

METADATA

Senator Beck Stream Gauge

Senator Beck Stream Gauge (SBSG) data: <http://snowstudies.org/data1.html>
 Senator Beck Basin Study Area (SBBSA), San Juan Mountains
 Center for Snow and Avalanche Studies (CSAS)

I. Senator Beck Stream Gauge (SBSG)

- 1) Type of Site
 - a) Senator Beck Stream Gauge is located at the pour point of the Senator Beck Basin Study Area catchment with a drainage area estimated at 719 acres (290 ha). The broad-crested, notched weir structure is located in a NE/SW oriented gorge through a bedrock outcrop and is anchored to bedrock. Although the weir was installed in a comparatively low-gradient segment of this gorge, in general, this stream was judged too steep for other gauging structures, such as a Parshall Flume.
- 2) Site Datum
 - a) Location: August 2008 GPS Lat 37° 54' 24.42274", Lon -107° 42' 33.94108"
 - i) Originally estimated as 37° 54' 24" N, 107° 42' 31" W; per USGS Ironton, Colorado quadrangle 1955, NAD 1927
 - b) Elevation: August 2008 GPS survey: 11,031.0 feet (3,362 meters)
 - i) Originally estimated as 11,020 feet (3,359 meters) per USGS Ironton, Colorado quadrangle 1955, NAD 1927
 - c) Aspect & Slope: na
 - d) Soils: weir constructed on bedrock on south end and colluvium on north end
 - e) Vegetation: typical subalpine
 - f) Ownership: SASP is located on public lands and authorized by the Uncompahgre National Forest under a Special Use Permit issued to the CSAS
 - g) Changes to site: weir construction required pouring a concrete structure across the existing stream channel and extending the north side of the weir with a berm consisting of rock and soils removed for weir construction; a tower housing the stream gauge datalogger and radio telemetry gear, and power supply, was installed on the bench above the weir, to the north.
 - h) Photographs: see CSAS website at <http://snowstudies.org/sbsg1.html>
- 3) System Operation
 - a) Measurements began for weir calibration during summer of 2004 and early spring 2005 using manual discharge measurements performed at the weir at various stage heights by Colorado Division of Water Resources. Those data were used by the weir contractor, R&M Construction, to conform the "Q" function for the actual construction and a discharge table for the weir was finalized using the equation:

$$Q = K1(h1 + K2)^u$$

where: h1 = stage height

$$K1 = 11$$

$$K2 = .07$$

$$u = 2.75$$

- b) Stream channel bed movement during spring runoff typically requires removing materials and restoring the gauge pool to its nominal depth in mid/late summer.
- c) Occasional manual measurements performed to rate quality of SBSG data (most recent was June 11, 2012 manual gauging by USGS, yielding “Fair” rating of SBSG data (within 7% of manual measurement).
- d) Automated sensors operated for collection of 'Summer' datasets only, from early spring through late fall. All sensors are removed from the water in late fall due to ice damage potential during winter months.
- e) Data Arrays
 - (1) 10 minute arrays: *Flag* field = 401 (Year 2005 only)
 - (2) 1 hour data arrays: *Flag* field = 401
 - (3) 24 hour data arrays: *Flag* field = 424
- f) All data collected on Mountain Standard Time, by day-of-year (DOY)
 - i) System clocks *not* switched from/to Mountain Daylight Time in Fall or Spring
 - ii) 24 hour summary datasets (*Flag* = 424) are calendar day

4) System Operations Notes (see also Sensor History notes for individual sensors)

Year	Date(s)	Day of Year	Note
2016	March 4	64	Automated measurements resume
2015	Nov 29	333	Automated measurements terminated
2015	March 16	75	Automated measurements resume
2014	Nov 29	333	Automated measurements terminated
2014	March 17	76	Automated measurements resume
2013	TBD	TBD	All automated measurements terminated; sensors removed
2013	June 21	172	Bed movement cleared and weir pool restored to nominal depth
2012	Nov 9	313	All automated measurements terminated; sensors removed
2012	June 11	163	USGS manual measurement; SBSG measurement (4.99 cfs) 7% higher than USGS measurement (4.66 cfs)
2012	--	--	No bed movement; pool remained at nominal depth
2012	Mar 11	71	All automated measurements resume
2011	Nov 15	319	All automated measurements terminated; sensors removed
2011	Aug 1	213	Pool restored to nominal depth
2011	Mar 15	74	All automated measurements resume
2010	Nov 26	330	All automated measurements terminated; sensors removed
2010	June 17	168	Pool restored to nominal depth
2010	Mar 7	66	All automated measurements resume
2009	Nov 21	325	All automated measurements terminated; sensors removed
2009	Aug 1	213	Pool restored to nominal depth
2009	Mar 3	62	All automated measurements resume
2008	Nov 23	328	Power supply upgraded
2008	Nov 23	328	All automated measurements terminated; sensors removed
2008	Jun 27	179	Pool restored to nominal depth
2008	Mar 15	75	All automated measurements resume
2007	Nov 18	322	All automated measurements terminated; sensors removed
2007	Aug 1	213	Pool restored to nominal depth
2007	Mar 15	74	All automated measurements resume
2006	Oct 31	304	All automated measurements terminated; sensors removed

2006	Aug 22	234	Pool restored to nominal depth
2006	April 5	95	All automated measurements resume
2005	Nov 3	307	Automated measurements terminated; sensors removed
2005	Sep 2-8	245-251	Tailrace construction interrupts data
2005	May 15	135	Automated stage measurements begin
2005	April 10	100	Automated water temperature and EC measurements begin
2004	Summer	--	Calibration season – no data presented
2003	Nov 1	305	Weir construction completed

5) Power

- a) Solar powered by 10 watt photovoltaic panel providing regulated charge to 8 amp hour lead-acid 12V DC battery through September 6, 2008; second 10 watt photovoltaic panel added to power supply on September 6. Larger 12 amp-hour battery pack installed at shut-down of system on November 23, 2008 and operated since.

6) Sensors

a) Stage Height

i) Properties

- (a) Make: Druck (GE Infrastructure Sensors)
- (b) Model: PDCR 1830-8388 transducer (CS420)
- (c) Serial Number: 1892202
- (d) Type: 2.5 psi transducer
- (e) Specifications: [CSI_cs420_transducer_manual.pdf](#)

ii) Installation

- (a) Located two feet upstream of weir crest (centerline) and 0.1 feet below weir notch base, in open-top, white PVC pipe 'well' covered by open nylon mesh
- (b) Comments: vented sensor cable housed in flexible PVC and steel conduit to desiccant enclosure on mast.
- (c) Comments: sensor removed from stream during mid-winter to prevent ice damage
- (d) Data begin: April 10, 2005 (DOY 100)

iii) Sensor History:

Serial #	Date	Action	Condition
1892202	Apr 21, 2005	Tested by GE	Tested AOK
1892202	May 2004	Installed at startup	New sensor

b) Water Temperature and Electrical Conductivity

i) Properties

- (a) Make: Campbell Scientific
- (b) Model: CS547A
- (c) Serial Number: 3997
- (d) Type: thermistor for temperature, resistance for EC
- (e) Specifications: [CSI_cs547a_manual.pdf](#)

ii) Installation

- (a) Located in perforated, white PVC tube mounted horizontally on weir's upstream face, below notch level

(b) Comments: sensor removed from stream during mid-winter to prevent ice damage

(c) Data begin: April 10, 2005 (DOY 100)

iii) Sensor History:

Serial #	Date	Action	Condition
3997	May 2004	Installed at startup	New sensor

7) Datalogger

- a) Make: Campbell Scientific
- b) Model: CR10 (replaced CR10X in September, 2006)
- c) Serial Number: 14652
- d) Type: fully programmable measurement and control system with ring memory, extended temperature tested (-55 to +85C)
- e) Specifications: [CSI_cr10_manual.pdf](#)
- f) Sensor History:

Serial #	Date	Action	Condition
CR10 14652	Sep 20, 2006	Installed, replacing 39210	CSI serviced Nov 2004
CR10X 39210	May 2004	Installed at startup	New

8) Data Retrieval

- a) RF Station ID = 4
- b) Radio telemetry using phone-to-RF base station; no repeater utilized
 - i) Campbell Scientific model RF 310M modem; serial #2532
 - ii) Model RF310 Maxon SD-125 V2 VHF radio: serial #040106488, moved to Putney Study Plot on August 2, 2009 and replaced with Midland brand radio S# 0801000120 on September 21, 2009
 - iii) Antennex brand Yagi type antenna with 9' coax cable, two Type N connectors; antenna serial #38089
 - iv) Poly-Phaser IS-50NX-C2 in-line antenna surge protector

9) Software

- a) Campbell Scientific LoggerNet 2.1c
- b) Contact CSAS for specific Winter or Summer season Loggernet programming

10) Observer Contact Information

- a) Name: Chris Landry - Executive Director
- b) Agency: Center for Snow and Avalanche Studies
- c) Address: PO Box 190, Silverton, CO, USA 81433
- d) Telephone: (970) 387-5080
- e) Email: clandry@snowstudies.org
- f) Website: <http://www.snowstudies.org>

11) Data processing and output methods:

- a) Measurement execution interval: 5 seconds
- b) Measurements and Loggernet instructions: see table below
 - i) Location # in the table below refers to position in data file string (within a given array) as well as column number in relevant Excel spreadsheet header

Spreadsheet Labels	Loc'n #	LoggerNet 2.1c Output Instruction	Type of Measurement	Notes
ArrayID	1	P80	na	400 = 10 minute array 401 = 1 hour array 424 = 24 hour array
Year	2	P77	Na	Calendar year
DOY	3	P77	na	Sequential day of calendar year
Hour	4	P77	na	Mountain Standard Time at end of array period, in military time; previous day at midnight, 2400 at midnight
EC_mScm-1	5	P70	Sample	EC uncorrected for water temperature; units are mScm-1
Water_Temp_C	6	P71	Average	Array average water temperature (C)
EC_Correct_25C	7	P70	Sample	EC corrected to 25 deg C; units are mScm-1
Stage_Ft	8	P71	Average	Stage height in feet
Discharge_CFS	9	Na	Calculated field	Field is calculated in sequence of instructions using derived formula shown in <i>Part 2)a</i> of Metadata
Sys_Volts	10	P70	Sample	Voltage at datalogger
See also: Table of variables, CF standard names and attributes: snowstudies.org/data/metadata/SBSG_Variable_Table.xlsx				

Web Links for CSAS Metadata and Supplemental Documents:

- CF Standard Name Table for each variable measured:
http://snowstudies.org/data/metadata/SBSG_Variable_Table.xlsx

- Archived Datasets by Season, Snow Profiles, and Storm Reports:
<http://snowstudies.org/data1.html>

- Metadata for all CSAS Study Plots:
 Swamp Angel Study Plot: <http://snowstudies.org/data/metadata/SASP.pdf>
 Senator Beck Study Plot: <http://snowstudies.org/data/metadata/SBSP.pdf>
 Putney Study Plot: <http://snowstudies.org/data/metadata/PTSP.pdf>
 Senator Beck Stream Gauge: <http://snowstudies.org/data/metadata/SBSG.pdf>

- Photographs of all Study Plots:
 Swamp Angel Study Plot: <http://snowstudies.org/sasp1.html>
 Senator Beck Study Plot: <http://snowstudies.org/sbsp1.html>
 Putney Study Plot: <http://snowstudies.org/sasp1.html>
 Senator Beck Stream Gauge: <http://snowstudies.org/sbsg1.html>

- Instrument Manuals: <http://snowstudies.org/data/metadata/InstrumentManuals/>

- Interpolated Data Notes (Winter 2011/2012 and onward) for all CSAS Study Plots:
<http://snowstudies.org/data/metadata/DataNotes.xls>