

Office of Surface Water
10615 SE Cherry Blossom Drive
Portland, OR 97216

June 29, 2001

MEMORANDUM

To: Acting Chief, Office of Surface Water

From: John E. Costa, Portland, OR

Subject: Meetings—Suggestions and Comments from the Indirect Discharge Workshop

There were several important ideas and action items that arose during the Indirect Discharge Workshop. There are my notes that try to list them. I am also attaching two memos from Lamar Sanders in which he makes several good suggestions as well.

- a. Hydrotechs have too many things to do, and too much work
- b. There are not sufficient dollars for the Data program
- c. We need more pre-and post- processors and plotting routines for use in the Data Program
- d. More studies of roughness verification should be done
- e. Every District should have an updated and active water-quality flood plan. There is much to be learned about transport during floods
- f. Flood recurrence intervals should be reported with confidence intervals. OSW needs to devise a way to do this, and issue a technical memo
- g. The qualification codes for the Peak-Flow File need to be rethought. There need to be more and better codes.
- h. The Peak-Flow File is unprotected. It needs to be hardened and backed up with restricted access and change capability
- i. Transient hydraulic phenomenon such as translatory or roll waves can be a significant problem for high-water mark identification in some channels. Two discharges could be reported for such floods: one a 'base' flood discharge associated with the runoff from the watershed, the second a 'transient' peak associated with wave instabilities that form in steep sand-bed channels. There needs to be a formal OSW technical memo similar to OSW Technical Memorandum No. 92.11 "*Flow Process Recognition for Floods in Mountain Streams*". The memorandum should outline the field conditions under which flow instabilities could form, suggestions on how to recognize the occurrence of such processes, and the appropriate way to describe and document the event.
- j. There needs to be a National database for indirect discharge files, crest stage data, as well as other flow information. These data should be included in ADAPS with all the other flow information

- k. It would be helpful if pertinent reports and information relative to indirect measurements would be aggregated and presented on the OSW homepage along with the memos about indirects that are already there
- l. A tool to measure simply surface velocity would be valuable (HIF radar gun; Hydro21 bankside equipment)
- m. There needs to be far more discussion and information about the use of rapid methods (slope-conveyance, critical-depth) for estimating flow, especially at ungaged sites
- n. OSW needs to organize and convene a workshop on flood frequency within the next 12 months

Memos from Lamar Sanders:

John, thanks for the seminar and letting me do the War of Northern Aggression speech.

I was concerned that you may not have completely understood my recommendation about warning about transitory waves in the West. I gathered that all regionalized flood frequency reports developed by the USGS in the west were determined for non-transitory wave conditions. If so, the highway departments probably should adjust their bridge openings for these waves, if they might occur. So, in addition to us checking for them in our own indirects, I was wanting us to develop a method by which the highway departments or maybe even FEMA could test to see if these waves might exist, and if so, how to adjust their hydraulics for them. These warnings should be issued to the highway departments, FEMA, and other agencies who might use our reports. Also, such warnings and predictive methods should be included in all new flood frequency studies. These waves could be serious threats for lives, bridges, houses, etc.

I assume the conditions are a function of slope, n , conveyance, or other characteristic that could be numerically tested for prediction and calculation of the wave heights and discharges.

I am not sending this suggestion to anyone else except Larry Bohman, so it is up to you to decide if or what needs to be done.

I would like to propose that NRP conduct nuts-and-bolts research on the rating of streams and applications of shifts. I believe research in these areas ceased several decades ago, and many questions still remain unanswered, and many techniques remain to be developed. If NRP had the funds (it certainly has the necessary smart and creative personnel), I believe it could make a lot of progress. I think the time has come to develop some new methods with our computer capabilities, data bases of measurement data, new methods of making flow measurements and studying stream bed behaviors, highly intelligent and capable researchers and field people, and so forth. There may be more prestigious fields for research, but the nuts-and-bolts computation of flow records is the mainstay of the Survey. Probably none of our engineers or data people are able to do this kind of research, and if they were, there are no funds or time for them to do it. If NRP could do some of this research, it would certainly earn the gratitude of the surface water USGS people.

I hope to do a little research myself. Here are some questions:

1 I believe I have come up with a modified spline regression method that will allow us to go back into the history of the measurements at gaging stations to establish average master ratings, and base shift curves. I can apply rating offsets at the three segments of the rating as required. The ideal is to establish families of base rating curves and base shift curves, especially in the sand channels of the west. Statistically, can it be done? Can we normalize the curves by applying offsets for the sand that filled in? Can we do families of spline rating curves and families of shift curves? What else could NRP think up?

2. It is known at some stations, considerable scour occurs during high flow measurements. Would the increase in area and decrease in velocity cancel each other out, so that the stage- q rating stays about the same? If not, can we measure the rises and falls of a lot of streams, and determine if we can adjust discharges for the scour, velocity, and fill on a daily basis? We have a ton of scour/discharge data already available from the scour studies. Can we improve on the rising/falling stage methods traditionally presented in our twri's? Bob Faye, the retired GW specialist of the SE region had proposed a method for rising and falling stages that accounted for momentum. How would that work, if tested?

3. Practically, what are the mechanics of ratings in sand channels? Work has been done establishing regimes of flow in sand channels, but can we apply these methods to real streams? I feel that the mechanics of some channels are that there are just huge waves of sand that move down the river, functions of where it was dumped last time, upstream or at the gage, and the power of the water. Can we do longitudinal studies to predict this? Can we develop statistical methods that would imitate the changes in ratings as the sand is dumped by a flood, taken away by a flood, or gradually washed away?

4. One of the great mysteries is when to apply shifts between measurements. Should they be prorated among several peaks or be applied on the highest peak, or the first peak? We assume that scouring shifts are applied on the rising stages with assumed higher velocities and filling shifts on falling stages with supposed slower velocities, but is this right? If so, do you apply them when flows are in banks, out of banks, at the upper part of the rise, the lower part of the rise? We assume things, but just don't know. If we apply shifts on rising and falling stages, should it be prorated by cumulated discharge or stage (useful for semi-automation of shifts) or something else?

5. For low shifts, we assume usually that they occur uniformly with time, but is it so?

6. How can we semi-automate the shifting process from the development of the shift curves to the application with time and stage? I have some definite ideas, but what could the minds of NRP come up with? This could save tremendous amounts of time and money.

7. How can we handle loop ratings cost-effectively? Improve the old green-book methods? Implement the Faye method? Fake in an unsteady flow model using estimated channel sections and topo maps? Does it really cancel out if you neglect the effects of rising and falling stages for daily values?

8. Can we differentiate and quantify rating changes resulting from changes to a control, conveyance, or changes in low water slope and high water slope? Are high flow shifts caused by changes in fall, whereas low flow changes are caused by changes in conveyance?

9. Can we use collected stream flow measurements, collect more measurements, implement step backwater or branch models, etc. to study the theoretical results on ratings to discover principles and rules of ratings? Would it be useful to fake in a step backwater model or unsteady flow model to understand the rating behavior of a rating at most stations, in addition to the statistical studies suggested in (1) above? Whatever the method, it has to be simple and robust, and not require much field work.

10. Would a study of velocity contours at a station help develop area-velocity ratings? Can rules be developed for how long the reach should be to get equilibrium velocity contours, or do they ever reach equilibrium?

11. Could a single acoustic velocity meter of the type with the 50-60 ft range improve accuracy at ALL gaging stations having enough depth, say at least helping to determine when shifts occurred, even if a true area-velocity rating was not determined?

12. I found one swamp station to have seasonal shifts because of the downstream vegetation. This is simple to test and adjust for, but could be documented. So, are there seasonal aspects to shifts that would improve accuracy and simplify the shifting process?

13. If theoretical methods for developing ratings and applying shifts can be developed, can those methods be used by ordinary human beings?

14. Can anything new be thought up for computation of ice records? Are the index station methods in use really viable?

15. Etc, Etc, Etc. The above are just quick questions off the top of my head -- there are bound to be many others that could be investigated also.