Total Maximum Daily Load for

Sediment and Turbidity

with consideration of

Habitat Modification

in the waters of

Lemon Creek, Alaska

TMDL AT A GLANCE

Water Quality Limited?	*Yes*
Standards of Concern:	*Sediment*
	Turbidity
Pollutants of Concern:	*Total Suspended Solids*
	Settleable Solids
	Turbidity
	Habitat Modification
Primary Use Affected:	*Aquatic Life*
Sources:	*Material Stockpiling*
	Gravel Operations
	Roads and Embankments
	Residential Urban Stormwater Runoff
	Industrial Urban Stormwater Runoff
	Natural
Loading Capacity:	*0.2 to 61.8 tons TSS/year*
	0.0 to 45.6 tons SS/year
Total Load Allocation:	*0.2 to 60.1 tons TSS/year*
	0.0 to 45.6 tons SS/year
Wasteload Allocation:	*None*

September 1995

FACT SHEET

- **Listing** Lemon Creek, an urban stream within the City and Borough of Juneau, Alaska, has appeared on Alaska's list of impaired waterbodies ["303(d) List"] since 1990.

- **Stressors** The 303(d) list identifies three stressors responsible for the creek's impaired status: sediment, turbidity, and habitat modification.

- **Assessments** A water quality assessment was completed in early 1995 and revised in August 1995. The assessment concluded that additional controls were needed to restore water quality, suggesting the Total Maximum Daily Load (TMDL) process.

- **TMDLs** A TMDL is a planning and management mechanism to restore water quality. At the heart of the process is estimating loading capacities, allocating loads to identified sources of pollution, and specifying controls to meet targeted load reductions.

- **Phasing** A phased approach to a TMDL is appropriate when existing data are not adequate to determine needed load reductions from the pollutant sources being addressed, or to determine the controls necessary to address impairments. The TMDL for Lemon Creek employs a phased approach.

- **Parameters** The phased Lemon Creek TMDL is developed for sediment and turbidity. It also considers, however, impacts from habitat modification.

- **Sources** Identified sources contributing sediment and turbidity to Lemon Creek include material stockpiling, gravel operations, road surfaces and embankments, and urban stormwater runoff.

- **Actual Load** Sources are estimated to contribute between 0.4 and 51.1 tons of total suspended solids (TSS) per day to Lemon Creek depending on the time of year.

- **Loading Capacity** The sediment and turbidity loading capacity, expressed in terms of TSS, is estimated at 0.2 to 61.8 tons per day again depending on the time of year.

- **Load Reductions** Specified controls target an overall reduction of a little more than 60 percent of the current TSS load during the critical winter months. That reduction should be sufficient to restore Lemon water quality to within water quality standard limits.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue
Seattle, Washington 98101

SEP 27 1995

RECEIVED
OCT 02 1995
DEPARTMENT OF
ENVIRONMENTAL CONSERVATION

Reply to
Attn Of: WD-139

Gene Burden
Commissioner
Department of Environmental Conservation
410 Willoughby Ave., Suite 105
Juneau, Alaska 99801-1795

Re: Approval of Total Maximum Daily Loads (TMDLs)

Dear Mr. Burden:

We are pleased to approve the TMDLs for Lemon and Vanderbilt Creeks, submitted by your Department on September 1, 1995. These TMDLs were particularly challenging, as they were the first to be completed by your Department on waterbodies affected mainly by nonpoint sources of pollution. Members of your staff, along with a contractor, did excellent work in producing these TMDLs in a short time frame.

The TMDL provisions for Lemon and Vanderbilt Creeks are aimed at improving the fish spawning and rearing habitat of the streams and reducing the sediment load and turbidity attributable to human activities. Our analysis indicates these provisions are reasonably expected to bring Lemon Creek and Vanderbilt Creek into compliance with applicable water quality standards. To ensure achievement of the standards, the TMDLs include a monitoring plan to measure the effectiveness of the initial load reductions and a plan to revise the TMDLs to require whatever future load reductions, if any, are found necessary by that monitoring.

I commend your Department for completing these TMDLs. We look forward to continuing to work closely with your TMDL staff to ensure that two more TMDLs are completed by the September 1, 1996 deadline. We are interested in learning which waters your Department will choose for this next effort: early planning will ensure that the waterbodies chosen will be the highest priority waterbodies for the state.

Sincerely,

David Tetzlaff

Jan Hastings
Acting Director, Water Division

cc: Susan Braley, ADEC
Dan Easton, Easton Environmental

STATE OF ALASKA
TONY KNOWLES, GOVERNOR

DEPT. OF ENVIRONMENTAL CONSERVATION

OFFICE OF THE COMMISSIONER
410 Willoughby Ave., Suite 105
Juneau, Alaska 99801-1795

Phone: (907) 465-5066
Fax: (907) 465-5070

September 1, 1995

Phil Millam, Director
Office of Water (WD-131)
Environmental Protection Agency
1200 Sixth Avenue
Seattle, Washington 98101

Dear Mr. Millam:

The Alaska Department of Environmental Conservation is pleased to transmit to the Environmental Protection Agency (EPA) the final Total Maximum Daily Load (TMDL) determinations and submittal pages for Lemon Creek and Vanderbilt Creek in Juneau, Alaska. The TMDLs and load allocations have been established in accordance with Section 303(d) of the Clean Water Act and are submitted here for EPA approval. EPA staff were closely involved in all aspects of preparing these final documents. This final submittal triggers the statutory 30-day time frame for the EPA approval action.

We have proposed a phased approach for implementing the two TMDLs because both Lemon and Vanderbilt Creeks are primarily impacted from nonpoint sources of pollution which are inherently difficult to control. Central to a phased approach is the monitoring plan which is included as part of each TMDL. The monitoring data collected will be used to evaluate the effectiveness of controls and to possibly revise and update either TMDL.

We have worked closely with the City and Borough of Juneau, with members of the public, local contractors and businesses, other state agencies, EPA Region 10, and with the Native Corporation which owns lands within these two watersheds. We held a public reception and public workshop and provided an opportunity for public comment on the draft TMDLs. A public responsiveness summary has also been completed, consistent with EPA requirements, and is enclosed for your files. A copy of the public notice requesting public comment on the draft TMDLs is also enclosed. The public participation and cooperation of all parties has been a rewarding aspect in preparing these two TMDLs.

The Department believes that the nonpoint source reductions will be achieved through the identified controls. For example, all of the parties affected by the Phase 1 controls have committed to implementing these actions. In addition, we have developed a Memorandum of Agreement between the City and Borough of Juneau and the State of Alaska to implement Section 303(d) of the Clean Water Act for impaired waterbodies in Juneau.

We appreciate EPA Region 10's cooperation and I commend both DEC and EPA staff for ir hard work to develop these two TMDLs in compliance with the short, court-ordered ıdline. Full implementation of the TMDLs will require additional funds. Upon EPA approval, will request release of the remaining Section 104(b)(3) grant funds EPA has reserved for plementation of the Lemon Creek and Vanderbilt Creek TMDLs.

Sincerely,

for Gene Burden
Commissioner

IB/JAG/DRR/jag/sl (G:\COMM\MS\LVFINAL.LTR)

c: Charles Findley, EPA Region 10

Enclosures: TMDL documents
Responsiveness Summary
Public Notice

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Part 1 BACKGROUND INFORMATION

1.a General Waterbody and Watershed Description

Lemon Creek is located in Southeast Alaska, five miles northwest of downtown Juneau (Figure 1-1). Originating in snowfields and glaciers, the creek drains approximately 25 square miles and flows for about six miles before entering the saltwater of Gastineau Channel. The mainly gravel substrate creek bed varies from 30 to 50 feet wide, 1 to 3 feet deep, with a gradient of 0.006 (Bethers et al., 1993). Four clear water tributaries enter Lemon Creek at various points. Tidal wetlands occur at the lower portion of Lemon Creek, and other wetland areas occur periodically along the stream.

Southeast Alaska has a temperate maritime climate, with relatively mild winter temperatures in the range of 10 to 40 degrees, and cool summers with temperatures generally in the range of 50 to 70 degrees. Average annual precipitation at the airport is 53 inches. Due to its glacial origins and seasonal changes, Lemon Creek's water level and amount of flow varies considerably throughout the year. Stream flow is lowest during the winter months. When the glaciers are melting, from spring through fall, the stream carries a high level of glacial silt. During the winter months the stream runs clear.

The headwaters of Lemon Creek are located in alpine and forested terrain within the Tongass National Forest. Upper stream reaches are primarily forested. The lower portion runs through what were once forested and wetland areas which have been converted to commercial, industrial, and residential uses.

Lemon Creek supports populations of Coho, Pink, and Chum salmon, Dolly Varden, and Cutthroat trout. These species use portions of the stream and its tributaries for spawning and rearing habitat. Historical data for quantitative measures of fish populations and species diversity is limited. Pink salmon spawn in the lower main stream channel, while Coho, Dolly Varden, and Cutthroat trout use the upper, clear water tributaries. The rearing habitat in the main stream appears to be only fair, while excellent rearing habitat is found in the clear water tributaries, which have experienced no documented impacts. Lemon Creek has no barriers to fish migration. (Bethers, et al., 1993).

Between the early 1900's and about 1950, principal uses of Lemon Creek valley included logging, homesteading, and fishing. Commercial, industrial, and residential development occurred in the area from about 1950 to the present. The Lemon Creek valley provides a very necessary source of gravel for development of the community. Several gravel extraction operations have occurred primarily on the south side of the creek. Some operators were authorized to dredge material from

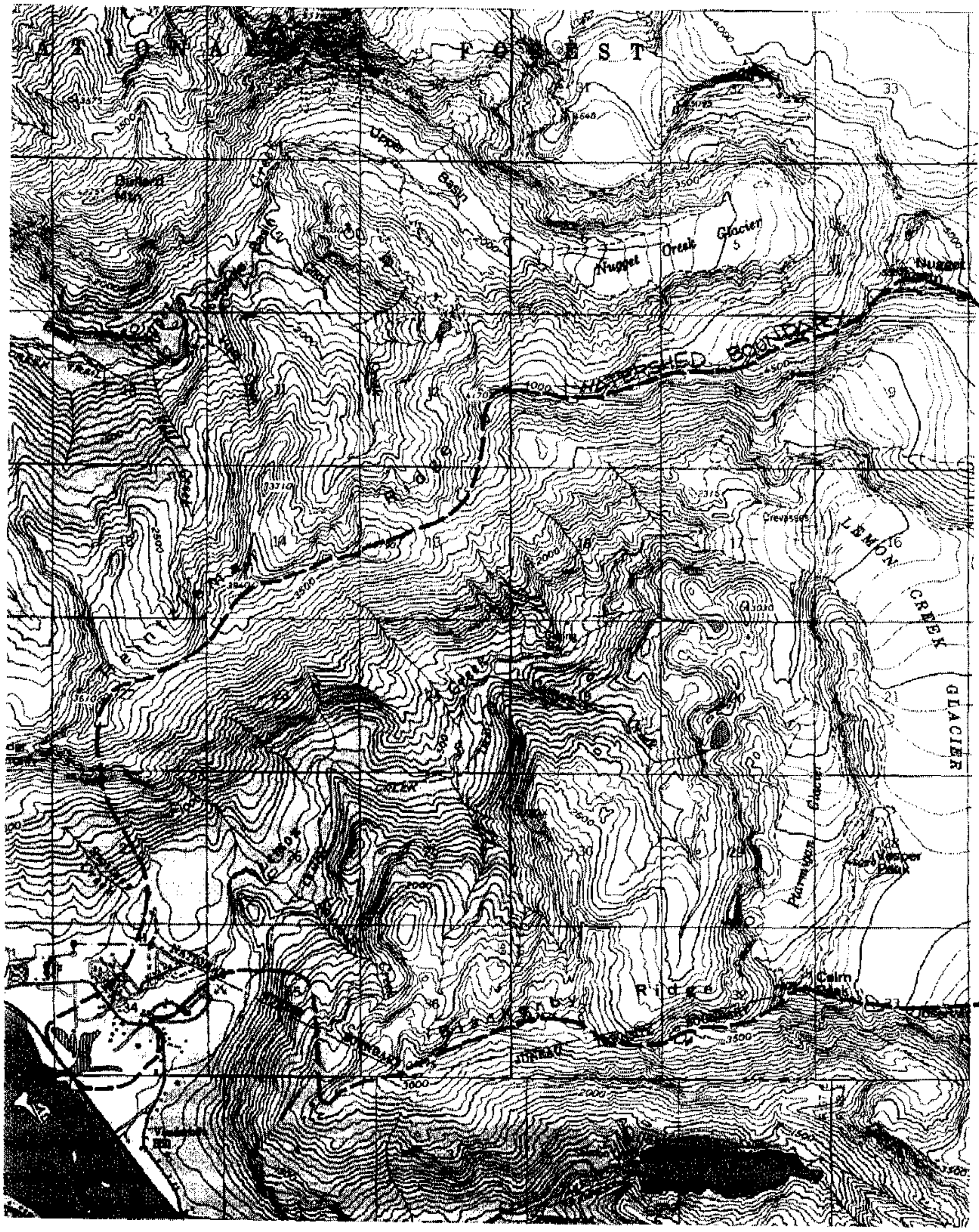


Figure 1-1
Vicinity Map

the streambed of Lemon Creek in the past.[1] No operation is currently extracting gravels from the stream. Gravel and rock are being mined from the upper valley area, and processing and stockpiling activities are taking place in the east end of the lower valley. One large upland area of extraction has now been subdivided and developed as a commercial/industrial subdivision. Some sand and gravel processing is occurring west of Glacier Highway. Limited gravel extraction took place on the north side of Lemon Creek but the area has primarily developed as a residential area.

1.b Study Area Boundaries

The study area boundaries are from the headwaters to the east, below Lemon Glacier, to the wetlands and Gastineau Channel in the west. The northern boundaries are the Davis Street residential area, east of Glacier Highway, and Pinewood Park trailer park west of Glacier Highway. The southwestern boundary of the study area, along the lower section of the creek extends to Tonsgard Court. Above the Glacier Highway bridge the boundary extends to Jenkins Drive.

The study area can be divided into three general areas. The lower stream section stretches from the mouth of the creek in the Mendenhall Wetlands to the Glacier Highway bridge, a distance of approximately one mile. The mid-section is located between the Glacier Highway bridge and the lower natural bedrock gorge just up creek from the Lemon Creek Correctional Facility. This section is about 1.5 miles in length. The upper stream section continues from the lower gorge up to the headwaters to the east, another 3.5 miles or so.

1.c TMDL Process

Section 303(d)(1) of the Clean Water Act requires each state to establish the Total Maximum Daily Load (TMDL) for each water identified by the state as failing to meet water quality standards after imposition of technology-based standards. Lemon Creek was identified as water quality limited by the Alaska Department of Environmental Conservation (DEC) in 1988. It has appeared on the State's biennial 303(d) list since 1990. The consequence of a 303(d) listing is that a waterbody may be subject to the TMDL process.

A TMDL is a planning and management mechanism to restore water quality. There are three steps in the TMDL process: assessment, strategy, and implementation. A draft Water Quality Assessment Report for Lemon Creek was completed in early 1995 by the DEC and revised in August 1995. If an assessment concludes that additional controls are needed, the next step is to prepare a TMDL strategy and implementation schedule. The Lemon Creek Assessment Report

[1]While it was occurring, mining of gravel from the stream channel was known to affect water quality. It is interesting, however, to note that another effect of the past mining activity was to increase the hydraulic capacity of the channel so as to reduce the potential for flooding.

concluded that additional controls were necessary and the TMDL strategy and implementation phase began.

Meeting and maintaining water quality standards, and restoring the beneficial uses of a stream are the primary goals of a TMDL. The TMDL document is a tool for implementing State water quality standards and is based on the relationship between pollution sources and in-stream water quality conditions. The TMDL establishes the allowable loadings for a waterbody and thereby provides a basis for water-quality based controls. With an appropriate margin of safety, these controls should provide the pollution reduction necessary for a waterbody to meet water quality standards.

A phased approach to a TMDL is appropriate when existing data are not adequate to determine needed load reductions from the pollutant sources being addressed, or to determine the controls necessary to address impairments. The addition of a monitoring plan and a TMDL revision process in the phased approach is intended to resolve the initial data limitations and validate or revise the TMDL, if necessary. The phased approach provides for pollution reduction while waiting for new monitoring data collection and analysis and then uses the new monitoring data and the measured effectiveness of initial controls to evaluate and revise the TMDL. A phased approach is being used in this Lemon Creek TMDL.

Part 2 PROBLEM DESCRIPTION

2.a Pollutants of Concern

Waters within the Lemon Creek drainage have been identified as impaired due to sediment, turbidity, and habitat modification stressors -- although there are few available data to quantify the degree of impairment. The presence of debris was also identified as a stressor in the State's draft list of impaired waterbodies (known as the "303(d) list"). The water quality assessment prepared subsequently, however, did not find adverse impacts due to the presence of debris. Accordingly, the presence of debris was dropped as an identified stressor from the final list. Insofar as debris is a potential concern for most any waterbody, this document still touches on the potential for debris to impact Lemon Creek and its uses.

In a general sense, the effects of excessive amounts of sediment are well-known. Field and laboratory investigations have documented lethal and sub-lethal effects of suspended and deposited sediments on freshwater aquatic organisms (Peterson, et al., 1985). The effects of fine sediments on streambed composition with resulting impacts on benthic habitat and salmonid spawning success have been extensively documented. Changes in sediment loads can also affect stream morphology affecting channel shape, sinuosity and the balance between pools and riffles. (MacDonald, 1991.)

Excessive turbidity reduces the amount of light available for green plant growth and photosynthesis. It can inhibit instream movement of fish, and may inhibit the ability of fish to see prey. Turbidity and settled solids can reduce invertebrate populations and can cause an increase in invertebrate drift to other parts of the stream. Settled solids can have effects on aquatic biota and habitat by smothering fish eggs, alevin, and invertebrates, reducing intergravel flow and oxygen levels, and by coating aquatic vegetation. High levels of solids in suspension can cause physical damage to fish, such as gill irritation.

2.b Applicable Water Quality Standards

The Clean Water Act requires that all waters of the U.S. be designated for specific uses that must then be protected. Once the uses have been designated, criteria are established to protect them. Together, criteria and designated uses constitute the State's water quality standards.[2]

Designated, protected uses for Lemon Creek waters, as identified in Alaska's Water Quality Standard Regulations (18 AAC 70), include its use as a source of water for drinking, industrial and

[2]A third component of water quality standards is a provision known as an "antidegradation clause."

aquacultural purposes; for contact and secondary (non-contact) recreation uses; and growth and propagation of aquatic life and wildlife. Both existing and attainable uses are protected under state regulation.

Alaska's water quality standards for turbidity, sediment and residues (defined as floating solids, debris, sludge, deposits, foam, scum, or other residues) intended to protect water quality for various uses are as follows:

> **Turbidity:** 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 15 NTU.
>
> **Sediment:** 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 from 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). . . . 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.
>
> **Residues:** May not, alone or in combination with other substances or wastes, make the water unfit or unsafe for the use, or cause acute or chronic problem levels as determined by bioassay or other appropriate methods. May not, alone or in combination with other substances, cause a film, sheen, or discoloration on the surface of the water or adjoining shorelines, or cause leaching of toxic or deleterious substances, or cause a sludge, solid, or emulsion to be deposited beneath or upon the surface of the water, within the water column, on the bottom, or upon adjoining shorelines.

In addition to the water quality standards, the water quality criteria specifically for protection of aquatic life as the identified impaired use are of interest. In the case of sediment and residues, there is no difference between the water quality standards and the water quality criteria for protection of aquatic life. In the case of turbidity, however, the aquatic life criterion is somewhat less stringent than the standard:

> **Turbidity (Protection of Aquatic Life):** May not exceed 25 NTU above natural conditions. For all lake waters, may not exceed 5 NTU above natural conditions.

While this specific turbidity criterion for protection of aquatic life is of interest from the standpoint of gaging the potential for impacts on one of the protected uses, TMDLs must be based on water quality standards -- in this case, the 5 NTU turbidity increase required for protection of all designated uses.

The Alaska Water Quality Standards regulations (18 AAC 70) do not include standards or criteria for habitat modification. The procedure for identifying impaired waterbodies focuses on impacts on uses, and allows for professional judgment in determining whether uses are impaired in the absence of specific water quality standards. Habitat modification was identified as a Lemon Creek stressor in this manner.

2.c Beneficial Uses Affected

The water quality assessment conducted previously suggests that the most significant beneficial use of Lemon Creek is as fish spawning and rearing habitat. The assessment finds degradation of habitat as a result of channelization, flow modifications, removal of riparian vegetation, stream bank modification and alteration of the streambed. Major changes have occurred at the mid and lower stream sections. (DEC, 1995.) Human activities such as gravel extractions, fills, surface topography changes, and removal of vegetative mats may have influenced groundwater flow direction and rates. Groundwater and surface waters at the mouth of Lemon Creek are also influenced by tidal action, resulting in mixing of groundwater with marine water. (Noll, 1992.)

Habitat quality is listed as moderate to poor due to the lack of undercut banks, little overhead cover, seasonally high turbidity, fluctuating water levels, and scarcity of rearing pools (Adamus, 1987). Better rearing habitat exists in the non-impacted tributaries. Spawning habitat for Chum, Coho, and Pink salmon in the main stream is reported as good. (Bethers, et al., 1993.)

2.d Available Monitoring Data

Flow and Solids Data

The U.S. Geological Survey (USGS) maintained a gaging station approximately 0.3 miles upstream from the confluence of Canyon Creek from 1951 to 1973. That station yielded a near-continuous 22-year streamflow record. In addition, the USGS collected 23 sets of water quality data between 1948 and 1972. Fifteen of those data sets include suspended sediment concentrations and loads.

The USGS also maintained a gaging station approximately 1.0 mile upstream of the mouth for the

period 1982 to 1986. The station yielded flow data for the period October 1982 to September 1986.

DEC collected turbidity and TSS data near the Glacier Highway bridge during stream channel gravel extraction activity on March 17, 1982. Samples were collected at half-hour intervals. DEC also collected turbidity and TSS data for the reach from the Glacier Highway bridge upstream to the Juneau Correctional Facility from June 28 to September 7, 1982. Samples were collected from six stations approximately weekly.

As part of developing this TMDL strategy and document, DEC collected additional samples from an upstream point at the end of the road, and a downstream point below the Juneau Ready Mix operation. Samples were collected at four-hour intervals between July 14 and 18, 1995 and analyzed for TSS and turbidity. In addition, settleable solids were measured twice during the same period at both the upper and lower stations.

Copies of the flow and solids data used in this analysis are included in Appendix D.

Other Data

In addition to the above data, several monitoring projects involving tests primarily for metals and organic compounds have been conducted on Lemon Creek between 1982 and 1993. Both surface water and groundwater samples have been periodically collected from the lower Lemon Creek area and evaluated by DEC and Channel Landfill. Sampling has also been conducted under the 1991 Juneau Streams Project and a City and Borough of Juneau groundwater monitoring program. The water quality assessment (DEC, 1995) includes further discussion of these sampling efforts and data.

2.e Pollutant Sources

Primary pollutant sources to Lemon Creek are identified in the water quality assessment as resulting from urban runoff and gravel mining. The assessment suggests that sedimentation has occurred as a result of non-point pollution runoff from gravel mining, road development and maintenance, and material stockpiling. For the purposes of the TMDL analysis, eight sources of actual or potential sediment and turbidity loading were identified:

- stormwater runoff from, or sloughing of, material stockpile areas (see Figure 2-1),
- stormwater runoff from areas disturbed by gravel operations (see Figures 2-2 and 2-3),

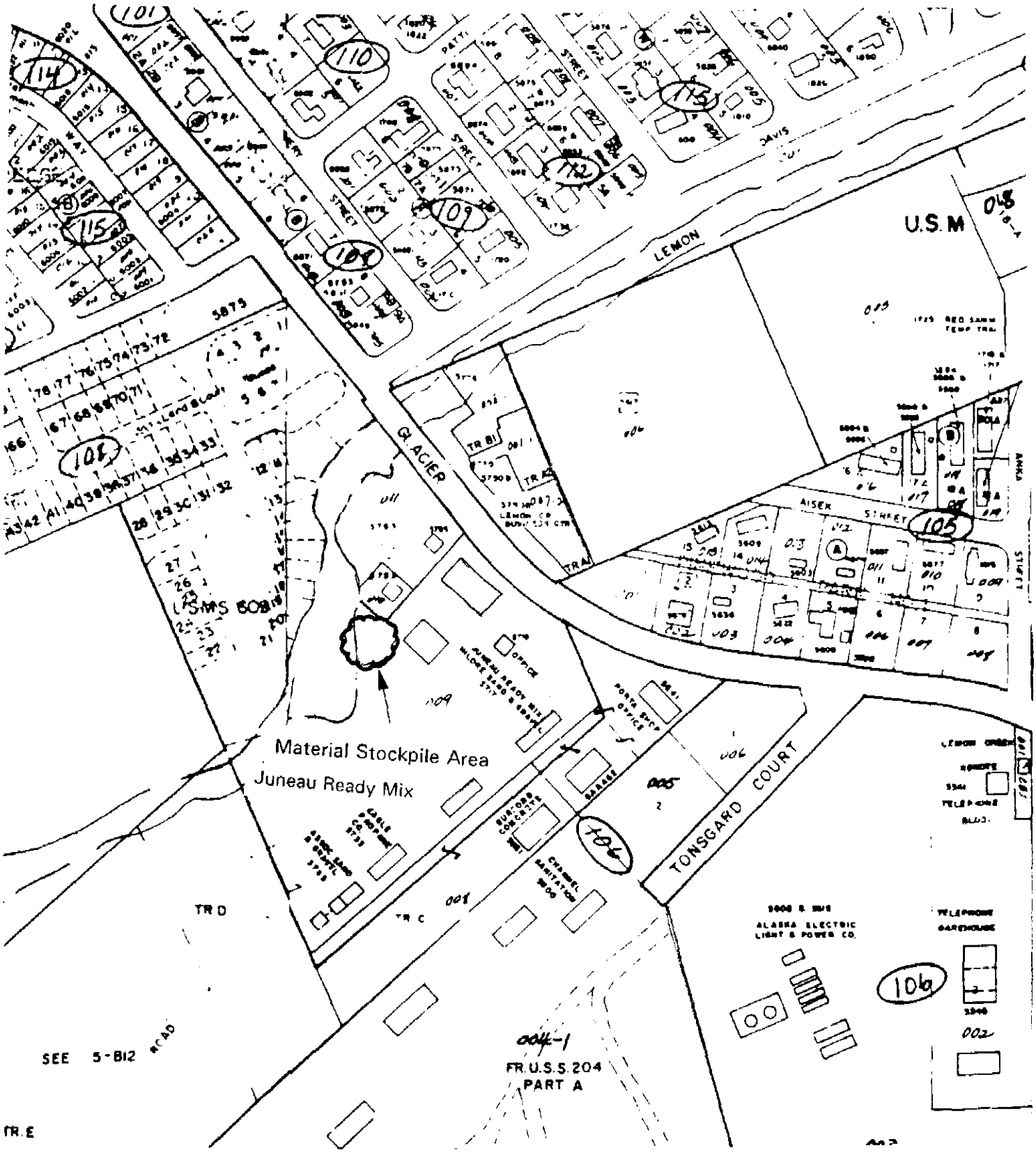


Figure 2-1
Sediment Sources

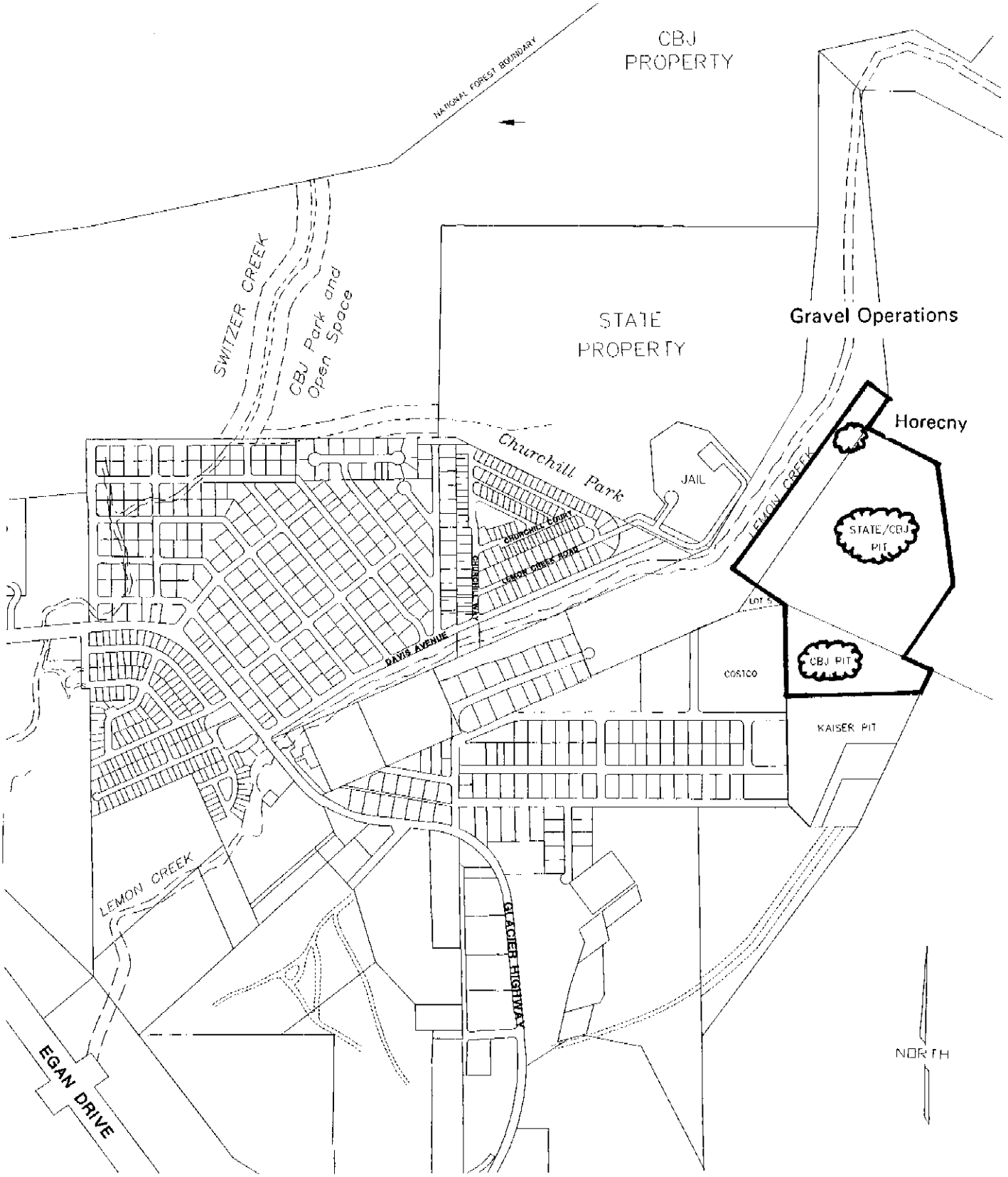


Figure 2-2
Sediment Sources

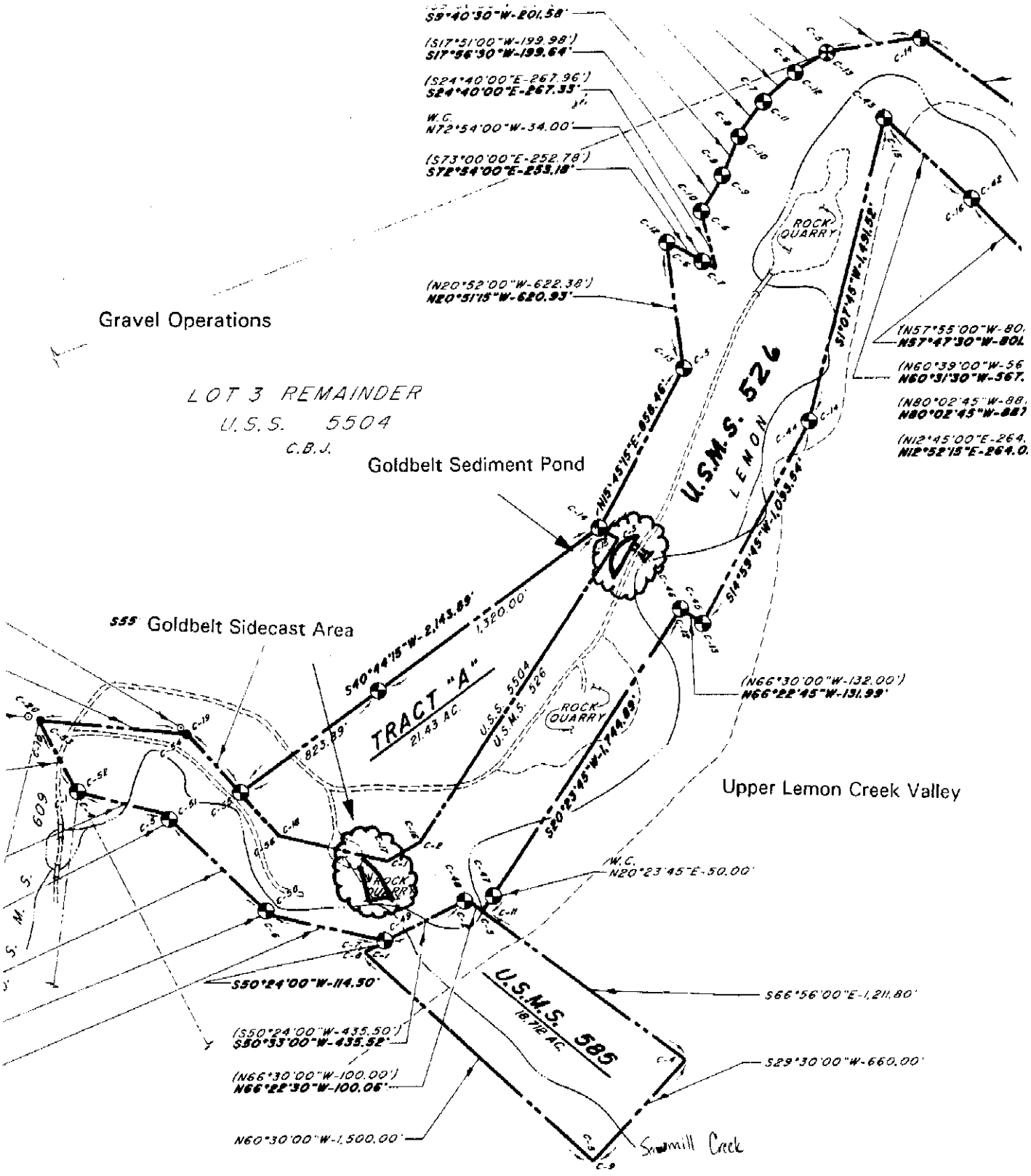


Figure 2-3
Sediment Sources

- stormwater runoff from the lower gravel haul road surface and cut/fill slopes (see Figure 2-4),
- stormwater runoff from urban residential areas (primarily north of the creek -- see Figure 2-5),
- stormwater runoff from industrial areas (primarily south of the creek -- see Figure 2-6),
- stormwater runoff and direct deposit of sediments from Glacier Highway and Egan Expressway, and
- natural sources.

2.f Existing Pollutant Controls

A tabulated summary of existing federal, state, and local statutes, regulations, ordinances, master planning documents, memoranda of agreement, etc. that currently apply to projects undertaken within the study area is included in Appendix E. It is illustrative to identify from the array of controls the key authorities, the key implementation processes, and the controls that have resulted.

Key Authorities

- the permitting authority of the U.S. Department of the Army, Corps of Engineers for the discharge of dredged or fill materials into waters (including wetlands) of the U.S. under Section 404 of the Clean Water Act;

- the permitting authority of the EPA for the discharge of wastewaters (including stormwater) to waters of the U.S. under Section 402 of the Clean Water Act;

- DEC's authority under Section 401 of the Clean Water Act to certify compliance with state law (primarily water quality standards) for all federal Clean Water Act permits;

- the permitting authority of the Alaska Department of Fish and Game to protect anadromous fish streams under Title 16 of the Alaska Statutes;

- the authority of the Alaska Department of Natural Resources to allocate appropriation of water for different uses and to different users including the maintenance of water quality and habitat through the reservation of instream flows;

- the City and Borough of Juneau's authority to plan for and to regulate land use and development; and

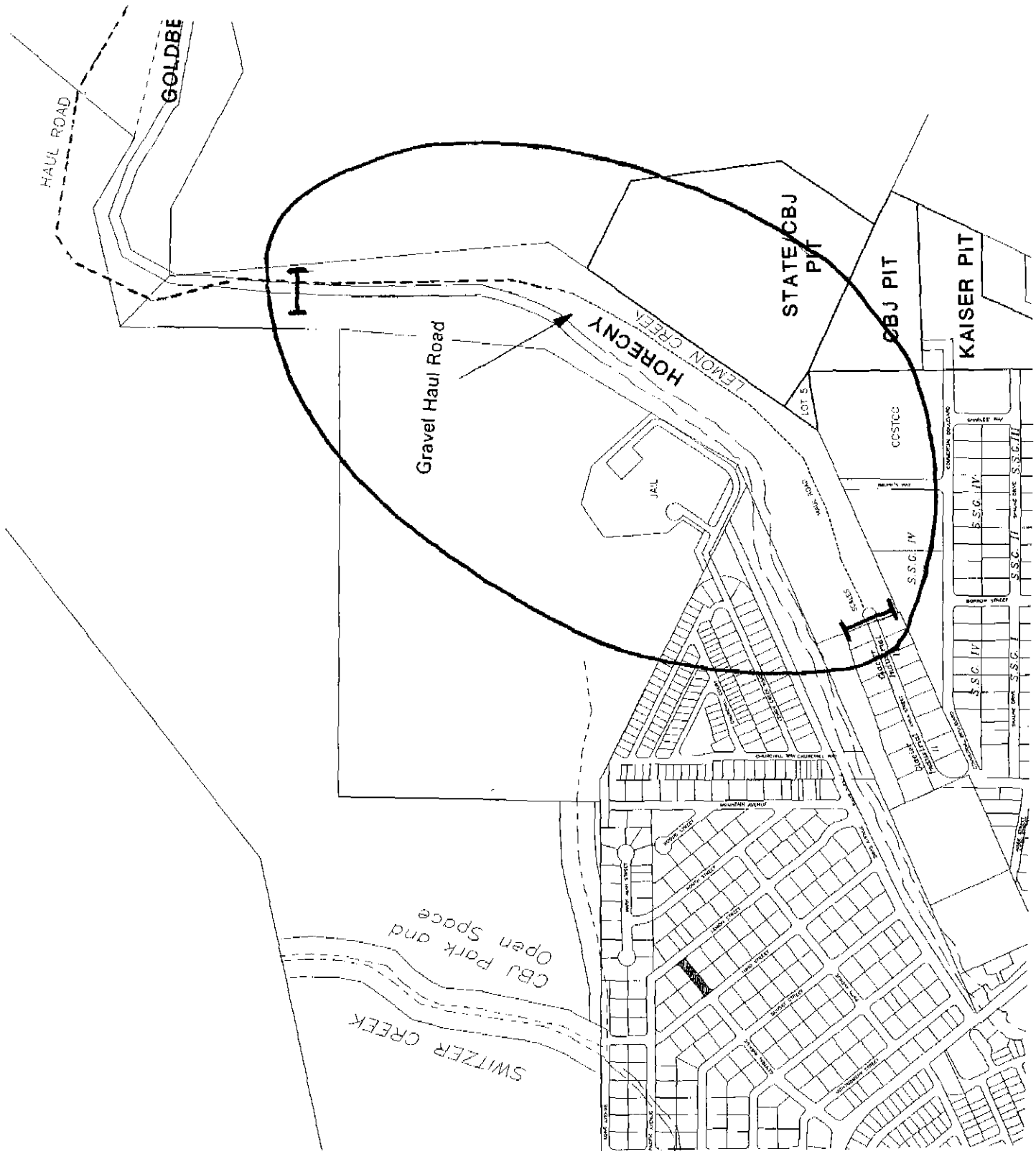


Figure 2-4
Sediment Sources

Figure 2-5
Sediment Sources

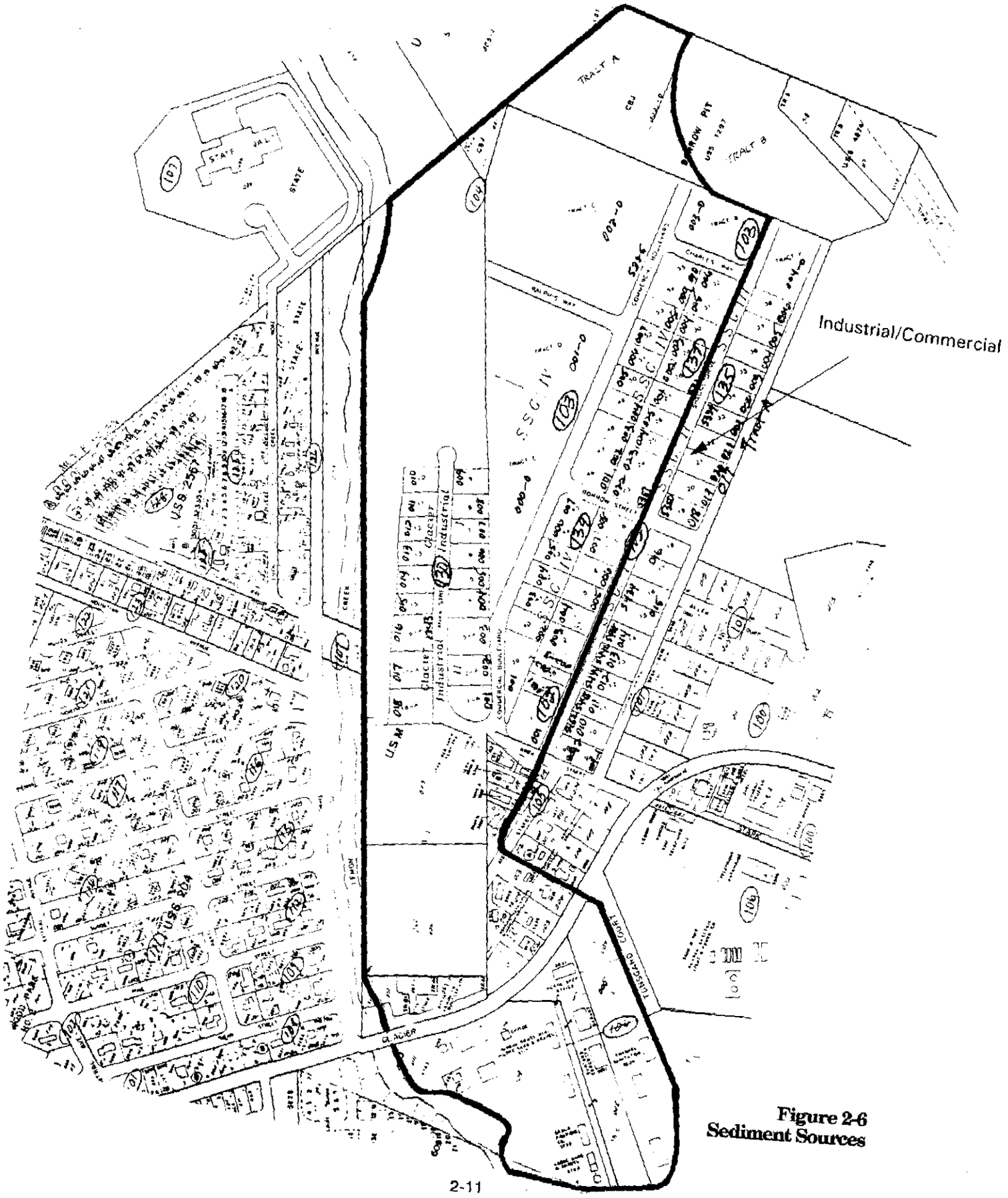


Figure 2-6
Sediment Sources

- state and local authority to regulate impacts on coastal areas under local and state coastal management programs.

Key Implementation Processes

- federal-state agency coordination of permitting activities under the Fish & Wildlife Coordination Act and Section 7 of the Endangered Species Act;

- state agency coordination of coastal management consistency review and state permit processing under the Alaska Coastal Management Program consistency review process;

- federal-state coordination of Section 404 permit processing and the coastal consistency review process;

- a CBJ-DEC agreement calling for coordinating policies and actions with respect to impaired waterbodies (including Lemon Creek) for the purpose of protecting, maintaining and improving water quality; and

- an internal DEC policy regarding impaired waterbodies stating that permitted projects should not be allowed to cause further degradation of water quality for the pollutants of concern, or cause or contribute to violations of other pollutant standards.

Key Existing Controls

- A 50-foot vegetated buffer is currently maintained in some areas. Provision for a 50-foot vegetated buffer on each side of Lemon Creek exists in local land use ordinance (CBJ Title 49), the Juneau Coastal Management Plan, and the Juneau Wetlands Management Plan. The land use ordinance prohibits development within 50 feet of the banks of the stream corridor, and disturbance within 25 feet. The Juneau Coastal Management Plan calls for a 50-foot, vegetated setback of structures and foundations from the ordinary high water mark where feasible and prudent. The Juneau Wetlands Management Plan calls for management of any jurisdictional wetlands located within the 50-foot corridor as wetlands Category A. In all cases, variances are allowed under some circumstances.

- There was no discharge of processing water from the gravel processing operations observed during field surveys of the area.

- Settling or infiltration basins have been established where there could be a discharge of

stormwater from gravel extraction operations.

Analysis

Existing authorities are ample to achieve needed water quality improvements. Adequate means for implementing controls exist, and mechanisms have been established for coordinating processing of some permits. Implementation of controls has been effective in correcting the most substantial -- primarily point source -- problems of the past, and has probably been successful in avoiding a number of potential problems. With growing recognition of the potential for sediment and other habitat problems, has come better controls. Controls established for newer operations and included in more recent authorizations are likely more effective than those put in place in the past. CBJ land use permitting authority is key to addressing non-point source and habitat issues.

Lacking is organization and interpretation of existing authorities into a single set of standards for authorizing activities while controlling primarily non-point source-derived impacts and habitat modification. In addition, the temporal spread in permitting actions over a period of changing requirements has resulted in significant variability in the type and effectiveness of stipulated controls.

2.g Pollution Control Strategy

There are two elements to the pollution control strategy. "PHASE 1 controls" are intended to address the most significant, immediate problems first, and attempt to identify practicable, cost-effective, short-term control measures primarily by working with the landowners.

The second element of the strategy involves longer term, PHASE 2 controls. PHASE 2 measures are often more intrusive and expensive than PHASE 1 measures. As a consequence, specific design and implementation of PHASE 2 controls is intended to be based upon data produced by a monitoring program to better identify pollutant sources and to better characterize loads. PHASE 2 measures may also be required should monitoring indicate that the PHASE 1 measures are not sufficient to reach target load reductions. PHASE 2 controls are also called for to guard against impacts from future activities. An objective of the PHASE 2 strategy is to establish a process by which future problems can be prevented.

While the nature of the PHASE 2 controls is longer term, the process leading to their implementation is intended to begin in the very near term, with implementation of the controls as soon thereafter as practicable.

PHASE 1 Controls	PHASE 2 Controls
•Address Water Quality Issues Only	•Address Habitat and Water Quality Issues
•Deal only with Discrete Sources	•Deal with Disperse as well as Discrete Sources
•Short-Term (Less than One Year)	•Longer-Term (Less than Five Years)
•Simple, Inexpensive	•More Complex, More Costly
•Based on Estimates and Judgments	•Based on Monitoring and Modeling
•Exclusively Remedial	•Preventative as well as Remedial
•Developed Cooperatively with Landowners	•May be More Regulatory in Nature
•Prescriptive	•More Performance or Procedural in Nature

Part 3 PROBLEM DEFINITION

3.a Loading Capacity Estimates

A loading capacity is the amount of a pollutant from point, non-point, and natural background sources that can be carried by a waterbody while still meeting water quality standards. While loading capacities are most often expressed as a mass per unit time, data limitations or the expression of water quality standards in non-conservative terms can make it difficult to calculate water quality standard-based, mass per unit time-type loading capacities. EPA regulations and guidance, consequently, allow for use of other terms. A more detailed explanation of the derivation of Lemon Creek loading capacities is included in Appendix F.

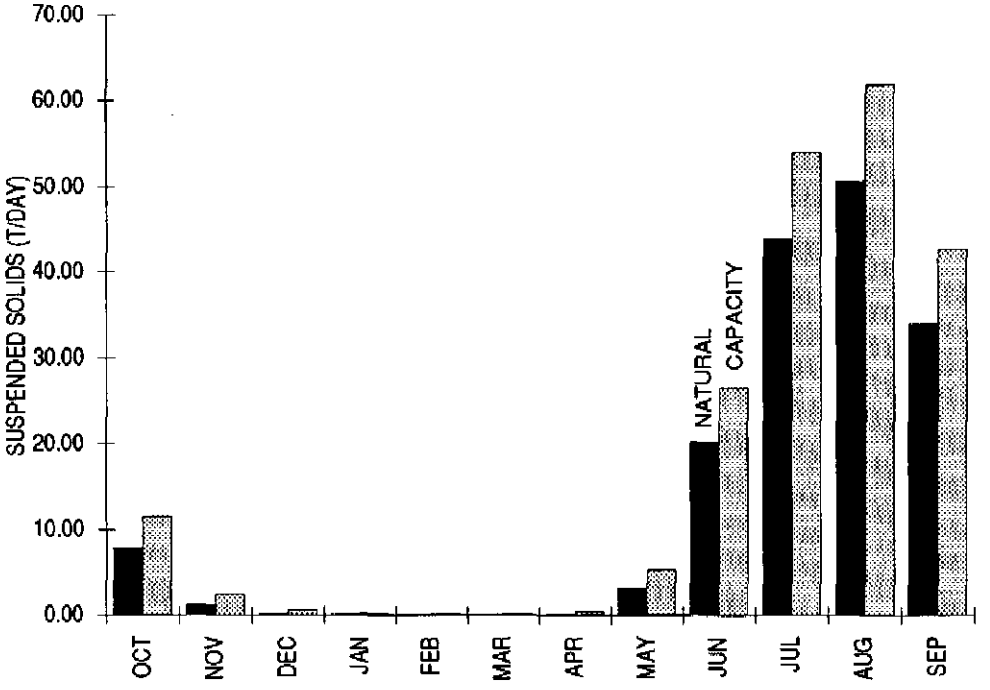
Total Suspended Solids and Turbidity

By relating sediment expressed as total suspended solids and turbidity, a single measure, the total suspended solids load, can be used to represent both sediment and turbidity. Because there is significant seasonal variability in the natural suspended sediment load of Lemon Creek, loading capacities were developed for each month. Total suspended solids loading capacities, along with the actual natural sediment loads are shown in Table 3-1 below, and in Figure 3-1 on the following page.

Table 3-1
Monthly Total Suspended Solids Loading Capacity

MONTH	MEAN MONTHLY FLOW (CFS)	NATURAL SUS SEDIMENT LOAD (TONS/DAY)	SUS SEDIMENT LOAD CAPACITY (TONS/DAY)
OCT	147.0	7.9	11.5
NOV	49.2	1.3	2.5
DEC	17.6	0.2	0.7
JAN	8.0	0.1	0.3
FEB	5.4	0.0	0.2
MAR	5.8	0.0	0.2
APR	12.9	0.1	0.5
MAY	85.4	3.2	5.3
JUN	261.0	20.2	26.6
JUL	418.0	43.8	54.0
AUG	457.0	50.7	61.8
SEP	358.0	34.0	42.7

Figure 3-1
Monthly Total Suspended Solids Loading Capacity



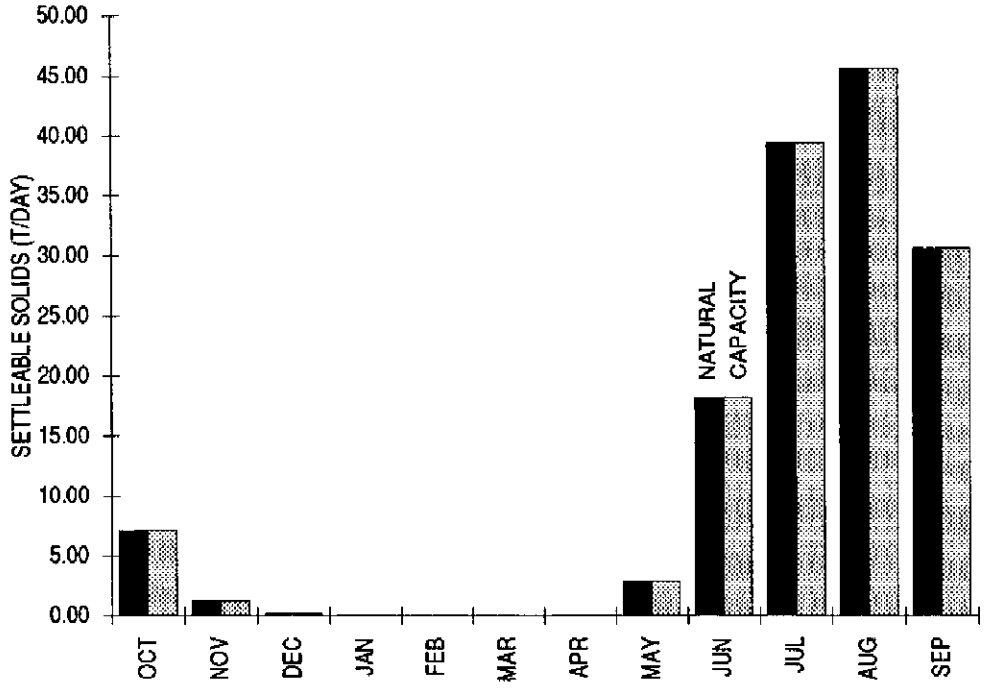
Settleable Solids

To establish a loading capacity for coarser, settleable solids, the settleable fraction of the total suspended sediment load was estimated, and the following loading capacities adopted as initial estimates. It should be emphasized that these are estimates only, and subject to revision as better data become available. Settleable solids loading capacities, along with the actual natural loads are shown in Table 3-2 and Figure 3-2 on the following page.

Table 3-2
Monthly Settleable Solids Loading Capacity

MONTH	MEAN MONTHLY FLOW (CFS)	NATURAL SET SOLIDS LOAD (TONS/DAY)	SET SOLIDS LOAD CAPACITY (TONS/DAY)
OCT	147.0	7.1	7.1
NOV	49.2	1.2	1.2
DEC	17.6	0.2	0.2
JAN	8.0	0.1	0.1
FEB	5.4	0.0	0.0
MAR	5.8	0.0	0.0
APR	12.9	0.1	0.1
MAY	85.4	2.9	2.9
JUN	261.0	18.2	18.2
JUL	418.0	39.4	39.4
AUG	457.0	45.6	45.6
SEP	358.0	30.6	30.6

Figure 3-2
Monthly Settleable Solids Loading Capacity



3.b Pollutant Source Load Estimates

Annual sediment and turbidity contributions for each identified sediment source were estimated as described in Appendix G. It should be emphasized that these initial estimates are intended only to begin the process of quantifying loads as required by the TMDL process. The estimates are intended to be updated with actual monitoring data as they become available.

Table 3-3
Source Load Estimates

SOURCE	TOTAL SUSPENDED SOLIDS (TONS/DAY)	SETTLEABLE SOLIDS (TONS/DAY)
JUNEAU READY MIX STOCKPILE	<0.01	<0.01
RSH RETENTION BASIN	<0.01	<0.01
GOLDBELT UPPER SEDIMENT POND	<0.01	<0.01
GOLDBELT SIDECAST AREA	<0.01	<0.01
HAUL ROAD SURFACE AND EMBANKMENTS	0.2	0.18
RESIDENTIAL URBAN RUNOFF	<0.01	<0.01
INDUSTRIAL URBAN RUNOFF	0.1	0.09
NATURAL	<0.1 TO 50.7	<0.1 TO 45.6

3.c Target Load Reductions

Target load reductions are the reductions in source loads needed so that the total load from all sources is less than or equal to the loading capacity. They represent the difference between the existing source load and the load allocations. The load allocations are the basis for permitting actions and development of management practices.

Total Suspended Solids and Turbidity

Tables 3-4 through 3-15 (following pages) show the annual total suspended solids source load estimates expressed as a monthly average, the target load reductions, and the load allocations (the difference between the source load and the load reduction) for each month.

An overall reduction in total suspended solids of approximately 60 percent is required to bring the sediment load to within Lemon Creek's least loading capacity (during the month of February) -- while allowing for a 15 percent margin of safety. In order to achieve the 60 percent overall target reduction, the efficiency of control measures was set at 70 percent, with the exception of stormwater runoff from residential areas which was set at 50 percent. In our judgment, a removal efficiency of 70 percent should be achievable with implementation of the controls described in the following chapter. The one exception is control of sediment transported by runoff from residential areas where controls are expected to be more difficult to implement, and likely less efficient when implemented.

Table 3-4
January TSS Load Allocations

SOURCE	ESTIMATED SEDIMENT CONTRIBUTION (T/DAY)	TARGET LOAD REDUCTION (PERCENT)	LOAD ALLOCATION (T/DAY)	LOADING CAPACITY (T/DAY)
JUNEAU READY MIX STOCKPILE	0.01	70	0.003	
RSH RETENTION BASIN	0.01	70	0.003	
GOLDBELT UPPER SEDIMENT POND	0.01	70	0.003	
GOLDBELT SIDECAST AREA	0.01	70	0.003	
HAUL ROAD SURFACE/EMBANKMENTS	0.20	70	0.06	
RESIDENTIAL URBAN RUNOFF	0.01	50	0.005	
INDUSTRIAL URBAN RUNOFF	0.10	70	0.03	
NATURAL	0.07	0	0.07	
MARGIN OF SAFETY			0.04	
TOTALS	**0.42**		**0.21**	**0.26**

Table 3-5
February TSS Load Allocations

SOURCE	ESTIMATED SEDIMENT CONTRIBUTION (T/DAY)	TARGET LOAD REDUCTION (PERCENT)	LOAD ALLOCATION (T/DAY)	LOADING CAPACITY (T/DAY)
JUNEAU READY MIX STOCKPILE	0.01	70	0.003	
RSH RETENTION BASIN	0.01	70	0.003	
GOLDBELT UPPER SEDIMENT POND	0.01	70	0.003	
GOLDBELT SIDECAST AREA	0.01	70	0.003	
HAUL ROAD SURFACE/EMBANKMENTS	0.20	70	0.06	
RESIDENTIAL URBAN RUNOFF	0.01	50	0.005	
INDUSTRIAL URBAN RUNOFF	0.10	70	0.03	
NATURAL	0.04	0	0.04	
MARGIN OF SAFETY			0.03	
TOTALS	**0.39**		**0.17**	**0.17**

Table 3-6
March TSS Load Allocations

SOURCE	ESTIMATED SEDIMENT CONTRIBUTION (T/DAY)	TARGET LOAD REDUCTION (PERCENT)	LOAD ALLOCATION (T/DAY)	LOADING CAPACITY (T/DAY)
JUNEAU READY MIX STOCKPILE	0.01	70	0.003	
RSH RETENTION BASIN	0.01	70	0.003	
GOLDBELT UPPER SEDIMENT POND	0.01	70	0.003	
GOLDBELT SIDECAST AREA	0.01	70	0.003	
HAUL ROAD SURFACE/EMBANKMENTS	0.2	70	0.06	
RESIDENTIAL URBAN RUNOFF	0.01	50	0.005	
INDUSTRIAL URBAN RUNOFF	0.1	70	0.03	
NATURAL	0.04	0	0.04	
MARGIN OF SAFETY			0.03	
TOTALS	**0.39**		**0.17**	**0.18**

Table 3-7
April TSS Load Allocations

SOURCE	ESTIMATED SEDIMENT CONTRIBUTION (T/DAY)	TARGET LOAD REDUCTION (PERCENT)	LOAD ALLOCATION (T/DAY)	LOADING CAPACITY (T/DAY)
JUNEAU READY MIX STOCKPILE	0.01	70	0.003	
RSH RETENTION BASIN	0.01	70	0.003	
GOLDBELT UPPER SEDIMENT POND	0.01	70	0.003	
GOLDBELT SIDECAST AREA	0.01	70	0.003	
HAUL ROAD SURFACE/EMBANKMENTS	0.2	70	0.06	
RESIDENTIAL URBAN RUNOFF	0.01	50	0.005	
INDUSTRIAL URBAN RUNOFF	0.1	70	0.03	
NATURAL	0.15	0	0.15	
MARGIN OF SAFETY			0.07	
TOTALS	**0.50**		**0.32**	**0.46**

Table 3-8
May TSS Load Allocations

SOURCE	ESTIMATED SEDIMENT CONTRIBUTION (T/DAY)	TARGET LOAD REDUCTION (PERCENT)	LOAD ALLOCATION (T/DAY)	LOADING CAPACITY (T/DAY)
JUNEAU READY MIX STOCKPILE	0.01	70	0.003	
RSH RETENTION BASIN	0.01	70	0.003	
GOLDBELT UPPER SEDIMENT POND	0.01	70	0.003	
GOLDBELT SIDECAST AREA	0.01	70	0.003	
HAUL ROAD SURFACE/EMBANKMENTS	0.2	70	0.06	
RESIDENTIAL URBAN RUNOFF	0.01	50	0.005	
INDUSTRIAL URBAN RUNOFF	0.1	70	0.03	
NATURAL	3.23	0	3.23	
MARGIN OF SAFETY			0.80	
TOTALS	**3.58**		**4.13**	**5.31**

Table 3-9
June TSS Load Allocations

SOURCE	ESTIMATED SEDIMENT CONTRIBUTION (T/DAY)	TARGET LOAD REDUCTION (PERCENT)	LOAD ALLOCATION (T/DAY)	LOADING CAPACITY (T/DAY)
JUNEAU READY MIX STOCKPILE	0.01	70	0.003	
RSH RETENTION BASIN	0.01	70	0.003	
GOLDBELT UPPER SEDIMENT POND	0.01	70	0.003	
GOLDBELT SIDECAST AREA	0.01	70	0.003	
HAUL ROAD SURFACE/EMBANKMENTS	0.2	70	0.06	
RESIDENTIAL URBAN RUNOFF	0.01	50	0.005	
INDUSTRIAL URBAN RUNOFF	0.1	70	0.03	
NATURAL	20.23	0	20.23	
MARGIN OF SAFETY			3.99	
TOTALS	**20.58**		**24.32**	**26.57**

Table 3-10
July TSS Load Allocations

SOURCE	ESTIMATED SEDIMENT CONTRIBUTION (T/DAY)	TARGET LOAD REDUCTION (PERCENT)	LOAD ALLOCATION (T/DAY)	LOADING CAPACITY (T/DAY)
JUNEAU READY MIX STOCKPILE	0.01	70	0.003	
RSH RETENTION BASIN	0.01	70	0.003	
GOLDBELT UPPER SEDIMENT POND	0.01	70	0.003	
GOLDBELT SIDECAST AREA	0.01	70	0.003	
HAUL ROAD SURFACE/EMBANKMENTS	0.2	70	0.06	
RESIDENTIAL URBAN RUNOFF	0.01	50	0.005	
INDUSTRIAL URBAN RUNOFF	0.1	70	0.03	
NATURAL	43.82	0	43.82	
MARGIN OF SAFETY			8.10	
TOTALS	**44.17**		**52.02**	**53.98**

Table 3-11
August TSS Load Allocations

SOURCE	ESTIMATED SEDIMENT CONTRIBUTION (T/DAY)	TARGET LOAD REDUCTION (PERCENT)	LOAD ALLOCATION (T/DAY)	LOADING CAPACITY (T/DAY)
JUNEAU READY MIX STOCKPILE	0.01	70	0.003	
RSH RETENTION BASIN	0.01	70	0.003	
GOLDBELT UPPER SEDIMENT POND	0.01	70	0.003	
GOLDBELT SIDECAST AREA	0.01	70	0.003	
HAUL ROAD SURFACE/EMBANKMENTS	0.2	70	0.06	
RESIDENTIAL URBAN RUNOFF	0.01	50	0.005	
INDUSTRIAL URBAN RUNOFF	0.1	70	0.03	
NATURAL	50.73	0	50.73	
MARGIN OF SAFETY			9.28	
TOTALS	**51.08**		**60.11**	**61.83**

Table 3-12
September TSS Load Allocations

SOURCE	ESTIMATED SEDIMENT CONTRIBUTION (T/DAY)	TARGET LOAD REDUCTION (PERCENT)	LOAD ALLOCATION (T/DAY)	LOADING CAPACITY (T/DAY)
JUNEAU READY MIX STOCKPILE	0.01	70	0.003	
RSH RETENTION BASIN	0.01	70	0.003	
GOLDBELT UPPER SEDIMENT POND	0.01	70	0.003	
GOLDBELT SIDECAST AREA	0.01	70	0.003	
HAUL ROAD SURFACE/EMBANKMENTS	0.2	70	0.06	
RESIDENTIAL URBAN RUNOFF	0.01	50	0.005	
INDUSTRIAL URBAN RUNOFF	0.1	70	0.03	
NATURAL	33.98	0	33.98	
MARGIN OF SAFETY			6.40	
TOTALS	**34.33**		**40.49**	**42.68**

Table 3-13
October TSS Load Allocations

SOURCE	ESTIMATED SEDIMENT CONTRIBUTION (T/DAY)	TARGET LOAD REDUCTION (PERCENT)	LOAD ALLOCATION (T/DAY)	LOADING CAPACITY (T/DAY)
JUNEAU READY MIX STOCKPILE	0.01	70	0.003	
RSH RETENTION BASIN	0.01	70	0.003	
GOLDBELT UPPER SEDIMENT POND	0.01	70	0.003	
GOLDBELT SIDECAST AREA	0.01	70	0.003	
HAUL ROAD SURFACE/EMBANKMENTS	0.2	70	0.06	
RESIDENTIAL URBAN RUNOFF	0.01	50	0.005	
INDUSTRIAL URBAN RUNOFF	0.1	70	0.03	
NATURAL	7.88	0	7.88	
MARGIN OF SAFETY			1.72	
TOTALS	**8.23**		**9.71**	**11.45**

Table 3-14
November TSS Load Allocations

SOURCE	ESTIMATED SEDIMENT CONTRIBUTION (T/DAY)	TARGET LOAD REDUCTION (PERCENT)	LOAD ALLOCATION (T/DAY)	LOADING CAPACITY (T/DAY)
JUNEAU READY MIX STOCKPILE	0.01	70	0.003	
RSH RETENTION BASIN	0.01	70	0.003	
GOLDBELT UPPER SEDIMENT POND	0.01	70	0.003	
GOLDBELT SIDECAST AREA	0.01	70	0.003	
HAUL ROAD SURFACE/EMBANKMENTS	0.2	70	0.06	
RESIDENTIAL URBAN RUNOFF	0.01	50	0.005	
INDUSTRIAL URBAN RUNOFF	0.1	70	0.03	
NATURAL	1.31	0	1.31	
MARGIN OF SAFETY			0.38	
TOTALS	**1.66**		**1.79**	**2.50**

Table 3-15
December TSS Load Allocations

SOURCE	ESTIMATED SEDIMENT CONTRIBUTION (T/DAY)	TARGET LOAD REDUCTION (PERCENT)	LOAD ALLOCATION (T/DAY)	LOADING CAPACITY (T/DAY)
JUNEAU READY MIX STOCKPILE	0.01	70	0.003	
RSH RETENTION BASIN	0.01	70	0.003	
GOLDBELT UPPER SEDIMENT POND	0.01	70	0.003	
GOLDBELT SIDECAST AREA	0.01	70	0.003	
HAUL ROAD SURFACE/EMBANKMENTS	0.2	70	0.06	
RESIDENTIAL URBAN RUNOFF	0.01	50	0.005	
INDUSTRIAL URBAN RUNOFF	0.1	70	0.03	
NATURAL	0.24	0	0.24	
MARGIN OF SAFETY			0.10	
TOTALS	**0.59**		**0.45**	**0.67**

Settleable Solids and Gravel Embeddedness

For the settleable sediment fraction, the target is to essentially eliminate the non-natural load. Target reductions then are equivalent to the estimated source loads as presented in Table 3-3.

Part 4 CONTROL ACTIONS

This part describes the control actions required to achieve target load reductions, and to prevent further problems from developing. Operators, ADEC and CBJ staff will be jointly involved in promoting and carrying out these control actions. ADF&G and ADOT/PF will also be involved in selected controls. The current MOA between CBJ and ADEC outlines respective responsibilities.

Source-specific control measures are summarized in Table 4-1 on the next page, and are described more fully in Appendix C.

In addition to the source-specific control measures, there is a need for additional measures to address less specific, longer-range water quality issues as well as habitat modification issues. The following control measures are included for that purpose.

4.a Streamside Buffers

Objective: Establish a stable, minimum 50-foot, vegetated buffer along both sides of Lemon Creek in accordance with local ordinance.

Streamside buffers have both sediment control and habitat value. Provision for a 50-foot vegetated buffer on Lemon Creek currently exists in local land use ordinance (CBJ Title 40), the Juneau Coastal Management Plan, and the Juneau Wetlands Management Plan (see Appendix E). The land use ordinance prohibits development within 50 feet of the banks of the stream corridor, and disturbance within 25 feet. The Juneau Coastal Management Plan calls for a 50-foot, vegetated setback of structures and foundations from the ordinary high water mark where feasible and prudent. The Juneau Wetlands Management Plan calls for management of any jurisdictional wetlands located within the 50-foot corridor as wetlands Category A. In all cases, variances are allowed under some circumstances.

The following control measures are intended to support the objective:

Measure$_1$ Seek public ownership of lands necessary for streamside buffers and a right-of-way corridor for the haul road adjacent to Lemon Creek.

This measure envisions DEC and CBJ working cooperatively with landowners to acquire properties through purchase or land trades. Priority should be given the area south of Lemon Creek between Anka Street and the gorge.

Table 4-1
Lemon Creek
Sediment Sources and Controls

	Phase 1 Controls	Phase 2 Controls
Source-Specific Controls		
Juneau Ready Mix Stockpile	Terrace with reverse slope. Stabilize stream bank below terrace.	Additional measures if required.
RSH Retention Basin	Maintain storage and retention capacity.	None identified.
Goldbelt Upper Sediment Pond	Re-direct main flow to lower infiltration basin. Increase pond volume. Establish silt dikes in ditch.	Additional measures if required.
Goldbelt Sidecast Area	Establish stable cover in grass and alder.	Additional measures if required.
Haul Road Surface/Embankments	None identified.	Shift alignment below gorge away from creek. Improve road surfacing and maintenance.
Watershed and Habitat Controls		Establish stable, vegetated, 50-foot buffer. Install sediment control devices on conveyances. Develop and implement construction BMPs. Monitor and improve habitat. Improve agency and public awareness. Establish implementation and oversight committee.
Natural	None.	None.

Measure$_2$ Incorporate water quality- and habitat-based criteria into CBJ variance criteria.

Current criteria for variances from the 50-foot setback requirements do not address water quality and habitat impacts. There is a need to incorporate specific criteria intended to ensure that consideration of variance requests includes water quality and habitat considerations, and provision for water quality- and habitat-based stipulations in granting variances.

Measure$_3$ Develop criteria for buffer areas including types of vegetative cover, stability, and permissible uses.

Measure$_4$ Incorporate buffer provisions into CBJ development permits and state certification of Section 404 permits.

4.b Stormwater Treatment

Objective: Install sediment control structures on stormwater conveyances discharging to Lemon Creek.

While vegetated buffers are effective in controlling near-stream erosion, surface runoff sediment transport, and improving habitat values, sediment may also be transported to the stream via stormwater conveyances such as storm sewers, culverts and ditches. An array of treatment practices are available to control stormwater-conveyed sediments: retention, detention and infiltration basins; sediment traps; swales and filter strips; constructed wetlands; sediment dikes; etc. In most cases, site-specific considerations will dictate the most practicable and effective treatment practice. Specific objectives include installing sediment control devices on all new stormwater conveyances, and actively working to retro-fit sediment control devices on existing conveyances.

The following control measures are intended to support the objective:

Measure$_1$ Identify all existing stormwater conveyances and prioritize the need for treatment.

Measure$_2$ Work cooperatively with landowners to retro-fit or improve stormwater treatment controls on existing conveyances with highest need.

Measure$_3$ Require treatment measures for all new conveyances.

Measure4 Develop applicability, performance and design criteria for stormwater treatment practices.

4.c Haul Road Improvements

Objective: Improve the haul road surfacing and alignment between Anka Street and the gorge to significantly reduce the associated sediment load.

While the haul road surface and unstable embankments are identified as major sediment sources, little can be done in the short term to reduce sediment loads. The following measures envision a cooperative effort with landowners to seek the longer-term and more extensive changes that will be required to address this source.

Measure1 Work cooperatively with landowners to develop opportunities for increasing the distance between Lemon Creek and the haul road below the gorge and thereby allowing less steeply sloped and more stable embankments.

Measure2 Work cooperatively with landowners to define a final alignment for the road below the gorge that would accommodate needed separation between the road and Lemon Creek.

Measure3 Work cooperatively with landowners to develop opportunities for improving surfacing, access, and maintenance of the road.

4.d Best Management Practices

Objective: Establish best management practices to reduce sediment from construction activities.

Source controls are those intended to reduce the amount of sediment at the source or property line. Source controls often take the form of specified practices for managing activities to reduce the amount of sediment (or other pollutants) transported from a site. Application of best management practices (BMPs) to activities that have the greatest potential for generating sediment loads -- such as construction activity -- can result in significant improvement in the quality of stormwater runoff.

The following control measures are intended to support the objective:

Measure1 Develop a set of best management practices (BMPs) for construction activities in

the Lemon Creek watershed.

Measure2 Implement the BMPs through the CBJ development and building permits, and DEC Section 401 federal permit certification authority.

4.e Habitat Improvement

Objective: Establish habitat indices, conduct monitoring and work with landowners to develop opportunities to monitor, restore and improve habitat values.

Lemon Creek habitat has been affected in a number of ways other than through sediment loading. The restoration plan seeks to monitor, restore and improve overall habitat values.

The following control measures are intended to support the objective:

Measure1 Establish and monitor indices of habitat condition.

Measure2 Organize cleanups to remove litter and debris that could diminish habitat or threaten aquatic life or wildlife.

Measure3 Work with landowners and others to develop specific opportunities for improving important habitat values through land trades, acquisition of grant funds, incorporating habitat improvements into development plans, and other means.

4.f Agency and Public Awareness

Objective: Improve agency and public awareness of Lemon Creek values and efforts to protect them.

There is a need to raise public and agency awareness of the importance of Lemon Creek and the surrounding area as a key source of resources for the City and Borough of Juneau, its importance from the standpoint of potential future development, and its importance as an anadromous fish stream and due to its other habitat values.

The following control measures are intended to support the objective:

Measure1 Seek and develop opportunities for raising agency awareness through memoranda of agreement, distribution of this document and fact sheets, and other means.

Measure$_2$ Seek and develop opportunities for raising public awareness through signage, development of informational materials, distribution of fact sheets, improved methods of engaging the public in agency decisionmaking, and other means.

4.g Implementation and Oversight Committee

Objective: Establish a joint agency-landowner committee to oversee and assist in the implementation of TMDL controls and other activities.

The following control measure is intended to support the objective:

Establish an oversight and implementation committee consistent with a watershed management approach to problem solving.

The committee's responsibilities will include:

- Overseeing the installation and implementation of the other control measures set out in this document in accordance with the implementation schedule.

- Identifying information needs and overseeing the design and conduct of monitoring, other data collection, and modeling efforts.

- Developing specific objectives for improving habitat values and addressing habitat modifications that allow for development and industrial use.

- Working with landowners to develop opportunities for improving habitat, implementing other control measures, and accommodating development through land trades and other agreements.

- Serving as a forum for review of permit applications.

- Identifying and pursuing appropriate funding sources for ongoing monitoring, application of control measures, and restoration.

- In light of monitoring data, providing input on revising loading capacities, when appropriate, source load allocations, and load reductions.

- Helping agencies assess attainment of water quality standards and habitat

improvements, and developing modifications to the source-specific, watershed and habitat controls for subsequent phases of the TMDL process.

CBJ and ADEC will provide leadership in organizing and managing the committee's activities.

Part 5 IMPLEMENTATION

Implementation of the phased Lemon Creek TMDL is summarized in Table 5-1 on the next page.

Critical to the success of any strategy to implement the elements of this TMDL is the involvement and cooperation of area property owners. Another important element of the strategy is the creation of opportunities for improvement through land exchanges, partnership agreements, grant funding, etc. Innovative ideas for specific measures should be actively pursued.

A discussion of the general overall strategy outlined in this document follows. In it we have endeavored to seek the cooperation and commitment of private property owners and to encourage the further development of ideas for improvement.

5.a Implementing Controls

Site-specific controls are recommended for each individual sediment source and are broken down into Phase 1 and Phase 2 actions. Phase 1 controls typically consist of immediate, first effort actions intended to identify effective, short-term control measures which will reduce source loads. Phase 2 controls tend to be more complex and potentially more expensive solutions based upon data produced by a monitoring program. In addition to the Phase 1 and Phase 2 control actions for specific sources, the plan calls for implementation of broader watershed and habitat measures. The time frame for Phase 1 controls is one year. The Phase 2 and broader watershed and habitat controls are expected to be completed within five years, but the process leading to implementation of specific Phase 2 controls is expected to be initiated upon approval of the TMDL by the EPA.

Where possible, source-specific controls have been discussed with the affected party and implementation dates which reflect the date which the desired result can be expected, have been arrived at with their cooperation.

The longer-range water quality and habitat objectives will be achieved through the actions of various agencies and the landowners. An implementation and oversight committee is envisioned which will be comprised of local landowners, interested public, local, state, and federal agency personnel. The group will have a list of specific tasks related to the broader objectives described in the previous chapter and will oversee their implementation.

The Environmental Protection Agency can implement measures by assisting in the development of applicability, performance, and design criteria for stormwater treatment practices, conditioning permits with applicable stipulations, participating in the public oversight and implementation

Table 5-1
Lemon Creek
Implementation Plan

Site/Action	Responsibility	Completion Date
Phase 1 Site-Specific Control Installation		
Juneau Ready Mix Stockpile		
Establish terrace with reverse slope.	Juneau Ready Mix	11/1/95
Stabilize stream bank below terrace.	Juneau Ready Mix	7/15/96
RSH Retention Basin		
Maintain storage and retention capacity.	RSH Company	Ongoing as needed
Goldbelt Upper Sediment Pond		
Re-direct flow to lower infiltration basin.	Goldbelt, Inc.	11/1/95
Increase pond volume.	Goldbelt, Inc.	11/1/95
Establish silt dikes in ditch.	Goldbelt, Inc.	11/1/95
Goldbelt Sidecast Area		
Establish surface cover in grass and alder.	Goldbelt, Inc.	7/15/96
Phase 2 Site-Specific Control Installation		
Additional Juneau Ready Mix stockpile measures if required.	Juneau Ready Mix	7/15/97
Additional Goldbelt Upper Sediment Pond measures if required.	Goldbelt, Inc.	7/15/96
Additional Goldbelt Sidecast Area measures if required.	Goldbelt, Inc.	7/15/97
Haul Road Surface/Embankments		
Shift alignment below gorge away from creek.	RSH, CBJ	10/1/00
Surface road.	RSH, CBJ	10/1/00
Watershed Control Installation		
Establish stable, vegetated, 50-foot buffer.	DEC, CBJ	10/1/00
Install sediment control devices on conveyances.	DEC,CBJ	10/1/00
Develop and implement construction BMPs.		10/1/00
Monitor and improve habitat.		10/1/00
Improve agency and public awareness.		10/1/00
Establish implementation and oversight committee.	DEC	1/1/96
Monitoring		
Initiate monitoring per monitoring plan.	DEC	10/1/95
Annual Progress Assessments		
First annual progress assessment.	DEC	10/1/96
TMDL Updates		
First TMDL update.	DEC	w/in 3 to 5 years

committee, and public education and outreach efforts. The U.S. Army Corps of Engineers (and National Marine Fisheries Service and the Fish & Wildlife Service through their coordination act) will have opportunities to incorporate buffer provisions and best management practices when issuing permits, and will be invited to participate in the oversight and implementation committee. In addition, the National Marine Fisheries Service and the U.S. Fish & Wildlife Service can provide valuable input in establishing indices of habitat condition, developing criteria for buffer areas, and looking for other opportunities to improve habitat. The Alaska Department of Fish & Game can play a key role in implementation through their participation in permitting, development of buffer provisions and habitat-based variance criteria, establishment of habitat indices, and development of additional opportunities for improving habitat values. Their participation in the implementation and oversight committee will also be important.

The Department of Environmental Conservation will have overall responsibility for seeing that the provisions of the TMDL are implemented. Their involvement in each of the objectives will range from coordination of the efforts of others to substantive involvement in establishing criteria, determining best management practices, etc. Facilitation and follow-up will also be their responsibility.

The City & Borough of Juneau will also have a major role to play. As local landowners, land use planners and permitters, they will be involved in implementing most of the objectives as well. Seeking public ownership of key lands for road alignments and vegetated buffers, amending CBJ variance criteria to incorporate water quality and habitat based criteria, developing best management practices to include in development and building permits are all measures directly affecting them and in which they will play a major role. The CBJ is also expected to be an important participant in the oversight and implementation committee.

5.b Implementing Monitoring Provisions

Measuring and monitoring current conditions, and collection of specific data for informed decision-making is a key part of a phased TMDL. Phase 1 controls are applied to begin the process of reduction of loads and are based on the best information at hand. Phase 2 controls can be more specifically tailored to address source loads when an accurate assessment of the situation has been made. As further study occurs, more details on the specific locations for assessment work, the frequency of testing necessary to collect the required information, and a method to correlate this information to habitat impacts will be developed. DEC will be responsible for sampling, either themselves, or through agency agreements or contract. This will begin immediately upon approval of the program.

5.c Program Review and Revision

Annual Progress Assessments

After initial controls are in place and monitoring conducted for one year, DEC and the implementation and oversight committee will review the collected data as part of the first annual progress assessment. Subsequent assessments will occur each year thereafter. The annual progress assessments will gauge progress towards meeting water quality standards and other quantifiable end-points. They will also include re-evaluating loading capacities, load allocations, identification of sediment sources, source load estimates, habitat modification/habitat indicators, and debris. Modifications necessary to more finely tune the approach may be made in light of the new information.

TMDL Revision and Update

DEC, with the assistance of the implementation and oversight committee, will begin production of a full revision of the TMDL document within three to five years after initial approval depending on the need for revision as evidenced by the annual progress assessments.

Part 6 MONITORING PLAN

6.a Objectives

1. Verify that upland best management practices specified in the TMDL are being implemented.

2. Provide sufficient data to monitor the effectiveness of management controls employed on Lemon Creek capable of measuring changes in the turbidity/total suspended solids relationship; determine if water quality standards are met in Lemon Creek.

3. Provide sufficient data to more accurately calculate source load determinations for Lemon Creek, with specific emphasis upon flow and the relationship of turbidity and total suspended solids, to account for seasonal variations and event related extremes.

4. Provide sufficient data to more accurately calculate the loading capacity of Lemon Creek, with specific emphasis upon turbidity, total suspended solids and flow.

6.b Approach

A Total Maximum Daily Load (TMDL) for total suspended solids is determined through a function of weight to volume, which can be calculated through a knowledge of the weight to volume relationship of the suspended particles in a particular volume of water column. Water sampling for Total Suspended Solids will accomplish this. Additionally, Settleable Solids are an issue with Lemon Creek, since it is part of the natural load, particularly during the summer glacial melt period and is also a function of the volume of water flow.

Turbidity, on the other hand is purely a measure of light to reflected off suspended particles in the water column at a 90° angle. This measure is independent of the volume of water; i.e. it does not depend upon the flow of the creek. Turbidity does maintain an approximate correlation to the suspended particles in the water column of a particular stream. This relationship must be established for each system, due to each system's unique variability provided through hydrology, chemistry and geology.

With a sufficient number of observations taking both extremes in water flow and seasonal variations into account, a relationship between turbidity and total suspended solids is derived mathematically. Turbidity, total suspended solids and stream flow data must be collected in sufficient quantity over a three year period (minimum) to derive this relationship with some degree of certainty.

Settleable solids were identified as contributing to the sediment associated with Lemon Creek and it is necessary to quantify the contribution of sources. Depth-integrated, cross-sectional composite sampling is probably the most reliable way to estimate background conditions. This must occur at critical times over the year in addition to accounting for full seasonal variability to establish an estimate of background settleable solids conditions.

6.c Methods

Objective 1 can be addressed through event related continuous sampling during both high and low runoff periods for identified sources at various times throughout the year. Continuous sampling above, below and at the specific source for flow, turbidity and total suspended solids will provide data necessary to calculate source load determinations for these parameters at hourly intervals prior to, during and following an event. More limited settleable solids sampling above and below sources using depth integrated compositing techniques will provide a reasonable estimate of source load contributions. This would include quarterly rainfall & dry spell events and spring breakup. It would be more economical, where multiple sources have identical land-use functions to limit sampling activities to those sources representative of the particular source. For instance, instead of sampling each of 5 gravel extraction and storage sites that might contribute a load, group sites with similar features and sample 1 from each group. These groupings might include quantities of material stockpiled (small, as opposed to large operations).

Objective 2 can be addressed through the continuous monitoring of an upstream background location over the course of a 3 to 5 year period for turbidity, total suspended solids, settleable solids and flow to account for both seasonal and natural variation of extremes. The most effective way to accomplish the measurement of flow in Lemon Creek would be to contract with the US Geological Survey (USGS) to establish a stream gauging station at a background upstream location, where stream flow is measured continuously with periodic depth integrated sampling for turbidity, settleable solids and suspended solids.

Through specific measurements of non-point sources and point sources below this gauging site, downstream flow totals can be estimated. Verification of the estimates can be made through flow measurements of Lemon Creek at various times throughout the year from a downstream location below all source inputs. It may be necessary to work from bridges or a boat attached to a rope suspended across Lemon Creek, particularly in the summer and early fall, when flows are more extreme.

Objective 3 can be addressed only after Objectives 1 & 2 have identified a satisfactory baseline, upstream background conditions are defined and management controls are implemented.

Effectiveness can then be quantified through the use of either:

Selective management control project monitoring---Short-term
Overall trend monitoring---Long-term

Short-term selective management control project monitoring would include specific monitoring of the performance of a particular management control or set of management controls for a specific type of land-use activity. This may include monitoring over the duration of the project both upstream and downstream of the project site, or focus upon particular seasonal events to which the controls are designed to address, again both at upstream and downstream sites. Automated sampling over time for turbidity and total suspended solids both prior to and following implementation of management controls will measure the effectiveness of instituted controls.

Long term trend monitoring will evaluate the overall strength of integrated management controls implemented for a variety of development projects throughout the Lemon Creek watershed and should utilize regular grab sampling techniques for turbidity and total suspended solids at regularly specified intervals over a five to ten year period, in addition to short-term automated sampling programs during identified critical extremes over the course of a five year period following management control implementation.

6.d. Implementation

The Monitoring Plan for Lemon Creek included in Appendix H outlines four objectives for follow-up monitoring. The objectives are ranked in order of relative priority and address verification that best management practices specified in the TMDL are being implemented, monitoring to determine if water quality standards are being met, and providing improved data on calculating source load determinations and loading capacity of Lemon Creek.

New funding will be required to fully accomplish Objectives 3 and 4. The Department requests EPA's commitment to award the remaining available Lemon Creek project 104(b)(3) grant funds to CBJ and ADEC to fully address the four objectives. The Department reserves the right to modify monitoring frequency, critical period identification and station locations identified in the Monitoring Plan based on available funding or logistical reasons. Some objectives of the Monitoring Plan require the participation of the CBJ, ADF&G, USGS and ADNR.

Part 7 PUBLIC PARTICIPATION

The Lemon Creek TMDL has been made available for public comment and significant efforts were made to involve others in determining which pollution sources should bear the treatment or control burden needed to reach allowable loadings.

Memorandum of Agreement Between the City and Borough of Juneau and the State of Alaska

At the end of March 1995 a Memorandum of Agreement (MOA) between the City and Borough of Juneau (CBJ) and the State of Alaska was ratified regarding the implementation of Section 303(d) of the Clean Water Act and TMDLs. Within the MOA the CBJ and the Alaska Department of Conservation (ADEC) specifically agree that "(p)rovisions for public education and public involvement shall be jointly pursued and encouraged" and that "(t)wo workshops will be held annually to solicit industry and public participation in the restoration of impaired waterbodies."

Identification of water quality-limited waterbodies

The public was solicited for review and comment of all existing and readily available data in the listing and assessment of Lemon Creek as a water quality-limited waterbody.

Public Reception

In June of 1995, the Alaska Department of Environmental Conservation, in cooperation with the CBJ, issued a public notice of a *public reception* on Wednesday, June 21, 1995 at 7:00 p.m. in the Hickel Room at Centennial Hall in Juneau. The reception was held to explain the initiation of the TMDL plan development and the focus of the TMDL to control pollutant sources into Lemon Creek and to seek public input at this time. Approximately 30-40 members of the public and local and state agencies attended the reception.

Prior to the public reception, a mass mailout letter was sent to each property owner and business within the Lemon Creek watershed on June 16, 1995 from a list generated in cooperation with the City and Borough of Juneau. This mailout informed addressees about the problems within Lemon Creek and noticed the initiation of the plan process, and also invited public input and attendance at the upcoming public reception on June 21, 1995.

Two days prior to the reception a display ad ran in the local newspaper, in addition to a brief news article explaining the process for improving water quality in Lemon Creek. In addition to the public

notice display ad in the local newspaper, a public notice flyer on the reception was developed and posted which specifically encouraged public review, comment and feedback.

At the reception for those attending were copies of the Lemon Creek draft TMDL assessment, several question and answer sheets regarding the 303(d) water quality-limited waters and the TMDL process.

Agency and Public Contacts

As part of the process to develop the Lemon Creek TMDL, ADEC involved the Environmental Protection Agency's Region 10 office early in the process, in addition to the local EPA office. Throughout the TMDL development process the ADEC has involved the CBJ, the Alaska Department of Fish and Game, and the Alaska Department of Transportation/Public Facilities.

In addition to the above entities, the ADEC worked closely and on the ground with key operators, businesses, and the local Native corporation in the development of the draft Phase 1 and 2 source specific controls.

Draft TMDL and Public Workshop

The ADEC made available the draft TMDL, and the draft TMDL assessment, for Lemon Creek on August 7, 1995 and a public comment period from August 7 to August 25, 1995. As part of this process a responsiveness summary has been done on the public comment received and was completed by the end of August 1995 towards finalization and refinement of the final TMDL.

A *public workshop* was conducted on August 15, 1995 to explain the draft TMDL for Lemon Creek and also gain additional public input at this time. Notice of the availability of the draft TMDL and public comment period in addition to the public workshop was noticed in the local Juneau newspaper via display ad and in the "calendar" section of the paper, the local cable company's scanner channel for public service announcements, and via PSA on local radio stations.

APPENDICES

Appendix A REFERENCES and BIBLIOGRAPHY

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Appendix B GLOSSARY OF TERMS

"anadromous fish" has the meaning given that term in the definitions section of the Catalog of Waters Important for Spawning, Rearing, or Migration of Anadromous Fishes;

"best management practices (BMP's)" are defined as physical, structural, and/or managerial practices that, when used single, or in combination, prevent or reduce the pollution of water;

"embeddedness" is a phenomenon whereby sand, silt, and even clay fill up the interstitial voids between larger cobbles and gravels, which may reduce the circulation of water, organic matter, and oxygen to filter-feeding aquatic insects that live among and under the bed sediments;

"erosion" means the wearing away of the land surface by wind or water. Erosion occurs naturally from weather or runoff but can be intensified by land clearing practices related to farming, residential or industrial development, road building, or timber cutting;

"impervious surface" means a hard surface area which either prevents or retards the entry of water into the soil mantle as under natural conditions prior to development, and/or a hard surface area which causes water to run off the surface in greater quantities or at an increased rate of flow from the flow present under natural conditions prior to development;

"natural condition" means any physical, chemical, biological, or radiological condition existing in a waterbody before any human-caused influence on, discharge to, or addition of material to, the waterbody;

"non-point source" means a source of pollution other than a point source;

"point source" means a discernible, confined, discrete conveyance, including a pipe, ditch, channel, tunnel, conduit, well, container, rolling stock, or vessel or other floating craft, from which pollutants are or could be discharged;

"pollution" means the contamination or altering of waters, land or subsurface land of the state in a manner which creates a nuisance or makes waters, land or subsurface land unclean, or noxious, or impure, or unfit so that they are actually or potentially harmful or detrimental or injurious to public health, safety or welfare, to domestic, commercial, industrial, or recreational use, or to livestock, wild animals, bird, fish, or other aquatic life;

"residues" means floating solids, debris, sludge, deposits, foam, scum, or any other material or substance remaining in a waterbody as a result of direct or nearby human activity;

"sediment" means solid material of organic or mineral origin that is transported by, suspended in, or deposited from water and includes chemical and biochemical precipitates and organic material such as humus;

"sedimentation" means the gravitational settling of suspended solids;

"settleable solids" means solid material of organic or mineral origin that is transported by and deposited from water, as measured by the volumetric Imhoff cone method and at the method detection limits specified in method 2540(F), Standard Methods for the Examination of Water and Wastewater, 18th edition (1992);

"sheen" means an iridescent appearance on the water surface;

"spawning" means the process of producing, emitting, or depositing eggs, sperm, seed, germ, larvae, young, or juveniles, especially in large numbers, by aquatic life;

"TMDL" means total maximum daily load;

"TNFR" means total nonfilterable residue;

"turbidity" means an expression of the optical property that causes light to be scattered and absorbed rather than transmitted in straight lines through a water sample; turbidity in water is caused by the presence of suspended matter such as clay, silt, finely divided organic and inorganic matter, plankton, and other microscopic organisms;

"water quality criteria" is an element of a state water quality standard, composed of a pollutant concentration or level, or narrative statement that represents a quality of water that supports a particular use;

"water quality standard" means a law or regulation that consists of the beneficial designated use of a waterbody, the numeric and narrative water quality criteria that are necessary to the protect the uses of that particular waterbody, and an antidegradation statement;

"watershed" refers to a geographic area in which water, sediments, and dissolved materials drain to a common outlet such as a larger river, lake, underground water, or ocean;

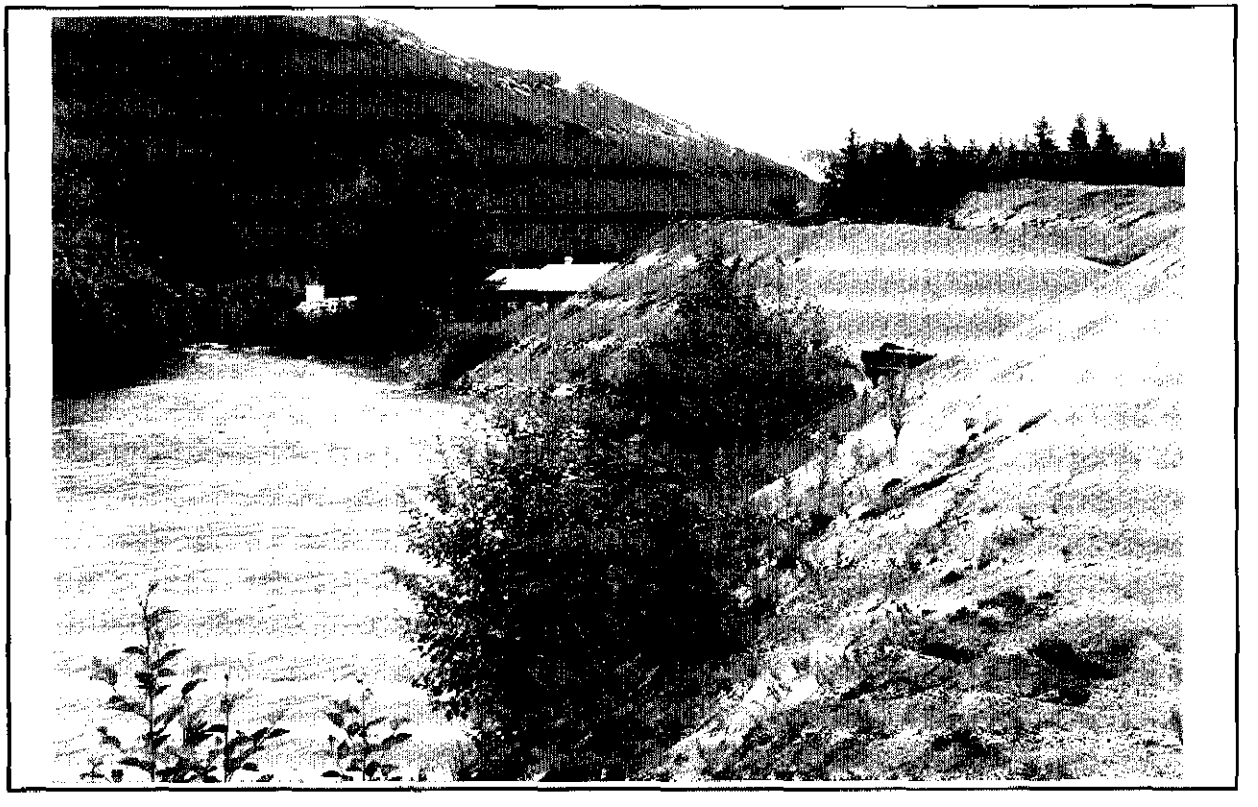
"wildlife" means all species of mammals, birds, reptiles, and amphibians;

Appendix C SOURCE-SPECIFIC CONTROLS

Source **Juneau Ready Mix Stockpile**

Affected Waterbody Lemon Creek

Affected Reach Lower reach downstream of Glacier Highway below stockpile.



Description This potential source of sediment is stockpiled material on the southern bank of lower Lemon Creek. The material consists of primarily processed sand, although there are other, coarser as well as finer materials present. The northern side of the mound is sloped at a relatively steep angle and encroaches on the bank of Lemon Creek.

Sources of Sediment and Turbidity Because the surface of the stockpile is comprised primarily of sand and coarser materials, sediment yield as a result of stormwater runoff is likely small. Due to the relatively steep, unconsolidated nature of the slope, however, there is some potential for coarser sediments to be physically dislodged and deposited in the creek, or to be eroded from the toe of the pile. Stockpiled materials that find their way into the creek are less likely to contribute to the suspended sediment load and in-stream turbidity, than they are to affect the bedload and bed

composition.

Sediment and Turbidity Loading Contribution No stormwater runoff from the embankment was observed during the study period, and no monitoring data are available. Sediment contributions, consequently, had to be estimated using best professional judgment based on observations of the type of material present both within the stockpile, and within the stream below the stockpile. Both total suspended settleable solids loads were estimated at less than 0.01 tons per day.

PHASE 1 Control Measures PHASE 1 control measures will be implemented in accordance with the implementation plan, along with monitoring to determine their effectiveness in achieving load reductions and water quality improvements.

1. Reduce the potential for materials to reach the creek by constructing a terrace between the stockpile and the creek. The terrace should be end sloped towards the remaining stockpile to capture any runoff or dislodged materials.

2. Establish a stable, vegetated stream bank below the constructed terrace. This condition will likely result if the stream bank is graded to a stable slope and left undisturbed. PHASE 2 measures may be required if a stable condition has not been achieved in the time frame set out in the implementation plan.

PHASE 2 Control Measures PHASE 2 measures will be implemented in accordance with the implementation plan if PHASE 1 measures are ineffective in meeting target load reductions, or if load allocations need to be reduced to meet quantifiable end-points and water quality standards.

1. If the streambank does not re-vegetate naturally, use additional measures to re-vegetate the slope, such as use of jute matting, and planting grass, alders or conifers.

Source Target Load Reduction PHASE 1 controls are projected to essentially eliminate the stockpile as a source of total suspended solids, turbidity and settleable solids. A 70 percent reduction in total suspended solids and a 100 percent reduction in settleable solids are targeted.

Load Allocation A total of 0.003 tons total suspended solids per day and no settleable solids are allocated to this source.

Source **RSH Retention Basin**

Affected Waterbody Lemon Creek

Affected Reach Lemon Creek below the correctional facility and culvert discharge.

Description This retention basin is located below a gravel processing operation. At the time of the field surveys, there was no discharge to the basin, although surface runoff from the surrounding area is channeled through the basin. The basin is formed by the road embankment on one side and a culvert under the road serves as an outlet to Lemon Creek. At the time of the inspection, the basin had been filled to the elevation of the culvert, and afforded little retention capacity, though it appeared to be functioning somewhat as a vegetative filter.

Sources of Sediment and Turbidity While no sediment discharge was observed, there is potential for erosion of exposed soils and stormwater transport of sediments to the basin and the creek during significant rain events.

Sediment and Turbidity Loading Contribution No stormwater runoff through the retention basin was observed during the study period, and no monitoring data are available. Sediment contributions, consequently, had to be estimated using best professional judgment based on observations of the types of material present in the basin and its drainage area. Both total suspended settleable solids loads were estimated at less than 0.01 tons per day.

PHASE 1 Control Measures PHASE 1 control measures will be implemented in accordance with the implementation plan, along with monitoring to determine their effectiveness in achieving load reductions and water quality improvements.

1. Maintain storage and retention capacity by periodically removing deposited materials from the bottom of the basin.

PHASE 2 Control Measures PHASE 2 measures will be implemented in accordance with the implementation plan if PHASE 1 measures are ineffective in meeting target load reductions, or if load allocations need to be reduced to meet quantifiable end-points and water quality standards.

1. Because the pond is a temporary feature, no long-term, PHASE 2 control measures are specified.

Source Target Load Reduction The pond is expected to be effective in removing essentially all settleable solids, and the vast majority of suspended solids. Target source load reductions are 70 percent of the total suspended solids, and 100 percent of the settleable solids.

Load Allocation A total of 0.003 tons total suspended solids per day and no settleable solids are allocated to this source.

Source **Goldbelt Upper Sediment Pond**

Affected Waterbody Lemon Creek

Affected Reach Upper Lemon Creek below the culvert discharge.

Description Most of the stormwater runoff from the gravel operations on Goldbelt property is directed to a large sediment pond between the haul road and Lemon Creek. Stormwater collected in the pond percolates into the underlying gravels. Stormwater runoff from the northern-most end of the present operations above the road, however, is conveyed via a roadside ditch to a smaller sediment pond next to the haul road with a culvert outlet to Lemon Creek. The roadside ditch is comprised of a mix of sand and gravel. Fines are periodically removed from the pond.

Sources of Sediment and Turbidity Because the drainage area is a relatively porous sand and gravel deposit, the ratio of runoff to infiltration is low. Nevertheless, the pond appears somewhat undersized, and during significant rainfall events, the pond would afford little retention time, and settling efficiency would likely be small.

Sediment and Turbidity Loading Contribution No stormwater runoff through the retention basin was observed during the study period, and no monitoring data are available. Sediment contributions, consequently, had to be estimated using best professional judgment based on observations of the types of material present in the basin and its drainage area. Both total suspended settleable solids loads were estimated at less than 0.01 tons per day.

PHASE 1 Control Measures PHASE 1 control measures will be implemented in accordance with the implementation plan, along with monitoring to determine their effectiveness in achieving load reductions and water quality improvements.

1. Redirect as much of the current flow to the pond as possible to the lower, main settling pond.

2. Increase the size of the settling pond as much as possible without creating steep, unstable slopes around the pond. Stockpile removed fines at another location upstream of the pond (so that they do not encroach on the pond).

3. Establish a series of silt dikes in the ditch upstream of the pond to remove coarser suspended materials upstream of the pond. This should serve to reduce the frequency of need for pond maintenance (though it will require additional removal of materials from the ditch).

PHASE 2 Control Measures PHASE 2 measures will be implemented in accordance with the implementation plan if PHASE 1 measures are ineffective in meeting target load reductions, or if load allocations need to be reduced to meet quantifiable end-points and water quality standards.

1. Additional measures as may be required. (No specific measures could be identified.)

Source Target Load Reduction The pond is expected to be effective in removing essentially all settleable solids, and the vast majority of suspended solids. Target source load reductions are 70 percent of the total suspended solids, and 100 percent of the settleable solids.

Load Allocation A total of 0.003 tons total suspended solids per day and no settleable solids are allocated to this source.

Source **Goldbelt Sidecast Area**

Affected Waterbody Lemon Creek

Affected Reach Mid Lemon Creek below the slope.

Description This area is an embankment formed by sidecasting overburden from gravel and rock quarry operations. The slope begins at the edge of a rock quarry and descends at a steep vertical angle for a distance of approximately 150 feet to its toe near the right bank of Lemon Creek. A band of alders a few tens of feet wide separates the toe from the stream. Much of the slope is not currently vegetated, and exposed materials consist of primarily silts and fine sands.

Sources of Sediment and Turbidity There is evidence of erosion from the unvegetated, steep slope. Eroded material is also present at the toe of the slope. Stormwater runoff from the slope appears to drain to a small pond formed near the toe, and does not presently appear to enter the creek channel directly under less-than-flood-flow conditions. Flood flows, however, could carry deposited materials downstream.

A first attempt to seed the slope in grass was made in 1994. Seed was applied late in the season. While partially successful, particularly on the more level surfaces, it may have been too late in the year for the more steeply sloped areas.

Long-term plans call for removing the overburden materials as rock is mined from the hillside.

Sediment and Turbidity Loading Contribution No stormwater runoff from the embankment was observed during the study period, and no monitoring data are available. Sediment and turbidity contributions, consequently, were first estimated using the Universal Soil Loss Equation which yielded very high erosion rates due to the steepness of the slope. Source loads were subsequently modified using best professional judgment to more realistically reflect the observed erosion, to add a delivery ratio, and to reflect suspended and settleable fractions. In this way, both total suspended settleable solids loads were estimated at less than 0.01 tons per day.

PHASE 1 Control Measures PHASE 1 control measures will be implemented in accordance with the implementation plan, along with monitoring to determine their effectiveness in achieving load reductions and water quality improvements.

1. Establish a soil cover by seeding the slope in grass.

2. Stabilize the slope by establishing alder growth. Planting will be required if alder growth does not occur naturally.

PHASE 2 Control Measures PHASE 2 measures will be implemented in accordance with the implementation plan if PHASE 1 measures are ineffective in meeting target load reductions, or if load allocations need to be reduced to meet quantifiable end-points and water quality standards.

1. Additional measures to reduce surface erosion and to stabilize the slope if required.

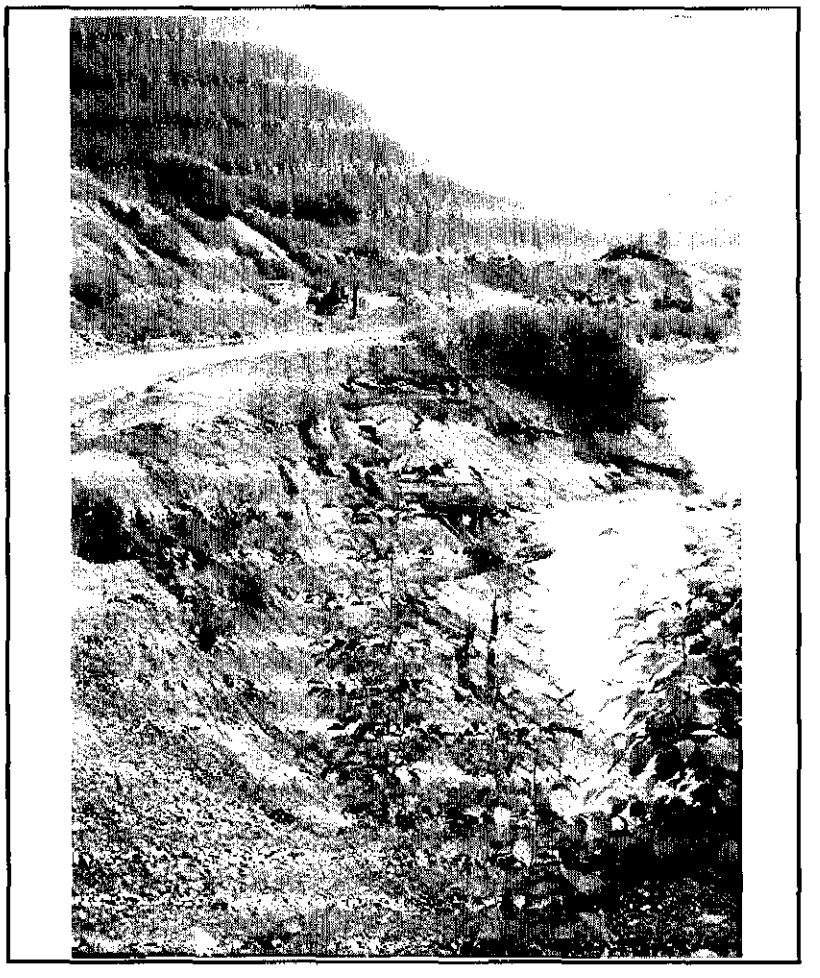
Source Target Load Reduction Control measures are anticipated to be effective in removing essentially all settleable solids, and the vast majority of suspended solids. Target source load reductions are 70 percent of the total suspended solids, and 100 percent of the settleable solids.

Load Allocation A total of 0.003 tons total suspended solids per day and no settleable solids are allocated to this source.

Source **Haul Road Surface and Embankments**

Affected Waterbody Lemon Creek

Affected Reach Lemon Creek below gorge and downstream.



Description The gravel-surfaced haul road runs for a distance of approximately two miles from its beginning as an extension of Anka Street near COSTCO to a deadend on Goldbelt property. The road generally parallels the creek, crossing it once just north of the gorge and again near its western end. The distance from the road to the creek varies from as much as more than a thousand feet in some places to as little as a few feet in others. Where the creek exits the gorge, the haul road skirts the hillside above, and an unstable embankment drops steeply to an active cut bank below.

Sources of Sediment and Turbidity Sediment sources include the haul road surface and unstable slopes primarily below the gorge. Gravel road surfaces are known sources of sediment, and sediment contribution from logging roads has been the subject of considerable study. Those studies suggest that sediment contribution is far greatest during road construction, and decreases thereafter (Megahan, 1980). Once a logging road is constructed, road cuts and fills are typically the largest sources of sediment (Swift,1984), although the road surfacing has an impact. Sections of the haul road appear to contain a significant fraction of fines available for transport by stormwater runoff.

Two mechanisms are at work to introduce sediment from the unstable embankments below the gorge into the creek: Rainfall runoff from the embankment will carry sediments down the steep slope to the creek. Particles physically dislodged from the face of the embankment by means other than rainfall -- such as vibration from truck traffic or falling rock -- will enter the creek. At the same time, active erosion of the cut bank by the creek serves to maintain the embankment in a destabilized state. Both fine and coarse sediments are present and may contribute to both wash loads, as well as affect the streambed composition.

Sediment and Turbidity Loading Contribution No stormwater runoff from the haul road or its embankments was observed during the study period, and no monitoring data are available. Sediment and turbidity contributions for embankment areas, consequently, were first estimated using the Universal Soil Loss Equation which yielded very high erosion rates due to the steepness of the slopes. Source loads were subsequently calculated by using a published sediment yield for construction land use activities which was deemed to be representative of the exposed surface and embankments. In this way, source loads were estimated at 0.2 tons per day total suspended solids and 0.18 tons per day settleable solids.

PHASE 1 Control Measures No PHASE 1 control measures could be identified. See the following discussion of PHASE 2 measures.

PHASE 2 Control Measures In this particular case, controlling the source is more difficult than in many of the other cases. Because some of the embankment areas below the gorge are very steep and unstable, and because the creek is actively working to undermine the toe of the embankment in some spots, there is little that can be done short of moving the road away from the creek to allow for a more gradual slope from the road to the creek. None of the conventional controls -- seeding with or without the use of jute matting, terracing, armoring -- holds much promise as long as the creek continues to undermine the toe, and the embankment materials continue to slough into the stream. Moving the road away from the slope would involve removing massive amounts of rock from the upper hillside, and involves property issues. In the short term, the magnitude of the

problem is probably not commensurate with the complexity and expense of available solutions.

While little can be done in the short term to control erosion of the embankment, there is more potential in the long term. The property owner is seeking to mine rock from the hillside which would allow the road alignment to be shifted away from the creek, and a more gentle embankment grade established. There may be potential to address property issues through land trades. The implementation plan acknowledges the complexity and longer term time scale of the following PHASE 2 control measure.

PHASE 2 measures will include the following:

1. Stabilize the exposed embankment areas below the gorge by shifting the road alignment to the south and establishing an embankment slope of 1.5:1 or less, providing short-term post-construction erosion control by seeding the slope in grass or other effective means, and thereafter leaving the slope undisturbed allowing the slope to re-vegetate in native cover.

2. Surfacing the road up to the gorge in crusher run gravel or other material to reduce the amount of fines available for transport.

Source Target Load Reduction Control measures are anticipated to be effective in removing essentially all settleable solids, and the vast majority of suspended solids. Target source load reductions are 70 percent of the total suspended solids, and 100 percent of the settleable solids.

Load Allocation A total of 0.04 tons total suspended solids per day and no settleable solids are allocated to this source.

Appendix D AVAILABLE MONITORING DATA

Copies of the flow and solids data used in this analysis are contained within this Appendix.

Source: Williams, R, Juneau Streams, A Water Quality Study, 1993

The table below was taken from the Juneau Streams document. The sampling site was located on the north bank of Lemon Creed about 150 feet below the Old Glacier Highway bridge.

Table 7. Lemon Creek data.

Parameter	Units	Criteria	Date	Results	Date	Results	Date	Results
Dissolved O_2	mg/L	>7	2/19/91	12.4	5/7/91	12.8	9/9/91	12.2
Temperature	° Celsius	≤ 20	2/19/91	2	5/7/91	6	9/9/91	5
pH	-	6.5 - 9.0	2/19/91	6.17	5/7/91	7.57	9/9/91	7.34
Conductivity	µS/cm 25°C	-	2/19/91	127	5/7/91	57	9/9/91	29
Turbidity	NTU's	Amb. + 25	2/19/91	1.2	5/7/91	2.9	9/9/91	45
Alkalinity	mg/L $CaCO_3$	-	2/19/91	27.4	5/7/91	15.3	9/9/91	6.6
Arsenic	µg/L	≤50	2/19/91	< 2.1	5/7/91	< 2.1	9/9/91	6.7
Barium	µg/L	≤1000	2/19/91	41	5/7/91	31	9/9/91	100
Cadmium	µg/L	≤10*	2/19/91	< 0.2	5/7/91	0.19	9/9/91	3.9
Chromium	µg/L	≤50*	2/19/91	< 1.7	5/7/91	1.7	9/9/91	44
Lead	µg/L	≤50*	2/19/91	< 1.0	5/7/91	< 1.0	9/9/91	2.3
Selenium	µg/L	≤10	2/19/91	< 1.3	5/7/91	< 1.3	9/9/91	< 1.30
Silver	µg/L	≤0.12	2/19/91	< 3.10	5/7/91	< 0.31	9/9/91	0.5
Mercury	µg/L	≤0.012	2/19/91	< 0.11	5/7/91	< 0.11	9/9/91	< 0.11
TDS	mg/L	≤500	2/19/91	79	5/7/91	51	9/5/91	31
TSS	mg/L	-	2/19/91	< 11	5/7/91	< 11	9/5/91	97.6
VOC	µg/L	≤10 Total	2/19/91	< 1.0	5/8/91	< 1.0	9/9/91	< 1.0
MCEO	mg/L	-	2/19/91	< 1.0	-	-	9/9/91	n.a.
Nitrates	µg/L	≤10,000	2/19/91	< 50	5/30/91	< 120	9/9/91	97

MCEO = Methylene Chloride Extractable Organics
<## = Less than the Method Detection Limit value indicated by the ##.
* = Drinking water standards' maximum contaminate limit.

Source: Department of Environmental Conservation, Lemon Creek TMDL Study
Total suspended solids(TSS) and turbidity

DEC collected samples from upper and lower Lemon Creek between July 14 and 20, 1995 which were analyzed for total suspended solids(TSS) and turbidity. In the table LC stands for Lemon Creek, U stands for upper station, and L stands for lower station. (ie: 3 LC - U means that is the third sample in sequence that was taken at the upper station of Lemon Creek). Where there is no U or L designation it defaults to the lower station.

MONTGOMERY LABORATORIES

Laboratory Report

State of Alaska
Alaska Department of Environmental Conservation
10107 Bentwood Place
Juneau, AK 99801

Attn: Jeff Hock

MONTGOMERY LABORATORIES
Submitted on
JUL 20 1995
M. Bonnet
Group 21645

712 West 12th Street
Juneau, Alaska
99801

Tel: 907 780 6868
Fax: 907 780 6870

Quality Environmental Analysis

MONTGOMERY LABORATORIES
5438 Shauna Drive
Juneau, Alaska 99801
907 790 6668

Laboratory
Report
#21645

Samples Received
18 July 1995 12:25 PM
Analyses Reported
20 July 1995 4:09 pm

AK Department of Environmental Conservation
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951170	50 VC-U		
	Turbidity	0.40	NTU
951171	51 VC-U		
	Total Suspended Solids	ND	mg/l
	Turbidity	0.40	NTU
951172	52 VC-U		
	Total Suspended Solids	ND	mg/l
	Turbidity	0.35	NTU
951173	24 LC-L		
	Total Suspended Solids	59	mg/l
	Turbidity	28	NTU
951174	25 LC-L		
	Total Suspended Solids	43	mg/l
	Turbidity	26	NTU
951175	26 LC-L		
	Total Suspended Solids	38	mg/l
	Turbidity	29	NTU
951176	27 LC-L		
	Total Suspended Solids	43	mg/l
	Turbidity	30	NTU
951177	28 LC-L		
	Total Suspended Solids	34	mg/l
	Turbidity	31	NTU
951178	29 LC-L		
	Total Suspended Solids	30	mg/l
	Turbidity	25	NTU
951179	30 LC-L		
	Total Suspended Solids	33	mg/l
	Turbidity	28	NTU
951180	31 LC-L		
	Total Suspended Solids	32	mg/l

(continued)

MONTGOMERY LABORATORIES
5438 Shaune Drive
Juneau, Alaska 99801
907 780 6668

Laboratory
Report
#21645

AK Department of Environmental Conservation
Page 5

951180	31 LC-L		
	Turbidity	28	NTU
951181	32 LC-L		
	Total Suspended Solids	32	mg/l
	Turbidity	27	NTU
951182	33 LC-L		
	Total Suspended Solids	31	mg/l
	Turbidity	24	NTU
951183	34 LC-L		
	Total Suspended Solids	30	mg/l
	Turbidity	25	NTU
951184	35 LC-L		
	Total Suspended Solids	36	mg/l
	Turbidity	24	NTU
951185	36 LC-L		
	Total Suspended Solids	49	mg/l
	Turbidity	31	NTU
951186	37 LC-L		
	Total Suspended Solids	59	mg/l
	Turbidity	34	NTU
951187	38 LC-L		
	Total Suspended Solids	54	mg/l
	Turbidity	31	NTU
951188	39 LC-L		
	Total Suspended Solids	47	mg/l
	Turbidity	31	NTU
951189	40 LC-L		
	Total Suspended Solids	40	mg/l
	Turbidity	28	NTU
951190	41 LC-L		
	Total Suspended Solids	41	mg/l

(continued)

MONTGOMERY LABORATORIES
5438 Shaune Drive
Juneau, Alaska 99801
907 780 6668

Laboratory
Report
#21645

AK Department of Environmental Conservation
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951190	41 LC-L		
	Turbidity	32	NTU
951191	42 LC-L		
	Total Suspended Solids	34	mg/l
	Turbidity	27	NTU
951192	43 LC-L		
	Total Suspended Solids	32	mg/l
	Turbidity	28	NTU
951193	44 LC-L		
	Total Suspended Solids	34	mg/l
	Turbidity	28	NTU
951194	45 LC-L		
	Total Suspended Solids	29	mg/l
	Turbidity	26	NTU
951195	46 LC-L		
	Total Suspended Solids	33	mg/l
	Turbidity	27	NTU
951196	47 LC-L		
	Total Suspended Solids	34	mg/l
	Turbidity	28	NTU
951197	1 LC-U		
	Total Suspended Solids	62	mg/l
	Turbidity	32	NTU
951198	2 LC-U		
	Total Suspended Solids	54	mg/l
	Turbidity	31	NTU
951199	3 LC-U		
	Total Suspended Solids	56	mg/l
	Turbidity	36	NTU
951200	4 LC-U		
	Total Suspended Solids	48	mg/l

(continued)

MONTGOMERY LABORATORIES
5438 Shaune Drive
Juneau, Alaska 99801
907 780 6868

Laboratory
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#21645

AK Department of Environmental Conservation
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951200	4 LC-U		
	Turbidity	33	NTU
951201	5 LC-U		
	Total Suspended Solids	45	mg/l
	Turbidity	32	NTU
951202	6 LC-U		
	Total Suspended Solids	43	mg/l
	Turbidity	32	NTU
951203	7 LC-U		
	Total Suspended Solids	40	mg/l
	Turbidity	33	NTU
951204	8 LC-U		
	Total Suspended Solids	36	mg/l
	Turbidity	31	NTU
951205	9 LC-U		
	Total Suspended Solids	36	mg/l
	Turbidity	28	NTU
951206	10 LC-U		
	Total Suspended Solids	36	mg/l
	Turbidity	26	NTU
951207	11 LC-U		
	Total Suspended Solids	37	mg/l
	Turbidity	27	NTU
951208	12 LC-U		
	Total Suspended Solids	45	mg/l
	Turbidity	26	NTU
951209	13 LC-U		
	Total Suspended Solids	66	mg/l
	Turbidity	36	NTU
951210	14 LC-U		
	Total Suspended Solids	68	mg/l

(continued)

MONTGOMERY LABORATORIES
5438 Shaune Drive
Juneau, Alaska 99801
907 790 6688

Laboratory
Report
#21645

AK Department of Environmental Conservation
Page 8

951210	14 LC-U		
	Turbidity	36	NTU
951211	15 LC-U		
	Total Suspended Solids	55	mg/l
	Turbidity	31	NTU
951212	16 LC-U		
	Total Suspended Solids	58	mg/l
	Turbidity	29	NTU
951213	17 LC-U		
	Total Suspended Solids	49	mg/l
	Turbidity	28	NTU
951214	18 LC-U		
	Total Suspended Solids	43	mg/l
	Turbidity	27	NTU
951215	19 LC-U		
	Total Suspended Solids	38	mg/l
	Turbidity	27	NTU
951216	20 LC-U		
	Total Suspended Solids	34	mg/l
	Turbidity	28	NTU
951217	21 LC-U		
	Total Suspended Solids	32	mg/l
	Turbidity	27	NTU
951218	22 LC-U		
	Total Suspended Solids	38	mg/l
	Turbidity	29	NTU
951219	23 LC-U		
	Total Suspended Solids	32	mg/l
	Turbidity	28	NTU
951220	24 LC-U		
	Total Suspended Solids	32	mg/l

(continued)

MONTGOMERY LABORATORIES
5438 Shaune Drive
Juneau, Alaska 99801
907 780 8888

Laboratory
Report
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AK Department of Environmental Conservation
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951220	24 LC-U Turbidity	28	NTU

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MONTGOMERY LABORATORIES

Laboratory Report

State of Alaska
Alaska Deparment of Environmental Conservation
10107 Bentwood Place
Juneau, AK 99801

Attn: Jeff Hock

MONTGOMERY LABORATORIES
Submitted on
JUL 20 1995
Group 21604

712 West 12th Street
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99801

Tel: 907 780 6868
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Quality Environmental Analysis

MONTGOMERY LABORATORIES
5438 Shaune Drive
Juneau, Alaska 99801
907 780 6868

Laboratory Report #21604

Samples Received
14 July 1995 11:33AM

Analyses Reported
18 July 1995 7:14PM

951088	1 LC		
	Total Suspended Solids	80	mg/l
	Turbidity	26	NTU
951089	2 LC		
	Total Suspended Solids	140	mg/l
	Turbidity	37	NTU
951090	3 LC		
	Total Suspended Solids	91	mg/l
	Turbidity	35	NTU
951091	4 LC		
	Total Suspended Solids	63	mg/l
	Turbidity	32	NTU
951092	5 LC		
	Total Suspended Solids	59	mg/l
	Turbidity	29	NTU
951093	6 LC		
	Total Suspended Solids	48	mg/l
	Turbidity	27	NTU
951094	7 LC		
	Total Suspended Solids	41	mg/l
	Turbidity	25	NTU
951095	8 LC		
	Total Suspended Solids	35	mg/l
	Turbidity	23	NTU
951096	9 LC		
	Total Suspended Solids	39	mg/l
	Turbidity	22	NTU
951097	10 LC		
	Total Suspended Solids	44	mg/l

(continued)

MONTGOMERY LABORATORIES
5438 Shaune Drive
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Laboratory Report #21604

AK Department of Environmental Conservation
Page 3

951097	10 LC		
	Turbidity	22	NTU
951098	11 LC		
	Total Suspended Solids	40	mg/l
	Turbidity	23	NTU
951099	12 LC		
	Total Suspended Solids	40	mg/l
	Turbidity	23	NTU
951100	13 LC		
	Total Suspended Solids	41	mg/l
	Turbidity	28	NTU
951101	14 LC		
	Total Suspended Solids	34	mg/l
	Turbidity	30	NTU
951102	15 LC		
	Total Suspended Solids	33	mg/l
	Turbidity	32	NTU
951103	16 LC		
	Total Suspended Solids	29	mg/l
	Turbidity	31	NTU
951104	17 LC		
	Total Suspended Solids	28	mg/l
	Turbidity	33	NTU
951105	18 LC		
	Total Suspended Solids	28	mg/l
	Turbidity	27	NTU
951106	19 LC		
	Total Suspended Solids	23	mg/l
	Turbidity	30	NTU
951107	20 LC		
	Total Suspended Solids	85	mg/l

(continued)

MONTGOMERY LABORATORIES
5438 Shaune Drive
Juneau, Alaska 99801
907 780 6868

Laboratory Report #21604

Sample Received 14 July 1995 11:33 AM

Analysis Reported 18 July 1995 7:14 PM

AK Department of Environmental Conservation
Page 3

951107	20 LC		
	Turbidity	39	NTU
951108	21 LC		
	Total Suspended Solids	46	mg/l
	Turbidity	39	NTU
951109	22 LC		
	Total Suspended Solids	100	mg/l
	Turbidity	55	NTU
951110	23 LC		
	Total Suspended Solids	120	mg/l
	Turbidity	50	NTU
951111	11 VC-L		
	Total Suspended Solids	ND	mg/l
	Turbidity	9.1	NTU
951112	12 VC-L		
	Total Suspended Solids	ND	mg/l
	Turbidity	5.7	NTU
951113	13 VC-L		
	Total Suspended Solids	20	mg/l
	Turbidity	28	NTU
951114	14 VC-L		
	Total Suspended Solids	24	mg/l
	Turbidity	37	NTU
951115	15 VC-L		
	Total Suspended Solids	ND	mg/l
	Turbidity	12	NTU
951116	16 VC-L		
	Total Suspended Solids	22	mg/l
	Turbidity	18	NTU
951117	17 VC-L		
	Total Suspended Solids	6	mg/l

(continued)

Source: U.S.G.S. flow data, .3 miles north of the confluence of Canyon Creek, 1951 to 1973

15052000 Lemon Creek near Juneau

LOCATION.--Lat 58°23'30", long 134°28'15", City and Borough of Juneau, in Tongass National Forest, on left bank 0.5 mi (0.5 km) upstream from Canyon Creek, 4.5 mi (7.2 km) upstream from mouth at Gastineau Channel, and 6 mi (10 km) north of Juneau.

DRAINAGE AREA.--12.1 mi² (31.3 km²).

PERIOD OF RECORD.--August 1951 to November 1953, July 1954 to September 1973 (discontinued).

GAGE.--Water-stage recorder. Altitude of gage is 650 ft (198 m), from topographic map. Prior to Oct. 24, 1967, at datum 1.09 ft (0.332 m) higher.

AVERAGE DISCHARGE.--21 years, 154 ft³/s (4.361 m³/s), 172.84 in/yr (4,390 mm/yr), 111,000 acre-ft/yr (137 hm³/yr).

EXTREMES.--Current year: Maximum discharge, 1,160 ft³/s (32.9 m³/s) Aug. 12, gage height, 4.41 ft (1.344 m); minimum daily, 5.0 ft³/s (0.14 m³/s) Mar. 16-22.
Period of record: Maximum discharge, 3,370 ft³/s (95.4 m³/s) Aug. 13, 1961, gage height, 5.51 ft (1.618 m), datum then in use, from rating curve extended above 1,200 ft³/s (34.0 m³/s); minimum not determined.

REMARKS.--Records good except those for Oct. 16 to Apr. 2, which are poor. Large diurnal fluctuations caused by glacier melt at source. Records of suspended-sediment loads for the current year are published in Part 2 of this report.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1972 TO SEPTEMBER 1973

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	340	50	18	16	7.0	5.5	7.0	40	60	243	477	484
2	485	46	17	14	7.0	5.5	7.0	47	83	254	329	446
3	295	36	16	12	7.0	5.5	14	44	77	281	472	343
4	168	27	16	11	7.0	5.5	8.7	48	105	292	377	342
5	240	25	15	10	7.0	5.5	7.2	94	157	242	560	470
6	610	23	15	9.0	7.0	5.5	7.0	37	151	244	437	445
7	470	21	14	9.0	7.0	5.5	6.9	55	180	259	454	329
8	173	19	14	8.5	7.0	5.5	12	48	154	245	345	467
9	319	18	14	8.0	7.0	5.5	14	34	148	247	479	382
10	94	17	14	8.0	7.0	5.5	41	34	129	247	364	291
11	80	16	13	8.5	6.5	5.5	18	34	135	314	458	261
12	75	14	13	8.5	6.5	5.5	14	40	240	365	485	241
13	61	19	13	8.5	6.5	5.5	18	55	285	417	502	224
14	55	60	13	8.5	7.0	5.5	13	168	311	369	742	194
15	55	18	13	8.5	8.0	5.5	11	252	283	350	420	168
16	55	17	13	8.0	12	5.0	13	190	252	313	315	135
17	60	17	12	8.0	20	5.0	13	142	245	404	270	130
18	70	17	12	8.0	14	5.0	13	133	224	365	227	125
19	90	26	12	8.0	11	5.0	13	122	224	451	200	123
20	70	70	12	8.0	15	5.0	13	72	196	401	226	128
21	50	150	12	10	12	5.0	15	84	234	361	270	150
22	70	100	12	10	9.0	5.0	14	54	247	352	249	241
23	150	70	11	11	8.0	5.5	17	53	219	358	234	191
24	350	50	11	9.0	7.0	5.5	14	88	240	348	468	162
25	140	45	11	8.0	6.0	5.5	23	45	307	327	293	137
26	130	40	11	7.5	6.0	6.0	46	70	281	324	543	190
27	100	30	11	7.5	6.0	8.0	34	70	251	317	434	261
28	80	25	11	7.5	6.0	20	22	79	242	348	435	240
29	70	22	11	7.5	-------	15	20	72	260	407	421	197
30	65	20	10	7.5	-------	11	28	74	282	444	316	113
31	60	------	17	7.5	-------	9.0	------	68	-------	488	209	-------
TOTAL	6,675	1,052	416	287.5	257.5	203.0	496.4	2,412	6,195	10,701	14,287	7,294
MEAN	151	35.1	13.4	9.27	9.20	6.55	16.5	77.8	206	345	461	243
MAX	610	150	18	16	20	20	46	252	311	487	742	467
MIN	50	16	11	7.5	6.0	5.0	6.5	34	60	239	209	113
CFSM	12.5	2.90	1.11	.77	.76	.54	1.36	6.43	17.0	28.5	37.9	19.8
IN.	14.37	3.23	1.28	.68	.73	.62	1.53	7.42	19.04	33.02	43.91	22.15
AC-FT	9,230	2,090	825	570	471	403	985	4,780	12,280	21,220	28,340	14,470

CAL YR 1972 TOTAL 58,958.5 MEAN 161 MAX 1,210 MIN 6.0 CFSM 13.3 IN 181.28 AC-FT 116,960
WTR YR 1973 TOTAL 48,006.4 MEAN 132 MAX 866 MIN 5.0 CFSM 10.9 IN 147.59 AC-FT 95,220

NOTE.--No gage-height record Oct. 1 to Dec. 6, Dec. 8 to Apr. 2.

UNITED STATES DEPARTMENT OF THE INTERIOR - GEOLOGICAL SURVEY - ALASKA DISTRICT 06/26/95

STATION NUMBER 15052000 LEMON C NR JUNEAU AK STREAM SOURCE AGENCY USGS
LATITUDE 582330 LONGITUDE 1342515 DRAINAGE AREA 12.10 DATUM 650.00 STATE 02 COUNTY 110

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1950 TO SEPTEMBER 1951
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	---	---	---	---	---	---	---	---	---	---	410	441
2	---	---	---	---	---	---	---	---	---	---	484	410
3	---	---	---	---	---	---	---	---	---	---	379	415
4	---	---	---	---	---	---	---	---	---	---	309	484
5	---	---	---	---	---	---	---	---	---	---	282	513
6	---	---	---	---	---	---	---	---	---	---	316	525
7	---	---	---	---	---	---	---	---	---	---	362	410
8	---	---	---	---	---	---	---	---	---	---	342	604
9	---	---	---	---	---	---	---	---	---	---	354	637
10	---	---	---	---	---	---	---	---	---	---	490	358
11	---	---	---	---	---	---	---	---	---	---	508	513
12	---	---	---	---	---	---	---	---	---	---	457	276
13	---	---	---	---	---	---	---	---	---	---	496	543
14	---	---	---	---	---	---	---	---	---	---	518	467
15	---	---	---	---	---	---	---	---	---	---	431	415
16	---	---	---	---	---	---	---	---	---	---	346	496
17	---	---	---	---	---	---	---	---	---	---	320	592
18	---	---	---	---	---	---	---	---	---	---	346	720
19	---	---	---	---	---	---	---	---	---	---	320	467
20	---	---	---	---	---	---	---	---	---	---	451	279
21	---	---	---	---	---	---	---	---	---	---	484	295
22	---	---	---	---	---	---	---	---	---	---	384	279
23	---	---	---	---	---	---	---	---	---	---	713	306
24	---	---	---	---	---	---	---	---	---	---	513	152
25	---	---	---	---	---	---	---	---	---	---	316	107
26	---	---	---	---	---	---	---	---	---	---	309	82
27	---	---	---	---	---	---	---	---	---	---	295	66
28	---	---	---	---	---	---	---	---	---	---	316	64
29	---	---	---	---	---	---	---	---	---	---	451	72
30	---	---	---	---	---	---	---	---	---	---	358	82
31	---	---	---	---	---	---	---	---	---	---	441	---
TOTAL	---	---	---	---	---	---	---	---	---	---	12601	11070
MEAN	---	---	---	---	---	---	---	---	---	---	406	369
MAX	---	---	---	---	---	---	---	---	---	---	713	720
MIN	---	---	---	---	---	---	---	---	---	---	282	64
AC-FT	---	---	---	---	---	---	---	---	---	---	24990	21960
CFSM	---	---	---	---	---	---	---	---	---	---	33.6	30.5
IN.	---	---	---	---	---	---	---	---	---	---	38.74	34.03

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1951 - 1951, BY WATER YEAR (WY)

MEAN	101	18.9	5.00	1.50	1.00	1.50	7.00	47.0	158	310	383	429
MAX	101	18.9	5.00	1.50	1.00	1.50	7.00	47.0	158	310	383	429
(WY)	1951	1951	1951	1951	1951	1951	1951	1951	1951	1951	1951	1951
MIN	101	18.9	5.00	1.50	1.00	1.50	7.00	47.0	158	310	383	429
(WY)	1951	1951	1951	1951	1951	1951	1951	1951	1951	1951	1951	1951

STATISTICS COMPUTED BY: HRSEITZ DATE: 10/09/1991 AT: 09:45:40

UNITED STATES DEPARTMENT OF THE INTERIOR - GEOLOGICAL SURVEY - ALASKA DISTRICT 06/26/95

STATION NUMBER 15052000 LEMON C NR JUNEAU AK STREAM SOURCE AGENCY USGS
LATITUDE 582330 LONGITUDE 1342515 DRAINAGE AREA 12.10 DATUM 650.00 STATE 02 COUNTY 110

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1951 TO SEPTEMBER 1952
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	63	25	5.0	1.5	1.0	1.5	7.0	40	79	218	298	902
2	55	38	5.0	1.5	1.0	1.5	7.0	40	78	254	285	543
3	53	63	5.0	1.5	1.0	1.5	7.0	40	63	246	312	320
4	46	70	5.0	1.5	1.0	1.5	7.0	40	94	229	298	269
5	124	41	5.0	1.5	1.0	1.5	7.0	40	109	202	269	248
6	295	70	5.0	1.5	1.0	1.5	7.0	40	80	226	309	243
7	379	55	5.0	1.5	1.0	1.5	7.0	40	63	354	323	177
8	379	30	5.0	1.5	1.0	1.5	7.0	40	78	415	379	128
9	205	10	5.0	1.5	1.0	1.5	7.0	40	79	350	342	104
10	183	10	5.0	1.5	1.0	1.5	7.0	40	158	354	285	110
11	370	10	5.0	1.5	1.0	1.5	7.0	40	215	379	292	195
12	193	10	5.0	1.5	1.0	1.5	7.0	40	215	384	316	137
13	129	10	5.0	1.5	1.0	1.5	7.0	40	212	379	326	631
14	93	10	5.0	1.5	1.0	1.5	7.0	40	179	358	320	1480
15	72	10	5.0	1.5	1.0	1.5	7.0	40	146	392	273	748
16	59	10	5.0	1.5	1.0	1.5	7.0	40	129	316	362	342
17	52	10	5.0	1.5	1.0	1.5	7.0	40	150	282	706	457
18	45	10	5.0	1.5	1.0	1.5	7.0	40	172	243	692	657
19	40	10	5.0	1.5	1.0	1.5	7.0	40	179	282	637	402
20	35	6.0	5.0	1.5	1.0	1.5	7.0	40	202	276	798	285
21	32	6.0	5.0	1.5	1.0	1.5	7.0	40	205	346	537	263
22	29	6.0	5.0	1.5	1.0	1.5	7.0	40	197	386	425	354
23	27	6.0	5.0	1.5	1.0	1.5	7.0	40	193	379	388	346
24	25	6.0	5.0	1.5	1.0	1.5	7.0	40	197	338	298	662
25	24	6.0	5.0	1.5	1.0	1.5	7.0	40	193	289	229	720
26	22	6.0	5.0	1.5	1.0	1.5	7.0	40	179	302	210	420
27	21	6.0	5.0	1.5	1.0	1.5	7.0	47	197	298	550	338
28	20	6.0	5.0	1.5	1.0	1.5	7.0	76	243	282	484	519
29	19	6.0	5.0	1.5	1.0	1.5	7.0	117	223	282	289	379
30	19	6.0	5.0	1.5	---	1.5	7.0	96	226	273	212	490
31	19	---	5.0	1.5	---	1.5	---	82	---	298	422	---
TOTAL	3127	568.0	155.0	46.5	29.0	46.5	210.0	1458	4733	9614	11866	12869
MEAN	101	18.9	5.00	1.50	1.00	1.50	7.00	47.0	158	310	383	429
MAX	379	70	5.0	1.5	1.0	1.5	7.0	117	243	415	798	1480
MIN	19	6.0	5.0	1.5	1.0	1.5	7.0	40	63	202	210	104
AC-FT	6200	1130	307	92	58	92	417	2890	9390	19070	23540	25530
CFSM	8.34	1.56	.41	.12	.08	.12	.58	3.89	13.0	25.6	31.6	35.5
IN.	9.61	1.75	.48	.14	.09	.14	.65	4.48	14.55	29.56	36.48	39.56

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1951 - 1952, BY WATER YEAR (WY)

MEAN	225	42.9	7.50	2.25	1.00	1.50	9.50	81.0	234	378	449	393
MAX	350	66.9	10.0	3.00	1.00	1.50	12.0	115	310	446	515	429
(WY)	1952	1952	1952	1952	1951	1951	1952	1952	1952	1952	1952	1951
MIN	101	18.9	5.00	1.50	1.00	1.50	7.00	47.0	158	310	383	358
(WY)	1951	1951	1951	1951	1951	1951	1951	1951	1951	1951	1951	1952

SUMMARY STATISTICS FOR 1952 WATER YEAR WATER YEARS 1951 - 1952

ANNUAL TOTAL 44722.0

ANNUAL MEAN	122			122	
HIGHEST ANNUAL MEAN				122	1951
LOWEST ANNUAL MEAN				122	1951
HIGHEST DAILY MEAN	1480	Sep 14		1480	Sep 14 1951
LOWEST DAILY MEAN	1.0	Feb 1		1.0	Feb 1 1951
ANNUAL SEVEN-DAY MINIMUM	1.0	Feb 1		1.0	Feb 1 1951
ANNUAL RUNOFF (AC-FT)	88710			88520	
ANNUAL RUNOFF (CFSM)	10.1			10.1	
ANNUAL RUNOFF (INCHES)	137.49			137.21	
10 PERCENT EXCEEDS	359			430	
50 PERCENT EXCEEDS	26			40	
90 PERCENT EXCEEDS	1.5			1.5	

STATISTICS COMPUTED BY: HRSEITZ DATE: 10/09/1991 AT: 09:46:04

UNITED STATES DEPARTMENT OF THE INTERIOR - GEOLOGICAL SURVEY - ALASKA DISTRICT 06/26/95

STATION NUMBER 15052000 LEMON C NR JUNEAU AK STREAM SOURCE AGENCY USGS
LATITUDE 582330 LONGITUDE 1342515 DRAINAGE AREA 12.10 DATUM 650.00 STATE 02 COUNTY 110

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1952 TO SEPTEMBER 1953
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	447	210	10	3.0	2.0	1.5	12	40	220	406	306	408
2	510	251	10	3.0	2.0	1.5	12	45	295	366	292	313
3	229	150	10	3.0	2.0	1.5	12	50	273	306	354	485
4	181	101	10	3.0	2.0	1.5	12	65	254	257	402	418
5	664	86	10	3.0	2.0	1.5	12	55	243	243	457	638
6	384	80	10	3.0	2.0	1.5	12	50	257	266	496	500
7	273	75	10	3.0	2.0	1.5	12	55	295	410	611	431
8	223	105	10	3.0	2.0	1.5	12	53	334	484	618	454
9	156	140	10	3.0	2.0	1.5	12	52	289	549	637	444
10	158	122	10	3.0	2.0	1.5	12	51	229	561	790	344
11	257	75	10	3.0	2.0	1.5	12	50	229	567	988	608
12	231	55	10	3.0	2.0	1.5	12	60	282	496	618	685
13	148	45	10	3.0	2.0	1.5	12	130	285	425	671	741
14	190	34	10	3.0	2.0	1.5	12	110	282	720	1460	480
15	148	28	10	3.0	2.0	1.5	12	105	240	980	932	327
16	104	24	10	3.0	2.0	1.5	12	104	263	692	520	252
17	121	21	10	3.0	2.0	1.5	12	105	240	637	462	367
18	535	58	10	3.0	2.0	1.5	12	119	226	484	431	341
19	910	42	10	3.0	2.0	1.5	12	152	226	502	367	327
20	865	32	10	3.0	2.0	1.5	12	148	248	392	296	267
21	531	45	10	3.0	2.0	1.5	12	133	289	342	255	208
22	316	42	10	3.0	2.0	1.5	12	150	279	338	228	158
23	215	35	10	3.0	2.0	1.5	12	162	279	374	306	195
24	177	31	10	3.0	2.0	1.5	12	166	295	388	296	444
25	124	27	10	3.0	2.0	1.5	12	177	338	502	306	288
26	86	24	10	3.0	2.0	1.5	12	195	446	441	252	202
27	151	21	10	3.0	2.0	1.5	12	188	457	370	375	134
28	1030	18	10	3.0	2.0	1.5	12	263	441	350	396	102
29	865	16	10	3.0	---	1.5	12	195	741	342	671	96
30	379	15	10	3.0	---	1.5	12	156	531	334	706	84
31	234	---	10	3.0	---	1.5	---	183	---	312	458	---
TOTAL	10842	2008	310	93.0	56.0	46.5	360	3567	9306	13836	15957	10741
MEAN	350	66.9	10.0	3.00	2.00	1.50	12.0	115	310	446	515	358
MAX	1030	251	10	3.0	2.0	1.5	12	263	741	980	1460	741
MIN	86	15	10	3.0	2.0	1.5	12	40	220	243	228	84
AC-FT	21510	3980	615	184	111	92	714	7080	18460	27440	31650	21300
CFSM	28.9	5.53	.83	.25	.17	.12	.99	9.51	25.6	36.9	42.5	29.6
IN.	33.33	6.17	.95	.29	.17	.14	1.11	10.97	28.61	42.54	49.06	33.02

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1951 - 1953, BY WATER YEAR (WY):

MEAN	217	38.0	7.50	2.25	1.00	1.50	9.50	81.0	234	367	407	375
MAX	350	66.9	10.0	3.00	1.00	1.50	12.0	115	310	446	515	429
(WY)	1952	1952	1952	1952	1951	1951	1952	1952	1952	1952	1952	1951
MIN	101	18.9	5.00	1.50	1.00	1.50	7.00	47.0	158	310	324	338
(WY)	1951	1951	1951	1951	1951	1951	1951	1951	1951	1951	1953	1953

SUMMARY STATISTICS	FOR 1952 CALENDAR YEAR	FOR 1953 WATER YEAR	WATER YEARS 1951 - 1953
ANNUAL TOTAL	54032.0	67122.5	

ANNUAL MEAN	148			184			122	
HIGHEST ANNUAL MEAN							122	1951
LOWEST ANNUAL MEAN							122	1951
HIGHEST DAILY MEAN	1480	Sep 14		1460	Aug 14		1480	Sep 14 1951
LOWEST DAILY MEAN	1.0	Feb 1		1.5	Mar 1		1.0	Feb 1 1951
ANNUAL SEVEN-DAY MINIMUM	1.0	Feb 1		1.5	Mar 1		1.0	Feb 1 1951
ANNUAL RUNOFF (AC-FT)	107200			133100			88520	
ANNUAL RUNOFF (CFSM)	12.2			15.2			10.1	
ANNUAL RUNOFF (INCHES)	166.11			206.36			137.21	
10 PERCENT EXCEEDS	384			498			425	
50 PERCENT EXCEEDS	40			75			64	
90 PERCENT EXCEEDS	1.5			2.0			1.5	

STATISTICS COMPUTED BY: HRSEITZ DATE: 10/09/1991 AT: 09:46:36

UNITED STATES DEPARTMENT OF THE INTERIOR - GEOLOGICAL SURVEY - ALASKA DISTRICT 06/26/95

STATION NUMBER 15052000 LEMON C NR JUNEAU AK STREAM SOURCE AGENCY USGS
LATITUDE 582330 LONGITUDE 1342515 DRAINAGE AREA 12.10 DATUM 650.00 STATE 02 COUNTY 110

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1953 TO SEPTEMBER 1954
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	35	28	---	---	---	---	---	---	---	370	383	270
2	50	28	---	---	---	---	---	---	---	310	348	231
3	70	28	---	---	---	---	---	---	---	340	320	200
4	120	28	---	---	---	---	---	---	---	300	292	170
5	316	28	---	---	---	---	---	---	---	270	296	175
6	413	28	---	---	---	---	---	---	---	300	310	267
7	225	28	---	---	---	---	---	---	---	327	327	334
8	440	28	---	---	---	---	---	---	---	285	379	330
9	237	28	---	---	---	---	---	---	---	243	418	285
10	255	28	---	---	---	---	---	---	---	222	387	255
11	273	28	---	---	---	---	---	---	---	222	355	185
12	160	28	---	---	---	---	---	---	---	234	310	188
13	140	28	---	---	---	---	---	---	---	255	327	222
14	110	28	---	---	---	---	---	---	---	288	341	228
15	92	28	---	---	---	---	---	---	---	327	327	235
16	84	28	---	---	---	---	---	---	---	404	252	175
17	77	28	---	---	---	---	---	---	---	426	279	140
18	76	28	---	---	---	---	---	---	---	379	270	122
19	104	28	---	---	---	---	---	---	---	320	255	110
20	240	28	---	---	---	---	---	---	---	391	302	601
21	285	28	---	---	---	---	---	---	---	520	318	1100
22	699	28	---	---	---	---	---	---	---	650	267	798
23	310	28	---	---	---	---	---	---	---	540	234	720
24	172	28	---	---	---	---	---	---	---	454	276	776
25	162	28	---	---	---	---	---	---	---	341	316	650
26	418	28	---	---	---	---	---	---	---	344	355	579
27	225	28	---	---	---	---	---	---	---	391	387	310
28	144	28	---	---	---	---	---	---	---	338	338	215
29	108	28	---	---	---	---	---	---	---	288	395	148
30	80	28	---	---	---	---	---	---	---	267	379	132
31	65	---	---	---	---	---	---	---	---	375	302	---
TOTAL	6185	840	---	---	---	---	---	---	---	10721	10043	10141
MEAN	200	28.0	---	---	---	---	---	---	---	346	324	338
MAX	699	28	---	---	---	---	---	---	---	650	418	1100
MIN	35	28	---	---	---	---	---	---	---	222	234	110
AC-FT	12270	1670	---	---	---	---	---	---	---	21270	19920	20110
CFSM	16.5	2.31	---	---	---	---	---	---	---	28.6	26.8	27.9
IN.	19.02	2.58	---	---	---	---	---	---	---	32.96	30.88	31.18

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1951 - 1954, BY WATER YEAR (WY)

MEAN	182	47.9	15.1	3.33	1.74	1.50	7.83	68.8	216	373	417	354
MAX	350	77.8	30.3	5.50	2.50	1.50	12.0	115	310	446	515	429
(WY)	1952	1954	1954	1954	1954	1951	1952	1952	1952	1952	1952	1951
MIN	78.6	18.9	5.00	1.50	1.00	1.50	4.50	44.4	158	310	324	290
(WY)	1954	1951	1951	1951	1951	1951	1954	1954	1951	1951	1953	1954

SUMMARY STATISTICS WATER YEARS 1951 - 1954

ANNUAL MEAN 126

HIGHEST ANNUAL MEAN	130		1954
LOWEST ANNUAL MEAN	122		1951
HIGHEST DAILY MEAN	1480	Sep 14	1951
LOWEST DAILY MEAN	1.0	Feb 1	1951
ANNUAL SEVEN-DAY MINIMUM	1.0	Feb 1	1951
ANNUAL RUNOFF (AC-FT)	91480		
ANNUAL RUNOFF (CFSM)	10.4		
ANNUAL RUNOFF (INCHES)	141.79		
10 PERCENT EXCEEDS	418		
50 PERCENT EXCEEDS	54		
90 PERCENT EXCEEDS	1.5		

STATISTICS COMPUTED BY: HRSEITZ DATE: 10/09/1991 AT: 09:47:00

UNITED STATES DEPARTMENT OF THE INTERIOR - GEOLOGICAL SURVEY - ALASKA DISTRICT 06/26/95

STATION NUMBER 15052000 LEMON C NR JUNEAU AK STREAM SOURCE AGENCY USGS
LATITUDE 582330 LONGITUDE 1342515 DRAINAGE AREA 12.10 DATUM 650.00 STATE 02 COUNTY 110

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1954 TO SEPTEMBER 1955
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	55	202	15	5.5	2.5	1.5	4.5	17	48	222	379	590
2	55	122	16	5.5	2.5	1.5	4.5	17	50	276	296	713
3	55	130	20	5.5	2.5	1.5	4.5	17	50	363	267	510
4	55	234	13	5.5	2.5	1.5	4.5	17	60	371	279	436
5	55	246	13	5.5	2.5	1.5	4.5	17	44	387	422	270
6	55	150	13	5.5	2.5	1.5	4.5	17	36	387	755	202
7	55	102	13	5.5	2.5	1.5	4.5	17	41	375	734	188
8	55	80	13	5.5	2.5	1.5	4.5	17	104	375	557	155
9	55	69	13	5.5	2.5	1.5	4.5	17	194	379	692	152
10	55	58	13	5.5	2.5	1.5	4.5	17	400	431	706	182
11	55	52	13	5.5	2.5	1.5	4.5	17	290	495	535	210
12	55	46	13	5.5	2.5	1.5	4.5	17	140	454	520	270
13	46	42	13	5.5	2.5	1.5	4.5	23	110	444	699	327
14	66	38	13	5.5	2.5	1.5	4.5	26	101	371	568	348
15	100	32	13	5.5	2.5	1.5	4.5	47	100	302	462	338
16	284	29	45	5.5	2.5	1.5	4.5	138	107	264	375	240
17	114	25	95	5.5	2.5	1.5	4.5	106	124	264	320	285
18	180	37	96	5.5	2.5	1.5	4.5	102	138	270	273	395
19	188	33	110	5.5	2.5	1.5	4.5	98	138	299	341	270
20	110	66	146	5.5	2.5	1.5	4.5	84	170	320	418	175
21	79	95	63	5.5	2.5	1.5	4.5	56	208	454	302	132
22	65	60	38	5.5	2.5	1.5	4.5	50	258	614	249	112
23	45	38	26	5.5	2.5	1.5	4.5	60	302	495	243	151
24	45	66	14	5.5	2.5	1.5	4.5	56	348	449	302	559
25	45	102	14	5.5	2.5	1.5	4.5	72	367	458	408	500
26	54	58	14	5.5	2.5	1.5	4.5	54	313	614	546	348
27	60	36	14	5.5	2.5	1.5	4.5	43	306	495	449	246
28	42	30	14	5.5	2.5	1.5	4.5	42	330	408	540	178
29	44	33	14	5.5	---	1.5	4.5	38	327	359	400	128
30	58	22	14	5.5	---	1.5	4.5	33	273	348	359	98
31	152	---	14	5.5	---	1.5	---	35	---	393	449	---
TOTAL	2437	2333	938	170.5	70.0	46.5	135.0	1377	6387	12134	13845	8708
MEAN	78.6	77.8	30.3	5.50	2.50	1.50	4.50	44.4	180	391	447	290
MAX	284	246	146	5.5	2.5	1.5	4.5	138	400	614	755	713
MIN	42	22	13	5.5	2.5	1.5	4.5	17	36	222	243	98
AC-FT	4830	4630	1860	338	139	92	268	2730	10690	24070	27460	17270
CFSM	6.50	6.43	2.50	.45	.21	.12	.37	3.67	14.8	32.3	36.9	24.0
IN.	7.49	7.17	2.88	.52	.22	.14	.42	4.23	16.56	37.30	42.56	26.77

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1951 - 1955, BY WATER YEAR (WY)

MEAN	156	42.7	12.8	3.25	1.83	1.50	7.25	74.9	298	380	454	341
MAX	350	77.8	30.3	5.50	2.50	1.50	12.0	115	310	446	602	429
(WY)	1952	1954	1954	1954	1954	1951	1952	1952	1952	1952	1955	1951
MIN	51.1	18.9	5.00	1.50	1.00	1.50	4.50	44.4	158	310	324	290
(WY)	1955	1951	1951	1951	1951	1951	1954	1954	1951	1951	1953	1954

SUMMARY STATISTICS	FOR 1955 WATER YEAR	WATER YEARS 1951 - 1955
ANNUAL TOTAL	47581.0	

ANNUAL MEAN	130			131		
HIGHEST ANNUAL MEAN				140		1955
LOWEST ANNUAL MEAN				122		1951
HIGHEST DAILY MEAN	755	Aug	6	1480	Sep 14	1951
LOWEST DAILY MEAN	1.5	Mar	1	1.0	Feb 1	1951
ANNUAL SEVEN-DAY MINIMUM	1.5	Mar	1	1.0	Feb 1	1951
ANNUAL RUNOFF (AC-FT)	94380			94790		
ANNUAL RUNOFF (CFSM)	10.8			10.8		
ANNUAL RUNOFF (INCHES)	146.28			146.93		
10 PERCENT EXCEEDS	400			422		
50 PERCENT EXCEEDS	45			45		
90 PERCENT EXCEEDS	2.5			1.5		

STATISTICS COMPUTED BY: HRSEITZ DATE: 10/09/1991 AT: 09:47:32

UNITED STATES DEPARTMENT OF THE INTERIOR - GEOLOGICAL SURVEY - ALASKA DISTRICT 06/26/95

STATION NUMBER 15052000 LEMON C NR JUNEAU AK STREAM SOURCE AGENCY USGS
LATITUDE 582330 LONGITUDE 1342515 DRAINAGE AREA 12.10 DATUM 650.00 STATE 02 COUNTY 110

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1955 TO SEPTEMBER 1956
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	84	22	6.0	3.0	2.0	1.5	5.5	18	120	240	706	367
2	98	22	6.0	3.0	2.0	1.5	5.5	19	132	264	614	279
3	89	22	6.0	3.0	2.0	1.5	5.5	21	132	296	706	222
4	89	22	6.0	3.0	2.0	1.5	5.5	27	128	296	505	192
5	88	22	6.0	3.0	2.0	1.5	5.5	40	122	296	400	270
6	140	22	6.0	3.0	2.0	1.5	5.5	58	126	324	436	334
7	90	22	6.0	3.0	2.0	1.5	5.5	50	120	344	500	363
8	58	22	6.0	3.0	2.0	1.5	5.5	60	126	316	540	363
9	48	22	6.0	3.0	2.0	1.5	5.5	96	120	288	400	375
10	40	22	6.0	3.0	2.0	1.5	5.5	53	116	279	338	296
11	43	22	6.0	3.0	2.0	1.5	5.5	33	124	258	327	217
12	60	22	6.0	3.0	2.0	1.5	5.5	24	122	258	348	261
13	38	22	6.0	3.0	2.0	1.5	5.5	24	128	363	418	310
14	33	22	6.0	3.0	2.0	1.5	5.5	88	144	485	418	408
15	37	22	6.0	3.0	2.0	1.5	5.5	136	170	476	400	320
16	42	22	6.0	3.0	2.0	1.5	5.5	138	200	449	383	246
17	35	22	6.0	3.0	2.0	1.5	5.5	82	222	449	431	330
18	30	22	6.0	3.0	2.0	1.5	5.5	102	316	510	580	552
19	32	22	6.0	3.0	2.0	1.5	5.5	148	330	510	783	1040
20	63	22	6.0	3.0	2.0	1.5	5.5	212	302	671	1160	699
21	37	22	6.0	3.0	2.0	1.5	5.5	178	288	569	828	355
22	27	22	6.0	3.0	2.0	1.5	5.5	192	310	638	657	220
23	76	22	6.0	3.0	2.0	1.5	5.5	178	267	664	769	150
24	54	22	6.0	3.0	2.0	1.5	5.5	126	205	540	925	108
25	33	22	6.0	3.0	2.0	1.5	5.5	170	225	422	925	84
26	26	22	6.0	3.0	2.0	1.5	5.5	144	200	387	1080	67
27	22	22	6.0	3.0	2.0	1.5	5.5	96	188	440	602	69
28	21	22	6.0	3.0	2.0	1.5	5.5	76	200	431	805	69
29	19	22	6.0	3.0	2.0	1.5	5.5	62	192	375	664	52
30	17	22	6.0	3.0	---	1.5	5.5	130	205	320	562	92
31	15	---	6.0	3.0	---	1.5	---	126	---	426	440	---
TOTAL	1584	660	186.0	93.0	58.0	46.5	165.0	2891	5580	12583	18660	8730
MEAN	51.1	22.0	6.00	3.00	2.00	1.50	5.50	93.3	186	406	602	291
MAX	140	22	6.0	3.0	2.0	1.5	5.5	212	330	671	1160	1040
MIN	15	22	6.0	3.0	2.0	1.5	5.5	18	116	240	327	52
AC-FT	3140	1310	369	184	115	92	327	5730	11070	24960	37010	17320
CFSM	4.22	1.82	.50	.25	.17	.12	.45	7.71	15.4	33.5	49.7	24.0
IN.	4.87	2.03	.57	.29	.18	.14	.51	8.89	17.16	38.68	57.37	26.84

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1951 - 1956, BY WATER YEAR (WY)

MEAN	138	47.3	18.6	5.40	1.83	1.80	7.70	81.4	225	378	448	375
MAX	350	77.8	41.9	14.0	2.50	3.00	12.0	115	310	446	602	543
(WY)	1952	1954	1956	1956	1954	1956	1952	1952	1952	1952	1955	1956
MIN	50.8	18.9	5.00	1.50	1.00	1.50	4.50	44.4	158	310	324	290
(WY)	1956	1951	1951	1951	1951	1951	1954	1954	1951	1951	1953	1954

SUMMARY STATISTICS	FOR 1955 CALENDAR YEAR	FOR 1956 WATER YEAR	WATER YEARS 1951 - 1956
ANNUAL TOTAL	44303.0	51236.5	

ANNUAL MEAN	121			140			131		
HIGHEST ANNUAL MEAN							140		1955
LOWEST ANNUAL MEAN							122		1951
HIGHEST DAILY MEAN	755	Aug	6	1160	Aug	20	1480	Sep	14 1951
LOWEST DAILY MEAN	1.5	Mar	1	1.5	Mar	1	1.0	Feb	1 1951
ANNUAL SEVEN-DAY MINIMUM	1.5	Mar	1	1.5	Mar	1	1.0	Feb	1 1951
ANNUAL RUNOFF (AC-FT)	87870			101600			94790		
ANNUAL RUNOFF (CFSM)	10.0			11.6			10.8		
ANNUAL RUNOFF (INCHES)	136.20			157.52			146.93		
10 PERCENT EXCEEDS	400			432			422		
50 PERCENT EXCEEDS	22			22			43		
90 PERCENT EXCEEDS	2.5			2.0			2.0		

STATISTICS COMPUTED BY: HRSEITZ DATE: 10/09/1991 AT: 09:48:00

UNITED STATES DEPARTMENT OF THE INTERIOR - GEOLOGICAL SURVEY - ALASKA DISTRICT 06/26/95

STATION NUMBER 15052000 LEMON C NR JUNEAU AK STREAM SOURCE AGENCY USGS
LATITUDE 582330 LONGITUDE 1342515 DRAINAGE AREA 12.10 DATUM 650.00 STATE 02 COUNTY 110

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1956 TO SEPTEMBER 1957
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	76	9.0	118	14	5.0	3.0	6.0	35	162	306	387	476
2	62	9.0	40	14	5.0	3.0	6.0	35	195	330	344	348
3	63	9.0	40	14	5.0	3.0	6.0	35	215	327	404	338
4	65	9.0	40	14	5.0	3.0	6.0	35	231	422	520	400
5	43	9.0	40	14	5.0	3.0	6.0	35	279	413	422	472
6	60	9.0	40	14	5.0	3.0	6.0	35	320	327	391	449
7	43	9.0	40	14	5.0	3.0	6.0	35	310	296	395	449
8	54	24	40	14	5.0	3.0	6.0	51	306	299	485	436
9	158	36	40	14	5.0	3.0	6.0	52	306	296	626	720
10	152	23	40	14	5.0	3.0	6.0	56	279	262	644	1180
11	160	22	10	14	5.0	3.0	6.0	58	264	391	495	783
12	96	24	10	14	5.0	3.0	6.0	58	310	436	408	500
13	66	15	10	14	5.0	3.0	6.0	61	355	348	387	568
14	62	15	10	14	5.0	3.0	6.0	76	338	306	367	422
15	53	15	10	14	5.0	3.0	6.0	95	352	279	444	327
16	42	15	10	14	5.0	3.0	13	120	334	276	426	264
17	36	15	10	14	5.0	3.0	13	178	330	310	383	220
18	44	15	10	14	5.0	3.0	13	270	310	313	355	172
19	32	15	10	14	5.0	3.0	13	296	302	413	355	185
20	27	38	10	14	5.0	3.0	13	240	296	387	341	285
21	27	202	15	14	5.0	3.0	13	196	313	395	387	540
22	24	118	15	14	5.0	3.0	13	172	292	379	540	858
23	21	95	15	14	5.0	3.0	13	148	292	426	480	734
24	19	254	15	14	5.0	3.0	13	124	292	602	444	418
25	17	310	15	14	5.0	3.0	13	120	310	525	391	359
26	15	172	15	14	5.0	3.0	13	142	310	371	327	418
27	14	138	100	14	5.0	3.0	13	134	313	316	313	880
28	12	140	292	14	5.0	3.0	13	120	306	327	296	776
29	11	178	110	14	---	3.0	13	98	282	395	338	898
30	10	168	75	14	---	3.0	13	96	296	431	371	1430
31	9.0	---	55	14	---	3.0	---	124	---	454	575	---
TOTAL	1576.0	2110.0	1300	434	140.0	93.0	285.0	3331	8803	11378	13045	16305
MEAN	50.8	70.3	41.9	14.0	5.00	3.00	9.50	107	293	367	421	543
MAX	160	310	292	14	5.0	3.0	13	296	355	602	644	1430
MIN	9.0	9.0	10	14	5.0	3.0	6.0	35	162	276	296	172
AC-FT	3130	4190	2580	861	278	184	565	6610	17450	22570	25870	32340
CFSM	4.20	5.81	3.47	1.16	.41	.25	.79	8.86	24.2	30.3	34.8	44.9
IN.	4.85	6.49	4.00	1.33	.43	.29	.88	10.24	27.05	34.98	40.11	50.13

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1951 - 1957, BY WATER YEAR (WY)

MEAN	143	54.9	17.1	6.50	2.61	2.08	9.94	84.8	250	392	450	354
MAX	350	101	41.9	14.0	5.00	3.50	21.1	115	371	480	602	543
(WY)	1952	1957	1956	1956	1957	1957	1957	1952	1957	1957	1955	1956
MIN	50.8	18.9	5.00	1.50	1.00	1.50	4.50	44.4	158	310	324	228
(WY)	1956	1951	1951	1951	1951	1951	1954	1954	1951	1951	1953	1957

SUMMARY STATISTICS	FOR 1956 CALENDAR YEAR	FOR 1957 WATER YEAR	WATER YEARS 1951 - 1957
ANNUAL TOTAL	53792.5	58797.0	

ANNUAL MEAN	147		161		139		
HIGHEST ANNUAL MEAN					165		1957
LOWEST ANNUAL MEAN					122		1951
HIGHEST DAILY MEAN	1160	Aug 20	1430	Sep 30	1480	Sep 14	1951
LOWEST DAILY MEAN	1.5	Mar 1	3.0	Mar 1	1.0	Feb 1	1951
ANNUAL SEVEN-DAY MINIMUM	1.5	Mar 1	3.0	Mar 1	1.0	Feb 1	1951
ANNUAL RUNOFF (AC-FT)	106700		116600		100900		
ANNUAL RUNOFF (CFSM)	12.1		13.3		11.5		
ANNUAL RUNOFF (INCHES)	165.38		180.76		156.40		
10 PERCENT EXCEEDS	432		422		422		
50 PERCENT EXCEEDS	40		40		45		
90 PERCENT EXCEEDS	2.0		5.0		2.0		

STATISTICS COMPUTED BY: HRSEITZ DATE: 10/09/1991 AT: 09:48:32

UNITED STATES DEPARTMENT OF THE INTERIOR - GEOLOGICAL SURVEY - ALASKA DISTRICT 06/26/95

STATION NUMBER 15052000 LEMON C NR JUNEAU AK STREAM SOURCE AGENCY USGS
LATITUDE 582330 LONGITUDE 1342515 DRAINAGE AREA 12.10 DATUM 650.00 STATE 02 COUNTY 110

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1957 TO SEPTEMBER 1958
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	555	163	15	12	5.0	3.5	8.0	46	295	276	615	166
2	240	505	15	12	5.0	3.5	10	41	295	306	606	155
3	155	565	15	12	5.0	3.5	12	58	302	350	374	220
4	113	388	13	12	5.0	3.5	14	59	323	364	605	338
5	86	218	12	12	5.0	3.5	14	59	320	420	850	388
6	69	153	11	12	5.0	3.5	16	84	342	402	692	761
7	63	99	10	12	5.0	3.5	16	79	397	354	540	555
8	58	92	11	12	5.0	3.5	16	63	366	292	354	354
9	49	88	10	12	5.0	3.5	18	47	348	276	295	266
10	44	98	15	12	5.0	3.5	19	39	358	298	295	207
11	129	66	21	12	5.0	3.5	48	30	320	410	289	189
12	285	51	15	12	5.0	3.5	44	27	316	374	330	170
13	323	44	13	12	5.0	3.5	26	37	388	336	425	170
14	226	37	12	12	5.0	3.5	20	51	309	358	580	170
15	248	34	10	12	5.0	3.5	18	63	276	505	811	170
16	212	32	10	12	5.0	3.5	16	59	520	445	600	170
17	166	35	8.8	12	5.0	3.5	13	47	535	392	270	170
18	133	34	6.0	12	5.0	3.5	12	56	480	510	226	170
19	104	25	6.0	12	5.0	3.5	11	79	500	525	420	170
20	77	24	6.0	12	5.0	3.5	11	144	605	850	565	170
21	60	25	6.0	12	5.0	3.5	12	202	670	876	545	170
22	47	29	6.0	12	5.0	3.5	10	215	465	648	490	170
23	41	24	6.0	12	5.0	3.5	10	207	350	515	994	179
24	39	34	6.0	12	5.0	3.5	11	177	302	470	811	170
25	65	40	6.0	12	5.0	3.5	14	127	374	362	415	170
26	290	29	6.0	12	5.0	3.5	19	111	350	379	279	170
27	370	23	6.0	12	5.0	3.5	38	134	276	505	257	170
28	346	24	6.0	12	5.0	3.5	52	161	240	505	212	170
29	292	22	6.0	12	---	3.5	54	181	243	555	181	170
30	202	18	6.0	12	---	3.5	52	210	269	1000	174	170
31	172	---	6.0	12	---	3.5	---	260	---	1020	384	---
TOTAL	5249	3016	300.8	372	140.0	108.5	634.0	3153	11126	14879	14284	6029
MEAN	169	101	9.70	12.0	5.00	3.50	21.1	102	371	480	461	228
MAX	555	565	21	12	5.0	3.5	54	260	670	1020	994	761
MIN	39	18	6.0	12	5.0	3.5	8.0	27	240	276	174	155
AC-FT	10410	5980	597	738	278	215	1260	6250	22070	29510	28330	13550
CFSM	14.0	8.31	.80	.99	.41	.29	1.75	8.41	30.7	39.7	38.1	18.8
IN.	16.14	9.27	.92	1.14	.43	.33	1.95	9.69	34.21	45.74	43.91	20.99

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1951 - 1958, BY WATER YEAR (WY)

MEAN	141	51.6	15.7	6.29	2.88	2.36	9.90	84.9	256	408	448	338
MAX	350	101	41.9	14.0	5.00	4.00	21.1	115	371	518	602	543
(WY)	1952	1957	1956	1956	1957	1958	1957	1952	1957	1958	1955	1956
MIN	50.8	18.9	5.00	1.50	1.00	1.50	4.50	44.4	158	310	324	224
(WY)	1956	1951	1951	1951	1951	1951	1954	1954	1951	1951	1953	1958

SUMMARY STATISTICS	FOR 1957 CALENDAR YEAR	FOR 1958 WATER YEAR	WATER YEARS 1951 - 1958
ANNUAL TOTAL	62376.8	60090.3	

ANNUAL MEAN	171		165		141		
HIGHEST ANNUAL MEAN					165		1957
LOWEST ANNUAL MEAN					122		1951
HIGHEST DAILY MEAN	1430	Sep 30	1020	Jul 31	1480	Sep 14	1951
LOWEST DAILY MEAN	3.0	Mar 1	3.5	Mar 1	1.0	Feb 3	1951
ANNUAL SEVEN-DAY MINIMUM	3.0	Mar 1	3.5	Mar 1	1.0	Feb 1	1951
ANNUAL RUNOFF (AC-FT)	123700		119200		101900		
ANNUAL RUNOFF (CFSM)	14.1		13.6		11.6		
ANNUAL RUNOFF (INCHES)	191.77		184.74		157.89		
10 PERCENT EXCEEDS	426		474		420		
50 PERCENT EXCEEDS	51		52		44		
90 PERCENT EXCEEDS	5.0		5.0		3.0		

STATISTICS COMPUTED BY: HRSEITZ DATE: 10/09/1991 AT: 09:49:00

UNITED STATES DEPARTMENT OF THE INTERIOR - GEOLOGICAL SURVEY - ALASKA DISTRICT 06/26/95

STATION NUMBER 15052000 LEMON C NR JUNEAU AK STREAM SOURCE AGENCY USGS
LATITUDE 582330 LONGITUDE 1342515 DRAINAGE AREA 12.10 DATUM 650.00 STATE 02 COUNTY 110

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1958 TO SEPTEMBER 1959
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	130	28	7.0	5.0	4.0	4.0	8.0	11	164	319	580	500
2	130	28	7.0	5.0	4.0	4.0	8.0	11	168	304	382	327
3	130	28	7.0	5.0	4.0	4.0	8.0	12	157	382	301	213
4	130	28	7.0	5.0	4.0	4.0	8.0	13	155	400	422	150
5	130	28	7.0	5.0	4.0	4.0	8.0	16	173	315	560	123
6	130	28	7.0	5.0	4.0	4.0	8.0	27	168	304	924	114
7	130	28	7.0	5.0	4.0	4.0	8.0	34	164	312	840	104
8	130	28	7.0	5.0	4.0	4.0	8.0	33	166	323	945	90
9	130	28	7.0	5.0	4.0	4.0	8.0	27	182	335	698	153
10	130	28	7.0	5.0	4.0	4.0	8.0	25	210	364	422	197
11	130	28	7.0	5.0	4.0	4.0	8.0	20	274	391	396	178
12	130	28	7.0	5.0	4.0	4.0	8.0	18	315	386	339	258
13	130	28	7.0	5.0	4.0	4.0	8.0	64	315	656	495	248
14	130	28	7.0	5.0	4.0	4.0	8.0	126	287	740	650	335
15	130	28	7.0	5.0	4.0	4.0	8.0	136	274	585	530	233
16	130	28	7.0	5.0	4.0	4.0	8.0	164	287	746	400	195
17	130	28	7.0	5.0	4.0	4.0	8.0	103	351	1200	319	218
18	130	28	7.0	5.0	4.0	4.0	8.0	93	404	722	258	239
19	130	28	7.0	5.0	4.0	4.0	8.0	90	400	555	245	205
20	130	28	7.0	5.0	4.0	4.0	8.0	90	422	600	290	140
21	130	28	7.0	5.0	4.0	4.0	8.0	94	386	550	386	109
22	130	28	7.0	5.0	4.0	4.0	8.0	125	339	628	331	123
23	130	28	7.0	5.0	4.0	4.0	8.0	187	335	515	233	312
24	130	28	7.0	5.0	4.0	4.0	11	150	339	351	264	396
25	130	28	7.0	5.0	4.0	4.0	12	144	373	287	342	368
26	130	28	7.0	5.0	4.0	4.0	18	155	422	233	335	261
27	130	28	7.0	5.0	4.0	4.0	19	164	432	251	294	192
28	130	28	7.0	5.0	4.0	4.0	16	140	396	502	210	170
29	130	28	7.0	5.0	---	4.0	16	118	351	875	274	161
30	130	28	7.0	5.0	---	4.0	13	119	355	1040	248	414
31	130	---	7.0	5.0	---	4.0	---	142	---	896	368	---
TOTAL	4030	840	217.0	155.0	112.0	124.0	289.0	2649	8767	16067	13282	6726
MEAN	130	28.0	7.00	5.00	4.00	4.00	9.63	85.5	292	518	428	224
MAX	130	28	7.0	5.0	4.0	4.0	19	187	432	1200	945	800
MIN	130	28	7.0	5.0	4.0	4.0	8.0	11	155	233	210	90
AC-FT	7990	1670	430	307	222	246	573	5250	17390	31870	26340	13340
CFSM	10.7	2.31	.58	.41	.33	.33	.80	7.06	24.2	42.8	35.4	18.5
IN.	12.39	2.58	.67	.48	.34	.38	.89	8.14	26.95	49.40	40.83	20.68

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1951 - 1959, BY WATER YEAR (WY)

MEAN	143	50.1	15.5	6.25	3.24	2.69	11.2	87.1	253	417	446	354
MAX	350	101	41.9	14.8	5.00	5.00	21.1	115	371	516	602	543
(WY)	1952	1957	1956	1956	1957	1959	1957	1952	1957	1958	1955	1956
MIN	50.8	18.9	5.00	1.50	1.00	1.50	4.50	44.4	158	310	324	224
(WY)	1956	1951	1951	1951	1951	1951	1954	1954	1951	1951	1953	1958

SUMMARY STATISTICS	FOR 1958 CALENDAR YEAR	FOR 1959 WATER YEAR	WATER YEARS 1951 - 1959
ANNUAL TOTAL	56611.5	53258.0	

ANNUAL MEAN	155		146		145		
HIGHEST ANNUAL MEAN					166		1959
LOWEST ANNUAL MEAN					122		1951
HIGHEST DAILY MEAN	1020	Jul 31	1200	Jul 17	1480	Sep 14	1951
LOWEST DAILY MEAN	3.5	Mar 1	4.0	Feb 1	1.0	Feb 1	1951
ANNUAL SEVEN-DAY MINIMUM	3.5	Mar 1	4.0	Feb 1	1.0	Feb 1	1951
ANNUAL RUNOFF (AC-FT)	112300		105600		105000		
ANNUAL RUNOFF (CFSM)	12.8		12.1		12.0		
ANNUAL RUNOFF (INCHES)	174.05		163.74		162.70		
10 PERCENT EXCEEDS	433		396		425		
50 PERCENT EXCEEDS	46		28		45		
90 PERCENT EXCEEDS	5.0		4.0		3.0		

STATISTICS COMPUTED BY: HRSEITZ DATE: 10/09/1991 AT: 09:49:32

UNITED STATES DEPARTMENT OF THE INTERIOR - GEOLOGICAL SURVEY - ALASKA DISTRICT 06/26/95

STATION NUMBER 15052000 LEMON C NR JUNEAU AK STREAM SOURCE AGENCY USGS
LATITUDE 582330 LONGITUDE 1342515 DRAINAGE AREA 12.10 DATUM 650.00 STATE 02 COUNTY 110

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1959 TO SEPTEMBER 1960
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	803	49	48	6.0	5.0	5.0	13	54	103	382	722	173
2	728	39	29	6.0	5.0	5.0	13	54	111	351	722	226
3	404	32	21	6.0	5.0	5.0	13	65	103	432	847	440
4	224	29	19	6.0	5.0	5.0	13	80	109	600	622	360
5	126	31	18	6.0	5.0	5.0	13	90	116	555	545	331
6	91	34	16	6.0	5.0	5.0	13	93	123	427	427	319
7	67	48	16	6.0	5.0	5.0	13	90	153	364	422	327
8	57	136	16	6.0	5.0	5.0	13	75	150	355	450	1140
9	50	70	16	6.0	5.0	5.0	13	65	134	319	525	764
10	42	50	16	6.0	5.0	5.0	13	65	178	287	560	698
11	35	39	14	6.0	5.0	5.0	13	79	190	470	465	1020
12	52	30	10	6.0	5.0	5.0	13	80	175	639	369	634
13	134	30	10	6.0	5.0	5.0	13	79	144	555	308	746
14	331	30	10	6.0	5.0	5.0	13	77	150	400	331	422
15	146	30	10	6.0	5.0	5.0	13	81	185	368	840	350
16	109	30	10	6.0	5.0	5.0	13	80	205	520	868	300
17	86	30	10	6.0	5.0	5.0	13	84	233	734	752	350
18	70	30	10	6.0	5.0	5.0	13	74	218	495	455	400
19	67	30	10	6.0	5.0	5.0	13	72	205	339	400	330
20	97	30	10	6.0	5.0	5.0	15	98	218	267	347	510
21	89	30	10	6.0	5.0	5.0	16	138	251	242	280	570
22	114	30	10	6.0	5.0	5.0	18	166	347	233	251	640
23	185	30	10	6.0	5.0	5.0	20	170	373	368	202	710
24	114	30	10	6.0	5.0	5.0	27	166	360	606	185	600
25	91	30	10	6.0	5.0	5.0	33	175	339	570	190	510
26	70	30	10	6.0	5.0	5.0	39	161	331	634	173	400
27	63	55	10	6.0	5.0	5.0	49	144	368	680	296	330
28	59	39	10	6.0	5.0	5.0	52	150	460	868	347	295
29	144	30	10	6.0	5.0	5.0	51	150	530	692	261	270
30	103	24	10	6.0	---	5.0	54	126	427	590	195	325
31	85	---	10	6.0	---	5.0	---	104	---	833	180	---
TOTAL	4816	1155	429	186.0	145.0	155.0	621	3186	6989	15175	13532	14480
MEAN	155	38.5	13.8	6.00	5.00	5.00	20.7	103	233	490	437	483
MAX	803	136	48	6.0	5.0	5.0	54	175	530	868	868	1140
MIN	35	24	10	6.0	5.0	5.0	13	54	103	233	173	173
AC-FT	9550	2290	851	369	288	307	1230	6320	13860	30100	26840	28720
CFSM	12.8	3.18	1.14	.50	.41	.41	1.71	8.49	19.3	40.5	36.1	39.9
IN.	14.81	3.55	1.32	.57	.45	.48	1.91	9.79	21.49	46.65	41.60	44.52

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1951 - 1960, BY WATER YEAR (WY)

MEAN	146	50.5	17.4	6.74	5.24	5.41	12.4	88.7	266	431	473	350
MAX	350	101	91.9	14.0	9.00	9.23	21.4	115	375	557	718	543
(WY)	1952	1957	1956	1956	1957	1960	1960	1952	1960	1960	1960	1956
MIN	50.8	18.9	5.00	1.50	1.00	1.50	4.50	44.4	158	310	324	224
(WY)	1956	1951	1951	1951	1951	1951	1954	1954	1951	1951	1953	1954

SUMMARY STATISTICS	FOR 1959 CALENDAR YEAR	FOR 1960 WATER YEAR	WATER YEARS 1951 - 1960
ANNUAL TOTAL	54571.0	60869.0	

ANNUAL MEAN	150		166		145			
HIGHEST ANNUAL MEAN					166		1959	
LOWEST ANNUAL MEAN					122		1951	
HIGHEST DAILY MEAN	1200	Jul 17	1140	Sep 8	2660	Aug 13	1960	
LOWEST DAILY MEAN	4.0	Feb 1	5.0	Feb 1	1.0	Feb 1	1951	
ANNUAL SEVEN-DAY MINIMUM	4.0	Feb 1	5.0	Feb 1	1.0	Feb 1	1951	
ANNUAL RUNOFF (AC-FT)	108200		120700		105000			
ANNUAL RUNOFF (CFSM)	12.4		13.7		12.0			
ANNUAL RUNOFF (INCHES)	167.77		187.13		162.79			
10 PERCENT EXCEEDS	400		521		435			
50 PERCENT EXCEEDS	34		54		48			
90 PERCENT EXCEEDS	4.0		5.0		3.0			

STATISTICS COMPUTED BY: HRSEITZ DATE: 10/09/1991 AT: 09:50:00

UNITED STATES DEPARTMENT OF THE INTERIOR - GEOLOGICAL SURVEY - ALASKA DISTRICT 06/26/95

STATION NUMBER 15052000 LEMON C NR JUNEAU AK STREAM SOURCE AGENCY USGS
LATITUDE 582330 LONGITUDE 1342515 DRAINAGE AREA 12.10 DATUM 650.00 STATE 02 COUNTY 110

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1960 TO SEPTEMBER 1961
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	310	79	13	21	7.0	8.0	53	56	779	280	418	400
2	330	61	13	29	7.0	8.0	33	46	764	287	530	560
3	280	98	12	23	7.0	8.0	20	42	422	432	606	535
4	364	127	12	18	7.0	8.0	16	41	355	680	555	331
5	323	308	12	16	7.0	8.0	14	40	436	740	674	236
6	195	166	60	13	7.0	8.0	13	41	470	590	722	173
7	114	91	89	11	12	8.0	18	37	386	515	746	565
8	91	70	81	11	13	8.0	17	35	339	445	500	716
9	190	59	67	11	13	8.0	14	38	355	495	335	396
10	242	53	45	10	11	8.0	22	46	319	987	339	284
11	166	48	35	11	10	8.0	17	54	301	875	626	242
12	116	46	26	10	10	8.0	11	50	294	1210	1750	261
13	97	44	21	9.4	9.8	8.0	9.1	73	267	740	2660	270
14	102	38	20	8.8	8.0	8.0	7.7	108	335	500	2130	267
15	126	34	18	9.4	8.0	8.0	16	116	315	418	980	236
16	126	32	14	9.4	8.0	8.0	18	124	267	414	445	400
17	103	30	14	8.4	8.0	8.0	12	140	274	414	301	264
18	126	32	13	8.2	8.0	8.0	10	136	432	786	290	515
19	159	26	12	8.0	8.0	8.0	9.4	142	455	966	287	560
20	192	24	12	7.8	8.0	8.0	10	126	343	798	280	294
21	213	22	12	7.6	8.0	8.0	11	111	294	525	284	192
22	449	18	55	7.0	8.0	8.0	12	98	294	440	418	148
23	230	17	59	7.0	8.0	8.0	14	123	301	386	1090	374
24	150	16	48	7.0	8.0	8.0	20	180	450	355	1730	402
25	175	16	36	7.0	8.0	8.0	26	138	378	373	722	242
26	142	15	28	7.0	8.0	8.0	30	134	355	391	595	175
27	100	14	27	7.0	8.0	8.0	37	150	315	436	427	119
28	73	14	47	7.0	8.0	8.0	46	136	319	445	422	94
29	61	14	56	7.0	---	8.0	50	146	343	440	520	146
30	98	13	29	7.0	---	8.0	55	161	304	450	427	209
31	114	---	22	7.0	---	46	---	280	---	445	450	---
TOTAL	5557	1625	1009	331.0	240.8	286.0	641.2	3148	11261	17258	22259	9604
MEAN	179	54.2	32.5	10.7	8.60	9.23	21.4	102	375	557	718	320
MAX	449	308	89	29	13	46	55	280	779	1210	2660	716
MIN	61	13	12	7.0	7.0	8.0	7.7	35	267	280	280	84
AC-FT	11020	3220	2000	657	478	567	1270	6240	22340	34230	44150	19050
CFSM	14.8	4.48	2.69	.88	.71	.76	1.77	8.39	31.0	46.0	59.3	26.5
IN.	17.08	5.00	3.10	1.02	.74	.88	1.97	9.68	34.62	53.06	68.42	29.53

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1951 - 1961, BY WATER YEAR (WY)

MEAN	149	47.9	16.1	7.05	3.58	3.37	12.1	85.9	265	428	471	356
MAX	350	101	41.9	14.0	5.64	9.23	21.4	115	375	557	718	543
(WY)	1952	1957	1956	1956	1961	1960	1960	1952	1960	1960	1960	1956
MIN	50.8	18.9	4.71	1.50	1.00	1.50	4.50	44.4	158	310	324	224
(WY)	1956	1951	1961	1951	1951	1951	1954	1954	1951	1951	1953	1958

SUMMARY STATISTICS	FOR 1960 CALENDAR YEAR	FOR 1961 WATER YEAR	WATER YEARS 1951 - 1961
ANNUAL TOTAL	62659.0	73219.0	

ANNUAL MEAN	171		201		146		
HIGHEST ANNUAL MEAN					166		1959
LOWEST ANNUAL MEAN					122		1951
HIGHEST DAILY MEAN	1140	Sep 8	2660	Aug 13	2660	Aug 13	1960
LOWEST DAILY MEAN	5.0	Feb 1	7.0	Jan 22	1.0	Feb 1	1951
ANNUAL SEVEN-DAY MINIMUM	5.0	Feb 1	7.0	Jan 22	1.0	Feb 1	1951
ANNUAL RUNOFF (AC-FT)	124300		145200		105500		
ANNUAL RUNOFF (CFSM)	14.1		16.6		12.0		
ANNUAL RUNOFF (INCHES)	192.64		225.10		163.52		
10 PERCENT EXCEEDS	510		506		431		
50 PERCENT EXCEEDS	74		61		45		
90 PERCENT EXCEEDS	5.0		8.0		3.0		

STATISTICS COMPUTED BY: HRSEITZ DATE: 10/09/1991 AT: 09:50:32

UNITED STATES DEPARTMENT OF THE INTERIOR - GEOLOGICAL SURVEY - ALASKA DISTRICT 06/26/95

STATION NUMBER 15052000 LEMON C NR JUNEAU AK STREAM SOURCE AGENCY USGS
LATITUDE 582330 LONGITUDE 1342515 DRAINAGE AREA 12.10 DATUM 650.00 STATE 02 COUNTY 110

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1961 TO SEPTEMBER 1962
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	412	28	6.0	12	12	3.0	4.0	11	319	258	400	328
2	811	27	6.0	14	12	3.0	4.0	12	109	314	416	200
3	898	27	6.0	15	11	3.0	4.0	15	110	318	374	188
4	550	27	5.0	16	10	3.0	4.0	17	132	294	304	279
5	308	26	5.0	16	10	3.0	5.0	18	141	338	332	625
6	203	21	5.0	16	9.0	3.0	5.0	19	205	400	311	432
7	154	20	5.0	16	8.0	3.0	5.0	21	328	393	258	294
8	141	42	5.0	16	7.0	3.0	6.0	20	228	370	349	683
9	95	29	5.0	15	6.0	3.0	6.0	39	164	363	412	660
10	74	22	5.0	14	6.0	3.0	7.0	22	143	393	363	342
11	64	19	5.0	13	6.0	3.0	8.0	26	145	508	321	191
12	56	40	5.0	12	5.0	3.0	8.0	33	168	440	308	173
13	118	40	4.0	11	5.0	3.0	9.0	44	242	363	332	247
14	226	22	4.0	10	4.0	3.0	10	37	349	335	389	213
15	242	26	4.0	10	4.0	3.0	11	30	328	349	400	182
16	135	63	4.0	9.0	4.0	3.0	12	42	264	318	575	282
17	143	25	4.0	8.0	4.0	3.0	12	58	226	352	530	226
18	154	19	4.0	7.0	4.0	3.0	13	46	200	285	382	377
19	85	16	4.0	6.0	4.0	3.0	13	52	205	374	346	412
20	66	13	4.0	5.0	3.0	3.0	13	56	250	400	396	467
21	56	12	4.0	5.0	3.0	3.0	13	65	276	420	498	396
22	61	11	4.0	5.0	3.0	3.0	13	72	258	710	776	376
23	49	10	4.0	5.0	3.0	3.0	13	86	264	550	975	716
24	42	10	4.0	5.0	3.0	3.0	13	104	321	472	968	940
25	38	9.0	4.0	4.0	3.0	3.0	13	116	440	370	595	1300
26	35	9.0	4.0	4.0	3.0	3.0	12	134	393	325	436	830
27	31	8.0	4.0	4.0	3.0	3.0	11	158	378	370	462	532
28	40	8.0	4.0	5.0	3.0	3.0	10	160	400	428	352	228
29	85	7.0	4.0	6.0	---	3.0	10	122	349	440	285	285
30	59	7.0	5.0	9.0	---	3.0	10	119	285	444	503	208
31	36	---	10	11	---	3.0	---	104	---	440	480	---
TOTAL	5467	603.0	146.0	304.0	158.0	93.0	277.0	1857	7420	12334	13828	12212
MEAN	176	21.4	4.71	9.81	5.64	3.00	9.23	59.9	247	398	446	407
MAX	898	63	10	16	12	3.0	13	198	440	710	975	1300
MIN	31	7.0	4.0	4.0	3.0	3.0	4.0	11	109	258	258	173
AC-FT	10840	1280	290	603	313	184	549	3680	14720	24460	27430	24220
CFSM	14.6	1.77	.39	.81	.47	.25	.76	4.95	20.4	32.9	36.9	33.6
IN.	16.81	1.98	.45	.93	.49	.29	.85	5.71	22.81	37.92	42.51	37.54

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1951 - 1962, BY WATER YEAR (WY)

MEAN	149	53.9	20.7	7.41	4.12	3.99	12.1	95.3	260	427	466	370
MAX	350	120	67.0	14.0	7.96	9.52	21.4	189	375	557	718	543
(WY)	1952	1962	1962	1956	1962	1962	1960	1962	1960	1960	1960	1956
MIN	50.8	18.9	4.71	1.50	1.00	1.50	4.50	44.4	158	310	324	224
(WY)	1956	1951	1961	1951	1951	1951	1954	1954	1951	1951	1953	1958

SUMMARY STATISTICS	FOR 1961 CALENDAR YEAR	FOR 1962 WATER YEAR	WATER YEARS 1951 - 1962
ANNUAL TOTAL	71285.0	54739.0	

ANNUAL MEAN	195			150			150	
HIGHEST ANNUAL MEAN							179	1962
LOWEST ANNUAL MEAN							122	1951
HIGHEST DAILY MEAN	2660	Aug 13		1300	Sep 25		2660	Aug 13 1960
LOWEST DAILY MEAN	4.0	Dec 13		3.0	Feb 20		1.0	Feb 1 1951
ANNUAL SEVEN-DAY MINIMUM	4.0	Dec 13		3.0	Feb 20		1.0	Feb 1 1951
ANNUAL RUNOFF (AC-FT)	141400			108600			108600	
ANNUAL RUNOFF (CFSM)	16.1			12.4			12.4	
ANNUAL RUNOFF (INCHES)	219.16			168.29			168.26	
10 PERCENT EXCEEDS	522			412			436	
50 PERCENT EXCEEDS	40			26			48	
90 PERCENT EXCEEDS	7.0			3.0			3.5	

STATISTICS COMPUTED BY: HRSEITZ DATE: 10/09/1991 AT: 09:51:00

UNITED STATES DEPARTMENT OF THE INTERIOR - GEOLOGICAL SURVEY - ALASKA DISTRICT 06/26/95

STATION NUMBER 15052000 LEMON C NR JUNEAU AK STREAM SOURCE AGENCY USGS
LATITUDE 582330 LONGITUDE 1342515 DRAINAGE AREA 12.10 DATUM 650.00 STATE 02 COUNTY 110

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1962 TO SEPTEMBER 1963
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	186	580	17	18	8.0	11	6.0	50	171	314	526	352
2	134	521	16	17	7.0	11	6.0	60	168	356	467	393
3	110	579	15	16	7.0	12	6.0	70	200	494	440	521
4	104	352	14	15	7.0	12	6.0	80	236	498	605	600
5	106	232	13	15	7.0	13	6.0	95	218	472	432	575
6	135	203	12	13	7.0	13	6.0	120	149	404	338	800
7	119	166	11	15	7.0	14	6.0	150	122	374	360	842
8	76	124	11	15	7.0	15	6.0	200	134	400	615	650
9	62	89	13	14	7.0	16	7.0	250	135	370	555	698
10	51	74	15	13	7.0	16	8.0	150	154	352	404	605
11	47	65	51	12	7.0	14	9.0	150	156	385	454	545
12	44	56	288	11	7.0	13	10	200	160	367	540	660
13	37	51	352	10	7.0	12	12	250	149	352	545	540
14	34	45	250	10	7.0	11	15	300	132	356	458	512
15	202	40	213	10	8.0	10	15	250	139	352	400	426
16	186	38	179	10	8.0	9.0	13	200	256	472	378	291
17	149	33	107	9.0	8.0	8.0	11	200	318	752	332	416
18	119	49	73	9.0	8.0	7.0	9.2	250	285	1040	311	670
19	94	38	61	9.0	8.0	6.0	8.9	300	297	710	304	485
20	82	34	51	9.0	8.0	6.0	10	300	288	449	356	728
21	68	33	43	9.0	8.0	6.0	12	350	270	336	356	600
22	53	30	38	9.0	8.0	6.0	14	400	250	301	285	393
23	44	25	34	9.0	9.0	6.0	15	250	382	264	273	261
24	190	27	32	8.0	9.0	6.0	12	171	363	321	342	393
25	266	28	30	8.0	10	6.0	12	130	279	393	378	440
26	270	24	27	8.0	10	6.0	15	117	226	374	449	367
27	250	21	25	8.0	10	6.0	19	122	233	301	472	250
28	179	19	23	8.0	11	6.0	25	137	215	363	408	244
29	149	19	22	8.0	---	6.0	30	205	226	335	363	625
30	402	18	21	8.0	---	6.0	40	186	273	311	389	891
31	462	---	20	8.0	---	6.0	---	171	---	440	389	---
TOTAL	4410	3612	2077	343.0	223.0	295.0	370.1	5864	6586	13010	12924	15775
MEAN	142	120	67.0	11.1	7.96	9.52	12.3	189	220	420	417	526
MAX	462	580	352	18	11	16	40	400	382	1040	615	891
MIN	34	18	11	8.0	7.0	6.0	6.0	50	122	264	273	244
AC-FT	8750	7160	4120	680	442	585	734	11630	13060	25810	25630	31290
CFSM	11.8	9.95	5.54	.91	.66	.79	1.02	15.6	18.1	34.7	34.5	43.5
IN.	13.56	11.10	6.39	1.05	.69	.91	1.14	18.03	20.25	40.00	39.73	48.50

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1951 - 1963, BY WATER YEAR (WY)

MEAN	153	51.1	20.2	7.63	4.33	3.93	12.2	92.8	264	428	459	357
MAX	350	120	67.0	14.0	7.96	9.52	21.4	189	375	557	718	543
(WY)	1952	1962	1962	1956	1962	1962	1960	1962	1960	1960	1960	1956
MIN	50.8	17.8	4.71	1.50	1.00	1.50	4.50	44.4	158	310	324	205
(WY)	1956	1963	1961	1951	1951	1951	1954	1954	1951	1951	1953	1963

SUMMARY STATISTICS	FOR 1962 CALENDAR YEAR	FOR 1963 WATER YEAR	WATER YEARS 1951 - 1963
ANNUAL TOTAL	98582.0	65489.1	

ANNUAL MEAN	160		179		149		
HIGHEST ANNUAL MEAN					179		1962
LOWEST ANNUAL MEAN					122		1951
HIGHEST DAILY MEAN	1300	Sep 25	1040	Jul 18	2660	Aug 13	1960
LOWEST DAILY MEAN	3.0	Feb 20	6.0	Mar 19	1.0	Feb 1	1951
ANNUAL SEVEN-DAY MINIMUM	3.0	Feb 20	6.0	Mar 19	1.0	Feb 1	1951
ANNUAL RUNOFF (AC-FT)	116200		129900		107700		
ANNUAL RUNOFF (CFSM)	13.3		14.8		12.3		
ANNUAL RUNOFF (INCHES)	180.10		201.34		166.94		
10 PERCENT EXCEEDS	414		464		431		
50 PERCENT EXCEEDS	51		94		45		
90 PERCENT EXCEEDS	3.0		7.6		4.0		

STATISTICS COMPUTED BY: HRSEITZ DATE: 10/09/1991 AT: 09:51:32

UNITED STATES DEPARTMENT OF THE INTERIOR - GEOLOGICAL SURVEY - ALASKA DISTRICT 06/26/95

STATION NUMBER 15052000 LEMON C NR JUNEAU AK STREAM SOURCE AGENCY USGS
LATITUDE 582330 LONGITUDE 1342515 DRAINAGE AREA 12.10 DATUM 650.00 STATE 02 COUNTY 110

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1963 TO SEPTEMBER 1964
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	630	45	15	14	5.0	7.0	10	9.0	393	360	352	250
2	432	49	20	17	5.0	6.0	14	12	352	396	314	236
3	273	36	25	18	5.0	6.0	18	12	321	645	311	218
4	168	31	30	19	4.0	6.0	18	11	314	600	297	198
5	128	29	25	16	4.0	5.0	13	13	288	590	328	171
6	101	26	23	15	4.0	5.0	12	16	244	458	346	179
7	98	23	21	14	4.0	5.0	16	58	250	530	308	171
8	191	23	20	13	4.0	5.0	22	51	297	454	304	160
9	213	23	19	12	4.0	4.0	24	37	335	378	311	160
10	233	22	17	12	4.0	4.0	20	25	332	349	374	143
11	332	19	16	11	4.0	4.0	16	22	279	412	490	137
12	311	18	15	11	4.0	4.0	14	21	261	393	480	132
13	219	17	14	10	4.0	4.0	12	22	314	349	396	191
14	198	16	13	10	4.0	3.0	11	22	321	385	420	253
15	570	15	13	9.0	4.0	3.0	9.6	26	304	530	462	288
16	545	14	12	9.0	5.0	3.0	9.2	29	294	490	440	284
17	349	13	11	9.0	5.0	3.0	9.0	27	291	420	328	226
18	264	12	10	9.0	6.0	3.0	12	36	276	370	276	210
19	177	12	10	8.0	7.0	3.0	13	41	291	335	382	229
20	171	11	9.0	8.0	8.0	3.0	11	42	270	321	560	191
21	139	10	9.0	7.0	9.0	3.0	10	36	282	338	458	242
22	134	10	9.0	7.0	10	3.0	10	40	270	321	328	314
23	132	9.0	8.0	7.0	11	2.0	11	35	239	444	270	258
24	86	9.0	8.0	6.0	10	2.0	18	35	228	508	435	213
25	78	8.0	8.0	6.0	9.0	2.0	13	44	342	472	530	156
26	64	8.0	8.0	6.0	9.0	2.0	11	53	396	363	480	184
27	61	8.0	8.0	6.0	8.0	2.0	10	82	291	346	426	228
28	54	8.0	8.0	6.0	8.0	3.0	9.6	138	244	619	363	160
29	50	9.0	9.0	5.0	7.0	4.0	9.0	282	363	570	363	203
30	43	11	10	5.0	---	5.0	8.0	356	428	444	264	162
31	54	---	12	5.0	---	7.0	---	420	---	382	233	---
TOTAL	6497	535.0	435.0	310.0	174.0	121.0	393.4	2055.0	9110	13572	11631	6148
MEAN	210	17.8	14.0	10.0	6.00	3.90	13.1	66.3	304	438	375	205
MAX	630	45	30	19	11	7.0	24	420	428	645	560	314
MIN	43	8.0	8.0	5.0	4.0	2.0	8.0	9.0	228	321	233	132
AC-FT	12890	1060	863	615	345	240	780	4080	18070	26920	23070	12190
CFSM	17.3	1.47	1.16	.83	.50	.32	1.08	5.48	25.1	36.2	31.0	16.9
IN.	19.97	1.64	1.34	.95	.53	.37	1.21	6.32	28.01	41.73	35.76	18.90

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1951 - 1964, BY WATER YEAR (WY)

MEAN	157	50.6	20.6	9.02	4.33	4.08	12.6	89.6	259	425	454	359
MAX	350	120	67.0	25.8	7.96	9.52	21.4	189	375	557	718	543
(WY)	1952	1962	1962	1964	1962	1962	1960	1962	1960	1960	1960	1956
MIN	50.8	17.8	4.71	1.50	1.00	1.50	4.50	44.4	158	310	324	205
(WY)	1956	1963	1961	1951	1951	1951	1954	1954	1951	1951	1953	1963

SUMMARY STATISTICS	FOR 1963 CALENDAR YEAR	FOR 1964 WATER YEAR	WATER YEARS 1951 - 1964
ANNUAL TOTAL	62857.1	50981.4	

ANNUAL MEAN	172		139		149		
HIGHEST ANNUAL MEAN					179		1962
LOWEST ANNUAL MEAN					122		1951
HIGHEST DAILY MEAN	1040	Jul 18	645	Jul 3	2660	Aug 13	1960
LOWEST DAILY MEAN	6.0	Mar 19	2.0	Mar 23	1.0	Feb 1	1951
ANNUAL SEVEN-DAY MINIMUM	6.0	Mar 19	2.3	Mar 21	1.0	Feb 1	1951
ANNUAL RUNOFF (AC-FT)	124700		101100		107700		
ANNUAL RUNOFF (CFSM)	14.2		11.5		12.3		
ANNUAL RUNOFF (INCHES)	193.25		156.74		166.94		
10 PERCENT EXCEEDS	462		394		428		
50 PERCENT EXCEEDS	50		24		45		
90 PERCENT EXCEEDS	7.6		5.0		4.0		

STATISTICS COMPUTED BY: HRSEITZ DATE: 10/09/1991 AT: 09:52:04

UNITED STATES DEPARTMENT OF THE INTERIOR - GEOLOGICAL SURVEY - ALASKA DISTRICT 06/26/95

STATION NUMBER 15052000 LEMON C NR JUNEAU AK STREAM SOURCE AGENCY USGS
LATITUDE 582330 LONGITUDE 1342515 DRAINAGE AREA 12.10 DATUM 650.00 STATE 02 COUNTY 110

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1964 TO SEPTEMBER 1965
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	114	51	16	13	14	5.5	5.0	27	185	348	416	555
2	106	47	15	13	13	6.0	5.0	40	205	404	370	505
3	120	44	15	13	12	6.0	5.0	29	141	464	334	520
4	143	40	20	12	11	6.0	6.0	26	172	560	303	432
5	188	60	40	12	10	6.0	7.0	20	192	476	320	362
6	230	46	80	12	9.0	6.0	6.0	21	129	373	334	472
7	236	37	100	12	8.5	6.0	6.0	25	125	424	352	565
8	331	37	60	12	8.0	6.0	6.0	22	163	480	380	436
9	432	39	45	12	7.5	6.5	6.0	17	236	460	373	348
10	275	33	35	12	7.0	7.0	7.0	16	198	432	388	289
11	242	30	30	12	6.5	6.5	8.0	17	266	428	460	248
12	416	27	26	12	6.0	6.0	9.0	16	198	416	396	227
13	384	26	23	11	6.0	5.0	8.0	16	143	432	282	205
14	266	29	22	15	5.5	6.0	9.0	16	143	468	227	175
15	175	113	20	17	5.5	6.0	10	18	168	392	310	151
16	151	71	20	20	5.5	6.0	19	25	257	328	384	202
17	129	64	19	25	5.0	6.0	17	28	266	278	565	257
18	260	63	19	50	5.0	6.0	15	27	188	248	525	392
19	452	72	18	100	5.0	6.0	13	33	185	239	535	515
20	314	65	17	70	5.0	6.0	12	42	182	248	460	917
21	242	63	17	60	5.0	6.0	12	51	141	266	356	620
22	366	45	16	50	5.0	6.0	18	50	127	356	376	530
23	208	36	16	43	5.0	6.0	16	53	175	352	370	444
24	151	31	15	36	5.0	6.0	20	57	190	488	342	540
25	118	27	15	31	5.0	6.0	38	91	159	366	296	338
26	100	24	15	28	5.0	6.0	92	112	151	286	224	239
27	91	21	14	24	5.0	6.0	56	120	151	356	198	218
28	81	19	14	21	5.0	5.5	50	147	180	392	195	266
29	67	17	14	18	---	5.5	33	137	185	388	266	185
30	61	16	14	16	---	5.0	29	124	239	396	819	165
31	54	---	14	15	---	5.0	---	161	---	396	668	---
TOTAL	6483	1293	804	799	195.0	184.5	543.0	1585	5440	11940	11824	11318
MEAN	209	43.1	25.9	25.8	6.96	5.95	18.1	51.1	181	385	381	377
MAX	452	113	100	100	14	7.0	92	161	266	560	819	917
MIN	54	16	14	12	5.0	5.0	5.0	16	125	279	195	151
AC-FT	12860	2560	1590	1580	387	366	1080	3140	10790	23680	23450	22450
CFSM	17.3	3.56	2.14	2.13	.58	.49	1.50	4.23	15.0	31.8	31.5	31.2
IN.	19.93	3.98	2.47	2.46	.60	.57	1.67	4.87	16.72	36.71	36.35	34.80

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1951 - 1965, BY WATER YEAR (WY)

MEAN	160	49.3	20.0	8.59	4.09	4.37	12.8	87.0	255	422	455	360
MAX	350	120	67.0	25.8	7.96	9.52	21.4	189	375	557	718	543
(WY)	1952	1962	1962	1964	1962	1962	1960	1962	1960	1960	1960	1956
MIN	50.8	17.8	4.71	1.50	1.00	1.50	4.50	44.4	158	310	324	205
(WY)	1956	1963	1961	1951	1951	1951	1954	1954	1951	1951	1953	1963

SUMMARY STATISTICS	FOR 1964 CALENDAR YEAR	FOR 1965 WATER YEAR	WATER YEARS 1951 - 1965
ANNUAL TOTAL	52094.4	52408.5	

ANNUAL MEAN	142		144		149		
HIGHEST ANNUAL MEAN					179		1962
LOWEST ANNUAL MEAN					122		1951
HIGHEST DAILY MEAN	645	Jul 3	917	Sep 20	2660	Aug 13	1960
LOWEST DAILY MEAN	2.0	Mar 23	5.0	Feb 17	.78	Feb 13	1965
ANNUAL SEVEN-DAY MINIMUM	2.3	Mar 21	5.6	Feb 17	.73	Feb 13	1965
ANNUAL RUNOFF (AC-FT)	103300		104000		107800		
ANNUAL RUNOFF (CFSM)	11.8		11.9		12.3		
ANNUAL RUNOFF (INCHES)	160.16		161.12		167.07		
10 PERCENT EXCEEDS	393		409		431		
50 PERCENT EXCEEDS	40		50		45		
90 PERCENT EXCEEDS	5.0		6.0		4.0		

STATISTICS COMPUTED BY: HRSEITZ DATE: 10/09/1991 AT: 09:52:32

UNITED STATES DEPARTMENT OF THE INTERIOR - GEOLOGICAL SURVEY - ALASKA DISTRICT 06/26/95

STATION NUMBER 15052000 LEMON C NR JUNEAU AK STREAM SOURCE AGENCY USGS
LATITUDE 582330 LONGITUDE 1342515 DRAINAGE AREA 12.10 DATUM 650.00 STATE 02 COUNTY 110

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1965 TO SEPTEMBER 1966
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	139	135	23	3.5	1.6	1.3	20	23	71	230	656	480
2	122	112	21	3.1	1.5	1.2	16	54	108	254	656	359
3	303	92	19	2.9	1.3	1.2	15	52	205	233	535	310
4	359	80	17	2.7	1.2	1.1	15	39	251	210	448	752
5	310	61	15	2.4	1.1	1.1	17	63	239	200	412	492
6	388	48	14	2.3	1.0	1.1	23	88	251	210	404	345
7	400	40	13	2.2	1.0	1.1	24	119	272	221	424	275
8	248	35	12	2.1	1.0	1.1	25	118	292	233	460	208
9	159	32	12	2.1	1.1	1.1	19	77	263	266	540	200
10	119	28	11	2.0	1.1	1.1	16	57	224	260	428	159
11	202	25	11	2.0	.90	1.1	14	82	208	266	412	161
12	122	23	11	2.0	.80	1.1	12	76	202	251	362	149
13	101	21	12	2.3	.70	1.2	13	61	178	260	362	300
14	107	19	13	2.6	.70	1.2	9.5	57	185	310	570	428
15	77	18	14	3.2	.74	1.2	8.5	45	198	273	496	420
16	72	17	15	4.0	.80	1.1	8.0	44	370	472	448	432
17	71	16	14	5.0	.74	1.1	7.7	46	404	448	535	342
18	57	15	14	4.8	.70	1.1	8.6	53	345	436	456	306
19	50	14	13	4.6	.74	1.1	15	51	334	440	396	510
20	52	13	13	4.6	.80	1.1	14	45	257	424	505	328
21	78	12	12	4.4	.70	1.1	17	37	230	420	452	352
22	244	12	11	4.1	2.5	1.2	21	42	202	416	359	221
23	412	11	10	3.8	3.0	1.2	16	37	180	480	877	246
24	224	11	9.0	3.4	10	1.4	16	30	168	535	945	352
25	137	10	8.0	3.1	5.4	2.5	14	27	165	540	540	368
26	200	10	7.0	2.8	3.0	6.0	13	27	178	464	370	692
27	464	10	6.0	2.5	2.0	15	12	30	192	535	352	560
28	416	12	5.4	2.3	1.5	50	13	27	205	668	303	468
29	260	15	4.7	2.0	---	60	16	31	200	620	263	373
30	202	18	4.3	1.8	---	56	17	39	192	565	296	636
31	198	---	3.8	1.7	---	35	---	56	---	605	452	---
TOTAL	6293	965	368.2	92.3	53.62	252.1	453.3	1633	6760	11845	14714	11266
MEAN	203	32.2	11.9	2.98	1.91	8.13	15.1	52.7	225	382	475	376
MAX	464	135	23	5.0	10	60	25	119	404	668	945	752
MIN	50	10	3.8	1.7	.70	1.1	7.7	23	71	200	263	149
AC-FT	12480	1910	730	183	106	500	899	3240	13410	23490	29190	22350
CFSM	16.8	2.66	.98	.25	.16	.67	1.25	4.35	18.6	31.6	39.2	31.0
IN.	19.35	2.97	1.13	.28	.16	.78	1.39	5.02	20.78	36.42	45.24	34.64

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1951 - 1966, BY WATER YEAR (WY)

MEAN	159	48.1	19.3	8.53	4.26	4.39	12.7	86.0	260	419	459	369
MAX	350	120	67.0	25.8	7.96	9.52	21.4	189	375	557	718	543
(WY)	1952	1962	1962	1964	1962	1962	1960	1962	1960	1960	1960	1956
MIN	50.8	17.8	4.71	1.50	1.00	1.50	4.50	44.4	158	310	324	205
(WY)	1956	1963	1961	1951	1951	1951	1954	1954	1951	1951	1953	1963

SUMMARY STATISTICS	FOR 1965 CALENDAR YEAR	FOR 1966 WATER YEAR	WATER YEARS 1951 - 1966
ANNUAL TOTAL	51454.7	54695.52	

ANNUAL MEAN	141		150		150		
HIGHEST ANNUAL MEAN					179		1962
LOWEST ANNUAL MEAN					122		1951
HIGHEST DAILY MEAN	917	Sep 20	945	Aug 24	2660	Aug 13	1960
LOWEST DAILY MEAN	3.8	Dec 31	.70	Feb 13	.70	Feb 13	1965
ANNUAL SEVEN-DAY MINIMUM	5.0	Feb 17	.73	Feb 13	.73	Feb 13	1965
ANNUAL RUNOFF (AC-FT)	102100		108500		108900		
ANNUAL RUNOFF (CFSM)	11.7		12.4		12.4		
ANNUAL RUNOFF (INCHES)	158.19		168.15		168.83		
10 PERCENT EXCEEDS	407		448		432		
50 PERCENT EXCEEDS	38		40		44		
90 PERCENT EXCEEDS	6.0		1.2		4.0		

STATISTICS COMPUTED BY: HRSEITZ DATE: 10/09/1991 AT: 09:53:04

UNITED STATES DEPARTMENT OF THE INTERIOR - GEOLOGICAL SURVEY - ALASKA DISTRICT 06/26/95

STATION NUMBER 15052000 LEMON C NR JUNEAU AK STREAM SOURCE AGENCY USGS
LATITUDE 582330 LONGITUDE 1342515 DRAINAGE AREA 12.10 DATUM 650.00 STATE 02 COUNTY 110

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1966 TO SEPTEMBER 1967
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	352	106	11	10	5.7	6.0	3.1	38	161	380	448	550
2	242	65	10	10	6.0	6.3	3.2	41	159	356	540	854
3	345	78	9.5	9.0	6.3	6.6	3.5	43	163	331	448	764
4	698	145	9.0	8.0	6.5	6.8	3.7	39	163	366	392	476
5	448	69	8.5	8.0	6.7	7.0	4.0	41	172	370	352	384
6	320	46	8.2	9.0	7.0	7.0	4.5	33	155	328	334	370
7	289	35	8.0	10	7.0	7.0	5.0	30	145	408	359	484
8	230	31	8.0	10	7.0	6.7	5.5	35	163	338	635	630
9	145	29	8.0	11	7.0	6.4	6.0	45	190	285	791	610
10	113	24	8.2	10	7.0	6.0	6.5	68	198	266	640	400
11	84	22	8.5	10	7.0	5.7	6.8	66	208	320	605	282
12	68	20	9.0	9.5	6.7	5.4	7.0	63	230	359	464	480
13	65	18	9.5	9.0	6.3	5.0	7.2	61	272	359	468	562
14	63	16	10	8.8	6.0	4.7	7.3	68	324	345	505	1030
15	68	15	11	8.5	5.7	4.5	7.4	96	436	362	456	1080
16	61	14	12	8.2	5.4	4.2	7.5	82	373	362	359	698
17	52	13	12	7.8	5.3	4.0	7.6	80	420	314	356	662
18	64	12	12	7.3	5.2	3.8	7.7	76	452	286	388	996
19	50	11	12	7.0	5.1	3.5	7.8	58	432	260	625	777
20	37	10	12	6.5	5.0	3.3	8.0	71	432	342	746	384
21	36	10	12	6.0	5.0	3.2	9.2	102	404	432	752	251
22	30	12	11	5.6	5.0	3.1	9.5	76	384	408	550	215
23	29	15	11	5.3	5.0	3.0	10	67	388	448	408	370
24	26	14	11	5.0	5.2	3.0	11	66	428	412	338	236
25	24	13	10	5.0	5.3	3.0	14	68	400	356	595	245
26	22	12	10	5.0	5.4	3.0	25	71	376	356	662	334
27	21	12	10	5.0	5.6	3.0	28	92	472	515	610	362
28	19	12	10	5.0	5.8	3.0	32	125	570	580	480	227
29	27	12	10	5.0	---	3.0	33	135	510	468	535	165
30	33	12	10	5.2	---	3.0	35	163	448	356	540	145
31	30	---	10	5.5	---	3.0	---	149	---	396	590	---
TOTAL	4891	903	311.4	235.2	166.2	143.2	326.0	2248	9628	11465	15971	15123
MEAN	132	30.1	10.0	7.59	5.94	4.62	10.9	72.5	321	370	515	504
MAX	698	145	12	11	7.0	7.0	35	163	570	580	791	1080
MIN	19	10	8.0	5.0	5.0	3.0	3.1	30	145	260	334	145
AC-FT	8110	1790	618	467	330	284	647	4460	19100	22740	31680	30000
CFSM	10.9	2.49	.83	.63	.49	.38	.90	5.99	26.5	30.6	42.6	41.7
IN.	12.58	2.78	.96	.72	.51	.44	1.00	6.91	29.60	35.25	49.10	46.49

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1951 - 1967, BY WATER YEAR (WY)

MEAN	155	48.6	19.0	8.47	5.06	5.58	12.7	87.9	260	420	453	371
MAX	350	120	67.0	25.8	13.6	23.5	21.4	189	375	557	718	543
(WY)	1952	1962	1962	1964	1967	1967	1960	1962	1960	1960	1960	1956
MIN	50.8	17.8	4.71	1.50	1.00	1.50	4.50	44.4	158	310	328	205
(WY)	1956	1963	1961	1951	1951	1951	1954	1954	1951	1951	1953	1963

SUMMARY STATISTICS	FOR 1966 CALENDAR YEAR	FOR 1967 WATER YEAR	WATER YEARS 1951 - 1967
ANNUAL TOTAL	52374.72	60611.0	

ANNUAL MEAN	143		166		150		
HIGHEST ANNUAL MEAN					179		1962
LOWEST ANNUAL MEAN					122		1951
HIGHEST DAILY MEAN	945	Aug 24	1080	Sep 15	2660	Aug 13	1960
LOWEST DAILY MEAN	.70	Feb 13	3.0	Mar 23	.70	Feb 13	1965
ANNUAL SEVEN-DAY MINIMUM	.73	Feb 13	3.0	Mar 23	.73	Feb 13	1965
ANNUAL RUNOFF (AC-FT)	103900		120200		108900		
ANNUAL RUNOFF (CFSM)	11.9		13.7		12.4		
ANNUAL RUNOFF (INCHES)	161.02		186.34		168.77		
10 PERCENT EXCEEDS	448		478		432		
50 PERCENT EXCEEDS	30		33		45		
90 PERCENT EXCEEDS	1.2		5.1		4.0		

STATISTICS COMPUTED BY: HRSEITZ DATE: 10/09/1991 AT: 09:53:32

UNITED STATES DEPARTMENT OF THE INTERIOR - GEOLOGICAL SURVEY - ALASKA DISTRICT 06/26/95

STATION NUMBER 15052000 LEMON C NR JUNEAU AK STREAM SOURCE AGENCY USGS
LATITUDE 582330 LONGITUDE 1342515 DRAINAGE AREA 12.10 DATUM 650.00 STATE 02 COUNTY 110

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	155	29	25	11	5.0	45	12	16	169	376	516	527
2	106	25	20	10	4.5	40	11	17	217	386	343	516
3	73	23	25	9.5	4.5	35	11	15	285	446	315	366
4	56	21	20	9.0	4.0	40	11	14	215	528	322	582
5	55	19	16	8.0	5.0	45	14	16	195	600	376	1020
6	49	39	15	7.0	8.0	35	12	21	188	551	393	1110
7	43	46	13	6.5	15	30	11	22	184	502	318	839
8	51	60	14	6.0	25	29	17	31	199	623	334	703
9	292	36	15	5.5	22	25	18	37	239	512	338	570
10	294	25	14	5.5	20	22	12	45	308	446	352	589
11	152	23	12	5.0	17	21	13	56	257	419	226	420
12	146	20	33	5.0	15	18	9.8	59	212	378	312	271
13	140	19	14	5.0	14	16	10	77	259	353	308	208
14	162	47	23	5.0	13	15	9.8	69	260	337	330	329
15	222	125	20	5.0	11	14	10	69	260	326	293	250
16	133	101	15	4.5	10	13	10	82	262	310	312	323
17	92	62	13	4.5	9.5	12	13	78	259	288	317	265
18	80	45	12	4.5	9.0	12	12	142	268	288	295	167
19	69	54	12	4.5	8.5	13	12	259	278	292	267	137
20	76	52	11	4.5	8.0	31	12	328	278	314	264	141
21	56	200	10	4.5	8.0	47	11	286	286	339	384	128
22	55	195	9.5	5.0	9.0	32	12	248	230	367	456	107
23	49	105	9.0	20	12	23	15	224	216	374	383	116
24	51	65	9.0	17	11	18	16	205	284	367	300	348
25	42	47	9.0	15	12	16	18	194	358	362	241	280
26	41	42	9.0	12	15	14	17	187	385	452	198	144
27	52	38	10	10	20	14	16	166	307	512	182	421
28	57	35	15	9.0	30	13	13	159	307	764	234	695
29	47	30	10	8.0	50	13	18	168	353	497	561	365
30	48	28	11	7.0	---	13	18	156	387	446	542	248
31	38	---	12	6.0	---	13	---	141	---	660	801	---
TOTAL	2982	1656	435.5	239.0	395.0	727	394.6	3583	7905	13415	10893	12177
MEAN	96.2	55.2	14.0	7.71	13.6	23.5	13.2	116	263	433	351	406
MAX	294	200	25	20	50	47	18	328	387	764	801	1110
MIN	38	19	9.0	4.5	4.0	12	9.8	14	169	288	182	107
AC-FT	5910	3288	864	474	783	1440	783	7110	15680	26610	21610	24150
CFSM	7.95	4.56	1.16	.64	1.13	1.94	1.09	9.55	21.8	35.8	29.0	33.5
IN.	9.17	5.09	1.34	.73	1.21	2.24	1.21	11.02	24.30	41.24	33.49	37.44

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1951 - 1968, BY WATER YEAR (WY)

MEAN	150	46.8	18.2	8.13	5.05	5.65	13.3	69.1	267	423	447	367
MAX	350	120	67.0	25.8	13.6	23.5	23.4	189	382	557	716	543
(WY)	1952	1962	1962	1964	1967	1967	1968	1962	1968	1960	1960	1956
MIN	50.8	17.5	4.71	1.50	1.00	1.50	4.50	44.4	158	310	324	205
(WY)	1956	1968	1961	1951	1951	1951	1954	1954	1951	1951	1953	1963

SUMMARY STATISTICS	FOR 1967 CALENDAR YEAR	FOR 1968 WATER YEAR	WATER YEARS 1951 - 1968
ANNUAL TOTAL	60379.1	54802.1	

ANNUAL MEAN	165		150		150		
HIGHEST ANNUAL MEAN					179		1962
LOWEST ANNUAL MEAN					122		1951
HIGHEST DAILY MEAN	1080	Sep 15	1110	Sep 6	2660	Aug 13	1960
LOWEST DAILY MEAN	3.0	Mar 23	4.0	Feb 4	.70	Feb 13	1965
ANNUAL SEVEN-DAY MINIMUM	3.0	Mar 23	4.6	Jan 15	.73	Feb 13	1965
ANNUAL RUNOFF (AC-FT)	119800		108700		108900		
ANNUAL RUNOFF (CFSM)	13.7		12.4		12.4		
ANNUAL RUNOFF (INCHES)	185.63		168.48		168.77		
10 PERCENT EXCEEDS	474		384		431		
50 PERCENT EXCEEDS	47		47		42		
90 PERCENT EXCEEDS	5.1		9.0		4.0		

STATISTICS COMPUTED BY: HRSEITZ DATE: 10/09/1991 AT: 09:54:04

UNITED STATES DEPARTMENT OF THE INTERIOR - GEOLOGICAL SURVEY - ALASKA DISTRICT 06/26/95

STATION NUMBER 15052000 LEMON C NR JUNEAU AK STREAM SOURCE AGENCY USGS
LATITUDE 582330 LONGITUDE 1342515 DRAINAGE AREA 12.10 DATUM 650.00 STATE 02 COUNTY 110

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	180	26	13	3.0	2.5	2.8	30	19	414	294	425	291
2	158	26	11	3.0	2.5	2.8	25	23	331	282	354	370
3	160	22	11	3.0	2.5	2.8	25	24	361	284	318	305
4	172	18	10	2.8	2.5	2.8	25	19	371	271	300	233
5	105	17	9.5	2.7	2.5	2.9	25	23	319	255	291	218
6	77	16	9.0	2.6	2.5	3.0	27	16	288	287	417	229
7	62	15	8.5	2.5	2.5	3.0	30	32	312	368	556	361
8	56	32	8.0	2.5	2.5	3.0	32	35	328	643	565	332
9	48	28	7.5	2.5	2.6	3.0	30	33	334	1140	570	643
10	42	20	7.0	2.5	2.7	3.0	28	56	329	860	506	910
11	37	18	6.5	2.5	2.9	3.0	24	57	331	732	479	704
12	34	15	6.0	2.5	3.0	3.0	19	39	360	725	312	702
13	31	14	5.5	2.5	3.0	3.0	15	32	405	758	570	367
14	30	13	5.2	2.5	3.0	3.0	13	34	463	538	409	256
15	25	11	5.0	2.5	3.0	3.0	17	35	528	448	303	220
16	35	10	5.0	2.5	3.0	3.0	37	47	569	368	243	181
17	56	10	5.0	2.5	2.9	3.0	32	55	547	332	329	235
18	37	11	5.0	2.5	2.9	3.0	23	74	500	346	421	246
19	33	17	5.0	2.5	2.8	3.0	18	108	444	360	315	211
20	40	13	5.0	2.5	2.8	3.0	15	116	420	382	270	172
21	34	11	4.7	2.5	2.8	3.0	14	135	380	408	267	236
22	47	11	4.4	2.5	2.8	3.0	14	205	345	417	371	270
23	51	12	4.2	2.5	2.8	3.0	13	244	363	443	279	243
24	68	11	4.0	2.5	2.8	3.5	24	318	351	371	261	218
25	40	10	3.8	2.5	2.8	5.0	24	303	350	484	222	184
26	32	19	3.6	2.5	2.8	10	32	233	358	671	217	155
27	28	16	3.5	2.5	2.8	20	37	217	353	510	236	141
28	25	45	3.4	2.5	2.8	25	20	185	345	350	194	151
29	22	22	3.3	2.5	---	25	17	180	335	318	214	222
30	20	15	3.2	2.5	---	22	17	186	322	430	267	278
31	22	---	3.1	2.5	---	30	---	265	---	538	323	---
TOTAL	1808	524	188.9	79.6	77.0	208.6	702	3348	11456	14624	10804	9284
MEAN	58.3	17.5	6.09	2.57	2.75	6.73	23.4	108	382	472	349	309
MAX	180	45	13	3.0	3.0	30	37	318	569	1140	570	910
MIN	20	10	3.1	2.5	2.5	2.8	13	16	288	255	194	141
AC-FT	3590	1040	375	158	153	414	1390	6640	22720	29010	21430	18410
CFSM	4.82	1.44	.50	.21	.23	.56	1.93	8.93	31.6	39.0	28.8	25.6
IN.	5.56	1.61	.58	.24	.24	.64	2.16	10.29	35.22	44.96	33.22	28.54

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1951 - 1969, BY WATER YEAR (WY)

MEAN	150	51.1	19.1	8.00	5.54	5.95	13.3	87.5	267	421	447	368
MAX	350	129	67.0	25.8	13.6	23.5	23.4	189	382	557	718	543
(WY)	1952	1969	1962	1964	1967	1967	1968	1962	1968	1960	1960	1956
MIN	50.8	17.5	4.71	1.50	1.00	1.50	4.50	44.4	158	310	324	205
(WY)	1956	1968	1961	1951	1951	1951	1954	1954	1951	1951	1953	1963

SUMMARY STATISTICS	FOR 1968 CALENDAR YEAR	FOR 1969 WATER YEAR	WATER YEARS 1951 - 1969
ANNUAL TOTAL	52249.5	53104.1	

ANNUAL MEAN	143		145		151		
HIGHEST ANNUAL MEAN					179		1962
LOWEST ANNUAL MEAN					122		1951
HIGHEST DAILY MEAN	1110	Sep 6	1140	Jul 9	2660	Aug 13	1960
LOWEST DAILY MEAN	3.1	Dec 31	2.5	Jan 7	.70	Feb 13	1965
ANNUAL SEVEN-DAY MINIMUM	3.4	Dec 25	2.5	Jan 7	.73	Feb 13	1965
ANNUAL RUNOFF (AC-FT)	103600		105300		109400		
ANNUAL RUNOFF (CFSM)	11.8		12.0		12.5		
ANNUAL RUNOFF (INCHES)	160.63		163.26		169.54		
10 PERCENT EXCEEDS	384		411		432		
50 PERCENT EXCEEDS	30		30		43		
90 PERCENT EXCEEDS	5.5		2.7		4.0		

STATISTICS COMPUTED BY: HRSEITZ DATE: 10/09/1991 AT: 09:54:36

UNITED STATES DEPARTMENT OF THE INTERIOR - GEOLOGICAL SURVEY - ALASKA DISTRICT 06/26/95

STATION NUMBER 15052000 LEMON C NR JUNEAU AK STREAM SOURCE AGENCY USGS
LATITUDE 582330 LONGITUDE 1342515 DRAINAGE AREA 12.10 DATUM 650.00 STATE 02 COUNTY 110

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1969 TO SEPTEMBER 1970
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	174	759	73	16	5.0	9.8	13	21	150	290	449	515
2	139	814	69	13	6.0	10	10	18	177	328	480	608
3	199	341	77	11	8.0	8.9	10	13	406	392	370	416
4	455	198	70	10	6.5	9.8	11	25	475	620	370	452
5	426	144	48	8.0	6.0	7.9	11	33	304	490	378	579
6	448	111	52	7.0	5.0	7.5	12	20	263	424	427	442
7	478	91	100	6.5	4.5	7.4	9.2	21	267	553	457	309
8	390	79	95	6.0	4.0	7.5	8.5	28	214	539	640	271
9	278	76	60	5.5	4.0	8.0	8.9	22	188	377	546	240
10	210	69	46	5.0	4.0	7.5	9.3	24	186	310	608	162
11	166	59	35	4.5	3.5	7.1	9.0	75	201	296	527	129
12	174	49	30	4.0	3.5	6.7	8.3	95	205	290	443	109
13	113	44	25	3.5	3.0	7.3	7.7	84	283	260	391	99
14	101	50	22	3.3	3.0	9.0	8.3	76	299	426	548	97
15	164	42	19	3.1	3.0	14	9.6	78	243	424	572	144
16	143	35	18	3.0	3.0	9.3	11	69	201	337	478	383
17	84	30	18	2.8	5.0	6.7	15	68	195	294	364	269
18	71	26	17	2.8	10	18	16	54	201	400	350	269
19	65	22	15	2.8	40	11	15	50	198	353	698	394
20	52	20	13	3.0	30	9.2	13	55	236	320	517	350
21	52	20	12	3.5	24	9.0	14	79	298	300	557	322
22	40	23	11	4.0	28	8.8	17	115	345	292	550	257
23	33	25	10	4.5	25	9.8	12	98	309	333	476	173
24	28	25	10	5.0	35	10	11	104	342	336	346	118
25	27	26	10	4.0	20	11	11	94	350	319	278	157
26	24	42	10	4.0	13	16	13	72	329	410	263	394
27	23	26	11	5.0	10	27	12	67	270	601	264	596
28	22	282	15	6.0	9.6	19	16	66	243	507	264	760
29	37	210	13	7.0	---	17	20	70	255	415	323	1420
30	81	124	12	10	---	14	22	78	268	403	495	949
31	266	---	14	7.0	---	19	---	129	---	438	462	---
TOTAL	4954	3862	1021	180.8	321.6	344.2	363.8	1899	7911	12177	13890	11183
MEAN	160	129	32.9	5.83	11.5	11.1	12.1	61.3	264	393	448	373
MAX	478	814	100	16	40	27	22	129	475	620	698	1420
MIN	22	20	10	2.8	3.0	6.7	7.7	13	150	260	263	97
AC-FT	9830	7660	2030	359	638	683	722	3770	15690	24150	27550	22190
CFSM	13.2	10.6	2.72	.48	.95	.92	1.00	5.06	21.8	32.5	37.0	30.8
IN.	15.23	11.87	3.14	.56	.99	1.06	1.12	5.84	24.32	37.44	42.70	34.38

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1951 - 1970, BY WATER YEAR (WY)

MEAN	151	51.6	18.4	8.09	5.47	5.73	13.0	85.1	266	421	451	365
MAX	350	129	67.0	25.8	13.6	23.5	23.4	189	382	557	718	543
(WY)	1952	1969	1962	1964	1967	1967	1968	1962	1968	1966	1960	1956
MIN	50.8	17.5	4.71	1.50	1.00	1.50	4.50	42.6	158	310	324	205
(WY)	1956	1968	1961	1951	1951	1951	1954	1970	1951	1951	1953	1963

SUMMARY STATISTICS	FOR 1969 CALENDAR YEAR	FOR 1970 WATER YEAR	WATER YEARS 1951 - 1970
ANNUAL TOTAL	60420.2	58107.4	

ANNUAL MEAN	166			159			151	
HIGHEST ANNUAL MEAN							179	1962
LOWEST ANNUAL MEAN							122	1951
HIGHEST DAILY MEAN	1140	Jul	9	1420	Sep	29	2660	Aug 13 1960
LOWEST DAILY MEAN	2.5	Jan	7	2.8	Jan	17	.70	Feb 13 1965
ANNUAL SEVEN-DAY MINIMUM	2.5	Jan	7	3.0	Jan	14	.73	Feb 13 1965
ANNUAL RUNOFF (AC-FT)	119800			115300			109300	
ANNUAL RUNOFF (CFSM)	13.7			13.2			12.5	
ANNUAL RUNOFF (INCHES)	185.75			178.64			169.46	
10 PERCENT EXCEEDS	425			448			432	
50 PERCENT EXCEEDS	52			55			43	
90 PERCENT EXCEEDS	2.7			6.3			3.6	

STATISTICS COMPUTED BY: HRSEITZ DATE: 10/09/1991 AT: 09:55:04

UNITED STATES DEPARTMENT OF THE INTERIOR - GEOLOGICAL SURVEY - ALASKA DISTRICT 06/26/95

STATION NUMBER 15052000 LEMON C NR JUNEAU AK STREAM SOURCE AGENCY USGS
LATITUDE 582330 LONGITUDE 1342515 DRAINAGE AREA 12.10 DATUM 650.00 STATE 02 COUNTY 110

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1970 TO SEPTEMBER 1971
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	640	264	11	3.5	1.5	2.5	2.0	13	79	268	524	484
2	563	227	10	4.0	1.5	2.5	3.2	13	80	276	774	462
3	526	189	9.0	5.5	1.5	2.5	4.1	21	66	270	702	669
4	335	137	8.5	16	1.5	2.5	5.4	17	75	275	598	557
5	215	91	8.0	38	1.5	2.0	3.8	15	142	282	456	558
6	155	71	8.0	80	2.0	2.0	9.5	30	291	316	413	478
7	121	62	7.0	36	4.0	2.0	7.4	57	293	344	537	451
8	114	53	7.0	22	9.5	2.0	5.2	26	291	387	492	334
9	119	51	7.0	15	11	2.0	3.9	17	278	459	411	247
10	183	46	7.5	11	9.5	2.0	4.1	27	245	448	394	226
11	138	62	7.5	8.5	8.5	2.0	4.3	59	203	426	398	221
12	139	67	7.5	7.5	8.0	2.0	3.6	76	187	383	431	242
13	171	55	7.5	6.0	7.0	1.5	5.6	60	159	344	449	212
14	165	52	7.0	5.0	6.0	1.5	14	39	148	334	611	268
15	178	55	6.5	4.5	6.0	1.5	6.3	32	152	443	567	173
16	102	47	5.5	4.0	5.0	1.5	5.2	29	171	692	548	225
17	75	38	5.0	3.5	4.5	1.5	5.2	30	184	628	472	425
18	62	33	4.5	3.5	4.5	1.5	5.7	38	195	522	479	424
19	64	28	4.5	3.0	4.0	1.5	5.2	45	232	457	853	338
20	52	26	4.5	3.0	4.0	1.5	4.8	48	289	525	802	313
21	45	22	5.0	3.0	4.0	1.5	4.3	66	330	565	606	396
22	42	20	5.0	2.5	3.5	1.5	5.0	50	329	443	589	353
23	41	19	5.0	2.5	3.5	1.5	7.3	39	366	362	699	293
24	40	17	5.0	2.5	3.5	1.5	11	42	388	337	685	215
25	36	16	5.0	2.0	3.0	1.5	12	48	434	363	511	158
26	34	15	4.0	2.0	3.0	1.5	26	52	422	454	445	125
27	39	14	3.5	2.0	3.0	1.5	20	58	352	471	343	114
28	34	13	3.5	2.0	3.0	1.5	14	74	315	508	301	85
29	133	12	3.0	2.0	---	1.5	14	83	284	517	325	75
30	205	11	3.0	2.0	---	1.5	14	59	270	514	407	75
31	195	---	3.5	1.5	---	1.5	---	57	---	523	356	---
TOTAL	4961	1813	188.5	303.5	127.5	54.5	235.1	1320	7250	13136	16167	9196
MEAN	160	60.4	6.08	9.79	4.55	1.76	7.84	42.6	242	424	522	307
MAX	640	264	11	80	11	2.5	26	83	434	692	853	669
MIN	34	11	3.0	1.5	1.5	1.5	2.0	13	66	268	301	75
AC-FT	9840	3600	374	602	253	108	466	2620	14380	26060	32070	18240
CFSM	13.2	4.99	.50	.81	.38	.15	.65	3.52	20.0	35.0	43.1	25.3
IN.	15.25	5.57	.58	.93	.39	.17	.72	4.06	22.29	40.39	49.70	28.27

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1951 - 1971, BY WATER YEAR (WY)

MEAN	147	49.9	17.8	7.93	5.43	5.72	12.7	85.7	264	422	458	364
MAX	350	129	67.0	25.8	13.6	23.5	23.4	189	382	557	718	543
(WY)	1952	1969	1962	1964	1967	1967	1968	1962	1960	1960	1960	1956
MIN	50.8	16.4	4.71	1.50	1.00	1.50	4.50	42.6	158	310	324	205
(WY)	1956	1971	1961	1951	1951	1951	1954	1970	1951	1951	1953	1963

SUMMARY STATISTICS	FOR 1970 CALENDAR YEAR	FOR 1971 WATER YEAR	WATER YEARS 1951 - 1971
ANNUAL TOTAL	55232.9	54752.1	

ANNUAL MEAN	151		150		151		
HIGHEST ANNUAL MEAN					179		1962
LOWEST ANNUAL MEAN					122		1951
HIGHEST DAILY MEAN	1420	Sep 29	853	Aug 19	2660	Aug 13	1960
LOWEST DAILY MEAN	2.8	Jan 17	1.5	Jan 31	.70	Feb 13	1965
ANNUAL SEVEN-DAY MINIMUM	3.0	Jan 14	1.5	Mar 13	.73	Feb 13	1965
ANNUAL RUNOFF (AC-FT)	109600		108600		109400		
ANNUAL RUNOFF (CFSM)	12.5		12.4		12.5		
ANNUAL RUNOFF (INCHES)	169.81		168.33		169.59		
10 PERCENT EXCEEDS	442		466		436		
50 PERCENT EXCEEDS	45		39		42		
90 PERCENT EXCEEDS	5.0		2.0		4.0		

STATISTICS COMPUTED BY: HRSEIT2 DATE: 10/09/1991 AT: 09:55:32

UNITED STATES DEPARTMENT OF THE INTERIOR - GEOLOGICAL SURVEY - ALASKA DISTRICT 06/26/95

STATION NUMBER 15052000 LEMON C NR JUNEAU AK STREAM SOURCE AGENCY USGS
LATITUDE 582330 LONGITUDE 1342515 DRAINAGE AREA 12.10 DATUM 650.00 STATE 02 COUNTY 110

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1971 TO SEPTEMBER 1972
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	109	19	8.4	6.1	4.5	4.5	7.0	9.5	309	264	326	434
2	118	17	8.2	6.1	4.5	4.5	7.0	12	225	220	336	417
3	91	15	8.2	6.1	4.5	4.5	6.7	15	171	264	506	385
4	101	35	8.2	5.9	4.5	4.5	6.5	22	137	457	719	413
5	171	24	8.2	6.1	4.5	4.5	6.3	30	124	542	832	303
6	150	15	8.2	5.9	4.5	4.5	6.3	45	159	595	1040	261
7	122	14	7.9	5.9	4.5	4.5	6.1	52	152	511	738	267
8	243	13	7.7	5.4	5.0	4.5	5.9	58	140	448	930	212
9	150	12	8.4	5.2	5.0	4.5	6.1	71	155	520	790	198
10	150	11	8.0	5.0	5.0	4.5	6.5	67	152	457	570	361
11	133	16	8.0	5.0	5.0	5.0	6.7	71	164	448	479	452
12	85	14	7.5	5.0	5.0	5.0	6.3	55	271	502	385	621
13	80	11	7.5	5.0	5.0	5.0	6.3	49	178	421	329	853
14	61	11	7.0	4.5	5.0	5.0	6.3	49	196	497	378	1140
15	50	11	7.0	4.5	5.0	5.0	6.1	40	258	542	448	1210
16	51	12	7.0	4.5	5.0	5.5	6.1	32	285	421	542	590
17	55	19	7.0	4.5	5.0	5.5	5.9	30	264	488	547	343
18	44	60	7.0	4.5	5.0	5.5	5.6	29	258	466	475	228
19	37	34	7.0	4.5	5.0	5.5	5.9	30	249	425	425	162
20	25	20	6.8	4.5	5.0	5.5	6.1	146	246	452	413	124
21	32	16	7.0	4.0	5.0	5.5	5.6	240	222	524	448	98
22	32	13	6.5	4.0	5.0	5.5	5.4	193	212	506	556	78
23	40	12	7.0	4.0	5.0	6.0	5.4	125	246	475	965	68
24	35	11	6.7	4.0	5.0	6.7	5.6	81	273	434	944	61
25	28	10	6.5	4.0	5.0	7.7	9.5	64	368	375	707	53
26	22	10	6.5	4.0	5.0	7.9	11	56	322	350	972	46
27	23	9.7	6.5	4.5	5.0	7.4	10	97	279	378	707	46
28	23	9.5	6.5	4.5	5.0	7.2	12	201	329	375	497	63
29	22	9.0	6.5	4.5	5.0	7.0	10	270	303	322	488	378
30	21	8.4	6.5	4.5	---	7.0	9.0	357	303	294	448	683
31	23	---	6.3	4.5	---	7.0	---	485	---	315	506	---
TOTAL	2337	491.6	225.7	150.7	141.5	172.4	209.2	3001.5	6850	13296	18446	10548
MEAN	75.4	16.4	7.28	4.86	4.88	5.56	6.97	96.8	228	429	595	352
MAX	243	60	8.4	6.1	5.0	7.9	12	405	368	595	1040	1210
MIN	21	8.4	6.3	4.0	4.5	4.5	5.4	9.5	124	228	326	46
AC-FT	4640	975	448	299	281	342	415	5950	13590	26370	36590	20920
CFSM	6.23	1.35	.60	.40	.40	.46	.58	8.00	18.9	35.4	49.2	29.1
IN.	7.18	1.51	.69	.46	.44	.53	.64	9.23	21.06	40.88	56.71	32.43

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1951 - 1972, BY WATER YEAR (WY)

MEAN	147	49.2	17.6	8.00	5.43	5.76	12.9	85.4	261	418	457	358
MAX	350	129	67.0	25.8	13.6	23.5	23.4	189	382	557	718	543
(WY)	1952	1969	1962	1964	1967	1967	1968	1962	1968	1960	1960	1956
MIN	50.8	16.4	4.71	1.50	1.00	1.50	4.50	42.6	158	310	324	205
(WY)	1956	1971	1961	1951	1951	1951	1954	1970	1951	1951	1953	1963

SUMMARY STATISTICS	FOR 1971 CALENDAR YEAR	FOR 1972 WATER YEAR	WATER YEARS 1951 - 1972
ANNUAL TOTAL	50843.9	55869.6	

ANNUAL MEAN	139		153		151		
HIGHEST ANNUAL MEAN					179		1962
LOWEST ANNUAL MEAN					122		1951
HIGHEST DAILY MEAN	853	Aug 19	1210	Sep 15	2660	Aug 13	1960
LOWEST DAILY MEAN	1.5	Jan 31	4.0	Jan 21	.70	Feb 13	1965
ANNUAL SEVEN-DAY MINIMUM	1.5	Mar 13	4.1	Jan 20	.73	Feb 13	1965
ANNUAL RUNOFF (AC-FT)	100800		110800		109400		
ANNUAL RUNOFF (CFSM)	11.5		12.6		12.5		
ANNUAL RUNOFF (INCHES)	156.31		171.76		169.59		
10 PERCENT EXCEEDS	456		476		432		
50 PERCENT EXCEEDS	23		22		42		
90 PERCENT EXCEEDS	2.0		5.0		4.0		

STATISTICS COMPUTED BY: HRSEITZ DATE: 10/09/1991 AT: 09:56:04

UNITED STATES DEPARTMENT OF THE INTERIOR - GEOLOGICAL SURVEY - ALASKA DISTRICT 06/26/95

STATION NUMBER 15052000 LEMON C NR JUNEAU AK STREAM SOURCE AGENCY USGS
LATITUDE 582330 LONGITUDE 1342515 DRAINAGE AREA 12.10 DATUM 650.00 STATE 02 COUNTY 110

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1972 TO SEPTEMBER 1973
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	389	50	18	16	7.0	5.5	7.0	40	66	263	377	383
2	405	40	17	14	7.0	5.5	7.0	47	87	250	325	445
3	225	30	16	12	7.0	5.5	14	45	77	281	672	393
4	168	27	16	11	7.0	5.5	8.7	44	103	292	777	392
5	240	25	15	10	7.0	5.5	7.2	44	130	282	560	374
6	616	23	15	9.0	7.0	5.5	7.0	37	151	248	437	345
7	270	21	14	9.0	7.0	5.5	6.5	33	180	239	454	327
8	173	19	14	9.0	7.0	5.5	11	44	158	243	563	467
9	119	18	14	9.0	7.0	5.5	14	39	143	267	470	382
10	94	17	14	9.0	7.0	5.5	41	36	129	297	364	291
11	80	16	14	8.5	6.5	5.5	16	36	133	376	439	251
12	75	16	13	8.5	6.5	5.5	14	40	230	365	885	225
13	61	19	13	8.5	6.5	5.5	14	55	295	477	862	208
14	55	20	13	8.5	7.0	5.5	13	168	311	429	742	168
15	55	18	13	8.5	9.0	5.5	11	237	253	350	429	144
16	55	17	13	8.0	12	5.0	13	190	252	313	310	135
17	60	17	12	8.0	20	5.0	13	162	250	306	270	130
18	70	17	12	8.0	14	5.0	13	133	249	365	227	125
19	90	20	12	8.0	11	5.0	13	122	224	451	200	123
20	70	70	12	8.0	15	5.0	11	72	196	463	226	120
21	50	150	12	10	12	5.0	15	66	234	384	278	150
22	70	100	12	14	9.0	5.0	18	54	247	332	299	241
23	150	70	11	11	8.0	5.5	17	53	219	338	434	193
24	350	50	11	9.0	7.0	5.5	19	81	240	349	426	142
25	180	45	11	8.0	6.0	5.5	23	85	307	327	623	137
26	130	40	11	7.5	6.0	6.0	46	79	281	324	593	190
27	100	30	11	7.5	6.0	8.0	34	78	257	317	434	261
28	80	25	11	7.5	6.0	20	22	79	262	398	425	206
29	70	22	11	7.5	---	15	20	72	264	487	421	147
30	65	20	18	7.5	---	11	28	75	265	444	316	113
31	60	---	17	7.5	---	9.0	---	66	---	484	249	---
TOTAL	4675	1052	416	287.5	237.5	203.0	496.4	2412	6193	10741	14087	7206
MEAN	151	35.1	13.4	9.27	8.48	6.55	16.5	77.8	206	346	454	240
MAX	616	150	18	16	20	20	46	237	311	487	885	467
MIN	50	16	11	7.5	6.0	5.0	6.5	33	66	239	200	113
AC-FT	9270	2090	825	570	471	403	985	4780	12280	21300	27940	14290
CFSM	12.5	2.90	1.11	.77	.70	.54	1.37	6.43	17.1	28.6	37.6	19.9
IN.	14.37	3.23	1.28	.88	.73	.62	1.53	7.42	19.04	33.02	43.31	22.15

Source: U.S.G.S. water quality data, .3 miles north of the confluence of Canyon Creek, 1948 to 1972

MISCELLANEOUS STATION ANALYSES

15052000 LEMON C NR JUNEAU AK (LAT 58 23 30N LONG 134 25 15W)

DATE	CARBONATE WATER WH PET FIELD MG/L AS CO3 (00445)	NITROGEN, NITRATE DISSOLVED (MG/L AS N) (00618)	HARDNESS TOTAL (MG/L AS CACO3) (00900)	HARDNESS NONCARB WH WAT TOT FLD (MG/L AS CACO3) (00902)	CALCIUM DISSOLVED (MG/L AS CA) (00915)	MAGNESIUM DISSOLVED (MG/L AS MG) (00925)	SODIUM, DISSOLVED (MG/L AS NA) (00930)	SODIUM ADSORPTION RATIO (00931)	SODIUM PERCENT (00932)	SODIUM+POTASSIUM DISSOLVED (MG/L AS NA) (00933)	POTASSIUM, DISSOLVED (MG/L AS K) (00935)
OCT 1948											
10...	---	0.00	26	4	8.5	1.1	---	---	---	1.8	---
MAY 1949											
02...	---	0.160	28	4	---	---	---	---	---	3.4	---
JUL											
14...	---	0.110	13	0	---	---	---	---	---	3.2	---
SEP 1950											
27...	---	0.050	20	2	6.2	0.99	---	---	---	2.5	---
APR 1967											
21...	---	---	---	---	---	---	---	---	---	---	---
FEB 1968											
15...	---	0.200	28	7	8.9	0.80	0.50	0.0	4	---	1.4
JUN											
06...	---	0.00	19	3	5.1	0.39	0.48	0.0	7	---	0.50
JUL											
03...	---	0.050	7	0	2.4	0.30	0.30	0.0	8	---	0.30
AUG											
01...	---	0.050	5	1	1.8	0.30	0.20	0.0	7	---	0.40
APR 1969											
16...	---	---	---	---	---	---	---	---	---	---	---
MAY											
22...	0	0.160	16	4	5.6	0.50	0.50	0.0	6	---	1.2
APR 1970											
27...	---	0.340	31	5	11	0.80	1.4	0.1	6	---	2.7
JUN											
19...	0	0.020	15	0	4.4	0.90	0.70	0.1	9	---	1.2
AUG											
19...	---	0.00	8	0	3.4	0.60	0.50	0.1	11	---	0.90
OCT											
13...	---	---	---	---	---	---	---	---	---	---	---
MAR 1971											
23...	0	0.160	25	7	8.2	1.0	0.90	0.1	7	---	1.6
MAY											
17...	---	---	26	8	---	---	---	---	---	---	---
SEP											
24...	---	---	---	---	---	---	---	---	---	---	---
NOV											
13...	---	---	---	---	---	---	---	---	---	---	---
MAR 1972											
22...	0	0.430	43	10	15	2.3	1.2	0.1	6	---	1.5
JUL											
05...	---	---	---	---	---	---	---	---	---	---	---
OCT											
03...	---	---	---	---	---	---	---	---	---	---	---
DEC											
06...	---	---	---	---	---	---	---	---	---	---	---

MISCELLANEOUS STATION ANALYSES

DATE	TIME	TEMPERATURE WATER (DEG C) (00010)	SURFACE AREA (SQ MI) (00049)	DISCHARGE, INST. CUBIC FEET PER SECOND (00061)	GAGE HEIGHT (FEET) (00065)	COLOR (PLATINUM-COBALT UNITS) (00080)	SPECIFIC CONDUCTANCE (US/CM) (00095)	PH WATER WHOLE FIELD (STANDARD UNITS) (00400)	CARBON DIOXIDE DISSOLVED (MG/L AS CO2) (00405)	ALKALINITY WAT WH TOT PET FIELD MG/L AS CACO3 (00410)	BICARBONATE WATER WH PET FIELD MG/L AS HCO3 (00440)
		15052000		LEMON C NR JUNEAU AK (LAT 58 23 30N LONG 134 25 15W)							
OCT 1948											
10...	--	--	12	--	--	--	54	--	--	21	26
MAY 1949											
02...	1325	--	12	--	--	--	71	6.3	24	25	30
JUL											
14...	1000	4.0	12	100	--	--	39	5.9	30	12	15
SEP 1950											
27...	--	5.5	12	100	--	5	48	7.2	2.2	18	22
APR 1967											
21...	0930	1.0	12	8.5	--	--	--	--	--	--	--
FEB 1968											
15...	1350	0.5	12	11	--	0	78	7.0	4.2	21	26
JUN											
06...	1600	3.5	12	179	--	10	34	6.5	7.1	11	14
JUL											
03...	1245	3.5	12	417	--	5	22	6.5	4.0	7	8
AUG											
01...	1315	3.0	12	458	--	--	16	6.9	1.2	5	6
APR 1969											
18...	1430	2.0	12	21	--	--	--	--	--	--	--
MAY											
22...	--	3.5	12	176	242.00	0	42	7.5	0.8	12	15
APR 1970											
27...	1300	3.5	12	11	--	--	78	7.4	1.7	21	26
JUN											
19...	1210	3.0	12	187	--	--	34	7.9	0.3	14	17
AUG											
19...	1330	2.5	12	697	--	--	15	6.8	2.3	7	9
OCT											
13...	1200	3.0	12	192	--	--	22	--	--	--	--
MAR 1971											
23...	1250	0.5	12	1.5	--	5	56	7.3	1.7	17	21
MAY											
17...	1255	2.0	12	23	--	--	62	7.4	1.4	18	22
SEP											
24...	1300	3.5	12	172	--	--	21	--	--	--	--
NOV											
23...	1215	1.5	12	12	--	--	73	--	--	--	--
MAR 1972											
22...	0910	1.0	12	5.5	--	0	99	7.0	5.6	29	35
JUL											
08...	1325	1.0	12	450	--	--	20	--	--	--	--
OCT											
09...	1300	0.0	12	120	--	--	39	--	--	--	--
DEC											
06...	1245	0.0	12	15	--	--	82	--	--	--	--

MISCELLANEOUS STATION ANALYSES

DATE	CHLORIDE, DISSOLVED (MG/L AS CL) (00940)	SULFATE DISSOLVED (MG/L AS SO4) (00945)	FLUORIDE, DISSOLVED (MG/L AS F) (00950)	SILICA, DISSOLVED (MG/L AS SIO2) (00955)	IRON, TOTAL RECOVERABLE (UG/L AS FE) (01045)	MANGANESE, TOTAL RECOVERABLE (UG/L AS MN) (01055)	SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L) (70301)	SOLIDS, DISSOLVED (TONS PER DAY) (70302)	SOLIDS, DISSOLVED (TONS PER AC-FT) (70303)	SED. SUSP. FALL DIAM. % FINER THAN .062 MM (70342)
	15052000		LEMON C NR JUNEAU AK (LAT 58 23 30N LONG 134 25 15W)							
OCT 1948										
10...	0.30	7.0	--	4.0	--	--	36	--	0.05	--
MAY 1949										
02...	1.1	7.5	--	4.0	--	--	--	--	--	--
JUL										
14...	2.2	4.0	--	1.8	--	--	--	--	--	--
SEP 1950										
27...	1.0	5.9	--	3.1	--	--	31	8.37	0.04	--
APR 1967										
21...	--	--	--	--	--	--	--	--	--	--
FEB 1968										
15...	0.0	12	0.0	2.1	--	--	40	1.20	0.05	--
JUN										
06...	0.40	2.9	0.0	1.1	--	--	17	8.02	0.02	--
JUL										
03...	0.80	0.40	0.0	0.60	--	--	9	10.4	0.01	--
AUG										
01...	0.50	0.20	0.10	0.30	--	--	7	8.62	0.01	--
APR 1969										
18...	--	--	--	--	--	--	--	--	--	--
MAY										
22...	0.70	6.2	0.0	1.4	--	--	24	11.5	0.03	--
APR 1970										
27...	1.1	11	0.0	2.6	--	--	45	1.34	0.06	--
JUN										
19...	0.50	3.0	0.0	0.90	--	--	20	18.1	0.03	--
AUG										
19...	0.40	1.5	0.0	1.0	--	--	11	21.1	0.02	--
OCT										
13...	--	--	--	--	--	--	--	--	--	--
MAR 1971										
23...	1.0	6.8	0.10	5.4	--	--	36	0.14	0.05	--
MAY										
17...	--	--	--	--	--	--	--	--	--	--
SEP										
24...	--	--	--	--	--	--	--	--	--	--
NOV										
23...	--	--	--	--	--	--	--	--	--	--
MAR 1972										
22...	0.60	14	0.10	3.4	290	10	56	0.83	0.08	--
JUL										
08...	--	--	--	--	--	--	--	--	--	76
OCT										
09...	--	--	--	--	--	--	--	--	--	--
DEC										
06...	--	--	--	--	--	--	--	--	--	--

MISCELLANEOUS STATION ANALYSES

DATE	SED. SUSP. FALL DIAM. % FINER THAN .125 MM (70343)	SED. SUSP. FALL DIAM. % FINER THAN .250 MM (70344)	SED. SUSP. FALL DIAM. % FINER THAN .500 MM (70345)	NITRO-GEN, NITRATE DIS-SOLVED (MG/L AS NO3) (71851)	MANGA-NESE (UG/L AS MN) (71883)	IRON (UG/L AS FE) (71885)	ELEV. OF LAND SURFACE DATUM (FT. ABOVE NGVD) (72000)	SEDI-MENT, SUS-PENDED (MG/L) (80154)	SEDI-MENT, DIS-CHARGE, SUS-PENDED (T/DAY) (80155)	DRAIN-AGE AREA (SQ. MI.) (81024)
15052000 LEMON C NR JUNEAU AK (LAT 58 23 30N LONG 134 25 15W)										
OCT 1948										
10...	--	--	--	0.0	--	--	650	--	--	12.1
MAY 1949										
02...	--	--	--	1.6	--	--	650	--	--	12.1
JUL										
14...	--	--	--	0.50	--	--	650	--	--	12.1
SEP 1950										
27...	--	--	--	0.20	--	70	650	--	--	12.1
APR 1967										
21...	--	--	--	--	--	--	650	5	0.11	12.1
FEB 1968										
15...	--	--	--	0.90	--	40	650	--	--	12.1
JUN										
06...	--	--	--	0.0	--	610	650	16	7.7	12.1
JUL										
03...	--	--	--	0.20	--	590	650	--	--	12.1
AUG										
01...	--	--	--	0.20	--	720	650	45	56	12.1
APR 1969										
18...	--	--	--	--	--	--	650	0	0.0	12.1
MAY										
22...	--	--	--	0.70	--	1500	650	--	--	12.1
APR 1970										
27...	--	--	--	1.5	--	60	650	3	0.09	12.1
JUN										
19...	--	--	--	0.10	--	290	650	30	15	12.1
AUG										
19...	--	--	--	0.0	--	40	650	83	156	12.1
OCT										
13...	--	--	--	--	--	--	650	21	11	12.1
MAR 1971										
23...	--	--	--	0.80	20	--	650	2	0.01	12.1
MAY										
17...	--	--	--	--	--	--	650	3	0.19	12.1
SEP										
24...	--	--	--	--	--	--	650	12	5.6	12.1
NOV										
23...	--	--	--	--	--	--	650	8	0.26	12.1
MAR 1972										
22...	--	--	--	1.9	--	--	650	--	--	12.1
JUL										
08...	92	98	100	--	--	--	650	88	107	12.1
OCT										
09...	--	--	--	--	--	--	650	17	5.5	12.1
DEC										
06...	--	--	--	--	--	--	650	1	0.04	12.1

MISCELLANEOUS STATION ANALYSES

DATE	TIME	TEMPERATURE WATER (DEG C) (00010)	DISCHARGE, INST. CUBIC FEET PER SECOND (00061)	COLOR (PLATINUM-COBALT UNITS) (00080)	SPECIFIC CONDUCTANCE (US/CM) (00095)	PH WATER WHOLE FIELD (STANDARD UNITS) (00400)	CARBON DIOXIDE DISSOLVED (MG/L AS CO2) (00405)	ALKALINITY WAT WH TOT FET FIELD MG/L AS CACO3 (00410)	BICARBONATE WATER WH FET FIELD MG/L AS HCO3 (00440)	CARBONATE WATER WH FET FIELD MG/L AS CO3 (00445)
15052010	LEMON C BL JAIL NR JUNEAU AK (LAT 58 21 38N LONG 134 29 02W)									
MAY 1968										
28...	0920	3.0	--	0	41	6.9	3.8	16	19	0
15052020	LEMON C AT BRIDGE NR JUNEAU AK (LAT 58 21 27N LONG 134 29 56W)									
NOV 1966										
22...	1530	--	55	--	75	7.3	2.2	24	27	--
MAY 1968										
28...	0900	3.5	--	5	41	6.9	4.0	16	20	0

MISCELLANEOUS STATION ANALYSES

DATE	NITRO-GEN, NITRATE DIS-SOLVED (MG/L AS N) (00618)	HARD-NESS TOTAL (MG/L AS CACO3) (00900)	HARD-NESS NONCARB WH WAT TOT FLD MG/L AS CACO3 (00902)	CALCIUM DIS-SOLVED (MG/L AS CA) (00915)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) (00925)	SODIUM, DIS-SOLVED (MG/L AS NA) (00930)	SODIUM AD-SORP-TION RATIO (00931)	SODIUM PERCENT (00932)	POTAS-SIUM, DIS-SOLVED (MG/L AS K) (00935)
15052010 LEMON C BL JAIL NR JUNEAU AK (LAT 58 21 38N LONG 134 29 02W)									
MAY 1968									
28...	0.050	16	0	6.0	0.30	0.40	0.0	5	0.60
15052020 LEMON C AT BRIDGE NR JUNEAU AK (LAT 58 21 27N LONG 134 29 56W)									
NOV 1966									
22...	0.020	29	8	10	1.0	3.0	0.2	--	--
MAY 1968									
28...	0.020	14	0	5.2	0.20	0.40	0.0	6	0.70

MISCELLANEOUS STATION ANALYSES

DATE	CHLORIDE, DISSOLVED (MG/L AS CL) (00940)	SULFATE DISSOLVED (MG/L AS SO4) (00945)	FLUORIDE, DISSOLVED (MG/L AS F) (00950)	SILICA, DISSOLVED (MG/L AS SIO2) (00955)	SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L) (70301)	SOLIDS, DISSOLVED (TONS PER DAY) (70302)	SOLIDS, DISSOLVED (TONS PER AC-FT) (70303)	NITROGEN, NITRATE DISSOLVED (MG/L AS NO3) (71851)	IRON (UG/L AS FE) (71885)
15052010 LEMON C BL JAIL NR JUNEAU AK (LAT 58 21 38N LONG 134 29 02W)									
MAY 1968									
28...	0.30	4.2	0.0	2.0	23	--	0.03	0.20	710
15052020 LEMON C AT BRIDGE NR JUNEAU AK (LAT 58 21 27N LONG 134 29 56W)									
NOV 1966									
22...	3.2	9.6	--	6.3	47	6.98	0.06	0.10	30
MAY 1968									
28...	0.30	4.0	0.0	2.0	23	--	0.03	0.10	--

Source: U.S.G.S. flow data, .1 mile upstream from mouth of Lemon Creek, 1982 to 1986.

15052009 LEMON CREEK NEAR MOUTH NEAR JUNEAU

LOCATION.--Lat 58°21'57", long 134°28'41", in SW¼SW¼ sec.26, T.40 S., R.66 E., City and Borough of Juneau, Hydrologic Unit 19060000, in Tongass National Forest, on right bank 1.0 mi upstream from mouth and 5 mi northwest of Juneau.

DRAINAGE AREA.--22.9 mi².

PERIOD OF RECORD.--October 1982 to September 1986 (discontinued).

GAGE.--Water-stage recorder. Elevation of gage is 50 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Nov. 8-12, Nov. 16 to Dec. 5, Dec. 17, 18, Feb. 15-27, and Sept. 13-30. Records good except for estimated daily discharges, which are fair.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 4,510 ft³/s, Aug. 23, 1983, gage height, 16.12 ft, from rating curve extended above 1,900 ft³/s; maximum gage height, 16.37 ft, Nov. 26, 1985, backwater from ice; minimum daily discharge, 17 ft³/s, Feb. 20 and Dec. 29 and 30, 1983.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,820 ft³/s, Dec. 18, gage height, 15.59 ft; maximum gage height, 16.37 ft, Nov. 26, backwater from ice; minimum daily discharge, 25 ft³/s, Dec. 2, 3.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	737	82	26	73	86	97	45	83	284	539	514	786
2	718	79	25	64	99	73	45	90	261	491	670	539
3	478	76	25	60	67	95	52	91	223	377	862	405
4	529	72	27	59	55	102	56	94	229	358	988	381
5	330	67	110	56	50	68	63	97	260	387	877	399
6	256	68	97	56	47	60	55	107	294	427	975	406
7	214	67	56	78	46	56	62	121	394	470	810	373
8	205	64	43	67	44	53	57	120	316	435	531	323
9	275	62	39	62	44	49	47	103	320	452	479	363
10	290	60	39	70	41	52	44	88	272	514	569	330
11	227	60	38	57	41	52	42	81	230	559	1040	306
12	198	63	35	69	41	54	42	80	205	555	908	266
13	190	74	36	146	39	58	42	74	232	523	1180	245
14	218	86	37	106	37	54	38	76	533	486	796	225
15	172	64	43	79	34	57	37	81	556	473	521	200
16	165	55	53	62	33	53	41	89	426	526	482	180
17	174	48	211	57	32	49	43	106	400	532	452	165
18	161	44	989	54	32	50	42	84	388	560	380	150
19	138	42	388	50	32	59	54	94	405	589	349	140
20	127	38	532	48	31	174	77	113	392	564	327	130
21	117	36	341	46	31	138	59	111	417	530	311	270
22	111	34	351	45	31	90	53	112	571	577	289	380
23	106	32	236	43	30	74	49	110	704	719	613	500
24	105	31	256	43	40	63	47	140	678	915	427	300
25	101	30	206	133	100	58	44	206	475	792	434	230
26	96	29	143	170	110	66	47	243	400	651	412	200
27	91	28	114	103	180	70	61	273	512	886	519	180
28	88	28	98	69	191	65	58	270	612	594	880	165
29	92	27	84	58	---	58	61	299	570	466	795	160
30	92	26	81	53	---	53	74	314	539	427	492	260
31	87	---	86	62	---	48	---	293	---	399	503	---
TOTAL	6484	1572	4845	2198	1644	2148	1537	4243	12098	16773	19385	8957
MEAN	209	52.4	156	70.9	58.7	69.3	51.2	137	403	541	625	299
MAX	737	86	989	170	191	174	77	314	704	915	1180	786
MIN	87	26	25	43	30	48	37	74	205	358	289	130
CFSM	9.49	2.29	6.81	3.10	2.56	3.03	2.24	5.98	17.6	23.6	27.3	13.1
IN.	11.19	2.55	7.87	3.57	2.67	3.49	2.50	6.89	19.65	27.25	31.49	14.55
AC-FT	12860	3120	9610	4360	3260	4260	3050	8420	24000	33270	38450	17770

WTR YR 1985	TOTAL	83237	MEAN 228	MAX 989	MIN 23	CFSM 9.96	IN 135.21	AC-FT 165100			
WTR YR 1986	TOTAL	82268	MEAN 225	MAX 1180	MIN 25	CFSM 9.83	IN 133.67	AC-FT 163200			

UNITED STATES DEPARTMENT OF THE INTERIOR - GEOLOGICAL SURVEY - ALASKA DISTRICT 06/26/95

STATION NUMBER 15052009 LEMON C NR MOUTH NR JUNEAU AK STREAM SOURCE AGENCY USGS
LATITUDE 582157 LONGITUDE 1342841 DRAINAGE AREA 22.90 DATUM 00 STATE 02 COUNTY 110

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1982 TO SEPTEMBER 1983
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1000	95	30	21	29	33	36	90	245	300	357	683
2	800	88	30	21	29	21	26	73	235	325	291	1410
3	630	80	29	27	27	19	27	86	210	340	295	1260
4	450	96	29	26	25	19	86	76	200	340	257	1060
5	340	84	28	25	24	19	68	93	195	320	250	821
6	520	73	28	26	26	18	42	100	190	300	334	400
7	310	66	28	43	26	18	35	96	190	305	431	280
8	380	60	31	91	25	18	32	85	200	325	339	160
9	350	74	29	28	23	18	29	74	220	360	318	150
10	470	70	27	54	22	33	27	74	220	400	493	140
11	750	62	27	70	21	39	24	89	220	350	482	140
12	1020	57	38	58	21	33	38	110	240	300	381	145
13	1050	56	47	45	19	28	42	114	260	260	406	155
14	650	61	49	126	19	26	48	129	320	270	706	175
15	450	58	36	79	19	29	62	109	350	280	976	250
16	320	50	31	50	19	30	116	105	380	300	644	190
17	250	45	28	57	18	27	167	114	360	320	477	125
18	200	42	27	71	18	26	80	84	340	360	567	100
19	180	39	26	88	19	25	56	133	300	390	478	110
20	170	36	25	57	17	23	50	216	280	350	386	824
21	150	34	24	40	20	22	55	156	285	300	1010	595
22	130	33	23	35	19	22	56	176	300	280	2200	713
23	120	32	23	32	34	20	57	147	330	260	3010	747
24	110	33	23	29	49	20	85	150	370	230	1080	600
25	115	34	22	30	34	19	115	146	390	260	869	330
26	120	37	22	30	28	18	92	119	380	260	1280	250
27	110	36	23	28	25	19	102	126	360	280	1080	190
28	100	34	23	34	24	19	100	212	340	320	962	150
29	110	33	23	24		20	103	283	320	350	785	112
30	110	31	22	24	---	21	90	417	300	393	621	137
31	100	---	21	25	---	27	---	310	---	464	626	---
TOTAL	11265	1643	872	1306	676	717	1941	4291	8530	9862	22391	12322
MEAN	363	54.8	28.1	42.1	24.2	23.1	64.7	138	284	319	722	411
MAX	1050	96	49	126	49	39	167	417	390	464	3010	1410
MIN	100	31	21	21	17	18	26	73	190	230	250	100
AC-FT	22340	3260	1730	2590	1340	1420	3850	8510	16920	19620	44410	24440
CFSM	15.9	2.39	1.23	1.84	1.06	1.01	2.83	6.04	12.4	13.9	31.5	17.9
IN.	18.30	2.67	1.42	2.12	1.10	1.16	3.15	6.97	13.86	16.07	36.37	20.02

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1982 - 1983, BY WATER YEAR (WY)

MEAN	200	57.1	26.6	39.3	39.8	61.6	80.5	190	322	419	617	333
MAX	363	59.5	28.1	42.1	54.4	100	100	241	359	519	722	411
(WY)	1982	1983	1982	1982	1982	1983	1983	1983	1983	1983	1982	1982
MIN	170	54.8	25.1	36.5	24.2	23.1	64.7	138	284	319	512	256
(WY)	1982	1982	1983	1982	1983	1982	1983	1982	1982	1982	1983	1983

SUMMARY STATISTICS FOR 1983 WATER YEAR

ANNUAL TOTAL 95848

ANNUAL MEAN	208	
HIGHEST DAILY MEAN	3010	Aug 23
LOWEST DAILY MEAN	17	Feb 28
ANNUAL SEVEN-DAY MINIMUM	18	Feb 14
ANNUAL RUNOFF (AC-FT)	150400	
ANNUAL RUNOFF (CFSM)	9.07	
ANNUAL RUNOFF (INCHES)	123.21	
10 PERCENT EXCEEDS	473	
50 PERCENT EXCEEDS	95	
90 PERCENT EXCEEDS	22	

STATISTICS COMPUTED BY: HRSEITZ DATE: 10/09/1991 AT: 10:13:24

UNITED STATES DEPARTMENT OF THE INTERIOR - GEOLOGICAL SURVEY - ALASKA DISTRICT 06/26/95

STATION NUMBER 15052009 LEMON C NR MOUTH NR JUNEAU AK STREAM SOURCE AGENCY USGS
LATITUDE 582157 LONGITUDE 1342841 DRAINAGE AREA 22.90 DATUM 50 STATE 02 COUNTY 110

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1983 TO SEPTEMBER 1984
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	238	89	40	45	56	39	119	142	349	366	453	320
2	203	86	40	70	59	45	95	170	400	477	426	295
3	413	93	40	50	65	45	89	199	331	478	435	300
4	325	80	40	60	90	60	120	175	302	386	449	320
5	203	91	39	50	82	58	119	160	307	388	443	315
6	160	81	38	45	70	71	88	155	308	479	445	280
7	165	76	33	38	86	108	75	170	307	490	475	260
8	161	68	27	34	85	119	71	190	300	428	550	250
9	89	63	26	31	76	122	72	220	298	798	615	240
10	110	64	25	29	72	169	70	222	336	918	760	235
11	160	63	24	31	66	177	81	225	320	724	733	230
12	238	67	24	32	58	135	88	230	328	625	538	225
13	183	63	23	31	51	125	94	241	349	672	500	220
14	147	56	22	30	44	99	96	244	498	581	419	225
15	94	55	22	29	38	80	95	263	422	544	371	260
16	73	55	21	28	36	67	93	281	317	899	344	330
17	105	56	21	27	38	63	90	276	305	712	335	460
18	243	55	20	29	41	65	89	269	290	516	365	420
19	240	50	20	31	45	102	91	285	300	456	371	385
20	328	46	20	32	52	112	102	291	319	405	594	340
21	194	44	20	32	50	76	120	278	365	377	465	290
22	203	45	19	32	46	69	150	252	429	358	350	265
23	171	44	19	31	42	124	145	266	438	384	371	280
24	158	42	19	30	38	112	126	291	419	454	726	160
25	195	41	19	28	36	108	110	298	376	502	1240	140
26	127	41	19	25	38	135	100	292	503	437	986	135
27	86	42	19	27	37	124	97	276	518	388	574	135
28	145	41	18	35	39	95	98	279	387	363	450	145
29	77	39	17	42	36	120	106	283	359	417	380	180
30	75	43	17	45	---	146	122	257	353	560	340	230
31	91	--	26	51	---	144	---	254	---	503	370	---
TOTAL	5256	1785	777	1130	1578	3104	3007	7461	10784	16089	15873	7670
MEAN	170	59.5	25.1	36.5	54.4	100	100	241	359	519	512	256
MAX	413	93	40	70	90	177	150	298	518	918	1240	460
MIN	73	39	17	25	36	39	70	140	298	358	335	135
AC-FT	10430	3540	1540	2240	3130	6160	5960	14800	21390	31910	31480	15210
CSM	7.40	2.60	1.09	1.59	2.38	4.37	4.38	10.5	15.7	22.7	22.4	11.2
IN.	8.54	2.90	1.26	1.84	2.56	5.04	4.88	12.12	17.52	26.14	25.78	12.46

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1953 - 1984, BY WATER YEAR (WY)

MEAN	260	55.4	29.6	65.9	58.6	51.1	69.6	177	342	479	570	370
MAX	360	59.5	35.5	119	54.4	100	100	241	382	600	722	443
(WY)	1982	1983	1984	1984	1983	1983	1982	1983	1984	1984	1982	1984
MIN	170	52.0	25.1	36.5	54.2	23.1	43.9	138	284	319	475	256
(WY)	1983	1984	1983	1983	1982	1982	1984	1982	1982	1982	1984	1983

SUMMARY STATISTICS	FOR 1983 CALENDAR YEAR	FOR 1984 WATER YEAR	WATER YEARS 1983 - 1984
ANNUAL TOTAL	69886	74514	

ANNUAL MEAN	193		204		206		
HIGHEST ANNUAL MEAN					208		1982
LOWEST ANNUAL MEAN					204		1983
HIGHEST DAILY MEAN	3010	Aug 23	1240	Aug 25	3010	Aug 23	1982
LOWEST DAILY MEAN	17	Feb 20	17	Dec 29	17	Feb 20	1982
ANNUAL SEVEN-DAY MINIMUM	18	Feb 14	18	Dec 24	18	Feb 14	1982
ANNUAL RUNOFF (AC-FT)	138600		147800		149000		
ANNUAL RUNOFF (CFSM)	8.36		8.89		8.98		
ANNUAL RUNOFF (INCHES)	113.53		121.04		122.04		
10 PERCENT EXCEEDS	396		453		509		
50 PERCENT EXCEEDS	89		126		108		
90 PERCENT EXCEEDS	20		21		26		

STATISTICS COMPUTED BY: HRSEITZ DATE: 10/09/1991 AT: 10:13:52

UNITED STATES DEPARTMENT OF THE INTERIOR - GEOLOGICAL SURVEY - ALASKA DISTRICT 06/26/95

STATION NUMBER 15052000 LEMON C NR MOUTH NR JUNEAU AK STREAM SOURCE AGENCY USGS
LATITUDE 582157 LONGITUDE 1342841 DRAINAGE AREA 22.90 DATUM 50 STATE 02 COUNTY 110

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1984 TO SEPTEMBER 1985
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	700	66	33	25	55	42	47	47	366	751	488	368
2	356	60	32	68	50	39	35	89	395	646	682	663
3	230	56	31	41	47	36	33	94	466	500	606	600
4	170	60	32	94	40	32	34	94	530	509	524	589
5	160	70	47	98	46	32	32	94	535	529	459	411
6	358	66	99	57	43	32	30	88	388	490	518	317
7	640	59	73	57	41	31	47	86	293	465	524	265
8	660	57	65	99	40	29	74	81	255	456	522	232
9	360	54	54	134	39	29	55	99	246	505	524	247
10	290	50	45	86	38	30	45	84	228	640	513	539
11	300	48	44	134	98	31	40	72	294	773	575	409
12	210	48	43	178	37	35	57	64	432	736	438	379
13	190	44	41	105	37	32	63	75	415	760	463	334
14	180	40	36	79	36	31	47	83	344	664	710	278
15	190	38	34	71	36	30	41	124	290	543	553	731
16	169	40	32	230	35	30	39	127	260	565	532	836
17	138	46	30	146	35	30	42	136	421	570	433	503
18	126	38	29	96	35	31	41	127	582	544	338	337
19	110	38	28	105	34	30	42	104	431	573	268	287
20	104	37	27	219	34	29	42	111	345	676	276	285
21	99	74	26	255	37	28	42	110	300	649	451	282
22	163	103	25	205	40	27	42	143	272	550	781	243
23	409	69	24	260	39	26	45	233	272	669	693	653
24	306	54	23	195	39	26	49	288	346	767	491	603
25	260	47	22	150	39	25	47	304	473	804	326	903
26	164	43	22	112	41	24	44	285	408	636	291	589
27	126	40	21	91	80	24	44	280	336	550	319	391
28	116	44	21	79	49	23	41	273	327	538	388	305
29	94	37	21	69	---	23	40	290	495	538	360	239
30	82	34	22	63	---	25	39	316	703	526	324	482
31	72	---	22	60	---	38	---	340	---	482	350	---
TOTAL	7630	1560	1102	3690	1155	929	1317	4745	11452	18604	14740	13300
MEAN	246	52.0	35.5	119	41.3	30.0	43.9	153	382	600	475	443
MAX	700	103	99	260	80	42	74	340	703	804	781	903
MIN	72	34	21	25	34	23	32	47	228	456	276	232
AC-FT	15130	3090	2190	7320	2290	1840	2610	9410	22720	36900	29240	26380
CFSM	10.7	2.27	1.55	5.20	1.80	1.31	1.92	6.66	16.7	26.2	20.8	19.4
IN.	12.39	2.53	1.79	5.99	1.88	1.51	2.14	7.71	18.60	30.22	23.94	21.61

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1983 - 1985, BY WATER YEAR (WY)

MEAN	250	54.7	41.2	67.1	46.9	55.6	65.0	167	357	495	584	352
MAX	363	59.6	196	119	58.9	106	130	241	403	600	722	443
(WY)	1982	1983	1985	1984	1985	1983	1982	1983	1985	1984	1982	1984
MIN	170	52.0	25.1	36.5	34.0	27.1	45.9	137	284	319	475	256
(WY)	1983	1984	1983	1983	1982	1982	1984	1985	1982	1982	1984	1983

SUMMARY STATISTICS	FOR 1984 CALENDAR YEAR	FOR 1985 WATER YEAR	WATER YEARS 1983 - 1985
ANNUAL TOTAL	76988	80224	

ANNUAL MEAN	210		220		212		
HIGHEST ANNUAL MEAN					225		1985
LOWEST ANNUAL MEAN					204		1983
HIGHEST DAILY MEAN	1240	Aug 25	903	Sep 25	3010	Aug 23	1982
LOWEST DAILY MEAN	21	Dec 27	21	Dec 27	17	Feb 20	1982
ANNUAL SEVEN-DAY MINIMUM	22	Dec 25	22	Dec 25	18	Feb 14	1982
ANNUAL RUNOFF (AC-FT)	152700		159100		153800		
ANNUAL RUNOFF (CFSM)	9.15		9.60		9.27		
ANNUAL RUNOFF (INCHES)	125.06		130.32		125.95		
10 PERCENT EXCEEDS	461		552		526		
50 PERCENT EXCEEDS	131		99		106		
90 PERCENT EXCEEDS	32		31		28		

STATISTICS COMPUTED BY: HRSEIT2 DATE: 10/09/1991 AT: 10:14:28

UNITED STATES DEPARTMENT OF THE INTERIOR - GEOLOGICAL SURVEY - ALASKA DISTRICT 06/26/95

STATION NUMBER 15052009 LEMON C NR MOUTH NR JUNEAU AK STREAM SOURCE AGENCY USGS
LATITUDE 582157 LONGITUDE 1343841 DRAINAGE AREA 22.90 DATUM 50 STATE 02 COUNTY 110

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	737	82	26	73	86	97	45	83	264	539	514	786
2	718	79	25	64	99	75	45	90	261	491	670	539
3	478	76	25	60	67	95	52	91	223	377	862	405
4	529	72	27	59	55	102	56	94	229	358	988	381
5	330	67	110	56	50	66	63	97	260	387	877	399
6	256	68	97	56	47	60	55	107	294	429	975	406
7	214	67	56	78	46	58	62	121	394	470	810	373
8	205	64	43	67	44	53	97	120	316	435	531	323
9	275	62	39	62	44	49	47	103	320	452	475	363
10	290	60	39	70	41	52	44	88	272	514	569	330
11	227	60	38	59	41	52	42	83	230	559	1040	306
12	198	63	35	65	41	54	42	80	205	555	908	266
13	190	74	36	146	39	58	42	74	222	523	1180	245
14	218	86	37	106	37	54	38	76	533	486	796	225
15	172	64	43	79	34	57	37	81	556	473	521	200
16	165	55	53	62	33	53	41	89	426	526	482	180
17	174	48	211	57	32	49	43	106	400	532	452	165
18	161	44	989	54	---	50	42	84	388	560	380	150
19	138	43	388	50	32	59	54	94	405	589	349	140
20	127	38	532	46	31	174	77	113	392	564	327	130
21	117	36	341	46	31	138	59	111	417	530	311	270
22	111	34	351	45	31	90	53	112	571	577	289	380
23	106	32	436	43	30	74	49	110	704	719	613	500
24	105	31	256	43	40	63	47	140	678	915	427	300
25	101	30	206	133	100	58	46	206	475	792	434	230
26	96	29	143	170	110	66	47	243	400	651	412	200
27	91	28	114	103	180	70	61	273	512	886	519	180
28	88	28	98	69	191	65	58	270	612	594	880	165
29	92	27	84	58	---	58	61	299	570	466	795	160
30	92	26	81	53	---	53	74	314	539	427	492	260
31	87	---	66	62	---	48	---	293	---	399	503	---
TOTAL	6888	1572	4845	2198	1644	2148	1637	4243	12098	16773	19385	8957
MEAN	222	52.4	156	70.9	58.7	69.3	54.6	137	403	541	625	299
MAX	737	86	989	170	191	174	77	314	704	915	1180	786
MIN	87	26	25	43	30	48	37	74	205	358	289	130
AC-FT	13660	3120	9610	4360	3260	4260	3250	8420	24000	33270	38450	17770
CFSM	9.70	2.29	6.82	3.10	2.56	3.03	2.24	5.98	17.6	23.6	27.3	13.0
IN.	11.19	2.55	7.87	3.57	2.67	3.49	2.50	6.89	19.65	27.25	31.49	14.55

Appendix E EXISTING CONTROLS

Regulatory Authorities

A summary table of existing federal, state, and local statutes, regulations, ordinances, master planning documents, and memorandum of agreements that currently apply to projects undertaken within the study area has been prepared as part of the Lemon Creek TMDL and follows on page E-6.

Implementation Processes

On the Federal level, all projects which involve the discharge of dredged or fill material into waters of the United States are required to get a permit from the Department of the Army, Corps of Engineers. The Fish & Wildlife Coordination Act requires that the Army Corps of Engineers give the US Fish & Wildlife Service, the National Marine Fisheries Service, and AK Dept of Fish & Game an opportunity to review and comment on the project as part of their review.

If more than one permit is required from the State of Alaska, or if a federal permit and a state permit is required for a project within the Coastal Zone (most of Juneau), the State of Alaska, Division of Governmental Coordination will coordinate review of the project by all State agencies and the local coastal district for consistency with the Coastal Management Program. Each state agency also adjudicates the individual permit that they have authority for (ie: Fish Habitat permit by Fish & Game, 401 Certificate by Environmental Conservation, lease by Natural Resources, etc.).

All activities that occur within the Borough limits and which involve the subdivision of land, change in use of an existing structure, or construction of a new building need a development permit from the City & Borough of Juneau(CBJ) and review under the Juneau Coastal Management Program.

Long-term land use planning documents by the State of Alaska and the CBJ for the Juneau area exist. The Juneau State Land Use Plan was completed in December, 1993, and the CBJ is currently updating their Comprehensive Plan. Neither document makes specific recommendations pertaining to Lemon Creek, but both address impacts to streams generally. Both recommend measures for protection of streams in the Juneau area primarily through stream buffer setbacks..

In recognition of the "impaired" water body status of seven streams and lakes in the Juneau area, the CBJ and Department of Environmental Conservation entered into a Memorandum of

Agreement (MOA) to address water quality concerns. Both parties commit to coordinating policies and actions that will result in compliance with water quality standards for the purpose of protecting, maintaining and improving water quality. Commitments vary from coordination of review of development approvals, CBJ capital projects, leases, and disposal of lands, to development of a database specifically related to permits and restoration efforts, compilation of a manual of Best Management Practices, and public education efforts, some of which are contingent upon the successful acquisition of additional implementation funding.

Questions concerning permitting within TMDL watersheds prompted the Department of Environmental Conservation to institute a policy for review and approval of new or modified projects in February, 1993. The policy states that permitted projects should not be allowed to cause further degradation of water quality for the pollutants under investigation in a TMDL activity, or cause or contribute to violations of other pollutant standards. Use of available controls within the permit and certification process is recommended. Early and full disclosure of the sensitivity of the waters involved and good communication with the applicants is stressed, as is attempting to assure the viability of the project proposal.

Key Existing Controls

The City and Borough of Juneau (CBJ) adopted The Juneau Coastal Management Program (JCMP) as Part Two of the Juneau Comprehensive Plan in November, 1986. Findings were made which indicated that development along stream corridors can have adverse impacts such as "destruction of streambanks, increased runoff, sedimentation and pollution, and increased danger of flooding". The Plan also found that "carefully designed development responsive to the conditions of the site can diminish the potential negative impacts on the aquatic and terrestrial ecosystems of these areas." In response to those findings, the JCMP incorporated an enforceable policy which addressed those concerns. It states that all structures and foundations adjacent to anadromous streams, shall have a fifty foot setback from each side of the stream measured from the ordinary high water mark, where feasible and prudent. The enforceable policies of the JCMP were codified into the CBJ Title 49, Land Use Ordinance during a major revision of that document in 1987.

During the Land Use Code revision, the CBJ also adopted somewhat stricter requirements for setbacks for habitat in designated sensitive areas. CBJ 49.70.310 Habitat prohibits development within fifty feet of the banks of anadromous stream corridors. Development is defined in fairly broad terms and includes construction, change in use, removal of vegetative cover, excavation, or any site work in preparation or anticipation of development activities. In addition it requires that there be no disturbance within twenty-five feet of anadromous stream corridors. Proposals for project development near to anadromous streams are subject to these requirements. An applicant can

request a variance to this dimensional standard under the same process that is applied to all variance requests. The Planning Commission may require a lesser distance or no buffer at all based on eight standard variance criteria stipulated in the Land Use Code. These criteria look at whether granting the variance will injure nearby property, will allow a use not normally allowed, whether compliance with existing standards would prevent the owner from using the property for a permissible principal use, etc. No information on the possible impacts to habitat or water quality is required of the applicant, however staff does try to get input from ADFG and DEC on these aspects. Under the present process the Planning Commission can consider potential impacts to water quality and habitat as part of the decision making process, but the approval or disapproval must be based on the eight standard variance criteria.

CBJ Title 49, Land Use Ordinance

Specified Area Provisions

49.70.310 Habitat (a) There is adopted the sensitive areas map dated September 9, 1987, as same may be amended form time to time by the assembly by ordinance. (Currently under revision as part of the Comprehensive Plan update) Development in the following areas, some of which are designated on the map, (under the new revision they will just list the anadromous streams in the Juneau area) is prohibited:

(4) Within fifty feet of the banks of designated stream corridors; and

(b) In addition to the above requirements there shall be no disturbance in the following areas:

(1) Within twenty-five feet of designated stream corridors

"Development" means any of the following:

(1) Construction, reconstruction or enlargement of a structure involving more than one hundred twenty square feet;

(2) A subdivision;

(3) Conduct of a home occupation;

(4) Change in use of the lot, including any structure thereon:

(5) Installation or emplacement of a mobile or modular home;

(6) Removal of substantial vegetative cover;

(7) Excavation, dredge or fill activity;

(8) Installation of a sign;

(9) For the purposes of Article I.....(not applicable)

(10)Any site work in preparation or anticipation of the above.

49.20.200 Variance. A variance is required to vary dimensions or design standards of this title.

49.20.250 Grounds for Variances. (a) Where hardship and practical difficulties resulting from an extraordinary situation or unique physical feature affecting only a specific parcel of property or structures lawfully existing thereon and render it difficult to carry out provisions of this title, the board of adjustment may grant a variance in harmony with the general purpose and intent of this title. A variance may vary any requirement or regulation of this title concerning dimensional and other design standards, but not those concerning the use of land or structures or those establishing construction standards. A variance may be granted after the prescribed hearing and after it is shown that all the following conditions have been met.

(b) In considering all variances the board of adjustment must determine:

(1) Whether a lesser relaxation than that applied for would give substantial relief to the owner of the property involved and be more consistent with justice to other property owners;

(2) That relief can be granted in such a fashion that the intent of this title will be observed and the public safety and welfare preserve;

(3) That the authorization of the variance will not injure nearby property;

(4) That the variance does not authorize uses not allowed in the district involved;

(5) that compliance with the existing standards would unreasonable prevent the owner from using the property for a permissible principal use and would be unnecessarily burdensome because it would impose peculiar and practical difficulties to, or exceptional and undue hardship upon the developer of such property; unless because of preexisting nonconforming conditions on the subject parcel, the grant of the variance would not result in a net decrease in overall compliance with the land use code, CBJ Title 49, or the building code, CBJ Title 19, or both;

(6) That a grant of a variance would result in more benefits than detriments to the neighborhood; and

(7) That the variance would not violate housing density, gross nonresidential floor area, or building and lot coverage.

49.20.260 Conditions of Approval. The board may attach to a variance conditions regarding the location, character and other features of the proposed structures or uses as it finds necessary to carry out the intent of this title and to protect public interest.

Juneau Coastal Management Plan (enforceable policies codified in Title 49)

49.70.950 Habitat (f) All structures and foundations located adjacent to streams or lakes listed in Table VI-2 of Appendix C of the JCMP (List of anadromous streams in the Juneau area) shall have a fifty-foot setback from each side of the stream or lake measured from the ordinary high water mark, where feasible and prudent; provided docks, bridges, culverts and public structures whose purpose is access to or across the stream or lake are not subject to this policy, and provided further, uses which must be in or adjacent to the stream or lake in order to function, such as mining

activities, fish culturing, water supply intakes and similar uses, are exempt from the setback requirement. The setback shall be vegetated or revegetated, where feasible and prudent, and such vegetation or revegetation shall be kept or arranged to maximize shade on the stream.
(h) Development in buffer areas prescribed in subsections (f) and (g) of this section shall incorporate measures to prevent erosion and subsequent increases in turbidity and sediment within the waterway and adjacent wetlands within the buffer.

Juneau Wetlands Management Plan (codified in Title 49)

49.70.1080 Standards for Review of Wetlands Permits. (a) The standards set forth in this section will be applied by the wetlands review board in its review and approval of wetland permits These standards will also be applied by the director to wetland development activities not covered by the General Permit, through the coastal management consistency process coordinated by the State of Alaska for projects requiring dredge and fill permits for the US Army Corps of Engineers.

(b) The standards for review of wetlands permits are as follows:
(5) Shoreline Corridor Designation Rules,

(A) For riverain wetlands (rivers): All catalogued anadromous fish streams shall have a fifty-foot shoreline corridor on each side of the stream, measured from ordinary high water in the main channel. The fifty-foot corridor shall be designated and managed as wetlands Category A. This rule applies only to wetlands adjacent to anadromous fish streams included in the "Catalog of Waters Important for Spawning, Rearing or Migration of Fish and Game and streams that were nominated for inclusion in the catalog as of October 31, 1991. The shoreline corridor extends upstream to the limit of anadromous fish use indicated in the catalog. Additional streams may be catalogued by the Alaska Department of Fish and Game subsequent to the approval of the Juneau Wetlands Management Plan. Once catalogued, these streams would also be subject to the Shoreline Corridor Designation Rules.

EXISTING CONTROLS

AGENCY	AUTHORITY	TYPE OF CONTROL	INTENT	COMMENTS
City & Borough of Juneau (CBJ) Community Development Department	Title 49/Land Use Ordinance 49.15.330 49.15.320	Conditional Use Permit Allowable Use Permit	To review and condition land use permits to reduce or prevent adverse impacts.	Conditions on water quality, habitat protection, etc. can be placed on these.
	49.20.200	Variance	Permit authorizing applicant to vary dimensional or design standards.	Variance criteria is standard. Does not include environmental criteria.
	Title 19	Building Permit	Review construction plans for building code, and land use code requirements when no development permit is required.	
	49.70.310 (a)(4) & (5); (b)(1)(2)	Habitat/ Streamside Setback	To protect water quality and habitat in and adjacent to anadromous fish streams	Can get a variance to this based on established variance criteria.
	49.35.510(a)	Public Improvements/ Drainage	To show all drainage facilities and the effect of any changes on adjacent properties.	
	49.35.540	Public Improvements/ Easements	To provide and dedicate easements along any stream in such width as City Engineer determines is necessary for protection.	
	Title 49/Land Use Ordinance 49.40.230(c)	Parking & Circulation Stds.	To see that parking lots are suitably drained and any off-site drainage facilities and structures requiring modification are done to CBJ standards.	
	49.15.430	Subdivision Plat Review	Review and approve subdivisions of land for development in compliance with City Ordinances (ie:drainage, erosion control, stream habitat protection, floodplain)	

EXISTING CONTROLS

AGENCY	AUTHORITY	TYPE OF CONTROL	INTENT	COMMENTS
City & Borough of Juneau (CBJ)	49.70.240-260	Hillside Development	To provide erosion and drainage control, protect water quality, minimize injury or damage to people or property and minimize aesthetic impact.	
	49.50.300	Vegetative Cover	To maintain a certain percentage of a lot in vegetative cover for erosion and aesthetic purposes.	
	49.70.400	Floodplains	To control uses and/or alteration of the natural floodplains and stream channels that accommodate or channel floodwaters and prevent erosion damage.	
	49.65.210(7)(A) & (I); 49.65.230(6)&(7)	Sand & Gravel Permit	To show drainage and specify measures to protect water quality; & ensure adequate drainage or collection & storage of surface waters to protect surrounding property.	
	Title 49/Land Use Ordinance/Juneau Coastal Management Program 49.70.905(4), 49.70.950 & 49.70.955	Coastal Development, Habitat, & Air, Land, and Water Quality Enforceable Policies	Minimize or prevent impacts to fish habitat and water quality as a result of coastal development.	
	Juneau Wetlands Plan 49.70.1080(b)(5)(A) & (C); (b)(7)	Wetlands Management Enforceable Policies	Protect stream corridors adjacent to identified wetland units.	
	Comprehensive Plan 49.05.200 Policy 3.1 Implementing Actions 3.1.1 -3.1.8	Stream Corridors Protection	Protect stream corridors from adverse effects of development and to provide for higher level of protection for non-urban shorelines in public ownership.	

EXISTING CONTROLS

AGENCY	AUTHORITY	TYPE OF CONTROL	INTENT	COMMENTS
City & Borough of Juneau (CBJ)	Policy 3..2 Implementing Actions 3.2.8 - 3.2.10 & 3.2.17	Wetlands Management	Protect wetlands from adverse effects of development through land use management.	Greenbelts along fish streams, vacate unecessary CBJ right-of-way's, cooperate in wetland & stream restoration & enhancement efforts, etc.
	Policy 3.3 Implementing Actions 3.3.1-3.3.8	Water Quality	To protect, maintain, and improve surface water, & groundwater so they are in compliance with AK Water Quality Stds.	
	Policy 4.17 Implementing Action 4.17.7	Open Space	Preserve as public open space publicly owned shoreline areas which possess important recreation scenic, wildlife & other environmental qualities.	Designate open space corridors on CBJ, state & federal land along anadromous fish streams, greater than 50', less than 200'.
City & Borough of Juneau (CBJ) Engineering Department	1991 Uniform Building Code Chapters 70, 29	Grading and Drainage Permit/ Erosion Control	To prevent damage from grading or erosion to adjoining property.	
State of Alaska/ Department of Environmental Conservation (DEC)	Federal Statute/ 33 U.S.C. 1341 (Clean Water Act, Section 401) Alaska Statute/ AS 46.03 Regulations/ 18 AAC 72	Certificate of Reasonable Assurance	Assure federal permits will result in compliance with state water quality standards.	Issued for all NPDES permits by EPA and 404 permits by Corps of Engineers (COE).
	Federal Statute/ Clean Water Act , Section 303 Alaska Statute/ AS 46.03 Regulations 18 AAC 70	Alaska Water Quality Standards	Limit water quality impacts and protect designated uses.	

EXISTING CONTROLS

AGENCY	AUTHORITY	TYPE OF CONTROL	INTENT	COMMENTS
State of Alaska/ Department of Environmental Conservation (DEC)	Alaska Statute/ AS 46.03 Regulations/ 18 AAC 72	State Wastewater Discharge Permits	Specify wastewater treatment levels and control environmental impacts .	Seldom issued. Issued only for discharges too small to warrant an EPA NPDES permit.
	Alaska Statute/ AS 46.03 Regulations/ 18 AAC 72	Wastewater System Plan Review	Assure wastewater systems meet minimum design criteria.	
	Alaska Statute/ AS 46.03 Regulation/ 18 AAC 72	Subdivision Plan Review	Assure safe means of securing potable water and disposing of wastewater from subdivision development.	
	Alaska Statute/ AS 46.03 Regulations/ 18 AAC 60	Solid Waste Permit	Control environmental impacts associated with solid waste disposal.	
	Alaska Statute/ AS 46.40 Regulations/ 6 AAC 80.140	Alaska Coastal Management Program Air, Land, & Water Quality Standards	To protect or minimize impacts to water quality and habitat from development within the coastal zone.	
	Federal Statute/ Clean Water Act, Section 402 Regulation/ 18 AAC 72	State certification of NPDES Wastewater Discharge Permit	Ensure that federally permitted discharge will not cause violation of State Water Quality Standards.	Applies only for discharges to water.

EXISTING CONTROLS

AGENCY	AUTHORITY	TYPE OF CONTROL	INTENT	COMMENTS
State of Alaska/ Department of Environmental Conservation (DEC)	Federal Statute/ Clean Water Act, Section 402	State certification of NPDES Stormwater Discharge Permit	Control impacts of stormwater runoff on receiving waters.	Applies only for discharges to water.
	Director's Policy/ Division of Environmental Quality/ Menge, 2/28/93	Policy on permitting within TMDL watersheds	Establishes a policy and procedures for processing permit applications within a TMDL watershed.	
City & Borough of Juneau/ State of Alaska, Department of Environmental Conservation	Memorandum of Agreement	Cooperative Agreement	Commitment to work together for water quality restoration on water quality -limited waters in Juneau.	Expires 12/31/96. May be continued or renegotiated by mutual consent.
State of Alaska/ Office of the Governor/ Division of Governmental Coordination	Federal Statute/ 16 U.S.C. 1454, Coastal Management Act, Section 305 Alaska Statute/ AS 46.40 Regulation 6 AAC 50 6 AAC 80	Alaska Coastal Management Program Coordination of project review Consistency Determination	Identify the permits required by State resource agencies and determine the project's consistency with the standards of the ACMP and enforceable policies of approved district coastal mgt programs	
	Federal Statute/ Coastal Zone Act Reauthorization Amendments/ Section 6217	Coastal Non-point Source Pollution Program		

EXISTING CONTROLS

AGENCY	AUTHORITY	TYPE OF CONTROL	INTENT	COMMENTS
State of Alaska/ Department of Fish & Game	Alaska Statute/ Anadromous Fish Act/ AS 16.05.870 - 900 Regulation/ 5 AAC 95	Fish Habitat Permit	To protect and conserve fish and game populations and their habitats within anadromous streams and to assure that human activities within fish streams do not impede the free and efficient passage of fish.	
	Alaska Statute/ 46.40 Regulation/ 6 AAC 80.130 & 140	Alaska Coastal Management Program Habitat; Air, Land & Water Quality Standards	To protect and/or minimize impacts to habitat and water quality from development within the coastal zone.	
	Alaska Statute/ Fishway Act/ AS 16.05.840	Fish Habitat Permit	To protect fish habitat values in streams used by fish.	
State of Alaska/ Department of Trans-portation & Public Facilities			DOT/PF projects must go through permit process. Federal, State, or local agencies can place water quality, habitat conditions on approval of projects	
State of Alaska/ Department of Natural Resources/ Division of Land	Alaska Statute/ AS 38.04.065 Regulation/ 11 AAC 55.010-.030	Juneau State Land Use Plan	To guide management of state lands in Juneau area to stimulate economic activity while providing for protection of important resources and natural values of the area.	Recommended widths for public access, building setbacks, & fish habitat mgt zones along shoreline and stream corridors when transferring land out of state ownership or leasing land.
United States/ Department of the Army/ Corps of Engineers	Federal Statute/ Clean Water Act, Section 404	Permit for discharge of dredged or fill material into waters of the United States.	Protect water quality, habitat	

EXISTING CONTROLS

AGENCY	AUTHORITY	TYPE OF CONTROL	INTENT	COMMENTS
United States/ Department of the Army/ Corps of Engineers	Federal Statute/ Fish & Wildlife Coordination Act/ 16 U.S.C. 666 - 666C	Permit Review	Any activity to control or modify a body of water must coordinate review with USFWS, NMFS, and ADFG, as appropriate.	
United States/ Environmental Protection Agency	Federal Statute/ Clean Water Act, Section 402	NPDES Wastewater Discharge Permit	Assure treatment of wastewater prior to discharge and control impacts on receiving waters.	Applies only to discharge of water.
	Federal Statute/ Clean Water Act, Section 402	NPDES Stormwater Discharge Permit	Control impacts of stormwater runoff on receiving waters.	Applies only for discharges to water.
State of Alaska/ Department of Natural Resources/ Div of Mining and Water Mgmt	Alaska Statute/ AS46.15 and 11 AAC 93	Water Allocation Permitting	Orderly and equitable allocation for optimal water resource development, supporting beneficial uses of water while protecting water quality and aquatic habitat.	Instream Flow Reservations may be established to help maintain water quality. Water Rights adjudications must consider effects on habitat, recreation, water quality, etc.

MEMORANDUM OF AGREEMENT

BETWEEN

THE CITY AND BOROUGH OF JUNEAU

AND

THE STATE OF ALASKA

REGARDING

IMPLEMENTATION OF SECTION 303(d)

OF THE CLEAN WATER ACT:

TOTAL MAXIMUM DAILY LOADS

A. Introduction

The Clean Water Act (CWA), Section 303(d), requires that States identify and rank by priority, waters for which technology-based effluent limitations are not stringent enough to implement water quality standards applicable to such waters (water quality-limited waters). 33 U.S.C. 1313(d)(1)(A). In accordance with the priority ranking, States must establish total maximum daily loads (TMDLs) for waters for which more stringent effluent limitations required by state or local law or other pollution practices will not result in attainment of applicable water quality standards. 40 C.F.R. 130.7(b). The U.S. Environmental Protection Agency's (EPA) CWA regulations require the States to submit the list of waters, pollutants causing impairment, and the priority ranking including waters targeted for TMDL development every two years. 40 C.F.R.130.7(d)(1).

A TMDL is the sum of the individual waste load allocations for point sources and load allocations for nonpoint sources and natural background. 40 C.F.R.130.2(i). The TMDL allocation for a given waterbody is defined in terms of loading capacity. Loading capacity is the greatest amount of a specific pollutant, originating from both point and nonpoint sources, that a waterbody can sustain without violating water quality standards. 40 C.F.R. 130.2(f).

EPA must establish its own list of water quality-limited segments if a state fails to do so or submits a list that EPA disapproves. 33 U.S.C. 1313(d)(2); *Alaska Center for Env't v. Reilly*, 796 F.Supp.1374, 1377 (W.D.Wash. 1992).
Similarly, EPA has a mandatory duty to develop TMDLs when States fail to do so. 33 U.S.C. 1313(d)(2); *Scott v. City of Hammond, Ind.*, 741 F.2d 992 (7th Cir. 1984); *Alaska Center for Env't v. Reilly*, 762 F.Supp. 1422, 1429 (W.D.Wash. 1991).

The Alaska Department of Environmental Conservation (ADEC) entered into a Memorandum of Understanding (MOU) with EPA in 1992 to implement section 303(d) of the CWA. The U.S. District Court for the Western District of Washington adopted in full this MOU as a partial, short-term solution to TMDL implementation for the State of Alaska.[1] *Alaska Center for Env't v. Reilly*, 796 F.Supp. 1374, 1379 (W.D.Wash. 1992). However, the Court required EPA to provide a long-term schedule for TMDL development in Alaska. *Id.* at 1380. EPA submitted the long-term schedule to the Court in September, 1992.

Currently, seven waterbodies in the City Borough of Juneau (CBJ) have exceeded state water quality standards and are listed as water quality-limited under 303(d). These include North and South Twin Lakes, Lemon, Vanderbilt, Duck, Salmon, and Pederson Hill Creeks. ADEC has completed TMDL assessments on Pederson Hill, Lemon and Vanderbilt Creeks and will develop TMDL allocations by September of 1995 on Lemon and Vanderbilt Creeks. ADEC will complete a waterbody assessment on Duck Creek by June 30, 1995. The remaining waters are subject to TMDL assessment and may be subject to TMDL allocations.

[1] The MOU expired in June, 1994.

ADEC's objective is to assure that existing controls such as permit conditions, enforcement, and best management practices are implemented to maximize compliance with state water quality standards. Where compliance cannot be achieved with existing controls, ADEC will develop TMDL allocations.

B. Statement of Purpose

Both CBJ and ADEC desire to assure compliance with state water quality standards within CWA section 303(d) listed waterbodies in the City and Borough of Juneau. By this agreement, CBJ and ADEC establish a common agenda to work together for water quality restoration on these water quality-limited waters. Both parties commit to coordinating policies and actions that will result in compliance with water quality standards and CWA section 303(d) for the purpose of protecting , maintaining and improving water quality.

Coordinated activities that will benefit these aquatic resources include CBJ and State permitting, comments on federal permits, planning for projects on CBJ lands, capital projects budgeting, and road projects. Most importantly, specific mutual goals are set forth to be accomplished within set time frames.

C. CBJ and ADEC Agree:

1. The ADEC Contact for initiating the activities defined in this Memorandum shall be the Southeast Regional Office TMDL Project Coordinator, with assistance from the Juneau District Office. The Contact for CBJ shall be the City Manager or designated CBJ staff. The contact personnel for CBJ and ADEC will meet quarterly to review terms and document the progress achieved under this agreement.

2. Amendments or additional appendices to this Memorandum may be developed and implemented by mutual agreement at any time, without renegotiating the entire document.

3. This Memorandum creates no cause of action against ADEC or CBJ beyond those, if any, that may already exist under State or federal law. This agreement shall not be construed to create any right to judicial review involving the compliance or noncompliance of ADEC or CBJ with the provisions contained herein.

4. This Memorandum and all obligations arising hereunder, shall terminate on December 31, 1996. The agreement may be continued or renegotiated by mutual consent. The State and CBJ intend, in any case, to continue to work cooperatively to carry through with any remaining objectives not met by the expiration date.

5. ADEC and CBJ acknowledge that some of the activities outlined in this Memorandum will require additional resources and/or personnel. Accordingly, areas of italicized text contained herein indicate those items necessarily contingent upon the successful acquisition of

implementation funding. CBJ and ADEC agree to actively pursue all potential sources for financing these commitments. Options to be considered include CWA Section 104(b)(3) grants, CWA Section 319 sources, and State, municipal and private sector funding.

6. CBJ and ADEC shall develop effective lines of communication to address new development projects within 303(d) impaired watersheds and the State and City regulation of such activities. CBJ shall commit to giving routine opportunity to ADEC to comment and consult on those permit approvals, renewals, and actions that would potentially affect 303(d) listed waterbodies. These should include applicable CBJ issued approvals including Allowable Use, Conditional Use, Wetlands, Streamside Variances, and Subdivisions; CBJ comments on federal permits; leases and disposals of CBJ land; projects on CBJ lands; road and drainage projects; and capital projects planning. The commenting period on CBJ permit actions will be 15 days. Reviews performed under this MOA are not subject to ADEC fees, unless required under 18 AAC 72 and 18 AAC 15.180. CBJ will notify ADEC of any enforcement of CBJ permit conditions. ADEC shall commit to providing CBJ advance notice of any decisions or policies related to 303(d) watersheds that may impact municipal development, including certification of federal permits, findings of water quality violations, and potential enforcement action, to the extent this would not undermine the enforcement action. CBJ and ADEC shall routinely respond, if requested, within ten days of receipt of correspondence.

7. *CBJ and ADEC shall cooperatively develop a database of information as it relates specifically to permit conditions, permit compliance and watershed restoration within and adjacent to CWA 303(d) listed waterbodies.*

8. ADEC shall finalize by September 1, 1995, TMDL allocations and Waterbody Recovery Plans for Lemon and Vanderbilt Creeks. As part of the development of TMDL allocations, ADEC will develop Waterbody Recovery Plans, which will identify and describe sources of contamination, address habitat impacts and other beneficial uses, propose Best Management Practices (BMPs), develop BMP monitoring programs, and provide for public and industry participation. ADEC will take the lead in developing TMDL allocations and Waterbody Recovery Plans; CBJ commits to consultation and cooperative implementation of plan specifics. *ADEC shall also within two years perform additional Water Quality Assessments on other CBJ impaired watersheds.* The goal again is to bring waters into compliance with State Water Quality Standards. Once water quality standards are achieved, waters may be removed from the list of impaired waters.

9. *ADEC shall take the lead, in cooperation with CBJ, in developing a Best Management Practices Manual within one year that includes a comprehensive listing of BMPs applicable to the prevention and mitigation of nonpoint sources of pollution.* CBJ will incorporate mutually approved BMPs into CBJ-issued approvals and Comprehensive Plan amendments.

10. CBJ shall provide for the inclusion of a Section, in the revised CBJ Comprehensive Plan, devoted exclusively to 303(d) listed waterbody issues and ways to cooperatively adopt

water quality restoration approaches in conjunction with industry and the State. Maintaining State Water Quality Standards for all CBJ waterways shall be specifically addressed in City Land Use Policy.

11. Provisions for public education and citizen involvement shall be jointly pursued and encouraged. Two workshops will be conducted annually to solicit industry and public participation in the restoration of impaired waterbodies. Incentives shall be explored for industry to provide funding and personnel for developing restoration projects.

12. *ADEC shall within two years conduct field monitoring to both verify the extent of beneficial use impairment and to assess the implementation and effectiveness of Best Management Practices within and adjacent to CBJ 303(d) listed waterbodies.*

13. *ADEC shall, in consultation with CBJ, coordinate on-site inspections of commercial operations within and adjacent to 303(d) listed watersheds to assure compliance with permit stipulations. The goal is to verify permit conditions, evaluate all major commercial activities for permit compliance, and include enforcement when permit or State Water Quality Standards violations occur.*

The following consent to the above agreement for the mutual benefit to the State of Alaska and to the City and Borough of Juneau.

Mark Palesh, City Manager — Date
City and Borough of Juneau

3/31/95

Gene Burden, Commissioner — Date
Alaska Department of
Environmental Conservation

3/30/95

Michael A. Conway — Date
Area Public Service Manager
Alaska Department of
Environmental Conservation

MEMORANDUM

State of Alaska

Department of Environmental Conservation

TO: Dick Stokes, Reg. Admin., SERO
Svend Brandt-Erichsen, Reg. Admin., SCRO
Pete McGee, Reg. Admin., NRO
Bob Flint, Acting Reg. Admin., PCRO

DATE: May 10, 1993

FILE NO: h:\home\dougr\tmdl.pol

THRU:

TELEPHONE NO: (907) 465-5260/Fax 465-5274

FROM: Michael L. Menge, Director
Division of Environmental Quality

SUBJECT: Policy on Addressing New Permit Proposals in TMDL Watersheds

In January 1991, the Department and the Environmental Protection Agency (EPA) signed a Memorandum of Understanding (MOU) establishing joint responsibilities and procedures for completing the first phase of assessments and strategies to address five categories of impaired waterbodies, commonly called "Total Maximum Daily Load" or "TMDL" waterbodies. In September 1992, the Department approved a schedule with the EPA for jointly completing TMDL water quality assessments for 27 impaired waterbodies from FY 93 through FY 97.

The Regional Offices have requested guidance on the Department's policy and procedures for dealing with new project applications within the watersheds of these candidate TMDL waterbodies. On February 11, a meeting was held with Southeast Regional Office permit staff to discuss the framework for a policy. This memorandum establishes the Department's policy in this matter.

A number of issues are addressed in this policy. First is whether the Department or the Division of Governmental Coordination (DGC) are legally mandated to deny approval of Section 404 and other permit applications within TMDL watersheds by virtue of federal regulation or the existing DEC/EPA TMDL Memorandum of Understanding. The answer to this question is clearly no. There is no language in the Clean Water Act, the MOU, or other sources that indicates that permits should be categorically denied. Precedents in other Region X states have not included a categorical prohibition on permitting new developments within TMDL watersheds.

A second question is how a proposed project should be controlled in light of pending or ongoing TMDL activity. Clearly, the goal of the TMDL process is to first, assess water quality, followed, as appropriate, by bringing the waterbody into compliance with

water quality standards. This may be achieved ultimately through a TMDL strategy that describes "wasteload allocations" for point sources, implemented through discharge permits, and "load allocations", implemented through nonpoint pollution control plans. *In the interim period, a new or modified project should have stipulations attached such that, to the maximum extent feasible, further degradation of water quality for the pollutants under investigation would be strictly limited.*

Early and *full disclosure of the sensitivity of the waters* in question should be made by the Department in a letter to applicants or, in the case of multiple applicants, directly by industry associations. The letter should include a summary of water quality problems tentatively identified, the schedule for assessment activity, a goal of minimizing water quality impacts pending the outcome of the assessment and, as necessary, the possibility of reopening the project for load or wasteload allocations if developed through a TMDL strategy. A standard reopener clause will need to be developed for 401 certifications. Coastal districts with TMDL waters should be notified so that they are aware of department policy and can assist in notifying and working with applicants.

A face-to-face meeting with applicants is encouraged to go over these written concerns.

In developing terms of permits and certifications, the Department must include stipulations, as appropriate given the phase of assessing the waterbody, to assure that the project will not cause a ~~marked~~ increase in water quality degradation with respect to TMDL pollutants, or cause or contribute to violations of standards of other pollutants. At the same time, the Department must work closely with applicants to attempt to assure viability of project proposals. Available controls in permits and certifications include effluent limitations for point sources, and specific *"pollution control plans" to address nonpoint source concerns in both construction and operation phases.*

The controls in permits and certifications should not attempt to prejudge the outcome of a potential TMDL strategy for a waterbody or to impose waste allocations prior to development of a TMDL strategy. Rather, such controls should attempt to avoid degradation of water quality, with the recognition that permits may be reopened as necessary to implement waste allocations developed through a TMDL assessment and strategy. ov WBRP

An additional question is how project proposals within TMDL watersheds are reviewed under timelines in the Alaska Coastal Management Program consistency review. During the coastal consistency review, the Department may request more information by day 25 of the review. Where appropriate, the request should include specifics of a "pollution control plan" needed to address the identified problems for the waterbody, including construction and operational plans to reduce pollution.

The site-specific controls on new developments within or adjacent to TMDL waters are a function of the pollutants likely to be introduced into the waters, project location with respect to the impaired segment, and applicant-proposed mitigation and pollution prevention controls. For example, a construction project in a TMDL watershed listed as impaired for bacteria or color standards may not need the same level of pollution control than if the impairment were due to sediment and hydrocarbons.

The Department has the lead responsibility for TMDLs on nonpoint source-affected waters and projects, typically those requiring a dredge and fill permit under Section 404 of the Clean Water Act. EPA has the lead on requiring pollution control plans for point source-affected TMDL waters, such as Ward Cove, Silver Bay and Unalaska Bay.

Please circulate this policy within your regions to staff responsible for TMDL work, certification of NPDES and 404 permits, and issuance of State wastewater permits. Thank you for your assistance in developing and carrying out this policy.

DR/MLM/gh
cc: Paul Rusanowski., Ph.D., Director, DGC

MEMORANDUM STATE OF ALASKA

To: Project Review Coordinators
Project Review Assistants
Project Analysts

Date: May 19, 1993

Telephone: 465-3562
Telecopy: 465-3075

From: Paul C. Rusanowski, Ph.D.
Director
Division of Governmental Coordination

Subject: TMDL Guidance

The Department of Environmental Conservation (DEC) central office recently provided guidance to DEC regional offices on policy and procedures for dealing with new projects proposed within watersheds of candidate Total Maximum Daily Load (TMDL) waterbodies. TMDLs are "impaired" waterbodies. The guidance memorandum from DEC is attached (Enclosure 1). A list of the 27 TMDL waterbodies in Alaska appears in Enclosure 2.

Following is a brief summary of salient points from that memorandum that relate to the Alaska Coastal Management Program:

1. Neither DEC or DGC are legally mandated to deny approval of Section 404 or other permit applications within TMDL watersheds. Permitting new developments is <u>not</u> categorically prohibited.

2. In TMDL watersheds, the goal is to bring the waterbody into compliance with water quality standards. Ultimately, this may be achieved through a TMDL strategy. In the interim period, a new or modified project should have stipulations attached such that, to the maximum extent feasible, further degradation of water quality for the pollutants under investigation would be strictly limited. DEC must include stipulations to ensure the project will not cause a marked increase in water quality degradation with respect to TMDL pollutants.

3. DEC should provide early and full disclosure of the sensitivity of waters in question to applicants. DEC should also notify coastal districts of TMDL waters so they are aware of department policy.

4. ACMP consistency review timelines apply to project proposals within TMDL watersheds. During a 50-day consistency review, DEC may request additional information by day 25 of the review. Where appropriate, the request should ask for specifics of a "pollution control plan" needed to address the identified TMDL pollutants for the waterbody.

Please refer to the DEC memorandum for further detail. If you have further questions, please let me know.

Enclosures (2)

cc:

Susan Braley, DEC

Appendix F LOADING CAPACITIES

Affected Beneficial Uses

The water quality assessment for Lemon Creek identifies fish habitat as the most important beneficial use of Lemon Creek, and the water body restoration plan focuses on mitigating impacts on that particular use.

Applicable Water Quality Standards

The 303(d) listing document identifies sediment, turbidity, debris and habitat modification as the parameters of concern. Alaska's water quality standards set out criteria for turbidity, sediment and residues (defined as floating solids, debris, sludge, deposits, foam, scum, or other residues) intended to protect water quality for aquatic life and wildlife:

Turbidity: 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 15 NTU.

Sediment: 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 from 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). . . . 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.

Residues: May not, alone or in combination with other substances or wastes, make the water unfit or unsafe for the use, or cause acute or chronic problem levels as determined by bioassay or other appropriate methods. May not, alone or in combination with other substances, cause a film, sheen, or discoloration on the surface of the water or adjoining shorelines, or cause leaching of toxic or deleterious substances, or cause a sludge, solid, or emulsion to be deposited beneath or upon the surface of the water, within the water column, on the bottom, or upon adjoining shorelines.

There are no standards or criteria for habitat modification.

Selection of Loading Capacity Parameters

As is to be expected, the water quality criteria parameters do not lend themselves to direct application in estimating loading capacity. Turbidity as an optical, non-conservative parameter, for example, cannot be directly translated into a load expressed in terms of mass per time. The sediment criterion expressed in terms of percent fines in spawning gravels also cannot be expressed as a load, and does not apply over the entire reach of Lemon Creek. The narrative criterion for residues (inclusive of debris) is also not easily expressed as a load.

In order to assure that water quality criteria for both turbidity and sediment are met and beneficial uses protected, the strategy adopted is to limit the total suspended sediment load, and to provide specific limits on the more harmful, settleable fraction of the total load. Parameters such as total suspended solids (TSS) or total nonfilterable residue (TNFR) expressed as mass per unit volume are readily converted into loads expressed as mass per time as long as the flow is known. While turbidity, as an optical property of water, is not universally related to mass-per-unit-volume-type sediment concentrations, such as TSS or TNFR, a strong relationship often exists at a particular stream site. The strategy employed in this analysis calls for examining the relationship between Lemon Creek turbidity and sediment concentrations, and using suspended sediment concentrations and loads (with an appropriate margin of safety) as a surrogate for controlling turbidity.

While controlling suspended sediment concentrations should be adequate to control turbidity, it will not in and of itself control impacts on spawning gravels or the streambed in general. Because Lemon Creek carries a significant natural load of sediments during parts of the year, it is probably less important to control total suspended loads during those periods, than it is to control specifically sediments that are coarser than the natural load to guard against deposition and consequent impacts on spawning gravels and the composition of the stream bed in general. In Alaska, sediments less than 0.1 millimeters (mm) in diameter are typically transported as suspended sediments, while sediments greater than 1.0 mm in diameter are transported as bedload (Everest et al. 1987).

One method of guarding against an increase in coarser sediments would be to actually establish a load in terms of concentrations of sediments of a certain size. For example, given sufficient data it would be possible to derive a loading capacity specifically for sediments larger than 0.1 mm in diameter. As a practical matter, however, such measurements are difficult and costly. Instead, the strategy adopts settleable solids to measure the coarser fraction of solids. The settleable solids

measure produces a result in terms of volume per volume which is not easily converted into a load, but it is possible to express settleable solids as a mass per unit weight, or as a fraction of the total suspended solids load.

The test for settleable solids involves measuring the volume of sediment that settles from a water sample under quiescent conditions. Adopting settleable solids as a parameter for loading calculations is intended to assure compliance with the water quality criteria for fines in spawning gravels.

Margin of Safety

CWA section 303(d) and EPA regulations (40 CFR Parts 35 and 130) require that determination of loading capacities include a margin of safety which allows for uncertainties in the analysis. The margin of safety can be expressed by reserving a portion of the loading capacity to a separate margin of safety, or by including a margin of safety within the individual load allocations.

For total suspended solids and settleable solids, a margin of safety of 15 percent of the loading capacity was adopted.

Quantifiable End-Points

The strategy calls for developing loading capacities based on the following quantifiable end-points. The end-points are also intended as standards against which the effectiveness of controls can be measured.

Turbidity: Increase from upstream to downstream not to exceed 5 NTUs.

Sediment (Total Suspended): Annual average overall increase from upstream to downstream not to exceed a load and concentration corresponding to a 5 NTU increase in turbidity.

Sediment (Settleable): No increase from upstream to downstream in settleable solids load and concentration.

Sediment (Spawning Gravels): Percent accumulation of fine sediment in the range of 0.1 mm to 4.0 mm in spawning gravels less than 30% by weight.

Debris: Essentially no debris present, and no debris that would interfere with aquatic life uses.

Habitat Modification: No further degradation of aquatic habitat. Restoration of habitat values to the extent practicable.

Loading Calculations

Total Suspended Solids

Data were available from the U.S. Department of the Interior, Geological Survey (USGS) for a gaging station located 0.3 mile upstream of the confluence of Canyon Creek with Lemon Creek. The data included daily stream flows for the period August 1951 through November 1953, and July 1954 through September 1973. Available data also included 14 sets of non-zero measurements of suspended sediments as a concentration (milligrams per liter) and as a load (tons per day). Copies of the data are included in Appendix D.

The process used to calculate loading capacities is set out below.

Calculate the Natural Suspended Sediment Load

Plot the background flow vs. suspended sediment data for the USGS data at the station 0.3 miles upstream of the confluence of Canyon Creek with Lemon Creek.

A log-log plot of the data is shown in Figure F-1.

Use regression analysis to determine the relationship between background flows and suspended sediment yields.

We assumed a linear relationship between the log of the suspended sediment load and the log of the flow. Linear regression of the available, non-zero data produced the following relationship:

$$\log(SS) = [1.64 \times \log(Q)] - 2.66$$

or

$$SS = 0.0022 \times Q^{1.64}$$

Where: SS = suspended sediment load in tons per day, and
Q = stream flow in cubic feet per second.

The relationship yields a coefficient of determination of 0.956 suggesting good correlation between

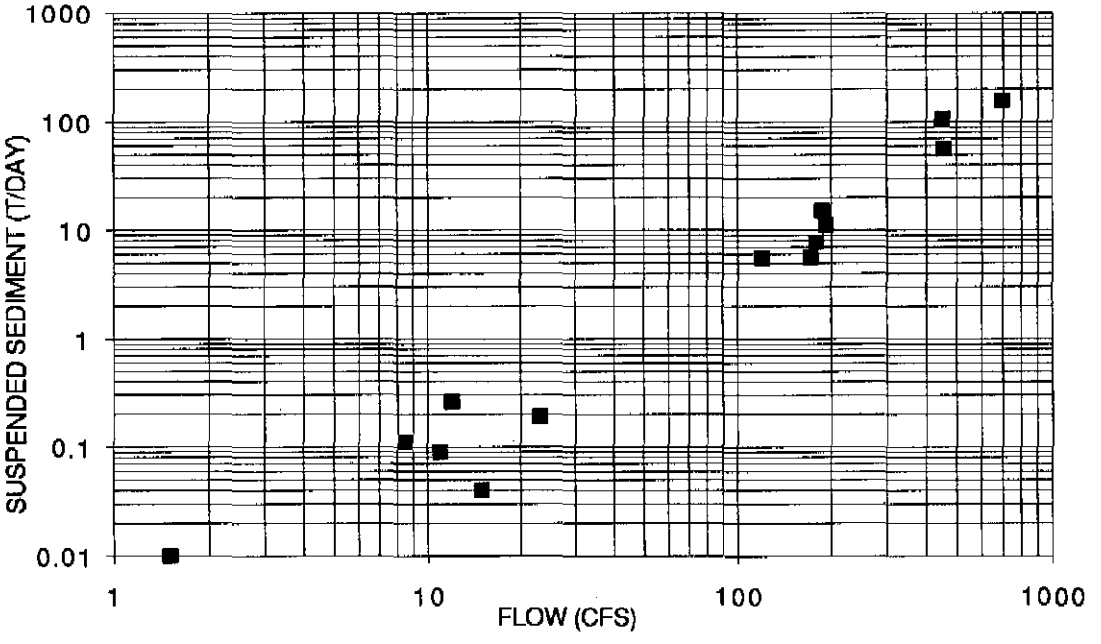

Figure F-1
Flow vs. TSS Load

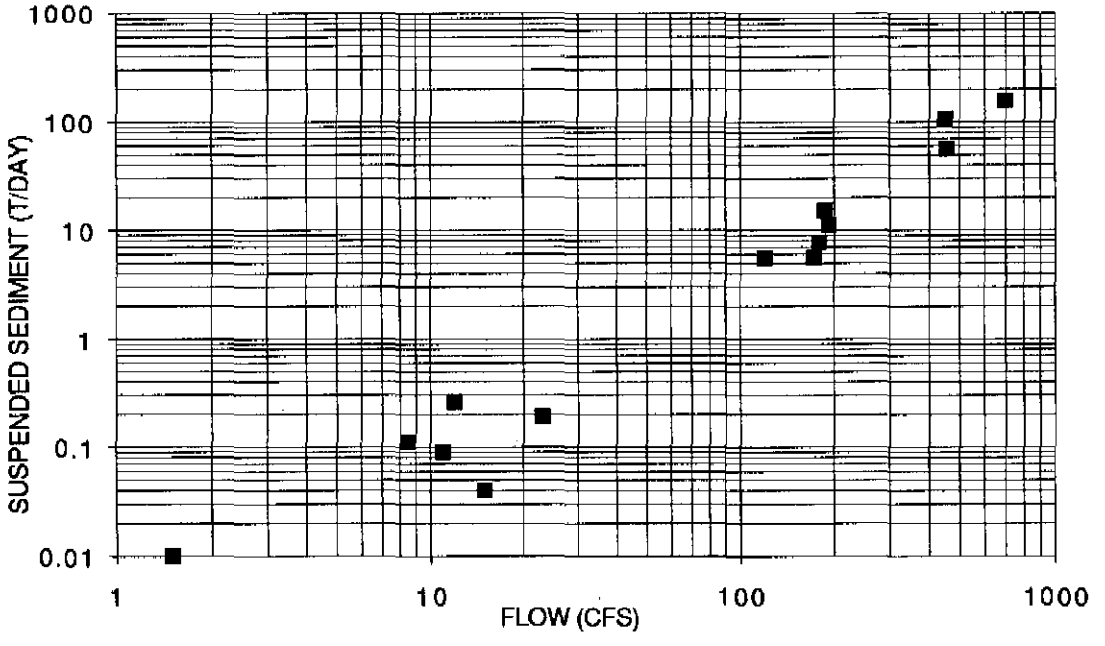

Figure F-1
Flow vs. TSS Load

the log of the flow and the log of the suspended sediment load. A plot of actual and predicted suspended sediment yields is included in Figure F-2.

Using the USGS record mean monthly flows, predict background mean monthly suspended sediment yields using the relationship between flow and suspended sediment load derived in the previous step.

A plot of the mean monthly flows for the 1951-1973 USGS upstream gaging records is shown in Figure F-3. Figure F-4 shows the predicted background mean monthly suspended sediment loads in Lemon Creek (at 0.3 mile above Canyon Creek).

Convert mean monthly suspended sediment loads in tons per day into total suspended sediment concentrations in milligrams per liter (mg/l). The relationship between the suspended sediment load in tons per day, and the suspended sediment concentration in milligrams per liter derived by the USGS is given as follows:

$$SS\ (T/day) = 0.0027 \times SS\ (mg/l) \times Q\ (cfs)$$

or

$$SS\ (mg/l) = \frac{370 \times SS\ (T/day)}{Q\ (cfs)}$$

Where: SS (T/day) = suspended sediment load in tons per day,
SS (mg/l) = suspended sediment concentration in milligrams per liter, and
Q = stream flow in cubic feet per second.

Equate suspended sediment concentrations with total suspended solids (TSS) concentrations. While there could be a difference between suspended sediment, which does not include organic particles, and total suspended solids, which includes both organic and inorganic particles, the vast majority of upper Lemon Creek's suspended particulates are thought to be of clastic origin (glacial silt). The organic contribution to the suspended solids load is very likely negligible.

Calculate the Allowable Increase in Suspended Sediment Load

This step equates to converting an allowable increase in turbidity of 5 NTUs into an allowable increase in suspended sediment concentrations and loads.

Examine available data for a relationship between suspended sediments and turbidity to permit expression of the allowable 5 NTU turbidity increase in terms of an allowable increase in suspended sediment concentrations and loads. Turbidity vs. total nonfilterable residue (TNFR) data are available only for lower Lemon Creek. Figure F-5 is a plot of TNFR vs. turbidity based on

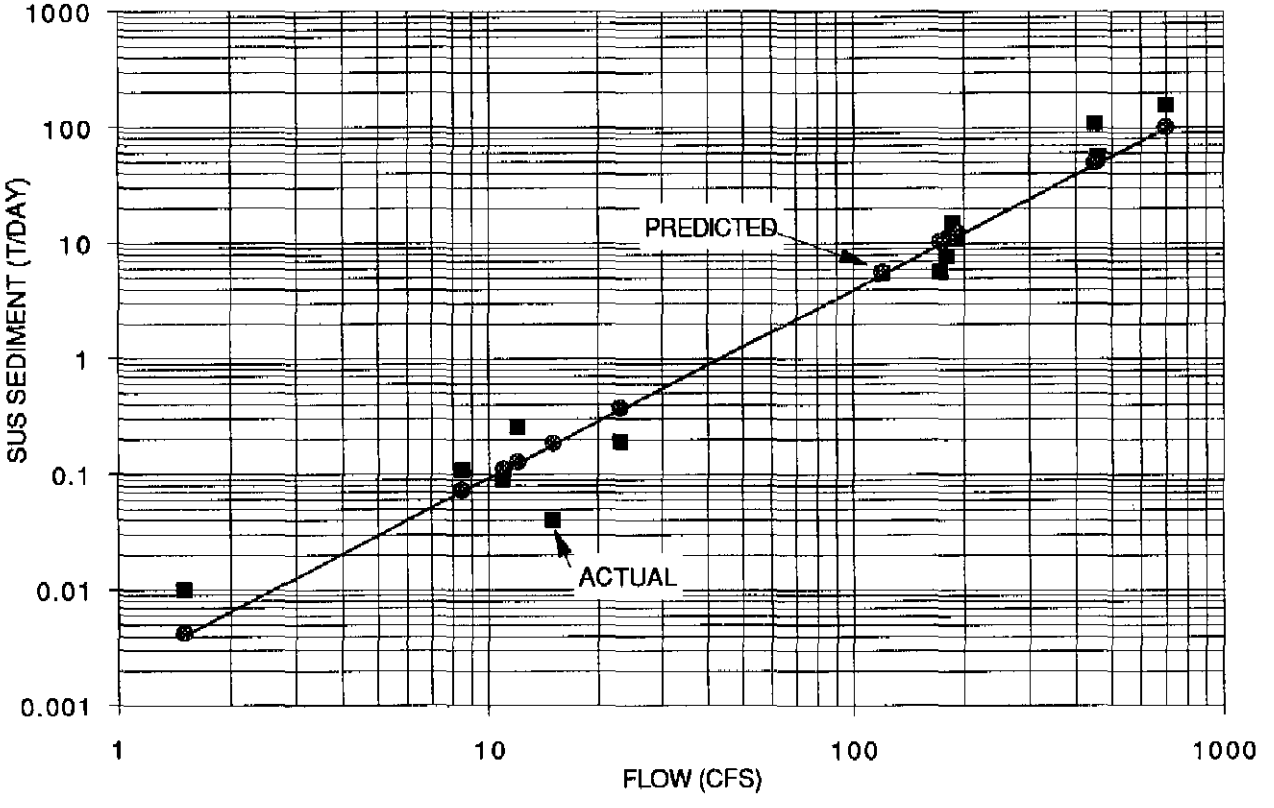

Figure F-2
Relationship Used to Predict Natural TSS Loads From Flows

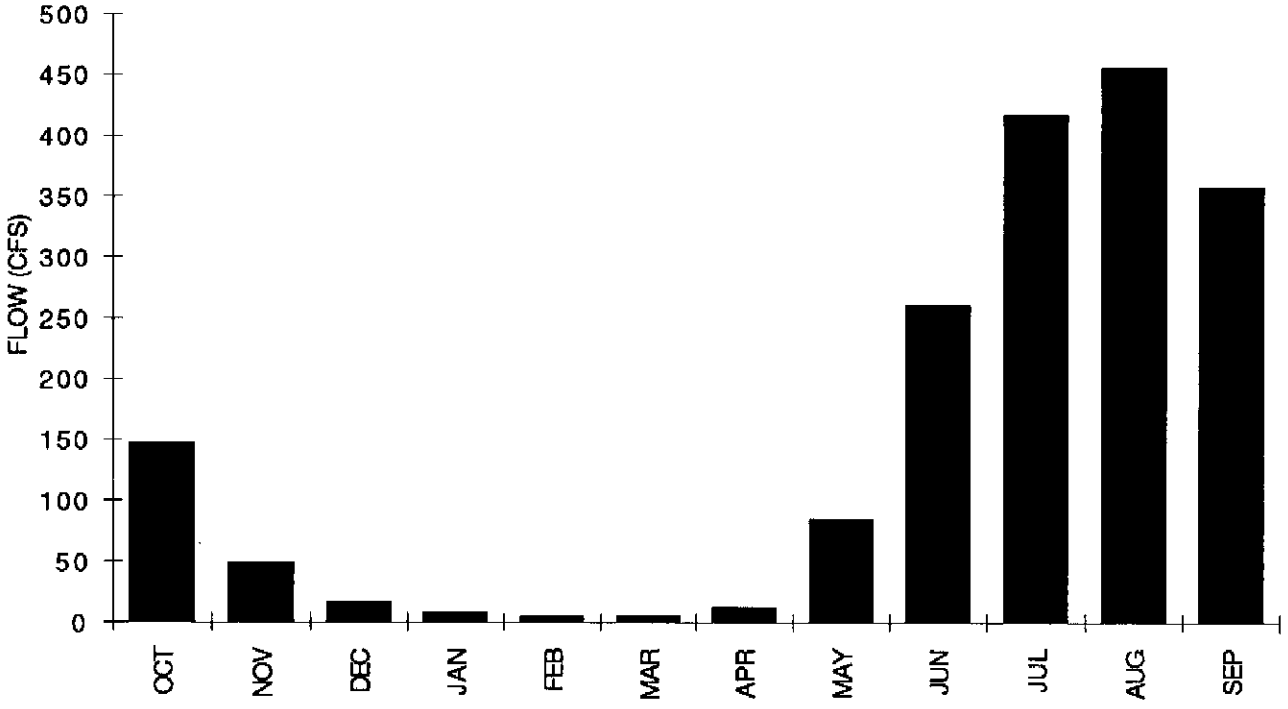

Figure F-3
Mean Monthly Lemon Creek Flows

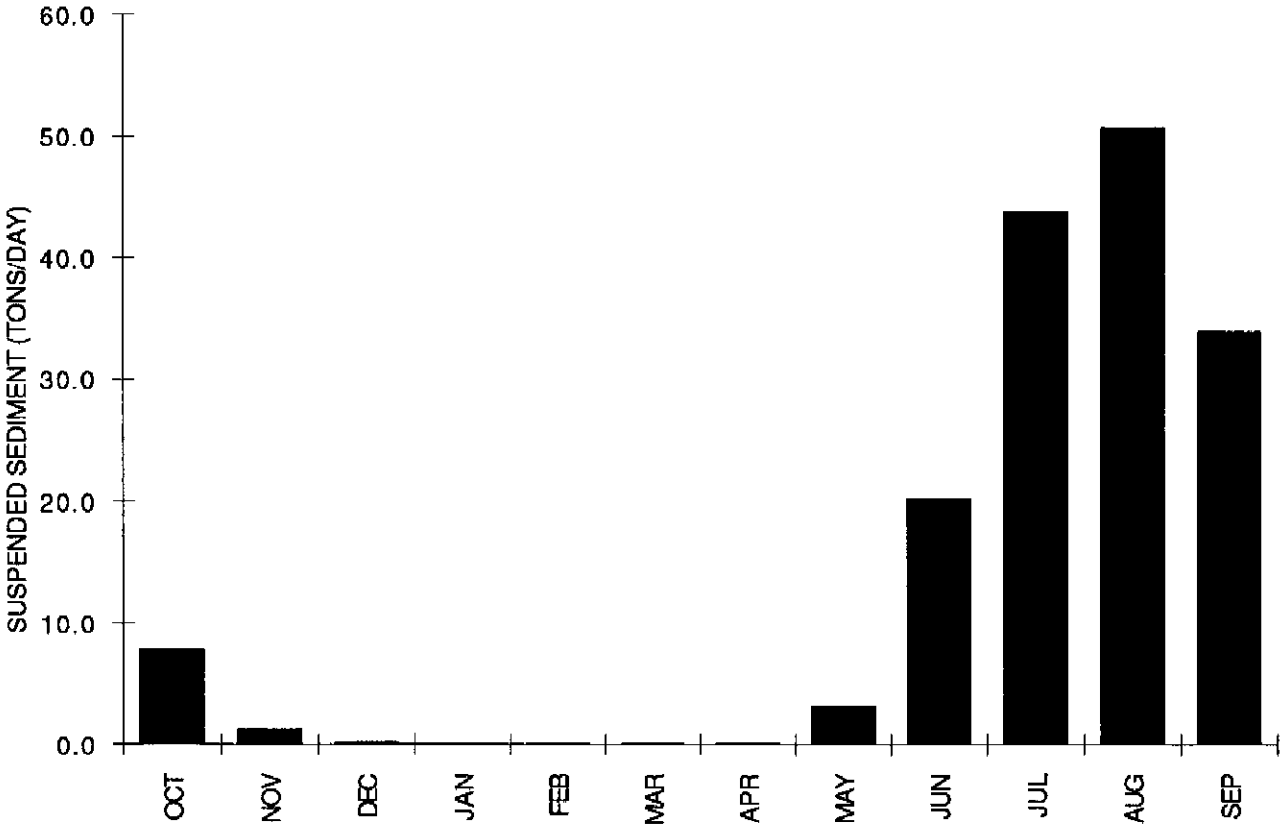

Figure F-4
Estimated Mean Monthly Natural TSS Loads

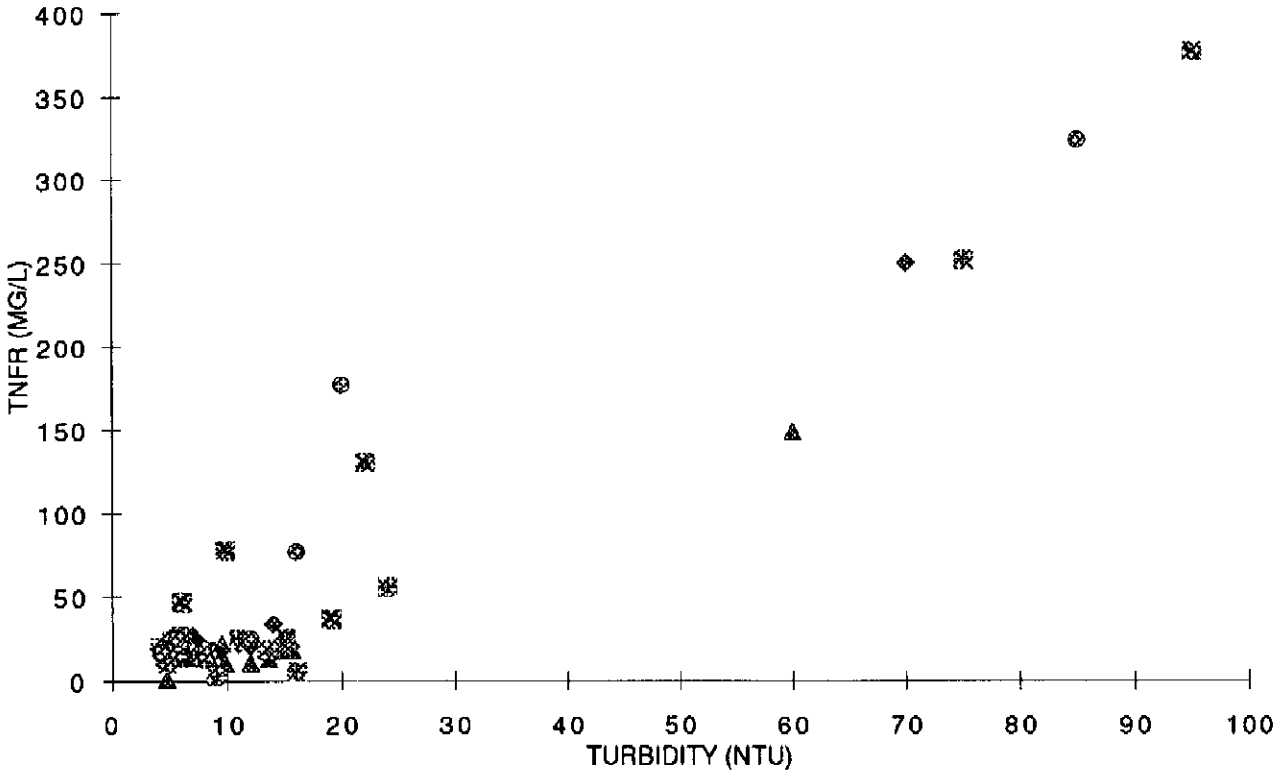

Figure F-5
Plot of TNFR (TSS) vs. Turbidity Data

data collected by DEC in 1982. (For a number of reasons, the data are less than desirable for use in deriving a turbidity vs. suspended sediment relationship. Additional data from planned monitoring will be used to improve the relationship as it becomes available.)

Use regression analysis to determine a best fit curve between TNFR and turbidity. We tested both exponential and linear relationships, and found that while neither produced a particularly good fit -- especially in the lower ranges where there is appreciable scatter -- that the linear regression produced slightly better results. That relationship is shown in Figure F-6 and can be expressed as follows:

$$TNFR\ (mg/l) = [3.67 \times Turbidity\ (NTU)] - 8.91$$

Where: TNFR (mg/l) = total nonfilterable residue in milligrams per liter, and
Turbidity (NTU) = turbidity in nephelometric turbidity units.

Determine the allowable increase in total nonfilterable residue corresponding with an allowable increase in turbidity of 5 NTUs. Using the above equation, the allowable increase in TNFR corresponding to a 5 NTU increase in turbidity is approximately 9 mg/l.

Calculate the Loading Capacity

Determine the suspended sediment loading capacity as the background load plus the load associated with an allowable suspended sediment concentration increase of 9 mg/l. Inherent in this step is the equation of TNFR to total suspended sediment. The validity of that assumption will be tested as additional monitoring data become available.

Figure F-7 shows the natural total suspended solids loadings and the loading capacities for Lemon Creek.

Settleable Solids

Two settleable solids measurements were taken -- one each from upper and lower Lemon Creek stations -- and the volume of settleable solids weighed to provide a density. The density was then used to convert three other settleable solids volumetric measurements to weight per volume (gravimetric) concentrations. The two measured gravimetric concentrations and three derived gravimetric concentrations were then compared to total suspended solids concentrations (Figure F-8). Settleable solids fractions ranged from 50 to over 100 percent by weight of the total suspended solids concentrations -- with the greater than 100 percent results likely due to the non-simultaneous measurements and a high degree of spatial and temporal variability in both total

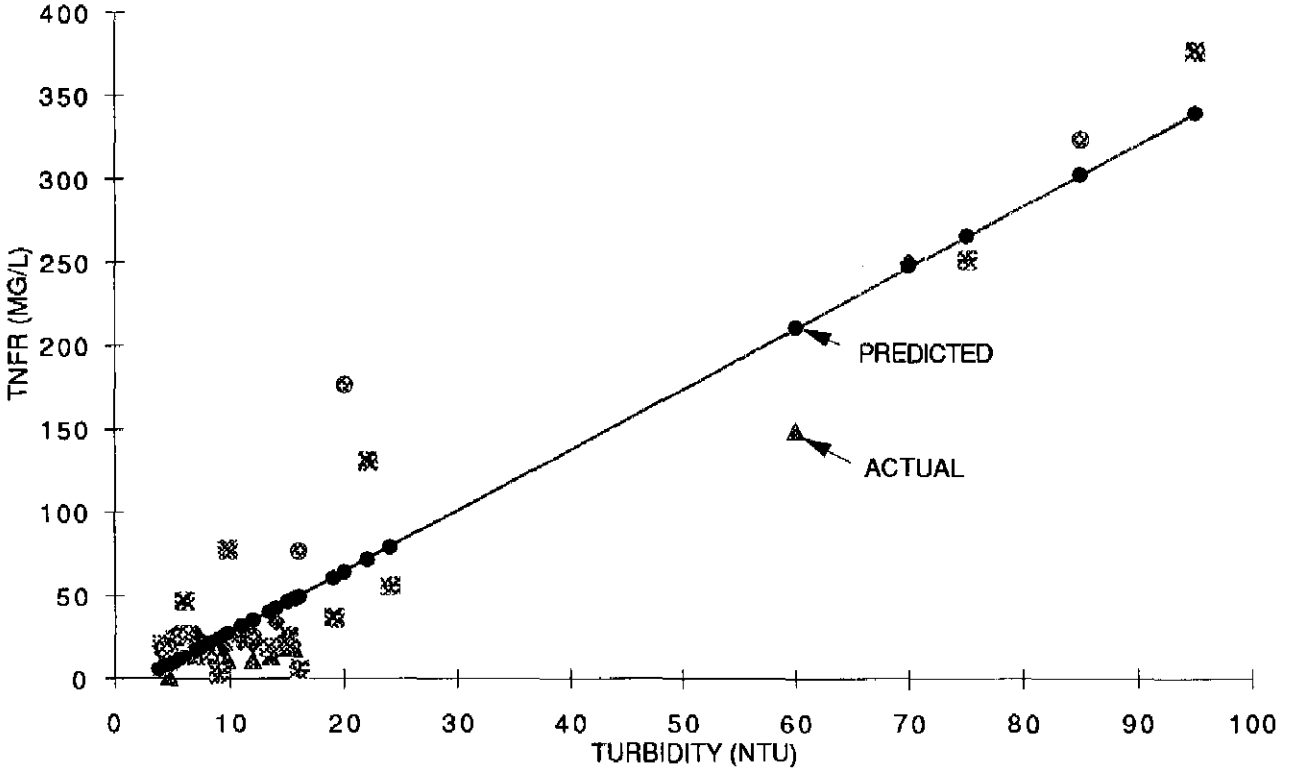

Figure F-6
Relatioship Between TNFR (TSS) and Turbidity

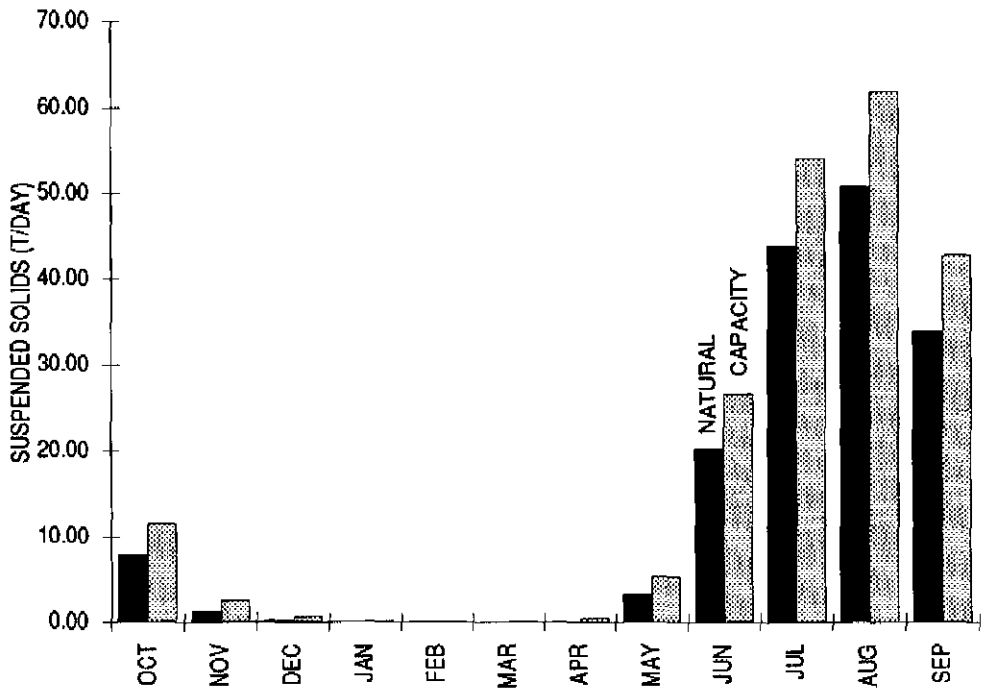

Figure F-7
Natural TSS Loads and Loading Capacities

	UPPER LEMON				
DATE	TIME				
14-Jul	1300	62	TSS	SS/TSS =	65%
	1200	40	SS		
18-Jul	900	32	TSS	SS/TSS =	100%
	1030	120	SS		
	LOWER LEMON				
DATE	TIME				
11-Jul	1502	41	TSS	SS/TSS =	100%
	1340	60	SS		
14-Jul	702	120	TSS	SS/TSS =	50%
	915	60	SS		
18-Jul	702	34	TSS	SS/TSS =	71%
	1125	24	SS		

Figure F-8
TSS vs. Settleable Solids Data

suspended solids and settleable solids levels. In the absence of more and better data, it was assumed that settleable solids represent 90 percent (by weight) of the total suspended solids load and the natural loads and loading capacities developed accordingly. The fraction of settleable solids likely varies with flow, and with further monitoring data that relationship should be able to be better defined.

Debris

The "loading capacity" for debris that essentially none be present and that no debris be present that would interfere with aquatic life uses was derived directly from the water quality standard for residues.

Habitat Modifications

In the absence of a specific standard, the quantifiable end-point of no further degradation of aquatic habitat and restoration of habitat values to the extent practicable was used.

Appendix G SOURCE LOADS

Source loads are estimates of the amount of pollutant or other form of stressor contributed by each of the identified sources.

Total Suspended Solids

Estimates of the amount of total suspended solids contributed by the identified sources were derived from a combination of published sediment yield values and best professional judgment. Contributions from the smaller sources were estimated using best professional judgment at less than 0.01 ton per day with some degree of confidence because of the limited amount of source material present.

In the case of the other sources, yield values from studies conducted in the Pacific Northwest, and elsewhere, were used to approximate annual sediment loads associated with industrial and residential development, roads and natural forest processes (see page G-2 through G-4).

Settleable Solids

As a starting point, settleable solids source loads were estimated based on an assumption that settleable solids represent 90 percent of the untreated total suspended solids loads. For treated (retention basin) discharges, settleable solids would likely be a smaller fraction of the total suspended load. Since total loads for treated discharges were all less than the 0.01 ton per day minimum, however, settleable solids loads were not specified except to indicate that they too would be less than 0.01 ton per day.

Debris and Habitat Modification

As it is not possible to allocate loads for these parameters, no source loads were assigned.

USE PUBLISHED YIELD VALUES TO ESTIMATE LOADS ASSOCIATED WITH LAND USES

LAND USE	YIELD (LBS/AC-YR)	SOURCE
INDUSTRIAL	860	(TABLE 2-3)
RESIDENTIAL	190	(TABLE 2-3)
HIGHWAY	450	(TABLE 2-6 MEDIAN)
CONSTRUCTION (HAUL ROAD)	60000	(TABLE 2-3)

LAND USE	AREA (ACRES)	YIELD (LBS/AC-YR)	YIELD (LBS/YR)	YIELD (TONS/YR)	YIELD (TONS/DAY)
INDUSTRIAL	100	860	86000	43.0	0.1
RESIDENTIAL	80	190	15200	7.6	0.0
HIGHWAY	9	450	4050	2.0	0.0
CONSTRUCTION (HAUL ROAD)	2	60000	120000	60.0	0.2
TOTAL			225250	112.6	0.3

Table 2.3—Typical pollutant loadings (lbs/acre-y) from urban land uses.

LAND USE	TSS	TP	TKN	NH_3-N	NO_2-N	BOD	COD	Pb	Zn	Cu
Commercial	1,000	1.5	6.7	1.9	3.1	62	420	2.7	2.1	0.4
Parking lot	400	0.7	5.1	2.0	2.9	47	270	0.8	0.8	0.04
High-density residential	420	1.0	4.2	0.8	2.0	27	170	0.8	0.7	0.03
Medium-density residential	190	0.5	2.5	0.5	1.4	13	72	0.2	0.2	0.14
Low-density residential	10	0.04	0.03	0.02	0.1	NA	NA	0.01	0.04	0.01
Freeway	880	0.9	7.9	1.5	4.2	NA	NA	4.5	2.1	0.37
Industrial	860	1.3	3.8	0.2	1.3	NA	NA	2.4	7.3	0.50
Park	3	0.03	1.5	NA	0.3	NA	2	0.005	NA	NA
Construction	60,000	80	NA	NA	NA	NA	NA	NA	NA	NA

NA not available.

Source: Pitt, 1991; Horner and Mar, 1982.

Source: Pitt, 1991; Horner and Mar, 1982
as included in Horner et al., 1994

Table 2.6—Pollutant loading ranges[a] for various land uses.

LAND USE	TSS	TP	TN	Pb	Zn	Cu	FC	COD
Road	281	0.59	1.3	0.49	0.18	0.03	7.1E+07	112
	723	1.50	3.5	1.10	0.45	0.09	2.8E+08	289
	502	1.10	2.4	0.78	0.31	0.06	1.8E+08	201
Commercial	242	0.69	1.6	1.60	1.70	1.10	1.7E+09	306
	1,369	0.91	8.8	4.70	4.90	3.20	9.5E+09	1,728
	805	0.80	5.2	3.10	3.30	2.10	5.6E+09	1,017
Single family low density	60	0.46	3.3	0.03	0.07	0.09	2.8E+09	NA
	340	0.64	4.7	0.09	0.20	0.27	1.6E+10	NA
	200	0.55	4.0	0.06	0.13	0.18	9.3E+09	NA
Single family high density	97	0.54	4.0	0.05	0.11	0.15	4.5E+09	NA
	547	0.76	5.6	0.15	0.33	0.45	2.6E+10	NA
	322	0.65	5.8	0.10	0.22	0.30	1.5E+10	NA
Multifamily residential	133	0.59	4.7	0.35	0.17	0.17	6.3E+09	100
	755	0.81	6.6	1.05	0.51	0.34	3.6E+10	566
	444	0.70	5.6	0.70	0.34	0.51	2.1E+10	333
Forest	26	0.10	1.1	0.01	0.01	0.02	1.2E+09	NA
	146	0.13	2.8	0.03	0.03	0.03	6.8E+09	NA
	86	0.11	2.0	0.02	0.02	0.03	4.0E+09	NA
Grass	80	0.01	1.2	0.03	0.02	0.02	4.8E+09	NA
	588	0.25	7.1	0.10	0.17	0.04	2.7E+10	NA
	346	0.13	4.2	0.07	0.10	0.03	1.6E+10	NA
Pasture	103	0.01	1.2	0.004	0.02	0.02	4.8E+09	NA
	583	0.25	7.1	0.015	0.17	0.04	2.7E+10	NA
	343	0.13	4.2	0.010	0.10	0.03	1.6E+10	NA

[a] For each pollutant and land use, loadings are listed as kg/ha-y (except no./ha-y for FC) in the order minimum, maximum, median.

NA Not available.

Multiply loadings in kg/ha by 0.89 to get lbs/acre.

Source: Horner, 1992.

Source: Horner, 1992
as included in Horner et al., 1994

Appendix H MONITORING PLAN

As discussed in Part 6 of the document, a key element of any TMDL -- and particularly a phased TMDL -- is follow-up monitoring. The following seven pages set out a detailed plan for the monitoring associated with implementation of the Lemon Creek TMDL.

ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION MONITORING PLAN[1]

Total Maximum Daily Load (TMDL)
STREAM WATER QUALITY
Lemon Creek, Juneau, Alaska

Project Manager . . . . . Drew Grant, ADEC/Watershed Section

Laboratory Designated . . . . . .
. . . . . ADEC/Juneau Environmental Analysis Laboratory or Approved Commercial Laboratory

Inspection & Sampling Personnel.....ADEC and CBJ Staff or Selected Contractors

Sampling Schedule and Milestones:

August, 1995	Quality Assurance Plan
September, 1995	Station Identification
October, 1995-August 1996	Field Data Collection
August, 1996	Analytical Results Compiled
September 1996	Data Review & Program Assessment

Site Location: Lemon Creek, Juneau Alaska

PROJECT OVERVIEW

A series of locationally-related field sampling events designed to evaluate the extreme surface discharges from non-point sources will be carried out on the Lemon Creek system during high run-off, high flow periods. Sampling locations will include an upstream site selected for its unimpaired background conditions, along with downstream sites selected to represent the affect of specific land-use activities. Automated discrete and manual grab sampling will be conducted to take advantage of high flow events. Water samples for turbidity, total suspended solids, total Settleable solids and flow will be collected on Lemon Creek.

[1]Some aspects of this monitoring plan are expected to be carried out by the City & Borough of Juneau, either independent of DEC or in cooperation with DEC. The long term monitoring plan after FY96 is discussed on page 4.

Objectives and Intended Use of Data. The objectives of the monitoring program, in order of priority, are to:

1. Verify that new upland best management practices specified in the TMDL are being implemented.

2. Provide sufficient data to determine if Lemon Creek meets Alaska's water quality standards for turbidity, total suspended solids and total settleable solids

3. Provide sufficient data to more accurately calculate source load determinations for Lemon Creek, with specific emphasis upon flow and the relationship of turbidity, total suspended solids and total settleable solids, to account for seasonal variations and event related extremes.

4. Provide sufficient data to more accurately calculate the loading capacity of Lemon Creek, with specific emphasis upon turbidity, total suspended solids, total settleable solids and flow.

Objectives 3 and 4 will require additional funding to be implemented. Monitoring frequency and station locations may be modified based on available funding.

Practical Approach.

Routine Monitoring (Objective 1 & 2): Visual verification of best management practices for this TMDL will be conducted through direct inspections of control implementation efforts to address Objective 1.

Primary emphasis will be given to representative sampling that includes an upstream, reference location to establish background loads and a downstream site that integrates all source load contributions to address Objective 2. The upstream location will establish a long-term upstream reference station with no identified impacts. The upstream reference site will function as a satisfactory long-term monitoring site. The downstream location that integrates all source load contributions is above the asphalt plant and below the Juneau Ready Mix storage site. More than 200 yards below the disassembled bridge crossing, tidal influences become considerable with the introduction of saline waters. Routine sample collection for turbidity, total suspended solids and settleable solids will be possible from these locations. Due to considerable variability in solids and turbidity, routine sampling on a year-round basis should occur weekly, beginning in October, 1995

Source Load Verification Monitoring (Objective 3 & 4): Secondary activities will concentrate on seven (7) identified source load contributors, identified as:

- Juneau Ready Mix Stockpile
- RSH Retention Basin
- Goldbelt Upper Sediment Pond

- Goldbelt Sidecast Area
- Haul Road Surface Embankments
- Residential Urban Runoff
- Industrial Urban Runoff

Seven representative source locations will be sampled with ISCO sampler's over the course of an approximately 24 hour period prior to, during and just following critical times throughout the year: Discrete water samples will be collected at 4 hour intervals and analyzed for turbidity and total suspended solids. Settleable solids will be collected 3 times during this period for verification of original estimates.

Except in the winter low-flow period, Lemon Creek is not a wadable stream. Stream flows should be measured simultaneously during each one of the critical periods to relate measured solids and turbidity levels with stream flows. Stream flow measurements, on a routine basis are problematic due to the turbulent glacial flows in the spring, summer and fall periods, particularly at the upper background site. The lower site could be measured by from a bridge or working from a boat fixed to a line suspended across the channel. The long-term solution would be to work cooperatively with the Alaska Department of Natural Resources and contract with the US Geological Survey to establish a fixed hydrologic gauging station near the upper sampling location.

CRITICAL PERIODS for SOURCE LOAD SAMPLING:

- October-November, 1995 Rainfall Period
- January-April, 1996 Snow melt Breakup Period
- March-May, 1996 Spring Rainfall Period
- May-July, 1996 Rainfall Period

Additional ISCO samplers will be solicited from the Alaska Department of Natural Resources in Fairbanks and borrowed to supplement those already available in Juneau.

Sample Stations: Ten (10) sample stations along Lemon Creek are planned, including one (1) background control; a lower long-term station representative of the integrated summation of all the specific input sources; and eight (8) representative downstream source sites. These sites are located in the following areas, with some source notations:

1. Background Control at the upper end of the Lemon Creek haul road
2. Goldbelt Sediment Pond Effluent
3. Goldbelt Sidecast Area Effluent
4. Industrial Urban Runoff from culvert at end of Anka St.
5. Residential Urban Runoff from Lemon Creek Subdivision culvert
6. Residential Urban Runoff from Trailer Park culvert

7. #1 Haul Road Surface & Embankment Source input
8. #2 Haul Road Surface & Embankment Source input
9. Lemon Creek @ Old Glacier Highway Bridge above Juneau Ready-Mix source
10. Downstream integrated source site, below Juneau Ready Mix bridge

LONG TERM MONITORING PLAN (POST-FY96)

Long term (after August 1996) monitoring is necessary, at varying frequencies, to fully address Objectives 1 through 4. Annual monitoring will occur to address Objective 1 (verifying BMP implementation) and Objective 2 (water quality standards compliance). Yearly cost estimates for Objective 2 monitoring (hand grab samples, turbidity/TSS at two stations) totals $1400 for Lemon Creek.

Monitoring objectives 3 and 4 (source-specific contributions) will be addressed every two years (year 1, 3 and 5), contingent on receipt of additional funding. The scope and specific details of this monitoring plan beyond FY96 will depend on the results of year 1 sampling and an evaluation of the effectiveness of Phase 1 controls. Pending the outcome of monitoring Phase 1 controls during FY96, which will establish appropriate Phase 2 controls for implementation, adjustments may be necessary in sampling stations, frequency, and critical periods to ensure a cost-effective program. Annual cost estimates for a comprehensive monitoring program to address Objectives 3 and 4 (ISCO samplers, 8 stations, frequency as specified for FY96) total $9600.

As stated above, award of additional funds will be necessary to fully address Objectives 3 and 4. The department is requesting that EPA award the remaining balance of 104(b)(3) grant funds reserved for implementation of the Vanderbilt/Lemon Creek TMDLs to accomplish these objectives during FY96 and beyond.

SAMPLING PROCEDURES

Water Samples

Grab by Hand: Four to six (4-6)grab water samples from the Background Control station (#1) and the Lower Lemon Creek station (#10) will be collected during daytime hours at approximately 6-8 hour intervals during the course of each 24 hour ISCO source load sampling period. Grab sampling from Stations 1 and 10 (Objective 2) are most cost effective and will be collected, should the ISCO sampling program (Objective 3 & 4) not be possible due to available funding. Discrete grab samples from the Background Reference station (#1) and the Lower Lemon Creek station (#10) will be collected during daytime hours at weekly intervals (Objective #2). Grab samples will be collected from areas representative of turbulent, fast moving waters as far from the banks as is reasonably prudent and from a depth greater than 12" below the surface, where feasible.

Settleable Solids: A flow measurement is made along with settleable solids collected from each of the identified locations. A settleable solids determination is made in the Imhoff cone.

ISCO Discrete Grab Samples: ISCO Model 3700's or 1600's will be used for the collection of discrete turbidity & total suspended solids samples at the source load stations. Each unit will be programmed to collect 300 ml samples of water at 4 hour intervals over a 24 hour period, producing 6 samples per station. Sample containers are clean plastic 1 liter bottles. Stainless steel or plastic strainers will be used on lengths of 3/8" ID tubing. Silicone tubing is used in the peristaltic pump.

Habitat Inventory

The Alaska Department of Fish & Game will be requested to participate in leading the habitat evaluation associated with haitat modifications along the full length of Lemon Creek.

SAMPLING EQUIPMENT

Manual Grab Sampling Techniques: The inverted bottle technique will be used to collect grab samples by hand.

Automated Sampling Techniques and Apparatus: Automated sampling will utilize ISCO Model 3700's and ISCO Model 1680 samplers programmed to collect 300 ml samples at 4 hour intervals over a 24 hour period, and transferred to the laboratory for analysis of TSS and turbidity. ISCO's will be iced for preservation of samples during the collection period.

Sample Containers: Grab samples will employ 250 ml clean poly bottles. Clean, 1 liter ISCO poly bottles will be used for automated sampling. Glass, 1 liter Imhoff cones will be used for settleable solids.

Sample Holding and Preservation: Automated discrete samples for TSS and turbidity will be stored in an iced ISCO system during the 24 hour sampling period. Collected samples will be stored and transported in a cooler with blue ice. Subsequent refrigerated storage will provide a 4° C environment until analysis.

Grab sample analysis for settleable solids will be conducted on-site immediately after the sample is collected in glass or plastic Imhoff cones.

Stream Flow: Arrangements with USGS and the Alaska Department of Natural Resources will be initiated to cooperatively develop reliable means to measure stream flow in Lemon Creek at periodic intervals through August 1996, particularly during the critical periods. Flow measurements from culverts may be determined from the pipe diameter and head measurements to the top end of each culvert. Where feasible, a Marsh -McBirney Model 201D flow meter , top-setting wading rod and fiberglass tape will be

used to measure source discharges.

Chain of Custody: Chain of custody procedures are not required for this project.

Preventive Maintenance: Manufacturer's recommendations will be followed for preventive maintenance of field equipment. Spare parts and tools will be available for routine repair. Field personnel will check supplies, equipment, and instrumentation for proper operation prior to going to the field.

Table 1 -- Sampling & Storage Requirements

Parameter	Matrix	Sample Container	Storage Time	Preservation
Total Non-Filterable Residue (TNFR) *or total suspended solids (TSS)*	Water	1 Liter Poly Bottle or 250 ml poly bottle	7 days	4°X_ov_ιχε_ _
Turbidity	Water	1 Liter Poly Bottle or 100 ml poly bottle	48 hours	4°X_ov_ιχε_ _
Settleable Solids	Water	1 Liter Glass Imhoff cone	On-site	None

ANALYTICAL PROCEDURES

Analytical Methods: The chemical analyses will be performed according to the individual methods specified. Each of these methods was specifically selected for its low detection limits and applicability to the matrix involved. Sources include EPA's Methods for Chemical Analysis of Water and Wastes and Standard Methods for the Examination of Water and Wastewater, 18th edition.

Calibration Procedures, Frequency and Traceability of Standards: Any laboratory instrument calibrations will follow the procedures specified in the respective methods manuals.

Laboratory Quality Control Samples: Quality control samples, including reference samples, split samples, method blanks and matrix spikes, shall be included in the analyses as prescribed in the methods listed in Table 2, below

Data Reduction: All required calculations will be made as specified by the analytical method. Method and equipment blanks will be reported separately and not subtracted from the analytical results of the samples.

QUALITY ASSURANCE PROCEDURES

Quality Assurance Objectives for Measurement Data: All measurements shall be made so that the results are consistent with and representative of the water conditions at the time and place sampled.

The data quality objectives are summarized in Table 2.

Table 2 – Laboratory Data Quality Objectives

Parameter	Analytical Method	Detection Limit	Precision	Accuracy	Completeness
Total Suspended Solids	2540 D (SM 18th)	2 mg/l	+/- 25%	+/- 40%	90%
Turbidity	2130-B (SM 18th)	1 NTU	+/- 25%	+/- 25%	90%
Settleable Solids	2540 F (SM 18th)	0.1 ml/L	+/- 25%	+/- 40%	90%

The accuracy objective is expressed in terms of the percent recovery of target analytes in laboratory control samples. The precision objective is expressed as the relative percent difference of target analytes in field replicates and laboratory control samples. The QA data objective for completeness is 90%.

Comparability: Data previously gathered by DEC, Alaska Department of Natural Resources, Alaska Department of Fish and Game, and others will be used to evaluate the results obtained from this portion of the project and to aid in further refining load estimates.

Data Validation: The quality control and sample analytical data from those methods involving quality control procedures will be checked to verify that the analytical systems were in control and proper methods were used. Sufficient documentation will be stored electronically or by hard copy so that any determination along with the associated quality control samples can be reconstructed. All laboratory data reviews will be performed by and signed off by the laboratory supervisor or QA officer

Corrective Action for Out-of-Control Situations: Analytical out-of-control situations will be determined by the lab analyst. If method blank contamination or other problem is observed, the analyst will note the problem and take the necessary corrective action.

Preventive Maintenance: Preventive maintenance of analytical instrumentation follows the routine procedures specified in the equipment manufacturers' manuals and is documented in the equipment SOP. Field personnel will verify the performance of the field equipment before going to the field.

Data Reporting

All analytical and quality control data will be reported within 30 days after the completion of the analyses for each set of samples. The final data report will be issued by DEC not later than September 1, 1996.

All data will be reported with correction, normalization and/or qualification, as necessary. EXCEL spreadsheets will be used to consolidate the data for comparison purposes. All results will be available to project managers in hard copy or electronic form, upon request.