

Upper Colorado River
Wild & Scenic
Stakeholder Group

**Channel Maintenance
Flow Observational
Monitoring Plan**

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1 Introduction

The Amended and Restated Upper Colorado River Wild and Scenic Stakeholder Group (SG) Management Plan (A&R SG Plan), adopted in June 2020, lists Channel Maintenance Flows (CMF) as a Resource Guide related to the Recreational Fishing Outstandingly Remarkable Value (ORV). The A&R SG Plan states that “CMF are important for maintaining a healthy aquatic and riparian and ecosystem that, in turn, supports a healthy recreational fishery and fishing experience. The SG will develop an Observational Monitoring Plan to better understand the effects that peak flows have on channel maintenance processes in Segments 4 through 6” and “this CMF monitoring plan, when completed, will be included in the Long-Term Monitoring Plan, and will be implemented as soon as practical.” It also states that “the SG has agreed that the purpose of the CMF monitoring plan is not to identify a target flow, or range of flows for CMF, but will monitor the effects that a given year’s peak flows have on accomplishing general channel maintenance functions of mobilizing and transporting bedload substrate and channel maintenance processes of:

1. Maintaining amount and diversity of aquatic habitat.
2. Maintaining active channel geometry.
3. The creation and maintenance of non-vegetated sand and gravel features.
4. Preventing growth of new rooted vegetation and/or scouring rooted plants from active channel.”

This document identifies the methods, frequency and locations that will be used to monitor CMF functions and processes. The [Technical Guidance for Observational Monitoring for Channel Maintenance Flows along the Colorado River, prepared by Stillwater Sciences](#) for the SG was an important resource in the creation of this Observational Monitoring Plan (Plan). See the January 2022 CMF Methodology Summaries memo for more information.

2 Plan Overview

- 1) The Plan will monitor effects of a given year’s peak flows as described in the A&R SG Plan. The work will be performed by the stakeholders, with expert help and contractors, as determined.
- 2) The Plan will be reviewed and updated periodically by the Monitoring Committee with outside expert assistance, as needed and with SG approval. The objective of this review is to ensure the Plan is meeting the goal of monitoring the effects that a given year’s peak flows have on accomplishing the CMF functions and four general channel maintenance processes defined above.
- 3) The summary information from the observational monitoring will be reported in the W&S SG Annual Monitoring Report. The detailed information will be indexed and stored electronically.
- 4) This Plan will be implemented on an annual basis, subject to budgetary constraints.

3 Implementation Plan for Observational Monitoring

The following actions will implement the Plan. The information from the monitoring activities will help to inform the SG process and actions under cooperative measures.

3.1 Administration

The Plan will be administered by the SG Monitoring Committee.

3.2 Funding

All monitoring outlined in this Plan is subject to available funding and annual SG budget approval. A combination of revenue sources should be utilized to fund monitoring activities in this Plan, such as IG dues, CWCB W&S River Funds (if available), proceeds from the W&S Endowment Fund, grants, in-kind contributions, and other to-be-determined sources. The intent is to keep this Plan relatively low-cost and subject to budget constraints. The annual costs of the Plan are expected to be highly variable depending on the methods that are deployed in a given year and some years will be significantly higher or lower than the average.

3.3 Monitoring Activities

The following methods will be used to monitor CMF processes:

1. General Observer Notes: Includes general observations of geomorphology, substrate, riparian vegetation, and aquatic health characterizations (e.g., large fish pools). This method provides general awareness of channel condition.
2. Repeated Photo Points: Repeating photos to provide additional information and documentation related to geomorphology, substrate, riparian vegetation, and aquatic habitat characterizations. This can be done periodically or automated to take photos daily during a season or during an event.
3. Drone-Based Aerial Imagery/Photogrammetry: Imagery (RGB) and lidar topography of current conditions (i.e., 2023). The information will characterize channel topography from bank-to-bank (excluding areas beneath water surface), bank vegetation, and the nature of the channel morphology in the selected monitoring areas. Lidar data collected by the State of Colorado could be used to complement the Drone-Based Aerial Imagery/Photogrammetry analysis.
4. Cross-Sectional Channel Surveys: Systematic survey of cross-section topography that can capture riffle, run, and pool features. It may be used to monitor vegetation encroachment if it is noted where vegetation is present.
5. Substrate Measures (Pebble counts, % course/fine, algae, embeddedness): These methods enable better understanding of channel changes. Geomorphic measure to identify grain size distribution and median bed particle size. Presence/absence of macrophyte coverage to provide an indication of potential movement. Quantify the percentage of fine sediments on the surface of a habitat feature such as a riffle or pool tail using a grid frame.

In addition, the SG may identify a need or desire to employ other no-cost methods (e.g., painted rocks, scour chains) to better understand CMF functions and processes. Like other monitoring activities, these additional methods and use of any data for analysis is subject to SG approval.

This Plan also relies on outfitters/guides to identify notable events that might affect the river channel and/or the Fishing ORV. This includes coordinating with boating and fishing guides and frequent visitors to provide first-hand, real-time reporting of notable events. The SG may decide to collect additional data based on these events.

3.3.1 Year 1 (2022)

In Year 1 the following activities will be refined: (1) The methodologies for the General Observer Notes and Photo Points, (2) Scopes of work to carry out the Drone-Based Aerial Imagery/Photogrammetry, Cross-Sectional Channel Surveys, and Substrate Measures, (3) Outside experts will be hired per the SG Contractor Protocols, and (4) Costs of all methodologies.

3.4 Frequency: Monitoring Schedule and Rationale

3.4.1 Year 1 (2022)

No monitoring data will be collected because Plan will be refined (see section 3.5).

3.4.2 Year 2 (2023)

All methods will be performed during baseflows (late October – early November).

3.4.3 Future Years

Table 1 –Sampling frequency and analysis/ reporting associated with each method.

Methods	Sampling Frequency	Responsible Party for Analysis & Reporting¹
1. General Observer Notes	<ul style="list-style-type: none"> Monitor in years where daily average flow is at or above 2,500 cfs at the Kremmling gage (USGS 09058000) for a minimum of three consecutive days during the calendar year. Monitor at least once every 3 years. 	Outside expert and/or Monitoring Committee
2. Repeated Photo Points	<ul style="list-style-type: none"> Monitor in years where daily average flow is at or above 2,500 cfs at the Kremmling gage for a minimum of three consecutive days during the calendar year. Monitor at least once every 3 years. 	Outside expert and/or Monitoring Committee
3. Drone-Based Aerial Imagery/Photogrammetry (includes lidar):	Every 10 years, with some flexibility to adjust depending on recent peak flows. Coordinate data collection with macroinvertebrates monitoring.	Outside expert
4. Cross-sectional Channel Surveys	When drone flights occur, and at least one other time within the 10 years, for years when the daily average flow was at or above	Outside expert

¹ See section 3.8.

	2,500 cfs at the Kremmling gage for a minimum of three consecutive days in a calendar year. Coordinate data collection with macroinvertebrates monitoring.	
5. Substrate Measures	When drone flights occur, and at least one other time within the 10 years, for years when the daily average flow was at or above 2,500 cfs at the Kremmling gage for a minimum of three consecutive days in a calendar year. Coordinate data collection with macroinvertebrates monitoring.	Outside expert

The frequency of the Drone-Based Aerial Imagery/Photogrammetry, Cross-sectional Channel Surveys cross-sections, and Substrate Measures methods may be adjusted to coincide with years with significant peaks flows. A regular fixed interval may not detect the effectiveness of the flow event and may not be cost-effective for the SG. Monitoring will be generally done during baseflows (late October – early November).

3.5 Monitoring Locations

3.5.1 Year 1 (2022)

Monitoring locations will be screened and prioritized in 2022, as there are still decisions about the specific monitoring locations and site access. The intention of the site selection is to determine a list of locations for each method in Year 1.

The report, Technical Guidance for Observational Monitoring for Channel Maintenance Flows along the Colorado River (2021, Stillwater Sciences), subdivides Segments 5 and 6 of the A&R SG Plan into 12 reaches. One of the 12 reaches is characterized as “confined” due to the steep canyon wall and the railroad embankment closely bordering the river. Therefore, there are a total of 11 reaches that will be considered in the CMF site selection.

3.5.1.1 General Observer Notes, Repeated Photo Points

Anticipated monitoring locations for General Observer Notes and Repeated Photo Points are outlined in the January 2022 CMF Methodology Summaries memo. The exact monitoring sites will be refined during Year 1. There will be 1-3 sites per reach and they will be distributed among geomorphic types (riffles, pools, and bars).

3.5.1.2 Drone-Based Aerial Imagery/Photogrammetry

The drone flights will survey an area of 20 – 30 acres in each of the 11 reaches. The drone survey area for each reach will encompass specific sampling sites for the other methods. Seven of the 11 reaches are

previously sampled macroinvertebrate monitoring sites.² In those seven reaches, the drone survey area will include the macroinvertebrate sample sites. In the other four reaches, the drone survey areas will be refined during 2022.

3.5.1.3 Cross-Sectional Channel Surveys

Measurements of the river cross-section may be performed within the drone survey areas. The CMF monitoring will measure 12 to 27 specific cross-sections distributed among geomorphic types (riffles, pools, and bars).

3.5.1.4 Substrate Measures

River channel substrate measurements will be performed at the five locations in the [Long-Term Macroinvertebrate Sampling and Analysis Protocol](#) and at other cross section locations as determined in Year 1.

3.5.2 Future Years

Monitoring will occur at the locations finalized during the Year 1 effort. The final Plan allows discontinuing or adding locations as CMF data becomes available.

3.6 Responsible Party

Data collection will be performed by the stakeholders, with expert help and contractors as determined. Each time data is collected, analysis and reporting will be conducted by the SG or outside experts as identified in Table 1.

3.7 Data Management

The observational monitoring data will be catalogued and electronically filed. The cross-section survey data will be processed and reduced by the surveyor prior to being catalogued. Raw and processed aerial imagery, lidar data, and base maps will be archived. The SG currently contracts with Grand County Water Information Network and RRC Associates for data storage. These storage options will be considered in addition to other options.

3.8 Analysis & Reporting

A summary of each year's observational monitoring activities will be included in the Annual Monitoring Report. Refer to Table 1 for the sampling frequency for each method. The results for each given method will be reported in the Annual Monitoring Report by either SG members or outside experts per Table 1. This may include a description of any observed changes between execution of the monitoring methodologies as a result of the period's peak flow by the SG. Outside experts will conduct a full review of data and comparative analysis from multiple CMF methods, typically at five-year intervals to align with cross-section, substrate, and drone-based monitoring activities.

² Five locations with SG plan macroinvertebrate sampling and analysis protocol and 2 locations with historical macro invertebrate sampling (Colorado River Inventory Assessment, 2014).