GCDAMP FY2017 Knowledge Assessment Summary: Drivers & Constraints

March 29, 2017

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| --- |
| **Symbol Key** |
| **Strength of Effect** | **Direction of Effect** | **Confidence** |
| **Strong** | **Moderate** | **Weak** | **Unknown** | **Positive** | **Neither** | **Negative** | **Unknown** | **High** | **Medium** | **Low** |
|  |  |  |  |  |  |  |  |  |  |  |

## AQUATIC FOOD BASE

| **Resource Characteristic🡺****Driver or Constraint 🡻** | **Food base diversity** | **Secondary production** |
| --- | --- | --- |
| **Algae and aquatic macrophyte quantity and quality** |  |  |
| **Cool water temperatures** |  |  |
| **Fall flood disturbance (HFEs)** |  |  |
| **Flow fluctuation** |  |  |
| **High sustained discharges (e.g., equalization)** |  |  |
| **Leaf litter and similar inputs (allochthonous input)** |  |  |
| **Low dissolved oxygen (<5mg/L) in water column and/or substrate** |  |  |
| **Nutrients** |  |  |
| **Spring flood disturbance (HFEs)** |  |  |
| **Substrate quality** |  |  |
| **Turbidity and suspended sediment** |  |  |

## ARCHAEOLOGICAL & CULTURAL RESOURCES

| **Resource Characteristic🡺****Driver or Constraint 🡻** | **Depositional Integrity (Arch site stability)** | **National Register Integrity** |
| --- | --- | --- |
| **Destruction of feature** |  |  |
| **Displacement of feature/artifact** |  |  |
| **Human visitation** |  |  |
| **Loss of matrix** |  |  |
| **Sand bar erosion (versus deposition)** |  |  |
| **Vegetation encroachment** |  |  |
| **Water erosion** |  |  |
| **Wind erosion** |  |  |

## HUMPBACK CHUB

| **Resource Characteristic🡺****Driver or Constraint 🡻** | **Adult population in western Grand Canyon** | **Adult population that spawns in the LCR** | **Juvenile chub population in CR near the LCR**  | **Juvenile chub population in LCR and CR near the LCR** | **Juvenile chub population in western Grand Canyon** |
| --- | --- | --- | --- | --- | --- |
| **Aquatic food base** |  |  |  |  |  |
| **HFE frequency** |  |  |  |  |  |
| **High-sediment floods in LCR** |  |  |  |  |  |
| **Humpback chub recruitment from LCR** |  |  |  |  |  |
| **Humpback chub recruitment from smaller size classes** |  |  |  |  |  |
| **Predation and displacement by rainbow trout** |  |  |  |  |  |
| **Temperature in CR in western Grand Canyon** |  |  |  |  |  |
| **Temperature in CR near the LCR regularly < 12°C** |  |  |  |  |  |
| **Temperature in CR near the LCR regularly > 15°C** |  |  |  |  |  |
| **Temperature in CR near the LCR regularly 12-15°C** |  |  |  |  |  |
| **Turbidity** |  |  |  |  |  |

## HYDROPOWER & ENERGY

| **Resource Characteristic🡺****Driver or Constraint 🡻** | **Electric generation (capacity)** | **Electric generation (energy production)** | **Electric generation (energy value)** | **Emissions** | **Hydro-mechanical equipment** | **Load following capability** | **Net firming purchases** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Daily fluctuation limits** |  |  |  |  |  |  |  |
| **Declining reservoir elevation** |  |  |  |  |  |  |  |
| **Equalization events** |  |  |  |  |  |  |  |
| **Experimentation (HFEs, LSFs, etc.)** |  |  |  |  |  |  |  |
| **Maintenance constraints** |  |  |  |  |  |  |  |
| **Minimum and maximum release caps** |  |  |  |  |  |  |  |
| **Monthly volume distribution** |  |  |  |  |  |  |  |
| **Ramp rate limits**  |  |  |  |  |  |  |  |
| **Transmission constraints** |  |  |  |  |  |  |  |

## INVASIVE FISH SPECIES

| **Resource Characteristic🡺****Driver or Constraint 🡻** | **All non-native coldwater fish** | **All non-native coolwater fish** | **All non-native warmwater fish** | **Brown Trout at Lees Ferry Reach** | **Brown Trout below Lees Ferry Reach** | **Green Sunfish** | **Smallmouth Bass** | **Walleye** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Brown trout recruitment in Lees Ferry Reach** |  |  |  |  |  |  |  |  |
| **Brown trout spawning habitat and recruitment below Lees Ferry Reach** |  |  |  |  |  |  |  |  |
| **High flow event(s)** |  |  |  |  |  |  |  |  |
| **Increasing temperature** |  |  |  |  |  |  |  |  |
| **Increasing temperature 1-3 degrees** |  |  |  |  |  |  |  |  |
| **Increasing temperature 3-5 degrees** |  |  |  |  |  |  |  |  |
| **Increasing temperature 5-10 degrees** |  |  |  |  |  |  |  |  |
| **Smallmouth bass numbers in Lake Powell** |  |  |  |  |  |  |  |  |
| **Walleye numbers in Lake Powell** |  |  |  |  |  |  |  |  |

## RAINBOW TROUT

| **Resource Characteristic🡺****Driver or Constraint 🡻** | **LCR Inflow Area & Marble Canyon Rainbow Trout Fishery - Movement** | **LCR Inflow Area & Marble Canyon Rainbow Trout Fishery - Recruitment** | **Lees Ferry Rainbow Trout Sport Fishery - Age0 Growth** | **Lees Ferry Rainbow Trout Sport Fishery - Age0 Survival** | **Lees Ferry Rainbow Trout Sport Fishery - Growth and condition** | **Lees Ferry Rainbow Trout Sport Fishery - Recruitment** | **Lees Ferry Rainbow Trout Sport Fishery - RTELSS Age0 recruitment** | **Lees Ferry Rainbow Trout Sport Fishery - Spawning magnitude/hatch success**  | **Rainbow Trout Maximum Size** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Algae and invertebrate production** |  |  |  |  |  |  |  |  |  |
| **Controlled high and/or steady flows (incl. equalization)** |  |  |  |  |  |  |  |  |  |
| **High annual, summer, and spring flow** |  |  |  |  |  |  |  |  |  |
| **High winter flow and/or low spring flow** |  |  |  |  |  |  |  |  |  |
| **Invertebrate drift availability** |  |  |  |  |  |  |  |  |  |
| **Invertebrate drift size distribution** |  |  |  |  |  |  |  |  |  |
| **Prey-size and abundance** |  |  |  |  |  |  |  |  |  |
| **Rainbow trout density (# fish/km, >150mm)** |  |  |  |  |  |  |  |  |  |
| **Spring 2008 HFE** |  |  |  |  |  |  |  |  |  |
| **Temperature in CR** |  |  |  |  |  |  |  |  |  |

## RECREATIONAL EXPERIENCE

| **Resource Characteristic🡺****Driver or Constraint 🡻** | **Backpacking/day-use shore access** | **Backpacking/day-use shore availability** | **Backpacking/day-use usable campsite area** | **Flatwater floating in Glen Canyon NRA** | **Glen Canyon walk-in angling access and safety** | **Glen Canyon walk-in angling trout abundance** | **Glen Canyon walk-in angling trout condition** | **Glen Canyon watercraft angling access and safety** | **Glen Canyon watercraft angling trout abundance** | **Glen Canyon watercraft angling trout condition** | **Whitewater boat mooring (i.e., reduced beaching risk)** | **Whitewater navigational risk** | **Whitewater navigational risk Diamond down** | **Whitewater river crowding (i.e., rapids, beaches)** | **Whitewater river running experience (i.e., rapids)** | **Whitewater time on river** | **Whitewater usable campsite area** | **Wilderness experience** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Annual whitewater and aircraft launches for recreational visitors** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Annual whitewater & aircraft launches for resource mgt., research, and transport** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Flow fluctuation** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Flow magnitude** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Past HFEs** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Rainbow trout abundance** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Rainbow trout condition** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Riparian vegetation expansion** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

## RIPARIAN VEGETATION

| **Resource Characteristic🡺****Driver or Constraint 🡻** | **Area of herbaceous marsh habitats** | **Area of woody vegetation** | **Community heterogeneity** | **Functional group cover** | **Native to non-native ratio** | **Species richness** | **Total vegetation cover** | **Vegetation structure (vertical layering)** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Base flows** |  |  |  |  |  |  |  |  |
| **Harvesting by beaver** |  |  |  |  |  |  |  |  |
| **Inundation disturbance interval and timing** |  |  |  |  |  |  |  |  |
| **Magnitude and duration of floods** |  |  |  |  |  |  |  |  |
| **Past vegetation restoration** |  |  |  |  |  |  |  |  |
| **Proportion of silt in substrate** |  |  |  |  |  |  |  |  |
| **Sediment erosion/deposition disturbance interval and timing** |  |  |  |  |  |  |  |  |
| **Tamarisk beetle** |  |  |  |  |  |  |  |  |

## SEDIMENT

| **Resource Characteristic🡺****Driver or Constraint 🡻** | **Availability of sand for aoelian transport in support of archeological site preservation** | **Campsite area** | **Sand storage** | **Sandbar volume** |
| --- | --- | --- | --- | --- |
| **Annual release volume** |  |  |  |  |
| **Short duration high flows** |  |  |  |  |
| **Sustained high flows** |  |  |  |  |
| **Sustained low flows** |  |  |  |  |
| **Vegetation expansion** |  |  |  |  |
| **Vegetation loss** |  |  |  |  |

## WATER QUALITY

| **Resource Characteristic🡺****Driver or Constraint 🡻** | **GCD outflow concentrations of dissolved oxygen** | **GCD outflow concentrations of metals (e.g., selenium, mercury, uranium, etc.)** | **GCD outflow concentrations of nutrients (e.g., phosphorous, nitrogen)** | **GCD outflow concentrations of phytoplankton, zooplankton, chlorophyll a** | **GCD outflow salinity, TDS, specific conductance** | **GCD outflow temperature** | **GCD outflow turbidity/sediment load** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Lake Powell biological oxygen demand** |  |  |  |  |  |  |  |
| **Lake Powell chemical oxygen demand** |  |  |  |  |  |  |  |
| **Lake Powell inflow dynamics** |  |  |  |  |  |  |  |
| **Lake Powell inflow: spring runoff or baseflow** |  |  |  |  |  |  |  |
| **Lake Powell nutrient concentrations (e.g., phosphorous, nitrogen)** |  |  |  |  |  |  |  |
| **Lake Powell thermal stratification regime** |  |  |  |  |  |  |  |
| **Lake Powell water clarity/turbidity** |  |  |  |  |  |  |  |
| **Lake Powell water surface elevation (high versus low)** |  |  |  |  |  |  |  |