Appendix B
Environmental - Habitat Assessment
Crabtree Swamp Aquatic Ecosystem Restoration Project

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US Army Corps of Engineers ®

Horry County STORM WATER MANAGEMENT

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1.0 Habitat Assessment

For the purpose of this report, measures mentioned and described will only include those that were used during the Cost Incremental and Benefit Analysis (CE/ICA). During the plan formulation process, other measures were considered and later screened out before the analysis, due to lack of constructability and feasibility to the project. The measures screened out of plan formulation are discussed in Sections 3.4 and 3.7. The three areas that will be discussed include Reach 1 Daniel Road to El Bethel Road, Reach 2 El Bethel Road to Millpond Road, and Reach 3 Highway 701 to Long Avenue.

Section 3.11 of the Integrated Draft Report and Environmental Assessment discusses the CE/ICA process in detail, the Recommended Plan and the comparison of the plan's benefits and costs. This appendix is limited to the discussion of the habitat benefits of each area alternative.

1.1 Habitat Suitability Index Model

Model Selection

For this study, the Redbreast Sunfish Model, utilizing a Habitat Suitability Index (HSI) and Habitat Evaluation Procedure (HEP), was selected to assess the Crabtree Swamp riverine habitat. As discussed in Section 3.4.1, the redbreast sunfish is an appropriate proxy for restoration of Crabtree Swamp. The sunfish serves as host species for propagation of the Savannah Lilliput mussel (*Toxoplasma pullus*), a federal species of concern and a species of special concern ranked as critically imperiled in South Carolina. USACE coordinated the selection of this model with USFWS.

Redbreast Sunfish Habitat Suitability Index Model

The Redbreast Sunfish Model was developed to quantify changes in habitats located on the Savannah River Plant (SRP) near Aiken, South Carolina. The model is designed for use primarily in the southeastern coastal plain, where streams are low gradient with few riffle and pool systems (Aho et al. 1986). The authors utilized the concept of maximum performance (Li et al. 1984) to define an individual suitability index. An individual or population response was used as the measure of performance, with the suitability index representing the highest proportion of the maximum known performance measured against each independent variable value. Variables with a suitability index of 1.0 are assumed to be necessary for the occurrence of maximum species performance.

The framework and associated environmental relationships were developed using information detailing the distribution, survivorship, growth rate abundance, and reproductive capabilities of the redbreast sunfish and similar species, as described in the literature, to develop the suitability index curves based on how the identified variables could limit population response. The model identifies potential pathways through food, water quality, reproduction, and cover components (Figure 1). However, the model gives equal weight to all variables so classifying a variable under a specific component is not required. The model outcome is an HSI with a value from 0 to 1 (1 representing optimal habitat) that is based on the minimum suitability index score for any habitat variable.

Habitat Evaluation Procedure

A baseline assessment was required before any habitat impacts to the study area could be identified. The HEP process involves defining the study area, delineating within the study area, selecting evaluation models, and characterizing the study area based on the results of the HEP.

Species	Life Requisites	HSI Formula
Redbreast Sunfish	Food/Cover, Reproduction, Water Quality, Other Habitat Variables	HSI= Minimum SI of [V1,V2,V4,V5,V6,V7,V8,V9,V10,V13]
	V1	Hard Structural Cover
	V2	Vegetative Cover
	V4	Temperature During Spawning Season
	V5	Current Velocity
	V6	Substrate Composition
	V7	pH
	V8	Dissolved Oxygen
	V9	Turbidity
	V10	Temperature During Growing Season
	V13	Stream Width

Figure 1. Redbreast Sunfish Habitat Suitability Index Model.

HEP was developed by the USFWS in order to quantify the impacts of habitat changes resulting from land or water development projects (USFWS 1980). HEP is based on an assumption that habitat for a specific fish or wildlife species can be described by a Habitat Suitability Index (HSI). HSI models provide a quantitative description of the habitat requirements for a species or group of species. The models use measurements of appropriate variables to rate the habitat on a scale from 0.0 (unsuitable) to 1.0 (optimal).

Habitat models consist of a list of variables that are considered important in characterizing the fish and wildlife habitat; a Suitability Index graph for each variable, which defines the assumed relationship between habitat quality and different variable values; and a mathematical formula that combines the Suitability Index for each variable into a single value for habitat quality. The single value is referred to as the Habitat Suitability Index (HSI).

The Suitability Index graph is a graphic representation of how fish and wildlife habitat of a given habitat type is predicted to change as values of the given variable change. It also allows the model user to numerically describe, through the Suitability Index, the habitat quality of an area for any variable value. The Suitability Index ranges from 0.1 to 1.0, with 1.0 representing optimal condition for the variable in question (Tables 16-19).

After a Suitability Index has been developed, a mathematical formula that combines all Suitability Indices into a single HSI value is constructed. Because the Suitability Indices range from 0.1 to 1.0 the HSI also ranges from 0.1 to 1.0, and is a numerical representation of the overall habitat quality of the specific habitat being evaluated. The HSI formula defines the combination of Suitability Indices in a

manner that is unique to each species depending on how the formula is constructed (Table 1).

1.1.1 Habitat Units and Annualization of Habitat Quality

The values assessed were used to identify the habitat impacts for the proposed ecosystem restoration objectives. The HSI scores were multiplied by the net change in area and condition of the impacted areas to calculate the net change in Habitat Units (HUs). HUs represent a numerical combination of quality (i.e. HSI) and quantity (acres) existing at any given point in time.

$$\int_0^T HU\ dt = (T_2 - T_1)\left[\left(\frac{A_1H_1 + A_2H_2}{3}\right) + \left(\frac{A_2H_1 + A_1H_2}{6}\right)\right]$$

Where:

$$\int_0^T HU\ dt = Cumulative\ HUs$$

T1= first target year of time interval

T2 = last target year of time interval

A1 = area of available habitat at beginning of time interval

A2= area of available habitat as the end of time interval

H1 = HSI at the beginning of time interval

H2 = HSI at the end of time interval

3 and 6 = constants derived from integration of HSI x Area for the interval between any two target years

This formula was developed to precisely calculate cumulative HUs when either an HSI or an area or both, change over a time interval. (USFWS 1980). Habitat Unit gains or losses are annualized by summing the cumulative HUs calculated using the above equation across all target years in the period of analysis and dividing the total (cumulative HUs) by the number of years in the planning horizon (i.e. 50 years). This calculation results in the Average Annual Habitat Units (AAHUs). The difference in AAHUs between the FWOP and the FWP represents the net impact attributable to the project in terms of habitat quantity and quality.

1.1.2 Target Years

Target Year (TY) 0 habitat conditions are represented by the existing, or baseline, habitat conditions. The field and desktop collected data were used to describe the habitat and quantify habitat units. Target Year 0 conditions serve as a basis of comparison for both FWOP and FWP scenarios. Additional TYs were identified based on when implemented measures would be expected to elicit community responses represented by changes in the projected habitat variables.

Target Year 1 is used as a standard comparison year to identify and capture changes in habitat conditions that occur within one year after measures have been constructed. Reduction in invasive species, pool development, and water regimes are likely variables that may improve within this time period.

Target Year 5 was selected to allow enough time to review natural plant establishment. Vegetative

abundance, growth, and diversity are key variables to assess community response at this target year.

Target Year 10 is used as a point after the initial growth of vegetation and the likely increase in size and benefits plantings have sustained.

TY 25 was also selected to capture the riparian habitat associated with the restored riparian habitats. Riparian plant abundance and diversity are also key response variables for this target year.

Target Year 50 is the planning life span of the project and is used as the last projected TY for the study. Restoration measures should produce mature habitat by this target year and represent the habitat types within the study area.

1.2 Data Collection

The habitat assessment for Crabtree Swamp utilized available data from site visits, aerial photographs, USGS water quality data collection, GIS resources, and available literature. Site visits were conducted on November 20, 2019 and December 4, 2019. A USGS water quality monitoring station at the Long Avenue Bridge across Crabtree Swamp provides historic and real- time data on flow, velocity, dissolved oxygen, and turbidity. Coastal Carolina provided several published documents related to monitoring of the 2009 and 2012 constructed floodplains and studies recently conducted to evaluate the source of water quality impairments. Additionally, NRCS provided GIS shapefiles of existing agriculture related drainages in the Crabtree Swamp watershed. A field delineation of wetlands has not been performed.

1.3 FWOP and FWP Conditions

Under the FWOP condition there would be no ecosystem restoration within the Crabtree Swamp study area. Section 2.1 is a general description of the likely future conditions in the study area over the 50 year life of the project in the future without project. The habitat type analyzed for the FWOP is riverine. The study area encompasses a 150-foot width area surrounding and including Crabtree Swamp that is currently under easements and managed by the City of Conway.

Section 4.6 describes the likely future conditions in the study area over the 50 year life of the future with project. Because this is an ecosystem restoration project, the FWP is assumed to provide habitat benefits to all areas. Habitat benefits will be gained by native riparian plantings, removal of low quality vegetation, creation of floodplain features, installation of log drop and root wad structures, berm breaches, and invasive species management.

1.4 Existing and FWOP

<u>REACH 1: DANIEL ROAD TO EL BETHEL ROAD</u>

Reach 1 is located at the northern extent of the study area beginning at Daniel Road and extending to where El Bethel Road crosses Crabtree Swamp. The stream is narrow and highly channelized in this area, and experiences low flow conditions during the summer. During storm events, the channel receives flows from the many NRCS culverts installed in past years to facilitate draining of agricultural lands. This reach also receives input from tributaries draining to the channel including Oakley Swamp and Four mile Swamp. These high velocity flows transport erosional sediments into Crabtree Swamp where they continue downstream. The city of Conway maintains the channel and stream banks in this area, turning the riverine habitat into grassed swales with little shade, detritus, or opportunity to develop aquatic habitat.

The redbreast sunfish HSI scores for Reach 1 were equal to 0.1 for all target years (Table 2). The main contributing factor to the low HSI scores was V4, temperature during spawning season (Table 1). Because this area lacked vegetation to shade the water during the months of spawning season, the value of the metric was lowered, resulting in an overall low HSI and HU. Since the area would receive continued maintenance, this trend was assumed through all target years. The final AAHU for Reach 1 is 3.62 (Table 2).

Table 1. Reach 1 Habitat Index Scores for Each Variable for Baseline and Target Years.

Location	Target Year	Acres	V1	V2	V4	V5	V6	V7	V8	V9	V10	V13
REACH 1	Variable		% Hard Structural Cover	% Vegetative Cover	Temp during Spawning Season	% stream with Velocity < or = 20 cm/s and is at least 20 cm in depth	% bottom area at preferred spawning depth during spawning composed of coarse sand or fine gravel	least pH during spawn/growing season	Min DO during spawn/growing season	Max Monthly Avg Turbidity during spawn/growing season	Max Weekly Temp during Growing Season	Mean stream width at average summer flow
	0	36.2	0.4	0.5	0.1	0.4	0.4	1	0.4	0.8	0.38	0.4
	1	36.2	0.4	0.5	0.1	0.4	0.4	1	0.4	0.8	0.38	0.4
	5	36.2	0.4	0.5	0.1	0.45	0.4	1	0.4	0.8	0.38	0.4
	10	36.2	0.4	0.45	0.1	0.45	0.45	1	0.4	0.7	0.38	0.4
	25	36.2	0.4	0.4	0.1	0.5	0.45	0.9	0.4	0.6	0.38	0.5
	50	36.2	0.4	0.4	0.1	0.5	0.5	0.9	0.4	0.5	0.38	0.5

Table 2. Reach 1 FWOP Habitat Conditions.

Evaluation Method	Target Year											
		0		1		5		10		25		50	
	Acres	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU
Redbreast Sunfish Reach 1	36.2	0.1	3.62	0.1	3.62	0.1	3.62	0.1	3.62	0.1	3.62	0.1	3.62

REACH 2:

Reach 2 is located directly south of Reach 1. This reach begins at El Bethel Road and extends to Millpond Road. Similar to Reach 1, the stream in this area is highly channelized and disconnected from the floodplain. The channel and streambanks are regularly maintained, leaving the area devoid of woody vegetation to reduce water temperatures in the summer months. While the very upper section of the reach currently has some beaver dam activity, the majority of the reach is trapezoidal and homogenous with no bed diversity. This area also has numerous culverts feeding into the channel from historic NRCS agriculture drainage projects as well as large storm inputs from Altman Branch and an unnamed tributary.

The lower section of this reach passes under Highway 501. This crossing consists of three large perched culverts where water is able to pass beneath and through the culverts. The large scour hole beneath the culverts limits fish passage during periods of low flow and the high velocity storm flows have eroded the left streambank (facing south), leaving raw dirt exposed. The right streambank is restricted by a bulkhead. The HSI score for this model is equal to the lowest suitability index rating for a habitat variable. For Reach 2, the HSI was reduced due to variable V4, temperature during spawning season (Table 3). Optimal temperatures for redbreast sunfish spawning are typically 21.0 to 25.0 ˚ C. The final AAHU score for Reach 2 is 2.73 (Table 4). The difference in AAHU scores between Reach 1 and Reach 2 are related to acreage.

Table 3. Reach 2 Habitat Index Scores for Each Variable for Baseline and Target Years.

Location	Target Year	Acres	V1	V2	V4	V5	V6	V7	V8	V9	V10	V13
REACH 2	Variable		% Hard Structural Cover	% Vegetative Cover	Temp during Spawning Season	% stream with Velocity<or= 20cm/s and is at least 20cm in depth	% bottom area at preferred spawning depth during spawning composed of coarse sand or fine gravel	least pH during spawn/growing season	Min DO during spawn/growing season	Max Monthly Avg Turbidity during spawn/growing season	Max Weekley Temp during Growing Season	Mean stream width at average summer flow
	0	27.3	0.5	0.5	0.1	0.6	0.5	1	0.4	0.8	0.38	0.6
	1	27.3	0.4	0.4	0.1	0.6	0.5	1	0.4	0.8	0.38	0.6
	5	27.3	0.4	0.4	0.1	0.6	0.5	1	0.4	0.8	0.38	0.6
	10	27.3	0.4	0.4	0.1	0.5	0.55	1	0.4	0.7	0.38	0.6
	25	27.3	0.4	0.4	0.1	0.5	0.55	0.9	0.4	0.6	0.38	0.8
	50	27.3	0.4	0.4	0.1	0.5	0.6	0.9	0.4	0.5	0.38	0.8

Table 4. Reach 2 FWOP Habitat Conditions.

Evaluation Method	Target Year											
		0		1		5		10		25		50	
	Acres	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU
Redbreast Sunfish Reach 2	27.3	0.1	2.73	0.1	2.73	0.1	2.73	0.1	2.73	0.1	2.73	0.1	2.73

REACH 3:

Reach 3 extends from Highway 701 to Long Avenue and has the lowest acreage of the three study reaches. This area receives tidal influence and has a recreational trail on one streambank. A steep berm on both sides of the channel disconnects the channel from large areas of floodplain wetlands. This reach also receives daily tidal influence. While a thin area of pine trees line one bank between the trail and the channel, there are numerous open spaces without vegetation. The wide width of the dredged channel leaves a large area of surface water exposed to the sun, increasing water temperatures. The HSI scores were also reduced by V4, the temperature during spawning, variable (Table 5). The total AAHUs for Reach 3 is 1.6 (Table 6).

Table 5. Reach 3 Habitat Index Scores for Each Variable for Baseline and Target Years.

Location	Target Year	Acres	V1	V2	V4	V5	V6	V7	V8	V9	V10	V13
REACH 3	Variable		% Hard Structural Cover	% Vegetative Cover	Temp during Spawning Season	%stream with Velocity<or=20 cm/s and is at least 20cm in depth	% bottom area at preferred spawning depth during spawning composed of coarse sand or fine gravel	least pH during spawn/growing season	Min DO during spawn/growing season	Max Monthly Avg Turbidity during spawn/growing season	Max Weekley Temp during GrowingSeason	Mean stream width at average summer flow
	0	16	0.5	0.5	0.1	1	0.4	1	0.4	0.8	0.37	1
	1	16	0.5	0.5	0.1	1	0.4	1	0.4	0.8	0.37	1
	5	16	0.5	0.5	0.1	1	0.4	1	0.4	0.8	0.37	1
	10	16	0.5	0.45	0.1	1	0.4	1	0.4	0.7	0.37	1
	25	16	0.5	0.4	0.1	1	0.4	0.9	0.4	0.6	0.37	1
	50	16	0.5	0.4	0.1	1	0.4	0.9	0.4	0.5	0.37	1

Table 6. Reach 3 FWOP Habitat Conditions.

Evaluation Method	Target Year											
		0		1		5		10		25		50	
	Acres	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU
Redbreast Sunfish Reach 3	16	0.01	1.6	0.01	1.6	0.01	1.6	0.01	1.6	0.01	1.6	0.01	1.6

1.5 Future with Project Habitat Conditions

All areas and acreages are assumed to be the same as the FWP. The differences in benefits are dependent on the measures that are assumed to be implemented at the site. Alternatives were developed based on the baseline conditions and potential for functional improvement. Reach 1 has 3 alternatives; Reach 2 has 15 alternatives; and Reach 3 has one alternative.

Reach 1: Daniel Road to El Bethel Road Riverine Restoration

The restoration goals for Reach 1 are to restore transport of water on the floodplain, create diverse bedforms and to improve temperature and oxygen regulation to meet species requirements. As mentioned previously, this reach of Crabtree Swamp is a homogenous, deeply incised channel that is currently disconnected from its floodplain and lacks woody vegetation on the stream banks. The restoration strategy is to restore floodplain connectivity, increase bedform diversity, and establish a diverse native riparian community.

The Reach 1 conditions incorporate the following measures:

- Excavation of Floodplain Bench with Native Woody Species Plantings
- Installation of Log Structures
- Post Construction Invasive Species Management,

These measures provide hydraulic, geomorphic, and physiochemical components that area critical for a resilient and sustainable riverine system. The excavation of the floodplain bench would provide additional storage and filtration for storm flows by decreasing the bank height ratio and increasing the entrenchment ratio. The installation of log drop structures would increase bed diversity by encouraging the development of pools and would also provide woody debris for aquatic habitat. Site-specific, native woody tree and shrub species would be planted on the floodplain to establish a diverse riparian community. In an effort to minimize risk to the planted vegetation, post construction monitoring and control of invasive species would be required. An integrated invasive species management plan would be developed and implemented post- construction utilizing chemical, mechanical, and/or biological controls.

Table 7 below depicts the increase of HSI scores beginning at Year 1. The optimum habitat units would occur in year 50 with the implementation of alternative 1c which incorporates both measures and generates 19.9 habitat units.

Table 7. FWP Habitat Conditions for Reach 1.

Evaluation Method	Target Year												
		0		1		5		10		25		50	
	Acres	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU
Alternative 1a: Floodplain Bench with Plantings	36.2	0.1	3.6	0.38	13.8	0.4	14.5	0.4	14.5	0.5	18.1	0.5	18.1
Alternative 1b Log Drop Structure	36.2	0.1	3.6	0.1	3.6	0.1	3.6	0.1	3.6	0.1	3.6	0.4	14.5
Alternative 1c: Combination of Floodplain Bench with Plantings and log drop structure	36.2	0.1	3.6	0.38	13.8	0.4	14.5	0.4	14.5	0.5	18.1	0.55	19.9

Reach 2: El Bethel Road to Millpond Road

Reach 2 incorporates the same two measures as Reach 1 but adds root wads and a rock riffle structure. The root wads would reduce bank erosion, provide fish cover, and provide refuge. The rock riffle structure would allow for fish passage. Combining the various measures for this reach generated 15 alternatives (Table 8). When evaluated individually, the log drop (Alternative 2b), root wad (Alternative 2c), and rock riffle (Alternative d) structures generated the same HSI at year 50. When measures were combined, the alternative incorporating all 4 measures (Alternative 2o) had the highest HSI, at year 50. Overall the alternatives with the lowest HSIs at year 50 were those alternatives that did not include the floodplain bench with plantings.

The Reach 2 conditions incorporate the following measures:

- Excavation of Floodplain Bench with Native Woody Species Plantings,
- Installation of Log Structures,
- Installation of root wads,
- Installation of Rock Riffle Structure
- Post Construction Invasive Species Management

Table 8. FWP Habitat Conditions for Reach 2.

Evaluation Method	Target Year												
		0		1		5		10		25		50	
	Acres	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU
Alternative 2a	27.3	.1	2.73	.38	10.4	.4	10.9	.4	10.9	.6	16.4	.65	17.7
Alternative 2b	27.3	.1	2.73	.1	2.73	.1	2.73	.1	2.73	.4	10.9	.4	10.9
Alternative 2c	27.3	.1	2.73	.1	2.73	.1	2.73	.1	2.73	.4	10.9	.4	10.9
Alternative 2d	27.3	.1	2.73	.1	2.73	.1	2.73	.1	10.9	.4	10.9	.4	10.9
Alternative 2e	27.3	.1	2.73	.38	10.4	.38	10.4	.55	15	.6	16.4	.7	19.1
Alternative 2f	27.3	.1	2.73	.38	10.4	.38	10.4	.6	16.4	.6	16.4	..65	17.7
Alternative 2g	27.3	.1	2.73	.38	10.4	.4	10.9	.6	16.4	.65	17.7	.7	19.1
Alternative 2h	27.3	.1	2.73	.1	2.73	.1	2.73	.38	10.4	.4	10.9	.4	10.9
Alternative 2i	27.3	.1	2.73	.1	2.73	.1	2.73	.4	10.9	.4	10.9	.4	10.9
Alternative 2j	27.3	.1	2.73	.1	2.73	.1	2.73	.4	10.9	.4	10.9	.4	10.9
Alternative 2k	27.3	.1	2.73	.38	10.4	.4	10.9	.55	15	.6	16.38	.65	17.7
Alternative 2l	27.3	.1	2.73	.38	10.4	.4	10.9	.6	16.4	.65	17.7	.7	19.1
Alternative 2m	27.3	.1	2.73	.38	10.4	.4	10.9	.6	16.4	.65	17.7	.7	19.1
Alternative 2n	27.3	.1	2.73	.1	2.73	.1	10.9	.4	10.9	.4	10.9	.4	10.9
Alternative 2o	27.3	.1	2.73	.38	10.4	.38	10.9	.4	17.7	.65	19.1	.75	20.5

Reach 3: Highway 701 to Long Avenue

Reach 3 would incorporate breaching the berm in six areas to provide floodplain access for Crabtree Swamp. This would allow for water exchange between the wetlands and the stream channel, reducing storm velocities and improving water quality parameters.

Reach 3 FWP conditions incorporate the following measure:

- Breaching of Floodplain Berms in 6 Locations

Table 9 below depicts the increase in HSI scores beginning at Year 1. The optimum habitat units would occur in Year 10 and continue through the life of the project (Table 9).

Table 9. FWP Habitat Conditions for Area 3.

Evaluation Method	Target Year												
		0		1		5		10		25		50	
	Acres	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU
Alt 3a Berm breaches	16	.1	1.6	.1	1.6	.1	1.6	.4	6.4	.4	6.4	.4	6.4

1.6 Benefits

Environmental restoration benefits are calculated by subtracting the FWOP AAHU from the FWP AAHU. Table 10 below depicts the alternatives for each reach with the annual benefits. Although some the measures for Reach 1 and Reach 2 are similar, there are differences between the amounts of AAHUs gained for each alternative due to the varying acreage of each area. The greatest AAHU benefit based on existing conditions and FWP conditions is the reach 2 alternative with all four measures incorporated. The floodplain bench with plantings combined with the log drop, root wad, and rock riffle structures provide the optimal habitat for the redbreast sunfish. The least beneficial alternative is the berm breaches along Reach 3.

Table 10. Benefits of Alternatives for Each Area.

Area	Alternative	Acres	FWOP AAHUs	FWP AAHUs	ANNUAL BENEFITS
REACH 1	1a. FP Bench with plantings	36.2	3.62	16.69	13.07
	1b. Log Drop	36.2	3.62	6.34	2.72
	1c. FP bench with plantings, and log drop	36.2	3.62	17.14	13.52
REACH 2	2a. FP Bench with Plantings	27.3	2.73	14.7	11.97
	2b. Log Drop	27.3	2.73	8.05	5.32
	2c. Root wads	27.3	2.73	8.05	5.32
	2d. Rock Riffle	27.3	2.73	9.69	6.96
	2e. FP bench with plantings and log drop	27.3	2.73	15.81	13.08
	2f. FP bench with plantings and root wads	27.3	2.73	15.74	13.01
	2g. FP bench with plantings and rock riffle	27.3	2.73	16.68	13.95
	2h. Log drop and root wads	27.3	2.73	9.58	6.85
	2i. Log drop and rock riffle	27.3	2.73	9.69	6.96
	2j. Rock riffle and root wads	27.3	2.73	9.69	6.96
	2k. FP bench with plantings, log drop and root wads	27.3	2.73	15.52	12.79
	2l. FP bench with plantings, log drop and rock riffle	27.3	2.73	16.68	13.95
	2m. FP bench with plantings, root wads, rock riffle	27.3	2.73	16.68	13.95
	2n. Log drop, root wads, rock riffle	27.3	2.73	10.43	7.7
	2o. FP bench with plantings, log drop, root wads, rock riffle	27.3	2.73	17.84	15.11
REACH 3	3a. Berm Breaches	16	1.6	5.68	4.08