

APPENDIX 3.2
Air Quality

Monthly Climate Summaries for Selected Climate Stations Near Fort Wainwright and Fort Greely (Western Regional Climate Center 1998).

Eielson Field, Alaska													
Period of Record Monthly Climatic Summary													
Period of Record: September 2, 1949 to June 30, 1997													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average Max. Temperature (°F)	-2.3	6.4	23.2	41.3	58.2	68.9	70.6	65.6	53.9	31.5	10.2	-0.2	35.7
Average Min. Temperature (°F)	-18.5	-14.7	-2.9	19.7	37.2	48.0	51.1	46.2	35.0	16.6	-5.1	-15.8	16.5
Average Temperature (°F)	-10.5	-4.2	10.2	29.7	47.4	58.0	60.9	55.9	44.7	23.8	1.3	-7.8	25.8
Average Total Precipitation (in.)	0.70	0.52	0.50	0.32	0.71	1.73	2.38	2.23	1.35	0.95	0.78	0.71	12.9
Average Total Snowfall (in.)	11.7	8.9	7.7	4.2	0.9	0.0	0.0	0.0	2.3	12.4	15.4	12.8	76.4
Average Snow Depth (in.)	14	17	18	7	0	0	0	0	0	2	8	12	6

Big Delta FAA/AMOS AP, Alaska													
Period of Record Monthly Climatic Summary													
Period of Record: February 1, 1937 to June 30, 1997													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average Max. Temperature (°F)	3.6	11.7	23.9	40.9	57.2	67.1	69.5	64.6	52.5	31.9	13.5	4.8	36.8
Average Min. Temperature (°F)	-11.1	-5.9	1.6	20.3	36.8	47.1	50.4	45.5	35.3	18.0	-0.8	-9.6	19.0
Average Temperature (°F)	-4.0	2.2	13.5	30.4	46.8	56.8	60.2	55.4	44.4	24.5	5.5	-1.6	27.8
Average Total Precipitation (in.)	0.34	0.35	0.27	0.25	0.88	2.37	2.65	1.91	1.13	0.65	0.51	0.41	11.71
Average Total Snowfall (in.)	5.5	5.4	4.4	2.9	0.6	0.0	0.0	0.0	1.8	9.1	8.6	6.2	44.5
Average Snow Depth (in.)	8	10	9	4	0	0	0	0	0	2	5	6	4

Air Quality - Clean Air Act

The Clean Air Act (CAA), passed in 1963 and subsequently amended, is the primary federal statute regulating the emission of air pollutants within the United States. The intent of the CAA is to protect and enhance the quality of the Nation's air, public health, and welfare. In general, the CAA delegates responsibility to state and local governments to prevent and control air pollution. The CAA directs the U. S. Environmental Protection Agency (EPA) to set National Ambient Air Quality Standards, (NAAQS). These standards limit the maximum concentration levels of pollutants in the outdoor air. Air pollutants are categorized as either primary or secondary. Primary air quality standards are established to protect human health; secondary standards are established to

prevent negative effects on animals, plants, structures, and materials and to protect public welfare. EPA has established NAAQS for six atmospheric criteria pollutants: ozone (O₃), carbon monoxide (CO), sulfur dioxide (SO₂), nitrogen dioxide (NO₂), particulate matter 10-microns or less in size (PM₁₀), and lead (Pb). These pollutants were chosen because they can injure health, harm the environment, and cause property damage. The NAAQS for these pollutants are depicted in the following table.

National Ambient Air Quality Standards (NAAQS). Standards other than those for O₃ and PM₁₀ are not to be exceeded more than once a year. For O₃ and PM₁₀, compliance is determined by the number of days on which the respective standard is exceeded. The 3-year running average of the number of exceedances is not to be more than 1.0 (40 CFR 50, 51; 18 AAC 50).

Pollutant	Averaging Period	Primary NAAQS	Secondary NAAQS	PSD Class I Increments	PSD Class II Increments
Ozone (O ₃)	Daily Maximum Hourly Average	235 µg/m ³	235 µg/m ³	-	-
Carbon Monoxide (CO)	1-hour Average 8-hour Average	40 mg/m ³ 10 mg/m ³	- -	- -	- -
Sulfur Dioxide (SO ₂)	3-hour Maximum 24-hour Maximum Annual Arithmetic Mean	- 365 µg/m ³ 80 µg/m ³	1,300 µg/m ³ - -	25 µg/m ³ 5 µg/m ³ 2 µg/m ³	512 µg/m ³ 91 µg/m ³ 20 µg/m ³
Nitrogen Dioxide (NO ₂)	Annual Arithmetic Mean	100 µg/m ³	100 µg/m ³	2.5 µg/m ³	2.5 µg/m ³
Particulate Matter of 10 Microns or Less (PM ₁₀)	24-hour Average Annual Arithmetic Mean	150 µg/m ³ 50 µg/m ³	150 µg/m ³ 50 µg/m ³	8 µg/m ³ 4 µg/m ³	30 µg/m ³ 17 µg/m ³
Lead (Pb)	Annual Quarterly Average	1.5 µg/m ³	1.5 µg/m ³	-	-

At the federal level, NAAQS standards are applied in two ways. Primary standards, such as sulfur dioxide, particulate matter, and nitrogen oxides are emitted from an identifiable source. Secondary pollutants are formed in the atmosphere by chemical reactions involving primary pollutants. This is illustrated by ozone, which is formed by photochemical reactions involving NO₂ and intense, short-wavelength, radiant energy from the sun. The following table lists the principle primary and secondary pollutants in the United States and their sources. These pollutants are found in areas of concentrated human population. Special regulatory requirements are set by the CAA for areas with air quality failing to meet the limitations set by the NAAQS. These areas are considered “nonattainment” for a particular pollutant when any standard is not met for more than three times (on separate days) at any point during a three calendar year period. Areas that are currently meeting the established air quality standards are considered to be “in attainment”. Additionally, areas can be considered

“unclassified” if there are insufficient data to determine its status and are usually considered to be in compliance with NAAQS.

Sources of Pollutant Emissions. In the United States, the principle primary and secondary air pollutants are particulate matter, sulfur dioxide, carbon monoxide, nitrogen oxides, hydrocarbons, lead, and ozone (USAF 1995).

	Natural	Domestic	Commercial	Agricultural	Industrial	Transportation-related
Particulate matter	X	X		X	X	X
Gases (ozone)	X					
Sulfur oxides (SO _x)		X			X	X
Carbon monoxide (CO)		X			X	X
Nitrogen oxides (NO _x)		X		X	X	X
Hydrocarbons			X		X	X
Lead					X	X
Chlorines			X			
Hydrogen sulfide					X	
Carbon dioxide (CO ₂)		X				

Areas having air quality levels meeting the established standards are also known as PSD areas. The Prevention of Significant Deterioration (PSD) program was established to control and regulate the air quality of areas that met or exceed the NAAQS. The U.S. EPA is required to design and implement a program that prevents unlimited industrial growth from degrading air quality where the NAAQS are to be met. This program includes the classification of areas into three categories to establish the amount of protection needed to prevent future air pollution. Class I areas were designated to protect wilderness, national parks, and other areas by maintaining pristine air quality in those areas with more stringent air quality standards. New or modified emission sources may use up to approximately 10 percent of the NAAQS. Four PSD Class I areas have been designated within the state of Alaska: Denali National Park, Tuxedni National Wilderness Area, Bering Sea (St. Matthews Island) National Wilderness Area, and Simeonof National Wilderness Area. PSD Class I areas are also protected against visibility degradation. Poor visibility includes degradation of contrast and visual range and increases in air coloration. These conditions are a result of the interactions between fine particulate matter, sulfur dioxide, and humidity and

development of ice fog.

Class II areas include all other areas not in the Class I category and those designated as being in attainment of the NAAQS or unclassifiable due to lack of information or data. Fort Wainwright Yukon Training Area and Fort Greely are Class II areas. There are no Class III designations in Alaska. Thus, all areas not classified as Class I are Class II. This designation allows for a larger amount of air quality degradation. The table *National Ambient Air Quality Standards (NAAQS)* lists the increments allowed within areas designated as PSD Class I and PSD Class II.

Each state is required to prepare a State Implementation Plan (SIP) to fulfill the overall goals of the Clean Air Act. The purpose of the SIP is to provide for the implementation, maintenance, and enforcement of each NAAQS. States may choose to implement standards that are more stringent than those at the national level, but not less. A more stringent standard is typically set when an area is experiencing very poor air quality. Commonly, states will set emission standards coinciding with or replacing NAAQS simply for measurement and enforcement ease. Emissions from stationary sources such as power plants and other industrial facilities, and mobile sources, such as vehicles, are regulated. Stationary source facilities are typically required to obtain state permits for operation, modification, and construction. These facilities may also be subject to performance testing and emissions monitoring to ensure compliance with the emissions standards. States typically enforce annual vehicle emissions testing by a permit program to regulate vehicle emissions.

Summary of Major Sources of Air Pollution Located on Fort Wainwright Cantonment Area (U.S. Army Center for Health Promotion and Preventive Medicine 1997a). These sources were identified as part of the Title V operating permit required by the Alaska Air Quality Control Regulations, 18 AAC 50.335.

Group ID Number	Equipment Description Manufacturer/Model/Serial No.	Installed On	Modified On	Rated Capacity
EU01	Central Power Plant Boilers, Wickes and Garret & Shafer	1953, 1949	--	230 mmBtu/hr 154 mmBtu/hr
EU02	3 Aboveground Storage Tanks with Tanker Truck Loading	1995	--	13,000 gallons each
EU03	Standby Diesel Generator Plant	1949-1950	--	3@500 kW 2@1000 kW
EU04	Aerospace Activity	--	--	--
EU05	Sanitary Landfill	1962	--	--
EU06	Clear Creek Landfill	1984	--	--
EU07	Remediation Sites	1995 and 1996	--	--
EU08	Firefighter Training/Prescribed Burning	--	--	--
EU09	Ozone Depleting Substances	--	--	--
EU10	Fugitive Dust	--	--	--

Summary of *Potential* Emissions from Major Sources Located on Fort Wainwright Cantonment Area Including Regulated and Hazardous Air Contaminants (U.S. Army Center for Health Promotion and Preventive Medicine 1997a). All values are reported in tons per year unless specified.

Group ID Number	Unit Description	NO _x	SO ₂	CO	PM	VOC
EU01	Central Power Plant Boilers	2352	1310	2388	1152.07	8.4
EU02	Aboveground Storage Tank with Tanker Truck Loading	0.00	0.00	0.00	0.00	7.12
EU03	Standby Diesel Generator Plant	0.00	0.00	0.00	0.00	0.00
EU04	Aerospace Activity	0.00	0.00	0.00	0.17	8.78
EU05	Sanitary Landfill	0.00	0.00	0.00	0.00	7.97
EU06	Clear Creek Landfill	0.00	0.00	0.00	0.00	0.80
EU07	Remediation Sites	0.00	0.00	0.00	0.00	1
EU08 ²	Firefighter Training/Prescribed Burning	400.16	0.00	17781.60	1648.68	0.76
EU09	Ozone Depleting Substances	0.00	0.00	0.00	0.00	0.00
EU10 ²	Fugitive Dust	0.00	0.00	0.00	50.01	0.00
TOTAL³		2352.00	1310.00	2388.00	1152.24	33.07

² Fugitive emissions source

³ Total does not include fugitive emissions (for applicability purposes) based on the definition of potential to emit in 18 AAC 210(b).

Summary of Assessable Emissions from Major Sources Located on Fort Wainwright Cantonment Area Including Regulated and Hazardous Air Contaminants (U.S. Army Center for Health Promotion and Preventive Medicine 1997a). All values are reported in tons per year unless specified.

Group ID Number	Unit Description	NO _x	SO ₂	CO	PM	VOC
EU01	Central Power Plant Boilers	1188.90	644.80	283.2	489.94	4.25
EU02	Aboveground Storage Tank with Tanker Truck Loading	0.00	0.00	0.00	0.00	2.33
EU03	Standby Diesel Generator Plant	0.00	0.00	0.00	0.00	0.00
EU04	Aerospace Activity	0.00	0.00	0.00	0.04	2.08
EU05	Sanitary Landfill	0.00	0.00	0.00	0.00	7.07
EU06	Clear Creek Landfill	0.00	0.00	0.00	0.00	0.80
EU07	Remediation Sites	0.00	0.00	0.00	0.00	16.47
EU08	Firefighter Training/Prescribed Burning	200.08	0.00	8890.80	824.34	0.38
EU09	Ozone Depleting Substances	0.00	0.00	0.00	0.00	0.00
EU10	Fugitive Dust	0.00	0.00	0.00	13.32	0.00
Insignificant Sources - Emission Rate Basis	Miscellaneous Sources	1.12	0.09	1.41	0.23	2.78
Insignificant Sources - Size Basis	Miscellaneous Sources	0.88	0.59	0.23	0.08	0.08
TOTAL³		1390.98	645.48	9175.64	1327.95	36.24

³ Total does not include fugitive emissions (for applicability purposes) based on the definition of potential to emit in 18 AAC 210(b).

Emissions List of All Regulated Contaminants Emitted from Major Sources Located on Fort Wainwright Cantonment Area (U.S. Army Center for Health Promotion and Preventive Medicine 1997a).

Precursor or Contaminant With Ambient Air Quality Standards:		
Nitrogen Dioxide Sulfur Oxides Carbon Monoxide	PM ₁₀ Lead VOC (ozone precursors)	
New Source Performance Standards (NSPS) -Contaminants:		
VOC		
National Emission Standards for Hazardous Air Pollutants (NESHAPs) - Pre-1990:		
asbestos		
National Emission Standards for Hazardous Air Pollutants (NESHAPS) - Post-1990, MACT Standards:		
ethyl benzene methylene chloride toluene 1,1,2,2-tetrachloroethane 1,2-dichloroethane carbon disulfide chloroethane mercury methyl isobutyl ketone cobalt hydrogen fluoride hydrogen chloride vinyl chloride	cumene chloroform benzene hexane naphthalene xylenes (o,m,p) 1,1-dichloroethane 1,2-dichloropropane carbon tetrachloride dichloromethane methyl ethyl ketone perchloroethylene phenol	formaldehyde 1,1,1-trichloroethane chlorobenzene arsenic cadmium acrylonitrile 1,1-dichloroethene carbonyl sulfide chromium trichloroethylene lead styrene hexamethylene-1,6-diisocyanate
Ozone-Depleting Substances (CAA 602):		
CFC-12 HCFC-22 R-502	Halon-1301 Halon-1211	
Hazardous Air Pollutant (HAP):		

Emissions List of All Regulated Contaminants Emitted from Major Sources Located on Fort Wainwright Cantonment Area (U.S. Army Center for Health Promotion and Preventive Medicine 1997a).

cumene styrene toluene 1,1,2,2-tetrachloroethane 1,2-dichloroethane carbon disulfide carbonyl sulfide chloroethane ethyl benzene methyl isobutyl ketone vinyl chloride lead hexamethylene-1,6-diisocyanate	chloroform benzene ethyl benzene methylene chloride 1,1-dichloroethane 1,2-dichloropropane carbon tetrachloride mercury cadmium chromium perchloroethylene cobalt hydrogen fluoride hydrogen chloride	arsenic formaldehyde 1,1,1-trichloroethane chlorobenzene hexane naphthalene xylenes (o,m,p) 1,1-dichloroethene acrylonitrile carbonyl disulfide dichloromethane methyl ethyl ketone trichloroethylene phenol
Air Contaminants Regulated Under Accidental Release Prevention:		
propane	chlorine	

**Summary of Major Sources of Air Pollution Located on Fort Greely
(U.S. Army Center for Health Promotion and Preventive Medicine**

1997b). These sources were identified as part of the Title V operating permit required by the Alaska Air Quality Control Regulations, 18 AAC 50.335.

Group ID Number	Equipment Description Manufacturer/Model/Serial No.	Installed On	Modified On	Rated Capacity
EU01	2 Industrial Boilers, English Tube, Serial Nos. 92-193-A & 92-193-B	1993	--	57.9 mmBtu
EU02	Industrial Boilers, Erie City Iron Works, Serial No. 94268	1954	--	67.3 mm Btu
EU03	Generator, Standby, Enterprise, Model No. DSQ316, Serial No. 54033	1953	--	1000 kW
EU04	Generator, Standby, Enterprise, Model No. DSQ316, Serial No. 54032	1953	--	1000 kW
EU05	Generator, Standby, Enterprise, Model No. DSQ316, Serial No. 54031	1953	--	1000 kW
EU06	Generator, Standby, Enterprise, Model No. DSQ38, Serial No. 59019	1962	--	1250 kW
EU07	Generator, Standby, Enterprise, Model No. DSQ38, Serial No. 59020	1962	--	1250 kW
EU08	3 Generators, Primary, Caterpillar, Model No. CAT3306B, Serial Nos. PC-3785273, PC-3785272, XC-3785275	1991	--	125 kW
EU09	Open Burn Pit, Municipal Refuse 12 feet wide x 30 feet long x 12 feet deep	--	--	--
EU10	Storage Tank, Aboveground, Horizontal, Diesel Fuel Arctic, Bldg. 2035	1994	--	20,000 gallons
EU11	2 Storage Tanks, Underground, Horizontal, Diesel Fuel Arctic, Bldg. 606	1992	--	35,000 gallons
EU12	Storage Tanks, Underground, Horizontal, Diesel Fuel Arctic, Bldg. 2019	1993	--	30,000 gallons
EU13	Storage Tanks, Underground, Horizontal, Diesel Fuel Arctic, Bldg. 1928	1989	--	15,000 gallons
EU14	Storage Tank, Aboveground, Horizontal with Tanker Truck Loading, Jet Fuel (JP4) Bldg. 110	1994	--	20,000 gallons

Summary of Major Sources of Air Pollution Located on Fort Greely (U.S. Army Center for Health Promotion and Preventive Medicine 1997b). These sources were identified as part of the Title V operating permit required by the Alaska Air Quality Control Regulations, 18 AAC 50.335.

Group ID Number	Equipment Description Manufacturer/Model/Serial No.	Installed On	Modified On	Rated Capacity
EU15	Storage Tank, Aboveground, Vertical Fixed Roof, Diesel Fuel Arctic, Bldg. 618	1954	1995	630,000 gallons
EU16	Firefighter training/Prescribed burning	--	--	--
EU17	Ozone Depleting Substances	--	--	--
EU18	Fugitive Dust	--	--	--
EU19	Municipal Landfill	--	--	--

Summary of *Potential* Emissions from Major Sources Located on Fort Greely Including Regulated and Hazardous Air Contaminants (U.S. Army Center for Health Promotion and Preventive Medicine 1997b). All values are reported in tons per year unless specified. AST = Aboveground Storage Tank. UST = Underground Storage Tank. DFA = Diesel Fuel Arctic.

Group ID Number	Unit Description	NO _x	SO ₂	CO	PM	VOC
EU01	2 Industrial Boilers, 57.9 mmBtu	81.96	174.60	20.50	4.10	0.82
EU02	Industrial Boiler, 67.3 mmBtu	47.64	101.47	11.91	2.38	0.48
EU03	Generator, 1000 kW	151.37	15.31	34.69	2.83	4.05
EU04	Generator, 1000 kW	151.37	15.31	34.69	2.83	4.05
EU05	Generator, 1000 kW	151.37	15.31	34.69	2.83	4.05
EU06	Generator, 1250 kW	185.54	18.76	42.52	3.47	4.96
EU07	Generator, 1250 kW	185.54	18.76	42.52	3.47	4.96
EU08	3 Generators, 125 kW	91.65	6.06	19.75	6.50	7.42
EU09	Open Burn Pit	122.67	4.09	347.55	65.42	122.67
EU10	AST, 20,000 gal, DFA	0.00	0.00	0.00	0.00	<0.01
EU11	2 UST, 35,000 gal, DFA	0.00	0.00	0.00	0.00	0.18
EU12	UST, 30,000 gal, DFA	0.00	0.00	0.00	0.00	<0.01
EU13	UST, 15,000 gal, DFA	0.00	0.00	0.00	0.00	<0.01
EU14	UST, 20,000 gal, JP4	0.00	0.00	0.00	0.00	1.83
EU15	AST, 630,000 gal, DFA	0.00	0.00	0.00	0.00	0.07
EU16 ¹	Firefighter Training/ Prescribed Burning	160.00	NA	7457.95	659.20	NA
EU17	Ozone Depleting Substances	0.00	0.00	0.00	0.00	0.00
EU18 ¹	Fugitive Dust	0.00	0.00	0.00	6.21	0.00
EU19	Municipal Landfill	0.00	0.00	0.00	0.00	1.04
TOTAL²		1169.11	369.67	588.82	93.83	156.61

¹ Fugitive emissions source

² Total does not include fugitive emissions (for applicability purposes) based on the definition of potential to emit in 18 AAC 210(b).

Summary of Assessable Emissions from Major Sources Located on Fort Greely Including Regulated and Hazardous Air Contaminants (U.S. Army Center for Health Promotion and Preventive Medicine 1997b). All values are reported in tons per year unless specified. AST = Aboveground Storage Tank. UST = Underground Storage Tank. DFA = Diesel Fuel Arctic.

Group ID Number	Unit Description	NO _x	SO ₂	CO	PM	VOC
EU01	2 Industrial Boilers, 57.9 mmBtu	12.20	6.93	3.05	0.62	0.12
EU02	Industrial Boiler, 67.3 mmBtu	6.10	3.47	1.53	0.31	0.06
EU03	Generator, 1000 kW	2.09	0.06	0.56	0.04	0.06
EU04	Generator, 1000 kW	2.09	0.06	0.56	0.04	0.06
EU05	Generator, 1000 kW	2.09	0.06	0.56	0.04	0.06
EU06	Generator, 1250 kW	2.61	0.07	0.69	0.05	0.07
EU07	Generator, 1250 kW	2.61	0.07	0.69	0.05	0.07
EU08	3 Generators, 125 kW	15.94	1.05	3.44	1.12	1.30
EU09	Open Burn Pit	7.08	1.18	100.35	18.89	35.42
EU10	AST, 20,000 gal, DFA	0	0	0	0	<0.01
EU11	2 UST, 35,000 gal, DFA	0	0	0	0	0.02
EU12	UST, 30,000 gal, DFA	0	0	0	0	<0.01
EU13	UST, 15,000 gal, DFA	0	0	0	0	<0.01
EU14	UST, 20,000 gal, JP4	0	0	0	0	0.50
EU15	AST, 630,000 gal, DFA	0	0	0	0	0.06
EU16	Firefighter Training/ Prescribed Burning	80.00	NA	3555.20	329.60	NA
EU17	Ozone Depleting Substances	0.00	0.00	0.00	0.00	0.00
EU18	Fugitive Dust	0.00	0.00	0.00	1.56	0.00
EU19	Municipal Landfill	0.00	0.00	0.00	0.00	0.40
Insignificant Sources Emission Rate Basis	Miscellaneous Sources	2.89	1.01	0.71	0.50	2.77
Insignificant Sources Size Basis	Miscellaneous Sources	0.77	0.49	0.22	0.13	0.16

Summary of *Assessable* Emissions from Major Sources Located on Fort Greely Including Regulated and Hazardous Air Contaminants (U.S. Army Center for Health Promotion and Preventive Medicine

1997b). All values are reported in tons per year unless specified. AST = Aboveground Storage Tank. UST = Underground Storage Tank. DFA = Diesel Fuel Arctic.

Group ID Number	Unit Description	NO _x	SO ₂	CO	PM	VOC
TOTAL		136.47	14.45	3667.56	352.95	41.16

Emissions List of All Regulated Contaminants Emitted from Major Sources Located on Fort Greely (U.S. Army Center for Health Promotion and Preventive Medicine 1997b).

Precursor or Contaminant With Ambient Air Quality Standards:		
Nitrogen Dioxide Sulfur Oxides Carbon Monoxide	PM ₁₀ Lead VOC (ozone precursors)	
New Source Performance Standards (NSPS) - Contaminants:		
VOC	Particulate Matter	
National Emission Standards for Hazardous Air Pollutants (NESHAPs) - Pre-1990:		
asbestos		
National Emission Standards for Hazardous Air Pollutants (NESHAPS) - Post-1990, MACT Standards:		
acetaldehyde 1,3-butadiene polycyclic organic matter ethyl benzene methylene chloride toluene 1,1,2,2-tetrachloroethane 1,2-dichloroethane carbon disulfide chloroethane mercury methyl isobutyl ketone vinyl chloride polyaromatic	acrolein chloroform benzene hexane naphthalene xylenes (o,m,p) 1,1-dichloroethane 1,2-dichloropropane carbon tetrachloride dichloromethane methyl ethyl ketone perchloroethylene nickel hydrocarbons	formaldehyde 1,1,1-trichloroethane chlorobenzene arsenic beryllium cadmium 1,1-dichloroethene acrylonitrile carbonyl sulfide chromium manganese trichloroethylene lead
Ozone-Depleting Substances (CAA 602):		
CFC-12 HCFC-22	R-502 Halon-1301	
Hazardous Air Pollutant (HAP):		
acetaldehyde 1,3-butadiene polycyclic organic matter cumene styrene toluene 1,1,2,2-tetrachloroethane 1,2-dichloroethene carbon disulfide chloroethane ethyl benzene methyl isobutyl ketone vinyl chloride	acrolein chloroform benzene ethyl benzene methylene chloride 1,2,4-trichlorobenzene 1,1-dichloroethane 1,2-dichloropropane carbon tetrachloride chloroform mercury perchloroethylene	formaldehyde 1,1,1-trichloroethane chlorobenzene hexane naphthalene xylenes (o,m,p) 1,1-dichloroethene acrylonitrile carbonyl disulfide dichloromethane methyl ethyl ketone trichloroethylene

Emissions List of All Regulated Contaminants Emitted from Major Sources Located on Fort Greely (U.S. Army Center for Health Promotion and Preventive Medicine 1997b).

Air Contaminants Regulated Under Accidental Release Prevention:	
propane	chlorine

Carbon Monoxide Emissions From Mobile Sources for Fairbanks Military Bases

1990 Base year mobile sources:

1. On road (roadway)- Eielson contribution

1990 roadway emissions= 86.77 tons/day (TPD)

Prorate Eielson contribution based on 1990 Vehicle Miles Traveled (VMT) estimates(1)

Eielson on base VMT = 20,175

Total VMT = 1,446,484

Eielson on-base emissions = $20,175 / 1,446,686 (86.77) = 1.21$ TPD

2. Off road (off Highway)(2)- Military contribution

-Snowmachines / ATV - Ft. Wainwright(0.03) + Ft. Eielson(0.22) = 0.25 TPD

- Refuse / Snow removal - Ft. Wainwright(0.06) + Ft. Eielson(0.07) = 0.13 TPD

- Home snowblower (not broken out by military usage) = 0

- Agricultural equipment, RV's, lawn and garden equipment, and construction = 0
equipment assumed to have no wintertime emissions in Fairbanks

Total Military Emissions = 0.38 TPD

3. Aircraft(2) - Military contribution

-Fairbanks International Airport military contribution = 0.11TPD

-Ft. Wainwright = 0.87 TPD

-Eielson Air Force Base = 1.36TPD

Total Military Emissions = 2.34TPD

4. Railroad - not broken out for military = 0

NOTES

* On-road emission values for Eielson are prorated based on available VMT estimates. Ft. Wainwright VMT estimates were not available, so the Ft. Wainwright contribution is not included in the 1.21 TPD emissions estimate.

* See the following tables for total point, area and mobile source emissions for 1990, 1995, and 2000. These are from the Alaska State Air Quality Control Plan.

Footnotes

(1) 2/28/92 letter from Kelly McMullen (App III.C.3 of Alaska State Air Quality Control Plan)

(2) "Fairbanks 1990 Base Year Emissions Inventory" prepared by Sierra Research 12/29/93 (App III.C.3 of Alaska State Air Quality Control Plan)

**Daily Wintertime Carbon Monoxide Emissions for Fairbanks, Alaska
(1990 Base Year).** Percentages may not add up due to rounding.

Source Category	Tons / Day	Percent of Total Daily
Roadway	86.77	78.0
Off Highway	1.62	1.5
Aircraft	3.76	3.4
Railroad	0.02	0.0
TOTAL MOBILE	92.17	82.9
Fuel Oil Combustion	0.58	0.5
Coal Combustion	0.56	0.5
Propane Combustion	0.01	0.0
Wood Combustion	11.74	10.6
Industrial Equipment	<0.01	0.0
Solid Waste Incineration	<0.01	0.0
Open Burning/Structural Fires	0.11	0.1
TOTAL AREA SOURCES	13.00	11.7
MAPCO Petroleum	0.18	0.2
Eielson Air Force Base	1.38	1.2
Fort Wainwright	1.59	1.4
Golden Valley Electric Association/Fairbanks	0.58	0.5
Golden Valley Electric Association/Fairbanks	0.19	0.2
University of Alaska/Fairbanks	0.40	0.4
Petro-Star	0.01	0.0
Fairbanks Municipal Utilities System (FMUS)	1.21	1.1
Alyeska Pump Station No. 8	0.52	0.5
TOTAL POINT SOURCES	6.06	5.4
TOTAL EMISSIONS	111.23	100.0

Daily Wintertime Carbon Monoxide Emissions for Fairbanks, Alaska (1995 Projected Year). Percentages may not add up due to rounding. Roadway emissions are based on assumed I/M program effectiveness of 85% of MOBILES test-only credits.

Source Category	Tons / Day	Percent of Total Daily
Roadway	63.64"	72.2
Off Highway	1.62	1.8
Aircraft	3.76	4.3
Railroad	0.2	0.0
TOTAL MOBILE	69.04	78.4
Fuel Oil Combustion	0.58	0.7
Coal Combustion	0.56	0.6
Propane Combustion	0.01	0.0
Wood Combustion	11.74	13.3
Industrial Equipment	<0.01	0.0
Solid Waste Incineration	<0.01	0.0
Open Burning/Structural Fires	0.11	0.1
TOTAL AREA SOURCES	13.00	14.8
MAPCO Petroleum	0.18	0.2
Eielson Air Force Base	1.38	1.6
Fort Wainwright	1.59	1.8
Golden Valley Electric Association/Fairbanks	0.58	0.7
Golden Valley Electric Association/Fairbanks	0.19	0.2
University of Alaska/Fairbanks	0.40	0.5
Petro-Star	0.01	0.0
Fairbanks Municipal Utilities System (FMUS)	1.21	1.4
Alyeska Pump Station No. 8	0.52	0.6
TOTAL POINT SOURCES	6.06	6.9
TOTAL EMISSIONS	88.10	100.0

Daily Wintertime Carbon Monoxide Emissions for Fairbanks, Alaska

(2000 Projected year). Percentages may not add up due to rounding. Roadway emissions are based on an assumed I/M program effectiveness of 85% of MOBILES test-only credits.

Source Category	Tons / Day	Percent of Total Daily
Roadway	47.70"	66.1
Off Highway	1.62	2.2
Aircraft	3.76	5.2
Railroad	0.02	0.0
TOTAL MOBILE	53.10	73.6
Fuel Oil Combustion	0.58	0.8
Coal Combustion	0.56	0.8
Propane Combustion	0.01	0.0
Wood Combustion	11.74	16.3
Industrial Equipment	<0.01	0.0
Solid Waste Incineration	<0.01	0.0
Open Burning/Structural Fires	0.11	0.2
TOTAL AREA SOURCES	13.00	18.0
MAPCO Petroleum	0.18	0.2
Eielson Air Force Base	1.38	1.9
Fort Wainwright	1.59	2.2
Golden Valley Electric Association/Fairbanks	0.58	0.8
Golden Valley Electric Association/Fairbanks	0.19	0.3
University of Alaska/Fairbanks	0.40	0.6
Petro-Star	0.01	0.0
Fairbanks Municipal Utilities System (FMUS)	1.21	1.7
Alyeska Pump Station No. 8	0.52	0.7
TOTAL POINT SOURCES	6.06	8.4
TOTAL EMISSIONS	72.16	100.0

APPENDIX 3.4
Selected Geologic Terms
and
Geologic Time Scale

Selected Geologic Terms Used in Chapters 3.4 and 3.5

(Simplified Definitions for Practical Use)

epicenter	a point on the surface of the earth which is directly above an earthquake's point of origin
geothermal	heat from natural processes that occur within the earth
granitic	a type of crystalline rock characterized by specific minerals such as quartz, feldspar, and mica
igneous	a category of rocks which have formed by solidifying from a molten state (includes volcanic rocks)
intrusive	a rock body (such as a pluton) which forms when molten material migrates into an existing rock body and solidifies without reaching the surface
lode	mineral deposit occurring in solid rock
loess	windblown silt
metamorphic	a category of rocks which have been chemically, physically, and/or structurally altered from their original state
moraine	rock and soil debris carried and deposited by a glacier
outwash	sediments (mostly sand and gravel) deposited by meltwater from a glacier
placer	unconsolidated material (gravel, sand, etc.) containing particles of valuable minerals
plate	a major block of the earth's crust
pluton	a rock body formed when molten material (magma) intrudes other rocks and cools to a solid mass without reaching the surface
porphyry	crystalline rock in which certain minerals are conspicuously larger than the main mass
riprap	coarse, blocky rock material used for fill and slope protection
sedimentary	a category of rocks made from solidified gravel, sand, silt, or clay; transported by water, air, or gravity
sulfide	a mineral that is composed of sulfur combined with other elements such as iron, lead, zinc. Many ores consist of sulfide minerals.
terrane	a collection of rocks that share a geologic history and have often traveled far from where they originated
volcanic	rock that forms when molten material reaches the earth's surface before solidifying
volcanogenic	originating from a volcanic process

The Geologic Time Scale

Source: U.S. Geological Survey Web Site. URL: <http://geology.er.usgs.gov/paleo/geotime.shtml>
Last modified: June 1998

Cenozoic Era 66 million years ago - present

Quaternary Period 2 million years ago - present

Holocene Epoch 8,000 years ago - present

Pleistocene Epoch . . . 2 million - 8,000 years ago

Tertiary Period 66 - 2 million years ago

Pliocene Epoch 5 - 2 million years ago

Miocene Epoch 24 - 5 million years ago

Oligocene Epoch . . . 37 - 24 million years ago

Eocene Epoch 58 - 37 million years ago

Paleocene Epoch . . . 66 - 58 million years ago

Mesozoic Era 250 - 66 million years ago

Cretaceous Period 135 - 66 million years ago

Jurassic Period 205 - 135 million years ago

Triassic Period 250 - 205 million years ago

Paleozoic Era 570 - 250 million years ago

Permian Period 290 - 250 million years ago

Carboniferous Period . . . 365 - 290 million years ago

Pennsylvanian Period . . . 310 - 290 million years ago

Mississippian Period . . . 365 - 310 million years ago

Devonian Period 400 - 365 million years ago

Silurian Period 425 - 400 million years ago

Ordovician Period 500 - 425 million years ago

Cambrian Period 570 - 500 million years ago

Precambrian Formation of Earth to 570 million years ago

APPENDIX 3.8

Surface Water

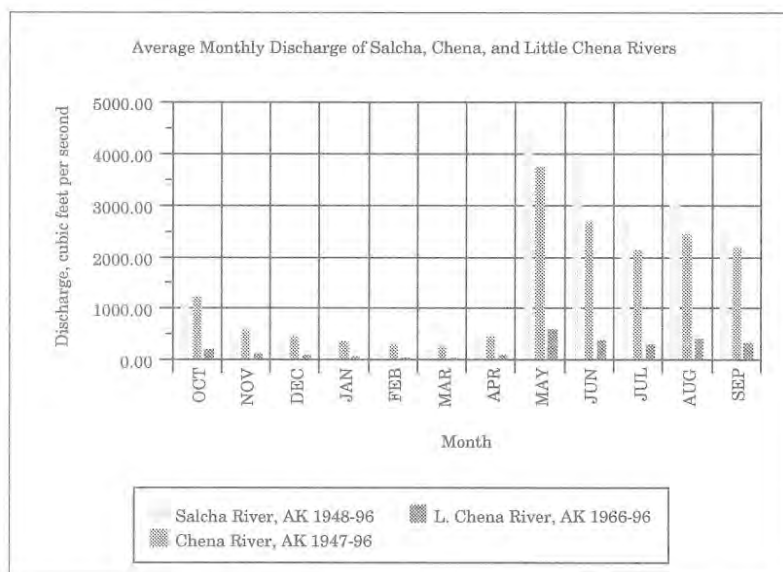
3.8.A Streamflow	APP-127
3.8.B Floodplains	APP-131
3.8.C Water Quality Criteria	APP-135
3.8.D Water Quality Values	APP-147
3.8.E Ice Bridge Permits	APP-175

Appendix 3.8.A

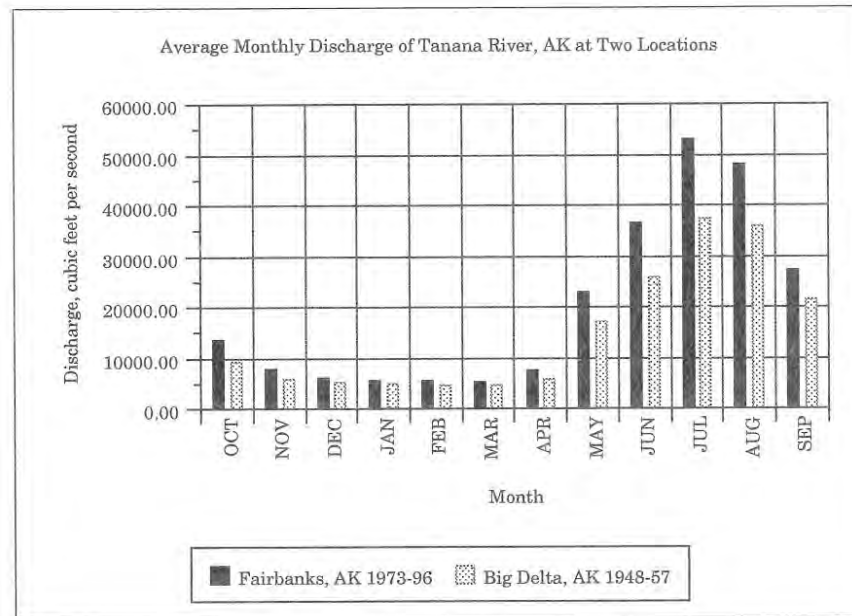
Streamflow

General Description of Tanana River Basin

Fort Wainwright Yukon Training Area and Fort Greely West and East Training Areas are within the Tanana River drainage basin. The Tanana River basin covers approximately 44,500 square miles, with 576 square miles of its headwaters in Canada. Sources of flow for the Tanana River include the glaciers and slopes of the Wrangell, Mentasta and Nutzotin Mountains. The Tanana River eventually empties into the larger Yukon River. The average streamflow of the Tanana River near its mouth is estimated as 37,000 cfs (cubic feet per second). Approximately 85% of this discharge originates in the Alaska Range; approximately 50% of this discharge originating in the Alaska Range is contributed by four tributaries from the south side: the Kantishna, Nenana, Nebesna, and Delta rivers (Anderson 1970). The remaining 15% of Tanana basin discharge originates in the Yukon-Tanana Upland. The four main tributaries are the Salcha, Tolovana, Chena, and Goodpaster rivers (Anderson 1970).



The average low flow, 31 cfs, and high flow, 588 cfs, of the Little Chena River near Fairbanks occurs in March and May, respectively. The average yearly discharge for the Little Chena River is 213 cfs. A peak discharge of 17,000 cfs occurred on August 13, 1967. Similarly, an average low flow of 260 cfs and an average high flow of 3,731 cfs occurred in March and May for the Chena River at Fairbanks. The average discharge for the Chena River is 1,394 cfs. A peak discharge of 74,400 cfs occurred on August 15, 1967. The Salcha River, which is the largest river of the three, has an average yearly discharge of 1,630 cfs. Low and high flows of 193 cfs and 4,404 cfs occurred in March and May. The highest discharge value recorded for the Salcha River was 97,000 cfs, which occurred on August 14, 1967 (United States Geological Survey 1998).



Average low flows of 4,716 cfs at Big Delta and 5,371 cfs at Fairbanks occurred in March. Highest average discharges of 37,408 and 53,089 cfs were recorded in July at Big Delta and Fairbanks, respectively. The yearly average discharge for the Tanana River between Big Delta and Fairbanks is approximately 17,500 cfs. The highest peak flow of 62,800 cfs recorded at the Big Delta station occurred on July 29, 1949. The highest peak flow of 125,000 cfs occurred on August 16, 1967 at the Fairbanks station (United States Geological Survey 1998).

Appendix 3.8.B Floodplains

Federal Emergency Management Agency's National Flood Insurance Program

The National Flood Insurance Program (NFIP) was delegated by the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This program requires the Fairbanks North Star Borough (FNSB), of which Fort Wainwright is a part, to periodically revise and update its Flood Insurance Study/Flood Insurance Rate Map. This information is used by FNSB to update existing floodplain regulations and to promote sound land use and floodplain development. Each flood insurance study provides 100-year flood elevations and delineations of the 100 and 500-year floodplain boundaries and 100-year floodway values to assist communities in developing floodplain management measures.

Figure 3.8.c illustrates the 100-year, 500-year, and outside of the 500-year floodplain boundaries for the areas surrounding Fort Wainwright Yukon Training Area. The one percent annual chance (100-year) flood is considered the base flood for floodplain management purposes. The 0.2 percent annual chance (500-year) flood is used to identify additional areas of flood risk. Zone A is considered a special flood hazard area and is inundated by the 100-year flood. However, no base flood elevations were determined. Zone X is considered a moderate flood hazard area and is within the 500-year floodplain. This zone also includes areas where the 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile occur and areas protected by levees from the 100-year flood. Zone XO includes areas determined to be outside of the 500-year floodplain (Federal Emergency Management Agency 1982a).

The upper northwest portion of Fort Wainwright Yukon Training Area relies on the Chena River Lakes Flood Control Project for flood protection. The Flood Control Project consists of an earthfill dam across the Chena River, a 12-foot levee along the north bank of the Tanana River and various drainage ditches. Stream flow is not impeded under normal conditions. When flooding occurs, water will be temporarily detained until the flood threat passes; if this holding area is filled, a spillway will take the excess into the Tanana River (Nakata Planning Group 1987).

A Flood Insurance Study was completed for the incorporated areas of the City of Delta Junction, Southeast Fairbanks Division, Alaska. The Delta River and Jarvis Creek were studied in detail even though they were not within the corporate limits of the community. The main flood-related problems within Delta Junction have been erosion along the Delta River and flooding from Jarvis Creek (Federal Emergency Management Agency 1982b).

The east bank of the Delta River is higher than the west bank. As a result, the low west bank, as well as the large floodplain, creates very low probabilities of overbank flooding to the east (Nelson 1995). The principle risk to local communities is not from river flooding, but from lateral erosion of the east bank

of the Delta River. Numerous groins and bank-protection structures have been installed to prevent bank erosion. According to studies performed by the Alaska District U.S. Army Corps of Engineers, the 500-year flood would not flood the communities on the east side of the Delta River (Federal Emergency Management Agency 1982).

Jarvis Creek has historical problems with overflow into an old channel, located approximately 14 miles above the confluence of Jarvis Creek and the Delta River that runs through Delta Junction. The U.S. Army placed a barrier at the overflow location after the flood of 1967, and since then, flooding along this old channel has not occurred (Federal Emergency Management Agency 1982). In addition, flooding from Jarvis Creek may occur due to ice jams.

Appendix 3.8.C

Water Quality Criteria

Water Quality Criteria for Fresh Water Uses as Set by the State of Alaska in 18 AAC 70.

(1) FRESH WATER USES	FECAL COLIFORM BACTERIA (FC) (See note 1)	DISSOLVED GAS	PH (Variation of pH for waters naturally outside the specified range must be towards the range)	TURBIDITY (not applicable to groundwater)	TEMPERATURE
(A) Water Supply (i) drinking, culinary, and food processing	Based on minimum of 5 samples taken in a 30-day period, the mean may not exceed 20 FC/100 ml, and not more than 10% of the samples may exceed 40 FC/100 ml. For groundwater, the FC concentration must be less than 1 FC/100 ul, using the fecal coliform Membrane Filter Technique, or less than 3 FC/100 ml, using the fecal coliform most probable number (MPN) technique.	Dissolved Oxygen (D.O.) must be greater than or equal to 4 mg/l (this does not apply to lakes or reservoirs in which supplies are taken from below the thermocline, or to groundwater).	May not be less than 6.0 or greater than 8.5. May not vary more than 0.5 pH unit from natural conditions.	May not exceed 5 nephelometric turbidity units (NTU) above natural conditions when the natural turbidity is 50 NTU or less, and may not have more than 10% increase in turbidity when the natural turbidity is more than 50 NTU, not to exceed a maximum increase of 25 NTU.	May not exceed 15 C.
(A) Water Supply (ii) agriculture including irrigation and stock watering	For products normally cooked and for dairy sanitation of pasteurized products, the mean, based on a minimum of 5 samples taken in a 30-day period, may not exceed 200 FC/100 ml, and not more than 10% of the samples may exceed 400 FC/ml. For products not normally cooked and for dairy sanitation of unpasteurized products, the criteria for drinking water supply (1)(A)(i), apply.	D.O. must be greater than 3 mg/l in surface waters.	May not be less than 5.0 or greater than 9.0; for dairy sanitation, pH may not be less than 6.8 or greater than 8.5.	May not cause detrimental effects on indicated use.	May not exceed 30 C.

Water Quality Criteria for Fresh Water Uses as Set by the State of Alaska in 18 AAC 70.

(1) FRESH WATER USES	FECAL COLIFORM BACTERIA (FC) (See note 1)	DISSOLVED GAS	PH (Variation of pH for waters naturally outside the specified range must be towards the range)	TURBIDITY (not applicable to groundwater)	TEMPERATURE
(A)Water Supply (iii) aquaculture	For products normally cooked, the mean, based on a minimum of 5 samples taken in a 30-day period, may not exceed 200 FC/100 ml and not more than 10% of the samples may exceed 400 FC/100 ml. For products not normally cooked, the criteria for drinking water supply, (1)(A)(i) apply.	D.O. must be greater than 7 mg/l in surface waters. The concentration of D.O. may not exceed 110% of saturation at any point of sample collection.	May not be less than 6.5 or greater than 8.5. May not vary more than 0.5 pH unit from natural conditions.	May not exceed 25 NTU above natural conditions. For all lake waters, may not exceed 5 NTU above natural conditions.	May not exceed 20 C at any time. The following maximum temperatures may not be exceeded, where applicable: Migration routes 15 C Spawning areas 13 C Rearing areas 15 C Egg & fry incubation 13C
(A)Water Supply (iv) industrial	Where worker contact is present, the mean, based on a minimum of 5 samples taken in a 30-day period, may not exceed 200 FC/100 ml, and not more than 10% of the samples may exceed 400 FC/100 ml.	May not cause detrimental effects on established water supply treatment levels.	May not be less than 5.0 or greater than 9.0.	May not cause detrimental effects on established water supply treatment levels.	May not exceed 25 C.
(B)Water Recreation (i) contact recreation	Based on a minimum of 5 samples taken in a 30-day period, the mean may not exceed 100 FC/100 ml, and not more than one sample, or more than 10% of the samples if there are more than 10 samples, may exceed 200 FC/100 ml.	D.O. must be greater than or equal to 4 mg/l.	May not be less than 6.5 or greater than 8.5. May not vary more than 0.5 pH unit from natural conditions. If the natural condition is outside this range, substances may not be added that cause an increase in the buffering capacity of the water.	May not exceed 5 NTU above natural conditions when the natural turbidity is 50 NTU or less, and may not have more than 10% increase in turbidity when the natural turbidity is more than 50 NTU, not to exceed a maximum increase of 15 NTU. May not exceed 5 NTU above natural turbidity for all lake waters.	Same as (1)(A)(ii).

Water Quality Criteria for Fresh Water Uses as Set by the State of Alaska in 18 AAC 70.

(1) FRESH WATER USES	FECAL COLIFORM BACTERIA (FC) (See note 1)	DISSOLVED GAS	PH (Variation of pH for waters naturally outside the specified range must be towards the range)	TURBIDITY (not applicable to groundwater)	TEMPERATURE
(B) Water Recreation (ii) secondary recreation	Based on a minimum of 5 samples taken in a 30-day period, the mean may not exceed 200 FC/100 ml, and not more than 10% of the total samples may exceed 400 FC/100 ml.	Same as (1)(B)(i).	Same as (1)(A)(iv).	May not exceed 10 NTU above natural conditions when the natural turbidity is 50 NTU or less, and may not have more than 20% increase in turbidity when the natural turbidity is more than 50 NTU, not to exceed a maximum increase of 15 NTU. May not exceed 5 NTU above natural turbidity for all lake waters.	Not applicable.
(C) Growth and Propagation of Fish, Shellfish, Other Aquatic Life, and Wildlife	Not applicable.	D.O. must be greater than 7 mg/l in water used by anadromous and resident fish. In no case may D.O. be less than 5 mg/l to a depth of 20 cm in the interstitial waters of gravel used by anadromous or resident fish for spawning. For waters not used for anadromous or resident fish, D.O. must be greater than or equal to 5 mg/l. In no case may D.O. be greater than 17 mg/l. The concentration of D.O. may not exceed 110% of saturation at any point of sample collection.	May not be less than 6.5 or greater than 9.0. May not vary more than 0.5 pH unit from natural conditions.	Same as (1)(A)(iii).	Same as (1)(A)(iii).

Water Quality Criteria for Fresh Water Uses as Set by the State of Alaska in 18 AAC 70.

(1) FRESH WATER USES	DISSOLVED INORGANIC SUBSTANCES	SEDIMENT (Not applicable to groundwater)	TOXIC AND OTHER DELETERIOUS ORGANIC AND INORGANIC SUBSTANCES	COLOR	PETROLEUM HYDROCARBONS, OILS AND GREASE
(A) Water Supply (I) drinking, culinary, and food processing	Total dissolved solids (TDS) from all sources may not exceed 500 mg/l. Neither chlorides nor sulfates may exceed 200 mg/l.	No measurable increase in concentration of settleable solids above natural conditions, as measured by the volumetric Imhoff cone method (See note 13).	Substances may not exceed Alaska Drinking Water Standards (18 AAC 80) or where those standards do not exist, EPA Quality Criteria for Water (See note 5).	May not exceed 15 color units or the natural condition, whichever is greater.	May not cause a visible sheen upon the surface of the water. May not exceed concentrations that individually or in combination impart odor or taste as determined by organoleptic tests.
(A) Water Supply (II) agriculture including irrigation and stock watering	TDS may not exceed 1,000 mg/l. Sodium absorption ratio must be less than 2.5, sodium percentage less than 60%, residual carbonate less than 1.25 mg/l, and boron less than 0.3 mg/l (See note 6).	For sprinkler irrigation, water must be free of particles of 0.074 mm or coarser. For irrigation or water spreading, may not exceed 200 mg/l for an extended period of time.	Same as (1)(A)(i) where contact with a product destined for human consumption is present. Same as (1)(C) or Federal Water Pollution Control Administration, Water Quality Criteria (WQC/FWPCA), as applicable to substances for stockwaters; irrigation waters may not exceed WQC/FWPCA or WQC 1972 (See notes 6 and 7).	Not applicable.	May not cause a visible sheen upon the surface of the water.

Water Quality Criteria for Fresh Water Uses as Set by the State of Alaska in 18 AAC 70.

(1) FRESH WATER USES	DISSOLVED INORGANIC SUBSTANCES	SEDIMENT (Not applicable to groundwater)	TOXIC AND OTHER DELETERIOUS ORGANIC AND INORGANIC SUBSTANCES	COLOR	PETROLEUM HYDROCARBONS, OILS AND GREASE
(A)Water Supply (iii) aquaculture	TDS may not exceed 1,500 mg/l, including natural conditions. Increase in TDS may not exceed one-third of the concentration of the natural condition of the water body.	No imposed loads that will interfere with established water supply treatment levels.	Same as (1)(C).	May not exceed 50 color units or the natural condition, whichever is greater.	Total aqueous hydrocarbons (TaQH) in the water column may not exceed 15 ug/l (See note 8). Total aromatic hydrocarbons (TAH) in the water column may not exceed 10 ug/l (See note 8). There may be not concentrations of petroleum hydrocarbons, animal fats, or vegetable oils in shoreline or bottom sediments that cause deleterious effects to aquatic life. Surface waters and adjoining shorelines must be virtually free from floating oil, film, sheen, or discoloration.
(A)Water Supply (iv) industrial	No amounts above natural conditions that can cause corrosion, scaling, or process problems.	Same as (1)(A)(iii).	Substances that pose hazards to worker contact may not be present.	May not cause detrimental effects on established water supply treatment levels.	May not make the water unfit or unsafe for the use.
(B)Water Recreation (i) contact recreation	Not applicable.	Same as (1)(A)(i).	Same as (1)(A)(i).	Same as (1)(A)(i).	May not cause a film, sheen, or discoloration on the surface or floor of the waterbody or adjoining shorelines. Surface waters must be virtually free from floating oils.
(B)Water Recreation (ii) secondary recreation	Not applicable.	May not pose hazards to incidental human contact or cause interference with the use.	Substances that pose hazards to incidental human contact may not be present.	May not interfere with or make the water unfit or unsafe for the use.	Same as (1)(B)(i).

Water Quality Criteria for Fresh Water Uses as Set by the State of Alaska in 18 AAC 70.

(1) FRESH WATER USES	DISSOLVED INORGANIC SUBSTANCES	SEDIMENT (Not applicable to groundwater)	TOXIC AND OTHER DELETERIOUS ORGANIC AND INORGANIC SUBSTANCES	COLOR	PETROLEUM HYDROCARBONS, OILS AND GREASE
(C) Growth and Propagation of Fish, Shellfish, Other Aquatic Life, and Wildlife	Same as (1)(A)(iii).	The percent accumulation of fine sediment in the range of 0.1 mm to 4.0 mm in the gravel bed of waters used by anadromous or resident fish for spawning may not be increased more than 5% by weight above natural conditions (as shown by grain size accumulation graph). In no case may the 0.1 mm to 4.0 mm fine sediment range in those gravel beds exceed a maximum of 30% by weight (as shown from grain size accumulation graph) (See notes 3 and 4). In all other surface waters no sediment loads (suspended or deposited) that can cause adverse effects on aquatic animal or plant life, their reproduction or habitat may be present.	Individual substances may not exceed criteria in EPA, Quality Criteria for Water (See note 5) or, if those criteria do not exist, may not exceed the Primary Maximum Contaminant Levels of the Alaska Drinking Water Standards (18 AAC 80). If those criteria are absent, or if the department finds that the criteria are not appropriate for sensitive resident Alaskan species, the department will, in its discretion, establish in regulation chronic and acute criteria to protect sensitive and biologically important life stages of resident Alaskan species, using methods approved by the EPA or alternate methods approved by the department. There may be no concentrations of toxic substances in water or in shoreline or bottom sediments, that, singly or in combination, cause, or reasonably can be expected to cause, toxic effects on aquatic life, except as authorized by this chapter. Substances may not be present in concentrations that individually or in combination impart undesirable odor or taste to fish or other aquatic organisms, as determined by either bioassay or organoleptic tests (See note 5).	Color or apparent color may not reduce the depth of the compensation point for photosynthetic activity by more than 10% from the seasonally established norm for aquatic life. For all waters without a seasonally established norm for aquatic life, color or apparent color may not exceed 50 color units or the natural condition, whichever is greater.	Same as (1)(A)(iii).

Water Quality Criteria for Fresh Water Uses as Set by the State of Alaska in 18 AAC 70.

(1) FRESH WATER USES	DISSOLVED INORGANIC SUBSTANCES	SEDIMENT (Not applicable to groundwater)	TOXIC AND OTHER DELETERIOUS ORGANIC AND INORGANIC SUBSTANCES	COLOR	PETROLEUM HYDROCARBONS, OILS AND GREASE
(A) Water Supply (I) drinking, culinary, and food processing	Total dissolved solids (TDS) from all sources may not exceed 500 mg/l. Neither chlorides nor sulfates may exceed 200 mg/l.	No measurable increase in concentration of settleable solids above natural conditions, as measured by the volumetric Imhoff cone method (See note 13).	Substances may not exceed Alaska Drinking Water Standards (18 AAC 80) or where those standards do not exist, EPA Quality Criteria for Water (See note 5).	May not exceed 15 color units or the natural condition, whichever is greater.	May not cause a visible sheen upon the surface of the water. May not exceed concentrations that individually or in combination impart odor or taste as determined by organoleptic tests.
(A) Water Supply (II) agriculture including irrigation and stock watering	TDS may not exceed 1,000 mg/l. Sodium absorption ratio must be less than 2.5, sodium percentage less than 60%, residual carbonate less than 1.25 mg/l, and boron less than 0.3 mg/l (See note 6).	For sprinkler irrigation, water must be free of particles of 0.074 mm or coarser. For irrigation or water spreading, may not exceed 200 mg/l for an extended period of time.	Same as (1)(A)(i) where contact with a product destined for human consumption is present. Same as (1)(C) or Federal Water Pollution Control Administration, Water Quality Criteria (WQC/FWPCA), as applicable to substances for stockwaters; concentrations for irrigation waters may not exceed WQC/FWPCA or WQC 1972 (See notes 6 and 7).	Not applicable.	May not cause a visible sheen upon the surface of the water.

Notes to table:

1. Wherever cited in the section, fecal coliform bacteria must be determined by the membrane filter technique or most probable number procedure according to *Standard Methods for the Examination of Water and Wastewater*, 18th edition, 1992 or in accordance with other standards approved by the department and the United States Environmental Protection Agency (EPA).
2. Wherever cited in this chapter, dissolved oxygen (DO) concentrations in interstitial waters of gravel beds will be measured using the technique found in *Variations in the Dissolved Oxygen Content of Intragravel Water in Four Spawning Streams of Southeastern Alaska*, Special Scientific Report - Fisheries No. 402, February 1962, by William J. McNeil, available from the United States Department of the Interior. See note 14.
3. Wherever cited in this chapter, fine sediments must be sampled by the method described in *An Improved Technique for Freeze Sampling Streambed Sediments*, United States Department of Agriculture (USDA) Forest Service Research Note PNW-281, October 1976, by William J. Walkotten, available from the USDA Forest Service Pacific Northwest Forest and Range Experiment Station, P.O. Box 909, Juneau, AK 99802, or by the technique found in *Success of Pink Salmon Spawning Relative to Size of Spawning Bed Materials*, Special Scientific Report Fisheries No. 469, January 1964, by William J. McNeil and W.H. Ahnell, pages 1 through 3, available from the United States Fish and Wildlife Service. See note 14.
4. Wherever cited in this chapter, percent accumulation of fine sediments will be measured by the technique found in the *Manual on Test Sieving Methods*, Guidelines for Establishing Sieve Analysis Procedures, STP 447A, 1972 edition, available from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103. See note 14.
5. The term "EPA Quality Criteria for Water" includes *Quality Criteria for Water*, July 1976, United States Environmental Protection Agency, Washington, D.C. 20460, United States Government Printing Office: 1977 0-222-904, the Ambient Water Quality Criteria for the 64 toxic pollutants listed in the Federal Register, Vol. 45, No. 231, pg. 79318, November 1980, the Ambient Water Quality Document for 2, 3, 7, 8-tetrachlorodibenzopdioxin (TCDD) listed in the Federal Register, Vol. 49, No. 32, pg. 5831, February 1984, and the final ambient water quality criteria documents listed in the Federal Register, Vol. 50, No. 145, pg. 30784, July 1985. These documents may be seen at the department's Juneau office or may be purchased through the National Technical Information Service, United States Department of Commerce, Springfield, Virginia 22161.
6. *The Report of the Committee on Water Quality Criteria*, Federal Water Pollution Control Administration, Washington, D.C., April 1, 1968, available from the Superintendent of Documents, United States Government Printing Office,

Washington, D.C. See note 14.

7. Water Quality Criteria 1972, Environmental Studies Board of the National Academy of Sciences and the National Academy of Engineering, Washington, D.C., 1972, EPA-R3-73-033, March 1973, is available from the Superintendent of Documents, United States Government Printing Office, Washington, D.C. 20204 (Stock No. 5501-00520). See note 14.

8. Samples to determine concentrations of total aromatic hydrocarbons (TAH) and total aqueous hydrocarbons (TAqH) must be collected in marine and fresh waters below the surface and away from any observable sheen. Concentrations of TAqH must be determined and summed using a combination of: (A) EPA Method 602 (plus Xylenes) to quantify monoaromatic hydrocarbons and to measure TAH; and (B) EPA Method 610 to quantify polynuclear aromatic hydrocarbons. Use of an alternative method requires department approval. The EPA methods referred to in this note may be found in 40 CFR 136, Appendix A, as amended as of February 14, 1996, adopted by reference. They may be reviewed at the department or are available from the Office of Monitoring Systems and Quality Assurance, Office of Research and Development, United States Environmental Protection Agency, Washington, D.C. 20460.

9. Color is measured in color units on the platinum-cobalt scale according to *Standard Methods for the Examination of Waste and Wastewater*, 18th edition, 1992.

10. Wherever cited in this chapter, 10 CFR Part 20 means the *Standards for Protection Against Radiation* published in the *Code of Federal Regulations*, January 1, 1978. See note 14.

11. Wherever cited in this chapter, *National Bureau of Standards Handbook 69* means *Maximum Permissible Body Burdens and Maximum Permissible Concentrations of Radionuclides in Air and Water for Occupational Exposure*, United States Department of Commerce, National Bureau of Standards Handbook 69, June 5, 1959, available from the Superintendent of Documents, United States Government Printing Office, Washington, D.C. See note 14.

12. Wherever cited in this chapter, the *National Shellfish Sanitation Program, Manual of Operations, Part I, means Sanitation of Shellfish Growing Areas*, 1965 Revision, United States Department of Health, Education, and Welfare, Public Health Service Publication No. 33 Part I, available from the Superintendent of Documents, United States Government Printing Office, Washington, D.C. 20402. See note 14.

13. Volumetric measurements of settleable solids must be determined according to the following procedure: fill an Imhoff cone to the one-liter mark with thoroughly mixed sample; settle for 45 minutes; gently stir sides of cone with a rod or by spinning; settle 15 minutes longer, and record volume of settleable

matter in the cone as milliliters per liter; if the settled matter contains pockets of liquid between large settled particles, estimate volume of these and subtract from volume of settled matter.

14. The cited document is on file in the lieutenant governor's office and may be seen at the department office in Anchorage, Fairbanks, and Juneau.

Appendix 3.8.D

Water Quality Values

Surface Water Quality Values for the Salcha River Sampled Eight Miles Above Salchaket, AK (Earth Info, 1993). All values are reported as mg/l unless otherwise specified.

Date	6/14/71	8/9/71	10/13/71	4/7/75	7/23/75	9/19/75	3/15/76	8/6/76	9/29/76	MCL ³
Discharge (cubic feet per second)	11,200	4,060	--	156	6,270	2,440	--	1,190	817	NS
Water temperature (°F)	48.2	49.1	34.7	33.8	39.2	44.6	32.0	61.7	41.0	NS
Dissolved oxygen	11.0	10.6	14.2	9.5	9.4	11.8	11.8	--	13.9	NS
pH (standard units)	7.4	7.7	7.1	6.9	6.6	7.5	7.0	7.5	7.3	6.5 (min) - 8.5 (max) ²
Alkalinity	33	43	49	59	30	50	60	55	59	NS
Bicarbonate	40	53	60	72	37	61	73	67	72	NS
Specific conductance	87	115	145	--	88	131	150	115	122	NS
Nitrogen - Ammonia	--	--	--	0.01	0.01	0.25	0.02	--	--	NS
Nitrogen - Total	--	--	--	0.62	0.79	0.50	--	--	--	10 (as Nitrogen) ¹
Sodium	1.2	1.5	1.9	2.2	1.5	1.5	1.8	1.7	1.9	250 ²
Magnesium	3.1	4.3	5.0	5.9	3.7	4.5	6.1	5.2	5.4	NS
Calcium	12.0	16.0	16.0	20.0	11.0	16.0	20.0	20.0	19.0	NS
Potassium	0.8	0.9	1.5	1.3	0.7	0.9	1.0	1.0	1.0	NS
Iron	150	110	--	60	220	140	70	100	70	0.3 ²
Silica	5.4	6.9	7.7	7.5	7.4	7.6	7.9	6.4	6.5	NS
Dissolved solids	1600	789	--	40	1350	573	--	--	194	500 ²
Suspended sediment	--	--	--	2.0	64.0	3.0	--	10.0	2.0	NS
Suspended sediment	--	--	--	0.84	1080	20.0	--	32.0	4.4	NS

¹ - Primary MCL. ² - Secondary MCL. ³ - Maximum Contaminant Levels - MCLs as set forth in Alaska Drinking Water Standards (18 AAC 80) . NS - No set standard.

Surface Water Quality Values for the Chena River at North Pole, AK for a Portion of the 1971 Water Year (Earth Info, 1993). All values are reported as mg/l unless otherwise specified.

	5/25/72	6/22/72	7/28/72	8/23/72	9/1/72	Maximum Contaminant Levels - MCLs as set forth in Alaska Drinking Water Standards (18 AAC 80)
Discharge (cubic feet per second)	5,300	1,540	--	1,100	1,130	NS
Water temperature (°F)	41.0	49.1	52.7	50.9	47.3	NS
Dissolved oxygen	10.9	9.3	10.2	10.2	10	NS
pH (standard units)	7.2	7.6	7.6	7.9	7.8	6.5 (minimum) - 8.5 (maximum) ²
Alkalinity	31	54	58	61	64	NS
Bicarbonate	38	66	71	74	78	NS
Specific conductance	80	125	150	170	165	NS
Nitrogen - Ammonia	--	0	0.05	0.03	0.04	NS
Nitrogen - Nitrate	0.2	0.23	0.25	0.18	0.34	10 (as Nitrogen) ¹
Nitrogen - Total	0.33	0.12	0.09	0.07	0.1	10 (as Nitrogen) ¹
Phosphate - Ortho	0	0.03	0.03	0	0	NS
Sodium	1.0	1.6	1.6	1.6	1.7	250 ²
Magnesium	2.6	4.0	4.5	4.6	4.8	NS
Calcium	11.0	19.0	21.0	22.0	23.0	NS
Potassium	0.8	0.9	1.0	1.0	1.0	NS
Iron	90	460	490	200	220	0.3 ²
Silica	3.9	5.4	6.3	6.5	6.5	NS
Dissolved solids	687	--	--	270	293	500 ²
Suspended sediment	135	16	--	0.8	5	NS
BOD (Biological Oxygen Demand)	2.7	--	--	0	0.4	NS
COD (Chemical Oxygen Demand)	46	9	9	6	6	NS

¹ - Primary MCL. ² - Secondary MCL. NS - No set standard.

**Surface Water Quality Values for the Chena River at North Pole, AK
for the 1972 Water Year (Earth Info, 1993).** All values are reported as mg/l
unless otherwise specified.

	10/26/72	11/17/72	12/6/72	2/9/73	3/22/73	4/18/73	5/10/73	7/19/73	9/29/73	MCL ³
Discharge (cubic feet per second)	900	651	445	196	142	453	3,290	1,470	1,100	NS
Temperature (F)	32.9	32.9	32.9	32.0	32.0	32.0	36.5	49.1	37.4	NS
Dissolved oxygen	11.7	9.2	8.8	5.8	6.0	10.9	11.5	9.5	11.2	NS
pH (standard units)	7.5	7.4	7.2	7.2	6.9	--	7.2	7.0	7.4	6.5 (min) - 8.5 (max) ²
Alkalinity	67	57	62	64	71	34	32	26	66	NS
Bicarbonate	82	80	81	78	87	42	39	32	80	NS
Specific conductance	160	170	170	171	190	200	100	150	160	NS
Nitrogen - Ammonia	<0.01	0.02	<0.01	0.01	--	--	0.04	0.03	<0.01	NS
Nitrogen - Nitrate	0.43	0.09	0.07	0.05	--	0.05	--	--	--	10 (as Nitroge n) ¹
Nitrogen - Total	2.5	0.4	0.03	0.06	--	--	0.1	0.13	0.15	10 (as Nitroge n) ¹
Phosphate - Ortho	0.03	--	--	--	0.03	--	0	0	0.06	NS
Sodium	1.6	1.9	1.8	1.8	1.9	1.8	1.2	1.7	--	250 ²
Magnesium	5.2	5.2	4.8	5.2	5.3	6.1	3.3	4.5	--	NS
Calcium	24.0	23.0	25.0	24.0	20.0	24.0	15.0	23.0	--	NS
Potassium	1.0	0.9	0.8	0.5	1.0	0.7	1.1	1.0	--	NS
Iron	280	390	--	290	320	260	--	210	--	0.3 ²
Silica	7.3	10.0	7.6	6.9	7.9	6.9	4.6	6.5	--	NS
Dissolved solids	245	172	118	52.4	38	127	542	373	--	500 ²
Biological Oxygen Demand	0.2	0.3	0.3	0.4	0.7	0.5	1.8	0.7	0.4	NS
Chemical Oxygen Demand	28	7	4.0	8.4	6.0	7.4	54	8.0	11.0	NS

¹ - Primary MCL. ² - Secondary MCL. ³ - Maximum Contaminant Levels - MCLs as set forth in
Alaska Drinking Water Standards (18 AAC 80). NS - No set standard.

**Surface Water Quality Values for the Chena River at North Pole, AK
for the 1973 Water Year (Earth Info 1993).** All values are reported as mg/l
unless otherwise specified.

	10/25/73	11/20/73	12/21/73	2/7/74	3/14/74	4/18/74	6/13/74	Maximum Contaminant Levels - MCLs as set forth in Alaska Drinking Water Standards (18 AAC 80)
Discharge (cubic feet per second)	275	350	214	97	55	85	753	NS
Water temperature (°F)	32.0	32.0	32.0	32.0	32.0	32.0	51.8	NS
Dissolved oxygen	10.0	8.1	7.0	6.2	6.3	11.6	10.7	NS
pH (standard units)	6.8	--	6.8	7.0	6.6	7.2	7.4	6.5 (min) - 8.5 (max) ²
Alkalinity	68	--	66	65	63	51	52	NS
Bicarbonate	83	--	80	79	77	62	63	NS
Specific conductance	180	160	155	180	168	155	150	NS
Nitrogen - Ammonia	0.03	0.05	0.04	0.06	0.04	0.02	0.02	NS
Nitrogen - Total	0.23	0.21	0.44	0.48	0.25	0.26	0.41	10 (as Nitrogen) ¹
Phosphate - Ortho	0.12	0.06	0.06	0.03	0.03	0.03	0	NS
BOD (Biological Oxygen Demand)	0.5	0.7	0.6	0.8	0.4	0.9	0.4	NS
COD (Chemical Oxygen Demand)	3.0	7.0	5.0	8.0	6.0	8.0	11.0	NS

¹ - Primary MCL. ² - Secondary MCL. NS - No set standard.

Water Quality Data Collected from Redmond Creek, Ninety-eight Creek, and McCoy Creek in 1974 and 1975 (adapted from U.S. Army Alaska, 1980).

Date	Stream	Water Temperature (°F)	Dissolved Oxygen (mg/l)	pH	Total Hardness (mg/l)	Color
12/23/74	Redmond Creek	33.8 - 35.6	1 - 3	--	--	--
12/7/75	Redmond Creek	32.0	0.8	6.4	84.0	--
6/18/75	Redmond Creek	53.6	10.0	6.5	85.5	reddish
	Ninety-eight Creek	55.4	11.0	8.0	85.5	reddish
	McCoy Creek	55.4	12.0	7.5	51.3	reddish
6/20/75	Redmond Creek	55.4	13.0	6.5	85.5	reddish
7/2/75	Ninety-eight Creek	59.0	10.0	7.5	85.5	reddish
	McCoy Creek	59.0	10.0	7.5	68.4	reddish
7/30/75	Redmond Creek	59.0	9.0	7.0	51.3	reddish
	Ninety-eight Creek	60.8	10.0	7.5	68.4	reddish
	McCoy Creek	57.2	11.0	7.5	48.2	reddish
9/17/75	Redmond Creek	48.2	12.0	7.0	68.4	reddish
	Ninety-eight Creek	48.2	13.0	8.0	68.4	reddish
	McCoy Creek	48.2	12.0	7.5	51.3	reddish

Surface Water Quality Values Collected Upstream for Selected Streams Located on Fort Greely (adapted from U.S. Army Environmental Hygiene Agency 1990). All values are reported as mg/l unless otherwise specified.

Parameter	Jarvis Creek	Delta River	100-Mile Creek	Delta Creek	Little Delta River	MCL ³
<u>Metals</u>						
Aluminum	0.54	3.9	0.26	9.3	5.4	0.2 ²
Arsenic	0.006	0.005	0.005	0.007	0.005	0.05 ¹
Barium	0.03	0.08	0.06	0.20	0.15	2.0 ¹
Cadmium	<0.0005	<0.0005	<0.0005	<0.0005	0.0017	0.005 ¹
Calcium	49.0	32.0	29.0	54.0	58.0	NS
Chromium	0.002	0.009	0.002	0.028	0.018	0.1 ¹
Copper	<0.010	<0.010	<0.010	0.010	<0.010	1.0 ²
Iron	1.7	6.4	0.54	12.0	11.0	0.3 ²
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	NS
Magnesium	22.0	12.0	7.7	15.0	17.0	NS
Manganese	0.06	0.14	0.04	0.24	0.20	0.05 ²
Mercury	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.002 ¹
Selenium	<0.001	<0.001	<0.001	<0.001	0.003	0.05 ¹
Silver	<0.010	<0.010	<0.010	<0.010	<0.010	0.1 ²
Zinc	0.01	<0.01	<0.01	0.02	0.07	5.0 ²
<u>Nonmetals</u>						
Hardness	213.0	129.0	104.0	197.0	215.0	NS
Sulfates	120.0	49.0	37.0	120.0	140.0	250 ²
Conductivity	441.0	279.0	266.0	405.0	436.0	NS
pH SU	7.9	8.0	8.1	8.4	8.2	6.5 (min) - 8.5 (max) ²
Temp. (°C)	5.9	5.6	3.4	0.4	1.6	NS
Diss. Oxygen	12.1	9.7	10.4	11.2	10.2	NS
NO ₂ +NO ₃ -N	<0.2	0.24	0.22	0.23	0.20	10 (as Nitrogen) ¹
NH ₃ -N	<0.05	<0.05	<0.05	<0.05	<0.05	NS
PO ₄ -P	0.10	0.46	0.12	0.22	0.42	NS
T-ALK	110.0	83.0	74.0	66.0	78.0	NS
TKN	0.34	0.39	0.39	0.92	0.31	NS

Surface Water Quality Values Collected Upstream for Selected Streams Located on Fort Greely (adapted from U.S. Army Environmental Hygiene Agency 1990). All values are reported as mg/l unless otherwise specified.

Parameter	Jarvis Creek	Delta River	100-Mile Creek	Delta Creek	Little Delta River	MCL ³
TOC	1.4	1.3	2.3	0.70	0.91	NS
<u>Explosives</u>						
HMX	<0.100	<0.100	<0.100	<0.100	<0.100	--
RDX	<0.030	<0.030	<0.030	<0.030	<0.030	--
TNT	<0.001	<0.001	<0.001	<0.001	<0.001	--
2,6-DNT	<0.001	<0.001	<0.001	<0.001	<0.001	--
2,4-DNT	<0.001	<0.001	<0.001	<0.001	<0.001	--
Tetryl	<0.010	<0.010	<0.010	<0.010	<0.010	--

¹ - Primary MCL. ² - Secondary MCL. ³ - Maximum Contaminant Levels - MCLs as set forth in Alaska Drinking Water Standards (18 AAC 80). NS - No set standard.

Sediment Quality Sampled Upstream for Selected Streams Located on Fort Greely (adapted from U.S. Army Environmental Hygiene Agency 1990). All values are reported as mg/kg unless otherwise specified.

Parameter	Jarvis Creek	Delta River	100-Mile Creek	Delta Creek	Little Delta River
<u>Metals</u>					
Aluminum	1900.0	7900.0	6400.0	9600.0	8600.0
Arsenic	11.0	13.0	5.2	8.2	5.6
Barium	10.0	61.0	32.0	160.0	130.0
Cadmium	<0.25	<0.25	0.53	<0.25	0.47
Chromium	4.7	13	9.8	20	20
Copper	13.0	36.0	19.0	34.0	30.0
Iron	11000.0	19000.0	18000.0	17000.0	20000.0
Lead	3.5	4.6	7.4	2.4	3.4
Magnesium	2300.0	5400.0	5100.0	5700.0	7000.0
Manganese	220.0	320.0	340.0	240.0	350.0
Mercury	<0.10	<0.10	<0.10	<0.10	<0.10
Selenium	<0.50	<0.50	0.60	0.60	<0.50
Silver	<0.50	<0.50	<0.50	<0.50	<0.50
Zinc	18.0	40.0	56.0	42.0	52.0
<u>Nonmetals</u>					
Moisture %	20.4	19.6	17.4	15.5	19.9
NH ₃ -N	120.0	140.0	<12.0	83.0	35.0
NO ₂ +NO ₃ -N	0.75	<0.75	0.97	<0.75	<0.75
PO ₄ -P	280.0	460.0	280.0	280.0	290.0
TKN	120.0	140.0	140.0	830.	84.0
TOM %	0.66	0.62	0.62	<0.05	0.63
<u>Explosives</u>					
HMX	<0.001	<0.001	<0.001	<0.001	<0.001
RDX	<0.001	<0.001	<0.001	<0.001	<0.001
TNT	<0.001	<0.001	<0.001	<0.001	<0.001
2,6-DNT	<0.001	<0.001	<0.001	<0.001	<0.001
2,4-DNT	<0.001	<0.001	<0.001	<0.001	<0.001
Tetryl	<0.001	<0.001	<0.001	<0.001	<0.001

Surface Water Quality Values Collected Downstream for Selected Streams Located on Fort Greely (adapted from U.S. Army Environmental Hygiene Agency 1990). All values are reported as mg/l unless otherwise specified.

Parameter	Jarvis Creek	Delta River	100-Mile Creek	Delta Creek above 100-Mile Creek	Delta Creek	Little Delta River	MCL ³
<u>Metals</u>							
Aluminum	0.84	7.9	5.5	7.8	10.0	5.9	0.2 ²
Arsenic	0.005	0.008	<0.005	0.008	0.005	<0.005	0.05 ¹
Barium	0.03	0.11	0.09	0.19	0.22	0.18	2.0 ¹
Cadmium	<0.0005	<0.0005	<0.0005	0.0009	<0.0005	<0.0005	0.005 ¹
Calcium	49.0	31.0	16.0	49.0	42.0	54.0	NS
Chromium	0.002	0.0182	0.008	0.026	0.026	0.015	0.1 ¹
Copper	<0.010	<0.010	<0.010	<0.010	0.03	<0.010	1.0 ²
Iron	2.4	12.0	9.5	11.0	14.0	11.0	0.3 ²
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	NS
Magnesium	22.0	12.0	4.2	13.0	12.0	15.0	NS
Manganese	0.006	0.24	0.16	0.22	0.24	0.20	0.05 ²
Mercury	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.002 ¹
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.05 ¹
Silver	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.1 ²
Zinc	0.01	0.02	0.01	0.03	0.03	0.03	5.0 ²
<u>Nonmetals</u>							
Hardness	213.0	129.0	57.0	176.0	154.0	197.0	NS
Sulfates	110.0	48.0	15.0	110.0	83.0	120.0	250 ²
Conductivity	437.0	256.0	126.0	390.0	311.0	404.0	NS
pH SU	8.2	8.2	8.4	8.4	8.3	8.3	6.5 (min) - 8.5 (max) ²
Temp. (°C)	6.3	6.1	3.8	1.5	1.8	3.6	NS
Diss. Oxygen	12.0	10.2	14.0	13.6	19.5	10.9	NS
NO ₂ +NO ₃ -N	0.28	0.22	0.28	0.26	<0.20	0.26	10 (as Nitrogen) ¹
NH ₃ -N	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	NS
PO ₄ -P	0.13	0.52	0.28	0.35	0.22	0.34	NS
T-ALK	110.0	74.0	42.0	70.0	62.0	77.0	NS
TKN	0.39	0.42	1.0	0.78	0.98	0.70	NS

Surface Water Quality Values Collected Downstream for Selected Streams Located on Fort Greely (adapted from U.S. Army Environmental Hygiene Agency 1990). All values are reported as mg/l unless otherwise specified.

Parameter	Jarvis Creek	Delta River	100-Mile Creek	Delta Creek above 100-Mile Creek	Delta Creek	Little Delta River	MCL ³
TOC	1.5	1.1	8.4	3.5	3.9	3.8	NS
<u>Explosives</u>							
HMX	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	--
RDX	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	--
TNT	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	--
2,6-DNT	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	--
2,4-DNT	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	--
Tetryl	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	--

¹ - Primary MCL. ² - Secondary MCL. ³ - Maximum Contaminant Levels - MCLs as set forth in Alaska Drinking Water Standards (18 AAC 80). NS - No set standard.

Sediment Quality Sampled Downstream for Selected Streams Located on Fort Greely (adapted from U.S. Army Environmental Hygiene Agency 1990). All values are reported as mg/kg unless otherwise specified.

Parameter	Jarvis Creek	Delta River	100-Mile Creek	Delta Creek above 100-Mile Creek	Delta Creek	Little Delta River
<u>Metals</u>						
Aluminum	1900.0	6600.0	6800.0	7800.0	8800.0	7000.0
Arsenic	9.4	4.5	3.8	4.2	4.0	4.8
Barium	14.0	56.0	71.0	120.0	150.0	140.0
Cadmium	<0.25	<0.25	0.39	<0.25	<0.25	0.35
Chromium	5.5	10	10	15	18	15
Copper	22.0	15.0	15.0	16.0	18.0	27.0
Iron	17000.0	12000.0	14000.0	13000.0	15000.0	16000.0
Lead	4.9	2.7	6.6	3.3	4.4	3.1
Magnesium	3000.0	3800.0	3600.0	5000.0	5300.0	5000.0
Manganese	320.0	220.0	290.0	250.0	260.0	270.0
Mercury	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Selenium	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Silver	<0.50	<0.50	<0.50	<0.50	<0.50	1.6
Zinc	27.0	21.0	39.0	34.0	35.0	37.0
<u>Nonmetals</u>						
Moisture %	22.7	21.6	22.2	18.8	21.3	20.2
NH3-N	72.0	<12.0	140.0	52.0	53.0	<12.0
NO2+NO3-N	0.91	<0.75	0.77	<0.75	<0.75	<0.75
PO4-P	300.0	290.0	270.0	230.0	280.0	280.0
TKN	72.0	110.0	140.0	120.0	120.0	120.0
TOM %	0.76	<0.05	0.69	<0.05	<0.05	0.61
<u>Explosives</u>						
HMX	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
RDX	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
TNT	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2,6-DNT	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2,4-DNT	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Tetryl	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Average Water and Sediment Chemistries Collected Upstream and Downstream of Fort Greely (adapted from U.S. Army Environmental Hygiene Agency 1990). Upstream = sample sites 1,3,5,7, and 10. Downstream = 2,4,6,9, and 11. Conductivity in umhos/cm.

	Water (mg/l)		Sediment (mg/kg)	
	Upstream	Downstream	Upstream	Downstream
<u>Metals</u>				
Aluminum	3.88	50.28	6880	6220
Arsenic	0.0056	0.0056	8.6	5.3
Barium	0.104	0.126	78.6	86.2
Cadmium	<0.0008	<0.0005	<0.35	<0.298
Calcium	44.4	38.4	--	--
Chromium	0.0118	0.0138	13.5	11.7
Copper	<0.010	<0.014	26.4	17.4
Iron	6.328	9.78	17000	14800
Lead	<0.001	<0.001	4.26	4.34
Magnesium	14.74	13.04	5100	4140
Manganese	0.1360	0.1800	394	272
Mercury	<0.0002	<0.0002	<0.10	<0.10
Selenium	<0.0014	<0.0012	<0.54	<0.50
Silver	<0.010	<0.010	<0.5	<0.72
Zinc	<0.024	<0.020	41.6	31.8
<u>Nonmetals</u>				
Hardness	171.6	150.0	--	--
Sulfates	93.2	75.2	--	--
Conductivity	365.4	306.8	--	--
NO ₂ +NO ₃ -N	0.218	0.248	<0.79	<0.786
NH ₃ -N	<0.05	<0.05	78	57.8
PO ₄ -P	0.264	0.298	319	284
T-Alk	82.2	72.4	--	--
TKN	0.474	0.698	113.4	112.4
TOC	1.322	3.74	--	--
TOM %	--	--	0.516	0.432
<u>Explosives</u>				
HMX	<0.1	<0.1	<0.01	<0.01
RDX	<0.03	<0.03	<0.001	<0.001

Average Water and Sediment Chemistries Collected Upstream and Downstream of Fort Greely (adapted from U.S. Army Environmental Hygiene Agency 1990). Upstream = sample sites 1,3,5,7, and 10. Downstream = 2,4,6,9, and 11. Conductivity in umhos/cm.

	Water (mg/l)		Sediment (mg/kg)	
	Upstream	Downstream	Upstream	Downstream
TNT	<0.001	<0.001	<0.001	<0.001
2,6-DNT	<0.001	<0.001	<0.001	<0.001
2,4-DNT	<0.001	<0.001	<0.001	<0.001
Tetryl	<0.010	<0.010	<0.001	<0.001

Surface Water Quality Values Collected on June 3, 1975 for North Twin, South Twin, and Mark Lakes Located on Fort Greely (Earth Info, 1991). All values are reported as mg/l unless otherwise specified.

	North Twin Lake	South Twin Lake	Mark Lake	Maximum Contaminant Levels - MCLs as set forth in Alaska Drinking Water Standards (18 AAC 80)
Depth (m)	2	2	2	NS
Temperature (°C)	12	12	11.5	NS
Alkalinity	31	43	37	NS
Bicarbonate	38	52	45	NS
Specific conductance	67	99	97	NS
Nitrogen - Ammonia	0.01	0.04	0.04	NS
Nitrogen - Nitrate	0.05	0.09	0.03	10 (as Nitrogen) ¹
Nitrogen - Nitrite	0.05	0.09	0.03	1 (as Nitrogen) ¹
Nitrogen - Total	0.41	0.69	0.80	10 (as Nitrogen) ¹
Phosphate - Ortho	0.03	0.03	0.06	NS
Sodium	1.3	1.2	0.8	250 ²
Magnesium	2.1	2.3	3.3	NS
Calcium	10.0	13.0	11.0	NS
Potassium	1.8	4.3	2.4	NS
Iron	40	60	110	0.3 ²
Silica	0.1	0.4	0.4	NS
Dissolved solids	0.09	0.09	0.09	500 ²

¹ - Primary MCL. ² - Secondary MCL. NS - No set standard.