**Core Monitoring Plan**

**See Appendix A: Core Monitoring Information Needs**

**Table A-1.** Original AMP goals and Core Monitoring Information Needs, as modified and ranked by the 2005 Science Planning Group (SPG) participants. Column 1 lists the ranked GCDAMP goals from 1 to 12. Column 3 provides the revised wording of the CMINS, as modified by the SPG, and Column 4 shows how SPG managers prioritized the revised CMINs within each goal.

**Goal 1: Protect or improve the aquatic food base so that it will support viable populations of desired species at higher trophic levels**

CMIN 1.1.1 Determine and track the composition and biomass of primary producers below Glen Canyon Dam in conjunction with measurements of flow, nutrients, water temperature, and light regime.

CMIN 1.2.1 Determine and track the composition and biomass of benthic invertebrates below Glen Canyon Dam in conjunction with measurements of flow, nutrients, water temperature, and light regime.

CMIN 1.5.1 Determine and track the composition and bio-mass of drift in the Colorado River in conjunction with measurements of flow, nutrients, water temperature, and light regime.

**Goal 2: Maintain or attain viable populations of existing native fish, remove jeopardy for humpback chub and razorback sucker, and prevent adverse modification to their critical habitats**

CMIN 2.1.2 - Determine and track recruitment (identify life stage), abundance, and distribution of HBC in the LCR.

CMIN 2.4.2 - Determine and track the abundance and distribution of nonnative predatory fish species in the Colorado River.

CMIN 2.3.1 Determine and track the parasite loads on humpback chub and other native fish found in the LCR and in the Colorado River ecosystem.

CMIN2.4.1 Determine and track the abundance and distribution of non-native predatory fish species in the Colorado River.

CMIN 2.6.1 Determine and track the abundance and distribution of flannelmouth sucker, bluehead sucker, and speckled dace populations in the Colorado River ecosystem.

**Goal 3: Restore populations of extirpated species, as feasible and advisable**

The basic information need for goal 3 is to determine the feasibility and advisability of restoring species into the Colorado River in Grand Canyon. The GCDAMP has not identified any specific CMINs for Goal 3, therefore none are included in the prioritized list of CMINs in Appendix A.

**Goal 4: Maintain a naturally reproducing population of rainbow trout above** the Paria River, to the extent practicable and consistent with the maintenance of viable populations of native fish

CMIN 4.1.1 Determine annual population estimates for age II+ trout in the Lees Ferry reach.

CMIN 4.1.4 Determine annual growth rate, standard condition (Kn), and relative weight of rainbow trout in the Lees Ferry reach.

CMIN 4.1.2 Determine annual proportional stock density of rainbow trout in the Lees Ferry reach.

**Goal 5: Maintain or attain viable populations of Kanab Ambersnail**

CMIN 5.1.1 Determine and track the abundance and distribution of Kanab ambersnail at Vaseys Paradise in the lower zone (below 100,000 cfs) and the upper zone (above 100,000 cfs).

CMIN 5.2.1 Determine and track the size and composition of the habitat used by Kanab ambersnail at Vaseys Paradise.

**Goal 6: Protect or improve the biotic riparian and spring communities, including threatened and endangered species and their critical habitat**

CMIN 6.1.1 Determine and track the abundance, composition, distribution, and area of the marsh community as measured at 5-year or other appropriate intervals based on life cycles of the species and rates of change for the community.

CMIN 6.6.1 Determine and track the composition, abundance, and distribution of seep and spring communities as measured at 5-year or other appropriate intervals based on life cycles of the species and rates of change for the community.

CMIN 6.2.1 Determine and track the patch number, patch distribution, composition and area of the NHWZ, OHWZ, and sand beach communities as measured at 5-year or other appropriate intervals based on life cycles of the species and rates of change for the community.

CMIN 6.5.1 Determine and track the distribution and abundance of non-native species in the Colorado River ecosystem as measured at 5-year or other appropriate intervals based on life cycles of the species and rates of change for the community.

**Goal 7: Establish water temperature, quality, and flow dynamics to achieve the GCDAMP ecosystem goals**

CMIN 7.4.2 (Goal 7 Priority 1) Determine and track flow releases (gage data and SCADA data; time interval still TBD) from Glen Canyon Dam, under all operating conditions, particularly related to flow duration, upramp, and downramp conditions. (Parameters are upramp and downramp rates, volume, daily minimum and max).

CMIN 7.1.1 (Goal 7 Priority 2) Determine the water temperature dynamics in the mainstem, tributaries (as appropriate, temperature only in mainstem and LCR), backwaters, and near-shore areas throughout the Colorado River ecosystem.

CMIN 7.2.1 (Goal 7 Priority 3) Monitor seasonal and yearly trends in turbidity, specific conductance, dissolved oxygen, and pH in the mainstem Colorado River.

CMIN 7.1.2 (Goal 7 Priority 4) Monitor discharge and temperature of the mainstem Little Colorado River near the mouth.

**Goal 8: Maintain or attain levels of sediment storage within the main channel and along shorelines to achieve the GCDAMP ecosystem goals**

CMIN 8.1.3 Track, as appropriate, the monthly sand and silt/clay -input volumes and grain-size characteristics, by reach, as measured or estimated at the Paria and Little Colorado River stations, other major tributaries like Kanab and Havasu creeks, and “lesser” tributaries?

CMIN 8.2.1 (Priority 2) Track, as appropriate, the biennial or annual sandbar area, volume and grain-size changes within and outside of eddies between 5,000 and 25,000 cfs stage, by reach.

CMIN 8.1.1 (Priority 4) Determine and track the biennial sandbar area and fine-sediment volume and grain-size changes within eddies below 5,000 cfs stage, by reach.

CMIN 8.5.1 (Priority 5) Track, as appropriate, the biennial sandbar area, volume and grain-size changes above 25,000 cfs stage, by reach.

CMIN 8.6.1 (Priority 6) Determine and track the change in coarse sediment abundance and distribution.

**Goal 9: Maintain or improve the quality of recreational experiences for users of the Colorado River ecosystem, within the framework of the GCDAMP ecosystem goals**

CMIN 9.3.1. Determine and track the size, quality and distribution of camping beaches by reach and stage level in Glen and Grand Canyons.

CMIN 9.1.1. Determine and track the changes attributable to dam operations in recreational quality, opportunities and use, impacts, serious incidents, and perceptions of users, including the level of satisfaction, in the Colorado River ecosystem.

CMIN 9.5.1 Determine and track the frequency and scheduling of research and monitoring activity in Glen and Canyon.

CMIN 9.1.2 Determine and track the frequency and scheduling of river-related use patterns.

CMIN 9.2.2 Determine and track accident rates for visitors participating in river-related activities, including causes and location (i.e., on river or off-river), equipment type, operator experience, and other factors of these accidents in the Colorado River Ecosystem.

**Goal 10: Maintain power production capacity and energy generation, and increase where feasible and advisable, within the framework of the GCDAMP ecosystem goals**

CMIN 10.1.1 Determine and track the marketable capacity and energy produced through dam operations in relation to various release scenarios (daily fluctuation limits, upramp and downramp limits, maximum and minimum daily flow limits).

**Goal 11: Preserve, protect, manage, and treat cultural resources for the inspiration and benefit of past, present, and future generations**

CMIN 11.1.1 Determining and track the condition and integrity of prehistoric and historic sites in the Colorado River ecosystem through tracking rates of erosion, visitor impacts, and other relevant variables

CMIN 11.1.2 Determine the condition and integrity of traditional cultural properties.

CMIN 11.2.1 Determine the condition of traditionally important resources and locations using tribal perspectives and values.

**Goal 12: Maintain a high-quality monitoring, research, and adaptive management program**

* Determine and track the abundance, composition, distribution, and area of terrestrial native and 3 nonnative vegetation plant species in the CRE (goal 6).
* Determine and track the fine sediment area, volume, and grain size changes at all stages within eddies, below the 5,000 cfs stage elsewhere in the main channel, and above the 5,000 cfs stage for sandbars outside of eddies (goal 8).
* Determine and track, as appropriate, changes in coarse sediment (> 2 mm) abundance and distribution (goal 8).
* Determine and track the size, frequency, and distribution of camping beaches by reach and stage level in Glen and Grand Canyons (goal 9).
* Determine and track rates of erosion, visitor impacts, and other relevant variables within archaeological sites that pose a threat to cultural resources and possibly track effectiveness of mitigation efforts (goal 11).