

**SHIP CREEK DATA REPORT
2004-2005**

**Data collected under an ACWA Grant
By the Alaska Hydrologic Survey
ADNR**

June 2005

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BACKGROUND:

Ship Creek's lowest ten miles are arguably at greatest risk to water quality, quantity, and aquatic habitat degradation of any Alaska watercourse. Immediately adjacent to Ship Creek are two large military bases, and the City of Anchorage. The Alaska Railroad and extensive industrial development along the course of Lower Ship Creek have substantially altered the natural channel morphology. Of all Alaskan Streams, Ship Creek has the highest proportion of appropriated use of any stream in Alaska.

Ship Creek has been identified as a priority water in need of recovery due to water quality and quantity concerns. Allocated water use is very high which potentially could reduce baseflow and negatively impact aquatic life. This project initial objective was to establish a gaging station in the lower river to determine if water appropriations are affecting stream baseflow, provide streamflow and water quality data necessary to implement a fecal coliform Total Maximum Daily Load (TMDL) recovery plan, help adjudicate instream flow reservation applications, and help provide flow data necessary to successfully manage the stream to provide for a highly important sport fishery.

The Alaska Hydrologic Survey (AHS) applied for and received a grant administered by the Alaska Department of Environmental Conservation (ADEC) to undertake a year-long data collection effort to document stream discharge and water quality parameters. This report represents the results of that grant workplan.

INITIAL PROJECT OBJECTIVES AND WORKPLANS:

As originally planned, the principle objective of this grant project was to establish a stream gage on lower Ship Creek for collection of streamflow and water quality data, intended to meet the following objectives:

- start to ascertain if water appropriations are affecting stream baseflow
- provide streamflow and water quality data for fecal coliform TMDL recovery plan
- help adjudicate instream flow reservation applications
- extend record through correlations with historic USGS data
- provide flow data for highly visible fishery

To meet the objectives the old USGS gage site known as *Ship Creek below power plant at Elmendorf Air Force Base* (USGS site number 15276570) was relocated and reinstrumented. Site 15276570 was maintained and record available for the period 1970 through 1981. Historic elevational values were obtained to allow for correlation of new data with older data. A site survey was completed to correlate all data. Appendix B contains a map with sites identified, and historical mean monthly flows for all sites.

Two stream stage recorders coupled with pressure transducers were installed and set to record hourly. Each pressure transducer has a built in thermister that allowed for simultaneous continuous recording of temperature. Additionally, an electrodeless conductivity sensor was installed on each sensor block to allow for the hourly recording of conductivity. Photos 1 and 2 below show both the sensor block configuration, and the recorder instrument shelter.

Photo 1: Sensor block



Photo 2: Instrument shelter.



In addition to the hourly recording of stage, temperature, and conductivity; monthly visits were scheduled to the site to both allow for the establishment of a stage discharge relation; and collection of water quality data. The monthly water quality data collected was to be used for calibration of the continuous monitoring installed for temperature and conductivity, and to provide additional point in time data on dissolved oxygen and pH. Monthly water quality data were collected using a Hydrolab Quanta water quality instrument. With minor exception due to lead-time to obtain instrumentation and permitting/grant delay issues all work was begun according to plan, and installations were completed as originally planned.

INITIAL PROJECT RESULTS:

Results did not meet expectations. By late September 2004 unexpectedly high flows and velocities caused damage to the pressure transducers that left the sensors severed from the recorders and useless. The discovery of the loss of all pressure transducer function was not discovered until late October of 2004. Only three monthly servicing trips had been completed to begin the process of establishing a stage discharge relation essential to continuous discharge record tabulations. Three data points are insufficient to establish a meaningful relationship of stage to discharge, negating all of the stage data collected during the first three months of the project to valueless. Accordingly, that recorded stage data being of no value is not presented in this report.

Water quality data collected by the recorder/sensor array is valid, and all presented in Appendix D. Calibration of data collected with the Hydrolab Quanta followed strict pre and post calibration requirements as defined in the QAPP. Analysis and conclusions from the data are included later in this report.

MODIFIED PROJECT OBJECTIVES AND WORKPLANS:

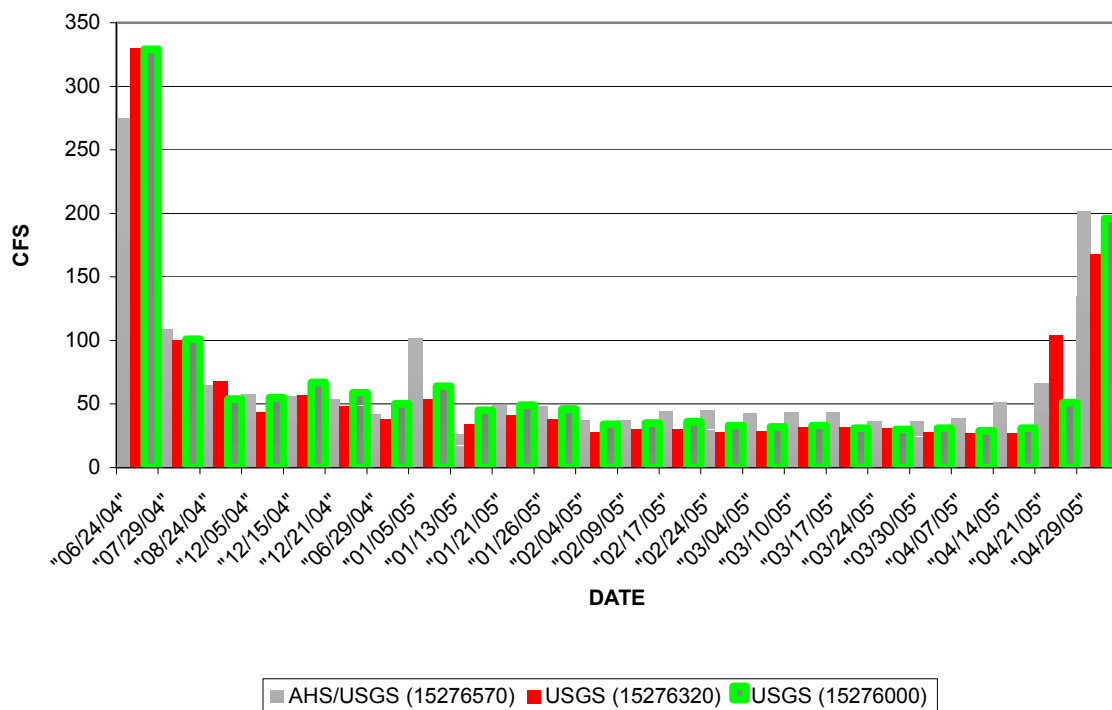
Following discovery of the loss of pressure transducer data collection, ADEC was notified, and the process of assessing what alternatives to continue the project were begun. The time of year for discovery of the damage was problematic; winter freeze-up was imminent; higher flows were present due to fall precipitation preventing active work in the channel; and lead time of three to six weeks were needed to obtain replacement pressure transducers. It quickly became evident that re-instrumenting the site and return to the original work plan was impractical, or impossible with the time and budget available.

The essential alteration to the original objective and workplans that was agreed to was the elimination of the continuous recording equipment previously installed; and the substitution of more frequent on-site discharge and water quality measurements. To remain within the same approximate budget the frequency of site visits was set at one per week; with a discharge measurement at each visit; and a water quality measurement once per month. This schedule was agreed to and approved in early December 2004. The weekly schedule of completing discharge measurements, with once monthly water quality measurement was adhered to until high flows that made wading the stream unsafe.

MODIFIED PROJECT RESULTS:

All collected data is presented in Appendix A data summary spreadsheet. Discharge data is shown below in Graph 1.

Graph 1: Discharge data collected at Ship Creek.



In the above graph discharge in cubic feet per second (cfs) is on the y-axis, and date is on the x-axis. Three sets of data are presented. The columns in gray represent discrete instantaneous measured values of discharge collected by AHS in this project measured at the old USGS gage site (15276570). At this site the drainage area measured is 113.4 miles². The data in red is provisional mean daily data collected by the USGS at a site a short distance upstream (15276320) where the gage captures 104.6 miles². Still further upstream are provisional mean daily flow data presented in green (15276000) where the gage captures 89.5 miles² of the drainage.

The principle conclusion that can be drawn from the above data sets pertain to winter low flow conditions. During the period of early January through mid April a mostly consistent pattern is evident of base flow values at the AHS site being in the upper 30 cfs to lower 40 cfs range; with the notable exception of the 01/05/2005 measurement. The likely explanation of the anomaly on that date is the comparison of mean daily flow values at the upper two sites with an instantaneous value at the AHS gage site. The AHS measurement could have occurred at the high flow value of the day, while the data at the other two sites average flow values over the entire day period.

The second principle conclusion that can be drawn from the data in Graph 1 is that during the winter base flow period the lower reach of Ship Creek is a gaining reach. Throughout the winter low/base flow period the discharge values collected at the lowest AHS data collection site were higher than those collected at the higher in the basin USGS site. The likely explanation for the increased discharge at the lowest gage site is

release of storage from alluvial gravels. Too little data are available to speculate on flow dynamics outside of the low flow winter months.

Water Quality data collected on site with the Hydrololab Quanta are summarized in the Table 1 below. Water Quality data collected represent discrete point-in-time values. Evidence of seasonal trends are apparent in pH and specific conductivity values, each which increase during the winter months likely due to the greater flow contribution from ground water storage.

Table 1: Water Data collected at Ship Creek

DATE	TEMP (°C)	pH	SPECIFIC COND. (mS/cm @ 25°C)	DISSOLVED OXYGEN	
				(mg/L)	(% saturation)
6/24/2004	7.72	7.81	147.00	12.24	102.00
6/24/2004	10.67	7.73	169.00	11.42	103.00
7/29/2004	13.62	7.78	201.00	10.10	97.30
8/24/2004	17.00	7.87	220.00	9.18	96.50
12/21/2004	na	7.70	236.00	13.80	105.00
1/21/2005	6.83	7.83	246.00	11.42	96.00
2/24/2005	8.58	8.18	253.00	12.54	110.00
3/17/2005	9.40	8.17	250.00	12.45	108.90
4/21/2005	9.88	8.03	226.00	11.60	104.10

Temperature data documented a surprisingly high range. Summer values were recorded as high as 17°C (62°F). Winter temperatures were never found below 6.83°C (44°F). Throughout the winter period no ice accumulation was ever seen in the instrumented reach of the channel.

CONCLUSIONS AND RECOMMENDATIONS:

The principle water quantity conclusion that can be drawn from this data collection work is with respect to winter low flows. Data demonstrates that winter low flows at the gage site are in the 40 cfs range. Additionally, the lower reach above the AHS site and the two USGS sites is a gaining reach of channel. The likely source of the additional discharge is release from surrounding gravels. The increases in pH and conductivity support the contention of a greater ground water contribution to total flow under winter low flow conditions.

Mean monthly flows measured by the USGS at the same site for the period of record (1971-1980) for the months of January through March is approximately 27.5 cfs. Base flow measured in this project appears higher at approximately 40 cfs; however it is important to consider that flow values collected under this project are instantaneous values, where the USGS values are monthly averages, and hence should not be correlated. Indications from this project would support a higher base flow value today than in the 1971-1980 time period. Similarly, it appears from this one year of data that appropriations have not diminished base flows, which should aid in adjudication of instream flow applications. Additional discharge data collection is recommended to confirm the conclusions made here.

Temperature data collected documents a surprisingly high temperature throughout the year. Throughout the winter season no ice was seen forming on the lower portions of Ship Creek despite many days with sub zero air temperatures. The reasons for the high temperatures have not been investigated. Additional future work is recommended to further document the high temperatures in this highly visible urban fishery, identify the source/reason for the temperatures, and assess if the high temperatures have any adverse impact on the fisheries.

EVALUATION OF PROJECT ACCOMPLISHMENTS:

Loss of the continuous data recorder at the end of the summer of 2004 represented both a large loss of data resolution and the allied ability to draw conclusions from the data. The effective point-in-time discrete/instantaneous nature of the data available limits the ability to draw correlations with other continuous recorder sites, and with previous historic data. Data presented in this report have been collected according to accepted methodologies, and following quality assurance guidelines. Changing the workplan to a weekly data collection schedule was an unfortunate best alternative change resulting from unexpected loss of sensors at a time of year that made re-installation an essential impossibility given budget constraints.

The requirements of the grant include an assessment of the environmental benefits of the data collected through a determination of the *quality and quantity of the data collected, the correlation with current and historic records, and the ability to assess how current day flow conditions compare with historic data*. Due to the loss of continuous data recording the quantity of data collected did not meet expectations, and that loss of data limited comparisons to existing records. The quality of the data collected is high, and can be used to help assess current conditions, and in TMDL recovery plans.

APPENDIX A:
SHIP CREEK DATA SUMMARY SPREADSHEET

SHIP CREEK DATA SUMMARY SPREADSHEET

DATE	ACTUAL 6/2/2004	CORRECTED VISIT 1	NOTES	ACTUAL 6/24/2004	CORRECTED VISIT 2	NOTES	ACTUAL 7/29/2004	CORRECTED VISIT 3	NOTES	ACTUAL 8/24/2004	CORRECTED VISIT 4	NOTES	ACTUAL 8/25/2004	CORRECTED VISIT 5	NOTES
H.I.#1															
H.I.#2															
BM 1:				4.82	84.64		4.90	84.64		5.10	84.64		5.05	84.64	
BM 2:															
BM 3: (Top Shelter Post)															
TP 1:															
REW (@Gage)				7.08	82.38					8.18	81.56				
Top Upstream/shoreward Block (DOS)				8.12	80.82	3	8.19	80.83	3	8.38	80.84	3	8.33	81.36	4
Top Downstream Block (DOS)				8.14	80.69	3	8.22	80.69	3	8.43	80.68	3	8.37	81.32	4
Depth over block (DOB) upper/shoreward	1.70			1.60			0.75			0.41					
Depth over block (DOB) lower/outward	1.75			1.65			0.80			0.45					
LEW Elevation (@ X Section)				7.03	82.43		7.83	81.71		8.26	81.48		8.22	81.47	
R2 VALUE, UPPER													0.53	0.77	
R2 VALUE, LOWER													0.58	0.66	
Measured DOS UPPER										0.58			0.45		
Measured DOS LOWER										0.54			0.54		
Discharge				275.00			109.00			64.60					
Average Velocity				4.33			2.73			2.11					
Channel width				42.30			39.20			38.30					
Channel area				63.50			39.90			30.60					
Water Temperature (Quanta)	7.72			10.67			13.62			17.00					
Water Temp (R2/sensor/UP/SHORE)	7.90			10.90			13.60			15.80					
Water Temp (R2/sensor/DOWN/OUT)	7.90			10.90			13.60			15.60					
pH	7.81			7.73			7.78			7.87					
Specific Conductance (Quanta)	147.00			169.00			201.00			220.00					
Specific Conductance, R2 upper/SHORE	135.00	121		148.00	114		123.00	85		141.00	87		147.00	187	1
Specific Conductance, R2 lower/OUT	141.00	117		156.00	113		122.00	77		147.00	79		143.00	169	1
DO	12.24			11.42			10.10			9.18					
% Saturation	102.00			103.00			97.30			96.50					
USGS Ship Crk nr Anchorage Gage				330			100			68					

Note 1: Value for conductivity read from R2 prior to sensor movement and prior to any cleaning of sensor (interior of "donut" packed with organic & inorganic material).

Note 4: Values for elevation of sensor block does not include correction factors listed under note 3 below.

change sensor location
no discharge measurement made
second measurements after sensor movement

DATE	ACTUAL 8/25/2004	CORRECTED VISIT 5	NOTES	ACTUAL 12/5/2004	CORRECTED VISIT 6	NOTES	ACTUAL 12/15/2004	CORRECTED VISIT 7	NOTES	ACTUAL 12/21/2004	CORRECTED VISIT 8	NOTES	ACTUAL 12/29/2004	CORRECTED VISIT 9	NOTES
H.I.#1															
H.I.#2															
BM 1:	5.05	84.64		5.19	84.64		4.96	84.64		5.31	84.64		4.80	84.64	
BM 2:															
BM 3: (Top Shelter Post)															
TP 1:															
REW (@Gage)															
Top Upstream/shoreward Block (DOS)	8.85	80.84	3												
Top Downstream Block (DOS)	9.00	80.69	3												
Depth over block (DOB) upper/shoreward	1.28														
Depth over block (DOB) lower/outward	1.45			8.83	81.00		8.58	81.02		8.95	81.00		8.52	80.92	
LEW Elevation (@ X Section)															
R2 VALUE, UPPER	1.13														
R2 VALUE, LOWER	1.37														
Measured DOS UPPER															
Measured DOS LOWER															
Discharge				57.60			56.50			53.90			41.90		
Average Velocity				2.59			2.50			2.46			2.19		
Channel width				32.20			32.20			31.70			31.30		
Channel area				22.20			22.60			21.90			19.10		
Water Temperature (Quanta)															
Water Temp (R2/sensor/UP/SHORE)															
Water Temp (R2/sensor/DOWN/OUT)															
pH										7.70					
Specific Conductance (Quanta)										236.00					
Specific Conductance, R2 upper/SHORE	222.00	275	2												
Specific Conductance, R2 lower/OUT	221.00	261	2												
DO															
% Saturation										13.80					
USGS Ship Crk nr Anchorage Gage				44			57			48			38		

Note 2: Value for conductivity read from R2 after sensor movement and after cleaning of sensor (interior of "donut" packed with organic & inorganic material).

Note 3: Values for upstream block are reestablished on visit 5 8/25/04 after moving sensors to deeper part of channel. Correction factor of -0.52 is applied to all earlier data for the upper block; and -0.63 to the lower block.

SHIP CREEK DATA SUMMARY SPREADSHEET

DATE	ACTUAL 1/5/2005	CORRECTED VISIT 10	NOTES	ACTUAL 1/13/2005	CORRECTED VISIT 11	NOTES	ACTUAL 1/21/2005	CORRECTED VISIT 12	NOTES	ACTUAL 1/26/2005	CORRECTED VISIT 13	NOTES	ACTUAL 2/4/2005	CORRECTED VISIT 14	NOTES	DATE
H.I.#1																H.I.#1
H.I. #2																H.I. #2
BM 1:	5.35	84.64		5.15	84.64		5.36	84.64		5.50	84.64		5.49	84.64		BM 1:
BM 2:																BM 2:
BM 3: (Top Shelter Post)																BM 3: (Top Shelter Post)
TP 1:																TP 1:
REW (@Gage)																REW (@Gage)
Top Upstream/shoreward Block (DOS)																Top Upstream/shoreward Block (DOS)
Top Downstream Block (DOS)																Top Downstream Block (DOS)
Depth over block (DOB) upper/shoreward																Depth over block (DOB) upper/shoreward
Depth over block (DOB) lower/outward																Depth over block (DOB) lower/outward
LEW Elevation (@ X Section)	8.63	81.36		8.96	80.83		9.07	80.93		9.20	80.94		9.33	80.80		LEW Elevation (@ X Section)
R2 VALUE, UPPER																R2 VALUE, UPPER
R2 VALUE, LOWER																R2 VALUE, LOWER
Measured DOS UPPER																Measured DOS UPPER
Measured DOS LOWER																Measured DOS LOWER
Discharge	102.00			26.40			48.50			48.10			37.60			Discharge
Average Velocity	3.23			1.60			2.32			2.22			2.11			Average Velocity
Channel width	33.00			30.70			31.20			31.20			30.60			Channel width
Channel area	31.60			16.50			20.90			22.10			17.80			Channel area
Water Temperature (Quanta)							6.83									Water Temperature (Quanta)
Water Temp (R2/sensor/UP/SHORE)																Water Temp (R2/sensor/UP/SHORE)
Water Temp (R2/sensor/DOWN/OUT)																Water Temp (R2/sensor/DOWN/OUT)
pH							7.83									pH
Specific Conductance (Quanta)							246.00									Specific Conductance (Quanta)
Specific Conductance, R2 upper/SHORE																Specific Conductance, R2 upper/SHORE
Specific Conductance, R2 lower/OUT																Specific Conductance, R2 lower/OUT
DO							11.42									DO
% Saturation							96.00									% Saturation
USGS Ship Crk nr Anchorage Gage	54			34			41			38			28			USGS Ship Crk nr Anchorage Gage

DATE	ACTUAL 2/9/2005	CORRECTED VISIT 15	NOTES	ACTUAL 2/17/2005	CORRECTED VISIT 16	NOTES	ACTUAL 2/24/2005	CORRECTED VISIT 17	NOTES	ACTUAL 3/4/2005	CORRECTED VISIT 18	NOTES	ACTUAL 3/10/2005	CORRECTED VISIT 19	NOTES	DATE
H.I.#1																H.I.#1
H.I. #2																H.I. #2
BM 1:	5.40	84.64		5.54	84.64		5.51	84.64		5.64	84.64		5.77	84.64		BM 1:
BM 2:																BM 2:
BM 3: (Top Shelter Post)																BM 3: (Top Shelter Post)
TP 1:																TP 1:
REW (@Gage)																REW (@Gage)
Top Upstream/shoreward Block (DOS)																Top Upstream/shoreward Block (DOS)
Top Downstream Block (DOS)																Top Downstream Block (DOS)
Depth over block (DOB) upper/shoreward																Depth over block (DOB) upper/shoreward
Depth over block (DOB) lower/outward																Depth over block (DOB) lower/outward
LEW Elevation (@ X Section)	9.17	80.87		9.22	80.96		9.20	80.95		9.40	80.88		9.49	80.92		LEW Elevation (@ X Section)
R2 VALUE, UPPER																R2 VALUE, UPPER
R2 VALUE, LOWER																R2 VALUE, LOWER
Measured DOS UPPER																Measured DOS UPPER
Measured DOS LOWER																Measured DOS LOWER
Discharge	37.50			44.30			45.30			42.90			43.20			Discharge
Average Velocity	2.12			2.25			2.25			2.11			2.10			Average Velocity
Channel width	30.60			30.80			30.90			30.90			31.30			Channel width
Channel area	17.70			19.70			20.10			20.30			20.60			Channel area
Water Temperature (Quanta)							8.58									Water Temperature (Quanta)
Water Temp (R2/sensor/UP/SHORE)																Water Temp (R2/sensor/UP/SHORE)
Water Temp (R2/sensor/DOWN/OUT)																Water Temp (R2/sensor/DOWN/OUT)
pH							8.18									pH
Specific Conductance (Quanta)							253.00									Specific Conductance (Quanta)
Specific Conductance, R2 upper/SHORE																Specific Conductance, R2 upper/SHORE
Specific Conductance, R2 lower/OUT																Specific Conductance, R2 lower/OUT
DO							12.54									DO
% Saturation							110.10									% Saturation
USGS Ship Crk nr Anchorage Gage	30			30			28			29			32			USGS Ship Crk nr Anchorage Gage

SHIP CREEK DATA SUMMARY SPREADSHEET

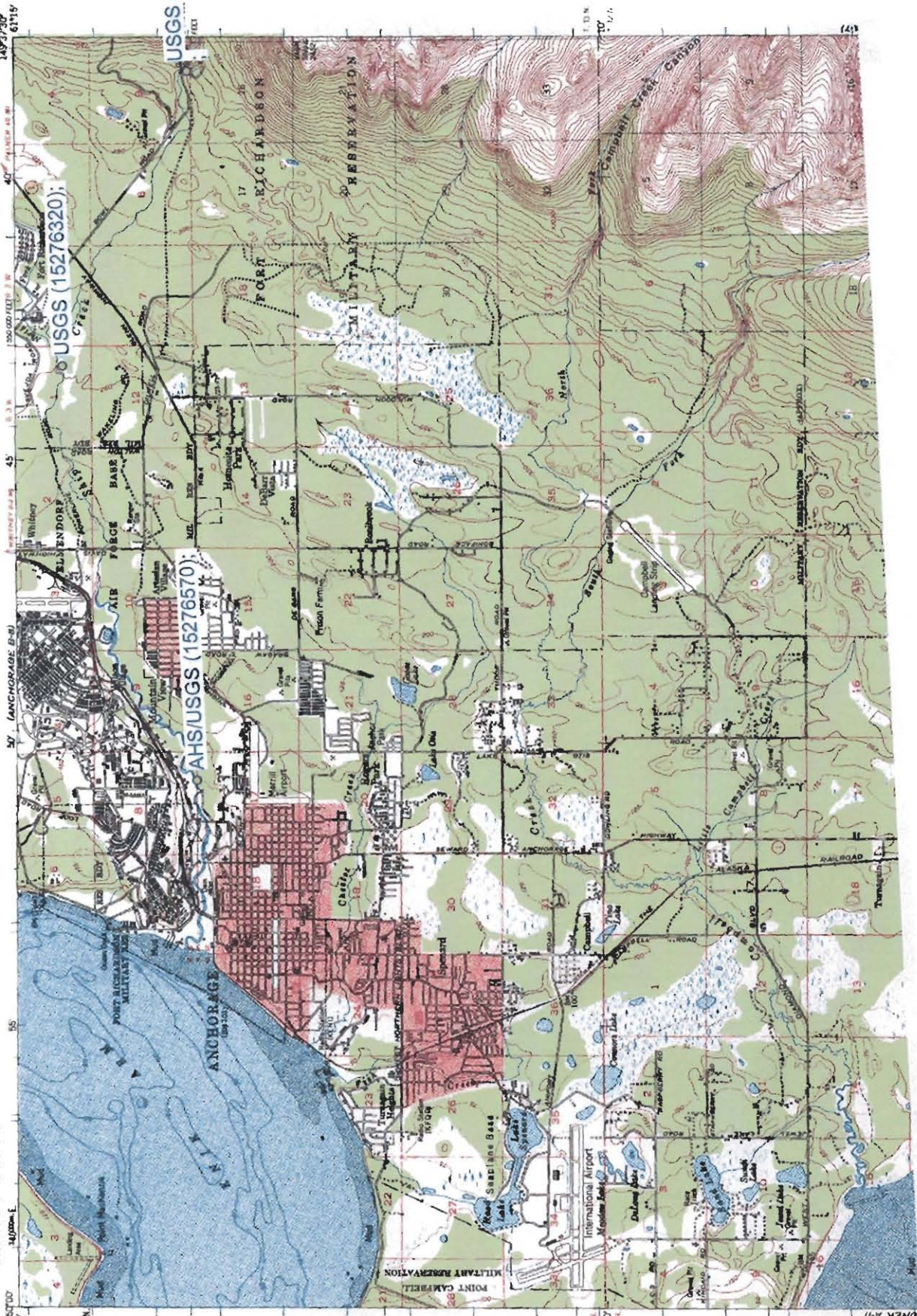
DATE	ACTUAL 3/17/2005	CORRECTED VISIT 20	NOTES	ACTUAL 3/24/2005	CORRECTED VISIT 21	NOTES	ACTUAL 3/30/2005	CORRECTED VISIT 22	NOTES	ACTUAL 4/7/2005	CORRECTED VISIT 23	NOTES	ACTUAL 4/14/2005	CORRECTED VISIT 24	NOTES	DATE
H.I.#1																H.I.#1
H.I.#2																H.I.#2
BM 1:	5.37	84.64		5.47	84.64		5.50	84.64		5.46	84.64		5.26	84.64		BM 1:
BM 2:																BM 2:
BM 3: (Top Shelter Post)																BM 3: (Top Shelter Post)
TP 1:																TP 1:
REW (@Gage)																REW (@Gage)
Top Upstream/shoreward Block (DOS)																Top Upstream/shoreward Block (DOS)
Top Downstream Block (DOS)																Top Downstream Block (DOS)
Depth over block (DOB) upper/shoreward																Depth over block (DOB) upper/shoreward
Depth over block (DOB) lower/outward																Depth over block (DOB) lower/outward
LEW Elevation (@ X Section)	9.10	80.91		9.23	80.88		9.33	80.81		9.23	80.87		8.96	80.94		LEW Elevation (@ X Section)
R2 VALUE, UPPER																R2 VALUE, UPPER
R2 VALUE, LOWER																R2 VALUE, LOWER
Measured DOS UPPER																Measured DOS UPPER
Measured DOS LOWER																Measured DOS LOWER
Discharge	43.90			36.40			37.10			38.40			51.90			Discharge
Average Velocity	2.15			1.94			1.97			1.92			2.46			Average Velocity
Channel width	31.00			30.50			30.00			30.30			30.30			Channel width
Channel area	20.40			18.80			18.80			20.00			21.10			Channel area
Water Temperature (Quanta)	9.40															Water Temperature (Quanta)
Water Temp (R2/sensor/UP/SORE)																Water Temp (R2/sensor/UP/SORE)
Water Temp (R2/sensor/DOWN/OUT)	8.17															Water Temp (R2/sensor/DOWN/OUT)
pH	250.00															pH
Specific Conductance (Quanta)																Specific Conductance (Quanta)
Specific Conductance, R2 upper/SORE																Specific Conductance, R2 upper/SORE
Specific Conductance, R2 lower/OUT																Specific Conductance, R2 lower/OUT
DO	12.45															DO
% Saturation	108.90															% Saturation
USGS Ship Crtk nr Anchorage Gage	32			31			28			27			27			USGS Ship Crtk nr Anchorage Gage

DATE	ACTUAL 4/21/2005	CORRECTED VISIT 25	NOTES	ACTUAL 4/29/2005	CORRECTED VISIT 26	NOTES	ACTUAL 5/5/2005	CORRECTED VISIT 27	NOTES	ACTUAL ??	CORRECTED VISIT ??	NOTES	ACTUAL ??	CORRECTED VISIT ??	NOTES	DATE
H.I.#1																H.I.#1
H.I.#2																H.I.#2
BM 1:	5.29	84.64		5.25	84.64		TOO HIGH TOO WADES SAFELY									BM 1:
BM 2:																BM 2:
BM 3: (Top Shelter Post)																BM 3: (Top Shelter Post)
TP 1:																TP 1:
REW (@Gage)																REW (@Gage)
Top Upstream/shoreward Block (DOS)																Top Upstream/shoreward Block (DOS)
Top Downstream Block (DOS)																Top Downstream Block (DOS)
Depth over block (DOB) upper/shoreward																Depth over block (DOB) upper/shoreward
Depth over block (DOB) lower/outward																Depth over block (DOB) lower/outward
LEW Elevation (@ X Section)	8.90	81.03		8.25	81.64											LEW Elevation (@ X Section)
R2 VALUE, UPPER																R2 VALUE, UPPER
R2 VALUE, LOWER																R2 VALUE, LOWER
Measured DOS UPPER																Measured DOS UPPER
Measured DOS LOWER																Measured DOS LOWER
Discharge	66.40			202.00												Discharge
Average Velocity	2.52			3.83												Average Velocity
Channel width	31.90			39.30												Channel width
Channel area	26.30			52.80												Channel area
Water Temperature (Quanta)	9.88															Water Temperature (Quanta)
Water Temp (R2/sensor/UP/SORE)																Water Temp (R2/sensor/UP/SORE)
Water Temp (R2/sensor/DOWN/OUT)																Water Temp (R2/sensor/DOWN/OUT)
pH	8.03															pH
Specific Conductance (Quanta)	226.00															Specific Conductance (Quanta)
Specific Conductance, R2 upper/SORE																Specific Conductance, R2 upper/SORE
Specific Conductance, R2 lower/OUT																Specific Conductance, R2 lower/OUT
DO	11.60															DO
% Saturation	104.10															% Saturation
USGS Ship Crtk nr Anchorage Gage	45			168												USGS Ship Crtk nr Anchorage Gage

**APPENDIX B:
USGS GAGE SITES AND DATA**

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

ANCHORAGE A-8 QUADRANGLE
ALASKA
1:63,360 SERIES (TOPOGRAPHIC)



USGS (1527600)

USGS (15276320)

AHS/USGS (15276570)

**Water Resources****Data Category:**

Site Information ▼

Geographic Area:

Alaska ▼

go

USGS 15276570 SHIP C BL POWER PLANT AT ELMENDORF AFB AK**Available data for this site**

Site home page ▼

GO

Site Description**LOCATION**

Latitude 61°13'29", Longitude 149°50'39" NAD27,
Municipality Of Anchorage County, Alaska , Hydrologic Unit 19020401

DRAINAGE AREA

113.4 square miles

GAGE

Datum of gage is 80.00 feet above sea level NGVD29.

SITE TYPE:

Stream / River

AVAILABLE DATA:

Data Type	Begin Date	End Date	Count
<u>Peak streamflow</u>	1971-08-09	1980-06-12	10
<u>Daily streamflow</u>	1970-10-01	1981-01-31	3776
<u>Water Quality Samples</u>	1971-02-12	2000-08-10	71

OPERATION:

Record for this site is maintained by the USGS Alaska Water Science Center

CONTACT INFORMATIONEmail questions about this site to [Alaska NWISWeb Data Inquiries](#)Questions about data [Alaska NWISWeb Data Inquiries](#)[Top](#)Feedback on this website [Alaska NWISWeb Maintainer](#)[Explanation of terms](#)**** USGS 15276570 SHIP C BL POWER PLANT AT ELMENDORF AFB AK**<http://waterdata.usgs.gov/ak/nwis/nwisman?>

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1.11 1.1 nadww01



Water Resources

Data Category:

Surface Water

Geographic Area:

Alaska

go

Daily Streamflow Statistics for Alaska

USGS 15276570 SHIP C BL POWER PLANT AT ELMENDORF AFB AK

Available data for this site

Surface-water: Daily streamflow statistics

GO

Municipality Of Anchorage County, Alaska

Hydrologic Unit Code 19020401

Latitude 61°13'29", Longitude 149°50'39" NAD27

Drainage area 113.4 square miles

Gage datum 80.00 feet above sea level NGVD29

Output formats

HTML table of all data

Tab-separated data

Reselect output format

Day of month	Mean of daily mean values for this day for 11 years of record ¹ , in ft ³ /s											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	41.6	26.5	21.0	22.8	45.2	304	463	245	139	212	111	68.0
2	39.0	26.9	21.2	22.9	48.9	321	442	241	133	204	100	59.1
3	38.5	26.4	21.7	23.2	52.6	329	436	230	127	190	101	60.4
4	38.8	26.5	21.9	25.9	56.1	345	436	224	125	181	104	52.8
5	39.2	26.5	21.3	26.0	58.4	368	451	220	128	180	98.3	54.0
6	41.0	26.4	20.6	26.3	59.2	389	471	226	129	180	99.8	51.1
7	40.5	26.1	20.8	27.7	59.3	389	479	229	135	176	101	52.2
8	38.9	26.2	20.8	27.9	61.3	390	465	271	131	182	97.6	52.5
9	37.9	25.8	21.1	28.3	64.2	418	455	313	128	180	94.9	50.6
10	37.1	25.3	20.5	28.4	67.5	437	442	277	132	174	99.3	50.4
11	36.6	24.8	20.6	28.2	74.3	467	447	260	158	173	111	49.0
12	36.3	24.8	20.4	27.6	80.4	510	469	235	175	167	104	48.5
13	35.5	24.7	20.0	26.7	83.1	522	452	224	212	161	105	47.7
14	34.5	24.3	20.1	26.2	89.2	533	412	222	204	166	92.0	45.1
15	34.6	23.5	20.9	26.1	99.5	579	386	216	211	169	90.4	43.0
16	34.5	22.9	21.2	26.7	104	577	357	213	225	168	84.3	42.7
17	34.7	22.4	21.3	26.4	104	534	328	211	209	166	81.2	42.5
18	34.6	21.8	20.7	26.3	107	496	317	212	209	158	77.2	43.9
19	34.2	22.9	21.1	26.3	120	457	319	207	201	145	79.4	43.6
20	33.4	23.7	20.4	26.8	129	452	328	203	196	144	83.7	45.5

21	33.7	24.1	20.8	28.0	129	462	325	200	265	138	83.1	46.5
22	35.5	23.7	21.0	29.6	131	453	309	196	268	134	79.7	46.1
23	34.1	23.7	21.1	29.8	139	465	293	186	239	129	72.8	46.5
24	33.0	23.5	21.0	31.2	147	501	285	176	224	130	66.4	48.5
25	33.8	22.8	20.5	32.9	154	514	278	167	212	128	65.1	46.8
26	36.3	22.2	20.8	34.6	172	530	271	160	207	124	66.8	46.2
27	33.5	21.9	20.9	35.3	192	518	276	156	208	118	68.3	44.9
28	31.5	21.0	20.9	37.4	214	507	291	156	224	118	76.1	43.4
29	30.8	22.7	20.7	38.8	241	489	272	150	221	114	75.3	42.7
30	29.0		20.8	41.8	258	482	255	146	229	111	78.4	41.5
31	29.5		22.4		280		254	142		116		39.8

1 -- Available period of record may be less than value shown for certain days of the year.

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Surface Water data for Alaska: Daily Streamflow Statistics

<http://waterdata.usgs.gov/ak/nwis/dvstat?>

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1.27 1.25 nadww01



Water Resources

Data Category:

Site Information

Geographic Area:

Alaska

go

USGS 15276320 SHIP C BL FISH HATCHERY NR ANCHORAGE AK

Available data for this site

Site home page

GO

Site Description

LOCATION

Latitude 61°14'36", Longitude 149°43'19" NAD27,
Municipality Of Anchorage County, Alaska , Hydrologic Unit 19020401

DRAINAGE AREA

104.6 square miles

GAGE

Datum of gage is 225 feet above sea level NGVD29.

SITE TYPE:

Stream / River

AVAILABLE DATA:

Data Type	Begin Date	End Date	Count
Peak streamflow	2002-12-28	2004-05-23	2
Daily streamflow	2002-10-01	2004-09-30	731

OPERATION:

Record for this site is maintained by the USGS Alaska Water Science Center

CONTACT INFORMATION

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** USGS 15276320 SHIP C BL FISH HATCHERY NR ANCHORAGE AK

<http://waterdata.usgs.gov/ak/nwis/nwisman?>

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1.08 1.07 nadww01



Water Resources

Data Category:

Surface Water

Geographic Area:

Alaska

go

Daily Streamflow Statistics for Alaska

USGS 15276320 SHIP C BL FISH HATCHERY NR ANCHORAGE AK

Available data for this site

Surface-water: Daily streamflow statistics

GO

Municipality Of Anchorage County, Alaska
 Hydrologic Unit Code 19020401
 Latitude 61°14'36", Longitude 149°43'19" NAD27
 Drainage area 104.6 square miles
 Gage datum 225 feet above sea level NGVD29

Output formats

[HTML table of all data](#)
[Tab-separated data](#)
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Day of month	Mean of daily mean values for this day for 2 years of record ¹ , in ft ³ /s											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	70.0	50.5	44.0	35.0	125	368	246	105	124	245	190	118
2	66.0	50.0	44.0	37.0	137	349	266	102	122	236	182	111
3	68.5	49.5	41.5	36.0	143	339	281	99.0	122	284	170	108
4	69.0	49.0	41.5	36.0	152	346	248	95.0	118	330	167	114
5	69.0	49.0	40.5	35.0	166	367	227	95.0	112	273	168	110
6	66.0	49.0	36.0	36.0	187	381	215	92.5	108	271	169	105
7	65.0	48.5	38.5	37.5	211	397	202	90.5	105	329	161	101
8	64.5	49.0	41.5	38.5	236	416	192	88.5	102	328	166	103
9	66.0	48.5	37.5	36.0	235	390	181	88.0	100	296	156	98.0
10	66.0	46.5	41.5	35.5	230	390	182	87.5	98.0	262	153	97.0
11	65.5	47.5	42.0	35.5	236	407	182	88.5	96.0	240	153	97.0
12	62.0	45.0	41.5	36.5	240	416	169	108	93.5	235	153	95.5
13	61.0	47.0	40.5	37.0	256	428	160	115	97.5	220	145	89.0
14	61.0	46.5	40.5	38.0	268	430	152	128	92.5	213	138	89.0
15	60.0	44.5	40.5	40.0	271	430	153	127	90.0	210	120	83.5
16	59.5	40.0	40.0	42.5	273	383	154	159	88.5	215	109	82.5
17	59.5	41.5	38.5	42.5	273	384	147	158	86.5	210	106	81.5
18	59.5	43.5	39.5	43.0	275	389	140	144	85.0	220	96.0	81.5
19	57.0	46.0	34.5	44.0	284	380	127	136	84.0	215	95.5	79.0
20	58.0	47.5	37.0	46.5	298	374	124	132	86.5	265	99.5	81.5

21	58.5	47.0	38.5	49.0	320	363	130	123	92.5	280	116	79.0
22	58.5	46.5	40.5	53.5	340	336	129	116	90.5	260	117	79.0
23	57.5	45.5	39.5	58.5	409	324	125	109	93.0	245	117	77.5
24	55.5	45.0	39.0	61.5	414	309	125	105	89.0	276	114	75.0
25	52.0	44.5	38.0	65.0	375	295	126	107	93.5	302	108	70.5
26	54.0	44.0	37.0	71.5	372	283	119	138	136	296	103	69.0
27	54.0	44.5	37.0	80.0	351	270	117	164	132	257	99.5	102
28	53.0	44.0	36.5	89.5	354	258	120	161	123	235	102	366
29	52.5	33.0	36.0	105	341	250	117	146	132	235	112	300
30	50.5		35.0	115	361	244	112	137	265	220	129	77.0
31	49.5		32.5		375		109	130		200		76.5

1 -- Available period of record may be less than value shown for certain days of the year.

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1.39 1.23 nadww01

**Water Resources****Data Category:**

Site Information

Geographic Area:

Alaska

go

USGS 15276000 SHIP C NR ANCHORAGE AK**Available data for this site**

Site home page

GO

Site Description**LOCATION**

Latitude 61°13'32", Longitude 149°38'06" NAD27,
Municipality Of Anchorage County, Alaska , Hydrologic Unit 19020401

DRAINAGE AREA

89.5 square miles

GAGE

Datum of gage is 490 feet above sea level NGVD29.

SITE TYPE:

Stream / River

AVAILABLE DATA:

Data Type	Begin Date	End Date	Count
<u>Real-time</u>	This is a real-time site		
<u>Peak streamflow</u>	1947-05-31	2004-05-23	58
<u>Daily streamflow</u>	1946-10-01	2004-09-30	21185
<u>Water Quality Samples</u>	1948-10-19	1981-06-30	157

OPERATION:

Record for this site is maintained by the USGS Alaska Water Science Center

CONTACT INFORMATION

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**** USGS 15276000 SHIP C NR ANCHORAGE AK**

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Water Resources

Data Category:

Surface Water

Geographic Area:

Alaska

go

Daily Streamflow Statistics for Alaska

USGS 15276000 SHIP C NR ANCHORAGE AK

Available data for this site

Surface-water: Daily streamflow statistics

GO

Municipality Of Anchorage County, Alaska
 Hydrologic Unit Code 19020401
 Latitude 61°13'32", Longitude 149°38'06" NAD27
 Drainage area 89.5 square miles
 Gage datum 490 feet above sea level NGVD29

Output formats

[HTML table of all data](#)
[Tab-separated data](#)
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Day of month	Mean of daily mean values for this day for 58 years of record ¹ , in ft ³ /s											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	38.3	27.3	19.8	17.7	56.2	377	406	227	198	206	103	61.1
2	37.6	26.8	19.6	17.9	58.7	381	396	229	193	198	99.9	58.8
3	37.2	26.4	19.0	18.2	63.1	389	390	222	185	192	97.6	57.6
4	36.6	26.6	18.7	18.3	66.1	407	383	214	189	191	97.1	56.3
5	36.6	26.5	18.6	18.2	69.8	424	380	208	193	184	94.1	56.2
6	35.1	25.9	18.7	18.4	73.9	442	375	210	196	188	93.4	54.8
7	34.6	24.9	18.2	18.5	77.7	463	364	210	200	186	91.5	53.9
8	34.1	24.4	18.2	18.5	85.6	472	350	217	193	179	89.6	53.5
9	33.6	24.1	18.0	18.6	90.9	471	340	219	188	175	87.2	54.0
10	33.3	24.1	18.3	19.0	98.6	469	335	208	186	171	91.2	54.4
11	32.9	23.8	18.1	19.4	106	473	341	203	186	179	90.2	53.9
12	32.7	23.7	17.4	19.9	114	479	335	204	194	174	87.4	51.9
13	32.5	23.5	17.2	20.2	122	483	322	216	201	165	84.6	51.5
14	32.0	23.2	17.0	20.6	131	485	307	223	195	159	80.4	50.6
15	32.0	22.8	16.8	20.9	138	488	296	214	198	152	76.9	49.5
16	31.6	22.2	16.8	21.7	149	491	288	206	204	149	74.0	48.5
17	31.6	21.9	16.7	22.6	159	479	286	197	207	143	72.6	46.7
18	31.4	21.6	16.7	23.9	169	479	278	190	224	141	70.2	45.9
19	31.0	21.8	16.8	24.9	180	470	269	185	221	137	69.1	46.7
20	32.1	22.2	16.9	26.0	191	475	267	186	233	137	71.4	47.8

21	35.2	21.5	17.2	26.8	204	476	264	184	251	134	72.4	46.3
22	34.5	21.6	17.0	27.7	217	461	253	185	242	132	70.6	45.4
23	32.1	21.5	17.0	29.7	232	453	247	185	230	129	69.5	43.1
24	30.3	21.1	17.4	32.0	250	446	243	189	224	128	67.8	42.2
25	30.0	21.0	17.5	35.9	265	443	238	197	218	125	65.3	41.5
26	29.0	20.8	17.5	37.6	285	437	235	209	212	122	64.0	41.8
27	28.4	20.6	17.8	41.7	298	427	229	211	212	118	65.8	42.7
28	28.1	20.3	17.4	45.4	309	425	229	207	208	114	64.7	50.3
29	27.1	20.8	17.1	49.1	336	421	223	198	206	111	63.2	47.6
30	27.2		17.4	52.4	353	416	227	192	217	106	63.9	40.9
31	27.8		17.7		368		230	190		105		39.5

1 -- Available period of record may be less than value shown for certain days of the year.

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1.26 1.24 nadww01

APPENDIX C:
ADDITIONAL SECTION PHOTO DOCUMENTATION



Discharge Cross Section Site.



Channel reach instrumented and measured, viewed from immediately above cross section.



Channel reach immediately below discharge cross section.

APPENDIX D:
SENSOR/RECORDER DATA COLLECTED

**SENSOR/RECORDER
DATA COLLECTED**

DATE	TEMP (°C)	DEPTH (ft)	SPECIFIC COND. <small>(mS/cm @ 25°C)</small>
6/2/2004	8.87	2.25	111.82
6/3/2004	8.45	2.22	109.17
6/4/2004	8.92	2.24	105.33
6/5/2004	9.43	2.29	107.38
6/6/2004	9.84	2.31	105.50
6/7/2004	10.19	2.42	111.17
6/8/2004	8.63	2.57	107.21
6/9/2004	8.25	2.49	106.58
6/10/2004	8.19	2.37	109.29
6/11/2004	8.25	2.26	110.75
6/12/2004	8.92	2.14	112.46
6/13/2004	9.72	2.09	114.29
6/14/2004	10.50	2.06	115.96
6/15/2004	9.96	2.10	114.46
6/16/2004	8.58	2.09	112.17
6/17/2004	9.82	2.23	112.54
6/18/2004	11.17	2.29	112.92
6/19/2004	11.87	2.29	114.54
6/20/2004	12.15	2.25	110.38
6/21/2004	12.40	2.21	111.54
6/22/2004	12.36	2.17	110.63
6/23/2004	12.47	2.11	108.75
6/24/2004	12.71	2.05	112.75
6/25/2004	13.11	2.00	111.33
6/26/2004	14.00	1.96	113.42
6/27/2004	13.60	1.95	114.38
6/28/2004	12.22	1.93	106.33
6/29/2004	11.65	1.89	104.08
6/30/2004	11.31	1.81	104.17
7/1/2004	11.37	1.78	104.00
7/2/2004	11.58	1.74	105.13
7/3/2004	12.13	1.70	107.46
7/4/2004	12.75	1.67	111.00
7/5/2004	13.02	1.65	111.04
7/6/2004	13.77	1.61	112.21
7/7/2004	14.83	1.57	114.83
7/8/2004	15.29	1.54	115.88
7/9/2004	15.31	1.50	117.13
7/10/2004	14.90	1.47	117.00
7/11/2004	15.47	1.44	118.79
7/12/2004	16.10	1.41	121.00
7/13/2004	16.13	1.40	121.04
7/14/2004	15.38	1.41	119.46
7/15/2004	15.36	1.43	118.71
7/16/2004	15.26	1.44	119.29
7/17/2004	14.58	1.45	117.92
7/18/2004	14.03	1.45	117.38
7/19/2004	14.87	1.43	119.04
7/20/2004	15.17	1.40	120.33

SENSOR/RECORDER DATA COLLECTED

DATE	TEMP (°C)	DEPTH (ft)	SPECIFIC COND. (mS/cm @ 25°C)
7/21/2004	14.64	1.40	118.88
7/22/2004	14.07	1.39	117.13
7/23/2004	14.22	1.37	118.46
7/24/2004	14.58	1.35	119.54
7/25/2004	14.21	1.33	118.33
7/26/2004	14.12	1.33	118.71
7/27/2004	13.67	1.34	117.75
7/28/2004	13.65	1.40	115.54
7/29/2004	14.28	1.36	123.88
7/30/2004	14.52	1.32	133.21
7/31/2004	14.34	1.30	132.63
8/1/2004	14.24	1.29	136.08
8/2/2004	15.03	1.27	139.67
8/3/2004	15.76	1.24	142.42
8/4/2004	16.38	1.22	144.58
8/5/2004	16.32	1.24	142.38
8/6/2004	16.15	1.24	142.50
8/7/2004	15.89	1.24	140.63
8/8/2004	15.83	1.23	140.38
8/9/2004	16.43	1.23	142.04
8/10/2004	16.77	1.21	143.54
8/11/2004	17.53	1.18	146.92
8/12/2004	17.51	1.16	147.42
8/13/2004	16.65	1.17	144.46
8/14/2004	15.76	1.16	142.04
8/15/2004	15.53	1.16	141.75
8/16/2004	16.23	1.15	144.00
8/17/2004	17.58	1.08	150.29
8/18/2004	18.05	1.07	153.25
8/19/2004	16.95	1.13	148.67
8/20/2004	16.47	1.17	145.17
8/21/2004	15.64	1.17	142.67
8/22/2004	16.18	1.15	145.46
8/23/2004	16.55	1.13	147.21
8/24/2004	16.64	1.11	148.13
8/25/2004	16.61	1.11	187.42
8/26/2004	15.41	1.24	204.25
8/27/2004	12.62	1.54	183.17
8/28/2004	11.37	1.59	170.50
8/29/2004	11.71	1.46	178.71
8/30/2004	12.75	1.38	186.25
8/31/2004	12.77	1.32	187.92
9/1/2004	13.12	1.28	190.33
9/2/2004	13.15	1.28	189.92
9/3/2004	12.80	1.27	188.13
9/4/2004	11.03	1.26	185.33
9/5/2004	10.81	1.23	187.54
9/6/2004	11.38	1.21	191.13
9/7/2004	11.31	1.19	191.29

**SENSOR/RECORDER
DATA COLLECTED**

DATE	TEMP (°C)	DEPTH (ft)	SPECIFIC COND. <small>(mS/cm @ 25°C)</small>
9/8/2004	11.15	1.19	191.25
9/9/2004	11.07	1.18	191.71
9/10/2004	11.39	1.17	193.54
9/11/2004	10.90	1.17	192.33
9/12/2004	11.20	1.16	193.13
9/13/2004	10.90	1.21	188.04
9/14/2004	9.85	1.17	187.96
9/15/2004	9.11	1.15	186.04
9/16/2004	8.75	1.15	184.79
9/17/2004	8.49	1.14	184.58
9/18/2004	7.90	1.13	182.54
9/19/2004	8.80	1.12	185.88
9/20/2004	9.85	1.16	187.83
9/21/2004	9.68	1.23	180.75
9/22/2004	9.63	1.24	176.96
9/23/2004	9.38	1.27	176.88
9/24/2004	7.62	1.23	172.46
9/25/2004	5.83	1.25	162.83
9/26/2004	5.46	1.58	147.63
9/27/2004	5.42	1.65	138.17
9/28/2004	5.40	1.53	141.29