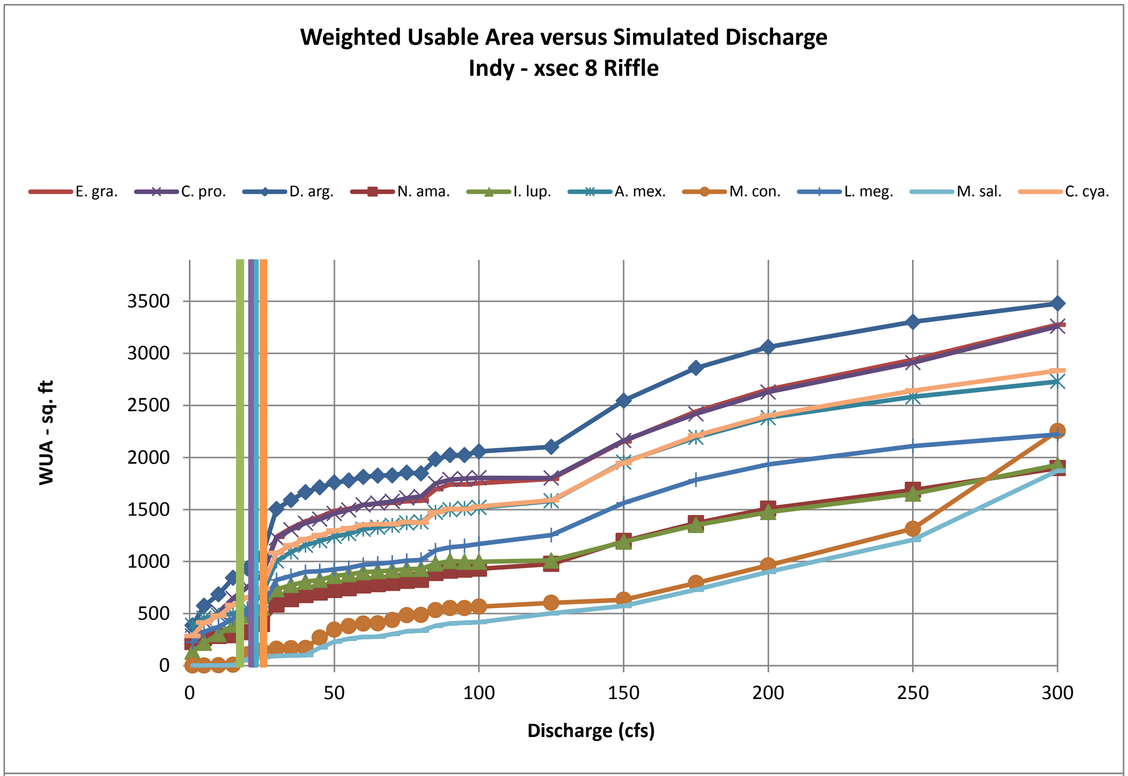
Table 11-14 Percent of maximum WUA versus simulated discharge at Indy Creek (Riffle 1).

Indy - xsec 6 Riffle

Q	Min All	E. gra.	C. pro.	D. arg.	N. ama.	I. lup.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	3%	10%	10%	14%	10%	7%	14%	4%	12%	3%	12%
5	14%	22%	22%	28%	22%	18%	27%	17%	25%	14%	24%
10	23%	29%	30%	36%	31%	24%	35%	25%	35%	23%	33%
15	27%	34%	35%	42%	37%	31%	41%	28%	41%	27%	38%
20	31%	44%	45%	56%	48%	42%	55%	32%	54%	31%	49%
25	33%	55%	57%	71%	60%	53%	70%	35%	67%	33%	62%
30	33%	61%	62%	78%	66%	59%	77%	36%	73%	33%	67%
35	40%	64%	66%	80%	70%	65%	80%	45%	74%	40%	70%
40	43%	68%	69%	83%	74%	69%	84%	49%	77%	43%	73%
45	44%	70%	72%	85%	76%	72%	85%	51%	78%	44%	75%
50	46%	72%	74%	87%	78%	75%	87%	52%	80%	46%	76%
55	48%	74%	76%	88%	79%	77%	88%	55%	82%	48%	77%
60	56%	77%	79%	89%	81%	81%	89%	65%	83%	56%	79%
65	66%	79%	81%	90%	83%	84%	90%	77%	84%	66%	79%
70	70%	82%	84%	90%	85%	87%	91%	82%	85%	70%	80%
75	74%	84%	86%	91%	87%	90%	92%	87%	86%	74%	82%
80	76%	86%	88%	91%	87%	92%	92%	90%	85%	76%	83%
85	80%	92%	94%	97%	93%	97%	98%	94%	91%	80%	89%
90	83%	95%	96%	99%	95%	99%	100%	97%	95%	83%	91%
95	85%	96%	97%	99%	96%	100%	100%	97%	95%	85%	92%
100	86%	97%	98%	99%	96%	100%	100%	98%	95%	86%	93%
125	91%	100%	100%	100%	99%	99%	100%	100%	91%	91%	96%
150	95%	99%	100%	99%	100%	96%	99%	100%	95%	97%	98%
175	92%	97%	97%	98%	98%	92%	96%	97%	100%	100%	100%
200	94%	94%	96%	95%	95%	94%	94%	100%	102%	103%	99%
250	88%	89%	93%	88%	93%	93%	91%	94%	102%	101%	92%
300	83%	83%	90%	83%	92%	87%	89%	90%	100%	97%	90%
350	79%	79%	85%	79%	88%	98%	86%	89%	93%	89%	79%
400	70%	75%	81%	76%	84%	104%	84%	89%	84%	80%	70%
500	59%	72%	74%	61%	80%	102%	76%	74%	59%	63%	63%

Indy - QT 0.75 - xsec 6 Riffle

Q	Min All	E. gra.	C. pro.	D. arg.	N. ama.	I. lup.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	0%	2%	2%	10%	0%	0%	10%	0%	0%	0%	0%
5	0%	14%	15%	22%	7%	0%	21%	8%	5%	5%	8%
10	0%	22%	23%	32%	22%	0%	31%	23%	13%	13%	23%
15	15%	23%	23%	38%	28%	15%	36%	28%	24%	24%	28%
20	23%	28%	28%	41%	34%	40%	38%	29%	23%	23%	32%
25	20%	32%	33%	41%	35%	51%	39%	32%	20%	20%	27%
30	17%	33%	34%	60%	42%	58%	58%	39%	17%	17%	33%
35	10%	35%	36%	60%	43%	73%	59%	27%	10%	10%	29%
40	4%	35%	36%	60%	49%	75%	59%	22%	4%	4%	35%
45	4%	51%	53%	62%	49%	86%	61%	28%	4%	4%	27%
50	8%	52%	54%	80%	49%	87%	78%	26%	8%	8%	22%
55	8%	53%	55%	100%	49%	92%	97%	26%	8%	8%	20%
60	8%	54%	55%	98%	48%	92%	98%	30%	8%	8%	17%
65	4%	54%	56%	97%	42%	92%	99%	27%	4%	4%	14%
70	4%	56%	58%	96%	64%	95%	96%	25%	4%	4%	40%
75	7%	72%	73%	93%	58%	95%	97%	61%	7%	7%	38%
80	4%	91%	93%	92%	56%	100%	98%	60%	4%	4%	36%
85	4%	95%	97%	95%	52%	100%	100%	54%	4%	4%	37%
90	4%	96%	98%	95%	53%	100%	98%	51%	4%	4%	40%
95	4%	97%	99%	94%	50%	99%	98%	56%	4%	4%	35%
100	4%	98%	99%	94%	50%	91%	94%	44%	4%	4%	35%
125	47%	100%	100%	87%	97%	63%	91%	69%	47%	47%	98%
150	47%	96%	96%	85%	99%	47%	86%	100%	51%	51%	98%
175	39%	86%	87%	94%	100%	39%	92%	99%	100%	100%	100%
200	58%	81%	82%	91%	98%	58%	90%	99%	157%	157%	101%
250	60%	82%	84%	91%	101%	60%	86%	98%	135%	135%	101%
300	47%	79%	81%	88%	103%	47%	86%	82%	135%	135%	102%
350	75%	75%	77%	88%	114%	169%	84%	100%	122%	122%	95%
400	75%	75%	77%	76%	99%	189%	82%	103%	107%	107%	83%
500	0%	75%	74%	44%	93%	216%	67%	90%	0%	0%	41%



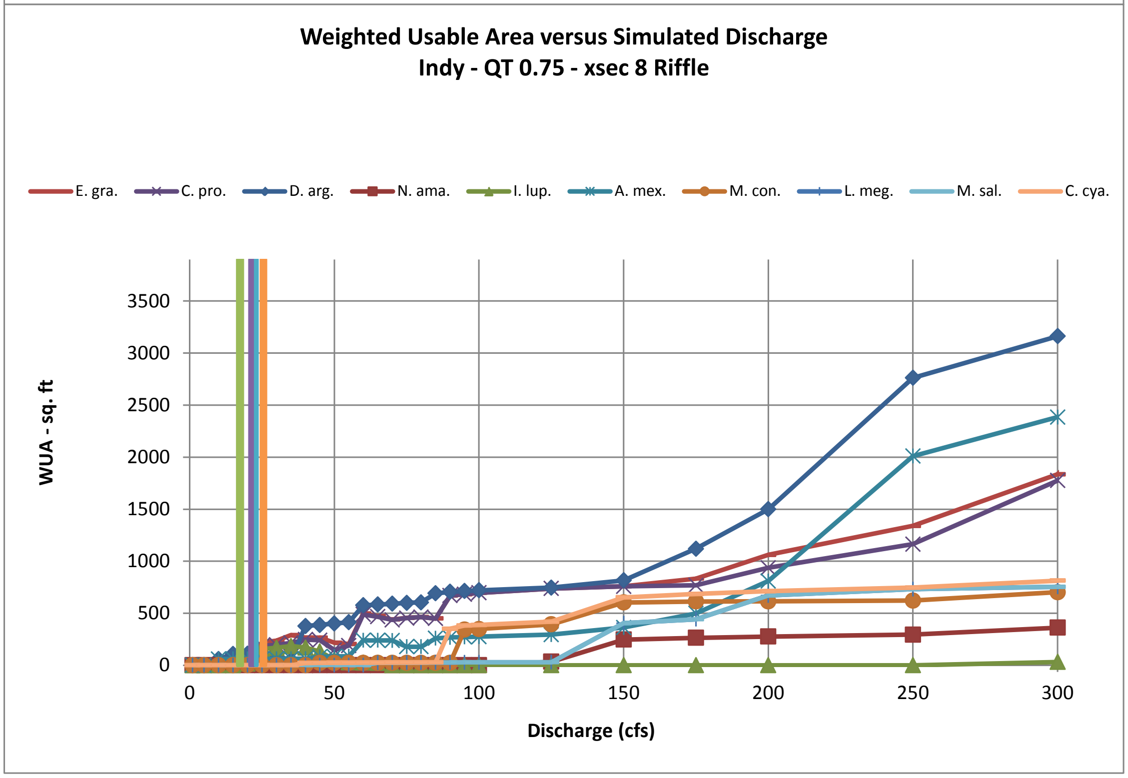


Figure 11-15 Weighted usable area versus simulated discharge at Indy Creek (Riffle 2).

Table 11-15 Percent of maximum WUA versus simulated discharge at Indy Creek (Riffle 2).

Indy - xsec 8 Riffle

Q	Min All	E. gra.	C. pro.	D. arg.	N. ama.	I. lup.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	0%	12%	12%	14%	16%	10%	18%	0%	13%	0%	13%
5	0%	17%	17%	20%	19%	16%	21%	0%	18%	0%	19%
10	0%	21%	21%	24%	21%	22%	22%	1%	21%	0%	22%
15	1%	26%	27%	29%	21%	29%	23%	1%	25%	1%	26%
20	9%	31%	31%	33%	23%	36%	25%	14%	28%	9%	30%
25	11%	36%	36%	37%	29%	41%	31%	18%	32%	11%	34%
30	13%	51%	51%	53%	43%	54%	46%	20%	46%	13%	49%
35	13%	54%	54%	56%	47%	57%	50%	21%	48%	13%	52%
40	14%	57%	57%	58%	49%	60%	53%	21%	50%	14%	55%
45	24%	59%	58%	60%	51%	61%	55%	34%	51%	24%	57%
50	32%	61%	60%	62%	53%	64%	57%	43%	52%	32%	59%
55	35%	62%	62%	62%	54%	65%	58%	48%	53%	35%	60%
60	38%	63%	64%	63%	56%	66%	60%	51%	54%	38%	61%
65	38%	64%	65%	64%	57%	67%	61%	51%	55%	38%	61%
70	42%	64%	65%	64%	58%	68%	61%	55%	55%	42%	61%
75	45%	65%	67%	65%	60%	69%	62%	61%	56%	45%	62%
80	46%	65%	67%	65%	60%	69%	63%	61%	57%	46%	62%
85	52%	69%	72%	69%	65%	73%	67%	67%	62%	52%	67%
90	55%	71%	74%	71%	67%	74%	68%	70%	64%	55%	68%
95	56%	71%	74%	71%	67%	74%	69%	70%	64%	56%	68%
100	57%	72%	75%	72%	68%	74%	69%	71%	66%	57%	69%
125	69%	74%	74%	74%	71%	75%	72%	76%	70%	69%	72%
150	79%	88%	89%	89%	87%	88%	89%	80%	88%	79%	88%
175	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
200	107%	109%	109%	107%	110%	109%	109%	121%	108%	123%	109%
250	116%	120%	120%	116%	123%	122%	118%	166%	118%	166%	119%
300	122%	134%	135%	122%	139%	143%	125%	284%	124%	257%	128%
350	126%	144%	146%	126%	151%	160%	130%	329%	129%	292%	134%
400	128%	151%	153%	128%	160%	176%	134%	360%	132%	314%	136%
500	130%	156%	161%	130%	172%	196%	139%	386%	138%	338%	137%

Indy - QT 0.75 - xsec 8 Riffle

Q	Min All	E. gra.	C. pro.	D. arg.	N. ama.	I. lup.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
5	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
10	0%	0%	0%	5%	0%	0%	12%	0%	0%	0%	0%
15	0%	0%	0%	10%	0%	0%	12%	0%	0%	0%	0%
20	0%	2%	2%	10%	0%	9%	12%	0%	0%	0%	0%
25	0%	26%	24%	8%	0%	85%	12%	0%	0%	0%	0%
30	0%	28%	26%	8%	0%	91%	13%	0%	0%	0%	0%
35	0%	35%	28%	5%	0%	100%	13%	0%	0%	0%	0%
40	0%	32%	32%	34%	0%	92%	13%	0%	0%	0%	3%
45	0%	32%	31%	35%	0%	72%	16%	4%	0%	0%	3%
50	0%	26%	19%	36%	0%	29%	17%	4%	0%	0%	4%
55	0%	24%	25%	37%	0%	16%	17%	4%	0%	0%	4%
60	0%	59%	64%	51%	0%	14%	48%	4%	0%	0%	4%
65	0%	57%	61%	52%	0%	13%	48%	4%	5%	5%	4%
70	0%	53%	57%	53%	0%	0%	48%	4%	6%	6%	4%
75	0%	55%	59%	54%	0%	0%	36%	4%	6%	6%	4%
80	0%	56%	60%	54%	0%	0%	36%	4%	6%	6%	4%
85	0%	54%	59%	62%	0%	0%	52%	4%	6%	6%	4%
90	0%	80%	87%	63%	0%	0%	54%	4%	6%	6%	51%
95	0%	82%	89%	64%	0%	0%	54%	56%	6%	6%	56%
100	0%	83%	91%	64%	0%	0%	55%	57%	6%	6%	57%
125	0%	88%	96%	67%	13%	0%	59%	64%	7%	7%	61%
150	0%	91%	99%	73%	94%	0%	73%	98%	92%	92%	95%
175	0%	100%	100%	100%	100%	0%	100%	100%	100%	100%	100%
200	0%	127%	122%	134%	105%	0%	163%	100%	152%	152%	104%
250	0%	161%	151%	247%	112%	0%	403%	101%	166%	166%	109%
300	17%	220%	231%	282%	137%	17%	479%	115%	170%	170%	119%
350	30%	379%	405%	303%	188%	30%	521%	166%	171%	171%	161%
400	162%	409%	443%	314%	328%	238%	541%	250%	162%	162%	228%
500	214%	439%	477%	323%	770%	432%	565%	441%	214%	214%	421%

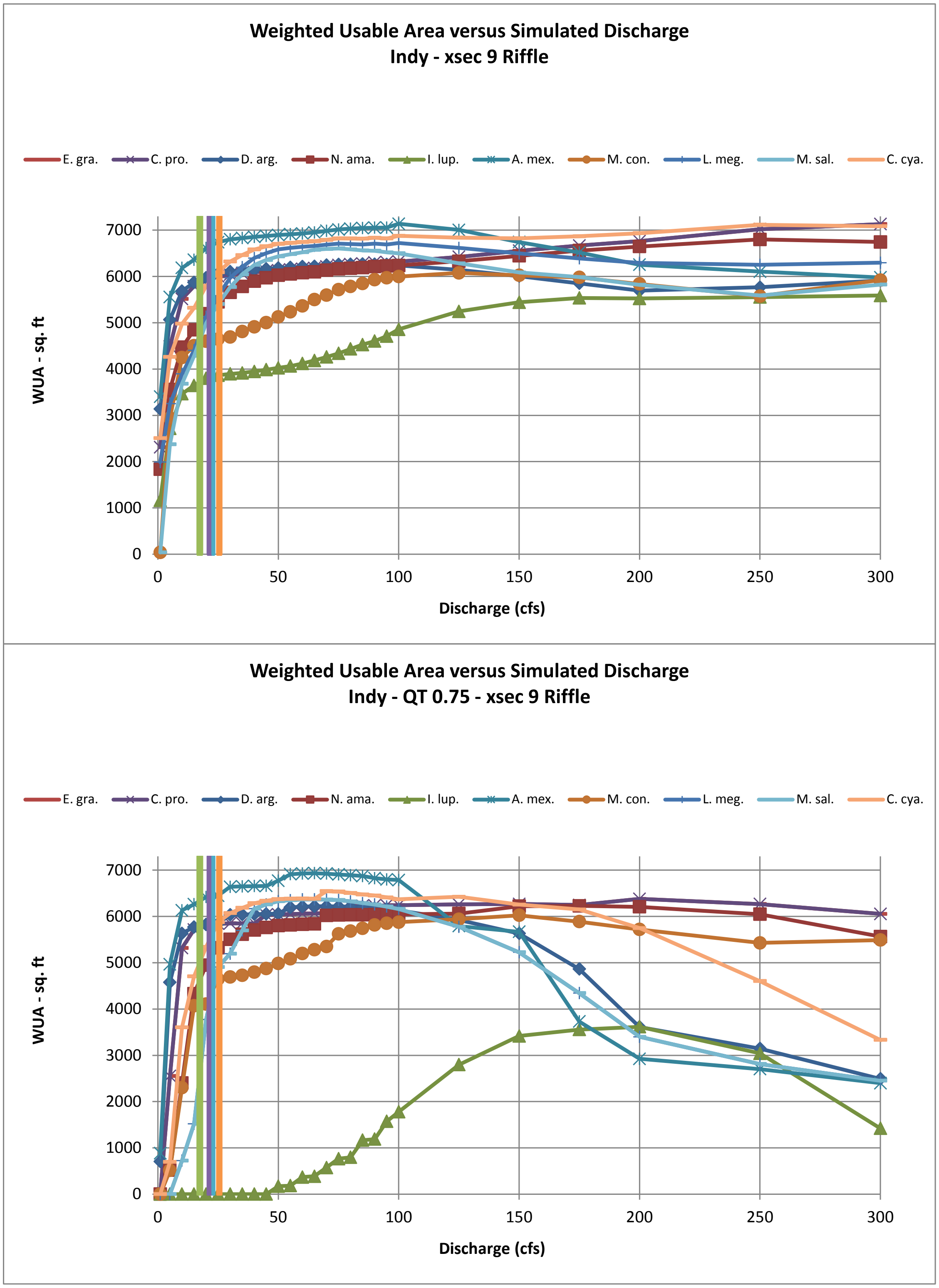


Figure 11-16 Weighted usable area versus simulated discharge at Indy Creek (Riffle 3).

Table 11-16 Percent of maximum WUA versus simulated discharge at Indy Creek (Riffle 3).

Indy - xsec 9 Riffle

Q	Min All	E. gra.	C. pro.	D. arg.	N. ama.	I. lup.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	1%	35%	35%	50%	28%	21%	48%	1%	30%	1%	36%
5	36%	67%	67%	81%	54%	49%	78%	48%	48%	36%	62%
10	56%	83%	83%	91%	68%	63%	87%	70%	58%	56%	72%
15	65%	87%	87%	94%	74%	66%	89%	74%	66%	65%	77%
20	69%	89%	89%	95%	79%	69%	93%	76%	76%	76%	84%
25	70%	90%	90%	97%	83%	70%	94%	76%	83%	82%	89%
30	70%	91%	91%	97%	86%	70%	95%	77%	89%	87%	92%
35	71%	91%	91%	98%	88%	71%	96%	79%	92%	92%	94%
40	71%	91%	91%	98%	90%	71%	96%	81%	95%	95%	96%
45	72%	92%	92%	98%	91%	72%	96%	82%	97%	96%	97%
50	73%	92%	92%	99%	92%	73%	97%	84%	98%	97%	97%
55	73%	92%	92%	99%	92%	73%	97%	86%	98%	98%	98%
60	74%	92%	92%	99%	93%	74%	97%	88%	99%	99%	98%
65	76%	93%	93%	99%	93%	76%	97%	90%	99%	100%	98%
70	77%	93%	93%	100%	93%	77%	98%	92%	99%	100%	99%
75	78%	94%	94%	100%	94%	78%	98%	94%	100%	100%	99%
80	80%	94%	94%	100%	94%	80%	99%	95%	100%	100%	99%
85	82%	94%	94%	100%	94%	82%	99%	96%	100%	99%	99%
90	83%	94%	94%	100%	95%	83%	99%	98%	100%	99%	99%
95	85%	95%	95%	100%	95%	85%	99%	98%	100%	99%	99%
100	88%	95%	95%	100%	95%	88%	100%	99%	100%	98%	100%
125	95%	96%	96%	98%	96%	95%	98%	100%	98%	95%	99%
150	92%	98%	98%	96%	98%	98%	94%	99%	97%	92%	99%
175	91%	100%	100%	93%	100%	100%	91%	98%	95%	91%	100%
200	88%	101%	101%	91%	101%	100%	88%	96%	94%	88%	101%
250	85%	105%	105%	92%	104%	100%	86%	92%	93%	85%	103%
300	84%	107%	107%	94%	103%	101%	84%	97%	94%	88%	103%
350	82%	107%	107%	95%	100%	101%	82%	99%	94%	89%	102%
400	83%	107%	107%	95%	97%	100%	83%	100%	92%	90%	102%
500	85%	108%	108%	96%	96%	102%	85%	105%	85%	93%	103%

Indy - QT 0.75 - xsec 9 Riffle

Q	Min All	E. gra.	C. pro.	D. arg.	N. ama.	I. lup.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	0%	0%	0%	11%	0%	0%	13%	0%	0%	0%	0%
5	0%	41%	41%	74%	8%	0%	72%	9%	0%	0%	11%
10	0%	85%	85%	91%	39%	0%	88%	38%	11%	11%	55%
15	0%	91%	91%	93%	70%	0%	90%	68%	24%	24%	72%
20	0%	93%	93%	94%	79%	0%	93%	68%	59%	59%	82%
25	0%	93%	93%	94%	85%	0%	93%	77%	77%	77%	90%
30	0%	93%	93%	97%	88%	0%	96%	78%	82%	82%	93%
35	0%	93%	93%	97%	90%	0%	96%	78%	89%	89%	94%
40	0%	93%	93%	97%	92%	0%	96%	80%	97%	97%	96%
45	0%	96%	96%	97%	93%	0%	96%	81%	98%	98%	97%
50	5%	96%	96%	97%	93%	5%	98%	83%	99%	99%	97%
55	5%	96%	96%	100%	93%	5%	100%	84%	100%	100%	97%
60	10%	97%	97%	100%	94%	10%	100%	86%	100%	100%	98%
65	11%	97%	97%	100%	94%	11%	100%	88%	100%	100%	97%
70	16%	97%	97%	100%	97%	16%	100%	89%	100%	100%	100%
75	22%	97%	97%	100%	97%	22%	100%	93%	100%	100%	100%
80	22%	99%	99%	100%	97%	22%	99%	94%	99%	99%	99%
85	33%	99%	99%	100%	97%	33%	99%	95%	99%	99%	99%
90	33%	99%	99%	99%	97%	33%	98%	97%	98%	98%	99%
95	44%	100%	100%	99%	97%	44%	98%	97%	98%	98%	98%
100	50%	100%	100%	99%	97%	50%	98%	98%	97%	97%	97%
125	79%	100%	100%	95%	97%	79%	84%	99%	91%	91%	98%
150	82%	100%	100%	91%	100%	96%	82%	100%	82%	82%	96%
175	54%	100%	100%	78%	100%	100%	54%	98%	68%	68%	94%
200	42%	102%	102%	58%	100%	102%	42%	95%	53%	53%	88%
250	39%	100%	100%	51%	97%	86%	39%	90%	44%	44%	70%
300	35%	97%	97%	40%	89%	40%	35%	91%	38%	38%	51%
350	26%	105%	105%	38%	74%	26%	31%	91%	34%	34%	43%
400	28%	94%	103%	33%	49%	28%	32%	87%	35%	36%	39%
500	30%	80%	80%	50%	43%	30%	49%	70%	33%	35%	43%

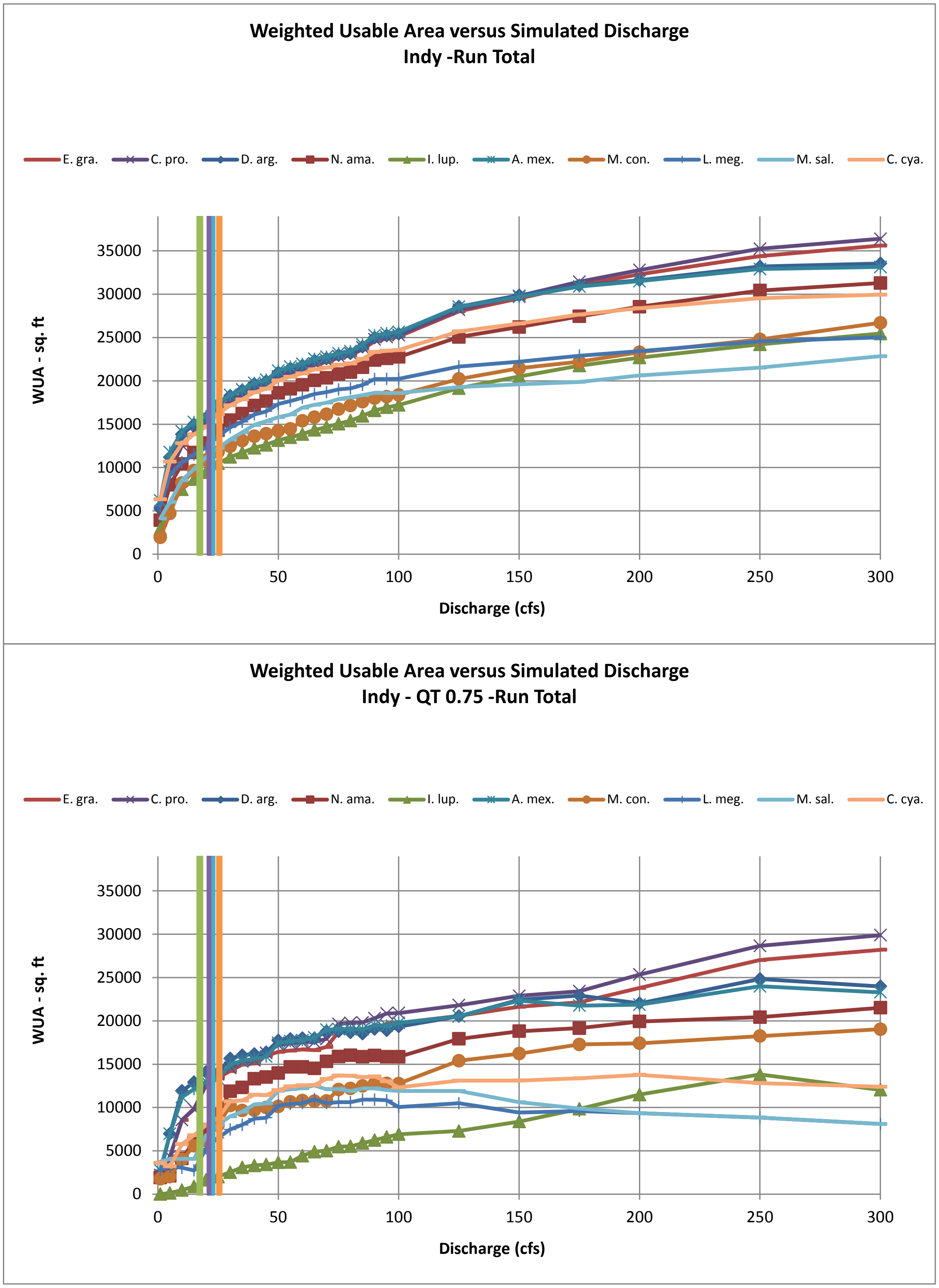


Figure 11-17 Weighted usable area versus simulated discharge at Indy Creek (Run Total).

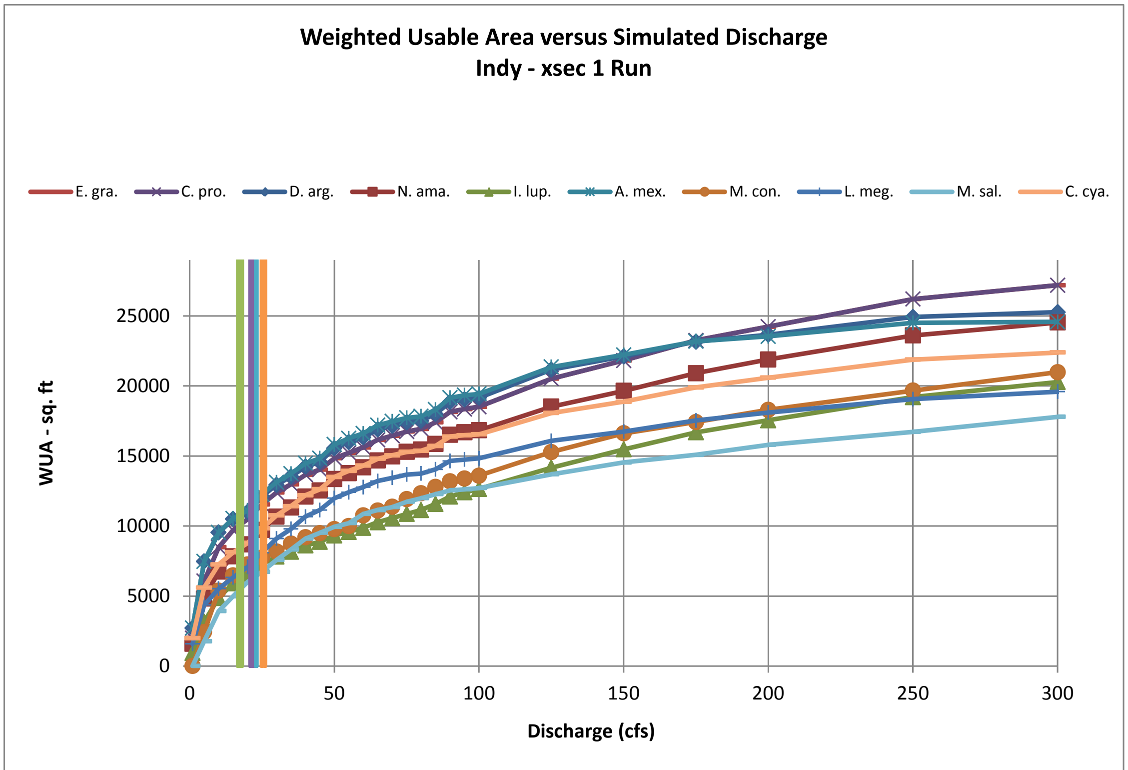
Table 11-17 Percent of maximum WUA versus simulated discharge at Indy Creek (Run Total).

Indy -Run Total

Q	Min All	E. gra.	C. pro.	D. arg.	N. ama.	I. lup.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	9%	15%	14%	17%	14%	13%	20%	9%	24%	21%	23%
5	21%	31%	30%	36%	29%	25%	38%	21%	40%	30%	39%
10	34%	40%	40%	45%	38%	34%	46%	37%	46%	43%	46%
15	40%	45%	45%	48%	43%	40%	49%	43%	50%	50%	50%
20	44%	49%	48%	51%	47%	44%	52%	49%	54%	56%	53%
25	48%	54%	53%	56%	52%	48%	56%	53%	59%	62%	58%
30	52%	57%	56%	59%	56%	52%	60%	56%	64%	67%	62%
35	54%	59%	58%	61%	59%	54%	62%	59%	67%	71%	65%
40	56%	61%	61%	63%	62%	56%	64%	61%	70%	75%	68%
45	58%	63%	62%	64%	64%	58%	65%	63%	72%	77%	69%
50	60%	66%	65%	68%	68%	60%	69%	64%	76%	80%	72%
55	62%	67%	67%	69%	70%	62%	70%	65%	77%	81%	74%
60	64%	69%	68%	70%	71%	64%	71%	69%	79%	85%	75%
65	66%	70%	70%	72%	73%	66%	73%	71%	81%	87%	77%
70	67%	71%	71%	73%	74%	67%	74%	73%	82%	88%	78%
75	69%	73%	73%	74%	76%	69%	75%	75%	83%	90%	79%
80	71%	74%	74%	75%	77%	71%	76%	77%	83%	91%	80%
85	73%	76%	76%	77%	79%	73%	78%	79%	85%	92%	81%
90	76%	79%	79%	81%	82%	76%	82%	81%	88%	94%	84%
95	78%	80%	80%	81%	82%	78%	83%	82%	88%	94%	85%
100	79%	81%	80%	82%	83%	79%	83%	83%	88%	94%	85%
125	88%	90%	90%	92%	91%	88%	92%	91%	95%	97%	93%
150	94%	95%	95%	96%	96%	94%	96%	97%	97%	99%	96%
175	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
200	102%	104%	104%	102%	104%	104%	102%	105%	102%	104%	103%
250	107%	111%	112%	107%	111%	111%	107%	112%	107%	108%	107%
300	107%	115%	116%	108%	114%	117%	107%	120%	109%	115%	108%
350	107%	117%	118%	108%	116%	124%	107%	124%	108%	117%	108%
400	105%	119%	118%	108%	117%	132%	106%	128%	105%	116%	107%
500	99%	121%	121%	106%	118%	146%	106%	131%	99%	113%	103%

Indy - QT 0.75 -Run Total

Q	Min All	E. gra.	C. pro.	D. arg.	N. ama.	I. lup.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	0%	10%	9%	10%	10%	0%	12%	10%	26%	30%	27%
5	1%	20%	19%	30%	11%	1%	31%	12%	29%	32%	24%
10	5%	39%	37%	52%	21%	5%	50%	23%	28%	33%	42%
15	9%	45%	42%	56%	32%	9%	54%	32%	25%	33%	50%
20	17%	57%	54%	61%	39%	17%	58%	36%	48%	54%	58%
25	21%	61%	59%	61%	48%	21%	59%	46%	59%	64%	64%
30	26%	64%	62%	68%	62%	26%	67%	59%	68%	72%	78%
35	31%	68%	65%	70%	64%	31%	69%	56%	73%	76%	79%
40	34%	68%	66%	71%	70%	34%	70%	56%	80%	83%	84%
45	35%	72%	70%	71%	71%	35%	71%	58%	81%	84%	84%
50	37%	74%	74%	77%	73%	37%	78%	59%	94%	95%	88%
55	38%	75%	74%	78%	77%	38%	79%	62%	95%	97%	91%
60	45%	75%	75%	79%	77%	45%	80%	62%	96%	97%	92%
65	50%	75%	75%	78%	76%	50%	81%	62%	100%	100%	92%
70	51%	77%	77%	82%	80%	51%	85%	62%	96%	97%	97%
75	56%	85%	84%	82%	83%	56%	85%	70%	97%	97%	100%
80	56%	85%	84%	81%	84%	56%	85%	71%	97%	95%	100%
85	60%	84%	85%	81%	83%	60%	85%	72%	100%	97%	99%
90	63%	86%	87%	83%	84%	63%	87%	74%	100%	97%	99%
95	67%	89%	89%	83%	83%	67%	87%	74%	99%	96%	95%
100	70%	89%	89%	84%	83%	70%	88%	74%	92%	95%	90%
125	74%	93%	93%	90%	94%	74%	92%	89%	96%	95%	96%
150	85%	98%	98%	98%	98%	85%	100%	94%	86%	85%	96%
175	79%	100%	100%	100%	100%	100%	97%	100%	88%	79%	98%
200	74%	108%	108%	96%	104%	117%	98%	101%	85%	74%	101%
250	70%	122%	122%	108%	107%	140%	107%	106%	81%	70%	94%
300	65%	127%	128%	105%	112%	122%	104%	110%	74%	65%	91%
350	60%	140%	136%	109%	117%	136%	104%	113%	69%	60%	86%
400	57%	140%	133%	109%	114%	148%	107%	109%	65%	57%	75%
500	34%	148%	139%	99%	122%	205%	110%	111%	39%	34%	71%



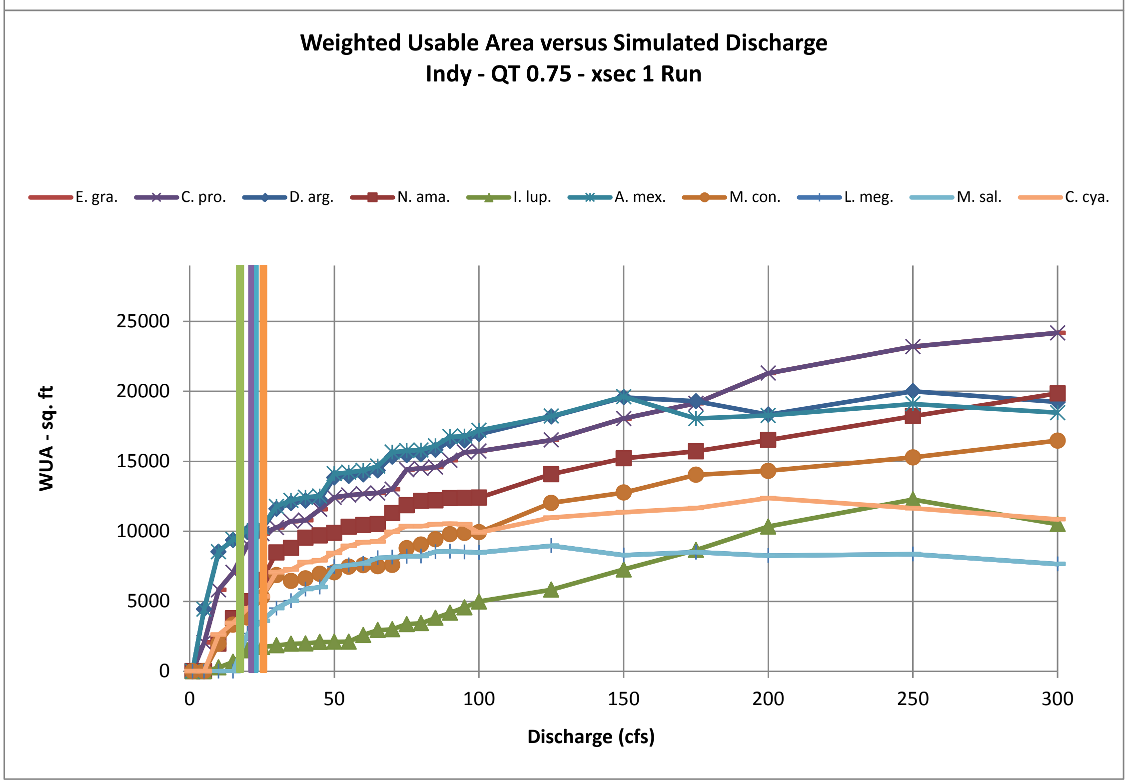


Figure 11-18 Weighted usable area versus simulated discharge at Indy Creek (Run 1).

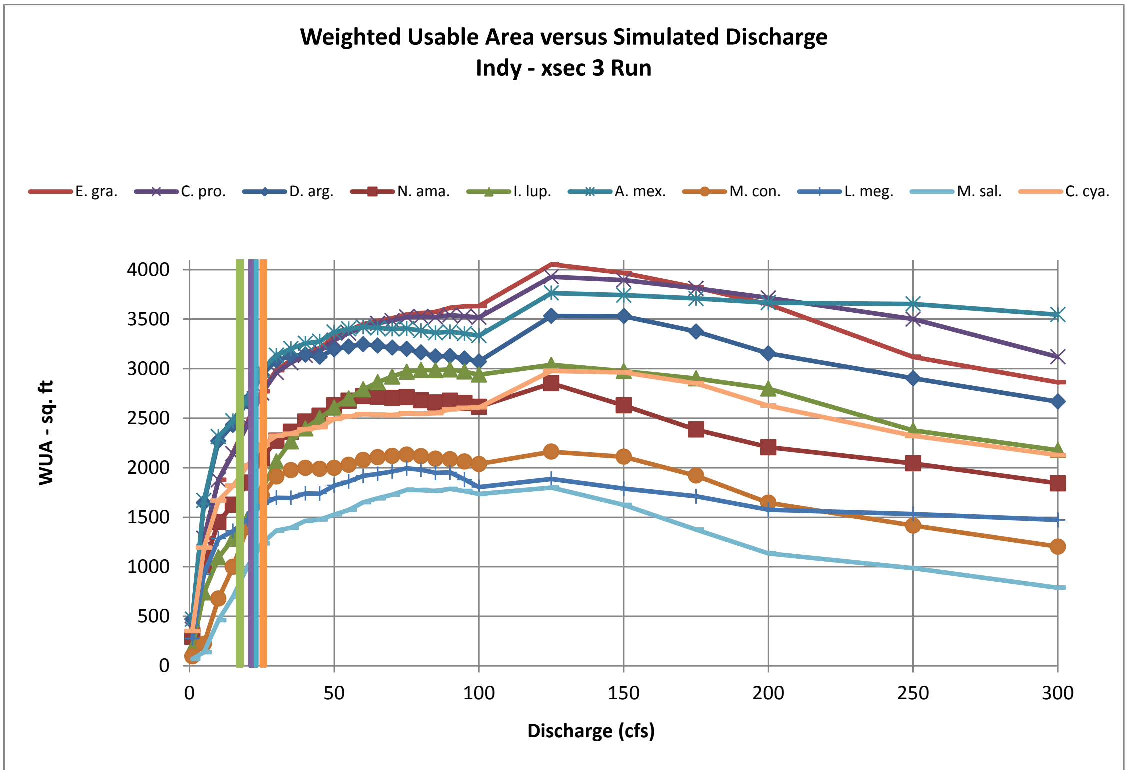
Table 11-18 Percent of maximum WUA versus simulated discharge at Indy Creek (Run 1).

Indy - xsec 1 Run

Q	Min All	E. gra.	C. pro.	D. arg.	N. ama.	I. lup.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	0%	9%	9%	12%	8%	6%	12%	0%	9%	0%	10%
5	12%	26%	26%	32%	23%	19%	32%	14%	25%	12%	28%
10	26%	36%	36%	41%	32%	29%	41%	31%	32%	26%	36%
15	33%	42%	42%	45%	37%	35%	45%	37%	36%	33%	41%
20	40%	45%	45%	47%	42%	40%	48%	42%	40%	40%	44%
25	44%	50%	50%	52%	46%	44%	53%	44%	46%	45%	49%
30	47%	53%	53%	56%	51%	47%	57%	47%	52%	50%	54%
35	49%	56%	56%	58%	54%	49%	59%	50%	56%	55%	57%
40	52%	59%	59%	61%	58%	52%	62%	53%	61%	60%	61%
45	53%	60%	60%	63%	60%	53%	64%	54%	64%	63%	63%
50	56%	64%	64%	67%	64%	56%	68%	56%	68%	66%	68%
55	57%	66%	66%	69%	66%	57%	70%	57%	71%	68%	70%
60	59%	67%	67%	70%	68%	59%	72%	62%	73%	72%	72%
65	62%	69%	69%	73%	70%	62%	74%	64%	75%	74%	74%
70	63%	71%	71%	74%	72%	63%	75%	65%	77%	75%	76%
75	65%	72%	72%	75%	73%	65%	76%	68%	78%	78%	77%
80	67%	73%	73%	76%	74%	67%	77%	71%	78%	79%	77%
85	69%	75%	75%	78%	76%	69%	79%	73%	80%	81%	79%
90	73%	78%	78%	81%	79%	73%	83%	76%	84%	83%	82%
95	74%	79%	79%	82%	80%	74%	83%	77%	84%	84%	83%
100	76%	80%	80%	83%	80%	76%	84%	78%	85%	84%	83%
125	85%	88%	88%	91%	89%	85%	92%	88%	92%	91%	91%
150	93%	94%	94%	95%	94%	93%	96%	95%	96%	96%	95%
175	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
200	102%	104%	104%	102%	105%	105%	102%	105%	103%	105%	103%
250	106%	113%	113%	108%	113%	115%	106%	113%	109%	111%	110%
300	106%	117%	117%	109%	117%	122%	106%	120%	112%	118%	113%
350	105%	119%	119%	109%	120%	128%	105%	125%	113%	121%	113%
400	104%	121%	121%	109%	121%	134%	104%	129%	112%	123%	112%
500	103%	122%	122%	105%	122%	145%	103%	132%	105%	120%	109%

Indy - QT 0.75 - xsec 1 Run

Q	Min All	E. gra.	C. pro.	D. arg.	N. ama.	I. lup.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
5	0%	11%	11%	23%	0%	0%	23%	0%	0%	0%	0%
10	0%	30%	30%	44%	13%	3%	44%	14%	0%	0%	22%
15	0%	37%	37%	48%	24%	8%	48%	24%	0%	0%	30%
20	17%	47%	47%	51%	32%	17%	51%	27%	30%	30%	39%
25	20%	51%	51%	52%	41%	20%	53%	38%	40%	40%	46%
30	21%	54%	54%	59%	54%	21%	60%	49%	50%	50%	61%
35	23%	56%	56%	61%	56%	23%	62%	46%	56%	56%	62%
40	23%	56%	56%	62%	61%	23%	63%	47%	66%	66%	67%
45	24%	60%	60%	63%	62%	24%	64%	50%	67%	67%	68%
50	24%	65%	65%	71%	63%	24%	72%	50%	83%	83%	72%
55	24%	66%	66%	71%	66%	24%	72%	53%	85%	85%	77%
60	30%	66%	66%	72%	66%	30%	73%	54%	86%	86%	79%
65	34%	67%	67%	73%	67%	34%	75%	54%	90%	90%	80%
70	35%	68%	68%	78%	72%	35%	80%	54%	91%	91%	85%
75	39%	75%	75%	79%	75%	39%	80%	63%	92%	92%	89%
80	40%	76%	76%	79%	77%	40%	81%	65%	92%	92%	89%
85	44%	76%	76%	81%	78%	44%	82%	67%	95%	95%	90%
90	48%	79%	79%	84%	79%	48%	85%	70%	95%	95%	90%
95	53%	82%	82%	84%	79%	53%	86%	70%	95%	95%	90%
100	58%	82%	82%	87%	79%	58%	88%	71%	95%	95%	85%
125	67%	86%	86%	93%	90%	67%	93%	86%	100%	100%	94%
150	84%	94%	94%	100%	97%	84%	100%	91%	93%	93%	98%
175	92%	100%	100%	99%	100%	100%	92%	100%	95%	95%	100%
200	92%	111%	111%	94%	105%	119%	93%	102%	92%	92%	106%
250	93%	121%	121%	102%	116%	142%	97%	109%	93%	93%	100%
300	85%	126%	126%	98%	126%	121%	94%	117%	85%	85%	93%
350	84%	135%	135%	98%	125%	130%	88%	116%	84%	84%	98%
400	79%	135%	135%	100%	123%	129%	91%	116%	79%	79%	84%
500	47%	140%	140%	91%	127%	178%	95%	127%	47%	47%	84%



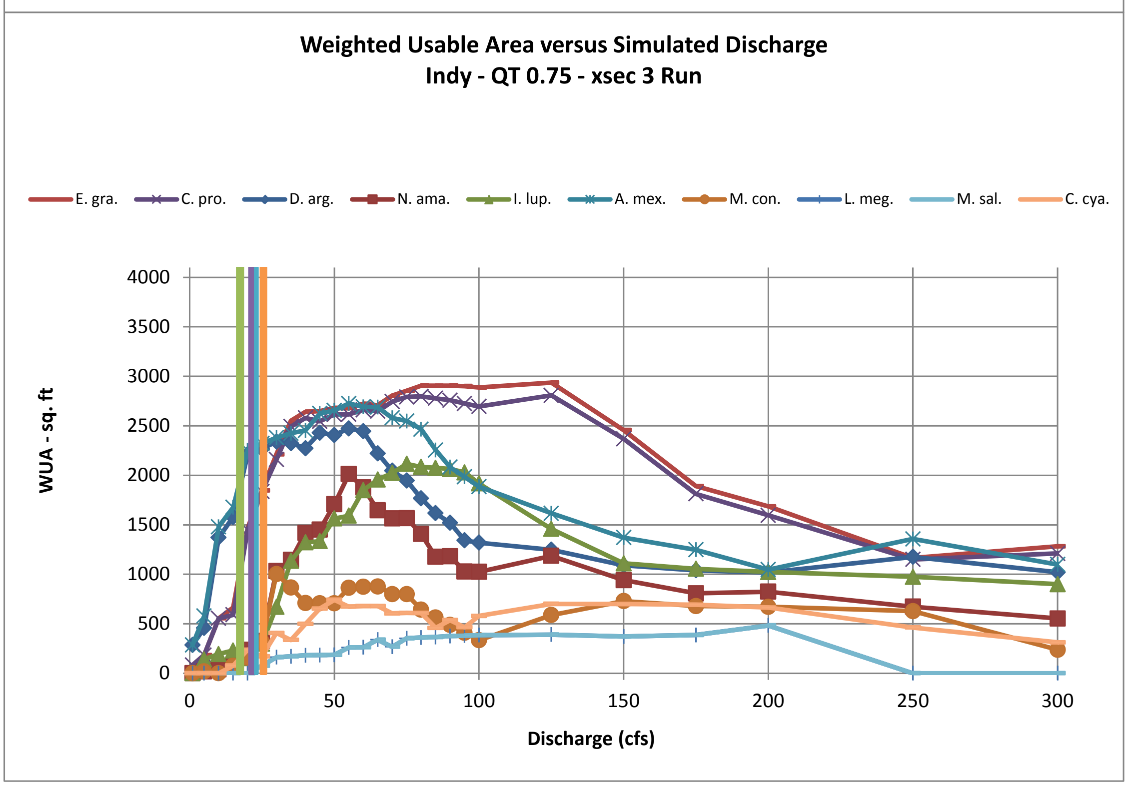


Figure 11-19 Weighted usable area versus simulated discharge at Indy Creek (Run 2).

Table 11-19 Percent of maximum WUA versus simulated discharge at Indy Creek (Run 2).

Indy - xsec 3 Run

Q	Min All	E. gra.	C. pro.	D. arg.	N. ama.	I. lup.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	4%	9%	9%	13%	10%	6%	13%	4%	14%	4%	12%
5	8%	32%	33%	47%	36%	24%	44%	10%	46%	8%	40%
10	26%	46%	48%	64%	51%	36%	61%	31%	64%	26%	56%
15	39%	53%	55%	69%	57%	42%	66%	46%	68%	39%	61%
20	49%	61%	62%	76%	65%	49%	72%	65%	74%	56%	68%
25	59%	68%	70%	83%	73%	59%	79%	79%	82%	69%	75%
30	68%	74%	75%	87%	80%	68%	83%	88%	85%	76%	78%
35	75%	76%	78%	89%	83%	75%	85%	91%	85%	77%	79%
40	78%	78%	80%	89%	86%	79%	86%	92%	87%	81%	80%
45	79%	79%	81%	88%	89%	82%	87%	92%	87%	82%	81%
50	82%	82%	84%	90%	92%	86%	90%	92%	91%	85%	84%
55	84%	84%	86%	91%	94%	89%	90%	94%	93%	87%	85%
60	85%	85%	87%	92%	95%	92%	91%	96%	96%	92%	85%
65	85%	86%	88%	92%	95%	94%	91%	97%	97%	94%	85%
70	85%	87%	89%	91%	95%	96%	90%	98%	98%	96%	85%
75	86%	88%	90%	91%	95%	98%	90%	99%	100%	99%	86%
80	85%	88%	90%	90%	94%	98%	90%	98%	99%	99%	85%
85	86%	88%	90%	88%	93%	98%	89%	97%	98%	98%	86%
90	87%	89%	90%	89%	94%	98%	90%	96%	98%	99%	87%
95	87%	90%	90%	88%	93%	98%	89%	95%	94%	98%	87%
100	87%	90%	90%	87%	92%	97%	89%	94%	91%	96%	88%
125	95%	100%	100%	100%	100%	100%	100%	100%	95%	100%	100%
150	90%	98%	99%	100%	92%	98%	99%	98%	90%	90%	99%
175	76%	94%	97%	96%	84%	95%	99%	89%	86%	76%	96%
200	63%	90%	95%	89%	77%	92%	97%	76%	79%	63%	88%
250	55%	77%	89%	82%	72%	78%	97%	66%	77%	55%	78%
300	44%	71%	79%	76%	65%	72%	94%	56%	74%	44%	71%
350	42%	66%	74%	72%	61%	67%	90%	50%	68%	42%	65%
400	35%	64%	68%	69%	56%	66%	84%	46%	58%	35%	63%
500	35%	67%	74%	72%	56%	74%	82%	50%	55%	35%	59%

Indy - QT 0.75 - xsec 3 Run

Q	Min All	E. gra.	C. pro.	D. arg.	N. ama.	I. lup.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	0%	3%	3%	12%	0%	0%	10%	0%	0%	0%	0%
5	0%	6%	7%	18%	1%	7%	21%	2%	0%	0%	0%
10	0%	19%	20%	55%	2%	9%	54%	0%	0%	0%	0%
15	0%	23%	21%	64%	4%	11%	62%	8%	0%	0%	10%
20	0%	50%	52%	89%	12%	7%	83%	16%	0%	0%	32%
25	14%	63%	65%	92%	16%	14%	85%	31%	20%	20%	23%
30	32%	75%	77%	95%	51%	32%	87%	100%	41%	41%	55%
35	44%	87%	89%	94%	57%	54%	89%	86%	44%	44%	45%
40	46%	90%	92%	92%	70%	62%	90%	71%	46%	46%	67%
45	47%	90%	91%	98%	72%	63%	96%	70%	47%	47%	88%
50	48%	91%	93%	97%	85%	74%	97%	71%	48%	48%	100%
55	67%	91%	93%	100%	100%	75%	100%	86%	67%	67%	91%
60	67%	93%	95%	99%	93%	87%	99%	87%	67%	67%	92%
65	82%	92%	94%	90%	82%	92%	99%	87%	87%	87%	92%
70	69%	95%	98%	83%	78%	96%	95%	80%	69%	69%	82%
75	78%	97%	99%	79%	78%	100%	93%	80%	91%	91%	82%
80	64%	99%	100%	71%	70%	99%	90%	64%	92%	92%	82%
85	56%	99%	99%	65%	58%	98%	83%	56%	94%	94%	62%
90	49%	99%	98%	61%	59%	97%	76%	49%	96%	96%	72%
95	41%	99%	97%	54%	51%	96%	73%	41%	97%	97%	63%
100	33%	98%	96%	53%	51%	91%	69%	33%	99%	99%	78%
125	50%	100%	100%	50%	59%	69%	59%	59%	100%	100%	95%
150	44%	84%	84%	44%	47%	52%	50%	73%	95%	95%	94%
175	40%	64%	65%	42%	40%	50%	46%	68%	99%	99%	93%
200	38%	57%	57%	41%	41%	48%	38%	67%	124%	124%	89%
250	0%	40%	41%	48%	33%	46%	50%	63%	0%	0%	62%
300	0%	44%	43%	41%	27%	43%	40%	24%	0%	0%	42%
350	0%	44%	41%	56%	16%	40%	51%	8%	0%	0%	0%
400	0%	35%	34%	36%	0%	33%	51%	0%	0%	0%	0%
500	0%	36%	36%	0%	0%	32%	40%	0%	0%	0%	0%

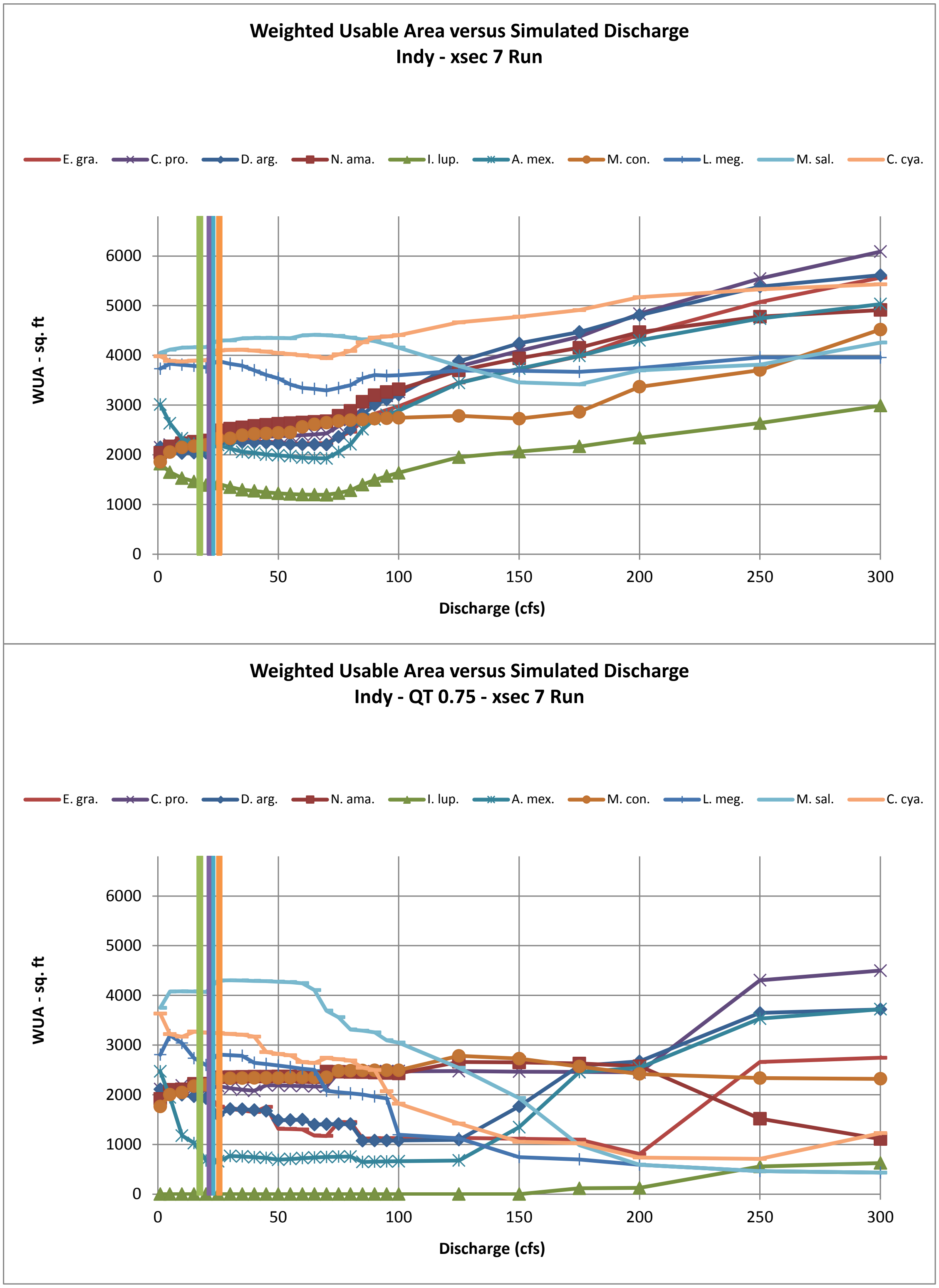


Figure 11-20 Weighted usable area versus simulated discharge at Indy Creek (Run 3).

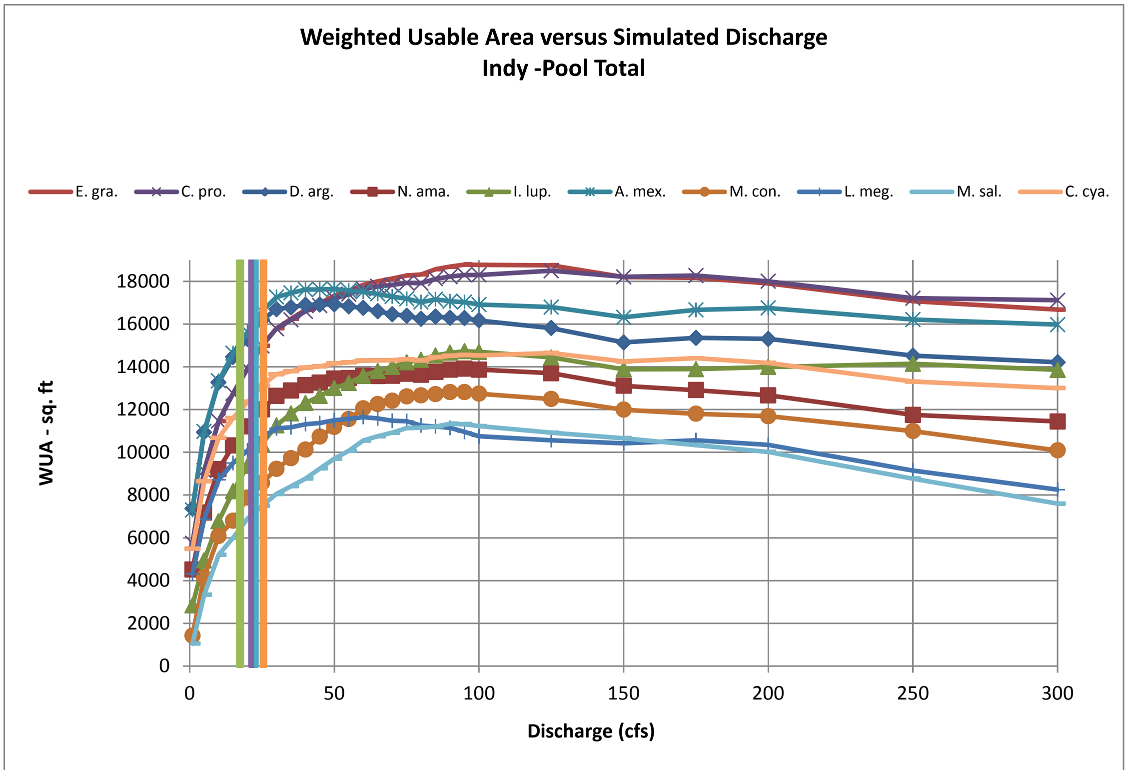
Table 11-20 Percent of maximum WUA versus simulated discharge at Indy Creek (Run 3).

Indy - xsec 7 Run

Q	Min All	E. gra.	C. pro.	D. arg.	N. ama.	I. lup.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	48%	54%	49%	48%	49%	84%	76%	65%	96%	92%	81%
5	46%	55%	50%	46%	52%	76%	66%	72%	99%	93%	79%
10	45%	56%	51%	45%	54%	71%	58%	75%	98%	94%	79%
15	46%	55%	50%	46%	54%	67%	56%	76%	98%	94%	79%
20	46%	54%	50%	46%	55%	64%	53%	77%	97%	94%	79%
25	50%	58%	54%	50%	60%	65%	55%	81%	100%	97%	83%
30	50%	58%	54%	50%	61%	62%	53%	81%	99%	98%	84%
35	50%	57%	54%	50%	61%	60%	52%	84%	98%	98%	84%
40	50%	57%	54%	50%	62%	59%	51%	84%	95%	99%	83%
45	50%	57%	54%	50%	63%	57%	50%	85%	93%	99%	83%
50	50%	56%	54%	50%	63%	56%	50%	85%	91%	99%	82%
55	49%	56%	54%	49%	63%	56%	49%	86%	88%	98%	82%
60	49%	56%	55%	49%	64%	55%	49%	89%	86%	100%	82%
65	48%	56%	55%	49%	64%	55%	48%	91%	86%	100%	81%
70	48%	56%	56%	49%	64%	55%	48%	92%	85%	100%	80%
75	52%	59%	59%	53%	67%	57%	52%	94%	86%	100%	82%
80	55%	62%	62%	56%	69%	59%	55%	94%	88%	99%	83%
85	63%	67%	67%	63%	74%	65%	63%	95%	91%	98%	87%
90	67%	71%	71%	67%	77%	69%	68%	95%	93%	97%	89%
95	70%	73%	73%	70%	79%	72%	70%	96%	92%	96%	89%
100	72%	75%	75%	72%	80%	76%	72%	96%	93%	94%	90%
125	86%	87%	86%	87%	89%	90%	86%	97%	95%	86%	95%
150	78%	93%	93%	95%	95%	95%	94%	95%	95%	78%	97%
175	77%	100%	100%	100%	100%	100%	100%	100%	94%	77%	100%
200	84%	111%	111%	108%	108%	108%	108%	118%	96%	84%	105%
250	86%	127%	127%	120%	115%	122%	119%	129%	102%	86%	109%
300	97%	140%	139%	126%	118%	138%	126%	158%	102%	97%	111%
350	94%	148%	145%	128%	120%	162%	131%	164%	95%	94%	111%
400	88%	156%	149%	133%	126%	197%	138%	171%	88%	90%	111%
500	81%	162%	155%	135%	130%	237%	147%	174%	84%	81%	103%

Indy - QT 0.75 - xsec 7 Run

Q	Min All	E. gra.	C. pro.	D. arg.	N. ama.	I. lup.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	0%	97%	85%	82%	72%	0%	100%	63%	88%	87%	100%
5	0%	97%	85%	80%	79%	0%	79%	72%	100%	95%	89%
10	0%	100%	88%	77%	79%	0%	48%	73%	95%	95%	87%
15	0%	98%	87%	76%	83%	0%	42%	78%	86%	95%	90%
20	0%	96%	85%	75%	84%	0%	27%	79%	81%	95%	90%
25	0%	81%	88%	62%	88%	0%	27%	84%	88%	100%	89%
30	0%	79%	86%	66%	89%	0%	31%	84%	87%	100%	89%
35	0%	77%	85%	66%	89%	0%	31%	84%	87%	100%	88%
40	0%	76%	84%	66%	89%	0%	30%	84%	83%	100%	87%
45	0%	80%	89%	65%	89%	0%	29%	84%	82%	100%	79%
50	0%	60%	88%	58%	89%	0%	28%	84%	81%	99%	78%
55	0%	60%	88%	58%	89%	0%	29%	84%	80%	99%	77%
60	0%	60%	88%	58%	89%	0%	29%	84%	79%	99%	73%
65	0%	54%	88%	54%	88%	0%	30%	84%	78%	95%	73%
70	0%	54%	87%	55%	93%	0%	30%	84%	65%	86%	76%
75	0%	66%	99%	55%	92%	0%	31%	89%	64%	83%	75%
80	0%	66%	99%	55%	92%	0%	31%	89%	63%	77%	74%
85	0%	51%	99%	42%	92%	0%	26%	89%	63%	76%	70%
90	0%	51%	100%	42%	92%	0%	27%	90%	61%	76%	69%
95	0%	52%	100%	42%	92%	0%	27%	90%	60%	72%	57%
100	0%	52%	100%	42%	91%	0%	27%	90%	37%	71%	50%
125	0%	52%	100%	42%	100%	0%	27%	100%	35%	59%	39%
150	0%	51%	100%	68%	100%	0%	55%	98%	23%	45%	29%
175	22%	50%	99%	100%	99%	100%	99%	92%	22%	23%	28%
200	14%	37%	99%	103%	97%	108%	103%	87%	19%	14%	20%
250	11%	122%	174%	141%	57%	476%	143%	84%	15%	11%	20%
300	10%	126%	182%	144%	42%	536%	151%	83%	14%	10%	34%
350	0%	179%	193%	172%	91%	1058%	182%	114%	0%	0%	12%
400	0%	185%	179%	175%	94%	2231%	186%	88%	0%	0%	11%
500	0%	219%	193%	182%	129%	3421%	200%	49%	0%	0%	0%



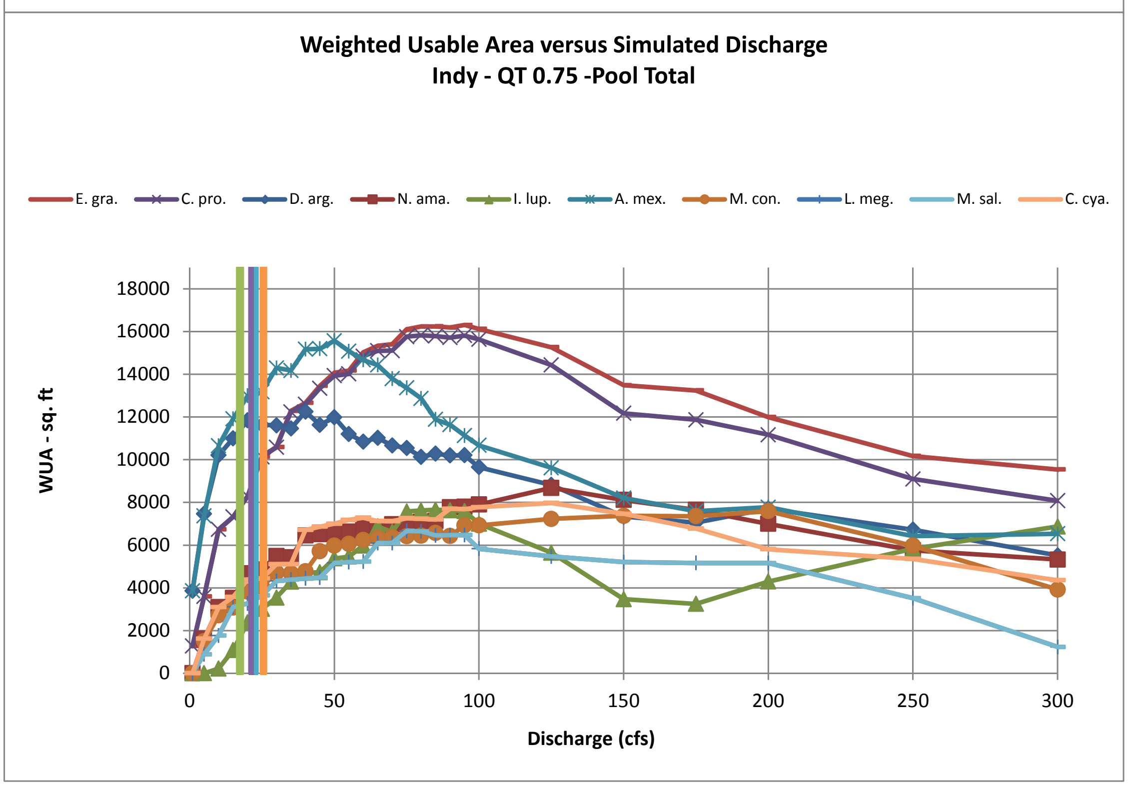


Figure 11-21 Weighted usable area versus simulated discharge at Indy Creek (Pool Total).

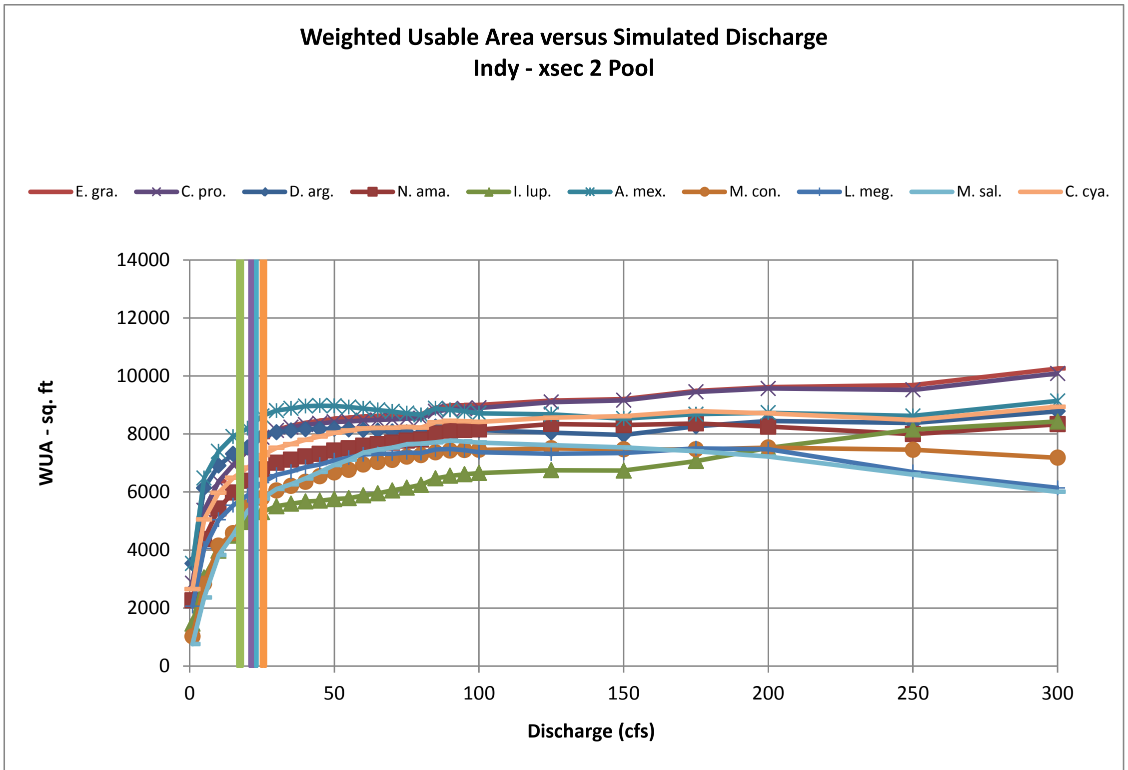
Table 11-21 Percent of maximum WUA versus simulated discharge at Indy Creek (Pool Total).

Indy -Pool Total

Q	Min All	E. gra.	C. pro.	D. arg.	N. ama.	I. lup.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	9%	31%	31%	44%	32%	19%	41%	11%	37%	9%	37%
5	29%	49%	49%	65%	52%	34%	62%	32%	59%	29%	59%
10	46%	61%	62%	78%	66%	46%	76%	47%	75%	46%	73%
15	53%	68%	69%	85%	74%	56%	83%	53%	82%	53%	79%
20	61%	74%	75%	90%	81%	64%	89%	61%	87%	61%	84%
25	66%	80%	81%	96%	86%	71%	94%	67%	92%	66%	90%
30	71%	84%	85%	99%	91%	76%	98%	72%	95%	71%	93%
35	74%	86%	88%	99%	93%	80%	99%	76%	96%	74%	94%
40	77%	89%	90%	100%	94%	84%	100%	79%	97%	77%	95%
45	82%	90%	91%	100%	95%	86%	100%	84%	98%	82%	96%
50	86%	92%	93%	100%	97%	88%	100%	87%	99%	86%	97%
55	89%	93%	94%	99%	97%	90%	100%	90%	99%	89%	97%
60	92%	95%	95%	99%	98%	92%	99%	94%	100%	93%	98%
65	94%	96%	96%	98%	98%	94%	99%	96%	99%	95%	98%
70	95%	96%	96%	97%	98%	95%	98%	97%	99%	96%	98%
75	96%	97%	97%	97%	98%	96%	97%	98%	98%	98%	98%
80	96%	98%	97%	96%	98%	97%	97%	99%	97%	98%	98%
85	96%	99%	98%	97%	99%	99%	97%	99%	96%	99%	99%
90	96%	99%	99%	96%	100%	100%	97%	100%	96%	100%	99%
95	94%	100%	99%	96%	100%	100%	97%	100%	94%	100%	99%
100	92%	100%	99%	96%	100%	100%	96%	99%	92%	99%	99%
125	91%	100%	100%	93%	99%	98%	95%	97%	91%	96%	100%
150	89%	97%	98%	89%	94%	94%	93%	94%	89%	94%	97%
175	91%	97%	99%	91%	93%	94%	94%	92%	91%	91%	98%
200	88%	95%	97%	90%	91%	95%	95%	91%	89%	88%	97%
250	77%	91%	93%	86%	84%	96%	92%	86%	79%	77%	91%
300	67%	89%	93%	84%	82%	94%	91%	79%	71%	67%	89%
350	60%	86%	90%	81%	80%	89%	90%	72%	64%	60%	85%
400	56%	89%	94%	87%	77%	92%	95%	72%	68%	56%	88%
500	47%	90%	96%	88%	72%	91%	98%	65%	67%	47%	86%

Indy - QT 0.75 -Pool Total

Q	Min All	E. gra.	C. pro.	D. arg.	N. ama.	I. lup.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	0%	8%	8%	31%	0%	0%	25%	0%	0%	0%	0%
5	0%	22%	23%	61%	19%	0%	47%	20%	13%	13%	20%
10	3%	41%	43%	83%	36%	3%	68%	37%	27%	27%	39%
15	14%	45%	46%	90%	41%	14%	77%	42%	47%	47%	45%
20	31%	51%	52%	97%	54%	31%	83%	52%	49%	49%	55%
25	39%	62%	64%	95%	56%	39%	85%	55%	55%	55%	56%
30	46%	65%	67%	95%	63%	46%	92%	64%	65%	65%	64%
35	56%	75%	77%	94%	63%	56%	91%	64%	66%	66%	64%
40	61%	78%	80%	100%	74%	61%	97%	65%	67%	67%	84%
45	62%	83%	84%	95%	75%	62%	98%	78%	67%	67%	86%
50	70%	86%	88%	98%	76%	70%	100%	81%	78%	78%	88%
55	71%	87%	89%	91%	76%	71%	97%	82%	78%	78%	90%
60	78%	92%	94%	88%	78%	78%	94%	85%	78%	78%	91%
65	79%	94%	95%	90%	79%	90%	93%	86%	91%	91%	89%
70	80%	94%	95%	87%	80%	86%	89%	86%	92%	92%	89%
75	80%	99%	100%	86%	80%	99%	86%	87%	100%	100%	91%
80	82%	100%	100%	83%	82%	100%	83%	87%	100%	100%	91%
85	76%	100%	100%	84%	82%	100%	76%	89%	97%	97%	90%
90	75%	99%	99%	83%	90%	100%	75%	87%	97%	97%	97%
95	72%	100%	100%	83%	90%	99%	72%	94%	97%	97%	96%
100	69%	99%	99%	79%	91%	91%	69%	94%	88%	88%	98%
125	62%	94%	91%	72%	100%	74%	62%	98%	82%	82%	100%
150	45%	83%	77%	60%	93%	45%	53%	100%	78%	78%	94%
175	42%	81%	75%	58%	88%	42%	49%	100%	78%	78%	85%
200	50%	74%	71%	63%	81%	56%	50%	103%	77%	77%	73%
250	41%	62%	57%	55%	66%	76%	41%	81%	53%	53%	67%
300	19%	59%	51%	45%	61%	90%	42%	53%	19%	19%	55%
350	2%	52%	52%	32%	53%	80%	39%	49%	2%	2%	30%
400	0%	50%	51%	36%	34%	68%	39%	45%	0%	0%	15%
500	0%	48%	47%	37%	20%	69%	31%	28%	0%	0%	3%



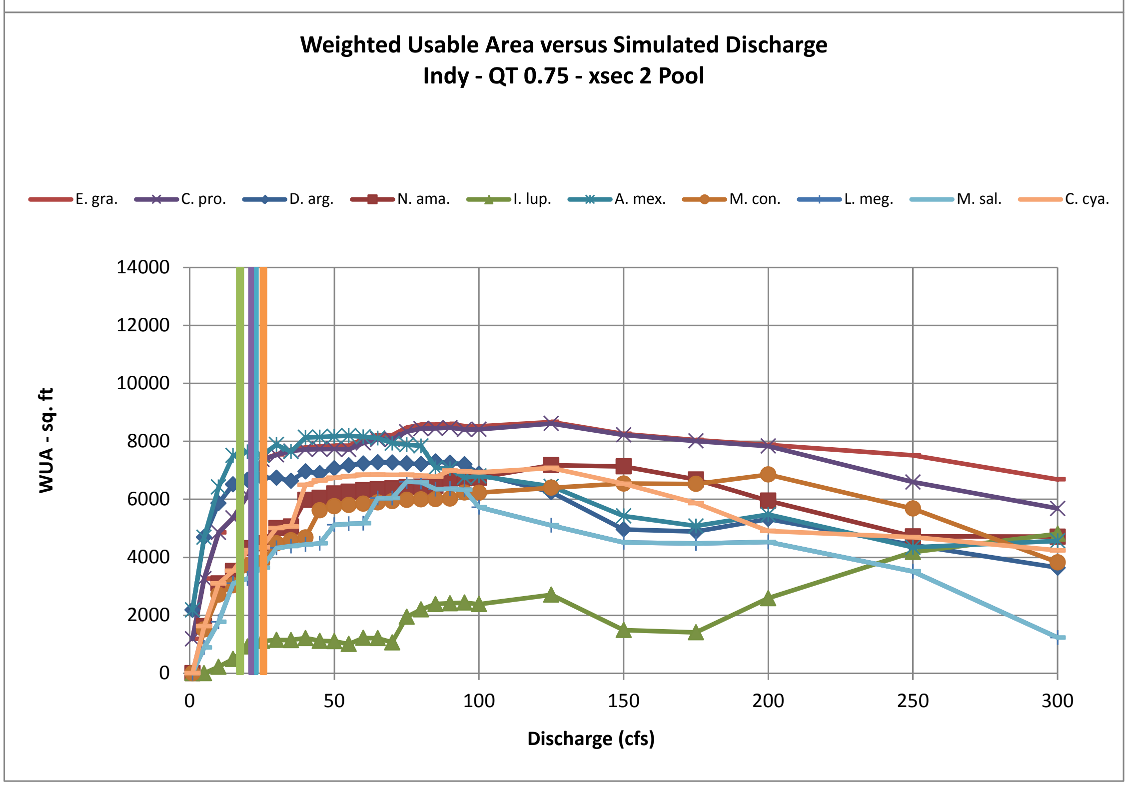


Figure 11-22 Weighted usable area versus simulated discharge at Indy Creek (Pool 1).

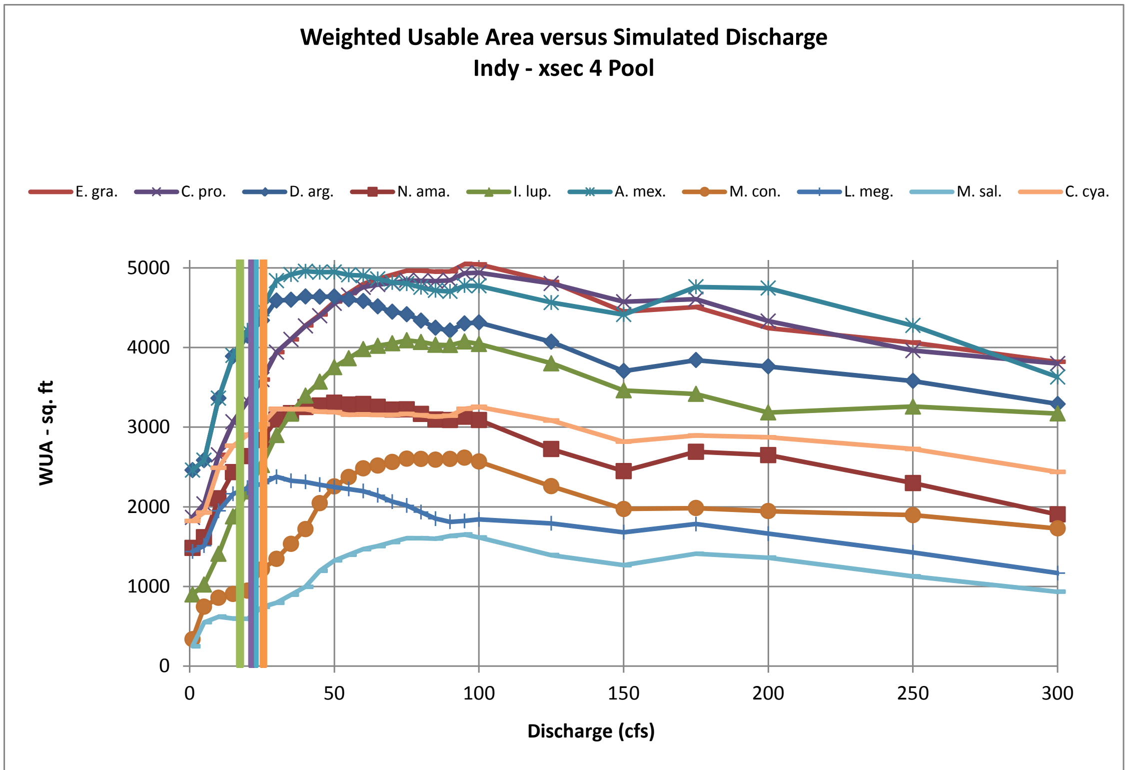
Table 11-22 Percent of maximum WUA versus simulated discharge at Indy Creek (Pool 1).

Indy - xsec 2 Pool

Q	Min All	E. gra.	C. pro.	D. arg.	N. ama.	I. lup.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	10%	30%	30%	43%	27%	21%	39%	14%	28%	10%	30%
5	30%	57%	57%	74%	52%	43%	72%	38%	54%	30%	58%
10	49%	67%	67%	84%	65%	56%	82%	55%	67%	49%	68%
15	58%	73%	73%	89%	72%	64%	88%	61%	74%	58%	74%
20	69%	78%	79%	91%	76%	70%	91%	73%	78%	69%	78%
25	74%	83%	83%	96%	81%	75%	96%	77%	84%	74%	83%
30	78%	86%	86%	98%	84%	78%	98%	81%	88%	79%	86%
35	79%	87%	87%	98%	85%	79%	99%	83%	89%	81%	87%
40	80%	88%	88%	99%	86%	80%	100%	85%	91%	83%	89%
45	81%	89%	89%	99%	87%	81%	100%	87%	93%	86%	90%
50	81%	90%	89%	99%	89%	81%	100%	89%	95%	89%	91%
55	82%	90%	89%	99%	90%	82%	99%	90%	96%	91%	92%
60	83%	91%	90%	98%	91%	83%	99%	93%	97%	95%	93%
65	84%	91%	90%	98%	91%	84%	98%	94%	98%	96%	93%
70	86%	91%	90%	98%	92%	86%	98%	95%	98%	97%	93%
75	87%	91%	90%	97%	93%	87%	97%	96%	98%	98%	94%
80	88%	92%	90%	97%	93%	88%	96%	97%	98%	99%	94%
85	92%	94%	93%	100%	96%	92%	99%	98%	99%	99%	96%
90	93%	95%	94%	100%	97%	93%	98%	99%	100%	100%	96%
95	94%	95%	94%	99%	97%	94%	98%	99%	99%	100%	96%
100	94%	95%	94%	98%	97%	94%	97%	99%	98%	99%	96%
125	96%	96%	96%	97%	100%	96%	97%	100%	98%	98%	97%
150	95%	97%	97%	96%	99%	95%	95%	100%	98%	97%	98%
175	95%	100%	100%	100%	100%	100%	97%	100%	100%	95%	100%
200	93%	101%	101%	102%	99%	106%	97%	100%	100%	93%	99%
250	85%	102%	101%	101%	96%	115%	96%	99%	89%	85%	97%
300	77%	108%	107%	106%	100%	119%	102%	96%	82%	77%	102%
350	70%	111%	110%	111%	99%	118%	104%	91%	76%	70%	103%
400	67%	121%	123%	127%	100%	127%	118%	95%	86%	67%	111%
500	60%	135%	138%	142%	99%	142%	134%	92%	89%	60%	117%

Indy - QT 0.75 - xsec 2 Pool

Q	Min All	E. gra.	C. pro.	D. arg.	N. ama.	I. lup.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	0%	14%	14%	30%	0%	0%	27%	0%	0%	0%	0%
5	0%	38%	38%	64%	23%	0%	57%	23%	13%	13%	23%
10	8%	56%	56%	80%	43%	8%	78%	41%	27%	27%	44%
15	18%	62%	62%	89%	49%	18%	92%	46%	47%	47%	50%
20	34%	71%	71%	91%	60%	34%	93%	57%	49%	49%	60%
25	41%	85%	86%	92%	62%	41%	92%	58%	55%	55%	61%
30	42%	87%	87%	92%	70%	42%	96%	68%	65%	65%	71%
35	42%	89%	89%	91%	71%	42%	93%	70%	66%	66%	71%
40	45%	90%	90%	95%	83%	45%	99%	72%	67%	67%	92%
45	41%	90%	90%	94%	84%	41%	99%	86%	68%	68%	94%
50	41%	91%	90%	97%	86%	41%	100%	88%	77%	77%	95%
55	37%	91%	90%	98%	87%	37%	100%	89%	78%	78%	96%
60	45%	93%	92%	99%	88%	45%	100%	89%	78%	78%	97%
65	45%	95%	94%	100%	88%	45%	99%	90%	91%	91%	97%
70	39%	95%	94%	99%	89%	39%	97%	91%	91%	91%	97%
75	72%	98%	97%	99%	89%	72%	96%	91%	100%	100%	97%
80	81%	99%	98%	99%	90%	81%	96%	92%	100%	100%	96%
85	86%	99%	98%	100%	90%	88%	86%	92%	96%	96%	96%
90	86%	99%	98%	99%	94%	89%	86%	92%	96%	96%	99%
95	82%	98%	98%	99%	94%	90%	82%	95%	96%	96%	98%
100	83%	98%	98%	94%	94%	88%	83%	95%	87%	87%	98%
125	77%	100%	100%	85%	100%	100%	79%	98%	77%	77%	100%
150	55%	95%	95%	68%	99%	55%	66%	100%	68%	68%	92%
175	52%	93%	93%	67%	93%	52%	62%	100%	68%	68%	83%
200	67%	91%	91%	73%	83%	96%	67%	105%	69%	69%	69%
250	53%	87%	77%	61%	66%	154%	53%	87%	53%	53%	66%
300	19%	77%	66%	50%	66%	177%	56%	59%	19%	19%	60%
350	2%	71%	70%	39%	62%	152%	57%	55%	2%	2%	34%
400	0%	70%	70%	53%	41%	129%	58%	50%	0%	0%	17%
500	0%	72%	67%	62%	25%	153%	53%	31%	0%	0%	4%



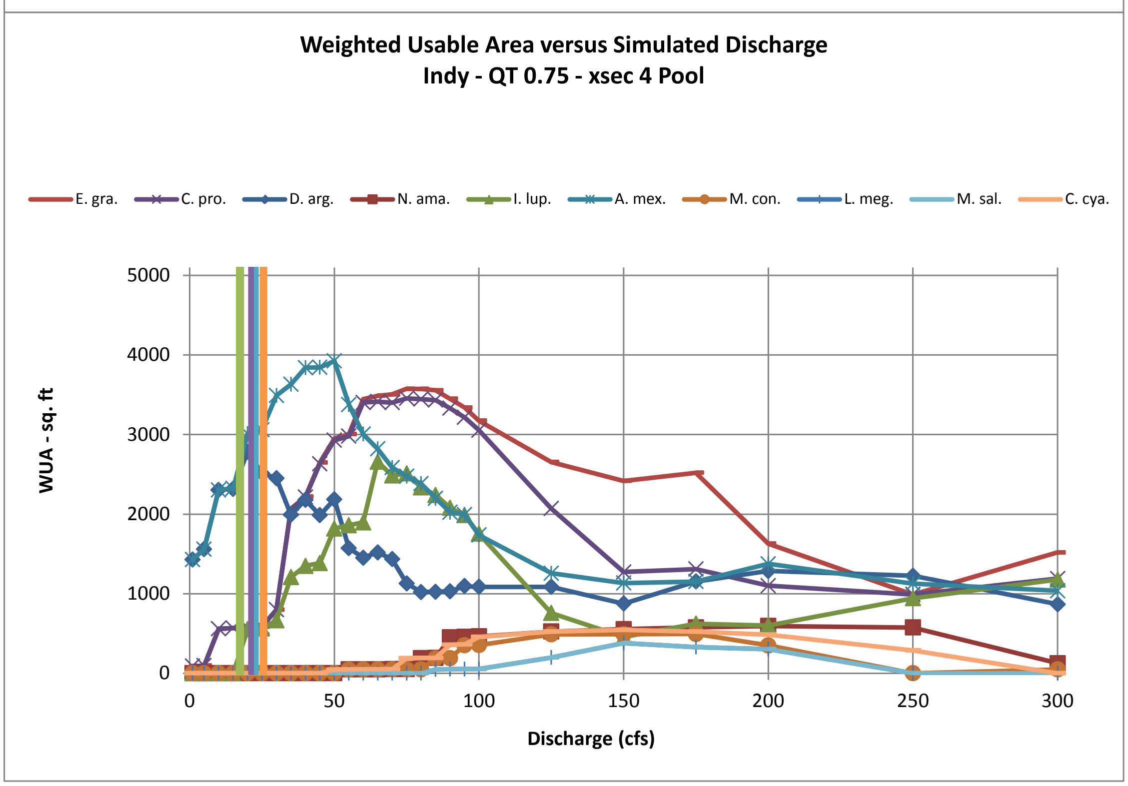


Figure 11-23 Weighted usable area versus simulated discharge at Indy Creek (Pool 2).

Table 11-23 Percent of maximum WUA versus simulated discharge at Indy Creek (Pool 2).

Indy - xsec 4 Pool

Q	Min All	E. gra.	C. pro.	D. arg.	N. ama.	I. lup.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	13%	37%	38%	53%	45%	22%	50%	13%	61%	15%	56%
5	25%	40%	41%	56%	49%	25%	52%	28%	64%	33%	59%
10	33%	53%	54%	72%	64%	34%	68%	33%	82%	38%	76%
15	35%	61%	62%	84%	74%	46%	79%	35%	91%	36%	85%
20	36%	66%	67%	89%	80%	54%	85%	36%	94%	36%	89%
25	45%	71%	73%	94%	86%	62%	90%	46%	96%	45%	93%
30	48%	78%	80%	99%	94%	71%	98%	51%	100%	48%	99%
35	54%	81%	83%	99%	96%	77%	99%	59%	98%	54%	99%
40	60%	85%	86%	100%	98%	83%	100%	66%	97%	60%	99%
45	72%	87%	89%	100%	99%	87%	100%	78%	96%	72%	98%
50	80%	91%	92%	100%	100%	92%	100%	86%	95%	80%	98%
55	85%	93%	94%	99%	99%	95%	99%	91%	93%	85%	97%
60	89%	95%	96%	99%	99%	97%	99%	95%	92%	89%	97%
65	90%	96%	97%	97%	98%	98%	98%	96%	90%	91%	97%
70	87%	97%	97%	96%	97%	99%	97%	98%	87%	94%	97%
75	85%	98%	98%	95%	97%	100%	97%	100%	85%	97%	97%
80	81%	98%	98%	93%	96%	100%	96%	99%	81%	97%	97%
85	78%	98%	98%	92%	94%	99%	95%	99%	78%	97%	96%
90	76%	98%	98%	91%	93%	99%	95%	99%	76%	99%	97%
95	77%	100%	100%	93%	95%	100%	96%	100%	77%	100%	99%
100	77%	100%	100%	93%	93%	99%	96%	98%	77%	98%	100%
125	75%	96%	97%	88%	82%	93%	92%	86%	75%	84%	95%
150	71%	88%	93%	80%	74%	85%	89%	75%	71%	77%	87%
175	75%	89%	93%	83%	81%	84%	96%	76%	75%	85%	89%
200	70%	84%	88%	81%	80%	78%	96%	74%	70%	82%	88%
250	60%	80%	80%	77%	69%	80%	86%	72%	60%	68%	84%
300	49%	76%	77%	71%	58%	78%	73%	66%	49%	57%	75%
350	36%	71%	74%	61%	50%	72%	69%	55%	36%	47%	66%
400	33%	63%	71%	53%	39%	67%	64%	45%	33%	34%	55%
500	16%	42%	54%	38%	26%	42%	60%	25%	24%	16%	40%

Indy - QT 0.75 - xsec 4 Pool

Q	Min All	E. gra.	C. pro.	D. arg.	N. ama.	I. lup.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	0%	3%	3%	51%	0%	0%	36%	0%	0%	0%	0%
5	0%	3%	3%	56%	0%	0%	40%	0%	0%	0%	0%
10	0%	16%	16%	83%	0%	0%	59%	0%	0%	0%	0%
15	0%	16%	16%	83%	0%	0%	59%	0%	0%	0%	0%
20	0%	16%	17%	100%	0%	21%	77%	0%	0%	0%	0%
25	0%	16%	17%	90%	0%	21%	78%	0%	0%	0%	0%
30	0%	22%	23%	88%	0%	25%	89%	0%	0%	0%	0%
35	0%	58%	60%	72%	0%	45%	93%	0%	0%	0%	0%
40	0%	62%	64%	78%	0%	51%	98%	0%	0%	0%	0%
45	0%	74%	76%	71%	0%	52%	98%	0%	0%	0%	0%
50	0%	83%	85%	79%	0%	68%	100%	0%	0%	0%	9%
55	0%	84%	86%	57%	8%	70%	86%	10%	0%	0%	9%
60	0%	96%	98%	52%	9%	71%	77%	10%	0%	0%	9%
65	0%	98%	99%	55%	9%	100%	72%	10%	0%	0%	9%
70	0%	98%	98%	52%	9%	93%	66%	10%	0%	0%	9%
75	0%	100%	100%	41%	9%	94%	63%	10%	0%	0%	34%
80	0%	100%	100%	37%	33%	88%	61%	10%	0%	0%	35%
85	13%	99%	99%	37%	33%	84%	56%	38%	13%	13%	35%
90	13%	96%	96%	37%	78%	78%	52%	39%	13%	13%	65%
95	14%	93%	93%	39%	79%	75%	51%	71%	14%	14%	66%
100	14%	89%	88%	39%	80%	66%	44%	72%	14%	14%	84%
125	28%	74%	60%	39%	91%	28%	32%	99%	52%	52%	96%
150	17%	68%	37%	31%	96%	17%	29%	99%	100%	100%	100%
175	23%	70%	38%	41%	100%	23%	29%	100%	87%	87%	96%
200	23%	46%	32%	46%	103%	23%	35%	71%	80%	80%	89%
250	0%	28%	29%	44%	100%	35%	29%	0%	0%	0%	53%
300	0%	42%	34%	31%	22%	44%	26%	10%	0%	0%	0%
350	0%	34%	33%	13%	0%	35%	14%	0%	0%	0%	0%
400	0%	22%	23%	0%	0%	25%	12%	0%	0%	0%	0%
500	0%	18%	17%	0%	0%	13%	0%	0%	0%	0%	0%

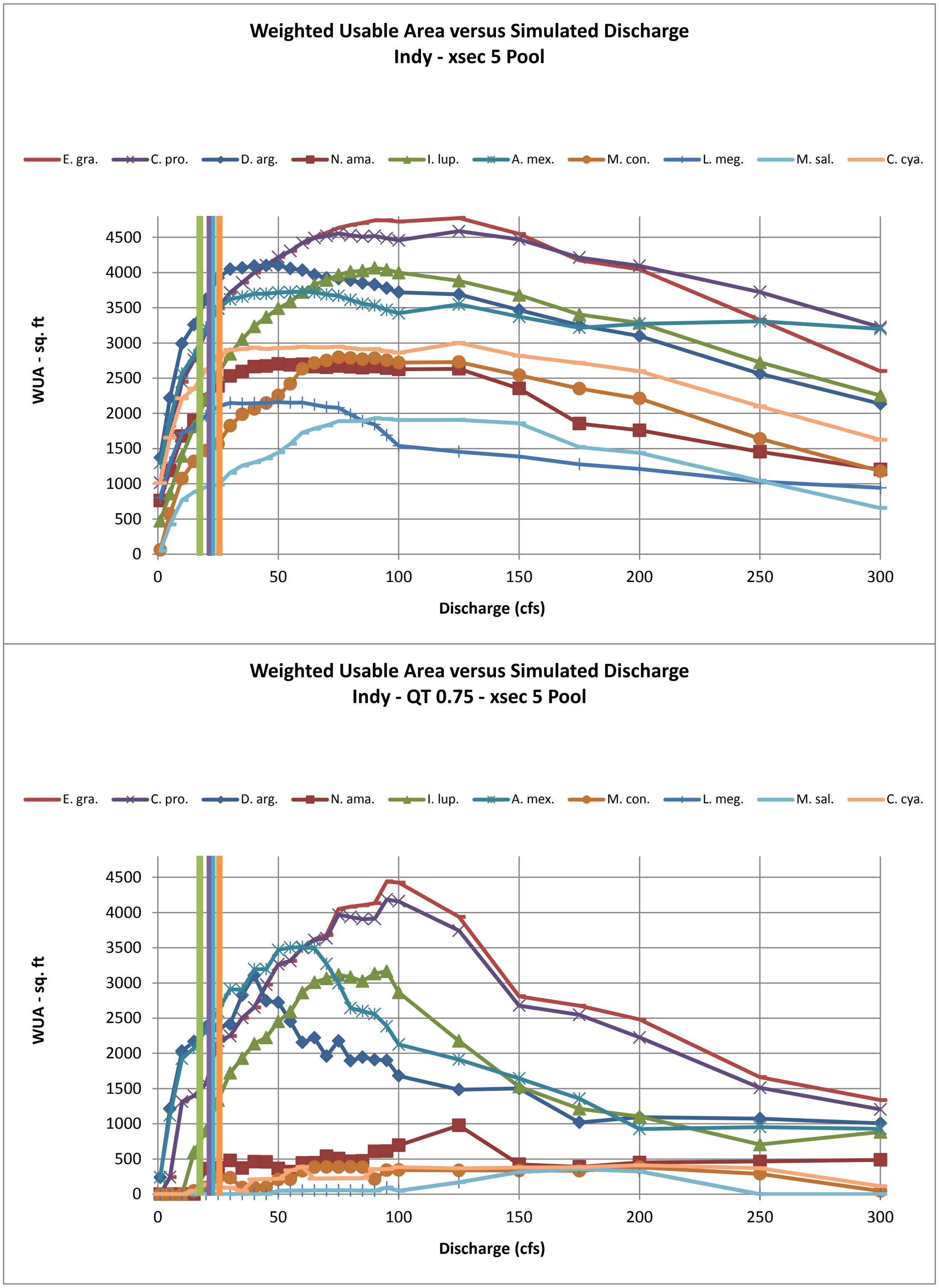


Figure 11-24 Weighted usable area versus simulated discharge at Indy Creek (Pool 3).

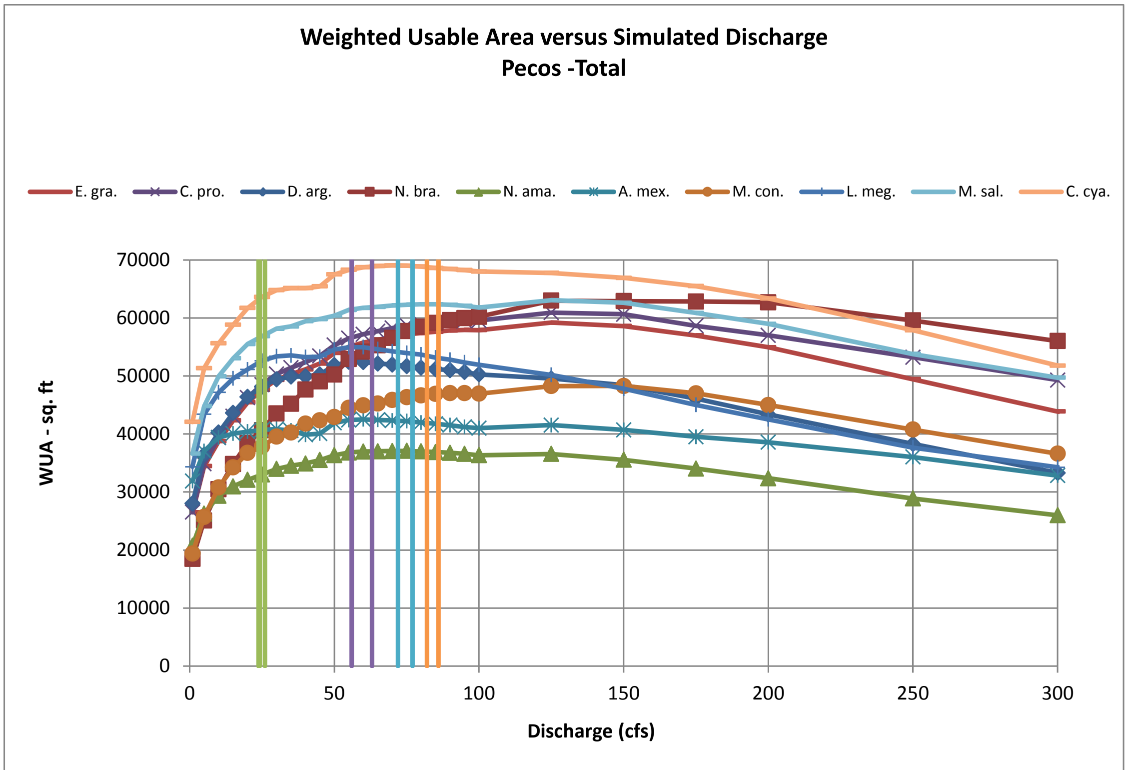
Table 11-24 Percent of maximum WUA versus simulated discharge at Indy Creek (Pool 3).

Indy - xsec 5 Pool

Q	Min All	E. gra.	C. pro.	D. arg.	N. ama.	I. lup.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	2%	21%	22%	33%	28%	12%	35%	2%	37%	2%	34%
5	20%	36%	38%	54%	44%	21%	51%	20%	60%	22%	55%
10	34%	51%	53%	73%	62%	34%	69%	38%	80%	40%	74%
15	45%	58%	60%	79%	70%	45%	76%	47%	83%	46%	78%
20	49%	66%	69%	88%	81%	54%	86%	53%	91%	49%	87%
25	51%	73%	76%	96%	88%	63%	93%	56%	97%	51%	94%
30	60%	78%	81%	99%	94%	70%	97%	65%	99%	60%	97%
35	65%	81%	84%	99%	96%	75%	98%	71%	99%	65%	97%
40	68%	84%	87%	100%	99%	80%	99%	74%	99%	68%	98%
45	70%	86%	89%	100%	99%	83%	99%	77%	99%	70%	97%
50	75%	88%	92%	100%	100%	86%	100%	81%	100%	75%	98%
55	81%	90%	94%	99%	99%	88%	100%	87%	100%	81%	98%
60	89%	93%	96%	98%	100%	92%	100%	94%	100%	89%	98%
65	92%	94%	98%	97%	99%	94%	100%	97%	98%	92%	98%
70	95%	96%	99%	96%	98%	96%	99%	98%	97%	95%	98%
75	95%	97%	99%	95%	99%	98%	98%	100%	96%	98%	98%
80	92%	98%	99%	95%	98%	99%	97%	100%	92%	98%	97%
85	88%	99%	98%	94%	98%	99%	95%	99%	88%	98%	97%
90	85%	99%	99%	93%	99%	100%	95%	100%	85%	100%	97%
95	78%	99%	98%	92%	98%	99%	93%	98%	78%	99%	96%
100	71%	99%	97%	91%	97%	98%	92%	97%	71%	99%	95%
125	67%	100%	100%	90%	97%	95%	95%	98%	67%	99%	100%
150	64%	95%	97%	85%	87%	91%	90%	91%	64%	96%	94%
175	59%	87%	92%	79%	69%	84%	86%	84%	59%	79%	91%
200	56%	85%	89%	76%	65%	81%	88%	79%	56%	74%	87%
250	48%	70%	81%	62%	54%	67%	89%	59%	48%	54%	70%
300	34%	54%	70%	52%	44%	55%	86%	42%	44%	34%	54%
350	30%	43%	57%	43%	43%	45%	84%	33%	39%	30%	43%
400	29%	44%	51%	43%	42%	45%	79%	32%	33%	29%	44%
500	23%	40%	44%	33%	29%	42%	64%	28%	26%	23%	33%

Indy - QT 0.75 - xsec 5 Pool

Q	Min All	E. gra.	C. pro.	D. arg.	N. ama.	I. lup.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	0%	0%	0%	8%	0%	0%	7%	0%	0%	0%	0%
5	0%	5%	6%	39%	0%	0%	32%	0%	0%	0%	0%
10	0%	30%	31%	65%	0%	0%	55%	0%	0%	0%	0%
15	0%	31%	33%	70%	0%	19%	59%	12%	0%	0%	12%
20	0%	35%	38%	76%	37%	28%	67%	24%	0%	0%	36%
25	0%	49%	52%	76%	38%	42%	74%	61%	0%	0%	24%
30	0%	51%	54%	78%	49%	54%	83%	60%	0%	0%	24%
35	0%	56%	60%	91%	38%	61%	83%	25%	0%	0%	12%
40	0%	60%	63%	100%	47%	67%	91%	24%	0%	0%	54%
45	0%	67%	71%	88%	47%	70%	91%	24%	0%	0%	55%
50	13%	73%	78%	88%	37%	77%	99%	54%	13%	13%	56%
55	14%	75%	79%	79%	33%	82%	100%	55%	14%	14%	88%
60	15%	79%	84%	69%	45%	90%	100%	86%	15%	15%	100%
65	15%	82%	86%	71%	46%	95%	100%	99%	15%	15%	58%
70	15%	83%	87%	63%	55%	97%	93%	100%	15%	15%	58%
75	15%	91%	95%	70%	52%	98%	85%	100%	15%	15%	59%
80	15%	92%	94%	61%	48%	97%	75%	100%	15%	15%	59%
85	14%	92%	93%	63%	48%	96%	74%	99%	14%	14%	59%
90	14%	93%	93%	61%	62%	99%	73%	55%	14%	14%	92%
95	26%	100%	100%	61%	63%	100%	68%	88%	26%	26%	92%
100	13%	100%	99%	54%	71%	91%	61%	89%	13%	13%	100%
125	47%	89%	89%	48%	100%	69%	54%	88%	47%	47%	95%
150	43%	63%	64%	48%	43%	48%	47%	87%	88%	88%	98%
175	33%	60%	61%	33%	40%	38%	39%	86%	100%	100%	100%
200	26%	56%	53%	35%	46%	35%	26%	99%	90%	90%	107%
250	0%	37%	36%	35%	48%	22%	27%	75%	0%	0%	96%
300	0%	30%	29%	32%	50%	28%	26%	12%	0%	0%	30%
350	0%	25%	26%	23%	22%	34%	22%	0%	0%	0%	0%
400	0%	28%	29%	17%	0%	33%	22%	0%	0%	0%	0%
500	0%	22%	23%	0%	0%	26%	15%	0%	0%	0%	0%



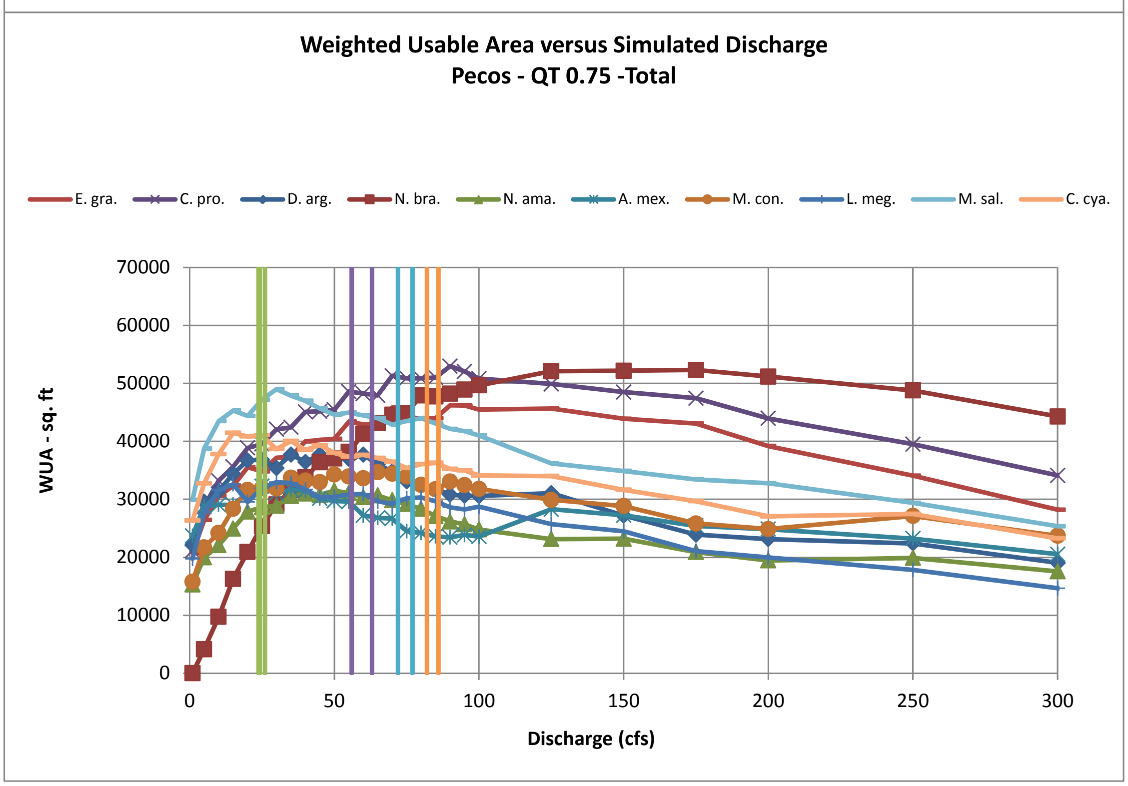


Figure 11-25 Weighted usable area versus simulated discharge at Pecos River (Total).

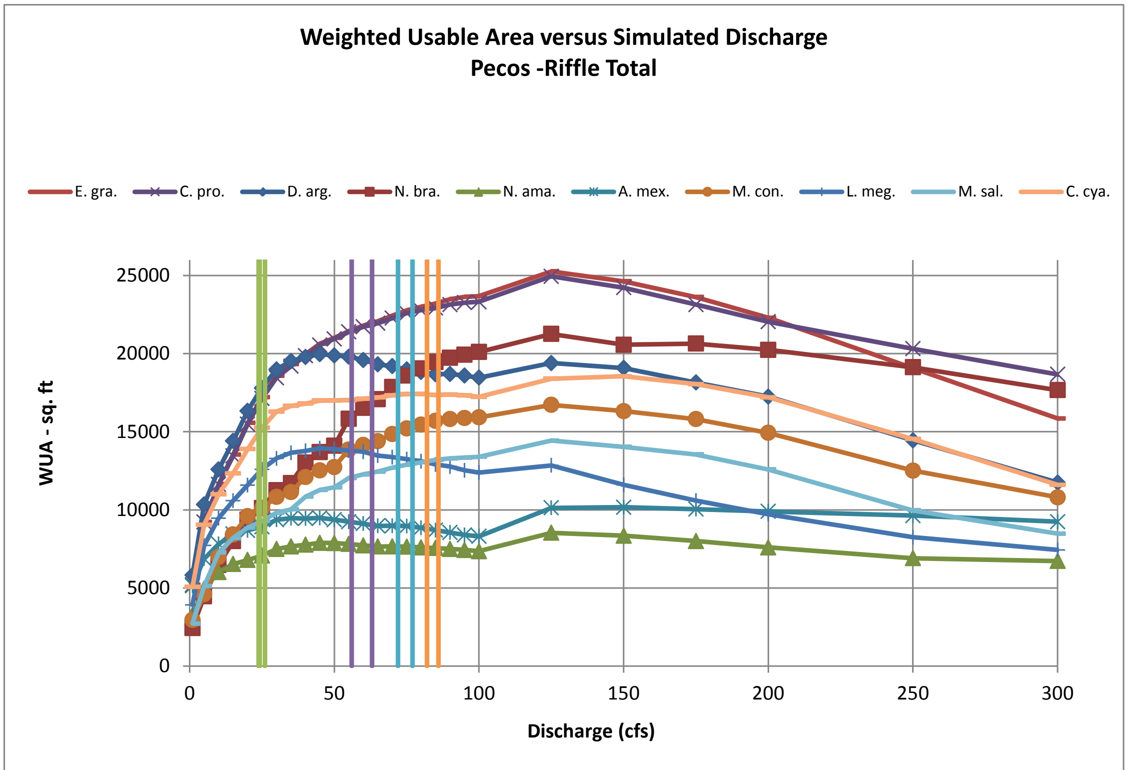
Table 11-25 Percent of maximum WUA versus simulated discharge at Pecos River (Total).

Pecos -Total

Q	Min All	E. gra.	C. pro.	D. arg.	N. bra.	N. ama.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	29%	45%	44%	53%	29%	56%	75%	40%	62%	58%	61%
5	40%	58%	57%	69%	40%	71%	87%	53%	79%	71%	74%
10	48%	65%	65%	77%	48%	79%	93%	64%	86%	79%	81%
15	55%	72%	71%	83%	55%	84%	94%	71%	90%	84%	85%
20	61%	77%	76%	89%	61%	87%	95%	76%	93%	88%	89%
25	65%	80%	80%	92%	65%	89%	96%	78%	96%	90%	92%
30	69%	83%	83%	94%	69%	92%	96%	82%	97%	92%	94%
35	72%	85%	84%	95%	72%	93%	95%	83%	97%	93%	94%
40	76%	86%	86%	95%	76%	94%	94%	87%	97%	94%	94%
45	78%	88%	88%	96%	78%	96%	94%	88%	97%	95%	95%
50	80%	91%	91%	99%	80%	98%	99%	89%	99%	96%	98%
55	84%	93%	93%	100%	84%	99%	100%	92%	100%	97%	99%
60	86%	94%	94%	100%	86%	100%	100%	93%	100%	98%	100%
65	88%	95%	95%	99%	88%	100%	100%	94%	99%	98%	100%
70	90%	96%	96%	99%	90%	100%	100%	95%	99%	99%	100%
75	92%	97%	96%	99%	92%	100%	99%	96%	98%	99%	100%
80	93%	97%	97%	98%	93%	100%	99%	97%	98%	99%	100%
85	94%	97%	97%	98%	94%	99%	98%	97%	97%	99%	99%
90	95%	98%	98%	97%	95%	99%	98%	97%	96%	99%	99%
95	95%	98%	98%	97%	95%	99%	97%	97%	95%	98%	99%
100	94%	98%	98%	96%	96%	98%	96%	97%	94%	98%	98%
125	91%	100%	100%	95%	100%	99%	98%	100%	91%	100%	98%
150	87%	99%	100%	92%	100%	96%	96%	100%	87%	99%	97%
175	82%	96%	96%	88%	100%	92%	93%	97%	82%	97%	95%
200	77%	93%	94%	83%	100%	87%	91%	93%	77%	94%	92%
250	69%	84%	87%	73%	95%	78%	85%	84%	69%	85%	84%
300	62%	74%	81%	64%	89%	70%	77%	76%	62%	79%	75%
350	57%	69%	76%	59%	82%	66%	75%	68%	57%	73%	69%
400	49%	63%	70%	52%	74%	62%	71%	60%	49%	67%	64%
500	39%	53%	57%	42%	59%	46%	62%	45%	39%	54%	55%

Pecos - QT 0.75 -Total

Q	Min All	E. gra.	C. pro.	D. arg.	N. bra.	N. ama.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	0%	45%	40%	59%	0%	49%	73%	46%	60%	61%	64%
5	8%	57%	54%	78%	8%	63%	89%	63%	84%	79%	79%
10	19%	66%	63%	83%	19%	70%	90%	70%	96%	89%	91%
15	31%	70%	67%	91%	31%	79%	90%	82%	99%	92%	100%
20	40%	77%	73%	97%	40%	88%	97%	91%	90%	91%	99%
25	49%	75%	75%	98%	49%	91%	100%	92%	97%	96%	99%
30	56%	80%	79%	94%	56%	92%	96%	92%	100%	100%	93%
35	60%	81%	80%	100%	60%	97%	98%	97%	99%	98%	97%
40	65%	86%	85%	97%	65%	98%	98%	96%	96%	96%	93%
45	70%	87%	85%	100%	70%	98%	93%	95%	92%	93%	95%
50	71%	87%	86%	98%	71%	100%	92%	99%	92%	91%	92%
55	73%	94%	92%	98%	73%	99%	92%	98%	94%	92%	90%
60	79%	93%	91%	100%	79%	96%	84%	97%	94%	91%	91%
65	82%	91%	90%	96%	82%	97%	83%	100%	90%	90%	90%
70	83%	99%	97%	92%	85%	95%	83%	99%	89%	88%	88%
75	76%	96%	96%	88%	86%	93%	76%	98%	92%	89%	85%
80	75%	95%	96%	86%	92%	90%	75%	94%	92%	90%	87%
85	73%	95%	96%	84%	91%	86%	73%	91%	90%	88%	88%
90	73%	100%	100%	82%	92%	83%	73%	95%	87%	86%	85%
95	74%	100%	98%	81%	94%	81%	74%	94%	86%	85%	84%
100	73%	98%	96%	81%	95%	79%	73%	92%	87%	84%	82%
125	73%	99%	94%	82%	100%	73%	88%	86%	78%	74%	82%
150	71%	95%	92%	72%	100%	74%	84%	83%	74%	71%	76%
175	63%	93%	90%	63%	100%	66%	79%	75%	64%	68%	72%
200	61%	85%	83%	61%	98%	62%	77%	72%	61%	67%	65%
250	54%	74%	75%	59%	93%	63%	72%	78%	54%	60%	66%
300	44%	61%	64%	51%	85%	56%	64%	68%	44%	52%	56%
350	36%	61%	60%	49%	80%	44%	59%	51%	36%	41%	39%
400	27%	58%	52%	38%	69%	42%	54%	33%	27%	29%	33%
500	13%	47%	40%	24%	50%	30%	41%	13%	20%	18%	21%



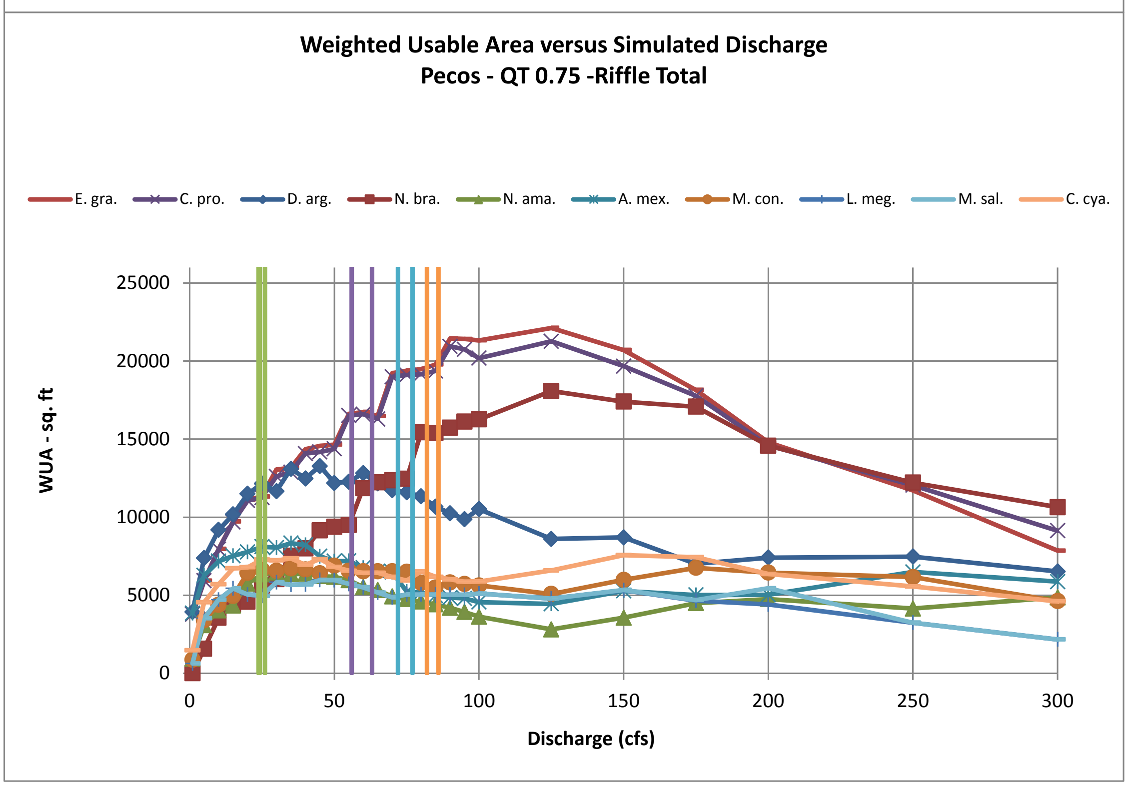


Figure 11-26 Weighted usable area versus simulated discharge at Pecos River (Riffle Total).

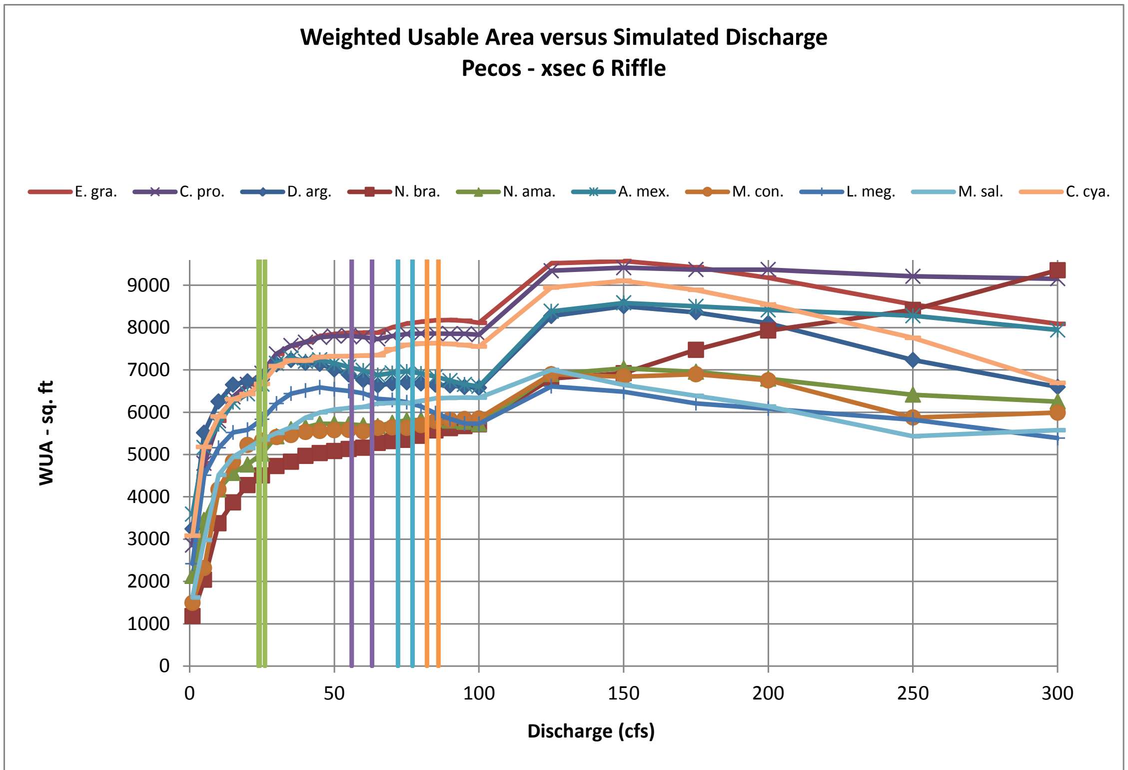
Table 11-26 Percent of maximum WUA versus simulated discharge at Pecos River (Riffle Total).

Pecos -Riffle Total

Q	Min All	E. gra.	C. pro.	D. arg.	N. bra.	N. ama.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	11%	21%	21%	29%	11%	38%	51%	18%	28%	19%	27%
5	21%	36%	37%	52%	21%	58%	68%	27%	55%	35%	49%
10	30%	46%	47%	63%	30%	71%	77%	42%	68%	50%	59%
15	38%	54%	54%	72%	38%	77%	83%	50%	76%	57%	66%
20	44%	62%	62%	82%	44%	80%	85%	57%	83%	61%	75%
25	48%	68%	69%	89%	48%	83%	88%	60%	90%	64%	82%
30	53%	74%	74%	95%	53%	88%	92%	65%	95%	68%	88%
35	55%	76%	77%	98%	55%	90%	93%	67%	98%	69%	90%
40	61%	79%	80%	99%	61%	91%	93%	72%	99%	75%	91%
45	64%	82%	82%	100%	64%	92%	93%	75%	100%	78%	92%
50	66%	83%	84%	100%	66%	92%	92%	76%	100%	79%	92%
55	74%	85%	86%	99%	74%	92%	91%	83%	99%	83%	92%
60	78%	86%	87%	98%	78%	91%	90%	85%	98%	85%	92%
65	80%	87%	88%	97%	80%	90%	88%	86%	97%	86%	93%
70	84%	89%	89%	96%	84%	90%	88%	89%	96%	88%	93%
75	87%	90%	91%	95%	87%	90%	88%	91%	95%	89%	94%
80	87%	91%	91%	94%	90%	89%	87%	92%	94%	90%	94%
85	86%	92%	92%	94%	92%	89%	86%	94%	93%	91%	94%
90	84%	93%	93%	94%	93%	88%	84%	95%	92%	92%	94%
95	83%	94%	93%	93%	94%	87%	83%	95%	90%	92%	93%
100	82%	94%	93%	92%	95%	86%	82%	95%	89%	93%	93%
125	92%	100%	100%	97%	100%	100%	100%	100%	92%	100%	99%
150	83%	97%	97%	96%	97%	98%	100%	98%	83%	97%	100%
175	76%	93%	93%	91%	97%	94%	99%	95%	76%	94%	97%
200	70%	88%	88%	86%	95%	89%	97%	89%	70%	87%	93%
250	59%	75%	81%	72%	90%	81%	95%	75%	59%	69%	78%
300	53%	63%	75%	59%	83%	79%	91%	65%	53%	59%	63%
350	46%	53%	65%	48%	76%	76%	88%	56%	46%	52%	51%
400	34%	46%	58%	40%	66%	73%	83%	47%	34%	45%	44%
500	26%	37%	45%	35%	53%	56%	70%	35%	26%	30%	36%

Pecos - QT 0.75 -Riffle Total

Q	Min All	E. gra.	C. pro.	D. arg.	N. bra.	N. ama.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	0%	17%	18%	30%	0%	15%	46%	13%	11%	11%	20%
5	9%	27%	28%	56%	9%	48%	75%	49%	59%	59%	60%
10	20%	36%	37%	69%	20%	63%	86%	64%	79%	79%	75%
15	24%	44%	46%	77%	24%	67%	90%	72%	91%	91%	89%
20	25%	50%	52%	87%	25%	89%	93%	93%	84%	84%	90%
25	31%	51%	53%	91%	31%	98%	97%	96%	83%	83%	96%
30	33%	59%	59%	88%	33%	100%	97%	95%	97%	97%	95%
35	42%	60%	61%	99%	42%	99%	100%	98%	95%	95%	97%
40	44%	65%	66%	94%	44%	99%	99%	97%	95%	95%	92%
45	51%	66%	67%	100%	51%	96%	90%	93%	100%	100%	97%
50	52%	66%	68%	92%	52%	96%	86%	100%	100%	100%	90%
55	53%	75%	78%	92%	53%	92%	86%	95%	96%	96%	87%
60	66%	76%	78%	97%	66%	86%	81%	95%	92%	92%	85%
65	68%	74%	77%	92%	68%	83%	78%	95%	87%	87%	85%
70	68%	87%	89%	88%	68%	76%	78%	95%	81%	81%	81%
75	63%	88%	90%	87%	69%	74%	63%	94%	84%	84%	78%
80	62%	88%	90%	85%	85%	71%	62%	84%	84%	84%	86%
85	60%	89%	91%	80%	85%	68%	60%	80%	84%	84%	82%
90	58%	97%	98%	77%	87%	65%	58%	84%	84%	84%	79%
95	58%	97%	98%	74%	89%	61%	58%	83%	84%	84%	77%
100	55%	96%	95%	79%	90%	56%	55%	82%	85%	85%	78%
125	44%	100%	100%	65%	100%	44%	53%	74%	80%	80%	87%
150	55%	94%	93%	66%	96%	55%	63%	87%	89%	89%	100%
175	53%	82%	84%	53%	94%	70%	60%	98%	78%	78%	98%
200	56%	67%	69%	56%	81%	74%	60%	94%	74%	91%	84%
250	53%	53%	57%	56%	68%	64%	78%	89%	54%	54%	73%
300	35%	35%	43%	49%	59%	75%	70%	67%	36%	36%	61%
350	0%	37%	47%	46%	68%	59%	71%	66%	0%	0%	29%
400	0%	36%	38%	38%	63%	51%	70%	25%	0%	0%	24%
500	0%	29%	28%	19%	45%	39%	57%	10%	0%	0%	0%



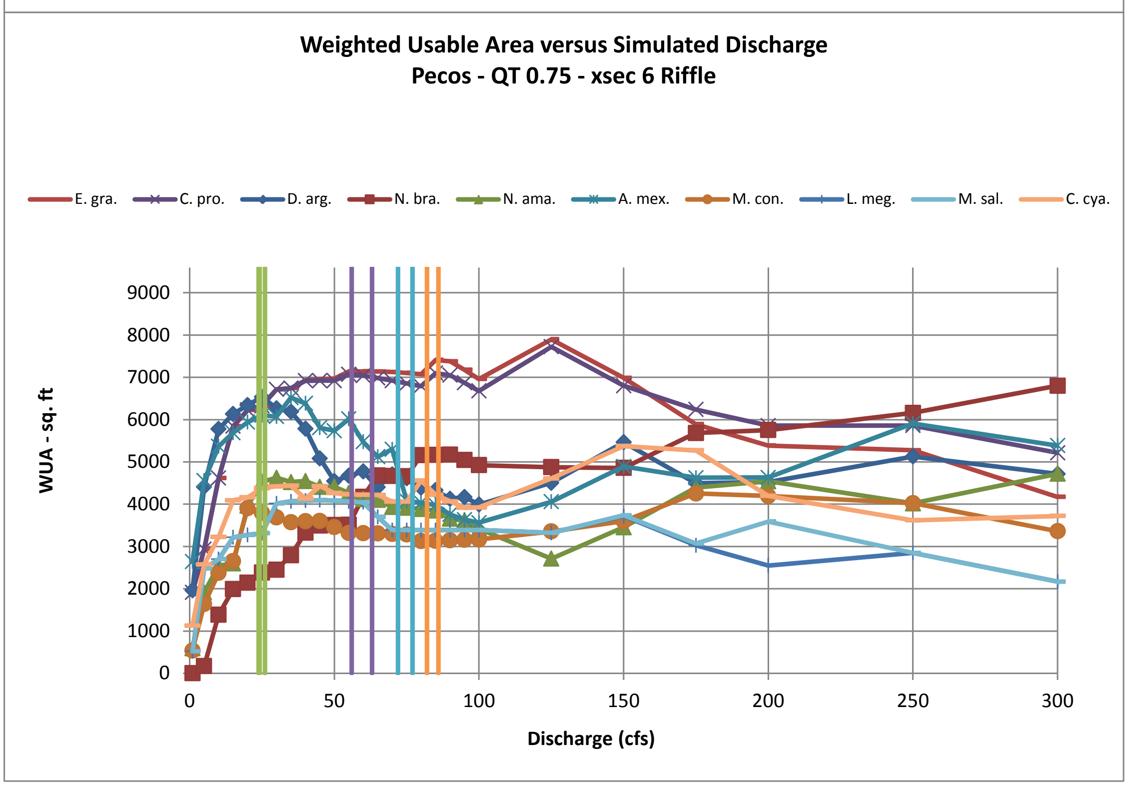


Figure 11-27 Weighted usable area versus simulated discharge at Pecos River (Riffle 1).

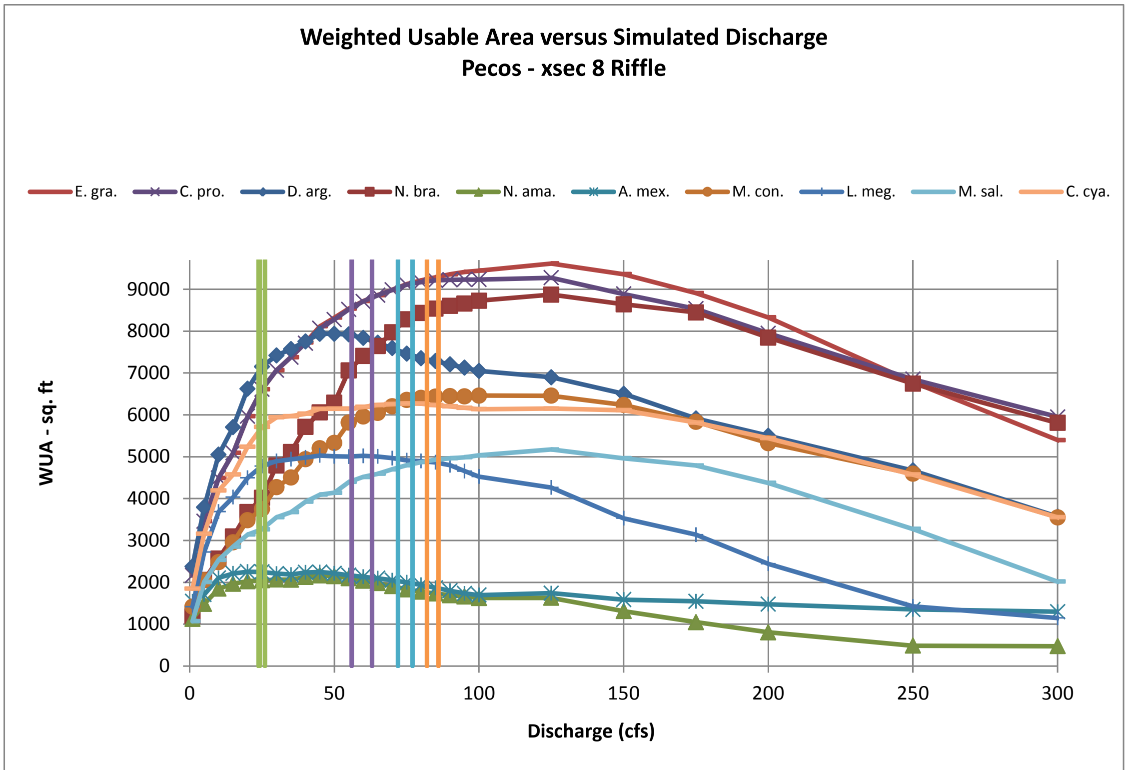
Table 11-27 Percent of maximum WUA versus simulated discharge at Pecos River (Riffle 1).

Pecos - xsec 6 Riffle

Q	Min All	E. gra.	C. pro.	D. arg.	N. bra.	N. ama.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	16%	30%	30%	38%	16%	30%	42%	22%	37%	23%	34%
5	27%	50%	51%	65%	27%	49%	60%	34%	68%	43%	57%
10	45%	61%	62%	74%	45%	59%	67%	60%	78%	65%	65%
15	52%	66%	68%	78%	52%	65%	73%	70%	84%	71%	69%
20	57%	70%	71%	79%	57%	68%	75%	76%	84%	74%	71%
25	60%	72%	73%	80%	60%	71%	78%	77%	88%	76%	73%
30	63%	77%	78%	84%	63%	77%	83%	78%	94%	79%	78%
35	65%	79%	80%	85%	65%	80%	85%	79%	97%	81%	79%
40	66%	80%	81%	84%	66%	80%	84%	80%	99%	84%	79%
45	67%	82%	83%	84%	67%	81%	84%	81%	100%	86%	80%
50	68%	82%	83%	82%	68%	81%	83%	81%	99%	87%	80%
55	69%	82%	83%	81%	69%	81%	82%	81%	98%	87%	80%
60	69%	82%	83%	79%	69%	81%	81%	80%	98%	88%	81%
65	71%	82%	82%	78%	71%	81%	80%	82%	95%	89%	81%
70	71%	84%	83%	79%	71%	82%	81%	82%	95%	89%	82%
75	72%	85%	83%	79%	72%	83%	81%	82%	94%	89%	83%
80	73%	85%	83%	79%	73%	83%	81%	83%	93%	90%	84%
85	75%	85%	83%	78%	75%	83%	80%	84%	90%	90%	84%
90	75%	85%	83%	78%	75%	82%	79%	84%	88%	91%	84%
95	76%	85%	83%	78%	76%	82%	78%	85%	87%	91%	83%
100	76%	85%	83%	77%	76%	81%	77%	85%	87%	91%	83%
125	91%	99%	99%	97%	91%	98%	98%	100%	100%	100%	98%
150	93%	100%	100%	100%	93%	100%	100%	99%	98%	95%	100%
175	91%	98%	100%	98%	100%	99%	99%	100%	94%	91%	98%
200	88%	96%	100%	95%	106%	97%	98%	98%	92%	88%	94%
250	78%	89%	98%	85%	113%	91%	96%	85%	88%	78%	85%
300	73%	84%	97%	78%	125%	89%	93%	87%	81%	80%	73%
350	67%	79%	94%	72%	127%	85%	90%	84%	70%	76%	67%
400	55%	74%	89%	65%	123%	83%	86%	78%	55%	68%	63%
500	44%	69%	78%	58%	117%	64%	75%	66%	44%	51%	53%

Pecos - QT 0.75 - xsec 6 Riffle

Q	Min All	E. gra.	C. pro.	D. arg.	N. bra.	N. ama.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	0%	24%	25%	30%	0%	13%	40%	13%	13%	13%	21%
5	3%	37%	38%	67%	3%	41%	70%	38%	61%	61%	48%
10	24%	58%	60%	88%	24%	55%	82%	56%	66%	66%	60%
15	35%	74%	76%	94%	35%	56%	87%	62%	79%	79%	76%
20	38%	79%	81%	97%	38%	86%	91%	92%	80%	80%	77%
25	42%	80%	82%	100%	42%	98%	94%	89%	81%	81%	81%
30	43%	85%	87%	96%	43%	100%	93%	87%	98%	98%	82%
35	49%	85%	87%	95%	49%	98%	100%	84%	99%	99%	83%
40	59%	88%	90%	88%	59%	98%	98%	85%	100%	100%	77%
45	61%	88%	90%	78%	61%	95%	89%	85%	100%	100%	82%
50	62%	88%	90%	70%	62%	95%	88%	81%	100%	100%	79%
55	62%	90%	92%	71%	62%	92%	92%	78%	99%	99%	79%
60	73%	90%	91%	73%	73%	89%	84%	78%	99%	99%	79%
65	67%	90%	90%	67%	82%	89%	79%	78%	90%	90%	78%
70	72%	90%	90%	72%	82%	85%	81%	78%	83%	83%	76%
75	63%	90%	89%	71%	82%	85%	63%	77%	83%	83%	76%
80	62%	90%	88%	67%	91%	84%	62%	74%	83%	83%	85%
85	61%	94%	92%	66%	91%	83%	61%	74%	83%	83%	79%
90	58%	93%	91%	63%	91%	79%	58%	74%	83%	83%	76%
95	56%	91%	89%	64%	89%	78%	56%	74%	83%	83%	73%
100	55%	88%	86%	61%	87%	74%	55%	74%	83%	83%	73%
125	59%	100%	100%	69%	86%	59%	62%	79%	81%	81%	86%
150	75%	88%	88%	84%	85%	75%	75%	85%	91%	91%	100%
175	69%	75%	81%	69%	100%	95%	71%	100%	74%	75%	98%
200	62%	68%	76%	69%	101%	98%	71%	99%	62%	88%	78%
250	67%	67%	76%	78%	108%	87%	91%	95%	70%	70%	67%
300	53%	53%	68%	72%	120%	102%	83%	79%	53%	53%	69%
350	0%	70%	85%	71%	155%	79%	84%	77%	0%	0%	40%
400	0%	71%	72%	67%	147%	68%	83%	33%	0%	0%	32%
500	0%	69%	64%	37%	127%	51%	68%	17%	0%	0%	0%



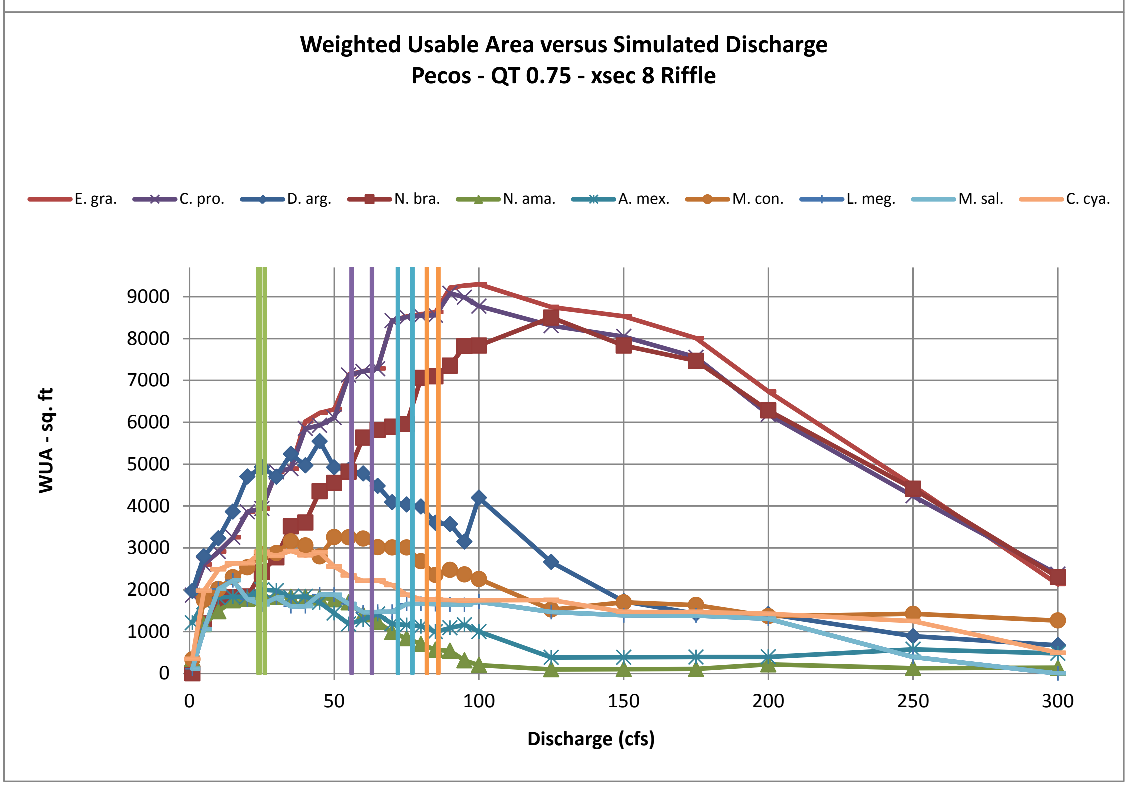


Figure 11-28 Weighted usable area versus simulated discharge at Pecos River (Riffle 2).

Table 11-28 Percent of maximum WUA versus simulated discharge at Pecos River (Riffle 2).

Pecos - xsec 8 Riffle

Q	Min All	E. gra.	C. pro.	D. arg.	N. bra.	N. ama.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	13%	22%	23%	30%	13%	52%	69%	22%	28%	21%	29%
5	23%	36%	37%	48%	23%	69%	76%	32%	54%	39%	50%
10	29%	47%	48%	64%	29%	85%	93%	38%	73%	49%	67%
15	35%	53%	55%	72%	35%	91%	98%	46%	80%	55%	73%
20	41%	62%	64%	83%	41%	94%	100%	54%	89%	61%	84%
25	45%	69%	71%	90%	45%	95%	100%	58%	95%	63%	91%
30	54%	73%	76%	93%	54%	95%	98%	66%	97%	69%	95%
35	58%	77%	80%	95%	58%	95%	97%	70%	98%	71%	95%
40	64%	80%	83%	98%	64%	98%	99%	76%	99%	76%	96%
45	68%	84%	87%	100%	68%	100%	100%	81%	100%	79%	98%
50	71%	87%	89%	100%	71%	99%	98%	82%	100%	80%	98%
55	80%	89%	92%	100%	80%	97%	96%	90%	100%	85%	98%
60	83%	91%	94%	99%	83%	94%	95%	92%	100%	87%	99%
65	86%	92%	95%	97%	86%	92%	93%	94%	100%	89%	99%
70	88%	93%	97%	96%	90%	88%	91%	96%	99%	91%	100%
75	85%	95%	98%	94%	93%	85%	89%	98%	98%	93%	100%
80	82%	96%	99%	93%	95%	82%	86%	99%	97%	94%	100%
85	80%	97%	99%	92%	96%	80%	83%	100%	97%	95%	99%
90	78%	97%	99%	91%	97%	78%	80%	100%	95%	96%	99%
95	77%	98%	100%	90%	98%	77%	77%	100%	93%	96%	98%
100	75%	98%	100%	89%	98%	75%	75%	100%	90%	97%	98%
125	75%	100%	100%	87%	100%	75%	77%	100%	85%	100%	98%
150	61%	97%	96%	82%	97%	61%	70%	97%	70%	96%	97%
175	48%	93%	92%	75%	95%	48%	69%	90%	62%	93%	93%
200	37%	87%	86%	69%	88%	37%	66%	82%	49%	85%	87%
250	22%	71%	74%	59%	76%	22%	60%	71%	28%	63%	73%
300	22%	56%	64%	45%	65%	22%	58%	55%	23%	39%	57%
350	19%	43%	56%	29%	53%	21%	55%	38%	19%	26%	37%
400	9%	30%	45%	17%	37%	17%	44%	23%	9%	18%	22%
500	3%	11%	22%	7%	15%	12%	30%	10%	3%	7%	9%

Pecos - QT 0.75 - xsec 8 Riffle

Q	Min All	E. gra.	C. pro.	D. arg.	N. bra.	N. ama.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	0%	20%	21%	36%	0%	19%	61%	10%	5%	5%	12%
5	14%	28%	29%	50%	14%	64%	85%	54%	47%	47%	68%
10	21%	31%	32%	58%	21%	81%	91%	62%	91%	91%	85%
15	21%	35%	36%	70%	21%	95%	92%	70%	100%	100%	90%
20	22%	42%	43%	85%	22%	97%	92%	78%	80%	80%	90%
25	29%	42%	43%	89%	29%	99%	100%	87%	74%	74%	99%
30	33%	52%	53%	85%	33%	100%	99%	88%	81%	81%	96%
35	41%	53%	54%	95%	41%	100%	91%	97%	72%	72%	100%
40	42%	65%	64%	90%	42%	100%	92%	94%	72%	72%	96%
45	51%	67%	65%	100%	51%	99%	85%	86%	85%	85%	99%
50	54%	68%	67%	89%	54%	97%	72%	100%	85%	85%	87%
55	57%	77%	78%	88%	57%	93%	59%	100%	75%	75%	80%
60	64%	78%	79%	86%	66%	77%	64%	99%	66%	66%	76%
65	66%	78%	80%	81%	68%	67%	71%	92%	66%	66%	76%
70	54%	91%	93%	74%	69%	54%	59%	92%	66%	66%	72%
75	46%	92%	94%	73%	70%	46%	58%	92%	75%	75%	64%
80	38%	92%	94%	72%	83%	38%	56%	82%	75%	75%	61%
85	31%	93%	94%	65%	83%	31%	50%	72%	74%	74%	60%
90	30%	99%	100%	64%	86%	30%	54%	76%	74%	74%	60%
95	17%	100%	99%	57%	92%	17%	58%	73%	74%	74%	60%
100	11%	100%	97%	76%	92%	11%	50%	69%	77%	77%	60%
125	5%	94%	91%	48%	100%	5%	19%	47%	66%	66%	60%
150	6%	92%	89%	31%	92%	6%	19%	52%	62%	62%	50%
175	6%	86%	83%	26%	88%	6%	20%	50%	62%	62%	50%
200	12%	72%	68%	26%	74%	12%	20%	42%	59%	59%	49%
250	7%	48%	47%	16%	52%	7%	29%	44%	18%	18%	43%
300	0%	23%	26%	12%	27%	8%	24%	39%	0%	0%	17%
350	0%	11%	20%	11%	23%	8%	23%	38%	0%	0%	0%
400	0%	9%	9%	7%	19%	8%	21%	11%	0%	0%	4%
500	0%	6%	6%	3%	7%	9%	17%	0%	0%	0%	0%

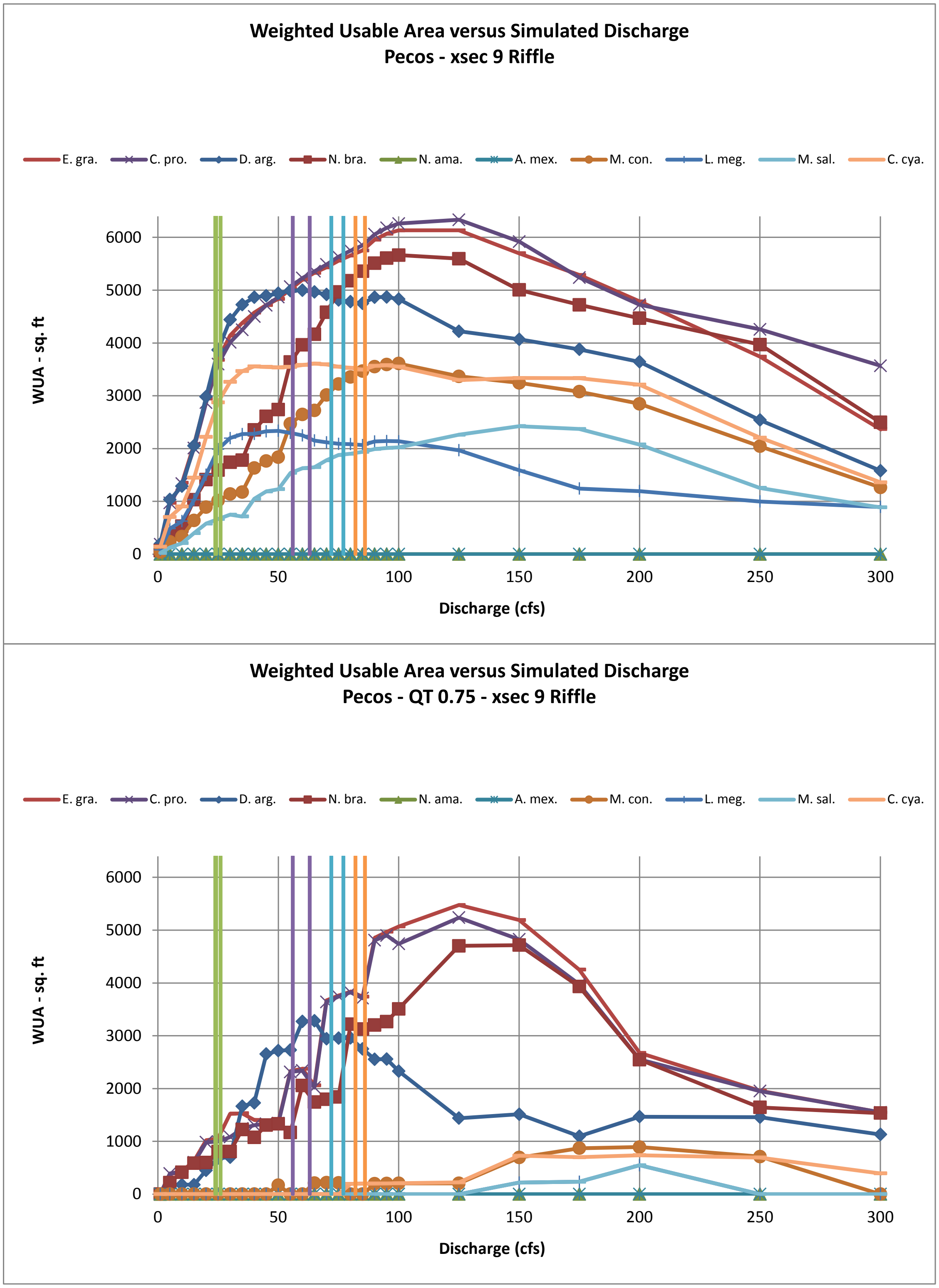


Figure 11-29 Weighted usable area versus simulated discharge at Pecos River (Riffle 3).

Table 11-29 Percent of maximum WUA versus simulated discharge at Pecos River (Riffle 3).

Pecos - xsec 9 Riffle

Q	Min All	E. gra.	C. pro.	D. arg.	N. bra.	N. ama.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	#DIV/0!	3%	3%	4%	1%	#DIV/0!	#DIV/0!	1%	4%	1%	4%
5	#DIV/0!	16%	15%	21%	7%	#DIV/0!	#DIV/0!	6%	21%	5%	19%
10	#DIV/0!	22%	21%	26%	9%	#DIV/0!	#DIV/0!	9%	27%	9%	25%
15	#DIV/0!	34%	32%	41%	18%	#DIV/0!	#DIV/0!	18%	44%	16%	40%
20	#DIV/0!	48%	45%	60%	25%	#DIV/0!	#DIV/0!	25%	64%	24%	62%
25	#DIV/0!	60%	57%	77%	28%	#DIV/0!	#DIV/0!	28%	85%	27%	80%
30	#DIV/0!	68%	63%	89%	31%	#DIV/0!	#DIV/0!	32%	94%	31%	90%
35	#DIV/0!	71%	67%	95%	31%	#DIV/0!	#DIV/0!	33%	97%	29%	96%
40	#DIV/0!	75%	71%	97%	42%	#DIV/0!	#DIV/0!	45%	98%	43%	99%
45	#DIV/0!	77%	74%	98%	46%	#DIV/0!	#DIV/0!	49%	100%	49%	98%
50	#DIV/0!	79%	77%	99%	48%	#DIV/0!	#DIV/0!	51%	100%	51%	98%
55	#DIV/0!	82%	80%	100%	64%	#DIV/0!	#DIV/0!	68%	98%	64%	98%
60	#DIV/0!	85%	83%	100%	70%	#DIV/0!	#DIV/0!	73%	96%	67%	99%
65	#DIV/0!	87%	85%	99%	74%	#DIV/0!	#DIV/0!	75%	92%	68%	100%
70	#DIV/0!	89%	87%	98%	81%	#DIV/0!	#DIV/0!	83%	91%	73%	100%
75	#DIV/0!	91%	89%	96%	88%	#DIV/0!	#DIV/0!	89%	89%	77%	98%
80	#DIV/0!	92%	91%	96%	91%	#DIV/0!	#DIV/0!	93%	89%	78%	98%
85	#DIV/0!	94%	92%	95%	95%	#DIV/0!	#DIV/0!	96%	88%	80%	97%
90	#DIV/0!	97%	96%	97%	97%	#DIV/0!	#DIV/0!	98%	91%	82%	99%
95	#DIV/0!	99%	98%	97%	99%	#DIV/0!	#DIV/0!	99%	92%	83%	99%
100	#DIV/0!	100%	99%	97%	100%	#DIV/0!	#DIV/0!	100%	92%	84%	98%
125	#DIV/0!	100%	100%	85%	99%	#DIV/0!	#DIV/0!	93%	84%	93%	91%
150	#DIV/0!	93%	93%	81%	88%	#DIV/0!	#DIV/0!	90%	68%	100%	92%
175	#DIV/0!	86%	83%	78%	83%	#DIV/0!	#DIV/0!	85%	53%	98%	92%
200	#DIV/0!	78%	75%	73%	79%	#DIV/0!	#DIV/0!	79%	51%	86%	89%
250	#DIV/0!	61%	67%	51%	70%	#DIV/0!	#DIV/0!	57%	43%	52%	61%
300	#DIV/0!	39%	56%	32%	44%	#DIV/0!	#DIV/0!	35%	38%	37%	38%
350	#DIV/0!	30%	36%	25%	32%	#DIV/0!	#DIV/0!	29%	34%	35%	27%
400	#DIV/0!	27%	29%	22%	27%	#DIV/0!	#DIV/0!	29%	26%	34%	28%
500	#DIV/0!	29%	28%	30%	20%	#DIV/0!	#DIV/0!	18%	26%	18%	35%

Pecos - QT 0.75 - xsec 9 Riffle

Q	Min All	E. gra.	C. pro.	D. arg.	N. bra.	N. ama.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	#DIV/0!	0%	0%	0%	0%	#DIV/0!	#DIV/0!	0%	0%	0%	0%
5	#DIV/0!	7%	7%	5%	5%	#DIV/0!	#DIV/0!	0%	0%	0%	0%
10	#DIV/0!	8%	8%	5%	9%	#DIV/0!	#DIV/0!	0%	0%	0%	0%
15	#DIV/0!	12%	11%	5%	12%	#DIV/0!	#DIV/0!	0%	0%	0%	0%
20	#DIV/0!	19%	19%	14%	13%	#DIV/0!	#DIV/0!	0%	0%	0%	0%
25	#DIV/0!	19%	19%	21%	17%	#DIV/0!	#DIV/0!	0%	0%	0%	0%
30	#DIV/0!	28%	21%	21%	17%	#DIV/0!	#DIV/0!	0%	0%	0%	0%
35	#DIV/0!	28%	24%	51%	26%	#DIV/0!	#DIV/0!	0%	0%	0%	0%
40	#DIV/0!	26%	25%	53%	23%	#DIV/0!	#DIV/0!	0%	0%	0%	0%
45	#DIV/0!	25%	25%	81%	28%	#DIV/0!	#DIV/0!	0%	0%	0%	0%
50	#DIV/0!	25%	26%	83%	28%	#DIV/0!	#DIV/0!	20%	0%	0%	0%
55	#DIV/0!	43%	44%	83%	25%	#DIV/0!	#DIV/0!	0%	0%	0%	0%
60	#DIV/0!	43%	45%	100%	44%	#DIV/0!	#DIV/0!	0%	0%	0%	0%
65	#DIV/0!	38%	39%	100%	37%	#DIV/0!	#DIV/0!	24%	0%	0%	0%
70	#DIV/0!	67%	70%	90%	38%	#DIV/0!	#DIV/0!	25%	0%	0%	0%
75	#DIV/0!	69%	71%	90%	39%	#DIV/0!	#DIV/0!	25%	0%	0%	0%
80	#DIV/0!	70%	73%	90%	68%	#DIV/0!	#DIV/0!	0%	0%	0%	27%
85	#DIV/0!	68%	71%	84%	66%	#DIV/0!	#DIV/0!	0%	0%	0%	27%
90	#DIV/0!	89%	92%	78%	68%	#DIV/0!	#DIV/0!	23%	0%	0%	28%
95	#DIV/0!	91%	94%	78%	69%	#DIV/0!	#DIV/0!	23%	0%	0%	28%
100	#DIV/0!	93%	90%	71%	74%	#DIV/0!	#DIV/0!	24%	0%	0%	28%
125	#DIV/0!	100%	100%	44%	100%	#DIV/0!	#DIV/0!	24%	0%	0%	31%
150	#DIV/0!	95%	92%	46%	100%	#DIV/0!	#DIV/0!	80%	93%	93%	100%
175	#DIV/0!	78%	76%	33%	83%	#DIV/0!	#DIV/0!	100%	100%	100%	96%
200	#DIV/0!	49%	49%	45%	54%	#DIV/0!	#DIV/0!	103%	233%	233%	101%
250	#DIV/0!	36%	37%	44%	35%	#DIV/0!	#DIV/0!	82%	0%	0%	95%
300	#DIV/0!	28%	30%	34%	33%	#DIV/0!	#DIV/0!	0%	0%	0%	54%
350	#DIV/0!	29%	30%	27%	33%	#DIV/0!	#DIV/0!	0%	0%	0%	0%
400	#DIV/0!	29%	29%	8%	33%	#DIV/0!	#DIV/0!	0%	0%	0%	0%
500	#DIV/0!	8%	8%	0%	9%	#DIV/0!	#DIV/0!	0%	0%	0%	0%

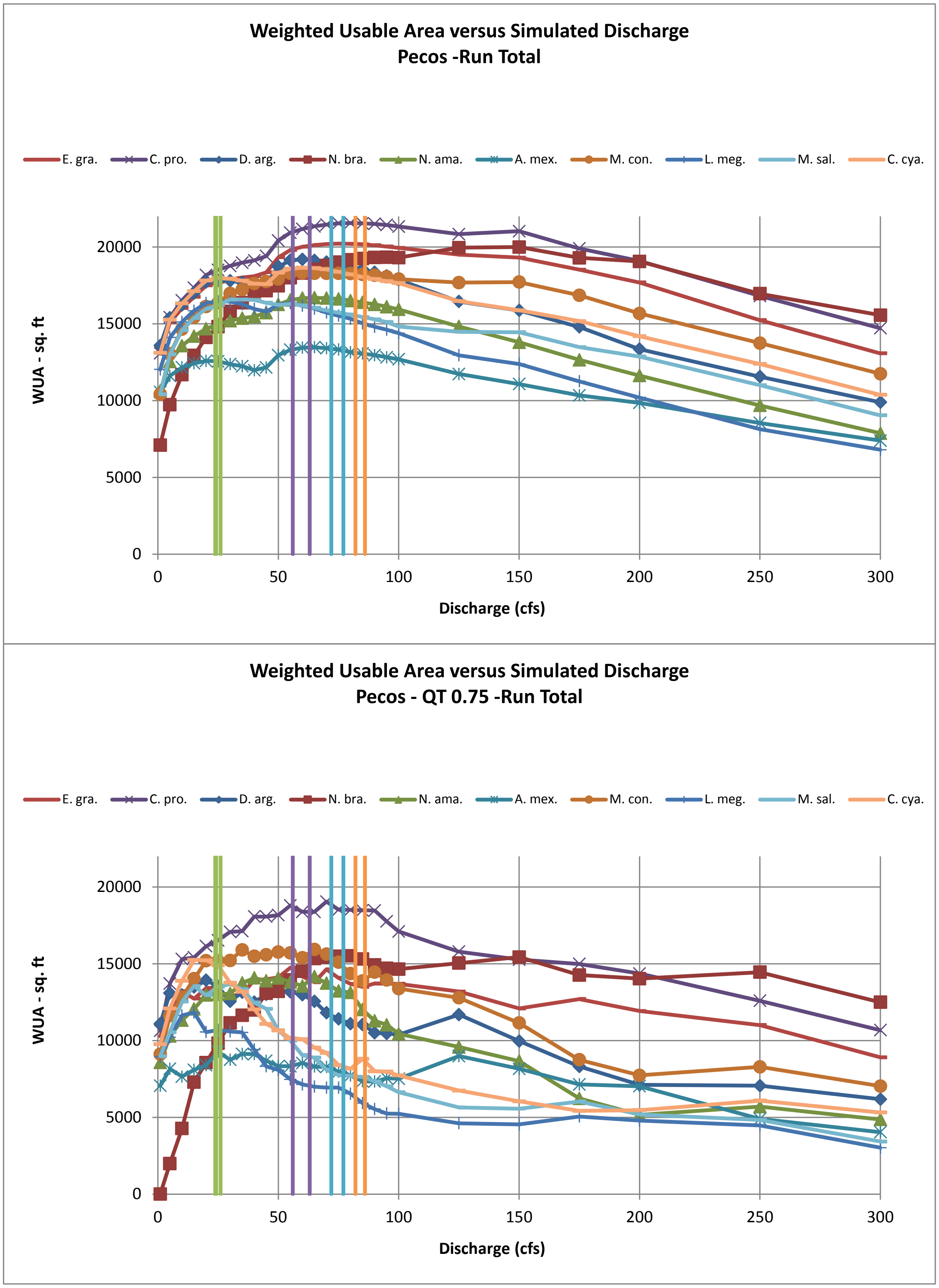


Figure 11-30 Weighted usable area versus simulated discharge at Pecos River (Run Total).

Table 11-30 Percent of maximum WUA versus simulated discharge at Pecos River (Run Total).

Pecos -Run Total

Q	Min All	E. gra.	C. pro.	D. arg.	N. bra.	N. ama.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	36%	65%	61%	71%	36%	64%	78%	57%	73%	63%	70%
5	49%	75%	71%	80%	49%	75%	86%	71%	86%	78%	82%
10	58%	79%	77%	84%	58%	81%	90%	80%	92%	88%	88%
15	65%	83%	80%	89%	65%	85%	92%	84%	96%	93%	92%
20	71%	87%	84%	92%	71%	88%	93%	88%	99%	96%	96%
25	74%	88%	86%	93%	74%	90%	93%	89%	100%	98%	96%
30	79%	89%	87%	93%	79%	91%	92%	93%	100%	100%	96%
35	82%	89%	88%	92%	82%	92%	91%	94%	99%	100%	95%
40	84%	90%	89%	91%	84%	93%	89%	96%	97%	100%	94%
45	86%	91%	90%	92%	86%	94%	90%	97%	96%	99%	94%
50	87%	96%	95%	98%	87%	97%	96%	98%	99%	98%	98%
55	90%	98%	97%	100%	90%	99%	99%	100%	99%	98%	100%
60	92%	99%	98%	100%	92%	100%	100%	100%	98%	98%	100%
65	93%	100%	99%	100%	93%	100%	100%	100%	97%	97%	100%
70	94%	100%	100%	99%	94%	100%	100%	100%	96%	96%	99%
75	94%	100%	100%	98%	95%	100%	99%	100%	94%	95%	99%
80	93%	100%	100%	98%	96%	99%	98%	100%	93%	94%	98%
85	91%	100%	100%	97%	96%	98%	97%	99%	91%	93%	97%
90	90%	99%	100%	96%	97%	97%	96%	99%	90%	92%	96%
95	89%	99%	99%	94%	97%	96%	95%	99%	89%	91%	95%
100	87%	99%	99%	93%	97%	95%	94%	98%	87%	89%	95%
125	79%	96%	97%	86%	100%	89%	87%	97%	79%	87%	88%
150	75%	95%	98%	83%	100%	83%	82%	97%	75%	87%	85%
175	68%	92%	92%	77%	97%	76%	77%	92%	68%	81%	81%
200	62%	87%	89%	70%	95%	70%	73%	86%	62%	78%	76%
250	49%	75%	78%	60%	85%	58%	63%	75%	49%	66%	66%
300	41%	65%	68%	52%	78%	47%	55%	64%	41%	55%	56%
350	40%	63%	67%	53%	70%	43%	55%	56%	40%	46%	53%
400	33%	57%	60%	47%	62%	37%	52%	48%	33%	38%	46%
500	20%	44%	47%	33%	46%	24%	40%	30%	20%	24%	31%

Pecos - QT 0.75 -Run Total

Q	Min All	E. gra.	C. pro.	D. arg.	N. bra.	N. ama.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	0%	70%	56%	80%	0%	60%	76%	57%	76%	66%	64%
5	13%	81%	72%	94%	13%	73%	88%	73%	86%	77%	79%
10	28%	90%	80%	93%	28%	80%	82%	81%	98%	92%	91%
15	47%	86%	81%	97%	47%	85%	87%	88%	100%	99%	100%
20	55%	91%	85%	100%	55%	92%	90%	95%	89%	95%	100%
25	63%	88%	87%	97%	63%	92%	100%	95%	90%	99%	98%
30	72%	88%	90%	90%	72%	92%	94%	96%	90%	100%	90%
35	75%	88%	90%	94%	75%	97%	98%	100%	89%	98%	86%
40	77%	95%	95%	90%	77%	99%	98%	97%	80%	91%	79%
45	70%	95%	95%	93%	84%	98%	94%	98%	70%	88%	73%
50	68%	96%	95%	95%	85%	99%	90%	99%	68%	78%	70%
55	63%	100%	99%	95%	90%	98%	90%	99%	63%	73%	67%
60	60%	96%	97%	93%	94%	96%	92%	97%	60%	66%	66%
65	59%	94%	96%	90%	99%	100%	90%	100%	59%	65%	63%
70	59%	99%	100%	85%	99%	97%	89%	98%	59%	59%	60%
75	55%	95%	97%	82%	100%	93%	86%	95%	59%	57%	55%
80	54%	93%	97%	80%	100%	93%	83%	90%	55%	56%	54%
85	50%	92%	97%	79%	99%	85%	79%	87%	50%	56%	58%
90	47%	93%	97%	75%	96%	80%	79%	91%	47%	54%	52%
95	44%	93%	93%	75%	95%	78%	81%	88%	44%	51%	52%
100	44%	93%	90%	75%	94%	74%	81%	84%	44%	49%	51%
125	39%	89%	83%	84%	97%	68%	97%	80%	39%	41%	44%
150	38%	82%	80%	72%	99%	61%	88%	70%	38%	41%	40%
175	36%	86%	79%	60%	92%	44%	77%	55%	43%	44%	36%
200	36%	81%	75%	51%	90%	36%	76%	49%	40%	38%	36%
250	35%	75%	66%	51%	93%	40%	53%	52%	38%	35%	40%
300	25%	60%	56%	44%	81%	34%	43%	44%	26%	25%	35%
350	15%	58%	49%	43%	65%	30%	38%	33%	18%	15%	19%
400	8%	52%	42%	31%	58%	29%	32%	22%	10%	8%	14%
500	0%	40%	31%	18%	43%	16%	19%	12%	0%	0%	2%

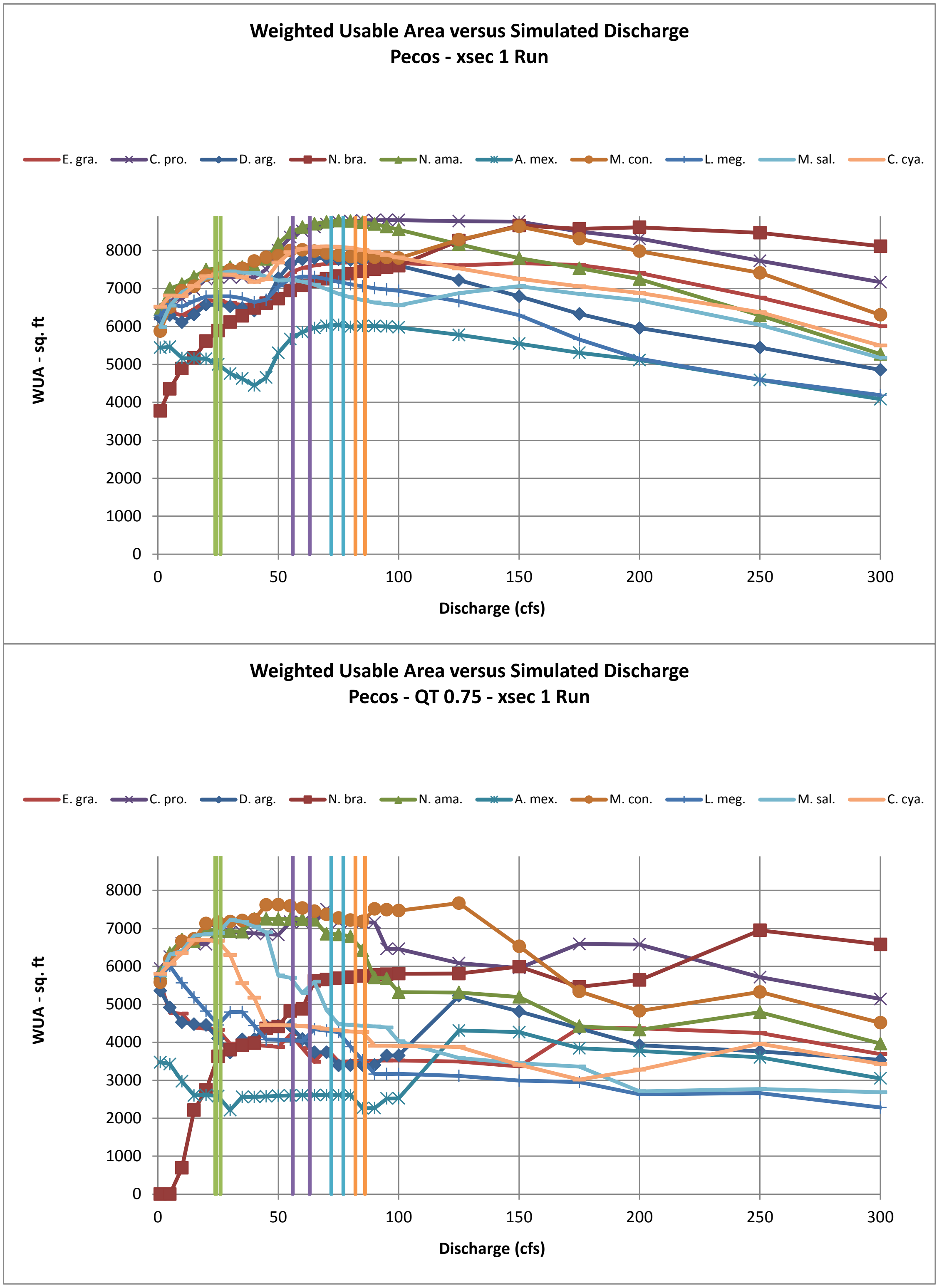


Figure 11-31 Weighted usable area versus simulated discharge at Pecos River (Run1).

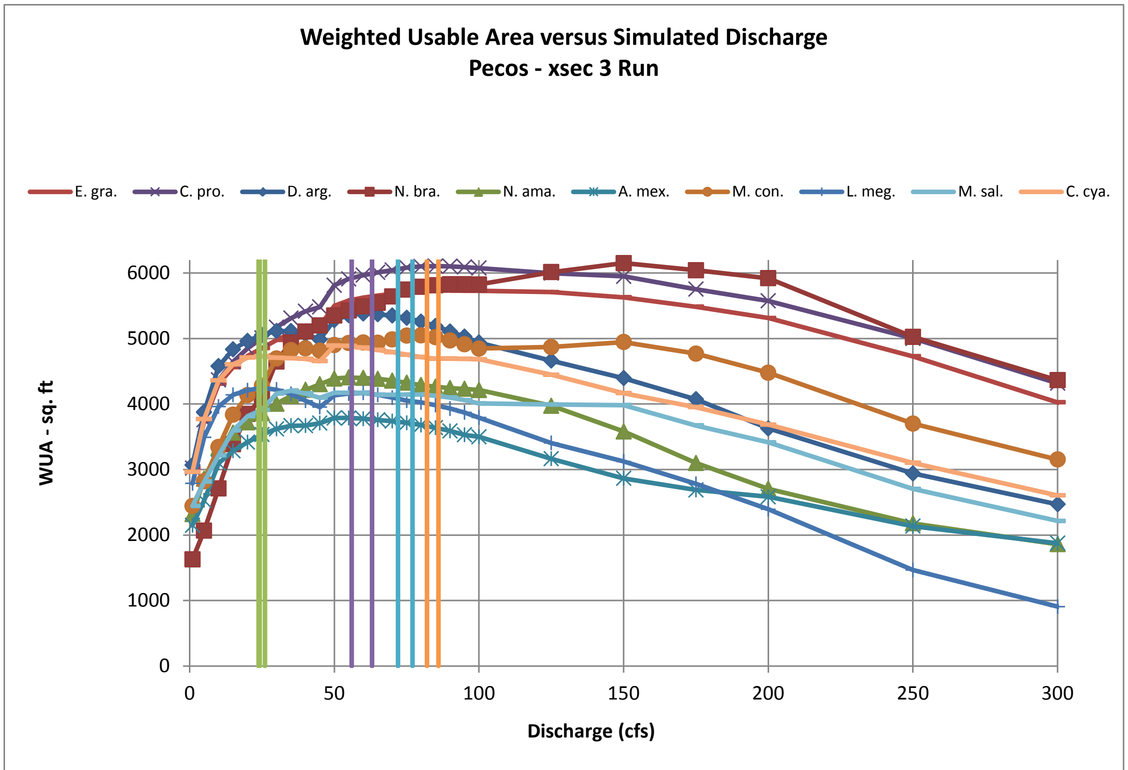
Table 11-31 Percent of maximum WUA versus simulated discharge at Pecos River (Run 1).

Pecos - xsec 1 Run

Q	Min All	E. gra.	C. pro.	D. arg.	N. bra.	N. ama.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	44%	82%	72%	80%	44%	73%	90%	68%	86%	80%	80%
5	50%	83%	76%	81%	50%	80%	90%	75%	90%	88%	84%
10	56%	82%	77%	78%	56%	81%	86%	80%	89%	93%	84%
15	60%	84%	79%	81%	60%	83%	85%	82%	91%	95%	87%
20	65%	87%	82%	84%	65%	85%	85%	85%	93%	98%	90%
25	68%	87%	83%	84%	68%	86%	83%	86%	93%	99%	91%
30	71%	86%	83%	84%	71%	86%	79%	87%	93%	100%	91%
35	73%	85%	83%	83%	73%	86%	77%	87%	92%	100%	90%
40	74%	85%	83%	82%	75%	86%	74%	89%	91%	99%	88%
45	76%	87%	85%	85%	76%	88%	77%	91%	92%	98%	89%
50	78%	93%	91%	93%	78%	93%	88%	91%	96%	97%	95%
55	80%	97%	95%	98%	80%	96%	94%	93%	99%	97%	98%
60	82%	98%	97%	100%	82%	98%	97%	93%	100%	96%	99%
65	83%	99%	98%	100%	83%	99%	99%	92%	100%	95%	100%
70	84%	99%	99%	100%	84%	100%	100%	92%	99%	94%	100%
75	85%	100%	99%	100%	85%	100%	100%	91%	98%	92%	100%
80	85%	100%	100%	99%	85%	100%	99%	91%	97%	91%	100%
85	86%	100%	100%	99%	86%	100%	99%	91%	96%	90%	99%
90	87%	100%	100%	99%	87%	99%	100%	91%	96%	89%	98%
95	87%	100%	100%	98%	87%	98%	99%	90%	95%	88%	97%
100	88%	100%	100%	97%	88%	97%	99%	90%	95%	88%	96%
125	91%	99%	100%	93%	95%	93%	96%	96%	91%	92%	93%
150	86%	100%	99%	87%	100%	89%	92%	100%	86%	95%	89%
175	77%	99%	96%	81%	99%	86%	88%	96%	77%	92%	87%
200	70%	96%	94%	76%	99%	82%	85%	92%	70%	90%	85%
250	63%	88%	88%	70%	98%	72%	76%	86%	63%	81%	79%
300	57%	78%	81%	62%	94%	60%	68%	73%	57%	69%	68%
350	47%	68%	72%	56%	78%	54%	62%	60%	47%	56%	56%
400	38%	59%	62%	47%	66%	49%	57%	50%	38%	46%	47%
500	28%	46%	47%	31%	50%	33%	41%	33%	28%	30%	32%

Pecos - QT 0.75 - xsec 1 Run

Q	Min All	E. gra.	C. pro.	D. arg.	N. bra.	N. ama.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	0%	100%	79%	100%	0%	80%	81%	73%	95%	80%	87%
5	0%	86%	83%	92%	0%	88%	79%	81%	100%	87%	91%
10	12%	85%	88%	84%	12%	92%	69%	87%	92%	89%	95%
15	37%	79%	88%	84%	37%	92%	60%	88%	86%	94%	100%
20	46%	78%	88%	83%	46%	96%	61%	93%	80%	95%	100%
25	60%	78%	92%	76%	61%	96%	60%	93%	74%	95%	100%
30	51%	71%	92%	70%	63%	96%	51%	94%	80%	100%	94%
35	59%	71%	92%	76%	65%	95%	59%	94%	80%	99%	83%
40	59%	71%	92%	76%	66%	100%	59%	94%	74%	98%	77%
45	60%	70%	91%	83%	73%	100%	60%	99%	68%	95%	67%
50	60%	70%	91%	83%	74%	100%	60%	99%	68%	80%	67%
55	60%	75%	96%	83%	80%	100%	60%	99%	67%	79%	66%
60	60%	69%	95%	76%	81%	100%	60%	98%	67%	73%	66%
65	60%	63%	95%	70%	94%	100%	60%	97%	72%	77%	66%
70	61%	69%	100%	70%	94%	95%	61%	96%	72%	67%	65%
75	61%	63%	95%	63%	95%	94%	61%	95%	71%	62%	65%
80	61%	63%	95%	63%	95%	94%	61%	94%	65%	62%	64%
85	52%	63%	95%	63%	96%	88%	52%	94%	59%	61%	64%
90	53%	63%	95%	64%	96%	79%	53%	98%	53%	61%	58%
95	53%	63%	86%	68%	97%	78%	58%	98%	53%	61%	58%
100	53%	63%	86%	68%	97%	73%	59%	97%	53%	56%	58%
125	50%	63%	81%	97%	97%	73%	100%	100%	52%	50%	58%
150	48%	60%	79%	90%	100%	72%	99%	85%	50%	48%	51%
175	45%	79%	88%	82%	91%	61%	89%	70%	49%	47%	45%
200	37%	78%	88%	73%	94%	60%	88%	63%	44%	37%	49%
250	38%	76%	76%	70%	116%	66%	84%	69%	44%	38%	59%
300	37%	66%	69%	66%	110%	55%	71%	59%	38%	37%	51%
350	29%	62%	51%	62%	86%	53%	66%	48%	35%	29%	31%
400	16%	59%	49%	43%	71%	51%	61%	33%	19%	16%	32%
500	0%	47%	40%	26%	59%	32%	41%	24%	0%	0%	5%



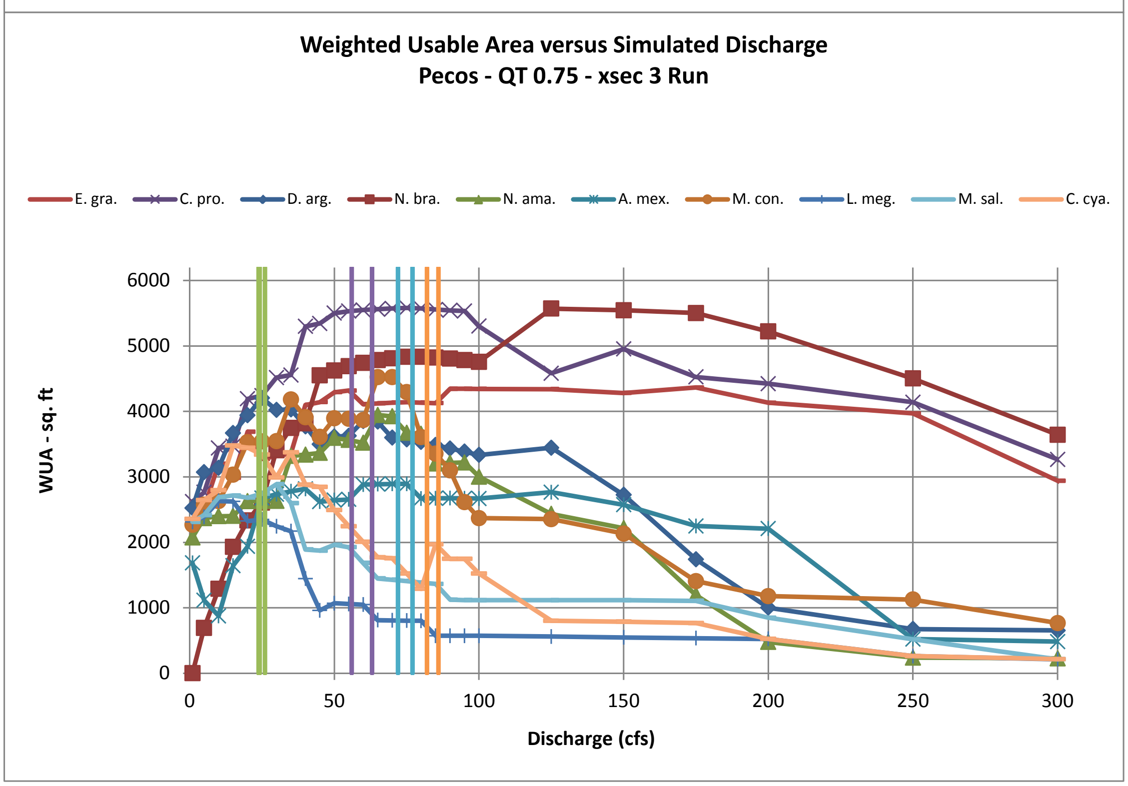


Figure 11-32 Weighted usable area versus simulated discharge at Pecos River (Run 2).

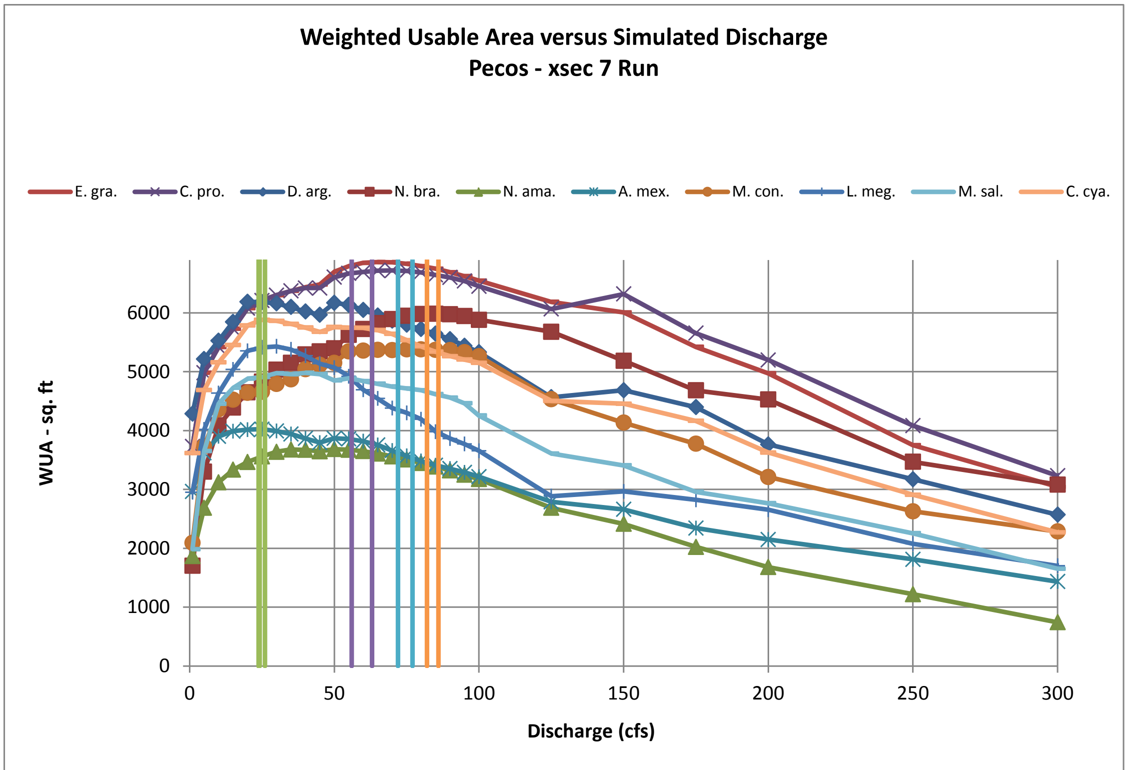
Table 11-32 Percent of maximum WUA versus simulated discharge at Pecos River (Run 2).

Pecos - xsec 3 Run

Q	Min All	E. gra.	C. pro.	D. arg.	N. bra.	N. ama.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	26%	53%	50%	57%	26%	53%	57%	48%	66%	58%	61%
5	34%	65%	62%	72%	34%	65%	67%	56%	82%	67%	77%
10	44%	75%	72%	85%	44%	76%	82%	66%	93%	77%	89%
15	55%	80%	76%	90%	55%	81%	87%	76%	97%	86%	94%
20	63%	83%	79%	92%	63%	84%	90%	82%	99%	91%	96%
25	67%	85%	82%	94%	67%	88%	93%	85%	100%	93%	97%
30	76%	87%	85%	95%	76%	91%	96%	93%	99%	99%	96%
35	80%	89%	87%	95%	80%	94%	97%	96%	98%	100%	96%
40	83%	90%	89%	94%	83%	96%	97%	96%	95%	99%	96%
45	85%	91%	90%	93%	85%	98%	98%	95%	93%	97%	95%
50	87%	96%	95%	98%	87%	100%	100%	97%	97%	99%	100%
55	88%	97%	97%	100%	88%	100%	100%	98%	98%	99%	100%
60	89%	98%	98%	100%	89%	100%	100%	98%	98%	99%	99%
65	90%	99%	98%	100%	90%	100%	99%	98%	97%	99%	99%
70	92%	99%	99%	99%	92%	99%	99%	99%	96%	98%	98%
75	93%	100%	100%	99%	93%	98%	98%	100%	95%	99%	97%
80	94%	100%	100%	98%	94%	97%	97%	100%	95%	99%	96%
85	94%	100%	100%	97%	95%	97%	96%	99%	94%	98%	96%
90	93%	100%	100%	95%	95%	96%	95%	98%	93%	98%	96%
95	91%	100%	100%	93%	95%	96%	93%	97%	91%	97%	96%
100	89%	100%	100%	92%	95%	96%	92%	96%	89%	95%	96%
125	80%	100%	98%	87%	98%	90%	84%	96%	80%	95%	91%
150	74%	98%	97%	82%	100%	81%	76%	98%	74%	95%	85%
175	65%	96%	94%	76%	98%	70%	71%	95%	65%	87%	81%
200	56%	93%	91%	67%	96%	61%	68%	89%	56%	81%	75%
250	35%	82%	82%	55%	82%	49%	56%	73%	35%	64%	63%
300	21%	70%	71%	46%	71%	42%	49%	62%	21%	53%	53%
350	17%	59%	61%	38%	63%	28%	44%	53%	17%	40%	46%
400	11%	50%	53%	29%	54%	16%	38%	40%	11%	27%	36%
500	0%	26%	35%	12%	29%	5%	31%	15%	0%	12%	14%

Pecos - QT 0.75 - xsec 3 Run

Q	Min All	E. gra.	C. pro.	D. arg.	N. bra.	N. ama.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	0%	60%	47%	60%	0%	53%	58%	50%	88%	80%	68%
5	12%	58%	50%	73%	12%	60%	39%	57%	91%	84%	76%
10	23%	73%	62%	75%	23%	61%	30%	58%	100%	93%	80%
15	35%	68%	62%	87%	35%	61%	57%	67%	100%	94%	100%
20	42%	85%	75%	94%	42%	67%	67%	78%	88%	93%	99%
25	47%	75%	76%	100%	47%	67%	92%	78%	89%	95%	96%
30	61%	76%	81%	96%	61%	67%	94%	78%	85%	100%	86%
35	67%	77%	82%	96%	67%	84%	96%	93%	82%	90%	97%
40	55%	94%	95%	90%	68%	85%	97%	86%	55%	65%	83%
45	37%	95%	96%	83%	82%	85%	91%	80%	37%	65%	82%
50	41%	98%	99%	86%	83%	91%	91%	86%	41%	68%	72%
55	40%	99%	99%	86%	84%	90%	92%	86%	40%	67%	65%
60	40%	94%	99%	92%	85%	89%	100%	86%	40%	58%	58%
65	31%	94%	100%	91%	86%	100%	100%	100%	31%	50%	51%
70	31%	95%	100%	86%	86%	99%	100%	100%	31%	49%	50%
75	31%	95%	100%	85%	87%	93%	100%	95%	31%	49%	44%
80	30%	95%	100%	84%	87%	93%	92%	80%	30%	48%	37%
85	22%	95%	100%	83%	87%	81%	92%	74%	22%	47%	57%
90	22%	100%	99%	82%	86%	81%	92%	69%	22%	39%	50%
95	22%	100%	99%	80%	86%	82%	92%	58%	22%	39%	50%
100	22%	100%	95%	79%	85%	76%	92%	52%	22%	39%	44%
125	21%	99%	82%	82%	100%	62%	96%	52%	21%	39%	23%
150	21%	98%	89%	65%	100%	56%	89%	47%	21%	39%	23%
175	20%	100%	81%	41%	99%	30%	78%	31%	20%	38%	22%
200	12%	95%	79%	24%	94%	12%	76%	26%	20%	29%	15%
250	6%	91%	74%	16%	81%	6%	18%	25%	10%	18%	8%
300	6%	67%	59%	16%	65%	6%	17%	17%	8%	7%	6%
350	0%	41%	40%	0%	47%	0%	9%	15%	0%	0%	6%
400	0%	24%	22%	0%	28%	0%	0%	10%	0%	0%	0%
500	0%	15%	7%	0%	11%	0%	0%	0%	0%	0%	0%



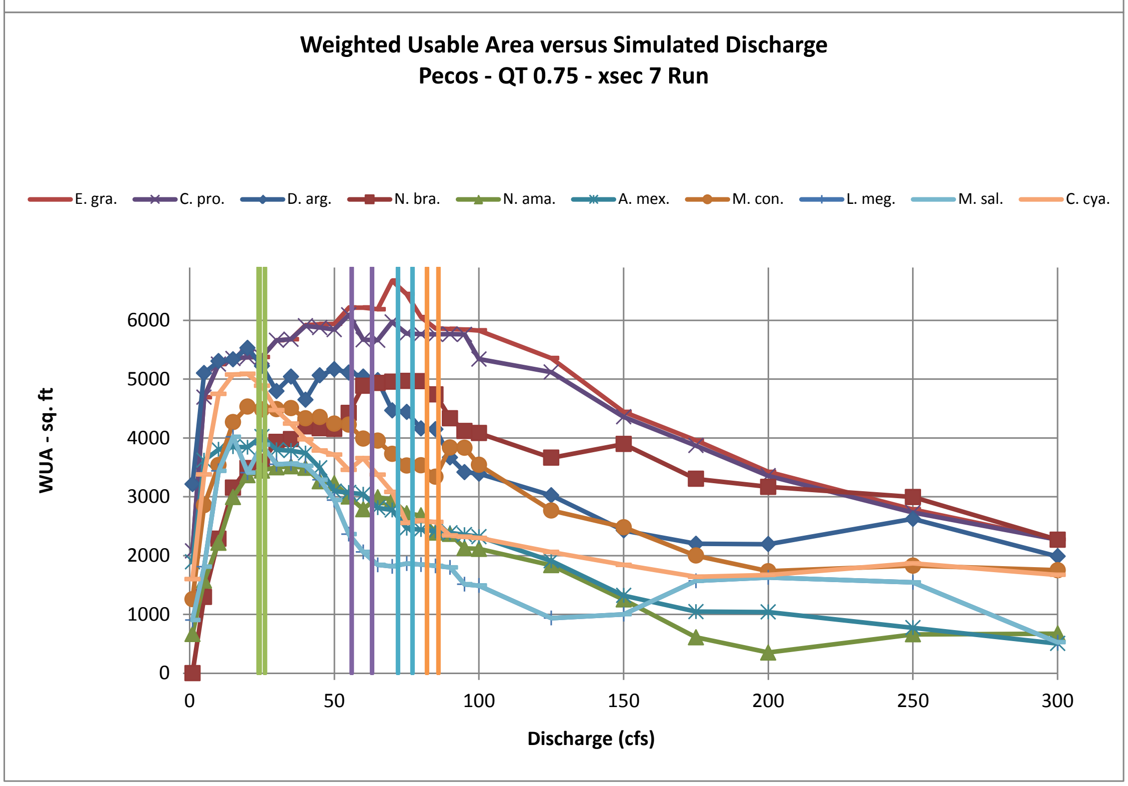


Figure 11-33 Weighted usable area versus simulated discharge at Pecos River (Run 3).

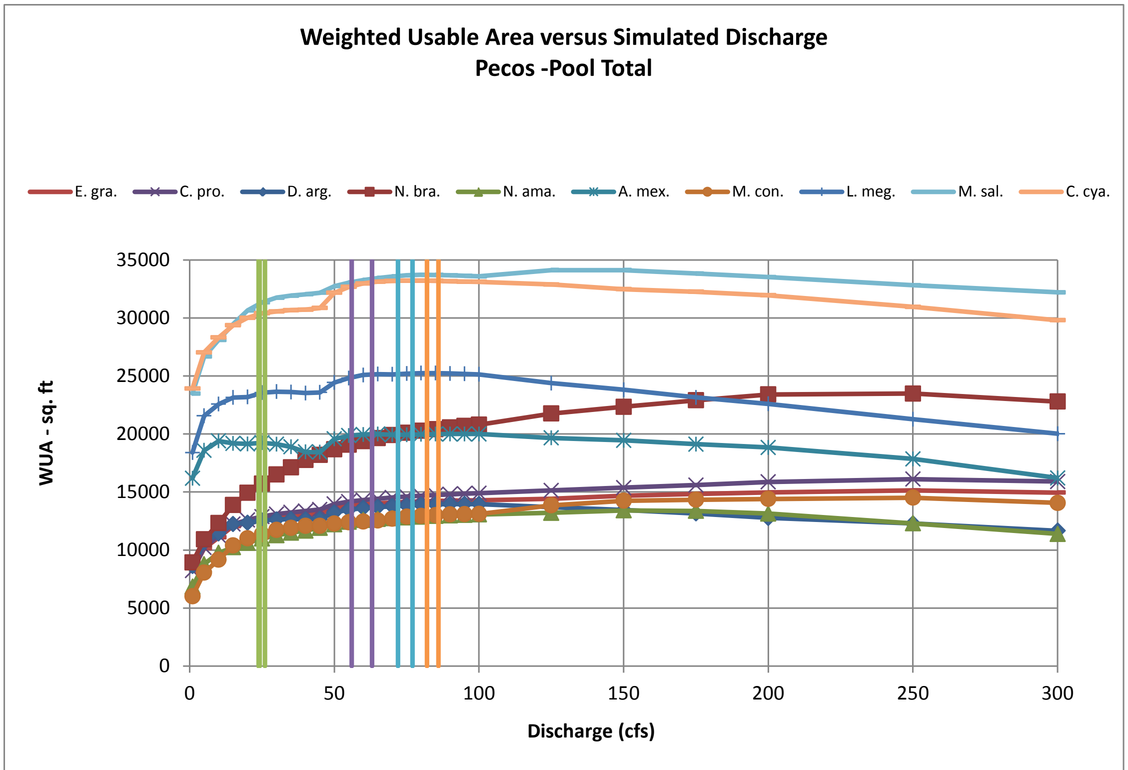
Table 11-33 Percent of maximum WUA versus simulated discharge at Pecos River (Run 3).

Pecos - xsec 7 Run

Q	Min All	E. gra.	C. pro.	D. arg.	N. bra.	N. ama.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	28%	54%	56%	69%	28%	51%	74%	39%	54%	40%	61%
5	55%	73%	74%	84%	55%	73%	90%	69%	74%	73%	80%
10	68%	79%	81%	89%	68%	85%	97%	81%	85%	89%	88%
15	73%	83%	85%	95%	73%	91%	99%	84%	93%	95%	93%
20	78%	89%	90%	100%	78%	94%	100%	86%	99%	98%	98%
25	81%	90%	92%	100%	81%	97%	100%	87%	100%	99%	100%
30	84%	92%	94%	100%	84%	99%	99%	89%	100%	100%	100%
35	86%	93%	95%	99%	86%	100%	98%	91%	99%	100%	99%
40	88%	94%	96%	97%	88%	100%	96%	94%	97%	100%	98%
45	89%	94%	96%	96%	89%	99%	94%	95%	95%	100%	97%
50	90%	98%	98%	100%	90%	100%	96%	96%	93%	97%	98%
55	91%	99%	99%	99%	94%	100%	96%	99%	91%	98%	98%
60	86%	100%	100%	98%	96%	99%	95%	100%	86%	97%	98%
65	84%	100%	100%	96%	97%	98%	93%	100%	84%	96%	97%
70	81%	100%	100%	95%	98%	97%	91%	100%	81%	95%	96%
75	79%	100%	100%	94%	99%	95%	89%	100%	79%	95%	94%
80	77%	99%	100%	93%	100%	94%	87%	100%	77%	94%	92%
85	73%	98%	99%	91%	100%	92%	85%	100%	73%	93%	91%
90	71%	97%	98%	90%	100%	90%	83%	100%	71%	92%	89%
95	69%	96%	97%	88%	99%	88%	82%	99%	69%	90%	88%
100	67%	95%	96%	86%	98%	86%	80%	98%	67%	85%	88%
125	53%	90%	90%	74%	95%	73%	69%	84%	53%	72%	77%
150	55%	88%	94%	76%	87%	66%	66%	77%	55%	68%	76%
175	52%	79%	84%	71%	78%	55%	58%	70%	52%	59%	71%
200	46%	72%	77%	61%	76%	46%	53%	60%	49%	56%	62%
250	33%	55%	61%	51%	58%	33%	45%	49%	38%	45%	49%
300	20%	44%	48%	42%	52%	20%	36%	42%	31%	33%	39%
350	32%	59%	64%	61%	56%	32%	51%	45%	44%	37%	52%
400	34%	61%	63%	62%	55%	34%	52%	46%	42%	35%	50%
500	24%	57%	58%	52%	50%	26%	44%	36%	24%	25%	43%

Pecos - QT 0.75 - xsec 7 Run

Q	Min All	E. gra.	C. pro.	D. arg.	N. bra.	N. ama.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	0%	31%	34%	58%	0%	19%	47%	28%	22%	22%	31%
5	26%	70%	77%	92%	26%	45%	90%	63%	45%	45%	66%
10	46%	79%	86%	96%	46%	63%	95%	78%	86%	86%	93%
15	63%	80%	88%	97%	63%	85%	96%	94%	100%	100%	100%
20	70%	81%	88%	100%	70%	96%	96%	100%	85%	85%	100%
25	72%	81%	88%	94%	72%	98%	100%	99%	97%	97%	96%
30	79%	85%	93%	87%	79%	100%	94%	99%	88%	88%	88%
35	80%	85%	93%	91%	80%	100%	94%	99%	89%	89%	83%
40	78%	89%	97%	84%	84%	99%	93%	96%	88%	88%	78%
45	74%	89%	96%	92%	84%	93%	87%	96%	82%	82%	74%
50	73%	89%	96%	93%	84%	92%	77%	94%	73%	73%	73%
55	59%	93%	100%	92%	89%	85%	76%	93%	59%	59%	68%
60	51%	93%	93%	91%	98%	79%	76%	88%	51%	51%	72%
65	46%	93%	93%	90%	99%	85%	70%	87%	46%	46%	66%
70	45%	100%	98%	81%	100%	84%	69%	82%	45%	45%	61%
75	46%	97%	95%	80%	100%	77%	61%	78%	46%	46%	50%
80	46%	91%	95%	75%	100%	76%	61%	78%	46%	46%	51%
85	45%	88%	95%	75%	95%	68%	60%	74%	45%	45%	51%
90	45%	88%	95%	66%	87%	67%	59%	85%	45%	45%	46%
95	38%	88%	95%	62%	83%	60%	59%	85%	38%	38%	46%
100	37%	87%	88%	61%	82%	60%	58%	78%	37%	37%	45%
125	23%	80%	84%	55%	74%	52%	47%	61%	23%	23%	41%
150	25%	67%	72%	44%	78%	36%	33%	55%	25%	25%	36%
175	17%	59%	64%	40%	66%	17%	26%	44%	39%	39%	32%
200	10%	51%	55%	40%	64%	10%	26%	38%	41%	41%	33%
250	19%	42%	45%	47%	60%	19%	19%	40%	38%	38%	37%
300	13%	34%	37%	36%	46%	19%	13%	39%	13%	13%	33%
350	0%	50%	54%	48%	45%	10%	10%	19%	0%	0%	10%
400	0%	49%	53%	38%	64%	10%	9%	12%	0%	0%	0%
500	0%	39%	41%	19%	50%	0%	0%	0%	0%	0%	0%



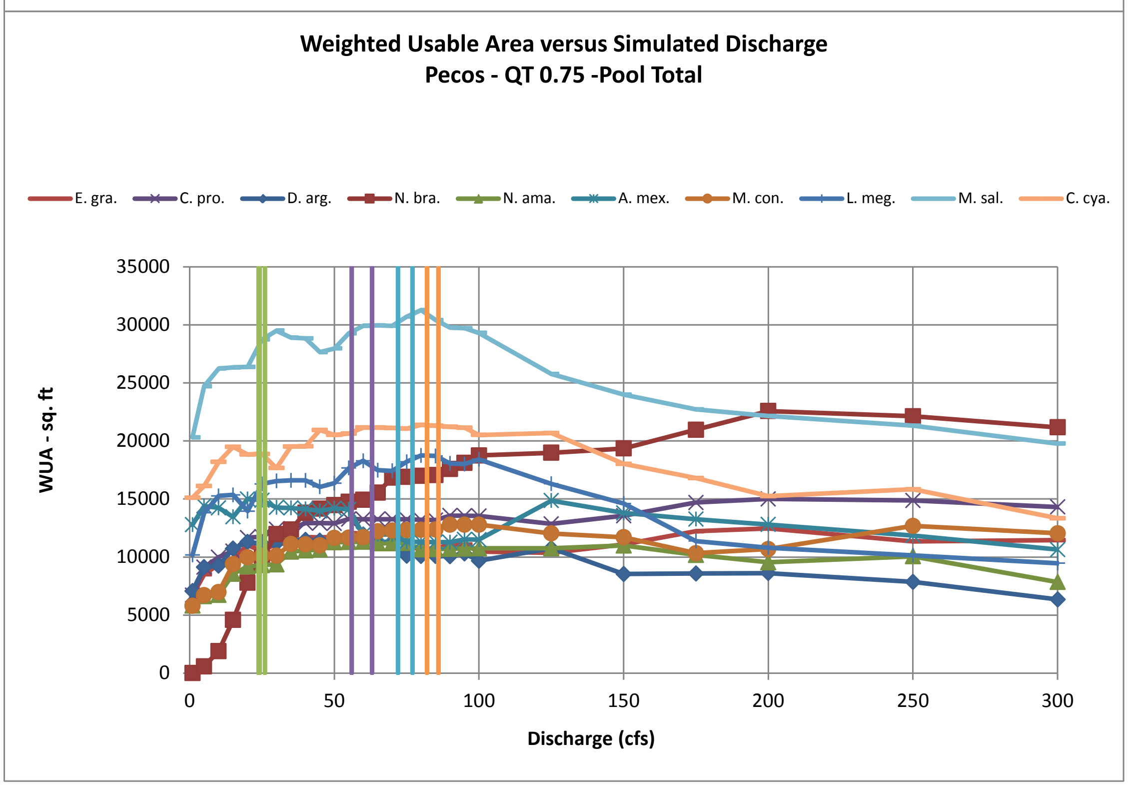


Figure 11-34 Weighted usable area versus simulated discharge at Pecos River (Pool Total).

Table 11-34 Percent of maximum WUA versus simulated discharge at Pecos River (Pool Total).

Pecos -Pool Total

Q	Min All	E. gra.	C. pro.	D. arg.	N. bra.	N. ama.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	39%	55%	53%	62%	39%	51%	81%	42%	73%	69%	72%
5	48%	68%	66%	76%	48%	65%	93%	56%	85%	78%	81%
10	54%	75%	72%	82%	54%	73%	97%	64%	89%	82%	85%
15	61%	81%	78%	88%	61%	76%	96%	72%	92%	86%	88%
20	65%	84%	81%	88%	65%	79%	96%	77%	92%	90%	90%
25	69%	85%	83%	90%	69%	82%	96%	79%	93%	92%	92%
30	72%	87%	84%	90%	72%	84%	96%	82%	94%	93%	92%
35	75%	87%	85%	91%	75%	86%	94%	83%	94%	94%	92%
40	78%	88%	86%	90%	78%	87%	92%	84%	93%	94%	92%
45	79%	89%	87%	91%	79%	89%	92%	84%	93%	94%	93%
50	82%	92%	90%	95%	82%	91%	98%	86%	97%	96%	97%
55	83%	93%	91%	96%	83%	93%	99%	86%	98%	97%	98%
60	85%	94%	92%	97%	85%	94%	100%	87%	99%	97%	99%
65	86%	94%	92%	98%	86%	94%	100%	88%	100%	98%	100%
70	87%	95%	93%	99%	87%	95%	100%	89%	100%	98%	100%
75	88%	95%	94%	99%	88%	96%	100%	90%	100%	99%	100%
80	89%	96%	94%	99%	89%	96%	100%	90%	100%	99%	100%
85	89%	96%	95%	100%	89%	96%	100%	91%	100%	99%	100%
90	90%	96%	95%	100%	90%	97%	100%	91%	100%	99%	100%
95	90%	96%	95%	100%	90%	97%	100%	91%	100%	99%	100%
100	91%	96%	96%	100%	91%	97%	100%	91%	100%	98%	100%
125	95%	97%	97%	98%	95%	98%	98%	97%	97%	100%	99%
150	94%	99%	99%	96%	98%	100%	97%	99%	94%	100%	98%
175	92%	100%	100%	94%	100%	100%	96%	100%	92%	99%	97%
200	89%	101%	102%	91%	102%	98%	94%	100%	89%	98%	96%
250	84%	102%	103%	88%	103%	92%	89%	101%	84%	96%	93%
300	79%	101%	102%	83%	100%	85%	81%	98%	79%	94%	90%
350	74%	98%	99%	78%	95%	82%	78%	92%	74%	91%	85%
400	66%	96%	96%	71%	89%	79%	74%	85%	66%	86%	83%
500	58%	87%	87%	64%	75%	63%	69%	73%	58%	76%	78%

Pecos - QT 0.75 -Pool Total

Q	Min All	E. gra.	C. pro.	D. arg.	N. bra.	N. ama.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	0%	55%	46%	59%	0%	51%	85%	45%	54%	65%	71%
5	3%	70%	62%	77%	3%	59%	96%	52%	74%	79%	75%
10	9%	77%	68%	78%	9%	60%	95%	54%	81%	84%	85%
15	22%	81%	72%	90%	22%	76%	90%	73%	82%	84%	91%
20	37%	90%	79%	95%	37%	81%	100%	78%	74%	84%	88%
25	48%	86%	80%	94%	48%	82%	99%	79%	87%	92%	88%
30	57%	91%	84%	94%	57%	83%	95%	79%	88%	94%	83%
35	59%	92%	85%	96%	59%	93%	95%	87%	89%	92%	91%
40	66%	96%	88%	96%	66%	93%	94%	87%	89%	92%	91%
45	68%	96%	88%	96%	68%	94%	93%	86%	86%	88%	98%
50	69%	96%	88%	97%	69%	100%	95%	91%	87%	89%	96%
55	70%	99%	90%	97%	70%	100%	94%	91%	94%	94%	96%
60	71%	98%	90%	100%	71%	100%	80%	92%	98%	96%	99%
65	74%	98%	90%	95%	74%	99%	80%	96%	93%	96%	99%
70	80%	98%	90%	95%	80%	99%	80%	96%	93%	96%	99%
75	76%	88%	90%	85%	81%	99%	76%	96%	97%	98%	99%
80	75%	88%	90%	85%	81%	94%	75%	97%	100%	100%	100%
85	75%	88%	90%	85%	81%	95%	75%	97%	100%	97%	100%
90	75%	91%	92%	84%	84%	95%	75%	100%	96%	95%	99%
95	77%	91%	92%	86%	86%	95%	77%	100%	96%	95%	99%
100	77%	86%	92%	81%	89%	95%	77%	100%	98%	94%	96%
125	82%	85%	87%	90%	91%	95%	99%	94%	87%	82%	97%
150	72%	91%	92%	72%	92%	97%	92%	91%	78%	77%	84%
175	61%	100%	100%	72%	100%	90%	88%	81%	61%	73%	79%
200	58%	102%	102%	72%	108%	84%	85%	84%	58%	71%	71%
250	54%	93%	101%	66%	106%	89%	79%	99%	54%	68%	74%
300	51%	94%	97%	53%	101%	69%	71%	94%	51%	63%	62%
350	52%	94%	85%	53%	92%	53%	64%	62%	52%	58%	53%
400	41%	90%	77%	41%	73%	51%	58%	48%	41%	42%	46%
500	16%	77%	62%	34%	54%	42%	44%	16%	35%	27%	38%

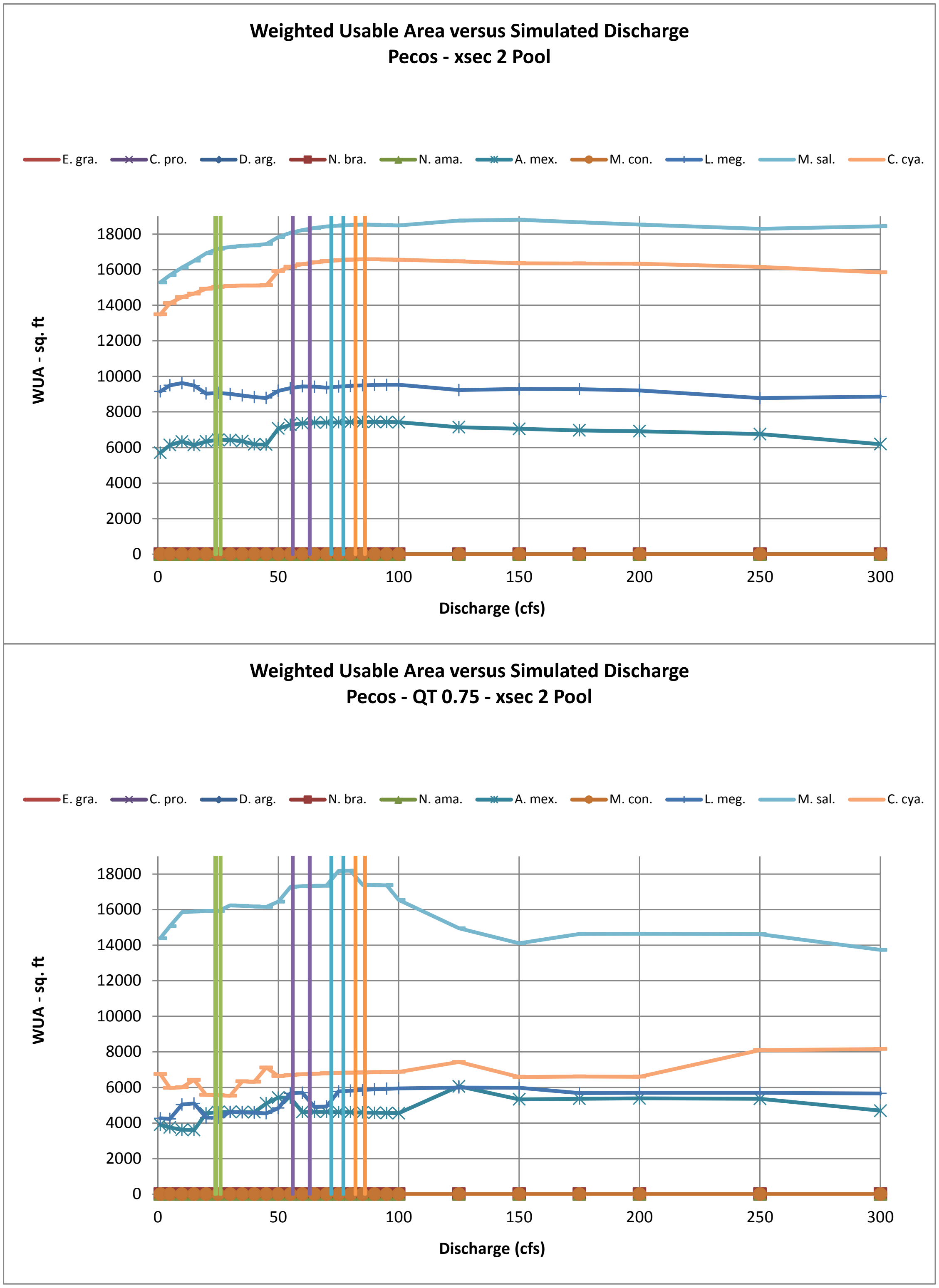


Figure 11-35 Weighted usable area versus simulated discharge at Pecos River (Pool 1).

Table 11-35 Percent of maximum WUA versus simulated discharge at Pecos River (Pool 1).

Pecos - xsec 2 Pool

Q	Min All	E. gra.	C. pro.	D. arg.	N. bra.	N. ama.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	77%	#DIV/0!	95%	81%	81%
5	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	83%	#DIV/0!	99%	83%	85%
10	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	85%	#DIV/0!	100%	86%	87%
15	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	83%	#DIV/0!	99%	88%	88%
20	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	85%	#DIV/0!	94%	90%	90%
25	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	86%	#DIV/0!	94%	91%	91%
30	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	86%	#DIV/0!	94%	92%	91%
35	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	85%	#DIV/0!	93%	92%	91%
40	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	83%	#DIV/0!	92%	92%	91%
45	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	83%	#DIV/0!	91%	93%	91%
50	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	95%	#DIV/0!	95%	95%	96%
55	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	98%	#DIV/0!	97%	96%	97%
60	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	99%	#DIV/0!	98%	97%	98%
65	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	100%	#DIV/0!	98%	98%	99%
70	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	100%	#DIV/0!	97%	98%	99%
75	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	100%	#DIV/0!	98%	98%	100%
80	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	100%	#DIV/0!	98%	98%	100%
85	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	100%	#DIV/0!	99%	99%	100%
90	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	100%	#DIV/0!	99%	99%	100%
95	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	100%	#DIV/0!	99%	98%	100%
100	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	100%	#DIV/0!	99%	98%	100%
125	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	96%	#DIV/0!	96%	100%	99%
150	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	95%	#DIV/0!	97%	100%	99%
175	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	94%	#DIV/0!	96%	99%	99%
200	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	93%	#DIV/0!	96%	99%	98%
250	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	91%	#DIV/0!	91%	97%	97%
300	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	83%	#DIV/0!	92%	98%	96%
350	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	80%	#DIV/0!	92%	97%	93%
400	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	77%	#DIV/0!	92%	96%	92%
500	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	70%	#DIV/0!	87%	89%	87%

Pecos - QT 0.75 - xsec 2 Pool

Q	Min All	E. gra.	C. pro.	D. arg.	N. bra.	N. ama.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	64%	#DIV/0!	71%	79%	91%
5	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	62%	#DIV/0!	71%	83%	80%
10	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	60%	#DIV/0!	84%	87%	81%
15	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	59%	#DIV/0!	85%	87%	86%
20	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	75%	#DIV/0!	72%	88%	75%
25	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	76%	#DIV/0!	72%	87%	75%
30	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	76%	#DIV/0!	77%	89%	74%
35	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	76%	#DIV/0!	77%	89%	85%
40	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	76%	#DIV/0!	76%	89%	85%
45	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	84%	#DIV/0!	76%	89%	96%
50	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	90%	#DIV/0!	81%	90%	89%
55	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	89%	#DIV/0!	95%	95%	90%
60	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	76%	#DIV/0!	95%	95%	91%
65	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	76%	#DIV/0!	82%	95%	91%
70	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	76%	#DIV/0!	82%	95%	91%
75	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	76%	#DIV/0!	96%	100%	92%
80	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	76%	#DIV/0!	97%	100%	92%
85	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	76%	#DIV/0!	98%	96%	92%
90	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	75%	#DIV/0!	98%	96%	92%
95	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	75%	#DIV/0!	99%	95%	92%
100	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	75%	#DIV/0!	99%	91%	93%
125	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	100%	#DIV/0!	100%	82%	100%
150	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	88%	#DIV/0!	100%	78%	89%
175	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	88%	#DIV/0!	95%	80%	89%
200	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	89%	#DIV/0!	95%	80%	89%
250	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	88%	#DIV/0!	95%	80%	109%
300	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	77%	#DIV/0!	94%	76%	110%
350	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	75%	#DIV/0!	119%	75%	109%
400	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	58%	#DIV/0!	120%	70%	99%
500	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	43%	#DIV/0!	108%	47%	99%

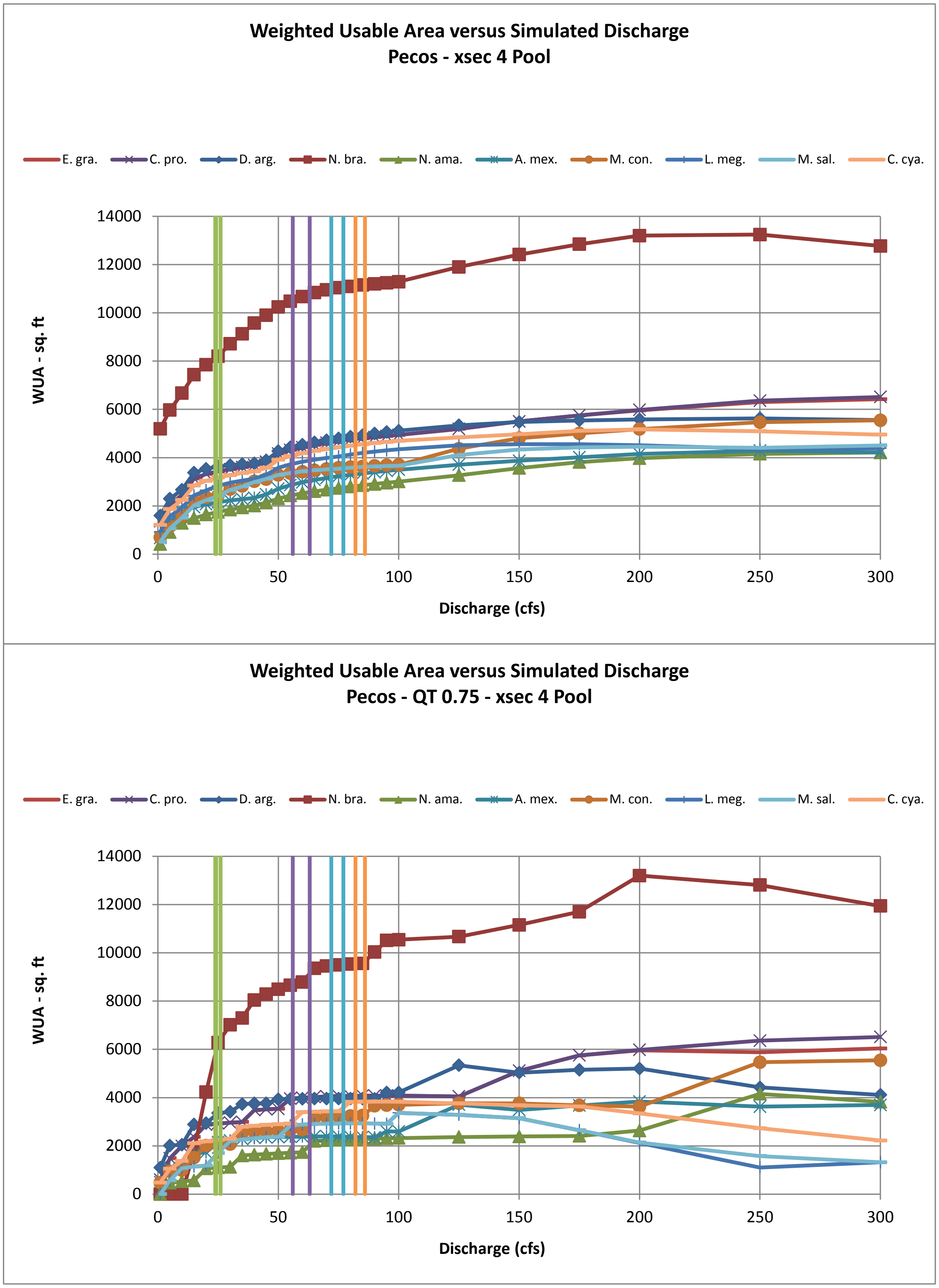


Figure 11-36 Weighted usable area versus simulated discharge at Pecos River (Pool 2).

Table 11-36 Percent of maximum WUA versus simulated discharge at Pecos River (Pool 2).

Pecos - xsec 4 Pool

Q	Min All	E. gra.	C. pro.	D. arg.	N. bra.	N. ama.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	11%	24%	24%	29%	40%	11%	17%	14%	21%	12%	24%
5	23%	36%	36%	41%	47%	24%	34%	23%	34%	24%	37%
10	32%	43%	43%	48%	52%	34%	44%	32%	42%	34%	44%
15	39%	55%	55%	61%	58%	39%	48%	44%	53%	46%	56%
20	43%	58%	58%	64%	61%	43%	52%	47%	58%	51%	59%
25	46%	60%	60%	66%	64%	46%	54%	49%	62%	54%	62%
30	48%	61%	61%	67%	68%	48%	55%	54%	65%	60%	64%
35	51%	63%	63%	67%	71%	51%	57%	57%	67%	63%	66%
40	53%	64%	64%	68%	75%	53%	58%	60%	69%	68%	67%
45	56%	67%	67%	70%	77%	56%	62%	62%	72%	71%	70%
50	61%	73%	72%	77%	80%	61%	67%	66%	79%	74%	77%
55	64%	75%	75%	80%	82%	64%	71%	67%	82%	76%	80%
60	66%	77%	77%	82%	83%	66%	74%	68%	84%	78%	82%
65	68%	79%	79%	84%	84%	68%	77%	70%	86%	79%	84%
70	70%	80%	80%	85%	85%	70%	79%	71%	88%	79%	85%
75	72%	82%	82%	87%	86%	72%	80%	72%	89%	80%	87%
80	72%	83%	83%	88%	86%	73%	82%	72%	91%	81%	88%
85	73%	84%	83%	89%	87%	75%	83%	73%	92%	82%	89%
90	73%	84%	84%	90%	87%	76%	85%	73%	93%	82%	90%
95	74%	85%	85%	91%	88%	78%	86%	74%	94%	83%	91%
100	74%	86%	86%	92%	88%	79%	87%	74%	95%	83%	92%
125	86%	90%	90%	96%	93%	86%	92%	87%	99%	93%	95%
150	94%	96%	96%	99%	97%	94%	96%	96%	100%	98%	97%
175	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
200	99%	104%	104%	101%	103%	104%	103%	104%	99%	101%	101%
250	96%	110%	111%	102%	103%	109%	107%	109%	96%	100%	100%
300	96%	112%	113%	100%	99%	110%	105%	111%	96%	102%	97%
350	93%	113%	115%	97%	96%	111%	104%	110%	93%	101%	94%
400	80%	114%	115%	90%	91%	113%	104%	105%	80%	95%	94%
500	74%	109%	107%	79%	74%	101%	116%	92%	74%	86%	99%

Pecos - QT 0.75 - xsec 4 Pool

Q	Min All	E. gra.	C. pro.	D. arg.	N. bra.	N. ama.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	0%	10%	10%	21%	0%	0%	13%	13%	0%	0%	13%
5	0%	26%	26%	38%	0%	19%	29%	25%	17%	17%	28%
10	0%	35%	35%	38%	0%	22%	31%	26%	32%	32%	36%
15	16%	41%	41%	54%	16%	23%	45%	40%	34%	34%	55%
20	35%	50%	50%	55%	36%	44%	47%	53%	35%	35%	57%
25	46%	51%	51%	63%	54%	46%	58%	54%	51%	51%	59%
30	47%	52%	52%	64%	60%	47%	60%	55%	65%	65%	60%
35	52%	52%	52%	70%	62%	66%	62%	68%	67%	67%	73%
40	61%	61%	61%	70%	69%	68%	63%	69%	69%	69%	74%
45	61%	61%	61%	70%	71%	69%	63%	69%	70%	70%	75%
50	62%	62%	62%	74%	73%	70%	64%	70%	71%	71%	76%
55	64%	69%	69%	74%	74%	71%	64%	70%	85%	85%	76%
60	64%	69%	69%	74%	75%	72%	64%	71%	86%	86%	89%
65	65%	70%	70%	74%	80%	91%	65%	84%	86%	86%	89%
70	65%	70%	70%	74%	81%	92%	65%	85%	87%	87%	89%
75	64%	71%	71%	74%	81%	93%	64%	86%	87%	87%	90%
80	64%	71%	71%	74%	81%	94%	64%	86%	87%	87%	100%
85	64%	71%	71%	74%	82%	95%	64%	87%	87%	87%	100%
90	63%	71%	71%	74%	86%	95%	63%	97%	87%	87%	100%
95	70%	71%	71%	79%	90%	96%	70%	98%	87%	87%	100%
100	70%	71%	71%	79%	90%	96%	70%	98%	100%	100%	100%
125	70%	70%	70%	100%	91%	98%	100%	100%	98%	98%	98%
150	89%	89%	89%	94%	95%	99%	94%	100%	94%	94%	96%
175	79%	100%	100%	96%	100%	100%	99%	98%	79%	79%	95%
200	63%	104%	104%	97%	113%	109%	103%	96%	63%	64%	87%
250	33%	102%	111%	83%	109%	172%	98%	145%	33%	47%	71%
300	39%	105%	113%	77%	102%	159%	100%	147%	39%	39%	58%
350	43%	107%	107%	77%	89%	127%	90%	97%	47%	47%	43%
400	14%	100%	108%	64%	68%	117%	93%	82%	14%	14%	39%
500	0%	98%	87%	52%	48%	107%	69%	23%	0%	0%	10%

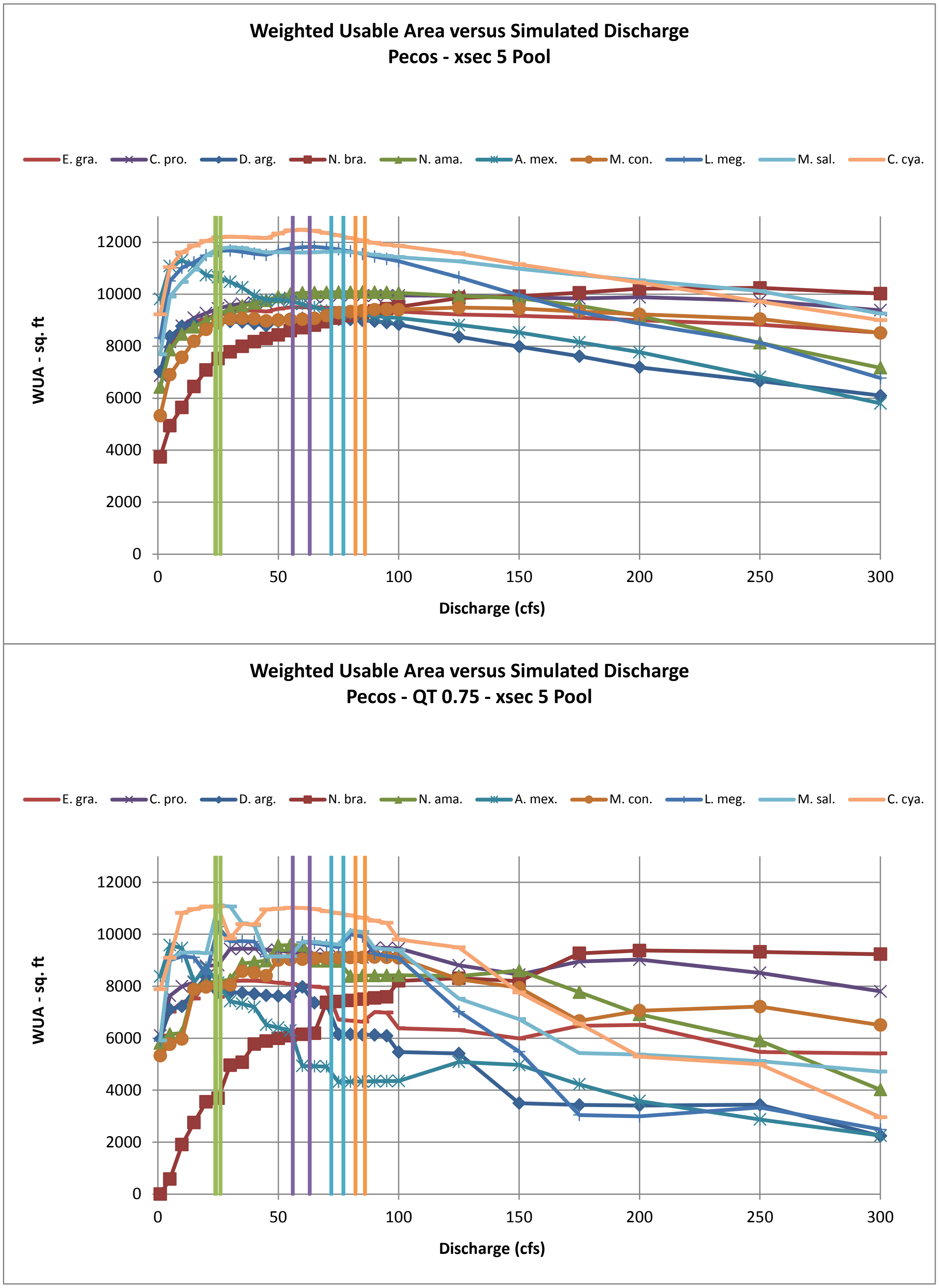


Figure 11-37 Weighted usable area versus simulated discharge at Pecos River (Pool 3).

Table 11-37 Percent of maximum WUA versus simulated discharge at Pecos River (Pool 3).

Pecos - xsec 5 Pool

Q	Min All	E. gra.	C. pro.	D. arg.	N. bra.	N. ama.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	37%	72%	69%	77%	37%	64%	87%	56%	70%	65%	74%
5	49%	85%	82%	92%	49%	78%	98%	73%	89%	84%	88%
10	56%	91%	88%	97%	56%	84%	100%	80%	93%	89%	93%
15	64%	94%	91%	98%	64%	87%	98%	86%	95%	93%	95%
20	70%	96%	93%	97%	70%	89%	95%	91%	97%	97%	97%
25	75%	97%	95%	98%	75%	92%	94%	94%	99%	100%	98%
30	77%	98%	96%	99%	77%	93%	93%	95%	99%	100%	98%
35	79%	99%	97%	98%	79%	95%	91%	96%	98%	100%	98%
40	81%	99%	97%	98%	81%	96%	88%	95%	98%	99%	98%
45	82%	98%	97%	97%	82%	97%	87%	95%	97%	98%	97%
50	84%	99%	98%	99%	84%	98%	87%	95%	99%	98%	99%
55	85%	100%	99%	100%	85%	99%	86%	95%	100%	98%	100%
60	85%	100%	99%	100%	87%	100%	85%	95%	100%	98%	100%
65	84%	100%	99%	100%	88%	100%	84%	96%	100%	98%	100%
70	83%	100%	100%	100%	89%	100%	83%	97%	100%	99%	99%
75	82%	100%	100%	100%	90%	100%	82%	98%	99%	99%	98%
80	82%	99%	100%	100%	91%	100%	82%	98%	99%	98%	97%
85	82%	99%	100%	99%	92%	100%	82%	99%	98%	98%	97%
90	81%	99%	100%	99%	93%	100%	81%	99%	97%	98%	96%
95	81%	99%	100%	98%	94%	100%	81%	99%	96%	97%	95%
100	80%	98%	100%	97%	95%	100%	80%	99%	95%	97%	95%
125	78%	97%	100%	92%	98%	99%	78%	100%	90%	95%	93%
150	75%	97%	99%	88%	99%	98%	75%	100%	84%	93%	89%
175	72%	96%	99%	84%	100%	95%	72%	98%	79%	91%	87%
200	69%	95%	99%	79%	102%	91%	69%	97%	75%	89%	84%
250	60%	93%	98%	73%	102%	81%	60%	95%	69%	86%	78%
300	51%	90%	94%	67%	100%	71%	51%	90%	57%	78%	72%
350	47%	86%	90%	62%	95%	67%	48%	81%	47%	70%	64%
400	35%	80%	85%	55%	88%	63%	43%	73%	35%	61%	60%
500	24%	70%	74%	50%	75%	46%	35%	62%	24%	45%	51%

Pecos - QT 0.75 - xsec 5 Pool

Q	Min All	E. gra.	C. pro.	D. arg.	N. bra.	N. ama.	A. mex.	M. con.	L. meg.	M. sal.	C. cya.
1	0%	74%	64%	72%	0%	61%	87%	58%	57%	53%	71%
5	6%	86%	81%	85%	6%	64%	100%	63%	88%	82%	82%
10	21%	90%	84%	86%	21%	65%	99%	65%	89%	84%	98%
15	30%	92%	86%	94%	30%	83%	85%	86%	89%	84%	99%
20	38%	99%	93%	100%	38%	85%	91%	87%	82%	83%	100%
25	40%	92%	93%	93%	40%	86%	85%	88%	100%	100%	100%
30	54%	100%	99%	93%	54%	86%	77%	88%	95%	100%	89%
35	55%	100%	100%	93%	55%	93%	76%	94%	95%	94%	94%
40	62%	100%	100%	92%	62%	93%	75%	93%	94%	93%	94%
45	64%	100%	99%	91%	64%	94%	68%	92%	89%	82%	99%
50	65%	99%	99%	91%	65%	100%	67%	99%	89%	82%	99%
55	66%	98%	98%	91%	66%	100%	66%	99%	89%	82%	100%
60	52%	98%	98%	95%	66%	100%	52%	99%	94%	87%	99%
65	51%	97%	97%	88%	67%	94%	51%	99%	94%	87%	99%
70	51%	97%	97%	88%	80%	94%	51%	100%	93%	87%	98%
75	45%	82%	97%	74%	80%	94%	45%	100%	92%	86%	98%
80	45%	81%	96%	74%	80%	88%	45%	100%	97%	91%	97%
85	45%	81%	96%	73%	81%	88%	45%	100%	96%	91%	96%
90	45%	85%	100%	73%	81%	88%	45%	100%	90%	85%	95%
95	45%	85%	100%	73%	82%	88%	45%	100%	89%	85%	94%
100	45%	78%	100%	65%	89%	88%	45%	100%	88%	84%	89%
125	53%	77%	93%	65%	90%	88%	53%	91%	68%	68%	86%
150	42%	73%	89%	42%	88%	90%	52%	87%	53%	61%	70%
175	30%	79%	94%	41%	100%	81%	44%	73%	30%	49%	59%
200	29%	79%	95%	41%	101%	72%	37%	77%	29%	48%	48%
250	30%	67%	90%	41%	101%	62%	30%	79%	32%	46%	45%
300	24%	66%	82%	27%	100%	42%	24%	71%	24%	42%	27%
350	10%	65%	67%	26%	95%	31%	17%	46%	10%	26%	14%
400	0%	63%	53%	18%	80%	31%	18%	33%	0%	0%	9%
500	0%	46%	44%	16%	62%	22%	16%	13%	0%	0%	4%

12 Appendix D Spreadsheet Details

The report provides several examples of how the results from the tools developed as part of this study may be used to support the BBEST in the development of Instream Flow-Habitat relationships supporting flow regime recommendations. This report does not include, nor did it intend to include, a flow recommendation, rather the project provides a flexible and adaptable approach to predicting the instream habitat response to different base flows and displaying these responses in a format that can be useful to the BBEST in their deliberations to develop flow recommendations to maintain a sound ecological environment.

The approach is flexible in that it provides many options to evaluate alternative scenarios and display results[4]. It is adaptable in that it may be improved if additional data or better understanding of the habitat response of species to hydraulic habitat conditions is developed. Unfortunately a flexible and adaptable tool carries a certain level of complexity. While not a comprehensive user's manual, the following describes how the excel spreadsheet program works and provides guidance should modifications be desired as part of future studies.

The products produced as part of this project are primarily produced as Excel spreadsheets. The first set, in the Batch folder contain files with the suffix "_PHAB", contain the complete hydraulic habitat models for each site. The PHAB spreadsheets incorporate the programming approach originally developed by the Fort Collins Instream flow group called PHABSIM (Physical HABitat model SIMulation) and subsequently updated into the MS windows platform. The spreadsheet does not include all of the options available in the PHABSIM/PHABWIN software but has the benefit of displaying results in a manner more accessible to a wider range of users. The main PHAB spreadsheets include a number of sheets. In general, the sheets "FieldData", "RatingCurve" and "Site_xsecs" (possibly "Criteria", which contains the habitat suitability criteria for the species included in this analysis) should be viewed as places to input data to the spreadsheet. "Calibration" and "Simulation" are for developing and executing the hydrodynamic part of the program and "Habitat" applies the habitat suitability to the hydrodynamic results to calculate weighted useable area. The "Control" sheet allows user input to evaluate alternative for the hydraulic and habitat simulations, several cells in the sheet contain comments viewable when hovering the mouse over these cells. The models are executed using a Visual Basic macro tilted "Results" and there are several additional macros for producing and viewing intermediate results. Table 12-1 provides a quick reference to the sheets and macros included in this spreadsheet.

Many iterations of the basic models were performed and there are therefore many versions of the PHAB-type spreadsheets for each site. The alternative iterations were performed for a number of purposes. The first were to perform a sensitivity analysis on several components of the model calibration including the depth calibration which is sensitive to the selection of discharge to water surface elevation rating curve and the velocity calibrations which is dependent on the selection of an approach to distribute the velocities across the channel. There were also a number of runs to investigate the robustness of the habitat suitability criteria employed at each

[4] Cells within the spreadsheets that are outlined and highlighted yellow are intended as user inputs and in many cases include drop down menus to guild the user, however it is recommended that a backup file be saved before attempting to modify these values

location. Finally there were runs to investigate the importance of habitat quality including thresholds for habitat quality at 0.5 and 0.75 combined suitability indices.

After running the basic simulations, results were summarized in a set of spreadsheets that are used to compare results from different runs. These spreadsheets (DepthCal_Results.xlsm, VelCal_Results.xlsm, HSCCal_Results.xlsm and QT_Results.xlsm) all contain links to other spreadsheets. Since this links depend on folder structure, users should click "no" when prompted to update links.

Table 12-1 Summary of spreadsheet sheets and macros.

Sheets	
Control	User Inputs for simulation alternatives
Site_xsecs	Summary Information for each cross section including GIS locations, cell lengths, WSE and Q, Thalweg and Stage of zero flow elevations which are used by other sheets.
FieldData	Cross section field data. Depth, velocity and substrate for each station.
Criteria	Habitat suitability criteria for depth, velocity and substrate. This sheet was developed based on data provided by the BBEST with support of TPWD.
RatingCurve	Rating curve for converting flow to WSE. Includes placeholders for developing log-log regressions based on USGS or site specific data. WSE-Q pairs may also be imported from other sources such as PHABWIN hydraulic model which includes more sophisticated approaches such as WSP step backwater model.
Calibration	Part 1 of the Hydrologic model designed to aid in processing and evaluating the field data and refining calibration parameters, primarily the velocity distribution coefficient (N) and the choice of whether to use a velocity adjustment factor.
Simulation	Part 2 of the Hydraulic model applies the calibration parameter to predict velocities and depths at all stations for the range of flows simulated.
Habitat	Applies habitat criteria to results of hydraulic model to calculate weighted usable area for range of flows modeled.
WUA	Weighted usable area results includes options for displaying HEFR flow estimates on curves and percent of maximum habitat at these flows.
Results	Weighted usable area results for all species and flows simulated.

Macros	
UpdateCharts	Updates x-axis scales for charts on hydraulics and habitats sheets (does not work for velocity simulations chart on habitat sheet). (control-p)
ChartsStep	Automates visualization of cross section station charts on Habitat sheet (starting about row 72). Steps through the range of flow simulated. Currently set to display every other flow. (control-i)
UpdateHAB	Produces WUA results for one cross section for all flows and species only saves results on Habitat sheet. (control-u)
Results	Produces WUA results for all cross sections for a all species at all flows and saves them to Results sheet. (control-k)