

ReadMe for 2016 “Transient” Archive
Bartholow - 2/19/2018

In May of 2017, a subset of the Poudre Runs Through It (PRTI) group decided to launch an “initiative” to explore large, abrupt, short-lived (“transient”) flow fluctuations on the Cache la Poudre River near Fort Collins. Through a series of physical, telephone, or email meetings interspersed with notes and progress reports, supported by an aggregation of the existing 15-minute streamflow and diversion data by Northern Water, this group made some progress in identifying likely causes, identifying potential biological or physical impacts, and reporting results back to the PRTI group, which was the charge. There was no call to take any concrete actions with the results. This “initiative” was concluded – at least for now – with a poster made available at the 2018 Poudre River Forum.

This ReadMe file documents data files to be archived in case they may prove useful if something like this is initiated in the future, and concludes with a few notes as to likely avenues for further investigation.

The “heavy lifting” of the analysis was done by me, John Bartholow, but always with opportunity for input by the group, affectionately referred to as the Transient Explorers though not everyone liked that name ☺, which consisted of Scott Hummer, Ken Kehmeier, Steve Malers, Andy Pineda, Jen Shanahan, Luke Shawcross, Kristin Swaim, Reagan Waskom, and Brad Wind. Mark Simpson, the Poudre River Commissioner, was consulted by the group toward the end but was not part of the group. Bob Milhous, retired USGS hydrologist, was also regularly consulted for his perspective, to “keep me honest”, and because he is perpetually interested in this kind of hydrologic exploration.

If something like this is done in the future, there are at least four areas that particularly need attention:

(1) On the hydrologic analysis side, it would be quite useful to be able to better quantify how often different kinds of transient events occur. This is somewhat difficult to explain, but I’ll give it a shot. The two metrics I calculated, absolute and relative, each looked ahead 24 hours to calculate the largest positive or negative deviations from each 15-minute flow observation. Those deviations were graphed and that was fine as far as it went, but it was difficult to discern what the biggest peaks (or troughs) were if there were many within a 24-hour period. In fact, they were often many, many such peaks within a day. My skills with Excel were not good enough to go further with this, but someone could certainly do so – or write a program to do so.

For example, the next step that makes sense to me would be to look at each calendar day and pick out the maximum-maximum spike (or minimum-minimum trough) for that day. This would do a far better job of assessing just how many of these events there really are, which was a deficit in what has been done. (This would not be perfect because there could still be multiple transients within one 24-hour day, but it would be better than what I did.) To explain further, I sampled from among the largest events. That too was fine as far as it went – it was not too hard to say that some were “explainable” by expected on/off decisions up and down the river, some were “explainable” because of diversion maintenance issues, some because of timing issues, and some not explainable at all. BUT, I could not really get at the frequency of each of these types there were. If the vast majority of transients are from simple on/off decisions, which implies a far different set of potential mitigation actions than if most transients are timing issues.

And if diversion maintenance only amounts to 1% of the transients, then maybe they are not worth pursuing. I'm sure you see where I'm going

(2) The biologically meaningful criteria need far more work. This means digging further into the literature, communicating with others who may have faced similar challenges in other drainages (though I am not aware of anything myself), developing hydrologic metrics that much more accurately characterize likely biological "bottlenecks" due to transients (and could be used to measure improvement/change through time and alternative management experiments.

It might also be useful to include two other issues we did not really examine in any meaningful sense in this "biological" mix, namely water temperature and sediment transport. We know that Horsetooth releases (and termination of those releases) can create large, abrupt changes in water temperature with effects felt for miles downstream. It could be that these are ripe for a new look. Flow spikes can, at least in theory, add their own fraction to the motility of at least sand and small gravels. Is this important in the broader flushing flow discussion?

We can hope that new work monitoring fish populations may shed some light on the effect, if any, of transients.

(3) On the institutional side, our analysis did nothing except to raise consciousness of the issue a bit more than before. It seems clear to me that Northern Water is anticipating some changes, but whether those changes can "work" will require much broader buy-in from the largest diverters as well as the River Commissioner and (potentially) his chain of command. Said another way, do all the legally vested parties have the "desire and ability to administer ... alternative release/diversion rates".

(4) And of course, find any errors I made!

File Name(s)	Explanation
2016 Flow Data Findings 1.doc 2106 Flow Data Findings 2.docx 2016 Flow Data Findings 3.docx 2016 Flow Data Findings 4.docx	These four files document the progress made as data were manipulated and displayed in various ways, usually with opportunities for group feedback and reflection.
Transient Technical Notes.txt Transient Agenda and Notes Transient Conference Call Meeting Notes Transient Flashers Progress 1.doc Transient Phone Conference Agenda 1.doc Notes for Nov 17 PRTI Meeting.doc Questions for Mark Simpson.doc	These files are other, less formal notes circulated as the analysis proceeded, mostly internal to the group, but also for the PRTI group on occasion.

<p>PoudreFlowData15.xlsx JB_PoudreFlowData15.xlsx JB_Poudre15ShortCut.xlsx</p>	<p>PoudreFlowData15 is the original spreadsheet supplied by Luke Shawcross. The next was my copy with some slight edits, such as deleting NAs. The short cut file was a slimmed down version of just the flow data used to create the actual analysis spreadsheets.</p>
<p>jb_PoudreGageMetrics.xlsx jb_PoudreGageMetrics_Width.xlsx jb_CanyonDays.xlsx jb_LincolnDays.xlsx JB_Poudre15_LincolnAbsDates.xlsx JB_Poudre15_BoxDates.xlsx JB_Poudre15_HSC.xlsx</p>	<p>These spreadsheets are the meat of the analysis. The Gage Metrics is where the relative and absolute indices were calculated. (Gage metrics width was an experiment to index width changes instead of flow changes, but it did not add much value.) The Days spreadsheets were tailored to each of the three gages examined. I broke Lincoln up because it was getting too big. HSC is the Hansen Supply Canal.</p>
<p>PRTI-TransientFlows-Malers-Comments-2017-11-24_jb.docx Poudre_IO_Table_Final.xlsx Transient_Report_Draft_3.pptx Transient_Report_Smaller_4.pptx Transient_Progress_Report.pdf Transient PRTI Handout.doc</p>	<p>Files used to assemble the final presentation to the PRTI group in January, 2018. The first was comments on a draft. Number 3 PPT is a longer version which contains potentially useful information, but which was pruned to the smaller number 4 PPT because of time constraints. The PDF is just a copy of #4 and the handout accompanied the presentation.</p>
<p>Poster_Storyboard_Legal.doc Brown_trout_pair.jpg CLP_Barebones_Map.pptx Pretty Graphs for Poster.xlsx Transient_Poster_Final.pdf</p>	<p>Files used in preparation for the February 2018 Poudre River Forum Poster. This was assembled by Mary Boyts who works for the City of Fort Collins Natural Areas department. The poster itself is the PDF file. A handout was also made, but I do not have that file.</p>
<p>Final_Draft_R-B_Index.pdf Milhous Flash Figure.jpg Milhous_flash.xlsx Milhous_RMHRC_Presentation.pdf</p>	<p>Files sent or supplied by Bob Milhous dealing with flow fluctuations as well as his own separate data analysis.</p>

<p>An Experimental Study of the Stranding of... Effects of Fluctuating Flows and a Control... Estimating Stranding Risk Due To Hydropea... Fish Stranding in freshwater systems.pdf Halleraker_et_al-2003- River_Research_a... Hydropower-related pulsed-flow impacts.... Irvine_et_al-2009- River_Research_and_A... Marty_et_al-2009- River_Research_and_... PARASIEWICZ_et_al-1998- Fisheries_Ma... Relative Activity of Brook Trout and Walle... Schmutz_et_al-2015-River_Research_an... Smokorowski_et_al-2011- Ecohydrology.pdf</p>	<p>These PDF files were journal articles scanned to glean information regarding the physical and biological effects of rapid flow fluctuations on aquatic systems. They were selected from Google Scholar searches but were not meant to be an exhaustive research effort.</p>
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