REPORT TT

A SPREADSHEET ANALYSIS OF SUSPENDED SEDIMENT SAMPLING ERRORS

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By

John Skinner

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CONVERSION FACTORS AND ABBREVIATIONS

For readers who prefer English units instead of the metric units used in this report, values may be converted by using the following factors:

Multiply	by	to obtain
millimeter (mm)	3.937×10^{-2}	inch
centimeter (cm)	3.937×10^{-1}	inch
gram (g)	3.527×10^{-2}	ounce, avoirdupois

Suspended-sediment concentration is expressed in this report as milligrams per liter (mg/L). It is computed as one million times the ratio of the dry weight of sediment in grams to the volume of the mixture in cubic centimeters.

ABSTRACT

Accurate sampling of suspended sediment requires isokinetic flow into an upstream- facing nozzle. To prevent errors arising from concentrating or diluting samples, flow must enter the nozzle without undergoing acceleration, but meeting these exacting requirements for isokinetic sampling is often difficult in practice. Shifts in water temperature, variations in the dimensions of manufactured parts, and engineering compromises in sampler design all contribute to departures from ideal sampling conditions.

This report presents a spreadsheet analysis of errors in sampling at a single vertical by depth integration. Four hypothetical samplers are analyzed under three flow conditions and four discreet sediment particle sizes. The spreadsheet can be easily changed to permit study of other samplers under different conditions.

INTRODUCTION

A modern suspended-sediment sampler consists of a container fitted to a nozzle that faces directly into the approaching flow. For accurate sampling, the nozzle collects water while preserving its original flow direction and speed. In other words, water approaching the nozzle moves into the opening without undergoing acceleration. The term "isokinetic" is commonly applied to describe this particular flow.

In 1941, errors caused by a failure to sample isokinetically were measured and documented (FISP Report 5, 1941). The report was limited to studying errors occurring at a point within a flow cross section. Another report (FISP Report 3, 1941) analyzed sampling errors along a line extending from the surface of a stream to its bed; however, this report considered only errors stemming from improper volumetric weighting of flow at various depths. This report builds on the two previous reports by presenting a mathematical analysis that combines sampling errors caused by improper weighting with errors stemming from non-isokinetic intake rates. This analysis is based on a computer spreadsheet that can be easily tailored to fit particular samplers and flow conditions.

Information in this report centers on theory rather than procedural details. Readers are encouraged to expand their knowledge of equipment operation by contacting the Chief, Federal Interagency Sedimentation Project (FISP), Waterways Experiment Station, 3909 Halls Ferry Road, Vicksburg, MS, 39180-6199, or visiting the FISP website at http://fisp.wes.army.mil.

Purpose

This report is intended to aid not only those engaged in the design of suspended-sediment samplers but also those who select and use samplers in studies of sediment movement in rivers, irrigation canals and other open channels.

Although isokinetic sampling is one goal of designers, they must also consider other requirements such as equipment reliability and ruggedness along with chemical stability of a sampler's parts. Striking a balance among these sometimes requires compromising isokinetic performance. Also, sedimentologists involved in collecting suspended-sediment samples often operate under less than ideal conditions resulting in the lack of isokinetic performance.

Scope

River sampling follows two protocols: (a) point integration in which samples are taken only at discrete locations along a vertical and (b) depth integration in which a single sample is collected while traversing along a vertical. Depth integration is the only method covered in this study. In depth integration, the sampler is lowered through the water column at a steady rate. Then, as soon as the sampler touches bottom, traversing is reversed and the sampler is hoisted at a steady rate. Usually, lowering and lifting speeds are equal. Throughout this process, the nozzle is open and water enters at rates set by the approach velocities and the sampler's intake characteristics.

A river's entire cross section is sampled at several verticals (Edwards and Glysson 1999); however this study is restricted to depth integration at only one vertical. Three flows, high, medium and low, are studied along with four sizes of sediment grains. High flow corresponds to a depth of 10 feet and a mean velocity of 6 ft/sec. Medium flow is a depth of 6 feet and a mean velocity of 4 ft/sec. Low flow is a depth of 3 feet and a velocity of 2 ft/sec. Sediment grain sizes used are 0.45, 0.15, 0.06 and 0.01 mm.

This study is based on four hypothetical samplers differing with regard to intake characteristics. A key assumption is that these intake characteristics apply regardless of a sampler's depth or its speed of ascent or descent through the water. In practice, certain conditions must be met to insure this assumption holds. A sampler must be lowered and lifted within prescribed rates to insure the approaching flow is closely aligned with the nozzle's axis and to insure external pressures change slowly to avoid disruptions in the venting of air from the sample container. These restrictions on lowering and lifting speeds impose limits on the sampler's operating depth.

SAMPLER INTAKE RATES

The U.S. suspended-sediment samplers are designed to collect specimens of water-sediment mixtures from open-channels such as rivers and streams. Each sampler has a nozzle that faces upstream so as to minimize disturbances to the flow as it enters the opening. Controlled laboratory tests (FISP, Report 5) show that changes in the direction or speed of the flow filament causes entrained sediment particles to either deflect away from the nozzle or converge toward it. The relation between flow velocity inside the nozzle, commonly referred to as intake velocity, and flow velocity upstream of the nozzle, commonly referred to as approach velocity, is plotted from laboratory flume tests.

Measurement Procedures

A sampler's intake rates are usually measured in a laboratory flume where flow can be regulated. To begin the measurements, flume discharge is stabilized and the velocity is measured with a rotating-cup current meter placed midway between the flume walls. The meter's depth is chosen to minimize disturbances created by the flume bottom and by surface waves. The depth is normally between one and two feet. The meter is then removed and the sampler is lowered until its nozzle is positioned at the test point. When the nozzle passes downward through the water surface, a timer is started. After a prescribed interval, the sampler is lifted and the timer is stopped when the nozzle clears the flow. After measuring the water volume collected in the sample container, the sampler's intake velocity is calculated based on the sampling interval, the sample volume and the cross sectional area of the nozzle bore. This intake velocity is then plotted opposite the approach velocity as registered by the current meter. Measurements are repeated at several flow velocities to obtain a complete chart of the sampler's intake characteristics.

Intake Characteristics of Test Samplers

Figure 1 shows the intake characteristics of five hypothetical samplers used in this study.

An ideal sampler automatically maintains a perfect match between intake velocity and approach velocity. This "isokinetic" condition is labeled "Ideal Sampler" on the figure. The remaining four plots are associated with samplers suffering from certain deficiencies. It must be stressed that the magnitudes of these deficiencies are not typical of production samplers of the

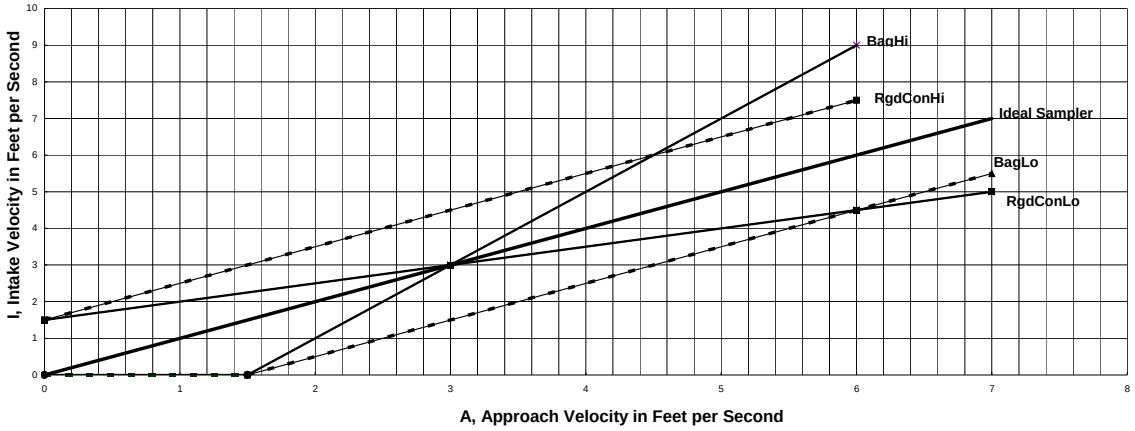

Figure 1-- Intake characteristics of test samplers

U.S. series. Intake characteristics of production samplers deviate from the ideal but by only a few percent. The curves shown in figure 1 greatly exaggerate irregularities in an effort to accentuate sampling errors and their underlying causes.

Even though the curves of figure 1 exaggerate departures from ideal, each curve reflects certain types of imperfections found in manufactured units. Lines "RgdConHi" and "RgdConLo" typify rigid-container samplers that collect water-sediment mixtures in bottles or jars. This category, which includes many in the U.S. series, exhausts air as it is displaced by the incoming sample. The exhaust tube is slightly higher than the nozzle to insure a slow inflow even when a sampler is in slack water. This feature not only permits sampling lakes and slow-moving backwaters but also helps prevent water from flooding the air-exhaust tube and thereby initiating reverse flow of air and water. In approach velocities higher than about 2 ft/sec, intake velocities may exceed ideal values if air-vent suction pressures or water temperatures are unusually high. In such case, the curve RgdConHi applies. If suction pressures or water temperatures are low, intake velocities may fall below ideal rates in fast approach velocities. In this case the RgdConLo curve applies.

Lines "BagLo" and "BagHi" typify collapsible-bag samplers developed by the FISP (Davis 2001, Davis 2005, McGregor 2006). These samplers collect water in collapsible plastic or perfluoroalkoxy (PFA) bags. Collapsing the bag before submerging the sampler acts to purge

air; consequently, an exhaust tube is not required. If approach velocities are slower than about 2 ft/sec, the force of the incoming water is not enough to open the bag and expel the water in the cavity of the sampler. Below this critical speed, sampling either stops or is greatly reduced. In flows faster than about 2 ft/sec, pressures are sufficient to open the bag and expel the water in the sampler cavity, thereby facilitating near isokinetic sampling. The relation between intake velocity and approach velocity now follows either of two trends. If suction of the nozzle is strong or if water temperatures are abnormally high, the trend line BagHi applies. If suction is weak or water temperatures are low, the line BagLo applies.

Plots on figure 1 provide a visual comparison of test-sampler performance; however, the lines must be converted to equations for use in spreadsheets described later. The equations, which are listed in table 1, are of two types. The first, which covers samplers RgdConHi, RgdConLo, and Ideal Sampler, consists of one equation spanning the entire intake range. The second, which covers BagLo and BagHi, consists of two equations each spanning a portion of the range.

Table 1-- Operating equations for various sampler intake characteristics. In the operating equations, "I" is intake velocity in ft/sec; "A" is approach velocity in ft/sec.

Sampler Label	Intake Velocity	Operating Equation	
RgdConHi	higher than ideal	I=1.5 + A	
RgdConLo	falls below ideal level at approach velocities greater that 3 feet per second	I=1.5 + 0.5A	
Ideal Sampler	ideal.	I=A	
BagLo	lower than ideal	For 0<A<=1.5 I=0	For A>1.5 I= -1.5 + A
BagHi	rises above ideal level at approach velocities greater than 3 feet per second	For 0<A<=1.5 I=0	For A>1.5 I= -3 + 2A

NON-ISOKINETIC SAMPLING ERRORS

Historical Review

In 1941 the Sedimentation Committee published results of sampling errors caused by adverse flows at entrances of sampling nozzles (FISP Report 5, 1941). A water-sediment mixture was circulated through a closed conduit fitted with two upstream facing nozzles located side-by-side

at equal distances from the flume centerline. Because of their symmetrical placement, the nozzles faced identical approach velocities and sediment concentrations. Isokinetic samples from one nozzle served as references for hypokinetic and hyperkinetic samples collected with the other nozzle.

The tests revealed that hypokinetic sampling (nozzle inflows slower that approach velocities), acts to concentrate sediment. In other words, concentrations within samples exceed concentrations in the approaching flows. Acting in the opposite way, hyperkinetic sampling (nozzle inflows exceed approach velocities) dilutes sediment. Concentrations within samples are less than concentrations in approaching flows. Tests were run for four grain sizes of sediment: 0.45, 0.15, 0.06 and 0.01 mm.

Concentration Error Equations

Errors documented in FISP Report 5 (1941) were presented only as graphs. Attempts to find a single equation spanning all errors for the 0.45-mm sediment ended in failure because of extreme curvature of the plot. To resolve the problem, one polynomial was fitted to errors in the hypokinetic range and another polynomial to the hyperkinetic range. For uniformity, two polynomials are fitted to error curves for each of the other three particle-size classes. Table 2 gives coefficients for the fourth-order power-series expressions for the various grain sizes.

Table 2-- Power series for concentration-error equations

Sediment grain size, mm	0.2<S<=1					1<S<5				
	S^4	S^3	S^2	S	S^0	S^4	S^3	S^2	S	S^0
0.45	1305.9	-3803.6	4125.3	-2033.7	406.58	0.434	-5.8939	29.836	-70.621	45.728
0.15	343.6	-1011.5	1146.5	-634.54	156.13	0.7671	-9.118	40.173	-79.193	47.293
0.06	66.451	-201.53	226.78	-117.55	25.844	0.0877	-1.0519	4.6261	-9.8266	6.151
0.01	0	0	0	-3.7474	3.7277	0	0	0	0	0

In the table, "S" denotes relative sampling rate. For example, for the low range of "S" and 0.45-mm sediment the percent concentration error = $1305.9S^4 - 3803.6S^3 + 4125.3S^2 + 2033.7S + 406.58$. For the high range of "S" and 0.01-mm grain size, sampling errors are zero. Correlation coefficients exceed 0.997 for all grain sizes. Eight equations, two for each grain size, are plotted in figure 2 from data in table 2. Through the full range of relative sampling rates, certain trends are evident. At any specified S value, errors decrease with shifts toward smaller grain sizes. The effect is traceable to momentum possessed by individual grains. At hypokinetic rates, water diverges from a nozzle's entrance but sediment particles separate from the diverging flow to maintain a nearly straight-line path into the nozzle. As a result, particles separate from filaments of flow that carry them toward the sampler. At hyperkinetic rates, water converges toward the

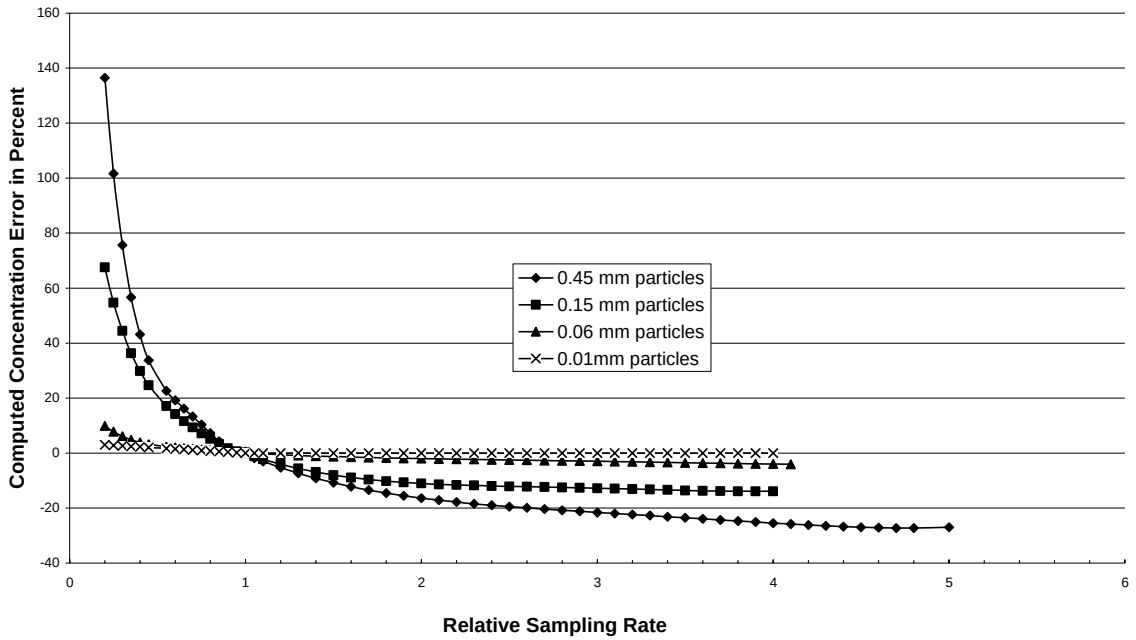

Figure 2-- Sampling errors of nonisokinetic sampling rates, computed from coefficients in table 2

nozzle's entrance, but particles maintain their nearly straight-line path. Some particles now miss the entrance and follow a trajectory that carries them downstream past the nozzle. In effect, momentum acts to screen out particles that should be captured. Momentum is strongest for the largest particles and weakens with shifts toward smaller particles. The smallest particles tested (0.01 mm) resisted most separation forces and followed diverging and converging flow patterns.

COMPUTATIONAL METHOD

Based on characteristics of the hypothetical test samplers, intake rates are merged with stream-flow rates on a spreadsheet (figure 3), where sample concentrations for selected grain sizes are computed. Once spreadsheet cells are loaded with the proper equations, global constants are easily revised to study different stream-flow depths and velocities. The spreadsheet applies to only one vertical at a time, but the input data can be changed to represent a vertical at any location within a river cross section.

ASSIGNED CONSTANTS	f, Fractional depth at sampling vertical (0 is surface, 1 is bottom)	Relative height of segment boundaries above stream bed	Stream velocity at segment boundaries, ft/s.	A, Average velocity in segment. Also ideal sampler average intake velocity, ft/s	Q, For ideal sampler, volume of sample collected in interval, ml	Sediment concentration at segment boundary, mg/L	Average concentration in segment. Also for ideal sampler, concentration of sample in segment, mg/L	For ideal sampler, mass of sediment collected in segment, mg	Intake Velocity of test sampler (TS), ft/s	Volume of sample collected in interval by TS, ml	Relative sampling rate for TS	Sediment concentration error for TS, percent	Concentration of sample collected in segment by TS, mg/L	Mass of sediment collected in segment by TS, mg
Sampler RgdConLo, Insert intake characteristic equation in column J.	0	1	2.63			0.00								
No, Sediment Concentration at Stream Bottom, mg/L	0.05	0.95	2.60	2.62	25.27	0.00	0.00	0.00	2.81	27.12	1.07	-2.41	0.00	0.00
1000	0.1	0.9	2.57	2.58	24.94	0.00	0.00	0.00	2.79	26.96	1.08	-2.59	0.00	0.00
c, Fall Velocity of particles, cm/s.	0.15	0.85	2.53	2.55	24.60	0.00	0.00	0.00	2.77	26.79	1.09	-2.79	0.00	0.00
7.6	0.2	0.8	2.49	2.51	24.25	0.00	0.00	0.00	2.76	26.61	1.10	-3.00	0.00	0.00
n, Manning roughness coefficient	0.25	0.75	2.45	2.47	23.86	0.01	0.01	0.00	2.74	26.42	1.11	-3.23	0.01	0.00
0.04	0.3	0.7	2.41	2.43	23.45	0.02	0.01	0.00	2.71	26.21	1.12	-3.48	0.01	0.00
D, Stream depth at sampling vertical, ft.	0.35	0.65	2.36	2.38	23.02	0.04	0.03	0.00	2.69	25.99	1.13	-3.76	0.03	0.00
3	0.4	0.6	2.31	2.33	22.55	0.08	0.06	0.00	2.67	25.76	1.14	-4.06	0.06	0.00
Vm, mean velocity in vertical, ft/s	0.45	0.55	2.25	2.28	22.04	0.18	0.13	0.00	2.64	25.50	1.16	-4.40	0.12	0.00
2	0.5	0.5	2.19	2.22	21.48	0.39	0.28	0.01	2.61	25.22	1.17	-4.78	0.27	0.01
d, sampler nozzle diameter, in.	0.55	0.45	2.13	2.16	20.87	0.86	0.62	0.01	2.58	24.92	1.19	-5.21	0.59	0.01
0.25	0.6	0.4	2.05	2.09	20.18	1.87	1.36	0.03	2.55	24.58	1.22	-5.71	1.29	0.03
T, sampling time in each segment, s.	0.65	0.35	1.97	2.01	19.42	4.11	2.99	0.06	2.51	24.19	1.25	-6.30	2.80	0.07
1	0.7	0.3	1.87	1.92	18.54	9.01	6.56	0.12	2.46	23.75	1.28	-7.01	6.10	0.14
	0.75	0.25	1.76	1.81	17.51	19.75	14.38	0.25	2.41	23.24	1.33	-7.88	13.25	0.31
	0.8	0.2	1.61	1.68	16.27	43.29	31.52	0.51	2.34	22.62	1.39	-9.00	28.68	0.65
	0.85	0.15	1.43	1.52	14.71	94.91	69.10	1.02	2.26	21.84	1.48	-10.54	61.82	1.35
	0.9	0.1	1.18	1.30	12.59	208.07	151.49	1.91	2.15	20.78	1.65	-12.83	132.05	2.74
	0.95	0.05	0.74	0.96	9.23	456.15	332.11	3.07	1.98	19.10	2.07	-16.91	275.95	5.27
	1	0	0	0.37	3.56	1000.00	728.08	2.59	1.68	16.26	4.57	-27.12	530.59	8.63
				Total volume collected by ideal sampler, ml ===>	388.33		Total sediment mass collected by ideal sampler, mg ====>	9.58	Total volume collected by test sampler, ml ===>	483.85			Total sediment mass collected by test sampler, mg ===>	19.22
			Concentration of sample collected by ideal sample, rmg/L		24.66			Concentration of sample collected by test sampler, mg/L		39.73				

Figure 3-- Sample spreadsheet for sampling error in a vertical (RgdConLo sampler, 0.45-mm sediment and low flow, copied from B34 appendix)

Distributions of flow velocity and sediment along a vertical are based on concepts presented in FISP Report 3 (1941). Flow velocity follows a logarithmic distribution varying between a maximum at the water surface and a minimum at the streambed. Sediment concentration follows an exponential distribution varying between a minimum at the water surface and a maximum at the streambed.

After velocity profiles and concentration profiles have been established, intake rates for the chosen sampler are computed from its intake characteristics and its position along a vertical. For computational purposes, verticals are divided into twenty segments. First of all, the quantity of water collected within each segment is computed. Then, based on the sampler's intake rate, the sediment-concentration error is computed from table 2 and applied to stream-flow concentrations within each segment. Next, the sampled concentration and sampled volume of water are used to determine the mass of sediment collected within each segment. Finally, the total mass of sediment collected in all segments is divided by the total volume of water in all segments to obtain the sample concentration for the entire vertical.

Concentrations collected by the test samplers must be compared with benchmarks to determine errors. Concentrations collected by an ideal sampler, an instrument with isokinetic intake rates, meets this need. Since sampling is isokinetic, concentration errors are nonexistent; therefore, sampled concentrations are equated to stream-flow concentrations. The true concentration for the entire vertical is obtained by dividing the total mass of collected sediment by the total volume of collected water.

Appendix A presents a detailed explanation of how the spreadsheet operates.

SUMMARY OF RESULTS

Table 3 is a summary of data extracted from spreadsheets modeled after figure 3 and included in the appendix. The first half of table 3 applies to depth integration through entire verticals. In other words, the samplers traverse all twenty segments between the water surface and stream bottom. Column A identifies spreadsheets from which data in columns B through G are transcribed. Datum in H3, concentration of samples collected by the ideal sampler, is computed from the expression "=(E3/D3)*1000" which is pasted to all cells in column H. Datum in cell I3, concentration of samples collected by the test sampler, is computed from the expression " =(G3/F3)*1000" which is pasted to all cells in column I. Test and ideal concentrations are then compared to obtain the concentration error for the test sampler. Error datum in J3 is obtained from the expression " =((I3-H3)/H3)*100" which is pasted to all cells in column J. Positive errors indicate over-sampling since concentrations from the test sampler exceed concentrations from the ideal sampler. Conversely, negative errors indicate under-sampling.

Table 3-- Summary of basic data

	A	B	C	D	E	F	G	H	I	J
1	Basic Data Spreadsheet	Sampler	Grain Size, mm	Ideal Sample Volume, ml	Ideal Sediment mass, mg	Test Sample Volume, ml	Test Sediment Mass, mg	Ideal Conc., mg/L	Test Conc., mg/L	Conc. Error, percent
2			**High Flow-- Integration Through Total Depth**							
3	B2	RgdConLo	0.45	1158.6	116.27	868.99	106.91	100.35	123.03	22.59
4	B3	RgdConLo	0.15	1158.6	497.22	868.99	411.53	429.16	473.57	10.35
5	B4	RgdConLo	0.06	1158.6	879.5	868.99	674.98	759.11	776.74	2.32
6	B5	RgdConLo	0.01	1158.6	1142.23	868.99	865.03	985.87	995.44	0.97
7	B6	BagHi	0.45	1158.6	116.27	1738.78	129.92	100.35	74.72	-25.54
8	B7	BagHi	0.15	1158.6	497.22	1738.78	659.58	429.16	379.33	-11.61
9	B8	BagHi	0.06	1158.6	879.5	1738.78	1288.02	759.11	740.76	-2.42
10	B9	BagHi	0.01	1158.6	1142.23	1738.78	1713.31	985.87	985.35	-0.05
11	B10	RgdConHi	0.45	1158.6	116.27	1448.28	147.18	100.35	101.62	1.27
12	B11	RgdConHi	0.15	1158.6	497.22	1448.28	603.7	429.16	416.84	-2.87
13	B12	RgdConHi	0.06	1158.6	879.5	1448.28	1098.44	759.11	758.44	-0.09
14	B13	RgdConHi	0.01	1158.6	1142.23	1448.28	1428.29	985.87	986.20	0.03
15	B14	BagLo	0.45	1158.6	116.27	869.39	80.98	100.35	93.15	-7.18
16	B15	BagLo	0.15	1158.6	497.22	869.39	384.24	429.16	441.97	2.98
17	B16	BagLo	0.06	1158.6	879.5	869.39	660.39	759.11	759.60	0.07
18	B17	BagLo	0.01	1158.6	1142.23	869.39	864.11	985.87	993.93	0.82
19			**Medium Flow-- Integration Through Total Depth**							
20	B18	RgdConLo	0.45	774.1	48	676.74	54.05	62.01	79.87	28.80
21	B19	RgdConLo	0.15	774.1	251.35	676.74	240.31	324.70	355.10	9.36
22	B20	RgdConLo	0.06	774.1	530.37	676.74	476.14	685.14	703.58	2.69
23	B21	RgdConLo	0.01	774.1	758.97	676.74	667.5	980.45	986.35	0.60
24	B22	BagHi	0.45	774.1	48	980.91	39.41	62.01	40.18	-35.21
25	B23	BagHi	0.15	774.1	251.35	980.91	277.22	324.70	282.62	-12.96
26	B24	BagHi	0.06	774.1	530.37	980.91	650	685.14	662.65	-3.28
27	B25	BagHi	0.01	774.1	758.97	980.91	960.85	980.45	979.55	-0.09
28	B26	RgdConHi	0.45	774.1	48	1063.79	70.59	62.01	66.36	7.01
29	B27	RgdConHi	0.15	774.1	251.35	1063.79	337.59	324.70	317.35	-2.26
30	B28	RgdConHi	0.06	774.1	530.37	1063.79	731.12	685.14	687.28	0.31
31	B29	RgdConHi	0.01	774.1	758.97	1063.79	1043.68	980.45	981.10	0.07
32	B30	BagLo	0.45	774.1	48	490.45	25.91	62.01	52.83	-14.80
33	B31	BagLo	0.15	774.1	251.35	490.45	165.05	324.70	336.53	3.64
34	B32	BagLo	0.06	774.1	530.37	490.45	333.71	685.14	680.42	-0.69
35	B33	BagLo	0.01	774.1	758.97	490.45	486.49	980.45	991.93	1.17
36			**Low Flow-- Integration Through Total Depth**							
37	B34	RgdConLo	0.45	388.33	9.58	483.85	19.22	24.67	39.72	61.02
38	B35	RgdConLo	0.15	388.33	64.64	483.85	93.95	166.46	194.17	16.65
39	B36	RgdConLo	0.06	388.33	201.01	483.85	263.91	517.63	545.44	5.37
40	B37	RgdConLo	0.01	388.33	374.78	483.85	468.28	965.11	967.82	0.28
41	B38	BagHi	0.45	388.33	9.58	233.43	0.67	24.67	2.87	-88.37
42	B39	BagHi	0.15	388.33	64.64	233.43	24.76	166.46	106.07	-36.28
43	B40	BagHi	0.06	388.33	201.01	233.43	105.82	517.63	453.33	-12.42
44	B41	BagHi	0.01	388.33	374.78	233.43	226.18	965.11	968.94	0.40
45	B42	RgdConHi	0.45	388.33	9.58	678.02	22.58	24.67	33.30	34.99
46	B43	RgdConHi	0.15	388.33	64.64	678.02	120.95	166.46	178.39	7.17
47	B44	RgdConHi	0.06	388.33	201.01	678.02	360.39	517.63	531.53	2.69
48	B45	RgdConHi	0.01	388.33	374.78	678.02	655.67	965.11	967.04	0.20
49	B46	BagLo	0.45	388.33	9.58	116.71	0.49	24.67	4.20	-82.98
50	B47	BagLo	0.15	388.33	64.64	116.71	15.54	166.46	133.15	-20.01
51	B48	BagLo	0.06	388.33	201.01	116.71	54.83	517.63	469.80	-9.24
52	B49	BagLo	0.01	388.33	374.78	116.71	114.58	965.11	981.75	1.72

Table 3-- Summary of basic data (continued)

	A	B	C	D	E	F	G	H	I	J
53	Basic Data Spreadsheet	Sampler	Grain Size, mm	Ideal Sample Volume, ml	Ideal Sediment mass, mg	Test Sample Volume, ml	Test Sediment Mass, mg	Ideal Conc., mg/L	Test Conc., mg/L	Conc. Error, percent
54			**High Flow-- Integration Through 95% Depth**							
55	B2	RgdConLo	0.45	1144.6	104.18	847.51	90.46	91.02	106.74	17.27
56	B3	RgdConLo	0.15	1144.6	483.78	847.51	392.63	422.66	463.27	9.61
57	B4	RgdConLo	0.06	1144.6	865.67	847.51	654.05	756.31	771.73	2.04
58	B5	RgdConLo	0.01	1144.6	1128.24	847.51	843.56	985.71	995.34	0.98
59	B6	BagHi	0.45	1144.6	104.18	1738.78	129.92	91.02	74.72	-17.91
60	B7	BagHi	0.15	1144.6	483.78	1738.78	659.58	422.66	379.33	-10.25
61	B8	BagHi	0.06	1144.6	865.67	1738.78	1288.02	756.31	740.76	-2.06
62	B9	BagHi	0.01	1144.6	1128.24	1738.78	1713.31	985.71	985.35	-0.04
63	B10	RgdConHi	0.45	1144.6	104.18	1419.79	126.69	91.02	89.23	-1.96
64	B11	RgdConHi	0.15	1144.6	483.78	1419.79	579.42	422.66	408.10	-3.44
65	B12	RgdConHi	0.06	1144.6	865.67	1419.79	1070.89	756.31	754.26	-0.27
66	B13	RgdConHi	0.01	1144.6	1128.24	1419.79	1399.82	985.71	985.93	0.02
67	B14	BagLo	0.45	1144.6	104.18	869.39	80.98	91.02	93.15	2.34
68	B15	BagLo	0.15	1144.6	483.78	869.39	384.24	422.66	441.97	4.57
69	B16	BagLo	0.06	1144.6	865.67	869.39	660.39	756.31	759.60	0.44
70	B17	BagLo	0.01	1144.6	1128.24	869.39	864.11	985.71	993.93	0.83
71			**Medium Flow-- Integration Through 95% Depth**							
72	B18	RgdConLo	0.45	765.65	41.06	658.03	41.43	53.63	62.96	17.40
73	B19	RgdConLo	0.15	765.65	243.37	658.03	224.69	317.86	341.46	7.42
74	B20	RgdConLo	0.06	765.65	522.07	658.03	458.16	681.87	696.26	2.11
75	B21	RgdConLo	0.01	765.65	750.53	658.03	648.81	980.25	985.99	0.59
76	B22	BagHi	0.45	765.65	41.06	980.91	39.41	53.63	40.18	-25.08
77	B23	BagHi	0.15	765.65	243.37	980.91	277.22	317.86	282.62	-11.09
78	B24	BagHi	0.06	765.65	522.07	980.91	650	681.87	662.65	-2.82
79	B25	BagHi	0.01	765.65	750.53	980.91	960.85	980.25	979.55	-0.07
80	B26	RgdConHi	0.45	765.65	41.06	1040.86	55.6	53.63	53.42	-0.39
81	B27	RgdConHi	0.15	765.65	243.37	1040.86	318.6	317.86	306.09	-3.70
82	B28	RgdConHi	0.06	765.65	522.07	1040.86	709.19	681.87	681.35	-0.08
83	B29	RgdConHi	0.01	765.65	750.53	1040.86	1020.77	980.25	980.70	0.05
84	B30	BagLo	0.45	765.65	41.06	490.45	25.91	53.63	52.83	-1.49
85	B31	BagLo	0.15	765.65	243.37	490.45	165.05	317.86	336.53	5.87
86	B32	BagLo	0.06	765.65	522.07	490.45	333.71	681.87	680.42	-0.21
87	B33	BagLo	0.01	765.65	750.53	490.45	486.49	980.25	991.93	1.19
88			**Low Flow-- Integration Through 95% Depth**							
89	B34	RgdConLo	0.45	384.77	6.99	467.59	10.59	18.17	22.65	24.67
90	B35	RgdConLo	0.15	384.77	61.41	467.59	80.87	159.60	172.95	8.36
91	B36	RgdConLo	0.06	384.77	197.56	467.59	248.81	513.45	532.11	3.63
92	B37	RgdConLo	0.01	384.77	371.23	467.59	452.04	964.81	966.74	0.20
93	B38	BagHi	0.45	384.77	6.99	233.43	0.67	18.17	2.87	-84.20
94	B39	BagHi	0.15	384.77	61.41	233.43	24.76	159.60	106.07	-33.54
95	B40	BagHi	0.06	384.77	197.56	233.43	105.82	513.45	453.33	-11.71
96	B41	BagHi	0.01	384.77	371.23	233.43	226.18	964.81	968.94	0.43
97	B42	RgdConHi	0.45	384.77	6.99	659.98	12.96	18.17	19.64	8.09
98	B43	RgdConHi	0.15	384.77	61.41	659.98	105.08	159.60	159.22	-0.24
99	B44	RgdConHi	0.06	384.77	197.56	659.98	343.57	513.45	520.58	1.39
100	B45	RgdConHi	0.01	384.77	371.23	659.98	637.66	964.81	966.18	0.14
101	B46	BagLo	0.45	384.77	6.99	116.71	0.49	18.17	4.20	-76.89
102	B47	BagLo	0.15	384.77	61.41	116.71	15.54	159.60	133.15	-16.57
103	B48	BagLo	0.06	384.77	197.56	116.71	54.83	513.45	469.80	-8.50
104	B49	BagLo	0.01	384.77	371.23	116.71	114.58	964.81	981.75	1.76

In field practice, integration through the entire depth of a flow is usually impossible. A sampler's bottom, being a few inches below its intake, strikes the streambed and thereby limits the extent of motion. The unsampled zone is set by the elevation from the sampler's bottom to its nozzle. If the sampler sinks into a soft river bottom or if the sampler is lowered behind a dune, the nozzle may traverse the entire depth of flow, but the sampler may also scoop bed material and contaminate the suspended sample. To approximate an unsampled zone, the second page of table 3 shows data on integration through 95 percent of total depth. These data are obtained by deducting the volume of water and mass of sediment collected in the bottom segments of the verticals. Data for bottom segments are listed in spreadsheet rows labeled "0" for "relative height of segment boundaries above streambed."

Table 4 ranks the test samplers according to their absolute errors within each category of grain size and flow regime. Absolute errors are obtained by disregarding positive and negative signs on errors in column J of table 3; however, the associated signs are shown in parenthesis in table 4. Table 4 indicates errors are linked to sediment grain sizes. All samplers operate with errors less than 2 percent for 0.01-mm grains because this finely divided sediment is almost uniformly dispersed through the verticals. Not only are concentrations nearly the same at all depths, but the particles resist separation at sampler intakes during non-isokinetic entrance conditions. Errors are greatest for the 0.45-mm particles. For most samplers of a given type, errors diminish with shifts to smaller particle sizes.

Performance of Sampler RgdConHi

Within every category, RgdConHi ranks ahead of the remaining three samplers. Characterized by hyperkinetic operation at all intake rates, RgdConHi has the best accuracy through the entire ranges of flow velocity, flow depth and particle size. Its broad-range hyperkinetic characteristic exerts a stabilizing influence because all segments are sampled, but some errors are large, particularly with 0.45-mm grains in low flow. Magnitudes of errors in table 4 emphasize the importance of using samplers with isokinetic intake characteristics.

With sampler RgdConHi operating in low-flow, relative sampling rates shift from 1.57 at the surface to 5.07 near the bottom. Corresponding concentration errors for 0.45-mm sediment range from -11 percent to -26 percent; however, the concentration error for the entire vertical and 0.45-mm sediment is +35 percent. Despite the fact that errors for all individual segments are *negative*, the error for the composite sample representing the entire vertical is *positive*. The cause of this sign reversal, which occurs with other samplers, is easiest to visualize with coarse particles which have sparse populations near the water surface and dense populations near the stream bottom. Because RgdConHi over-samples water volumes in the bottom segments, the composite sample for the vertical is biased toward these high-concentration zones. Excessive sample volumes collected from the bottom segments contaminate the composite with an over abundance of sediment as indicated by the positive error.

In medium flow, relative sampling rates range between 1.3 at the surface and 2.7 near the bottom. Concentration errors are negative in all segments, but the composite error for the

Table 4-- Rank of samplers by concentration errors. Samplers are listed in order of absolute error with the most desirable sampler (smallest error) at the head of each group. Percent errors are shown in parenthesis.

Percent of depth integrated	Grain Size					
	0.45 mm			0.15 mm		
	High Flow	Medium Flow	Low Flow	High Flow	Medium Flow	Low Flow
100	RgdConHi(1.3) BagLo(-7.2) RgdConLo(22.6) BagHi(-25.5)	RgdConHi(7.0) BagLo(-14.8) RgdConLo(28.8) BagHi(-35.2)	RgdConHi(35.0) RgdConLo(61.0) BagLo(-83.0)* BagHi(-88.4)*	RgdConHi(-2.9) BagLo(3.0) RgdConLo(10.4) BagHi(-11.6)	RgdConHi(-2.3) BagLo(3.6) RgdConLo(9.4) BagHi(-13.0)	RgdConHi(7.2) RgdConLo(16.7) BagLo(-20.0)* BagHi(-36.3)
95	RgdConHi(-2.0) BagLo(2.3) RgdConLo(17.3) BagHi(-17.9)	RgdConHi(-0.4) BagLo(-1.5) RgdConLo(17.4) BagHi(-25.1)	RgdConHi(8.1) RgdConLo(24.7) BagLo(-76.9)* BagHi(-84.2)*	RgdConHi(-3.4) BagLo(4.6) RgdConLo(9.6) BagHi(-10.3)	RgdConHi(-3.7) BagLo(5.9) RgdConLo(7.4) BagHi(-11.1)	RgdConHi(-0.2) RgdConLo(8.4) BagLo(-16.6) BagHi(-33.5)

Percent of depth integrated	Grain Size					
	0.06 mm			0.01 mm		
	High Flow	Medium Flow	Low Flow	High Flow	Medium Flow	Low Flow
100	RgdConHi(-0.1) BagLo(0.1) RgdConLo(2.3) BagHi(-2.4)	RgdConHi(0.3) BagLo(-0.7) RgdConLo(2.7) BagHi(-3.3)	RgdConHi(2.7) RgdConLo(5.4) BagLo(-9.2) BagHi(-12.4)	RgdConHi(0.0) BagHi(-0.1) BagLo(0.8) RgdConLo(1.0)	RgdConHi(0.1) BagHi(-0.1) RgdConLo(0.6) BagLo(1.2)	RgdConHi(0.2) RgdConLo(0.3) BagHi(0.4) BagLo(1.7)
95	RgdConHi(-0.3) BagLo(0.4) RgdConLo(2.0) BagHi(-2.1)	RgdConHi(-0.1) BagLo(-0.2) RgdConLo(2.1) BagHi(-2.8)	RgdConHi(1.4) RgdConLo(3.6) BagLo(-8.5) BagHi(-11.7)	RgdConHi(0.0) BagHi(0.0) BagLo(0.8) RgdConLo(1.0)	RgdConHi(0.1) BagHi(-0.1) RgdConLo(0.6) BagLo(1.2)	RgdConHi(0.1) RgdConLo(0.2) BagHi(0.4) BagLo(1.8)

***Errors estimated because relative sampling rates fall beyond experimental measurements**

vertical is + 7 percent. The sign reversal again occurs because of over sampling in the bottom segment.

In high flow, relative sampling rates range between 1.2 near the surface to 2.0 near the bottom. This comparatively small shift yields a composite error for the entire vertical of only 1.3 percent, the smallest of errors for all samplers in the 0.45-mm sediment category.

Establishing an overall-accuracy ranking among the BagLo, BagHi, and RgdConLo samplers is somewhat arbitrary. In a few cases, rankings change order with shifts in grain size and flow. Within the three largest grain sizes where errors are most significant, samplers can be ranked by

errors which range from smallest to largest in each category. Total rankings across grain sizes and flows indicate sampler BagLo occupies second place behind sampler RgdConHi. RgdConLo takes third place, and BagHi takes fourth place as being the least accurate sampler.

Performance of Sampler BagLo

In low flow, the sampler operates hypokinetically at all depths. Near the surface, relative intake rates are about 0.4, but below the 85 percent depth all sampling stops. At certain depths, relative intake rates fall beyond limits of experimental data; consequently, computed errors may be slightly inaccurate but are certainly very large. The spreadsheet indicates that for 0.45-mm sediment, sampled concentrations at all levels have positive errors even though the error for the complete vertical is - 83 percent. This shift in sign occurs because the composite is weighted toward surface flows where concentrations are less than at any point in the vertical.

In medium flow, the sampler operates hypokinetically in all segments. At the surface, the relative intake rate is only 0.71. The bottom five percent of the vertical goes completely unsampled. For the 0.45-mm sediment, the error for the entire vertical is negative owing to sample-volume bias toward surface flows.

In high flow with 0.45-mm sediment, the sampling error for the vertical is only -7.2 percent because compared to medium and high flows, sediment is more evenly distributed in the vertical.

Performance of Sampler RgdConLo

The RgdConLo sampler operates isokinetically in approach velocities of 3.0 ft/s. In low flow, the sampler operates almost isokinetically near the surface, but as the sampler moves down, intake rates increase toward a maximum of 4.6 in the bottom segment. Concentration errors are negative in all segments, but with 0.45-mm sediment, the error for the entire vertical is + 61 percent because of over sampling the bottom segment where concentrations are highest in the vertical.

In medium flow with 0.45-mm sediment, the sampler has a +29 percent error for the complete vertical. Compared to its error at low flow, the sampler's error at medium flow is smaller because of more uniform dispersion of sediment in the vertical.

In high flow with 0.45-mm sediment, the composite error is +22.6 percent. The relative sampling rate at the surface is 0.7 but increases to 1.53 in the bottom segment. In all segments except the bottom, concentration errors are positive.

Performance of Sampler BagHi

With the BagHi sampler in low flow, depths below the 85 percent level go completely unsampled. At the water surface, the relative sampling rate is a maximum but still only 0.85. The entire vertical is sampled hypokinetically with positive concentration errors in all segments.

Because the sampler fails to admit water from the bottom three segments, the composite is biased toward flow at the surface where sediment is present only in low concentrations. Dilution from the surface flow is responsible for negative errors in composites.

In medium flow, BagHi samples isokinetically at about the 85 percent depth. Below this level, operation is hypokinetic, but above it operation is hyperkinetic. Because the volume of the composite exceeds the ideal, surface flow contributes more than its proper share. This bias accounts for the negative error (-35.2 percent) in sampling the complete vertical for 0.45-mm sediment.

In high flow, BagHi samples hyperkinetically throughout the entire depth except for the bottom segment. At the surface the relative sampling rate is 1.6, but at the 95 percent depth only 1.13. Because of hyperkinetic rates, the composite-sample volume is larger than ideal. For 0.45-mm sediment, sample concentrations in most segments are about 10 percent lower than ideal, but over-sampling sediment-deficient zones near the water surface amplifies the individual errors and produces a composite error of -26 percent for the vertical.

Errors with Partially Sampled Verticals

The bottom half of table 4 shows errors associated with sampling only 95 percent of a vertical by leaving the bottom segment unsampled. These data approximate results linked to unsampled zones in field operations.

Within any category of particle size and flow, shifting from a fully-sampled vertical (top half of table 4) to a partially-sampled vertical (bottom half of table 4) does not alter rankings of the samplers. For example, the ranking is RgdConHi followed by BagLo, RgdConLo, and BagHi for fully-sampled as well as partially-sampled verticals provided the comparison remains in high flows carrying 0.45-mm particles.

Within the 0.06 and 0.01-mm particle-size groups, errors diminish slightly with a shift from full- to partial-depth integration; however, reductions are too small to be significant and probably fall within the range of computational errors caused by dividing the verticals into only twenty segments.

Within the 0.45 and 0.15-mm particle-size group, substantial changes in errors occur with shifts from full- to partial-depth integration, but not every change is a reduction. In a few cases, errors increase by a few percent. Reductions in errors are more significant. With 0.45-mm sediment in medium flow, the error for sampler RgdConHi decreases from +7.0 percent to -0.4 percent. Within the same category, the error for sampler BagLo decreases from -14.8 percent to only -1.5 percent. Other samplers perform with improved accuracy when they are not exposed to the bottom zone with its highly-concentrated sediment load, but of course the transport of sediment in this critical zone escapes detection.

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Appendix A

Cell Addressing

Columns in the spreadsheet are lettered from left to right beginning with “A” on the left. Rows are numbered from top to bottom beginning with “1” at the top. Cells in a spreadsheet contain mathematical expressions, but only the values obtained from the expressions are printed. Within the expressions, cells are referenced through two modes: absolute addressing and relative addressing. In absolute addressing, reference is made to a cell by its row and column coordinates. For example, if the expression " =$A$5" is embedded in a cell, it is loaded with the contents of cell A5. Dollar signs denote row and column coordinates that are fixed and unchanging.

In relative addressing, reference is made to a cell at a location relative to the current cell. For example, assume the expression " =B2" is in cell C2. The content of B2 is copied into C2, the cell to the left of the current cell. If the expression is pasted into C3, it fills with the contents of B3, the cell to the left of the new current cell. Omitting dollar signs invokes relative addressing when expressions are pasted into new cells.

Global Constants

Column A of figure 3 contains constants that are used repeatedly throughout the spreadsheet. A text label in the cell immediately above each constant identifies its purpose. Cells A2 and A3 specify the sampler type, RgdConLo in this case. As mentioned in the label, the sampler type must match the sampler intake equations in cells J3 through J22.

Cell A4 labels the constant of 1000 in cell A5. "No" is the corresponding symbol commonly used in some classical concentration equations. The value of 1000 is chosen arbitrarily and has no effect on sampling errors computed for a vertical. For example, if the constant is doubled, all sediment quantities collected by the samplers, both test and ideal, also double; consequently, sampling errors, which involve ratios of test and ideal concentrations, remain unchanged. The value of the constant is significant if samples from two or more verticals are composited or if samples from two or more particle-size classes are combined.

Cell A6 labels the entry in A7 as the fall velocity of the sediment particles, 7.6 cm/s in this case. Four particle-size classes, 0.45, 0.15, 0.06 and 0.01-mm are covered in this report. Corresponding fall velocities of 7.6, 2.0, 0.6 and 0.03-cm/s are used to compute concentrations at points along the vertical.

Cell A8 identifies the constant in A9 as Manning's roughness coefficient "n," 0.04 in this case. The value is adjusted to meet specific channel conditions (Roberson and Crowe, 1990). A value of 0.012 is typical of channels lined with smooth concrete, 0.025 for straight channels with gravel beds, 0.030 for sinuous earth-lined channels with no vegetation, 0.04 for straight channels lined with large boulders, and 0.06 for channels lined with dense vegetation.

Cell A10 labels the entry in A11 as stream depth at the sampling vertical, 3.0 feet in this case.

Cell A12 labels the entry in A13 as mean velocity in the vertical, 2.0 ft/sec in this case. Cells A11 and A13 together specify three flows, which in subsequent discussions are labeled high, medium, and low. High flow corresponds to a depth of 10 feet and a mean velocity of 6 ft/sec. Medium flow is a depth of 6 feet and a mean velocity of 4 ft/sec. Low flow is a depth of 3 feet and a velocity of 2 ft/sec.

Cell A14 labels the entry in A15 (0.25), as the bore diameter of the nozzle which is traditionally specified in inches. Nozzles with tapered bores are sized at their upstream (intake) ends.

Cell A16 labels the value in A17 as the duration in seconds that the sampler spends traversing each segment of the vertical. In depth integration, a sampler spends part of the duration moving downward through a segment and the remaining interval moving upward through the same segment. Duration is one factor used to determine the amount of water and sediment collected.

Computed Values

Computed values span columns B through O. Identifying labels and commonly used symbols are at the head of each column. Cells B2 through B22 divide the vertical into twenty segments starting with zero at the water surface and incrementing in 0.05 steps to reach a value of 1.0 at the bottom. At the cost of greater complexity, slightly improved accuracy may be achieved by using more than twenty segments.

Cell C2 contains the expression "=1-B2" which is then pasted into cells C3 through C22. The resulting data facilitates computing concentrations and velocities by re-labeling the segment boundaries. In column C, the water surface corresponds to 1.0 and the stream bottom to zero.

Cell D2 contains the expression "=$A$13*(1 + 9.5 *($A$9/$A$11^0.16666)*(1 + LN (C2))) which is then pasted into cells D3 through D21. These cells fill with data on stream velocity computed from the equation (FISP Report 3, 1941)

$V = V_m[1 + (9.5n/D^{1/6})(1 + \log_e h)]$ ……(1)

where

V= stream velocity at h,

V_m = mean velocity in the vertical,

n = Manning roughness coefficient

D = stream depth at the sampling vertical and

h = ratio of distance to a point above the streambed to the total depth of the stream.

Equation 1 has the deficiency of yielding negative velocities *near* the streambed and an indeterminate velocity *at* the bed. Overriding the equation by manually inserting a value of zero in cell D22 solves the problem.

Column E shows average velocities within the segments. Stream velocity varies from point-to-point along the vertical but within each segment, velocity is taken as the average of velocities at the top and bottom of the segment. The expression "=(D2 + D3)/2" is entered in E3 and then

pasted into E4 through E22. Cell E2 is empty because the average velocity for the top segment occupies cell E3. The average for the bottom segment is in E22.

Column F shows water volumes collected within the segments by the ideal sampler. The expression "= 154.5 * (E3) * ($A$15 ^ 2) * ($A$17)" is entered in F3 and then pasted into cells F4 through F22. This expression is the product of (a) a constant which yields volumes in milliliters, (b) the average velocity in the segment, (c) a factor proportional to the nozzle bore area, and (d) the sampling interval. The mix of English units for velocities and metric units for sample volumes matches traditional units used by FISP in calibrating suspended-sediment samplers.

Cell E24 labels F24 as the sum of water volumes collected by the ideal sampler through the entire vertical. Cell F24 contains the expression "=SUM (F3: F23)."

Column G shows sediment concentrations at the segment boundaries. The expression "=$A$5 * (2.7183 ^ (((-0.1376/($A$9 * $A$13)) * (C2) * ($A$7) * ($A$11 ^ 0.16666))))" is entered in G2 and then pasted into G3 through G22. This expression is a translation of the equation (FISP, report 3, 1941)

$N = N_o e^{-16tz}$ ……(2)

where

$t= (0.0086cD^{1/6})/(nV_m)$……..(3).

In these equations,

N = sediment concentration at relative elevation h as defined in equation 1,

N_o = sediment concentration at the streambed,

c = fall velocity in cm/s of the particle-size class,

Vm = mean velocity in the vertical,

n = Manning's roughness coefficient and

D = stream depth at the vertical.

Another equation expressing sediment concentrations along a sampling vertical is (ASCE, 1975),

$Cy/Ca = [(D-y)/y] [(a/(D-a)]^z$……(4)

where

Cy = concentration of a particle-size class at distance y above the streambed,

Ca = concentration of the particle size class at elevation "a" above the streambed,

D= stream depth at the vertical and

z = a constant with values discussed in the Sedimentation Engineering Manual (ASCE, 1975).

Column H shows data on average concentrations within the segments. Concentration varies from point-to-point along the vertical; however, within each segment, concentration is taken as the average of values at the segment extremities. The expression "=(G2 + G3)/2" is entered into H3 and then pasted into cells H3 through H22. As in column F, the record of averages is displaced downward one row so that the average for the top segment lies in H3.

Column I contains the mass of sediment collected by the ideal sampler. The expression "= 0.001 * H3 * F3" is entered in I3 and then pasted into I4 through I22. The sediment mass is the

average concentration in a segment multiplied by the water volume collected in the segment. The factor 0.001 converts sediment mass to milligrams.

Cell H24 labels I24 as the total sediment mass collected by the ideal sampler as it traverses the entire vertical. Cell I24 contains the expression " = SUM (I3: I22)."

Column J shows test-sampler intake velocities as indicated in figure 1. For the spreadsheet, the equations in table 1 are used. Because the spreadsheet applies to sampler RgdConLo, the expression "= 1.5 + (0.5)*E3" is inserted into J3 and pasted into J4 through J22.

Column K shows water volumes collected by the test sampler RgdConLo. The expression " = 154.5 * (J3) * ($A$15 ^ 2) * ($A$17)" is entered into K3 and pasted into K4 through K22. The volume is the product of four factors: (a) a constant which converts water volumes to milliliters, (b) the sampler's intake velocity, (c) a constant proportional to the area of the nozzle bore and (d) the sampling duration.

Column L shows relative sampling rates for sampler RgdConLo. The expression "=J3/E3" is entered in L3 and then pasted into L4 through L22.

Column M shows percent errors in concentrations collected by sampler RgdConLo.
The expression in cell M3 is " = IF (L3 <=1, 1305.9*L3^4 - 3803.6*L3^3 + 4125.3*L3^2 - 2033.7*L3 + 406.58, 0.434*L3^4 - 5.8939*L3^3 + 29.836*L3^2 - 70.621*L3 + 45.728). If the value in cell L3 is equal to or less than 1.0, the expression left of the second comma applies. If, L3 is greater than 1.0, the expression right of the comma applies.

Column N shows concentrations of samples collected by the test sampler RgdConLo. The expression "= H3 * ((M3/100) +1)" is entered in N3 and then pasted into N4 through N22. These data are computed from the defining equation

$$\%E = [(M-T)/T]\ 100 \quad \text{.....(5)}$$

where
%E = percent error,
M = a measured value and
T = the true value.

Column O shows the mass of sediment collected by RgdConLo. The expression "= 0.001 * N3 *K3" is entered in cell O3 and then pasted into cells O4 through O22. Sediment mass is the product of three factors: (a) the constant which converts mass to milligrams, (b) sample concentration and (c) sample volume.

Cell N24 identifies cell O24 as the total mass of sediment collected through the entire vertical by the test sampler RgdConLo. The expression " = SUM (O3: O22)" is entered in cell O24.

Cell F26 is the concentration for the entire vertical as gauged by the Ideal Sampler. The cell expression "= (I24/F24) * 1000" is sediment mass divided by sample volume both being collected by the ideal sampler. The constant of 1000 converts the concentration to mg/L.

Cell K26 is the concentration for the entire vertical as gauged by the test sampler RgdConLo. The cell contains the expression "= (O24/K24) * 1000" which translates to sediment mass divided by water volume both being collected by the test sampler. The constant of 1000 converts the concentration to mg/L.

APPENDIX B

Basic Data Spreadsheets

This index classifies spreadsheets included in this appendix and used in analyzing the test samplers

Page No.	Test Samplers				Grain Size, mm				Flow		
	RgdConLo	BagHi	RgdConHi	BagLo	0.45	0.15	0.06	0.01	High	Medium	Low
B2	X				X				X		
B3	X					X			X		
B4	X						X		X		
B5	X							X	X		
B6		X			X				X		
B7		X				X			X		
B8		X					X		X		
B9		X						X	X		
B10			X		X				X		
B11			X			X			X		
B12			X				X		X		
B13			X					X	X		
B14				X	X				X		
B15				X		X			X		
B16				X			X		X		
B17				X				X	X		
B18	X				X					X	
B19	X					X				X	
B20	X						X			X	
B21	X							X		X	
B22		X			X					X	
B23		X				X				X	
B24		X					X			X	
B25		X						X		X	
B26			X		X					X	
B27			X			X				X	
B28			X				X			X	
B29			X					X		X	
B30				X	X					X	
B31				X		X				X	
B32				X			X			X	
B33				X				X		X	
B34	X				X						X
B35	X					X					X
B36	X						X				X
B37	X							X			X
B38		X			X						X
B39		X				X					X
B40		X					X				X
B41		X						X			X
B42			X		X						X
B43			X			X					X
B44			X				X				X
B45			X					X			X
B46				X	X						X
B47				X		X					X
B48				X			X				X
B49				X				X			X

ASSIGNED CONSTANTS	f, Fractional depth at sampling vertical (0 is surface, 1 is bottom)	Relative height of segment boundaries above stream bed	Stream velocity at segment boundaries, ft/s.	A, Average velocity in segment. Also ideal sampler average intake velocity, ft/s	Q, For ideal sampler, volume of sample collected in interval, ml	Sediment concentration at segment boundary, mg/L	Average concentration in segment. Also for ideal sampler, concentration of sample in segment, mg/L	For ideal sampler, mass of sediment collected in segment, mg	Intake Velocity of test sampler (TS), ft/s	Volume of sample collected in interval by TS, ml	Relative sampling rate for TS	Sediment concentration error for TS, percent	Concentration of sample collected in segment by TS, mg/L	Mass of sediment collected in segment by TS, mg
Sampler RgdConLo, Insert intake characteristic equation in column J.	0	1	7.55			1.67								
	0.05	0.95	7.47	7.51	72.55	2.30	1.98	0.14	5.26	50.76	0.70	13.32	2.25	0.11
No, Sediment Concentration at Stream Bottom, mg/L	0.1	0.9	7.39	7.43	71.76	3.16	2.73	0.20	5.22	50.37	0.70	13.19	3.09	0.16
1000	0.15	0.85	7.30	7.35	70.93	4.36	3.76	0.27	5.17	49.95	0.70	13.05	4.25	0.21
c, Fall Velocity of particles, cm/s.	0.2	0.8	7.21	7.25	70.04	6.00	5.18	0.36	5.13	49.51	0.71	12.90	5.84	0.29
7.6	0.25	0.75	7.11	7.16	69.11	8.26	7.13	0.49	5.08	49.04	0.71	12.74	8.03	0.39
n, Manning roughness coefficient	0.3	0.7	7.00	7.05	68.10	11.37	9.81	0.67	5.03	48.54	0.71	12.56	11.04	0.54
0.04	0.35	0.65	6.88	6.94	67.03	15.65	13.51	0.91	4.97	48.00	0.72	12.36	15.18	0.73
D, Stream depth at sampling vertical, ft.	0.4	0.6	6.76	6.82	65.88	21.55	18.60	1.23	4.91	47.42	0.72	12.14	20.86	0.99
10	0.45	0.55	6.62	6.69	64.62	29.67	25.61	1.65	4.85	46.80	0.72	11.89	28.65	1.34
Vm, mean velocity in vertical, ft/s	0.5	0.5	6.48	6.55	63.26	40.85	35.26	2.23	4.78	46.11	0.73	11.60	39.35	1.81
6	0.55	0.45	6.31	6.39	61.75	56.25	48.55	3.00	4.70	45.36	0.73	11.27	54.02	2.45
d, sampler nozzle diameter, in.	0.6	0.4	6.13	6.22	60.08	77.44	66.84	4.02	4.61	44.52	0.74	10.87	74.11	3.30
0.25	0.65	0.35	5.92	6.03	58.19	106.62	92.03	5.36	4.51	43.58	0.75	10.40	101.61	4.43
T, sampling time in each segment, s.	0.7	0.3	5.68	5.80	56.03	146.80	126.71	7.10	4.40	42.50	0.76	9.82	139.15	5.91
1	0.75	0.25	5.40	5.54	53.51	202.12	174.46	9.34	4.27	41.24	0.77	9.07	190.29	7.85
	0.8	0.2	5.05	5.23	50.47	278.28	240.20	12.12	4.11	39.72	0.79	8.07	259.58	10.31
	0.85	0.15	4.61	4.83	46.64	383.14	330.71	15.42	3.91	37.80	0.81	6.62	352.59	13.33
	0.9	0.1	3.98	4.29	41.44	527.52	455.33	18.87	3.65	35.20	0.85	4.29	474.88	16.72
	0.95	0.05	2.90	3.44	33.20	726.31	626.92	20.81	3.22	31.08	0.94	0.47	629.89	19.58
	1	0	0	1.45	14.00	1000.00	863.15	12.09	2.22	21.48	1.53	-11.28	765.83	16.45
				Total volume collected by ideal sampler, ml ====>	1158.60		Total sediment mass collected by ideal sampler, mg ====>	116.27	Total volume collected by test sampler, ml ====>	868.99			Total sediment mass collected by test sampler, mg ====>	106.91
			Concentration of sample collected by ideal sample, rmg/L		100.35			Concentration of sample collected by test sampler, mg/L		123.02				

Spreadsheet for RgdConLo sampler, 0.45-mm sediment and high flow

ASSIGNED CONSTANTS	f, Fractional depth at sampling vertical (0 Is surface, 1 is bottom)	Relative height of segment boundaries above stream bed	Stream velocity at segment boundaries, ft/s.	A, Average velocity in segment. Also ideal sampler average intake velocity, ft/s	Q, For ideal sampler, volume of sample collected in interval, ml	Sediment concentration at segment boundary, mg/L	Average concentration in segment. Also for ideal sampler, concentration of sample in segment, mg/L	For ideal sampler, mass of sediment collected in segment, mg	Intake Velocity of test sampler (TS), ft/s	Volume of sample collected in interval by TS, ml	Relative sampling rate for TS	Sediment concentration error for TS, percent	Concentration of sample collected in segment by TS, mg/L	Mass of sediment collected in segment by TS, mg
Sampler RgdConLo, Insert intake characteristic equation in column J.	0	1	7.55			185.80								
No, Sediment Concentration at Stream Bottom, mg/L	0.05	0.95	7.47	7.51	72.55	202.12	193.96	14.07	5.26	50.76	0.70	9.31	212.01	10.76
1000	0.1	0.9	7.39	7.43	71.76	219.86	210.99	15.14	5.22	50.37	0.70	9.21	230.42	11.61
c, Fall Velocity of particles, cm/s.	0.15	0.85	7.30	7.35	70.93	239.16	229.51	16.28	5.17	49.95	0.70	9.10	250.40	12.51
2	0.2	0.8	7.21	7.25	70.04	260.16	249.66	17.49	5.13	49.51	0.71	8.99	272.10	13.47
n, Manning roughness coefficient	0.25	0.75	7.11	7.16	69.11	283.00	271.58	18.77	5.08	49.04	0.71	8.86	295.65	14.50
0.04	0.3	0.7	7.00	7.05	68.10	307.85	295.43	20.12	5.03	48.54	0.71	8.73	321.21	15.59
D, Stream depth at sampling vertical, ft.	0.35	0.65	6.88	6.94	67.03	334.88	321.36	21.54	4.97	48.00	0.72	8.58	348.93	16.75
10	0.4	0.6	6.76	6.82	65.88	364.28	349.58	23.03	4.91	47.42	0.72	8.41	378.98	17.97
Vm, mean velocity in vertical, ft/s	0.45	0.55	6.62	6.69	64.62	396.26	380.27	24.57	4.85	46.80	0.72	8.22	411.55	19.26
6	0.5	0.5	6.48	6.55	63.26	431.05	413.66	26.17	4.78	46.11	0.73	8.02	446.81	20.60
d, sampler nozzle diameter, in.	0.55	0.45	6.31	6.39	61.75	468.89	449.97	27.79	4.70	45.36	0.73	7.78	484.96	22.00
0.25	0.6	0.4	6.13	6.22	60.08	510.06	489.48	29.41	4.61	44.52	0.74	7.50	526.17	23.43
T, sampling time in each segment, s.	0.65	0.35	5.92	6.03	58.19	554.84	532.45	30.98	4.51	43.58	0.75	7.17	570.62	24.87
1	0.7	0.3	5.68	5.80	56.03	603.55	579.20	32.45	4.40	42.50	0.76	6.77	618.40	26.28
	0.75	0.25	5.40	5.54	53.51	656.54	630.05	33.71	4.27	41.24	0.77	6.27	669.55	27.61
	0.8	0.2	5.05	5.23	50.47	714.19	685.36	34.59	4.11	39.72	0.79	5.62	723.86	28.75
	0.85	0.15	4.61	4.83	46.64	776.89	745.54	34.77	3.91	37.80	0.81	4.71	780.62	29.51
	0.9	0.1	3.98	4.29	41.44	845.10	810.99	33.61	3.65	35.20	0.85	3.31	837.81	29.49
	0.95	0.05	2.90	3.44	33.20	919.29	882.19	29.29	3.22	31.08	0.94	0.91	890.23	27.67
	1	0	0	1.45	14.00	1000.00	959.65	13.44	2.22	21.48	1.53	-8.33	879.74	18.90
				Total volume collected by ideal sampler, ml ===>	1158.60		Total sediment mass collected by ideal sampler, mg =====>	497.22	Total volume collected by test sampler, ml ===>	868.99			Total sediment mass collected by test sampler, mg ===>	411.53
			Concentration of sample collected by ideal sample, rmg/L		429.15			Concentration of sample collected by test sampler, mg/L		473.58				

Spreadsheet for RgdConLo sampler, 0.15-mm sediment and high flow

ASSIGNED CONSTANTS	f, Fractional depth at sampling vertical (0 is surface, 1 is bottom)	Relative height of segment boundaries above stream bed	Stream velocity at segment boundaries, ft/s.	A, Average velocity in segment. Also ideal sampler average intake velocity, ft/s	Q, For ideal sampler, volume of sample collected in interval, ml	Sediment concentration at segment boundary, mg/L	Average concentration in segment. Also for ideal sampler, concentration of sample in segment, mg/L	For ideal sampler, mass of sediment collected in segment, mg	Intake Velocity of test sampler (TS), ft/s	Volume of sample collected in interval by TS, ml	Relative sampling rate for TS	Sediment concentration error for TS, percent	Concentration of sample collected in segment by TS, mg/L	Mass of sediment collected in segment by TS, mg
Sampler RgdConLo, Insert intake characteristic equation in column J.	0	1	7.55			603.55								
No, Sediment Concentration at Stream Bottom, mg/L	0.05	0.95	7.47	7.51	72.55	618.99	611.27	44.35	5.26	50.76	0.70	1.51	620.52	31.50
1000	0.1	0.9	7.39	7.43	71.76	634.81	626.90	44.99	5.22	50.37	0.70	1.50	636.31	32.05
c, Fall Velocity of particles, cm/s.	0.15	0.85	7.30	7.35	70.93	651.04	642.93	45.60	5.17	49.95	0.70	1.49	652.50	32.59
0.6	0.2	0.8	7.21	7.25	70.04	667.69	659.36	46.19	5.13	49.51	0.71	1.48	669.10	33.12
n, Manning roughness coefficient	0.25	0.75	7.11	7.16	69.11	684.76	676.22	46.73	5.08	49.04	0.71	1.46	686.11	33.65
0.04	0.3	0.7	7.00	7.05	68.10	702.27	693.51	47.23	5.03	48.54	0.71	1.45	703.54	34.15
D, Stream depth at sampling vertical, ft.	0.35	0.65	6.88	6.94	67.03	720.22	711.24	47.68	4.97	48.00	0.72	1.43	721.40	34.63
10	0.4	0.6	6.76	6.82	65.88	738.64	729.43	48.05	4.91	47.42	0.72	1.41	739.70	35.08
Vm, mean velocity in vertical, ft/s	0.45	0.55	6.62	6.69	64.62	757.52	748.08	48.34	4.85	46.80	0.72	1.39	758.45	35.49
6	0.5	0.5	6.48	6.55	63.26	776.89	767.20	48.53	4.78	46.11	0.73	1.36	777.65	35.86
d, sampler nozzle diameter, in.	0.55	0.45	6.31	6.39	61.75	796.75	786.82	48.59	4.70	45.36	0.73	1.33	797.30	36.17
0.25	0.6	0.4	6.13	6.22	60.08	817.12	806.94	48.48	4.61	44.52	0.74	1.30	817.41	36.39
T, sampling time in each segment, s.	0.65	0.35	5.92	6.03	58.19	838.01	827.57	48.16	4.51	43.58	0.75	1.26	837.96	36.52
1	0.7	0.3	5.68	5.80	56.03	859.44	848.73	47.56	4.40	42.50	0.76	1.20	858.95	36.51
	0.75	0.25	5.40	5.54	53.51	881.41	870.43	46.58	4.27	41.24	0.77	1.14	880.34	36.30
	0.8	0.2	5.05	5.23	50.47	903.95	892.68	45.05	4.11	39.72	0.79	1.05	902.05	35.83
	0.85	0.15	4.61	4.83	46.64	927.06	915.50	42.70	3.91	37.80	0.81	0.92	923.92	34.93
	0.9	0.1	3.98	4.29	41.44	950.76	938.91	38.91	3.65	35.20	0.85	0.70	945.49	33.29
	0.95	0.05	2.90	3.44	33.20	975.07	962.92	31.97	3.22	31.08	0.94	0.24	965.24	30.00
	1	0	0	1.45	14.00	1000.00	987.54	13.83	2.22	21.48	1.53	-1.35	974.21	20.93
				Total volume collected by ideal sampler, ml ===>	1158.60		Total sediment mass collected by ideal sampler, mg ====>	879.50	Total volume collected by test sampler, ml ===>	868.99			Total sediment mass collected by test sampler, mg ===>	674.98
			Concentration of sample collected by ideal sample, rmg/L		759.11			Concentration of sample collected by test sampler, mg/L		776.74				

Spreadsheet for RgdConLo sampler, 0.06-mm sediment and high flow

ASSIGNED CONSTANTS	f, Fractional depth at sampling vertical (0 is surface, 1 is bottom)	Relative height of segment boundaries above stream bed	Stream velocity at segment boundaries, ft/s.	A, Average velocity in segment. Also ideal sampler average intake velocity, ft/s	Q, For ideal sampler, volume of sample collected in interval, ml	Sediment concentration at segment boundary, mg/L	Average concentration in segment. Also for ideal sampler, concentration of sample in segment, mg/L	For ideal sampler, mass of sediment collected in segment, mg	Intake Velocity of test sampler (TS), ft/s	Volume of sample collected in interval by TS, ml	Relative sampling rate for TS	Sediment concentration error for TS, percent	Concentration of sample collected in segment by TS, mg/L	Mass of sediment collected in segment by TS, m
Sampler RgdConLo, Insert intake characteristic equation in column J.	0	1	7.55			975.07								
	0.05	0.95	7.47	7.51	72.55	976.30	975.69	70.79	5.26	50.76	0.70	1.11	986.48	50.07
No, Sediment Concentration at Stream Bottom, mg/L	0.1	0.9	7.39	7.43	71.76	977.53	976.92	70.11	5.22	50.37	0.70	1.10	987.64	49.74
1000	0.15	0.85	7.30	7.35	70.93	978.77	978.15	69.38	5.17	49.95	0.70	1.09	988.80	49.39
c, Fall Velocity of particles, cm/s.	0.2	0.8	7.21	7.25	70.04	980.01	979.39	68.60	5.13	49.51	0.71	1.08	989.96	49.01
0.03	0.25	0.75	7.11	7.16	69.11	981.24	980.62	67.77	5.08	49.04	0.71	1.07	991.10	48.60
n, Manning roughness coefficient	0.3	0.7	7.00	7.05	68.10	982.48	981.86	66.87	5.03	48.54	0.71	1.06	992.24	48.16
0.04	0.35	0.65	6.88	6.94	67.03	983.72	983.10	65.90	4.97	48.00	0.72	1.04	993.37	47.68
D, Stream depth at sampling vertical, ft.	0.4	0.6	6.76	6.82	65.88	984.97	984.35	64.84	4.91	47.42	0.72	1.03	994.48	47.16
10	0.45	0.55	6.62	6.69	64.62	986.21	985.59	63.69	4.85	46.80	0.72	1.01	995.58	46.59
Vm, mean velocity in vertical, ft/s	0.5	0.5	6.48	6.55	63.26	987.46	986.83	62.42	4.78	46.11	0.73	1.00	996.66	45.96
6	0.55	0.45	6.31	6.39	61.75	988.70	988.08	61.01	4.70	45.36	0.73	0.97	997.71	45.26
d, sampler nozzle diameter, in.	0.6	0.4	6.13	6.22	60.08	989.95	989.33	59.44	4.61	44.52	0.74	0.95	998.73	44.47
0.25	0.65	0.35	5.92	6.03	58.19	991.20	990.58	57.64	4.51	43.58	0.75	0.92	999.70	43.57
T, sampling time in each segment, s.	0.7	0.3	5.68	5.80	56.03	992.45	991.83	55.58	4.40	42.50	0.76	0.89	1000.61	42.53
1	0.75	0.25	5.40	5.54	53.51	993.71	993.08	53.14	4.27	41.24	0.77	0.84	1001.42	41.30
	0.8	0.2	5.05	5.23	50.47	994.96	994.34	50.18	4.11	39.72	0.79	0.78	1002.08	39.80
	0.85	0.15	4.61	4.83	46.64	996.22	995.59	46.43	3.91	37.80	0.81	0.69	1002.46	37.90
	0.9	0.1	3.98	4.29	41.44	997.48	996.85	41.31	3.65	35.20	0.85	0.54	1002.27	35.28
	0.95	0.05	2.90	3.44	33.20	998.74	998.11	33.14	3.22	31.08	0.94	0.22	1000.30	31.09
	1	0	0	1.45	14.00	1000.00	999.37	13.99	2.22	21.48	1.53	0.00	999.37	21.47
				Total volume collected by ideal sampler, ml ===>	1158.60		Total sediment mass collected by ideal sampler, mg ====>	1142.23	Total volume collected by test sampler, ml ===>	868.99			Total sediment mass collected by test sampler, mg ===>	865.03
			Concentration of sample collected by ideal sample, rmg/L		985.88			Concentration of sample collected by test sampler, mg/L		995.45				

Spreadsheet for RgdConLo sampler, 0.01-mm sediment and high flow

ASSIGNED CONSTANTS	f, Fractional depth at sampling vertical (0 is surface, 1 is bottom)	Relative height of segment boundaries above stream bed	Stream velocity at segment boundaries, ft/s.	A, Average velocity in segment. Also ideal sampler average intake velocity, ft/s	Q, For ideal sampler, volume of sample collected in interval, ml	Sediment concentration at segment boundary, mg/L	Average concentration in segment. Also for ideal sampler, concentration of sample in segment, mg/L	For ideal sampler, mass of sediment collected in segment, mg	Intake Velocity of test sampler (TS), ft/s	Volume of sample collected in interval by TS, ml	Relative sampling rate for TS	Sediment concentration error for TS, percent	Concentration of sample collected in segment by TS, mg/L	Mass of sediment collected in segment by TS, mg
Sampler BagHi, Insert intake characteristic equation in column J.	0	1	7.55			1.67								
	0.05	0.95	7.47	7.51	72.55	2.30	1.98	0.14	12.03	116.14	1.60	-12.19	1.74	0.20
No, Sediment Concentration at Stream Bottom, mg/L	0.1	0.9	7.39	7.43	71.76	3.16	2.73	0.20	11.86	114.56	1.60	-12.13	2.40	0.27
1000	0.15	0.85	7.30	7.35	70.93	4.36	3.76	0.27	11.69	112.89	1.59	-12.07	3.31	0.37
c, Fall Velocity of particles, cm/s.	0.2	0.8	7.21	7.25	70.04	6.00	5.18	0.36	11.51	111.12	1.59	-12.00	4.56	0.51
7.6	0.25	0.75	7.11	7.16	69.11	8.26	7.13	0.49	11.31	109.24	1.58	-11.92	6.28	0.69
n, Manning roughness coefficient	0.3	0.7	7.00	7.05	68.10	11.37	9.81	0.67	11.11	107.24	1.57	-11.84	8.65	0.93
0.04	0.35	0.65	6.88	6.94	67.03	15.65	13.51	0.91	10.88	105.09	1.57	-11.75	11.92	1.25
D, Stream depth at sampling vertical, ft.	0.4	0.6	6.76	6.82	65.88	21.55	18.60	1.23	10.64	102.78	1.56	-11.64	16.44	1.69
10	0.45	0.55	6.62	6.69	64.62	29.67	25.61	1.65	10.38	100.28	1.55	-11.52	22.66	2.27
Vm, mean velocity in vertical, ft/s	0.5	0.5	6.48	6.55	63.26	40.85	35.26	2.23	10.10	97.54	1.54	-11.38	31.25	3.05
6	0.55	0.45	6.31	6.39	61.75	56.25	48.55	3.00	9.79	94.53	1.53	-11.22	43.10	4.07
d, sampler nozzle diameter, in.	0.6	0.4	6.13	6.22	60.08	77.44	66.84	4.02	9.44	91.18	1.52	-11.03	59.47	5.42
0.25	0.65	0.35	5.92	6.03	58.19	106.62	92.03	5.36	9.05	87.41	1.50	-10.80	82.09	7.18
T, sampling time in each segment, s.	0.7	0.3	5.68	5.80	56.03	146.80	126.71	7.10	8.61	83.10	1.48	-10.51	113.39	9.42
1	0.75	0.25	5.40	5.54	53.51	202.12	174.46	9.34	8.08	78.05	1.46	-10.13	156.79	12.24
	0.8	0.2	5.05	5.23	50.47	278.28	240.20	12.12	7.45	71.97	1.43	-9.60	217.13	15.63
	0.85	0.15	4.61	4.83	46.64	383.14	330.71	15.42	6.66	64.31	1.38	-8.81	301.59	19.39
	0.9	0.1	3.98	4.29	41.44	527.52	455.33	18.87	5.58	53.91	1.30	-7.38	421.71	22.74
	0.95	0.05	2.90	3.44	33.20	726.31	626.92	20.81	3.88	37.43	1.13	-3.71	603.63	22.60
	1	0	0	1.45	14.00	1000.00	863.15	12.09	0.00	0.00	0.00	406.58	4372.56	0.00
				Total volume collected by ideal sampler, ml ===>	1158.60		Total sediment mass collected by ideal sampler, mg ====>	116.27	Total volume collected by test sampler, ml ===>	1738.78			Total sediment mass collected by test sampler, mg ===>	129.92
			Concentration of sample collected by ideal sample, rmg/L		100.35			Concentration of sample collected by test sampler, mg/L		74.72				

Spreadsheet for BagHi sampler, 0.45-mm sediment and high flow

ASSIGNED CONSTANTS	f, Fractional depth at sampling vertical (0 is surface, 1 is bottom)	Relative height of segment boundaries above stream bed	Stream velocity at segment boundaries, ft/s.	A, Average velocity in segment. Also ideal sampler average intake velocity, ft/s	Q, For ideal sampler, volume of sample collected in interval, ml	Sediment concentration at segment boundary, mg/L	Average concentration in segment. Also for ideal sampler, concentration of sample in segment, mg/L	For ideal sampler, mass of sediment collected in segment, mg	Intake Velocity of test sampler (TS), ft/s	Volume of sample collected in interval by TS, ml	Relative sampling rate for TS	Sediment concentration error for TS, percent	Concentration of sample collected in segment by TS, mg/L	Mass of sediment collected in segment by TS, mg
Sampler BagHi, Insert intake characteristic equation in column J.	0	1	7.55			185.80								
	0.05	0.95	7.47	7.51	72.55	202.12	193.96	14.07	12.03	116.14	1.60	-8.90	176.70	20.52
No, Sediment Concentration at Stream Bottom, mg/L	0.1	0.9	7.39	7.43	71.76	219.86	210.99	15.14	11.86	114.56	1.60	-8.86	192.29	22.03
1000	0.15	0.85	7.30	7.35	70.93	239.16	229.51	16.28	11.69	112.89	1.59	-8.82	209.26	23.62
c, Fall Velocity of particles, cm/s.	0.2	0.8	7.21	7.25	70.04	260.16	249.66	17.49	11.51	111.12	1.59	-8.78	227.74	25.31
2	0.25	0.75	7.11	7.16	69.11	283.00	271.58	18.77	11.31	109.24	1.58	-8.73	247.86	27.08
n, Manning roughness coefficient	0.3	0.7	7.00	7.05	68.10	307.85	295.43	20.12	11.11	107.24	1.57	-8.68	269.78	28.93
0.04	0.35	0.65	6.88	6.94	67.03	334.88	321.36	21.54	10.88	105.09	1.57	-8.62	293.65	30.86
D, Stream depth at sampling vertical, ft.	0.4	0.6	6.76	6.82	65.88	364.28	349.58	23.03	10.64	102.78	1.56	-8.56	319.66	32.86
10	0.45	0.55	6.62	6.69	64.62	396.26	380.27	24.57	10.38	100.28	1.55	-8.48	348.01	34.90
Vm, mean velocity in vertical, ft/s	0.5	0.5	6.48	6.55	63.26	431.05	413.66	26.17	10.10	97.54	1.54	-8.40	378.93	36.96
6	0.55	0.45	6.31	6.39	61.75	468.89	449.97	27.79	9.79	94.53	1.53	-8.29	412.66	39.01
d, sampler nozzle diameter, in.	0.6	0.4	6.13	6.22	60.08	510.06	489.48	29.41	9.44	91.18	1.52	-8.17	449.49	40.99
0.25	0.65	0.35	5.92	6.03	58.19	554.84	532.45	30.98	9.05	87.41	1.50	-8.02	489.76	42.81
T, sampling time in each segment, s.	0.7	0.3	5.68	5.80	56.03	603.55	579.20	32.45	8.61	83.10	1.48	-7.83	533.87	44.36
1	0.75	0.25	5.40	5.54	53.51	656.54	630.05	33.71	8.08	78.05	1.46	-7.57	582.34	45.45
	0.8	0.2	5.05	5.23	50.47	714.19	685.36	34.59	7.45	71.97	1.43	-7.21	635.93	45.77
	0.85	0.15	4.61	4.83	46.64	776.89	745.54	34.77	6.66	64.31	1.38	-6.65	695.92	44.75
	0.9	0.1	3.98	4.29	41.44	845.10	810.99	33.61	5.58	53.91	1.30	-5.62	765.41	41.26
	0.95	0.05	2.90	3.44	33.20	919.29	882.19	29.29	3.88	37.43	1.13	-2.76	857.88	32.11
	1	0	0	1.45	14.00	1000.00	959.65	13.44	0.00	0.00	0.00	156.13	2457.94	0.00
				Total volume collected by ideal sampler, ml ===>	1158.60		Total sediment mass collected by ideal sampler, mg ====>	497.22	Total volume collected by test sampler, ml ===>	1738.78			Total sediment mass collected by test sampler, mg ===>	659.58
			Concentration of sample collected by ideal sample, rmg/L		429.15			Concentration of sample collected by test sampler, mg/L		379.34				

Spreadsheet for BagHi sampler, 0.15-mm sediment and high flow

ASSIGNED CONSTANTS	f, Fractional depth at sampling vertical (0 is surface, 1 is bottom)	Relative height of segment boundaries above stream bed	Stream velocity at segment boundaries, ft/s.	A, Average velocity in segment. Also ideal sampler average intake velocity, ft/s	Q, For ideal sampler, volume of sample collected in interval, ml	Sediment concentration at segment boundary, mg/L	Average concentration in segment. Also for ideal sampler, concentration of sample in segment, mg/L	For ideal sampler, mass of sediment collected in segment, mg	Intake Velocity of test sampler (TS), ft/s	Volume of sample collected in interval by TS, ml	Relative sampling rate for TS	Sediment concentration error for TS, percent	Concentration of sample collected in segment by TS, mg/L	Mass of sediment collected in segment by TS, mg
Sampler BagHi, Insert intake characteristic equation in column J.	0	1	7.55			603.55								
	0.05	0.95	7.47	7.51	72.55	618.99	611.27	44.35	12.03	116.14	1.60	-1.46	602.32	69.95
No, Sediment Concentration at Stream Bottom, mg/L	0.1	0.9	7.39	7.43	71.76	634.81	626.90	44.99	11.86	114.56	1.60	-1.46	617.77	70.77
1000	0.15	0.85	7.30	7.35	70.93	651.04	642.93	45.60	11.69	112.89	1.59	-1.45	633.61	71.53
c, Fall Velocity of particles, cm/s.	0.2	0.8	7.21	7.25	70.04	667.69	659.36	46.19	11.51	111.12	1.59	-1.44	649.87	72.21
0.6	0.25	0.75	7.11	7.16	69.11	684.76	676.22	46.73	11.31	109.24	1.58	-1.43	666.55	72.82
n, Manning roughness coefficient	0.3	0.7	7.00	7.05	68.10	702.27	693.51	47.23	11.11	107.24	1.57	-1.42	683.67	73.32
0.04	0.35	0.65	6.88	6.94	67.03	720.22	711.24	47.68	10.88	105.09	1.57	-1.41	701.23	73.69
D, Stream depth at sampling vertical, ft.	0.4	0.6	6.76	6.82	65.88	738.64	729.43	48.05	10.64	102.78	1.56	-1.39	719.25	73.93
10	0.45	0.55	6.62	6.69	64.62	757.52	748.08	48.34	10.38	100.28	1.55	-1.38	737.75	73.98
Vm, mean velocity in vertical, ft/s	0.5	0.5	6.48	6.55	63.26	776.89	767.20	48.53	10.10	97.54	1.54	-1.36	756.75	73.81
6	0.55	0.45	6.31	6.39	61.75	796.75	786.82	48.59	9.79	94.53	1.53	-1.34	776.25	73.38
d, sampler nozzle diameter, in.	0.6	0.4	6.13	6.22	60.08	817.12	806.94	48.48	9.44	91.18	1.52	-1.32	796.29	72.61
0.25	0.65	0.35	5.92	6.03	58.19	838.01	827.57	48.16	9.05	87.41	1.50	-1.29	816.89	71.41
T, sampling time in each segment, s.	0.7	0.3	5.68	5.80	56.03	859.44	848.73	47.56	8.61	83.10	1.48	-1.25	838.08	69.64
1	0.75	0.25	5.40	5.54	53.51	881.41	870.43	46.58	8.08	78.05	1.46	-1.21	859.92	67.12
	0.8	0.2	5.05	5.23	50.47	903.95	892.68	45.05	7.45	71.97	1.43	-1.14	882.48	63.51
	0.85	0.15	4.61	4.83	46.64	927.06	915.50	42.70	6.66	64.31	1.38	-1.04	905.95	58.26
	0.9	0.1	3.98	4.29	41.44	950.76	938.91	38.91	5.58	53.91	1.30	-0.87	930.76	50.18
	0.95	0.05	2.90	3.44	33.20	975.07	962.92	31.97	3.88	37.43	1.13	-0.41	958.93	35.90
	1	0	0	1.45	14.00	1000.00	987.54	13.83	0.00	0.00	0.00	25.84	1242.75	0.00
				Total volume collected by ideal sampler, ml ===>	1158.60		Total sediment mass collected by ideal sampler, mg ====>	879.50	Total volume collected by test sampler, ml ===>	1738.78			Total sediment mass collected by test sampler, mg ===>	1288.02
			Concentration of sample collected by ideal sample, rmg/L		759.11			Concentration of sample collected by test sampler, mg/L		740.76				

Spreadsheet for BagHi sampler, 0.06-mm sediment and high flow

ASSIGNED CONSTANTS	f, Fractional depth at sampling vertical (0 is surface, 1 is bottom)	Relative height of segment boundaries above stream bed	Stream velocity at segment boundaries, ft/s.	A, Average velocity in segment. Also ideal sampler average intake velocity, ft/s	Q, For ideal sampler, volume of sample collected in interval, ml	Sediment concentration at segment boundary, mg/L	Average concentration in segment. Also for ideal sampler, concentration of sample in segment, mg/L	For ideal sampler, mass of sediment collected in segment, mg	Intake Velocity of test sampler (TS), ft/s	Volume of sample collected in interval by TS, ml	Relative sampling rate for TS	Sediment concentration error for TS, percent	Concentration of sample collected in segment by TS, mg/L	Mass of sediment collected in segment by TS, mg
Sampler BagHi, Insert intake characteristic equation in column J.	0	1	7.55			975.07								
	0.05	0.95	7.47	7.51	72.55	976.30	975.69	70.79	12.03	116.14	1.60	0.00	975.69	113.31
No, Sediment Concentration at Stream Bottom, mg/L	0.1	0.9	7.39	7.43	71.76	977.53	976.92	70.11	11.86	114.56	1.60	0.00	976.92	111.91
1000	0.15	0.85	7.30	7.35	70.93	978.77	978.15	69.38	11.69	112.89	1.59	0.00	978.15	110.42
c, Fall Velocity of particles, cm/s.	0.2	0.8	7.21	7.25	70.04	980.01	979.39	68.60	11.51	111.12	1.59	0.00	979.39	108.83
0.03	0.25	0.75	7.11	7.16	69.11	981.24	980.62	67.77	11.31	109.24	1.58	0.00	980.62	107.13
n, Manning roughness coefficient	0.3	0.7	7.00	7.05	68.10	982.48	981.86	66.87	11.11	107.24	1.57	0.00	981.86	105.30
0.04	0.35	0.65	6.88	6.94	67.03	983.72	983.10	65.90	10.88	105.09	1.57	0.00	983.10	103.32
D, Stream depth at sampling vertical, ft.	0.4	0.6	6.76	6.82	65.88	984.97	984.35	64.84	10.64	102.78	1.56	0.00	984.35	101.17
10	0.45	0.55	6.62	6.69	64.62	986.21	985.59	63.69	10.38	100.28	1.55	0.00	985.59	98.83
Vm, mean velocity in vertical, ft/s	0.5	0.5	6.48	6.55	63.26	987.46	986.83	62.42	10.10	97.54	1.54	0.00	986.83	96.26
6	0.55	0.45	6.31	6.39	61.75	988.70	988.08	61.01	9.79	94.53	1.53	0.00	988.08	93.40
d, sampler nozzle diameter, in.	0.6	0.4	6.13	6.22	60.08	989.95	989.33	59.44	9.44	91.18	1.52	0.00	989.33	90.21
0.25	0.65	0.35	5.92	6.03	58.19	991.20	990.58	57.64	9.05	87.41	1.50	0.00	990.58	86.59
T, sampling time in each segment, s.	0.7	0.3	5.68	5.80	56.03	992.45	991.83	55.58	8.61	83.10	1.48	0.00	991.83	82.42
1	0.75	0.25	5.40	5.54	53.51	993.71	993.08	53.14	8.08	78.05	1.46	0.00	993.08	77.51
	0.8	0.2	5.05	5.23	50.47	994.96	994.34	50.18	7.45	71.97	1.43	0.00	994.34	71.56
	0.85	0.15	4.61	4.83	46.64	996.22	995.59	46.43	6.66	64.31	1.38	0.00	995.59	64.02
	0.9	0.1	3.98	4.29	41.44	997.48	996.85	41.31	5.58	53.91	1.30	0.00	996.85	53.74
	0.95	0.05	2.90	3.44	33.20	998.74	998.11	33.14	3.88	37.43	1.13	0.00	998.11	37.36
	1	0	0	1.45	14.00	1000.00	999.37	13.99	0.00	0.00	0.00	3.73	1036.62	0.00
				Total volume collected by ideal sampler, ml ===>	1158.60		Total sediment mass collected by ideal sampler, mg ====>	1142.23	Total volume collected by test sampler, ml ===>	1738.78			Total sediment mass collected by test sampler, mg ===>	1713.31
			Concentration of sample collected by ideal sample, rmg/L		985.88			Concentration of sample collected by test sampler, mg/L		985.35				

Spreadsheet for BagHi sampler, 0.01-mm sediment and high flow

ASSIGNED CONSTANTS	f, Fractional depth at sampling vertical (0 is surface, 1 is bottom)	Relative height of segment boundaries above stream bed	Stream velocity at segment boundaries, ft/s.	A, Average velocity in segment. Also ideal sampler average intake velocity, ft/s	Q, For ideal sampler, volume of sample collected in interval, ml	Sediment concentration at segment boundary, mg/L	Average concentration in segment. Also for ideal sampler, concentration of sample in segment, mg/L	For ideal sampler, mass of sediment collected in segment, mg	Intake Velocity of test sampler (TS), ft/s	Volume of sample collected in interval by TS, ml	Relative sampling rate for TS	Sediment concentration error for TS, percent	Concentration of sample collected in segment by TS, mg/L	Mass of sediment collected in segment by TS, mg
Sampler RgdConHi, Insert intake characteristic equation in column J.	0	1	7.55			1.67								
No, Sediment Concentration at Stream Bottom, mg/L	0.05	0.95	7.47	7.51	72.55	2.30	1.98	0.14	9.01	87.04	1.20	-5.33	1.88	0.16
1000	0.1	0.9	7.39	7.43	71.76	3.16	2.73	0.20	8.93	86.25	1.20	-5.38	2.58	0.22
c, Fall Velocity of particles, cm/s.	0.15	0.85	7.30	7.35	70.93	4.36	3.76	0.27	8.85	85.41	1.20	-5.43	3.56	0.30
7.6	0.2	0.8	7.21	7.25	70.04	6.00	5.18	0.36	8.75	84.53	1.21	-5.48	4.89	0.41
n, Manning roughness coefficient	0.25	0.75	7.11	7.16	69.11	8.26	7.13	0.49	8.66	83.59	1.21	-5.54	6.73	0.56
0.04	0.3	0.7	7.00	7.05	68.10	11.37	9.81	0.67	8.55	82.59	1.21	-5.61	9.26	0.76
D, Stream depth at sampling vertical, ft.	0.35	0.65	6.88	6.94	67.03	15.65	13.51	0.91	8.44	81.52	1.22	-5.68	12.74	1.04
10	0.4	0.6	6.76	6.82	65.88	21.55	18.60	1.23	8.32	80.36	1.22	-5.76	17.53	1.41
Vm, mean velocity in vertical, ft/s	0.45	0.55	6.62	6.69	64.62	29.67	25.61	1.65	8.19	79.11	1.22	-5.85	24.11	1.91
6	0.5	0.5	6.48	6.55	63.26	40.85	35.26	2.23	8.05	77.74	1.23	-5.95	33.16	2.58
d, sampler nozzle diameter, in.	0.55	0.45	6.31	6.39	61.75	56.25	48.55	3.00	7.89	76.23	1.23	-6.07	45.60	3.48
0.25	0.6	0.4	6.13	6.22	60.08	77.44	66.84	4.02	7.72	74.56	1.24	-6.20	62.70	4.67
T, sampling time in each segment, s.	0.65	0.35	5.92	6.03	58.19	106.62	92.03	5.36	7.53	72.68	1.25	-6.36	86.18	6.26
1	0.7	0.3	5.68	5.80	56.03	146.80	126.71	7.10	7.30	70.52	1.26	-6.55	118.41	8.35
	0.75	0.25	5.40	5.54	53.51	202.12	174.46	9.34	7.04	67.99	1.27	-6.80	162.60	11.06
	0.8	0.2	5.05	5.23	50.47	278.28	240.20	12.12	6.73	64.95	1.29	-7.12	223.11	14.49
	0.85	0.15	4.61	4.83	46.64	383.14	330.71	15.42	6.33	61.12	1.31	-7.57	305.69	18.68
	0.9	0.1	3.98	4.29	41.44	527.52	455.33	18.87	5.79	55.92	1.35	-8.29	417.61	23.35
	0.95	0.05	2.90	3.44	33.20	726.31	626.92	20.81	4.94	47.68	1.44	-9.77	565.66	26.97
	1	0	0	1.45	14.00	1000.00	863.15	12.09	2.95	28.49	2.03	-16.65	719.42	20.49
				Total volume collected by ideal sampler, ml ===>	1158.60		Total sediment mass collected by ideal sampler, mg ====>	116.27	Total volume collected by test sampler, ml ===>	1448.28			Total sediment mass collected by test sampler, mg ===>	147.18
			Concentration of sample collected by ideal sample, rmg/L		100.35			Concentration of sample collected by test sampler, mg/L		101.63				

Spreadsheet for RgdConHi sampler, 0.45-mm sediment and high flow

ASSIGNED CONSTANTS	f, Fractional depth at sampling vertical (0 is surface, 1 is bottom)	Relative height of segment boundaries above stream bed	Stream velocity at segment boundaries, ft/s.	A, Average velocity in segment. Also ideal sampler average intake velocity, ft/s	Q, For ideal sampler, volume of sample collected in interval, ml	Sediment concentration at segment boundary, mg/L	Average concentration in segment. Also for ideal sampler, concentration of sample in segment, mg/L	For ideal sampler, mass of sediment collected in segment, mg	Intake Velocity of test sampler (TS), ft/s	Volume of sample collected in interval by TS, ml	Relative sampling rate for TS	Sediment concentration error for TS, percent	Concentration of sample collected in segment by TS, mg/L	Mass of sediment collected in segment by TS, mg
Sampler RgdConHi, Insert intake characteristic equation in column J.	0	1	7.55			185.80								
No, Sediment Concentration at Stream Bottom, mg/L	0.05	0.95	7.47	7.51	72.55	202.12	193.96	14.07	9.01	87.04	1.20	-4.05	186.11	16.20
1000	0.1	0.9	7.39	7.43	71.76	219.86	210.99	15.14	8.93	86.25	1.20	-4.09	202.37	17.45
c, Fall Velocity of particles, cm/s.	0.15	0.85	7.30	7.35	70.93	239.16	229.51	16.28	8.85	85.41	1.20	-4.13	220.04	18.79
2	0.2	0.8	7.21	7.25	70.04	260.16	249.66	17.49	8.75	84.53	1.21	-4.17	239.26	20.22
n, Manning roughness coefficient	0.25	0.75	7.11	7.16	69.11	283.00	271.58	18.77	8.66	83.59	1.21	-4.22	260.13	21.74
0.04	0.3	0.7	7.00	7.05	68.10	307.85	295.43	20.12	8.55	82.59	1.21	-4.27	282.82	23.36
D, Stream depth at sampling vertical, ft.	0.35	0.65	6.88	6.94	67.03	334.88	321.36	21.54	8.44	81.52	1.22	-4.32	307.47	25.06
10	0.4	0.6	6.76	6.82	65.88	364.28	349.58	23.03	8.32	80.36	1.22	-4.38	334.25	26.86
Vm, mean velocity in vertical, ft/s	0.45	0.55	6.62	6.69	64.62	396.26	380.27	24.57	8.19	79.11	1.22	-4.45	363.33	28.74
6	0.5	0.5	6.48	6.55	63.26	431.05	413.66	26.17	8.05	77.74	1.23	-4.53	394.91	30.70
d, sampler nozzle diameter, in.	0.55	0.45	6.31	6.39	61.75	468.89	449.97	27.79	7.89	76.23	1.23	-4.62	429.18	32.72
0.25	0.6	0.4	6.13	6.22	60.08	510.06	489.48	29.41	7.72	74.56	1.24	-4.72	466.35	34.77
T, sampling time in each segment, s.	0.65	0.35	5.92	6.03	58.19	554.84	532.45	30.98	7.53	72.68	1.25	-4.85	506.64	36.82
1	0.7	0.3	5.68	5.80	56.03	603.55	579.20	32.45	7.30	70.52	1.26	-4.99	550.27	38.80
	0.75	0.25	5.40	5.54	53.51	656.54	630.05	33.71	7.04	67.99	1.27	-5.18	597.42	40.62
	0.8	0.2	5.05	5.23	50.47	714.19	685.36	34.59	6.73	64.95	1.29	-5.42	648.22	42.10
	0.85	0.15	4.61	4.83	46.64	776.89	745.54	34.77	6.33	61.12	1.31	-5.76	702.62	42.95
	0.9	0.1	3.98	4.29	41.44	845.10	810.99	33.61	5.79	55.92	1.35	-6.28	760.05	42.51
	0.95	0.05	2.90	3.44	33.20	919.29	882.19	29.29	4.94	47.68	1.44	-7.33	817.54	38.98
	1	0	0	1.45	14.00	1000.00	959.65	13.44	2.95	28.49	2.03	-11.18	852.33	24.28
				Total volume collected by ideal sampler, ml ===>	1158.60		Total sediment mass collected by ideal sampler, mg ====>	497.22	Total volume collected by test sampler, ml ===>	1448.28			Total sediment mass collected by test sampler, mg ===>	603.70
			Concentration of sample collected by ideal sample, rmg/L		429.15			Concentration of sample collected by test sampler, mg/L		416.84				

Spreadsheet for RgdConHi sampler, 0.15-mm sediment and high flow

ASSIGNED CONSTANTS	f, Fractional depth at sampling vertical (0 is surface, 1 is bottom)	Relative height of segment boundaries above stream bed	Stream velocity at segment boundaries, ft/s.	A, Average velocity in segment. Also ideal sampler average intake velocity, ft/s	Q, For ideal sampler, volume of sample collected in interval, ml	Sediment concentration at segment boundary, mg/L	Average concentration in segment. Also for ideal sampler, concentration of sample in segment, mg/L	For ideal sampler, mass of sediment collected in segment, mg	Intake Velocity of test sampler (TS), ft/s	Volume of sample collected in interval by TS, ml	Relative sampling rate for TS	Sediment concentration error for TS, percent	Concentration of sample collected in segment by TS, mg/L	Mass of sediment collected in segment by TS, mg
Sampler RgdConHi, Insert intake characteristic equation in column J.	0	1	7.55			603.55								
No, Sediment Concentration at Stream Bottom, mg/L	0.05	0.95	7.47	7.51	72.55	618.99	611.27	44.35	9.01	87.04	1.20	-0.61	607.52	52.88
1000	0.1	0.9	7.39	7.43	71.76	634.81	626.90	44.99	8.93	86.25	1.20	-0.62	623.01	53.73
c, Fall Velocity of particles, cm/s.	0.15	0.85	7.30	7.35	70.93	651.04	642.93	45.60	8.85	85.41	1.20	-0.63	638.90	54.57
0.6	0.2	0.8	7.21	7.25	70.04	667.69	659.36	46.19	8.75	84.53	1.21	-0.63	655.19	55.38
n, Manning roughness coefficient	0.25	0.75	7.11	7.16	69.11	684.76	676.22	46.73	8.66	83.59	1.21	-0.64	671.89	56.16
0.04	0.3	0.7	7.00	7.05	68.10	702.27	693.51	47.23	8.55	82.59	1.21	-0.65	689.01	56.90
D, Stream depth at sampling vertical, ft.	0.35	0.65	6.88	6.94	67.03	720.22	711.24	47.68	8.44	81.52	1.22	-0.66	706.57	57.60
10	0.4	0.6	6.76	6.82	65.88	738.64	729.43	48.05	8.32	80.36	1.22	-0.67	724.56	58.23
Vm, mean velocity in vertical, ft/s	0.45	0.55	6.62	6.69	64.62	757.52	748.08	48.34	8.19	79.11	1.22	-0.68	743.00	58.78
6	0.5	0.5	6.48	6.55	63.26	776.89	767.20	48.53	8.05	77.74	1.23	-0.69	761.90	59.23
d, sampler nozzle diameter, in.	0.55	0.45	6.31	6.39	61.75	796.75	786.82	48.59	7.89	76.23	1.23	-0.71	781.27	59.56
0.25	0.6	0.4	6.13	6.22	60.08	817.12	806.94	48.48	7.72	74.56	1.24	-0.72	801.11	59.73
T, sampling time in each segment, s.	0.65	0.35	5.92	6.03	58.19	838.01	827.57	48.16	7.53	72.68	1.25	-0.74	821.43	59.70
1	0.7	0.3	5.68	5.80	56.03	859.44	848.73	47.56	7.30	70.52	1.26	-0.77	842.23	59.39
	0.75	0.25	5.40	5.54	53.51	881.41	870.43	46.58	7.04	67.99	1.27	-0.80	863.50	58.71
	0.8	0.2	5.05	5.23	50.47	903.95	892.68	45.05	6.73	64.95	1.29	-0.84	885.23	57.50
	0.85	0.15	4.61	4.83	46.64	927.06	915.50	42.70	6.33	61.12	1.31	-0.89	907.35	55.46
	0.9	0.1	3.98	4.29	41.44	950.76	938.91	38.91	5.79	55.92	1.35	-0.98	929.71	51.99
	0.95	0.05	2.90	3.44	33.20	975.07	962.92	31.97	4.94	47.68	1.44	-1.16	951.72	45.38
	1	0	0	1.45	14.00	1000.00	987.54	13.83	2.95	28.49	2.03	-2.05	967.30	27.55
				Total volume collected by ideal sampler, ml ===>	1158.60		Total sediment mass collected by ideal sampler, mg ====>	879.50	Total volume collected by test sampler, ml ===>	1448.28			Total sediment mass collected by test sampler, mg ===>	1098.44
			Concentration of sample collected by ideal sample, rmg/L		759.11			Concentration of sample collected by test sampler, mg/L		758.45				

Spreadsheet for RgdConHi sampler, 0.06-mm sediment and high flow

ASSIGNED CONSTANTS	f, Fractional depth at sampling vertical (0 is surface, 1 is bottom)	Relative height of segment boundaries above stream bed	Stream velocity at segment boundaries, ft/s.	A, Average velocity in segment. Also ideal sampler average intake velocity, ft/s	Q, For ideal sampler, volume of sample collected in interval, ml	Sediment concentration at segment boundary, mg/L	Average concentration in segment. Also for ideal sampler, concentration of sample in segment, mg/L	For ideal sampler, mass of sediment collected in segment, mg	Intake Velocity of test sampler (TS), ft/s	Volume of sample collected in interval by TS, ml	Relative sampling rate for TS	Sediment concentration error for TS, percent	Concentration of sample collected in segment by TS, mg/L	Mass of sediment collected in segment by TS, mg
Sampler RgdConHi, Insert intake characteristic equation in column J.	0	1	7.55			975.07								
	0.05	0.95	7.47	7.51	72.55	976.30	975.69	70.79	9.01	87.04	1.20	0.00	975.69	84.92
No, Sediment Concentration at Stream Bottom, mg/L	0.1	0.9	7.39	7.43	71.76	977.53	976.92	70.11	8.93	86.25	1.20	0.00	976.92	84.26
1000	0.15	0.85	7.30	7.35	70.93	978.77	978.15	69.38	8.85	85.41	1.20	0.00	978.15	83.55
c, Fall Velocity of particles, cm/s.	0.2	0.8	7.21	7.25	70.04	980.01	979.39	68.60	8.75	84.53	1.21	0.00	979.39	82.79
0.03	0.25	0.75	7.11	7.16	69.11	981.24	980.62	67.77	8.66	83.59	1.21	0.00	980.62	81.97
n, Manning roughness coefficient	0.3	0.7	7.00	7.05	68.10	982.48	981.86	66.87	8.55	82.59	1.21	0.00	981.86	81.09
0.04	0.35	0.65	6.88	6.94	67.03	983.72	983.10	65.90	8.44	81.52	1.22	0.00	983.10	80.14
D, Stream depth at sampling vertical, ft.	0.4	0.6	6.76	6.82	65.88	984.97	984.35	64.84	8.32	80.36	1.22	0.00	984.35	79.10
10	0.45	0.55	6.62	6.69	64.62	986.21	985.59	63.69	8.19	79.11	1.22	0.00	985.59	77.97
Vm, mean velocity in vertical, ft/s	0.5	0.5	6.48	6.55	63.26	987.46	986.83	62.42	8.05	77.74	1.23	0.00	986.83	76.72
6	0.55	0.45	6.31	6.39	61.75	988.70	988.08	61.01	7.89	76.23	1.23	0.00	988.08	75.33
d, sampler nozzle diameter, in.	0.6	0.4	6.13	6.22	60.08	989.95	989.33	59.44	7.72	74.56	1.24	0.00	989.33	73.77
0.25	0.65	0.35	5.92	6.03	58.19	991.20	990.58	57.64	7.53	72.68	1.25	0.00	990.58	71.99
T, sampling time in each segment, s.	0.7	0.3	5.68	5.80	56.03	992.45	991.83	55.58	7.30	70.52	1.26	0.00	991.83	69.94
1	0.75	0.25	5.40	5.54	53.51	993.71	993.08	53.14	7.04	67.99	1.27	0.00	993.08	67.52
	0.8	0.2	5.05	5.23	50.47	994.96	994.34	50.18	6.73	64.95	1.29	0.00	994.34	64.59
	0.85	0.15	4.61	4.83	46.64	996.22	995.59	46.43	6.33	61.12	1.31	0.00	995.59	60.85
	0.9	0.1	3.98	4.29	41.44	997.48	996.85	41.31	5.79	55.92	1.35	0.00	996.85	55.75
	0.95	0.05	2.90	3.44	33.20	998.74	998.11	33.14	4.94	47.68	1.44	0.00	998.11	47.59
	1	0	0	1.45	14.00	1000.00	999.37	13.99	2.95	28.49	2.03	0.00	999.37	28.47
				Total volume collected by ideal sampler, ml ===>	1158.60		Total sediment mass collected by ideal sampler, mg = ==>	1142.23	Total volume collected by test sampler, ml ===>	1448.28			Total sediment mass collected by test sampler, mg ===>	1428.29
			Concentration of sample collected by ideal sample, rmg/L		985.88			Concentration of sample collected by test sampler, mg/L		986.20				

Spreadsheet for RgdConHi sampler, 0.01-mm sediment and high flow

ASSIGNED CONSTANTS	f, Fractional depth at sampling vertical (0 is surface, 1 is bottom)	Relative height of segment boundaries above stream bed	Stream velocity at segment boundaries, ft/s.	A, Average velocity in segment. Also ideal sampler average intake velocity, ft/s	Q, For ideal sampler, volume of sample collected in interval, ml	Sediment concentration at segment boundary, mg/L	Average concentration in segment. Also for ideal sampler, concentration of sample in segment, mg/L	For ideal sampler, mass of sediment collected in segment, mg	Intake Velocity of test sampler (TS), ft/s	Volume of sample collected in interval by TS, ml	Relative sampling rate for TS	Sediment concentration error for TS, percent	Concentration of sample collected in segment by TS, mg/L	Mass of sediment collected in segment by TS, mg
Sampler BagLo, Insert intake characteristic equation in column J.	0	1	7.55			1.67								
	0.05	0.95	7.47	7.51	72.55	2.30	1.98	0.14	6.01	58.07	0.80	7.24	2.13	0.12
No, Sediment Concentration at Stream Bottom, mg/L	0.1	0.9	7.39	7.43	71.76	3.16	2.73	0.20	5.93	57.28	0.80	7.38	2.93	0.17
1000	0.15	0.85	7.30	7.35	70.93	4.36	3.76	0.27	5.85	56.44	0.80	7.53	4.04	0.23
c, Fall Velocity of particles, cm/s.	0.2	0.8	7.21	7.25	70.04	6.00	5.18	0.36	5.75	55.56	0.79	7.68	5.57	0.31
7.6	0.25	0.75	7.11	7.16	69.11	8.26	7.13	0.49	5.66	54.62	0.79	7.86	7.69	0.42
n, Manning roughness coefficient	0.3	0.7	7.00	7.05	68.10	11.37	9.81	0.67	5.55	53.62	0.79	8.05	10.60	0.57
0.04	0.35	0.65	6.88	6.94	67.03	15.65	13.51	0.91	5.44	52.55	0.78	8.26	14.63	0.77
D, Stream depth at sampling vertical, ft.	0.4	0.6	6.76	6.82	65.88	21.55	18.60	1.23	5.32	51.39	0.78	8.49	20.18	1.04
10	0.45	0.55	6.62	6.69	64.62	29.67	25.61	1.65	5.19	50.14	0.78	8.76	27.85	1.40
Vm, mean velocity in vertical, ft/s	0.5	0.5	6.48	6.55	63.26	40.85	35.26	2.23	5.05	48.77	0.77	9.05	38.45	1.88
6	0.55	0.45	6.31	6.39	61.75	56.25	48.55	3.00	4.89	47.27	0.77	9.40	53.11	2.51
d, sampler nozzle diameter, in.	0.6	0.4	6.13	6.22	60.08	77.44	66.84	4.02	4.72	45.59	0.76	9.80	73.39	3.35
0.25	0.65	0.35	5.92	6.03	58.19	106.62	92.03	5.36	4.53	43.71	0.75	10.27	101.48	4.44
T, sampling time in each segment, s.	0.7	0.3	5.68	5.80	56.03	146.80	126.71	7.10	4.30	41.55	0.74	10.85	140.46	5.84
1	0.75	0.25	5.40	5.54	53.51	202.12	174.46	9.34	4.04	39.03	0.73	11.58	194.66	7.60
	0.8	0.2	5.05	5.23	50.47	278.28	240.20	12.12	3.73	35.99	0.71	12.54	270.32	9.73
	0.85	0.15	4.61	4.83	46.64	383.14	330.71	15.42	3.33	32.15	0.69	13.91	376.71	12.11
	0.9	0.1	3.98	4.29	41.44	527.52	455.33	18.87	2.79	26.96	0.65	16.13	528.80	14.25
	0.95	0.05	2.90	3.44	33.20	726.31	626.92	20.81	1.94	18.72	0.56	21.58	762.22	14.27
	1	0	0	1.45	14.00	1000.00	863.15	12.09	0.00	0.00	0.00	406.58	4372.56	0.00
				Total volume collected by ideal sampler, ml ===>	1158.60		Total sediment mass collected by ideal sampler, mg ====>	116.27	Total volume collected by test sampler, ml ===>	869.39			Total sediment mass collected by test sampler, mg ===>	80.98
			Concentration of sample collected by ideal sample, rmg/L		100.35			Concentration of sample collected by test sampler, mg/L		93.15				

Spreadsheet for BagLo sampler, 0.45-mm sediment and high flow

ASSIGNED CONSTANTS	f, Fractional depth at sampling vertical (0 is surface, 1 is bottom)	Relative height of segment boundaries above stream bed	Stream velocity at segment boundaries, ft/s.	A, Average velocity in segment. Also ideal sampler average intake velocity, ft/s	Q, For ideal sampler, volume of sample collected in interval, ml	Sediment concentration at segment boundary, mg/L	Average concentration in segment. Also for ideal sampler, concentration of sample in segment, mg/L	For ideal sampler, mass of sediment collected in segment, mg	Intake Velocity of test sampler (TS), ft/s	Volume of sample collected in interval by TS, ml	Relative sampling rate for TS	Sediment concentration error for TS, percent	Concentration of sample collected in segment by TS, mg/L	Mass of sediment collected in segment by TS, mg
Sampler BagLo, Insert intake characteristic equation in column J.	0	1	7.55			185.80								
	0.05	0.95	7.47	7.51	72.55	202.12	193.96	14.07	6.01	58.07	0.80	5.09	203.84	11.84
No, Sediment Concentration at Stream Bottom, mg/L	0.1	0.9	7.39	7.43	71.76	219.86	210.99	15.14	5.93	57.28	0.80	5.18	221.92	12.71
1000	0.15	0.85	7.30	7.35	70.93	239.16	229.51	16.28	5.85	56.44	0.80	5.27	241.61	13.64
c, Fall Velocity of particles, cm/s.	0.2	0.8	7.21	7.25	70.04	260.16	249.66	17.49	5.75	55.56	0.79	5.37	263.07	14.62
2	0.25	0.75	7.11	7.16	69.11	283.00	271.58	18.77	5.66	54.62	0.79	5.48	286.47	15.65
n, Manning roughness coefficient	0.3	0.7	7.00	7.05	68.10	307.85	295.43	20.12	5.55	53.62	0.79	5.60	311.98	16.73
0.04	0.35	0.65	6.88	6.94	67.03	334.88	321.36	21.54	5.44	52.55	0.78	5.74	339.80	17.86
D, Stream depth at sampling vertical, ft.	0.4	0.6	6.76	6.82	65.88	364.28	349.58	23.03	5.32	51.39	0.78	5.89	370.16	19.02
10	0.45	0.55	6.62	6.69	64.62	396.26	380.27	24.57	5.19	50.14	0.78	6.06	403.31	20.22
Vm, mean velocity in vertical, ft/s	0.5	0.5	6.48	6.55	63.26	431.05	413.66	26.17	5.05	48.77	0.77	6.26	439.53	21.44
6	0.55	0.45	6.31	6.39	61.75	468.89	449.97	27.79	4.89	47.27	0.77	6.48	479.14	22.65
d, sampler nozzle diameter, in.	0.6	0.4	6.13	6.22	60.08	510.06	489.48	29.41	4.72	45.59	0.76	6.75	522.53	23.82
0.25	0.65	0.35	5.92	6.03	58.19	554.84	532.45	30.98	4.53	43.71	0.75	7.08	570.13	24.92
T, sampling time in each segment, s.	0.7	0.3	5.68	5.80	56.03	603.55	579.20	32.45	4.30	41.55	0.74	7.48	622.52	25.87
1	0.75	0.25	5.40	5.54	53.51	656.54	630.05	33.71	4.04	39.03	0.73	8.00	680.46	26.56
	0.8	0.2	5.05	5.23	50.47	714.19	685.36	34.59	3.73	35.99	0.71	8.71	745.07	26.81
	0.85	0.15	4.61	4.83	46.64	776.89	745.54	34.77	3.33	32.15	0.69	9.77	818.37	26.31
	0.9	0.1	3.98	4.29	41.44	845.10	810.99	33.61	2.79	26.96	0.65	11.60	905.10	24.40
	0.95	0.05	2.90	3.44	33.20	919.29	882.19	29.29	1.94	18.72	0.56	16.26	1025.64	19.20
	1	0	0	1.45	14.00	1000.00	959.65	13.44	0.00	0.00	0.00	156.13	2457.94	0.00
				Total volume collected by ideal sampler, ml ===>	1158.60		Total sediment mass collected by ideal sampler, mg ====>	497.22	Total volume collected by test sampler, ml ===>	869.39			Total sediment mass collected by test sampler, mg ===>	384.24
			Concentration of sample collected by ideal sample, rmg/L		429.15			Concentration of sample collected by test sampler, mg/L		441.97				

Spreadsheet for BagLo sampler, 0.15-mm sediment and high flow

ASSIGNED CONSTANTS	f, Fractional depth at sampling vertical (0 is surface, 1 is bottom)	Relative height of segment boundaries above stream bed	Stream velocity at segment boundaries, ft/s.	A, Average velocity in segment. Also ideal sampler average intake velocity, ft/s	Q, For ideal sampler, volume of sample collected in interval, ml	Sediment concentration at segment boundary, mg/L	Average concentration in segment. Also for ideal sampler, concentration of sample in segment, mg/L	For ideal sampler, mass of sediment collected in segment, mg	Intake Velocity of test sampler (TS), ft/s	Volume of sample collected in interval by TS, ml	Relative sampling rate for TS	Sediment concentration error for TS, percent	Concentration of sample collected in segment by TS, mg/L	Mass of sediment collected in segment by TS, mg
Sampler BagLo, Insert intake characteristic equation in column J.	0	1	7.55			603.55								
	0.05	0.95	7.47	7.51	72.55	618.99	611.27	44.35	6.01	58.07	0.80	0.98	617.24	35.84
No, Sediment Concentration at Stream Bottom, mg/L	0.1	0.9	7.39	7.43	71.76	634.81	626.90	44.99	5.93	57.28	0.80	0.99	633.09	36.26
1000	0.15	0.85	7.30	7.35	70.93	651.04	642.93	45.60	5.85	56.44	0.80	1.00	649.37	36.65
c, Fall Velocity of particles, cm/s.	0.2	0.8	7.21	7.25	70.04	667.69	659.36	46.19	5.75	55.56	0.79	1.02	666.06	37.01
0.6	0.25	0.75	7.11	7.16	69.11	684.76	676.22	46.73	5.66	54.62	0.79	1.03	683.20	37.32
n, Manning roughness coefficient	0.3	0.7	7.00	7.05	68.10	702.27	693.51	47.23	5.55	53.62	0.79	1.05	700.78	37.58
0.04	0.35	0.65	6.88	6.94	67.03	720.22	711.24	47.68	5.44	52.55	0.78	1.07	718.83	37.77
D, Stream depth at sampling vertical, ft.	0.4	0.6	6.76	6.82	65.88	738.64	729.43	48.05	5.32	51.39	0.78	1.09	737.36	37.89
10	0.45	0.55	6.62	6.69	64.62	757.52	748.08	48.34	5.19	50.14	0.78	1.11	756.39	37.92
Vm, mean velocity in vertical, ft/s	0.5	0.5	6.48	6.55	63.26	776.89	767.20	48.53	5.05	48.77	0.77	1.14	775.93	37.84
6	0.55	0.45	6.31	6.39	61.75	796.75	786.82	48.59	4.89	47.27	0.77	1.17	796.01	37.62
d, sampler nozzle diameter, in.	0.6	0.4	6.13	6.22	60.08	817.12	806.94	48.48	4.72	45.59	0.76	1.20	816.64	37.23
0.25	0.65	0.35	5.92	6.03	58.19	838.01	827.57	48.16	4.53	43.71	0.75	1.24	837.87	36.62
T, sampling time in each segment, s.	0.7	0.3	5.68	5.80	56.03	859.44	848.73	47.56	4.30	41.55	0.74	1.30	859.72	35.72
1	0.75	0.25	5.40	5.54	53.51	881.41	870.43	46.58	4.04	39.03	0.73	1.36	882.26	34.43
	0.8	0.2	5.05	5.23	50.47	903.95	892.68	45.05	3.73	35.99	0.71	1.44	905.57	32.59
	0.85	0.15	4.61	4.83	46.64	927.06	915.50	42.70	3.33	32.15	0.69	1.57	929.84	29.90
	0.9	0.1	3.98	4.29	41.44	950.76	938.91	38.91	2.79	26.96	0.65	1.77	955.49	25.76
	0.95	0.05	2.90	3.44	33.20	975.07	962.92	31.97	1.94	18.72	0.56	2.25	984.61	18.43
	1	0	0	1.45	14.00	1000.00	987.54	13.83	0.00	0.00	0.00	25.84	1242.75	0.00
				Total volume collected by ideal sampler, ml ===>	1158.60		Total sediment mass collected by ideal sampler, mg ====>	879.50	Total volume collected by test sampler, ml ===>	869.39			Total sediment mass collected by test sampler, mg ===>	660.39
			Concentration of sample collected by ideal sample, rmg/L		759.11			Concentration of sample collected by test sampler, mg/L		759.60				

Spreadsheet for BagLo sampler, 0.06-mm sediment and high flow

ASSIGNED CONSTANTS	f, Fractional depth at sampling vertical (0 is surface, 1 is bottom)	Relative height of segment boundaries above stream bed	Stream velocity at segment boundaries, ft/s.	A, Average velocity in segment. Also ideal sampler average intake velocity, ft/s	Q, For ideal sampler, volume of sample collected in interval, ml	Sediment concentration at segment boundary, mg/L	Average concentration in segment. Also for ideal sampler, concentration of sample in segment, mg/L	For ideal sampler, mass of sediment collected in segment, mg	Intake Velocity of test sampler (TS), ft/s	Volume of sample collected in interval by TS, ml	Relative sampling rate for TS	Sediment concentration error for TS, percent	Concentration of sample collected in segment by TS, mg/L	Mass of sediment collected in segment by TS, mg
Sampler BagLo, Insert intake characteristic equation in column J.	0	1	7.55			975.07								
	0.05	0.95	7.47	7.51	72.55	976.30	975.69	70.79	6.01	58.07	0.80	0.73	982.79	57.07
No, Sediment Concentration at Stream Bottom, mg/L	0.1	0.9	7.39	7.43	71.76	977.53	976.92	70.11	5.93	57.28	0.80	0.74	984.11	56.37
1000	0.15	0.85	7.30	7.35	70.93	978.77	978.15	69.38	5.85	56.44	0.80	0.75	985.44	55.62
c, Fall Velocity of particles, cm/s.	0.2	0.8	7.21	7.25	70.04	980.01	979.39	68.60	5.75	55.56	0.79	0.76	986.78	54.83
0.03	0.25	0.75	7.11	7.16	69.11	981.24	980.62	67.77	5.66	54.62	0.79	0.77	988.13	53.97
n, Manning roughness coefficient	0.3	0.7	7.00	7.05	68.10	982.48	981.86	66.87	5.55	53.62	0.79	0.78	989.50	53.06
0.04	0.35	0.65	6.88	6.94	67.03	983.72	983.10	65.90	5.44	52.55	0.78	0.79	990.87	52.07
D, Stream depth at sampling vertical, ft.	0.4	0.6	6.76	6.82	65.88	984.97	984.35	64.84	5.32	51.39	0.78	0.80	992.26	50.99
10	0.45	0.55	6.62	6.69	64.62	986.21	985.59	63.69	5.19	50.14	0.78	0.82	993.67	49.82
Vm, mean velocity in vertical, ft/s	0.5	0.5	6.48	6.55	63.26	987.46	986.83	62.42	5.05	48.77	0.77	0.84	995.11	48.53
6	0.55	0.45	6.31	6.39	61.75	988.70	988.08	61.01	4.89	47.27	0.77	0.86	996.57	47.10
d, sampler nozzle diameter, in.	0.6	0.4	6.13	6.22	60.08	989.95	989.33	59.44	4.72	45.59	0.76	0.88	998.07	45.50
0.25	0.65	0.35	5.92	6.03	58.19	991.20	990.58	57.64	4.53	43.71	0.75	0.91	999.62	43.69
T, sampling time in each segment, s.	0.7	0.3	5.68	5.80	56.03	992.45	991.83	55.58	4.30	41.55	0.74	0.95	1001.24	41.60
1	0.75	0.25	5.40	5.54	53.51	993.71	993.08	53.14	4.04	39.03	0.73	0.99	1002.96	39.14
	0.8	0.2	5.05	5.23	50.47	994.96	994.34	50.18	3.73	35.99	0.71	1.06	1004.83	36.16
	0.85	0.15	4.61	4.83	46.64	996.22	995.59	46.43	3.33	32.15	0.69	1.14	1006.98	32.38
	0.9	0.1	3.98	4.29	41.44	997.48	996.85	41.31	2.79	26.96	0.65	1.29	1009.71	27.22
	0.95	0.05	2.90	3.44	33.20	998.74	998.11	33.14	1.94	18.72	0.56	1.62	1014.23	18.98
	1	0	0	1.45	14.00	1000.00	999.37	13.99	0.00	0.00	0.00	3.73	1036.62	0.00
				Total volume collected by ideal sampler, ml ===>	1158.60		Total sediment mass collected by ideal sampler, mg ====>	1142.23	Total volume collected by test sampler, ml ===>	869.39			Total sediment mass collected by test sampler, mg ===>	864.11
			Concentration of sample collected by ideal sample, rmg/L		985.88			Concentration of sample collected by test sampler, mg/L		993.92				

Spreadsheet for BagLo sampler, 0.01-mm sediment and high flow

ASSIGNED CONSTANTS	f, Fractional depth at sampling vertical (0 is surface, 1 is bottom)	Relative height of segment boundaries above stream bed	Stream velocity at segment boundaries, ft/s.	A, Average velocity in segment. Also ideal sampler average intake velocity, ft/s	Q, For ideal sampler, volume of sample collected in interval, ml	Sediment concentration at segment boundary, mg/L	Average concentration in segment. Also for ideal sampler, concentration of sample in segment, mg/L	For ideal sampler, mass of sediment collected in segment, mg	Intake Velocity of test sampler (TS), ft/s	Volume of sample collected in interval by TS, ml	Relative sampling rate for TS	Sediment concentration error for TS, percent	Concentration of sample collected in segment by TS, mg/L	Mass of sediment collected in segment by TS, mg
Sampler RgdConLo, Insert intake characteristic equation in column J.	0	1	5.13			0.15								
No, Sediment Concentration at Stream Bottom, mg/L	0.05	0.95	5.07	5.10	49.23	0.23	0.19	0.01	4.05	39.10	0.79	7.62	0.20	0.01
1000	0.1	0.9	5.01	5.04	48.66	0.36	0.30	0.01	4.02	38.81	0.80	7.41	0.32	0.01
c, Fall Velocity of particles, cm/s.	0.15	0.85	4.94	4.98	48.06	0.56	0.46	0.02	3.99	38.51	0.80	7.18	0.49	0.02
7.6	0.2	0.8	4.88	4.91	47.41	0.87	0.71	0.03	3.96	38.19	0.81	6.93	0.76	0.03
n, Manning roughness coefficient	0.25	0.75	4.80	4.84	46.73	1.35	1.11	0.05	3.92	37.85	0.81	6.65	1.18	0.04
0.04	0.3	0.7	4.73	4.76	46.01	2.10	1.72	0.08	3.88	37.49	0.81	6.35	1.83	0.07
D, Stream depth at sampling vertical, ft.	0.35	0.65	4.64	4.68	45.23	3.26	2.68	0.12	3.84	37.10	0.82	6.02	2.84	0.11
6	0.4	0.6	4.55	4.60	44.39	5.06	4.16	0.18	3.80	36.68	0.83	5.66	4.39	0.16
Vm, mean velocity in vertical, ft/s	0.45	0.55	4.45	4.50	43.48	7.86	6.46	0.28	3.75	36.22	0.83	5.25	6.80	0.25
4	0.5	0.5	4.35	4.40	42.49	12.21	10.04	0.43	3.70	35.73	0.84	4.79	10.52	0.38
d, sampler nozzle diameter, in.	0.55	0.45	4.23	4.29	41.39	18.97	15.59	0.65	3.64	35.18	0.85	4.27	16.26	0.57
0.25	0.6	0.4	4.09	4.16	40.18	29.48	24.22	0.97	3.58	34.57	0.86	3.68	25.11	0.87
T, sampling time in each segment, s.	0.65	0.35	3.94	4.02	38.81	45.79	37.63	1.46	3.51	33.89	0.87	3.00	38.76	1.31
1	0.7	0.3	3.77	3.86	37.24	71.14	58.46	2.18	3.43	33.11	0.89	2.22	59.76	1.98
	0.75	0.25	3.56	3.67	35.41	110.51	90.82	3.22	3.33	32.19	0.91	1.35	92.05	2.96
	0.8	0.2	3.31	3.44	33.20	171.68	141.10	4.69	3.22	31.09	0.94	0.48	141.77	4.41
	0.85	0.15	2.99	3.15	30.42	266.71	219.20	6.67	3.08	29.70	0.98	0.07	219.34	6.51
	0.9	0.1	2.53	2.76	26.65	414.35	340.53	9.07	2.88	27.81	1.04	-1.66	334.88	9.31
	0.95	0.05	1.75	2.14	20.67	643.70	529.02	10.93	2.57	24.82	1.20	-5.36	500.69	12.43
	1	0	0	0.87	8.45	1000.00	821.85	6.94	1.94	18.71	2.21	-17.92	674.60	12.62
				Total volume collected by ideal sampler, ml ===>	774.10		Total sediment mass collected by ideal sampler, mg ====>	48.00	Total volume collected by test sampler, ml ===>	676.74			Total sediment mass collected by test sampler, mg ===>	54.05
			Concentration of sample collected by ideal sample, rmg/L		62.01			Concentration of sample collected by test sampler, mg/L		79.86				

Spreadsheet for RgdConLo sampler, 0.45-mm sediment and medium flow

ASSIGNED CONSTANTS	f, Fractional depth at sampling vertical (0 is surface, 1 is bottom)	Relative height of segment boundaries above stream bed	Stream velocity at segment boundaries, ft/s.	A, Average velocity in segment. Also ideal sampler average intake velocity, ft/s	Q, For ideal sampler, volume of sample collected in interval, ml	Sediment concentration at segment boundary, mg/L	Average concentration in segment. Also for ideal sampler, concentration of sample in segment, mg/L	For ideal sampler, mass of sediment collected in segment, mg	Intake Velocity of test sampler (TS), ft/s	Volume of sample collected in interval by TS, ml	Relative sampling rate for TS	Sediment concentration error for TS, percent	Concentration of sample collected in segment by TS, mg/L	Mass of sediment collected in segment by TS, mg
Sampler RgdConLo, Insert intake characteristic equation in column J.	0	1	5.13			98.42								
	0.05	0.95	5.07	5.10	49.23	110.51	104.46	5.14	4.05	39.10	0.79	5.33	110.04	4.30
No, Sediment Concentration at Stream Bottom, mg/L	0.1	0.9	5.01	5.04	48.66	124.10	117.30	5.71	4.02	38.81	0.80	5.20	123.40	4.79
1000	0.15	0.85	4.94	4.98	48.06	139.35	131.72	6.33	3.99	38.51	0.80	5.05	138.38	5.33
c, Fall Velocity of particles, cm/s.	0.2	0.8	4.88	4.91	47.41	156.48	147.91	7.01	3.96	38.19	0.81	4.90	155.16	5.93
2	0.25	0.75	4.80	4.84	46.73	175.71	166.09	7.76	3.92	37.85	0.81	4.73	173.95	6.58
n, Manning roughness coefficient	0.3	0.7	4.73	4.76	46.01	197.31	186.51	8.58	3.88	37.49	0.81	4.55	194.99	7.31
0.04	0.35	0.65	4.64	4.68	45.23	221.56	209.43	9.47	3.84	37.10	0.82	4.34	218.53	8.11
D, Stream depth at sampling vertical, ft.	0.4	0.6	4.55	4.60	44.39	248.79	235.18	10.44	3.80	36.68	0.83	4.12	244.87	8.98
6	0.45	0.55	4.45	4.50	43.48	279.37	264.08	11.48	3.75	36.22	0.83	3.88	274.32	9.94
Vm, mean velocity in vertical, ft/s	0.5	0.5	4.35	4.40	42.49	313.71	296.54	12.60	3.70	35.73	0.84	3.60	307.23	10.98
4	0.55	0.45	4.23	4.29	41.39	352.27	332.99	13.78	3.64	35.18	0.85	3.29	343.96	12.10
d, sampler nozzle diameter, in.	0.6	0.4	4.09	4.16	40.18	395.57	373.92	15.02	3.58	34.57	0.86	2.94	384.92	13.31
0.25	0.65	0.35	3.94	4.02	38.81	444.19	419.88	16.30	3.51	33.89	0.87	2.54	430.54	14.59
T, sampling time in each segment, s.	0.7	0.3	3.77	3.86	37.24	498.79	471.49	17.56	3.43	33.11	0.89	2.07	481.25	15.93
1	0.75	0.25	3.56	3.67	35.41	560.10	529.45	18.75	3.33	32.19	0.91	1.53	537.53	17.30
	0.8	0.2	3.31	3.44	33.20	628.94	594.52	19.74	3.22	31.09	0.94	0.91	599.95	18.65
	0.85	0.15	2.99	3.15	30.42	706.25	667.60	20.31	3.08	29.70	0.98	0.32	669.76	19.89
	0.9	0.1	2.53	2.76	26.65	793.06	749.66	19.98	2.88	27.81	1.04	-1.05	741.77	20.63
	0.95	0.05	1.75	2.14	20.67	890.54	841.80	17.40	2.57	24.82	1.20	-4.07	807.55	20.04
	1	0	0	0.87	8.45	1000.00	945.27	7.98	1.94	18.71	2.21	-11.64	835.20	15.62
				Total volume collected by ideal sampler, ml ===>	774.10		Total sediment mass collected by ideal sampler, mg ====>	251.35	Total volume collected by test sampler, ml ===>	676.74			Total sediment mass collected by test sampler, mg ===>	240.31
			Concentration of sample collected by ideal sample, rmg/L		324.70			Concentration of sample collected by test sampler, mg/L		355.10				

Spreadsheet for RgdConLo sampler, 0.15-mm sediment and medium flow

ASSIGNED CONSTANTS	f, Fractional depth at sampling vertical (0 is surface, 1 is bottom)	Relative height of segment boundaries above stream bed	Stream velocity at segment boundaries, ft/s.	A, Average velocity in segment. Also ideal sampler average intake velocity, ft/s	Q, For ideal sampler, volume of sample collected in interval, ml	Sediment concentration at segment boundary, mg/L	Average concentration in segment. Also for ideal sampler, concentration of sample in segment, mg/L	For ideal sampler, mass of sediment collected in segment, mg	Intake Velocity of test sampler (TS), ft/s	Volume of sample collected in interval by TS, ml	Relative sampling rate for TS	Sediment concentration error for TS, percent	Concentration of sample collected in segment by TS, mg/L	Mass of sediment collected in segment by TS, mg
Sampler RgdConLo, Insert intake characteristic equation in column J.	0	1	5.13			498.79								
No, Sediment Concentration at Stream Bottom, mg/L	0.05	0.95	5.07	5.10	49.23	516.44	507.62	24.99	4.05	39.10	0.79	1.01	512.75	20.05
1000	0.1	0.9	5.01	5.04	48.66	534.72	525.58	25.58	4.02	38.81	0.80	0.99	530.79	20.60
c, Fall Velocity of particles, cm/s.	0.15	0.85	4.94	4.98	48.06	553.64	544.18	26.15	3.99	38.51	0.80	0.97	549.46	21.16
0.6	0.2	0.8	4.88	4.91	47.41	573.24	563.44	26.71	3.96	38.19	0.81	0.95	568.78	21.72
n, Manning roughness coefficient	0.25	0.75	4.80	4.84	46.73	593.53	583.38	27.26	3.92	37.85	0.81	0.92	588.77	22.29
0.04	0.3	0.7	4.73	4.76	46.01	614.53	604.03	27.79	3.88	37.49	0.81	0.90	609.44	22.85
D, Stream depth at sampling vertical, ft.	0.35	0.65	4.64	4.68	45.23	636.28	625.40	28.28	3.84	37.10	0.82	0.87	630.81	23.40
6	0.4	0.6	4.55	4.60	44.39	658.80	647.54	28.74	3.80	36.68	0.83	0.83	652.92	23.95
Vm, mean velocity in vertical, ft/s	0.45	0.55	4.45	4.50	43.48	682.11	670.45	29.15	3.75	36.22	0.83	0.79	675.77	24.48
4	0.5	0.5	4.35	4.40	42.49	706.25	694.18	29.49	3.70	35.73	0.84	0.75	699.38	24.99
d, sampler nozzle diameter, in.	0.55	0.45	4.23	4.29	41.39	731.25	718.75	29.75	3.64	35.18	0.85	0.70	723.77	25.46
0.25	0.6	0.4	4.09	4.16	40.18	757.12	744.19	29.90	3.58	34.57	0.86	0.64	748.94	25.89
T, sampling time in each segment, s.	0.65	0.35	3.94	4.02	38.81	783.92	770.52	29.90	3.51	33.89	0.87	0.57	774.91	26.26
1	0.7	0.3	3.77	3.86	37.24	811.66	797.79	29.71	3.43	33.11	0.89	0.48	801.65	26.54
	0.75	0.25	3.56	3.67	35.41	840.39	826.03	29.25	3.33	32.19	0.91	0.38	829.14	26.69
	0.8	0.2	3.31	3.44	33.20	870.13	855.26	28.40	3.22	31.09	0.94	0.24	857.32	26.65
	0.85	0.15	2.99	3.15	30.42	900.92	885.53	26.94	3.08	29.70	0.98	0.07	886.17	26.32
	0.9	0.1	2.53	2.76	26.65	932.81	916.87	24.43	2.88	27.81	1.04	-0.16	915.43	25.46
	0.95	0.05	1.75	2.14	20.67	965.82	949.31	19.62	2.57	24.82	1.20	-0.62	943.45	23.42
	1	0	0	0.87	8.45	1000.00	982.91	8.30	1.94	18.71	2.21	-2.24	960.91	17.98
				Total volume collected by ideal sampler, ml ===>	774.10		Total sediment mass collected by ideal sampler, mg ====>	530.37	Total volume collected by test sampler, ml ===>	676.74			Total sediment mass collected by test sampler, mg ===>	476.14
			Concentration of sample collected by ideal sample, rmg/L		685.14			Concentration of sample collected by test sampler, mg/L		703.58				

Spreadsheet for RgdConLo sampler, 0.06-mm sediment and medium flow

ASSIGNED CONSTANTS	f, Fractional depth at sampling vertical (0 is surface, 1 is bottom)	Relative height of segment boundaries above stream bed	Stream velocity at segment boundaries, ft/s.	A, Average velocity in segment. Also ideal sampler average intake velocity, ft/s	Q, For ideal sampler, volume of sample collected in interval, ml	Sediment concentration at segment boundary, mg/L	Average concentration in segment. Also for ideal sampler, concentration of sample in segment, mg/L	For ideal sampler, mass of sediment collected in segment, mg	Intake Velocity of test sampler (TS), ft/s	Volume of sample collected in interval by TS, ml	Relative sampling rate for TS	Sediment concentration error for TS, percent	Concentration of sample collected in segment by TS, mg/L	Mass of sediment collected in segment by TS, mg
Sampler RgdConLo, Insert intake characteristic equation in column J.	0	1	5.13			965.82								
No, Sediment Concentration at Stream Bottom, mg/L	0.05	0.95	5.07	5.10	49.23	967.50	966.66	47.59	4.05	39.10	0.79	0.75	973.92	38.08
1000	0.1	0.9	5.01	5.04	48.66	969.18	968.34	47.12	4.02	38.81	0.80	0.74	975.49	37.86
c, Fall Velocity of particles, cm/s.	0.15	0.85	4.94	4.98	48.06	970.87	970.03	46.61	3.99	38.51	0.80	0.72	977.06	37.63
0.03	0.2	0.8	4.88	4.91	47.41	972.56	971.72	46.07	3.96	38.19	0.81	0.71	978.61	37.37
n, Manning roughness coefficient	0.25	0.75	4.80	4.84	46.73	974.25	973.41	45.49	3.92	37.85	0.81	0.69	980.15	37.10
0.04	0.3	0.7	4.73	4.76	46.01	975.95	975.10	44.86	3.88	37.49	0.81	0.67	981.68	36.80
D, Stream depth at sampling vertical, ft.	0.35	0.65	4.64	4.68	45.23	977.65	976.80	44.18	3.84	37.10	0.82	0.65	983.19	36.47
6	0.4	0.6	4.55	4.60	44.39	979.35	978.50	43.43	3.80	36.68	0.83	0.63	984.67	36.12
Vm, mean velocity in vertical, ft/s	0.45	0.55	4.45	4.50	43.48	981.05	980.20	42.62	3.75	36.22	0.83	0.61	986.14	35.72
4	0.5	0.5	4.35	4.40	42.49	982.76	981.91	41.72	3.70	35.73	0.84	0.58	987.57	35.28
d, sampler nozzle diameter, in.	0.55	0.45	4.23	4.29	41.39	984.47	983.62	40.71	3.64	35.18	0.85	0.54	988.95	34.79
0.25	0.6	0.4	4.09	4.16	40.18	986.18	985.33	39.59	3.58	34.57	0.86	0.50	990.28	34.24
T, sampling time in each segment, s.	0.65	0.35	3.94	4.02	38.81	987.90	987.04	38.31	3.51	33.89	0.87	0.46	991.54	33.60
1	0.7	0.3	3.77	3.86	37.24	989.62	988.76	36.82	3.43	33.11	0.89	0.40	992.68	32.86
	0.75	0.25	3.56	3.67	35.41	991.34	990.48	35.07	3.33	32.19	0.91	0.32	993.66	31.99
	0.8	0.2	3.31	3.44	33.20	993.07	992.21	32.95	3.22	31.09	0.94	0.22	994.38	30.91
	0.85	0.15	2.99	3.15	30.42	994.80	993.93	30.24	3.08	29.70	0.98	0.07	994.63	29.54
	0.9	0.1	2.53	2.76	26.65	996.53	995.66	26.53	2.88	27.81	1.04	0.00	995.66	27.69
	0.95	0.05	1.75	2.14	20.67	998.26	997.40	20.61	2.57	24.82	1.20	0.00	997.40	24.75
	1	0	0	0.87	8.45	1000.00	999.13	8.44	1.94	18.71	2.21	0.00	999.13	18.69
				Total volume collected by ideal sampler, ml ===>	774.10		Total sediment mass collected by ideal sampler, mg ====>	758.97	Total volume collected by test sampler, ml ===>	676.74			Total sediment mass collected by test sampler, mg ===>	667.50
			Concentration of sample collected by ideal sample, rmg/L		980.45			Concentration of sample collected by test sampler, mg/L		986.35				

Spreadsheet for RgdConLo sampler, 0.01-mm sediment and medium flow

ASSIGNED CONSTANTS	f, Fractional depth at sampling vertical (0 is surface, 1 is bottom)	Relative height of segment boundaries above stream bed	Stream velocity at segment boundaries, ft/s.	A, Average velocity in segment. Also ideal sampler average intake velocity, ft/s	Q, For ideal sampler, volume of sample collected in interval, ml	Sediment concentration at segment boundary, mg/L	Average concentration in segment. Also for ideal sampler, concentration of sample in segment, mg/L	For ideal sampler, mass of sediment collected in segment, mg	Intake Velocity of test sampler (TS), ft/s	Volume of sample collected in interval by TS, ml	Relative sampling rate for TS	Sediment concentration error for TS, percent	Concentration of sample collected in segment by TS, mg/L	Mass of sediment collected in segment by TS, mg
Sampler BagHi, Insert intake characteristic equation in column J.	0	1	5.13			0.15								
	0.05	0.95	5.07	5.10	49.23	0.23	0.19	0.01	7.20	69.50	1.41	-9.36	0.17	0.01
No, Sediment Concentration at Stream Bottom, mg/L	0.1	0.9	5.01	5.04	48.66	0.36	0.30	0.01	7.08	68.35	1.40	-9.25	0.27	0.02
1000	0.15	0.85	4.94	4.98	48.06	0.56	0.46	0.02	6.95	67.14	1.40	-9.12	0.42	0.03
c, Fall Velocity of particles, cm/s.	0.2	0.8	4.88	4.91	47.41	0.87	0.71	0.03	6.82	65.86	1.39	-8.98	0.65	0.04
7.6	0.25	0.75	4.80	4.84	46.73	1.35	1.11	0.05	6.68	64.50	1.38	-8.83	1.01	0.07
n, Manning roughness coefficient	0.3	0.7	4.73	4.76	46.01	2.10	1.72	0.08	6.53	63.04	1.37	-8.66	1.57	0.10
0.04	0.35	0.65	4.64	4.68	45.23	3.26	2.68	0.12	6.37	61.48	1.36	-8.46	2.45	0.15
D, Stream depth at sampling vertical, ft.	0.4	0.6	4.55	4.60	44.39	5.06	4.16	0.18	6.19	59.81	1.35	-8.25	3.82	0.23
6	0.45	0.55	4.45	4.50	43.48	7.86	6.46	0.28	6.01	57.99	1.33	-8.00	5.94	0.34
Vm, mean velocity in vertical, ft/s	0.5	0.5	4.35	4.40	42.49	12.21	10.04	0.43	5.80	56.00	1.32	-7.71	9.26	0.52
4	0.55	0.45	4.23	4.29	41.39	18.97	15.59	0.65	5.57	53.82	1.30	-7.37	14.44	0.78
d, sampler nozzle diameter, in.	0.6	0.4	4.09	4.16	40.18	29.48	24.22	0.97	5.32	51.39	1.28	-6.96	22.54	1.16
0.25	0.65	0.35	3.94	4.02	38.81	45.79	37.63	1.46	5.04	48.65	1.25	-6.45	35.20	1.71
T, sampling time in each segment, s.	0.7	0.3	3.77	3.86	37.24	71.14	58.46	2.18	4.71	45.52	1.22	-5.81	55.07	2.51
1	0.75	0.25	3.56	3.67	35.41	110.51	90.82	3.22	4.33	41.85	1.18	-4.95	86.33	3.61
	0.8	0.2	3.31	3.44	33.20	171.68	141.10	4.69	3.88	37.44	1.13	-3.72	135.85	5.09
	0.85	0.15	2.99	3.15	30.42	266.71	219.20	6.67	3.30	31.88	1.05	-1.77	215.32	6.86
	0.9	0.1	2.53	2.76	26.65	414.35	340.53	9.07	2.52	24.33	0.91	1.20	344.61	8.38
	0.95	0.05	1.75	2.14	20.67	643.70	529.02	10.93	1.28	12.37	0.60	19.24	630.79	7.80
	1	0	0	0.87	8.45	1000.00	821.85	6.94	0.00	0.00	0.00	406.58	4163.32	0.00
				Total volume collected by ideal sampler, ml ===>	774.10		Total sediment mass collected by ideal sampler, mg ====>	48.00	Total volume collected by test sampler, ml ===>	980.91			Total sediment mass collected by test sampler, mg ===>	39.41
			Concentration of sample collected by ideal sample, rmg/L		62.01			Concentration of sample collected by test sampler, mg/L		40.18				

Spreadsheet for BagHi sampler, 0.45-mm sediment and medium flow

ASSIGNED CONSTANTS	f, Fractional depth at sampling vertical (0 is surface, 1 is bottom)	Relative height of segment boundaries above stream bed	Stream velocity at segment boundaries, ft/s.	A, Average velocity in segment. Also ideal sampler average intake velocity, ft/s	Q, For ideal sampler, volume of sample collected in interval, ml	Sediment concentration at segment boundary, mg/L	Average concentration in segment. Also for ideal sampler, concentration of sample in segment, mg/L	For ideal sampler, mass of sediment collected in segment, mg	Intake Velocity of test sampler (TS), ft/s	Volume of sample collected in interval by TS, ml	Relative sampling rate for TS	Sediment concentration error for TS, percent	Concentration of sample collected in segment by TS, mg/L	Mass of sediment collected in segment by TS, mg
Sampler BagHi, Insert intake characteristic equation in column J.	0	1	5.13			98.42								
	0.05	0.95	5.07	5.10	49.23	110.51	104.46	5.14	7.20	69.50	1.41	-7.05	97.10	6.75
No, Sediment Concentration at Stream Bottom, mg/L	0.1	0.9	5.01	5.04	48.66	124.10	117.30	5.71	7.08	68.35	1.40	-6.97	109.13	7.46
1000	0.15	0.85	4.94	4.98	48.06	139.35	131.72	6.33	6.95	67.14	1.40	-6.88	122.66	8.24
c, Fall Velocity of particles, cm/s.	0.2	0.8	4.88	4.91	47.41	156.48	147.91	7.01	6.82	65.86	1.39	-6.78	137.89	9.08
2	0.25	0.75	4.80	4.84	46.73	175.71	166.09	7.76	6.68	64.50	1.38	-6.67	155.02	10.00
n, Manning roughness coefficient	0.3	0.7	4.73	4.76	46.01	197.31	186.51	8.58	6.53	63.04	1.37	-6.55	174.30	10.99
0.04	0.35	0.65	4.64	4.68	45.23	221.56	209.43	9.47	6.37	61.48	1.36	-6.41	196.01	12.05
D, Stream depth at sampling vertical, ft.	0.4	0.6	4.55	4.60	44.39	248.79	235.18	10.44	6.19	59.81	1.35	-6.25	220.47	13.19
6	0.45	0.55	4.45	4.50	43.48	279.37	264.08	11.48	6.01	57.99	1.33	-6.07	248.05	14.38
Vm, mean velocity in vertical, ft/s	0.5	0.5	4.35	4.40	42.49	313.71	296.54	12.60	5.80	56.00	1.32	-5.86	279.16	15.63
4	0.55	0.45	4.23	4.29	41.39	352.27	332.99	13.78	5.57	53.82	1.30	-5.61	314.31	16.92
d, sampler nozzle diameter, in.	0.6	0.4	4.09	4.16	40.18	395.57	373.92	15.02	5.32	51.39	1.28	-5.30	354.10	18.20
0.25	0.65	0.35	3.94	4.02	38.81	444.19	419.88	16.30	5.04	48.65	1.25	-4.92	399.23	19.42
T, sampling time in each segment, s.	0.7	0.3	3.77	3.86	37.24	498.79	471.49	17.56	4.71	45.52	1.22	-4.42	450.64	20.51
1	0.75	0.25	3.56	3.67	35.41	560.10	529.45	18.75	4.33	41.85	1.18	-3.75	509.62	21.33
	0.8	0.2	3.31	3.44	33.20	628.94	594.52	19.74	3.88	37.44	1.13	-2.76	578.13	21.64
	0.85	0.15	2.99	3.15	30.42	706.25	667.60	20.31	3.30	31.88	1.05	-1.14	659.96	21.04
	0.9	0.1	2.53	2.76	26.65	793.06	749.66	19.98	2.52	24.33	0.91	1.43	760.36	18.50
	0.95	0.05	1.75	2.14	20.67	890.54	841.80	17.40	1.28	12.37	0.60	14.28	962.01	11.90
	1	0	0	0.87	8.45	1000.00	945.27	7.98	0.00	0.00	0.00	156.13	2421.12	0.00
				Total volume collected by ideal sampler, ml ===>	774.10		Total sediment mass collected by ideal sampler, mg ====>	251.35	Total volume collected by test sampler, ml ===>	980.91			Total sediment mass collected by test sampler, mg ===>	277.22
			Concentration of sample collected by ideal sample, rmg/L		324.70			Concentration of sample collected by test sampler, mg/L		282.62				

Spreadsheet for BagHi sampler, 0.15-mm sediment and medium flow

ASSIGNED CONSTANTS	f, Fractional depth at sampling vertical (0 is surface, 1 is bottom)	Relative height of segment boundaries above stream bed	Stream velocity at segment boundaries, ft/s.	A, Average velocity in segment. Also ideal sampler average intake velocity, ft/s	Q, For ideal sampler, volume of sample collected in interval, ml	Sediment concentration at segment boundary, mg/L	Average concentration in segment. Also for ideal sampler, concentration of sample in segment, mg/L	For ideal sampler, mass of sediment collected in segment, mg	Intake Velocity of test sampler (TS), ft/s	Volume of sample collected in interval by TS, ml	Relative sampling rate for TS	Sediment concentration error for TS, percent	Concentration of sample collected in segment by TS, mg/L	Mass of sediment collected in segment by TS, mg
Sampler BagHi, Insert intake characteristic equation in column J.	0	1	5.13			498.79								
	0.05	0.95	5.07	5.10	49.23	516.44	507.62	24.99	7.20	69.50	1.41	-1.11	501.97	34.89
No, Sediment Concentration at Stream Bottom, mg/L	0.1	0.9	5.01	5.04	48.66	534.72	525.58	25.58	7.08	68.35	1.40	-1.10	519.81	35.53
1000	0.15	0.85	4.94	4.98	48.06	553.64	544.18	26.15	6.95	67.14	1.40	-1.08	538.29	36.14
c, Fall Velocity of particles, cm/s.	0.2	0.8	4.88	4.91	47.41	573.24	563.44	26.71	6.82	65.86	1.39	-1.07	557.44	36.71
0.6	0.25	0.75	4.80	4.84	46.73	593.53	583.38	27.26	6.68	64.50	1.38	-1.05	577.28	37.23
n, Manning roughness coefficient	0.3	0.7	4.73	4.76	46.01	614.53	604.03	27.79	6.53	63.04	1.37	-1.03	597.83	37.69
0.04	0.35	0.65	4.64	4.68	45.23	636.28	625.40	28.28	6.37	61.48	1.36	-1.00	619.14	38.07
D, Stream depth at sampling vertical, ft.	0.4	0.6	4.55	4.60	44.39	658.80	647.54	28.74	6.19	59.81	1.35	-0.97	641.23	38.35
6	0.45	0.55	4.45	4.50	43.48	682.11	670.45	29.15	6.01	57.99	1.33	-0.94	664.12	38.51
Vm, mean velocity in vertical, ft/s	0.5	0.5	4.35	4.40	42.49	706.25	694.18	29.49	5.80	56.00	1.32	-0.91	687.88	38.52
4	0.55	0.45	4.23	4.29	41.39	731.25	718.75	29.75	5.57	53.82	1.30	-0.87	712.52	38.35
d, sampler nozzle diameter, in.	0.6	0.4	4.09	4.16	40.18	757.12	744.19	29.90	5.32	51.39	1.28	-0.82	738.11	37.93
0.25	0.65	0.35	3.94	4.02	38.81	783.92	770.52	29.90	5.04	48.65	1.25	-0.75	764.72	37.20
T, sampling time in each segment, s.	0.7	0.3	3.77	3.86	37.24	811.66	797.79	29.71	4.71	45.52	1.22	-0.67	792.42	36.07
1	0.75	0.25	3.56	3.67	35.41	840.39	826.03	29.25	4.33	41.85	1.18	-0.57	821.35	34.38
	0.8	0.2	3.31	3.44	33.20	870.13	855.26	28.40	3.88	37.44	1.13	-0.41	851.72	31.89
	0.85	0.15	2.99	3.15	30.42	900.92	885.53	26.94	3.30	31.88	1.05	-0.17	884.01	28.18
	0.9	0.1	2.53	2.76	26.65	932.81	916.87	24.43	2.52	24.33	0.91	0.36	920.13	22.39
	0.95	0.05	1.75	2.14	20.67	965.82	949.31	19.62	1.28	12.37	0.60	2.05	968.73	11.98
	1	0	0	0.87	8.45	1000.00	982.91	8.30	0.00	0.00	0.00	25.84	1236.93	0.00
				Total volume collected by ideal sampler, ml ===>	774.10		Total sediment mass collected by ideal sampler, mg ====>	530.37	Total volume collected by test sampler, ml ===>	980.91			Total sediment mass collected by test sampler, mg ===>	650.00
			Concentration of sample collected by ideal sample, rmg/L		685.14			Concentration of sample collected by test sampler, mg/L		662.65				

Spreadsheet for BagHi sampler, 0.06-mm sediment and medium flow

ASSIGNED CONSTANTS	f, Fractional depth at sampling vertical (0 is surface, 1 is bottom)	Relative height of segment boundaries above stream bed	Stream velocity at segment boundaries, ft/s.	A, Average velocity in segment. Also ideal sampler average intake velocity, ft/s	Q, For ideal sampler, volume of sample collected in interval, ml	Sediment concentration at segment boundary, mg/L	Average concentration in segment. Also for ideal sampler, concentration of sample in segment, mg/L	For ideal sampler, mass of sediment collected in segment, mg	Intake Velocity of test sampler (TS), ft/s	Volume of sample collected in interval by TS, ml	Relative sampling rate for TS	Sediment concentration error for TS, percent	Concentration of sample collected in segment by TS, mg/L	Mass of sediment collected in segment by TS, mg
Sampler BagHi, Insert intake characteristic equation in column J.	0	1	5.13			965.82								
	0.05	0.95	5.07	5.10	49.23	967.50	966.66	47.59	7.20	69.50	1.41	0.00	966.66	67.18
No, Sediment Concentration at Stream Bottom, mg/L	0.1	0.9	5.01	5.04	48.66	969.18	968.34	47.12	7.08	68.35	1.40	0.00	968.34	66.19
1000	0.15	0.85	4.94	4.98	48.06	970.87	970.03	46.61	6.95	67.14	1.40	0.00	970.03	65.13
c, Fall Velocity of particles, cm/s.	0.2	0.8	4.88	4.91	47.41	972.56	971.72	46.07	6.82	65.86	1.39	0.00	971.72	64.00
0.03	0.25	0.75	4.80	4.84	46.73	974.25	973.41	45.49	6.68	64.50	1.38	0.00	973.41	62.78
n, Manning roughness coefficient	0.3	0.7	4.73	4.76	46.01	975.95	975.10	44.86	6.53	63.04	1.37	0.00	975.10	61.47
0.04	0.35	0.65	4.64	4.68	45.23	977.65	976.80	44.18	6.37	61.48	1.36	0.00	976.80	60.06
D, Stream depth at sampling vertical, ft.	0.4	0.6	4.55	4.60	44.39	979.35	978.50	43.43	6.19	59.81	1.35	0.00	978.50	58.52
6	0.45	0.55	4.45	4.50	43.48	981.05	980.20	42.62	6.01	57.99	1.33	0.00	980.20	56.84
Vm, mean velocity in vertical, ft/s	0.5	0.5	4.35	4.40	42.49	982.76	981.91	41.72	5.80	56.00	1.32	0.00	981.91	54.99
4	0.55	0.45	4.23	4.29	41.39	984.47	983.62	40.71	5.57	53.82	1.30	0.00	983.62	52.93
d, sampler nozzle diameter, in.	0.6	0.4	4.09	4.16	40.18	986.18	985.33	39.59	5.32	51.39	1.28	0.00	985.33	50.63
0.25	0.65	0.35	3.94	4.02	38.81	987.90	987.04	38.31	5.04	48.65	1.25	0.00	987.04	48.02
T, sampling time in each segment, s.	0.7	0.3	3.77	3.86	37.24	989.62	988.76	36.82	4.71	45.52	1.22	0.00	988.76	45.01
1	0.75	0.25	3.56	3.67	35.41	991.34	990.48	35.07	4.33	41.85	1.18	0.00	990.48	41.46
	0.8	0.2	3.31	3.44	33.20	993.07	992.21	32.95	3.88	37.44	1.13	0.00	992.21	37.15
	0.85	0.15	2.99	3.15	30.42	994.80	993.93	30.24	3.30	31.88	1.05	0.00	993.93	31.68
	0.9	0.1	2.53	2.76	26.65	996.53	995.66	26.53	2.52	24.33	0.91	0.31	998.71	24.30
	0.95	0.05	1.75	2.14	20.67	998.26	997.40	20.61	1.28	12.37	0.60	1.49	1012.21	12.52
	1	0	0	0.87	8.45	1000.00	999.13	8.44	0.00	0.00	0.00	3.73	1036.38	0.00
				Total volume collected by ideal sampler, ml ===>	774.10		Total sediment mass collected by ideal sampler, mg ====>	758.97	Total volume collected by test sampler, ml ===>	980.91			Total sediment mass collected by test sampler, mg ===>	960.85
			Concentration of sample collected by ideal sample, rmg/L		980.45			Concentration of sample collected by test sampler, mg/L		979.55				

Spreadsheet for BagHi sampler, 0.01-mm sediment and medium flow

ASSIGNED CONSTANTS	f, Fractional depth at sampling vertical (0 is surface, 1 is bottom)	Relative height of segment boundaries above stream bed	Stream velocity at segment boundaries, ft/s.	A, Average velocity in segment. Also ideal sampler average intake velocity, ft/s	Q, For ideal sampler, volume of sample collected in interval, ml	Sediment concentration at segment boundary, mg/L	Average concentration in segment. Also for ideal sampler, concentration of sample in segment, mg/L	For ideal sampler, mass of sediment collected in segment, mg	Intake Velocity of test sampler (TS), ft/s	Volume of sample collected in interval by TS, ml	Relative sampling rate for TS	Sediment concentration error for TS, percent	Concentration of sample collected in segment by TS, mg/L	Mass of sediment collected in segment by TS, mg
Sampler RgdConHi, Insert intake characteristic equation in column J.	0	1	5.13			0.15								
No, Sediment Concentration at Stream Bottom, mg/L	0.05	0.95	5.07	5.10	49.23	0.23	0.19	0.01	6.60	63.72	1.29	-7.25	0.18	0.01
1000	0.1	0.9	5.01	5.04	48.66	0.36	0.30	0.01	6.54	63.14	1.30	-7.32	0.27	0.02
c, Fall Velocity of particles, cm/s.	0.15	0.85	4.94	4.98	48.06	0.56	0.46	0.02	6.48	62.54	1.30	-7.39	0.43	0.03
7.6	0.2	0.8	4.88	4.91	47.41	0.87	0.71	0.03	6.41	61.90	1.31	-7.47	0.66	0.04
n, Manning roughness coefficient	0.25	0.75	4.80	4.84	46.73	1.35	1.11	0.05	6.34	61.22	1.31	-7.55	1.03	0.06
0.04	0.3	0.7	4.73	4.76	46.01	2.10	1.72	0.08	6.26	60.49	1.31	-7.65	1.59	0.10
D, Stream depth at sampling vertical, ft.	0.35	0.65	4.64	4.68	45.23	3.26	2.68	0.12	6.18	59.71	1.32	-7.75	2.47	0.15
6	0.4	0.6	4.55	4.60	44.39	5.06	4.16	0.18	6.10	58.87	1.33	-7.86	3.83	0.23
Vm, mean velocity in vertical, ft/s	0.45	0.55	4.45	4.50	43.48	7.86	6.46	0.28	6.00	57.96	1.33	-7.99	5.94	0.34
4	0.5	0.5	4.35	4.40	42.49	12.21	10.04	0.43	5.90	56.97	1.34	-8.13	9.22	0.53
d, sampler nozzle diameter, in.	0.55	0.45	4.23	4.29	41.39	18.97	15.59	0.65	5.79	55.88	1.35	-8.29	14.30	0.80
0.25	0.6	0.4	4.09	4.16	40.18	29.48	24.22	0.97	5.66	54.66	1.36	-8.48	22.17	1.21
T, sampling time in each segment, s.	0.65	0.35	3.94	4.02	38.81	45.79	37.63	1.46	5.52	53.29	1.37	-8.71	34.36	1.83
1	0.7	0.3	3.77	3.86	37.24	71.14	58.46	2.18	5.36	51.73	1.39	-8.98	53.21	2.75
	0.75	0.25	3.56	3.67	35.41	110.51	90.82	3.22	5.17	49.90	1.41	-9.32	82.36	4.11
	0.8	0.2	3.31	3.44	33.20	171.68	141.10	4.69	4.94	47.69	1.44	-9.77	127.31	6.07
	0.85	0.15	2.99	3.15	30.42	266.71	219.20	6.67	4.65	44.91	1.48	-10.40	196.40	8.82
	0.9	0.1	2.53	2.76	26.65	414.35	340.53	9.07	4.26	41.13	1.54	-11.40	301.69	12.41
	0.95	0.05	1.75	2.14	20.67	643.70	529.02	10.93	3.64	35.15	1.70	-13.44	457.91	16.10
	1	0	0	0.87	8.45	1000.00	821.85	6.94	2.37	22.93	2.71	-20.45	653.77	14.99
				Total volume collected by ideal sampler, ml ===>	774.10		Total sediment mass collected by ideal sampler, mg ====>	48.00	Total volume collected by test sampler, ml ===>	1063.79			Total sediment mass collected by test sampler, mg ===>	70.59
			Concentration of sample collected by ideal sample, rmg/L		62.01			Concentration of sample collected by test sampler, mg/L		66.36				

Spreadsheet for RgdConHi sampler, 0.45-mm sediment and medium flow

ASSIGNED CONSTANTS	f, Fractional depth at sampling vertical (0 is surface, 1 is bottom)	Relative height of segment boundaries above stream bed	Stream velocity at segment boundaries, ft/s.	A, Average velocity in segment. Also ideal sampler average intake velocity, ft/s	Q, For ideal sampler, volume of sample collected in interval, ml	Sediment concentration at segment boundary, mg/L	Average concentration in segment. Also for ideal sampler, concentration of sample in segment, mg/L	For ideal sampler, mass of sediment collected in segment, mg	Intake Velocity of test sampler (TS), ft/s	Volume of sample collected in interval by TS, ml	Relative sampling rate for TS	Sediment concentration error for TS, percent	Concentration of sample collected in segment by TS, mg/L	Mass of sediment collected in segment by TS, mg
Sampler RgdConHi, Insert intake characteristic equation in column J.	0	1	5.13			98.42								
No, Sediment Concentration at Stream Bottom, mg/L	0.05	0.95	5.07	5.10	49.23	110.51	104.46	5.14	6.60	63.72	1.29	-5.52	98.69	6.29
1000	0.1	0.9	5.01	5.04	48.66	124.10	117.30	5.71	6.54	63.14	1.30	-5.57	110.77	6.99
c, Fall Velocity of particles, cm/s.	0.15	0.85	4.94	4.98	48.06	139.35	131.72	6.33	6.48	62.54	1.30	-5.63	124.31	7.77
2	0.2	0.8	4.88	4.91	47.41	156.48	147.91	7.01	6.41	61.90	1.31	-5.68	139.50	8.64
n, Manning roughness coefficient	0.25	0.75	4.80	4.84	46.73	175.71	166.09	7.76	6.34	61.22	1.31	-5.75	156.55	9.58
0.04	0.3	0.7	4.73	4.76	46.01	197.31	186.51	8.58	6.26	60.49	1.31	-5.82	175.66	10.63
D, Stream depth at sampling vertical, ft.	0.35	0.65	4.64	4.68	45.23	221.56	209.43	9.47	6.18	59.71	1.32	-5.89	197.10	11.77
6	0.4	0.6	4.55	4.60	44.39	248.79	235.18	10.44	6.10	58.87	1.33	-5.97	221.13	13.02
Vm, mean velocity in vertical, ft/s	0.45	0.55	4.45	4.50	43.48	279.37	264.08	11.48	6.00	57.96	1.33	-6.07	248.07	14.38
4	0.5	0.5	4.35	4.40	42.49	313.71	296.54	12.60	5.90	56.97	1.34	-6.17	278.25	15.85
d, sampler nozzle diameter, in.	0.55	0.45	4.23	4.29	41.39	352.27	332.99	13.78	5.79	55.88	1.35	-6.29	312.06	17.44
0.25	0.6	0.4	4.09	4.16	40.18	395.57	373.92	15.02	5.66	54.66	1.36	-6.42	349.90	19.13
T, sampling time in each segment, s.	0.65	0.35	3.94	4.02	38.81	444.19	419.88	16.30	5.52	53.29	1.37	-6.58	392.24	20.90
1	0.7	0.3	3.77	3.86	37.24	498.79	471.49	17.56	5.36	51.73	1.39	-6.78	439.54	22.74
	0.75	0.25	3.56	3.67	35.41	560.10	529.45	18.75	5.17	49.90	1.41	-7.02	492.29	24.56
	0.8	0.2	3.31	3.44	33.20	628.94	594.52	19.74	4.94	47.69	1.44	-7.33	550.96	26.27
	0.85	0.15	2.99	3.15	30.42	706.25	667.60	20.31	4.65	44.91	1.48	-7.76	615.82	27.65
	0.9	0.1	2.53	2.76	26.65	793.06	749.66	19.98	4.26	41.13	1.54	-8.41	686.62	28.24
	0.95	0.05	1.75	2.14	20.67	890.54	841.80	17.40	3.64	35.15	1.70	-9.63	760.73	26.74
	1	0	0	0.87	8.45	1000.00	945.27	7.98	2.37	22.93	2.71	-12.39	828.17	18.99
				Total volume collected by ideal sampler, ml ===>	774.10		Total sediment mass collected by ideal sampler, mg ====>	251.35	Total volume collected by test sampler, ml ===>	1063.79			Total sediment mass collected by test sampler, mg ===>	337.59
			Concentration of sample collected by ideal sample, rmg/L		324.70			Concentration of sample collected by test sampler, mg/L		317.35				

Spreadsheet for RgdConHi sampler, 0.15-mm sediment and medium flow

ASSIGNED CONSTANTS	f, Fractional depth at sampling vertical (0 is surface, 1 is bottom)	Relative height of segment boundaries above stream bed	Stream velocity at segment boundaries, ft/s.	A, Average velocity in segment. Also ideal sampler average intake velocity, ft/s	Q, For ideal sampler, volume of sample collected in interval, ml	Sediment concentration at segment boundary, mg/L	Average concentration in segment. Also for ideal sampler, concentration of sample in segment, mg/L	For ideal sampler, mass of sediment collected in segment, mg	Intake Velocity of test sampler (TS), ft/s	Volume of sample collected in interval by TS, ml	Relative sampling rate for TS	Sediment concentration error for TS, percent	Concentration of sample collected in segment by TS, mg/L	Mass of sediment collected in segment by TS, mg
Sampler RgdConHi, Insert intake characteristic equation in column J.	0	1	5.13			498.79								
No, Sediment Concentration at Stream Bottom, mg/L	0.05	0.95	5.07	5.10	49.23	516.44	507.62	24.99	6.60	63.72	1.29	-0.85	503.29	32.07
1000	0.1	0.9	5.01	5.04	48.66	534.72	525.58	25.58	6.54	63.14	1.30	-0.86	521.06	32.90
c, Fall Velocity of particles, cm/s.	0.15	0.85	4.94	4.98	48.06	553.64	544.18	26.15	6.48	62.54	1.30	-0.87	539.45	33.74
0.6	0.2	0.8	4.88	4.91	47.41	573.24	563.44	26.71	6.41	61.90	1.31	-0.88	558.49	34.57
n, Manning roughness coefficient	0.25	0.75	4.80	4.84	46.73	593.53	583.38	27.26	6.34	61.22	1.31	-0.89	578.19	35.40
0.04	0.3	0.7	4.73	4.76	46.01	614.53	604.03	27.79	6.26	60.49	1.31	-0.90	598.59	36.21
D, Stream depth at sampling vertical, ft.	0.35	0.65	4.64	4.68	45.23	636.28	625.40	28.28	6.18	59.71	1.32	-0.91	619.69	37.00
6	0.4	0.6	4.55	4.60	44.39	658.80	647.54	28.74	6.10	58.87	1.33	-0.93	641.53	37.77
Vm, mean velocity in vertical, ft/s	0.45	0.55	4.45	4.50	43.48	682.11	670.45	29.15	6.00	57.96	1.33	-0.94	664.13	38.49
4	0.5	0.5	4.35	4.40	42.49	706.25	694.18	29.49	5.90	56.97	1.34	-0.96	687.52	39.17
d, sampler nozzle diameter, in.	0.55	0.45	4.23	4.29	41.39	731.25	718.75	29.75	5.79	55.88	1.35	-0.98	711.70	39.77
0.25	0.6	0.4	4.09	4.16	40.18	757.12	744.19	29.90	5.66	54.66	1.36	-1.00	736.72	40.27
T, sampling time in each segment, s.	0.65	0.35	3.94	4.02	38.81	783.92	770.52	29.90	5.52	53.29	1.37	-1.03	762.57	40.64
1	0.7	0.3	3.77	3.86	37.24	811.66	797.79	29.71	5.36	51.73	1.39	-1.07	789.29	40.83
	0.75	0.25	3.56	3.67	35.41	840.39	826.03	29.25	5.17	49.90	1.41	-1.11	816.88	40.76
	0.8	0.2	3.31	3.44	33.20	870.13	855.26	28.40	4.94	47.69	1.44	-1.16	845.31	40.31
	0.85	0.15	2.99	3.15	30.42	900.92	885.53	26.94	4.65	44.91	1.48	-1.24	874.54	39.27
	0.9	0.1	2.53	2.76	26.65	932.81	916.87	24.43	4.26	41.13	1.54	-1.37	904.35	37.20
	0.95	0.05	1.75	2.14	20.67	965.82	949.31	19.62	3.64	35.15	1.70	-1.62	933.92	32.83
	1	0	0	0.87	8.45	1000.00	982.91	8.30	2.37	22.93	2.71	-2.71	956.23	21.93
				Total volume collected by ideal sampler, ml ===>	774.10		Total sediment mass collected by ideal sampler, mg ====>	530.37	Total volume collected by test sampler, ml ===>	1063.79			Total sediment mass collected by test sampler, mg ===>	731.12
			Concentration of sample collected by ideal sample, rmg/L		685.14			Concentration of sample collected by test sampler, mg/L		687.28				

Spreadsheet for RgdConHi sampler, 0.06-mm sediment and medium flow

ASSIGNED CONSTANTS	f, Fractional depth at sampling vertical (0 is surface, 1 is bottom)	Relative height of segment boundaries above stream bed	Stream velocity at segment boundaries, ft/s.	A, Average velocity in segment. Also ideal sampler average intake velocity, ft/s	Q, For ideal sampler, volume of sample collected in interval, ml	Sediment concentration at segment boundary, mg/L	Average concentration in segment. Also for ideal sampler, concentration of sample in segment, mg/L	For ideal sampler, mass of sediment collected in segment, mg	Intake Velocity of test sampler (TS), ft/s	Volume of sample collected in interval by TS, ml	Relative sampling rate for TS	Sediment concentration error for TS, percent	Concentration of sample collected in segment by TS, mg/L	Mass of sediment collected in segment by TS, mg
Sampler RgdConHi, Insert intake characteristic equation in column J.	0	1	5.13			965.82								
No, Sediment Concentration at Stream Bottom, mg/L	0.05	0.95	5.07	5.10	49.23	967.50	966.66	47.59	6.60	63.72	1.29	0.00	966.66	61.59
1000	0.1	0.9	5.01	5.04	48.66	969.18	968.34	47.12	6.54	63.14	1.30	0.00	968.34	61.15
c, Fall Velocity of particles, cm/s.	0.15	0.85	4.94	4.98	48.06	970.87	970.03	46.61	6.48	62.54	1.30	0.00	970.03	60.66
0.03	0.2	0.8	4.88	4.91	47.41	972.56	971.72	46.07	6.41	61.90	1.31	0.00	971.72	60.15
n, Manning roughness coefficient	0.25	0.75	4.80	4.84	46.73	974.25	973.41	45.49	6.34	61.22	1.31	0.00	973.41	59.59
0.04	0.3	0.7	4.73	4.76	46.01	975.95	975.10	44.86	6.26	60.49	1.31	0.00	975.10	58.98
D, Stream depth at sampling vertical, ft.	0.35	0.65	4.64	4.68	45.23	977.65	976.80	44.18	6.18	59.71	1.32	0.00	976.80	58.33
6	0.4	0.6	4.55	4.60	44.39	979.35	978.50	43.43	6.10	58.87	1.33	0.00	978.50	57.61
Vm, mean velocity in vertical, ft/s	0.45	0.55	4.45	4.50	43.48	981.05	980.20	42.62	6.00	57.96	1.33	0.00	980.20	56.81
4	0.5	0.5	4.35	4.40	42.49	982.76	981.91	41.72	5.90	56.97	1.34	0.00	981.91	55.94
d, sampler nozzle diameter, in.	0.55	0.45	4.23	4.29	41.39	984.47	983.62	40.71	5.79	55.88	1.35	0.00	983.62	54.96
0.25	0.6	0.4	4.09	4.16	40.18	986.18	985.33	39.59	5.66	54.66	1.36	0.00	985.33	53.86
T, sampling time in each segment, s.	0.65	0.35	3.94	4.02	38.81	987.90	987.04	38.31	5.52	53.29	1.37	0.00	987.04	52.60
1	0.7	0.3	3.77	3.86	37.24	989.62	988.76	36.82	5.36	51.73	1.39	0.00	988.76	51.15
	0.75	0.25	3.56	3.67	35.41	991.34	990.48	35.07	5.17	49.90	1.41	0.00	990.48	49.42
	0.8	0.2	3.31	3.44	33.20	993.07	992.21	32.95	4.94	47.69	1.44	0.00	992.21	47.32
	0.85	0.15	2.99	3.15	30.42	994.80	993.93	30.24	4.65	44.91	1.48	0.00	993.93	44.63
	0.9	0.1	2.53	2.76	26.65	996.53	995.66	26.53	4.26	41.13	1.54	0.00	995.66	40.96
	0.95	0.05	1.75	2.14	20.67	998.26	997.40	20.61	3.64	35.15	1.70	0.00	997.40	35.06
	1	0	0	0.87	8.45	1000.00	999.13	8.44	2.37	22.93	2.71	0.00	999.13	22.91
				Total volume collected by ideal sampler, ml ===>	774.10		Total sediment mass collected by ideal sampler, mg ====>	758.97	Total volume collected by test sampler, ml ===>	1063.79			Total sediment mass collected by test sampler, mg ===>	1043.68
			Concentration of sample collected by ideal sample, rmg/L		980.45			Concentration of sample collected by test sampler, mg/L		981.10				

Spreadsheet for RgdConHi sampler, 0.01-mm sediment and medium flow

ASSIGNED CONSTANTS	f, Fractional depth at sampling vertical (0 is surface, 1 is bottom)	Relative height of segment boundaries above stream bed	Stream velocity at segment boundaries, ft/s.	A, Average velocity in segment. Also ideal sampler average intake velocity, ft/s	Q, For ideal sampler, volume of sample collected in interval, ml	Sediment concentration at segment boundary, mg/L	Average concentration in segment. Also for ideal sampler, concentration of sample in segment, mg/L	For ideal sampler, mass of sediment collected in segment, mg	Intake Velocity of test sampler (TS), ft/s	Volume of sample collected in interval by TS, ml	Relative sampling rate for TS	Sediment concentration error for TS, percent	Concentration of sample collected in segment by TS, mg/L	Mass of sediment collected in segment by TS, mg
Sampler BagLo, Insert intake characteristic equation in column J.	0	1	5.13			0.15								
	0.05	0.95	5.07	5.10	49.23	0.23	0.19	0.01	3.60	34.75	0.71	12.96	0.22	0.01
No, Sediment Concentration at Stream Bottom, mg/L	0.1	0.9	5.01	5.04	48.66	0.36	0.30	0.01	3.54	34.18	0.70	13.16	0.33	0.01
1000	0.15	0.85	4.94	4.98	48.06	0.56	0.46	0.02	3.48	33.57	0.70	13.38	0.52	0.02
c, Fall Velocity of particles, cm/s.	0.2	0.8	4.88	4.91	47.41	0.87	0.71	0.03	3.41	32.93	0.69	13.62	0.81	0.03
7.6	0.25	0.75	4.80	4.84	46.73	1.35	1.11	0.05	3.34	32.25	0.69	13.87	1.26	0.04
n, Manning roughness coefficient	0.3	0.7	4.73	4.76	46.01	2.10	1.72	0.08	3.26	31.52	0.69	14.15	1.97	0.06
0.04	0.35	0.65	4.64	4.68	45.23	3.26	2.68	0.12	3.18	30.74	0.68	14.46	3.06	0.09
D, Stream depth at sampling vertical, ft.	0.4	0.6	4.55	4.60	44.39	5.06	4.16	0.18	3.10	29.90	0.67	14.81	4.77	0.14
6	0.45	0.55	4.45	4.50	43.48	7.86	6.46	0.28	3.00	28.99	0.67	15.20	7.44	0.22
Vm, mean velocity in vertical, ft/s	0.5	0.5	4.35	4.40	42.49	12.21	10.04	0.43	2.90	28.00	0.66	15.64	11.61	0.33
4	0.55	0.45	4.23	4.29	41.39	18.97	15.59	0.65	2.79	26.91	0.65	16.16	18.11	0.49
d, sampler nozzle diameter, in.	0.6	0.4	4.09	4.16	40.18	29.48	24.22	0.97	2.66	25.69	0.64	16.77	28.29	0.73
0.25	0.65	0.35	3.94	4.02	38.81	45.79	37.63	1.46	2.52	24.33	0.63	17.51	44.22	1.08
T, sampling time in each segment, s.	0.7	0.3	3.77	3.86	37.24	71.14	58.46	2.18	2.36	22.76	0.61	18.45	69.25	1.58
1	0.75	0.25	3.56	3.67	35.41	110.51	90.82	3.22	2.17	20.93	0.59	19.71	108.73	2.28
	0.8	0.2	3.31	3.44	33.20	171.68	141.10	4.69	1.94	18.72	0.56	21.58	171.55	3.21
	0.85	0.15	2.99	3.15	30.42	266.71	219.20	6.67	1.65	15.94	0.52	24.84	273.65	4.36
	0.9	0.1	2.53	2.76	26.65	414.35	340.53	9.07	1.26	12.16	0.46	32.75	452.06	5.50
	0.95	0.05	1.75	2.14	20.67	643.70	529.02	10.93	0.64	6.18	0.30	75.99	931.00	5.76
	1	0	0	0.87	8.45	1000.00	821.85	6.94	0.00	0.00	0.00	406.58	4163.32	0.00
				Total volume collected by ideal sampler, ml ===>	774.10		Total sediment mass collected by ideal sampler, mg ====>	48.00	Total volume collected by test sampler, ml ===>	490.45			Total sediment mass collected by test sampler, mg ===>	25.91
			Concentration of sample collected by ideal sample, rmg/L		62.01			Concentration of sample collected by test sampler, mg/L		52.84				

Spreadsheet for BagLo sampler, 0.45-mm sediment and medium flow

ASSIGNED CONSTANTS	f, Fractional depth at sampling vertical (0 is surface, 1 is bottom)	Relative height of segment boundaries above stream bed	Stream velocity at segment boundaries, ft/s.	A, Average velocity in segment. Also ideal sampler average intake velocity, ft/s	Q, For ideal sampler, volume of sample collected in interval, ml	Sediment concentration at segment boundary, mg/L	Average concentration in segment. Also for ideal sampler, concentration of sample in segment, mg/L	For ideal sampler, mass of sediment collected in segment, mg	Intake Velocity of test sampler (TS), ft/s	Volume of sample collected in interval by TS, ml	Relative sampling rate for TS	Sediment concentration error for TS, percent	Concentration of sample collected in segment by TS, mg/L	Mass of sediment collected in segment by TS, mg
Sampler BagLo, Insert intake characteristic equation in column J.	0	1	5.13			98.42								
	0.05	0.95	5.07	5.10	49.23	110.51	104.46	5.14	3.60	34.75	0.71	9.03	113.90	3.96
No, Sediment Concentration at Stream Bottom, mg/L	0.1	0.9	5.01	5.04	48.66	124.10	117.30	5.71	3.54	34.18	0.70	9.19	128.08	4.38
1000	0.15	0.85	4.94	4.98	48.06	139.35	131.72	6.33	3.48	33.57	0.70	9.35	144.04	4.84
c, Fall Velocity of particles, cm/s.	0.2	0.8	4.88	4.91	47.41	156.48	147.91	7.01	3.41	32.93	0.69	9.54	162.02	5.34
2	0.25	0.75	4.80	4.84	46.73	175.71	166.09	7.76	3.34	32.25	0.69	9.74	182.27	5.88
n, Manning roughness coefficient	0.3	0.7	4.73	4.76	46.01	197.31	186.51	8.58	3.26	31.52	0.69	9.96	205.09	6.46
0.04	0.35	0.65	4.64	4.68	45.23	221.56	209.43	9.47	3.18	30.74	0.68	10.22	230.83	7.10
D, Stream depth at sampling vertical, ft.	0.4	0.6	4.55	4.60	44.39	248.79	235.18	10.44	3.10	29.90	0.67	10.50	259.86	7.77
6	0.45	0.55	4.45	4.50	43.48	279.37	264.08	11.48	3.00	28.99	0.67	10.82	292.65	8.48
Vm, mean velocity in vertical, ft/s	0.5	0.5	4.35	4.40	42.49	313.71	296.54	12.60	2.90	28.00	0.66	11.19	329.72	9.23
4	0.55	0.45	4.23	4.29	41.39	352.27	332.99	13.78	2.79	26.91	0.65	11.62	371.70	10.00
d, sampler nozzle diameter, in.	0.6	0.4	4.09	4.16	40.18	395.57	373.92	15.02	2.66	25.69	0.64	12.14	419.33	10.77
0.25	0.65	0.35	3.94	4.02	38.81	444.19	419.88	16.30	2.52	24.33	0.63	12.78	473.56	11.52
T, sampling time in each segment, s.	0.7	0.3	3.77	3.86	37.24	498.79	471.49	17.56	2.36	22.76	0.61	13.60	535.61	12.19
1	0.75	0.25	3.56	3.67	35.41	560.10	529.45	18.75	2.17	20.93	0.59	14.69	607.21	12.71
	0.8	0.2	3.31	3.44	33.20	628.94	594.52	19.74	1.94	18.72	0.56	16.26	691.18	12.94
	0.85	0.15	2.99	3.15	30.42	706.25	667.60	20.31	1.65	15.94	0.52	18.81	793.18	12.64
	0.9	0.1	2.53	2.76	26.65	793.06	749.66	19.98	1.26	12.16	0.46	24.08	930.19	11.32
	0.95	0.05	1.75	2.14	20.67	890.54	841.80	17.40	0.64	6.18	0.30	44.57	1217.01	7.53
	1	0	0	0.87	8.45	1000.00	945.27	7.98	0.00	0.00	0.00	156.13	2421.12	0.00
				Total volume collected by ideal sampler, ml ===>	774.10		Total sediment mass collected by ideal sampler, mg ====>	251.35	Total volume collected by test sampler, ml ===>	490.45			Total sediment mass collected by test sampler, mg ===>	165.05
			Concentration of sample collected by ideal sample, rmg/L		324.70			Concentration of sample collected by test sampler, mg/L		336.52				

Spreadsheet for BagLo sampler, 0.15-mm sediment and medium flow

ASSIGNED CONSTANTS	f, Fractional depth at sampling vertical (0 is surface, 1 is bottom)	Relative height of segment boundaries above stream bed	Stream velocity at segment boundaries, ft/s.	A, Average velocity in segment. Also ideal sampler average intake velocity, ft/s	Q, For ideal sampler, volume of sample collected in interval, ml	Sediment concentration at segment boundary, mg/L	Average concentration in segment. Also for ideal sampler, concentration of sample in segment, mg/L	For ideal sampler, mass of sediment collected in segment, mg	Intake Velocity of test sampler (TS), ft/s	Volume of sample collected in interval by TS, ml	Relative sampling rate for TS	Sediment concentration error for TS, percent	Concentration of sample collected in segment by TS, mg/L	Mass of sediment collected in segment by TS, mg
Sampler BagLo, Insert intake characteristic equation in column J.	0	1	5.13			498.79								
	0.05	0.95	5.07	5.10	49.23	516.44	507.62	24.99	3.60	34.75	0.71	1.48	515.14	17.90
No, Sediment Concentration at Stream Bottom, mg/L	0.1	0.9	5.01	5.04	48.66	534.72	525.58	25.58	3.54	34.18	0.70	1.50	533.46	18.23
1000	0.15	0.85	4.94	4.98	48.06	553.64	544.18	26.15	3.48	33.57	0.70	1.52	552.45	18.55
c, Fall Velocity of particles, cm/s.	0.2	0.8	4.88	4.91	47.41	573.24	563.44	26.71	3.41	32.93	0.69	1.54	572.12	18.84
0.6	0.25	0.75	4.80	4.84	46.73	593.53	583.38	27.26	3.34	32.25	0.69	1.56	592.50	19.11
n, Manning roughness coefficient	0.3	0.7	4.73	4.76	46.01	614.53	604.03	27.79	3.26	31.52	0.69	1.59	613.62	19.34
0.04	0.35	0.65	4.64	4.68	45.23	636.28	625.40	28.28	3.18	30.74	0.68	1.62	635.51	19.54
D, Stream depth at sampling vertical, ft.	0.4	0.6	4.55	4.60	44.39	658.80	647.54	28.74	3.10	29.90	0.67	1.65	658.20	19.68
6	0.45	0.55	4.45	4.50	43.48	682.11	670.45	29.15	3.00	28.99	0.67	1.68	681.72	19.77
Vm, mean velocity in vertical, ft/s	0.5	0.5	4.35	4.40	42.49	706.25	694.18	29.49	2.90	28.00	0.66	1.72	706.13	19.77
4	0.55	0.45	4.23	4.29	41.39	731.25	718.75	29.75	2.79	26.91	0.65	1.77	731.45	19.68
d, sampler nozzle diameter, in.	0.6	0.4	4.09	4.16	40.18	757.12	744.19	29.90	2.66	25.69	0.64	1.82	757.75	19.47
0.25	0.65	0.35	3.94	4.02	38.81	783.92	770.52	29.90	2.52	24.33	0.63	1.89	785.08	19.10
T, sampling time in each segment, s.	0.7	0.3	3.77	3.86	37.24	811.66	797.79	29.71	2.36	22.76	0.61	1.97	813.54	18.52
1	0.75	0.25	3.56	3.67	35.41	840.39	826.03	29.25	2.17	20.93	0.59	2.09	843.27	17.65
	0.8	0.2	3.31	3.44	33.20	870.13	855.26	28.40	1.94	18.72	0.56	2.25	874.53	16.37
	0.85	0.15	2.99	3.15	30.42	900.92	885.53	26.94	1.65	15.94	0.52	2.53	907.94	14.47
	0.9	0.1	2.53	2.76	26.65	932.81	916.87	24.43	1.26	12.16	0.46	3.16	945.80	11.51
	0.95	0.05	1.75	2.14	20.67	965.82	949.31	19.62	0.64	6.18	0.30	6.11	1007.31	6.23
	1	0	0	0.87	8.45	1000.00	982.91	8.30	0.00	0.00	0.00	25.84	1236.93	0.00
				Total volume collected by ideal sampler, ml ===>	774.10		Total sediment mass collected by ideal sampler, mg ====>	530.37	Total volume collected by test sampler, ml ===>	490.45			Total sediment mass collected by test sampler, mg ===>	333.71
			Concentration of sample collected by ideal sample, rmg/L		685.14			Concentration of sample collected by test sampler, mg/L		680.41				

Spreadsheet for BagLo sampler, 0.06-mm sediment and medium flow

ASSIGNED CONSTANTS	f, Fractional depth at sampling vertical (0 is surface, 1 is bottom)	Relative height of segment boundaries above stream bed	Stream velocity at segment boundaries, ft/s.	A, Average velocity in segment. Also ideal sampler average intake velocity, ft/s	Q, For ideal sampler, volume of sample collected in interval, ml	Sediment concentration at segment boundary, mg/L	Average concentration in segment. Also for ideal sampler, concentration of sample in segment, mg/L	For ideal sampler, mass of sediment collected in segment, mg	Intake Velocity of test sampler (TS), ft/s	Volume of sample collected in interval by TS, ml	Relative sampling rate for TS	Sediment concentration error for TS, percent	Concentration of sample collected in segment by TS, mg/L	Mass of sediment collected in segment by TS, mg
Sampler BagLo, Insert intake characteristic equation in column J.	0	1	5.13			965.82								
	0.05	0.95	5.07	5.10	49.23	967.50	966.66	47.59	3.60	34.75	0.71	1.08	977.13	33.95
No, Sediment Concentration at Stream Bottom, mg/L	0.1	0.9	5.01	5.04	48.66	969.18	968.34	47.12	3.54	34.18	0.70	1.10	978.95	33.46
1000	0.15	0.85	4.94	4.98	48.06	970.87	970.03	46.61	3.48	33.57	0.70	1.11	980.79	32.93
c, Fall Velocity of particles, cm/s.	0.2	0.8	4.88	4.91	47.41	972.56	971.72	46.07	3.41	32.93	0.69	1.13	982.65	32.36
0.03	0.25	0.75	4.80	4.84	46.73	974.25	973.41	45.49	3.34	32.25	0.69	1.14	984.52	31.75
n, Manning roughness coefficient	0.3	0.7	4.73	4.76	46.01	975.95	975.10	44.86	3.26	31.52	0.69	1.16	986.41	31.09
0.04	0.35	0.65	4.64	4.68	45.23	977.65	976.80	44.18	3.18	30.74	0.68	1.18	988.33	30.38
D, Stream depth at sampling vertical, ft.	0.4	0.6	4.55	4.60	44.39	979.35	978.50	43.43	3.10	29.90	0.67	1.20	990.27	29.61
6	0.45	0.55	4.45	4.50	43.48	981.05	980.20	42.62	3.00	28.99	0.67	1.23	992.25	28.77
Vm, mean velocity in vertical, ft/s	0.5	0.5	4.35	4.40	42.49	982.76	981.91	41.72	2.90	28.00	0.66	1.26	994.26	27.84
4	0.55	0.45	4.23	4.29	41.39	984.47	983.62	40.71	2.79	26.91	0.65	1.29	996.32	26.81
d, sampler nozzle diameter, in.	0.6	0.4	4.09	4.16	40.18	986.18	985.33	39.59	2.66	25.69	0.64	1.33	998.45	25.65
0.25	0.65	0.35	3.94	4.02	38.81	987.90	987.04	38.31	2.52	24.33	0.63	1.38	1000.65	24.34
T, sampling time in each segment, s.	0.7	0.3	3.77	3.86	37.24	989.62	988.76	36.82	2.36	22.76	0.61	1.44	1002.98	22.83
1	0.75	0.25	3.56	3.67	35.41	991.34	990.48	35.07	2.17	20.93	0.59	1.51	1005.47	21.04
	0.8	0.2	3.31	3.44	33.20	993.07	992.21	32.95	1.94	18.72	0.56	1.62	1008.23	18.87
	0.85	0.15	2.99	3.15	30.42	994.80	993.93	30.24	1.65	15.94	0.52	1.76	1011.47	16.12
	0.9	0.1	2.53	2.76	26.65	996.53	995.66	26.53	1.26	12.16	0.46	2.02	1015.75	12.36
	0.95	0.05	1.75	2.14	20.67	998.26	997.40	20.61	0.64	6.18	0.30	2.61	1023.39	6.33
	1	0	0	0.87	8.45	1000.00	999.13	8.44	0.00	0.00	0.00	3.73	1036.38	0.00
				Total volume collected by ideal sampler, ml ===>	774.10		Total sediment mass collected by ideal sampler, mg ====>	758.97	Total volume collected by test sampler, ml ===>	490.45			Total sediment mass collected by test sampler, mg ===>	486.49
			Concentration of sample collected by ideal sample, rmg/L		980.45			Concentration of sample collected by test sampler, mg/L		991.92				

Spreadsheet for BagLo sampler, 0.01-mm sediment and medium flow

ASSIGNED CONSTANTS	f, Fractional depth at sampling vertical (0 is surface, 1 is bottom)	Relative height of segment boundaries above stream bed	Stream velocity at segment boundaries, ft/s.	A, Average velocity in segment. Also ideal sampler average intake velocity, ft/s	Q, For ideal sampler, volume of sample collected in interval, ml	Sediment concentration at segment boundary, mg/L	Average concentration in segment. Also for ideal sampler, concentration of sample in segment, mg/L	For ideal sampler, mass of sediment collected in segment, mg	Intake Velocity of test sampler (TS), ft/s	Volume of sample collected in interval by TS, ml	Relative sampling rate for TS	Sediment concentration error for TS, percent	Concentration of sample collected in segment by TS, mg/L	Mass of sediment collected in segment by TS, mg
Sampler RgdConLo, Insert intake characteristic equation in column J.	0	1	2.63			0.00								
No, Sediment Concentration at Stream Bottom, mg/L	0.05	0.95	2.60	2.62	25.27	0.00	0.00	0.00	2.81	27.12	1.07	-2.41	0.00	0.00
1000	0.1	0.9	2.57	2.58	24.94	0.00	0.00	0.00	2.79	26.96	1.08	-2.59	0.00	0.00
c, Fall Velocity of particles, cm/s.	0.15	0.85	2.53	2.55	24.60	0.00	0.00	0.00	2.77	26.79	1.09	-2.79	0.00	0.00
7.6	0.2	0.8	2.49	2.51	24.25	0.00	0.00	0.00	2.76	26.61	1.10	-3.00	0.00	0.00
n, Manning roughness coefficient	0.25	0.75	2.45	2.47	23.86	0.01	0.01	0.00	2.74	26.42	1.11	-3.23	0.01	0.00
0.04	0.3	0.7	2.41	2.43	23.45	0.02	0.01	0.00	2.71	26.21	1.12	-3.48	0.01	0.00
D, Stream depth at sampling vertical, ft.	0.35	0.65	2.36	2.38	23.02	0.04	0.03	0.00	2.69	25.99	1.13	-3.76	0.03	0.00
3	0.4	0.6	2.31	2.33	22.55	0.08	0.06	0.00	2.67	25.76	1.14	-4.06	0.06	0.00
Vm, mean velocity in vertical, ft/s	0.45	0.55	2.25	2.28	22.04	0.18	0.13	0.00	2.64	25.50	1.16	-4.40	0.12	0.00
2	0.5	0.5	2.19	2.22	21.48	0.39	0.28	0.01	2.61	25.22	1.17	-4.78	0.27	0.01
d, sampler nozzle diameter, in.	0.55	0.45	2.13	2.16	20.87	0.86	0.62	0.01	2.58	24.92	1.19	-5.21	0.59	0.01
0.25	0.6	0.4	2.05	2.09	20.18	1.87	1.36	0.03	2.55	24.58	1.22	-5.71	1.29	0.03
T, sampling time in each segment, s.	0.65	0.35	1.97	2.01	19.42	4.11	2.99	0.06	2.51	24.19	1.25	-6.30	2.80	0.07
1	0.7	0.3	1.87	1.92	18.54	9.01	6.56	0.12	2.46	23.75	1.28	-7.01	6.10	0.14
	0.75	0.25	1.76	1.81	17.51	19.75	14.38	0.25	2.41	23.24	1.33	-7.88	13.25	0.31
	0.8	0.2	1.61	1.68	16.27	43.29	31.52	0.51	2.34	22.62	1.39	-9.00	28.68	0.65
	0.85	0.15	1.43	1.52	14.71	94.91	69.10	1.02	2.26	21.84	1.48	-10.54	61.82	1.35
	0.9	0.1	1.18	1.30	12.59	208.07	151.49	1.91	2.15	20.78	1.65	-12.83	132.05	2.74
	0.95	0.05	0.74	0.96	9.23	456.15	332.11	3.07	1.98	19.10	2.07	-16.91	275.95	5.27
	1	0	0	0.37	3.56	1000.00	728.08	2.59	1.68	16.26	4.57	-27.12	530.59	8.63
				Total volume collected by ideal sampler, ml ===>	388.33		Total sediment mass collected by ideal sampler, mg =====>	9.58	Total volume collected by test sampler, ml ===>	483.85			Total sediment mass collected by test sampler, mg ===>	19.22
			Concentration of sample collected by ideal sample, rmg/L		24.66			Concentration of sample collected by test sampler, mg/L		39.73				

Spreadsheet for RgdConLo sampler, 0.45-mm sediment and low flow

ASSIGNED CONSTANTS	f, Fractional depth at sampling vertical (0 is surface, 1 is bottom)	Relative height of segment boundaries above stream bed	Stream velocity at segment boundaries, ft/s.	A, Average velocity in segment. Also ideal sampler average intake velocity, ft/s	Q, For ideal sampler, volume of sample collected in interval, ml	Sediment concentration at segment boundary, mg/L	Average concentration in segment. Also for ideal sampler, concentration of sample in segment, mg/L	For ideal sampler, mass of sediment collected in segment, mg	Intake Velocity of test sampler (TS), ft/s	Volume of sample collected in interval by TS, ml	Relative sampling rate for TS	Sediment concentration error for TS, percent	Concentration of sample collected in segment by TS, mg/L	Mass of sediment collected in segment by TS, mg
Sampler RgdConLo, Insert intake characteristic equation in column J.	0	1	2.63			16.06								
No, Sediment Concentration at Stream Bottom, mg/L	0.05	0.95	2.60	2.62	25.27	19.75	17.91	0.45	2.81	27.12	1.07	-1.68	17.60	0.48
1000	0.1	0.9	2.57	2.58	24.94	24.28	22.01	0.55	2.79	26.96	1.08	-1.83	21.61	0.58
c, Fall Velocity of particles, cm/s.	0.15	0.85	2.53	2.55	24.60	29.85	27.07	0.67	2.77	26.79	1.09	-2.00	26.53	0.71
2	0.2	0.8	2.49	2.51	24.25	36.70	33.28	0.81	2.76	26.61	1.10	-2.17	32.55	0.87
n, Manning roughness coefficient	0.25	0.75	2.45	2.47	23.86	45.12	40.91	0.98	2.74	26.42	1.11	-2.36	39.94	1.06
0.04	0.3	0.7	2.41	2.43	23.45	55.47	50.30	1.18	2.71	26.21	1.12	-2.57	49.01	1.28
D, Stream depth at sampling vertical, ft.	0.35	0.65	2.36	2.38	23.02	68.20	61.84	1.42	2.69	25.99	1.13	-2.79	60.11	1.56
3	0.4	0.6	2.31	2.33	22.55	83.85	76.03	1.71	2.67	25.76	1.14	-3.04	73.72	1.90
Vm, mean velocity in vertical, ft/s	0.45	0.55	2.25	2.28	22.04	103.09	93.47	2.06	2.64	25.50	1.16	-3.31	90.38	2.30
2	0.5	0.5	2.19	2.22	21.48	126.74	114.91	2.47	2.61	25.22	1.17	-3.61	110.76	2.79
d, sampler nozzle diameter, in.	0.55	0.45	2.13	2.16	20.87	155.82	141.28	2.95	2.58	24.92	1.19	-3.96	135.69	3.38
0.25	0.6	0.4	2.05	2.09	20.18	191.57	173.70	3.51	2.55	24.58	1.22	-4.35	166.15	4.08
T, sampling time in each segment, s.	0.65	0.35	1.97	2.01	19.42	235.53	213.55	4.15	2.51	24.19	1.25	-4.80	203.30	4.92
1	0.7	0.3	1.87	1.92	18.54	289.57	262.55	4.87	2.46	23.75	1.28	-5.34	248.53	5.90
	0.75	0.25	1.76	1.81	17.51	356.01	322.79	5.65	2.41	23.24	1.33	-5.99	303.47	7.05
	0.8	0.2	1.61	1.68	16.27	437.69	396.85	6.46	2.34	22.62	1.39	-6.79	369.89	8.37
	0.85	0.15	1.43	1.52	14.71	538.11	487.90	7.18	2.26	21.84	1.48	-7.84	449.63	9.82
	0.9	0.1	1.18	1.30	12.59	661.58	599.85	7.55	2.15	20.78	1.65	-9.28	544.18	11.31
	0.95	0.05	0.74	0.96	9.23	813.38	737.48	6.81	1.98	19.10	2.07	-11.28	654.26	12.50
	1	0	0	0.37	3.56	1000.00	906.69	3.23	1.68	16.26	4.57	-11.27	804.50	13.08
				Total volume collected by ideal sampler, ml ===>	388.33		Total sediment mass collected by ideal sampler, mg ====>	64.64	Total volume collected by test sampler, ml ===>	483.85			Total sediment mass collected by test sampler, mg ===>	93.95
			Concentration of sample collected by ideal sample, rmg/L		166.45			Concentration of sample collected by test sampler, mg/L		194.17				

Spreadsheet for sampler RgdConLo, 0.15-mm sediment and low flow

ASSIGNED CONSTANTS	f, Fractional depth at sampling vertical (0 is surface, 1 is bottom)	Relative height of segment boundaries above stream bed	Stream velocity at segment boundaries, ft/s.	A, Average velocity in segment. Also ideal sampler average intake velocity, ft/s	Q, For ideal sampler, volume of sample collected in interval, ml	Sediment concentration at segment boundary, mg/L	Average concentration in segment. Also for ideal sampler, concentration of sample in segment, mg/L	For ideal sampler, mass of sediment collected in segment, mg	Intake Velocity of test sampler (TS), ft/s	Volume of sample collected in interval by TS, ml	Relative sampling rate for TS	Sediment concentration error for TS, percent	Concentration of sample collected in segment by TS, mg/L	Mass of sediment collected in segment by TS, mg
Sampler RgdConLo, Insert intake characteristic equation in column J.	0	1	2.63			289.57								
No, Sediment Concentration at Stream Bottom, mg/L	0.05	0.95	2.60	2.62	25.27	308.08	298.82	7.55	2.81	27.12	1.07	-0.25	298.07	8.08
1000	0.1	0.9	2.57	2.58	24.94	327.77	317.93	7.93	2.79	26.96	1.08	-0.27	317.06	8.55
c, Fall Velocity of particles, cm/s.	0.15	0.85	2.53	2.55	24.60	348.73	338.25	8.32	2.77	26.79	1.09	-0.30	337.24	9.03
0.6	0.2	0.8	2.49	2.51	24.25	371.02	359.88	8.73	2.76	26.61	1.10	-0.32	358.71	9.54
n, Manning roughness coefficient	0.25	0.75	2.45	2.47	23.86	394.74	382.88	9.14	2.74	26.42	1.11	-0.35	381.53	10.08
0.04	0.3	0.7	2.41	2.43	23.45	419.98	407.36	9.55	2.71	26.21	1.12	-0.38	405.79	10.64
D, Stream depth at sampling vertical, ft.	0.35	0.65	2.36	2.38	23.02	446.83	433.40	9.98	2.69	25.99	1.13	-0.42	431.59	11.22
3	0.4	0.6	2.31	2.33	22.55	475.39	461.11	10.40	2.67	25.76	1.14	-0.46	459.00	11.82
Vm, mean velocity in vertical, ft/s	0.45	0.55	2.25	2.28	22.04	505.78	490.59	10.81	2.64	25.50	1.16	-0.50	488.14	12.45
2	0.5	0.5	2.19	2.22	21.48	538.11	521.95	11.21	2.61	25.22	1.17	-0.55	519.10	13.09
d, sampler nozzle diameter, in.	0.55	0.45	2.13	2.16	20.87	572.52	555.32	11.59	2.58	24.92	1.19	-0.60	551.99	13.75
0.25	0.6	0.4	2.05	2.09	20.18	609.12	590.82	11.92	2.55	24.58	1.22	-0.66	586.91	14.42
T, sampling time in each segment, s.	0.65	0.35	1.97	2.01	19.42	648.06	628.59	12.20	2.51	24.19	1.25	-0.73	623.97	15.10
1	0.7	0.3	1.87	1.92	18.54	689.49	668.77	12.40	2.46	23.75	1.28	-0.82	663.28	15.75
	0.75	0.25	1.76	1.81	17.51	733.56	711.52	12.46	2.41	23.24	1.33	-0.93	704.91	16.38
	0.8	0.2	1.61	1.68	16.27	780.46	757.01	12.32	2.34	22.62	1.39	-1.07	748.93	16.94
	0.85	0.15	1.43	1.52	14.71	830.35	805.41	11.85	2.26	21.84	1.48	-1.26	795.28	17.37
	0.9	0.1	1.18	1.30	12.59	883.44	856.89	10.79	2.15	20.78	1.65	-1.54	843.66	17.53
	0.95	0.05	0.74	0.96	9.23	939.91	911.67	8.42	1.98	19.10	2.07	-2.09	892.66	17.05
	1	0	0	0.37	3.56	1000.00	969.96	3.45	1.68	16.26	4.57	-4.29	928.39	15.10
				Total volume collected by ideal sampler, ml ===>	388.33		Total sediment mass collected by ideal sampler, mg ====>	201.01	Total volume collected by test sampler, ml ===>	483.85			Total sediment mass collected by test sampler, mg ===>	263.91
			Concentration of sample collected by ideal sample, rmg/L		517.62			Concentration of sample collected by test sampler, mg/L		545.42				

Spreadsheet for RgdConLo sampler, 0.06-mm sediment and low flow

ASSIGNED CONSTANTS	f, Fractional depth at sampling vertical (0 is surface, 1 is bottom)	Relative height of segment boundaries above stream bed	Stream velocity at segment boundaries, ft/s.	A, Average velocity in segment. Also ideal sampler average intake velocity, ft/s	Q, For ideal sampler, volume of sample collected in interval, ml	Sediment concentration at segment boundary, mg/L	Average concentration in segment. Also for ideal sampler, concentration of sample in segment, mg/L	For ideal sampler, mass of sediment collected in segment, mg	Intake Velocity of test sampler (TS), ft/s	Volume of sample collected in interval by TS, ml	Relative sampling rate for TS	Sediment concentration error for TS, percent	Concentration of sample collected in segment by TS, mg/L	Mass of sediment collected in segment by TS, mg
Sampler RgdConLo, Insert intake characteristic equation in column J.	0	1	2.63			939.91								
No, Sediment Concentration at Stream Bottom, mg/L	0.05	0.95	2.60	2.62	25.27	942.83	941.37	23.79	2.81	27.12	1.07	0.00	941.37	25.53
1000	0.1	0.9	2.57	2.58	24.94	945.76	944.29	23.56	2.79	26.96	1.08	0.00	944.29	25.46
c, Fall Velocity of particles, cm/s.	0.15	0.85	2.53	2.55	24.60	948.69	947.22	23.31	2.77	26.79	1.09	0.00	947.22	25.37
0.03	0.2	0.8	2.49	2.51	24.25	951.63	950.16	23.04	2.76	26.61	1.10	0.00	950.16	25.28
n, Manning roughness coefficient	0.25	0.75	2.45	2.47	23.86	954.59	953.11	22.74	2.74	26.42	1.11	0.00	953.11	25.18
0.04	0.3	0.7	2.41	2.43	23.45	957.55	956.07	22.42	2.71	26.21	1.12	0.00	956.07	25.06
D, Stream depth at sampling vertical, ft.	0.35	0.65	2.36	2.38	23.02	960.52	959.04	22.07	2.69	25.99	1.13	0.00	959.04	24.93
3	0.4	0.6	2.31	2.33	22.55	963.50	962.01	21.69	2.67	25.76	1.14	0.00	962.01	24.78
Vm, mean velocity in vertical, ft/s	0.45	0.55	2.25	2.28	22.04	966.49	965.00	21.26	2.64	25.50	1.16	0.00	965.00	24.61
2	0.5	0.5	2.19	2.22	21.48	969.49	967.99	20.79	2.61	25.22	1.17	0.00	967.99	24.42
d, sampler nozzle diameter, in.	0.55	0.45	2.13	2.16	20.87	972.50	971.00	20.26	2.58	24.92	1.19	0.00	971.00	24.19
0.25	0.6	0.4	2.05	2.09	20.18	975.52	974.01	19.66	2.55	24.58	1.22	0.00	974.01	23.94
T, sampling time in each segment, s.	0.65	0.35	1.97	2.01	19.42	978.54	977.03	18.97	2.51	24.19	1.25	0.00	977.03	23.64
1	0.7	0.3	1.87	1.92	18.54	981.58	980.06	18.17	2.46	23.75	1.28	0.00	980.06	23.28
	0.75	0.25	1.76	1.81	17.51	984.63	983.10	17.21	2.41	23.24	1.33	0.00	983.10	22.85
	0.8	0.2	1.61	1.68	16.27	987.68	986.16	16.04	2.34	22.62	1.39	0.00	986.16	22.31
	0.85	0.15	1.43	1.52	14.71	990.75	989.22	14.55	2.26	21.84	1.48	0.00	989.22	21.60
	0.9	0.1	1.18	1.30	12.59	993.82	992.29	12.49	2.15	20.78	1.65	0.00	992.29	20.62
	0.95	0.05	0.74	0.96	9.23	996.91	995.36	9.19	1.98	19.10	2.07	0.00	995.36	19.01
	1	0	0	0.37	3.56	1000.00	998.45	3.55	1.68	16.26	4.57	0.00	998.45	16.24
				Total volume collected by ideal sampler, ml ===>	388.33		Total sediment mass collected by ideal sampler, mg ====>	374.78	Total volume collected by test sampler, ml ===>	483.85			Total sediment mass collected by test sampler, mg ===>	468.28
			Concentration of sample collected by ideal sample, rmg/L		965.09			Concentration of sample collected by test sampler, mg/L		967.82				

Spreadsheet for RgdConLo sampler, 0.01-mm sediment and low flow

ASSIGNED CONSTANTS	f, Fractional depth at sampling vertical (0 is surface, 1 is bottom)	Relative height of segment boundaries above stream bed	Stream velocity at segment boundaries, ft/s.	A, Average velocity in segment. Also ideal sampler average intake velocity, ft/s	Q, For ideal sampler, volume of sample collected in interval, ml	Sediment concentration at segment boundary, mg/L	Average concentration in segment. Also for ideal sampler, concentration of sample in segment, mg/L	For ideal sampler, mass of sediment collected in segment, mg	Intake Velocity of test sampler (TS), ft/s	Volume of sample collected in interval by TS, ml	Relative sampling rate for TS	Sediment concentration error for TS, percent	Concentration of sample collected in segment by TS, mg/L	Mass of sediment collected in segment by TS, mg
Sampler BagHi, Insert intake characteristic equation in column J.	0	1	2.63			0.00								
	0.05	0.95	2.60	2.62	25.27	0.00	0.00	0.00	2.23	21.56	0.85	4.07	0.00	0.00
No, Sediment Concentration at Stream Bottom, mg/L	0.1	0.9	2.57	2.58	24.94	0.00	0.00	0.00	2.17	20.92	0.84	4.92	0.00	0.00
1000	0.15	0.85	2.53	2.55	24.60	0.00	0.00	0.00	2.10	20.24	0.82	5.88	0.00	0.00
c, Fall Velocity of particles, cm/s.	0.2	0.8	2.49	2.51	24.25	0.00	0.00	0.00	2.02	19.52	0.81	6.95	0.00	0.00
7.6	0.25	0.75	2.45	2.47	23.86	0.01	0.01	0.00	1.94	18.76	0.79	8.13	0.01	0.00
n, Manning roughness coefficient	0.3	0.7	2.41	2.43	23.45	0.02	0.01	0.00	1.86	17.94	0.76	9.43	0.01	0.00
0.04	0.35	0.65	2.36	2.38	23.02	0.04	0.03	0.00	1.77	17.07	0.74	10.85	0.03	0.00
D, Stream depth at sampling vertical, ft.	0.4	0.6	2.31	2.33	22.55	0.08	0.06	0.00	1.67	16.12	0.72	12.42	0.07	0.00
3	0.45	0.55	2.25	2.28	22.04	0.18	0.13	0.00	1.56	15.10	0.69	14.14	0.15	0.00
Vm, mean velocity in vertical, ft/s	0.5	0.5	2.19	2.22	21.48	0.39	0.28	0.01	1.45	13.99	0.65	16.09	0.33	0.00
2	0.55	0.45	2.13	2.16	20.87	0.86	0.62	0.01	1.32	12.76	0.61	18.41	0.74	0.01
d, sampler nozzle diameter, in.	0.6	0.4	2.05	2.09	20.18	1.87	1.36	0.03	1.18	11.40	0.56	21.51	1.66	0.02
0.25	0.65	0.35	1.97	2.01	19.42	4.11	2.99	0.06	1.02	9.86	0.51	26.38	3.78	0.04
T, sampling time in each segment, s.	0.7	0.3	1.87	1.92	18.54	9.01	6.56	0.12	0.84	8.11	0.44	35.82	8.91	0.07
1	0.75	0.25	1.76	1.81	17.51	19.75	14.38	0.25	0.63	6.05	0.35	58.12	22.73	0.14
	0.8	0.2	1.61	1.68	16.27	43.29	31.52	0.51	0.37	3.57	0.22	121.74	69.90	0.25
	0.85	0.15	1.43	1.52	14.71	94.91	69.10	1.02	0.05	0.45	0.03	348.14	309.68	0.14
	0.9	0.1	1.18	1.30	12.59	208.07	151.49	1.91	0.00	0.00	0.00	406.58	767.43	0.00
	0.95	0.05	0.74	0.96	9.23	456.15	332.11	3.07	0.00	0.00	0.00	406.58	1682.41	0.00
	1	0	0	0.37	3.56	1000.00	728.08	2.59	0.00	0.00	0.00	406.58	3688.28	0.00
				Total volume collected by ideal sampler, ml ===>	388.33		Total sediment mass collected by ideal sampler, mg ====>	9.58	Total volume collected by test sampler, ml ===>	233.43			Total sediment mass collected by test sampler, mg ===>	0.67
			Concentration of sample collected by ideal sample, rmg/L		24.66			Concentration of sample collected by test sampler, mg/L		2.88				

Spreadsheet for BagHi sampler, 0.45-mm sediment and low flow

ASSIGNED CONSTANTS	f, Fractional depth at sampling vertical (0 is surface, 1 is bottom)	Relative height of segment boundaries above stream bed	Stream velocity at segment boundaries, ft/s.	A, Average velocity in segment. Also ideal sampler average intake velocity, ft/s	Q, For ideal sampler, volume of sample collected in interval, ml	Sediment concentration at segment boundary, mg/L	Average concentration in segment. Also for ideal sampler, concentration of sample in segment, mg/L	For ideal sampler, mass of sediment collected in segment, mg	Intake Velocity of test sampler (TS), ft/s	Volume of sample collected in interval by TS, ml	Relative sampling rate for TS	Sediment concentration error for TS, percent	Concentration of sample collected in segment by TS, mg/L	Mass of sediment collected in segment by TS, mg
Sampler BagHi, Insert intake characteristic equation in column J.	0	1	2.63			16.06								
	0.05	0.95	2.60	2.62	25.27	19.75	17.91	0.45	2.23	21.56	0.85	3.17	18.47	0.40
No, Sediment Concentration at Stream Bottom, mg/L	0.1	0.9	2.57	2.58	24.94	24.28	22.01	0.55	2.17	20.92	0.84	3.68	22.82	0.48
1000	0.15	0.85	2.53	2.55	24.60	29.85	27.07	0.67	2.10	20.24	0.82	4.26	28.22	0.57
c, Fall Velocity of particles, cm/s.	0.2	0.8	2.49	2.51	24.25	36.70	33.28	0.81	2.02	19.52	0.81	4.91	34.91	0.68
2	0.25	0.75	2.45	2.47	23.86	45.12	40.91	0.98	1.94	18.76	0.79	5.65	43.22	0.81
n, Manning roughness coefficient	0.3	0.7	2.41	2.43	23.45	55.47	50.30	1.18	1.86	17.94	0.76	6.50	53.57	0.96
0.04	0.35	0.65	2.36	2.38	23.02	68.20	61.84	1.42	1.77	17.07	0.74	7.48	66.46	1.13
D, Stream depth at sampling vertical, ft.	0.4	0.6	2.31	2.33	22.55	83.85	76.03	1.71	1.67	16.12	0.72	8.62	82.58	1.33
3	0.45	0.55	2.25	2.28	22.04	103.09	93.47	2.06	1.56	15.10	0.69	9.95	102.77	1.55
Vm, mean velocity in vertical, ft/s	0.5	0.5	2.19	2.22	21.48	126.74	114.91	2.47	1.45	13.99	0.65	11.56	128.20	1.79
2	0.55	0.45	2.13	2.16	20.87	155.82	141.28	2.95	1.32	12.76	0.61	13.57	160.45	2.05
d, sampler nozzle diameter, in.	0.6	0.4	2.05	2.09	20.18	191.57	173.70	3.51	1.18	11.40	0.56	16.20	201.83	2.30
0.25	0.65	0.35	1.97	2.01	19.42	235.53	213.55	4.15	1.02	9.86	0.51	19.93	256.12	2.53
T, sampling time in each segment, s.	0.7	0.3	1.87	1.92	18.54	289.57	262.55	4.87	0.84	8.11	0.44	25.88	330.48	2.68
1	0.75	0.25	1.76	1.81	17.51	356.01	322.79	5.65	0.63	6.05	0.35	36.94	442.01	2.67
	0.8	0.2	1.61	1.68	16.27	437.69	396.85	6.46	0.37	3.57	0.22	62.19	643.63	2.30
	0.85	0.15	1.43	1.52	14.71	538.11	487.90	7.18	0.05	0.45	0.03	137.77	1160.08	0.52
	0.9	0.1	1.18	1.30	12.59	661.58	599.85	7.55	0.00	0.00	0.00	156.13	1536.39	0.00
	0.95	0.05	0.74	0.96	9.23	813.38	737.48	6.81	0.00	0.00	0.00	156.13	1888.91	0.00
	1	0	0	0.37	3.56	1000.00	906.69	3.23	0.00	0.00	0.00	156.13	2322.30	0.00
				Total volume collected by ideal sampler, ml ===>	388.33		Total sediment mass collected by ideal sampler, mg ====>	64.64	Total volume collected by test sampler, ml ===>	233.43			Total sediment mass collected by test sampler, mg ===>	24.76
			Concentration of sample collected by ideal sample, rmg/L		166.45			Concentration of sample collected by test sampler, mg/L		106.07				

Spreadsheet for BagHi sampler, 0.15-mm sediment and low flow

ASSIGNED CONSTANTS	f, Fractional depth at sampling vertical (0 is surface, 1 is bottom)	Relative height of segment boundaries above stream bed	Stream velocity at segment boundaries, ft/s.	A, Average velocity in segment. Also ideal sampler average intake velocity, ft/s	Q, For ideal sampler, volume of sample collected in interval, ml	Sediment concentration at segment boundary, mg/L	Average concentration in segment. Also for ideal sampler, concentration of sample in segment, mg/L	For ideal sampler, mass of sediment collected in segment, mg	Intake Velocity of test sampler (TS), ft/s	Volume of sample collected in interval by TS, ml	Relative sampling rate for TS	Sediment concentration error for TS, percent	Concentration of sample collected in segment by TS, mg/L	Mass of sediment collected in segment by TS, mg
Sampler BagHi, Insert intake characteristic equation in column J.	0	1	2.63			289.57								
	0.05	0.95	2.60	2.62	25.27	308.08	298.82	7.55	2.23	21.56	0.85	0.68	300.85	6.49
No, Sediment Concentration at Stream Bottom, mg/L	0.1	0.9	2.57	2.58	24.94	327.77	317.93	7.93	2.17	20.92	0.84	0.76	320.35	6.70
1000	0.15	0.85	2.53	2.55	24.60	348.73	338.25	8.32	2.10	20.24	0.82	0.85	341.13	6.90
c, Fall Velocity of particles, cm/s.	0.2	0.8	2.49	2.51	24.25	371.02	359.88	8.73	2.02	19.52	0.81	0.95	363.29	7.09
0.6	0.25	0.75	2.45	2.47	23.86	394.74	382.88	9.14	1.94	18.76	0.79	1.06	386.92	7.26
n, Manning roughness coefficient	0.3	0.7	2.41	2.43	23.45	419.98	407.36	9.55	1.86	17.94	0.76	1.17	412.13	7.39
0.04	0.35	0.65	2.36	2.38	23.02	446.83	433.40	9.98	1.77	17.07	0.74	1.30	439.02	7.49
D, Stream depth at sampling vertical, ft.	0.4	0.6	2.31	2.33	22.55	475.39	461.11	10.40	1.67	16.12	0.72	1.43	467.72	7.54
3	0.45	0.55	2.25	2.28	22.04	505.78	490.59	10.81	1.56	15.10	0.69	1.59	498.37	7.53
Vm, mean velocity in vertical, ft/s	0.5	0.5	2.19	2.22	21.48	538.11	521.95	11.21	1.45	13.99	0.65	1.76	531.14	7.43
2	0.55	0.45	2.13	2.16	20.87	572.52	555.32	11.59	1.32	12.76	0.61	1.97	566.26	7.23
d, sampler nozzle diameter, in.	0.6	0.4	2.05	2.09	20.18	609.12	590.82	11.92	1.18	11.40	0.56	2.25	604.09	6.89
0.25	0.65	0.35	1.97	2.01	19.42	648.06	628.59	12.20	1.02	9.86	0.51	2.66	645.29	6.36
T, sampling time in each segment, s.	0.7	0.3	1.87	1.92	18.54	689.49	668.77	12.40	0.84	8.11	0.44	3.38	691.41	5.60
1	0.75	0.25	1.76	1.81	17.51	733.56	711.52	12.46	0.63	6.05	0.35	4.94	746.65	4.52
	0.8	0.2	1.61	1.68	16.27	780.46	757.01	12.32	0.37	3.57	0.22	8.99	825.07	2.95
	0.85	0.15	1.43	1.52	14.71	830.35	805.41	11.85	0.05	0.45	0.03	22.46	986.26	0.44
	0.9	0.1	1.18	1.30	12.59	883.44	856.89	10.79	0.00	0.00	0.00	25.84	1078.35	0.00
	0.95	0.05	0.74	0.96	9.23	939.91	911.67	8.42	0.00	0.00	0.00	25.84	1147.29	0.00
	1	0	0	0.37	3.56	1000.00	969.96	3.45	0.00	0.00	0.00	25.84	1220.63	0.00
				Total volume collected by ideal sampler, ml ===>	388.33		Total sediment mass collected by ideal sampler, mg ====>	201.01	Total volume collected by test sampler, ml ===>	233.43			Total sediment mass collected by test sampler, mg ===>	105.82
			Concentration of sample collected by ideal sample, rmg/L		517.62			Concentration of sample collected by test sampler, mg/L		453.32				

Spreadsheet for BagHi sampler, 0.06-mm sediment and low flow

ASSIGNED CONSTANTS	f, Fractional depth at sampling vertical (0 is surface, 1 is bottom)	Relative height of segment boundaries above stream bed	Stream velocity at segment boundaries, ft/s.	A, Average velocity in segment. Also ideal sampler average intake velocity, ft/s	Q, For ideal sampler, volume of sample collected in interval, ml	Sediment concentration at segment boundary, mg/L	Average concentration in segment. Also for ideal sampler, concentration of sample in segment, mg/L	For ideal sampler, mass of sediment collected in segment, mg	Intake Velocity of test sampler (TS), ft/s	Volume of sample collected in interval by TS, ml	Relative sampling rate for TS	Sediment concentration error for TS, percent	Concentration of sample collected in segment by TS, mg/L	Mass of sediment collected in segment by TS, mg
Sampler BagHi, Insert intake characteristic equation in column J.	0	1	2.63			939.91								
	0.05	0.95	2.60	2.62	25.27	942.83	941.37	23.79	2.23	21.56	0.85	0.53	946.35	20.41
No, Sediment Concentration at Stream Bottom, mg/L	0.1	0.9	2.57	2.58	24.94	945.76	944.29	23.56	2.17	20.92	0.84	0.58	949.81	19.87
1000	0.15	0.85	2.53	2.55	24.60	948.69	947.22	23.31	2.10	20.24	0.82	0.64	953.33	19.30
c, Fall Velocity of particles, cm/s.	0.2	0.8	2.49	2.51	24.25	951.63	950.16	23.04	2.02	19.52	0.81	0.71	956.91	18.68
0.03	0.25	0.75	2.45	2.47	23.86	954.59	953.11	22.74	1.94	18.76	0.79	0.78	960.57	18.02
n, Manning roughness coefficient	0.3	0.7	2.41	2.43	23.45	957.55	956.07	22.42	1.86	17.94	0.76	0.86	964.30	17.30
0.04	0.35	0.65	2.36	2.38	23.02	960.52	959.04	22.07	1.77	17.07	0.74	0.95	968.14	16.52
D, Stream depth at sampling vertical, ft.	0.4	0.6	2.31	2.33	22.55	963.50	962.01	21.69	1.67	16.12	0.72	1.05	972.09	15.67
3	0.45	0.55	2.25	2.28	22.04	966.49	965.00	21.26	1.56	15.10	0.69	1.16	976.18	14.74
Vm, mean velocity in vertical, ft/s	0.5	0.5	2.19	2.22	21.48	969.49	967.99	20.79	1.45	13.99	0.65	1.29	980.45	13.72
2	0.55	0.45	2.13	2.16	20.87	972.50	971.00	20.26	1.32	12.76	0.61	1.44	984.93	12.57
d, sampler nozzle diameter, in.	0.6	0.4	2.05	2.09	20.18	975.52	974.01	19.66	1.18	11.40	0.56	1.61	989.70	11.28
0.25	0.65	0.35	1.97	2.01	19.42	978.54	977.03	18.97	1.02	9.86	0.51	1.82	994.85	9.81
T, sampling time in each segment, s.	0.7	0.3	1.87	1.92	18.54	981.58	980.06	18.17	0.84	8.11	0.44	2.09	1000.54	8.11
1	0.75	0.25	1.76	1.81	17.51	984.63	983.10	17.21	0.63	6.05	0.35	2.43	1007.02	6.09
	0.8	0.2	1.61	1.68	16.27	987.68	986.16	16.04	0.37	3.57	0.22	2.91	1014.80	3.62
	0.85	0.15	1.43	1.52	14.71	990.75	989.22	14.55	0.05	0.45	0.03	3.61	1024.96	0.46
	0.9	0.1	1.18	1.30	12.59	993.82	992.29	12.49	0.00	0.00	0.00	3.73	1029.27	0.00
	0.95	0.05	0.74	0.96	9.23	996.91	995.36	9.19	0.00	0.00	0.00	3.73	1032.47	0.00
	1	0	0	0.37	3.56	1000.00	998.45	3.55	0.00	0.00	0.00	3.73	1035.67	0.00
				Total volume collected by ideal sampler, ml ===>	388.33		Total sediment mass collected by ideal sampler, mg ====>	374.78	Total volume collected by test sampler, ml ===>	233.43			Total sediment mass collected by test sampler, mg ===>	226.18
			Concentration of sample collected by ideal sample, rmg/L		965.09			Concentration of sample collected by test sampler, mg/L		968.95				

Spreadsheet for BagHi sampler, 0.01-mm sediment and low flow

ASSIGNED CONSTANTS	f, Fractional depth at sampling vertical (0 is surface, 1 is bottom)	Relative height of segment boundaries above stream bed	Stream velocity at segment boundaries, ft/s.	A, Average velocity in segment. Also ideal sampler average intake velocity, ft/s	Q, For ideal sampler, volume of sample collected in interval, ml	Sediment concentration at segment boundary, mg/L	Average concentration in segment. Also for ideal sampler, concentration of sample in segment, mg/L	For ideal sampler, mass of sediment collected in segment, mg	Intake Velocity of test sampler (TS), ft/s	Volume of sample collected in interval by TS, ml	Relative sampling rate for TS	Sediment concentration error for TS, percent	Concentration of sample collected in segment by TS, mg/L	Mass of sediment collected in segment by TS, mg
Sampler RgdConHi, Insert intake characteristic equation in column J.	0	1	2.63			0.00								
No, Sediment Concentration at Stream Bottom, mg/L	0.05	0.95	2.60	2.62	25.27	0.00	0.00	0.00	4.12	39.75	1.57	-11.82	0.00	0.00
1000	0.1	0.9	2.57	2.58	24.94	0.00	0.00	0.00	4.08	39.43	1.58	-11.92	0.00	0.00
c, Fall Velocity of particles, cm/s.	0.15	0.85	2.53	2.55	24.60	0.00	0.00	0.00	4.05	39.09	1.59	-12.03	0.00	0.00
7.6	0.2	0.8	2.49	2.51	24.25	0.00	0.00	0.00	4.01	38.73	1.60	-12.15	0.00	0.00
n, Manning roughness coefficient	0.25	0.75	2.45	2.47	23.86	0.01	0.01	0.00	3.97	38.35	1.61	-12.28	0.00	0.00
0.04	0.3	0.7	2.41	2.43	23.45	0.02	0.01	0.00	3.93	37.94	1.62	-12.41	0.01	0.00
D, Stream depth at sampling vertical, ft.	0.35	0.65	2.36	2.38	23.02	0.04	0.03	0.00	3.88	37.50	1.63	-12.57	0.02	0.00
3	0.4	0.6	2.31	2.33	22.55	0.08	0.06	0.00	3.83	37.03	1.64	-12.73	0.05	0.00
Vm, mean velocity in vertical, ft/s	0.45	0.55	2.25	2.28	22.04	0.18	0.13	0.00	3.78	36.52	1.66	-12.92	0.11	0.00
2	0.5	0.5	2.19	2.22	21.48	0.39	0.28	0.01	3.72	35.96	1.67	-13.13	0.25	0.01
d, sampler nozzle diameter, in.	0.55	0.45	2.13	2.16	20.87	0.86	0.62	0.01	3.66	35.35	1.69	-13.36	0.54	0.02
0.25	0.6	0.4	2.05	2.09	20.18	1.87	1.36	0.03	3.59	34.67	1.72	-13.64	1.18	0.04
T, sampling time in each segment, s.	0.65	0.35	1.97	2.01	19.42	4.11	2.99	0.06	3.51	33.90	1.75	-13.96	2.57	0.09
1	0.7	0.3	1.87	1.92	18.54	9.01	6.56	0.12	3.42	33.02	1.78	-14.34	5.62	0.19
	0.75	0.25	1.76	1.81	17.51	19.75	14.38	0.25	3.31	31.99	1.83	-14.82	12.25	0.39
	0.8	0.2	1.61	1.68	16.27	43.29	31.52	0.51	3.18	30.75	1.89	-15.42	26.66	0.82
	0.85	0.15	1.43	1.52	14.71	94.91	69.10	1.02	3.02	29.19	1.98	-16.25	57.87	1.69
	0.9	0.1	1.18	1.30	12.59	208.07	151.49	1.91	2.80	27.08	2.15	-17.49	124.99	3.38
	0.95	0.05	0.74	0.96	9.23	456.15	332.11	3.07	2.46	23.72	2.57	-19.81	266.32	6.32
	1	0	0	0.37	3.56	1000.00	728.08	2.59	1.87	18.04	5.07	-26.74	533.38	9.62
				Total volume collected by ideal sampler, ml ===>	388.33		Total sediment mass collected by ideal sampler, mg ====>	9.58	Total volume collected by test sampler, ml ===>	678.02			Total sediment mass collected by test sampler, mg ===>	22.58
			Concentration of sample collected by ideal sample, rmg/L		24.66			Concentration of sample collected by test sampler, mg/L		33.30				

Spreadsheet for RgdConHi sampler, 0.45-mm sediment and low flow

ASSIGNED CONSTANTS	f, Fractional depth at sampling vertical (0 is surface, 1 is bottom)	Relative height of segment boundaries above stream bed	Stream velocity at segment boundaries, ft/s.	A, Average velocity in segment. Also ideal sampler average intake velocity, ft/s	Q, For ideal sampler, volume of sample collected in interval, ml	Sediment concentration at segment boundary, mg/L	Average concentration in segment. Also for ideal sampler, concentration of sample in segment, mg/L	For ideal sampler, mass of sediment collected in segment, mg	Intake Velocity of test sampler (TS), ft/s	Volume of sample collected in interval by TS, ml	Relative sampling rate for TS	Sediment concentration error for TS, percent	Concentration of sample collected in segment by TS, mg/L	Mass of sediment collected in segment by TS, mg
Sampler RgdConHi, Insert intake characteristic equation in column J.	0	1	2.63			16.06								
No, Sediment Concentration at Stream Bottom, mg/L	0.05	0.95	2.60	2.62	25.27	19.75	17.91	0.45	4.12	39.75	1.57	-8.67	16.35	0.65
1000	0.1	0.9	2.57	2.58	24.94	24.28	22.01	0.55	4.08	39.43	1.58	-8.73	20.09	0.79
c, Fall Velocity of particles, cm/s.	0.15	0.85	2.53	2.55	24.60	29.85	27.07	0.67	4.05	39.09	1.59	-8.80	24.68	0.96
2	0.2	0.8	2.49	2.51	24.25	36.70	33.28	0.81	4.01	38.73	1.60	-8.87	30.32	1.17
n, Manning roughness coefficient	0.25	0.75	2.45	2.47	23.86	45.12	40.91	0.98	3.97	38.35	1.61	-8.95	37.25	1.43
0.04	0.3	0.7	2.41	2.43	23.45	55.47	50.30	1.18	3.93	37.94	1.62	-9.03	45.75	1.74
D, Stream depth at sampling vertical, ft.	0.35	0.65	2.36	2.38	23.02	68.20	61.84	1.42	3.88	37.50	1.63	-9.12	56.20	2.11
3	0.4	0.6	2.31	2.33	22.55	83.85	76.03	1.71	3.83	37.03	1.64	-9.22	69.01	2.56
Vm, mean velocity in vertical, ft/s	0.45	0.55	2.25	2.28	22.04	103.09	93.47	2.06	3.78	36.52	1.66	-9.33	84.75	3.09
2	0.5	0.5	2.19	2.22	21.48	126.74	114.91	2.47	3.72	35.96	1.67	-9.45	104.05	3.74
d, sampler nozzle diameter, in.	0.55	0.45	2.13	2.16	20.87	155.82	141.28	2.95	3.66	35.35	1.69	-9.59	127.74	4.52
0.25	0.6	0.4	2.05	2.09	20.18	191.57	173.70	3.51	3.59	34.67	1.72	-9.74	156.78	5.44
T, sampling time in each segment, s.	0.65	0.35	1.97	2.01	19.42	235.53	213.55	4.15	3.51	33.90	1.75	-9.91	192.38	6.52
1	0.7	0.3	1.87	1.92	18.54	289.57	262.55	4.87	3.42	33.02	1.78	-10.12	235.99	7.79
	0.75	0.25	1.76	1.81	17.51	356.01	322.79	5.65	3.31	31.99	1.83	-10.36	289.35	9.26
	0.8	0.2	1.61	1.68	16.27	437.69	396.85	6.46	3.18	30.75	1.89	-10.65	354.58	10.90
	0.85	0.15	1.43	1.52	14.71	538.11	487.90	7.18	3.02	29.19	1.98	-11.02	434.14	12.67
	0.9	0.1	1.18	1.30	12.59	661.58	599.85	7.55	2.80	27.08	2.15	-11.50	530.86	14.37
	0.95	0.05	0.74	0.96	9.23	813.38	737.48	6.81	2.46	23.72	2.57	-12.20	647.49	15.36
	1	0	0	0.37	3.56	1000.00	906.69	3.23	1.87	18.04	5.07	-3.00	879.50	15.87
				Total volume collected by ideal sampler, ml ===>	388.33		Total sediment mass collected by ideal sampler, mg ====>	64.64	Total volume collected by test sampler, ml ===>	678.02			Total sediment mass collected by test sampler, mg ===>	120.95
			Concentration of sample collected by ideal sample, rmg/L		166.45			Concentration of sample collected by test sampler, mg/L		178.38				

Spreadsheet for RgdConHi sampler, 0.15-mm sediment and low flow

ASSIGNED CONSTANTS	f, Fractional depth at sampling vertical (0 is surface, 1 is bottom)	Relative height of segment boundaries above stream bed	Stream velocity at segment boundaries, ft/s.	A, Average velocity in segment. Also ideal sampler average intake velocity, ft/s	Q, For ideal sampler, volume of sample collected in interval, ml	Sediment concentration at segment boundary, mg/L	Average concentration in segment. Also for ideal sampler, concentration of sample in segment, mg/L	For ideal sampler, mass of sediment collected in segment, mg	Intake Velocity of test sampler (TS), ft/s	Volume of sample collected in interval by TS, ml	Relative sampling rate for TS	Sediment concentration error for TS, percent	Concentration of sample collected in segment by TS, mg/L	Mass of sediment collected in segment by TS, mg
Sampler RgdConHi, Insert intake characteristic equation in column J.	0	1	2.63			289.57								
No, Sediment Concentration at Stream Bottom, mg/L	0.05	0.95	2.60	2.62	25.27	308.08	298.82	7.55	4.12	39.75	1.57	-1.42	294.59	11.71
1000	0.1	0.9	2.57	2.58	24.94	327.77	317.93	7.93	4.08	39.43	1.58	-1.43	313.38	12.36
c, Fall Velocity of particles, cm/s.	0.15	0.85	2.53	2.55	24.60	348.73	338.25	8.32	4.05	39.09	1.59	-1.44	333.37	13.03
0.6	0.2	0.8	2.49	2.51	24.25	371.02	359.88	8.73	4.01	38.73	1.60	-1.46	354.63	13.73
n, Manning roughness coefficient	0.25	0.75	2.45	2.47	23.86	394.74	382.88	9.14	3.97	38.35	1.61	-1.47	377.24	14.47
0.04	0.3	0.7	2.41	2.43	23.45	419.98	407.36	9.55	3.93	37.94	1.62	-1.49	401.28	15.22
D, Stream depth at sampling vertical, ft.	0.35	0.65	2.36	2.38	23.02	446.83	433.40	9.98	3.88	37.50	1.63	-1.51	426.85	16.01
3	0.4	0.6	2.31	2.33	22.55	475.39	461.11	10.40	3.83	37.03	1.64	-1.53	454.05	16.81
Vm, mean velocity in vertical, ft/s	0.45	0.55	2.25	2.28	22.04	505.78	490.59	10.81	3.78	36.52	1.66	-1.56	482.96	17.64
2	0.5	0.5	2.19	2.22	21.48	538.11	521.95	11.21	3.72	35.96	1.67	-1.58	513.69	18.47
d, sampler nozzle diameter, in.	0.55	0.45	2.13	2.16	20.87	572.52	555.32	11.59	3.66	35.35	1.69	-1.61	546.37	19.31
0.25	0.6	0.4	2.05	2.09	20.18	609.12	590.82	11.92	3.59	34.67	1.72	-1.65	581.09	20.15
T, sampling time in each segment, s.	0.65	0.35	1.97	2.01	19.42	648.06	628.59	12.20	3.51	33.90	1.75	-1.69	617.98	20.95
1	0.7	0.3	1.87	1.92	18.54	689.49	668.77	12.40	3.42	33.02	1.78	-1.74	657.15	21.70
	0.75	0.25	1.76	1.81	17.51	733.56	711.52	12.46	3.31	31.99	1.83	-1.80	698.73	22.35
	0.8	0.2	1.61	1.68	16.27	780.46	757.01	12.32	3.18	30.75	1.89	-1.88	742.78	22.84
	0.85	0.15	1.43	1.52	14.71	830.35	805.41	11.85	3.02	29.19	1.98	-1.99	789.36	23.04
	0.9	0.1	1.18	1.30	12.59	883.44	856.89	10.79	2.80	27.08	2.15	-2.17	838.28	22.70
	0.95	0.05	0.74	0.96	9.23	939.91	911.67	8.42	2.46	23.72	2.57	-2.58	888.18	21.07
	1	0	0	0.37	3.56	1000.00	969.96	3.45	1.87	18.04	5.07	-3.90	932.16	16.82
				Total volume collected by ideal sampler, ml ===>	388.33		Total sediment mass collected by ideal sampler, mg ====>	201.01	Total volume collected by test sampler, ml ===>	678.02			Total sediment mass collected by test sampler, mg ===>	360.39
			Concentration of sample collected by ideal sample, rmg/L		517.62			Concentration of sample collected by test sampler, mg/L		531.53				

Spreadsheet for RgdConHi sampler, 0.06-mm sediment and low flow

ASSIGNED CONSTANTS	f, Fractional depth at sampling vertical (0 is surface, 1 is bottom)	Relative height of segment boundaries above stream bed	Stream velocity at segment boundaries, ft/s.	A, Average velocity in segment. Also ideal sampler average intake velocity, ft/s	Q, For ideal sampler, volume of sample collected in interval, ml	Sediment concentration at segment boundary, mg/L	Average concentration in segment. Also for ideal sampler, concentration of sample in segment, mg/L	For ideal sampler, mass of sediment collected in segment, mg	Intake Velocity of test sampler (TS), ft/s	Volume of sample collected in interval by TS, ml	Relative sampling rate for TS	Sediment concentration error for TS, percent	Concentration of sample collected in segment by TS, mg/L	Mass of sediment collected in segment by TS, mg
Sampler RgdConHi, Insert intake characteristic equation in column J.	0	1	2.63			939.91								
	0.05	0.95	2.60	2.62	25.27	942.83	941.37	23.79	4.12	39.75	1.57	0.00	941.37	37.42
No, Sediment Concentration at Stream Bottom, mg/L	0.1	0.9	2.57	2.58	24.94	945.76	944.29	23.56	4.08	39.43	1.58	0.00	944.29	37.23
1000	0.15	0.85	2.53	2.55	24.60	948.69	947.22	23.31	4.05	39.09	1.59	0.00	947.22	37.03
c, Fall Velocity of particles, cm/s.	0.2	0.8	2.49	2.51	24.25	951.63	950.16	23.04	4.01	38.73	1.60	0.00	950.16	36.80
0.03	0.25	0.75	2.45	2.47	23.86	954.59	953.11	22.74	3.97	38.35	1.61	0.00	953.11	36.55
n, Manning roughness coefficient	0.3	0.7	2.41	2.43	23.45	957.55	956.07	22.42	3.93	37.94	1.62	0.00	956.07	36.27
0.04	0.35	0.65	2.36	2.38	23.02	960.52	959.04	22.07	3.88	37.50	1.63	0.00	959.04	35.97
D, Stream depth at sampling vertical, ft.	0.4	0.6	2.31	2.33	22.55	963.50	962.01	21.69	3.83	37.03	1.64	0.00	962.01	35.62
3	0.45	0.55	2.25	2.28	22.04	966.49	965.00	21.26	3.78	36.52	1.66	0.00	965.00	35.24
Vm, mean velocity in vertical, ft/s	0.5	0.5	2.19	2.22	21.48	969.49	967.99	20.79	3.72	35.96	1.67	0.00	967.99	34.81
2	0.55	0.45	2.13	2.16	20.87	972.50	971.00	20.26	3.66	35.35	1.69	0.00	971.00	34.32
d, sampler nozzle diameter, in.	0.6	0.4	2.05	2.09	20.18	975.52	974.01	19.66	3.59	34.67	1.72	0.00	974.01	33.77
0.25	0.65	0.35	1.97	2.01	19.42	978.54	977.03	18.97	3.51	33.90	1.75	0.00	977.03	33.12
T, sampling time in each segment, s.	0.7	0.3	1.87	1.92	18.54	981.58	980.06	18.17	3.42	33.02	1.78	0.00	980.06	32.36
1	0.75	0.25	1.76	1.81	17.51	984.63	983.10	17.21	3.31	31.99	1.83	0.00	983.10	31.45
	0.8	0.2	1.61	1.68	16.27	987.68	986.16	16.04	3.18	30.75	1.89	0.00	986.16	30.33
	0.85	0.15	1.43	1.52	14.71	990.75	989.22	14.55	3.02	29.19	1.98	0.00	989.22	28.88
	0.9	0.1	1.18	1.30	12.59	993.82	992.29	12.49	2.80	27.08	2.15	0.00	992.29	26.87
	0.95	0.05	0.74	0.96	9.23	996.91	995.36	9.19	2.46	23.72	2.57	0.00	995.36	23.61
	1	0	0	0.37	3.56	1000.00	998.45	3.55	1.87	18.04	5.07	0.00	998.45	18.01
				Total volume collected by ideal sampler, ml ===>	388.33		Total sediment mass collected by ideal sampler, mg ====>	374.78	Total volume collected by test sampler, ml ===>	678.02			Total sediment mass collected by test sampler, mg ===>	655.67
			Concentration of sample collected by ideal sample, rmg/L		965.09			Concentration of sample collected by test sampler, mg/L		967.04				

Spreadsheet for RgdConHi sampler, 0.01-mm sediment and low flow

ASSIGNED CONSTANTS	f, Fractional depth at sampling vertical (0 is surface, 1 is bottom)	Relative height of segment boundaries above stream bed	Stream velocity at segment boundaries, ft/s.	A, Average velocity in segment. Also ideal sampler average intake velocity, ft/s	Q, For ideal sampler, volume of sample collected in interval, ml	Sediment concentration at segment boundary, mg/L	Average concentration in segment. Also for ideal sampler, concentration of sample in segment, mg/L	For ideal sampler, mass of sediment collected in segment, mg	Intake Velocity of test sampler (TS), ft/s	Volume of sample collected in interval by TS, ml	Relative sampling rate for TS	Sediment concentration error for TS, percent	Concentration of sample collected in segment by TS, mg/L	Mass of sediment collected in segment by TS, mg
Sampler BagLo, Insert intake characteristic equation in column J.	0	1	2.63			0.00								
	0.05	0.95	2.60	2.62	25.27	0.00	0.00	0.00	1.12	10.78	0.43	37.69	0.00	0.00
No, Sediment Concentration at Stream Bottom, mg/L	0.1	0.9	2.57	2.58	24.94	0.00	0.00	0.00	1.08	10.46	0.42	39.09	0.00	0.00
1000	0.15	0.85	2.53	2.55	24.60	0.00	0.00	0.00	1.05	10.12	0.41	40.70	0.00	0.00
c, Fall Velocity of particles, cm/s.	0.2	0.8	2.49	2.51	24.25	0.00	0.00	0.00	1.01	9.76	0.40	42.57	0.00	0.00
7.6	0.25	0.75	2.45	2.47	23.86	0.01	0.01	0.00	0.97	9.38	0.39	44.76	0.01	0.00
n, Manning roughness coefficient	0.3	0.7	2.41	2.43	23.45	0.02	0.01	0.00	0.93	8.97	0.38	47.36	0.02	0.00
0.04	0.35	0.65	2.36	2.38	23.02	0.04	0.03	0.00	0.88	8.53	0.37	50.48	0.04	0.00
D, Stream depth at sampling vertical, ft.	0.4	0.6	2.31	2.33	22.55	0.08	0.06	0.00	0.83	8.06	0.36	54.29	0.09	0.00
3	0.45	0.55	2.25	2.28	22.04	0.18	0.13	0.00	0.78	7.55	0.34	59.05	0.21	0.00
Vm, mean velocity in vertical, ft/s	0.5	0.5	2.19	2.22	21.48	0.39	0.28	0.01	0.72	6.99	0.33	65.12	0.47	0.00
2	0.55	0.45	2.13	2.16	20.87	0.86	0.62	0.01	0.66	6.38	0.31	73.08	1.08	0.01
d, sampler nozzle diameter, in.	0.6	0.4	2.05	2.09	20.18	1.87	1.36	0.03	0.59	5.70	0.28	83.91	2.51	0.01
0.25	0.65	0.35	1.97	2.01	19.42	4.11	2.99	0.06	0.51	4.93	0.25	99.27	5.96	0.03
T, sampling time in each segment, s.	0.7	0.3	1.87	1.92	18.54	9.01	6.56	0.12	0.42	4.05	0.22	122.38	14.59	0.06
1	0.75	0.25	1.76	1.81	17.51	19.75	14.38	0.25	0.31	3.02	0.17	159.93	37.37	0.11
	0.8	0.2	1.61	1.68	16.27	43.29	31.52	0.51	0.18	1.79	0.11	228.23	103.46	0.18
	0.85	0.15	1.43	1.52	14.71	94.91	69.10	1.02	0.02	0.22	0.02	376.43	329.23	0.07
	0.9	0.1	1.18	1.30	12.59	208.07	151.49	1.91	0.00	0.00	0.00	406.58	767.43	0.00
	0.95	0.05	0.74	0.96	9.23	456.15	332.11	3.07	0.00	0.00	0.00	406.58	1682.41	0.00
	1	0	0	0.37	3.56	1000.00	728.08	2.59	0.00	0.00	0.00	406.58	3688.28	0.00
				Total volume collected by ideal sampler, ml ===>	388.33		Total sediment mass collected by ideal sampler, mg ====>	9.58	Total volume collected by test sampler, ml ===>	116.71			Total sediment mass collected by test sampler, mg ===>	0.49
			Concentration of sample collected by ideal sample, rmg/L		24.66			Concentration of sample collected by test sampler, mg/L		4.18				

Spreadsheet for BagLo sampler, 0.45-mm sediment and low flow

ASSIGNED CONSTANTS	f, Fractional depth at sampling vertical (0 is surface, 1 is bottom)	Relative height of segment boundaries above stream bed	Stream velocity at segment boundaries, ft/s.	A, Average velocity in segment. Also ideal sampler average intake velocity, ft/s	Q, For ideal sampler, volume of sample collected in interval, ml	Sediment concentration at segment boundary, mg/L	Average concentration in segment. Also for ideal sampler, concentration of sample in segment, mg/L	For ideal sampler, mass of sediment collected in segment, mg	Intake Velocity of test sampler (TS), ft/s	Volume of sample collected in interval by TS, ml	Relative sampling rate for TS	Sediment concentration error for TS, percent	Concentration of sample collected in segment by TS, mg/L	Mass of sediment collected in segment by TS, mg
Sampler BagLo, Insert intake characteristic equation in column J.	0	1	2.63			16.06								
	0.05	0.95	2.60	2.62	25.27	19.75	17.91	0.45	1.12	10.78	0.43	26.92	22.73	0.25
No, Sediment Concentration at Stream Bottom, mg/L	0.1	0.9	2.57	2.58	24.94	24.28	22.01	0.55	1.08	10.46	0.42	27.69	28.11	0.29
1000	0.15	0.85	2.53	2.55	24.60	29.85	27.07	0.67	1.05	10.12	0.41	28.55	34.79	0.35
c, Fall Velocity of particles, cm/s.	0.2	0.8	2.49	2.51	24.25	36.70	33.28	0.81	1.01	9.76	0.40	29.52	43.10	0.42
2	0.25	0.75	2.45	2.47	23.86	45.12	40.91	0.98	0.97	9.38	0.39	30.63	53.44	0.50
n, Manning roughness coefficient	0.3	0.7	2.41	2.43	23.45	55.47	50.30	1.18	0.93	8.97	0.38	31.91	66.35	0.60
0.04	0.35	0.65	2.36	2.38	23.02	68.20	61.84	1.42	0.88	8.53	0.37	33.42	82.50	0.70
D, Stream depth at sampling vertical, ft.	0.4	0.6	2.31	2.33	22.55	83.85	76.03	1.71	0.83	8.06	0.36	35.20	102.78	0.83
3	0.45	0.55	2.25	2.28	22.04	103.09	93.47	2.06	0.78	7.55	0.34	37.35	128.38	0.97
Vm, mean velocity in vertical, ft/s	0.5	0.5	2.19	2.22	21.48	126.74	114.91	2.47	0.72	6.99	0.33	40.01	160.89	1.13
2	0.55	0.45	2.13	2.16	20.87	155.82	141.28	2.95	0.66	6.38	0.31	43.38	202.56	1.29
d, sampler nozzle diameter, in.	0.6	0.4	2.05	2.09	20.18	191.57	173.70	3.51	0.59	5.70	0.28	47.78	256.69	1.46
0.25	0.65	0.35	1.97	2.01	19.42	235.53	213.55	4.15	0.51	4.93	0.25	53.78	328.40	1.62
T, sampling time in each segment, s.	0.7	0.3	1.87	1.92	18.54	289.57	262.55	4.87	0.42	4.05	0.22	62.42	426.42	1.73
1	0.75	0.25	1.76	1.81	17.51	356.01	322.79	5.65	0.31	3.02	0.17	75.82	567.53	1.72
	0.8	0.2	1.61	1.68	16.27	437.69	396.85	6.46	0.18	1.79	0.11	99.01	789.77	1.41
	0.85	0.15	1.43	1.52	14.71	538.11	487.90	7.18	0.02	0.22	0.02	146.69	1203.62	0.27
	0.9	0.1	1.18	1.30	12.59	661.58	599.85	7.55	0.00	0.00	0.00	156.13	1536.39	0.00
	0.95	0.05	0.74	0.96	9.23	813.38	737.48	6.81	0.00	0.00	0.00	156.13	1888.91	0.00
	1	0	0	0.37	3.56	1000.00	906.69	3.23	0.00	0.00	0.00	156.13	2322.30	0.00
				Total volume collected by ideal sampler, ml ===>	388.33		Total sediment mass collected by ideal sampler, mg ====>	64.64	Total volume collected by test sampler, ml ===>	116.71			Total sediment mass collected by test sampler, mg ===>	15.54
			Concentration of sample collected by ideal sample, rmg/L		166.45			Concentration of sample collected by test sampler, mg/L		133.12				

Spreadsheet for BagLo sampler, 0.15-mm sediment and low flow

ASSIGNED CONSTANTS	f, Fractional depth at sampling vertical (0 is surface, 1 is bottom)	Relative height of segment boundaries above stream bed	Stream velocity at segment boundaries, ft/s.	A, Average velocity in segment. Also ideal sampler average intake velocity, ft/s	Q, For ideal sampler, volume of sample collected in interval, ml	Sediment concentration at segment boundary, mg/L	Average concentration in segment. Also for ideal sampler, concentration of sample in segment, mg/L	For ideal sampler, mass of sediment collected in segment, mg	Intake Velocity of test sampler (TS), ft/s	Volume of sample collected in interval by TS, ml	Relative sampling rate for TS	Sediment concentration error for TS, percent	Concentration of sample collected in segment by TS, mg/L	Mass of sediment collected in segment by TS, mg
Sampler BagLo, Insert intake characteristic equation in column J.	0	1	2.63			289.57								
	0.05	0.95	2.60	2.62	25.27	308.08	298.82	7.55	1.12	10.78	0.43	3.52	309.35	3.34
No, Sediment Concentration at Stream Bottom, mg/L	0.1	0.9	2.57	2.58	24.94	327.77	317.93	7.93	1.08	10.46	0.42	3.62	329.45	3.45
1000	0.15	0.85	2.53	2.55	24.60	348.73	338.25	8.32	1.05	10.12	0.41	3.74	350.90	3.55
c, Fall Velocity of particles, cm/s.	0.2	0.8	2.49	2.51	24.25	371.02	359.88	8.73	1.01	9.76	0.40	3.87	373.81	3.65
0.6	0.25	0.75	2.45	2.47	23.86	394.74	382.88	9.14	0.97	9.38	0.39	4.03	398.29	3.74
n, Manning roughness coefficient	0.3	0.7	2.41	2.43	23.45	419.98	407.36	9.55	0.93	8.97	0.38	4.21	424.49	3.81
0.04	0.35	0.65	2.36	2.38	23.02	446.83	433.40	9.98	0.88	8.53	0.37	4.42	452.56	3.86
D, Stream depth at sampling vertical, ft.	0.4	0.6	2.31	2.33	22.55	475.39	461.11	10.40	0.83	8.06	0.36	4.68	482.69	3.89
3	0.45	0.55	2.25	2.28	22.04	505.78	490.59	10.81	0.78	7.55	0.34	5.00	515.11	3.89
Vm, mean velocity in vertical, ft/s	0.5	0.5	2.19	2.22	21.48	538.11	521.95	11.21	0.72	6.99	0.33	5.40	550.14	3.85
2	0.55	0.45	2.13	2.16	20.87	572.52	555.32	11.59	0.66	6.38	0.31	5.92	588.20	3.75
d, sampler nozzle diameter, in.	0.6	0.4	2.05	2.09	20.18	609.12	590.82	11.92	0.59	5.70	0.28	6.62	629.92	3.59
0.25	0.65	0.35	1.97	2.01	19.42	648.06	628.59	12.20	0.51	4.93	0.25	7.59	676.30	3.34
T, sampling time in each segment, s.	0.7	0.3	1.87	1.92	18.54	689.49	668.77	12.40	0.42	4.05	0.22	9.03	729.16	2.96
1	0.75	0.25	1.76	1.81	17.51	733.56	711.52	12.46	0.31	3.02	0.17	11.33	792.11	2.40
	0.8	0.2	1.61	1.68	16.27	780.46	757.01	12.32	0.18	1.79	0.11	15.42	873.72	1.56
	0.85	0.15	1.43	1.52	14.71	830.35	805.41	11.85	0.02	0.22	0.02	24.10	999.50	0.22
	0.9	0.1	1.18	1.30	12.59	883.44	856.89	10.79	0.00	0.00	0.00	25.84	1078.35	0.00
	0.95	0.05	0.74	0.96	9.23	939.91	911.67	8.42	0.00	0.00	0.00	25.84	1147.29	0.00
	1	0	0	0.37	3.56	1000.00	969.96	3.45	0.00	0.00	0.00	25.84	1220.63	0.00
				Total volume collected by ideal sampler, ml ===>	388.33		Total sediment mass collected by ideal sampler, mg ====>	201.01	Total volume collected by test sampler, ml ===>	116.71			Total sediment mass collected by test sampler, mg ===>	54.83
			Concentration of sample collected by ideal sample, rmg/L		517.62			Concentration of sample collected by test sampler, mg/L		469.78				

Spreadsheet for BagLo sampler, 0.06-mm sediment and low flow

ASSIGNED CONSTANTS	f, Fractional depth at sampling vertical (0 is surface, 1 is bottom)	Relative height of segment boundaries above stream bed	Stream velocity at segment boundaries, ft/s.	A, Average velocity in segment. Also ideal sampler average intake velocity, ft/s	Q, For ideal sampler, volume of sample collected in interval, ml	Sediment concentration at segment boundary, mg/L	Average concentration in segment. Also for ideal sampler, concentration of sample in segment, mg/L	For ideal sampler, mass of sediment collected in segment, mg	Intake Velocity of test sampler (TS), ft/s	Volume of sample collected in interval by TS, ml	Relative sampling rate for TS	Sediment concentration error for TS, percent	Concentration of sample collected in segment by TS, mg/L	Mass of sediment collected in segment by TS, mg
Sampler BagLo, Insert intake characteristic equation in column J.	0	1	2.63			939.91								
	0.05	0.95	2.60	2.62	25.27	942.83	941.37	23.79	1.12	10.78	0.43	2.13	961.41	10.37
No, Sediment Concentration at Stream Bottom, mg/L	0.1	0.9	2.57	2.58	24.94	945.76	944.29	23.56	1.08	10.46	0.42	2.16	964.65	10.09
1000	0.15	0.85	2.53	2.55	24.60	948.69	947.22	23.31	1.05	10.12	0.41	2.19	967.93	9.80
c, Fall Velocity of particles, cm/s.	0.2	0.8	2.49	2.51	24.25	951.63	950.16	23.04	1.01	9.76	0.40	2.22	971.25	9.48
0.03	0.25	0.75	2.45	2.47	23.86	954.59	953.11	22.74	0.97	9.38	0.39	2.25	974.60	9.14
n, Manning roughness coefficient	0.3	0.7	2.41	2.43	23.45	957.55	956.07	22.42	0.93	8.97	0.38	2.29	978.01	8.77
0.04	0.35	0.65	2.36	2.38	23.02	960.52	959.04	22.07	0.88	8.53	0.37	2.34	981.46	8.37
D, Stream depth at sampling vertical, ft.	0.4	0.6	2.31	2.33	22.55	963.50	962.01	21.69	0.83	8.06	0.36	2.39	984.98	7.94
3	0.45	0.55	2.25	2.28	22.04	966.49	965.00	21.26	0.78	7.55	0.34	2.44	988.58	7.47
Vm, mean velocity in vertical, ft/s	0.5	0.5	2.19	2.22	21.48	969.49	967.99	20.79	0.72	6.99	0.33	2.51	992.26	6.94
2	0.55	0.45	2.13	2.16	20.87	972.50	971.00	20.26	0.66	6.38	0.31	2.58	996.06	6.36
d, sampler nozzle diameter, in.	0.6	0.4	2.05	2.09	20.18	975.52	974.01	19.66	0.59	5.70	0.28	2.67	1000.01	5.70
0.25	0.65	0.35	1.97	2.01	19.42	978.54	977.03	18.97	0.51	4.93	0.25	2.78	1004.15	4.95
T, sampling time in each segment, s.	0.7	0.3	1.87	1.92	18.54	981.58	980.06	18.17	0.42	4.05	0.22	2.91	1008.57	4.09
1	0.75	0.25	1.76	1.81	17.51	984.63	983.10	17.21	0.31	3.02	0.17	3.08	1013.39	3.07
	0.8	0.2	1.61	1.68	16.27	987.68	986.16	16.04	0.18	1.79	0.11	3.32	1018.86	1.82
	0.85	0.15	1.43	1.52	14.71	990.75	989.22	14.55	0.02	0.22	0.02	3.67	1025.52	0.23
	0.9	0.1	1.18	1.30	12.59	993.82	992.29	12.49	0.00	0.00	0.00	3.73	1029.27	0.00
	0.95	0.05	0.74	0.96	9.23	996.91	995.36	9.19	0.00	0.00	0.00	3.73	1032.47	0.00
	1	0	0	0.37	3.56	1000.00	998.45	3.55	0.00	0.00	0.00	3.73	1035.67	0.00
				Total volume collected by ideal sampler, ml ===>	388.33		Total sediment mass collected by ideal sampler, mg ====>	374.78	Total volume collected by test sampler, ml ===>	116.71			Total sediment mass collected by test sampler, mg ===>	114.58
			Concentration of sample collected by ideal sample, rmg/L		965.09			Concentration of sample collected by test sampler, mg/L		981.70				

Spreadsheet for BagLo sampler, 0.01-mm sediment and low flow