Prepared in cooperation with the
Alaska Department of Environmental Conservation and
City and Borough of Juneau

Baseline Characteristics of Jordan Creek, Juneau, Alaska

Open-File Report 2004-1220

U.S. Department of the Interior
U.S. Geological Survey

Cover. Jordan Creek at the Juneau Airport study reach, June 1999. View is looking upstream from transect 6. Photograph taken by Randy Host, U.S. Geological Survey

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By Randy H. Host and Edward G. Neal

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CONVERSION FACTORS, VERTICAL DATUM, AND ABBREVIATIONS

Multiply	By	To obtain
	Length	
inch (in.)	2.54	centimeter (cm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	Area	
square mile (mi^2)	2.590	square kilometer (km^2)
	Flow rate	
foot per year (ft/yr)	0.3048	meter per year (m/yr)
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:

$$°F=(1.8\times°C)+32$$

Vertical coordinate information is referenced to the insert datum name (and abbreviation) here for instance, “North American Vertical Datum of 1988 (NAVD 88).”

Horizontal coordinate information is referenced to the insert datum name (and abbreviation) here for instance, “North American Datum of 1983 (NAD 83).”

Altitude, as used in this report, refers to distance above the vertical datum.

Specific conductance is given in microsiemens per centimeter at 25 degrees Celsius (µS/cm at 25 °C).

Concentrations of chemical constituents in water are given either in milligrams per liter (mg/L) or micrograms per liter (µg/L).

ABBREVIATIONS

Certain measurements used in this report are given only in metric units:

mL, milliliter

mm, millimeter

µm, micrometer

mg/L, milligrams per liter

µs/cm, microsiemens per centimeter

µg/L, micrograms per liter

WATER YEAR

Water year is the 12-month period, October 1 through September 30. The water year is designated by the calendar year in which it ends and which includes 9 of the 12 months. Thus, the year ending September 30, 2002, is called the “2002 water year.”

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Abstract

Anadromous fish populations historically have found healthy habitat in Jordan Creek, Juneau, Alaska. Concern regarding potential degradation to the habitat by urban development within the Mendenhall Valley led to a cooperative study among the City and Borough of Juneau, Alaska Department of Environmental Conservation, and the U.S. Geological Survey, that assessed current hydrologic, water-quality, and physical-habitat conditions of the stream corridor.

Periods of no streamflow were not uncommon at the Jordan Creek below Egan Drive near Auke Bay stream gaging station. Additional flow measurements indicate that periods of no flow are more frequent downstream of the gaging station. Although periods of no flow typically were in March and April, streamflow measurements collected prior to 1999 indicate similar periods in January, suggesting that no flow conditions may occur at any time during the winter months. This dewatering in the lower reaches likely limits fish rearing and spawning habitat as well as limiting the migration of juvenile salmon out to the ocean during some years.

Dissolved-oxygen concentrations may not be suitable for fish survival during some winter periods in the Jordan Creek watershed. Dissolved-oxygen concentrations were measured as low as 2.8 mg/L at the gaging station and were measured as low as 0.85 mg/L in a tributary to Jordan Creek. Intermittent measurements of pH and dissolved-oxygen concentrations in the mid-reaches of Jordan Creek were all within acceptable limits for fish survival, however, few measurements of these parameters were made during winter-low-flow conditions. One set of water quality samples was collected at six different sites in the Jordan Creek watershed and analyzed for major ions and dissolved nutrients. Major-ion chemistry showed Jordan Creek is calcium bicarbonate type water with little variation between sampling sites.

Introduction

Jordan Creek historically has provided healthy habitats for anadromous fish populations, including coho, chum, and pink salmon; cutthroat and steelhead/rainbow trout; and Dolly Varden. Jordan Creek is one of several streams within the Mendenhall Valley, City and Borough of Juneau, Alaska (fig. 1). Duck Creek, a watershed of similar size located just west of Jordan Creek watershed in a more heavily developed portion of the Mendenhall Valley, has experienced fundamental declines in water quality and fish habitat. In recent years, local residents along with city, state, and federal officials have become concerned that urban development within the Mendenhall Valley could also degrade water quality and aquatic habitat in the Jordan Creek watershed.

In 1999, the U. S. Geological Survey (USGS), in cooperation with the Juneau International Airport (City and Borough of Juneau, CBJ) and Alaska Department of Environmental Conservation (ADEC), launched an investigation to document streamflow, water-quality, and physical-habitat characteristics of the Jordan Creek stream corridor. Data collected for this study will aid managers and planners in evaluating and prescribing future stream-habitat protection.

Purpose and Scope

The purpose of this study was to collect streamflow, water-quality, and physical-habitat data on Jordan Creek. This report describes the environmental setting of the watershed; the hydrology and water-chemistry data collected on Jordan Creek and its tributaries through water year 2002; and the aquatic-habitat data collected on Jordan Creek in 1999 and 2000. The report also indicates how these data could be used to improve the understanding of hydrologic influences on fish population. The streamflow and water-quality data collected during this study can be retrieved from the USGS National Water System (NWIS) http://nwis.waterdata.usgs.gov/ak/nwis.

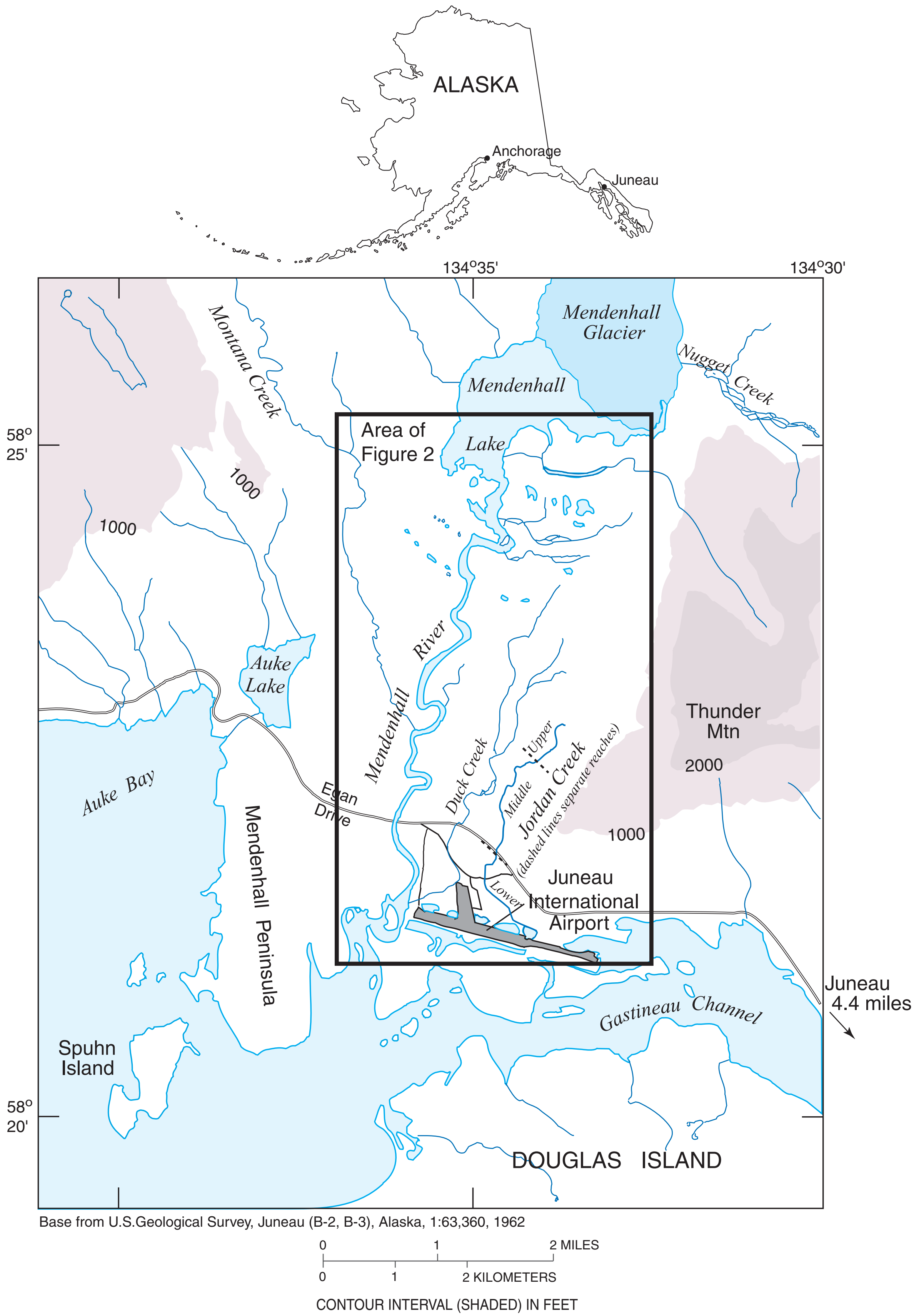

Figure 1. Location of Jordan Creek in Juneau, Alaska.

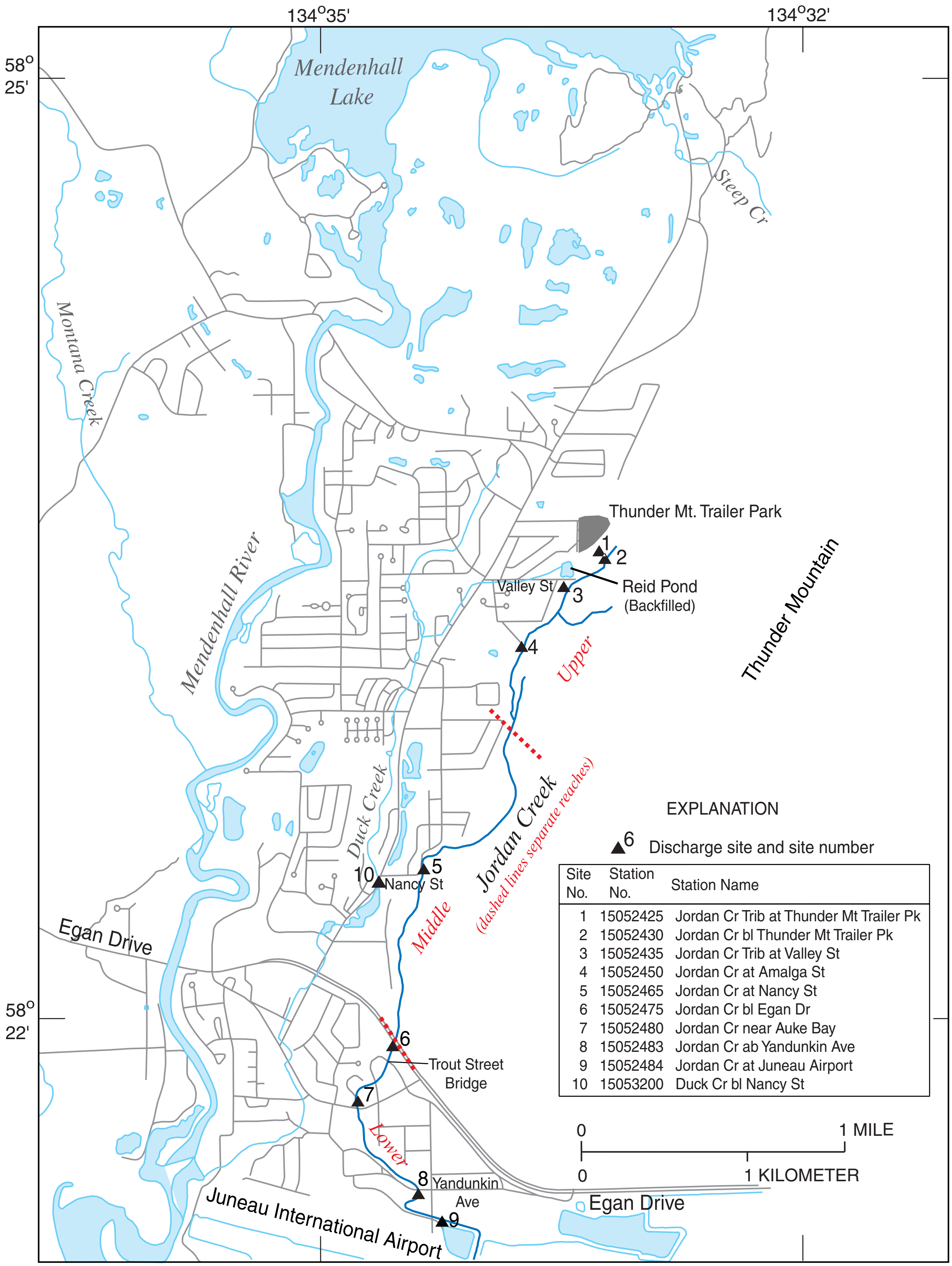

Figure 2. Location of discharge sites along Jordan Creek.

Table 1. Stream sites in the Jordan Creek watershed near Auke Bay, Alaska [--, not reported]

Site	USGS Station Number	Station Name	Drainage area (square miles)	Miles upstream from mouth
1	15052425	Jordan Creek Trib at Thunder Mt Trailer Park near Auke Bay	--	--
2	15052430	Jordan Creek below Thunder Mt Trailer Park near Auke Bay	0.8	3.4
3	15052435	Jordan Creek Trib at Valley Street near Auke Bay	--	--
4	15052450	Jordan Creek at Amalga Street near Auke Bay	1.1	3.1
5	15052465	Jordan Creek at Nancy Street near Auke Bay	2.3	2.0
6	15052475	Jordan Creek below Egan Drive near Auke Bay	2.6	1.5
7	15052480	Jordan Creek near Auke Bay	2.7	0.9
8	15052483	Jordan Creek above Yandunkin Avenue near Auke Bay	--	0.5
9	15052484	Jordan Creek at Juneau Airport near Auke Bay	3.0	0.4

Environmental Setting

The City of Juneau, located on the continental mainland, is surrounded by the archipelago of Southeast Alaska and is the largest population center in southeast Alaska (fig. 1). Juneau's total population has grown from 9,045 in 1959 to 30,711 in 2000 (U.S. Census Bureau, 2001). The Mendenhall Valley, located about 10 mi northwest of the downtown Juneau, is densely populated and has grown from 2,940 in 1966 (Barnwell and Boning, 1968) to more than 12,200 in 1998 (K.J. Bailey, City and Borough of Juneau, written commun., 2001). Jordan Creek flows through the eastern edge of the Mendenhall Valley and drains about a 3 mi^2 area (fig. 2, table 1).

The upper reaches of Jordan Creek originate along the western side of Thunder Mountain and are relatively undeveloped. The western slopes of Thunder Mountain attain altitudes exceeding 2,800 ft and are covered by spruce forest. The eastern banks of the upper and middle reaches of Jordan Creek border spruce forest and muskeg. The western banks for most of Jordan Creek are bordered by spruce forest and are intermittently bounded by housing developments and apartment complexes. Downstream from Egan Drive (fig. 2) the impacts of urbanization become more apparent as Jordan Creek flows through office complexes, parking lots, and multiple road crossings. Several storm drains enter Jordan Creek through this lower reach. Degradation of the riparian zone has occurred where buildings, parking lots, and roads encroach on the stream. Minor flooding occurred through this reach in August 1998 and December 1999.

Jordan Creek provides aquatic habitat for chum, coho, and pink salmon; cutthroat and steelhead/rainbow trout; and Dolly Varden. In 2002, the Alaska Department of Fish and Game (ADF&G) counted as many as 1,396 adult coho salmon within the Jordan Creek watershed (Judy Lum, ADF&G, written commun., 2003). In the spring of 2001, ADF&G counted 26,600 out-migrating coho salmon smolt in the Jordan Creek watershed (Brian Glynn, ADF&G, oral commun., 2001). These values indicate that high quality rearing habitat still exists in the watershed during some years.

Climate

The maritime climate of Juneau is characterized by frequent storms and abundant precipitation as is true for most of southeast Alaska. The highly variable temperature and precipitation within the region result from the mountainous terrain in the Juneau area. Mean annual precipitation from 1943 to 2002 is 53 inches at the Juneau Airport, compared to 93 inches in downtown Juneau, which is located just 10 mi to the southeast. The mean annual air temperature at Juneau International Airport for the same period is 41.9 ºF. The mean annual runoff from May 1997 to September 2002 at Jordan Creek below Egan Drive (site 6, fig. 2) is 40.5 inches. Regional storms dominate the fall months and produce the highest monthly precipitation. The lowest monthly precipitation is in early/late spring (U.S. National Oceanic and Atmosphere Administration, 2002, table 2).

Geology

The Mendenhall Valley is underlain by metamorphosed Mesozoic bedrock of igneous and sedimentary origins (Brew and Ford, 1985). Glacier moraines, deltaic deposits, marine sediments, and alluvial fan debris charac-

Table 2. Mean monthly temperature 1943-2002, and total monthly and annual precipitation and snowfall for 1997 through 2002, Juneau International Airport, Alaska [--, missing or not reported]

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	ANNUAL
Temperature (degrees Fahrenheit)													
1943-2002													
Mean daily maximum	34.8	35.1	36	45.9	54.9	62.4	60.7	60.2	55.1	48.2	44.2	35.9	47.8
Mean daily minimum	26.3	26.4	20.5	26.6	39.2	47.1	48.4	48.5	44	40.4	35.9	27.9	35.9
Mean	30.6	30.8	28.3	36.3	47.1	54.8	54.6	54.4	49.6	44.3	40.1	31.9	41.9
Precipitation (water equivalent, in inches)													
1997	2.73	8.17	3.91	4.41	3.25	3.51	10.40	3.93	8.26	7.85	4.63	13.60	74.60
1998	2.54	1.90	3.71	3.12	2.21	2.50	4.95	6.80	6.17	12.10	1.72	5.45	53.20
1999	8.14	2.66	2.58	7.48	5.69	2.69	4.10	6.77	10.60	12.20	5.77	10.30	79.00
2000	4.82	1.56	5.75	4.40	3.25	5.72	6.65	6.12	10.00	10.10	6.37	4.17	69.00
2001	7.43	4.40	3.33	2.19	5.19	1.65	7.26	3.66	8.37	7.80	3.62	4.49	59.40
2002	3.28	5.62	1.33	0.47	2.37	3.40	4.72	10.50	6.08	10.70	7.95	5.86	62.30
Mean (1997 -2002)	4.82	4.05	3.44	3.68	3.66	3.25	6.35	6.30	8.25	10.20	5.01	7.31	66.20
Snowfall (inches)													
1997	12.3	17.3	19.2	0.4	0	0	0	0	0	1.9	1.2	14.9	67.2
1998	12.9	0.5	--	--	--	--	--	--	--	--	--	22.8	--
1999	53.1	34.2	7.3	1.1	Trace	0	0	0	0	Trace	5.1	19.9	121
2000	13.6	4.6	Trace	Trace	0	0	0	0	Trace	2.3	1	2.3	23.8
2001	7.6	14.9	0.6	Trace	Trace	0	0	0	0	3.4	3.1	25.5	55.1
2002	18.9	28.9	2.5	Trace	0	0	0	0	0	0	0	17.7	68

terize the surficial geology. The Valley itself was formed by glaciation during the Pleistocene Epoch. The ice sheet in the Valley was 4,000 to 5,000 ft thick at its maximum about 18,000 years ago and began to melt about 17,000 years ago, depositing unconsolidated moraine sediments as it retreated (Coulter and others, 1965). As the ice sheet retreated about 10,000 to 12,000 years ago, marine sediments were deposited along with stream-sorted sands and gravels that contained organic and detrital materials from deltaic fans (Barnwell and Boning, 1968).

The Little Ice Age advance of the Mendenhall Glacier began 700 years before present as the climate cooled and became wetter (Motyka and Beget, 1996). The Mendenhall Glacier reached its maximum position about 240 years ago. Since then, the Mendenhall Glacier has been retreating continuously except for a minor advance in the 1830s (Lawrence, 1950; Lacher, 1999). As the Glacier retreated, several terminal moraines were deposited. Melt waters from the Mendenhall Glacier and Nugget Creek deposited glacial outwash sediments along the east side of the Valley and formed the channels of modern day Jordan and Duck Creeks. Vast amounts of gravels and sands were deposited nearly the entire length of the eastern side of Valley floor (Barnwell and Boning, 1968).

The Mendenhall Glacier retreated into the Mendenhall Lake basin between 1760 and 1900. Overflow from the lake basin topped the morainal material and created the modern-day Mendenhall River, which rapidly incised a channel through the flood-plain deposits on the western side of the valley. Owing to the formation of the modern-day Mendenhall River, melt waters from the Mendenhall Glacier no longer provide a source of streamflow to Jordan and Duck Creeks (Barnwell and Boning, 1968).

Regional Uplift

Regional land surface altitude is changing relative to sea level. Hicks and Shofnos (1965) first documented uplift rates in the Juneau area of about 0.05 ft/yr for the period from 1936 to 1962. Hicks and Shofnos speculated that the most probable cause of the uplift is rebound from localized deglaciation in combination with post-Wisconsin deglaciation. Hudson and others (1982) measured comparable uplift rates from 1959 to 1979.

Effects of such uplift to Mendenhall Valley hydrology and geomorphology are not well quantified. Channel incision in the lower reaches of the Mendenhall River will continue as the channel adjusts to continuous uplift with respect to sea level (Neal and Host, 1999). An increased frequency of stream channel dewatering and a lower water table relative to the land surface could be expected as the land surface rises with respect to sea level. These effects could be particularly significant in the distal reaches of both Jordan and Duck Creeks. Continued study of ground-water and streamflow data will be required to increase the understanding of such implications to the watersheds.

Streamflow Characteristics

Stream discharge data have been collected continuously since May 1997 at the USGS stream-gaging station, Jordan Creek below Egan Drive near Auke Bay (site 6 on fig. 2). Prior to October 1996, discharge data for this site were collected on an irregular basis at the site Jordan Creek at Trout Street Bridge near Auke Bay, Alaska, which was about 500 ft downstream but at a different datum.

The gaging station (site 6) drains an area of about 2.6 mi^2. A mean annual discharge of 7.76 ft^3/s was calculated for water years (ending September 30) 1998-2002 (U.S. Geological Survey, 1997-2002, figs. 3 and 4). The daily mean discharge at the gaging station for water years 2000-2002 is shown in figure 3, and the maximum, minimum and mean monthly discharges from May 1997 through September 2002 are shown in figure 4. The highest flows are typically in the fall in response to frequent storms. However, the maximum discharge recorded at the stream-gaging station was 149 ft^3/s on December 28, 1999. This peak flow was the result of a warm and wet storm that struck the Juneau area on December 27-28, 1999. The storm dropped 2.95 inches of rain at the Juneau International Airport (U.S. National Oceanic and Atmosphere Administration, 1999) and resulted in minor flooding along Jordan Creek below Egan Drive.

The relatively stable higher flows of the fall are in sharp contrast with the low flows of winter and early spring during which Jordan Creek periodically dewaters in the reach near the gaging station. Flow duration curves show the average percentage of time that specific daily flows are equaled or exceeded at sites where continuous records of daily flow are available, and can be used to determine the frequency at which critical flow thresholds are breached. Jordan Creek streamflow is equal to or less than 1 ft^3/s approximately 10 percent of the time and flow is less than 0.1 ft^3/s more than 1 percent of the time (fig. 5). Streamflow records after May of 1997 show two periods of channel dewatering, or zero flow, at the gaging station: the first is from March 3 through March 9, 1999 and the second is from April 8 through April 18, 2002.

Streamflow measurements made on March 10, 2000 (table 3) indicate that the stream channel downstream of Egan Drive may dewater when flows at the gage fall below 0.6 ft^3/s. Flows equal to or less than 0.6 ft^3/s have been recorded at the Egan Drive gaging station on 100 days during the period of record. Zero flow has been measured at Jordan Creek at Trout Street bridge on three separate occasions since 1984: March 3, 1989, March 5, 1996, and January 1, 1997. The discharge measurement of 0.36 ft^3/s made at this site on December 6, 1995 is considered low flow.

Same-day stream discharge measurements at six sites were collected nine times within the March 1999 to April 2001 time span (table 3, fig. 2). These measurements show Jordan Creek tends to increase in flow from Thunder Mt. Trailer Park (site 2) downstream to Nancy Street (site 5). During extended dry periods, Jordan Creek loses water in a downstream direction from Nancy Street (site 5) to Yandukin Avenue (site 8). Measurements indicate that it may not be uncommon for sites 2, 6, 7, and 8 to have no flow during periods of cold dry weather in the winter months. Similar periods of no flow have been shown to occur downstream of neighboring Duck Creek below Nancy Street (site 10) with a greater frequency than that of Jordan Creek (U.S. Geological Survey, 1997-2002).

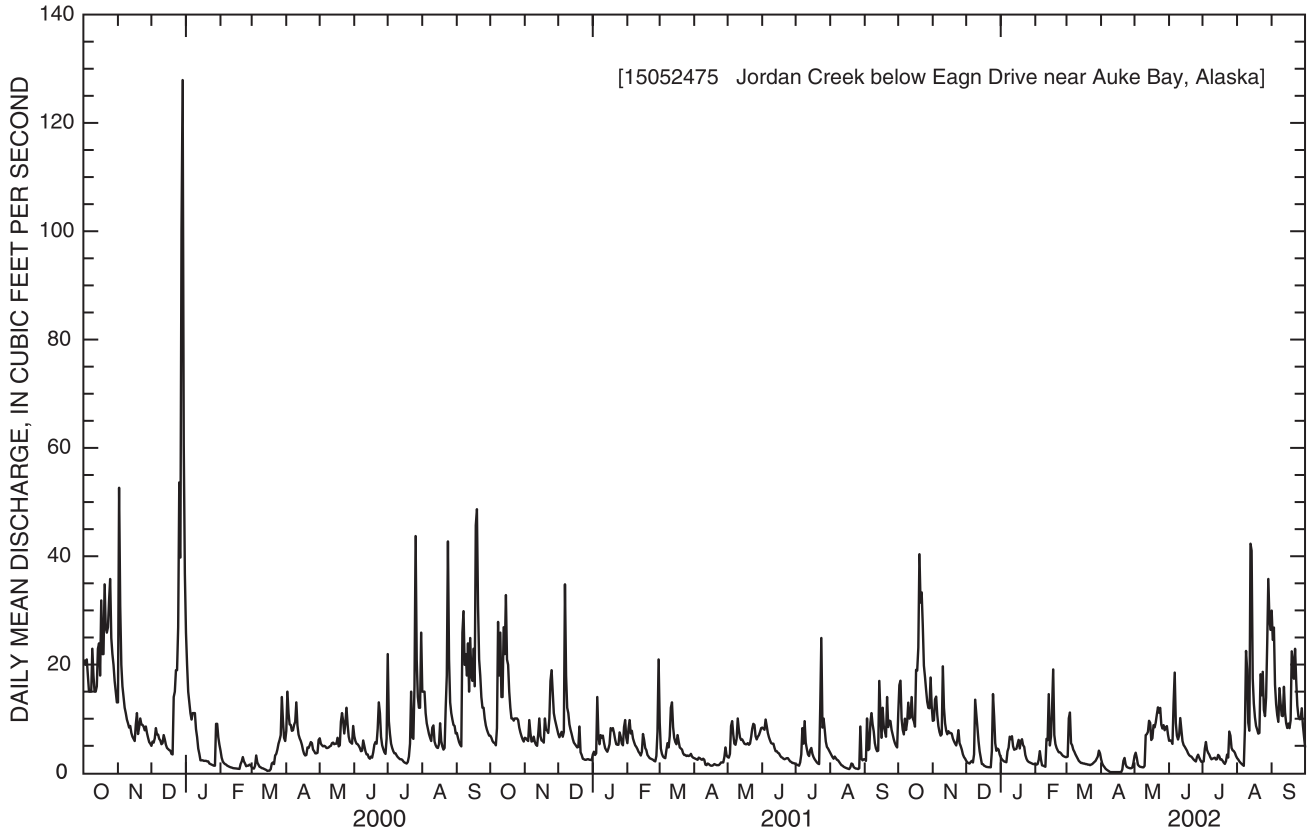

Figure 3. Hydrograph of Jordan Creek below Egan Drive near Auke Bay (site 6), daily mean discharge, 2000-2002 water year.

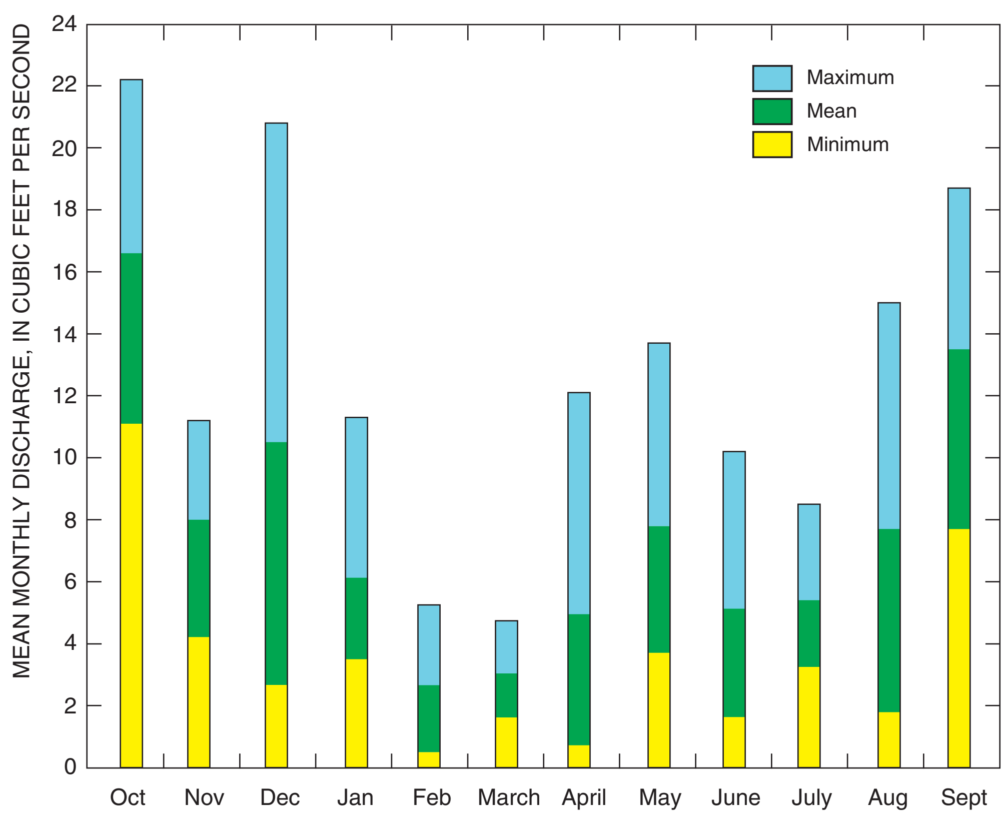

Figure 4. Maximum, minimum, and mean monthly discharges for Jordan Creek from May 1997 through September 2002.

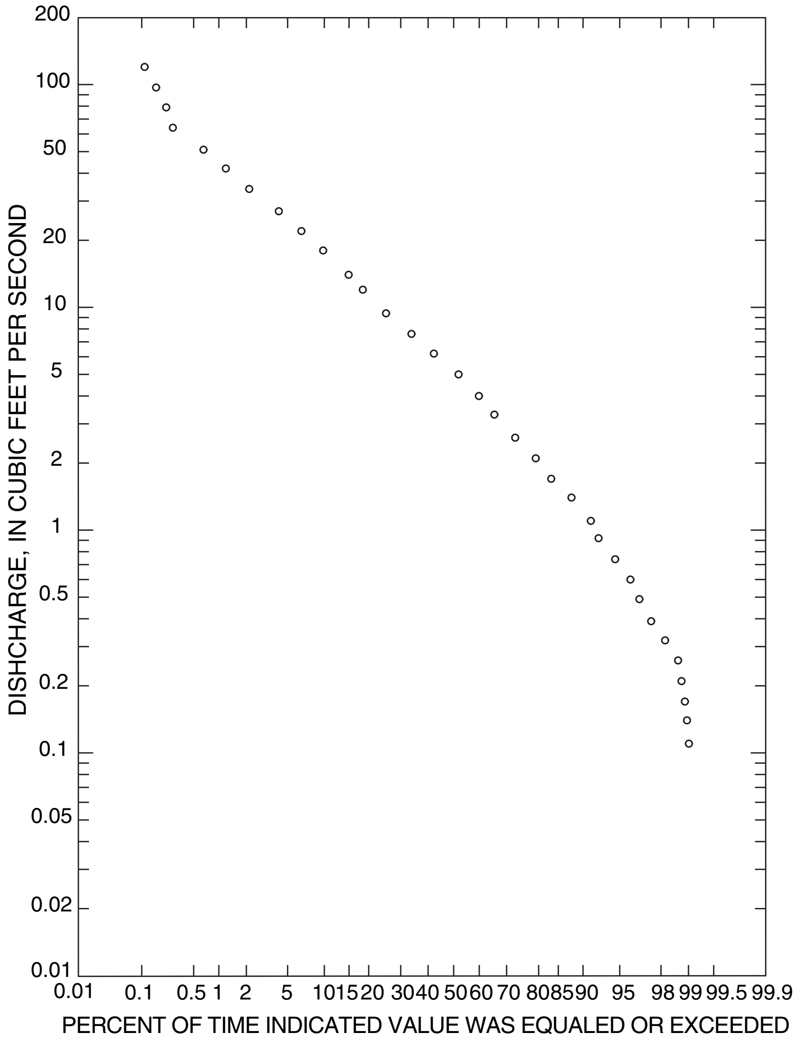

Figure 5. Flow-duration curve for Jordan Creek below Egan Drive near Auke Bay (site 6), 1998-2002.

Low Flow and Salmon Survival

Extremely low flow during the incubation or intergravel phase of salmonid life is one of the most limiting flow-related factors to salmon production in Southeast Alaska (Nadeau and Lyons, 1987). Low flows likely decrease wetted area, increase stranding in isolated pools, and increase predation vulnerability thereby reducing overall salmonid productivity (Sandercock, 1991, p. 420). Although the extent and recurrence interval of low flows resulting in channel dewatering have not been accurately determined, it appears that both are important factors in juvenile coho salmon productivity in Jordan Creek.

Smolt migration counts conducted by ADF&G in the spring further indicate that juvenile coho salmon smolt productivity may be linked with streamflow. In spring of 2001, the smolt count of 26,600 (Brian Glynn, ADF&G, oral commun., 2001) followed a relatively wet and warm winter and spring in which flows did not fall below 2 ft^3/s at the gaging station. In 2002, only 7,860 migrating smolt were counted (Judy Lum, ADF&G, written commun., 2003). This followed a cold and dry late-winter and 10 days of zero streamflow at the gaging station in early-spring.

Migration of juvenile chum and pink salmon out to the ocean also may be limited by low flows on Jordan Creek; but the data for the ADF&G Jordan Creek 2001 and 2002 migration counts were unavailable. It is known that emigration of pink salmon fry in Auke Creek, located about 3.5 mi west of Jordan Creek, often begins in March with few out migrating fry counted after late April (Judy Lum, ADF&G, written commun., 2003). This emigration period coincides with periods of no flow noted at the Jordan Creek gaging station in 1999 and 2002.

Water Quality

Methods

Water samples collected from Jordan Creek were analyzed for field parameters, major ions, dissolved solids, nutrients, trace elements, and suspended sediment. All the sampling equipment was thoroughly cleaned prior to use with a nonphosphate laboratory detergent, rinsed in 5 percent hydrochloric acid, rinsed with distilled water, and rinsed by stream water prior to the sample collection. Sampling equipment used for collecting volatile organic compounds (VOCs) also were cleaned with methanol and rinsed with organic-free water. Depth-integrated water samples were collected across the stream by equal discharge-increment method and processed in the lab using equipment and methods described by Shelton (1994). All water samples were sent to the USGS National Water-Quality Laboratory (NWQL) in Lakewood, Colorado, for analysis using standard USGS analytical methods (Fisherman, Friedman, 1989; Patton and Truitt, 1992; Fisherman, 1993; Connor and others, 1998). A minimum reporting level was used for nutrients and VOCs. A laboratory reporting level was used for the major ions and trace elements. A VOC was marked estimated when its existence

Table 3. Stream-discharge measurements at six sites in the Jordan Creek watershed, Alaska, and gains in stream discharge between sites, 1999-2001

[All data in cubic feet per second; e, estimated;--, no data; NA, not applicable]

Site	March 9, 1999		May 2, 1999		July 6, 1999	
	Discharge	Gain	Discharge	Gain	Discharge	Gain
2	0.00	NA	3.49	NA	0.21	NA
4	0.01	0.01	8.31	4.82	1.42	1.21
5	0.41	0.40	15.30	6.99	2.12	0.70
6	0.00	-0.41	15.30	0.00	2.50	0.38
7	0.00	0.00	13.90	-1.40	1.63	-0.87
8	0.00	0.00	13.80	-0.10	0.92	-0.71
	August 2, 1999		August 5, 1999		January 20, 2000	
	Discharge	Gain	Discharge	Gain	Discharge	Gain
2	0.46	NA	--	NA	0.23	NA
4	2.70	2.24	2.20	NA	1.40	1.17
5	5.32	2.62	--	NA	--	--
6	5.10	-0.22	4.12	NA	1.97	NA
7	5.27	0.17	2.81	-1.31	1.28	-0.69
8	5.31	0.04	3.29	0.48	0.73	-0.55
	March 10, 2000		March 14, 2000		April 10, 2001	
	Discharge	Gain	Discharge	Gain	Discharge	Gain
2	0.00	NA	e 0	NA	0.10	NA
4	0.16	0.16	0.06	NA	0.86	0.76
5	0.69	0.53	0.50	0.44	1.96	1.10
6	0.58	-0.11	0.27	-0.23	1.33	-0.63
7	0.07	-0.51	0.00	-0.27	1.40	0.07
8	0.00	-0.07	0.00	0.00	0.93	-0.47

was confirmed but there was uncertainty about the laboratory measurement. The measurement uncertainty could be caused by 1) calculated concentrations that are less than or greater than the lowest or greatest calibration standards, 2) the compound was detected in instrument blanks, 3) or matrix interference. Suspended sediment samples were sent to the USGS Sediment Analysis Laboratory in Vancouver, Washington for particle size and concentration analysis. A Hydrolab or a Yellow Springs Instrument meter was used to measure dissolved-oxygen concentration, specific conductance, pH, and water temperature at the time of sampling.

Specific Conductance

Specific conductance is a measure of how well water can conduct an electrical current and is determined by the concentration and type of ions in solution (Hem, 1985). Specific conductance can be used to indicate the amount of dissolved ions in water. Values within the Jordan Creek watershed ranged from 77 µs/cm at Jordan Creek near Auke Bay (site 7) to 205µs/cm at Jordan Creek tributary at Valley St. (site 3) (tables 4-10).

pH

The pH of water is a measure of hydrogen-ion activity and can range from 0 (very acidic) to 14 (very alkaline). A river not influenced by pollution generally has a pH in the range of 6.5 to 8.5 standard units (Hem, 1985). For fish survival, pH should be from 6.5 through 9.0 standard units: all pH values measured within the Jordan Creek watershed were within this range (tables 4-10).

Water Temperature

A water temperature sensor with 15-minute recording intervals was installed at the gaging station (site 6) on July 15, 1999. The sensor is accurate within 0.5°C. Additional temperature measurements at several cross-sections near the sensor showed no cross-sectional variation within the channel. Figure 6 shows daily mean water temperatures during the 2000-2002 water years. The maximum instantaneous water temperature recorded on Jordan Creek was 13°C on July 1, 2002. Minimum temperatures of 0°C were recorded on many days during the winter months.

Freezing water temperatures and freezing spawning beds are a significant source of mortality in the eggs and alevins of pink and chum salmon in Southeast Alaska streams (Sandercock, 1991, p. 420). Jordan Creek experienced both of these conditions during the study period. Extended periods of water temperature near or at 0°C occurred during every winter in the 2000-2002 water years. Additionally, zero flow conditions were observed under a frozen surface at the Jordan Creek gage. These data indicate that freezing water temperatures and spawning beds (redds) may limit pink and chum spawning habitat during some years.

Dissolved Oxygen

Dissolved-oxygen concentrations are directly related to atmospheric pressure and inversely related to water temperature. Sources of dissolved-oxygen include photosynthesis by aquatic plants, aeration, and inflow from turbulent water. Dissolved-oxygen can be depleted from decay of organic matter, direct chemical oxidation, and

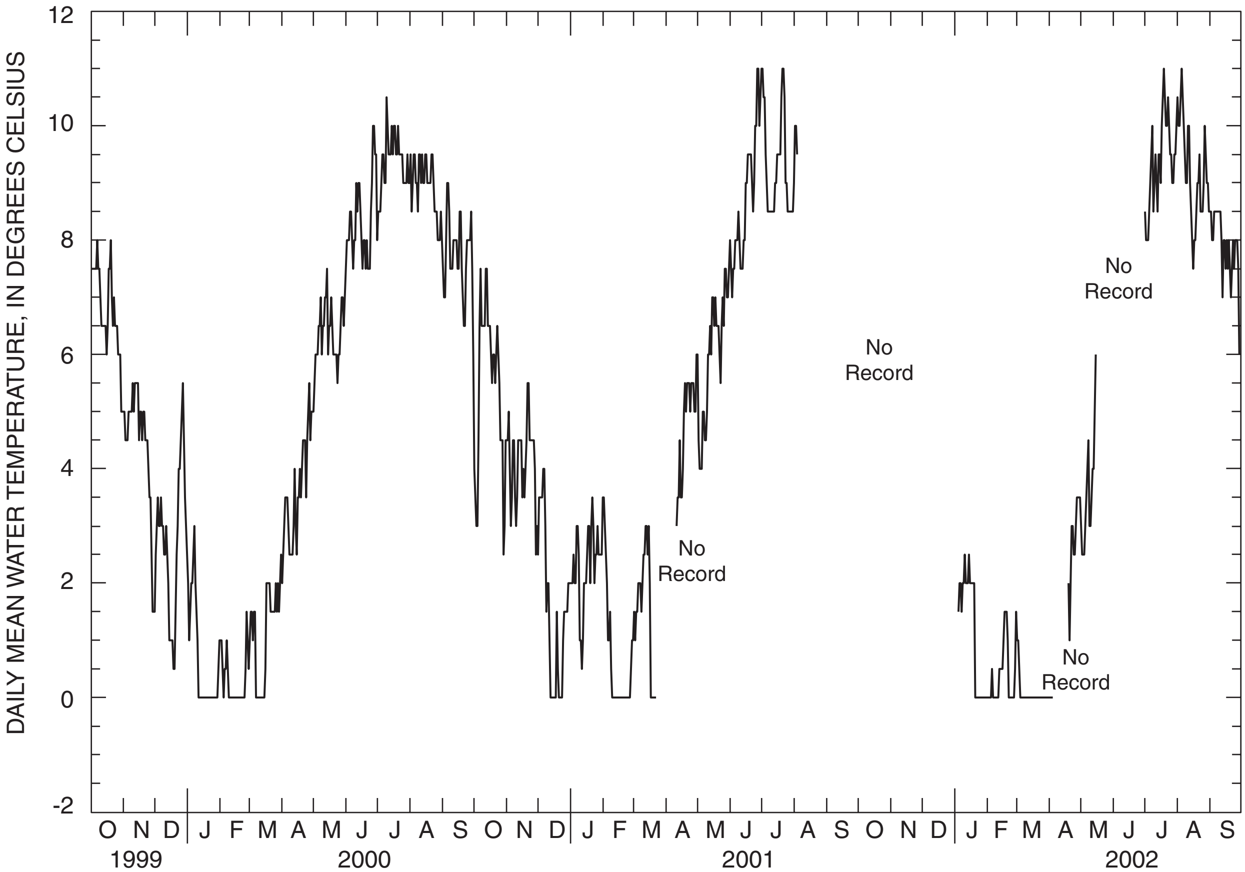

Figure 6. Daily mean water temperature of Jordan Creek below Egan Drive near Auke Bay (site 6), October 1999 through September 2002.

respiration from fish and aquatic plants (Brown, 1985). Dissolved-oxygen concentrations for seven sites on Jordan Creek are listed in tables 4-10.

Salmon and other fish require well-oxygenated water throughout their life span. Juvenile salmonid growth rates decline when dissolved-oxygen concentration is less than 5 mg/L and death will result at concentrations less than 1-2 mg/L (Brown, 1985). Adult salmon performance (swimming speeds) has been shown to decrease at dissolved-oxygen concentration less than 6.5-7.0 mg/L (Reiser and Bjornn, 1979). Dissolved-oxygen concentrations at Jordan Creek tributary at Valley St. (site 3) varied from 0.85 mg/L to 5.4 mg/L (table 5) indicating that dissolved-oxygen concentrations fall below critical threshold values for salmonids. Dissolved-oxygen concentrations at Jordan Creek below Egan Drive (site 6) ranged from 2.8 mg/L to 9.7 mg/L (table 8). A dissolved-oxygen concentration of 2.8 mg/L occurred at this site on January 29, 1998 at a flow of 1.5 ft^3/s, indicating that reduced concentrations of dissolved-oxygen may coincide with winter low-flow conditions. The remaining sites sampled within the Jordan Creek watershed ranged from 7.0 mg/L to 12.2 mg/L. This would indicate oxygen concentrations sufficient to support fish existed at the time the samples were collected (tables 4-10); however, no winter and few low-flow measurements of dissolved-oxygen were recorded at these sites.

Volatile Organic Compounds

The headwaters of Jordan Creek formerly contained Reid Pond, which formed when precipitation and ground water filled a gravel excavation site. Household debris, junked equipment, appliances, fuel, lubricant containers, overburden, and excess excavation material have been dumped into the site since its inception. The site is now completely backfilled and covered with overburden (Dave Gregovich, ADF&G, oral commun., 2001). A small seep on the fringe of the former pond flows into Jordan Creek. A water sample was collected from this seep on August 4, 1999 (Jordan Creek tributary at Valley St., site 3). In addition to the major ions and nutrients, the sample was analyzed for 85 VOCs (tables 5 and 11). An estimated dichlorodifluoromethane concentration of 1.68 µg/L was the only VOC that was detected at the USGS NWQL.

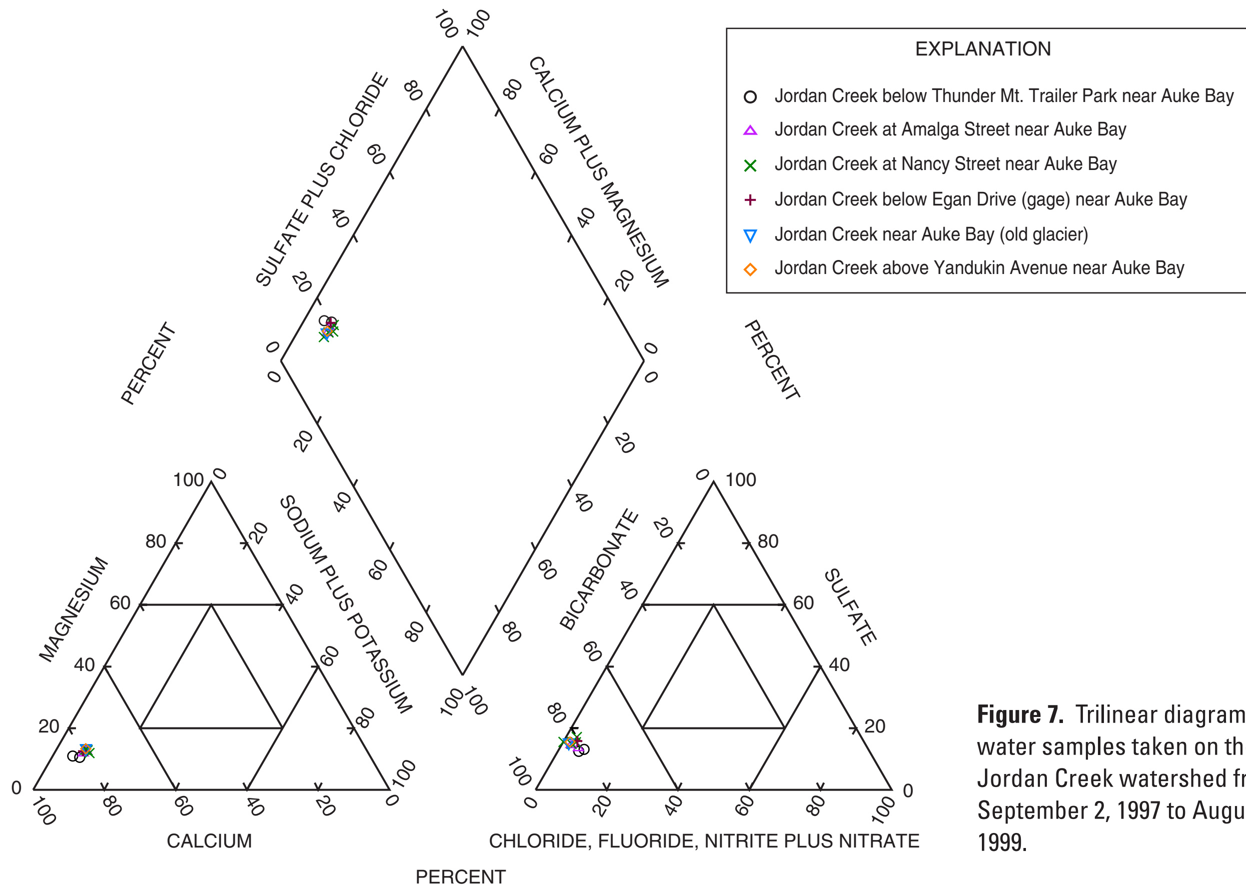

Figure 7. Trilinear diagram of water samples taken on the Jordan Creek watershed from September 2, 1997 to August 5, 1999.

Dichlorodifluoromethane, commonly known as Freon 12, is a chlorofluorocarbon that is used as a refrigerant for refrigerators and air conditioning units.

Major Ions and Dissolved Solids

Major ions and dissolved solids in rivers are generally derived from inorganic minerals and primarily result from soil and rock weathering. Streams draining basins with rocks and soils containing insoluble minerals typically contain lower concentrations of dissolved solids. Sixteen water samples, collected from the Jordan Creek watershed from September 1965 to August 1999 (sites 2-8, fig. 2) were analyzed for major ions and dissolved solids (tables 4-10). Concentrations of dissolved solids ranged from 56 mg/L at the gaging station (table 8) to 113 mg/L at the Jordan Creek tributary at Valley St. (table 5).

The trilinear diagram displays water-chemistry data in a manner that facilitates classification of the chemical composition of the water (Drever, 1997). On the basis of the samples collected from September 2, 1997 to August 5, 1999, the Jordan Creek watershed is classified as calcium bicarbonate water (fig. 7). The similarity in chemical composition among the sites indicates no significant inflow of water with different chemical composition within the watershed. Jordan Creek tributary at Valley St. (site 3) was not plotted on the trilinear diagram because of insufficient data.

Physical Characteristics of the Study Reaches

Procedure for Determining Physical Characteristics

Three stream reaches were selected to characterize physical attributes of Jordan Creek. The first, located on lower Jordan Creek, is identified as the Juneau Airport study reach. This reach is within the Juneau International Airport, just upstream of the taxiway. The second, located on middle Jordan Creek, is identified as the Nancy Street study reach. The third, located on upper Jordan Creek, is identified as the Thunder Mt. Trailer Park study reach. The three areas typify the mouth (lower reach), the middle (middle reach), and the headwaters (upper reach) of the watershed, respectively.

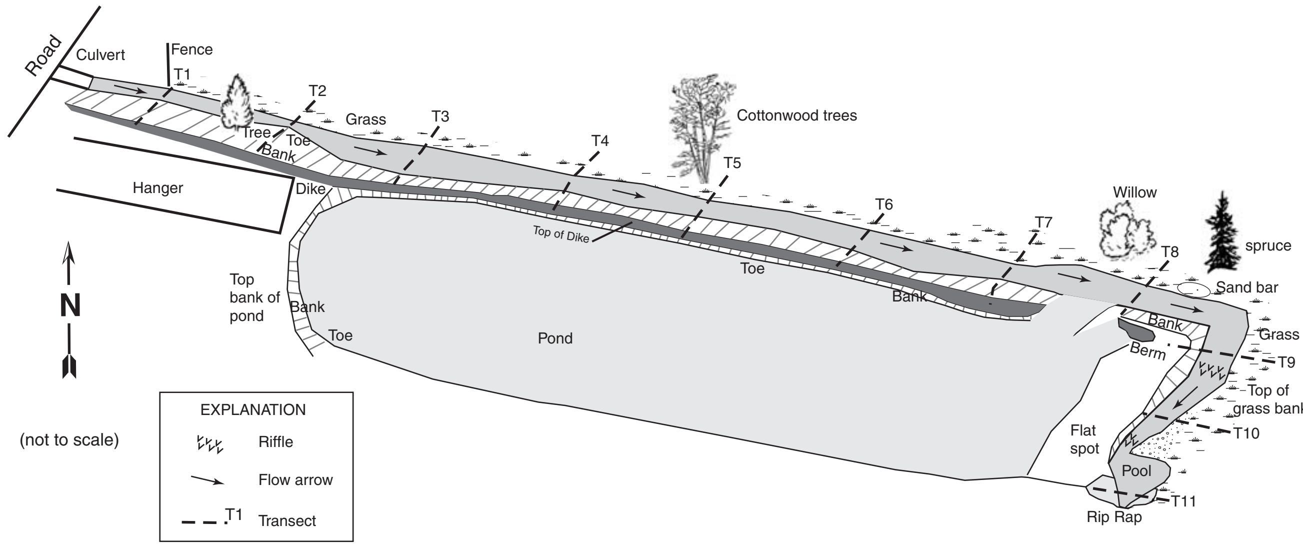

Figure 8. Major geomorphic features of Jordan Creek at the Juneau Airport study reach, June 1999.

Data were collected following protocols developed for the USGS National Water-Quality Assessment Program (Fitzpatrick and others, 1998). Physical characterization of each reach included channel-geometry surveys, channel widths, depths, water velocities, and riparian features. Eleven equally-spaced transects were surveyed at each physical characterization study reach (appendix 1). Data collected at each transect were habitat type, channel width, flow aspect, open canopy angles, bank characteristics, habitat cover, and point velocity measurements. Habitat type for this study is defined by woody debris, overhanging bank, and bank vegetation. Flow aspect is the direction of flow at the particular transect with respect to the compass referenced from true north. Open canopy angle is the maximum potential sun angle visible from the middle of the transect facing towards each bank with a maximum value of 180^{o}. Bank characteristics included bank angle, percentage of vegetation cover, and bank composition. Photographs of the right bank, left bank, and looking downstream/upstream were collected at each transect and archived in a database at the USGS office in Anchorage, Alaska.

Airport Study Reach

The Juneau Airport study reach is approximately 500 ft upstream from the mouth and 20 ft upstream from the taxiway (figs. 8 and 9). This reach has been intensively modified and channelized during airport construction projects. The entire airport reach is contained within levees to eliminate the potential for flooding within the airport property. The reach is approximately 1,380 ft in length with transects numbered from one at the upstream end of the reach to eleven at the downstream end (appendix 1). This reach is tidally influenced; tides of 20.0 ft or higher affect Jordan Creek stage at the Yandukin Avenue site (site 8).

The levee in this reach was breached between transects 7 and 8 at some time prior to 1999. This formed an inter-tidal pond on the south side of Jordan Creek, which created habitat for birds and rearing salmon. Because large bird populations near the airport create a safety threat to aircraft, airport personnel repaired the levee and backfilled the pond. The reach characterization for this study was done before the pond was filled.

Jordan Creek at Juneau Airport was surveyed June 3, 1999. Physical characteristics were measured on June 7, 1999. The physical characteristics are shown in appendixes 2 and 3. This reach had low sinuosity and consisted mainly of small pools and riffles flowing through a constructed channel with high levees. The dominant riparian land use along the study reach was classified as urban/industrial. Flow aspect ranged from 210^{o} at the downstream end of the reach to 101^{o} at the upstream end. Open canopy angles ranged from a minimum of 103^{o} at transect 2 to a maximum of 173^{o} at transect 11. The average open canopy angle for the reach was 143^{o}, or 79 percent open. Lack of trees and heavy vegetation along the south side of Jordan Creek increased the open canopy angle. Bank angles averaged about 24^{o} above horizontal. The bank angle along the levee on the south side of Jordan Creek averaged 38^{o} and is 100 percent covered in vegetation. The combination of dense grasses and shallow bank angles provided

Figure 9. Jordan Creek at the Juneau Airport study reach, June 1999. View is looking downstream from transect 9. Photograph taken by Randy Host, U.S. Geological Survey.

a stable bank. Bank substrate was predominately silt, organic detritus, and sand (0.063-2 mm) from transects 1 to 10. The bank material at transect 11 consisted of large boulders. Transect 11 is just upstream of a culvert that runs underneath the taxiway. The approach of the culvert was riprapped to minimize erosion around the culvert entrance. In the spring of 2001, all trees remaining along this reach were cut down.

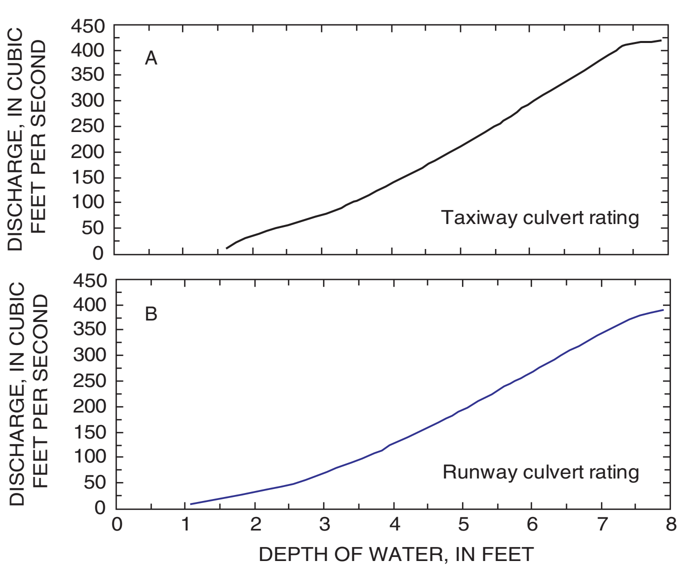

Figure 10. Relation between instantaneous discharge and instantaneous gage height for (A) taxiway culvert and (B) runway culvert.

Hydraulic Analysis of Culverts within the Airport Study Reach

Two separate culverts in Jordan Creek run underneath the runway and taxiway at the Juneau International Airport. Both culverts are subject to tidal influence and observed to be completely submerged by seawater on a 20.0-ft high tide. Culvert and channel geometry just upstream of the culvert entrance were surveyed and data were analyzed using the USGS Culvert Analysis Program (Fulford, 1995) to estimate the maximum routing capability of each culvert. The taxiway and runway culverts are both round aluminum corrugated culverts with diameters of 7.9 ft and roughness coefficients of 0.021 (Bodhaine, 1968). The culverts are mitered with concrete headwalls and wingwalls. The taxiway culvert is located upstream of the runway culvert and has a span 242 ft. The runway culvert runs has a span of 370 ft. Figures 10A and 10B show standard stage-discharge ratings for the taxiway and runway culverts.

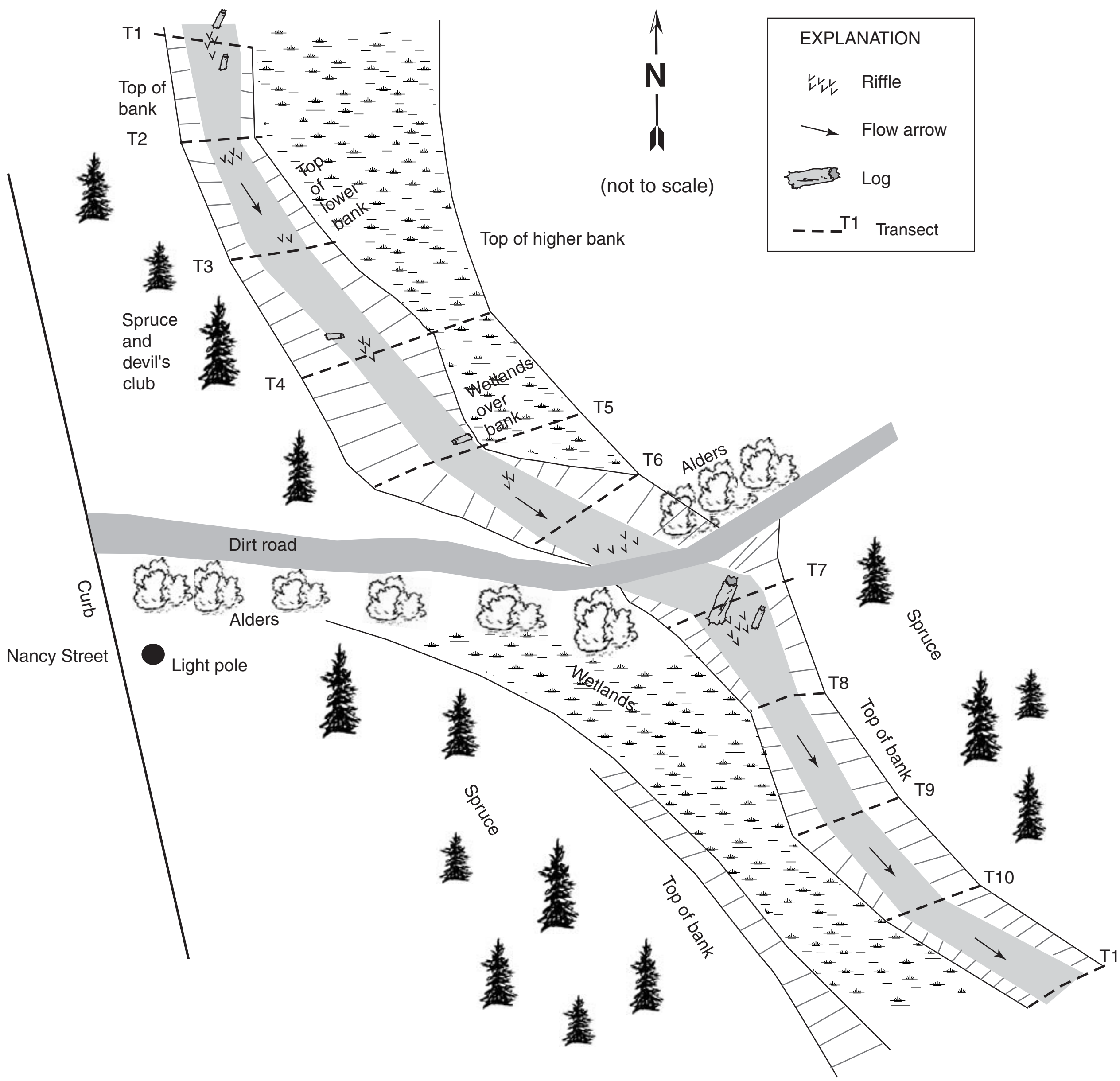

Figure 11. Major geomorphic features of Jordan Creek at the Nancy Street study reach, December 1999 and January 2000.

Nancy Street Study Reach

The Nancy Street study reach is near the middle of the Jordan Creek watershed (figs. 11 and 12), in an environment with few anthropogenic disturbances. A few houses are built along the banks of Jordan Creek just upstream from this reach. A spruce and alder buffer ranging from 50 to 120 ft separates the creek from Nancy Street. The reach is composed of riffles, runs, and pools with heavy vegetation along its banks. Eleven equally-spaced transects were surveyed in a 420 foot reach. These transects were numbered from 1 at the upstream end of the reach to 11 at the downstream end (appendix 1).

The Nancy Street study reach was surveyed December 8, 1999. Physical characteristics were measured on January 8, 2000. The physical characteristics are shown in appendixes 2 and 3. Flow aspects ranged from 95° at the upstream end of the reach to 181° at transect 8. The open canopy angles ranged from a minimum of 0° at transect 4 to a maximum of 76° at transect 5. The mean open canopy angle for the reach was about 36°, or 20 percent open. The dominant riparian land use for the reach was undeveloped woodlands. Large spruce, alders and devil's club along its banks provided stream canopy cover. The average bank angle was about 43° above horizontal. The bank was 90 to 100 percent covered with vegetation with the bank mate-

Figure 12. Jordan Creek at the Nancy Street study reach. View is looking downstream from transect 1. Photograph taken by Randy Host, U.S. Geological Survey.

rial composed primarily of silt, organic detritus, and sand. Bank erosion was noted at all transects except transects 9 and 10. There was one all-terrain vehicle (ATV) or four-wheel drive dirt road crossing located between transect 6 and 7. Bank degradation appeared to be accelerated between these two transects. Undercut banks, overhanging vegetation, and submerged woody debris provided potential fish habitat. The bed substrate consisted predominately of sand (0.063-2 mm) and coarse gravels (16-32 mm).

Thunder Mt. Trailer Park Study Reach

The Thunder Mt. Trailer Park study reach is near the headwaters of the watershed (figs. 13 and 14). This reach is situated within a mostly undisturbed natural environment; however, there is an extensive network of ATV trails that run throughout this area. The ATV trails are used frequently and cross Jordan Creek. The reach is composed of riffles, runs, and pools with dense vegetation along the banks. The reach is approximately 360 ft in length with 11 equally-spaced transects numbered sequentially beginning at the upstream end of the reach (appendix 1).

The Thunder Mt. Trailer Park reach was surveyed May 22, 1999. Physical characteristics were measured on July 1, 1999. The physical characteristics are shown in appendixes 2 and 3. Flow aspects ranged from 234° at the upstream end of the reach to 195° at transect 9. The open canopy angles ranged from a minimum of 0° at transects 1 and 6 to a maximum of 41° at transect 3. The average open canopy angle for the reach was about 17°, or 9 percent open. The dominant riparian land use for the reach was undeveloped spruce forest. Large spruce, alder trees, along with devil's club along its banks gave the stream canopy cover. The average bank angle was about 41° above horizontal. The bank was 100 percent covered with vegetation and bank material was composed primarily of silt/organic detritus. Bank erosion was evident at all transects except transects 1, 2, and 4. There were two ATV or four-wheel drive crossings within the reach. One ATV trail was located between transects 5 and 6 and the second ATV trail was adjacent to transects 8 and 9 on the right bank (looking downstream). Bank degradation was accelerated on both banks between these transects. Undercut banks, overhanging vegetation, and submerged woody debris provided potential fish habitat. The bed substrate consisted predominately of sand (0.063-2 mm) and coarse gravels (16-32 mm).

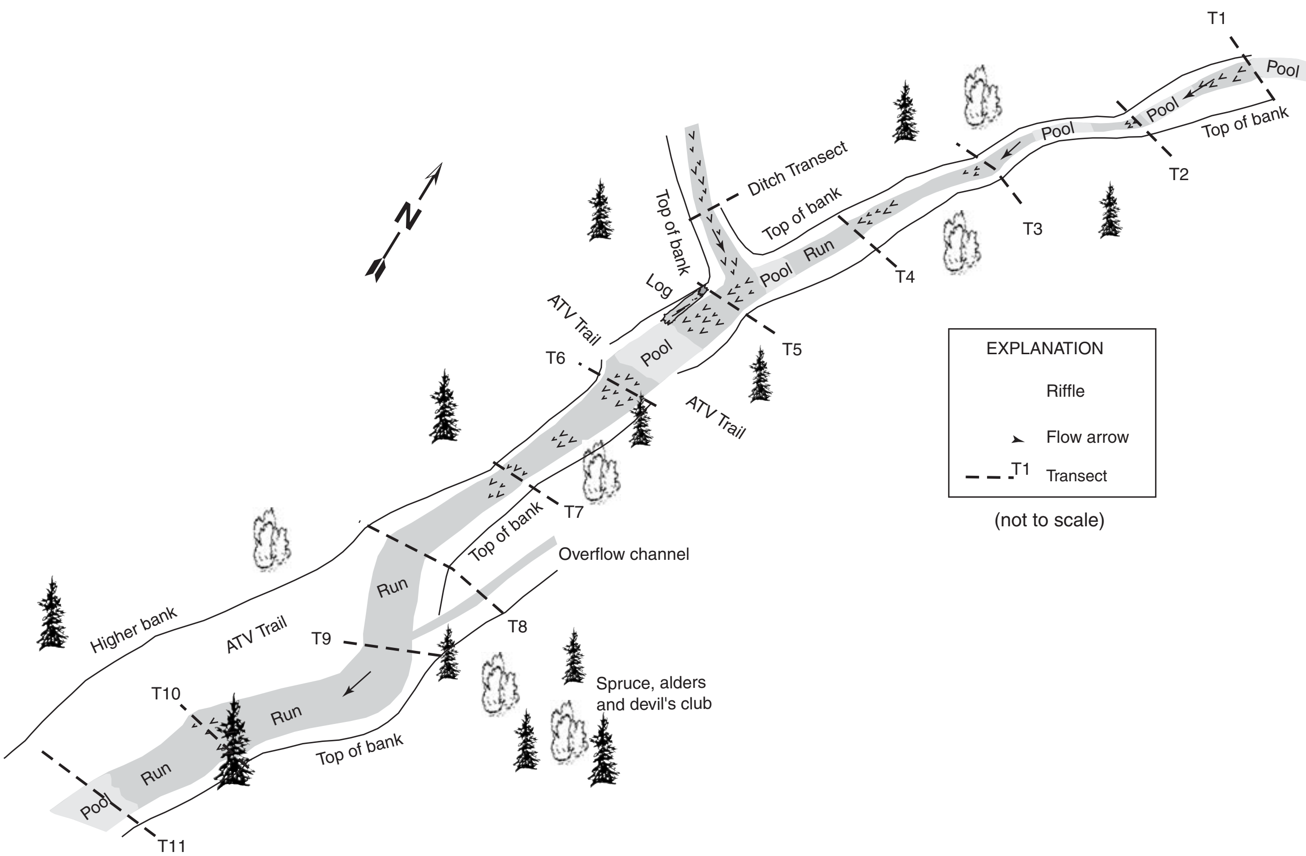

Figure 13. Major geomorphic features of Jordan Creek at Thunder Mt. Trailer Park study reach, May and July 1999.

A tributary to Jordan Creek, known as Jordan Creek tributary at Thunder Mt. Trailer Park (site 1), is located between transects 4 and 5. The tributary is a man-made ditch constructed by Thunder Mt. Trailer Park that runs along the eastern fringe of the trailer park for drainage purposes. The transect of this ditch is shown in appendix 1. The physical characteristics are shown in appendixes 2 and 3. Flow aspect was 165° at the confluence of Jordan Creek. The open canopy angle was 41°, or 23 percent open. The bank angles were 61° on the left bank and 55° on the right bank. The bank was 100 percent covered with vegetation and bank material was composed primarily of sand and gravels (.22-64mm). Active erosion was occurring along the banks due to the steep bank angle. The tributary was observed to be dry several times during the study period.

Summary

The Jordan Creek watershed, located in the Mendenhall Valley, drains an area of about 3 mi^2. Melt waters from the Mendenhall Glacier no longer provide a source of streamflow to Jordan Creek because of the formation of the modern-day Mendenhall River. The rise in land surface with respect to sea level will likely lower the water table and may result in increased frequency of stream channel dewatering of distal reaches of Jordan and Duck Creeks.

Jordan Creek streamflow is equal to or less than 1 ft^3/s approximately 10 percent of the time and flow is less than 0.1 ft^3/s more than 1 percent of the time. Streamflow data indicate that periods of no flow are not uncommon at the Jordan Creek below Egan Drive stream gaging station. Although periods of no flow typically were in March and April, streamflow measurements collected prior to stream-gage installation indicate similar periods in January; this indicates no flow conditions may occur at any time during the winter months. Additional streamflow measurements indicate that the periods of no flow occur more frequently downstream of the gaging station. Dewatering in the lower reaches likely limits fish rearing and spawning habitat as well as the migration of juvenile chum and pink salmon out to the ocean during some years.

Frequent measurements of 0°C water temperature and a single dissolved-oxygen concentration measurement of 2.8 mg/L indicate that the stream channel near the stream-gaging station may not be suitable for fish survival during

Figure 14. Jordan Creek at Thunder Mt. Trailer Park study reach. View is looking downstream from transect 1. Photograph taken by Randy Host, U.S. Geological Survey.

some winter periods. Measurement of dissolved-oxygen concentrations in Jordan Creek tributary at Valley St. ranged from 0.85 to 5.4 mg/L indicating that it may also be unsuitable for fish survival. Dissolved-oxygen concentrations in the middle reach of Jordan Creek were all within acceptable limits for fish survival; however, few measurements of these parameters were made during winter-low-flow conditions. Water-quality samples collected at six different sites in the Jordan Creek drainage revealed little difference in major-ion chemistry throughout the watershed. Water sampled from Jordan Creek was classified as calcium bicarbonate. In addition to the major ions and nutrients, water from Jordan Creek tributary at Valley St. was analyzed for 85 volatile organic compounds. Dichlorodifluoromethane, commonly known as Freon 12, was the only compound with a concentration measured greater than the minimum reporting level.

The upper and middle reaches of Jordan Creek are relatively untouched by development with respect to the reaches below Egan Drive. The eastern banks of middle and upper Jordan Creek border spruce forest and muskeg while housing developments and apartment complexes intermittently bound the western banks. Below Egan Drive degradation of the riparian zone has occurred as a result of buildings, parking lots, and roads encroaching on the stream. The surveyed reach of the stream at the Juneau Airport shows a reduction in physical habitat diversity.

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Tables 4-11

Table 4. Physical properties and water-quality of streamflow samples collected from Jordan Creek below Thunder Mt. Trailer Park, September 1998 through August 1999 (site 2)

[ft^3/s, cubic feet per second; µs/cm, microsiemens per centimeter; °C, degrees Celsius; mg/L, milligrams per liter; --, no data; E, estimated]

Date (mm/dd/yy)	Time	Discharge (ft^3/s)	Specific conductance (µs/cm)	pH	Water temperature (°C)	Dissolved oxygen (mg/L)	Calcium dissolved (mg/L)	Magnesium dissolved (mg/L)	Sodium dissolved (mg/L)	Potassium dissolved (mg/L)
09/01/98	1000	5.7	127	7.0	8.0	9.7	17.6	1.36	0.73	2.1
05/02/99	1505	3.5	132	7.2	5.0	10.2	--	--	--	--
07/06/99	1330	0.21	123	6.8	7.1	7.4	--	--	--	--
08/02/99	1245	0.46	120	7.2	8.0	7.0	--	--	--	--
08/04/99	1100	0.35	122	7.0	7.5	7.5	19.3	1.53	0.82	1.1
Date (mm/dd/yy)	**Time**	**Bicarbonate dissolved (mg/L as HCO_3)**	**Alkalinity dissolved (mg/L as $CaCO_3$)**	**Sulfate dissolved (mg/L)**	**Chloride dissolved (mg/L)**	**Fluoride dissolved (mg/L)**	**Silica dissolved (mg/L)**	**Iron dissolved (mg/L)**	**Maganese dissolved (mg/L)**	**Solids residue at 180 °C dissolved (mg/L)**
09/01/98	1000	57	46	7.2	0.50	<0.1	4.4	13.1	< 4.	77
08/04/99	1100	61	50	7.2	0.38	<0.1	5.0	E 6.0	E 1.5	79
Date (mm/dd/yy)	**Time**	**Nitrogen, nitrite dissolved (mg/L as N)**	**Nitrogen, NO_2+NO_3 dissolved (mg/L as N)**	**Nitrogen, Ammonia dissolved (mg/L as N)**	**Nitrogen, ammonia + organic dissolved (mg/L as N)**	**Phosphorus dissolved (mg/L)**	**Phosphorus, ortho dissolved (mg/L as P)**			
09/01/98	1000	<0.01	0.94	<0.02	0.11	<0.01	<0.01			
08/04/99	1100	<0.01	0.84	<0.02	<0.1	<0.05	<0.01			

Table 5. Physical properties and water-quality of streamflow samples collected from Jordan Creek tributary at Valley St., September 1998 through August 1999 (site 3)

[ft³/s, cubic feet per second; µs/cm, microsiemens per centimeter; °C, degrees Celsius; mg/L, milligrams per liter; --, no data; µg/L, micrograms per liter]

Date (mm/dd/yy)	Time	Discharge (ft³/s)	Specific conductance (µs/cm)	pH	Water temperature (°C)	Dissolved oxygen (mg/L)	Calcium dissolved (mg/L)	Magnesium dissolved (mg/L)	Sodium dissolved (mg/L)	Bicarbonate dissolved (mg/L as HCO_3)
05/02/99	1405	0.12	152	6.9	3.5	5.4	--	--	--	--
07/06/99	1240	0.08	201	6.7	8.0	0.85	--	--	--	--
08/02/99	1210	0.22	205	6.7	8.0	2.9	--	--	--	--
08/04/99	1000	0.2	209	6.9	8.5	2.0	29.5	2.2	1.6	115

Date (mm/dd/yy)	Time	Alkalinity dissolved (mg/L as $CaCO_3$)	Sulfate dissolved (mg/L)	Chloride dissolved (mg/L)	Fluoride dissolved (mg/L)	Silica dissolved (mg/L)	Iron dissolved (mg/L)	Maganese dissolved (mg/L)	Bromide dissolved (mg.L)	Arsenic dissolved (µg/L)
08/04/99	1000	94	4.4	2.5	<0.1	7.1	4960.0	245	<0.01	<1

Date (mm/dd/yy)	Time	Barium dissolved (µg/L)	Beryllium dissolved (µg/L)	Cadmium dissolved (µg/L)	Chromium dissolved (µg/L)	Colbalt dissolved (µg/L)	Copper dissolved (µg/L)	Lithium dissolved (µg/L)	Mercury dissolved (µg/L)	Lead dissolved (µg/L)
08/04/99	1000	99.0	<1.6	<8	8.1	<7	<10	<6	<0.1	<100

Date (mm/dd/yy)	Time	Molybdenum dissolved (µg/L)	Nickel dissolved (µg/L)	Silver dissolved (µg/L)	Selenium (µg/L)	Strontium dissolved (µg/L)	Vanadium dissolved (µg/L)	Zinc dissolved (µg/L)	Solids, Residues at 180 °C Diss-loved (mg/L)
08/04/99	1000	<50	<40	<4	<1	125.0	<10	<20	113

Table 6. Physical properties and water-quality of streamflow samples collected from Jordan Creek at Amalga Street, July 1997 through August 1999 (site 4)

[ft³/s, cubic feet per second; µs/cm, microsiemens per centimeter; °C, degrees Celsius; mg/L, milligrams per liter; --, no data; E, estimated]

Date (mm/dd/yy)	Time	Discharge (ft³/s)	Specific conductance (µs/cm)	pH	Water temperature (°C)	Dissolved oxygen (mg/L)	Calcium dissolved (mg/L)	Magnesium dissolved (mg/L)	Sodium dissolved (mg/L)	Potassium dissolved (mg/L)	Bicarbonate dissolved (mg/L as HCO_3)
07/14/97	1410	4.3	--	--	7.0	--	--	--	--	--	--
08/13/97	1400	4.0	--	--	--	--	--	--	--	--	--
08/27/98	1015	2.4	128	7.0	7.5	8.1	19.5	1.7	1.2	1.8	61
10/19/98	1200	13.0	--	--	7.0	--	--	--	--	--	--
10/20/98	1730	47.0	--	--	7.0	--	--	--	--	--	--
05/02/99	1330	8.3	120	6.8	4.0	9.7	--	--	--	--	--
05/28/99	1830	17.0	--	--	6.0	--	--	--	--	--	--
07/06/99	1431	1.4	108	7.0	8.5	9.9	--	--	--	--	--
08/02/99	1331	2.7	117	7.3	9.0	8.4	--	--	--	--	--
08/05/99	900	2.2	115	6.9	7.0	11.6	16.7	1.6	1.1	1.6	52

Date (mm/dd/yy)	Time	Alkalinity dissolved (mg/L as $CaCO_3$)	Sulfate dissolved (mg/L)	Chloride dissolved (mg/L)	Fluoride dissolved (mg/L)	Silica dissolved (mg/L)	Iron dissolved (mg/L)	Maganese dissolved (mg/L)	Solids residue at 180 °C dissolved (mg/L)	Nitrogen, nitrite dissolved (mg/L as N)	Nitrogen, NO_2+NO_3 dissolved (mg/L as N)
07/14/97	1410	--	--	--	--	--	--	--	--	--	--
08/13/97	1400	--	--	--	--	--	--	--	--	--	--
08/27/98	1015	50	7.8	0.79	<0.1	5.9	331	55.4	79	<0.01	0.59
08/05/99	900	44	<0.1	<0.1	<0.1	5.4	80	20.8	70	<0.01	0.39

Date (mm/dd/yy)	Time	Nitrogen, Ammonia dissolved (mg/L as N)	Nitrogen, ammonia + organic dissolved (mg/L as N)	Phosphorus dissolved (mg/L)	Phosphorus, ortho dissolved (mg/L as P)	Sediment Suspended (mg/L)
07/14/97	1410	--	--	--	--	3
08/13/97	1400	--	--	--	--	14
08/27/98	1015	0.05	0.1	0.01	<0.01	6
08/05/99	900	0.1	E 0.07	<0.05	0.01	--

Table 7. Physical properties and water-quality of streamflow samples collected from Jordan Creek at Nancy Street, September 1998 through August 1999 (site 5)

[ft^3/s, cubic feet per second; µs/cm, microsiemens per centimeter; °C, degrees Celsius; mg/L, milligrams per liter; --, no data; E, estimated]

Date (mm/dd/yy)	Time	Discharge (ft^3/s)	Specific conductance (µs/cm)	pH	Water temperature (°C)	Dissolved oxygen (mg/L)	Calcium dissolved (mg/L)	Magnesium dissolved (mg/L)	Sodium dissolved (mg/L)	Potassium dissolved (mg/L)	Bicarbonate dissolved (mg/L as HCO_3)
05/02/99	1245	15.3	94	--	3.5	10.9	--	--	--	--	--
07/06/99	1505	2.10	107	7.3	10.0	10.9	--	--	--	--	--
08/02/99	1405	5.3	100	7.4	9.0	10.3	--	--	--	--	--
08/04/99	1130	4	74	7.3	8.5	10.0	16.0	1.5	1.1	1.1	50
Date (mm/dd/yy)	**Time**	**Alkalinity dissolved (mg/L as $CaCO_3$)**	**Sulfate dissolved (mg/L)**	**Chloride dissolved (mg/L)**	**Fluoride dissolved (mg/L)**	**Silica dissolved (mg/L)**	**Iron dissolved (mg/L)**	**Maganese dissolved (mg/L)**	**Solids residue at 180 °C dissolved (mg/L)**	**Nitrogen, nitrite dissolved (mg/L as N)**	**Nitrogen, NO_2+NO_3 dissolved (mg/L as N)**
08/04/99	1130	41	7.7	0.6	<.1	5.4	63	41.7	69	<0.01	0.29
Date (mm/dd/yy)	**Time**	**Nitrogen, Ammonia dissolved (mg/L as N)**	**Nitrogen, ammonia + organic dissolved (mg/L as N)**	**Phosphorus dissolved (mg/L)**	**Phosphorus, ortho dissolved (mg/L as P)**						
08/04/99	1130	0.07	E .09	<0.05	<0.01						

Table 8. Physical properties and water-quality of streamflow samples collected from Jordan Creek below Egan Dr, July 1997 through August 1999 (site 6)

[ft^3/s, cubic feet per second; µs/cm, microsiemens per centimeter; °C, degrees Celsius; mg/L, milligrams per liter; --, no data]

Date (mm/dd/yy)	Time	Discharge (ft^3/s)	Specific conductance (µs/cm)	pH	Water temperature (°C)	Dissolved oxygen (mg/L)	Calcium dissolved (mg/L)	Magnesium dissolved (mg/L)	Sodium dissolved (mg/L)	Potassium dissolved (mg/L)	Bicarbonate dissolved (mg/L as HCO_3)
07/14/97	935	18.5	--	--	9.5	--	--	--	--	--	--
08/13/97	1330	41	--	--	12.0	--	--	--	--	--	--
09/02/97	1225	2.3	95	7.3	9.0	9.6	15.34	1.5	1.2	1.2	49
01/29/98	1345	1.5	88	7.3	2.0	2.8	12.22	1.2	1.1	0.8	37
09/02/98	1100	34	82	7.0	8.0	9.7	12.02	1.1	1.0	1.2	37
10/19/98	930	55	--	--	4.0	--	--	--	--	--	--
10/20/98	1240	146	--	--	8.0	--	--	--	--	--	--
08/05/99	1015	4.1	103	7.5	8.0	--	15.1	1.5	1.1	1.1	48

Date (mm/dd/yy)	Time	Alkalinity dissolved (mg/L as $CaCO_3$)	Sulfate dissolved (mg/L)	Chloride dissolved (mg/L)	Fluoride dissolved (mg/L)	Silica dissolved (mg/L)	Iron dissolved (mg/L)	Maganese dissolved (mg/L)	Solids residue at 180 °C dissolved (mg/L)	Nitrogen, nitrite dissolved (mg/L as N)	Nitrogen, NO_2+NO_3 dissolved (mg/L as N)
07/14/97	935	--	--	--	--	--	--	--	--	--	--
08/13/97	1330	--	--	--	--	--	--	--	--	--	--
09/02/97	1225	40	6.9	0.9	<0.1	5.5	89	46.2	66	<0.01	0.35
01/29/98	1345	30	6.1	0.8	<0.1	5.1	152	33.6	56	<0.01	0.27
09/02/98	1100	30	5.5	0.9	<0.1	4.6	135	28.6	57	0.013	0.38
10/19/98	930	--	--	--	--	--	--	--	--	--	--
10/20/98	1240	--	--	--	--	--	--	--	--	--	--
08/05/99	1015	40	6.9	<0.1	<0.1	5.3	65	27.6	67	<0.01	0.242

Date (mm/dd/yy)	Time	Nitrogen, Ammonia dissolved (mg/L as N)	Nitrogen, ammonia + organic dissolved (mg/L as N)	Phosphorus dissolved (mg/L)	Phosphorus, ortho dissolved (mg/L as P)	Sediment Suspended (mg/L)
07/14/97	935	--	--	--	--	2
08/13/97	1330	--	--	--	--	49
09/02/97	1225	0.06	<0.2	<0.01	<0.01	--
01/29/98	1345	<0.02	<0.1	<0.1	<0.01	--
09/02/98	1100	0.04	<0.1	<0.1	0.02	11
10/19/98	930	--	--	--	--	27
10/20/98	1240	--	--	--	--	217
08/05/99	1015	0.09	0.13	<0.05	0.01	--

Table 9. Physical properties and water-quality of streamflow samples collected from Jordan Creek near Auke Bay, July 1997 through August 1999 (site 7)

[ft^3/s, cubic feet per second; µs/cm, microsiemens per centimeter; °C, degrees Celsius; mg/L, milligrams per liter; --, no data]

Date (mm/dd/yy)	Time	Discharge (ft^3/s)	Specific conductance (µs/cm)	pH	Water temperature (°C)	Dissolved oxygen (mg/L)	Calcium dissolved (mg/L)	Magnesium dissolved (mg/L)	Sodium dissolved (mg/L)	Potassium dissolved (mg/L)	Bicarbonate dissolved (mg/L as HCO_3)
08/30/65	1520	28	--	--	9.5	--	--	--	--	--	--
09/01/65	1400	28	77	6.5	9.5	--	12	0.5	0.8	a 0.0	--
11/28/66	1315	4	120	7.7	0.5	--	14	1.3	8.5	--	--
03/15/68	1810	5.8	101	7.1	1.5	--	16	1.0	0.9	1.4	--
05/29/68	0830	4.6	93	7.1	8.5	--	14	1.1	0.8	1.0	--
05/02/99	1100	13.9	90	6.9	3.0	12.2	--	--	--	--	--
07/06/99	1049	1.63	104	7.6	10.0	11.1	--	--	--	--	--
08/02/99	1450	5.3	102	7.5	--	9.0	--	--	--	--	--
08/05/99	0945	2.8	104	7.6	9.0	--	14.8	1.5	1.1	1.1	49

Date (mm/dd/yy)	Time	Alkalinity dissolved (mg/L as $CaCO_3$)	Sulfate dissolved (mg/L)	Chloride dissolved (mg/L)	Fluoride dissolved (mg/L)	Silica dissolved (mg/L)	Iron total (mg/L)	Maganese dissolved (mg/L)	Solids residue at 180 °C dissolved (mg/L)	Nitrogen, nitrate dissolved (mg/L as N)	Nitrogen, NO_2+NO_3 dissolved (mg/L as N)
08/30/65	1520	--	--	--	--	--	--	--	--	--	--
09/01/65	1400	--	2.4	a 0.0	0.1	2.1	--	--	--	a 0.0	--
11/28/66	1315	--	8.2	12	--	4.2	--	--	--	a 0.0	--
03/15/68	1810	--	6.1	0.7	0.1	5	--	--	--	0.43	--
05/29/68	0830	--	6.6	0.4	0	3.6	--	--	--	0.11	--
08/05/99	0945	40	7.2	<0.1	<0.1	5.2	48	17.2	65	--	0.25

Date (mm/dd/yy)	Time	Nitrogen, Ammonia dissolved (mg/L as N)	Nitrogen, ammonia + organic dissolved (mg/L as N)	Phosphorus dissolved (mg/L)	Phosphorus, ortho dissolved (mg/L as P)	Sediment Suspended (mg/L)
08/30/65	1520	--	--	--	--	21
08/05/99	0945	0.14	0.15	<0.05	0.01	--

a The water samples were analyzed in the District Water Quality Lab in Anchorage, Alaska. No minimum reporting level (MRL) were available at the time of analysis.

Table 10. Physical properties and water-quality of streamflow samples collected from Jordan Creek above Yandunkin Ave, July 1997 through August 1999 (site 8)

[ft^3/s, cubic feet per second; µs/cm, microsiemens per centimeter; °C, degrees Celsius; mg/L, milligrams per liter; --, no data]

Date (mm/dd/yy)	Time	Discharge (ft^3/s)	Specific conductance (µs/cm)	pH	Water temperature (°C)	Dissolved oxygen (mg/L)	Calcium dissolved (mg/L)	Magnesium dissolved (mg/L)	Sodium dissolved (mg/L)	Potassium dissolved (mg/L)	Bicarbonate dissolved (mg/L as HCO_3)
05/02/99	1022	13.7	87	6.8	3.0	11.8	--	--	--	--	--
05/02/99	1028	13.8	87	6.8	3.0	11.8	--	--	--	--	--
07/06/99	1020	0.92	104	7.9	13.0	9.4	--	--	--	--	--
08/02/99	1430	5.3	104	7.5	9.5	10.2	--	--	--	--	--
08/05/99	1100	3.3	101	7.6	10.0	8.1	15.3	1.5	1.2	1.1	49

Date (mm/dd/yy)	Time	Alkalinity dissolved (mg/L as $CaCO_3$)	Sulfate dissolved (mg/L)	Chloride dissolved (mg/L)	Fluoride dissolved (mg/L)	Silica dissolved (mg/L)	Iron dissolved (mg/L)	Maganese dissolved (mg/L)	Solids residue at 180 °C dissolved (mg/L)	Nitrogen, nitrite dissolved (mg/L as N)	Nitrogen, NO_2+NO_3 dissolved (mg/L as N)
08/05/99	1100	40	6.8	<0.1	<0.1	5.4	70	11.2	64	<0.01	0.25

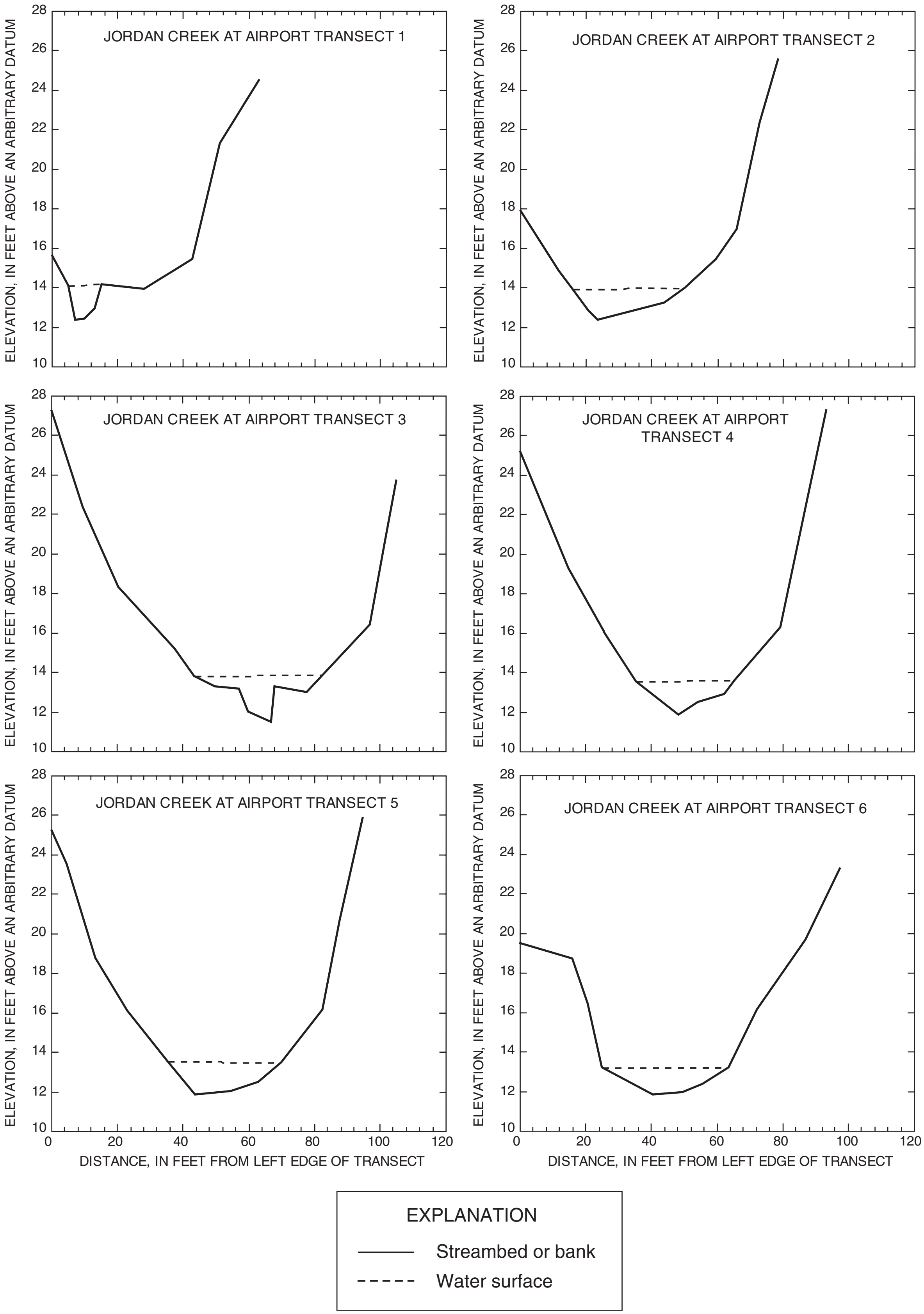
Date (mm/dd/yy)	Time	Nitrogen, Ammonia dissolved (mg/L as N)	Nitrogen, ammonia + organic dissolved (mg/L as N)	Phosphorus dissolved (mg/L)	Phosphorus, ortho dissolved (mg/L as P)
08/05/99	1100	0.18	0.2	<0.05	0.01

Table 11. Volatile organic compounds analyzed for detection in Jordan Creek tributary at Valley St (site 3)

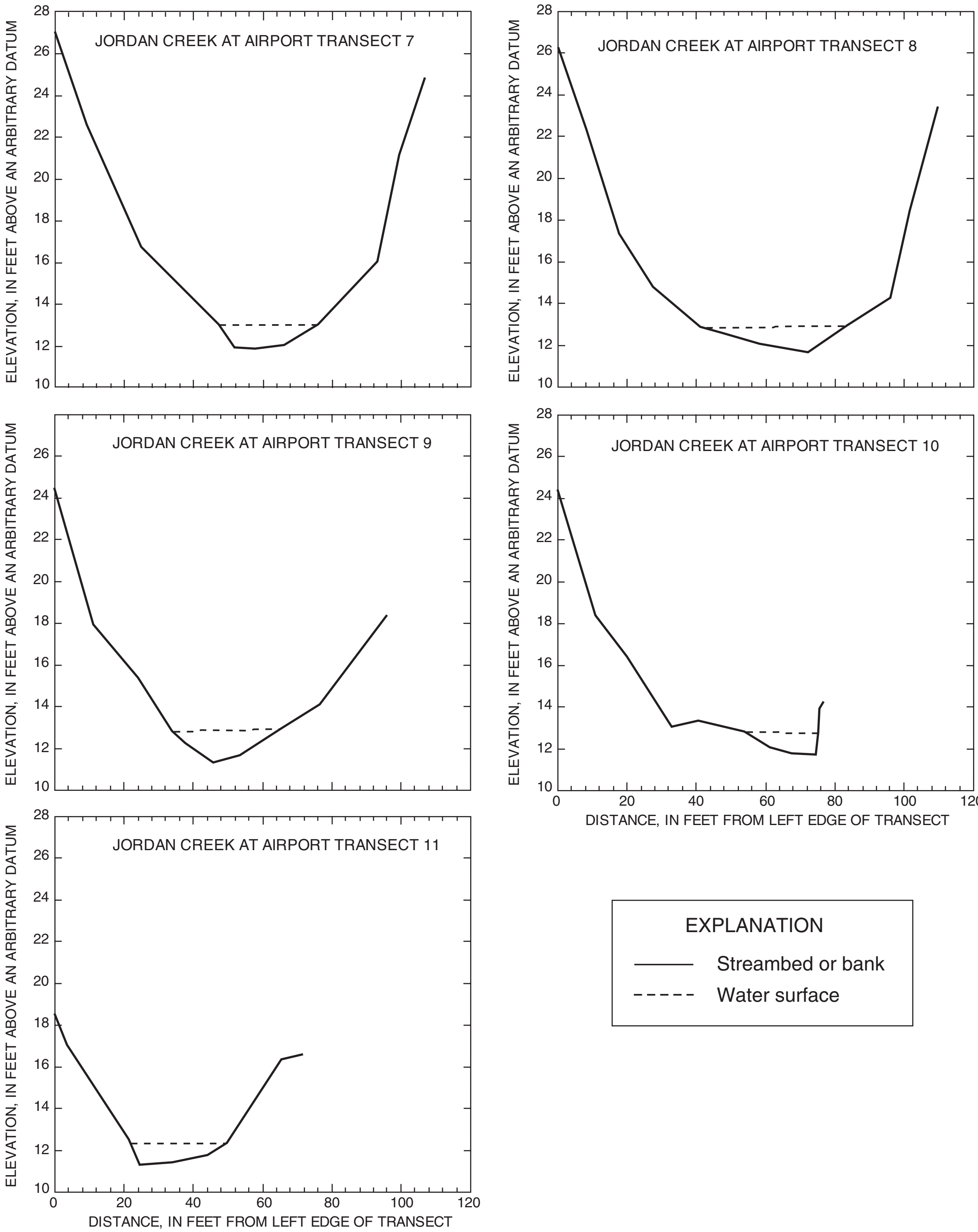
1,2,3,4-Tetramethylbenzene	1,1,1,2-Tetrachloroethane	Chloromethane
1,2,3,5-Tetramethylbenzene	1,1,1-Trichloroethane	Methyl iodide
2-Butanone	1,1,2-Trichlorotrifluoroethane	*tert*-Butyl methyl ether
trans-1,4-Dichloro-2-butene	1,2-Dibromoethane	Dibromomethane
2-Hexanone	1,2-Dichloroethane	Dichloromethane
4-Methyl-2-pentanone	Hexachloroethane	Naphthalene
Acetone	1,1,2,2-Tetrachloroethane	*o*-Xylene
Acrylonitrile	Chloroethane	4-Isopropyl-1-methylbenzene
Benzene	Diethyl ether	1,2,3-Trichloropropane
1,2,3-Trichlorobenzene	Ethyl tert-butyl ether	1,3-Dichloropropane
1,2,3-Trimethylbenzene	*cis*-1,2-Dichloroethylene	2,2-Dichloropropane
1,2,4-Trichlorobenzene	Tetrachloroethylene	1,2-Dibromo-3-chloropropane
Bromobenzene	*trans*-1,2-Dichloroethylene	1,1-Dichloropropene
Chlorobenzene	Trichloroethylene	3-Chloropropene
Ethylbenzene	1,1-Dichloroethane	*cis*-1,3-Dichloropropene
1,3-Dichlorobenzene	Tetrahydrofuran	*trans*-1,3-Dichloropropene
Butylbenzene	Diisopropyl ether	1,2-Dichloropropane
n-Propylbenzene	*m*- and *p*-Xylene	1,2,4-Trimethylbenzene
1,2-Dichlorobenzene	1,3,5-Trimethylbenzene	Styrene
1,4-Dichlorobenzene	Ethyl methacrylate	*tert*-Pentyl methyl ether
sec-Butylbenzene	Methyl methacrylate	Toluene
tert-Butylbenzene	Methyl acrylonitrile	2-Chlorotoluene
Bromoethene	Bromochloromethane	o-Ethyl toluene
Bromoform	Bromodichloromethane	4-Chlorotoluene
Hexachlorobutadiene	Dibromochloromethane	Vinyl chloride
Carbon disulfide	Dichlorodifluoromethane	1,1,2-Trichloroethane
Tetrachloromethane	Trichlorofluoromethane	1,1-Dichloroethylene
Chloroform	Methyl acrylate	
Isopropylbenzene	Bromomethane	

Appendixes 1-3

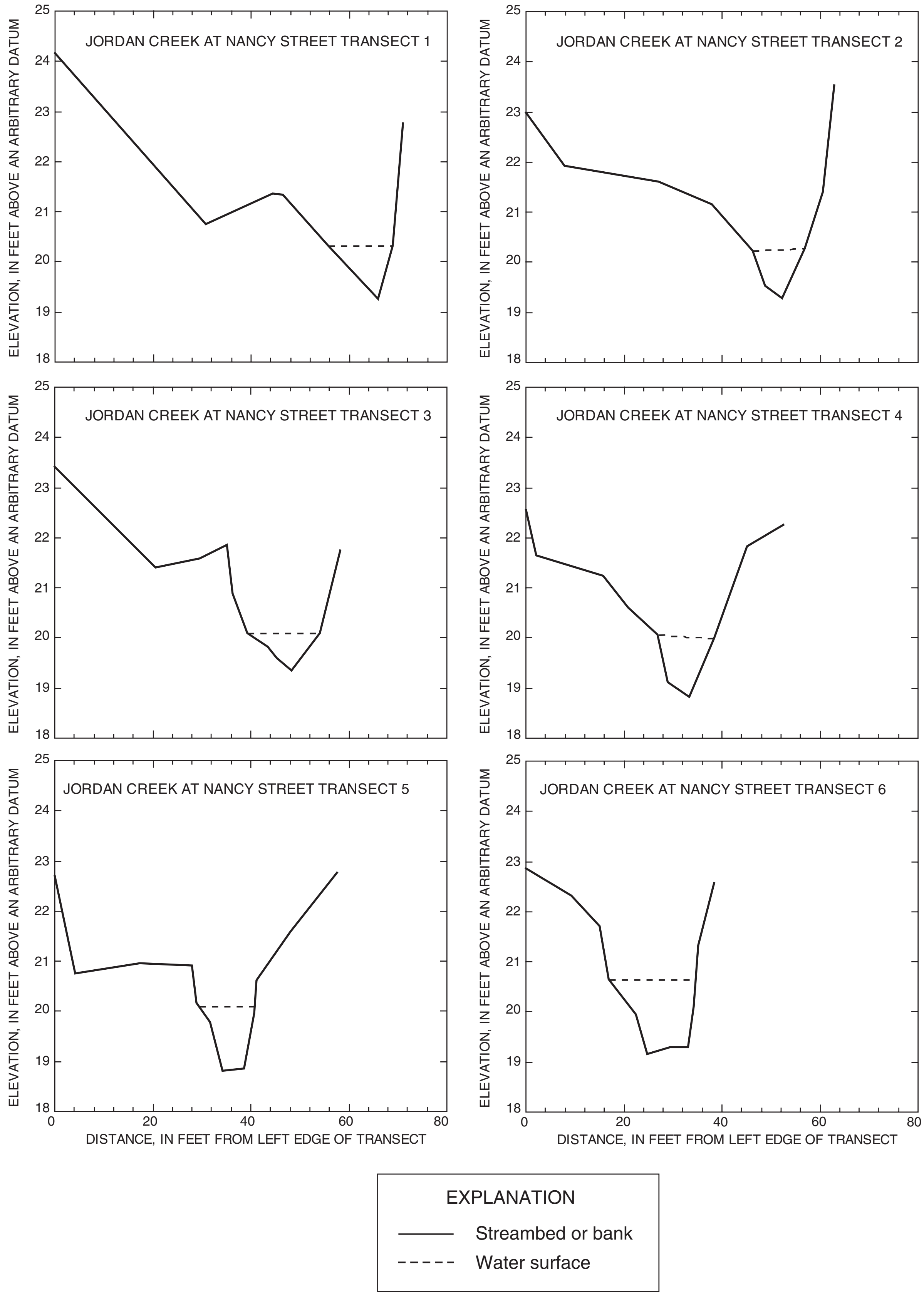
Appendix 1. Transects of three Jordan Creek study reaches.



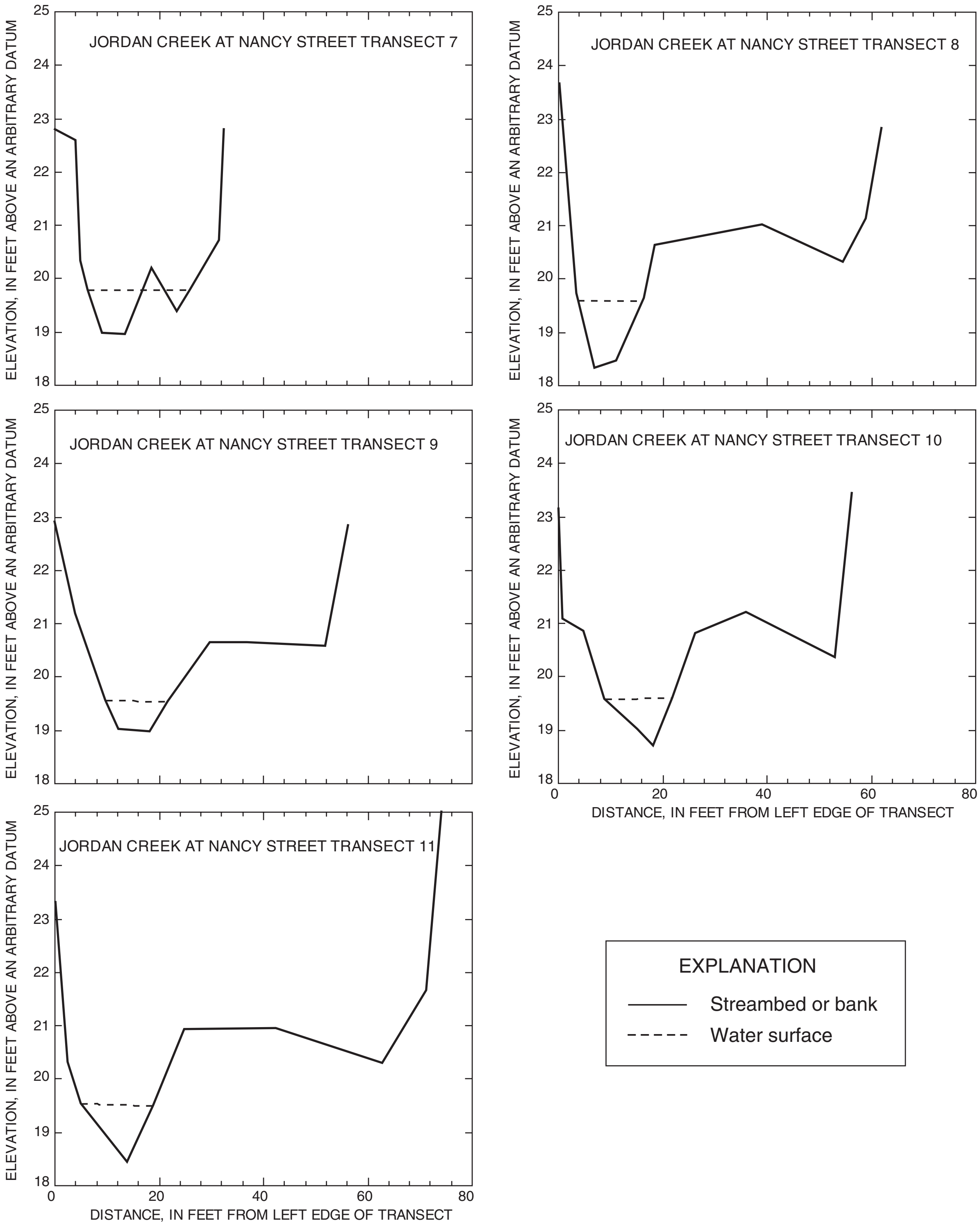
Appendix 1. Transects of three Jordan Creek study reaches—Continued.



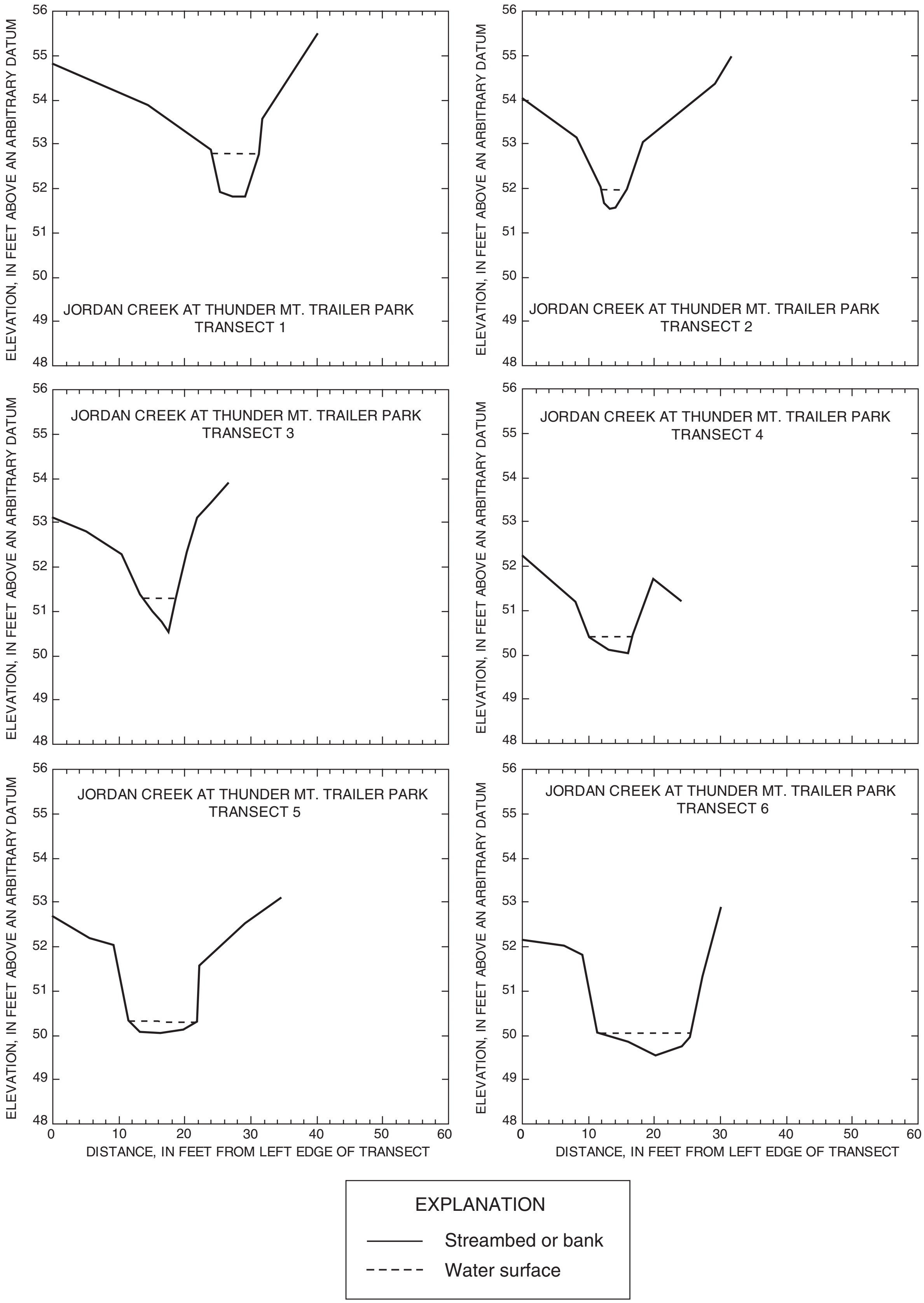
Appendix 1. Transects of three Jordan Creek study reaches—Continued.



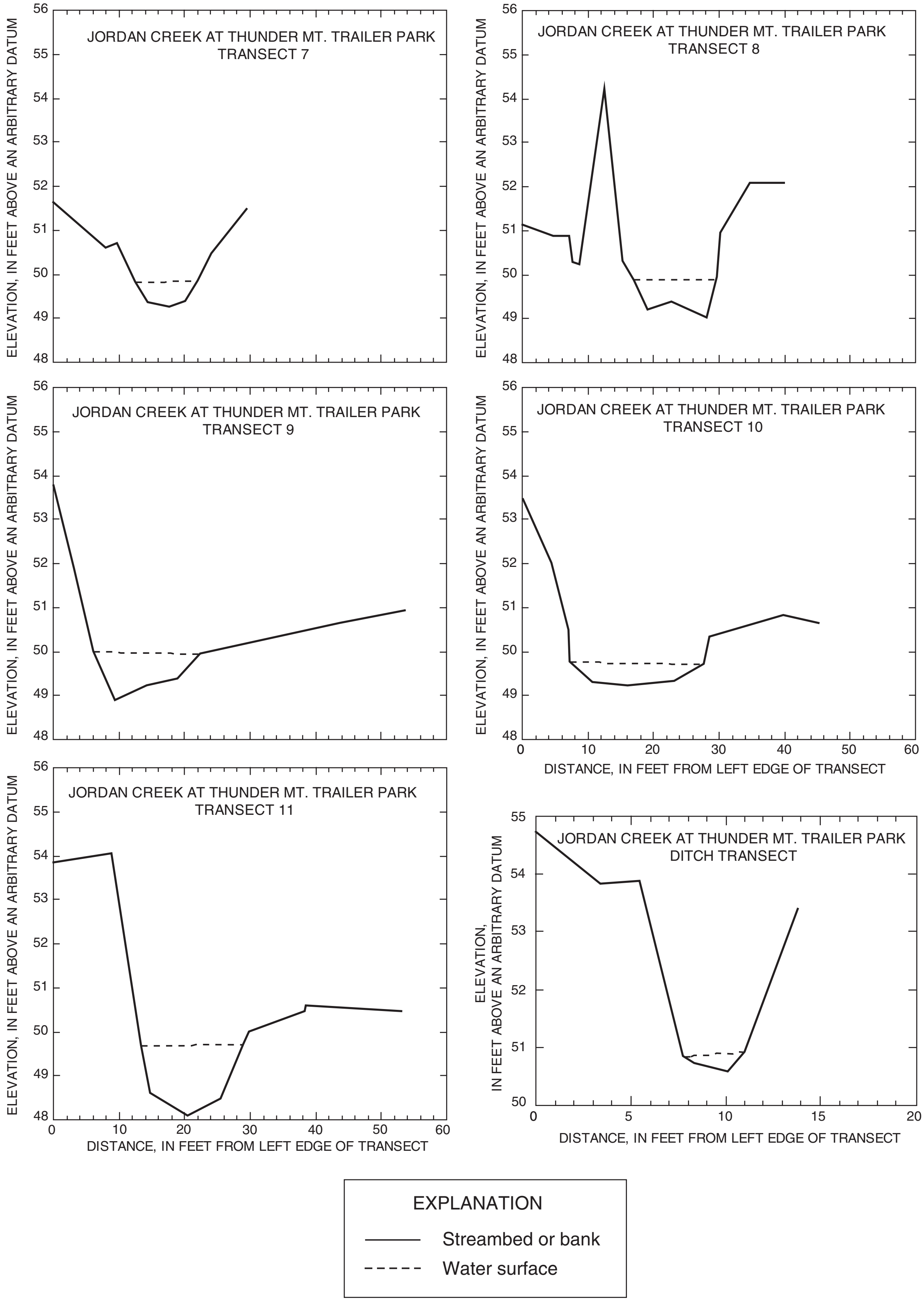
Appendix 1. Transects of three Jordan Creek study reaches—Continued.



Appendix 1. Transects of three Jordan Creek study reaches—Continued.



Appendix 1. Transects of three Jordan Creek study reaches—Continued.



Appendix 2. Selected physical characteristics measured in the physical characterization study reaches
[ft, feet; °,degrees]

Transect	Habitat type	Wetted Channel Width (ft)	Flow aspect (°)	Left bank canopy angle (°)	Right bank canopy angle (°)	Open canopy angle (°)	Eye Height (ft)
Physical Charateritics of Jordan Creek below Thunder Mt. Trailer Park (site 2)							
Thunder Mt. Ditch	riffle	2.4	165	72	67	41	5.33
1	pool	8.7	234	90	90	0	5.33
2	pool	4.4	230	69	89	22	5.33
3	pool	5.0	226	63	76	41	5.33
4	pool	2.3	241	85	61	34	5.33
5	pool	10.2	220	75	74	31	5.33
6	riffle	9.9	220	90	90	0	5.33
7	run	8.2	210	83	80	17	5.33
8	run	14.1	204	84	90	6	5.33
9	run	16.2	195	83	90	7	5.33
10	riffle	20.5	245	90	71	19	5.33
11	pool	16.0	240	90	76	14	5.33
Physical Characteristics of Jordan Creek at Nancy Street (site 5)							
1	run	13.7	95	59	74	47	5.33
2	run	14.5	190	44	85	51	5.33
3	run	15.6	162	66	90	24	5.33
4	run	14.3	166	90	90	0	5.33
5	run	12.5	144	57	47	76	5.33
6	run	14.4	129	76	79	25	5.33
7	run	20.7	176	50	63	67	5.33
8	run	14.9	181	90	42	48	5.33
9	run	17.8	161	59	57	64	5.33
10	run	15.3	146	90	64	26	5.33
11	run	15.7	140	90	69	21	5.33
Physical Characteristics of Jordan Creek at Juneau Airport (site 9)							
1	run	10.4	145	39	14	127	5.33
2	riffle	34.0	130	61	16	103	5.33
3	run	39.0	101	41	11	128	5.33
4	run	30.0	107	39	11	130	5.33
5	run	34.3	114	32	12	136	5.33
6	run	31.6	115	40	7	133	5.33
7	run	29.0	102	8	9	163	5.33
8	run	42.3	122	20	14	146	5.33
9	run	31.7	205	10	3	167	5.33
10	run	21.6	210	6	3	171	5.33
11	riffle	25.2	198	7	0	173	5.33

Appendix 3. Selected physical and habitat characteristics measured in the physical characterization study reaches

[LEW, left edge of water; ft, feet; ft/s, feet per second; mm, millimeters; °,degrees; ft3/s, cubic feet per second; --, no data; Y, yes; N, no; REW, right edge of water]

Physical and Habitat characteristics of Jordan Creek below Thunder Mt. Trailer Park (site 2)

Transect	Distance from LEW (ft)	Depth (ft)	Velocity (ft/s)	Bed Substrate (mm)	Embeddedness (percent)	Silt present	Thalweg	Bank Angle (°)	Bank Height (ft)	Bank Substrate (mm)	Bank vegetation cover (percent)	Bank erosion	Discharge (ft^3/s)
Thunder Mt. ditch	LEW	--	--	--	--	--	--	61	3.3	16-64mm	100	Y	--
	0.6	0.25	1.22	2-64mm	0	N	N	--	--	--	--	--	0.22
	0.9	0.20	0.25	2-64mm	0	N	Y	--	--	--	--	--	--
	1.8	0.18	0.38	2-64mm	0	N	N	--	--	--	--	--	--
	REW	--	--	--	--	--	--	55	2.8	16-64mm	100	Y	--
1	LEW	--	--	--	--	--	--	85	3	<.063mm	100	N	--
	3.0	0.75	0.04	2-32mm	0	N	N	--	--	--	--	--	0.43
	5.0	0.70	0.05	2-32mm	0	N	N	--	--	--	--	--	--
	7.0	0.75	0.05	2-32mm	0	N	Y	--	--	--	--	--	--
	REW	--	--	--	--	--	--	75	3.5	<.063mm	100	N	--
2	LEW	--	--	--	--	--	--	51	2.5	<.063mm	100	N	--
	1.7	0.18	0.15	.063-2mm	0	N	N	--	--	--	--	--	0.43
	2.7	0.20	0.05	.063-2mm	0	N	N	--	--	--	--	--	--
	3.7	0.22	0.04	.063-2mm	0	N	Y	--	--	--	--	--	--
	REW	--	--	--	--	--	--	48	3.4	<.063mm	100	N	--
3	LEW	--	--	--	--	--	--	15	2.6	<.063mm	100	N	--
	2.0	0.38	0.00	2-32mm	0	N	N	--	--	--	--	--	0.43
	3.0	0.55	0.13	2-32mm	0	N	Y	--	--	--	--	--	--
	4.0	0.50	0.08	2-32mm	0	N	N	--	--	--	--	--	--
	REW	--	--	--	--	--	--	60	3.1	<.063mm	100	Y	--

Appendix 3. Selected physical and habitat characteristics measured in the physical characterization study reaches—Continued

[LEW, left edge of water; ft, feet; ft/s, feet per second; mm, millimeters; º,degrees; ft3/s, cubic feet per second; --, no data; Y, yes; N, no; REW, right edge of water]

Transect	Distance from LEW (ft)	Depth (ft)	Velocity (ft/s)	Bed Substrate (mm)	Embeddedness (percent)	Silt present	Thalweg	Bank Angle (º)	Bank Height (ft)	Bank Substrate (mm)	Bank vegetation cover (percent)	Bank erosion	Discharge (ft^3/s)
4	LEW	--	--	--	--	--	--	23	2.9	<.063mm	100	N	--
	0.8	0.15	0.65	2-32mm	0	N	N	--	--	--	--	--	0.43
	1.3	0.18	0.43	2-32mm	0	N	Y	--	--	--	--	--	--
	1.8	0.12	0.49	2-32mm	0	N	N	--	--	--	--	--	--
	REW	--	--	--	--	--	--	35	2.2	<.063mm	100	N	--
5	LEW	--	--	--	--	--	--	61	2.6	<.063mm	100	N	--
	3.0	0.42	0.18	.063-32mm	0	N	Y	--	--	--	--	--	0.43
	5.0	0.20	0.31	.063-32mm	0	N	N	--	--	--	--	--	--
	8.0	0.15	0.17	.063-32mm	0	N	N	--	--	--	--	--	--
	REW	--	--	--	--	--	--	90	3	<.063mm	100	N	--
6	LEW	--	--	--	--	--	--	30	2.6	<.063mm	100	Y	--
	2.5	0.20	0.88	.063-16mm	0	N	Y	--	--	--	--	--	0.43
	5.0	0.15	0.16	.063-2mm	0	Y	N	--	--	--	--	--	--
	7.0	0.20	0.90	.063-16mm	0	N	N	--	--	--	--	--	--
	REW	--	--	--	--	--	--	29	3.5	<.063mm	100	Y	--
7	LEW	--	--	--	--	--	--	16	2.4	<.063mm	100	N	--
	2.7	0.38	0.44	.063-2mm	0	Y	Y	--	--	--	--	--	0.43
	4.2	0.30	0.10	.063-2mm	0	Y	N	--	--	--	--	--	--
	5.7	0.26	0.20	.063-2mm	0	Y	N	--	--	--	--	--	--
	REW	--	--	--	--	--	--	80	2.2	<.063mm	100	Y	--
8	LEW	--	--	--	--	--	--	83	5.2	<.063mm	100	N	--
	3.0	0.52	0.17	.063-2mm	0	Y	Y	--	--	--	--	--	0.43
	7.0	0.30	0.05	.063-2mm	0	Y	N	--	--	--	--	--	--
	11.0	0.50	0.10	.063-2mm	0	Y	N	--	--	--	--	--	--
	REW	--	--	--	--	--	--	34	3.1	<.063mm	100	Y	--

Appendix 3. Selected physical and habitat characteristics measured in the physical characterization study reaches—Continued

[LEW, left edge of water; ft, feet; ft/s, feet per second; mm, millimeters; °,degrees; ft3/s, cubic feet per second; --, no data; Y, yes; N, no; REW, right edge of water]

Transect	Distance from LEW (ft)	Depth (ft)	Velocity (ft/s)	Bed Substrate (mm)	Embeddedness (percent)	Silt present	Thalweg	Bank Angle (°)	Bank Height (ft)	Bank Substrate (mm)	Bank vegetation cover (percent)	Bank erosion	Discharge (ft^3/s)
9	LEW	--	--	--	--	--	--	34	2	<.063mm	100	Y	--
	2.2	0.56	0.15	<.063mm	0	Y	N	--	--	--	--	--	0.43
	4.7	0.80	0.05	<.063mm	0	Y	Y	--	--	--	--	--	--
	7.2	0.30	0.23	<.063mm	0	Y	N	--	--	--	--	--	--
	REW	--	--	--	--	--	--	53	4.9	<.063mm	100	N	--
10	LEW	--	--	--	--	--	--	55	4.2	<.063mm	100	Y	--
	8.0	0.18	0.05	.063-2mm	0	Y	N	--	--	--	--	--	0.43
	12.2	0.38	0.49	.063-2mm	0	Y	Y	--	--	--	--	--	--
	16.5	0.25	0.33	.063-2mm	0	Y	N	--	--	--	--	--	--
	REW	--	--	--	--	--	--	64	1.4	<.063mm	100	N	--
11	LEW	--	--	--	--	--	--	50	6	<.063mm	100	Y	--
	5.0	1.25	0.00	<.063mm	0	Y	N	--	--	--	--	--	0.43
	10.0	1.40	0.04	<.063mm	0	Y	Y	--	--	--	--	--	--
	12.5	1.00	0.05	<.063mm	0	Y	N	--	--	--	--	--	--
	REW	--	--	--	--	--	--	21	2.4	<.063mm	100	N	--

Appendix 3. Selected physical and habitat characteristics measured in the physical characterization study reaches—Continued

[LEW, left edge of water; ft, feet; ft/s, feet per second; mm, millimeters; °,degrees; ft3/s, cubic feet per second; --, no data; Y, yes; N, no; REW, right edge of water]

Physical and Habitat characteristics of Jordan Creek at Nancy Street (site 5)

Transect	Distance from LEW (ft)	Depth (ft)	Velocity (ft/s)	Bed Substrate (mm)	Embeddedness (percent)	Silt present	Thalweg	Bank Angle (°)	Bank Height (ft)	Bank Substrate (mm)	Bank vegetation cover (percent)	Bank erosion	Discharge (ft^3/s)
1	LEW	--	--	--	--	--	--	58	--	>.063mm	90	Y	--
	4.0	1.45	0.72	>.063-16mm	0	Y	N	--	--	--	--	--	9.30
	6.5	1.70	1.28	>.063-2mm	0	Y	Y	--	--	--	--	--	--
	9.0	1.52	0.28	>.063-2mm	0	Y	N	--	--	--	--	--	--
	REW	--	--	--	--	--	--	47	--	>.063-2mm	90	Y	--
2	LEW	--	--	--	--	--	--	9	--	>.063mm	90	N	--
	5.0	1.28	0.38	>.063-16mm	0	Y	N	--	--	--	--	--	9.30
	7.0	1.50	0.73	>.063-16mm	0	Y	Y	--	--	--	--	--	--
	11.0	1.15	1.02	>.063-32m	0	Y	N	--	--	--	--	--	--
	REW	--	--	--	--	--	--	32	--	>.063mm	90	Y	--
3	LEW	--	--	--	--	--	--	54	--	>.063-2mm	100	Y	--
	4.0	0.72	0.69	>.063-2mm	0	Y	N	--	--	--	--	--	9.30
	8.0	1.10	0.42	>.063-2mm	0	Y	N	--	--	--	--	--	--
	11.0	1.50	0.77	>.063-2mm	0	Y	Y	--	--	--	--	--	--
	13.0	0.70	0.83	>.063-2mm	0	Y	N	--	--	--	--	--	--
	REW	--	--	--	--	--	--	46	--	>.063-2mm	90	Y	--

Appendix 3. Selected physical and habitat characteristics measured in the physical characterization study reaches—Continued

[LEW, left edge of water; ft, feet; ft/s, feet per second; mm, millimeters; °,degrees; ft3/s, cubic feet per second; --, no data; Y, yes; N, no; REW, right edge of water]

Transect	Distance from LEW (ft)	Depth (ft)	Velocity (ft/s)	Bed Substrate (mm)	Embeddedness (percent)	Silt present	Thalweg	Bank Angle (°)	Bank Height (ft)	Bank Substrate (mm)	Bank vegetation cover (percent)	Bank erosion	Discharge (ft^3/s)
4	LEW	--	--	--	--	--	--	32	--	>.063mm	90	N	--
	4.0	0.42	0.65	>.063-32mm	0	Y	N	--	--	--	--	--	9.30
	8.0	1.65	0.73	>.063-32mm	0	Y	Y	--	--	--	--	--	--
	13.0	1.15	0.32	>.063-32mm	0	Y	N	--	--	--	--	--	--
	REW	--	--	--	--	--	--	41	--	>.063mm	80	Y	--
5	LEW	--	--	--	--	--	--	27	--	>.063mm	100	N	--
	4.0	1.05	0.61	>.063-2mm	0	Y	N	--	--	--	--	--	9.30
	7.5	1.68	0.63	>.063-2mm	0	Y	Y	--	--	--	--	--	--
	10.0	1.38	0.44	>.063-2mm	0	Y	N	--	--	--	--	--	--
	REW	--	--	--	--	--	--	56	--	>.063mm	90	N	--
6	LEW	--	--	--	--	--	--	69	--	>.063mm	80	Y	--
	0.5	0.88	1.26	>.063-16mm	0	Y	N	--	--	--	--	--	9.30
	8.5	0.90	1.60	>.063-32mm	0	Y	Y	--	--	--	--	--	--
	11.5	0.75	1.51	2-64mm	0	Y	N	--	--	--	--	--	--
	REW	--	--	--	--	--	--	29	--	>.063mm	90	Y	--
7	LEW	--	--	--	--	--	--	34	--	>.063mm	100	Y	--
	3.5	1.22	1.20	32-64mm	0	Y	N	--	--	--	--	--	9.30
	6.0	1.45	0.66	32-64mm	0	Y	Y	--	--	--	--	--	--
	11.0	1.10	0.07	32-64mm	0	Y	N	--	--	--	--	--	--
	16.0	0.55	0.28	32-64mm	0	Y	N	--	--	--	--	--	--
	REW	--	--	--	--	--	--	33	--	>.063mm	100	N	--

Appendix 3. Selected physical and habitat characteristics measured in the physical characterization study reaches—Continued

[LEW, left edge of water; ft, feet; ft/s, feet per second; mm, millimeters; °,degrees; ft3/s, cubic feet per second; --, no data; Y, yes; N, no; REW, right edge of water]

Transect	Distance from LEW (ft)	Depth (ft)	Velocity (ft/s)	Bed Substrate (mm)	Embeddedness (percent)	Silt present	Thalweg	Bank Angle (°)	Bank Height (ft)	Bank Substrate (mm)	Bank vegetation cover (percent)	Bank erosion	Discharge (ft^3/s)
8	LEW	--	--	--	--	--	--	63	--	>.063mm	100	Y	--
	3.0	1.20	0.35	>.063mm	0	Y	N	--	--	--	--	--	9.30
	6.0	1.80	0.36	>.063mm	0	Y	Y	--	--	--	--	--	--
	10.0	0.95	0.27	>.063mm	0	Y	N	--	--	--	--	--	--
	REW	--	--	--	--	--	--	68	--	>.063mm	100	Y	--
9	LEW	--	--	--	--	--	--	20	--	>.063mm	90	N	--
	4.5	0.98	0.82	>.063mm	0	Y	N	--	--	--	--	--	9.30
	9.5	1.10	0.75	>.063-2mm	0	Y	Y	--	--	--	--	--	--
	14.0	0.49	0.30	>.063mm	0	Y	N	--	--	--	--	--	--
	REW	--	--	--	--	--	--	16	--	>.063mm	100	N	--
10	LEW	--	--	--	--	--	--	32	--	>.063mm	90	N	--
	3.0	0.49	0.62	>.063-2mm	0	Y	N	--	--	--	--	--	9.30
	7.5	0.82	1.02	>.063-2mm	0	Y	N	--	--	--	--	--	--
	10.5	1.18	0.90	>.063-2mm	0	Y	Y	--	--	--	--	--	--
	13.5	0.78	0.72	>.063-2mm	0	Y	N	--	--	--	--	--	--
	REW	--	--	--	--	--	--	47	--	>.063mm	100	N	--
11	LEW	--	--	--	--	--	--	14	--	>.063mm	100	Y	--
	4.0	0.90	0.45	>.063mm	0	Y	N	--	--	--	--	--	9.30
	8.0	0.88	0.95	>.063mm	0	Y	N	--	--	--	--	--	--
	11.0	1.10	0.87	>.063mm	0	Y	Y	--	--	--	--	--	--
	14.0	0.50	0.42	>.063mm	0	Y	N	--	--	--	--	--	--
	REW	--	--	--	--	--	--	20	--	>.063mm	90	N	--

Appendix 3. Selected physical and habitat characteristics measured in the physical characterization study reaches—Continued

[LEW, left edge of water; ft, feet; ft/s, feet per second; mm, millimeters; °,degrees; ft3/s, cubic feet per second; --, no data; Y, yes; N, no; REW, right edge of water]

Physical and Habitat characteristics of Jordan Creek at Airport (site 9)

Transect	Distance from LEW (ft)	Depth (ft)	Velocity (ft/s)	Bed Substrate (mm)	Embeddedness (percent)	Silt present	Thalweg	Bank Angle (°)	Bank Height (ft)	Bank Substrate (mm)	Bank vegetation cover (percent)	Bank erosion	Discharge (ft^3/s)
1	LEW	--	--	--	--	--	--	85	14.9	>.063mm	70	N	--
	1.5	1.45	2.30	2-16mm	20	Y	Y	--	--	--	--	--	12.80
	2.7	1.50	1.74	2-16mm	20	Y	N	--	--	--	--	--	--
	4.9	1.38	1.86	16-32mm	20	Y	N	--	--	--	--	--	--
	REW	--	--	--	--	--	--	28	12.1	>.063mm	100	N	--
2	LEW	--	--	--	--	--	--	13	14.9	>.063mm	100	N	--
	3.0	0.90	1.42	32-64mm	30	Y	N	--	--	--	--	--	12.80
	6.0	1.30	1.59	16-32mm	0	Y	Y	--	--	--	--	--	--
	9.0	0.62	1.25	.063-16mm	30	Y	N	--	--	--	--	--	--
	REW	--	--	--	--	--	--	5	13.2	>.063mm	100	N	--
3	LEW	--	--	--	--	--	--	21	15.8	>.063mm	100	N	--
	3.5	1.45	0.84	.063-2mm	40	Y	N	--	--	--	--	--	12.80
	7.0	1.90	1.02	16-32mm	40	Y	Y	--	--	--	--	--	--
	10.0	1.65	0.45	.063-2mm	40	Y	N	--	--	--	--	--	--
	REW	--	--	--	--	--	--	84	12.2	>.063mm	100	N	--
4	LEW	--	--	--	--	--	--	17	13.4	>.063mm	100	N	--
	7.0	1.35	0.96	.063-2mm	40	Y	N	--	--	--	--	--	12.80
	9.0	1.75	0.94	.063-2mm	--	Y	Y	--	--	--	--	--	--
	13.0	1.32	0.96	.063-2mm	--	Y	N	--	--	--	--	--	--
	REW	--	--	--	--	--	--	11	15.5	>.063mm	100	N	--

Appendix 3. Selected physical and habitat characteristics measured in the physical characterization study reaches—Continued

[LEW, left edge of water; ft, feet; ft/s, feet per second; mm, millimeters; °,degrees; ft3/s, cubic feet per second; --, no data; Y, yes; N, no; REW, right edge of water]

Transect	Distance from LEW (ft)	Depth (ft)	Velocity (ft/s)	Bed Substrate (mm)	Embeddedness (percent)	Silt present	Thalweg	Bank Angle (°)	Bank Height (ft)	Bank Substrate (mm)	Bank vegetation cover (percent)	Bank erosion	Discharge (ft^3/s)
5	LEW	--	--	--	--	--	--	22	13.4	>.063mm	100	N	--
	4.0	1.12	0.48	.063-2mm	30	Y	N	--	--	--	--	--	12.80
	7.5	1.42	0.98	.063-2mm	30	Y	Y	--	--	--	--	--	--
	14.0	1.00	0.35	.063-2mm	--	Y	N	--	--	--	--	--	--
	20.0	0.92	0.54	.063-2mm	--	Y	N	--	--	--	--	--	--
	REW	--	--	--	--	--	--	11	14	>.063mm	100	N	--
6	LEW	--	--	--	--	--	--	9	15.9	>.063mm	100	N	--
	3.5	0.55	1.69	2-64mm	30	Y	N	--	--	--	--	--	12.80
	7.0	1.35	1.25	>.063mm	--	Y	Y	--	--	--	--	--	--
	10.5	0.92	0.61	>.063mm	--	Y	N	--	--	--	--	--	--
	REW	--	--	--	--	--	--	5	11	>.063mm	100	N	--
7	LEW	--	--	--	--	--	--	27	15.3	>.063mm	100	N	--
	2.5	1.00	1.66	2-16mm	50	Y	N	--	--	--	--	--	12.80
	5.0	1.45	1.33	2-64mm	80	Y	Y	--	--	--	--	--	--
	7.5	0.90	0.71	>.063mm	--	Y	N	--	--	--	--	--	--
	REW	--	--	--	--	--	--	11	12.9	>.063mm	100	N	--
8	LEW	--	--	--	--	--	--	6	14.5	>.063mm	100	N	--
	10.0	0.55	0.98	2-64mm	40	Y	N	--	--	--	--	--	12.80
	22.0	0.48	1.59	.063-2mm	30	Y	N	--	--	--	--	--	--
	27.0	1.00	1.49	>.063mm	--	Y	N	--	--	--	--	--	--
	29.0	1.10	1.00	>.063mm	--	Y	Y	--	--	--	--	--	--
	REW	--	--	--	--	--	--	39	11.7	>.063mm	100	N	--

Appendix 3. Selected physical and habitat characteristics measured in the physical characterization study reaches—Continued

[LEW, left edge of water; ft, feet; ft/s, feet per second; mm, millimeters; °,degrees; ft3/s, cubic feet per second; --, no data; Y, yes; N, no; REW, right edge of water]

Transect	Distance from LEW (ft)	Depth (ft)	Velocity (ft/s)	Bed Substrate (mm)	Embeddedness (percent)	Silt present	Thalweg	Bank Angle (°)	Bank Height (ft)	Bank Substrate (mm)	Bank vegetation cover (percent)	Bank erosion	Discharge (ft^3/s)
9	LEW	--	--	--	--	--	--	8	13.1	>.063mm	95	N	--
	4.5	0.60	1.22	.063-16mm	20	Y	N	--	--	--	--	--	12.80
	9.0	1.24	1.09	.063-16mm	20	Y	Y	--	--	--	--	--	--
	13.5	1.08	0.88	.063-16mm	20	Y	N	--	--	--	--	--	--
	REW	--	--	--	--	--	--	4	7	>.063mm	100	N	--
10	LEW	--	--	--	--	--	--	9	2.5	>.063mm	85	N	--
	6.0	0.50	0.50	.063-2mm	10	Y	N	--	--	--	--	--	12.80
	15.0	0.88	0.88	.063-2mm	30	Y	N	--	--	--	--	--	--
	17.0	0.90	0.90	.063-2mm	30	Y	Y	--	--	--	--	--	--
	REW	--	--	--	--	--	--	75	12.7	>.063mm	95	Y	--
11	LEW	--	--	--	--	--	--	25	13.1	>.063mm	0	N	--
	1.5	0.62	0.49	>512mm	0	Y	N	--	--	--	--	--	12.80
	2.8	1.00	1.25	>512mm	0	Y	Y	--	--	--	--	--	--
	10.0	0.65	0.94	>512mm	0	Y	N	--	--	--	--	--	--
	17.0	0.25	1.36	>512mm	0	Y	N	--	--	--	--	--	--
	REW	--	--	--	--	--	--	20	5.8	>.063mm	0	N	--