Bonita Peak Mining District
Hydrologic Budget for 2018-2020 Time Period

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List of Abbreviations and Acronyms

AT	American Tunnel
BPMD	Bonita Peak Mining District
CFS	Cubic Feet per Second
CCSG	Cement Creek Stream Gage
DQO	Data Quality Objective
DRMS	Division of Reclamation and Mining Safety
EGSG	Eureka Gulch Stream Gage
EPA	Environmental Protection Agency
ESAT	Environmental Services Assistance Team
Ft^3	Cubic feet
Ft^2	Square feet
FCS	Flow Control Structure
FSP	Field Sampling Plan
GK	Gold King Mine
GPS	Global Positioning System
IWTP	Interim Water Treatment Plant
MSI	Mountain Studies Institute
N.O.	Natalie Occidental Mine
NPL	National Priorities List
NRCS	Natural Resource Conservation Service
OU	Operating Unit for BPMD RI
OU3	Bonita Peak Groundwater Operating Unit for BPMD
QA/QC	Quality Assurance, Quality Control
QAPP	Quality Assurance Project Plan
R&B	Red and Bonita Mine
RI	Remedial Investigation
RMP	Red Mountain Pass (SNOTEL site)
SNOTEL	Snow telemetry
SOP	Standard Operating Procedure
USGS	United States Geologic Survey

1.0 Executive Summary

The purpose of this report is to summarize and interpret all continuous hydrologic data sets in the Cement Creek watershed being monitored under the Bonita Peak Mining District Remedial Investigation. The data include stream discharge from seven locations along Cement Creek and two locations in Eureka gulch, discharge from six major draining mines and precipitation data from three independent weather stations.

Timeframe: Two water years; 2019 and 2020 (October 1, 2018 through Sept 30, 2020). Instrumentation installations occurred between 2016 and 2018 at most locations, providing complete data sets for the water years of 2019 and 2020.

Summary of results:

- Stream gages were successfully converted to discharge using exponential function rating curves and the fit ($r^{\wedge 2}$) was greater than 0.92 at all locations in both years.
- Results emphasize the importance to allocate greater amounts of annual funding and field efforts to within the narrow window of spring runoff to provide the best results for establishing stream gage stage/discharge relationships.
- Using the daily total discharge from each of the mines it was possible to determine the overall contribution of mine drainage to the surface waters at stream gage locations downstream of individual mines.
- Mine waters contributed 59-82% of all baseflow at CCSG 1 during the study.
- Mine discharge contribution to baseflow in Cement Creek was greater in the fall and winter following a large snowmelt season (2019) which demonstrates a lag in the conveyance of seasonal recharge to discharge in areas with significant mine workings.
- Obtaining year-round daily discharge values was most successful at gages having continuously open and flowing channels sustained by minimum flows greater than ~2 cfs (CCSG_1,2,3); discharge monitoring in the smaller drainages was limited to only summer and fall monitoring due to inaccessibility to these locations in winter and spring.

- Future direct monitoring of subsurface mine waters/pools (via wells) will be most beneficial to further understand the mine discharge trends in relation to climate driven water balance variability.
- Annual snowmelt is the primary driver of both stream and mine discharge increases annually so additional understanding of the timing and magnitude of annual snowmelt will strengthen the understanding of this relationship across BPMD OU3.
- On site weather stations provided detailed information on the timing and magnitude of precipitation in the study area and were in strong agreement with a long-term weather station at the headwaters of the adjacent Mineral Creek watershed.
- Future comparisons of runoff efficiency between Cement Creek and Eureka Gulch, using the established gages, may assist in further understanding of the potential impact of mine workings moving OU3 groundwaters across watershed boundaries.
- A full list of recommendations on ways to incorporate this report into the larger RI as well as ways to address remaining data gaps is provided in the conclusions at the end of this report.

2.0 Introduction

A hydrologic water balance was conducted to support the Bonita Peak Mining District (BPMD) Remedial Investigation (RI) conceptual site model (CSM) with the following primary objectives. First, this water balance provides an accurate temporal quantification of mine discharges to the catchments forming the upper watersheds of the Animas River. Secondly, it was important to determine the overall volumetric contributions (surface water discharge) coming from the areas around the draining mines to understand the relative contributions of natural runoff versus mine impacted discharges. Third, the timing and magnitude of both incoming water (precipitation) and outgoing water (stream discharge) must be understood to determine how mine workings are influencing the surface water and groundwater interactions in the BPMD operation unit 3 (OU3).

3.0 Methods

The primary objective of this study was to design, build and monitor stream and mine discharge monitoring stations and to operate two weather stations in the BPMD. Work began in 2016 and has continued through 2020 with additional sites and instrumentation added over successive years. All methods used in this study were documented each year through annual updates to the site wide BPMD quality assurance project plan (QAPP) and individual field sampling plans (FSP) for each type of hydrologic monitoring (CDM Smith, 2016, 2017, 2018(2), 2020; MSI, 2018, 2019, 2020). Approved standard operating procedures (SOP) and data quality objectives (DQO) for all instrumentation, equipment, and measurement techniques can be found in the site wide documents which were updated each year of the study prior to the start of field activities (https://cumulis.epa.gov/supercpad/SiteProfiles/index.cfm?fuseaction=second.docdata&id=0802497).

3.1 Field activities

Data acquisition for the different types of hydrologic measurements (stream gaging, draining mine monitoring, and precipitation monitoring) required weekly field activities throughout the study. Many field activities were performed in conjunction with other ongoing tasks including water quality sampling and other monitoring activities within the BPMD.

Stream gaging required monthly visits (weekly during high flows) to all sites to download instruments, collect field parameters, and keep instrumentation running correctly. Activities included maintaining cameras and performing snow and ice removal in the winter months and frequent stream flow measurements during the summer months.

Monthly monitoring of mines included downloading dataloggers (e.g., pressure transducers in flumes installed in mine discharge flows) and collection of field parameters (temperature, pH, specific conductivity). A key component of the field activities for draining mines was to perform continuous cleaning of flow measurement structures to prevent drift caused by sludge build up on the measurement area (throat) of the flumes. Ongoing efforts also included post processing of data to convert water depth in the flume (measured as a pressure exerted on a sensor placed in a stilling well connected to the flume) to discharge. In locations

where a manufactured flume was installed the conversion from water depth to discharge utilized exiting conversion charts which can be found in the BPMD site wide QAPP (CDM Smith, 2020).

Field activities also include monthly visits to the weather stations to collect ground truthing measurements (*i.e.*, confirming snow depths) and perform instrument maintenance.

3.2. Sampling Locations

All sampling and monitoring locations have been previously documented through the annually updated site wide BPMD QAPP and the task specific field sampling plans (CDM Smith, 2016, 2017, 2018(2), 2020; MSI, 2018, 2019, 2020). This report focuses on the hydrology of the upper Cement Creek watershed and the associated draining mines, defined as BPMD OU3. Some additional data was collected from two stream gage locations in the Eureka Gulch basin on the East (Animas River) side of Bonita Peak. In total there were 10 stream gages, three weather stations, and six draining mines in this study (figures 1,2).

3.2.1 Stream Gages

Stream gage locations included the USGS stream gage for cement creek (https://waterdata.usgs.gov/co/nwis/uv?site_no=09358550) which has been previously identified as sampling location CC48 within the BPMD. This location represents the full Cement Creek Watershed above the confluence with the Animas River and will define and quantify the relationships between the upper watershed areas and the full watershed.

Seven additional gages were installed in upper Cement Creek starting in 2017. Gage ID and locations can be found in Table 5-1 of the 2020 BPMD Field Sampling Plan (MSI, 2020). The furthest downstream gage, CCSG_1, was established just below Gladstone and the confluence of the main stem with the South Fork of Cement Creek. Moving upstream, CCSG_2 represents the South Fork of Cement Creek, just above the confluence with the main stem. CCSG_3 is located on the main stem at the road culvert adjacent to the Gladstone IWTP and just downstream from the AT discharge point but above the effluent discharge point of the IWTP. CCSG_4 was established on Minnehaha creek, a tributary to the South Fork of Cement Creek, located upstream of the road to Velocity basin, San Juan County Road 52. CCSG_5 was established on the North Fork of Cement Creek just upstream of the road crossing and downstream of point where the GK and R&B water pipelines cross the stream channel. CCSG_6

was established on Cement Creek just upstream of where the R&B mine discharge enters the stream channel. CCSG_7 was established on Cement Creek just downstream of where the Mogul mine discharge, along with several other tributaries, enter the stream channel. Stream gages CCSG_6 and CCSG_7 do not represent separate tributaries to the Cement Creek but rather were established to improve the resolution of stream flow monitoring in association with the locations of the existing draining mines of Mogul and R&B. The establishment of the two upper most gages was therefore intended to support specific monitoring objectives related to ongoing EPA removal and remedial actions at the nearby mine sites, such as the closure of the R&B bulkhead and were not specifically established to identify long term hydrologic trends.

Two additional gages were established in the Eureka Gulch drainage on the East side of Bonita Peak. The first gage, EGSG_1, was established near Eureka townsite at the mouth of the canyon and just above the confluence with the Animas River. EGSG_1 represents the primary surface water catchment on the east side of Bonita Peak and is inclusive of many of the Sunnyside mine workings near former Lake Emma. The second gage, EGSG_2 was established near the headwaters of Eureka Gulch at a location just below the Ben Franklin mine portal which represented all discharge from the Lake Emma headwater area. Due to lack of access, and major damage to the EG gages from historic avalanches of 2019, only partial data records were obtained at these locations.

Photos 1-2: Examples of stream gage locations, with CCSG_7 in fall on the left and CCSG_1 in mid-winter on the right.

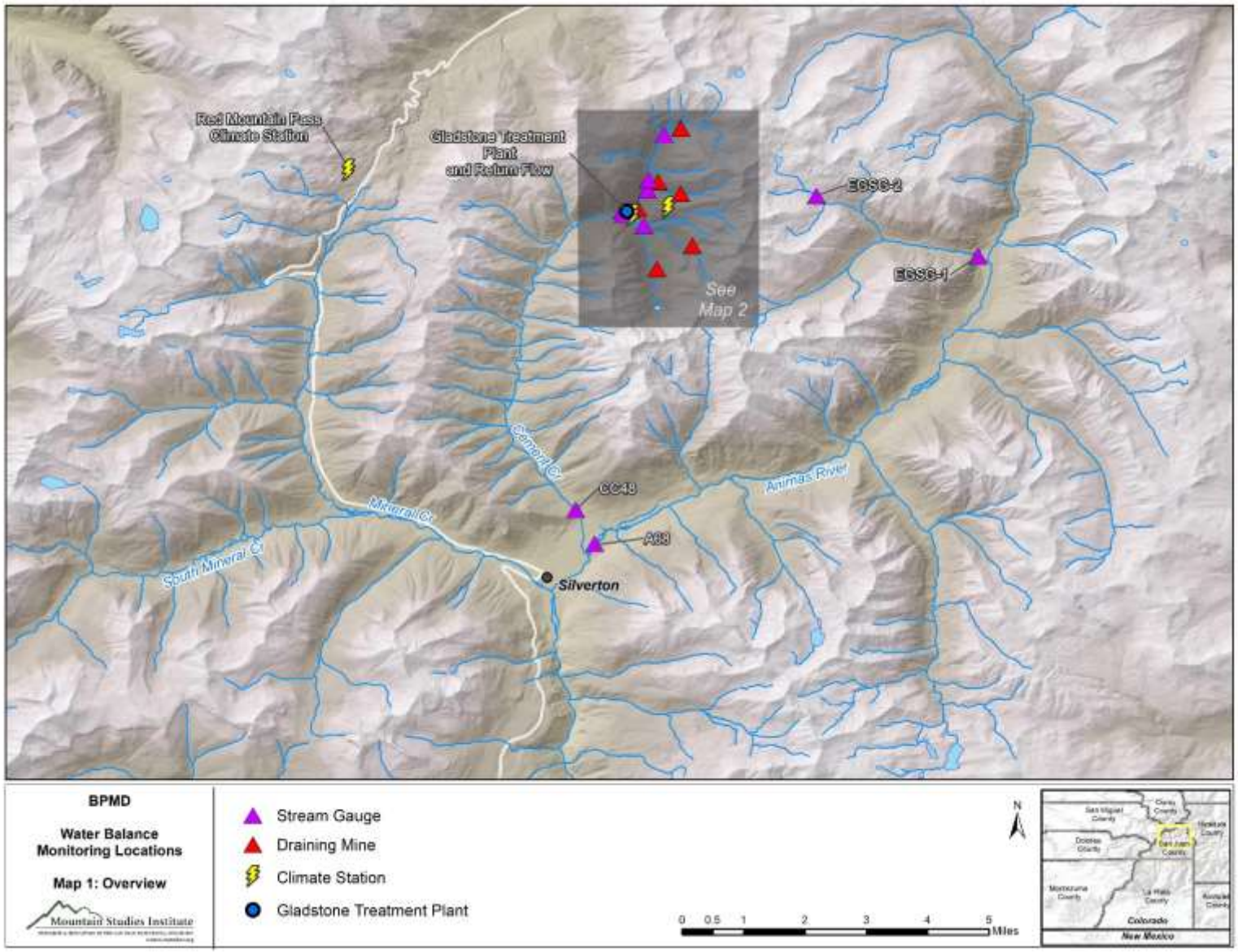


Figure 1: **Site map of stream gages, monitored draining mines, and weather stations.**

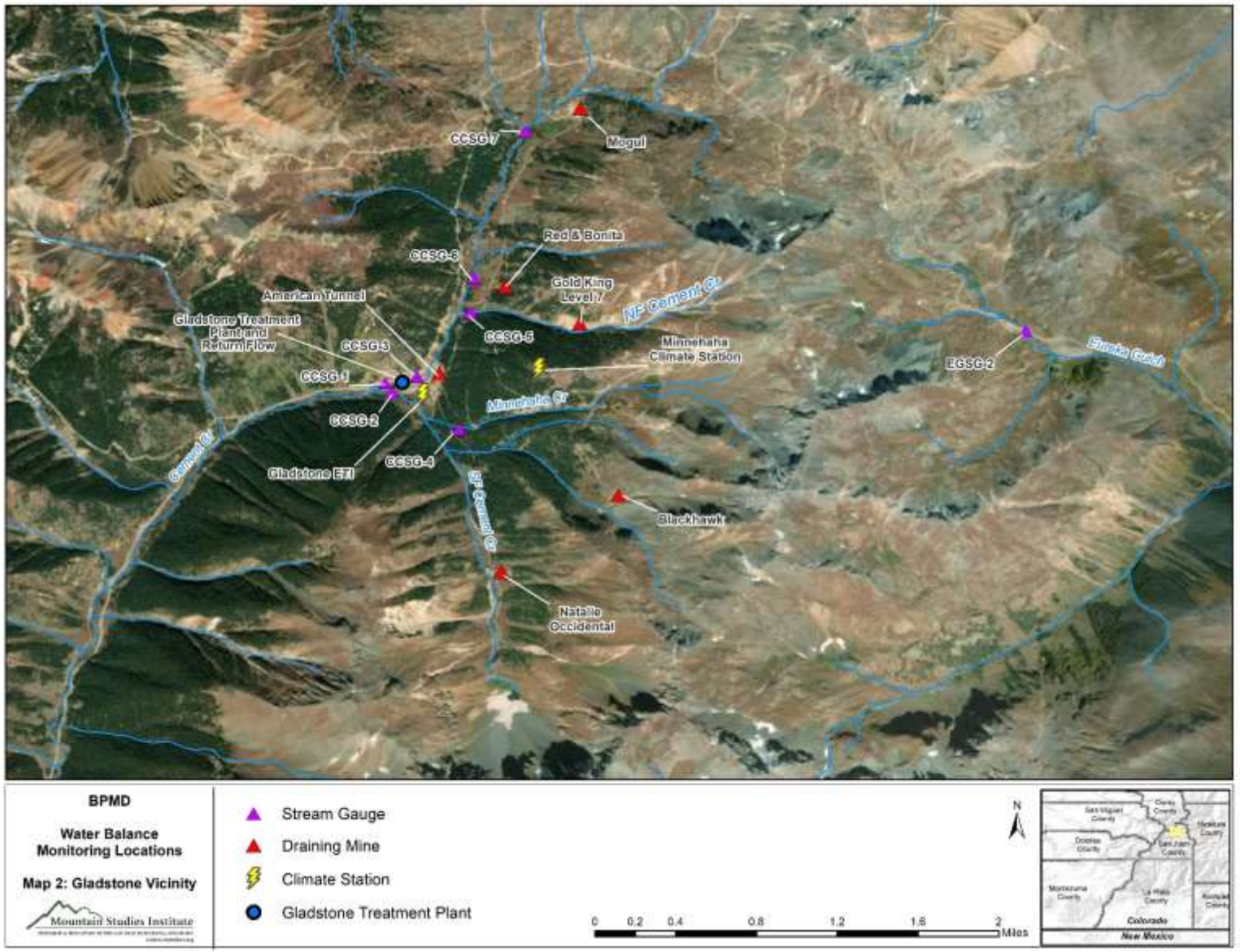


Figure 2: **Detailed site map of monitoring locations in Upper Cement Creek**

3.2.2 Draining mines

A total of six draining mines were instrumented and monitored for this study (see table 5-2 in the 2020 FSP). The mines represent the largest volume discharging mines in the upper Cement Creek watershed above Gladstone. All six mine portals had received some form of safety closure, stabilization, or flow control prior to the start of this study. Two of the mine locations were the Mogul and American Tunnel (AT) which both have existing bulkheads installed and had been monitored intermittently prior to BPMD NPL designation. A third mine, the Red and Bonita (R&B), had a bulkhead installed prior to the study but the bulkhead remained open for most of the study with water free flowing through a discharge pipe. The R&B bulkhead was closed for a test period where no flows went from R&B directly to Cement Creek from July 2020 through the end of the study (September 30, 2020).

The fourth mine was the Gold King Level 7 adit which had a flow control structure (FCS) installed prior to the start of this study. Similar to the R&B, GK flows were not altered by the FCS during the study and all water was able to freely flow past the FCS and through a water conveyance system to the IWTP.

The fifth and sixth mine discharges monitored in this study, the Blackhawk, and Natalie Occidental, were both free flowing with no engineered flow control structures at the portals. These two mine portals had only safety closures over the openings at the start of the study and no established flow monitoring locations or devices. Detailed descriptions of the mine instrumentation at each location are below.

American Tunnel (CC19)

The AT had an existing flume installed in the drainage ditch outside the mine prior to the start of this study. After rehab of the AT portal a new 2-inch Parshall flume was installed inside the mine portal in 2018 at the end of the existing drainage ditch and upstream of a newly installed water conveyance system (photo 3). The flume was located about 20 feet inside of the gated mine portal and behind an air curtain for protection from vandalism, avalanches, and freezing conditions. The AT flume was the most challenging to maintain due to high iron precipitate build up on the flume walls. Cleaning of the flume was required at monthly intervals to minimize drift and measured drift had to be removed from the data record monthly.

Photo 3: American Tunnel flume

Photo 4: Mogul Mine flume installation

Mogul Mine (CC01B)

At the Mogul Mine a 2-inch Parshall flume was installed in a similar location to the AT, just inside of the portal door, to protect the flume from vandalism and damage from winter snowpack (photo 4). The discharging water primarily comes from seeps and dripping around the existing bulkhead and has traveled along the flooded mine tunnel floor to the portal. Flow was not controlled after passing through the flume and exiting the mine portal.

Red and Bonita (CC03D)

At the R&B the discharge was measured using a Spirax/Sarco UTM 10 transit time flow meter attached to the discharge pipe downstream of the bulkhead (photos 5,6). The discharge pipe remained fully opened and free flowing throughout the study until the test closure in July 2020. The pipe flow sensor was placed at a specific location in the tunnel to ensure full pipe flow and behind the air door to prevent freezing of the instrumentation. The instrument was connected to a data logger which was powered by a deep cycle battery. Due to the underground location and extreme snow depths covering the portal in winter there was initially no solar power charging and batteries were changed out seasonally. However, in conjunction with the 2020 bulkhead test, the flow sensor instrumentation was connected to a solar charging system and the data logger was connected to a radio communication network relaying real time data to the internet connection at the IWTP. Data can now be downloaded remotely without direct mine portal access.

Photos 5-6: R&B mine discharge pipe flow sensor and data logger station.

Gold King (CC06)

A custom steel weir box was designed by Deere and Ault consultants and installed on the upstream side of the FCS (photo 7). Flow through the FCS was measured by recording the depth of water through the weir box using multiple sensors. Conversion of water depth to discharge was maintained by Deere and Ault consultants. Duplicate pressure transducers were installed on the side of the box and directly below a non-contact sonic sensor (mounted on top of the white

tube in photo 7). All water level sensors were connected to data loggers located at the mine portal. The pressure transducer data was then connected to satellite communications and data was directly uploaded to a third-party data hosting site maintained by the instrument manufacturer, In-Situ. The sonic depth sensor was connected to a data logger at the portal which was downloaded monthly during the study. In the summer of 2020, the GK data logger was connected to the internet via radio communications to Gladstone IWTP as part of the infrastructure improvements for the R&B bulkhead test closure.

Additionally, all discharge from the GK portal was measured as inflow to the IWTP. This discharge data was monitored for agreement with the discharge measured at the FCS by the EPA removal program during the study period. Since 100% of GK discharge was treated by the IWTP before being discharged to Cement Creek at Gladstone (between CCSG_1 and CCSG_3) it was determined that the discharge values directly from the IWTP were the most appropriate for use in this report. The IWTP outflow rates were assumed to be equal to the measured inflow rates for the purpose of this study because the treated water is released back to the creek and not stored on-site for any extended periods of time. Additionally, during the final three months of water year 2020 the R&B bulkhead test was performed and all waters exiting the R&B during and after the test were sent to the IWTP and treated along with the GK water. Therefore, all R&B waters discharged to Cement Creek in this period were discharged from the IWTP, further making the IWTP discharge record the most accurate values to use for mine discharge calculations.

Photo 7: GK flow control structure weir box and associated water depth sensors.

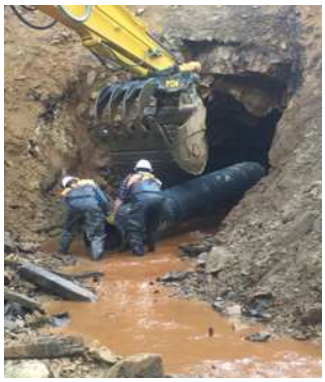
Natalie Occidental (CC14)

At the Natalie Occidental a 30-inch-wide custom flume box was installed in 2017 to monitor discharge at the portal (photo 8). Due to the large amount of iron precipitate and sludge in the mine discharge, a standard Parshall flume could not be used because the precipitate would alter flume dimensions and cause flow data to drift. The constructed flume also provided a solid bottom and defined side walls to constrain flow and improve accuracy of manual discharge measurements. A stilling well was attached to the outside of the box and water elevations were monitored using a pressure transducer. Water depths in the custom flume were converted to discharge using a manually developed stage-discharge rating curve.

Photo 8: Natalie Occidental mine discharge custom flume

Blackhawk (CC50)

Following portal stabilization and installation of a drainage culvert by EPA removal program in 2018, a 3-inch Parshall flume was installed at the terminus of the culvert on 10/2/18. A custom snow shed was built to protect the flume from winter snow depths of over 10 ft and allow year-round measurements with a pressure transducer. Due to the lower overall iron content of the mine discharge, there was minimal build up in the flume which was important as the site was inaccessible for several months each winter when avalanche conditions were high.


Photos 9-11: Blackhawk Mine portal stablization and flume install with snow shed.

3.3 Precipitation

Two weather stations were installed in the Gladstone area of Upper Cement Creek in 2017 to provide localized monitoring of precipitation, snow depth, air temperature, humidity, wind speed and wind direction in the vicinity of the draining mines listed above. The BLM provided funding, land, and access to install the full weather station located at tree line in the Minnehaha basin (11,774 ft). A second station was installed at the Gladstone IWTP (10,538 ft) to measure precipitation only. Both stations were built to run on solar power and are connected to the EPA internet at the IWTP via radio communication. Live data is uploaded to a server for near real-time data viewing. The data is publicly available at (http://205.220.219.73/index.html).

Photo 12: Gladstone ETI NOAH 2 precipitation gage installation.

The ETI NOAH 2 precipitation gage consists of a vertical cylinder on top of a load cell which weighs the precipitation in the cylinder and converts to a depth of precipitation landing in the cylinder per unit of time. The scale is connected to a data logger and the devices are powered by a solar charged battery. To convert solid precipitation (snow) to a liquid volume the gage contains several inches of anti-freeze to melt the snow. A thin layer of low-density mineral oil is also maintained in the gage and it resides on the top of the water column to create an evaporation barrier and prevent measured loss of total precipitation from evaporation.

Photo 13: Minnehaha weather station.

The Minnehaha station includes an ETI NOAH 2 precipitation gage (identical to Gladstone) as well as a tower containing instruments to monitor air temperature, humidity, wind speed and direction, and snow depth. All weather station instruments are manufactured by Campbell Scientific. The snow depth is measured by an ultrasonic sensor which measures the distance from sensor down to the snow surface which is subtracted from the total distance to bare ground to calculate snow depth in inches. All data collected at the station is stored in a data logger that is connected to a radio and antenna which relays data to the Gladstone IWTP at which point it is connected to the EPA satellite internet providing live readings and upload to a remote server. All site instruments are run on a solar charged battery.

A third weather station, maintained by the NRCS National Water and Climate center, was used to cross check the newly installed BPMD stations. This station is known as the Red Mountain Pass SNOTEL site (#713) located approximately six miles west of Gladstone at the headwaters of Mineral Creek (11,200 ft) and has the longest and most complete precipitation record in the area. This data is publicly available at (https://wcc.sc.egov.usda.gov/nwcc/site?sitenum=713). Red Mountain Pass SNOTEL (abbreviated as RMP for this report) site has 40 years of precipitation record and the average values are reported as the 30-year moving average which is updated each decade. For this report, the average annual precipitation was taken as the mean of 1980-2010.

Daily cumulative P was measured at both BPMD stations and from the RMP site. The RMP site served as a cross check or QC of our data to demonstrate the percent change from our site to RMP on an annual basis and to observe how storm event totals compared across the region. The RMP site was also used to gap fill missing data at the BPMD sites that occurred in March of 2019 due to the large storm cycle which closed access to the BPMD sites (road closed due to avalanches) and prevented O&M of the gages. The March 2019 precipitation events overwhelmed/overtopped the BPMD precipitation gages preventing accurate daily totals until the gages could be restored in April 2019.

The cumulative precipitation was divided annually into Snow and Rain based on the snow water equivalent of the annual snowpack at maximum accumulation relative to the annual total precipitation. Precipitation totals for all stations were also broken down into annual rain vs snow. For this report a simple seasonal period was assigned for precipitation as winter snow (October – April) and summer rain (May-September). A May 1 date for seasonal transition each water year was supported by the dates of maximum Snow Water Equivalent (SWE) at the RMP station. Maximum SWE occurred on May 3, 2019 and April 25, 2020, close to the May 1 date. Quantifying total precipitation as snow via SWE was performed to demonstrate that the predominant source of incoming precipitation was in the form of snow and release of snowpack melt water was the dominant driver of seasonal increases in stream discharge hydrographs.

Spatial distribution of precipitation was studied by first confirming that there was not a dramatic elevational gradient in precipitation distribution based on data from three stations across the BPMD. Both the Minnehaha and RMP stations were in similar elevation band (just below tree line) and resided at the headwaters of adjacent drainages so similar precipitation

records were anticipated. With no significant gradient, it was determined that the most accurate volume for precipitation would be from the Minnehaha station as it resided within the watershed area for the stream gages and draining mines of this study and was at an approximate median elevation within that watershed area and within the BPMD OU3 (Bonita Peak groundwater system). The OU3 topographical area in Cement Creek had an elevation range of 10,500 ft at Gladstone to over 13,200 at the top of the surrounding peaks, with the Minnehaha station residing at 11,774 ft.

3.4 Discharge

To capture instantaneous stream conditions, continuous monitoring stations consisting of an Aqua Troll 700 pressure transducer (https://in-situ.com/us/level-troll-700h-data-logger), a game camera, and a stage card were installed and maintained at the locations that were selected in 2017 (CDM Smith, 2017). Stage cards and pressure transducers were attached to steel T-posts. Water level was measured at ten locations using stream gauges with a continuously recording vented pressure transducers. The water level was converted to volumetric discharges by empirical rating curves (appendix 2) that were constructed each year using manual measurements taken ~10 times each year over the full range of the hydrograph. Due to the high gradients of the stream channels and alteration of stream channel cross-sectional area at the staff gage, caused by ongoing scouring and deposition of stream bed materials, a new rating curve was developed each year to ensure the most accurate stage-discharge relationship for all locations. Manual measurements were taken using instrumentation and methods defined in the FSP and associated standard operating procedures. Due to winter access issues and freezing conditions, the pressure transducers were installed each spring and removed in the fall. The objective was to provide high resolution monitoring of the stream stage heights during high flow periods associated with annual snowmelt and summer monsoon rains. The winter period represents low flows with much less daily variability, so stream stage/discharge measurements were taken approximately monthly during the winter (when sites were safely accessible) and daily values were linearly interpolated between manual sampling events. Additionally, time-lapse cameras were maintained at each gage throughout the study and provided additional stage height values between manual recordings by storing images of the staff gage heights at hourly intervals. Time lapse photos were used to gap fill when instruments malfunctioned or were uninstalled in winter. For winter low

flow periods (October-April), the camera photos were used to gap fill actual stage heights to weekly resolution in between the manual monthly measurements. During higher flow periods (May-September), the camera photos were also used to provide a daily mean stage height to gap fill when the pressure transducer data was either not available or unreliable. During peak flows following snowmelt, turbulent flows occasionally overtopped the existing stream gages at the upper locations (*i.e.*, CCSG_6) due to steep narrow channels and limited flow control infrastructure (photo 14). At times when accurate stage heights could not be discerned, gaps in discharge values were interpolated using a proportional relationship with downstream gages. The proportional relationships were established by referencing data periods when all gages were working properly and/or by cross-checking manual flows taken on similar dates at the different gages.

The upper gages were the most difficult to maintain throughout the year due to extreme conditions (snowpack and ice). Accuracy was also challenging due to the high gradient of the stream channels creating turbulent and high velocity flows at the station locations. The gages for this project were installed without any permanent structural construction such as impermeable concrete weirs or stream bank containment *(e.g.*, bridge abutments common at USGS gaging locations). Therefore, it was very difficult to maintain a consistent cross-sectional area at the gage location due to high mobility of the stream bed materials along the reaches leading to ongoing scouring and filling with changing flows. During high flow conditions it was also difficult to accurately measure stage height with the stilling wells due to turbulent flows (see photo 14). As with CCSG_5, both locations reside in narrow, high-gradient, stream channels with significant winter snowpack limiting access and monitoring for much of the year. Spring access was also difficult due to late snowpack, so it was challenging to install monitoring instruments in time to capture the rising limb of the spring hydrograph.

Photo 14: Turbulent flows overtopping staff gage at CCSG_6, June 6, 2020.

All recorded stage heights were normalized to the staff gage, which remained in a fixed location and elevation throughout the study. Due to the installation and removal of pressure transducers seasonally, for periodic maintenance and cleaning and to ensure full instrument submersion during low flows, it was necessary to first ensure that all recorded stage data was normalized to the staff gage. Pressure transducer depth data was converted to absolute stage height by linear regression. All manual stage readings and camera recorded stage readings were in reference to the absolute values of the staff gage. Discharge values were thus calculated by converting all stage measurements to a discharge using the established stage-discharge equations for each year at each location. The stage-discharge curves and equations are included in appendix 2.

Discharge data was calculated as a daily mean value (CFS) as well as a daily total volume (cubic feet). By calculating a daily total in cubic feet, it was therefore possible to sum daily totals and generate annual total discharge from each gage location.

It is important to note that there are inherent challenges with accurate streamflow measurements in high gradient alpine streams (Marchand *et. al.*, 1984). Therefore, it is necessary to acknowledge an assumed level of precision (constrained by random error) with measuring stage heights and stream discharges. Although quantitative error analysis was beyond the scope of this report, a conservative estimate of error for acceptable stream discharge measurements would be between 3% and 6% (Sauer and Meyer, 1992). Therefore, all streamflow results should

be interpreted with this understanding of variability and statistical significance of results are not included in this report.

3.5 Water balance calculations

To quantify the hydrologic relationship between incoming water (precipitation), outgoing water (stream gages), and relative proportions of water moving directly through mine workings (mine discharge), annual water balance variables were calculated for the two water years of the study (2019-2020).

A water balance is defined as:

Q = P – ET - ΔS

Where **Q** is discharge, **P** is precipitation, **ET** is evapotranspiration, and **ΔS** is change in storage. This study focused on quantifying **Q** and **P** while **ET** and **ΔS** were not directly measured. To provide an analysis on the relationship between water entering a catchment as precipitation and leaving the catchment as surface waters, the runoff efficiency was calculated. Runoff efficiency (K) for each catchment was calculated as:

K = Q (ft) / P (ft)

Where Q is measured as the seasonal specific discharge for the catchment and P is the specific precipitation entering the catchment annually.

The precipitation, stream gage, and draining mine water volumes were calculated using compatible units. Discharge volumes were presented in cubic feet per unit time and precipitation in depth of water (ft) per unit of time. The precipitation (ft) was multiplied by surface area (ft^2) to calculate a total volume of water (ft^3) over a specified time-period. Specific discharge is equal to the depth of water over the entire watershed that passed by the discharge point (stream gage) for a set period of time (water year). Specific precipitation is the depth of precipitation over the entire watershed. Watershed size was calculated for each stream discharge point using GIS and determining drainage area upstream of that point location. Watershed size cannot be calculated for mine discharges as the source waters may not originate from within the topographical drainage area upgradient of a mine portal location. Additionally, the geographical extent of source water flow paths to draining mine portals are complex and diverse due to the subsurface interactions of different mine workings in conjunction with other groundwater

conduits such as faults, fractures, and hydrogeologic features creating variable permeabilities throughout the subsurface. Interconnected mine workings and mine water pools may extend beyond topographical watershed boundaries nullifying source area quantification.

Runoff efficiency was calculated for stream gage locations where a complete annual discharge was measured. The runoff efficiency was calculated as the specific discharge divided by the specific precipitation for a unit of time, in this case a water year. The value represents the percent of water coming into the system (precipitation) that exits the system (stream discharge). In a natural hydrologic system, 1 – the runoff efficiency represents the amount of water that exited the watershed as evapotranspiration (ET) and/or a change in storage (ΔS) over the time-period of measure. However, there was an added complexity of potential groundwater storage volumes residing directly in mine workings and the timing and magnitude of the "mine pool" reservoirs within BPMD were still unknown at the time of this report. Determining changes in mine pool and groundwater reservoir volumes at scale would require extensive water table monitoring with wells and was beyond the scope of this report. Therefore ΔS in mine pool water could only be presented qualitatively in this report using observed changes in annual mine discharge in relation to annual stream discharge. Due to the known sub-surface trans-watershed connections of the American Tunnel and Sunnyside mine workings (spanning Cement Creek and Eureka Gulch drainages) it would also be necessary to quantify the water balance of both drainages over the same time periods to more accurately monitor for any mine-workings driven subsurface hydrologic connectivity of separate surface water drainages.

Quantification of the ET would enable a verification of the amount of water exiting the system prior to reaching surface waters or ground water reservoirs. The timing and magnitude of ET is dependent on many factors including vegetation distribution (*e.g.,* forested vs. alpine areas) and several other geographic and climactic parameters, including elevation, solar exposure (aspect), air temperature, humidity, wind speeds, etc., which were beyond the scope of this report. Future analysis of the ET component of the watershed would be best performed with additional weather station data points across Bonita Peak that better quantify the spatial variability of meteorological parameters such as solar radiation, soil heat flux, and wind speeds. Fortunately, the objective of this report was to make interannual comparisons of the same areas (catchments) over two different water years rather than different areas in the same time period. Therefore, it was not necessary to specifically quantify ET nor change in storage. Additionally,

this study site is dominated by alpine topography and vegetation driven ET is less important to overall water balance calculations in alpine basins (Cowie *et al*., 2017, Cochand *et al*., 2019). The limitations noted above are intended to highlight potential data gaps that could be addressed in the future if a more detailed hydrologic flux analysis is desired.

3.5.1 Mine discharge contributions to streamflow

In addition to measuring the runoff efficiency of different portions of the watershed, the overall contributions of mine discharges to stream discharge were measured. Using the daily total discharge from each of the mines, it was possible to determine the overall contribution of mine drainage to the surface waters at stream gage locations downstream of individual mines. For this study, the discharges from the six draining mines in Cement Creek were compared to the total discharge for Cement Creek immediately downstream of Gladstone and the confluence of the South Fork (CCSG_1, figure 1). The gage CCSG_1 is below the confluence of Cement Creek with South Fork Cement Creek and below the discharge point of the BPMD IWTP at Gladstone; therefore, CCSG_1 was inclusive of all six mine discharges, including the treated water from the GK mine.

Additionally, Cement Creek above Gladstone was divided into the main stem and the South Fork with stream gages CCSG_3, and CCSG_2 representing those stream segments, respectively. There are two of six mines contributing to the South Fork (N.O. and Blackhawk) while three mines (Mogul, R&B, AT) discharge upstream of CCSG_3. The GK mine portal resides upstream of CCSG_3 however the discharging water is conveyed to the IWTP and does not discharge to Cement Creek until below CCSG_3 but above CCSG_1.

For the water balance objective, this study was designed to quantify the timing and magnitude of mine discharges relative to the overall discharge of the receiving waters (streams). Results are intended to support development of a conceptual site model (CSM), specifically to understand how water is moving into, through and out of the BPMD OU3 (Bonita Peak groundwater system) and to understand the role of the associated mine workings in conveying water to the streams. The volume and residence times of specific mine pool waters (*i.e.,* Sunnyside mine workings) relative to the overall magnitude and residence time of all groundwaters within the OU3 had not been quantified at the time of this report.

4.0 Results

4.1 Precipitation

Daily and cumulative precipitation totals for all three weather stations, and snow depth data from RMP and Minnehaha are in Appendix 1. The water year of 2019 was an above average precipitation year and 2020 was a below average year based on long term (1980-2010) annual water year average of 43.3 inches of precipitation for RMP SNOTEL (https://wcc.sc.egov.usda.gov/nwcc/site?sitenum=713). In fact, the water year 2019 had 106% of average total precipitation while water year 2020 was just 75% of average total precipitation at the RMP SNOTEL site. Total annual precipitation was 30% lower in 2020 than in 2019. For reference, the three years prior to this study also had large variability in annual precipitation with 2018 being the driest year in the 38-year record at RMP site with just 23.3" of precipitation while 2016 and 2017 were relatively average hydrologic years at 45.9" and 44.5" of precipitation, respectively.

All three weather stations recorded very similar annual precipitation totals (Table 1, Figure 3). In both years, the RMP site recorded the highest total amount with the Minnehaha station recording 4% less precipitation than RMP and Gladstone recording 5% less precipitation than RMP in both years. Slightly lower totals at Gladstone were expected as the Gladstone station is at 10,538 ft elevation, 700-1,200ft lower than the Minnehaha and RMP stations (11,774 ft and 11,200 ft) respectively. The consistent agreement between total cumulative precipitation at the three stations, spanning two watersheds and over 1,000 ft elevation gradient, strongly supports the notion that incoming precipitation is consistent across the different drainages (Mineral Creek and Cement Creek) within the BPMD. Additionally, the results indicate that there is <1% change in precipitation totals across the elevation gradient from Gladstone to Minnehaha, which resides within the Cement Creek watershed above Gladstone (the focus area of this study). Therefore, for the purpose of this study, the cumulative annual precipitation totals from the Minnehaha station will be applied to the water balance calculations. The Minnehaha station resides at tree line in the middle of the elevation range of the Upper Cement Creek watersheds and thus provides an ideal in-situ measurement location for precipitation entering the watershed above the stream gages and draining mines in this study. Precipitation is generally not measured at point locations in the alpine due to the common occurrence of snow redistribution (scouring and loading) making accurate quantification at spatial scale difficult (see Cowie et al.,

2017). A more detailed spatial analysis and distribution of precipitation inputs would require more detailed analysis of snowpack distribution in alpine basins and is thus beyond the scope of this report. Recommendations for future monitoring to increase resolution of precipitation in the BPMD are provided at the end of this report.

Table 1: **Precipitation totals from three weather stations in the BPMD for water years 2019 and 2020.**

Site	Water year	Total P (inches)	% snow	% rain
RMP	2019	46.2	77.9	22.1
Minnehaha	2019	44.19	77.3	22.7
Gladstone	2019	43.82	77.5	22.5
RMP	2020	32.3	80.2	19.8
Minnehaha	2020	31.01	74.3	25.7
Gladstone	2020	30.77	74.5	25.5

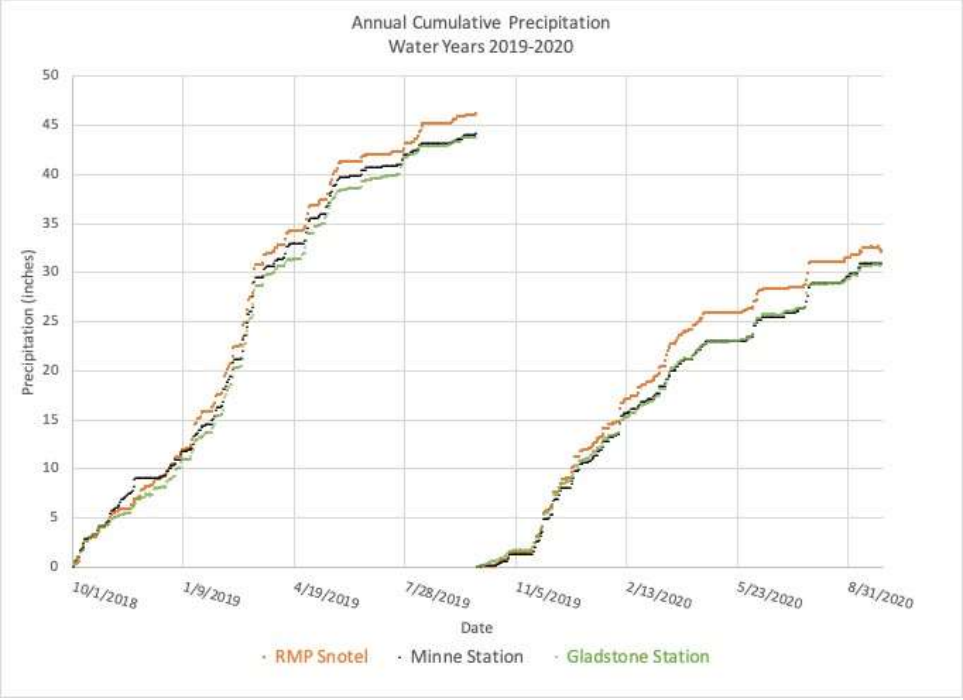


Figure 3: **Cumulative annual precipitation from three weather stations in the BPMD area. The Red Mountain Pass SNOTEL site #713, and two BPMD stations at Minnehaha and Gladstone.**

4.2 Precipitation type; Snow and rain

Snowpack timing and magnitude at the RMP and Minnehaha stations are plotted in figure 4. The timing and magnitude of snowpack depth from RMP site in upper Mineral Creek basin is nearly identical to that measured at the Minnehaha station, providing confidence in the results collected for this study. The winter of 2019 had more precipitation overall with maximum snow depths ~50% greater than the winter of 2020. The large storm cycle of early March 2019, which caused an historic avalanche cycle across the study area, was a major factor in the overall larger snowpack that year. In addition to the increase in maximum snow depths in 2019, there was also a delayed onset of snowmelt and later melt out date for the snowpack than in 2020. The snowpack did not fully melt until July 10, 2019 at the Minnehaha site while snowpack was completely melted out one month earlier (June 11, 2020) the following year. The observed inter-annual variability in magnitude and timing of winter snowpack can be summarized by stating that 2019 was an above average precipitation year and 2020 was a below average year based on long term (1980-2010) annual water year average of 43.3 inches of precipitation for RMP SNOTEL (https://wcc.sc.egov.usda.gov/nwcc/site?sitenum=713). The observed variability in annual precipitation provided an ideal situation in which the corresponding hydrologic responses of both stream flows and mine discharges could be observed and used to further understand potential hydrologic variability of the BPMD OU3 under current and future scenarios, further assisting the overall RI. With current and future changes in climate expected to alter the timing and magnitude of snow accumulation and melt (Hamlet et al., 2005; Mote et al., 2005; Stewart et al., 2005; Nayak et al., 2010), changes in groundwater recharge and flow will be increasingly important to monitor.

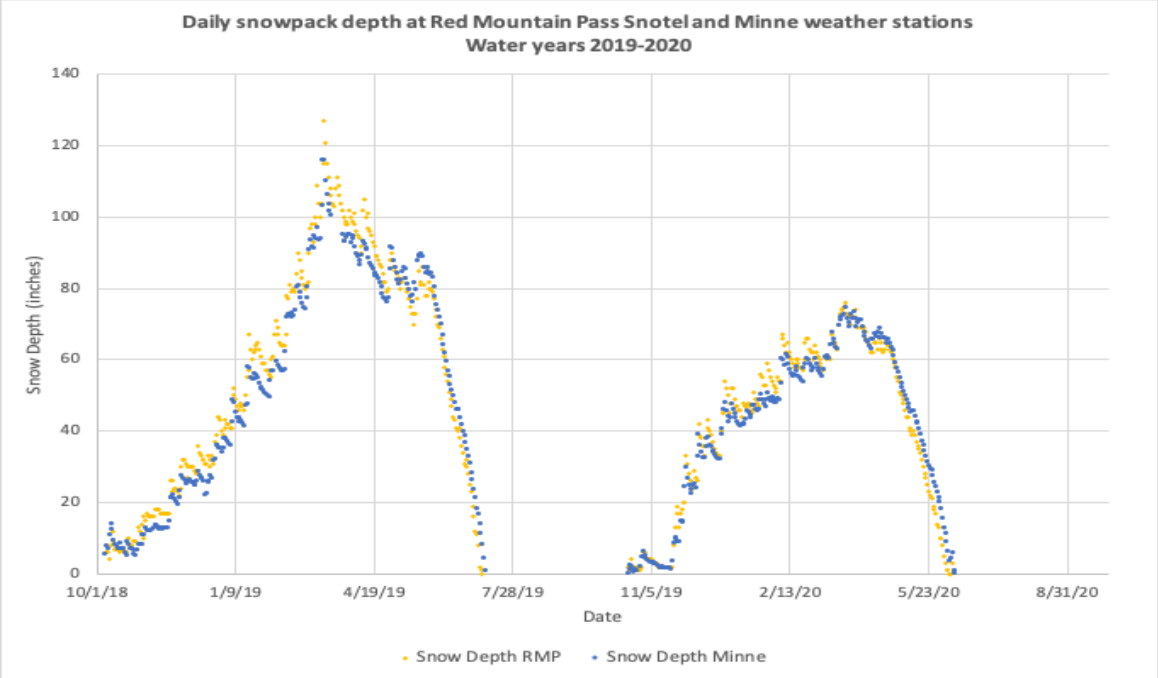


Figure 4: **Daily Snowpack depths at Red Mountain Pass SNOTEL site #713 and BPMD Minnehaha Station for water years 2019 and 2020.**

4.3 Stream Gages

4.3.1 Drainage areas

The drainage area of each stream gage location was calculated to quantify the size of the Cement Creek watershed represented at each site (Table 2). The USGS gage at CC_48 represents the entire watershed as it is the closest stream flow monitoring station above the confluence with the Animas River. CCSG_1 represents all of Cement Creek from a point just downstream of the confluence with South Fork Cement Creek, which was approximately one third of the entire watershed above CC_48. The watershed area represented by CCSG_1 ranges in elevation from 10,500 to over 13,200 ft on Bonita and Emory Peaks. The catchment area encompasses both forested sub-alpine (below ~11,700 ft) and alpine tundra (above ~11,700 ft) ecotones. The percent of forested vs. alpine area was not explicitly calculated for this study.

CCSG_2 and CCSG_3 each represent about one half of CCSG_1, with each representing different stream segments that confluence just above CCSG_1. Gages CCSG_4 and CCSG_5 represented the Middle Fork and North Fork tributaries, respectively, and were the smallest catchments monitored in this study. The uppermost two gages in Cement Creek, CCSG_6 and

CCSG_7, represented successively smaller portions of the main stem of Cement Creek and reside within the drainage area measured at CCSG_3. CCSG_6 represented the catchment area above the inflow of R&B mine while CCSG_7 represented the uppermost portion of the catchment from a point just below the inflows from the Mogul mine (see figures 1,2).

Table 2: Stream gage catchment areas.

Gage ID	Acre	Km^2	Mile^2	Ft ^2	% Cement Creek
CC48	12864	52.06	20.1	560,388,000	100
CCSG_1	43.09	17.44	6.73	187,632,400	33.48
CCSG_2	1,969.89	7.97	3.08	85,870,400	15.32
CCSG_3	2,288.6	9.26	3.58	99,810,400	17.81
CCSG_4	320.57	1.3	0.5	13,940,000	2.49
CCSG_5	310.69	1.26	0.49	13,661,200	2.44
CCSG_6	1,773.75	7.18	2.77	77,227,600	13.78
CCSG_7	1,057.47	4.28	1.65	46,002,000	8.21
EGSG_1	4,863.97	19.68	7.6	211,888,000	NA
EGSG_2	738.66	2.99	1.15	32,062,000	NA

4.3.2 Stage-discharge rating curves

A stage-discharge relationship curve was built for each gage in each year (appendix 2). All rating curves were fit using an exponential function and the fit (r^2) was greater than 0.92 for all locations and all years. In most cases the R^2 was greater than 0.95. Due to limited seasonal access at some locations, it was not possible to capture the full range of the hydrograph because sites were still inaccessible at the time of peak flow in the spring and early summer (example EGSG_2 in Upper Eureka. This scenario was more prevalent in 2019 due to the avalanches in March of 2019. Additionally, due to contractual delays beyond the control of the contractor (MSI) there was a delay in the start of stream gage monitoring and transducer acquisition and installation in 2019, which resulted in a sampling gap for the rising limb peak flows at many locations. Peak discharge had passed by the time the first discharge measurement was taken which resulted in rating curve establishment without a maximum value. This was particularly evident at CCSG_1, CCSG_2 and CCSG_3 as the lower elevation gages tend to see peak flows sooner each year. Fortunately, there was still confidence in the rating curves, and they were able to be applied to the transducer data collected on the recession limb in 2019. With the late

installation and monitoring there was an additional unanticipated labor effort to use other methods (camera photos, relative proportions, interpolation, etc.,) to fill in the rising limb of the hydrograph in 2019 to an acceptable level of confidence. Therefore, the results highlight the critical importance of initiating annual stream gage monitoring efforts prior to start of the snowmelt season because runoff will not adhere to contractual delays.

Another observable result of the stage discharge calculations was that increased stream discharge occurred in a relatively short annual window (a few weeks at peak snowmelt), which was the most important time to make repeated manual flow measurements to satisfy even distribution of points on the rating curves. Therefore, it is important to highlight the need to disproportionately allocate greater amounts of annual funding and field efforts to within the narrow window of spring runoff to provide the best results for establishing stage/discharge relationships.

4.3.3 Daily discharge

A daily mean discharge value was calculated at each stream gage location over the study period when validated data was available (Appendix 3). Stream stage height readings were converted to discharge using rating curves (Appendix 2). The primary source for stage height data was from the continuously recording pressure transducers with additional data provided by camera photos and manual readings. A complete set of daily discharge values were compiled for the gages CC_48, CCSG_1, CCSG_2, CCSG_3, CCSG_6, and CCSG_7 (figures 5 and 6) and annual totals in table 3.

The CC_48 stream gage measured 1.7 billion cubic feet of water in 2019 and only 0.86 billion cubic feet of water in 2020. In spatial units that was 40,000 acre-feet in 2019 and just under 20,000 acre-feet in 2020. In 2019 peak discharge was 408 cfs on June 9 and peaked at 184 cfs on June 6, 2020. The minimum average daily baseflow was very similar at 10.4 cfs in 2019 and 11.6 in 2020. In both years, streamflow begins to increase around April 1 which was earlier than the upper gages due to earlier snowmelt in the lower elevations of the catchment below Gladstone. Although the date of peak discharge was similar in both years, the recession limb was more sustained and gradual in 2019. The gradual recession of 2019 also masked increases in discharge from summer rain events, with a large event in July 2020 clearly visible.

CCSG_1 recorded peak flows of 134 cfs and 93 cfs on June 8, 2019 and 2020 respectively. Low flows were 5.16 cfs in March 2019 and 3.78 cfs in December of 2019. The drainage area of CCSG_1 was 33% of the total drainage area of CC48 and both the peak discharge and the total annual volume of discharge was nearly identical to these proportions in 2019. In 2019 peak mean daily discharge was 33% of the peak value at CC48 and total volume of discharge 31% of the CC48 total. In 2020 the total discharge at CCSG_1 was 39% of the total discharge measured at CC48, and 50% of peak discharge at CC48, a slightly larger overall contribution when normalized by area. The measured increase in overall % of Cement Creek discharge coming from above CCSG_1 may have been attributed to greater % contributions from mine discharges relative to streamflow in 2020 because of the lower precipitation and smaller peak flows in surface waters. The increase in relative contribution may also have been attributed to other hydrologic factors including increased evapotranspiration (water loss before reaching the stream) in the lower forested portions of Cement Creek below CCSG_1. Other factors including increased % annual total mine water contributions to streamflow above CCSG_1 could also have contributed to the increase in relative contributions from the upper watershed and they will be discussed in the next section.

Moving upgradient from CCSG_1 the discharge was divided into near equal segments from South Fork Cement Creek (CCSG_2) and Main Stem Cement Creek (CCSG_3). As anticipated both stream gages had similar hydrographs (figure 5) and represented similar volumetric contributions to streamflow. CCSG_2 had peak mean daily discharges of 60 cfs in 2019 and 39 cfs in 2020 while CCSG_3 peaked at 71 cfs in 2019 and 52 cfs in 2020. Minimum baseflows were similar (~ 2 cfs each) throughout the study with the exception of CCSG_3 decreasing to less than 1 cfs in September of 2020. The drop in flow at the end of the study is directly attributed to the R&B bulkhead test as R&B mine discharge was not entering the stream above CCSG_3 during this time. The decrease in flow at CCSG_3 during the R&B bulkhead test provides initial indications that the closing of the R&B bulkhead increased storage of groundwater in the immediate vicinity of the mine during the test. However, the water balance study ended on September 30,2020 (end of 2020 water year) and thus was not able to fully quantify when or where the groundwater backed up behind the bulkhead ultimately returned to Cement Creek. Another characteristic of the hydrographs as CCSG_2 and CCSG_3 was that although similar in peak and total annual discharge (table 3) the timing of seasonal flows

differed. CCSG_3 had a slightly earlier and steeper rising limb while CCSG_2 had a longer and more gradual recession limb (Figure 5). The earlier and steeper rising limb at CCSG-3 likely indicates slightly earlier snowmelt in that catchment (Upper Cement Creek) as compared to the South Fork of Cement Creek. Hillslope aspects likely play a role here and data suggest that the South Fork Cement Creek has a later snow melt especially in the predominantly North-facing cirque around Velocity basin headwater area. Another snowpack scenario worthy of consideration is that there are dozens of avalanche debris fields, created by the Silverton Mountain Ski area avalanche mitigation, in the South Fork Cement Creek catchment. These debris fields are of very high-density snow and tend to melt out much later than areas of uncompacted snow. There are typically fewer avalanche debris piles in Upper Cement Creek and there also a significant portion of the watershed that is south facing on the slopes above Mogul mine, supporting an earlier melt scenario.

The longer and more gradual recession limb of CCSG_2 compared to CCSG_3 supports the above statements of later snowmelt, but it also suggest a few other scenarios. First, there could be an additional source water in late summer such as melting permafrost ice lenses, or rock glaciers in the alpine talus areas. Secondly, there may be a larger overall contribution of groundwater to streamflow which discharges more gradually than seasonal snowmelt runoff. The pathways of the discharging groundwater are from seeps, springs and draining mines. The role of the draining mines in this relationship could be significant and will be considered in this report.

Continuing upgradient are stream gages CCSG_4 in the Middle Fork of Cement Creek and CCSG_5 in the North Fork of Cement Creek. Unfortunately, the gage location at CCSG_4 proved to be insufficient for monitoring discharge with a pressure transducer due to a constantly changing stream channel location and sub-surface flows. Specifically, there was no access to bedrock under the stream channel so surface flows were regularly going below the streambed within unconsolidated materials and thus not easily measurable. All data collected at this location was prior to the start of WY 2019 so was not interpreted in this report.

At CCSG_5 a partial discharge record was collected seasonally (figure 6, appendix 3).

This location is in a deep ravine with steep gradient and the snow depths exceeded 12 feet in winter due to snow deposition. It was not feasible to monitor this site in the winter months either manually or with a camera. Additionally, the stream bed has significant mobile material residing on top of the bedrock so during low flow conditions it was difficult to capture complete

flows as the flows are constantly moving among the mobile debris and there was no available bedrock to control the cross-sectional area. During snow-free periods a transducer was installed to capture flow. The flow data was also used to quantify the North Fork tributary inflow during two Cement Creek stream tracer studies performed by the USGS within the period of this study. The established stream gage was also useful to monitor the approximate timing of peak flows and to monitor for any major changes in flows caused by other sources such as mine releases. A valuable lesson learned from this gage location would be to consider replacing CCSG_5 with two gages on Cement Creek located directly above and below the confluence with the North Fork Cement to better capture the total discharge from North Fork Cement. The main stem gages would be more accessible for a longer portion of the year.

Overall, the CCSG_5 gage site was accessible from 7/28/19 to 10/8/19 and from 6/5/20 to 9/30/20. Peak discharge was inaccessible in 2019 and the highest measured daily mean discharge was 2.95 cfs on day of install, decreasing to 0.05 cfs in October. In 2020, with earlier access to the site, the stream gage was installed days before peak discharge and recorded a peak flow of 4.7 cfs on 6/8/20. The last recorded flow on 9/30/20 was just 0.002 cfs. At peak discharge in 2020 the North Fork of Cement (CCSG_5) represented 9.4% of Cement Creek at CCSG_3 and at low flow was just 0.02% of Cement Creek at CCSG_3. The data confirms that if Gold King discharge were to enter directly into the North Fork at the portal it would represent somewhere between 20% and 99.8% of the water in the North Fork under current flow scenarios.

The upper two gages, CCSG_6 and CCSG_7 had a consistent discharge relationship throughout the study with 7 being consistently and proportionately lower than 6 (figure 6). Peak daily mean discharge in 2019 was 53.53 cfs at CCSG_6 and 40.05 cfs at CCSG_7 and decreased to peaks of 43.95 cfs and 26.4 cfs in 2020. Minimum flows were similar at both sites at around 0.2 cfs. Total annual discharge relationship was steady between years with both sites measuring 50% less flow in 2020 than 2019 and CCSG_7 recording 65-66% of the annual flow at CCSG_6. The area above CCSG_7 is 60% of that area of CCSG_6 so overall the gages are in good agreement. With a large portion of peak flow passing CCSG_3 also being measured at the higher gages of CCSG_6 and CCSG_7 it demonstrates that the main source of runoff is from snowmelt originating in the highest elevation areas of the catchment.

The specific discharge (discharge normalized to area) increased from CCSG_6 to CCSG_7 in both years (table 3) indicating that the watershed area above CCSG_7 was slightly

more efficient at delivering water to the discharge point. This is supported by the landscape with mostly alpine above CCSG_7 and more forested area above CCSG_6 so an expected greater water loss from ET at the lower gage. The lower elevation gage also had an earlier seasonal rise in discharge which agrees with earlier snowmelt at lower elevation. Overall, both gages were in good agreement and the only major draining mine (Mogul) was above both gages, so its contribution was captured by both. The upper two gages were the most difficult to maintain annually due to winter inaccessibility and challenging stream morphology and likely had some of the largest error in quantifying flows over full water years. However, the gages can be functional in monitoring changes at the reach scale and thus may provide future utility in monitoring changes to stream conditions between the R&B and Mogul mines with future remedial actions such a closing the R&B bulkhead. There were several seeps and springs which emerge near or within the streambed between CCSG_6 and CCSG_7 and any changes in groundwater contributions to streamflow along this reach influenced by remedial actions, like permanent bulkhead closure, would benefit from long term monitoring of these gage sites. The detailed data collected during the short-duration 2020 R&B bulkhead evaluation test will be presented in a separate report.

The stream gages EGSG_1 and EGSG_2 in Eureka Gulch collected data seasonally. The lower gage EGSG_1 was destroyed in March of 2019 by a massive avalanche which also physically moved the exiting stream channel to a new location (photo 15). The EGSG_1 gage site was re-established in the new stream channel on June 8, 2020 with daily discharge measured through September 30, 2020 (Figure 7). First access to EGSG_2 in 2019 was not until late July and discharge was collected from 7/29/19 through 10/17/19, capturing the recession limb of 2019 hydrograph and installed again in 2020 from 6/12/20 through 9/30/20. Both gages were in good agreement with a permanent USGS gage 09358000 located on the Animas River at Silverton (https://waterdata.usgs.gov/co/nwis/uv?site_no=09358000) and known as site A68 within the BPMD. The discharges remained relatively proportionate to each other and to A68 suggesting they are representative of the Eureka Gulch portion of the Animas River watershed.

Photo 15: Location of EGSG_1 stream gage after March 2019 avalanches.

Continued monitoring of the gage locations will help to further understand the water balance of Eureka Gulch on the Eastern side if Bonita Peak in relation to the Cement Creek Watershed on the Western Side of Bonita Peak, both of which reside within the BPMD OU3 area. Future comparisons of runoff efficiency between Cement Creek and Eureka Gulch, using the established gages may assist in further understanding of the potential impact of mine working moving OU3 groundwaters across watershed boundaries. Long term data records from these established gages will be an important mechanism for investigating the hydrologic influences of the mine workings while reducing uncertainty from inter-annual climate variability.

Figure 5: **Mean daily discharge at the four lowest elevation stream gage locations on Cement Creek for water years 2019 and 2020. The gages are from CC_48, CCSG_1, CCSG_2, and CCSG_3. Discharge is presented in log scale for clarity**.

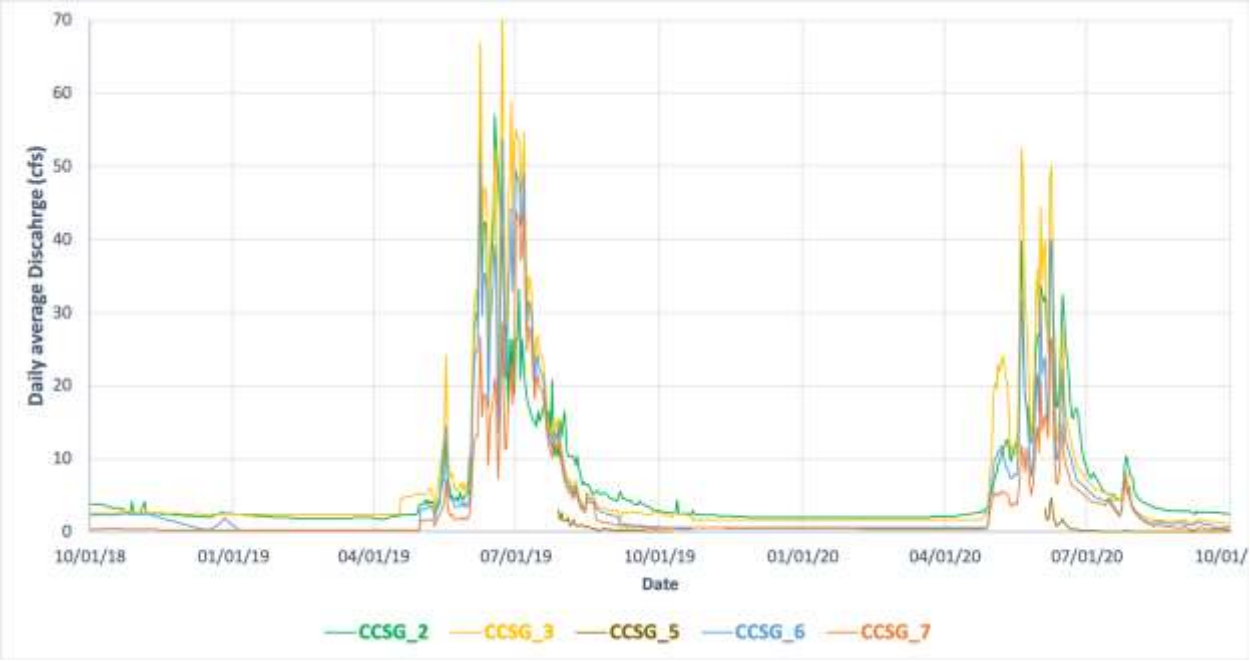


Figure 6: **Mean daily discharge for five of the upper Cement Creek gages including CCSG_2, CCSG_3, CCSG_5, CCSG_6, and CCSG_7 for water years 2019 and 2020.**

Table 3: Annual cumulative discharge in cubic feet and specific discharge in feet from six stream gages for water years 2019 and 2020. Specific discharge is discharge normalized by area.

Gage	2019 Total Q (ft^3)	2019 Sp Q (ft)	2020 Total Q (Ft^3)	2020 Sp Q (ft)
CC48	1,721,589,120	3.07	864,768,960	1.54
CCSG_1	539,902,211	2.88	339,687,915	1.81
CCSG_2	220,182,672	2.56	173,242,593	2.02
CCSG_3	264,283,988	2.65	168,357,705	1.69
CCSG_6	185,707,794	2.40	103,244,446	1.34
CCSG_7	121,412,195	2.64	68,449,411	1.49

Figure 7: Daily mean discharge for Eureka Gulch stream gages in 2019 and 2020. The USGS gage Animas River above Silverton (A68) is plotted for reference. Discharge plotted on log scale for clarity.

4.4 Mine Discharges

The six instrumented draining mines in Cement Creek above Gladstone had discharge measured at hourly intervals over the study period with daily total discharge calculated for each of the mines (figure 8, Appendix 3). The daily discharge for Cement Creek at CC48 was also plotted in figure 8 to provide context to the timing of mine discharges relative to timing of

streamflow response to snowmelt at the watershed scale. The timing and magnitude of discharge from all monitored mines was fairly consistent over the 2-year study period and the peak of combined mine discharges occurred after the peak in stream discharge in Cement Creek. The total annual discharge and percent of summed discharge from all six mines was consistent from year to year (Table 4). It is important to note that in 2020 the R&B bulkhead closure test was performed between 7/15/20 and 9/30/20 which significantly altered the R&B discharge during that period. As shown in figure 8, the R&B discharge drops to zero at the start of the bulkhead test and remains null until the end of the study (September 30, 2020). In the final week of the study period (9/21-9/30/20) the R&B bulkhead was re-opened, and all water was sent to the IWTP for treatment before being returned to Cement Creek. Therefore, the flows presented as GK (previously identified as the effluent discharge from the IWTP) are the true combined flows from both R&B and GK during a brief period at the start of the test when R&B bulkhead pressures were being held constant at 50 ft head, and again during drawdown of impounded waters starting on 9/21/20. These combined flows are identified in figure 8 for clarity. Data were presented in this format because the true discharge point for waters at both mines was at the IWTP and thus only contribute to Cement Creek flows at this location (below CCSG_3, above CCSG_1), which factors into the water balance calculations.

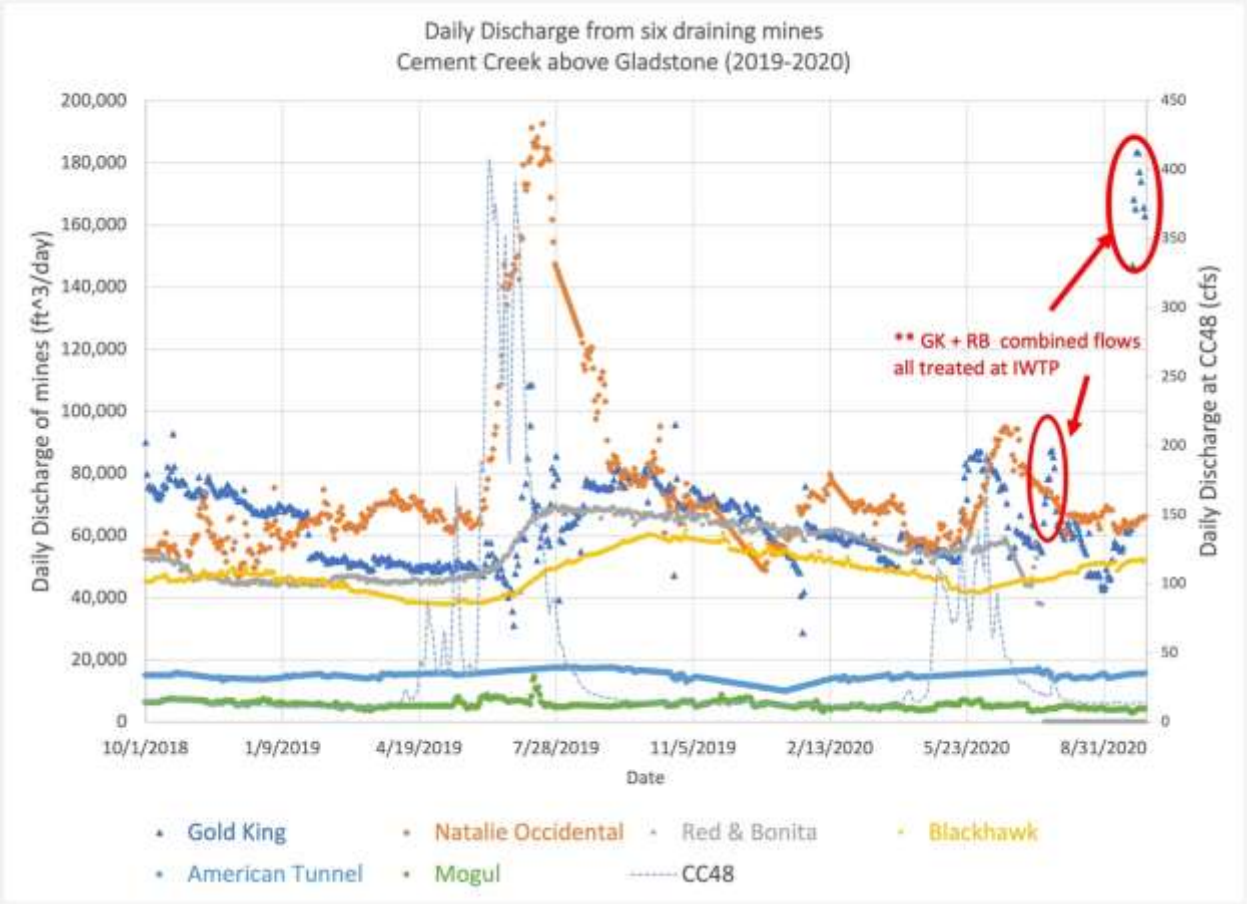


Figure 8: **Daily mean discharge from six draining mines in Cement Creek for water years 2019 and 2020. Streamflow as daily mean discharge at CC48 is also plotted to compare timing and magnitude of watershed streamflow relative to mine discharges.**

Table 4: **Totals annual discharge from six monitored mines in Cement Creek for water years 2019-2020.**

Mine	Total Q 2019	% mines 2019	Total Q 2020	% mines 2020
GK	23,024,431	23.89	24,167,846	26.28
R&B	18,947,575	19.66	17,184,427	18.68
N.O.	29,955,325	31.09	24,941,427	27.12
Blackhawk	16,600,842	17.23	18,558,282	20.18
Mogul	2,162,059	2.24	1,903,043	2.07
AT	5,667,981	5.88	5,215,641	5.67
Total	96,358,213	100	91,970,666	100

The mines with existing closed bulkheads, Mogul and AT, had the lowest and most consistent flows throughout the study. The Mogul discharge represented 2.0-2.2% of the annual mine discharges while the AT represented 5.7-5.9% of the annual mine discharges monitored in this study. The only noticeable increase in discharge at either site occurred in the Mogul Mine during the 2019 snowmelt period. Documented field observations indicate that this increase in measured discharge at the mine portal flume was due to additional snowmelt surface runoff waters entering the mine tunnel just upstream of the flume and separate from the perennial waters flowing in the mine tunnel around the bulkhead. Both mines exhibited a small (< 10%) decrease in total flow in 2020 as compared to 2019. This was likely a result of decreased total precipitation in 2020, however the decrease of <10% total discharge was far smaller than the overall decrease in precipitation inputs (30%) suggesting that the mine pools and groundwater reservoirs behind the bulkheads at these two locations have a delayed or muted response to inputs that was not captured in the two-year study period. The small inter-annual change in discharge from bulkheaded mines also indicates that the near-portal bulkheads are effective at dampening the variable, recharge induced, pressures behind the bulkheads and/or that those locations are less impacted by basin wide changes in annual recharge. One reasonable explanation is that there are additional internal bulkheads within both mine complexes which would further dampen the seasonal snow melt infiltration pressure wave prior to reaching the outermost bulkheads, especially if said recharge is predominantly occurring in alpine basins which reside above the deeper inner workings of the mines.

The Blackhawk and R&B mines represented nearly the same overall volumetric contributions to mine discharge at 17-20% of total mine flows each (see table 4) and also displayed steady discharge with gradual daily increases that occur in conjunction with annual snowmelt runoff (figure 8). However, Blackhawk has a more delayed rise in discharge during both years. The steady delayed rise in discharge from July through October suggests a deep groundwater source with either a large storage capacity or long flow path before reaching the mine tunnel and portal rather than quick flow through or groundwater head response from seasonal snowmelt. The R&B discharge increased earlier than the Blackhawk discharge and while CC48 discharge was at its highest from spring runoff. However, seasonal increase in R&B discharge was still much more gradual and steadier than the N.O. and GK mines (figure 8). The gradual nature of change in discharge at R&B also supports that waters are coming from a large

well mixed groundwater reservoir with long and or slow-moving flow paths from the point of recharge (snowmelt and rain entering subsurface) to discharge at the mine portal. Both Blackhawk and R&B have long and slow recession limbs of the annual peak discharge, which also support the above-mentioned groundwater flow paths and/or storage reservoir scenarios. Interestingly, the Blackhawk mine discharge peaks much later than does any of the other monitored mines and therefore has a unique discharge pattern which may indicate a slightly different source water contribution and/or flow path not seen in the other mines. One possible scenario is an additional source water coming into the Blackhawk mine in late summer which could be from melting ice (rock glaciers, ice lenses) and permafrost which does not melt until late summer when alpine areas have been warming for the entire summer. This scenario may be unique to the Blackhawk mine and would require further investigation of the source areas above the mine working to confirm or refute.

The total discharge from R&B was 9% lower in 2020 than in 2019 which follows similarly to what was observed at the AT and Mogul mines. However, the R&B had zero discharge to the stream from July 17, 2020 through the end of the water year due to the bulkhead test. The test closure represented ~20% of the water year so we would have expected to see upwards of 20% less total water out of the R&B in 2020. This result suggests that the theoretical total R&B discharge was proportionately greater in water year 2020 than in 2019 even considering 30% less precipitation. Therefore, the source waters exiting the R&B likely have a residence time significantly greater than the seasonal responses to snowmelt seen in all stream and some mine hydrographs. This result is in strong agreement with the 2020 BPMD Seeps and Springs report (Cowie and Roberts, 2020) which reported the stable isotopes of water in the mine waters at R&B to remain consistent and well mixed year-round, also suggesting a large well-mixed source water reservoir that does not rapidly respond to seasonal inputs. These findings will be further supported in future reports where additional groundwater age dating data will be combined with hydrologic, geochemical, and isotopic data to better understand the sources and timing of groundwater delivery to draining mines in the BPMD OU3 area. Additionally, full interpretation of the high-resolution hydrologic data collected during the bulkhead test can be combined with these results to assist in further development of the OU3 CSM.

Natalie Occidental (N.O.) was the largest single mine discharge above Gladstone during several time periods and was also the largest annual contributor to mine discharge in both years

at 27-30% of the total (see table 4). Discharge increased dramatically during, and immediately following, snowmelt each year. Specifically, the peak daily discharge occurred one week after the snowpack melted out at Minnehaha Station in both years even though that peak occurred nearly one month earlier in 2020. The peak daily average mine discharge occurred on 7/18/19 following snowpack melt out on 7/10/19 and then on 6/20/20 following snowpack melt out on 6/12/20 (see figures 4,8). Peak flows were greater in 2019 which likely corresponds to the large snowpack in that year. The N.O. saw an overall decrease of 17% in total discharge in 2020 over 2019 which was greater than the change observed at the other mines. The change in discharge more closely followed the relative decrease in total precipitation and suggests that the annual discharge is rapidly influenced by seasonal snowmelt. The steep recession of limb of seasonal discharge from the N.O. is more similar to a stream gage than the other mines, which further supports strong seasonal influence of source waters entering and exiting the mine. The results therefore suggest that the residence times (and/or flow paths) for water discharging at the N.O. are quite short and that water entering the subsurface as snowmelt is quickly finding its way to the mine tunnel. Again, these results are supported by Cowie and Roberts (2020) who found the stable water isotope signal at the N.O. to also change more significantly and rapidly at this mine than at that other mine sites during annual snowmelt.

The high-resolution monitoring of the N.O. has proven to be very informative in understanding the hydrologic variability. First, the rapid increase in discharge during a short window near peak snowmelt suggests there are one or more short or direct pathways for infiltrating snowmelt to be entering the mine workings, which is not observed at this scale at the other mines in this study. Secondly, the fluctuations in flow throughout the year, even during winter low flow conditions, suggests variable conditions inside the mine. This finding warrants further investigation at the site to determine if the fluctuating flows are related to potential mine blockages and associated risks as well as potential remedial actions to address infiltration. Third, the results support reporting of increased metals loading from the N.O. during spring runoff presented in the 2020 BPMD Seeps and Springs Report (Cowie and Roberts, 2020). Finally, the results also demonstrate that exact timing of historical and future water quality sampling (*i.e.*, metals concentrations) will likely convert to large variability in loading calculations depending on where the sample date resides on the annual mine discharge hydrograph.

The GK mine discharge was the second largest contributor to mine discharge in the study at 24-26% of annual mine discharge from the six mines (table 4) and the most variable at daily resolution (figure 8). Due to the operation of the IWTP for treating all GK mine discharge, the results for GK are reported as the IWTP influent/effluent because this represented the location where mine derived waters enter Cement Creek. There was minimal storage capacity in the GK conveyance and treatment system so portal discharge and treated effluent volumes are on essentially the same time step. Overall, GK total discharge increased ~5% in 2020 from 2019 despite the lower precipitation totals. This would be in-step with the results from the Blackhawk where an increase in cumulative discharge could be the result of a delay in delivery of source waters (snowmelt) due to a large slow-moving reservoir. However, in 2020 the R&B bulkhead test added additional water to the IWTP as it was treating all waters passing the bulkhead during bulkhead tests. Waters from R&B were sent to the plant for approximately one week during the initial test start up and then again for the final few weeks of the 2020 water year during the drawdown period. The additional volumes of treated waters are highlighted in figure 8. As a result of measuring combined treated flows, it is difficult to draw specific conclusions on the total volume of water from the GK in water years 2019 and 2020. Additional discharge for GK flows at the mine portal (behind FCS) has been collected by the EPA removal program since 2017 and could be used for further analysis in future reports but were not finalized at the time of this report. Based on the flow record from the GK portal since the release in 2015 it should also be noted that discharges were much higher in 2015-2018 (generally over 500 gpm) than during the two years of this study (300-400 gpm) (C. Goss, Deere & Ault Consultants, Inc., Longmont, CO, *personal communication*., April 19, 2021). The long multi-year period of increased flows following the portal release/opening further suggests that there was a very large groundwater reservoir behind the GK portal which took several years to fully drain down to the more consistent flow levels observed during this study. The annual pulse of snowmelt does not bring the GK mine discharge up to the 500-600gpm levels seen following the 2015 release and therefore suggests that one-year annual snowmelt has a minimal impact on filling the full capacity of the groundwater reservoir sourcing the GK discharge.

In summary, the GK mine discharge had considerable daily and weekly fluctuations in flow throughout the study period, but the cumulative discharge was quite similar from year to year. The similarity in total discharge for both years of the study also indicates that the current

mine water reservoir sourcing the GK discharge may be approaching a relative equilibrium as flows are much more consistent than they were for the two years prior to this study and following the release in 2015. The small change in annual discharge relative to the larger change observed in annual precipitation suggests that the dominant source water reservoir for the GK discharge is large and/or that the flow paths delivering that water to the mine tunnel are long and slow moving and thus not directly and rapidly influenced by seasonal water inputs. Again, these results agree with Cowie and Roberts (2020) who found the stable water isotope signal from GK discharge to be of very small amplitude with minimal seasonal fluctuations. Overall, there was also a clear seasonal fluctuation in GK discharge with the lowest flows occurring through winter and into early summer, then a few short rapid increases during snowmelt (similar in timing with N.O. increases), followed by a gradual sustained increase in flow with flattened peaks around October in 2018 and 2019. The brief rapid peaks in step with snowmelt could suggest that there are some short pathways for meltwater to enter the mine and contribute to increased flows for a short period. For example, the GK mine has six levels of mine workings above the level 7 portal with multiple surface and near surface expressions which could provide a conduit for snowmelt to rapidly enter the mine workings and increase flows. Conversely, the predominant sustained source water flow paths driving slow increases over the full summer period are likely long and have at least a several month delay before influencing portal discharge.

Another way to interpret the delayed seasonal increases is to consider that water is pushed into and through the mine due to increased head pressure on the groundwater reservoir sourcing the mine discharge and that pressure wave takes several months to influence discharge at the portal. Finally, the GK also exhibits times with marked changes in discharge (such as the sudden drop in flow in February 2019) which were captured both at the FCS (data not shown) and the IWTP and cannot be explained by seasonal hydrologic fluctuations. The changes may indicate other changes in mine water flow paths within the mine caused by actions such as tunnel collapse, sludge dams, and connection/disconnection of the mine water flow from other groundwater/mine water pathways or reservoirs like open workings or large fracture systems. The high-resolution discharge monitoring has therefore been successful in monitoring for changes in flow that had not been anticipated or accounted for previously.

To help visualize the relationship of daily total discharge from the six draining mines, discharge from each of the mines was stacked to represent total mine discharge in both volume

(figure 9) and as a percent of all mine discharge (figure 10). The stacked order of mines in each figure was chosen for visual clarity. In figure 9 the mines with the most stable discharges were plotted beneath the more variable discharges while in figure 10 the mines were stacked from largest to smallest contributors to help easily decipher approximate % contributions to streamflow through time. The figures highlight the daily relative contributions between mines and show when individual mines have significant influence on the overall mine discharge in Cement Creek. The date of peak discharge at CCSG_1 (June 8 both years) is also plotted on these graphs to demonstrate mine discharge increases relative to peak surface water runoff. Interestingly, in 2019 GK flows increased several weeks after peak stream discharge occurred while in 2020 GK flows began increasing before peak stream discharge. Additionally, the N.O. discharge increases to ~50% of all mine discharge in July 2019 but has a smaller % contribution in July 2020. The impact of the R&B bulkhead test closure is also quite visible when R&B discharge drops to zero in July 2020 and at the very end of the study period when the R&B drawdown was sending high volumes of water to the IWTP. To focus on the four draining mines in the Main Stem of Cement Creek, the daily volumetric discharges were plotted excluding the Blackhawk and N.O. mines which drain to the South Fork of Cement Creek (Figure 11). From figure 11 it is easier to see that GK is the most responsive and flashy of the Main Stem Cement Creek mines with respect to discharges following annual snowmelt. Additionally, the Mogul, AT, and R&B, mine discharges are relatively consistent through the study until the start of the R&B bulkhead test in July 2020. During the R&B bulkhead test it was clear that the GK represented most of the remaining mine discharge into the Main Stem of Cement Creek.

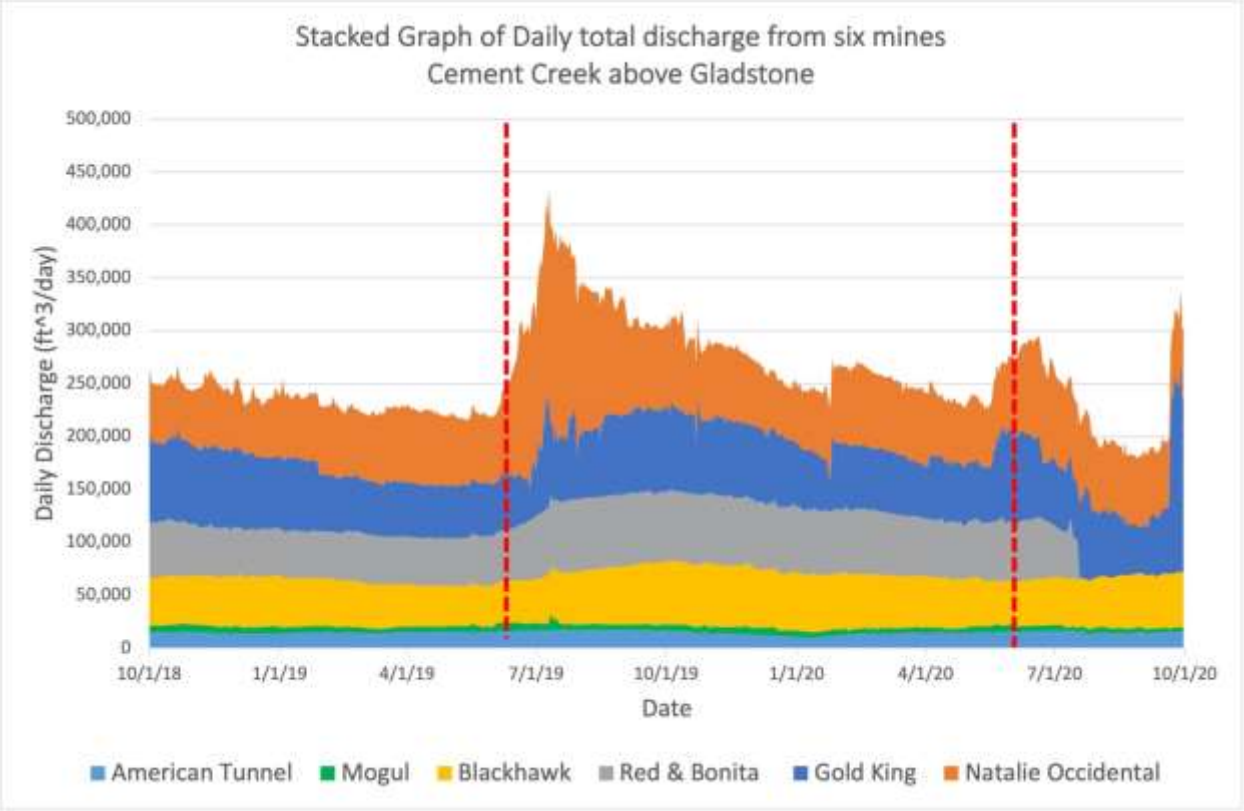


Figure 9: **Stacked graph of the mine discharges from the six largest mines in Cement Creek above Gladstone for water years 2019 and 2020. Daily total discharge in Cubic feet per day. The abrupt end to R&B discharge (in grey) corresponds to the start of the 2020 bulkhead test. Red dotted lines depict date of peak discharge at CCSG_1 stream gage for reference.**

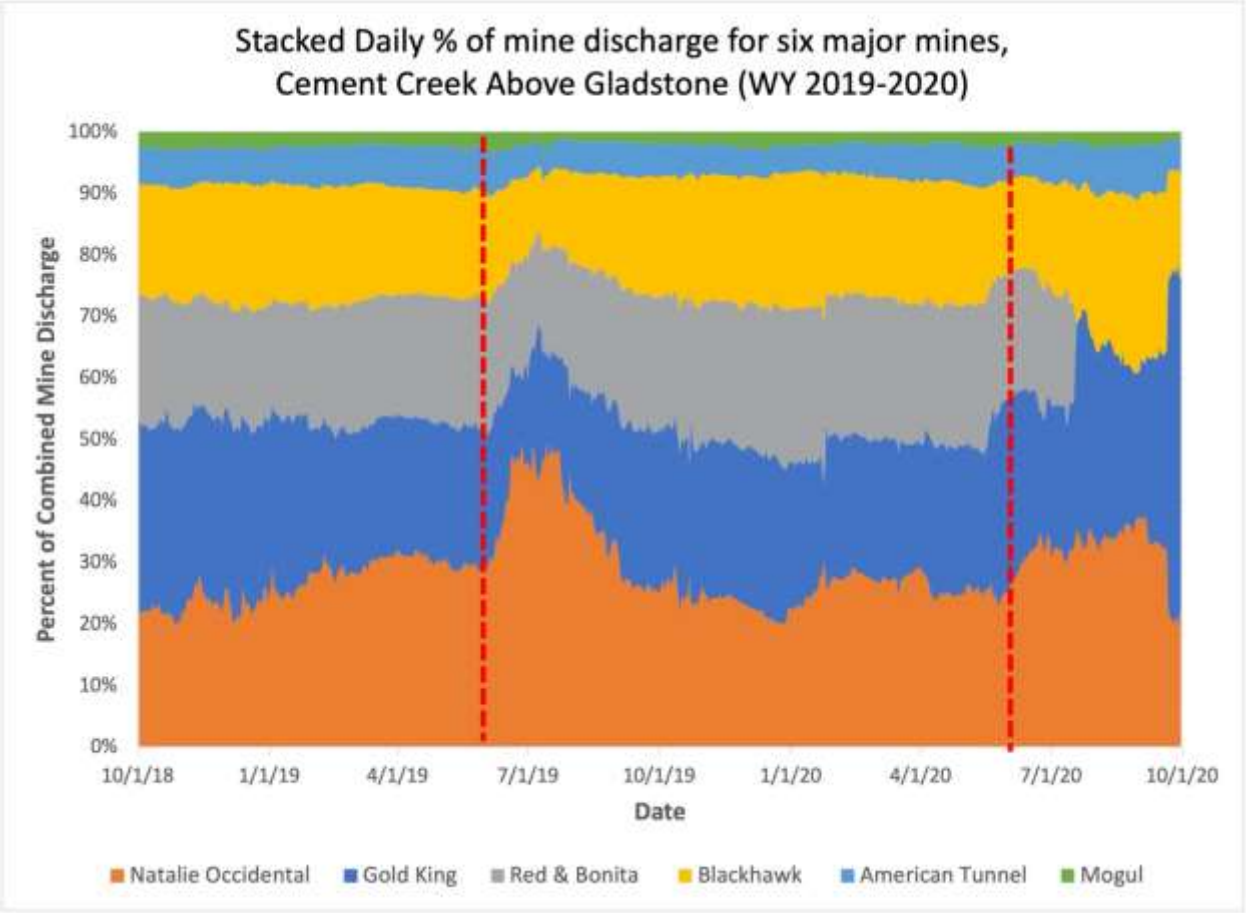


Figure 10: **Stacked daily discharge as a percent from each of the six monitored mines for water years 2019 and 2020.The abrupt end to R&B discharge (grey) corresponds to the start of the 2020 bulkhead test. Red dotted lines depict date of peak discharge at CCSG_1 stream gage for reference.**

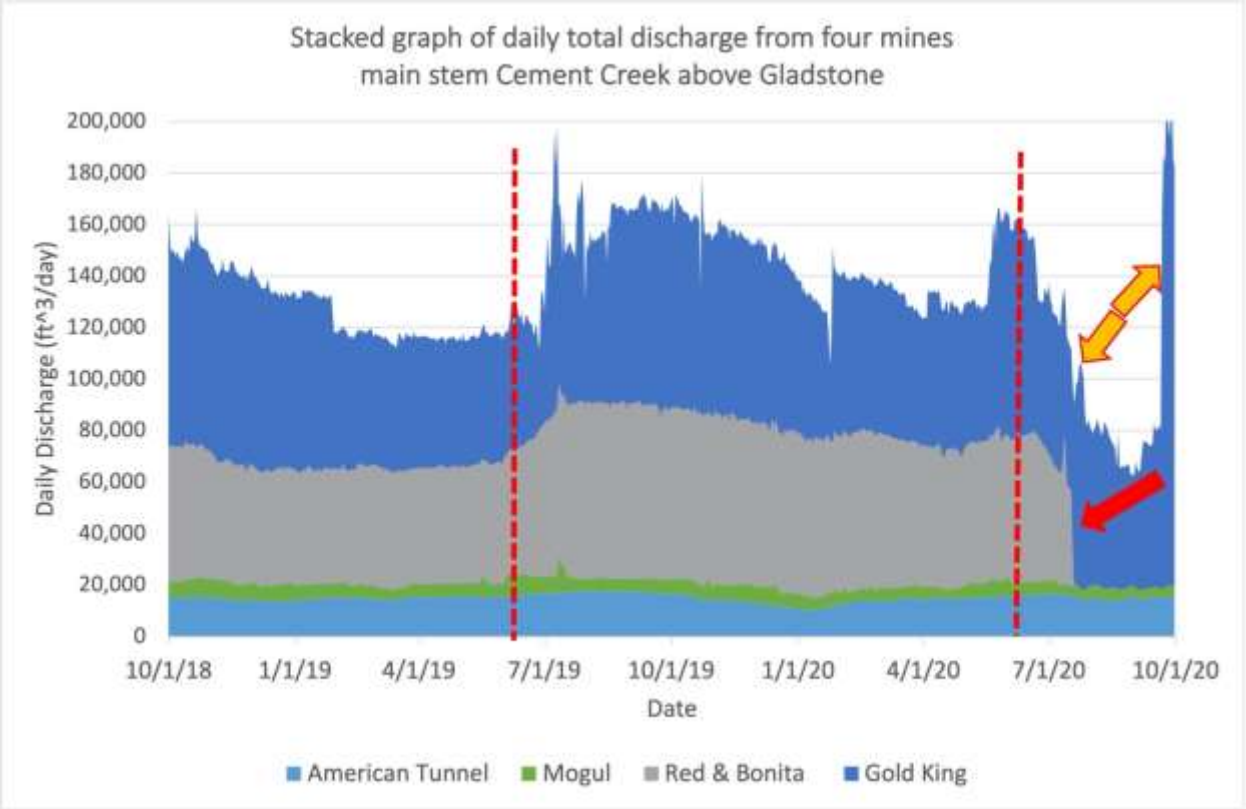


Figure 11: **Stacked graph of the mine discharges from the four largest mines in Main Stem Cement Creek above Gladstone for water years 2019 and 2020. Daily total discharge in Cubic feet per day. The graph excludes the two mine drainages in South Fork Cement Creek. Red arrow marks the start of the 2020 R&B bulkhead test. Orange arrows depict combined GK and R&B flows all treated by IWTP during bulkhead test. Red dotted lines depict date of peak discharge at CCSG_1 stream gage for reference.**

4.5 Water Budget

For stream gages with complete annual streamflow records a Runoff Efficiency (K) was calculated for each year. The total annual precipitation was calculated using the precipitation totals from the Minnehaha weather station as defined previously. Since it was determined that there was no significant change in precipitation with elevation between Gladstone and Minnehaha stations there was no need for spatial distribution of precipitation with elevation so total annual depth of precipitation was equal to specific precipitation. Specific precipitation in 2019 was 3.6825 ft and in 2020 was 2.50 feet (see table 1). The specific discharges were

presented in table 3. The runoff efficiencies for CC48, CCSG_1, CCSG_2, CCSG_3, CCSG_6 and CCSG_7 is presented in table 5.

Table 5: Runoff efficiency (K) for all stream gages with complete annual discharge record for water years 2019 and 2020.

Gage	2019 K (%)	2020 K (%)
CC48	83.43	61.73
CCSG_1	78.14	72.42
CCSG_2	69.63	80.70
CCSG_3	71.90	67.47
CCSG_6	65.30	53.48
CCSG_7	71.67	59.52

Overall, K values were within the ranges observed in other water balance studies in alpine areas of Colorado (Caine, 1995) but were potentially higher than expected for catchments with significant areas below tree line (Cowie, 2015) due to expected increases in water loss at ET in forested areas (Molotch *et al*., 2007). Sustained elevated baseflows from mine drainages may explain the higher K values and are discussed in detail below.

Calculated K at CC48 provided a baseline for the Cement Creek Watershed. K was highest of all gages in 2019 at 83%. However, there were no precipitation records for the lower elevations of Cement Creek (Silverton to Gladstone) the precipitation from Minnehaha was used for calculating K at CC48. The result is likely an overestimate for total precipitation as a considerable portion of the watershed above CC48 was still well below the elevation of Gladstone (10,600 ft) and total annual precipitation tends to decrease with elevation in the Rocky Mountain region (Barry, 1992). Measuring precipitation over the entire watershed could be improved with additional precipitation data at a lower elevation, closer to Silverton, to represent the full range of elevation for Cement Creek watershed. The K decrease by over 20% at CC48 in 2020 with the lower precipitation totals but the decrease was proportionately less than the decrease in total precipitation (32%). The observed changes in K at CCSG_1-3 were far more complicated and likely influenced by large portions of streamflow from nearby draining mines which will be discussed in more detail below. However, the overall decrease of K by 12% at both uppermost gages of CCSG_6 and CCSG_7 was in good agreement with the decreased K observed at the watershed scale. The upper gages are above most of mine discharge (only the

small discharge of Mogul upstream) and therefore would be expected to have minimal impacts of mine drainages on the annual hydrologic budget.

In general, we would expect to see K decrease for snow dominated mountain catchments in years when snowpack was smaller, and melt occurred earlier for several reasons. First, earlier melts tend to be more gradual, providing a sustained release of melt water that has more time to recharge the subsurface (soil water and groundwater recharge), so less water flows directly to the stream channel. Secondly, earlier melt equates to a longer snow-free growing season and potentially higher amounts of water leaving the system as ET. Conversely, later snowmelt tends to coincide with warmer air temperatures (more energy to melt snow) so the melt occurs more rapidly from onset to completion and meltwater runoff exits the system more quickly (Cayan, 1996; Clow, 2010). Therefore, the trend in decreasing K from 2019 to 2020 (regardless of the absolute % as related to overestimate of total P) at CC48 makes sense from a hydrologic perspective and provides a baseline to compare with the trends at the upper gages.

Moving up to the CCSG_1 gage, K is similar to CC48 in 2019 and decreases in 2020 but not as substantially as seen at CC48. The decrease in K from 2019 to 2020 follows suit with a dryer year, however the smaller than expected decrease may suggest that the mine discharges, were providing enough sustained contribution to stream flow at CCSG_1 to lessen the magnitude of decreased K with decreased P. Total annual mine discharge from all six mines decreased < 5% from 2019 to 2020 while total stream flow decreased 37% at CCSG_1 over the same time period. The small decrease in total mine discharge was most likely attributed to the R&B bulkhead test where no mine water from R&B was discharged for six+ weeks in 2020. However, even with the bulkhead test, the total percent of discharge at CCSG_1 that came from all six draining mines increases from 17.8% in 2019 to 27% in 2020 indicating that the reservoirs for mine water discharge did not respond to the lower annual P in the same manner that stream discharges declined. This further suggests that the fluctuations in mine water reservoirs are not in 1 to 1 relationship with annual recharge, at least when summarized within a hydrologic water year. The percent of mine water in the stream water at CCSG 1can be seen at daily resolution in figure 12. In 2019 mine waters contributed a low of just 2.1% of total daily discharge during peak snowmelt to a high of 58.4% of daily discharge on 9/30/19. In 2020, the low was similar at 3.4% of daily stream discharge during peak melt to a high of 82% of all stream flow in December of 2019. The contributions from mines during snowmelt remains under 10% for about 4-6 weeks

each year. From Figure 12 it is clear that mine discharge contributions were greater in the late fall and early winter of 2019-2020 than that time period the previous year. The winter of 2018 was following a very dry water year (2018, prior to this study) while the winter of 2019 was following the large water year of 2019. Therefore, this relationship further supports that mine water discharge lags relative to the timing of stream discharge (directly from snowmelt) and therefore has the greatest contributions to, and influence on, stream discharge during the recession limb and fall baseflow periods of the hydrograph. This is in good agreement with the individual mine discharge results presented earlier, especially in regard to the long gradual recession limb of the R&B, Blackhawk and GK mine discharges (see figure 9).

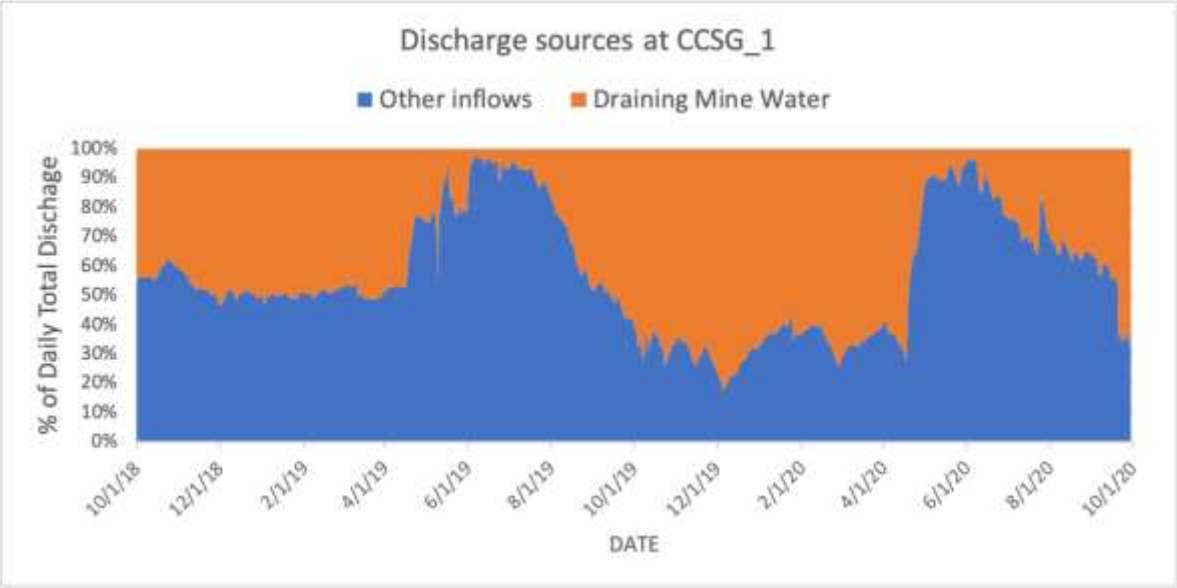


Figure 12: Daily total discharge at CCSG_1 represented as a percent directly from draining mines (orange) relative to the percent of water from non-mine sources (in blue, labeled stream water) for water years 2019 and 2020.

Moving further upgradient to CCSG_2 and CCSG_3, K becomes more complicated to discern, but presents several unique trends. Both gages had very similar K in 2019 at ~ 70% but then K increased by 10% at CCSG_2 in 2020 while decreasing 4.5% at CCSG_3 (table 5). The two gages represent different drainages, and they represent different mine contributions with the N.O. and Blackhawk mines draining to CCSG_2 and the AT, R&B and Mogul mines draining to CCSG_3 (GK discharge from IWTP is below CCSG_3 and is only accounted for at CCSG_1).

At CCSG_2 the combined mine discharges were 21 % of total stream discharge in 2019 and increased to 25% in 2020. At CCSG_3 combined mine discharges were 10% of total stream discharge in 2019 and 14.4% of total stream discharge in 2020. Although the % mine discharge at CCSG_3 still increased in 2020 the overall runoff efficiency still decreased in similar fashion to the relative contributions at CCSG_1. The most likely reason for the observed trends was because of the 2020 R&B bulkhead test which eliminated about 20% of the annual R&B discharge during bulkhead closure and thus decreased the "expected" total mine discharge entering Cement Creek above CCSG_3. In fact, during R&B closure, the % of mine water at CCGS_3 decreased from 18% to just 6.4%. Some of the "removed" R&B water did still become accounted for at CCSG_1 in the last 10 days of the water year as the R&B bulkhead drawdown water was treated at the IWTP and returned to the stream above CCSG_1 but below CCSG_3. Much of the remaining mine water held back during the bulkhead test equated to added groundwater storage which will likely continue to slowly discharge back to the stream through seeps and springs over the winter of 2020-2021.

To further visualize the relative contributions of mine discharges to streamflow for CCSG_2 and CCSG_3, additional relative contribution plots were made for both gages (figures 13,14). At CCSG_2, daily % contribution from mine discharge were similar to what was seen at CCSG_1 with a low of 2-3% during peak flows to a maximum of 75-78% during low flows. At CCSG_3 daily % contributions from mine discharge were < 2% during peak flows and increased to a maximum of about 50% in September of 2019 and 66% a few months later in November 2019 (water year 2020). In figure 14 it is also easy to discern when the R&B bulkhead test was occurring in 2020 as the % mine water at CCSG_3 does not increase after the snowmelt period because R&B discharge was eliminated from July through the end of the study.

Overall, the relative percent of streamflow coming from draining mines increased in Cement Creek in water year 2020 from 2019 even though overall stream discharges decreased. From figures 12-14, it is now clear that the increase in overall mine discharge in water year 2020 was most likely attributed to greater mine water discharges relative to volume of stream baseflow through the winter low flow periods (October 2019 through April 2020). The most likely reasoning for these results was that the mine discharge in this time-period was still elevated and/or sustained from the large snowmelt recharge 6 months earlier in July of 2019. Additionally, the water year prior to the start of the study (2018) was one of the driest

precipitation years on record (see section 4.1) which likely translated into the lower overall mine discharge contributions in the fall-winter of the 2019 water year.

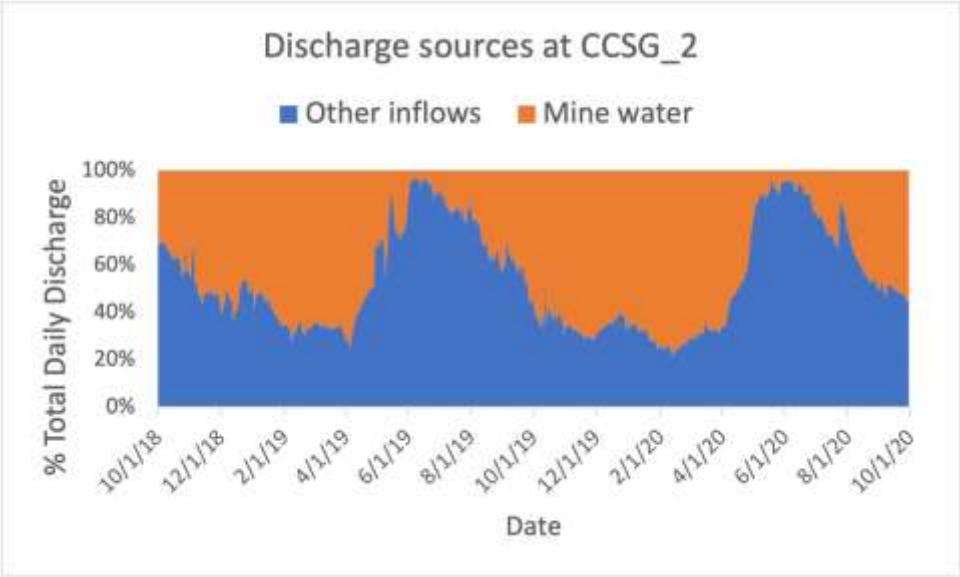


Figure 13: **Daily discharge at CCSG_2 represented as a percent from the sum of draining mines above the gage (N.O. + Blackhawk) relative to % of water from non-mine sources for water years 2019 and 2020.**

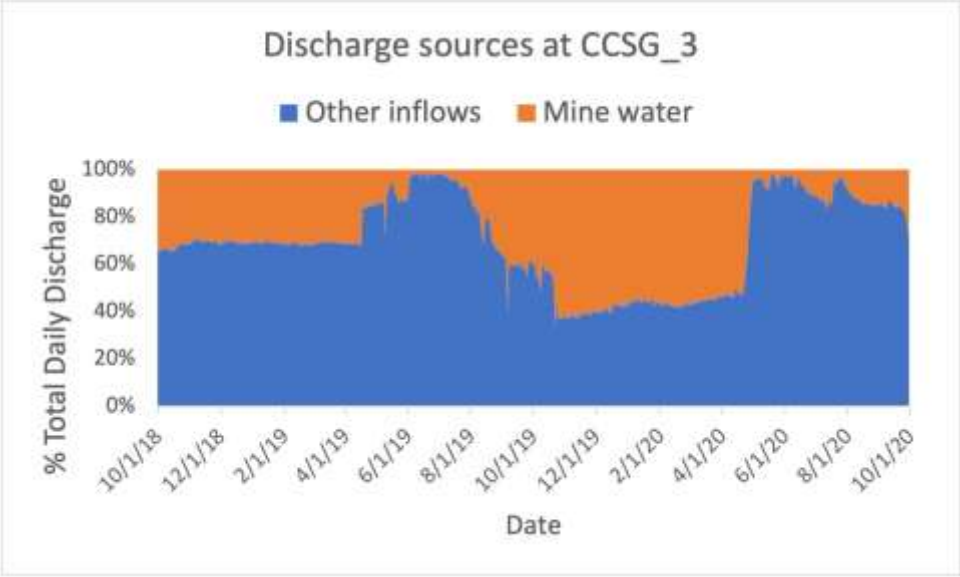


Figure 14: **Daily discharge at CCSG_3 represented as a percent from the sum of draining mines above the gage (Mogul + AT + R&B) relative to % of water from non-mine sources for water years 2019 and 2020. Note this does not include GK flow as they enter the stream from the IWTP and below the gage location.**

5.0 Conclusion and Recommendations

In conclusion, the two-year water budget study provided a significant amount of quantitative information with regards to the hydrology of upper Cement Creek and the relationships of mine discharges to streamflow dynamics. The study also provided considerable information on climate variability and its impacts on the overall hydrology in the area. The report was able to highlight the challenges with conducting year-round hydrologic monitoring of streams and draining mines in snow dominated high mountain watersheds while presenting unique methods to help overcome those challenges. The results presented in this report will help to further the development of the BPMD OU3 CSM and can be used to make informed decisions on the next steps in the BPMD RI including continued monitoring and addressing remaining data gaps.

Below is a list of recommendations for ways to incorporate this report into the BPMD RI and development of the OU3 CSM.

- Integrate results into the Conceptual Site Model (CSM).
- Combine results with R&B bulkhead test results to increase understanding of mine bulkheading impacts to water quantity and quality at reach and watershed scales.
- Combine with recently collected groundwater age dating data and REE data.
- Combine with USGS tracer study results from 2019 and 2020.
- Combine with the existing high temporal resolution mine and stream water chemistry in the 2020 S&S report (Cowie and Roberts, 2020)

Additional recommendations for addressing data gaps observed while conducting this study.

- The most helpful future monitoring would be mine pool depths and temporal variability behind the existing Sunnyside Mine bulkheads by installing well(s) in the Lake Emma vicinity. This would provide an improved understanding of the spatial and temporal groundwater behavior in the mine pools relative to the observed mine and stream discharges in Cement Creek and Eureka Gulch.

- Consider establishing a hydrologic reference site to monitor water balance characteristics without mine drainage influence. This would help to separate out the non-stationary climate/environmental factors from mining influences.
- Consider focusing on extent and magnitude of snowpack, and timing of snowpack melt as more valuable to understanding site hydrology rather than adding additional weather stations in Ross Basin or Lake Emma areas (likely recharge locations for OU3 groundwater recharge). Actions could include adding a snow pillow measurement station instead of weather station, adding snow ablation stakes over the lake Emma area and conducting annual maximum accumulation snow surveys (~May 1 annually).
- Consider using LiDAR flown at max snow (May 1) for upper basins, can be compared with the existing snow-free LiDAR data (USFS) to compile a spatially distributed snowpack.
- Selective additional water quality sampling at specific time periods (not just HF/LF synoptic) to ensure we are capturing seasonality and variability of mine hydrographs in addition to stream hydrographs.
- Adding capital budget to improve the stream gage infrastructure at locations deemed most important for longer term monitoring. Reducing total number of gages may be one way to improve efficiency of labor costs while maintaining the best data records. Suggested sites to maintain year-round are CCSG_1, 2, 3 and EGSG_1, while CCSG_5,7 and EGSG_2 could be maintained for seasonal monitoring and monitoring of additional RI actions such as additional bulkhead testing.
- Capital investment in non-contact water level sensors for draining mines to reduce drift from sludge accumulation on instruments.
- Ensure that the timing of hydrologic task orders and funding follow BMPs for hydrologic monitoring as suggested in the report.
- Consider building a comprehensive instrument data communication system for all stream, mine, and precipitation sites in the Gladstone area. This action will greatly improve data uploading and management, and enable compatible real-time monitoring across the important sites while also increasing the efficiency of ongoing O&M and reducing risk to field personnel from hazardous conditions (avalanches etc.)

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7.0 Appendices

Appendix 1 Precipitation

Appendix 2 Stage Discharge Rating Curves

Appendix 3A Stream Discharge

Appendix 3B Mine Discharge

Appendix 4A Mine Field Parameters

Appendix 4B Stream Field Parameters

Date	Red Mountain Pass Daily Total Precipitation (in)	Red Mountain Pass Cumulative Precipitation (in)	Minnehaha Daily Total Precipitation (in)	Minnehaha Cumulative Precipitation (in)	Gladstone Daily Total Precipitation (in)	Gladstone Cumulative Precipitation (in)	Minnehaha Snow Depth (Inches)	Red Mountain Pass Snow Depth (Inches)
10/1/2018	0.0	0.0	0.0	0.0	0.0	0.0	0	
10/2/2018	0.0	0.0	0.0	0.0	0.0	0.0	0	
10/3/2018	0.3	0.3	0.6	0.7	0.6	0.6	0	
10/4/2018	0.0	0.3	0.2	0.8	0.1	0.7	5	6
10/5/2018	0.2	0.5	0.2	1.0	0.2	0.9	8	6
10/6/2018	0.0	0.5	0.0	1.0	0.0	0.9	7	4
10/7/2018	0.1	0.6	0.0	1.0	0.1	1.0	11	8
10/8/2018	1.0	1.6	0.8	1.8	0.5	1.5	14	12
10/9/2018	0.2	1.8	0.2	2.0	0.2	1.7	12	9
10/10/2018	0.0	1.8	0.0	2.0	0.1	1.7	9	7
10/11/2018	0.4	2.2	0.4	2.4	0.4	2.1	8	7
10/12/2018	0.5	2.7	0.4	2.9	0.5	2.6	8	7
10/13/2018	0.0	2.7	0.0	2.9	0.0	2.6	7	6
10/14/2018	0.0	2.7	0.0	2.9	0.0	2.6	7	7
10/15/2018	0.0	2.7	0.0	2.9	-0.1	2.6	8	7
10/16/2018	0.2	2.9	0.1	3.0	0.3	2.9	7	7
10/17/2018	0.0	2.9	0.1	3.1	0.2	3.0	7	6
10/18/2018	0.1	3.0	0.2	3.2	0.2	3.3	6	6
10/19/2018	0.0	3.0	0.1	3.3	0.1	3.3	5	10
10/20/2018	0.1	3.1	0.0	3.4	0.0	3.3	9	10
10/21/2018	0.0	3.1	0.0	3.4	0.0	3.3	8	8
10/22/2018	0.0	3.1	0.0	3.4	0.0	3.3	7	8
10/23/2018	0.3	3.4	0.4	3.8	0.4	3.8	7	9
10/24/2018	0.3	3.7	0.3	4.1	0.3	4.1	7	9
10/25/2018	0.2	3.9	0.1	4.2	0.0	4.1	5	9
10/26/2018	0.1	4.0	0.0	4.2	0.0	4.1	5	7
10/27/2018	0.0	4.0	0.0	4.2	0.0	4.1	7	13
10/28/2018	0.0	4.0	0.0	4.2	0.0	4.1	8	12
10/29/2018	0.0	4.0	0.0	4.2	0.0	4.1	8	14
10/30/2018	0.1	4.1	0.0	4.2	0.0	4.1	8	10
10/31/2018	0.3	4.4	0.3	4.5	0.2	4.3	11	16

Date	Red Mountain Pass Daily Total Precipitation (in)	Red Mountain Pass Cumulative Precipitation (in)	Minnehaha Daily Total Precipitation (in)	Minnehaha Cumulative Precipitation (in)	Gladstone Daily Total Precipitation (in)	Gladstone Cumulative Precipitation (in)	Minnehaha Snow Depth (Inches)	Red Mountain Pass Snow Depth (Inches)
11/1/2018	0.0	4.4	0.1	4.6	0.0	4.3	11	15
11/2/2018	0.2	4.6	0.1	4.7	0.1	4.4	13	17
11/3/2018	0.1	4.7	0.1	4.8	0.1	4.5	12	16
11/4/2018	0.4	5.1	0.8	5.6	0.2	4.6	12	16
11/5/2018	0.2	5.3	0.2	5.8	0.3	5.0	12	16
11/6/2018	0.2	5.5	0.1	5.8	0.0	5.0	12	16
11/7/2018	0.0	5.5	0.1	5.9	0.1	5.0	12	16
11/8/2018	0.1	5.6	0.1	6.0	0.0	5.0	13	18
11/9/2018	0.0	5.6	0.1	6.1	0.0	5.1	14	18
11/10/2018	0.1	5.7	0.0	6.2	0.1	5.2	14	18
11/11/2018	0.1	5.8	0.1	6.2	0.0	5.2	13	18
11/12/2018	0.0	5.8	0.2	6.4	0.0	5.2	12	17
11/13/2018	0.1	5.9	0.3	6.6	0.1	5.3	13	17
11/14/2018	0.1	6.0	0.3	6.9	0.0	5.3	12	17
11/15/2018	0.0	6.0	0.0	6.9	0.0	5.4	13	17
11/16/2018	0.0	6.0	0.1	7.0	0.0	5.4	13	17
11/17/2018	0.0	6.0	0.1	7.1	0.1	5.4	13	17
11/18/2018	0.0	6.0	0.1	7.2	0.0	5.4	13	17
11/19/2018	0.0	6.0	0.2	7.4	0.0	5.5	15	26
11/20/2018	0.0	6.0	0.1	7.5	0.0	5.5	21	23
11/21/2018	0.0	6.0	0.0	7.5	0.0	5.5	21	26
11/22/2018	0.0	6.0	0.1	7.6	0.0	5.5	22	24
11/23/2018	0.3	6.3	0.1	7.7	0.6	6.1	21	24
11/24/2018	0.1	6.4	0.2	7.8	0.0	6.0	20	23
11/25/2018	0.3	6.7	0.4	8.3	0.2	6.3	19	22
11/26/2018	0.2	6.9	0.8	9.0	0.1	6.4	21	24
11/27/2018	0.0	6.9	0.0	9.0	0.1	6.5	23	30
11/28/2018	0.0	6.9	0.0	9.1	0.7	7.2	27	32
11/29/2018	0.1	7.0	0.0	9.1	0.0	7.2	27	32
11/30/2018	0.0	7.0	0.0	9.1	0.0	7.2	26	31
12/1/2018	0.3	7.3	0.0	9.1	0.0	7.2	26	30

Date	Red Mountain Pass Daily Total Precipitation (in)	Red Mountain Pass Cumulative Precipitation (in)	Minnehaha Daily Total Precipitation (in)	Minnehaha Cumulative Precipitation (in)	Gladstone Daily Total Precipitation (in)	Gladstone Cumulative Precipitation (in)	Minnehaha Snow Depth (Inches)	Red Mountain Pass Snow Depth (Inches)
12/2/2018	0.5	7.8	0.0	9.1	0.0	7.2	25	27
12/3/2018	0.1	7.9	0.0	9.1	-0.1	7.1	26	30
12/4/2018	0.1	8.0	0.0	9.1	0.1	7.2	26	30
12/5/2018	0.1	8.1	0.0	9.1	0.1	7.3	26	30
12/6/2018	0.1	8.2	0.0	9.1	0.2	7.5	25	29
12/7/2018	0.1	8.3	0.0	9.1	-0.1	7.4	25	28
12/8/2018	0.0	8.3	0.0	9.1	0.0	7.4	25	29
12/9/2018	0.0	8.3	0.0	9.1	-0.1	7.3	26	36
12/10/2018	0.0	8.3	0.0	9.1	0.2	7.5	28	34
12/11/2018	0.1	8.4	0.0	9.1	0.0	7.4	27	33
12/12/2018	0.0	8.4	0.0	9.1		7.4	27	32
12/13/2018	0.3	8.7	0.0	9.1	0.5	8.0	26	32
12/14/2018	0.3	9.0	0.0	9.1	0.1	8.0	26	31
12/15/2018	0.0	9.0	0.0	9.1	0.0	8.1	22	31
12/16/2018	0.0	9.0	0.0	9.1	-0.1	8.0	22	33
12/17/2018	0.0	9.0	0.0	9.1	0.1	8.1	26	32
12/18/2018	0.0	9.0	0.0	9.1	-0.1	8.1	26	30
12/19/2018	0.0	9.0	0.2	9.3	0.1	8.2	27	33
12/20/2018	0.1	9.1	0.1	9.3	0.0	8.2	27	31
12/21/2018	0.1	9.2	0.0	9.3	0.0	8.2	32	37
12/22/2018	0.0	9.2	0.1	9.4	-0.1	8.1	32	39
12/23/2018	0.0	9.2	0.0	9.4	0.0	8.1	36	44
12/24/2018	0.0	9.2	0.0	9.4	0.1	8.3	36	44
12/25/2018	0.3	9.5	0.4	9.8	0.4	8.6	35	43
12/26/2018	0.3	9.8	0.1	9.9	0.2	8.8	35	40
12/27/2018	0.3	10.1	0.2	10.1	0.2	9.0	34	39
12/28/2018	0.1	10.2	0.0	10.1	0.0	8.9	35	41
12/29/2018	0.2	10.4	0.3	10.4	0.0	8.9	38	43
12/30/2018	0.1	10.5	0.0	10.4	0.2	9.2	38	42
12/31/2018	0.0	10.5	0.0	10.4	0.1	9.3	37	42
1/1/2019	0.1	10.6	0.2	10.6	0.0	9.3	36	41

Date	Red Mountain Pass Daily Total Precipitation (in)	Red Mountain Pass Cumulative Precipitation (in)	Minnehaha Daily Total Precipitation (in)	Minnehaha Cumulative Precipitation (in)	Gladstone Daily Total Precipitation (in)	Gladstone Cumulative Precipitation (in)	Minnehaha Snow Depth (Inches)	Red Mountain Pass Snow Depth (Inches)
1/2/2019	0.5	11.1	0.4	11.0	0.7	10.0	36	41
1/3/2019	0.2	11.3	0.0	11.0	0.0	10.0	43	52
1/4/2019	0.0	11.3	0.0	11.0	0.1	10.1	49	50
1/5/2019	0.0	11.3	0.0	11.0	0.0	10.1	48	49
1/6/2019	0.0	11.3	0.0	11.0	0.0	10.1	45	47
1/7/2019	0.4	11.7	0.6	11.6	0.5	10.6	43	46
1/8/2019	0.3	12.0	0.3	11.8	0.3	10.9	42	48
1/9/2019	0.0	12.0	0.0	11.8	0.0	10.9	43	47
1/10/2019	0.0	12.0	0.0	11.8	0.0	10.9	43	47
1/11/2019	0.0	12.0	0.0	11.9	0.0	10.9	42	46
1/12/2019	0.1	12.1	0.0	11.9	0.1	11.0	41	50
1/13/2019	0.1	12.2	0.1	12.0	0.0	11.0	47	55
1/14/2019	0.0	12.2	0.0	12.0	0.0	11.0	48	57
1/15/2019	0.1	12.3	0.0	12.0	0.0	11.0	58	67
1/16/2019	0.1	12.4	0.1	12.1	0.3	11.3	57	63
1/17/2019	0.6	13.0	0.0	12.2	0.5	11.7	55	60
1/18/2019	0.3	13.3	0.4	12.5	0.3	12.0	54	62
1/19/2019	1.3	14.6	1.0	13.5	0.9	12.9	56	63
1/20/2019	0.1	14.7	0.1	13.6	0.1	13.0	54	64
1/21/2019	0.0	14.7	0.0	13.6	0.0	13.0	56	65
1/22/2019	0.4	15.1	0.1	13.7	0.1	13.0	55	63
1/23/2019	0.0	15.1	0.2	13.9	0.2	13.3	53	61
1/24/2019	0.2	15.3	0.0	14.0	-0.1	13.2	52	59
1/25/2019	0.4	15.7	0.3	14.3	0.1	13.3	52	59
1/26/2019	0.1	15.8	0.1	14.4	0.1	13.3	51	59
1/27/2019	0.0	15.8	0.0	14.4	0.0	13.4	51	57
1/28/2019	0.0	15.8	0.0	14.4	0.3	13.6	50	57
1/29/2019	0.1	15.9	0.1	14.6	0.1	13.7	50	56
1/30/2019	0.0	15.9	0.0	14.6	0.0	13.7	49	55
1/31/2019	0.0	15.9	0.0	14.6	0.0	13.7	54	60
2/1/2019	0.0	15.9	0.0	14.6	0.0	13.7	57	61

Date	Red Mountain Pass Daily Total Precipitation (in)	Red Mountain Pass Cumulative Precipitation (in)	Minnehaha Daily Total Precipitation (in)	Minnehaha Cumulative Precipitation (in)	Gladstone Daily Total Precipitation (in)	Gladstone Cumulative Precipitation (in)	Minnehaha Snow Depth (Inches)	Red Mountain Pass Snow Depth (Inches)
2/2/2019	0.0	15.9	0.0	14.6	0.0	13.7	57	67
2/3/2019	0.0	15.9	0.0	14.6	0.0	13.7		71
2/4/2019	0.4	16.3	0.4	15.0	0.4	14.1		69
2/5/2019	0.2	16.5	0.2	15.2	0.2	14.3	59	67
2/6/2019	0.3	16.8	0.3	15.5	0.3	14.6	58	65
2/7/2019	0.6	17.4	0.6	16.1	0.6	15.2	57	64
2/8/2019	0.2	17.6	0.2	16.3	0.2	15.4	57	64
2/9/2019	0.0	17.6	0.0	16.3	0.0	15.4	57	64
2/10/2019	0.0	17.6	0.0	16.3	0.0	15.4	57	67
2/11/2019	0.0	17.6	0.0	16.3	0.0	15.4	62	78
2/12/2019	0.2	17.8	0.2	16.5	0.2	15.6	72	77
2/13/2019	0.0	17.8	0.0	16.5	0.0	15.6	73	81
2/14/2019	0.4	18.2	0.4	16.9	0.4	16.0	72	79
2/15/2019	1.3	19.5	1.3	18.2	1.3	17.3	72	80
2/16/2019	0.3	19.8	0.3	18.5	0.3	17.6	73	80
2/17/2019	0.4	20.2	0.4	18.9	0.4	18.0	72	79
2/18/2019	0.0	20.2	0.0	18.9	0.0	18.0	74	84
2/19/2019	0.3	20.5	0.3	19.2	0.3	18.3	80	90
2/20/2019	0.3	20.8	0.3	19.5	0.3	18.6	81	88
2/21/2019	0.0	20.8	0.0	19.5	0.0	18.6	79	85
2/22/2019	0.7	21.5	0.7	20.2	0.7	19.3	77	83
2/23/2019	0.8	22.3	0.8	21.0	0.8	20.1	76	81
2/24/2019	0.2	22.5	0.2	21.2	0.2	20.3	74	80
2/25/2019	0.0	22.5	0.0	21.2	0.0	20.3	74	81
2/26/2019	0.0	22.5	0.0	21.2	0.0	20.3	77	82
2/27/2019	0.0	22.5	0.0	21.2	0.0	20.3	80	90
2/28/2019	0.0	22.5	0.0	21.2	0.0	20.3	91	97
3/1/2019	0.1	22.6	0.1	21.3	0.1	20.4	93	98
3/2/2019	0.1	22.7	0.1	21.4	0.1	20.5	91	93
3/3/2019	0.7	23.4	0.7	22.1	0.7	21.2	91	98
3/4/2019	1.2	24.6	1.2	23.3	1.2	22.4	94	100

Date	Red Mountain Pass Daily Total Precipitation (in)	Red Mountain Pass Cumulative Precipitation (in)	Minnehaha Daily Total Precipitation (in)	Minnehaha Cumulative Precipitation (in)	Gladstone Daily Total Precipitation (in)	Gladstone Cumulative Precipitation (in)	Minnehaha Snow Depth (Inches)	Red Mountain Pass Snow Depth (Inches)
3/5/2019	0.4	25.0	0.4	23.7	0.4	22.8	94	109
3/6/2019	0.0	25.0	0.0	23.7	0.0	22.8	97	104
3/7/2019	0.8	25.8	0.8	24.5	0.8	23.6	94	100
3/8/2019	0.5	26.3	0.5	25.0	0.5	24.1	94	104
3/9/2019	0.9	27.2	0.9	25.9	0.9	25.0	103	115
3/10/2019	0.3	27.5	0.3	26.2	0.3	25.3	116	127
3/11/2019	0.0	27.5	0.0	26.2	0.0	25.3	116	121
3/12/2019	0.4	27.9	0.4	26.6	0.4	25.7	110	115
3/13/2019	1.1	29.0	1.1	27.7	1.1	26.8	106	111
3/14/2019	1.4	30.4	1.4	29.1	1.4	28.2	103	108
3/15/2019	0.5	30.9	0.5	29.6	0.5	28.7	101	106
3/16/2019	0.0	30.9	0.0	29.6	0.0	28.7	100	104
3/17/2019	0.0	30.9	0.0	29.6	0.0	28.7		103
3/18/2019	0.0	30.9	0.0	29.6	0.0	28.7		108
3/19/2019	0.0	30.9	0.0	29.6	0.0	28.7		111
3/20/2019	0.0	30.9	0.0	29.6	0.0	28.7		109
3/21/2019	0.0	30.9	0.0	29.6	0.0	28.7		106
3/22/2019	0.1	31.0	0.1	29.7	0.1	28.8		104
3/23/2019	0.8	31.8	0.8	30.5	0.8	29.6		102
3/24/2019	0.1	31.9	0.1	30.6	0.1	29.7	95	100
3/25/2019	0.1	32.0	0.1	30.7	0.1	29.8	93	98
3/26/2019	0.0	32.0	0.0	30.7	0.0	29.8	93	99
3/27/2019	0.0	32.0	0.0	30.7	0.0	29.8	94	98
3/28/2019	0.0	32.0	0.0	30.7	0.0	29.8	95	102
3/29/2019	0.0	32.0	0.0	30.7	0.0	29.8	95	100
3/30/2019	0.1	32.1	0.1	30.8	0.1	29.9	93	99
3/31/2019	0.0	32.1	0.0	30.8	0.0	29.9	95	101
4/1/2019	0.2	32.3	0.2	31.0	0.2	30.1	94	98
4/2/2019	0.3	32.6	0.3	31.3	0.3	30.4	91	96
4/3/2019	0.0	32.6	0.0	31.3	0.0	30.4	90	95
4/4/2019	0.2	32.8	0.2	31.5	0.2	30.6	89	94

Date	Red Mountain Pass Daily Total Precipitation (in)	Red Mountain Pass Cumulative Precipitation (in)	Minnehaha Daily Total Precipitation (in)	Minnehaha Cumulative Precipitation (in)	Gladstone Daily Total Precipitation (in)	Gladstone Cumulative Precipitation (in)	Minnehaha Snow Depth (Inches)	Red Mountain Pass Snow Depth (Inches)
4/5/2019	0.0	32.8	0.0	31.5	0.0	30.6	87	92
4/6/2019	0.0	32.8	0.0	31.5	0.0	30.6	86	90
4/7/2019	0.0	32.8	0.0	31.5	0.0	30.6	89	102
4/8/2019	0.0	32.8	0.0	31.5	0.0	30.6	93	105
4/9/2019	0.1	32.9	0.1	31.6	0.1	30.7	92	100
4/10/2019	0.0	32.9	0.0	31.6	0.0	30.7	91	101
4/11/2019	0.5	33.4	0.5	32.1	0.3	31.0	91	97
4/12/2019	0.6	34.0	0.6	32.7	0.3	31.3	88	96
4/13/2019	0.1	34.1	0.1	32.8	0.1	31.3	87	95
4/14/2019	0.1	34.2	0.1	32.9	0.0	31.3	86	93
4/15/2019	0.1	34.3	0.1	33.0	0.0	31.3	85	92
4/16/2019	0.0	34.3	0.0	33.0	0.0	31.3	84	89
4/17/2019	0.0	34.3	0.0	33.0	0.0	31.4	83	89
4/18/2019	0.0	34.3	0.0	33.0	0.0	31.3	83	88
4/19/2019	0.0	34.3	0.0	33.0	0.0	31.4	82	87
4/20/2019	0.0	34.3	0.0	33.0	0.0	31.4	81	86
4/21/2019	0.0	34.3	0.0	33.0	0.0	31.4	80	84
4/22/2019	0.0	34.3	0.0	33.0	0.0	31.4	78	82
4/23/2019	0.0	34.3	0.0	33.0	0.0	31.5	77	82
4/24/2019	0.0	34.3	0.0	33.0	0.0	31.5	77	79
4/25/2019	0.0	34.3	0.0	33.0	0.0	31.5	76	80
4/26/2019	0.0	34.3	0.0	33.0	0.4	31.8	77	88
4/27/2019	0.1	34.4	0.1	33.1	0.1	31.9	85	88
4/28/2019	0.2	34.6	0.2	33.3	0.0	31.9	92	90
4/29/2019	0.1	34.7	0.1	33.4	0.7	32.6	91	86
4/30/2019	0.8	35.5	0.8	34.2	0.7	33.3	88	85
5/1/2019	0.5	36.0	0.5	34.7	0.6	34.0	86	84
5/2/2019	0.7	36.7	0.7	35.4	0.0	34.0	84	83
5/3/2019	0.1	36.8	0.1	35.5	0.0	34.0	82	82
5/4/2019	0.1	36.9	0.1	35.6	0.0	34.0	81	80
5/5/2019	0.0	36.9	0.0	35.6	0.0	34.0	82	82

Date	Red Mountain Pass Daily Total Precipitation (in)	Red Mountain Pass Cumulative Precipitation (in)	Minnehaha Daily Total Precipitation (in)	Minnehaha Cumulative Precipitation (in)	Gladstone Daily Total Precipitation (in)	Gladstone Cumulative Precipitation (in)	Minnehaha Snow Depth (Inches)	Red Mountain Pass Snow Depth (Inches)
5/6/2019	0.0	36.9	0.0	35.6	0.0	34.1	84	83
5/7/2019	0.0	36.9	0.0	35.6	0.6	34.7	86	83
5/8/2019	0.0	36.9	0.0	35.6	0.0	34.7	85	80
5/9/2019	0.0	36.9	0.0	35.6	0.0	34.7	83	79
5/10/2019	0.0	36.9	0.0	35.6	0.0	34.7	81	77
5/11/2019	0.2	37.1	0.2	35.8	0.2	34.9	79	75
5/12/2019	0.2	37.3	0.2	36.0	0.0	34.9	78	73
5/13/2019	0.1	37.4	0.1	36.1	0.0	34.9	76	70
5/14/2019	0.0	37.4	0.0	36.1	0.0	34.9	78	73
5/15/2019	0.0	37.4	0.0	36.1	0.0	35.0	81	73
5/16/2019	0.0	37.4	0.0	36.1	0.0	35.0	80	77
5/17/2019	0.0	37.4	0.0	36.1	0.5	35.6	87	85
5/18/2019	0.1	37.5	0.6	36.7	0.2	35.8	89	82
5/19/2019	0.5	38.0	0.2	36.9	0.2	36.0	89	81
5/20/2019	0.1	38.1	0.2	37.1	0.6	36.6	90	86
5/21/2019	0.9	39.0	0.8	37.9	0.3	36.9	89	81
5/22/2019	0.2	39.2	0.3	38.2	0.2	37.1	86	78
5/23/2019	0.3	39.5	0.2	38.4	0.4	37.5	84	78
5/24/2019	0.6	40.1	0.6	38.9	0.0	37.6	85	82
5/25/2019	0.2	40.3	0.0	38.9	0.1	37.6	86	80
5/26/2019	0.1	40.4	0.0	38.9	0.1	37.7	84	80
5/27/2019	0.0	40.4	0.2	39.1	0.4	38.1	84	79
5/28/2019	0.2	40.6	0.3	39.4	0.2	38.3	83	77
5/29/2019	0.6	41.2	0.2	39.6	0.1	38.4	80	74
5/30/2019	0.0	41.2	0.1	39.8	0.0	38.4	78	72
5/31/2019	0.1	41.3	0.0	39.8	0.1	38.5	75	70
6/1/2019	0.1	41.4	0.0	39.8	0.0	38.5	74	69
6/2/2019	0.0	41.4	0.0	39.8	0.0	38.5	72	66
6/3/2019	0.0	41.4	0.0	39.8	0.0	38.5	70	63
6/4/2019	0.0	41.4	0.0	39.8	0.0	38.5	67	61
6/5/2019	0.0	41.4	0.0	39.8	0.0	38.5	64	58

Date	Red Mountain Pass Daily Total Precipitation (in)	Red Mountain Pass Cumulative Precipitation (in)	Minnehaha Daily Total Precipitation (in)	Minnehaha Cumulative Precipitation (in)	Gladstone Daily Total Precipitation (in)	Gladstone Cumulative Precipitation (in)	Minnehaha Snow Depth (Inches)	Red Mountain Pass Snow Depth (Inches)
6/6/2019	0.0	41.4	0.0	39.8	0.0	38.6	62	56
6/7/2019	0.0	41.4	0.0	39.8	0.0	38.6	59	54
6/8/2019	0.0	41.4	0.0	39.9	0.0	38.6	57	51
6/9/2019	0.0	41.4	0.0	39.9	0.0	38.5	55	49
6/10/2019	0.0	41.4	0.0	39.9	0.0	38.6	53	47
6/11/2019	0.0	41.4	0.0	39.9	0.0	38.6	51	44
6/12/2019	0.0	41.4	0.0	39.9	0.0	38.6	50	43
6/13/2019	0.0	41.4	0.0	39.9	0.0	38.6	48	41
6/14/2019	0.0	41.4	0.0	39.9	0.0	38.6	46	40
6/15/2019	0.0	41.4	0.0	39.9	0.0	38.6	46	41
6/16/2019	0.0	41.4	0.0	39.9	0.0	38.6	46	38
6/17/2019	0.0	41.4	0.0	39.9	0.0	38.6	44	36
6/18/2019	0.0	41.4	0.2	40.0	0.2	38.8	42	34
6/19/2019	0.4	41.8	0.5	40.5	0.5	39.3	40	31
6/20/2019	0.1	41.9	0.0	40.5	0.0	39.3	38	32
6/21/2019	0.0	41.9	0.0	40.5	0.0	39.3	37	30
6/22/2019	0.0	41.9	0.0	40.5	0.1	39.4	35	28
6/23/2019	0.2	42.1	0.2	40.7	0.0	39.4	33	25
6/24/2019	0.0	42.1	0.0	40.7	0.1	39.5	31	23
6/25/2019	0.0	42.1	0.0	40.7	0.0	39.5	28	19
6/26/2019	0.0	42.1	0.0	40.7	0.0	39.5	26	16
6/27/2019	0.0	42.1	0.0	40.7	0.0	39.5	24	12
6/28/2019	0.0	42.1	0.0	40.7	0.0	39.6	21	11
6/29/2019	0.0	42.1	0.0	40.7	0.0	39.6	18	8
6/30/2019	0.0	42.1	0.0	40.7	0.0	39.6	17	2
7/1/2019	0.0	42.1	0.0	40.8	0.0	39.6	14	1
7/2/2019	0.0	42.1	0.0	40.8	0.0	39.6	11	0
7/3/2019	0.0	42.1	0.1	40.8	0.0	39.6	8	
7/4/2019	0.0	42.1	0.0	40.8	0.0	39.7	4	
7/5/2019	0.0	42.1	0.0	40.8	0.0	39.7	1	
7/6/2019	0.0	42.1	0.0	40.8	0.0	39.7	0	

Date	Red Mountain Pass Daily Total Precipitation (in)	Red Mountain Pass Cumulative Precipitation (in)	Minnehaha Daily Total Precipitation (in)	Minnehaha Cumulative Precipitation (in)	Gladstone Daily Total Precipitation (in)	Gladstone Cumulative Precipitation (in)	Minnehaha Snow Depth (Inches)	Red Mountain Pass Snow Depth (Inches)
7/7/2019	0.0	42.1	0.0	40.8	0.1	39.7	0	
7/8/2019	0.0	42.1	0.1	40.9	0.0	39.8		
7/9/2019	0.0	42.1	0.1	41.0	0.1	39.8		2
7/10/2019	0.0	42.1	0.0	41.0	0.1	39.9	0	1
7/11/2019	0.0	42.1	0.0	41.0	0.0	39.8	1	2
7/12/2019	0.0	42.1	0.0	41.0	0.0	39.9	2	4
7/13/2019	0.0	42.1	0.0	41.0	0.0	39.9	2	1
7/14/2019	0.0	42.1	0.0	41.0	0.0	39.9	0	2
7/15/2019	0.1	42.2	0.0	41.0	0.0	39.9	1	2
7/16/2019	0.1	42.3	0.0	41.0	0.0	40.0	1	1
7/17/2019	0.0	42.3	0.0	41.0	0.0	39.9	0	1
7/18/2019	0.0	42.3	0.0	41.0	0.0	39.9	0	1
7/19/2019	0.0	42.3	0.0	41.0	0.0	40.0	2	2
7/20/2019	0.0	42.3	0.0	41.0	0.0	39.9	5	6
7/21/2019	0.0	42.3	0.0	41.0	0.1	40.0	6	6
7/22/2019	0.0	42.3	0.0	41.0	0.0	40.0	5	4
7/23/2019	0.0	42.3	0.0	41.0	0.1	40.1	4	4
7/24/2019	0.0	42.3	0.1	41.1	0.7	40.8	4	4
7/25/2019	0.0	42.3	0.4	41.5	0.3	41.1	3	4
7/26/2019	0.1	42.4	0.2	41.7	0.3	41.5	3	4
7/27/2019	0.2	42.6	0.4	42.0	0.4	41.8	3	3
7/28/2019	0.6	43.2	0.0	42.1	0.0	41.8	3	3
7/29/2019	0.0	43.2	0.0	42.1	0.0	41.8	3	3
7/30/2019	0.0	43.2	0.0	42.1	0.0	41.8	3	3
7/31/2019	0.0	43.2	0.0	42.1	0.1	41.9	2	2
8/1/2019	0.0	43.2	0.1	42.1	0.1	42.1	2	2
8/2/2019	0.0	43.2	0.2	42.3	0.0	42.1	1	2
8/3/2019	0.1	43.3	0.0	42.3	0.0	42.1	1	2
8/4/2019	0.0	43.3	0.0	42.3	0.0	42.1	2	2
8/5/2019	0.1	43.4	0.2	42.5	0.0	42.1	2	2
8/6/2019	0.2	43.6	0.0	42.5	0.1	42.2	1	2

Date	Red Mountain Pass Daily Total Precipitation (in)	Red Mountain Pass Cumulative Precipitation (in)	Minnehaha Daily Total Precipitation (in)	Minnehaha Cumulative Precipitation (in)	Gladstone Daily Total Precipitation (in)	Gladstone Cumulative Precipitation (in)	Minnehaha Snow Depth (Inches)	Red Mountain Pass Snow Depth (Inches)
8/7/2019	0.0	43.6	0.0	42.5	0.1	42.2	1	2
8/8/2019	0.3	43.9	0.1	42.6	0.1	42.3	2	2
8/9/2019	0.1	44.0	0.1	42.6	0.4	42.7	1	2
8/10/2019	0.3	44.3	0.4	43.0	0.1	42.8	1	2
8/11/2019	0.2	44.5	0.0	43.0	0.1	42.9	3	8
8/12/2019	0.4	44.9	0.2	43.2	0.0	42.9	8	13
8/13/2019	0.3	45.2	0.0	43.2	0.0	42.9	9	19
8/14/2019	0.1	45.3	0.0	43.2	0.0	43.0	10	17
8/15/2019	0.0	45.3	0.0	43.2	0.0	43.0	9	13
8/16/2019	0.0	45.3	0.0	43.2	0.0	42.9	9	17
8/17/2019	0.0	45.3	0.0	43.2	0.0	42.9	15	18
8/18/2019	0.0	45.3	0.0	43.2	0.0	43.0	14	20
8/19/2019	0.0	45.3	0.0	43.2	0.0	43.0	14	20
8/20/2019	0.0	45.3	0.0	43.2	0.0	43.0	24	33
8/21/2019	0.0	45.3	0.0	43.2	-0.1	42.9	30	31
8/22/2019	0.0	45.3	0.0	43.2	0.0	42.9	27	28
8/23/2019	0.0	45.3	0.0	43.2	0.0	42.9	25	26
8/24/2019	0.0	45.3	0.0	43.2	0.0	43.0	23	25
8/25/2019	0.0	45.3	0.0	43.2	0.0	43.0	22	24
8/26/2019	0.0	45.3	0.0	43.2	0.0	43.0	25	29
8/27/2019	0.0	45.3	0.0	43.2	0.0	43.0	25	27
8/28/2019	0.0	45.3	0.0	43.2	0.0	43.0	24	26
8/29/2019	0.0	45.3	0.0	43.2	0.0	43.0	33	42
8/30/2019	0.0	45.3	0.0	43.2	0.0	43.0	39	39
8/31/2019	0.0	45.3	0.0	43.2	0.0	43.0	36	38
9/1/2019	0.0	45.3	0.0	43.2	0.0	43.0	34	36
9/2/2019	0.0	45.3	0.0	43.2	0.0	43.0	32	33
9/3/2019	0.0	45.3	0.0	43.2	0.0	43.0	32	36
9/4/2019	0.0	45.3	0.0	43.2	0.0	43.0	36	41
9/5/2019	0.0	45.3	0.0	43.2	0.0	43.0	38	43
9/6/2019	0.0	45.3	0.0	43.3	0.0	43.0	38	40

Date	Red Mountain Pass Daily Total Precipitation (in)	Red Mountain Pass Cumulative Precipitation (in)	Minnehaha Daily Total Precipitation (in)	Minnehaha Cumulative Precipitation (in)	Gladstone Daily Total Precipitation (in)	Gladstone Cumulative Precipitation (in)	Minnehaha Snow Depth (Inches)	Red Mountain Pass Snow Depth (Inches)
9/7/2019	0.0	45.3	0.0	43.3	0.0	43.1	36	39
9/8/2019	0.1	45.4	0.1	43.4	0.1	43.2	35	37
9/9/2019	0.1	45.5	0.0	43.4	0.0	43.2	34	34
9/10/2019	0.2	45.7	0.0	43.4	0.2	43.3	34	35
9/11/2019	0.0	45.7	0.1	43.6	0.0	43.3	33	34
9/12/2019	0.0	45.7	0.0	43.6	0.0	43.3	32	33
9/13/2019	0.2	45.9	0.0	43.6	0.0	43.3	32	33
9/14/2019	0.1	46.0	0.0	43.6	0.0	43.4	32	40
9/15/2019	0.0	46.0	0.0	43.6	0.0	43.4	39	45
9/16/2019	0.0	46.0	0.0	43.6	0.0	43.4	40	45
9/17/2019	0.0	46.0	0.0	43.6	0.3	43.7	46	54
9/18/2019	0.0	46.0	0.4	44.0	0.0	43.7	48	52
9/19/2019	0.0	46.0	0.0	44.0	0.1	43.8	46	50
9/20/2019	0.0	46.0	0.1	44.1	-0.1	43.8	44	48
9/21/2019	0.1	46.1	0.0	44.1	0.0	43.7	42	45
9/22/2019	0.0	46.1	0.0	44.1	0.0	43.8	43	52
9/23/2019	0.0	46.1	0.0	44.1	0.0	43.7	48	52
9/24/2019	0.0	46.1	0.0	44.1	0.0	43.8	46	49
9/25/2019	0.0	46.1	0.0	44.1	0.1	43.8	45	47
9/26/2019	0.0	46.1	0.0	44.1	0.0	43.8	44	47
9/27/2019	0.0	46.1	0.0	44.1	-0.1	43.8	42	46
9/28/2019	0.0	46.1	0.0	44.1	0.0	43.8	42	46
9/29/2019	0.0	46.1	0.0	44.1	0.1	43.9	41	44
9/30/2019	0.1	46.2	0.1	44.2	0.0	43.8	42	48
							42	47
10/1/2019	0.0	0.0	0.0	0.0	0.0	0.0	42	47
10/2/2019	0.0	0.0	0.0	0.0	0.0	0.0	43	47
10/3/2019	0.0	0.0	0.0	0.0	0.1	0.1	45	48
10/4/2019	0.0	0.0	0.0	0.0	0.2	0.2	45	47
10/5/2019	0.0	0.0	0.1	0.1	0.0	0.2	44	46
10/6/2019	0.0	0.0	0.0	0.1	0.0	0.2	44	45

Date	Red Mountain Pass Daily Total Precipitation (in)	Red Mountain Pass Cumulative Precipitation (in)	Minnehaha Daily Total Precipitation (in)	Minnehaha Cumulative Precipitation (in)	Gladstone Daily Total Precipitation (in)	Gladstone Cumulative Precipitation (in)	Minnehaha Snow Depth (Inches)	Red Mountain Pass Snow Depth (Inches)
10/7/2019	0.0	0.0	0.0	0.1	0.0	0.2	47	51
10/8/2019	0.0	0.0	0.0	0.1	0.0	0.2	47	49
10/9/2019	0.0	0.0	0.0	0.1	0.1	0.3	46	48
10/10/2019	0.0	0.0	0.0	0.1		0.3	45	47
10/11/2019	0.0	0.0	0.0	0.1	0.1	0.4	46	49
10/12/2019	0.0	0.0	0.0	0.1	0.0	0.4	48	56
10/13/2019	0.0	0.0	0.0	0.1	0.0	0.5	50	55
10/14/2019	0.0	0.0	0.0	0.1	0.1	0.6	49	53
10/15/2019	0.0	0.0	0.0	0.1	0.0	0.6	47	53
10/16/2019	0.0	0.0	0.0	0.1	0.0	0.6	47	51
10/17/2019	0.0	0.0	0.0	0.1	0.0	0.6	48	59
10/18/2019	0.0	0.0	0.0	0.1	0.0	0.6	51	57
10/19/2019	0.3	0.3	0.2	0.3	0.1	0.7	49	55
10/20/2019	0.0	0.3	0.0	0.3	0.0	0.7	48	54
10/21/2019	0.2	0.5	0.2	0.4	0.1	0.8	49	53
10/22/2019	0.1	0.6	0.1	0.5	0.1	0.9	48	52
10/23/2019	0.0	0.6	0.0	0.5	0.0	1.0	48	51
10/24/2019	0.1	0.7	0.1	0.6	0.0	1.0	48	55
10/25/2019	0.1	0.8	0.1	0.6	0.1	1.1	49	54
10/26/2019	0.0	0.8	0.0	0.6	0.0	1.1	49	54
10/27/2019	0.0	0.8	0.0	0.6	0.1	1.2	53	66
10/28/2019	0.0	0.8	0.0	0.6	0.1	1.3	60	67
10/29/2019	0.2	1.0	0.3	0.9	0.3	1.5	60	64
10/30/2019	0.4	1.4	0.4	1.3	-0.1	1.5	58	62
10/31/2019	0.1	1.5	0.0	1.3	0.2	1.6	61	65
11/1/2019	0.0	1.5	0.0	1.3	0.0	1.6	61	62
11/2/2019	0.0	1.5	0.0	1.3	0.0	1.6	59	61
11/3/2019	0.0	1.5	0.0	1.3	0.1	1.7	57	60
11/4/2019	0.0	1.5	0.0	1.3	0.0	1.7	56	59
11/5/2019	0.0	1.5	0.0	1.3	0.0	1.7	55	58
11/6/2019	0.0	1.5	0.0	1.3	0.0	1.7	55	60

Date	Red Mountain Pass Daily Total Precipitation (in)	Red Mountain Pass Cumulative Precipitation (in)	Minnehaha Daily Total Precipitation (in)	Minnehaha Cumulative Precipitation (in)	Gladstone Daily Total Precipitation (in)	Gladstone Cumulative Precipitation (in)	Minnehaha Snow Depth (Inches)	Red Mountain Pass Snow Depth (Inches)
11/7/2019	0.0	1.5	0.0	1.3	0.0	1.7	58	60
11/8/2019	0.0	1.5	0.0	1.3	0.0	1.7	57	59
11/9/2019	0.0	1.5	0.0	1.3	0.0	1.7	55	58
11/10/2019	0.0	1.5	0.0	1.3	0.0	1.7	55	58
11/11/2019	0.0	1.5	0.0	1.3	-0.1	1.6	54	57
11/12/2019	0.0	1.5	0.0	1.3	0.1	1.7	54	60
11/13/2019	0.0	1.5	0.0	1.3	0.0	1.7	58	65
11/14/2019	0.0	1.5	0.0	1.3	0.0	1.7	59	66
11/15/2019	0.0	1.5	0.0	1.3	0.0	1.7	60	66
11/16/2019	0.0	1.5	0.0	1.3	0.0	1.7	60	63
11/17/2019	0.0	1.5	0.0	1.3	0.1	1.8	59	62
11/18/2019	0.1	1.6	0.0	1.3	-0.1	1.7	58	62
11/19/2019	0.0	1.6	0.0	1.3	0.1	1.8	57	60
11/20/2019	0.0	1.6	0.0	1.3	0.3	2.1	57	64
11/21/2019	0.4	2.0	0.4	1.7	0.3	2.4	60	62
11/22/2019	0.5	2.5	0.4	2.1	0.1	2.5	59	61
11/23/2019	0.5	3.0	0.5	2.6	0.6	3.2	57	60
11/24/2019	0.0	3.0	0.0	2.6	0.0	3.2	57	59
11/25/2019	0.0	3.0	0.0	2.6	0.0	3.2	56	58
11/26/2019	0.3	3.3	0.2	2.8	0.2	3.4	55	57
11/27/2019	0.2	3.5	0.4	3.2	0.4	3.8	57	61
11/28/2019	0.3	3.8	0.3	3.5	0.2	4.0	61	60
11/29/2019	0.2	4.0	0.2	3.7	0.2	4.1	60	61
11/30/2019	1.5	5.5	1.2	4.9	1.2	5.4	61	61
12/1/2019	0.1	5.6	0.1	5.0	0.0	5.4	60	60
12/2/2019	0.1	5.7	0.0	5.0	0.2	5.6	64	67
12/3/2019	0.1	5.8	0.0	5.0	0.0	5.6	68	65
12/4/2019	0.0	5.8	0.0	5.0	0.0	5.6	66	65
12/5/2019	0.2	6.0	0.1	5.1	0.2	5.7	64	64
12/6/2019	0.2	6.2	0.3	5.4	0.2	5.9	63	63
12/7/2019	0.0	6.2	0.0	5.4	0.0	5.9	63	70

Date	Red Mountain Pass Daily Total Precipitation (in)	Red Mountain Pass Cumulative Precipitation (in)	Minnehaha Daily Total Precipitation (in)	Minnehaha Cumulative Precipitation (in)	Gladstone Daily Total Precipitation (in)	Gladstone Cumulative Precipitation (in)	Minnehaha Snow Depth (Inches)	Red Mountain Pass Snow Depth (Inches)
12/8/2019	0.2	6.4	0.0	5.4	0.2	6.1	70	73
12/9/2019	1.2	7.6	1.5	6.9	1.3	7.4	71	74
12/10/2019	0.0	7.6	0.0	6.9	0.0	7.4	72	74
12/11/2019	0.0	7.6	0.0	6.9	0.0	7.4	72	75
12/12/2019	0.0	7.6	0.0	6.9	0.0	7.4	73	76
12/13/2019	0.0	7.6	0.1	7.0	0.2	7.6	74	73
12/14/2019	0.5	8.1	0.5	7.4	0.4	8.0	71	72
12/15/2019	0.4	8.5	0.4	7.8	0.2	8.3	70	70
12/16/2019	0.5	9.0	0.3	8.1	0.2	8.5	69	72
12/17/2019	0.0	9.0	0.0	8.1	0.1	8.6	73	72
12/18/2019	0.0	9.0	0.0	8.1	0.0	8.6	71	72
12/19/2019	0.0	9.0	0.0	8.1	0.0	8.6	73	74
12/20/2019	0.0	9.0	0.0	8.1	0.1	8.6	71	71
12/21/2019	0.1	9.1	0.0	8.1	0.0	8.7	69	69
12/22/2019	0.0	9.1	0.0	8.1	0.0	8.7	70	71
12/23/2019	0.0	9.1	0.0	8.1	0.1	8.8	71	69
12/24/2019	0.0	9.1	0.0	8.1		8.8	71	69
12/25/2019	0.6	9.7	0.5	8.6	0.3	9.0	69	69
12/26/2019	0.4	10.1	0.3	8.9	0.2	9.3	68	68
12/27/2019	0.1	10.2	0.2	9.1	0.1	9.4	66	66
12/28/2019	1.0	11.2	0.7	9.8	0.9	10.3	65	65
12/29/2019	0.0	11.2	0.0	9.8	-0.1	10.3	65	64
12/30/2019	0.0	11.2	0.0	9.8	0.0	10.3	64	62
12/31/2019	0.0	11.2	0.0	9.8	0.1	10.3	63	62
1/1/2020	0.0	11.2	0.2	10.0	0.0	10.9	66	66
1/2/2020	0.7	11.9	0.6	10.6	0.6	10.9	66	65
1/3/2020	0.0	11.9	0.0	10.6	0.0	10.9	67	65
1/4/2020	0.0	11.9	0.0	10.6	0.0	10.9	66	63
1/5/2020	0.1	12.0	0.1	10.7	0.1	11.0	67	66
1/6/2020	0.0	12.0	0.0	10.7	0.0	11.0	69	63
1/7/2020	0.0	12.0	0.0	10.7	0.1	11.0	66	65

Date	Red Mountain Pass Daily Total Precipitation (in)	Red Mountain Pass Cumulative Precipitation (in)	Minnehaha Daily Total Precipitation (in)	Minnehaha Cumulative Precipitation (in)	Gladstone Daily Total Precipitation (in)	Gladstone Cumulative Precipitation (in)	Minnehaha Snow Depth (Inches)	Red Mountain Pass Snow Depth (Inches)
1/8/2020	0.0	12.0	0.0	10.7	0.1	11.1	67	62
1/9/2020	0.0	12.0	0.0	10.7	0.0	11.2	66	63
1/10/2020	0.2	12.2	0.2	10.9	0.0	11.2	66	66
1/11/2020	0.0	12.2	0.0	10.9	0.2	11.4	66	64
1/12/2020	0.1	12.3	0.1	11.0	0.0	11.4	64	64
1/13/2020	0.1	12.4	0.1	11.1	0.2	11.7	66	63
1/14/2020	0.2	12.6	0.2	11.3	0.1	11.8	64	62
1/15/2020	0.1	12.7	0.1	11.4	-0.1	11.7	63	60
1/16/2020	0.0	12.7	0.0	11.4	0.2	11.9	62	59
1/17/2020	0.1	12.8	0.1	11.5	0.2	12.1	61	58
1/18/2020	0.3	13.1	0.3	11.8	0.1	12.2	59	55
1/19/2020	0.1	13.2	0.1	11.9	0.0	12.1	58	54
1/20/2020	0.1	13.3	0.1	12.0	0.2	12.3	56	51
1/21/2020	0.0	13.3	0.0	12.0	0.3	12.6	55	50
1/22/2020	0.3	13.6	0.3	12.3	0.1	12.8	53	49
1/23/2020	0.5	14.1	0.5	12.8	0.4	13.2	52	48
1/24/2020	0.0	14.1	0.0	12.8	0.1	13.2	51	46
1/25/2020	0.1	14.2	0.1	12.9	-0.1	13.2	50	44
1/26/2020	0.0	14.2	0.0	12.9	0.0	13.2	49	44
1/27/2020	0.0	14.2	0.0	12.9	0.0	13.2	47	41
1/28/2020	0.4	14.6	0.4	13.3	0.3	13.5	46	40
1/29/2020	0.0	14.6	0.0	13.3	-0.1	13.4	45	39
1/30/2020	0.0	14.6	0.0	13.3	0.1	13.5	46	40
1/31/2020	0.0	14.6	0.0	13.3	0.0	13.5	45	39
2/1/2020	0.1	14.7	0.1	13.4	-0.1	13.4	44	37
2/2/2020	0.0	14.7	0.0	13.4	0.0	13.4	43	36
2/3/2020	0.0	14.7	0.0	13.4	0.1	13.5	42	35
2/4/2020	0.2	14.9	0.2	13.6		13.5	41	34
2/5/2020	0.0	14.9	0.0	13.6	0.2	13.7	39	32
2/6/2020	0.0	14.9	0.0	13.6	0.0	13.7	37	30
2/7/2020	1.2	16.1	1.2	14.8	0.9	14.6	36	28

Date	Red Mountain Pass Daily Total Precipitation (in)	Red Mountain Pass Cumulative Precipitation (in)	Minnehaha Daily Total Precipitation (in)	Minnehaha Cumulative Precipitation (in)	Gladstone Daily Total Precipitation (in)	Gladstone Cumulative Precipitation (in)	Minnehaha Snow Depth (Inches)	Red Mountain Pass Snow Depth (Inches)
2/8/2020	0.7	16.8	0.7	15.5	0.3	14.9	34	27
2/9/2020	0.0	16.8	0.0	15.5	0.1	15.0	33	25
2/10/2020	0.1	16.9	0.1	15.6	0.1	15.2	31	23
2/11/2020	0.1	17.0	0.1	15.7	0.1	15.2	30	22
2/12/2020	0.1	17.1	0.1	15.8	0.1	15.3	29	21
2/13/2020	0.0	17.1	0.0	15.8	0.0	15.3	29	19
2/14/2020	0.0	17.1	0.0	15.8	0.0	15.3	27	18
2/15/2020	0.1	17.2	0.1	15.9	0.1	15.4	26	17
2/16/2020	0.0	17.2	0.0	15.9	0.0	15.4	24	14
2/17/2020	0.3	17.5	0.3	16.2	0.3	15.7	23	13
2/18/2020	0.0	17.5	0.0	16.2	0.0	15.7	21	10
2/19/2020	0.0	17.5	0.0	16.2	0.0	15.8	20	10
2/20/2020	0.0	17.5	0.0	16.2	-0.1	15.7	18	8
2/21/2020	0.0	17.5	0.0	16.2	0.1	15.8	15	5
2/22/2020	0.0	17.5	0.0	16.2	0.3	16.1	13	3
2/23/2020	0.3	17.8	0.2	16.3	0.1	16.1	11	1
2/24/2020	0.5	18.3	0.2	16.5	0.1	16.2	9	1
2/25/2020	0.0	18.3	0.1	16.6	0.2	16.4	6	0
2/26/2020	0.2	18.5	0.3	16.9	0.2	16.5	3	0
2/27/2020	0.1	18.6	0.0	16.9	0.0	16.5	4	3
2/28/2020	0.0	18.6	0.0	16.9	0.0	16.5	6	1
2/29/2020	0.0	18.6	0.0	16.9	0.1	16.6	1	
3/1/2020	0.0	18.6	0.0	16.9		16.6	0	
3/2/2020	0.3	18.9	0.2	17.1	0.2	16.8		
3/3/2020	0.0	18.9	0.0	17.1	-0.1	16.7		
3/4/2020	0.0	18.9	0.0	17.1	0.1	16.8		
3/5/2020	0.0	18.9	0.0	17.1	0.0	16.8		
3/6/2020	0.0	18.9	0.0	17.1	0.0	16.8		
3/7/2020	0.1	19.0	0.0	17.1	0.0	16.8		
3/8/2020	0.0	19.0	0.0	17.2	0.2	17.0		
3/9/2020	0.3	19.3	0.3	17.5	0.2	17.2		

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3/10/2020	0.1	19.4	0.2	17.7	0.1	17.4		
3/11/2020	0.0	19.4	0.1	17.7	0.2	17.5		
3/12/2020	0.2	19.6	0.1	17.8	0.0	17.5		
3/13/2020	0.1	19.7	0.0	17.8	0.0	17.5		
3/14/2020	0.7	20.4	0.6	18.4	0.6	18.1		
3/15/2020	0.1	20.5	0.0	18.5	0.1	18.2		
3/16/2020	0.0	20.5	0.0	18.5	0.0	18.2		
3/17/2020	0.0	20.5	0.0	18.5	0.0	18.2		
3/18/2020	0.0	20.5	0.0	18.5	0.0	18.2		
3/19/2020	0.5	21.0	0.2	18.7	0.6	18.8		
3/20/2020	0.7	21.7	0.5	19.2	0.0	18.8		
3/21/2020	0.3	22.0	0.1	19.2	0.3	19.1		
3/22/2020	0.3	22.3	0.3	19.5	0.6	19.7		
3/23/2020	0.2	22.5	0.1	19.6	0.1	19.8		
3/24/2020	0.3	22.8	0.4	20.1	0.4	20.3		
3/25/2020	0.0	22.8	0.0	20.1	0.0	20.3		
3/26/2020	0.0	22.8	0.0	20.1	0.0	20.3		
3/27/2020	0.0	22.8	0.0	20.1	0.0	20.3		
3/28/2020	0.1	22.9	0.2	20.2	0.2	20.5		
3/29/2020	0.2	23.1	0.3	20.5	0.1	20.7		
3/30/2020	0.3	23.4	0.0	20.5	0.3	20.9		
3/31/2020	0.3	23.7	0.2	20.8	0.0	21.0		
4/1/2020	0.0	23.7	0.0	20.8	0.0	21.0		
4/2/2020	0.0	23.7	0.0	20.8	0.1	21.0		
4/3/2020	0.1	23.8	0.3	21.0	0.0	21.0		
4/4/2020	0.1	23.9	0.0	21.0	0.2	21.3		
4/5/2020	0.1	24.0	0.2	21.3	0.0	21.3		
4/6/2020	0.1	24.1	0.0	21.3	0.0	21.2		
4/7/2020	0.0	24.1	0.0	21.3	0.0	21.2		
4/8/2020	0.0	24.1	0.0	21.3	0.0	21.3		
4/9/2020	0.1	24.2	0.0	21.3	0.0	21.3		

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4/10/2020	0.0	24.2	0.0	21.3	0.0	21.2		
4/11/2020	0.0	24.2	0.0	21.3	0.0	21.2		
4/12/2020	0.0	24.2	0.0	21.3	0.0	21.5		
4/13/2020	0.5	24.7	0.4	21.7	0.3	21.6		
4/14/2020	0.0	24.7	0.2	21.8	0.1	21.6		
4/15/2020	0.1	24.8	0.0	21.9	0.0	21.8		
4/16/2020	0.0	24.8	0.0	21.9	0.1	22.0		
4/17/2020	0.1	24.9	0.3	22.2	0.3	22.0		
4/18/2020	0.2	25.1	0.0	22.2	0.1	22.1		
4/19/2020	0.0	25.1	0.1	22.3	0.2	22.3		
4/20/2020	0.2	25.3	0.2	22.5	0.0	22.3		
4/21/2020	0.1	25.4	0.0	22.5	0.2	22.6		
4/22/2020	0.4	25.8	0.2	22.7	0.0	22.6		
4/23/2020	0.1	25.9	0.0	22.7	0.1	22.7		
4/24/2020	0.0	25.9	0.1	22.8	0.1	22.8		
4/25/2020	0.0	25.9	0.2	23.0	0.0	22.8		
4/26/2020	0.0	25.9	0.0	23.0	0.1	22.9		
4/27/2020	0.0	25.9	0.0	23.0	0.0	22.9		
4/28/2020	0.0	25.9	0.0	23.0	0.0	22.9		
4/29/2020	0.0	25.9	0.0	23.0	0.0	22.9		
4/30/2020	0.0	25.9	0.0	23.0	0.0	22.9		
5/1/2020	0.0	25.9	0.0	23.0	0.0	22.9		
5/2/2020	0.0	25.9	0.0	23.0	0.0	22.9		
5/3/2020	0.0	25.9	0.0	23.0	0.0	22.9		
5/4/2020	0.0	25.9	0.0	23.0	0.0	22.9		
5/5/2020	0.0	25.9	0.0	23.0	0.0	22.9		
5/6/2020	0.0	25.9	0.0	23.0	0.1	23.0		
5/7/2020	0.0	25.9	0.0	23.0	-0.1	22.9		
5/8/2020	0.0	25.9	0.0	23.0	0.0	22.9		
5/9/2020	0.0	25.9	0.0	23.0	0.0	22.9		
5/10/2020	0.0	25.9	0.0	23.0	0.1	23.0		

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5/11/2020	0.0	25.9	0.0	23.0	0.0	23.0		
5/12/2020	0.0	25.9	0.0	23.0	0.0	23.0		
5/13/2020	0.0	25.9	0.0	23.1	0.0	23.0		
5/14/2020	0.0	25.9	0.0	23.1	0.0	23.0		
5/15/2020	0.0	25.9	0.0	23.1	0.0	23.0		
5/16/2020	0.0	25.9	0.0	23.1	0.1	23.0		
5/17/2020	0.0	25.9	0.0	23.1	0.0	23.0		
5/18/2020	0.0	25.9	0.0	23.1	0.0	23.0		
5/19/2020	0.0	25.9	0.0	23.1	0.0	23.0		
5/20/2020	0.0	25.9	0.0	23.1		23.0		
5/21/2020	0.0	25.9	0.0	23.1	0.0	23.1		
5/22/2020	0.0	25.9	0.0	23.1	0.0	23.1		
5/23/2020	0.0	25.9	0.0	23.1	0.0	23.1		
5/24/2020	0.0	25.9	0.0	23.1	-0.1	23.0		
5/25/2020	0.0	25.9	0.0	23.1	0.0	23.1		
5/26/2020	0.1	26.0	0.0	23.1	0.1	23.1		
5/27/2020	0.0	26.0	0.0	23.1	0.0	23.1		
5/28/2020	0.1	26.1	0.0	23.1	0.1	23.2		
5/29/2020	0.0	26.1	0.0	23.1	0.0	23.2		
5/30/2020	0.1	26.2	0.0	23.1	0.1	23.3		
5/31/2020	0.1	26.3	0.1	23.1	0.1	23.3		
6/1/2020	0.0	26.3	0.3	23.5	0.0	23.3		
6/2/2020	0.1	26.4	0.0	23.5	0.1	23.4		
6/3/2020	0.0	26.4	0.0	23.5	0.0	23.4		
6/4/2020	0.0	26.4	0.0	23.5	0.0	23.4		
6/5/2020	0.0	26.4	0.0	23.5	0.3	23.6		
6/6/2020	0.1	26.5	0.3	23.8	0.1	23.7		
6/7/2020	0.6	27.1	0.9	24.7	1.1	24.7		
6/8/2020	0.0	27.1	0.0	24.7	0.1	24.8		
6/9/2020	0.2	27.3	0.2	25.0	0.2	25.0		
6/10/2020	0.5	27.8	0.2	25.2	0.4	25.4		

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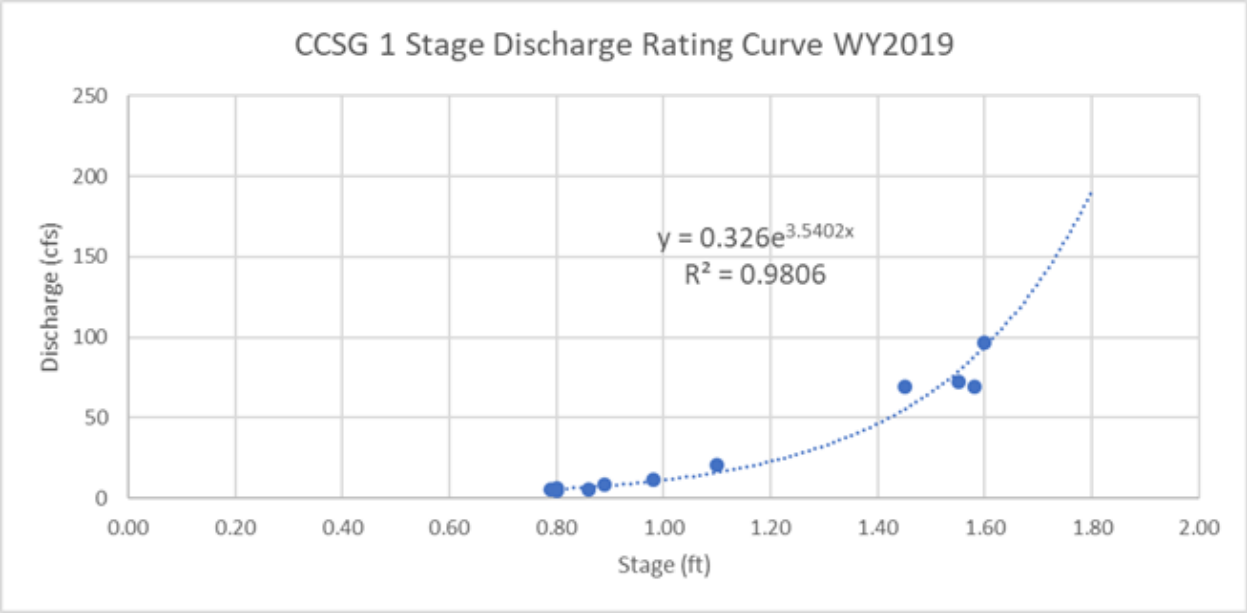
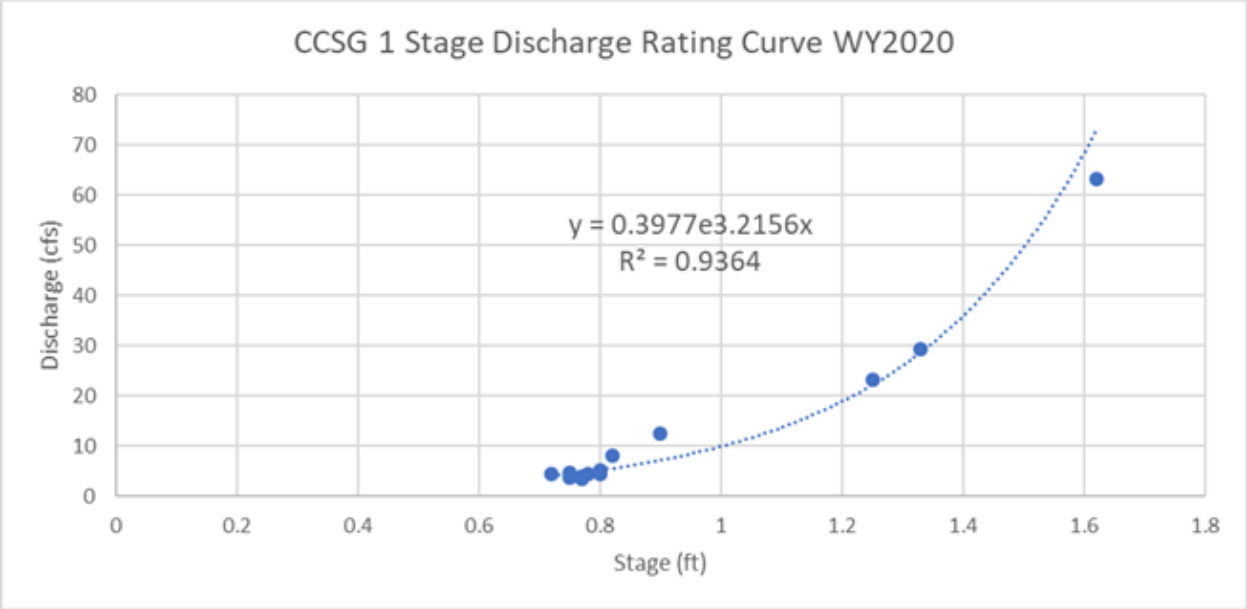
6/11/2020	0.3	28.1	0.0	25.2	0.0	25.4		
6/12/2020	0.1	28.2	0.0	25.2	0.0	25.4		
6/13/2020	0.1	28.3	0.0	25.2	0.0	25.4		
6/14/2020	0.0	28.3	0.3	25.5	0.3	25.7		
6/15/2020	0.0	28.3	0.0	25.5	0.0	25.8		
6/16/2020	0.1	28.4	0.0	25.5	0.0	25.8		
6/17/2020	0.0	28.4	0.0	25.5	0.0	25.8		
6/18/2020	0.0	28.4	0.0	25.5	0.0	25.7		
6/19/2020	0.0	28.4	0.0	25.5	0.0	25.7		
6/20/2020	0.0	28.4	0.0	25.5	0.1	25.8		
6/21/2020	0.0	28.4	0.0	25.5	0.0	25.8		
6/22/2020	0.0	28.4	0.0	25.5	0.0	25.8		
6/23/2020	0.0	28.4	0.0	25.5	0.0	25.8		
6/24/2020	0.0	28.4	0.0	25.5	0.0	25.8		
6/25/2020	0.0	28.4	0.0	25.5	0.0	25.8		
6/26/2020	0.0	28.4	0.0	25.5	0.0	25.8		
6/27/2020	0.0	28.4	0.0	25.5	0.0	25.7		
6/28/2020	0.0	28.4	0.0	25.5	0.0	25.7		
6/29/2020	0.0	28.4	0.0	25.5	0.0	25.7		
6/30/2020	0.0	28.4	0.0	25.5	0.0	25.7		
7/1/2020	0.0	28.4	0.0	25.5	0.1	25.8		
7/2/2020	0.0	28.4	0.0	25.5	0.0	25.8		
7/3/2020	0.0	28.4	0.0	25.5	0.0	25.8		
7/4/2020	0.0	28.4	0.0	25.5	0.1	25.9		
7/5/2020	0.0	28.4	0.4	25.9	0.1	26.0		
7/6/2020	0.0	28.4	0.0	25.9	0.0	26.1		
7/7/2020	0.0	28.4	0.0	25.9	0.0	26.0		
7/8/2020	0.0	28.4	0.0	25.9	0.0	26.1		
7/9/2020	0.1	28.5	0.0	25.9	0.0	26.1		
7/10/2020	0.0	28.5	0.0	25.9	0.0	26.1		
7/11/2020	0.0	28.5	0.0	25.9	0.0	26.1		

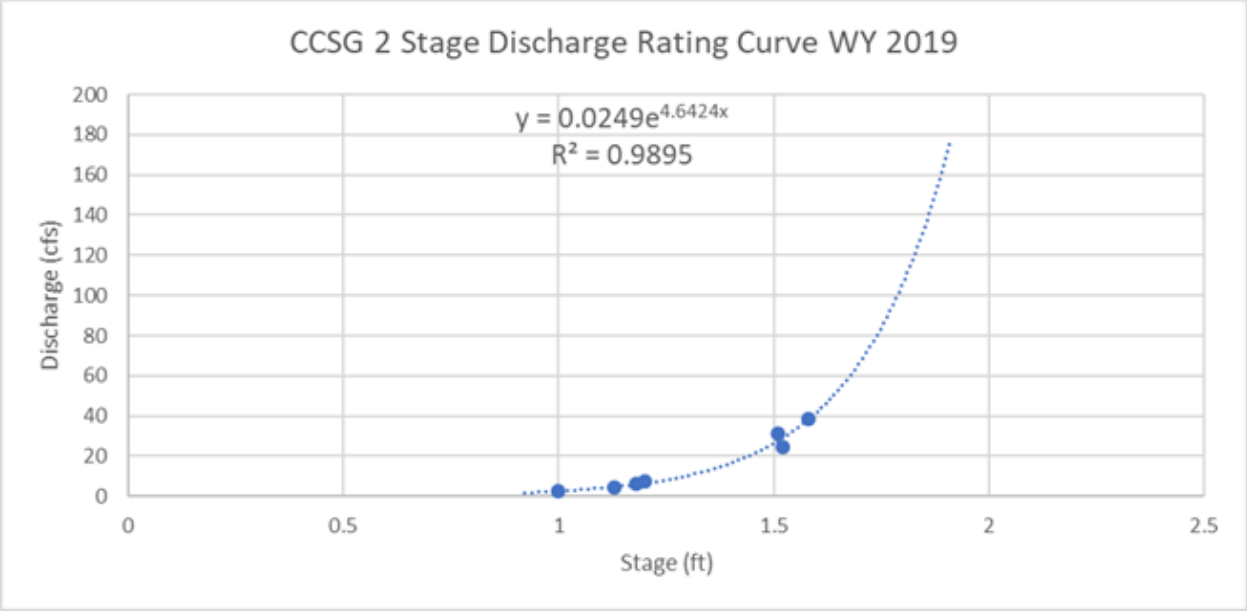
Date	Red Mountain Pass Daily Total Precipitation (in)	Red Mountain Pass Cumulative Precipitation (in)	Minnehaha Daily Total Precipitation (in)	Minnehaha Cumulative Precipitation (in)	Gladstone Daily Total Precipitation (in)	Gladstone Cumulative Precipitation (in)	Minnehaha Snow Depth (Inches)	Red Mountain Pass Snow Depth (Inches)
7/12/2020	0.0	28.5	0.0	25.9	0.0	26.1		
7/13/2020	0.0	28.5	0.0	26.0	0.0	26.2		
7/14/2020	0.0	28.5	0.0	26.0	0.1	26.2		
7/15/2020	0.0	28.5	0.0	26.0	0.1	26.3		
7/16/2020	0.0	28.5	0.1	26.1	0.1	26.4		
7/17/2020	0.0	28.5	0.1	26.2	0.0	26.4		
7/18/2020	0.0	28.5	0.2	26.4	0.0	26.4		
7/19/2020	0.0	28.5	0.0	26.4	0.0	26.4		
7/20/2020	0.0	28.5	0.0	26.4	0.0	26.4		
7/21/2020	0.1	28.6	0.0	26.4	0.0	26.4		
7/22/2020	0.1	28.7	0.0	26.4	0.0	26.4		
7/23/2020	0.1	28.8	0.1	26.5	0.1	26.5		
7/24/2020	0.5	29.3	0.7	27.2	1.5	28.0		
7/25/2020	0.7	30.0	0.5	27.7	0.7	28.7		
7/26/2020	1.0	31.0	0.8	28.5	0.1	28.7		
7/27/2020	0.0	31.0	0.1	28.6	0.0	28.7		
7/28/2020	0.2	31.2	0.3	28.9	0.1	28.8		
7/29/2020	0.0	31.2	0.1	29.0	0.0	28.8		
7/30/2020	0.0	31.2	0.0	29.0	0.0	28.8		
7/31/2020	0.0	31.2	0.0	29.0	0.0	28.9		
8/1/2020	0.0	31.2	0.0	29.0	0.0	28.9		
8/2/2020	0.0	31.2	0.0	29.0	0.0	28.9		
8/3/2020	0.0	31.2	0.0	29.0	0.0	28.9		
8/4/2020	0.0	31.2	0.0	29.0	0.0	28.9		
8/5/2020	0.0	31.2	0.0	29.0	0.0	28.9		
8/6/2020	0.0	31.2	0.0	29.0	0.0	28.9		
8/7/2020	0.0	31.2	0.0	29.0	0.0	28.9		
8/8/2020	0.0	31.2	0.0	29.0	0.0	28.9		
8/9/2020	0.0	31.2	0.0	29.0	0.0	28.9		
8/10/2020	0.0	31.2	0.0	29.0	0.0	28.9		
8/11/2020	0.0	31.2	0.0	29.0	0.0	28.9		

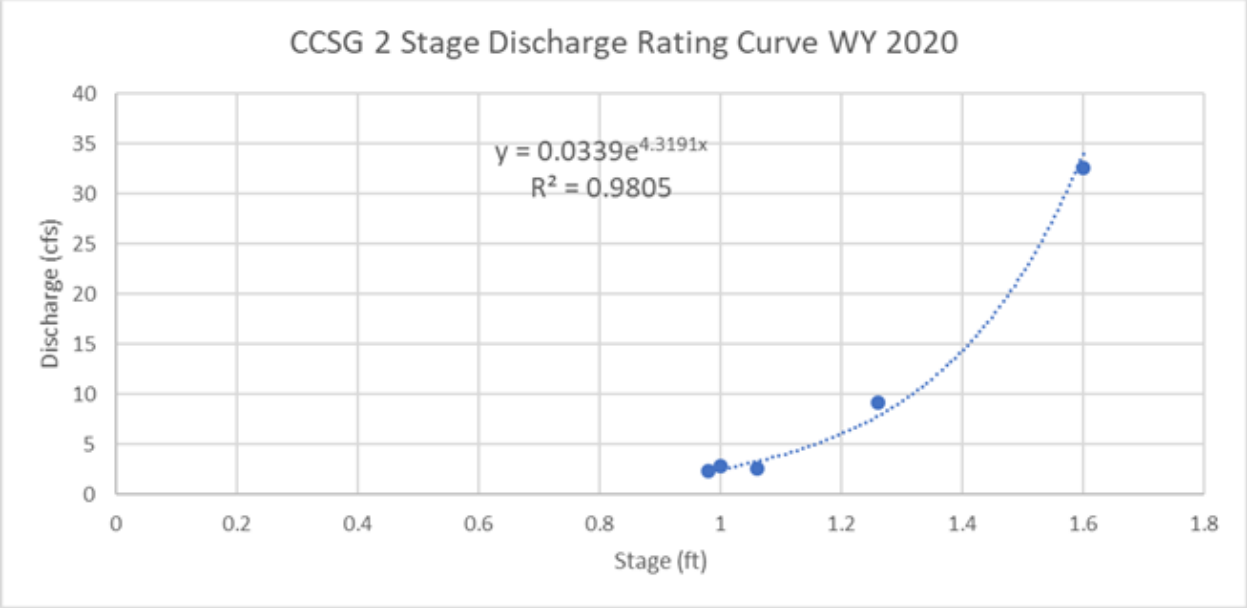
Date	Red Mountain Pass Daily Total Precipitation (in)	Red Mountain Pass Cumulative Precipitation (in)	Minnehaha Daily Total Precipitation (in)	Minnehaha Cumulative Precipitation (in)	Gladstone Daily Total Precipitation (in)	Gladstone Cumulative Precipitation (in)	Minnehaha Snow Depth (Inches)	Red Mountain Pass Snow Depth (Inches)
8/12/2020	0.0	31.2	0.0	29.0	0.0	28.9		
8/13/2020	0.0	31.2	0.0	29.0	0.0	28.9		
8/14/2020	0.0	31.2	0.0	29.0	0.0	28.9		
8/15/2020	0.0	31.2	0.0	29.0	0.0	28.9		
8/16/2020	0.0	31.2	0.0	29.0	0.0	28.9		
8/17/2020	0.0	31.2	0.0	29.0	0.0	28.9		
8/18/2020	0.0	31.2	0.0	29.0	0.1	29.0		
8/19/2020	0.0	31.2	0.0	29.0	0.0	28.9		
8/20/2020	0.0	31.2	0.0	29.0	0.0	28.9		
8/21/2020	0.0	31.2	0.0	29.0	0.0	28.9		
8/22/2020	0.0	31.2	0.0	29.0	0.0	28.9		
8/23/2020	0.0	31.2	0.0	29.0	0.0	28.9		
8/24/2020	0.0	31.2	0.0	29.0	0.0	29.0		
8/25/2020	0.0	31.2	0.1	29.1	0.0	29.0		
8/26/2020	0.0	31.2	0.1	29.2	0.0	29.0		
8/27/2020	0.0	31.2	0.1	29.3	0.0	29.0		
8/28/2020	0.2	31.4	0.0	29.3	0.0	29.0		
8/29/2020	0.1	31.5	0.2	29.5	0.2	29.2		
8/30/2020	0.0	31.5	0.2	29.6	0.2	29.3		
8/31/2020	0.0	31.5	0.1	29.8	0.1	29.5		
9/1/2020	0.1	31.6	0.0	29.8	0.0	29.5		
9/2/2020	0.0	31.6	0.3	30.0	0.3	29.7		
9/3/2020	0.2	31.8	0.0	30.0	0.0	29.8		
9/4/2020	0.0	31.8	0.0	30.0	0.0	29.8		
9/5/2020	0.0	31.8	0.0	30.0	0.0	29.8		
9/6/2020	0.0	31.8	0.0	30.0	0.0	29.8		
9/7/2020	0.0	31.8	0.0	30.0	0.0	29.7		
9/8/2020	0.0	31.8	0.0	30.0	0.0	29.7		
9/9/2020	0.1	31.9	0.6	30.6	0.5	30.3		
9/10/2020	0.1	32.0	0.0	30.6	0.0	30.3		
9/11/2020	0.3	32.3	0.4	31.0	0.3	30.6		

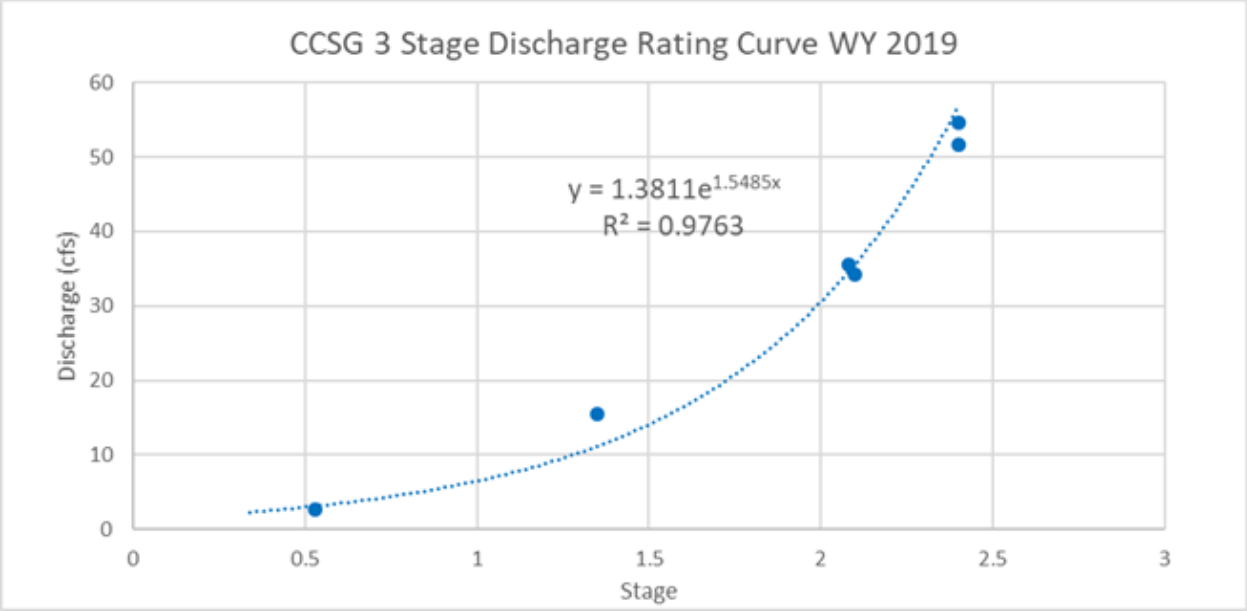
Date	Red Mountain Pass Daily Total Precipitation (in)	Red Mountain Pass Cumulative Precipitation (in)	Minnehaha Daily Total Precipitation (in)	Minnehaha Cumulative Precipitation (in)	Gladstone Daily Total Precipitation (in)	Gladstone Cumulative Precipitation (in)	Minnehaha Snow Depth (Inches)	Red Mountain Pass Snow Depth (Inches)
9/12/2020	-0.1	32.2	0.0	31.0	0.0	30.6		
9/13/2020	0.3	32.5	0.0	31.0	0.0	30.7		
9/14/2020	0.1	32.6	0.0	31.0	0.0	30.7		
9/15/2020	-0.1	32.5	0.0	31.0	0.0	30.7		
9/16/2020	0.0	32.5	0.0	31.0	0.0	30.7		
9/17/2020	0.1	32.6	0.0	31.0	0.0	30.7		
9/18/2020	-0.1	32.5	0.0	31.0	0.0	30.7		
9/19/2020	0.0	32.5	0.0	31.0	0.0	30.7		
9/20/2020	0.2	32.7	0.0	31.0	0.0	30.7		
9/21/2020	-0.2	32.5	0.0	31.0	0.0	30.7		
9/22/2020	0.1	32.6	0.0	31.0	0.1	30.8		
9/23/2020	-0.1	32.5	0.0	31.0	0.0	30.8		
9/24/2020	0.0	32.5	0.0	31.0	0.0	30.8		
9/25/2020	0.1	32.6	0.0	31.0	0.0	30.8		
9/26/2020	-0.1	32.5	0.0	31.0	0.0	30.8		
9/27/2020	0.2	32.7	0.0	31.0	0.0	30.8		
9/28/2020	-0.3	32.4	0.0	31.0	-0.1	30.7		
9/29/2020	-0.2	32.2	0.0	31.0	0.1	30.8		
9/30/2020	0.1	32.3	0.0	31.0	0.0	30.8		

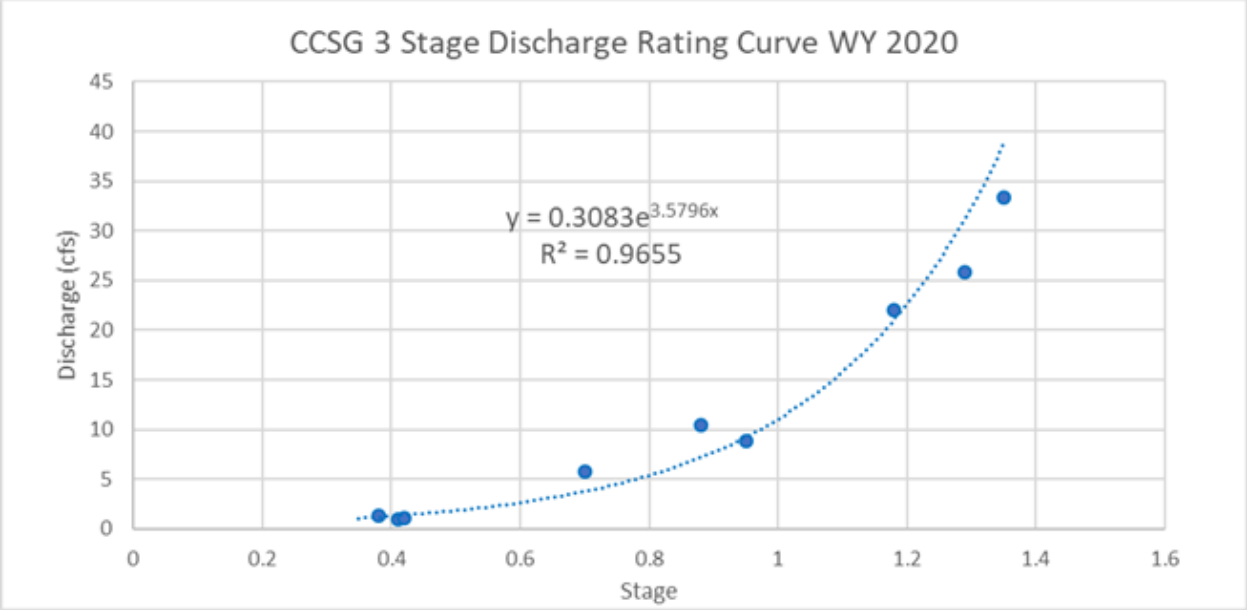

CCSG 1 Stage Discharge Rating Curve WY2019
Discharge (cfs)
Stage (ft)
y = 0.326e3.5402x
R² = 0.9806
0
50
100
150
200
250
0.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40
1.60
1.80
2.00

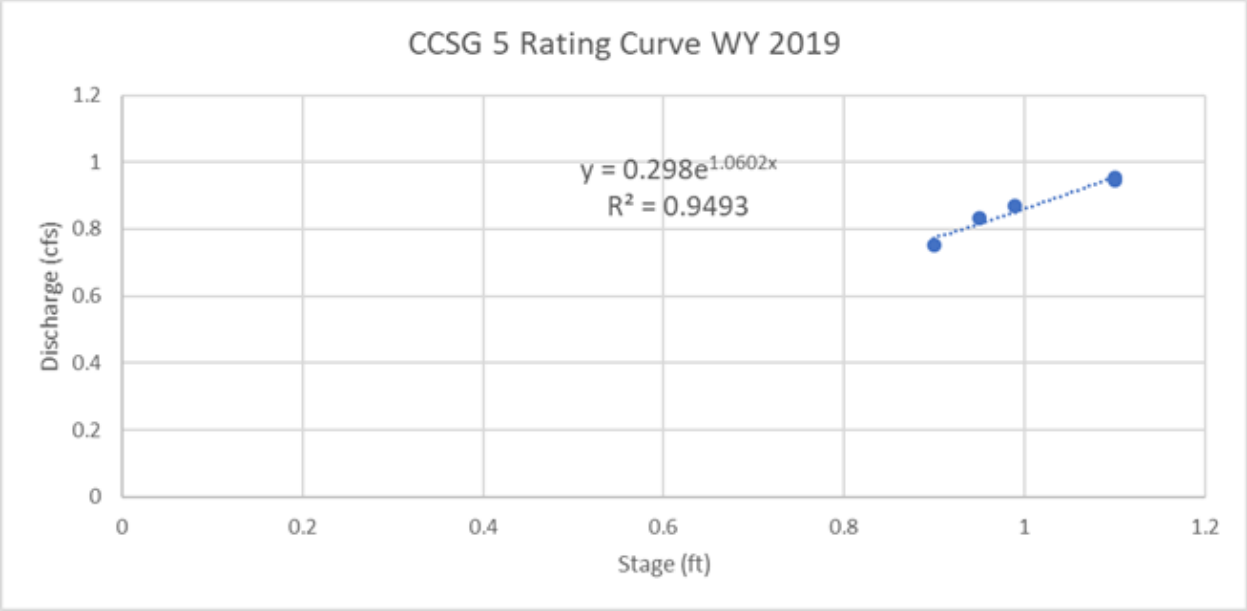

CCSG 1 Stage Discharge Rating Curve WY2020
Discharge (cfs)
Stage (ft)
y = 0.3977e3.2156x
R² = 0.9364
0
10
20
30
40
50
60
70
80
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8

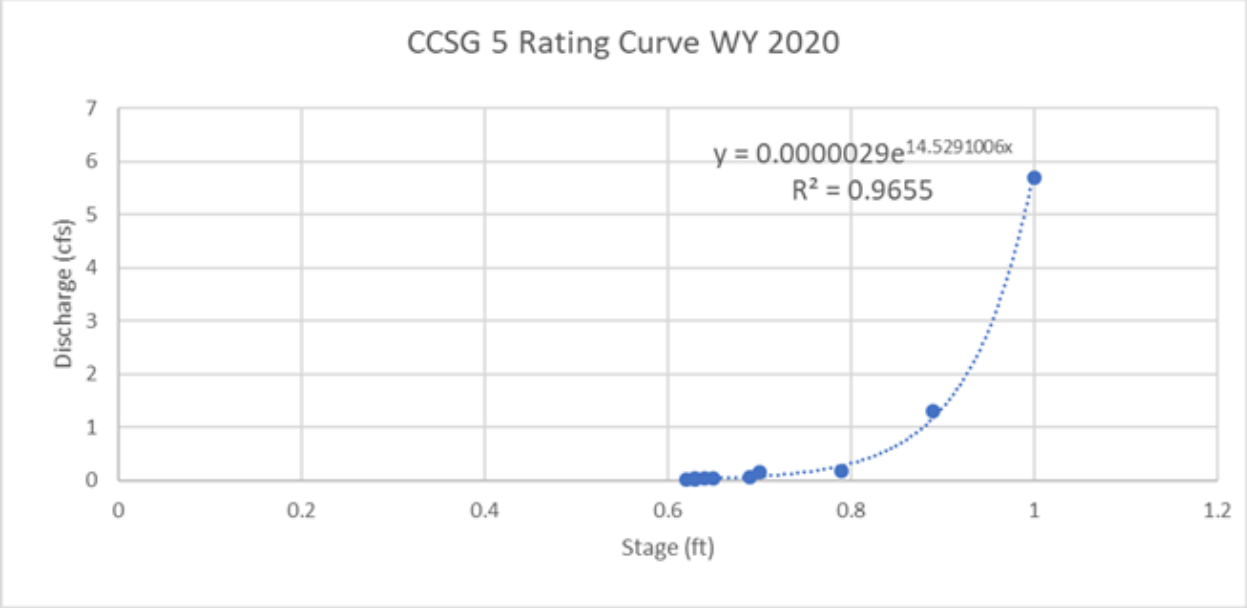

CCSG 2 Stage Discharge Rating Curve WY 2019
y = 0.0249e4.6424x
R² = 0.9895
Discharge (cfs)
Stage (ft)
0
20
40
60
80
100
120
140
160
180
200
0
0.5
1
1.5
2
2.5

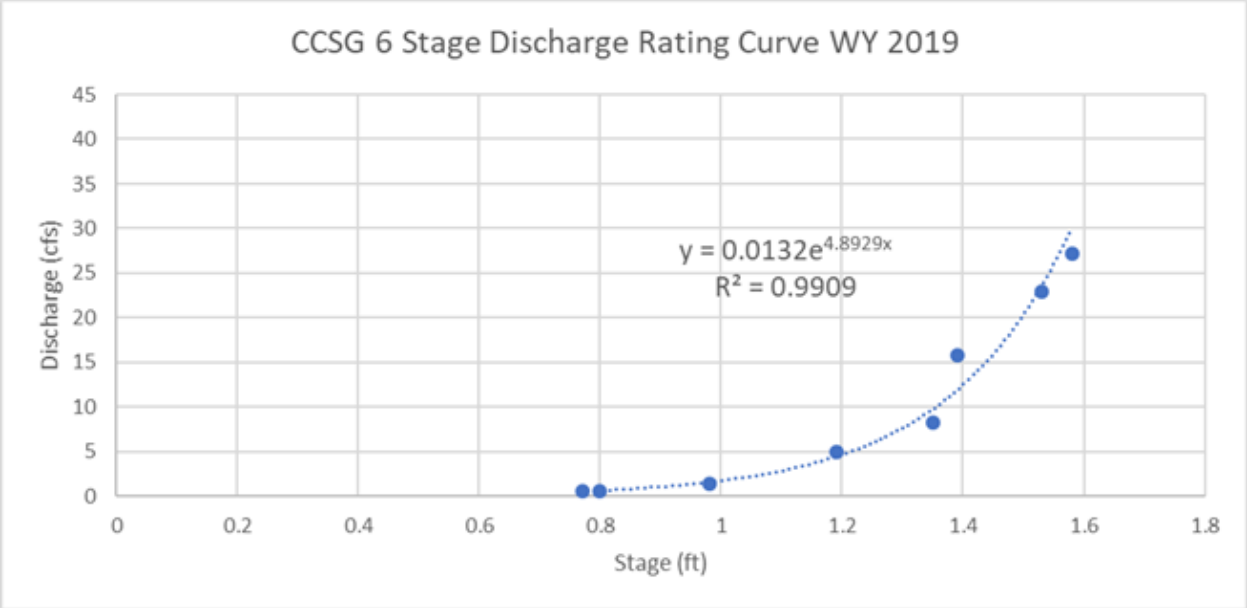

CCSG 2 Stage Discharge Rating Curve WY 2020
y = 0.0339e4.3191x
R² = 0.9805
Discharge (cfs)
Stage (ft)
0
5
10
15
20
25
30
35
40
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8

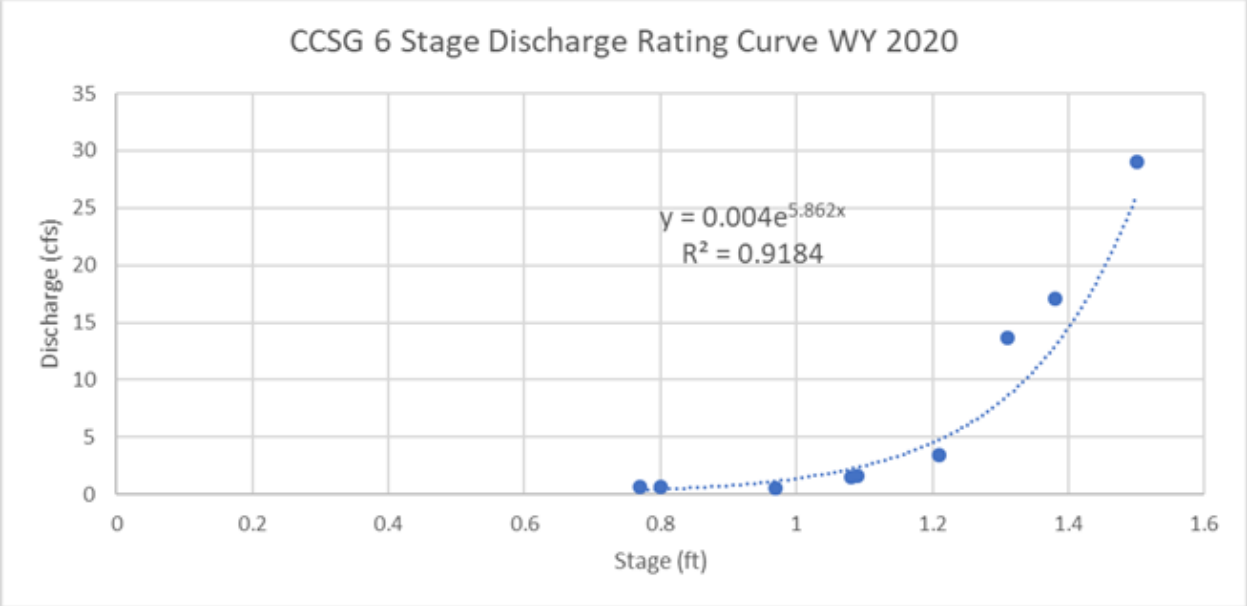

CCSG 3 Stage Discharge Rating Curve WY 2019
y = 1.3811e1.5485x
R² = 0.9763
Discharge (cfs)
Stage
0
10
20
30
40
50
60
0
0.5
1
1.5
2
2.5
3

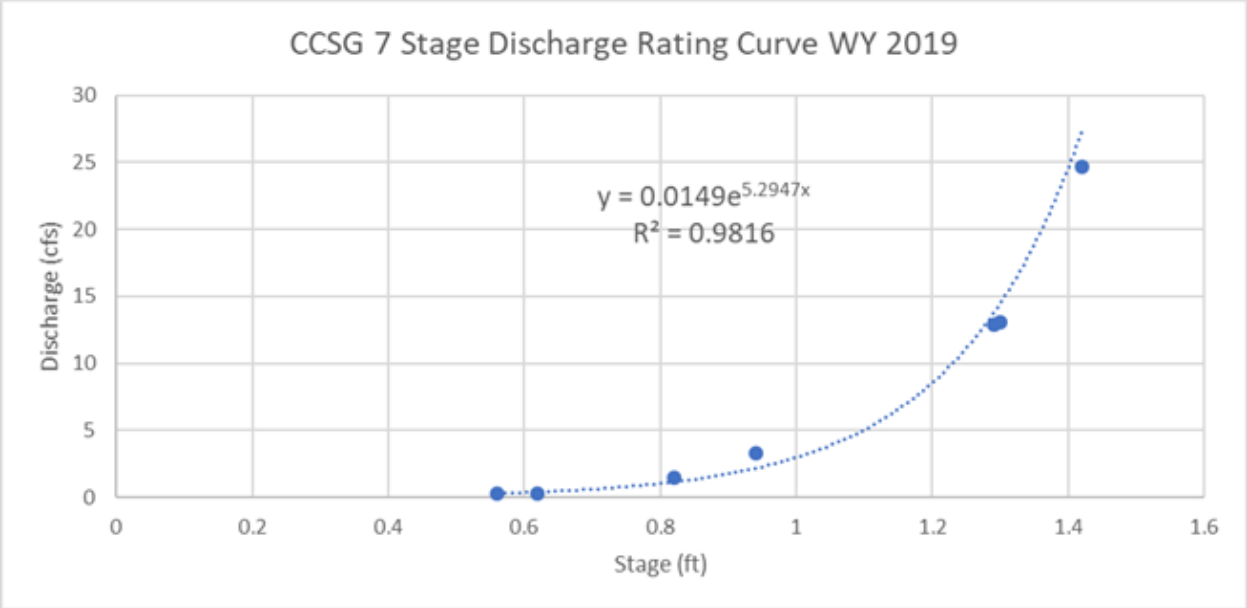

CCSG 3 Stage Discharge Rating Curve WY 2020
y = 0.3083e3.5796x
R² = 0.9655
Discharge (cfs)
Stage
0
5
10
15
20
25
30
35
40
45
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6

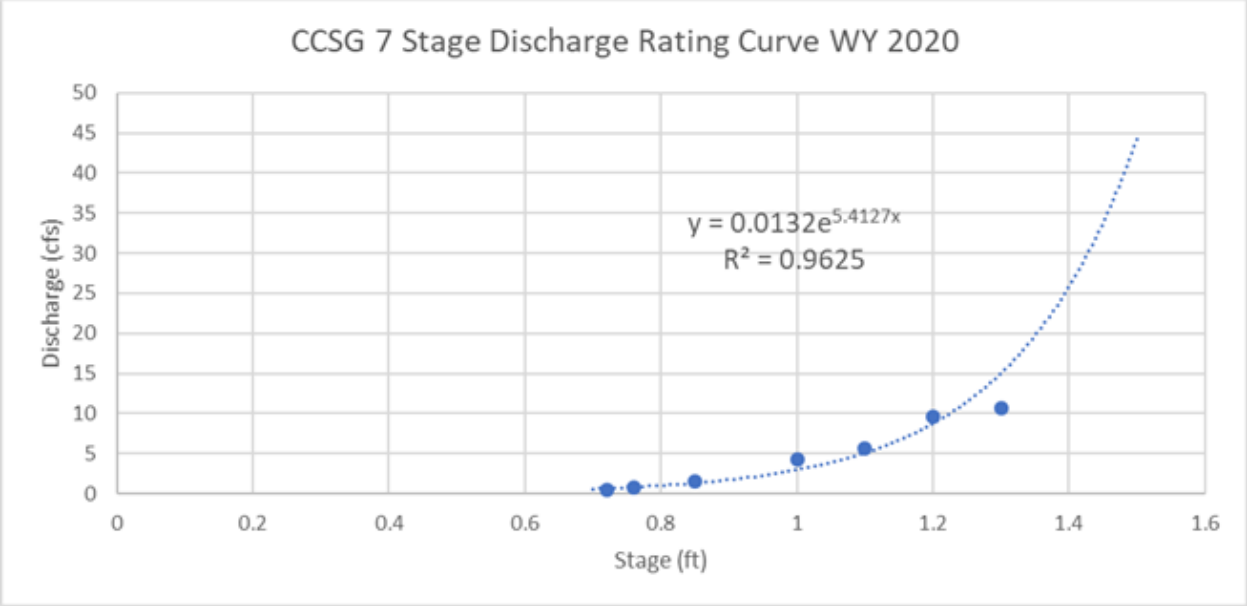

CCSG 5 Rating Curve WY 2019
y = 0.298e1.0602x
R² = 0.9493
Discharge (cfs)
Stage (ft)
0
0.2
0.4
0.6
0.8
1
1.2

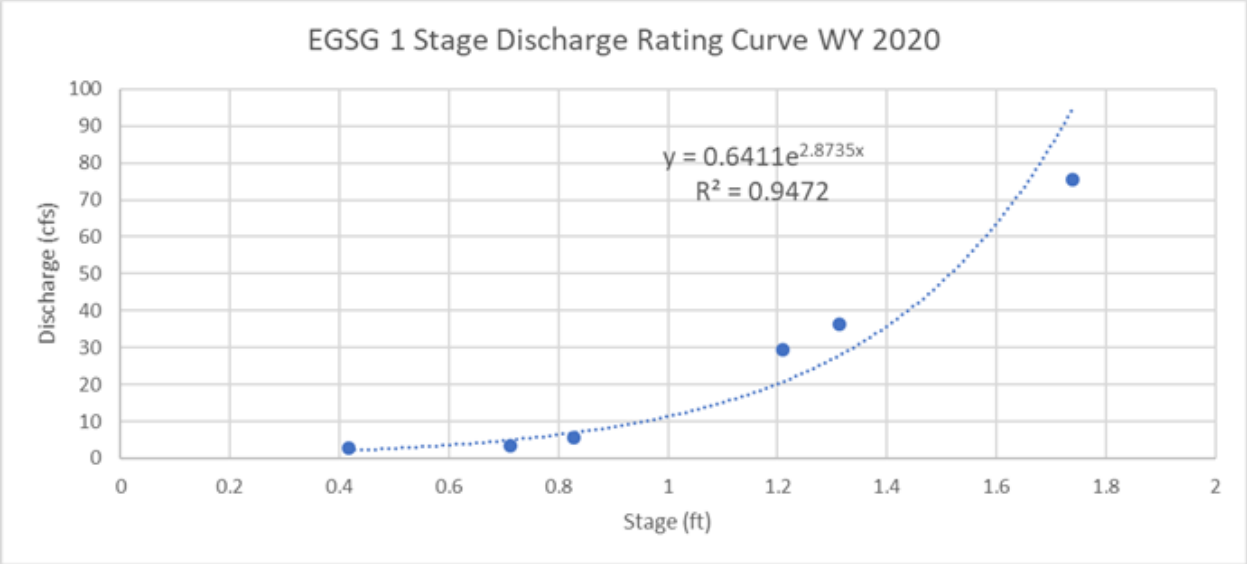

CCSG 5 Rating Curve WY 2020
y = 0.0000029e14.5291006x
R² = 0.9655
Discharge (cfs)
Stage (ft)
0
1
2
3
4
5
6
7
0.2
0.4
0.6
0.8
1
1.2

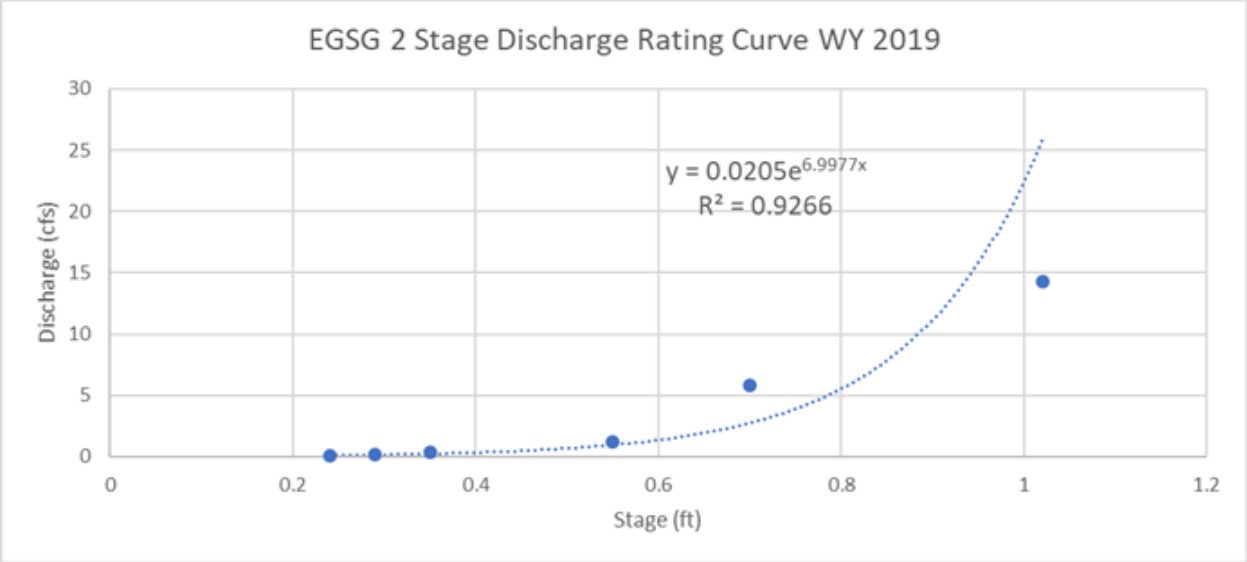

CCSG 6 Stage Discharge Rating Curve WY 2019
Discharge (cfs)
Stage (ft)
y = 0.0132e4.8929x
R² = 0.9909
0
5
10
15
20
25
30
35
40
45
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8

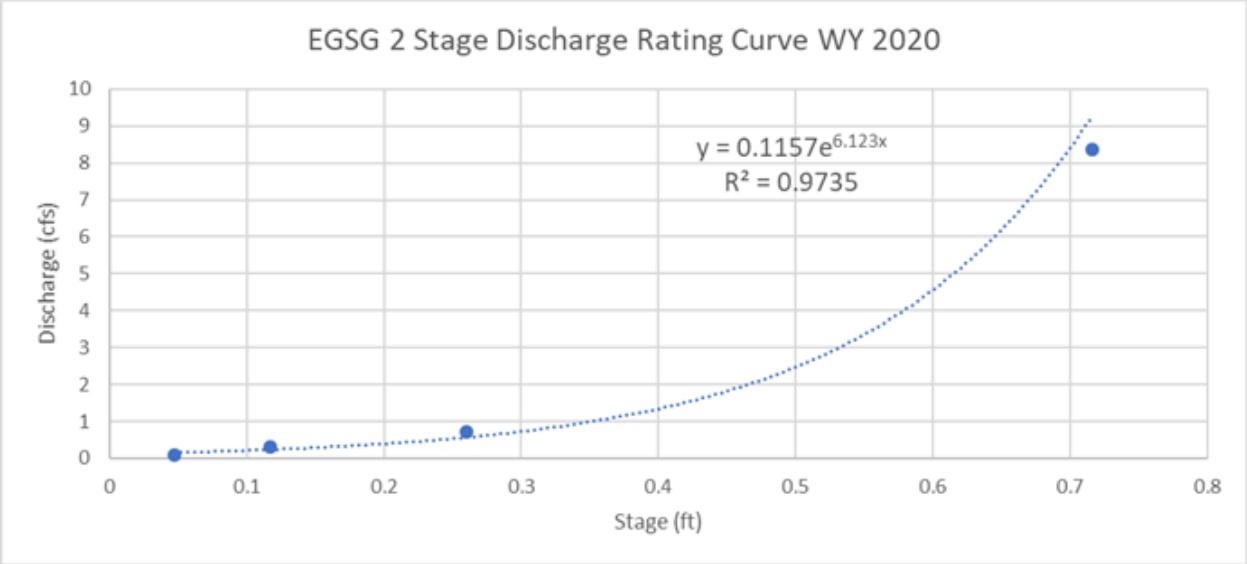

CCSG 6 Stage Discharge Rating Curve WY 2020
Discharge (cfs)
Stage (ft)
y = 0.004e5.862x
R² = 0.9184
0
5
10
15
20
25
30
35
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6


CCSG 7 Stage Discharge Rating Curve WY 2019
y = 0.0149e5.2947x
R² = 0.9816
Discharge (cfs)
Stage (ft)
0
5
10
15
20
25
30
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6


CCSG 7 Stage Discharge Rating Curve WY 2020
y = 0.0132e5.4127x
R² = 0.9625
Discharge (cfs)
Stage (ft)
0
5
10
15
20
25
30
35
40
45
50
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6


EGSG 1 Stage Discharge Rating Curve WY 2020
y = 0.6411e2.8735x
R² = 0.9472
Discharge (cfs)
Stage (ft)
0
10
20
30
40
50
60
70
80
90
100
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2


EGSG 2 Stage Discharge Rating Curve WY 2019
y = 0.0205e6.9977x
R² = 0.9266
Discharge (cfs)
Stage (ft)
0
5
10
15
20
25
30
0
0.2
0.4
0.6
0.8
1
1.2


EGSG 2 Stage Discharge Rating Curve WY 2020
y = 0.1157e^6.123x
R² = 0.9735
Discharge (cfs)
Stage (ft)
0
1
2
3
4
5
6
7
8
9
10
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8

Date	CC_48 Daily Mean Discharge (cfs)	CCSG_1 Daily Mean Discharge Discharge (cfs)	CCSG_2 Daily Mean Discharge (cfs)	CCSG_3 Daily Mean Discharge (cfs)	CCSG_5 Daily Mean Discharge (cfs)	CCSG_6 Daily Mean Discharge (cfs)	CCSG_7 Daily Mean Discharge (cfs)	A68 Daily Mean Discharge Discharge (cfs)	EGSG 1 Daily Mean Discharge (cfs)	EGSG 2 Daily Mean Discharge (cfs)
10/01/18	13.70	6.61	3.76	2.50		2.60	0.30			
10/02/18	16.30	6.61	3.76	2.50		2.68	0.31			
10/03/18	15.40	6.61	3.76	2.51		2.75	0.33			
10/04/18	16.50	6.61	3.76	2.52		2.83	0.34			
10/05/18	14.70	6.61	3.76	2.52		2.91	0.36			
10/06/18	14.30	6.61	3.76	2.53		2.99	0.37			
10/07/18	15.90	6.61	3.76	2.53		3.08	0.39			
10/08/18	15.90	6.61	3.76	2.54		3.17	0.40			
10/09/18	15.20	6.61	3.69	2.54		3.21	0.41			
10/10/18	15.60	6.61	3.62	2.54		3.26	0.43			
10/11/18	15.80	6.61	3.56	2.53		3.30	0.44			
10/12/18	17.40	6.61	3.49	2.53		3.35	0.46			
10/13/18	17.60	6.61	3.43	2.53		3.39	0.47			
10/14/18	16.00	6.61	3.36	2.52		3.44	0.49			
10/15/18	14.40	6.61	3.30	2.52		3.49	0.50			
10/16/18	14.60	6.79	3.28	2.51		3.47	0.49			
10/17/18	14.80	6.97	3.26	2.50		3.44	0.47			
10/18/18	15.20	7.15	3.24	2.54		3.42	0.46			
10/19/18	14.70	7.33	3.22	2.58		3.40	0.44			
10/20/18	14.70	7.51	3.20	2.62		3.37	0.43			
10/21/18	14.90	7.69	3.18	2.66		3.35	0.41			
10/22/18	15.40	7.89	3.16	2.70		3.32	0.40			
10/23/18	17.40	7.79	2.88	2.74		3.28	0.40			
10/24/18	17.50	7.69	2.60	2.75		3.23	0.40			
10/25/18	16.50	7.59	2.60	2.73		3.19	0.40			
10/26/18	15.80	7.49	2.60	2.71		3.14	0.40			
10/27/18	15.40	7.39	2.60	2.69		3.10	0.40			
10/28/18	15.30	7.29	4.10	2.67		3.01	0.40			
10/29/18	15.30	7.09	2.60	2.67		2.95	0.40			
10/30/18	15.40	7.04	2.60	2.66		2.89	0.40			

10/31/18	14.70	6.99	2.60	2.65		2.83	0.40			
11/01/18	14.20	6.94	2.60	2.64		2.77	0.40			
11/02/18	14.40	6.89	2.60	2.63		2.71	0.40			
11/03/18	15.20	6.84	3.10	2.62		2.65	0.40			
11/04/18	14.90	6.79	3.60	2.61		2.59	0.40			
11/05/18	15.00	6.74	4.10	2.62		2.53	0.40			
11/06/18	14.60	6.69	2.60	2.64		2.47	0.39			
11/07/18	14.30	6.64	2.59	2.66		2.41	0.38			
11/08/18	14.20	6.59	2.57	2.67		2.35	0.36			
11/09/18	13.10	6.54	2.56	2.66		2.29	0.35			
11/10/18	13.30	6.49	2.54	2.65		2.23	0.34			
11/11/18	13.90	6.44	2.53	2.64		2.17	0.33			
11/12/18	13.50	6.39	2.51	2.63		2.11	0.32			
11/13/18	12.90	6.34	2.50	2.62		2.05	0.31			
11/14/18	13.20	6.29	2.48	2.61		1.99	0.29			
11/15/18	13.30	6.24	2.47	2.60		1.93	0.28			
11/16/18	13.30	6.19	2.45	2.59		1.87	0.27			
11/17/18	13.30	6.14	2.44	2.58		1.81	0.26			
11/18/18	13.40	6.09	2.42	2.57		1.75	0.25			
11/19/18	12.60	6.04	2.41	2.56		1.69	0.24			
11/20/18	13.00	5.99	2.39	2.55		1.63	0.22			
11/21/18	12.70	5.94	2.38	2.54		1.57	0.21			
11/22/18	13.30	5.89	2.36	2.53		1.51	0.20			
11/23/18	13.00	5.84	2.35	2.52		1.45	0.20			
11/24/18	13.40	5.79	2.33	2.51		1.39	0.20			
11/25/18	12.80	5.74	2.32	2.50		1.33	0.20			
11/26/18	12.80	5.69	2.30	2.49		1.27	0.20			
11/27/18	13.00	5.64	2.29	2.48		1.21	0.20			
11/28/18	13.20	5.59	2.27	2.47		1.15	0.20			
11/29/18	13.30	5.54	2.26	2.46		1.09	0.20			
11/30/18	13.30	5.54	2.24	2.45		1.03	0.20			
12/01/18	13.10	5.54	2.23	2.44		0.97	0.20			
12/02/18	12.90	5.54	2.21	2.43		0.91	0.20			
12/03/18	12.80	5.54	2.20	2.42		0.85	0.20			

12/04/18	12.70	5.54	2.18	2.41		0.79	0.20			
12/05/18	12.70	5.54	2.17	2.40		0.73	0.20			
12/06/18	12.60	5.54	2.15	2.39		0.67	0.20			
12/07/18	12.50	5.54	2.14	2.50		0.61	0.20			
12/08/18	12.50	5.54	2.12	2.49		0.55	0.20			
12/09/18	12.40	5.54	2.11	2.48		0.49	0.20			
12/10/18	12.40	5.54	2.09	2.47		0.43	0.20			
12/11/18	12.30	5.54	2.08	2.46		0.37	0.20			
12/12/18	12.30	5.54	2.06	2.45		0.31	0.20			
12/13/18	12.30	5.54	2.05	2.44		0.31	0.20			
12/14/18	12.30	5.54	2.03	2.43		0.31	0.20			
12/15/18	12.30	5.54	2.02	2.42		0.29	0.20			
12/16/18	12.30	5.54	2.00	2.42		0.34	0.20			
12/17/18	12.30	5.54	2.00	2.42		0.41	0.20			
12/18/18	12.20	5.54	2.09	2.42		0.48	0.20			
12/19/18	12.10	5.54	2.17	2.42		0.57	0.20			
12/20/18	12.10	5.54	2.26	2.42		0.68	0.20			
12/21/18	12.10	5.54	2.34	2.42		0.80	0.20			
12/22/18	12.00	5.54	2.43	2.42		0.95	0.20			
12/23/18	12.00	5.54	2.51	2.42		1.13	0.20			
12/24/18	12.00	5.54	2.60	2.42		1.33	0.20			
12/25/18	11.90	5.54	2.58	2.42		1.58	0.20			
12/26/18	11.90	5.54	2.56	2.42		1.87	0.20			
12/27/18	11.90	5.54	2.55	2.42		1.88	0.20			
12/28/18	11.80	5.54	2.53	2.42		1.59	0.20			
12/29/18	11.80	5.54	2.51	2.42		1.35	0.20			
12/30/18	11.80	5.54	2.49	2.42		1.14	0.20			
12/31/18	11.80	5.54	2.48	2.42		0.97	0.20			
01/01/19	11.80	5.54	2.46	2.42		0.82	0.20			
01/02/19	11.70	5.54	2.44	2.42		0.69	0.20			
01/03/19	11.60	5.54	2.42	2.42		0.58	0.20			
01/04/19	11.60	5.54	2.40	2.42		0.38	0.20			
01/05/19	11.50	5.54	2.39	2.42		0.24	0.20			
01/06/19	11.50	5.54	2.37	2.42		0.24	0.20			

01/07/19	11.40	5.54	2.35	2.42		0.24	0.20			
01/08/19	11.30	5.54	2.33	2.43		0.24	0.20			
01/09/19	11.30	5.54	2.32	2.43		0.24	0.20			
01/10/19	11.20	5.54	2.30	2.44		0.24	0.20			
01/11/19	11.20	5.54	2.28	2.44		0.24	0.20			
01/12/19	11.20	5.54	2.26	2.44		0.24	0.20			
01/13/19	11.20	5.54	2.24	2.45		0.24	0.20			
01/14/19	11.30	5.54	2.23	2.45		0.24	0.20			
01/15/19	11.30	5.54	2.21	2.46		0.24	0.20			
01/16/19	11.30	5.54	2.19	2.45		0.24	0.20			
01/17/19	11.40	5.54	2.17	2.45		0.24	0.20			
01/18/19	11.40	5.53	2.16	2.45		0.24	0.20			
01/19/19	11.40	5.52	2.14	2.44		0.24	0.20			
01/20/19	11.30	5.51	2.12	2.44		0.24	0.20			
01/21/19	11.30	5.50	2.10	2.44		0.24	0.20			
01/22/19	11.20	5.49	2.08	2.43		0.24	0.20			
01/23/19	11.20	5.48	2.07	2.43		0.24	0.20			
01/24/19	11.20	5.47	2.05	2.43		0.24	0.20			
01/25/19	11.20	5.46	2.03	2.42		0.24	0.20			
01/26/19	11.20	5.45	2.01	2.42		0.24	0.20			
01/27/19	11.10	5.45	2.00	2.42		0.24	0.20			
01/28/19	11.10	5.44	1.98	2.41		0.24	0.20			
01/29/19	11.00	5.43	1.96	2.41		0.24	0.20			
01/30/19	11.00	5.42	1.95	2.41		0.24	0.20			
01/31/19	10.90	5.41	1.95	2.40		0.24	0.20			
02/01/19	10.90	5.40	1.94	2.40		0.24	0.20			
02/02/19	10.80	5.39	1.94	2.40		0.24	0.20			
02/03/19	10.80	5.38	1.94	2.39		0.24	0.20			
02/04/19	10.80	5.37	1.93	2.39		0.24	0.20			
02/05/19	10.80	5.36	1.93	2.39		0.24	0.20			
02/06/19	10.80	5.35	1.92	2.38		0.24	0.20			
02/07/19	10.70	5.34	1.92	2.38		0.24	0.20			
02/08/19	10.70	5.35	1.92	2.38		0.24	0.20			
02/09/19	10.60	5.35	1.91	2.42		0.24	0.20			

02/10/19	10.60	5.36	1.91	2.44		0.24	0.20			
02/11/19	10.50	5.36	1.90	2.47		0.24	0.20			
02/12/19	10.40	5.37	1.90	2.49		0.24	0.20			
02/13/19	10.40	5.37	1.90	2.51		0.24	0.20			
02/14/19	10.40	5.38	1.89	2.54		0.24	0.20			
02/15/19	10.40	5.38	1.89	2.56		0.24	0.20			
02/16/19	10.40	5.39	1.89	2.59		0.24	0.20			
02/17/19	10.40	5.40	1.88	2.61		0.24	0.20			
02/18/19	10.40	5.40	1.88	2.63		0.24	0.20			
02/19/19	10.40	5.41	1.87	2.66		0.24	0.20			
02/20/19	10.40	5.41	1.87	2.68		0.24	0.20			
02/21/19	10.40	5.42	1.87	2.70		0.24	0.20			
02/22/19	10.40	5.42	1.86	2.73		0.24	0.20			
02/23/19	10.40	5.43	1.86	2.75		0.24	0.20			
02/24/19	10.40	5.43	1.85	2.78		0.24	0.20			
02/25/19	10.40	5.44	1.85	2.80		0.24	0.20			
02/26/19	10.40	5.44	1.87	2.82		0.24	0.20			
02/27/19	10.40	5.45	1.87	2.85		0.24	0.20			
02/28/19	10.40	5.46	1.87	2.87		0.24	0.20			
03/01/19	10.40	5.46	1.87	2.90		0.24	0.20			
03/02/19	10.40	5.47	1.87	2.92		0.24	0.20			
03/03/19	10.40	5.47	1.87	2.94		0.24	0.20			
03/04/19	10.40	5.48	1.87	2.97		0.24	0.20			
03/05/19	10.40	5.48	1.87	2.99		0.24	0.20			
03/06/19	10.50	5.49	1.87	3.02		0.24	0.20			
03/07/19	10.60	5.49	1.88	3.04		0.24	0.20			
03/08/19	10.60	5.50	1.88	3.06		0.24	0.20			
03/09/19	10.70	5.50	1.89	3.09		0.24	0.20			
03/10/19	10.70	5.51	1.89	3.11		0.24	0.20			
03/11/19	10.80	5.52	1.89	3.13		0.24	0.20			
03/12/19	10.80	5.16	1.90	3.16		0.24	0.20			
03/13/19	10.90	5.16	1.90	3.18		0.24	0.20			
03/14/19	10.90	5.16	1.90	3.21		0.24	0.20			
03/15/19	10.90	5.16	1.91	3.23		0.24	0.20			

03/16/19	10.90	5.16	1.91	3.25		0.24	0.20			
03/17/19	11.00	5.16	1.91	3.28		0.24	0.20			
03/18/19	11.30	5.16	1.92	3.30		0.24	0.20			
03/19/19	11.70	5.16	1.92	3.33		0.24	0.20			
03/20/19	12.00	5.16	1.92	3.35		0.24	0.20			
03/21/19	12.40	5.16	1.93	3.37		0.24	0.20			
03/22/19	12.90	5.16	1.93	**3.40**		0.24	0.20			
03/23/19	12.80	5.16	1.94	3.45		0.24	0.20			
03/24/19	12.80	5.16	1.94	3.49		0.24	0.20			
03/25/19	12.80	5.16	1.94	3.54		0.24	0.20			
03/26/19	13.20	5.16	1.95	3.58		0.44	0.20			
03/27/19	13.70	5.16	1.95	3.63		0.64	0.20			
03/28/19	14.60	5.21	1.95	3.67		0.84	0.20			
03/29/19	14.80	5.26	1.96	3.72		1.04	0.20			
03/30/19	13.90	5.31	1.92	3.76		1.23	0.20			
03/31/19	13.80	5.36	1.89	3.81		1.43	0.20			
04/01/19	13.60	5.41	1.86	3.85		1.63	0.20			
04/02/19	13.70	5.46	1.83	3.90		1.83	0.20			
04/03/19	13.80	5.54	1.79	3.94		2.03	0.20			
04/04/19	13.90	5.54	1.76	3.99		2.23	0.20			
04/05/19	14.90	5.54	1.73	4.03		2.43	0.20			
04/06/19	15.70	5.54	1.70	4.08		2.63	0.20			
04/07/19	17.00	5.54	1.76	4.12		2.83	0.20			
04/08/19	21.50	5.54	1.81	4.17		3.03	0.20			
04/09/19	24.00	5.54	1.87	4.21		3.22	0.20			
04/10/19	21.90	5.54	1.93	4.26		3.42	0.20			
04/11/19	18.30	5.54	1.98	4.30		3.62	0.20			
04/12/19	16.60	5.54	2.04	4.35		3.82	0.72			
04/13/19	15.70	5.54	2.10	4.39		4.02	1.25			
04/14/19	15.80	5.54	2.15	4.44		4.22	1.77			
04/15/19	18.20	5.54	2.17	4.48		4.42	2.29			
04/16/19	19.60	5.54	2.20	4.53		4.62	2.82			
04/17/19	20.70	5.54	2.22	4.57		4.82	3.34			
04/18/19	27.80	6.35	2.25	4.62		5.02	3.86			

04/19/19	41.10	7.16	2.28	4.66		5.21	4.38			
04/20/19	45.00	7.97	2.30	4.71		5.41	4.91			
04/21/19	39.70	8.78	2.33	4.75		5.61	5.43			
04/22/19	40.50	9.59	2.36	4.80		5.81	5.95			
04/23/19	43.80	10.40	2.37	4.84		6.01	6.48			
04/24/19	58.80	11.21	2.39	4.89		6.21	7.00			
04/25/19	87.80	11.24	2.40	4.93		6.41	6.78			
04/26/19	81.80	11.10	2.42	4.98		6.61	6.56			
04/27/19	69.50	10.96	2.43	5.02		6.81	6.33			
04/28/19	66.80	10.82	2.45	5.07		7.00	6.11			
04/29/19	64.00	10.68	2.47	5.11		7.20	5.89			
04/30/19	50.70	10.54	3.75	5.16		7.40	5.67			
05/01/19	39.00	10.40	3.75	5.20		7.60	5.44			
05/02/19	33.40	10.26	3.75	5.25		7.80	5.22			
05/03/19	33.10	10.11	3.92	5.29		**8.00**	5.00			
05/04/19	37.30	10.47	4.31	5.34		**7.33**	5.00			
05/05/19	41.70	10.85	3.75	5.38		**6.67**	5.00			
05/06/19	54.90	11.24	4.31	5.43		**6.00**	5.00			
05/07/19	66.20	12.06	3.92	5.47		**6.00**	5.00			
05/08/19	61.60	11.24	4.11	5.52		**6.00**	5.00			
05/09/19	44.60	9.42	3.75	5.56		**6.00**	5.00			
05/10/19	35.90	5.54	2.58	5.61		**6.00**	5.00			
05/11/19	34.90	10.47	3.26	5.65		**6.00**	5.00			
05/12/19	50.20	13.41	3.26	**5.70**		**6.00**	5.00			
05/13/19	77.90	16.01	4.11	7.13		**6.00**	5.00			
05/14/19	108.00	19.11	7.18	8.56		**8.00**	5.00			
05/15/19	136.00	22.81	9.48	9.99		9.48	5.00			
05/16/19	170.00	25.37	13.12	11.43		10.96	5.00			
05/17/19	148.00	47.98	11.42	12.86		12.44	5.00			
05/18/19	90.80	24.49	7.52	14.29		13.92	5.00			
05/19/19	65.10	16.59	6.24	15.72		15.40	5.00			
05/20/19	52.00	14.92	4.73	17.15		16.88	5.00			
05/21/19	42.90	16.01	4.95	18.58		18.36	5.00			
05/22/19	36.90	12.06	4.31	20.01		19.84	5.00			

05/23/19	33.70	11.24	4.31	21.45		21.32	5.00			
05/24/19	32.30	11.24	4.73	22.88		22.80	5.00			
05/25/19	38.70	12.06	4.11	24.31		24.28	5.00			
05/26/19	43.10	12.50	5.43	25.74		25.76	5.00			
05/27/19	39.40	13.41	4.51	27.17		27.24	7.08			
05/28/19	37.20	11.24	4.31	28.60		28.72	9.15			
05/29/19	36.50	13.41	4.95	30.03		30.20	11.23			
05/30/19	34.90	11.24	4.95	31.47		31.68	13.31			
05/31/19	44.40	12.06	5.43	32.90		33.16	15.38			
06/01/19	88.00	12.06	9.93	34.33		34.64	17.46			
06/02/19	138.00	25.37	9.48	35.76		36.12	19.54			
06/03/19	190.00	46.31	18.16	37.19		37.60	21.62			
06/04/19	184.00	61.48	19.02	38.62		39.08	23.69			
06/05/19	180.00	65.99	20.88	40.05		40.56	25.77			
06/06/19	269.00	65.99	41.89	41.49		42.04	27.85			
06/07/19	306.00	94.02	52.83	42.92		43.52	29.92			
06/08/19	383.00	133.95	53.71	44.35		**45.00**	32.10			
06/09/19	408.00	78.76	54.58	45.78		**44.56**	25.23			
06/10/19	399.00	94.02	55.46	44.73		**44.12**	18.36			
06/11/19	387.00	94.02	56.34	52.25		**43.68**	11.49			
06/12/19	364.00	87.59	57.21	45.35		**43.24**	4.62			
06/13/19	371.00	45.40	58.09	56.35		**42.81**	5.59			
06/14/19	375.00	75.54	58.97	66.82		**42.37**	5.70			
06/15/19	355.00	83.28	59.84	70.10		**41.93**	8.70			
06/16/19	297.00	90.11	60.72	75.50		**41.49**	16.41			
06/17/19	287.00	76.93	56.90	52.33		**41.05**	12.96			
06/18/19	242.00	109.75	53.08	48.00		**40.61**	9.29			
06/19/19	243.00	78.01	49.26	18.26		**40.17**	3.76			
06/20/19	321.00	67.57	45.44	29.44		**39.73**	2.50			
06/21/19	353.00	85.02	41.62	52.90		**39.30**	6.31			
06/22/19	288.00	103.52	37.80	71.38		**38.86**	9.78			
06/23/19	197.00	75.24	33.98	50.48		**38.42**	5.50			
06/24/19	188.00	32.02	30.16	28.17		**37.98**	2.40			
06/25/19	230.00	35.14	26.33	28.58		**37.54**	2.42			

06/26/19	285.00	57.19	16.55	43.66		**37.10**	5.42			
06/27/19	348.00	76.85	26.33	48.76		**36.66**	6.38			
06/28/19	392.00	76.12	20.88	58.89		**36.22**	7.35			
06/29/19	372.00	55.58	26.33	43.81		**35.78**	8.31			
06/30/19	359.00	56.20	19.02	53.10		**35.35**	8.46			
07/01/19	353.00	59.61	26.33	54.94		**34.91**	8.61			
07/02/19	328.00	54.51	26.33	53.76		**34.47**	8.76			
07/03/19	291.00	85.35	33.21	53.73		**34.03**	8.91			
07/04/19	274.00	88.81	20.88	46.33		**33.59**	9.06			
07/05/19	233.00	78.00	26.33	47.99		**33.15**	9.28			
07/06/19	204.00	90.89	22.91	33.96		**32.71**	10.24			
07/07/19	179.00	90.77	19.93	25.17		**32.27**	10.49			
07/08/19	182.00	71.19	18.16	19.23		**31.84**	10.74			
07/09/19	176.00	73.59	17.34	21.78		**31.40**	10.99			
07/10/19	163.00	70.22	16.55	21.49		**30.96**	11.20			
07/11/19	153.00	67.82	15.80	20.06		**30.52**	12.17			
07/12/19	145.00	65.57	15.08	16.66		**30.08**	13.13			
07/13/19	142.00	58.35	15.08	14.11		20.08	14.10			
07/14/19	147.00	59.91	14.40	16.16		17.60	15.06			
07/15/19	145.00	63.09	16.55	16.72		28.76	16.02			
07/16/19	140.00	63.62	15.08	15.22		31.91	16.99			
07/17/19	139.00	64.08	15.85	15.10		30.59	17.95			
07/18/19	134.00	64.60	16.62	14.93		30.71	18.92			
07/19/19	124.00	60.33	17.39	13.35		31.47	19.88			
07/20/19	107.00	51.59	18.16	11.76		28.60	20.84			
07/21/19	94.30	42.80	15.08	10.09		19.69	21.81			
07/22/19	87.10	36.87	16.55	9.06		15.01	22.77			
07/23/19	78.60	33.35	13.12	8.50		14.07	23.74			
07/24/19	86.80	30.75	20.88	7.94		12.41	24.70			
07/25/19	86.80	37.59	11.96	9.58		15.01	25.30			
07/26/19	89.20	35.84	10.40	9.29		19.68	26.00			
07/27/19	90.20	35.67	11.42	8.67		18.37	23.83			
07/28/19	78.60	37.33	10.40	9.74	2.9485	22.32	21.66			
07/29/19	72.40	32.18	15.08	7.90	1.6646	15.30	19.49			22.36

07/30/19	63.30	28.95	13.12	7.14	2.6229	13.42	17.32			12.37
07/31/19	55.60	25.68	15.08	6.24	1.5762	11.86	15.15			8.95
08/01/19	55.80	23.02	16.55	5.32	1.4703	11.09	12.98			10.08
08/02/19	52.40	23.06	11.96	5.01	1.5762	11.04	10.81			7.92
08/03/19	46.00	21.40	10.40	4.39	1.9447	10.65	8.64			5.14
08/04/19	41.50	19.16	10.40	4.14	1.1376	9.75	6.46			4.61
08/05/19	41.20	17.60	10.40	4.36	0.7816	9.11	5.40			4.65
08/06/19	40.60	17.69	10.40	3.43	1.5367	8.77	7.79			4.43
08/07/19	38.80	17.13	9.93	3.83	1.5298	8.53	7.08			3.55
08/08/19	36.60	16.48	9.05	4.38	0.8322	8.09	5.09			2.98
08/09/19	37.10	15.89	10.40	3.65	0.8830	7.90	5.44			2.92
08/10/19	34.50	15.96	8.64	3.10	0.7513	8.00	4.62			2.40
08/11/19	36.00	15.17	7.87	2.61	0.8999	7.48	4.73			2.62
08/12/19	33.70	15.02	6.54	2.42	0.9651	7.06	4.26			2.14
08/13/19	30.30	14.35	6.85	2.19	0.6789	6.69	3.71			1.68
08/14/19	28.40	13.19	6.54	2.02	0.5684	6.11	2.88			1.41
08/15/19	27.20	12.48	6.54	1.90	0.8142	5.49	2.80			1.31
08/16/19	26.00	12.05	6.54	1.78	0.7935	4.89	2.31			1.25
08/17/19	24.80	11.62	5.96	1.67	0.5727	4.13	2.25			1.21
08/18/19	23.80	11.15	5.69	1.59	0.4731	3.84	2.04			1.14
08/19/19	22.90	10.69	5.19	1.53	0.4180	3.58	1.88			1.08
08/20/19	22.20	10.24	5.34	2.79	0.3676	3.39	1.75			1.02
08/21/19	21.50	9.88	5.49	3.78	0.3691	3.24	1.72			0.97
08/22/19	20.50	9.51	5.64	4.10	0.2886	3.12	1.50			0.90
08/23/19	20.00	9.15	5.25	4.45	0.2372	2.93	1.40			0.82
08/24/19	19.70	8.86	5.12	4.34	0.2265	2.77	1.29			0.77
08/25/19	19.90	8.77	5.15	4.26	0.3010	2.58	1.28			0.77
08/26/19	19.90	9.00	5.29	4.31	0.5038	2.57	1.37			0.79
08/27/19	19.50	9.01	5.35	4.31	0.5031	2.55	1.36			0.73
08/28/19	19.00	8.76	5.19	4.23	0.4033	2.50	1.26			0.66
08/29/19	18.50	8.38	4.92	4.13	0.3530	2.42	1.17			0.59
08/30/19	18.30	8.08	4.66	4.03	0.2603	2.36	1.10			0.56
08/31/19	18.00	8.03	4.56	4.05	0.3549	2.33	1.15			0.54
09/01/19	17.80	7.89	4.47	3.95	0.3023	2.26	1.06			0.52

09/02/19	17.60	7.77	4.46	3.88	0.2693	2.18	1.02			0.49
09/03/19	17.30	7.63	4.28	3.82	0.2483	2.11	1.00			0.46
09/04/19	17.40	7.56	4.19	3.73	0.2053	2.02	0.88			0.46
09/05/19	17.40	7.77	5.07	3.75	0.2220	1.67	0.95			0.46
09/06/19	17.10	7.76	5.56	3.74	0.2035	1.14	0.77			0.43
09/07/19	17.40	7.67	4.57	3.70	0.2041	1.11	0.81			0.44
09/08/19	17.00	7.75	4.70	3.74	0.2029	1.14	0.76			0.41
09/09/19	16.50	7.57	4.46	3.64	0.1996	1.10	0.90			0.36
09/10/19	16.50	7.41	4.31	3.55	0.2053	1.02	0.62			0.36
09/11/19	16.60	7.37	4.31	3.52	0.1821	0.97	0.60			0.35
09/12/19	16.00	7.40	4.31	3.54	0.1924	1.00	0.59			0.30
09/13/19	15.80	7.12	4.04	3.40	0.1484	0.91	0.63			0.27
09/14/19	15.60	6.96	3.88	3.36	0.1484	0.86	0.61			0.25
09/15/19	15.50	6.87	3.80	3.32	0.1444	0.83	0.59			0.25
09/16/19	15.50	6.85	3.72	3.30	0.1054	0.82	0.70			0.24
09/17/19	16.80	6.72	3.68	3.31	0.1061	0.82	0.59			0.34
09/18/19	15.90	7.38	4.24	3.50	0.1640	0.93	0.64			0.25
09/19/19	15.70	7.01	3.88	3.34	0.1395	0.85	0.59			0.24
09/20/19	15.60	6.79	3.79	3.29	0.1354	0.80	0.57			0.23
09/21/19	15.20	6.71	3.77	3.26	0.1180	0.79	0.54			0.21
09/22/19	15.00	6.46	3.54	3.17	0.0882	0.74	0.51			0.20
09/23/19	14.90	6.33	3.42	3.13	0.0814	0.71	0.50			0.19
09/24/19	14.80	6.19	3.36	3.12	0.0709	0.70	0.47			0.18
09/25/19	14.80	6.06	3.33	3.09	0.0692	0.68	0.48			0.17
09/26/19	14.80	6.07	3.13	3.23	0.0812	0.68	0.48			0.17
09/27/19	14.80	6.01	2.82	3.35	0.0753	0.67	0.48			0.16
09/28/19	14.80	6.07	2.89	3.35	0.0887	0.67	0.48			0.16
09/29/19	14.90	6.06	2.89	3.34	0.0897	0.66	0.48			0.17
09/30/19	14.60	6.01	2.89	3.36	0.0762	0.68	0.46			0.16
10/01/19	14.50	5.87	2.79	3.27	0.0633	0.64	0.70			0.15
10/02/19	14.30	5.82	2.75	3.24	0.0656	0.62	0.44			0.14
10/03/19	14.10	5.63	2.67	3.20	0.0544	0.60	0.43			0.14
10/04/19	14.60	5.35	2.62	3.17	0.0489	0.59	0.43			0.15
10/05/19	14.30	5.56	2.73	3.26	0.0518	0.63	0.44			0.14

10/06/19	14.10	5.36	2.64	3.18	0.0469	0.60	0.43			0.13
10/07/19	14.10	5.16	2.60	3.16	0.0450	0.59	0.42			0.13
10/08/19	14.10	5.01	2.54	3.14	0.0478	0.58	0.70			0.13
10/09/19	14.10	5.30	2.60	3.16	0.0479	0.58	0.42			0.12
10/10/19	13.90	5.82	2.64	3.16		0.58	0.42			0.12
10/11/19	13.50	5.62	2.59	3.14		0.58	0.42			0.14
10/12/19	13.70	5.30	4.35	3.25		0.58	0.40			0.12
10/13/19	13.70	5.36	2.45	3.07		0.58	0.41			0.12
10/14/19	13.80	5.33	2.45	3.06		0.58	0.41			0.11
10/15/19	13.70	5.31	2.50	3.07		0.58	0.41			0.11
10/16/19	13.80	5.32	2.46	3.07		0.58	0.41			0.11
10/17/19	13.90	5.40	2.45	3.07		0.58	0.41			0.10
10/18/19	14.10	5.30	2.46	3.07		0.58	0.40			
10/19/19	13.70	5.26	2.51	3.13		0.58	0.41			
10/20/19	13.80	5.07	2.38	3.05		0.58	0.40			
10/21/19	13.70	5.00	2.43	3.06		0.58	0.39			
10/22/19	13.60	4.92	2.91	3.09		0.58	0.62			
10/23/19	13.90	4.79	2.39	3.10		0.58	0.61			
10/24/19	13.80	4.96	2.38	1.60		0.58	0.61			
10/25/19	13.70	4.44	2.37	1.60		0.58	0.60			
10/26/19	13.80	4.55	2.36	1.60		0.58	0.59			
10/27/19	13.70	4.66	2.35	1.60		0.58	0.59			
10/28/19	13.80	4.77	2.34	1.60		0.58	0.58			
10/29/19	13.80	4.88	2.33	1.60		0.58	0.50			
10/30/19	12.70	4.99	2.32	1.60		0.58	0.57			
10/31/19	13.10	5.10	2.31	1.60		0.58	0.57			
11/01/19	13.60	5.21	2.30	1.60		0.58	0.56			
11/02/19	13.50	5.19	2.29	1.60		0.58	0.56			
11/03/19	13.50	5.16	2.28	1.60		0.58	0.55			
11/04/19	13.60	5.14	2.27	1.60		0.58	0.55			
11/05/19	13.50	5.11	2.26	1.60		0.58	0.54			
11/06/19	13.60	5.09	2.25	1.60		0.58	0.54			
11/07/19	13.50	5.06	2.24	1.60		0.58	0.54			
11/08/19	13.30	5.04	2.22	1.60		0.58	0.53			

11/09/19	13.40	4.95	2.21	1.60		0.58	0.53			
11/10/19	13.50	4.87	2.20	1.60		0.58	0.53			
11/11/19	13.40	4.78	2.19	1.60		0.58	0.52			
11/12/19	13.40	4.70	2.18	1.60		0.58	0.50			
11/13/19	13.30	4.61	2.17	1.60		0.58	0.51			
11/14/19	13.30	4.53	2.16	1.60		0.58	0.51			
11/15/19	13.40	4.44	2.15	1.60		0.58	0.50			
11/16/19	13.40	4.50	2.14	1.60		0.58	0.50			
11/17/19	13.30	4.57	2.13	1.60		0.58	0.49			
11/18/19	13.10	4.63	2.12	1.60		0.58	0.48			
11/19/19	12.80	4.69	2.11	1.60		0.58	0.50			
11/20/19	13.20	4.75	2.10	1.60		0.58	0.48			
11/21/19	13.20	4.82	2.09	1.60		0.58	0.48			
11/22/19	13.10	4.88	2.08	1.60		0.58	0.48			
11/23/19	12.90	4.80	2.07	1.60		0.58	0.48			
11/24/19	12.20	4.71	2.06	1.60		0.58	0.48			
11/25/19	12.10	4.63	2.05	1.60		0.58	0.50			
11/26/19	12.00	4.55	2.04	1.60		0.58	0.48			
11/27/19	12.20	4.47	2.02	1.60		0.58	0.48			
11/28/19	13.20	4.38	2.01	1.60		0.58	0.48			
11/29/19	13.80	4.30	2.00	1.60		0.58	0.48			
11/30/19	13.40	4.23	2.00	1.60		0.58	0.47			
12/01/19	13.20	4.15	2.00	1.60		0.58	0.47			
12/02/19	13.40	4.08	2.00	1.60		0.58	0.47			
12/03/19	13.50	4.00	2.00	1.60		0.58	0.47			
12/04/19	13.90	3.93	1.99	1.60		0.58	0.47			
12/05/19	14.10	3.85	1.99	1.60		0.58	0.47			
12/06/19	13.50	3.78	1.99	1.60		0.58	0.47			
12/07/19	13.30	3.80	1.99	1.60		0.58	0.47			
12/08/19	13.10	3.82	1.99	1.60		0.58	0.47			
12/09/19	13.00	3.84	1.99	1.60		0.58	0.47			
12/10/19	12.30	3.86	1.99	1.60		0.58	0.47			
12/11/19	12.80	3.88	1.99	1.60		0.58	0.46			
12/12/19	13.60	3.90	1.98	1.60		0.58	0.46			

12/13/19	14.00	3.92	1.98	1.60		0.58	0.46			
12/14/19	14.10	3.94	1.98	1.60		0.58	0.46			
12/15/19	14.00	3.96	1.98	1.60		0.58	0.46			
12/16/19	13.20	3.98	1.98	1.60		0.58	0.46			
12/17/19	12.50	4.00	1.98	1.60		0.58	0.46			
12/18/19	12.50	4.02	1.98	1.60		0.58	0.46			
12/19/19	12.50	4.04	1.98	1.60		0.58	0.46			
12/20/19	12.50	4.06	1.97	1.60		0.58	0.46			
12/21/19	12.50	4.08	1.97	1.60		0.58	0.46			
12/22/19	13.00	4.10	1.97	1.60		0.58	0.45			
12/23/19	13.10	4.12	1.97	1.60		0.58	0.45			
12/24/19	13.30	4.14	1.97	1.60		0.58	0.45			
12/25/19	13.30	4.16	1.97	1.60		0.58	0.45			
12/26/19	13.20	4.18	1.97	1.60		0.58	0.45			
12/27/19	13.50	4.20	1.97	1.60		0.58	0.45			
12/28/19	13.20	4.22	1.96	1.60		0.58	0.45			
12/29/19	12.20	4.24	1.96	1.60		0.58	0.45			
12/30/19	12.30	4.26	1.96	1.60		0.58	0.45			
12/31/19	12.30	4.28	1.96	1.60		0.58	0.45			
01/01/20	12.30	4.30	1.96	1.60		0.58	0.45			
01/02/20	12.70	4.32	1.96	1.60		0.58	0.44			
01/03/20	12.60	4.34	1.96	1.60		0.58	0.44			
01/04/20	12.80	4.36	1.96	1.60		0.58	0.44			
01/05/20	12.90	4.38	1.96	1.60		0.58	0.44			
01/06/20	12.80	4.40	1.96	1.60		0.58	0.44			
01/07/20	12.60	4.42	1.96	1.60		0.58	0.44			
01/08/20	12.90	4.44	1.96	1.60		0.58	0.44			
01/09/20	12.80	4.46	1.96	1.60		0.58	0.44			
01/10/20	12.60	4.48	1.96	1.60		0.58	0.44			
01/11/20	12.60	4.50	1.96	1.60		0.58	0.44			
01/12/20	12.70	4.52	1.96	1.60		0.58	0.44			
01/13/20	12.80	4.54	1.96	1.60		0.58	0.43			
01/14/20	12.50	4.56	1.96	1.60		0.58	0.43			
01/15/20	12.70	4.58	1.96	1.60		0.58	0.43			

01/16/20	12.70	4.60	1.95	1.60		0.58	0.43			
01/17/20	12.90	4.62	1.95	1.60		0.58	0.43			
01/18/20	11.80	4.64	1.95	1.60		0.58	0.43			
01/19/20	12.60	4.66	1.95	1.60		0.58	0.43			
01/20/20	12.20	4.68	1.95	1.60		0.58	0.43			
01/21/20	12.90	4.70	1.95	1.60		0.58	0.43			
01/22/20	12.80	4.72	1.95	1.60		0.58	0.43			
01/23/20	12.60	4.74	1.95	1.60		0.58	0.43			
01/24/20	12.50	4.76	1.95	1.60		0.58	0.42			
01/25/20	12.50	4.78	1.95	1.60		0.58	0.42			
01/26/20	12.80	4.80	1.95	1.60		0.58	0.42			
01/27/20	12.70	4.82	1.95	1.60		0.58	0.42			
01/28/20	12.60	4.84	1.95	1.60		0.58	0.42			
01/29/20	12.60	4.86	1.95	1.60		0.58	0.42			
01/30/20	12.80	4.88	1.95	1.60		0.58	0.42			
01/31/20	12.10	4.90	1.95	1.60		0.58	0.42			
02/01/20	12.50	4.92	1.95	1.60		0.58	0.42			
02/02/20	12.70	4.94	1.95	1.60		0.58	0.42			
02/03/20	12.80	4.96	1.95	1.60		0.58	0.42			
02/04/20	12.90	4.98	1.95	1.60		0.58	0.41			
02/05/20	12.50	5.00	1.95	1.60		0.58	0.41			
02/06/20	12.60	5.02	1.95	1.60		0.58	0.41			
02/07/20	12.70	5.04	1.95	1.60		0.58	0.41			
02/08/20	12.60	5.06	1.95	1.60		0.58	0.41			
02/09/20	12.50	5.08	1.95	1.60		0.58	0.41			
02/10/20	12.60	5.10	1.95	1.60		0.58	0.41			
02/11/20	12.60	5.12	1.95	1.60		0.58	0.41			
02/12/20	12.70	5.14	1.95	1.60		0.58	0.41			
02/13/20	12.30	5.16	1.95	1.60		0.58	0.41			
02/14/20	12.40	5.21	1.94	1.60		0.58	0.41			
02/15/20	12.40	5.13	1.94	1.60		0.58	0.40			
02/16/20	12.40	5.04	1.94	1.60		0.58	0.40			
02/17/20	12.40	4.96	1.94	1.60		0.58	0.40			
02/18/20	12.40	4.87	1.94	1.60		0.58	0.40			

02/19/20	12.40	4.79	1.94	1.60		0.58	0.40			
02/20/20	11.70	4.70	1.94	1.60		0.58	0.40			
02/21/20	12.00	4.62	1.94	1.60		0.58	0.40			
02/22/20	12.60	4.54	1.94	1.60		0.58	0.40			
02/23/20	12.60	4.45	1.94	1.60		0.58	0.40			
02/24/20	12.40	4.37	1.94	1.60		0.58	0.40			
02/25/20	12.30	4.28	1.94	1.60		0.58	0.40			
02/26/20	11.70	4.20	1.94	1.60		0.58	0.40			
02/27/20	12.40	4.11	1.94	1.60		0.58	0.39			
02/28/20	12.30	4.03	1.94	1.60		0.58	0.39			
02/29/20	12.50	4.08	1.94	1.60		0.58	0.39			
03/01/20	12.50	4.13	1.95	1.60		0.58	0.39			
03/02/20	12.40	4.18	1.95	1.60		0.58	0.39			
03/03/20	12.40	4.24	1.95	1.60		0.58	0.39			
03/04/20	12.20	4.29	1.96	1.60		0.58	0.39			
03/05/20	12.10	4.34	1.96	1.60		0.58	0.39			
03/06/20	12.00	4.39	1.97	1.60		0.58	0.39			
03/07/20	12.00	4.44	1.97	1.60		0.58	0.39			
03/08/20	11.90	4.42	1.97	1.60		0.58	0.39			
03/09/20	11.90	4.40	1.98	1.60		0.58	0.38			
03/10/20	11.90	4.38	1.98	1.60		0.58	0.38			
03/11/20	11.90	4.36	1.98	1.60		0.58	0.38			
03/12/20	11.80	4.34	1.99	1.60		0.58	0.38			
03/13/20	11.80	4.32	1.99	1.60		0.58	0.38			
03/14/20	11.80	4.30	1.99	1.60		0.58	0.38			
03/15/20	11.80	4.32	2.00	1.60		0.58	0.38			
03/16/20	11.80	4.34	2.00	1.60		0.58	0.38			
03/17/20	11.80	4.36	2.01	1.60		0.58	0.38			
03/18/20	11.80	4.38	2.01	1.60		0.58	0.38			
03/19/20	11.80	4.40	2.01	1.60		0.58	0.38			
03/20/20	11.70	4.42	2.02	1.60		0.58	0.37			
03/21/20	11.70	4.44	2.02	1.60		0.58	0.37			
03/22/20	11.70	4.46	2.02	1.60		0.58	0.37			
03/23/20	11.70	4.48	2.03	1.60		0.58	0.37			

03/24/20	11.60	4.51	2.03	1.60		0.58	0.37			
03/25/20	11.60	4.53	2.03	1.60		0.58	0.37			
03/26/20	11.60	4.55	2.04	1.60		0.58	0.37			
03/27/20	11.60	4.57	2.04	1.60		0.58	0.37			
03/28/20	11.70	4.59	2.04	1.60		0.58	0.37			
03/29/20	11.90	4.61	2.05	1.60		0.58	0.37			
03/30/20	12.60	4.63	2.05	1.60		0.58	0.37			
03/31/20	13.00	4.65	2.06	1.60		0.58	0.36			
04/01/20	13.70	4.67	2.06	1.60		0.58	0.36			
04/02/20	13.70	4.69	2.06	1.60		0.58	0.36			
04/03/20	13.50	4.71	2.07	1.60		0.58	0.36			
04/04/20	13.80	4.73	2.07	1.60		0.58	0.36			
04/05/20	14.10	4.66	2.10	1.60		0.58	0.36			
04/06/20	15.30	4.59	2.13	1.60		0.58	0.36			
04/07/20	16.90	4.53	2.16	1.60		0.58	0.36			
04/08/20	19.10	4.46	2.19	1.60		0.69	0.36			
04/09/20	20.70	4.39	2.22	1.60		0.81	0.36			
04/10/20	22.60	4.32	2.25	1.60		0.92	0.36			
04/11/20	23.50	4.25	2.28	1.60		1.03	0.35			
04/12/20	21.70	4.19	2.31	1.60		1.14	0.35			
04/13/20	17.10	4.12	2.34	1.60		1.26	0.35			
04/14/20	15.60	4.05	2.37	1.60		1.37	0.35			
04/15/20	15.00	3.98	2.40	1.60		1.48	0.35			
04/16/20	14.60	3.91	2.43	1.60		1.59	0.35			
04/17/20	14.50	3.85	2.46	1.60		1.71	0.35			
04/18/20	14.90	3.78	2.49	1.60		1.82	0.35			
04/19/20	15.30	4.76	2.52	1.60		1.93	0.35			
04/20/20	15.60	5.73	2.55	1.60		2.05	0.35			
04/21/20	16.70	6.71	2.58	1.60		2.16	0.35			
04/22/20	18.40	7.12	2.61	1.60		2.27	0.34			
04/23/20	19.40	7.37	2.62	1.70		2.38	0.34			
04/24/20	21.00	7.42	2.80	1.83		2.50	0.34			
04/25/20	27.10	7.56	2.77	2.10		2.61	0.34			
04/26/20	33.20	8.30	2.98	2.30		2.72	0.37			

04/27/20	45.80	9.22	3.21	2.86		2.83	0.59			
04/28/20	63.10	10.51	3.47	3.64		2.95	0.90			
04/29/20	79.60	13.13	4.02	5.47		3.06	1.77			
04/30/20	84.80	16.56	4.80	8.44		4.96	2.96			
05/01/20	103.00	18.86	5.42	10.91		6.65	3.98			
05/02/20	110.00	24.20	6.48	18.27		8.80	5.29			
05/03/20	107.00	26.72	7.44	20.45		10.10	5.29			
05/04/20	110.00	27.14	8.16	19.54		10.31	4.89			
05/05/20	101.00	29.72	9.17	22.85		11.04	5.18			
05/06/20	98.60	28.95	9.66	21.89		10.97	4.98			
05/07/20	101.00	29.09	10.58	23.04		11.78	5.48			
05/08/20	96.60	30.04	11.21	24.07		11.62	5.48			
05/09/20	92.10	29.40	11.72	22.56		9.56	5.28			
05/10/20	88.00	28.45	12.43	20.95		8.75	5.30			
05/11/20	81.30	27.77	12.61	20.48		8.78	5.16			
05/12/20	78.20	26.06	11.39	15.16		7.95	4.39	232.00		
05/13/20	81.50	23.50	9.62	10.91		7.26	3.49	242.00		
05/14/20	81.60	25.07	10.44	11.69		7.42	3.54	251.00		
05/15/20	79.60	25.45	11.33	11.78		7.81	4.04	261.00		
05/16/20	81.10	24.63	11.71	10.47		7.85	3.91	266.00	17.20	
05/17/20	98.80	26.38	12.61	10.79		7.81	3.75	316.00	24.10	
05/18/20	118.00	35.11	15.66	18.44		14.94	5.22	390.00	30.00	
05/19/20	125.00	46.89	32.17	37.75		16.64	8.14	415.00	29.40	
05/20/20	119.00	58.02	39.71	52.41		18.34	11.86	403.00	28.00	
05/21/20	101.00	50.58	25.00	47.54		20.04	10.20	345.00	21.10	
05/22/20	94.30	40.16	18.78	32.12		21.74	8.25	331.00	20.00	
05/23/20	88.70	36.51	17.26	28.82		17.16	7.87	326.00	19.60	
05/24/20	80.00	34.57	16.92	23.89		14.81	7.26	298.00	16.60	
05/25/20	73.00	29.02	13.80	17.27		13.02	6.09	263.00	14.20	
05/26/20	76.80	25.36	12.19	12.72		10.79	5.45	287.00	14.80	
05/27/20	89.20	27.68	13.72	15.17		11.41	6.15	350.00	21.20	
05/28/20	106.00	34.86	18.02	21.75		14.98	8.11	462.00	82.10	
05/29/20	119.00	47.43	24.54	32.17		32.92	10.38	546.00		
05/30/20	117.00	58.28	26.73	35.93		27.57	16.39	558.00		

05/31/20	142.00	55.71	26.95	27.38		23.12	16.83	640.00		
06/01/20	125.00	71.54	33.81	44.44		28.45	16.23	588.00		
06/02/20	125.00	84.33	32.55	34.23		33.78	17.75	580.00		
06/03/20	121.00	92.92	31.53	38.46		33.30	14.94	592.00		
06/04/20	114.00	86.40	32.17	39.92	3.1453	32.81	20.78	553.00		
06/05/20	111.00	73.28	27.43	26.86	1.6557	32.33	14.60	546.00		
06/06/20	184.00	77.37	28.26	24.44	1.6441	31.85	12.64	749.00		
06/07/20	127.00	85.17	36.73	48.61	3.6700	31.37	15.26	642.00		
06/08/20	97.70	92.89	39.66	50.06	4.7081	30.89	17.89	458.00	69.30	
06/09/20	81.20	43.93	31.48	33.40	2.3301	30.41	20.48	359.00	56.60	
06/10/20	67.60	28.65	24.47	18.83	1.5625	29.93	16.19	289.00	29.30	
06/11/20	64.80	22.68	17.32	12.47	0.7927	28.97	12.84	280.00	28.00	
06/12/20	69.50	22.68	17.08	12.47	0.8746	29.57	13.76	321.00	35.50	5.48
06/13/20	80.40	25.45	20.07	15.96	1.0659	29.69	16.34	400.00	60.20	7.62
06/14/20	89.00	37.62	25.37	22.47	1.4339	29.81	19.04	481.00	82.70	8.06
06/15/20	79.70	43.58	32.44	27.98	1.7717	29.93	18.32	423.00	69.80	7.17
06/16/20	73.20	33.74	29.32	19.67	1.2416	30.05	19.41	384.00	56.90	6.89
06/17/20	68.80	29.34	25.52	15.76	0.9736	30.17	19.10	357.00	49.30	6.51
06/18/20	62.90	26.64	23.30	14.77	0.7966	30.29	16.72	319.00	40.10	5.80
06/19/20	54.90	23.66	21.42	13.78	0.5275	30.41	15.08	282.00	31.00	4.68
06/20/20	49.60	20.60	17.63	12.79	0.3989	24.26	11.67	249.00	25.50	4.10
06/21/20	48.40	19.36	15.66	11.80	0.3528	21.97	10.51	242.00	25.00	4.16
06/22/20	48.50	19.37	15.57	10.82	0.3236	21.25	10.18	247.00	28.00	4.42
06/23/20	47.90	19.53	16.83	9.83	0.3139	21.18	10.23	251.00	28.40	4.54
06/24/20	46.70	19.50	16.81	8.84	0.3065	20.34	10.61	245.00	27.00	4.14
06/25/20	44.00	19.00	15.98	8.60	0.2798	17.05	11.88	225.00	22.90	3.41
06/26/20	40.00	17.74	13.82	8.37	0.1978	12.17	13.24	202.00	18.40	2.73
06/27/20	36.80	15.82	11.68	8.13	0.1668	10.91	10.35	190.00	16.50	2.42
06/28/20	34.00	14.60	10.36	7.90	0.1416	9.61	8.93	175.00	15.00	2.18
06/29/20	33.00	13.83	9.43	7.66	0.1499	8.86	7.93	175.00	15.10	2.20
06/30/20	31.20	13.57	9.16	7.43	0.1535	8.57	7.48	164.00	14.30	2.06
07/01/20	29.40	13.09	8.54	7.19	0.1365	8.07	7.06	151.00	13.30	1.95
07/02/20	28.50	12.56	7.79	6.96	0.1273	7.44	6.14	148.00	13.40	1.91
07/03/20	28.20	12.23	7.51	6.72	0.1270	7.21	5.89	148.00	13.90	1.89

07/04/20	30.70	11.93	7.32	6.49	0.1148	7.05	5.94	159.00	14.70	1.95
07/05/20	28.90	12.72	8.08	6.25	0.1274	7.58	6.97	153.00	13.70	1.83
07/06/20	27.80	12.62	7.63	6.02	0.1070	7.07	5.64	146.00	13.00	1.77
07/07/20	26.90	11.65	7.29	5.78	0.1014	6.60	5.59	137.00	12.10	1.69
07/08/20	25.60	11.48	6.92	5.70	0.0962	6.23	5.13	128.00	11.40	1.59
07/09/20	24.30	11.19	6.54	5.62	0.0873	5.89	4.86	117.00	10.50	1.51
07/10/20	23.10	10.49	6.12	5.54	0.0811	5.47	4.50	109.00	9.90	1.46
07/11/20	22.60	9.99	5.78	5.46	0.0730	5.11	4.26	102.00	9.20	1.40
07/12/20	22.10	9.62	5.49	5.38	0.0662	4.76	3.88	97.70	8.80	1.36
07/13/20	21.90	9.40	5.30	5.30	0.0595	4.63	3.62	98.40	8.80	1.35
07/14/20	21.80	9.33	5.20	5.22	0.0595	4.69	3.66	101.00	8.90	1.35
07/15/20	21.40	9.32	5.26	5.14	0.0584	4.95	6.56	95.30	8.50	1.29
07/16/20	20.20	8.84	5.14	5.06	0.0515	4.65	6.72	88.50	7.80	1.17
07/17/20	21.50	8.28	5.05	4.36	0.0476	4.17	5.02	88.90	7.80	1.17
07/18/20	19.70	8.48	5.09	4.35	0.0560	4.01	4.70	82.30	7.20	1.07
07/19/20	19.20	7.84	4.72	4.35	0.0419	3.50	3.86	78.50	6.70	1.01
07/20/20	18.70	7.64	4.55	4.34	0.0394	3.17	3.26	71.90	6.20	0.94
07/21/20	18.20	7.40	4.41	4.34	0.0370	2.96	2.88	67.30	5.90	0.89
07/22/20	18.20	7.22	4.29	4.33	0.0346	2.53	2.60	65.40	5.70	0.87
07/23/20	19.30	7.12	4.23	4.32	0.0341	2.35	2.44	66.70	5.80	0.98
07/24/20	27.00	8.21	6.32	5.50	0.0636	3.16	3.11	120.00	8.90	1.29
07/25/20	38.50	11.05	9.13	7.00	0.0919	5.18	7.72	162.00	11.90	1.78
07/26/20	30.50	15.84	10.39	8.00	0.2083	8.81	12.74	170.00	12.70	1.57
07/27/20	26.70	12.81	9.52	6.00	0.0963	6.19	11.99	148.00	11.00	1.34
07/28/20	24.10	10.98	8.07	4.30	0.0699	5.70	8.53	140.00	9.80	1.24
07/29/20	21.10	10.14	7.55	4.28	0.0590	6.15	6.91	121.00	8.50	1.07
07/30/20	19.70	8.51	7.52	3.30	0.0460	4.15	4.31	106.00	7.40	0.98
07/31/20	18.80	7.88	5.69	3.02	0.0419	3.50	3.50	95.30	6.70	0.91
08/01/20	18.20	7.38	5.16	2.81	0.0396	3.07	3.20	87.90	6.20	0.87
08/02/20	17.90	7.08	4.76	2.63	0.0369	2.77	2.88	81.90	5.80	0.84
08/03/20	17.40	7.00	4.59	2.50	0.0352	2.58	2.69	76.50	5.50	0.80
08/04/20	17.10	7.01	4.34	2.36	0.0327	2.30	2.46	70.90	5.20	0.75
08/05/20	16.90	6.87	4.13	2.14	0.0306	2.00	2.20	66.70	5.10	0.74
08/06/20	16.70	6.56	4.00	2.11	0.0297	1.90	2.04	63.00	4.80	0.70

08/07/20	16.30	6.34	3.89	1.99	0.0281	1.68	1.83	58.80	4.60	0.66
08/08/20	16.10	6.13	3.77	1.88	0.0269	1.51	1.63	55.90	4.40	0.65
08/09/20	15.90	6.45	3.69	1.83	0.0260	1.39	1.52	53.80	4.30	0.63
08/10/20	15.70	7.64	3.60	1.78	0.0251	1.29	1.48	51.80	4.20	0.61
08/11/20	15.40	7.44	3.53	1.72	0.0245	1.20	1.35	49.30	4.00	0.59
08/12/20	15.20	7.13	3.46	1.66	0.0240	1.10	1.22	47.10	4.00	0.58
08/13/20	15.00	6.80	3.37	1.62	0.0238	1.02	1.15	45.80	3.90	0.56
08/14/20	14.80	6.56	3.31	1.59	0.0236	1.47	1.05	44.40	3.70	0.55
08/15/20	14.60	6.34	3.26	1.56	0.0234	1.40	1.00	42.60	3.60	0.54
08/16/20	14.50	6.11	3.19	1.53	0.0231	1.34	0.92	41.20	3.50	0.53
08/17/20	14.40	5.86	3.12	1.50	0.0229	1.29	0.85	40.50	3.50	0.52
08/18/20	14.30	5.68	3.07	1.49	0.0230	1.24	0.80	39.70	3.40	0.51
08/19/20	14.00	6.22	3.02	1.49	0.0231	1.20	0.76	38.80	3.30	0.51
08/20/20	13.80	6.36	3.00	1.48	0.0233	1.17	0.73	38.20	3.30	0.50
08/21/20	13.80	5.96	2.96	1.47	0.0233	1.15	0.71	37.50	3.20	0.49
08/22/20	13.60	5.75	2.91	1.45	0.0232	1.11	0.67	36.90	3.20	0.49
08/23/20	13.50	5.61	2.88	1.44	0.0232	1.08	0.63	36.70	3.20	0.48
08/24/20	13.50	5.59	2.85	1.44	0.0233	1.07	0.61	36.40	3.20	0.49
08/25/20	13.60	5.64	2.88	1.47	0.0240	1.11	0.66	36.70	3.20	0.48
08/26/20	13.60	5.87	2.91	1.48	0.0239	1.11	0.54	36.80	3.10	0.49
08/27/20	13.60	5.94	2.88	1.47	0.0239	1.11	0.59	36.90	3.10	0.48
08/28/20	13.90	5.99	2.81	1.45	0.0235	1.08	0.51	38.40	3.20	0.51
08/29/20	14.10	6.03	2.80	1.52	0.0246	1.18	0.52	39.10	3.20	0.51
08/30/20	13.80	5.94	2.80	1.53	0.0249	1.20	0.62	38.40	3.30	0.51
08/31/20	13.70	5.85	2.79	1.54	0.0249	1.22	0.76	37.60	3.20	0.49
09/01/20	14.30	5.75	2.70	1.49	0.0145	1.15	0.54	38.60	3.30	0.52
09/02/20	13.40	5.96	2.81	1.61	0.0023	1.22	0.78	36.50	3.10	0.48
09/03/20	13.30	5.74	2.91	1.44	0.0021	1.09	0.45	34.80	3.00	0.46
09/04/20	13.20	5.66	2.88	1.40	0.0021	1.02	0.37	33.70	2.90	0.45
09/05/20	13.10	5.30	2.72	1.37	0.0021	0.98	0.33	32.80	2.90	0.44
09/06/20	13.10	5.13	2.65	1.35	0.0021	0.95	0.29	32.10	2.80	0.44
09/07/20	13.10	5.09	2.52	1.32	0.0021	0.93	0.25	31.80	2.80	0.44
09/08/20	15.10	5.03	2.46	1.33	0.0022	0.91	0.23	38.00	3.20	0.48
09/09/20	14.00	5.66	2.81	1.52	0.0024	5.84	0.31	37.70	3.10	0.47

09/10/20	14.50	5.40	2.63	1.59	0.0023	9.70	0.45	39.30	3.30	0.49
09/11/20	14.00	5.51	2.61	1.67	0.0023	1.27	0.52	38.00	3.30	0.47
09/12/20	13.80	5.46	2.66	1.67	0.0023	1.34	0.67	37.30	3.30	0.56
09/13/20	13.70	5.33	2.68	1.58	0.0022	1.18	0.54	36.30	3.30	0.50
09/14/20	13.50	5.26	2.68	1.51	0.0022	1.10	0.46	35.00	3.20	0.47
09/15/20	13.40	5.20	2.68	1.46	0.0022	1.06	0.41	34.60	3.10	0.47
09/16/20	13.40	5.15	2.67	1.41	0.0022	1.03	0.38	34.30	3.00	0.47
09/17/20	13.30	5.08	2.63	1.40	0.0022	1.00	0.35	33.80	3.00	0.47
09/18/20	13.20	5.04	2.62	1.39	0.0022	1.00	0.34	33.20	2.90	0.46
09/19/20	13.20	5.01	2.59	1.37	0.0023	1.00	0.33	32.90	2.90	0.46
09/20/20	13.20	5.10	2.60	1.37	0.0023	0.82	0.36	32.40	2.80	0.45
09/21/20	13.50	5.12	2.59	1.36	0.0023	0.57	0.41	32.10	2.80	0.44
09/22/20	14.00	5.38	2.58	1.35	0.0023	0.57	0.39	31.90	2.80	0.45
09/23/20	13.90	5.67	2.60	1.37	0.0024	0.59	0.45	31.40	2.80	0.44
09/24/20	13.90	5.61	2.57	1.33	0.0023	0.58	0.39	30.70	2.80	0.44
09/25/20	13.90	5.65	2.56	1.29	0.0023	0.56	0.37	30.10	2.70	0.44
09/26/20	13.90	5.67	2.54	1.25	0.0023	0.55	0.35	29.70	2.70	0.44
09/27/20	13.80	5.70	2.51	1.18	0.0023	0.57	0.33	29.10	2.70	0.44
09/28/20	13.70	5.81	2.50	1.04	0.0023	0.57	0.30	28.90	2.60	0.44
09/29/20	13.60	5.75	2.47	0.82	0.0022	0.59	0.23	28.50	2.60	0.44
09/30/20	13.60	5.67	2.43	0.91	0.0021	0.58	0.21	27.90	2.60	0.44

Date	Gold King Daily Mean Discharge (cfs)	Natalie Occidental Daily Mean Discharge (cfs)	Red and Bonita Daily Mean Discharge (cfs)	Blackhawk Daily Mean Discharge (cfs)	American Tunnel Daily Mean Discharge (cfs)	Mogul Daily Mean Discharge (cfs)	
10/1/2018	1.04	0.64	0.61	0.52	0.17	0.07	
10/2/2018	0.92	0.64	0.61	0.52	0.17	0.07	
10/3/2018	0.87	0.64	0.61	0.52	0.17	0.07	
10/4/2018	0.88	0.64	0.61	0.52	0.17	0.07	
10/5/2018	0.87	0.64	0.61	0.52	0.17	0.07	
10/6/2018	0.87	0.64	0.60	0.52	0.17	0.07	
10/7/2018	0.88	0.64	0.61	0.52	0.17	0.07	
10/8/2018	0.86	0.64	0.61	0.53	0.17	0.07	
10/9/2018	0.84	0.64	0.61	0.54	0.17	0.07	
10/10/2018	0.85	0.64	0.60	0.54	0.17	0.07	
10/11/2018	0.83	0.66	0.60	0.54	0.17	0.07	
10/12/2018	0.84	0.67	0.61	0.54	0.17	0.08	
10/13/2018	0.85	0.66	0.62	0.54	0.17	0.08	
10/14/2018	0.88	0.67	0.62	0.54	0.17	0.08	
10/15/2018	0.87	0.67	0.60	0.54	0.17	0.08	
10/16/2018	0.88	0.70	0.60	0.55	0.17	0.08	
10/17/2018	0.95	0.65	0.60	0.54	0.17	0.08	
10/18/2018	0.91	0.63	0.61	0.52	0.17	0.08	
10/19/2018	0.90	0.65	0.60	0.53	0.17	0.09	
10/20/2018	0.94	0.65	0.60	0.52	0.17	0.09	
10/21/2018	1.07	0.66	0.59	0.52	0.18	0.08	
10/22/2018	0.95	0.66	0.59	0.53	0.18	0.08	
10/23/2018	0.90	0.64	0.59	0.53	0.18	0.08	
10/24/2018	0.89	0.63	0.60	0.52	0.18	0.08	
10/25/2018	0.88	0.62	0.60	0.53	0.18	0.08	
10/26/2018	0.89	0.59	0.59	0.53	0.18	0.08	
10/27/2018	0.90	0.57	0.59	0.53	0.18	0.08	
10/28/2018	0.90	0.57	0.58	0.52	0.18	0.08	

10/29/2018	0.89	0.58	0.58	0.52	0.18	0.08	
10/30/2018	0.88	0.58	0.57	0.52	0.18	0.08	
10/31/2018	0.85	0.58	0.58	0.53	0.18	0.08	
11/1/2018	0.85	0.64	0.57	0.54	0.18	0.08	
11/2/2018	0.86	0.62	0.56	0.53	0.18	0.08	
11/3/2018	0.85	0.63	0.56	0.53	0.18	0.08	
11/4/2018	0.84	0.67	0.55	0.54	0.18	0.08	
11/5/2018	0.84	0.68	0.53	0.54	0.17	0.08	
11/6/2018	0.84	0.69	0.53	0.54	0.17	0.08	
11/7/2018	0.86	0.68	0.53	0.54	0.17	0.08	
11/8/2018	0.86	0.70	0.53	0.54	0.17	0.08	
11/9/2018	0.91	0.77	0.53	0.55	0.17	0.08	
11/10/2018	0.87	0.80	0.53	0.54	0.17	0.08	
11/11/2018	0.85	0.76	0.54	0.54	0.17	0.08	
11/12/2018	0.84	0.82	0.55	0.55	0.17	0.08	
11/13/2018	0.84	0.85	0.55	0.56	0.17	0.08	
11/14/2018	0.86	0.80	0.54	0.54	0.17	0.08	
11/15/2018	0.90	0.76	0.55	0.54	0.17	0.08	
11/16/2018	0.91	0.71	0.53	0.54	0.17	0.07	
11/17/2018	0.89	0.74	0.55	0.54	0.17	0.07	
11/18/2018	0.89	0.69	0.53	0.54	0.17	0.07	
11/19/2018	0.87	0.69	0.54	0.55	0.16	0.07	
11/20/2018	0.87	0.70	0.54	0.55	0.16	0.07	
11/21/2018	0.86	0.67	0.53	0.54	0.16	0.07	
11/22/2018	0.85	0.66	0.54	0.54	0.16	0.07	
11/23/2018	0.84	0.65	0.53	0.55	0.17	0.08	
11/24/2018	0.85	0.68	0.53	0.55	0.16	0.07	
11/25/2018	0.86	0.66	0.52	0.55	0.17	0.08	
11/26/2018	0.86	0.67	0.52	0.56	0.15	0.07	
11/27/2018	0.85	0.63	0.52	0.55	0.15	0.07	
11/28/2018	0.87	0.63	0.52	0.54	0.16	0.08	
11/29/2018	0.85	0.60	0.54	0.55	0.16	0.08	

11/30/2018	0.89	0.68	0.53	0.55	0.16	0.08	
12/1/2018	0.88	0.75	0.53	0.56	0.16	0.08	
12/2/2018	0.85	0.76	0.52	0.56	0.16	0.08	
12/3/2018	0.86	0.76	0.52	0.57	0.16	0.08	
12/4/2018	0.86	0.64	0.51	0.57	0.16	0.08	
12/5/2018	0.84	0.67	0.51	0.57	0.16	0.07	
12/6/2018	0.85	0.56	0.51	0.55	0.16	0.07	
12/7/2018	0.83	0.54	0.52	0.55	0.16	0.06	
12/8/2018	0.82	0.54	0.52	0.55	0.16	0.06	
12/9/2018	0.83	0.57	0.51	0.56	0.16	0.06	
12/10/2018	0.82	0.59	0.52	0.56	0.16	0.07	
12/11/2018	0.82	0.55	0.52	0.55	0.16	0.07	
12/12/2018	0.87	0.59	0.51	0.55	0.16	0.07	
12/13/2018	0.82	0.74	0.52	0.56	0.16	0.07	
12/14/2018	0.81	0.69	0.52	0.57	0.16	0.06	
12/15/2018	0.81	0.64	0.51	0.55	0.16	0.07	
12/16/2018	0.80	0.64	0.52	0.55	0.16	0.07	
12/17/2018	0.80	0.63	0.52	0.55	0.16	0.07	
12/18/2018	0.79	0.63	0.52	0.55	0.16	0.07	
12/19/2018	0.78	0.58	0.53	0.55	0.16	0.07	
12/20/2018	0.78	0.57	0.52	0.55	0.16	0.07	
12/21/2018	0.79	0.60	0.53	0.55	0.16	0.07	
12/22/2018	0.78	0.60	0.53	0.54	0.16	0.08	
12/23/2018	0.77	0.63	0.52	0.55	0.16	0.07	
12/24/2018	0.77	0.66	0.51	0.55	0.16	0.08	
12/25/2018	0.78	0.64	0.53	0.55	0.16	0.08	
12/26/2018	0.78	0.65	0.51	0.54	0.16	0.08	
12/27/2018	0.77	0.64	0.52	0.55	0.16	0.08	
12/28/2018	0.77	0.72	0.52	0.56	0.16	0.08	
12/29/2018	0.78	0.74	0.52	0.56	0.16	0.08	
12/30/2018	0.80	0.72	0.51	0.56	0.16	0.08	
12/31/2018	0.80	0.65	0.51	0.55	0.16	0.08	

1/1/2019	0.79	0.70	0.52	0.55	0.16	0.07	
1/2/2019	0.78	0.73	0.51	0.56	0.16	0.07	
1/3/2019	0.78	0.87	0.51	0.55	0.16	0.07	
1/4/2019	0.79	0.75	0.51	0.54	0.16	0.06	
1/5/2019	0.79	0.70	0.51	0.53	0.16	0.07	
1/6/2019	0.81	0.72	0.52	0.53	0.16	0.07	
1/7/2019	0.81	0.69	0.51	0.53	0.16	0.07	
1/8/2019	0.80	0.68	0.52	0.53	0.16	0.06	
1/9/2019	0.80	0.65	0.52	0.52	0.17	0.07	
1/10/2019	0.78	0.66	0.53	0.53	0.17	0.07	
1/11/2019	0.79	0.67	0.53	0.53	0.17	0.07	
1/12/2019	0.79	0.68	0.52	0.53	0.17	0.06	
1/13/2019	0.80	0.70	0.52	0.54	0.17	0.06	
1/14/2019	0.80	0.70	0.51	0.54	0.17	0.06	
1/15/2019	0.79	0.69	0.51	0.54	0.17	0.06	
1/16/2019	0.80	0.66	0.51	0.53	0.17	0.07	
1/17/2019	0.78	0.66	0.51	0.53	0.17	0.06	
1/18/2019	0.79	0.66	0.51	0.53	0.17	0.07	
1/19/2019	0.77	0.71	0.51	0.53	0.17	0.06	
1/20/2019	0.78	0.70	0.51	0.52	0.17	0.07	
1/21/2019	0.78	0.72	0.51	0.52	0.17	0.07	
1/22/2019	0.78	0.74	0.52	0.52	0.17	0.07	
1/23/2019	0.76	0.73	0.52	0.53	0.17	0.07	
1/24/2019	0.77	0.73	0.52	0.53	0.17	0.07	
1/25/2019	0.76	0.74	0.51	0.53	0.17	0.07	
1/26/2019	0.78	0.74	0.51	0.53	0.17	0.07	
1/27/2019	0.78	0.73	0.52	0.53	0.17	0.07	
1/28/2019	0.70	0.76	0.51	0.52	0.17	0.07	
1/29/2019	0.61	0.75	0.51	0.53	0.18	0.07	
1/30/2019	0.61	0.75	0.52	0.53	0.18	0.07	
1/31/2019	0.61	0.75	0.51	0.53	0.18	0.06	
2/1/2019	0.62	0.75	0.51	0.52	0.18	0.06	

2/2/2019	0.62	0.74	0.51	0.52	0.18	0.06	
2/3/2019	0.63	0.75	0.51	0.52	0.18	0.07	
2/4/2019	0.62	0.76	0.53	0.52	0.18	0.07	
2/5/2019	0.62	0.74	0.52	0.51	0.18	0.07	
2/6/2019	0.62	0.77	0.51	0.51	0.18	0.06	
2/7/2019	0.62	0.78	0.52	0.53	0.18	0.06	
2/8/2019	0.61	0.87	0.51	0.53	0.17	0.06	
2/9/2019	0.61	0.82	0.51	0.52	0.17	0.06	
2/10/2019	0.59	0.77	0.51	0.51	0.17	0.06	
2/11/2019	0.60	0.81	0.52	0.52	0.17	0.06	
2/12/2019	0.59	0.76	0.52	0.51	0.17	0.06	
2/13/2019	0.60	0.77	0.52	0.51	0.17	0.06	
2/14/2019	0.60	0.72	0.53	0.50	0.17	0.06	
2/15/2019	0.61	0.71	0.53	0.50	0.18	0.06	
2/16/2019	0.60	0.68	0.54	0.50	0.18	0.06	
2/17/2019	0.60	0.72	0.54	0.51	0.17	0.07	
2/18/2019	0.60	0.75	0.54	0.52	0.17	0.06	
2/19/2019	0.60	0.78	0.54	0.50	0.17	0.06	
2/20/2019	0.60	0.75	0.53	0.51	0.17	0.06	
2/21/2019	0.60	0.80	0.54	0.52	0.17	0.05	
2/22/2019	0.60	0.77	0.53	0.50	0.17	0.06	
2/23/2019	0.62	0.73	0.54	0.50	0.17	0.06	
2/24/2019	0.61	0.72	0.54	0.51	0.17	0.06	
2/25/2019	0.61	0.73	0.54	0.51	0.17	0.06	
2/26/2019	0.59	0.74	0.54	0.50	0.17	0.06	
2/27/2019	0.58	0.73	0.54	0.50	0.17	0.06	
2/28/2019	0.58	0.73	0.54	0.49	0.17	0.06	
3/1/2019	0.59	0.73	0.54	0.49	0.17	0.06	
3/2/2019	0.59	0.72	0.54	0.48	0.17	0.06	
3/3/2019	0.59	0.73	0.54	0.49	0.17	0.06	
3/4/2019	0.59	0.71	0.54	0.49	0.17	0.05	
3/5/2019	0.59	0.72	0.54	0.48	0.17	0.05	

3/6/2019	0.59	0.72	0.53	0.49	0.16	0.05	
3/7/2019	0.60	0.74	0.54	0.48	0.16	0.05	
3/8/2019	0.59	0.77	0.54	0.49	0.16	0.05	
3/9/2019	0.59	0.76	0.54	0.49	0.16	0.05	
3/10/2019	0.58	0.72	0.53	0.49	0.16	0.04	
3/11/2019	0.58	0.75	0.53	0.48	0.16	0.05	
3/12/2019	0.58	0.76	0.52	0.48	0.16	0.05	
3/13/2019	0.57	0.79	0.53	0.48	0.16	0.06	
3/14/2019	0.56	0.77	0.53	0.49	0.16	0.04	
3/15/2019	0.57	0.78	0.52	0.48	0.17	0.04	
3/16/2019	0.57	0.79	0.52	0.48	0.17	0.05	
3/17/2019	0.62	0.79	0.53	0.48	0.17	0.05	
3/18/2019	0.61	0.81	0.53	0.48	0.17	0.05	
3/19/2019	0.60	0.81	0.52	0.48	0.16	0.05	
3/20/2019	0.59	0.81	0.52	0.48	0.17	0.05	
3/21/2019	0.60	0.81	0.53	0.47	0.16	0.06	
3/22/2019	0.61	0.81	0.52	0.47	0.17	0.06	
3/23/2019	0.61	0.81	0.52	0.47	0.18	0.05	
3/24/2019	0.60	0.81	0.51	0.47	0.18	0.05	
3/25/2019	0.60	0.81	0.52	0.47	0.18	0.05	
3/26/2019	0.60	0.82	0.51	0.47	0.18	0.06	
3/27/2019	0.58	0.82	0.52	0.47	0.18	0.06	
3/28/2019	0.61	0.82	0.52	0.47	0.18	0.06	
3/29/2019	0.59	0.83	0.52	0.47	0.18	0.06	
3/30/2019	0.59	0.85	0.52	0.47	0.18	0.06	
3/31/2019	0.59	0.81	0.53	0.46	0.17	0.06	
4/1/2019	0.59	0.86	0.52	0.47	0.17	0.06	
4/2/2019	0.59	0.84	0.52	0.46	0.17	0.06	
4/3/2019	0.59	0.82	0.52	0.46	0.18	0.06	
4/4/2019	0.59	0.83	0.52	0.46	0.18	0.06	
4/5/2019	0.59	0.80	0.51	0.46	0.18	0.06	
4/6/2019	0.59	0.82	0.52	0.46	0.18	0.06	

4/7/2019	0.59	0.79	0.52	0.46	0.18	0.06	
4/8/2019	0.59	0.81	0.52	0.45	0.18	0.06	
4/9/2019	0.58	0.80	0.53	0.45	0.18	0.06	
4/10/2019	0.58	0.81	0.52	0.45	0.18	0.06	
4/11/2019	0.58	0.79	0.52	0.44	0.18	0.06	
4/12/2019	0.59	0.80	0.52	0.45	0.18	0.06	
4/13/2019	0.57	0.84	0.52	0.45	0.18	0.06	
4/14/2019	0.57	0.83	0.53	0.44	0.18	0.06	
4/15/2019	0.56	0.84	0.53	0.45	0.18	0.06	
4/16/2019	0.57	0.81	0.53	0.44	0.18	0.06	
4/17/2019	0.58	0.81	0.53	0.45	0.18	0.06	
4/18/2019	0.57	0.82	0.53	0.45	0.18	0.06	
4/19/2019	0.58	0.81	0.53	0.45	0.18	0.06	
4/20/2019	0.56	0.79	0.51	0.45	0.18	0.06	
4/21/2019	0.58	0.82	0.52	0.44	0.18	0.06	
4/22/2019	0.58	0.79	0.52	0.44	0.18	0.06	
4/23/2019	0.58	0.77	0.52	0.44	0.18	0.06	
4/24/2019	0.58	0.78	0.52	0.44	0.18	0.06	
4/25/2019	0.58	0.77	0.53	0.44	0.18	0.06	
4/26/2019	0.58	0.75	0.53	0.44	0.18	0.06	
4/27/2019	0.58	0.76	0.52	0.44	0.18	0.06	
4/28/2019	0.57	0.76	0.53	0.44	0.18	0.06	
4/29/2019	0.56	0.76	0.53	0.44	0.18	0.06	
4/30/2019	0.58	0.79	0.53	0.44	0.18	0.06	
5/1/2019	0.58	0.75	0.52	0.44	0.18	0.06	
5/2/2019	0.57	0.79	0.53	0.44	0.18	0.06	
5/3/2019	0.59	0.78	0.53	0.44	0.18	0.06	
5/4/2019	0.56	0.78	0.53	0.44	0.18	0.06	
5/5/2019	0.57	0.77	0.52	0.44	0.18	0.06	
5/6/2019	0.57	0.75	0.52	0.44	0.18	0.06	
5/7/2019	0.57	0.75	0.52	0.44	0.18	0.06	
5/8/2019	0.58	0.72	0.52	0.44	0.18	0.06	

5/9/2019	0.58	0.72	0.53	0.44	0.18	0.06	
5/10/2019	0.58	0.73	0.53	0.44	0.18	0.06	
5/11/2019	0.59	0.71	0.53	0.44	0.18	0.06	
5/12/2019	0.58	0.73	0.53	0.44	0.18	0.06	
5/13/2019	0.56	0.71	0.54	0.44	0.18	0.06	
5/14/2019	0.57	0.72	0.53	0.44	0.18	0.07	
5/15/2019	0.58	0.73	0.53	0.44	0.18	0.07	
5/16/2019	0.58	0.75	0.54	0.44	0.17	0.08	
5/17/2019	0.61	0.79	0.53	0.46	0.17	0.09	
5/18/2019	0.60	0.79	0.53	0.45	0.18	0.09	
5/19/2019	0.58	0.77	0.54	0.45	0.18	0.08	
5/20/2019	0.58	0.76	0.54	0.45	0.18	0.07	
5/21/2019	0.58	0.76	0.53	0.45	0.18	0.07	
5/22/2019	0.58	0.77	0.53	0.45	0.18	0.07	
5/23/2019	0.58	0.74	0.55	0.45	0.18	0.06	
5/24/2019	0.58	0.75	0.54	0.45	0.18	0.05	
5/25/2019	0.59	0.78	0.54	0.44	0.18	0.05	
5/26/2019	0.59	0.76	0.55	0.44	0.18	0.05	
5/27/2019	0.58	0.72	0.54	0.44	0.18	0.06	
5/28/2019	0.58	0.73	0.54	0.45	0.18	0.06	
5/29/2019	0.58	0.73	0.55	0.45	0.18	0.05	
5/30/2019	0.57	0.74	0.55	0.44	0.18	0.05	
5/31/2019	0.57	0.74	0.54	0.45	0.18	0.05	
6/1/2019	0.56	0.74	0.55	0.44	0.18	0.06	
6/2/2019	0.56	0.76	0.56	0.44	0.18	0.07	
6/3/2019	0.55	0.74	0.55	0.44	0.18	0.09	
6/4/2019	0.55	0.79	0.55	0.45	0.18	0.09	
6/5/2019	0.54	0.83	0.56	0.44	0.18	0.09	
6/6/2019	0.59	0.80	0.57	0.44	0.18	0.09	
6/7/2019	0.67	0.87	0.56	0.45	0.18	0.10	
6/8/2019	0.62	0.90	0.56	0.45	0.18	0.10	
6/9/2019	0.57	0.98	0.56	0.45	0.18	0.09	

6/10/2019	0.67	0.98	0.56	0.45	0.19	0.09	
6/11/2019	0.63	0.99	0.57	0.45	0.19	0.09	
6/12/2019	0.59	1.02	0.57	0.46	0.19	0.09	
6/13/2019	0.57	1.07	0.58	0.46	0.19	0.09	
6/14/2019	0.61	1.10	0.57	0.46	0.19	0.10	
6/15/2019	0.55	1.19	0.58	0.46	0.19	0.09	
6/16/2019	0.54	1.25	0.58	0.46	0.19	0.09	
6/17/2019	0.57	1.26	0.59	0.46	0.19	0.09	
6/18/2019	0.57	1.37	0.60	0.46	0.19	0.09	
6/19/2019	0.54	1.62	0.60	0.47	0.19	0.09	
6/20/2019	0.52	1.70	0.62	0.48	0.19	0.08	
6/21/2019	0.52	1.67	0.61	0.47	0.19	0.08	
6/22/2019	0.51	1.56	0.62	0.47	0.19	0.08	
6/23/2019	0.46	1.62	0.62	0.48	0.19	0.08	
6/24/2019	0.48	1.63	0.63	0.48	0.19	0.08	
6/25/2019	0.50	1.66	0.65	0.48	0.19	0.08	
6/26/2019	0.41	1.67	0.64	0.47	0.19	0.08	
6/27/2019	0.36	1.71	0.66	0.47	0.19	0.08	
6/28/2019	0.55	1.69	0.67	0.47	0.19	0.08	
6/29/2019	0.62	1.73	0.67	0.48	0.19	0.08	
6/30/2019	0.59	1.74	0.68	0.48	0.19	0.08	
7/1/2019	0.49	1.65	0.69	0.49	0.19	0.08	
7/2/2019	0.68	1.81	0.70	0.49	0.19	0.08	
7/3/2019	0.84	1.80	0.70	0.49	0.19	0.08	
7/4/2019	0.69	2.08	0.70	0.50	0.19	0.08	
7/5/2019	0.68	2.00	0.72	0.50	0.19	0.07	
7/6/2019	0.89	1.98	0.72	0.51	0.19	0.07	
7/7/2019	0.98	2.00	0.72	0.51	0.20	0.07	
7/8/2019	1.25	2.09	0.74	0.51	0.20	0.08	
7/9/2019	1.10	2.10	0.74	0.52	0.20	0.07	
7/10/2019	1.26	2.21	0.75	0.52	0.20	0.10	
7/11/2019	0.82	2.16	0.77	0.53	0.20	0.16	

7/12/2019	0.80	2.14	0.77	0.53	0.20	0.17	
7/13/2019	0.79	2.16	0.75	0.54	0.20	0.12	
7/14/2019	0.60	2.18	0.77	0.53	0.20	0.12	
7/15/2019	0.81	2.14	0.77	0.54	0.20	0.13	
7/16/2019	0.65	2.08	0.77	0.55	0.20	0.10	
7/17/2019	0.69	2.08	0.77	0.55	0.20	0.07	
7/18/2019	0.72	2.23	0.77	0.55	0.20	0.07	
7/19/2019	0.72	2.09	0.79	0.56	0.20	0.07	
7/20/2019	0.73	2.14	0.77	0.56	0.20	0.06	
7/21/2019	0.67	2.11	0.79	0.56	0.20	0.07	
7/22/2019	0.68	2.14	0.78	0.56	0.20	0.06	
7/23/2019	0.66	2.09	0.78	0.57	0.20	0.06	
7/24/2019	0.81	1.95	0.78	0.57	0.20	0.07	
7/25/2019	0.95	1.87	0.79	0.57	0.20	0.06	
7/26/2019	0.88	1.79	0.80	0.57	0.20	0.06	
7/27/2019	0.93	1.71	0.81	0.57	0.20	0.05	
7/28/2019	0.99	1.69	0.80	0.57	0.20	0.06	
7/29/2019	0.91	1.68	0.79	0.58	0.20	0.06	
7/30/2019	0.45	1.66	0.79	0.58	0.20	0.06	
7/31/2019	0.68	1.65	0.79	0.58	0.20	0.06	
8/1/2019	0.72	1.64	0.79	0.58	0.20	0.06	
8/2/2019	0.67	1.62	0.80	0.59	0.20	0.05	
8/3/2019	0.78	1.61	0.78	0.59	0.20	0.06	
8/4/2019	0.72	1.59	0.79	0.59	0.20	0.05	
8/5/2019	0.74	1.58	0.80	0.60	0.20	0.06	
8/6/2019	0.73	1.57	0.79	0.60	0.20	0.06	
8/7/2019	0.73	1.55	0.79	0.60	0.20	0.06	
8/8/2019	0.73	1.54	0.79	0.59	0.20	0.06	
8/9/2019	0.74	1.52	0.78	0.59	0.20	0.06	
8/10/2019	0.74	1.51	0.79	0.59	0.20	0.06	
8/11/2019	0.74	1.50	0.79	0.60	0.20	0.06	
8/12/2019	0.78	1.48	0.78	0.60	0.20	0.06	

8/13/2019	0.76	1.47	0.78	0.60	0.20	0.06	
8/14/2019	0.78	1.45	0.79	0.60	0.20	0.06	
8/15/2019	0.63	1.44	0.78	0.61	0.20	0.06	
8/16/2019	0.80	1.41	0.79	0.61	0.20	0.06	
8/17/2019	0.81	1.33	0.77	0.62	0.20	0.06	
8/18/2019	0.88	1.31	0.78	0.62	0.20	0.06	
8/19/2019	0.90	1.37	0.79	0.62	0.20	0.06	
8/20/2019	0.89	1.39	0.79	0.62	0.20	0.06	
8/21/2019	0.89	1.35	0.79	0.62	0.20	0.06	
8/22/2019	0.89	1.38	0.78	0.62	0.20	0.06	
8/23/2019	0.87	1.40	0.78	0.63	0.20	0.06	
8/24/2019	0.89	1.32	0.78	0.62	0.20	0.06	
8/25/2019	0.88	1.20	0.79	0.62	0.20	0.06	
8/26/2019	0.88	1.13	0.80	0.62	0.20	0.06	
8/27/2019	0.87	1.15	0.80	0.63	0.20	0.06	
8/28/2019	0.87	1.22	0.79	0.63	0.20	0.06	
8/29/2019	0.87	1.28	0.79	0.63	0.20	0.06	
8/30/2019	0.87	1.28	0.76	0.63	0.20	0.06	
8/31/2019	0.87	1.30	0.79	0.64	0.20	0.06	
9/1/2019	0.88	1.26	0.79	0.64	0.20	0.06	
9/2/2019	0.87	1.20	0.79	0.64	0.20	0.06	
9/3/2019	0.87	1.05	0.79	0.64	0.20	0.06	
9/4/2019	0.87	0.97	0.79	0.65	0.20	0.06	
9/5/2019	0.88	0.95	0.79	0.65	0.20	0.06	
9/6/2019	0.87	0.94	0.79	0.65	0.20	0.06	
9/7/2019	0.88	0.96	0.80	0.65	0.20	0.06	
9/8/2019	0.90	0.99	0.80	0.65	0.20	0.06	
9/9/2019	0.93	0.98	0.77	0.65	0.20	0.06	
9/10/2019	0.94	0.99	0.79	0.66	0.20	0.06	
9/11/2019	0.94	0.96	0.78	0.66	0.20	0.06	
9/12/2019	0.94	0.87	0.78	0.66	0.20	0.06	
9/13/2019	0.90	0.92	0.79	0.66	0.19	0.06	

9/14/2019	0.88	0.91	0.78	0.67	0.19	0.06	
9/15/2019	0.88	0.91	0.77	0.67	0.19	0.07	
9/16/2019	0.87	0.94	0.79	0.67	0.20	0.07	
9/17/2019	0.93	0.93	0.78	0.67	0.20	0.07	
9/18/2019	0.91	0.93	0.78	0.67	0.20	0.06	
9/19/2019	0.91	0.92	0.79	0.67	0.20	0.06	
9/20/2019	0.91	0.89	0.78	0.67	0.20	0.06	
9/21/2019	0.91	0.89	0.78	0.67	0.20	0.06	
9/22/2019	0.92	0.92	0.76	0.68	0.19	0.06	
9/23/2019	0.92	0.95	0.73	0.68	0.19	0.06	
9/24/2019	0.92	0.91	0.78	0.68	0.19	0.06	
9/25/2019	0.90	0.92	0.75	0.68	0.19	0.06	
9/26/2019	0.89	0.88	0.78	0.69	0.19	0.06	
9/27/2019	0.89	0.90	0.77	0.69	0.19	0.07	
9/28/2019	0.90	0.90	0.76	0.69	0.19	0.07	
9/29/2019	0.90	0.88	0.77	0.69	0.19	0.07	
9/30/2019	0.92	0.88	0.76	0.69	0.19	0.07	
10/1/2019	0.94	0.90	0.78	0.69	0.19	0.07	
10/2/2019	0.93	0.91	0.76	0.69	0.19	0.07	
10/3/2019	0.82	0.96	0.77	0.70	0.19	0.07	
10/4/2019	0.96	0.96	0.77	0.70	0.19	0.07	
10/5/2019	0.94	0.93	0.78	0.70	0.19	0.07	
10/6/2019	0.93	0.97	0.78	0.70	0.19	0.07	
10/7/2019	0.92	1.00	0.76	0.70	0.19	0.07	
10/8/2019	0.91	0.98	0.77	0.69	0.19	0.07	
10/9/2019	0.90	0.95	0.76	0.69	0.19	0.07	
10/10/2019	0.89	0.93	0.76	0.69	0.19	0.07	
10/11/2019	0.88	1.05	0.77	0.69	0.19	0.07	
10/12/2019	0.88	1.10	0.76	0.69	0.19	0.07	
10/13/2019	0.87	0.94	0.77	0.69	0.19	0.07	
10/14/2019	0.87	0.85	0.76	0.68	0.19	0.07	
10/15/2019	0.85	0.71	0.75	0.68	0.19	0.07	

10/16/2019	0.86	0.77	0.75	0.68	0.18	0.07	
10/17/2019	0.87	0.83	0.77	0.68	0.18	0.06	
10/18/2019	0.86	0.81	0.79	0.68	0.18	0.07	
10/19/2019	0.88	0.80	0.76	0.67	0.18	0.06	
10/20/2019	0.88	0.84	0.77	0.68	0.17	0.06	
10/21/2019	0.85	0.84	0.78	0.68	0.17	0.06	
10/22/2019	0.55	0.87	0.79	0.69	0.16	0.06	
10/23/2019	1.11	0.83	0.75	0.68	0.16	0.07	
10/24/2019	0.91	0.80	0.76	0.68	0.17	0.07	
10/25/2019	0.82	0.77	0.78	0.69	0.16	0.06	
10/26/2019	0.81	0.74	0.76	0.68	0.17	0.07	
10/27/2019	0.80	0.76	0.76	0.68	0.18	0.08	
10/28/2019	0.81	0.76	0.75	0.68	0.18	0.08	
10/29/2019	0.80	0.81	0.76	0.69	0.17	0.07	
10/30/2019	0.80	0.84	0.74	0.70	0.16	0.08	
10/31/2019	0.80	0.89	0.78	0.71	0.15	0.07	
11/1/2019	0.81	0.84	0.76	0.68	0.16	0.08	
11/2/2019	0.80	0.82	0.79	0.68	0.16	0.07	
11/3/2019	0.79	0.82	0.78	0.68	0.16	0.08	
11/4/2019	0.87	0.80	0.75	0.68	0.16	0.08	
11/5/2019	0.87	0.79	0.77	0.68	0.16	0.08	
11/6/2019	0.87	0.80	0.76	0.68	0.17	0.07	
11/7/2019	0.86	0.81	0.75	0.68	0.17	0.06	
11/8/2019	0.86	0.81	0.77	0.68	0.17	0.06	
11/9/2019	0.86	0.80	0.76	0.68	0.17	0.06	
11/10/2019	0.84	0.80	0.77	0.68	0.17	0.06	
11/11/2019	0.83	0.81	0.77	0.68	0.17	0.07	
11/12/2019	0.82	0.81	0.73	0.68	0.16	0.06	
11/13/2019	0.83	0.80	0.77	0.67	0.16	0.07	
11/14/2019	0.82	0.80	0.77	0.67	0.16	0.07	
11/15/2019	0.83	0.80	0.76	0.67	0.16	0.07	
11/16/2019	0.83	0.81	0.77	0.67	0.16	0.07	

11/17/2019	0.83	0.80	0.75	0.67	0.16	0.07	
11/18/2019	0.82	0.80	0.74	0.67	0.16	0.07	
11/19/2019	0.84	0.82	0.74	0.67	0.16	0.07	
11/20/2019	0.84	0.83	0.74	0.67	0.16	0.08	
11/21/2019	0.83	0.79	0.74	0.67	0.16	0.08	
11/22/2019	0.82	0.79	0.74	0.67	0.16	0.08	
11/23/2019	0.81	0.78	0.75	0.67	0.16	0.08	
11/24/2019	0.81	0.77	0.74	0.67	0.15	0.08	
11/25/2019	0.80	0.77	0.74	0.67	0.15	0.09	
11/26/2019	0.80	0.76	0.73	0.68	0.15	0.10	
11/27/2019	0.80	0.75	0.73	0.70	0.15	0.08	
11/28/2019	0.79	0.75	0.73	0.68	0.15	0.08	
11/29/2019	0.81	0.74	0.74	0.67	0.15	0.08	
11/30/2019	0.80	0.73	0.73	0.68	0.15	0.08	
12/1/2019	0.80	0.73	0.74	0.67	0.15	0.07	
12/2/2019	0.82	0.72	0.73	0.65	0.15	0.07	
12/3/2019	0.82	0.71	0.75	0.64	0.15	0.08	
12/4/2019	0.82	0.71	0.71	0.64	0.15	0.08	
12/5/2019	0.82	0.70	0.75	0.64	0.15	0.08	
12/6/2019	0.81	0.70	0.74	0.64	0.14	0.08	
12/7/2019	0.80	0.69	0.73	0.64	0.14	0.08	
12/8/2019	0.80	0.68	0.74	0.63	0.14	0.08	
12/9/2019	0.78	0.68	0.73	0.64	0.14	0.09	
12/10/2019	0.76	0.67	0.71	0.64	0.14	0.08	
12/11/2019	0.75	0.66	0.71	0.64	0.14	0.08	
12/12/2019	0.75	0.66	0.71	0.63	0.14	0.09	
12/13/2019	0.77	0.65	0.75	0.63	0.14	0.09	
12/14/2019	0.81	0.64	0.73	0.63	0.14	0.09	
12/15/2019	0.81	0.64	0.71	0.63	0.14	0.09	
12/16/2019	0.80	0.63	0.75	0.64	0.14	0.09	
12/17/2019	0.78	0.62	0.72	0.66	0.14	0.09	
12/18/2019	0.78	0.62	0.71	0.65	0.14	0.08	

12/19/2019	0.77	0.61	0.72	0.63	0.13	0.06	
12/20/2019	0.80	0.60	0.71	0.64	0.13	0.06	
12/21/2019	0.80	0.60	0.71	0.63	0.13	0.06	
12/22/2019	0.80	0.59	0.74	0.62	0.13	0.06	
12/23/2019	0.76	0.59	0.72	0.61	0.13	0.07	
12/24/2019	0.75	0.58	0.72	0.62	0.13	0.07	
12/25/2019	0.74	0.57	0.74	0.62	0.13	0.07	
12/26/2019	0.73	0.57	0.73	0.63	0.13	0.06	
12/27/2019	0.72	0.58	0.73	0.63	0.13	0.06	
12/28/2019	0.71	0.56	0.73	0.63	0.13	0.07	
12/29/2019	0.71	0.60	0.74	0.64	0.13	0.07	
12/30/2019	0.69	0.67	0.73	0.66	0.13	0.07	
12/31/2019	0.70	0.66	0.72	0.65	0.12	0.07	
1/1/2020	0.69	0.65	0.72	0.63	0.12	0.07	
1/2/2020	0.69	0.63	0.72	0.63	0.12	0.07	
1/3/2020	0.68	0.65	0.74	0.64	0.12	0.07	
1/4/2020	0.67	0.66	0.69	0.63	0.12	0.07	
1/5/2020	0.66	0.63	0.72	0.62	0.12	0.06	
1/6/2020	0.66	0.64	0.71	0.62	0.12	0.06	
1/7/2020	0.66	0.65	0.69	0.63	0.12	0.06	
1/8/2020	0.65	0.65	0.70	0.63	0.12	0.06	
1/9/2020	0.66	0.64	0.71	0.62	0.12	0.06	
1/10/2020	0.65	0.65	0.72	0.63	0.12	0.06	
1/11/2020	0.65	0.69	0.70	0.64	0.12	0.06	
1/12/2020	0.63	0.68	0.69	0.63	0.12	0.06	
1/13/2020	0.62	0.70	0.73	0.64	0.12	0.06	
1/14/2020	0.62	0.68	0.72	0.63	0.12	0.06	
1/15/2020	0.62	0.69	0.71	0.62	0.12	0.06	
1/16/2020	0.61	0.70	0.71	0.62	0.12	0.06	
1/17/2020	0.59	0.70	0.72	0.61	0.12	0.06	
1/18/2020	0.59	0.71	0.69	0.62	0.12	0.05	
1/19/2020	0.58	0.71	0.70	0.61	0.13	0.05	

1/20/2020	0.57	0.72	0.70	0.61	0.13	0.06	
1/21/2020	0.56	0.80	0.71	0.61	0.13	0.06	
1/22/2020	0.56	0.79	0.71	0.61	0.13	0.07	
1/23/2020	0.47	0.77	0.70	0.61	0.13	0.06	
1/24/2020	0.33	0.78	0.69	0.61	0.13	0.06	
1/25/2020	0.48	0.80	0.68	0.61	0.13	0.07	
1/26/2020	0.88	0.81	0.68	0.61	0.14	0.06	
1/27/2020	0.74	0.80	0.72	0.60	0.14	0.07	
1/28/2020	0.74	0.80	0.70	0.61	0.14	0.07	
1/29/2020	0.73	0.84	0.70	0.62	0.14	0.07	
1/30/2020	0.72	0.85	0.70	0.61	0.14	0.07	
1/31/2020	0.72	0.86	0.70	0.62	0.14	0.06	
2/1/2020	0.73	0.85	0.70	0.62	0.14	0.05	
2/2/2020	0.72	0.85	0.70	0.60	0.14	0.06	
2/3/2020	0.72	0.84	0.70	0.60	0.15	0.08	
2/4/2020	0.71	0.84	0.70	0.61	0.15	0.07	
2/5/2020	0.69	0.84	0.70	0.63	0.15	0.06	
2/6/2020	0.71	0.83	0.71	0.63	0.15	0.05	
2/7/2020	0.70	0.83	0.71	0.61	0.15	0.04	
2/8/2020	0.70	0.82	0.71	0.60	0.15	0.04	
2/9/2020	0.70	0.87	0.71	0.60	0.15	0.05	
2/10/2020	0.70	0.85	0.71	0.60	0.16	0.05	
2/11/2020	0.69	0.85	0.71	0.60	0.16	0.05	
2/12/2020	0.69	0.88	0.71	0.61	0.16	0.05	
2/13/2020	0.69	0.92	0.71	0.61	0.16	0.05	
2/14/2020	0.68	0.91	0.71	0.61	0.16	0.05	
2/15/2020	0.69	0.89	0.71	0.59	0.16	0.05	
2/16/2020	0.71	0.89	0.71	0.60	0.16	0.05	
2/17/2020	0.69	0.88	0.72	0.59	0.16	0.06	
2/18/2020	0.69	0.87	0.72	0.59	0.16	0.05	
2/19/2020	0.69	0.87	0.71	0.60	0.16	0.05	
2/20/2020	0.68	0.86	0.71	0.59	0.16	0.05	

2/21/2020	0.69	0.85	0.71	0.60	0.16	0.05	
2/22/2020	0.68	0.85	0.71	0.58	0.16	0.06	
2/23/2020	0.67	0.84	0.71	0.58	0.17	0.05	
2/24/2020	0.67	0.83	0.70	0.59	0.17	0.06	
2/25/2020	0.66	0.83	0.70	0.60	0.16	0.05	
2/26/2020	0.67	0.82	0.70	0.61	0.15	0.05	
2/27/2020	0.68	0.81	0.70	0.60	0.15	0.05	
2/28/2020	0.68	0.81	0.70	0.58	0.16	0.06	
2/29/2020	0.70	0.80	0.69	0.58	0.16	0.06	
3/1/2020	0.69	0.82	0.69	0.58	0.16	0.06	
3/2/2020	0.69	0.78	0.69	0.58	0.16	0.06	
3/3/2020	0.69	0.79	0.69	0.58	0.16	0.06	
3/4/2020	0.68	0.80	0.69	0.58	0.16	0.06	
3/5/2020	0.68	0.82	0.68	0.57	0.16	0.06	
3/6/2020	0.67	0.81	0.68	0.58	0.16	0.06	
3/7/2020	0.68	0.82	0.68	0.57	0.16	0.06	
3/8/2020	0.70	0.81	0.68	0.57	0.16	0.06	
3/9/2020	0.69	0.79	0.68	0.57	0.16	0.06	
3/10/2020	0.67	0.79	0.68	0.57	0.16	0.05	
3/11/2020	0.67	0.79	0.67	0.57	0.16	0.05	
3/12/2020	0.67	0.80	0.67	0.57	0.16	0.05	
3/13/2020	0.67	0.81	0.67	0.57	0.16	0.05	
3/14/2020	0.65	0.80	0.67	0.57	0.17	0.05	
3/15/2020	0.65	0.79	0.67	0.57	0.17	0.06	
3/16/2020	0.66	0.68	0.66	0.57	0.17	0.06	
3/17/2020	0.66	0.74	0.66	0.57	0.17	0.05	
3/18/2020	0.66	0.79	0.66	0.56	0.17	0.06	
3/19/2020	0.64	0.78	0.66	0.56	0.17	0.05	
3/20/2020	0.61	0.78	0.66	0.57	0.17	0.05	
3/21/2020	0.60	0.80	0.65	0.57	0.17	0.05	
3/22/2020	0.60	0.80	0.65	0.57	0.17	0.06	
3/23/2020	0.61	0.78	0.65	0.57	0.17	0.06	

3/24/2020	0.61	0.80	0.65	0.57	0.17	0.06	
3/25/2020	0.58	0.81	0.65	0.57	0.17	0.06	
3/26/2020	0.60	0.78	0.65	0.56	0.17	0.06	
3/27/2020	0.59	0.82	0.64	0.56	0.18	0.06	
3/28/2020	0.59	0.82	0.64	0.57	0.17	0.06	
3/29/2020	0.58	0.82	0.64	0.57	0.16	0.05	
3/30/2020	0.59	0.84	0.64	0.57	0.16	0.06	
3/31/2020	0.57	0.81	0.64	0.56	0.17	0.06	
4/1/2020	0.57	0.81	0.63	0.56	0.16	0.07	
4/2/2020	0.57	0.79	0.63	0.55	0.17	0.06	
4/3/2020	0.58	0.79	0.63	0.56	0.17	0.05	
4/4/2020	0.68	0.80	0.63	0.57	0.16	0.06	
4/5/2020	0.70	0.81	0.63	0.56	0.17	0.06	
4/6/2020	0.70	0.78	0.63	0.56	0.17	0.06	
4/7/2020	0.70	0.74	0.63	0.55	0.17	0.05	
4/8/2020	0.70	0.70	0.63	0.55	0.18	0.05	
4/9/2020	0.70	0.68	0.63	0.55	0.18	0.05	
4/10/2020	0.69	0.66	0.63	0.55	0.18	0.05	
4/11/2020	0.68	0.65	0.64	0.55	0.18	0.05	
4/12/2020	0.69	0.69	0.64	0.55	0.17	0.05	
4/13/2020	0.67	0.65	0.64	0.56	0.17	0.05	
4/14/2020	0.66	0.68	0.60	0.56	0.17	0.05	
4/15/2020	0.66	0.68	0.60	0.57	0.17	0.05	
4/16/2020	0.66	0.68	0.59	0.55	0.17	0.05	
4/17/2020	0.66	0.68	0.63	0.55	0.17	0.04	
4/18/2020	0.66	0.68	0.63	0.55	0.17	0.04	
4/19/2020	0.60	0.68	0.63	0.54	0.17	0.05	
4/20/2020	0.65	0.68	0.64	0.54	0.17	0.04	
4/21/2020	0.66	0.68	0.64	0.54	0.17	0.04	
4/22/2020	0.65	0.68	0.64	0.54	0.17	0.05	
4/23/2020	0.65	0.65	0.62	0.54	0.17	0.04	
4/24/2020	0.64	0.66	0.62	0.54	0.17	0.05	

4/25/2020	0.64	0.65	0.63	0.54	0.17	0.05	
4/26/2020	0.64	0.67	0.62	0.54	0.17	0.05	
4/27/2020	0.64	0.66	0.60	0.53	0.17	0.05	
4/28/2020	0.64	0.65	0.60	0.53	0.17	0.05	
4/29/2020	0.64	0.65	0.59	0.53	0.17	0.05	
4/30/2020	0.64	0.66	0.61	0.53	0.17	0.05	
5/1/2020	0.65	0.67	0.61	0.53	0.17	0.06	
5/2/2020	0.64	0.68	0.62	0.53	0.17	0.07	
5/3/2020	0.64	0.74	0.63	0.53	0.17	0.06	
5/4/2020	0.64	0.72	0.63	0.54	0.17	0.07	
5/5/2020	0.62	0.72	0.63	0.54	0.17	0.07	
5/6/2020	0.64	0.73	0.63	0.54	0.17	0.07	
5/7/2020	0.64	0.69	0.63	0.54	0.17	0.07	
5/8/2020	0.64	0.69	0.63	0.54	0.17	0.07	
5/9/2020	0.62	0.70	0.63	0.52	0.17	0.07	
5/10/2020	0.61	0.68	0.62	0.51	0.17	0.07	
5/11/2020	0.61	0.71	0.64	0.50	0.17	0.07	
5/12/2020	0.61	0.65	0.64	0.50	0.17	0.07	
5/13/2020	0.60	0.66	0.63	0.50	0.17	0.06	
5/14/2020	0.60	0.66	0.64	0.50	0.18	0.06	
5/15/2020	0.60	0.64	0.64	0.50	0.18	0.07	
5/16/2020	0.61	0.68	0.64	0.50	0.18	0.07	
5/17/2020	0.61	0.69	0.64	0.49	0.18	0.06	
5/18/2020	0.68	0.71	0.64	0.49	0.18	0.07	
5/19/2020	0.79	0.75	0.65	0.48	0.18	0.08	
5/20/2020	0.76	0.79	0.65	0.48	0.18	0.08	
5/21/2020	0.91	0.77	0.64	0.48	0.18	0.08	
5/22/2020	0.96	0.73	0.65	0.48	0.18	0.08	
5/23/2020	0.83	0.75	0.67	0.48	0.18	0.08	
5/24/2020	0.94	0.74	0.68	0.48	0.18	0.07	
5/25/2020	0.98	0.71	0.69	0.49	0.18	0.07	
5/26/2020	0.98	0.73	0.70	0.49	0.18	0.07	

5/27/2020	0.98	0.75	0.63	0.49	0.18	0.07	
5/28/2020	0.98	0.77	0.63	0.48	0.18	0.07	
5/29/2020	0.98	0.78	0.65	0.48	0.18	0.07	
5/30/2020	1.01	0.80	0.65	0.48	0.18	0.08	
5/31/2020	1.00	0.80	0.65	0.48	0.18	0.08	
6/1/2020	0.98	0.81	0.65	0.48	0.18	0.08	
6/2/2020	1.01	0.84	0.63	0.48	0.18	0.08	
6/3/2020	0.94	0.82	0.64	0.48	0.18	0.07	
6/4/2020	0.94	0.88	0.65	0.49	0.18	0.06	
6/5/2020	0.94	0.87	0.65	0.49	0.18	0.06	
6/6/2020	0.98	0.89	0.65	0.49	0.18	0.06	
6/7/2020	0.98	0.91	0.65	0.49	0.18	0.06	
6/8/2020	0.97	0.94	0.65	0.49	0.18	0.06	
6/9/2020	0.97	0.96	0.67	0.50	0.18	0.06	
6/10/2020	0.94	1.00	0.66	0.50	0.18	0.05	
6/11/2020	0.94	0.99	0.66	0.50	0.18	0.06	
6/12/2020	0.93	1.01	0.66	0.50	0.18	0.06	
6/13/2020	0.93	1.05	0.66	0.50	0.18	0.06	
6/14/2020	0.92	1.03	0.66	0.50	0.18	0.06	
6/15/2020	0.91	1.05	0.66	0.51	0.18	0.06	
6/16/2020	0.86	1.05	0.67	0.51	0.19	0.06	
6/17/2020	0.88	1.08	0.67	0.51	0.19	0.06	
6/18/2020	0.87	1.08	0.67	0.51	0.19	0.06	
6/19/2020	0.88	1.10	0.67	0.51	0.19	0.06	
6/20/2020	0.87	1.10	0.68	0.51	0.19	0.06	
6/21/2020	0.82	1.10	0.67	0.51	0.19	0.06	
6/22/2020	0.73	1.08	0.66	0.51	0.19	0.06	
6/23/2020	0.62	1.07	0.65	0.51	0.19	0.06	
6/24/2020	0.62	1.07	0.64	0.52	0.19	0.06	
6/25/2020	0.63	0.99	0.63	0.52	0.19	0.06	
6/26/2020	0.63	0.94	0.62	0.52	0.19	0.06	
6/27/2020	0.65	0.97	0.61	0.52	0.19	0.06	

6/28/2020	0.72	1.09	0.60	0.52	0.19	0.07	
6/29/2020	0.71	1.09	0.59	0.52	0.19	0.07	
6/30/2020	0.70	1.05	0.58	0.53	0.19	0.06	
7/1/2020	0.77	0.95	0.56	0.53	0.19	0.06	
7/2/2020	0.70	0.92	0.55	0.53	0.19	0.06	
7/3/2020	0.69	0.96	0.54	0.52	0.19	0.07	
7/4/2020	0.67	0.95	0.52	0.52	0.19	0.06	
7/5/2020	0.69	0.94	0.51	0.53	0.19	0.07	
7/6/2020	0.68	0.93	0.51	0.53	0.19	0.07	
7/7/2020	0.69	0.92	0.51	0.53	0.19	0.05	
7/8/2020	0.66	0.92	0.51	0.53	0.19	0.04	
7/9/2020	0.65	0.91	0.51	0.53	0.19	0.04	
7/10/2020	0.74	0.88	0.51	0.54	0.19	0.04	
7/11/2020	0.73	0.90	0.57	0.53	0.19	0.04	
7/12/2020	0.67	0.89	0.67	0.52	0.19	0.04	
7/13/2020	0.65	0.89	0.61	0.52	0.19	0.04	
7/14/2020	0.66	0.88	0.44	0.52	0.20	0.04	
7/15/2020	0.65	0.88	0.44	0.53	0.19	0.04	
7/16/2020	0.64	0.86	0.44	0.53	0.18	0.04	
7/17/2020	0.63	0.86	0.44	0.52	0.18	0.04	
7/18/2020	0.74	0.86	0.17	0.53	0.19	0.04	
7/19/2020	0.82	0.86	0.00	0.53	0.19	0.04	
7/20/2020	0.84	0.87	0.00	0.53	0.19	0.05	
7/21/2020	0.90	0.86	0.00	0.53	0.19	0.05	
7/22/2020	0.91	0.86	0.00	0.53	0.18	0.05	
7/23/2020	1.01	0.86	0.00	0.53	0.17	0.05	
7/24/2020	1.01	0.83	0.00	0.53	0.17	0.05	
7/25/2020	0.99	0.83	0.00	0.53	0.16	0.05	
7/26/2020	0.95	0.83	0.00	0.53	0.16	0.05	
7/27/2020	0.79	0.82	0.00	0.54	0.16	0.05	
7/28/2020	0.74	0.83	0.00	0.54	0.16	0.05	
7/29/2020	0.73	0.80	0.00	0.54	0.17	0.06	

7/30/2020	0.75	0.79	0.00	0.55	0.17	0.06	
7/31/2020	0.71	0.78	0.00	0.55	0.17	0.06	
8/1/2020	0.70	0.74	0.00	0.55	0.17	0.06	
8/2/2020	0.68	0.71	0.00	0.55	0.17	0.06	
8/3/2020	0.70	0.72	0.00	0.55	0.17	0.06	
8/4/2020	0.72	0.70	0.00	0.56	0.17	0.06	
8/5/2020	0.74	0.77	0.00	0.55	0.17	0.06	
8/6/2020	0.72	0.77	0.00	0.56	0.17	0.06	
8/7/2020	0.71	0.77	0.00	0.56	0.17	0.06	
8/8/2020	0.69	0.77	0.00	0.56	0.16	0.06	
8/9/2020	0.70	0.76	0.00	0.55	0.16	0.06	
8/10/2020	0.75	0.77	0.00	0.55	0.16	0.06	
8/11/2020	0.74	0.77	0.00	0.56	0.16	0.05	
8/12/2020	0.72	0.77	0.00	0.56	0.16	0.05	
8/13/2020	0.70	0.77	0.00	0.57	0.17	0.05	
8/14/2020	0.68	0.75	0.00	0.58	0.17	0.05	
8/15/2020	0.66	0.75	0.00	0.58	0.17	0.05	
8/16/2020	0.65	0.76	0.00	0.58	0.17	0.05	
8/17/2020	0.64	0.77	0.00	0.58	0.17	0.06	
8/18/2020	0.63	0.76	0.00	0.58	0.17	0.05	
8/19/2020	0.55	0.75	0.00	0.58	0.17	0.05	
8/20/2020	0.70	0.76	0.00	0.58	0.16	0.05	
8/21/2020	0.56	0.75	0.00	0.59	0.16	0.05	
8/22/2020	0.54	0.77	0.00	0.59	0.16	0.05	
8/23/2020	0.55	0.76	0.00	0.59	0.17	0.05	
8/24/2020	0.55	0.77	0.00	0.59	0.17	0.05	
8/25/2020	0.55	0.76	0.00	0.59	0.17	0.05	
8/26/2020	0.55	0.76	0.00	0.59	0.17	0.05	
8/27/2020	0.55	0.74	0.00	0.59	0.17	0.05	
8/28/2020	0.54	0.72	0.00	0.59	0.17	0.05	
8/29/2020	0.51	0.77	0.00	0.59	0.18	0.05	
8/30/2020	0.49	0.78	0.00	0.59	0.18	0.05	

8/31/2020	0.49	0.79	0.00	0.59	0.18	0.05	
9/1/2020	0.50	0.79	0.00	0.59	0.18	0.05	
9/2/2020	0.57	0.80	0.00	0.58	0.17	0.05	
9/3/2020	0.54	0.80	0.00	0.58	0.16	0.04	
9/4/2020	0.53	0.79	0.00	0.59	0.16	0.04	
9/5/2020	0.54	0.79	0.00	0.59	0.17	0.04	
9/6/2020	0.60	0.79	0.00	0.59	0.17	0.04	
9/7/2020	0.65	0.74	0.00	0.59	0.17	0.05	
9/8/2020	0.67	0.72	0.00	0.60	0.17	0.05	
9/9/2020	0.66	0.72	0.00	0.60	0.17	0.05	
9/10/2020	0.66	0.71	0.00	0.56	0.17	0.05	
9/11/2020	0.65	0.71	0.00	0.56	0.17	0.05	
9/12/2020	0.64	0.72	0.00	0.57	0.17	0.05	
9/13/2020	0.64	0.72	0.00	0.58	0.17	0.05	
9/14/2020	0.65	0.73	0.00	0.58	0.17	0.05	
9/15/2020	0.75	0.75	0.00	0.59	0.17	0.05	
9/16/2020	0.71	0.75	0.00	0.59	0.18	0.05	
9/17/2020	0.71	0.73	0.00	0.59	0.18	0.05	
9/18/2020	0.70	0.73	0.00	0.59	0.18	0.05	
9/19/2020	0.73	0.74	0.00	0.60	0.18	0.04	
9/20/2020	0.72	0.74	0.00	0.60	0.18	0.04	
9/21/2020	1.70	0.74	0.00	0.60	0.18	0.03	
9/22/2020	1.95	0.74	0.00	0.60	0.18	0.04	
9/23/2020	1.91	0.73	0.00	0.60	0.18	0.04	
9/24/2020	2.12	0.75	0.00	0.60	0.18	0.05	
9/25/2020	2.12	0.75	0.00	0.60	0.18	0.05	
9/26/2020	2.05	0.76	0.00	0.60	0.18	0.05	
9/27/2020	2.01	0.76	0.00	0.61	0.18	0.05	
9/28/2020	2.34	0.76	0.00	0.60	0.18	0.05	
9/29/2020	1.92	0.76	0.00	0.59	0.18	0.05	
9/30/2020	1.89	0.76	0.00	0.60	0.18	0.05	

Site Name	Date	Manual/ Flume Discharge (cfs)	pH	Specific Conductance (us/cm)	Water Temperature (degrees C)	Notes
American Tunnel	10/9/2018	0.132	4.21	2316	7.4	
American Tunnel	10/17/2018	0.147				Remove sensors from old flume. New 2" Parshall flume installed; Ha .38"; Hb 0.1"
American Tunnel	11/20/2018	0.161	4.3	1777.0	7.6	0.42 Pre scrape; 0.4 Post scrape
American Tunnel	12/16/2018	0.161	4.21	1517	7.5	0.42 Pre scrape; 0.4 Post scrape
American Tunnel	1/7/2019	0.168	4.17	1716	7.6	Frost heave prevents board from laying flat and flume may be changing shape
American Tunnel	2/5/2019	0.161	4.15	1260	7.6	Good; some film at top of stilling well
American Tunnel	3/21/2019	0.174	4.12	1910	7.6	3/4” to 1” of sludge built up
American Tunnel	5/7/2019	0.200	4.13	2213	7.6	
American Tunnel	6/24/2019	0.228				Cannot find parameters
American Tunnel	7/8/2019		4.52	2341	7.7	Flume backed up and not working properly
American Tunnel	8/5/2019	0.207	4.3	2400	7.7	
American Tunnel	9/3/2019	0.194	4.3	2380	7.7	Seeps and springs survey
American Tunnel	9/10/2019					
American Tunnel	10/15/2019	0.214	4.19	2238	7.6	HTR sampling
American Tunnel	10/25/2019	0.174	5.06	2260	7.5	
American Tunnel	11/5/2019	0.158	4.74	2337	7.6	
American Tunnel	12/6/2019	0.200	4.32	2462	7.4	
American Tunnel	1/11/2020	0.168	4.37	1115	7.3	frost heave affecting downstream face of flume
American Tunnel	2/17/2020	0.200	4.13	2429	7.3	
American Tunnel	2/24/2020	0.207	4.3	2466	7.3	
American Tunnel	3/12/2020	0.228	4.15	2321	7.5	
American Tunnel	3/17/2020	0.207	4.19	2421	7.4	
American Tunnel	4/6/2020	0.228	4.22	2437	7.5	
American Tunnel	4/14/2020	0.213	4.21	2470	7.6	
American Tunnel	5/1/2020		4.19	2524	7.4	Flume backed up due to clogged pipe and not functioning properly
American Tunnel	5/8/2020		4.17	2417	7.4	Flume backed up due to clogged pipe and not functioning properly
American Tunnel	6/3/2020		4.08	2149	7.8	Flume backed up due to clogged pipe and not functioning properly
American Tunnel	7/7/2020	0.200	4.78	2040	7.7	
American Tunnel	7/21/2020	0.214	4.43	1914	7.9	
American Tunnel	7/28/2020	0.200	4.89	1979	7.7	Two cups of sediment removed from stilling well
American Tunnel	7/29/2020	0.174				No survey taken on this date.
American Tunnel	8/3/2020	0.157	4.79	1591	7.7	
American Tunnel	8/10/2020	0.161	4.34	1558	7.7	
American Tunnel	8/17/2020	0.161	4.83	2210	7.8	

Site Name	Date	Manual/ Flume Discharge (cfs)	pH	Specific Conductance (us/cm)	Water Temperature (degrees C)	Notes
American Tunnel	8/26/2020	0.174	4.17	2160	7.9	
American Tunnel	9/1/2020	0.168	4.08	2140	8	
American Tunnel	9/7/2020	0.174	4.27	2180	8	
American Tunnel	9/19/2020	0.174	4.46	2000	8.1	
Blackhawk	10/3/2018	0.517	6.96	1532	8.00	
Blackhawk	10/4/2018	0.517				
Blackhawk	10/16/2018	0.539				
Blackhawk	11/28/2018	0.526	6.70		8.00	
Blackhawk	12/18/2018	0.526	7.13	1512	8.00	
Blackhawk	5/15/2019	0.432	7.42	1460	7.90	
Blackhawk	6/25/2019	0.480				
Blackhawk	7/9/2019	0.539	6.44	1540	7.60	
Blackhawk	7/23/2019		6.76	1508	7.60	
Blackhawk	8/6/2019	0.627	6.86	1523	7.70	
Blackhawk	9/3/2019	0.680	6.24	1567		
Blackhawk	9/10/2019	0.667				
Blackhawk	9/18/2019	0.735	6.58	1586	7.90	
Blackhawk	10/15/2019	0.719	6.58	1559	7.90	
Blackhawk	5/9/2020	0.521	7.04	1651	7.90	
Blackhawk	6/2/2020	0.502	7.01	1642	7.90	
Blackhawk	7/7/2020	0.576	6.82	1421	7.80	
Blackhawk	7/10/2020	0.551	7.24	1260	7.80	
Blackhawk	8/11/2020	0.601	6.43	1091	7.90	
Blackhawk	9/7/2020	0.627	6.52	1514	7.90	
Gold King	10/9/2018	0.829	4.47	1825	7.10	
Gold King outflow	10/9/2018					
Gold King outflow	11/20/2018		5.13	1353	8.40	
Gold King outflow	12/16/2018		5.10	1471	8.20	
Gold King outflow	1/8/2019		5.23	1316	7.80	
Gold King outflow	2/4/2019		5.60	968	7.60	
Gold King outflow	3/21/2019		5.70	1680	7.80	
Gold King outflow	5/7/2019		5.72	1637	7.80	

Site Name	Date	Manual/ Flume Discharge (cfs)	pH	Specific Conductance (us/cm)	Water Temperature (degrees C)	Notes
Gold King Portal	3/16/2020		5.70	1802	7.60	
Gold King Portal	4/7/2020		5.73	1792	7.60	
Gold King Portal	4/14/2020		5.91	1794	7.60	
Gold King Portal	5/9/2020		5.91	1794	7.60	
Gold King Portal	6/3/2020					
Gold King Portal	6/10/2020					
Gold King Portal	7/21/2020		3.12	1950	7.70	
Gold King Portal	8/3/2020		3.14	1667	7.70	
Gold King Portal	8/18/2020		3.29	1641	8.00	
Gold King Portal	8/25/2020		3.30	1962	7.90	
Gold King Portal	9/1/2020		3.22	1947	8.00	
Gold King Portal	9/7/2020		3.49	1996	7.70	
Mogul	10/9/2018	0.078	3.66	1352	5.10	
Mogul	11/14/2018	0.083	3.63	1024	5.10	
Mogul	12/18/2018		3.59	1335	4.90	
Mogul	1/9/2019	0.068	3.55	989	4.90	
Mogul	2/12/2019	0.068	3.70	735	4.70	
Mogul	3/27/2019	0.068	3.81	574	5.30	
Mogul	4/2/2019		3.69	1106	5.30	
Mogul	5/3/2019	0.078	3.71	1235	5.20	
Mogul	6/11/2019		3.52	1267	5.10	
Mogul	6/19/2019	0.098	3.68	1220	5.00	
Mogul	7/8/2019	0.083	3.61	1245	5.50	
Mogul	7/19/2019	0.073	3.40	1160	5.30	
Mogul	8/5/2019	0.059	3.55	1339	5.30	
Mogul	9/3/2019	0.068	3.54	868	5.20	
Mogul	9/10/2019	0.059	3.38	1440	5.60	
Mogul	10/15/2019	0.078	3.46	1430	5.10	
Mogul	11/5/2019	0.073	3.56	1392	5.00	
Mogul	12/6/2019		3.62	1505	4.80	
Mogul	12/17/2019	0.083				
Mogul	1/14/2020		3.63	1192	4.70	
Mogul	2/21/2020	0.055	3.68	1344	4.50	

Site Name	Date	Manual/ Flume Discharge (cfs)	pH	Specific Conductance (us/cm)	Water Temperature (degrees C)	Notes
Mogul	2/24/2020	0.055	3.68	1493	4.70	
Mogul	3/10/2020	0.055	3.60	1488	4.90	
Mogul	3/16/2020	0.055	3.57	1484	5.00	
Mogul	4/6/2020	0.059	3.61	1474	5.10	
Mogul	4/14/2020	0.055	3.52	1471	4.50	
Mogul	5/8/2020	0.068	3.48	1370	4.90	
Mogul	6/2/2020	0.059	3.49	1082	5.31	
Mogul	6/16/2020	0.064	3.51	1360	4.84	
Mogul	7/6/2020	0.051	3.62	1162	5.20	
Mogul	7/20/2020	0.047	3.36	1342	5.30	
Mogul	7/28/2020	0.047	3.08	1214	5.30	
Mogul	8/3/2020	0.043	3.55	1151	5.30	
Mogul	8/10/2020	0.043		998		
Mogul	8/17/2020	0.047	3.49	1436	5.20	
Mogul	8/24/2020	0.047	3.66	1388	5.50	
Mogul	8/24/2020	0.047	3.66	1388	5.50	
Mogul	9/1/2020	0.047	3.62	1396	5.50	
Mogul	9/7/2020	0.051	3.66	1383	5.10	
Mogul	9/19/2020	0.047	3.69	1308	5.80	
Mogul	9/22/2020	0.047	3.70	1310	5.80	
Natalie Occidental	10/9/2018	0.601	6.46	1120	5.70	
Natalie Occidental	11/20/2018	0.671	6.89	435	5.70	
Natalie Occidental	12/17/2018	0.474	6.42	930	5.70	
Natalie Occidental	1/8/2019	0.515	6.45	846	5.70	
Natalie Occidental	2/4/2019	0.528	6.48	648	5.70	
Natalie Occidental	3/27/2019		6.80	1089	5.70	
Natalie Occidental	5/7/2019	0.464	6.29	1127	5.70	
Natalie Occidental	6/18/2019	1.787	6.08	1072	5.40	
Natalie Occidental	6/20/2018		6.08	1061	5.40	
Natalie Occidental	7/8/2019	2.241	5.59	825	5.30	
Natalie Occidental	7/25/2019		6.12	862	5.30	
Natalie Occidental	8/6/2019	1.600	6.29	896	5.40	
Natalie Occidental	8/14/2019		6.03	923	5.04	

Site Name	Date	Manual/ Flume Discharge (cfs)	pH	Specific Conductance (us/cm)	Water Temperature (degrees C)	Notes
Natalie Occidental	8/15/2019	1.451	6.03	923	5.40	
Natalie Occidental	9/3/2019	1.096	6.23	996	5.50	
Natalie Occidental	9/10/2019	0.987	6.22	969	5.50	
Natalie Occidental	9/18/2019		6.23	1024	5.50	
Natalie Occidental	10/15/2019	0.879	6.39	1044	5.60	
Natalie Occidental	10/21/2019					
Natalie Occidental	11/5/2019	0.879	6.59	1059	5.60	
Natalie Occidental	12/6/2019	0.850	6.55	1123	5.40	
Natalie Occidental	1/15/2020	0.750	6.44	1154	5.60	
Natalie Occidental	2/24/2020	0.662	6.59	1184	5.60	
Natalie Occidental	3/16/2020	0.671	6.54	1195	5.60	
Natalie Occidental	4/7/2020	0.592				
Natalie Occidental	4/14/2020	0.681	6.27	1223	5.70	
Natalie Occidental	5/5/2020	0.679	6.24	1140	5.00	
Natalie Occidental	5/8/2020		6.25	1121	5.30	
Natalie Occidental	6/3/2020	0.947	5.80	1106	5.60	
Natalie Occidental	7/1/2020	1.155	6.14	818	5.50	
Natalie Occidental	7/7/2020	1.175	6.38	910	5.60	
Natalie Occidental	8/11/2020	0.763	6.40	775	5.60	
Natalie Occidental	9/7/2020	0.648	6.24	1035	6.20	
Red and Bonita	10/9/2018	0.596	5.79	2225	6.70	
Red and Bonita	10/16/2018	0.572				
Red and Bonita	11/14/2018		5.80	1720	6.70	
Red and Bonita	12/19/2018		5.94	2175	6.60	
Red and Bonita	1/8/2019	0.524	5.78	1480	6.70	
Red and Bonita	2/5/2019		5.68	1214	6.70	
Red and Bonita	3/27/2019		5.72	2182	6.60	
Red and Bonita	5/7/2019	0.517	5.73	2182	6.70	
Red and Bonita	6/19/2019	0.607	5.30	2140	6.30	
Red and Bonita	7/8/2019		5.73	2066	6.80	
Red and Bonita	8/5/2019		5.60	2001	6.80	
Red and Bonita	9/3/2019		5.60	2034	6.60	
Red and Bonita	10/15/2019	0.634		2114	6.70	

Site Name	Date	Manual/ Flume Discharge (cfs)	pH	Specific Conductance (us/cm)	Water Temperature (degrees C)	Notes
Red and Bonita	11/5/2019		5.88	2144	6.60	
Red and Bonita	12/6/2019		5.83	2269	6.60	
Red and Bonita	1/14/2020	0.616	5.81	2305	6.60	
Red and Bonita	1/27/2020					
Red and Bonita	2/21/2020	0.567	5.77	2320	6.60	
Red and Bonita	2/24/2020	0.589	5.37	2316	6.60	
Red and Bonita	3/16/2020	0.520	5.77	2339	6.70	
Red and Bonita	4/14/2020	0.497	5.75	2347	6.70	
Red and Bonita	5/8/2020	0.706	5.35	2061	5.70	
Red and Bonita	5/28/2020	0.576	5.73	2340	6.90	
Red and Bonita	6/2/2020	0.598	5.78	2330	6.90	
Red and Bonita	6/18/2020	0.616	5.66	2279	6.80	
Red and Bonita	6/24/2020	0.640	5.80	2260	7.00	
Red and Bonita	7/6/2020		6.06	1801	7.40	
Red and Bonita	7/21/2020		5.00	1712	6.40	
Red and Bonita	8/10/2020		3.59	2210	6.20	
Red and Bonita	8/17/2020		6.00	1434	6.70	
Red and Bonita	8/28/2020		6.00	1768	6.80	
Red and Bonita	8/31/2020		5.78	2080	6.20	
Red and Bonita	9/7/2020		5.80	1869	6.70	
Red and Bonita	9/19/2020		5.79	1531	6.50	

Site Name	Date	Manual Discharge (cfs)	Stage (ft)	pH	Specific Conductance (us/cm)	Water Temperature (degrees C)	Notes
CCSG_1	10/9/2018	5.50	0.86	5.76			
CCSG_1	10/29/2018		0.88	5.59	1200	6.40	
CCSG_1	12/7/2018		0.82	5.77	1326	2.70	
CCSG_1	12/17/2018		0.79	5.87	1111	2.70	
CCSG_1	1/7/2019		0.79	5.87	1037	1.90	
CCSG_1	1/17/2019		0.78				
CCSG_1	2/7/2019			5.84	759	0.10	
CCSG_1	2/26/2019		0.78	5.75	756	3.50	
CCSG_1	3/26/2019		0.78				
CCSG_1	4/3/2019		0.78	5.34	1298	2.10	
CCSG_1	6/8/2019		1.75	3.93	307	2.40	
CCSG_1	6/12/2019	96.40	1.6	4.52	236	3.20	
CCSG_1	6/18/2019	69.00	1.45	4.43	297	0.08	
CCSG_1	6/25/2019	72.40	1.55	5.23	270	4.00	
CCSG_1	7/9/2019	69.40	1.58	6.01	300	3.90	
CCSG_1	8/6/2019	20.26	1.1	6.01	547	9.80	
CCSG_1	8/19/2019	11.55	0.98	5.71	739	9.10	
CCSG_1	9/3/2019	8.18	0.89	5.08	945	10.40	
CCSG_1	10/8/2019	6.06	0.8	4.85	1222	8.20	
CCSG_1	10/15/2019	5.53	0.79	4.70	1253	6.90	
CCSG_1	10/23/2019	4.36	0.8	5.81	1350	4.10	
CCSG_1	11/5/2019	5.04	0.8	5.47	1297	4.30	
CCSG_1	12/9/2019	4.36	0.8	6.20	1425	2.20	
CCSG_1	2/25/2020	4.01	0.77	5.37	1437	0.90	
CCSG_1	3/17/2020	3.61	0.75	5.64	1465	2.50	
CCSG_1	4/14/2020	4.43	0.78	5.14	1318	5.10	
CCSG_1	4/20/2020	3.48	0.77				
CCSG_1	5/1/2020						
CCSG_1	5/4/2020	23.20	1.25	3.87	538	5.80	
CCSG_1	5/4/2020	29.40	1.33				
CCSG_1	5/8/2020		1.21	3.99	506	5.60	

Site Name	Date	Manual Discharge (cfs)	Stage (ft)	pH	Specific Conductance (us/cm)	Water Temperature (degrees C)	Notes
CCSG_1	5/13/2020		1.23				
CCSG_1	6/3/2020	63.29	1.62	5.62	289	5.80	
CCSG_1	7/7/2020	12.50	0.9	5.70	609	11.40	
CCSG_1	7/21/2020	8.00	0.82	6.19	714	10.00	
CCSG_1	7/28/2020		0.86	5.42	303	5.50	
CCSG_1	8/3/2020		0.86	6.00	585	14.00	
CCSG_1	8/10/2020		0.79	5.68	753	10.80	
CCSG_1	8/18/2020		0.79	5.54	797	14.10	
CCSG_1	8/25/2020		0.76	5.38	992	11.20	
CCSG_1	9/1/2020		0.76	4.57	984	13.20	
CCSG_1	9/8/2020	4.58	0.75	5.79	1053	5.30	
CCSG_1	9/19/2020	4.46	0.72	5.76	903	5.00	
CCSG_1	10/1/2020		0.76				
CCSG_2	10/10/2018	2.50	1	6.55		4.5	
CCSG_2	10/24/2018						
CCSG_2	10/29/2018		0.99	6.79	941	4.9	
CCSG_2	12/7/2018			6.76	1014	1.5	
CCSG_2	12/17/2018		0.97	6.79	843	2	
CCSG_2	1/7/2019		1	6.73	787	1.3	
CCSG_2	1/29/2019		0.93	6.77	757	1.5	
CCSG_2	2/7/2019			6.42	631	0.1	
CCSG_2	2/26/2019		0.93	6.7	577	2.4	
CCSG_2	4/3/2019		0.92	6.32	999	2.5	
CCSG_2	4/22/2019		1.91				
CCSG_2	6/7/2019	24.60	1.52	5.28	267	2.2	
CCSG_2	6/12/2019		1.5	5.67	211	3.3	
CCSG_2	6/21/2019	38.50	1.58	3.3	220	5.79	
CCSG_2	6/25/2019	31.00	1.51	6.07	240	4.1	
CCSG_2	8/6/2019		1.51	6.62	406	6.63	
CCSG_2	8/19/2019	7.36	1.2	5.94	519	6.8	

Site Name	Date	Manual Discharge (cfs)	Stage (ft)	pH	Specific Conductance (us/cm)	Water Temperature (degrees C)	Notes
CCSG_2	8/20/2019	6.40	1.18	6.33	528	8.7	
CCSG_2	9/5/2019	4.23	1.13	5.84	633	9.6	
CCSG_2	10/8/2019	2.85	1	6.09	836	7	
CCSG_2	10/23/2019	2.38	0.98	6.86	914	4.5	
CCSG_2	4/20/2020						
CCSG_2	5/4/2020	9.20	1.26	5.48	530	4.8	
CCSG_2	5/4/2020	11.70		5.15	491	3.2	
CCSG_2	6/3/2020	32.56	1.6	6.34	249	5.5	
CCSG_2	7/14/2020		1.33	6.81	539	11.5	
CCSG_2	7/28/2020		1.3				
CCSG_2	9/1/2020		1.2	6.12	781	11.6	
CCSG_2	9/8/2020	2.59	1.06	5.68	852	5.1	
CCSG_2	10/1/2020		1.03				
CCSG_3	10/8/2018		0.42				
CCSG_3	10/30/2018		0.45	4	1162		
CCSG_3	12/7/2018		0.41	3.95	1541		
CCSG_3	12/16/2018		0.39	4.02	1389		
CCSG_3	1/7/2019		0.36	4.05	1238		
CCSG_3	2/7/2019		0.37	3.99	891		
CCSG_3	2/26/2019		0.34	4.02	909	3.7	
CCSG_3	4/22/2019						
CCSG_3	5/15/2019		0.89				
CCSG_3	6/7/2019		1.65	3.77	270	2.5	
CCSG_3	6/10/2019	51.72	2.1	3.85	244	3.2	
CCSG_3	6/11/2019		2	3.84	237	1.5	
CCSG_3	6/12/2019	34.18	2.1	3.86	230	3.5	
CCSG_3	6/21/2019	54.62	2.4	4.05	224	3	
CCSG_3	6/25/2019	35.56	2.08	4.06	270	4.7	
CCSG_3	7/24/2019	15.57	1.35	4.72	395	4.4	
CCSG_3	8/6/2019		1.16	4.22	557	13.7	

Site Name	Date	Manual Discharge (cfs)	Stage (ft)	pH	Specific Conductance (us/cm)	Water Temperature (degrees C)	Notes
CCSG_3	8/19/2019		0.96	4.03	799	6	
CCSG_3	9/4/2019	2.61	0.53	3.54	1100	14.2	
CCSG_3	10/8/2019		0.45	3.65	1469	9.9	
CCSG_3	10/23/2019		0.46	3.98	1533	4.5	
CCSG_3	4/21/2020		0.44	3.63	1519	7.1	
CCSG_3	4/24/2020		0.47	3.64	1341	8.2	
CCSG_3	4/29/2020		0.69	3.62	713	0.4	
CCSG_3	5/1/2020	10.50	0.88	3.68	535	3	
CCSG_3	5/4/2020	22.00	1.18	3.71	415	3.7	
CCSG_3	5/28/2020	25.80	1.29	3.99	262	6	
CCSG_3	6/3/2020	33.40	1.35	4.23	264	6.9	
CCSG_3	6/10/2020		1.1				
CCSG_3	6/24/2020	8.84	0.95	4.26	469	14.1	
CCSG_3	7/7/2020	5.78	0.7	4.06	618	12.7	
CCSG_3	7/14/2020		0.64	3.97	796	14.4	
CCSG_3	7/21/2020						
CCSG_3	7/28/2020	4.30		3.86	516	12.7	
CCSG_3	8/3/2020		0.54	3.8	600	15.4	
CCSG_3	8/10/2020		0.48	3.79	735	12.1	
CCSG_3	8/18/2020	0.96	0.41	4.53	1011	15.5	
CCSG_3	8/24/2020		0.41	3.59	1089	13.4	
CCSG_3	8/31/2020		0.41				
CCSG_3	9/8/2020	1.13	0.42	3.62	1160	5.9	
CCSG_3	9/19/2020	1.29	0.38	3.62	1059	5.9	
CCSG_5	10/8/2018		0.43				
CCSG_5	10/22/2018		0.4	3.01	1014	0.8	Removed transducer
CCSG_5	12/7/2018		0.4	3:07	1598	0.2	Camera battery changed, shoveled out camera
CCSG_5	12/19/2018		0.4	3.04	1520	0.6	Ice
CCSG_5	1/8/2019		0.4	3.2	1283	0.7	Removed camera
CCSG_5	6/10/2019			3.16	498	1.5	Channel widened to the north leaving stage card out of water

Site Name	Date	Manual Discharge (cfs)	Stage (ft)	pH	Specific Conductance (us/cm)	Water Temperature (degrees C)	Notes
CCSG_5	6/12/2019	2.95		3.19	450	1.7	Moved stilling well & stake. Need stage card
CCSG_5	6/19/2019	2.39		3.23	511	1.8	Moved rocks around stilling well, likely changed stage
CCSG_5	6/21/2019	4.31		3.44	347	1.8	Took discharge down in road crossing
CCSG_5	7/25/2019	1.10	1.1	3.4	369	4	
CCSG_5	8/2/2019	0.68	1.1	3.24	480	5.9	
CCSG_5	8/19/2019	0.24	0.99	3.21	660	2.9	108 gpm
CCSG_5	9/5/2019	0.15	0.95	2.79	438	10.3	RT700 downloaded, 85% capture w flume, 65.6gpm
CCSG_5	10/9/2019	0.04	0.9	3.13	1287	2.2	
CCSG_5	10/22/2019		1.03				95 capture
CCSG_5	5/28/2020			3.26	411	4.3	
CCSG_5	6/2/2020	5.70	1	3.3	258	5.7	install LT500
CCSG_5	6/10/2020	1.30	0.89	3.38	382	6.6	
CCSG_5	6/24/2020	0.18	0.79	3.17	514	13.6	
CCSG_5	7/6/2020	0.16	0.7	2.68	708	13.9	
CCSG_5	7/14/2020		0.67				
CCSG_5	7/21/2020	0.03	0.65	2.88	945	8.3	downloaded
CCSG_5	7/28/2020	0.06	0.69	2.93	913	11.6	15 percent loss
CCSG_5	8/3/2020			2.89	973	16	downloaded. Some sediment build-up due to recent rains.
CCSG_5	8/10/2020		0.67	2.88	939	9.8	
CCSG_5	8/18/2020	0.02	0.63	4.58	1346	8.5	
CCSG_5	8/25/2020	0.02	0.62	3.02	1466	8.4	
CCSG_5	8/31/2020	0.04	0.63	2.86	1431	11.7	
CCSG_5	9/7/2020	0.03	0.64				Game camera date was set to 1 day behind the true date. Date corrected.
CCSG_6	10/29/2018		1.14	5.02	535	3	
CCSG_6	11/14/2018		1.24	5.45	483	0	
CCSG_6	12/19/2018		1.19	5.23	448	0.2	
CCSG_6	1/8/2019		1.03	5.24	595	0.6	
CCSG_6	2/5/2019		1	5.26	461	0.7	

Site Name	Date	Manual Discharge (cfs)	Stage (ft)	pH	Specific Conductance (us/cm)	Water Temperature (degrees C)	Notes
CCSG_6	6/10/2019	17.50		4.35	123	1.9	Camera dangling stage card missing stilling well dislodged. Big tree downstream in line of previous discharge measurements. Water level beyond camera stake
CCSG_6	6/12/2019	40.54		4.42	124	1.8	Removed tree. Installed level troll 700, experiencing lots of noise in depth measurement. Could be the stake wobbling or not enough holes in stilling well causing water to bubble up. Moved stage card up. Removed stage of 1.63 consequently reading lower
CCSG_6	6/25/2019	27.20	1.58	4.87	141	3.6	Removed tree stuck on stilling well
CCSG_6	7/8/2019			5.33	155	3.6	Stilling well knocked loose by tree
CCSG_6	7/11/2019	22.93	1.53	5.66	185	5.1	
CCSG_6	7/23/2019	15.78	1.39	6.4	238	8.4	
CCSG_6	8/2/2019	8.20	1.35				
CCSG_6	8/15/2019	5.03	1.19	5.89	341	10.4	
CCSG_6	9/4/2019	1.44	0.98	5.18	458	12.6	cond could be affected by temp sensor, camera date/time off, angle of shot too high
CCSG_6	10/9/2019	0.62	0.8	5.04	623	6.2	fixed timestamp
CCSG_6	10/25/2019	0.61	0.77	4.88	750	0	
CCSG_6	4/27/2020		0.98	4.32	426	1.6	install LT500 sn 732224
CCSG_6	4/29/2020			4.28	277	1.3	1.8 stage seems questionablly high, removed
CCSG_6	5/8/2020	13.67	1.31	4.27	171	2.2	
CCSG_6	5/28/2020	17.05	1.38	4.15	160	5.5	
CCSG_6	6/2/2020	28.98	1.5				
CCSG_6	6/24/2020		1.39	6.10	230	11.8	nr moved rocks downstream and stage decreased from 1.33 to 1.28. removed anomalous Q of 6.89
CCSG_6	7/6/2020	3.47	1.21	5.98	290	10	
CCSG_6	7/14/2020		1.09	5.98	333	10.1	
CCSG_6	7/21/2020	1.63	1.09	5.71	355	5.6	
CCSG_6	8/3/2020	1.55	1.08	5.66	336	11.2	
CCSG_6	8/10/2020		1.06	5.58	391	9.1	
CCSG_6	8/17/2020		1	5.27	420	13.6	
CCSG_6	8/24/2020		0.98	4.64	547	13.3	

Site Name	Date	Manual Discharge (cfs)	Stage (ft)	pH	Specific Conductance (us/cm)	Water Temperature (degrees C)	Notes
CCSG_6	9/7/2020		0.97	5.18	621	8.2	did not download photos, 160 photos, Gaia map showed 2 CCSG6 waypoints. Data downloaded.
CCSG_6	9/19/2020	0.59	0.97	5.01	590	8.7	
CCSG_7	10/8/2018		0.62	4.03	613	6.1	oakton
CCSG_7	10/29/2018		0.65	3.97	507	2.5	
CCSG_7	11/14/2018			4.04	438	2.2	
CCSG_7	12/18/2018		0.51	3.78	710	1.1	camera set to motion detect
CCSG_7	2/12/2019		0.48	3.73	487	0.6	
CCSG_7	5/2/2019		0.7	4.15	178	1.3	Replaced batteries in camera. Camera stake was compromised, reattached camera to face stage. Could use more straps for camera. No discharge due to snow cover.
CCSG_7	6/10/2019	17.50		4.13	182	1.2	Camera did not work
CCSG_7	6/13/2019	24.70	1.42	4.45	154	1.2	remove anomalous stage of 1.65 and t depth of .88. did it flush or change after this?
CCSG_7	6/24/2019	13.10	1.3	4.74	203	1.6	0.76
CCSG_7	7/24/2019	12.88	1.29	6.99	231	7.5	check camera for correct stage
CCSG_7	8/2/2019		1.25	6.27	268	7.9	missing SD card reader. branch sitting on stilling well.
CCSG_7	8/15/2019	3.31	0.94	6.02	323	8.2	
CCSG_7	9/4/2019	1.47	0.82	4.43	411	9.1	cond could be influenced by tracer
CCSG_7	10/9/2019	0.29	0.62	4.03	560	5.4	used 4" baski
CCSG_7	10/22/2019	0.26	0.56				estimate 75% capture
CCSG_7	4/29/2020		0.87	3.93	304	0.8	pre scour tdepthof 0.45
CCSG_7	5/8/2020	5.65	1.1	3.98	232	1.6	
CCSG_7	5/28/2020	10.70	1.3	4.14	164	3.7	
CCSG_7	6/2/2020		1.5	4.99	157	4.5	70.2 not pissible
CCSG_7	6/24/2020	9.60	1.2	6.14	220	9.8	
CCSG_7	7/6/2020	4.28	1	6.6	270	5.3	
CCSG_7	7/14/2020		0.9	5.87	319	5.9	q from rating curve, not manually measured
CCSG_7	7/28/2020		0.93	4.59	314	6.3	tdepth 0.6672459
CCSG_7	8/3/2020	1.46	0.85	4.5	313	6.9	

Site Name	Date	Manual Discharge (cfs)	Stage (ft)	pH	Specific Conductance (us/cm)	Water Temperature (degrees C)	Notes
CCSG_7	8/10/2020		0.8	4.32	312	5	39741.36042
CCSG_7	8/17/2020	0.71	0.76	4.12	392	6.8	Set to motion sensor - reset to photo every hour. Stilling well is loose. Bring Zip ties. Consider mounting to board next year. Secured temporarily with stick and rock. Downloaded probe data.
CCSG_7	8/24/2020		0.74	4.06	520	9.6	
CCSG_7	8/31/2020	0.53	0.72				
CCSG_7	9/7/2020		0.7	3.97	579	7.1	Did not download photos, no computer, 163 photos. Downloaded logger
CCSG_7	9/19/2020		0.71	3.93	540	9.3	