**To:** Mike Johnson[mike.johnson@copperenv.com]; 'Brown, Anthony R (RM)'[anthony.brown@bp.com]; 'Lombardi, Marc'[marc.lombardi@amecfw.com]; 'McCarthy, Dave T (Copper Environmental Consulting)'[dave.mccarthy@copperenv.com]; 'Andy Slavik'[Andy.slavik@copperenv.com]; abby.cazier@copperenv.com[abby.cazier@copperenv.com]; 'Doug Carey'[douglas.carey@waterboards.ca.gov]; 'Greg Reller'[gr@burlesonconsulting.com]; 'Stetler, Chris@waterboards.ca.gov'[Chris.Stetler@waterboards.ca.gov]
**From:** Deschambault, Lynda
**Sent:** Tue 3/14/2017 3:50:21 AM
**Subject:** FW: Leviathan Mine - OW - El Nino Monitoring January 7-9, 2017

For powerpoint slide 3:

Any update and more current figures and stats on this? i.e udated figures

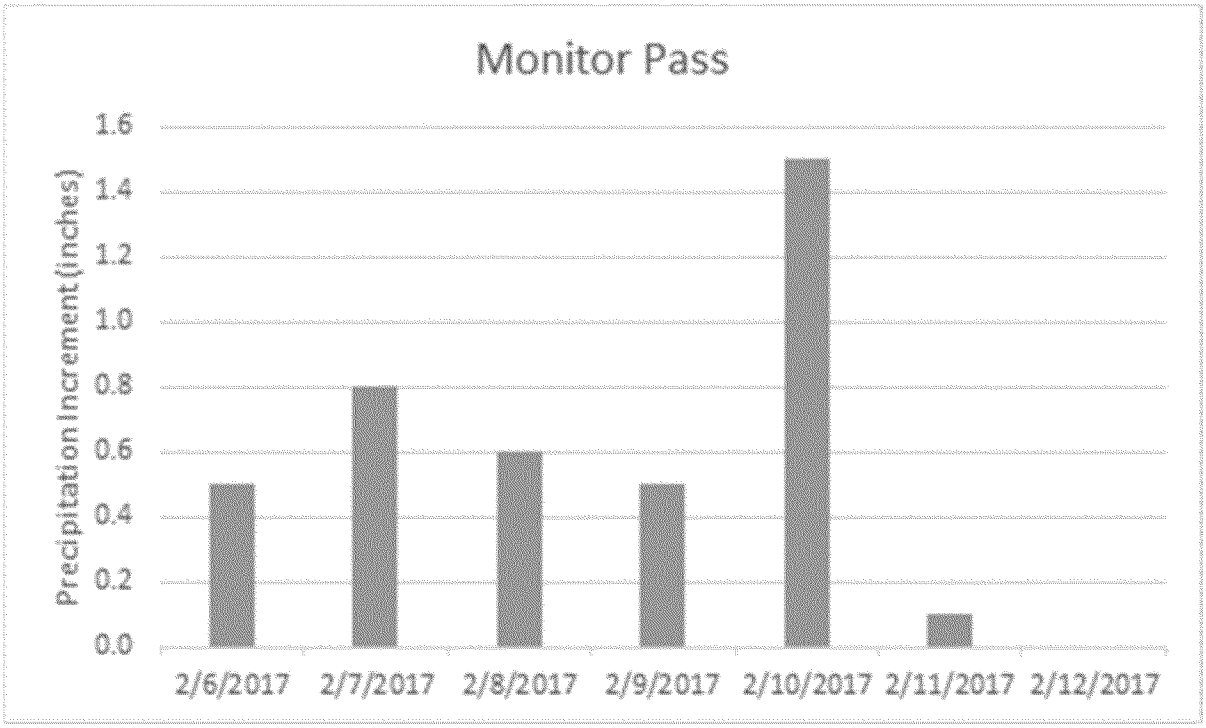
**From:** Lombardi, Marc [mailto:Marc.Lombardi@amecfw.com]
**Sent:** Tuesday, February 14, 2017 6:18 PM
**To:** Deschambault, Lynda <Deschambault.Lynda@epa.gov>; Riley, Gary <riley.gary@epa.gov>
**Cc:** Greg Reller <gr@burlesonconsulting.com>; Cory Koger <Cory.S.Koger@usace.army.mil>; Cohen, Adam <Adam.Cohen@dgslaw.com>; Brown, Anthony R (RM) <anthony.brown@bp.com>; Starr, Robert <Robert.Starr@amecfw.com>; Jefferson, Jill <Jill.Jefferson@amecfw.com>
**Subject:** RE: Leviathan Mine - OW - El Nino Monitoring January 7-9, 2017

Lynda/Gary,

Below is a summary of precipitation at Monitor Pass, and streamflow and water quality for Leviathan Creek at Station 15 during the most recent period of winter storms (February 6 – 13, 2017), with a comparison on longer term results for mid-December through mid-February.

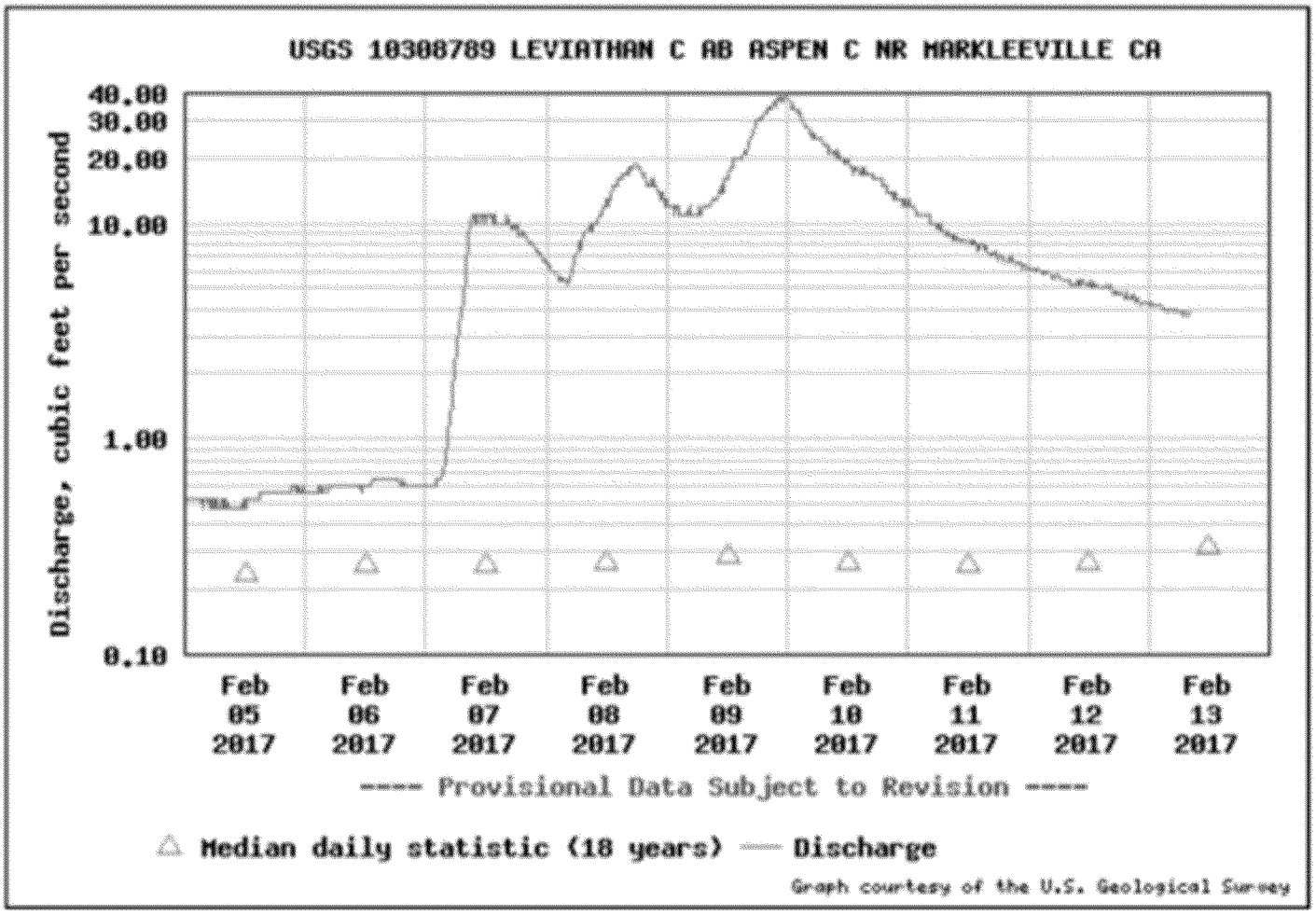
Precipitation

Precipitation measured by the Monitor Pass SNOTEL station shows that precipitation fell most days in this 8-day period. Precipitation exceeded 1 inch on only one day. The total precipitation during this period was 4.0 inches.

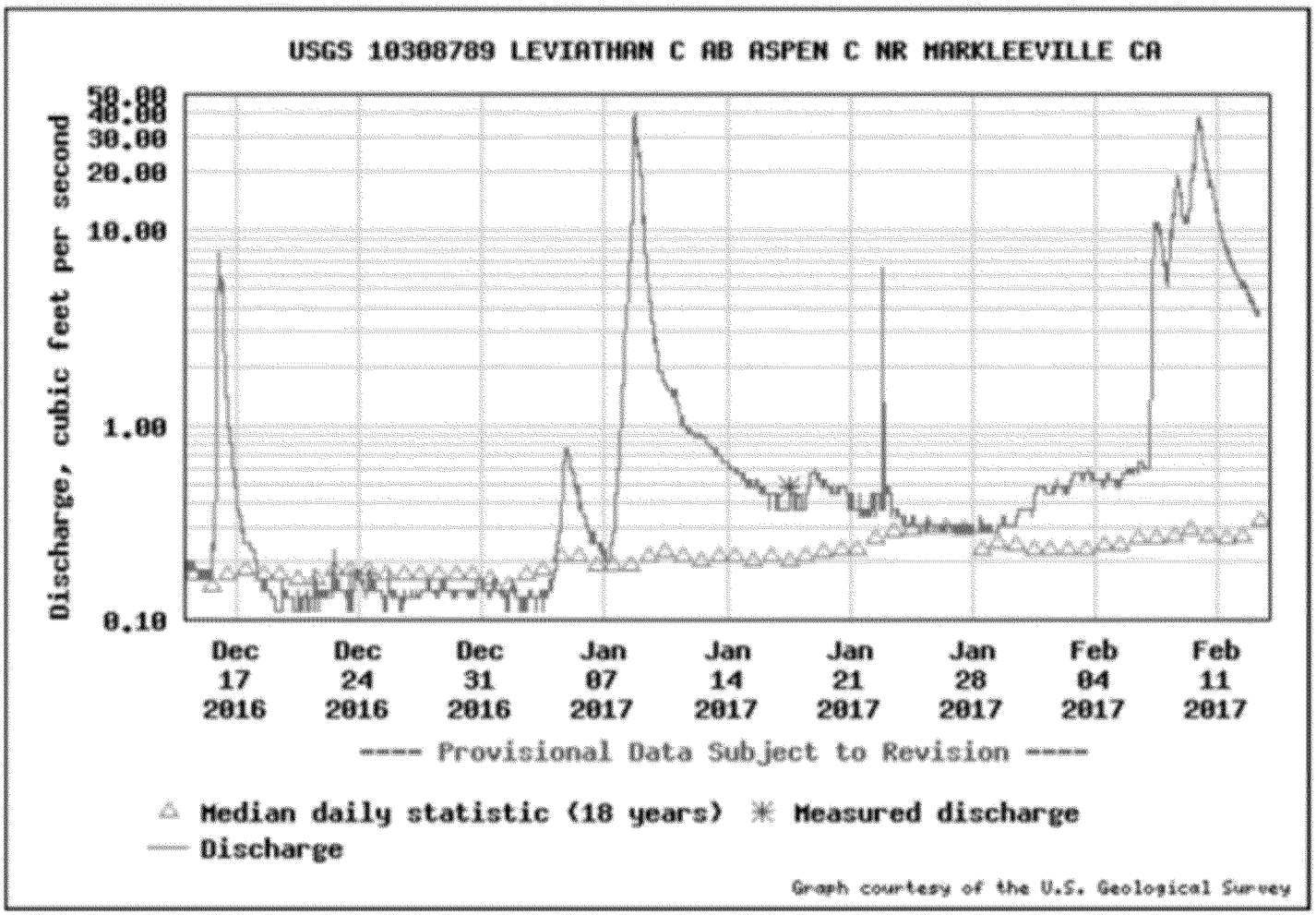


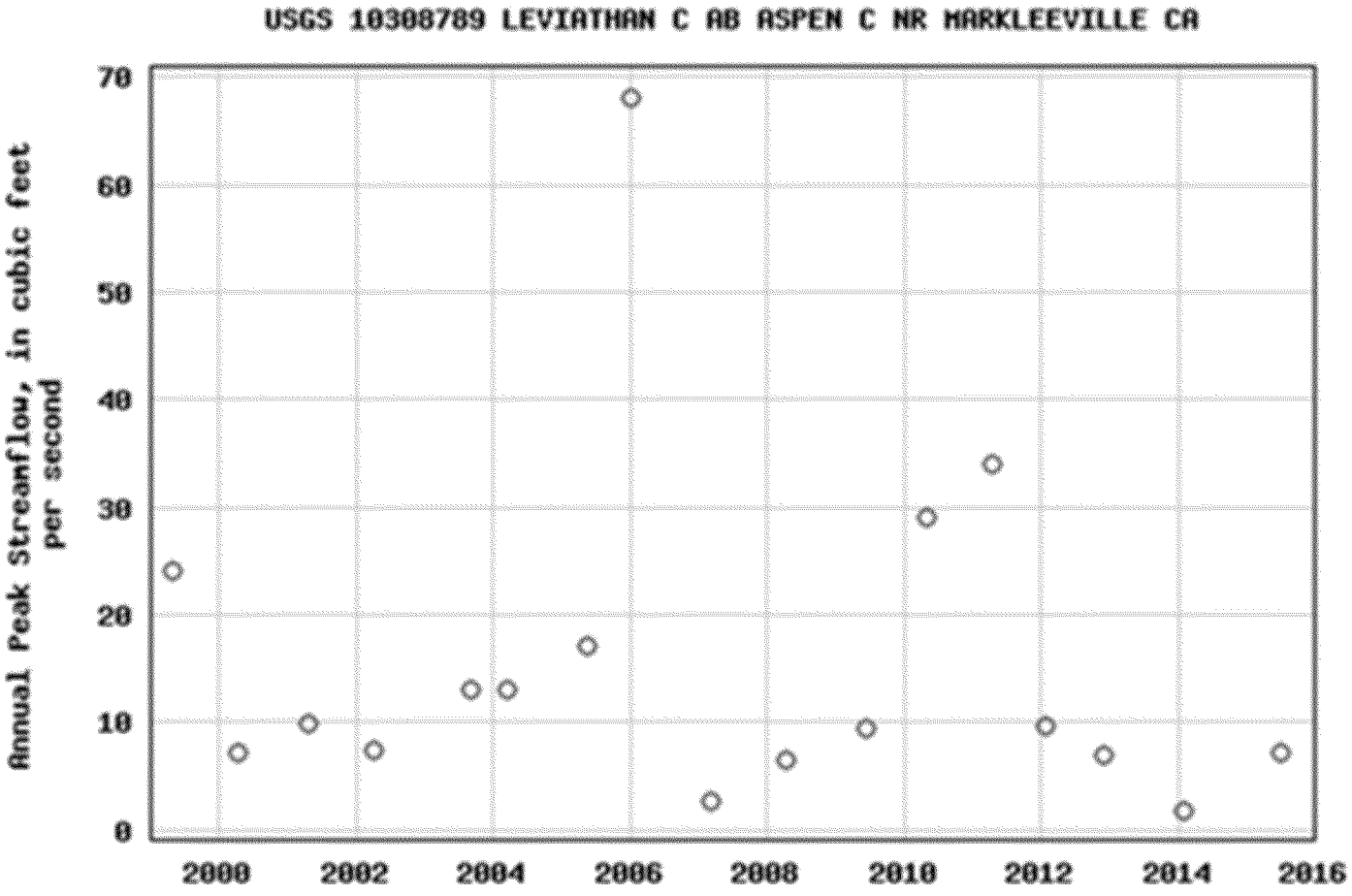

Streamflow

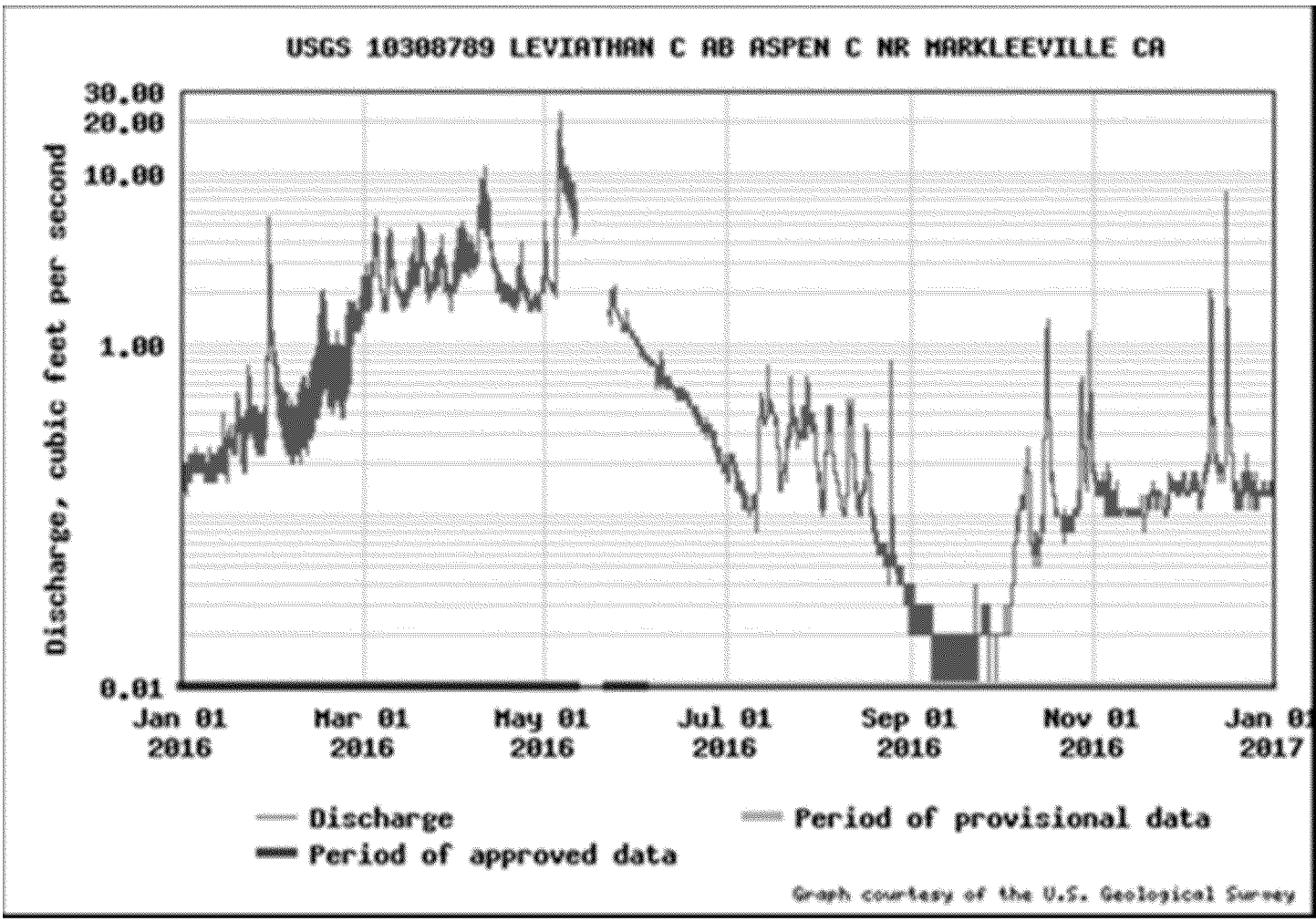
Streamflow in Leviathan Creek is measured at Station 15, the USGS gaging station downstream of the beaver dam/pond complex but upstream of the confluence with Aspen Creek. Streamflow was approximately 0.5 cubic feet per second (cfs) on February 6, followed by a higher flow event that began on February 7. Streamflow increased to approximately 10 cfs on February 7, declined to approximately 5 cfs overnight, increased to approximately 20 cfs on February 8, declined to approximately 10 cfs overnight, reached a maximum of 38 cfs at midnight February 9 and 0100 February 10, and steadily declined to approximately 4 cfs at 1000 February 13.




The February 9-10 38 cfs (17,000) peak is the third largest flow event recorded at this site. The largest flow, 68 cfs (30,500 gpm) was measured December 31, 2006, and the second, 40 cfs (18,000 gpm), was measured January 8, 2017. Other relatively large flowrates >20 cfs occurred in 1999, 2010, 2011, and 2016.

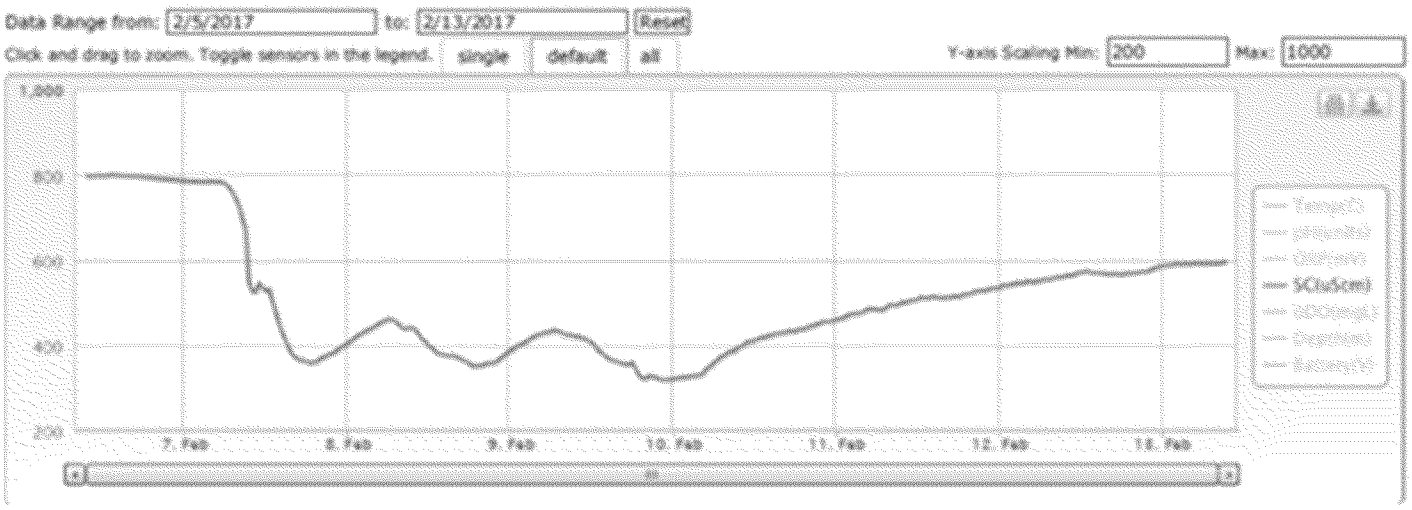

USGS 10308789 LEVIATHAN C AB ASPEN C NR MARKLEEVILLE CA
Discharge, cubic feet per second
50.00
40.00
30.00
20.00
10.00
1.00
0.10
Dec 17 2016
Dec 24 2016
Dec 31 2016
Jan 07 2017
Jan 14 2017
Jan 21 2017
Jan 28 2017
Feb 04 2017
Feb 11 2017
---- Provisional Data Subject to Revision ----
Median daily statistic (18 years)
Measured discharge
Discharge
Graph courtesy of the U.S. Geological Survey


USGS 10308789 LEVIATHAN C AB ASPEN C NR MARKLEEVILLE CA
Annual Peak Streamflow, in cubic feet per second
0
10
20
30
40
50
60
70
2000
2002
2004
2006
2008
2010
2012
2014
2016

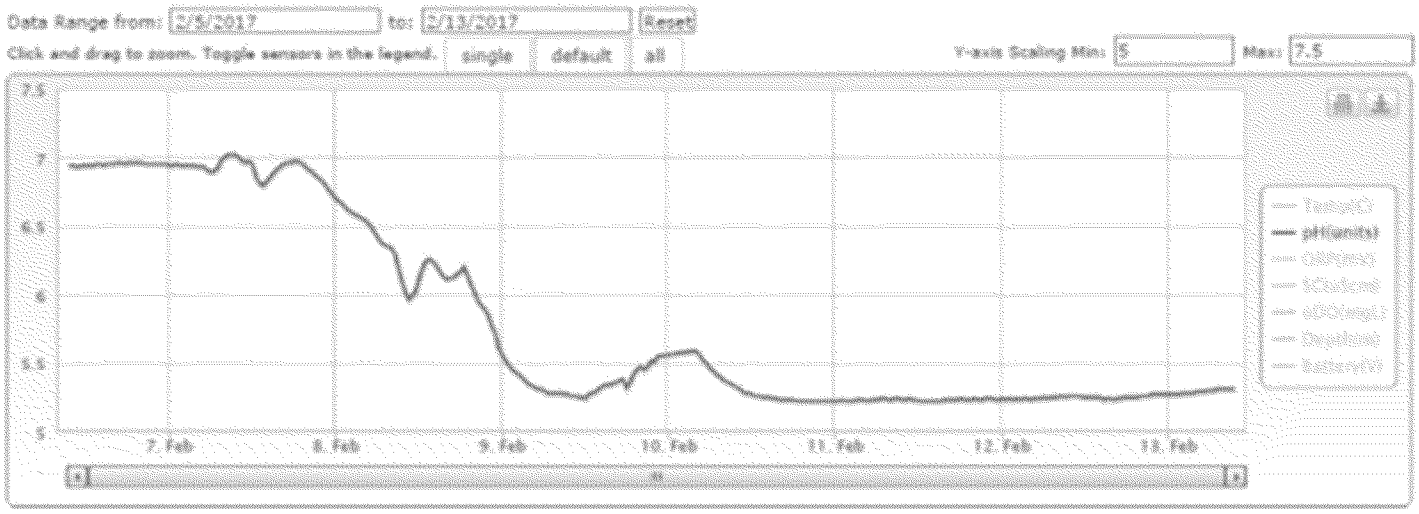



Water Quality

Water quality parameters specific conductance (SC) and pH (as well as other parameters) are measured by U.S. EPA's water quality monitor adjacent to the streamflow station. During the high flow event that began February 7, SC declined from a pre-event value of approximately 800 uS/cm to approximately 400 uS/cm on February 7, was relatively stable at approximately 400 uS/cm until mid-day February 10, and then gradually increased to approximately 600 uS/cm on February 13.



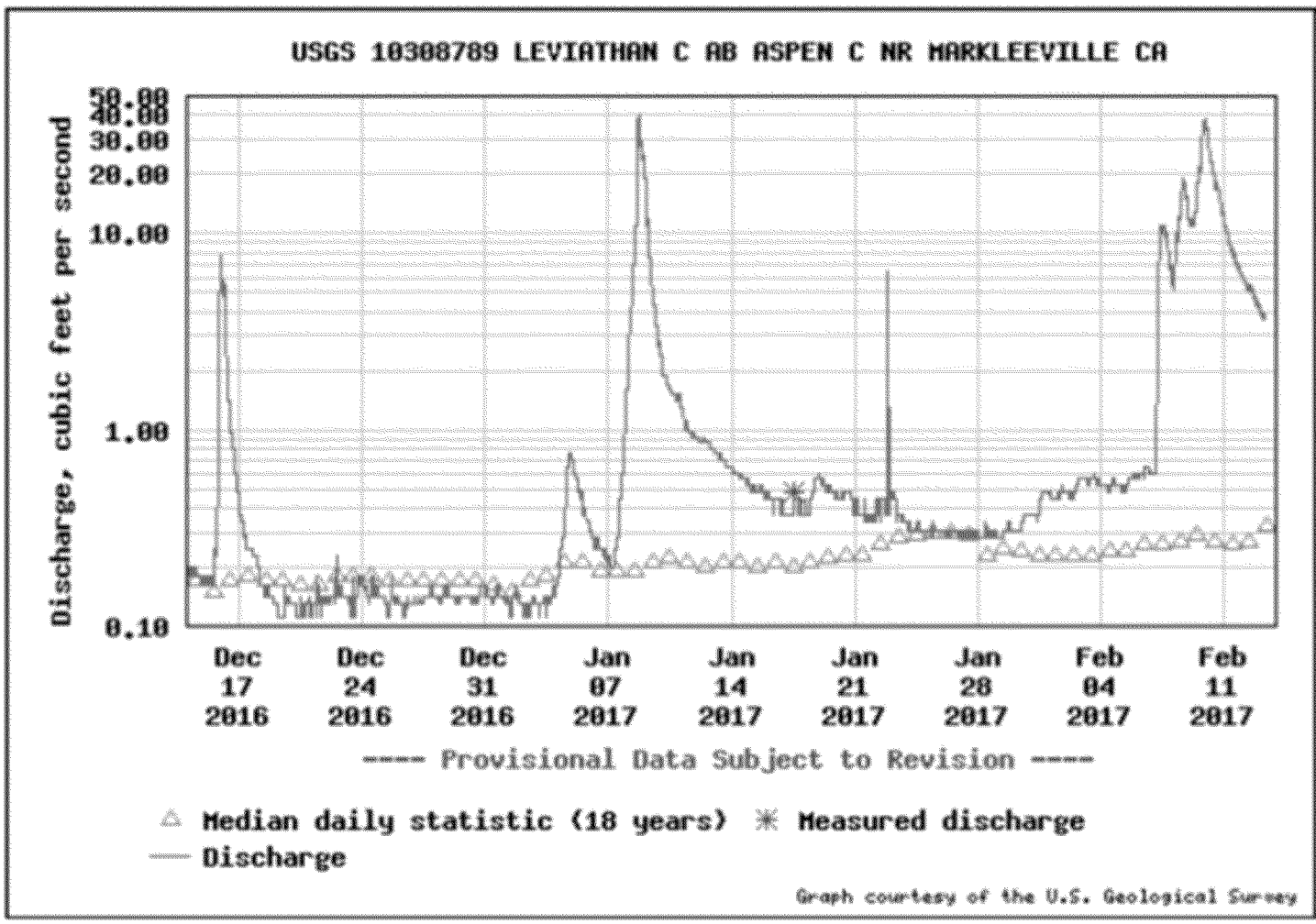

pH prior to the high flow event that began February 7 was approximately 7.0 standard units. pH gradually declined to approximately 5.3 standard units over the course of two days (February 7 – 9), increased to approximately 5.6 standard units and declined back to approximately 5.3 on February 10, and has remained fairly stable since.



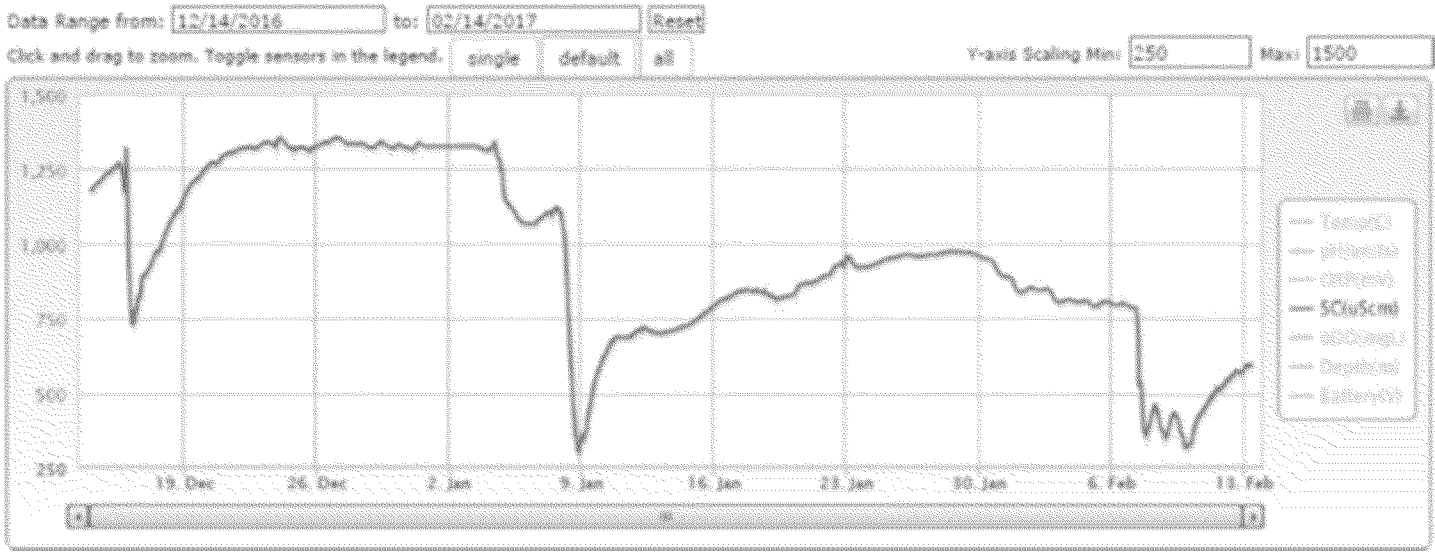

<u>Streamflow and Water Quality Mid-December through Mid-February</u>

The following plots show streamflow, SC, and pH from mid-December through mid-February.

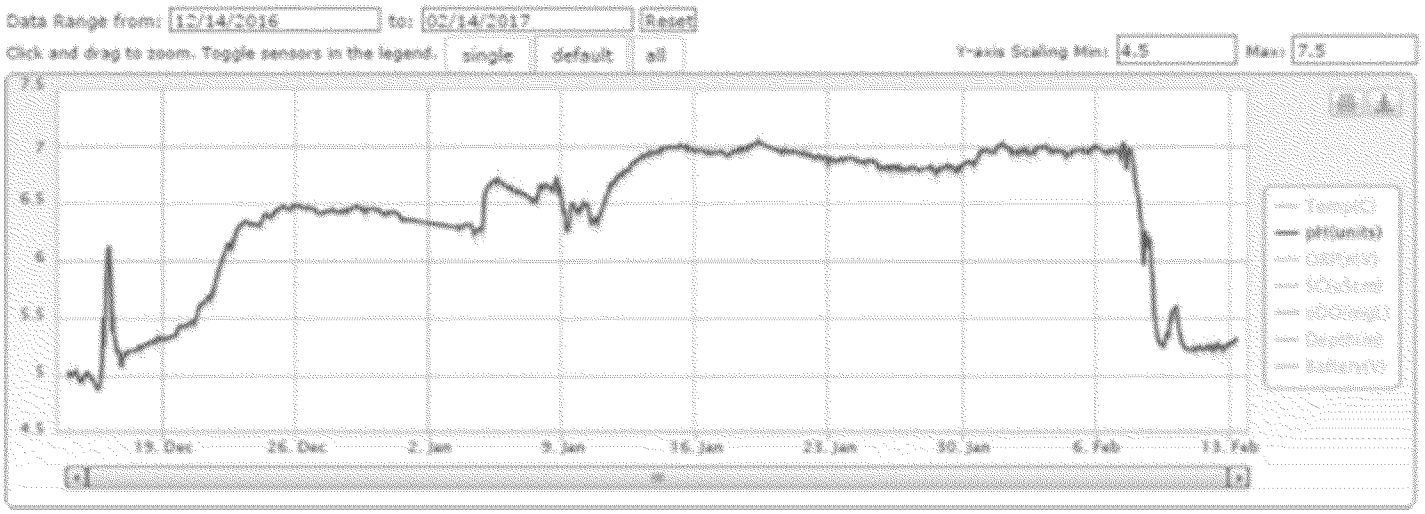
Streamflow exceeded 1 cfs during the weeks of December 10, January 7, January 21, and February 4, and there was a smaller (<1 cfs) event the week of December 31. The January 21 flow event was much shorter than the others.




SC showed an abrupt decline during each flow event (except the short duration event the week of January 21) followed by a rebound – but to a lower value that the pre-flow event value.




pH variations during this period are more complicated than the SC variations. During mid-December, pH gradually increased from about 5 to 6.5 standard units and had a short term increase to about 6.1 associated with the December flow event during this gradual increase. pH was relatively stable at approximately 6.3 to 6.5 until the flow event the week of December 31. During the flow events that occurred the weeks of December 31 and January 7, pH increased from about 6.3 to 6.7, and then declined and fluctuated between about 6.3 and 6.5. pH increased from about 6.3 on January 11 to 7.0 on January 14 and remained fairly constant at 6.8 to 7.0 until February 7, then declined to about 5.3 on February 9 during the most recent high flow event, and remained at approximately 5.3 to 5.5 through February 13.




If you have any questions or comments, please contact Tony Brown at (714) 228-6770 or anthony.brown@bp.com.

Thanks,

Marc

**Marc R. Lombardi, CEM, PG**

Principal Geologist / Office Manager, Environment & Infrastructure Americas, Amec Foster Wheeler

10940 White Rock Road, Suite 190, Rancho Cordova, CA 95670, USA

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marc.lombardi@amecfw.com amecfw.com

**From:** Deschambault, Lynda [mailto:Deschambault.Lynda@epa.gov]
**Sent:** Tuesday, February 14, 2017 8:01 AM
**To:** Brown, Anthony R (RM) <anthony.brown@bp.com>; Lombardi, Marc <Marc.Lombardi@amecfw.com>

**Cc:** Riley, Gary <riley.gary@epa.gov>; Greg Reller <gr@burlesonconsulting.com>; Cory Koger <Cory.S.Koger@usace.army.mil>
**Subject:** FW: Leviathan Mine - OW - El Nino Monitoring January 7-9, 2017

Please provide an update.

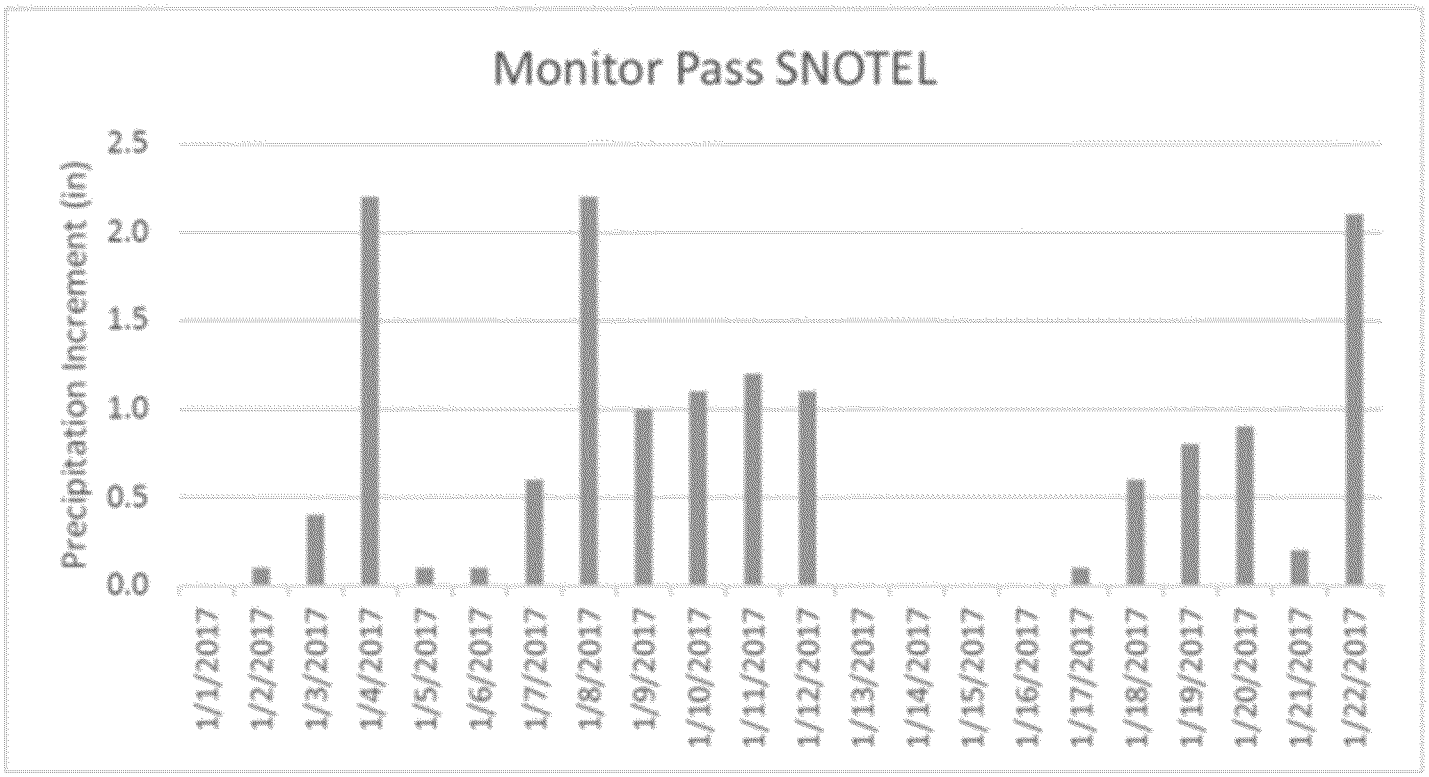
**From:** Lombardi, Marc [mailto:Marc.Lombardi@amecfw.com]
**Sent:** Tuesday, January 24, 2017 1:23 PM
**To:** Deschambault, Lynda <Deschambault.Lynda@epa.gov>; Riley, Gary <riley.gary@epa.gov>
**Cc:** Brown, Anthony R (RM) <anthony.brown@bp.com>; Sanchez, Yolanda <Sanchez.Yolanda@epa.gov>; Greg Reller <gr@burlesonconsulting.com>; Cohen, Adam <Adam.Cohen@dgslaw.com>
**Subject:** RE: Leviathan Mine - OW - El Nino Monitoring January 7-9, 2017

Gary / Lynda,

Below is a summary of observations of precipitation at Monitor Pass, and streamflow and water quality for Leviathan Creek at Station 15 for approximately the first three weeks of January 2017.

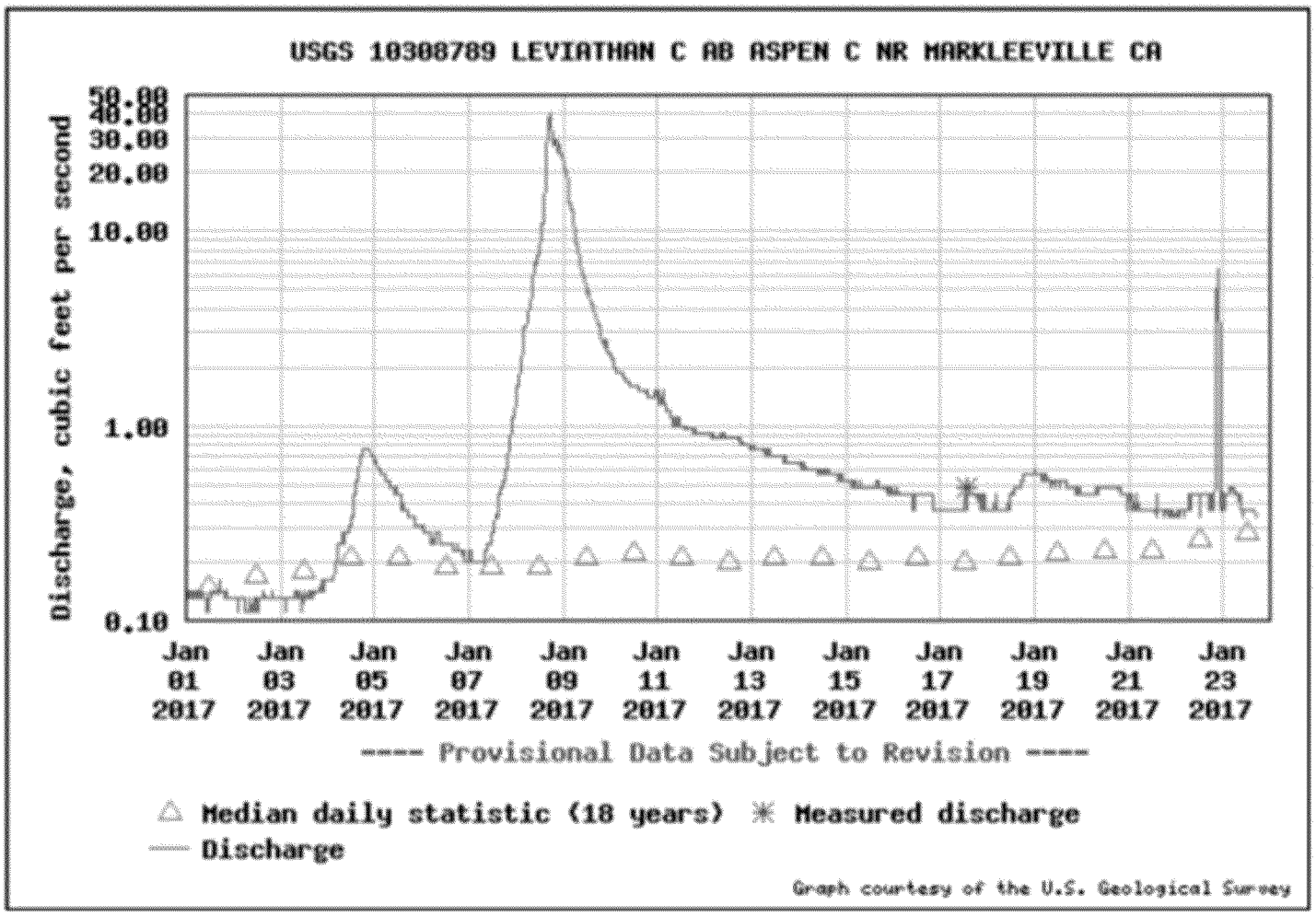
Precipitation

Precipitation measured by the Monitor Pass SNOTEL station shows that precipitation fell most days, with more than 2 inches falling on three days and 1 inch or more falling on an additional 4 days of this 22 day period. The cumulative precipitation during this period is 14.8 inches.



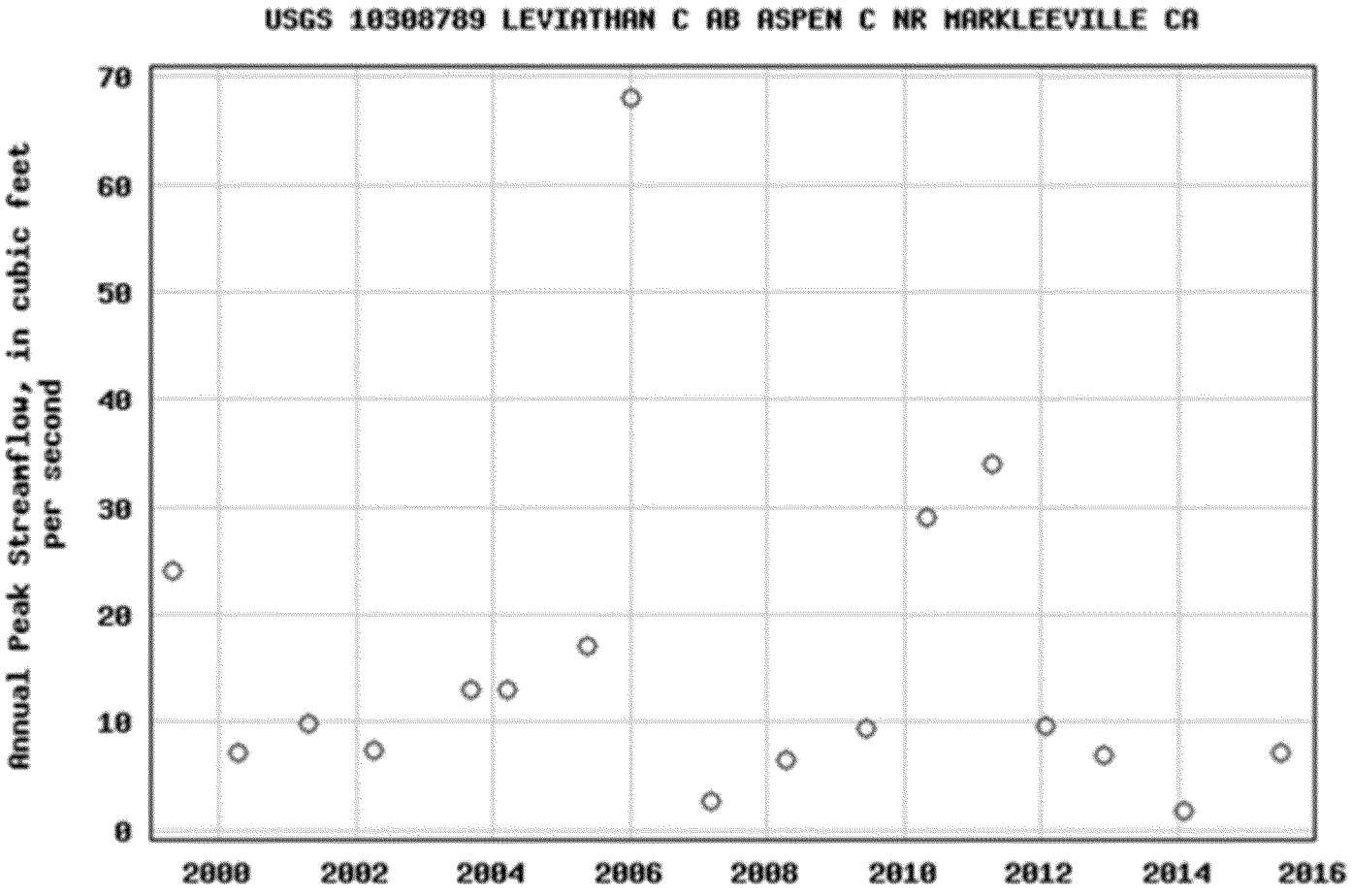

Streamflow

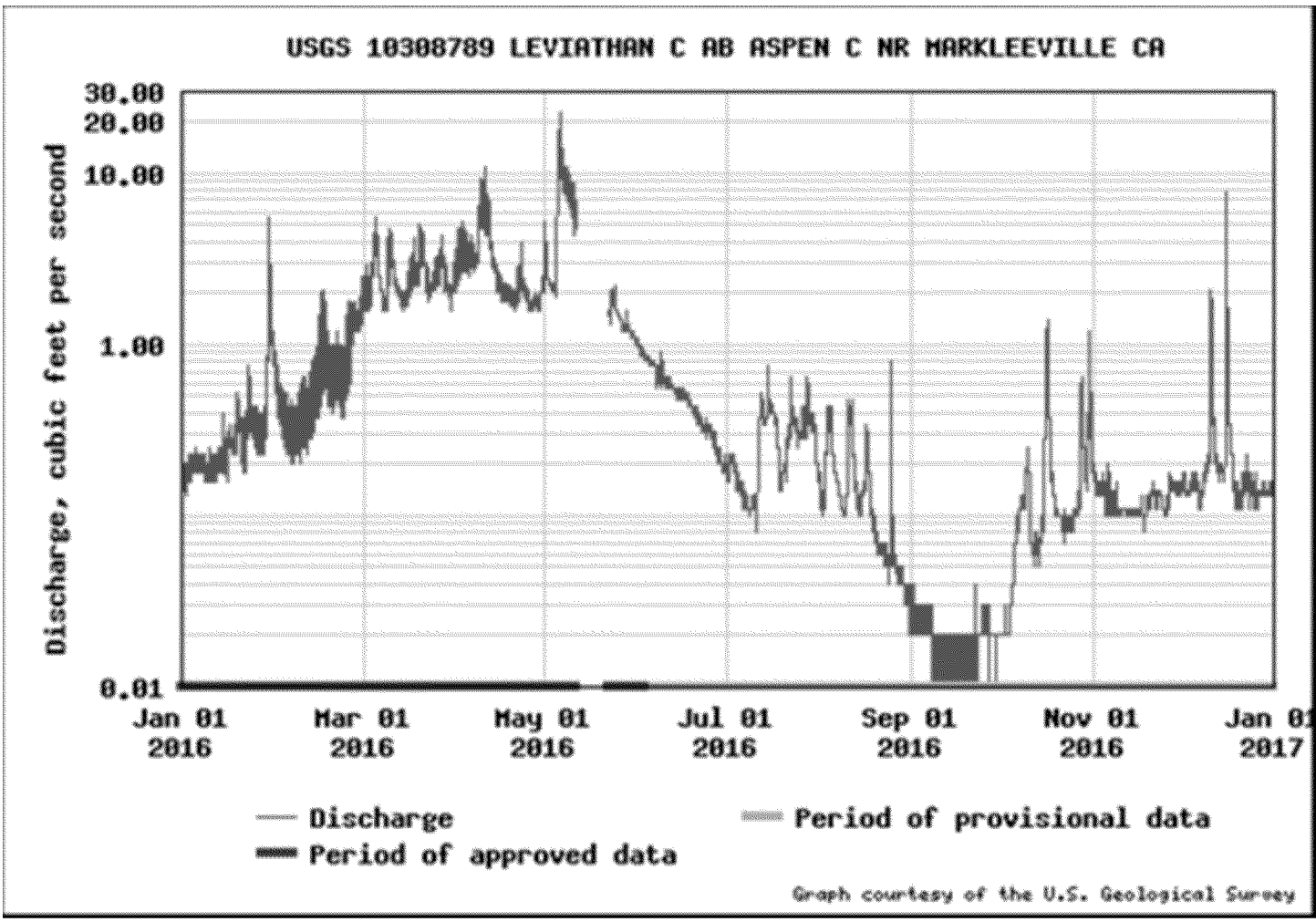
Streamflow in Leviathan Creek is measured at Station 15, the USGS gaging station downstream of the beaver dam/pond complex but upstream of the confluence with Aspen Creek. Three relatively high flow events correspond with the >2 inch precipitation events. The first, on January 4, had a peak flow of approximately 0.8 cubic feet per second (cfs) or approximately 360 gallons per minute (gpm). This relatively small flowrate appears as a peak because it was substantially higher than the flowrate before or after the event, and because flowrate is plotted on a log scale. The second, on January 8, had a much higher flowrate of approximately 40 cfs (~17,950 gpm). The third, on January 22, had a peak flowrate of approximately 7 cfs (~3,140 gpm).




The January 8 high flow event is the second largest flow event recorded at this site. The largest flow, 68 cfs (~30,520 gpm), was measured on December 31, 2005.

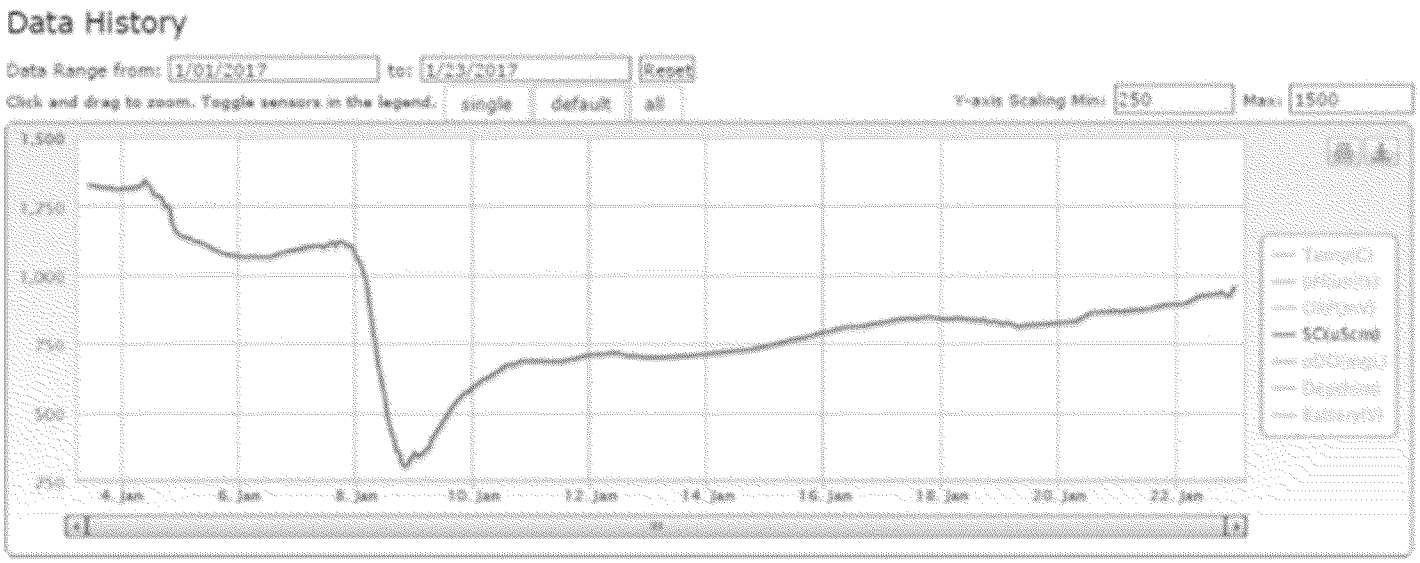
Other relatively large flowrates >20 cfs (>8,975 gpm) occurred in 1999, 2010, 2011, and 2016.


USGS 10308789 LEVIATHAN C AB ASPEN C NR MARKLEEVILLE CA
Annual Peak Streamflow, in cubic feet per second
0
10
20
30
40
50
60
70
2000
2002
2004
2006
2008
2010
2012
2014
2016

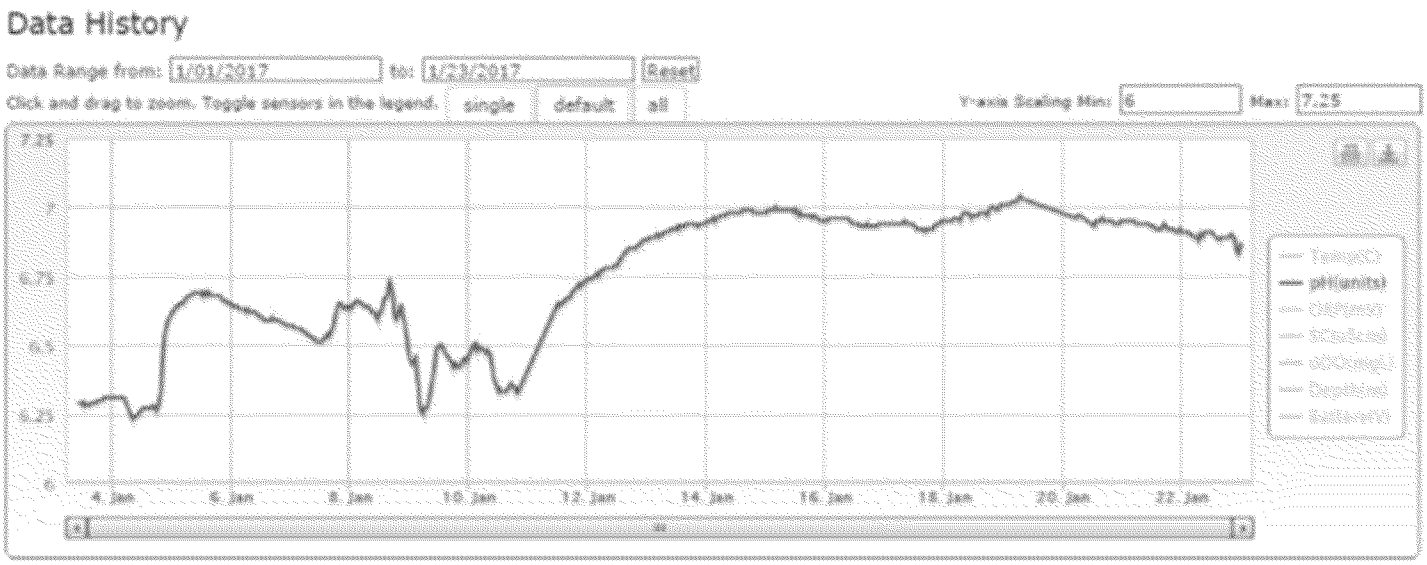



Water Quality

Water quality parameters specific conductance and pH (as well as other parameters) are measured by U.S. EPA's water quality monitor adjacent to the streamflow station. SC values showed an abrupt decline from approximately 1300 to 1100 uS/cm that corresponded with the first (~0.8 cfs) peak flow event; an abrupt decline from approximately 1,100 to 300 uS/cm that corresponded with the second (40 cfs) peak flow event, followed by an increase to about 900 uS/cm. SC did not show a significant change in conjunction with the third peak flow event (~7 cfs).




pH is a measure of the acid – alkaline condition of water. The pH in early January was ~6.25 standard units. Similar to SC, pH values changed abruptly in conjunction with the first two peak flow events. pH increased from about 6.25 to 6.7 in conjunction with the first peak flow event (~0.8 cfs), and then gradually declined over several days to about 6.5. The pH response during the second peak flow event (40 cfs) was more complicated; an initial increase to 6.75, a decline to 6.25, increase to about 6.5, and then a decline to about 6.3. Beginning late January 10, pH gradually increased to approximately 7 on January 19, and then drifted downward slightly to approximately 6.8 to 6.9 by January 22. There was a small (<0.1 unit) pH response in conjunction with the third peak flow event (7 cfs). Note that the scale of the graph makes these relatively small changes – a few tenths of a pH unit – appear more dramatic than they actually are.




If you have any questions or comments, please contact Tony Brown at (714) 228-6770 or anthony.brown@bp.com.

Thanks,

Marc

**Marc R. Lombardi, CEM, PG**

Principal Geologist / Office Manager, Environment & Infrastructure Americas, Amec Foster Wheeler

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