California Water Research

California Water Research Technical Memo

July 2018 Prepared by Deirdre Des Jardins

Flows are tidal in the Sacramento River above the Delta Cross Channel

Summary of Results

For this study, flow and velocity data from the Sacramento River above the Delta Cross Channel were analyzed. The data show that flows of 5,000 cfs may not be sufficient to maintain positive velocities in the Sacramento River above the Delta Cross Channel, and flows of 7,000 cfs may be insufficient to maintain velocities of greater than 0.4 ft/sec. If channel velocities above 0.4 ft/sec are needed for protection of fish, higher flows may be needed.

More detailed studies with field data from the actual intake locations at Hood need to be done.

Sensor Choice

The CDEC web page for the Sacramento River at Hood (SRH) states,

> The following data types are available online. Select one of the links below to retrieve recent data.

The station meta-data does not list any stage, discharge, or water velocity data as available online.

The SDC station above the Delta Cross Channel is the closest downstream sensor to the propose intake locations at Hood with published flow data. Data and graphs were obtained from the SDC station on the California Data Exchange Center[1] and the associated U.S. Geological Survey sensor 11447890 on the National Water Information System website. [2]

As of this date, the California Data Exchange Center site no longer reports tidally filtered discharge at the Delta Cross Channel stations, although the USGS website still does.

[1] Graphs and data for CDEC sensor SDC were obtained from http://cdec.water.ca.gov/dynamicapp/staMeta?station_id=SDC.

[22] Graphs and data for USGS sensor 11447890 were obtained from https://waterdata.usgs.gov/ca/nwis/uv/?site_no=11447890&PARAmeter_cd=00065,00060.

SACRAMENTO R ABOVE DELTA CROSS CHANNEL

Map of surrounding area

Station ID	SDC	**Elevation**	10.0 ft
River Basin	SACRAMENTO R	**County**	SACRAMENTO
Hydrologic Area	SACRAMENTO RIVER	**Nearby City**	WALNUT GROVE
Latitude	38.257°	**Longitude**	-121.518°
Operator	US Geological Survey	**Data Collection**	

For this analysis, some example graphs of subdaily variations in mean water velocity at flows from 3000 cfs to 11,500 cfs were obtained from CDEC, together with associated tidally filtered discharge from the USGS website. The 2014 drought year was selected because it has low flows that are in the range of the proposed minimum bypass flows of 5,000 and 7,000 cfs during Spring.

The available mean water velocity data with tidally filtered discharge was also downloaded from the US Geological Survey website. The data points marked as approved by USGS were selected for further analysis.

1. Figures 1 and 2 show that mean velocity at the SDC sensor goes negative on April 10 at the SDC station at a flow of around 6500 cfs.
2. Figures 3 and 4 show that mean velocity at SDC sensor can go down to -0.7 ft/sec at flows below 5,000 cfs at the SDC station.
3. Figure 5 and 6 show the range and distribution of mean velocity at the SDC sensor at tidally filtered discharges of 4500 – 5500 cfs, centered around the proposed bypass flows of 5,000 cfs. The distribution is bimodal, reflecting the tidal influence. The lower mode of the distribution is close to zero ft/sec. Figures 5 and 6 clearly show that flows are tidal at the SDC sensor at the proposed bypass flows of 5,000 cfs, and that velocities go negative (upstream.)
4. Figure 7 shows the distribution of mean velocity at the SDC sensor at tidally filtered discharges of 6500 – 7500 cfs, centered around the proposed bypass flow of 7,000 cfs. The distribution is also bimodal, reflecting the tidal influence. The lower mode of the distribution around 0.4 ft/sec.
5. Table 1 shows the frequency counts for flows at 4500-5500 cfs. About 35% of the data has flows below 0.4 ft/sec.
6. Table 2 shows the frequency counts for flows at 6500-7500 cfs. About 16% of the data has flows below 0.4 ft/sec.

1. **Flows from 11,500 cfs to 5,500 cfs**

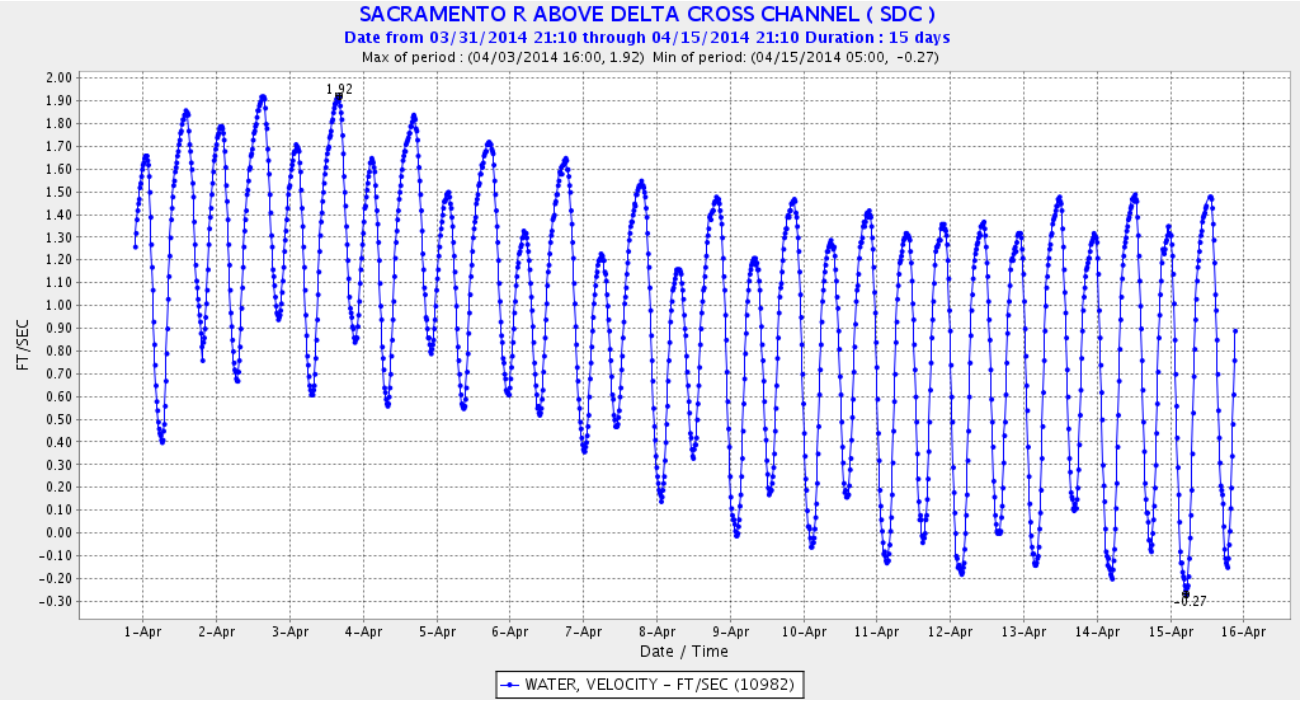

Figure 1 April 1- 15, 2014 data showing subdaily variations in velocity at 11500 to 5500 cfs

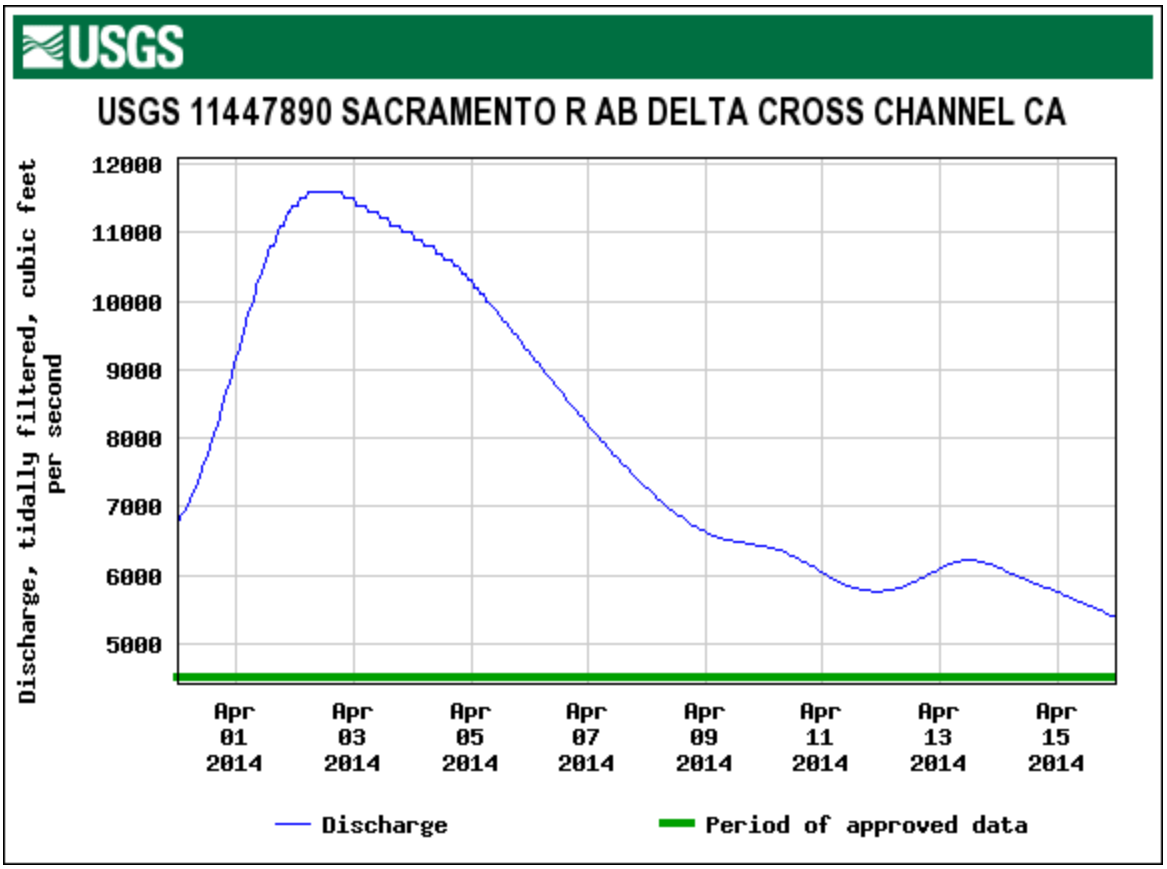

Figure 2 Tidally filtered discharge from April 1-15, 2014

2. Flows from 3000 cfs to 5000 cfs

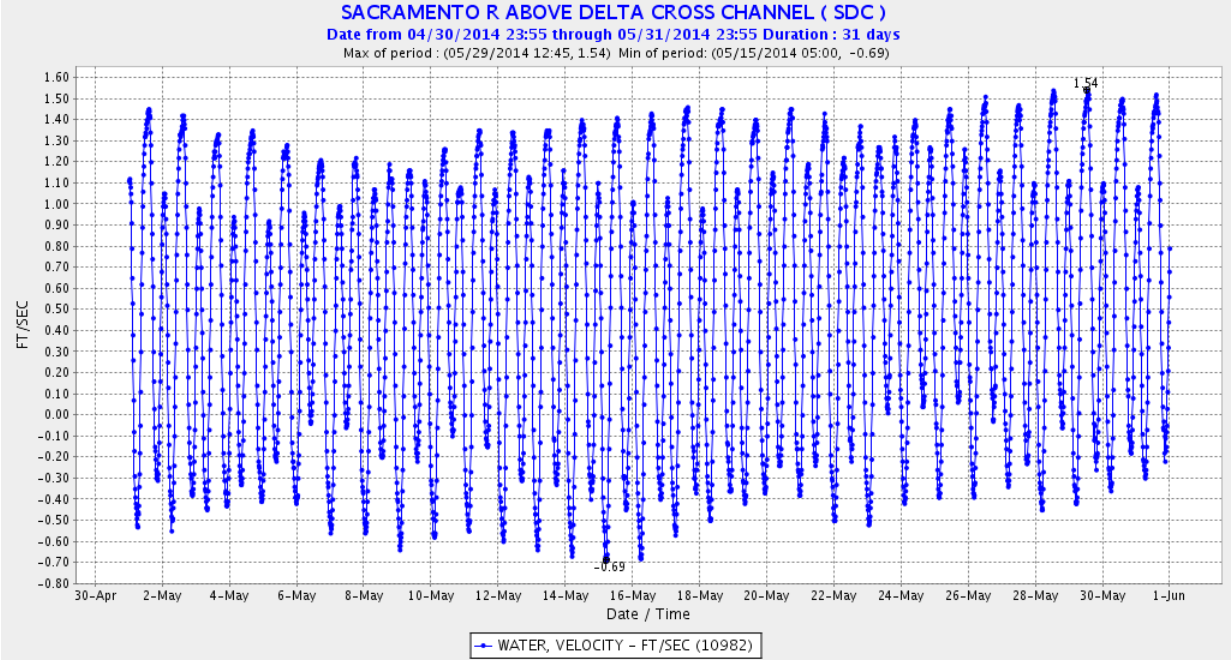

Figure 3 May 1- 30, 2014 data showing subdaily variations in velocity at 11500 to 5500 cfs

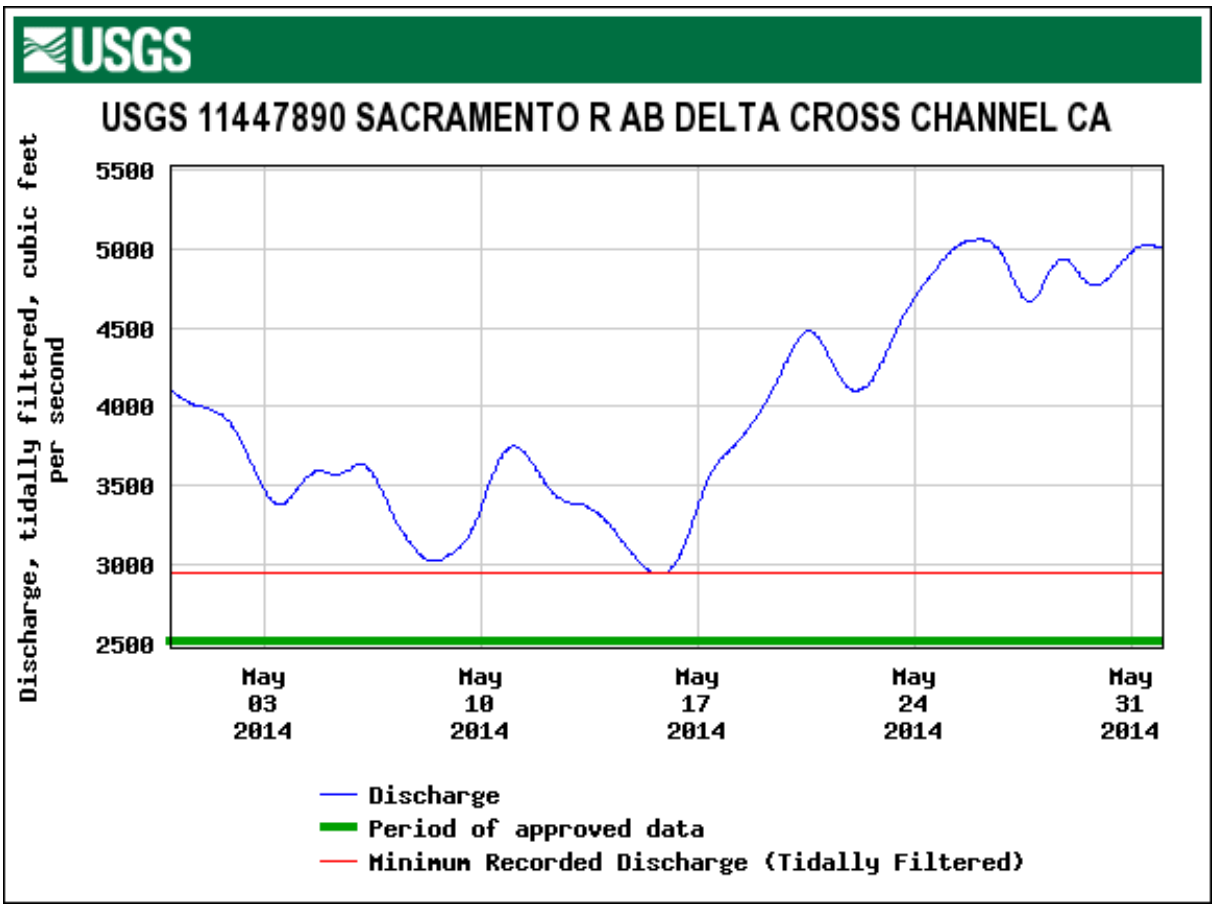

Figure 4 Tidally filtered discharge from May 1-30, 2014

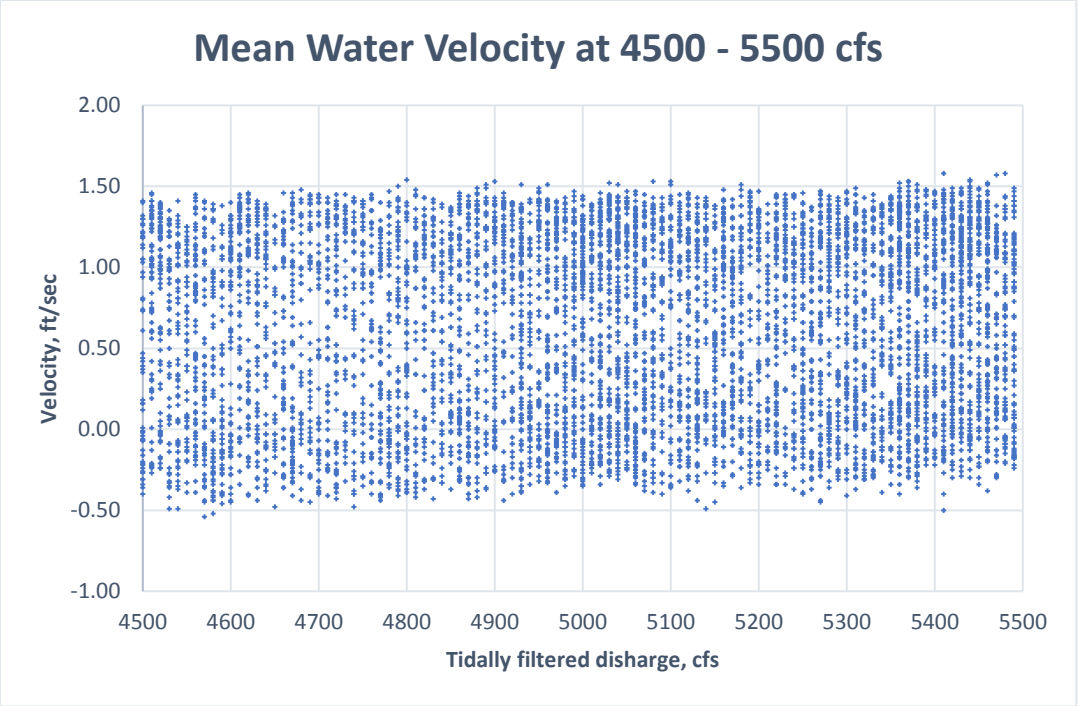

Figure 5 Mean water velocity at tidally filtered discharges of 4500-5500 cfs

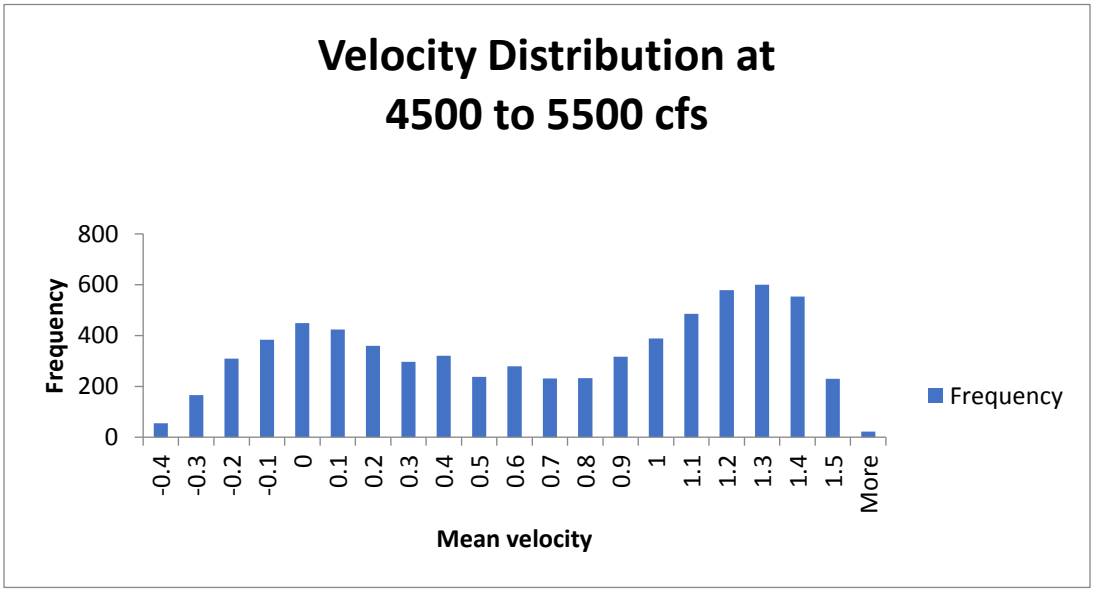

Figure 6 Histogram showing frequencies of mean water velocity at 4500-5500 cfs

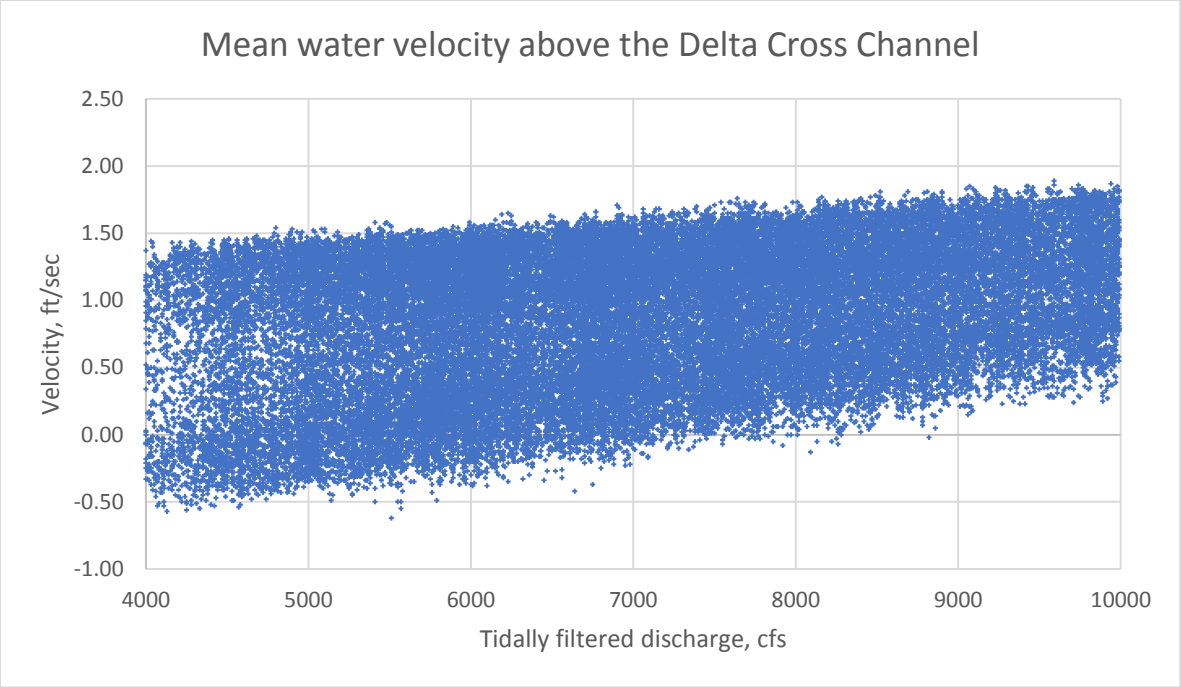

Figure 7 Mean water velocity at tidally filtered discharges of 4,000 - 10,000 cfs

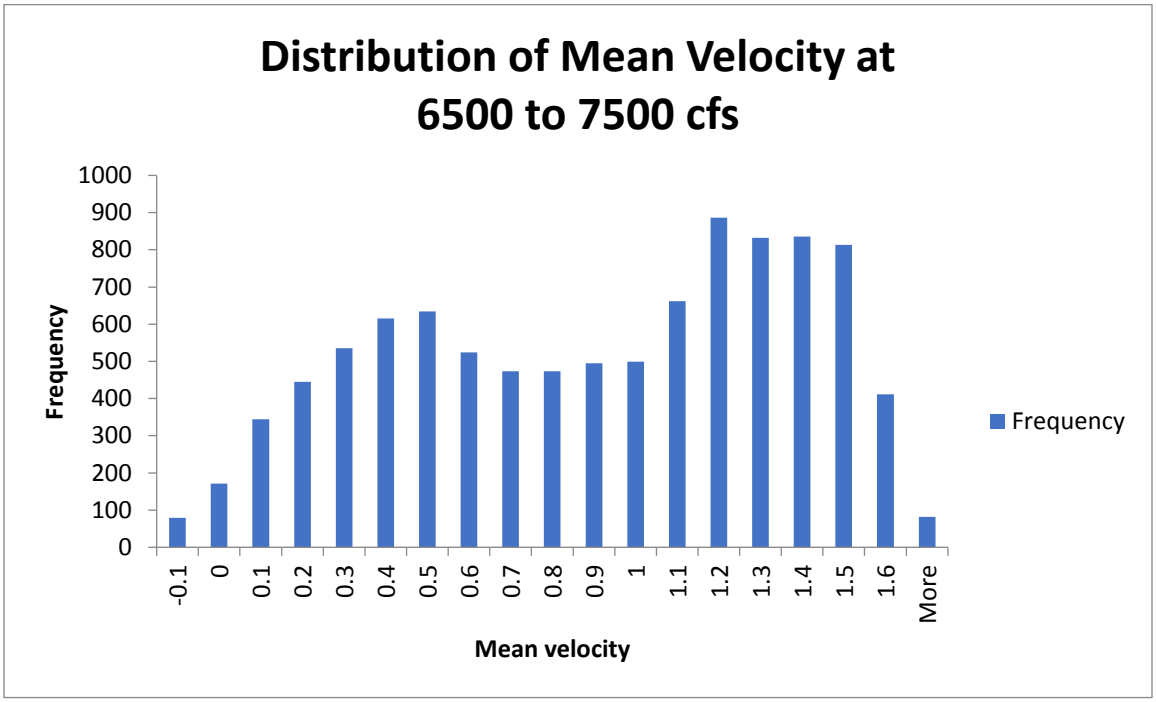

Figure 8 Histogram showing frequencies of mean water velocity at 6500-7500 cfs

Table 1 Mean Velocities at 6500 to 7500 cfs

Mean velocity	*Frequency*
-0.4	55
-0.3	166
-0.2	309
-0.1	384
0	449
0.1	424
0.2	359
0.3	296
0.4	321
0.5	238
0.6	279
0.7	231
0.8	232
0.9	317
1	389
1.1	486
1.2	579
1.3	600
1.4	553
1.5	230
More	22
Total	6919

Velocities at 0.3 cfs and lower: 2442

Fraction of total data points: 35%

Table 2 Mean Velocities at 6500 to 7500 cfs

Mean velocity	*Frequency*
-0.1	79
0	171
0.1	344
0.2	445
0.3	535
0.4	615
0.5	634
0.6	524
0.7	473
0.8	473
0.9	495
1	499
1.1	662
1.2	886
1.3	832
1.4	836
1.5	813
1.6	411
More	82
Total	9809

Velocities at 0.3 cfs and lower: 1574

Fraction of total data points: 16%