Seepage Study on the Henrys Fork and Snake River, Idaho

FINAL PROGRESS REPORT

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August 15, 2003

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INTRODUCTION AND OBJECTIVES

This study was one component of the general Eastern Snake Hydrologic Modeling Committee strategy to refine and enhance the conceptual and computer models of the Eastern Snake River Plain (ESRP) hydrologic system. Information gathered during this study will be combined with the results of other work being done on the plain to enhance the conceptual model of the hydrologic system and refine ground-water and surface-water computer flow models. Data collection and analyses were performed in a collaborative effort by the U.S. Geological Survey (USGS) and Idaho Power Company (IPCo). The specific objective of this study was to estimate gains from and losses to ground water in selected river reaches in the ESRP during five detailed seepage studies.

APPROACH

Seepage studies were designed and conducted in three separate reaches of the Snake River and Henrys Fork (fig.1). These reaches included (1) the reach of the Snake River from the gaging station near the outlet of Lake Walcott (Minidoka Dam) downstream to the gaging station at King Hill (lower reach); (2) the reach from the gaging station near Shelley downstream to the gaging station near Lake Walcott (middle reach); and reach of the Snake River, from the gaging station near Heise downstream to the gaging station near Shelley, and the Henrys Fork, from the gaging station near Ashton downstream to the mouth (upper reach). Data collected in each reach included discharge values from USGS and/or IPCo gaging stations, discharge values at several intermediate locations obtained using acoustic Doppler instrumentation (Acoustic Doppler Current Profilers, ADCPs; and Acoustic Doppler Profilers, ADPs), and measured and/or inspected discharge values for several miscellaneous inflows (mostly tributaries) along the entire length of each reach obtained by field personnel.

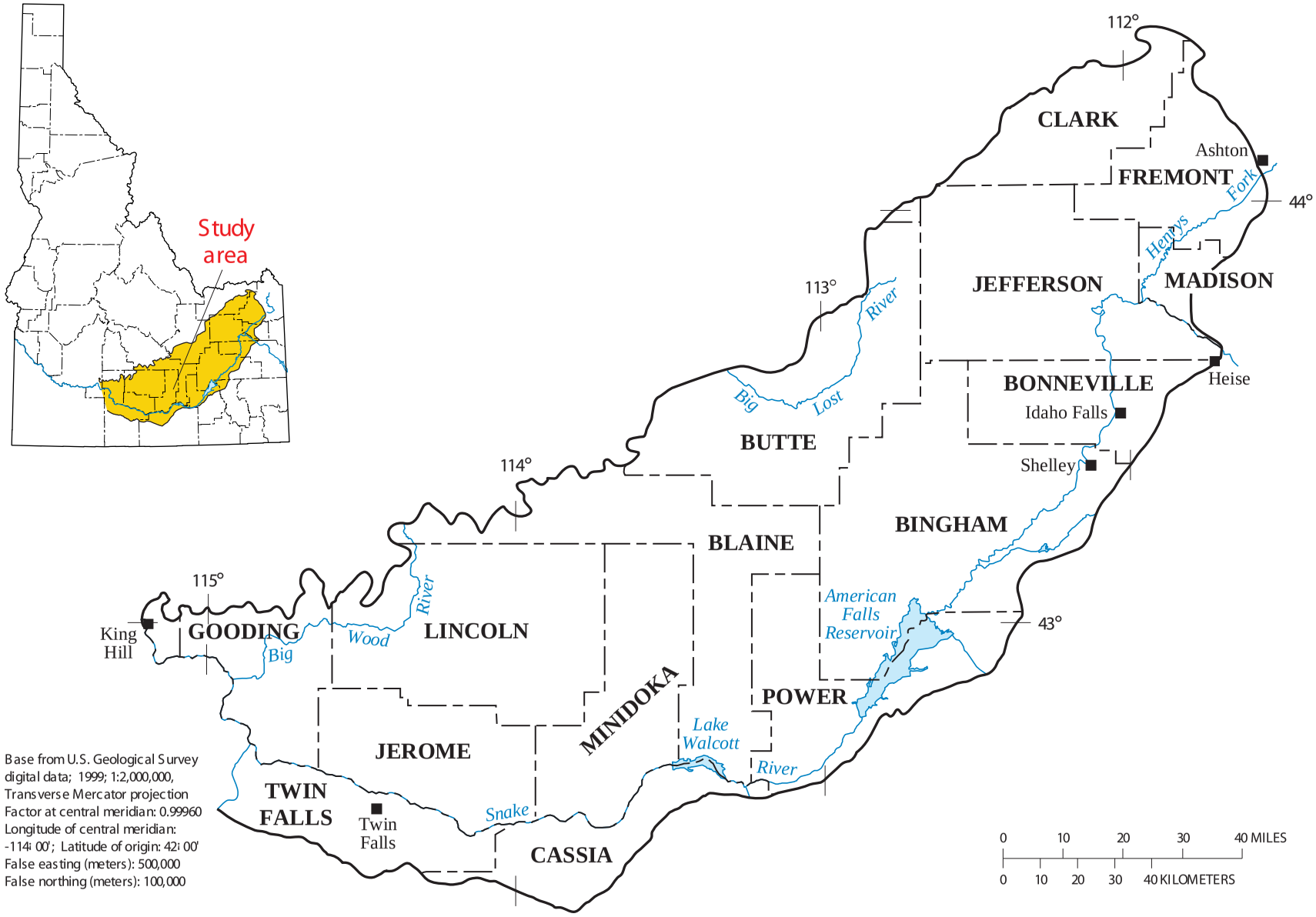


Figure 1. Location of study area, eastern Snake River Plain, eastern and south-central Idaho.

EQUIPMENT

The collaborative effort between the USGS and IPCo resulted in a large variety and highly diverse set of equipment resources from which to choose, allowing for measurements to be performed under a wide range of river conditions. Examples of watercraft that were used during this study include: aluminum hulled jet boats, inflatable motor-powered watercrafts, a motor-powered cataraft, and a self-propelled kayak. Examples of the different types of acoustic Doppler instruments used include: 600 kHz transducers (capable of measuring in depths around 200 feet deep), 1200 kHz transducers (capable of measuring in depths ranging from approximately 2 to 60 feet) and 3,000 kHz transducers (capable of measuring in depths from approximately 1.5 feet to 22 feet).

ACCURACY AND LIMITATIONS

Implementation of modern acoustic Doppler instrumentation specifically designed to measure river discharge currently allows us to measure discharge more efficiently than ever. However, there are still limitations in the application of this instrumentation to measure discharge, which should be discussed. These limitations include the inability to measure water velocities at all points in a specific cross section and the potential for error. Although the existence of unmeasured areas may ultimately contribute to the overall error of a measurement, these subjects are discussed separately.

Unmeasured Areas

Acoustic Doppler instrumentation is not capable of measuring water velocities in every area of a river cross section. These unmeasured areas (top, bottom, left edge, and right edge) are illustrated in figure 2. The depth of the unmeasured top section is a function of the transducer depth (distance the transducer extends into the water) and the blanking distance (time lag between when the sensor sends a signal and when it is ready to receive that signal). A section at the bottom cannot be measured because of side-lobe interference (physical characteristic of the acoustic beam where the side-lobe reflects off of the bottom before the main beam, which ultimately interferes with the reception of the remaining velocity data). Discharge in the top and

bottom unmeasured sections is estimated using either (1) a power law method, (2) a constant method, or (3) a three-point regression method, depending on the velocity characteristics at the section and the type of instrument being used.

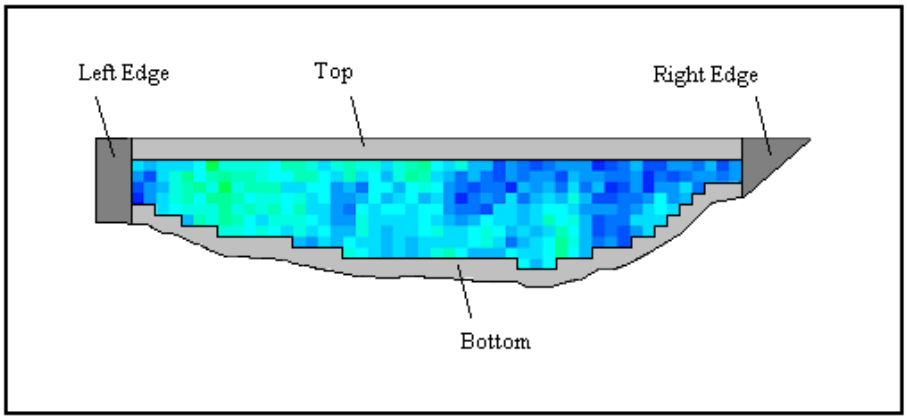


Figure 2. A typical river cross section with sections where velocity data cannot be measured.

A portion a each edge of a cross section also cannot be measured because of minimum operational depth requirements and beam interference along vertical or nearly vertical edges. In general, the minimum measurement depth decreases with increasing transducer frequency. For example, the highest frequency instrument used in this study was a 3,000 kHz unit with a minimum operational depth of approximately 1.5 feet, and the lowest frequency transducer used was a 600 kHz unit with a minimum operational depth of approximately 3 feet. Beam interference can occur along vertical walls in much the same manner as described previously with regard to the river bottom. Edge discharges are estimated using an interpolation method based on the last recorded water velocities, the distance to the edge of water, and the general shape of the unmeasured section (triangular or vertical).

Error

Analysis of discharge measurements can reveal two different types of error; random error and systematic error (bias). The first type of error that can enter into a set of discharge measurements is random error. Random error can be attributed to the accuracy of the instrumentation with regard to pulse length, transmit frequency, signal-to-noise ratio, and beam angle. However,

channel and flow characteristics can greatly affect the magnitude of random error. The following is a list of conditions that may cause higher magnitudes of random error.

- channel bottom is fairly irregular or lined with large boulders
- turbulent or non-laminar flow
- unstable water surface conditions, caused by wave action
- unstable control of the acoustic Doppler instrument in general
- inability to retrace identical measurement path
- inability to maintain steady boat velocity and direction
- interference caused by objects such as fish not moving at the same speed and in the same direction as the flow

The effects of random error can be minimized first by carefully and thoughtfully performing each set of measurements in a manner to minimize the effects mentioned above. The effects are also minimized by averaging several individual measurements.

The second type of error is systematic error (bias). This error can be separated into two parts; instrument-caused and operator-caused. Instrument-caused systematic errors relate to the operation of the instrument and the physical properties of the acoustic signal. Most of these errors are thought by manufacturers to be small and insignificant. However, if not closely monitored, the following can significantly affect the accuracy of discharge measurements.

- beam-angle errors
- depth-measurement errors
- speed-of-sound errors (temperature and salinity)
- improper estimation techniques for the top and bottom unmeasured portions

The operator-caused systematic errors listed below can be easily monitored and rectified, however, failure to do so could significantly affect the accuracy of discharge measurements.

- inaccurate setting of transducer depth
- consistently over or under estimation of distance-to-edge
- inaccurate characterization of edge shapes
- moving bed - a quantity of sediment moving near the bottom that is large enough to completely attenuate the bottom echo, causing a loss of bottom track - this phenomenon results in a consistent underestimation of discharge

- boat velocities that are consistently higher than average water velocities
- poor cross section selection

It can be very difficult to identify or quantify systematic error from a measurement summary. Thus, it is critical (especially in a study such as this) to take great care to ensure that these influences are not present.

As with any discharge measurement, the final assessment of the measurement is based on a qualitative judgment of measuring conditions and a quantitative evaluation of the individual measurements. The coefficient of variation (COV) is a useful statistic for making the quantitative assessment of the measurement. The coefficient of variation is equal to the standard deviation of the individual measurements divided by the mean of the measurements. These calculations are illustrated in tables 1 and 2 for different numbers of individual measurements.

Table 1. Example of standard deviation and coefficient of variation calculations for a group of eight individual measurements.

Individual measurements	Measured discharge, in cubic feet per second
Measurement #1	1,325
Measurement #2	1,115
Measurement #3	1,297
Measurement #4	1,182
Measurement #5	1,261
Measurement #6	1,291
Measurement #7	1,086
Measurement #8	1,347
Mean (μ)	1,238
Standard Deviation (σ)	113
Coefficient of Variation (COV)	0.09

Table 2. Example of standard deviation and coefficient of variation calculations for a group of four individual measurements.

Individual measurements	Measured discharge, in cubic feet per second
Measurement #1	932
Measurement #2	927
Measurement #3	911
Measurement #4	951
Mean (μ)	930
Standard Deviation (σ)	16
Coefficient of Variation (COV)	0.02

While performing a set of discharge measurements, if the COV of the first four individual measurements for a site is greater than 0.05, USGS policy requires that four more individual measurements. The final discharge value is then the average of all eight measurements. Idaho

Power Company followed similar procedures during this study and in some cases made more than eight individual measurements at a single site. Often, when more than four individual measurements were made at a site, the COV still remained above 0.05. High magnitudes of COV can indicate either or both of the following; flow variability at the time of the measurements and/or the presence of random error influences discussed earlier. However, this is not directly related to the overall accuracy of the measurement.

CALCULATION METHODS

Gains or losses for each subreach were calculated using a basic conservation of mass equation (Inflow +/- ΔStorage = Outflow). For any specific subreach of the study area, the equation is as follows:

$$\text{Gain/(Loss)} = \text{U/S Discharge} + \text{Inflow} - \text{Outflow} + \Delta\text{Storage} - \text{D/S Discharge}.$$

Performing the seepage studies during the non-irrigation season allows for the removal of the "Outflow" term in most instances. Coordinating steady releases from the dams located within the study area virtually negates the "ΔStorage" term in most cases. Thus, the equation most often used in the final calculations is as follows:

$$\text{Gain/(Loss)} = \text{U/S Discharge} + \text{Inflow} - \text{D/S Discharge}.$$

Values for the U/S and D/S Discharge terms were obtained from either gaging stations or instantaneous acoustic Doppler measurements. If gaging station data were used, the actual value typically was the instantaneous value based on an estimated travel time downstream to the next measurement site. In a few instances where unsteady releases from a power plant resulted in unsteady discharges, 30-day average discharges were used at adjacent gaging stations for comparisons.

Although efforts were made to coordinate steady releases from all dams within the study reaches, actual reservoir levels were somewhat variable during some seepage runs. In these instances, estimates of changes in storage were made by analyzing the reservoir level data and determining an estimate of change in storage over a specific time period. This storage volume was then transformed to an average flow rate over the analysis time period.

ACOUSTIC DOPPLER MEASUREMENT LOCATIONS

The criteria used when determining the locations of measurement sites between gaging stations included: (1) the likelihood of it being a good measuring section; (2) accessibility by road or boat; and (3) river distance to the adjacent measurement sites. River channel data for each of the specific acoustic Doppler measurement sites are presented in Appendix D at the back of this report. This data includes a site map, the site location, width and depth during one flow, and a picture of the site, if available.

TIMING OF ACOUSTIC DOPPLER MEASUREMENTS

The timing of the acoustic Doppler measurements turned out to be more important than originally thought mainly because of difficulties in coordinating steady flows, as well as other entities' ability to ensure steady flow during specific time periods. The timing of measurements was especially important in the middle reach because of the possible occurrence of unsteady flows resulting from two small hydro-generation facilities located upstream near Idaho Falls. Following the initial seepage runs in the Spring of 2001, more emphasis was placed on analyzing flow conditions at gaging stations and making all acoustic Doppler measurements within a specific subreach within a specific time frame. Intermediate acoustic Doppler measurements were started only after flow conditions were steady for an amount of time that was consistent with the estimated travel time within that subreach. The hydrographs in figure 3 show flow conditions during April 3-4, 2001 in the middle reach between Shelley and Blackfoot. Plotting the acoustic Doppler measurement times shows how unsteady flow conditions likely had some effect on the analysis in this reach during the Spring of 2001.

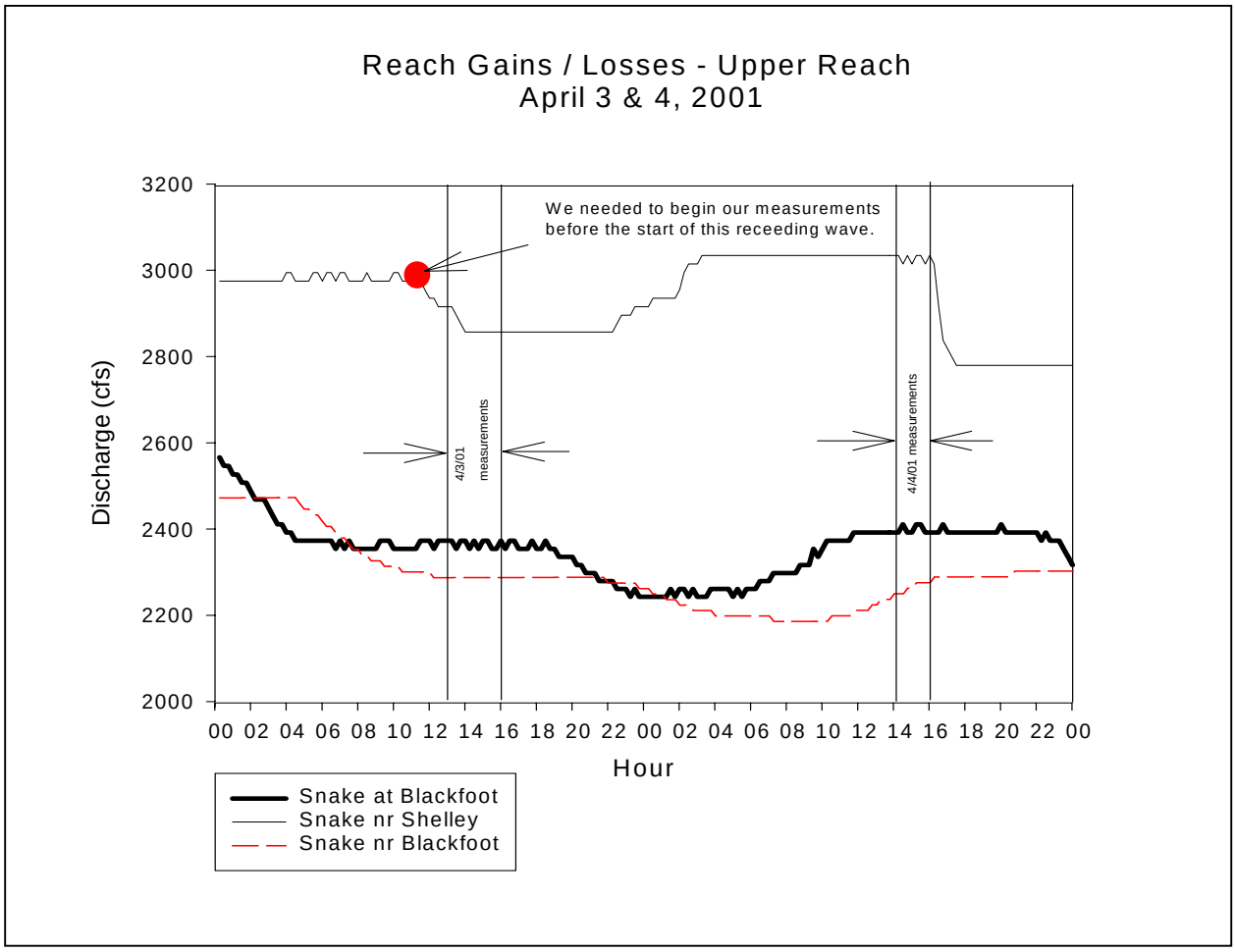


Figure 3. Hydrographs and acoustic Doppler measurement times showing how unsteady flows may affect gain/loss estimates.

REACH ANALYSES

The study area was divided into three reaches primarily to improve the efficiency of the data collection efforts and data analyses. The lower (Minidoka Dam downstream to King Hill) and middle (Shelley downstream to Minidoka Dam) reaches were studied a total of five times beginning in March 2001 and ending in November 2002. The upper reach (Heise downstream to Shelley and Ashton downstream to the mouth) was studied four times beginning in November 2001 and ending in November 2002.

Lower Reach (Minidoka to King Hill)

A map showing the locations of all gaging stations and intermediate acoustic Doppler measurement locations within this reach is presented in Appendix A, figure A1.

Spring 2001

Field Activities

The initial seepage run for this reach was performed during March 5-6, 2001, and coincided with the bi-annual springs measurements performed along portions of the lower reach by the USGS for IDWR. A total of 12 main-channel measurements were performed within the lower reach using acoustic Doppler instruments. Discharge data from 7 gaging stations located within this reach were also obtained. One person each from the USGS and IPCo inspected tributaries and agricultural return drains for inflows within the reach. Wading measurements were made at some tributary and drain sites as necessary. Based on field observations, it was assumed that the total inflow values determined for each subreach represented a majority if not all of the actual inflows occurring at the time of the study.

Summary

A summary of the data collected during the Spring 2001 seepage run for this reach is presented in Appendix A. Included in this information are a detailed summary table (table A1), a gaging station discharge summary table (table A2), an acoustic Doppler discharge summary table (table A3), and an inflow and outflow inspection summary table (table A4). A map showing all main-channel measurement locations and gain/loss estimates for the Spring of 2001 is presented in figure A2.

No measurement was made at site L2 because of poor weather and unsafe river conditions. A measurement was made at site L3 but was not used in the final calculations because it was not consistent with adjacent data.

Fall 2001

Field Activities

The seepage run for this reach was performed during November 5-7, 2001, and again coincided with springs measurements performed along portions of the lower reach by the USGS for IDWR.

A total of 13 main-channel measurements were performed within the lower reach using acoustic Doppler instruments. Discharge data from 7 gaging stations located within this reach were also obtained. One person each from the USGS and IPCo inspected tributaries and agricultural return drains for inflows within the reach. Wading measurements were made at some tributary and drain sites as necessary. Based on field observations and past experience, it was assumed that the total inflow values determined for each subreach represented a majority if not all of the actual inflows occurring at the time of the study.

Summary

A summary of the data collected during the Fall 2001 seepage run for this reach is presented in Appendix A. Included in this information are a detailed summary table (table A5), a gaging station discharge summary table (table A6), an acoustic Doppler discharge summary table (table A7), and an inflow and outflow inspection summary table (table A8). A map showing all main-channel measurement locations and gain/loss estimates for the Fall of 2001 is presented in figure A3.

Above normal algae growth, as a result of extended low flows for much of 2001, hampered measurement procedures at some locations. This resulted in extremely high variances associated with some estimates, most noticeably at sites L2 and L3. At other sites, the actual measurement location was moved slightly because of algae growth at the original location. An estimate was not determined for the reach between L15 and L16 because of unsteady reservoir levels above Lower Salmon Falls Power Plant. In addition, the measurement at L17 likely was affected by unsteady flow conditions out of Lower Salmon Falls Power Plant and was not used in the final analysis.

Spring 2002

Field Activities

The seepage run for this reach was performed during March 11-12, 2002, and again coincided with springs measurements performed along portions of the lower reach by the USGS for IDWR. A total of 12 main-channel measurements were performed within the lower reach using acoustic Doppler instruments. Discharge data from 7 gaging stations located within this reach were also

obtained. One person each from the USGS and IPCo inspected tributaries and agricultural return drains for inflows within the reach. Wading measurements were made at some tributary and drain sites as necessary. Based on field observations, it was assumed that the total inflow values determined for each subreach represented a majority if not all of the actual inflows occurring at the time of the study.

Summary

A summary of the data collected during the Spring 2002 seepage run for this reach is presented in Appendix A. Included in this information are a detailed summary table (table A9), a gaging station discharge summary table (table A10), an acoustic Doppler discharge summary table (table A11), and an inflow and outflow inspection summary table (table A12). A map showing all main-channel measurement locations and gain/loss estimates for the Spring of 2001 is presented in figure A4.

No measurement was made at site L3 because of poor weather and unsafe river conditions. An estimate was not determined for the reach between sites L19 and L20 because, although an estimate of 100 ft^3/s inflow from Clover Creek was made on March 20, it is likely that Clover Creek flows, resulting from snowmelt runoff, were much greater on March 12.

Summer 2002

Field Activities

The seepage run for this reach was performed during July 24-25, 2002. A total of 13 main-channel measurements were performed within the lower reach using acoustic Doppler instruments. Discharge data from 7 gaging stations located within this reach were also obtained. Because of the large number of expected agricultural returns and tributary inflows during the summer months, several persons from the USGS and IPCo inspected tributaries and agricultural return drains for inflows within the reach. Wading measurements were made at some sites as necessary. Based on field observations, it was assumed that the total inflow values determined for each subreach represented a majority (possibly up to 90%) of the actual inflows occurring at the time of the study.

Summary

A summary of the data collected during the Summer 2002 seepage run for this reach is presented in Appendix A. Included in this information are a detailed summary table (table A13), a gaging station discharge summary table (table A14), an acoustic Doppler discharge summary table (table A15), and an inflow and outflow inspection summary table (table A16). A map showing all main-channel measurement locations and gain/loss estimates for the Summer of 2002 is presented in figure A5.

Flow conditions and reservoir levels were relatively steady throughout the summer study period. There were some large variations in outflows from Lower Salmon Falls Power Plant and Bliss Dam, but these did not seem to affect any of the calculations. As noted previously, a large number of agricultural drains were active during this seepage run. Although extensive efforts were made to ensure that a majority of the inflows were inspected, it is possible that some significant inflow sites were not inspected and thus, are not reflected in the final calculations.

Fall 2002

Field Activities

The seepage run for this reach was performed during November 6-8, 2002. A total of 12 main-channel measurements were performed within the lower reach using acoustic Doppler instruments. Discharge data from 7 gaging stations located within this reach were also obtained. Since the USGS and IPCo gaging station data for this time period is included in water year 2003, it has not be published as final data and is still subject to review. However, the data was analyzed and adjusted if necessary, based on data from actual measurements made very close to the time of the seepage runs, to ensure that it is as accurate as possible. One person each from the USGS and IPCo inspected tributaries and agricultural return drains for inflows within the reach. Wading measurements were made at some tributary and drain sites as necessary. Based on field observations, it was assumed that the total inflow values determined for each subreach represented a majority if not all of the actual inflows occurring at the time of the study.

Summary

A summary of the data collected during the Fall 2002 seepage run for this reach is presented in Appendix A. Included in this information are a detailed summary table (table A17), a gaging station discharge summary table (table A18), an acoustic Doppler discharge summary table (table A19), and an inflow and outflow inspection summary table (table A20). A map showing all main-channel measurement locations and gain/loss estimates for the Fall of 2002 is presented in figure A6.

Flow conditions out of Milner Dam were somewhat unsteady and may have affected some of the final calculations, especially those between sites L6 and L9. A measurement was made at site L17 but was not used in the final analysis because it was not consistent with other adjacent measurements. No measurement was made at site L19 because of unsafe river conditions.

Reach Summary

Streamflow data for the reach of the Snake River between Minidoka Dam and King Hill were collected and analyzed during five separate seepage runs performed between March 2001 and November 2002. These included two spring runs, two fall runs, and one summer run. Estimates of gains and/or losses for specific subreaches were determined. Further analysis may be required to analyze trends with respect to time. A summary of the estimated gains and losses for the lower study reach, excluding the summer estimates, is presented in graphical format in Appendix A, figure A7.

Middle Reach (Shelley to Minidoka)

A map showing the locations of all gaging stations and intermediate acoustic Doppler measurement locations within this reach is presented in Appendix B, figure B1.

Spring 2001

Field Activities

The initial seepage run for this reach was performed during April 3-4, 2001. A total of 11 acoustic Doppler measurements were performed within the reach. Discharge data from 5 gaging stations located within this reach were also obtained. Two persons from the USGS, Idaho Falls

Field Office, were involved in the inspection of tributaries and agricultural drains, as well as river guidance based on their knowledge and experience in the area. One of IPCo's river crews also assisted with field inspections. Wading measurements were made at certain locations as necessary. Based on field observations, it was assumed that the total inflow values determined for each subreach represented a majority if not all of the actual inflows occurring at the time of the study.

Summary

A summary of the data collected during the Spring 2001 seepage run for this reach is presented in Appendix B. Included in this information are a detailed summary table (table B1), a gaging station discharge summary table (table B2), an acoustic Doppler discharge summary table (table B3), and an inflow and outflow inspection summary table (table B4). A map showing all main-channel measurement locations and gain/loss estimates for the Spring of 2001 is presented in figure B2.

Two small hydro-generation facilities are located on the Snake River near Idaho Falls. Because of their power-generation requirements, coordination of steady flows with these entities was not possible. Although these hydro-generation facilities are small, they do have the ability to affect flows. As a result, unsteady flows were encountered in the middle reach during portions of the study period. In addition, Bureau of Reclamation (BOR) had planned to hold flows steady out of Palisades and American Falls Reservoirs during the study period. Unfortunately, the unexpected suspension of flow into a major irrigation canal on April 3 created a surcharge condition in American Falls Reservoir. In order to relieve the situation, BOR had no choice but to increase flows out of American Falls. As a result, the measurements made at sites M13, M14, and M15 were made during very unsteady flow conditions and were not used in the final analysis.

Fall 2001

Field Activities

The seepage run for this reach was performed during October 31 and November 1, 2001. The sites between Neeley and Minidoka were not visited until November 20, 2001 because of access problems due to low streamflow conditions.

A total of 10 acoustic Doppler measurements were performed within the reach. Discharge data from 5 gaging stations located within this reach were also obtained. This included one measurement at a location approximately 12 miles upstream from American Falls Dam, which is typically located in the reservoir. Below normal reservoir levels during this study period allowed for a measurement at this location. The measurement data is presented for general use, but it was not used in the final analyses. Personnel from the USGS and IPCo were involved in the inspection of tributaries and agricultural drains. Wading measurements were made at certain locations as necessary. Based on field observations and past experience, it was assumed that the total inflow values determined for each subreach represented a majority if not all of the actual inflows occurring at the time of the study.

Summary

A summary of the data collected during the Fall 2001 seepage run for this reach is presented in Appendix B. Included in this information are a detailed summary table (table B5), a gaging station discharge summary table (table B6), an acoustic Doppler discharge summary table (table B7), and an inflow and outflow inspection summary table (table B8). A map showing all main-channel measurement locations and gain/loss estimates for the Fall of 2001 is presented in figure B3.

As previously discussed, two small hydro-generation facilities located on the Snake River near Idaho Falls have the ability to affect flows. As a result, unsteady flow conditions may have affected the analysis of certain subreaches. Inspection of the data revealed that the estimates for the reach between sites M2 and M3 and between sites M7 and M8 were very likely affected by unsteady flows and may not have the same accuracy as other estimates. In addition, site M14 was not accessible because of extremely low flow conditions and therefore, was not measured.

Spring 2002

Field Activities

The seepage run for this reach was performed during April 9-10, 2002. The sites between Neeley and Minidoka were not visited until May 7, 2002 because of unsteady streamflow releases from American Falls Dam.

A total of 9 acoustic Doppler measurements were performed within the reach. Discharge data from 5 gaging stations located within this reach were also obtained. Personnel from the USGS and IPCo were involved in the inspection of tributaries and agricultural drains. Wading measurements were made at certain locations as necessary. Based on field observations and past experience, it was assumed that the total inflow values determined for each subreach represented a majority if not all of the actual inflows occurring at the time of the study.

Summary

A summary of the data collected during the Spring 2002 seepage run for this reach is presented in Appendix B. Included in this information are a detailed summary table (table B9), a gaging station discharge summary table (table B10), an acoustic Doppler discharge summary table (table B11), and an inflow and outflow inspection summary table (table B12). A map showing all main-channel measurement locations and gain/loss estimates for the Spring of 2002 is presented in figure B4.

Unsteady releases from the two small hydro-generation facilities located on the Snake River near Idaho Falls did not affect the analysis during this seepage run. Flows were relatively steady along the entire study reach during the study period. Site M10 was not accessible and site M15 was not measured because of unsafe measuring conditions.

Summer 2002

Field Activities

The seepage run for this reach was performed during July 23-24, 2002. A total of 9 acoustic Doppler measurements were performed within the reach. Discharge data from 5 gaging stations located within this reach were also obtained. Because of the large number of expected agricultural returns and tributary inflows during the summer months, several persons from the USGS and IPCo inspected tributaries and agricultural return drains for inflows within the reach. Wading measurements were made at some sites as necessary. Based on field observations, it was assumed that the total inflow values determined for each subreach represented a majority (possibly up to 90%) of the actual inflows occurring at the time of the study.

Summary

A summary of the data collected during the Summer 2002 seepage run for this reach is presented in Appendix B. Included in this information are a detailed summary table (table B13), a gaging station discharge summary table (table B14), an acoustic Doppler discharge summary table (table B15), and an inflow and outflow inspection summary table (table B16). A map showing all main-channel measurement locations and gain/loss estimates for the Summer of 2002 is presented in figure B5.

Unsteady releases from the two small hydro-generation facilities located on the Snake River near Idaho Falls did not affect the analysis during this seepage run. Flows were relatively steady along the entire study reach during the study period. Site M10 was not accessible and site M11 could not be measured because of sediment buildup and braided channel conditions.

Fall 2002

Field Activities

The seepage run for this reach was performed during November 5-6, 2002. A total of 11 acoustic Doppler measurements were performed within the reach. Discharge data from 5 gaging stations located within this reach were also obtained. Since the USGS gaging station data for this time period is included in water year 2003, it has not be published as final data and is still subject to review. However, the data was analyzed and adjusted if necessary, based on data from actual measurements made very close to the time of the seepage runs, to ensure that it is as accurate as possible. Personnel from the USGS and IPCo were involved in the inspection of tributaries and agricultural drains. Wading measurements were made at certain locations as necessary. Based on field observations and past experience, it was assumed that the total inflow values determined for each subreach represented a majority if not all of the actual inflows occurring at the time of the study.

Summary

A summary of the data collected during the Fall 2002 seepage run for this reach is presented in Appendix B. Included in this information are a detailed summary table (table B17), a gaging station discharge summary table (table B18), an acoustic Doppler discharge summary table (table

B19), and an inflow and outflow inspection summary table (table B20). A map showing all main-channel measurement locations and gain/loss estimates for the Fall of 2002 is presented in figure B6.

Unsteady releases from the two small hydro-generation facilities located on the Snake River near Idaho Falls did not affect the analysis during this seepage run. Flows were relatively steady along the entire study reach during the study period and all sites were accessible and able to be measured.

Reach Summary

Streamflow data for the reach of the Snake River between Shelley and Minidoka Dam were collected and analyzed during five separate seepage runs performed between March 2001 and November 2002. These included two spring runs, two fall runs, and one summer run. Estimates of gains and/or losses for specific subreaches were determined. Further analysis may be required to analyze trends with respect to time. A summary of the estimated gains and losses for the middle study reach is presented in graphical format in Appendix B, figure B7.

Upper Reach (Ashton to mouth / Heise to Shelley)

A map showing the locations of all gaging stations and intermediate acoustic Doppler measurement locations within this reach is presented in Appendix C, figure C1.

Fall 2001

Field Activities

The initial seepage run for these reaches was performed during October 29-31, 2001. A total of 10 acoustic Doppler measurements were performed within the reaches. Discharge data from 8 gaging stations located within the reaches were also obtained. Personnel from the USGS and IPCo were involved in the inspection of tributaries and agricultural drains. Wading measurements were made at certain locations as necessary. Based on field observations, it was assumed that the total inflow values determined for each subreach represented a majority if not all of the actual inflows occurring at the time of the study.

Summary

A summary of the data collected during the Fall 2001 seepage measurements for this reach is presented in Appendix C. Included in this information are a detailed summary table (table C1), a gaging station discharge summary table (table C2), an acoustic Doppler discharge summary table (table C3), and an inflow and outflow inspection summary table (table C4). A map showing all main-channel measurement locations and gain/loss estimates for the Fall of 2001 is presented in figure C2.

Measurement conditions were good throughout the reaches. Measurements were made at all of the originally planned sites. After reviewing the data, it was determined that measurements on the Snake River and Henrys Fork in the areas immediately upstream from the confluence would be beneficial to the gain/loss calculations. As a result, attempts were made to measure these sites during all subsequent seepage runs. Because of the lack of data at the confluence, the gain/loss estimate between sites U12 and U14 includes any gains or losses within the approximately 9-mi subreach on the Henrys Fork between the Rexburg gaging station (U7) and the mouth.

Overall, the measurements made within these study reaches were thought to be relatively good. Because unsteady releases from the two small hydro-generation facilities located on the Snake River near Idaho Falls make it difficult to accurately calculate gains/losses over a short time period, 30-day average daily mean discharges were used in the calculations. The use of average values may reduce some of the variability in the gain/loss calculations, however, any variability in inflows or outflows within this reach would not be accounted for and could possibly result in estimates with somewhat high levels of error.

Spring 2002

Field Activities

The seepage run for these reaches was performed during April 8-9, 2002. A total of 12 acoustic Doppler measurements were performed within the reaches. Discharge data from 8 gaging stations located within the reaches were also obtained. Personnel from the USGS and IPCo were involved in the inspection of tributaries and agricultural drains. Wading measurements were made at certain locations as necessary. Based on field observations, it was assumed that the total

inflow values determined for each subreach represented a majority if not all of the actual inflows occurring at the time of the study.

Summary

A summary of the data collected during the Spring 2002 seepage measurements for this reach is presented in Appendix C. Included in this information are a detailed summary table (table C5), a gaging station discharge summary table (table C6), an acoustic Doppler discharge summary table (table C7), and an inflow and outflow inspection summary table (table C8). A map showing all main-channel measurement locations and gain/loss estimates for the Spring of 2002 is presented in figure C3.

Measurement conditions were good throughout the reaches. Measurements were made at all of the planned sites. Overall, the measurements made within these study reaches were thought to be very good. There were some questions concerning the ability to measure all of the flow at the site located immediately above the confluence (U13) on the Snake River. As a result, this measurement was not included in the final calculations. Because unsteady releases from the two small hydro-generation facilities located on the Snake River near Idaho Falls make it difficult to accurately calculate gains/losses over a short time period, 30-day average daily mean discharges were used in the calculations. The use of average values may reduce some of the variability in the gain/loss calculations, however, any variability in inflows or outflows within this reach would not be accounted for and could possibly result in estimates with somewhat high levels of error.

Summer 2002

Field Activities

The seepage run for these reaches was performed during July 22-23, 2002. A total of 10 acoustic Doppler measurements were performed within the reaches. Discharge data from 8 gaging stations located within the reaches were also obtained. Because of the large number of expected agricultural returns and tributary inflows during the summer months, several persons from the USGS and IPCo inspected tributaries and agricultural return drains for inflows within the reaches. Wading measurements were made at some sites as necessary. Based on field observations, it was assumed that the total inflow values determined for each subreach

represented a majority (possibly up to 90%) of the actual inflows occurring at the time of the study.

Summary

A summary of the data collected during the Summer 2002 seepage run for this reach is presented in Appendix C. Included in this information are a detailed summary table (table C9), a gaging station discharge summary table (table C10), an acoustic Doppler discharge summary table (table C11), and an inflow and outflow inspection summary table (table C12). A map showing all main-channel measurement locations and gain/loss estimates for the Summer of 2002 is presented in figure C4.

Because of relatively large discharges, measurement conditions were somewhat difficult at several locations. Measurements were made at all but two of the planned sites. A combination of equipment problems and high water velocities at sites U8 and U13, near the confluence, prevented the collections of data at these sites. In addition, measuring conditions at site U18 were very poor and although data were collected, the data were not used in the calculation of any gain/loss estimates.

Because unsteady releases from the two small hydro-generation facilities located on the Snake River near Idaho Falls make it difficult to accurately calculate gains/losses over a short time period, 30-day average daily mean discharges were used in the calculations. The use of average values may reduce some of the variability in the gain/loss calculations, however, any variability in inflows or outflows within this reach would not be accounted for and may result in estimates with somewhat high levels of error. This would be especially true during the summer seepage run when inflows and outflow may be quite variable over a 30-day period.

Fall 2002

Field Activities

The seepage run for these reaches was performed during November 4-5, 2002. A total of 10 acoustic Doppler measurements were performed within these reaches. Discharge data from 8 gaging stations located within the reaches were also obtained. Since USGS gaging station data for this time period is included in water year 2003, it has not be published as final data and is still

subject to review. However, the data was analyzed and adjusted if necessary, based on information from actual measurements made very close to the time of the seepage runs, to ensure that it is as accurate as possible. Personnel from the USGS and IPCo were involved in the inspection of tributaries and agricultural drains. Wading measurements were made at certain locations as necessary. Based on field observations, it was assumed that the total inflow values determined for each subreach represented a majority if not all of the actual inflows occurring at the time of the study.

Summary

A summary of the data collected during the Fall 2002 seepage measurements for this reach is presented in Appendix C. Included in this information are a detailed summary table (table C13), a gaging station discharge summary table (table C14), an acoustic Doppler discharge summary table (table C15), and an inflow and outflow inspection summary table (table C16). A map showing all main-channel measurement locations and gain/loss estimates for the Fall of 2002 is presented in figure C5.

Measurement conditions were relatively good at most locations within the study reaches. Measurements were made at all but two of the planned sites. Overall, the measurements made within these study reaches were thought to be very good. Again, there were some question concerning the ability to measure all of the flow at the site located immediately above the confluence (U13) on the Snake River. No measurements were made at sites U3 and U17 because of ice in the river channel. Because unsteady releases from the two small hydro-generation facilities located on the Snake River near Idaho Falls make it difficult to accurately calculate gains/losses over a short time period, 30-day average daily mean discharges were used in the calculations. The use of average values may reduce some of the variability in the gain/loss calculations, however, any variability in inflows or outflows within this reach would not be accounted for and may result in estimates with somewhat high levels of error.

Reach Summary

Streamflow data for the reaches of the Snake River between Heise and Shelley and the Henrys Fork between Ashton and the mouth were collected and analyzed during four separate seepage runs performed between October 2001 and November 2002. These included one spring run, two

fall runs, and one summer run. Estimates of gains and/or losses for specific subreaches were determined. Further analysis may be required to analyze trends with respect to time. A summary of the estimated gains and losses for the upper study reaches is presented in graphical format in Appendix C, figure C6.

SUMMARY

Streamflow discharge data were collected over a two-year period on portions of the Snake River and Henrys Fork in south-central and southeastern Idaho. The data was collected for analysis of gains and losses as one component of the general Eastern Snake Hydrologic Modeling Committee strategy to refine and enhance the conceptual and computer models of the ESRP hydrologic system. The information gathered will be combined with the results of other work being done on the plain to enhance the conceptual model of the hydrologic system and refine ground-water and surface-water computer flow models. Data collection and analyses were performed in a collaborative effort by the U.S. Geological Survey (USGS) and Idaho Power Company (IPCo).

The overall data collection process was very successful . The use of boat-mounted Acoustic Doppler Current Profilers (ADCPs) and Acoustic Doppler Profilers (ADPs) allowed for measurements to be made at intermediate locations between long-term gaging stations, where previously measurements would have been extremely difficult or impossible. As with any data collection effort, some problems arose which led to poor data or no data being collected at specific times and locations. Some of these problems included unsteady flow conditions, changes in reservoir storages, and unsafe measuring conditions.

The gain/loss estimates for the specific subreaches will allow the modelers to refine and enhance the surface water/ground water interaction portions of the ESRP model. The estimates may be used to show possible differences in gains and losses between varying time periods, varying flow regimes, and varying ground-water aquifer levels. However, any extensive trend analyses with respect to time would likely require additional data collected over a number of years.

APPENDICES

APPENDIX A

Gain and loss calculations and relevant data for the Snake River between Minidoka Dam and King Hill, Idaho

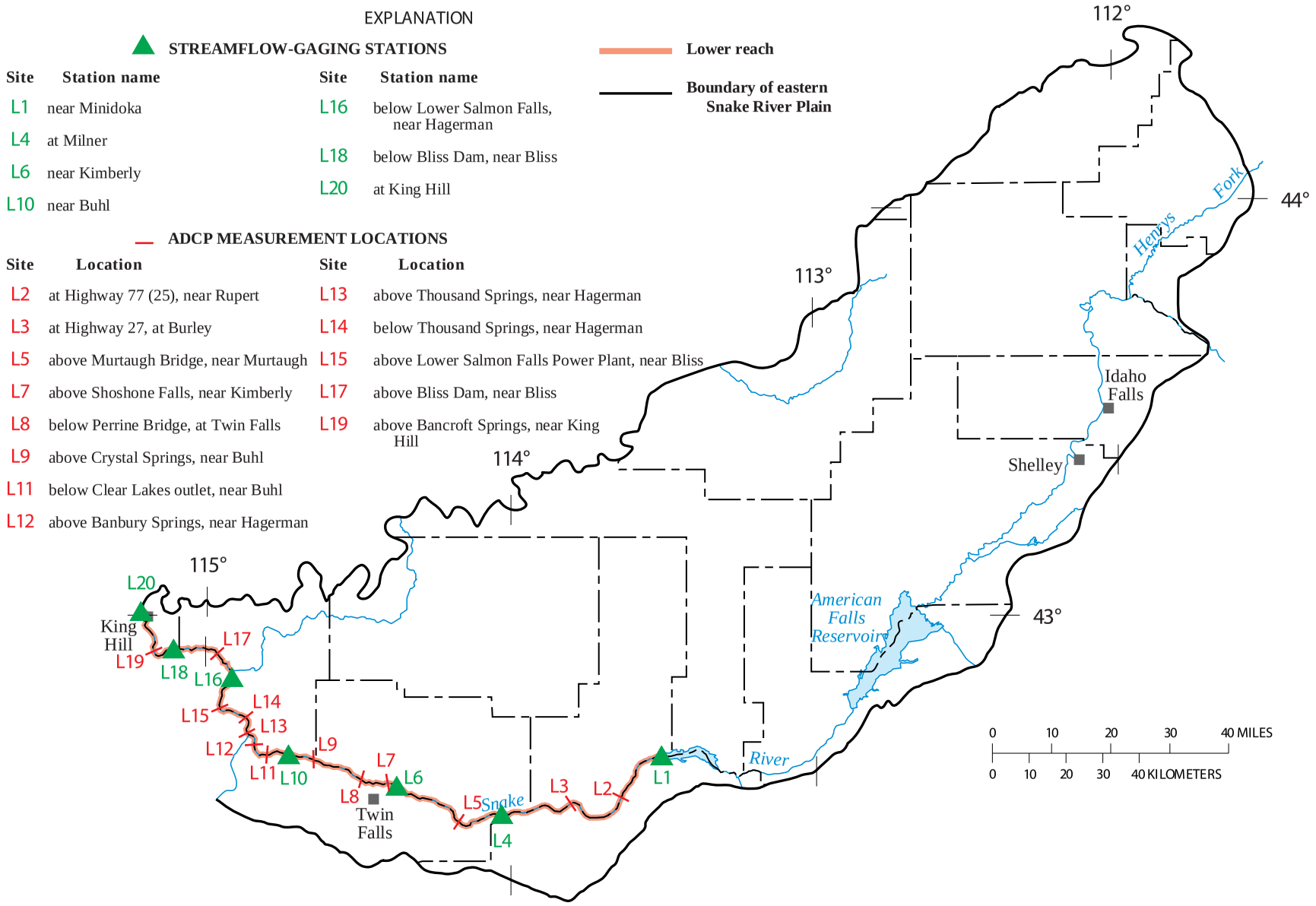


Figure A1. Locations of sites along the lower reach of the Snake River, Idaho, where streamflow was measured.

Table A1. Calculations of gains and losses in specified subreaches of the Snake River during March 5-6, 2001, between Minidoka Dam and King Hill, Idaho

[ADCP, Acoustic Doppler Current Profiler; ADP, Acoustic Doppler Profiler; ft^3/s, cubic feet per second; mi, mile; ---, no data]

Map number (fig. #)	Gaging station name (number)[1]/ ADCP/ADP measurement location	River mile		Discharge (ft^3/s)	Date	Time	Total gains/ (losses) (ft^3/s)	Gains/ (losses) per mile ($ft^3/s/mi$)
L1	**Snake River near Minidoka (13081500)**	673.5		595	3/5/2001	2230		
			total estimated inflow	0				
			total estimated outflow	0				
L2	Snake River at Highway 77(25) near Rupert	664.0		---[2]	---	---	---	---
			total estimated inflow	0				
			total estimated outflow	0				
			estimated outflow to storage in Milner Lake[3]	0				
L3	Snake River at Highway 27 at Burley	651.6		---[4]	---	---	---	---
			total estimated inflow	5				
			total estimated outflow	0				
			estimated outflow to storage in Milner Lake[3]	0				
L4	**Snake River at Milner (13088000)**	638.7		644	3/6/2001	1530	44	1
				636	3/5/2001	0730		
			total estimated inflow	0				
			total estimated outflow	0				
L5	Snake River above Murtaugh Bridge at Murtaugh	630.5		610	3/5/2001	1140	(26)	(3)
			total estimated inflow	0				
			total estimated outflow	0				
L6	**Snake River near Kimberly (13090000)**	617.2		884	3/5/2001	1800	274	21
				892	3/5/2001	1330		
			total estimated inflow	0				
			total estimated outflow	0				
L7	Snake River above Shoshone Falls near Kimberly	615.2		890	3/5/2001	1425	(2)	(1)
			total estimated inflow	0				
			total estimated outflow	0				
L8	Snake River below Perrine Bridge at Twin Falls	611.0		950	3/5/2001	1610	60	14
			total estimated inflow	57				
			total estimated outflow	0				

Table A1. Calculations of gains and losses in specified subreaches of the Snake River during March 5-6, 2001, between Minidoka Dam and King Hill, Idaho--Continued

Map number (fig. #)	Gaging station name (number)[1]/ ADCP/ADP measurement location	River mile		Discharge (ft^3/s)	Date	Time	Total gains/ (losses) (ft^3/s)	Gains/ (losses) per mile ($ft^3/s/mi$)
L9	Snake River above Crystal Springs near Buhl	601.1		1540	3/6/2001	0845	533	54
			total estimated inflow	33				
			total estimated outflow	0				
L10	**Snake River near Buhl (13094000)**	596.8		1900	3/6/2001	1045	327	76
				1890	3/6/2001	0915		
			total estimated inflow	0				
			total estimated outflow	0				
L11	Snake River below Clear Lakes outlet near Buhl	592.8		2510	3/6/2001	1115	620	155
			total estimated inflow	20				
			total estimated outflow	0				
L12	Snake River above Banbury Springs near Hagerman	589.2		2870	3/5/2001	1156	340	94
			total estimated inflow	125				
			total estimated outflow	0				
L13	Snake River above Thousand Springs near Hagerman	585.6		3640	3/5/2001	1031	645	179
			total estimated inflow	0				
			total estimated outflow	0				
L14	Snake River below Thousand Springs near Hagerman	582.9		4930	3/5/2001	0911	1,290	478
			total estimated inflow	72				
			total estimated outflow	0				
L15	Snake River above Lower Salmon Falls Power Plant near Bliss	576.8		5470	3/6/2001	1151	468	77
			total estimated inflow	30				
			total estimated outflow	0				
			estimated outflow to storage above Lower Salmon Falls power plant[5]	0				
L16	**Snake River below Lower Salmon Falls near Hagerman (13135000)**	572.5		5590	3/6/2001	1800	90	21
				5460	3/5/2001	1230		
			total estimated inflow	1304				
			total estimated outflow	0				
L17	Snake River above Bliss Dam near Bliss	564.9		6630	3/5/2001	1618	(134)	(18)
			total estimated inflow	0				

Table A1. Calculations of gains and losses in specified subreaches of the Snake River during March 5-6, 2001, between Minidoka Dam and King Hill, Idaho--Continued

Map number (fig. #)	Gaging station name (number)[1]/ ADCP/ADP measurement location	River mile		Discharge (ft^3/s)	Date	Time	Total gains/ (losses) (ft^3/s)	Gains/ (losses) per mile ($ft^3/s/mi$)
			total estimated outflow	0				
			estimated outflow to storage above Bliss Dam[5]	60				
L18	**Snake River below Bliss Dam near Bliss (13153776)**	559.1		6600	3/5/2001	1930	30	5
				6880	3/5/2001	1030		
			total estimated inflow	0				
			total estimated outflow	0				
L19	Snake River above Bancroft Springs near King Hill	553.2		7010	3/5/2001	1326	130	22
			total estimated inflow	10				
			total estimated outflow	0				
L20	**Snake River at King Hill (13154500)**	546.6		7090	3/5/2001	1630	70	11

[1] Long-term United States Geological Survey or Idaho Power Company gaging stations are in bold.

[2] Unable to measure because of river or weather conditions.

[3] Estimated based on reservoir stage data (USGS station number 13087900).

[4] Measurement was made but not used in the calculations (see table 3).

[5] Estimated based on reservoir stage data (Idaho Power Company).

Table A2. Gaging station discharge data during March 5-6, 2001, for the Snake River between Minidoka Dam and King Hill, Idaho

[Discharge given in cubic feet per second]

Map number (fig. #)	Gaging station name (number)	Date	Time	Discharge
L1	Snake River near Minidoka (13081500)	3/5/2001	2230	595
L4	Snake River at Milner (13088000)	3/6/2001	1530	644
		3/5/2001	0730	636
L6	Snake River near Kimberly (13090000)	3/5/2001	1800	884
		3/5/2001	1330	892
L10	Snake River near Buhl (13094000)	3/6/2001	1045	1900
		3/6/2001	0915	1890
L16	Snake River below Lower Salmon Falls near Hagerman (13135000)	3/6/2001	1800	5590
		3/5/2001	1230	5460
L18	Snake River below Bliss Dam near Bliss (13153776)	3/5/2001	1930	6600
		3/5/2001	1030	6880
L20	Snake River at King Hill (13154500)	3/5/2001	1630	7090

Table A3. Acoustic Doppler discharge measurement data during March 5-6, 2001, for the Snake River between Minidoka Dam and King Hill, Idaho

[ADCP, Acoustic Doppler Current Profiler; ADP, Acoustic Doppler Profiler; discharge given in cubic feet per second; COV, coefficient of variation; σ, standard deviation; μ, mean; ---, no data]

Map number (fig. #)	ADCP/ADP measurement location	Date	Time	Discharge	COV (σ/μ)
L2	Snake River at Highway 77(25) near Rupert	---[1]	---	---	---
L3	Snake River at Highway 27 at Burley	3/6/2001	0920	869	0.04
L5	Snake River above Murtaugh Bridge at Murtaugh	3/5/2001	1140	610	0.08
L7	Snake River above Shoshone Falls near Kimberly	3/5/2001	1425	890	0.09
L8	Snake River below Perrine Bride at Twin Falls	3/5/2001	1610	950	0.14
L9	Snake River above Crystal Springs near Buhl	3/6/2001	0845	1540	0.05
L11	Snake River below Clear Lakes outlet near Buhl	3/6/2001	1115	2510	0.12
L12	Snake River above Banbury Springs near Hagerman	3/5/2001	1156	2870	0.02
L13	Snake River above Thousand Springs near Hagerman	3/5/2001	1031	3640	0.04
L14	Snake River below Thousand Springs near Hagerman	3/5/2001	0911	4930	0.01
L15	Snake River above Lower Salmon Falls Power Plant near Bliss	3/6/2001	1151	5470	0.01
L17	Snake River above Bliss Dam near Bliss	3/5/2001	1618	6630	0.04
L19	Snake River above Bancroft Springs near King Hill	3/5/2001	1326	7010	0.04

[1] No measurement made because of shallow depths and limited access.

Table A4. Discharge data for all inspected inflow and outflow sites during March 2-6, 2001, for the Snake River between Minidoka Dam and King Hill, Idaho

[Latitude and longitude in degrees, minutes, seconds in North American Datum of 1983 (NAD83); DM, daily mean discharge; discharge given in cubic feet per second; map numbers shown in figure X; ---, no data]

Inspection site[1]	Station number[1]	Location		Date	Time	Discharge[2]
		Latitude	Longitude			
Subreach between map numbers L1 and L2						
F Drain near Declo	13082060	42 32 48	113 37 14	3/5/2001	---	0
D-3 Drain near Declo	13082032	42 36 49	113 36 10	3/5/2001	---	0
Subreach between map numbers L2 and L3						
D-5 Drain near Rupert	13082062	42 33 15	113 38 38	3/5/2001	---	---
D-4 Drain near Rupert	13082064	42 34 15	113 38 25	3/5/2001	---	0
Marsh Creek near Declo	13082320	42 31 26	113 40 02	3/5/2001	---	[3]---
Spring Creek near Declo	13082330	42 31 01	113 41 03	3/5/2001	---	[3]---
D-16 Drain near Heyburn	13084705	42 32 30	113 45 24	3/5/2001	---	0
Subreach between map numbers L3 and L4						
B Drain near Heyburn	13084707	42 33 33	113 47 01	3/5/2001	---	0
D-17 Drain near Heyburn	13085060	42 32 53	113 50 51	3/5/2001	---	0
Main Drain North near Heyburn	13085065	42 33 02	113 51 59	3/5/2001	1200	5
G Drain near Burley	13085070	42 31 56	113 53 12	3/5/2001	---	---
J Drain near Burley	13085080	42 31 53	113 53 29	3/5/2001	---	---
A&B Irrigation Pump near Milner	13085500	42 32 01	113 56 51	3/5/2001	DM	0
PA Lateral Pump near Milner	13085800	42 32 02	113 58 19	3/5/2001	DM	0
Milner Irrigation Pump near Milner	13086000	42 31 10	114 00 38	3/5/2001	DM	0
Northside A Lateral near Milner	13086510	42 32 17	114 02 40	3/5/2001	DM	0
Northside Crosscut Canal near Milner	13086520	42 33 31	114 03 08	3/5/2001	DM	0
Milner-Gooding Canal near Milner	13086530	42 33 39	114 02 59	3/5/2001	DM	0
North Side Main Canal near Milner	13087000	42 31 46	114 01 10	3/5/2001	DM	0
Twin Falls Main Canal near Milner	13087500	42 31 18	114 01 03	3/5/2001	DM	0
Subreach between map numbers L4 and L5						
---	---	---	---	---	---	---
Subreach between map numbers L5 and L6						
Miscellaneous agriculture return near Hansen	13089690	42 33 55	114 19 24	3/5/2001	---	0
Twin Falls Coulee near Hansen	13089695	42 34 11	114 20 32	3/5/2001	---	0
Devil's Washbowl Spring near Kimberly	13089600	42 35 18	114 20 45	3/12/2001	1015	[3]12.8
Subreach between map numbers L6 and L7						
Devil's Corral Springs near Kimberly	13090100	42 35 38	114 21 55	3/6/2001	0850	[3]37.4
Subreach between map numbers L7 and L8						
Fish Hatchery Waste O near Twin Falls	13090370	42 35 31	114 26 05	3/5/2001	---	---
Mary Alice Lake discharge near Twin Falls	---	42 35 46	114 26 51	3/5/2001	---	---
Subreach between map numbers L8 and L9						
Perrine Coulee near Twin Falls	13090460	42 35 53	114 28 20	3/5/2001	---	[3]2.4
Blue Lakes Outlet near Twin Falls	13091500	42 36 30	114 28 34	3/7/2001	---	[3]195
Warm Creek near Twin Falls	13091700	42 37 15	114 29 55	3/5/2001	1200	20
Rock Creek above Highway 30/93 at Twin Falls	**13092747**	42 33 47	114 29 42	3/6/2001	DM	37
Jerome Golf Course Drain 1	13091733	42 38 03	114 31 02	3/5/2001	---	0
Miscellaneous agriculture return near Twin Falls	---	42 37 21	114 33 23	3/5/2001	---	0
Sonnickson Drain near Twin Falls	13093150	42 38 40	114 33 26	3/5/2001	---	0
Miscellaneous agriculture return near Twin Falls	---	42 38 23	114 33 32	3/5/2001	---	0
Miscellaneous agriculture return near Twin Falls	---	42 37 36	114 34 29	3/5/2001	---	0
Sucker Flat Drain near Filer	13093190	42 38 25	114 35 30	3/5/2001	---	0
Miscellaneous agriculture return near Filer	---	42 37 51	114 35 41	3/5/2001	---	0
Miscellaneous agriculture return near Filer	---	42 38 54	114 36 58	3/5/2001	---	0

Table A4. Discharge data for all inspected inflow and outflow sites during March 2-6, 2001, for the Snake River between Minidoka Dam and King Hill, Idaho--Continued

Inspection site[1]	Station number[1]	Location		Date	Time	Discharge[2]
		Latitude	Longitude			
Subreach between map numbers L9 and L10						
Miscellaneous agriculture return near Filer	---	42 39 17	114 38 16	3/5/2001	---	---
Crystal Springs near Filer	13093400	42 39 36	114 38 32	3/8/2001	1245	[3]487
Cedar Draw near Filer	13093550	42 39 13	114 39 15	3/5/2001	---	33
Miscellaneous agriculture return near Buhl	---	42 39 31	114 40 42	3/5/2001	---	0
Waste I near Buhl	13093900	42 39 33	114 41 28	3/5/2001	---	0
Subreach between map numbers L10 and L11						
Miscellaneous agriculture return near Buhl	---	42 40 03	114 43 10	3/6/2001	---	0
Miscellaneous agriculture return near Buhl	---	42 40 07	114 44 18	3/6/2001	---	0
J8 Drain near Buhl	---	42 40 27	114 44 27	3/6/2001	---	0
Clear Lakes Outlet near Buhl	13094500	42 40 01	114 46 45	3/8/2001	1240	[3]471
Subreach between map numbers L11 and L12						
Mud Creek near Buhl[4]	13094700	42 39 33	114 47 20	3/6/2001	---	20
Deep Creek near Buhl[4]	---	42 39 29	114 48 38	3/6/2001	---	0
Briggs Creek Spring near Buhl	13095200	42 40 20	114 49 00	3/9/2001	1415	[3]104
Subreach between map numbers L12 and L13						
Irrigation Ditch to Blind Canyon near Buhl	13095490	42 42 28	114 47 30	3/6/2001	---	---
South Coulee (Cedar Draw) near Buhl	13095360	42 41 46	114 48 19	3/6/2001	---	---
Box Canyon Springs near Wendell	**13095500**	42 42 29	114 48 35	3/2/2001	1720	[3]356
Blind Canyon Spring near Buhl	13095400	42 42 12	114 49 20	3/5/2001	1305	[3]10.1
Unnamed Spring near Buhl	13095350	42 41 51	114 49 21	3/5/2001	1225	[3]2.7
Salmon Falls Creek near Hagerman	**13108150**	42 41 47	114 51 15	3/5/2001	DM	125
Subreach between map numbers L13 and L14						
Sand Springs near Hagerman	13132600	42 43 36	114 50 00	3/5/2001	1115	[3]70.9
Drain near Bickel Springs near Hagerman	13133785	42 45 28	114 50 48	3/5/2001	---	---
Bickel Spring near Hagerman	13132790	42 45 29	114 51 19	3/5/2001	1405	[3]15.8
Subreach between map numbers L14 and L15						
Riley Creek near Hagerman	13133800	42 45 50	114 51 40	3/5/2001	1430	72
Subreach between map numbers L15 and L16						
Billingsly Creek near Hagerman	13134600	42 46 44	114 51 22	3/6/2001	1310	30
Subreach between map numbers L16 and L17						
W Drain near Tuttle	13152895	42 51 50	114 51 58	3/6/2001	---	---
Birch Creek near Hagerman	13135100	42 51 10	114 53 30	3/6/2001	1110	11
Malad Power Flume near Bliss	**13152940**	42 51 54	114 53 11	3/2/2001	1115	1190
Malad River near Bliss	**13153500**	42 51 48	114 54 04	3/2/2001	1335	103
Subreach between map numbers L17 and L18						
Tuana Gulch near Bliss	---	42 54 34	115 00 02	3/6/2002	---	0
Irrigation Ditch near Bliss	13152450	42 55 56	115 00 19	3/6/2002	---	0
Subreach between map numbers L18 and L19						
---	---	---	---	---	---	---
Subreach between map numbers L19 and L20						
Clover Creek near Bliss	13154000	43 01 30	115 00 20	3/6/2001	---	10

[1] Long-term United States Geological Survey or Idaho Power Company gaging stations are in bold.

[2] Values in shaded areas indicate canal withdrawals.

[3] Surface flows resulting from spring discharge; not used in gain/loss calculations.

[4] Combined spring discharge and agriculture return flows; spring flow was subtraced from field measured value to obtain an approximate agriculture return flow value.

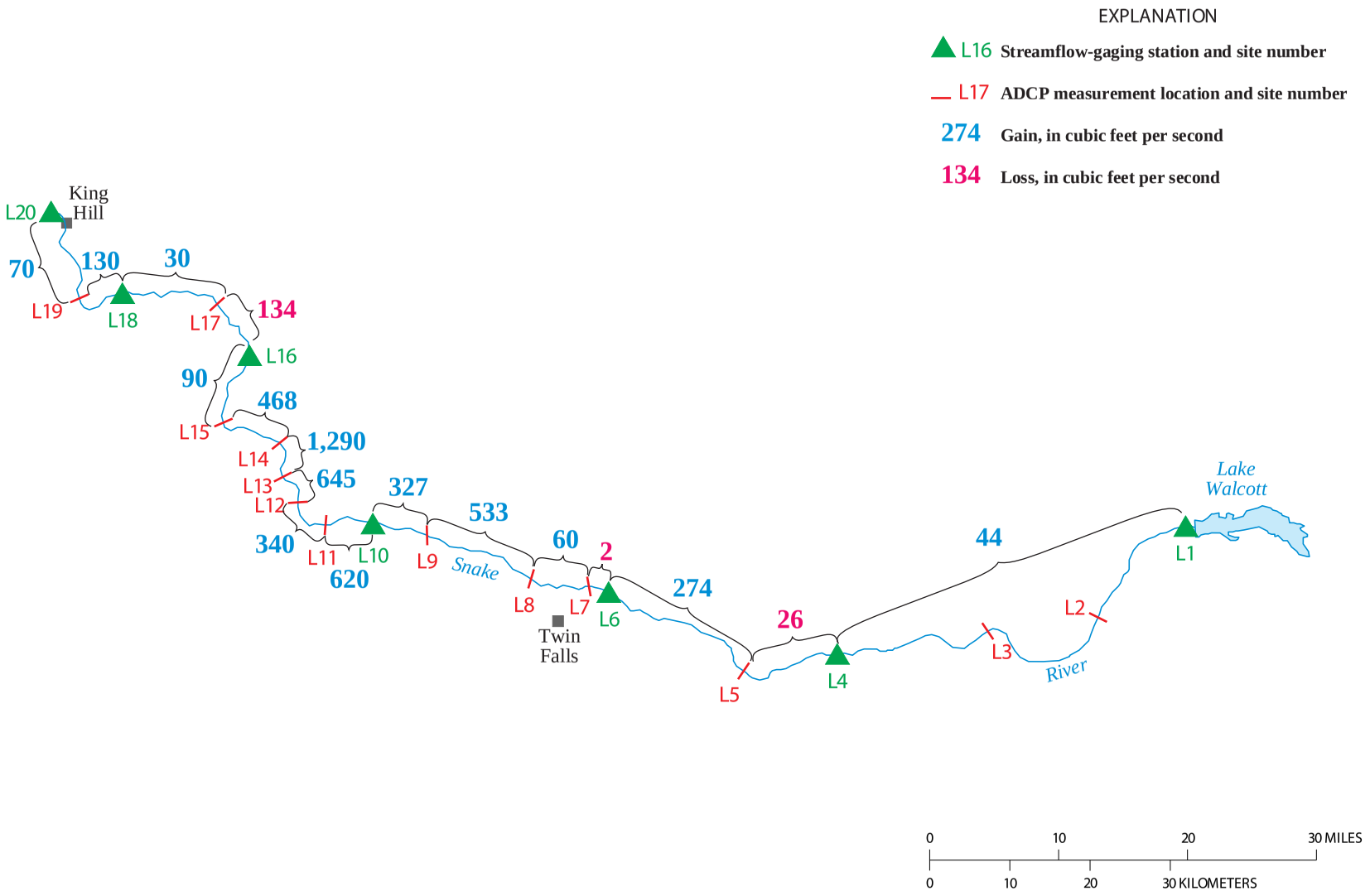


Figure A2. Streamflow gains and losses along the lower reach of the Snake River, Idaho, estimated during the March 5–6, 2001, seepage study.

Table A5. Calculations of gains and losses in specified subreaches of the Snake River during November 5-7, 2001, between Minidoka Dam and King Hill, Idaho

[ADCP, Acoustic Doppler Current Profiler; ADP, Acoustic Doppler Profiler; ft^3/s, cubic feet per second; mi, mile; ---, no data]

Map number (fig. #)	Gaging station name (number)[1]/ ADCP/ADP measurement location	River mile		Discharge (ft^3/s)	Date	Time	Total gains/ (losses) (ft^3/s)	Gains/ (losses) per mile ($ft^3/s/mi$)
L1	**Snake River near Minidoka (13081500)**	673.5		570	11/5/2001	0630		
			total estimated inflow	0				
			total estimated outflow	0				
L2	Snake River at Highway 77(25) near Rupert	664.0		574	11/5/2001	1100	4	0
			total estimated inflow	0				
			total estimated outflow	0				
			estimated outflow to storage in Milner Lake[2]	0				
L3	Snake River at Highway 27 at Burley	651.6		605	11/5/2001	1300	31	3
			total estimated inflow	25				
			total estimated outflow	0				
			estimated outflow to storage in Milner Lake[2]	0				
L4	**Snake River at Milner (13088000)**	638.7		635	11/5/2001	2300	5	0
				622	11/5/2001	1015		
			total estimated inflow	0				
			total estimated outflow	0				
L5	Snake River above Murtaugh Bridge at Murtaugh	630.5		694	11/5/2001	1411	72	9
			total estimated inflow	0				
			total estimated outflow	0				
L6	**Snake River near Kimberly (13090000)**	617.2		899	11/5/2001	2030	205	15
				969	11/7/2001	1545		
			total estimated inflow	0				
			total estimated outflow	0				
L7	Snake River above Shoshone Falls near Kimberly	615.2		1120	11/7/2001	1640	151	76
			total estimated inflow	30				
			total estimated outflow	0				
L8	Snake River below Perrine Bridge at Twin Falls	611.0		1250	11/7/2001	1530	100	24
			total estimated inflow	143				
			total estimated outflow	0				

Table A5. Calculations of gains and losses in specified subreaches of the Snake River during November 5-7, 2001, between Minidoka Dam and King Hill, Idaho--Continued

Map number (fig. #)	Gaging station name (number)[1]/ ADCP/ADP measurement location	River mile		Discharge (ft^3/s)	Date	Time	Total gains/ (losses) (ft^3/s)	Gains/ (losses) per mile ($ft^3/s/mi$)
L9	Snake River above Crystal Springs near Buhl	601.1		1700	11/7/2001	1340	307	31
			total estimated inflow	84				
			total estimated outflow	0				
L10	**Snake River near Buhl (13094000)**	596.8		2380	11/7/2001	1545	596	139
				2300	11/6/2001	1130		
			total estimated inflow	0				
			total estimated outflow	0				
L11	Snake River below Clear Lakes outlet near Buhl	592.8		2920	11/6/2001	1335	620	155
			total estimated inflow	0				
			total estimated outflow	0				
L12	Snake River above Banbury Springs near Hagerman	589.2		2810	11/6/2001	1315	(110)	(31)
			total estimated inflow	157				
			total estimated outflow	0				
L13	Snake River above Thousand Springs near Hagerman	585.6		3810	11/6/2001	1350	843	234
			total estimated inflow	0				
			total estimated outflow	0				
L14	Snake River below Thousand Springs near Hagerman	582.9		5110	11/6/2001	1140	1,300	481
			total estimated inflow	80				
			total estimated outflow	0				
L15	Snake River above Lower Salmon Falls Power Plant near Bliss	576.8		5850	11/7/2001	1145	660	108
			total estimated inflow	50				
			total estimated outflow	0				
			estimated outflow to storage above Lower Salmon Falls power plant[3]	[4]---				
L16	**Snake River below Lower Salmon Falls near Hagerman (13135000)**	572.5		---	---	---	---	---
				6490	11/6/2001	1030		
			total estimated inflow	1176				
			total estimated outflow	0				
L17	Snake River above Bliss Dam near Bliss	564.9		---[5]	---	---	---	---
			total estimated inflow	2				

Table A5. Calculations of gains and losses in specified subreaches of the Snake River during November 5-7, 2001, between Minidoka Dam and King Hill, Idaho--Continued

Map number (fig. #)	Gaging station name (number)[1]/ ADCP/ADP measurement location	River mile		Discharge (ft^3/s)	Date	Time	Total gains/ (losses) (ft^3/s)	Gains/ (losses) per mile ($ft^3/s/mi$)
			total estimated outflow	0				
			estimated outflow to storage above Bliss Dam[3]	(70)				
L18	**Snake River below Bliss Dam near Bliss (13153776)**	559.1		7800	11/6/2001	1700	62	5
				7820	11/6/2001	0745		
			total estimated inflow	0				
			total estimated outflow	0				
L19	Snake River above Bancroft Springs near King Hill	553.2		7800	11/6/2001	1050	(20)	(3)
			total estimated inflow	15				
			total estimated outflow	0				
L20	**Snake River at King Hill (13154500)**	546.6		7770	11/6/2001	1445	(45)	(7)

[1] Long-term United States Geological Survey or Idaho Power Company gaging stations are in bold.

[2] Estimated based on reservoir stage data (USGS station number 13087900).

[3] Estimated based on reservoir stage data (Idaho Power Company).

[4] Unable to estimate reservoir storage changes due to high variability.

[5] Measurement was made but not used in the calculations (see table 7).

Table A6. Gaging station discharge data during November 5-7, 2001, for the Snake River between Minidoka Dam and King Hill, Idaho

[Discharge given in cubic feet per second]

Map number (fig. #)	Gaging station name (number)	Date	Time	Discharge
L1	Snake River near Minidoka (13081500)	11/5/2001	0630	570
L4	Snake River at Milner (13088000)	11/5/2001	2300	635
		11/5/2001	1015	622
L6	Snake River near Kimberly (13090000)	11/5/2001	2030	899
		11/7/2001	1545	969
L10	Snake River near Buhl (13094000)	11/7/2001	1545	2380
		11/6/2001	1130	2300
L16	Snake River below Lower Salmon Falls near Hagerman (13135000)	---	---	---
		11/6/2001	1030	6490
L18	Snake River below Bliss Dam near Bliss (13153776)	11/6/2001	1700	7800
		11/6/2001	0745	7820
L20	Snake River at King Hill (13154500)	11/6/2001	1445	7770

Table A7. Acoustic Doppler discharge measurement data during November 5-7, 2001, for the Snake River between Minidoka Dam and King Hill, Idaho

[ADCP, Acoustic Doppler Current Profiler; ADP, Acoustic Doppler Profiler; discharge given in cubic feet per second; COV, coefficient of variation; σ, standard deviation; μ, mean; ---, no data]

Map number (fig. #)	ADCP/ADP measurement location	Date	Time	Discharge	COV (σ/μ)
L2	Snake River at Highway 77(25) near Rupert	11/5/2001	1100	574	0.29
L3	Snake River at Highway 27 at Burley	11/5/2001	1300	605	0.54
L5	Snake River above Murtaugh Bridge at Murtaugh	11/5/2001	1411	694	0.05
L7	Snake River above Shoshone Falls near Kimberly	11/7/2001	1640	1120	0.05
L8	Snake River below Perrine Bride at Twin Falls	11/7/2001	1530	1250	0.07
L9	Snake River above Crystal Springs near Buhl	11/7/2001	1340	1700	0.05
L11	Snake River below Clear Lakes outlet near Buhl	11/6/2001	1335	2920	0.03
L12	Snake River above Banbury Springs near Hagerman	11/6/2001	1315	2810	0.06
L13	Snake River above Thousand Springs near Hagerman	11/6/2001	1350	3810	0.02
L14	Snake River below Thousand Springs near Hagerman	11/6/2001	1140	5110	0.03
L15	Snake River above Lower Salmon Falls Power Plant near Bliss	11/7/2001	1145	5850	0.09
L17	Snake River above Bliss Dam near Bliss	11/6/2001	1408	8080	0.07
L19	Snake River above Bancroft Springs near King Hill	11/6/2001	1050	7800	0.02

Table A8. Discharge data for all inspected inflow sites during November 5-7, 2001, for the Snake River between Minidoka Dam and King Hill, Idaho

[Latitude and longitude in degrees, minutes, seconds in North American Datum of 1983 (NAD83); DM, daily mean discharge; discharge given in cubic feet per second; map numbers shown in figure X; ---, no data]

Inspection site[1]	Station number[1]	Location		Date	Time	Discharge[2]
		Latitude	Longitude			
	Subreach between map numbers L1 and L2					
F Drain near Declo	13082060	42 32 48	113 37 14	11/6/2001	---	0
D-3 Drain near Declo	13082032	42 36 49	113 36 10	11/6/2001	---	0
	Subreach between map numbers L2 and L3					
D-5 Drain near Rupert	13082062	42 33 15	113 38 38	11/6/2001	---	0
D-4 Drain near Rupert	13082064	42 34 15	113 38 25	11/6/2001	---	0
Marsh Creek near Declo	13082320	42 31 26	113 40 02	11/6/2001	---	[3]---
Spring Creek near Declo	13082330	42 31 01	113 41 03	11/6/2001	---	[3]---
D-16 Drain near Heyburn	13084705	42 32 30	113 45 24	11/6/2001	---	0
	Subreach between map numbers L3 and L4					
B Drain near Heyburn	13084707	42 33 33	113 47 01	11/6/2001	---	0
D-17 Drain near Heyburn	13085060	42 32 53	113 50 51	11/6/2001	0830	5
Main Drain North near Heyburn	13085065	42 33 02	113 51 59	11/6/2001	0900	20
G Drain near Burley	13085070	42 31 56	113 53 12	11/6/2001	---	---
J Drain near Burley	13085080	42 31 53	113 53 29	11/6/2001	---	---
A&B Irrigation Pump near Milner	13085500	42 32 01	113 56 51	11/6/2001	DM	0
PA Lateral Pump near Milner	13085800	42 32 02	113 58 19	11/6/2001	DM	0
Milner Irrigation Pump near Milner	13086000	42 31 10	114 00 38	11/6/2001	DM	0
Northside A Lateral near Milner	13086510	42 32 17	114 02 40	11/6/2001	DM	0
Northside Crosscut Canal near Milner	13086520	42 33 31	114 03 08	11/6/2001	DM	0
Milner-Gooding Canal near Milner	13086530	42 33 39	114 02 59	11/6/2001	DM	0
North Side Main Canal near Milner	13087000	42 31 46	114 01 10	11/6/2001	DM	0
Twin Falls Main Canal near Milner	13087500	42 31 18	114 01 03	11/6/2001	DM	0
	Subreach between map numbers L4 and L5					
---	---	---	---	---	---	---
	Subreach between map numbers L5 and L6					
Miscellaneous agriculture return near Hansen	13089690	42 33 55	114 19 24	11/6/2001	---	0
Twin Falls Coulee near Hansen	13089695	42 34 11	114 20 32	11/6/2001	---	0
Devil's Washbowl Spring near Kimberly	13089600	42 35 18	114 20 45	11/6/2001	---	---
	Subreach between map numbers L6 and L7					
Devil's Corral Springs near Kimberly	13090100	42 35 38	114 21 55	11/6/2001	---	---
	Subreach between map numbers L7 and L8					
Fish Hatchery Waste O near Twin Falls	13090370	42 35 31	114 26 05	11/6/2001	1130	30
Mary Alice Lake discharge near Twin Falls	---	42 35 46	114 26 51	11/6/2001	---	0
	Subreach between map numbers L8 and L9					
Perrine Coulee near Twin Falls	13090460	42 35 53	114 28 20	11/6/2001	1200	[3]3.0
Blue Lakes Outlet near Twin Falls	13091500	42 36 30	114 28 34	11/6/2001	---	---
Warm Creek near Twin Falls	13091700	42 37 15	114 29 55	11/6/2001	1230	40
Rock Creek above Highway 30/93 at Twin Falls	**13092747**	42 33 47	114 29 42	11/6/2001	DM	79
Jerome Golf Course Drain 1	13091733	42 38 03	114 31 02	11/6/2001	---	0
Miscellaneous agriculture return near Twin Falls	---	42 37 21	114 33 23	11/6/2001	---	0
Sonnickson Drain near Twin Falls	13093150	42 38 40	114 33 26	11/6/2001	---	0
Miscellaneous agriculture return near Twin Falls	---	42 38 23	114 33 32	11/6/2001	---	0
Miscellaneous agriculture return near Twin Falls	---	42 37 36	114 34 29	11/6/2001	1250	15
Sucker Flat Drain near Filer	13093190	42 38 25	114 35 30	11/6/2001	1330	5
Miscellaneous agriculture return near Filer	---	42 37 51	114 35 41	11/6/2001	1345	2
Miscellaneous agriculture return near Filer	---	42 38 54	114 36 58	11/6/2001	1350	2

Table A8: Discharge data for all inspected inflow sites during November 5-7, 2001, for the Snake River between Minidoka Dam and King Hill, Idaho--Continued

Inspection site[1]	Station number[1]	Location		Date	Time	Discharge[2]
		Latitude	Longitude			
Subreach between map numbers L9 and L10						
Miscellaneous agriculture return near Filer	---	42 39 17	114 38 16	11/6/2001	---	0
Crystal Springs near Filer	13093400	42 39 36	114 38 32	11/6/2001	---	---
Cedar Draw near Filer	13093550	42 39 13	114 39 15	11/6/2001	1455	54
Miscellaneous agriculture return near Buhl	---	42 39 31	114 40 42	11/6/2001	---	0
Waste I near Buhl	13093900	42 39 33	114 41 28	11/6/2001	1530	30
Subreach between map numbers L10 and L11						
Miscellaneous agriculture return near Buhl	---	42 40 03	114 43 10	11/6/2001	---	0
Miscellaneous agriculture return near Buhl	---	42 40 07	114 44 18	11/6/2001	---	0
J8 Drain near Buhl	---	42 40 27	114 44 27	11/6/2001	---	0
Clear Lakes Outlet near Buhl	13094500	42 40 01	114 46 45	11/6/2001	---	---
Subreach between map numbers L11 and L12						
Mud Creek near Buhl[4]	13094700	42 39 33	114 47 20	11/6/2001	---	---
Deep Creek near Buhl[4]	---	42 39 29	114 48 38	11/6/2001	---	---
Briggs Creek Spring near Buhl	13095200	42 40 20	114 49 00	11/6/2001	---	---
Subreach between map numbers L12 and L13						
Irrigation Ditch to Blind Canyon near Buhl	13095490	42 42 28	114 47 30	11/6/2001	---	---
South Coulee (Cedar Draw) near Buhl	13095360	42 41 46	114 48 19	11/6/2001	---	---
Box Canyon Springs near Wendell	**13095500**	42 42 29	114 48 35	11/6/2001	DM	[3]346
Blind Canyon Spring near Buhl	13095400	42 42 12	114 49 20	11/6/2001	---	---
Unnamed Spring near Buhl	13095350	42 41 51	114 49 21	11/6/2001	---	---
Salmon Falls Creek near Hagerman	**13108150**	42 41 47	114 51 15	11/6/2001	DM	157
Subreach between map numbers L13 and L14						
Sand Springs near Hagerman	13132600	42 43 36	114 50 00	11/6/2001	---	---
Drain near Bickel Springs near Hagerman	13133785	42 45 28	114 50 48	11/6/2001	---	---
Bickel Spring near Hagerman	13132790	42 45 29	114 51 19	11/6/2001	---	---
Subreach between map numbers L14 and L15						
Riley Creek near Hagerman	13133800	42 45 50	114 51 40	11/6/2001	---	80
Subreach between map numbers L15 and L16						
Billingsly Creek near Hagerman	13134600	42 46 44	114 51 22	11/6/2001	---	50
Subreach between map numbers L16 and L17						
W Drain near Tuttle	13152895	42 51 50	114 51 58	11/6/2001	---	---
Birch Creek near Hagerman	13135100	42 51 10	114 53 30	11/6/2001	---	10
Malad Power Flume near Bliss	**13152940**	42 51 54	114 53 11	11/6/2001	DM	1070
Malad River near Bliss	**13153500**	42 51 48	114 54 04	11/6/2001	DM	96
Subreach between map numbers L17 and L18						
Tuana Gulch near Bliss	---	42 54 34	115 00 02	11/6/2001	---	2
Irrigation Ditch near Bliss	13152450	42 55 56	115 00 19	11/6/2001	---	0
Subreach between map numbers L18 and L19						
---	---	---	---	---	---	---
Subreach between map numbers L19 and L20						
Clover Creek near Bliss	13154000	43 01 30	115 00 20	11/6/2001	---	15

[1] Long-term United States Geological Survey or Idaho Power Company gaging stations are in bold.

[2] Values in shaded areas indicate canal withdrawals.

[3] Surface flows resulting from spring discharge; not used in gain/loss calculations.

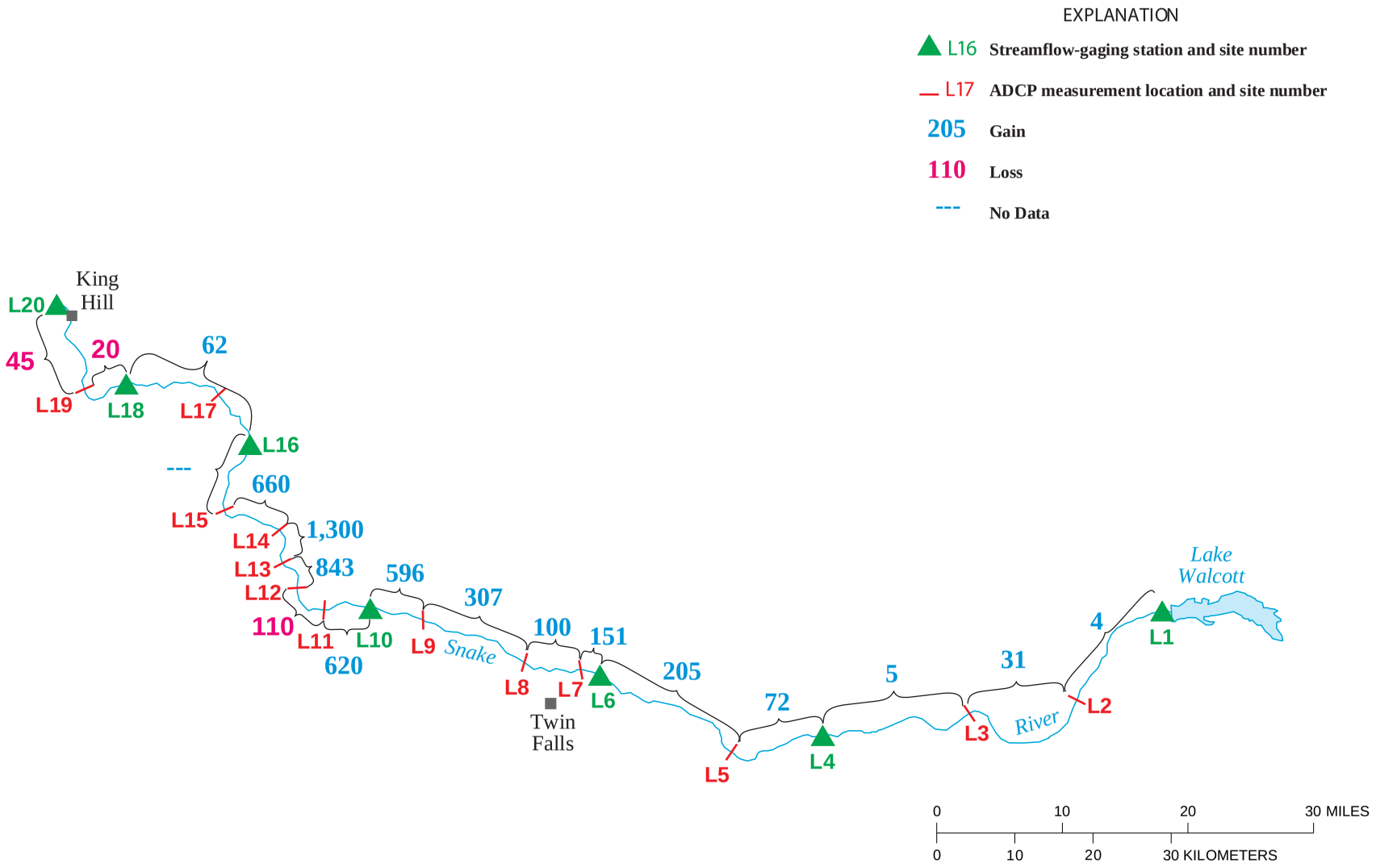


Figure A3. Streamflow gains and losses along the lower reach of the Snake River, Idaho, estimated during the November 5-7, 2001, seepage study.

Table A9. Calculations of gains and losses in specified subreaches of the Snake River during March 11-12, 2002, between Minidoka Dam and King Hill, Idaho

[ADCP, Acoustic Doppler Current Profiler; ADP, Acoustic Doppler Profiler; ft^3/s, cubic feet per second; mi, mile; ---, no data]

Map number (fig. #)	Gaging station name (number)[1]/ ADCP/ADP measurement location	River mile		Discharge (ft^3/s)	Date	Time	Total gains/ (losses) (ft^3/s)	Gains/ (losses) per mile ($ft^3/s/mi$)
L1	**Snake River near Minidoka (13081500)**	673.5		590	3/11/2002	0530		
			total estimated inflow	4				
			total estimated outflow	0				
L2	Snake River at Highway 77(25) near Rupert	664.0		594	3/11/2002	1000	0	0
			total estimated inflow	17				
			total estimated outflow	0				
			estimated outflow to storage in Milner Lake[2]	0				
L3	Snake River at Highway 27 at Burley	651.6		---[3]	---	---	---	---
			total estimated inflow	3				
			total estimated outflow	0				
			estimated outflow to storage in Milner Lake[2]	0				
L4	**Snake River at Milner (13088000)**	638.7		609	3/11/2002	1600	(5)	(0)
				614	3/11/2002	1200		
			total estimated inflow	0				
			total estimated outflow	0				
L5	Snake River above Murtaugh Bridge at Murtaugh	630.5		697	3/11/2002	1600	83	10
			total estimated inflow	0				
			total estimated outflow	0				
L6	**Snake River near Kimberly (13090000)**	617.2		834	3/11/2002	2230	137	10
				808	3/12/2002	0830		
			total estimated inflow	0				
			total estimated outflow	0				
L7	Snake River above Shoshone Falls near Kimberly	615.2		898	3/12/2002	0930	90	45
			total estimated inflow	0				
			total estimated outflow	0				
L8	Snake River below Perrine Bridge at Twin Falls	611.0		939	3/12/2002	0945	41	10
			total estimated inflow	94				
			total estimated outflow	0				

Table A9. Calculations of gains and losses in specified subreaches of the Snake River during March 11-12, 2002, between Minidoka Dam and King Hill, Idaho--Continued

Map number (fig. #)	Gaging station name (number)[1]/ ADCP/ADP measurement location	River mile		Discharge (ft^3/s)	Date	Time	Total gains/ (losses) (ft^3/s)	Gains/ (losses) per mile ($ft^3/s/mi$)
L9	Snake River above Crystal Springs near Buhl	601.1		1270	3/12/2002	1200	237	24
			total estimated inflow	34				
			total estimated outflow	0				
L10	**Snake River near Buhl (13094000)**	596.8		1930	3/12/2002	1400	626	146
				1950	3/12/2002	1145		
			total estimated inflow	0				
			total estimated outflow	0				
L11	Snake River below Clear Lakes outlet near Buhl	592.8		2750	3/12/2002	1255	800	200
			total estimated inflow	22				
			total estimated outflow	0				
L12	Snake River above Banbury Springs near Hagerman	589.2		2670	3/12/2002	1030	(102)	(28)
			total estimated inflow	116				
			total estimated outflow	0				
L13	Snake River above Thousand Springs near Hagerman	585.6		3500	3/12/2002	0940	714	198
			total estimated inflow	0				
			total estimated outflow	0				
L14	Snake River below Thousand Springs near Hagerman	582.9		4700	3/12/2002	0900	1,200	444
			total estimated inflow	71				
			total estimated outflow	0				
L15	Snake River above Lower Salmon Falls Power Plant near Bliss	576.8		5170	3/12/2002	1200	399	65
			total estimated inflow	23				
			total estimated outflow	0				
			estimated outflow to storage above Lower Salmon Falls power plant[4]	-80				
L16	**Snake River below Lower Salmon Falls near Hagerman (13135000)**	572.5		5310	3/12/2002	1400	37	9
				5310	3/12/2002	1000		
			total estimated inflow	1209				
			total estimated outflow	0				
L17	Snake River above Bliss Dam near Bliss	564.9		6630	3/12/2002	1400	111	15
			total estimated inflow	1				

Table A9. Calculations of gains and losses in specified subreaches of the Snake River during March 11-12, 2002, between Minidoka Dam and King Hill, Idaho--Continued

Map number (fig. #)	Gaging station name (number)[1]/ ADCP/ADP measurement location	River mile		Discharge (ft^3/s)	Date	Time	Total gains/ (losses) (ft^3/s)	Gains/ (losses) per mile ($ft^3/s/mi$)
			total estimated outflow	0				
			estimated outflow to storage above Bliss Dam[4]	40				
L18	**Snake River below Bliss Dam near Bliss (13153776)**	559.1		6740	3/12/2002	1700	149	26
				6740	3/12/2002	1215		
			total estimated inflow	0				
			total estimated outflow	0				
L19	Snake River above Bancroft Springs near King Hill	553.2		6730	3/12/2002	1515	(10)	(2)
			total estimated inflow	[5]---				
			total estimated outflow	0				
L20	**Snake River at King Hill (13154500)**	546.6		7310	3/12/2002	1830	[6]---	---

[1] Long-term United States Geological Survey or Idaho Power Company gaging stations are in bold.

[2] Estimated based on reservoir stage data (USGS station number 13087900).

[3] Unable to measure because of river or weather conditions.

[4] Estimated based on reservoir stage data (Idaho Power Company).

[5] Apparent snowmelt runoff event; flow on March 12, 2002 was likely much greater than the 100 ft^3/s reported on March 20, 2002.

[6] Not calculated because of unknown, and likely large, inflows from Clover Creek.

Table A10. Gaging station discharge data during March 11-12, 2002, for the Snake River between Minidoka Dam and King Hill, Idaho

[Discharge given in cubic feet per second]

Map number (fig. #)	Gaging station name (number)	Date	Time	Discharge
L1	Snake River near Minidoka (13081500)	3/11/2002	0530	590
L4	Snake River at Milner (13088000)	3/11/2002	1600	609
		3/11/2002	1200	614
L6	Snake River near Kimberly (13090000)	3/11/2002	2230	834
		3/12/2002	0830	808
L10	Snake River near Buhl (13094000)	3/12/2002	1400	1930
		3/12/2002	1145	1950
L16	Snake River below Lower Salmon Falls near Hagerman (13135000)	3/12/2002	1400	5310
		3/12/2002	1000	5310
L18	Snake River below Bliss Dam near Bliss (13153776)	3/12/2002	1700	6740
		3/12/2002	1215	6740
L20	Snake River at King Hill (13154500)	3/12/2002	1830	7310

Table A11. Acoustic Doppler discharge measurement data during March 11-12, 2002, for the Snake River between Minidoka Dam and King Hill, Idaho

[ADCP, Acoustic Doppler Current Profiler; ADP, Acoustic Doppler Profiler; discharge given in cubic feet per second; COV, coefficient of variation; σ, standard deviation; μ, mean; ---, no data]

Map number (fig. #)	ADCP/ADP measurement location	Date	Time	Discharge	COV (σ/μ)
L2	Snake River at Highway 77(25) near Rupert	3/11/2002	1000	594	0.07
L3	Snake River at Highway 27 at Burley	---[1]	---	---	---
L5	Snake River above Murtaugh Bridge at Murtaugh	3/11/2002	1600	697	0.03
L7	Snake River above Shoshone Falls near Kimberly	3/12/2002	0930	898	0.12
L8	Snake River below Perrine Bride at Twin Falls	3/12/2002	0945	939	0.03
L9	Snake River above Crystal Springs near Buhl	3/12/2002	1200	1270	0.06
L11	Snake River below Clear Lakes outlet near Buhl	3/12/2002	1255	2750	0.04
L12	Snake River above Banbury Springs near Hagerman	3/12/2002	1030	2670	0.04
L13	Snake River above Thousand Springs near Hagerman	3/12/2002	0940	3500	0.04
L14	Snake River below Thousand Springs near Hagerman	3/12/2002	0900	4700	0.01
L15	Snake River above Lower Salmon Falls Power Plant near Bliss	3/12/2002	1200	5170	0.01
L17	Snake River above Bliss Dam near Bliss	3/12/2002	1400	6630	0.04
L19	Snake River above Bancroft Springs near King Hill	3/12/2002	1515	6730	0.02

[1] No measurement made because of extremely high winds.

Table A12. Discharge data for all inspected inflow and outflow sites during March 11-12, 2002, for the Snake River between Minidoka Dam and King Hill, Idaho

[Latitude and longitude in degrees, minutes, seconds in North American Datum of 1983 (NAD83); DM, daily mean discharge; discharge given in cubic feet per second; map numbers shown in figure X; ---, no data]

Inspection site[1]	Station number[1]	Location		Date	Time	Discharge[2]
		Latitude	Longitude			
	Subreach between map numbers L1 and L2					
F Drain near Declo	13082060	42 32 48	113 37 14	3/12/2002	---	2
D-3 Drain near Declo	13082032	42 36 49	113 36 10	3/12/2002	---	2
	Subreach between map numbers L2 and L3					
D-5 Drain near Rupert	13082062	42 33 15	113 38 38	3/12/2002	---	2
D-4 Drain near Rupert	13082064	42 34 15	113 38 25	3/12/2002	---	3
Marsh Creek near Declo	13082320	42 31 26	113 40 02	3/12/2002	---	6
Spring Creek near Declo	13082330	42 31 01	113 41 03	3/12/2002	---	6
D-16 Drain near Heyburn	13084705	42 32 30	113 45 24	3/12/2002	---	0
	Subreach between map numbers L3 and L4					
B Drain near Heyburn	13084707	42 33 33	113 47 01	3/13/2002	---	1
D-17 Drain near Heyburn	13085060	42 32 53	113 50 51	3/13/2002	---	0
Main Drain North near Heyburn	13085065	42 33 02	113 51 59	3/13/2002	---	0
G Drain near Burley	13085070	42 31 56	113 53 12	3/13/2002	---	2
J Drain near Burley	13085080	42 31 53	113 53 29	3/13/2002	---	0
A&B Irrigation Pump near Milner	13085500	42 32 01	113 56 51	3/13/2002	DM	0
PA Lateral Pump near Milner	13085800	42 32 02	113 58 19	3/13/2002	DM	0
Milner Irrigation Pump near Milner	13086000	42 31 10	114 00 38	3/13/2002	DM	0
Northside A Lateral near Milner	13086510	42 32 17	114 02 40	3/13/2002	DM	0
Northside Crosscut Canal near Milner	13086520	42 33 31	114 03 08	3/13/2002	DM	0
Milner-Gooding Canal near Milner	13086530	42 33 39	114 02 59	3/13/2002	DM	0
North Side Main Canal near Milner	13087000	42 31 46	114 01 10	3/13/2002	DM	0
Twin Falls Main Canal near Milner	13087500	42 31 18	114 01 03	3/13/2002	DM	0
	Subreach between map numbers L4 and L5					
---	---	---	---	---	---	---
	Subreach between map numbers L5 and L6					
Miscellaneous agriculture return near Hansen	13089690	42 33 55	114 19 24	3/13/2002	---	0
Twin Falls Coulee near Hansen	13089695	42 34 11	114 20 32	3/13/2002	---	0
Devil's Washbowl Spring near Kimberly	13089600	42 35 18	114 20 45	3/14/2002	1545	[3]11.1
	Subreach between map numbers L6 and L7					
Devil's Corral Springs near Kimberly	13090100	42 35 38	114 21 55	3/11/2002	1000	[3]35.9
	Subreach between map numbers L7 and L8					
Fish Hatchery Waste O near Twin Falls	13090370	42 35 31	114 26 05	3/13/2002	---	0
Mary Alice Lake discharge near Twin Falls	---	42 35 46	114 26 51	3/12/2002	---	0
	Subreach between map numbers L8 and L9					
Perrine Coulee near Twin Falls	13090460	42 35 53	114 28 20	---	---	[3]---
Blue Lakes Outlet near Twin Falls	13091500	42 36 30	114 28 34	3/14/2002	1515	[3]183
Warm Creek near Twin Falls	13091700	42 37 15	114 29 55	3/14/2002	---	40
Rock Creek above Highway 30/93 at Twin Falls	**13092747**	42 33 47	114 29 42	3/13/2002	DM	43
Jerome Golf Course Drain 1	13091733	42 38 03	114 31 02	3/13/2002	---	0
Miscellaneous agriculture return near Twin Falls	---	42 37 21	114 33 23	3/13/2002	---	0
Sonnickson Drain near Twin Falls	13093150	42 38 40	114 33 26	3/13/2002	---	0
Miscellaneous agriculture return near Twin Falls	---	42 38 23	114 33 32	3/13/2002	---	0
Miscellaneous agriculture return near Twin Falls	---	42 37 36	114 34 29	3/13/2002	0945	5
Sucker Flat Drain near Filer	13093190	42 38 25	114 35 30	3/13/2002	0900	5
Miscellaneous agriculture return near Filer	---	42 37 51	114 35 41	3/13/2002	1020	1
Miscellaneous agriculture return near Filer	---	42 38 54	114 36 58	3/13/2002	---	0

Table A12: Discharge data for all inspected inflow and outflow sites during March 11-12, 2002, for the Snake River between Minidoka Dam and King Hill, Idaho--Continued

Inspection site[1]	Station number[1]	Location		Date	Time	Discharge[2]
		Latitude	Longitude			
Subreach between map numbers L9 and L10						
Miscellaneous agriculture return near Filer	---	42 39 17	114 38 16	3/13/2002	1310	1
Crystal Springs near Filer	13093400	42 39 36	114 38 32	3/13/2002	1200	[3]455
Cedar Draw near Filer	13093550	42 39 13	114 39 15	3/13/2002	1345	29
Miscellaneous agriculture return near Buhl	---	42 39 31	114 40 42	3/13/2002	1445	4
Waste I near Buhl	13093900	42 39 33	114 41 28	3/13/2002	---	0
Subreach between map numbers L10 and L11						
Miscellaneous agriculture return near Buhl	---	42 40 03	114 43 10	3/13/2002	---	0
Miscellaneous agriculture return near Buhl	---	42 40 07	114 44 18	3/13/2002	---	0
J8 Drain near Buhl	---	42 40 27	114 44 27	3/13/2002	---	0
Clear Lakes Outlet near Buhl	13094500	42 40 01	114 46 45	3/20/2002	1025	[3]468
Subreach between map numbers L11 and L12						
Mud Creek near Buhl[4]	13094700	42 39 33	114 47 20	3/13/2002	1120	22
Deep Creek near Buhl[4]	---	42 39 29	114 48 38	3/12/2002	1710	0
Briggs Creek Spring near Buhl	13095200	42 40 20	114 49 00	3/15/2002	1110	[3]103
Subreach between map numbers L12 and L13						
Irrigation Ditch to Blind Canyon near Buhl	13095490	42 42 28	114 47 30	3/13/2002	---	---
South Coulee (Cedar Draw) near Buhl	13095360	42 41 46	114 48 19	3/13/2002	---	---
Box Canyon Springs near Wendell	**13095500**	42 42 29	114 48 35	3/12/2002	1240	[3]335
Blind Canyon Spring near Buhl	13095400	42 42 12	114 49 20	3/12/2002	1125	[3]11.4
Unnamed Spring near Buhl	13095350	42 41 51	114 49 21	3/13/2002	1225	[3]2.7
Salmon Falls Creek near Hagerman	**13108150**	42 41 47	114 51 15	3/13/2002	DM	116
Subreach between map numbers L13 and L14						
Sand Springs near Hagerman	13132600	42 43 36	114 50 00	3/12/2002	1140	[3]67.0
Drain near Bickel Springs near Hagerman	13133785	42 45 28	114 50 48	3/12/2002	---	---
Bickel Spring near Hagerman	13132790	42 45 29	114 51 19	3/12/2002	1535	[3]15.8
Subreach between map numbers L14 and L15						
Riley Creek near Hagerman	13133800	42 45 50	114 51 40	3/12/2002	1530	71
Subreach between map numbers L15 and L16						
Billingsly Creek near Hagerman	13134600	42 46 44	114 51 22	3/11/2002	1415	23.1
Subreach between map numbers L16 and L17						
W Drain near Tuttle	13152895	42 51 50	114 51 58	3/12/2002	---	0
Birch Creek near Hagerman	13135100	42 51 10	114 53 30	3/11/2002	1220	10.5
Malad Power Flume near Bliss	**13152940**	42 51 54	114 53 11	3/11/2002	0825	1110
Malad River near Bliss	**13153500**	42 51 48	114 54 04	3/11/2002	1040	88.4
Subreach between map numbers L17 and L18						
Tuana Gulch near Bliss	---	42 54 34	115 00 02	3/11/2002	1455	1
Irrigation Ditch near Bliss	13152450	42 55 56	115 00 19	3/11/2002	1220	0
Subreach between map numbers L18 and L19						
---	---	---	---	---	---	---
Subreach between map numbers L19 and L20						
Clover Creek near Bliss	13154000	43 01 30	115 00 20	3/20/2002	0945	100[5]

[1] Long-term United States Geological Survey or Idaho Power Company gaging stations are in bold.

[2] Values in shaded areas indicate canal withdrawals.

[3] Surface flows resulting from spring discharge; not used in gain/loss calculations.

[4] Combined spring discharge and agriculture return flows; spring flow was subtraced from field measured value to obtain an approximate agriculture return flow value.

[5] Apparent snowmelt runoff event; flow on March 12, 2002 may have been much greater than 100 ft^3/s.

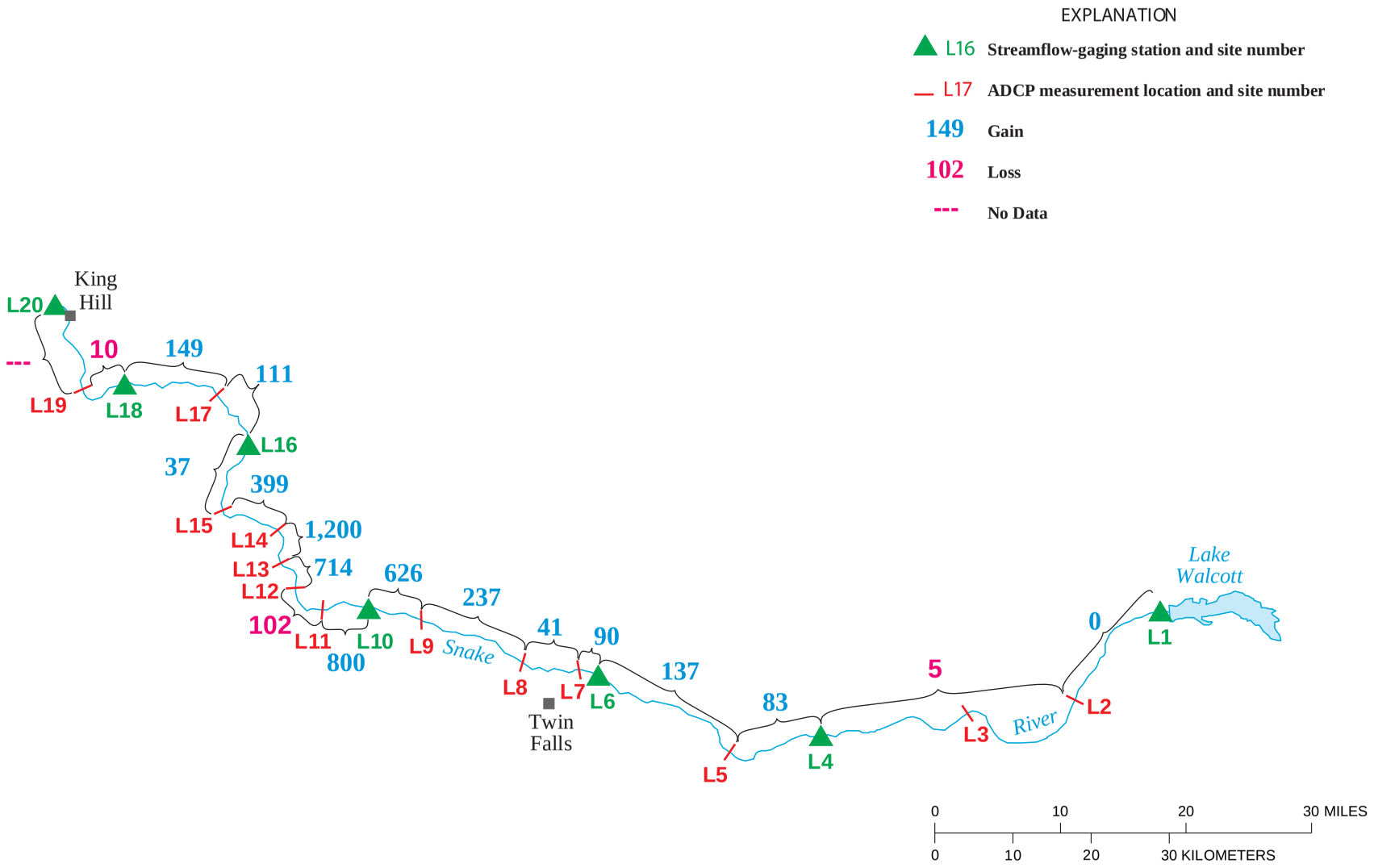


Figure A4. Streamflow gains and losses along the lower reach of the Snake River, Idaho, estimated during the March 11-12, 2002, seepage study.

Table A13. Calculations of gains and losses in specified subreaches of the Snake River during July 24-25, 2002, between Minidoka Dam and King Hill, Idaho

[ADCP, Acoustic Doppler Current Profiler; ADP, Acoustic Doppler Profiler; ft^3/s, cubic feet per second; mi, mile; ---, no data]

Map number (fig. #)	Gaging station name (number)[1]/ ADCP/ADP measurement location	River mile		Discharge (ft^3/s)	Date	Time	Total gains/ (losses) (ft^3/s)	Gains/ (losses) per mile ($ft^3/s/mi$)
L1	**Snake River near Minidoka (13081500)**	673.5		8650	7/25/2002	0200		
			total estimated inflow	24				
			total estimated outflow	0				
L2	Snake River at Highway 77(25) near Rupert	664.0		8320	7/25/2002	0630	(354)	(37)
			total estimated inflow	29				
			total estimated outflow	0				
			estimated outflow to storage in Milner Lake[2]	0				
L3	Snake River at Highway 27 at Burley	651.6		8540	7/25/2002	0735	191	(0)
			total estimated inflow	35				
			total estimated outflow	8200				
			estimated outflow to storage in Milner Lake[2]	0				
L4	**Snake River at Milner (13088000)**	638.7		238	7/25/2002	1345	54	2
				247	7/24/2002	0815		
			total estimated inflow	0				
			total estimated outflow	0				
L5	Snake River above Murtaugh Bridge at Murtaugh	630.5		295	7/24/2002	1210	48	6
			total estimated inflow	1				
			total estimated outflow	0				
L6	**Snake River near Kimberly (13090000)**	617.2		578	7/24/2002	1645	282	21
				581	7/24/2002	1130		
			total estimated inflow	0				
			total estimated outflow	0				
L7	Snake River above Shoshone Falls near Kimberly	615.2		725	7/24/2002	1228	144	72
			total estimated inflow	18				
			total estimated outflow	0				
L8	Snake River below Perrine Bridge at Twin Falls	611.0		732	7/24/2002	1504	(11)	(2)
			total estimated inflow	235				
			total estimated outflow	0				

Table A13. Calculations of gains and losses in specified subreaches of the Snake River during July 24-25, 2002, between Minidoka Dam and King Hill, Idaho--Continued

Map number (fig. #)	Gaging station name (number)[1]/ ADCP/ADP measurement location	River mile		Discharge (ft^3/s)	Date	Time	Total gains/ (losses) (ft^3/s)	Gains/ (losses) per mile ($ft^3/s/mi$)
L9	Snake River above Crystal Springs near Buhl	601.1		1310	7/24/2002	1719	343	35
			total estimated inflow	68				
			total estimated outflow	0				
L10	**Snake River near Buhl (13094000)**	596.8		2000	7/24/2002	1930	622	145
				2040	7/25/2002	1315		
			total estimated inflow	6				
			total estimated outflow	0				
L11	Snake River below Clear Lakes outlet near Buhl	592.8		2430	7/25/2002	1509	384	96
			total estimated inflow	78				
			total estimated outflow	0				
L12	Snake River above Banbury Springs near Hagerman	589.2		2770	7/25/2002	1100	262	73
			total estimated inflow	83				
			total estimated outflow	0				
L13	Snake River above Thousand Springs near Hagerman	585.6		3720	7/25/2002	1014	867	241
			total estimated inflow	3				
			total estimated outflow	0				
L14	Snake River below Thousand Springs near Hagerman	582.9		4710	7/25/2002	0939	987	365
			total estimated inflow	50				
			total estimated outflow	0				
L15	Snake River above Lower Salmon Falls Power Plant near Bliss	576.8		4760	7/25/2002	1300	0	0
			total estimated inflow	20				
			total estimated outflow	0				
			estimated outflow to storage above Lower Salmon Falls power plant[3]	0				
L16	**Snake River below Lower Salmon Falls near Hagerman (13135000)**	572.5		4980	7/25/2002	1500	200	47
				5000	7/25/2002	0730		
			total estimated inflow	1177				
			total estimated outflow	0				
L17	Snake River above Bliss Dam near Bliss	564.9		6310	7/25/2002	1110	133	18
			total estimated inflow	18				

Table A13. Calculations of gains and losses in specified subreaches of the Snake River during July 24-25, 2002, between Minidoka Dam and King Hill, Idaho--Continued

Map number (fig. #)	Gaging station name (number)[1]/ ADCP/ADP measurement location	River mile		Discharge (ft^3/s)	Date	Time	Total gains/ (losses) (ft^3/s)	Gains/ (losses) per mile ($ft^3/s/mi$)
			total estimated outflow	0				
			estimated outflow to storage above Bliss Dam[3]	0				
L18	**Snake River below Bliss Dam near Bliss (13153776)**	559.1		6330	7/25/2002	1400	3	0
				6330	7/25/2002	1330		
			total estimated inflow	0				
			total estimated outflow	0				
L19	Snake River above Bancroft Springs near King Hill	553.2		6310	7/25/2002	1510	(20)	(3)
			total estimated inflow	13				
			total estimated outflow	0				
L20	**Snake River at King Hill (13154500)**	546.6		6780	7/25/2002	1630	457	69

[1] Long-term United States Geological Survey or Idaho Power Company gaging stations are in bold.

[2] Estimated based on reservoir stage data (USGS station number 13087900).

[3] Estimated based on reservoir stage data (Idaho Power Company).

Table A14. Gaging station discharge data during July 24-25, 2002, for the Snake River between Minidok Dam and King Hill, Idaho

[Discharge given in cubic feet per second]

Map number (fig. #)	Gaging station name (number)	Date	Time	Discharge
L1	Snake River near Minidoka (13081500)	7/25/2002	0200	8650
L4	Snake River at Milner (13088000)	7/25/2002	1345	238
		7/24/2002	0815	247
L6	Snake River near Kimberly (13090000)	7/24/2002	1645	578
		7/24/2002	1130	581
L10	Snake River near Buhl (13094000)	7/24/2002	1930	2000
		7/25/2002	1315	2040
L16	Snake River below Lower Salmon Falls near Hagerman (13135000)	7/25/2002	1500	4980
		7/25/2002	0730	5000
L18	Snake River below Bliss Dam near Bliss (13153776)	7/25/2002	1400	6330
		7/25/2002	1330	6330
L20	Snake River at King Hill (13154500)	7/25/2002	1630	6780

Table A15. Acoustic Doppler discharge measurement data during July 24-25, 2002, for the Snake River between Minidoka Dam and King Hill, Idaho

[ADCP, Acoustic Doppler Current Profiler; ADP, Acoustic Doppler Profiler; discharge given in cubic feet per second; COV, coefficient of variation; σ, standard deviation; μ, mean; ---, no data]

Map number (fig. #)	ADCP/ADP measurement location	Date	Time	Discharge	COV (σ/μ)
L2	Snake River at Highway 77(25) near Rupert	7/25/2002	0630	8320	0.01
L3	Snake River at Highway 27 at Burley	7/25/2002	0735	8540	0.03
L5	Snake River above Murtaugh Bridge at Murtaugh	7/24/2002	1210	295	0.09
L7	Snake River above Shoshone Falls near Kimberly	7/24/2002	1228	725	0.11
L8	Snake River below Perrine Bride at Twin Falls	7/24/2002	1504	732	0.04
L9	Snake River above Crystal Springs near Buhl	7/24/2002	1719	1310	0.06
L11	Snake River below Clear Lakes outlet near Buhl	7/25/2002	1509	2430	0.02
L12	Snake River above Banbury Springs near Hagerman	7/25/2002	1100	2770	0.07
L13	Snake River above Thousand Springs near Hagerman	7/25/2002	1014	3720	0.05
L14	Snake River below Thousand Springs near Hagerman	7/25/2002	0939	4710	0.02
L15	Snake River above Lower Salmon Falls Power Plant near Bliss	7/25/2002	1300	4760	0.05
L17	Snake River above Bliss Dam near Bliss	7/25/2002	1110	6310	0.02
L19	Snake River above Bancroft Springs near King Hill	7/25/2002	1510	6310	0.02

Table A16. Discharge data for all inspected inflow and outflow sites during July 24-25, 2002, for the Snake River between Minidoka Dam and King Hill, Idaho

[Latitude and longitude in degrees, minutes, seconds in North American Datum of 1983 (NAD83); DM, daily mean discharge; discharge given in cubic feet per second; map numbers shown in figure X; ---, no data]

Inspection site[1]	Station number[1]	Location		Date	Time	Discharge[2]
		Latitude	Longitude			
Subreach between map numbers L1 and L2						
F Drain near Declo	13082060	42 32 48	113 37 14	7/25/2002	---	17.8
D-3 Drain near Declo	13082032	42 36 49	113 36 10	7/25/2002	---	6.5
Subreach between map numbers L2 and L3						
D-5 Drain near Rupert	13082062	42 33 15	113 38 38	7/25/2002	---	5.3
D-4 Drain near Rupert	13082064	42 34 15	113 38 25	7/25/2002	---	7.5
Marsh Creek near Declo[3]	13082320	42 31 26	113 40 02	7/25/2002	---	10.0
Spring Creek near Declo[3]	13082330	42 31 01	113 41 03	7/25/2002	---	0
D-16 Drain near Heyburn	13084705	42 32 30	113 45 24	7/25/2002	---	6.5
Subreach between map numbers L3 and L4						
B Drain near Heyburn	13084707	42 33 33	113 47 01	7/25/2002	---	4.3
D-17 Drain near Heyburn	13085060	42 32 53	113 50 51	7/25/2002	---	4
Main Drain North near Heyburn	13085065	42 33 02	113 51 59	7/25/2002	---	13.1
G Drain near Burley	13085070	42 31 56	113 53 12	7/25/2002	---	12.9
J Drain near Burley	13085080	42 31 53	113 53 29	7/25/2002	---	.2
A&B Irrigation Pump near Milner	13085500	42 32 01	113 56 51	7/25/2002	DM	177
PA Lateral Pump near Milner	13085800	42 32 02	113 58 19	7/25/2002	DM	62
Milner Irrigation Pump near Milner	13086000	42 31 10	114 00 38	7/25/2002	DM	237
Northside A Lateral near Milner	13086510	42 32 17	114 02 40	7/25/2002	DM	54
Northside Crosscut Canal near Milner	13086520	42 33 31	114 03 08	7/25/2002	DM	659
Milner-Gooding Canal near Milner	13086530	42 33 39	114 02 59	7/25/2002	DM	1445
North Side Main Canal near Milner	13087000	42 31 46	114 01 10	7/25/2002	DM	2351
Twin Falls Main Canal near Milner	13087500	42 31 18	114 01 03	7/25/2002	DM	3215
Subreach between map numbers L4 and L5						
---	---	---	---	---	---	---
Subreach between map numbers L5 and L6						
Miscellaneous agriculture return near Hansen	13089690	42 33 55	114 19 24	7/23/2002	1730	1
Twin Falls Coulee near Hansen	13089695	42 34 11	114 20 32	7/24/2002	1700	.2
Devil's Washbowl Spring near Kimberly	13089600	42 35 18	114 20 45	---	---	---
Subreach between map numbers L6 and L7						
Devil's Corral Springs near Kimberly	13090100	42 35 38	114 21 55	---	---	---
Subreach between map numbers L7 and L8						
Fish Hatchery Waste O near Twin Falls	13090370	42 35 31	114 26 05	7/24/2002	0945	16.5
Mary Alice Lake discharge near Twin Falls	---	42 35 46	114 26 51	7/24/2002	1700	1
Subreach between map numbers L8 and L9						
Perrine Coulee near Twin Falls	13090460	42 35 53	114 28 20	7/24/2002	1800	[4]3
Blue Lakes Outlet near Twin Falls	13091500	42 36 30	114 28 34	---	---	---
Warm Creek near Twin Falls	13091700	42 37 15	114 29 55	7/25/2002	---	30
Rock Creek above Highway 30/93 at Twin Falls	**13092747**	42 33 47	114 29 42	7/25/2002	DM	90
Jerome Golf Course Drain 1	13091733	42 38 03	114 31 02	7/25/2002	0800	4.8
Miscellaneous agriculture return near Twin Falls	---	42 37 21	114 33 23	7/25/2002	---	15
Sonnickson Drain near Twin Falls	13093150	42 38 40	114 33 26	7/24/2002	---	35
Miscellaneous agriculture return near Twin Falls	---	42 38 23	114 33 32	---	---	---
Miscellaneous agriculture return near Twin Falls	---	42 37 36	114 34 29	7/25/2002	1520	16.6
Sucker Flat Drain near Filer	13093190	42 38 25	114 35 30	7/25/2002	0700	40
Miscellaneous agriculture return near Filer	---	42 37 51	114 35 41	---	---	---
Miscellaneous agriculture return near Filer	---	42 38 54	114 36 58	7/25/2002	1315	3

Table A16. Discharge data for all inspected inflow and outflow sites during July 24-25, 2002, for the Snake River between Minidoka Dam and King Hill, Idaho--Continued

Inspection site[1]	Station number[1]	Location		Date	Time	Discharge[2]
		Latitude	Longitude			
Subreach between map numbers L9 and L10						
Miscellaneous agriculture return near Filer	---	42 39 17	114 38 16	7/25/2002	1235	3
Crystal Springs near Filer	13093400	42 39 36	114 38 32	---	---	---
Cedar Draw near Filer	13093550	42 39 13	114 39 15	7/24/2002	DM	56
Miscellaneous agriculture return near Buhl	---	42 39 31	114 40 42	7/25/2002	1005	2.6
Waste I near Buhl	13093900	42 39 33	114 41 28	7/25/2002	1300	6.7
Subreach between map numbers L10 and L11						
Miscellaneous agriculture return near Buhl	---	42 40 03	114 43 10	7/24/2002	1625	1
Miscellaneous agriculture return near Buhl	---	42 40 07	114 44 18	7/24/2002	1550	5
J8 Drain near Buhl	---	42 40 27	114 44 27	---	---	---
Clear Lakes Outlet near Buhl	13094500	42 40 01	114 46 45	---	---	---
Subreach between map numbers L11 and L12						
Mud Creek near Buhl[3]	13094700	42 39 33	114 47 20	7/25/2002	DM	21
Deep Creek near Buhl[3]	---	42 39 29	114 48 38	7/25/2002	0825	57
Briggs Creek Spring near Buhl	13095200	42 40 20	114 49 00	---	---	---
Subreach between map numbers L12 and L13						
Irrigation Ditch to Blind Canyon near Buhl	13095490	42 42 28	114 47 30	7/25/2002	DM	25.2
South Coulee (Cedar Draw) near Buhl	13095360	42 41 46	114 48 19	7/26/2002	0800	3.7
Box Canyon Springs near Wendell	**13095500**	42 42 29	114 48 35	---	---	---
Blind Canyon Spring near Buhl	13095400	42 42 12	114 49 20	---	---	---
Unnamed Spring near Buhl	13095350	42 41 51	114 49 21	---	---	---
Salmon Falls Creek near Hagerman	**13108150**	42 41 47	114 51 15	7/25/2002	DM	54
Subreach between map numbers L13 and L14						
Sand Springs near Hagerman	13132600	42 43 36	114 50 00	---	---	---
Drain near Bickel Springs near Hagerman	13133785	42 45 28	114 50 48	7/25/2002	1800	3.2
Bickel Spring near Hagerman	13132790	42 45 29	114 51 19	---	---	---
Subreach between map numbers L14 and L15						
Riley Creek near Hagerman	13133800	42 45 50	114 51 40	7/24/2002	---	50
Subreach between map numbers L15 and L16						
Billingsly Creek near Hagerman	13134600	42 46 44	114 51 22	7/24/2002	---	20
Subreach between map numbers L16 and L17						
W Drain near Tuttle	13152895	42 51 50	114 51 58	7/26/2002	1000	1.5
Birch Creek near Hagerman	13135100	42 51 10	114 53 30	7/23/2002	1120	7.2
Malad Power Flume near Bliss	**13152940**	42 51 54	114 53 11	7/25/2002	DM	1080
Malad River near Bliss	**13153500**	42 51 48	114 54 04	7/25/2002	DM	88
Subreach between map numbers L17 and L18						
Tuana Gulch near Bliss	---	42 54 34	115 00 02	7/22/2002	1430	1
Irrigation Ditch near Bliss	13152450	42 55 56	115 00 19	7/25/2002	DM	17
Subreach between map numbers L18 and L19						
---	---	---	---	---	---	---
Subreach between map numbers L19 and L20						
Clover Creek near Bliss	13154000	43 01 30	115 00 20	7/22/2002	1225	13

[1] Long-term United States Geological Survey or Idaho Power Company gaging stations are in bold.

[2] Values in shaded areas indicate canal withdrawals.

[3] Combined spring discharge and agriculture return flows; spring flow was subtraced from field measured value to obtain an approximate agriculture return flow value.

[4] Surface flows resulting from spring discharge; not used in gain/loss calculations.

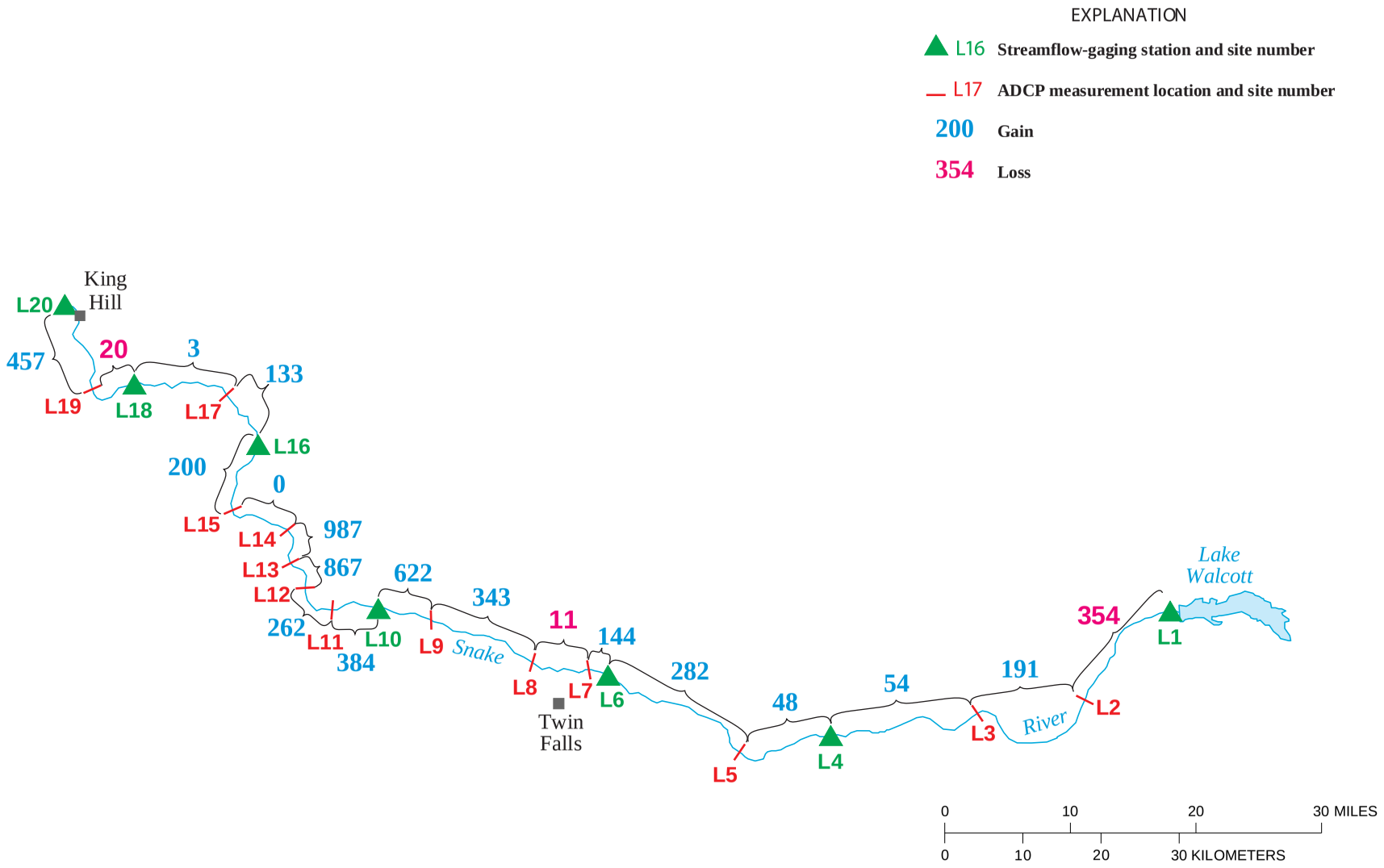


Figure A5. Streamflow gains and losses along the lower reach of the Snake River, Idaho, estimated during the July 24-25, 2002, seepage study.

Table A17. Calculations of gains and losses in specified subreaches of the Snake River during November 6-8,2002, between Minidoka Dam and King Hill, Idaho

[ADCP, Acoustic Doppler Current Profiler; ADP, Acoustic Doppler Profiler; ft^3/s, cubic feet per second; mi, mile; ---, no data]

Map number (fig. #)	Gaging station name (number)[1]/ ADCP/ADP measurement location	River mile		Discharge (ft^3/s)	Date	Time	Total gains/ (losses) (ft^3/s)	Gains/ (losses) per mile ($ft^3/s/mi$)
L1	**Snake River near Minidoka (13081500)**	673.5		600	11/6/2002	1000		
			total estimated inflow	1				
			total estimated outflow	0				
L2	Snake River at Highway 77(25) near Rupert	664.0		512	11/6/2002	1436	(89)	(9)
			total estimated inflow	10				
			total estimated outflow	0				
			estimated outflow to storage in Milner Lake[2]	0				
L3	Snake River at Highway 27 at Burley	651.6		465	11/6/2002	1621	(57)	(5)
			total estimated inflow	16				
			total estimated outflow	0				
			estimated outflow to storage in Milner Lake[2]	0				
L4	**Snake River at Milner (13088000)**	638.7		446	11/6/2002	2230	(92)	(7)
				443	11/7/2002	0330		
			total estimated inflow	0				
			total estimated outflow	0				
L5	Snake River above Murtaugh Bridge at Murtaugh	630.5		479	11/7/2002	0731	36	4
			total estimated inflow	0				
			total estimated outflow	0				
L6	**Snake River near Kimberley (13090000)**	617.2		758	11/7/2002	1400	279	21
				713	11/6/2002	1015		
			total estimated inflow	0				
			total estimated outflow	0				
L7	Snake River above Shoshone Falls near Kimberly	615.2		704	11/6/2002	1121	(9)	(5)
			total estimated inflow	16				
			total estimated outflow	0				
L8	Snake River below Perrine Bridge at Twin Falls	611.0		864	11/7/2002	1419	144	34
			total estimated inflow	154				
			total estimated outflow	0				

Table A17. Calculations of gains and losses in specified subreaches of the Snake River during November 6-8,2002, between Minidoka Dam and King Hill, Idaho--Continued

Map number (fig. #)	Gaging station name (number)[1]/ ADCP/ADP measurement location	River mile		Discharge (ft^3/s)	Date	Time	Total gains/ (losses) (ft^3/s)	Gains/ (losses) per mile ($ft^3/s/mi$)
L9	Snake River above Crystal Springs near Buhl	601.1		1160	11/6/2002	1432	142	14
			total estimated inflow	61				
			total estimated outflow	0				
L10	**Snake River near Buhl (13094000)**	596.8		1930	11/6/2002	1645	709	165
				2040	11/7/2002	0915		
			total estimated inflow	3				
			total estimated outflow	0				
L11	Snake River below Clear Lakes outlet near Buhl	592.8		2610	11/7/2002	1112	568	142
			total estimated inflow	78				
			total estimated outflow	0				
L12	Snake River above Banbury Springs near Hagerman	589.2		2600	11/7/2002	1058	(88)	(24)
			total estimated inflow	166				
			total estimated outflow	0				
L13	Snake River above Thousand Springs near Hagerman	585.6		3770	11/7/2002	1141	1,005	279
			total estimated inflow	0				
			total estimated outflow	0				
L14	Snake River below Thousand Springs near Hagerman	582.9		4920	11/7/2002	1212	1,150	426
			total estimated inflow	87				
			total estimated outflow	0				
L15	Snake River above Lower Salmon Falls Power Plant near Bliss	576.8		5110	11/7/2002	1343	103	17
			total estimated inflow	30				
			total estimated outflow	0				
			estimated outflow to storage above Lower Salmon Falls power plant[3]	230				
L16	**Snake River below Lower Salmon Falls near Hagerman (13135000)**	572.5		5140	11/7/2002	1600	230	54
				5020	11/6/2002	1700		
			total estimated inflow	1122				
			total estimated outflow	0				
L17	Snake River above Bliss Dam near Bliss	564.9		[4]---	---	---	---	---
			total estimated inflow	1				

Table A17. Calculations of gains and losses in specified subreaches of the Snake River during November 6-8,2002, between Minidoka Dam and King Hill, Idaho--Continued

Map number (fig. #)	Gaging station name (number)[1]/ ADCP/ADP measurement location	River mile		Discharge (ft^3/s)	Date	Time	Total gains/ (losses) (ft^3/s)	Gains/ (losses) per mile ($ft^3/s/mi$)
			total estimated outflow	0				
			estimated outflow to storage above Bliss Dam[3]	400				
L18	**Snake River below Bliss Dam near Bliss (13153776)**	559.1		6120	11/7/2002	0030	377	28
				6480	11/8/2002	1500		
			total estimated inflow	0				
			total estimated outflow	0				
L19	Snake River above Bancroft Springs near King Hill	553.2		[5]---	---	---	---	---
			total estimated inflow	5				
			total estimated outflow	0				
L20	**Snake River at King Hill (13154500)**	546.6		6290	11/8/2002	2115	(195)	(16)

[1] Long-term United States Geological Survey or Idaho Power Company gaging stations are in bold.

[2] Estimated based on reservoir stage data (USGS station number 13087900).

[3] Estimated based on reservoir stage data (Idaho Power Company).

[4] Measurement was made but not used in the calculations (see table X).

[5] Unable to measure because of river or weather conditions.

Table A18. Gaging station discharge data during November 6-8, 2002, for the Snake River between Minidoka Dam and King Hill, Idaho

[Discharge given in cubic feet per second]

Map number (fig. #)	Gaging station name (number)	Date	Time	Discharge
L1	Snake River near Minidoka (13081500)	11/6/2002	1000	600
L4	Snake River at Milner (13088000)	11/6/2002	2230	446
		11/7/2002	0330	443
L6	Snake River near Kimberly (13090000)	11/7/2002	1400	758
		11/6/2002	1015	713
L10	Snake River near Buhl (13094000)	11/6/2002	1645	1930
		11/7/2002	0915	2040
L16	Snake River below Lower Salmon Falls near Hagerman (13135000)	11/7/2002	1600	5140
		11/6/2002	1700	5020
L18	Snake River below Bliss Dam near Bliss (13153776)	11/7/2002	0030	6120
		11/8/2002	1500	6480
L20	Snake River at King Hill (13154500)	11/8/2002	2115	6290

Table A19. Acoustic Doppler discharge measurement data during November 6-8, 2002, for the Snake River between Minidoka Dam and King Hill, Idaho

[ADCP, Acoustic Doppler Current Profiler; ADP, Acoustic Doppler Profiler; discharge given in cubic feet per second; COV, coefficient of variation; σ, standard deviation; μ, mean; ---, no data]

Map number (fig. #)	ADCP/ADP measurement location	Date	Time	Discharge	COV (σ/μ)
L2	Snake River at Highway 77(25) near Rupert	11/6/2002	1436	512	0.04
L3	Snake River at Highway 27 at Burley	11/6/2002	1621	465	0.27
L5	Snake River above Murtaugh Bridge at Murtaugh	11/7/2002	0731	479	0.05
L7	Snake River above Shoshone Falls near Kimberly	11/6/2002	1121	704	0.10
L8	Snake River below Perrine Bride at Twin Falls	11/7/2002	1419	864	0.08
L9	Snake River above Crystal Springs near Buhl	11/6/2002	1432	1160	0.04
L11	Snake River below Clear Lakes outlet near Buhl	11/7/2002	1112	2610	0.10
L12	Snake River above Banbury Springs near Hagerman	11/7/2002	1058	2600	0.12
L13	Snake River above Thousand Springs near Hagerman	11/7/2002	1141	3770	0.02
L14	Snake River below Thousand Springs near Hagerman	11/7/2002	1212	4920	0.01
L15	Snake River above Lower Salmon Falls Power Plant near Bliss	11/7/2002	1343	5110	0.05
L17	Snake River above Bliss Dam near Bliss	11/8/2002	1211	6680	0.02
L19	Snake River above Bancroft Springs near King Hill	---[1]	---	---	---

[1] Unable to access measurement site because of unsafe water conditions.

Table A20. Discharge data for all inspected inflow sites during November 4-8, 2002, for the Snake River between Minidoka Dam and King Hill, Idaho

[Latitude and longitude in degrees, minutes, seconds in North American Datum of 1983 (NAD83); DM, daily mean discharge; discharge given in cubic feet per second; map numbers shown in figure X; ---, no data]

Inspection site[1]	Station number[1]	Location		Date	Time	Discharge[2]
		Latitude	Longitude			
	Subreach between map numbers L1 and L2					
F Drain near Declo	13082060	42 32 48	113 37 14	11/6/2002	---	0
D-3 Drain near Declo	13082032	42 36 49	113 36 10	11/4/2002	1600	1.3
	Subreach between map numbers L2 and L3					
D-5 Drain near Rupert	13082062	42 33 15	113 38 38	11/5/2002	1400	1
D-4 Drain near Rupert	13082064	42 34 15	113 38 25	11/4/2002	DM	3
Marsh Creek near Declo	13082320	42 31 26	113 40 02	11/5/2002	DM	[3]10.2
Spring Creek near Declo	13082330	42 31 01	113 41 03	11/5/2002	DM	[3]6.4
D-16 Drain near Heyburn	13084705	42 32 30	113 45 24	11/4/2002	DM	5.7
	Subreach between map numbers L3 and L4					
B Drain near Heyburn	13084707	42 33 33	113 47 01	11/6/2002	---	0
D-17 Drain near Heyburn	13085060	42 32 53	113 50 51	11/5/2002	DM	1.3
Main Drain North near Heyburn	13085065	42 33 02	113 51 59	11/5/2002	DM	14.6
G Drain near Burley	13085070	42 31 56	113 53 12	11/6/2002	---	0
J Drain near Burley	13085080	42 31 53	113 53 29	11/6/2002	---	0
A&B Irrigation Pump near Milner	13085500	42 32 01	113 56 51	11/6/2002	DM	0
PA Lateral Pump near Milner	13085800	42 32 02	113 58 19	11/6/2002	DM	0
Milner Irrigation Pump near Milner	13086000	42 31 10	114 00 38	11/6/2002	DM	0
Northside A Lateral near Milner	13086510	42 32 17	114 02 40	11/6/2002	DM	0
Northside Crosscut Canal near Milner	13086520	42 33 31	114 03 08	11/6/2002	DM	0
Milner-Gooding Canal near Milner	13086530	42 33 39	114 02 59	11/6/2002	DM	0
North Side Main Canal near Milner	13087000	42 31 46	114 01 10	11/6/2002	DM	0
Twin Falls Main Canal near Milner	13087500	42 31 18	114 01 03	11/6/2002	DM	0
	Subreach between map numbers L4 and L5					
---	---	---	---	---	---	---
	Subreach between map numbers L5 and L6					
Miscellaneous agriculture return near Hansen	13089690	42 33 55	114 19 24	11/6/2002	---	0
Twin Falls Coulee near Hansen	13089695	42 34 11	114 20 32	11/6/2002	---	0
Devil's Washbowl Spring near Kimberly	13089600	42 35 18	114 20 45	---	---	[3]---
	Subreach between map numbers L6 and L7					
Devil's Corral Springs near Kimberly	13090100	42 35 38	114 21 55	---	---	[3]---
	Subreach between map numbers L7 and L8					
Fish Hatchery Waste O near Twin Falls	13090370	42 35 31	114 26 05	11/8/2002	1510	15
Mary Alice Lake discharge near Twin Falls	---	42 35 46	114 26 51	11/8/2002	1430	1
	Subreach between map numbers L8 and L9					
Perrine Coulee near Twin Falls	13090460	42 35 53	114 28 20	11/6/2002	1100	[3]1.8
Blue Lakes Outlet near Twin Falls	13091500	42 36 30	114 28 34	---	---	[3]---
Warm Creek near Twin Falls	13091700	42 37 15	114 29 55	11/8/2002	1300	25
Rock Creek above Highway 30/93 at Twin Falls	**13092747**	42 33 47	114 29 42	11/7/2002	DM	70
Jerome Golf Course Drain 1	13091733	42 38 03	114 31 02	11/8/2002	1345	0
Miscellaneous agriculture return near Twin Falls	---	42 37 21	114 33 23	11/8/2002	1220	0
Sonnickson Drain near Twin Falls	13093150	42 38 40	114 33 26	11/6/2002	---	0
Miscellaneous agriculture return near Twin Falls	---	42 38 23	114 33 32	11/8/2002	1335	0
Miscellaneous agriculture return near Twin Falls	---	42 37 36	114 34 29	11/8/2002	1225	13.0
Sucker Flat Drain near Filer	13093190	42 38 25	114 35 30	11/6/2002	1430	31
Miscellaneous agriculture return near Filer	---	42 37 51	114 35 41	11/8/2002	1210	10
Miscellaneous agriculture return near Filer	---	42 38 54	114 36 58	11/8/2002	1145	5.0

Table A20: Discharge data for all inspected inflow sites during November 4-8, 2002, for the Snake River between Minidoka Dam and King Hill, Idaho--Continued

Inspection site[1]	Station number[1]	Location		Date	Time	Discharge[2]
		Latitude	Longitude			
Subreach between map numbers L9 and L10						
Miscellaneous agriculture return near Filer	---	42 39 17	114 38 16	11/8/2002	120	2
Crystal Springs near Filer	13093400	42 39 36	114 38 32	---	---	[3]---
Cedar Draw near Filer	13093550	42 39 13	114 39 15	11/8/2002	1030	44
Miscellaneous agriculture return near Buhl	---	42 39 31	114 40 42	11/8/2002	950	1
Waste I near Buhl	13093900	42 39 33	114 41 28	11/8/2002	908	14.3
Subreach between map numbers L10 and L11						
Miscellaneous agriculture return near Buhl	---	42 40 03	114 43 10	11/8/2002	850	0.5
Miscellaneous agriculture return near Buhl	---	42 40 07	114 44 18	11/8/2002	840	2
J8 Drain near Buhl	---	42 40 27	114 44 27	11/8/2002	840	0
Clear Lakes Outlet near Buhl	13094500	42 40 01	114 46 45	---	---	[3]---
Subreach between map numbers L11 and L12						
Mud Creek near Buhl[4]	13094700	42 39 33	114 47 20	11/5/2002	1500	58
Deep Creek near Buhl[4]	---	42 39 29	114 48 38	11/5/2002	1300	20
Briggs Creek Spring near Buhl	13095200	42 40 20	114 49 00	---	---	[3]---
Subreach between map numbers L12 and L13						
Irrigation Ditch to Blind Canyon near Buhl	13095490	42 42 28	114 47 30	11/7/2002	---	0
South Coulee (Cedar Draw) near Buhl	13095360	42 41 46	114 48 19	11/7/2002	830	3.5
Box Canyon Springs near Wendell	**13095500**	42 42 29	114 48 35	---	---	[3]---
Blind Canyon Spring near Buhl	13095400	42 42 12	114 49 20	---	---	[3]---
Unnamed Spring near Buhl	13095350	42 41 51	114 49 21	---	---	[3]---
Salmon Falls Creek near Hagerman	**13108150**	42 41 47	114 51 15	11/5/2002	1145	162
Subreach between map numbers L13 and L14						
Sand Springs near Hagerman	13132600	42 43 36	114 50 00	---	---	[3]---
Drain near Bickel Springs near Hagerman	13133785	42 45 28	114 50 48	11/7/2002	---	0
Bickel Spring near Hagerman	13132790	42 45 29	114 51 19	---	---	[3]---
Subreach between map numbers L14 and L15						
Riley Creek near Hagerman	13133800	42 45 50	114 51 40	11/5/2002	1010	87
Subreach between map numbers L15 and L16						
Billingsly Creek near Hagerman	13134600	42 46 44	114 51 22	11/4/2002	1600	29.9
Subreach between map numbers L16 and L17						
W Drain near Tuttle	13152895	42 51 50	114 51 58	11/8/2002	---	0
Birch Creek near Hagerman	13135100	42 51 10	114 53 30	11/4/2002	1423	11.9
Malad Power Flume near Bliss	**13152940**	42 51 54	114 53 11	11/4/2002	1352	1000
Malad River near Bliss	**13153500**	42 51 48	114 54 04	11/4/2002	1335	110
Subreach between map numbers L17 and L18						
Tuana Gulch near Bliss	---	42 54 34	115 00 02	11/4/2002	1230	1
Irrigation Ditch near Bliss	13152450	42 55 56	115 00 19	11/8/2002	---	0
Subreach between map numbers L18 and L19						
---	---	---	---	---	---	---
Subreach between map numbers L19 and L20						
Clover Creek near Bliss	13154000	43 01 30	115 00 20	11/4/2002	1100	5

[1] Long-term United States Geological Survey or Idaho Power Company gaging stations are in bold.

[2] Values in shaded areas indicate canal withdrawals.

[3] Surface flows resulting from spring discharge; not used in gain/loss calculations.

[4] Combined spring discharge and agriculture return flows; spring flow was subtraced from field measured value to obtain an approximate agriculture return flow value.

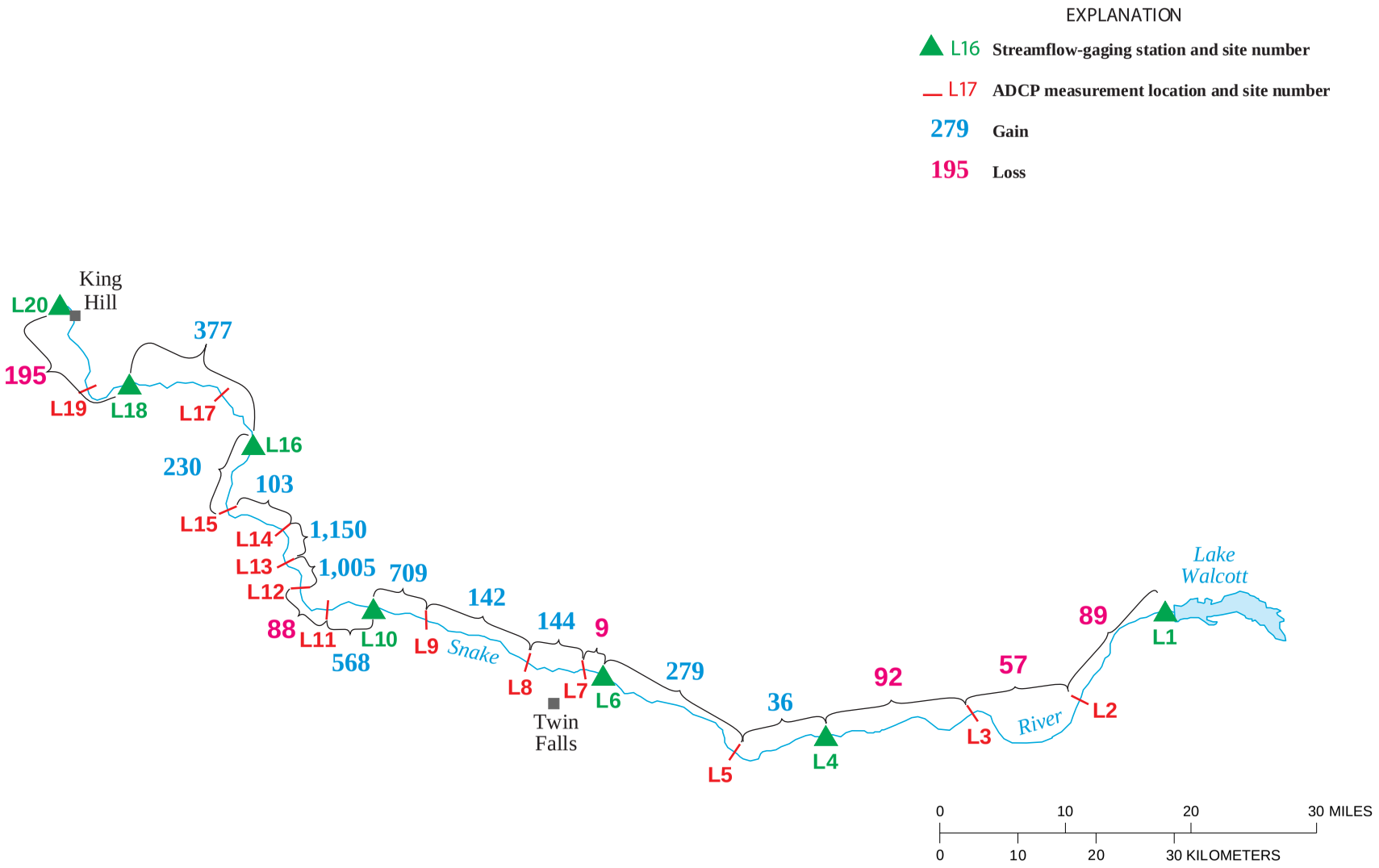
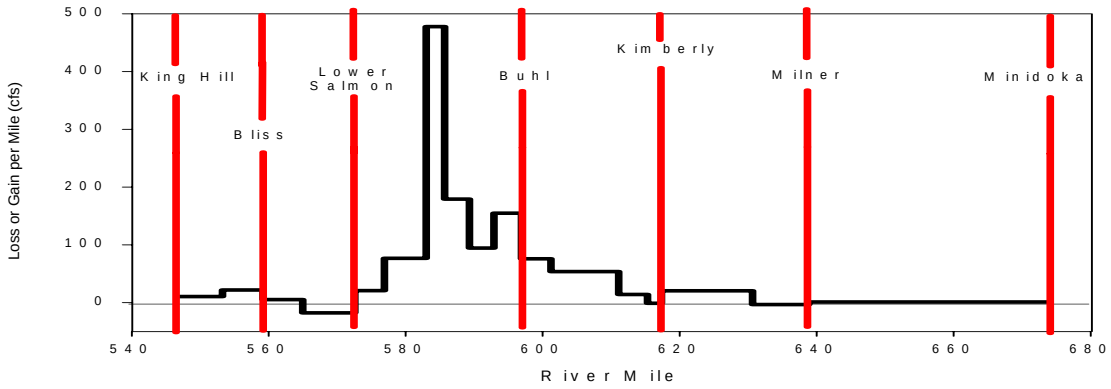
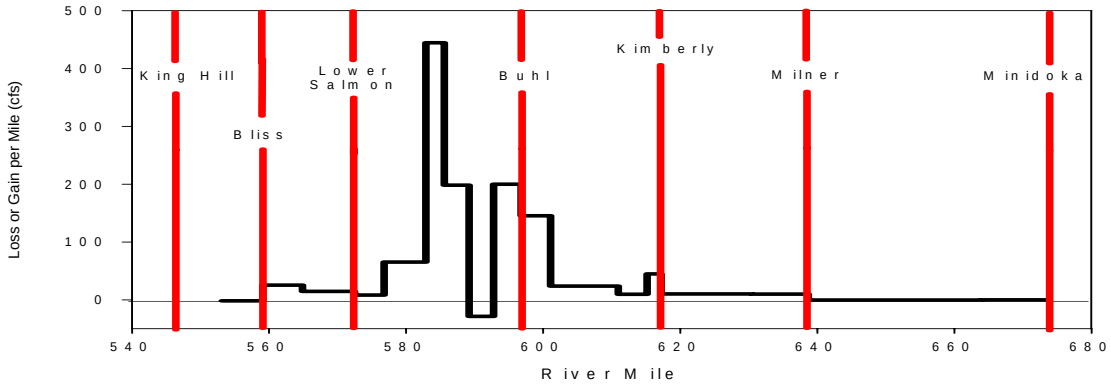


Figure A6. Streamflow gains and losses along the lower reach of the Snake River, Idaho, estimated during the November 6-8, 2002, seepage study.

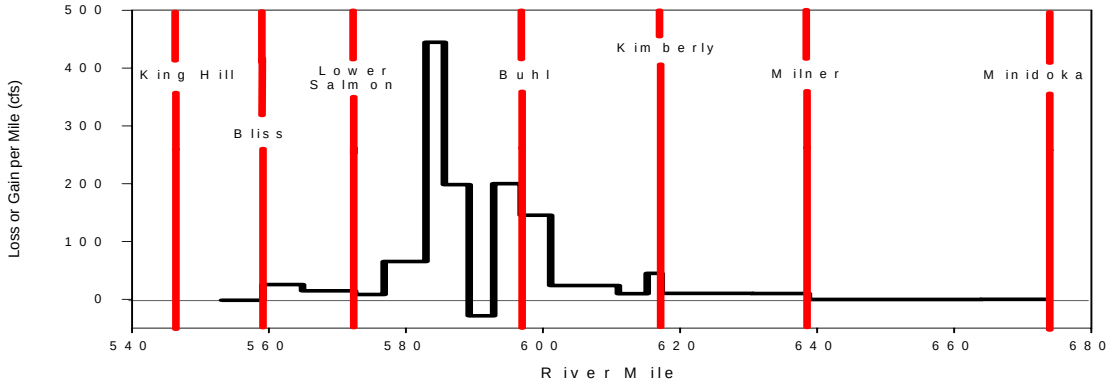
Spring 2001



Fall 2001



Spring 2002



Fall 2002

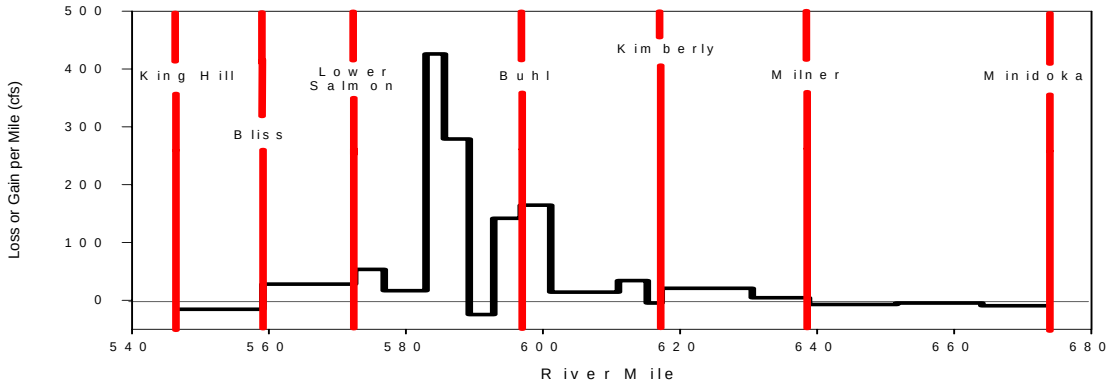


Figure A7. Summary plots of estimated gains and losses in specified subreaches of the Snake River between Minidoka Dam and King Hill, Idaho

APPENDIX B

Gain and loss calculations and relevant data for the Snake River between Shelley and Minidoka Dam, Idaho

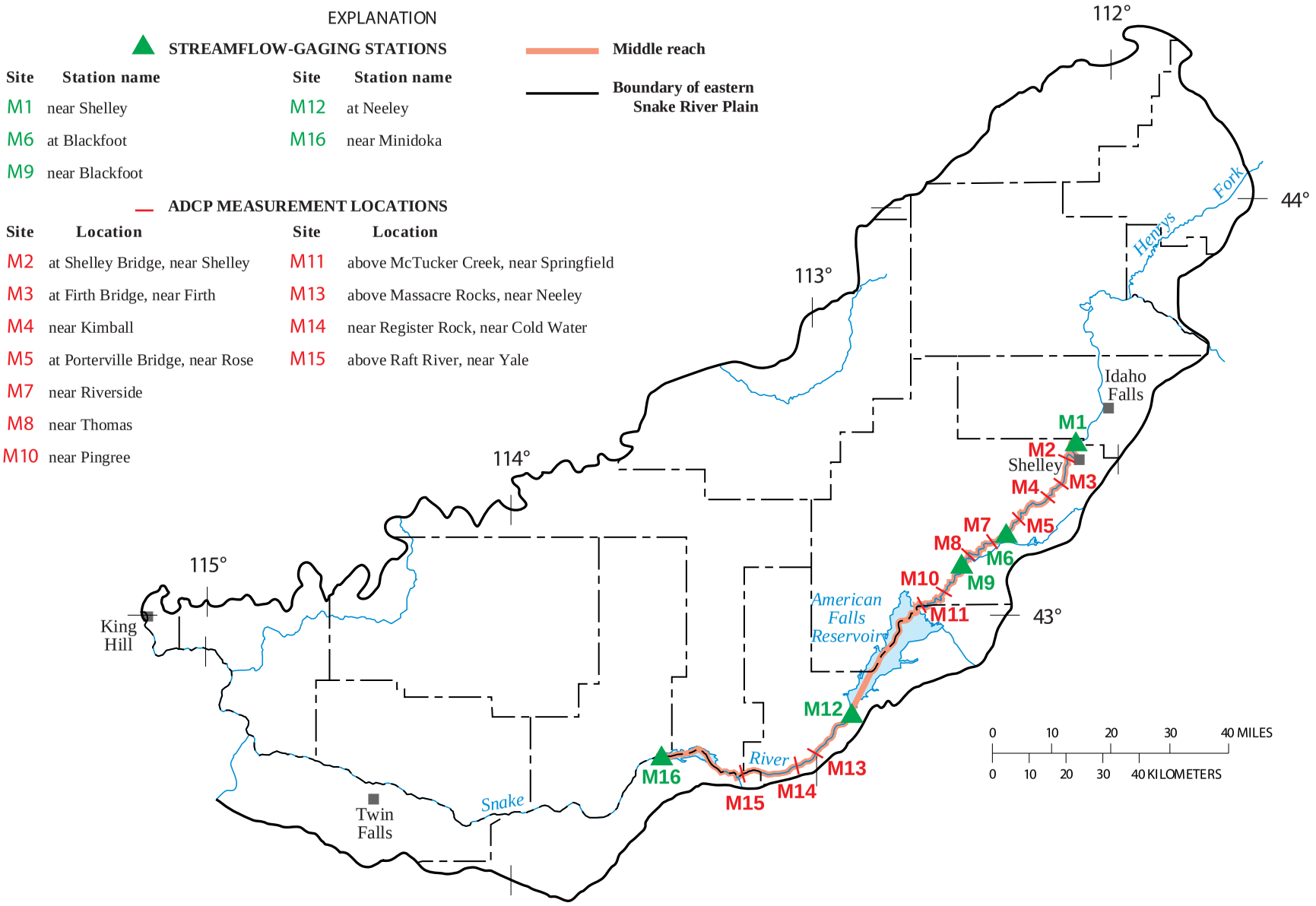


Figure B1. Locations of sites along the middle reach of the Snake River, Idaho, where streamflow was measured.

Table B1. Calculations of gains and losses in specified subreaches of the Snake River during April 3-6, 2001, between Shelley and Minidoka Dam, Idaho

[ADCP, Acoustic Doppler Current Profiler; ADP, Acoustic Doppler Profiler; ft^3/s, cubic feet per second; mi, mile; ---, no data]

Map number (fig. #)	Gaging station name (number)[1]/ ADCP/ADP measurement location	River mile		Discharge (ft^3/s)	Date	Time	Total gains/ (losses) (ft^3/s)	Gains/ (losses) per mile ($ft^3/s/mi$)
M1	**Snake River near Shelley (13060000)**	787.8		2940	4/3/2001	1030		
			total estimated inflow	0				
			total estimated outflow	0				
M2	Snake River at Shelley Bridge near Shelley	782.3		2790	4/3/2001	1320	(150)	(27)
			total estimated inflow	0				
			total estimated outflow	0				
M3	Snake River at Firth	777.3		2690	4/3/2001	1415	(100)	(20)
			total estimated inflow	0				
			total estimated outflow	0				
M4	Snake River at Kennedy Road near Firth	773.1		2620	4/3/2001	1520	(70)	(17)
			total estimated inflow	0				
			total estimated outflow	0				
M5	Snake River at Porterville Bridge near Blackfoot	767.5		2460	4/3/2001	1615	(160)	(29)
			total estimated inflow	0				
			total estimated outflow	0				
M6	**Snake River at Blackfoot (13062500)**	764.3		2470	4/3/2001	1745	10	3
				2490	4/4/2001	1245		
			total estimated inflow	0				
			total estimated outflow	0				
M7	Snake River near Riverside	760.2		2210	4/4/2001	1445	(280)	(68)
			total estimated inflow	0				
			total estimated outflow	0				
M8	Snake River near Thomas	753.5		2050	4/4/2001	1555	(160)	(24)
			total estimated inflow	109				
			total estimated outflow	0				
M9	**Snake River near Blackfoot (13069500)**	750.1		2290	4/4/2001	1745	131	39
				2190	4/4/2001	0845		
			total estimated inflow	0				
			total estimated outflow	0				

Table B1. Calculations of gains and losses in specified subreaches of the Snake River during April 3-6, 2001, between Shelley and Minidoka Dam, Idaho--Continued

Map number (fig. #)	Gaging station name (number)[1]/ ADCP/ADP measurement location	River mile		Discharge (ft^3/s)	Date	Time	Total gains/ (losses) (ft^3/s)	Gains/ (losses) per mile ($ft^3/s/mi$)
M10	Snake River near Pingree	743.3		2520	4/4/2001	1210	330	49
			total estimated inflow	0				
			total estimated outflow	0				
M11	Snake River above McTucker Creek near Pingree	738.0		2820	4/4/2001	1005	300	57
			total estimated inflow	588				
			total estimated outflow	0				
			estimated outflow to storage above American Falls Dam[2]	800				
M12	**Snake River at Neeley (13077000)**	714.1		3920	4/5/2001	0600	1,312	55
				3920	4/5/2001	0600		
			total estimated inflow	9				
			total estimated outflow	0				
M13	Snake River above Massacre Rocks near Neeley	707.7		[3]---	---	---	---	---
			total estimated inflow	37				
			total estimated outflow	0				
M14	Snake River at Register Rock near Cold Water	702.5		[3]---	---	---	---	---
			total estimated inflow	34				
			total estimated outflow	0				
M15	Snake River above Raft River near Yale	694		[3]---	---	---	---	---
			total estimated inflow	0				
			total estimated outflow	0				
			estimated outflow to storage above Minidoka Dam[2]	1150				
M16	**Snake River near Minidoka (13081500)**	673.5		2730	4/6/2001	0145	(121)	(3)

[1] Long-term United States Geological Survey gaging stations are in bold.

[2] Estimated based on reservoir stage data (US Bureau of Reclamation).

[3] Measurement was made but not used in the calculations (see table B3).

Table B2. Gaging station discharge data during April 3-6, 2001, for the Snake River between Shelley and Minidoka Dam, Idaho

[Discharge given in cubic feet per second]

Map number (fig. #)	Gaging station name (number)	Date	Time	Discharge
M1	Snake River near Shelley (13060000)	4/3/2001	1030	2940
M6	Snake River at Blackfoot (13062500)	4/3/2001	1745	2470
		4/4/2001	1245	2490
M9	Snake River near Blackfoot (13069500)	4/4/2001	1745	2290
		4/4/2001	0845	2190
M12	Snake River at Neeley (13077000)	4/5/2001	0600	3920
		4/5/2001	0600	3920
M16	Snake River near Minidoka (13081500)	4/6/2001	0145	2730

Table B3. Acoustic Doppler discharge measurement data during April 3-6, 2001, for the Snake River between Shelley and Minidoka Dam, Idaho

[ADCP, Acoustic Doppler Current Profiler; ADP, Acoustic Doppler Profiler; discharge given in cubic feet per second; COV, coefficient of variation; σ, standard deviation; μ, mean; ---, no data]

Map number (fig. #)	ADCP/ADP measurement location	Date	Time	Discharge	COV (σ/μ)
M2	Snake River at Shelley Bridge near Shelley	4/3/2001	1320	2790	0.03
M3	Snake River at Firth	4/3/2001	1415	2690	0.01
M4	Snake River at Kennedy Road near Firth	4/3/2001	1520	2620	0.01
M5	Snake River at Porterville Bridge near Blackfoot	4/3/2001	1615	2460	0.01
M7	Snake River near Riverside	4/4/2001	1445	2210	0.04
M8	Snake River near Thomas	4/4/2001	1555	2050	0.02
M10	Snake River near Pingree	4/4/2001	1210	2520	0.04
M11	Snake River above McTucker Creek near Pingree	4/4/2001	1005	2820	0.02
M13	Snake River above Massacre Rocks near Neeley	4/3/2001	1235	[1]4000	0.02
M14	Snake River at Register Rock near Cold Water	4/3/2001	1155	[1]3020	0.02
M15	Snake River above Raft River near Yale	4/3/2001	1005	[1]4860	0.01

[1] Measurements made during unsteady flow conditions.

Table B4. Discharge data for all inspected inflow and outflow sites during April 3-4, 2001, for the Snake River between Shelley and Minidoka Dam, Idaho

[Latitude and longitude in degrees, minutes, seconds in North American Datum of 1983 (NAD83); DM, daily mean discharge; discharge given in cubic feet per second; map numbers shown in figure X; ---, no data]

Inspection site[1]	Station number[1]	Location		Date	Time	Discharge[2]
		Latitude	Longitude			
Subreach between map numbers M1 and M2						
Miscellaneous agriculture return near Woodville	---	43 24 38	112 09 19	4/3/2001	---	0
Miscellaneous agriculture return near Woodville	---	43 24 57	112 08 48	4/3/2001	---	0
Shull Lateral near Shelley	---	43 24 26	112 08 00	4/3/2001	---	0
Reservation Canal near Shelley	13060500	43 22 24	112 09 13	4/3/2001	DM	0
Miscellaneous agriculture return near Shelley	---	43 22 42	112 10 11	4/3/2001	---	0
Subreach between map numbers M2 and M3						
Miscellaneous agriculture return near Shelley	---	43 22 26	112 10 11	4/3/2001	---	---
Blackfoot Canal near Shelley	13061430	43 21 18	112 09 53	4/3/2001	DM	0
Subreach between map numbers M3 and M4						
New Lavaside Canal near Firth	13061520	43 18 30	112 12 09	4/3/2001	DM	0
Peoples Canal near Firth	13061525	44 18 31	113 12 10	4/3/2001	DM	0
Aberdeen Springfield Canal near Firth	13061610	43 17 37	112 13 13	4/3/2001	DM	0
Subreach between map numbers M4 and M5						
Aberdeen Springfield Waste near Kimball	---	43 16 49	112 15 16	4/3/2001	---	0
Corbett Slough Canal near Kimball	13061650	43 15 40	112 15 30	4/3/2001	DM	0
Neilson-Hanson Canal near Kimball	13061670	43 15 29	112 17 07	4/3/2001	DM	0
Miscellaneous agriculture return near Wapello	---	43 14 47	112 17 58	4/3/2001	---	0
Riverside Canal near Rose	13061705	43 15 47	112 18 07	4/3/2001	DM	0
Lavaside and Riverside return near Rose	---	43 14 05	112 19 31	4/3/2001	---	0
Subreach between map numbers M5 and M6						
Miscellaneous agriculture return near Blackfoot	---	43 13 36	112 19 50	4/3/2001	---	0
Danskin Canal near Blackfoot	13061995	43 13 28	112 20 12	4/3/2001	DM	0
Miscellaneous agriculture return near Blackfoot	---	43 13 12	112 20 31	4/3/2001	---	0
Miscellaneous agriculture return at Blackfoot	---	43 12 12	112 22 12	4/3/2001	---	0
Subreach between map numbers M6 and M7						
Trego Canal near Blackfoot	13062050	43 12 05	112 22 00	4/3/2001	DM	0
Wearyrick Canal near Blackfoot	13062503	43 11 51	112 22 36	4/3/2001	DM	0
Watson Slough near Blackfoot	13062506	43 11 46	112 23 44	4/3/2001	DM	0
Parsons Ditch near Blackfoot	13062507	43 11 36	112 23 45	4/3/2001	DM	0
Subreach between map numbers M7 and M8						
Riverton Ditch near Thomas	---	43 09 00	112 27 04	4/3/2001	---	0
Crawford Ditch near Thomas	---	43 10 04	112 27 44	4/3/2001	---	0
Watson Slough return near Thomas	---	43 09 39	112 29 13	4/3/2001	---	0
Subreach between map numbers M8 and M9						
Blackfoot River near Blackfoot	**13068500**	43 07 50	112 28 35	4/4/2001	DM	109
Miscellaneous agriculture return near Thomas	---	43 08 04	112 30 54	4/3/2001	---	0
Subreach between map numbers M9 and M10						
Mud Slough near Fort Hall	---	43 05 40	112 31 04	4/3/2001	---	[3]---
Diggie Creek near Fort Hall	---	43 05 43	112 31 07	4/3/2001	---	[3]149
Jeff Cabin Creek near Fort Hall	---	43 04 05	112 33 00	4/3/2001	---	[3]0
Subreach between map numbers M10 and M11						
---	---	---	---	---	---	---
Subreach between map numbers M11 and M12						
Ross Fork near Fort Hall	---	42 00 21	111 29 47	4/4/2001	---	[3]10
Clear Creek near Fort Hall	---	43 02 23	112 32 33	---	---	[3]---
Spring Creek near Fort Hall	**13075983**	43 02 36	112 33 15	4/4/2001	DM	[3]332
McTucker Creek Springfield	---	43 02 05	112 38 36	4/3/2001	---	[3]20
Portneuf River near Tyhee	**13075910**	42 56 42	112 32 38	4/4/2001	DM	536

Table B4. Discharge data for all inspected inflow and outflow sites during April 3-4, 2001, for the Snake River between Shelley and Minidoka Dam, Idaho--Continued

Inspection site[1]	Station number[1]	Location		Date	Time	Discharge[2]
		Latitude	Longitude			
Danielson Creek near Springfield	---	43 03 32	112 41 27	4/4/2001	---	[3]45
Sterling Waste near Sterling	13069548	43 01 49	112 43 40	---	---	---
Unnamed Spring #1 near Sterling	---	43 03 37	112 43 19	---	---	---
Crystal Springs near Sterling	---	43 02 52	112 40 53	---	---	---
Unnamed Spring #2 near Sterling	---	42 59 39	112 45 37	---	---	---
Unnamed Spring #3 near Sterling	---	43 02 39	112 39 09	---	---	---
Bannock Creek near Michaud	---	42 53 12	112 38 35	4/4/2001	---	49
Aberdeen Waste Drain near Aberdeen	13069565	42 55 27	112 43 39	4/4/2001	---	1
Tarter Waster near American Falls	13076210	42 52 40	112 51 23	4/4/2001	---	0
Seagull Bay near American Falls	---	42 49 24	112 47 45	4/4/2001	---	0
Sunbeam near American Falls	---	42 47 55	112 50 53	4/4/2001	---	2
Spring Hallow near American Falls	---	42 48 39	112 53 30	4/4/2001	---	[3]0
Falls Irrigation Pump near American Falls	13076400	42 46 46	112 52 22	4/4/2001	DM	0
Subreach between map numbers M12 and M13						
Ferry Hallow near Neeley	---	42 45 43	112 52 57	4/4/2001	---	0
Warm Creek near Neeley	---	42 44 01	112 54 25	4/4/2001	1105	7.0
Little Creek near Neeley	---	42 42 47	112 55 53	4/4/2001	1140	1.9
Subreach between map numbers M13 and M14						
Rock Creek near Rockland	13077650	42 39 10	113 01 00	4/4/2001	1315	37.4
Dry Hallow Creek near Rockland	---	42 38 40	113 01 57	4/4/2001	---	0
Subreach between map numbers M14 and M15						
Little Warm Creek near Cold Water	---	43 38 07	113 03 43	4/4/2001	1420	5.3
Fall Creek near Cold Water	---	43 37 36	113 05 05	4/4/2001	1515	28.9
Lanes Gulch near Cold Water	---	42 37 10	113 07 11	4/4/2001	---	0
Subreach between map numbers M15 and M16						
Raft River near Yale	---	42 35 50	113 14 19	4/4/2001	---	0
Minidoka Northside Canal near Minidoka	13080000	42 40 15	113 29 00	4/4/2001	DM	105
Minidoka Southside Canal near Minidoka	13080500	42 39 45	113 29 20	4/4/2001	DM	0

[1] Long-term United States Geological Survey gaging stations are in bold.

[2] Values in shaded areas indicate canal withdrawals.

[3] Surface flows resulting from spring discharge; not used in gain/loss calculations.

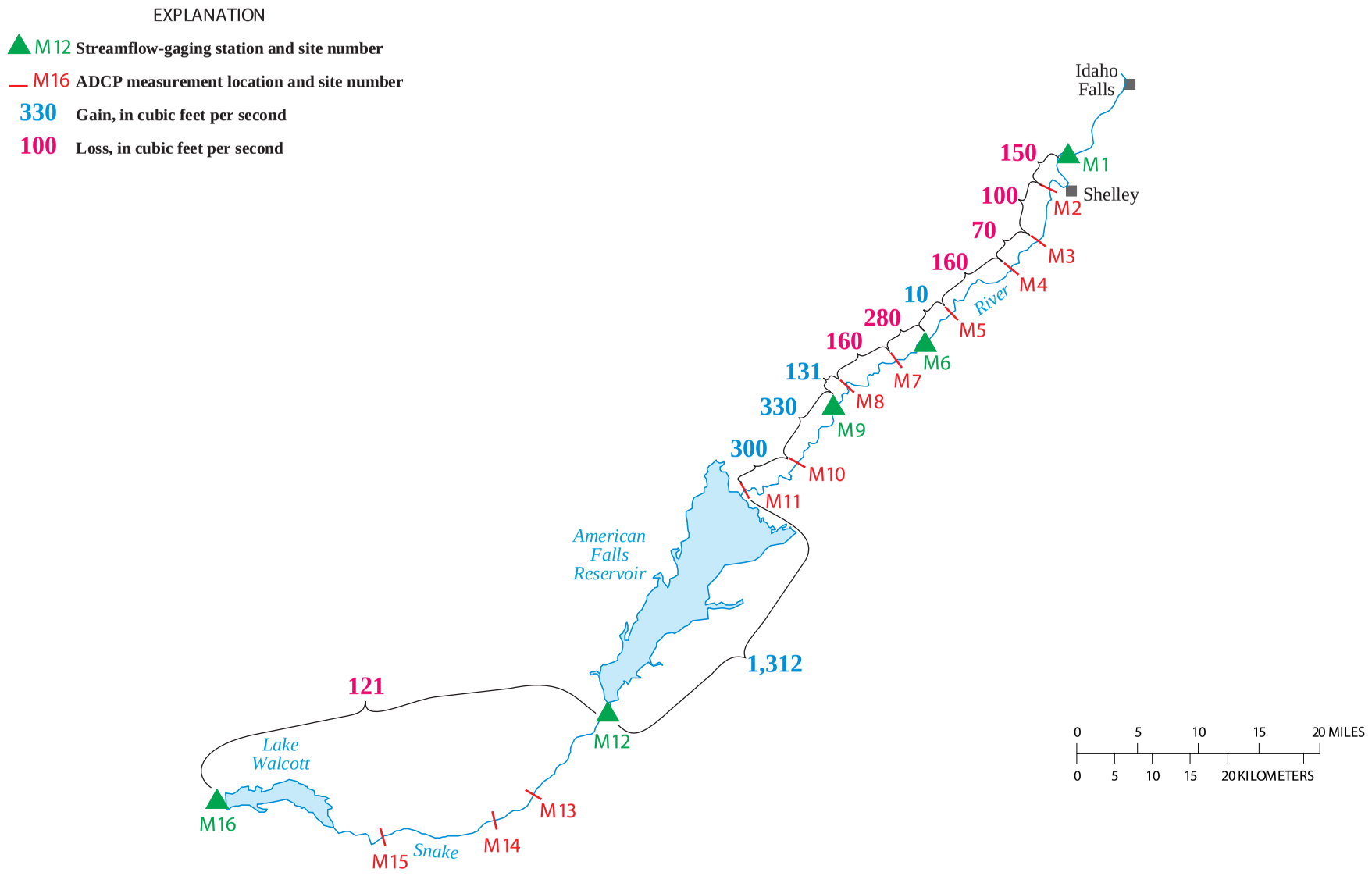


Figure B2. Streamflow gains and losses along the middle reach of the Snake River, Idaho, estimated during the April 3–6, 2001, seepage study.

Table B5. Calculations of gains and losses in specified subreaches of the Snake River during October 31, November 1, and November 20, 2001, between Shelley and Minidoka Dam, Idaho

[ADCP, Acoustic Doppler Current Profiler; ADP, Acoustic Doppler Profiler; ft^3/s, cubic feet per second; mi, mile; ---, no data]

Map number (fig. #)	Gaging station name (number)[1]/ ADCP/ADP measurement location	River mile		Discharge (ft^3/s)	Date	Time	Total gains/ (losses) (ft^3/s)	Gains/ (losses) per mile ($ft^3/s/mi$)
M1	**Snake River near Shelley (13060000)**	787.8		2130	10/31/2001	0745		
			total estimated inflow	0				
			total estimated outflow	0				
M2	Snake River at Shelley Bridge near Shelley	782.3		2090	10/31/2001	0930	(40)	(7)
			total estimated inflow	0				
			total estimated outflow	0				
M3	Snake River at Firth	777.3		1760	10/31/2001	1030	(330)	(66)
			total estimated inflow	0				
			total estimated outflow	0				
M4	Snake River at Kennedy Road near Firth	773.1		1840	10/31/2001	1115	80	19
			total estimated inflow	0				
			total estimated outflow	5				
M5	Snake River at Porterville Bridge near Blackfoot	767.5		1710	10/31/2001	1230	(125)	(22)
			total estimated inflow	0				
			total estimated outflow	0				
M6	**Snake River at Blackfoot (13062500)**	764.3		1690	10/31/2001	1330	(20)	(6)
				1700	10/31/2001	1215		
			total estimated inflow	0				
			total estimated outflow	7				
M7	Snake River near Riverside	760.2		1520	10/31/2001	1415	(173)	(42)
			total estimated inflow	6				
			total estimated outflow	0				
M8	Snake River near Thomas	753.5		1510	10/31/2001	1600	(16)	(2)
			total estimated inflow	90				
			total estimated outflow	0				
M9	**Snake River near Blackfoot (13069500)**	750.1		1570	10/31/2001	1745	(30)	(9)
				1810	11/1/2001	0530		
			total estimated inflow	0				
			total estimated outflow	0				

Table B5. Calculations of gains and losses in specified subreaches of the Snake River during October 31, November 1, and November 20, 2001, between Shelley and Minidoka Dam, Idaho--Continued

Map number (fig. #)	Gaging station name (number)[1]/ ADCP/ADP measurement location	River mile		Discharge (ft^3/s)	Date	Time	Total gains/ (losses) (ft^3/s)	Gains/ (losses) per mile ($ft^3/s/mi$)
M10	Snake River near Pingree	743.3		2410	11/1/2001	0845	600	88
			total estimated inflow	0				
			total estimated outflow	0				
M11	Snake River above McTucker Creek near Pingree	738		---[2]	---	---	---	---
			total estimated inflow	481				
			total estimated outflow	0				
			estimated outflow to storage above American Falls Dam[3]	4000				
M12	**Snake River at Neeley (13077000)**	714.1		354	11/2/2001	0715	1464	50
				377	11/20/2001	1130		
			total estimated inflow	4				
			total estimated outflow	0				
M13	Snake River above Massacre Rocks near Neeley	707.7		573	11/20/2001	1440	192	30
			total estimated inflow	19				
			total estimated outflow	0				
M14	Snake River at Register Rock near Cold Water	702.5		---[4]	---	---	---	---
			total estimated inflow	32				
			total estimated outflow	0				
M15	Snake River above Raft River near Yale	694		492	11/20/2001	1145	(131)	(10)
			total estimated inflow	0				
			total estimated outflow	0				
			estimated outflow to storage above Minidoka Dam[3]	0				
M16	**Snake River near Minidoka (13081500)**	673.5		545	11/20/2001	2145	53	3

[1] Long-term United States Geological Survey gaging stations are in bold.

[2] Unable to find a measurement location because of sediment build-up and braided channels.

[3] Estimated based on reservoir stage data (Bureau of Reclamation).

[4] Unable to access measurement location.

Table B6. Gaging station discharge data during October 31, November 1, and November 20, 2001, for the Snake River between Shelley and Minidoka Dam, Idaho

[Discharge given in cubic feet per second]

Map number (fig. #)	Gaging station name (number)	Date	Time	Discharge
M1	Snake River near Shelley (13060000)	10/31/2001	0745	2130
M6	Snake River at Blackfoot (13062500)	10/31/2001	1330	1690
		10/31/2001	1215	1700
M9	Snake River near Blackfoot (13069500)	10/31/2001	1745	1570
		11/1/2001	0530	1810
M12	Snake River at Neeley (13077000)	11/2/2001	0715	354
		11/20/2001	1130	377
M16	Snake River near Minidoka (13081500)	11/20/2001	2145	545

Table B7. Acoustic Doppler discharge measurement data during October 31, November 1, and November 20, 2001, for the Snake River between Shelley and Minidoka Dam, Idaho

[ADCP, Acoustic Doppler Current Profiler; ADP, Acoustic Doppler Profiler; discharge given in cubic feet per second; COV, coefficient of variation; σ, standard deviation; μ, mean; ---, no data]

Map number (fig. #)	ADCP/ADP measurement location	Date	Time	Discharge	COV (σ/μ)
M2	Snake River at Shelley Bridge near Shelley	10/31/2001	930	2090	0.04
M3	Snake River at Firth	10/31/2001	1030	1760	0.04
M4	Snake River at Kennedy Road near Firth	10/31/2001	1115	1840	0.02
M5	Snake River at Porterville Bridge near Blackfoot	10/31/2001	1230	1710	0.04
M7	Snake River near Riverside	10/31/2001	1415	1520	0.07
M8	Snake River near Thomas	10/31/2001	1600	1510	0.05
M10	Snake River near Pingree	11/1/2001	845	2410	0.03
M11	Snake River above McTucker Creek near Pingree	---	---	[1]---	---
---	12 miles above American Falls Dam, near Aberdeen	11/1/2001	1130	[2]2580	0.02
M13	Snake River above Massacre Rocks near Neeley	11/20/2001	1440	573	0.11
M14	Snake River at Register Rock near Cold Water	---	---	[3]---	---
M15	Snake River above Raft River near Yale	11/20/2001	1145	492	0.04

[1] Unable to find a measurement location because of sediment build-up and braided channels.

[2] Main-channel measurement within American Falls Reservoir during low-water conditions (not used in the analyses).

[3] Unable to access measurement location.

Table B8. Discharge data for all inspected inflow and outflow sites during October 31, November 1, and November 20, 2001, for the Snake River between Shelley and Minidoka Dam, Idaho

[Latitude and longitude in degrees, minutes, seconds in North American Datum of 1983 (NAD83); DM, daily mean discharge; discharge given in cubic feet per second; map numbers shown in figure X; ---, no data]

Inspection site[1]	Station number[1]	Location		Date	Time	Discharge[2]
		Latitude	Longitude			
Subreach between map numbers M1 and M2						
Miscellaneous agriculture return near Woodville	---	43 24 38	112 09 19	10/31/2001	---	0
Miscellaneous agriculture return near Woodville	---	43 24 57	112 08 48	10/31/2001	---	0
Shull Lateral near Shelley	---	43 24 26	112 08 00	10/31/2001	---	0
Reservation Canal near Shelley	13060500	43 22 24	112 09 13	10/31/2001	DM	0
Miscellaneous agriculture return near Shelley	---	43 22 42	112 10 11	10/31/2001	---	0
Subreach between map numbers M2 and M3						
Miscellaneous agriculture return near Shelley	---	43 22 26	112 10 11	10/31/2001	---	---
Blackfoot Canal near Shelley	13061430	43 21 18	112 09 53	10/31/2001	DM	0
Subreach between map numbers M3 and M4						
New Lavaside Canal near Firth	13061520	43 18 30	112 12 09	10/31/2001	DM	0
Peoples Canal near Firth	13061525	44 18 31	113 12 10	10/31/2001	DM	0
Aberdeen Springfield Canal near Firth	13061610	43 17 37	112 13 13	10/31/2001	DM	0
Subreach between map numbers M4 and M5						
Aberdeen Springfield Waste near Kimball	---	43 16 49	112 15 16	10/31/2001	---	0
Corbett Slough Canal near Kimball	13061650	43 15 40	112 15 30	10/31/2001	DM	0
Neilson-Hanson Canal near Kimball	13061670	43 15 29	112 17 07	10/31/2001	DM	5
Miscellaneous agriculture return near Wapello	---	43 14 47	112 17 58	10/31/2001	---	0
Riverside Canal near Rose	13061705	43 15 47	112 18 07	10/31/2001	DM	0
Lavaside and Riverside return near Rose	---	43 14 05	112 19 31	10/31/2001	---	0
Subreach between map numbers M5 and M6						
Miscellaneous agriculture return near Blackfoot	---	43 13 36	112 19 50	10/31/2001	---	0
Danskin Canal near Blackfoot	13061995	43 13 28	112 20 12	10/31/2001	DM	0
Miscellaneous agriculture return near Blackfoot	---	43 13 12	112 20 31	10/31/2001	---	0
Miscellaneous agriculture return at Blackfoot	---	43 12 12	112 22 12	10/31/2001	---	0
Subreach between map numbers M6 and M7						
Trego Canal near Blackfoot	13062050	43 12 05	112 22 00	10/31/2001	DM	0
Wearyrick Canal near Blackfoot	13062503	43 11 51	112 22 36	10/31/2001	DM	0
Watson Slough near Blackfoot	13062506	43 11 46	112 23 44	10/31/2001	DM	7
Parsons Ditch near Blackfoot	13062507	43 11 36	112 23 45	10/31/2001	DM	0
Subreach between map numbers M7 and M8						
Riverton Ditch near Thomas	---	43 09 00	112 27 04	10/31/2001	---	0
Crawford Ditch near Thomas	---	43 10 04	112 27 44	10/31/2001	---	2.5
Watson Slough return near Thomas	---	43 09 39	112 29 13	10/31/2001	---	3.2
Subreach between map numbers M8 and M9						
Blackfoot River near Blackfoot	**13068500**	43 07 50	112 28 35	10/31/2001	DM	90
Miscellaneous agriculture return near Thomas	---	43 08 04	112 30 54	10/31/2001	---	0
Subreach between map numbers M9 and M10						
Mud Slough near Fort Hall	---	43 05 40	112 31 04	11/1/2001	---	[3]---
Diggie Creek near Fort Hall	---	43 05 43	112 31 07	11/1/2001	---	[3]---
Jeff Cabin Creek near Fort Hall	---	43 04 05	112 33 00	11/1/2001	---	[3]0
Subreach between map numbers M10 and M11						
---	---	---	---	---	---	---
Subreach between map numbers M11 and M12						
Ross Fork near Fort Hall	---	43 00 21	111 29 47	11/1/2001	---	[3]44.6
Clear Creek near Fort Hall	---	43 02 23	112 32 33	11/1/2001	---	[3]21.1
Spring Creek near Fort Hall	**13075983**	43 02 36	112 33 15	11/1/2001	DM	[3]336
McTucker Creek Springfield	---	43 02 05	112 38 36	11/1/2001	---	[3]14.4
Portneuf River near Tyhee	**13075910**	42 56 42	112 32 38	11/1/2001	DM	448

Table B8. Discharge data for all inspected inflow and outflow sites during October 31, November 1, and November 20, 2001, for the Snake River between Shelley and Minidoka Dam, Idaho--Continued

Inspection site[1]	Station number[1]	Location		Date	Time	Discharge[2]
		Latitude	Longitude			
Danielson Creek near Springfield	---	43 03 32	112 41 27	11/1/2001	---	[3]49.7
Sterling Waste near Sterling	13069548	43 01 49	112 43 40	11/1/2001	---	[3]7.5
Unnamed Spring #1 near Sterling	---	43 03 37	112 43 19	11/1/2002	---	[3]0.7
Crystal Springs near Sterling	---	43 02 52	112 40 53	11/1/2001	---	[3]45.9
Unnamed Spring #2 near Sterling	---	42 59 39	112 45 37	11/1/2001	---	[3]3
Unnamed Spring #3 near Sterling	---	43 02 39	112 39 09	11/1/2001	---	[3]16.6
Bannock Creek near Michaud	---	42 53 12	112 38 35	11/1/2001	---	30
Aberdeen Waste Drain near Aberdeen	13069565	42 55 27	112 43 39	11/1/2001	---	1.3
Tarter Waster near American Falls	13076210	42 52 40	112 51 23	11/1/2001	---	---
Seagull Bay near American Falls	---	42 49 24	112 47 45	11/1/2001	---	0
Sunbeam near American Falls	---	42 47 55	112 50 53	11/1/2001	---	1
Spring Hallow near American Falls	---	42 48 39	112 53 30	11/1/2001	---	[3]2
Falls Irrigation Pump near American Falls	13076400	42 46 46	112 52 22	11/1/2001	DM	0
Subreach between map numbers M12 and M13						
Ferry Hallow near Neeley	---	42 45 43	112 52 57	11/1/2001	---	0
Warm Creek near Neeley	---	42 44 01	112 54 25	11/1/2001	---	2.2
Little Creek near Neeley	---	42 42 47	112 55 53	11/1/2001	---	1.5
Subreach between map numbers M13 and M14						
Rock Creek near Rockland	13077650	42 39 10	113 01 00	11/1/2001	---	18.6
Dry Hallow Creek near Rockland	---	42 38 40	113 01 57	11/1/2001	---	0
Subreach between map numbers M14 and M15						
Little Warm Creek near Cold Water	---	43 38 07	113 03 43	11/1/2001	---	2.2
Fall Creek near Cold Water	---	43 37 36	113 05 05	11/1/2001	---	29.3
Lanes Gulch near Cold Water	---	42 37 10	113 07 11	11/1/2001	---	0
Subreach between map numbers M15 and M16						
Raft River near Yale	---	42 35 50	113 14 19	11/1/2001	---	0
Minidoka Northside Canal near Minidoka	13080000	42 40 15	113 29 00	11/1/2001	DM	0
Minidoka Southside Canal near Minidoka	13080500	42 39 45	113 29 20	11/1/2001	DM	0

[1] Long-term United States Geological Survey gaging stations are in bold.

[2] Values in shaded areas indicate canal withdrawals.

[3] Surface flows resulting from spring discharge; not used in gain/loss calculations.

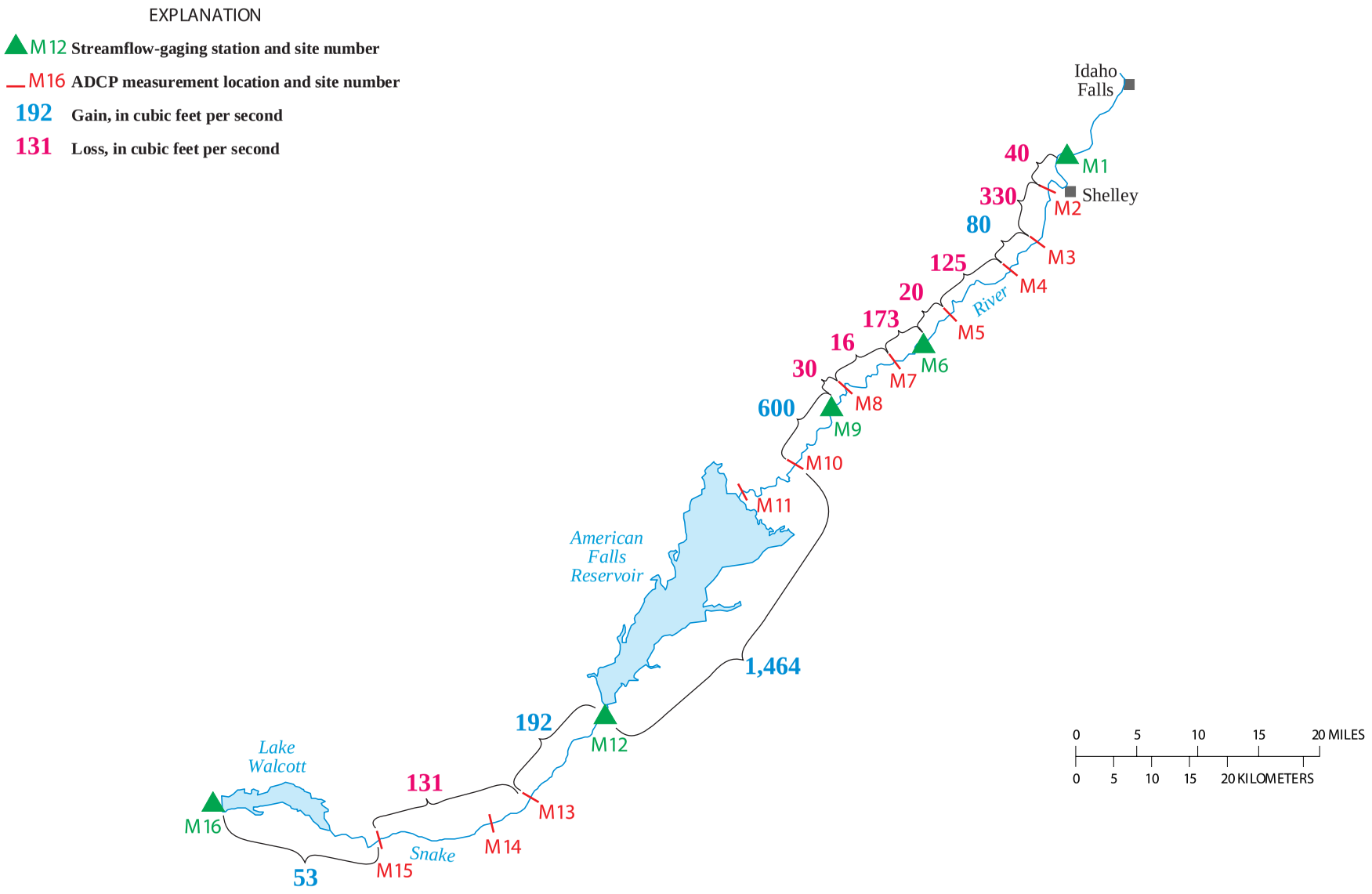


Figure B3. Streamflow gains and losses along the middle reach of the Snake River, Idaho, estimated during the October 31, November 1, and November 20, 2001, seepage study.

Table B9. Calculations of gains and losses in specified subreaches of the Snake River during April 9 - 10 and May 7, 2002, between Shelley and Minidoka Dam, Idaho

[ADCP, Acoustic Doppler Current Profiler; ADP, Acoustic Doppler Profiler; ft^3/s, cubic feet per second; mi, mile; ---, no data]

Map number (fig. #)	Gaging station name (number)[1]/ ADCP/ADP measurement location	River mile		Discharge (ft^3/s)	Date	Time	Total gains/ (losses) (ft^3/s)	Gains/ (losses) per mile ($ft^3/s/mi$)
M1	**Snake River near Shelley (13060000)**	787.8		2290	4/9/2002	0915		
			total estimated inflow	0				
			total estimated outflow	0				
M2	Snake River at Shelley Bridge near Shelley	782.3		2190	4/9/2002	1059	(100)	(18)
			total estimated inflow	0				
			total estimated outflow	0				
M3	Snake River at Firth	777.3		2290	4/9/2002	1155	100	20
			total estimated inflow	0				
			total estimated outflow	0				
M4	Snake River at Kennedy Road near Firth	773.1		2120	4/9/2002	1030	(170)	(40)
			total estimated inflow	0				
			total estimated outflow	0				
M5	Snake River at Porterville Bridge near Blackfoot	767.5		2050	4/9/2002	1130	(70)	(12)
			total estimated inflow	0				
			total estimated outflow	0				
M6	**Snake River at Blackfoot (13062500)**	764.3		1980	4/9/2002	1230	(70)	(22)
				1970	4/9/2002	1200		
			total estimated inflow	0				
			total estimated outflow	0				
M7	Snake River near Riverside	760.2		1790	4/9/2002	1330	(180)	(44)
			total estimated inflow	0				
			total estimated outflow	0				
M8	Snake River near Thomas	753.5		1660	4/9/2002	1430	(130)	(19)
			total estimated inflow	110				
			total estimated outflow	0				
M9	**Snake River near Blackfoot (13069500)**	750.1		1750	4/9/2002	1545	(20)	(6)
				1730	4/10/2002	0630		
			total estimated inflow	0				
			total estimated outflow	0				

Table B9. Calculations of gains and losses in specified subreaches of the Snake River during April 9 - 10 and May 7, 2002, between Shelley and Minidoka Dam, Idaho--Continued

Map number (fig. #)	Gaging station name (number)[1]/ ADCP/ADP measurement location	River mile		Discharge (ft^3/s)	Date	Time	Total gains/ (losses) (ft^3/s)	Gains/ (losses) per mile ($ft^3/s/mi$)
M10	Snake River near Pingree	743.3		[2]---	---	---	---	---
			total estimated inflow	0				
			total estimated outflow	0				
M11	Snake River above McTucker Creek near Pingree	738		2190	4/10/2002	1223	460	38
			total estimated inflow	538				
			total estimated outflow	0				
			estimated outflow to storage above American Falls Dam[3]	2300				
M12	**Snake River at Neeley (13077000)**	714.1		1660	4/11/2002	0600	1,232	52
				8450	5/7/2002	0400		
			total estimated inflow	5				
			total estimated outflow	0				
M13	Snake River above Massacre Rocks near Neeley	707.7		8680	5/7/2002	0715	225	35
			total estimated inflow	5				
			total estimated outflow	0				
M14	Snake River at Register Rock near Cold Water	702.5		8310	5/7/2002	0815	(375)	(72)
			total estimated inflow	15				
			total estimated outflow	0				
M15	Snake River above Raft River near Yale	694		[4]---	---	---	---	---
			total estimated inflow	0				
			total estimated outflow (canals)	660				
			estimated outflow to storage above Minidoka Dam[3]	250				
M16	**Snake River near Minidoka (13081500)**	673.5		6480	5/7/2002	2230	(935)	(32)

[1] Long-term United States Geological Survey gaging stations are in bold.

[2] Unable to access measurement location.

[3] Estimated based on reservoir stage data (Bureau of Reclamation).

[4] Unable to measure because of unsafe measuring conditions (high winds).

Table B10. Gaging station discharge data during April 9 - 10 and May 7, 2002, for the Snake River between Shelley and Minidoka Dam, Idaho

[Discharge given in cubic feet per second]

Map number (fig. #)	Gaging station name (number)	Date	Time	Discharge
M1	Snake River near Shelley (13060000)	4/9/2002	0915	2290
M6	Snake River at Blackfoot (13062500)	4/9/2002	1230	1980
		4/9/2002	1200	1970
M9	Snake River near Blackfoot (13069500)	4/9/2002	1545	1750
		4/10/2002	0630	1730
M12	Snake River at Neeley (13077000)	4/11/2002	0600	1660
		5/7/2002	0400	8450
M16	Snake River near Minidoka (13081500)	5/7/2002	2230	6480

Table B11. Acoustic Doppler discharge measurement data during April 9 - 10 and May 7, 2002, for the Snake River between Shelley and Minidoka Dam, Idaho

[ADCP, Acoustic Doppler Current Profiler; ADP, Acoustic Doppler Profiler; discharge given in cubic feet per second; COV, coefficient of variation; σ, standard deviation; μ, mean; ---, no data]

Map number (fig. #)	ADCP/ADP measurement location	Date	Time	Discharge	COV (σ/μ)
M2	Snake River at Shelley Bridge near Shelley	4/9/2002	1059	2190	0.04
M3	Snake River at Firth	4/9/2002	1155	2290	0.01
M4	Snake River at Kennedy Road near Firth	4/9/2002	1030	2120	0.03
M5	Snake River at Porterville Bridge near Blackfoot	4/9/2002	1130	2050	0.02
M7	Snake River near Riverside	4/9/2002	1330	1790	0.04
M8	Snake River near Thomas	4/9/2002	1430	1660	0.05
M10	Snake River near Pingree	---	---	---[1]	---
M11	Snake River above McTucker Creek near Pingree	4/10/2002	1223	2190	0.02
M13	Snake River above Massacre Rocks near Neeley	5/7/2002	715	8680	0.02
M14	Snake River at Register Rock near Cold Water	5/7/2002	815	8310	0.06
M15	Snake River above Raft River near Yale	---	---	---[2]	---

[1] Unable to access the measurement location.

[3] Unable to measure because of unsafe measuring conditions (high winds).

Table B12. Discharge data for all inspected inflow and outflow sites during April 9 - 10 and May 7, 2002, for the Snake River between Shelley and Minidoka Dam, Idaho

[Latitude and longitude in degrees, minutes, seconds in North American Datum of 1983 (NAD83); DM, daily mean discharge; discharge given in cubic feet per second; map numbers shown in figure X; ---, no data]

Inspection site[1]	Station number[1]	Location		Date	Time	Discharge[2]
		Latitude	Longitude			
Subreach between map numbers M1 and M2						
Miscellaneous agriculture return near Woodville	---	43 24 38	112 09 19	4/9/2002	---	0
Miscellaneous agriculture return near Woodville	---	43 24 57	112 08 48	4/9/2002	---	0
Shull Lateral near Shelley	---	43 24 26	112 08 00	4/9/2002	---	0
Reservation Canal near Shelley	13060500	43 22 24	112 09 13	4/9/2002	DM	0
Miscellaneous agriculture return near Shelley	---	43 22 42	112 10 11	4/9/2002	---	0
Subreach between map numbers M2 and M3						
Miscellaneous agriculture return near Shelley	---	43 22 26	112 10 11	4/9/2002	---	---
Blackfoot Canal near Shelley	13061430	43 21 18	112 09 53	4/9/2002	DM	0
Subreach between map numbers M3 and M4						
New Lavaside Canal near Firth	13061520	43 18 30	112 12 09	4/9/2002	DM	0
Peoples Canal near Firth	13061525	44 18 31	113 12 10	4/9/2002	DM	0
Aberdeen Springfield Canal near Firth	13061610	43 17 37	112 13 13	4/9/2002	DM	0
Subreach between map numbers M4 and M5						
Aberdeen Springfield Waste near Kimball	---	43 16 49	112 15 16	4/9/2002	---	0
Corbett Slough Canal near Kimball	13061650	43 15 40	112 15 30	4/9/2002	DM	0
Neilson-Hanson Canal near Kimball	13061670	43 15 29	112 17 07	4/9/2002	DM	0
Miscellaneous agriculture return near Wapello	---	43 14 47	112 17 58	4/9/2002	---	0
Riverside Canal near Rose	13061705	43 15 47	112 18 07	4/9/2002	DM	0
Lavaside and Riverside return near Rose	---	43 14 05	112 19 31	4/9/2002	---	0
Subreach between map numbers M5 and M6						
Miscellaneous agriculture return near Blackfoot	---	43 13 36	112 19 50	4/9/2002	---	0
Danskin Canal near Blackfoot	13061995	43 13 28	112 20 12	4/9/2002	DM	0
Miscellaneous agriculture return near Blackfoot	---	43 13 12	112 20 31	4/9/2002	---	0
Miscellaneous agriculture return at Blackfoot	---	43 12 12	112 22 12	4/9/2002	---	0
Subreach between map numbers M6 and M7						
Trego Canal near Blackfoot	13062050	43 12 05	112 22 00	4/9/2002	DM	0
Wearyrick Canal near Blackfoot	13062503	43 11 51	112 22 36	4/9/2002	DM	0
Watson Slough near Blackfoot	13062506	43 11 46	112 23 44	4/9/2002	DM	0
Parsons Ditch near Blackfoot	13062507	43 11 36	112 23 45	4/9/2002	DM	0
Subreach between map numbers M7 and M8						
Riverton Ditch near Thomas	---	43 09 00	112 27 04	4/9/2002	---	0
Crawford Ditch near Thomas	---	43 10 04	112 27 44	4/9/2002	---	0
Watson Slough return near Thomas	---	43 09 39	112 29 13	4/9/2002	---	0
Subreach between map numbers M8 and M9						
Blackfoot River near Blackfoot	**13068500**	43 07 50	112 28 35	4/9/2002	DM	110
Miscellaneous agriculture return near Thomas	---	43 08 04	112 30 54	4/9/2002	---	0
Subreach between map numbers M9 and M10						
Mud Slough near Fort Hall	---	43 05 40	112 31 04	4/10/2002	---	[3]---
Diggie Creek near Fort Hall	---	43 05 43	112 31 07	4/10/2002	---	[3]---
Jeff Cabin Creek near Fort Hall	---	43 04 05	112 33 00	4/10/2002	---	[3]0
Subreach between map numbers M10 and M11						
---	---	---	---	---	---	---
Subreach between map numbers M11 and M12						
Ross Fork near Fort Hall	---	43 00 21	111 29 47	4/10/2002	---	[3]---
Clear Creek near Fort Hall	---	43 02 23	112 32 33	4/10/2002	---	[3]---
Spring Creek near Fort Hall	**13075983**	43 02 36	112 33 15	4/10/2002	DM	[3]311
McTucker Creek Springfield	---	43 02 05	112 38 36	4/10/2002	---	[3]---
Portneuf River near Tyhee	**13075910**	42 56 42	112 32 38	4/10/2002	DM	518

Table B12. Discharge data for all inspected inflow and outflow sites during April 9 - 10 and May 7, 2002, for the Snake River between Shelley and Minidoka Dam, Idaho--Continued

Inspection site[1]	Station number[1]	Location		Date	Time	Discharge[2]
		Latitude	Longitude			
Danielson Creek near Springfield	---	43 03 32	112 41 27	4/10/2002	---	[3]---
Sterling Waste near Sterling	13069548	43 01 49	112 43 40	4/10/2002	---	[3]---
Unnamed Spring #1 near Sterling	---	43 03 37	112 43 19	4/10/2002	---	[3]---
Crystal Springs near Sterling	---	43 02 52	112 40 53	4/10/2002	---	[3]---
Unnamed Spring #2 near Sterling	---	42 59 39	112 45 37	4/10/2002	---	[3]---
Unnamed Spring #3 near Sterling	---	43 02 39	112 39 09	4/10/2002	---	[3]---
Bannock Creek near Michaud	---	42 53 12	112 38 35	4/10/2002	---	20
Aberdeen Waste Drain near Aberdeen	13069565	42 55 27	112 43 39	4/10/2002	---	0
Tarter Waster near American Falls	13076210	42 52 40	112 51 23	4/10/2002	---	---
Seagull Bay near American Falls	---	42 49 24	112 47 45	4/10/2002	---	0
Sunbeam near American Falls	---	42 47 55	112 50 53	4/10/2002	---	0
Spring Hallow near American Falls	---	42 48 39	112 53 30	4/10/2002	---	[3]---
Falls Irrigation Pump near American Falls	13076400	42 46 46	112 52 22	4/10/2002	DM	0
Subreach between map numbers M12 and M13						
Ferry Hallow near Neeley	---	42 45 43	112 52 57	5/7/2002	---	0
Warm Creek near Neeley	---	42 44 01	112 54 25	5/7/2002	---	5.0
Little Creek near Neeley	---	42 42 47	112 55 53	5/7/2002	---	---
Subreach between map numbers M13 and M14						
Rock Creek near Rockland	13077650	42 39 10	113 01 00	5/7/2002	---	4.5
Dry Hallow Creek near Rockland	---	42 38 40	113 01 57	5/7/2002	---	0
Subreach between map numbers M14 and M15						
Little Warm Creek near Cold Water	---	43 38 07	113 03 43	5/7/2002	---	---
Fall Creek near Cold Water	---	43 37 36	113 05 05	5/7/2002	---	15
Lanes Gulch near Cold Water	---	42 37 10	113 07 11	5/7/2002	---	---
Subreach between map numbers M15 and M16						
Raft River near Yale	---	42 35 50	113 14 19	5/7/2002	---	0
Minidoka Northside Canal near Minidoka	13080000	42 40 15	113 29 00	5/7/2002	DM	946
Minidoka Southside Canal near Minidoka	13080500	42 39 45	113 29 20	5/7/2002	DM	660

[1] Long-term United States Geological Survey gaging stations are in bold.

[2] Values in shaded areas indicate canal withdrawals.

[3] Surface flows resulting from spring discharge; not used in gain/loss calculations.

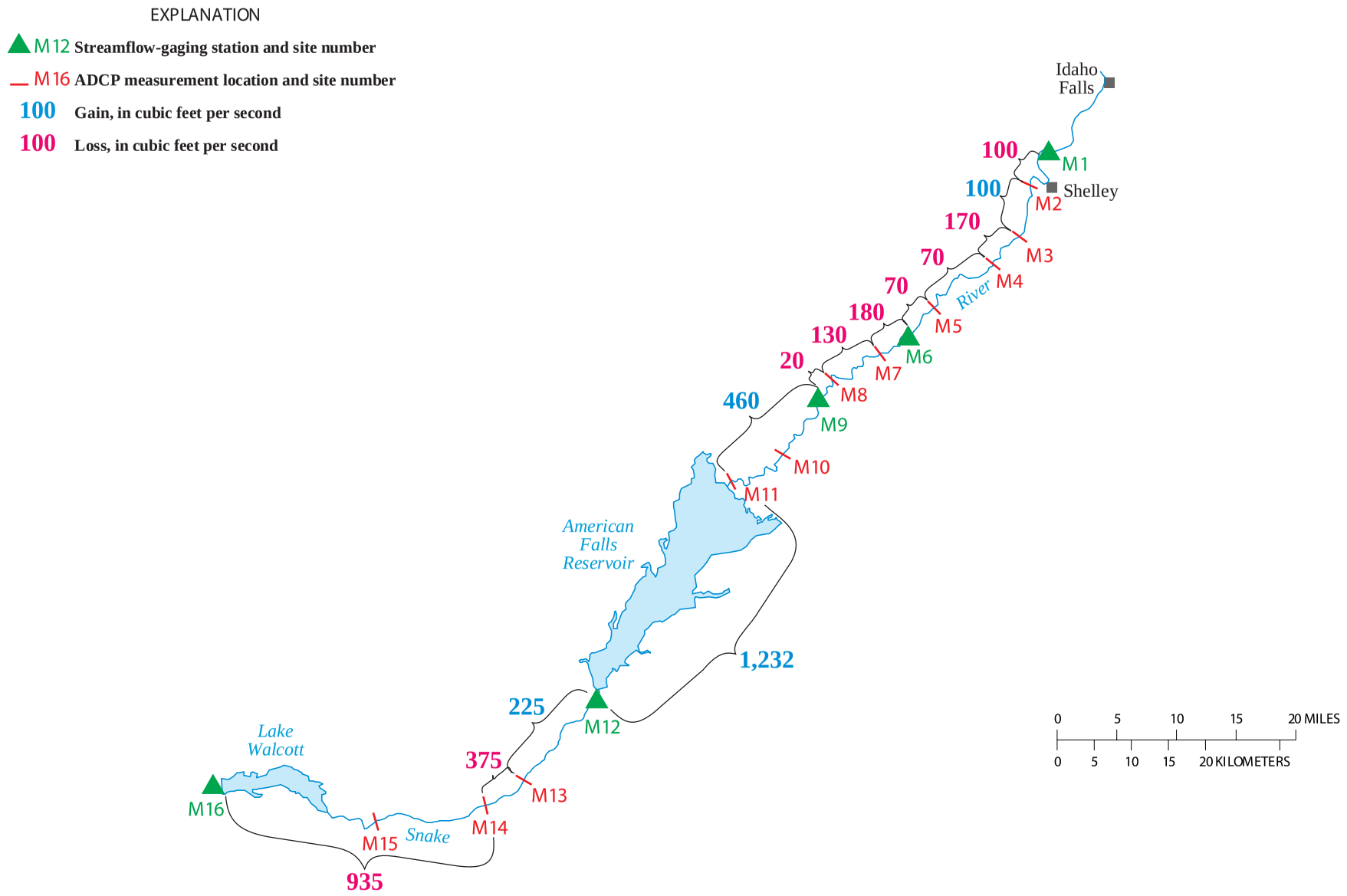


Figure B4. Streamflow gains and losses along the middle reach of the Snake River, Idaho, estimated during the April 9-10 and May 7, 2002, seepage study.

Table B13. Calculations of gains and losses in specified subreaches of the Snake River during July 23-24, 2002, between Shelley and Minidoka Dam, Idaho

[ADCP, Acoustic Doppler Current Profiler; ADP, Acoustic Doppler Profiler; ft^3/s, cubic feet per second; mi, mile; ---, no data]

Map number (fig. #)	Gaging station name (number)[1]/ ADCP/ADP measurement location	River mile		Discharge (ft^3/s)	Date	Time	Total gains/ (losses) (ft^3/s)	Gains/ (losses) per mile ($ft^3/s/mi$)
M1	**Snake River near Shelley (13060000)**	787.8		7330	7/23/2002	1215		
			total estimated inflow	8				
			total estimated outflow	360				
M2	Snake River at Shelley Bridge near Shelley	782.3		6730	7/23/2002	1407	(248)	(45)
			total estimated inflow	2				
			total estimated outflow	348				
M3	Snake River at Firth	777.3		6640	7/23/2002	1527	257	51
			total estimated inflow	0				
			total estimated outflow	1337				
M4	Snake River at Kennedy Road near Firth	773.1		4690	7/23/2002	1030	(613)	(146)
			total estimated inflow	92				
			total estimated outflow	249				
M5	Snake River at Porterville Bridge near Blackfoot	767.5		4660	7/23/2002	1145	127	23
			total estimated inflow	62				
			total estimated outflow	185				
M6	**Snake River at Blackfoot (13062500)**	764.3		4460	7/23/2002	1245	(77)	(24)
				4480	7/23/2002	1230		
			total estimated inflow	0				
			total estimated outflow	189				
M7	Snake River near Riverside	760.2		4460	7/23/2002	1400	169	41
			total estimated inflow	46				
			total estimated outflow	0				
M8	Snake River near Thomas	753.5		4060	7/23/2002	1515	(446)	(67)
			total estimated inflow	41				
			total estimated outflow	0				
M9	**Snake River near Blackfoot (13069500)**	750.1		3980	7/23/2002	1630	(121)	(36)
				3960	7/23/2002	0400		
			total estimated inflow	0				
			total estimated outflow	0				

Table B13. Calculations of gains and losses in specified subreaches of the Snake River during July 23-24, 2002, between Shelley and Minidoka Dam, Idaho--Continued

Map number (fig. #)	Gaging station name (number)[1]/ ADCP/ADP measurement location	River mile		Discharge (ft^3/s)	Date	Time	Total gains/ (losses) (ft^3/s)	Gains/ (losses) per mile ($ft^3/s/mi$)
M10	Snake River near Pingree	743.3		[2]---	---	---	---	---
			total estimated inflow	0				
			total estimated outflow	0				
M11	Snake River above McTucker Creek near Pingree	738		[3]---	---	---	---	---
			total estimated inflow	506				
			total estimated outflow	96				
			estimated outflow to storage above American Falls Dam[4]	(4900)				
M12	**Snake River at Neeley (13077000)**	714.1		10400	7/24/2002	0600	1,131	31
				10400	7/24/2002	0600		
			total estimated inflow	3				
			total estimated outflow	0				
M13	Snake River above Massacre Rocks near Neeley	707.7		10300	7/24/2002	0845	(103)	(16)
			total estimated inflow	20				
			total estimated outflow	0				
M14	Snake River at Register Rock near Cold Water	702.5		10300	7/24/2002	0745	(20)	(4)
			total estimated inflow	27				
			total estimated outflow	0				
M15	Snake River above Raft River near Yale	694		10400	7/24/2002	1030	74	9
			total estimated inflow	0				
			total estimated outflow	1811				
			estimated outflow to storage above Minidoka Dam[4]	165				
M16	**Snake River near Minidoka (13081500)**	673.5		8560	7/24/2002	2030	136	7

[1] Long-term United States Geological Survey gaging stations are in bold.

[2] Unable to access measurement location.

[3] Unable to find a measurement location because of sediment build-up and braided channels.

[4] Estimated based on reservoir stage data (US Bureau of Reclamation).

Table B14. Gaging station discharge data during July 23-24, 2002, for the Snake River between Shelley and Minidoka Dam, Idaho

[Discharge given in cubic feet per second]

Map number (fig. #)	Gaging station name (number)	Date	Time	Discharge
M1	Snake River near Shelley (13060000)	7/23/2002	1215	7330
M6	Snake River at Blackfoot (13062500)	7/23/2002	1245	4460
		7/23/2002	1230	4480
M9	Snake River near Blackfoot (13069500)	7/23/2002	1630	3980
		7/23/2002	0400	3960
M12	Snake River at Neeley (13077000)	7/24/2002	0600	10400
		7/24/2002	0600	10400
M16	Snake River near Minidoka (13081500)	7/24/2002	2030	8560

Table B15. Acoustic Doppler discharge measurement data during July 23-24, 2002, for the Snake River between Shelley and Minidoka Dam, Idaho

[ADCP, Acoustic Doppler Current Profiler; ADP, Acoustic Doppler Profiler; discharge given in cubic feet per second; COV, coefficient of variation; σ, standard deviation; μ, mean; ---, no data]

Map number (fig. #)	ADCP/ADP measurement location	Date	Time	Discharge	COV (σ/μ)
M2	Snake River at Shelley Bridge near Shelley	7/23/2002	1407	6730	0.08
M3	Snake River at Firth	7/23/2002	1527	6640	0.01
M4	Snake River at Kennedy Road near Firth	7/23/2002	1030	4690	0.05
M5	Snake River at Porterville Bridge near Blackfoot	7/23/2002	1145	4660	0.05
M7	Snake River near Riverside	7/23/2002	1400	4460	0.04
M8	Snake River near Thomas	7/23/2002	1515	4060	0.03
M10	Snake River near Pingree	---	---	[1]---	---
M11	Snake River above McTucker Creek near Pingree	---	---	[2]---	---
M13	Snake River above Massacre Rocks near Neeley	7/24/2002	845	10300	0.01
M14	Snake River at Register Rock near Cold Water	7/24/2002	745	10300	0.01
M15	Snake River above Raft River near Yale	7/24/2002	1030	10400	0.03

[1] Unable to access measurement location.

[2] Unable to find a measurement location because of sediment build-up and braided channels.

Table B16. Discharge data for all inspected inflow and outflow sites during July 23-24, 2002, for the Snake River between Shelley and Minidoka Dam, Idaho

[Latitude and longitude in degrees, minutes, seconds in North American Datum of 1983 (NAD83); DM, daily mean discharge; discharge given in cubic feet per second; map numbers shown in figure X; ---, no data]

Inspection site[1]	Station number[1]	Location		Date	Time	Discharge[2]
		Latitude	Longitude			
Subreach between map numbers M1 and M2						
Miscellaneous agriculture return near Woodville	---	43 24 38	112 09 19	7/24/2002	1645	3
Miscellaneous agriculture return near Woodville	---	43 24 57	112 08 48	7/24/2002	1655	1
Shull Lateral near Shelley	---	43 24 26	112 08 00	7/24/2002	1620	1
Reservation Canal near Shelley	13060500	43 22 24	112 09 13	7/23/2002	DM	360
Miscellaneous agriculture return near Shelley	---	43 22 42	112 10 11	7/24/2002	1630	3
Subreach between map numbers M2 and M3						
Miscellaneous agriculture return near Shelley	---	43 22 26	112 10 11	7/24/2002	1630	1.5
Blackfoot Canal near Shelley	13061430	43 21 18	112 09 53	7/23/2002	DM	348
Subreach between map numbers M3 and M4						
New Lavaside Canal near Firth	13061520	43 18 30	112 12 09	7/23/2002	DM	94
Peoples Canal near Firth	13061525	44 18 31	113 12 10	7/23/2002	DM	261
Aberdeen Springfield Canal near Firth	13061610	43 17 37	112 13 13	7/23/2002	DM	982
Subreach between map numbers M4 and M5						
Aberdeen Springfield Waste near Kimball	---	43 16 49	112 15 16	7/23/2002	---	90
Corbett Slough Canal near Kimball	13061650	43 15 40	112 15 30	7/23/2002	DM	130
Neilson-Hanson Canal near Kimball	13061670	43 15 29	112 17 07	7/23/2002	---	17
Miscellaneous agriculture return near Wapello	---	43 14 47	112 17 58	7/23/2002	---	2.4
Riverside Canal near Rose	13061705	43 15 47	112 18 07	7/23/2002	DM	102
Lavaside and Riverside return near Rose	---	43 14 05	112 19 31	7/23/2002	---	0
Subreach between map numbers M5 and M6						
Miscellaneous agriculture return near Blackfoot	---	43 13 36	112 19 50	7/23/2002	---	3.3
Danskin Canal near Blackfoot	13061995	43 13 28	112 20 12	7/23/2002	DM	185
Miscellaneous agriculture return near Blackfoot	---	43 13 12	112 20 31	7/23/2002	---	1
Miscellaneous agriculture return at Blackfoot	---	43 12 12	112 22 12	7/23/2002	---	58
Subreach between map numbers M6 and M7						
Trego Canal near Blackfoot	13062050	43 12 05	112 22 00	7/23/2002	DM	61
Wearyrick Canal near Blackfoot	13062503	43 11 51	112 22 36	7/23/2002	DM	37
Watson Slough near Blackfoot	13062506	43 11 46	112 23 44	7/23/2002	DM	60
Parsons Ditch near Blackfoot	13062507	43 11 36	112 23 45	7/23/2002	DM	31
Subreach between map numbers M7 and M8						
Riverton Ditch near Thomas	---	43 09 00	112 27 04	7/24/2002	---	2.4
Crawford Ditch near Thomas	---	43 10 04	112 27 44	7/23/2002	---	21
Watson Slough return near Thomas	---	43 09 39	112 29 13	7/24/2002	---	23
Subreach between map numbers M8 and M9						
Blackfoot River near Blackfoot	**13068500**	43 07 50	112 28 35	7/23/2002	DM	40
Miscellaneous agriculture return near Thomas	---	43 08 04	112 30 54	7/24/2002	---	1
Subreach between map numbers M9 and M10						
Mud Slough near Fort Hall	---	43 05 40	112 31 04	7/25/2002	---	[3]75
Diggie Creek near Fort Hall	---	43 05 43	112 31 07	7/25/2002	---	[3]500
Jeff Cabin Creek near Fort Hall	---	43 04 05	112 33 00	7/25/2002	---	[3]13
Subreach between map numbers M10 and M11						
---	---	---	---	---	---	---
Subreach between map numbers M11 and M12						
Ross Fork near Fort Hall	---	42 00 21	111 29 47	7/25/2002	---	[3]20
Clear Creek near Fort Hall	---	43 02 23	112 32 33	7/25/2002	---	[3]28
Spring Creek near Fort Hall	**13075983**	43 02 36	112 33 15	7/24/2002	DM	[3]272
McTucker Creek Springfield	---	43 02 05	112 38 36	7/24/2002	---	250
Portneuf River near Tyhee	**13075910**	42 56 42	112 32 38	7/24/2002	DM	166

Table B16. Discharge data for all inspected inflow and outflow sites during July 23-24, 2002, for the Snake River between Shelley and Minidoka Dam, Idaho--Continued

Inspection site[1]	Station number[1]	Location		Date	Time	Discharge[2]
		Latitude	Longitude			
Danielson Creek near Springfield	---	43 03 32	112 41 27	7/24/2002	---	10
Sterling Waste near Sterling	13069548	43 01 49	112 43 40	7/24/2002	---	[3]1
Unnamed Spring near Sterling	---	43 03 37	112 43 19	7/24/2002	---	[3]2
Crystal Springs near Sterling	---	43 02 52	112 40 53	7/24/2002	---	[3]37
Unnamed Spring near Sterling	---	42 59 39	112 45 37	7/24/2002	---	[3]1
Unnamed Spring near Sterling	---	43 02 39	112 39 09	7/24/2002	---	[3]12
Bannock Creek near Michaud	---	42 53 12	112 38 35	7/25/2002	---	30
Aberdeen Waste Drain near Aberdeen	13069565	42 55 27	112 43 39	7/24/2002	---	41
Tarter Waster near American Falls	13076210	42 52 40	112 51 23	7/24/2002	---	3
Seagull Bay near American Falls	---	42 49 24	112 47 45	7/25/2002	---	3
Sunbeam near American Falls	---	42 47 55	112 50 53	7/25/2002	---	3
Spring Hallow near American Falls	---	42 48 39	112 53 30	7/25/2002	---	[3]1
Falls Irrigation Pump near American Falls	13076400	42 46 46	112 52 22	7/24/2002	DM	96
Subreach between map numbers M12 and M13						
Ferry Hallow near Neeley	---	42 45 43	112 52 57	7/24/2002	---	0
Warm Creek near Neeley	---	42 44 01	112 54 25	7/24/2002	---	1.5
Little Creek near Neeley	---	42 42 47	112 55 53	7/24/2002	---	1.0
Subreach between map numbers M13 and M14						
Rock Creek near Rockland	13077650	42 39 10	113 01 00	7/24/2002	---	20
Dry Hallow Creek near Rockland	---	42 38 40	113 01 57	7/24/2002	---	0
Subreach between map numbers M14 and M15						
Little Warm Creek near Cold Water	---	43 38 07	113 03 43	7/24/2002	---	2.5
Fall Creek near Cold Water	---	43 37 36	113 05 05	7/24/2002	---	24
Lanes Gulch near Cold Water	---	42 37 10	113 07 11	7/24/2002	---	0
Subreach between map numbers M15 and M16						
Raft River near Yale	---	42 35 50	113 14 19	7/24/2002	---	0
Minidoka Northside Canal near Minidoka	13080000	42 40 15	113 29 00	7/24/2002	DM	942
Minidoka Southside Canal near Minidoka	13080500	42 39 45	113 29 20	7/24/2002	DM	869

[1] Long-term United States Geological Survey gaging stations are in bold.

[2] Values in shaded areas indicate canal withdrawals.

[3] Surface flows resulting from spring discharge; not used in gain/loss calculations.

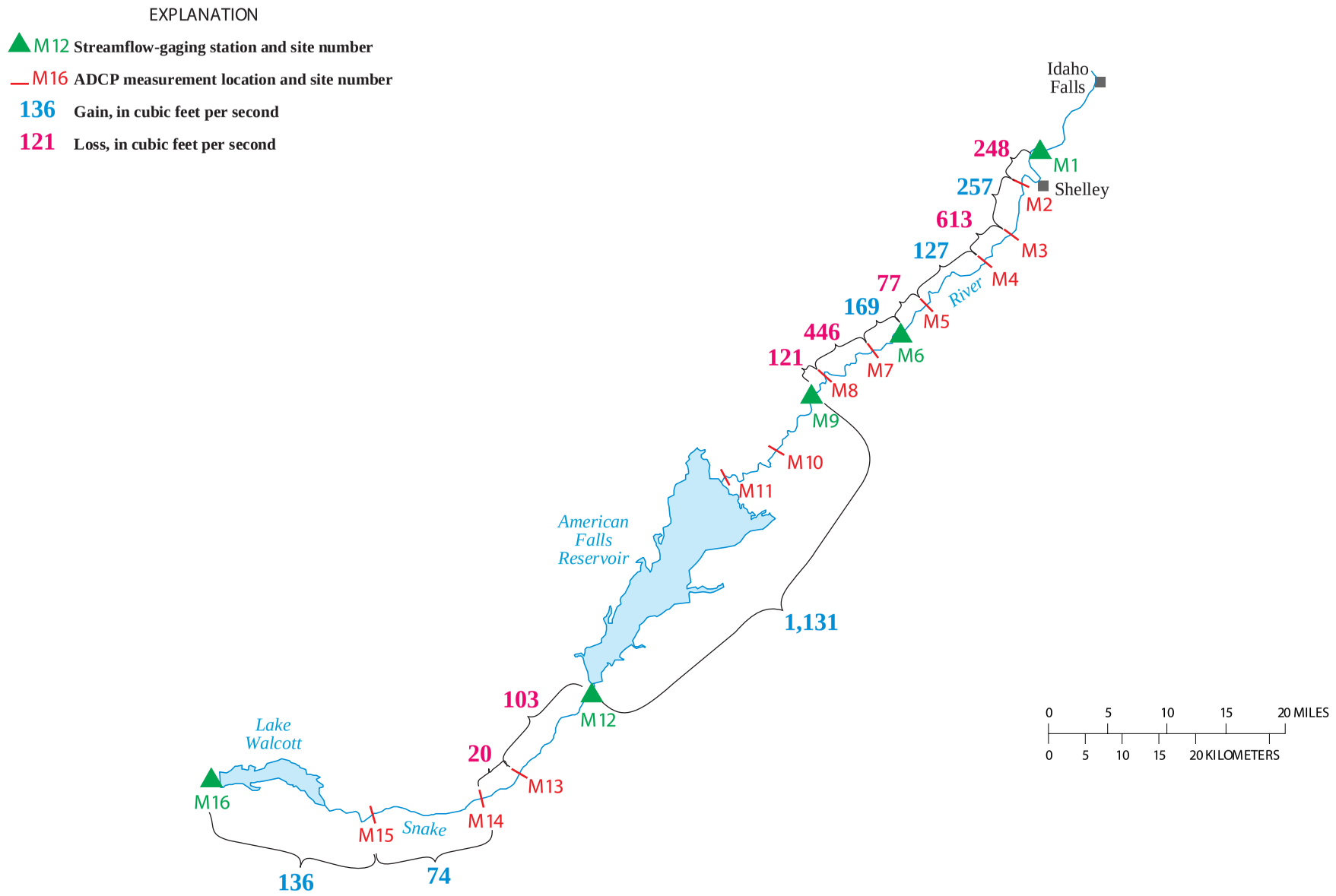


Figure B5. Streamflow gains and losses along the middle reach of the Snake River, Idaho, estimated during the July 23-24, 2002, seepage study.

Table B17. Calculations of gains and losses in specified subreaches of the Snake River during November 5-6, 2002, between Shelley and Minidoka Dam, Idaho

[ADCP, Acoustic Doppler Current Profiler; ADP, Acoustic Doppler Profiler; ft^3/s, cubic feet per second; mi, mile; ---, no data]

Map number (fig. #)	Gaging station name (number)[1]/ ADCP/ADP measurement location	River mile		Discharge (ft^3/s)	Date	Time	Total gains/ (losses) (ft^3/s)	Gains/ (losses) per mile ($ft^3/s/mi$)
M1	**Snake River near Shelley (13060000)**	787.8		2630	11/5/2002	0815		
			total estimated inflow	0				
			total estimated outflow	6				
M2	Snake River at Shelley Bridge near Shelley	782.3		2200	11/5/2002	1001	(424)	(77)
			total estimated inflow	0				
			total estimated outflow	16				
M3	Snake River at Firth	777.3		2440	11/5/2002	1258	256	51
			total estimated inflow	0				
			total estimated outflow	8				
M4	Snake River at Kennedy Road near Firth	773.1		2310	11/5/2002	1130	(122)	(29)
			total estimated inflow	38				
			total estimated outflow	18				
M5	Snake River at Porterville Bridge near Blackfoot	767.5		2280	11/5/2002	1219	(50)	(9)
			total estimated inflow	0				
			total estimated outflow	0				
M6	**Snake River at Blackfoot (13062500)**	764.3		2140	11/5/2002	1330	(140)	(44)
				2100	11/5/2002	1230		
			total estimated inflow	0				
			total estimated outflow	5				
M7	Snake River near Riverside	760.2		2060	11/5/2002	1406	(35)	(9)
			total estimated inflow	1				
			total estimated outflow	0				
M8	Snake River near Thomas	753.5		2060	11/5/2002	1456	(1)	(0)
			total estimated inflow	73				
			total estimated outflow	0				
M9	**Snake River near Blackfoot (13069500)**	750.1		1900	11/5/2002	1615	(233)	(69)
				2060	11/6/2002	0630		
			total estimated inflow	0				
			total estimated outflow	0				

Table B17. Calculations of gains and losses in specified subreaches of the Snake River during November 5-6, 2002, between Shelley and Minidoka Dam, Idaho--Continued

Map number (fig. #)	Gaging station name (number)[1]/ ADCP/ADP measurement location	River mile		Discharge (ft^3/s)	Date	Time	Total gains/ (losses) (ft^3/s)	Gains/ (losses) per mile ($ft^3/s/mi$)
M10	Snake River near Pingree	743.3		2430	11/6/2002	1355	370	54
			total estimated inflow	0				
			total estimated outflow	0				
M11	Snake River above McTucker Creek near Pingree	738		2550	11/6/2002	1224	120	23
			total estimated inflow	421				
			total estimated outflow	0				
			estimated outflow to storage above American Falls Dam[2]	4300				
M12	**Snake River at Neeley (13077000)**	714.1		367	11/7/2002	0830	2186	61
				415	11/6/2002	0545		
			total estimated inflow	1				
			total estimated outflow	0				
M13	Snake River above Massacre Rocks near Neeley	707.7		538	11/6/2002	0855	122	19
			total estimated inflow	20				
			total estimated outflow	0				
M14	Snake River at Register Rock near Cold Water	702.5		509	11/6/2002	0720	(49)	(9)
			total estimated inflow	24				
			total estimated outflow	0				
M15	Snake River above Raft River near Yale	694		1110	11/6/2002	1046	577	68
			total estimated inflow	0				
			total estimated outflow	0				
			estimated outflow to storage above Minidoka Dam[2]	0				
M16	**Snake River near Minidoka (13081500)**	673.5		585	11/6/2002	2045	(525)	(26)

[1] Long-term United States Geological Survey gaging stations are in bold.

[2] Estimated based on reservoir stage data (US Bureau of Reclamation).

Table B18. Gaging station discharge data during November 5-6, 2002, for the Snake River between Shelley and Minidoka Dam, Idaho

[Discharge given in cubic feet per second]

Map number (fig. #)	Gaging station name (number)	Date	Time	Discharge
M1	Snake River near Shelley (13060000)	11/5/2002	0815	2630
M6	Snake River at Blackfoot (13062500)	11/5/2002	1330	2140
		11/5/2002	1230	2100
M9	Snake River near Blackfoot (13069500)	11/5/2002	1615	1900
		11/6/2002	0630	2060
M12	Snake River at Neeley (13077000)	11/7/2002	0830	367
		11/6/2002	0545	415
M16	Snake River near Minidoka (13081500)	11/6/2002	2045	585

Table B19. Acoustic Doppler discharge measurement data during November 5-6, 2002, for the Snake River between Shelley and Minidoka Dam, Idaho

[ADCP, Acoustic Doppler Current Profiler; ADP, Acoustic Doppler Profiler; discharge given in cubic feet per second; COV, coefficient of variation; σ, standard deviation; μ, mean; ---, no data]

Map number (fig. #)	ADCP/ADP measurement location	Date	Time	Discharge	COV (σ/μ)
M2	Snake River at Shelley Bridge near Shelley	11/5/2002	1001	2200	0.09
M3	Snake River at Firth	11/5/2002	1258	2440	0.10
M4	Snake River at Kennedy Road near Firth	11/5/2002	1130	2310	0.03
M5	Snake River at Porterville Bridge near Blackfoot	11/5/2002	1219	2280	0.01
M7	Snake River near Riverside	11/5/2002	1406	2060	0.02
M8	Snake River near Thomas	11/5/2002	1456	2060	0.03
M10	Snake River near Pingree	11/6/2002	1355	2430	0.01
M11	Snake River above McTucker Creek near Pingree	11/6/2002	1224	2550	0.03
M13	Snake River above Massacre Rocks near Neeley	11/6/2002	855	538	0.08
M14	Snake River at Register Rock near Cold Water	11/6/2002	720	509	0.12
M15	Snake River above Raft River near Yale	11/6/2002	1046	1110	0.18

Table B20. Discharge data for all inspected inflow and outflow sites during November 4-7, 2002, for the Snake River between Shelley and Minidoka Dam, Idaho

[Latitude and longitude in degrees, minutes, seconds in North American Datum of 1983 (NAD83); DM, daily mean discharge; discharge given in cubic feet per second; map numbers shown in figure X; ---, no data]

Inspection site[1]	Station number[1]	Location		Date	Time	Discharge[2]
		Latitude	Longitude			
Subreach between map numbers M1 and M2						
Miscellaneous agriculture return near Woodville	---	43 24 38	112 09 19	11/6/2002	1240	0
Miscellaneous agriculture return near Woodville	---	43 24 57	112 08 48	11/6/2002	1245	0
Shull Lateral near Shelley	---	43 24 26	112 08 00	11/6/2002	1205	0
Reservation Canal near Shelley	13060500	43 22 24	112 09 13	11/6/2002	1225	6
Miscellaneous agriculture return near Shelley	---	43 22 42	112 10 11	11/6/2002	1235	0
Subreach between map numbers M2 and M3						
Miscellaneous agriculture return near Shelley	---	43 22 26	112 10 11	11/6/2002	1230	0
Blackfoot Canal near Shelley	13061430	43 21 18	112 09 53	11/5/2002	DM	16
Subreach between map numbers M3 and M4						
New Lavaside Canal near Firth	13061520	43 18 30	112 12 09	11/5/2002	DM	8
Peoples Canal near Firth	13061525	44 18 31	113 12 10	11/5/2002	DM	0
Aberdeen Springfield Canal near Firth	13061610	43 17 37	112 13 13	11/6/2002	DM	0
Subreach between map numbers M4 and M5						
Aberdeen Springfield Waste near Kimball	---	43 16 49	112 15 16	11/5/2002	---	33
Corbett Slough Canal near Kimball	13061650	43 15 40	112 15 30	11/6/2002	DM	0
Neilson-Hanson Canal near Kimball	13061670	43 15 29	112 17 07	11/5/2002	---	17
Miscellaneous agriculture return near Wapello	---	43 14 47	112 17 58	11/6/2002	---	5
Riverside Canal near Rose	13061705	43 15 47	112 18 07	11/5/2002	DM	1
Lavaside and Riverside return near Rose	---	43 14 05	112 19 31	11/5/2002	---	0
Subreach between map numbers M5 and M6						
Miscellaneous agriculture return near Blackfoot	---	43 13 36	112 19 50	11/6/2002	---	0
Danskin Canal near Blackfoot	13061995	43 13 28	112 20 12	11/6/2002	DM	0
Miscellaneous agriculture return near Blackfoot	---	43 13 12	112 20 31	11/6/2002	---	0
Miscellaneous agriculture return at Blackfoot	---	43 12 12	112 22 12	11/5/2002	---	0
Subreach between map numbers M6 and M7						
Trego Canal near Blackfoot	13062050	43 12 05	112 22 00	11/6/2002	DM	0
Wearyrick Canal near Blackfoot	13062503	43 11 51	112 22 36	11/6/2002	DM	1
Watson Slough near Blackfoot	13062506	43 11 46	112 23 44	11/6/2002	DM	3
Parsons Ditch near Blackfoot	13062507	43 11 36	112 23 45	11/6/2002	DM	1
Subreach between map numbers M7 and M8						
Riverton Ditch near Thomas	---	43 09 00	112 27 04	11/6/2002	---	0
Crawford Ditch near Thomas	---	43 10 04	112 27 44	11/6/2002	---	0
Watson Slough return near Thomas	---	43 09 39	112 29 13	11/6/2002	---	1
Subreach between map numbers M8 and M9						
Blackfoot River near Blackfoot	**13068500**	43 07 50	112 28 35	11/5/2002	DM	73
Miscellaneous agriculture return near Thomas	---	43 08 04	112 30 54	11/6/2002	---	0
Subreach between map numbers M9 and M10						
Mud Slough near Fort Hall	---	43 05 40	112 31 04	11/5/2002	---	[3]50
Diggie Creek near Fort Hall	---	43 05 43	112 31 07	11/5/2002	1605	[3]175
Jeff Cabin Creek near Fort Hall	---	43 04 05	112 33 00	11/7/2002	---	[3]18
Subreach between map numbers M10 and M11						
---	---	---	---	---	---	---
Subreach between map numbers M11 and M12						
Ross Fork near Fort Hall	---	42 00 21	111 29 47	11/7/2002	---	[3]9
Clear Creek near Fort Hall	---	43 02 23	112 32 33	11/7/2002	---	[3]24
Spring Creek near Fort Hall	**13075983**	43 02 36	112 33 15	11/6/2002	DM	[3]308
McTucker Creek Springfield	---	43 02 05	112 38 36	11/6/2002	---	[3]134
Portneuf River near Tyhee	**13075910**	42 56 42	112 32 38	11/6/2002	DM	397

Table B20. Discharge data for all inspected inflow and outflow sites during November 4-7, 2002, for the Snake River between Shelley and Minidoka Dam, Idaho--Continued

Inspection site[1]	Station number[1]	Location		Date	Time	Discharge[2]
		Latitude	Longitude			
Danielson Creek near Springfield	---	43 03 32	112 41 27	11/6/2002	---	[3]48
Sterling Waste near Sterling	13069548	43 01 49	112 43 40	11/6/2002	---	[3]5
Unnamed Spring near Sterling	---	43 03 37	112 43 19	11/6/2002	---	[3]1
Crystal Springs near Sterling	---	43 02 52	112 40 53	11/6/2002	---	[3]62
Unnamed Spring near Sterling	---	42 59 39	112 45 37	11/6/2002	---	[3]0
Unnamed Spring near Sterling	---	43 02 39	112 39 09	11/6/2002	---	[3]12
Bannock Creek near Michaud	---	42 53 12	112 38 35	11/7/2002	---	21
Aberdeen Waste Drain near Aberdeen	13069565	42 55 27	112 43 39	11/6/2002	---	2
Tarter Waster near American Falls	13076210	42 52 40	112 51 23	11/6/2002	---	0
Seagull Bay near American Falls	---	42 49 24	112 47 45	11/7/2002	---	1
Sunbeam near American Falls	---	42 47 55	112 50 53	11/7/2002	---	0
Spring Hallow near American Falls	---	42 48 39	112 53 30	11/7/2002	---	[3]1
Falls Irrigation Pump near American Falls	13076400	42 46 46	112 52 22	11/7/2002	DM	0
Subreach between map numbers M12 and M13						
Ferry Hallow near Neeley	---	42 45 43	112 52 57	11/4/2002	---	0
Warm Creek near Neeley	---	42 44 01	112 54 25	11/4/2002	---	1.0
Little Creek near Neeley	---	42 42 47	112 55 53	11/4/2002	---	.5
Subreach between map numbers M13 and M14						
Rock Creek near Rockland	13077650	42 39 10	113 01 00	11/4/2002	---	20
Dry Hallow Creek near Rockland	---	42 38 40	113 01 57	11/4/2002	---	0
Subreach between map numbers M14 and M15						
Little Warm Creek near Cold Water	---	43 38 07	113 03 43	11/4/2002	---	.8
Fall Creek near Cold Water	---	43 37 36	113 05 05	11/4/2002	---	24
Lanes Gulch near Cold Water	---	42 37 10	113 07 11	11/4/2002	---	0
Subreach between map numbers M15 and M16						
Raft River near Yale	---	42 35 50	113 14 19	11/4/2002	---	0
Minidoka Northside Canal near Minidoka	13080000	42 40 15	113 29 00	11/6/2002	DM	0
Minidoka Southside Canal near Minidoka	13080500	42 39 45	113 29 20	11/6/2002	DM	0

[1] Long-term United States Geological Survey gaging stations are in bold.

[2] Values in shaded areas indicate canal withdrawals.

[3] Surface flows resulting from spring discharge; not used in gain/loss calculations.

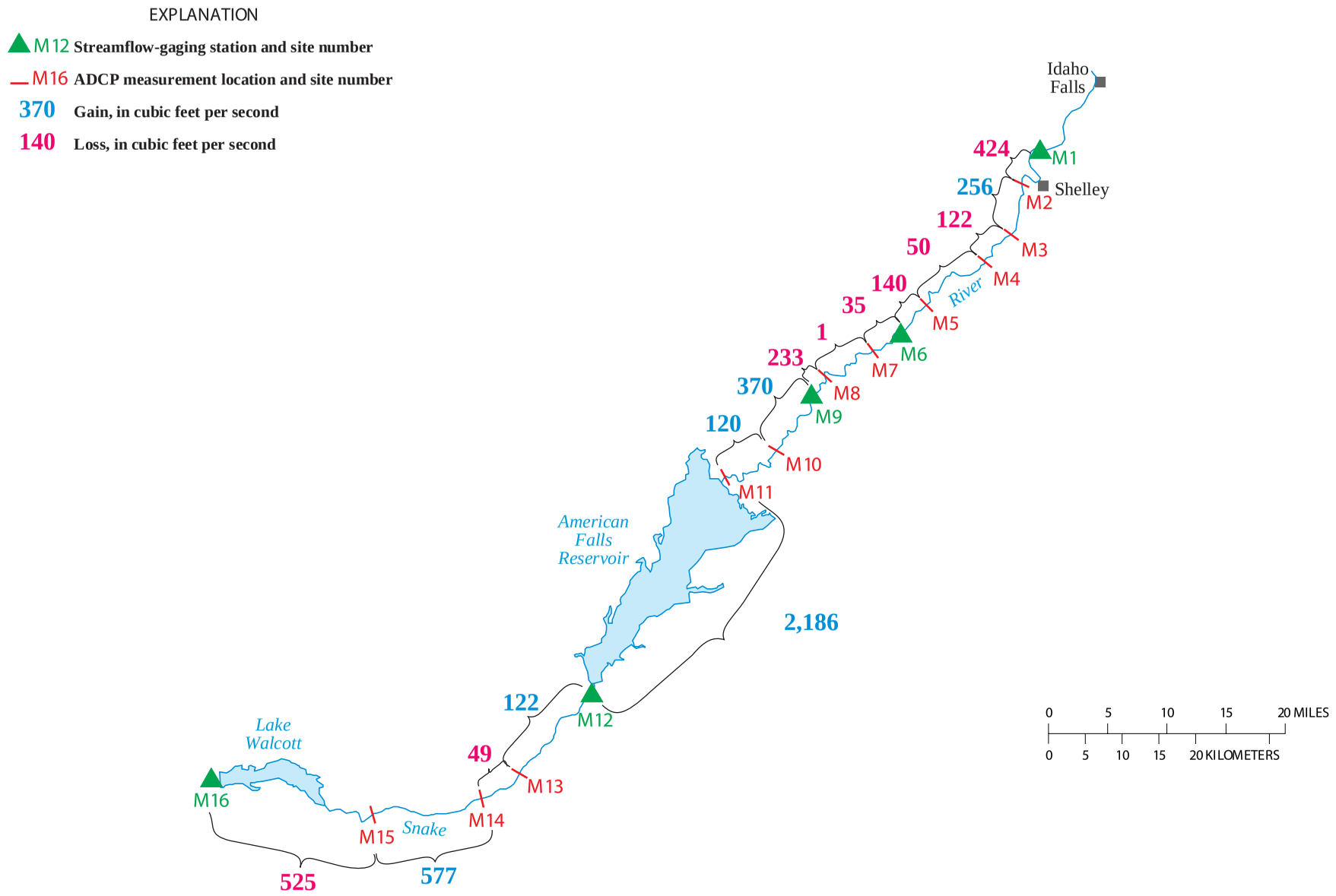
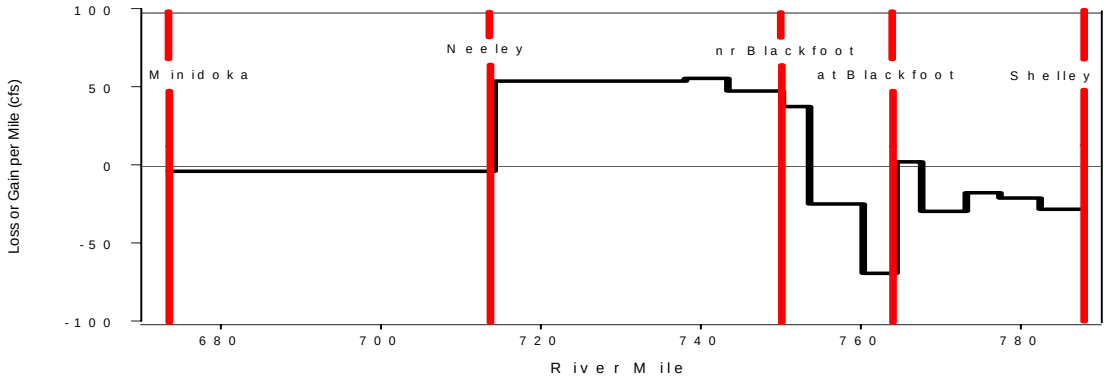
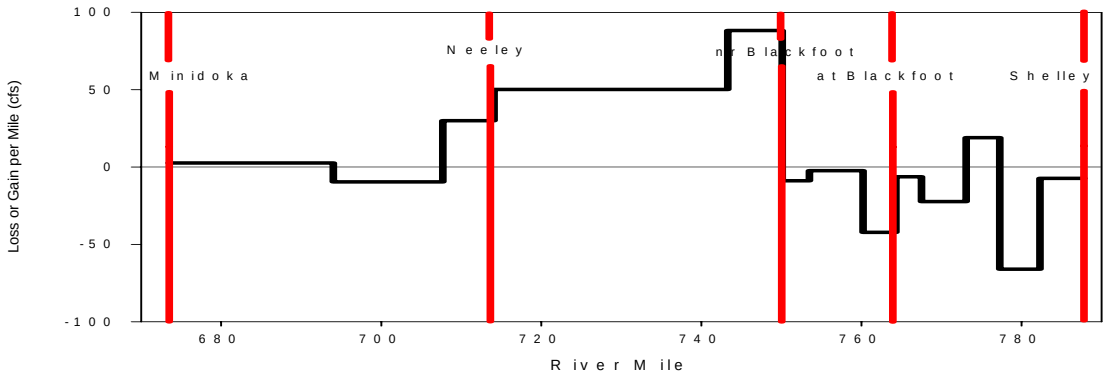


Figure B6. Streamflow gains and losses along the middle reach of the Snake River, Idaho, estimated during the November 5-6, 2002, seepage study.

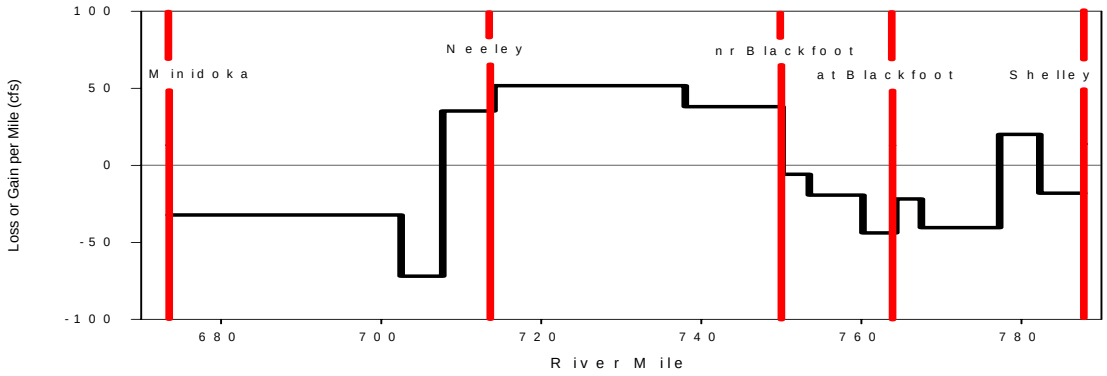
Spring 2001



Fall 2001



Spring 2002



Fall 2002

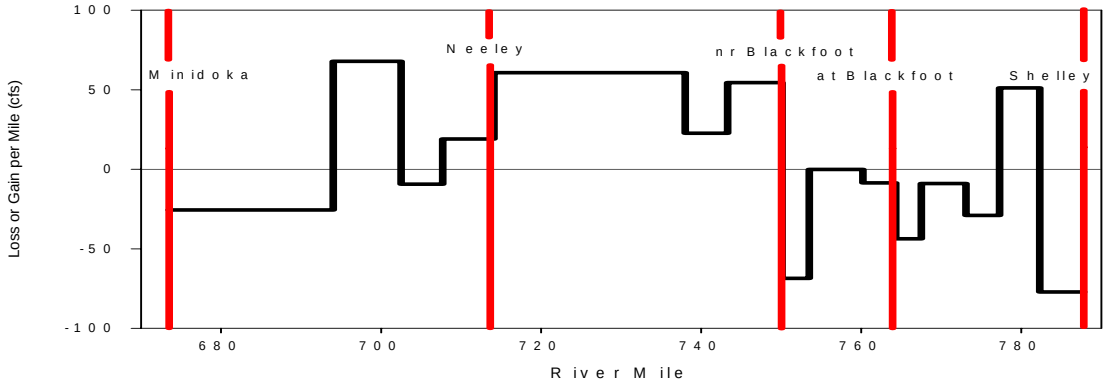


Figure B7. Summary plots of estimated gains and losses in specified subreaches of the Snake River between Shelley and Minidoka Dam, Idaho

APPENDIX C

Gain and loss calculations and relevant data for the Henrys Fork and Snake River between Ashton and the mouth and Heise and Shelley, Idaho

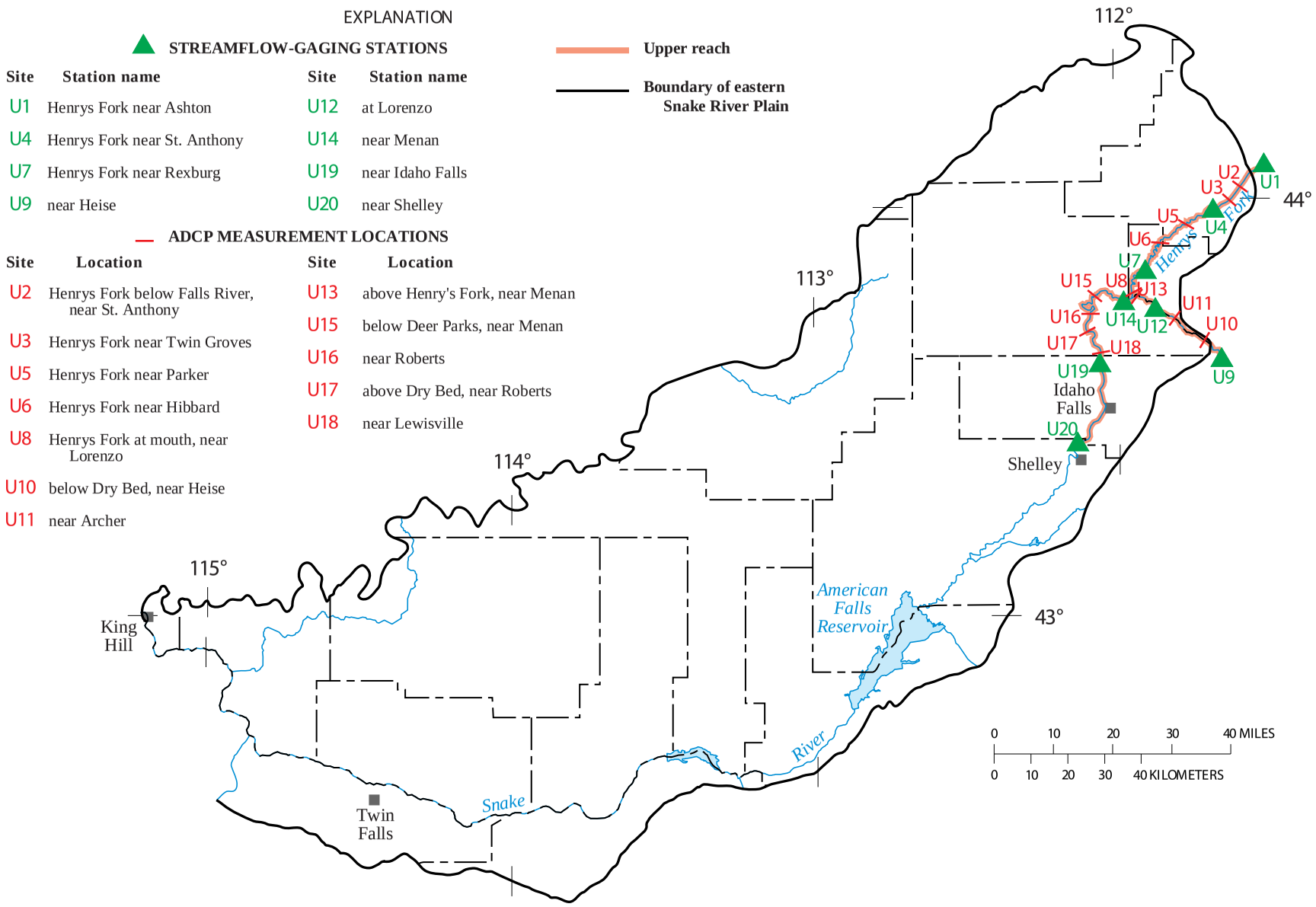


Figure C1. Locations of sites along the upper reach of the Snake River and Henrys Fork, Idaho, where streamflow gains and losses were measured.

Table C1. Calculations of gains and losses in specified subreaches of the Snake River and Henrys Fork during October 29-31, 2001, between Heise and Shelley and Ashton and the mouth, Idaho

[ADCP, Acoustic Doppler Current Profiler; ADP, Acoustic Doppler Profiler; ft^3/s, cubic feet per second; mi, mile; ---, no data]

Map number (fig. #)	Gaging station name (number)[1]/ ADCP/ADP measurement location	River mile		Discharge (ft^3/s)	Date	Time	Total gains/ (losses) (ft^3/s)	Gains/ (losses) per mile ($ft^3/s/mi$)
U1	**Henrys Fork near Ashton (13046000)**	44.2		787	10/29/2001	0645		
			total estimated inflow	391				
			total estimated outflow	6				
U2	Henrys Fork below Falls River, near Ashton	38.5		1240	10/29/2001	0930	68	12
			total estimated inflow	0				
			total estimated outflow	44				
U3	Henrys Fork near Twin Groves	35.6		1190	10/29/2001	1200	(6)	(2)
			total estimated inflow	0				
			total estimated outflow	84				
U4	**Henrys Fork near St Anthony (13050500)**	32.4		1120	10/29/2001	1330	14	4
				1120	10/29/2001	1045		
			total estimated inflow	0				
			total estimated outflow	80				
U5	Henrys Fork near Parker	25.6		1000	10/29/2001	1400	(40)	(6)
			total estimated inflow	113				
			total estimated outflow	0				
U6	Henrys Fork near Hibbard	19.0		1020	10/29/2001	1530	(93)	(14)
			total estimated inflow	35				
			total estimated outflow	0				
U7	**Henrys Fork near Rexburg (13056500)**	9.2		1000	10/29/2001	2015	(55)	(6)
				985	10/30/2001	0430		
			total estimated inflow	89				
			total estimated outflow	0				
U8	Henrys Fork at mouth, near Lorenzo	0.2		---[2]	---	---	---	---

Table C1. Calculations of gains and losses in specified subreaches of the Snake River and Henrys Fork during October 29-31, 2001, between Heise and Shelley and Ashton and the mouth, Idaho--Continued

Map number (fig. #)	Gaging station name (number)[1]/ ADCP/ADP measurement location	River mile		Discharge (ft^3/s)	Date	Time	Total gains/ (losses) (ft^3/s)	Gains/ (losses) per mile ($ft^3/s/mi$)
U9	**Snake near Heise (13037500)**	853.6		1400	10/30/2001	0630		
			total estimated inflow	2				
			total estimated outflow	363				
U10	Snake River below Dry Bed, near Heise	849.5		1050	10/30/2001	0830	11	3
			total estimated inflow	0				
			total estimated outflow	5				
U11	Snake River near Archer	842.8		787	10/30/2001	1015	(258)	(39)
			total estimated inflow	0				
			total estimated outflow	0				
U12	**Snake River at Lorenzo (13038500)**	837.9		641	10/30/2001	1245	(146)	(30)
				641	10/30/2001	0545		
			total estimated inflow	0				
			total estimated outflow	0				
U13	Snake River above Henrys Fork, near Menan	832.5		---[2]	---	---	---	---
			Henrys Fork estimated inflow	1074				
			total estimated inflow	17				
			total estimated outflow	0				
U14	**Snake River near Menan (13057000)**	830.0		2050	10/30/2001	0945	[3]319	19
				2050	10/30/2001	0945		
			total estimated inflow	0				
			total estimated outflow	0				
U15	Snake River below Deer Parks, near Menan	822.5		2000	10/30/2001	1330	(50)	(7)
			total estimated inflow	32				
			total estimated outflow	0				
U16	Snake River near Roberts	815.3		2020	10/30/2001	1145	(12)	(2)
			total estimated inflow	0				
			total estimated outflow	0				
U17	Snake River above Dry Bed, near Roberts	811.9		2050	10/30/2001	1515	30	9
			total estimated inflow	135				
			total estimated outflow	5				

Table C1. Calculations of gains and losses in specified subreaches of the Snake River and Henrys Fork during October 29-31, 2001, between Heise and Shelley and Ashton and the mouth, Idaho--Continued

Map number (fig. #)	Gaging station name (number)[1]/ ADCP/ADP measurement location	River mile		Discharge (ft^3/s)	Date	Time	Total gains/ (losses) (ft^3/s)	Gains/ (losses) per mile ($ft^3/s/mi$)
U18	Snake River near Lewisville	806.3		2210	10/30/2001	1615	30	5
			total estimated inflow	0				
			total estimated outflow	0				
U19	**Snake River near Idaho Falls (13057155)**	805.0		2070	10/30/2001	1645	(140)	(108)
				2380	10/16 - 11/14/2001	30-day average		
			total estimated inflow	0				
			total estimated outflow	0				
U20	**Snake River near Shelley (13060000)**	787.8		2410	10/16 - 11/14/2001	30-day average	30	2

[1] Long-term United States Geological Survey gaging stations are in bold.

[2] Did not measure; measured during subsequent seepage runs.

[3] Includes gain/loss between Henrys Fork near Rexburg and Henrys Fork at mouth.

Table C2. Gaging station discharge data during October 29-31, 2001, for the Snake River and Henrys Fork between Heise and Shelley and Ashton and the mouth, Idaho

[Discharge given in cubic feet per second]

Map number (fig. #)	Gaging station name (number)	Date	Time	Discharge
U1	Henrys Fork near Ashton (13046000)	10/29/2001	0645	787
U4	Henrys Fork near St Anthony (13050500)	10/29/2001	1330	1120
		10/29/2001	1045	1120
U7	Henrys Fork near Rexburg (13056500)	10/29/2001	2015	1000
		10/30/2001	0430	985
U9	Snake near Heise (13037500)	10/30/2001	0630	1400
U12	Snake River at Lorenzo (13038500)	10/30/2001	1245	641
		10/30/2001	0545	641
U14	Snake River near Menan (13057000)	10/30/2001	0945	2050
		10/30/2001	0945	2050
U19	Snake River near Idaho Falls (13057155)	10/30/2001	1645	2070
		10/16 - 11/14/2001	30-day average	2380
U20	Snake River near Shelley (13060000)	10/16 - 11/14/2001	30-day average	2410

Table C3. Acoustic Doppler discharge measurement data during October 29-31, 2001, for the Snake River and Henrys Fork between Heise and Shelley and Ashton and the mouth, Idaho

[ADCP, Acoustic Doppler Current Profiler; ADP, Acoustic Doppler Profiler; discharge given in cubic feet per second; COV, coefficient of variation; σ, standard deviation; μ, mean; ---, no data]

Map number (fig. #)	ADCP/ADP measurement location	Date	Time	Discharge	COV (σ/μ)
U2	Henrys Fork below Falls River, near Ashton	10/29/2001	0930	1240	0.10
U3	Henrys Fork near Twin Groves	10/29/2001	1200	1190	0.02
U5	Henrys Fork near Parker	10/29/2001	1400	1000	0.04
U6	Henrys Fork near Hibbard	10/29/2001	1530	1020	0.04
U8	Henrys Fork at mouth, near Lorenzo	---[1]	---	---	---
U10	Snake River below Dry Bed, near Heise	10/30/2001	0830	1050	0.07
U11	Snake River near Archer	10/30/2001	1015	787	0.04
U13	Snake River above Henrys Fork, near Menan	---[1]	---	---	---
U15	Snake River below Deer Parks, near Menan	10/30/2001	1330	2000	0.07
U16	Snake River near Roberts	10/30/2001	1145	2020	0.05
U17	Snake River above Dry Bed, near Roberts	10/30/2001	1515	2050	0.03
U18	Snake River near Lewisville	10/30/2001	1615	2210	0.05

[1] Did not measure, measured during subsequent seepage runs.

Table C4. Discharge data for all inspected inflow and outflow sites during October 29-31, 2001, for the Snake River and Henrys Fork between Heise and Shelley and Ashton and the mouth, Idaho

[Latitude and longitude in degrees, minutes, seconds in North American Datum of 1983 (NAD83); DM, daily mean discharge; discharge given in cubic feet per second; map numbers shown in figure X; ---, no data]

Inspection site[1]	Station number[1]	Location		Date	Time	Discharge[2]
		Latitude	Longitude			
Subreach between map numbers U1 and U2						
Arcadia Canal return near Ashton	---	---	---	10/29/2001	---	0
Snow Creek near Ashton	---	44 04 17	111 31 33	10/29/2001	---	4.5
Black Spring near Ashton	---	44 02 59	111 32 20	10/29/2001	---	[3]10.1
Sand Creek near Ashton	---	---	---	10/29/2001	---	0
Farmers Own return near Ashton	---	44 02 32	111 32 20	10/29/2001	---	0
Unnamed tributary near Ashton	---	44 01 40	111 32 57	10/29/2001	---	1.4
Falls River Diversion return near Ashton	---	44 01 40	111 33 20	10/29/2001	---	2.2
Falls River near Chester	**13049500**	44 01 06	111 33 57	10/29/2001	DM	383
Dewey Canal near Chester	13046310	44 01 12	111 34 56	10/29/2001	DM	6
Subreach between map numbers U2 and U3						
Last Chance Canal near Chester	13049550	44 01 01	111 35 10	10/29/2001	DM	0
Cross Cut Canal near Chester	13049560	44 00 58	111 34 57	10/29/2001	DM	44
Subreach between map numbers U3 and U4						
Farmers Friend Canal near Twin Groves	13049705	43 58 29	111 39 02	10/29/2001	DM	20
Twin Groves Canal near Twin Groves	13049710	43 57 21	111 40 05	10/29/2001	DM	0
St Anthony Union Canal near Twin Groves	13049725	43 58 19	111 38 27	10/29/2001	DM	0
Salem Union Canal near St. Anthony	13049805	43 58 20	111 39 01	10/29/2001	DM	64
Subreach between map numbers U4 and U5						
Egin Canal near St. Anthony	13050525	43 57 56	111 41 23	10/29/2001	DM	3
St Anthony Union Feeder near St. Anthony	13050530	43 57 38	111 41 59	10/29/2001	DM	0
Independent Canal near St. Anthony	13050535	43 57 29	111 42 21	10/29/2001	DM	4
Consolidated Farmers Canal near Parker	13050545	43 53 54	111 46 47	10/29/2001	---	73
Unnamed tributary near Parker	---	---	---	10/29/2001	---	0
Subreach between map numbers U5 and U6						
Roxana Canal return near Teton	---	43 53 55	111 48 31	10/29/2001	---	5.2
North Fork Teton River at Teton	**13055198**	43 53 53	111 40 38	10/29/2001	DM	108
Subreach between map numbers U6 and U7						
Teton Island Canal return near Teton	---	43 50 31	111 49 05	10/29/2001	---	0
Unnamed tributary near Teton	---	43 51 31	111 51 29	10/29/2001	---	0
Island Ward Canal return near Rexburg	---	43 51 18	111 51 28	10/29/2001	---	0
Clements Spori Ditch near Rexburg	---	43 50 26	111 51 11	10/29/2001	---	0
South Fork Teton River near Rexburg	**13055340**	43 50 07	111 46 38	10/29/2001	DM	35
St Anthony / Independent return near Rexburg	---	---	---	10/29/2001	---	0
Subreach between map numbers U7 and U8						
Rexburg Canal return near Rexburg	---	43 48 55	111 53 15	10/30/2001	---	29.3
Texas Slough Canal return near Rexburg	---	43 48 00	111 54 48	10/30/2001	---	0
Texas Slough near Rexburg	---	43 47 17	111 53 45	10/30/2001	---	52.5
Liberty Parks Canal return near Rexburg	---	43 47 24	111 55 27	10/30/2001	---	0
Bannock Jim Slough near Rexburg	---	43 46 30	111 56 11	10/30/2001	---	6.8
Subreach between map numbers U9 and U10						
Anderson Canal near Heise	13037505	43 36 54	111 39 37	10/30/2001	DM	0
Eagle Rock Canal near Heise	13037975	43 37 48	111 40 48	10/30/2001	DM	0
Farmers Friend Canal near Heise	13037980	43 37 47	111 41 29	10/30/2001	DM	0
Enterprise Canal near Heise	13037985	43 37 49	111 41 29	10/30/2001	DM	0
Dry Bed near Ririe	**13038000**	43 38 21	111 42 55	10/30/2001	DM	363
Kelly Canyon near Heise	---	43 37 44	111 39 40	10/30/2001	---	2.0
Hawley Warm Spring near Heise	---	43 38 56	111 42 15	10/30/2001	---	[3].5
Sunnydell Canal near Sunnydell[4]	13038392	43 38 56	111 42 17	10/30/2001	DM	0

Table C4. Discharge data for all inspected inflow and outflow sites during October 29-31, 2001, for the Snake River and Henrys Fork between Heise and Shelley and Ashton and the mouth, Idaho--Continued

Inspection site[1]	Station number[1]	Location Latitude	Longitude	Date	Time	Discharge[2]
Subreach between map numbers U10 and U11						
Lenroot Canal near Archer	13038426	43 41 18	111 46 40	10/30/2001	DM	5
Reid Canal near Archer	13038431	43 42 04	111 48 05	10/30/2001	DM	0
Subreach between map numbers U11 and U12						
Texas & Liberty Canal near Lorenzo	13038434	43 43 06	111 49 37	10/30/2001	DM	0
Bannock Jim Slough near Lorenzo	13038435	43 43 16	111 50 09	10/30/2001	DM	0
Subreach between map numbers U12 and U13						
---	---	---	---	---	---	---
Subreach between map numbers U13 and U14						
Annis Slough near Menan	---	43 44 46	111 56 37	10/30/2001	---	6.4
Scotts Slough near Menan	---	43 44 32	111 58 20	10/30/2001	---	10.1
Subreach between map numbers U14 and U15						
Butte & Market Lake Canal	13057025	43 45 13	111 58 51	10/30/2001	DM	0
Subreach between map numbers U15 and U16						
Big Six Canal return near Roberts	---	43 44 21	112 04 43	10/30/2001	---	0
Spring Creek near Roberts	---	43 43 15	112 04 21	10/30/2001	---	32.1
Subreach between map numbers U16 and U17						
---	---	---	---	---	---	---
Subreach between map numbers U17 and U18						
Dry Bed near Roberts	---	43 42 11	112 04 13	10/30/2001	---	135
South Parks Canal return near Roberts	---	43 41 19	112 03 47	10/30/2001	---	0
Butte Market Lake Canal return near Roberts	---	43 39 20	112 05 27	10/30/2001	---	0
Great Western Canal near Lewisville[4]	13057135	43 34 48	112 04 12	10/30/2001	DM	5
Idaho Canal near Lewisville	13057145	43 46 48	112 03 00	10/30/2001	DM	0
Subreach between map numbers U18 and U19						
Burgess Canal Drain near Idaho Falls	13057100	43 37 00	112 03 03	10/30/2001	DM	0
Subreach between map numbers U19 and U20						
North Willow Creek near Idaho Falls	---	43 30 42	112 03 04	10/30/2001	---	0
Porter Canal near Idaho Falls[4]	13057250	43 30 00	112 03 00	10/30/2001	DM	0
South Willow Creek near Idaho Falls	---	43 30 04	112 02 35	10/30/2001	---	0
Woodville Canal near Idaho Falls	13059505	43 25 48	112 06 00	10/30/2001	DM	0
Snake River Valley Canal near Idaho Falls	13059525	43 27 00	112 04 48	10/30/2001	DM	0

[1] Long-term United States Geological Survey or Idaho Power Company gaging stations are in bold.

[2] Values in shaded areas indicate canal withdrawals.

[3] Surface flows resulting from spring discharge; not used in gain/loss calculations.

[4] Actual canal discharge; spillback portion was accounted for.

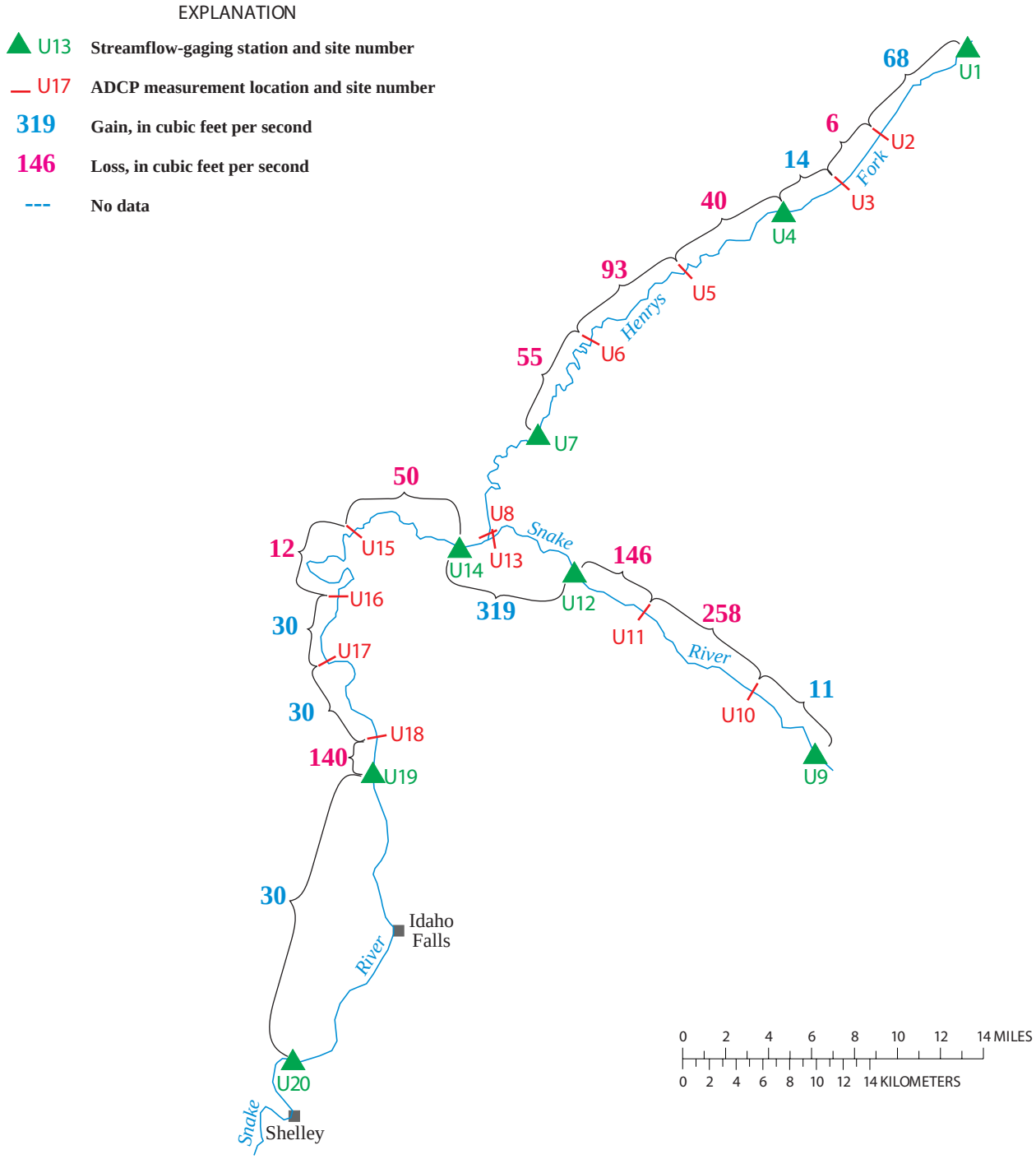


Figure C2. Streamflow gains and losses along the upper reach of the Snake River and Henrys Fork, Idaho, estimated during the October 29–31, 2001, seepage study.

Table C5. Calculations of gains and losses in specified subreaches of the Snake River and Henrys Fork during April 8-9, 2002, between Heise and Shelley and Ashton and the mouth, Idaho

[ADCP, Acoustic Doppler Current Profiler; ADP, Acoustic Doppler Profiler; ft^3/s, cubic feet per second; mi, mile; ---, no data]

Map number (fig. #)	Gaging station name (number)[1]/ ADCP/ADP measurement location	River mile		Discharge (ft^3/s)	Date	Time	Total gains/ (losses) (ft^3/s)	Gains/ (losses) per mile ($ft^3/s/mi$)
U1	**Henrys Fork near Ashton (13046000)**	44.2		1100	4/8/2002	0500		
			total estimated inflow	683				
			total estimated outflow	3				
U2	Henrys Fork below Falls River, near Ashton	38.5		1800	4/8/2002	0747	20	4
			total estimated inflow	0				
			total estimated outflow	22				
U3	Henrys Fork near Twin Groves	35.6		1740	4/8/2002	0856	(38)	(13)
			total estimated inflow	0				
			total estimated outflow	361				
U4	**Henrys Fork near St Anthony (13050500)**	32.4		1400	4/8/2002	1030	21	7
				1390	4/8/2002	0800		
			total estimated inflow	0				
			total estimated outflow	362				
U5	Henrys Fork near Parker	25.6		1140	4/8/2002	1118	112	16
			total estimated inflow	166				
			total estimated outflow	0				
U6	Henrys Fork near Hibbard	19.0		1150	4/8/2002	1228	(156)	(24)
			total estimated inflow	237				
			total estimated outflow	0				
U7	**Henrys Fork near Rexburg (13056500)**	9.2		1360	4/8/2002	1715	(27)	(3)
				1300	4/8/2002	1030		
			total estimated inflow	25				
			total estimated outflow	0				
U8	Henrys Fork at mouth, near Lorenzo	0.2		1390	4/8/2002	1456	65	7

Table C5. Calculations of gains and losses in specified subreaches of the Snake River and Henrys Fork during April 8-9, 2002, between Heise and Shelley and Ashton and the mouth, Idaho--Continued

Map number (fig. #)	Gaging station name (number)[1]/ ADCP/ADP measurement location	River mile		Discharge (ft^3/s)	Date	Time	Total gains/ (losses) (ft^3/s)	Gains/ (losses) per mile ($ft^3/s/mi$)
U9	**Snake near Heise (13037500)**	853.6		1490	4/8/2002	0830		
			total estimated inflow	0				
			total estimated outflow	0				
U10	Snake River below Dry Bed, near Heise	849.5		1450	4/8/2002	1030	(40)	(10)
			total estimated inflow	0				
			total estimated outflow	0				
U11	Snake River near Archer	842.8		1160	4/8/2002	1144	(290)	(43)
			total estimated inflow	0				
			total estimated outflow	0				
U12	**Snake River at Lorenzo (13038500)**	837.9		884	4/8/2002	1400	(276)	(56)
				852	4/8/2002	1300		
			total estimated inflow	0				
			total estimated outflow	0				
U13	Snake River above Henrys Fork, near Menan	832.5		---[2]	---	---	---	---
			Henrys Fork estimated inflow	1390				
			total estimated inflow	0				
			total estimated outflow	0				
U14	**Snake River near Menan (13057000)**	830.0		2670	4/8/2002	1645	428	25
				2730	4/9/2002	0445		
			total estimated inflow	0				
			total estimated outflow	0				
U15	Snake River below Deer Parks, near Menan	822.5		2280	4/9/2002	0820	(450)	(60)
			total estimated inflow	30				
			total estimated outflow	0				
U16	Snake River near Roberts	815.3		2300	4/9/2002	0842	(10)	(1)
			total estimated inflow	0				
			total estimated outflow	0				
U17	Snake River above Dry Bed, near Roberts	811.9		2280	4/9/2002	0700	(20)	(6)
			total estimated inflow	2				
			total estimated outflow	0				

Table C5. Calculations of gains and losses in specified subreaches of the Snake River and Henrys Fork during April 8-9, 2002, between Heise and Shelley and Ashton and the mouth, Idaho--Continued

Map number (fig. #)	Gaging station name (number)[1]/ ADCP/ADP measurement location	River mile		Discharge (ft^3/s)	Date	Time	Total gains/ (losses) (ft^3/s)	Gains/ (losses) per mile ($ft^3/s/mi$)
U18	Snake River near Lewisville	806.3		2320	4/9/2002	0951	38	7
			total estimated inflow	0				
			total estimated outflow	0				
				2410	4/9/2002	1030	90	69
U19	**Snake River near Idaho Falls (13057155)**	805.0		2390	3/26 - 4/24/2002	30-day average		
			total estimated inflow	0				
			total estimated outflow	5				
U20	**Snake River near Shelley (13060000)**	787.8		2180	3/26 - 4/24/2002	30-day average	(205)	(12)

[1] Long-term United States Geological Survey gaging stations are in bold.

[2] Measurement was made but not used in the calculations (see table C15).

Table C6. Gaging station discharge data during April 8-9, 2002, for the Snake River and Henrys Fork between Heise and Shelley and Ashton and the mouth, Idaho

[Discharge given in cubic feet per second]

Map number (fig. #)	Gaging station name (number)	Date	Time	Discharge
U1	Henrys Fork near Ashton (13046000)	4/8/2002	0500	1100
U4	Henrys Fork near St Anthony (13050500)	4/8/2002	1030	1400
		4/8/2002	0800	1390
U7	Henrys Fork near Rexburg (13056500)	4/8/2002	1715	1360
		4/8/2002	1030	1300
U9	Snake near Heise (13037500)	4/8/2002	0830	1490
U12	Snake River at Lorenzo (13038500)	4/8/2002	1400	884
		4/8/2002	1300	852
U14	Snake River near Menan (13057000)	4/8/2002	1645	2670
		4/9/2002	0445	2730
U19	Snake River near Idaho Falls (13057155)	4/9/2002	1030	2410
		3/26 - 4/24/2002	30-day average	2390
U20	Snake River near Shelley (13060000)	3/26 - 4/24/2002	30-day average	2180

Table C7. Acoustic Doppler discharge measurement data during April 8-9, 2002, for the Snake River and Henrys Fork between Heise and Shelley and Ashton and the mouth, Idaho

[ADCP, Acoustic Doppler Current Profiler; ADP, Acoustic Doppler Profiler; discharge given in cubic feet per second; COV, coefficient of variation; σ, standard deviation; μ, mean; ---, no data]

Map number (fig. #)	ADCP/ADP measurement location	Date	Time	Discharge	COV (σ/μ)
U2	Henrys Fork below Falls River, near Ashton	4/8/2002	0747	1800	0.03
U3	Henrys Fork near Twin Groves	4/8/2002	0856	1740	0.01
U5	Henrys Fork near Parker	4/8/2002	1118	1140	0.03
U6	Henrys Fork near Hibbard	4/8/2002	1228	1150	0.01
U8	Henrys Fork at mouth, near Lorenzo	4/8/2002	1456	1390	0.02
U10	Snake River below Dry Bed, near Heise	4/8/2002	1030	1450	0.03
U11	Snake River near Archer	4/8/2002	1144	1160	0.04
U13	Snake River above Henrys Fork, near Menan	4/8/2002	1531	960	0.09
U15	Snake River below Deer Parks, near Menan	4/9/2002	0820	2280	0.04
U16	Snake River near Roberts	4/9/2002	0842	2300	0.03
U17	Snake River above Dry Bed, near Roberts	4/9/2002	0700	2280	0.03
U18	Snake River near Lewisville	4/9/2002	0951	2320	0.03

Table C8. Discharge data for all inspected inflow and outflow sites during April 8-9, 2002, for the Snake River and Henrys Fork between Heise and Shelley and Ashton and the mouth, Idaho

[Latitude and longitude in degrees, minutes, seconds in North American Datum of 1983 (NAD83); DM, daily mean discharge; discharge given in cubic feet per second; map numbers shown in figure X; ---, no data]

Inspection site[1]	Station number[1]	Location		Date	Time	Discharge[2]
		Latitude	Longitude			
Subreach between map numbers U1 and U2						
Arcadia Canal return near Ashton	---	---	---	---	---	---
Snow Creek near Ashton	---	44 04 17	111 31 33	4/8/2002	---	8.7
Black Spring near Ashton	---	44 02 59	111 32 20	4/8/2002	---	[3]13.0
Sand Creek near Ashton	---	---	---	---	---	---
Farmers Own return near Ashton	---	44 02 32	111 32 20	4/8/2002	---	0
Unnamed tributary near Ashton	---	44 01 40	111 32 57	4/8/2002	---	---
Falls River Diversion return near Ashton	---	44 01 40	111 33 20	4/8/2002	---	---
Falls River near Chester	**13049500**	44 01 06	111 33 57	4/8/2002	DM	674
Dewey Canal near Chester	13046310	44 01 12	111 34 56	4/8/2002	DM	3.0
Subreach between map numbers U2 and U3						
Last Chance Canal near Chester	13049550	44 01 01	111 35 10	4/8/2002	DM	7
Cross Cut Canal near Chester	13049560	44 00 58	111 34 57	4/8/2002	---	15.0
Subreach between map numbers U3 and U4						
Farmers Friend Canal near Twin Groves	13049705	43 58 29	111 39 02	4/8/2002	---	71.7
Twin Groves Canal near Twin Groves	13049710	43 57 21	111 40 05	4/8/2002	---	43.5
St Anthony Union Canal near Twin Groves	13049725	43 58 19	111 38 27	4/8/2002	DM	190
Salem Union Canal near St. Anthony	13049805	43 58 20	111 39 01	4/8/2002	---	55.6
Subreach between map numbers U4 and U5						
Egin Canal near St. Anthony	13050525	43 57 56	111 41 23	4/8/2002	DM	132
St Anthony Union Feeder near St. Anthony	13050530	43 57 38	111 41 59	4/9/2002	---	69.5
Independent Canal near St. Anthony	13050535	43 57 29	111 42 21	4/9/2002	DM	128
Consolidated Farmers Canal near Parker	13050545	43 53 54	111 46 47	4/9/2002	---	32.3
Unnamed tributary near Parker	---	---	---	---	---	---
Subreach between map numbers U5 and U6						
Roxana Canal return near Teton	---	43 53 55	111 48 31	4/9/2002	---	3.6
North Fork Teton River at Teton	**13055198**	43 53 53	111 40 38	4/8/2002	DM	162
Subreach between map numbers U6 and U7						
Teton Island Canal return near Teton	---	43 50 31	111 49 05	4/9/2002	---	0
Unnamed tributary near Teton	---	43 51 31	111 51 29	4/9/2002	---	0
Island Ward Canal return near Rexburg	---	43 51 18	111 51 28	4/9/2002	---	0
Clements Spori Ditch near Rexburg	---	43 50 26	111 51 11	4/9/2002	---	0
South Fork Teton River near Rexburg	**13055340**	43 50 07	111 46 38	4/8/2002	DM	188
St Anthony / Independent return near Rexburg	---	---	---	4/10/2002	---	49.2
Subreach between map numbers U7 and U8						
Rexburg Canal return near Rexburg	---	43 48 55	111 53 15	4/30/2002	---	0
Texas Slough Canal return near Rexburg	---	43 48 00	111 54 48	4/8/2002	---	0
Texas Slough near Rexburg	---	43 47 17	111 53 45	4/2/2002	---	22.0
Liberty Parks Canal return near Rexburg	---	43 47 24	111 55 27	4/3/2002	---	1
Bannock Jim Slough near Rexburg	---	43 46 30	111 56 11	4/1/2002	---	1.7
Subreach between map numbers U9 and U10						
Anderson Canal near Heise	13037505	43 36 54	111 39 37	4/8/2002	DM	0
Eagle Rock Canal near Heise	13037975	43 37 48	111 40 48	4/9/2002	DM	0
Farmers Friend Canal near Heise	13037980	43 37 47	111 41 29	4/10/2002	DM	0
Enterprise Canal near Heise	13037985	43 37 49	111 41 29	4/8/2002	DM	0
Dry Bed near Ririe	**13038000**	43 38 21	111 42 55	4/8/2002	DM	0
Kelly Canyon near Heise	---	43 37 44	111 39 40	---	---	---
Hawley Warm Spring near Heise	---	43 38 56	111 42 15	---	---	[3]---
Sunnydell Canal near Sunnydell[4]	13038392	43 38 56	111 42 17	4/8/2002	---	0

Table C8. Discharge data for all inspected inflow and outflow sites during April 8-9, 2002, for the Snake River and Henrys Fork between Heise and Shelley and Ashton and the mouth, Idaho--Continued

Inspection site[1]	Station number[1]	Location		Date	Time	Discharge[2]
		Latitude	Longitude			
Subreach between map numbers U10 and U11						
Lenroot Canal near Archer	13038426	43 41 18	111 46 40	4/8/2002	---	0
Reid Canal near Archer	13038431	43 42 04	111 48 05	4/8/2002	---	0
Subreach between map numbers U11 and U12						
Texas & Liberty Canal near Lorenzo	13038434	43 43 06	111 49 37	4/8/2002	DM	0
Bannock Jim Slough near Lorenzo	13038435	43 43 16	111 50 09	4/8/2002	DM	0
Subreach between map numbers U12 and U13						
---	---	---	---	---	---	---
Subreach between map numbers U13 and U14						
Annis Slough near Menan	---	43 44 46	111 56 37	---	---	---
Scotts Slough near Menan	---	43 44 32	111 58 20	4/8/2002	---	0
Subreach between map numbers U14 and U15						
Butte & Market Lake Canal	13057025	43 45 13	111 58 51	4/9/2002	DM	0
Subreach between map numbers U15 and U16						
Big Six Canal return near Roberts	---	43 44 21	112 04 43	---	---	---
Spring Creek near Roberts	---	43 43 15	112 04 21	4/9/2002	---	30
Subreach between map numbers U16 and U17						
---	---	---	---	---	---	---
Subreach between map numbers U17 and U18						
Dry Bed near Roberts	---	43 42 11	112 04 13	4/9/2002	---	0
South Parks Canal return near Roberts	---	43 41 19	112 03 47	4/9/2002	---	0
Butte Market Lake Canal return near Roberts	---	43 39 20	112 05 27	4/9/2002	---	2.2
Great Western Canal near Lewisville[4]	13057135	43 34 48	112 04 12	4/9/2002	DM	0
Idaho Canal near Lewisville	13057145	43 46 48	112 03 00	4/9/2002	DM	0
Subreach between map numbers U18 and U19						
Burgess Canal Drain near Idaho Falls	13057100	43 37 00	112 03 03	4/9/2002	---	0
Subreach between map numbers U19 and U20						
North Willow Creek near Idaho Falls	---	43 30 42	112 03 04	---	---	---
Porter Canal near Idaho Falls[4]	13057250	43 30 00	112 03 00	4/9/2002	DM	5
South Willow Creek near Idaho Falls	---	43 30 04	112 02 35	---	---	---
Woodville Canal near Idaho Falls	13059505	43 25 48	112 06 00	4/9/2002	DM	0
Snake River Valley Canal near Idaho Falls	13059525	43 27 00	112 04 48	4/9/2002	DM	0

[1] Long-term United States Geological Survey or Idaho Power Company gaging stations are in bold.

[2] Values in shaded areas indicate canal withdrawals.

[3] Surface flows resulting from spring discharge; not used in gain/loss calculations.

[4] Actual canal discharge; spillback portion was accounted for.

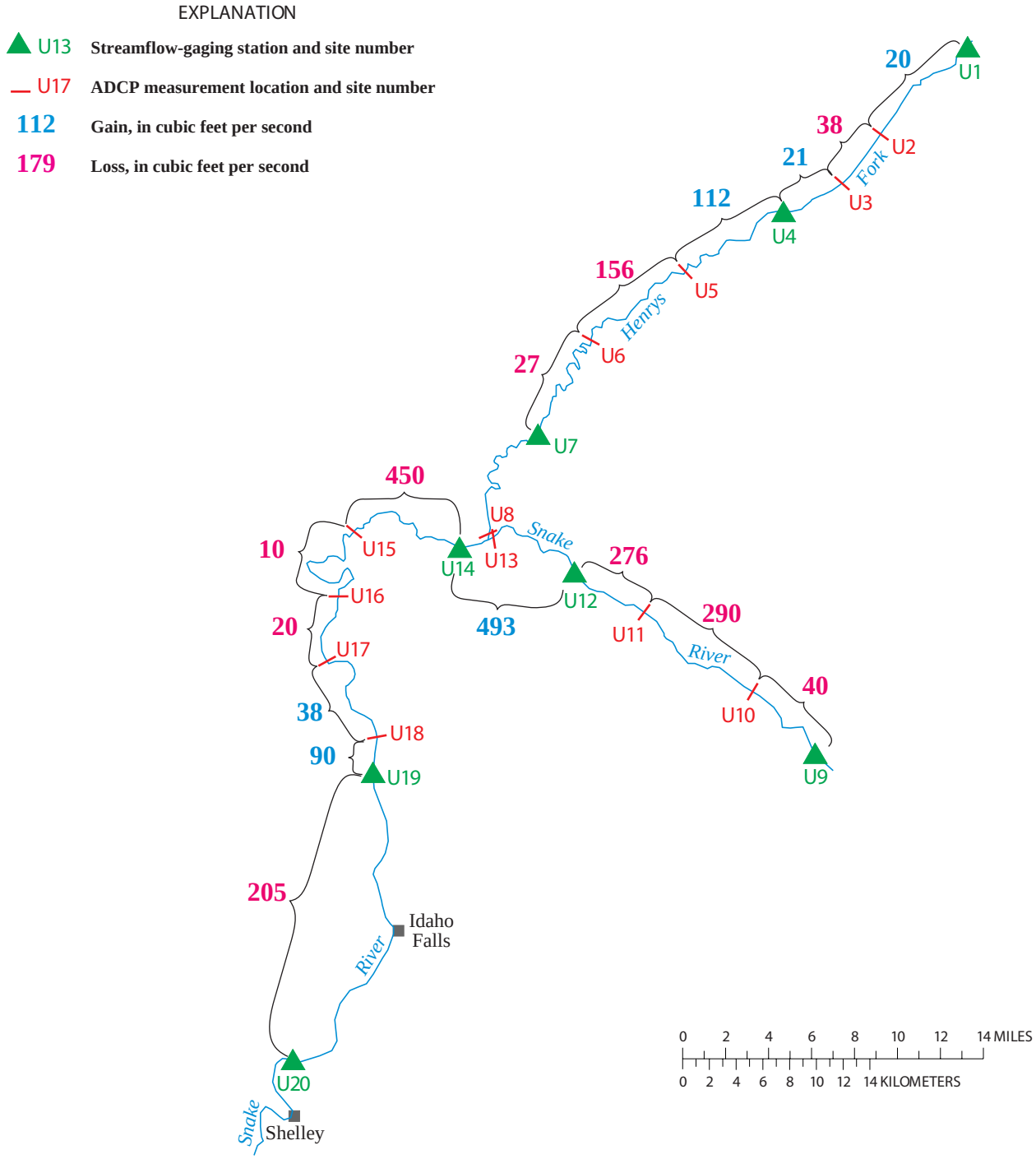


Figure C3. Streamflow gains and losses along the upper reach of the Snake River and Henrys Fork, Idaho, estimated during the April 8-9, 2002, seepage study.

Table C9. Calculations of gains and losses in specified subreaches of the Snake River and Henrys Fork during July 22-23, 2002, between Heise and Shelley and Ashton and the mouth, Idaho

[ADCP, Acoustic Doppler Current Profiler; ADP, Acoustic Doppler Profiler; ft^3/s, cubic feet per second; mi, mile; ---, no data]

Map number (fig. #)	Gaging station name (number)[1]/ ADCP/ADP measurement location	River mile		Discharge (ft^3/s)	Date	Time	Total gains/ (losses) (ft^3/s)	Gains/ (losses) per mile ($ft^3/s/mi$)
U1	**Henrys Fork near Ashton (13046000)**	44.2		1980	7/22/2002	0815		
			total estimated inflow	243				
			total estimated outflow	2				
U2	Henrys Fork below Falls River, near Ashton	38.5		2130	7/22/2002	1100	(91)	(16)
			total estimated inflow	0				
			total estimated outflow	537				
U3	Henrys Fork near Twin Groves	35.6		1670	7/22/2002	1145	77	27
			total estimated inflow	0				
			total estimated outflow	499				
U4	**Henrys Fork near St Anthony (13050500)**	32.4		1420	7/22/2002	1315	249	78
				1360	7/22/2002	1145		
			total estimated inflow	0				
			total estimated outflow	618				
U5	Henrys Fork near Parker	25.6		837	7/22/2002	1500	95	14
			total estimated inflow	255				
			total estimated outflow	0				
U6	Henrys Fork near Hibbard	19.0		896	7/22/2002	1540	(196)	(30)
			total estimated inflow	124				
			total estimated outflow	0				
U7	**Henrys Fork near Rexburg (13056500)**	9.2		1020	7/22/2002	2030	0	0
				1030	7/22/2002	1645		
			total estimated inflow	254				
			total estimated outflow	0				
U8	Henrys Fork at mouth, near Lorenzo	0.2		[2]---	---	---	---	---

Table C9. Calculations of gains and losses in specified subreaches of the Snake River and Henrys Fork during July 22-23, 2002, between Heise and Shelley and Ashton and the mouth, Idaho--Continued

Map number (fig. #)	Gaging station name (number)[1]/ ADCP/ADP measurement location	River mile		Discharge (ft^3/s)	Date	Time	Total gains/ (losses) (ft^3/s)	Gains/ (losses) per mile ($ft^3/s/mi$)
U9	**Snake near Heise (13037500)**	853.6		13700	7/22/2002	1500		
			total estimated inflow	1				
			total estimated outflow	4998				
U10	Snake River below Dry Bed, near Heise	849.5		8440	7/22/2002	1700	(263)	(64)
			total estimated inflow	0				
			total estimated outflow	528				
U11	Snake River near Archer	842.8		7580	7/22/2002	1545	(332)	(50)
			total estimated inflow	0				
			total estimated outflow	307				
E12	**Snake River at Lorenzo (13038500)**	837.9		7860	7/22/2002	1815	587	120
				7860	7/22/2002	1815		
			total estimated inflow	0				
			total estimated outflow	0				
U13	Snake River above Henrys Fork, near Menan	832.5		[2]---	---	---	---	---
			Henrys Fork estimated inflow	1284				
			total estimated inflow	9				
			total estimated outflow	0				
U14	**Snake River near Menan (13057000)**	830.0		9380	7/22/2002	2215	[3]228	13
				9380	7/23/2002	0515		
			total estimated inflow	0				
			total estimated outflow	392				
U15	Snake River below Deer Parks, near Menan	822.5		8350	7/23/2002	0900	(638)	(85)
			total estimated inflow	0				
			total estimated outflow	0				
U16	Snake River near Roberts	815.3		8540	7/23/2002	0745	190	26
			total estimated inflow	0				
			total estimated outflow	0				
U17	Snake River above Dry Bed, near Roberts	811.9		8470	7/23/2002	1750	(70)	(21)
			total estimated inflow	665				
			total estimated outflow	1124				

Table C9. Calculations of gains and losses in specified subreaches of the Snake River and Henrys Fork during July 22-23, 2002, between Heise and Shelley and Ashton and the mouth, Idaho--Continued

Map number (fig. #)	Gaging station name (number)[1]/ ADCP/ADP measurement location	River mile		Discharge (ft^3/s)	Date	Time	Total gains/ (losses) (ft^3/s)	Gains/ (losses) per mile ($ft^3/s/mi$)
U18	Snake River near Lewisville	806.3		[4]---	---	---	---	---
			total estimated inflow	1				
			total estimated outflow	0				
U19	**Snake River near Idaho Falls (13057155)**	805.0		8230	7/23/2002	1300	218	32
				7150	7/9 - 8/7/2002	30-day average		
			total estimated inflow	1				
			total estimated outflow	665				
U20	**Snake River near Shelley (13060000)**	787.8		6480	7/9 - 8/7/2002	30-day average	(6)	(0)

[1] Long-term United States Geological Survey gaging stations are in bold.

[2] No measurement was made because of equipment problems.

[3] Includes gain/loss between Henrys Fork near Rexburg and Henrys Fork at mouth.

[4] Measurement was made but not used in the calculations (see table C12).

Table C10. Gaging station discharge data during July 22-23, 2002, for the Snake River and Henrys Fork between Heise and Shelley and Ashton and the mouth, Idaho

[Discharge given in cubic feet per second]

Map number (fig. #)	Gaging station name (number)	Date	Time	Discharge
U1	Henrys Fork near Ashton (13046000)	7/22/2002	0815	1980
U4	Henrys Fork near St Anthony (13050500)	7/22/2002	1315	1420
		7/22/2002	1145	1360
U7	Henrys Fork near Rexburg (13056500)	7/22/2002	2030	1020
		7/22/2002	1645	1030
U9	Snake near Heise (13037500)	7/22/2002	1500	13,700
U12	Snake River at Lorenzo (13038500)	7/22/2002	1815	7860
		7/22/2002	1815	7860
U14	Snake River near Menan (13057000)	7/22/2002	2215	9380
		7/23/2002	0515	9380
U19	Snake River near Idaho Falls (13057155)	7/23/2002	1300	8230
		7/9 - 8/7/2002	30-day average	7150
U20	Snake River near Shelley (13060000)	7/9 - 8/7/2002	30-day average	6480

Table C11. Acoustic Doppler discharge measurement data during July 22-23, 2002, for the Snake River and Henrys Fork between Heise and Shelley and Ashton and the mouth, Idaho

[ADCP, Acoustic Doppler Current Profiler; ADP, Acoustic Doppler Profiler; discharge given in cubic feet per second; COV, coefficient of variation; σ, standard deviation; μ, mean; ---, no data]

Map number (fig. #)	ADCP/ADP measurement location	Date	Time	Discharge	COV (σ/μ)
U2	Henrys Fork below Falls River, near Ashton	7/22/2002	1100	2130	0.03
U3	Henrys Fork near Twin Groves	7/22/2002	1145	1670	0.05
U5	Henrys Fork near Parker	7/22/2002	1500	837	0.03
U6	Henrys Fork near Hibbard	7/22/2002	1540	896	0.04
U8	Henrys Fork at mouth, near Lorenzo	---[1]	---	---	---
U10	Snake River below Dry Bed, near Heise	7/22/2002	1700	8440	0.01
U11	Snake River near Archer	7/22/2002	1545	7580	0.03
U13	Snake River above Henrys Fork, near Menan	---[1]	---	---	---
U15	Snake River below Deer Parks, near Menan	7/23/2002	0900	8350	0.03
U16	Snake River near Roberts	7/23/2002	0745	8540	0.04
U17	Snake River above Dry Bed, near Roberts	7/23/2002	1750	8470	0.03
U18	Snake River near Lewisville	7/23/2002	1224	7420	0.02

[1] No measurement was made because of equipment problems.

Table C12. Discharge data for all inspected inflow and outflow sites during July 22-23, 2002, for the Snake River and Henrys Fork between Heise and Shelley and Ashton and the mouth, Idaho

[Latitude and longitude in degrees, minutes, seconds in North American Datum of 1983 (NAD83); DM, daily mean discharge; discharge given in cubic feet per second; map numbers shown in figure X; ---, no data]

Inspection site[1]	Station number[1]	Location		Date	Time	Discharge[2]
		Latitude	Longitude			
Subreach between map numbers U1 and U2						
Arcadia Canal return near Ashton	---	---	---	---	---	---
Snow Creek near Ashton	---	44 04 17	111 31 33	7/22/2002	---	0
Black Spring near Ashton	---	44 02 59	111 32 20	7/22/2002	---	[3]8.6
Sand Creek near Ashton	---	---	---	---	---	---
Farmers Own return near Ashton	---	44 02 32	111 32 20	7/22/2002	---	2
Unnamed tributary near Ashton	---	44 01 40	111 32 57	7/22/2002	---	4.0
Falls River Diversion return near Ashton	---	44 01 40	111 33 20	7/22/2002	---	3.5
Falls River near Chester	**13049500**	44 01 06	111 33 57	7/22/2002	DM	233
Dewey Canal near Chester	13046310	44 01 12	111 34 56	7/22/2002	DM	2
Subreach between map numbers U2 and U3						
Last Chance Canal near Chester	13049550	44 01 01	111 35 10	7/22/2002	DM	52
Cross Cut Canal near Chester	13049560	44 00 58	111 34 57	7/22/2002	DM	485
Subreach between map numbers U3 and U4						
Farmers Friend Canal near Twin Groves	13049705	43 58 29	111 39 02	7/22/2002	---	28.3
Twin Groves Canal near Twin Groves	13049710	43 57 21	111 40 05	7/22/2002	---	48.5
St Anthony Union Canal near Twin Groves	13049725	43 58 19	111 38 27	7/22/2002	DM	279
Salem Union Canal near St. Anthony	13049805	43 58 20	111 39 01	7/22/2002	DM	143
Subreach between map numbers U4 and U5						
Egin Canal near St. Anthony	13050525	43 57 56	111 41 23	7/22/2002	DM	333
St Anthony Union Feeder near St. Anthony	13050530	43 57 38	111 41 59	7/22/2002	DM	103
Independent Canal near St. Anthony	13050535	43 57 29	111 42 21	7/22/2002	DM	86
Consolidated Farmers Canal near Parker	13050545	43 53 54	111 46 47	7/22/2002	---	95.6
Unnamed tributary near Parker	---	---	---	---	---	0
Subreach between map numbers U5 and U6						
Roxana Canal return near Teton	---	43 53 55	111 48 31	7/22/2002	---	6.0
North Fork Teton River at Teton	**13055198**	43 53 53	111 40 38	7/22/2002	DM	249
Subreach between map numbers U6 and U7						
Teton Island Canal return near Teton	---	43 50 31	111 49 05	7/22/2002	---	14.1
Unnamed tributary near Teton	---	43 51 31	111 51 29	7/22/2002	---	0
Island Ward Canal return near Rexburg	---	43 51 18	111 51 28	7/22/2002	---	0
Clements Spori Ditch near Rexburg	---	43 50 26	111 51 11	7/22/2002	---	0
South Fork Teton River near Rexburg	**13055340**	43 50 07	111 46 38	7/22/2002	DM	92
St Anthony / Independent return near Rexburg	---	---	---	7/22/2002	---	17.5
Subreach between map numbers U7 and U8						
Rexburg Canal return near Rexburg	---	43 48 55	111 53 15	7/22/2002	---	11.5
Texas Slough Canal return near Rexburg	---	43 48 00	111 54 48	7/22/2002	---	16.5
Texas Slough near Rexburg	---	43 47 17	111 53 45	7/22/2002	---	176
Liberty Parks Canal return near Rexburg	---	43 47 24	111 55 27	7/22/2002	---	17.9
Bannock Jim Slough near Rexburg	---	43 46 30	111 56 11	7/22/2002	---	31.9
Subreach between map numbers U9 and U10						
Anderson Canal near Heise	13037505	43 36 54	111 39 37	7/22/2002	DM	334
Eagle Rock Canal near Heise	13037975	43 37 48	111 40 48	7/22/2002	DM	635
Farmers Friend Canal near Heise	13037980	43 37 47	111 41 29	7/22/2002	DM	329
Enterprise Canal near Heise	13037985	43 37 49	111 41 29	7/22/2002	DM	211
Dry Bed near Ririe	**13038000**	43 38 21	111 42 55	7/22/2002	DM	3470
Kelly Canyon near Heise	---	43 37 44	111 39 40	7/22/2002	---	.8
Hawley Warm Spring near Heise	---	43 38 56	111 42 15	7/22/2002	---	[3]0
Sunnydell Canal near Sunnydell[4]	13038392	43 38 56	111 42 17	7/22/2002	DM	19

Table C12. Discharge data for all inspected inflow and outflow sites during July 22-23, 2002, for the Snake River and Henrys Fork between Heise and Shelley and Ashton and the mouth, Idaho--Continued

Inspection site[1]	Station number[1]	Location Latitude	Longitude	Date	Time	Discharge[2]
Subreach between map numbers U10 and U11						
Lenroot Canal near Archer	13038426	43 41 18	111 46 40	7/22/2002	---	379
Reid Canal near Archer	13038431	43 42 04	111 48 05	7/22/2002	DM	149
Subreach between map numbers U11 and U12						
Texas & Liberty Canal near Lorenzo	13038434	43 43 06	111 49 37	7/22/2002	DM	263
Bannock Jim Slough near Lorenzo	13038435	43 43 16	111 50 09	7/22/2002	DM	44
Subreach between map numbers U12 and U13						
---	---	---	---	---	---	---
Subreach between map numbers U13 and U14						
Annis Slough near Menan	---	43 44 46	111 56 37	---	---	---
Scotts Slough near Menan	---	43 44 32	111 58 20	7/22/2002	---	8.6
Subreach between map numbers U14 and U15						
Butte & Market Lake Canal	13057025	43 45 13	111 58 51	7/23/2002	DM	392
Subreach between map numbers U15 and U16						
Big Six Canal return near Roberts	---	43 44 21	112 04 43	---	---	---
Spring Creek near Roberts	---	43 43 15	112 04 21	---	---	---
Subreach between map numbers U16 and U17						
---	---	---	---	---	---	---
Subreach between map numbers U17 and U18						
Dry Bed near Roberts	---	43 42 11	112 04 13	7/23/2002	---	620
South Parks Canal return near Roberts	---	43 41 19	112 03 47	7/23/2002	---	44.9
Butte Market Lake Canal return near Roberts	---	43 39 20	112 05 27	7/23/2002	---	.4
Great Western Canal near Lewisville[4]	13057135	43 34 48	112 04 12	7/23/2002	DM	214
Idaho Canal near Lewisville	13057145	43 46 48	112 03 00	7/23/2002	DM	910
Subreach between map numbers U18 and U19						
Burgess Canal Drain near Idaho Falls	13057100	43 37 00	112 03 03	7/23/2002	---	.8
Subreach between map numbers U19 and U20						
North Willow Creek near Idaho Falls	---	43 30 42	112 03 04	7/23/2002	---	1
Porter Canal near Idaho Falls[4]	13057250	43 30 00	112 03 00	7/23/2002	DM	251
South Willow Creek near Idaho Falls	---	43 30 04	112 02 35	7/23/2002	---	0
Woodville Canal near Idaho Falls	13059505	43 25 48	112 06 00	7/23/2002	DM	43
Snake River Valley Canal near Idaho Falls	13059525	43 27 00	112 04 48	7/23/2002	DM	371

[1] Long-term United States Geological Survey or Idaho Power Company gaging stations are in bold.

[2] Values in shaded areas indicate canal withdrawals.

[3] Surface flows resulting from spring discharge; not used in gain/loss calculations.

[4] Actual canal discharge; spillback portion was accounted for.

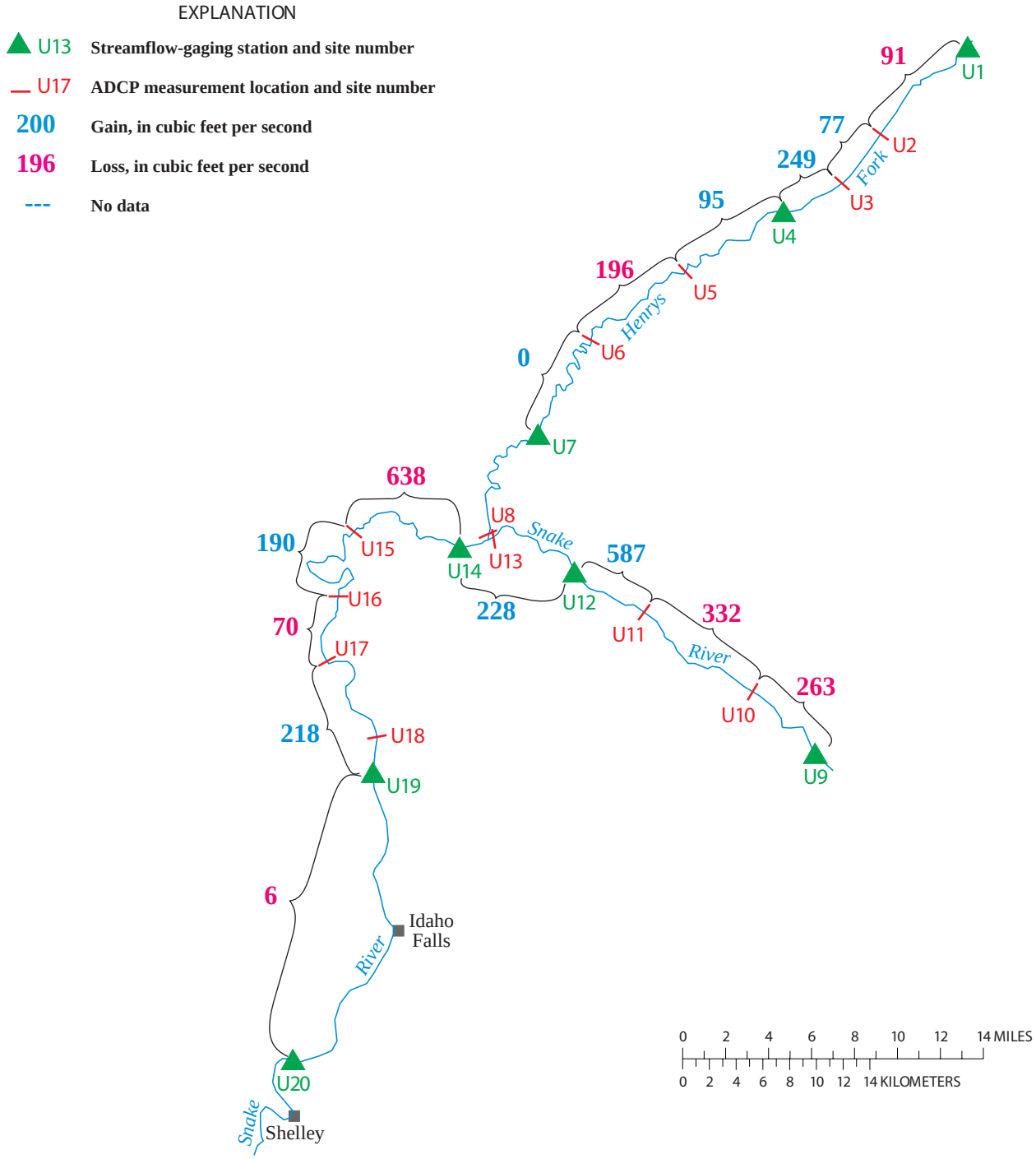


Figure C4. Streamflow gains and losses along the upper reach of the Snake River and Henrys Fork, Idaho, estimated during the July 22–23, 2002, seepage study.

Table C13. Calculations of gains and losses in specified subreaches of the Snake River and Henrys Fork during November 4-5, 2002, between Heise and Shelley and Ashton and the mouth, Idaho

[ADCP, Acoustic Doppler Current Profiler; ADP, Acoustic Doppler Profiler; ft^3/s, cubic feet per second; mi, mile; ---, no data]

Map number (fig. #)	Gaging station name (number)[1]/ ADCP/ADP measurement location	River mile		Discharge (ft^3/s)	Date	Time	Total gains/ (losses) (ft^3/s)	Gains/ (losses) per mile ($ft^3/s/mi$)
U1	**Henrys Fork near Ashton (13046000)**	44.2		929	11/5/2002	0445		
			total estimated inflow	425				
			total estimated outflow	0				
U2	Henrys Fork below Falls River, near Ashton	38.5		1220	11/5/2002	0739	(134)	(24)
			total estimated inflow	0				
			total estimated outflow	75				
U3	Henrys Fork near Twin Groves	35.6		---	---	---	---	---
			total estimated inflow	0				
			total estimated outflow	40				
U4	**Henrys Fork near St Anthony (13050500)**	32.4		1450	11/5/2002	1045	344	56
				1200	11/4/2002	1415		
			total estimated inflow	0				
			total estimated outflow	26				
U5	Henrys Fork near Parker	25.6		1130	11/4/2002	1732	(44)	(6)
			total estimated inflow	210				
			total estimated outflow	0				
U6	Henrys Fork near Hibbard	19.0		1280	11/4/2002	1650	(60)	(9)
			total estimated inflow	118				
			total estimated outflow	0				
U7	**Henrys Fork near Rexburg (13056500)**	9.2		1380	11/4/2002	2130	(18)	(2)
				1370	11/4/2002	1100		
			total estimated inflow	64				
			total estimated outflow	0				
U8	Henrys Fork at mouth, near Lorenzo	0.2		1370	11/4/2002	1523	(64)	(7)

Table C13. Calculations of gains and losses in specified subreaches of the Snake River and Henrys Fork during November 4-5, 2002, between Heise and Shelley and Ashton and the mouth, Idaho--Continued

Map number (fig. #)	Gaging station name (number)[1]/ ADCP/ADP measurement location	River mile		Discharge (ft^3/s)	Date	Time	Total gains/ (losses) (ft^3/s)	Gains/ (losses) per mile ($ft^3/s/mi$)
U9	**Snake near Heise (13037500)**	853.6		1550	11/4/2002	1130		
			total estimated inflow	2				
			total estimated outflow	520				
U10	Snake River below Dry Bed, near Heise	849.5		856	11/4/2002	1331	(176)	(43)
			total estimated inflow	0				
			total estimated outflow	36				
U11	Snake River near Archer	842.8		641	11/4/2002	1240	(179)	(27)
			total estimated inflow	0				
			total estimated outflow	2				
U12	**Snake River at Lorenzo (13038500)**	837.9		570	11/4/2002	1500	(69)	(14)
				558	11/4/2002	1230		
			total estimated inflow	0				
			total estimated outflow	0				
U13	Snake River above Henrys Fork, near Menan	832.5		---[2]	---	---	---	---
			Henrys Fork estimated inflow	1370				
			total estimated inflow	5				
			total estimated outflow	0				
U14	**Snake River near Menan (13057000)**	830.0		2450	11/4/2002	1615	517	30
				2280	11/5/2002	0600		
			total estimated inflow	0				
			total estimated outflow	6				
U15	Snake River below Deer Parks, near Menan	822.5		1980	11/5/2002	0937	(294)	(39)
			total estimated inflow	31				
			total estimated outflow	0				
U16	Snake River near Roberts	815.3		2030	11/5/2002	1524	19	3
			total estimated inflow	0				
			total estimated outflow	0				
U17	Snake River above Dry Bed, near Roberts	811.9		---	---	---	---	---
			total estimated inflow	231				
			total estimated outflow	0				

Table C13. Calculations of gains and losses in specified subreaches of the Snake River and Henrys Fork during November 4-5, 2002, between Heise and Shelley and Ashton and the mouth, Idaho--Continued

Map number (fig. #)	Gaging station name (number)[1]/ ADCP/ADP measurement location	River mile		Discharge (ft^3/s)	Date	Time	Total gains/ (losses) (ft^3/s)	Gains/ (losses) per mile ($ft^3/s/mi$)
U18	Snake River near Lewisville	806.3		2430	11/5/2002	1428	169	19
			total estimated inflow	0				
			total estimated outflow	0				
				2540	11/5/2002	1515	110	85
U19	**Snake River near Idaho Falls (13057155)**	805.0		2610	10/22 - 11/20/2002	30-day average		
			total estimated inflow	0				
			total estimated outflow	11				
U20	**Snake River near Shelley (13060000)**	787.8		2450	10/22 - 11/20/2002	30-day average	(149)	(9)

[1] Long-term United States Geological Survey gaging stations are in bold.

[2] Measurement was made but not used in the calculations (see table C15).

Table C14. Gaging station discharge data during November 4-5, 2002, for the Snake River and Henrys Fork between Heise and Shelley and Ashton and the mouth, Idaho

[Discharge given in cubic feet per second]

Map number (fig. #)	Gaging station name (number)	Date	Time	Discharge
U1	Henry's Fork near Ashton (13046000)	11/5/2002	0445	929
U4	Henry's Fork near St Anthony (13050500)	11/5/2002	1045	1450
		11/4/2002	1415	1200
U7	Henry's Fork near Rexburg (13056500)	11/4/2002	2130	1380
		11/4/2002	1100	1370
U9	Snake near Heise (13037500)	11/4/2002	1130	1550
U12	Snake River at Lorenzo (13038500)	11/4/2002	1500	570
		11/4/2002	1230	558
U14	Snake River near Menan (13057000)	11/4/2002	1615	2450
		11/5/2002	0600	2280
U19	Snake River near Idaho Falls (13057155)	11/5/2002	1515	2540
		10/22 - 11/20/2002	30-day average	2610
U20	Snake River near Shelley (13060000)	10/22 - 11/20/2002	30-day average	2450

Table C15. Acoustic Doppler discharge measurement data during November 4-5, 2002, for the Snake River and Henrys Fork between Heise and Shelley and Ashton and the mouth, Idaho

[ADCP, Acoustic Doppler Current Profiler; ADP, Acoustic Doppler Profiler; discharge given in cubic feet per second; COV, coefficient of variation; σ, standard deviation; μ, mean; ---, no data]

Map number (fig. #)	ADCP/ADP measurement location	Date	Time	Discharge	COV (σ/μ)
U2	Henrys Fork below Falls River, near Ashton	11/5/2002	0739	1220	0.02
U3	Henrys Fork near Twin Groves	---[1]	---	---	---
U5	Henrys Fork near Parker	11/4/2002	1732	1130	0.02
U6	Henrys Fork near Hibbard	11/4/2002	1650	1280	0.02
U8	Henrys Fork at mouth, near Lorenzo	11/4/2002	1523	1370	0.02
U10	Snake River below Dry Bed, near Heise	11/4/2002	1331	856	0.02
U11	Snake River near Archer	11/4/2002	1240	641	0.03
U13	Snake River above Henrys Fork, near Menan	11/4/2002	1507	614	0.02
U15	Snake River below Deer Parks, near Menan	11/5/2002	0937	1980	0.03
U16	Snake River near Roberts	11/5/2002	1524	2030	0.02
U17	Snake River above Dry Bed, near Roberts	---[1]	---	---	---
U18	Snake River near Lewisville	11/5/2002	1428	2430	0.09

[1] No measurement made because of ice on the river.

Table C16. Discharge data for all inspected inflow and outflow sites during November 4-5, 2002, for the Snake River and Henrys Fork between Heise and Shelley and Ashton and the mouth, Idaho

[Latitude and longitude in degrees, minutes, seconds in North American Datum of 1983 (NAD83); DM, daily mean discharge; discharge given in cubic feet per second; map numbers shown in figure X; ---, no data]

Inspection site[1]	Station number[1]	Location		Date	Time	Discharge[2]
		Latitude	Longitude			
Subreach between map numbers U1 and U2						
Arcadia Canal return near Ashton	---	---	---	---	---	---
Snow Creek near Ashton	---	44 04 17	111 31 33	11/4/2002	---	2.4
Black Spring near Ashton	---	44 02 59	111 32 20	11/4/2002	---	[3]10.3
Sand Creek near Ashton	---	---	---	---	---	---
Farmers Own return near Ashton	---	44 02 32	111 32 20	11/4/2002	---	0
Unnamed tributary near Ashton	---	44 01 40	111 32 57	11/4/2002	---	1
Falls River Diversion return near Ashton	---	44 01 40	111 33 20	11/4/2002	---	2
Falls River near Chester	**13049500**	44 01 06	111 33 57	11/5/2002	DM	420
Dewey Canal near Chester	13046310	44 01 12	111 34 56	11/4/2002	DM	0
Subreach between map numbers U2 and U3						
Last Chance Canal near Chester	13049550	44 01 01	111 35 10	11/4/2002	DM	15
Cross Cut Canal near Chester	13049560	44 00 58	111 34 57	11/4/2002	DM	60
Subreach between map numbers U3 and U4						
Farmers Friend Canal near Twin Groves	13049705	43 58 29	111 39 02	11/4/2002	---	.5
Twin Groves Canal near Twin Groves	13049710	43 57 21	111 40 05	11/4/2002	---	37.8
St Anthony Union Canal near Twin Groves	13049725	43 58 19	111 38 27	11/4/2002	DM	0
Salem Union Canal near St. Anthony	13049805	43 58 20	111 39 01	11/4/2002	---	1.5
Subreach between map numbers U4 and U5						
Egin Canal near St. Anthony	13050525	43 57 56	111 41 23	11/4/2002	DM	0
St Anthony Union Feeder near St. Anthony	13050530	43 57 38	111 41 59	11/4/2002	---	2.5
Independent Canal near St. Anthony	13050535	43 57 29	111 42 21	11/4/2002	---	.2
Consolidated Farmers Canal near Parker	13050545	43 53 54	111 46 47	11/4/2002	---	23.6
Unnamed tributary near Parker	---	---	---	11/4/2002	---	0
Subreach between map numbers U5 and U6						
Roxana Canal return near Teton	---	43 53 55	111 48 31	11/4/2002	---	3.0
North Fork Teton River at Teton	**13055198**	43 53 53	111 40 38	11/4/2002	DM	207
Subreach between map numbers U6 and U7						
Teton Island Canal return near Teton	---	43 50 31	111 49 05	11/4/2002	---	4.5
Unnamed tributary near Teton	---	43 51 31	111 51 29	11/5/2002	---	0
Island Ward Canal return near Rexburg	---	43 51 18	111 51 28	11/5/2002	---	0
Clements Spori Ditch near Rexburg	---	43 50 26	111 51 11	11/5/2002	---	0
South Fork Teton River near Rexburg	**13055340**	43 50 07	111 46 38	11/5/2002	DM	113
St Anthony / Independent return near Rexburg	---	---	---	11/4/2002	---	0
Subreach between map numbers U7 and U8						
Rexburg Canal return near Rexburg	---	43 48 55	111 53 15	11/4/2002	DM	0
Texas Slough Canal return near Rexburg	---	43 48 00	111 54 48	11/4/2002	DM	0
Texas Slough near Rexburg	---	43 47 17	111 53 45	11/4/2002	---	49.5
Liberty Parks Canal return near Rexburg	---	43 47 24	111 55 27	11/4/2002	---	2.4
Bannock Jim Slough near Rexburg	---	43 46 30	111 56 11	11/4/2002	---	12.3
Subreach between map numbers U9 and U10						
Anderson Canal near Heise	13037505	43 36 54	111 39 37	11/4/2002	DM	0
Eagle Rock Canal near Heise	13037975	43 37 48	111 40 48	11/4/2002	DM	0
Farmers Friend Canal near Heise	13037980	43 37 47	111 41 29	11/4/2002	DM	0
Enterprise Canal near Heise	13037985	43 37 49	111 41 29	11/4/2002	DM	0
Dry Bed near Ririe	**13038000**	43 38 21	111 42 55	11/4/2002	DM	517
Kelly Canyon near Heise	---	43 37 44	111 39 40	11/5/2002	---	1.5
Hawley Warm Spring near Heise	---	43 38 56	111 42 15	11/5/2002	---	[3]2.4
Sunnydell Canal near Sunnydell[4]	13038392	43 38 56	111 42 17	11/5/2002	---	2.5

Table C16. Discharge data for all inspected inflow and outflow sites during November 4-5, 2002, for the Snake River and Henrys Fork between Heise and Shelley and Ashton and the mouth, Idaho--Continued

Inspection site[1]	Station number[1]	Location		Date	Time	Discharge[2]
		Latitude	Longitude			
Subreach between map numbers U10 and U11						
Lenroot Canal near Archer	13038426	43 41 18	111 46 40	11/5/2002	---	0
Reid Canal near Archer	13038431	43 42 04	111 48 05	11/5/2002	---	35.8
Subreach between map numbers U11 and U12						
Texas & Liberty Canal near Lorenzo	13038434	43 43 06	111 49 37	11/5/2002	DM	2
Bannock Jim Slough near Lorenzo	13038435	43 43 16	111 50 09	11/5/2002	DM	0
Subreach between map numbers U12 and U13						
---	---	---	---	---	---	---
Subreach between map numbers U13 and U14						
Annis Slough near Menan	---	43 44 46	111 56 37	---	---	---
Scotts Slough near Menan	---	43 44 32	111 58 20	11/5/2002	---	4.6
Subreach between map numbers U14 and U15						
Butte & Market Lake Canal	13057025	43 45 13	111 58 51	11/5/2002	---	5.9
Subreach between map numbers U15 and U16						
Big Six Canal return near Roberts	---	43 44 21	112 04 43	11/5/2002	---	4.5
Spring Creek near Roberts	---	43 43 15	112 04 21	11/5/2002	---	26.8
Subreach between map numbers U16 and U17						
---	---	---	---	---	---	---
Subreach between map numbers U17 and U18						
Dry Bed near Roberts	---	43 42 11	112 04 13	11/4/2002	DM	231
South Parks Canal return near Roberts	---	43 41 19	112 03 47	11/5/2002	DM	0
Butte Market Lake Canal return near Roberts	---	43 39 20	112 05 27	11/5/2002	DM	0
Great Western Canal near Lewisville[4]	13057135	43 34 48	112 04 12	11/5/2002	DM	0
Idaho Canal near Lewisville	13057145	43 46 48	112 03 00	11/5/2002	DM	0
Subreach between map numbers U18 and U19						
Burgess Canal Drain near Idaho Falls	13057100	43 37 00	112 03 03	11/5/2002	---	0
Subreach between map numbers U19 and U20						
North Willow Creek near Idaho Falls	---	43 30 42	112 03 04	11/6/2002	---	0
Porter Canal near Idaho Falls[4]	13057250	43 30 00	112 03 00	11/6/2002	DM	10
South Willow Creek near Idaho Falls	---	43 30 04	112 02 35	11/6/2002	---	0
Woodville Canal near Idaho Falls	13059505	43 25 48	112 06 00	11/6/2002	DM	1
Snake River Valley Canal near Idaho Falls	13059525	43 27 00	112 04 48	11/5/2002	DM	0

[1] Long-term United States Geological Survey or Idaho Power Company gaging stations are in bold.

[2] Values in shaded areas indicate canal withdrawals.

[3] Surface flows resulting from spring discharge; not used in gain/loss calculations.

[4] Actual canal discharge; spillback portion was accounted for.

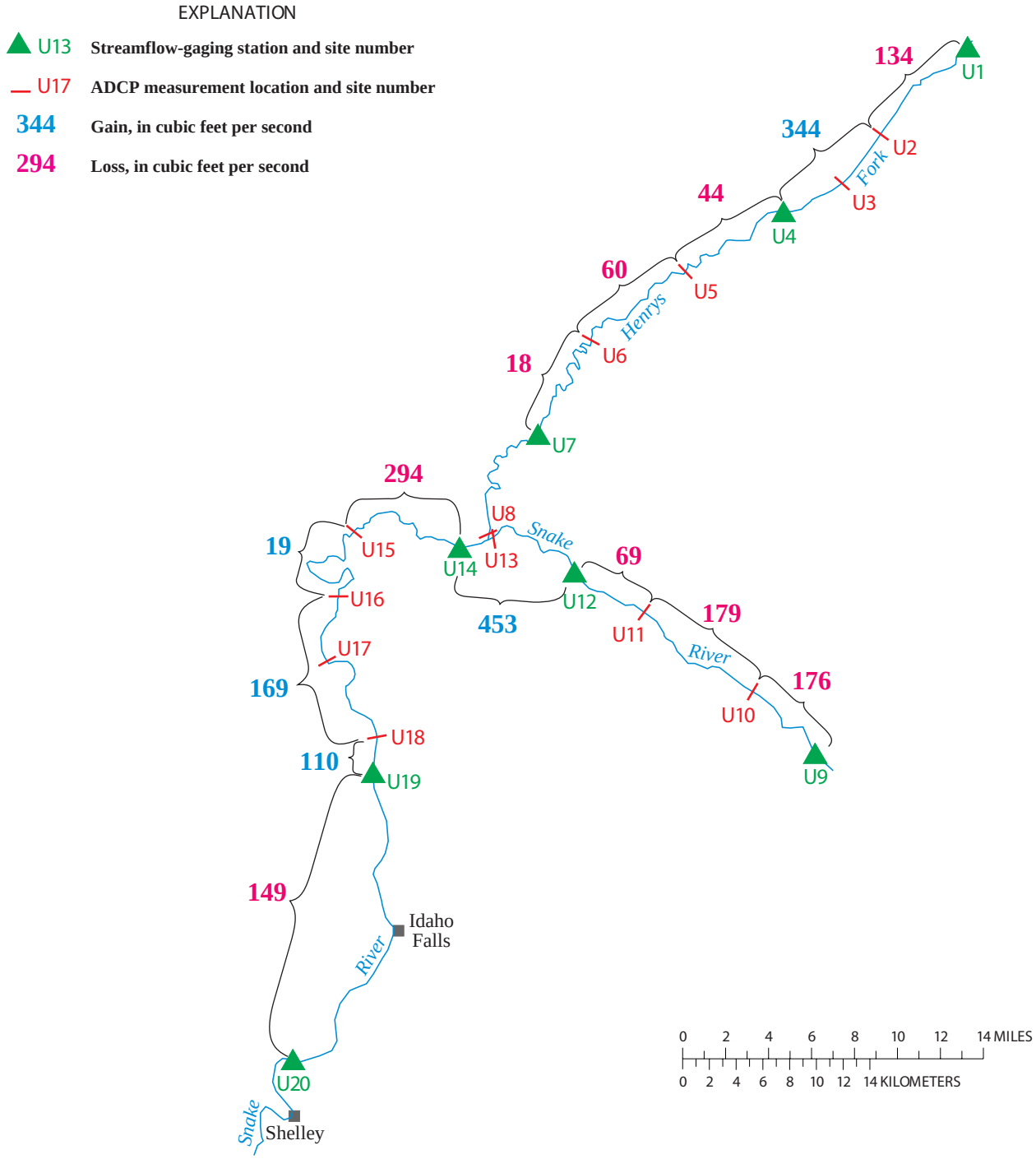
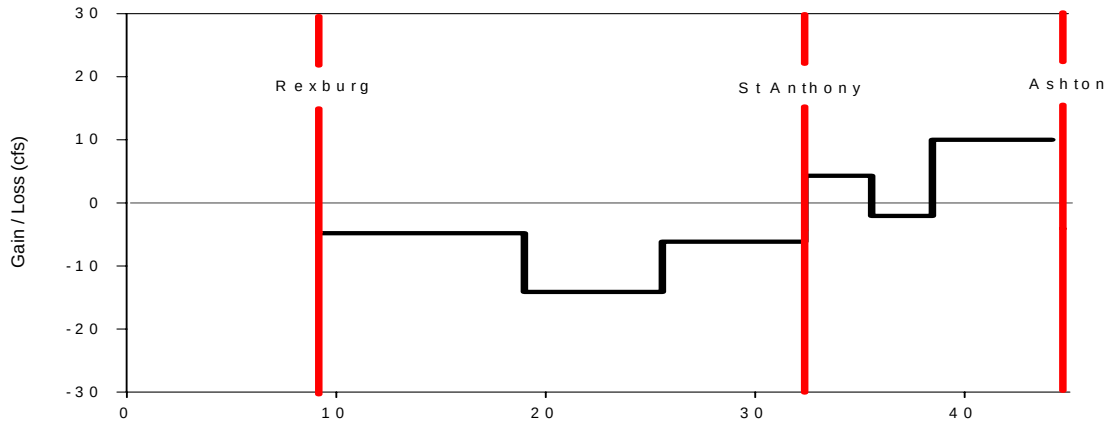
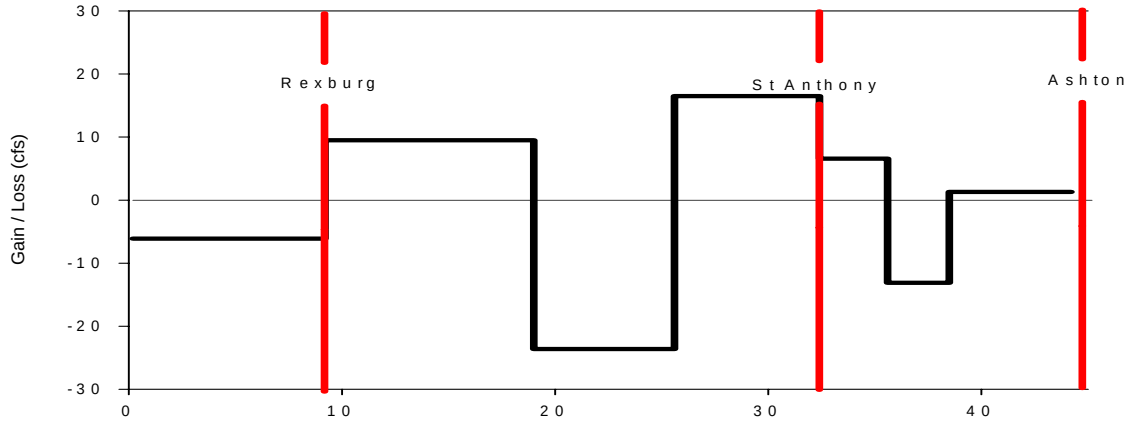


Figure C5. Streamflow gains and losses along the upper reach of the Snake River and Henrys Fork, Idaho, estimated during the November 4-5, 2002, seepage study.

Fall 2001



Spring 2002



Fall 2002

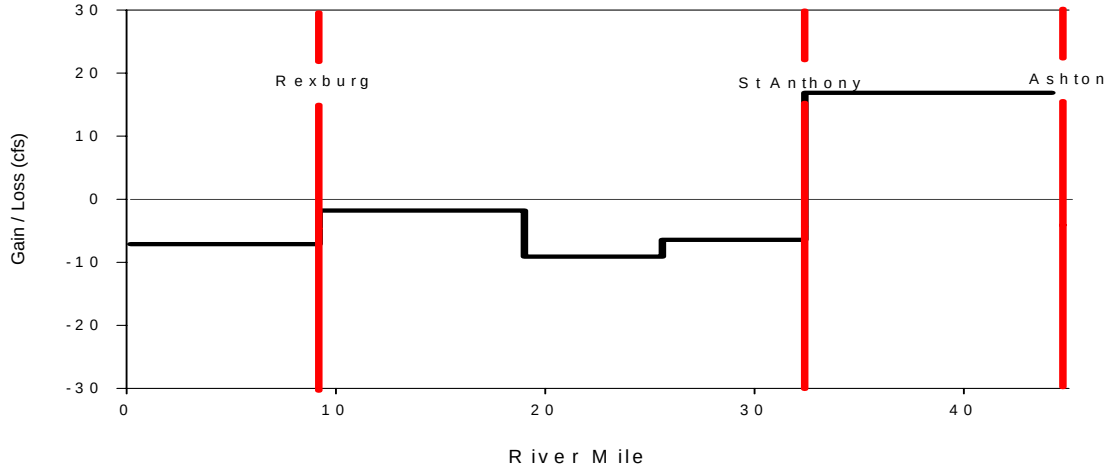
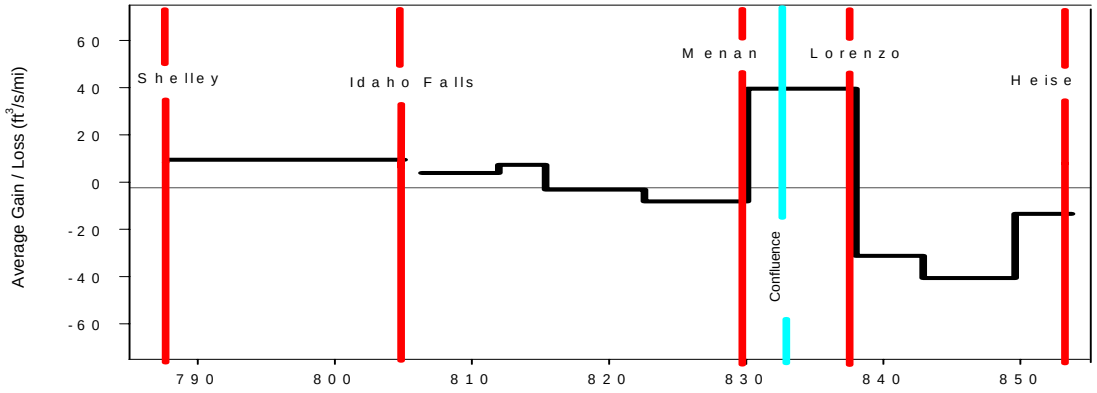
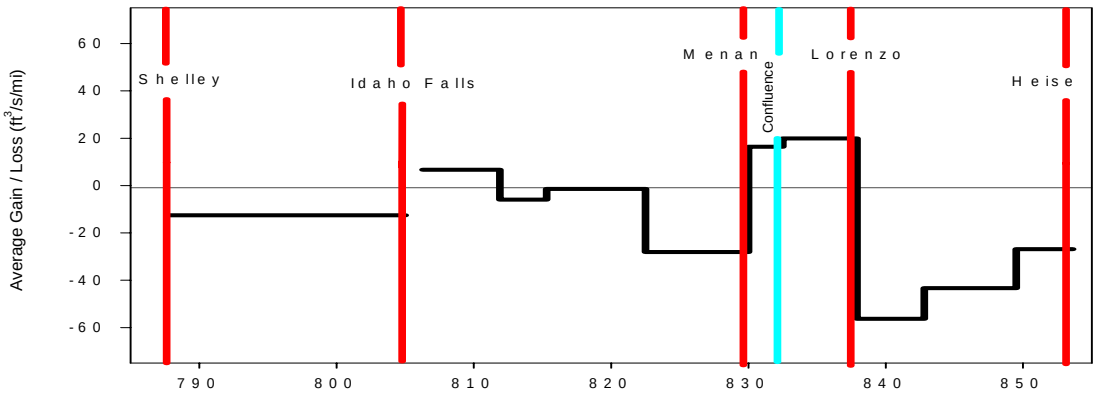


Figure C6. Summary plots of estimated gains and losses in specified subreaches of the Henrys Fork and Snake River between Ashton and the mouth and Heise and Shelley, Idaho

Fall 2001



Spring 2002



Fall 2002

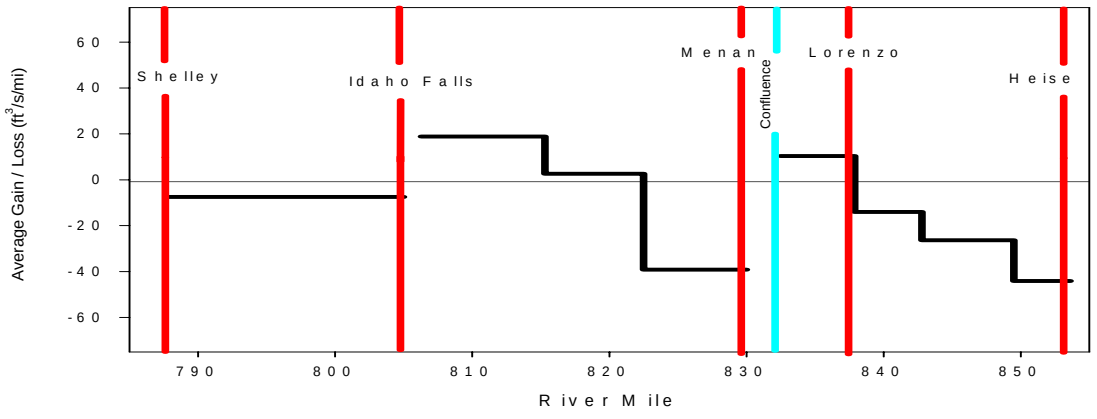


Figure C6. Summary plots of average estimated gains and losses per mile in specified subreaches of the Henrys Fork and Snake River between Ashton and the mouth and Heise and Shelley, Idaho—Continued

APPENDIX D

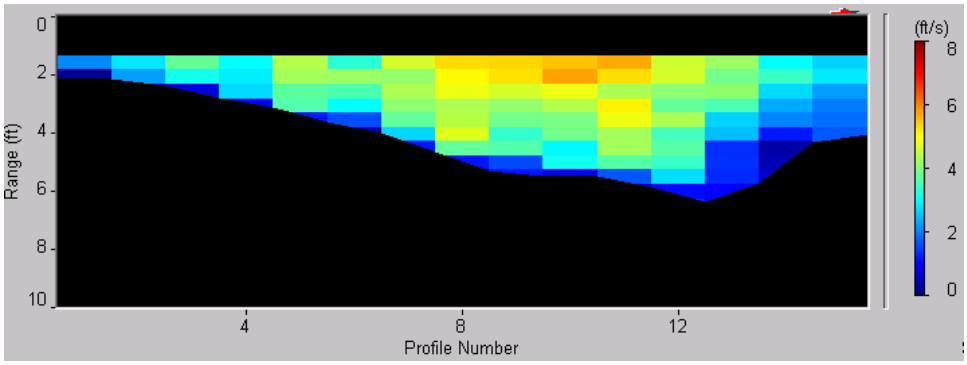
Descriptions and relevant information for the acoustic Doppler measurements sites used in this study

Henrys Fork near Ashton (USGS gage)

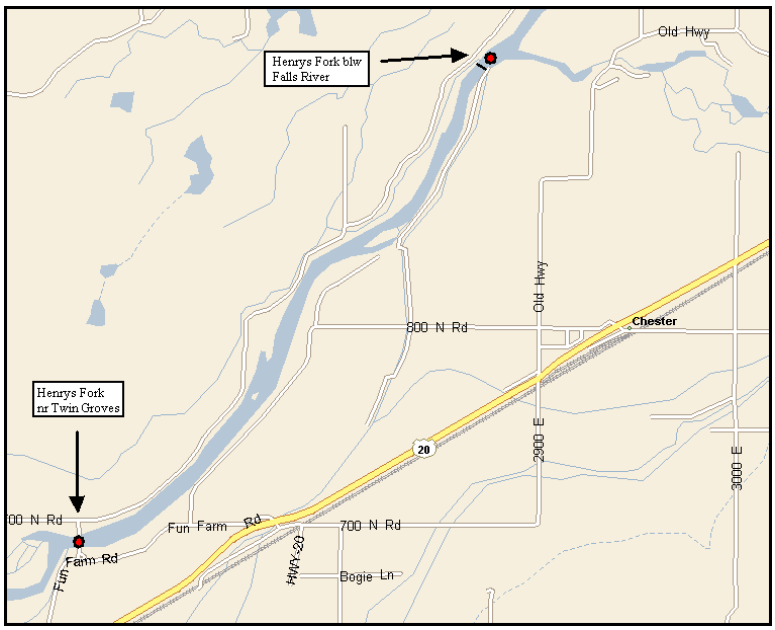
Access: Dirt road on left bank downstream of Henry's Fork Bridge Crossing.

Ashton (USGS gage)
July 2002

Latitude	44º04'11"
Longitude	111º30'38"
Discharge	1,960 cfs
Channel Width	105 feet
Max Depth	6.4 feet
Max Velocity	4.7 feet/sec



Henrys Fork near Ashton (USGS gage) July 2002.



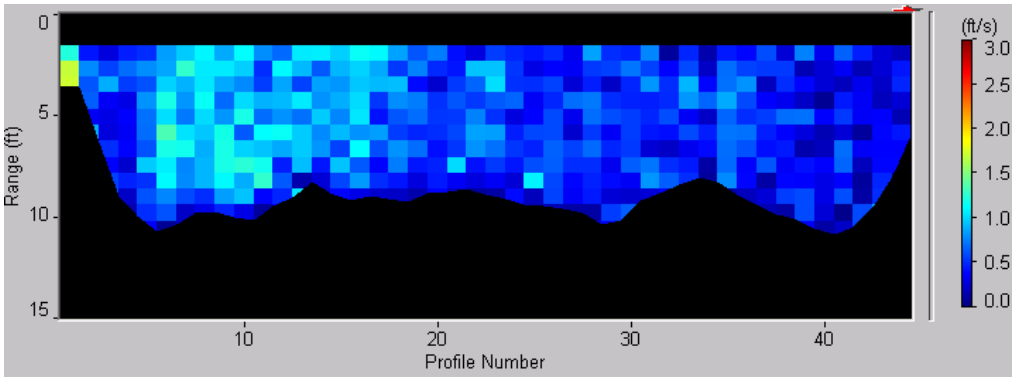
Henrys Fork below Falls River

Access: Travel upstream along the river on either the left bank or right bank.

HF below Falls River
April 2002

Latitude	44º01'08"
Longitude	111º34'57"
Discharge	1,940 cfs
Channel Width	450 feet
Max Depth	10.8 feet
Max Velocity	1.1 feet/sec

Henrys Fork below Falls River November 2002.

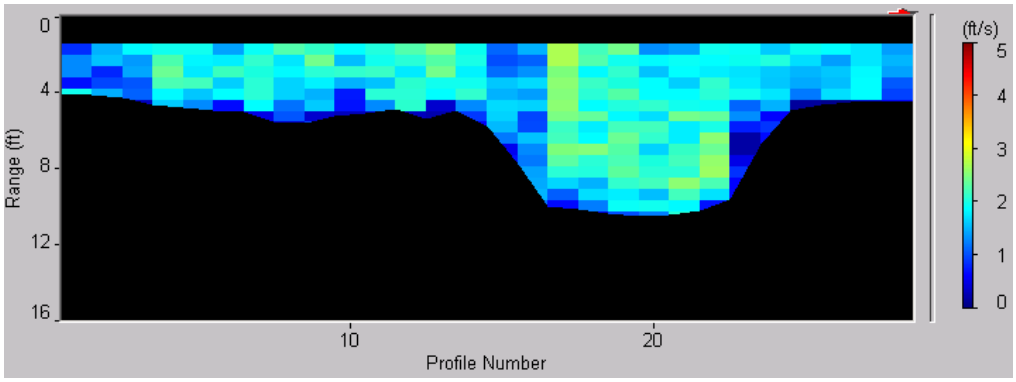


Henrys Fork below Falls River above diversion dam April 2002.

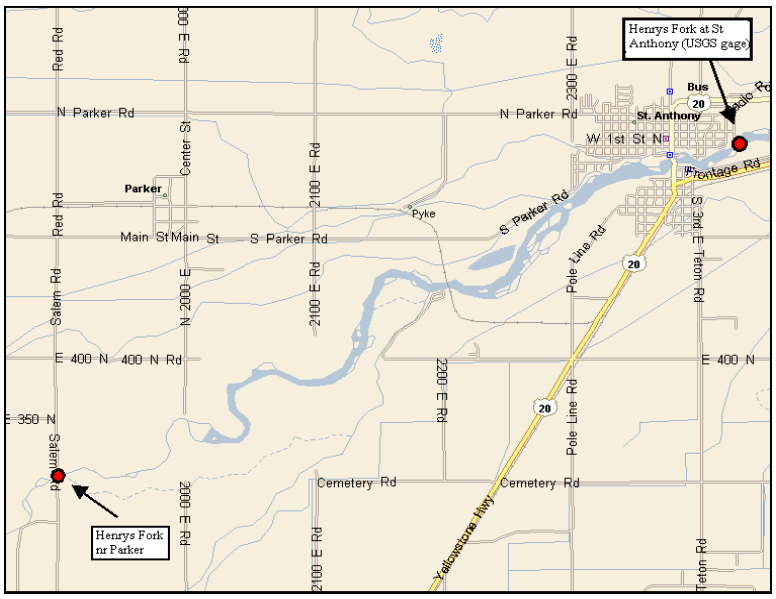
Henrys Fork near Twin Groves

HF near Twin Groves
April 2002

Latitude	43º58'59"	Channel Width	140 feet
Longitude	111º37'25"	Max Depth	10.6 feet
Discharge	1,140 cfs	Max Velocity	3.4 feet/sec



Henrys Fork near Twin Groves April 2002.

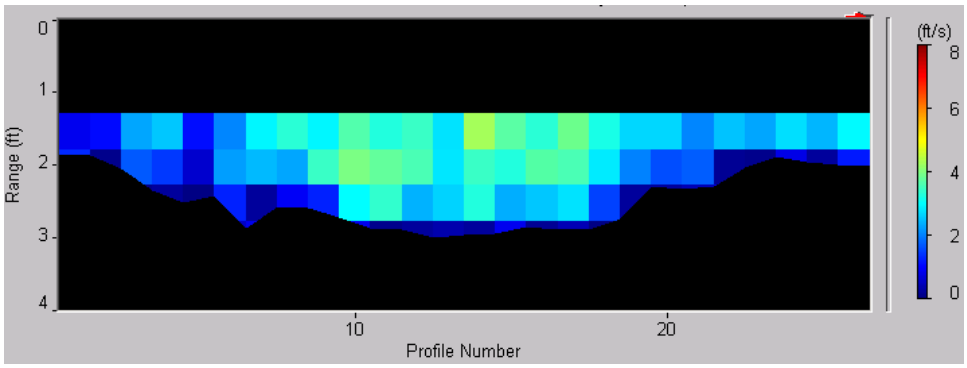


Henrys Fork at St Anthony (USGS gage)

Access: Walk down through clearing to cable way on the right bank in St Anthony.

St Anthony (USGS gage)
July 2002

Latitude	43º58'01"
Longitude	111º40'21"
Discharge	1,570 cfs
Channel Width	210 feet
Max Depth	3.0 feet
Max Velocity	3.9 feet/sec

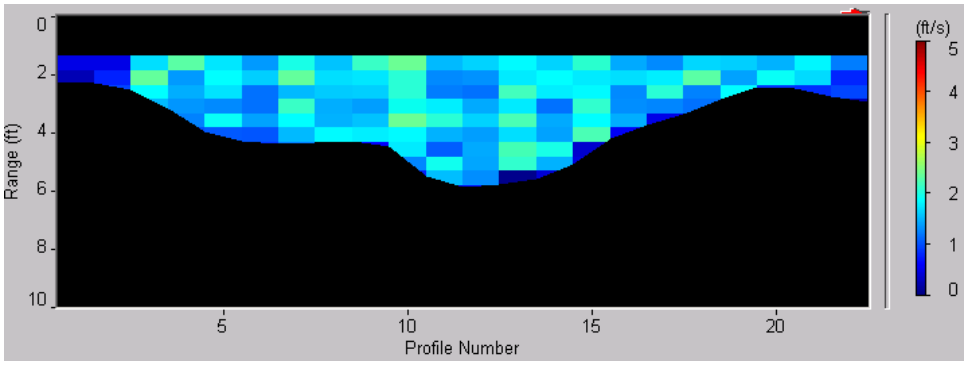


Henrys Fork near St Anthony (USGS gage) July 2002.

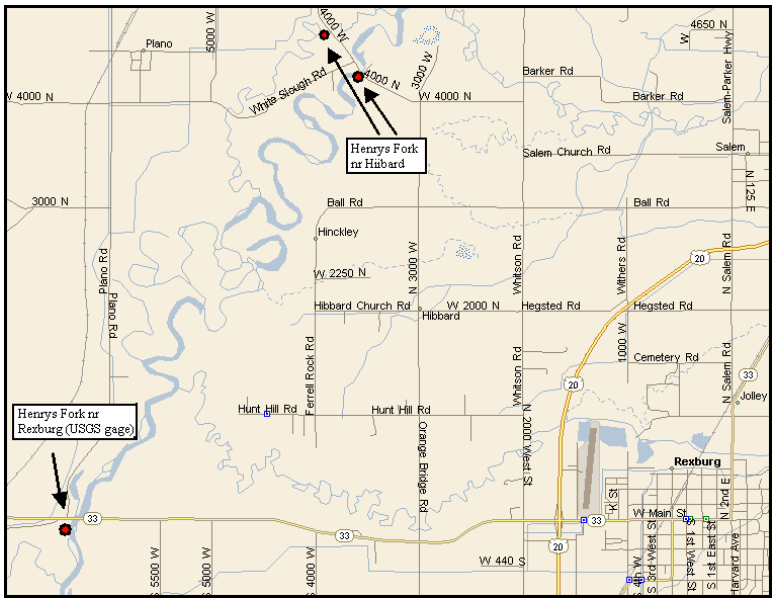
Henrys Fork near Parker

HF near Parker
November 2001

Latitude	43º55'39"	Channel Width	140 feet
Longitude	111º46'37"	Max Depth	5.9 feet
Discharge	1,000 cfs	Max Velocity	2.1 feet/sec



Henrys Fork near Parker October 2001.



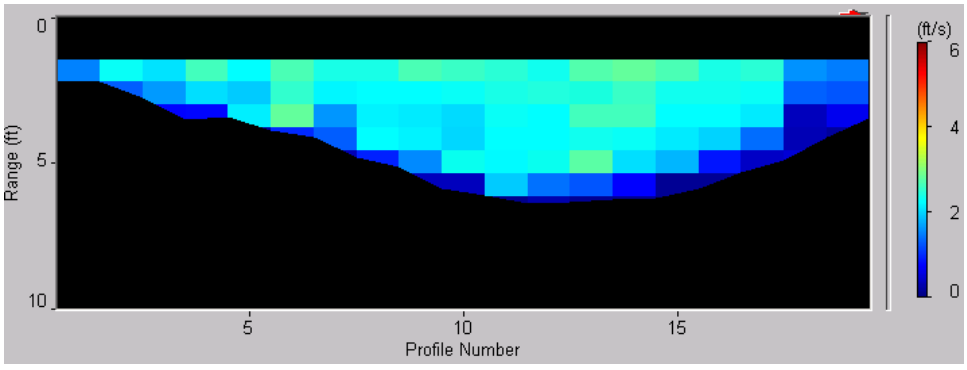
Henrys Fork near Hibbard November 2002.

Henrys Fork near Hibbard

Access: On right bank downstream of W4000N road crossing. Note: There is a second channel to the northwest that can be waded downstream of the W4000N crossing.

HF near Hibbard
November 2002

Latitude	43º53'16"
Longitude	111º50'57"
Discharge	1,280 cfs
Channel Width	110 feet
Max Depth	6.4 feet
Max Velocity	2.6 feet/sec

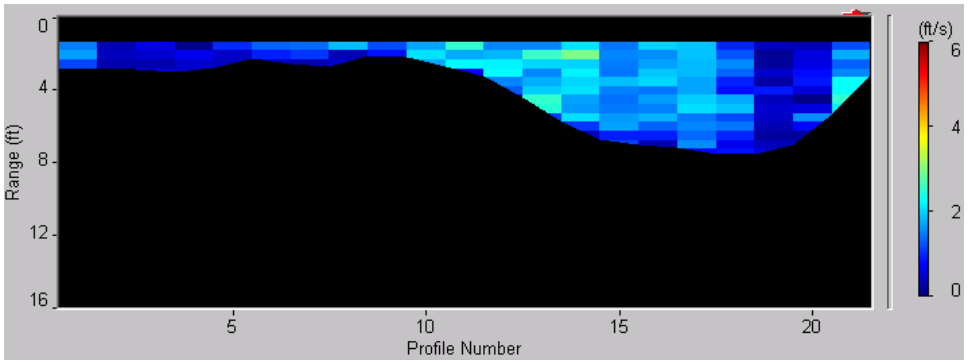


Henrys Fork near Hibbard November 2002.

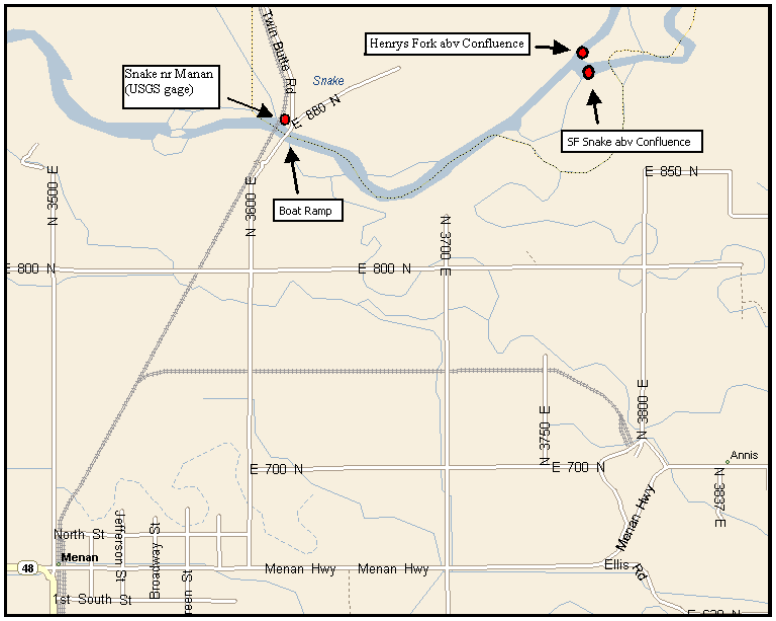
Henrys Fork near Rexburg (USGS gage)

Access: On the right bank downstream of the highway 33 crossing.

Rexburg (USGS gage) July 2002				
	Latitude	43º49'33"	Channel Width	170 feet
	Longitude	111º54'18"	Max Depth	7.6 feet
	Discharge	1,110 cfs	Max Velocity	2.1 feet/sec



Henrys Fork near Rexburg (USGS gage) July 2002.



Snake River near Menan (USGS gage)

Access: On the right bank upstream of the Twin Butte Road crossing.

Menan (USGS gage)	
Latitude	43º45'10"
Longitude	111º58'45"

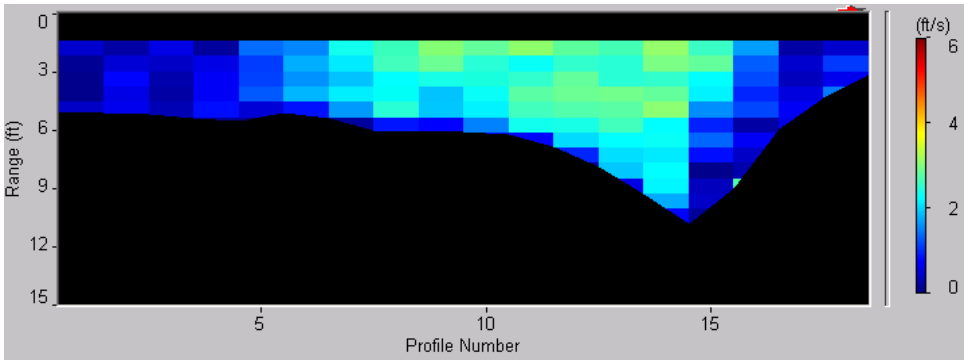
Henrys Fork above the Confluence

Access: Boat ramp on the left bank upstream of the Twin Butte Road crossing. Proceed up river approximately 2 miles to the confluence.

Henrys Fork above Confluence November 2002.

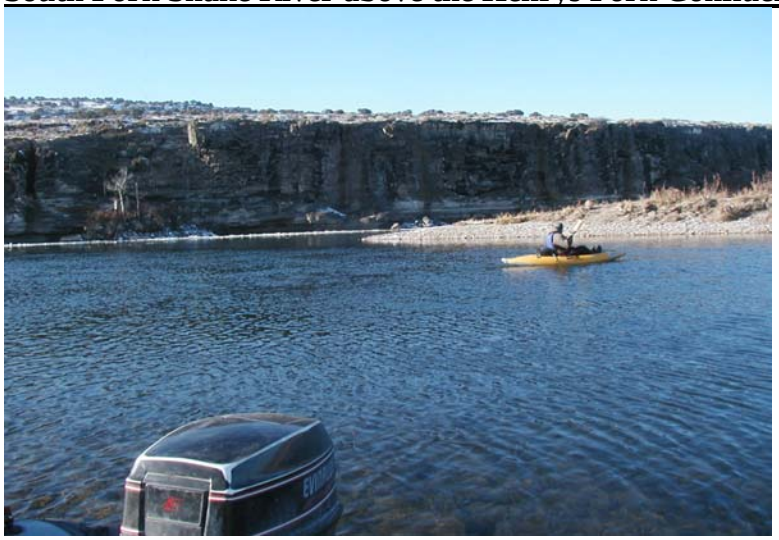
HF above Confluence
November 2002

Latitude	43º45'30"
Longitude	111º56'55"
Discharge	1,370 cfs
Channel Width	105 feet
Max Depth	10.8 feet
Max Velocity	2.6 feet/sec



Henrys Fork above Confluence November 2002.

South Fork Snake River above the Henrys Fork Confluence

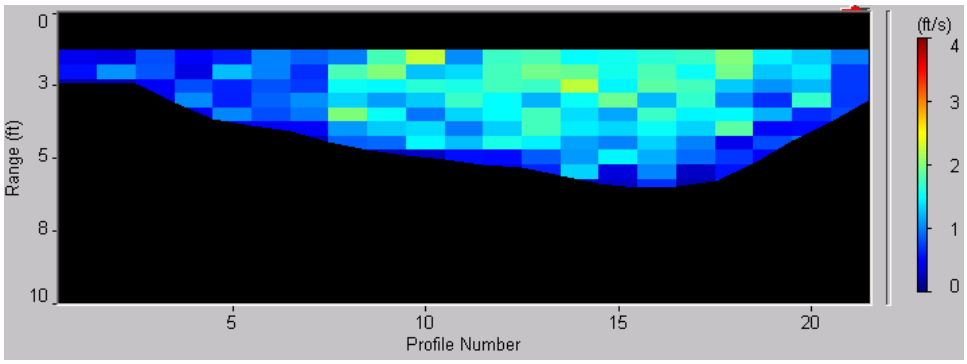


South Fork Snake River above Confluence November 2002.

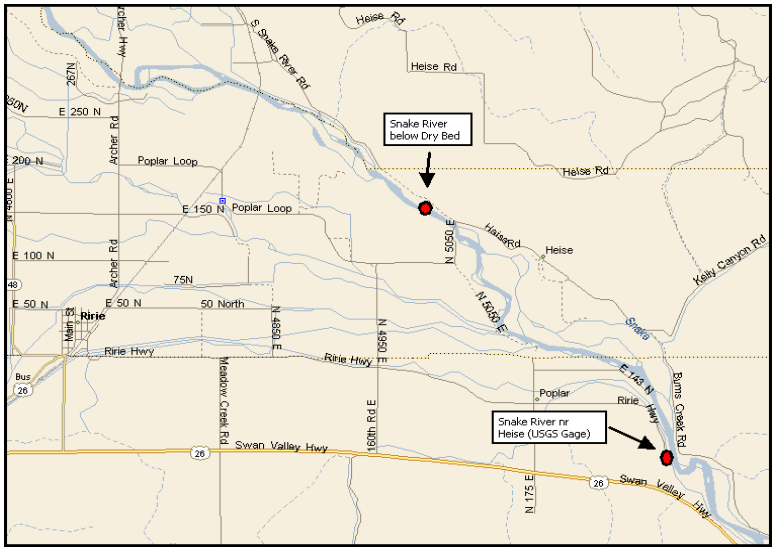
Access: Boat ramp on the left bank upstream of the Twin Butte Road crossing. Proceed up river approximately 2 miles to the confluence.

SF above Confluence
November 2002

Latitude	43º45'24"
Longitude	111º56'52"
Discharge	614 cfs
Channel Width	100 feet
Max Depth	6.0 feet
Max Velocity	1.7 feet



South Fork Snake River above Confluence November 2002.



Snake River near Heise (USGS gage)

Access: On the left bank, along Ririe highway, 850 feet upstream of the Anderson Canal headgate.

Heise (USGS gage)

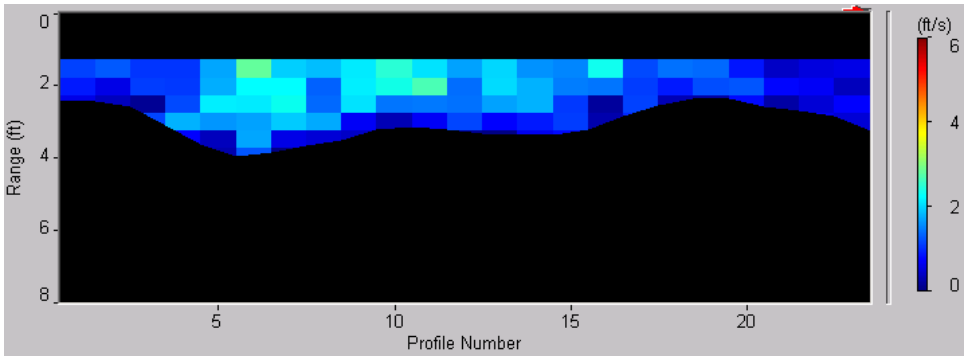
Latitude	43º36'45"
Longitude	111º39'36"

Snake River below Dry Bed Diversion

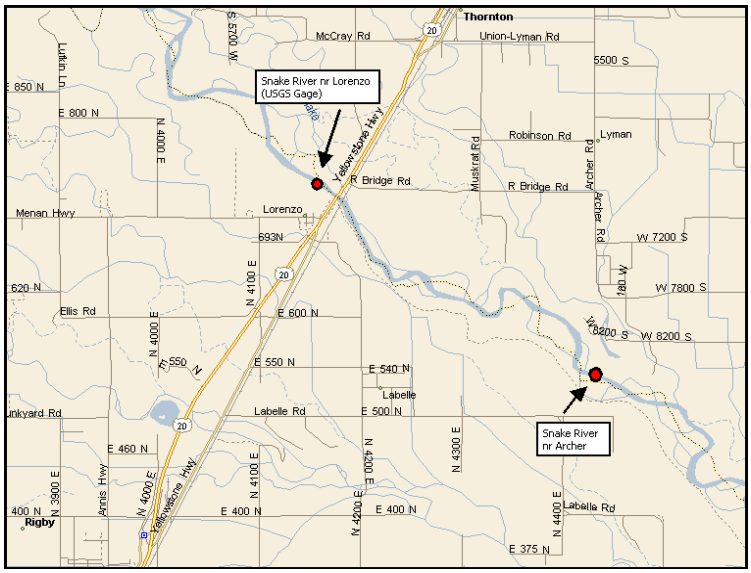
Access: From dirt road on right bank .25 miles downstream of N5050E crossing.

Snake below Dry Bed
November 2002

Latitude	43º39'04"	Channel Width	175 feet
Longitude	111º42'40"	Max Depth	4.0 feet
Discharge	856 cfs	Max Velocity	2.2 feet/sec



Snake River below Dry Bed November 2002.



Snake River near Archer

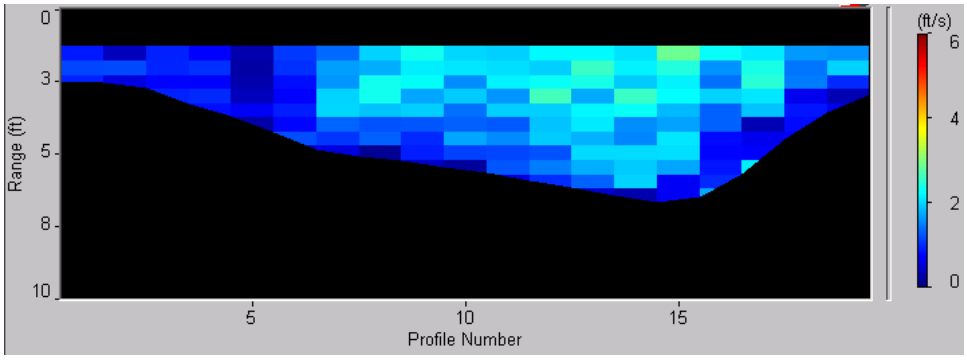
Access: Proceed onto dirt road (W8200S) over Reid Canal and through gate (always open), left at pump (crossing field) to levee, left (East) on levee for 100 yards & through wire gate to the right (South). This access is through BLM land.

Snake near Archer
November 2002

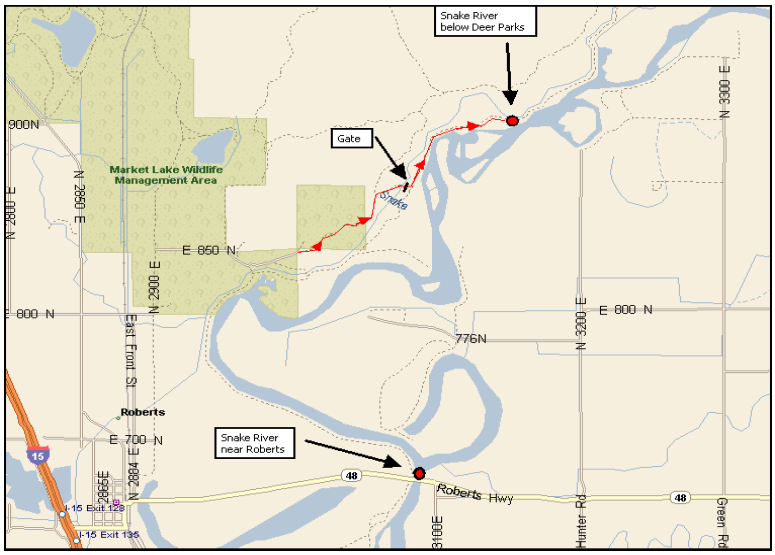
Latitude	43º42'09"
Longitude	111º48'30"
Discharge	641 cfs
Channel Width	90 feet
Max Depth	6.7 feet
Max Velocity	2.2 feet/sec

Snake River near Lorenzo (USGS gage)

Latitude	43º44'07"
Longitude	111º52'41"



Snake River near Archer November 2002.

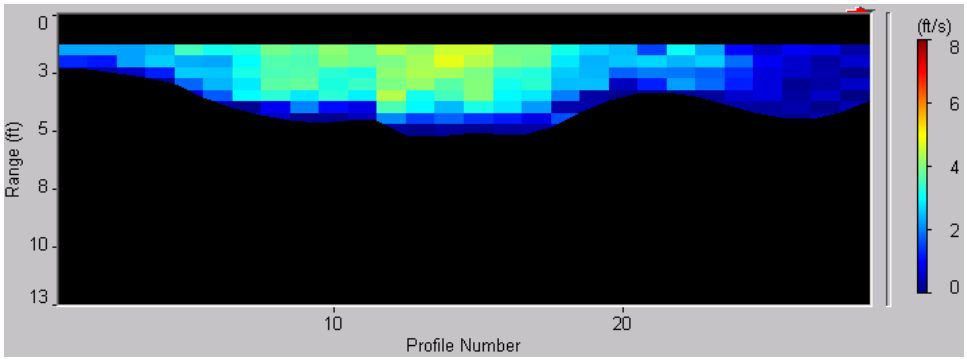


Snake River below Deer Parks

Access: Dirt Road from E850N, There is a chained gate (not locked) near Deer Parks Spillback structure. Access is through private land. Be sure to consult landowner as you pass his ranch. He is friendly.

Snake below Deer Parks
November 2002

Latitude	43º45'50"
Longitude	112º04'14"
Discharge	1,980 cfs
Channel Width	160 feet
Max Depth	5.3 feet
Max Velocity	4.1 feet/sec



Snake River below Deer Parks November 2002

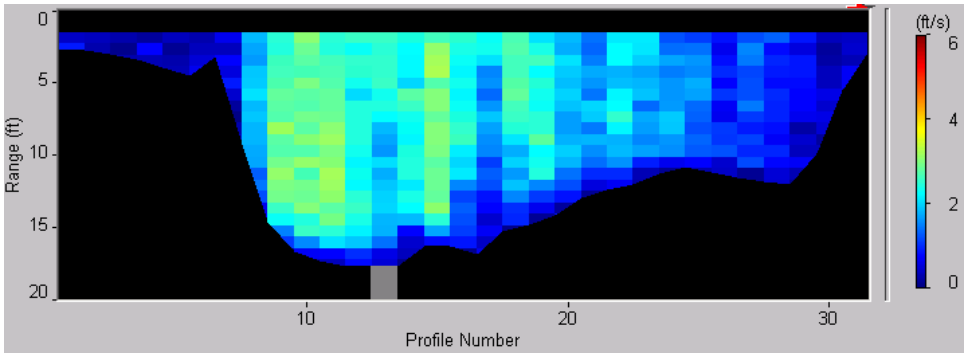
Snake River at Roberts Bridge

Access: Boat landing on the right bank upstream of the Roberts bridge.

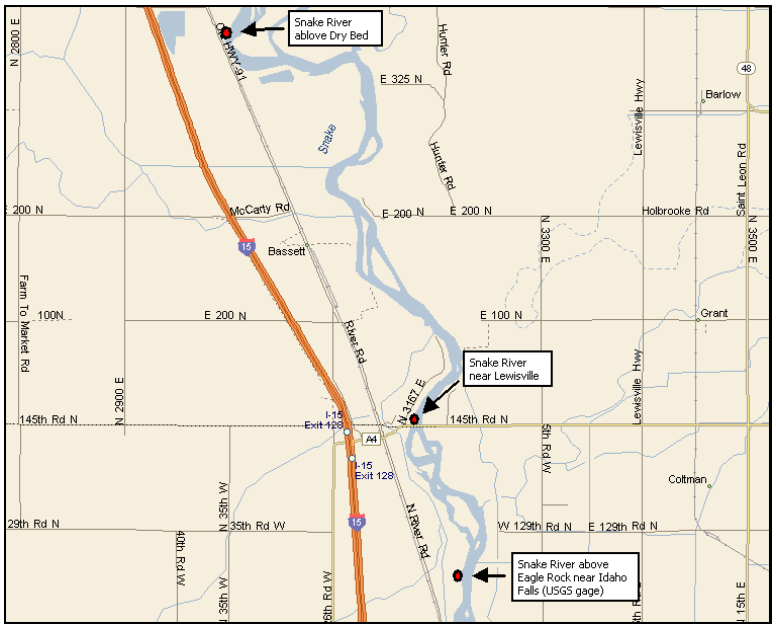

Snake River above Roberts Bridge November 2002.

Snake near Roberts
July 2002

Latitude	43º43'16"
Longitude	112º05'11"
Discharge	8,540 cfs
Channel Width	355 feet
Max Depth	18.0 feet
Max Velocity	3.0 feet



Snake River above Roberts Bridge Summer 2002.



Snake River above Dry Bed

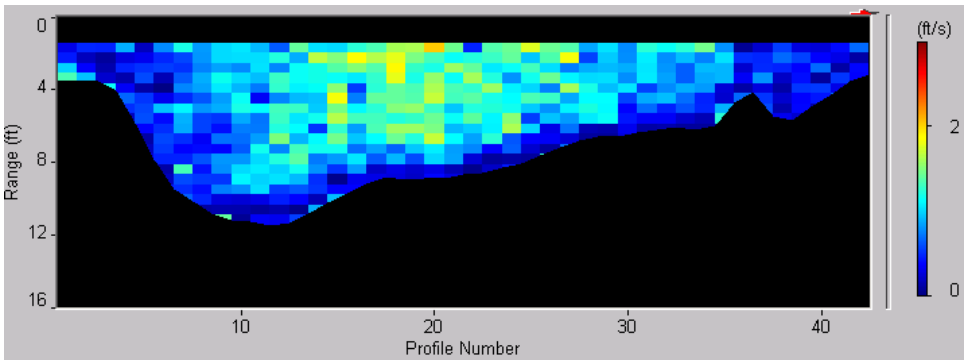
Access: Pull off old Highway 91. Carry equipment over railroad tracks.

Snake above Dry Bed
April 2002

Latitude	43º40'42"
Longitude	112º06'10"
Discharge	2,400 cfs
Channel Width	350 feet
Max Depth	13.3 feet
Max Velocity	2.4 feet/sec

Near Idaho Falls (USGS gage)

Latitude	43º36'17"
Longitude	112º03'31"



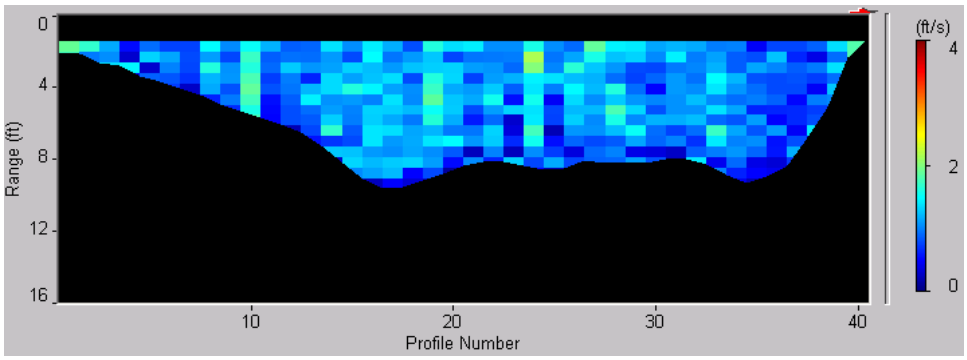
Snake River above Dry Bed Spring 2002.

Snake River near Lewisville

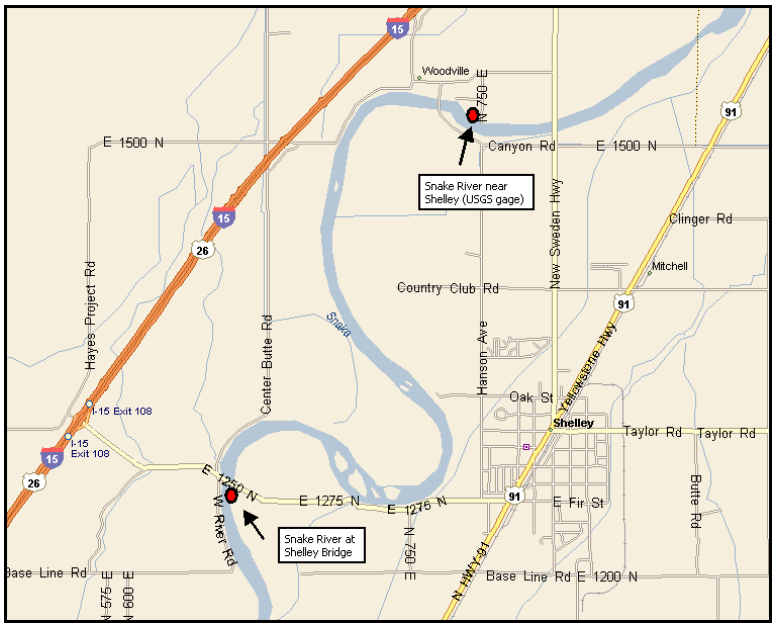
Access: On the right bank upstream of county road bridge crossing.

Snake near Lewisville
November 2001

Latitude	43º37'41"	Channel Width	365 feet
Longitude	112º04'00"	Max Depth	9.6 feet
Discharge	2,210 cfs	Max Velocity	1.6 feet/sec



Snake River near Lewisville Fall 2001.



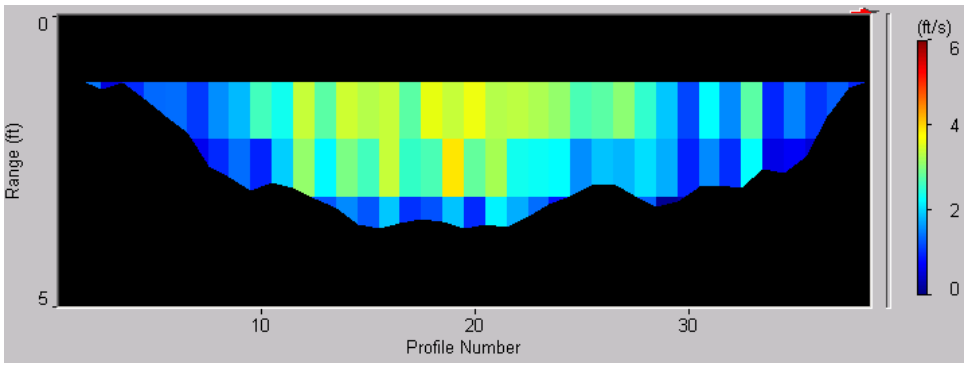
Snake River near Shelley USGS gage Fall 2001.

Snake River near Shelley (USGS gage)

Access: This is on private land. Contact Idaho Falls USGS office if access is required.

Near Shelley (USGS gage)
November 2001

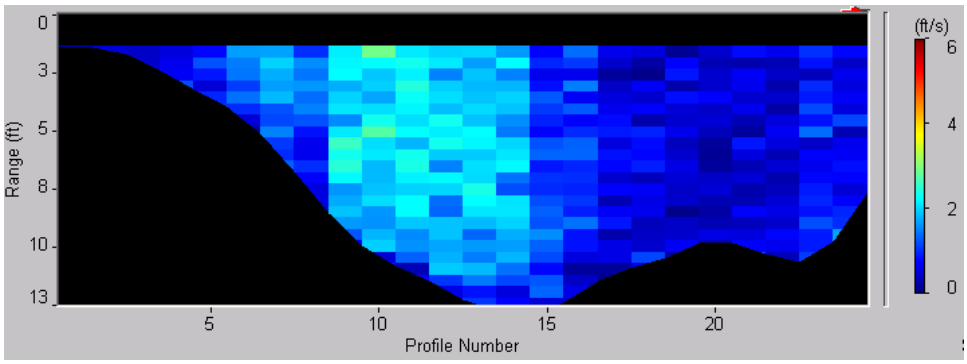
Latitude	43º24'48"
Longitude	112º08'03"
Discharge	1,910 cfs
Channel Width	460 feet
Max Depth	3.7 feet
Max Velocity	3.7 feet/sec



Snake River near Shelley USGS gage Fall 2001.

Snake River at Shelley Bridge

Snake at Shelley Bridge November 2001				
	Latitude	43º22'35"	Channel Width	240 feet
	Longitude	112º10'07"	Max Depth	12.9 feet
	Discharge	2,090 cfs	Max Velocity	2.1 feet/sec



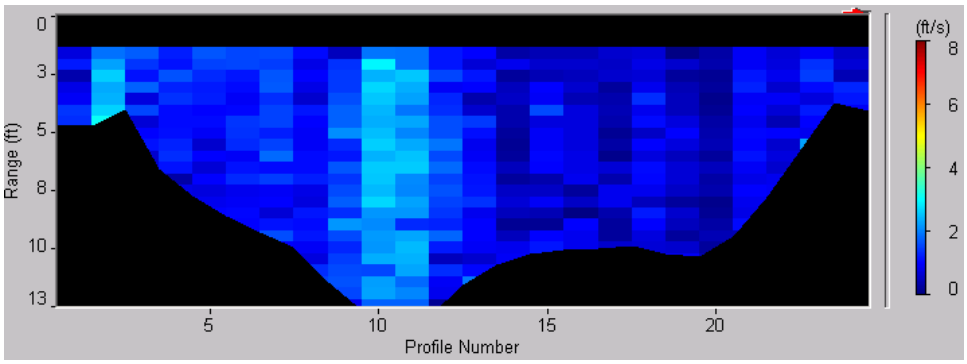
Snake River at Shelley Bridge Fall 2001.

Snake River at Firth Bridge

Access: Downstream of Firth Bridge on left bank.

Snake below Firth Bridge November 2001	
Latitude	43º18'45"
Longitude	112º11'00"
Discharge	1,760 cfs
Channel Width	320 feet
Max Depth	13.3 feet
Max Velocity	2.4 feet/sec

Snake River below Firth Bridge Fall 2001.



Snake River below Firth Bridge Fall 2001.

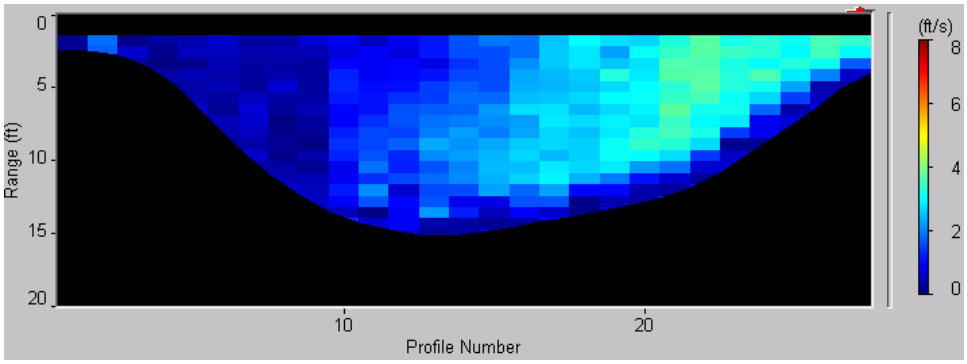

Snake River near Kimball Fall 2001.

Snake River near Kimball

Access: Through Private land at the end of Kennedy Road. Consult documentation for landowner information to arrange access.

Snake near Kimball
November 2002

Latitude	43º16'41"
Longitude	112º13'58"
Discharge	2,310 cfs
Channel Width	150 feet
Max Depth	15.2 feet
Max Velocity	3.4 feet/sec



Snake River near Kimball November 2002.

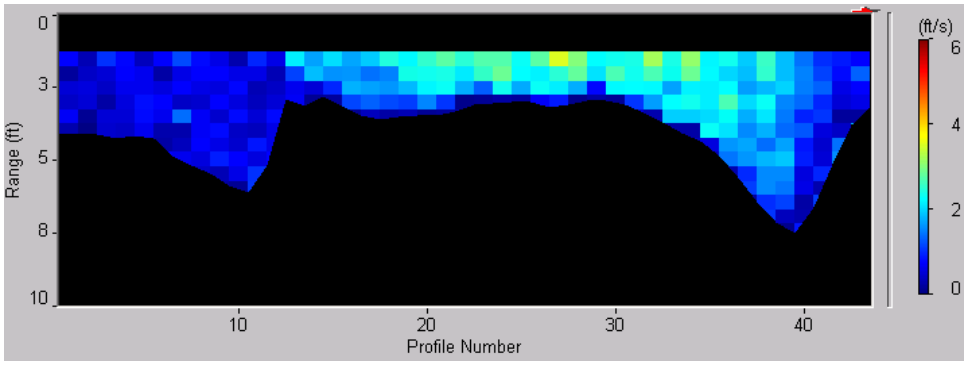
Snake River above Porterville Bridge Fall 2001.

Snake River at Porterville Bridge

Access: Boat ramp on the right bank upstream of Porterville Bridge.

Snake at Porterville Bridge
November 2002

Latitude	43º13'45"
Longitude	112º19'41"
Discharge	2,290 cfs
Channel Width	360 feet
Max Depth	7.5 feet
Max Velocity	2.9 feet/sec



Snake River above Porterville Bridge November 2002.

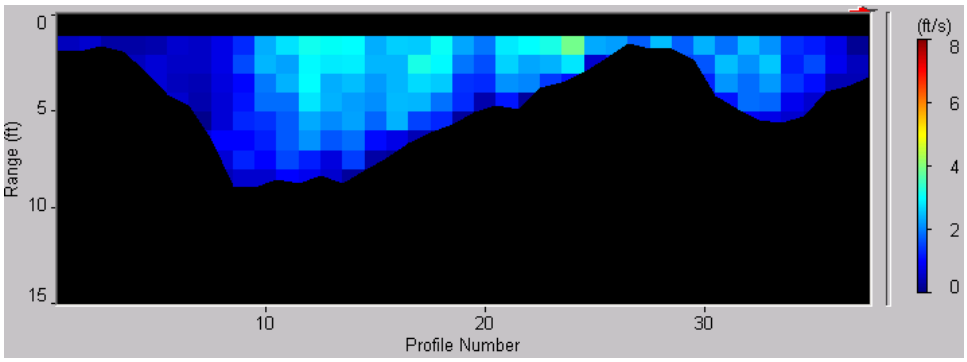
Snake River at Blackfoot (USGS gage)

Access: Between W Bridge Street and train bridge on left bank.

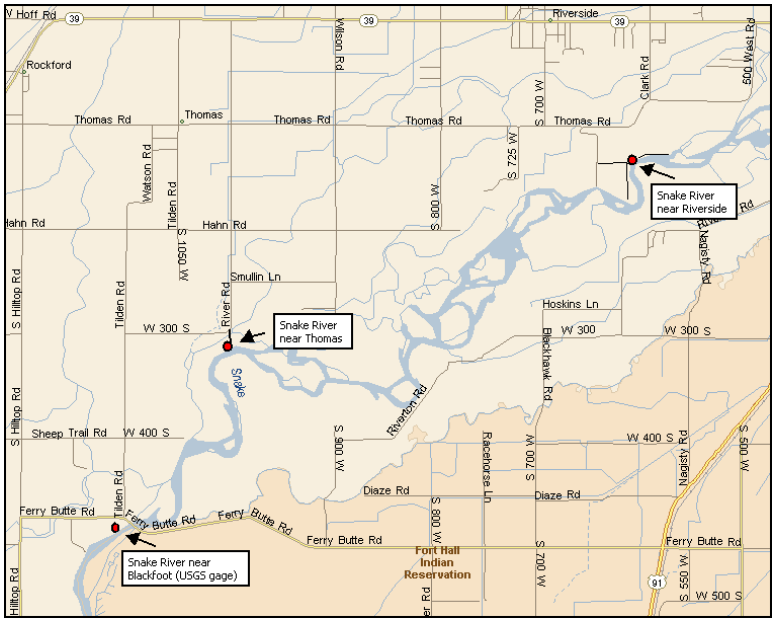
At Blackfoot (USGS gage)
November 2001

Latitude	43º11'51"
Longitude	112º22'09"
Discharge	1,630 cfs
Channel Width	325 feet
Max Depth	9.0 feet
Max Velocity	3.9 feet/sec

Snake River at Blackfoot USGS gage Fall 2001.



Snake River at Blackfoot USGS gage Fall 2001.



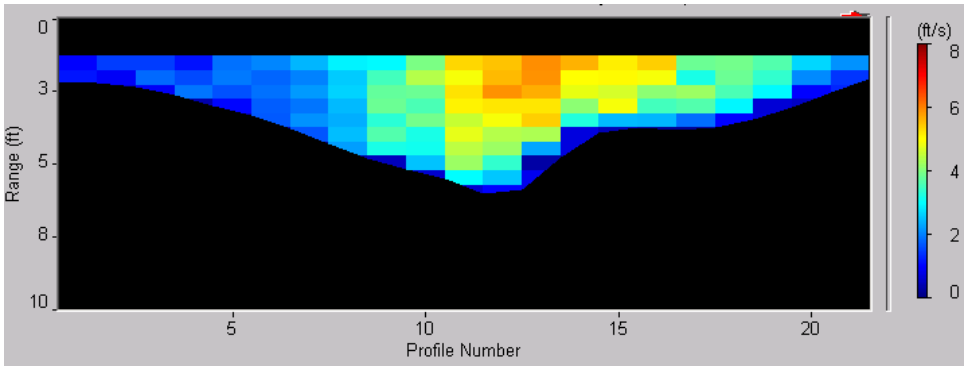
Snake River near Riverside Fall 2001.

Snake river near Riverside

Access: Access is through private land. Consult documentation for landowner information to arrange access.

Snake near Riverside
November 2002

Latitude	43º10'37"
Longitude	112º25'06"
Discharge	2,060 cfs
Channel Width	140 feet
Max Depth	6.0 feet
Max Velocity	4.9 feet/sec



Snake River near Riverside November 2002.

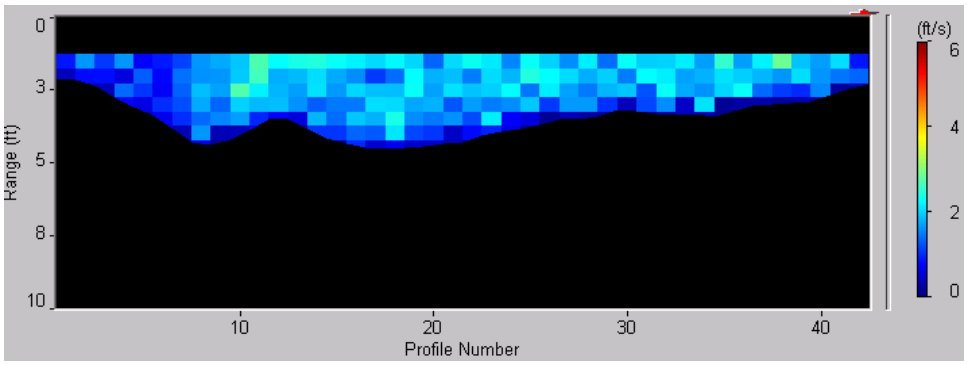
Snake River near Thomas

Access: Dirt boat launch on right bank 3 miles south of Hwy 39.

Snake River near Thomas November 2002.

Snake near Thomas
November 2002

Latitude	43º09'06"
Longitude	112º29'38"
Discharge	2,060 cfs
Channel Width	310 feet
Max Depth	4.6 feet/sec
Max Velocity	2.0 feet/sec



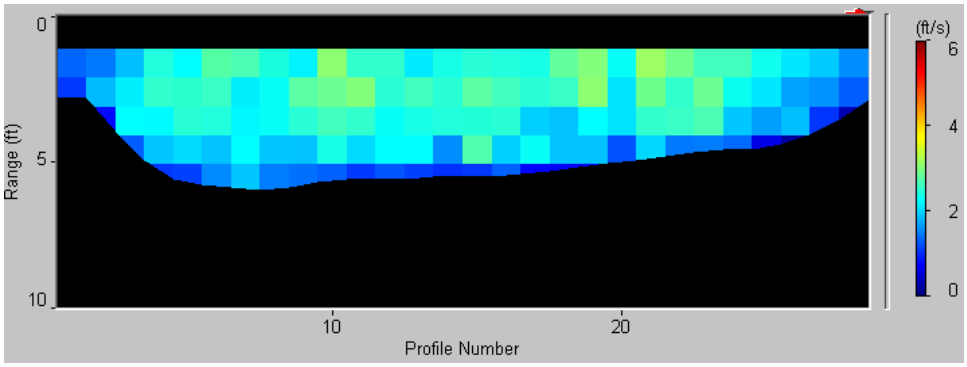
Snake River near Thomas November 2002.

Snake River near Blackfoot (USGS gage)

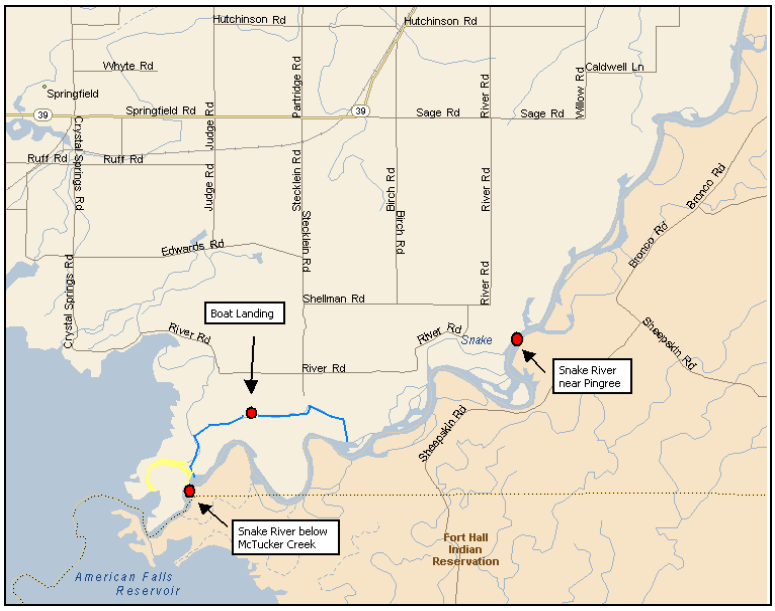
Access: On the right bank downstream of Tilden Bridge.

Nr Blackfoot (USGS gage)
November 2001

Latitude	43º07'31"	Channel Width	260 feet
Longitude	112º31'06"	Max Depth	6.0 feet
Discharge	1,670 cfs	Max Velocity	2.9 feet/sec



Snake River near Blackfoot USGS gage Spring 2001.



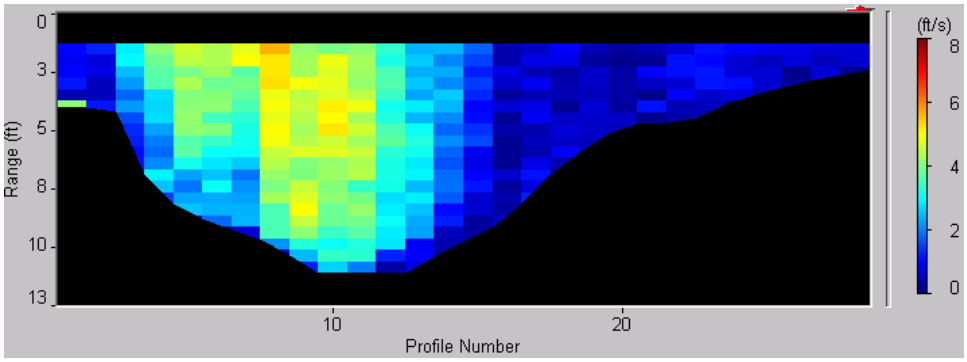
Snake River near Pingree November 2002.

Snake River near Pingree

Access: Either an almost 4 mile boat ride up from McTucker Creek or access through private land on the right bank

Snake near Pingree
November 2002

Latitude	43º03'35"
Longitude	112º34'34"
Discharge	2,430 cfs
Channel Width	135 feet
Max Depth	11.9 feet
Max Velocity	4.6 feet/sec



Snake River near Pingree November 2002.

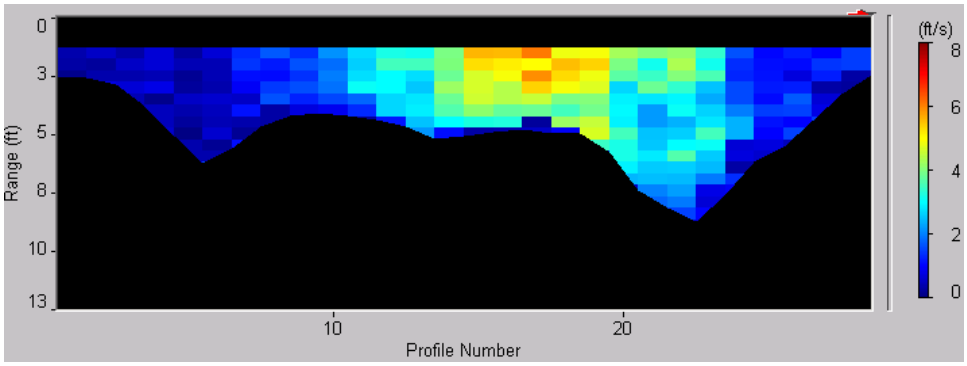
McTucker Creek Boat Landing November 2002.

Snake River below McTucker Creek

Access: Follow Sportsman's access signs from highway 39 just East of Springfield to BLM boat landing (1 mile upstream of Snake River). Navigation can be difficult at low water.

Snake below McTucker Creek
November 2002

Latitude	43º01'24"
Longitude	112º39'25"
Discharge	2,550 cfs
Channel Width	175 feet
Max Depth	8.8 feet
Max Velocity	5.1 feet/sec



Snake River below McTucker Creek November 2002.

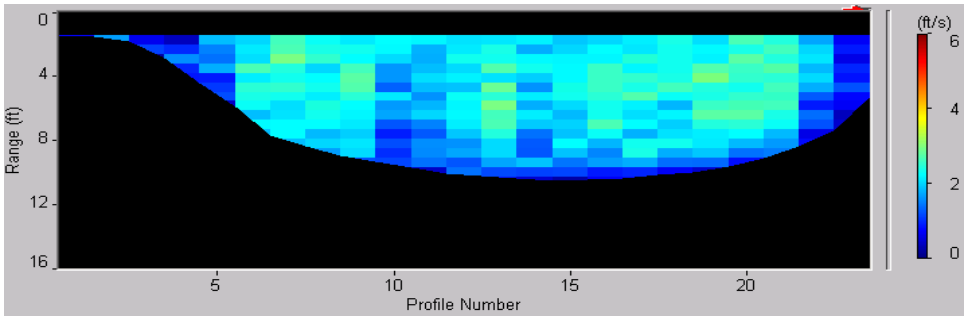
Snake River 12 miles above American Falls Dam

Access: Proceed up to a ½ mile to the North from the end of Beach Road. If the reservoir is low enough, the original river channel is exposed within 200 yards of the road.

Snake 12 miles above
American Falls Dam
November 2001

Latitude	42º55'43"
Longitude	112º45'41"
Discharge	2,580 cfs
Channel Width	150 feet
Max Depth	10.5 feet
Max Velocity	2.5 feet/sec

Snake River 12 miles above American Falls Dam Fall 2001.

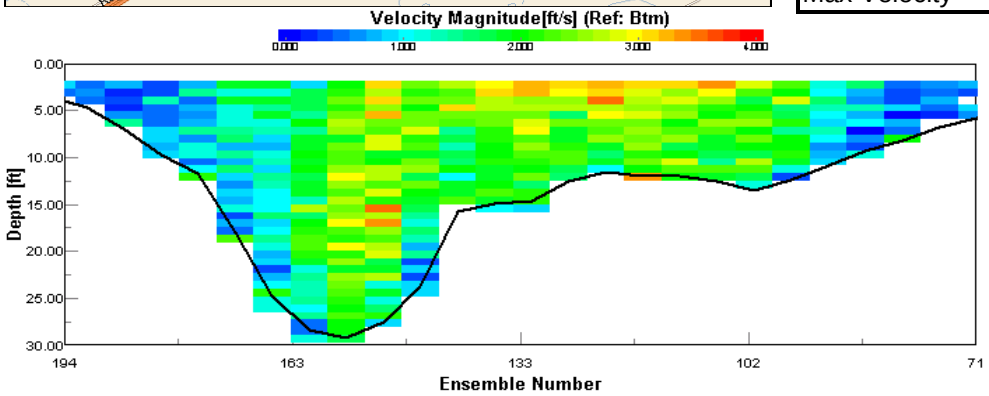


Snake River 12 miles above American Falls Dam Fall 2001.

Snake River near Neeley (USGS gage)

Neeley (USGS gage)

Latitude	42º46'03"
Longitude	112º52'46"



Snake River near Massacre Rocks July 2002.

Snake River near Massacre Rocks

Access: 2 to 3 mile boat ride upstream from Register Rock boat launch.

Snake near Massacre Rocks
July 2002

Latitude	42º41'05"
Longitude	112º58'47"
Discharge	10,300 cfs
Channel Width	330 feet
Max Depth	31.6 feet
Max Velocity	2.5 feet/sec

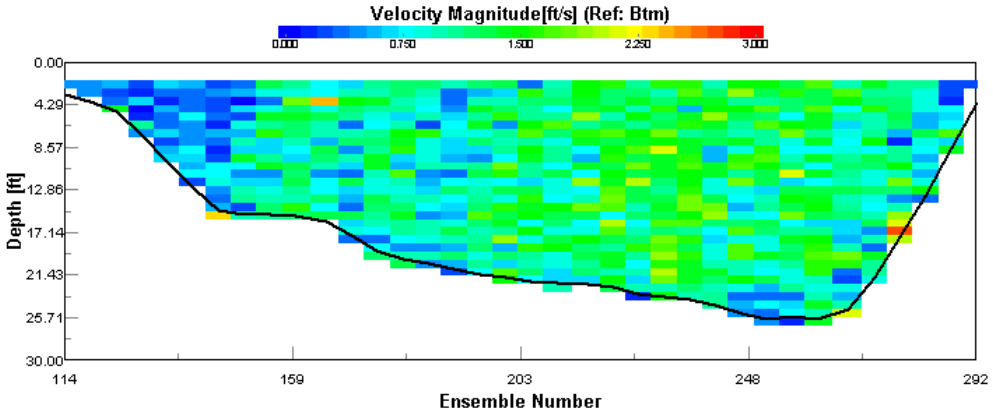
Snake River near Register Rocks November 2002.

Snake River at Register Rock

Access: Register Rock boat launch on left bank. Take Freeway exit 28.

Snake near Register Rock
July 2002

Latitude	42º39'39"
Longitude	113º00'09"
Discharge	10,300 cfs
Channel Width	510 feet
Max Depth	28.1 feet
Max Velocity	1.5 feet/sec



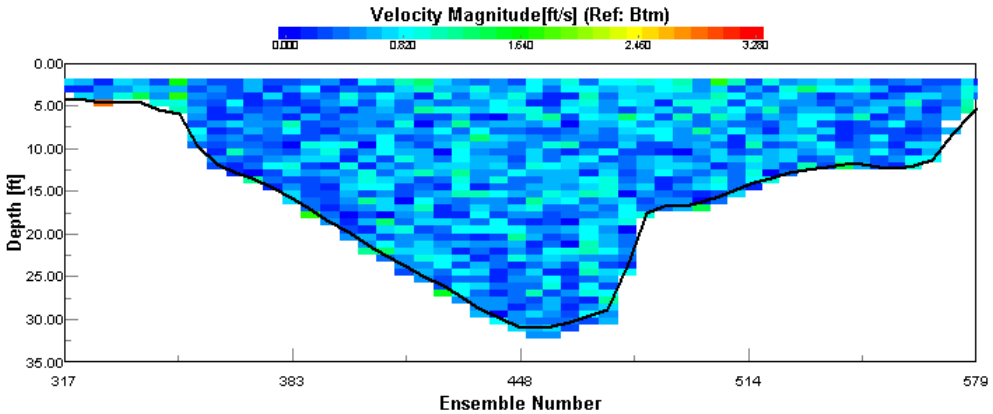
Snake River near Register Rocks July 2002.

Snake River above Raft River

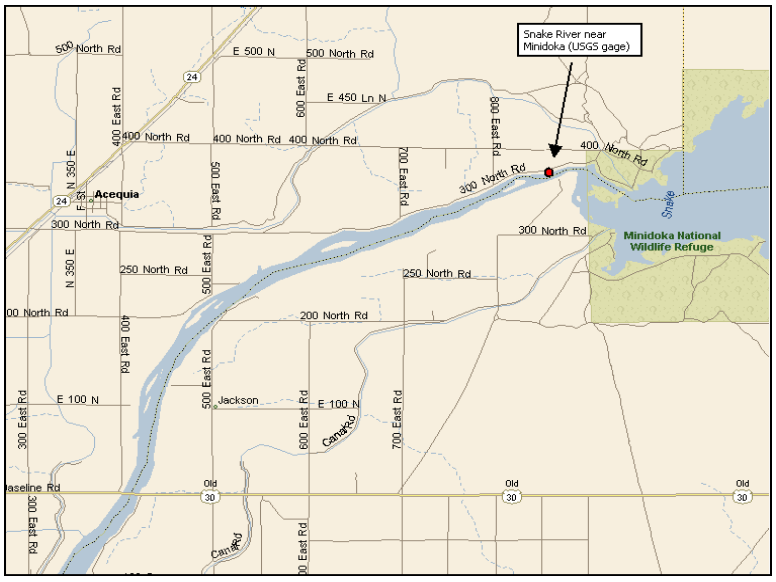
Access: Freeway exit 15 and follow Sportsman's access signs to a boat launch.

Snake above Raft River
July 2002

Latitude	42º37'31"
Longitude	113º14'12"
Discharge	10,400 cfs
Channel Width	1,430 feet
Max Depth	33.6 feet
Max Velocity	0.65 feet/sec



Snake River above Raft River July 2002.



Snake River near Minidoka (USGS gage)

Minidoka (USGS gage)

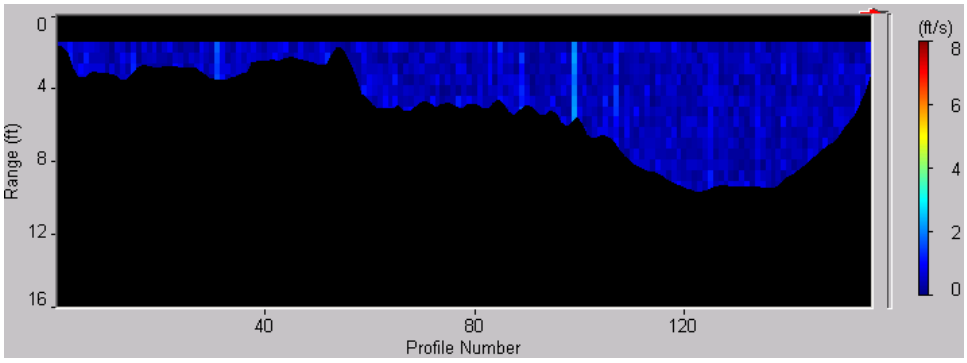
Latitude	42º40'23"
Longitude	113º29'58"

Snake River near Rupert

Access: Boat launch ¼ mile downstream of highway 77 on the right bank. Measure upstream of highway 77 bridge.

Snake near Rupert
April 2002

Latitude	42º34'58"
Longitude	113º37'28"
Discharge	590 cfs
Channel Width	960 feet
Max Depth	9.5 feet
Max Velocity	0.48 feet/sec

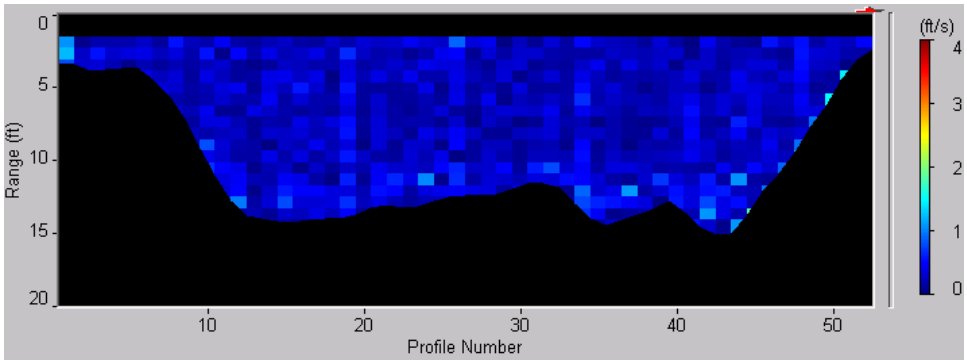


Snake River near Rupert April 2002.

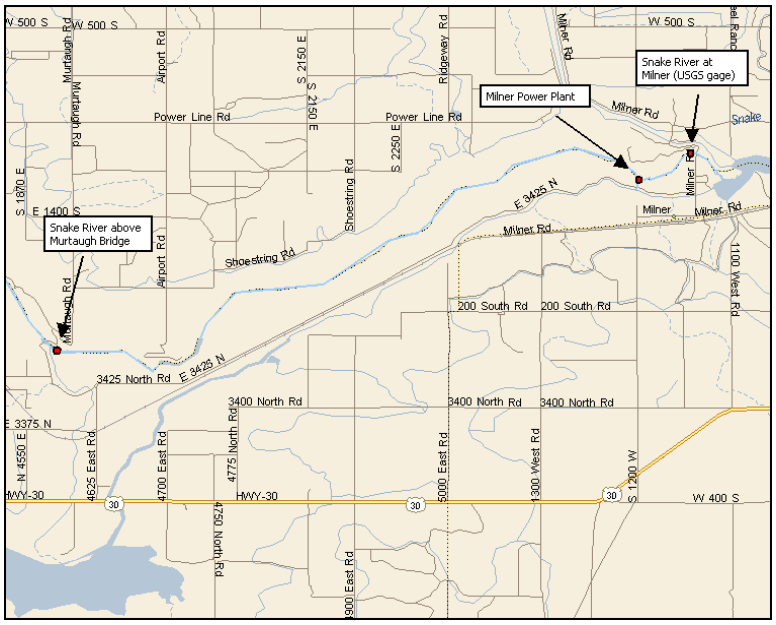
Snake River at Burley

Access: Pull-out under railroad bridge on right bank .1 mile downstream of highway 30.

Snake at Burley April 2002				
	Latitude	42º32'56"	Channel Width	620 feet
	Longitude	113º45'52"	Max Depth	16.2 feet
	Discharge	600 cfs	Max Velocity	0.3 feet/sec



Snake River at Burley April 2002.



Snake River near Milner

Lower Milner Power Plant

Latitude	42º31'29"
Longitude	114º01'46"

Milner Bypass (USGS gage)

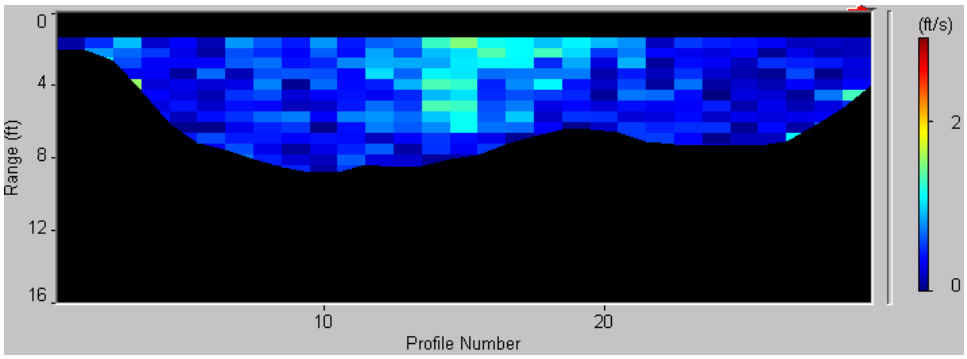
Latitude	42º31'41"
Longitude	114º01'04"

Snake River above Murtaugh Bridge

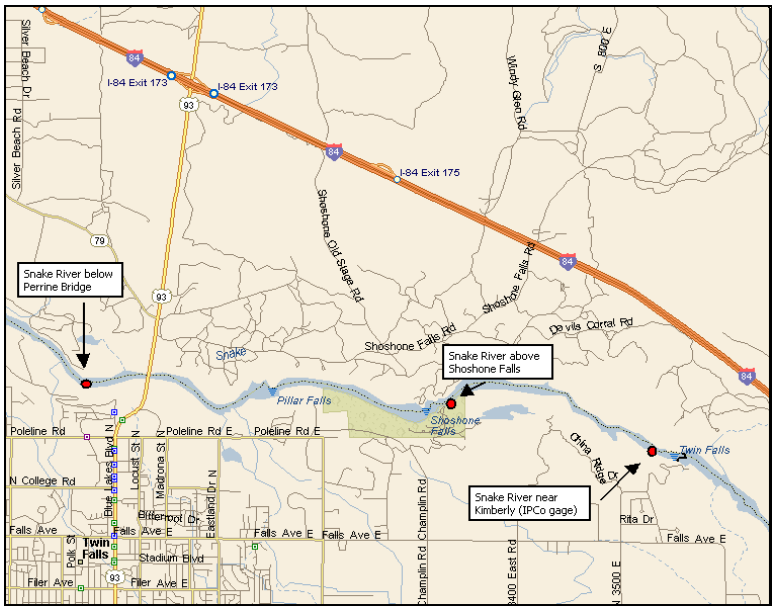
Snake above Murtaugh Bridge
November 2002

Latitude	42º29'57"
Longitude	114º09'10"
Discharge	480 cfs
Channel Width	145 feet
Max Depth	8.9 feet
Max Velocity	1.2 feet/sec

Access: Dirt Pull-out on right bank .1 mile upstream of murtaugh bridge.



Snake River above Murtaugh Bridge November 2002.

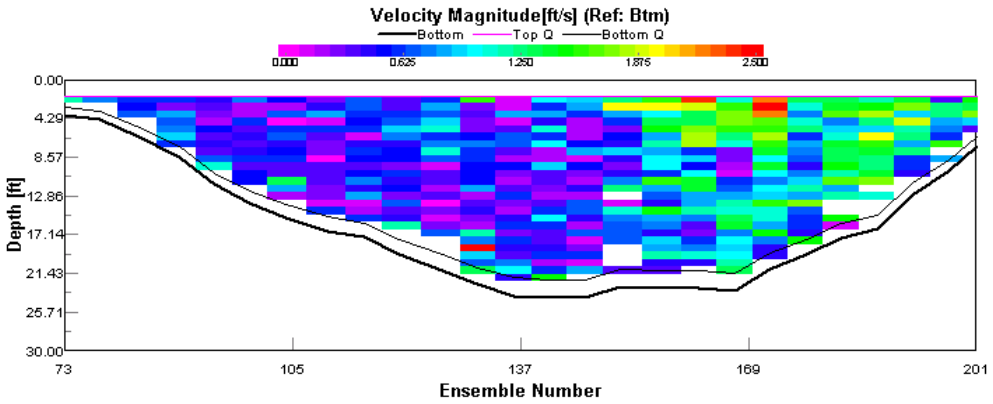


Snake River near Kimberly (IPCo gage)

Access: Twin Falls Power Plant private road on left bank. Contact IPCo to arrange access.

Kimberly (IPCo gage)
November 2002

Latitude	42º35'28"
Longitude	114º21'34"
Discharge	770 cfs
Channel Width	127 feet
Max Depth	24.0 feet
Max Velocity	1.4 feet/sec



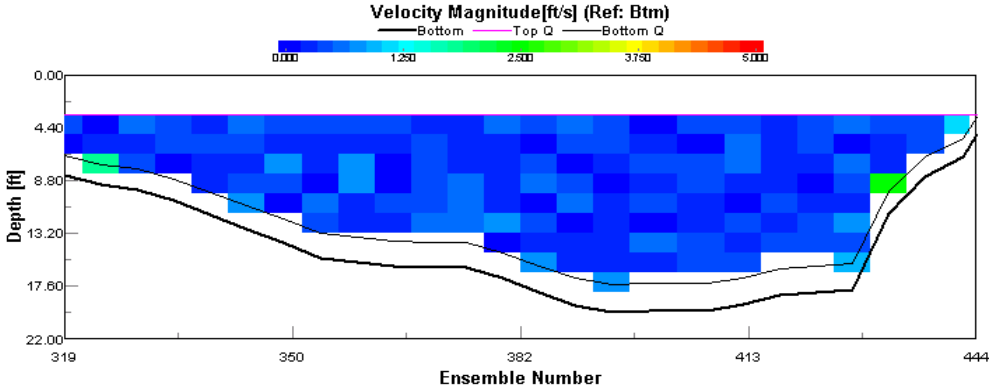
Snake River near Kimberly IPCo gage November 2002.

Snake River above Shoshone Falls

Access: Through Shoshone Falls municipal park (entry fee may apply). Proceed to boat landing.

Snake abv Shoshone Falls
April 2001

Latitude	42º35'57"	Channel Width	475 feet
Longitude	114º23'39"	Max Depth	19.7 feet
Discharge	890 cfs	Max Velocity	0.35 feet/sec



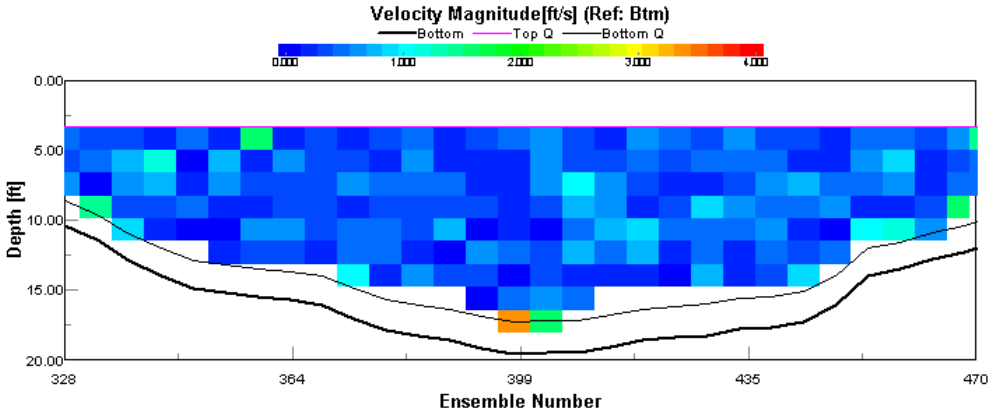
Snake River above Shoshone Falls Spring 2001.

Snake River below Perrine Bridge

Access: Boat landing in Centennial Waterfront Park on left bank.

Snake blw Perrine Bridge
April 2001

Latitude	42º36'05"	Channel Width	300 feet
Longitude	114º28'07"	Max Depth	19.5 feet
Discharge	950 cfs	Max Velocity	0.47 feet/sec



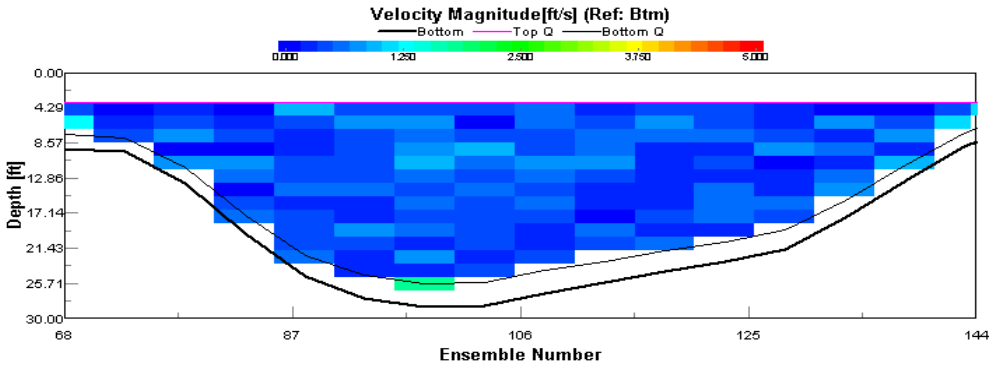
Snake River below Perrine Bridge Spring 2001.

Snake River above Crystal Springs

Access: Boat launch at fish hatchery on left bank 1 mile upstream of Cedar Draw mouth. Proceed upstream to a point above Crystal Springs (on right bank

Snake above Crystal Springs
April 2001

Latitude	42º39'14"
Longitude	114º38'02"
Discharge	1,540 cfs
Channel Width	280 feet
Max Depth	28.5 feet
Max Velocity	0.48 feet/sec



Snake River above Crystal Springs Spring 2001.

Snake River near Buhl (USGS gage)

Buhl (USGS gage)

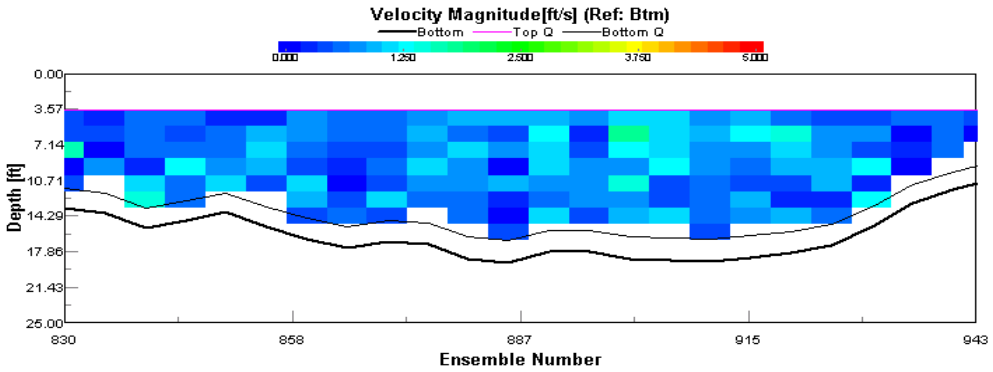
Latitude	42º39'58"
Longitude	114º42'41"

Snake River below Clear Lakes

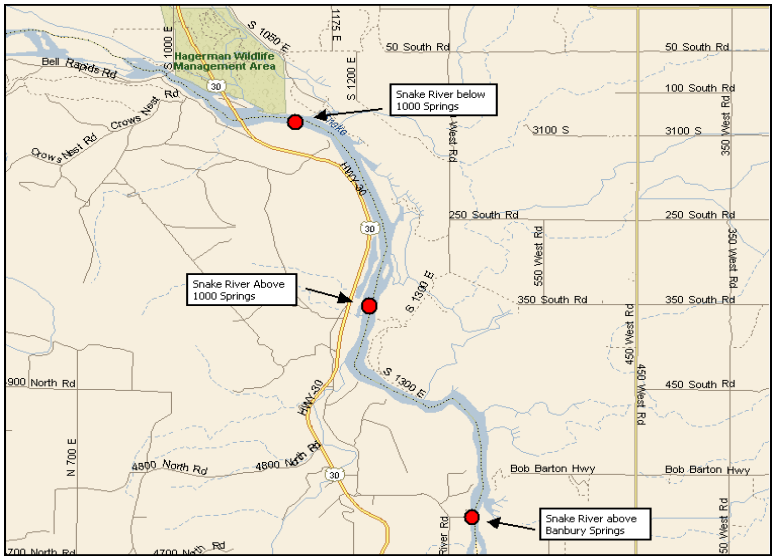
Access: Boat launch on the right bank of the Snake, downstream edge of Clear Lakes mouth.

Snake below Clear Lakes
April 2001

Latitude	42º39'55"	Channel Width	245 feet
Longitude	114º46'58"	Max Depth	18.3 feet
Discharge	2,510 cfs	Max Velocity	1.0 feet/sec



Snake River below Clear Lakes outlet Spring 2001.

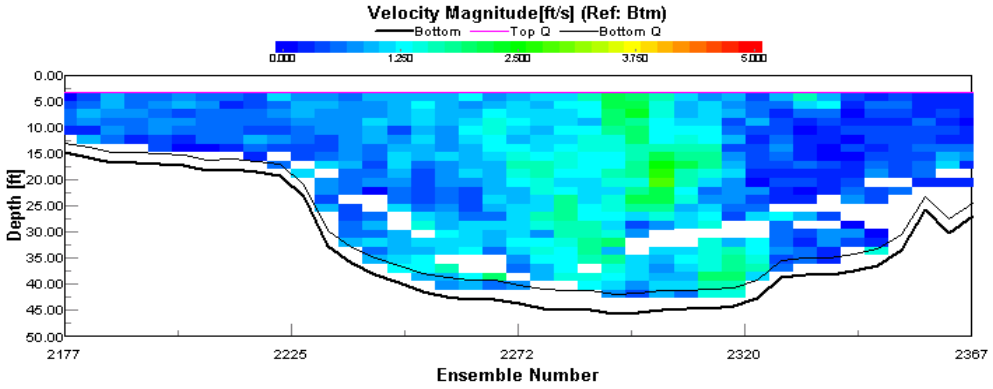


Snake River above Banbury Springs

Access: Private boat launch at Sligars Hot Springs on the left bank across from 1000 Springs (fee may apply)

Snake above Banbury Spring
July 2002

Latitude	42º41'12"
Longitude	114º49'33"
Discharge	2,770 cfs
Channel Width	100 feet
Max Depth	45.6 feet
Max Velocity	1.5 feet/sec

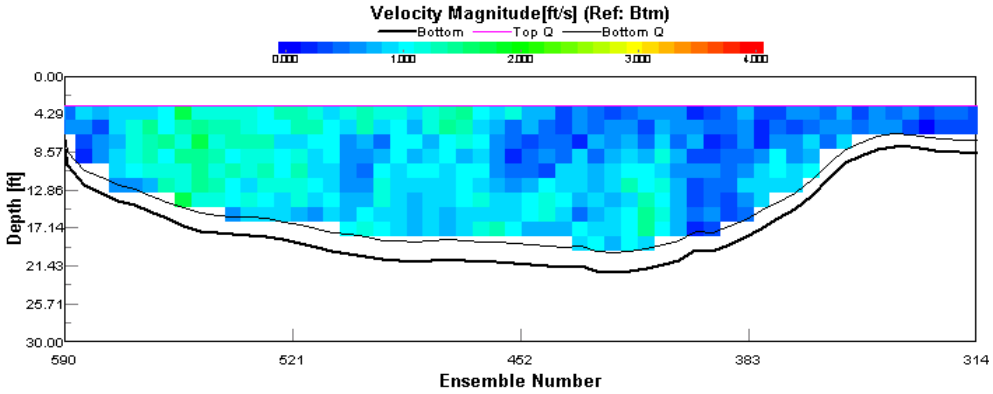


Snake River above Banbury Springs July 2002.

Snake River above Thousand Springs

Access: Private boat launch at Sligars Hot Springs on the left bank across from 1000 Springs (fee may apply).

Snake above 1000 Springs July 2002				
	Latitude	42º43'27"	Channel Width	245 feet
	Longitude	114º50'51"	Max Depth	22.0 feet
	Discharge	3,720 cfs	Max Velocity	1.4 feet/sec

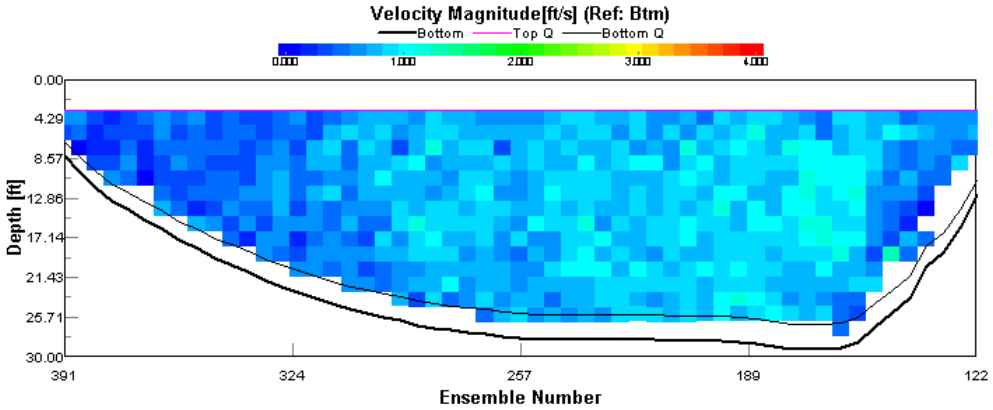


Snake River above thousand Springs July 2002.

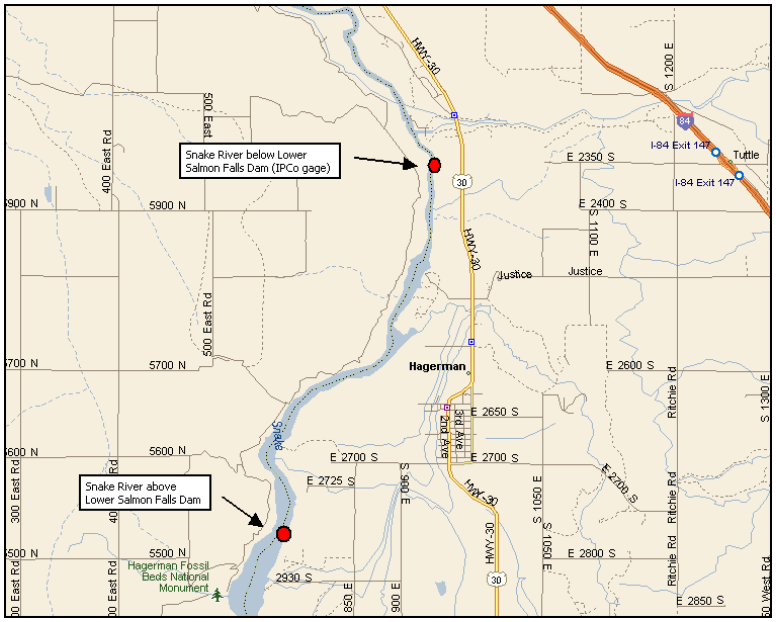
Snake River Below Thousand Springs

Access: Private boat launch at Sligars Hot Springs on the left bank across from 1000 Springs (fee may apply).

Snake below 1000 Springs July 2002				
	Latitude	42º45'25"	Channel Width	275 feet
	Longitude	114º52'08"	Max Depth	28.4 feet
	Discharge	4,710 cfs	Max Velocity	1.0 feet/sec



Snake River below Thousand Springs July 2002.

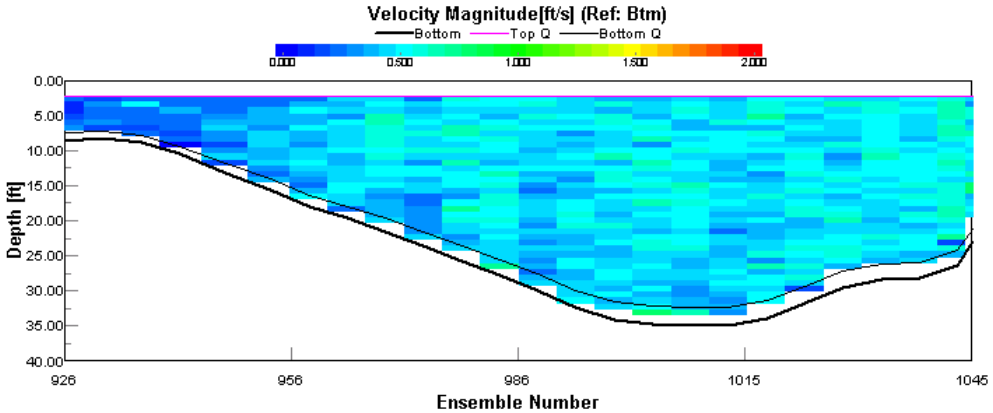


Snake River above Lower Salmon Dam

Access: Bell Rapids Boat Ramp 2 miles SW of Hagerman.

Snake abv Lower Salmon Dam
April 2002

Latitude	42º48'04"
Longitude	114º55'58"
Discharge	5,170 cfs
Channel Width	430 feet
Max Depth	34.8 feet
Max Velocity	0.57 feet/sec

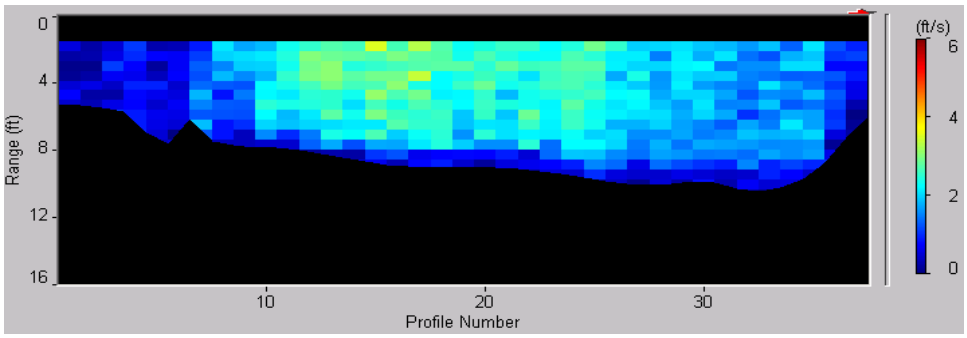


Snake River above Lower Salmon Dam April 2002.

Snake River below Lower Salmon Dam (IPCo gage)

Access: Boat launch on right bank just below Lower Salmon Dam.

Lower Salmon (IPCO gage) April 2002				
	Latitude	42º50'55"	Channel Width	300 feet
	Longitude	114º54'02"	Max Depth	10.4 feet
	Discharge	5,070 cfs	Max Velocity	2.7 feet/sec

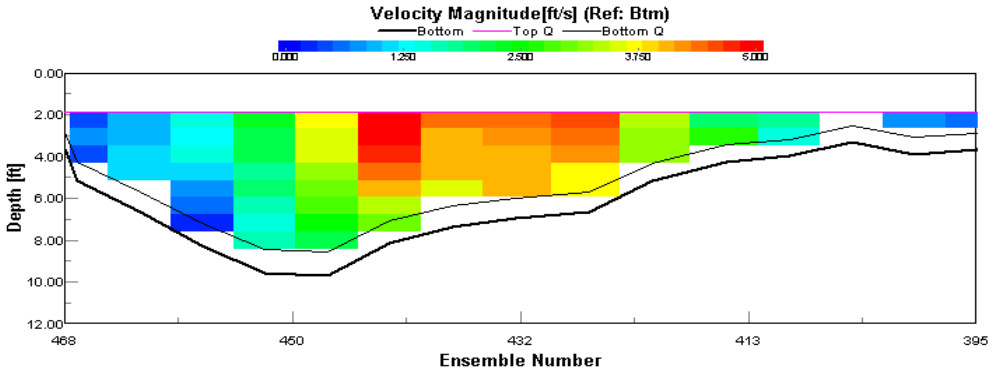


Snake River below Lower Salmon Dam IPCo gage April 2002.

Snake River above Bliss Reservoir

Access: Kayak access just above pumping station on right bank 1 mile below Bliss Shoestring Road river crossing (at the bottom of Bliss Grade).

Snake abv Bliss Reservoir July 2002	
Latitude	42º54'55"
Longitude	114º59'15"
Discharge	6,310 cfs
Channel Width	310 feet
Max Depth	9.7 feet
Max Velocity	4.5 feet/sec



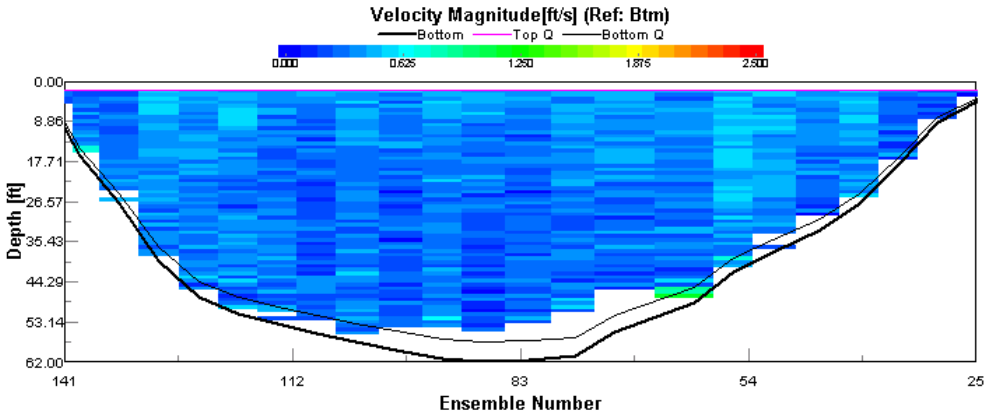
Snake River above Bliss Reservoir July 2002.

Snake River below Bliss Dam (IPCo gage).

Access: Boat landing at park on right bank just above Bliss Dam.

Bliss (IPCO gage)
November 2002

Latitude	42º54'52"	Channel Width	420 feet
Longitude	115º05'33"	Max Depth	61.6 feet
Discharge	5,890 cfs	Max Velocity	4.0 feet/sec



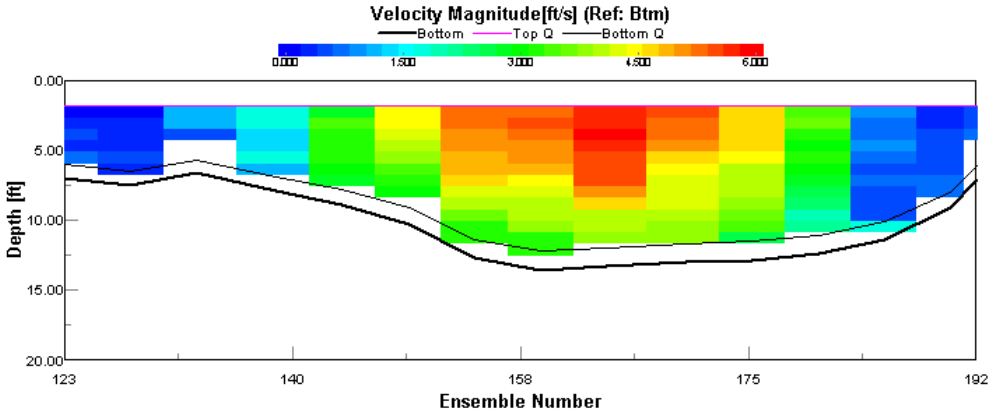
Snake River 100 yards above Bliss Dam November 2002.

Snake River above Bancroft Springs

Access: Dirt boat launch (right at measurement site) on left bank accessed through Paradise Valley Interstate exit.

Snake above Bancroft Springs
July 2002

Latitude	42º55'52"
Longitude	115º09'21"
Discharge	6,310 cfs
Channel Width	100 feet
Max Depth	13.5 feet
Max Velocity	5.1 feet/sec



Snake River above Bancroft Springs July 2002.

Snake River at King Hill (USGS gage)

King Hill (USGS gage)

Latitude	43º00'08"
Longitude	115º12'06"