In Reply Refer To: January 14, 2003
Mail Stop 415

OFFICE OF SURFACE WATER TECHNICAL MEMORANDUM NO. 2003.01

SUBJECT: Discharges computed using Sontek RiverSurveyor Acoustic Doppler Current Profiler

To ensure that data collected by the U.S. Geological Survey is of the highest quality and
scientifically defendable, the Office of Surface Water (OSW) is conducting a field evaluation of
commercially available acoustic Doppler current profilers (ADCPs) for use on moving boats. This
evaluation has identified two computational problems in SonTek RiverSurveyor software. The first
of these problems introduces a negative bias into all discharges processed with versions of
RiverSurveyor prior to version 3.4. The second problem is associated with processing data collected
using GPS.

The first problem results because versions of RiverSurveyor prior to 3.4 did not include the
"mounting/transducer depth" in the depth of flow used to compute the edge discharges. Thus, edge
discharges were computed with a water depth less than the actual water depth and measured
discharges are smaller than they should be. The magnitude of this error depends on the measurement
section; however, errors between 1 and 2 percent have been observed in the evaluation data collected
by the OSW. Version 3.4 of the RiverSurveyor software corrects this error. ***All discharges
processed with versions of Sontek RiverSurveyor prior to 3.4 during the 2002 Water Year should
be reprocessed with River Surveyor version 3.4.***

Sontek identified the second problem, which occurred when processing GPS-based discharges using
versions of RiverSurveyor prior to version 3.1. OSW personnel have not evaluated RiverSurveyor
version 3.1, but did identify this change in version 3.33. To understand problems associated with
GPS-based measurements computed using versions of River Surveyor prior to version 3.1, you need
to understand two groups of buttons that RiverSurveyor uses to set the velocity reference and bottom
track display (figure 1). The bottom track display is a confusing title for this group of buttons
because when set to GPS it displays the GPS track, not the bottom track. The bottom track display
set of buttons, based on their title, (figure 1) appears to only control the display, and this was the
case for versions prior to version 3.1. However, in version 3.1 and later, the rightmost buttons
(bottom track display) also determines how the widths of the cross section and individual profiles are
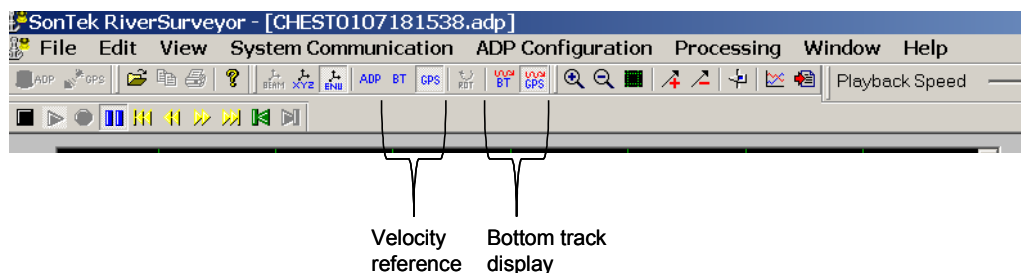

Figure 1. Toolbar from RiverSurveyor with velocity reference and bottom track
display buttons identified.

Table 1. Combination of water velocity and boat references available in
RiverSurveyor versions prior to 3.1.

	Velocity Reference Buttons	Bottom Track Display Buttons
1	Bottom Track	Bottom Track
2	Bottom Track	GPS
3	GPS	Bottom Track
4	GPS	GPS

computed (either based on bottom tracking or GPS) and thus alters the computed discharge. In
RiverSurveyor version 3.1 and later, the user can compute four different discharges (table 1). Only
the first and last combinations are valid, where both the velocity and track display references are the
same. The speed and direction of the boat is needed to correct the measured velocity for the
instrument motion and to measure how far the instrument has moved across the stream. If the two
sets of buttons are not set to the same value, RiverSurveyor will use different references for
computing the velocity and the width of the cross section. For example, using the second
combination in Table 1 would cause RiverSurveyor to correct the measured velocity with a boat
velocity measured from bottom tracking but compute the distance traveled across the river based on
GPS. RiverSurveyor 3.1 and later will permit any of the four combinations, so the user must be
careful to properly set both the velocity reference buttons and the bottom track display buttons to the
same reference. In RiverSurveyor versions prior to 3.1, combination 3 was always used when the
velocity reference was set to GPS. The bottom track display had no effect and bottom tracking was
always used to compute the widths of the cross section and individual profile. ***Therefore, because of
the improper computation of GPS-based discharges prior to RiverSurveyor 3.1 and the edge
discharge bias discussed herein, all GPS-based discharges should be reprocessed with
RiverSurveyor 3.4 with both the velocity reference buttons and track display buttons set to GPS.***

Sontek RiverSurveyor version 3.4 can be downloaded from Sontek's website using either the main
RiverSurveyor page:

http://www.sontek.com/product/sw/rivsurv/rssw.htm

or the direct download request:

http://www.sontek.com/cgi-bin/download.cgi?rsrv

Sontek RiverSurveyor version 3.4 also can be downloaded from OSW's Hydroacoustics Web pages,
http://hydroacoustics.usgs.gov/software/. Links to other SonTek software and SonTek
documentation are also available from the above url.

Issues addressed in this memorandum are the direct result of the hydroacoustics quality-assurance
testing program implemented by the Office of Surface Water and the WRD Instrumentation
Committee. As new hardware and software becomes available, additional testing and evaluation will
be completed. As problems are identified and (or) resolved and sufficient experience is gained to
provide sound operational guidance, additional memorandums will be released. Those using acoustic
Doppler profilers are encouraged to visit the USGS hydroacoustics web pages for guidance and
tools. The URL is: http://hydroacoustics.usgs.gov/

If you have any questions please contact David Mueller (email: dmueller@usgs.gov; phone: 502-493-1935) or Kevin Oberg (email kaoberg@usgs.gov ; phone: 217-344-0037 ext. 3004).

/signed/

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