Going with the Flow Update

An update and comparative analysis of five years of Water Sentinels flow data collection of the Upper Verde River

Rachel Shultis
Intern for Science-Practice Integration
Grand Canyon Chapter of the Sierra Club
April 2018
As determined in the 2013 “Going with the Flow Report,” the Above Verde Springs measurement site at mile 2.1 that begins just downstream of Stillman Lake and at the mouth of the Granite Creek River remains essentially dry. Although there are times when some water flow can be gaged, it often involves digging a channel or measuring just one small area of movement. Measurements from 2012 to 2017 continue the 2006-2011 pattern where flow measurements were less than 1.0 cubic feet per second (cfs); however, there was one measurement in January 2017 of 1.9 cfs. In 2013, most measurements were less than 0.2 cfs. Data from 2012 to 2017 demonstrate flow measurements of 0.17 cfs on average with most measurements falling below 0.1 or at 0.0.
Base Flow at the SRP Campbell Ranch Low-Flow Gage

The Salt River Project (SRP) installed a low-flow gage at river mile 3.2 that logs and records river flow in cfs every 15 minutes. These data are important because of the gage’s close proximity to Verde Springs, which is the primary source of baseflow for the river.

![Figure 2. Campbell Ranch Low-Flow Gage.](image)

Photo Credit: Gary Beverly

Water Sentinels obtained daily mean flow data from the SRP archives for years 2012-2017. These data were then calculated into monthly average cfs where sufficient data were available [See Appendix A].

The majority of the monthly mean flow of the Upper Verde River from January 2012 to December 2017 ranged between 14 and 16 cfs, a decrease in both the size of the range and the measurements themselves from the 2005-2011 flow data range of 17 to 20 cfs. In these sets of data specifically, it appears as measurements decrease, they also move closer together. Although this pattern of clustering as measurements decrease is not accurate in considering the long-term record from mid-1963 to 2018, it is an interesting observation in these most recent data sets.

![Chart 2. Monthly Mean Flow 2012-2017 – SRP Campbell Ranch Gage](chart)
The main body of data from the time of the gage’s installation in 2005 through 2017 demonstrates a well-defined decline in mean monthly flow through time, from approximately 21 cfs to 14 cfs. Data points that lie above the main trend represent runoff from both winter and summer storms.

Although scattered outliers exist, they become scarcer in the data over time and represent seasonal changes in the river flow due to monsoon season, snowmelt runoff, and winter storms. A clear decline in flow over a 12-year period indicates that the groundwater discharges at Verde Springs are gradually decreasing.

Comparison of the data from the SRP Campbell Ranch streamgage with the daily data for the same time period from the U.S. Geological Survey (USGS) Paulden streamgage demonstrates that the Verde River, from its headwaters through at least the first eight river miles to the Paulden gage, is a gaining reach.
USGS Stream Gage near Paulden

Approximately six river miles below the Campbell Ranch gage and 10 miles below the Sullivan Dam lies the USGS Paulden gage (09503700), which collects streamflow measurements every 15 minutes. The Water Sentinels obtained monthly mean flows from the USGS National Water Information System Web Interface to determine monthly average flows at the USGS Paulden gage between 2012 and 2017.¹

![Table 1. Monthly Means at Paulden Gage, cfs](image)

<table>
<thead>
<tr>
<th></th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>23.1</td>
<td>23.1</td>
<td>25.9</td>
<td>24.1</td>
<td>22.9</td>
<td>20</td>
<td>19.5</td>
<td>22.3</td>
<td>23.1</td>
<td>22.9</td>
<td>23.3</td>
<td>23.5</td>
</tr>
<tr>
<td>2013</td>
<td>24.5</td>
<td>24.7</td>
<td>21.8</td>
<td>19.1</td>
<td>19.5</td>
<td>18.2</td>
<td>60.8</td>
<td>29</td>
<td>29.6</td>
<td>21</td>
<td>21.2</td>
<td>20.5</td>
</tr>
<tr>
<td>2014</td>
<td>21.9</td>
<td>22.5</td>
<td>21.1</td>
<td>20.9</td>
<td>19.5</td>
<td>17.9</td>
<td>20</td>
<td>27.4</td>
<td>20.5</td>
<td>19.7</td>
<td>21.7</td>
<td>23.1</td>
</tr>
<tr>
<td>2015</td>
<td>23.4</td>
<td>24.7</td>
<td>34.5</td>
<td>19.9</td>
<td>18.5</td>
<td>17.2</td>
<td>17.4</td>
<td>17.4</td>
<td>18</td>
<td>18.5</td>
<td>19.2</td>
<td>19.9</td>
</tr>
<tr>
<td>2016</td>
<td>20.2</td>
<td>20.8</td>
<td>21.3</td>
<td>20.4</td>
<td>19.8</td>
<td>18.5</td>
<td>18.4</td>
<td>20.9</td>
<td>19.8</td>
<td>20.4</td>
<td>20.8</td>
<td>21.7</td>
</tr>
<tr>
<td>2017</td>
<td>34</td>
<td>38.5</td>
<td>72.7</td>
<td>21.2</td>
<td>20.2</td>
<td>19.6</td>
<td>19.3</td>
<td>19.8</td>
<td>18.3</td>
<td>18.9</td>
<td>19.0</td>
<td>19.3</td>
</tr>
</tbody>
</table>

Green and yellow highlighted values together demonstrate cfs below 22. Yellow demonstrate cfs below 20.

The Sierra Club (2013) report stated that between 1964 and 2003, monthly mean flows under 22 cfs occurred less than ten percent of the time.² From 2007 to 2012, monthly mean flows were less than 22 cfs thirty-seven percent of the time.² Just five years later, 2013-2017 data indicate that seventy-eight percent of the time the river is flowing below 22 cfs. This five-year span demonstrates a more than 100 percent reduction of streamflows to less than 22 cfs and a shift in the majority from 20-25 cfs in 2007-2011 to 17-22 cfs in 2012-2017. Should this pattern continue, all monthly mean river flow would be reduced to below 22 cfs by 2019. However, this reduction may be slowed by winter precipitation, snowmelt, and monsoon activity.

---


Monthly mean discharge values of historic lows below 20 cfs were recorded a total of 10 times from the 1963-2011 record. Over the 2012-2017 period, monthly mean flows drop to values less than 20 cfs 27 times for a combined total of 35 percent of all measurements at or below 20 cfs [See footnote for a list of dates]. From 2007-2011, just 0.08 percent of all measurements made up this same percentage. Averages remain higher in February and March as expected due to winter precipitation and snowmelt, though there are many instances where averages fall below the historic average flow of 25 cfs in these months. Nine out of twelve months experienced historic lows in 2015, indicating this may have been a particularly dry year. The pervasive nature of these lows may mark a shift from 20 cfs as a historic low to representative of a new normal.

The graphed values below represent the average of seven days or more of continuous lowest streamflow at the Paulden gage in each calendar year [See Appendix C]. This is used to estimate the rate of groundwater contribution to the stream in the summer months. Baseflow measurements in the winter are a bit higher, about a couple of cfs, because evapotranspiration is at a minimum in the winter.

---

Fifty-four full years, 1964-2017, of record at the Paulden streamgage show a substantial decline in monthly mean flows and annual discharge beginning in 2000. The average summer baseflow for the entire data set is 21 cfs. The average for 2000-2017 is 19 cfs. From 2010 through 2017 the average is 18 cfs. These changes likely represent some combination of the effect of regional climate change and long-term groundwater pumping in the Big Chino and Williamson Valleys and in the Prescott Active Management Area (AMA).

These graphs exemplify an evident decline in baseflow. Most, if not all, monthly mean flows greater than 60 cfs represent Pacific Ocean storms that skew the average annual discharge. Discounting average annual discharge for all years that have one or more months greater than 60 cfs results in average annual discharge ranges from 25 to 30 cfs from 1964 through 1999 and from 20 to 24 cfs from 2000 through 2017. That is a significant change, and it correlates well with the current drought. This may or may not be a manifestation of long-term climate change, but it clearly represents a prolonged—essentially two-decade—drought that is ongoing. It may reflect as well, a gradual decrease owing to the long-term effect of groundwater pumping in both the Big Chino Valley and the Prescott Active Management Area. It appears that the Upper Verde near Paulden is indeed, “going with the flow.”
Water Sentinels' Bear Siding Discharge Measurement Site

Free-flowing and wild with little evidence of human impact is Bear Siding, located at river mile 19.4, approximately 9.4 miles downstream of the USGS Paulden gage. The Water Sentinels monitored flow here from February 2007 through October 2009, beginning again in February 2013 to collect more data on the losing reach of river between the USGS Paulden gage and Perkinsville.

Figure 4. Verde River at Bear Siding in Winter.
Photo Credit: Tom Slaback

Monthly Measurements from 2013-2017 remain relatively consistent with 2007-2009 data. Monthly streamflow measurements appear relatively constant, with the majority of measurements ranging from 13-17 cfs. This is a decrease in range from 2007-2009 data where the majority of measurements were between 10 and 20 cfs.\(^5\) Discharge ranged from a minimum of 11.5 cfs to a maximum of 70.2 in February 2017.

Table 2. Monthly Measurements at Bear Siding, cfs

<table>
<thead>
<tr>
<th></th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>19.5</td>
<td>17.6</td>
<td>16.5</td>
<td>14.8</td>
<td>13.0</td>
<td>30.3</td>
<td>18.0</td>
<td>16.8</td>
<td>18.0</td>
<td>21.9</td>
<td>17.8</td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>20.2</td>
<td>14.3</td>
<td>19.2</td>
<td>17.3</td>
<td>14.9</td>
<td>14.0</td>
<td>14.7</td>
<td>21.3</td>
<td>17.8</td>
<td>15.1</td>
<td>14.5</td>
<td>16.4</td>
</tr>
<tr>
<td>2015</td>
<td>16.7</td>
<td>14.1</td>
<td>19.0</td>
<td>15.4</td>
<td>17.3</td>
<td>15.4</td>
<td>12.9</td>
<td>15.6</td>
<td>14.7</td>
<td>14.0</td>
<td>16.0</td>
<td>16.0</td>
</tr>
<tr>
<td>2016</td>
<td>17.2</td>
<td>16.4</td>
<td>16.4</td>
<td>14.4</td>
<td>14.2</td>
<td>14.8</td>
<td>15.5</td>
<td>17.2</td>
<td>16.2</td>
<td>18.2</td>
<td>18.4</td>
<td>N/A</td>
</tr>
<tr>
<td>2017</td>
<td>50.5</td>
<td>70.2</td>
<td>18.9</td>
<td>18.4</td>
<td>14.0</td>
<td>11.5</td>
<td>22.5</td>
<td>14.1</td>
<td>14.7</td>
<td>15.9</td>
<td>17.5</td>
<td>17.2</td>
</tr>
</tbody>
</table>

Green highlighted values demonstrate cfs 17-20. Yellow demonstrate cfs between 13-17.

Chart 8. Flow Rate Data 2013-2017 - Bear Siding Site

It is interesting to note that the lower end of the majority has increased from 10 to 13 cfs while the upper range has decreased, demonstrating a shift toward a smaller range over time. Streamflow measurements at Bear Siding are much lower than those at the Paulden gage, indicating this site is on a losing stretch of river. This decrease in flow supports the idea that this losing reach of the Upper Verde between Paulden and Perkinsville is in danger of becoming intermittent. Evapotranspiration contributes to a small part of the downstream loss, but infiltration of streamflow to the groundwater is likely much more significant. Combined effects of climate change and continuing and increasing pumping of groundwater in the Prescott AMA and Big Chino Valley likely threaten the river from the headwater springs through Perkinsville.
Monthly Water Sentinels’ Perkinsville Discharge Measurement Site

This flow measurement site is the most downstream measured by the Water Sentinels at river mile 24.

Perkinsville monthly measurements demonstrate a trend of decreasing flow. More than 50 percent of all flow measurements fall between the range of 8-13 cfs, making this the majority for 2012-2017 data. This is a decrease from the 2011-2012 range of 9-15 cfs.6

<table>
<thead>
<tr>
<th></th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>14.4</td>
<td>14.7</td>
<td>12.2</td>
<td>11.4</td>
<td>8.1</td>
<td>8.1</td>
<td>11.0</td>
<td>54.9</td>
<td>11.1</td>
<td>13.7</td>
<td>13.5</td>
<td>17.0</td>
</tr>
<tr>
<td>2013</td>
<td>14.3</td>
<td>14.2</td>
<td>13.4</td>
<td>12.4</td>
<td>11.0</td>
<td>7.9</td>
<td>14.4</td>
<td>12.5</td>
<td>12.7</td>
<td>14.2</td>
<td>17.4</td>
<td>15.3</td>
</tr>
<tr>
<td>2014</td>
<td>13.4</td>
<td>15.6</td>
<td>16.9</td>
<td>14.2</td>
<td>10.0</td>
<td>9.4</td>
<td>10.2</td>
<td>12.2</td>
<td>21.0</td>
<td>14.0</td>
<td>14.4</td>
<td>15.4</td>
</tr>
<tr>
<td>2015</td>
<td>15.1</td>
<td>16.0</td>
<td>16.0</td>
<td>12.2</td>
<td>11.9</td>
<td>10.2</td>
<td>8.8</td>
<td>12.8</td>
<td>10.7</td>
<td>13.1</td>
<td>14.7</td>
<td>15.6</td>
</tr>
<tr>
<td>2016</td>
<td>15.6</td>
<td>15.1</td>
<td>12.3</td>
<td>12.9</td>
<td>10.9</td>
<td>11.5</td>
<td>11.6</td>
<td>13.1</td>
<td>13.2</td>
<td>13.3</td>
<td>13.9</td>
<td>59.5</td>
</tr>
<tr>
<td>2017</td>
<td>45.8</td>
<td>61.8</td>
<td>15.4</td>
<td>14.1</td>
<td>10.5</td>
<td>7.9</td>
<td>24.7</td>
<td>11.4</td>
<td>10.3</td>
<td>12.5</td>
<td>13.2</td>
<td>14.9</td>
</tr>
</tbody>
</table>

Yellow highlighted values demonstrate cfs at or below 13. Green and yellow demonstrate cfs at or below 14.

In 2007, the majority of monthly measurements ranged from 16-21. Ten years later, data indicate a drastic reduction in the range, now between 8-14 cfs. However, although the range demonstrates a dramatic shift from 2007-2017, the 2012-2017 majority of 8-13 cfs is not a substantial shift from the 2011-2012 majority flow determined to be between 9-15 cfs.6 This indicates a relative slowing of loss of flow as measurements move closer together, clustering at 10 cfs. Flow measurements for the months of

---

May and June from 2012-2017 range only from 7.9-11.9 cfs, again supporting a continual shift toward smaller ranges as measurements near 0 cfs.

The graph above indicates the range in flow measurements is slowly decreasing, moving closer to 10 as an average where measurements have less flexibility as the size of the range itself is decreasing. Drastic highs and lows are more sparing in the 2012-2016 data; this trend of reduction in range of flow measurements or cfs clustering is also apparent in measurements taken at Campbell Ranch and Bear Siding. This identical trend in several sets of data demonstrates a streamflow that is steadily decreasing with smaller decreases over time as the majority of measurements move closer to 0.

The 2013 report estimated that the river was losing about 1 cfs per year. Measurements from 2012-2017 demonstrate a slower rate of change; however, it is apparent that streamflow is decreasing at the Perkinsville gage. Where many monthly measurements were once in and around 20 cfs, 2012-2016 data reflect a mild rate of change where measurements are becoming closer together and have reached 20 only once in September, which is historically a month of increased river flow due to monsoon activity. However, 2017 measurements feature a much greater range of data where streamflow reaches highs of approximately 60 cfs and drops to a new low of 7 cfs in September. This extreme variation may be due to increased precipitation in 2017.

---

The 10-year graph above including mean streamflow from 2007-2017 maintains a downward slope where flow continues to reach new historic lows. Where lows were once historic at 9 cfs, measurements of 8 and 9 have become increasingly commonplace and concern arises with a new low of 7 cfs. All of the lowest measurements were taken in the summer months. This is relevant because this is generally the time baseflow conditions arise, as streamflow is least influenced by precipitation. These low values provide critical information about the combined impact of drought and groundwater pumping on the river. Furthermore, these values indicate a rate of change of 2 cfs over five years, reinforcing the idea that the river is steadily decreasing, although the rate of decrease is becoming less severe as flow measurements move closer to 0.

There is a losing reach of river between Perkinsville and the Paulden gage, located approximately 14 miles upstream. Loss is demonstrated by the difference in the majority of the flow measurements, as well as by the progressive decrease in minimum values from Paulden to Bear Siding to Perkinsville. Perkinsville flow measurements fall between 8 and 13 cfs, while in Paulden, the majority of flows range from 17 to 22 cfs, describing a loss of 9-15 cfs between locations as pictured below. Paulden lows reach 17 cfs and decline through the losing reach to 7 cfs in Perkinsville. As flow decreases at the Paulden Gage, repercussions in the form of decreased flow at Perkinsville are apparent.

Another potential source of streamflow loss for the Upper Verde River comes from an irrigation ditch located an estimated one-third of a mile upstream from the Perkinsville measurement site. Water is diverted from the river into the irrigation ditch, which eventually joins with the Verde again below the Perkinsville measurement site. Flow measurements taken in the ditch give information about the streamflow that is added back to the river below the upper 26 miles of interest [See Appendix B]. However, it is not clear how much streamflow is diverted upstream. Measurements from the point of diversion into the ditch could be used to determine if this irrigation ditch is a significant factor in diminishing streamflow.

With new historic lows being reached in Perkinsville, trends of clustered flow measurements and cfs ranges greatly decreased as they move closer to 0, and once historic lows becoming the new norm in Paulden, it is evident the Upper Verde is indeed “going with the flow.” The 2013 report predicted the Upper Verde had approximately 10 cfs in baseflow to lose before intermittency began in the summer.
Five years later, baseflow has decreased and the Upper Verde now has approximately 8 cfs of baseflow to lose before becoming intermittent in dry summer months.
Appendix A. SRP Campbell Ranch Low-flow Gage Data
<table>
<thead>
<tr>
<th>Month</th>
<th>Monthly Average (cfs)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>04/2005</td>
<td>21.1633</td>
<td></td>
</tr>
<tr>
<td>05/2005</td>
<td>20.7932</td>
<td></td>
</tr>
<tr>
<td>06/2005</td>
<td>20.9144</td>
<td></td>
</tr>
<tr>
<td>07/2005</td>
<td>20.4644</td>
<td></td>
</tr>
<tr>
<td>08/2005</td>
<td>22.0208</td>
<td></td>
</tr>
<tr>
<td>09/2005</td>
<td></td>
<td>High flows, loss of data</td>
</tr>
<tr>
<td>10/2005</td>
<td></td>
<td>High flows, loss of data</td>
</tr>
<tr>
<td>11/2005</td>
<td></td>
<td>High flows, loss of data</td>
</tr>
<tr>
<td>12/2005</td>
<td></td>
<td>High flows, loss of data</td>
</tr>
<tr>
<td>01/2006</td>
<td>20.2700</td>
<td>High flows, loss of data</td>
</tr>
<tr>
<td>02/2006</td>
<td>19.9770</td>
<td></td>
</tr>
<tr>
<td>03/2006</td>
<td>20.3676</td>
<td></td>
</tr>
<tr>
<td>04/2006</td>
<td>19.9700</td>
<td></td>
</tr>
<tr>
<td>05/2006</td>
<td>19.5104</td>
<td></td>
</tr>
<tr>
<td>06/2006</td>
<td>19.1910</td>
<td></td>
</tr>
<tr>
<td>07/2006</td>
<td>20.1200</td>
<td></td>
</tr>
<tr>
<td>08/2006</td>
<td>20.4630</td>
<td></td>
</tr>
<tr>
<td>09/2006</td>
<td>20.0580</td>
<td></td>
</tr>
<tr>
<td>10/2006</td>
<td>18.9470</td>
<td></td>
</tr>
<tr>
<td>11/2006</td>
<td>19.3010</td>
<td>Float tap came off of encoder shaft</td>
</tr>
<tr>
<td>12/2006</td>
<td>19.3390</td>
<td></td>
</tr>
<tr>
<td>01/2007</td>
<td>19.4270</td>
<td></td>
</tr>
<tr>
<td>02/2007</td>
<td>19.2478</td>
<td></td>
</tr>
<tr>
<td>03/2007</td>
<td>19.3550</td>
<td></td>
</tr>
<tr>
<td>04/2007</td>
<td>19.0095</td>
<td></td>
</tr>
<tr>
<td>05/2007</td>
<td>18.4710</td>
<td></td>
</tr>
<tr>
<td>06/2007</td>
<td>17.9544</td>
<td></td>
</tr>
<tr>
<td>07/2007</td>
<td>20.9950</td>
<td></td>
</tr>
<tr>
<td>08/2007</td>
<td>28.7540</td>
<td></td>
</tr>
<tr>
<td>09/2007</td>
<td>18.6270</td>
<td></td>
</tr>
<tr>
<td>10/2007</td>
<td>17.9775</td>
<td></td>
</tr>
<tr>
<td>11/2007</td>
<td>18.1600</td>
<td></td>
</tr>
<tr>
<td>12/2007</td>
<td>18.1965</td>
<td></td>
</tr>
<tr>
<td>01/2008</td>
<td>25.6296</td>
<td></td>
</tr>
<tr>
<td>02/2008</td>
<td>20.8328</td>
<td></td>
</tr>
<tr>
<td>03/2008</td>
<td>19.4168</td>
<td></td>
</tr>
<tr>
<td>04/2008</td>
<td>18.6310</td>
<td></td>
</tr>
<tr>
<td>05/2008</td>
<td>18.1445</td>
<td></td>
</tr>
<tr>
<td>06/2008</td>
<td>17.8932</td>
<td></td>
</tr>
<tr>
<td>07/2008</td>
<td>17.5696</td>
<td></td>
</tr>
<tr>
<td>Month</td>
<td>Monthly Average (cfs)</td>
<td>Notes</td>
</tr>
<tr>
<td>-------</td>
<td>-----------------------</td>
<td>--------------------------------</td>
</tr>
<tr>
<td>08/2008</td>
<td>18.3686</td>
<td></td>
</tr>
<tr>
<td>09/2008</td>
<td>20.3467</td>
<td></td>
</tr>
<tr>
<td>10/2008</td>
<td>17.6344</td>
<td></td>
</tr>
<tr>
<td>11/2008</td>
<td>17.9231</td>
<td></td>
</tr>
<tr>
<td>12/2008</td>
<td>32.7342</td>
<td>High flows, loss of data</td>
</tr>
<tr>
<td>01/2009</td>
<td>27.0945</td>
<td>High flows, loss of data</td>
</tr>
<tr>
<td>02/2009</td>
<td>20.0517</td>
<td></td>
</tr>
<tr>
<td>03/2009</td>
<td>18.5645</td>
<td></td>
</tr>
<tr>
<td>04/2009</td>
<td>18.3289</td>
<td></td>
</tr>
<tr>
<td>05/2009</td>
<td>17.5229</td>
<td></td>
</tr>
<tr>
<td>06/2009</td>
<td>17.0276</td>
<td></td>
</tr>
<tr>
<td>07/2009</td>
<td>17.5984</td>
<td></td>
</tr>
<tr>
<td>08/2009</td>
<td>24.1481</td>
<td></td>
</tr>
<tr>
<td>09/2009</td>
<td>17.2783</td>
<td></td>
</tr>
<tr>
<td>10/2009</td>
<td>16.5824</td>
<td></td>
</tr>
<tr>
<td>11/2009</td>
<td>16.6510</td>
<td></td>
</tr>
<tr>
<td>12/2009</td>
<td>17.0484</td>
<td></td>
</tr>
<tr>
<td>01/2010</td>
<td>17.2310</td>
<td>High flows, loss of data</td>
</tr>
<tr>
<td>02/2010</td>
<td>17.2310</td>
<td>High flows, loss of data</td>
</tr>
<tr>
<td>03/2010</td>
<td>17.2310</td>
<td>High flows, loss of data</td>
</tr>
<tr>
<td>04/2010</td>
<td>17.9357</td>
<td>High flows, loss of data</td>
</tr>
<tr>
<td>05/2010</td>
<td>17.5340</td>
<td></td>
</tr>
<tr>
<td>06/2010</td>
<td>16.8281</td>
<td></td>
</tr>
<tr>
<td>07/2010</td>
<td>16.4047</td>
<td></td>
</tr>
<tr>
<td>08/2010</td>
<td>24.4513</td>
<td>Missing data due to power outage</td>
</tr>
<tr>
<td>09/2010</td>
<td>16.4652</td>
<td></td>
</tr>
<tr>
<td>10/2010</td>
<td>19.0895</td>
<td></td>
</tr>
<tr>
<td>11/2010</td>
<td>17.1149</td>
<td></td>
</tr>
<tr>
<td>12/2010</td>
<td>17.5682</td>
<td></td>
</tr>
<tr>
<td>01/2011</td>
<td>17.8068</td>
<td></td>
</tr>
<tr>
<td>02/2011</td>
<td>18.1930</td>
<td></td>
</tr>
<tr>
<td>03/2011</td>
<td>18.3789</td>
<td></td>
</tr>
<tr>
<td>04/2011</td>
<td>17.5357</td>
<td></td>
</tr>
<tr>
<td>05/2011</td>
<td>17.1451</td>
<td></td>
</tr>
<tr>
<td>06/2011</td>
<td>16.6985</td>
<td></td>
</tr>
<tr>
<td>07/2011</td>
<td>16.2988</td>
<td></td>
</tr>
<tr>
<td>08/2011</td>
<td>16.0743</td>
<td></td>
</tr>
<tr>
<td>09/2011</td>
<td>16.2820</td>
<td></td>
</tr>
<tr>
<td>10/2011</td>
<td>16.3588</td>
<td></td>
</tr>
<tr>
<td>11/2011</td>
<td>17.8407</td>
<td></td>
</tr>
<tr>
<td>12/2011</td>
<td>17.8180</td>
<td></td>
</tr>
<tr>
<td>Month</td>
<td>Monthly Average</td>
<td>Notes</td>
</tr>
<tr>
<td>--------</td>
<td>-----------------</td>
<td>------------------------------------------</td>
</tr>
<tr>
<td>1/2012</td>
<td>17.7</td>
<td></td>
</tr>
<tr>
<td>2/2012</td>
<td>17.6</td>
<td></td>
</tr>
<tr>
<td>3/2012</td>
<td>17.6</td>
<td></td>
</tr>
<tr>
<td>4/2012</td>
<td>17.1</td>
<td></td>
</tr>
<tr>
<td>5/2012</td>
<td>16.3</td>
<td></td>
</tr>
<tr>
<td>6/2012</td>
<td>15.6</td>
<td></td>
</tr>
<tr>
<td>7/2012</td>
<td>15.7</td>
<td></td>
</tr>
<tr>
<td>8/2012</td>
<td>17.1</td>
<td></td>
</tr>
<tr>
<td>9/2012</td>
<td>16.9</td>
<td></td>
</tr>
<tr>
<td>10/2012</td>
<td>16.0</td>
<td></td>
</tr>
<tr>
<td>11/2012</td>
<td>15.9</td>
<td></td>
</tr>
<tr>
<td>12/2012</td>
<td>16.2</td>
<td></td>
</tr>
<tr>
<td>1/2013</td>
<td>16.6</td>
<td></td>
</tr>
<tr>
<td>2/2013</td>
<td>16.5</td>
<td></td>
</tr>
<tr>
<td>3/2013</td>
<td>16.5</td>
<td></td>
</tr>
<tr>
<td>4/2013</td>
<td>16.0</td>
<td></td>
</tr>
<tr>
<td>5/2013</td>
<td>15.7</td>
<td></td>
</tr>
<tr>
<td>6/2013</td>
<td>15.8</td>
<td></td>
</tr>
<tr>
<td>7/2013</td>
<td><strong>19.8</strong></td>
<td>High flows, loss of data</td>
</tr>
<tr>
<td>8/2013</td>
<td><strong>18.9</strong></td>
<td>High flows, loss of data</td>
</tr>
<tr>
<td>9/2013</td>
<td><strong>19.1</strong></td>
<td>High flows, loss of data</td>
</tr>
<tr>
<td>10/2013</td>
<td>16.4</td>
<td></td>
</tr>
<tr>
<td>11/2013</td>
<td>15.9</td>
<td></td>
</tr>
<tr>
<td>12/2013</td>
<td>15.9</td>
<td></td>
</tr>
<tr>
<td>1/2014</td>
<td>16.0</td>
<td></td>
</tr>
<tr>
<td>2/2014</td>
<td>16.1</td>
<td></td>
</tr>
<tr>
<td>3/2014</td>
<td>16.2</td>
<td></td>
</tr>
<tr>
<td>4/2014</td>
<td>16.1</td>
<td></td>
</tr>
<tr>
<td>5/2014</td>
<td>15.5</td>
<td></td>
</tr>
<tr>
<td>6/2014</td>
<td>14.4</td>
<td></td>
</tr>
<tr>
<td>7/2014</td>
<td>14.7</td>
<td></td>
</tr>
<tr>
<td>Month</td>
<td>Monthly Average</td>
<td>Notes</td>
</tr>
<tr>
<td>---------</td>
<td>----------------</td>
<td>--------------------------------</td>
</tr>
<tr>
<td>8/2014</td>
<td>17.6</td>
<td>High flows, loss of data</td>
</tr>
<tr>
<td>9/2014</td>
<td>15.7</td>
<td></td>
</tr>
<tr>
<td>10/2014</td>
<td>15.5</td>
<td></td>
</tr>
<tr>
<td>11/2014</td>
<td>15.6</td>
<td></td>
</tr>
<tr>
<td>12/2014</td>
<td>15.7</td>
<td></td>
</tr>
<tr>
<td>1/2015</td>
<td>15.7</td>
<td></td>
</tr>
<tr>
<td>2/2015</td>
<td>16.0</td>
<td></td>
</tr>
<tr>
<td>3/2015</td>
<td>17.2</td>
<td>High flows, loss of data</td>
</tr>
<tr>
<td>4/2015</td>
<td>15.8</td>
<td></td>
</tr>
<tr>
<td>5/2015</td>
<td>15.0</td>
<td></td>
</tr>
<tr>
<td>6/2015</td>
<td>14.8</td>
<td></td>
</tr>
<tr>
<td>7/2015</td>
<td>14.7</td>
<td></td>
</tr>
<tr>
<td>8/2015</td>
<td>14.5</td>
<td></td>
</tr>
<tr>
<td>9/2015</td>
<td>14.6</td>
<td></td>
</tr>
<tr>
<td>10/2015</td>
<td>14.5</td>
<td></td>
</tr>
<tr>
<td>11/2015</td>
<td>14.3</td>
<td></td>
</tr>
<tr>
<td>12/2015</td>
<td>14.7</td>
<td></td>
</tr>
<tr>
<td>1/2016</td>
<td>15.3</td>
<td></td>
</tr>
<tr>
<td>2/2016</td>
<td>15.7</td>
<td></td>
</tr>
<tr>
<td>3/2016</td>
<td>15.6</td>
<td></td>
</tr>
<tr>
<td>4/2016</td>
<td>15.7</td>
<td></td>
</tr>
<tr>
<td>5/2016</td>
<td>15.1</td>
<td></td>
</tr>
<tr>
<td>6/2016</td>
<td>14.6</td>
<td></td>
</tr>
<tr>
<td>7/2016</td>
<td>14.7</td>
<td></td>
</tr>
<tr>
<td>8/2016</td>
<td>15.2</td>
<td></td>
</tr>
<tr>
<td>9/2016</td>
<td>14.7</td>
<td></td>
</tr>
<tr>
<td>10/2016</td>
<td>14.6</td>
<td></td>
</tr>
<tr>
<td>11/2016</td>
<td>14.9</td>
<td></td>
</tr>
<tr>
<td>12/2016</td>
<td>15.4</td>
<td></td>
</tr>
<tr>
<td>1/2017</td>
<td>18.4</td>
<td>High flows, loss of data</td>
</tr>
<tr>
<td>2/2017</td>
<td>16.0</td>
<td>High flows, loss of data</td>
</tr>
<tr>
<td>3/2017</td>
<td>20.1</td>
<td>High flows, loss of data</td>
</tr>
<tr>
<td>Month</td>
<td>Monthly Average</td>
<td>Notes</td>
</tr>
<tr>
<td>--------</td>
<td>-----------------</td>
<td>-------</td>
</tr>
<tr>
<td>4/2017</td>
<td>15.7</td>
<td></td>
</tr>
<tr>
<td>5/2017</td>
<td>15.4</td>
<td></td>
</tr>
<tr>
<td>6/2017</td>
<td>13.8</td>
<td></td>
</tr>
<tr>
<td>7/2017</td>
<td>14.5</td>
<td></td>
</tr>
<tr>
<td>8/2017</td>
<td>14.5</td>
<td></td>
</tr>
<tr>
<td>9/2017</td>
<td>13.8</td>
<td></td>
</tr>
<tr>
<td>10/2017</td>
<td>14.1</td>
<td></td>
</tr>
<tr>
<td>11/2017</td>
<td>14.2</td>
<td></td>
</tr>
<tr>
<td>12/2017</td>
<td>14.3</td>
<td></td>
</tr>
</tbody>
</table>

**Notes on Appendix A:** Monthly averages were not always possible to calculate due to flows exceeding 100 cfs or the streamgage being out of service. Yellow highlighted values signify averages calculated from an incomplete dataset, followed by an explanation of why data was missing in the adjacent column. Blank fields are included for information purposes and represent months without data. The reader is cautioned that the Water Sentinels calculations of monthly average values without data reflecting higher flows greater than 100 cfs in a month are biased. Data highlighted in yellow are qualified because the monthly average value is less than it otherwise would be if accurate higher flow data were included in the calculation of the monthly average.
Appendix B. Water Sentinels Discharge Measurements for All Sites
<table>
<thead>
<tr>
<th>Date</th>
<th>Flow (cfs)</th>
<th>Above Verde Springs</th>
<th>Bear Siding</th>
<th>Perkinsville</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/22/12</td>
<td>0.1</td>
<td>N/A</td>
<td>14.4</td>
<td></td>
</tr>
<tr>
<td>2/18/12</td>
<td>0.1</td>
<td>N/A</td>
<td>14.7</td>
<td></td>
</tr>
<tr>
<td>3/28/12</td>
<td>0.2</td>
<td>N/A</td>
<td>12.2</td>
<td></td>
</tr>
<tr>
<td>4/28/12</td>
<td>0.0</td>
<td>N/A</td>
<td>11.4</td>
<td></td>
</tr>
<tr>
<td>5/26/12</td>
<td>0.0</td>
<td>N/A</td>
<td>8.1</td>
<td></td>
</tr>
<tr>
<td>6/30/12</td>
<td>0.0</td>
<td>N/A</td>
<td>8.1</td>
<td></td>
</tr>
<tr>
<td>7/28/12</td>
<td>0.0</td>
<td>N/A</td>
<td>11.0</td>
<td></td>
</tr>
<tr>
<td>8/23/12</td>
<td>0.1</td>
<td>N/A</td>
<td>54.9</td>
<td></td>
</tr>
<tr>
<td>9/15/12</td>
<td>0.1</td>
<td>N/A</td>
<td>11.1</td>
<td></td>
</tr>
<tr>
<td>10/24/12</td>
<td>0.1</td>
<td>N/A</td>
<td>13.7</td>
<td></td>
</tr>
<tr>
<td>11/18/12</td>
<td>0.1</td>
<td>N/A</td>
<td>13.5</td>
<td></td>
</tr>
<tr>
<td>12/14/12</td>
<td>0.5</td>
<td>N/A</td>
<td>17.0</td>
<td></td>
</tr>
<tr>
<td>1/20/13</td>
<td>0.1</td>
<td>N/A</td>
<td>14.3</td>
<td></td>
</tr>
<tr>
<td>2/16/13</td>
<td>0.3</td>
<td>19.5</td>
<td>14.2</td>
<td></td>
</tr>
<tr>
<td>3/23/13</td>
<td>0.2</td>
<td>17.6</td>
<td>13.4</td>
<td></td>
</tr>
<tr>
<td>4/13/13</td>
<td>0.1</td>
<td>16.5</td>
<td>12.4</td>
<td></td>
</tr>
<tr>
<td>5/18/13</td>
<td>0.1</td>
<td>14.8</td>
<td>11.0</td>
<td></td>
</tr>
<tr>
<td>6/30/13</td>
<td>0.5</td>
<td>13.0</td>
<td>7.9</td>
<td></td>
</tr>
<tr>
<td>7/23/13</td>
<td>0.0</td>
<td>30.3</td>
<td>14.4</td>
<td></td>
</tr>
<tr>
<td>8/23/13</td>
<td>0.0</td>
<td>18.0</td>
<td>12.5</td>
<td></td>
</tr>
<tr>
<td>9/29/13</td>
<td>0.4</td>
<td>16.8</td>
<td>12.7</td>
<td></td>
</tr>
<tr>
<td>10/25/13</td>
<td></td>
<td>18.0</td>
<td>14.2</td>
<td></td>
</tr>
<tr>
<td>11/24/13</td>
<td></td>
<td>21.9</td>
<td>17.4</td>
<td></td>
</tr>
<tr>
<td>12/28/13</td>
<td></td>
<td>17.8</td>
<td>15.3</td>
<td></td>
</tr>
<tr>
<td>1/27/14</td>
<td>0.6</td>
<td>20.2</td>
<td>13.4</td>
<td></td>
</tr>
<tr>
<td>2/26/14</td>
<td>0.6</td>
<td>14.3</td>
<td>15.6</td>
<td></td>
</tr>
<tr>
<td>3/29/14</td>
<td>0.6</td>
<td>19.2</td>
<td>16.9</td>
<td></td>
</tr>
<tr>
<td>4/25/14</td>
<td>0.5</td>
<td>17.3</td>
<td>14.2</td>
<td></td>
</tr>
<tr>
<td>5/20/14</td>
<td>0.5</td>
<td>14.9</td>
<td>10.0</td>
<td></td>
</tr>
<tr>
<td>6/20/14</td>
<td>0.4</td>
<td>14.0</td>
<td>9.4</td>
<td></td>
</tr>
<tr>
<td>7/23/14</td>
<td>0.5</td>
<td>14.7</td>
<td>10.2</td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td>Above Verde Springs</td>
<td>Bear Siding</td>
<td>Perkinsville</td>
<td></td>
</tr>
<tr>
<td>----------</td>
<td>---------------------</td>
<td>-------------</td>
<td>--------------</td>
<td></td>
</tr>
<tr>
<td>8/26/14</td>
<td>0.7</td>
<td>21.3</td>
<td>12.2</td>
<td></td>
</tr>
<tr>
<td>9/21/14</td>
<td>0.3</td>
<td>17.8</td>
<td>21.0</td>
<td></td>
</tr>
<tr>
<td>10/28/14</td>
<td></td>
<td>15.1</td>
<td>14.0</td>
<td></td>
</tr>
<tr>
<td>11/21/14</td>
<td>0.2</td>
<td>14.5</td>
<td>14.4</td>
<td></td>
</tr>
<tr>
<td>12/19/14</td>
<td>0.2</td>
<td>16.4</td>
<td>15.4</td>
<td></td>
</tr>
<tr>
<td>1/26/15</td>
<td>0.3</td>
<td>16.7</td>
<td>15.1</td>
<td></td>
</tr>
<tr>
<td>2/26/15</td>
<td>0.3</td>
<td>14.1</td>
<td>16.0</td>
<td></td>
</tr>
<tr>
<td>3/25/15</td>
<td>0.2</td>
<td>19.0</td>
<td>16.0</td>
<td></td>
</tr>
<tr>
<td>4/30/15</td>
<td>0.3</td>
<td>15.4</td>
<td>12.2</td>
<td></td>
</tr>
<tr>
<td>5/22/15</td>
<td>0.0</td>
<td>17.3</td>
<td>11.9</td>
<td></td>
</tr>
<tr>
<td>6/30/15</td>
<td>0.0</td>
<td>15.4</td>
<td>10.2</td>
<td></td>
</tr>
<tr>
<td>7/27/15</td>
<td>0.0</td>
<td>12.9</td>
<td>8.8</td>
<td></td>
</tr>
<tr>
<td>8/27/15</td>
<td>0.1</td>
<td>15.6</td>
<td>12.8</td>
<td></td>
</tr>
<tr>
<td>9/30/15</td>
<td>0.0</td>
<td>14.7</td>
<td>10.8</td>
<td></td>
</tr>
<tr>
<td>10/28/15</td>
<td>0.0</td>
<td>14.0</td>
<td>13.1</td>
<td></td>
</tr>
<tr>
<td>11/23/15</td>
<td>0.1</td>
<td>16.0</td>
<td>14.7</td>
<td></td>
</tr>
<tr>
<td>12/30/15</td>
<td>0.0</td>
<td>16.0</td>
<td>15.6</td>
<td></td>
</tr>
<tr>
<td>1/27/16</td>
<td>0.1</td>
<td>17.2</td>
<td>15.6</td>
<td></td>
</tr>
<tr>
<td>2/22/16</td>
<td>0.1</td>
<td>16.4</td>
<td>15.1</td>
<td></td>
</tr>
<tr>
<td>3/30/16</td>
<td>0.0</td>
<td>16.4</td>
<td>12.3</td>
<td></td>
</tr>
<tr>
<td>4/27/16</td>
<td>0.0</td>
<td>14.4</td>
<td>12.9</td>
<td></td>
</tr>
<tr>
<td>5/24/16</td>
<td>0.0</td>
<td>14.2</td>
<td>10.9</td>
<td></td>
</tr>
<tr>
<td>6/29/16</td>
<td>0.0</td>
<td>14.8</td>
<td>11.5</td>
<td></td>
</tr>
<tr>
<td>7/27/16</td>
<td>0.0</td>
<td>15.5</td>
<td>11.6</td>
<td></td>
</tr>
<tr>
<td>8/31/16</td>
<td>0.0</td>
<td>17.2</td>
<td>13.1</td>
<td></td>
</tr>
<tr>
<td>9/29/16</td>
<td>0.0</td>
<td>16.2</td>
<td>13.2</td>
<td></td>
</tr>
<tr>
<td>10/26/16</td>
<td>0.0</td>
<td>18.2</td>
<td>13.3</td>
<td></td>
</tr>
<tr>
<td>11/30/16</td>
<td>0.0</td>
<td>18.4</td>
<td>13.9</td>
<td></td>
</tr>
<tr>
<td>12/28/16</td>
<td>0.0</td>
<td>59.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1/27/17</td>
<td>1.9</td>
<td>50.5</td>
<td>45.8</td>
<td></td>
</tr>
<tr>
<td>2/22/17</td>
<td>0.0</td>
<td>70.2</td>
<td>61.8</td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td>Flow</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------</td>
<td>--------</td>
<td>----</td>
<td>----</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Above Verde Springs</td>
<td>Bear Siding</td>
<td>Perkinsville</td>
<td></td>
</tr>
<tr>
<td>3/29/17</td>
<td>0.4</td>
<td>18.9</td>
<td>15.4</td>
<td></td>
</tr>
<tr>
<td>4/26/17</td>
<td>0.2</td>
<td>18.4</td>
<td>14.1</td>
<td></td>
</tr>
<tr>
<td>5/24/17</td>
<td>0.2</td>
<td>14.0</td>
<td>10.5</td>
<td></td>
</tr>
<tr>
<td>6/28/17</td>
<td>0.1</td>
<td>11.5</td>
<td>7.9</td>
<td></td>
</tr>
<tr>
<td>7/26/17</td>
<td></td>
<td>22.5</td>
<td>24.7</td>
<td></td>
</tr>
<tr>
<td>8/30/17</td>
<td></td>
<td>14.1</td>
<td>11.4</td>
<td></td>
</tr>
<tr>
<td>9/27/17</td>
<td></td>
<td>14.7</td>
<td>10.3</td>
<td></td>
</tr>
<tr>
<td>10/26/17</td>
<td></td>
<td>15.9</td>
<td>12.5</td>
<td></td>
</tr>
<tr>
<td>11/29/17</td>
<td></td>
<td>17.5</td>
<td>13.2</td>
<td></td>
</tr>
<tr>
<td>12/27/17</td>
<td></td>
<td>17.2</td>
<td>14.9</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Date</th>
<th>Perkinsville Ditch Flow (cfs) Measurements</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/22/12</td>
<td>&lt;0.1</td>
</tr>
<tr>
<td>2/18/12</td>
<td>&lt;0.1</td>
</tr>
<tr>
<td>3/28/12</td>
<td>2.4</td>
</tr>
<tr>
<td>4/28/12</td>
<td>1.7</td>
</tr>
<tr>
<td>5/26/12</td>
<td>0.6</td>
</tr>
<tr>
<td>6/30/12</td>
<td>1.0</td>
</tr>
<tr>
<td>7/28/12</td>
<td>0.1</td>
</tr>
<tr>
<td>8/23/12</td>
<td>1.9</td>
</tr>
<tr>
<td>9/15/12</td>
<td>0.7</td>
</tr>
<tr>
<td>5/18/13</td>
<td>0.9</td>
</tr>
<tr>
<td>6/30/13</td>
<td>1.3</td>
</tr>
<tr>
<td>7/23/13</td>
<td>2.2</td>
</tr>
<tr>
<td>8/23/13</td>
<td>0.8</td>
</tr>
<tr>
<td>9/29/13</td>
<td>1.1</td>
</tr>
<tr>
<td>10/25/13</td>
<td>0.8</td>
</tr>
<tr>
<td>4/30/15</td>
<td>3.5</td>
</tr>
<tr>
<td>5/22/15</td>
<td>1.4</td>
</tr>
<tr>
<td>6/30/15</td>
<td>2.6</td>
</tr>
<tr>
<td>7/27/15</td>
<td>2.3</td>
</tr>
<tr>
<td>8/27/15</td>
<td>1.7</td>
</tr>
<tr>
<td>9/30/15</td>
<td>2.4</td>
</tr>
<tr>
<td>10/28/15</td>
<td>1.4</td>
</tr>
<tr>
<td>3/30/16</td>
<td>2.9</td>
</tr>
<tr>
<td>4/27/16</td>
<td>1.7</td>
</tr>
<tr>
<td>Date</td>
<td>Value</td>
</tr>
<tr>
<td>----------</td>
<td>-------</td>
</tr>
<tr>
<td>5/24/16</td>
<td>1.0</td>
</tr>
<tr>
<td>6/29/16</td>
<td>1.4</td>
</tr>
<tr>
<td>7/27/16</td>
<td>1.1</td>
</tr>
<tr>
<td>8/31/16</td>
<td>0.9</td>
</tr>
<tr>
<td>9/29/16</td>
<td>1.3</td>
</tr>
<tr>
<td>10/26/16</td>
<td>1.4</td>
</tr>
<tr>
<td>11/30/16</td>
<td>1.4</td>
</tr>
<tr>
<td>12/28/16</td>
<td>1.0</td>
</tr>
<tr>
<td>5/24/17</td>
<td>1.4</td>
</tr>
<tr>
<td>6/28/17</td>
<td>1.6</td>
</tr>
<tr>
<td>7/26/17</td>
<td>2.5</td>
</tr>
<tr>
<td>8/30/17</td>
<td>1.3</td>
</tr>
<tr>
<td>9/27/17</td>
<td>1.3</td>
</tr>
<tr>
<td>11/29/17</td>
<td>0.2</td>
</tr>
<tr>
<td>12/27/17</td>
<td>0.3</td>
</tr>
</tbody>
</table>

**Notes on Appendix B:** Blank fields are included for information purposes and represent months without data due to either too high or too low flows to measure. Perkinsville ditch flow measurements demonstrate an approximation of how much water is being added to the Verde downstream where the ditch and river join together.
Appendix C. Annual Baseflow Values Calculated from 7 or More Low-flow Measurements
<table>
<thead>
<tr>
<th>Year</th>
<th>7-Day or More Average Low-flow (cfs)</th>
<th>Month(s) Recorded</th>
</tr>
</thead>
<tbody>
<tr>
<td>1963</td>
<td>18</td>
<td>Jul, Aug; record begins July 17, 1963</td>
</tr>
<tr>
<td>1964</td>
<td>15</td>
<td>18 in March, 15 in May, 19 in June, 22 in July, 20 in Nov</td>
</tr>
<tr>
<td>1965</td>
<td>19</td>
<td>19 in Oct, 20 in Sept and Oct</td>
</tr>
<tr>
<td>1966</td>
<td>21</td>
<td>Aug</td>
</tr>
<tr>
<td>1967</td>
<td>21</td>
<td>Jun and Oct</td>
</tr>
<tr>
<td>1968</td>
<td>21</td>
<td>Jul</td>
</tr>
<tr>
<td>1969</td>
<td>22</td>
<td>Jun, Jul, Sept, Oct</td>
</tr>
<tr>
<td>1970</td>
<td>22</td>
<td>Jan, Jul, Oct</td>
</tr>
<tr>
<td>1971</td>
<td>21</td>
<td>Jun, Jul, Sept</td>
</tr>
<tr>
<td>1972</td>
<td>18</td>
<td>18 in March, 20 in Jul</td>
</tr>
<tr>
<td>1973</td>
<td>22</td>
<td>Sep</td>
</tr>
<tr>
<td>1974</td>
<td>23</td>
<td>Feb, May, Jun, Jul, Oct</td>
</tr>
<tr>
<td>1975</td>
<td>23</td>
<td>Oct</td>
</tr>
<tr>
<td>1976</td>
<td>21</td>
<td>Jan-Feb, Jun, Jul, Sep</td>
</tr>
<tr>
<td>1977</td>
<td>20</td>
<td>Jul</td>
</tr>
<tr>
<td>1978</td>
<td>20</td>
<td>Sep-Oct</td>
</tr>
<tr>
<td>1979</td>
<td>23</td>
<td>Sep-Oct</td>
</tr>
<tr>
<td>1980</td>
<td>23</td>
<td>Sep-Oct</td>
</tr>
<tr>
<td>1981</td>
<td>23</td>
<td>Aug</td>
</tr>
<tr>
<td>1982</td>
<td>21</td>
<td>Sep</td>
</tr>
<tr>
<td>1983</td>
<td>25</td>
<td>Jan, Jun, Jul, Aug, Sep</td>
</tr>
<tr>
<td>1984</td>
<td>22</td>
<td>Sep</td>
</tr>
<tr>
<td>1985</td>
<td>26</td>
<td>Jun, Jul, Aug, Sep, Oct</td>
</tr>
<tr>
<td>1986</td>
<td>25</td>
<td>May, Jun, Jul</td>
</tr>
<tr>
<td>1987</td>
<td>24</td>
<td>Aug</td>
</tr>
<tr>
<td>1988</td>
<td>24</td>
<td>Jul</td>
</tr>
<tr>
<td>1989</td>
<td>22</td>
<td>Jul</td>
</tr>
<tr>
<td>1990</td>
<td>24</td>
<td>Jun</td>
</tr>
<tr>
<td>1991</td>
<td>21</td>
<td>Jul</td>
</tr>
<tr>
<td>1992</td>
<td>23</td>
<td>Jan, Nov</td>
</tr>
<tr>
<td>1993</td>
<td>25</td>
<td>May</td>
</tr>
<tr>
<td>Year</td>
<td>Value</td>
<td>Months</td>
</tr>
<tr>
<td>------</td>
<td>-------</td>
<td>-----------------</td>
</tr>
<tr>
<td>1994</td>
<td>26</td>
<td>Jun, Jul, Sep, Oct</td>
</tr>
<tr>
<td>1995</td>
<td>25</td>
<td>Jul, Aug, Sep</td>
</tr>
<tr>
<td>1996</td>
<td>24</td>
<td>Aug, Sep</td>
</tr>
<tr>
<td>1997</td>
<td>23</td>
<td>Jun, Jul</td>
</tr>
<tr>
<td>1998</td>
<td>23</td>
<td>Jun-Jul</td>
</tr>
<tr>
<td>1999</td>
<td>22</td>
<td>Jun-Jul</td>
</tr>
<tr>
<td>2000</td>
<td>20</td>
<td>Jun, Jul, Aug, Sep</td>
</tr>
<tr>
<td>2001</td>
<td>21</td>
<td>Jun-Jul</td>
</tr>
<tr>
<td>2002</td>
<td>20</td>
<td>Jun, Jul, Aug, Sep</td>
</tr>
<tr>
<td>2003</td>
<td>19</td>
<td>Jul, Aug</td>
</tr>
<tr>
<td>2004</td>
<td>19</td>
<td>Jul</td>
</tr>
<tr>
<td>2005</td>
<td>23</td>
<td>Oct</td>
</tr>
<tr>
<td>2006</td>
<td>20</td>
<td>Jun</td>
</tr>
<tr>
<td>2007</td>
<td>19</td>
<td>Jul</td>
</tr>
<tr>
<td>2008</td>
<td>20</td>
<td>Jul</td>
</tr>
<tr>
<td>2009</td>
<td>20</td>
<td>Jul, Aug</td>
</tr>
<tr>
<td>2010</td>
<td>18</td>
<td>Jul</td>
</tr>
<tr>
<td>2011</td>
<td>18</td>
<td>Aug, Sep</td>
</tr>
<tr>
<td>2012</td>
<td>18</td>
<td>Jun-Jul</td>
</tr>
<tr>
<td>2013</td>
<td>18</td>
<td>May, Jun</td>
</tr>
<tr>
<td>2014</td>
<td>18</td>
<td>Jun-Jul</td>
</tr>
<tr>
<td>2015</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>2017</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>1963-2017</td>
<td>21</td>
<td>Average of all years</td>
</tr>
<tr>
<td>2010-2017</td>
<td>18</td>
<td>Average of 2010-2017</td>
</tr>
</tbody>
</table>