

DRAFT MO's with TWG Comments

<i>TWG Comments</i>	<i>Responses</i>
1. Overall: Address bin issues (including proposed fundamental change to Principle 6), and all small group comments.	Concur.
2. Overall: Should Goals be limited to 2-3 resources?	Principle 1 describes the "nested set" approach being used in the Plan.
3. Overall: Which Goals are for natural processes, which are for the benefit of something else?	Goals 5 (water) and 6 (sediment) specifically address abiotic natural processes. Other goals have MOs that address biotic natural processes (e.g., competition, predation, disease, parasites).
4. Overall: MO's that relate to GCD operations need to be identified.	See Issue Paper #3 GCPA includes changes of dam operations and other MA's under other existing authorities. Identification of responsibility probably at the MA/IN level.
5. Overall: We're not limited by GCPA to dam operations.	See Response 4.
6. Implicit assumptions may be stated, rather than expanding MO to cover all resources (if we are taking care of one resource, our actions will take care of others).	No Response Needed. (NRN)

Goal 1. Protect or improve the aquatic foodbase so that it will support viable populations of desired species at higher trophic levels.

<i>TWG Comments</i>	<i>Responses</i>
7. <i>Goal 1: Add “desired” before the word “species” and substitute “appropriate” for “higher” – there may be undesirable species or upper limit of level.</i>	<i>Change made to read “desired species.” Higher trophic levels is the appropriate usage. Trophic levels are the strata in a food pyramid that begins with producers at the bottom and higher trophic levels (primary consumers, secondary consumers) at the top.</i>
8. <i>Goal 1: All Goal 1 MOs are for Goal 2.</i>	<i>Disagree. The foodbase is used not only by native fish, but by other consumers (e.g., birds, reptiles, amphibians).</i>
9. <i>Goal 1: Further discussion on trout fishery limited to above Paria River – historically trout fishery is to Davis Dam.</i>	<i>See Issue Paper #2</i>
10. <i>Goal 1: Managing for trout below Paria - how does it conflict with native fish?</i>	<i>See Issue Paper #2 Determining levels of competition predation between native and non-native fish will be considered for an IN.</i>
11. <i>Goal 1: Is it a conflict above the Paria?</i>	<i>See Response 10.</i>
12. <i>Goal 1: Division at Paria related to endangered fish recovery - separation has proven effective.</i>	<i>See Response 10.</i>

Goal 1. Protect or improve the aquatic foodbase so that it will support viable populations of desired species at higher trophic levels.

ID #	Perform some action	On some element	On some attribute	At some place	From the current level	To the target level (numbers to be validated by monitoring)	Comments
1	Maintain or attain	Algae / periphyton and aquatic macrophytes	Biomass	Above the Paria River to GCD	Cobble: 17.5 g/m ² AFDW Pools: 2.7 g/m ² AFDW (seasonal averages)	150 g/m ² AFDW, measured as a seasonal average	Shannon et al. 1999

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ID #	Perform some action	On some element	On some attribute	At some place	From the current level	To the target level (numbers to be validated by monitoring)	Comments
2			Composition	Above the Paria River to GCD	Lees Ferry: Cladophora 49.60% Chlorophyta 33.10% Fontinalis 9.10% Chromophyta 3.35% Rhodophyta 2.40% Cyanobacteria 2.50% Elsewhere in Reach Chara: No data(ND) No data available Egeria – ND No data available Potamogeton-ND No data available	x% algal species that support upright diatoms – obtain from literature	

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ID #	Perform some action	On some element	On some attribute	At some place	From the current level	To the target level (numbers to be validated by monitoring)	Comments
3			Production (is this a cost-effective measure?)		No available data	x Cladophora g/m ² /time – Information Need	
13.	<i>MO 1: Relationship of this to RNV in Principle 6.</i>				<i>See Issue Paper #6. The ad hoc believes that managing for natural pattern and process (an allochthonous foodbase) is not appropriate in Grand Canyon. Consistent with Principle 6, we believe that in this case, it is appropriate to experiment with other approaches to achieving the goal.</i>		
14.	<i>MO 1-18: Verify Current and Target levels for all MOs in Goal 1.</i>				<i>Concur.</i>		
15.	<i>MO 1-9 (?): Purpose may need to include hunting (ducks) - other than fish: shoreline reptiles, insects, and everything else.</i>				<i>Concur. See Response 8.</i>		
16.	<i>MO 3: Is managing for Clacophora what we really want to do?</i>				<i>See Response 13. We are measuring the dominant algae at this time which is cladophora.</i>		
17.	<i>MO 3: Production is a critical measure of nutrients - ties in w/flow rates.</i>				<i>Determining whether the increased information available through production estimates is worth the increased costs will be considered for an IN.</i>		
18.	<i>MOs 1-3 and 7-10: Why aquatic macrophytes aren't included with algae/periphytons?</i>				<i>Macrophytes will be included in the next draft.</i>		
19.	<i>MOs 1-3 and 7-10: Are there species of algae for which we don't want to increase biomass, productivity and composition?</i>				<i>See Response 16.</i>		

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ID #	Perform some action	On some element	On some attribute	At some place	From the current level	To the target level (numbers to be validated by monitoring)	Comments
4	Maintain or attain	Benthic Invertebrates	Biomass	Above the Paria River to GCD	Cobblebar: 5.0 g/m ² AFDM; Pool: 1.0 g/m ² AFDM	5000 g/m ² AFDW	Shannon et al. 1999
5			Composition		Cobblebar: Worms 0.4% Gammarus 3.6% Oligochaetes 5.5% Simulium 0.1% Midges 28.8% Misc. 3.8% Gastropoda 57.7% All 6937/m ² Pool: Worms 1.0% Gammarus 0.9% Oligochaetes 35.7% Simulium 0% Midges 22.3%	Relative percentages – Information Need	

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ID #	Perform some action	On some element	On some attribute	At some place	From the current level	To the target level (numbers to be validated by monitoring)	Comments
6			Production (is this a meaningful and cost-effective measure?)		No data available	Information Need	
7		Algae / Periphyton macrophytes	Biomass Mainstem below the Paria River		Cobblebar: 12.21 g/m ² AFDM Pool: 0.35 g/m ² AFDM	50 g / m ² on average	
8			Composition Mainstem below the Paria River		Cobblebar: 12.21 g/m ² AFDM Pool: 0.35 g/m ² AFDM Cladophora 29.9%; MAMB 23.7%; Oscillatoria 46.6% Pools: Cladophora 51.0%; MAMB 48.9%; Oscillatoria 0.1%	relative % of species – obtain from literature	

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ID #	Perform some action	On some element	On some attribute	At some place	From the current level	To the target level (numbers to be validated by monitoring)	Comments
9			Production (Is this a cost-effective measure?)		No data available	x g / m ² / time – Information Need	

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ID #	Perform some action	On some element	On some attribute	At some place	From the current level	To the target level (numbers to be validated by monitoring)	Comments
10			Distribution		Cobblebars at Mi 2, 61,68,127,205 for Cladophore, MAMB, Oscillatoria: 49.3, 43.3, 7.4 % 22.4, 43.1, 34.5 % 8.7, 7.2, 84.1 % 5.6, 12.4, 82 % 63.7, 12.4, 23.9 % Pools at Mi 2, 61,68,127,205 for Cladophore, MAMB, Oscillatoria: 60, 40, 0 % 28.6, 71.4, 0 % 80, 20, 0 % 15.2, 84.8, 0% 71.2, 28.5, 0.3% 15.2, 84.8, 0 % 71.2, 28.5, 0.3 %	Information Need	

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ID #	Perform some action	On some element	On some attribute	At some place	From the current level	To the target level (numbers to be validated by monitoring)	Comments
20.	<i>MO 4: Examine the numbers in Current and Target Levels</i>				<i>Concur.</i>		
21.	<i>MO 4: Some of these comments apply to more than one MO.</i>				<i>Concur.</i>		
22.	<i>Comment for all fish MOs: Purpose, as far as native/non-native above Paria, should be integrated with GLCA fish management plan.</i>				<i>Concur with consistency with NPS on values for which the park units were established with native fish and will consider the GLCA fish management plan.</i>		
23.	<i>MOs 7-10: add aquatic macrophytes to element?</i>				<i>Concur.</i>		

11	Maintain or attain	Benthic Invertebrates	Biomass	Mainstem Below the Paria River	Cobblebars: 0.96 g/m ² AFDM Pools: 0.054 g/m ² AFDM	x g / m ² on average – obtain from literature	
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Goal 1. Protect or improve the aquatic foodbase so that it will support viable populations of desired species at higher trophic levels.

12			Composition		<p>Cobblebars: Worm 0.4%, Gammarus 7.1%, Other oligochaete 8.2%, Simulium 4.3%, Chironomid 55.4%, Misc. 3.6%, Gastropod 21.0%</p> <p>Pools: Worm 0.4%, Gammarus 1.1%, Other oligochaete 30.1%, Simulium 14.3%, Chironomid 48.9%, Misc. 1.2%, Gastropod 4.0%</p>	relative % of species – obtain from literature	Shannon et al. 1999
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Goal 1. Protect or improve the aquatic foodbase so that it will support viable populations of desired species at higher trophic levels.

13			Production (Meaningful and cost- effective measure?)		No data available	x g / m ² / time Information Need	
14			Distribution		Cobblebars/ m2, worms, Gammarus, oligochaete s, Simulium, midges, misc., and gastropod: Mi. 2-- 20,500, 120,10,215 0, 20,1580	Information Need	
24. MO's 11-14: Benthic invertebrates downstream of the Paria River – is this place description specific enough?				Further information may result in discrimination by reaches.			
25. MO 15: Would we manage drift separately from algae and benthic invertebrates, or is this a monitoring need?				The need to manage drift separately for algae and inverts will be considered for an IN.			
15	Maintain or attain	Foodbase drift	Abundance	Mainstem below GCD	x g / m3 obtain from literature	x g / m ⁺ obtain from literature	
16			Composition		Obtain from literature	Obtain from literature	
26. MO 15: Do MOs adequately depict the downstream increasing heterotrophic nature of the river?				See Response 24.			
27. MOs 15 and 16: Purpose: Maintain satisfactory CRE function for the benefit of target resources.				Disagree. Purpose would restate the goal.			
28. MOs 15 and 16: Need a distribution attribute for drift?				See Response 24.			

Goal 2. Maintain or attain viable populations of existing native fish and remove jeopardy from humpback chub and razorback sucker.

<i>TWG Comments</i>	<i>Responses</i>
29. Goals 5 and 6 relate to Goal 2 - these two goals should be objectives under other goals.	We retained goals 5 and 6 because ecosystem processes are important considerations not only at the species level, but also at the biotic community and the ecosystem level.

ID #	Perform some action	On some element	On some attribute	At some place	From the current level	To the target level (numbers to be validated by monitoring)	Comments
15	Maintain or Attain	Foodbase drift	Abundance	Mainstem below GCD	Plants – .024g/m3/s; detritus - .056 g/m3/s; Inverts -- .001g/m3/s	X g / m3 Obtain from literature	
16			Composition		Plants – 29.2% Detritus – 69.3%; CPO M inverts 1.1%, FPOM inverts 0.4%	Obtain from literature	
17	Maintain or attain	Humpback chub (>=150 mm)	Abundance	LCR +/- 3 miles in mainstem	4,346 in LCR, 3,750 in CR	Based on 91-96 popn estimate; PVA; & Ne – IN	Douglas and Marsh 1996; Valdez and Ryel 1997
30. MO 17: Place should be “LCR <u>and</u> +/- 3 miles.”				Concur. Changes will be made throughout document.			
31. MO 17: Use updated numbers as we can.				Concur.			
32. MO 17: If numbers to remove jeopardy are published (this summer), use them.				See Issue Paper #8			
33. MOs 17-25 and 28: Mos should be consistent with recovery plans for listed fish.				See Issue Paper #8.			

Goal 2. Maintain or attain viable populations of existing native fish and remove jeopardy from humpback chub and razorback sucker.

34. <i>MOs 17-20: Significance of size indications?</i>	<i>HBC <50 mm are young-of-the-year. Fish between 50 and 150 mm are either YOY or age 1. Fish below 150 mm are too small to PIT tag, so they represent the size classes for which we do not have population estimates. Fish >150 mm are PIT tagged fish (not necessarily mature fish), and represent the size class for which population estimates exist. HBC do not usually become mature until they are larger than 150 mm</i>
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18	Maintain or attain	Humpback chub (>= 150 mm)	Abundance	Mainstem other than LCR +/- 3 miles	225 (1993 – 94 popn estimate)	Based on:91-96 popn estimate; PVA; & Ne – IN	
19		Humpback chub (> 50 mm and < 150 mm)			0-74 HBC captured/trip from 06-09/98	TBD CPUE – Information Need	Note: CPUE is a surrogate for abundance.
20					LCR +/- 3 miles in mainstem	06/99 in LCR: 11 HBC in 4 sets of 8 minnow traps; 8 HBC in 4 trammel net sets. 06/99 in CR at LCR: 2 HBC in 5 electrofishing runs; 8 HBC in 3 nights of trammel netting; 11 HBC in 29 hoopnet sets; 0 HBC in 24 minnow trap sets	

35. <i>MOs 17-18: Put confidence intervals in population estimates - current level.</i>	<i>Concur.</i>
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Goal 2. Maintain or attain viable populations of existing native fish and remove jeopardy from humpback chub and razorback sucker.

36.	MOs 18-20 and 22-25: For MOs re: humpback chub in mainstem, the purpose is not for - add to purpose "Maintain or attain viable populations."	Purpose is both viable populations and removal of jeopardy. Note, however, that removal of jeopardy may entail more than attaining a certain population size.
37.	MO 19: Should the action be "Maintain or increase," like MOs 17-20?	Concur.
38.	MOs 19 and 20: Do these lead to removal of jeopardy? (see Purpose)	Achieving these objectives should contribute, at least in part, to removal of jeopardy.
39.	MOs 19 and 20: In the Purpose - indicate they are <u>part</u> of removal of jeopardy.	We will delete purpose statements that restate the goal.

21	Establish	Humpback chub	Population	CRE downstream of GCD	One self-sustaining popn (LCR)	One additional self-sustaining population	Removal of jeopardy (other MOs or MAs may follow from review of the RPAs in the BO)
40.	MO 21: This MO doesn't relate to operation of GCD - may not be in AMP.			We retain this objective because it is necessary to achieve the goal (see Principle 1). The responsibility for accomplishing actions outside the AMP will eventually be noted in the Strategic Plan.			
41.	MO 21: This MO does relate to the operation of GCD.			See Response 40.			

22	Attain	Humpback chub	Condition	LCR +/- 3 miles in mainstem	Information Need	Information Need	To measure health of HBC
23			Health	Mainstem	Information Need	Information Need	To address disease and parasite issues
42.	MOs 22-23: Should these be for adults only or all life stages?			Determining the value of a condition attribute at various stages will be considered for an IN.			
43.	Can MOs 22 and 23 be combined?			Determining value of separate estimates will be considered for an IN.			
44.	MOs 22 and 23 refer to different groups of fish so they should be kept separate.			Determining value of separate estimates will be considered for an IN.			
45.	MOs 22 and 23: "Condition:" should we add an MO with "health" as an attribute to address disease and parasite issues?			Concur. See revised MO.			
46.	These may be necessary but not sufficient to remove jeopardy.			NRN.			

Goal 2. Maintain or attain viable populations of existing native fish and remove jeopardy from humpback chub and razorback sucker.

24	Maintain or attain	Humpback chub	Spawning	LCR +/- 3 miles in mainstem	08-09/98 56 YOY caught in minnow traps from LCR-Tanner	Information Need (metric is unknown)	Gorman and Bramblett 1999
47. MO 24: Why was spawning selected as the index as opposed to reproduction or recruitment?				The appropriate attribute will be determined by the Long-Term Fish Monitoring Group. Spawning is retained as a place holder.			
48. MO 24: Is monitoring spawning a smart objective? May have a good spawn only 1 in 5 years.				See Response 47.			
25	Maintain or attain	Humpback chub	Spawning	Mainstem	9 fry detected in 08-09/98	Information Need	Gorman and Bramblett 1999
49. MOs 24-25: Attribute should be "recruiting."				See Response 47.			

ID #	Perform some action	On some element	On some attribute	At some place	From the current level	To the target level (numbers to be validated by monitoring)	Comments
26	Reduce	Non-native fish	Predation on native fish	CRE downstream of GCD	1243 NN fish (58% of total) detected in CR, 06-09/98	Information Need	Gorman and Bramblett 1999
50. MO 26: Predator removal strategy for upper basin may be help with IN.				Concept of a predator removal strategy should be investigated. Will be considered for an IN.			
51. MO 26: Does this conflict with maintaining trout (MO 36)?				See Issue Paper # 2.			
52. MO 26: Should break out predators – may not be a conflict.				Determining species-specific rates of predation will be considered for an IN.			

27	Reduce	Non-native fish	Competition with native fish	CRE downstream of GCD	No data available	Information Need	No available data
53. MOs 26 and 27: Should the place be below the Paria? May conflict with MOs under Goal 4.				See Issue Paper #2.			

Goal 2. Maintain or attain viable populations of existing native fish and remove jeopardy from humpback chub and razorback sucker.

54.	MOs 26 and 27: Action should be “determine.”	We believe the hypothesis that non-native fish significantly impact native fish through competition and predation is valid. Determining species-specific competition will be considered for an IN.
55.	MOs 26 and 27: The action should be “reduce,” not “determine.” “Determine” is the IN.	See Response 54.
56.	MOs 26 and 27: The action should be “minimize.”	See Response 54.
57.	MOs 26 and 27: For 4 endangered fish, recovery goals may conflict with GLCA fish management plan. Resolution needed.	See Issue Paper #2.
58.	MOs 26 and 27: Should MO be “reduce non-native population?” (combine the two MOs)	We believe the MO is properly targeted. Whether or not reduction of non-native fish is warranted depends on the rates of predation and competition.
59.	MOs 26 and 27: Should MOs be split into separate non-native species?	Determining abundance and distribution of non-natives as well as species-specific rates of predation competition will be considered as INs.

28	Attain	Razorback Sucker	Populations	CRE downstream of GCD	None	Information Need: To the capability of the habitat to support the species	Gorman and Bramblett 1999
60.	MO 28: How is this related to dam operations?				See Response 40.		
61.	MO 28: Needs clarification: is removal of jeopardy the correct purpose? There are none in GC.				Removal of jeopardy is appropriate. See the Biological Opinion.		
62.	MO 28: Consider moving to Goal 3.				We retain it here because of the removal of jeopardy clause in the goal.		

29	Maintain or increase	Flannelmouth sucker	Abundance	CRE downstream of GCD	In CR in 06-09/99: FMS--113 (5.3%); BHS--41 (1.9%); SPD—391 (18.2%) of 2143 fish captured	Information Need	Gorman and Bramblett 1999
30		Bluehead sucker	Abundance				Gorman and Bramblett 1999
31		Speckled dace	Abundance				Gorman and Bramblett 1999
63.	MO 31: Use “Maintain” v. “Maintain or increase.”				Concur.		

Goal 2. Maintain or attain viable populations of existing native fish and remove jeopardy from humpback chub and razorback sucker.

64. MO 31: Attribute should be "populations" instead of "abundance."	Abundance is the appropriate attribute.
65. MO 31: Whole reach?	Yes. See Issue Paper #12.

Goal 3. Restore populations of extirpated species as feasible.

ID #	Perform some action	On some element	On some attribute	At some place	From the current level	To the target level (numbers to be validated by monitoring)	Comments
32	Restore	Colorado pikeminnow	Abundance	CRE downstream of GCD	None	TBD: obtain from literature and Information Need	To restore ecosystem patterns as articulated in Principle 6. Gorman and Bramblett 1999
66. MO 32: Concern about introduction of predator in trout fishery.				See Issue Paper #2. Determining for feasibility will be considered for an IN.			
33	Restore	Bonytail	Abundance	CRE downstream of GCD	None	TBD: obtain from literature and Information Need	To restore ecosystem patterns as articulated in Principle 6. Gorman and Bramblett 1999
67. MOs 32 and 33: Should be consistent with recovery plan.				See Issue Paper #8.			
68. MO 33: Should be more narrow description of Place, probably below the Paria.				See Issue Paper #2. Determining feasibility of reintroduction will be considered for an IN.			
69. MOs 32-34: Place should be downstream of the Paria.				See Response 68.			
70. MOs 32-34: Above the Paria includes native and non-native.				See Response 68.			
71. MO 33: Is there concern about hybrids between HBC and bonytail?				Concern will be addressed in determining the feasibility.			
34	Restore	Roundtail Chub	Abundance	CRE downstream of GCD	None	TBD: obtain from literature and Information Need	To restore ecosystem patterns as articulated in Principle 6. Gorman and Bramblett 1999
72. MO 34: Concern with hybridization with HBC.				See Response 71.			

Goal 3. Restore populations of extirpated species as feasible.

35	Restore	River otter	Abundance	CRE downstream of GCD	None	TBD: obtain from literature and Information Need	Reintroduce a top predator into the CRE to re-establish ecosystem patterns and processes, as articulated in Principle 6. Hoffmeister 1986
73.	<i>MOs 32 through 35: These MOs may be outside of the AMP. They are outside of effects, impact, and influence of operations of GCD.</i>			<i>See Response 40</i>			
74.	<i>MOs 32 through 35: These MOs are outside of the Loveless guidance document.</i>			<i>See Response 40.</i>			
75.	<i>MOs 32 through 35: It is outside of the ROD to restore species.</i>			<i>See Response 40.</i>			
76.	<i>MOs 32-34 are within the scoping program and guidance document.</i>			<i>See Response 40.</i>			
77.	<i>MO 35: Is this premature? Question as to whether they are as abundant as they ever were.</i>			<i>Concern will be addressed in determining feasibility and will be considered for an IN.</i>			
78.	<i>MO 35: Species is now extinct. The word “restoring” is not correct if extinct, would be restoring the function.</i>			<i>The feasibility should take into account questions regarding historic abundance in Grand Canyon, the validity of the sub-species, and park service policy that the “genetic type used in restoration most nearly approximates the extirpated genetic type.”</i>			
79.	<i>MO 35: Should be an IN, not an MO.</i>			<i>See Principle 6, and Response 66.</i>			

Goal 4. Maintain a wild reproducing population of rainbow trout above Lees Ferry, to the extent practicable and consistent with the maintenance of viable populations of native fish.

80. <i>Goal 4: Goal should read “above the Paria River” instead of “above Lees Ferry.”</i>	<i>Goal will be changed to “above the Paria River.”</i>
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ID #	Perform some action	On some element	On some attribute	At some place	From the current level	To the target level (numbers to be validated by monitoring)	Comments
36	Maintain or attain	Rainbow trout	Abundance	Above the Paria River	262,000 Age II+ (1998); CPUE = 7.1 (catch/min. electroshocking) in 09/97	100,000 Age II+	Sufficient to meet population target of >= 100,000 Age II+ McKinney and Persons 1999
37			Growth Rate		~ 15” by Age III	~ 18” by Age III	
38			Condition		Wr = 0.82	Wr = 0.90	
38A			Health				Referring to disease and parasites

81. <i>IN for MO 36: Evaluate the method by which Current Level and Target Level are derived.</i>	<i>Concur.</i>
82. <i>MO 38: Should “health” be changed to “condition”?</i>	<i>Health will be changed to condition.</i>
83. <i>MO 38: Change Attribute from “health” to “condition” to refer to disease and parasites.</i>	<i>We will add an MO for trout health.—38A</i>
84. <i>MOs 36-38 could be one MO with multiple Attributes - Element, Place, and Levels are the same.</i>	<i>Concur.</i>

39	Maintain or attain	Rainbow trout	Spawning	Above the Paria River	Information Need	Information Need	
85. <i>MO 39: Change Attribute from “spawning” to “recruitment.”</i>				<i>See Response 47.</i>			

Goal 5. Establish water temperature, quality, and flow dynamics to achieve GCDAMP ecosystem Goals.

ID #	Perform some action	On some element	On some attribute	At some place	From the current level	To the target level (numbers to be validated by monitoring)	Comments
40	Attain	Water	Temperature range	Mainstem	6.93-12.2°C nr CDam to 8.44-18.56 °C at Mile 226	Use decision process	Korn and Vernieu 1998
41			Seasonal variability of temperature		5.29 °C at Dam to 10.12 °C at Mile 226		
86.	<i>Combine MO 40 with MO 41 - multiple Attributes.</i>				<i>Concur.</i>		
87.	<i>MOs 40 and 41: Add an MO for water temperature in Lake Powell.</i>				<i>See Issue Paper #1.</i>		
88.	<i>MO 41: Expand the language in the Purpose to reflect range and variability.</i>				<i>Seasonal variability is in the attribute.</i>		
89.	<i>MO 41: Does this include spatial variability?</i>				<i>Longitudinal variability will be considered as the targets are set.</i>		

Goal 5. Establish water temperature, quality, and flow dynamics to achieve GCDAMP ecosystem Goals.

42	Maintain	Water	Quality (nutrients, salinity, pH, DO, nitrogen, phosphorus, microbiology, perhaps others)	Mainstem	As of Sept 1999 at Lees Ferry: Temp=11oC; Turbidity=0.25 NTU; Specific conduct. =714uS/cm; DO=7.4 mg/L; pH=8.0; Bicarb=160mg/L; Dslv NH4<0.02; Tot NH4=0.03; NH4+OrgN=.21; NO2+NO3=.28; Tot P<0.05; DslvOrt-P<.001; DslvOrgC=3.1; SuspOrgC<0.02; Dslv Ca=59 mg/L; Dslv Mg=20 mg/L; Dslv Na=57 mg/L; Dslv K=3.0 mg/L; Dslv Cl=33 mg/L; DslvSO4=165 mg/L; Dslv S=1 mg/L; Selenium=1 ug/L	Obtain from literature and use decision process	USGS. NASQWAN data (2000)
90. MO 42: This MO contains a lot of Attributes – will the most important ones be identified? Should there be an IN to ID those?					Significant attributes will be split out. Determining which attributes are significant will be considered for an IN.		
91. MO 42: Purpose is unclear. What does standard mean?					Delete ? *		

Goal 5. Establish water temperature, quality, and flow dynamics to achieve GCDAMP ecosystem Goals.

92.	<i>MO 42: We may not have any control over salinity or phosphorus.</i>	<i>See Response 40.</i>
93.	<i>MO 42: This should include Lake Powell or we need an additional MO.</i>	<i>See Issue Paper #1.</i>
94.	<i>MO 42: Add that the Navajo Nation uses water from the dam down to the LCR for drinking water.</i>	<i>Purpose is no longer relevant. MO revised.</i>
95.	<i>MO 42: Outside impacts will be pronounced and perhaps outside the AMP. Will we look at watershed activities and impacts?</i>	<i>See Response 40.</i>
96.	<i>MO 42: Others use drinking water from all of Colorado River.</i>	<i>Purpose was deleted.</i>
97.	<i>MO 42: May fall outside of AMP.</i>	<i>See Response 40.</i>

43	Maintain	Flow dynamics	Power plant operations	Mainstem	Remain within ROD	Information Need	U.S. Dept. Interior 1996
44			BHBF flows		45,000 cfs March to April	Use decision process	U.S. Dept. Interior 1996
45			Habitat maintenance flows		ROD	ROD	
98.	<i>MO 43: Purpose is for resource and ecosystem.</i>				<i>We will strike the statement as it is redundant with the goal.</i>		
99.	<i>MO 43: The Element could be Water. In that case, Attribute would be hydrology/power plant operations, hydrology/BHBF, etc.</i>				<i>Retain the element and attribute as written.</i>		
100.	<i>MO 43: The Element is Water, the Attribute is Flow Dynamics, and the Target would be the different flows.</i>				<i>See Response 99.</i>		
101.	<i>MO 43: Flow dynamics is the Attribute.</i>				<i>See Response 99.</i>		
102.	<i>MO 43: Keep it the way it is written.</i>				<i>See Response 99.</i>		

Goal 5. Establish water temperature, quality, and flow dynamics to achieve GCDAMP ecosystem Goals.

46	Conduct	Flow Dynamics	Experimental Flows	Mainstem	Experimental design recommendations to TWG/AMWG	Information Need	GCMRC Staff 1998
103. MO 46: Attribute should be experimental flows, and Purpose should be not just specifically for native fish but to move within the RNV.				Attribute will be changed to experimental flows and purpose will be deleted. Action changed to Conduct. Will change current level to IN and move to goal 13.			
104. MO 46: Purpose should be meeting conditions of the Biological Opinion.				See Response 103			
105. MO 46: Likes it the way it is written.				See Response 103.			
106. MO 46: Drop this as an MO. You're not maintaining it, you are conducting it. It doesn't meet the definition.				See Response 103.			
107. MOs 44 – 46: These are management actions.				See Response 103.			
108. MOs 44 – 46: Purpose - will this be defined more clearly – specific resources with flows attached to those resources?				See Response 103.			
109. MOs 43-46: All Flow Dynamics MOs could be one MO with purpose stated in the goal.				Concur with MOs 43-45. See Response 103.			

Goal 6: Maintain or attain levels of sediment within the main channel and along shorelines to achieve GCDAMP ecosystem goals.

<i>TWG Comments</i>	<i>Responses</i>
<i>110. Goal 6: Goal doesn't make sense: fine sediment storage is ephemeral in main channel.</i>	<i>Goal will be rewritten to "Maintain or attain levels of sediment within the main channel and along the shorelines to achieve GCDAMP ecosystem goals."</i>
<i>111. Goal 6: Prefer "supply" to "storage." Storage is for the sides; supply indicates a constant source of sediment into the system.</i>	<i>See Response 110.</i>
<i>112. Goal 6: Fish habitat is created below the water within the eddies.</i>	<i>NRN</i>
<i>113. Goal 6: Purpose of this goal is not related to ecosystem goals (including fish).</i>	<i>We retained goals 5 and 6 because ecosystem processes are important considerations not only at the species level, but also at the biotic community and the ecosystem level.</i>
<i>114. Goal 6: "Maintain a sustainable" is redundant.</i>	<i>See Response 110.</i>
<i>115. Goal 6: Define sediment so it's not just "fine." There should be a goal on coarse sediment or re-write this one. Coarse sediment is important for ecosystem (Cladophora, fish)</i>	<i>See Response 110.</i>
<i>116. Goal 6: The small group felt coarse sediment wasn't able to be manipulated like fine sediment.</i>	<i>NRN.</i>
<i>117. Goal 6: The possibility of manipulating coarse sediment becomes easier with higher flows.</i>	<i>NRN.</i>
<i>118. Goal 6: Coarse grain sediment is addressed with rapids MO.</i>	<i>NRN.</i>
<i>119. Goal 6: Concern about conflict between coarse and fine sediment because if we manage for fine sediment, what isn't fine will be coarse.</i>	<i>See Response 110.</i>
<i>120. Goal 6: Can add spawning MOs to the fish goals.</i>	<i>Concur.</i>

Goal 6: Maintain or attain levels of sediment within the main channel and along shorelines to achieve GCDAMP ecosystem goals.

ID #	Perform some action	On some element	On some attribute	At some place	From the current level	To the target level (numbers to be validated by monitoring)	Comments
47	Maintain or attain	Sediment	Abundance (area and volume)	Main channel below power plant capacity	No mass balance data presently published. On 990501 Upstrm fr/ LCR (total at 14 sites) =254,000 m ³ ; dnstrm fr/ LCR (total at 21 sites)=75,000 m ³ . Area data pending.	x m ² and x m ³ as a rolling average – IN	To support deposition on channel margins. Kaplinski et al. 2000; Topping et al. 2000
48			Grain-size characteristic		0.3-0.4 mm system-wide, but highly flow and time dependent	D50 <= x mm (upper limit) Information Need based on flooding levels and transport capabilities	
49			Distribution (area and volume)		See volume data above	x m ² and x m ³ average by reach – IN	
<i>121. MO 48: Fine sediment is that less than 2 mm</i>				<i>Concur.</i>			
<i>122. MO 49: How will it be measured? (Every year there are side-scan sonar sweeps for sediment on the channel bed.)</i>				<i>Determining methods will be considered for an IN.</i>			
<i>123. MOs 47-49: "Below power plant capacity" - storage starts at lower level of power plant capacity – 8-13,000 cfs at sandbars and margins, 5-8,000 cfs at mainstem and eddies.</i>				<i>NRN.</i>			

Goal 6: Maintain or attain levels of sediment within the main channel and along shorelines to achieve GCDAMP ecosystem goals.

ID #	Perform some action	On some element	On some attribute	At some place	From the current level	To the target level (numbers to be validated by monitoring)	Comments
50	Maintain or attain	Sediment	Abundance (area and volume)	Eddies up to power plant capacity	No mass balance data presently published. Volume on 990501 Upstrm fr/ LCR (total at 14 sites) =173,400 m3; dnstrm fr/ LCR (total at 21 sites)=115,720 m3. Area data pending.	x m ² and x m ³ Information Need	For backwater development and deposition on channel margins. Kaplinski et al. 2000; Topping et al. 2000
51			Grain-size characteristic		Ca. 0.15-0.18 mm	D50: x mm Information Need	
52			Distribution		See volume data above	x m ² and x m ³ average by reach Information Need	
124. MO 52: Why is abundance repeated? (typo - cross off "abundance and")					Concur. The attribute for MOs 47, 50 & 53 is abundance, and the metric is surface area and volume by reach. The attribute for MOs 49, 52 & 55 is distribution, and the metric is number of sandbars by reach.		
125. MO 50-52: One MO, multiple attributes.					Concur		
126. MO 50-52: More specificity in purpose – more on linked effects (e.g., sediment and flow)					Concur. Additional comments on linkages would be useful.		
127. MO 50-52: Provide linkages - put # of MO that this links to.					See Response 126.		

Goal 6: Maintain or attain levels of sediment within the main channel and along shorelines to achieve GCDAMP ecosystem goals.

ID #	Perform some action	On some element	On some attribute	At some place	From the current level	To the target level (numbers to be validated by monitoring)	Comments
53	Maintain or attain	Sediment	Abundance (area and volume)	Shorelines > power plant capacity or up to maximum BHBF	Mean relative Bar Ht in Glen Cyn=0.37m, in Marble Cyn=0.6m, in Grand Canyon=0.8m in relation to a MRBar Ht of ~ 0.5m prior to the 1996 Test Flood.	x m ² and x m ³ Information Need	Kaplinski et al. 2000
54			Grain-size characteristic		D50 = 0.15-0.18mm	D50: x mm Information Need	Topping et al. 2000
55			Distribution		See bar ht data above	x m ² and x m ³ average by reach Information Need	Kaplinski et al. 2000
128. MO 53: Purpose is camping beaches, cultural sites, and riparian area maintenance.				We will not add because it is redundant with goal.			
129. MO 53-55: Add "retention" as well as "storage" to the purpose.				See Responses 110 and 128.			
130. MOs 53-55: Retention is implied in "sustainable."				See Responses 110 and 128.			

Goal 7: Maintain or attain viable populations of Kanab ambersnail.

<i>TWG Comments</i>	<i>Responses</i>
<i>131. Goal 7: The expert panel said it's possible in a natural regime for a species to "blank out." The goal should be to prevent man-caused extinction, not prop up a population that could go extinct anyway.</i>	<i>NRN.</i>

ID #	Perform some action	On some element	On some attribute	At some place	From the current level	To the target level (numbers to be validated by monitoring)	Comments
56	Attain and Maintain	Kanab ambersnail	Population ¹	Vasey's Paradise	Low Zone (<70k cfs) in April, May, July, and late Sept./early October in 1998--9500, 7000, 8000, and 16000 KAS; in 1999--7100, 6400, 20000 and 35000	Viable population level as indicated by the appropriate model or analytical technique – Information Need	Meretsky 1999
<i>132. MO 56: Don't think the footnote is appropriate. First sentence - viability will not be measured. It's the things in 2nd sentence that will be measured.</i>					<i>We retained "population" as the attribute until the specific population viability attributes are identified. Determining these attributes will be considered for an IN..</i>		
<i>133. MO 56: There is a 98-99 draft report on the population estimates.</i>					<i>NRN.</i>		
<i>134. MO 56: Assumption in the Purpose column is debatable.</i>					<i>We deleted the purpose.</i>		
<i>135. MO 56: Spell out the Attributes as MOs.</i>					<i>See Response 132.</i>		

¹ The specific attribute will depend on how population viability is determined. Possible indicators include over-wintering abundance, health, recruitment, size class, patch size, etc.

Goal 7: Maintain or attain viable populations of Kanab ambersnail.

57	Attain and maintain	Kanab ambersnail	Population	AZ (3 trans-location sites in GC)	300 KAS released/site in 1998-1999: Keyhole Spr—3 KAS relocated in Sept 1999; Elves Chasm—21 KAS; Low Deer Cr. Spr—0 KAS	One additional Viable Population – Information Need	To meet the existing BO until it is revised. As indicated in Principle 7, some actions may be outside the AMP. AGFD 1999.
136. MO 57: Action should be “maintain.”				We retained the action here, and changed the action in MO56 to “Attain and Maintain.” The metric in both is some indicator of population viability. See Response 132.			
137. MO 57: BO doesn’t call for 3 populations – Place should be one site.				Disagree. The target, not the place, is one viable population			
138. MO 57: All 3 populations are protected if they survive – at least one would survive is the hope. “At least one.”				NRN.			
139. MO 57: In light of the panel, how will MOs change? How do we change an MO if the panel recommends differently?				MOs will be revised as new information is received..			
58	Maintain	Kanab ambersnail	Habitat (composition and area in m ²)	Vasey’s Paradise	Low zone (<70K cfs) in 1998: monkeyflower 82-99 m ² ; watercress 36.6 m ²	Sustain viable population – Information Need	Meretsky 1999
140. MO 58: There should be a MO on the -9 mile population (non-use) (different subspecies) in case the taxon turns out to be unique.				Disagree. Maintaining –9 mile spring biotic community is covered under Goal 9.			
141. MO 58: Should the goal be rewritten to specify the Vasey’s Paradise population only?				See response 131			
142. MO 58: Vasey’s Paradise is not listed.				NRN.			
143. MO 58: Panel thought taxonomy should be worked out before any major changes were made in treatment of the species.				NRN.			
144. MO 58: There is an process for these changes to occur (working out the taxonomy) – will take time.				NRN.			
145. MO 58: Use the term “oxyloma haydeni” instead of “Kanab ambersnail.”				The MO will be rewritten when the taxonomy is clarified.			

Goal 7: Maintain or attain viable populations of Kanab ambersnail.

Goal 8. Protect the presence of Southwestern willow flycatcher and its critical habitat in a manner consistent with riparian ecosystem Goals.

<i>TWG Comments</i>	<i>Responses</i>
<i>146. Goal 8: These birds are migratory so their presence is not protected. We can't control their presence – they can leave any time. Protect/Increase the habitat they would favor.</i>	<i>See 147</i>
<i>147. Goal 8: Amend the goal: "...flycatcher <u>and its critical habitat</u> in a manner..."</i>	<i>Concur. See revised goal.</i>
<i>148. Goal 8: USFWS protects the bird and its habitat.</i>	<i>NRN.</i>
<i>149. Goal 8: Protecting the habitat may conflict with current BHBF schedule.</i>	<i>Habitat was historically compatible with spring floods, BHBF, magnitude, timing, and not limited to SWWF.</i>
<i>150. Goal 8: Protect habitat - are we shifting? Could say the same of number of trout or HBC – they could leave, too. (Concern about potential change.)</i>	<i>Add MO on habitat</i>
<i>151. Goal 8: Make "habitat" an Attribute, the Action would be "protect."</i>	<i>See revised MO 59a.</i>
<i>152. Goal 8: USFWS has never protected one without the other.</i>	<i>NRN</i>
<i>153. Goal 8: Migratory avians are a different consideration – they can be exterminated by actions taken elsewhere.</i>	<i>NRN</i>
<i>154. Goal 8: Need to capture a tribal value for this bird?</i>	<i>Response needed from the tribes.</i>

ID #	Perform some action	On some element	On some attribute	At some place	From the current level	To the target level (numbers to be validated by monitoring)	Comments
59	Increase	SWWF habitat	Nesting success	CRE	Marble Cyn 0; Upper Lake Mead in GC ND; Total ND	Information Need	SCORE 1999
59A	Maintain	SWWF	Habitat	CRE above Separation Canyon	No data available	Information Need/Process	No available data
<i>155. MOs 59 - 61: MO 61 incorporates MOs 59 and 60 in it – 59 and 60 are finer levels of detail.</i>					<i>NRN.</i>		

Goal 8. Protect the presence of Southwestern willow flycatcher and its critical habitat in a manner consistent with riparian ecosystem Goals.

60	Reduce	Brown-headed Cowbird	Brood parasitism	CRE	50%	Information Need	Brown 1994
156. MO 60: Don't know what's limiting the species – presumptuous for us to think we can decrease bird parasitism, etc., by manipulating habitat (may be something in Costa Rica, e.g.)				It is likely that brood parasitism is an important factor for SWWF in Grand Canyon.			
157. MO 60: Definitions should include habitat to include nesting, feeding, and rearing habitat.				Determining which habitats to monitor will be considered for an IN.			
158. MO 60: In Goal 2, for the fish MOs, we targeted non-natives. Should the Element here be the brown-headed cowbird?				We changed the element to Brown-headed cowbird.			
159. MO 60: Is there evidence that brood parasitism is a greater problem than nest predation?				It is likely that both are important factors for SWWF in Grand Canyon.			
160. MO 60: Do dam operations impact on brood parasitism?				Dam operations could affect habitat patches and this has been shown in other systems.			

61	Maintain or increase	SWWF	Population (abundance, distribution, breeding pairs, etc., fledging success)	CRE below GCD	Birds, pairs, nests, success in 1999 in Marble Cyn— 2,1,1,0; Upper Lake Mead in GC-- 28,11,6,ND; Total--30,12,7, 0-???	To the capability of the habitat to support the species – Information Need	Paradzick et al. 2000
161. MO 61: Why is Place different? Should be CRE.				There is no habitat above GCD.			
162. MO 61: For Current Level, urge confidence intervals, not a point in time. (The numbers change at different times.)				Concur.			
163. MO 61: Maybe Target Level should be recovery goals (draft plan this spring).				See Issue Paper #8.			

Goal 9. Protect or improve the biotic riparian and spring communities.

ID #	Perform some action	On some element	On some attribute	At some place	From the current level	To the target level (numbers to be validated by monitoring)	Comments
62	Maintain	Marsh, NHWZ, OHWZ, and sand beach Communities (emphasizing native flora and fauna)	Abundance	CRE below GCD	254 (1991)-1215(1998) wet marsh patches; 7.3 (1991)-4.6 (1998) ha	Information Need and Decision Process	Habitat and food for species. Intrinsic value of the composition of the community itself. Patch dynamics, successional processes, and habitat availability. Stevens et al. 1995; SCORE 1999.
63			Distribution				
64			Composition (diversity – emphasizing native species, successional stage, and age class)				
164. MO 62-63: Why are springs not in Element for distribution? Or abundance?				The location of the springhead is fixed.			
165. MO 62-64: Need an MO to maintain OHWZ vegetation? Would take flows of 100,000 cfs to maintain.				Determining management actions for the OHWZ biotic community will be considered for an IN.			
166. MO 62-64: Can you protect marsh and OHWZ at same time?				We agree there may be a conflict and if so, will consider for an IN.			
167. MO 62-64: Can you protect NHWZ at same time as marsh and OHWZ?				See Response 166.			
168. MO 62-64: Time element could help - on a decadal scale, could protect all.				See Response 166.			
169. MO 62-64: Sand beach - conflict with recreational MOs.				Determining the conflict will be considered for an IN.			

Goal 9. Protect or improve the biotic riparian and spring communities.

ID #	Perform some action	On some element	On some attribute	At some place	From the current level	To the target level (numbers to be validated by monitoring)	Comments
65 66	Maintain	Culturally important species	Abundance Distribution	CRE below GCD	Total = 157 plant spp (30.4% for Hopi and 41% for So. Paiute in lower riparian zone): Hopi--141; Hualapia—46; Navajo—39; Southern Paiute—68 spp. Ethno-herp, bird and mammal data not located	Information Need	To enhance and preserve traditional cultures. Lomaomvaya et al. 1999; SWCA, Inc. 2000.
170. MO 66: Can combine with 63. Attribute abundance and distribution.					Disagree. MO's 62-64 are directed at the spring biotic community. MOs 65 & 66 are for featured species that occur at spring biotic communities.		
171. MO 66: The elements seem vague. Is this deliberate? What species?					Determining which species are culturally important will be considered for an IN.		
172. MO 66: Element should be culturally important native species.					See Response 171.		
173. MO 66: Element may be culturally important species that are non-native.					See Response 171.		
174. MOs 62, 63, 65, 66: Protecting the abundance and distribution of springs – MOs 62 and 63 are inconsistent with 65 & 66 (see endnote ²)					NRN.		

² From Debra Bills: I just wanted to follow up on a point I was trying to make at the TWG meeting the other day. Under Goal #9, Protect or improve the biotic riparian and spring communities, ID numbers 62 and 63 will maintain the abundance and distribution of marsh, NHWZ, OHWZ, and beach sand communities. ID #64 will maintain the composition of marsh, NHWZ, OHWZ, sand beach AND springs. When I asked about this at the meeting, Barry said dam operations could not affect the abundance and distribution of the springs, but could affect the composition. This makes sense... Then under ID #65 and 66, it states that we WILL maintain or increase the abundance and distribution of culturally important species, and as the goal implies wherever they occur in riparian and SPRING communities.

So thinking more about this, I think the goal is to maintain or increase the abundance and distribution of culturally important species IN the spring communities and not necessarily the springs themselves. If this is what was meant, then I have no recommended changes.

Goal 9. Protect or improve the biotic riparian and spring communities.

67 68	Reduce	Invasive Non-native species	Abundance Distribution	CRE below GCD	Plants \geq 95 spp (ca. 11%); invertebrates ND; 24 spp (85.7%) of fish; 3 birds (ca. 1%). Distribution-throughout the river corridor	Information Need	To enhance native species within riparian biotic communities. Stevens and Ayers in press.
175. MO 67: Move parenthetical comment to definitions. Element should be noxious or invasive non-native species.				We moved parenthetical comment to definition and changed the element to "invasive non-native species."			
176. MO 67-68: Does "non-native species" apply to flora and fauna?				Species refers to both flora and fauna.			
177. MO 67-68: Is this outside AMP? Should be NPS (particularly flora).				See Response 40.			
178. MO 68: Combine attribute with 67.				Concur.			
179. MO 68: Should be a statement on tamarisk.				See Issue Paper #4.			
180. MO 68: Maybe there should be a full list of species.				Identifying the invasive species will be considered for an IN. MAs would be directed at specific species.			
181. MO 68: In the goal, "biotic" means natural (native) or existing.				NRN.			

Goal 10: Maintain or improve the quality of unique recreational experiences for users of the Colorado River ecosystem, within the framework of GCDAMP ecosystem goals.

<i>TWG Comments</i>	<i>Responses</i>
182. Goal 10: Why add the word “unique?” Might be redundant – unique setting.	We struck “unique” from the Goal. However, we should clarify in the text that accompanies the Vision-Mission/Goals/MOs/IN&MAs that the experiences in Grand Canyon are unique.

ID #	Perform some action	On some element	On some attribute	At some place	From the current level	To the target level (numbers to be validated by monitoring)	Comments
69	Maintain	Visitor	Physical Access and Safety	Mainstem	Ca. 27,648 in 1998	GLCA and GRCA Management Plan levels	Myers et al. 1999
183. MO 69: Should be <u>physical</u> access.				See revised MO.			
184. MO 69: According to Behan, recreational goals should be set by NPS. Small group tried to be consistent with NPS management plans, didn't agree with all aspects of it.				See Response 183.			
185. MO 69: Disagree that the AMP should be same as NPS – rather, ecosystem comes first. Target should be consistent with ecosystem goals (concern about target).				See Responses 183 and 184. Park Service policy is consistent with the Goal statement that gives precedence to ecosystem goals. Recreational use of wilderness must "...enable the areas to retain their primeval character and influence; protect and preserve natural conditions...and preserve wilderness in an unimpaired condition."			
186. MO 69: In the Purpose, “sports people” should be more inclusive. Use visitors or people.				Concur. We will use “visitors.”			
187. MO 69: Purpose should be “safe access to river and attraction sites for visitors.”				See Response 183.			
188. MO 69: Purpose should read “River management practices should maintain ... (existing wording).”				See Response 183.			
189. MO 69: Access addresses access during different flows, not managing the number of recreational users.				NRN.			
190. MO 69: Purpose specifies “safe access.”				NRN.			
191. MO 69: What is metric for “safe access?” (IN?)				See Response 183.			
192. MO 69: “Safe river access” is a small subset of exp. Confusing purpose.				See Response 183.			

Goal 10: Maintain or improve the quality of unique recreational experiences for users of the Colorado River ecosystem, within the framework of GCDAMP ecosystem goals.

<i>Other aspects of access should be addressed.</i>	
<i>193. MO 69: Number of camping sites is an aspect of access.</i>	<i>See Response 183.</i>
<i>194. MO 69: Should be clear that it's access by land to and from river.</i>	<i>See Response 183.</i>
<i>195. MO 69: This is outside the AMP. Dam operations won't affect this.</i>	<i>See Response 40.</i>
<i>196. MO 69: Revise targets so they relate to dam operations and not to NPS management plans.</i>	<i>See Response 40.</i>

70	Maintain or improve	Recreational spectrum	Quality and Quantity	Glen Canyon	Data not located (NPS studies underway)	GLCA Management Plan levels	Quality hiking, camping, hunting, fishing and boating, for the full spectrum of appropriate recreational experiences.
<i>197. MO 69-70: Are Levels of referring to number of people? Needs to be clearer: trails, boat launches, other access points should be not less than today.</i>					<i>Changed element to recreational spectrum, changed attribute to Quality and Quantity, metrics will be developed as an IN, and levels will address the attributes.</i>		
<i>198. MO 70: Why only Glen Canyon? MO 76 is GRCA. Can these be combined?</i>					<i>We will keep separate because they are different.</i>		
<i>199. MO 70: Target levels should be consistent with capability of the ecosystem.</i>					<i>Concur.</i>		
<i>200. MO 70: This is outside the AMP. Dam operations won't affect this.</i>					<i>See Response 40.</i>		
<i>201. MO 70: Revise targets so they relate to dam operations and not to NPS management plans.</i>					<i>See Response 40.</i>		

Goal 10: Maintain or improve the quality of unique recreational experiences for users of the Colorado River ecosystem, within the framework of GCDAMP ecosystem goals.

71	Maintain or increase	Camping beaches	Size	Mainstem	Recent data not available on size or quality; 262 campsites in 09/96; 37% of total in critical reaches	Information Need	To meet the goal for recreation with a quality of camping experience defined by the studies of T. Hall, B. Stewart, and C. Roberts. Kearsley et al. 1999a.
72			Quality (vegetation, sanitation, shade)				
73			Number				
74			Distribution				
75	Maintain or improve	Rapids	Navigability	Mainstem	Despite the 1996 flood studies of debris fan shape, no data are available on navigability	IN and Decision Process – threshold to be developed from NPS on-river accident rates	See Myers et al. 1999 for a discussion of navigability of Grand Canyon rapids.
202. MO 72: May be in conflict with riparian vegetation - MOs 62-64.					Determining conflict, will consider for an IN.		
203. MO 71-74: Should Target Levels be IN?					Concur. Target level will be an IN, not a decision process.		
204. MO 72-74: Distribution of camping beaches – are we able to do anything about this?					Determining whether we can manage the distribution of beaches will be considered for an IN.		
205. MO 75: How do we affect access in Lake Mead?					Purpose deleted.		
206. MO 75: How do we change navigability in the mainstem?					See Comment 207.		
207. MO 75: We change navigability in the mainstem through flows.					NRN.		

Goal 10: Maintain or improve the quality of unique recreational experiences for users of the Colorado River ecosystem, within the framework of GCDAMP ecosystem goals.

76	Maintain or enhance	Experience	Wilderness	Grand Canyon	The Colorado River in Grand Canyon is presently managed as a potential wilderness with pre-existing motorized boat travel.	Information Need	Including primitive character, unconfined experience, undeveloped natural and wild character, opportunities for solitude, sounds of nature and scenic beauty, to ensure a quality wild river experience for visitors.
208. MO 76: Relation of 76 to 70 - distinction between GCPA and GCRA, recreation & wild - should be combined.					Disagree. The attribute is wilderness, which only occurs in the Grand Canyon section of the CRE.		
209. MO 76: There is a distinction between GCPA and GLCA – recreation and wilderness. MOs 76 and 70 should stay as they are.					Concur.		
210. MO 76: What does non-visitor refer to?					Non-use values addressed under Goal #13, MO84.		
211. MO 76: This is outside the AMP. Dam operations won't affect this.					See Response 40.		
212. MO 76: If you run flows at 8000 cfs, or 100,000 cfs, this will affect the wilderness experience.					NRN.		
213. MO 76: Revise targets so they relate to dam operations and not to NPS management plans.					We will change current and target levels to IN and consider NPS plans to develop the current and target levels.		
77	Reduce	Historic properties and cultural resources	Impacts from recreation, science, and tribes	Mainstem	Data on 264 sites not synthesized by NPS	Zero impact	To maintain integrity of sites and cultural and spiritual values to tribes and achieve NPS section 110 responsibilities. Leap et al. 2000
214. MO 77: Consider moving this MO to Goal 12.					Concur this was included with MOs 79 and 80. This will be included in 79 and 80 and management actions will be developed to accomplish this.		
215. MO 77: What is zero impact?					Zero impact refers to no loss of site integrity.		
216. MO 77: In the past 5-6 years, greatest impact is from hikers, river runners, and anglers. Zero impact could be achieved through education, or close areas if necessary.					Determining need for education, site closures, or alterations in monitoring protocols will be considered for an IN.		
217. MO 77: Impacts not only due to recreational use – from monitoring, as well.					See Response 216.		

Goal 10: Maintain or improve the quality of unique recreational experiences for users of the Colorado River ecosystem, within the framework of GCDAMP ecosystem goals.

<i>218. MO 77: Is zero impact achievable?</i>	<i>Determining if zero impact should be considered for an IN.</i>
<i>219. MO 77: Purpose should cite Section 110, not Section 100.</i>	<i>Concur.</i>
<i>220. MO 77: This doesn't fit under recreational values.</i>	<i>Concur. See Response 214.</i>
<i>221. MO 77: Change Place to CRE, MO and MA - promote or enhance or emphasize responsible recreational education on cultural sites and issues.</i>	<i>Within the framework of the operating criteria of the ROD and consistent with GCD goals.</i>

Goal 11: Maintain or increase power and energy generation within the framework of GCDAMP ecosystem goals.

<i>TWG Comments</i>	<i>Responses</i>
222. <i>Goal 11: Goal should include socio-economic values, with power being one of several MOs.</i>	<i>See Goal 13, MO 84, See Issue Paper #10</i>
223. <i>Goal 11: Group decided it isn't a goal in and of itself.</i>	<i>See Issue Paper #10.</i>
224. <i>Goal 11: Goal 11 is confusing – GCPA indicates power will be reduced, not increased.</i>	<i>Reduction occurred with the implementation of the ROD.</i>
225. <i>Goal 11: Within the ROD, want to “maintain or increase.”</i>	<i>See revised goal.</i>
226. <i>Goal 11: Should be a goal broader than power. Where will non-use values be?</i>	<i>See Response 222.</i>

ID #	Perform some action	On some element	On some attribute	At some place	From the current level	To the target level (numbers to be validated by monitoring)	Comments
78	Maintain or increase	Power	generation flexibility	GCD	ROD and current operating practices	Information Need	ROD 1996, U.S. Bureau of Reclamation 1999
227. <i>MO 78: Attribute should be “flexibility to generate power.”</i>					<i>Concur.</i>		
228. <i>MO 78: Element should be “power,” Action should be “maintain or increase,” and Attribute should be “flexibility.”</i>					<i>Concur.</i>		
229. <i>MO 78: Could use money for metric (could do the same with recreation)</i>					<i>Disagree. Will use IN to determine target and current levels for metric</i>		
230. <i>MO 78: Power doesn't have same value at all times – correct Element and Levels?</i>					<i>See revised MO</i>		

Goal 12: Preserve, protect, manage, and treat cultural resources ~~within the river corridor~~ for the inspiration and benefit of past, present and future generations.

<i>TWG Comments</i>	<i>Responses</i>
231. Goal 12: "Treat" refers to a broad category of preservation actions, from documentation to installing a check dam.	NRN.
232. Goal 12: The PEP will review MOs for changes	NRN.
233. Goal 12 deals with law, and also addresses tribal concerns, which may be different from federal law.	NRN.
234. Goal 12: Re: removing "within the river corridor"— concern about no limits.	Disagree. See response 40.
235. Goal 12: Should strike "within the river corridor."	See Response 234.
236. Goal 12: MOs may be outside AMP and outside the influence of dam operations.	See Response 40.
237. Goal 12: Add to the goal, "within the area of potential effects as defined in the PA."	See response 40.
238. Goal 12: Do not limit goal to "area of potential effect." That is only for National Register-eligible resources.	See Response 40.

ID #	Perform some action	On some element	On some attribute	At some place	From the current level	To the target level (numbers to be validated by monitoring)	Comments
79	Preserve	Register-eligible properties	National Register integrity	APE	Data not synthesized	100% of extant historic properties (as defined in NHPA)	U.S. Bureau of Reclamation 1997; Leap et al. 2000
239. MO 79: Register-eligible property is that deemed appropriate through the State Historic Preservation Officer (SHPO) and Tribal Historic Preservation Officer (THPO) to be on the National Register of Historic Places – though these won't be sent to the Keeper of the Register (there will be no formal nomination).					NRN.		
240. MO 79: Is Place the "area of potential effect?"					Concur.		

Goal 12: Preserve, protect, manage, and treat cultural resources ~~within the river corridor~~ for the inspiration and benefit of past, present and future generations.

ID #	Perform some action	On some element	On some attribute	At some place	From the current level	To the target level (numbers to be validated by monitoring)	Comments
241.	MO 79: Metric - how many sites in area of potential effect are eligible. Current level – BOR may be re-evaluating eligibility and TCPs. Register integrity is defined.			NRN.			

80	Preserve	Other cultural resources	Cultural values	CRE	More specificity needed to address this issue	Information Need	Preserve traditional tribal practices and beliefs
242.	MO 80: “Other Cultural Resources:” other tribal concerns, aren’t Register-eligible.			NRN.			
243.	MO 80: These could be the same as Traditional Cultural Resources.			We will change Other cultural resources to Traditional Cultural Resources			
244.	MO 80: How do we know? Tribes may not be willing to divulge a list – must keep tribes involved.			NRN.			
245.	MO 80: Definition of cultural values – how is this measured and quantified? (Each tribe ascribes these to resources – requires participation by tribes.)			Determining metric will be considered for an IN.			
246.	MO 80: Some is related to operations, some may be outside of AMP.			See Response 40.			
247.	MO 80: Purpose should be defined more clearly.			We will add purpose to “preserve traditional tribal practices and beliefs.”			
248.	MO 80: Purpose is the same as in MO 82.			See Comment 248.			

81	Attain and maintain	Management action	Consultation	CRE	Programmatic Agreement	100% of mgt. actions	U.S. Bureau of Reclamation 1997
249.	MO 81: Doesn’t appear to be a “future resource condition.”			Concur. It does not fit the definition very closely, but it makes more sense as an MO, than as a large number of MAs under many MOs.			
250.	MO 81: Is it measurable?			Determining the metric will be considered for an IN.			

Goal 12: Preserve, protect, manage, and treat cultural resources ~~within the river corridor~~ for the inspiration and benefit of past, present and future generations.

251. MO 81: Put it under goal 13?	<i>This MO could reasonably be placed in either goal 12 or 13, but retained it here because of its close link to preserving cultural resources.</i>
252. MO 81: If you are unable to preserve under MO 79, must consult as in MO 81 – that’s why it’s placed here.	<i>See Response 251.</i>
253. MO 81: Consultation may not be cultural.	<i>NRN.</i>
254. MO 81: Make consult the action?	<i>This MO could reasonably be arranged in several ways that have equal clarity. We retained the original wording.</i>

82	Protect and maintain	Traditional cultural resources	Physical Access	CRE	Programmatic Agreement	Information Need	Preserve traditional tribal practices and beliefs; U.S. Bureau of Reclamation 1997.
255. MO 82: Attribute should be “physical access.”				<i>Concur. The attribute will be changed to “physical access.”</i>			
256. MO 82: What is the metric?				<i>Determining the metric will be considered for an IN.</i>			

83	Integrate (meaning archive, synthesize, and summarize)	Information	Cultural and other resources	CRE	Synthesis report completed	Information Need	Improve outreach, education, and research efforts; SWCA, Inc. 2000.
257. MOs 79-83: Incongruity in Place. Here it is CRE, but was Mainstem on Goal 5.				<i>Disagree. The Desired Future Condition (DFC) for physical processes is (largely) in the mainstem because these MOs are achieved through dam operations. The DFC for cultural resources is throughout the CRE.</i>			
258. MO 83: This looks like an IN, not an MO.				<i>This MO does not fit the definition very closely, but it seems to make the most sense as an MO.</i>			

Goal 13. Maintain a high-quality monitoring, research, and adaptive management program.

ID #	Perform some action	On some element	On some attribute	At some place	From the current level	To the target level (numbers to be validated by monitoring)	Comments
84	Maintain or attain	Socio-economic data	Hydropower air quality wilderness recreation non-use values tribal & spiritual values	Place is specific to the information need	KWhrs: \$\$: System reliability:	N/A	To ensure fully informed AMP decisions. Information pending BOR release of data.
259. MO 84: This should be a goal.					See Issue Paper #10.		
260. MO 84: Not comfortable with this – the language needs to be refined, the Target should be full integration of these values into the AMP, and part of the State of the Canyon report.					See revised MO.		
85	Maintain and Attain	Monitoring & Research Program	Natural, cultural, and recreational resources of GRCA and GLCA	CRE	GCMRC Strategic Plan		To determine the effects of the Secretary's actions and provide information to the Secretary and the AMP
86	(Alternative to ID #85) Attain		That is sufficient to provide quality scientific information				To the Secretary and the AMP for decision-making
261. MO 86: For Attribute, strike “scientific” in order to incorporate other values (spiritual, etc.).					MO 86, the alternate language will be dropped in favor of MO 85.		
262. MOs 85-86: Where does power come in? Add “Power” to the Attribute. Should be monitored by GCMRC.					Power will be monitored under MO 78 and 84.		
263. MOs 85-86: What are the metrics?					Determining the metrics will be considered for an IN.		
264. MOs 85-86: Action – add “and maintain.”					Concur.		
265. MOs 85-86: MO 85 is in line with the program, prefer it to MO 86.					Concur.		
266. MOs 85-86: Element should be “monitoring and research activities,” Current Level should be “current level of understanding of the CRE,” Target Level should be “level of responsible stewardship of CRE.”					See Response 263.		

Goal 13. Maintain a high-quality monitoring, research, and adaptive management program.

87	Attain and Maintain	AMP composed of all stakeholders	That acknowledges uncertainty and uses experimentation, uses monitoring & research		ROD		Bases its recommendations for resource management on sound scientific information. U.S. Bureau of Reclamation 1996.
267. MO 87: Action – add “and maintain.”					The action will be changed to “attain and maintain.”		
268. MO 87: Action should be “attain and maintain.”					Concur.		
88	Attain and Maintain	Full tribal participation	Funding	AMP	Programmatic Agreement and ROD?		U.S. Bureau of Reclamation 1996, 1997
269. MO 88: The proposed goal to enhance tribal participation should be included with this as an MO.					It has been agreed to drop Goal 16 and retain MO 88 under Goal 13.		
270. MO 88: Action should be “attain and maintain.”					Concur.		
271. MO 88: Define “full tribal participation.”					Defining full tribal participation will be considered for an IN.		
272. MO 88: Target is an IN, determined between each tribe and Reclamation.					See Response 271.		
273. MO 88: Purpose should be “GCPA requirement for consultation.” Remove the word “intent” and add after AMP, “to fulfill the federal government’s trust responsibility.”					Purpose will be deleted as these concepts are addressed in the Vision and Mission Statement.		
274. MO 88: Provides funding to be fully engaged.					NRN.		
275. MO 88: MO 81 also addresses consultation, may be consolidated with MO 88.					MO 81 addresses consultation and MO 88 addresses funding.		
276. MO 88: MO 81 addresses only cultural resources.					See Response 275.		
277. MO 88: For the Purpose – other Acts and Executive Orders address consultation and should be acknowledged.					See Response 273.		
278. MO 88: No need to cite all laws.					See Response 273.		
279. MO 88: Concerns about fish and overall ecosystem throughout CRE – must deal with Executive Orders and Indian federal policy					See Response 273.		
280. MO 88: Consultation and participation should be separate.					See Response 275.		
281. MO 88: GCPA requirement for consultation is not limited to the AMP.					NRN.		

Goal 14. Build a broad, effective outreach program.

ID #	Perform some action	On some element	On some attribute	At some place	From the current level	To the target level (numbers to be validated by monitoring)	Comments
89	Broaden funding sources	AMP	Public Support	N/A	GCMRC and BOR web pages; GCDam Visitor Center programs and tours; AMWG Outreach Committee; scientific publications (see SCORE 1999 report); various individual AMWG member activities.	Information Need	To inform the public and build support for the program and educate and inform the public. GCMRC 1999; e.g., Austin et al. 2000.
	Conduct	Flow Dynamics	Experimental Flows	Mainstem	Numerous discussions on-going	Information Need	Webb et al. 1999; Topping et al. 2000
282. MO 89: Attribute should be "inform the public;" Purpose, "to obtain broad public support for the program."					See revised MO.		
283. MO 89: Purpose should be "to inform the public." It's their choice whether to support or not.					See revised MO.		
284. MO 89: Place could be very broad - world wide.					See revised MO.		
285. MO 89: Where is the ad hoc group on this?					Ad Hoc group has met and is developing activities.		
286. MO 89: The goal should be to educate and inform the public, and the MO to build an outreach program.					See revised MO		
287. MO 89: Is the program only for public, or also to interact with other adaptive management programs?					See revised MO		

Goal 15. Broaden the funding base to achieve GCDAMP Goals and Objectives.

<i>TWG Comments</i>	<i>Responses</i>
288. <i>Goal 15 MOs: MOs throughout should be defined that need outside funding (what are we broadening the funding base for?)</i>	<i>See Response 40.</i>
289. <i>Goal 15: Might want change "base" to "sources."</i>	<i>Concur.</i>

ID #	Perform some action	On some element	On some attribute	At some place	From the current level	To the target level (numbers to be validated by monitoring)	Comments
90	Attain	Foundation & Corporate	Funding		\$0	Information Need	To support the AMP
290. <i>MO 90: Is this broad enough to include private non-profits? (for money or in-kind services)</i>					<i>Yes. Non-profit funding comes mainly from foundation and corporate sources.</i>		
291. <i>MO 90: Should Action be "attain?"</i>					<i>Concur.</i>		

91	Maintain or Attain	Appropriated	Funding		Data not located	Information Need	To support the AMP
92		State Agency	Funding		\$0	Information Need	
292. <i>MO 92: Current Level should be "obtain from literature."</i>					<i>Concur.</i>		

93	Maintain or Attain	Participation	Externally-funded investigators		Small and cost-shared projects in NPS, AGFD, etc.	Information Need	On AMP issues
293. <i>MO 93: Switch Element and Attribute.</i>					<i>Concur.</i>		

94	Maintain or Attain	Funding	Power Revenues		\$6.22M GCMRC; \$1.443M BOR; Total \$7.663M	Information Need	U.S. Bureau of Reclamation data 2000 (courtesy of R. Peterson)
294. <i>MO 94: Element should be power and Attribute should be revenue.</i>					<i>See revised MO</i>		
295. <i>MO 94: Action should be "maintain or increase."</i>					<i>See revised MO</i>		
296. <i>MO 94: Place is CRE, Attribute is AMP, and Purpose is to enhance management of the CRE.</i>					<i>See revised MO</i>		

Goal 15. Broaden the funding base to achieve GCDAMP Goals and Objectives.

Information Needs, Management Actions and Notes

All Goals

Information Needs

All MOs: Fill in any blanks.

All MOs: Validate target levels through monitoring.

Goal 1

Information Needs

MO 1-16: Native fish food requirements.

MO 1, 2, 4, 7, 11: Biomass estimate that will sustain native fish.

MO 6: IN regarding use of PVA or comparable approach or Ne to establish a target population level.

Determine the adequacy of the foodbase in the LCR. (Not the responsibility of AMP.)

Is Glen Canyon the "bread basket" of the CRE?

MO11: IN to quantify other survivability issues (e.g., disease and parasites)

IN to identify predation rates of non-native fish on native fish and competition effects.

MO12: IN to determine feasibility of restoration.

MO13: IN to determine feasibility of restoration.

Management Actions

MO11: MA to reduce predation of non-native fish on native fish and competition between non-native and native fish.

Notes

MO 14: We think distribution might be important but we are not sure. This item is here as a placeholder for now. We will look at the literature and make a decision on its inclusion.

Goal 2

Information Needs

MO 17: Regarding use of PVA or comparable approach or Ne to establish a target population target.

MOs 26 and 27: Quantify other survivability issues for native fish (e.g., disease, and parasites).

MOs 26 and 27: Identify predation rates of non-native fish on native fish and competition effects.

Management Actions

MOs 26 and 27: Reduce predation of non-native fish on native fish and competition between non-native and native fish.

MO 28: Determine feasibility of restoration of razorback sucker.

Goal 3

Information Needs

MO 32-34: Determine feasibility of restoration of Colorado pikeminnow, Bonytail, and Roundtail chub.

MO 35: What is the feasibility of otter restoration?

MO 35: What is the cumulative/additive impact on the HBC from otter predation?

MO 35: What is evidence of historic abundance and distribution of otter in GC?

MO 35: Ascertain reintroduction of otter on predator-prey dynamics.

Goal 4

Information Needs

All MOs: What do trout need by way of physical habitat (spawning beds)?

All MOs: How would the TCD affect habitat in general?

All MOs: Can water releases (to impact water temperature and level) be seasonal in order to sustain the trout fishery and not harm native fish?

All MOs: Determine the interaction of native fish and trout and the implication of river level on those interactions.

Goal 6

Information Need

MOs 53-55: Determine maximum flow for BHBFs.

Management Actions

Conduct habitat maintenance flows and BHBFs when resource and hydrologic criteria are met.
Conduct experimental flows.

Goal 7

Information Needs

Is the snail at Vasey's Paradise Kanab ambersnail or a unique taxon?
Determine if KAS is endemic to Vasey's Paradise or part of a meta-population.
What is minimum habitat size needed to maintain a viable KAS population?
What is minimum KAS population size needed to maintain population viability?

Notes

Consider need to reconsult on Biological Opinion and Recovery Plan based on expert panel report.

Goal 8

Information Needs

Site fidelity to inform appropriate target levels?
Understanding of habitat utilization as compared to habitat suitability and availability.
Examine potential conflict between SWWF MO and riparian vegetation MOs?
Quantify survivorship of SWWF.

Goal 9

Notes

Definitions: *Riparian* - Those communities affected by riverine processes. Includes the Old High Water Zone (~ 100,000 cfs).
Spring - Those within the CRE.
Address linkages to physical resources
Grain size needs to include the full range of fine sediment, including silts and clays available from tributary inputs.
Nutrients that may be trapped in Lake Powell need to be considered for availability to riparian vegetation.
Above need to be considered within available ranges given existence of the dam.
Sediment needs to be understood as a substrate for vegetation and not just as a resource for beaches and sandbars.

Goal 12

Information Needs

MO 80: Determine what are the "other cultural resources" we are preserving.

Management Actions

MO 79: Preserve Register-eligible properties' integrity when possible using site preservation.
MO 79: Treat damage to Register-eligible properties, using treatments, when site preservation is not possible.
MO 79: Recover register-eligible data, using data recovery, when neither preservation nor treatments are possible.

Notes

Add an MO for floods to deposit sediment and buttress archeological sites?

Goal 13

Information Needs

Power – change in benefits
Air quality – regional impacts/costs
Wilderness values
Recreation – change in benefits
Social values
Tribal and spiritual values

Management Actions

Develop a conceptual model of the Colorado River ecosystem.
Management Objective to be added.
Maintain outside peer review of research proposals, reports, and other products produced by GCMRC and its contractors.
Maintain an objective experimental approach to adaptive management
Maintain an adequate level of high quality staff to accomplish adaptive management program goals.
Ensure monitoring and research activities are conducted in such a way as to minimize impacts on the aesthetic and spiritual values.
Build an effective Science Advisory Board.
Use the National Research Council to conduct a five-year review of the effectiveness of the adaptive management program and processes.
Maintain independence of roles and parity among TWG, AMWG, and GCMRC (see NRC pg. 46-47).
Annual SCORE report.

Goal 14

Management Action

Build a broad, effective outreach program by attaining and maintaining an AMP continuing education process.

Bin Items from Small Group Meetings

"Bin" items were those issues and questions that came up during the Small Group Meetings that could not be addressed at that time. Small Group Meetings consisted of members of the TWG who developed MOs for the various Goals. They were organized by topic.

Food and Fish (Goals 1, 2, 3 [fish], 4)

How hydrology affects drift, to be addressed by the Physical Resources group.

Want physical processes group to address linkage between cobbles and water clarity to diatoms and foodbase.

Need to link foodbase and avifauna concerns.

What is the foodbase element of plankton?

What is the foodbase element of terrestrial invertebrates?

How do we consider age-class structure for HBC?

Review items listed in the BO for removal of jeopardy of HBC to see which elements should be MOs, INs, or MAs (Debra Bills).

Physical group should address habitat issues for fish.

Riparian (Goal 3 [otter], 7-9)

Do we need a new definition of the riparian zone as the New High Water Zone (NHWZ) vs. the Old High Water Zone (OHWZ) since parts of the flora and fauna in the OHWZ are being lost?

Alternative Principle 6: Provide conditions (biotic and abiotic, process and structure) that will benefit the resources of concern. These may or may not be within the range of natural variability.

Physical Processes (Goals 5 and 6)

1. Once the desired ecosystem is defined, we'll be more easily able to make change.

2. People are leery of change if the consequences are unknown.

The desired ecosystem should be defined to drive MO development.

Recreation (Goal 10)

Old MO1 sounds a lot like our goal. But it was intended to capture the Wilderness quality of the river experience. So, we need an MO that does that. [Does our RMO5 do that?]

Need to find a reference for what a "wilderness" or "primitive" experience is.

Request that our concerns about shoreline vegetation be taken under advisement with the riparian vegetation group, as it applies to recreational access to attraction sites.

Abbreviations

AFDW	ash-free dry weight
AMP	adaptive management program
BHBF	beach/habitat building flow
BO	biological opinion
BRMO	biological resources MO ²
cfs	cubic feet per second
CPUE	catch per unit effort
CRE	Colorado River ecosystem
CRMO	cultural resources MO ³
D50	median grain size
DO	dissolved oxygen
EAMO	ecosystem assessment MO ²
GCD	Glen Canyon Dam
GCMRC	Grand Canyon Monitoring and Research Center
GISMO	geographic information system MO ²
GLCA	Glen Canyon National Recreation Area
GRCA	Grand Canyon National Park
HBC	Humpback chub
KAS	Kanab ambersnail
LCR	Little Colorado River
LPMO	Lake Powell MO ²
MA	management action
MO	management objective
Ne	effective population size
NHPA	National Historic Properties Act
NHWZ	new high water zone
NPS	National Park Service
OHWZ	old high water zone
popn	population
PVA	population viability analysis
Register	National Historic Register
RMO	recreation MO ²
RNV	range of natural variability
ROD	record of decision
RPA	reasonable and prudent alternative
SEMO	socio-economic MO ²
SMO	suggested MO ⁴
SRMO	sediment resources MO ²
SWWF	Southwestern willow flycatcher
TBD	to be determined
Wr	mean annual relative weight
WRMO	water resources MO ²

³ From the document named DRAFT GLEN CANYON DAM MANAGEMENT OBJECTIVES, June 10, 1998.

⁴ From the document named "Glen Canyon Dam Adaptive Management Work Group, Ad Hoc Committee on Goals, Report to AMWG, September 1999."