SOUTH FORK WAGES CREEK STREAMFLOW AND SEDIMENT TRANSPORT MONITORING WY2004-2005

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SOUTH FORK WAGES CREEK

STREAFLOW AND SEDIMENT TRANSPORT MONITORING PROJECT – WATER YEAR 2004-2005

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STREAMFLOW AND SEDIMENT TRANSPORT IN THE SOUTH FORK WAGES CREEK WATERSHED – WY2004 - 2005

1.0 INTRODUCTION

The purpose of this report is to describe the methods and results for streamflow and sediment transport monitoring conducted in the SF Wages Creek Watershed during the 2004 and 2005 water years. The SF Wages Creek watershed is located north of Fort Bragg, in Mendocino County, California (Figure 1, contained in the back of this report). SF Wages is a tributary to Wages Creek, which drains to the Pacific Ocean. SF Wages is located in the headwaters of Wages Creek and encompasses the watershed area above Tank Gulch.

This study was undertaken for the California Board of Forestry and Campbell Timberland Management and is intended to be the baseline data collection in a long-term streamflow and sediment transport monitoring study. This study is one of two components of the SF Wages Creek THP Effectiveness Monitoring Plan.

In Water Year 2004 Streamflow and sediment transport data were collected and analyzed by Graham Matthews and Associates at seven sites throughout the SF Wages Creek watershed (Figure 2, contained in the back of this report). In Water Year 2005 Campbell Timberland Management took over operation and data collection at the sites while Graham Matthews and Associates retained responsibility for computing and analyzing the data.

2.0 SCOPE AND OBJECTIVES

The scope of this project is to provide detailed streamflow and sediment transport data for the major sub-watershed areas in the SF Wages Creek watershed. The work consisted of collecting field data and developing and then completing the following tasks for each sampling site:

1. Install and operate 5 continuous streamflow/sediment transport gages within the SF Wages Creek project area along with 2 manual streamflow stations.
2. Collect streamflow measurements and turbidity/suspended sediment samples,
3. Develop stage/discharge relationships,
4. Develop turbidity/suspended sediment concentration (SSC) relationships,
5. Develop SSC/discharge relationships (Where appropriate),
6. Compute streamflow records, and
7. Compute sediment records

3.0 METHODS

3.1 GAGING STATION ESTABLISHMENT

In Water Year 2004 the gaging network consisted of 5 continuous recording and 2 periodic stations (Table 1). In Water Year 2005 the gaging network consisted of 4 continuous recording stations and 3 periodic stations (Table 2). The continuous recording stations consist of a datalogger, pressure transducer, turbidity probe, as well as a staff plate or fence post, pump sampler, turbidity boom, and a small equipment house. Photos of all the sites can be found in the back of this report.

TABLE 1
SOUTH FORK TENMILE WATERSHED
General Site Description WY2004

SITE NAME	ACRONYM	WSA (mi^2)	Continuous Station
Center Gulch above SF Wages	CASFW	0.29	yes
SF Wages above Center Gulch	SFWAC	1.10	yes
Grey Gulch above SF Wages	GASFW	0.17	no
Wood Creek above SF Wages	WASFW	0.10	yes
SF Wages above Wood Creek	SFWAW	0.73	no
Rock Creek above SF Wages	RASFW	0.24	yes
SF Wages above Rock Creek*	SFWAR	0.39	yes

*Continuous Site does not contain ISCO pump sampler

Dataloggers (Campbell Scientific CR510) and pump samplers (Isco 6712) were installed in steel enclosures to prevent vandalism and to provide a secure area to hold deep cycle batteries (Photo 1, Contained in the back of this report). Cable mounted booms were fabricated and installed to allow the turbidity sensors and pump sampler intakes to sample at the same relative position in the water column during a wide range of stages. In general fabrication and deployment followed the guidelines established by USFS, Pacific Southwest Research Station, Redwood Sciences Lab (Johnston et. al. 2001). A number of the sites required channel improvement at the gage location in order to collect reliable streamflow and turbidity data. At these sites, small weirs were constructed using on-site rock, concrete and/or wood.

3.2 STAGE AND STREAMFLOW MESUREMENT

3.2.1 Stage Measurement

Staff plates were attached to channel iron that was driven into the streambed at 2 of the 7 study sites as stage measuring devices. River stage was measured directly off the staff plate at each of these locations. At the other 5 locations, river stage was measured from the water surface to the top of a fence post using a pocket surveyor's tape. Crest gages were installed at periodic stations, to measure river stage in order to record the peak or maximum river stage during storm events.

TABLE 2
SOUTH FORK TENMILE WATERSHED
General Site Description WY2005

SITE NAME	ACRONYM	WSA (mi^2)	Continuous Station
Center Gulch above SF Wages	CASFW	0.29	yes
SF Wages above Center Gulch	SFWAC	1.10	yes
Grey Gulch above SF Wages	GASFW	0.17	no
Wood Creek above SF Wages	WASFW	0.10	yes
SF Wages above Wood Creek	SFWAW	0.73	no
Rock Creek above SF Wages*	RASFW	0.24	no
SF Wages above Rock Creek**	SFWAR	0.39	yes

*Site was continuous in WY 2004 then switched to a manual site in WY 2005

**Added pump sampler in WY 2005

Stage data collected using the fence posts were recorded as negative stages. In order to put the data in standard form, all fence post tops were assigned a positive reference elevation. The stage reading was added to this value to determine a positive river stage from the streambed to the water surface.

3.2.2 Continuous Stage Measurement

Continuous stage was read using pressure transducers. The pressure transducers (Design Analysis H-310), with an accuracy of less than or equal to 0.025% of the full scale output (FSO) were installed in flexible armored conduit down the streambank and anchored to the bottom of the streambed. Continuous stage readings were recorded in the datalogger at 15 minute intervals. Stage offsets were applied to the pressure transducer readings so that continuous stage readings matched observed stage heights taken from the fence posts or the staff plates.

3.2.3 Streamflow Measurements

Streamflow measurements were taken at all sites, with the exception of SFWAW, using standard or modified USGS methods. All measurements were performed by wading at the gage location. Streamflow equipment for wading measurements included a 4ft top-set wading rod, JBS Instruments AquaCalc 5000 -Advanced Stream Flow Computer, and either a Price AA or Pygmy current meter. All measurements were made with the magnetic head version of the Price AA or Pygmy meter. Due to the small size of the channels and the low flows it was necessary to perform measurements below the depth and velocity limits of the current meters. During periods of rapidly changing river stage, fewer verticals were used in order to improve the accuracy of the measurement. Fewer verticals were also used in some of measurements due to the limited width of the channel. However, most discharge measurements still contained 15-30 verticals.

3.3 STAGE AND STREAMFLOW COMPUTATION

All continuous stage and streamflow data was processed and computed using the WISKI Suite (Water Information Management System Kisters) developed by KISTERS AG. WISKI is a Windows based professional time series hydrological management package based on a relational database client-server platform such as Microsoft Sequel Server. The WISKI Suite is comprised of three components WISKI, BIBER, and SKED. The main WISKI shell is the hydrologic workbench where all data is organized and where computations on time series data are carried out. BIBER is used to evaluate and management discharge measurements as well as track current meters, counters and users of said equipment. SKED is a rating curve editor that uses graphical user interface to assist the hydrologist in developing, maintaining, and using rating curves. The U.S. version of WISKI uses standard hydrologic computations and techniques as set forth by the United States Geological Survey (USGS).

3.3.1 Stage Hydrographs

Stage hydrographs were developed for all sites with continuous stage records. Recorded gage height (GH) was plotted and compared to observed stage height (SH) observations. Gage height records were corrected to observed SH readings when necessary. In general only reliable (low to mid-staff height) readings were used to evaluate whether the GH record needed to be adjusted.

3.3.2 Rating Curves

Stage-discharge rating curves were developed in SKED for the following six sites: SFWAC, CASFW, GASFW, WASFC, RASFW, and SFWAR. Rating curve development involved plotting discharge verses stage and fitting a curve to the data. Regression equations were evaluated and used to guide curve development but ultimately all stage-discharge ratings were developed by eye fit. Once the curve had been developed skeletal rating points were pulled from the curve in order to develop the stage-discharge relationship. Log by Log interpolation was used between all skeletal rating points.

For sites that did not have stable stage-discharge relationships or where debris became lodged on the control rating shifts were developed.

3.3.3 Discharge Hydrographs

Discharge hydrographs were developed in WISKI using standard hydrologic practices. Corrected gage height records and discharge rating tables were used in the process. For sites without continuous gage height recorders, synthetic stage/discharge relationships were developed through a combination of direct and indirect methods. In general, sites with continuous records were scaled by watershed area to produce synthetic records at locations that did not have continuous records. Once a synthetic discharge hydrograph had been developed the record was adjusted based on discharge measurements made at the site.

Once discharge hydrographs were developed they were reviewed and checked against discharge measurements and to adjacent stations to insure that the records were as accurate as possible.

3.4 SEDIMENT SAMPLE COLLECTION

Sediment sampling included both measurements of turbidity and suspended sediment. In general the continuous stations were operated following the TTS protocols developed by USFS, Pacific Southwest Research Station, Redwood Sciences Lab (Johnston et. al. 2001). Suspended sediment was sampled with depth-integrating samplers (DH-48), and as much as practical and possible using procedures standardized by the USGS (Guy and Norman 1970, Edwards and Glysson 1988).

3.4.1 Turbidity and Suspended Sediment Sampling

At all study sites, sediment samples were needed to relate turbidity to suspended sediment concentration, to calibrate the turbidity probes, and to calibrate point pump samples to cross sectional depth-integrated samples. Depth-integrated turbidity and suspended sediment concentration (SSC) sampling was performed at all locations. Sediment samples were collected using a US DH-48 Depth-Integrating Suspended Sediment Sampler. Sampling sites were located at or near stage measurement sections. Standard methods, as developed by the USGS and described in Glysson and Edwards (1988) were generally used for sampling. In all cases depth integrated samples were collected using the Equal Width Increment Method (EWI). Due to the number of sites being sampled and the limited budget the following departures from the protocols were used: In Water Year 2004 transit rates for depth integrated samples were estimated and the distance between verticals was also estimated. For each sample the location, time, stage, number of verticals, estimated distance between verticals, bottle #, and whether a field replicate was taken were recorded. At locations where it was not possible to get a true depth-integrated sample, grab samples or modified depth-integrated samples were taken, and this information was recorded.

Samples were kept chilled after collection and stored in ice chests. Turbidity values were obtained within 48 hours using a Lamotte 2020 turbidimeter. Suspended sediment concentrations were determined in the GMA sediment lab following USGS and ASTM D-3977 protocols. A laboratory QAPP is available to interested parties.

3.4.2 Continuous Turbidity Sampling

A continuous turbidity probe was installed at each of the continuous sampling locations. The continuous stations were generally operated following the TTS protocols developed by USFS, Pacific Southwest Research Station, Redwood Sciences Lab (Johnston et. al. 2001). The turbidity probes used are the Forest Technologies Systems DTS-12 with wipers. The DTS-12 has a range between 0 and 1,600 FNU's. Accuracy of the unit is as follows: 0-499.99 FNU ± 2% of reading +0.2FNU and 500.00 to 1600 FNU ± 4% of reading. Each turbidity sensors was mounted in a PVC housing that was fixed to the end of a boom arm. Data was read by turbidity meter and recorded by the data logger. Recording interval was set to 15 minutes.

3.4.3 Pump Samples

In Water Year 2004 An ISCO 6700 or 3700 series pump sampler was installed at all continuous sites except one (SFWAR). In Water Year 2005 SFWAR was upgraded with the pump sampler that was removed from RASFW when the station was downgraded from a continuous site to a periodic station. The pump samplers were programmed following the TTS protocols developed by USFS, Pacific Southwest Research Station, Redwood Sciences Lab (Johnston et. al. 2001). Intakes for the pump samplers were located on the turbidity probe housings. Pumped samples were removed from sampler and processed for turbidity with in 48 hours or as soon as possible.

3.5 TURBIDITY AND SUSPENDED SEDIMENT TRANSPORT COMPUTATION

Turbidity and suspended sediment data can be analyzed in many ways. Some of the more common relationships that are investigated are turbidity versus suspended sediment concentration (SSC), turbidity versus discharge, SSC versus discharge, suspended sediment load versus discharge and suspended sediment yield. In Years past it was quite common to produce continuous concentration sedigraphs based on the relationship between discharge and SSC. In recent years however, affordable, accurate and dependable continuous turbidity probes have become readily available and have proved very reliable for producing sediment discharge records. For the SF Wages Creek THP effectives monitoring project it was determined that continuous turbidity would be an appropriate surrogate for SSC. Sediment analysis will focus on the relationship between turbidity and SSC at each of the study sites. If a good turbidity-SSC relationship did not exist at the site discharge-SSC relationships were investigated.

In general standard methods, as described by the USGS and described in Computation of Fluvial-Sediment Discharge (Porterfield 1977) were used for sediment computations.

3.5.1 Suspended Sediment Concentration

WISKI was used to develop sediment-tranport curves and continuous sediment concentration curves (sedigraphs). Sedigraphs were developed using the turbidity-SSC relationship (sediment tranport curve) that existed at each site. Many times several relationships existed at the site. For instance a relationship may have been developed for a specific storm, a set of storms or for the entire storm season. Based on these sediment-transport curves a sedigraph or set of sedigraphs was developed for each site. Once a base sedigraph had been developed, depth integrated and automatic samples were used to adjust the base sedigraph in order to produce a final sedigraph. Where sufficient sample data existed the sedigraph was adjusted to pass through all sample points. During periods when no sample data existed the transport curve was used to estimate continuous concentration.

Development and use of sediment-transport curves followed the basic principles outlined by the USGS and described in Sediment-Transport Curves (Glysson, 1987).

For periodic sites where continuous turbidity data was not available sediment concentration came from the depth integrated lab results. No attempt was made to develop continuous sedigraphs for these sites.

3.5.2 Suspended Sediment Discharge Computation

WISKI was used to compute continuous sediment discharge. Once sedigraphs were developed and finalized for all of the continuous sites the concentrations were transformed into continuous sediment discharge curves using the equation: Sediment Discharge = Q*SSC*.002697). Pump and depth integrated samples were also transformed.

3.5.3 Sediment Load Computation and Yield Computations

WISKI was used to compute all sediment loads for the continuous sites. Loads were totaled for each water year. At this time sediment loads have not been computed for individual storm events. Sediment loads were not calculated for periodic sites.

Sediment yields were computed in Excel on a per square mile basis. Sediment yields were computed for depth integrated and and pump samples for all sites.

4.0 RESULTS

4.1 GAGING STATION OPERATION

TTS sampling is dependent on the proper functioning of the electronic equipment at the site. In WY2004 and WY 2005 there were periodic electronic equipment failures. Most problems were pin-pointed and fixed, while others are still under investigation. Some problems have been; loose or faulty cable connections, ISCO sampler malfunctions, pressure transducer malfunctions, and over consumption of battery power.

Being the first year of a challenging study, many problems were encountered with the project in WY2004. Most of the problems were solved and fixed. However, some of the problems will require continued effort and are a result of the logistical challenges of the study and the specific site locations.

The location of the study area presented a significant challenge. A total time of about 2.5 hours is required to reach the study site from Fort Bragg. This includes truck travel time, ATV travel time, and the time it takes to load up all sampling gear, personal gear, and tools (Photo 2). The travel time is increased if fallen trees block the road. It was extremely important that the sampling crew was prepared for any problems that needed to be remedied.

The size and shape of the channel at the sampling sites made automated sampling problematic. On of the common problems with the channels in SF Wages Creek watershed is the width to depth ration of the channels. At several sites, depth during storms did not increase enough for the instrumentation to work properly. Shallow depths often caused the turbidity probes to see the channel bottom, which would initiate false pump samples. This caused the 24 bottle supplies in the Isco pump samplers to be exhausted. In an effort to

remedy this problem, large boulders were placed along the banks and within the channel at some of the sampling locations to decrease the width to depth ratio. Another factor that makes sampling problematic is the large amount of bedload transport in the system. The wood and rock weirs installed at many of the sampling locations, intended to provide stable channel controls, act as bedload traps. As bed material builds up behind the controls the bed elevation is raised making it necessary to increase the minimum stage in the TTS program. Due to the build up of material turbidity probes became buried. This is not a problem at sites where the width to depth ration was decreased. The final problem and the hardest to remedy is the turbulent flow nature of the channels. At many of the sites during high flows entrained air causes poor turbidity records. In some cases, the turbidity boom can be moved laterally along the cable, placing the probe in a less turbulent location. At other locations it was necessary to move the turbidity booms upstream or downstream.

During the second year of sampling gage operation was taken over by Campbell Timerland Management. Many of the challenges that existed in Water Year 2004 were encountered in Water Year 2005 (K. Faucher, Personal Communication). In general Campbell Timberland Management did a good job in keeping the sites in operating condition. When problems occurred they were remedied in a timely fashion.

In Water Year 2005 Rock Creek above SF Wages Creek was downgraded to periodic station and the Isco pump sampler was installed at SF Wages Creek above Rock Creek

4.2 STEAM FLOW MEASUREMENTS

All streamflow measurements were entered and cataloged using the standard USGS-type 9-207 discharge measurement summary form. A 9-207, for each site, summarizing all streamflow measurements made over the course of WY2004 and Water Year 2005 is contained in the appendix.

A total of 27 discharge measurements were made at the six of the seven sites in WY2004. Streamflow measurements were collected from December 2003 through February 2004. The number of streamflow measurements collected at each site is shown in Table 3. Between 4 and 5 discharge measurements were taken at six of the sampling sites. Six to eight discharge measured is preferred to adequately define a stage-discharge relationship, but due to the relative small range of discharge encountered in the SF Wages Creek watershed the number of discharge measurements was considered adequate for the first year of the program. Due to the small size of the stream channels, and low discharges that were encountered, it was necessary to modify standard discharge measurement protocol. When flows were very low the pygmy meter was used below the recommended depth and velocity limits. During periods of low flow it was not always possible to have less than 10%, the recommended maximum percent of flow for any one vertical, flow in each discharge verticals. When discharge measurements were made that fell outside of standard protocols the measurement quality was downgraded. No check measurements were made in WY 2004 and no gage height of zero flow (GZF) measurements were made.

A total of 35 discharge measurements were made at six of the seven sites in WY 2005. Streamflow measurements were collected between December 2004 and May of 2005. The

TABLE 3
SOUTH FORK WAGES CREEK WATERSHED
Streamflow Measurement Summary WY 2004

SITE NAME	ACRONYM	# of Streamflow Measurements collected in WY 2004
Center Gulch above SF Wages	CASFW	4
SF Wages above Center Gulch	SFWAC	5
Grey Gulch above SF Wages	GASFW	4
Wood Creek above SF Wages	WASFW	5
SF Wages above Wood Creek	SFWAW	0
Rock Creek above SF Wages	RASFW	5
SF Wages above Rock Creek	SFWAR	4

number of streamflow measurements collected at each site as well as the total number of measurements that have been collected at each site is summarized in Table 4. Collection of discharge measurements during Water Year 2005 focused on filling gaps in the stage-discharge relationships and adequately defining any stage-discharge shifts that may have occurred. During Water Year 2005 a few check measurements were made when a measured discharge indicated a departure from the current rating. In Water Year 2005 GZF's were also measured on a regular basis. This helped to improve the low end of the stage-discharge relations and greatly improved confidence in the low end of the rating curve. GZF's were also used as a check to verify that shifts had occurred when check measurements were not made.

In general the discharge measurements made in Water Year 2005 improved the quality of the stage-discharge relations at each of the sites. Further, the measurements adequately filled in gaps in the stage-discharge relationships and did a good job in defining the magnitude and timing of shifts in the stage-discharge relationships.

4.3 STREAMFLOW COMPUTATIONS

Surface water station analysis containing complete details of computations made at each continuous site can be found in the appendix.

TABLE 4
SOUTH FORK WAGES CREEK WATERSHED
Streamflow Measurement Summary WY 2005

SITE NAME	ACRONYM	# of Streamflow Measurements collected in WY 2005	Total Number of Streamflow Measurements
Center Gulch above SF Wages	CASFW	7	11
SF Wages above Center Gulch	SFWAC	7	12
Grey Gulch above SF Wages	GASFW	3	7
Wood Creek above SF Wages	WASFW	2	7
SF Wages above Wood Creek	SFWAW	0	0
Rock Creek above SF Wages	RASFW	9	14
SF Wages above Rock Creek	SFWAR	7	11

4.3.1 Rating Curve Development

Stage-discharge rating curves were developed in SKED for all sites except for SFWAW. Base curves were developed and percent differences from the rating were computed for each of the streamflow measurements. For sites that had unstable hydraulic controls shifts were developed Rating curves and rating tables can be found in the appendix for the six sites where stage-discharge relationships were developed.

Center Gulch above SF Wages Creek

Rating 2.1 was used for computation if Water Year 2004. In Water Year 2004 four discharge measurements (1-4) were made. Measured discharge ranged from 0.78 cfs to 13.8 cfs. Measurements 2-4 were used to develop the middle and upper portion of Rating 2.1. Measurement 1 was not used in rating develop. No shifts were used in Water Year 2004.

Rating 2.1 was continued in use in Water Year 2005. Seven discharge measurements (5-11) were made in Water Year 2005. Measured discharge ranged from 0.09 cfs to 6.13 cfs. Measurements 5-9 were used to develop the lower and middle portions of Rating 2.1. Measurement six was not used in rating development. Time variable shift (TV) TV05-1 and TV05-2 were developed to deal with debris that became lodged on the control between October 8, 2004 and October 13, 2004. Once the material had been cleared from the control Rating 2.1 was brought back into effect and continued in use for the remainder of the record.

Based on the measurement ratings, accuracy of Rating 2.1 is considered poor.

SF Wages Creek above Center Gulch

Rating 1.2 was used for computation in Water Year 2004. Five discharge measurements (1-5) were made in Water Year 2004. Measured discharge ranged from 5.45 cfs to 53.3 cfs. Measurements 1-5 were used to develop the middle and upper portions of Rating 1.2. TV04-1 was developed to deal with a debris jam that occurred between January 1, 2004 and January 7, 2004. After the debris jam had been cleared Rating 1.2 was put back into effect. No other shifts were used in Water Year 2004.

Rating 1.2 was continued in use for Water Year 2005. In Water Year 2005 seven discharge measurements (6-12) were made. Measured discharge ranged from 0.20 cfs to 34.2 cfs. Measurement 6 was used to develop the low-flow portion of Rating 1.2. Measurement 7 was used to check the mid-flow portion of Rating 1.2. Measurements 8 and 9 indicated a fill of the control had occurred. TV05-1 was developed based on the shifts indicated by measurements 8 and 9. TV05-1 was prorated into effect beginning on December 8, 2004 and reached full weight by December 9, 2004. Measurement 10 indicated a return to Rating 1.2. The return to Rating 1.2 was prorated into effect beginning on January 28, 2004 and was complete by January 29, 2005. Measurement 11, made on March 28, 2005, again indicated fill of the control had occurred. Measurement 11 was used to develop TV05-2, which was prorated into effect beginning on March 22, 2005. Measurement 12, made on May 18, 2005, indicated that scour of the control had occurred. Measurement 12 was used to develop TV05-3, which was prorated into effect beginning on April 8, 2005. TV05-3 was held in effect until the end of the record on July 7, 2005.

Based on the measurement ratings, the accuracy of Rating 1.2 is considered fair.

Grey Creek above SF Wages Creek

In Water Year 2004 four discharge measurements (1-4) were made. Measurements 1-4 were used to develop the middle and upper portions of Rating 1.2. Measured discharge ranged from 3.09 cfs to 7.90 cfs. Measurements 1-4 all plotted within 5% of Rating 1.2.

In Water Year 2005 three discharge measurements (5-7) were made. Measurement 5 was used to develop the low-flow portion of Rating 1.2 while measurement 6 and 7 were used to check the middle and upper portions of the rating. Measurements 5 and 7 plotted within 5%of Rating 1.2 and were rated poor and fair respectively. Measurement 6 plotted 8% from Rating 1.2 and was rated poor. No shift was computed for measurement 6 because it plotted within acceptable limits considering the measurement rating.

No continuous record is available for Grey Creek. Rating 1.2 was used to produce instantaneous flows and in calibration of the synthetic hydrograph discussed in section 4.2.3. Based on the measurement ratings, the accuracy of Rating 1.2 is considered fair.

Wood Creek above SF Wages Creek

In Water Year 2004 five discharge measurements (1-5) were made. Measurements 1-5 were used to develop the middle and upper portions of Rating 1.2. Measured discharge ranged from 0.17 cfs to 4.71 cfs. All measurements plotted within acceptable limits considering the measurement ratings.

In Water Year 2005 two discharge measurements (6 and 7) were made. Measured discharge ranged from 0.09 cfs to 2.52 cfs. Measurement 6 was used to develop the low-flow portion of Rating 1.2. Measurement 7 plotted -15% from Rating 1.2. No check measurement was made. No shift was computed for this measurement because no check measurement was made and no other information was available that would support a shift at this site.

Based on the measurement ratings, 4 poor and 3 fair, the accuracy of Rating 1.2 should be considered poor for the entire period.

SF Wages above Wood Creek

No rating was developed at this site.

Rock Creek above SF Wages Creek

In Water Year 2004 five discharge measurements (1-5) were made. Measured discharge ranged from 0.30 cfs to 11.3 cfs. Measurements 1-5 were used to develop the entire range of Rating 1.2. All measurements plotted within 5% of Rating 1.2.

In Water Year 2005 four discharge measurements (6-9) were made. Measured discharge ranged from 0.63 cfs to 5.97 cfs. Measurements 6-9 indicated that a change in rating had occurred to the low-flow and mid-flow portions of Rating 1.2. Measurements 6-9 were used to develop Rating 1.3. Rating 1.3 has a different shape than Rating 1.2 up to 3.29 ft. Above 3.29 ft Rating 1.3 is very similar is shape to Rating 1.2. Measurement 9 was used to verify this. All measurements plotted within acceptable limits given the measurement ratings.

No continuous record is available for Rock Creek. Rating 1.2 was used to produce instantaneous flows and in calibration of the synthetic hydrograph discussed in section 4.2.3. Based on the measurement ratings, the accuracy of Rating 1.2 and 1.3 is considered poor.

SF Wages above Rock Creek

In Water Year 2004 four discharge measurements (1-4) were made. Measured discharge ranged from 1.52 to 17.4 cfs. Measurements 1-4 were used to develop the middle and upper portions of Rating 1.2. Measurements 1-4 all plotted within acceptable limits given the measurement ratings.

In Water Year 2005 seven discharge measurements (5-11) were made. Measured discharge ranged from 0.08 cfs to 7.59 cfs. Measurement 5, made on October 13, 2004 was used to develop the low-flow portion of Rating 1.2. Measurements 7-10 all indicated that aggradation of the control (shift indicated: -0.02 ft to -0.03 ft) had occurred. Measurement 6 was not used in rating development because no left edge water was available for the measurement. Rating 2.1 was developed in for use in Water Year 2005 by shifting Rating 1.2 by -0.03 ft. Rating 2.1 has the same shape as Rating 1.2. Rating 2.1 was prorated into effect beginning at the peak of the December 8, 2004 storm. Measurements 7-10 all plotted

within acceptable limits given the measurement ratings. Measurement 11, made on May 18, 2005, indicated that the control had further aggraded. Measurement 11 was used to develop TV05-1. TV05-1 is prorated into effect beginning at the peak of the storm on March 29, 2005. TV05-1 is held in effect until the record ends on Jul 7, 2005.

Based on the measurement rating, the accuracy of Rating 1.2 is considered fair and the accuracy of Rating 2.1 is considered poor.

4.3.2 Discharge Hydrographs

For sites that had acceptable continuous gage height data discharge hydrographs were produced according to the station analysis. Discharge hydrographs for each of the sites can be found in the appendix.

In Water Year 2004 12 significant storms occurred between of December 2003 and April 2004. A significant storm event is defined as an event that causes SF Wages Creek above Center Gulch (SFWAC) to flow at 5 cfs or greater. 6 storms occurred in December (December 4th -6th, 9th-11th, 12th-14th, 23rd-25th, 28th-29th and 31st-January 1st), Two in January (January 8th-10th and 27th -28th), three storms in February (February 2nd -3rd, 15th -18th, and 24th – 27th), and one in April (April 18th -21st). The largest storm of the year occurred from December 31, 2003 through January 1, 2004. . The shape of the discharge hydrographs for each of the sites is very similar, differing only in discharge amount and only slightly in the timing of the event. Differences in the timing of events are due to the amount and timing of rainfall in each sub-basin as well as the size and shape of each sub-basin.

In Water Year 2005 14 significant storms occurred between December 2004 and June 2005. A significant storm event is defined as an event that causes SF Wages Creek above center gulch to flow at 5 cfs or greater. Two storms occurred in December (December 6th-8th and December 29th –January 2nd), two storms occurred in January (January 7th-11thand 27th-29th), two storms occurred in February (February 12th-14thand 19th-21st), three storms occurred in March (March 18th-21st, 22nd-23rd, and 26th-29th), one storm occurred in April (April 8th-9th), two storms occurred in May (May 7th-10thand 17th-18$^{th)}$, and two storms occurred in June (June 7th-9th and 17th-19th).

In Water Year 2004 and Water Year 2005 synthetic hydrographs were developed for Grey Creek above SF Wages (GASFW), SF Wages above Wood Creek (SFWAW), and Rock Creek above SF Wages (RASFW). Synthetic hydrographs were developed by using basin area relationships.

<u>Grey Creek above SF Wages Creek</u>
The Grey Creek above SF Wages Creek synthetic hydrograph was developed by scaling the SF Wages Creek above Center Gulch hydrograph by drainage basin area. Once a base synthetic hydrograph was developed streamflow measurements were used to further calibrate the hydrograph. This synthetic hydrograph could be improved if all staff height observations taken at the site were used to calibrate the hydrograph.

<u>SF Wages Creek above Wood Creek</u>

The SF Wages Creek above Wood Creek synthetic hydrograph was developed by scaling the SF Wages Creek above Center Gulch hydrograph by drainage basin area. No discharge measurements were taken at this site so it was not possible to calibrate the hydrograph. This hydrograph should be considered a rough estimate.

Rock Creek above SF Wages Creek

Rock Creek above SF wages Creek (RASFW) was initially set up as a continuous station in Water Year 2004. Rating 1.2 was developed by the continuous gage height file was not useable at the site. The pressure transducer continuously malfunctioned over the course of Water Year 2004. In Water Year 2005 RASFW was downgraded to a periodic sampling location. Discharge measurements were continued in WY 2005. A synthetic hydrograph was developed for RASFW by scaling the SF Wages above Rock Creek hydrograph by drainage basin area. The base synthetic hydrograph was then calibrated using the discharge measurements made in WY 2004 and WY 2005. This synthetic hydrograph could be improved if all staff height observations taken at the site were used to calibrate the hydrograph.

4.3.3 Peak Discharges

A summary of peak discharges, by water year, for each of the sub-watersheds is provided in Table 5 and Table6 below. The peak discharges for SFWAC, CASFW, WASFT, RASFW, and SFWAR were obtained directly from the appropriate rating tables. The remaining 2 peak discharges for SFWAW and GASFW were obtained from the developed synthetic hydrographs, and thus only represent estimates of the actual peak flows. Since complete streamflow records were not available for the entire water year, typical WY statistics were not computed.

TABLE 5
SOUTH FORK WAGES CREEK WATERSHED
Summary of Peak Discharge WY 2004

Site	Date	Discharge (cfs)	Note
CASFW	2/17/2004	15.6	
SFWAC	1/1/2004	102	
GASFW	1/1/2004	15.8	Obtained From Synthetic Hydrograph
WASFW	2/17/2004	5.28	
SFWAW	1/1/2004	67.8	Obtained From Synthetic Hydrograph
RASFW	12/13/2003	13.8	
SFWAR	12/13/2003	22.4	

TABLE 6
SOUTH FORK WAGES CREEK WATERSHED
Summary of Peak Discharge WY 2005

Site	Date	Discharge (cfs)	Note
CASFW	12/8/2004	12.1	
SFWAC	12/8/2004	56.2	
GASFW	12/8/2004	8.65	Obtained From Synthetic Hydrograph
WASFW	12/8/2004	17.0	
SFWAW	12/8/2004	37.3	Obtained From Synthetic Hydrograph
RASFW	12/8/2004	15.7	Obtained From Synthetic Hydrograph
SFWAR	12/8/2004	25.7	

Table 7 and 8 show the highest measured discharge, the computed peak discharge, the ratio between the computed and highest measured peak discharge, and the unit peak discharge for WY2004 and WY 2005. In Table 7 all of the ratios of computed peak to highest measured discharge are 2.0 and below, indicating that it was not necessary to extrapolate rating curves beyond 100% of the maximum measured discharge. Unit peak discharges range from 50 cfs/mi^2 to 95 cfs/mi^2. In WY 2005 the ratios of computed peak to highest measured

TABLE 7
SOUTH FORK WAGES WATERSHED
Comparison of Peak Discharges and Unit Peak Discharges WY 2004

SITE NAME	WSA	WY 2004 HIGHEST MEASURED DISCHARGE (cfs)	WY 2004 PEAK COMPUTED DISCHARGE (cfs)	RATIO COMPUTED PEAK TO HIGHEST MEASURED DISCHARGE (cfs)	WY 2004 UNIT PEAK DISCHARGE (cfs/mi^2)
CASFW	0.29	13.8	15.6	1.1	54.1
SFWAC	1.10	53.3	102	1.9	92.5
GASFW	0.17	7.90	15.8	2.0	94.9
WASFW	0.10	4.71	5.28	1.1	50.6
SFWAW	0.73	NA	67.8	NA	93.5
RASFW	0.24	11.3	13.8	1.2	58.6
SFWAR	0.39	17.4	22.4	1.3	57.5

Discharge was more varied than in WY 2004. Values ranged from 1.6 to 6.7 indicating that field crews did not do as good of a job getting high flow discharge measurements. Center Gulch above SF Wages, SF Wages above Center Gulch, and Grey Creek above SF Wages all had ratios under 2.0 indicating that a good job was done in obtaining high flow measurements. The Ratio of 6.7 for Wood Creek above SF Wages is high but Rating 1.2 is used in WY 2004 and WY 2005 with no shifts and high flow measurements were obtained in WY 2004. The ratios for Rock Creek above SF Wages and SF Wages above Rock Creek are not that significant because both sites are periodic stations. Unit peak discharges ranged from 42.0 cfs/mi^2 to 163 cfs/mi^2. Thing range was also greater than in WY2004.

TABLE 8
SOUTH FORK WAGES WATERSHED
Comparison of Peak Discharges and Unit Peak Discharges WY 2005

SITE NAME	WSA	WY 2005 HIGHEST MEASURED DISCHARGE (cfs)	WY 2005 PEAK COMPUTED DISCHARGE (cfs)	RATIO COMPUTED PEAK TO HIGHEST MEASURED DISCHARGE (cfs)	WY 2005 UNIT PEAK DISCHARGE (cfs/mi^2)
CASFW	0.29	6.13	12.1	2.0	42.0
SFWAC	1.10	34.2	56.2	1.6	51.0
GASFW	0.17	5.11	8.65	1.7	51.9
WASFW	0.10	2.52	17.0	6.7	163
SFWAW	0.73	NA	37.3	NA	51.4
RASFW	0.24	5.97	15.7	2.6	66.6
SFWAR	0.39	7.59	25.7	3.4	65.9

4.4 SEDIMENT TRANSPORT

A complete summary of all sediment samples listing the date and time of sample collection, sample measurement #, turbidity (NTU), SSC (mg/l), stage (ft), discharge (cfs), discharge per watershed area (cfs/mi^2), SSL (tons/day), SSLPA (tons/day/mi^2), type of sample, and notes for each site is contained in the appendix of this report.

4.4.1 Turbidity and Suspended Sediment Sampling

In Water Year 2004 a total of 131 turbidity and suspended sediment concentration (SSC) measurements were. This includes 88 depth-integrated samples and 43 pump samples. The number of samples for each site is listed below in Table 9. Between 11 and 33 samples were collected at each site.

TABLE 9
SOUTH FORK WAGES CREEK WATERSHED
Suspended Sediment Sample Summary WY 2004

SITE NAME	ACRONYM	# of Depth Integrated Suspended Sediment Samples Collected in WY 2004	# of ISCO Pump Suspended Sediment Samples Collected in WY 2004
Center Gulch above SF Wages	CASFW	14	8
SF Wages above Center Gulch	SFWAC	15	18
Grey Gulch above SF Wages	GASFW	12	NA
Wood Creek above SF Wages	WASFW	11	8
SF Wages above Wood Creek	SFWAW	12	NA
Rock Creek above SF Wages	RASFW	13	9
SF Wages above Rock Creek	SFWAR	11	NA

In Water Year 2005 a total of 137 turbidity and suspended sediment concentration measurements were made. This includes 72 depth-integrated samples and 65 pump samples. The number of sample for each site is listed below in Table 10. Between 8 and 38 samples were collected at each site.

TABLE 10
SOUTH FORK WAGES CREEK WATERSHED
Suspended Sediment Sample Summary WY 2005

SITE NAME	ACRONYM	# of Depth Integrated Suspended Sediment Samples Collected in WY 2005	# of ISCO Pump Suspended Sediment Samples Collected in WY 2005
Center Gulch above SF Wages	CASFW	13	15
SF Wages above Center Gulch	SFWAC	14	24
Grey Gulch above SF Wages	GASFW	11	NA
Wood Creek above SF Wages	WASFW	6	8
SF Wages above Wood Creek	SFWAW	8	NA
Rock Creek above SF Wages	RASFW	8	NA
SF Wages above Rock Creek	SFWAR	12	18

Not all samples collected were used in analysis. It was necessary to censor samples that contained erroneous data. Erroneous data was caused by pump sampler intakes being buried or being to close to the bottom and sampler nozzles striking the streambed during sampling. Censored sample are noted in the sediment sample summary contained in the appendix for each sit.

4.4.2 Pump Samples

In WY 2004 Isco pump samples were collected at four sampling locations (CASFW, SFWAC, WASFW, and RASFW). In WY 2005 the pump sampler from Rock Creek above SF Wages was moved to SF Wages above Rock Creek. The number of samples taken at each site during WY 2004 and WY2005 are listed in Table 9 and Table 10. These numbers only include samples that were taken to the lab and run for SSC. Pump samples that were triggered by erroneous turbidities during storm events were run for turbidity and not processed for SSC and used as a check for the turbidity probe. Once channel modifications were made and minimum stages for sampling were re-established at each site, erroneous turbidities and consequently pump samples were reduced.

Relatively few usable pump samples were taken in WY 2004. This was primarily due to turbidity thresholds being set too high for the SF Wages Creek watershed. The turbidity thresholds used ranged from 0 to 1850 ntu. The first rising threshold began at 20 ntu. Since most sampling locations only had peak turbidities of 15-25 ntu, only the first threshold was reached. The majorities of the pump samples taken during storm events were due to continuous erroneous turbidity readings or were triggered manually by field crews.

In Water Year 2005 turbidity thresholds were reduced and the coverage of pump samples during storm hydrographs increased. In Water Year 2005 the number of erroneous pumps was greatly reduced as well. Continued work on refining the turbidity thresholds should provide even better coverage during storms

Pump sample turbidity and SSC results were calibrated to cross-stream depth-integrated samples. In Water Year 2004 between one and three correlating pump samples to DIS samples were taken. This was mostly due to a lack of cover from rain at equipment houses (to cover lap top) and limited time available for sampling crews to be onsite. In some cases one of three calibration samples had a high variance from the other two samples. A Box coefficient was developed for each set of correlating set of pump and DIS samples. Box coefficients were evaluated on an individual basis as well as on a season or water year basis. Table 11 summarizes the box coefficients used at each site for both water years. With the exception of the SSC box coefficient at SFWAC in WY 2004 the box coefficients were reasonable. The SSC box coefficient of 1.7 at SFWAC in WY 2004 indicates that the pump intake location is not representative of the mean channel conditions. In WY 2005 the intake location was altered and the coefficient was much more reasonable.

4.4.3 Continuous Turbidity Records

Continuous turbidity was measured at 4 of the sampling locations (SFWAC, CASFW, WASFW, and SFWAR). Turbidity values measured by the DTS-12 turbidity meter were generally close to values obtained by depth integrated samples measured using the Lamotte 2020 Turbidimeter. When DTS-12 turbidities and depth-integrated turbidities did not agree it was usually due to turbulent flow or the DTS-12 being to close to the streambed. DTS-12 turbidities were not correlated to Lamotte 2020 turbidity values.
The 15 minute continuous turbidity records were plotted with their corresponding discharge hydrograph for Water Year 2004 and Water Year 2005. Plots of continuous discharge and

turbidity can be found in the appendix for each site. Also included on these graphs are the depth-integrated turbidity values and well as the corrected pump sample values.

TABLE 11
SOUTH FORK WAGES CREEK WATERSHED
Box Coefficients Used to Correct Pump Samples

	Water Year 2004		Water Year 2005		
Site Name	**Turbidity Coefficient**	**SSC Coeficient**	**Turbidity Coefficient**	**SSC Coeficient**	**Notes**
CASFW	1.0	1.0	1.0	1.0	First correlating set considered and outlier (WY04)
SFWAC	1.0	1.7	1.0	0.8	
GASFW	NA	NA	NA	NA	No pump sampler
WASFW	1.0	1.5	1.3	1.3	First correlating set considered and outlier (WY04)
SFWAW	NA	NA	NA	NA	No pump sampler
RASFW	0.9	0.8	NA	NA	based on one correlating set. No Pump Sampler in WY 2005
SFWAR	NA	NA	1.0	1.0	Pump sampler added in WY04

.

Except for SFWAC the turbidity records do not become useable until January of WY 2004. This is due to either the sites being dry or the fact that it took several storms to get the probes in the right position to collect valid turbidities over a wide range of flows. The turbidity record at SFWAC is good from November on.

In WY 2005 the continuous turbidity records for each of the sites was greatly improved. Far less time was spent in cleaning the turbidity record and in general the stations were much more reliable. SFWAC was operational by October 13, 2004 and the rest of the stations came online in late November or early December when flows became high enough for the turbidity meters to function properly.

4.4.4 Sediment Transport Rates

Turbidity verses SSC relationships were developed for both the continuous sites and the periodic sites. Initially, turbidity values were pulled from the DTS-12 continuous record, whereas the SSC values were a combination of the corrected pump samples and the depth-integrated samples. If no continuous turbidity record was available at the site then the depth-integrated turbidity values were used. If no relationship existed between turbidity and SSC then a discharge verses SSC relationship was developed. The results, by water year, are shown below in Table 12 and Table 13. Plots of each of these relationships can be found the appendix.

TABLE 12
WY 2004 REGRESSION EQUATIONS USED FOR SUSPENDED SEDIMENT

Site Name	X vs SSC	Equation	(r^2)
CASFW	Discharge	y = 1.55317x^1.11729	0.71
SFWAC	DTS-12 Turbidity	y = 1.45428x^0.826475	0.81
GASFW	DIS Turbidity	y = 1.94118x - 5.78901	0.96
WASFW	Discharge	y = 2.65992x - 1.60672	0.94
SFWAW	DIS Turbidity	y = 1.89499x - 4.89592	0.86
RASFW	DIS Turbidity	y = 1.7782x - 8.85853	0.85
SFWAR	DTS-12 Turbidity	y = 0.898812x - 1.64343	0.92

In Water Year 2004 only two of the continuous turbidity stations (SFWAC and SFWAR) had adequate enough relationships to produce continuous SSC concentration from turbidity. The other two continuous turbidity sites (CASFW and WASFW) had poor turbidity verses SSC relationship so discharge verses SSC relationships were developed. WASFW had a surprising good relationship (based on WY04-WY05 data) between discharge and SSC. CASFW had a fair to poor relationship between discharge and SSC. Because it was not possible to develop any good relationships at CASFW continuous SSC was only developed for two storms when sufficient depth-integrated and pump samples were available. Continuous SSC was developed for the following sites and periods:

CASFW: January 7, 2004, September 30, 2004
SFWAC: December 17, 2003-September 30, 2004
WASFW: January 1, 2004- September 30, 2004
SFWAR: February 2, 2040- September 30, 2004

No SSC was developed for sites where synthetic hydrographs (GASFW, SFWAW, and RASFW) where developed because the error associated with these estimates would be too great.

In Water Year 2005 three of the four (CASFW, SFWAC, and SFWAR) continuous turbidity stations had adequate relationships to develop continuous SSC from turbidity. The fourth continuous site, WASFW, did not show a strong relationship between turbidity and SSC but did have a good relationship (based on WY04-WY05 data) between discharge and SSC. Continuous SSC was developed for the following sites and periods:

CASFW: October1, 2004-July 7, 2005
SFWAC: October 19, 2004- July 7, 2005
WASFW: December 8, 2004- July 7, 2005
SFWAR: December 6, 2004- July 7, 2005

TABLE 13
WY 2005 REGRESSION EQUATIONS USED FOR SUSPENDED SEDIMENT

Site Name	SSC vs x	Equation	(r^2)
CASFW	DTS-12 Turbidity	y = 1.03243x + 0.0661806	0.83
SFWAC	DTS-12 Turbidity	y = 0.832588x + 1.81593	0.92
GASFW	DIS Turbidity	y = 2.1725x - 4.40485	0.97
WASFW	Discharge	y = 2.65992x - 1.60672	0.94
SFWAW	DIS Turbidity	y = 1.34937x^0.813326	0.79
RASFW	DIS Turbidity	y = 0.984669x^0.734836	0.55
SFWAR	DTS-12 Turbidity	y = 1.23261x - 1.85884	0.88

No SSC was developed for sites where synthetic hydrographs (GASFW, SFWAW, and RASFW) where developed because the error associated with these estimates would be too great.

4.4.5 Sediment Loads

Partial sediment loads and partial yields were calculated for each of the continuous Water Year. Results are summarized in Table 14. Discharge and sediment discharge plots can be found in the appendix.

TABLE 14
SOUTH FORK WAGES CREEK WATERSHED
Partial Suspended Sediment Load Water Year 2004

SITE NAME	WSA	SSL (tons)	SSLPA (tons/mi^2)
CASFW	0.29	0.32	1.12
SFWAC	1.10	0.44	0.40
GASFW	0.17	NA	NA
WASFW	0.10	0.06	0.53
SFWAW	0.73	NA	NA
RASFW	0.24	NA	NA
SFWAR	0.39	0.14	0.36

The loads presented for Water Year 2004 must be viewed with caution. Due to the amount of time that it took to get stations operating and the challenges that were encountered during the water year the loads presented are partial load. Yields were also calculated for each of the continuous stations but again one must be careful in interpreting this data. In addition to the partial loads computed for Water Year 2004 instantaneous loads and yield were computed for each sediment sample collected. These values are summarized in the sediment summary contained in the appendix of each station.

Total loads and total yields were calculated for each of the continuous sites in Water Year 2005. Results are summarized in Table 15. Plots of sediment discharge can be found in the appendix. Unlike Water Year 2004, the total loads calculated can be considered representative of the period. Total loads in Water Year 2005 ranged from 0.05 tons (WASFW) to 7.62 tons (SFWAC). Yields were also computed for Water Year 2005 and the results range from 0.36 tons/mi^2 (SFWAR) to 1.12 tons/mi^2(CASFW). CASFW had the highest yield even though it is the fourth largest sub-basin. WASFW, the smallest sub-basin, had the second highest yield, SFWAR the fifth largest sub-basin had the lowest yield, and SFWAC the largest sub-basin had the second lowest yield.

It is important to realize that the loads between the two water years are not comparable because the periods of record are different. The total loads computed in Water Year 2004 are not representative of the actual load during that year for the reasons discussed above.

Appendix H-1 and H-2 summarize the sediment yields on a watershed level for Water Year 2004. Appendix H-1 is a plot of sediment yield verses discharge. Appendix H-1 indicates that that sediment yield increased at roughly the same rate for SFWAC, SFWAW, and SFWAR. This is not to say the yields for a given discharge are the same but that as discharge increased the yields for each of these sub-basins increases at the same rate relative

TABLE 15
SOUTH FORK WAGES CREEK WATERSHED
Total Suspended Sediment Load Water Year 2005

SITE NAME	WSA	SSL (tons)	SSLPA (tons/mi^2)
CASFW	0.29	1.36	4.72
SFWAC	1.10	7.62	6.91
GASFW	0.17	NA	NA
WASFW	0.10	0.05	0.48
SFWAW	0.73	NA	NA
RASFW	0.24	0.53	2.24
SFWAR	0.39	1.69	4.33

to one another. Two sites, CASW and GASFW, increase at a much faster rate relative to the other sites. RASFW and WASFW have yields that increase at a slower rate than the other sub-basins. A more useful tool in watershed levels relationships is presented in Appendix H-2. Appendix H-2 is a plot of sediment yield verses discharge yield for the data collected in Water Year 2004. Plotting the data in this form makes each of the sub-basins directly compared to one another. WASFW immediately stands outs as having the lowest yield per unit discharge in Water Year 2004. Several of the sites SFWAW, SFWAC, GASFW, and CASFW all have very similar yields per unit discharge especially at the mid to high ranges of unit discharge. The yields for these sites diverge as unit discharges decrease.

Appendix H-3 and H-4 summarize the sediment yield data on a watershed level for Water Year 2005. In Water Year 2005 Appendix H-3 indicates that sediment yields increased at relatively the same rate for all of the sites. Again this is not to say that each of the sub-basins yields the same amount for a given discharge but rather that the rate of yield increases at relatively the same rate between the sub-basins. Appendix H-4 indicates that in Water Year 2005 WASFW, RASFW, and SFWAW all have very similar sediment yields for a given discharge. GASFW, CASFW, SFWAR, SFWAC all have higher yields per unit discharge.

5.0 CONCLUSIONS

A stream gage network was established throughout the South Fork Wages Creek Watershed in WY2004. Streamflow and sediment transport measurements were collected at 7 sites ranging in drainage area from 0.1 mi^2 to 1.10 mi^2. Over 131 measurements of turbidity and suspended sediment concentration were made over the winter of WY2004. Computed partial suspended sediment loads at the 7 sites ranged from0.06 tons to 0.44tons. Overall, most sites produced sediment at consistent rates.

Operation of the gage network continued in Water Year 2005. In Water Year 2005 RASFW creek was changed to a periodic station and SFWAR was upgraded with a pump sampler. Over 137 measurements of turbidity and suspended sediment were made in Water Year 2005. Computed total sediment loads ranged from 0.53 tons to 7.62 tons. Overall, most sites produces sediment at consistent rates. Station operation and data quality was much better in Water Year 2005 than in Water Year 2004. The data collected in Water Year 2005 is representative to the actual loads being transported in the watershed and can be used in future years for comparison

6.0 RECOMMENDATIONS

The following recommendations have been reached as a result of WY2004 and WY2005 data collection and analysis:

1. Where possible grade control structures should be installed to prevent shifts in rating. These grade controls structures should be installed at grade so as not to act as bedload traps

2. Every effort should be made to collect turbidity and SSC samples near the turbidity probe and pump intake. If the turbidity probe and pump intake are not in a representative reach they should be moved

3. Check measurements need to be made for every discharge measurement that does not plot within acceptable limits of the rating.

4. Staff plates and reference level gages need to be surveyed and checked on an annual basis

5. Further adjust of the turbidity thresholds is necessary to insure adequate coverage during a wide range of turbidity events.

6. Site visit forms should be developed so all pertinent and necessary information is written down each and every time the station is inspected and downloaded.

7. Transit rates for depth-integrated turbidity and SSC samples should be documented. It is not necessary to calculate a transit rate through a discharge each time. One easy way to do this would be for field crews to go to the thalweg and apply different transit rates until a bottle is filled between 60% and 90%. Knowing the depth at the thalweg and the transit time a transit rate can be calculated.

7.0 REFERENCES

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Johnston, L., Eads, R, and E. Keppeler, 2001. Turbidity Threshold Sampling Field Manual. Redwood Sciences Laboratory, USDA Forest Service.

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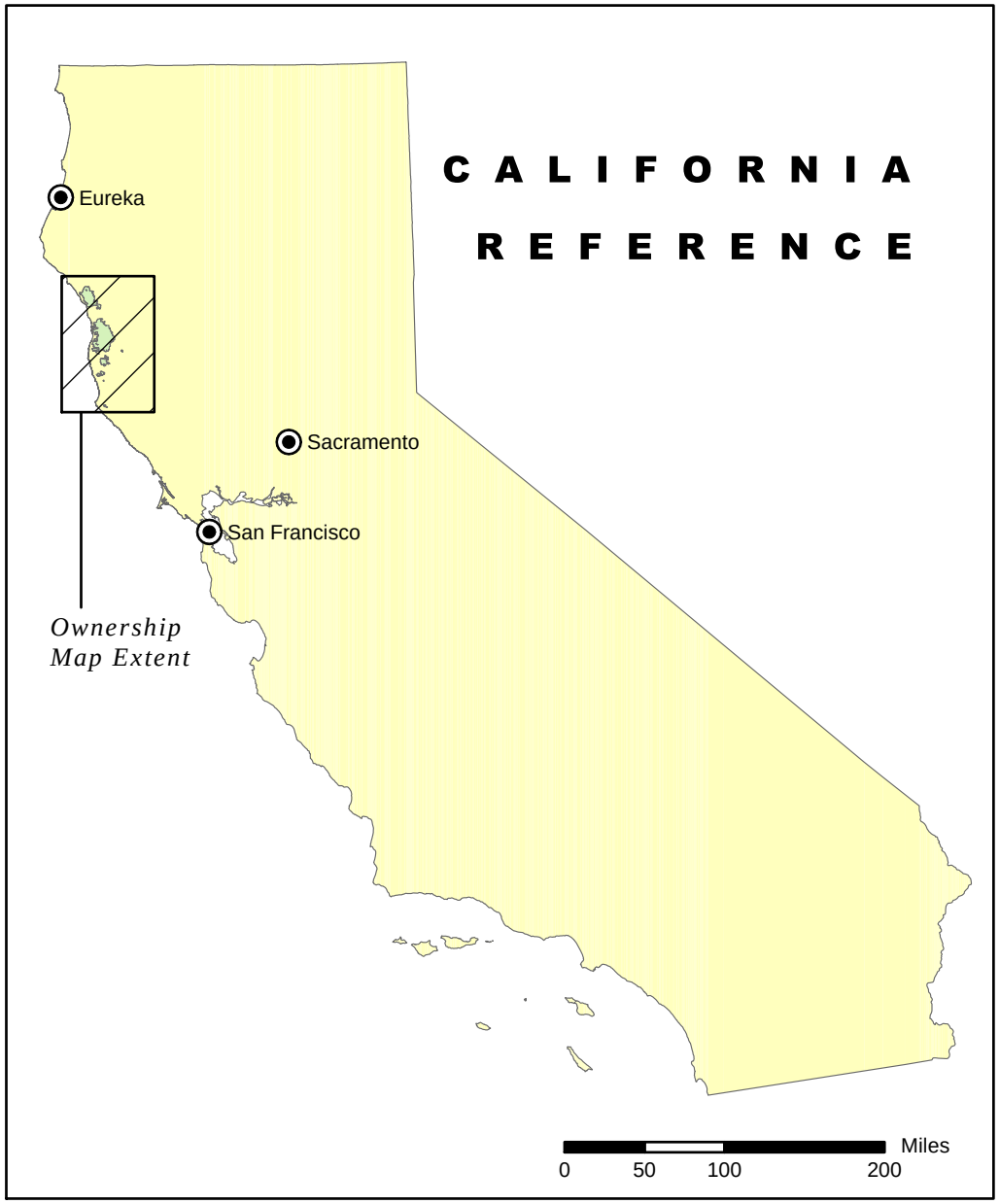
Rantz, S.E., and others, 1982, Measurement and Computation of Streamflow: USGS—Water Supply Paper 2175, V. 1, 2



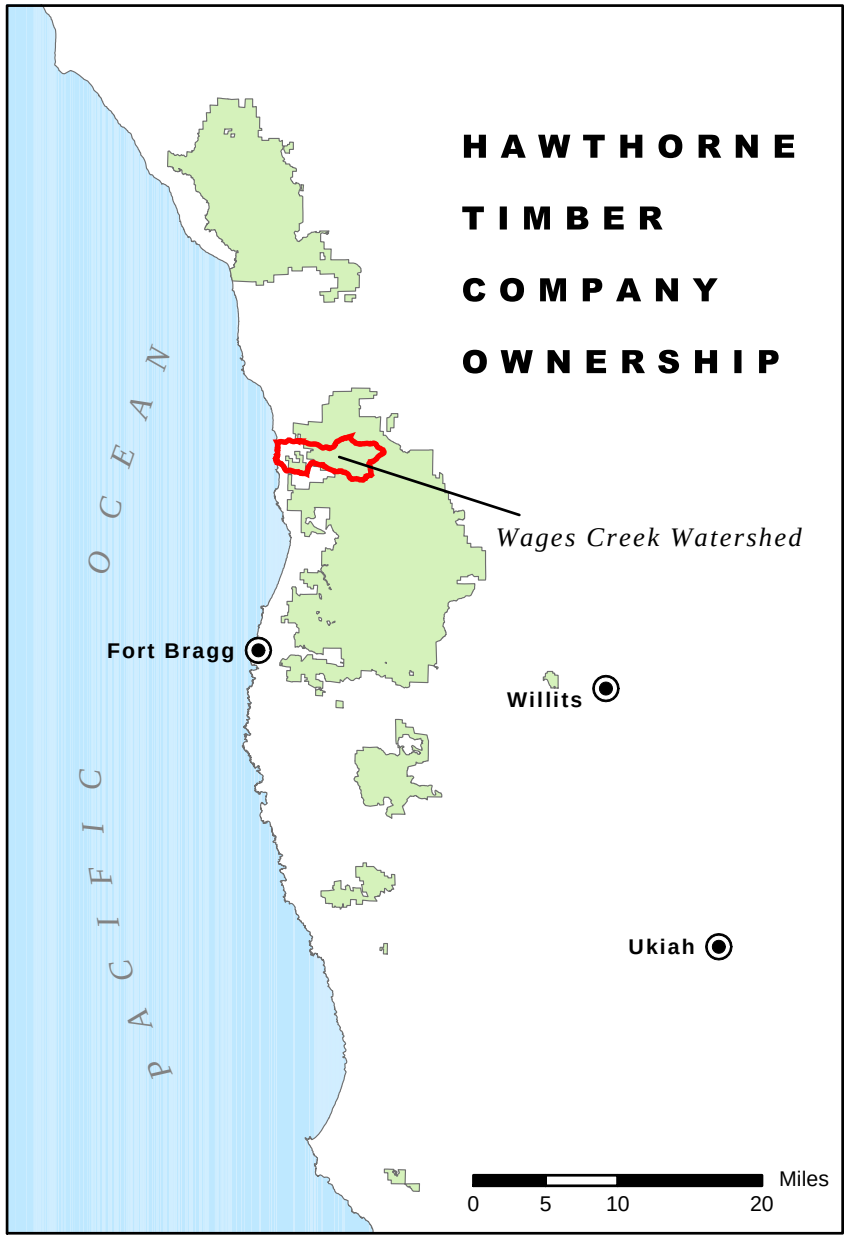


Figure 1. Regional Vicinity Map for The Hawthorne Timber Company

Hawthorne Timberlands
(Total Acres = 184,168)

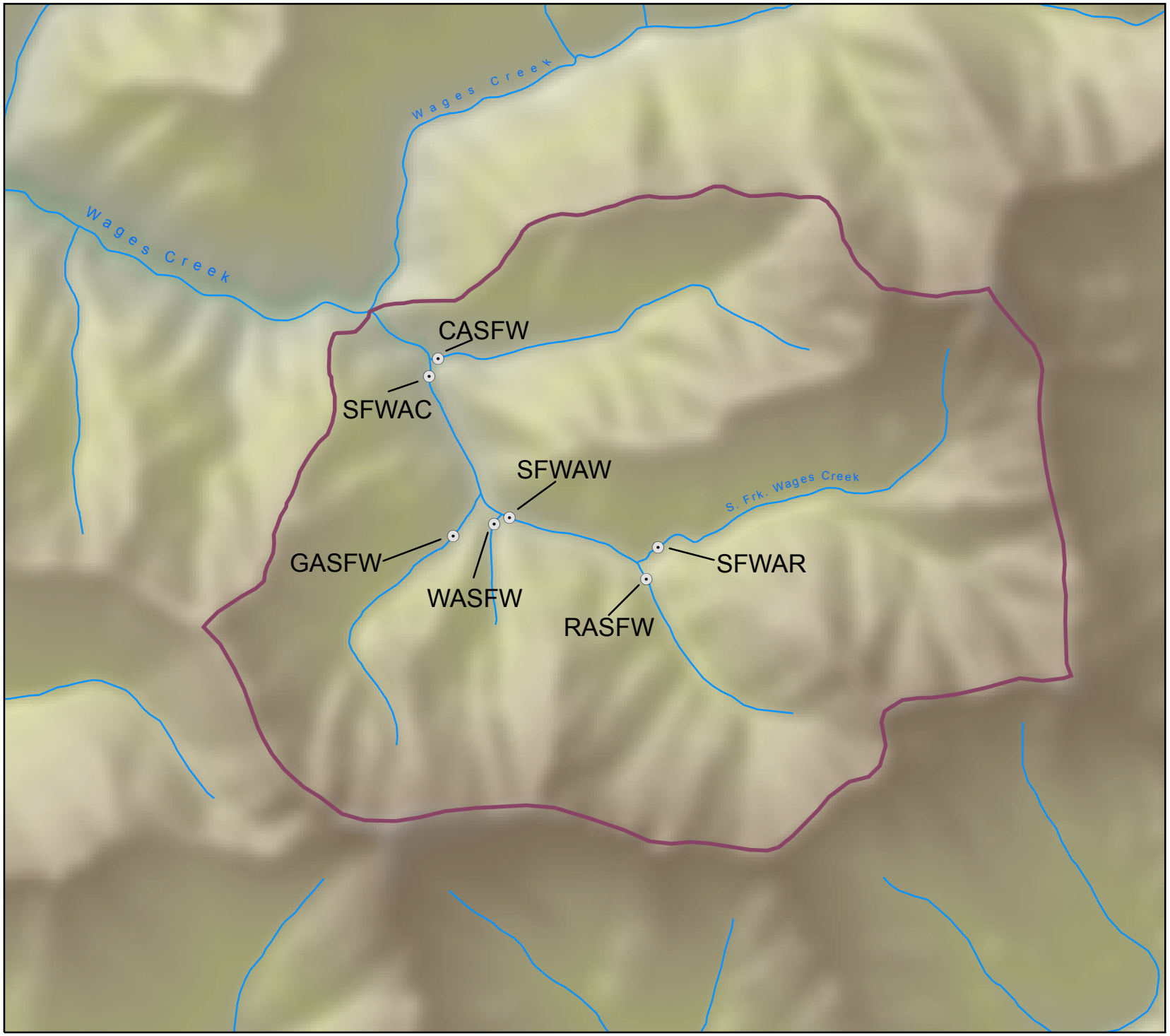
Wages Creek Watershed
(Total Acres = 8,583)

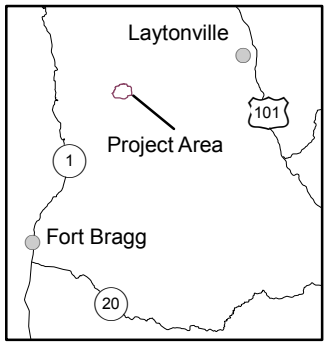
N
W
E
S

Campbell
TIMBERLAND MANAGEMENT LLC

7/17/2003 SH

Figure 2. South Fork Wages Creek Gauging Locations





Description

Gauging Stations

Watercourses
(modified from USGS NHD)

Watershed Boundary
(modified from CalWater 2.2.1)

N
W E
S

1:16,000

Feet
0 500 1,000

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SOUTH FORK WAGES CREEK STATION PHOTOS
WATER YEAR 2004

Photo 1. Steel Enclosure installed at Rock Creek.

Photo 2. Loading of ATV's at landing where the trucks are parked.

Photo 3. SF Wages above Center Gulch on 10/29/03 with a discharge of <1 cfs.

Photo 4. SF Wages above Center Gulch on 2/17/04 with a discharge of ~55 cfs. In this photo turbidity probe readings are being affected by turbulence. Boom has since been moved towards the right bank and out of the turbulence.

Photo 5. Center Gulch on 01/06/04 with a discharge of <1 cfs. Photo taken before boulders were added to channel in order to backwater turbidity probe.

Photo 6. Center Gulch on 02/17/04 with a discharge of ~13 cfs. Photo taken after boulders were added to channel in order to backwater turbidity probe.

Photo 7. Wood Creek above SF Wages on 10/29/03 with a discharge of 0 cfs.

Photo 8. Wood above SF Wages on 2/17/04 with a discharge of ~5 cfs. In this photo turbidity probe readings are being affected by turbulence. Boom has since been moved towards the right bank and out of the turbulence.

Photo 9. Rock Creek on 01/06/04 with a discharge of <1 cfs. Photo taken after channel shape had been modified by placement of large boulders.

Photo 10. Rock Creek on 2/17/04 with a discharge of ~14 cfs. Hydrologist is performing DIS sediment sample with a DH-48.

Photo 11. SF Wages above Rock Creek on 1/07/04 with a discharge of ~2.5 cfs. Photo taken before large boulders were added to channel.

Photo 12. SF Wages above Rock Creek on 2/18/04 with a discharge of ~17 cfs. Note that large boulders placed in channel are working well at backwatering the turbidity probe.

Photo 13. SF Wages above Wood Creek on 2/17/04 with a discharge of ~ 35 cfs. Note Crest Gage on right bank.

Photo 14. Grey Creek on 2/17/04 with a discharge of ~8 cfs. Note Crest Gage on left Bank. A rock weir was built to allow stage measurements.

CENTER GULCH ABOVE SOUTH FORK WAGES CREEK
(STATION # CTM 0283005)
STATION ANALYSIS
WATER YEAR 2004-2005

RECORDS – Surface Water & Water Quality

EQUIPMENT – A Turbidity Threshold Sampling (TTS) station is installed at the site. The TTS station includes an Isco 6712 full size portable sampler, a Campbell Scientific CR510 data collection platform (DCP), a waterlog H-310 pressure transducer and a forest technology systems DTS-12 turbidity sensor. The station battery power is supplemented by a solar panel. The DCP is housed in a locked steel box that is installed on the left bank. The DTS-12 is housed in an aluminum boom assembly, which is attached to a cable way strung over the creek. The pressure transducer is located on the left bank five feet downstream of the turbidity boom. One staff plate is located on the right bank 5 feet downstream of the cable way.
Inside recording gage: Less than or equal to 0.02% of full scale output (FSO) over temperature range referenced (0 to 40° C) to a straight line stretched from zero psi to maximum pressure (15 psi).
Outside staff gage: One USGS style C staff gage mounted on redwood and attached to channel iron that has been pounded into the streambed. Limits 0.00 ft. to 3.33 ft.

GAGE HEIGHT RECORDS – Record is incomplete for the period.
Water Year 2004 station operation began on October 29, 2003 at 12:00 hours. The station was down for maintenance on October 31, 2003 from 14:15 hours to 14:45 hours. A gap in the records exists on February 17, 2004 from 11:30 hours to 13:30 hours and from 16:30 hours to 19:15 hours. The field notes do not contain any record or station maintenance or troubleshooting during this time period. No other problems were encountered in Water Year 2004.
The Maximum gage height in Water Year 2004 of 1.03 ft occurred on February 17, 2004 at 14:00 hours.
The minimum gage in Water Year 2004 of 0.31 ft occurred on September 6, 2004 at 14:15 hours.
Gage operation continued in Water Year 2005. A debris jam occurred on October 8, 2004 17:45 and was cleared on October 13, 2004 11:43 changing the stage from 0.32 to 0.29. On November 1, 2004 a gap in the record exists from 16:30 hours to 17:00 hours while the station was down for maintenance. On November 12, 2004 a gap in the record exists from 12:00 hours to 12:30 hours. No entries could be found in the field notes on why the station was down. On December 14, 2004 a gap in the record exists from 12:00 hours to 12:30 hours. Field notes indicate that batteries were being replaced at the station and that maintenance was being performed. The record contains a gap from February 22, 2005 and 15:15 hours to February 23 at 15:15 hours. Field notes indicate that on February 22, 2005 that the Isco pump sampler was not operating due to a bad fuse. The fuse was replaced. Notes indicate that the Isco sampler problem was fixed and that the station was running. There are no field notes indicating a visit to the site on February 23, 2005 when the record begins again.
Staff height observations made on May 18, 2005 and May 19, 2005 indicated that the gage height file needed to be corrected by .08 ft and .07 ft respectively. A staff height observation made on April 22, 2005 at 11:27 hours indicated that the recorded gage height needed no correction and previously recorded staff heights had always been within .01ft to .02 ft of the recorded gage height. The gage height file was inspected for any obvious offsets but none where found. The field notes were re-checked to verify the staff height readings. On the July 7, 2005 station data download no staff observation was recorded. The gage height was corrected according to the staff height observations made on May 18 and May 19. The correction was started on May 18, 2005 05:15 hours. For the time period between April 22, 2005 at 11:30

hours and July 7, 2004 at 14:00 hours the record is considered suspect.
The maximum gage height in Water Year 2005 of 0.94 ft occurred on December 8, 2004 at 06:15 hours.
The minimum gage height in Water Year 2005 of 0.28 ft occurred on October 16, 2004 at 03:45 hours

DATUM CORRECTIONS – Staff plate has not been surveyed, no datum correction known.

CONTROL – The control is a four foot diameter downed redwood tree that creates a three foot waterfall on the downstream side. The channel at the gage has a steep vegetated right bank while the left bank has a large terrace. The left bank at the site will overtop during extreme events.

RATING – In Water Year 2004 four discharge measurements (1-4) were made. Measured discharge for the period ranged from 0.78 cfs to 13.8 cfs. Computed instantaneous discharge ranged from 0.15 cfs to 15.6 cfs. Measurements 2-4 were used to develop the upper portion of Rating 2.1. Measurement 1 was not used because the measurement was made by and inexperienced hydrographer and subsequent measurements indicated that it was not valid. Measurements 2-4 all plotted within 5% of Rating 2.1
In Water Year 2005 seven discharge measurements (5-11) were made. Measured discharge for the period ranged from 0.09 cfs to 6.13 cfs. Computed instantaneous discharge ranged from .05 cfs to 12.21 cfs. Rating 2.1 in use at the end of WY 2004 was continued in use.
Measurements 5-9 were used to develop the lower and middle portion of Rating 2.1. Measurement six was not used in rating development.
On October 13, 2004, when measurement 5 was made, the control was cleared of debris causing the gage height to drop 0.03 ft. Inspection of the gage height file indicated that the debris had become lodged on the control on October 8, 2004 starting at 18:30 hours. Using the gage height file and the staff height observations made on October 13, 2004 TV05-1 and TV05-2 were developed. TV05-1 is prorated into effect on October 8, 2004 at 19:45 hours. TV05-2 is prorated into effect beginning on October 8, 2004 at 19:45 hours and reaches full weight by October 13, 2004 at 11:30. TV05-2 is prorated into effect with the idea that after the initial obstruction of the control, as indicated by the gage height file, material began to build up slowly over time. Rating 2.1 is brought back into effect on October 13, 2004 at 11:45 hours after the control had been cleared and the gage height had stabilized.
Measurement 6 plotted -15% from Rating 2.1 and was rated poor. No check measurement was made. No shift was computed for measurement 6 because of the poor measurement rating, the relative inexperience of the hydrographer, and the lack of a check measurement.
Measurement 7 plotted withing 5% Rating 2.1 and was rated poor.
Measurement 8 plotted 6% from Rating 2.1 and was rated poor. No shift was computed for measurement six because of the poor measurement rating. A GZF measurement also verified that the elevation of the control had not changed.
Measurement 9 plotted 5% from Rating 2.1 and was rated poor.
Measurement 10 plotted 7% from Rating 2.1 and was rated poor. A GZF measurement indicated that the elevation of the control was 0.03ft higher but this is likely an artifact of a different hydrographer measuring the GZF. No shift was computed because the measured plotted within acceptable limits given the measurement rating.
Measurement 11 plotted -12% from Rating 2.1 and was rated poor. No check measurement was made. A GZF measurement indicated that the control was now 0.08 ft higher than earlier in the year and .05 ft higher than the previous GZF measurement made on March 28, 2005. No shift was computed because the measurement plotted with acceptable limits given the measurement rating.

DISCHARGE – Rating #2.1 was used during the WY 2004 – 2005 as follows:

Water Year 2004

Oct. 29 to Sept. 30 (24:00)	Rating 2.1

Water Year 2005

Oct. 1 to Oct. 8 (18:00)	Rating 2.1
Oct. 8 to Oct. 8 (19:45)	Prorate to TV05-1
Oct. 8 to Oct. 13 (11:30)	Prorate to TV05-2
Oct. 13 to Oct. 13 (11:45)	Direct to Rating 2.1
Oct. 13 to Jul. 7 (14:00)	Rating 2.1

SPECIAL COMPUTATIONS – None Made

REMARKS – Based on the error associated with the measurements and the hydraulic conditions at the site the record is considered poor for the entire period.

Gage height records worked by T. Gray 10-05
Gage height records checked by C. Pryor 10-05
Discharge computation worked by C. Pryor 11-05
Discharge computation checked by C. Pryor 12-05

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DISCHARGE SUMMARY SHEET

LOCATION: Center Gulch Above South Fork Wages Creeek **WATER YEAR: 2004-2005**

Measurement Number	WY Msmt #	Date	Made By	Width (feet)	Mean Depth (feet)	Area (ft^2)	Mean Velocity (ft/sec)	Gage Height (feet)	Discharge (cfs)	Rating 2.1 Shift Adj.	Rating 2.1 Percent Diff.	Method	No. of Msmt sections	Begin Time (hours)	End Time (hours)	Msmt Rating	GZF	Notes
1	2004-01	12/7/2003	T. Grey	2.9	0.20	0.59	1.32	0.51	0.78		-53	wading	13	14:23	14:41	fair		Inexperienced Hydrographer, No shift Computed
2	2004-02	2/4/2004	T. Grey	4.2	0.52	2.17	2.00	0.68	4.35		-4	wading	22	12:02	12:35	fair		
3	2004-03	2/17/2004	K. Faucher	5.9	0.72	4.23	3.26	0.99	13.8		-1	wading	26	17:50	18:18	fair		
4	2004-04	2/18/2004	T. Grey	5.0	0.75	3.73	2.53	0.85	9.42		5	wading	26	12:10	12:39	fair		
5	2005-01	10/13/2004	K. Fuacher	2.4	0.14	0.34	0.27	0.29	0.09		0	wading	13	11:07	11:42	Poor	0.20	
6	2005-02	12/28/2004	T. Bolton	4.4	0.34	1.51	0.57	0.45	0.86		-15	wading	14	13:33	13:52	Poor	X	Began on REW & no PZF; No shift computed
7	2005-03	1/3/2005	T. Bolton	3.4	0.27	0.93	1.59	0.49	1.47		4	wading	12	14:20	14:32	Poor	0.27	
8	2005-04	1/3/2005	T. Bolton	3.4	0.26	0.89	1.68	0.49	1.50		6	wading	12	14:36	14:44	Poor	0.27	
9	2005-05	2/22/2005	R. Leisse	3.0	0.27	0.81	1.57	0.47	1.27		5	wading	12	15:37	15:49	Poor	0.27	
10	2005-06	3/28/2005	K. Faucher	4.2	0.33	1.40	2.15	0.59	3.01		7	wading	14	10:33	10:49	Poor	0.30	
11	2005-07	5/18/2005	K. Faucher	4.1	0.51	2.09	2.93	0.78	6.13		-12	wading	14	20:57	21:09	Poor	0.35	

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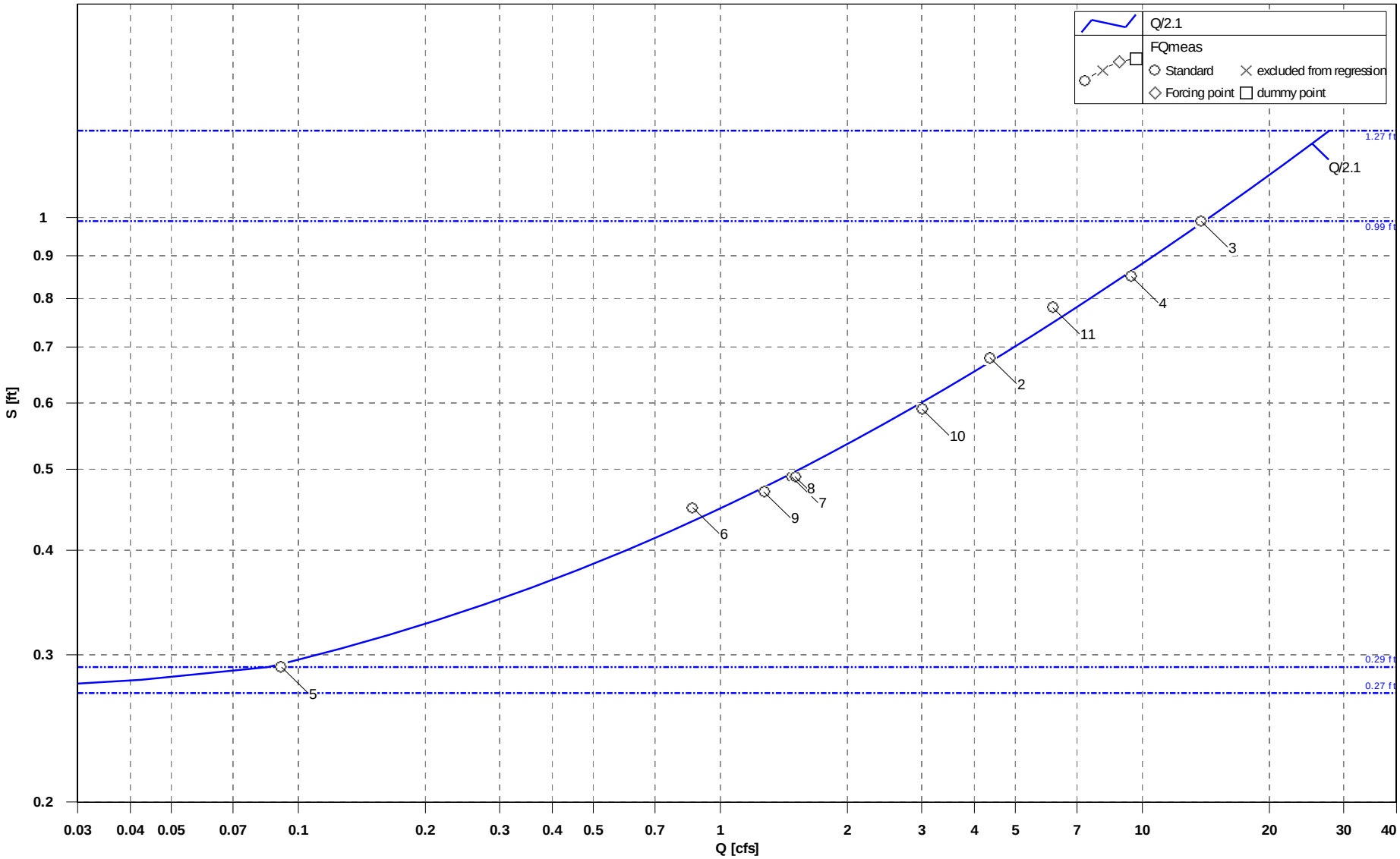
WY 04-05
APPENDIX

A-2

CENTER GULCH ABOVE SOUTH FORK WAGES CREEK
Discharge Rating Curve 2.1



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WY 04-05
APPENDIX

A-3

Graham Matthews & Associates

CENTER GULCH ABOVE SOUTH FORK WAGES CREEK

RATING TABLE NO.2.1 ------ Begin Date 02/04/04

GH	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	1st Diff	2nd Diff
0.0	---	---	---	---	---	---	---	---	---	---	---	---
0.1	---	---	---	---	---	---	---	---	---	---	---	---
0.2	---	---	---	---	---	---	---	*0.00*	*0.04*	*0.08*	---	---
0.3	0.11	0.14	0.18	0.21	0.26	0.30	0.35	0.41	0.47	0.53	0.45	
0.4	0.60	0.67	0.75	0.83	0.92	1.01	1.11	1.21	1.31	1.42	0.89	0.44
0.5	1.54	1.66	1.79	1.92	2.05	2.19	2.34	2.50	2.65	2.82	1.40	0.51
0.6	2.98	3.16	3.34	3.52	3.71	3.91	4.11	4.32	4.53	4.75	1.93	0.53
0.7	4.97	5.19	5.43	5.67	5.92	6.17	6.43	6.69	6.96	7.23	2.48	0.55
0.8	7.52	7.81	8.10	8.40	8.70	9.01	9.33	9.65	9.98	10.3	3.07	0.59
0.9	10.7	11.0	11.4	11.7	12.1	12.5	12.8	13.2	13.6	14.0	3.70	0.63
1.0	*14.4*	*14.8*	*15.2*	*15.7*	*16.1*	*16.5*	*17.0*	*17.5*	*17.9*	*18.4*	4.40	0.70
1.1	*18.8*	*19.3*	*19.8*	*20.3*	*20.8*	*21.3*	*21.8*	*22.3*	*22.8*	*23.3*	4.90	0.50
1.2	*23.8*	*24.4*	*24.9*	*25.5*	*26.0*	*26.6*	*27.2*	*27.7*	---	---	---	---
1.3	---	---	---	---	---	---	---	---	---	---	---	---
1.4	---	---	---	---	---	---	---	---	---	---	---	---
1.5	---	---	---	---	---	---	---	---	---	---	---	---
1.6	---	---	---	---	---	---	---	---	---	---	---	---
1.7	---	---	---	---	---	---	---	---	---	---	---	---
1.8	---	---	---	---	---	---	---	---	---	---	---	---
1.9	---	---	---	---	---	---	---	---	---	---	---	---
2.0	---	---	---	---	---	---	---	---	---	---	---	---
2.1	---	---	---	---	---	---	---	---	---	---	---	---
2.2	---	---	---	---	---	---	---	---	---	---	---	---
2.3	---	---	---	---	---	---	---	---	---	---	---	---
2.4	---	---	---	---	---	---	---	---	---	---	---	---
2.5	---	---	---	---	---	---	---	---	---	---	---	---

Values in italics are beyond the validated range of the rating

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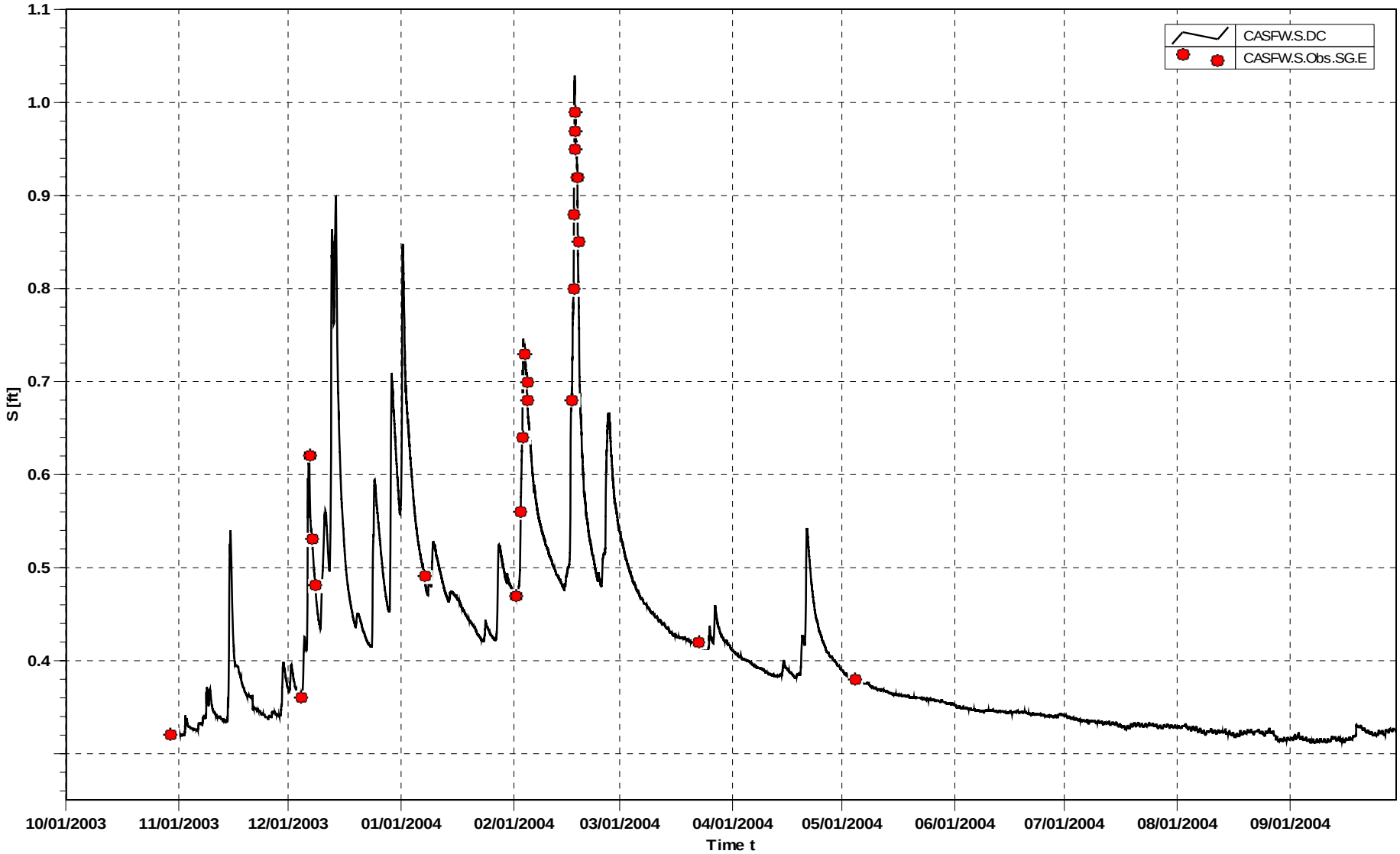
CENTER GULCH ABOVE SOUTH FORK WAGES CREEK
15-Minute Adjusted Gage Height Record and Observed Staff Gage Readings



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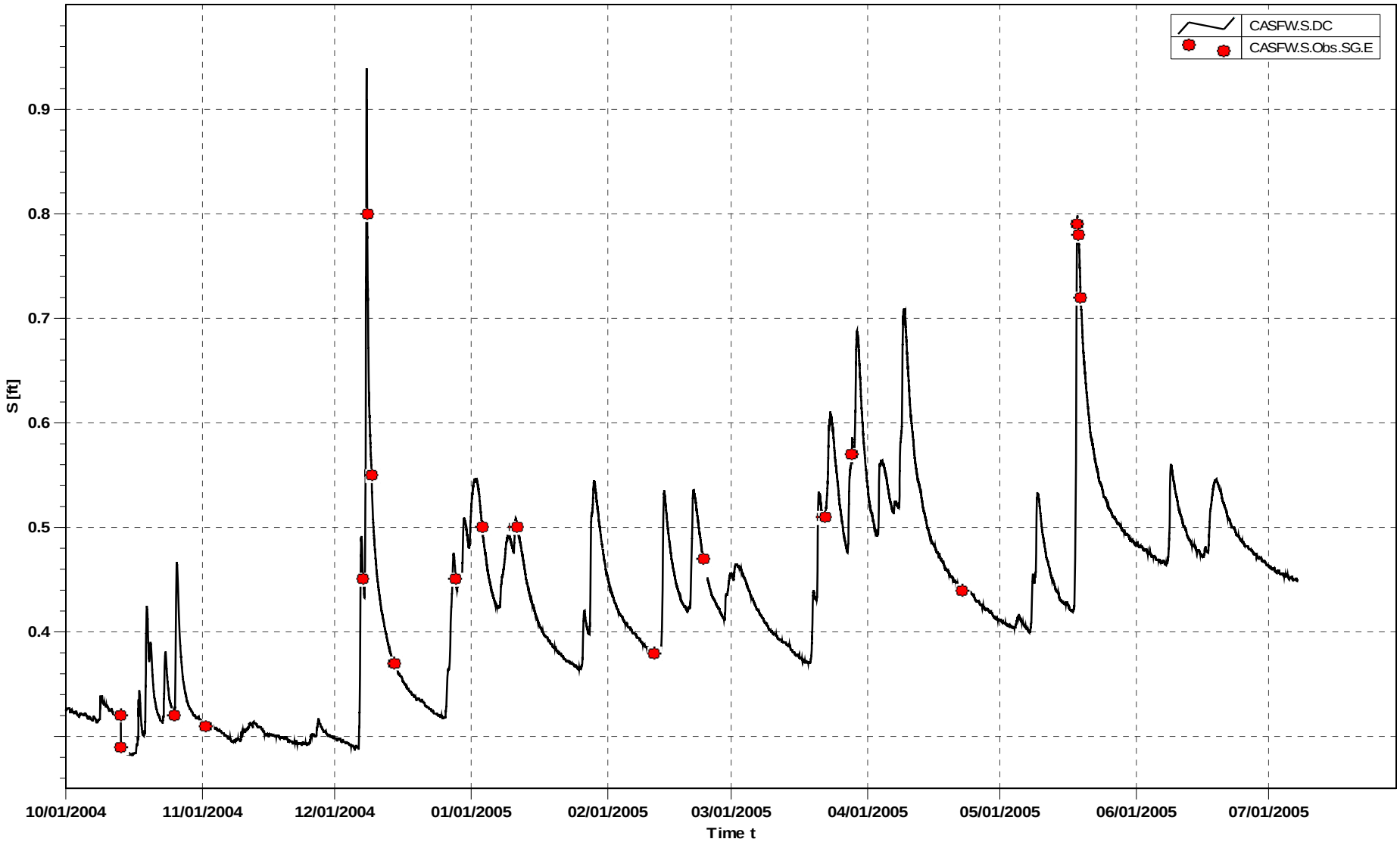
WY 2004
APPENDIX

A-5a

CENTER GULCH ABOVE SOUTH FORK WAGES CREEK
15-Minute Adjusted Gage Height Record and Observed Staff Gage Readings



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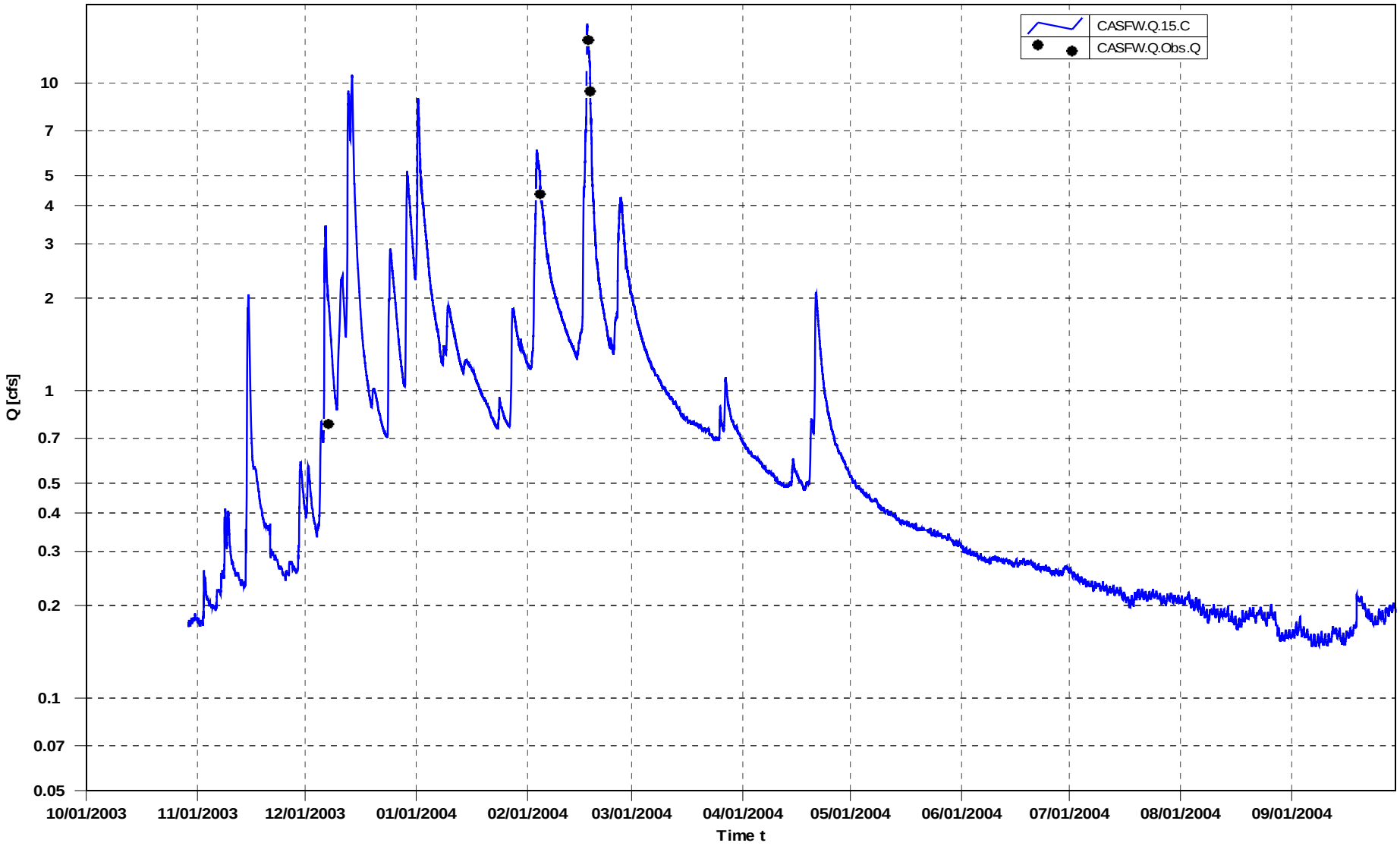
WY 2005
APPENDIX

A-5b

CENTER GULCH ABOVE SOUTH FORK WAGES CREEK
Discharge Hydrograph and Discharge Measurements



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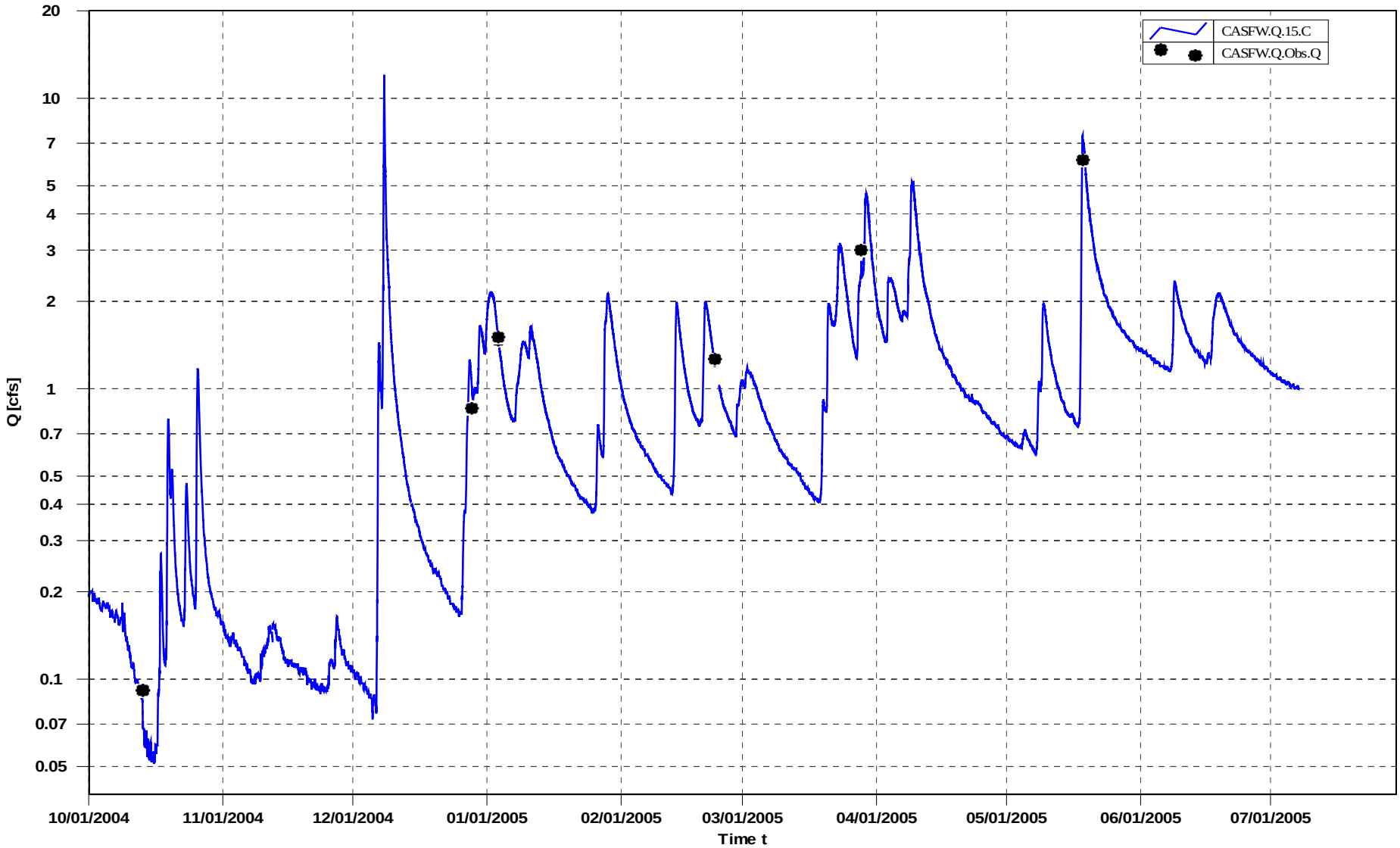
WY 2004
APPENDIX

A-6a

CENTER GULCH ABOVE SOUTH FORK WAGES CREEK
Discharge Hydrograph and Discharge Measurements



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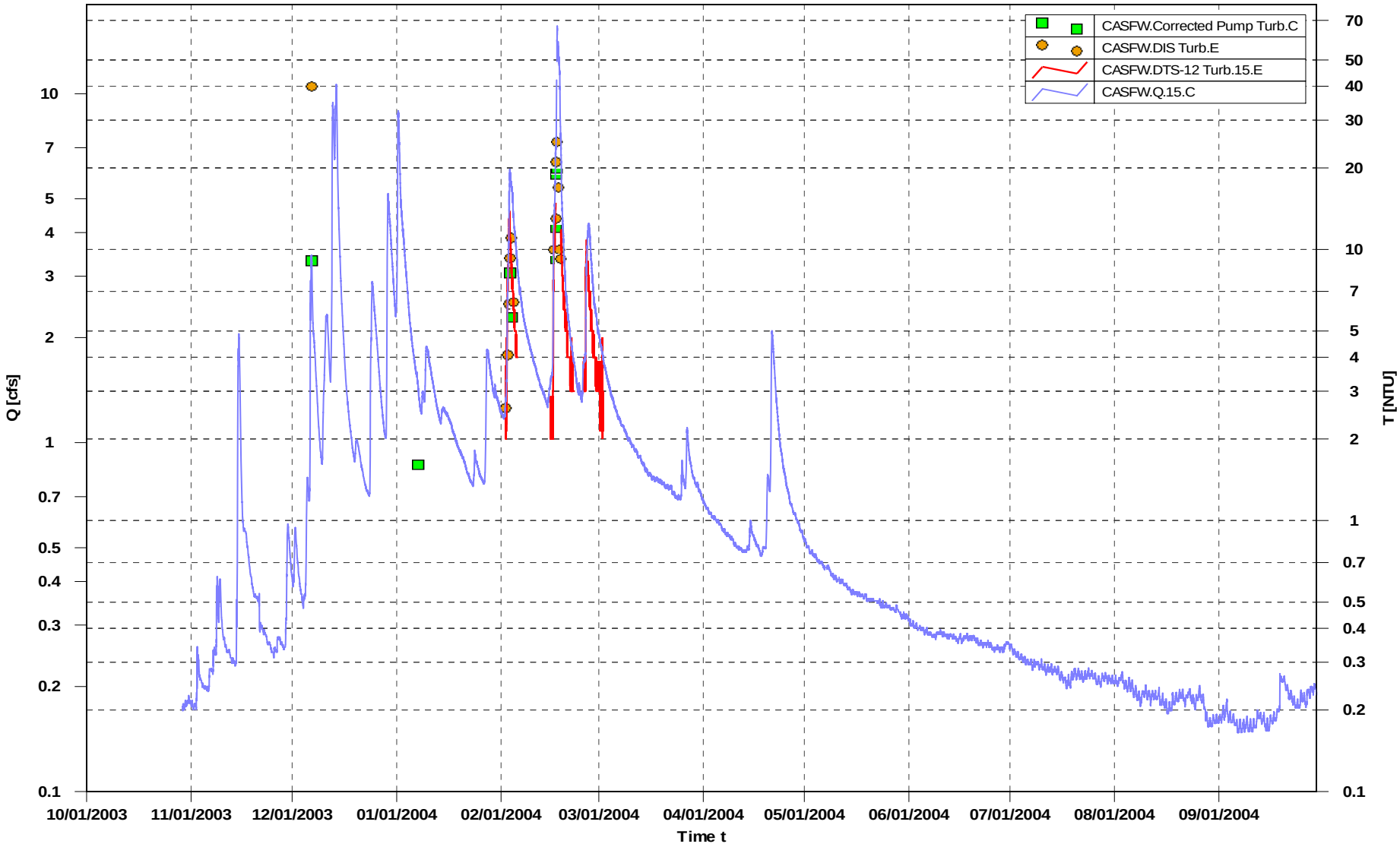
WY 2005
APPENDIX

A-6b

CENTER GULCH ABOVE SOUTH FORK WAGES CREEK
Discharge Hydrograph, Continuous Turbidity with Pump and Depth-Integrated Turbidity Samples



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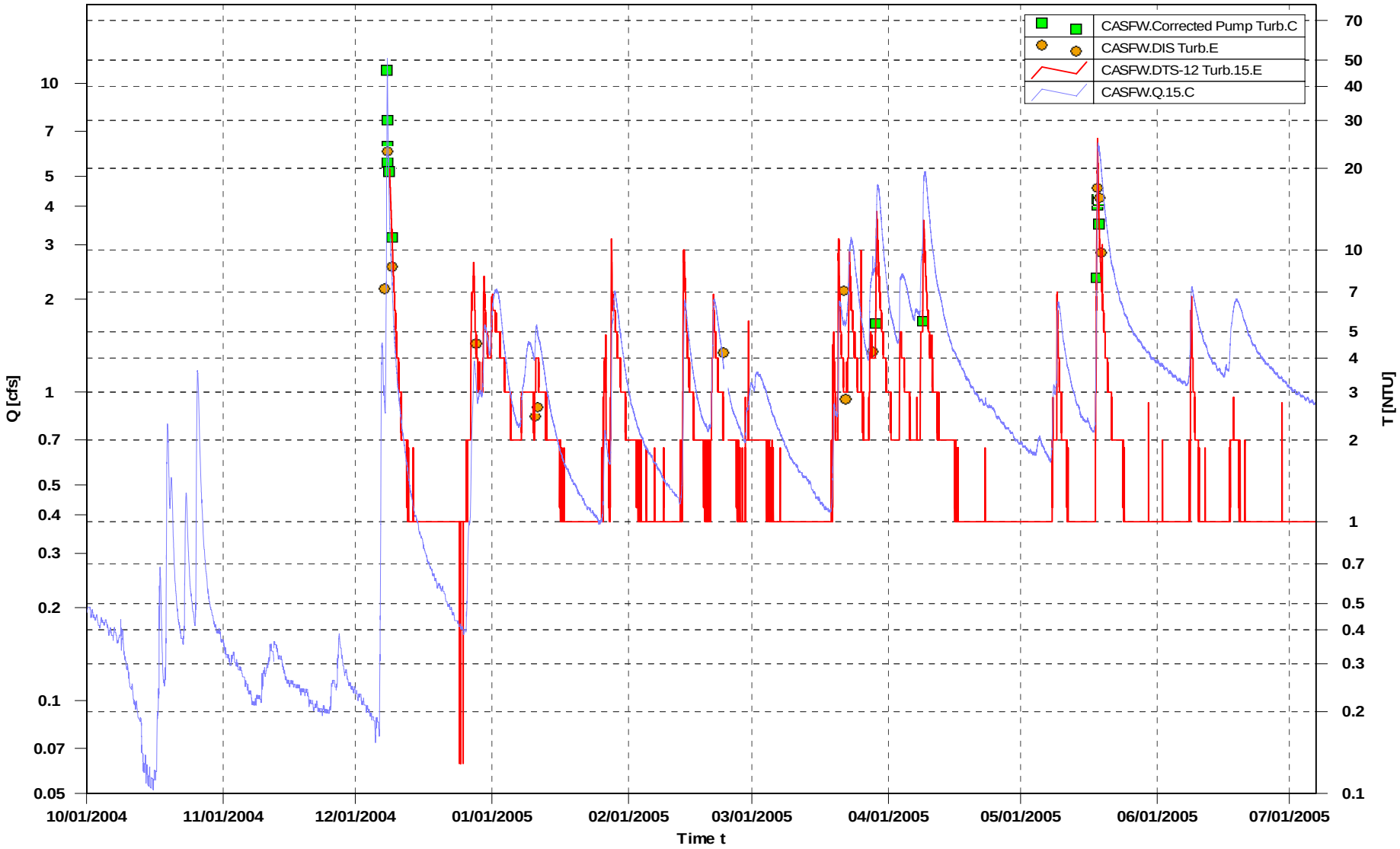
WY 2004
APPENDIX

A-7a

CENTER GULCH ABOVE SOUTH FORK WAGES CREEK
Discharge Hydrograph, Continuous Turbidity with Pump and Depth-Integrated Turbidity Samples



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WY 2005
APPENDIX

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SUSPENDED SEDIMENT MEASUREMENT SUMMARY SHEET

LOCATION: CENTER GULCH ABOVE SOUTH FORK WAGES CREEK **WATER YEAR:** 2004

Date/ Time	Msmt No.	Turbidity (NTU)	SSC (mg/l)	Stage (ft)	Discharge (cfs)	Q/WSA (cfs/mi^2)	SSL (tons/day)	SSLPA (tons/day/mi^2)	Type (DIS, Pump)	Notes
12/6/2003 18:16	CASFW-SSCT2004-01	40	201	0.63	3.52	12	1.9	6.6	DIS	Censored
12/6/2003 18:17	CASFW-SSCT2004-02	9.1	11	0.63	3.52	12	0.1	0.4	PUMP	
1/7/2004 13:01	CASFW-SSCT2004-03	2.6	0.5	0.50	1.54	5.3	0.0	0.0	PUMP	
2/2/2004 4:40	CASFW-SSCT2004-04	2.6	4.2	0.52	1.79	6.2	0.0	0.1	DIS	
2/2/2004 20:20	CASFW-SSCT2004-05	4.1	8.4	0.56	2.34	8.1	0.1	0.2	DIS	
2/3/2004 5:46	CASFW-SSCT2004-06	6.3	8.7	0.64	3.71	13	0.1	0.3	DIS	
2/3/2004 13:02	CASFW-SSCT2004-07	9.3	7.8	0.73	5.67	20	0.1	0.4	DIS	Bottle # 918
2/3/2004 13:02	CASFW-SSCT2004-08	9.2	9.0	0.73	5.67	20	0.1	0.4	PUMP	Calibrate w/ bottle # 918
2/3/2004 20:20	CASFW-SSCT2004-09	11	13	0.73	5.67	20	0.2	0.7	DIS	
2/4/2004 11:01	CASFW-SSCT2004-10	6.6	3.0	0.70	4.97	17	0.0	0.1	PUMP	T-PROBE = 7 NTU
2/4/2004 12:52	CASFW-SSCT2004-11	6.4	2.1	0.68	4.53	16	0.0	0.1	DIS	
2/16/2004 18:35	CASFW-SSCT2004-12	10	22	0.68	4.53	16	0.3	0.9	DIS	
2/17/2004 6:31	CASFW-SSCT2004-13	10	13	0.78	6.96	24	0.2	0.7	PUMP	T-PROBE = 17 NTU
2/17/2004 8:10	CASFW-SSCT2004-14	13	19	0.80	7.52	26	0.4	1.3	DIS	
2/17/2004 8:16	CASFW-SSCT2004-15	13	17	0.80	7.52	26	0.3	0.9	PUMP	T-PROBE = 26 NTU
2/17/2004 10:46	CASFW-SSCT2004-16	21	39	0.88	9.98	34	1.0	3.6	DIS	
2/17/2004 11:01	CASFW-SSCT2004-17	20	39	0.93	11.7	40	0.9	3.2	PUMP	T-PROBE = 105 NTU
2/17/2004 11:46	CASFW-SSCT2004-18	21	40	0.95	12.5	43	1.0	3.5	PUMP	T-PROBE = 316 NTU
2/17/2004 13:46	CASFW-SSCT2004-19	25	67	0.95	12.5	43	2.3	7.8	DIS	
2/17/2004 19:28	CASFW-SSCT2004-20	17	24	0.97	13.2	46	0.9	2.9	DIS	
2/18/2004 10:42	CASFW-SSCT2004-21	10	9.8	0.91	11.0	38	0.3	1.0	DIS	
2/18/2004 16:46	CASFW-SSCT2004-22	9.2	10.0	0.82	8.10	28	0.2	0.8	DIS	

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WY 2004 APPENDIX

A-8a

SEDIMENT SAMPLE SUMMARY SHEET

LOCATION: CENTER GULCH ABOVE SOUTH FORK WAGES **WATER YEAR: 2005**

Date Time	Sample Number	Turbidity (NTU)	SSC (mg/l)	Stage (ft)	Discharge (cfs)	Q/WSA (cfs/mi^2)	SSL (ton/day)	SSLPA (ton/day/mi2)	Type (DIS, PUMP)	Note
12/7/2004 13:18	CASFW-SSCT2005-01	7.2	4.5	0.45	1.01	3.5	0.0	0.0	DIS	
12/8/2004 01:46	CASFW-SSCT2005-02	82	174	0.61	3.13	11	1.5	5.1	PUMP	
12/8/2004 02:16	CASFW-SSCT2005-03	46	102	0.68	4.64	16	1.3	4.4	PUMP	
12/8/2004 05:46	CASFW-SSCT2005-04	30	61	0.91	11.2	39	1.8	6.4	PUMP	
12/8/2004 08:46	CASFW-SSCT2005-05	24	19	0.83	8.45	29	0.4	1.5	PUMP	
12/8/2004 09:31	CASFW-SSCT2005-06	24	14	0.80	7.80	27	0.3	1.0	PUMP	
12/8/2004 09:38	CASFW-SSCT2005-07	23	16	0.80	7.52	26	0.3	1.1	DIS	
12/8/2004 11:01	CASFW-SSCT2005-08	21	8.2	0.76	6.54	23	0.1	0.5	PUMP	
12/8/2004 14:01	CASFW-SSCT2005-09	19	7.4	0.71	5.34	18	0.1	0.4	PUMP	
12/9/2004 10:15	CASFW-SSCT2005-10	11	4.8	0.54	2.26	7.8	0.0	0.1	PUMP	
12/9/2004 10:20	CASFW-SSCT2005-11	8.7	1.2	0.55	2.19	7.6	0.0	0.0	DIS	
12/28/2004 12:42	CASFW-SSCT2005-12	4.5	2.8	0.45	1.01	3.5	0.0	0.0	DIS	
1/10/2005 22:07	CASFW-SSCT2005-13	2.5	4.7	0.50	1.54	5.3	0.0	0.1	DIS	
1/11/2005 11:20	CASFW-SSCT2005-14	2.6	3.6	0.50	1.55	5.3	0.0	0.1	DIS	
2/22/2005 15:40	CASFW-SSCT2005-15	4.2	77	0.47	1.21	4.2	0.3	0.9	DIS	sand, discharge taken from rating table not from 15 mintute discharge record, Censored
3/21/2005 18:39	CASFW-SSCT2005-16	7.1	30	0.51	1.66	5.7	0.1	0.5	DIS	Censored
3/22/2005 07:44	CASFW-SSCT2005-17	2.8	3.3	0.51	1.66	5.7	0.0	0.1	DIS	
3/28/2005 10:40	CASFW-SSCT2005-18	4.2	3.4	0.57	2.52	8.7	0.0	0.1	DIS	
3/29/2005 06:16	CASFW-SSCT2005-19	5.4	19	0.65	3.48	12	0.2	0.6	Pump	
4/8/2005 21:01	CASFW-SSCT2005-20	5.5	18	0.66	3.88	13	0.2	0.6	Pump	
5/18/2005 06:31	CASFW-SSCT2005-21	7.9	16	0.57	2.48	8.6	0.1	0.4	Pump	
5/18/2005 10:31	CASFW-SSCT2005-22	15	20	0.71	5.00	17	0.3	0.9	Pump	
5/18/2005 12:46	CASFW-SSCT2005-23	17	27	0.79	6.78	23	0.5	1.7	DIS	
5/18/2005 13:01	CASFW-SSCT2005-24	15	21	0.79	6.80	23	0.4	1.3	Pump	
5/18/2005 14:26	CASFW-SSCT2005-25	15	19	0.80	6.88	24	0.4	1.2	Pump	manual pump for calibration however DIS bottle broke and lost sample.
5/18/2005 17:01	CASFW-SSCT2005-26	13	12	0.78	6.34	22	0.2	0.7	Pump	
5/18/2005 20:14	CASFW-SSCT2005-27	16	7.8	0.78	6.16	21	0.1	0.4	DIS	
5/19/2005 07:38	CASFW-SSCT2005-28	9.8	11	0.72	4.75	16	0.1	0.5	DIS	

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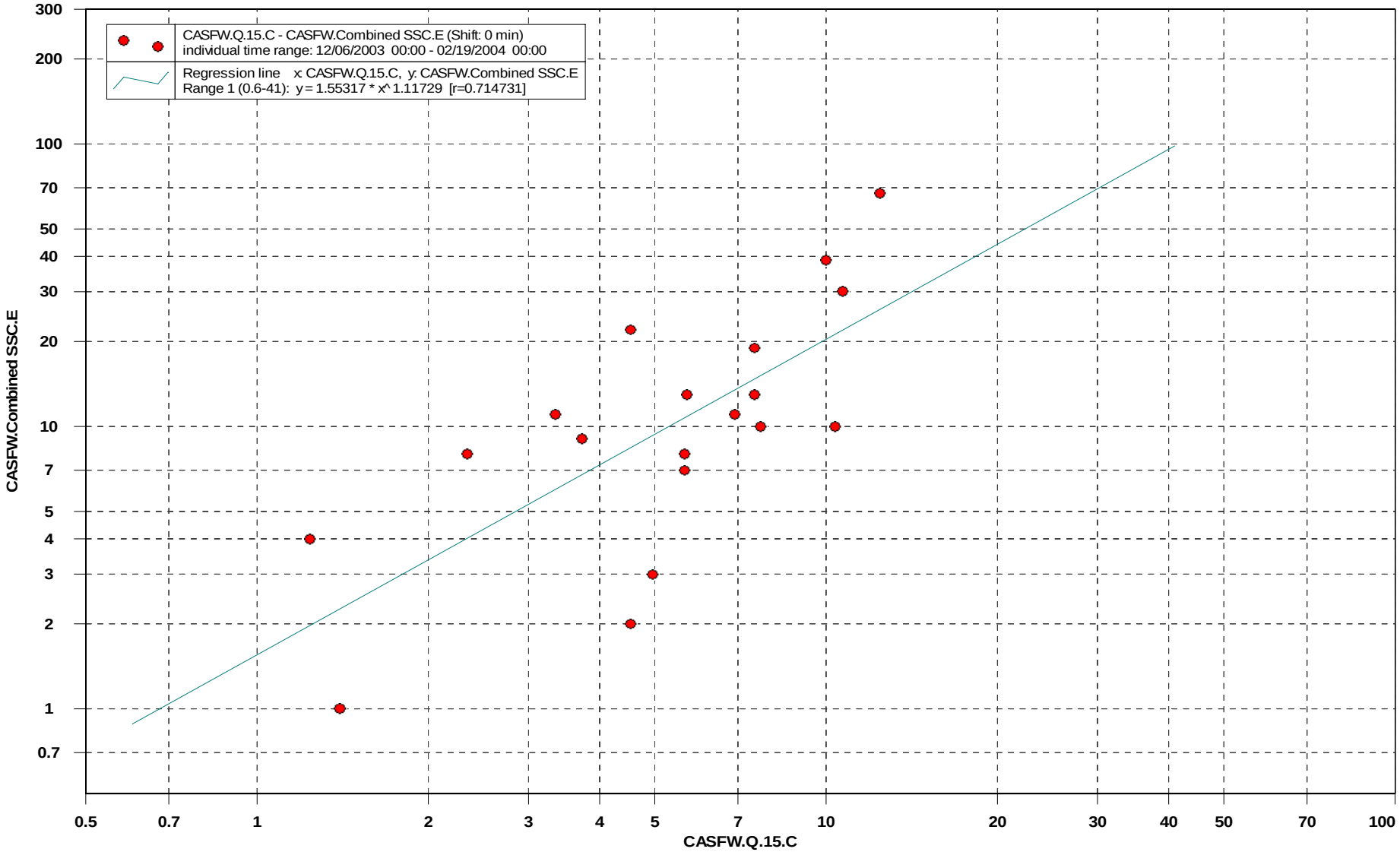
WY 2005 APPENDIX

A-8b

CENTER GULCH ABOVE SOUTH FORK WAGES CREEK
Discharge vs Depth-Integrated and Pump SSC



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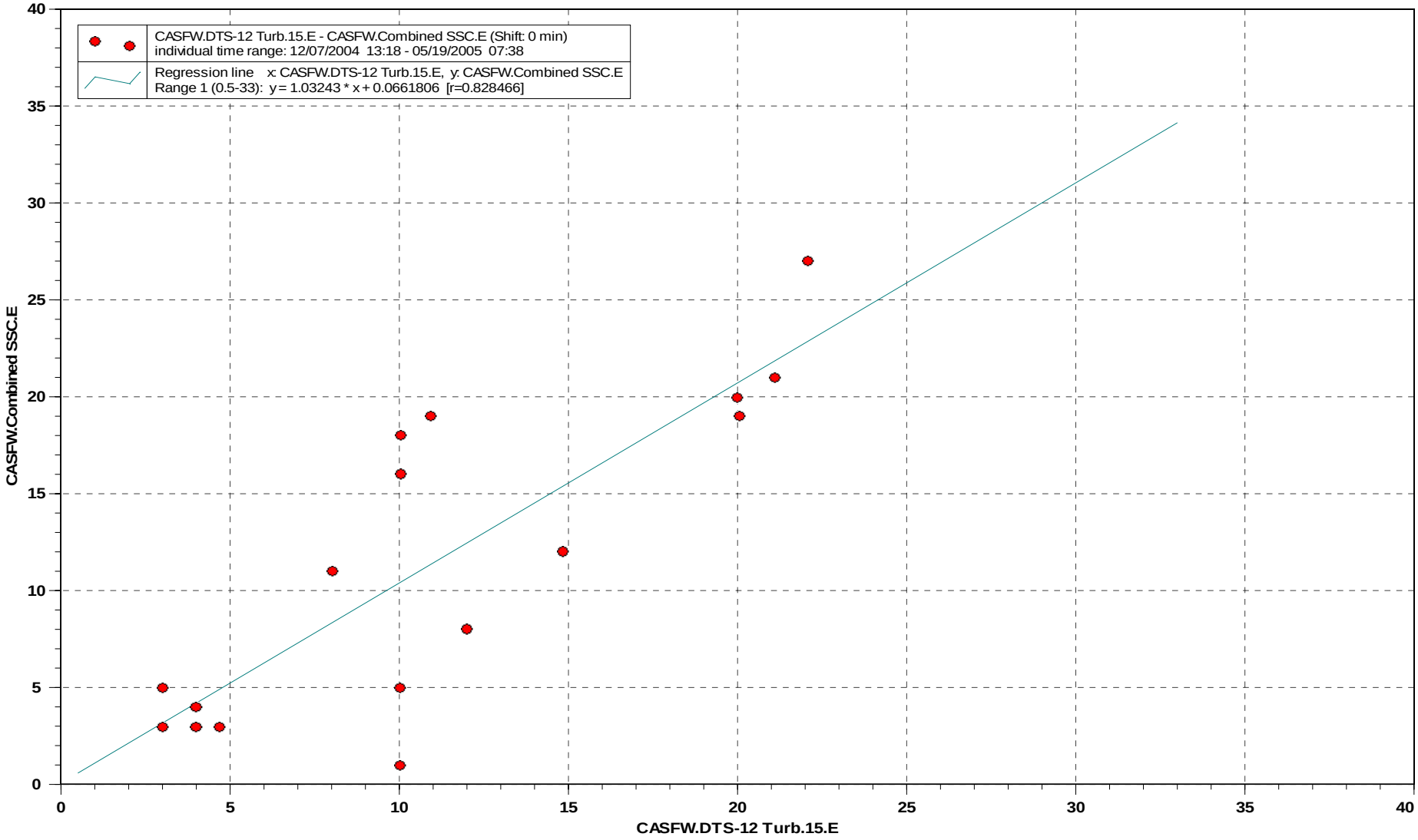
WY 2004
APPENDIX

A-9a

CENTER GULCH ABOVE SOUTH FORK WAGES CREEK
DTS-12 Turbidity vs Depth-Integrated and Pump SSC



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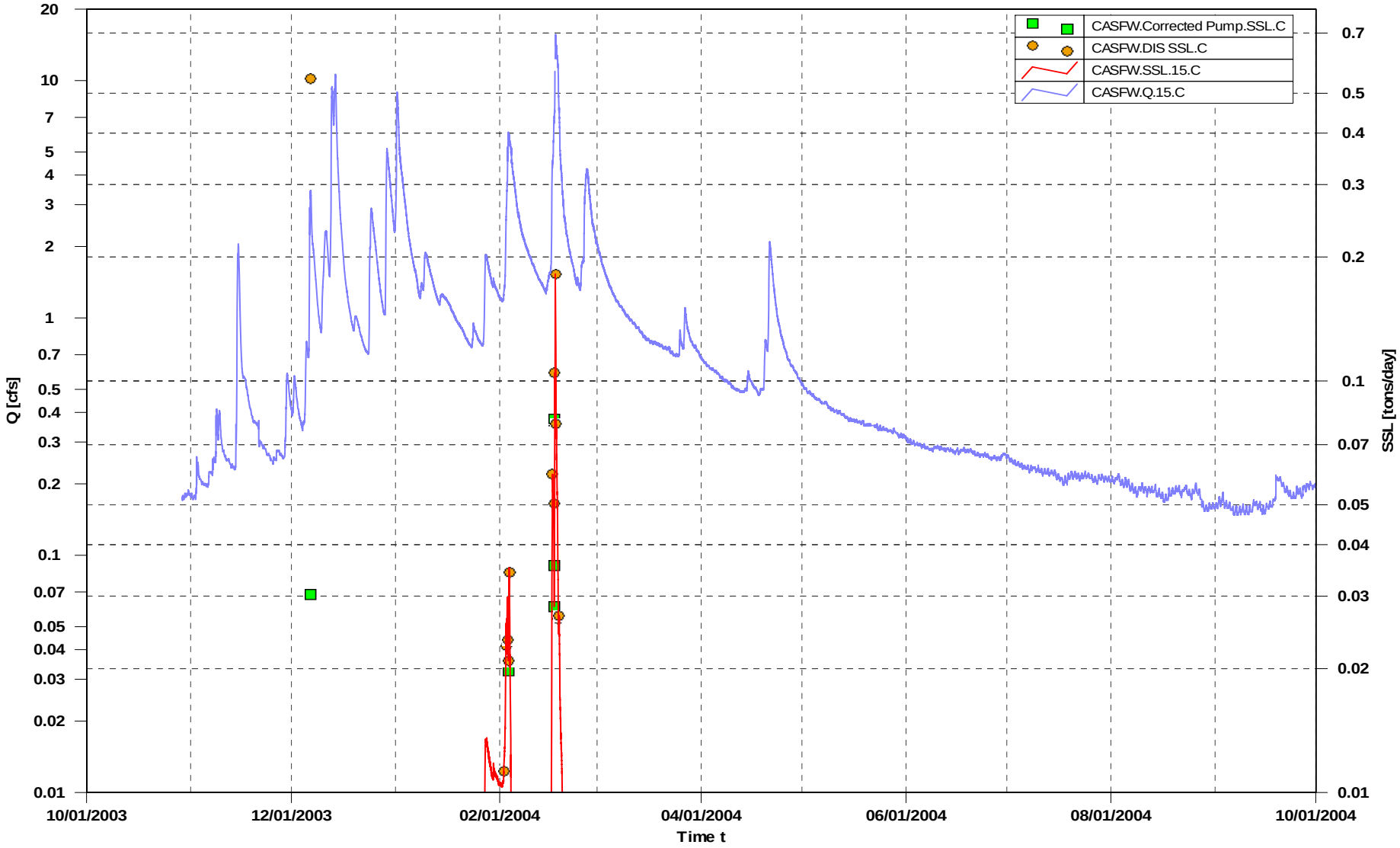
WY 2005
APPENDIX

A-9b

CENTER GULCH ABOVE SOUTH FORK WAGES CREEK
Discharge and Suspended Sediment Load



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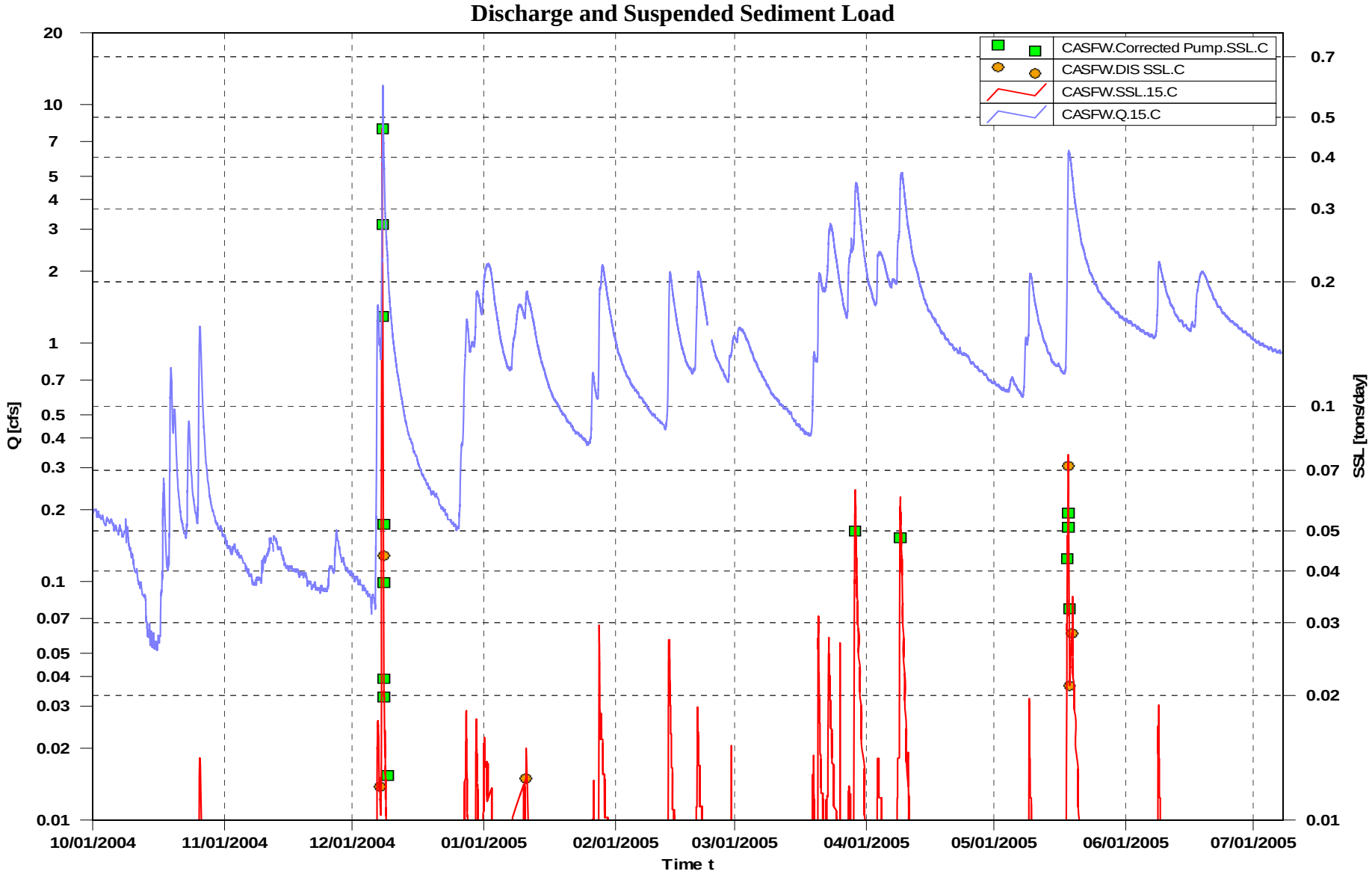

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WY 2005
APPENDIX

A-10b

SOUTH FORK WAGES CREEK ABOVE CENTER GULCH
(STATION # CTM 0283010)
STATION ANALYSIS
WATER YEAR 2004-2005

RECORDS – Surface Water

EQUIPMENT – A Turbidity Threshold Sampling (TTS) station is installed at this site. The TTS station includes an Isco 6712 full size portable sampler, a Campbell Scientific CR510 data collection platform (DCP), a waterlog H-310 pressure transducer and a forest technology systems DTS-12 turbidity sensor. The station battery power is supplemented by a solar panel. The DCP is housed in a locked steel box that is installed on the right bank. The DTS-12 is housed in an aluminum boom assembly, which is attached to a cable way strung over the creek. The pressure transducer is located on the right bank close to the cable way. One staff plate is located on the left bank 5 feet downstream of the cable way.
Inside recording gage: Less than or equal to 0.02% of full scale output (FSO) over temperature range referenced (0 to 40° C) to a straight line stretched from zero psi to maximum pressure (15 psi).
Outside staff gage: One USGS style A staff gage mounted on redwood and attached to channel iron that has been pounded into the streambed. Limits 0.00 ft. to 3.32 ft.

GAGE HEIGHT RECORDS – Record is incomplete for the period.
Water Year 2004 station operation of the station began on October 29, 2003 at 15:30 hours. Campbell datalogger malfunctioned on December 5, 2003 at 10:15 hours and was replaced on December 7, 2003 at 16:45 hours. Station operation became intermittent on August 4, 2004. Station operation ceased for the water year on August 5, 2005 at 15:45 hours.
The maximum gage height inWater Year 2004 of 2.16 ft occurred on January 1, 2004 at 14:00 hours. The minimum gage height in Water Year 2004 of 0.31 ft occurred on October 29, 2003 at 19:30 hours.
Water Year 2005 station operation began on October 13 at 10:45 hours. Gage height record runs through July 7, 2005 at 13:45 hours.
The maximum gage height in Water Year 2005 of 1.72 feet occurred on December 8, 2004 at 07:00 hours.
The minimum gage height in Water Year 2004 of 0.30 feet occurred on December 6, 2004 10:00 hours.

DATUM CORRECTIONS – Staff plate has not been surveyed, no datum correction known.

CONTROL – The low to mid range control is a semi-stable cobble and boulder riffle. During periods of very high flow (>100 cfs) the control becomes drown out and channel control dominates. The channel at the gage has a steep vegetated right bank while the left bank has a small terrace with a steep upper bank. The Left bank at the site will overtop during extreme events.

RATING – In Water Year 2004 five discharge measurements (1-5) were made. Measured discharge for the period ranged from 5.45 cfs to 53.3 cfs. Computed instantaneous discharge ranged 0.15 cfs to 102 cfs. Measurements 1-5 were used to develop the base rating 1.2.
On January 7, 2004 a debris jam downstream of the control was backwatering the site. The debris jam was cleared causing the gage height to drop from 1.17 ft to 0.82 ft. No information was available on when the debris jam had occurred. Based the observations made when the debris jam was cleared and inspection of the gage height file TV04-1 was developed. TV04-1 was prorated into effect beginning on January 1, 2004 and gained full weight by January 7, 2004 at 11:45 hours with the idea that the debris jam had initially

formed near the peak on January and that material had continued to collect on it until it was cleared. Rating 1.2 was prorated back into effect immediately after the debris had been cleared and the gage height stabilized.

In Water Year 2005 seven discharge measurements (6-12) were made. Measured discharge for the period ranged from 0.20 cfs to 34.2 cfs. Computed instantaneous discharge ranged from 0.14 cfs to 56.2 cfs

Rating

Rating 1.2 in used at the end of station operation in Water Year 2004 was continued in use. Measurement 6, made on October 13, 2004 (WY 2005), was used to refine the low end of the Rating 1.2. Measurement 7, made on December 28, 2004 plotted within 1% of Rating 1.2 and was rated poor.

Measurements 8 and 9, both made on January 3, 2005, plotted -10% and -16% from Rating 1.2. Measurement 9 was a check measurement for measurement 8. The shifts indicated by measurements 8 and 9 where -0.03 ft and -.04 ft respectively. Measurements 8 and 9 were used to develop time variable shift (TV) TV05-1. TV05-1 is prorated into effect beginning on December 8, 2004 at 07:00 hrs and reaches full weight on December 9 at 17:15 hours. TV05-1 is prorated into effect beginning at the peak of the December 8th storm with the idea that material was transported into the section and raised the elevation of the control. TV05-1 is defined by measurement 8 to within 1% and measurement 9 to within -6% of Rating 2.1.

Measurement 10, made on February 22, 2005 indicates a return to Rating 1.2. No check measurement was made for measurement 10. The return to Rating 1.2 is prorated into effect beginning on January 28, 2005 at 14:00 hours and is fully accomplished by January 29, 2005 at 07:30 with the idea that the material that had been transported into the section was removed by the high flows of January 28 and 29, 2005.

Measurement 11, made on March 28, 2005, plotted -14% from Rating 1.2. No check measurement was made. Measurement 11 indicates that material had been transported into the section raising the elevation of the control. The GZF measurement made concurrent with the discharge measurements confirms this. Measurement 11 was used to develop TV05-2, which is defined by measurement 11 to within 0% of Rating 1.2. TV05-2 is prorated into effect beginning on March 22, 2005 at 09:30 hours and reaches full weight by March 25 at 10:00 hours. TV05-2 is prorated into effect with the idea that material was transported into the section during the high flow of March 22, 2005 and that the control did not stabilize until March 25.

Measurement 12, made on May 18, 2005 indicates that scour of the control had occurred. No check measurement was made. The GZF recorded during the measurement verifies the elevation of the control had been lowered. Measurement 12 was used to develop TV05-3, which is defined by measurement 12 to within 0% of Rating 1.2. TV05-3 is prorated into effect beginning on April 8, 2005 at 09:45 hours and reaches full weight by April 09, 2005 at 10:15 hours with the idea that the material was removed from the control on the rising limb. TV05-3 is held in effect through July 7, 2005 when the record ends.

DISCHARGE – Rating #1.2 was used during WY 2004-2005 as follows:

<u>Water Year 2004</u>

Oct. 29 to Jan. 1. (14:00)	Rating 1.2
Jan. 1 to Jan. 7 (11:45)	Prorate to TV04-1 (0.32,-.35; 2.00,-.35; 2.36,-.35)
Jan. 7 to Jan. 7 (12:00)	Prorate to Rating 1.2
Jan. 7 to Aug. 5 (15:45)	Rating 1.2

<u>Water year 2005</u>

Oct. 13, to Dec. 8 (07:00)	Rating 1.2
Dec. 8 to Dec. 9 (17:15)	Prorate to TV05-1 (0.32,-0.03; 2.00;-.03; 2.36,0.00)
Dec. 9 to Jan. 28 (14:00)	TV05-1 (0.32,-0.03; 2.00;-.03; 2.36,0.00)
Jan. 28 to Jan 29 (07:30)	Prorate to Rating 1.2

Jan. 29 to Mar. 22 (09:30)	Rating 1.2
Mar. 22 to Mar 25 (10:00)	Prorate to TV05-2 (0.32,-.05; 2.00; -.05; 2.36,0.00)
Mar 25 to Apr. 8 (09:45)	TV05-2 (0.32,-.05; 2.00; -.05; 2.36,0.00)
Apr. 8 to Apr. 9 (10:15)	Prorate to TV05-3 (0.32,.04; 2.00,.04; 2.36,0.00)
Apr. 9 to Jul. 7(13:45)	TV 05-3 (0.32,.04; 2.00,.04; 2.36,0.00)

SPECIAL COMPUTATION: None

REMARKS – Records considered fair for Water Year 2004 and Water Year 2005. No regulation or diversion upstream from the station.

Gage height records worked by T. Grey 10-05
Gage height records checked by C. Pryor 10-05
Discharge computation worked by C. Pryor 11-05
Discharge computation checked by C. Pryor 12-05

DISCHARGE SUMMARY SHEET

LOCATION: South Fork Wages Creek Above Center Gulch **WATER YEAR: 2004-2005**

Measurement Number	WY Msmt #	Date	Made By:	Width (feet)	Mean Depth (feet)	Area (ft^2)	Mean Velocity (ft/sec)	Gage Height (feet)	Discharge (cfs)	Rating 1.2 Shift Adj.	Rating 1.2 Percent Diff.	Method	No. of Msmt sections	Begin Time (hours)	End Time (hours)	Msmt Rating	PZF level	Notes
1	2004-01	12/7/2003	T. Grey	7.1	0.54	3.85	1.42	0.82	5.45		-1	wading	27	12:47	13:34	fair		
2	2004-02	2/3/2004	K. Faucher	8.9	0.92	8.22	3.14	1.30	25.8		1	wading	21	13:54	14:28	fair		
3	2004-03	2/4/2004	T. Grey	8.0	0.90	7.18	2.73	1.19	19.6		1	wading	18	10:21	10:55	fair	0.26	
4	2004-04	2/17/2004	K. Faucher	8.8	1.45	12.78	4.17	1.68	53.3		1	wading	30	18:31	19:08	fair	0.27	
5	2004-05	2/18/2004	T. Grey	9.2	1.18	10.87	3.47	1.50	37.8		-2	wading	21	13:10	13:39	fair	0.27	
6	2005-01	10/13/04	K. Faucher	3.4	0.24	0.80	0.25	0.32	0.20		0	wading	18	11:54	11:15	poor		
7	2005-02	12/28/04	T. Bolton	8.6	0.54	4.66	1.08	0.80	5.04		1	wading	27	12:30	13:08	poor		no pzf measurement
8	2005-03	01/03/05	T. Bolton	8.7	0.51	4.46	1.75	0.93	7.82	-0.03		wading	30	12:37	13:15	fair	0.26	
9	2005-04	01/03/05	T. Bolton	8.9	0.48	4.26	1.78	0.94	7.55	-0.03	-6	wading	19	13:46	14:08	poor	0.27	2nd measure, quick and dirty
10	2005-05	02/22/05	T. Bolton	9.3	0.46	4.31	1.61	0.87	6.90		1	wading	32	14:19	15:05	fair	0.27	
11	2005-06	03/28/05	K. Faucher	10.0	0.56	5.64	2.24	1.09	12.7	-0.05		wading	20	11:10	11:51	fair	0.30	
12	2005-07	05/18/05	T. Bolton	10.0	0.85	8.47	3.70	1.40	34.2	0.04		wading	20	20:10	20:41	fair	0.28	

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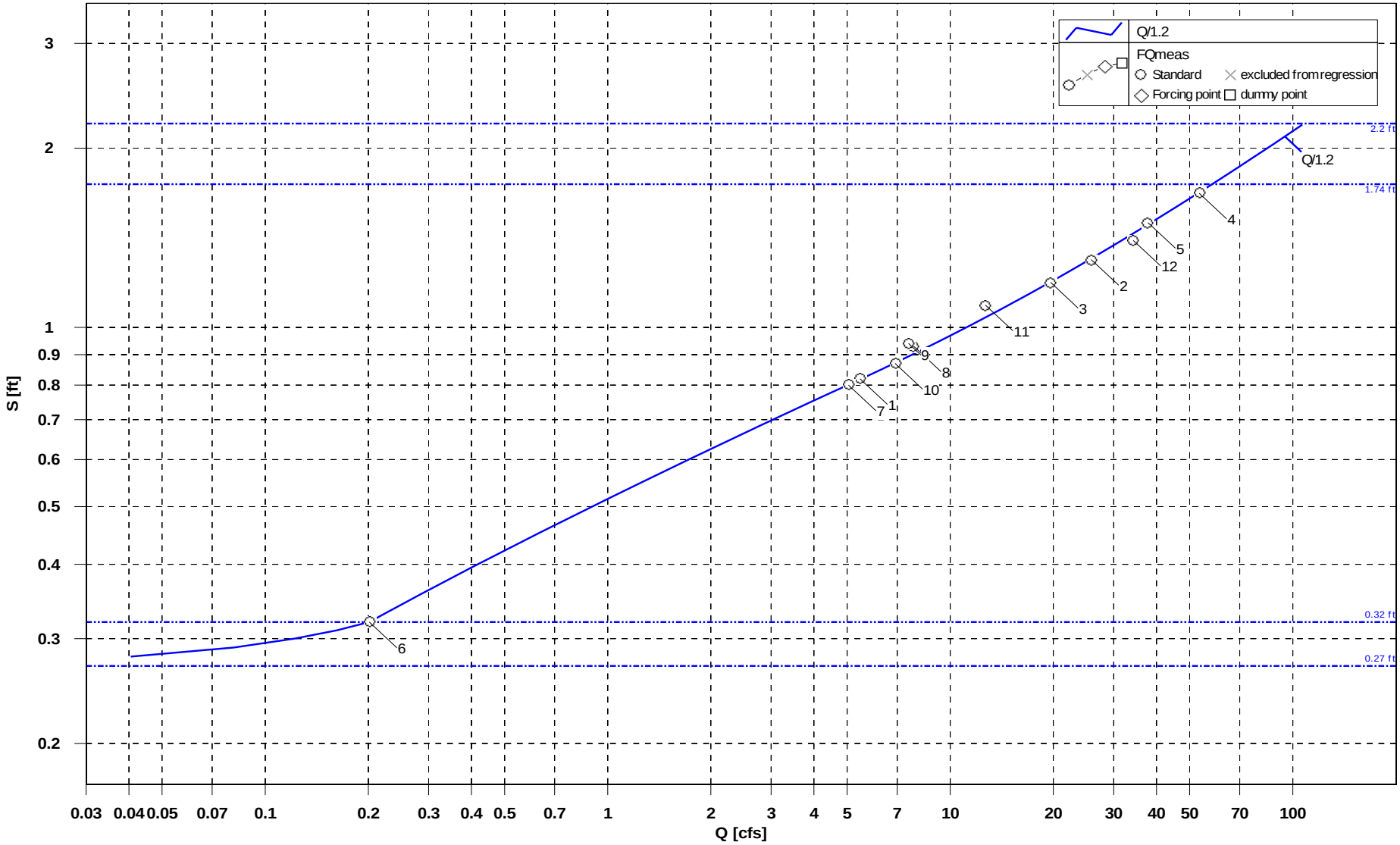
WY 04-05
APPENDIX

B-2

SOUTH FORK WAGES CREEK ABOVE CENTER GULCH
Discharge Rating Curve 1.2



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SOUTH FORK WAGES CREEK ABOVE CENTER GULCH

RATING TABLE NO.1.2 -- Begin Date 12/7/03

GH	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	1st Diff	2nd Diff
0.0	---	---	---	---	---	---	---	---	---	---		
0.1	---	---	---	---	---	---	---	---	---	---	---	
0.2	---	---	---	---	---	---	---	---	---	---	---	---
0.3	*0.12*	*0.16*	*0.20*	0.22	0.24	0.27	0.29	0.32	0.35	0.38	---	---
0.4	0.42	0.45	0.49	0.53	0.58	0.62	0.67	0.73	0.78	0.84	0.46	---
0.5	0.90	0.96	1.03	1.11	1.18	1.26	1.35	1.43	1.52	1.62	0.78	0.32
0.6	1.72	1.83	1.94	2.06	2.18	2.31	2.44	2.58	2.73	2.88	1.26	0.48
0.7	3.03	3.20	3.37	3.54	3.73	3.93	4.13	4.34	4.55	4.78	1.90	0.64
0.8	5.01	5.25	5.50	5.74	6.01	6.28	6.56	6.84	7.14	7.44	2.66	0.76
0.9	7.74	8.05	8.37	8.69	9.02	9.36	9.71	10.1	10.4	10.8	3.36	0.70
1.0	11.2	11.5	11.9	12.3	12.7	13.1	13.5	13.9	14.4	14.8	4.00	0.64
1.1	15.2	15.7	16.1	16.6	17.1	17.5	18.0	18.5	19.0	19.5	4.70	0.70
1.2	20.0	20.5	21.0	21.6	22.1	22.7	23.2	23.8	24.3	24.9	5.40	0.70
1.3	25.5	26.1	26.6	27.3	27.9	28.5	29.1	29.7	30.4	31.0	6.10	0.70
1.4	31.7	32.3	33.0	33.6	34.3	35.0	35.7	36.4	37.1	37.8	6.80	0.70
1.5	38.6	39.3	40.0	40.8	41.5	42.3	43.1	43.8	44.6	45.4	7.60	0.80
1.6	46.2	47.0	47.8	48.6	49.4	50.3	51.1	52.0	52.8	53.7	8.30	0.70
1.7	54.6	55.5	56.4	57.2	58.1	*59.0*	*60.0*	*60.9*	*61.8*	*62.8*	9.10	0.80
1.8	*63.7*	*64.7*	*65.6*	*66.6*	*67.6*	*68.5*	*69.5*	*70.5*	*71.5*	*72.6*	9.80	0.70
1.9	*73.6*	*74.6*	*75.6*	*76.7*	*77.7*	*78.8*	*79.9*	*81.0*	*82.0*	*83.1*	10.5	0.70
2.0	*84.2*	*85.3*	*86.4*	*87.6*	*88.7*	*89.8*	*91.0*	*92.1*	*93.3*	*94.5*	11.4	0.90
2.1	*95.6*	*96.8*	*98.0*	*99.2*	*100*	*102*	*103*	*104*	*105*	*107*	12.5	1.10
2.2	---	---	---	---	---	---	---	---	---	---	---	---
2.3	---	---	---	---	---	---	---	---	---	---	---	---
2.4	---	---	---	---	---	---	---	---	---	---	---	---
2.5	---	---	---	---	---	---	---	---	---	---	---	---

Values in italics are beyond the validated range of the rating

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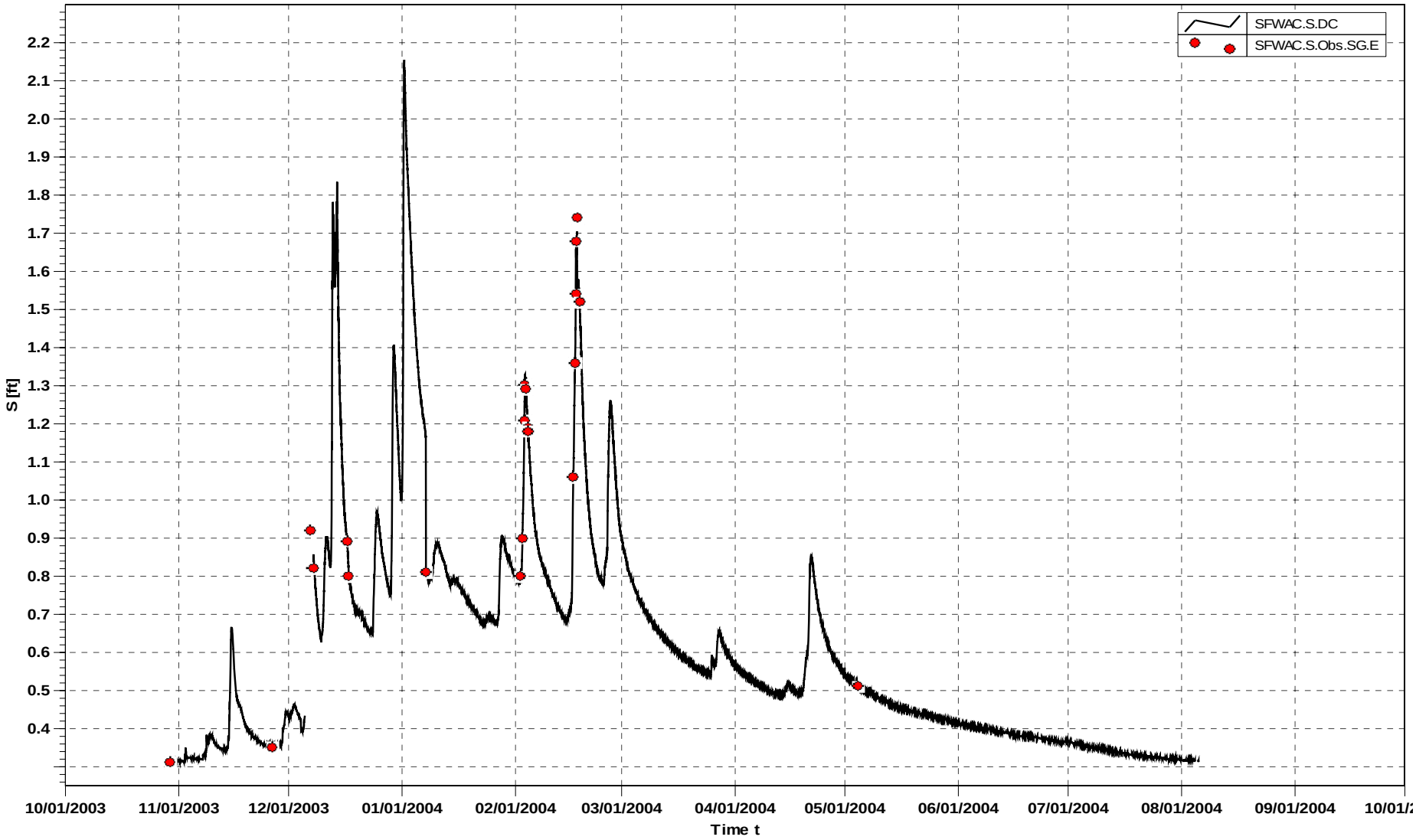
SOUTH FORK WAGES CREEK ABOVE CENTER GULCH
15-Minute Adjusted Gage Height Record and Observed Staff Gage Readings



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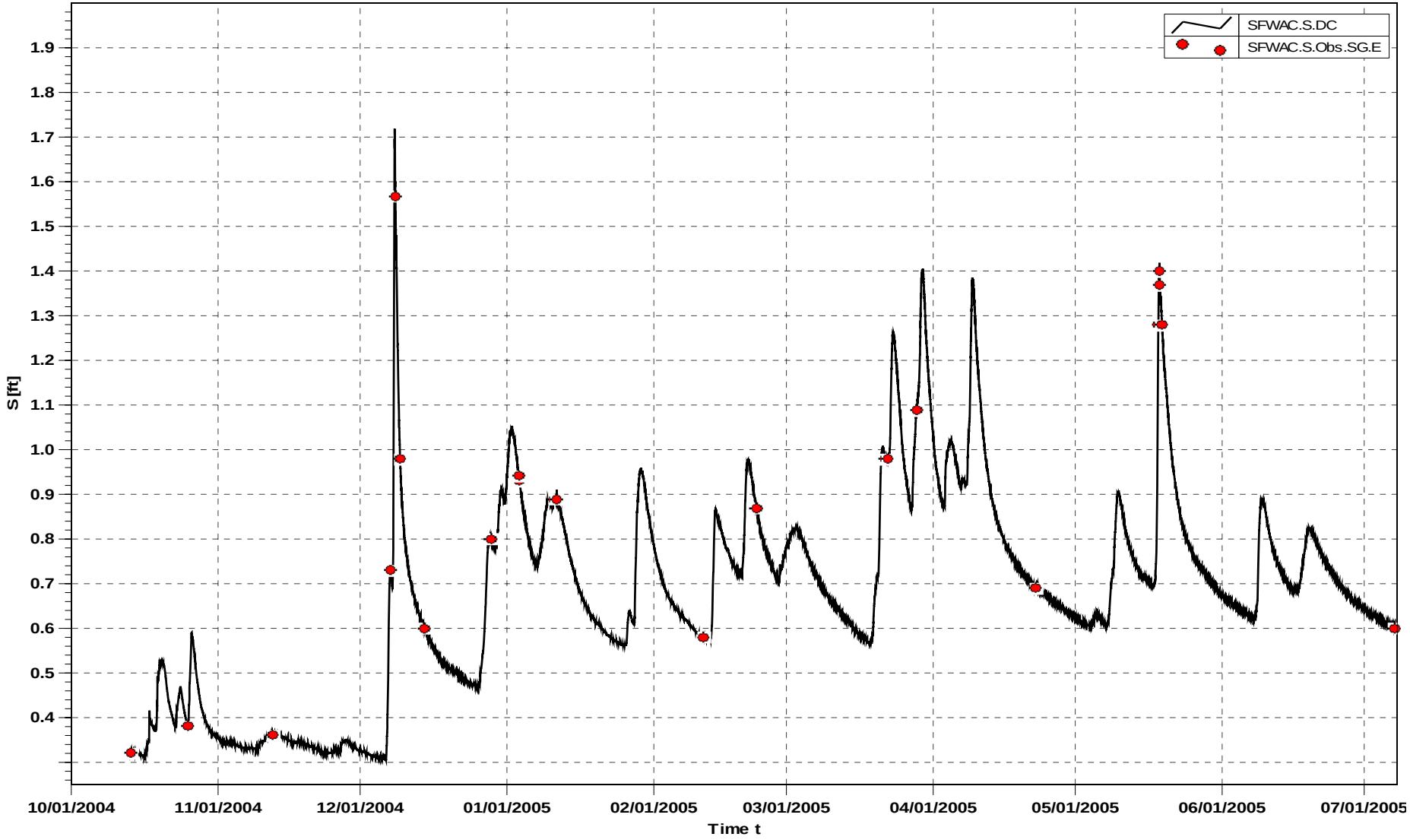
SOUTH FORK WAGES CREEK ABOVE CENTER GULCH
15-Minute Adjusted Gage Height Record and Observed Staff Gage Readings



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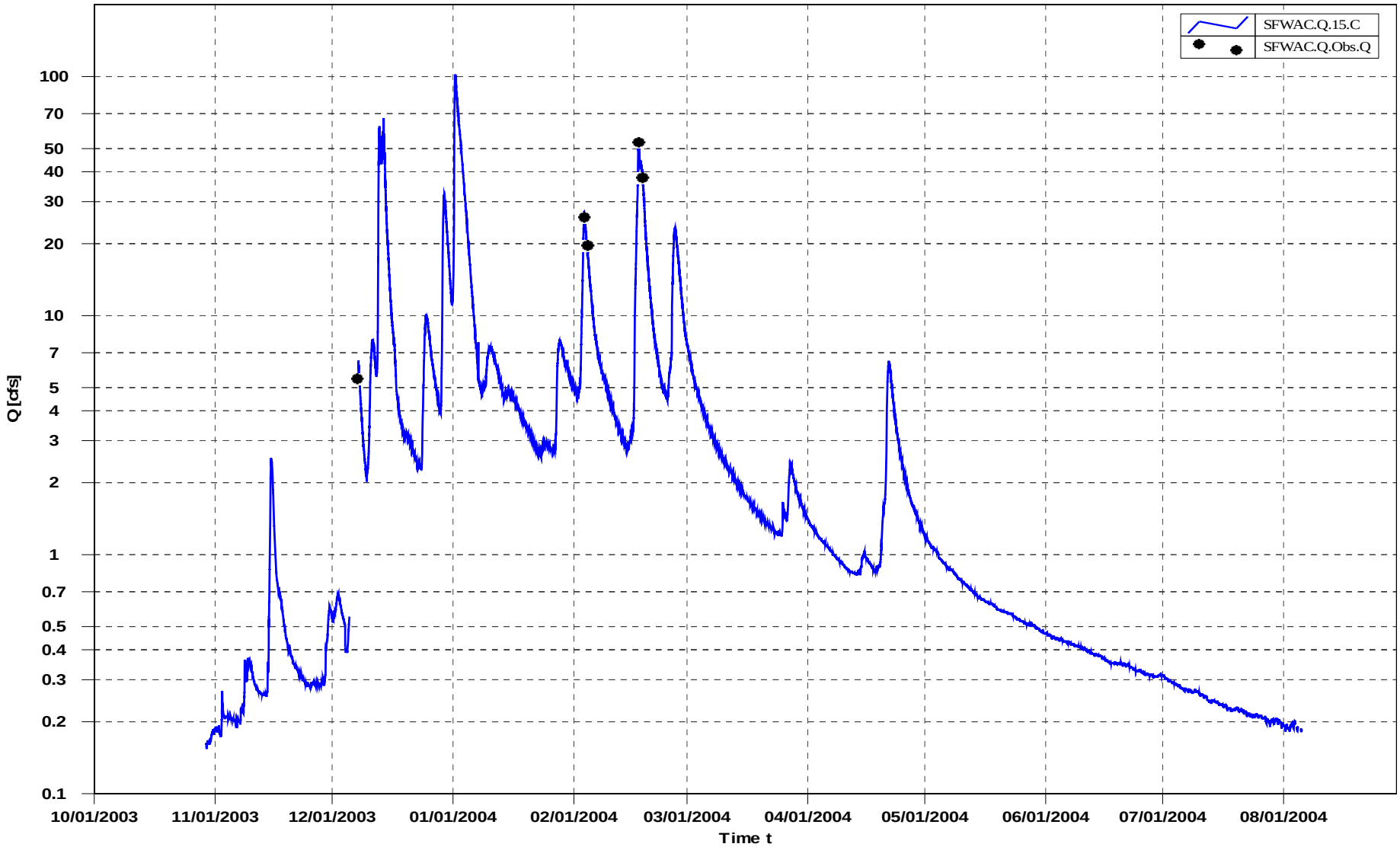
SOUTH FORK WAGES CREEK ABOVE CENTER GULCH
Discharge Hydrograph and Discharge Measurements



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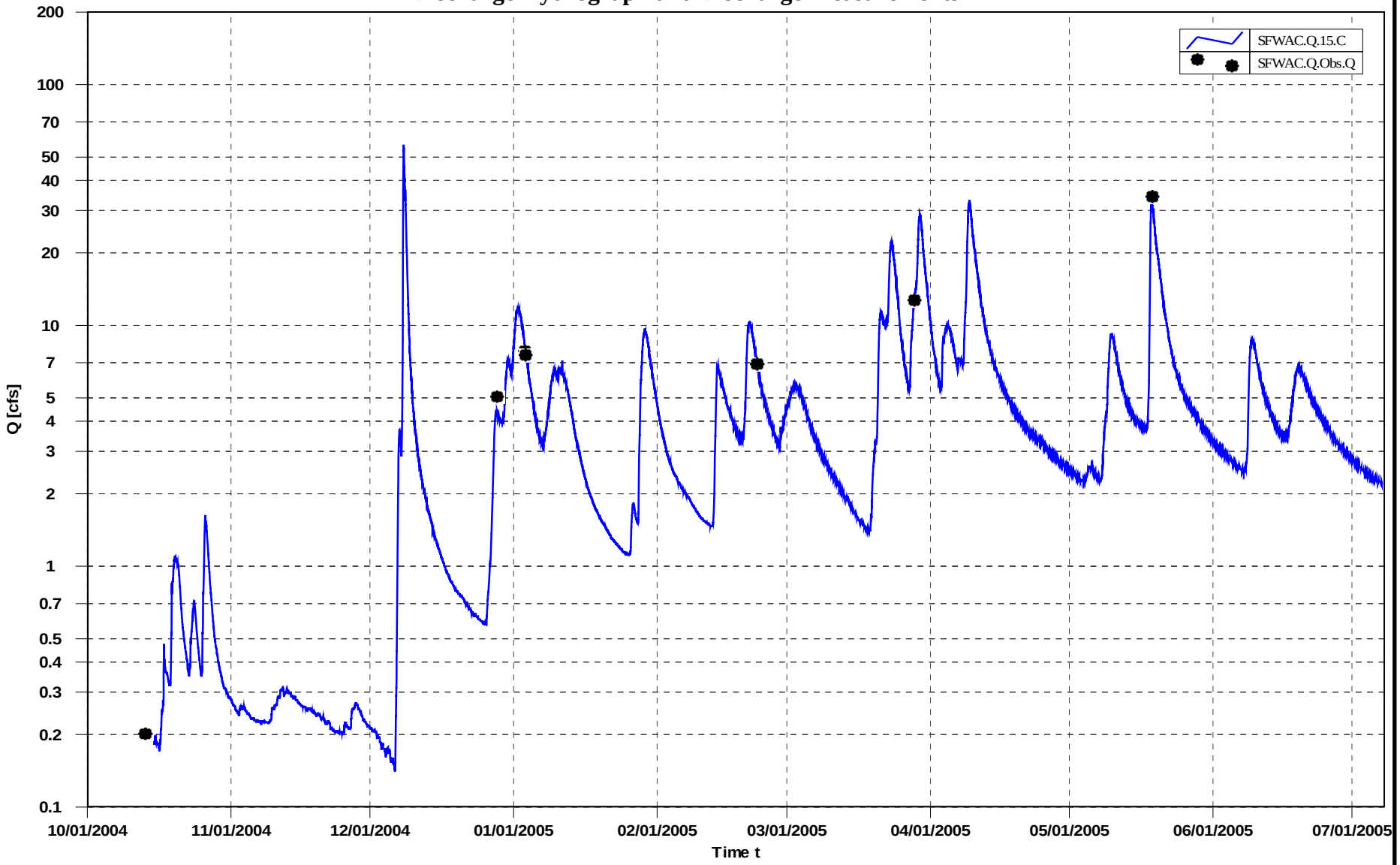

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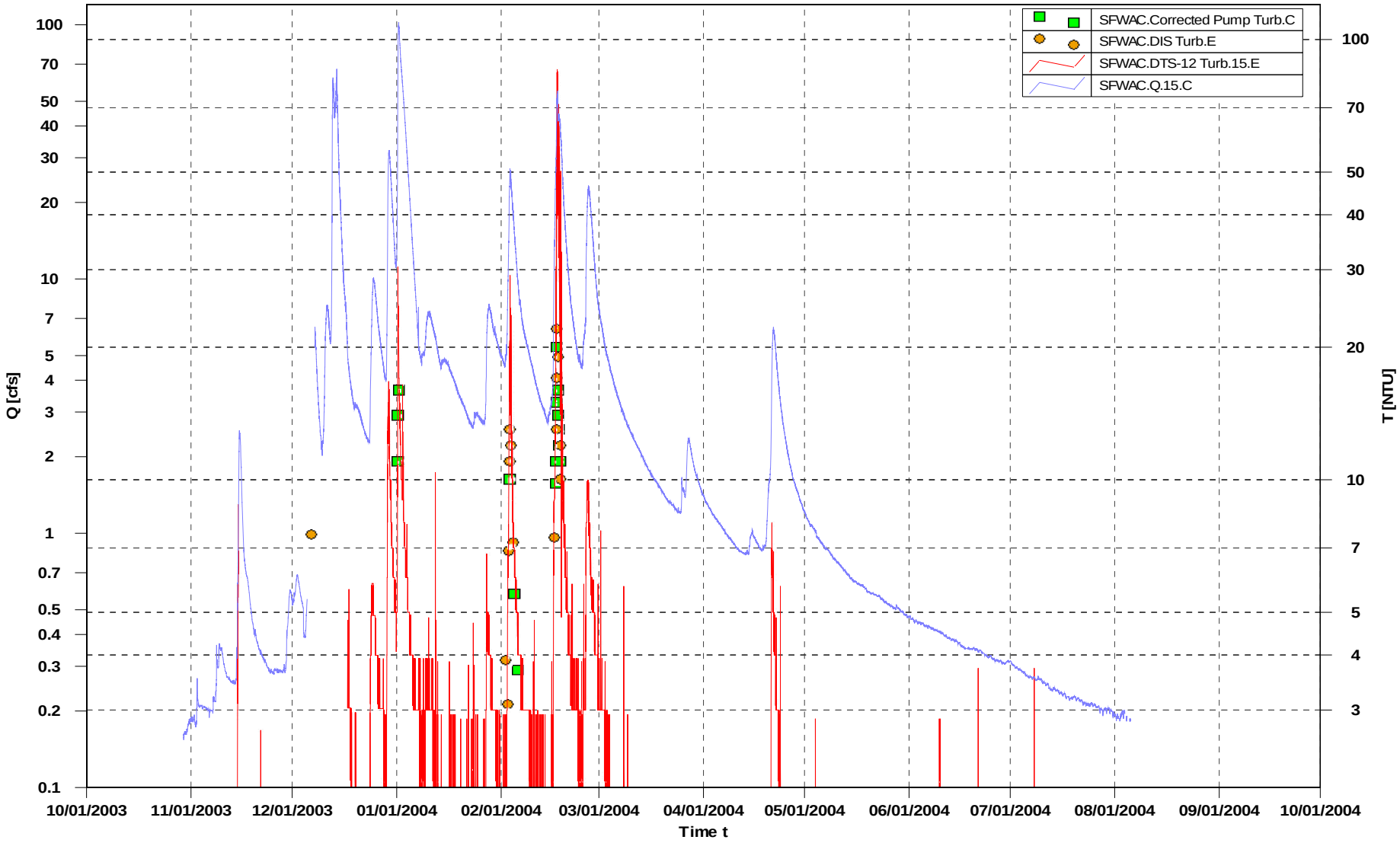
SOUTH FORK WAGES CREEK ABOVE CENTER GULCH
Discharge Hydrograph, Continuous Turbidity with Pump and Depth-Integrated Turbidity Samples



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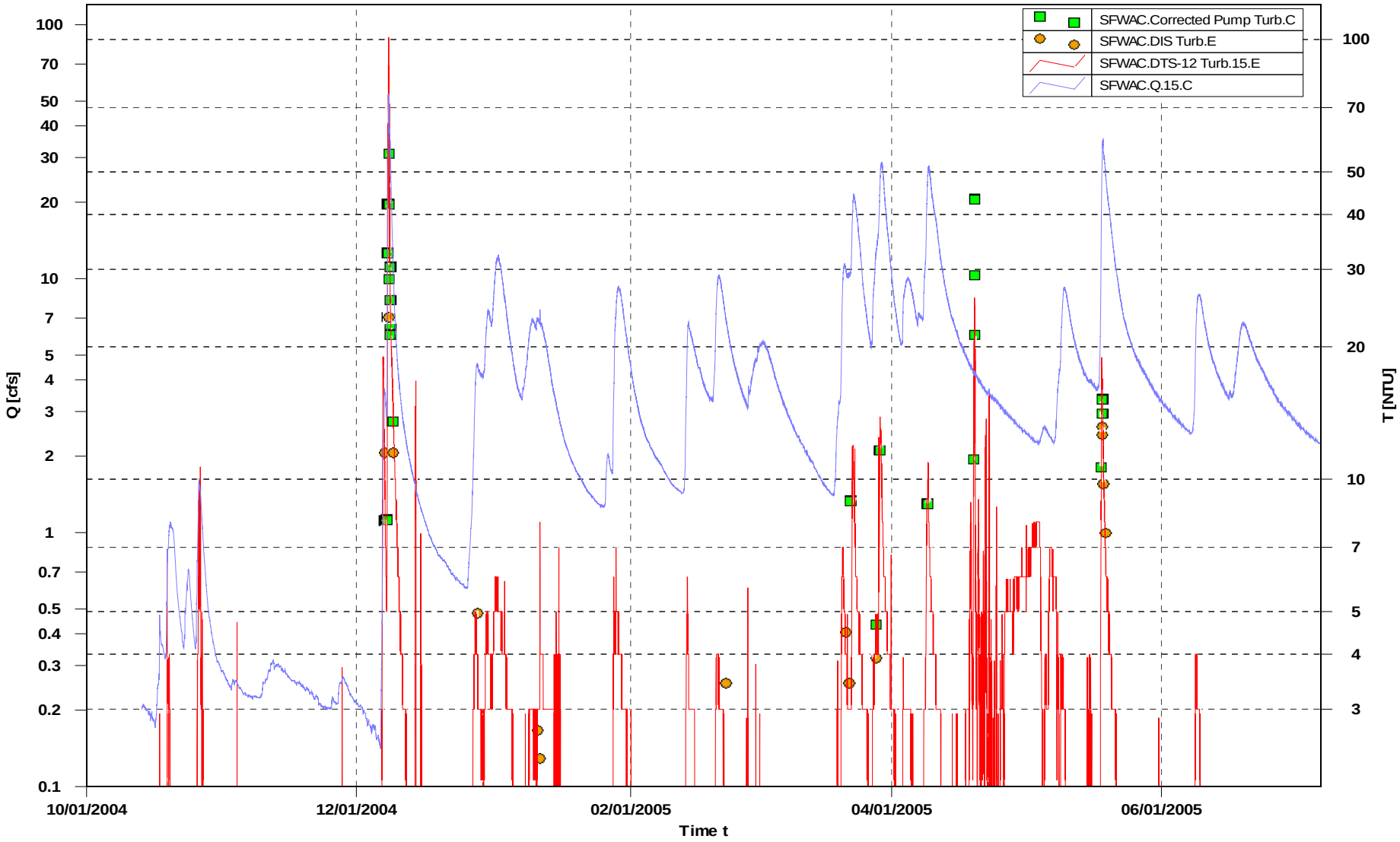
SOUTH FORK WAGES CREEK ABOVE CENTER GULCH
Discharge Hydrograph, Continuous Turbidity with Pump and Depth-Integrated Turbidity Samples



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APPENDIX

B-7b

SUSPENDED SEDIMENT MEASUREMENT SUMMARY SHEET

LOCATION: SOUTH FORK WAGES CREEK ABOVE CENTER GULCH **WATER YEAR:** 2004

Date/ Time	Msmt No.	Turbidity (NTU)	SSC (mg/l)	Stage (ft)	Discharge (cfs)	Q/WSA (cfs/mi2)	SSL (tons/day)	SSLPA (tons/day/mi2)	Type (DIS, PUMP)	Notes
12/6/03 19:24	SFWAC-SSCT2004-01	7.5	7	0.92	8.37	7.61	0.16	0.15	DIS	
1/1/04 8:01	SFWAC-SSCT2004-02	11	35	1.21	20.5	18.6	1.3	1.2	PUMP	
1/1/04 9:31	SFWAC-SSCT2004-03	17	36	1.35	28.5	25.9	2.0	1.8	PUMP	
1/1/04 12:16	SFWAC-SSCT2004-04	21	35	1.66	51.1	46.5	3.4	3.1	PUMP	
2/2/04 4:33	SFWAC-SSCT2004-05	3.9	146	0.80	5.01	4.55	2.0	1.8	DIS	Censored
2/2/04 20:30	SFWAC-SSCT2004-06	3.1	3	0.90	7.74	7.04	0.07	0.06	DIS	
2/3/04 5:30	SFWAC-SSCT2004-07	6.9	10	1.10	15.2	13.8	0.40	0.36	DIS	
2/3/04 9:45	SFWAC-SSCT2004-08	13	35	1.21	20.5	18.6	1.9	1.8	DIS	
2/3/04 13:30	SFWAC-SSCT2004-09	11	16	1.29	24.9	22.6	1.1	0.96	DIS	
2/3/04 13:31	SFWAC-SSCT2004-10	11	18	1.30	25.5	23.2	0.82	0.74	PUMP	Calibrate w/ bottle # 1082
2/3/04 16:31	SFWAC-SSCT2004-11	10	13	1.29	24.9	22.6	0.55	0.50	PUMP	
2/3/04 18:31	SFWAC-SSCT2004-12	11	13	1.28	24.3	22.1	0.51	0.47	PUMP	
2/3/04 20:25	SFWAC-SSCT2004-13	12	13	1.29	24.9	22.6	0.88	0.80	DIS	
2/4/04 12:43	SFWAC-SSCT2004-14	7.2	5	1.18	19.0	17.3	0.27	0.25	DIS	
2/4/04 17:31	SFWAC-SSCT2004-15	5.5	7	1.14	17.1	15.5	0.15	0.14	PUMP	
2/5/04 21:46	SFWAC-SSCT2004-16	3.7	10	0.97	10.1	9.18	0.16	0.15	PUMP	
2/16/04 18:43	SFWAC-SSCT2004-17	7.4	7	1.06	13.5	12.3	0.25	0.23	DIS	
2/17/04 5:46	SFWAC-SSCT2004-18	8.6	18	1.36	29.1	26.5	0.93	0.84	PUMP	
2/17/04 7:16	SFWAC-SSCT2004-19	11	25	1.38	30.4	27.6	1.4	1.2	PUMP	
2/17/04 8:18	SFWAC-SSCT2004-20	13	16	1.36	29.1	26.5	1.2	1.1	DIS	
2/17/04 10:51	SFWAC-SSCT2004-21	17	39	1.50	38.6	35.1	4.1	3.7	DIS	
2/17/04 13:51	SFWAC-SSCT2004-22	22	54	1.68	52.8	48.0	7.6	7.0	DIS	
2/17/04 14:16	SFWAC-SSCT2004-23	19	54	1.67	52.0	47.3	5.4	4.9	PUMP	
2/17/04 14:46	SFWAC-SSCT2004-24	21	61	1.64	49.4	44.9	5.8	5.3	PUMP	
2/17/04 19:01	SFWAC-SSCT2004-25	21	40	1.62	47.8	43.5	3.6	3.3	PUMP	
2/17/04 19:15	SFWAC-SSCT2004-26	19	34	1.74	58.1	52.8	5.3	4.8	DIS	
2/17/04 23:31	SFWAC-SSCT2004-27	17	27	1.55	42.3	38.5	2.1	1.9	PUMP	
2/18/04 4:01	SFWAC-SSCT2004-28	15	22	1.55	42.3	38.5	1.6	1.5	PUMP	
2/18/04 6:31	SFWAC-SSCT2004-29	13	19	1.56	43.1	39.2	1.5	1.3	PUMP	
2/18/04 10:31	SFWAC-SSCT2004-30	11	12	1.54	41.5	37.7	0.81	0.73	PUMP	
2/18/04 11:01	SFWAC-SSCT2004-31	11	13	1.52	40.0	36.4	1.8	1.6	PUMP	
2/18/04 11:01	SFWAC-SSCT2004-32	10	17	1.52	40.0	36.4	0.90	0.81	DIS	Calibrate with 1804
2/18/04 14:32	SFWAC-SSCT2004-33	12	7	1.48	37.1	33.7	0.72	0.65	DIS	

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WY 2004 APPENDIX

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SEDIMENT SAMPLE SUMMARY SHEET

LOCATION: SOUTH FORK WAGES ABOVE CENTER GULCH **WATER YEAR: 2005**

Date Time	Sample Number	Turbidity (NTU)	SSC (mg/l)	Stage (ft)	Discharge (cfs)	Q/WSA (cfs/mi^2)	SSD (ton/day)	SSY (ton/day/mi2)	Type (DIS, PUMP)	Note
12/7/2004 10:16	SFWAC-SSCT2005-01	12	10	0.73	3.49	3.17	0.09	0.09	DIS	Calibration for SSCT2005-02
12/7/2004 10:16	SFWAC-SSCT2005-02	8.0	12	0.73	3.49	3.17	0.11	0.10	Pump	
12/7/2004 23:01	SFWAC-SSCT2005-03	8.1	14	0.74	3.73	3.39	0.14	0.13	Pump	
12/8/2004 00:16	SFWAC-SSCT2005-04	23	42	0.81	5.11	4.65	0.57	0.52	Pump	
12/8/2004 00:46	SFWAC-SSCT2005-05	33	75	0.89	7.30	6.64	1.5	1.3	Pump	
12/8/2004 02:16	SFWAC-SSCT2005-06	40	54	1.17	17.8	16.2	2.61	2.4	Pump	
12/8/2004 06:16	SFWAC-SSCT2005-07	55	90	1.66	47.8	43.5	12	11	Pump	
12/8/2004 08:01	SFWAC-SSCT2005-08	40	54	1.70	51.9	47.2	7.5	6.8	Pump	
12/8/2004 10:01	SFWAC-SSCT2005-09	29	253	1.57	41.5	37.7	28	26	Pump	Bottle overflowed, Censored
12/8/2004 10:03	SFWAC-SSCT2005-10	23	31	1.57	41.5	37.7	3.4	3.1	DIS	
12/8/2004 12:16	SFWAC-SSCT2005-11	30	2890	1.52	38.0	34.5	296	269	Pump	Bottle overflowed, Censored
12/8/2004 12:46	SFWAC-SSCT2005-12	26	21	1.49	35.8	32.5	2.0	1.9	Pump	
12/8/2004 15:01	SFWAC-SSCT2005-13	22	22	1.42	31.3	28.5	1.8	1.6	Pump	
12/8/2004 16:01	SFWAC-SSCT2005-14	21	11	1.42	31.1	28.3	0.96	0.87	Pump	
12/9/2004 05:16	SFWAC-SSCT2005-15	14	5	1.07	12.6	11.5	0.16	0.15	Pump	
12/9/2004 10:50	SFWAC-SSCT2005-16	12	3	0.98	9.38	8.53	0.07	0.07	DIS	
12/28/2004 11:36	SFWAC-SSCT2005-17	5.0	8	0.80	4.50	4.09	0.10	0.09	DIS	
1/10/2005 22:12	SFWAC-SSCT2005-18	2.7	3	0.89	6.94	6.31	0.06	0.05	DIS	
1/11/2005 11:31	SFWAC-SSCT2005-19	2.3	1	0.89	6.94	6.31	0.02	0.02	DIS	
2/22/2005 14:51	SFWAC-SSCT2005-20	2.7	5	0.87	6.84	6.22	0.08	0.08	DIS	
3/21/2005 18:42	SFWAC-SSCT2005-21	4.5	13	0.98	10.4	9.45	0.37	0.33	DIS	
3/22/2005 07:50	SFWAC-SSCT2005-22	3.4	3	0.98	10.4	9.45	0.08	0.07	DIS	
3/22/2005 16:31	SFWAC-SSCT2005-23	8.9	18	0.98	10.4	9.45	0.51	0.46	Pump	
3/28/2005 11:00	SFWAC-SSCT2005-24	4.7	6	1.08	12.5	11.4	0.19	0.17	Pump	
3/28/2005 11:20	SFWAC-SSCT2005-25	3.9	5	1.09	12.6	11.5	0.16	0.15	DIS	Calibration for SSCT2005-24
3/29/2005 08:01	SFWAC-SSCT2005-26	12	15	1.31	23.0	20.9	0.90	0.82	Pump	
4/9/2005 03:31	SFWAC-SSCT2005-27	8.8	12	1.35	25.6	23.3	0.85	0.77	Pump	
4/19/2005 12:31	SFWAC-SSCT2005-28	11	4560	0.73	4.30	3.91	52.8	48	Pump	sand, Bottle overflowed, Censored
4/19/2005 16:01	SFWAC-SSCT2005-29	29	844	0.73	4.24	3.85	9.7	8.8	Pump	sand, Bottle overflowed, Censored
4/19/2005 19:16	SFWAC-SSCT2005-30	21	20200	0.73	4.23	3.85	231	210	Pump	sand, Bottle overflowed, Censored
4/19/2005 20:16	SFWAC-SSCT2005-31	40	23400	0.72	4.21	3.83	265	241	Pump	sand, Bottle overflowed, Censored
5/18/2005 10:01	SFWAC-SSCT2005-32	10.6	1280	1.10	17.2	15.6	59	54	Pump	sand, Bottle overflowed, Censored
5/18/2005 12:54	SFWAC-SSCT2005-33	13.2	21	1.28	26.6	24.2	1.5	1.4	DIS	
5/18/2005 14:16	SFWAC-SSCT2005-34	14.1	29	1.33	29.6	26.9	2.3	2.1	Pump	
5/18/2005 14:22	SFWAC-SSCT2005-35	12.6	24	1.31	30.1	27.4	1.9	1.8	DIS	Calibration for SSCT2005-34
5/18/2005 17:01	SFWAC-SSCT2005-36	15.2	18	1.40	34.7	31.5	1.7	1.6	Pump	
5/18/2005 20:24	SFWAC-SSCT2005-37	9.8	10	1.37	32.9	29.9	0.87	0.79	DIS	
5/19/2005 08:10	SFWAC-SSCT2005-38	7.6	5	1.28	26.7	24.3	0.38	0.35	DIS	

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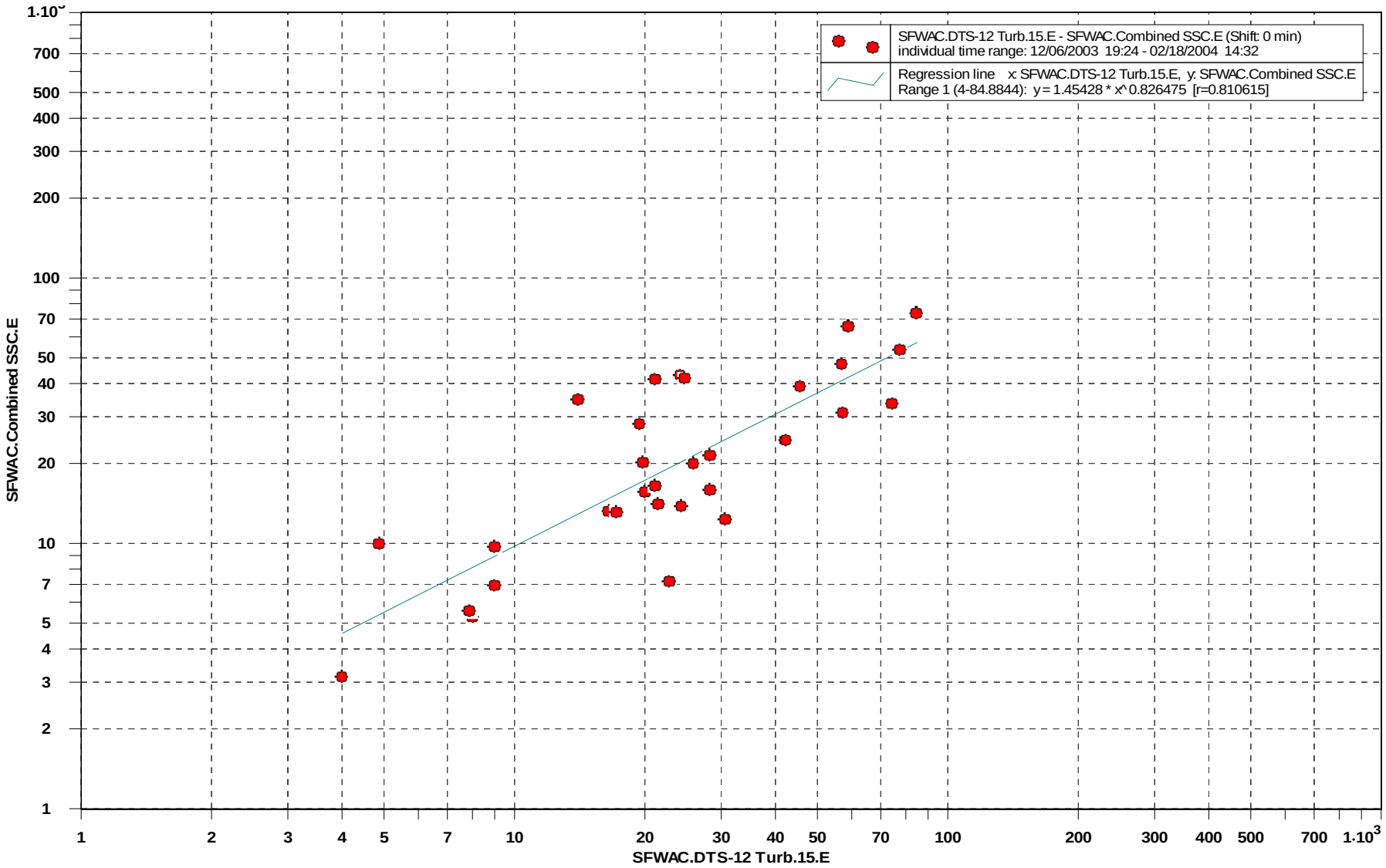
SOUTH FORK WAGES CREEK ABOVE CENTER GULCH
DTS-12 Turbidity vs Depth-Integrated and Pump SSC



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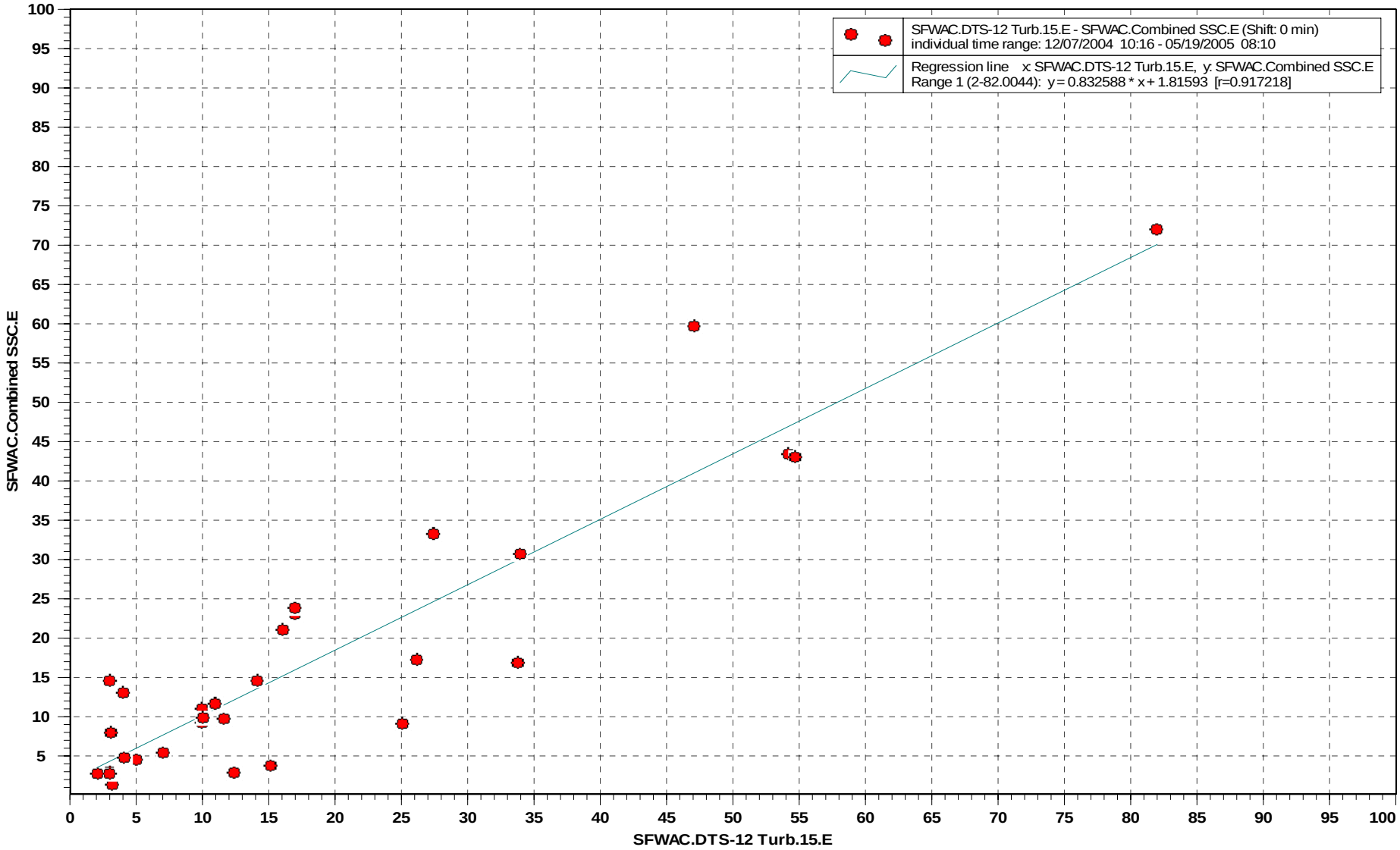
SOUTH FORK WAGES CREEK ABOVE CENTER GULCH
DTS-12 Turbidity vs Depth-Integrated and Pump SSC



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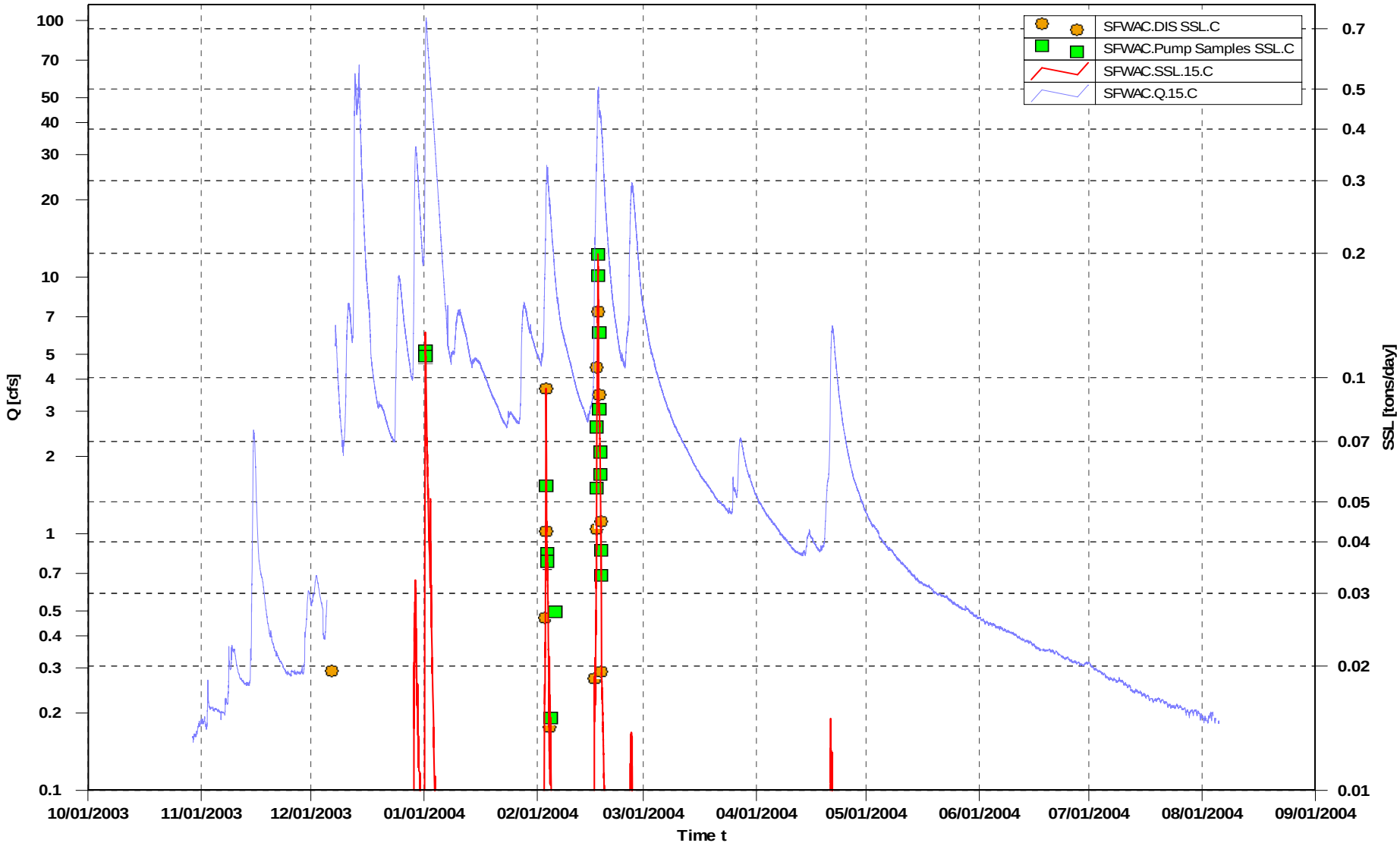
B-9b

SOUTH FORK WAGES CREEK ABOVE CENTER GULCH
Discharge versus Suspended Sediment Load



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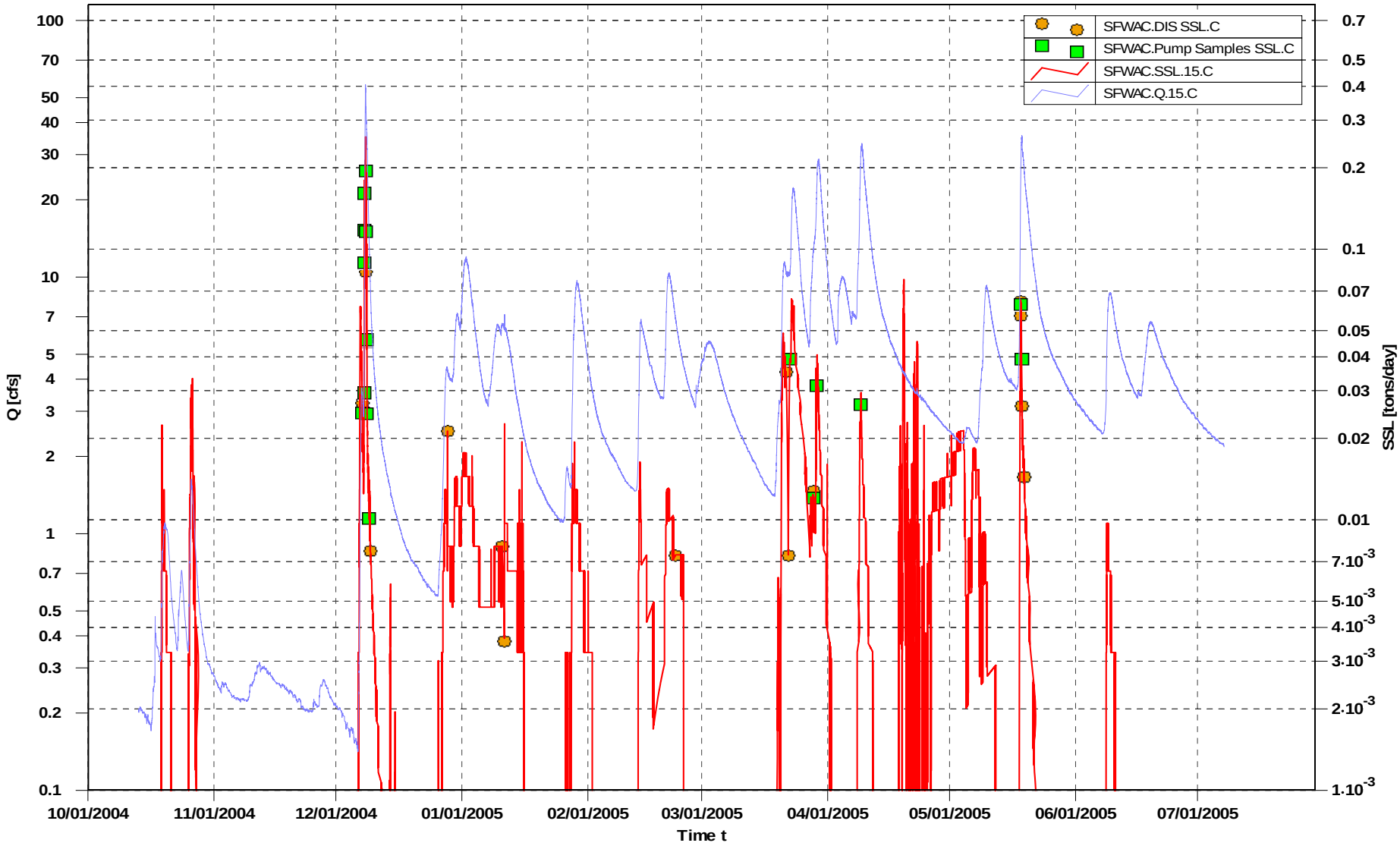
WY 2004
APPENDIX

B-10a

SOUTH FORK WAGES CREEK ABOVE CENTER GULCH
Discharge and Suspended Sediment Load



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APPENDIX

B-10b

DISCHARGE SUMMARY SHEET

LOCATION: Grey Creek Above South Fork Wages Creek **WATER YEAR: 2004 - 2005**

Measurement Number	Water Year Msmt #	Date	Made By	Width (feet)	Mean Depth (feet)	Area (ft^2)	Mean Velocity (ft/sec)	Gage Height (feet)	Discharge (cfs)	Rating 1.2 Shift Adj.	Rating 1.2 Percent Diff.	Method	No. of Msmt Sections	Begin Time (hours)	End Time (hours)	Msmt Rating	GZF (feet)	Notes
1	2004-01	2/3/2004	T. Grey	3.9	0.41	1.60	1.93	2.67	3.09		-5	wading	21	11:49	12:12	Poor		
2	2004-02	2/4/2004	T. Grey	4.0	0.38	1.51	1.75	2.63	2.64		-1	wading	21	16:07	16:30	Poor		
3	2004-03	2/17/2004	T. Grey	4.2	0.51	2.15	3.68	2.90	7.90		0	wading	21	16:04	16:31	Poor		
4	2004-04	2/18/2004	T. Grey	4.8	0.57	2.73	2.05	2.79	5.58		3	wading	24	14:35	15:03	Fair		
5	2005-01	2/22/2005	T. Bolton	2.3	0.23	0.52	1.43	2.45	0.76		-4	wading	9	16:45	16:54	Poor		
6	2005-02	3/28/2005	K. Faucher	3.0	0.32	0.97	2.02	2.56	1.95		8	wading	10	14:15	14:23	Poor		
7	2005-03	5/18/2005	K. Faucher	6.5	0.59	3.83	1.33	2.78	5.11		-2	wading	18	19:57	20:33	Fair	2.28	

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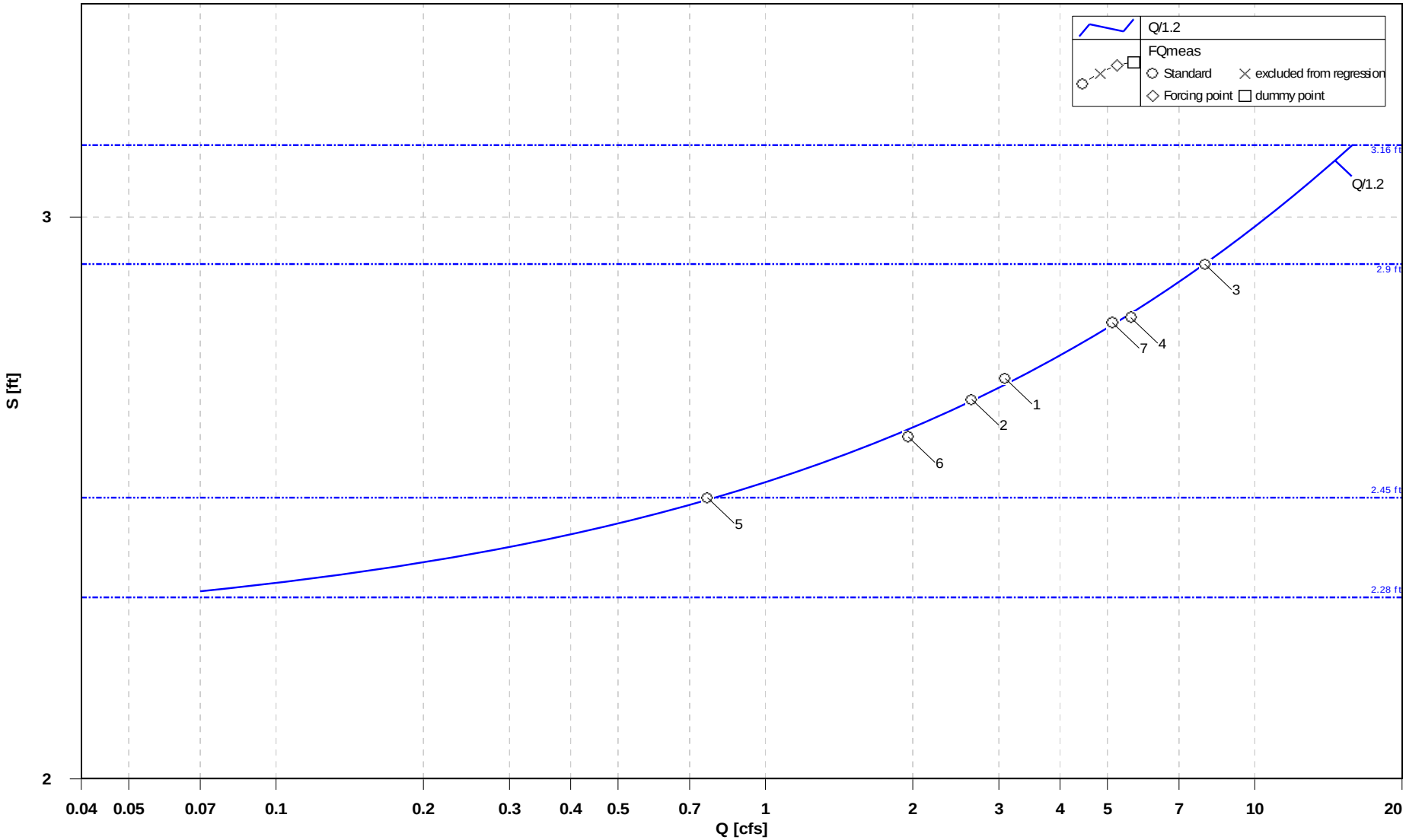
WY 04-05
APPENDIX

C-2

GREY CREEK ABOVE SOUTH FORK WAGES CREEK
Discharge Rating Curve 1.2



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WY 04-05
APPENDIX

C-3

Graham Matthews & Associates

GREY CREEK ABOVE SOUTH FORK WAGES CREEK

RATING TABLE NO.1.2 -- Begin Date 02/03/04

GH	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	1st Diff	2nd Diff
1.6	---	---	---	---	---	---	---	---	---	---	---	---
1.7	---	---	---	---	---	---	---	---	---	---	---	---
1.8	---	---	---	---	---	---	---	---	---	---	---	---
1.9	---	---	---	---	---	---	---	---	---	---	---	---
2.0	---	---	---	---	---	---	---	---	---	---	---	---
2.1	---	---	---	---	---	---	---	---	---	---	---	---
2.2	---	---	---	---	---	---	---	---	---	*0.07*	---	---
2.3	*0.09*	*0.12*	*0.14*	*0.17*	*0.21*	*0.24*	*0.28*	*0.32*	*0.37*	*0.42*	0.35	---
2.4	*0.47*	*0.53*	*0.59*	*0.65*	*0.72*	0.79	0.86	0.94	1.02	1.11	0.69	0.34
2.5	1.19	1.28	1.38	1.48	1.58	1.69	1.80	1.91	2.03	2.15	1.04	0.35
2.6	2.28	2.41	2.54	2.68	2.82	2.97	3.11	3.26	3.42	3.58	1.43	0.39
2.7	3.74	3.91	4.09	4.26	4.44	4.63	4.82	5.01	5.21	5.41	1.83	0.40
2.8	5.61	5.82	6.04	6.25	6.47	6.70	6.93	7.16	7.40	7.65	2.24	0.41
2.9	7.89	*8.14*	*8.40*	*8.66*	*8.92*	*9.18*	*9.46*	*9.74*	*10.0*	*10.3*	2.65	0.41
3.0	*10.6*	*10.9*	*11.2*	*11.5*	*11.8*	*12.1*	*12.4*	*12.7*	*13.1*	*13.4*	3.10	0.45
3.1	*13.7*	*14.1*	*14.4*	*14.8*	*15.1*	*15.5*	*15.8*	---	---	---	---	---
3.2	---	---	---	---	---	---	---	---	---	---	---	---
3.3	---	---	---	---	---	---	---	---	---	---	---	---
3.4	---	---	---	---	---	---	---	---	---	---	---	---
3.5	---	---	---	---	---	---	---	---	---	---	---	---
3.6	---	---	---	---	---	---	---	---	---	---	---	---
3.7	---	---	---	---	---	---	---	---	---	---	---	---
3.8	---	---	---	---	---	---	---	---	---	---	---	---
3.9	---	---	---	---	---	---	---	---	---	---	---	---
4.0	---	---	---	---	---	---	---	---	---	---	---	---

Values in italics are beyond the validated range of the rating

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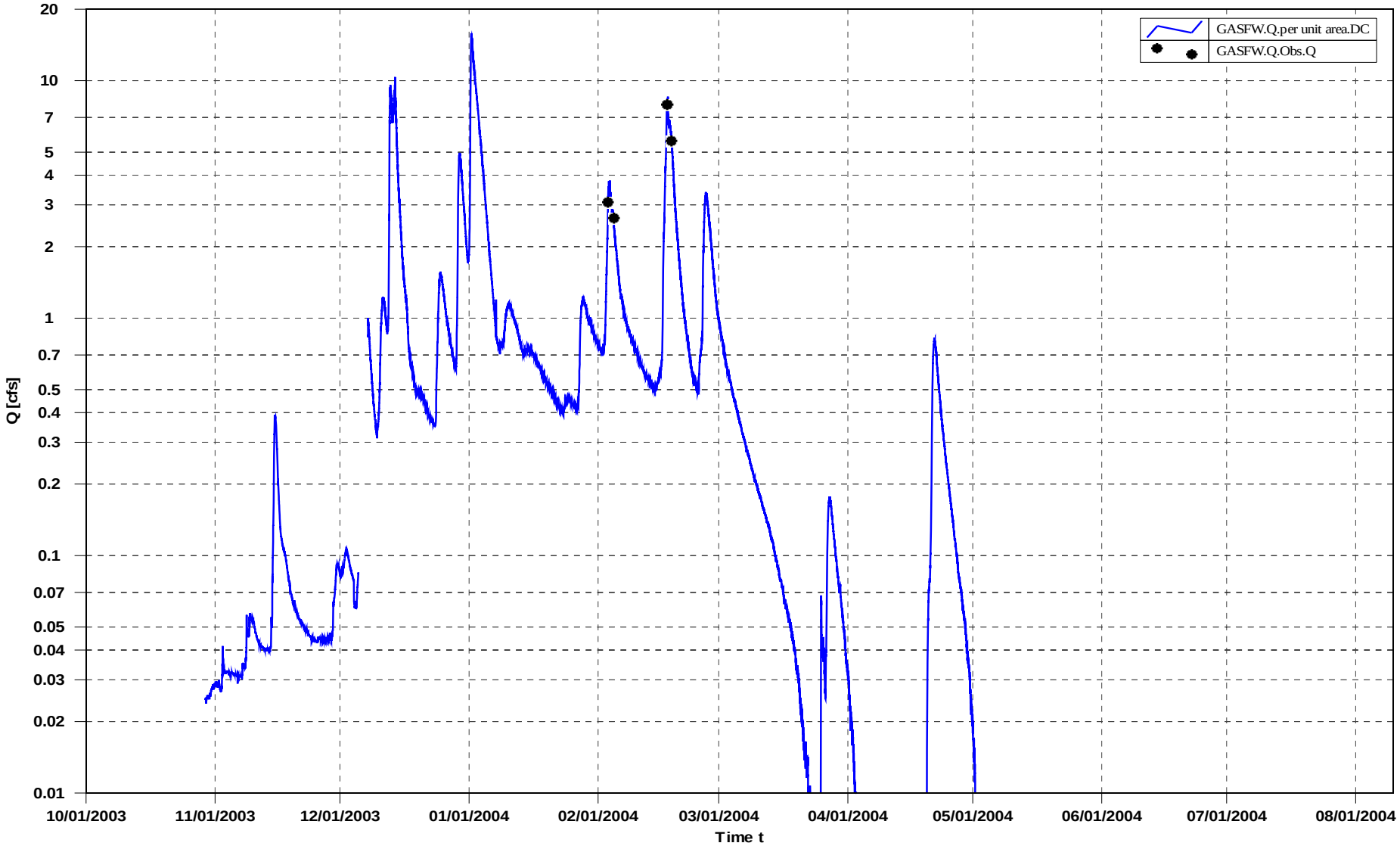
GREY CREEK ABOVE SOUTH FORK WAGES CREEK
Synthetic Discharge Hydrograph Derived from SFWAC Record and Discharge Measurements



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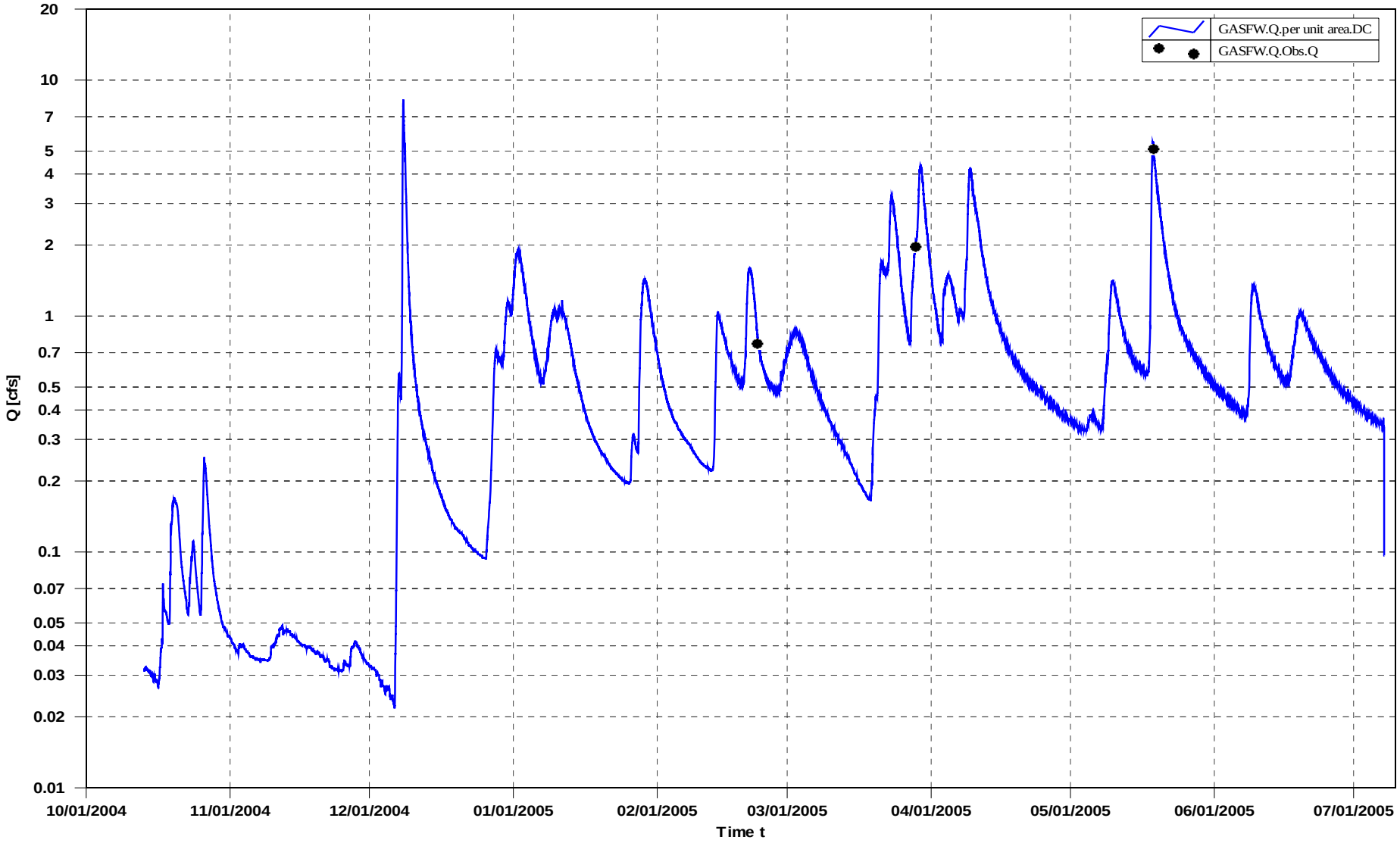
WY 2004
APPENDIX

C-6a

GREY CREEK ABOVE SOUTH FORK WAGES CREEK
Synthetic Discharge Hydrograph Derived from SFWAC Record and Discharge Measurements



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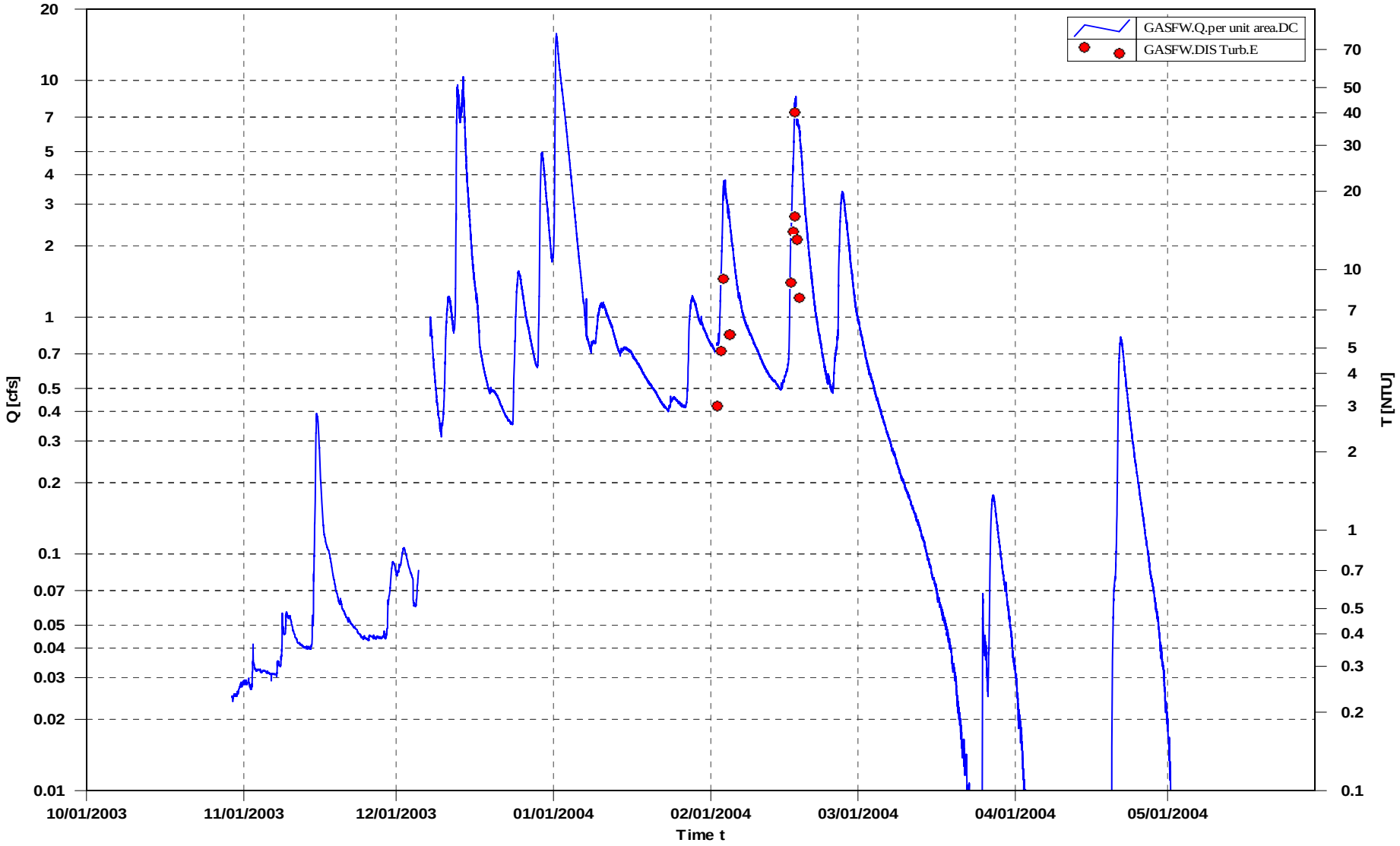
WY 2005
APPENDIX

C-6b

GREY CREEK ABOVE SOUTH FORK WAGES CREEK
Synthetic Discharge Hydrograph with Depth-Integrated Turbidity Samples



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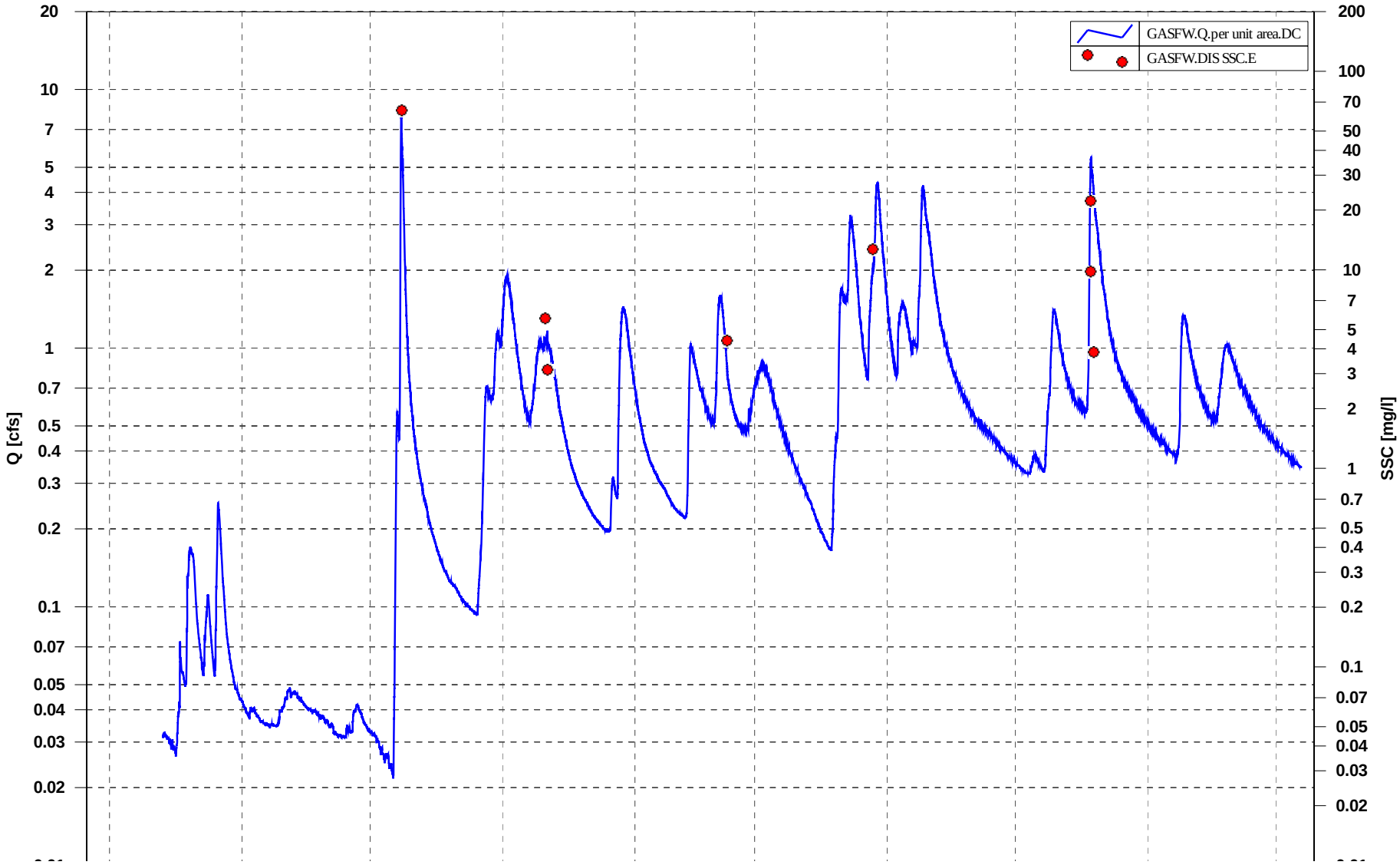
WY 2004
APPENDIX

C-7a

GREY CREEK ABOVE SOUTH FORK WAGES CREEK
Synthetic Discharge Hydrograph with Depth-Integrated Turbidity Samples



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WY 2005
APPENDIX

C-7b

SEDIMENT SAMPLE SUMMARY SHEET

LOCATION: GREY CREEK ABOVE SOUTH FORK WAGES **WATER YEAR: 2004**

Date Time	Sample Number	Turbidity (NTU)	SSC (mg/l)	Stage (ft)	Discharge (cfs)	Q/WSA (cfs/mi^2)	SSL (ton/day)	SSLPA (ton/day/mi2)	Type (DIS, PUMP)	Note
2/2/2004 05:04	GASFW-SSCT2004-01	3.0	5	2.40	0.47	2.76	0.01	0.04	DIS	
2/2/2004 21:08	GASFW-SSCT2004-02	4.9	3	2.47	0.94	5.53	0.01	0.04	DIS	
2/3/2004 06:03	GASFW-SSCT2004-03	7.3	43	2.58	2.03	11.9	0.24	1.4	DIS	Censored
2/3/2004 12:20	GASFW-SSCT2004-04	9.2	11	2.68	3.42	20.1	0.10	0.57	DIS	
2/4/2004 16:32	GASFW-SSCT2004-05	5.6	1	2.63	2.68	15.8	0.01	0.05	DIS	
2/16/2004 18:26	GASFW-SSCT2004-06	8.9	7	2.61	2.41	14.2	0.05	0.27	DIS	
2/17/2004 08:59	GASFW-SSCT2004-07	14	29	2.77	5.01	29.5	0.39	2.3	DIS	
2/17/2004 11:12	GASFW-SSCT2004-08	16	37	2.83	6.25	36.8	0.62	3.6	DIS	
2/17/2004 11:26	GASFW-SSCT2004-09	16	27	2.83	6.25	36.8	0.46	2.7	DIS	
2/17/2004 14:19	GASFW-SSCT2004-10	40	69	2.91	8.14	47.9	1.5	8.9	DIS	
2/17/2004 20:52	GASFW-SSCT2004-11	13	12	2.89	7.65	45.0	0.24	1.4	DIS	
2/18/2004 12:06	GASFW-SSCT2004-12	7.8	5	2.81	5.82	34.2	0.08	0.50	DIS	

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WY 2004 APPENDIX

C-8a

SEDIMENT SAMPLE SUMMARY SHEET

LOCATION: GREY CREEK ABOVE SOUTH FORK WAGES **WATER YEAR: 2005**

Date Time	Sample Number	Turbidity (NTU)	SSC (mg/l)	Stage (ft)	Discharge (cfs)	Q/WSA (cfs/mi^2)	SSL (ton/day)	SSLPA (ton/day/mi2)	Type (DIS, PUMP)	Note
12/8/2004 08:37	GASFW-SSCT2005-01	29	64	2.99	10.3	60.6	1.8	10.4	DIS	
12/8/2004 17:17	GASFW-SSCT2005-02	17	112	2.77	5.01	29.5	1.5	8.9	DIS	Censored
12/9/2004 13:04	GASFW-SSCT2005-03	9.5	45	2.55	1.69	9.94	0.21	1.2	DIS	Censored
1/10/2005 20:53	GASFW-SSCT2005-04	3.1	6	2.45	0.79	4.65	0.01	0.07	DIS	
1/11/2005 11:01	GASFW-SSCT2005-05	2.6	3	2.46	0.86	5.06	0.01	0.04	DIS	
2/22/2005 16:49	GASFW-SSCT2005-06	2.5	4	2.55	1.69	9.94	0.02	0.12	DIS	
3/28/2005 14:08	GASFW-SSCT2005-07	6.1	44	2.58	2.03	11.9	0.24	1.4	DIS	Censored
3/28/2005 14:10	GASFW-SSCT2005-08	6.0	13	2.58	2.03	11.9	0.07	0.41	DIS	
5/18/2005 13:11	GASFW-SSCT2005-09	15	22	2.78	5.21	30.6	0.31	1.8	DIS	
5/18/2005 18:29	GASFW-SSCT2005-10	10	10	2.82	6.04	35.5	0.16	0.94	DIS	
5/19/2005 09:17	GASFW-SSCT2005-11	5.7	4	2.72	4.09	24.1	0.04	0.25	DIS	

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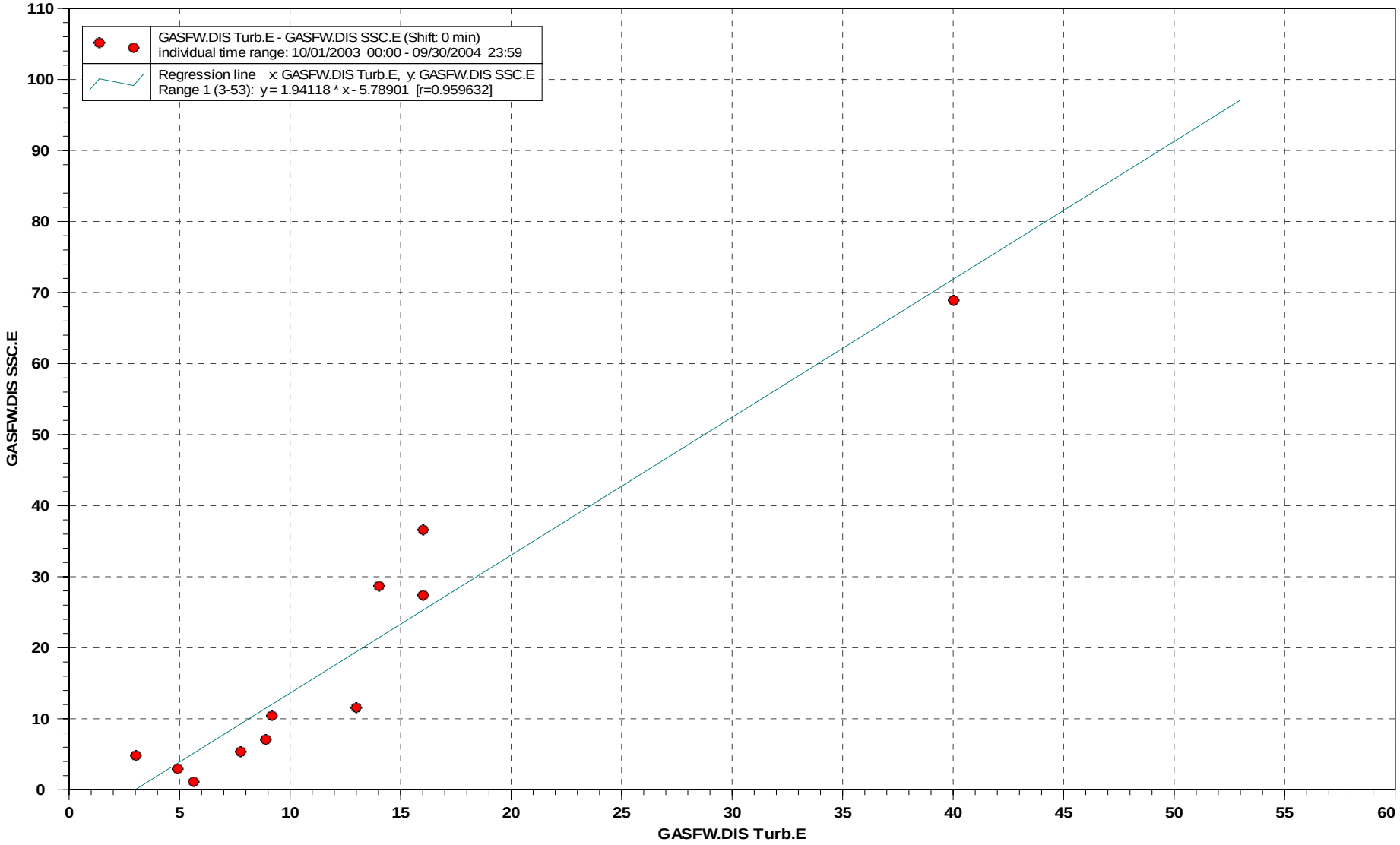
WY 2005 APPENDIX

C-8b

GREY CREEK ABOVE SOUTH FORK WAGES CREEK
Depth-Integrated Turbidity vs Depth-Integrated SSC



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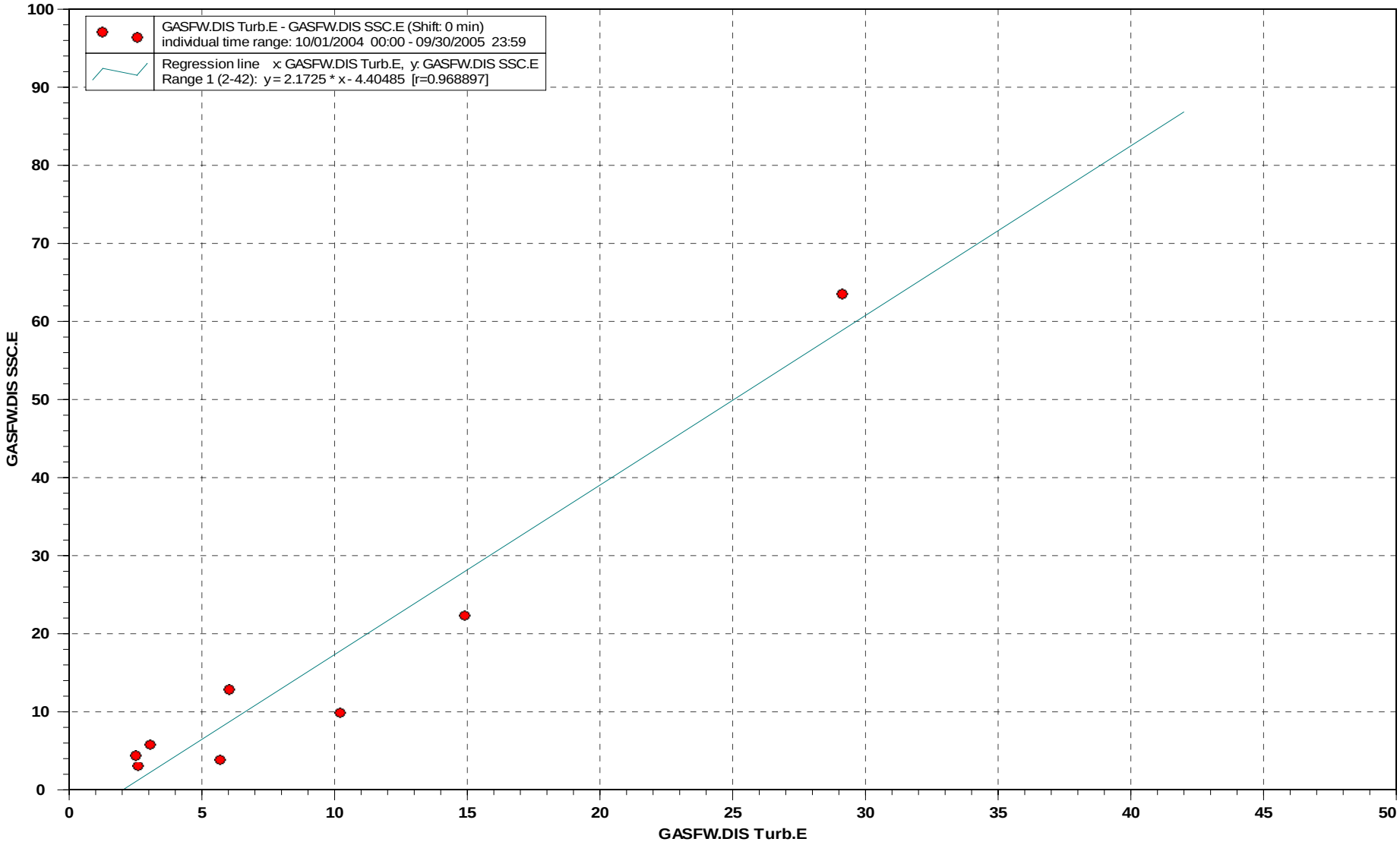
WY 2004
APPENDIX

C-9a

GREY CREEK ABOVE SOUTH FORK WAGES CREEK
Depth-Integrated Turbidity vs Depth-Integrated SSC



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WY 2005
APPENDIX

C-9b

WOOD CREEK ABOVE SOUTH FORK WAGES CREEK
(STATION # CTM 0283015)
STATION ANALYSIS
WATER YEAR 2004 -2005

RECORDS – Surface Water & Water Quality

EQUIPMENT – A Turbidity Threshold Sampling (TTS) station is installed at this site. The TTS station includes an Isco 6712 full size portable sampler, a Campbell Scientific CR510 data collection platform (DCP), a waterlog H-310 pressure transducer and a forest technology systems DTS-12 turbidity sensor. The DCP is housed in a locked steel box that is installed on the left bank. The DTS-12 is housed in an aluminum boom assembly, which is attached to a cable way strung over the creek. The pressure transducer is located on the left bank under the cable way. There is no staff plate installed at this site, a fence post is used as a stage reference point. The fence post is located on the left bank slightly downstream of the cable way.
Inside recording gage: Less than or equal to 0.02% of full scale output (FSO) over temperature range referenced (0 to 40° C) to a straight line stretched from zero psi to maximum pressure (15 psi).
Outside staff gage: A fence post is used as a stage reference. Top of the fence post has an elevation of five feet.

GAGE HEIGHT RECORDS – Record is incomplete for the period.
Water Year 2004 station operation began on December 17, 2003 at 14:00 hours. No problems were encountered for the remainder of Water Year 2004.
The maximum gage height of 1.84 ft occurred on February 17, 2004. The site goes dry between storm events. Minimum gage height of zero flow or GZF at the site is 1.50 ft.
Water Year 2005 station operation began on December 6, 2004 at 17:00 hours. On December 8, 2004 from 13:38 to 13:43 the section behind the wood weir was excavated. A gap in the gage height record exists from April 22, 2004 12:30 to May 18, 17:00. Field notes indicate the missing data is due to a dead battery. The record ends on July 7, 2005 at 15:30 hours.
The maximum gage height of 1.98 feet occurred December 8, 2004 at 08:00. Minimum gage height of zero flow or GZF at the site is 1.50 ft

DATUM CORRECTIONS – The fence post has not been surveyed, no datum correction known.

CONTROL – The control is a V-notched redwood weir. The weir acts as a bedload trap and occasionally it is necessary to excavate the section immediately upstream of the weir. The GZF is 1.50 ft.

RATING – In Water Year 2004, 5 discharge measurements (1-5) were made. Measured discharge ranged from 0.17 cfs to 4.71 cfs. Computed instantaneous discharge ranged from 0.00 cfs to 5.28 cfs.
Measurements 1-5 were used to develop the middle and upper portions of Rating 1.2. Measurements 1 and 2 plotted 2% and -3% respectively from Rating 1.2 and were both rated poor.
Measurement 3 plotted -6% from Rating 1.2 and was rated poor. No shift was computed because the measurements plotted within acceptable limits considering the measurement rating.
Measurement 4 and 5 plotted 0% and 3% from Rating 1.2 and were both rated fair.
In Water Year 2005, two discharge measurements (6 and 7) were made. Measured discharge ranged from 0.09 cfs to 2.52 cfs. Computed instantaneous discharge ranged from 0.00 cfs to 17.0 cfs.

Rating 1.2 in use at the end of Water Year 2004 was continued in use.
Measurement 6 was used to develop the low end of Rating 1.2. Measurement 6 was taken in the V-notch of the weir and was rated poor.
Measurement 7, made on May 19, 2005, plotted -15% from the Rating 1.2 and was rated fair. No check measurement was made. No shift was computed because no check measurement was made and there was no supporting documentation indicating that the weir had shifted.
In developing Rating 1.2 the break in slope was set to the gage height elevation (1.62 ft) at which water flows over the top of the entire weir.

DISCHARGE – Rating 1.2 was used during WY 2004-2005 as follows:

Water Year 2004

Dec. 17 to Sept. 30 (24:00)	Rating 1.2

Water Year 2005

Oct. 1 to Jul. 7 (15:30)	Rating 1.2

SPECIAL COMPUTATIONS – None Made

REMARKS – Due to the measurements ratings, 4 poor and 3 fair, the record should be considered poor for the entire period.

Gage height records worked by T. Grey 10-05
Gage height records checked by C. Pryor 10-05
Discharge computation worked by C. Pryor 11-05
Discharge computation checked by C. Pryor 12-05

DISCHARGE SUMMARY SHEET

LOCATION: Wood Creek Above South Fork Wages Creek **WATER YEAR: 2004 - 2005**

Measurement Number	WY Msmt #	Date	Made By:	Width (feet)	Mean Depth (feet)	Area (ft^2)	Mean Velocity (ft/sec)	Gage Height (feet)	Discharge (cfs)	Rating 1.2 Shift Adj.	Rating 1.2 Percent Diff.	Method	No. of Msmt sections	Begin Time (hours)	End Time (hours)	Msmt Rating	PZF	Notes
1	2004-01	2/3/2004	T. Grey	3.4	0.24	0.80	0.56	1.67	0.45		2	wading	16	10:43	11:14	Poor		
2	2004-02	2/3/2004	K. Faucher	3.3	0.35	1.15	1.08	1.73	1.24		-3	wading	16	18:53	19:10	Poor		
3	2004-03	2/4/2004	T. Grey	1.9	0.20	0.38	0.44	1.63	0.17		-6	wading	11	14:00	14:13	Poor		
4	2004-04	2/17/2004	K. Faucher	5.2	0.39	2.01	2.34	1.83	4.71		0	wading	25	15:41	16:07	Fair		
5	2004-05	2/18/2004	K. Faucher	4.2	0.43	1.79	1.14	1.76	2.04		3	wading	20	15:03	15:29	Fair		
6	2005-01	3/28/2005	K. Faucher	0.5	0.16	0.07	1.33	1.52	0.09		0	wading	3	12:44	12:46	Poor		
7	2005-02	5/19/2005	K. Faucher	4.2	0.30	1.25	2.02	1.79	2.52		-15	wading	14	17:39	17:50	Fair		No Shift Computed

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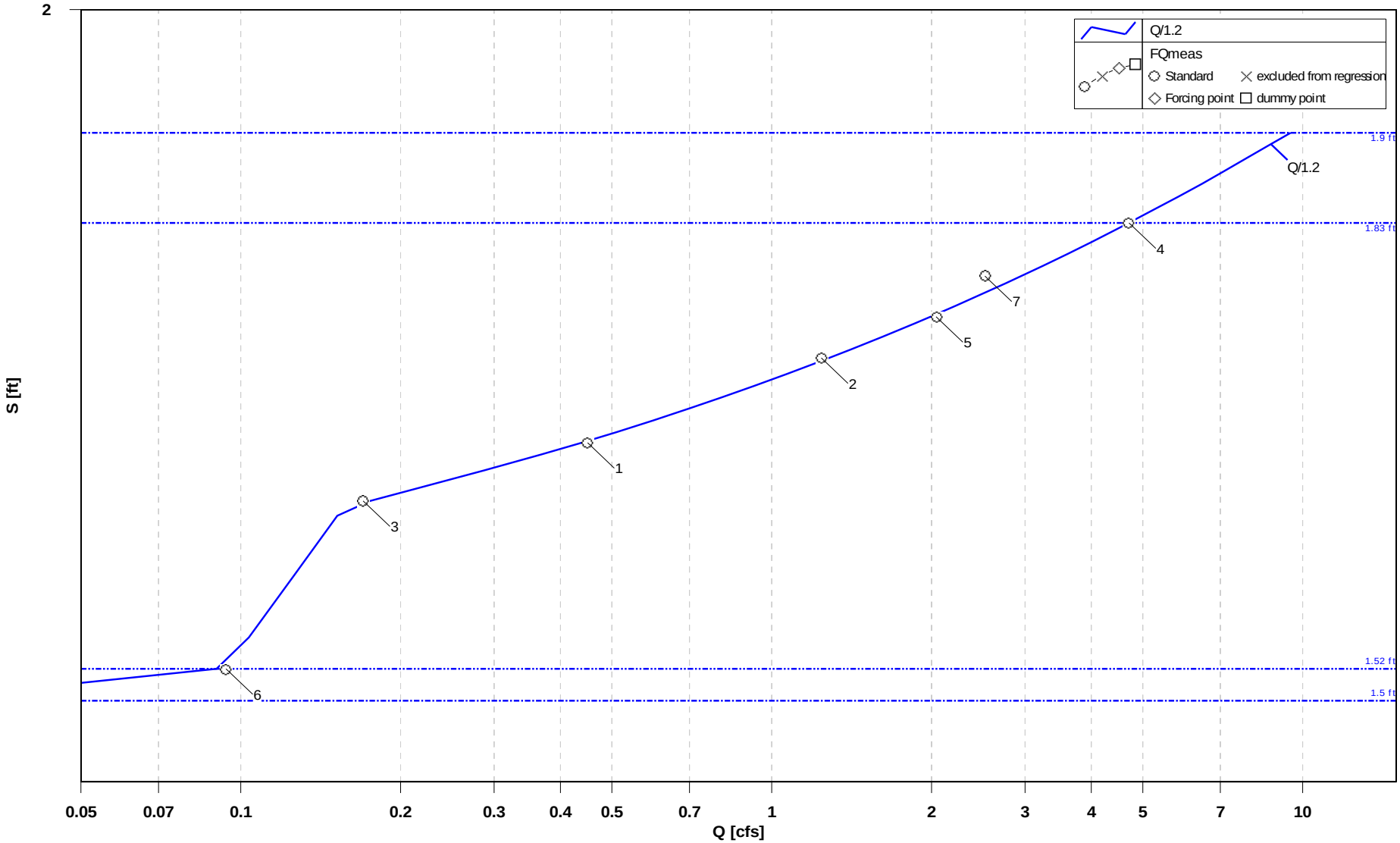
WY 04-05
APPENDIX

D-2

WOOD CREEK ABOVE SOUTH FORK WAGES CREEK
Discharge Rating Curve 1.2



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WY 04-05
APPENDIX

D-3

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WOOD CREEK ABOVE SOUTH FORK WAGES CREEK

RATING TABLE NO.1.2 -- Begin Date 12/08/2004

GH	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	1st Diff	2nd Diff
0.6	---	---	---	---	---	---	---	---	---	---	---	---
0.7	---	---	---	---	---	---	---	---	---	---	---	---
0.8	---	---	---	---	---	---	---	---	---	---	---	---
0.9	---	---	---	---	---	---	---	---	---	---	---	---
1.0	---	---	---	---	---	---	---	---	---	---	---	---
1.1	---	---	---	---	---	---	---	---	---	---	---	---
1.2	---	---	---	---	---	---	---	---	---	---	---	---
1.3	---	---	---	---	---	---	---	---	---	---	---	---
1.4	---	---	---	---	---	---	---	---	---	---	---	---
1.5	*0.00*	*0.04*	0.09	0.10	0.10	0.11	0.11	0.12	0.13	0.13	---	---
1.6	0.14	0.15	0.15	0.18	0.22	0.28	0.35	0.44	0.54	0.65	0.52	---
1.7	0.78	0.93	1.10	1.28	1.49	1.73	1.99	2.28	2.60	2.95	2.30	1.78
1.8	3.33	3.75	4.22	4.70	*5.24*	*5.83*	*6.46*	*7.12*	*7.84*	*8.63*	5.68	3.38
1.9	*9.49*	---	---	---	---	---	---	---	---	---	---	---
2.0	---	---	---	---	---	---	---	---	---	---	---	---
2.1	---	---	---	---	---	---	---	---	---	---	---	---
2.2	---	---	---	---	---	---	---	---	---	---	---	---
2.3	---	---	---	---	---	---	---	---	---	---	---	---
2.4	---	---	---	---	---	---	---	---	---	---	---	---
2.5	---	---	---	---	---	---	---	---	---	---	---	---
2.6	---	---	---	---	---	---	---	---	---	---	---	---
2.7	---	---	---	---	---	---	---	---	---	---	---	---
2.8	---	---	---	---	---	---	---	---	---	---	---	---
2.9	---	---	---	---	---	---	---	---	---	---	---	---
3.0	---	---	---	---	---	---	---	---	---	---	---	---

Values in italics are beyond the validated range of the rating

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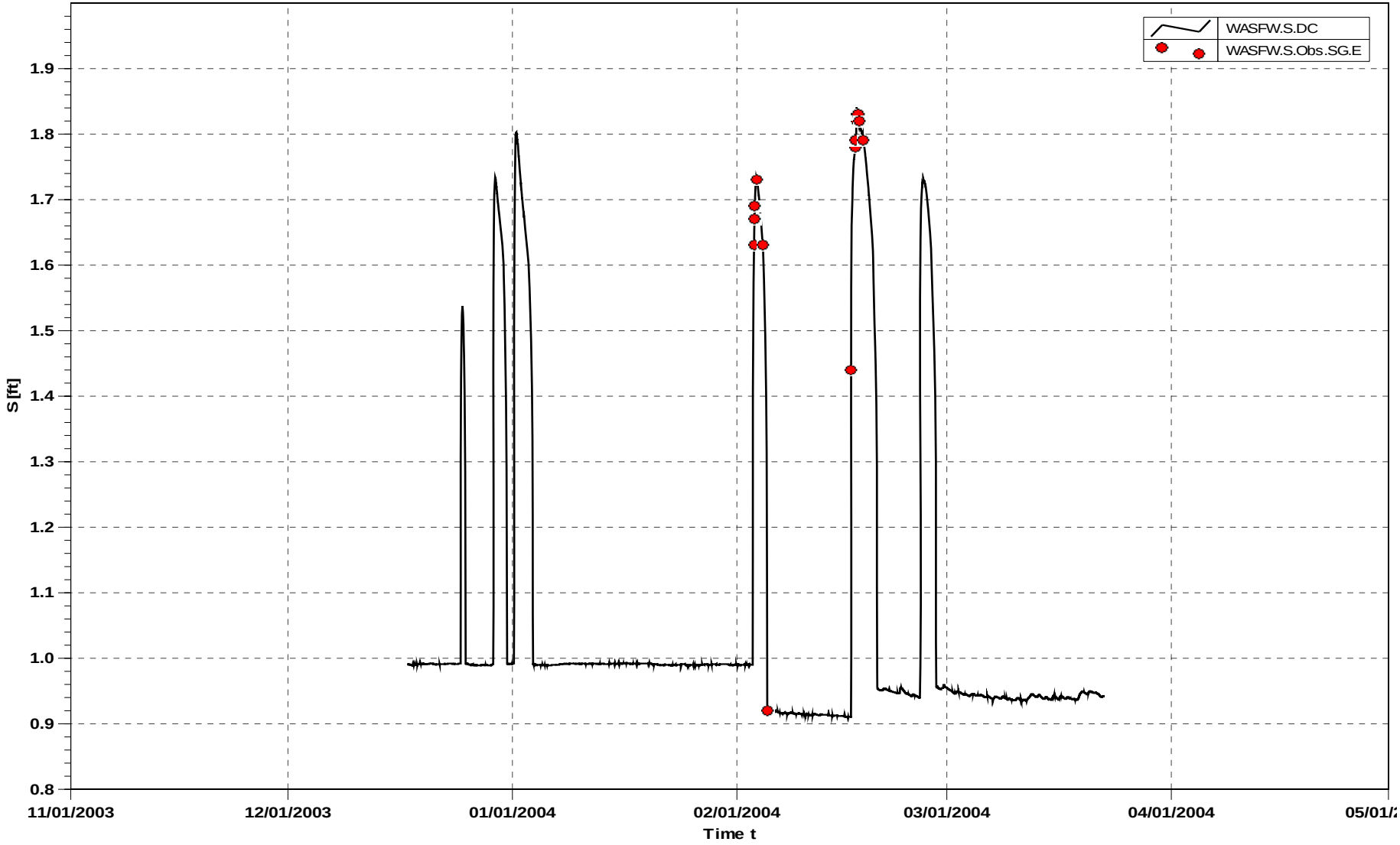
WOOD CREEK ABOVE SOUTH FORK WAGES CREEK
15-Minute Adjusted Gage Height Record and Observed Staff Gage Readings



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APPENDIX

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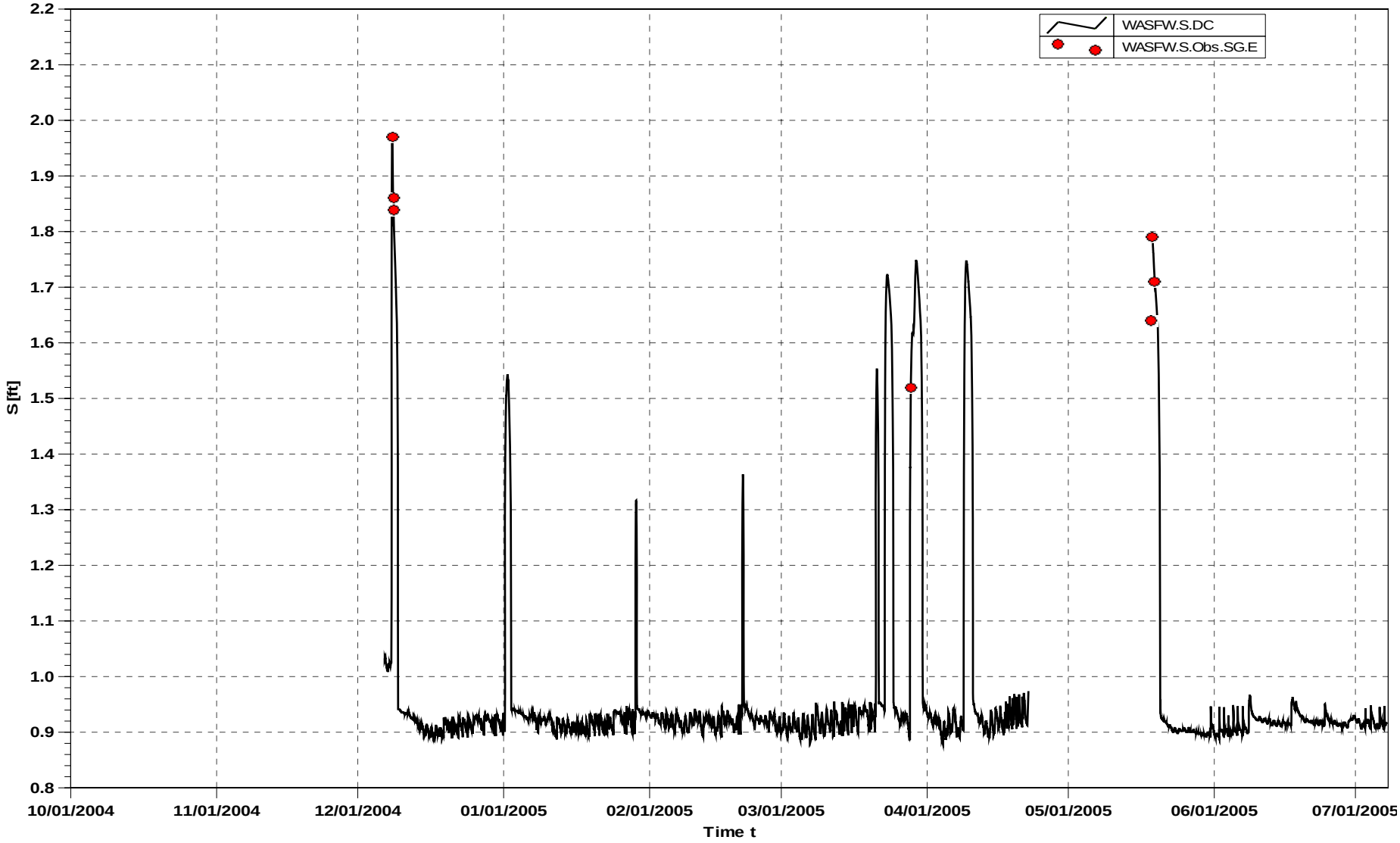
WOOD CREEK ABOVE SOUTH FORK WAGES CREEK
15-Minute Adjusted Gage Height Record and Observed Staff Gage Readings



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APPENDIX

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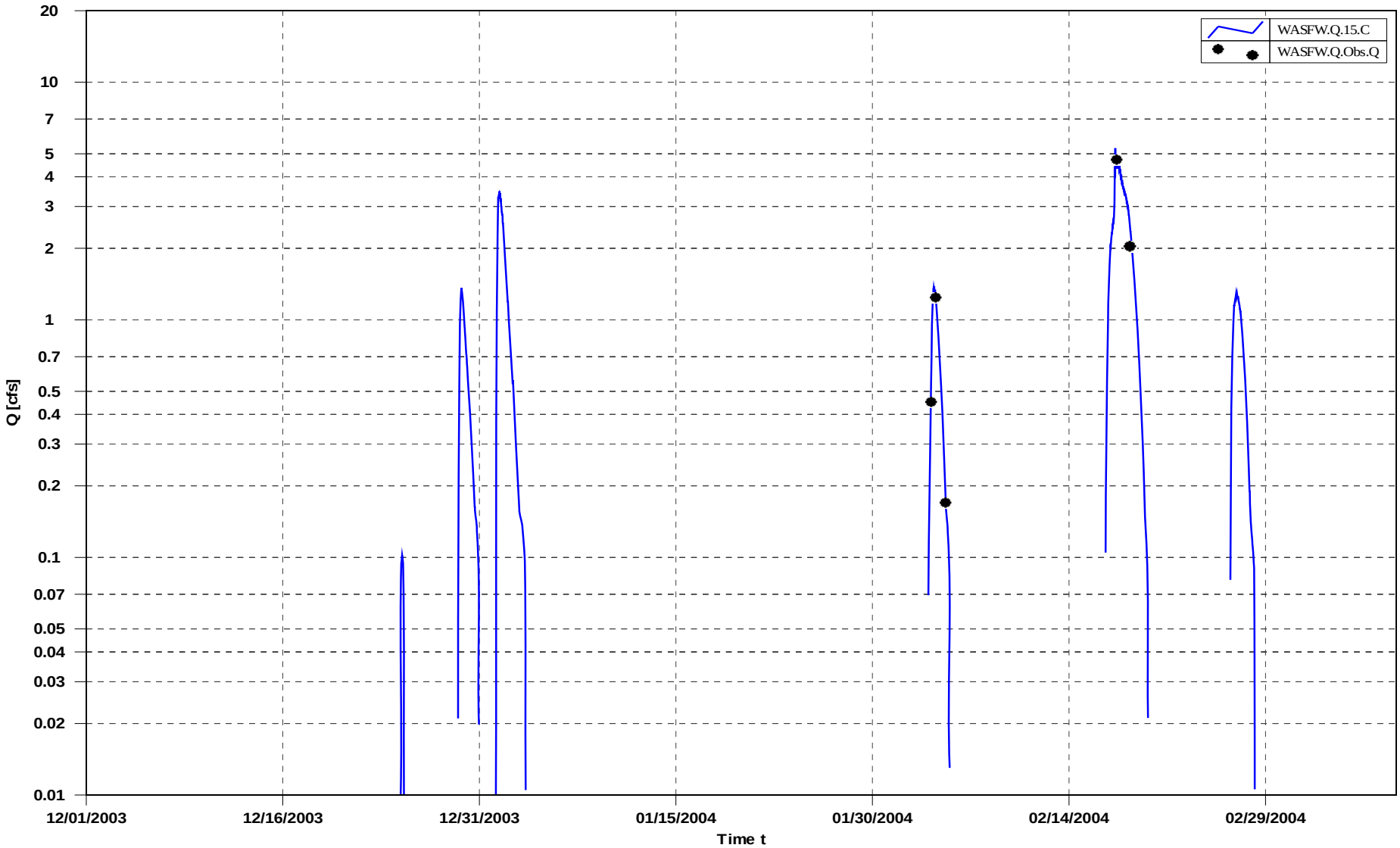
WOOD CREEK ABOVE SOUTH FORK WAGES CREEK
Discharge Hydrograph and Discharge Measurements



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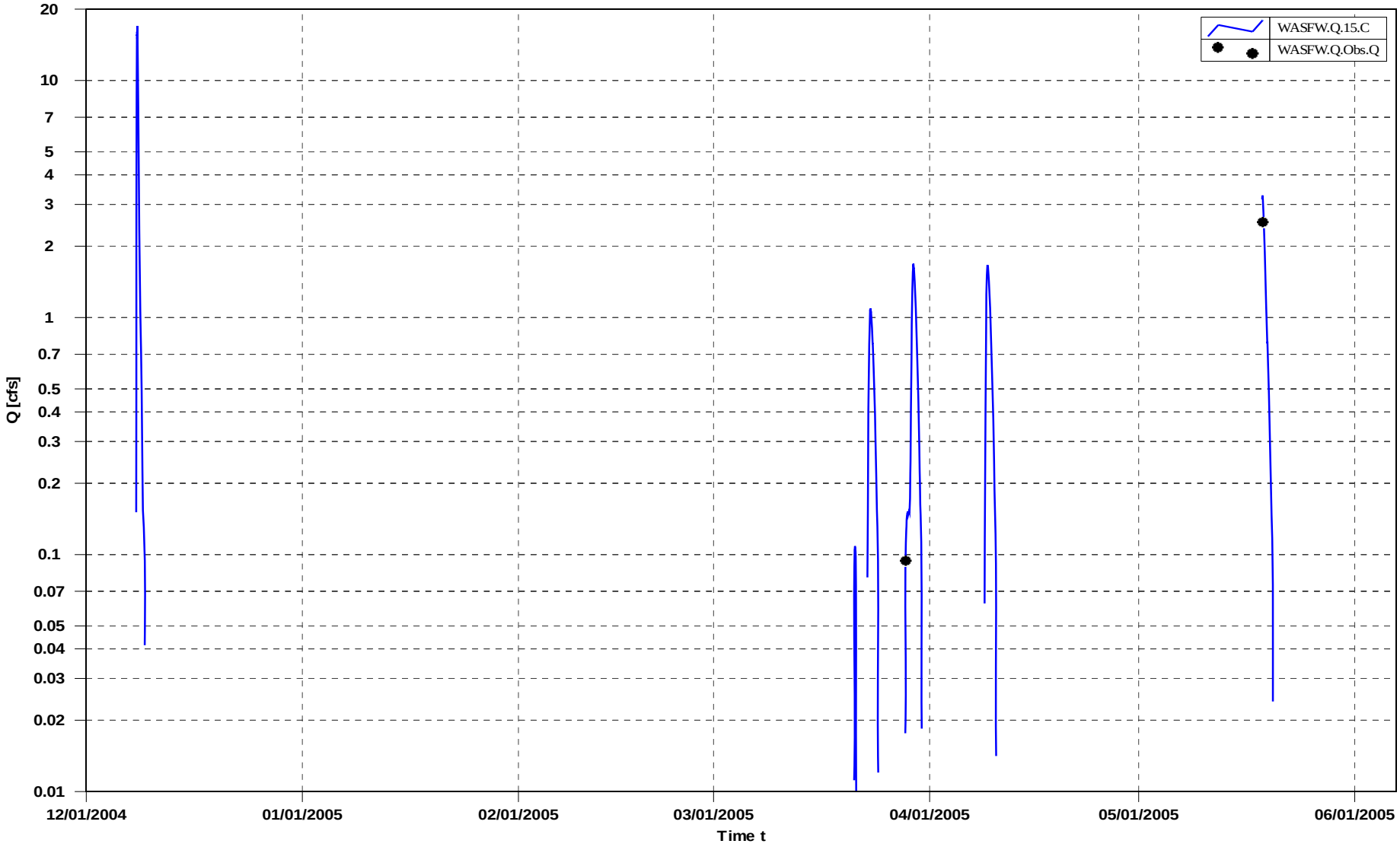
WOOD CREEK ABOVE SOUTH FORK WAGES CREEK
Discharge Hydrograph and Discharge Measurements



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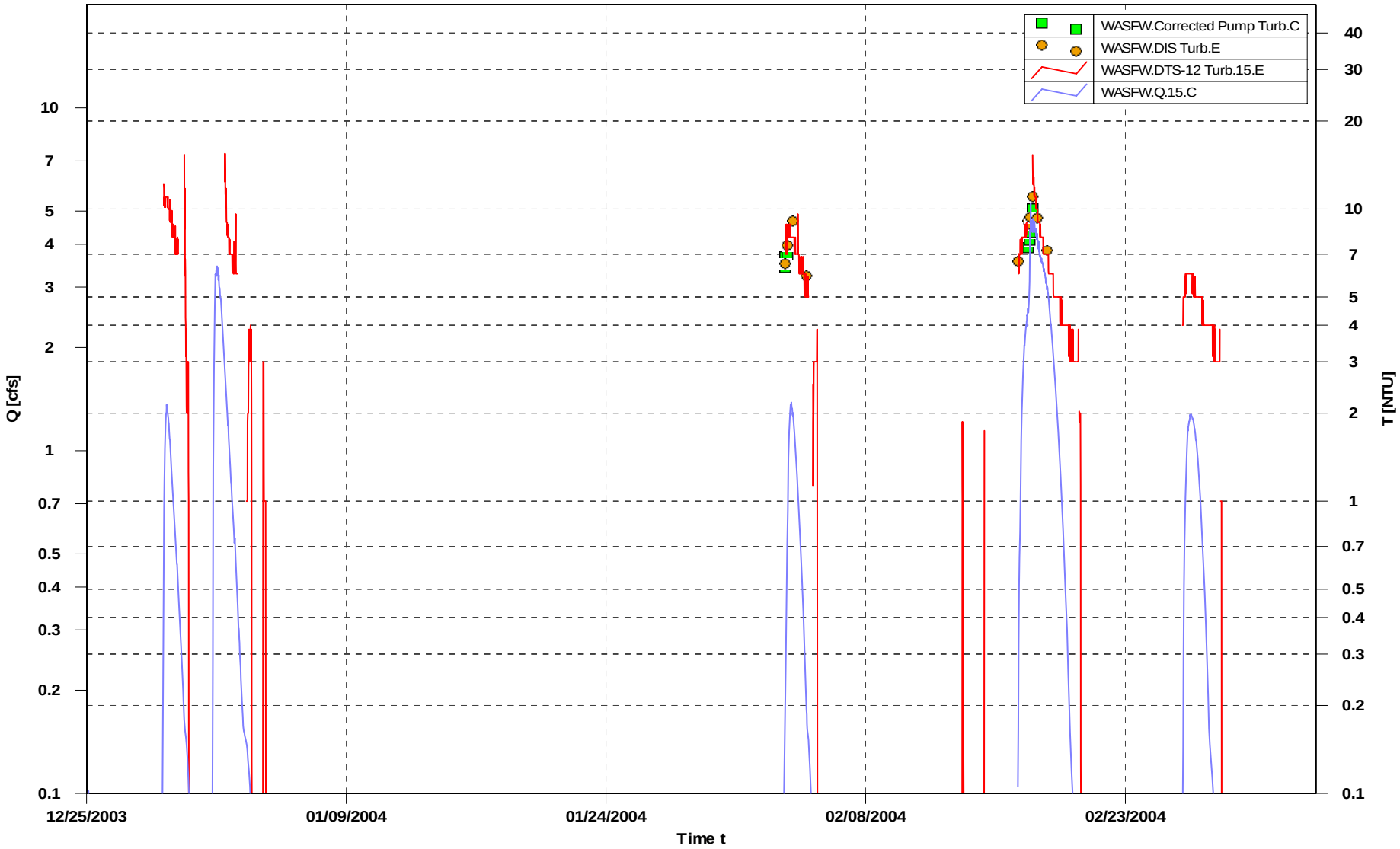
WOOD CREEK ABOVE SOUTH FORK WAGES CREEK
Discharge Hydrograph, Continuous Turbidity with Pump and Depth-Integrated Turbidity Samples



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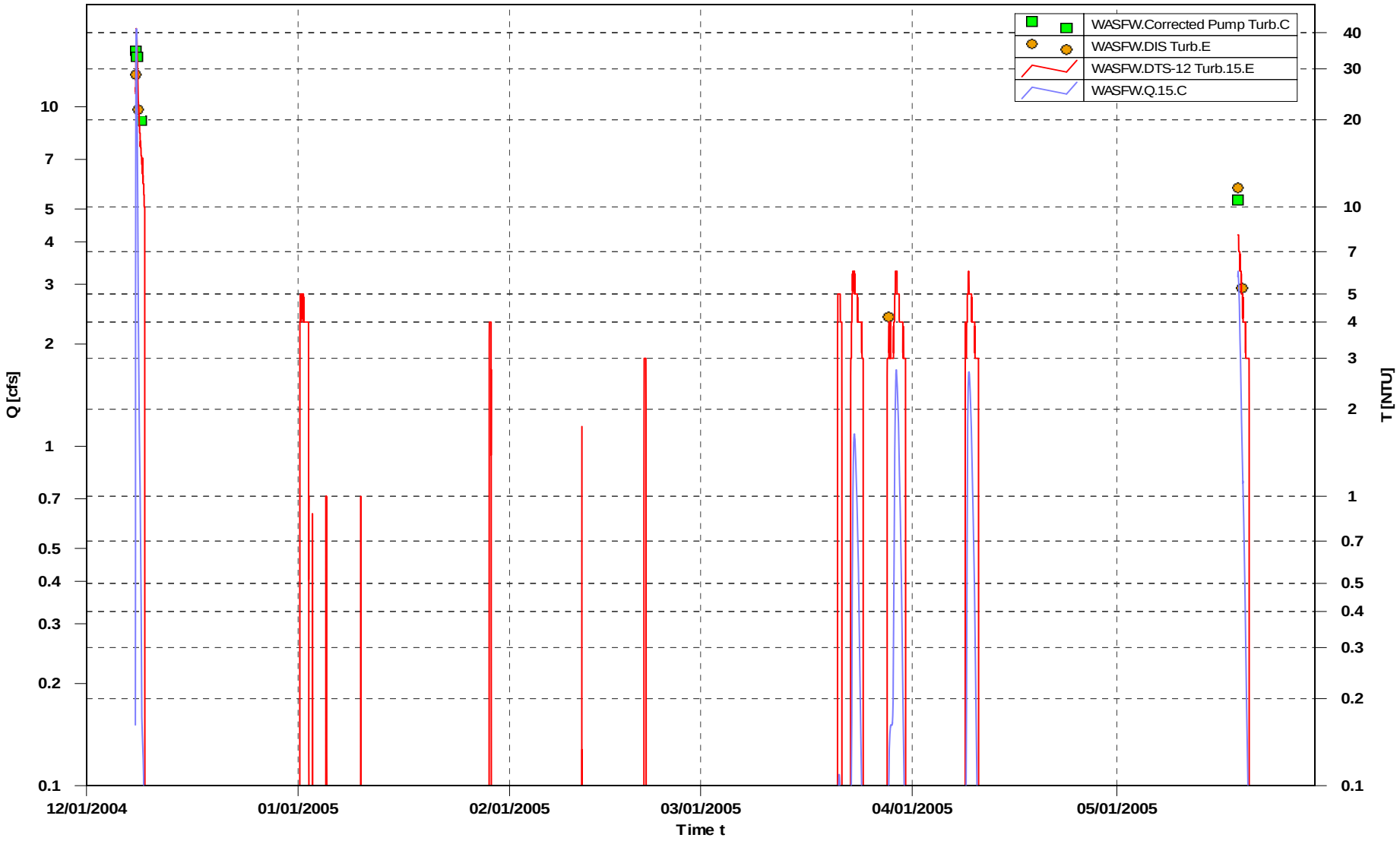
WOOD CREEK ABOVE SOUTH FORK WAGES CREEK
Discharge Hydrograph, Continuous Turbidity with Pump and Depth-Integrated Turbidity Samples



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APPENDIX

D-7b

SEDIMENT SAMPLE SUMMARY SHEET

LOCATION: WOOD CREEK ABOVE SOUTH FORK WAGES **WATER YEAR: 2004**

Date Time	Sample Number	Turbidity (NTU)	SSC (mg/l)	Stage (ft)	Discharge (cfs)	Q/WSA (cfs/mi^2)	SSL (ton/day)	SSLPA (ton/day/mi2)	Type (DIS, PUMP)	Note
2/3/2004 08:01	WASFW-SSCT2004-01	6.9	1	1.61	0.15	1.50	0.00	0.00	PUMP	
2/3/2004 08:16	WASFW-SSCT2004-02	6.5	2	1.63	0.18	1.80	0.00	0.01	DIS	
2/3/2004 08:31	WASFW-SSCT2004-03	6.3	1	1.62	0.15	1.50	0.00	0.00	PUMP	
2/3/2004 11:26	WASFW-SSCT2004-04	7.0	1	1.69	0.65	6.50	0.00	0.02	PUMP	Calibrate w/ bottle #1064
2/3/2004 11:46	WASFW-SSCT2004-05	7.5	1	1.69	0.65	6.50	0.00	0.01	DIS	
2/3/2004 19:21	WASFW-SSCT2004-06	9.1	10	1.73	1.28	12.8	0.03	0.34	DIS	
2/4/2004 14:02	WASFW-SSCT2004-07	5.9	3	1.63	0.18	1.80	0.00	0.01	DIS	
2/16/2004 18:37	WASFW-SSCT2004-08	6.6	2	1.44	0.10	1.00	0.00	0.00	DIS	
2/17/2004 09:00	WASFW-SSCT2004-09	9.1	2	1.78	2.60	26.0	0.01	0.12	DIS	
2/17/2004 09:16	WASFW-SSCT2004-10	7.4	2	1.76	1.99	19.9	0.01	0.09	PUMP	T-PROBE = 43 NTU
2/17/2004 10:31	WASFW-SSCT2004-11	7.8	4	1.77	2.28	22.8	0.03	0.25	PUMP	T-PROBE = 182 NTU
2/17/2004 11:06	WASFW-SSCT2004-12	8.9	3	1.79	2.95	29.5	0.02	0.25	DIS	
2/17/2004 12:00	WASFW-SSCT2004-13	9.4	9	1.82	4.22	42.2	0.10	1.0	DIS	
2/17/2004 12:01	WASFW-SSCT2004-14	8.3	3	1.80	3.33	33.3	0.03	0.27	PUMP	T-PROBE = 83 NTU
2/17/2004 15:00	WASFW-SSCT2004-15	11	6	1.83	4.70	47.0	0.08	0.76	DIS	
2/17/2004 15:01	WASFW-SSCT2004-16	9.4	4	1.81	3.75	37.5	0.05	0.45	PUMP	T-PROBE = 917 NTU
2/17/2004 15:31	WASFW-SSCT2004-17	10	6	1.81	3.75	37.5	0.06	0.64	PUMP	T-PROBE = 13 NTU
2/17/2004 21:06	WASFW-SSCT2004-18	9.3	2	1.82	4.22	42.2	0.02	0.17	DIS	
2/18/2004 11:49	WASFW-SSCT2004-19	7.2	2	1.79	2.95	29.5	0.01	0.12	DIS	

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WY 2004 APPENDIX

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SEDIMENT SAMPLE SUMMARY SHEET

LOCATION: WOOD CREEK ABOVE SOUTH FORK WAGES **WATER YEAR: 2005**

Date Time	Sample Number	Turbidity (NTU)	SSC (mg/l)	Stage (ft)	Discharge (cfs)	Q/WSA (cfs/mi^2)	SSL (ton/day)	SSLPA (ton/day/mi2)	Type (DIS, PUMP)	Note
12/8/2004 07:01	WASFW-SSCT2005-01	27	29	1.97	17.1	171	1.3	13	Pump	Calibrate with bottle #1944
12/8/2004 07:03	WASFW-SSCT2005-02	29	54	1.97	17.1	171	2.5	25	DIS	
12/8/2004 07:31	WASFW-SSCT2005-03	25	29	1.96	15.9	159	1.2	12	Pump	
12/8/2004 10:16	WASFW-SSCT2005-04	24	209	1.91	10.7	107	6.0	60	Pump	Censored
12/8/2004 10:46	WASFW-SSCT2005-05	23	319	1.90	9.69	96.9	8.3	83	Pump	Censored
12/8/2004 12:31	WASFW-SSCT2005-06	21	278	1.84	5.03	50.3	3.8	38	Pump	Censored
12/8/2004 13:16	WASFW-SSCT2005-07	15	236	1.82	4.14	41.4	2.6	26	Pump	Censored
12/8/2004 14:02	WASFW-SSCT2005-08	22	4	1.84	5.39	53.9	0.05	0.53	DIS	
12/9/2004 00:16	WASFW-SSCT2005-09	15	3	1.72	1.14	11.4	0.01	0.09	Pump	
3/28/2005 13:00	WASFW-SSCT2005-10	4.2	3	1.52	0.09	0.90	0.00	0.01	DIS	
5/18/2005 12:41	WASFW-SSCT2005-11	13	124	1.64	0.22	2.20	0.07	0.74	DIS	Censored, Discharge taken from rating table not from 15 minute record
5/18/2005 17:00	WASFW-SSCT2005-12	8.1	12	1.80	3.16	31.6	0.1	1.0	Pump	Calibrate with bottle #1020
5/18/2005 17:04	WASFW-SSCT2005-13	12	9	1.80	3.16	31.6	0.08	0.77	DIS	
5/19/2005 09:00	WASFW-SSCT2005-14	5.3	1	1.71	0.93	9.30	0.00	0.03	DIS	

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WY 2005 APPENDIX

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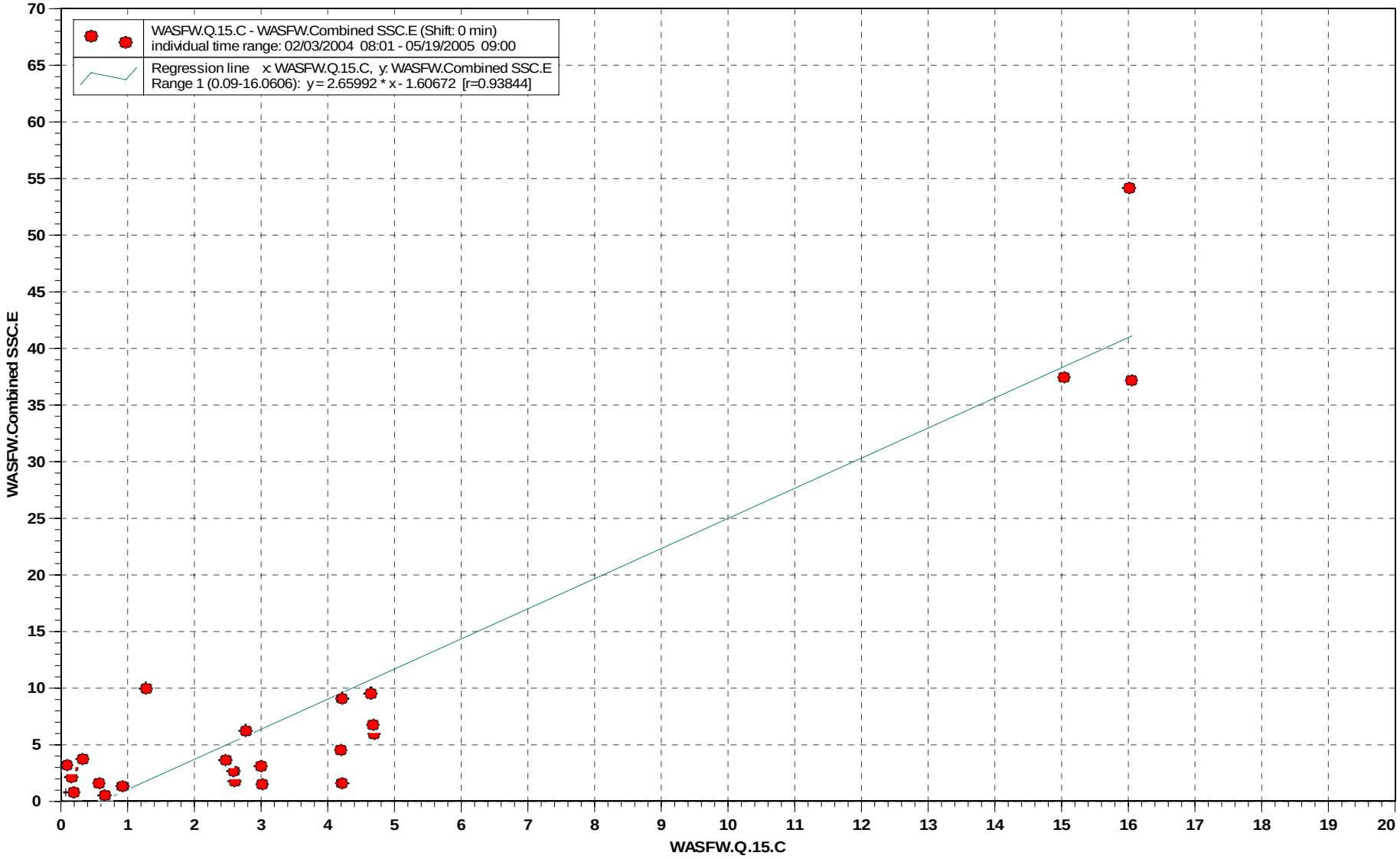
WOOD CREEK ABOVE SOUTH FOR WAGES CREEK
Discharge verses Combined SSC WY 2004 - 2005



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WY 04-05
APPENDIX

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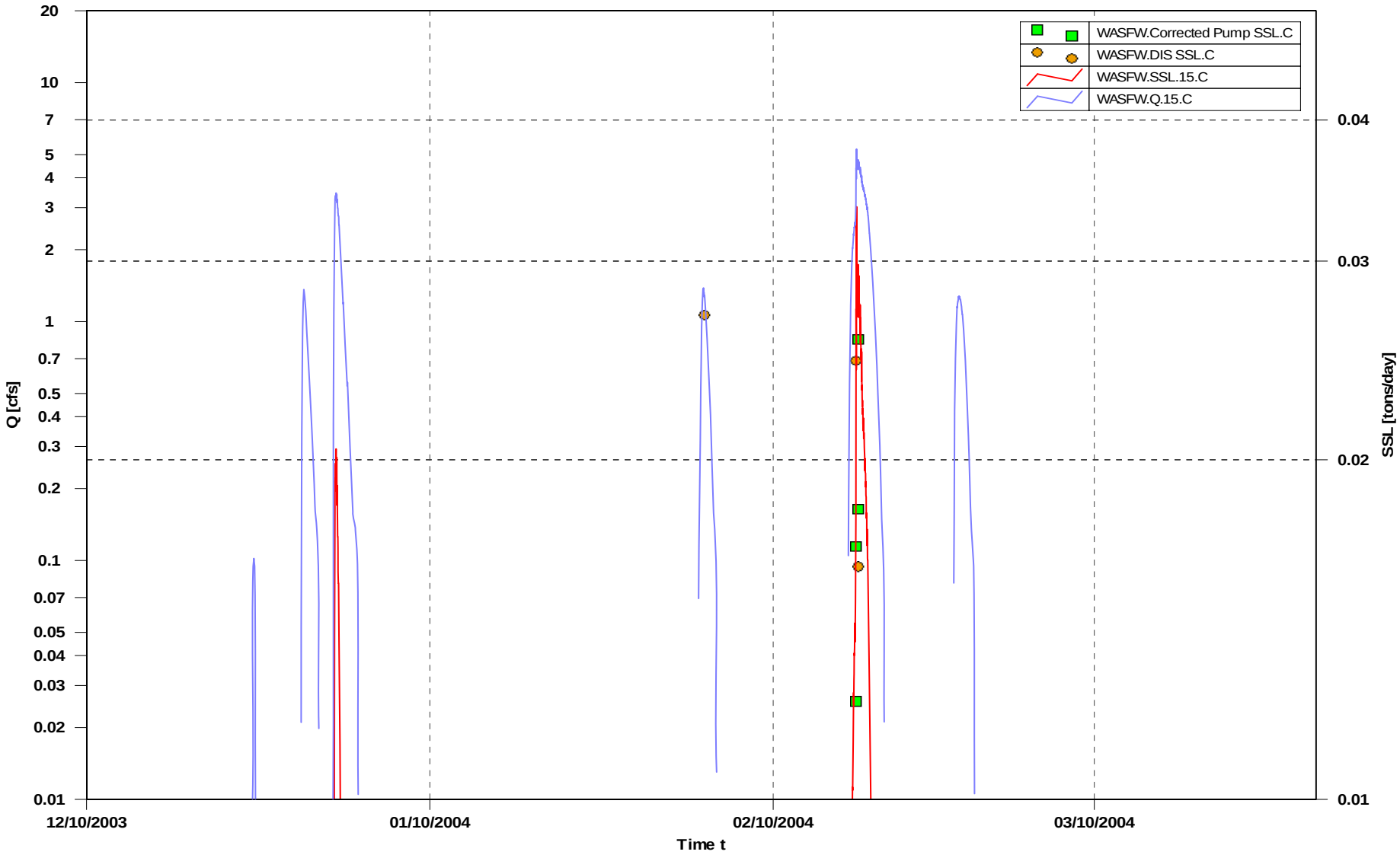
WOOD CREEK ABOVE SOUTH FORK WAGES CREEK
Discharge and Suspended Sediment Load



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WY 2004
APPENDIX

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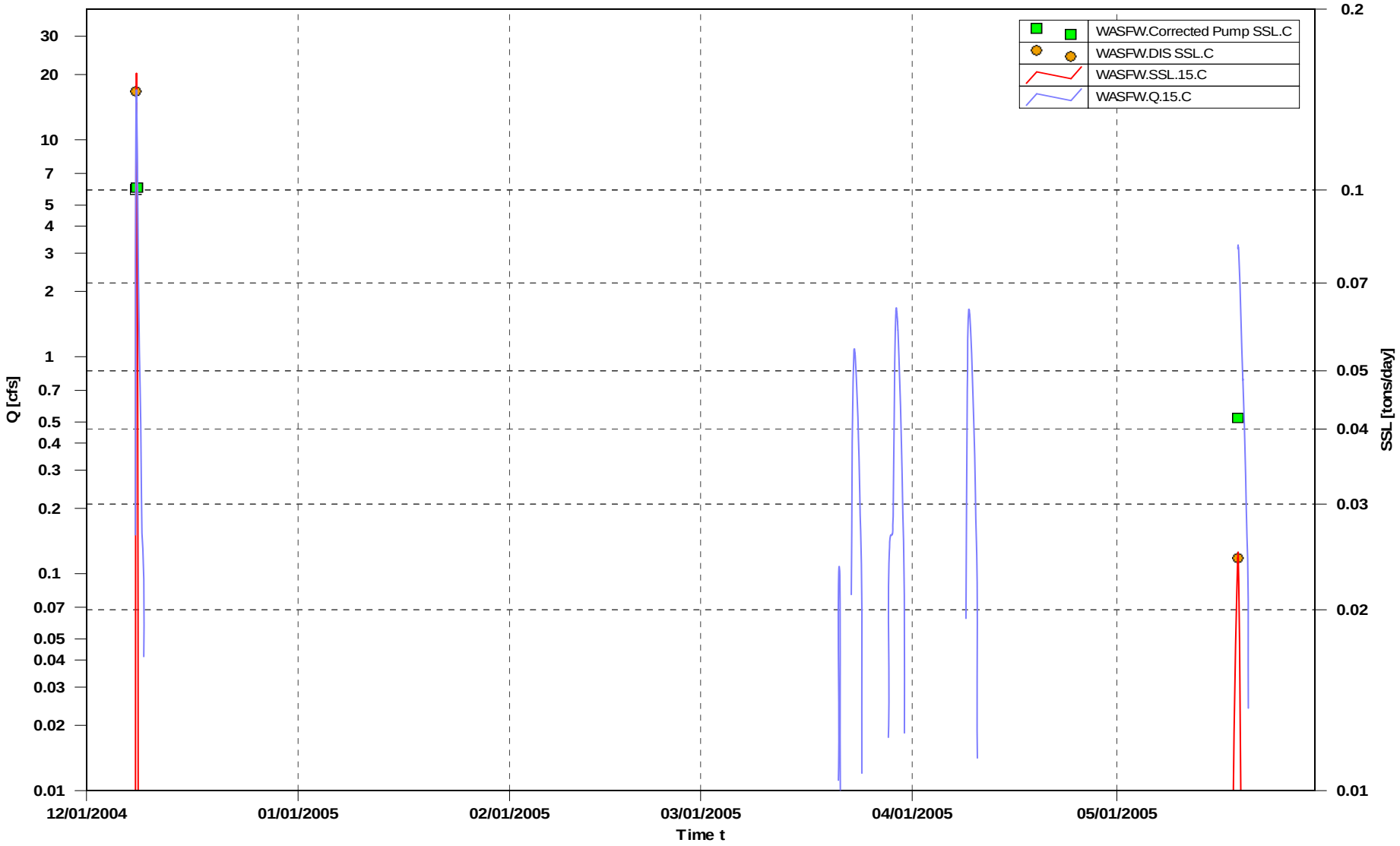
WOOD CREEK ABOVE SOUTH FORK WAGES CREEK
Discharge and Suspended Sediment Load



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APPENDIX

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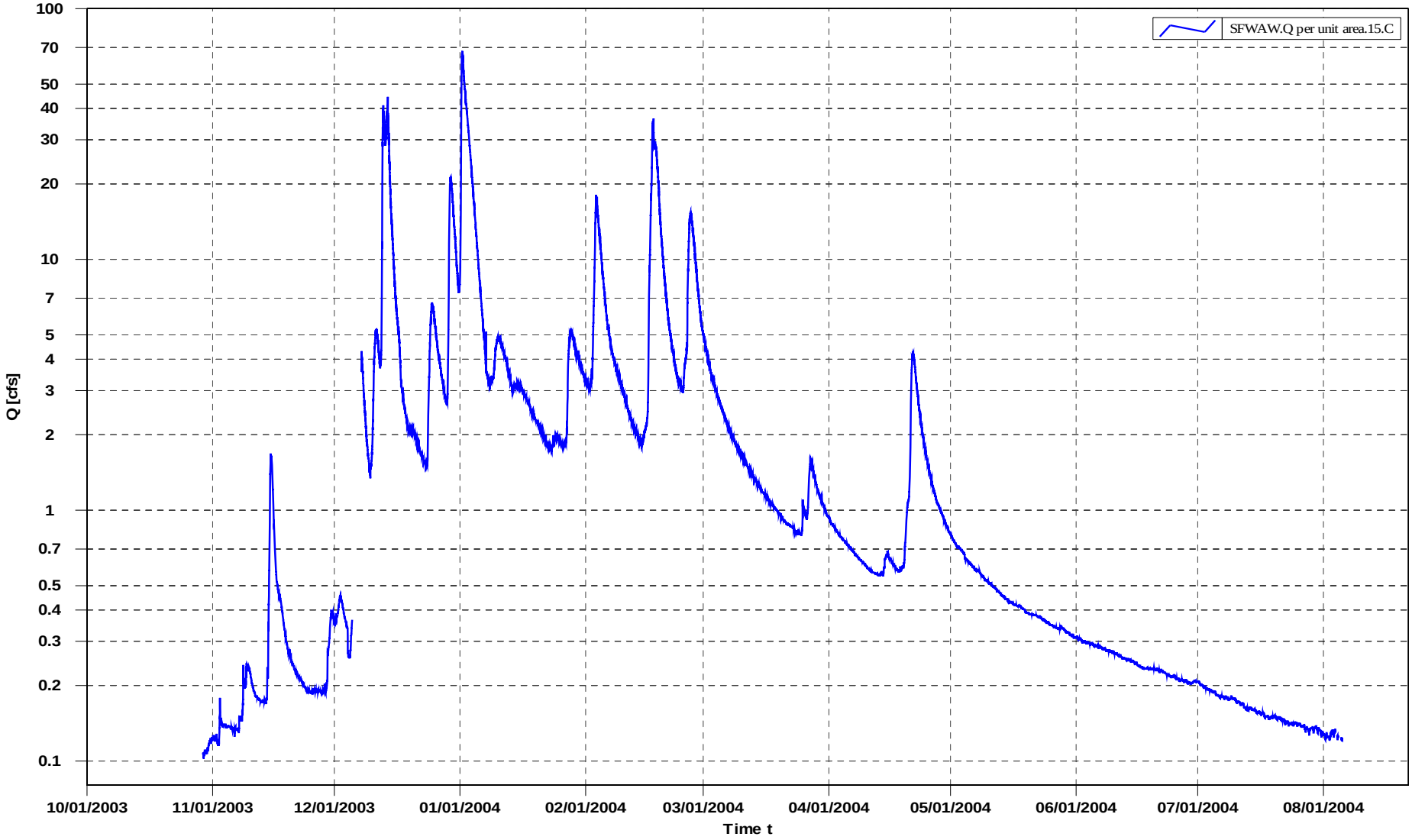
SOUTH FORK WAGES ABOVE WOOD CREEK
Synthetic Discharge Hydrograph Derived from SFWAC Record



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WY 2004
APPENDIX

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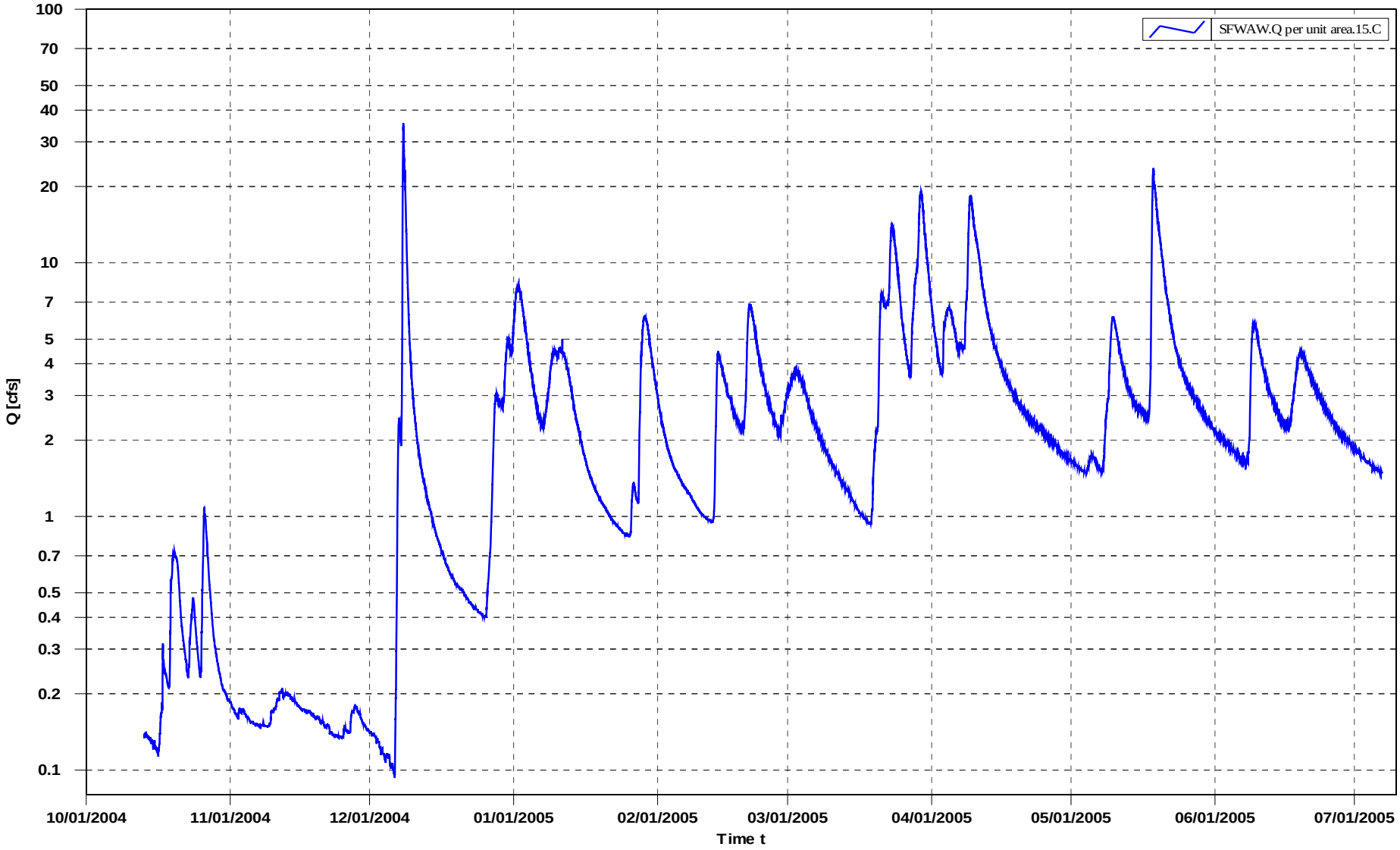
SOUTH FORK WAGES ABOVE WOOD CREEK
Synthetic Discharge Hydrograph Derived from SFWAC Record



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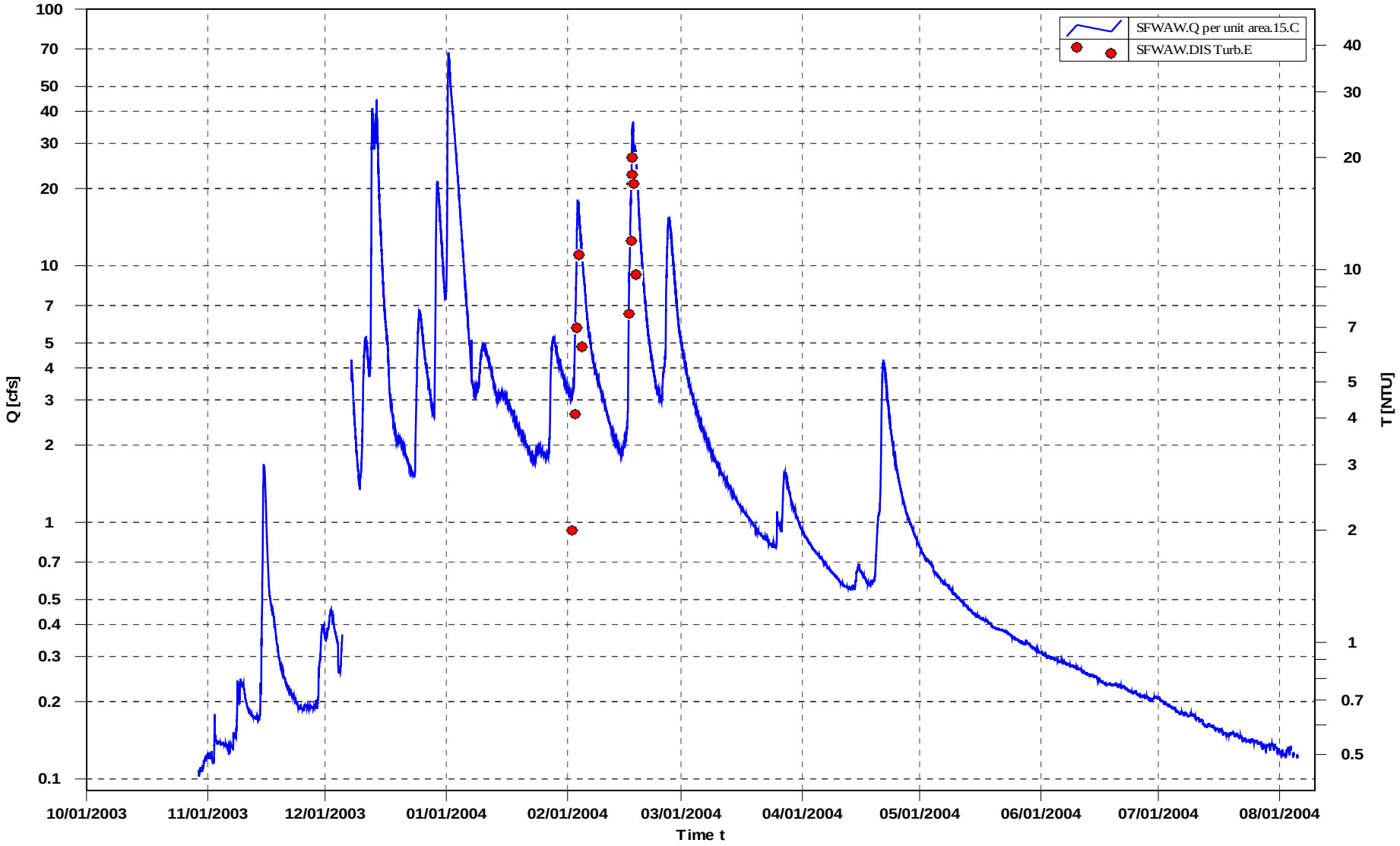
SOUTH FORK WAGES CREEK ABOVE WOOD CREEK
Synthetic Discharge Hydrograph with Depth-Integrated Turbidity Samples



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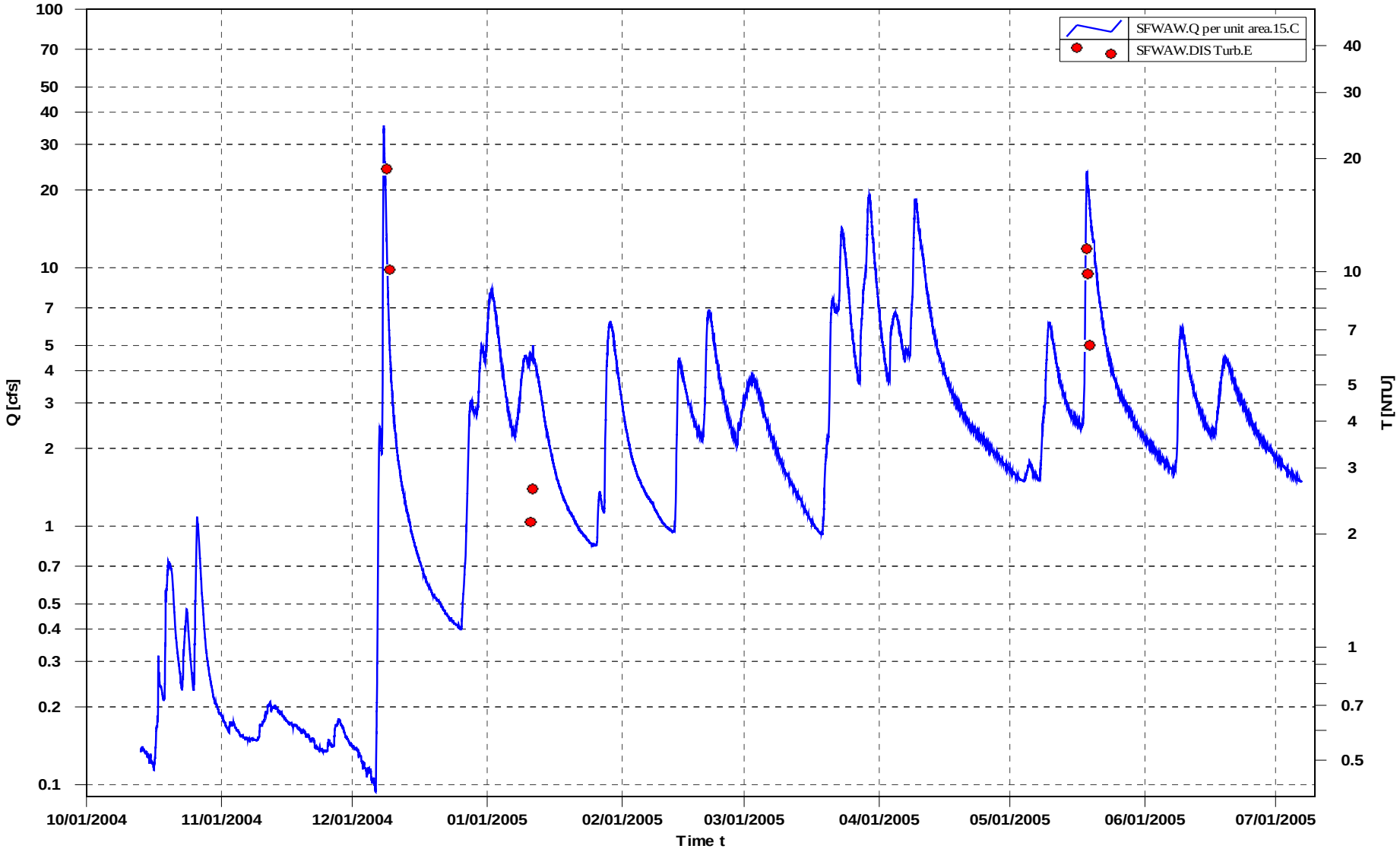
SOUTH FORK WAGES CREEK ABOVE WOOD CREEK
Synthetic Discharge Hydrograph with Depth-Integrated Turbidity Samples



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WY 2005
APPENDIX

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SEDIMENT SAMPLE SUMMARY SHEET

LOCATION: SOUTH FORK WAGES ABOVE WOOD CREEK **WATER YEAR: 2004**

Date Time	Sample Number	Turbidity (NTU)	SSC (mg/l)	Stage (ft)	Discharge (cfs)	Q/WSA (cfs/mi^2)	SSL (ton/day)	SSLPA (ton/day/mi2)	Type (DIS, PUMP)	Note
2/2/2004 05:28	SFWAW-SSCT2004-01	2.0	5	1.64	3.22	4.4	0.04	0.06	DIS	
2/2/2004 21:12	SFWAW-SSCT2004-02	4.1	7	1.77	5.39	7.4	0.10	0.13	DIS	
2/3/2004 06:12	SFWAW-SSCT2004-03	7.0	11	1.99	10.3	14	0.30	0.41	DIS	
2/3/2004 19:27	SFWAW-SSCT2004-04	11	24	2.15	16.3	22	1.0	1.4	DIS	
2/4/2004 16:25	SFWAW-SSCT2004-05	6.2	1	2.01	11.2	15	0.04	0.05	DIS	
2/16/2004 19:19	SFWAW-SSCT2004-06	7.6	4	1.92	9.60	13	0.12	0.16	DIS	
2/17/2004 08:44	SFWAW-SSCT2004-07	12	13	2.20	24.8	34	0.84	1.2	DIS	
2/17/2004 11:21	SFWAW-SSCT2004-08	17	31	2.30	30.0	41	2.5	3.4	DIS	
2/17/2004 11:37	SFWAW-SSCT2004-09	18	35	2.36	31.0	42	2.9	4.0	DIS	
2/17/2004 14:26	SFWAW-SSCT2004-10	20	39	2.46	34.0	47	3.6	4.9	DIS	
2/17/2004 20:58	SFWAW-SSCT2004-11	17	15	2.41	33.0	45	1.3	1.8	DIS	
2/18/2004 11:56	SFWAW-SSCT2004-12	9.7	6	2.28	27.0	37	0.45	0.61	DIS	

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WY 2004 APPENDIX

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SEDIMENT SAMPLE SUMMARY SHEET

LOCATION: SOUTH FORK WAGES ABOVE WOOD CREEK **WATER YEAR: 2005**

Date Time	Sample Number	Turbidity (NTU)	SSC (mg/l)	Stage (ft)	Discharge (cfs)	Q/WSA (cfs/mi^2)	SSL (ton/day)	SSLPA (ton/day/mi2)	Type (DIS, PUMP)	Note
12/8/2004 08:24	SFWAW-SSCT2005-01	33	3	2.57	28.5	39	0.19	0.26	DIS	Censored
12/8/2004 17:29	SFWAW-SSCT2005-02	19	9	2.24	17.9	25	0.45	0.61	DIS	
12/9/2004 12:53	SFWAW-SSCT2005-03	10	10	1.88	5.36	7.3	0.14	0.19	DIS	
1/10/2005 21:14	SFWAW-SSCT2005-04	2.2	4	1.75	4.60	6.3	0.05	0.07	DIS	
1/11/2005 11:13	SFWAW-SSCT2005-05	2.7	1	1.76	4.58	6.3	0.02	0.02	DIS	
5/18/2005 13:23	SFWAW-SSCT2005-06	12	19	2.11	19.7	27	1.0	1.4	DIS	
5/18/2005 18:35	SFWAW-SSCT2005-07	9.9	8	2.17	23.3	32	0.50	0.69	DIS	
5/19/2005 09:08	SFWAW-SSCT2005-08	6.4	6	2.06	17.0	23	0.29	0.40	DIS	

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WY 2005 APPENDIX

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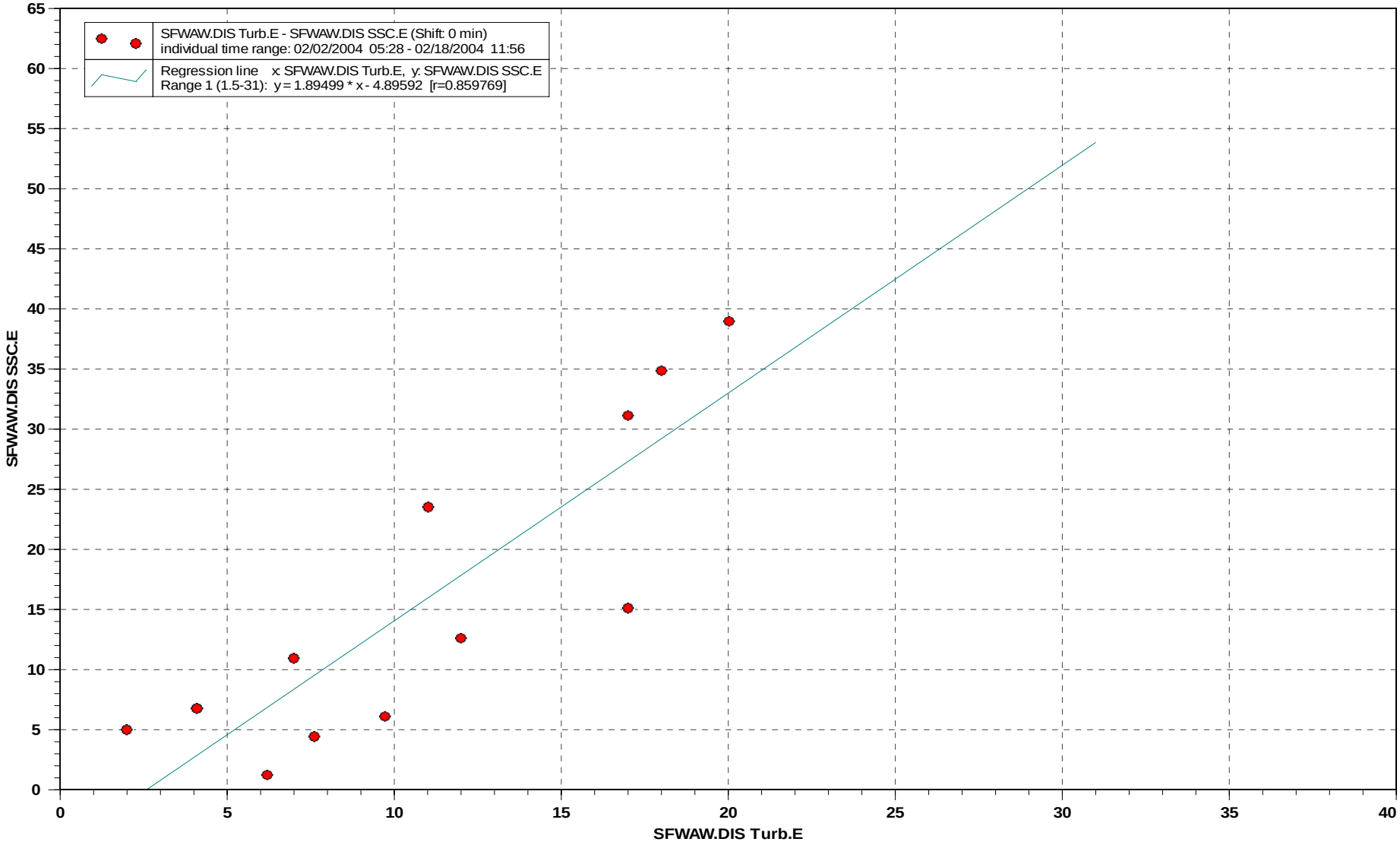
SOUTH FORK WAGES CREEK ABOVE WOOD CREEK
Depth-Integrated Turbidity vs Depth-Integrated SSC



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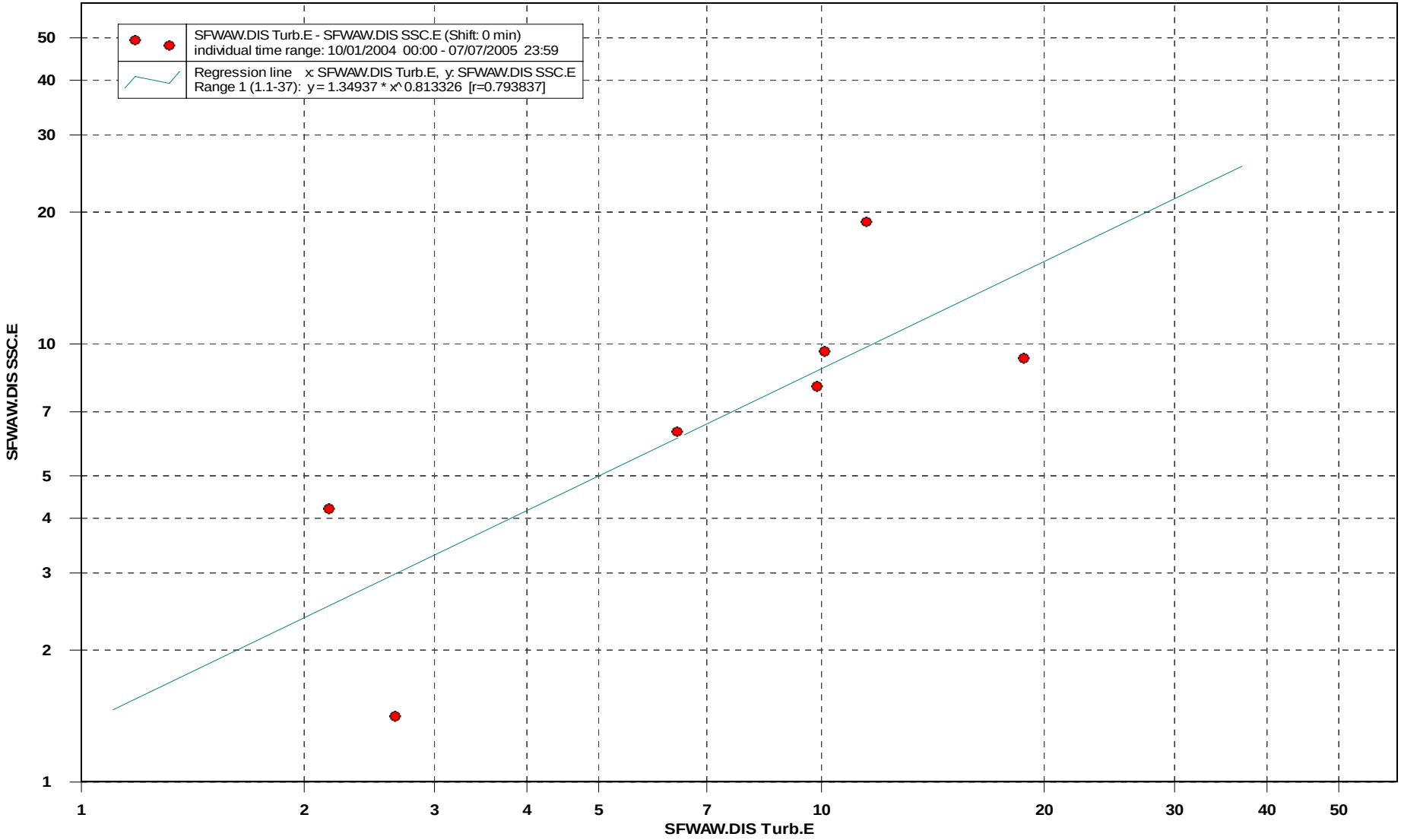
WY 2004
APPENDIX

E-9a

SOUTH FORK WAGES CREEK ABOVE WOOD CREEK
Depth-Integrated Turbidity vs Depth-Integrated SSC



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APPENDIX

E-9b

DISCHARGE SUMMARY SHEET

LOCATION: Rock Creek Above South Fork Wages Creeek **WATER YEAR:** 2004, 2005

Measurement Number	WY Msmt #	Date	Made By	Width (feet)	Mean Depth (feet)	Area (ft^2)	Mean Velocity (ft/sec)	Gage Height (feet)	Discharge (cfs)	Rating 1.2 Shift Adj.	Rating 1.2 Percent Diff.	Method	No. of Msmt sections	Begin Time (hours)	End Time (hours)	Msmt Rating	GZF (feet)	Notes
1	2004-01	2/2/2004	K. Faucher	1.0	0.24	0.24	1.26	2.36	0.30		0	wading	6	15:55	16:00	Poor		
2	2004-02	2/3/2004	T. Grey	6.0	0.62	3.71	1.04	3.04	3.84		-1	wading	25	08:44	09:17	Poor		
3	2004-03	2/3/2004	K. Faucher	6.7	0.61	4.08	1.16	3.20	4.74		-1	wading	23	17:23	18:12	Poor		
4	2004-04	2/4/2004	T. Grey	3.4	0.71	2.43	1.16	2.82	2.81		3	wading	17	14:53	15:14	Poor		
5	2004-05	2/17/2004	T. Grey	7.9	0.67	5.31	2.12	3.48	11.3		1	wading	29	18:19	18:57	Fair		
										Rating 1.3								
6	2005-01	2/22/2005	R. Leisse	2.7	0.37	1.01	0.62	2.67	0.63		7	wading	11	12:57	13:12	poor		
7	2005-02	2/22/2005	R. Leisse	2.7	0.36	0.98	0.57	2.69	0.58		-9	wading	11	13:18	13:28	poor		
8	2005-03	3/28/2005	K. Faucher	2.5	0.40	1.00	2.26	3.02	2.26		-1	wading	9	13:41	13:48	poor		
9	2005-04	5/18/2005	K. Faucher	8.7	0.42	3.69	1.62	3.29	5.97		0	wading	17	19:21	19:38	poor	2.39	high stage pzf, not applied to rating

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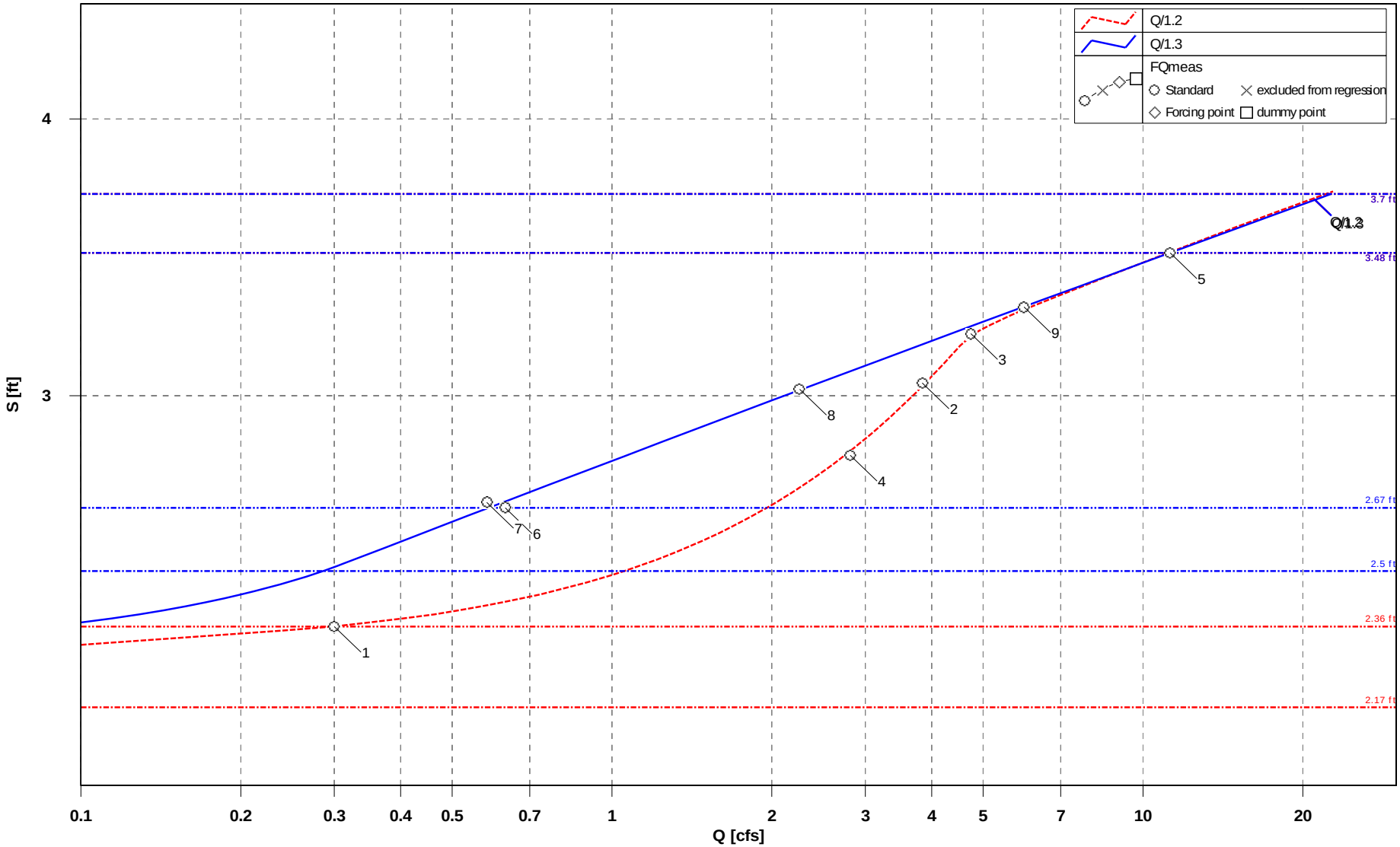
WY 04-05
APPENDIX

F-2

ROCK CREEK ABOVE SOUTH FORK WAGES CREEK
Discharge Rating Curves 1.2 & 1.3



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WY 04-05
APPENDIX

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Graham Matthews & Associates

ROCK CREEK ABOVE SOUTH FORK WAGES CREEK

RATING TABLE NO.1.2 -- Begin Date 10/1/03

GH	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	1st Diff	2nd Diff
1.8	---	---	---	---	---	---	---	---	---	---	---	---
1.9	---	---	---	---	---	---	---	---	---	---	---	---
2.0	---	---	---	---	---	---	---	---	---	---	---	---
2.1	---	---	---	---	---	---	---	---	---	---	---	---
2.2	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05		---
2.3	0.07	0.09	0.11	0.14	0.19	0.24	0.3	0.35	0.4	0.46	0.41	---
2.4	0.51	0.57	0.62	0.67	0.73	0.78	0.84	0.89	0.95	1.00	0.54	0.13
2.5	1.06	1.11	1.16	1.22	1.27	1.32	1.37	1.43	1.48	1.53	0.53	-0.01
2.6	1.59	1.64	1.69	1.74	1.8	1.85	1.9	1.96	2.01	2.06	0.53	0.00
2.7	2.12	2.17	2.22	2.27	2.33	2.38	2.43	2.48	2.54	2.59	0.53	0.00
2.8	2.64	2.69	2.74	2.8	2.85	2.9	2.95	3.01	3.06	3.11	0.52	-0.01
2.9	3.16	3.22	3.27	3.32	3.37	3.42	3.47	3.53	3.58	3.63	0.52	0.00
3.0	3.69	3.74	3.79	3.84	3.89	3.94	3.99	4.05	4.1	4.15	4.15	4.15
3.1	4.21	4.26	4.31	4.36	4.42	4.47	4.53	4.59	4.66	4.73	0.58	-3.57
3.2	4.8	4.92	5.04	5.17	5.31	5.46	5.61	5.78	5.95	6.14	1.41	0.83
3.3	6.34	6.54	6.75	6.97	7.19	7.42	7.66	7.9	8.15	8.41	2.27	0.86
3.4	8.67	8.95	9.23	9.53	9.83	10.1	10.5	10.8	11.1	11.5	3.09	0.82
3.5	11.9	12.2	12.6	13	13.4	13.9	14.3	14.8	15.2	15.7	4.20	1.11
3.6	16.2	16.7	17.2	17.8	18.3	18.9	19.5	20.1	20.8	21.4	5.70	1.50
3.7	22.1	22.8	---	---	---	---	---	---	---	---	---	---
3.8	*22.6*	---	---	---	---	---	---	---	---	---	---	---
3.9	---	---	---	---	---	---	---	---	---	---	---	---
4.0	---	---	---	---	---	---	---	---	---	---	---	---
4.1	---	---	---	---	---	---	---	---	---	---	---	---
4.2	---	---	---	---	---	---	---	---	---	---	---	---

Values in italics are beyond the validated range of the rating

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ROCK CREEK ABOVE SOUTH FORK WAGES CREEK

RATING TABLE NO.1.3 -- Begin Date 10/1/04

GH	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	1st Diff	2nd Diff
1.8	---	---	---	---	---	---	---	---	---	---	---	---
1.9	---	---	---	---	---	---	---	---	---	---	---	---
2.0	---	---	---	---	---	---	---	---	---	---	---	---
2.1	---	---	---	---	---	---	---	---	---	---	---	---
2.2	---	---	---	---	---	---	---	---	---	---	---	---
2.3	*0.00*	*0.01*	*0.03*	*0.04*	*0.06*	*0.07*	*0.09*	*0.10*	*0.11*	*0.13*	---	---
2.4	*0.14*	*0.16*	*0.17*	*0.19*	*0.20*	*0.21*	*0.23*	*0.24*	*0.26*	*0.27*	0.14	---
2.5	*0.29*	*0.3*	*0.31*	*0.33*	*0.34*	*0.36*	*0.37*	*0.39*	*0.40*	*0.42*	0.15	0.01
2.6	*0.44*	*0.46*	*0.48*	*0.50*	*0.52*	*0.54*	*0.56*	0.59	0.61	0.64	0.22	0.07
2.7	0.66	0.69	0.72	0.75	0.78	0.81	0.84	0.88	0.91	0.95	0.31	0.09
2.8	0.99	1.03	1.07	1.11	1.15	1.20	1.24	1.29	1.34	1.40	0.45	0.14
2.9	1.45	1.51	1.56	1.62	1.69	1.75	1.82	1.89	1.96	2.03	0.63	0.18
3.0	2.11	2.19	2.28	2.36	2.45	2.55	2.64	2.74	2.84	2.94	0.91	0.28
3.1	3.05	3.16	3.28	3.40	3.52	3.65	3.78	3.92	4.06	4.20	1.26	0.35
3.2	4.35	4.51	4.67	4.83	5.00	5.17	5.35	5.54	5.74	5.94	1.74	0.48
3.3	6.15	6.37	6.6	6.83	7.06	7.31	7.56	7.82	8.08	8.35	2.41	0.67
3.4	8.63	8.92	9.21	9.52	9.85	10.2	10.5	10.9	11.2	11.6	3.25	0.84
3.5	*12.0*	*12.4*	*12.8*	*13.2*	*13.6*	*14.1*	*14.5*	*15.0*	*15.5*	*16.0*	4.40	1.15
3.6	*16.5*	*17.1*	*17.6*	*18.2*	*18.7*	*19.3*	*19.9*	*20.6*	*21.2*	*21.9*	5.90	1.50
3.7	*22.6*	---	---	---	---	---	---	---	---	---	---	---
3.8	---	---	---	---	---	---	---	---	---	---	---	---
3.9	---	---	---	---	---	---	---	---	---	---	---	---
4.0	---	---	---	---	---	---	---	---	---	---	---	---
4.1	---	---	---	---	---	---	---	---	---	---	---	---
4.2	---	---	---	---	---	---	---	---	---	---	---	---

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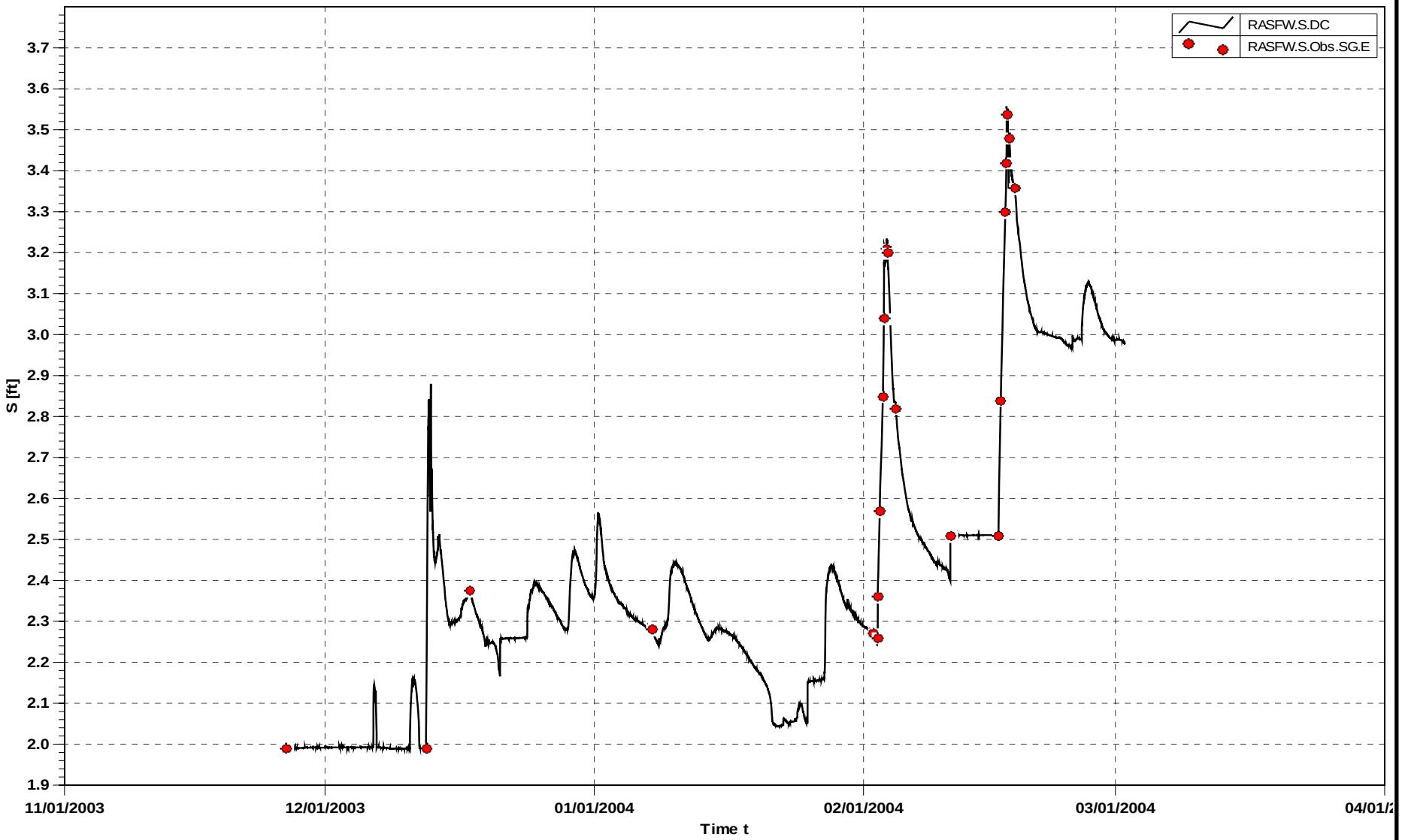
F-4b

ROCK CREEK ABOVE SOUTH FORK WAGES CREEK
15-Minute Adjusted Gage Height Record and Observed Staff Gage Readings



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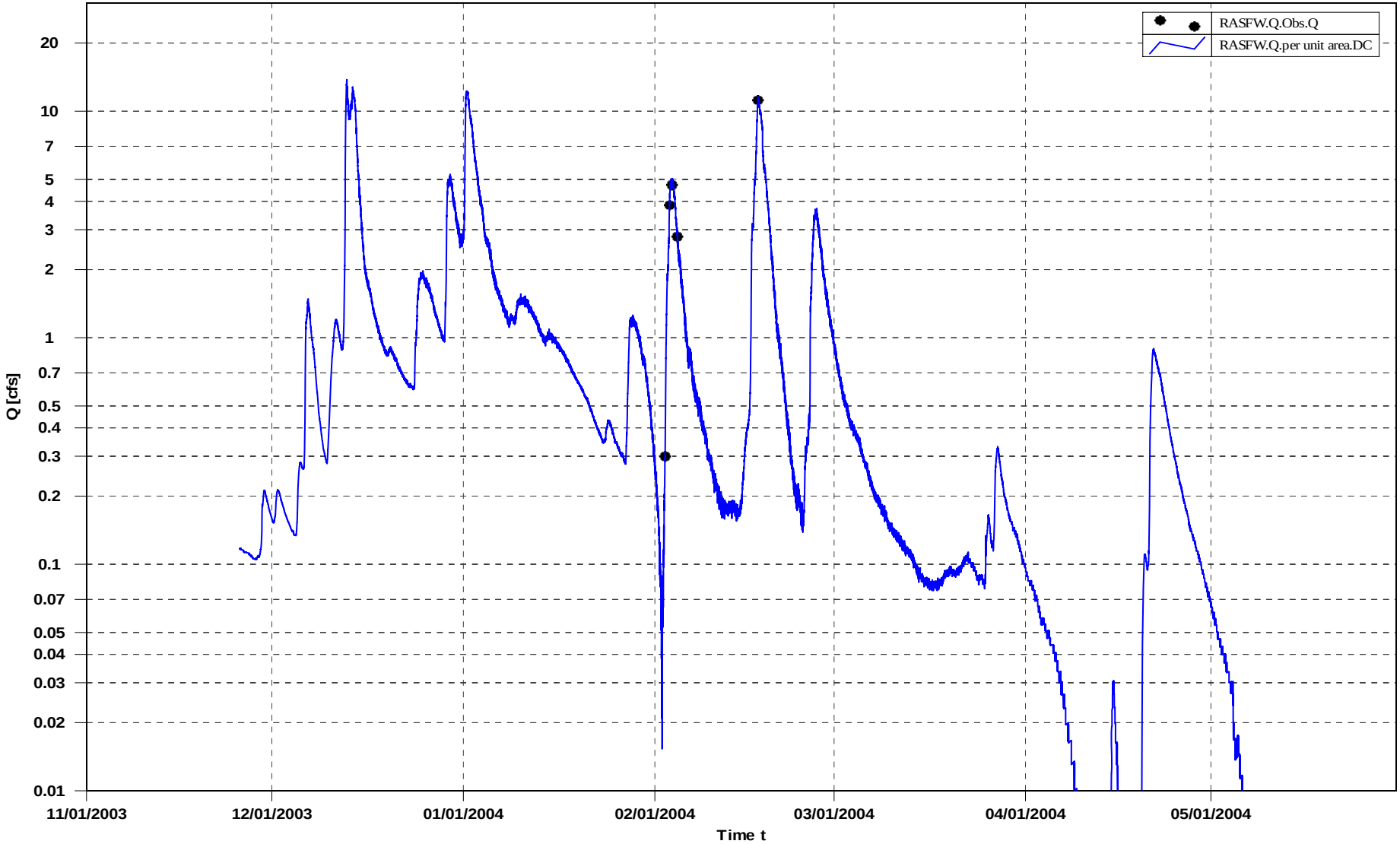
APPENDIX

F-5

ROCK CREEK ABOVE SOUTH FORK WAGES CREEK
Synthetic Hydrograph Derived from SFWAR Record and Discharge Measurements



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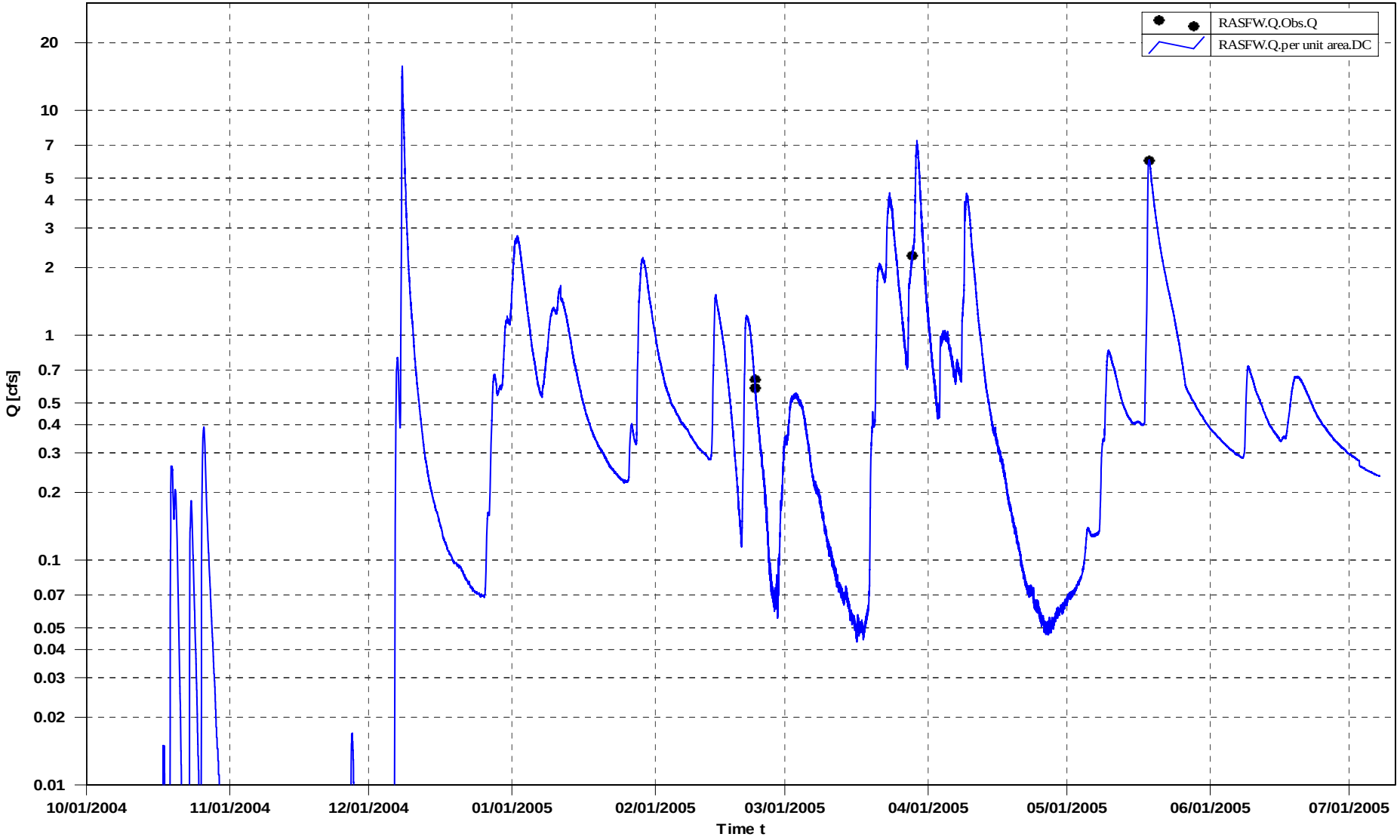
WY 2004
APPENDIX

F-6a

ROCK CREEK ABOVE SOUTH FORK WAGES CREEK
Synthetic Discharge Hydrograph Derived from SFWAR Record and Discharge Measurements



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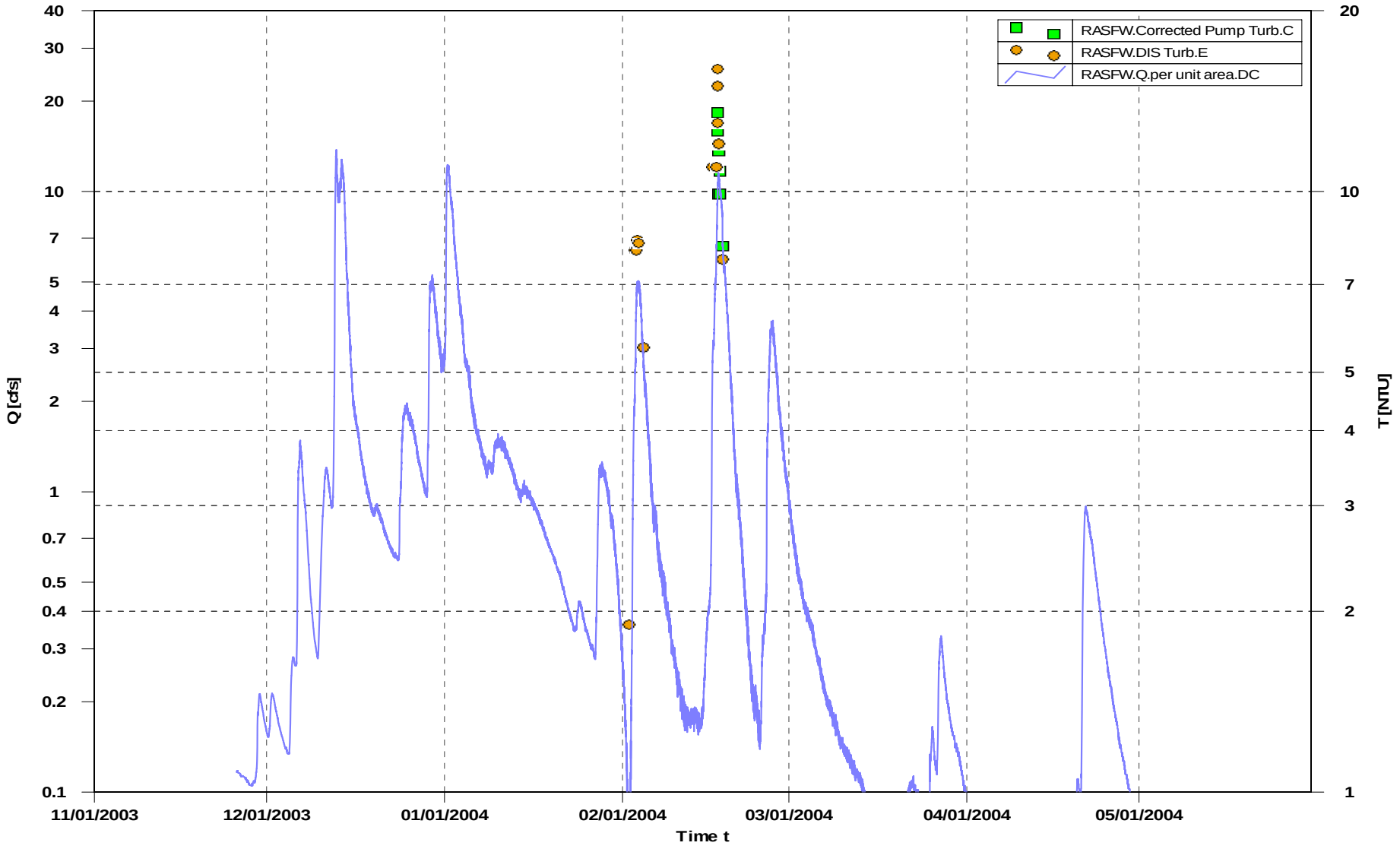
WY 2005
APPENDIX

F-6b

ROCK CREEK ABOVE SOUTH FORK WAGES CREEK
Synthetic Discharge Hydrograph Derived from SFWAR Record with Pump and Depth-Integrated Turbidity Samples



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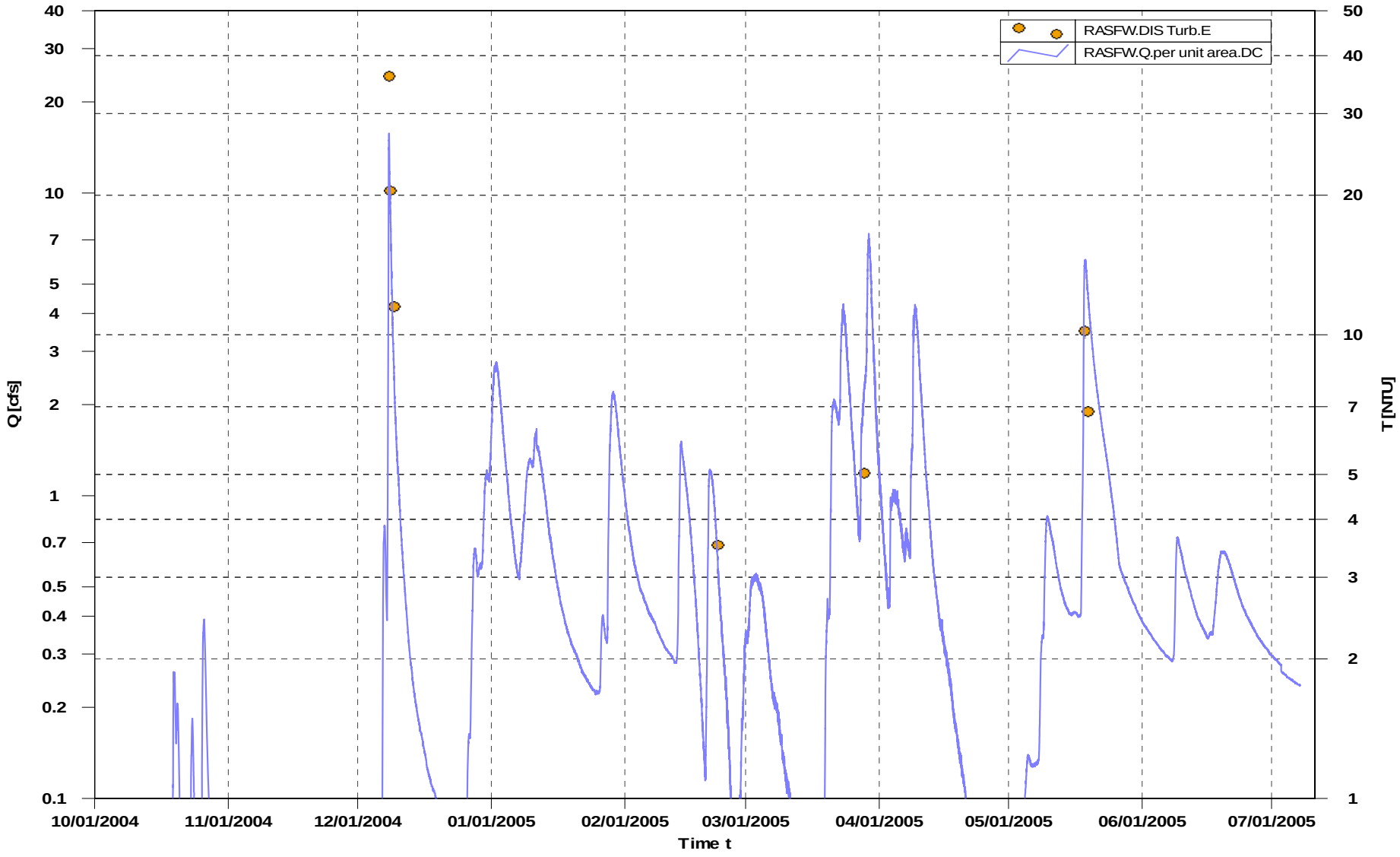
F-7a

ROCK CREEK ABOVE SOUTH FORK WAGES CREEK
Synthetic Discharge Hydrograph with Depth-Integrated Turbidity Samples



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WY 2005
APPENDIX

F-7b

SEDIMENT SAMPLE SUMMARY SHEET

LOCATION: ROCK CREEK ABOVE SOUTH FORK WAGES **WATER YEAR: 2004**

Date Time	Sample Number	Turbidity (NTU)	SSC (mg/l)	Stage (ft)	Discharge (cfs)	Q/WSA (cfs/mi^2)	SSL (ton/day)	SSLPA (ton/day/mi2)	Type (DIS, PUMP)	Note
2/2/2004 04:25	RASFW-SSCT2004-01	1.9	1	2.27	0.03	0.13	0.00	0.00	DIS	
2/2/2004 20:40	RASFW-SSCT2004-02	4.7	17	2.57	1.43	5.96	0.07	0.28	DIS	Censored
2/3/2004 05:34	RASFW-SSCT2004-03	8.0	5	2.85	2.90	12.1	0.04	0.16	DIS	
2/3/2004 08:30	RASFW-SSCT2004-04	8.0	6	3.04	3.89	16.2	0.06	0.25	DIS	
2/3/2004 15:51	RASFW-SSCT2004-05	8.3	5	3.21	4.92	20.5	0.06	0.26	DIS	
2/3/2004 18:27	RASFW-SSCT2004-06	8.2	3	3.20	4.80	20.0	0.04	0.16	DIS	
2/4/2004 16:06	RASFW-SSCT2004-07	5.5	1	2.82	2.74	11.4	0.00	0.02	DIS	
2/16/2004 18:54	RASFW-SSCT2004-08	11	4	2.84	2.85	11.9	0.03	0.13	DIS	
2/17/2004 08:27	RASFW-SSCT2004-09	11	13	3.30	6.34	26.4	0.22	0.93	DIS	
2/17/2004 10:44	RASFW-SSCT2004-10	13	19	3.42	9.23	38.5	0.48	2.0	DIS	
2/17/2004 10:46	RASFW-SSCT2004-11	15	23	2.73	2.27	9.46	0.14	0.58	PUMP	T-PROBE = 20 NTU
2/17/2004 14:15	RASFW-SSCT2004-12	16	23	3.54	13.4	55.8	0.84	3.5	DIS	
2/17/2004 14:46	RASFW-SSCT2004-13	15	17	2.73	2.27	9.46	0.10	0.43	PUMP	T-PROBE = 22 NTU
2/17/2004 15:31	RASFW-SSCT2004-14	14	17	2.72	2.22	9.25	0.10	0.42	PUMP	T-PROBE = 91 NTU
2/17/2004 18:01	RASFW-SSCT2004-15	13	14	2.78	2.54	10.6	0.10	0.40	PUMP	T-PROBE = 166 NTU
2/17/2004 18:46	RASFW-SSCT2004-16	13	17	2.88	3.06	12.8	0.14	0.60	PUMP	T-PROBE = 16 NTU
2/17/2004 19:08	RASFW-SSCT2004-17	12	11	3.48	11.1	46.3	0.32	1.3	DIS	
2/17/2004 19:31	RASFW-SSCT2004-18	11	7	2.88	3.06	12.8	0.06	0.25	PUMP	T-PROBE = 32 NTU
2/17/2004 21:46	RASFW-SSCT2004-19	12	5	2.82	2.74	11.4	0.03	0.15	PUMP	T-PROBE = 24 NTU
2/17/2004 22:46	RASFW-SSCT2004-20	11	5	2.81	2.69	11.2	0.03	0.14	PUMP	T-PROBE = 15 NTU
2/18/2004 09:30	RASFW-SSCT2004-21	7.7	3	3.36	7.66	31.9	0.06	0.27	DIS	
2/18/2004 09:31	RASFW-SSCT2004-22	9.0	12	2.74	2.33	9.71	0.07	0.31	PUMP	T-PROBE = 9 NTU

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WY 2004 APPENDIX

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SEDIMENT SAMPLE SUMMARY SHEET

LOCATION: ROCK CREEK ABOVE SOUTH FORK WAGES **WATER YEAR: 2005**

Date Time	Sample Number	Turbidity (NTU)	SSC (mg/l)	Stage (ft)	Discharge (cfs)	Q/WSA (cfs/mi^2)	SSL (ton/day)	SSLPA (ton/day/mi2)	Type (DIS, PUMP)	Note
12/8/2004 08:05	RASFW-SSCT2005-01	36	9	3.77	14.2	59.2	0.34	1.4	DIS	
12/8/2004 15:42	RASFW-SSCT2005-02	21	22	3.57	8.07	33.6	0.48	2.0	DIS	
12/9/2004 12:28	RASFW-SSCT2005-03	12	1	2.76	0.84	3.50	0.00	0.01	DIS	
2/22/2005 13:20	RASFW-SSCT2005-04	3.5	4	2.69	0.64	2.67	0.01	0.03	DIS	
3/28/2005 13:50	RASFW-SSCT2005-05	5.0	2	3.02	2.28	9.50	0.01	0.05	DIS	
5/18/2005 13:07	RASFW-SSCT2005-06	10	8	3.25	5.17	21.5	0.12	0.48	DIS	
5/18/2005 18:05	RASFW-SSCT2005-07	10	15	3.33	6.83	28.5	0.28	1.2	DIS	
5/19/2005 08:46	RASFW-SSCT2005-08	6.8	3	3.13	3.40	14.2	0.02	0.10	DIS	

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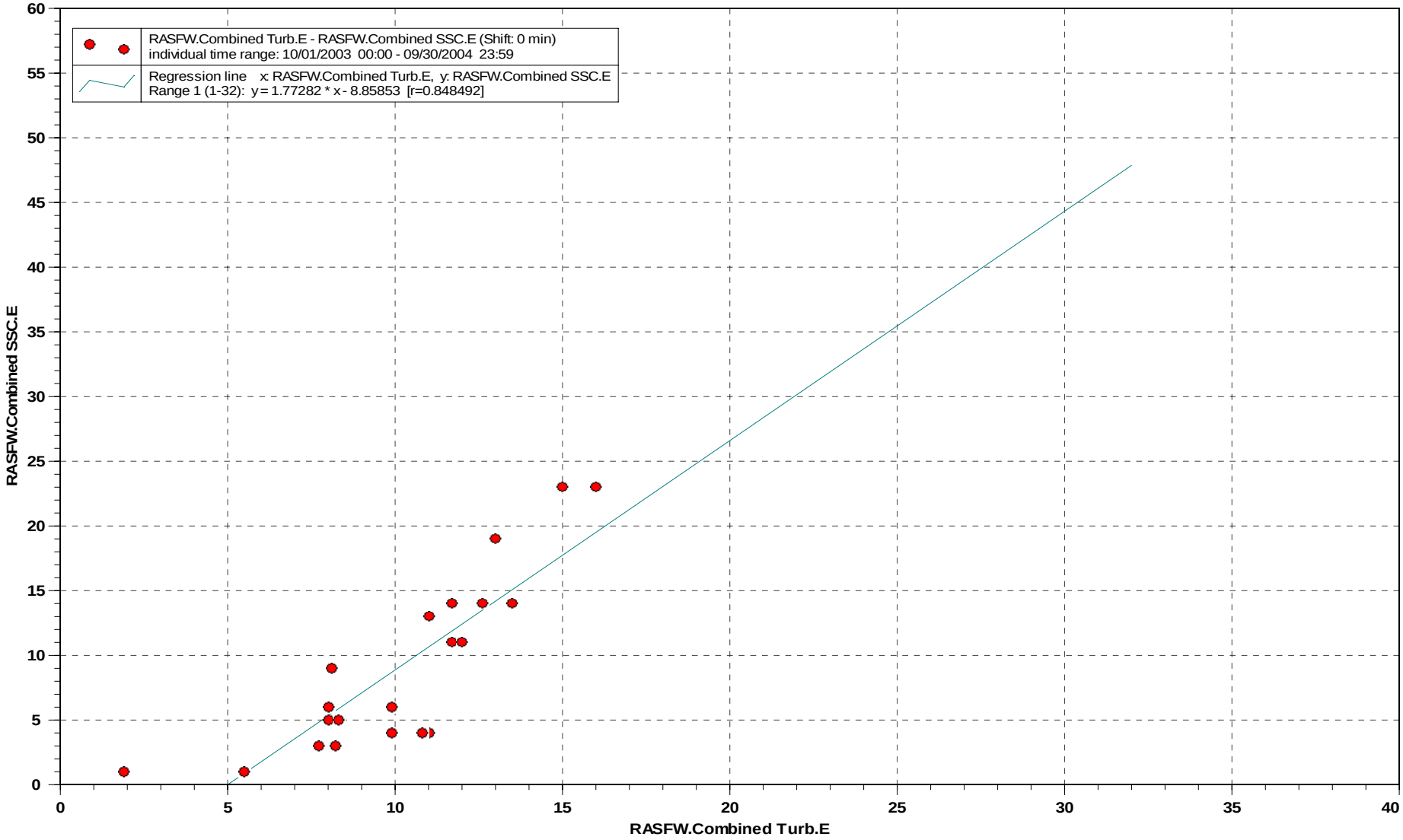
WY 2005 APPENDIX

F-8b

ROCK CREEK ABOVE SOUTH FORK WAGES CREEK
Depth-Integrated and Pump Turbidity vs Depth-Integrated and Pump SSC



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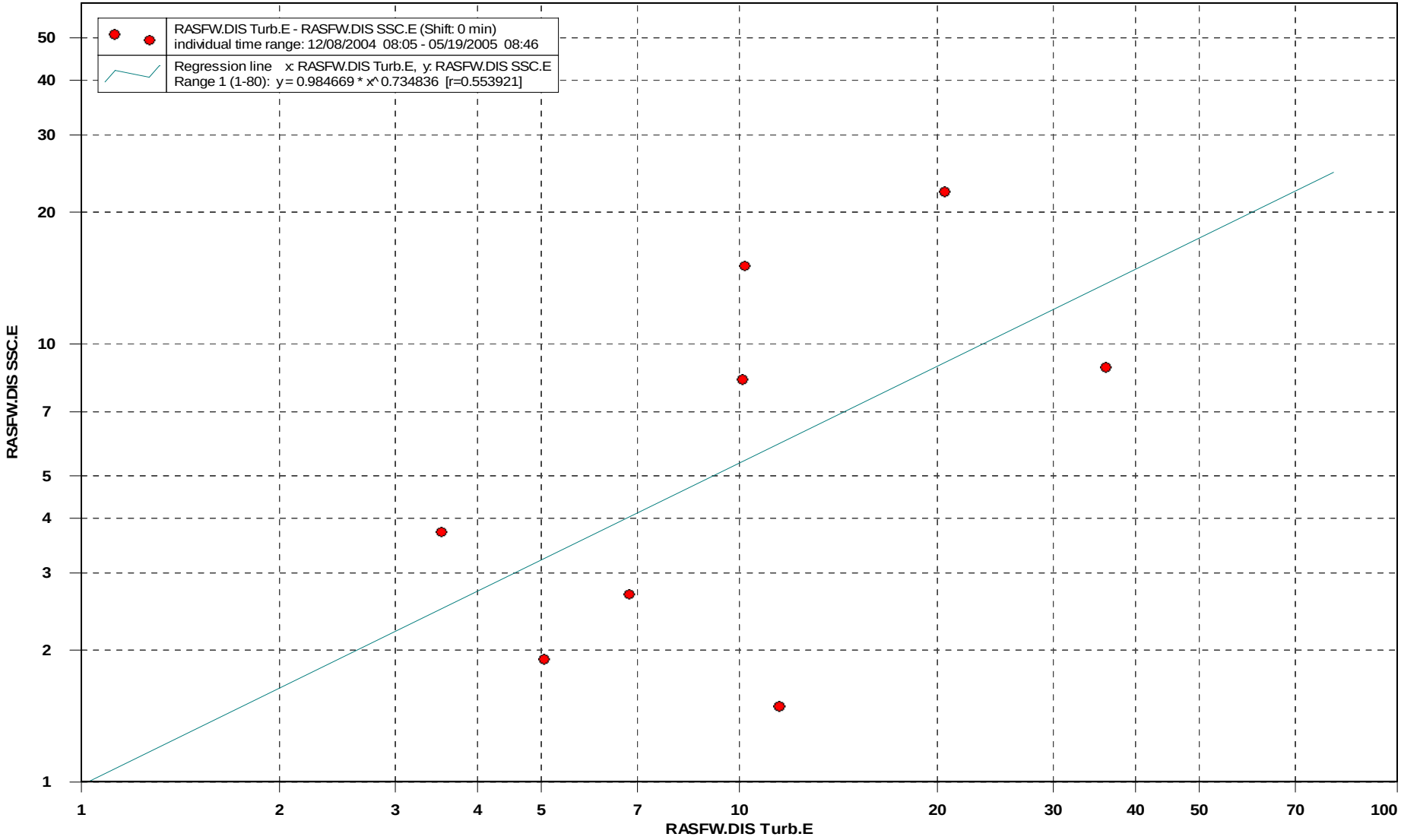
WY 2004
APPENDIX

F-9a

ROCK CREEK ABOVE SOUTH FORK WAGES CREEK
Depth-Integrated Turbidity vs Depth-Integrated SSC



PROJECT:

SOUTH FORK WAGES CREEK
STREAMFLOW AND SEDIMENT TRANSPORT MONITORING

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WY 2005
APPENDIX

F-9b

SOUTH FORK WAGES CREEK ABOVE ROCK CREEK
(STATION # CTM 0283030)
STATION ANALYSIS
WATER YEAR 2004-2005

RECORDS – Surface Water

EQUIPMENT – I Water Year 2004 a continuous streamflow and turbidity station was installed at this site. In Water Year 2005 the site was upgraded with a pump sampler. The TTS station includes an Isco 6712 full size portable sampler, a Campbell Scientific CR510 data collection platform (DCP), a waterlog H-310 pressure transducer and a forest technology systems DTS-12 turbidity sensor. The DCP is housed in a locked steel box that is installed on the right bank. The DTS-12 is housed in an aluminum boom assembly, which is attached to a cable way strung over the creek. The pressure transducer is located on the right bank 20 feet upstream of the turbidity boom. One staff plate is located on the left bank across from the pressure transducer.
Inside recording gage: Less than or equal to 0.02% of full scale output (FSO) over temperature range referenced (0 to 40° C) to a straight line stretched from zero psi to maximum pressure (15 psi).
Outside staff gage: One USGS style A staff gage mounted on redwood and attached to channel iron that has been pounded into the streambed. Limits 0.00 ft. to 3.32 ft.

GAGE HEIGHT RECORDS – The record is incomplete for the period.
Station operation began in Water Year 2004 on November 25, 2003 at 18:45 hours.
A gap in the record exists on December 4, 2003 from 13:30 hours to 14:00 hours. Field notes indicated the station was down for maintenance. A gap exists on December 16, 2003 from 16:15 hours to 17:30 hours. There are no field notes explaining this gap. No other gaps or problems were encountered in Water Year 2004.
The minimum gage height of 0.81 ft occurred on September 26, 2004 at 23:15 hours. The maximum gage height of 1.47 ft occurred on December 13, 2003 at 03:30 hours.
The station was operated across the water year boundary. A gap in the record exists from November 2, 2004 at 13:00 hours through November 3, 2004 at 14:45 hours. Field notes indicate that a new pump sampler was installed on November 3, 2004 and 14:00 hours and that a new program was sent to the DCP. No other gaps or problems were encountered in Water Year 2005
The maximum gage height of 1.50 ft occurred on December 8, 2004 at 06:45 hours. The minimum gage height of 0.79 ft occurred on October 15, 2004 at 00:00 hours.

DATUM CORRECTIONS – Staff plate has not been surveyed, no datum correction known.

CONTROL – The low to mid range control is a gravel riffle subject to periodic shifts. The channel at the gage has small terraces with steep right and left banks.

RATING – In Water Year 2004, four discharge measurements (1-4) were made 1 measurement made subsequent, measurement 5, is used in this analysis. Measured discharge ranged from 1.52 cfs to 17.4 cfs. Computed instantaneous discharge ranged from 0.08 cfs to 22.4 cfs.
Measurements 1-4 were used to develop the middle and upper portions of Rating 1.2. Measurements 1-4 were all rated fair and all plotted within acceptable limits given their measurement rating.

Measurement 5, made on October 13, 2004 was used to develop the low end of Rating 1.2. Measurement 5 plotted directly on the rating and was rated poor.
In Water Year 2005, 7 discharge measurements (5-11) were made. Measured discharge ranged from 0.08 cfs to 7.59 cfs.
Measurement 5 was used to verify that Rating 1.2 was still valid in the beginning of the water year.
Measurement 6, made on December 28, 2004, was not used in this analysis. Measurement 6 had no left edge water information in the AquaCalc Pro file or the field notes.
Measurement 7, made on January 11, 2005, indicated a -0.02 ft shift in Rating 1.2. No check measurement was made. Subsequent measurements, measurements 8, 9, and 10 also indicated a -0.02 ft to -0.03 ft shift in Rating 1.2.
Because the measurement range was fairly narrow in Water Year 2005 it was necessary to shift Rating 1.2 by -0.03 ft in order to be able to calculate flows in Water Year 2005.
Rating 2.1 was developed based on the shifts indicated by measurements 7-10 (-0.02 ft to -0.03 ft). Rating 2.1 has the same shape as Rating 1.2 but is shifted by -0.03 ft. Rating 2.1 is prorated into effect beginning on December 8, 2004 at 06:30 hours and is fully in effect by December 8, 2004 at 18:00 hours. Rating 2.1 is prorated into effect with the idea that the fill of the control had occurred between 06:30 hours, the peak of the December 8th storm, 18:00 hours.
Measurement 7 plotted 7% from Rating 2.1 and was rated poor.
Measurements 8, 9, and 10 all plotted within 5% of Rating 2.1 and were rated poor, poor, and fair respectively. Measurement 9 was a check measurement for measurement 8.
Measurement 11, made on May 18, 2005, plotted -25% from Rating 2.1 and was rated fair. No check measurement was made. The shift indicated by the measurement -0.05 ft and a reading of the GZF also indicated that the elevation of the control had changed. Measurement 11 was used to develop TV05-1.
TV05-1 is prorated into effect beginning on March 29, 2005 at 13:30 hours and reaches full weight by March 30, 2005 at 07:00 hours. TV05-1 is prorated into effect with the idea that fill occurred on the control between the peak of the storm on March 29, 2005 and that control most likely stabilized (at a higher elevation) by March 30, 2005 at 07:00 hours. TV05-1 is defined by measurement 11 to within -1 % of Rating 2.1

DISCHARGE – Rating 1.2 and 2.1 were used in Water Year 2005 as follows:

Water Year 2004

Nov. 25 to Sept. 30 (24:00)	Rating 1.2

Water Year 2005

Oct. 1 to Dec. 8 (06:30)	Rating 1.2
Dec. 8 to Dec. 8 (18:00)	Prorate to Rating 2.1
Dec. 8 to Mar. 29 (13:30)	Rating 2.1
Mar. 29 to Mar. 30 (07:00)	Prorate to TV05-1 (0.65,-.05; 1.11,-.05; 1.57,-.05)
Mar. 30 to Jul. 7 (15:00)	TV05-1 (0.65,-.05; 1.11,-.05; 1.57,-.05)

SPECIAL COMPUTATIONS – None Made

REMARKS – Based on the measurement ratings the record for Water Year 2004 is considered fair. Based on the measurement ratings for Water Year 2005 the record should be considered poor. The quality of the record is also downgraded in Water Year 2005 because Rating 1.2 was shifted uniformly and no high flow measurements were available to verify the shift at the higher end of the rating.

Gage height records worked by T. Gray 10-05
Gage height records checked by C. Pryor 10-05
Discharge computation worked by C. Pryor 11-05
Discharge computation checked by C. Pryor 12-05

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DISCHARGE SUMMARY SHEET

LOCATION: South Fork Wages Creek Above Rock Creek **WATER YEAR: 2004 - 2005**

Measurement Number	WY Msmt #	Date	Made By:	Width (feet)	Mean Depth (feet)	Area (ft^2)	Mean Velocity (ft/sec)	Gage Height (feet)	Discharge (cfs)	Rating 1.2 Shift Adj.	Rating 1.2 Percent Diff.	Method	No. of Msmt Sections	Begin Time (hours)	End Time (hours)	Msmt Rating	PZF	Notes
1	2004-01	12/7/2003	T. Grey	6.4	0.24	1.51	1.00	1.02	1.52		3	wading	20	16:04	16:33	fair		
2	2004-02	2/3/2004	T. Grey	7.5	0.45	3.36	2.03	1.24	6.82		-4	wading	26	09:38	10:06	fair		
3	2004-03	2/17/2004	T. Grey	8.1	0.64	5.22	3.33	1.42	17.4		-3	wading	17	19:57	20:18	fair		
4	2004-04	2/18/2004	K. Faucher	9.4	0.98	9.22	1.80	1.39	16.6		6	wading	28	13:13	13:50	fair		
5	2005-01	10/13/2004	S. Franco	1.5	0.14	0.21	0.38	0.79	0.08		0	wading	6	14:42	14:57	poor		
										Rating 2.1								
6	2005-02	12/28/2004	R. Leisse	4.8	0.27	1.31	0.68	1.01	0.89		-14	wading	16	14:57	15:34	poor		Began REW & no PZF; Had to assume LEW CTP
7	2005-03	1/11/2005	T. Bolton	4.6	0.33	1.51	1.91	1.12	2.88		7	wading	16	11:55	12:14	poor	0.65	
8	2005-04	2/22/2005	T. Bolton	4.8	0.27	1.30	1.72	1.09	2.23		5	wading	17	11:54	12:13	poor	0.64	
9	2005-05	2/22/2005	T. Bolton	4.8	0.27	1.29	1.67	1.09	2.14		1	wading	17	12:18	12:31	poor	0.64	Check Msmt
10	2005-06	3/28/2005	K. Faucher	4.6	0.56	2.58	1.78	1.20	4.59		-3	wading	19	13:08	13:29	fair	0.70	
11	2005-06	5/18/2005	K. Faucher	7.2	0.36	2.56	2.56	1.33	7.59	-0.05		wading	14	18:45	19:03	fair	0.88	

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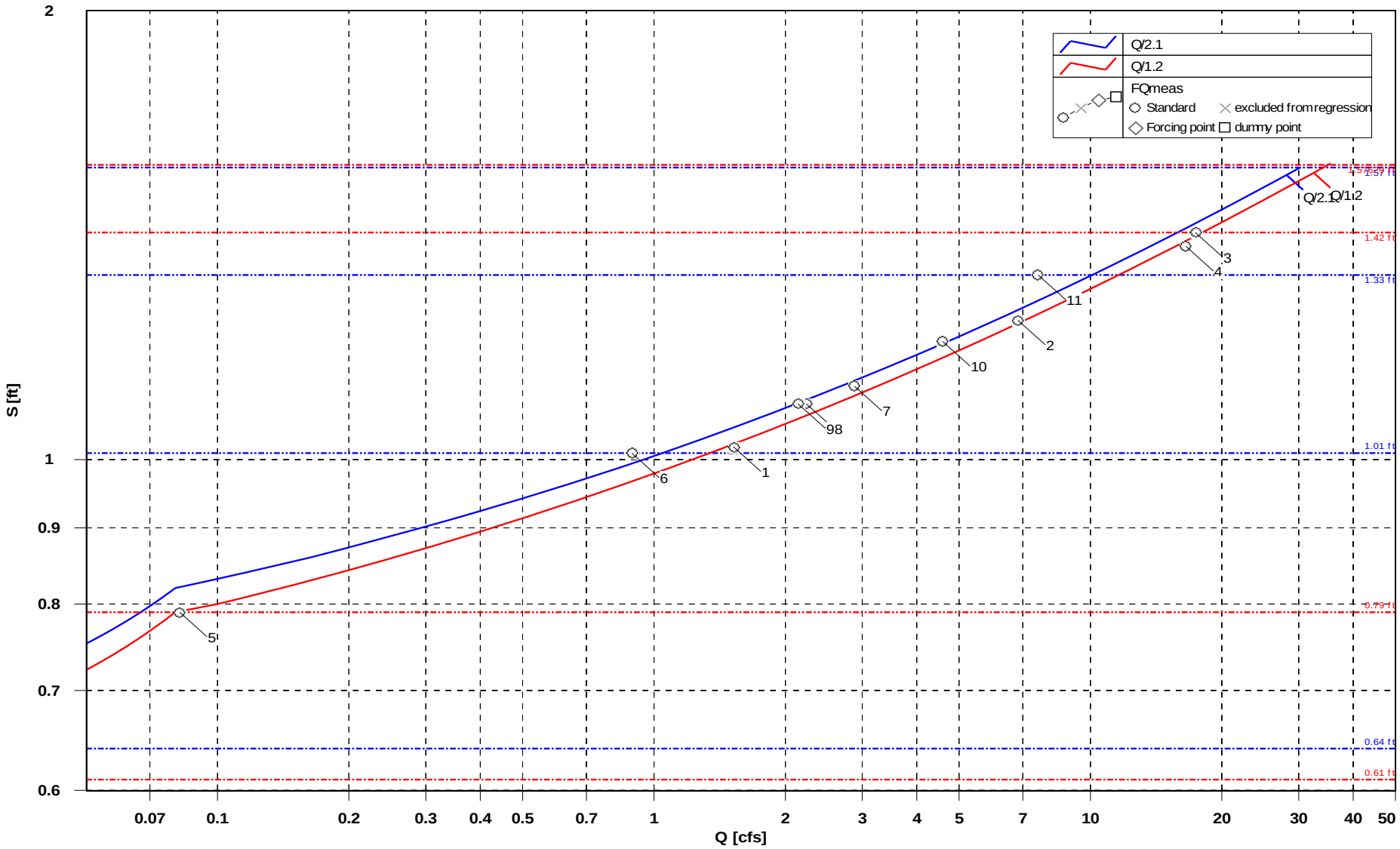
WY 04-05 APPENDIX

G-2

SOUTH FORK WAGES CREEK ABOVE ROCK CREEK
Discharge Rating Curves 1.2 and 2.1



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APPENDIX

G-3

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SOUTH FORK WAGES CREEK ABOVE ROCK CREEK

RATING TABLE NO.1.2 ------ Begin Date 12/7/2003

GH	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	1st Diff	2nd Diff
0.0	---	---	---	---	---	---	---	---	---	---	---	---
0.1	---	---	---	---	---	---	---	---	---	---	---	---
0.2	---	---	---	---	---	---	---	---	---	---	---	---
0.3	---	---	---	---	---	---	---	---	---	---	---	---
0.4	---	---	---	---	---	---	---	---	---	---	---	---
0.5	---	---	---	---	---	---	---	---	---	---	---	---
0.6	---	---	---	---	---	---	---	---	---	---	---	---
0.7	---	---	---	---	---	---	---	---	---	*0.08*	---	---
0.8	*0.10*	*0.12*	*0.14*	*0.16*	*0.19*	*0.22*	*0.25*	*0.29*	*0.33*	*0.38*	0.30	---
0.9	*0.43*	*0.48*	*0.54*	*0.60*	*0.67*	*0.75*	*0.83*	*0.92*	*1.01*	*1.11*	0.73	0.43
1.0	*1.23*	*1.34*	1.47	1.60	1.74	1.89	2.05	2.23	2.41	2.60	2.60	2.60
1.1	2.81	3.02	3.24	3.48	3.74	4.01	4.28	4.57	4.89	5.21	2.61	0.01
1.2	5.54	5.90	6.28	6.67	7.07	7.49	7.94	8.41	8.89	9.38	4.17	1.56
1.3	9.91	10.5	11.0	11.6	12.2	12.9	13.5	14.2	14.9	15.7	6.32	2.15
1.4	16.4	17.2	18.0	*18.9*	*19.8*	*20.7*	*21.6*	*22.6*	*23.6*	*24.6*	8.90	2.58
1.5	*25.7*	*26.8*	*27.9*	*29.1*	*30.3*	*31.5*	*32.8*	*34.2*	---	---	---	---
1.6	---	---	---	---	---	---	---	---	---	---	---	---
1.7	---	---	---	---	---	---	---	---	---	---	---	---
1.8	---	---	---	---	---	---	---	---	---	---	---	---
1.9	---	---	---	---	---	---	---	---	---	---	---	---
2.0	---	---	---	---	---	---	---	---	---	---	---	---
2.1	---	---	---	---	---	---	---	---	---	---	---	---
2.2	---	---	---	---	---	---	---	---	---	---	---	---
2.3	---	---	---	---	---	---	---	---	---	---	---	---
2.4	---	---	---	---	---	---	---	---	---	---	---	---
2.5	---	---	---	---	---	---	---	---	---	---	---	---

Values in italics are beyond the validated range of the rating

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SOUTH FORK WAGES CREEK ABOVE ROCK CREEK

RATING TABLE NO.2.1 -- Begin Date 12/08/2004

GH	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	1st Diff	2nd Diff
0.0	-	-	-	-	-	-	-	-	-	-	-	-
0.1	-	-	-	-	-	-	-	-	-	-	-	-
0.2	-	-	-	-	-	-	-	-	-	-	-	-
0.3	-	-	-	-	-	-	-	-	-	-	-	-
0.4	-	-	-	-	-	-	-	-	-	-	-	-
0.5	-	-	-	-	-	-	-	-	-	-	-	-
0.6	-	-	-	-	-	-	*0.01*	*0.01*	*0.02*	*0.02*	-	-
0.7	*0.03*	*0.03*	*0.04*	*0.04*	*0.04*	*0.05*	*0.05*	*0.06*	*0.06*	*0.07*	0.05	-
0.8	*0.07*	*0.08*	*0.08*	*0.10*	*0.12*	*0.14*	*0.16*	*0.19*	*0.22*	*0.25*	0.18	0.13
0.9	*0.29*	*0.34*	*0.38*	*0.43*	*0.49*	*0.55*	*0.62*	*0.69*	*0.77*	*0.85*	0.60	0.42
1.0	*0.95*	1.04	1.15	1.26	1.38	1.51	1.65	1.80	1.95	2.12	1.27	0.67
1.1	2.30	2.48	2.68	2.89	3.11	3.34	3.59	3.85	4.12	4.41	2.29	1.02
1.2	4.71	5.03	5.35	5.69	6.05	6.43	6.82	7.23	7.66	8.12	3.71	1.42
1.3	8.59	9.07	9.57	10.1	*10.7*	*11.2*	*11.8*	*12.4*	*13.1*	*13.7*	5.58	1.87
1.4	*14.4*	*15.1*	*15.8*	*16.6*	*17.4*	*18.2*	*19.0*	*19.9*	*20.8*	*21.7*	8.00	2.42
1.5	*22.7*	*23.7*	*24.7*	*25.7*	*26.8*	*27.9*	*29.1*	*30.2*	-	-	-	-
1.6	-	-	-	-	-	-	-	-	-	-	-	-
1.7	-	-	-	-	-	-	-	-	-	-	-	-
1.8	-	-	-	-	-	-	-	-	-	-	-	-
1.9	-	-	-	-	-	-	-	-	-	-	-	-
2.0	-	-	-	-	-	-	-	-	-	-	-	-
2.1	-	-	-	-	-	-	-	-	-	-	-	-
2.2	-	-	-	-	-	-	-	-	-	-	-	-
2.3	-	-	-	-	-	-	-	-	-	-	-	-
2.4	-	-	-	-	-	-	-	-	-	-	-	-
2.5	-	-	-	-	-	-	-	-	-	-	-	-

Values in italics are beyond the validated range of the rating

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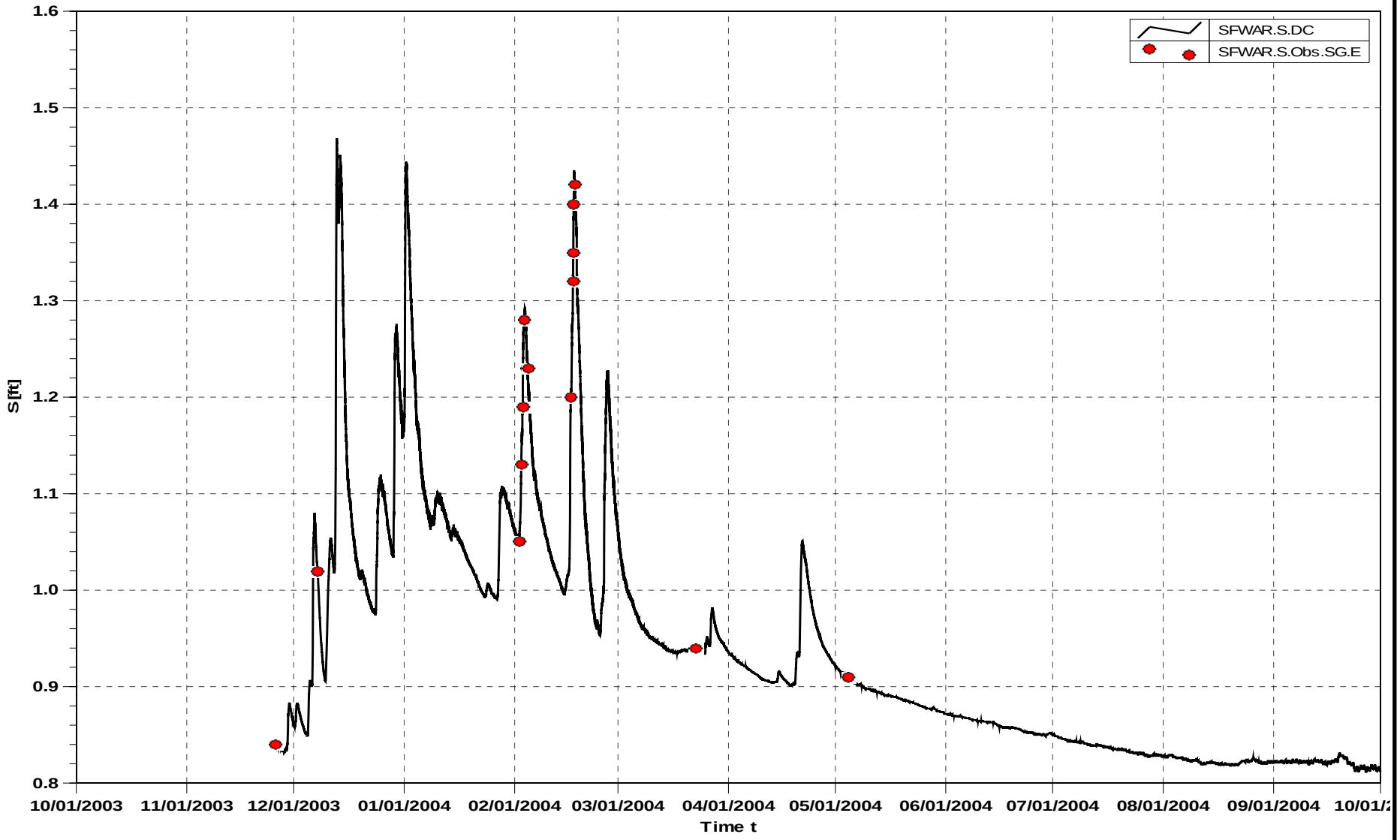
SOUTH FORK WAGES CREEK ABOVE ROCK CREEK
15-Minute Adjusted Gage Height Record and Observed Staff Gage Readings



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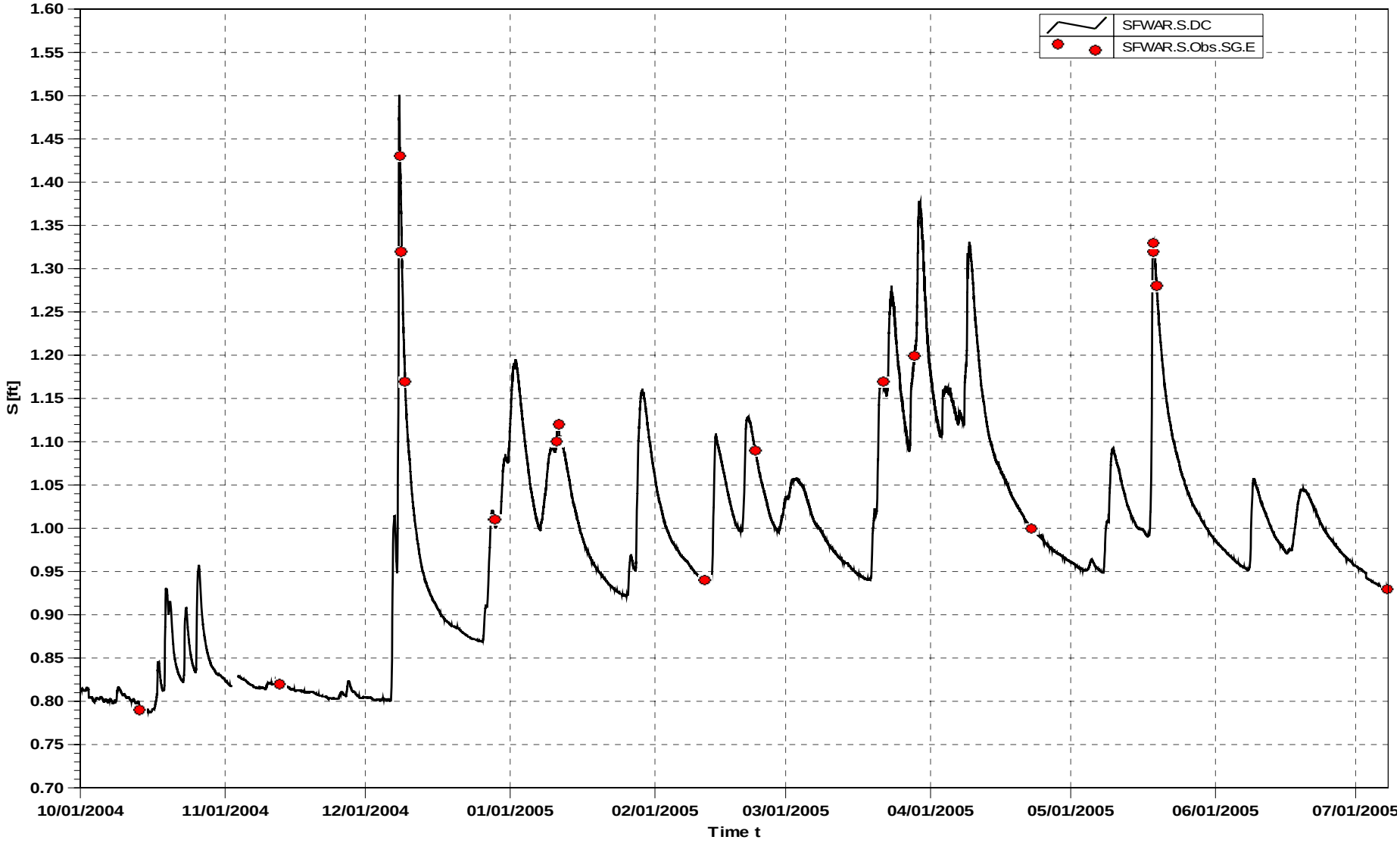
WY 2004
APPENDIX

G-5a

SOUTH FORK WAGES CREEK ABOVE ROCK CREEK
15-Minute Adjusted Gage Height Record and Observed Staff Gage Readings



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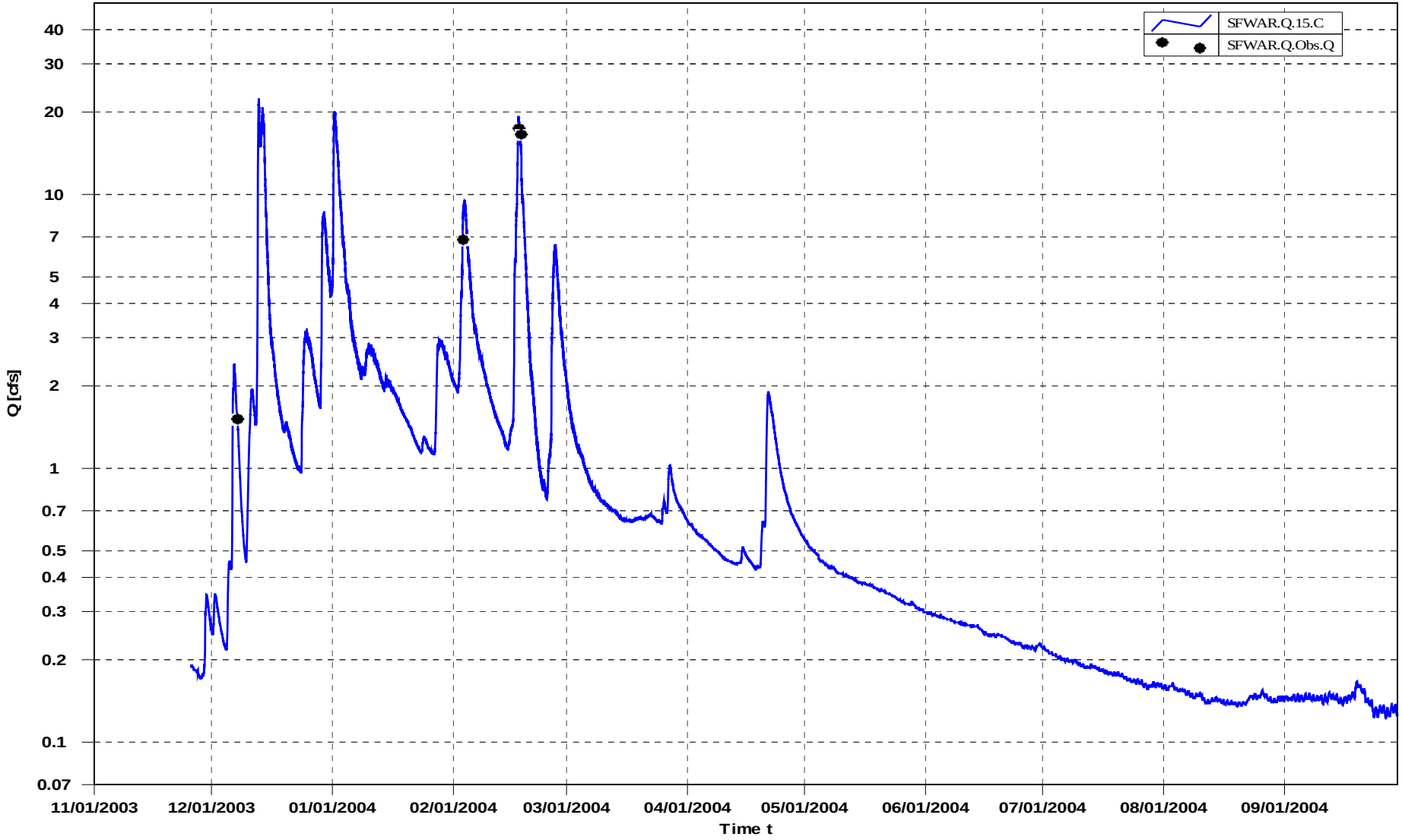
G-5b

SOUTH FORK WAGES CREEK ABOVE ROCK CREEK
Discharge Hydrograph and Discharge Measurements



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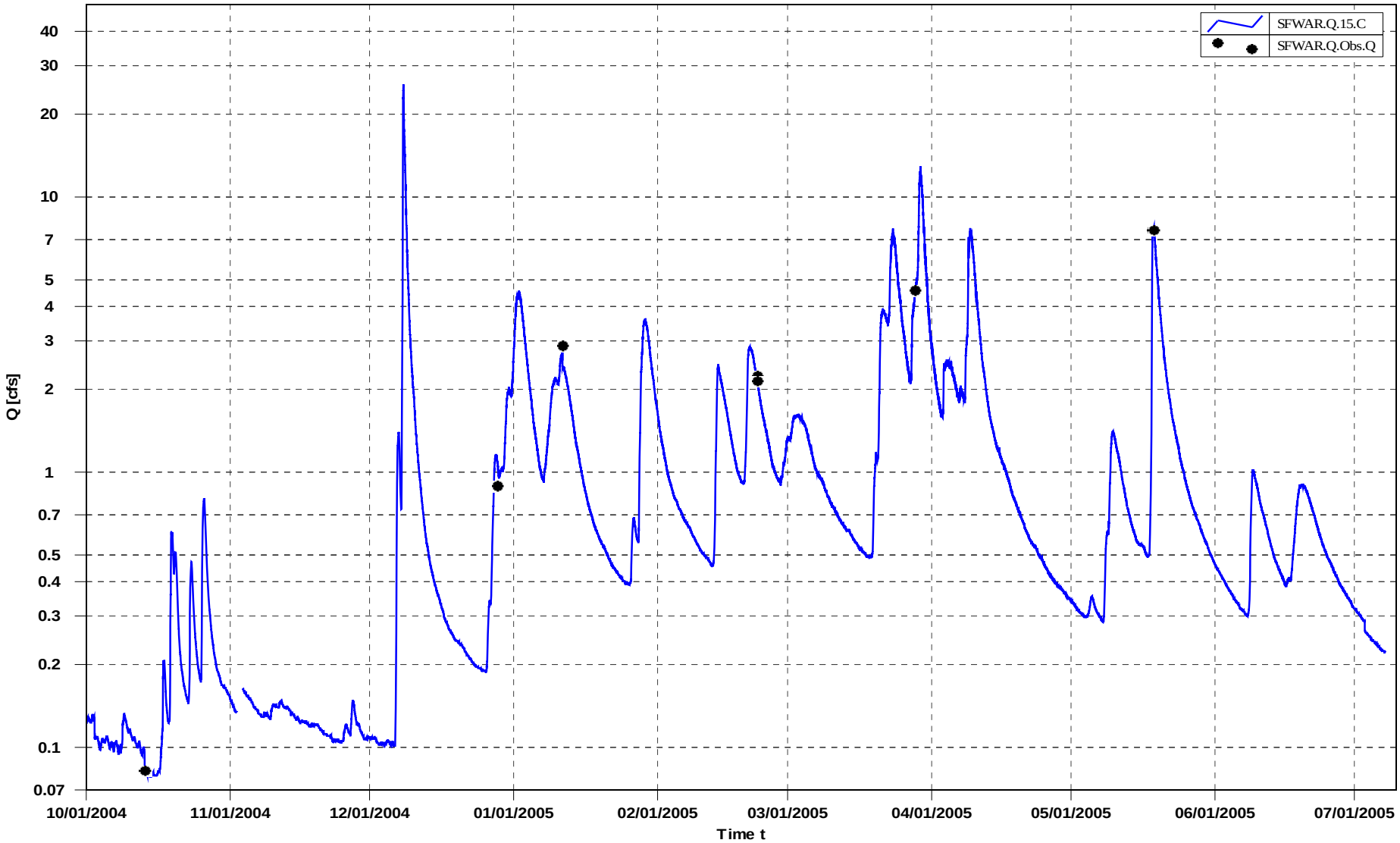
WY 2004
APPENDIX

G-6a

SOUTH FORK WAGES CREEK ABOVE ROCK CREEK
Discharge Hydrograph and Discharge Measurements



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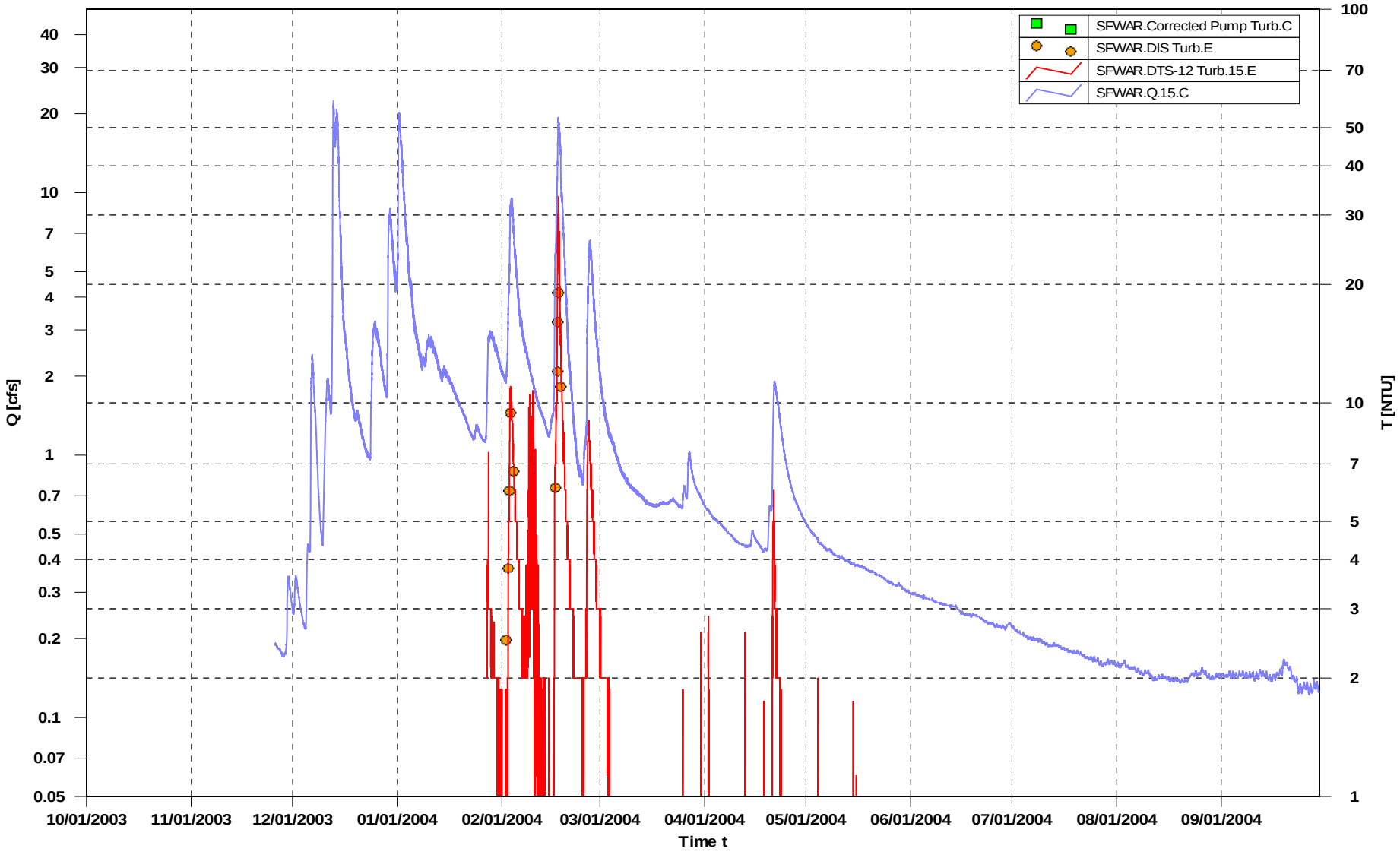
APPENDIX

G-6b

SOUTH FORK WAGES CREEK ABOVE ROCK CREEK
Discharge Hydrograph, Continuous Turbidity with Depth-Integrated Turbidity Samples



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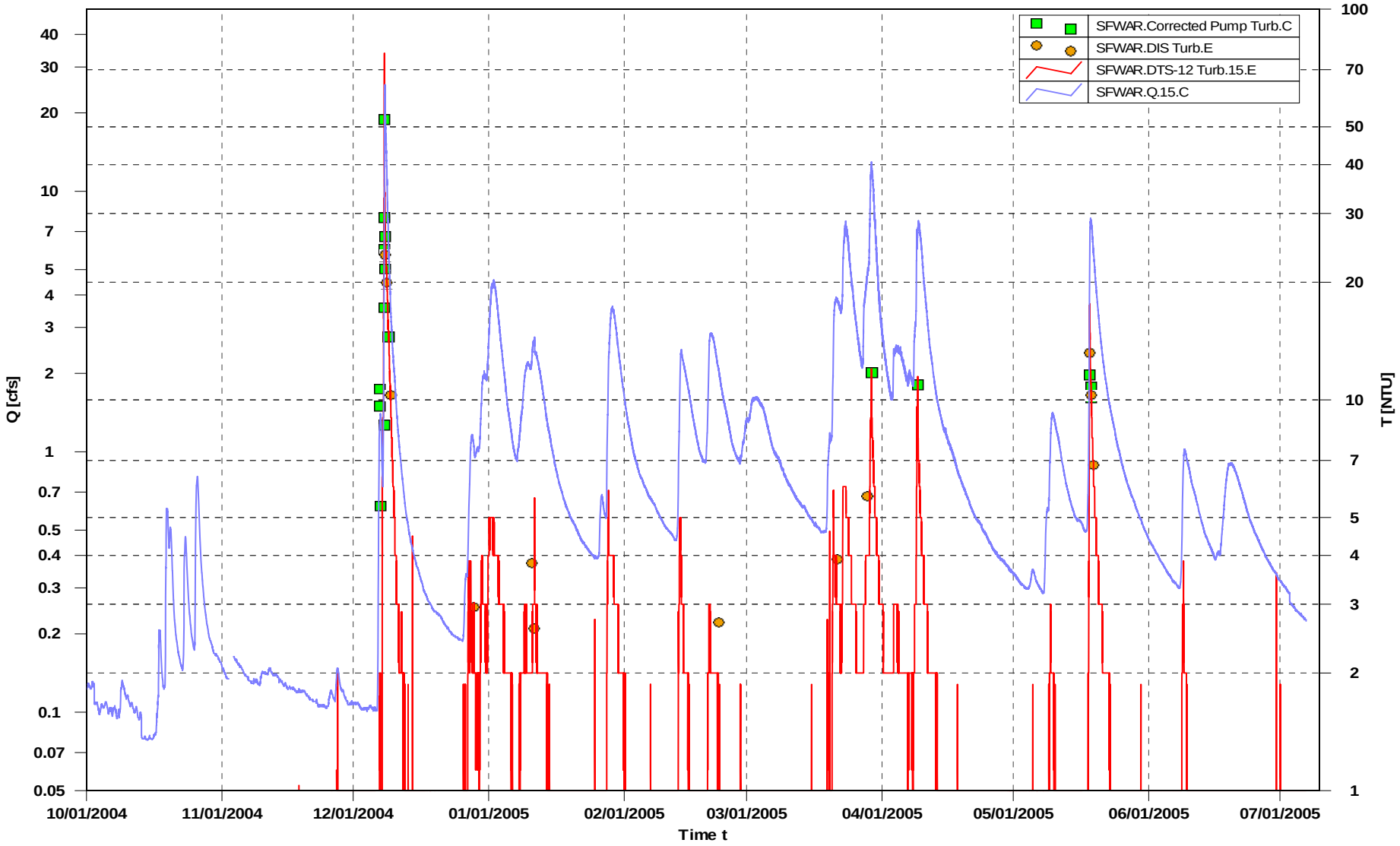
WY 2004
APPENDIX

G-7a

SOUTH FORK WAGES CREEK ABOVE ROCK CREEK
Discharge Hydrograph, Continuous Turbidity with Pump and Depth-Integrated Turbidity Samples



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WY 2005
APPENDIX

G-7b

SEDIMENT SAMPLE SUMMARY SHEET

LOCATION: SOUTH FORK WAGES ABOVE ROCK CREEK **WATER YEAR: 2004**

Date Time	Sample Number	Turbidity (NTU)	SSC (mg/l)	Stage (ft)	Discharge (cfs)	Q/WSA (cfs/mi^2)	SSL (ton/day)	SSLPA (ton/day/mi2)	Type (DIS, PUMP)	Note
2/2/2004 04:36	SFWAR-SSCT2004-01	2.5	3	1.05	1.51	3.9	0.01	0.03	DIS	
2/2/2004 20:49	SFWAR-SSCT2004-02	3.8	6	1.13	2.89	7.4	0.05	0.12	DIS	
2/3/2004 05:43	SFWAR-SSCT2004-03	6.0	4	1.19	4.41	11	0.05	0.14	DIS	
2/3/2004 16:02	SFWAR-SSCT2004-04	9.4	5	1.28	7.66	20	0.10	0.25	DIS	
2/4/2004 14:48	SFWAR-SSCT2004-05	6.7	0.7	1.23	5.69	15	0.01	0.03	DIS	
2/16/2004 19:02	SFWAR-SSCT2004-06	6.1	4	1.20	4.71	12	0.05	0.13	DIS	
2/17/2004 08:35	SFWAR-SSCT2004-07	12	10	1.32	9.57	25	0.25	0.63	DIS	
2/17/2004 10:52	SFWAR-SSCT2004-08	16	20	1.35	11.2	29	0.62	1.6	DIS	
2/17/2004 13:48	SFWAR-SSCT2004-09	19	32	1.40	14.4	37	1.2	3.1	DIS	
2/17/2004 19:20	SFWAR-SSCT2004-10	19	18	1.42	15.8	41	0.75	1.9	DIS	
2/18/2004 10:23	SFWAR-SSCT2004-11	11	7	1.43	16.6	43	0.33	0.85	DIS	

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WY 2004 APPENDIX

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SEDIMENT SAMPLE SUMMARY SHEET

LOCATION: SOUTH FORK WAGES ABOVE ROCK CREEK **WATER YEAR: 2005**

Date Time	Sample Number	Turbidity (NTU)	SSC (mg/l)	Stage (ft)	Discharge (cfs)	Q/WSA (cfs/mi^2)	SSL (ton/day)	SSLPA (ton/day/mi2)	Type (DIS, PUMP)	Note
12/7/2004 02:31	SFWAR-SSCT2005-01	11	13	1.01	1.29	3.3	0.05	0.12	Pump	
12/7/2004 03:31	SFWAR-SSCT2005-02	9.6	8	1.01	1.33	3.4	0.03	0.07	Pump	
12/7/2004 09:31	SFWAR-SSCT2005-03	5.4	5	1.00	1.28	3.3	0.02	0.04	Pump	
12/7/2004 23:01	SFWAR-SSCT2005-04	8.6	18	1.04	1.75	4.5	0.08	0.21	Pump	
12/8/2004 00:46	SFWAR-SSCT2005-05	17	27	1.10	2.82	7.2	0.21	0.53	Pump	
12/8/2004 02:01	SFWAR-SSCT2005-06	24	36	1.15	4.01	10	0.39	1.0	Pump	
12/8/2004 03:31	SFWAR-SSCT2005-07	50	113	1.30	9.97	26	3.0	7.8	Pump	
12/8/2004 04:01	SFWAR-SSCT2005-08	29	52	1.38	14.8	38	2.1	5.3	Pump	
12/8/2004 05:01	SFWAR-SSCT2005-09	26	44	1.47	23.1	59	2.7	7.0	Pump	
12/8/2004 07:46	SFWAR-SSCT2005-10	23	13	1.49	23.8	61	0.85	2.2	Pump	Calibrate with bottle #1038
12/8/2004 07:48	SFWAR-SSCT2005-11	24	11	1.43	23.8	61	0.71	1.8	DIS	Calibrate with bottle #313
12/8/2004 10:16	SFWAR-SSCT2005-12	22	13	1.42	17.7	45	0.60	1.5	Pump	
12/8/2004 15:01	SFWAR-SSCT2005-13	20	5	1.38	13.7	35	0.18	0.47	Pump	Calibrate with bottle #1035
12/8/2004 15:02	SFWAR-SSCT2005-14	20	16	1.32	13.7	35	0.60	1.5	DIS	Calibrate with bottle #315
12/9/2004 00:46	SFWAR-SSCT2005-15	15	4	1.26	6.82	17	0.07	0.18	Pump	
12/9/2004 12:11	SFWAR-SSCT2005-16	10	2	1.17	3.85	9.9	0.02	0.06	DIS	
12/28/2004 15:46	SFWAR-SSCT2005-17	3.0	3	1.01	1.05	2.7	0.01	0.02	DIS	
1/10/2005 21:34	SFWAR-SSCT2005-18	3.8	7	1.10	2.29	5.9	0.04	0.11	DIS	
1/11/2005 11:45	SFWAR-SSCT2005-19	2.6	0.5	1.12	2.68	6.9	0.00	0.01	DIS	
2/22/2005 12:30	SFWAR-SSCT2005-20	2.7	3	1.09	2.12	5.4	0.02	0.04	DIS	
3/21/2005 19:32	SFWAR-SSCT2005-21	3.9	6	1.17	3.85	9.9	0.06	0.16	DIS	
3/28/2005 13:35	SFWAR-SSCT2005-22	5.7	6	1.20	4.70	12	0.08	0.21	DIS	
3/29/2005 13:16	SFWAR-SSCT2005-23	12	27	1.37	12.5	32	0.91	2.3	Pump	
4/9/2005 03:46	SFWAR-SSCT2005-24	11	14	1.31	6.91	18	0.25	0.65	Pump	
5/18/2005 13:02	SFWAR-SSCT2005-25	13	31	1.32	7.22	19	0.61	1.6	DIS	
5/18/2005 14:01	SFWAR-SSCT2005-26	12	23	1.32	7.40	19	0.46	1.2	Pump	
5/18/2005 17:31	SFWAR-SSCT2005-27	11	13	1.33	7.70	20	0.27	0.68	Pump	Suspect SSC Value
5/18/2005 17:46	SFWAR-SSCT2005-28	10	8	1.33	7.65	20	0.16	0.40	Pump	Calibrate with bottle #1325
5/18/2005 17:47	SFWAR-SSCT2005-29	10	8	1.33	7.65	20	0.16	0.42	DIS	Calibrate with bottle #321
5/19/2005 08:40	SFWAR-SSCT2005-30	6.8	8	1.28	5.69	15	0.12	0.32	DIS	

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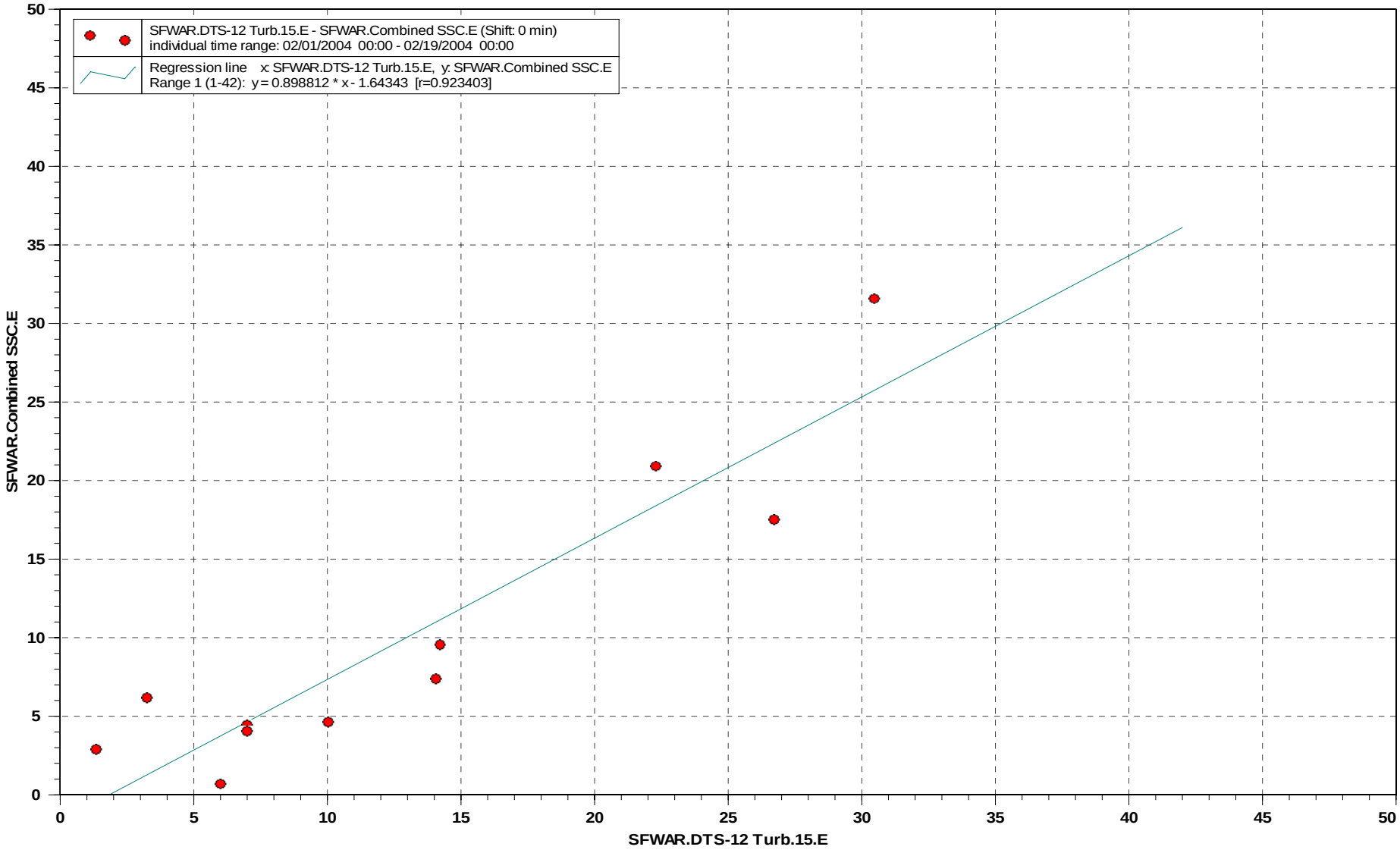
WY 2005 APPENDIX

G-8b

SOUTH FORK WAGES CREEK ABOVE ROCK CREEK
DTS-12 Turbidity verses Depth-Integrated and Pump SSC



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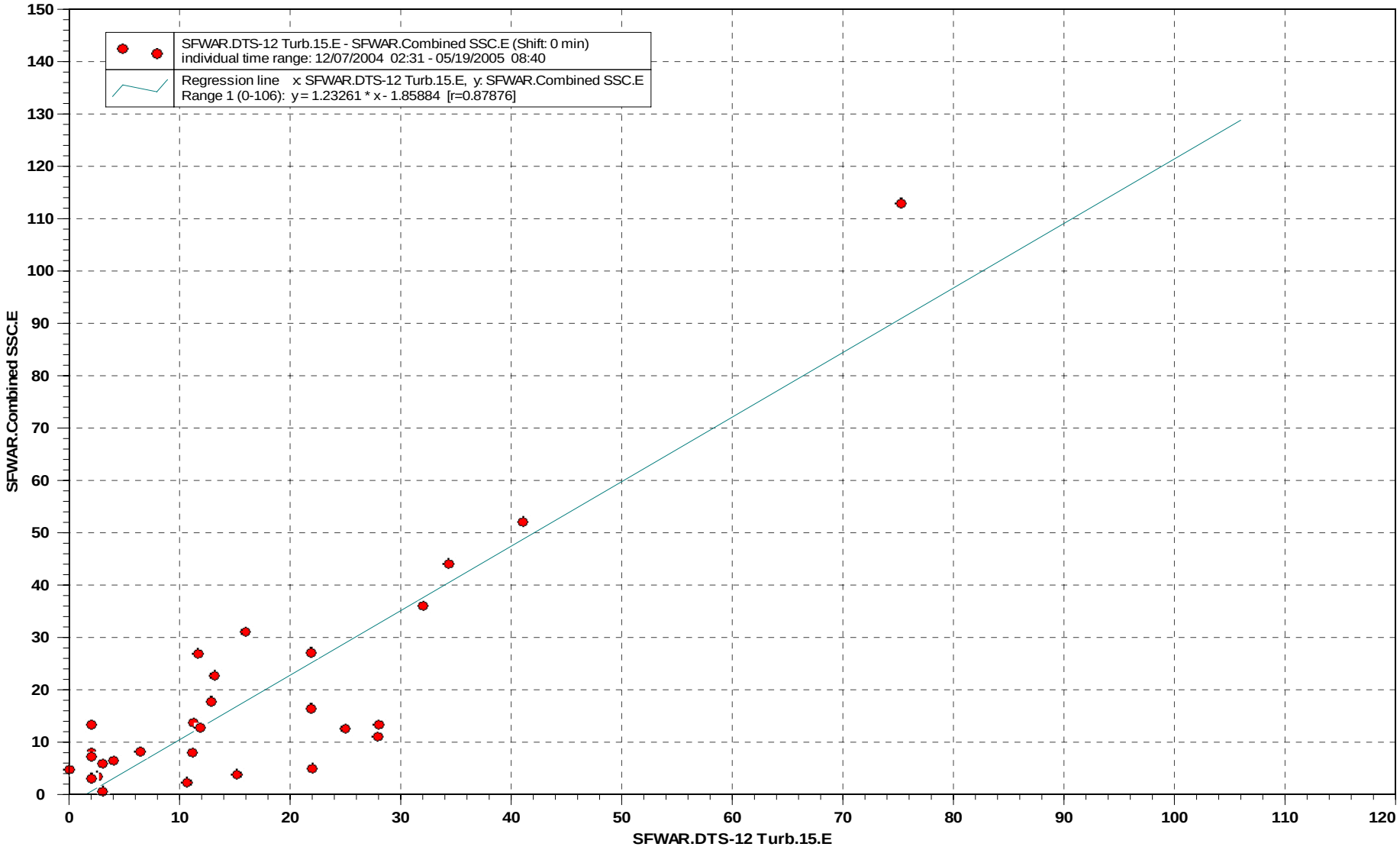
SOUTH FORK WAGES CREEK ABOVE ROCK CREEK
DTS-12 Turbidity verses Depth-Integrated and Pump SSC



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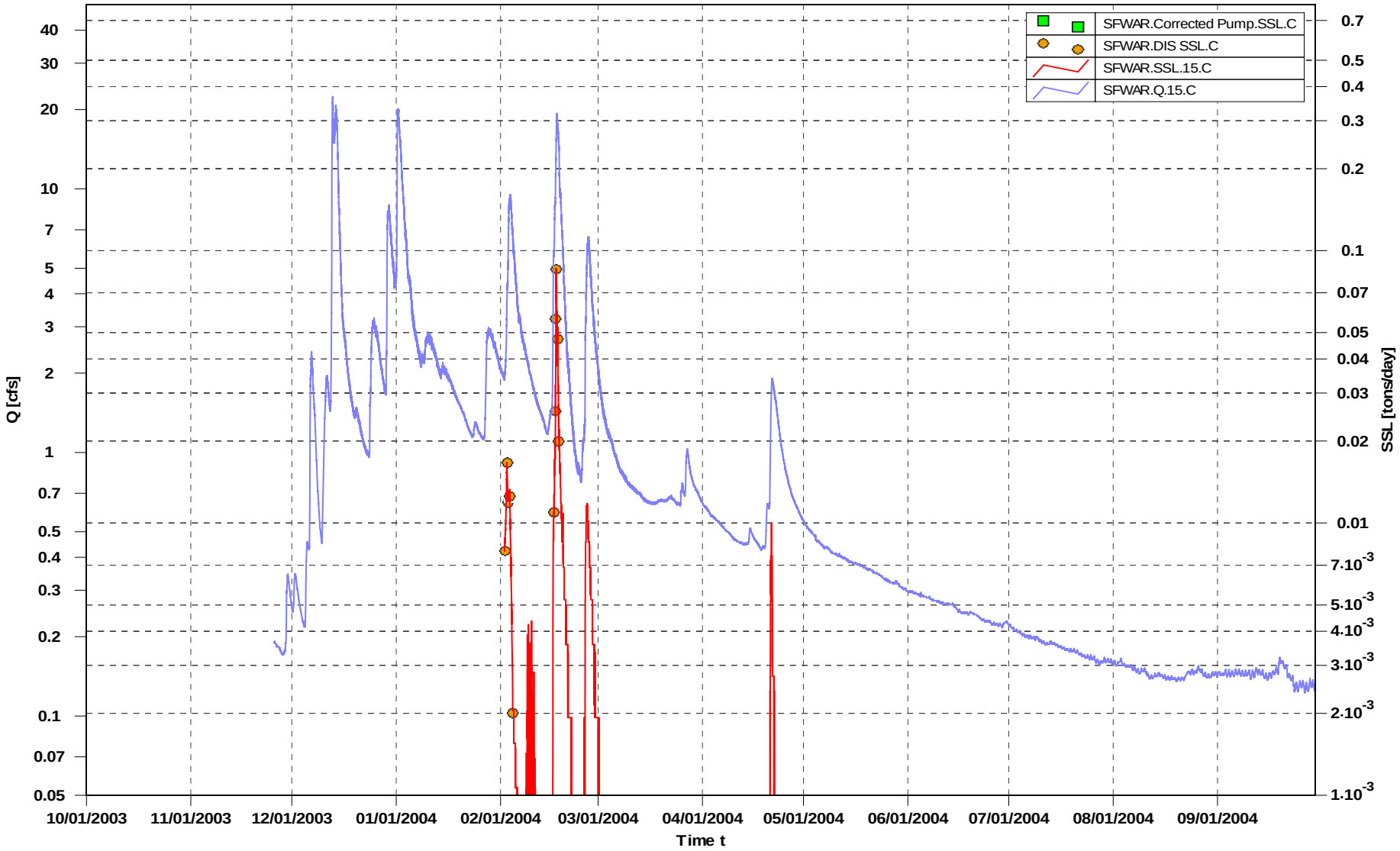
SOUTH FORK WAGES CREEK ABOVE ROCK CREEK
Discharge and Suspended Sediment Load



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APPENDIX

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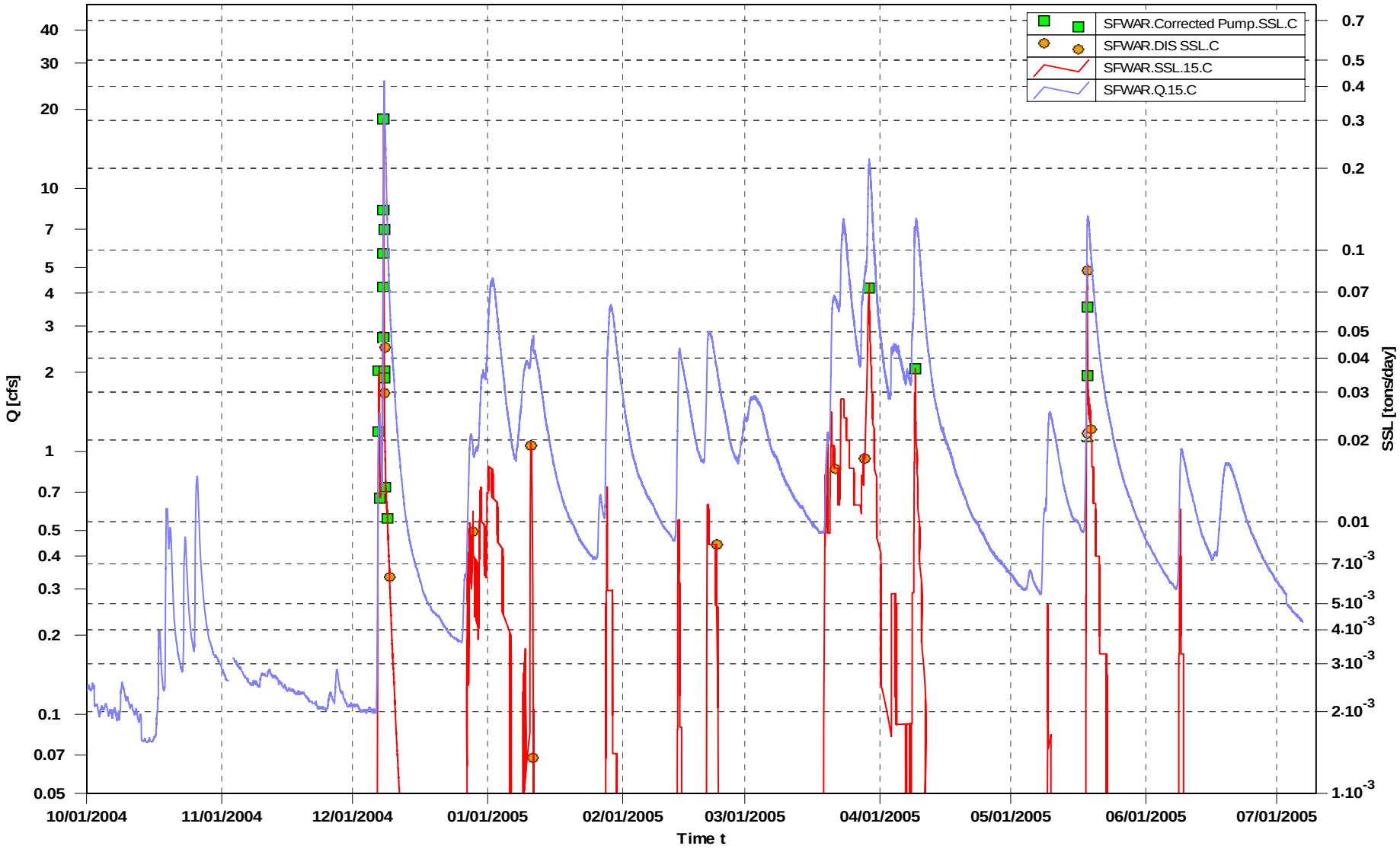
SOUTH FORK WAGES CREEK ABOVE ROCK CREEK
Discharge and Suspended Sediment Load



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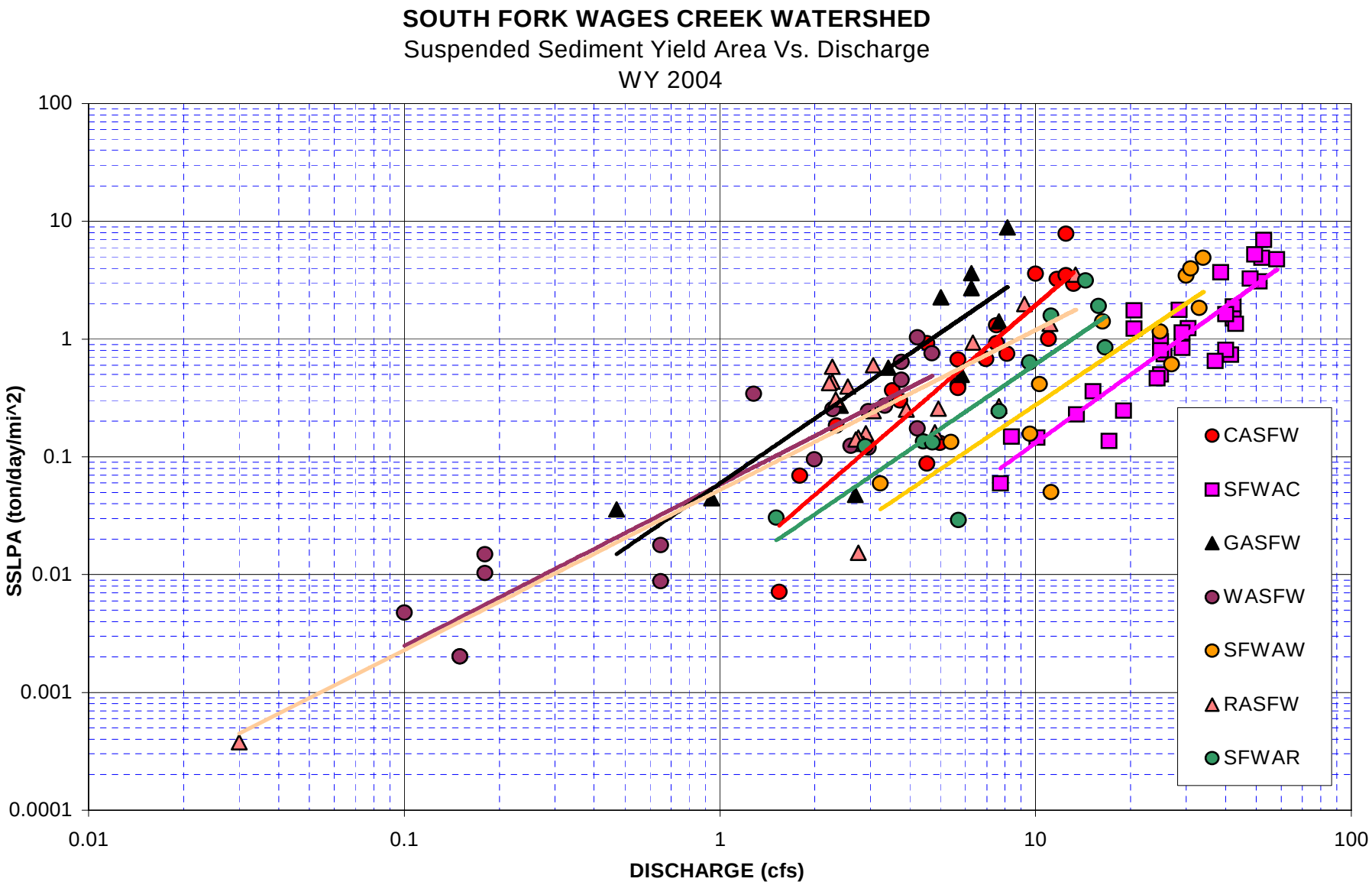

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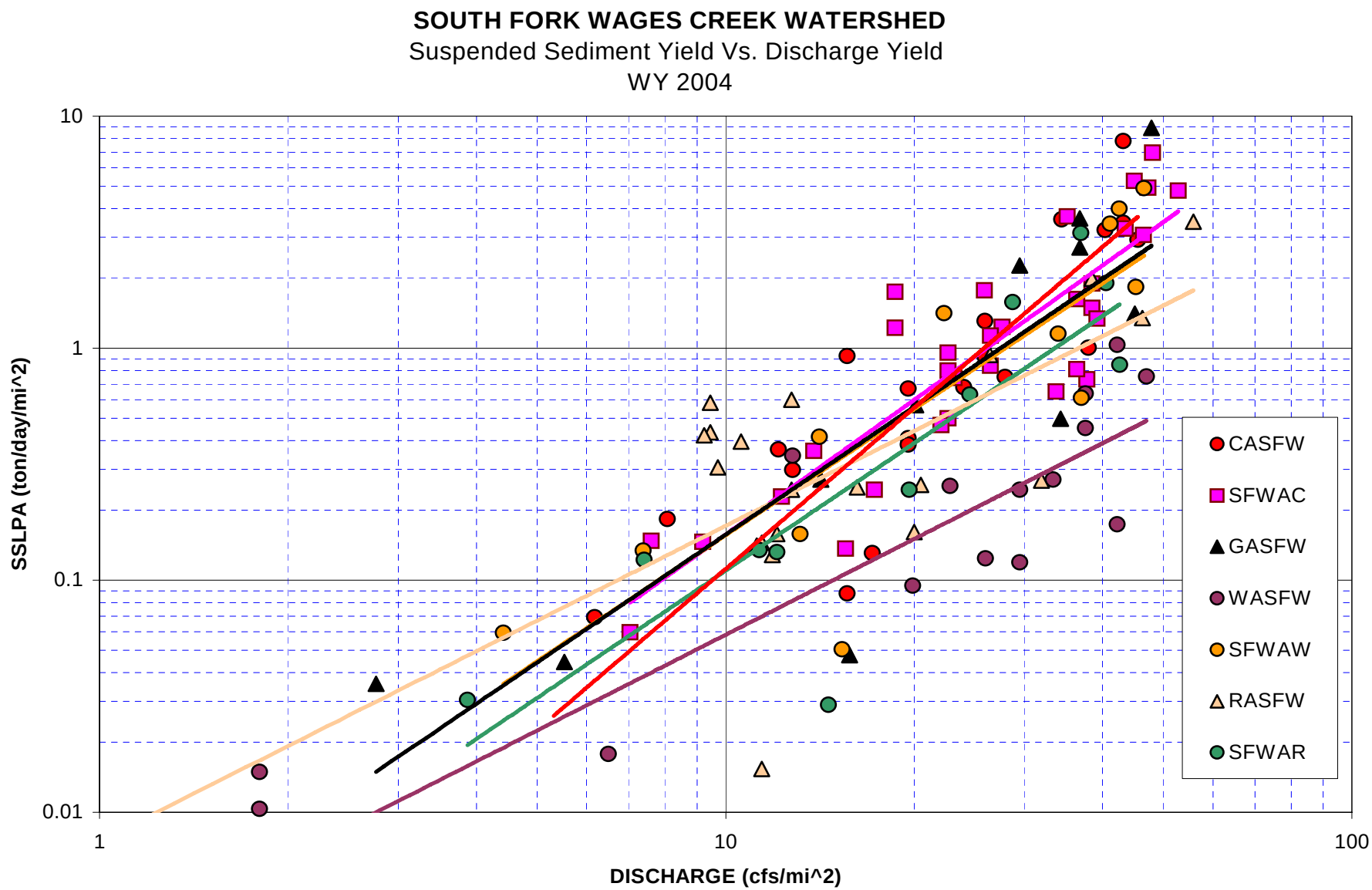

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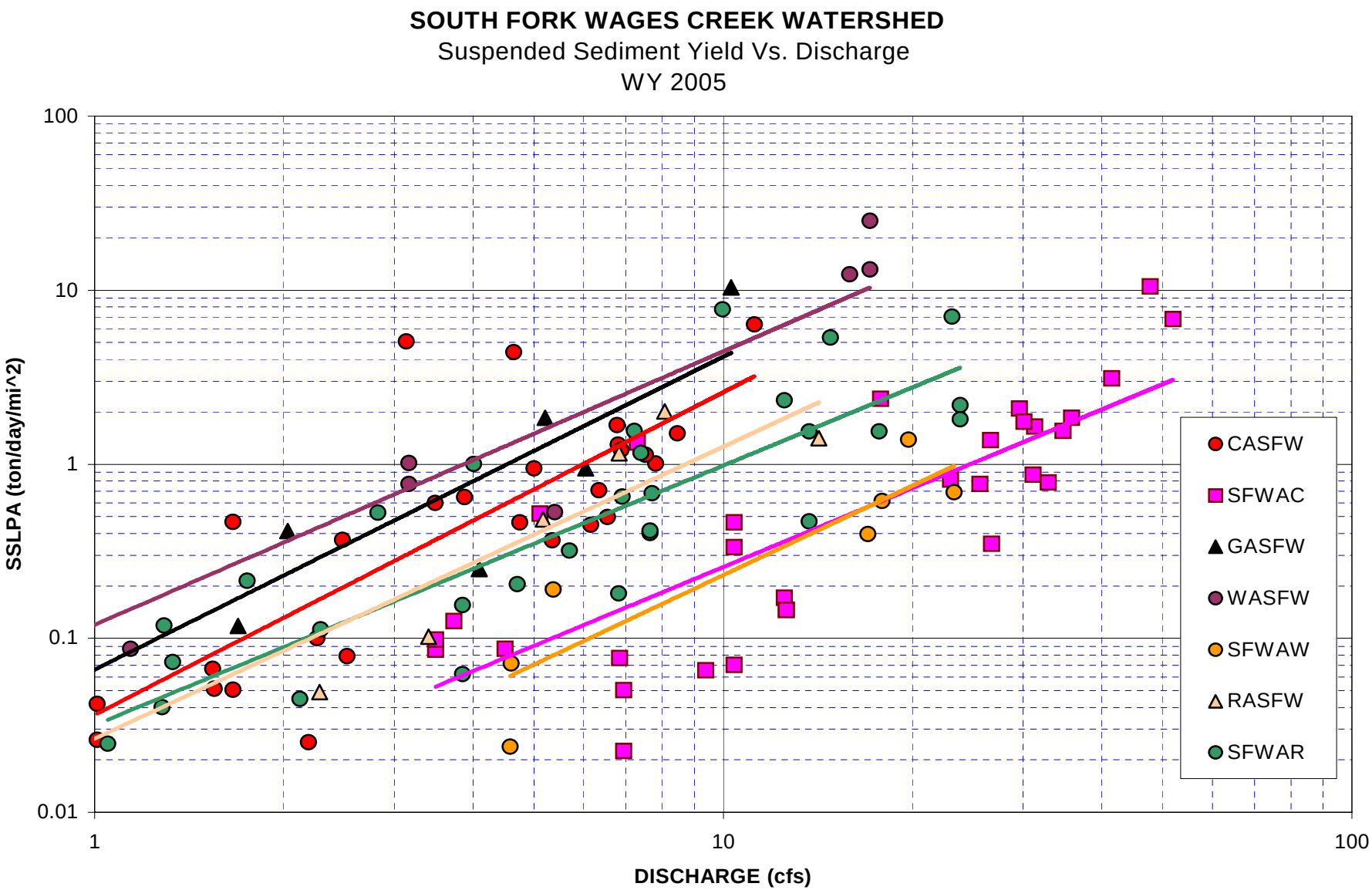

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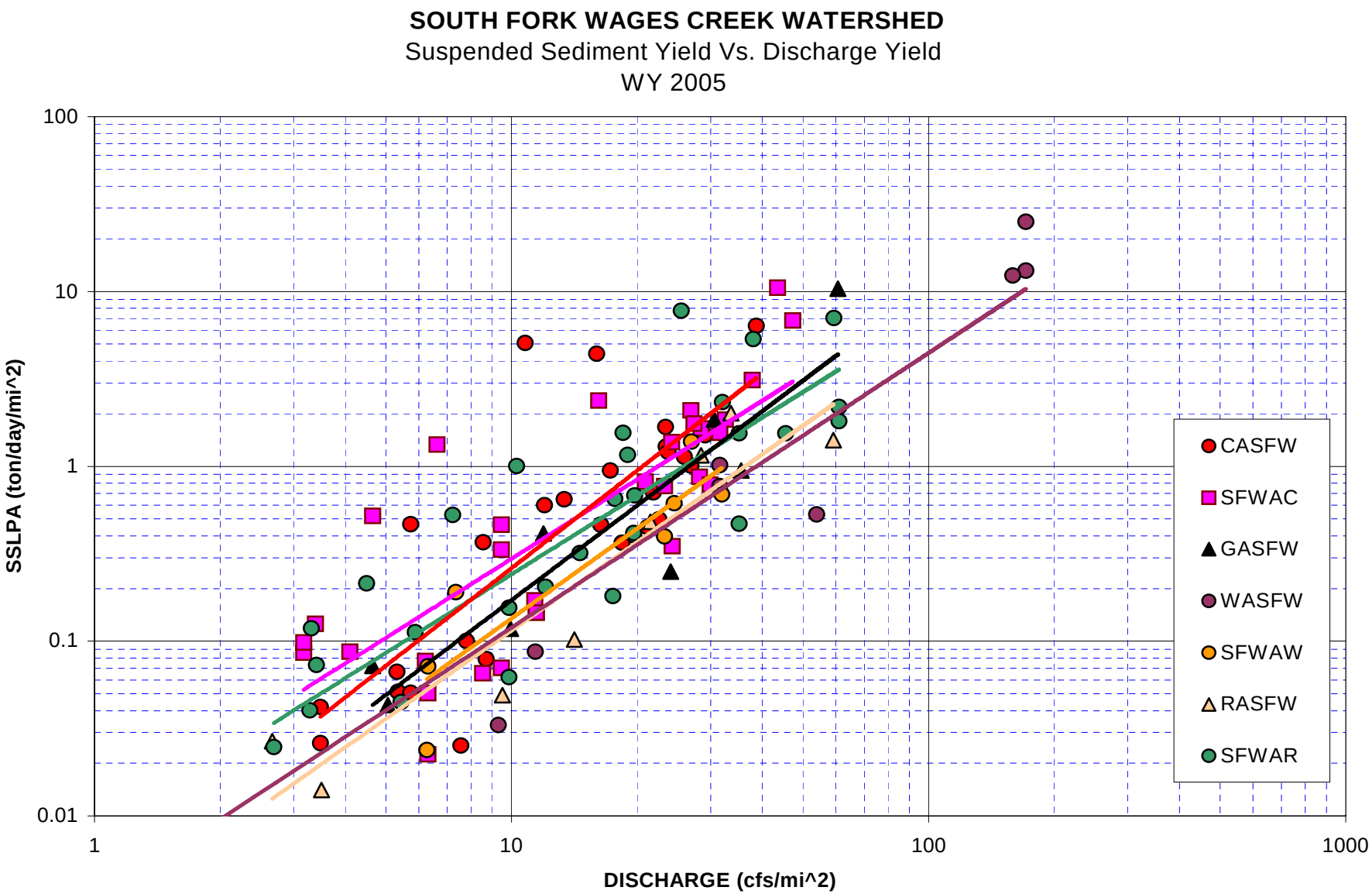

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