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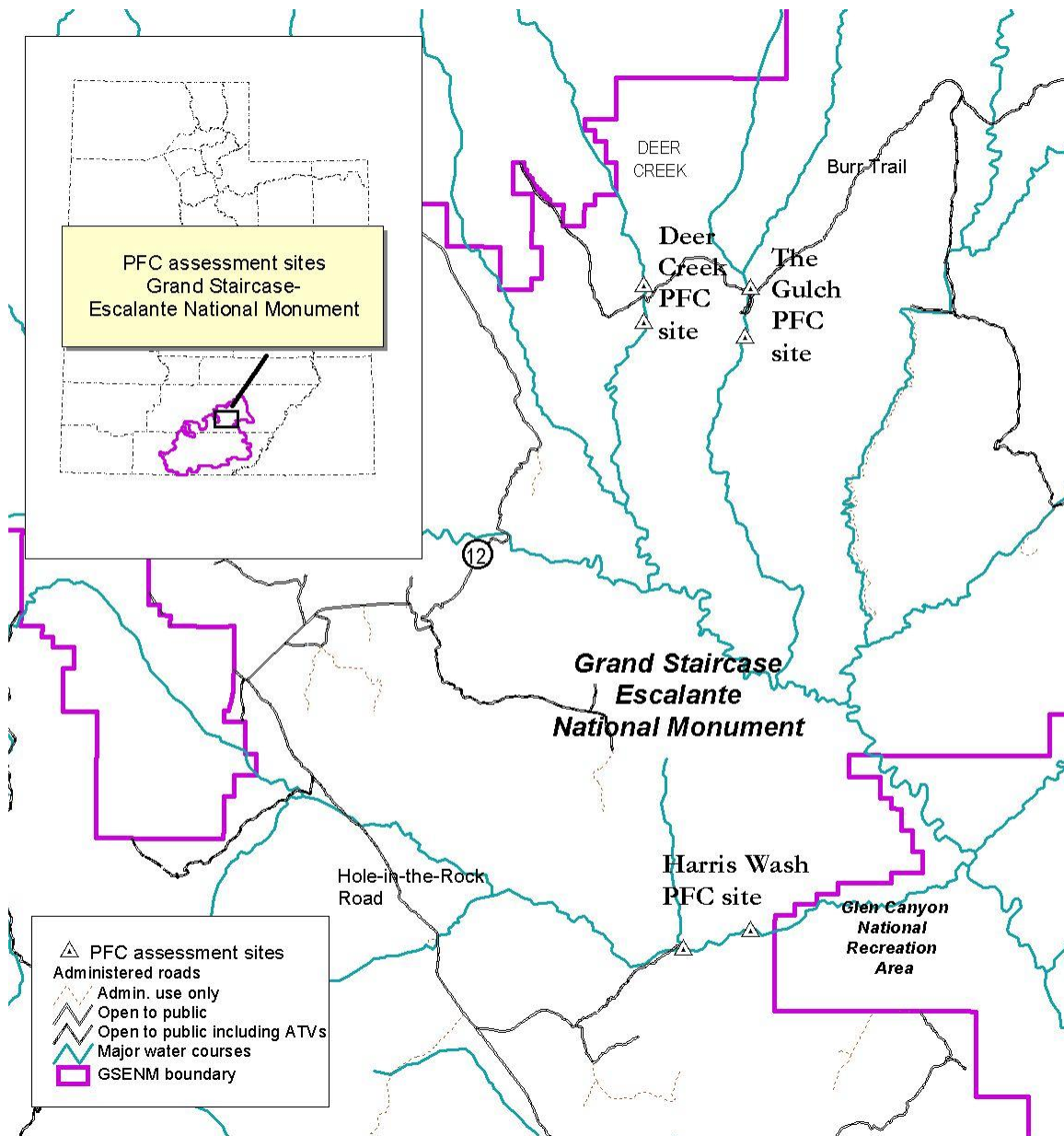


Figure 1. Site map for GSENM Study Areas

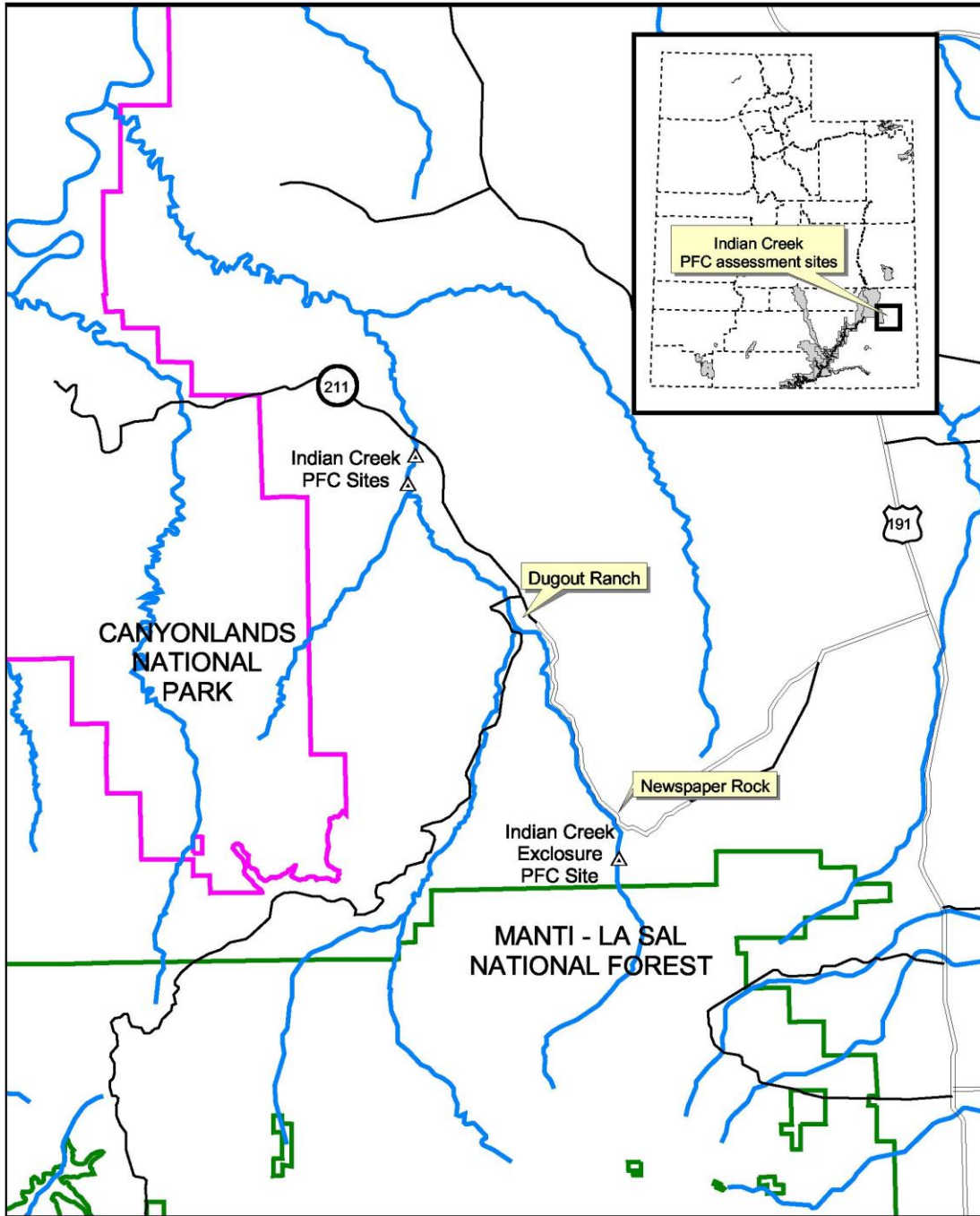


Figure 2. Site map for Indian Creek study area

Figure 3. Photographs of Deer Creek Study Area, in GSENM

Figure 4. Photograph of the Gulch Study Area, in GSENM

Figure 5. Photographs of the Harris Wash Study Area, in GSENM

Figure 6. Photographs of the Cottonwood Creek Study Area in GSENM.

Figure 7. Photographs of the Indian Creek Study Area in GSENM.

**APPENDIX A:**

## **BACKGROUND INFORMATION TO INTERPRET SITE VISIT DATA**

### **Water Quality (WQ)**

1. Determine the status of perennial flow from historical literature, commentary, and site visit observations.
2. Water quality data collected previously in the reach. The regional hydrological flow synthesis should be used to quantify six essential water quality parameters: temperature, dissolved oxygen concentration, specific conductance, pH, salinity, and turbidity. Many southwestern streams are naturally turbid, so high turbidity may actually represent GC conditions for many streams. Additional data on alkalinity, total nitrogen, orthophosphate, sulfate, and bacterial content are useful. The similarity for each of the above WQ variables is calculated as 100 minus the percent difference from the control level (derived from the control reaches, or agency guidelines). Biological anomalies (i.e., the absence of fish in apparently suitable streams) should be considered in light of the water quality synthesis.
3. Condition of the upland watershed, determined from a rangeland health assessment, using the “Interpreting Indicators of Rangeland Health” protocol (Pellent et al. 2000).

### **Hydro/Geomorphology (HG)**

1. Determine stream classification (e.g., Rosgen classification scheme).
2. Determine the flood history by analyzing the hydrograph, evaluating as many years of aerial photos as possible, and measuring the number and extent of changes in sinuosity.
- 3-6 . Several kinds of data are needed for hydrological analyses: a) the sources and alteration of flow (spring-fed, snow-melt, dammed, diverted, or augmented) for the period of record and paleoflood analyses; b) precipitation data or estimates from a regional model for the field site are desirable to help determine flood frequency; c) streamflow data from the nearest gauge for the period of record are needed to determine the timing, duration, frequency, magnitude, and ramping rate of flows; d) drainage basin size at the field site is also likely to aid in interpretation of flood frequency.
- 7-8. Determine the geologic strata that surround and underlay the stream, and confirm office worksheet data in the field on first site visit.
9. Determine the extent of beaver colonization of the study area from trapping records, scientific records, or other literature.

### **Fish/Aquatic Habitat (F/AH)**

1. Information on upstream and downstream barriers to fish movement.
2. Condition of aquatic habitat (instream and streambank), including the pool:riffle ratio if available
3. Presence or absence of key benthic invertebrates: has a survey been completed? Is a Biotic Condition Index (BCI) available?
4. Water temperature and streamflow data (especially during low summer flows)
5. Hydrophytic plant community types.

6. List known, historic, or suspected fish (native & non-native) in the reach, including estimates of abundance, if available.
7. History of management activities in the study reach.

**Riparian Vegetation (RV)**

1. List of prominent species/community types expected in reach (including sensitive species), based on elevation, and geologic substrate.
2. Historical vegetation cover by zone (LRZ, URZ) should be quantified from historical photos, interviews, etc., if possible.
3. Degree of ungulate impact to riparian zone (riparian forage utilization studies).
4. Distribution and abundance of non-native plant species: identify which species are non-native, their ecological role and threat(s) to the ecosystem. Identify which non-native species are invading the region and pose future threats.
5. History of riparian management activities.

**Wildlife/Habitat (WH)**

1. List of expected and known sensitive, indicator, and federally listed species
2. History of beaver presence in the region and in the study reaches.
3. Determine habitat configuration/connectivity changes over time (use aerial photos and historical photos to assess habitat fragmentation over time)
4. Data on past wildlife management activities in the riparian study area

**Human Activities/Impacts (HA)**

1. Dewatering data and stream regulation data are needed. Determine the frequency at which water is completely or partially removed from stream or spring, or regulated to the point where little to no water flows.
2. Information on how stream morphology may have been altered in the past is needed, including dikes, dams, diversions, roads, bridges, and other developments.
3. Grazing history, livestock capacity, utilization, season of use, AUM's permitted in AMP's, actual and reported use, etc.
4. Route and road history.

**APPENDIX B:  
REVISED PFCA CHECKLIST**

This appendix is a revised PFCA checklist that makes efficient use of the team's field time to provide a qualitative, accountable, and repeatable rating of stream and riparian ecosystem health, in comparison to acceptable conditions at reference sites (i.e., natural, unaltered conditions at relict sites). Factors are rated on a range of scores from 1 (low quality/poor condition) representing geomorphically inconsistent (GI) conditions, to 5 (high quality/excellent condition) representing geomorphically consistent (GC – see Appendix C for more instructions on how this term applies to the assessment) and unimpaired conditions. In the Question column: "X" involves use of the in-office worksheet (Appendix A), as well as field site visit data; "F" indicates an observation based on a field site visit. The mean score within an impact category is the arithmetic mean of the individual question scores. Some questions may be non-applicable ("n/a" or "unknown") and therefore are not included in the mean score calculation. The overall PFCA rating is the average of the impact category mean scores.

SCORE	Impact Category	Question
	<b>WQ</b>	<b>Water Quality</b>
	<i>Qualifier</i>	If the study reach is considered to be GC perennial, whether or not flow has been altered, continue. If not and flow has not been affected, this section gets an "n/a" - go to Hydro/Geomorphology. If not because flow has been eliminated, this section receives a mean score of 1.
	1 (X)	Is algal growth GC?
	2 (F)	At base flow, is the level of turbidity GC?
	3 (F)	Is the extent of channel shading GC?
	Mean Score	
	Comments	
	<b>H/G</b>	<b>Hydrology/Geomorphology</b>
	<i>Qualifier:</i>	If the study reach is not considered as GC perennial because flow has been eliminated, this section receives a mean score of 1
	1 (X,F)	Is sinuosity GC?
	2 (X)	How closely does the hydrograph resemble the GC natural hydrograph (timing, duration, frequency, magnitude, ramping rate)?
	3 (X,F)	Is the floodplain inundated in relatively frequent, GC events?
	4 (F)	Is the cover of fine sediment deposition on the streambed GC?
	5a (F)	Is the channel bank GC vertically stable?
	5b (X,F)	Is the channel GC laterally stable?
	6 (F)	Is the diversity of hydraulic habitats (e.g. oxbows, side channels, sand bars, gravel/cobble bars, terraces, cutbanks, islands) GC?
	7 (F)	Is the integrity of surface soils GC?
	8 (F)	Is the density and condition of beaver dams GC?
	Mean Score	
	Comments	

<b>F/AH</b>	<b>Fish/Aquatic Habitat</b>
<i>Qualifier:</i>	If the stream is no longer perennial, but historically was a fishery, this section receives a mean score of 1.
1 (F)	Is pool distribution sufficient to provide native fish habitat?
2a (F)	Does underbank cover provide GC aquatic habitat diversity?
2b (F)	Does overbank cover provide GC habitat for aquatic species?
2c (F)	Is the extent of channel shading GC?
3 (F)	Does the level of GC channel floor embeddedness allow for suitable spawning conditions?
4 (F)	Does GC large woody debris contribute to aquatic organism habitat?
5 (X)	Is the number and diversity of GC aquatic invertebrates consistent with stream type and geomorphic setting?
6 (F)	Does GC riparian vegetation provide for/enable terrestrial insects to drop into the stream?
7a (X)	Are native fish and other aquatic faunal population dynamics GC and consistent with the management objectives?
7b (X)	Are non-native fish and other aquatic faunal population dynamics GC and consistent with the management objectives?
8 (X&F)	Is the habitat in the study reach GC for aquatic species of special concern (e.g., sensitive, T&E, etc.)?
Mean Score	
Comments	
<b>RV</b>	<b>Riparian Vegetation</b>
1a (F)	Is native grass and forb relative abundance in the lower riparian zone (LRZ) GC?
1b (F)	Is native shrub relative abundance in the LRZ GC?
1c (F)	Is native middle canopy relative abundance in the LRZ GC?
1d (F)	Is native upper canopy relative abundance in the LRZ GC?
1e (F)	Is native grass/forb relative abundance in the upper riparian zone (URZ) GC?
1f (F)	Is native shrub relative abundance in the URZ GC?
1g (F)	Is native middle canopy relative abundance in the URZ GC?
1h (F)	Is native upper canopy relative abundance in the URZ GC?
Mean LRZ	
Mean URZ	
2a (F)	Does the % GC cover of LRZ vegetation by structural layer (shrub, canopy, etc.) offer suitable overall structure to maximize energy dissipation and wildlife habitat?
2b (F)	Does the % GC cover of URZ vegetation by structural layer (shrub, canopy, etc.) offer suitable overall structure to maximize energy dissipation and wildlife habitat?
3 (F)	Is the dominant shrub/woody tree species demography GC?
4a (F)	What is the relative extent of non-native plant species cover in the LRZ?
4b (F)	What is the relative extent of non-native plant species cover in the URZ?
5 (F)	Is the cover of vegetation contributing to GC large woody debris?
6a (F)	a. Is there evidence of GI mammalian herbivory impacts on ground cover?
6b (F)	b. Is there evidence of GI mammalian herbivory impacts on browse cover?
7 (F)	Does the LRZ woody and wetland vegetation indicate GC soil moisture?
8a (F)	a. Is LRZ vegetation growth vigorous?
8b (F)	b. is URZ vegetation growth vigorous?
Mean Score	
Comments	

<b>WH</b>	<b>Wildlife Habitat</b>
1 (X&F)	Is the habitat in the study reach GC for terrestrial species of special concern (e.g., sensitive, T&E, etc.)?
2 (F)	Are dense patches of shrubs GC and do they maximize wildlife habitat availability?
3 (F)	Are patches of middle canopy trees GC and do they maximize wildlife habitat?
4 (F)	Is the connectedness of upper canopy patches GC (i.e., are there well-connected canopies in alluvial reaches)?
5 (F)	Is the diversity and distribution of fluvial habitat types (i.e., pools, wet meadows, marshes, riparian vegetation stands) GC?
Mean Score	
Comments	
<b>HI</b>	<b>Human Impacts/activities</b>
1 (X)	To what extent is streamflow natural and GC (a dewatered stream receives a score of 1)?
2 (X)	To what extent is the state of the watershed's uplands GC?
3 (X)	Is livestock grazing within the grazing prescription appropriate to that outlined in the AMP?
4 (F)	Is the area free of development and other human impacts (i.e, parking lots, campsites, mines)?
5 (F)	Does channel geomorphology resemble the unaltered condition (i.e, impacts of channelization, check dams, irrigation canals, etc)?
6a (F)	To what extent is the area free of road impacts?
6b (F)	How far from the channel are road impacts?
Mean Score	
Comments	
Mean of Mean Scores	<b>FINAL PFCA RATING (average of scores for each of the 5 sections, not including human impacts section):</b>
<b>TREND</b>	<b>TREND: Upward, static or downward (answerable after one or more repeated visits)</b>
1 (FX)	Does the trend in water quality change indicate improvement through time?
2 (FX)	Does the trend in geomorphic change indicate improvement through time?
3 (FX)	Does the trend in fish/aquatic habitat change indicate improvement through time?
4 (FX)	Does the trend in vegetation change indicate improvement for wildlife through time?
5 (FX)	Does the trend in wildlife habitat and indicators indicate improvement through time?
Mean	
Comments	
<b>BLM ISSUES</b>	Are factors contributing to unacceptable conditions within the purview of BLM management?
Comments	If so, what are those factors?

**APPENDIX C: REVISED PFCA CHECKLIST SCORING DEFINITIONS**

A score of 1 indicates that extensive, geomorphically inconsistent (GI) alterations of an ecosystem characteristic have occurred, and a score of 5 indicates that the characteristic is geomorphically consistent (GC) and equivalent to that found in natural settings. An asterisk (\*) indicates that the question answered includes the use of the in-office worksheet (Appendix A). Note that work space is provided in this Appendix for composite scores for some questions in the Riparian Vegetation section. Some questions may be non-applicable (n/a) or unknown (unk): “n/a” and “unk” scores do not contribute to the average section score.

<b>WATER QUALITY</b>	<b>Scoring Definitions</b>
<b>WQ Qualifier Perennial Stream?*</b>	Is the study reach considered GC perennial? If not, this section gets an "n/a" - go to Hydro/Geomorphology
<b>WQ 1. Algal Growth</b>	1 pt = >50% GI algal cover
	2 pt = 25-50% GI algal cover
	3 pt = 10-25% GI algal cover
	4 pt = <10% GI algal cover, low diversity
	5 pt = <10% GI algal cover, with diversity
<b>WQ 1. Baseflow Turbidity</b>	1 pt = GI opaque water, or <40% similar to GC reference range value
	2 pt = GI near opaque, or 40-60% similar to GC reference range value
	3 pt = cloudy water, or 60-80% similar to GC reference range value
	4 pt = slight cloudiness, or 80-95% similar to GC reference range value
	5 pt = GC turbidity, >95% similar to GC reference range value
<b>WQ3. Solar Exposure/Shading</b>	1 pt = GI bare banks (completely exposed)
	2pt = GI slight shading
	3 pt = moderate shading
	4 pt = substantially shaded
	5 pt = Shading is GC
<b>HYDROGEOMORPHOLOGY</b>	
<b>Qualifier: Perennial Water?*</b>	If stream is no longer perennial, but was historically, this section receives a score of “1”.
<b>HG 1. Sinuosity*</b>	1 pt = GI straight channel (not actively moving)
	2 pt = GI minimal sinuosity
	3 pt = moderate amount of GI movement
	4 pt = Considerable GC sinuosity
	5 pt = actively and GC sinuous
<b>HG 2. Flow Regime*</b>	1 pt = Stream GI dewatered, only erratic storm-related

	flows
	2 pt = Mean baseflow GI reduced by $\geq 50\%$
	3 pt = Baseflow equivalent to natural, historic baseflow, but few, non-naturally-timed floods
	4 pt = Baseflow equivalent to natural, historic baseflow,, flood frequency and timing $>50\%$ of natural condition
	5 pt = Current flow regime is GC and indistinguishable from the natural hydrograph
<b>HG 3. Floodplain inundation (Fig. C-1)</b>	1 pt = GI bankfull/depth ratio $< 1.7$ x bankfull
	2 pt = GI, 1.5 to 1.7 x bankfull
	3 pt = GI, 1.4 to 1.5 x bankfull
	4 pt = GC, 1.4 to 1.3 x bankfull
	5 pt = GC, 1.0 to 1.2 x bankfull
<b>HG 4. Sediment deposition</b>	1 pt = $\geq 90\%$ of visible bed with GI deposition of fine sediment (no deposition at all, or excessive deposition)
	2 pt = 60-90% of bed with GI deposition
	3 pt = 30-90% of bed with GI deposition
	4 pt = 15-30% of bed with GI deposition
	5 pt = $\leq 5\%$ of bed with GI deposition
<b>HG 5a. Vertical bank stability</b>	1 pt = $\geq 90\%$ of channel bank is GI vertically unstable
	2 pt = 60-90% of channel bank is GI vertically unstable
	3 pt = 30-60% of channel bank is GI vertically unstable
	4 pt = 5-30% of channel bank is GI vertically unstable
	5 pt = $\leq 5\%$ channel bank is GI vertically unstable
<b>HG 5b. Lateral bank stability *</b>	1 pt = $\geq 90\%$ of channel is GI laterally unstable, widening or narrowing
	2 pt = 60% - 90% of channel is GI laterally unstable
	3 pt = 30% - 60% of channel is GI laterally unstable
	4 pt = 10% - 30% of channel is GI laterally unstable
	5 pt = $< 10\%$ of channel is GI laterally unstable
<b>HG 6. Hydraulic habitat diversity</b>	1 pt = no diversity of hydraulic habitats, GI
	2 pt = low diversity of hydraulic habitats, GI
	3 pt = moderate diversity of hydraulic habitats
	4 pt = moderately high diversity of GC hydraulic habitats
	5 pt = high diversity of GC hydraulic habitats
<b>HG 7. Riparian soil integrity</b>	1 pt = $> 50\%$ of riparian soil surface GI disturbed
	2 pt = 25-50% of riparian soil surface GI disturbed
	3 pt = 5-25% of riparian soil surface GI disturbed
	4 pt = 1-5% of riparian soil surface GI disturbed
	5 pt = $< 1\%$ of riparian soil surface GI disturbed
<b>HG 8. Beavers*</b>	1 pt = no (GC) beaver dams or beaver sign, beaver extirpated
	2 pt = no beaver dams, but limited recent beaver sign

	3 pt = conspicuous recent GC beaver activity, but no dams
	4 pt = much recent GC beaver activity, drags and some dams present (including evidence of those that have been washed out)
	5 pt = much recent GC beaver activity, stream channel dominated by beaver activity
<b>FISH/AQUATIC HABITAT</b>	<b>Scoring Definitions</b>
<b>Note: Perennial Water?*</b>	If stream is no longer perennial, but used to be a fishery, this section receives a score of "1".
<b>F/AH 1. Pool Distribution</b>	1 pt = No pool habitat, GI
	2 pt = 1 to several pools, GI
	3 pt = limited pool distribution, GI
	4 pt = moderate pool distribution, GC
	5 pt = abundant (~50%) pools, GC
<b>F/AH 2a. Underbank Cover</b>	1 pt = No GC underbank cover (concave bank)
	2 pt = GC underbank cover < 10% of reach
	3 pt = GC underbank cover 10% to 25% of reach
	4 pt = GC underbank cover 25% to 50% of reach
	5 pt = GC underbank cover $\geq$ 50% of reach
<b>F/AH 2b. Overbank Cover</b>	1 pt = No GC overbank cover
	2 pt = GC overbank cover < 25% of reach
	3 pt = GC overbank cover in 25-50% of reach
	4 pt = GC overbank cover in 50-90% of reach
	5 pt = >90% GC overbank cover
<b>F/AH 2c. Solar Exposure/ Shading</b>	1 pt = GI bare banks (completely exposed)
	2 pt = slight shading
	3 pt = moderate shading
	4 pt = substantially shaded
	5 pt = Shading is GC
<b>F/AH 3. Embeddedness</b>	1 pt = >50% GI gravel in riffles embedded with fine silt
	2 pt = 40 to 50% GI gravel in riffles embedded
	3 pt = 25-40% GI gravel in riffles embedded
	4 pt = 20-25% GI gravel in riffles embedded
	5 pt = <20% GI gravel in riffles embedded with fine silt
<b>F/AH 4. Role of Large Woody Debris (LWD)</b>	1 pt = No GC LWD (>10 cm in diameter, >2 m long)
	2 pt = <0.05 GC LWD pieces/m
	3 pt = 0.05-0.075 GC LWD pieces/m
	4 pt = 0.075-0.10 GC LWD pieces/m
	5 pt = >0.10 GC LWD pieces/m

<b>F/AH 5. Benthic Invertebrates*</b>	1 pt = No benthic invertebrates, GI
	2 pt = 1 GC aquatic invertebrate orders (Ephemeroptera, Plecoptera, Trichoptera, Coleoptera, Diptera) present (BCI <70)
	3 pt = 2 GC aquatic invertebrate orders present, BCI 70-80
	4 pt = 3 GC aquatic invertebrate orders present, BCI 80-90
	5 pt = 4 GC aquatic invertebrate orders present, BCI >90
<b>F/AH 6. Terrestrial Invertebrate Habitat</b>	1 pt = No GC grass/shrubs/trees overhanging the water)
	2 pt = <10% GC vegetation overhang
	3 pt = 10-25% GC vegetation overhang
	4 pt = 25-50% GC vegetation overhang
	5 pt = >50% GC vegetation overhang
<b>F/AH 7a. Native Fish (NF)*</b>	1 pt = NF historically present but all species extirpated
	2 pt = some NF species present but limited populations
	3 pt = most NF species present but <50% of population is non-native
	4 pt = all NF species present and moderately abundant
	5 pt = all NF species present and abundant
<b>F/AH 7b. Non-native Fish (NNF)*</b>	1 pt = One or more NNF populations dominate the study reach and no NF species present
	2 pt = One or more NNF populations $\leq 33\%$ or $\geq 300\%$ of management target level (MTL)
	3 pt = NNF populations 30-60% or 150-300% of MTL
	4 pt = NF populations 60-90% or 111-150% of MTL
	5 pt = NF populations >90% and <111% of MTL
<b>F/AH 8. Habitat Suitability for Aquatic Sensitive Species</b>	1. No GC habitat available for aquatic invertebrate and vertebrate sensitive species (AIVSS) in study reach
	2 pt = poor GC habitat suitability for AIVSS
	3 pt = Moderate GC habitat suitability for AIVSS
	4 pt = Good GC habitat suitability for AIVSS
	5 pt = Excellent GC habitat suitability for AIVSS
<b>RIPARIAN VEGETATION</b>	<b>Scoring Definitions</b>
<b>RV 1a, 1e. Native Vegetation Relative Abundance – Grasses, Herbs, Forbs</b>	1 pt = No native GC G/H/F species present
	2 pt = 50% of species present are native
	3 pt = 50-75% of species present are native
	4 pt = 75-90% of species present are native
	5 pt >90% of species present are native
<b>RV 1b, 1f. Native Vegetation Relative Abundance - Shrubs</b>	1 pt = No native GC shrub species present
	2 pt = 50% of species present are native
	3 pt = 50-75% of species present are native
	4 pt = 75-90% of species present are native

	5 pt >90% of species present are native
<b>RV 1c, 1g. Native Vegetation Relative Abundance</b> – <i>Mid Canopy</i>	1 pt = No native GC mid canopy species present
	2 pt = 50% of species present are native
	3 pt = 50-75% of species present are native
	4 pt = 75-90% of species present are native
	5 pt >90% of species present are native
<b>RV 1d, 1h. Native Vegetation Relative Abundance</b> – <i>Tall Canopy</i>	1 pt = No native GC upper canopy species present
	2 pt = 50% of species present are native
	3 pt = 50-75% of species present are native
	4 pt = 75-90% of species present are native
	5 pt >90% of species present are native
<b>Worksheet Space:</b>	<b>GC SC MCC TC Mean</b>
<b>RV 2a. LRZ Veg % cover by layer</b> (estimate points for Ground Cover, Shrub Cover Mid-Canopy Cover and Tall Canopy Cover; enter average value on checklist)	1 pt = <5% GC cover
	2 pt = 5-25% GC cover
	3 pt = 25-50% GC cover
	4 pt = 50-80% GC cover
	5 pt = >80% GC cover
<b>Worksheet Space:</b>	<b>GC SC MCC TC Mean</b>
<b>RV 2b. URZ Veg - % cover by layer</b> (estimate points for Ground Cover, Shrub Cover Mid-Canopy Cover and Tall Cover; enter average value)	1 pt = <5% GC cover
	2 pt = 5-25% GC cover
	3 pt = 25-50% GC cover
	4 pt = 50-80% GC cover
	5 pt = >80% GC cover
<b>RV 3. Vegetation Demography</b>	1 pt = no native and GC vegetation classes (seedlings, saplings, mature, snags) present
	2 pt = one native GC class present
	3 pt = two native and GC classes present (at least one of which is seedling or sapling)
	4 pt = three native and GC classes present
	5 pt = all native and GC classes present
<b>RV 4a. Estimated Non-native Plant Species (NNS) Cover on LRZ</b>	1 pt = >50% NNS cover
	2 pt = 25-50% NNS cover
	3 pt = 10-25% NNS cover
	4 pt = 5-10% NNS cover
	5 pt = 0-5% NNS cover
<b>RV 4b. Estimated Non-native Plant Species (NNS) Cover on</b>	1 pt = >50% NNS cover
	2 pt = 25-50% NNS cover

<b>LRZ</b>	3 pt = 10-25% NNS cover
	4 pt = 5-10% NNS cover
	5 pt = 0-5% NNS cover
<b>RV 5. Large Woody Debris (LWD) Production on Floodplain</b>	1 pt = no GC vegetation producing LWD (>10 cm in diameter and >2 m long) on floodplain
	2 pt = 1-10% of overall floodplain producing GC LWD
	3 pt = 10-25% of floodplain producing GC LWD
	4 pt = 25-50% of floodplain producing GC LWD
	5 pt = >50% of floodplain producing GC LWD
<b>RV 6a. Mammalian Herbivory Impacts on Ground Cover</b>	1 pt = >50% of ground covering plants damaged by mammalian herbivory, sign in every 1.0 m <sup>2</sup> , trampling/trailing common
	2 pt = 25-50% of plants damaged, sign ea. 10.0 m <sup>2</sup> , trampling/trails common
	3 pt = 5-25% of plants damaged, sign/trampling/trails fairly uncommon
	4 pt = 1-5% of plants damaged, sign/trampling/trails uncommon
	5 pt = <1% of plants damaged, no sign/trampling/trails
<b>RV 6b. Mammalian Herbivory Impacts on Shrub Cover</b>	1 pt = >50% of plants damaged by mammalian herbivory
	2 pt = 25-50% of plants damaged
	3 pt = 10-25% of plants damaged
	4 pt = 1-10% of plants damaged
	5 pt = <1% of plants damaged
<b>RV 7. LRZ Plant Assemblage and Soil Moisture</b>	1 pt = no GC vegetation in LRZ, and vegetation inconsistent with geomorphic setting
	2 pt = 1-25% of LRZ woody species are phreatophytes, no wetland grass/herb species present, GI
	3 pt = 25-50% of LRZ woody species are phreatophytes, <25% of grass/herb are wetland species
	4 pt = 50-75% of LRZ woody species are phreatophytes, 10-50% of grass/herb species are wetland species, GC
	5 pt = >90% of LRZ woody species are phreatophytes, >50% of grass/herb species are wetland species, GC
<b>RV 8a. LRZ Plant Vigor</b>	1 pt = LRZ perennial plants largely dead
	2 pt = >25% of LRZ perennial plants dying or dead
	3 pt = 5-25% of LRZ perennial plants wilted or dying
	4 pt = 1-5% of LRZ perennial plants wilted or dying
	5 pt = <1% of LRZ perennial plants wilted or dying stressed
<b>RV 8b. URZ Plant Vigor</b>	1 pt = URZ perennial plants largely dead
	2 pt = >25% of URZ perennial plants dying or dead
	3 pt = 5-25% of URZ perennial plants wilted or dying
	4 pt = 1-5% of URZ perennial plants wilted or dying
	5 pt = <1% of URZ perennial plants wilted or dying stressed

<b>WILDLIFE HABITAT</b>	<b>Scoring Definitions</b>
<b>WH 1. Habitat Suitability for Terrestrial Sensitive Species</b>	1. No GC habitat available for terrestrial sensitive species (TSS) potentially occurring in study reach
	2 pt = poor GC habitat suitability for TSS
	3 pt = Moderate GC habitat suitability TSS
	4 pt = Good GC habitat suitability for TSS
	5 pt = Excellent GC habitat suitability for TSS
<b>WH 2. Shrub Patch Density</b>	1 pt = No GC patches
	2 pt = Isolated small GC patches
	3 pt = Isolated GC patches
	4 pt = A few GC large open areas
	5 pt = Almost continuous GC dense shrub cover
<b>WH 3. Mid-Canopy Patch Density</b>	1 pt = No GC patches
	2 pt = Isolated small GC patches
	3 pt = Isolated GC patches, some of intermediate size
	4 pt = A few GC large open areas
	5 pt = Almost continuous GC dense mid-canopy cover
<b>WH 4. Upper Canopy Patch Connectivity</b>	1 pt = No large trees on reach, GI
	2 pt = 1-25% connected GC patches, with a few small, isolated patches or a few large trees
	3 pt = 25-50% of GC canopy patches connected
	4 pt = 50-75% of GC canopy patches connected
	5 pt = >75% of GC canopy patches connected
<b>WH 5. Fluvial Habitat Diversity</b>	1 pt = No other GC fluvial habitats present (i.e., floodplain pond, wet meadow, fluvial marsh, shrub stands, woodland stands, deciduous forest stands, etc.)
	2 pt = One other GC fluvial habitat present
	3 pt = Two other GC fluvial habitats present
	4 pt = Three other GC fluvial habitats present
	5 pt = Four or more GC fluvial habitats present
<b>HUMAN ACTIVITIES/ IMPACTS</b>	<b>Scoring Definitions (these results are not included in the final PFCA rating)</b>
<b>HI 1. Dewatering?*</b>	1 pt = no stream flow and no remnant pools supporting aquatic life, GI. In-office synthesis reveals that stream has been completely dewatered
	2 pt = no stream flow but a few remnant pools supporting aquatic life, GI
	3 pt = some, but consistent, GC surface flow between remnant pools supporting aquatic life
	4 pt = GC flow slightly reduced from expected or historic

	condition
	5 pt = stream with GC perennial flow; never dewatered and with relatively natural flood frequency. In-office synthesis reveals that stream has been completely dewatered
<b>HI 2. Upland Watershed Condition*</b>	1 pt = BLM upland range health assessments for allotment determined that upland ranges are not functioning
	3 pt = BLM upland ranges in allotment functioning at-risk
	5 pt = BLM upland ranges in allotment functioning properly
<b>HI 3. Livestock* (In Relation to Grazing Prescription)</b>	1 pt = levels of livestock grazing are much higher than the grazing prescription (many more cattle than prescribed in AMP)
	2 pt = levels of livestock grazing are higher than the grazing prescription
	4 pt = does not deviate from grazing prescription
	5 pt = less cattle than prescribed in AMP are permitted
<b>HI 4. Human Developments/ Other Impacts</b>	1 pt = 4 different impacts (parking lots, campgrounds, structures, mines, etc.)
	2 pt = 3 different impacts
	3 pt = 2 different impacts
	4 pt = 1 impact
	5 pt = no human developments/impacts
<b>HI 5. Geomorphology Change</b>	1 pt = Multiple, large GI changes from human impacts
	2 pt = Several, moderate GI changes due to human impacts
	3 pt = Moderate GI changes
	4 pt = GC, little altered by human impacts
	5 pt = GC with expected natural condition
<b>HI 6a. Road Impacts by Type</b>	1 pt = freeway adjacent to or crossing site
	2 pt = paved road adjacent to or crossing site
	3 pt = maintained dirt/gravel road adjacent to or crossing site
	4 pt = non-maintained jeep track with occasional use on site
	5 pt = no road impacts on site
<b>HI 6 b. Road Impacts Proximity</b>	1 pt = stream runs down road (old road bed)
	2 pt = road frequently crosses the stream bed
	3 pt = road does not cross the stream, but runs through LRZ

4 pt = road lies upslope from the LRZ, but within floodplain
5 pt = road is outside floodplain, or no road in vicinity

### Instructions on Revised PFCA Checklist Use

Below we describe the criteria for evaluating each element among the six Revised PFCA Checklist sections (Water Quality, Hydro/Geomorphology, Fish/Aquatic Habitat, Vegetation, Wildlife, and Human Impacts). The observer should use the background in-office information (Appendix A), the Scoring Definitions (Appendix C), and on-site visual assessments to score 1 (low quality) to 5 (high quality) points to each Checklist item. Note that all sections should be scored for their present condition, not an imagined future condition interpreted from signs of trend within the reach. Also, if the assessor rates a checklist item as “n/a” (not applicable), s/he should note why on the comment line at the end of that section. An indicator should receive an “n/a” because the item is not applicable given the known history and/or geomorphic conditions for the site (Appendix A). Also, an “n/a” may be assigned because of a lack of information about baseline/historic conditions, or may be a symptom of unusual or altered/artificial conditions. Indicators assigned an “n/a” are not included in the mean score for that impact category.

The 1-5 point ratings described in the above Scoring Definitions Sheet are designed to be used in typical, geomorphically consistent conditions found in smaller tributaries and streams on the lower elevation lands of the Colorado Plateau. In a situation where these ratings may be inappropriate because of unusual or inconsistent geomorphic conditions, then we ask the assessor to justify any deviation from these ratings in the comments section.

At the end of the checklist is a section to determine trend over the years for reaches that have received multiple PFCA’s using the revised methods. An observer can only assign a trend value to the various checklist categories and the study reach if the reach has received at least one previous PFCA.

## I. Water Quality

**WQ Qualifier. Flow:** Determine hydrographic flow patterns and status from background and historical data. The in-office database check should be consulted, and the segment should be walked to determine if it contains more-or-less permanent pools that can support invertebrates and fish, or subsurface flow that supports phreatophytic vegetation.

**WQ 1 Excessive algal growth:** Select and georeference on both endpoints the 200 m transect through the channel on the study reach. Use the ocular tube methods of Winkworth and Goodall (1962), as described in RV2 (below) and make an ocular reading every 2.0 m along the transect. Tally the total percent cover of alga and roughly estimate the morpho-species diversity of algae. Score according to the breakdown on the score-sheet. Algal growth in pristine southwestern streams is relatively common during mid-

summer, when low flows and high water clarity occurs. Therefore, algal growth may sometimes be geomorphically consistent.

**WQ 2. Turbidity.** Observe throughout the reach the relative clarity of the water column. A clear water column will allow the observer to clearly see streambed features. A cloudy water column is the result of fine sediment transport or organic particles. Opaque water is very cloudy due to large amounts of sediments being transported through the water column. The assessment should be made in the absence of storm runoff, which may affect water clarity. Scoring ranges from 1 for geomorphically inconsistent (GI) suspended sediment loads to 5 for geomorphically consistent (GC) water clarity. Many southwestern streams are naturally turbid, so high turbidity may actually represent GC conditions for many streams. Because of this, an alternate method for scoring this indicator would be simply to document the percent similarity to a comparable reference reach in the region.

**WQ 3. Shading.** Select three random points not in view from each others along the study reach to visually assess amount of shading over the water column. Shading can be a function of the landscape (i.e. cliff or canyon walls) or vegetation (i.e. trees and shrubs). Visually estimate the percent of stream shading within view of each observation point, and average those amounts to enter a score on the scoresheet. Record the time of day when this assessment is made (closer to mid-day is better), and record the cardinal orientation of the stream.

## II. Hydro/Geomorphology

When assessing the Hydro/Geomorphology components of the reach, the assessor should walk the entire survey reach, and then investigate the channel and both banks of the randomly selected, georeferenced 200 m-long transect used in WQ (above). For instream ratings, measurement and observation should be within the stream channel, in the wetted zone from bank to bank. For the streambank ratings, measurements and observation should be conducted using both banks.

**HG Qualifier:** If there is no flow currently, but this reach historically was a perennial stream, then the entire Hydro/Geomorphology section receives a score of 1. Continue on to Fish/Aquatic Habitat Section.

**HG 1. Sinuosity:** This is measured as the expected meander wave length and meander frequency from aerial photographs or detailed maps in the office. Analysis of aerial and oblique photographs has been used to interpret the magnitude and rate of channel changes in numerous studies, and can provide excellent insight into human impacts on stream channel changes. The user will score this item by assigning the sinuosity “grade” based on the Rosgen or similar stream classification scheme. The observer will take those results into the field to verify in-office finding, looking for features such as scarps that indicate evidence of channel movement.

**HG 2. *Flow regime:*** Stage-to-discharge relations are required for such interpretations, but are unfortunately usually not available. Therefore, a regional analysis of flow can be used to infer the timing of floods and droughts, and should be compiled for this question. In-the-field observations should be used to confirm or augment understanding of the extent to which flows have been modified. One good approach for interpreting the extent of flow alteration or change through time is to plot the mean pre-regulation daily flow by Julian day against that of the post-regulation period and determine the average percent change in flow (either decrease or increase in flow).

Baseflow levels are most important for fish and riparian variables; however, other components of the hydrograph (local if available, regional using the flow synthesis) will provide additional insight into flow regime changes. Using historic flow data or the regional synthesis of flows, compare the present flow regime with the historic regime including: peak, duration of peak, return frequency of peak, ramping rate to peak, and the seasonal timing of the peak. Analyses of historic flows should provide important insights into the variability of flows.

**HG 3. *Floodplain inundation:*** Using a transit or level in the field, use Fig. C-1 to determine the bankfull depth:depth ratio. Field observations of recent flood impacts (e.g., on driftwood, in debris piles, and sediment deposition) can also be used to infer or confirm relative frequency of floodplain inundation. Additionally, the same sources of data gleaned from the in-house worksheet and applied to HG2 (above) can help provide information on floodplain-inundating events.

**HG 4. *Sediment deposition:*** Use the ocular tube method in WQ2 (above) on the 200 m transect to quantify the extent of GI fine sediment deposition within riffles.

**HG 5a. *Vertical stability of stream banks:*** Estimate the percent of the length of the channel bank that exhibits actively-eroding, near-vertical cutbanks.

**HG 5b. *Lateral stability of stream banks:*** This checklist question will receive an “na” unless historical aerial photos are examined in relation to the present condition. Use aerial photography to determine any change in channel width over time. Natural alluvial channels wander across the landscape over time. Geomorphically inconsistent channel behavior may include narrowing (i.e. due to vegetation encroachment), dewatering, or entrenchment. Conversely, geomorphically inconsistent widening can result in the exposure of large, erosional surfaces. The appearance of geomorphic consistency would receive a score of 5, whereas extreme widening or narrowing would receive a score of 1.

**HG 6. *Hydraulic habitat diversity:*** Count the number of distinctive hydraulic habitats observed in the overall site walk-through, and use this number to rate this factor. Look for variably stable terraces, runs, cobble or boulder debris fans, oxbows and other off-river side channels, backwaters, sand-floored runs, and other geomorphic features. Alluvial channels can be expected to include many different hydraulic habitats, while geomorphically constrained and anthropogenically altered channels and flows may support fewer hydraulic habitats (i.e., channelized streams) or geomorphically

inconsistent habitat types (i.e., impounded ponds or lakes, deeply entrenched channels, etc.). Figure C-2 offers an example of how to score this checklist item

**HG 7. Riparian soil integrity:** Use the initial walkthrough to estimate the extent of soil disturbance throughout the study reach. Include indicators of both native ungulate and livestock hoof action, and anthropomorphic disturbances such as tire tracks when making this assessment.

**HG 8. Beavers:** Estimate the extent of beaver activity in the study reach by looking for tracks, sign, drags, digging marks, cut stems, burrows, dams, and caches.

### III. Fish/Aquatic Habitat

When assessing the Fish/Aquatic habitat components of the reach, the assessor should walk the entire survey reach, and then investigate the channel and both banks of the randomly selected, georeferenced 200 m-long transect used in WQ and HG (above). This distance is slightly longer than the standard segment measured (0.1 mile) in fisheries surveys by the State of Utah and corresponds to both BLM and USFS habitat transect measurement survey stations. For instream ratings (Question 2, 4, 6, and 8), measurement and observation should be within the stream channel, in the wetted zone from bank to bank. A U.S. Geological Survey wading rod or a staff rod marked in small length increments is adequate to quickly measure the variables to be rated. For the streambank ratings (Question 3a, b), measurements and observation should be conducted using both banks. The distribution, size and frequency of fluvial habitat features should be considered in the light of the type of stream (alluvial vs. constrained) and the geomorphic setting.

**F/AH - Qualifier:** If there is no flow currently, but this reach historically supported a fishery, then entire Fish/Aquatic habitat section receives a score of 1. Continue with Vegetation Section.

**F/AH 1. Pool distribution:** Note and record the number of pools and riffles within the 200 m. stream channel transect. Use the summary of these measurements and observations to rate pool distribution.

**F/AH 2a. Underbank Cover:** The rating should determine the amount of "undercut" bank, or underbank cover, within the reach using observations and measurements along both streambanks of the 200 m. stream channel transect (Figure C-2). For the purpose of this evaluation the underbank cover is that amount, by lineal bank distance, that has at least a 6-inch horizontal distance from the edge of the bank into the undercut (underwater). The distance can be either measured, or the undercut estimated by the observer inserting his/her boot into the bank undercut. If the boot foot can be inserted so that the bank hits the instep of the foot at the ankle height, then the undercut is at least 15 cm (6 in) under the streambank, and this is considered to be undercut. Note the total amount of underbank cover (undercut) for the entire reach, both banks, and divide by the

total to arrive at the percent undercover bank. Since the length of the transect where all stream measurements is taken is 200 m in length, the amount of streambank to be observed (both banks) would be 400 m. If the total lineal feet of both banks with undercut amounted to 80 m, the percent underbank cover would be 20% (80 m divided by 400 m total).

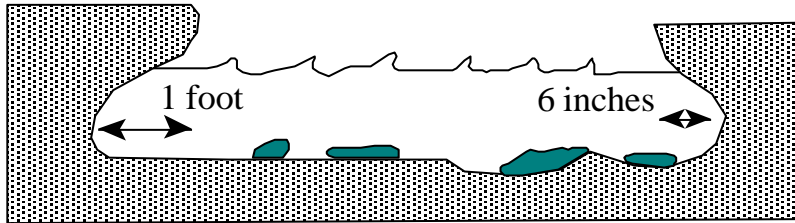


Figure C-3. Underbank Cover diagram.

**F/AH 2b. Overbank Cover:** This measures the amount of cover provided to the water surface (and corresponding cover provided for fish) within the stream reach being evaluated using both streambanks. Overbank cover includes grasses, shrubs, and tree branches that extend outward from the bank over the water (or touching it) within one foot of the existing water surface (Figure C-3). As with the underbank cover measurement above, note the amount of lineal feet on each bank that has any overbank cover, and record the total amount. The percent is derived similar to that noted above for undercover bank percent (F/AH3, above).

**F/AH 2c. Shading:** The observer should be concerned with distinguishing the extent of solar radiation impacts related to vegetation as compared to that naturally arising from the canyon walls or other natural fixed features of the landscape. Select three random points not in view of each other along the study reach, and georeference those points. Shading can be a function of the landscape (i.e., cliff, or canyon, walls) or vegetation (i.e., trees and shrubs). Estimate the percent of stream shading attributable to vegetation within view of this observation point. Record the time of day when this assessment is made (closer to mid-day is better), and record the cardinal orientation of the stream. A photograph from each point capturing hard landscape features is desirable.

**F/AH 3. Embeddedness:** To determine embeddedness of substrate (streambed gravels that are not fine surface materials or scoured gravels moving in the bed) randomly select five riffle areas in the 200 m-long transect and note the embeddedness. Randomly pick up five rocks in the riffle. Note the degree to which the rock is embedded within the substrate. A “sediment line” should be readily visible on the horizontal axis of the rock, separating separates that portion of the rock below the streambed and that above the bed in the flowing water zone (Figure C-4). If the sediment line separates the rock halfway between top and bottom, the rating is 50% embedded. Other percent ratings correspond to the relative observed degree to which the rock is embedded within the streambed.

**F/AH 4. Large woody debris:** LWD is defined as wood that is  $\geq 10$  cm in diameter and 2 m in length. Note the number of LWD pieces within the 200 m transect observed. One piece in 200m = 0.005 piece/m.

**F/AH 5. Benthic invertebrates:** This checklist item may be answered using both the in-office worksheet data and the PFCA site assessment, depending on what invertebrate data have been collected at the site in the past. Note the relative abundance and diversity of taxa within the reach. This can be done during the sampling for embeddedness in riffle areas. Pick up and observe organisms on the five rocks in each riffle area sampled. Note the numbers of each organism and its identify to Order (i.e., stonefly, mayfly, caddisfly, Diptera, beetle) to arrive at a rating score. EPA kick-netting can provide more detailed and quantifiable information, if desired. The addition of office data on the BCI would be helpful also, if available, for use in the rating score.

**F/AH 6. Terrestrial invertebrate habitat.** When walking the instream survey transect, ocularly estimate the percent of vegetation (both banks) that overhangs the main channel. Make this rough estimation for the full length of the 200 m. instream transect. Score according to Score Sheet.

**F/AH 7a. Native fish composition:** This question is based on the in-office worksheet and a sound understanding of the management objectives for the study reach, but observations the assessor makes in the field can contribute to this evaluation. If there are no existing fish survey data, or information on barriers to fish movement up and downstream, this item receives a rating of “unk(own)”.

**F/AH 7b. Non-native fish composition:** This question is based on the in-office worksheet and a sound understanding of the management objectives for the study reach, but observations the assessor will make in the field can contribute to this evaluation. If there are no existing fish survey data, or information on barriers to fish movement up and downstream, this item receives a rating of “unk(own)”.

Non-native fish, such as rainbow trout (*Oncorhynchus mykiss*) may be desirable components in some reaches, while they are viewed as undesirable in other settings. Reaches (i.e., reservoirs, some streams) may be selected for non-native fish species management, requiring interaction between state and federal fisheries managers. Management target levels (MTLs) should be established for each non-native species, based on consideration of habitat availability and population health of native species. MTLs are probably most parsimoniously developed as a percent catch per unit effort (CPUE) of the target fish species. The status of each non-native fish species may be calculated as:

$$S_{ij} = 100 * ( |P_{Oij} - P_{Tj}| / P_{Tj} )$$

where  $S_{ij}$  is the status of fish species  $i$  in reach  $j$ ,  $P_{Oij}$  is the observed CPUE of species  $i$  in reach  $j$ , and  $P_{Tj}$  is the management target level CPUE of species  $i$  in reach  $j$ . The

population levels of non-native fish species may be lower than, or in excess of, the desired MTL.

**F/AH 8. *Habitat for aquatic species of special concern:*** Aquatic habitat heterogeneity and complexity is likely to support the highest diversity of aquatic macroinvertebrate and vertebrate species of concern. This qualitative measure is generated during the initial walk-through by a visual qualitative evaluation of the entire study reach.

#### **IV. Riparian Vegetation**

Although several strategies have been proposed, the following nomenclature appears to best describe riparian plant zonation. The lower riparian zone (LRZ) is the active floodplain, the terrace overtopped by floods approximately every 1-2 yr. This may be subtended by a hydriparian zone (in and at the water's edge, particularly in wet meadow and springs habitats). The LRZ is occupied by wetland and phreatophyte graminoid, herb, shrub and tree species, but few upland species. The upper riparian zone (URZ) is the upper terrace, lying upslope from the approximate 10 yr flood peak stage and extending up to the top of fluvial deposits (the paleoflood peak stage). While some riparian phreatophyte trees occur in the URZ, it is also characterized by increasing abundance of upland species. The upland zone extends upslope from the URZ and supports only facultative riparian species, particularly at low elevations in arid regions.

Vegetation structural canopies are important to the wide variety of fauna using riparian habitats. Vegetation structure categories include the following. Ground cover is living grass and herbaceous vegetation occurring up to 1.0 m above the ground. Shrub cover is woody perennial vegetation occurring up to 4 m above the ground, middle canopy vegetation is small tree cover up to 4-10 m above the ground, and tall canopy vegetation is tree cover >10 m above the ground.

To answer the checklist items in the Vegetation Section, the user will walk the entire study reach, noting its general condition and keeping a list of all plant species encountered. The user will then conduct focused measurements on the 200 m-long georeferenced and photographed transect (the same as that used in the fisheries analyses above). Two 200m-long belt transects should be established, and should encompass the lower riparian zone (LRZ) and the upper riparian zone (URZ). The assessor should walk the LRZ and URZ transects separately, tallying plant species and making other measurements described below. These belt transects should be 5 m wide, with the edge of the transect at the water's edge (or channel edge if the stream is dry) in the LRZ, and the terrace edge in the URZ.

**RV 1a-h. *Plant species relative abundance:*** Vegetation composition should include a list of all species observed in the entire study reach in the LRZ (including those hydriparian species that are rooted in the water), and the URZ during the initial walk-through and during the walk on the 200 m. belt transects. This list should be compared with the regional list of riparian species to detect any sensitive species or unusual occurrences. Use the plant list to determine number of native, and exotic, species in the LRZ and URZ. Use these numbers, relative to total numbers of species, to answer RV 1.

**RV 2. Percent Cover by structural layer.** The 200 m-long transect should be walked in the LRZ and URZ, and the cover of vegetation observed in each structural layer (ground, shrub, midcanopy, and canopy) should be recorded. Cover is considered to be the percent of space occupied by the foliage within the structural layer. Every 2.0 m a vertically oriented ocular cross-hair tube should be used to detect (presence-absence) and cover by species in each of the four structural zones (ground cover, shrub cover, middle canopy and tree cover; Winkworth and Goodall 1962). Although this technique provides different detection sensitivities for each canopy layer (see review in Bonham 1989), the composite cover score (by structural layer) can provide an efficient, quantified estimate of vegetation cover per layer. Cover data should be compared with the average values obtained on the reference sites. Missing size classes may be geomorphically appropriate in some settings, such as constrained reaches, where recruitment is rare; however, even in these settings, size class variation is expected.

**RV 2a. LRZ Cover:** LRZ percent ground (<1 m high), shrub (1-4 m), mid-canopy (4-8 m high) and canopy (>8 m high) cover of vegetation should be estimated using the ocular tube (described above) on the transect, using “t” for a species with <1% cover. Use the number of “hits” through the ocular tube for cover in each structural layer (out of 100 samples along the 200 m transect) to determine percent cover for that layer. Use this data to achieve a percent cover estimate, and score, for each structural layer. Average the scores for the four layers to achieve an overall score for RV 2a. These data should be compared with the average of values obtained on the reference sites

**RV 2b. URZ Cover:** URZ ground, shrub, mid-canopy and canopy percent cover should be estimated using the methods described in RV 2a, and similarly compared to reference site data.

**RV 3. Demography:** The distribution of size classes of the dominant species is evaluated during the initial walk-through. Size classes are defined in RV2a (above). The observer also should comment on unexpected demographic conditions, such as absence of particular size classes of dominant species in each stratum of the vegetation.

**RV 4a. Estimated Non-native LRZ Plant Cover:** The general extent of cover and ecological importance of NNS of plants detected on the site should be visually estimated and noted during the general walk-through and while walking the 200 m LRZ belt transect.

**RV 4b. Estimated Non-native URZ Plant Cover:** The general extent of cover and ecological importance of NNS of plants detected on the site should be visually estimated and noted during the general walk-through and while walking the 200 m URZ belt transect.

**RV 5. Potential LWD Production:** Estimate the amount of mid and upper canopy vegetation capable of producing LWD, >10 cm in diameter and >2 m in length.

**RV 6a. Evidence of Mammalian Herbivory on Ground Cover:** The Winkworth and Goodall (1962) ocular tube described above and in RV2 should be used to estimate the percent mammalian herbivore impacts on ground cover on the two belt transects, and this issue should be noted in the whole study reach. This assessment can be performed simultaneously with the use of the ocular tube to assess % cover of vegetation by structural layer (RV2).

**RV 6b. Evidence of Herbivory on Browse Cover:** Mammalian herbivory impacts on browse cover should be generally estimated on the belt transects using the Winkler and Goodall (1962) ocular tube method, and commented upon in the entire study reach. This assessment can be performed simultaneously with the use of the ocular tube to assess % cover of vegetation by structural layer (RV2).

**RV 7. Soil Moisture:** The general cover of phreatophytic vegetation is a reasonable surrogate for determining GC soil moisture levels.

**RV 8a-b. LRZ and URZ Plant Vigor:** The vigor of LRZ and URZ vegetation should be noted on the transect, and commented upon in the entire study reach. Reduced plant vigor is evident from wilting, discolored foliage, die-back of branches, or dead perennial vegetation. In some situations (e.g., after exceptionally large floods), plants established under a higher than normal flow regime may die when flows return to normal, geomorphically consistent levels. Wetland vegetation, and riparian shrubs, trees and other woody taxa can exhibit clear signs of prolonged drought stress, with wilted or dead leaves, dead fine branches, etc.

## V. Wildlife Habitat (WH)

The specific needs of wildlife vary among species and at a spatial scale often greater than that encompassed in a 200 m transect. Therefore, most of the wildlife variables should be compiled on the initial full-reach walk. In general, terrestrial wildlife require particular plant species: butterflies and other insects often specialize on specific types of plants for feeding and/or breeding, while herpetofauna, birds and mammals often require specific habitat architectural configurations (e.g., dense canopy in a specific structural layer for nesting and cover) but sometimes appear to be insensitive to the particular species of plants that form the structural layer. In this checklist, the functional condition of the stream reach under analysis with respect to its native plant diversity is covered in the vegetation section of the form, while the condition of the aquatic system (which may be important to terrestrial species as a source of insect or vertebrate food) is covered in the fish/aquatic habitat section. Here, we focus on structural conditions of the systems that indicate whether or not the reach is likely to provide good habitat for the diversity of native southwestern riparian wildlife.

**WH 1. Habitat for terrestrial species of special concern:** Terrestrial habitat heterogeneity and complexity is likely to support the highest diversity of terrestrial

macroinvertebrate (e.g., landsnails, tiger beetles) and vertebrate species of concern. This qualitative measure is generated during the initial walk-through by a visual qualitative evaluation of the entire study reach.

**WH 2-3. *Shrub, mid-canopy and tall canopy patch densities:*** While in some situations, such as narrow canyons with rock sides, continuous bands of willows and other plants may not exist, alluvial reaches commonly support many such patches, particularly right along the channel. These qualitative metrics should be estimated from the initial full-site walk through. In scoring, the frequency of patches in the different structural zones should be considered in the context of the geomorphic setting.

**WH 4. *Canopy connectivity:*** Depending on the geomorphic setting, alluvial riparian zones often support many areas of continuously connected middle- and tall-canopy cottonwoods, willows, and other phreatophytes. In the larger streams and rivers, cottonwood recruitment may be episodic, and thus the canopy can and often will be of different ages and heights. To score this qualitative variable, the observer should note the connectivity of canopy patches over the full study reach.

**WH 5. *Fluvial landforms diversity:*** The different fluvial landforms should be noted during the initial walk-through, and include adjacent springs, wet meadows, marshes, cutbanks, stands of shrubs, woodlands and forests, etc. As always, the geomorphic setting will limit the potential number of fluvial landforms present on the reach. Canyons and very flat meadows support a lower diversity of fluvial landforms intermediate gradient streams with a confined flood plain.

## **VI. Human Impacts (HI)**

The Human Impacts Section should not be averaged into the final PFCA rating for the reach. Rather, it serves to inform the BLM of the various anthropogenic activities associated with the condition of the study reach. Data in this section may help the BLM evaluate the relationship between PFCA scores and human impacts, such as water diversions and stocking rate and season.

**HI 1. *Dewatering:*** This variable will be determined from the in-office worksheet and the site visit. In apparently ephemeral drainages, observers should look carefully for pools that may serve as fish and invertebrate refugia.

**HI 2. *Upland watershed condition:*** Derive the score for this variable from the BLM's completed upland range health assessments for the adjacent grazing allotment(s). These assessments should have been performed by the BLM using the newly adopted *Interpreting Indicators of Rangeland Health* protocol (Pellant et al. 2000). If the upland area is PFC, Question 4 will receive 5 points. If it is Functioning-at-Risk (FAR), it will receive 3 points, and if it is Non-Functioning (NF), it will receive 1 point. Question 4 will almost never receive 2, or 4, points. The only case where this would occur would be if the stream divides two different allotments, and the BLM found one of them to be PFC, and the other to be FAR. In this case, Question 4 would receive 4 points.

**HI 3. *Livestock use:*** This checklist item draws from the in-house worksheet. It is necessary to have obtained the Allotment Management Plan (AMP) for the grazing allotment that the reach is located within to answer this question. It is also necessary to have the most recent actual use numbers for livestock within the allotment. If the current numbers of livestock are substantially greater (by a third or more) than what is prescribed in the AMP, then this reach receives a 1 point for this question. If the current numbers of livestock are only somewhat greater (i.e., 10-15%) than what is prescribed, then this checklist item would receive a score of 2. A score of 4 reflects actual numbers of livestock that are about what is prescribed for that allotment. If actual numbers are less than the prescription or no livestock have grazed the site in the last few years though they are permitted to, this variable may receive a rating of 5. If the assessment reach occurs in an area other than a grazing allotment, and/or the current AMP does not call for grazing in this particular pasture, then this checklist item receives an “n/a.”

**HI 4. *Human development/other impacts:*** A count of the number of human impacts (e.g., parking lots, campgrounds, structures, mines, etc.) in the study reach will provide this score.

**HI 5. *Geomorphic Change:*** The estimated extent of channel and floodplain altered by human activities should be estimated during the initial walk-through. This includes evidence of flow alteration, as evidenced by unusual terrestrial plant growth near the water’s edge, signs of channel modification caused by trail and road construction, fencing, dikes, dams, culverts, diversions, riprap, bridges and off-road vehicle use.

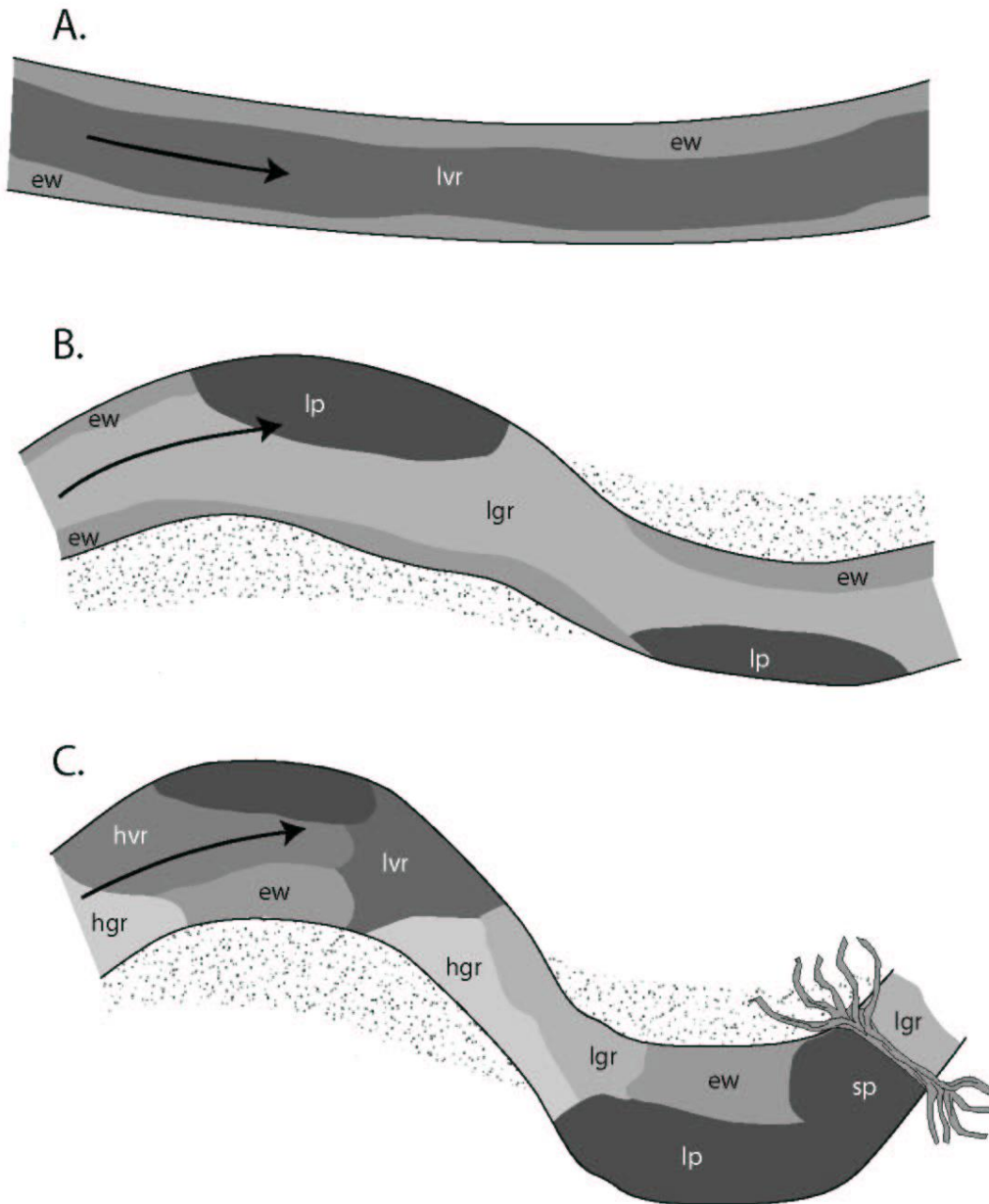
**HI 6 a-b. *Road Impacts:*** This question is only relevant if there are road impacts in the vicinity of the study reach. Question HI6a pertains to the kind of road (dirt track, maintained dirt, paved county or state, or freeway). Question HI6b pertains to the location of the road(s) in relation to the channel.

### **Final PFCA Scoring**

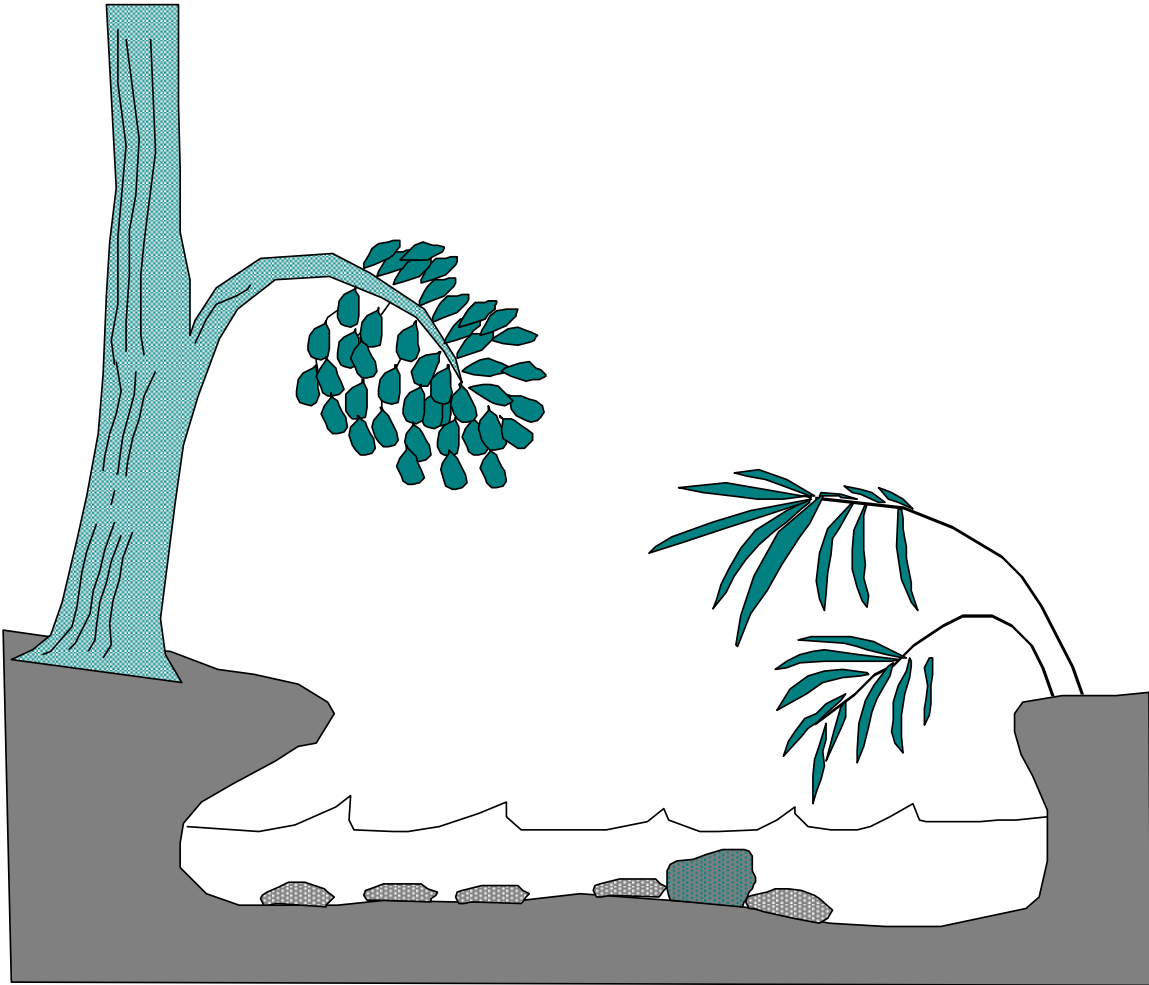
The individual scores for each item in each of the water quality, hydro-geomorphology, fish/aquatic habitat, riparian vegetation, wildlife, human impacts, ignoring the “n/a” and “unk” scores, to receive the mean section score. Section scores (except the human impacts section) are averaged to produce an overall site score for the PFCA rating. This number will range from 1 to 5. A score of about 4 should generally indicate that the site is in reasonable health and is capable of improving. A PFCA score of about 3 indicates that the site is Functioning at Risk (FAR), while lesser scores indicate that the site is Not Functioning. This analytical method should suffice until the methods can be applied to reference sites. When reference site data become available, these scores can be firmly grounded on rating levels that are scientifically credible. This scorecard approach will allow for refined interpretation of the site score, and will serve as a useful tool for future monitoring, and establishment of site trend. After a second sites visit has been conducted using our alternative protocol, a trend score can be determined.



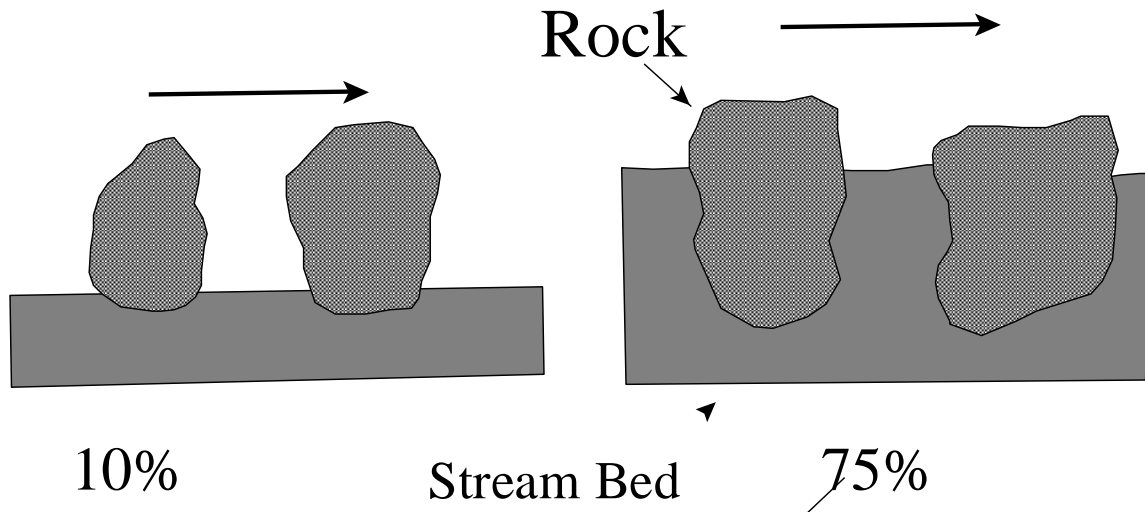
**Figure C-1. Determination of Bankfull Depth and Floodplain Access**



**Figure C-2. Example of how to Score Checklist Item HG 6, number of hydraulic habitats**



**Figure C-4. Overbank Cover, which for fish should be within 1 m of the water surface.**



**Figure C-5. Determining embeddedness**