Stream Gage Oversight Work Group

Subcommittee of the Governor's Drought and Water Supply Advisory Committee
http://dnrc.mt.gov/stream-gage-oversight

MEETING #6 SUMMARY NOTES

DATE: November 4, 2020
TIME: 10:00 – 12:30
LOCATION: ZOOM Webinar

Summary
This was the 6th meeting of the Stream Gage Oversight Work Group. Kirk Miller from the USGS gave a presentation on Cost effective ad reasonable alternatives to real-time stream gages. Nikki Sandve gave an overview of the results from the stream gage survey.

Action Items

- Paul will post approved summary notes from meeting #5 to web site.
- Paul will poll Working Group members on funding questions. Do we have enough information to start framing potential recommendations to address funding for USGS gages? What additional information do we need?
- Paul will poll members on next meeting date.

Member Present:

- Stephen Begley – Fish Wildlife & Parks – Co-Chair
- Paul Azevedo – Dept of Natural Resources – Co-Chair
- John Peterson – Dept of Ag
- Darrin Kron – Dept of Environmental Quality
- Wayne Johnston – Dept of Commerce

Attendees: Pedro Marques – Big Hole Watershed Committee, Jennifer Schoonen – Blackfoot Challenge, Ethan Kunard – MWCC, Laura Nowlin- Musselshell Watershed Coalition, Tracy Wendt – Sun River Watershed, Madeline Gotkowitz-MBMG; Seth Makepeace – CSKT, Mike Murphy – MT Water Users Association, Stephanie Adams – MACD, Morgan Case-MT Trout Unlimited, Kirk Miller-USGS, Nikki Sandve-DNRC,

Review of the August 12th meeting

- Paul provide a recap of August 12th meeting.
- Work Group approved August meeting summary.

Status of Work Plan Activities

- Paul provided a progress report on Work Plan objectives and tasks. Link HERE

Cost effective ad reasonable alternatives to real-time stream gages – Kirk Miller, USGS
Kirk Miller oversees the USGS stream gage program in Montana and Wyoming. His PowerPoint presentation can be found on the Stream Gage Work Group website HERE.

- Kirk's presentation was a follow-up to his August 12 stream gage funding presentation.
- Kirk covered various stream monitoring methods. These include both "traditional" and "alternative" methods. Some methods provide continuous monitoring whiles others are periodic. The end user's data needs or monitoring objectives should determine the monitoring method.
- A synopsis of Kirk's presentation on "traditional" monitoring methods is shown in Table 1.
- Kirk also discussed alternative methods for monitoring stream flows including Large-scale Particle-image Velocimetry (LSPIV), pulsed radar, statistical models and deterministic models (see Table 2).

Questions

- Q Darrin Kron – Does USGS use the upward looking sonar to monitor stream flow?
- A. Kirk – Acoustical uses sound waves to monitor velocity below the water surface. Discharge is computed as a function of stage – velocity relationship. WY-MT USGS Center does use acoustical monitoring at several sites to monitor sediment movement. Other USGS centers around the nation use acoustics to monitor stream flow. Equipment is more expensive than traditional monitoring methods.

- Q. Pedro Marques – How does the funding work for these other methods of monitoring? Is there a cost-share like the real-time gage sites or are they funded solely by USGS?
- A. Kirk – Sometimes they are entirely funded by USGS because they are part of a USGS initiative. Sometimes there are matching funds if the monitoring is being done in cooperation with a partner.

- Q. Stephen Begley – What are some of the questions partners should consider when evaluating which monitoring method is most appropriate?
- A. Kirk – Your data needs and objectives will determine what method you use. What question are you trying answer? USGS is happy to engage with interested stakeholders to help them determine the most appropriate method. USGS will also let stakeholders know if another entity is better suited to conduct the monitoring.

- Q. Darrin Kron – What is the error range of the LSPIV method versus traditional gaging methods?
- A. Kirk – Does not have enough experience with the method to respond.

- Q. Darrin Kron – Does it help have prior traditional flow measurements at a new LSPIV site?
- A. Kirk – LSPIV is not a 1:1 replacement for stream gaging. Prior knowledge of the stage-discharge relationship is helpful. However, discharge values from LSPIV would only be as good as your channel stability and ability to define the channel geometry. The question of whether LSPIV is "good enough" depends on your data objectives.

- Darrin Kron – DEQ has been using trail cams in conjunction with staff gages. The trail cams snap of photo of the staff gage at preset intervals. This provides a record of staff gage readings without having someone on site every day.

Table 1. Comparison of "Traditional" Steam Monitoring Methods

Monitoring Method	Data Products	Typical Monitoring Objectives	Required Infrastructure	Cost

Continuous Discharge
AKA – Stream gage, streamflow-gaging station
	• Continuous discharge (streamflow)
	  ○ Continuous stage (gage height)
	  ○ Stage-discharge relationship (rating) curve.
	  ○ Flow statistics
	  ○ Discrete discharge measurements
		• Streamflow (volume/time) at any given time.
		• Streamflow total volume (acre-feet) over time
			• Instrumentation
			  ○ Stage sensor
			  ○ Data logger (recorder)
			  ○ Telemetry to transmit data in real-time
			• Discharge measuring infrastructure such as a bridge or cableway for non-wadable streams
				O&M - $17,000 - $19,000 per site per year.
				
				Installation - $7,800 average but vary widely based on accessibility.

Continuous Stage
AKA – Stage-only station
	• Continuous stage (gage height)
	  ○ Flow statistics
		• Stream stage (gage height) at any given time.	• Instrumentation
			  ○ Stage sensor
			  ○ Data logger (recorder)
			  ○ Telemetry to transmit data in real-time
				O&M - $5,000 - $6,000 per site per year.
				
				Cost reduction reflects lack of discharge measurements and associated QA/QC.

Annual Maximum Discharge
AKA – Crest-stage gage
	• Annual max discharge (stream flow)
	  ○ Annual max stage (gage height)
	  ○ Stage-discharge relations (rating)
	  ○ Discrete discharge measurements
		• Annual maximum discharge over a period of time to estimate flood frequency.	• Crest-stage gage	• O&M - $1,500 - $2,000 per site, per year. Varies depending on site conditions and number of measurements per year.

Discharge Rating Only AKA Staff-gage, rating only site.	• Stage-discharge relation (rating) ○ Discrete discharge measurements	• Stage-discharge relationship (rating) curve for determining stream flow from periodic observations.	• Staff gage.	• O&M - $1,500 - $2,000 per site, per year. Varies depending on site conditions and number of measurements per year.
Periodic Discharge Measurements	Discrete discharge (stream flow) measurements	• Periodic stream flow	• None • Exception – Discharge measuring infrastructure if stream flows are non-wadable.	• Varies depending on site conditions and number of measurements per year. Can be a few hundred dollars per measurement IF USGS can sandwich them between other work.

Comparison of "Alternative" Steam Monitoring Methods

Monitoring Method	How it works	Comments	Cost
Large-Scale Particle-Image Velocimetry (LSPIV)	• Uses video to capture particles on the surface of stream. • Surface velocity is calculated based on the time it takes for particles to flow pass 4 known points in the video frame. • Discharge (volume/time) can be estimated if you know the relationship between channel discharge and surface velocity i.e. Velocity-Discharge curve.	• WY-MT USGS office is testing this method in several locations. • Results seem to provide a reliable estimate of discharge. • Must maintain viability of Velocity-Discharge curve by taking periodic discharge measurements. • Currently cannot monitor surface velocity on a continuous basis because the video files are too large to transmit in real-time. • Method does not work at night.	Difficult to estimate right now because technology is still being developed and method is not widely used.
Pulsed radar	• Surface velocity is measured with a device very similar to a radar speed gun. • Discharge (volume/time) can be estimated if you know the relationship between channel discharge and surface velocity i.e. Velocity-Discharge curve.	• WY-MT USGS office has not tested this method. • Can monitor surface velocity on continual basis because data files (surface velocity) are small enough to transmit in real-time.	Difficult to estimate right now because technology is still being developed.
Statistical Models	• Estimates of stream flow characteristics are based on statistical correlation between observed basin or environmental characteristics.	• Model accuracy depends on ability to correctly identify the underlying correlation. • Allows you to develop an estimate of discharge at locations where you do not have any monitoring data. • Estimates may be off by 50% - 100%. This may be perfectly acceptable to meet data objectives.	Cost is entirely dependent on the scope of the modeling effort.
Deterministic Models	• Estimates of stream flow characteristics are based on known hydrologic and hydraulic process.	• Model accuracy depends on ability to correctly identify the underlying hydrologic process. • Allows you to develop an estimate of discharge at locations where you do not have any monitoring data. • Estimates may be off by 50% - 100%. This may be perfectly acceptable to meet data objectives.	Cost is entirely dependent on the scope of the modeling effort.

Update on Stream Gage Survey – Nikki Sandve

- Objective 3 of the Work Plan is to identify users of the USGS stream gage network in MT. Task 1 is to develop a user's survey. Developing and conducting the survey was a big undertaking involving numerous people from several agencies and stakeholder groups.
- Nikki provided a brief overview of the results. Link to Nikki's presentation is HERE.
- The subcommittee that created the survey is still working through the results.

Development of Rapid Notification Process - Paul

- Objective 1 – Task 1 is to work with USGS WY-MT Science Center to establish a communication process for notifying the Work Group and interested stakeholders of funding or program changes.
- Stephen and Paul had a video call on Oct 20th with John Kilpatrick and Kirk Miller (USGS).
- This was an initial discussion on establishing a formal communication process for notifying the Work Group and interested stakeholders of funding or program changes. The end goal is minimizing network disruptions by exchanging information far enough in advance that it can be acted on.
- Paul drafted a strawman framework for building out the plan. A second meeting with USGS is scheduled for November 5th.
- Paul will share the concept with the group once the draft plan has enough meat on the bones for a discussion.

Public Comment

- Stakeholders provided input throughout the meeting. There was no additional input during public comment period.

Action Items

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Next meeting

- Next meeting will focus on stream gages outside of USGS network.
- Next meeting will be in February. Date and time will be determined by Doodle Poll. Legislative schedule may dictate meeting data.