Cook Inlet Basin

NAWQA News

National Water-Quality Assessment Program

Status Report, Summer 2000

What is NAWQA?

The Cook Inlet Basin in south-central Alaska (see map) is one of about 60 National Water-Quality Assessment (NAWQA) study units designed to assess the status and trends of the Nation's water quality. This program integrates the monitoring of surface- and ground-water chemistry with the study of aquatic ecosystems. The Cook Inlet Basin study began in 1997.

How can you obtain information from the Cook Inlet NAWQA study?

A large amount of data is generated during the course of a NAWQA study, and all of it is available to the public. Some sites equipped with telemetry have streamflow and water temperature data that are updated every few hours. Other types of data—for example chemical analyses—must be processed by our laboratory in Colorado and then reviewed by the NAWQA staff prior to being available to the public.

The most efficient means of accessing current data is from the Cook Inlet Basin web page (http://ak.water.usgs.gov/Projects/Nawqa). Data will be linked to the sites where they were collected and can be viewed or downloaded. Data also may be obtained by contacting the USGS office and making specific requests. Most data collected during a given water year (October 1 to September 30) are published annually in a statewide data report titled "USGS Water Resources Data--Alaska."

Interpretations of these data typically will be found in reports published by the USGS. An interpretive report takes much longer to produce than does a summary of results. A time frame of one year following data collection to write and publish a report is normal. That time can be considerably longer if sample results are not quickly available from the laboratory. For example, streambed sediment and fish tissue samples were collected during the summer of 1998, but the interpretive report on the results was published in January 2000. A list of publications produced by the NAWQA team can be found at http://ak.water.usgs.gov/Projects/Nawqa/nawqa_pubs.htm. The publications also will be available in PDF format at that web site.

Cook Inlet Basin landcover.

Most of the land in the Cook Inlet Basin is undeveloped; urban land is less than one percent of the total area.

USGS science for a changing world

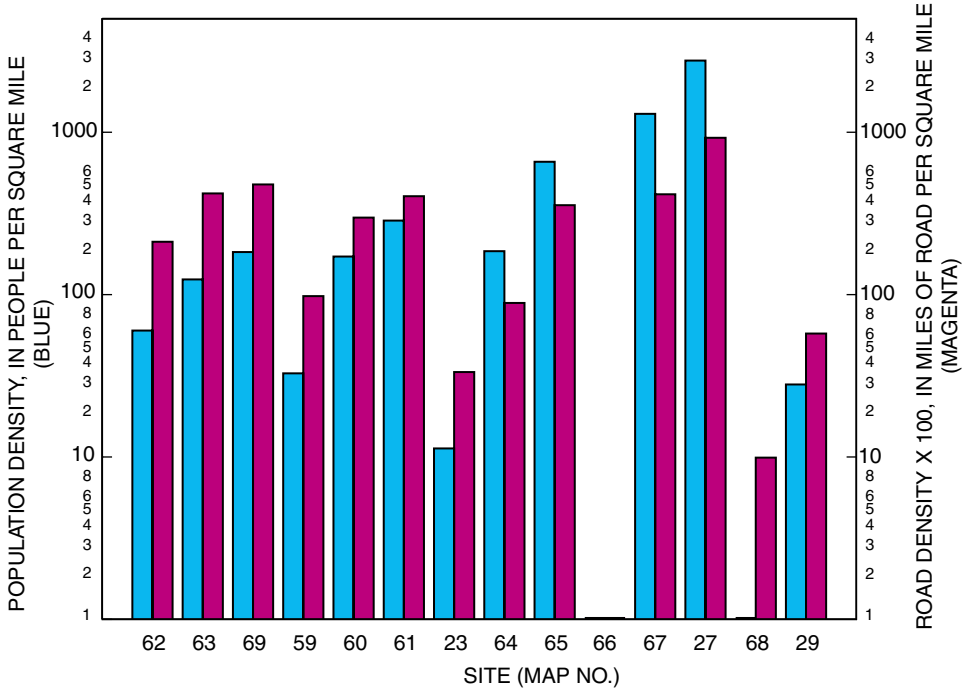
Cook Inlet Basin, Alaska
NAWQA News Number 2
Summer 2000
ak.water.usgs.gov/Projects/Nawqa

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

What can invertebrates tell us about the quality of water in our streams?

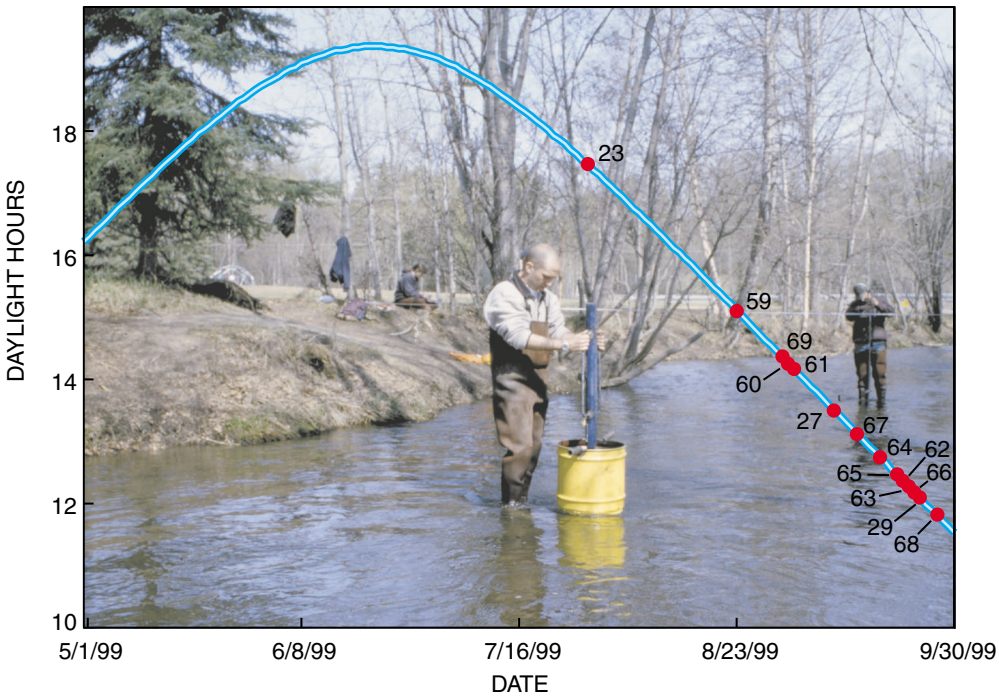
The effect of urbanization on stream invertebrates (e.g., insects, snails, and worms) was examined using information gathered during a 1999 reconnaissance of 14 sites in Anchorage for a larger scale study in 2000. We chose sites by examining maps and choosing areas far upstream and without many roads for our undisturbed sites; intermediate sites were downstream and had higher numbers of roads; and finally the most downstream sites were in heavily urbanized areas with many roads. It was also noted that there was a very strong positive relationship between road density (miles of road/square mile) and population density (persons/square mile). We collected data concerning numbers and species of invertebrates, water chemistry data (e.g., dissolved oxygen, pH, temperature, salts, and nutrients), and trace elements (e.g., zinc, mercury, and lead) in bed sediments.

A greater diversity of invertebrates generally means a stream is healthier than a stream with one or two dominant species. Measures of the invertebrate community were used with the data collected from the water chemistry and trace elements in bed sediments surveys to determine what factors affect the status of stream health. Our findings showed that species homogeneity (sameness), salts, and heavy metals were the factors that explained the gradient from healthy sites to those considered polluted. As population and road densities increased, so did the concentrations of salts and heavy metals, which caused a change from diverse invertebrate communities to communities with a few dominant, pollution-tolerant species. Chester Creek at Arctic Blvd. (map no. 27) scored lowest on all measures (most impacted), and had a high population density when compared to road density. Little Rabbit Creek at Nickleen Rd. (map no. 62) scored highest on all measures (least impacted), and had a low population density when compared to road density. These sites were the endpoints of the urban gradient found in Anchorage streams.



The most adversely impacted urban sites (map nos. 64, 65, 67, and 27) have greater population densities when compared to road densities. The other sites in the study are still considered to be in relatively good "health," given their population and road densities, but appear to be approaching the threshold where urbanization begins to impact the natural structure and function of a stream.

Hours of daylight in Anchorage and dates of invertebrate sampling



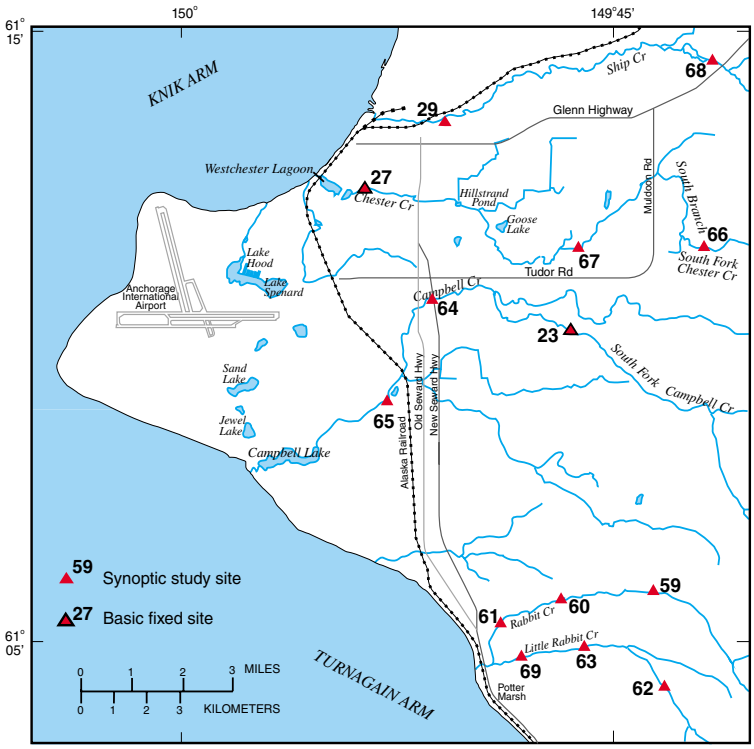
Daylight length in Cook Inlet area, due to its high latitudes, can be more than 19 hours on the summer solstice, June 20, in Anchorage. Invertebrates were sampled at the South Fork of Campbell Creek (map no. 23) on July 28, 1999, almost a full month before any of the other sites. Daylight length was about 17 hours. The next nearest sampling time was August 23 at Rabbit Creek (map no. 59), when daylight length was about 15 hours. The last site sampled was Ship Creek (map no. 68), when daylight length was about 12 hours. This change in the photoperiod over the sampling season can have a large effect on stream invertebrates. The amount of sunlight striking a stream can affect water temperature, which is known to affect invertebrate growth and emergence, as well as algal abundance, a potential food source. In the analysis of invertebrate data, South Fork of Campbell Creek (map no. 23) would be expected to compare similarly to other "reference condition" sites; however; it actually resembled more closely the urban impacted sites. Future invertebrate sampling should be performed in a more compressed time frame to avoid invertebrate community shifts caused by daylight length.

Are pesticides and volatile organic compounds found in Anchorage streams?

During the 1999 water year, water samples were collected and analyzed for pesticides and volatile organic compounds (VOCs) at an urbanized site on Chester Creek (map no. 27). Samples also were collected at South Fork Campbell Creek (map no. 23), which is a relatively undeveloped watershed. Pesticide sampling at Chester Creek (black and orange dots on graph) was done on a monthly basis with additional sampling during snowmelt and rainfall periods. Pesticide sampling at South Fork Campbell Creek was started during snowmelt in late May and continued on a monthly basis for the remainder of the water year with additional sampling during rainfall periods.

VOC sampling at Chester Creek (orange dots only on graph) was done during the coldest winter months and monthly during the open-water season (June through September), as well as during rainfall on August 12-13, and on August 25. Three VOC samples were collected at South Fork Campbell Creek in January, February, and March.

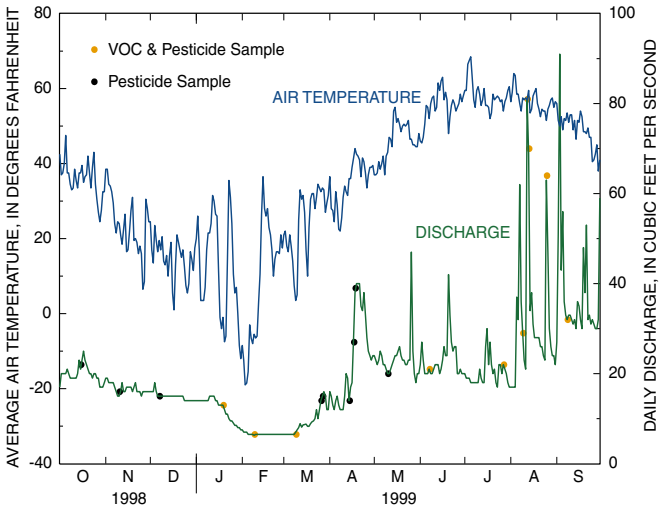
Streamflow during the coldest months in Anchorage is primarily from ground water discharging to the stream. Therefore, stream water samples collected during those times likely reflect the quality of shallow ground water.



Location of sampling sites in the Anchorage area.

Anchorage sampling sites

23	South Fork Campbell Creek near Anchorage
27	Chester Creek at Arctic Boulevard at Anchorage
29	Ship Creek below Power Plant at Elmendorf Air Force Base
59	Rabbit Creek at Hillside Dr. near Anchorage
60	Rabbit Creek at East 140th Ave. near Anchorage
61	Rabbit Creek at Porcupine Trail near Anchorage
62	Little Rabbit Creek at Nickleen St. near Anchorage
63	Little Rabbit Creek at Goldenview Dr. near Anchorage
64	Campbell Creek at New Seward Highway near Anchorage
65	Campbell Creek at C St near Anchorage
66	So. Branch of So. Fork Chester Creek at Tank Trail near Anchorage
67	So. Branch of So. Fork Chester Creek at Boniface Pkwy near Anchorage
68	Ship Creek at Glenn Highway near Anchorage
69	Little Rabbit Creek near Anchorage



VOC and pesticide sampling at Chester Creek at Arctic Boulevard, 1999 water year.

Pesticide results

At South Fork Campbell Creek, no pesticide compounds were detected. At Chester Creek, analyses of more than 100 compounds showed detections of only 8 compounds: p,p'-DDE (a degradation product of DDT), the insecticides carbaryl and diazinon, and the herbicides 2,4,D, 2,4,D methyl ester, clopyralid, dichlorprop, and prometon. Most of the detections were of carbaryl, diazinon, prometon, and 2,4,D, and occurred only during the open-water season. The detection of these compounds in an urban drainage area such as Chester Creek was not surprising. For example, carbaryl is widely used in the Anchorage area to control spruce bark beetles. The herbicide 2,4,D is one of the most common ingredients of "weed and feed" fertilizers. Diazinon is used to control ants and other insects in gardens. Prometon is used along roadways and other rights-of-way to control weed growth.

VOC results

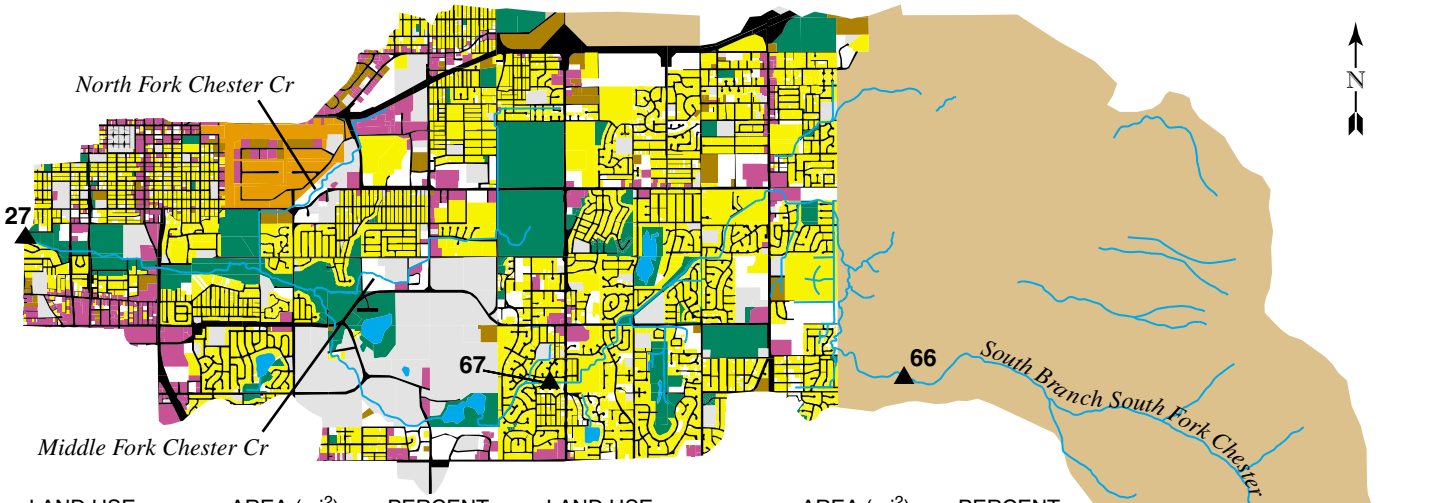
Of the 88 VOC's analyzed, 11 compounds were detected at Chester Creek. Most of the detections were at very low concentrations except for toluene, MTBE, chloroform, and methylethylketone. Detections were most common during the winter and may be attributable to lower volatility and greater partitioning of these compounds from air to water at cooler temperatures.

The VOC's detected in Chester Creek are byproducts of compounds used in gasoline, commercial, and industrial processes, and the chlorination of drinking water. MTBE is a fuel oxygenate added to gasoline to enhance combustion, reduce carbon monoxide emissions, and reduce concentrations of ozone in the atmosphere. MTBE was used as an additive to gasoline in Anchorage during the 1992-93 winters. Chloroform and bromodichloromethane are trihalomethanes produced as byproducts of water chlorination. Tetrachloroethene (PCE) is used for dry cleaning, in chlorofluorocarbon production, and in spot removers, degreasers, paint strippers, and rug cleaners. Methylethylketone is used in solvents and in manufacturing of colorless synthetic resins.

At South Fork Campbell Creek, during sampling in winter, toluene and benzene were found at estimated concentrations slightly lower than the minimum reporting limits. Toluene and benzene are gasoline additives and solvents. All other compounds were not detected.

What are the land uses of the Chester Creek basin?

Chester Creek drains an area of about 27 square miles above the site at Arctic Blvd. (map no. 27). The creek has three major forks: North Fork, Middle Fork, and South Branch South Fork. South Branch South Fork is the longest fork and originates in the Chugach Mountains and drains an undeveloped "natural" area east of Muldoon Road. West of Muldoon Road the South Fork has been channelized, straightened, and lowered to its intersection with the main stem. The Middle Fork originates at Russian Jack Springs Park; several sections have been rerouted through storm sewers. The North Fork serves primarily as a storm sewer. Land uses of the Chester Creek basin (as of 1994) are shown below.



LAND USE	AREA (mi^2)	PERCENT	LAND USE	AREA (mi^2)	PERCENT
Vacant	1.5	6	Parks, Greenbelts	1.9	7
Residential	5.5	20	Transportation (Airports)	0.4	1
Commerical	1.1	4	Roads	2.9	10
Industrial	0.4	1	Military	11.7	43
Institutional (Schools, Hospitals)	1.9	7	Water	0.2	1

Land use in the Chester Creek Basin, 1994 (Municipality of Anchorage).

0 1 2 3 MILES
0 1 2 3 KILOMETERS

This newsletter was prepared by the Cook Inlet Basin study team. The purpose of the newsletter is to keep members of the Cook Inlet NAWQA liaison committee informed of our activities. The newsletter represents the views of the COOK NAWQA team and is intended for information purposes only. It is not intended for redistribution or publication, and should not be cited. If you would like your name removed from or a name added to the mailing list for this newsletter, or if you have any comments regarding this newsletter or our workplans, please contact project chief Steve Frenzel at (907)786-7107, or write to COOK NAWQA, U.S. Geological Survey, 4230 University Drive, Suite 201, Anchorage, AK 99508-4664, or send email to sfrenzel@usgs.gov

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