APPENDIX TO

A HYDRAULIC EVALUATION OF FISH PASSAGE THROUGH ROADWAY CULVERTS IN ALASKA: DATA REPORT

by

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SECTION I
INTRODUCTION

Considerable design effort goes into sizing culverts. The main purpose of a culvert is to pass a design peak flow for a given return period, based on economic considerations. Often, these same drainage structures must be designed so that migrating fish are not impeded in their desired movements. While there are numerous new culvert installations every year and a greater awareness of environmental concerns, no concentrated effort has been made in the past to evaluate the performance of such structures and to examine what channel changes take place with time because of the presence of the structures.

This report is a review of prevailing conditions at culvert sites in northern and interior Alaska. The data contained herein is the result of an extensive field program during the summers of 1982 and 1983. Stream sites along major roads and highways were identified, surveyed and gaged and the culvert installations were inspected. Culvert installations inspected varied in age from just constructed to 20-30 years. Numerous culverts were observed that were not reported here for various reasons. Generally these were either at culvert sites with no apparent problems or streams not identified as containing fish.

The raw data in this report were originally collected for a study on fish passage through culverts for the State of Alaska Department of Transportation and Public Facilities. The data analysis for the fish passage project is found in another report. This report provides the data base to those with additional uses for this information.

FIELD METHODS

Stream names and locations generally were determined from USGS topographic quadrangle maps (1:63,360 scale). A road log with aerial photographs was available for the Denali Highway from Cantwell to Paxson (U.S. Department of Transportation etc, 1982). Reports and maps from Alyeska Pipeline Service Company and Northwest made possible the identification of streams sites along the pipeline corridor, including

all or parts of the Dalton, Elliott, and Richardson highways. Culvert markers at newer installations provided positive identification of streams.

The watershed boundaries above the highway stream crossing were delineated on the USGS topographic quadrangle maps. A Hewlett Packard 9874A digitizer was used to determine the watershed areas. The watersheds were digitized three times and the average area recorded.

The streams were gaged using a Price AA or pygmy current meter depending on the depth and velocity of the flow. The discharge measurement was performed in accordance with standard stream gaging practices of the U.S. Geological Survey, Water Resource Division (Rantz, 1982). A relatively straight section of the stream was preferred for the flow measurement. Velocity measurements were generally made at 0.6 depth along a stream transection.

Velocity profiles were taken at many of the stream sites, generally at the culvert entrance or exit. The measurements were started 0.10 ft or 0.15 ft from the streambed. Near the stream bottom, readings were taken at 0.10 ft increments. This spacing was maintained to the stream surface in relatively shallow streams. For deeper streams, the readings were spaced progressively further apart as the depth of the reading approached the surface of the stream. This variable spacing was used to better define the velocity profile close to the streambed where the greatest velocity change occurred, while economically reducing the number of readings required in deeper streams.

In most cases, the velocity profiles were taken with a cup-type current meter (Price AA or pygmy). Exceptions are noted when the velocity readings were taken with an electromagnetic flowmeter. Wellen and Kane (1983) discuss possible errors associated with electromagnetic flowmeters.

The water surface profile of each stream was surveyed at the same time as the stream gaging. The water surface slopes upstream and downstream of the culvert were measured over a 200 ft distance wherever possible. At most stream sites, especially in the tundra or areas with sparse vegetative growth, siting a survey rod at 200 ft was not a problem. Slopes were measured over a shorter distance only in areas of relatively dense vegetative cover.

The slope of the culvert crown was surveyed, as was the slope of the water surface in the culvert over the entire length of the culvert. Perched conditions at the culvert outfall were also surveyed when present. The length of the culvert was measured and the diameter or the span and rise were noted. General conditions at the culvert site were assessed, including, but not limited to:

-- existence of scour pools upstream and/or downstream of the culvert;
-- presence of drift or riprap in the culvert barrel;
-- maintenance or erosion problems;
-- perched conditions at the culvert outfall;
-- observance and location of fish;
-- inlet and outlet water depths;
-- estimated bedload size;
-- high water marks; and
-- observed icing conditions.

In a few cases, special fish passage facilities were installed at the culvert site, and the presence and condition of such facilities were also noted.

English units were used almost exclusively throughout the field program. Any metric measurements were converted to English units before being included in this report. Discharge measurements are reported in cubic feet per second (cfs), velocities are reported in feet per second (fps), stream depths and culvert dimensions are in feet (ft) and watershed areas are given in square miles (sq mi).

REPORT ORGANIZATION

The site data are organized in Section II by major road or highway, including sites along the following roads:

-- Alaska Highway.
-- Chena Hot Springs Road;

-- Dalton Highway;
-- Denali Highway;
-- Elliott Highway;
-- Glenn Highway
-- Old Seward Highway
-- Parks Highway;
-- Richardson Highway; and
-- Steese Highway.

In addition, two culverts with baffles were examined in the Anchorage area. The site number, stream name and location are listed for each site. The USGS quadrangle map name, township, range and section number are included to help the reader identify and locate the stream sites.

A schematic of the culvert site with pertinent data is included for all sites where water surface and culvert slope measurements were taken. Pictures show the conditions at both ends of the culvert, and upstream and downstream from the culvert. A brief narrative describes the site and contains information not in the schematic or pictures. Velocity profile measurements are plotted and discharge measurements are included.

The velocity profile data (if available) is graphically displayed with each stream in the data section. The actual depth and velocity measurements for these graphs appear in tabular form in Section III. Due to space limitations, the reader is also referenced to Section III when multiple profiles are available for the same location.

In Section IV is a listing of the streams included in the data section by major road or highway. Additional information is provided in this section, including:

-- an alphabetical list by highway of all the streams in the data section;
-- a list of streams with discharge measurements; and
-- a list of streams with velocity profiles.

These indices should help the reader identify and locate the information for the desired streams.

Section V includes a copy of the field evaluation form used to record data at each stream crossing.

REFERENCES

Rantz, S.E. 1982. Measurement and computation of streamflow. Water Resource Division, Department of Interior, U.S. Geological Survey, Government Printing Office, Washington, DC. Water Supply Paper 1275. 2 vols. 631 pp.

U.S. Department of Transportation, Federal Highway Administration and Alaska Department of Transportation and Public Facilities. 1982. Denali highway Cantwell to Paxson, environmental assessment. Alaska Department of Transportation and Public Facilities Project Number RS-0750(1).

Wellen, Paula M., and Kane, Douglas L.. 1983. A comparison of velocity measurements between cup-type and electromagnetic current meters. Proceedings, American Water Resources Association, Alaska Section, Chena Hot Springs, Alaska, November 10-11, 1983, University of Alaska. IWR Report 105, 14-1 to 14-12.

SECTION II

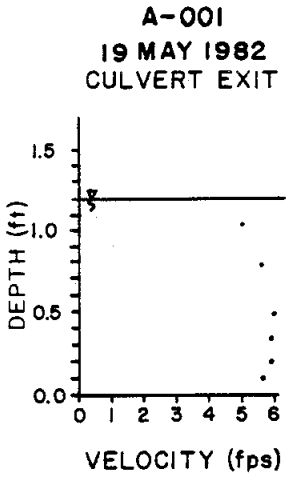
SPECIFIC DATA

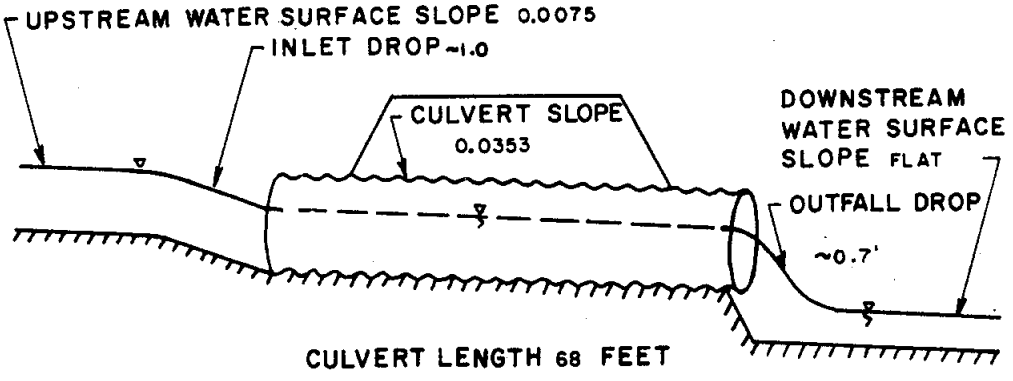
Site No. A-001 Unnamed Creek

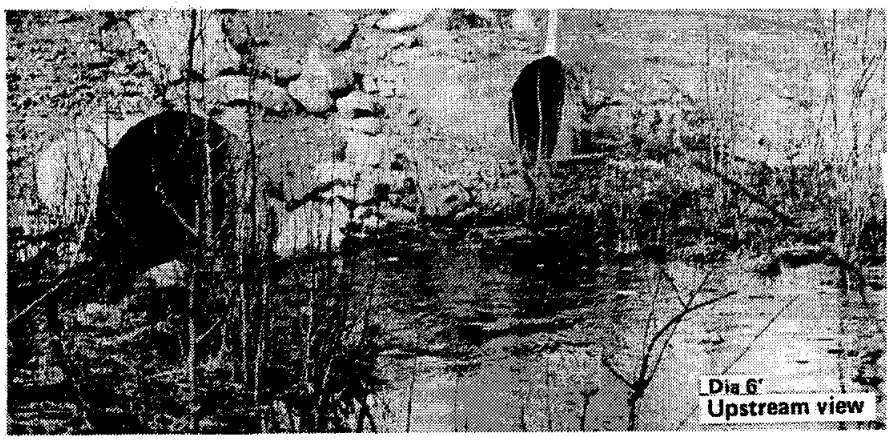
Location: Mile 1365 Alaska Highway

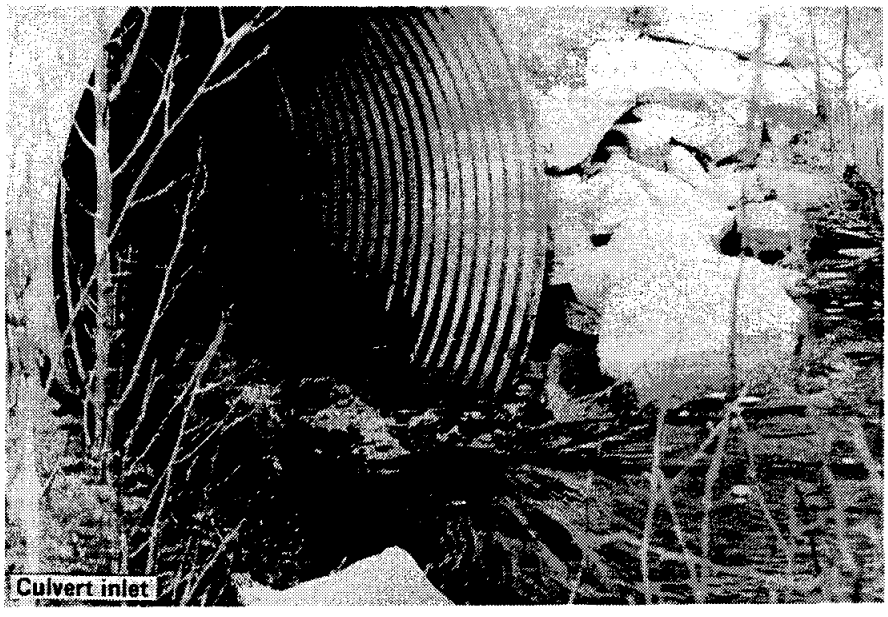
Map: Mt. Hayes C-1, T22N, R6E, Sec. 24

The discharge at this unnamed creek was 22.1 cfs on May 19, 1982. A single 6 ft diameter corrugated metal pipe culvert contained the flow from the 6.3 sq mi watershed. A 4 ft diameter overflow culvert was nearby but contained no flow. The main culvert barrel did not have a constant slope: the water depth in the barrel decreased for the first 20 ft where the slope was steeper. At this point a hydraulic jump occurred and the water depth increased. The culvert barrel was clean. The stream bed was brushy with grass on the bottom; the estimated bedload size was medium gravel. The flat slope and pools downstream were due to beaver activity. These pools provided rest areas for fishes; there were also some rest areas at high water at the upstream end of the culvert. The velocity profiles at this site were taken with an electromagnetic flowmeter.






Dia 6'
Upstream view


Culvert inlet

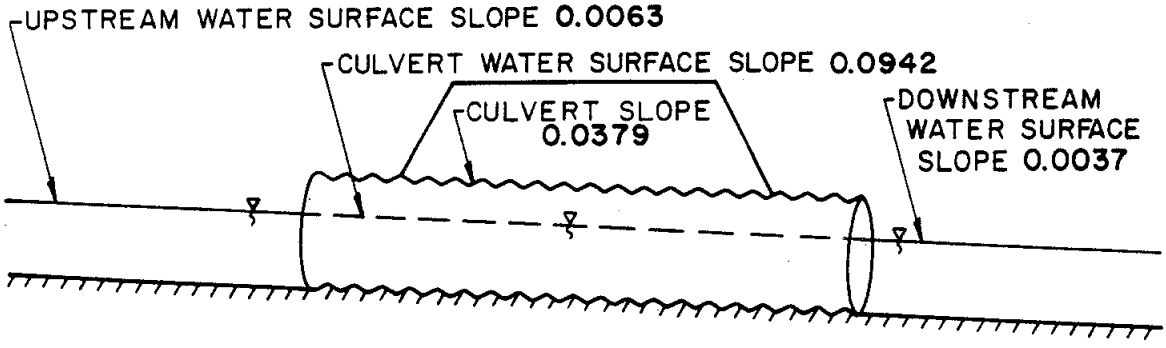

Culvert outlet

Site No. A-002 Unnamed Creek

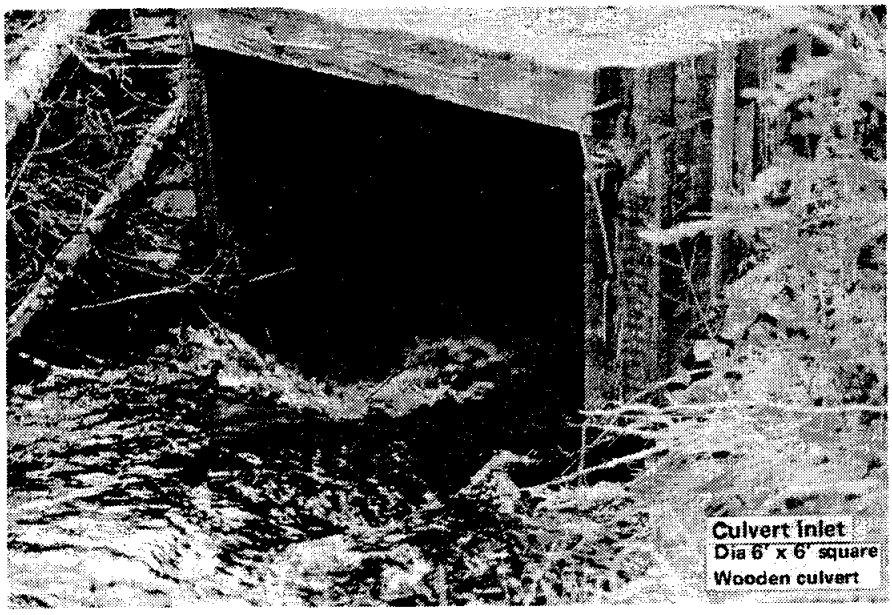
Location: Mile 1369 Alaska Highway (second creek east of Berry Creek)

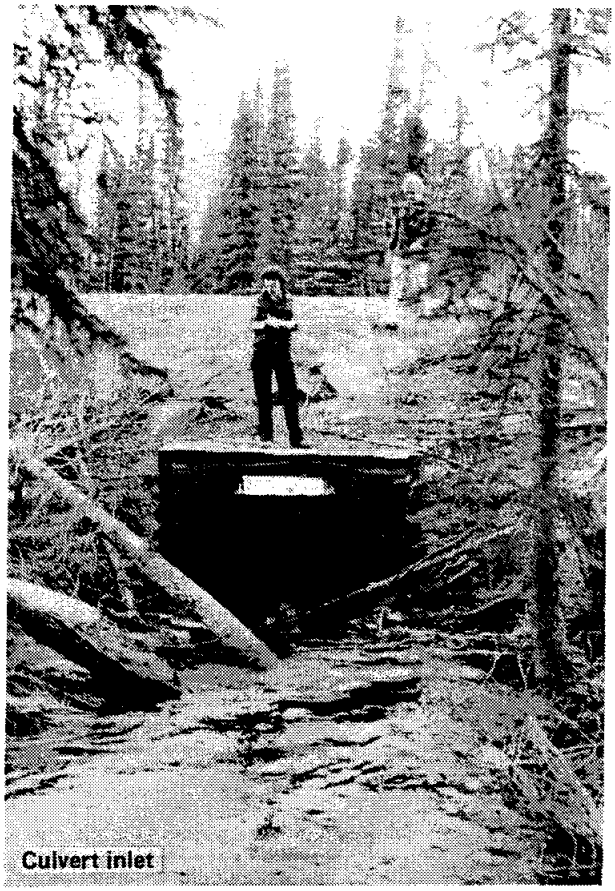
Map: Mt. Hayes C-1, T22N, R6E, Sec. 17

This unnamed creek was visited on May 20, 1982. The 35.8 cfs discharge was totally contained by a 6 ft square wooden culvert. The water surface profile for this installation is shown in the diagram. The inlet and outlet water depths were 1.45 and 0.50 ft, respectively. A 50 ft diameter pool was noted at the culvert outlet. A velocity profile was not measured at the culvert exit due to high water velocities from the steep culvert slope at the outlet. The downstream end of the culvert barrel appeared to be broken, causing the steeper outlet slope. The bed material was small gravel and the stream banks were sandy; roots and branches lined the stream banks. A USGS crest stage indicator was located at this site. For the period of record, the high water level was 2.3 ft above the present water level; in 1968 the high water mark was 0.9 ft above the present water level. The watershed area was 11.0 sq mi.

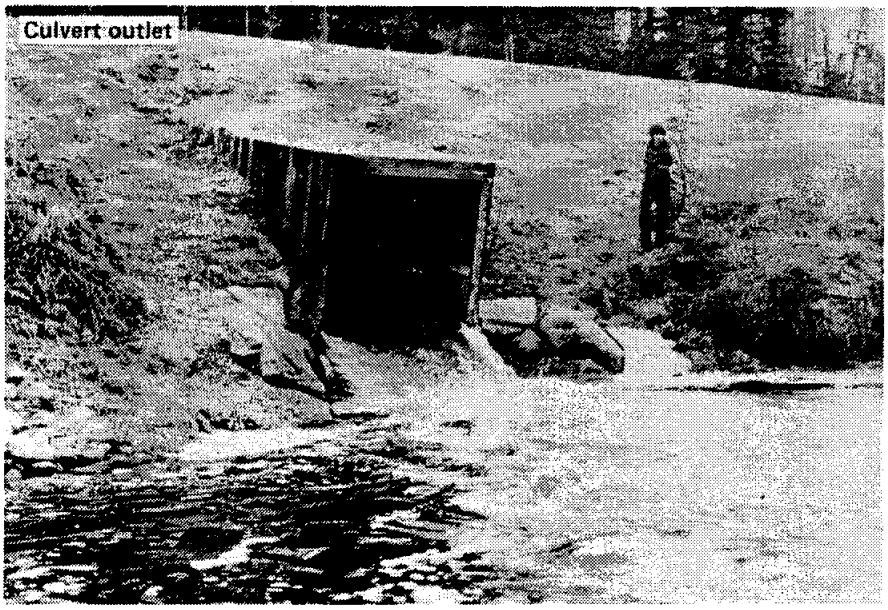


CULVERT LENGTH **66** FEET





Culvert inlet



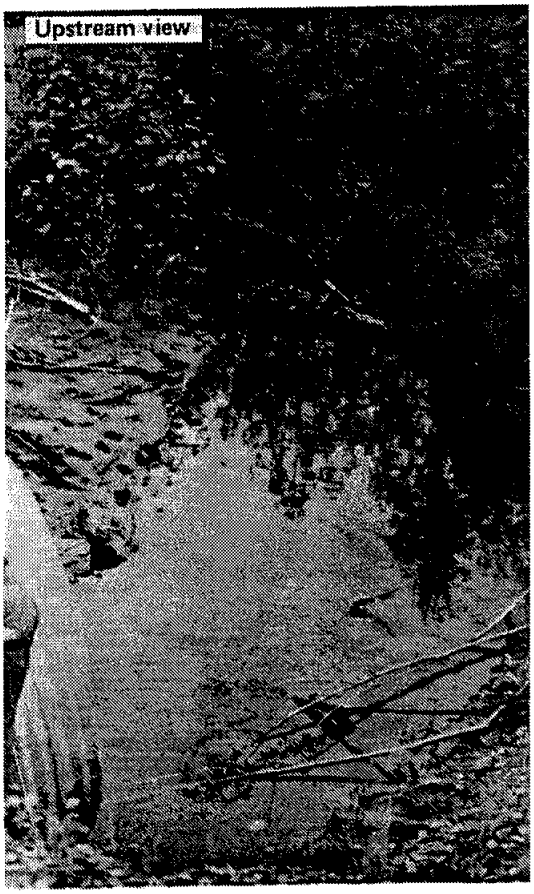
Culvert outlet

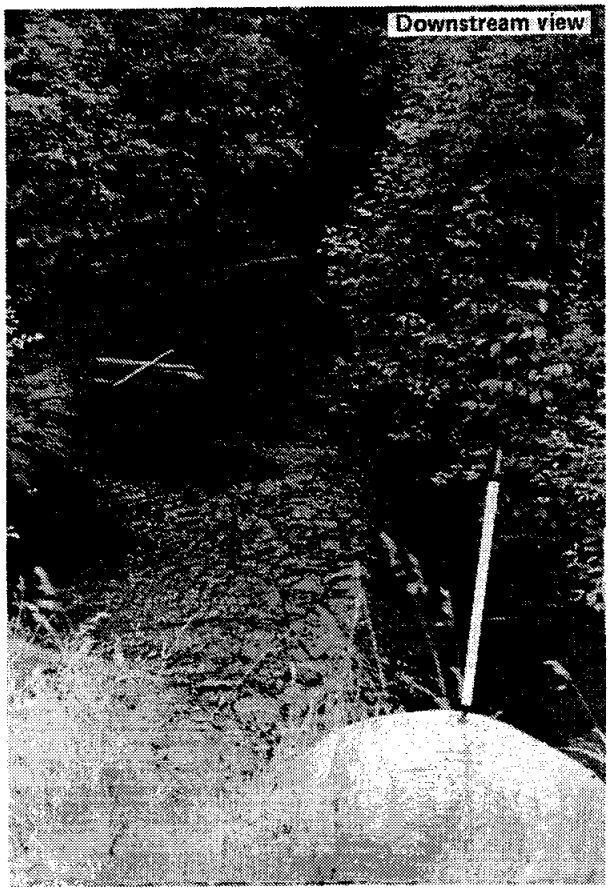
Site No. C-001 Steele Creek

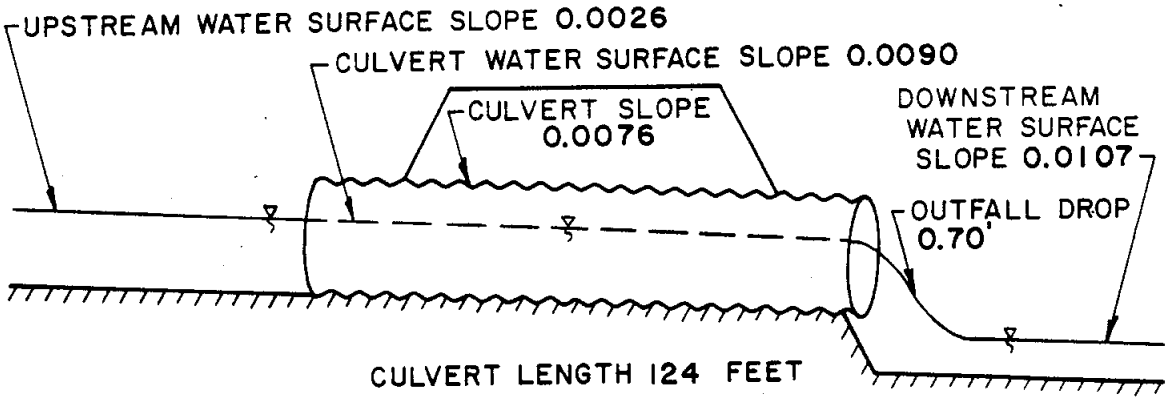
Location: Chena Hot Springs Road

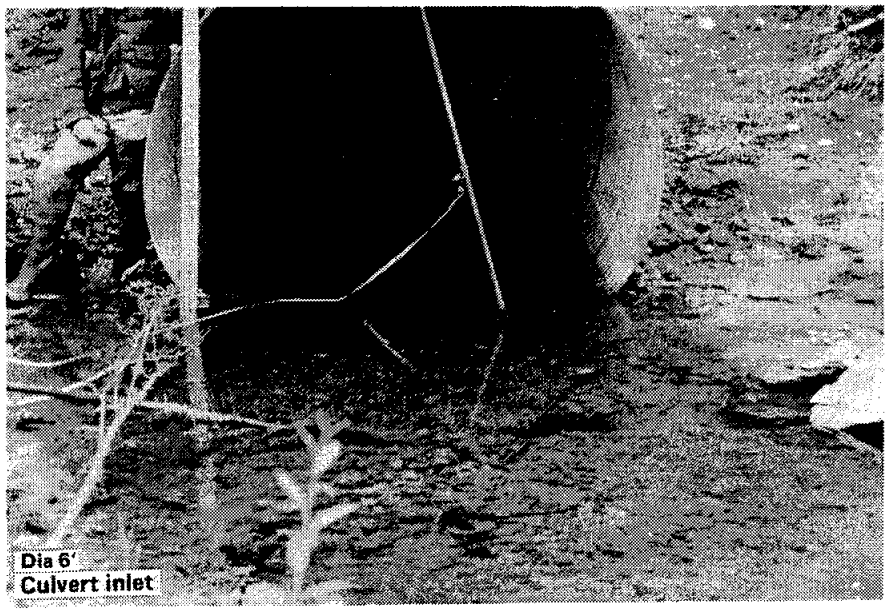
Map: Fairbanks D-1, T1N, R1E, Sec. 26

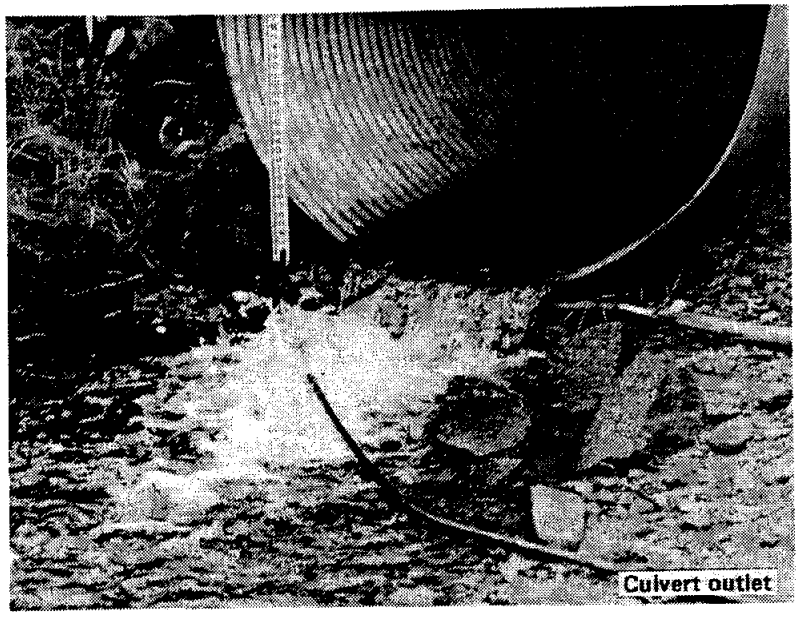
Three culverts were observed at the Steele Creek site along Chena Hot Springs Road on August 16, 1982. The main culvert (pictured) contained all of the flow (1.6 cfs). The water surface profile for this culvert and the stream appear in the diagram. A smaller overflow culvert (about 4 ft in diameter, crown slope 0.0054) was dry but erosion marks were visible at the outlet. A third culvert was completely buried at the outlet, and the inlet was only partially visible. The bedload was estimated as silt, sand, and very fine gravel. The first part of the main culvert barrel contained some drift, but the last part was clean. There was a quiet pool at the main culvert entrance, but none at the exit. The water depth at the culvert inlet was 0.70 ft and at the outlet was 0.30 ft. The watershed area was 10.60 sq mi.

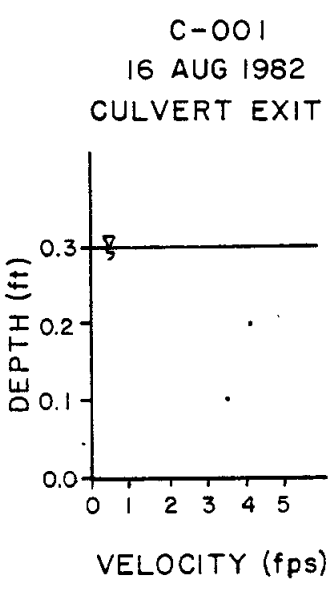





UPSTREAM WATER SURFACE SLOPE 0.0026
CULVERT WATER SURFACE SLOPE 0.0090
CULVERT SLOPE
0.0076
DOWNSTREAM
WATER SURFACE
SLOPE 0.0107
OUTFALL DROP
0.70'
CULVERT LENGTH 124 FEET


Dia 6'
Culvert inlet


Culvert outlet


C-001
16 AUG 1982
CULVERT EXIT
DEPTH (ft)
0.3
0.2
0.1
0.0
0 1 2 3 4 5
VELOCITY (fps)

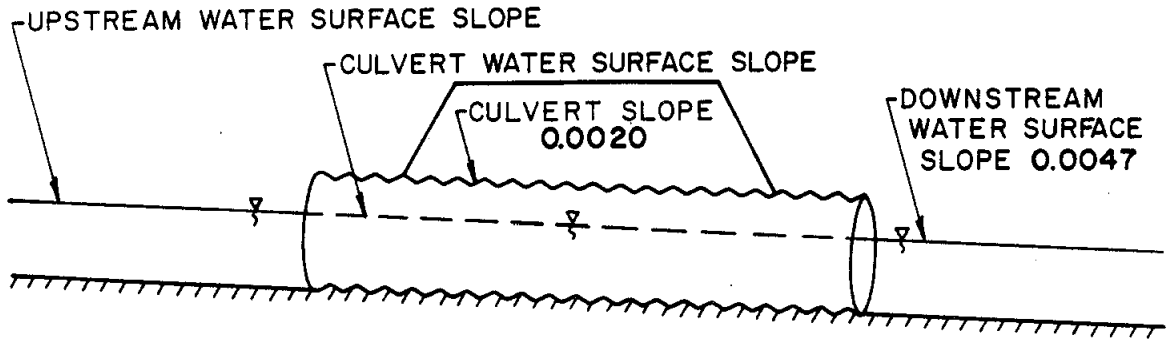
Site No. B-001 Woodchopper Creek

Location: Dalton Highway, 3 miles north of the Yukon River

Map: Livengood D-6, T12N, R11W, Sec. 2

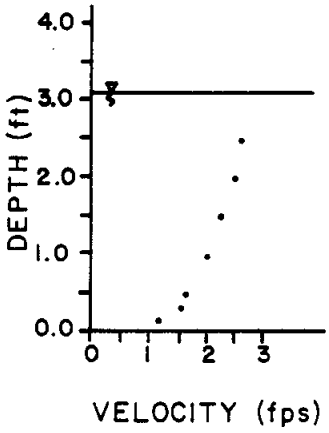
Woodchopper Creek was first observed on May 26, 1982. The discharge was 74.4 cfs from a watershed area of 13.4 sq mi. The water depths at the inlet and outlet of the culvert were 2.80 and 3.15 ft, respectively. The bedload was fine sand and silt; no sediment was observed in the culvert. There was a small pool just downstream of the culvert outlet. The brush and vegetation was too thick to obtain a slope measurement upstream of the culvert, other slopes are shown in the diagram.

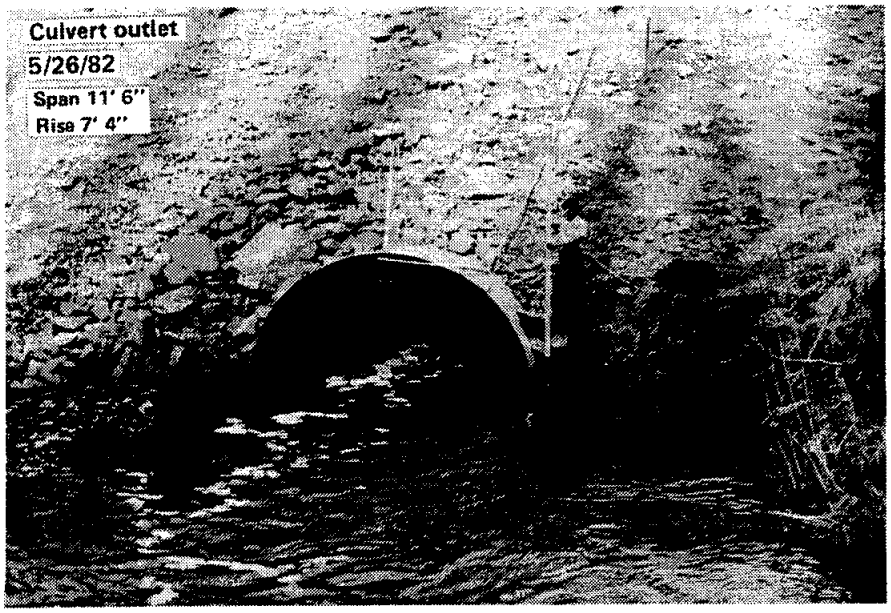
Culvert inlet and outlet depths on July 23, 1982 were 1.03 and 0.40 ft, respectively. A photo taken on May 10, 1983 shows ice conditions that exist during breakup.

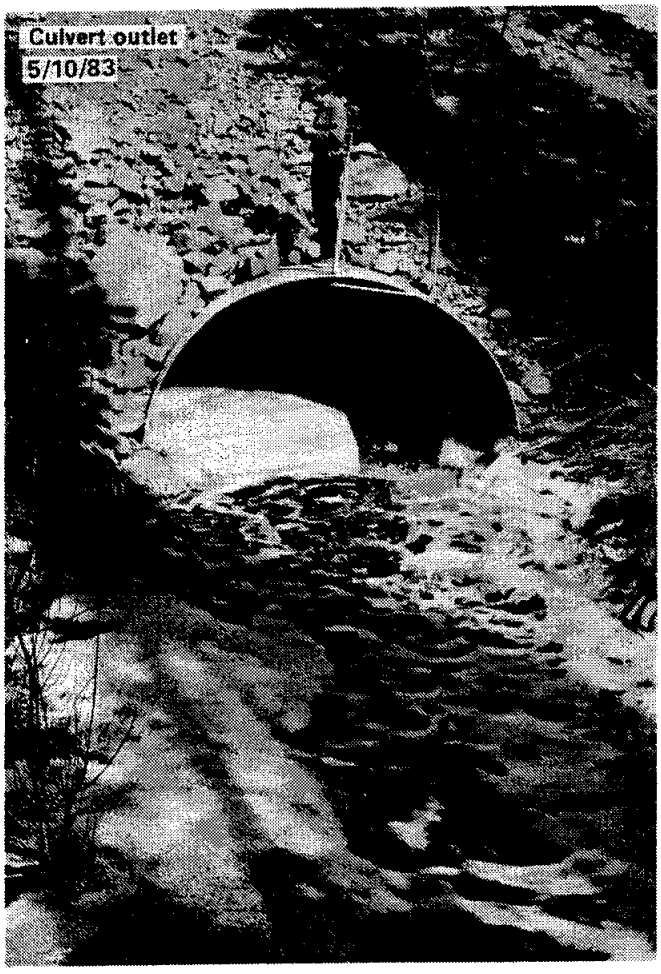


CULVERT LENGTH 100 FEET

B-001
26 MAY 1982
CULVERT EXIT




Culvert outlet
5/26/82
Span 11' 6"
Rise 7' 4"


Culvert outlet
5/10/83

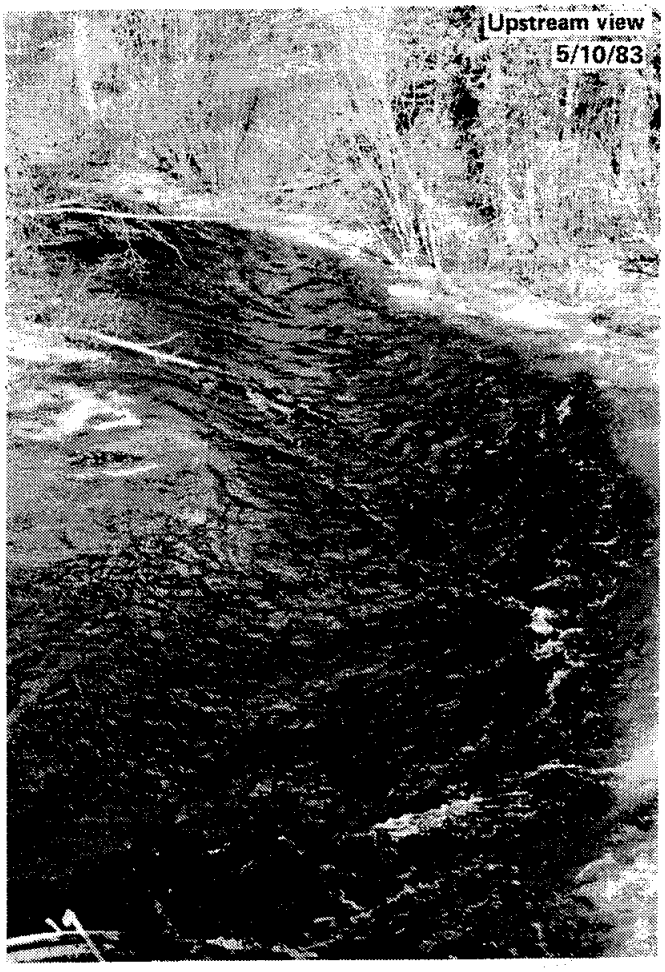
Site No. B-002 Fort Hamlin Hills Creek

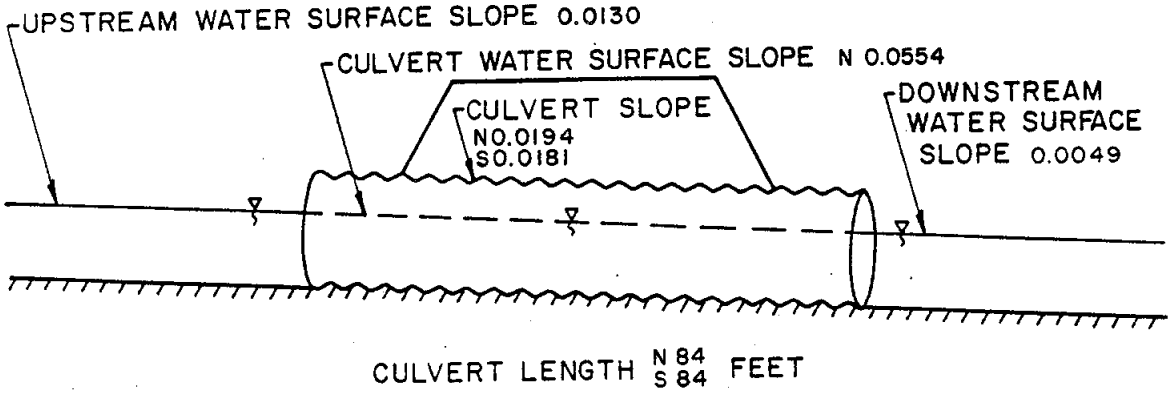
Location: Dalton Highway

Map: Bettles A-1, T14N, R12W, Sec. 17

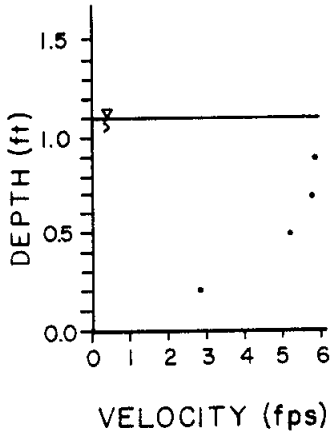
Two identical culverts contained the 50.2 cfs discharge in this creek on May 10, 1983. Ice was noted in both culverts, filling about 2/3 of each barrel. Anchor ice was present in the stream channel and the discharge measurement was taken on top of the ice. A velocity profile measurement was taken at the outlet of the north culvert. Here the ice was 5.62 ft thick and the water depth on top of the ice was 1.10 ft. The watershed area was 36.2 sq mi. The water surface profile for this stream is shown in the diagram.

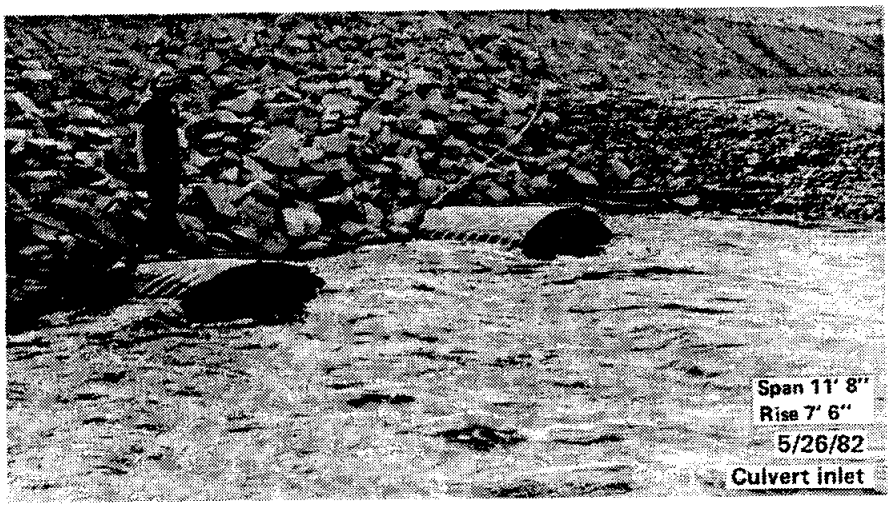
Fort Hamlin Hills Creek was also visited on May 26, 1982. Flow conditions appeared similar to those described above except less ice was noted. A 60 by 50 ft pool was situated downstream of the culvert installation while upstream of the north culvert was a 15 ft diameter pool.

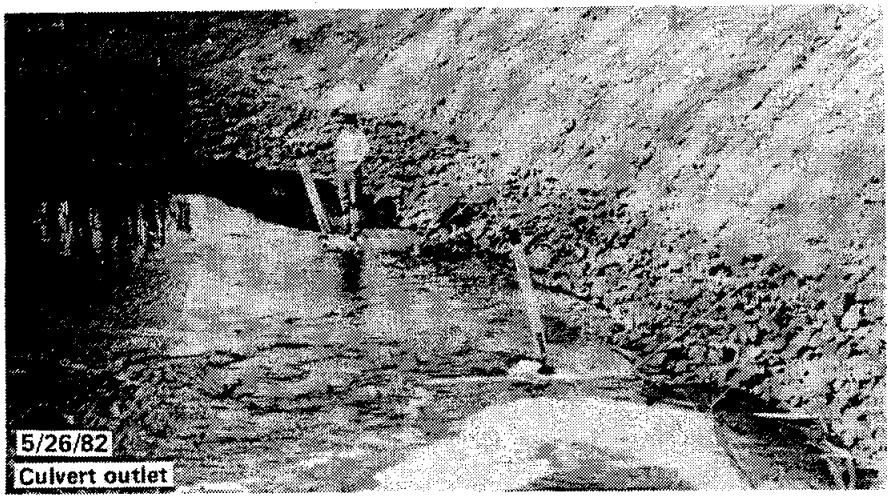


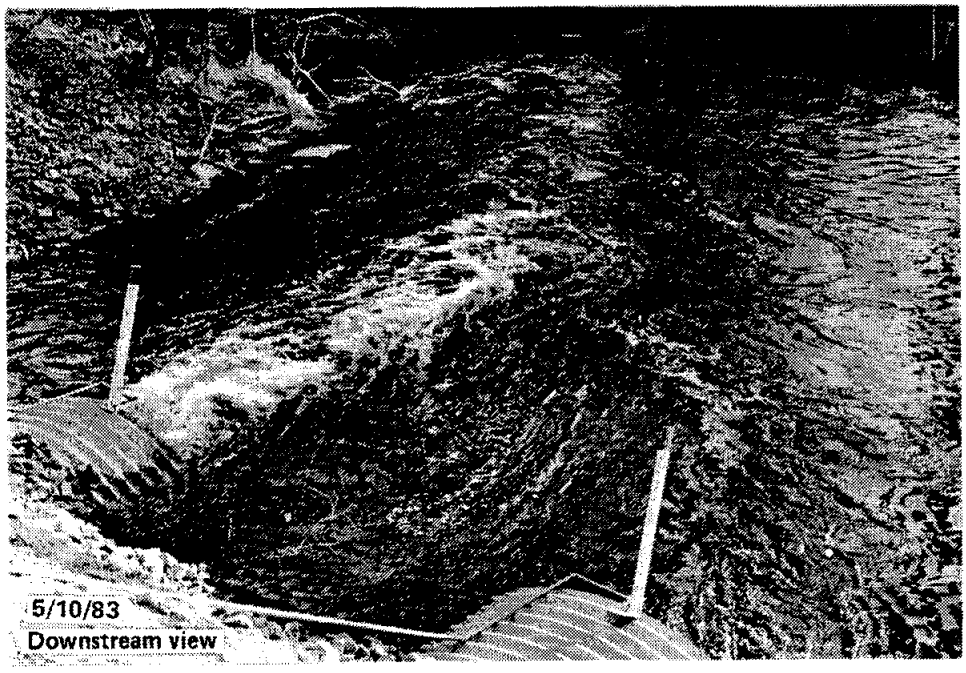


B-002
10 MAY 1983
CULVERT EXIT









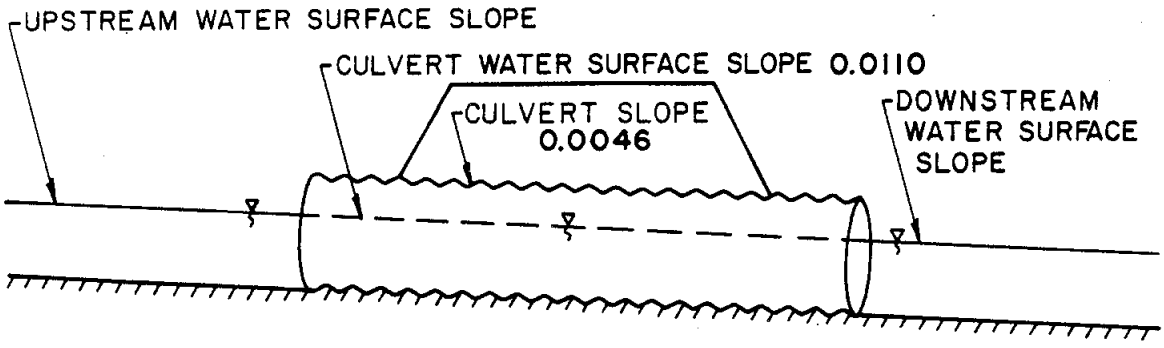
Site No. B-003 Fed Creek

Location: Dalton Highway

Map: Bettles A-1, T16N, R12W, Sec. 25

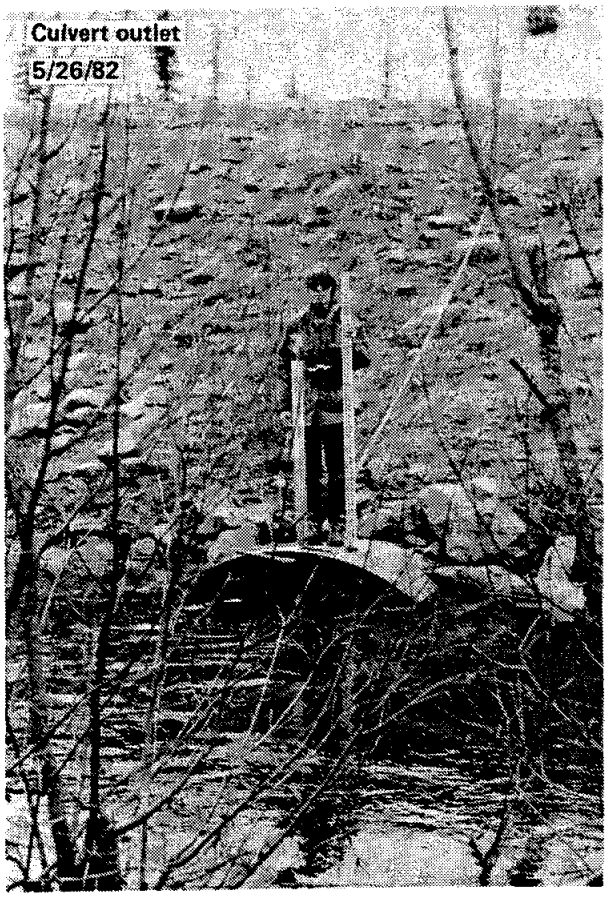
This site was first visited on May 26, 1982. No discharge measurement was made due to the aufeis up and downstream of the culvert. Upstream, the channel was full of ice causing the water to flow through the trees; downstream the channel was filled with debris and ice. Some ice was also noted inside the culvert. No slope measurements were made above and below the culvert due to the lack of a defined channel. The watershed area was 4.3 sq mi.

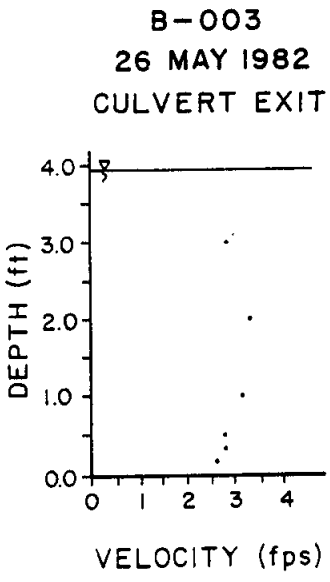
Fed Creek was again observed on July 23, 1982. Culvert inlet and outlet depths were measured: the water depth was 0.30 ft at the entrance and 0.55 ft at the exit. The barrel contained small rocks and silt.



CULVERT LENGTH 104 FEET


Culvert inlet
5/26/82
Span 8' 2"
Rise 5' 9"


Culvert outlet
5/26/82


B-003
26 MAY 1982
CULVERT EXIT
DEPTH (ft)
4.0
3.0
2.0
1.0
0.0
0
1
2
3
4
VELOCITY (fps)

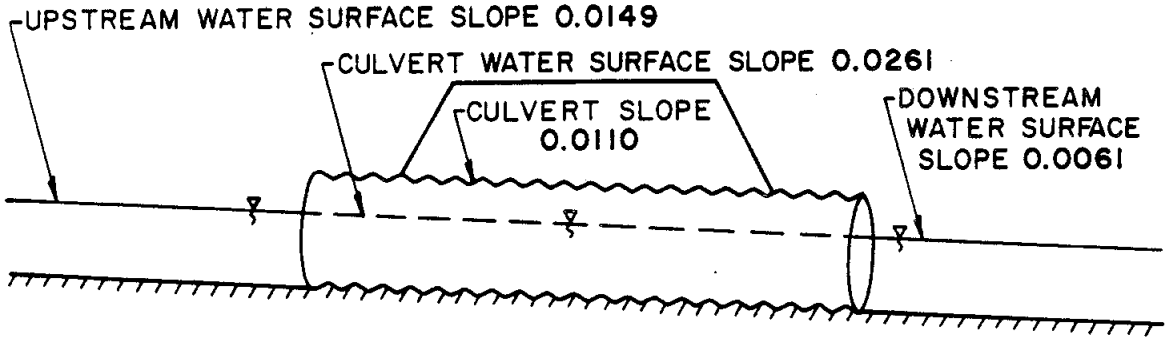
Site No. B-004A Middle Branch of the West Fork of the Dall River

Location: Dalton Highway

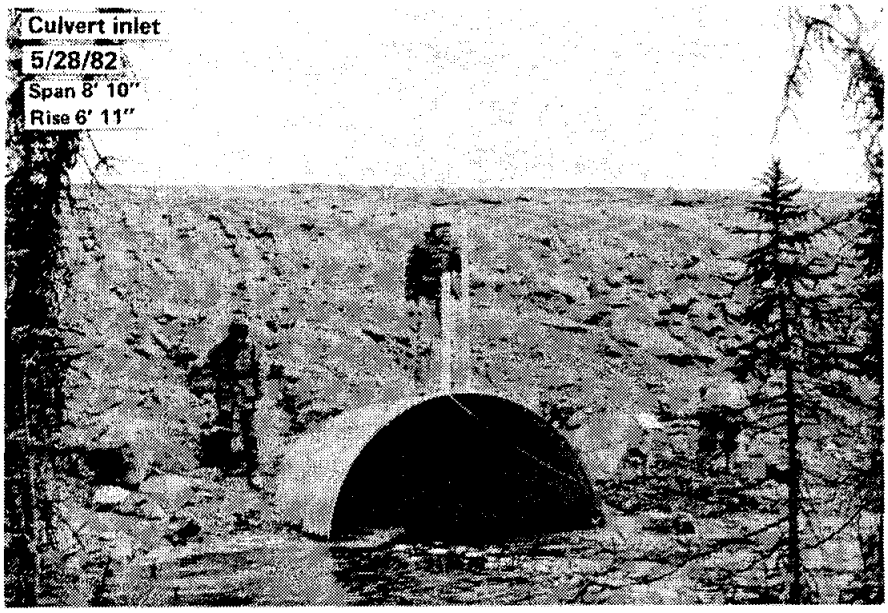
Map: Bettles B-1, T17N, R13W, Sec. 17

The culvert and stream at this location were measured on May 28, 1982 and the surveyed slopes are presented in the diagram. The discharge (55.9 cfs) was measured in the culvert entrance. Due to high discharge, channels were undefined both up and downstream of the culvert. A large shallow pool (70 by 20 ft) just upstream of the culvert may also have been a result of the high flows. There was no drift in the culvert although ice was observed in the barrel frozen to the sides about three feet up. The velocity at the culvert outlet appeared to be greater than at the inlet. The total depth at the inlet was 2.00 ft. A velocity profile was attempted at the culvert outlet but the combined water depth and velocity was too great. The watershed area was 4.0 sq mi.

Culvert inlet and outlet water depths were noted on July 23, 1982. At the barrel entrance the depth was 0.60 ft and the outlet depth was 0.30 ft.



CULVERT LENGTH 92 FEET


Culvert inlet
5/28/82
Span 8' 10"
Rise 6' 11"


Culvert outlet
5/28/82

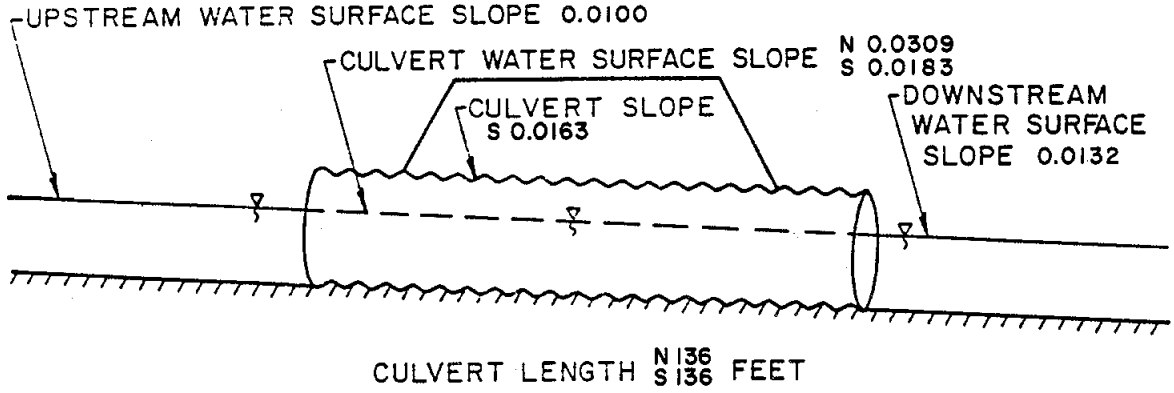
Site No. B-005 Olson Lake Creek

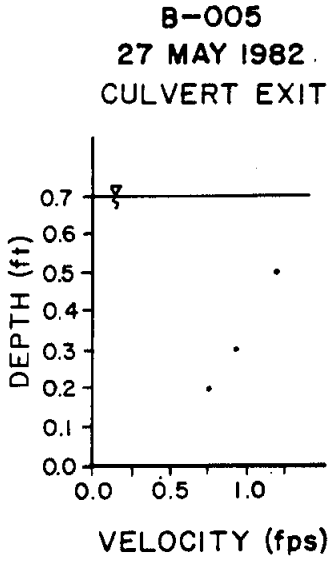
Location: Dalton Highway

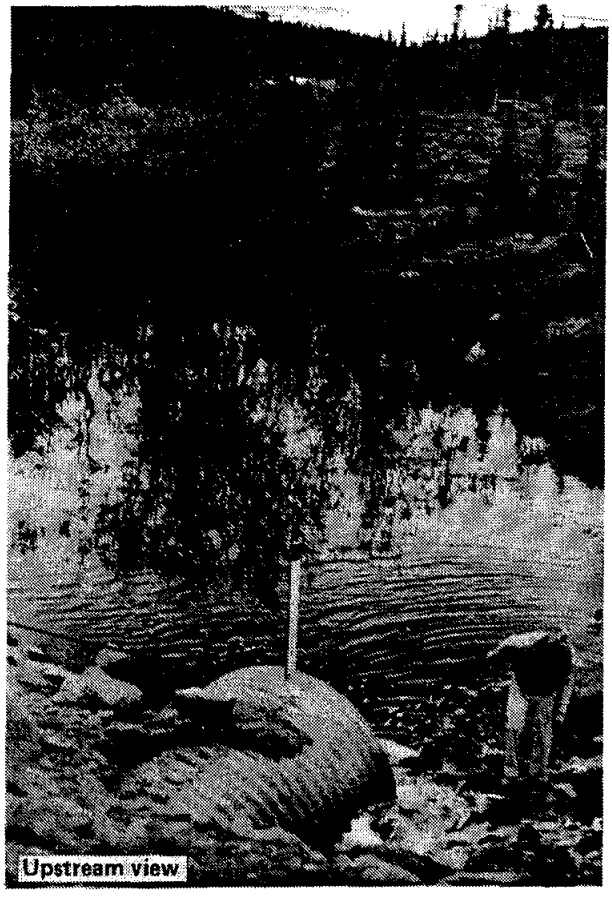
Map: Bettles B-1, T18N, R14W, Sec. 23

Olson Lake Creek was visited on May 27, 1982, when the flow was 63.8 cfs. Two culverts carried the flow, a circular overflow culvert to the north and an arch culvert to the south. The water surface profiles of the culverts and stream are shown in the diagram. The north culvert was completely submerged on the upstream side. This culvert was not flowing full however, and the outlet depth of flow was near 2 ft. The south culvert had an outlet water depth of 0.70 ft and the velocity profile recorded here was with an electromagnetic flow meter. The bedload size was small gravel and there was some gravel in the south culvert invert. The watershed area was 4.4 sq mi.

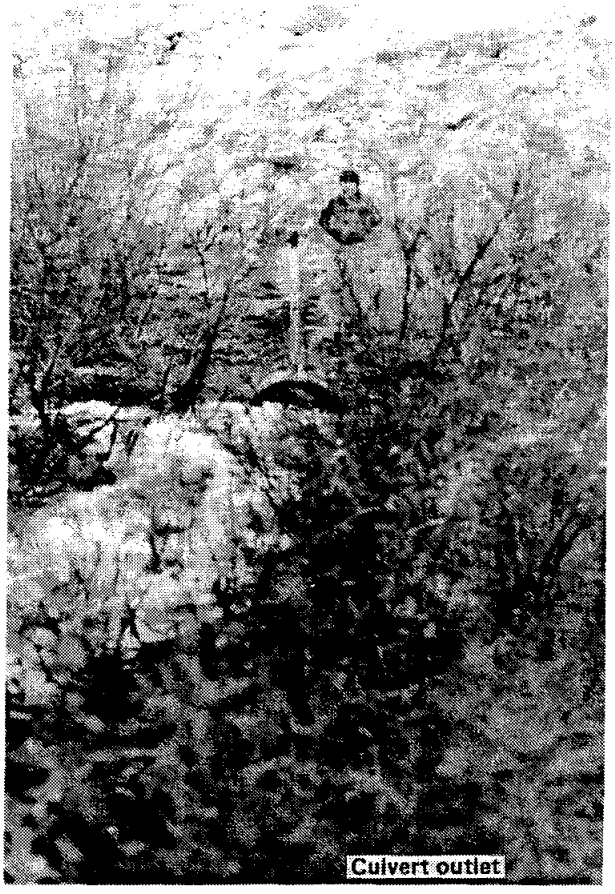
On July 23, 1982, the inlet and outlet water depths were recorded for Olson Lake Creek. They were 1.80 and 0.75 ft, respectively, for the north culvert. The south culvert was dry.







Upstream view



Culvert outlet

Arch culvert
Span 7'
Rise 5' 1"
Culvert outlet

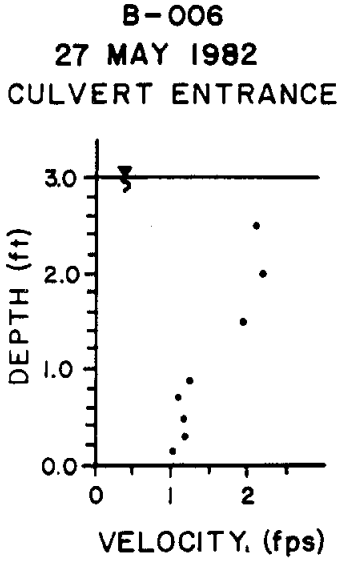
Site No. B-006 Caribou Mountain Creek

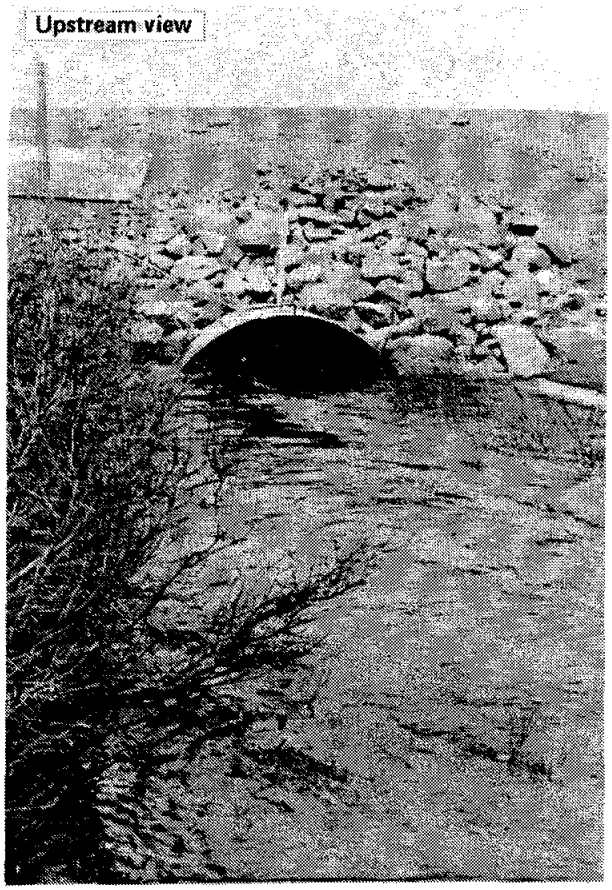
Location: Dalton Highway

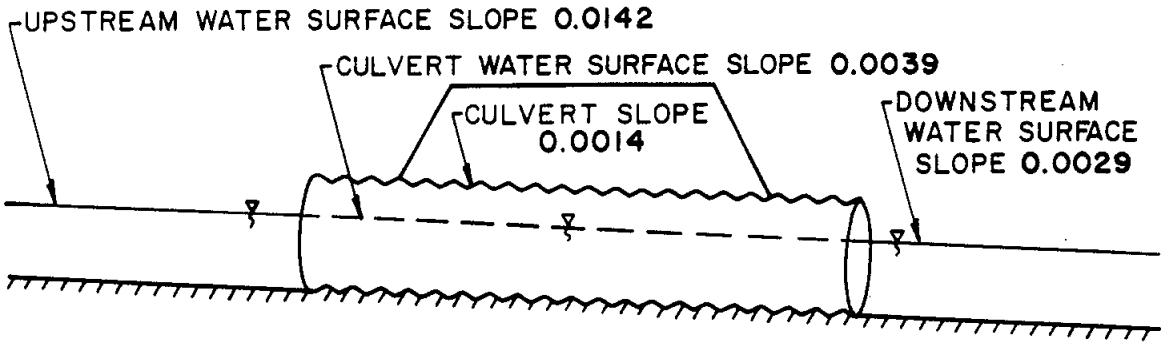
Map: Bettles B-2, T18N, R14W, Sec. 14

This creek was first observed on May 27, 1982. The surveying results are shown in the diagram. The total water depth at the culvert inlet was 3.00 ft. No discharge measurement was obtained due to the depth of flow. Snow and ice were observed in the stream channel. A velocity profile was taken at the culvert entrance with an electromagnetic flowmeter. The watershed area was 7.0 sq mi.

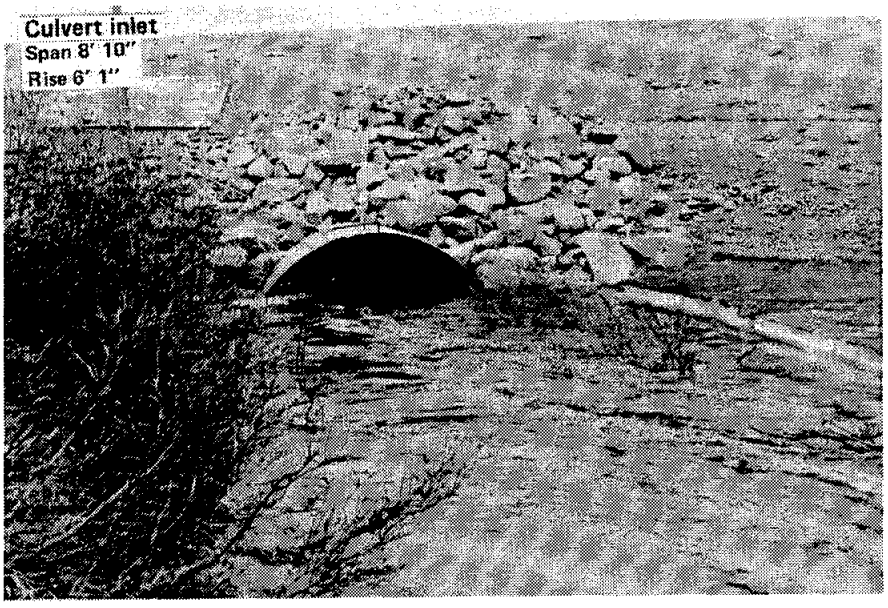
Culvert inlet and outlet depths were measured on July 23, 1982. The water depth at the culvert entrance was 1.15 ft and at the culvert exit was 1.28 ft.

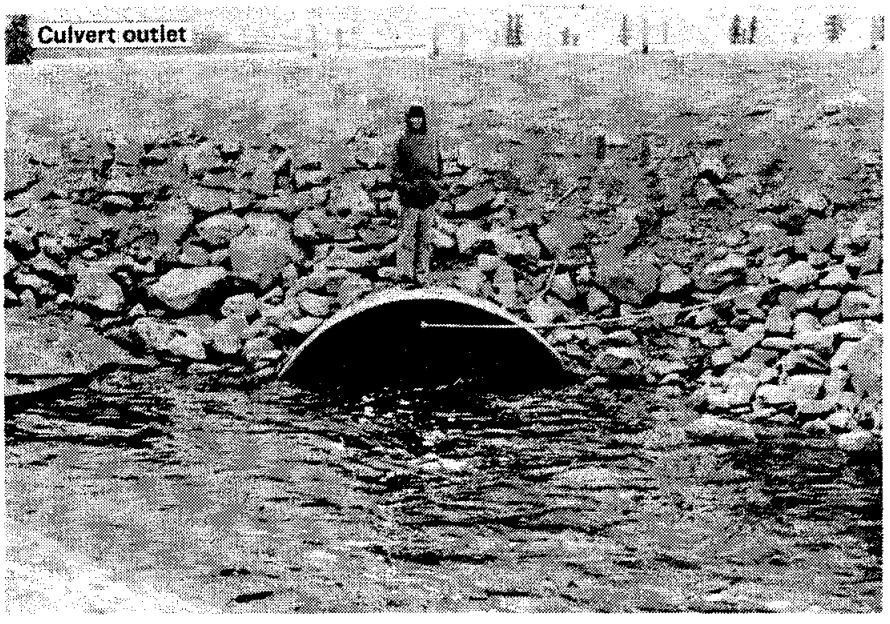






CULVERT LENGTH 70 FEET





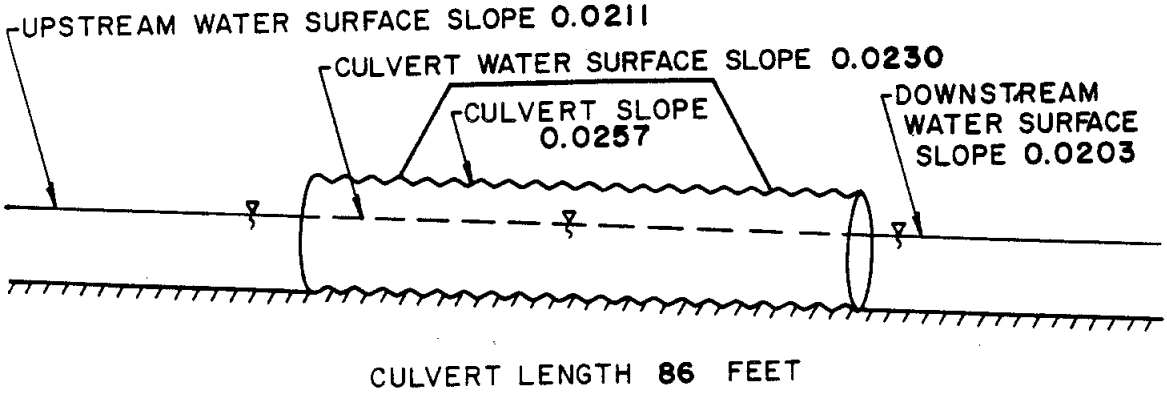
Site B-007 Alder Mountain Creek

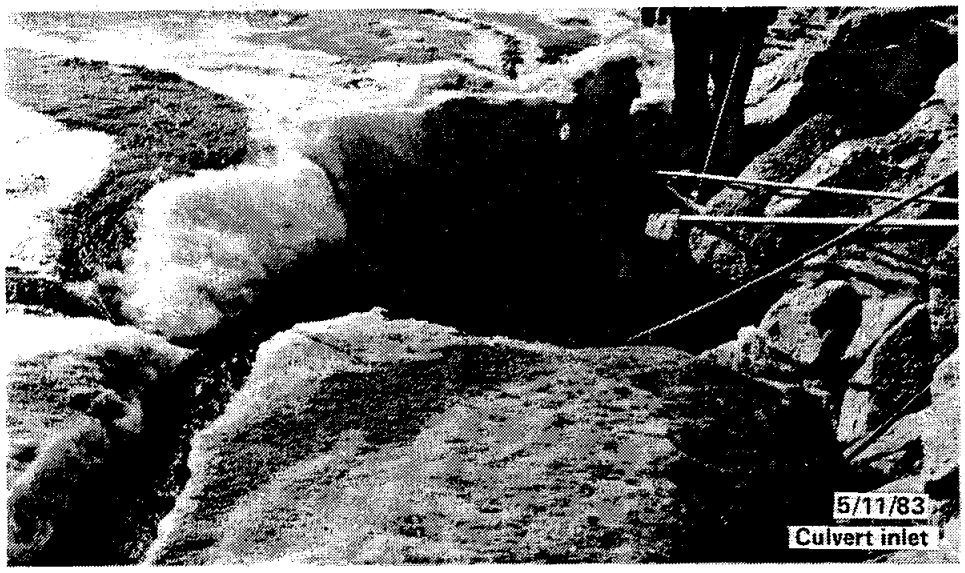
Location: Dalton Highway

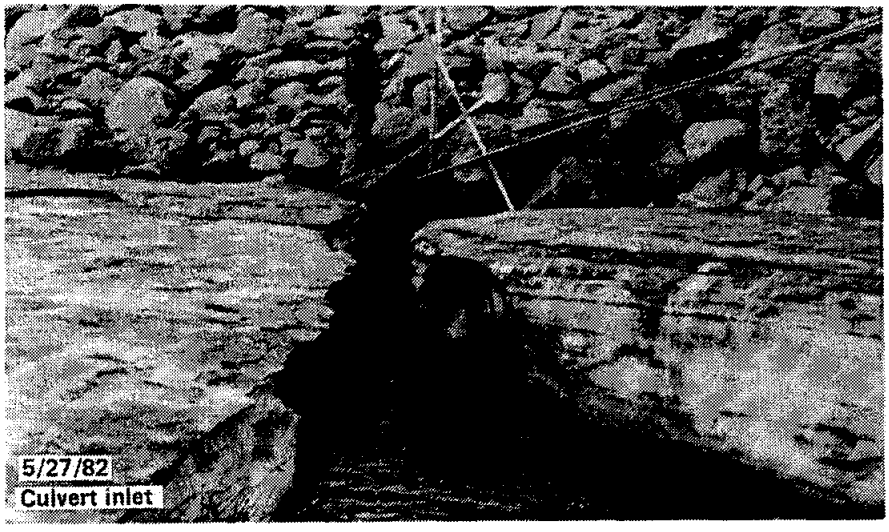
Map: Bettles C-2, T20N, R15W, Sec.8

The streamflow in Alder Mountain Creek was 49.6 cfs on May 27, 1982. The water surface profile for the stream and culvert is shown in the diagram. Gravel 3 to 4 in in diameter was noted in the culvert near the outlet; inlet drift conditions were not observed. No pools were noted either up or downstream from the culvert. Icing was a problem at this culvert; ice was observed inside the barrel on this date. Aufeis was apparent upstream of the culvert (see picture, right). The watershed area was 5.7 sq mi.

The inlet water depth was 0.50 ft. on July 23, 1982, and the water depth at the culvert exit was 0.32 ft.




5/11/83
Culvert inlet


5/27/82
Culvert inlet


Span 9' 6"
Rise 6' 5"
5/27/82
Culvert outlet

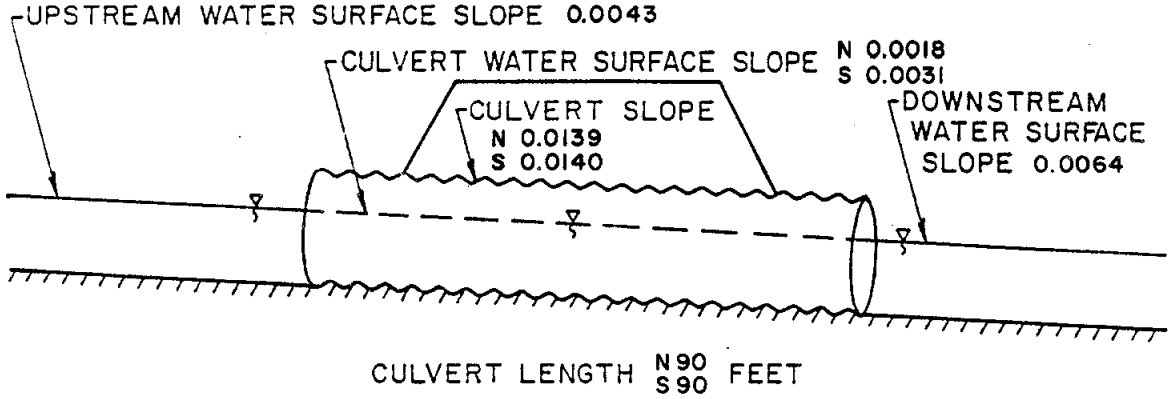
Site No. B-008 Pung's Crossing

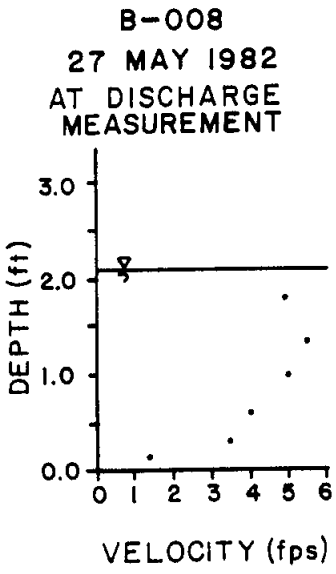
Location: Dalton Highway

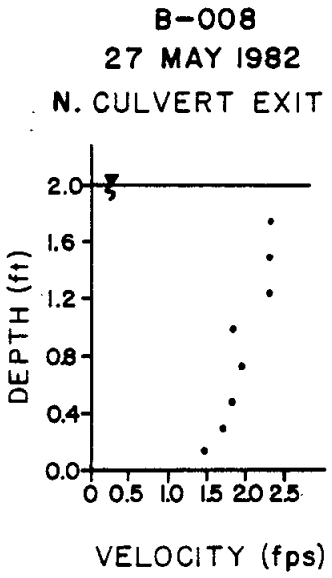
Map: Bettles C-2, T21N, R15W, Sec. 30

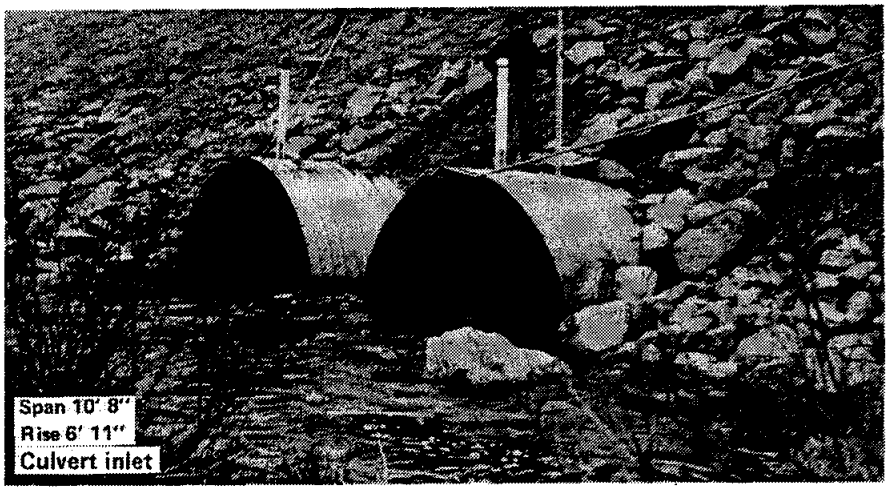
Two identical culverts (north and south) contained the flow in Pung's Crossing on May 27, 1982. The discharge was 73.6 cfs. The surveyed slopes for the culverts and stream are presented in the diagram. The water depth at the outlet of the north culvert was 2.00 ft. The bed material was 2 to 3 in diameter gravel in the culverts. The north barrel had more sediment than the south barrel. A pool (30 by 15 ft) with backwater eddies was noted at the culvert outlets; aufeis was noted upstream of the culverts. The culvert velocities were much lower than the downstream channel velocities, due to the enlarged cross section through the culverts. The velocity profiles were measured with an electromagnetic flowmeter. The watershed area was 10.5 sq mi.

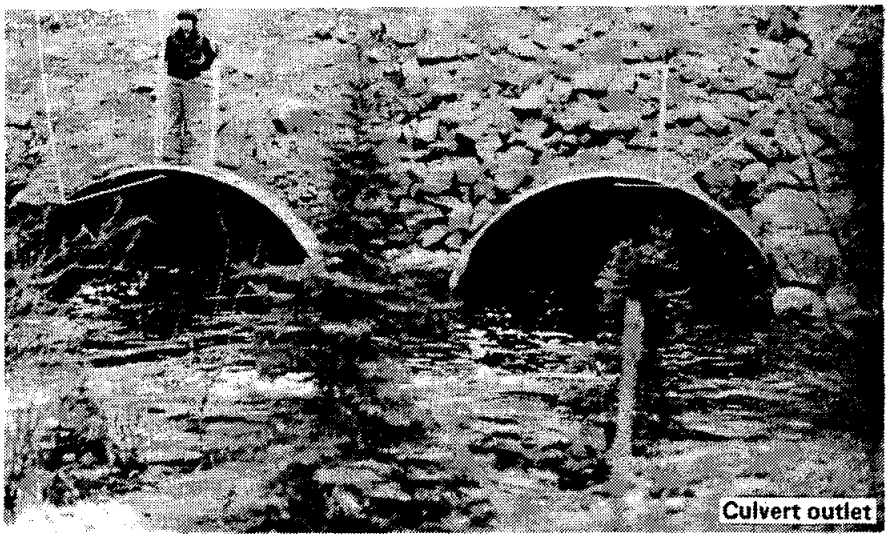
The water depths at the culvert inlets and outlets were measured on July 23, 1982. For the south culvert, the barrel entrance and exit depths were 0.60 and 1.08 ft, respectively. The north culvert had an inlet water depth of 0.90 ft and an outlet water depth of 0.80 ft.




B-008
27 MAY 1982
AT DISCHARGE
MEASUREMENT
DEPTH (ft)
3.0
2.0
1.0
0.0
0 1 2 3 4 5 6
VELOCITY (fps)


B-008
27 MAY 1982
N. CULVERT EXIT
DEPTH (ft)
2.0
1.6
1.2
0.8
0.4
0.0
0 0.5 1.0 1.5 2.0 2.5
VELOCITY (fps)


Span 10' 8"
Rise 6' 11"
Culvert inlet


Culvert outlet

Site No. B-009 South Fork of the Little Nasty Creek

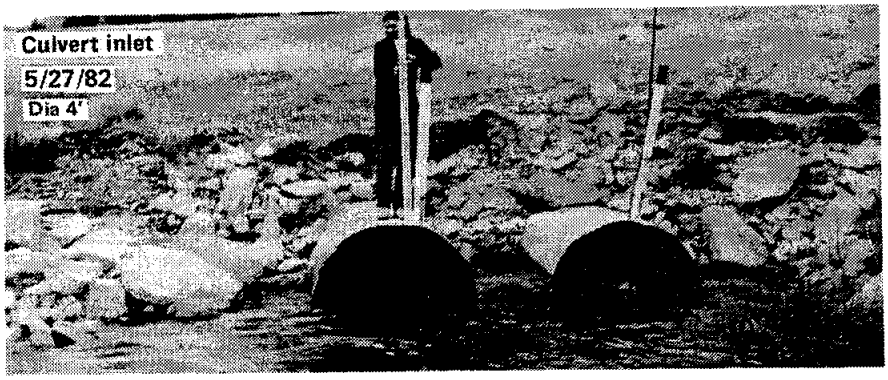
Location: Dalton Highway

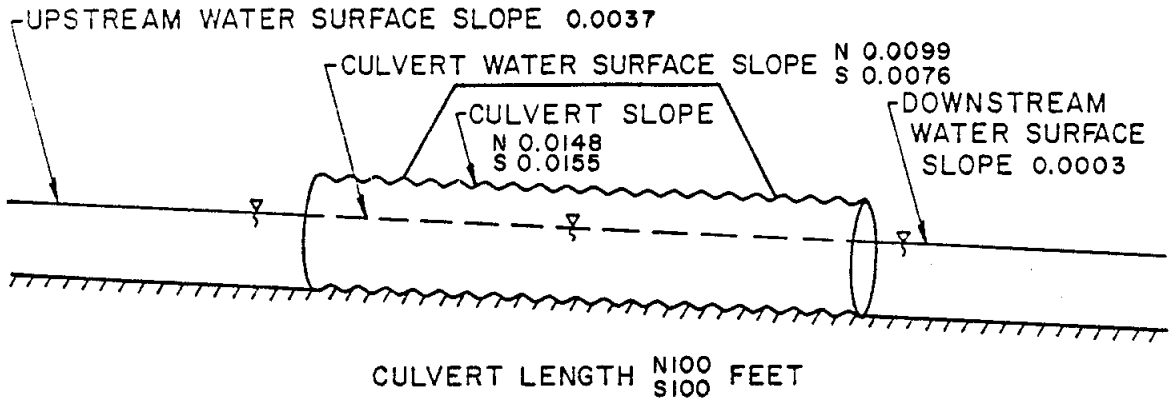
Map: Bettles B-2, T22N, R14W, Sec. 19

Site B-009 was first observed on May 27, 1982; two circular culverts (north and south) contained the 57.5 cfs flow. The south culvert inlet and outlet water depths were 2.10 and 2.20 ft, respectively. The velocity profiles at the entrance and exit of the south culvert were measured with an electromagnetic flowmeter. The water velocity appeared to increase inside of the culvert barrel. A small pool was noted at the culvert outlets; some ice remained upstream of the culvert. Parts of the culvert barrels contained sediment deposits; there was 0.8 ft of sediment at the outlet of the south culvert. The water surface profile for the culverts and stream are presented in the diagram. The watershed area was 1.8 sq mi.

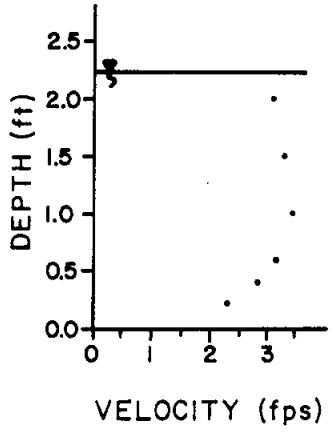
Inlet and outlet water depths were recorded for both culverts on July 23, 1982. The inlet water depths measured 0.30 and 0.60 ft for the north and south culverts, respectively. The water depth at the exit to the north barrel was 1.05 ft and 0.90 ft at the exit to the south barrel.

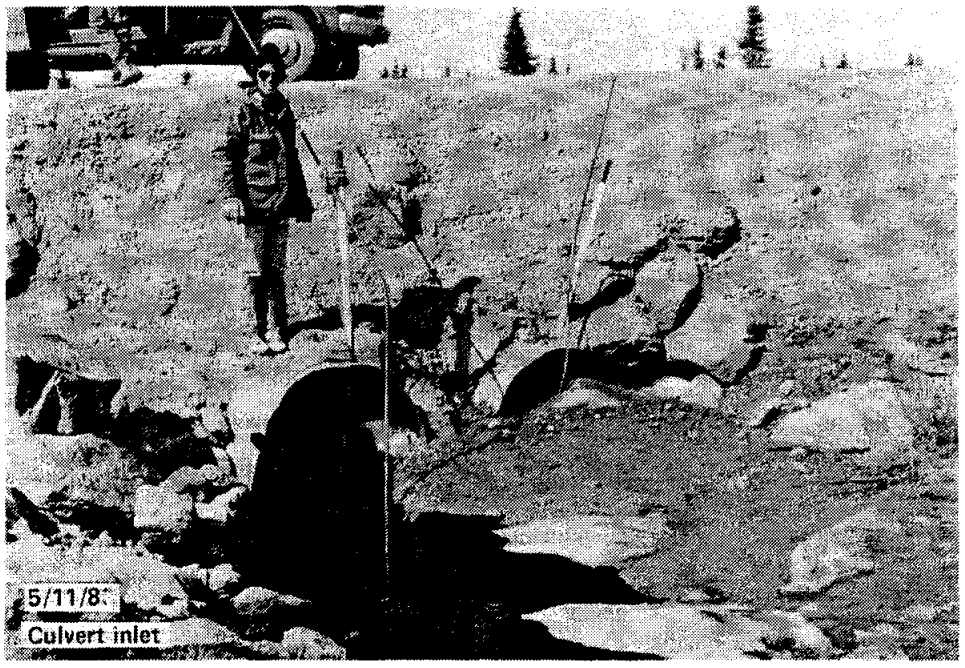
This site was visited a third time on May 11, 1983. Extensive icing was noted upstream, precluding a slope measurement. Other measured slopes were: north culvert crown, 0.0117; south culvert crown, 0.0150; culvert water, 0.0051; and downstream, 0.0063. The total discharge was 1.7 cfs.





B-009
27 MAY 1982
SOUTH
CULVERT EXIT





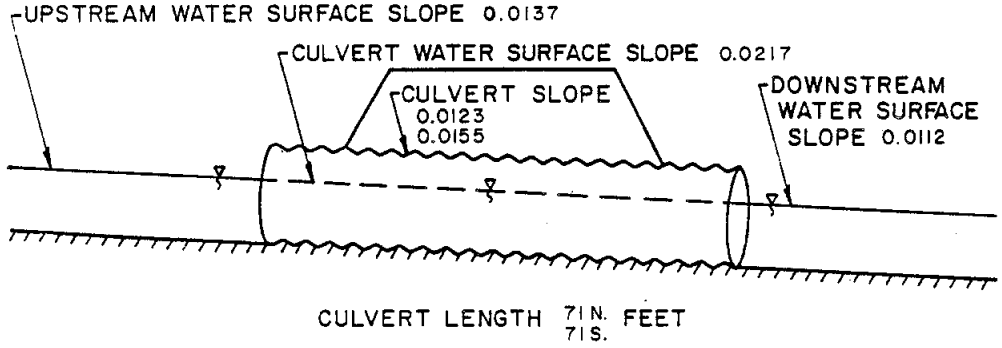
Site No. B-012 Douglas Creek (main culverts, north and south)

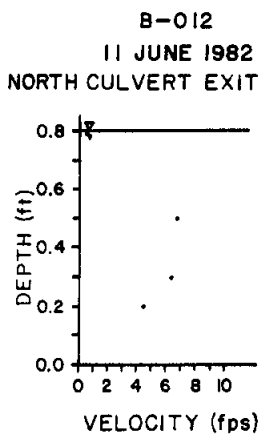
Location: Dalton Highway

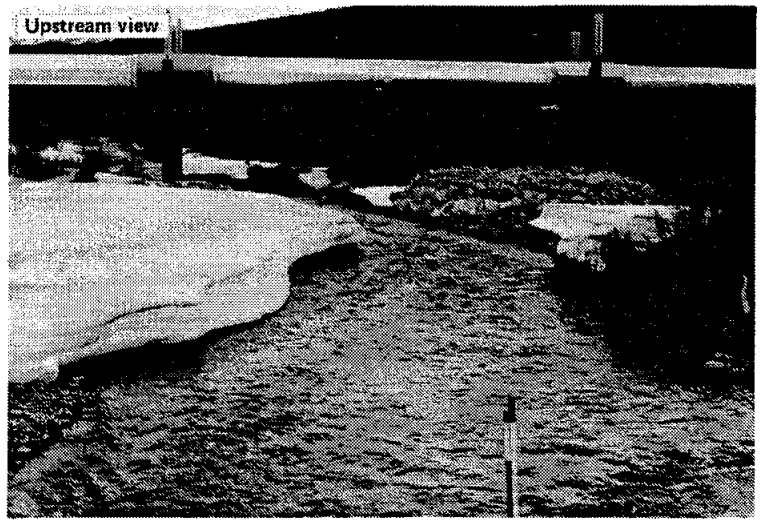
Map: Bettles D-2, T24N, R14W, Sec. 34

The three culverts (north, south and overflow) at Douglas Creek were observed on June 11, 1982. The stream conditions at the main north and south culverts are shown on these two pages. Site conditions at the overflow culvert are pictured on the two following pages. It appeared that Douglas Creek had been realigned and straightened when the north and south culverts were emplaced. The original channel was to the south and crossed the Dalton Highway at the overflow culvert.

The streamflow contained by the north and south culverts was 79.2 cfs. The water depth at the outlet of the north culvert was 0.80 ft; it carried more flow than the south culvert. The water surface profiles for the two culverts and the stream are shown in the diagram. The bed material was gravel up to 5 in diameter; both the north and south barrels were clean. The creek emptied into the Jim River 189 ft downstream of the main culverts. Severe icing conditions upstream of the main culverts obscured the principal stream channel, causing the discharge to flow through the willows on top of the ice. The watershed area was 16.6 sq mi.

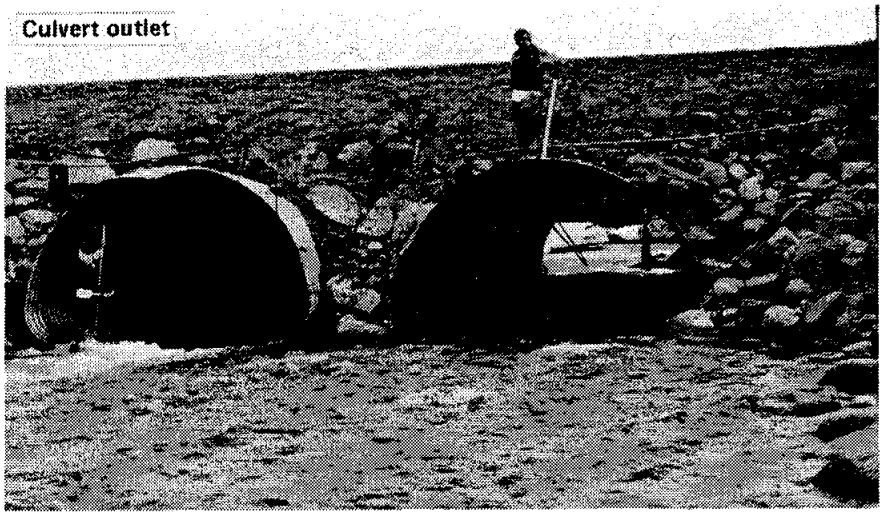




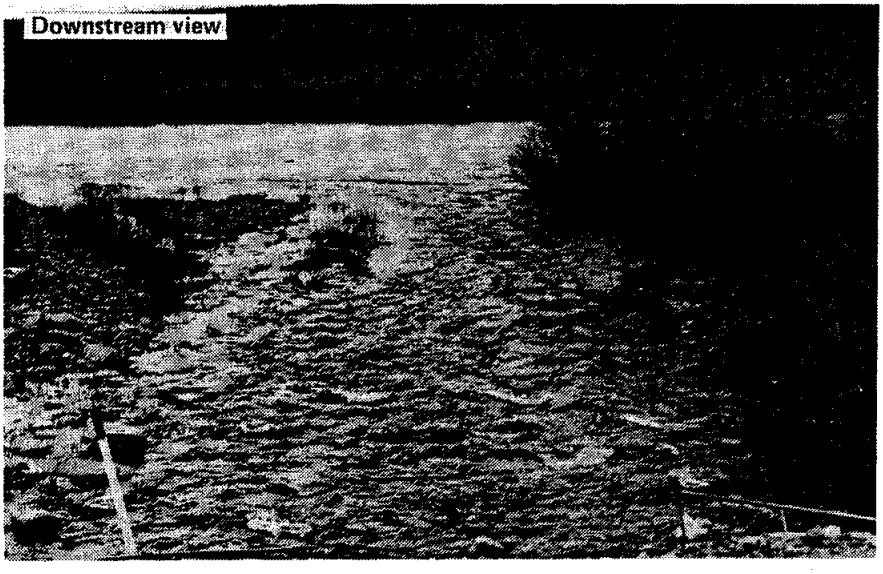


Culvert inlet
Span 12' 4"
Rise 7' 9"

Culvert outlet



Downstream view

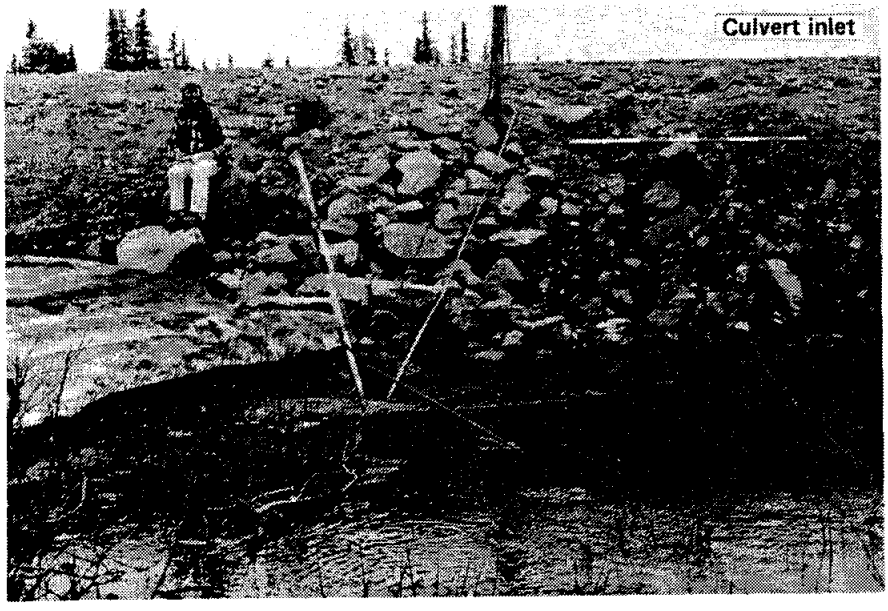


Site No. B-012 Douglas Creek (overflow culvert)

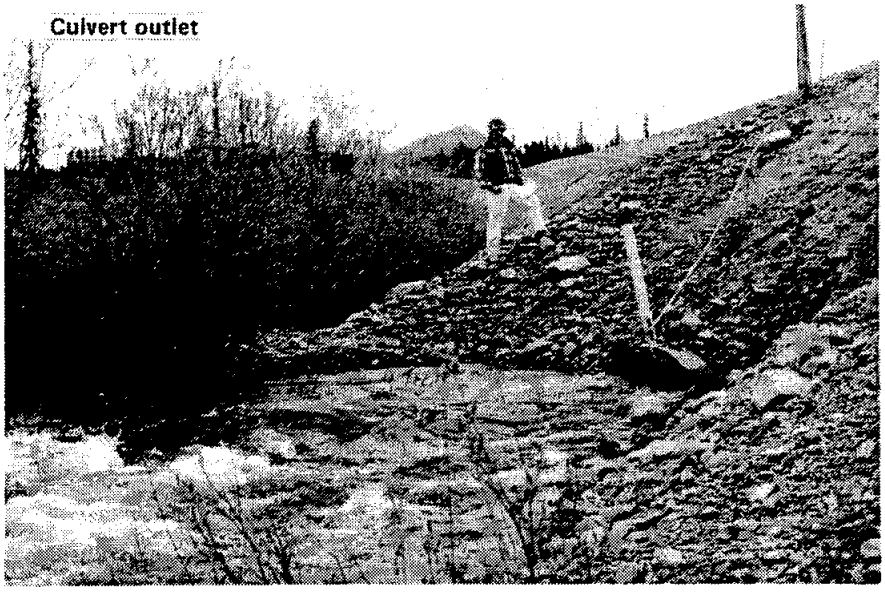
Location: Dalton Highway

Map: Bettles D-2, T24N, R14W, Sec. 34

The aufeis conditions encountered upstream of the Douglas Creek main culvert installation caused some of the discharge to flow south to the overflow culvert. No discharge measurement was taken to determine the flow through this culvert. The culvert was completely submerged at the inlet and flowing nearly full at the outlet.



Culvert outlet



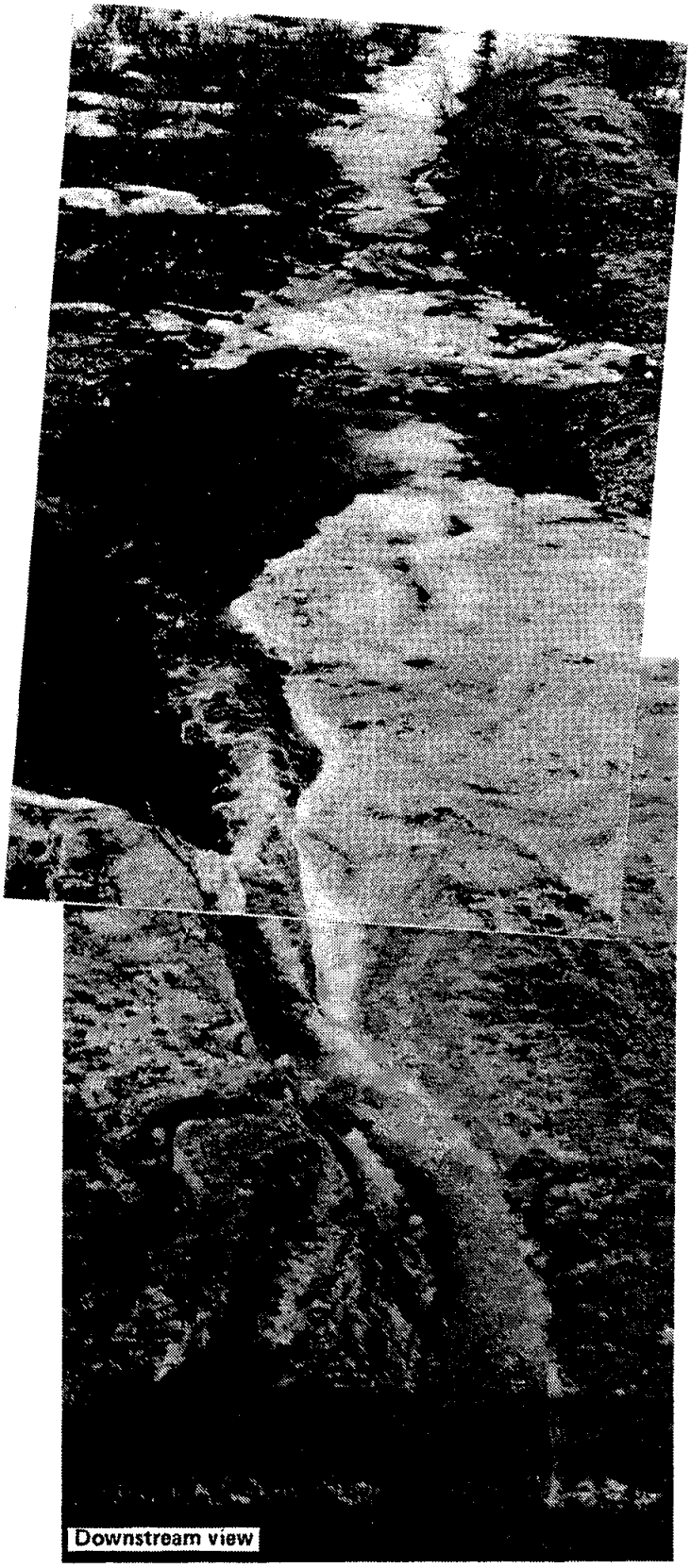
Downstream view

Site No. B-012 Douglas Creek (bridge)

Location: Dalton Highway

Map: Bettles D-2, T24N, R14W, Sec. 34

The culverts at Douglas Creek were replaced with a bridge in the summer of 1982. By the first spring (1983) severe icing and maintenance problems developed. The ice buildup came to within several inches of the bridge deck on May 11, 1983. Upstream of the bridge, highway maintenance personnel were cutting a channel through ice upwards of 10 ft thick.


Downstream view

Site No. B-016 Abba Dabba Creek

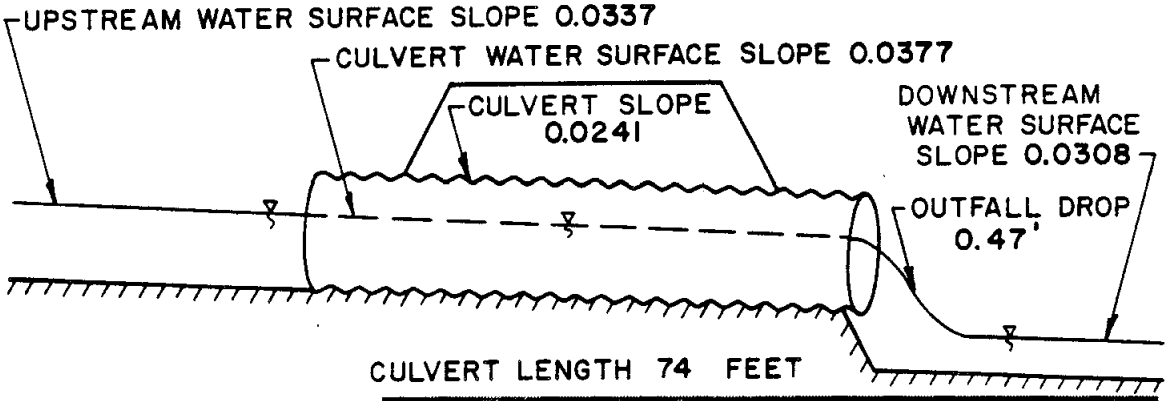
Location: Dalton Highway

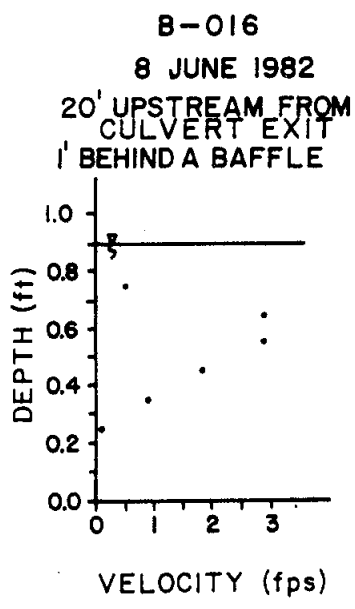
Map: Bettles D-1, T25N, R13W, Sec. 13

Abba Dabba Creek was first observed on June 8, 1982. The discharge (28.2 cfs) was contained in a single perched culvert. The surveyed water surface profiles are shown in the diagram. No pools were observed at either end of the culvert installation.

Baffles, consisting of vertical sheet metal sections connected by chains were installed after the culvert was placed. The baffles were 6 in high and 4 ft wide. They were alternately spaced 3 and 6 ft apart. The water surface slope in the barrel was higher in the upper part of the barrel where there was sediment behind the baffles. Some of the baffles on the lower end were damaged, bent or missing. The watershed area was 4.2 sq mi.

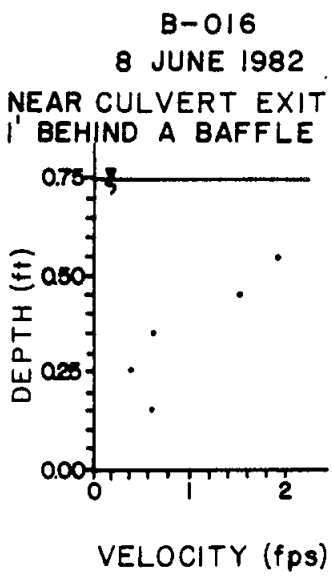
On July 23, 1982 culvert entrance and exit water depths were measured. The inlet depth was 0.60 ft and the outlet depth was 0.65 ft.






Span 9' 6"
Rise 6' 5"
Culvert inlet


Culvert outlet


B-016
8 JUNE 1982
NEAR CULVERT EXIT
1' BEHIND A BAFFLE
0.75
0.50
0.25
0.00
DEPTH (ft)
0
1
2
VELOCITY (fps)


Downstream view

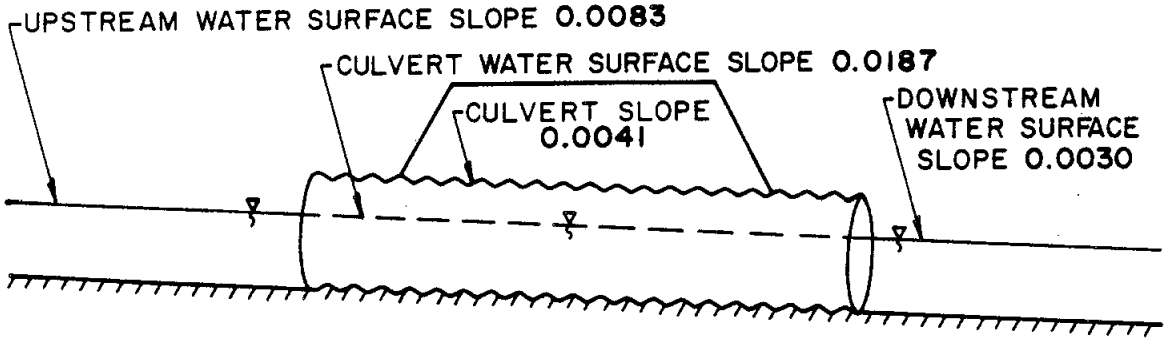
Site No. B-023 Rosie Creek

Location: Dalton Highway

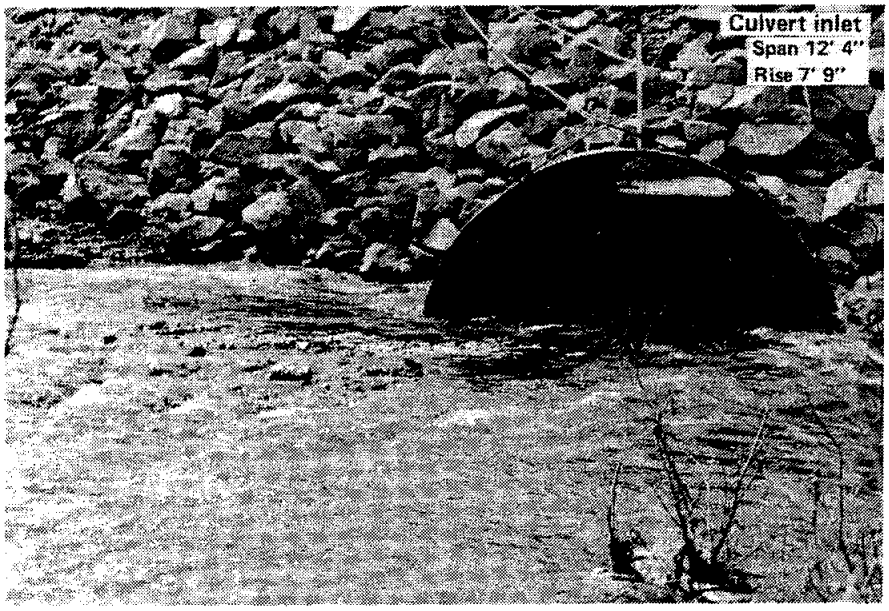
Map: Wiseman A-1, T27N, R12W, Sec. 6

Rosie Creek was observed on June 8, 1982. The discharge at that time was 88.0 cfs, and the total water depth at the culvert outlet was 1.80 ft. The bed material was gravel up to 4 in in diameter. Small pools at both ends of the culvert were due to the barrel being misaligned with the streamflow. This also caused some erosion problems along the banks near the culvert. The watershed area was 17.7 sq mi. The water surface profiles for the stream and culvert appear in the diagram.

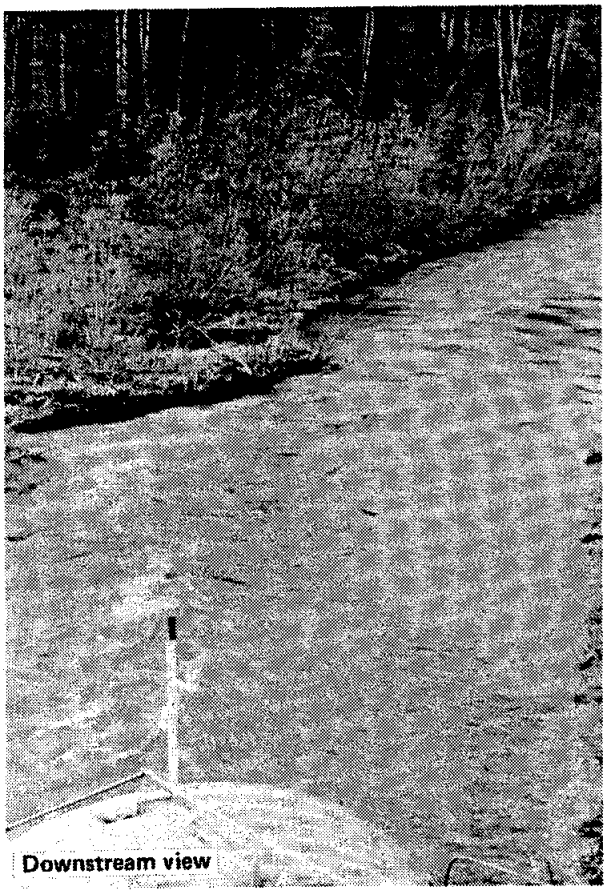
Rosie Creek was observed again on July 23, 1982. The inlet water depth was 1.90 ft and the water depth at the culvert outlet was 1.30 ft.



CULVERT LENGTH 110' FEET



Culvert outlet



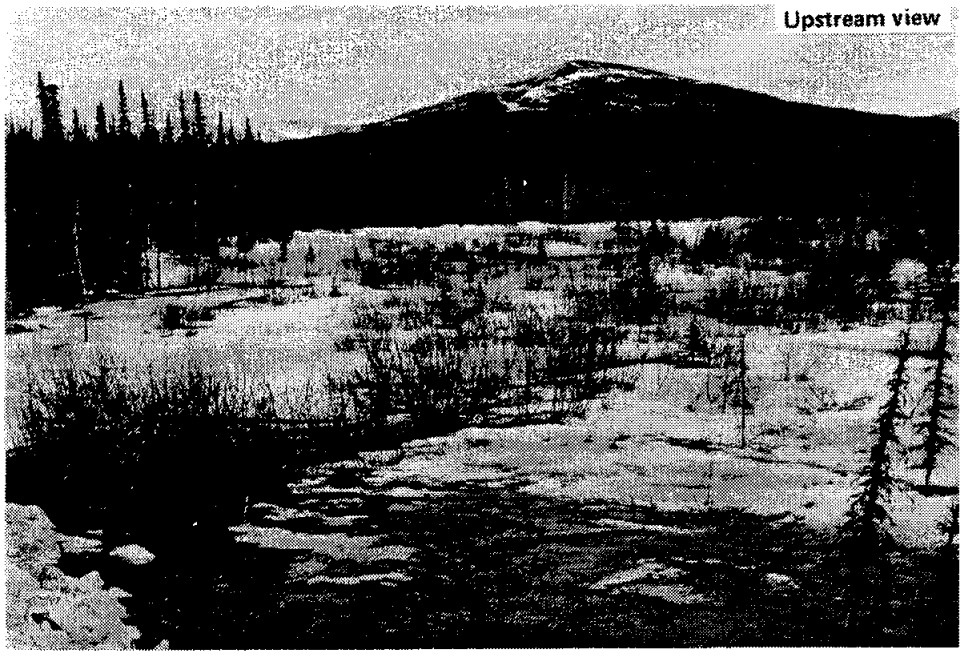
Downstream view

Site No. B-023 Rosie Creek

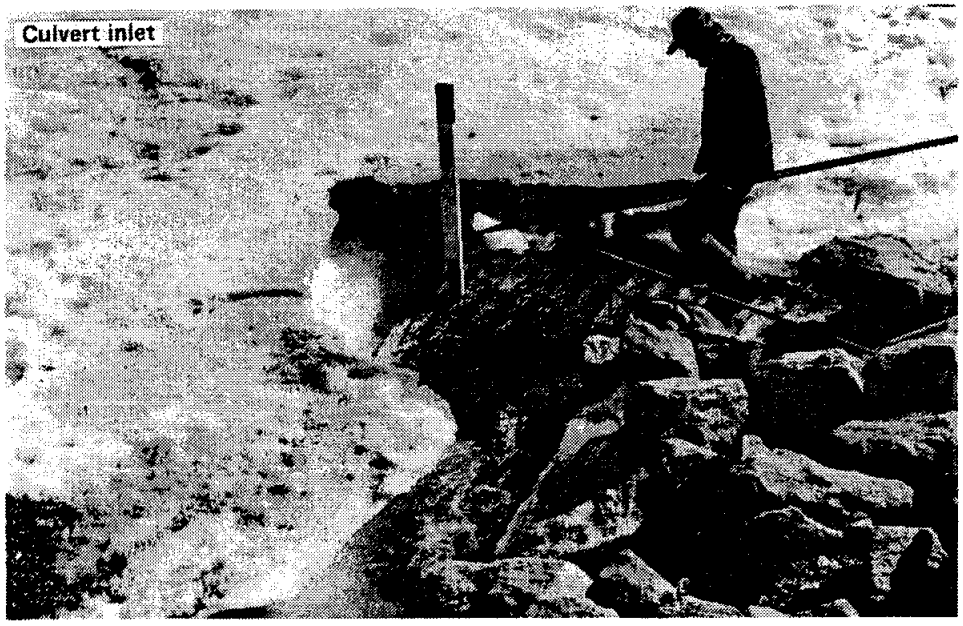
Location: Dalton Highway

Map: Wiseman A-1, T27N, R12W, Sec. 6

Rosie Creek was visited again on May 11, 1983. No measurements were recorded, but the pictures on these two pages show the icing conditions at this site. Flow upstream of the culvert was over the ice and through willows and brush; the main stream channel was not visible. Downstream, the creek was not flowing in the main channel from the previous summer but was mostly contained by a second channel. The culvert had ice up to the barrel crown; the flow dropped down from the ice into the culvert at the entrance and welled up at the exit to continue downstream on top of the ice.



Upstream view



Culvert inlet


Culvert outlet


Downstream view

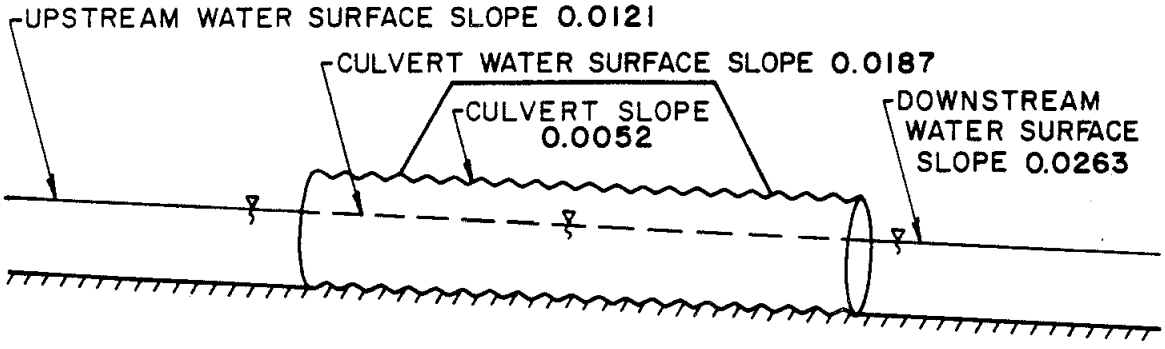
Site No. B-030 Nugget Creek

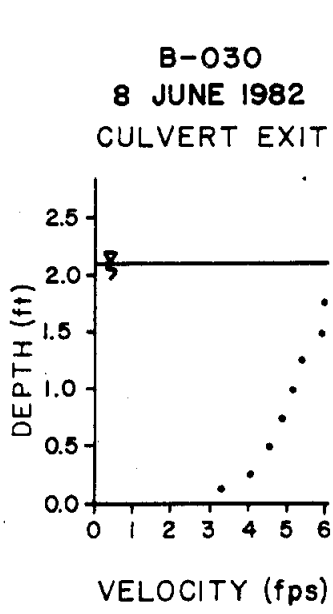
Location: Dalton Highway

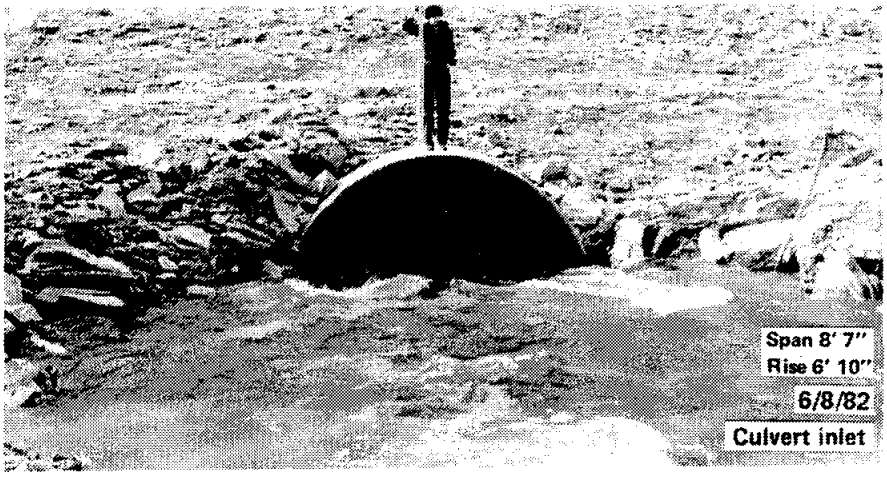
Map: Chandalar B-6, T31N, R11W, Sec. 30

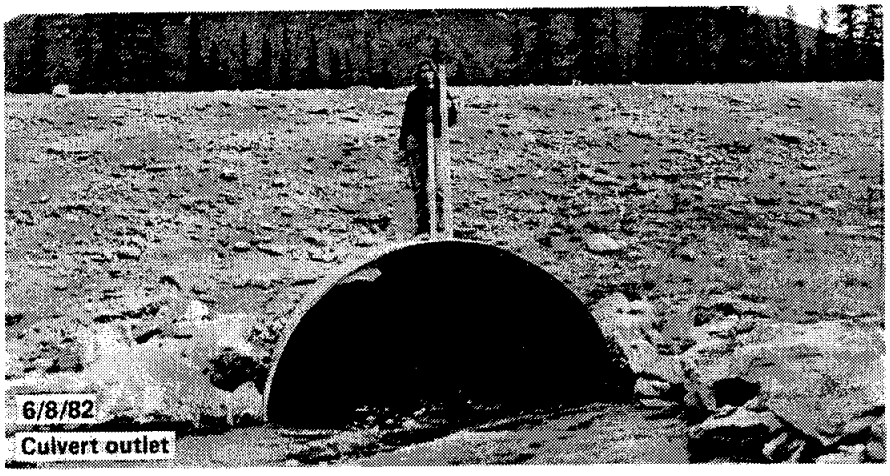
Nugget Creek was first observed on June 8, 1982 when the streamflow was 96.9 cfs. The water surface profile for this date is shown in the diagram. The watershed area was 9.6 sq mi. The total water depth at the culvert exit was 2.10 ft. The bedload size was 4 to 6 in diameter cobbles. Some large pieces of riprap were noted at the culvert entrance, otherwise the culvert barrel was clean. The velocity profile was taken with an electromagnetic flowmeter.

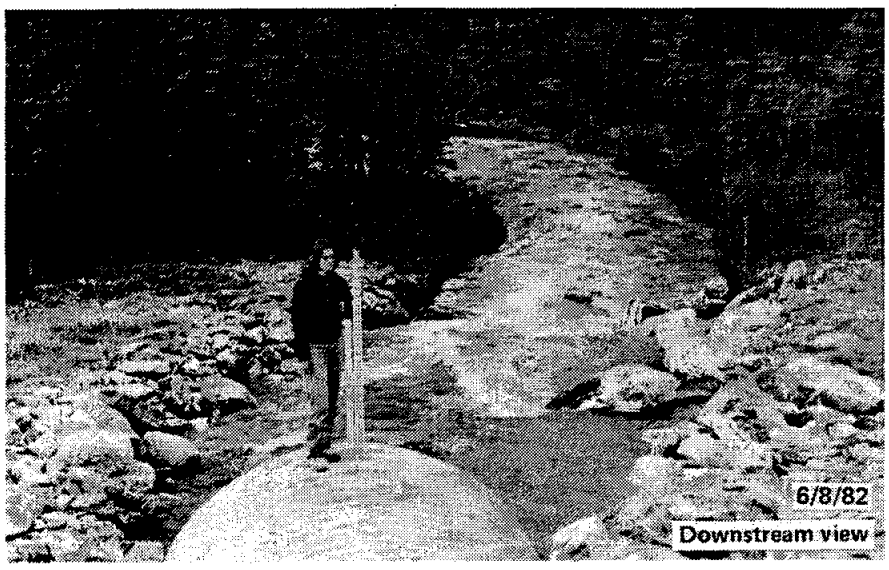
Measurements were made a second time at Nugget Creek on May 11, 1983. The flow was low, 5.9 cfs. The surveyed profiles for the culvert and stream were: upstream, 0.0194; culvert crown, 0.0053; culvert water, 0.0203; and downstream, 0.0258. The total depth at the culvert inlet was 0.90 ft.






Span 8' 7"
Rise 6' 10"
6/8/82
Culvert inlet


6/8/82
Culvert outlet


6/8/82
Downstream view

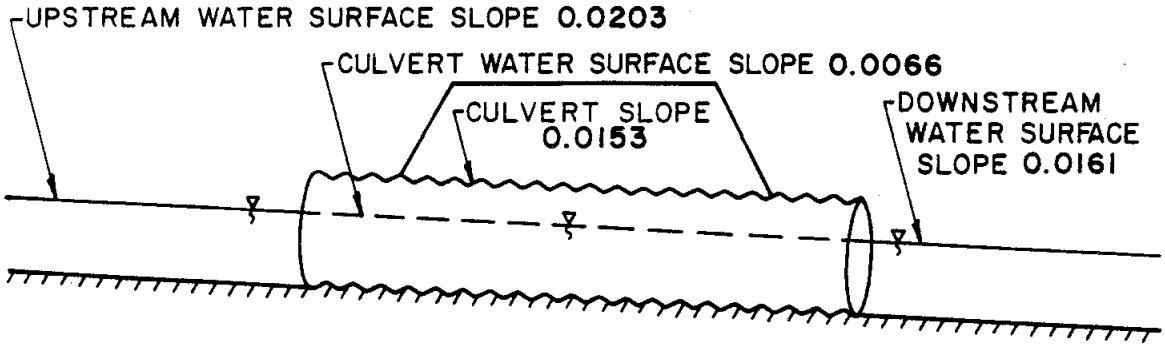
Site No. B-033 Linda Creek

Location: Dalton Highway

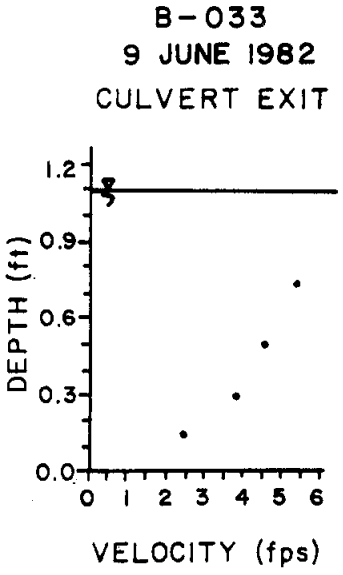
Map: Chandalar C-6, T31N, R10W, Sec. 8

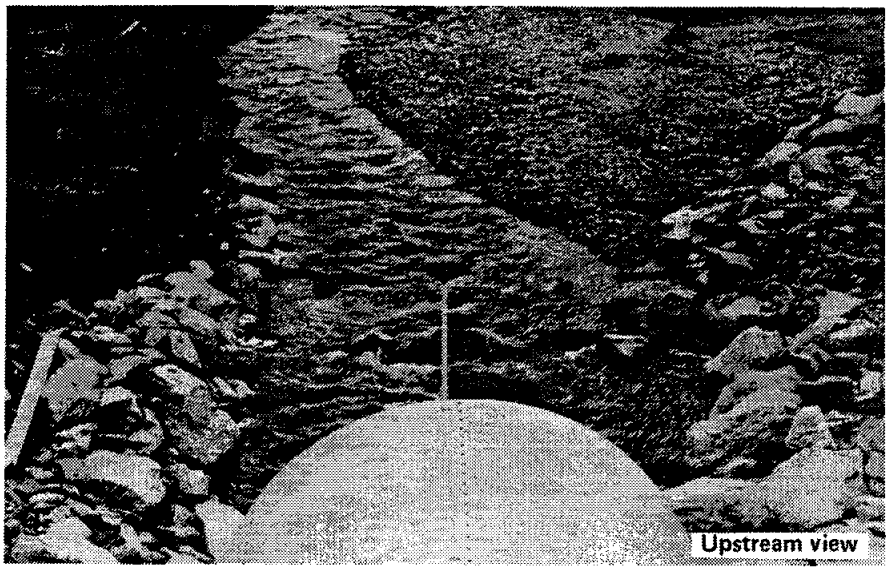
Linda Creek was first observed on June 9, 1982. The discharge through the culvert was 40.6 cfs. The surveyed slopes for this date appear in the diagram. The estimated bedload size was 4 to 6 in in diameter. A layer of cobbles and gravel was found throughout the barrel; the deposit was about 3 ft thick at the culvert outlet. No pools were observed. The water depths at the entrance to and exit from the culvert were 0.90 ft and 1.10 ft, respectively. The velocity profile was obtained with an electromagnetic flowmeter. The watershed area was 9.2 sq mi.

Linda Creek was observed again on May 11, 1983. The total discharge was quite a bit lower than the previous June, 4.6 cfs. The measured slopes were: upstream, 0.0197; culvert crown, 0.0233; culvert water, 0.0170; and downstream, 0.0181. Ice was noted throughout the culvert and stream channel, but did not present any special problems to the streamflow.



CULVERT LENGTH 118 FEET






Culvert inlet
Span 14' 10"
Rise 14'


Culvert outlet


Downstream view

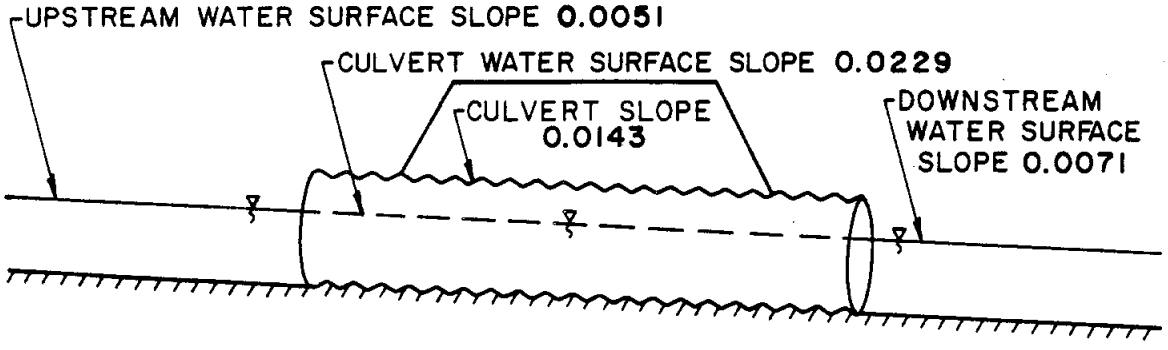
Site No. B-034 Sukapak Creek

Location: Dalton Highway

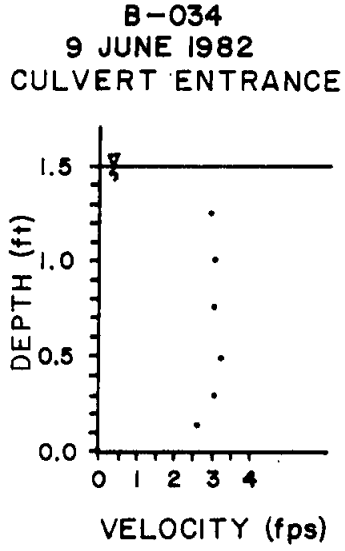
Map: Chandalar C-6, T32N, R10W, Sec. 21

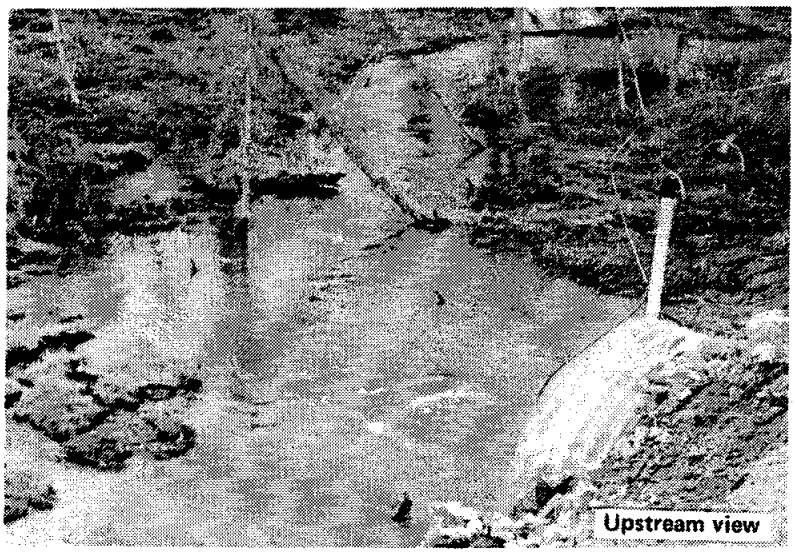
This creek was observed on June 9, 1982. The total streamflow on this date was 25.3 cfs and the watershed area was 6.1 sq mi. The surveyed stream profile appears in the diagram. Sukapak Creek was flowing bank full. The water depth at the culvert inlet was 1.50 ft; at the culvert outlet the water depth was 0.90 ft. The bed material was silt. Some riprap was in the culvert entrance, otherwise the barrel was clean. No pool was noted downstream; at the culvert entrance a pool existed due to thermal degradation of the permafrost in this area.

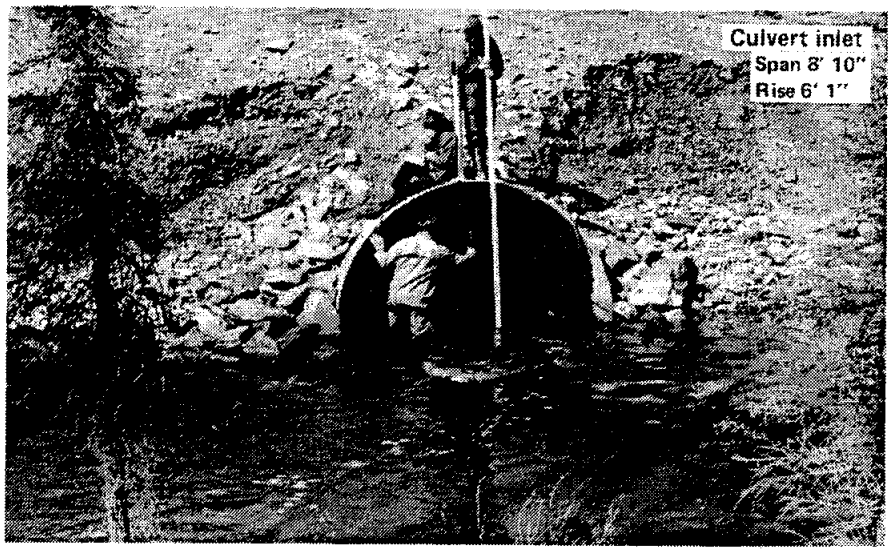
Sukapak Creek was visited again on May 11, 1983. The culvert was full of ice but water flowed through an opening at the bottom of the barrel, that had been thawed with steam pipes. The water boiled out at the exit and flowed downstream on top of ice and snow through the trees. The natural stream channel downstream was not visible. The pool area noted upstream of the culvert the year before in June, was still iced over and provided no still water or rest area for fishes.

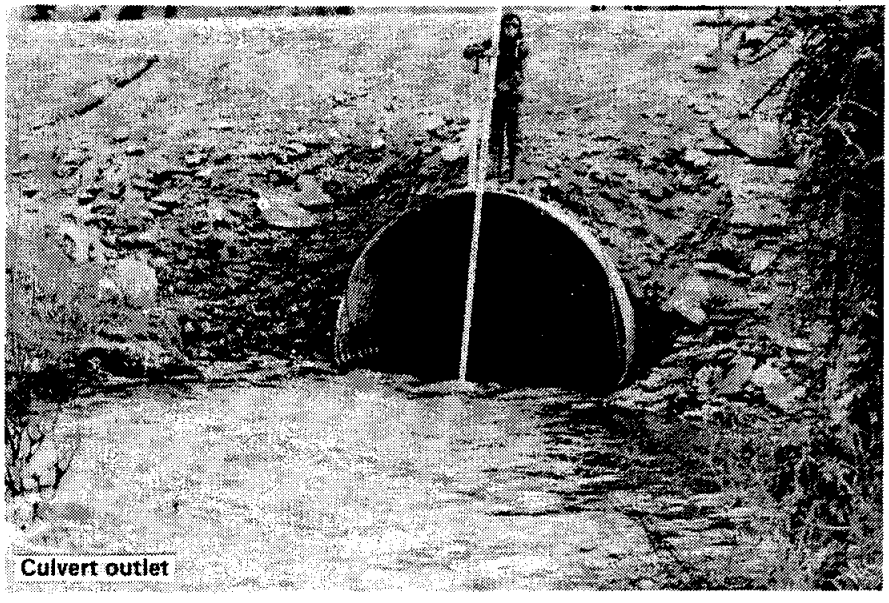


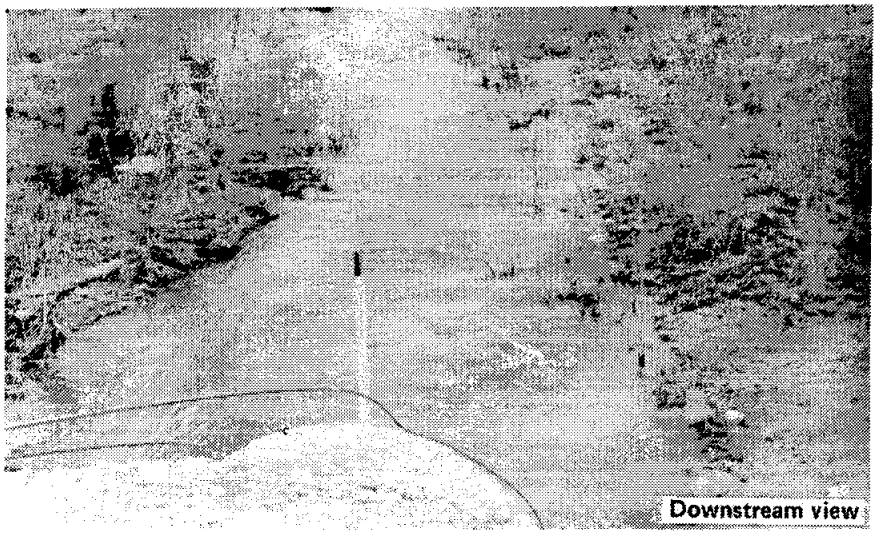
CULVERT LENGTH 82 FEET








Culvert outlet

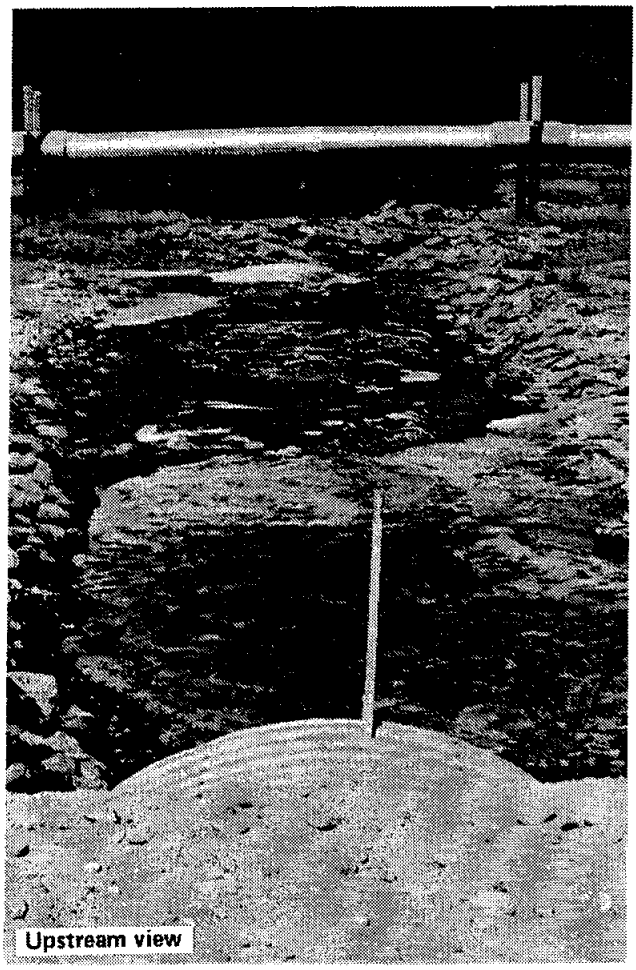

Downstream view

Site No. B-035 Eva's Alv

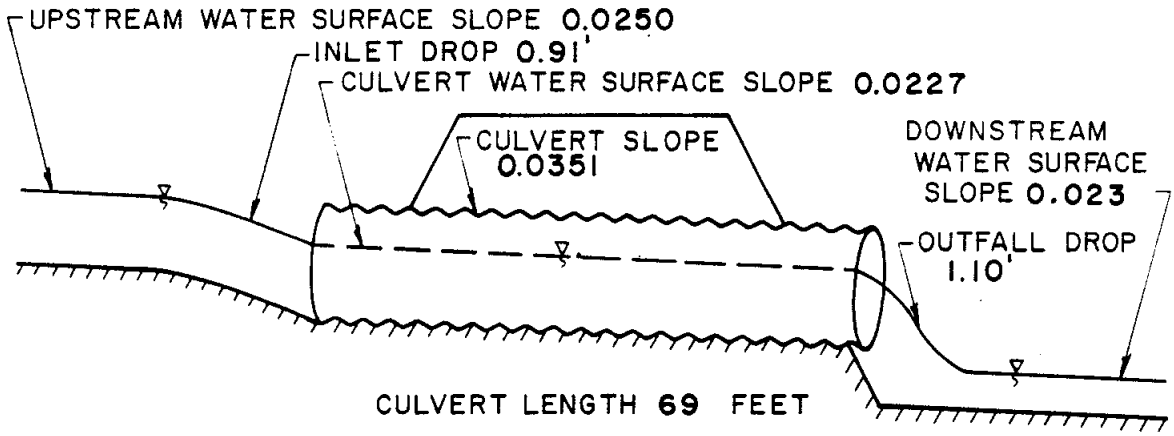
Location: Dalton Highway

Map: Chandalar C-6, T33N, R10W, Sec. 35

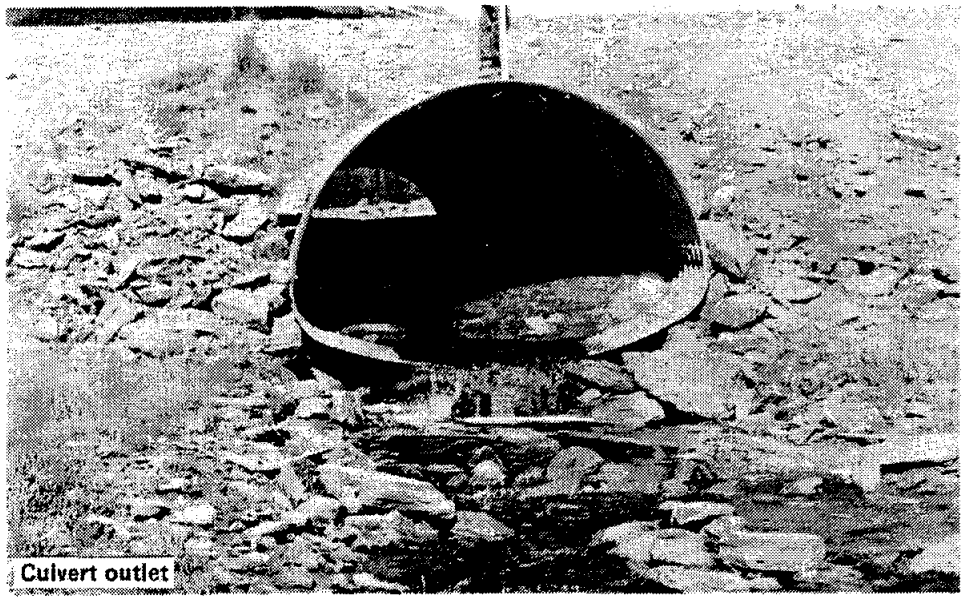
Measurements at Eva's Alv were taken on May 13, 1983. The diagram shows the stream profile surveyed on this date. The water depth at the culvert entrance was 0.15 ft; the discharge was 1.2 cfs. The barrel was clean at the outlet; some 1 ft diameter rocks were noted at the culvert entrance. There was ice in the culvert but it did not create an obstruction to flow. The culvert was perched at the outlet. About 215 ft downstream from the highway, Eva's Alv flowed into the Middle Fork of the Koyukuk River. The watershed area was 4.1 sq mi.


Upstream view


Downstream view


UPSTREAM WATER SURFACE SLOPE 0.0250
INLET DROP 0.91'
CULVERT WATER SURFACE SLOPE 0.0227
CULVERT SLOPE 0.0351
DOWNSTREAM WATER SURFACE SLOPE 0.023
OUTFALL DROP 1.10'
CULVERT LENGTH 69 FEET


Span 10' 10"
Rise 7' 2"
Culvert inlet

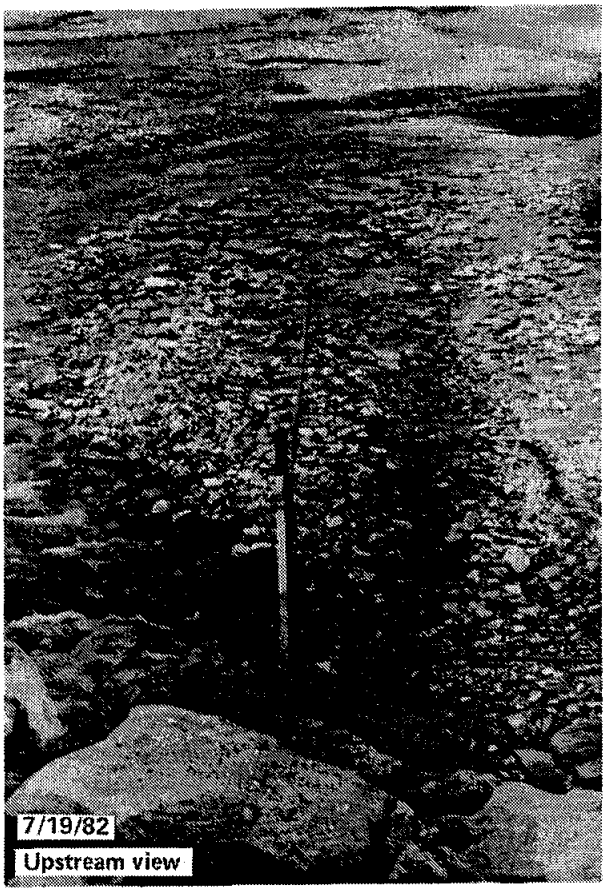

Culvert outlet

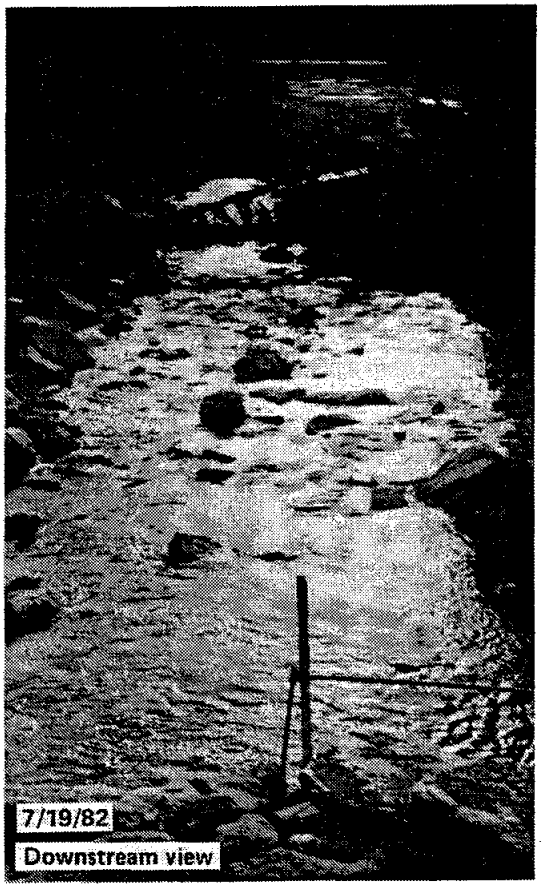
Site No. B-036 Brockman Creek

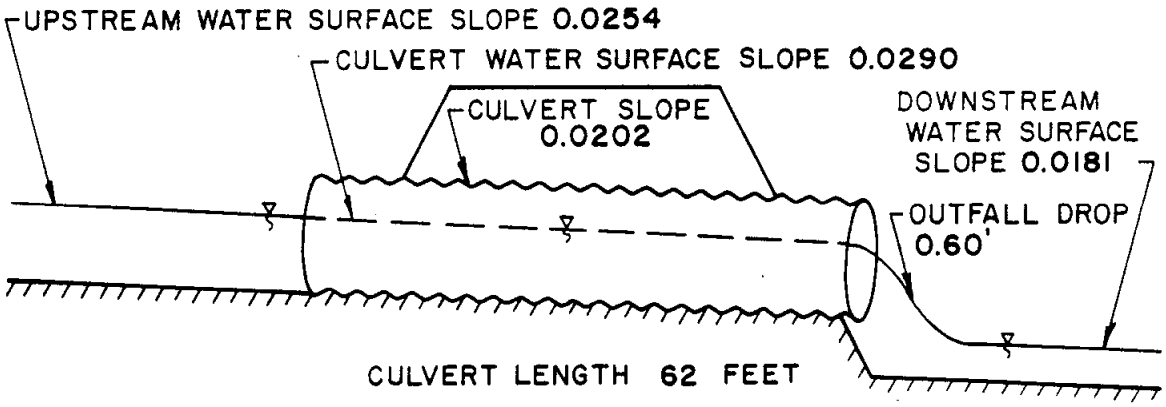
Location: Dalton Highway

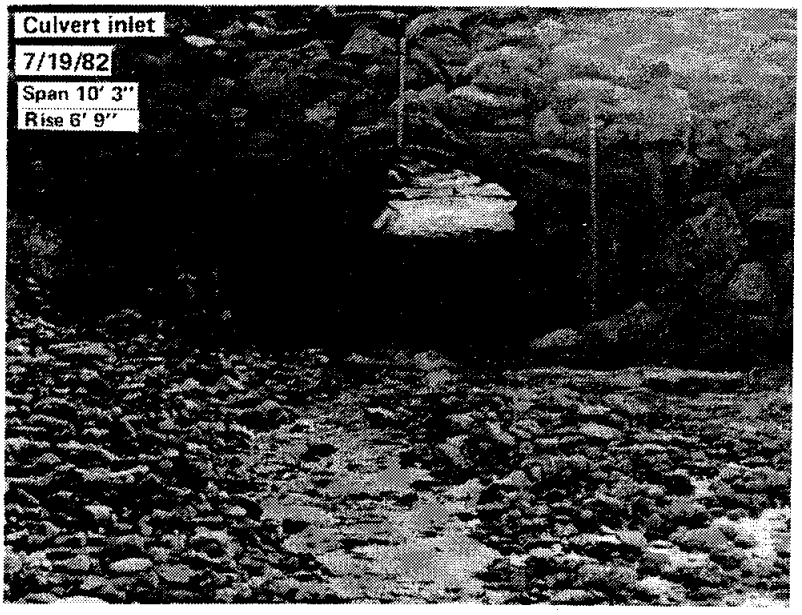
Map: Chandalar C-6, T33N, R10W, Sec. 25

Measurements at Brockman Creek were made on July 19, 1982. The streamflow was 10.4 cfs. The discharge measurement was poor due to the rocky shallow steam channel. The culvert inlet water depth was 0.70 ft, while the outlet water depth was 0.55 ft. The culvert barrel was clean except for some 5 to 6 in diameter rocks. At the culvert outlet a 20 ft diameter pool was noted. The stream channel at this location was rerouted when the culvert was installed. Upstream the channel was quite braided; downstream a man-made channel was cut. About 100 ft north of the main culvert was a small dry channel with no culvert installed. About 300 ft north of the main stream channel was a large dry overflow culvert and stream channel. The watershed area was 19.5 sq mi.

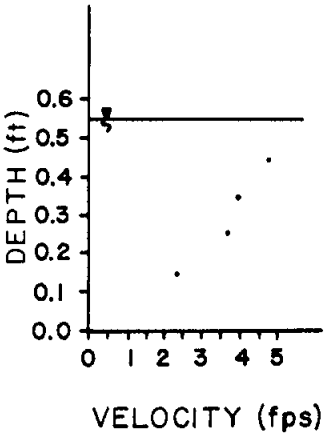


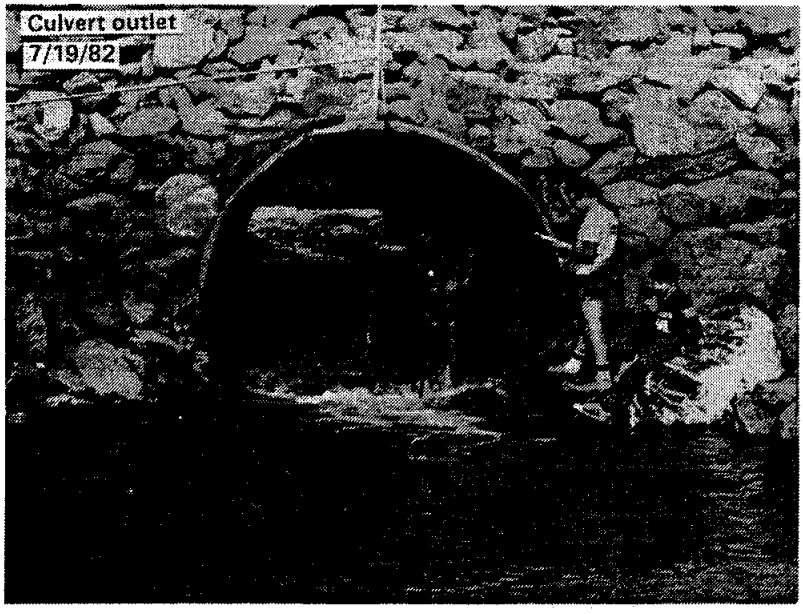


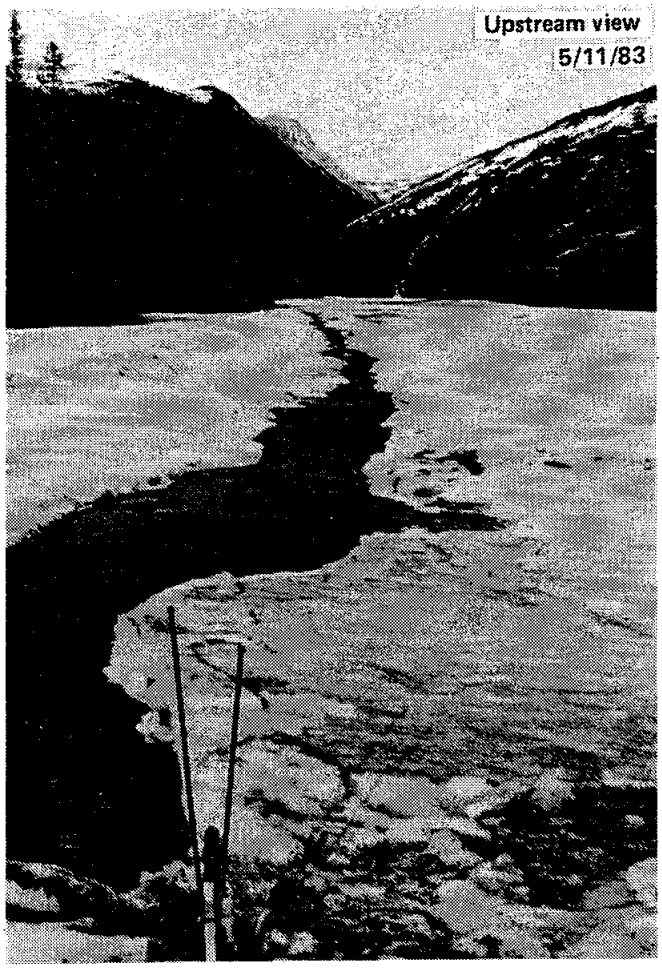


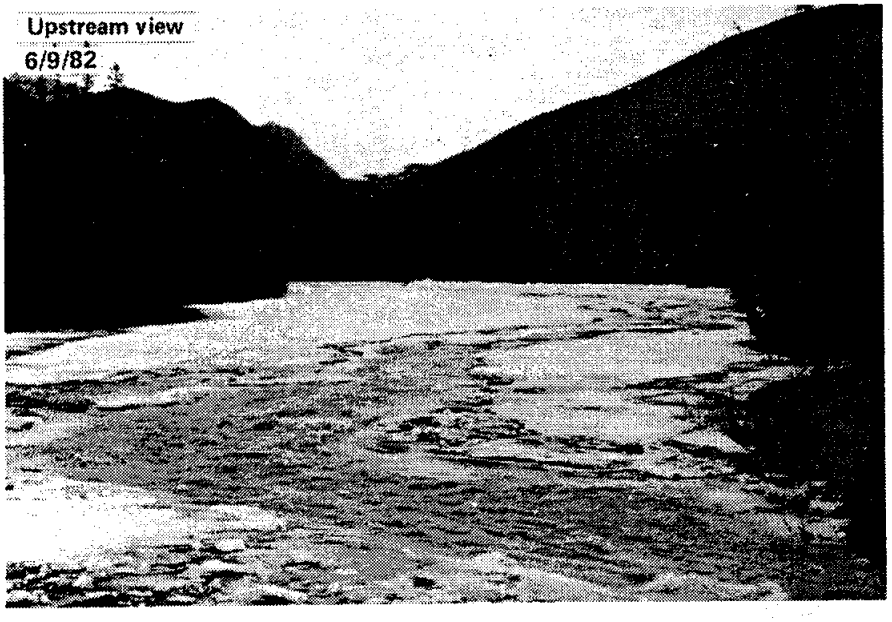


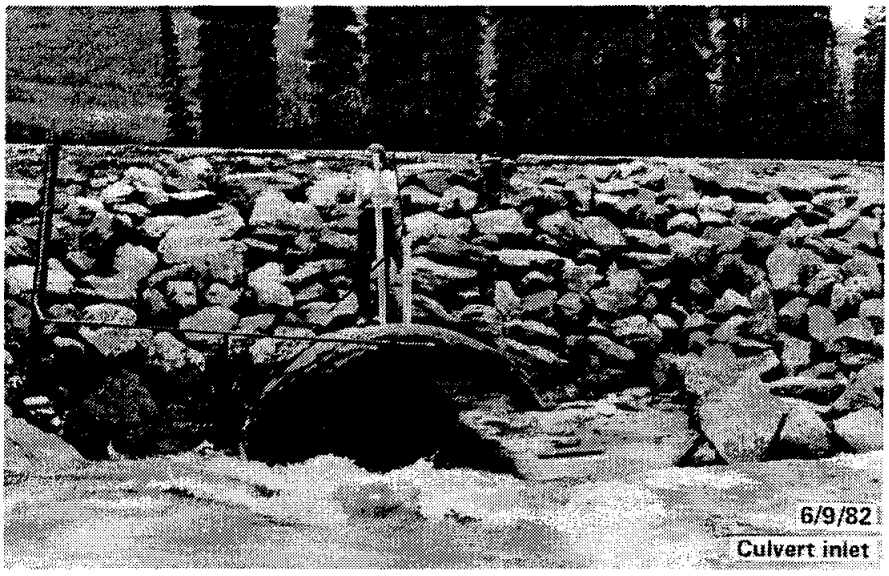
B-036
19 JULY 1982
CULVERT EXIT

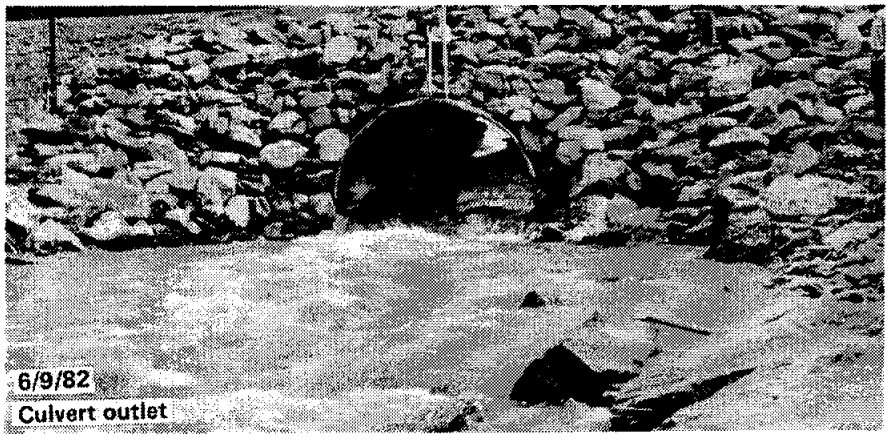





Upstream view
5/11/83


Upstream view
6/9/82


6/9/82
Culvert inlet


6/9/82
Culvert outlet

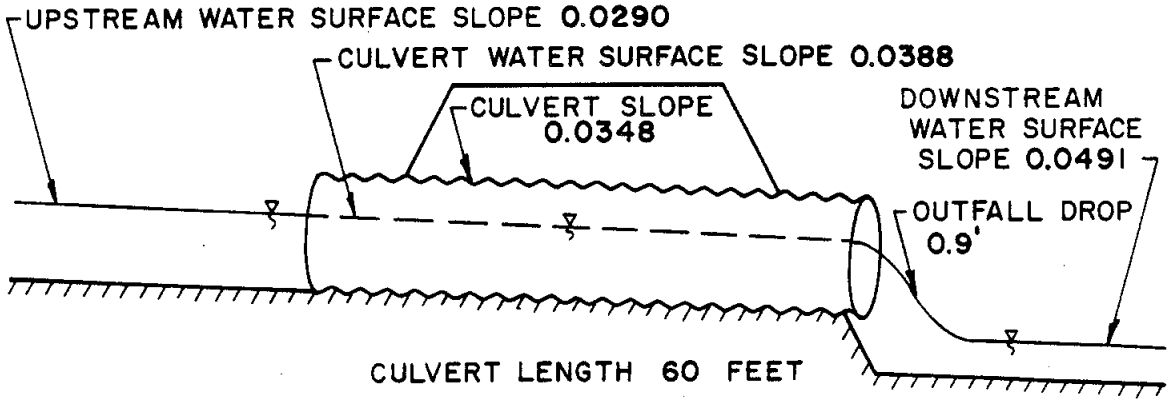

6/9/82
Downstream view

Site No. B-037 Disaster Creek

Location: Dalton Highway

Map: Chandalar C-6, T33N, R10W, Sec. 12

Measurements were taken at Disaster Creek on June 9, 1982. The culvert had inlet and outlet water depths of 1.00 and 0.70 ft, respectively. The discharge was 31.9 cfs and the watershed area was 6.4 sq mi. The channel had been straightened and was lined with riprap downstream of the culvert to contain the streamflow. Upstream of the culvert a dike had been installed to keep the stream out of an old borrow area. Extensive aufeis was noted in the culvert and the stream channel upstream of the culvert. The barrel was clean although large rocks were being swept through the culvert.



Span 9' 6"
Rise 6' 5"
Culvert inlet

Culvert outlet

Downstream view

Site No. B-038 Snowden Creek

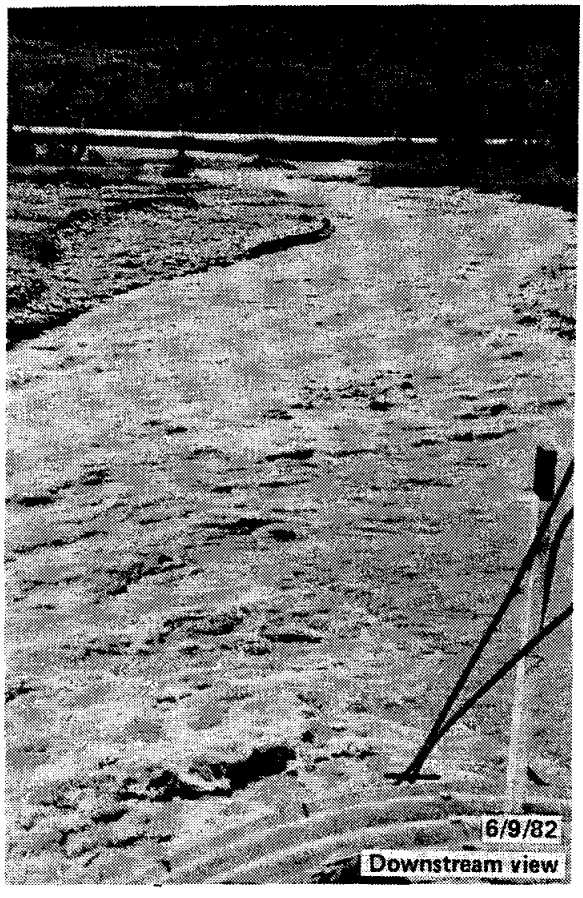
Location: Dalton Highway

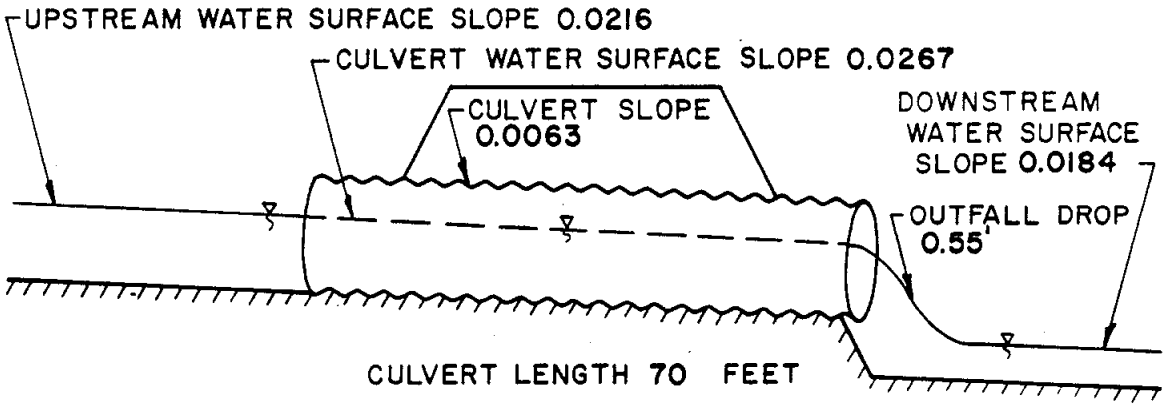
Map: Chandalar C-6, T34N, R10W, Sec. 26

Snowden Creek was measured on June 9, 1982. The discharge was gaged at 168.1 cfs. The surveyed water surface profiles for the culvert and creek are shown in the diagram. Backwater flow in the large pool at the culvert exit was eroding the road embankment around the culvert outlet; some of the riprap had previously been eroded and was missing. The barrel was clear although large rocks could be heard bouncing through the barrel. A high sediment load was observed. The watershed area was 16.4 sq mi.

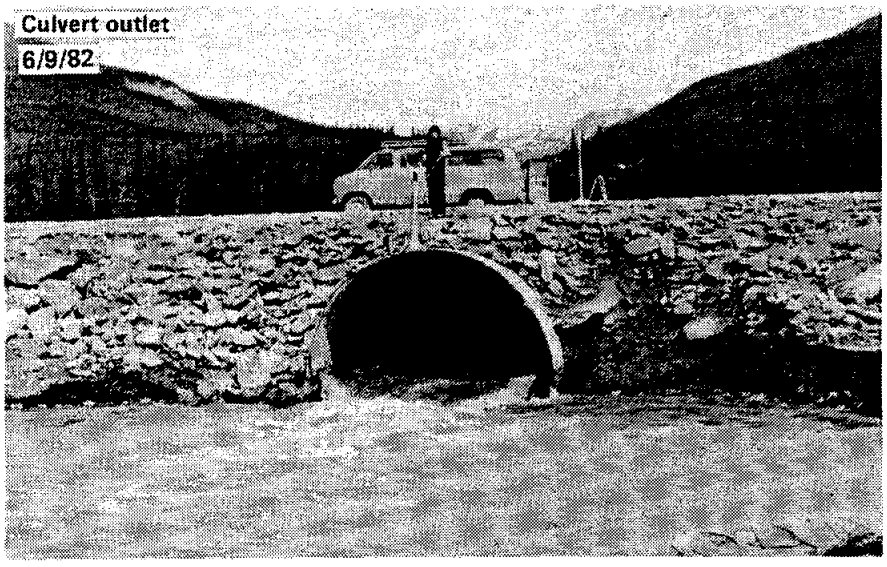
Culvert water depths were measured on July 22, 1982. The inlet depth was 2.20 ft and the outlet depth was 1.30 ft. These were poor measurements due to the high flows and misaligned culvert.

The discharge, measured again on May 12, 1983 was 16.6 cfs. Much of the stream channel and culvert were still filled with ice. The surveyed slopes for the culvert and stream were: upstream, 0.0191; culvert crown, 0.0071; culvert water, 0.0774; and downstream, 0.0225. This was a low flow measurement before the spring melt occurred.




UPSTREAM WATER SURFACE SLOPE 0.0216
CULVERT WATER SURFACE SLOPE 0.0267
CULVERT SLOPE
0.0063
DOWNSTREAM
WATER SURFACE
SLOPE 0.0184
OUTFALL DROP
0.55'
CULVERT LENGTH 70 FEET


Span 12' 8"
Rise 8' 11"
6/9/82
Culvert inlet

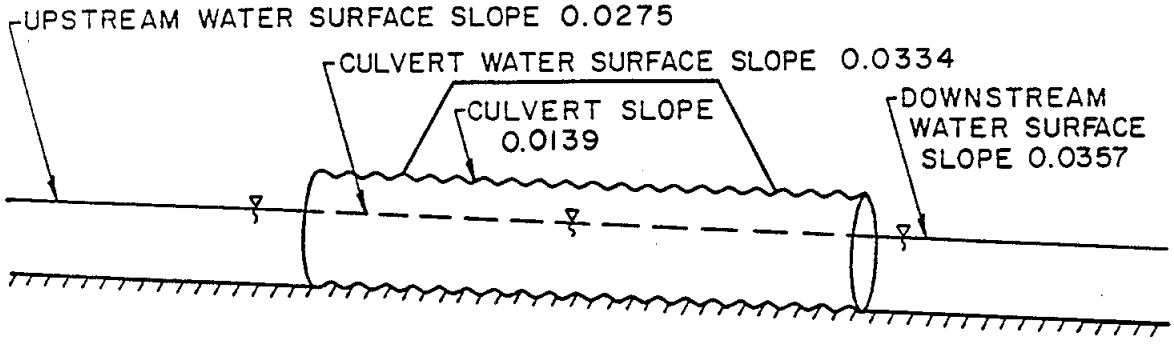

Culvert outlet
6/9/82

Site No. B-039 Numbers Lake Creek

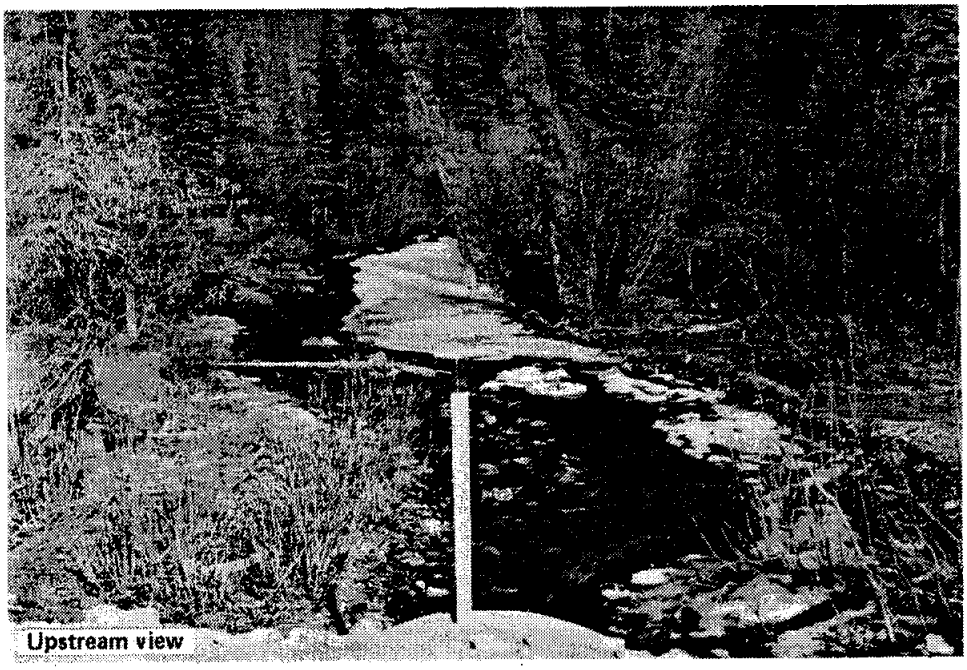
Location: Dalton Highway

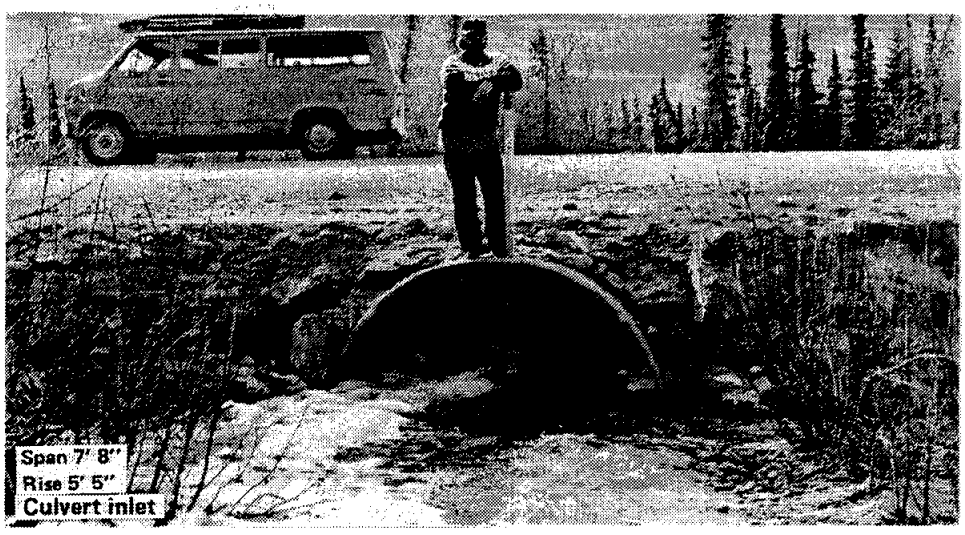
Map: Chandalar D-6, T34N, R10W, Sec. 23

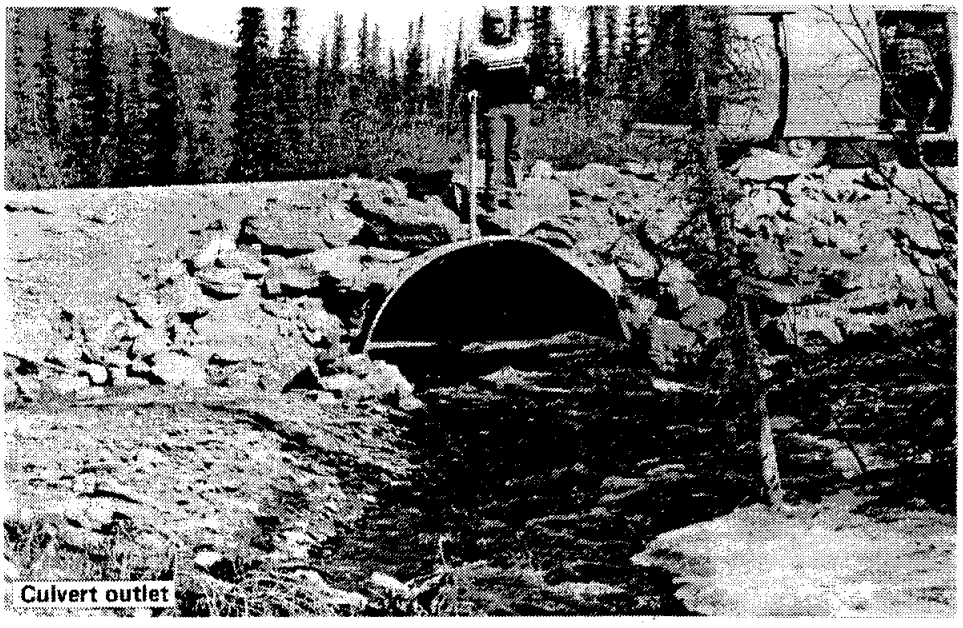
Numbers Lake Creek was observed on May 12, 1983. The discharge was 5.2 cfs; this was a poor measurement due to the rocky channel bottom and the shallow stream depth. Water flowed on top of and under ice in the culvert barrel. The water depth at the culvert exit was 0.80 ft. An upstream water depth was not obtained due to icing at the culvert entrance. The distance from the water surface to the culvert crown was 3.00 and 4.00 ft at the inlet and outlet, respectively. The watershed area was 3.4 sq mi.



CULVERT LENGTH 56 FEET


Upstream view


Span 7' 8"
Rise 5' 5"
Culvert inlet


Culvert outlet

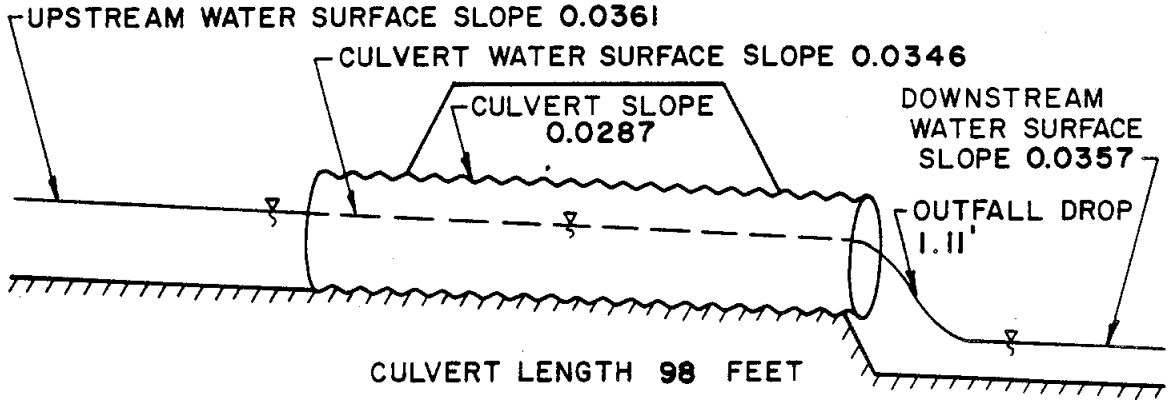

Downstream view

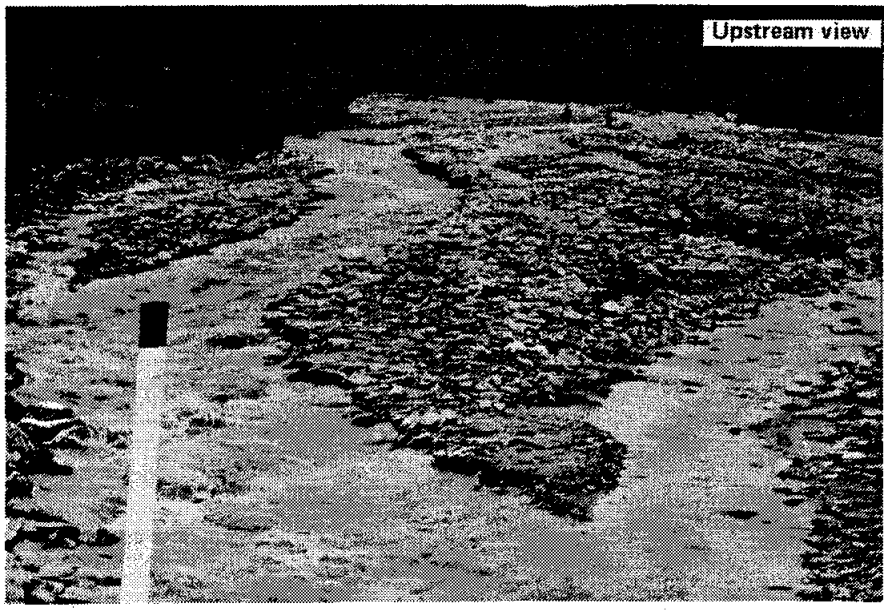
Site No. B-040A Steep Creek #1

Location: Dalton Highway

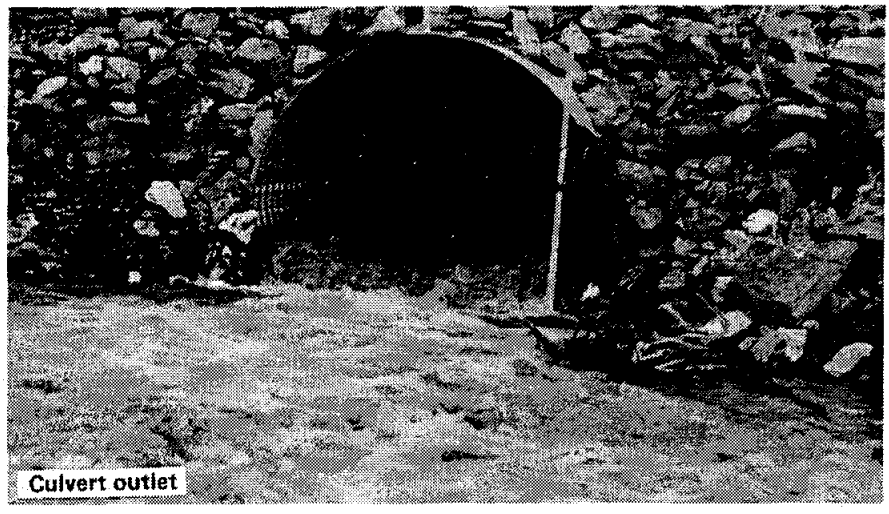
Map: Chandalar D-6, T35N, R10W, Sec. 28

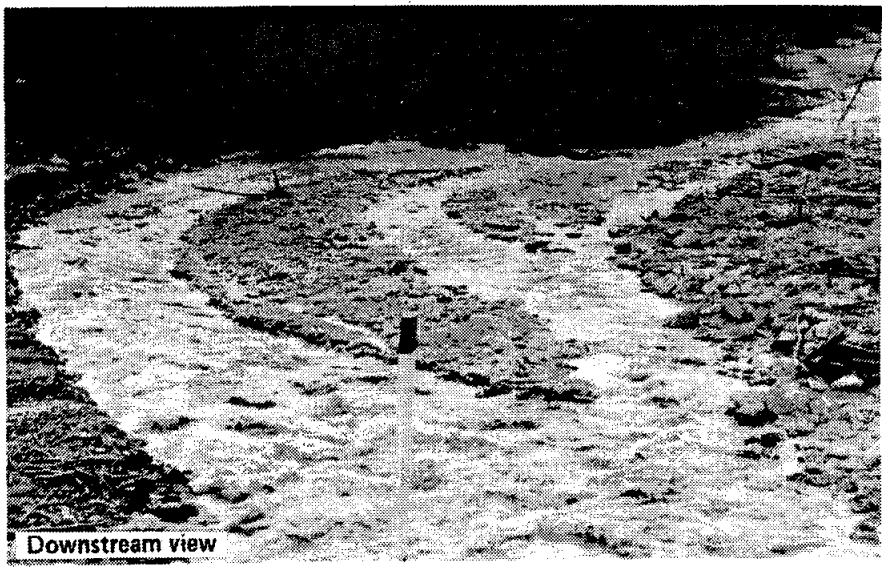
Measurements were made at this site on July 22, 1982. The discharge was 48.9 cfs. The water surface profile for the stream and culvert are shown in the diagram. The culvert inlet and outlet water depths were 0.70 and 0.80 ft respectively. The bedload size was up to 10 in in diameter. The barrel was clean but rocks could be heard bouncing through the culvert. This stream carried a high suspended sediment load. No pool was observed upstream of the culvert; a 10 ft diameter scour pool was noted downstream of the slightly perched culvert. The channel was very braided both above and below the highway. The watershed area was 7.0 sq mi.






No measure
Culvert inlet


Culvert outlet

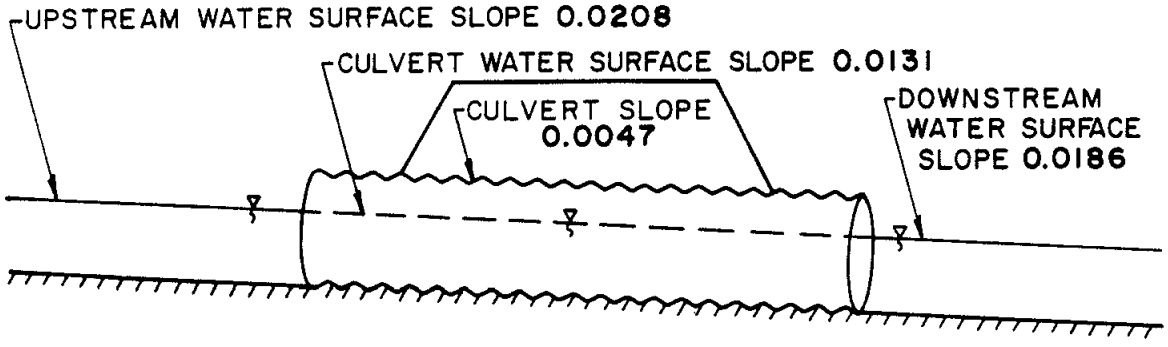

Downstream view

Site No. B-041 Tracey's Trickle

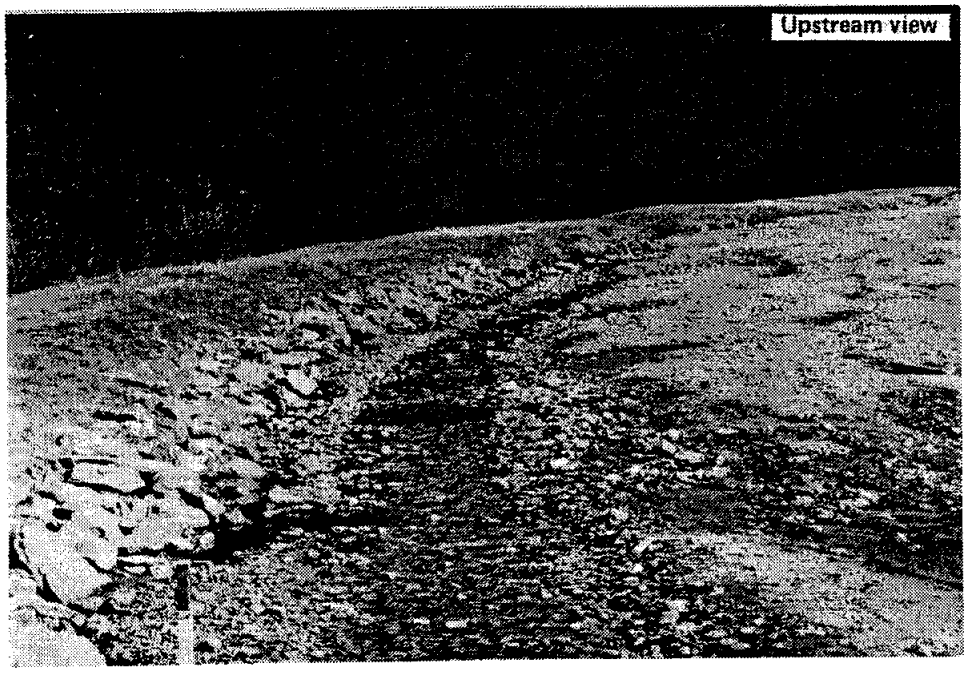
Location: Dalton Highway

Map: Chandalar D-6, T35N, R10W, Sec. 4

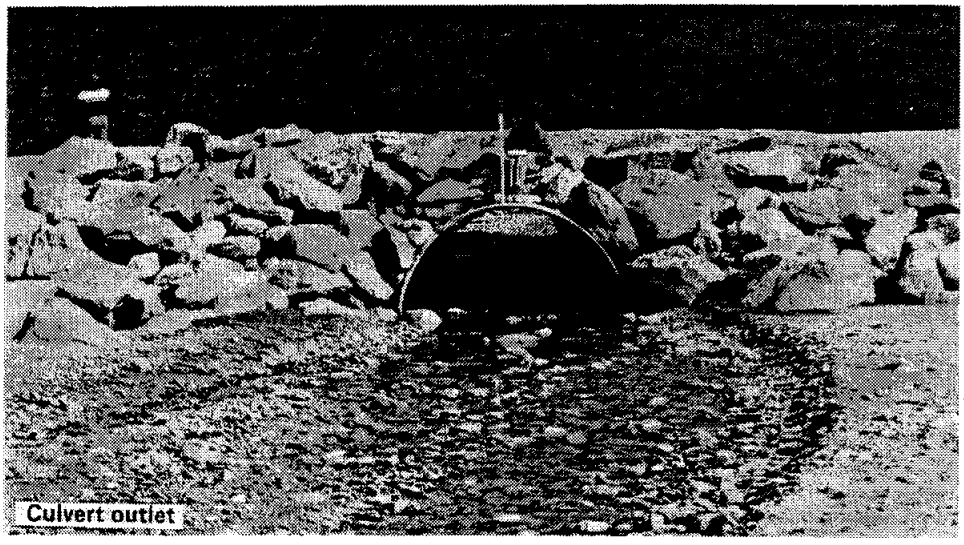
This site was measured and observed on May 12, 1983. The flow was 0.7 cfs and the water surface profile appears in the diagram. The culvert inlet and outlet depths were both 0.20 ft. About 2 ft of gravel was observed in the barrel: the distance from the culvert crown to the gravel was 3.8 ft at the inlet and 4.3 ft at the outlet. The stream had been rerouted to avoid a nearby gravel pit. This action appeared to increase the stream slope upstream and caused the drift into the barrel and large amounts of outwash below the culvert (see downstream picture). The watershed area was 4.0 sq mi.

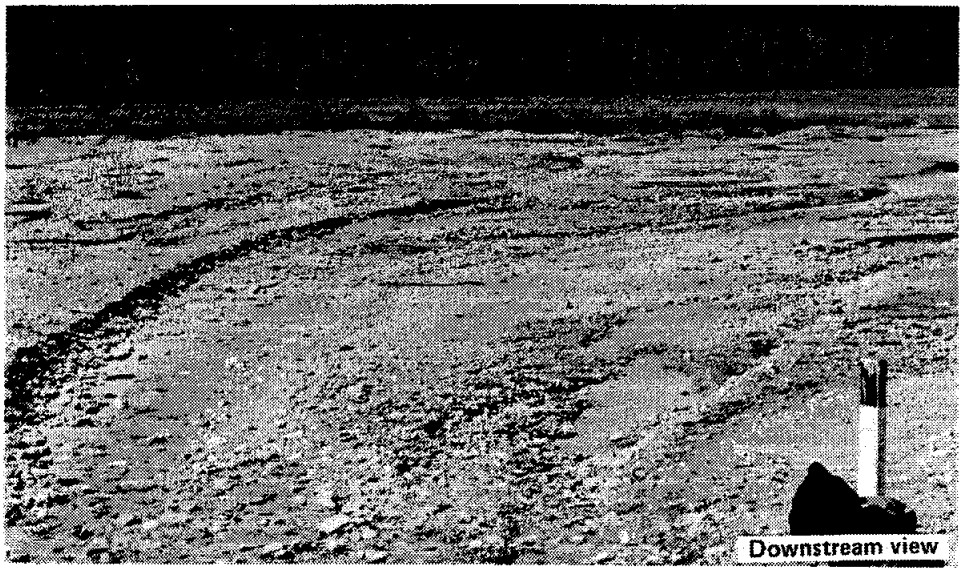


CULVERT LENGTH 58 FEET




Span 8' 10"
Rise 6' 1"
Culvert inlet


Culvert outlet

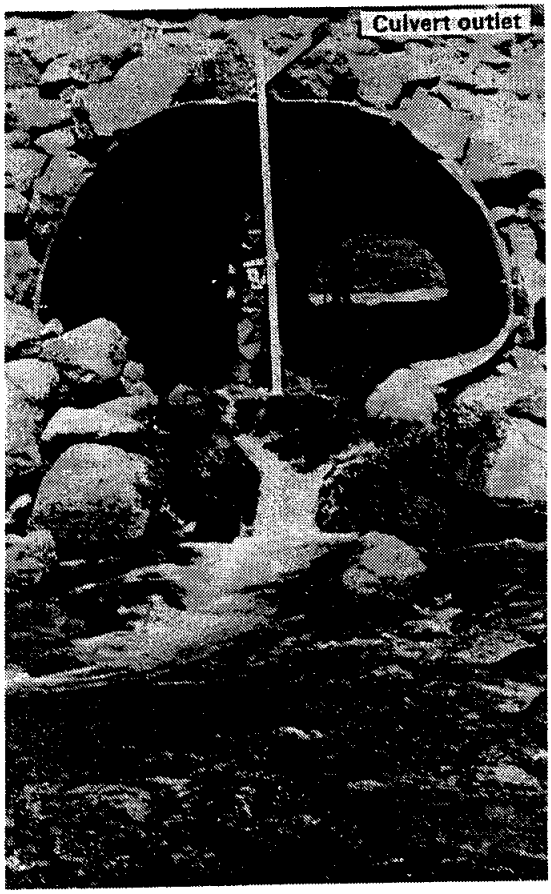

Downstream view

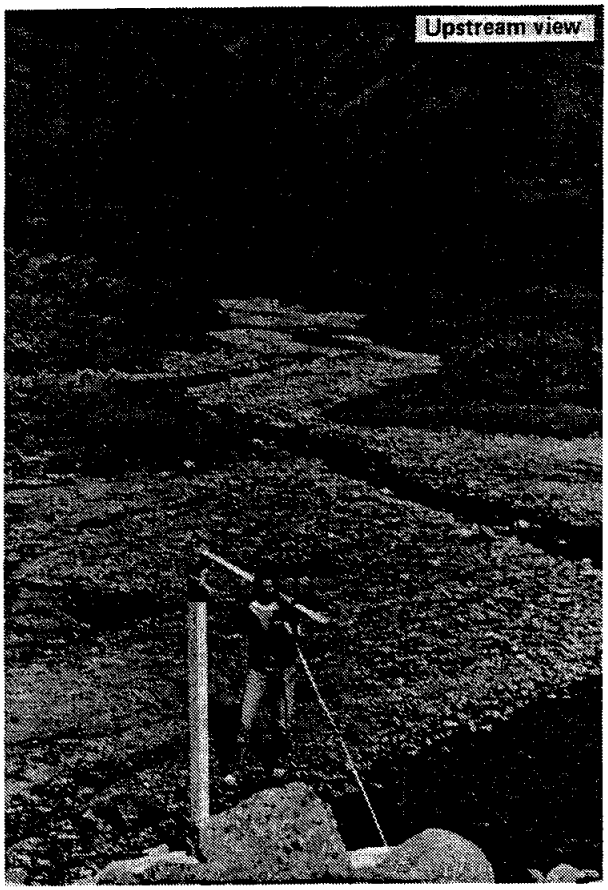
Site No. B-042A Unnamed Creek

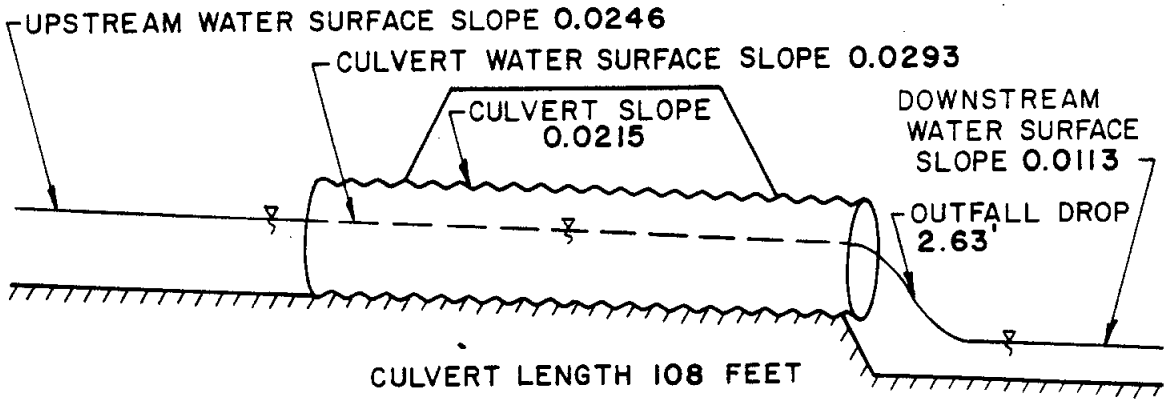
Location: Dalton Highway, 1 mile north of Chandalar Camp

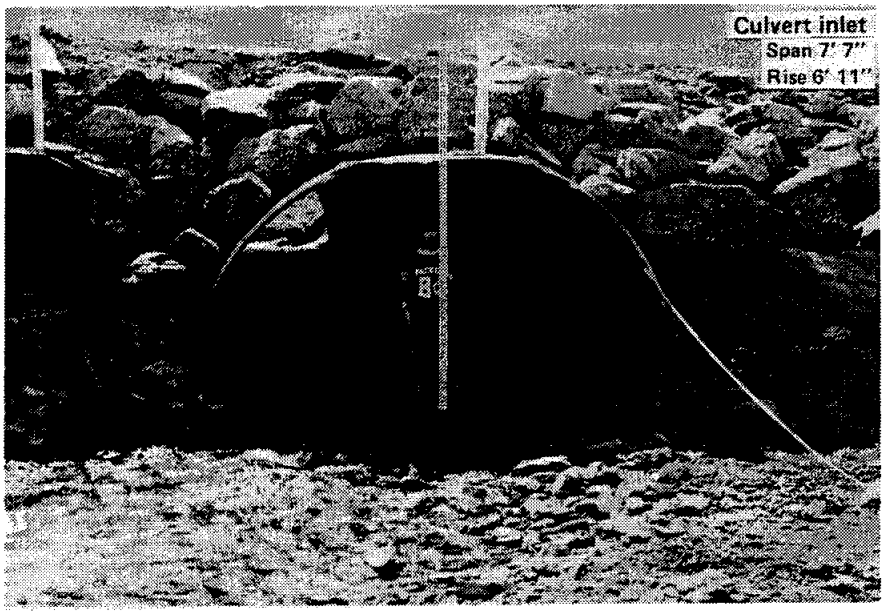
Map: Phillip Smith Mountains A-5, T16S, R11E, Sec. 3

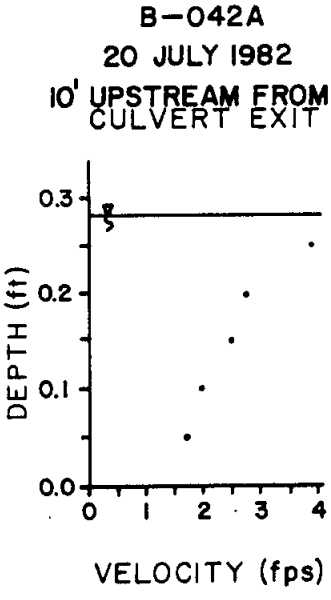
This small unnamed creek was observed on July 20, 1982. The discharge through the culvert was 3.4 cfs; the two overflow culverts were dry. The water surface profile for the creek and culvert are shown in the diagram. Culvert inlet and outlet water depths were 0.60 and 0.25 ft, respectively. The bedload was mostly cobbles 4 to 5 in in diameter. No pools were observed at either end of the culvert. The stream emptied directly into the Chandalar River at the culvert exit. Upstream of the culvert the streambed was highly braided. The lower 1/3 of the barrel was clean; the upper 2/3 had rocks up to 5 in diameter deposited in it. The watershed area was 2.1 sq mi.

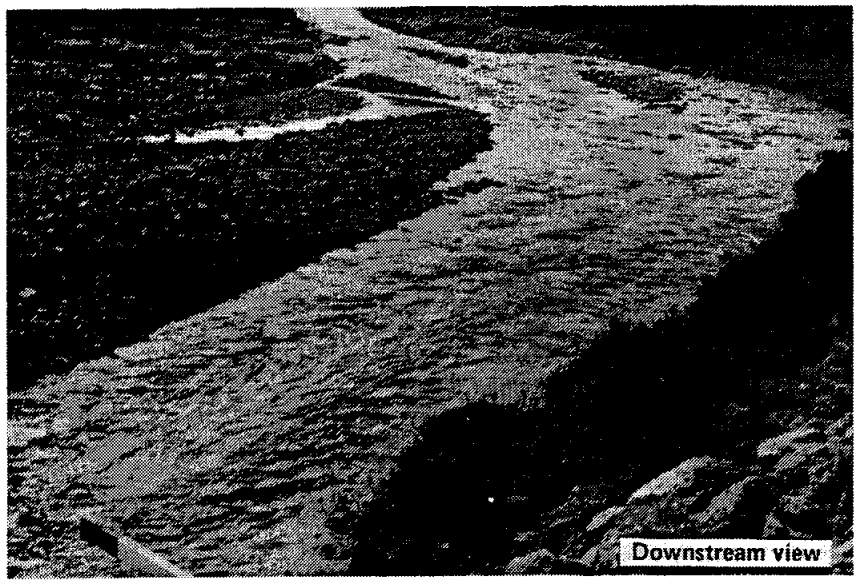





UPSTREAM WATER SURFACE SLOPE 0.0246
CULVERT WATER SURFACE SLOPE 0.0293
CULVERT SLOPE
0.0215
DOWNSTREAM
WATER SURFACE
SLOPE 0.0113
OUTFALL DROP
2.63'
CULVERT LENGTH 108 FEET


Culvert inlet
Span 7' 7"
Rise 6' 11"


B-042A
20 JULY 1982
10' UPSTREAM FROM
CULVERT EXIT
DEPTH (ft)
0.3
0.2
0.1
0.0
0
1
2
3
4
VELOCITY (fps)


Downstream view

Site No. B-042 Nutirwik Creek

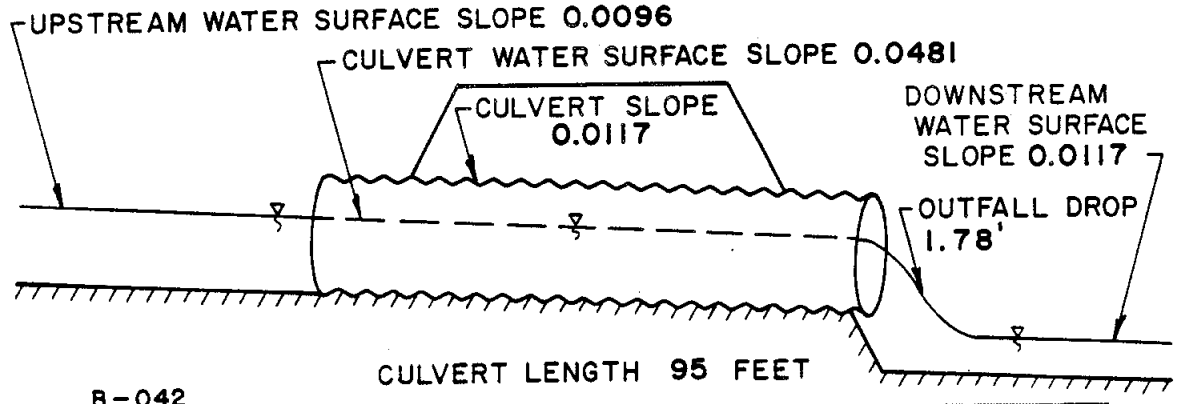
Location: Dalton Highway

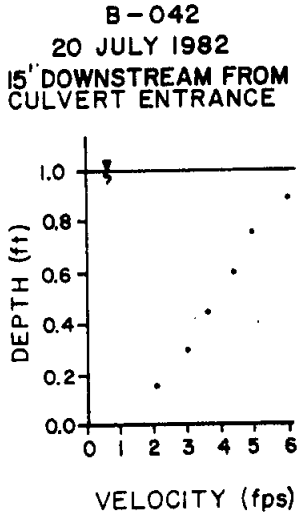
Map: Chandalar D-6, T36N, R10W, Sec. 21

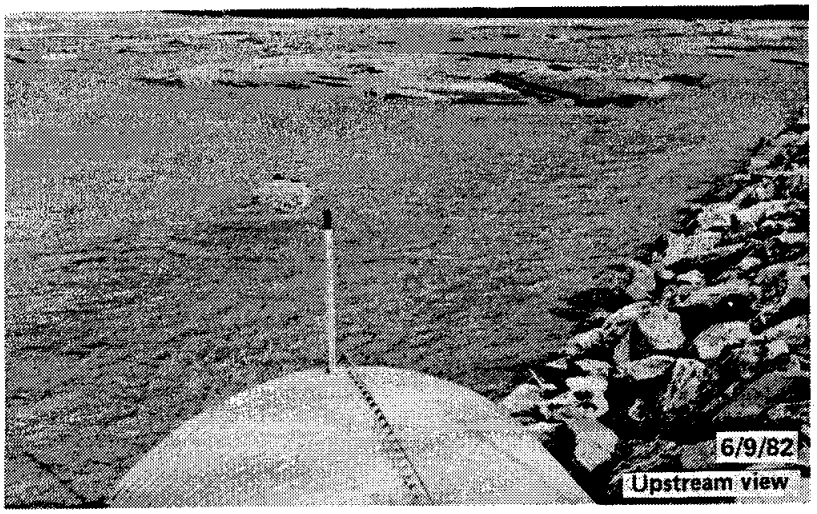
Nutirwik Creek was first observed on June 9, 1982. No discharge measurement was obtainable due to the depth and velocity of the water. Survey results appear in the diagram. The depth of flow at the culvert inlet was 5.3 ft and at the outlet the water depth was 1.6 ft. Upstream of the culvert, the channel had been straightened and lined with riprap. Trees and other debris caused a large drop in the water surface profile at the culvert entrance. The barrel was clean due to the high water velocities observed. Rocks approaching 1 ft in diameter were noted bouncing through the culvert. The culvert outlet was perched and just downstream of the installation a 75 ft diameter pool was observed. The watershed area was 28.9 sq mi.

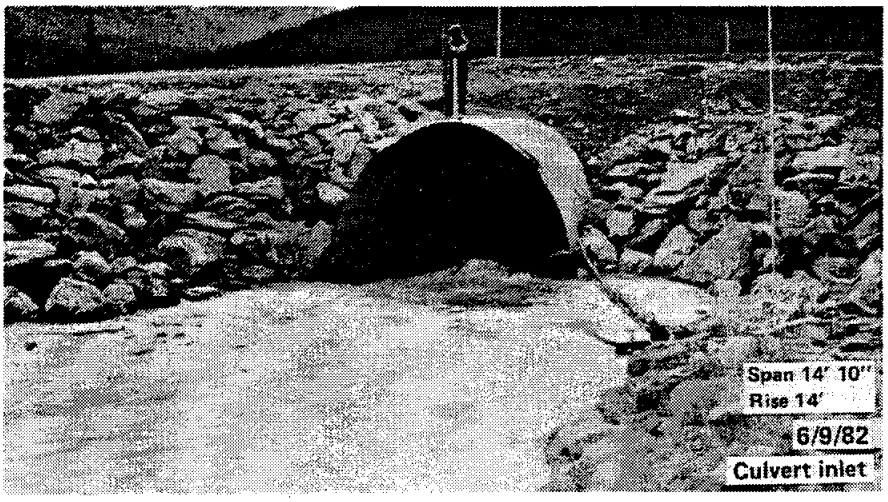
On July 20, 1982 a second observation at Nutirwik Creek was made. The total water depth at the culvert inlet was 0.80 ft and at the culvert outlet the water depth was 0.90 ft. The discharge was 23.8 cfs. Backwater eddies in the downstream pool had undercut the substrate beneath the last 10 ft of the culvert barrel. This caused the barrel to drop and increased the exit water velocity.

The culvert was removed and replaced with a bridge later in the summer of 1982. During the spring of 1983, the bridge was washed out during a high water event and was replaced with another bridge.

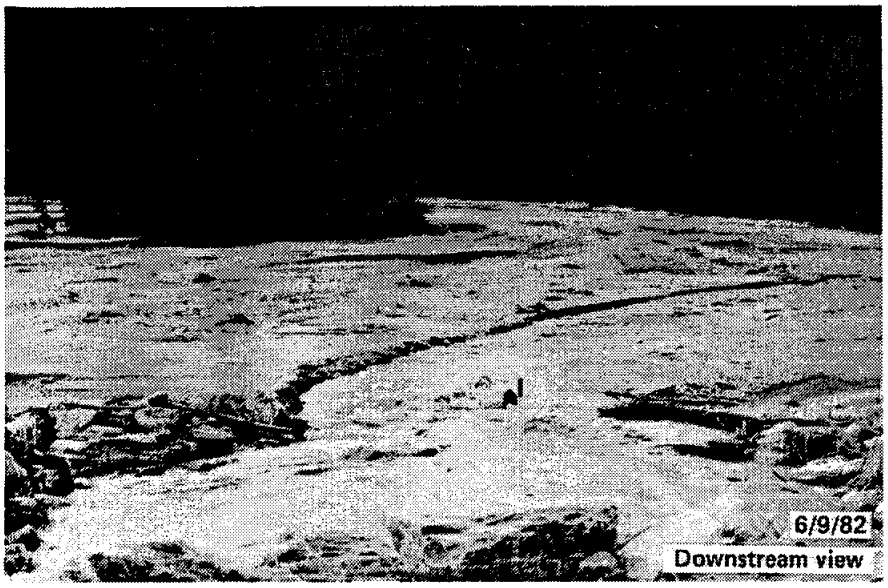







Span 14' 10"
Rise 14'
6/9/82
Culvert inlet


6/9/82
Culvert outlet

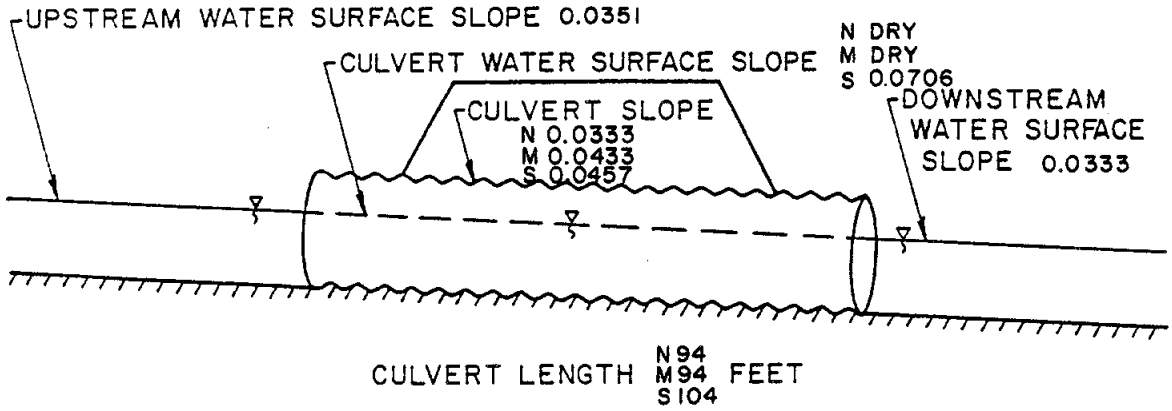

6/9/82
Downstream view

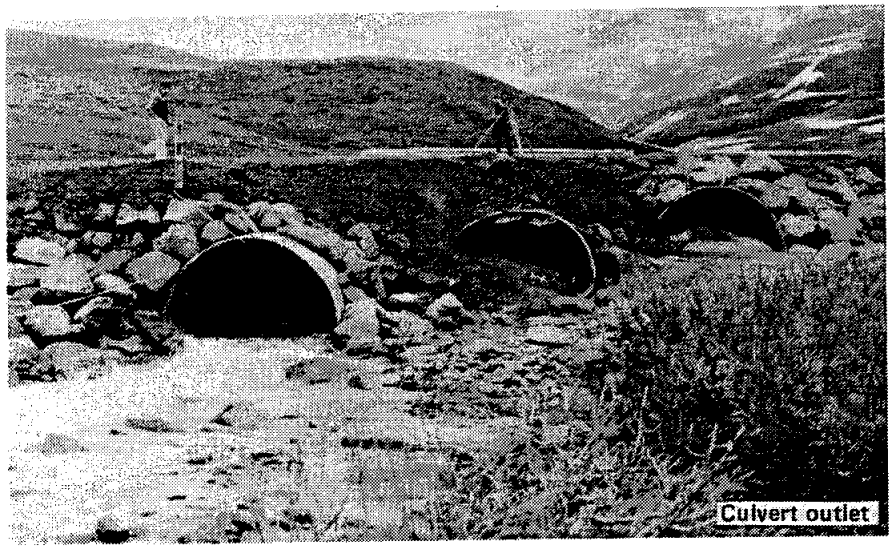
Site No. B-043 West Fork of the North Fork of the Chandalar River

Location: Dalton Highway

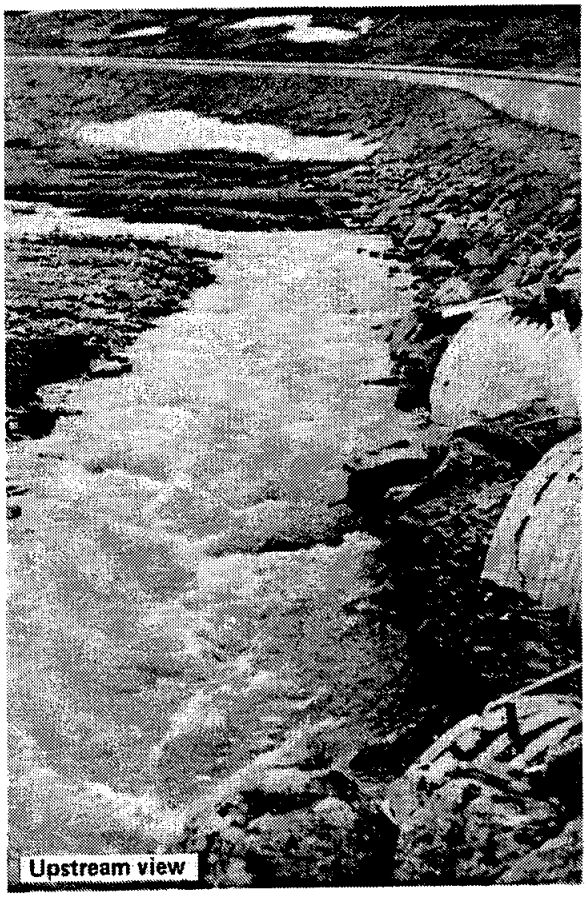
Map: Phillip Smith Mountains A-5, T15S, R11E, Sec. 26

This stream crossing along the Dalton Highway was observed on June 10, 1982. The flow on this date totalled 54.8 cfs. Three culverts were installed (north, middle and south), but at this time only the south culvert contained any flow. The culvert outlet water depth was 1.00 ft. The water surface profiles for the culverts and stream appear in the diagram. No pools were observed up or downstream of the culvert. The culverts were not aligned with the streamflow. A riprap berm trained the stream into the culverts. Riprap was eroded during high flows and was visible in the channel below the culverts. The south culvert had a nonuniform slope. The barrel was bowed in the center with a higher slope near the culvert outlet. Snow and debris upstream from the culvert installation indicated possible landslides and/or icings had occurred. The watershed area was 5.3 sq mi.




Culvert outlet


Span 10' 8"
Rise 6' 11"
Culvert inlet


Upstream view

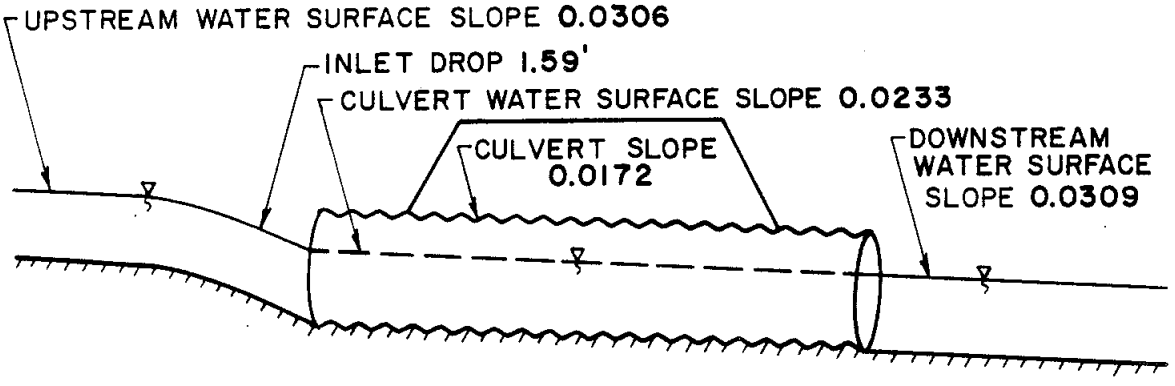

Downstream view

Site No. B-044A Upper Atigun River

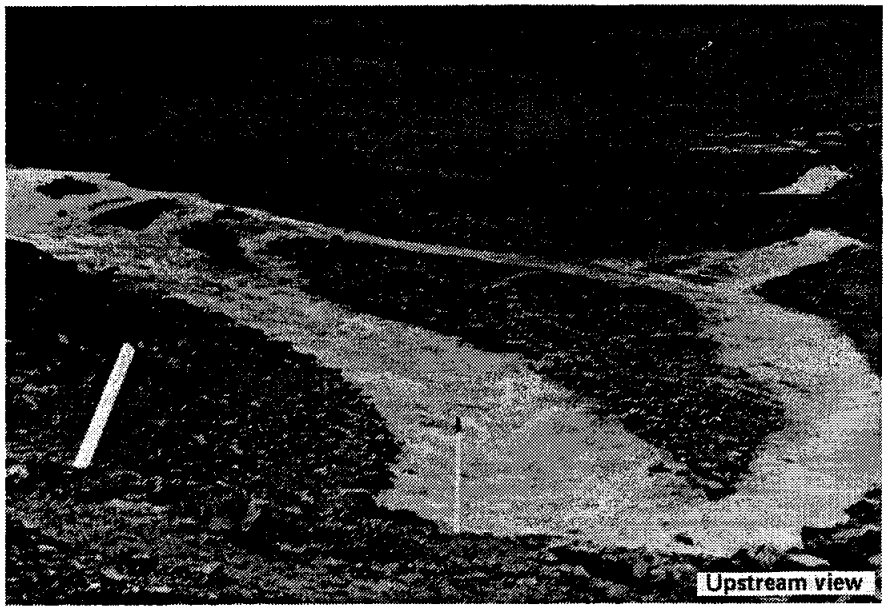
Location: Dalton Highway

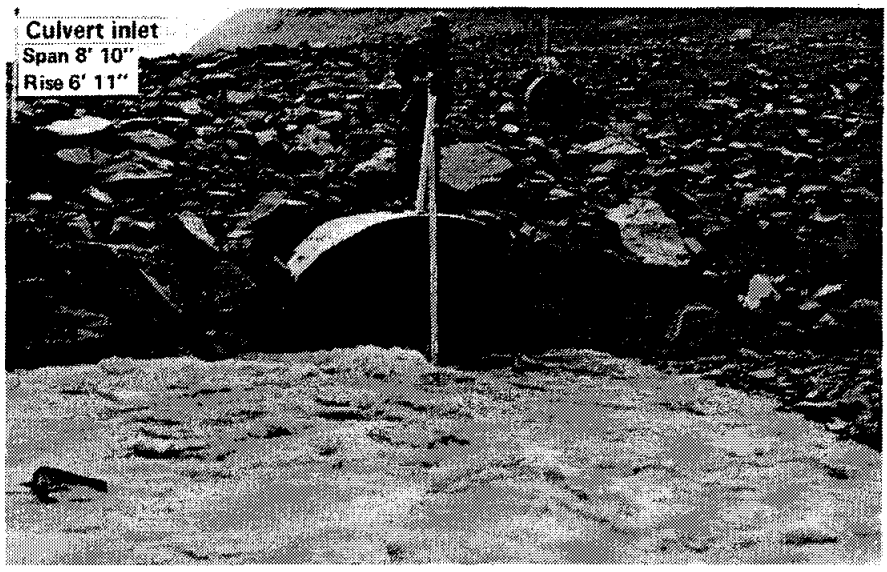
Map: Phillip Smith Mountains A-5, T15S, R12E, Sec. 18

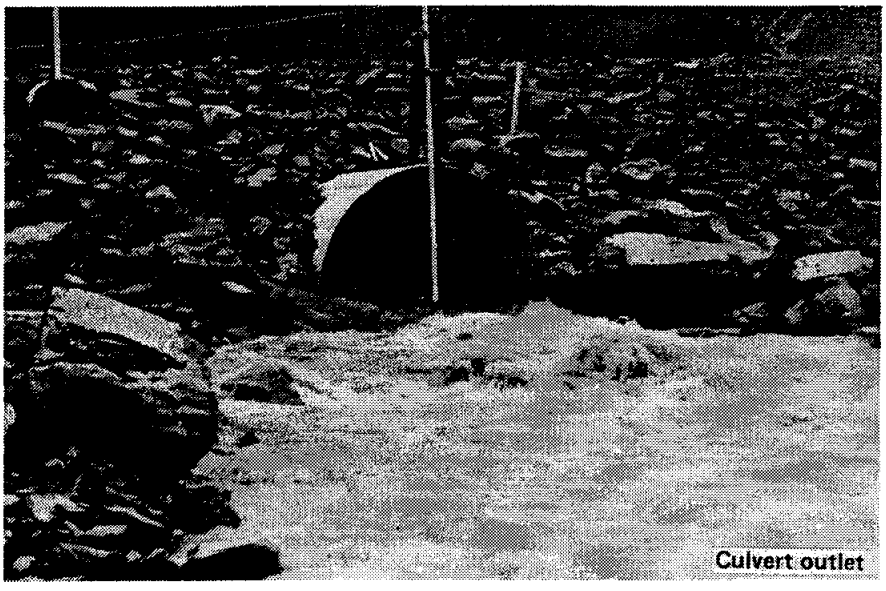
This stream crossing was measured on July 22, 1982. The 66.4 cfs discharge was totally contained by a single arch culvert; two dry overflow culverts were located nearby. The surveyed slopes for the stream and culvert are shown in the diagram. The high observed flow was due to a precipitation event. This high gradient headwater stream carried a large suspended sediment load. The stream was very braided with rocks up to 1 ft in diameter comprising the bed material. The watershed area was 3.8 sq mi.

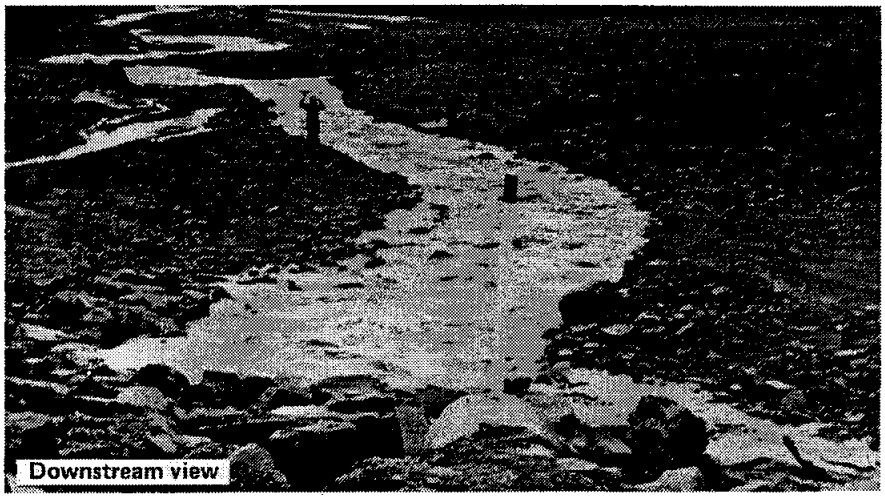


CULVERT LENGTH 140 FEET




Culvert inlet
Span 8' 10"
Rise 6' 11"


Culvert outlet

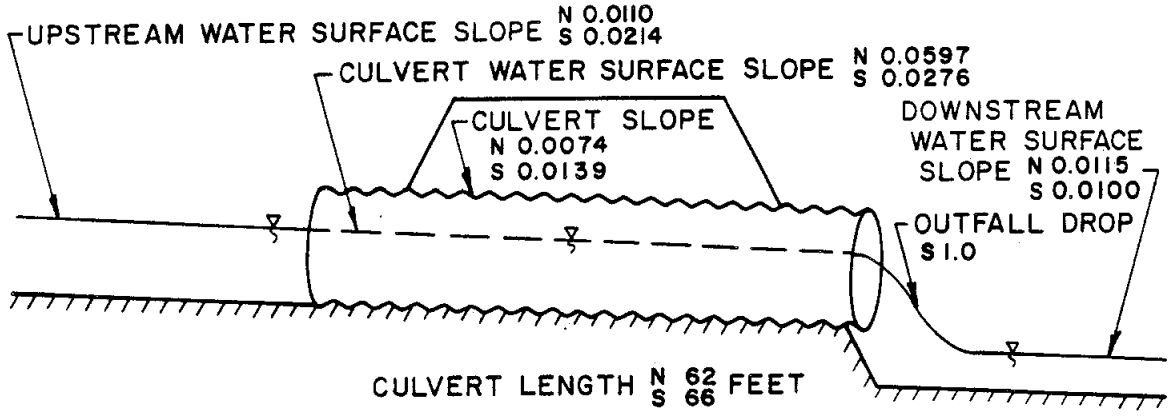

Downstream view

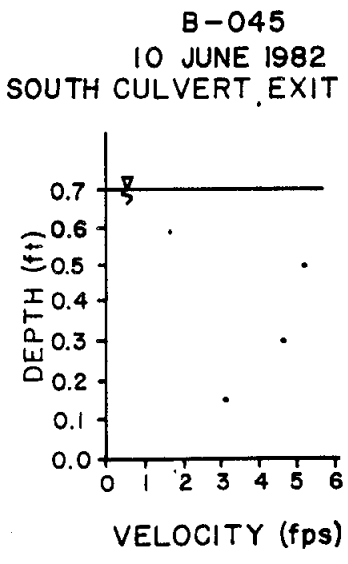
Site No. B-045 Spike Camp Creek

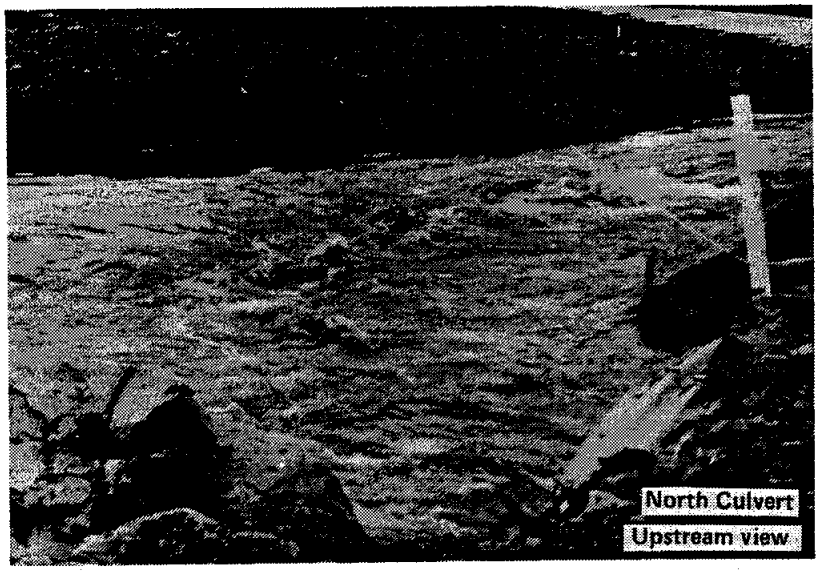
Location: Dalton Highway

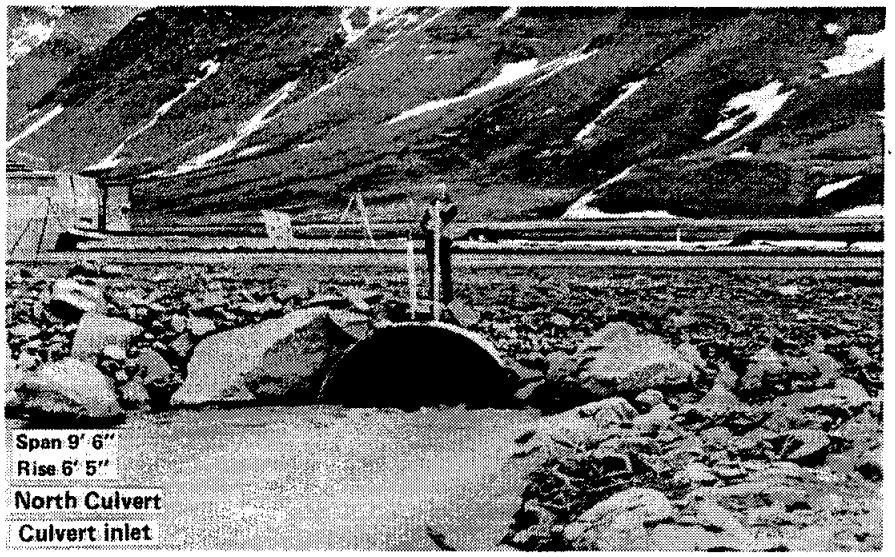
Map: Phillip Smith Mountains A-5, T15S, R12E, Sec. 6

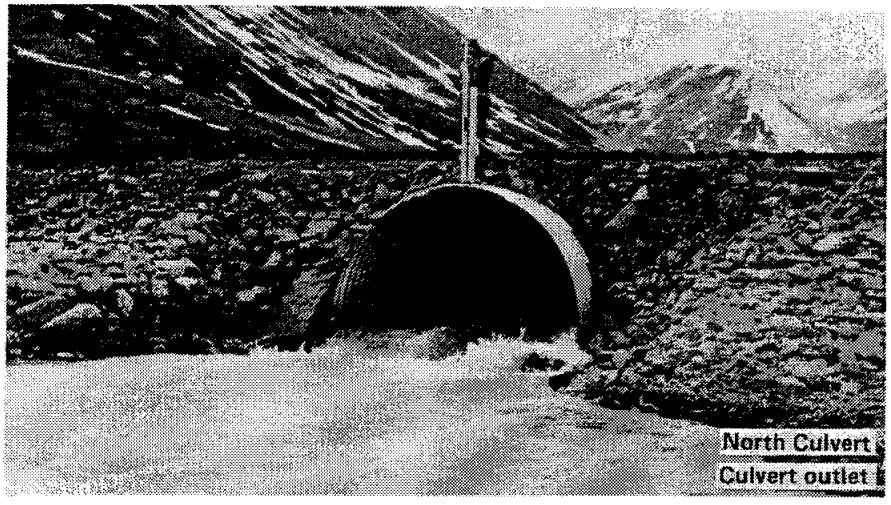
The discharge measured at Spike Camp Creek on June 10, 1982 totalled 143.3 cfs. Most of this flow (127.4 cfs) was contained by the north culvert while 15.9 cfs flowed through the south culvert. The two culverts were about 100 ft apart. The water surface profiles for the creek and culverts appear in the diagram. The bed material was cobbles up to 4 in in diameter; both barrels were clean. The south culvert was aligned with the stream and was not perched. The stream made a 90° bend to enter the north culvert. Twenty feet upstream of the north culvert exit, a hydraulic jump was noted; the culvert was perched. The water velocity and depth precluded any velocity profile measurement at the north culvert exit. Spike Camp Creek was braided both above and below the road; the culvert may have been aligned with the stream when first installed. The watershed areas was 15.2 sq mi.

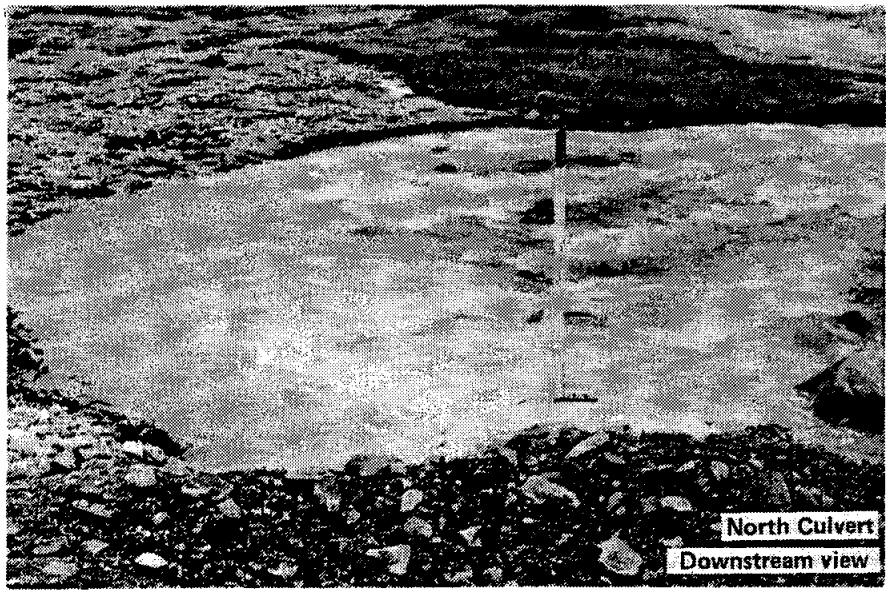







Span 9' 6"
Rise 6' 5"
North Culvert
Culvert inlet

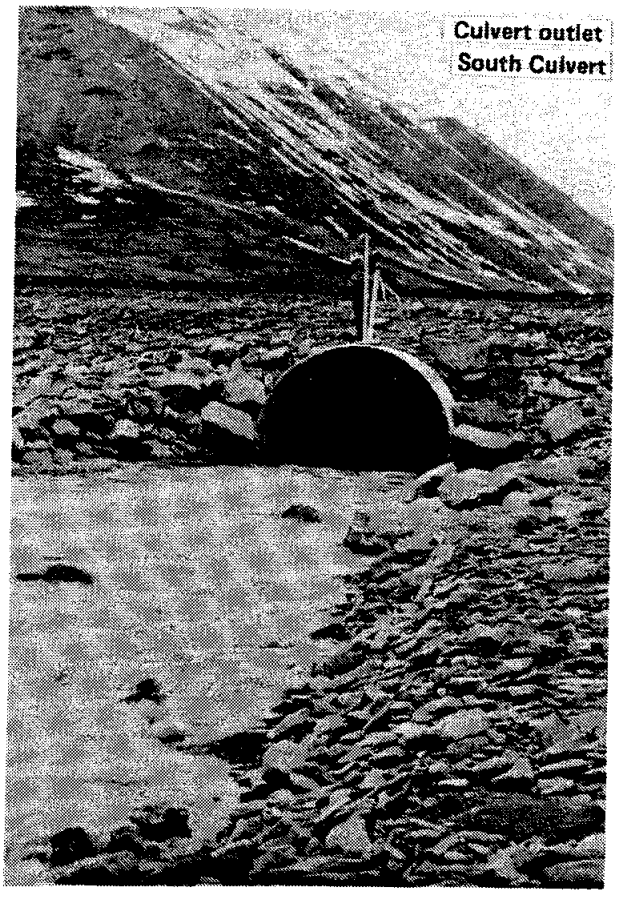

North Culvert
Culvert outlet


North Culvert
Downstream view

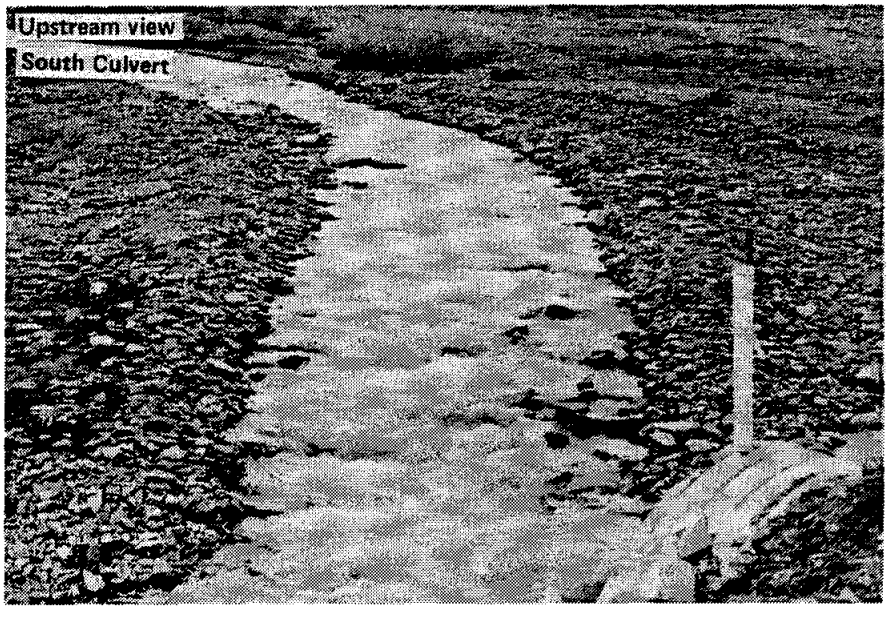
Site No. B-045 Spike Camp Creek

Location: Dalton Highway

Map: Phillip Smith Mountains A-5, T15S, R12E, Sec. 6




Downstream view
South Culvert


Upstream view
South Culvert

Site No. B-048 Trevor Creek

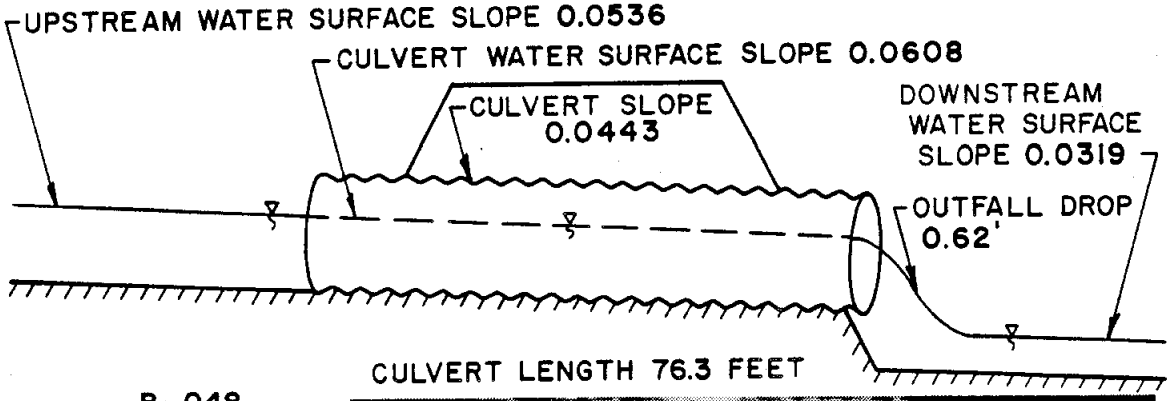
Location: Dalton Highway

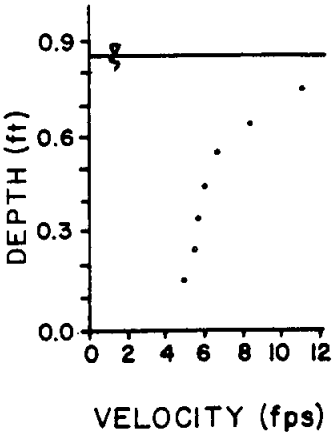
Map: Phillip Smith Mountains B-4, T13S, R12E, Sec. 28

Trevor Creek was first observed on June 10, 1982. The discharge (87.2 cfs) was mostly contained by the main culvert with a small amount of flow through the overflow culvert (68 ft long, 60 in in diameter). The water surface profiles for the creek and main culvert are presented in the diagram. A small turbulent pool at the culvert exit was noted with some backwater eddies. The water velocity was too high through the culvert to obtain a velocity profile. The bed material was composed of rocks up to 6 in in diameter; the culvert barrel was clean.

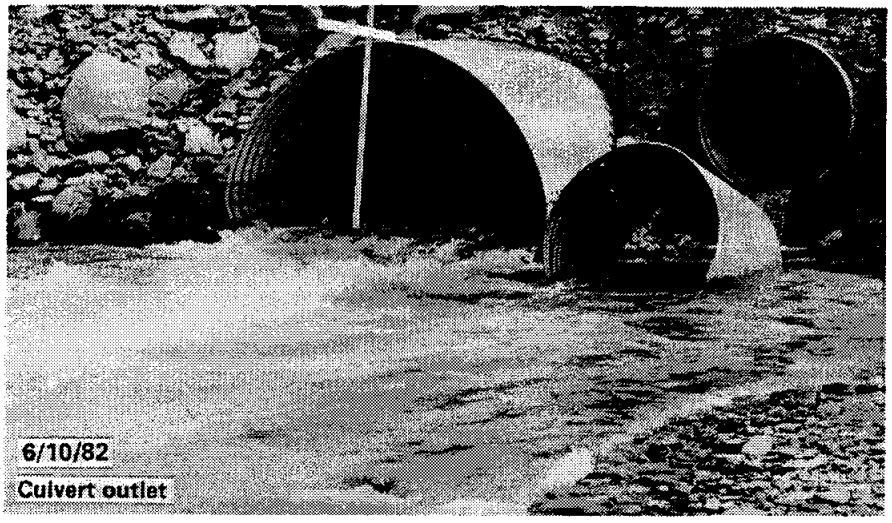
Two velocity profiles were obtained on July 20, 1982 at a lower flow. The outlet water depth at this time was 0.85 ft and the inlet water depth was 0.80 ft.

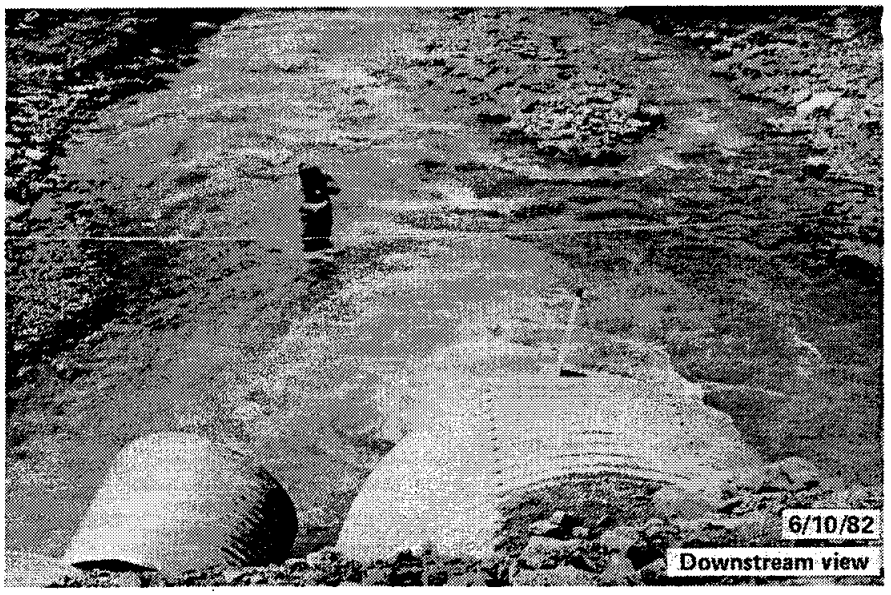
The watershed areas for this creek was combined with the watershed area for Tyler Creek (B-049). The total area for both creeks was 15.2 sq mi.






Span 10' 8"
Rise 6' 11"
6/10/82
Culvert inlet


6/10/82
Culvert outlet

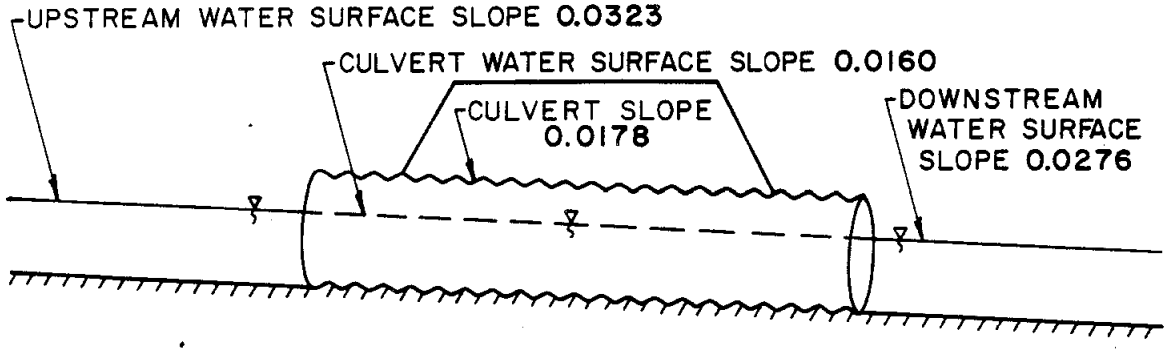

6/10/82
Downstream view

Site No. B-049 Tyler Creek

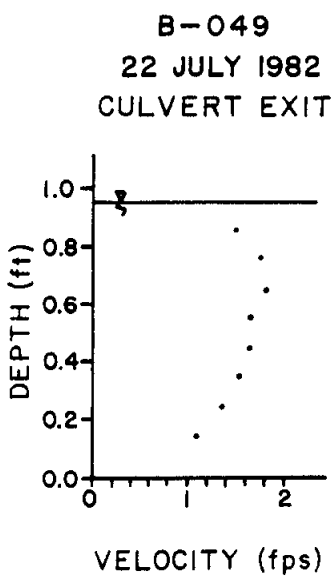
Location: Dalton Highway

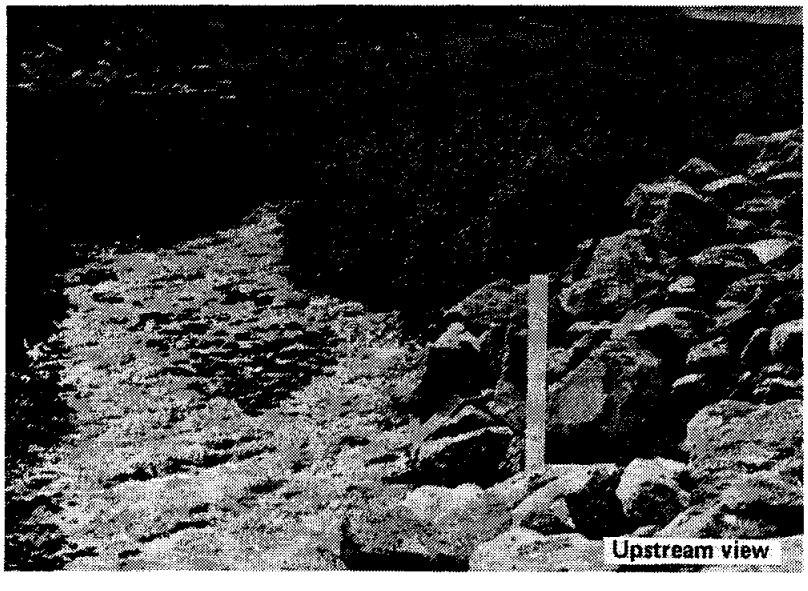
Map: Phillip Smith Mountains B-4, T13S, R12E, Sec. 28

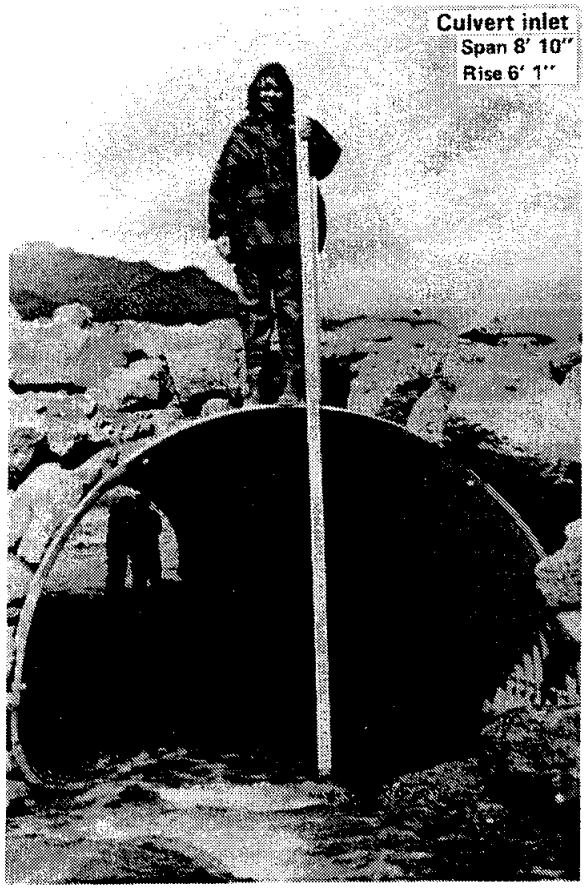
Measurements were made at Tyler Creek on July 22, 1982. The survey results are presented in the diagram. The observed discharge was 7.7 cfs. Culvert inlet and outlet water depths were 1.00 and 0.95 ft, respectively. The bedload size was cobbles up to 6 in in diameter. A small 5 by 10 ft pool at the culvert exit and the quiet water downstream of some large riprap in the culvert provided rest areas for fishes. Ten inch grayling were observed swimming in the culvert. Riprap (up to 2 ft in diameter) was observed in the middle of the culvert. Downstream from this riprap, a few cobbles up to 4 in in diameter were deposited in the center of the culvert. Upstream from the riprap, a larger amount of sediment (cobbles) was deposited covering the bottom of the barrel. The watershed area was 16.2 sq mi (combined with Trevor Creek, B-048).

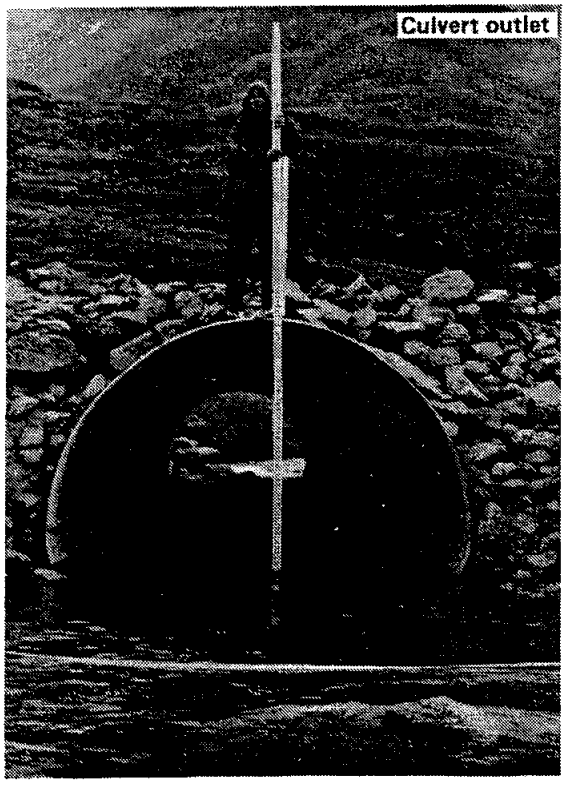


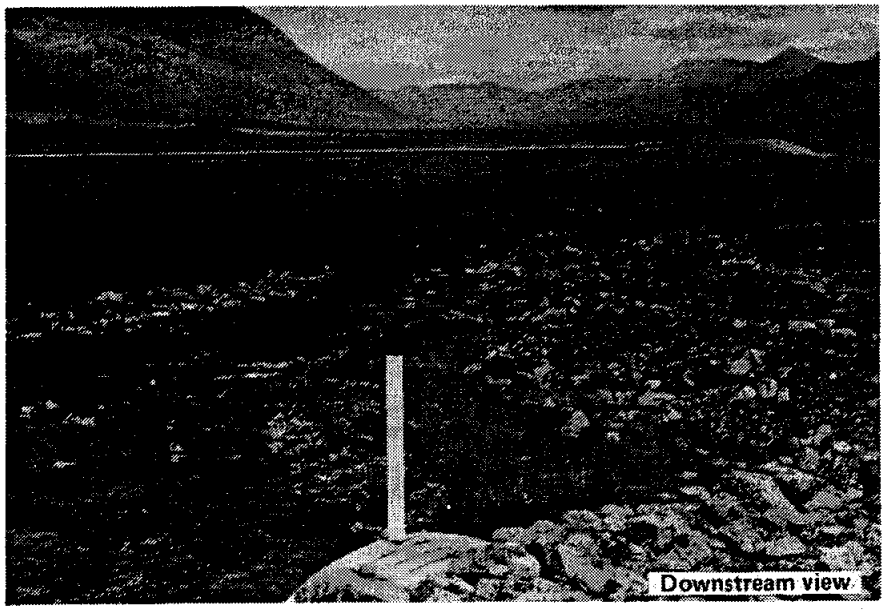
CULVERT LENGTH 60 FEET






Culvert inlet
Span 8' 10"
Rise 6' 1"


Culvert outlet


Downstream view

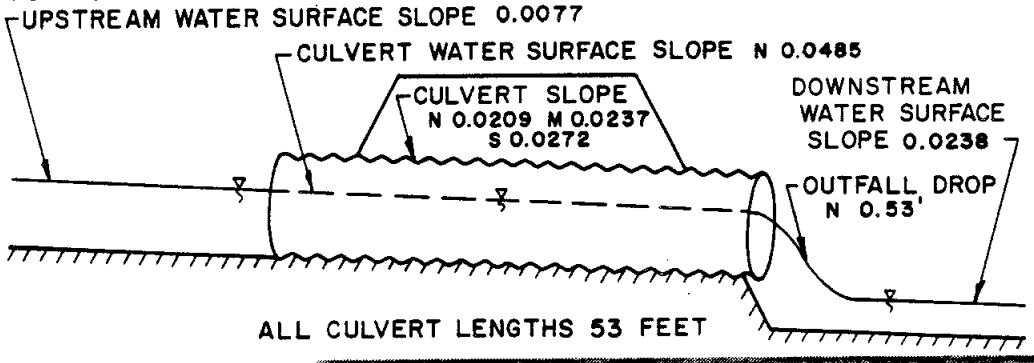
Site No. B-050 Roche Moutonee

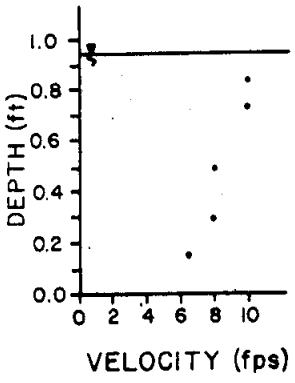
Location: Dalton Highway

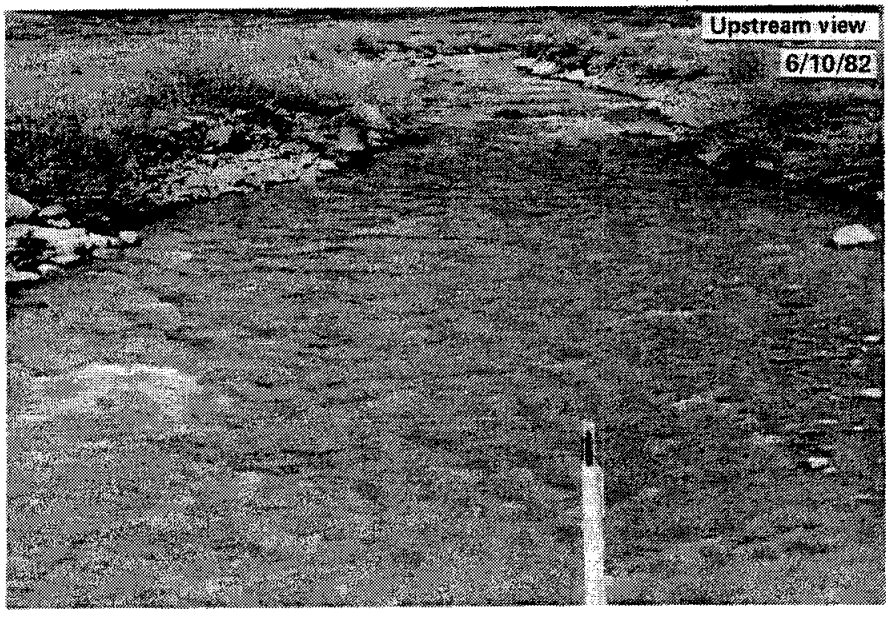
Map: Phillip Smith Mountains B-4, T12S, R12E, Sec. 28

Three culverts (north, middle and south) contained the discharge at this Dalton Highway stream crossing. The flow measured 213.6 cfs on June 10, 1982. The middle culvert carried the most flow and the least flow was through the south culvert. The water depth at the north culvert outlet was 0.95 ft. All three culverts were perched: the water surface drop out of the north culvert was 0.53 ft; the drop was less in the south culvert and more in the middle culvert. Water surface profiles for the culverts and stream are shown in the diagram. The north and middle barrels were clean while the south culvert contained large rocks. Erosion was noted around the culvert inlets. Eddies between the culverts at the downstream end served as rest areas for fishes. The estimated bedload size was rocks up to 2 ft in diameter. The watershed areas was 32.3 sq mi. Upstream of the culvert installation was a USGS gaging station

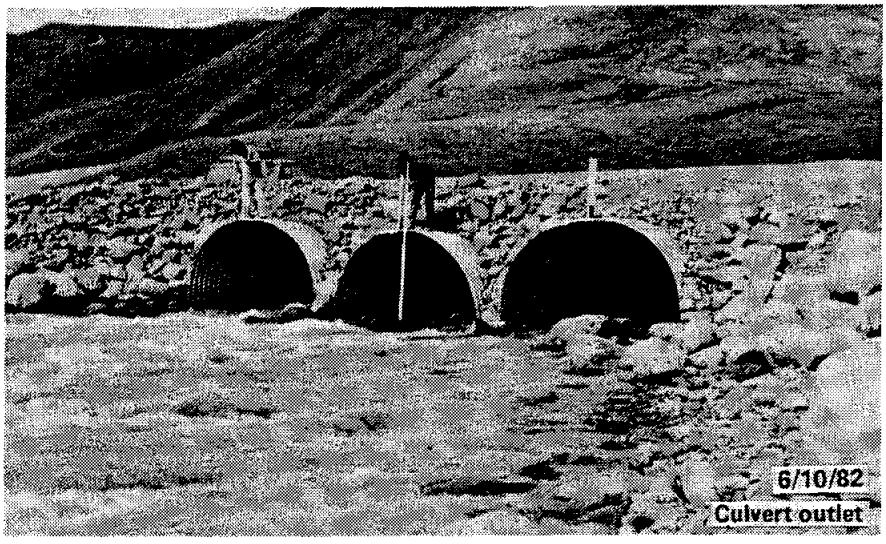
Culvert inlet and outlet depths were measured on July 22, 1982. The inlet depths were: north, 1.20 ft; middle, 1.50 ft; south, 0.30 ft. The outlet depths were: north, 1.00 ft; middle, 1.20 ft; south, 0.50 ft. The south culvert inlet depth was measured 5 ft inside the barrel due to rocks at the culvert entrance.

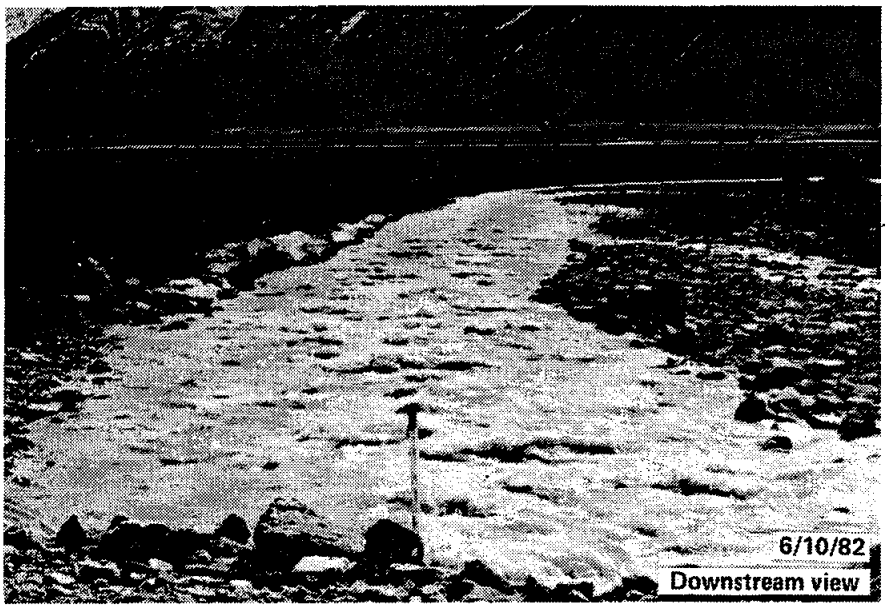







Span 9' 6"
Rise 6' 5"
6/10/82
Culvert inlet


6/10/82
Culvert outlet


6/10/82
Downstream view

Site No. B-051 Holden Creek

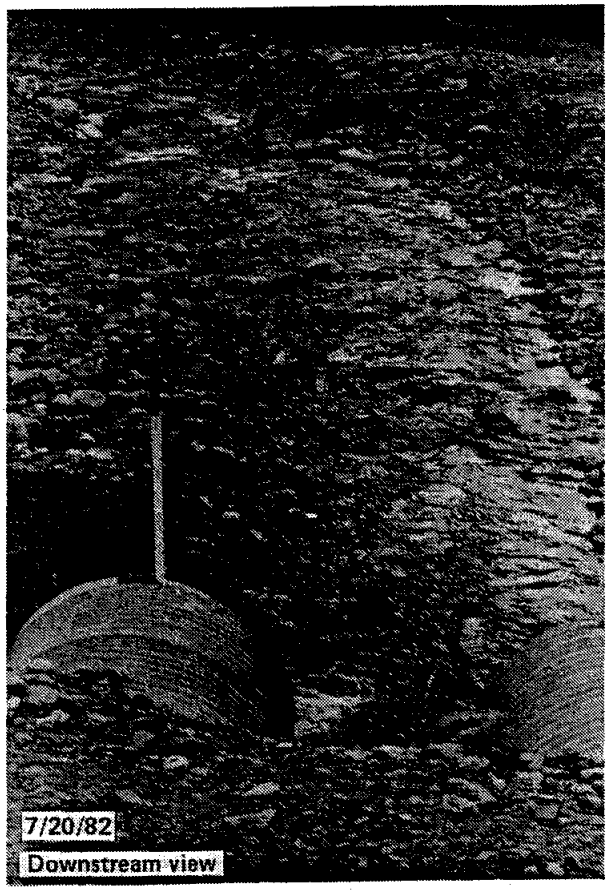
Location: Dalton Highway

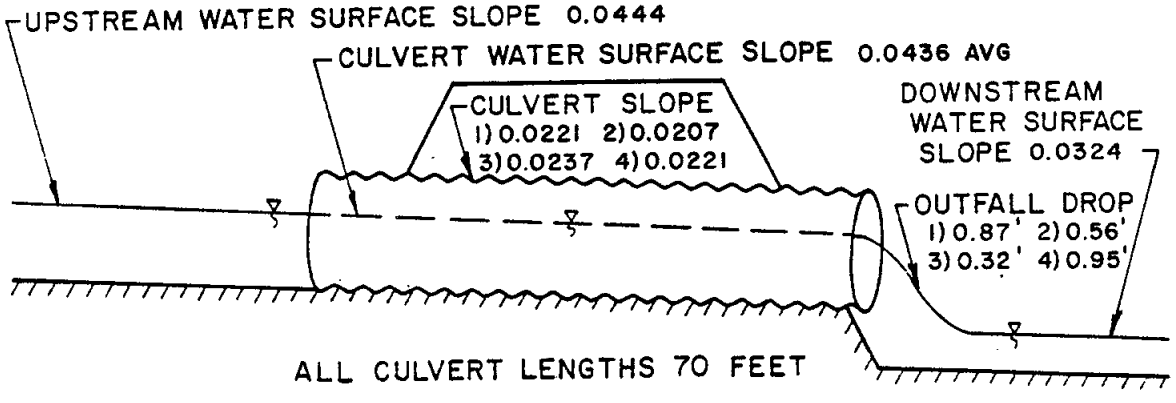
Map: Phillip Smith Mountains B-4, T12S, R12E, Sec. 16

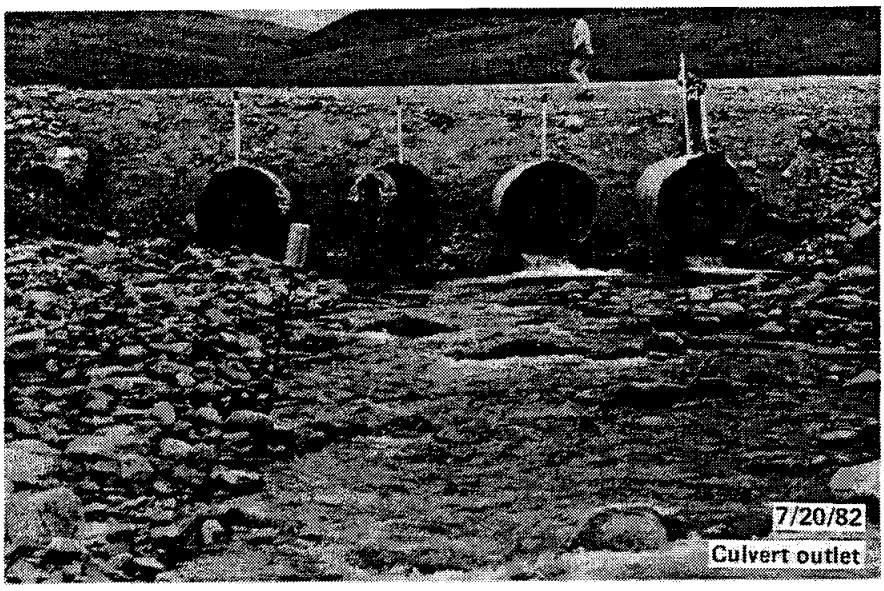
Holden Creek was observed on June 10, 1982 under high flow conditions and on July 20, 1982 under low flow conditions. Four culverts, labelled 1 to 4 (south to north) contained the flow from this 10 sq mi on both occasions.

A discharge measurement was made on July 20; the flow was 5.3 cfs. Inlet water depths for culverts 1 to 4 were 0.50, 0.75, 0.10, and 0.60 ft, respectively. Outlet water depths for culverts 1 to 4 were 0.50, 0.50, 0.10, and 0.45 ft, respectively.

Slopes were measured on June 10; the survey results are presented in the diagram. The water velocity and depth of flow prevented obtaining discharge or velocity profile measurements. No pools were observed, although all four barrels were perched at the outlets. The culverts were clean; rocks were being moved through the culvert. Some large boulders were noted at the entrance to the culverts.






7/20/82
Culvert outlet

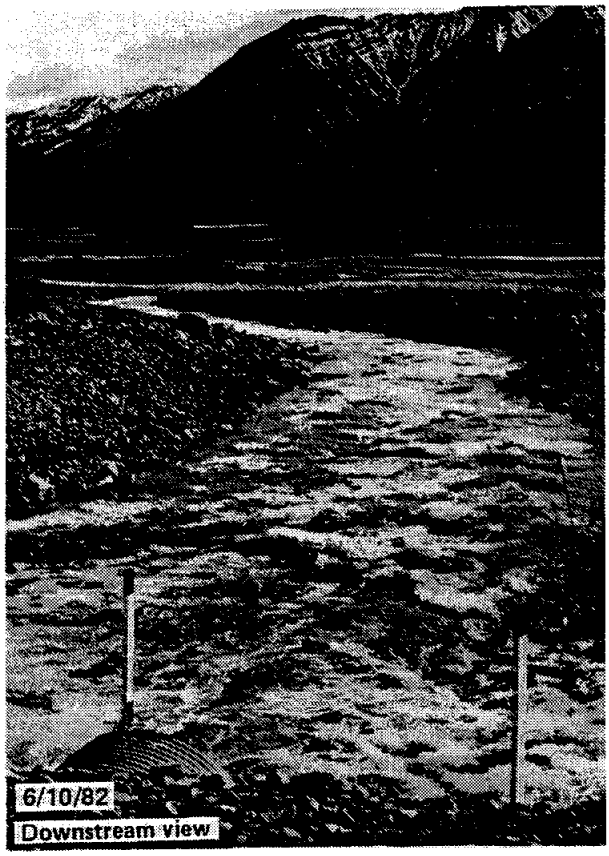

7/20/82
Culvert inlet

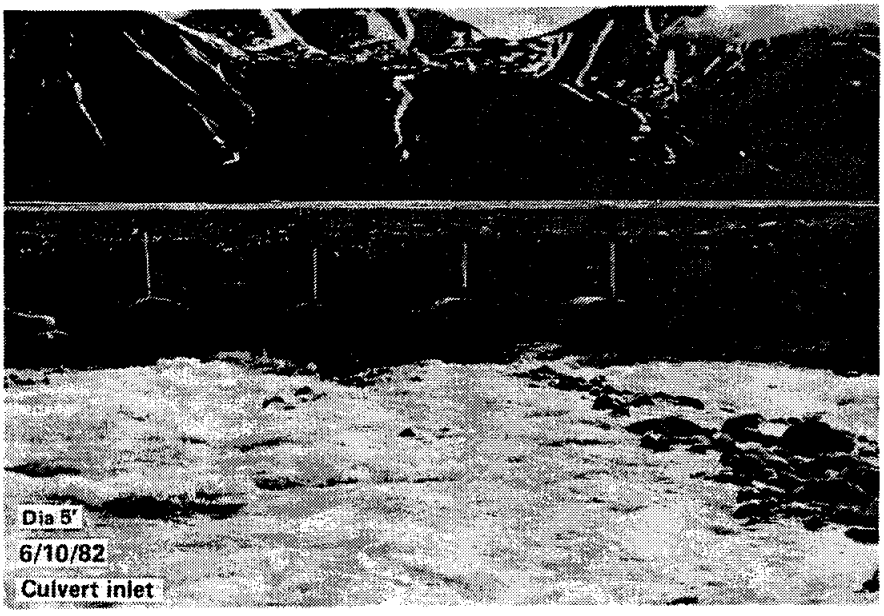

7/20/82
Upstream view

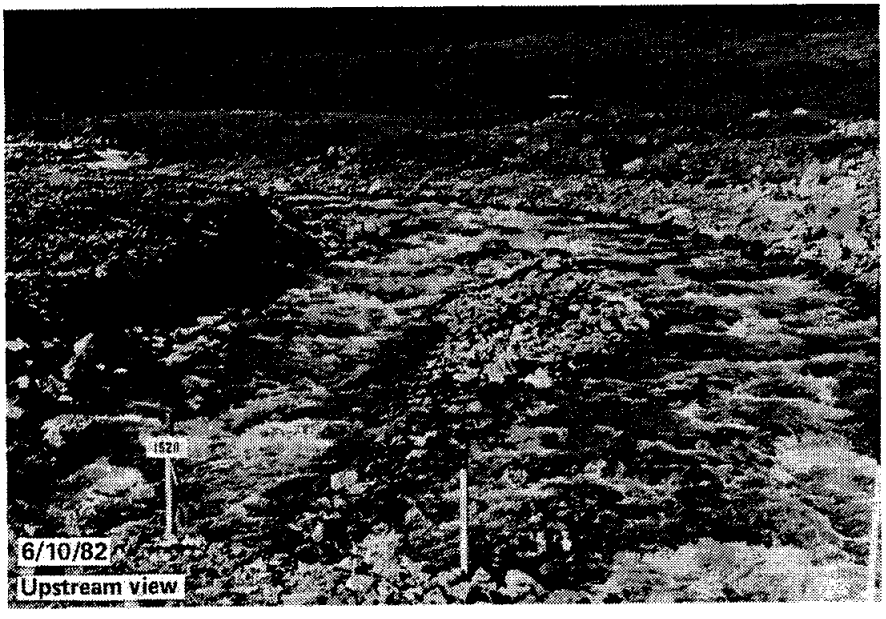
Site No. B-051 Holden Creek

Location: Dalton Highway

Map: Phillip Smith Mountains B-4, T12S, R12E, Sec. 16




Dia 5'
6/10/82
Culvert inlet

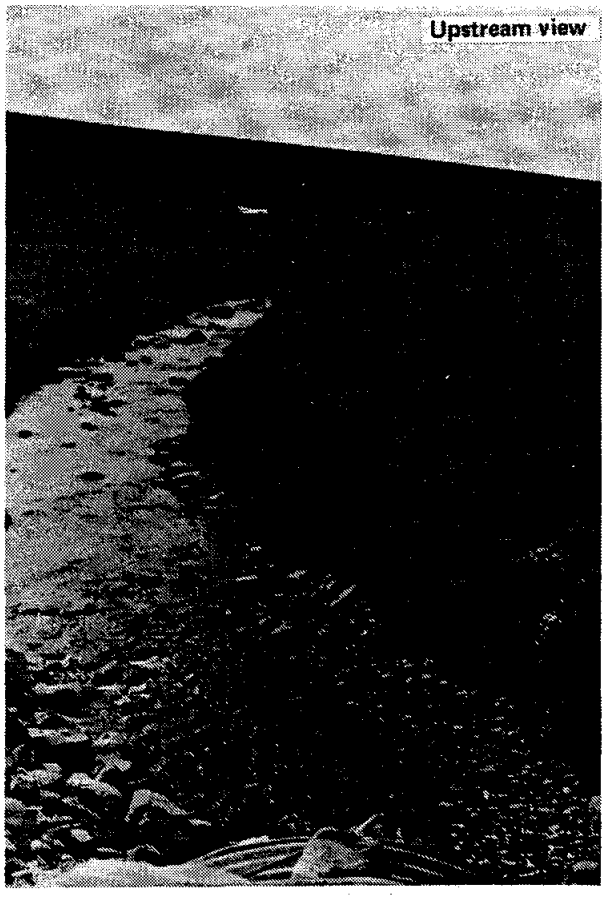

6/10/82
Upstream view

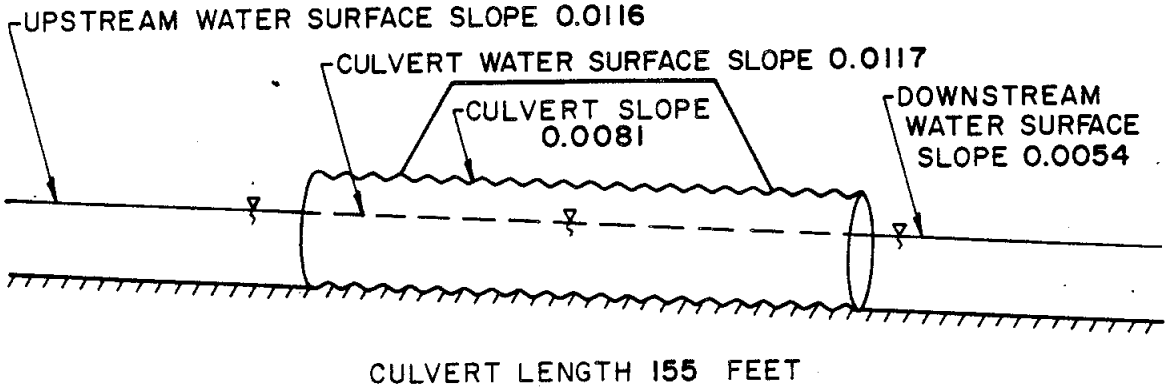
Site No. B-055 Dan Creek

Location: Dalton Highway

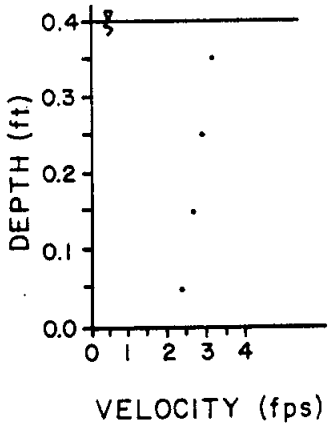
Map: Sagavanirktok A-4, T4S, R14E, Sec. 18

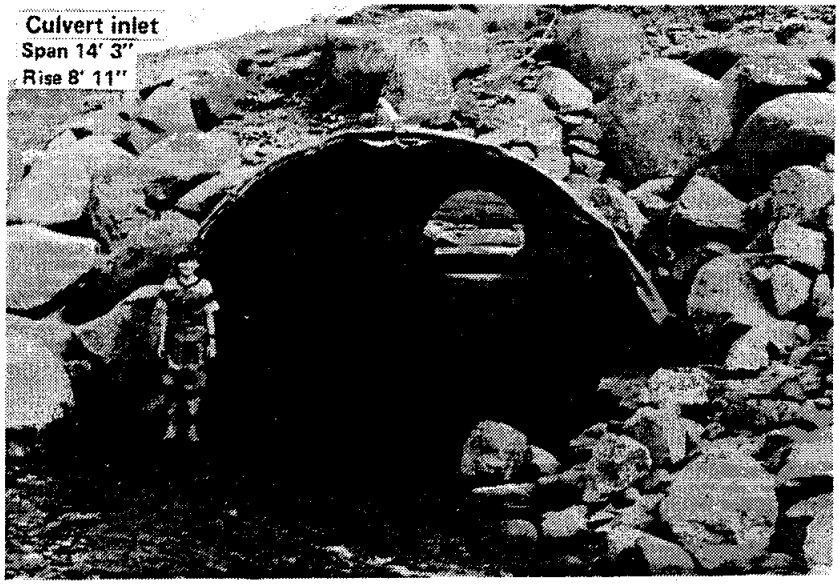
Observations were made at Dan Creek on July 21, 1982. A discharge of 8.2 cfs was contained by one large arch culvert. The water surface profiles for the creek and culvert appear in the diagram. The water depth at the culvert inlet was 2.00 ft. The water depth was 1.20 ft at the culvert outlet. The bedload size was difficult to measure. Some 2 ft diameter rocks were in the stream channel; smaller rocks (predominantly 3 to 4 in in diameter) were also noted. The culvert barrel was clean except for some rocks (1 to 2 ft in diameter) at the inlet. Pools (30 by 30 ft) were observed at each end of the culvert. The slope of the culvert increased through the barrel. Small fry and large grayling were noted inside the culvert. The watershed area was 34.4 sq mi.

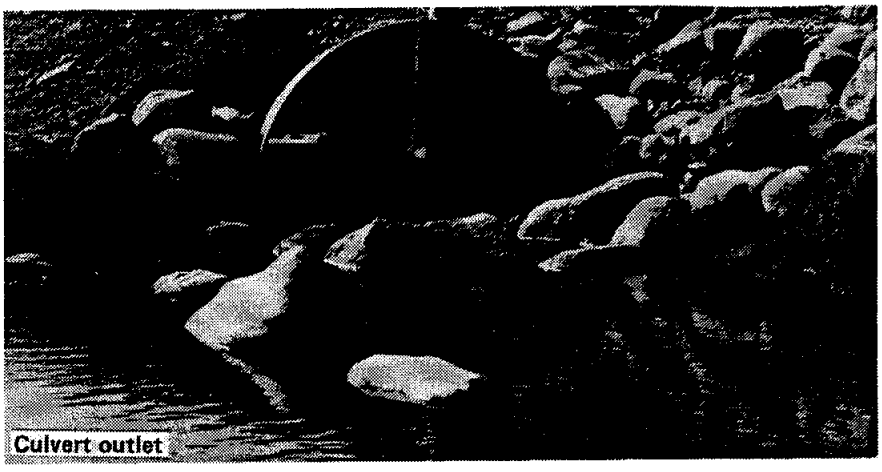




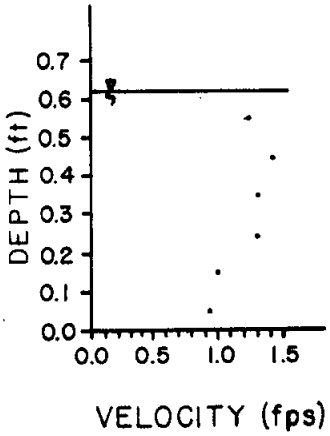
B-055
21 JULY 1982
10' DOWNSTREAM
FROM CULVERT EXIT

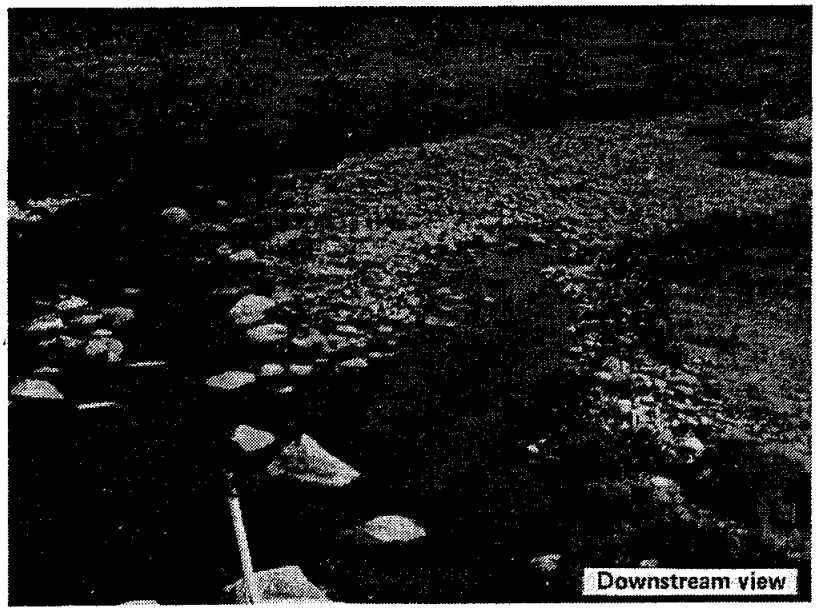






B-055
21 JULY 1982
100' DOWNSTREAM
FROM CULVERT EXIT



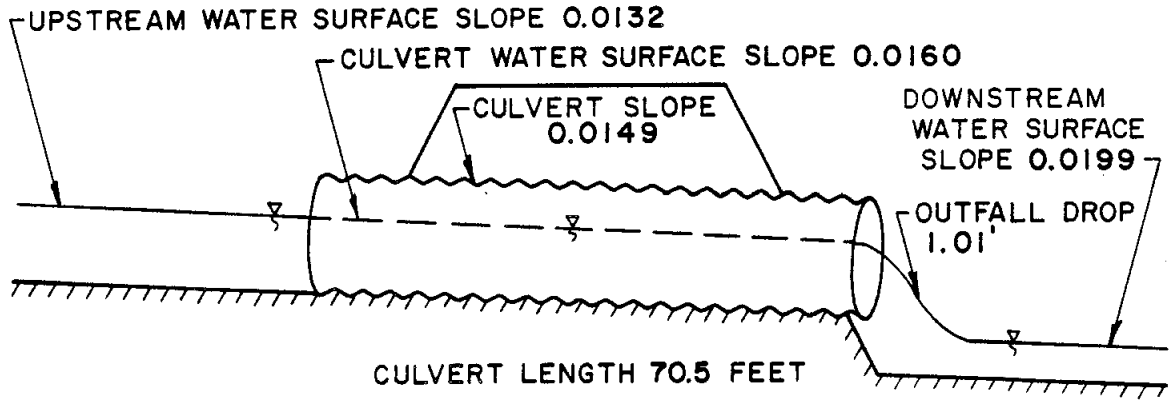


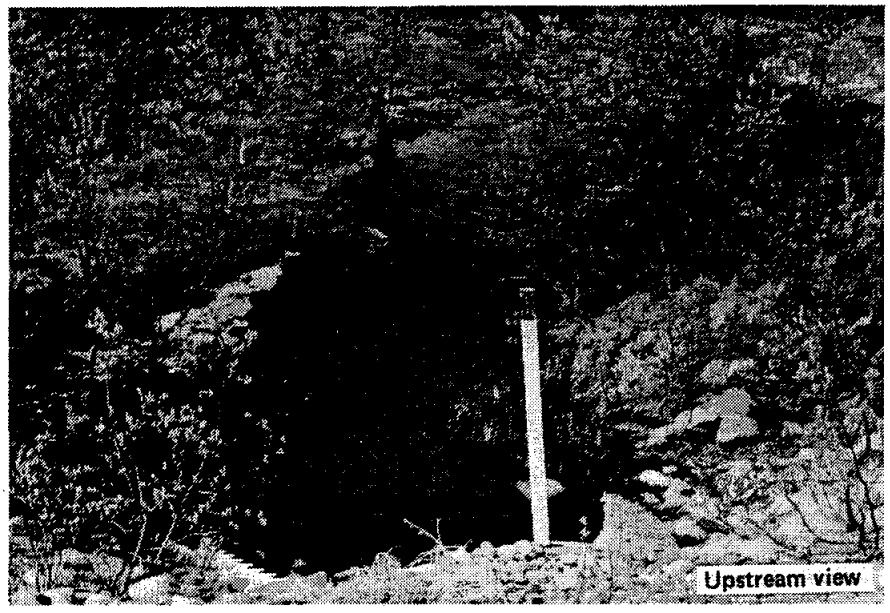
Site No. D-002 Unnamed Creek

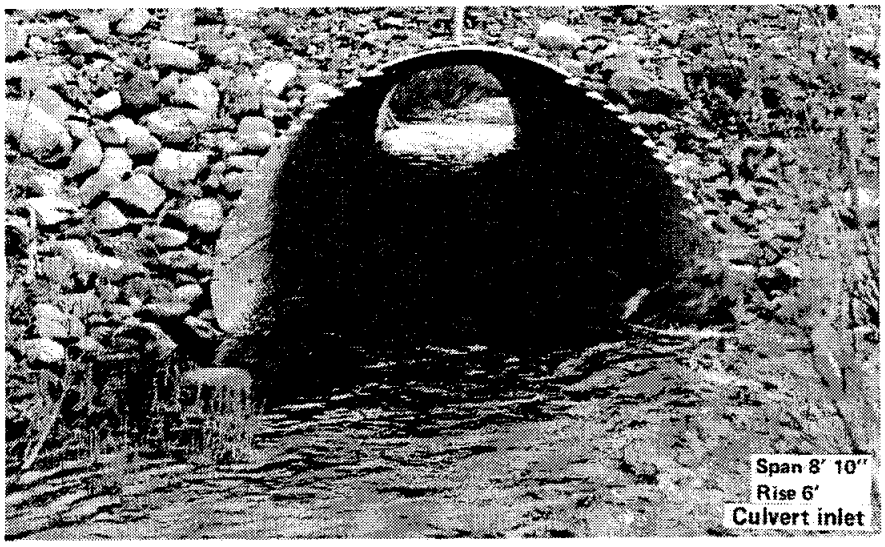
Location: Mile 17.9 Denali Highway

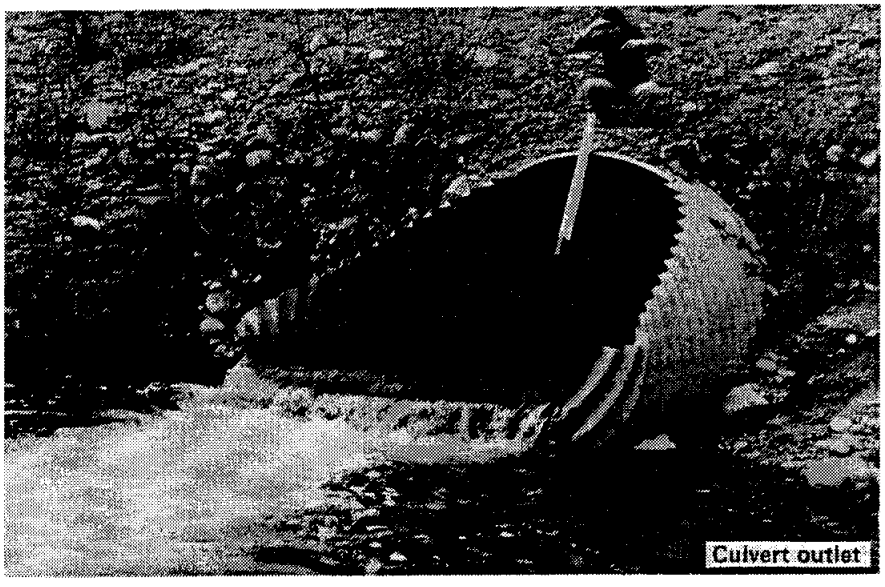
Map: Mt. Hayes A-4, T21S, R10E, Sec. 31

Measurements were made at this stream site on June 21, 1982. Due to rocks in the streambed, a poor discharge measurement was obtained; the streamflow was 21.9 cfs. A 25 ft diameter pool was downstream of the culvert. The downstream end of the culvert appeared to be damaged, causing perched conditions at the outlet. The water surface profile for this culvert and stream is shown in the diagram. The downstream embankment also had erosion problems. Although there were no erosion problems at the upstream end of the culvert, the barrel was not directly aligned with the streamflow. This caused the greatest water velocities at the culvert entrance. The watershed area was 2.7 sq mi.






Span 8' 10"
Rise 6'
Culvert inlet


Culvert outlet

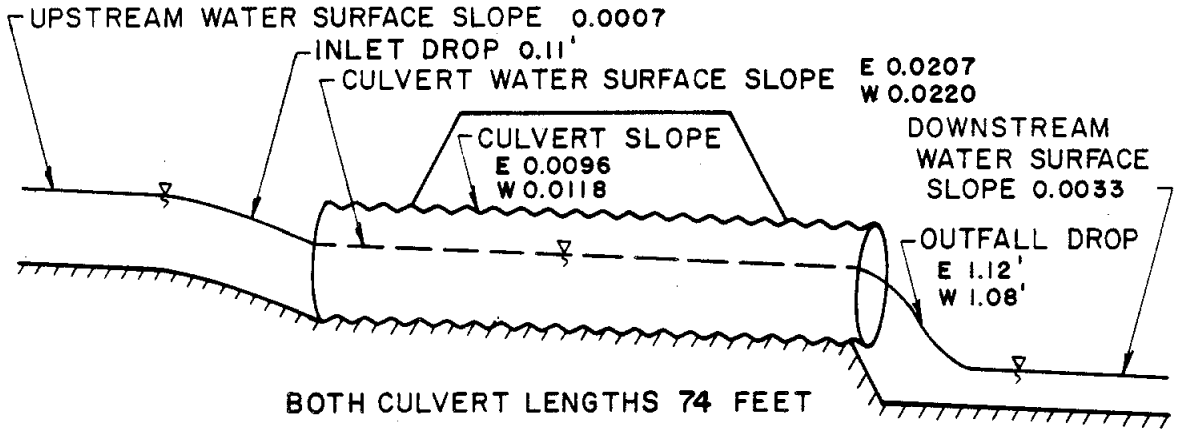

Downstream view

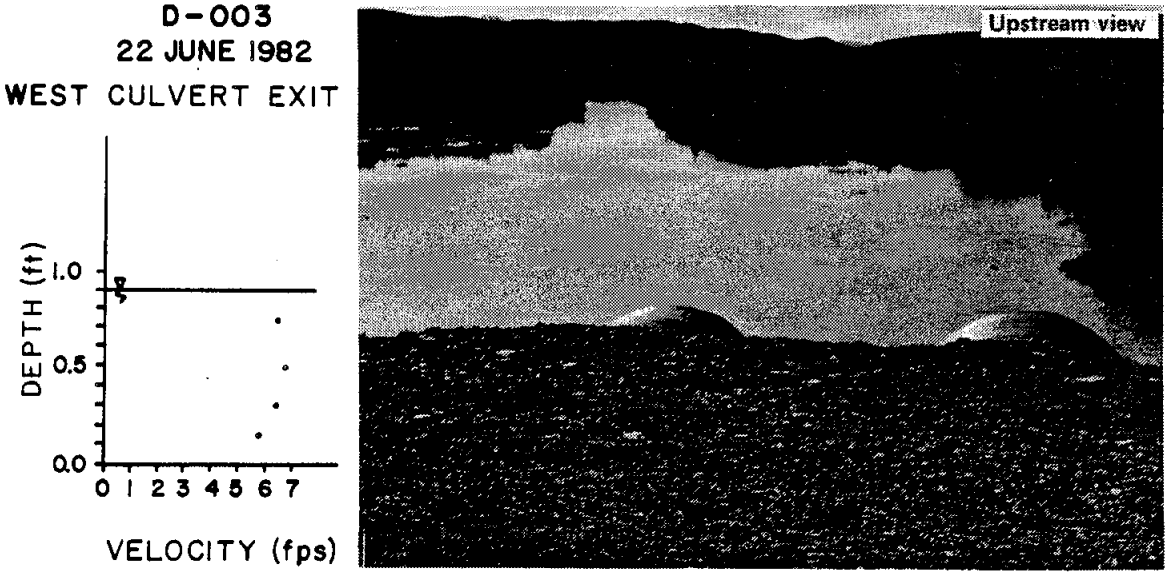
Site No. D-003 Unnamed Creek

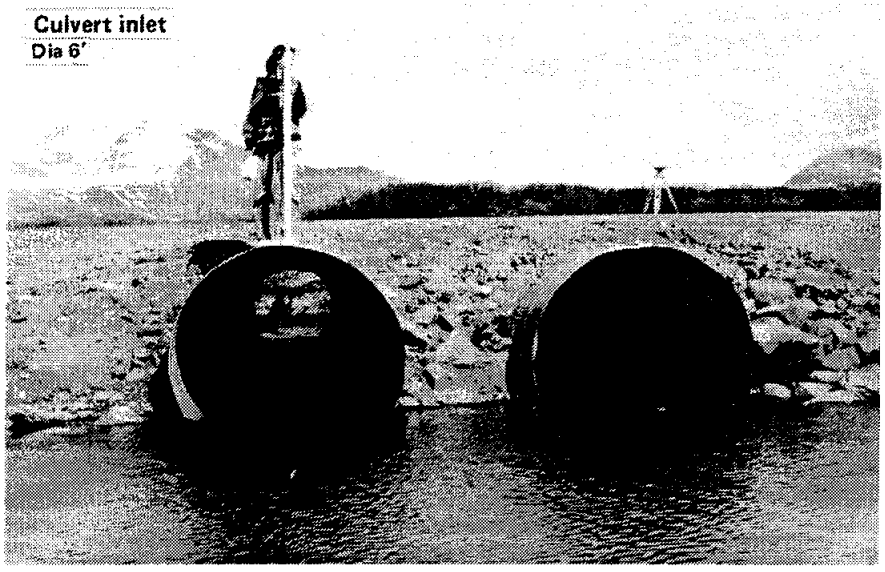
Location: Mile 18.5 Denali Highway

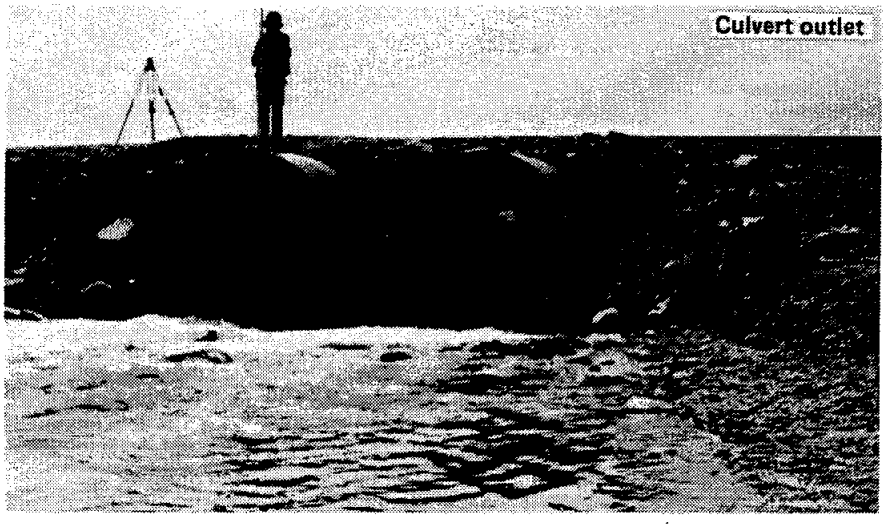
Map: Mt. Hayes A-4, T21S, R9E, Sec. 36

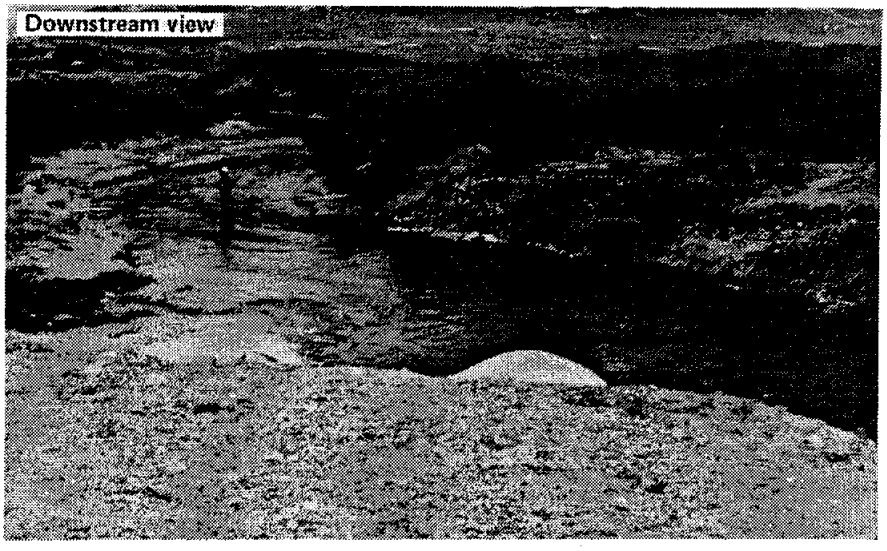
The stream crossing at 18.5 mile Denali Highway was inspected on June 22, 1982. Two identical corrugated metal pipes carried a combined flow of 33.6 cfs. A large pool with relatively low velocities was observed upstream of the culverts. The water surface profiles for the culverts and creek are shown in the diagram. The water depth at the outlet to the west culvert was 0.90 ft. A small pool was observed at the downstream end of the culverts. No drift was observed in either barrel. The estimated bed material size was 1 to 3 in in diameter. The watershed area was 8.8 sq mi.






Culvert inlet
Dia 6'


Culvert outlet

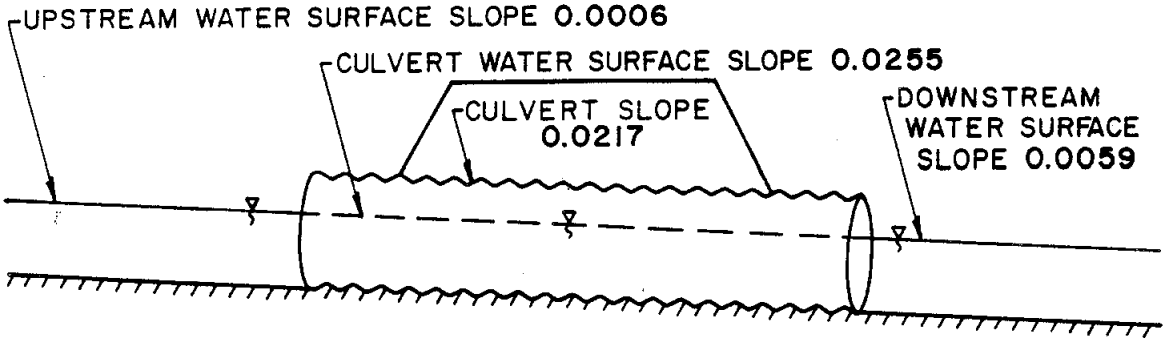

Downstream view

Site No. D-006 Osar Creek Tributary

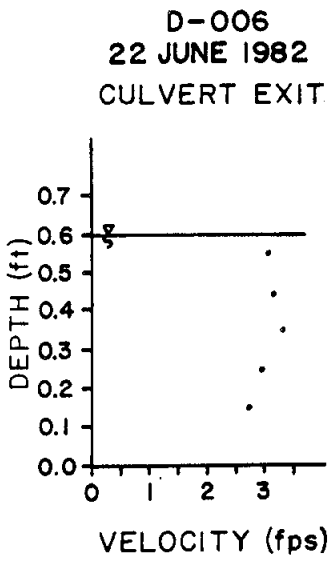
Location: Mile 47.7 Denali Highway

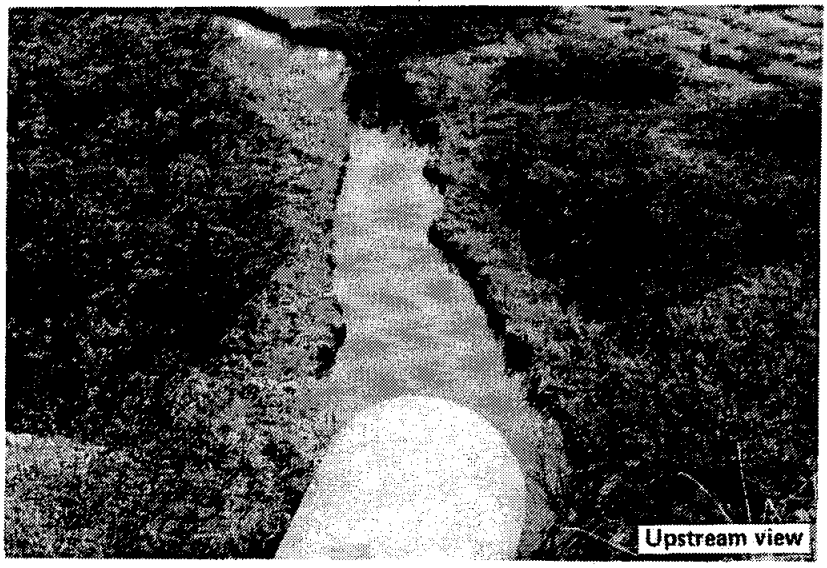
Map: Mt. Hayes A-6, T21W, R6E, Sec. 18

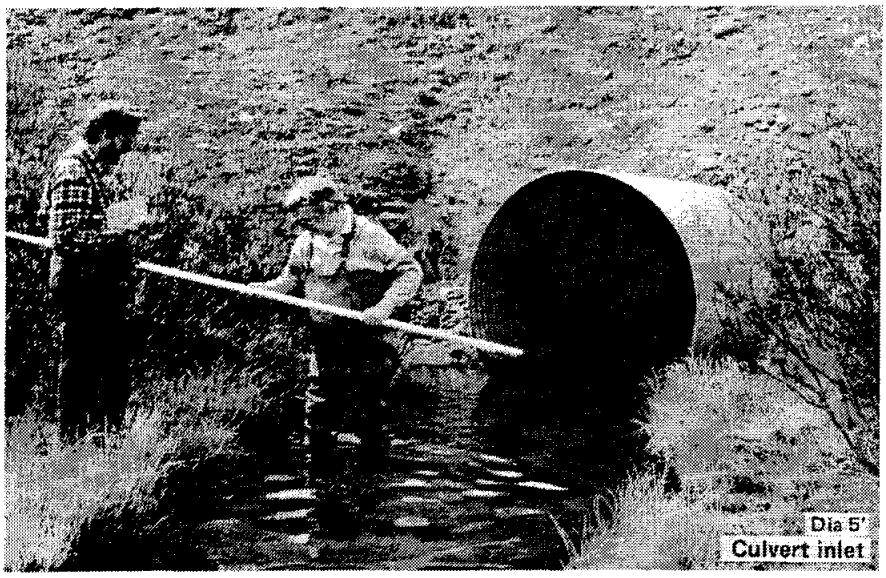
The Osar Creek Tributary was visited on June 22, 1982. A single 5 ft diameter culvert carried the discharge of 5.4 cfs. The minimum depth of flow in the culvert was 0.50 ft, while the total depth at the outlet was 0.60 ft. The surveyed slopes for this installation are presented in the diagram. Most of the water surface drop in the culvert occurred in the upper half of the culvert. There was a 30 ft diameter pool at the downstream end of the culvert; no pool was observed at the upstream end. Fish were sighted in the downstream pool. The culvert barrel was clean. The estimated bed material size ranged from fine sand (upstream of the culvert) to small gravel (downstream of the culvert). The watershed area was 8.2 sq mi.

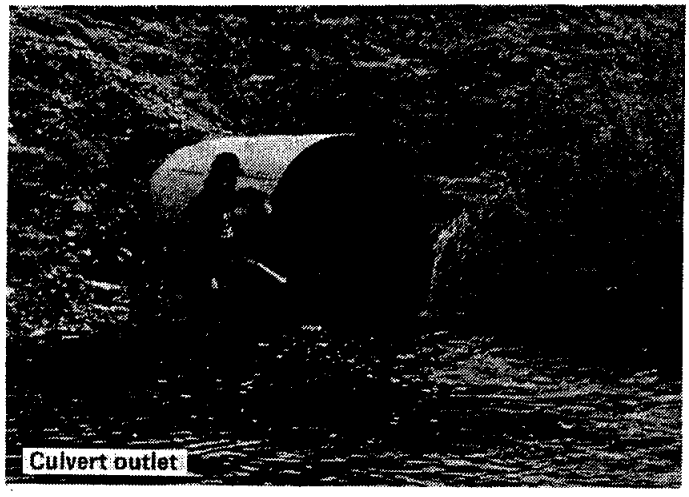


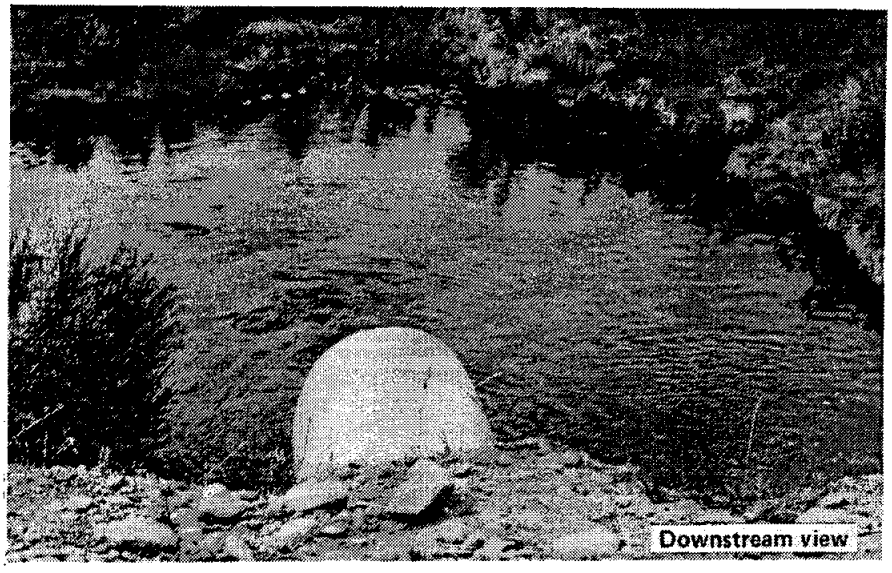
CULVERT LENGTH 77.3 FEET






Dia 5'
Culvert inlet


Culvert outlet

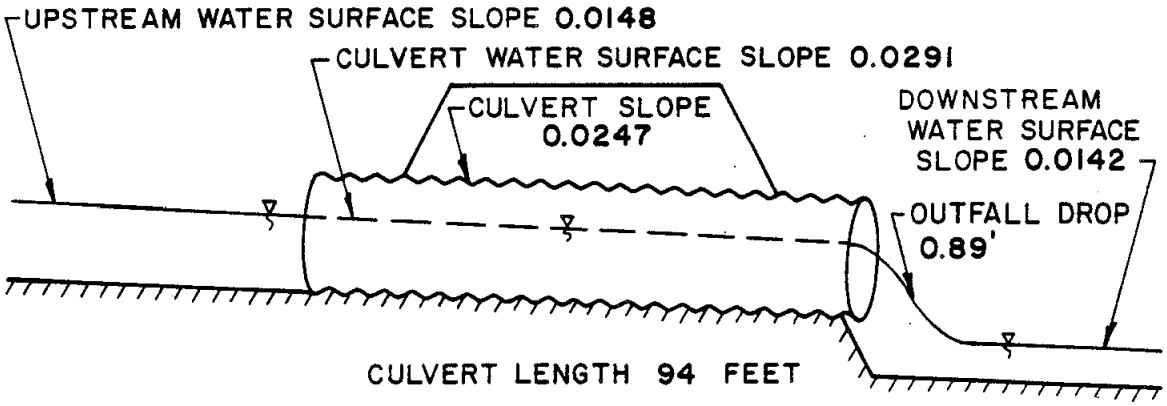

Downstream view

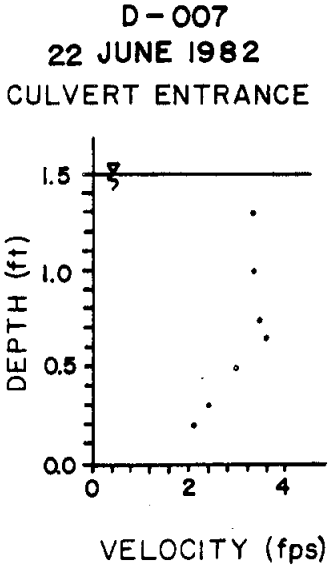
Site No. D-007 Osar Creek

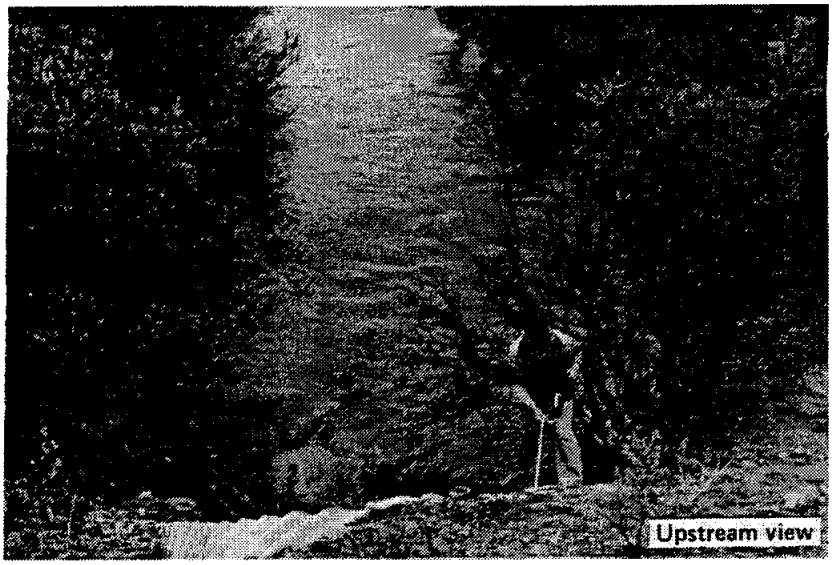
Location: Mile 51.9 Denali Highway

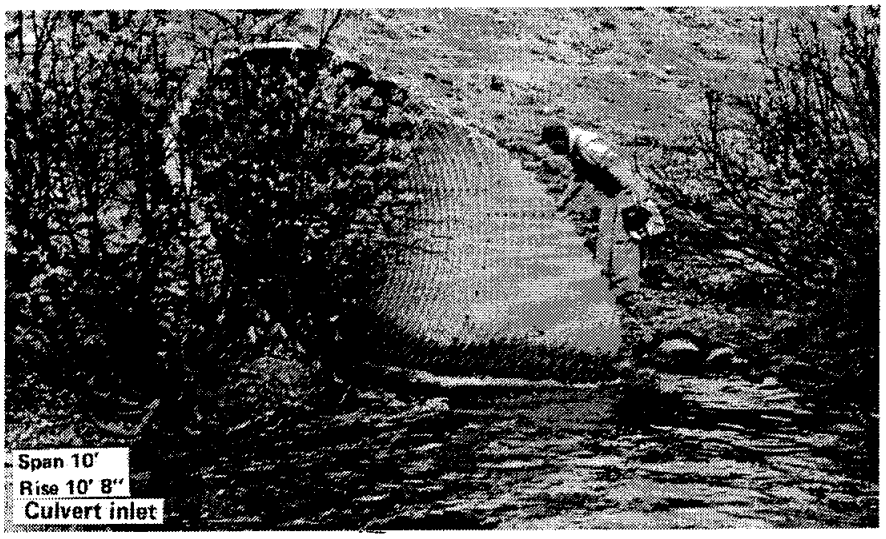
Map: Mt. Hayes A-6, T21W, R5E, Sec. 34

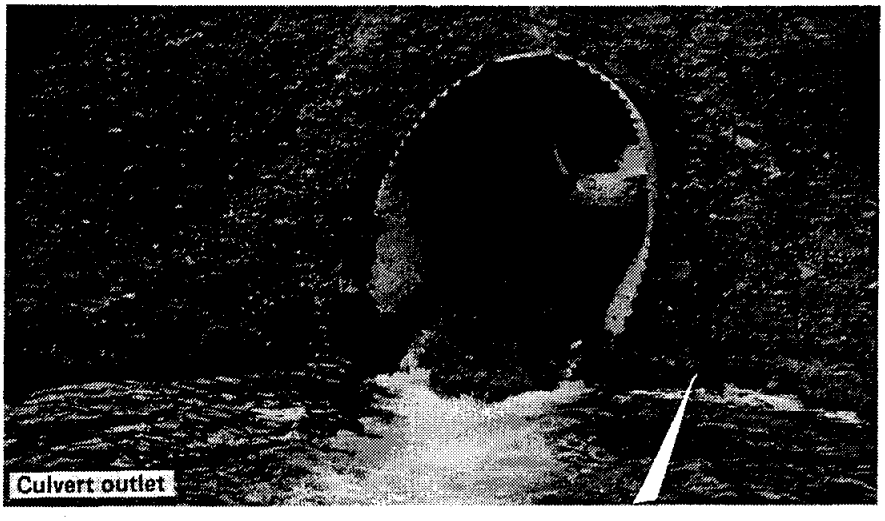
Measurements were taken at Osar Creek on June 22, 1982. The flow was gaged at 26.6 cfs. The water surface profiles appears in the diagram. In a 30 ft diameter pool at the culvert outlet fish were noted. The culvert barrel contained no drift. Velocity profiles were taken at both the culvert entrance and exit; the total water depths were 1.50 and 1.10 ft, respectively. A high water mark was surveyed 1.24 ft above the present water surface level 50 ft upstream of the culvert. The watershed area was 9.1 sq mi.

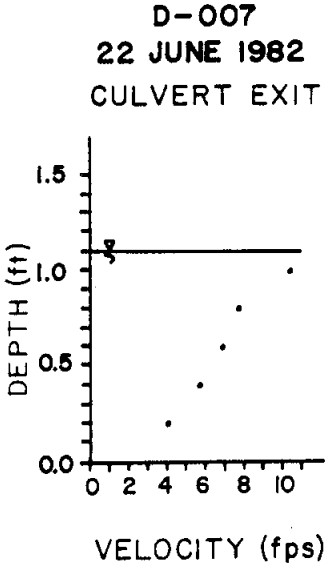


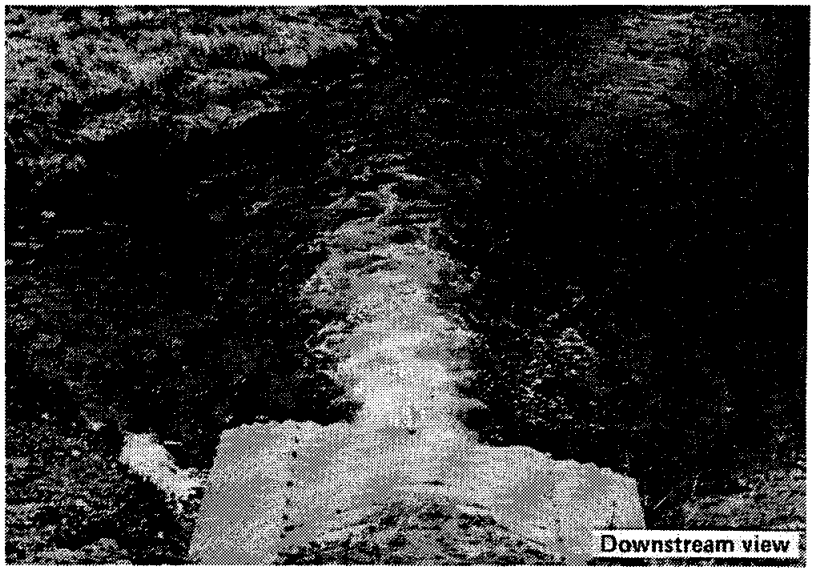





Span 10'
Rise 10' 8"
Culvert inlet


Culvert outlet


D-007
22 JUNE 1982
CULVERT EXIT
DEPTH (ft)
1.5
1.0
0.5
0.0
0 2 4 6 8 10
VELOCITY (fps)

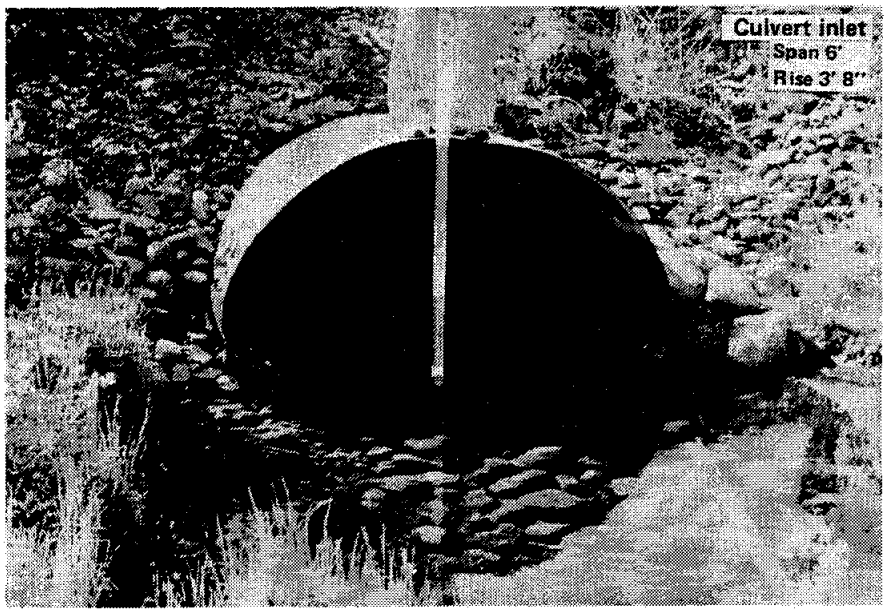

Downstream view

Site No. D-012 Unnamed Creek

Location: Mile 79.1 Denali Highway

Map: Healy A-2, T21S, R1E, Sec. 11

Measurements were taken at this unnamed creek site along the Denali Highway on June 23, 1982. Fine material consisting of silt and sand was the estimated bedload size. The depth of flow at the culvert inlet was 0.50 ft, and at the outlet was 0.40 ft. The barrel was clean, no drift was observed. Fish passage may be a problem when the flow declines and the water depths in the culvert decrease. No slope measurements were surveyed. The watershed boundaries were insufficiently defined so no area measurement was obtainable.



Culvert outlet

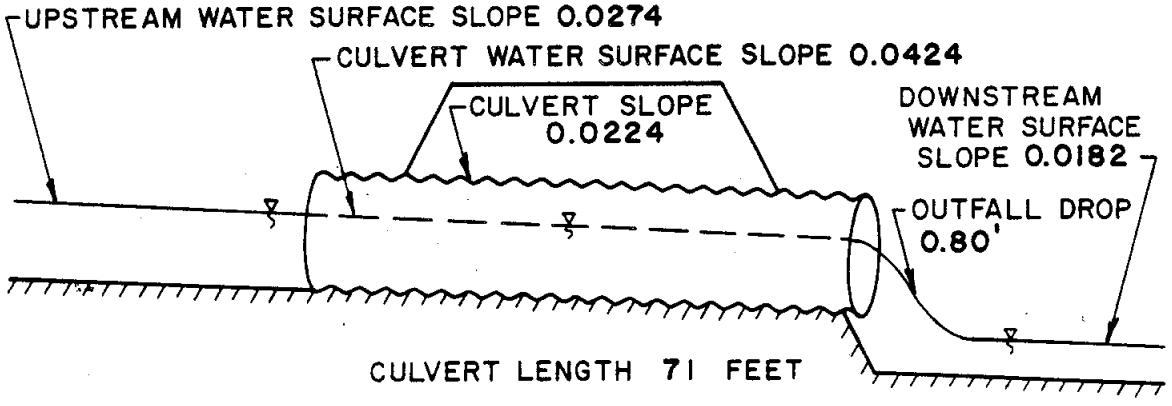
Downstream view

Site No. D-013 Unnamed Creek

Location: Mile 83.0 Denali Highway

Map: Healy A-2, T20S, R1E, Sec. 34

Measurements were taken at this unnamed creek along Denali Highway on June 23, 1982. A single culvert contained the 3.0 cfs flow, but the culvert size was not uniform. The diameter was 3.0 ft at the inlet and for the first 20 ft; the remainder of the culvert was 4.0 ft in diameter. Posts inside the culvert braced the crown and kept the culvert from deforming. The outlet of the culvert was broken (water depth 0.35 ft) and there was a 20 ft diameter scour pool noted at the culvert exit. Estimated bedload size was fine material and the culvert barrel was clean. The surveyed slopes for this site are shown in the diagram. The slope upstream of the culvert included a 1.54 ft drop 89 ft above the inlet. Grayling (up to 9 in long) were noted above and below the culvert, and above the upstream drop. The watershed area was 7.0 sq mi.




Culvert outlet

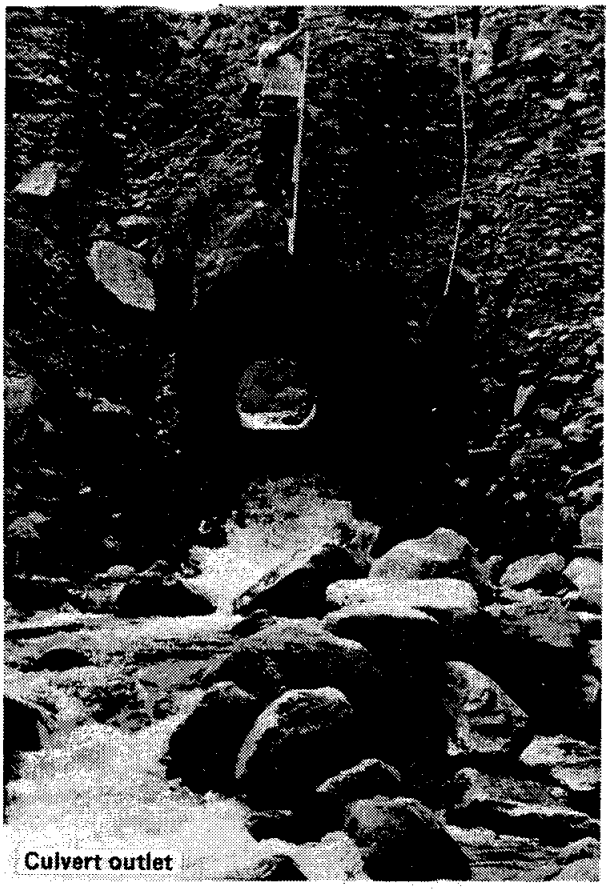

Downstream view

Site No. D-014 Unnamed Creek

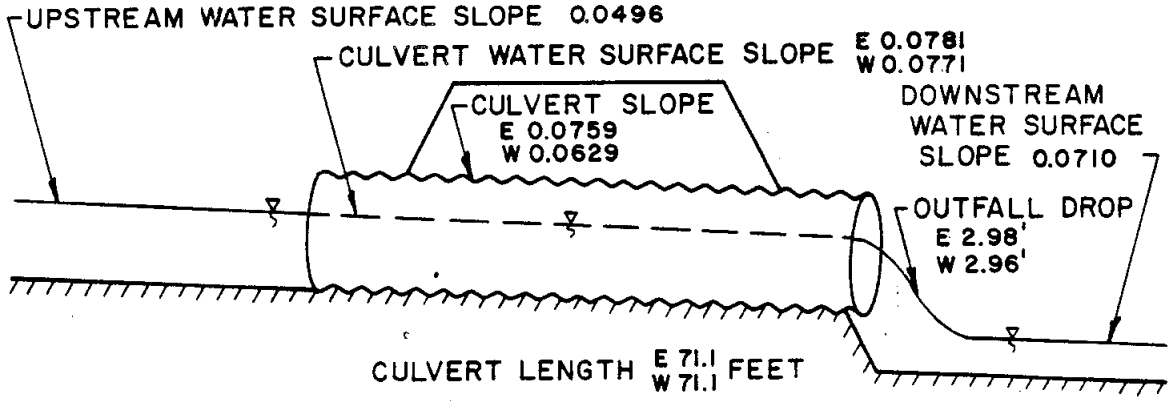
Location: Mile 87.7 Denali Highway

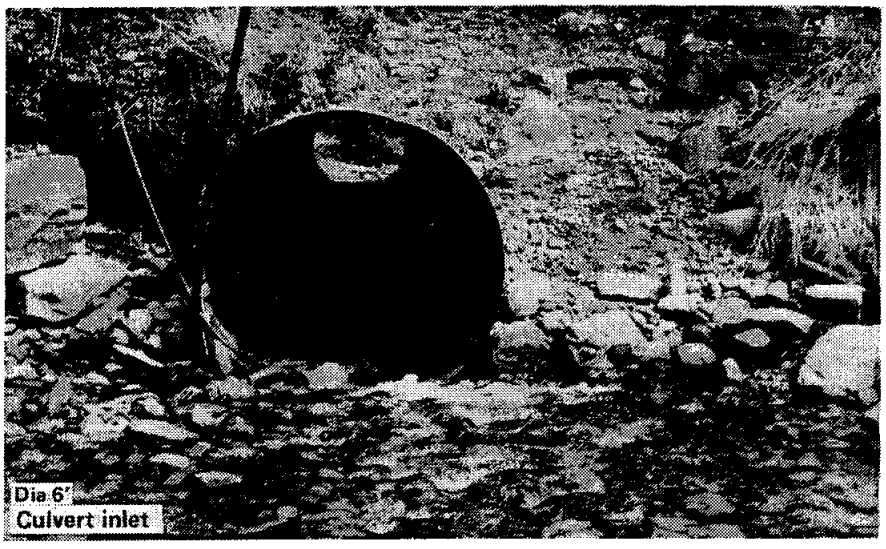
Map: Healy A-2, T20S, R1E, Sec. 7

A double barrel culvert installation contained the flow at this stream site. Observations were made on June 23, 1982. Both barrels were clean, although 3 to 4 in diameter gravel was noted passing through the culverts. The stream channel was fairly shallow with large rocks in it, so no streamflow measurement was obtained. Downstream of the culvert was one main stream channel, while the stream was braided above the culvert. The surveyed slopes appear in the diagram. The upstream slope was measured along the west channel. Much of the downstream water surface drop occurred within 20 ft of the culvert exit. The outlet water depth was 0.40 ft. The watershed area was 6.2 sq mi. A high water mark was observed 1.40 ft above the existing water surface 50 ft downstream of the culverts on the east bank.

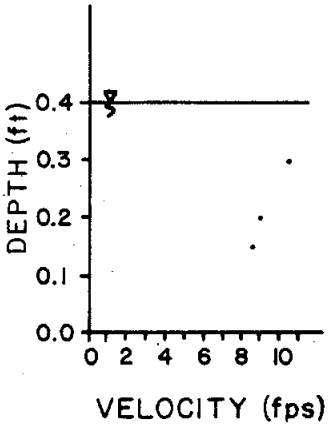


Culvert outlet





D-014
23 JUNE 1982
CULVERT EXIT

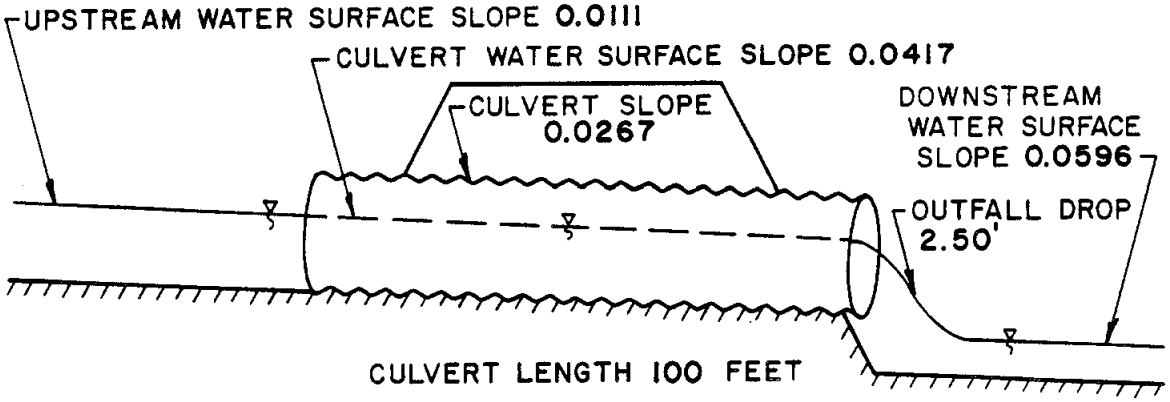


Site No. D-015 Unnamed Creek

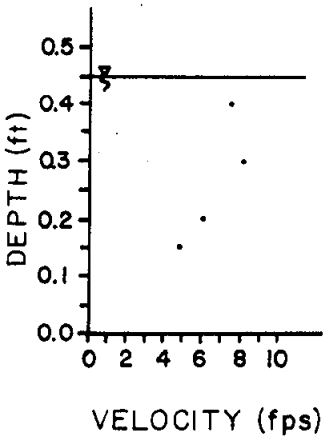
Location: Mile 89.9 Denali Highway

Map: Healy A-2, T20S, R1W, Sec. 1

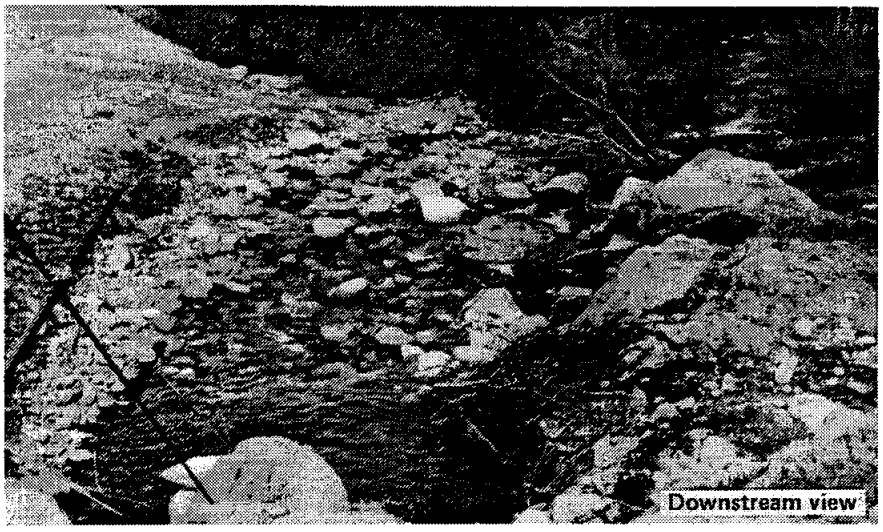
The creek at mile 89.9 on the Denali Highway was observed on June 23, 1982. The inlet and outlet depths were 2.00 and 0.45 ft, respectively. Pools were noted at both ends of the culvert: downstream was a smaller pool 12 ft in diameter and upstream was a larger 75 ft diameter pool. A high water mark was noted 1.42 ft above the existing water surface 104 ft upstream of the culvert. The bedload ranged from small to very large rocks. The water surface profile for the creek and culvert are shown in the diagram. The culvert slope changed substantially over the length of the culvert. Most of the drop through the culvert took place in a culvert section 30 to 40 ft from the culvert exit. Icing was a problem at this culvert, diverting some of the discharge to an overflow culvert to the east. The watershed area was 3.1 sq mi.



D-015
23 JUNE 1982
CULVERT EXIT




Culvert outlet


Downstream view

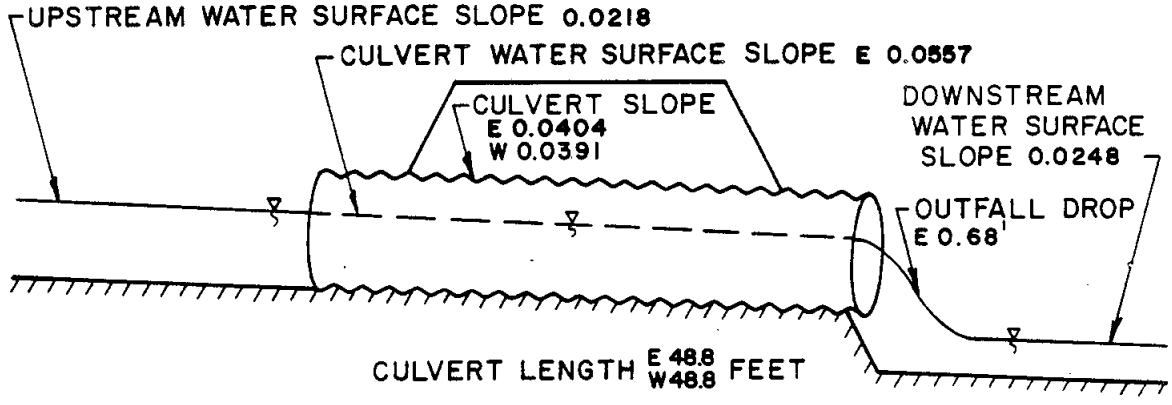
Site No. D-017 Unnamed Creek

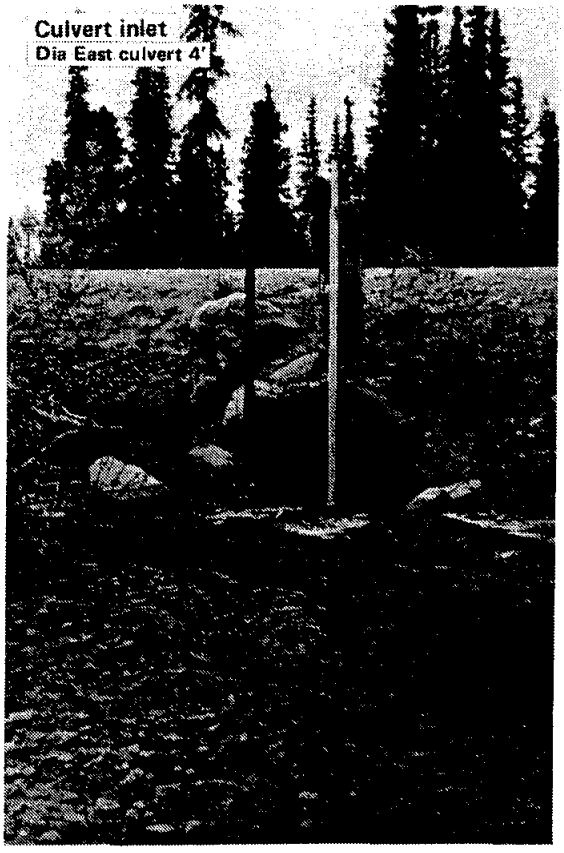
Location: Mile 99.4 Denali Highway

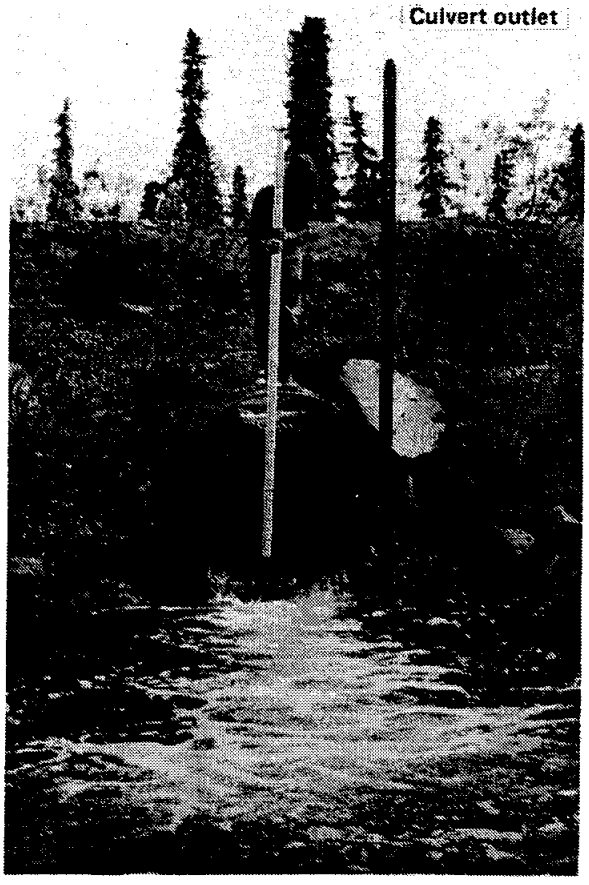
Map: Healy B-2, T19S, R2W, Sec. 10

Two culverts were located at this unnamed creek crossing along the Denali Highway. The slopes measured at this site are shown in the diagram. The majority of the measured flow (9.8 cfs on June 23, 1982) passed under the highway through the smaller eastern culvert. The measured water depths at the inlet and outlet of the west culvert were 0.15 and 0.20 ft, respectively. For the east culvert the inlet water depth was 1.15 ft and the outlet water depth was 0.71 ft. Both culverts were perched at the outlet. Two small interconnected pools (each about 20 ft in diameter) were noted at the downstream end of the culverts.

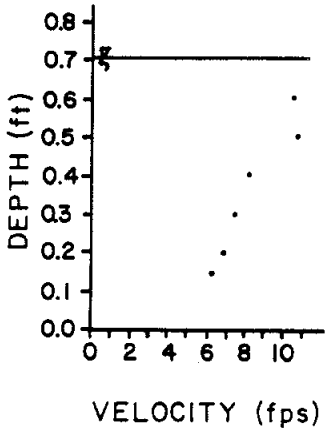
The owner of a nearby lodge stated summer flow in the creek approached 0 cfs. About 700 ft upstream of the culverts was a 4 ft drop that blocked any further fish passage. The estimated bedload size was 8 to 10 in diameter gravel. No drift was noted in either barrel. The watershed area was 5.9 sq mi.







D-017
23 JUNE 1982
CULVERT EXIT

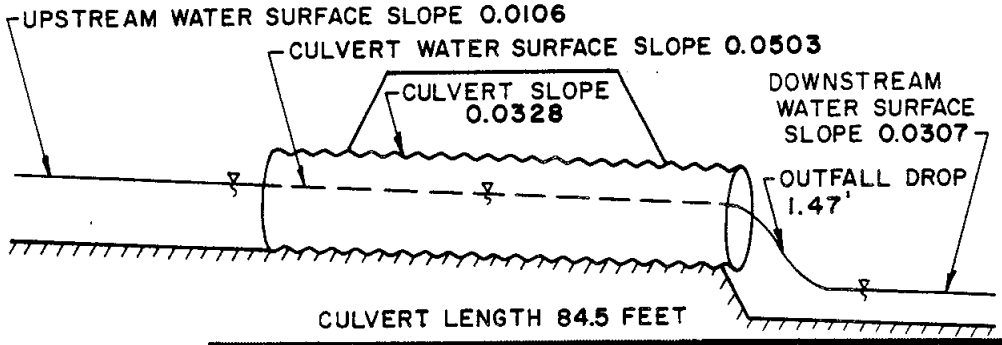


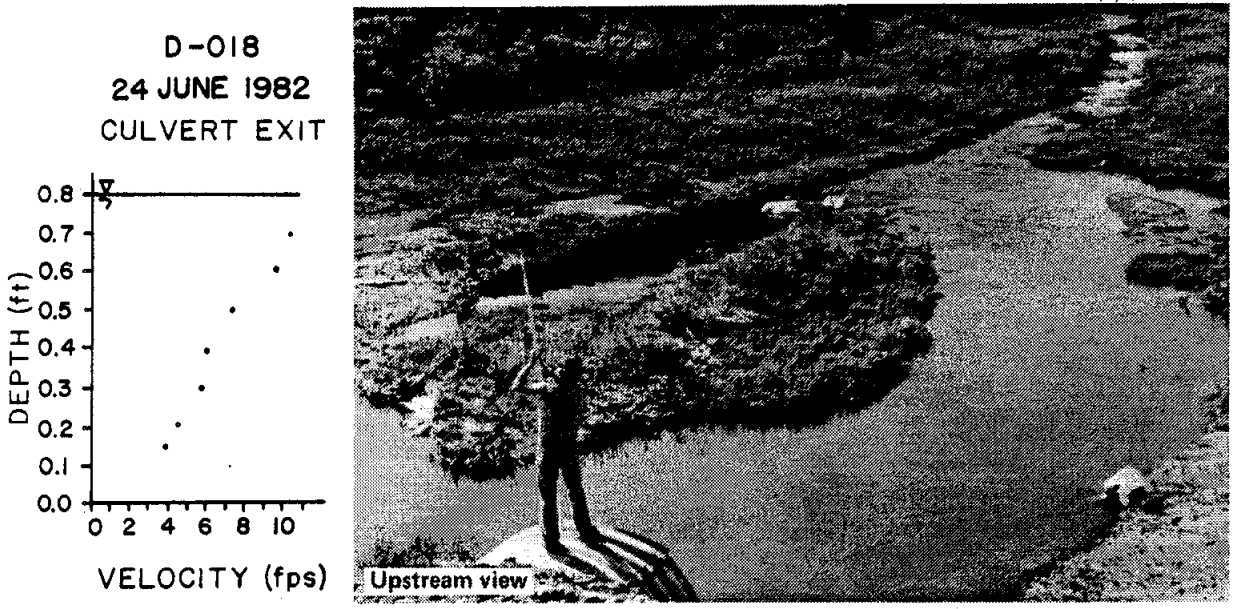
Site No. D-018 Stixkwan Creek

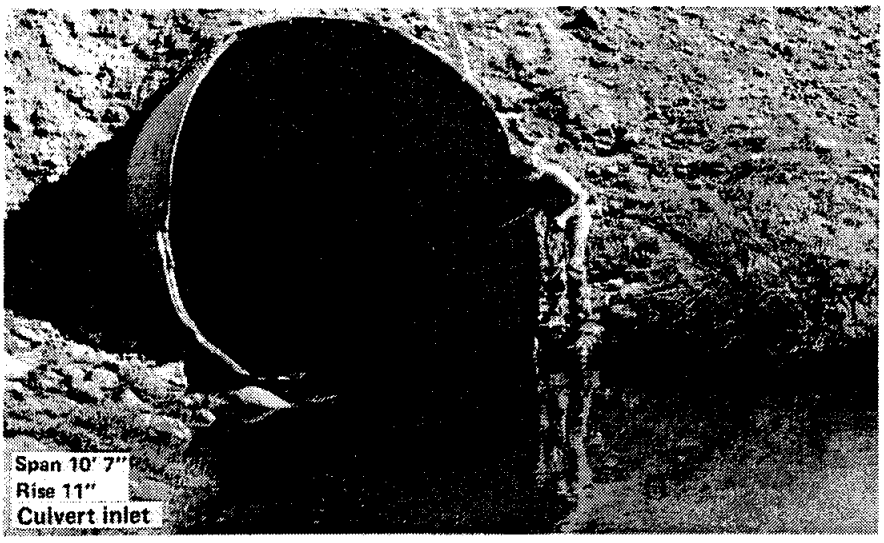
Location: Mile 107.2 Denali Highway

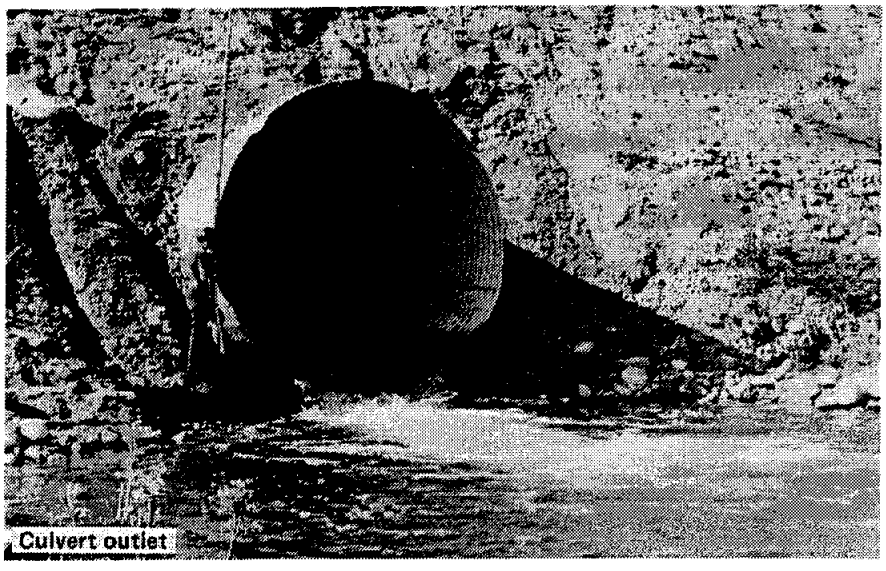
Map: Healy B-3, T19S, R3W, Sec. 4

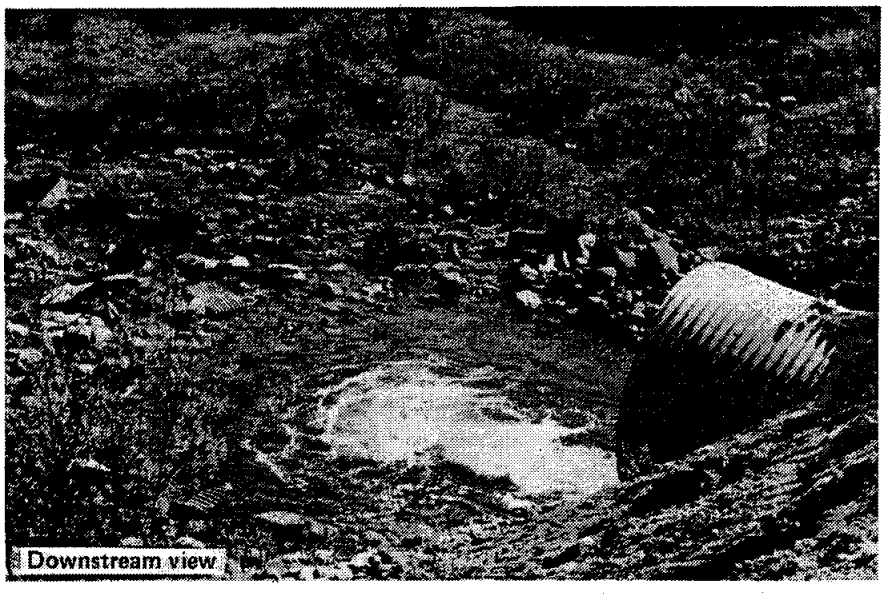
On June 24, 1982, measurements were made at Stixkwan Creek along the Denali Highway. The surveyed water surface profile is shown in the diagram. The single culvert had a middle section 10 ft in diameter. Extensions on both ends of the culvert resulted in nonuniform dimensions at the culvert entrance and exit. The span and rise at the inlet was 9.6 and 10.0 ft, respectively, while the span and rise at the outlet was 10.6 and 11.0 ft, respectively. The water depth at the inlet was 1.10 ft and the water depth at the outlet was 0.80 ft. The discharge measurement (14.6 cfs) was poor due to rocks in the stream channel. The bedload size ranged from 2 to 12 in in diameter and the barrel was clean, however, this stream carried considerable suspended sediments. Pools were present both upstream and downstream of the culvert: downstream was a 25 ft diameter pool while upstream was a long pool 100 by 20 ft. Grayling were noted in the upstream pool. The upstream slope included several drops; the downstream slope measurement was more uniform and representative of the stream gradient. The watershed area was 8.6 sq mi.






Span 10' 7"
Rise 11"
Culvert inlet


Culvert outlet

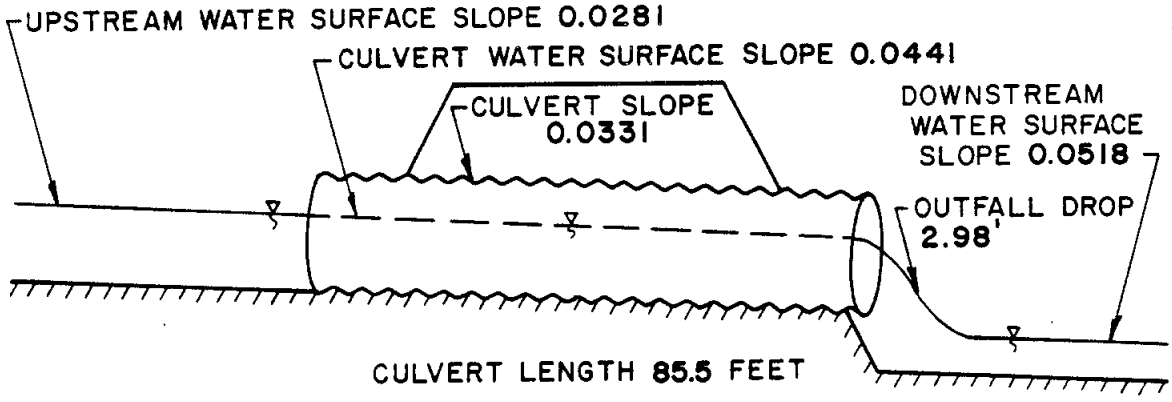

Downstream view

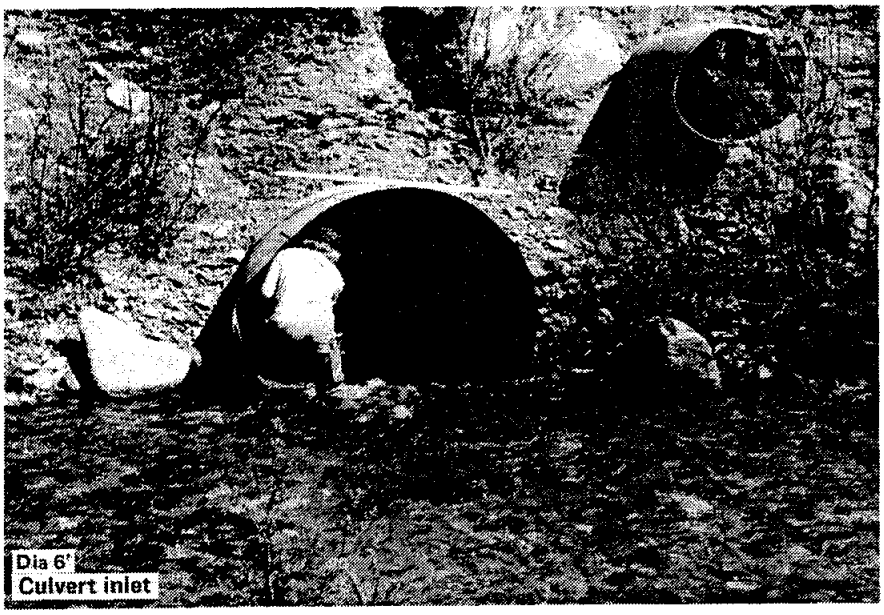
Site No. D-019 Lily Creek

Location: Mile 112.0 Denali Highway

Map: Healy B-3, T18S, R4W, Sec. 26

Lily Creek was observed on June 24, 1982. The inlet and outlet water depths were 1.60 and 0.95 ft, respectively. At the culvert outlet was a 25 ft diameter scour pool and the barrel was perched. A 3 ft diameter overflow culvert was dry. The bedload consisted of fine to small gravel upstream of the culvert and up to 6 in diameter gravel downstream. The culvert contained no drift although some ice remained inside the barrel. The surveyed slopes are shown in the diagram. The upstream slope was less than the downstream slope, and about 100 ft of the stream channel above the culvert was braided. The watershed area was 5.8 sq mi.




Dia 6'
Culvert inlet


Culvert outlet

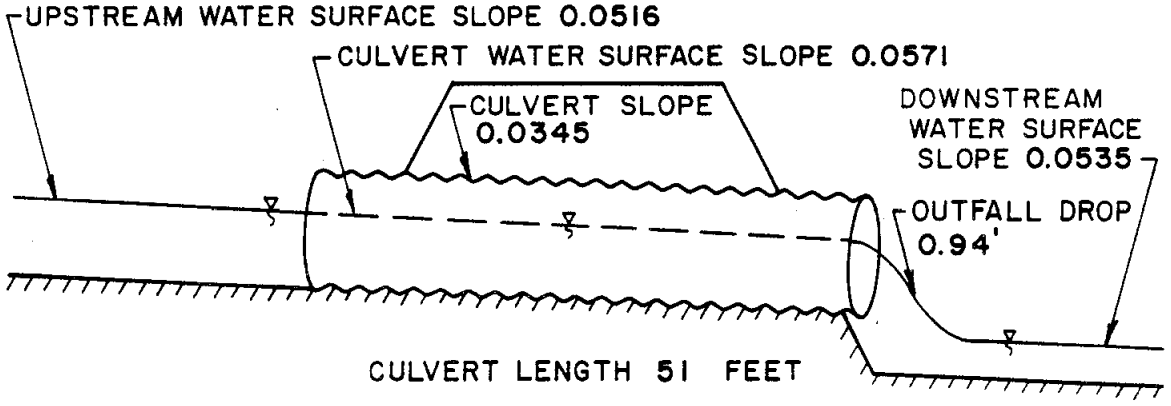

Downstream view

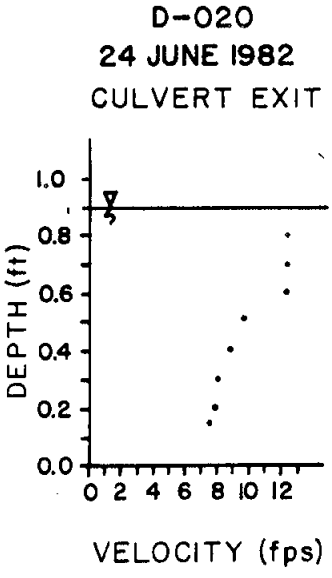
Site No. D-020 Unnamed Creek

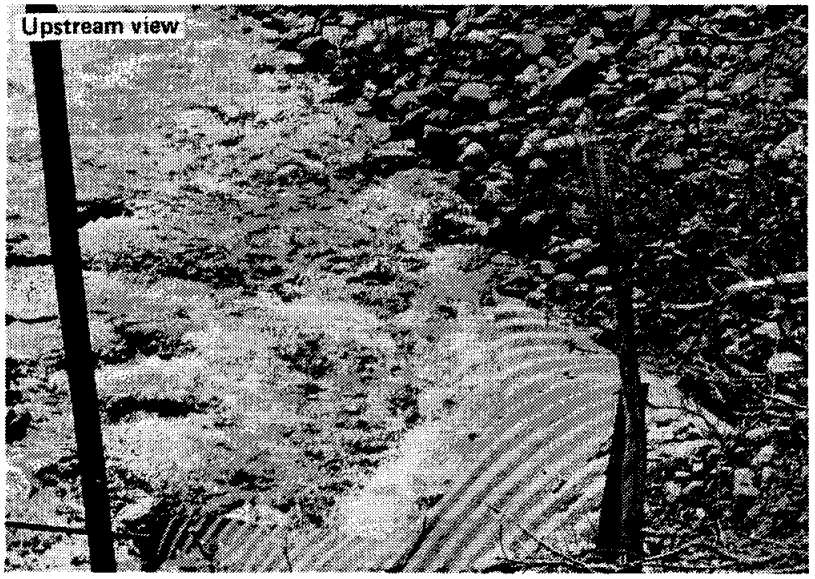
Location: Mile 117.3 Denali Highway

Map: Healy B-3, T18S, R4W, Sec. 7

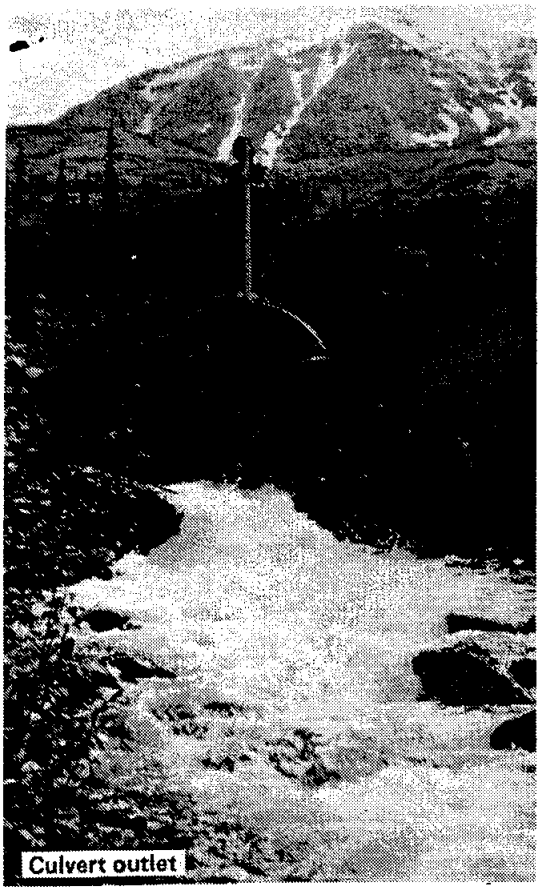
A single perched culvert contained the discharge from this high gradient stream on June 24, 1982. A discharge measurement was not obtained due to the rocky, shallow stream channel. The drop at the culvert outlet was 0.94 ft, and the water depth was 0.90 ft. The survey results are shown in the diagram. Within 15 ft of the culvert outlet, a 1.62 ft drop occurred. There was a very small turbulent scour pool at the culvert exit. The estimated bedload size was very large cobbles. The culvert was clean, although the barrel was about half full of ice; the ice was no obstruction to the flow. Ice was also present upstream of the culvert and had damaged the entrance. The water depth at the culvert inlet was 1.35 ft. The watershed area was 1.75 sq mi.








Dia 6'
Culvert inlet


Culvert outlet

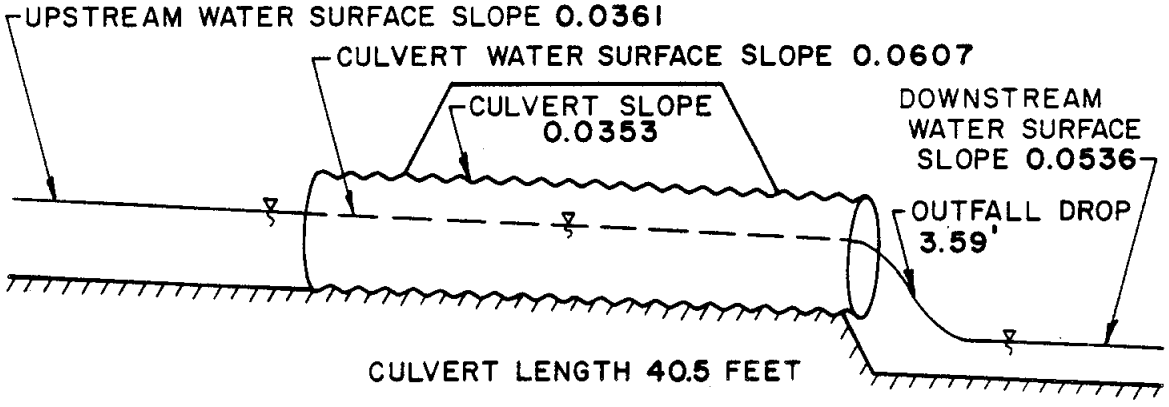

Downstream view

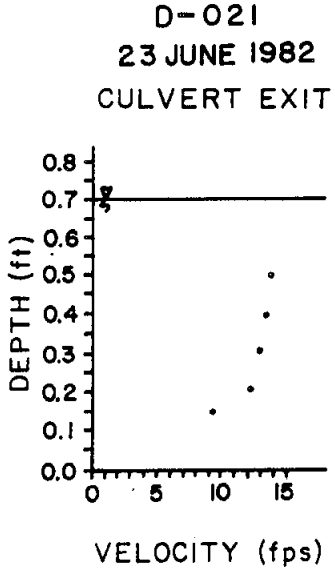
Site No. D-021 Unnamed Creek

Location: Mile 118.2 Denali Highway

Map: Healy B-3, T18S, R5W, Sec. 1

The unnamed stream at this location was observed on June 23, 1982. The water depths at the culvert inlet and outlet were 1.00 and 0.70 ft, respectively. The estimated bedload size was large cobbles; the culvert barrel was clean. Because of the large cobbles and shallow water depths, no streamflow measurement was taken. The water surface dropped 3.59 ft within 10 ft of the culvert exit. The watershed area was 2.65 sq mi.






Span 5'
Rise 3'
Culvert inlet


Culvert outlet


Downstream view

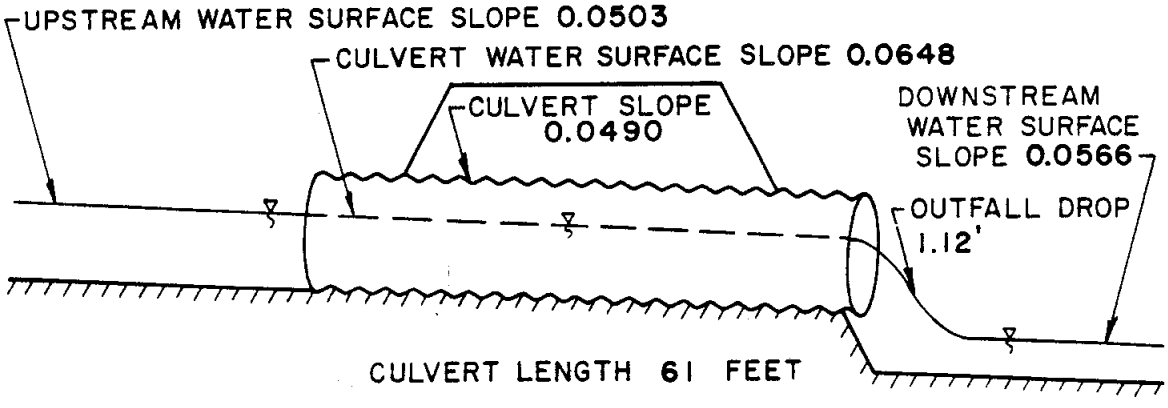
Site No. D-022 Edmonds Creek

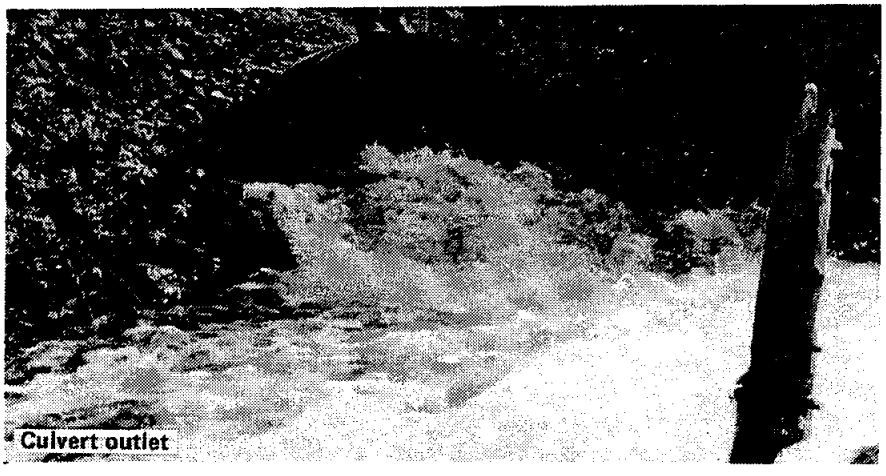
Location: Mile 121.2 Denali Highway

Map: Healy B-4, T17S, R5W, Sec. 33

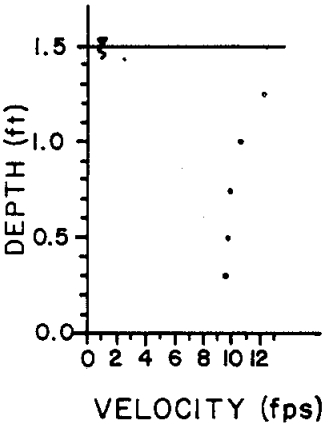
Measurements at Edmonds Creek were taken on June 24, 1982. No flow measurement was obtained due to the large cobbles in the streambed and relatively shallow water depth. The results of the surveying are shown in the diagram. The culvert barrel was clean, but slightly broken at the downstream end. The channel below the culvert contained debris and was ill defined; a new channel was in the process of being cut. The estimated bedload size was large cobbles. Culvert inlet and outlet water depths were 1.80 and 1.50 ft, respectively. A high water mark was surveyed 1.24 ft above the existing water surface 30 ft upstream from the culvert. The watershed area was 7.5 sq mi.


Upstream view





D-022
24 JUNE 1982
CULVERT EXIT

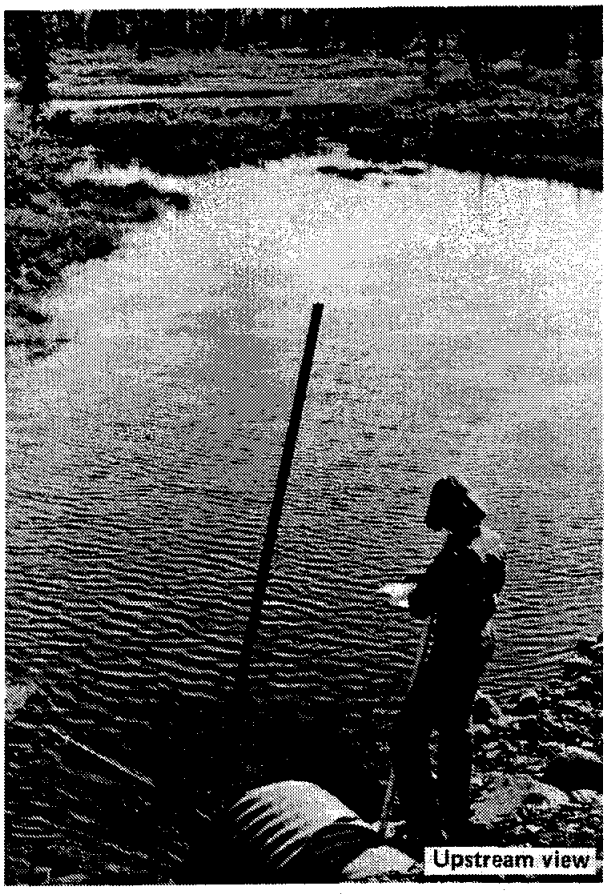


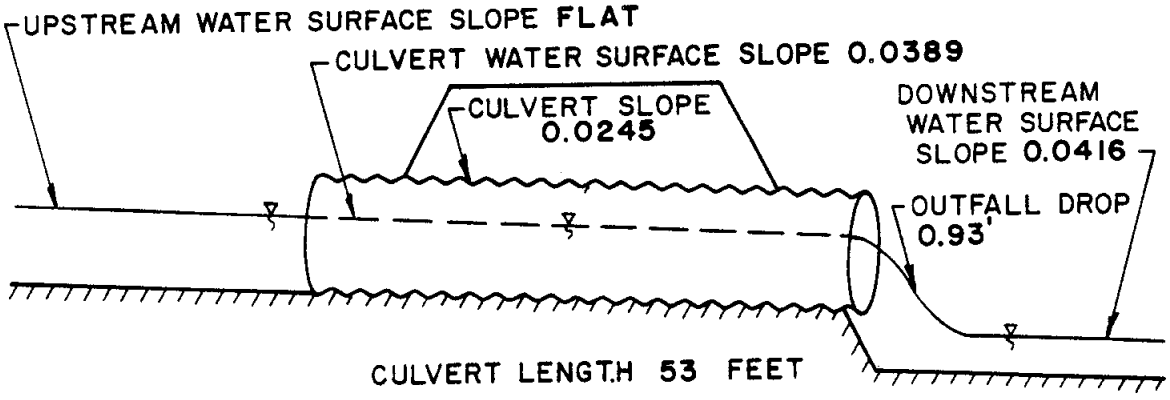
Site No. D-023 Unnamed Creek

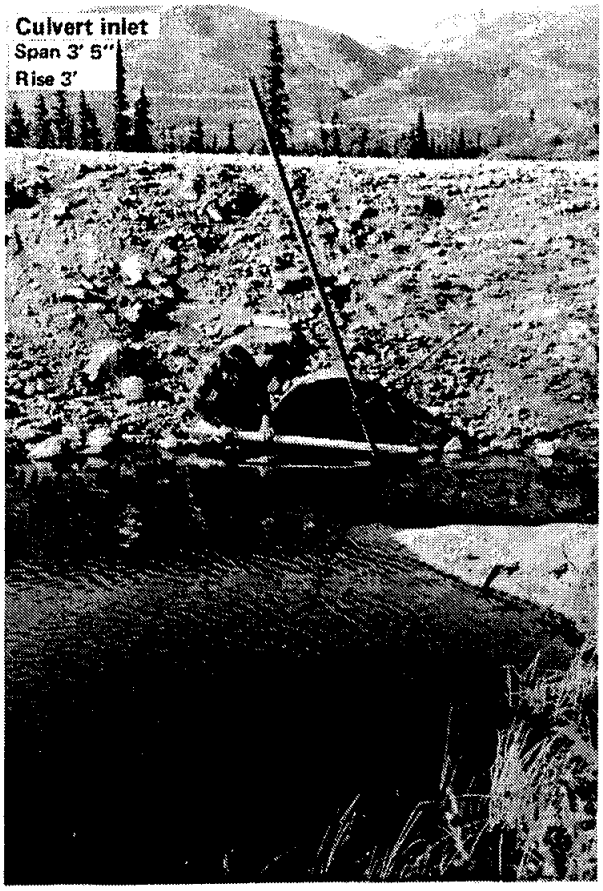
Location: Mile 123.7 Denali Highway

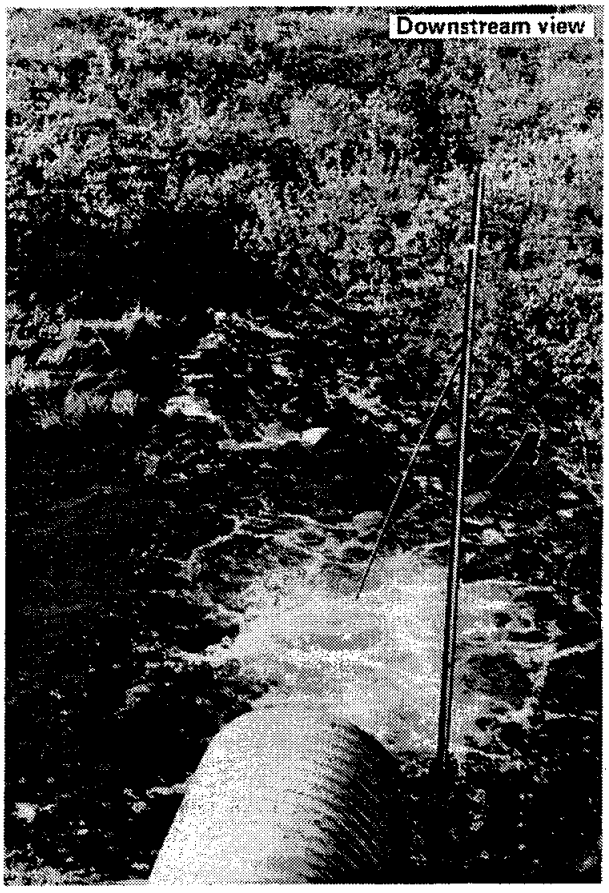
Map: Healy B-4, T18S, R6W, Sec. 1

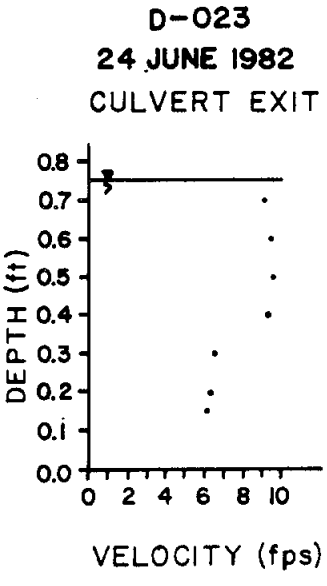
Measurements were taken on this unnamed creek on June 24, 1982. The water depth at the culvert exit was 0.75 ft and the water surface drop was 0.93 ft out of the culvert to the downstream pool. The downstream pool was about 10 ft in diameter, and the upstream pool was 100 by 150 ft. Above the upstream pool was a beaver dam and pond. In view of the flat water surface slope no upstream slope measurement was taken. The other slope measurements appear in the diagram. The culvert barrel was clean except for some debris tangled in the thaw pipe; the estimated bedload size was very fine material to small gravel. Small 3 inch fish (grayling?) were observed in the upstream pool. The watershed area was 1.35 sq mi.

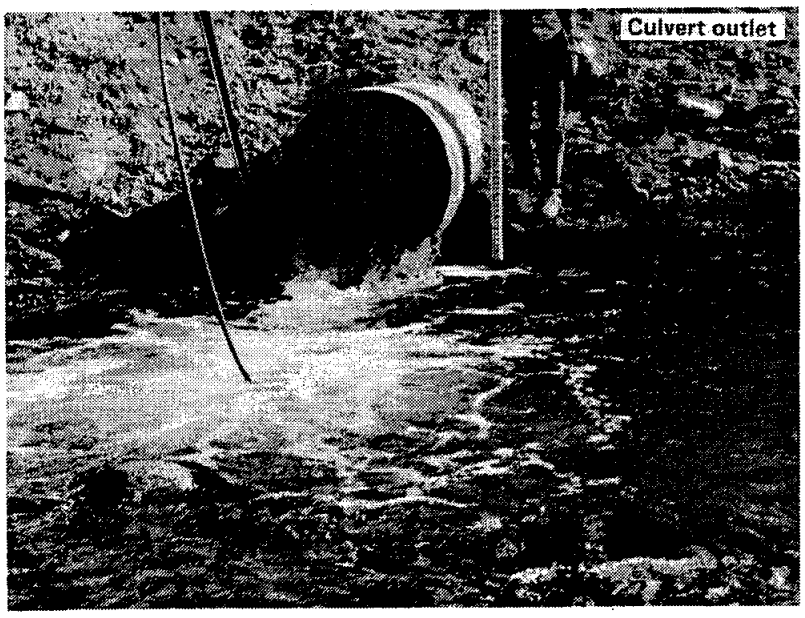





Culvert inlet
Span 3' 5"
Rise 3'


Downstream view


D-023
24 JUNE 1982
CULVERT EXIT
DEPTH (ft)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0 2 4 6 8 10
VELOCITY (fps)


Culvert outlet

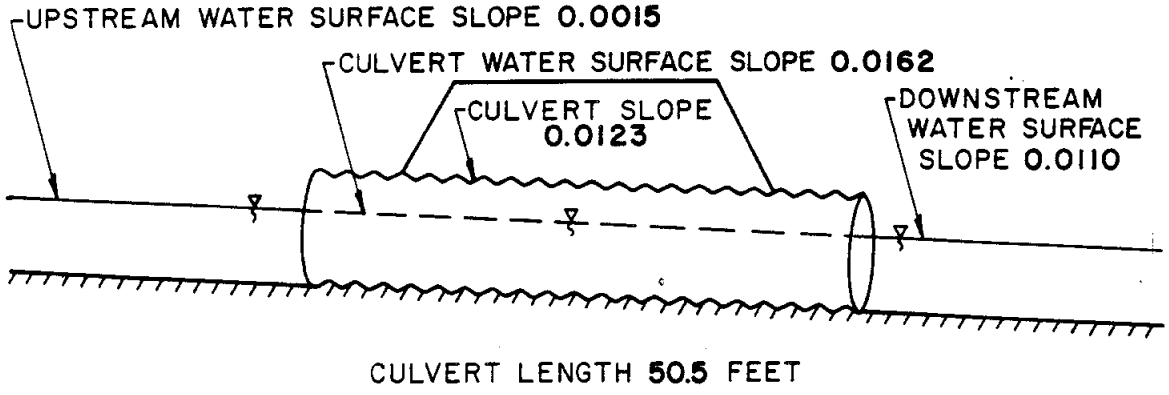
Site No. D-024 Unnamed Creek

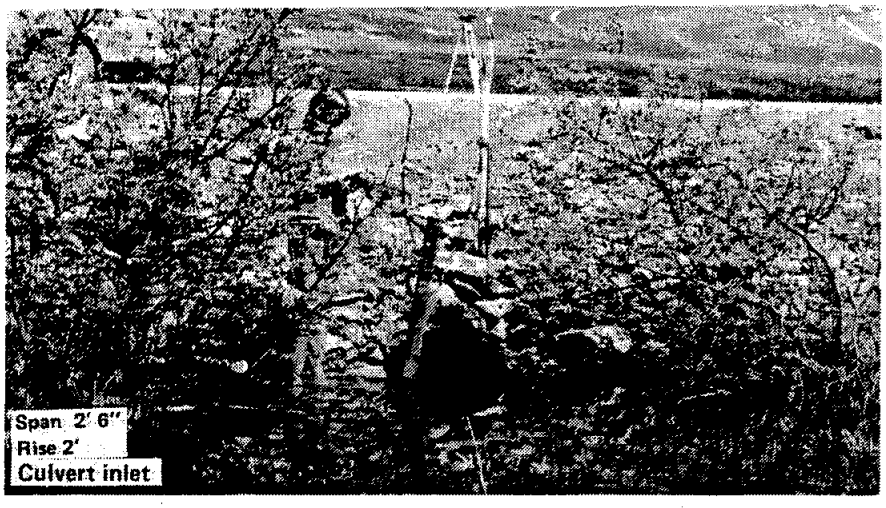
Location: Mile 130.7 Denali Highway

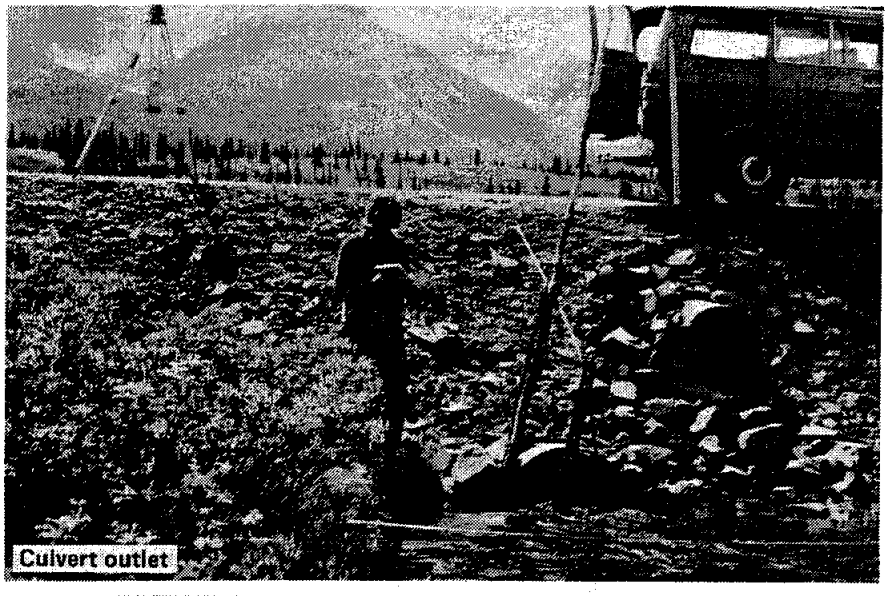
Map: Healy B-4, T18S, R7W, Sec. 12

The flow was 4.0 cfs at this unnamed creek on June 25, 1982. The water surface profile for the creek and culvert is shown in the diagram. The water depth at the culvert outlet was 0.80 ft. The estimated bedload was fine material, and the culvert barrel was clean. Pools were observed at both ends of the culvert: upstream was a pool about 15 ft long; downstream was a shallow pool 15 ft in diameter. Four inch grayling (?) were observed in the upstream pool. The culvert barrel was broken and pushed upwards at the entrance. The watershed boundaries were insufficiently defined to obtain an accurate area measurement.

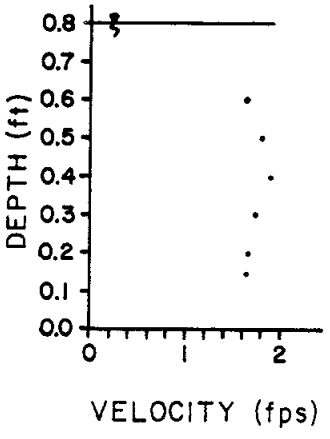

Upstream view







D-024
25 JUNE 1982
CULVERT EXIT

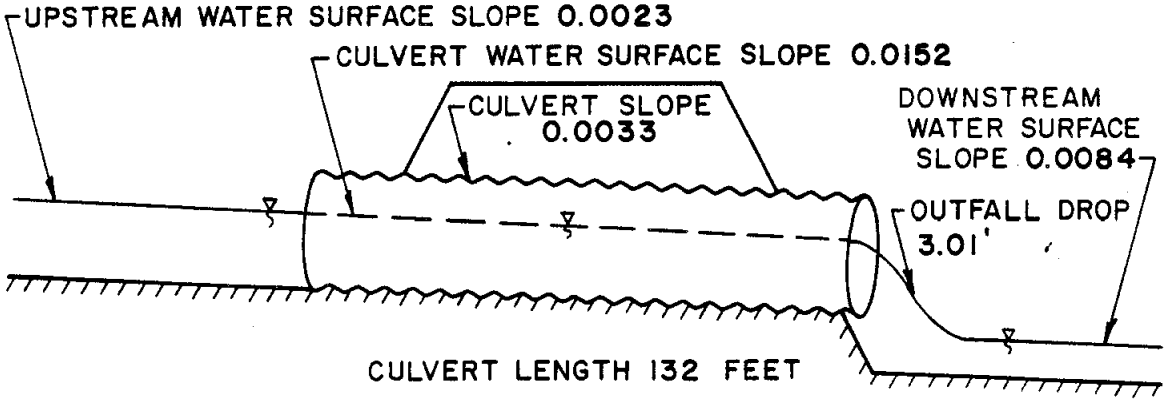


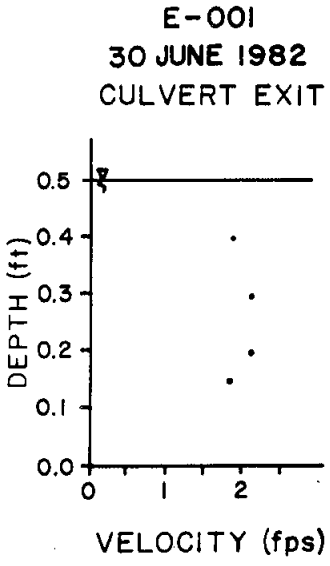
Site No. E-001 Dome Creek

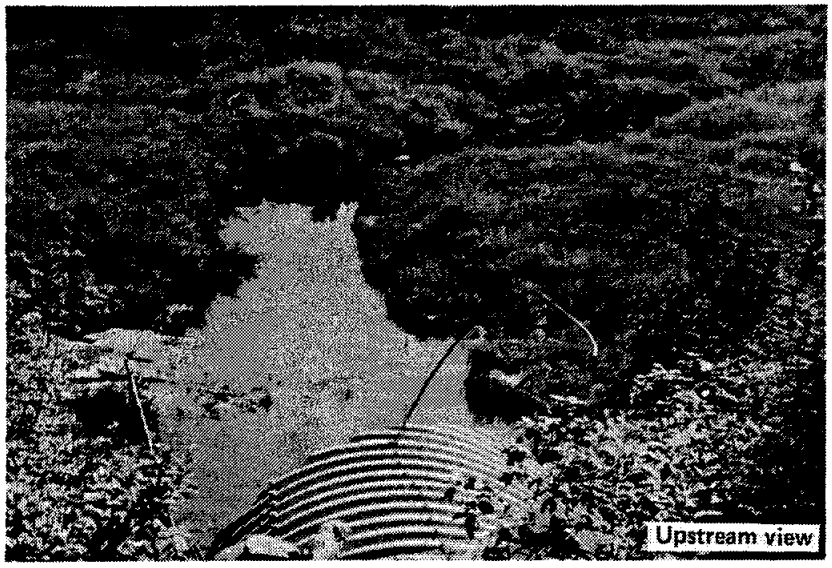
Location: Mile 8 Elliott Highway

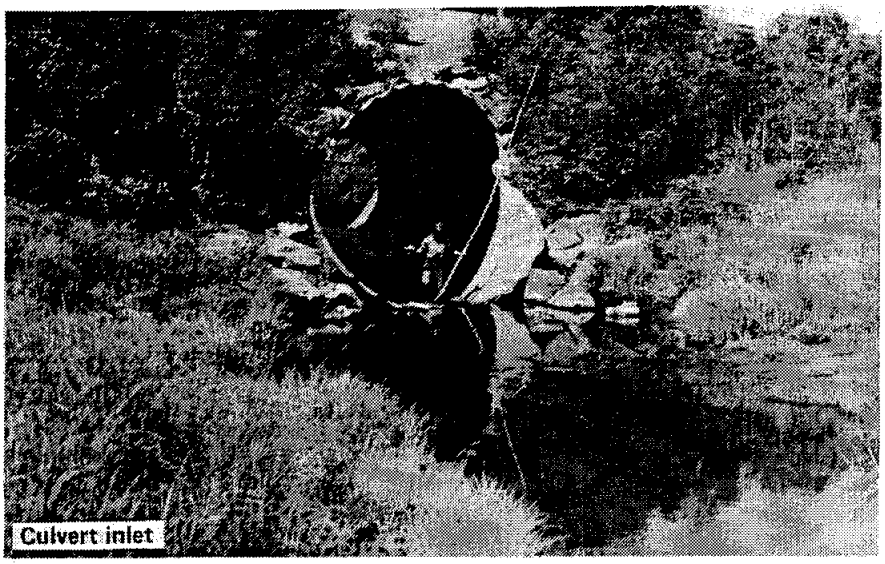
Map: Livengood A-2, T3N, R1W, Sec. 25

Observations were first made at Dome Creek on June 30, 1982. The discharge through the culvert at this time was 3.8 cfs. The surveyed slopes for the stream and culvert are shown in the diagram. Upstream of the culvert was a pool 10 ft wide and 20 ft long. The barrel was bent upwards at the entrance so the water depth just outside of the barrel was 1.40 ft and the water depth just inside of the culvert was 0.35 ft. The barrel was clean except for some large pieces of riprap in the first 15 ft of the culvert. The culvert outlet was perched and the water depth was 0.50 ft. No pool was observed downstream. The bedload size was estimated as fine sand and silt. A 2 ft diameter overflow culvert located 400 ft to the north was dry. The watershed area was 11.2 sq mi.



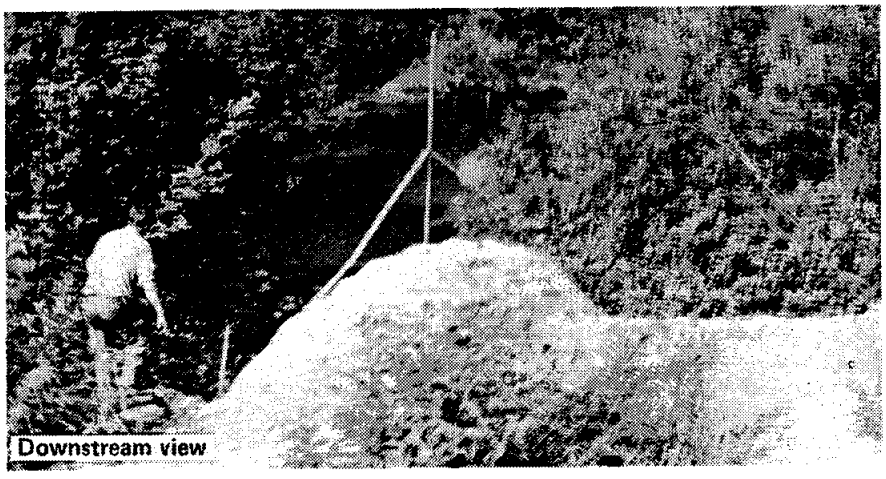






Culvert inlet

Culvert outlet



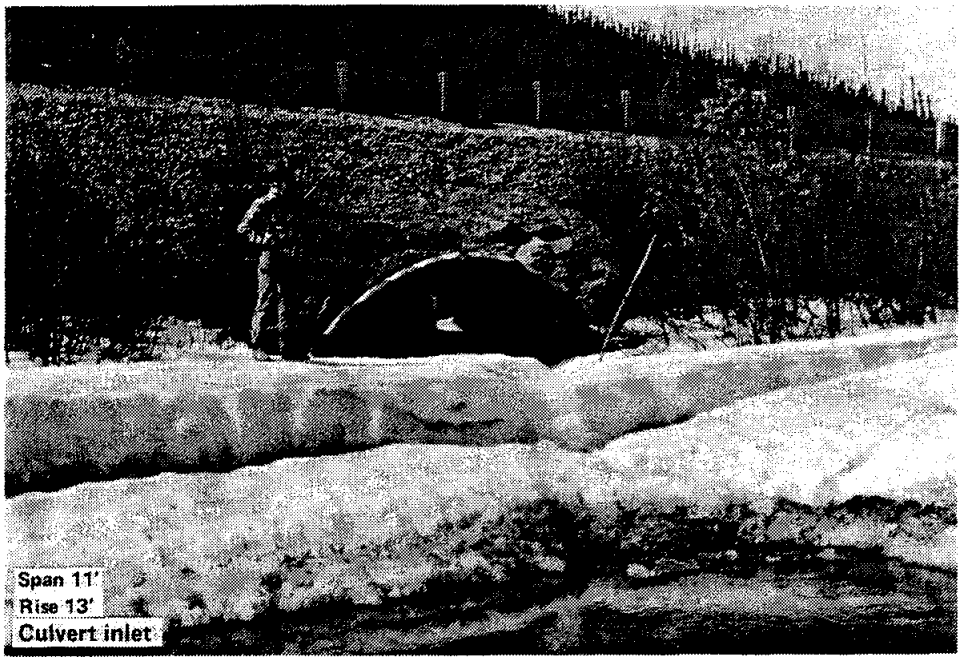
Downstream view

Site No. E-001 Dome Creek

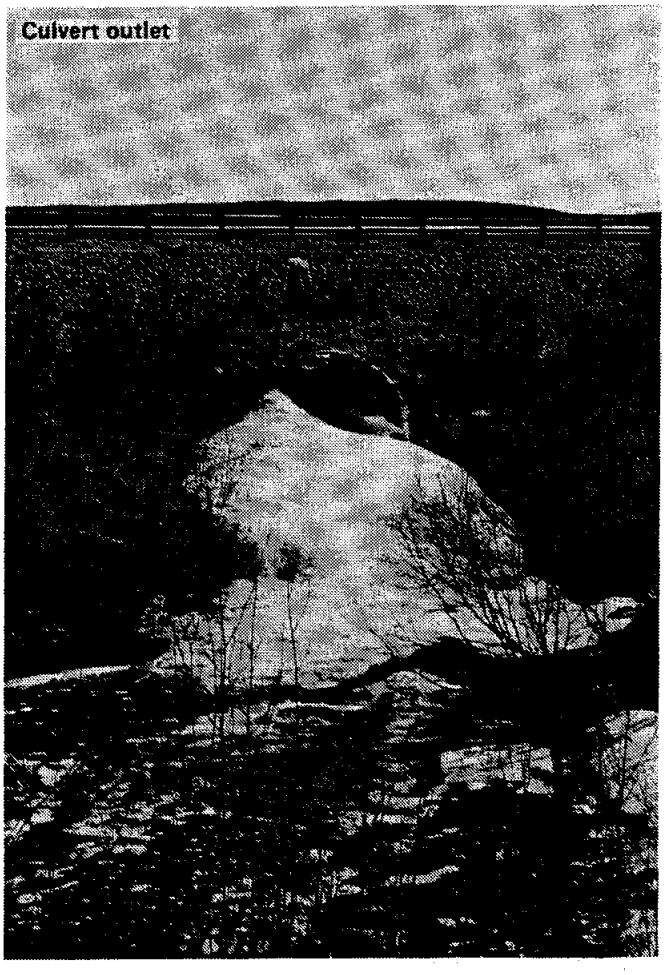
Location: Mile 8 Elliott Highway

Map: Livengood A-2, T3N, R1W, Sec. 25

This site was visited a second time on May 9, 1983. Although no measurements were made, the pictures on these two pages show the severe icing conditions that occurred at this culvert. Water was flowing through the culvert at this time in a channel cut in the ice. Upstream of the culvert, water flowed over the ice and snow; the natural streambed was not visible. Downstream of the culvert the water was contained in the stream channel, although some ice was noted along the banks.



Span 11'
Rise 13'
Culvert inlet



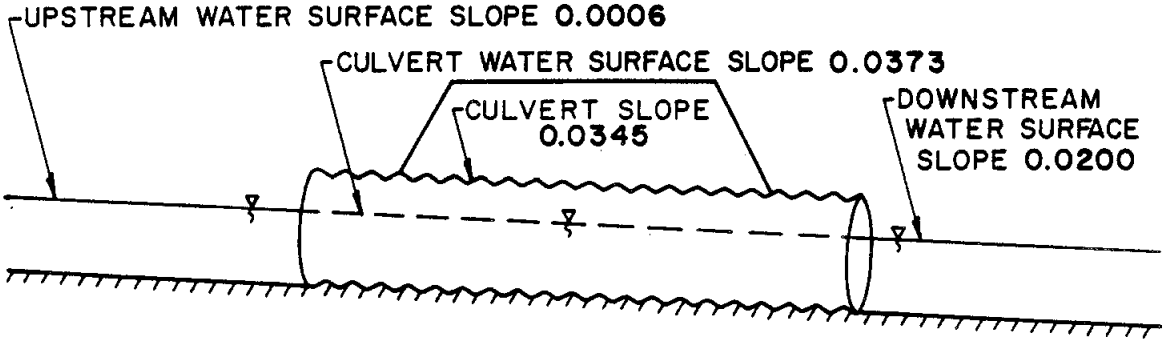
Culvert outlet

Site No. E-002 Cushman Creek

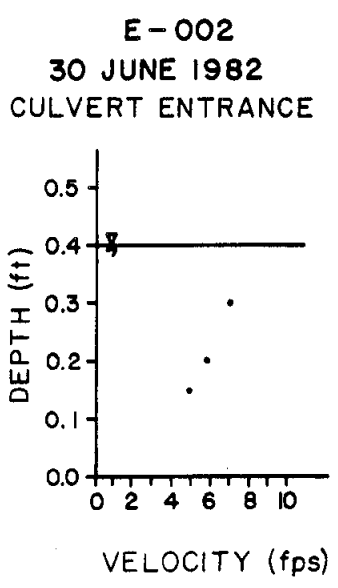
Location: Mile 20.5 Elliott Highway

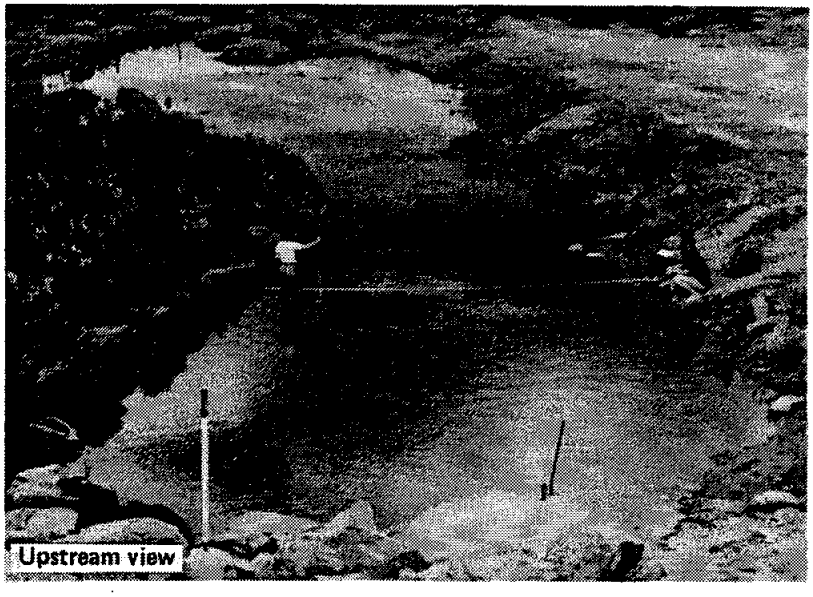
Map: Livengood A-2, T4N, R2W, Sec. 23

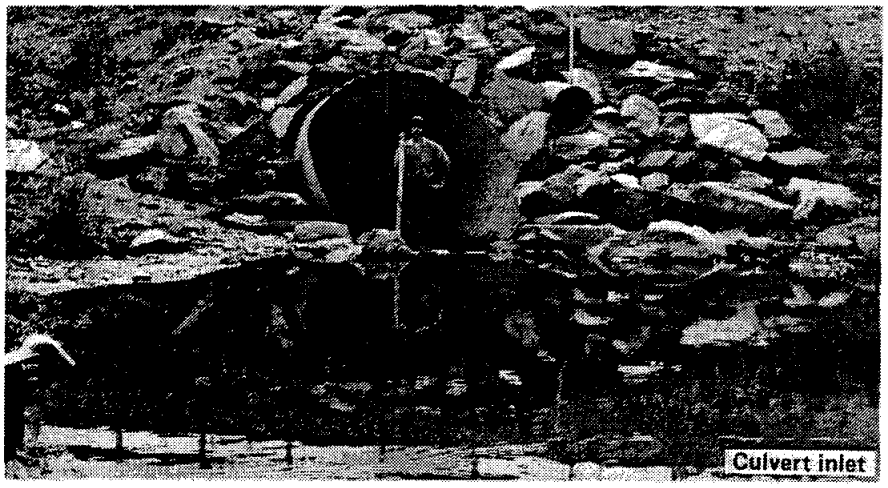
Cushman Creek along the Elliott Highway was first observed on June 30, 1982. The flow through the culvert was 3.7 cfs and drained a watershed area of 7.3 sq mi. The total water depth at the culvert inlet was 0.40 ft and the total depth at the outlet was 0.60 ft. The estimated bedload was fine sand and silt. The barrel was clean except for some large pieces of riprap in the last 20 ft of the culvert. A 50 ft diameter pool upstream of the culvert contained fish fry. Thirty-five ft downstream of the culvert the stream made a 90° bend, providing some quiet water along the bank for fish rest areas. The water surface profiles for the stream and culverts appear in the diagram. Most of the measured downstream drop occurred in the distance between the culvert outlet and the 90° bend (2.17 ft/39 ft).

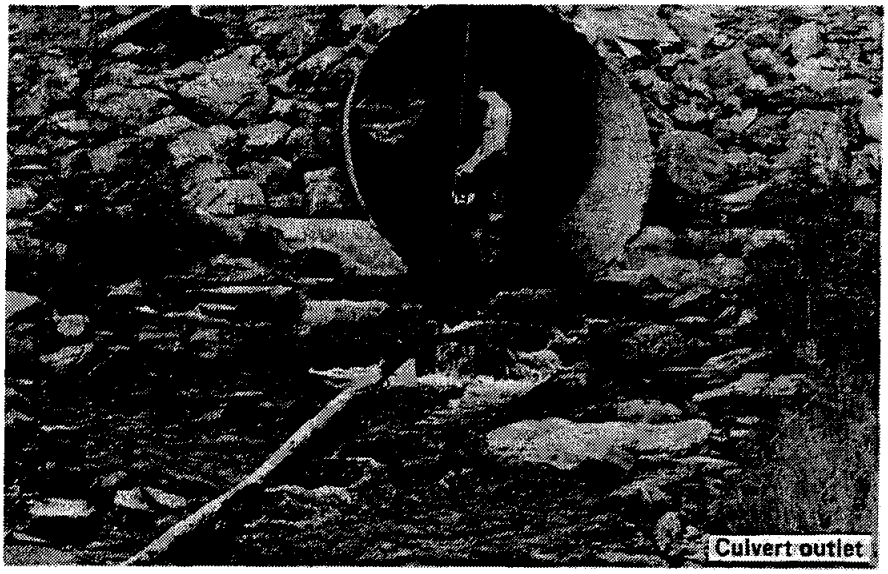


CULVERT LENGTH 117 FEET

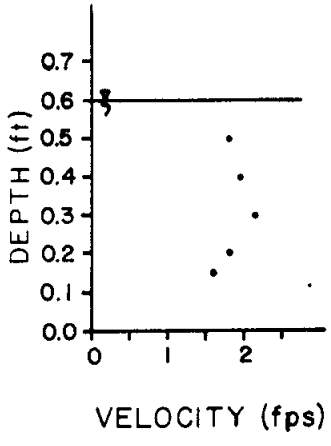





Culvert inlet


Culvert outlet

E-002
30 JUNE 1982
CULVERT EXIT



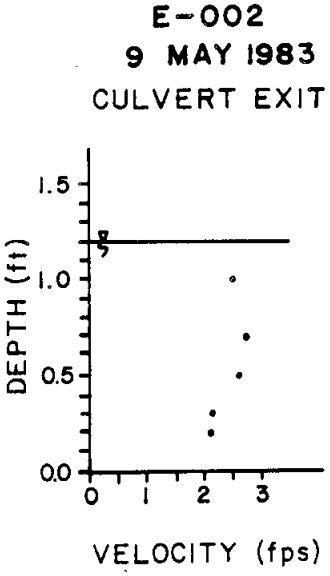

Downstream view

Site No. E-002 Cushman Creek

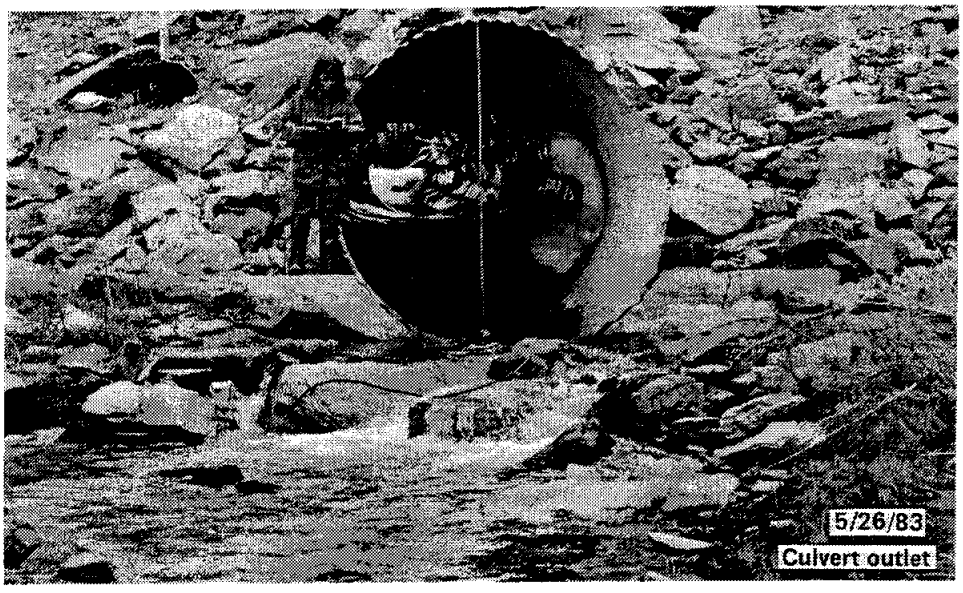
Location: Mile 20.5 Elliott Highway

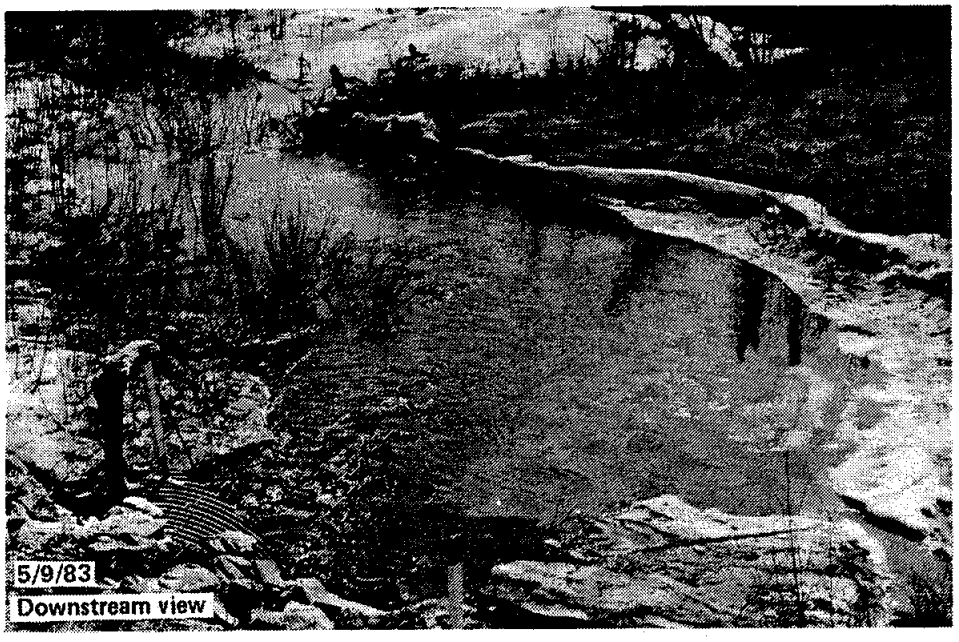
Map: Livengood A-2, T4N, R2W, Sec. 23

A higher flow was observed the following year at Cushman Creek on May 9, although no discharge measurement was taken. Pictures show the icing conditions at this location on May 9 and May 26, 1983. The flow receded to 2.8 cfs by May 26. The inlet depth was 0.40 ft and the outlet depth was 0.45 ft.




Culvert outlet
5/9/83
Dia 8'


5/26/83
Culvert outlet

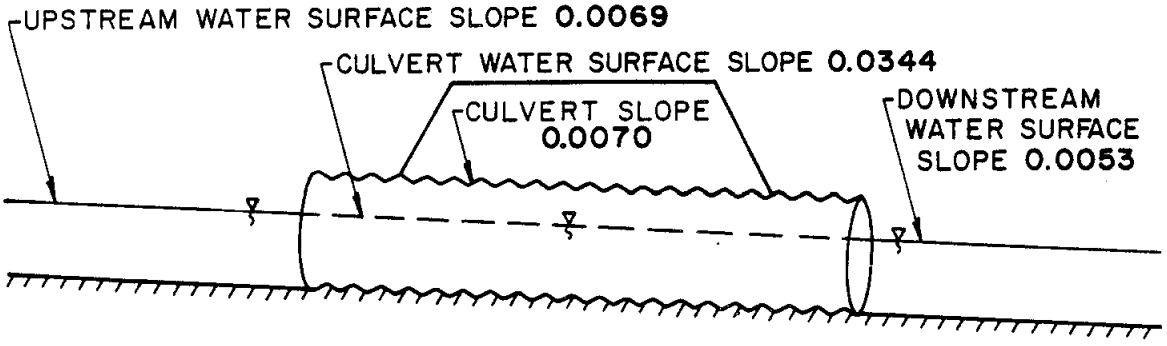

5/9/83
Downstream view

Site No. E-003 Globe Creek (South Crossing)

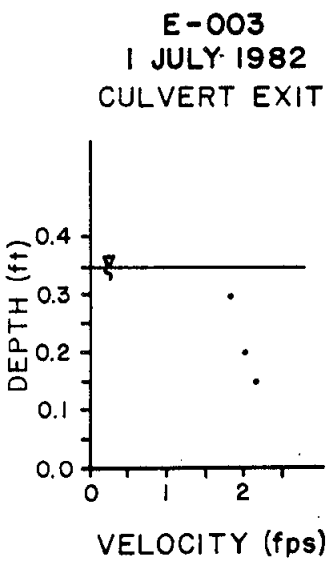
Location: Mile 35 Elliott Highway

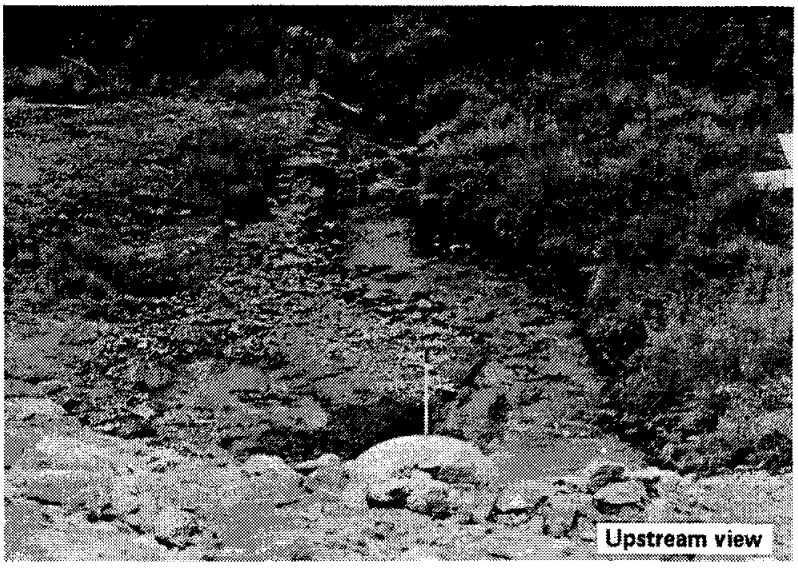
Map: Livengood A-3, T5N, R3W, Sec. 22

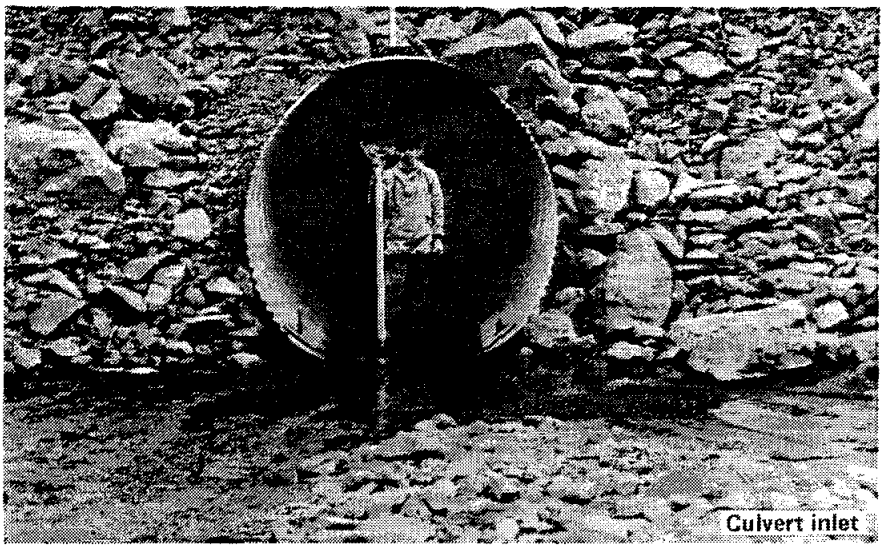
Measurements were first taken at Globe Creek on July 1, 1982. The observed discharge was 1.5 cfs and the surveyed slopes are shown in the diagram. The estimated bedload was sand and silt. The culvert barrel contained some small gravel (1 to 2 in in diameter) and rocks (up to 4 in in diameter). Some small breaks in the culvert slope occurred where barrel sections were joined together. The water depth at the culvert outlet was 0.35 ft. The stream made a 90° bend at the culvert exit. The watershed area was 13.6 sq mi.



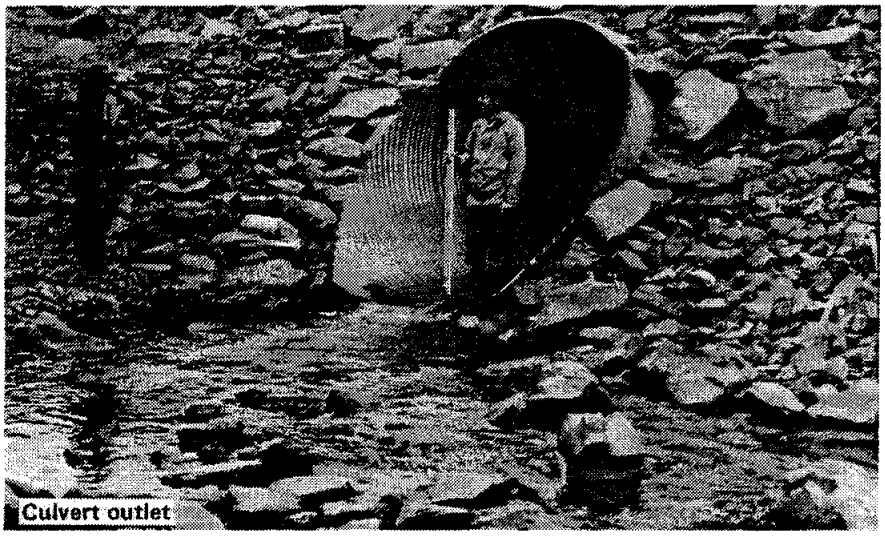
CULVERT LENGTH 142 FEET



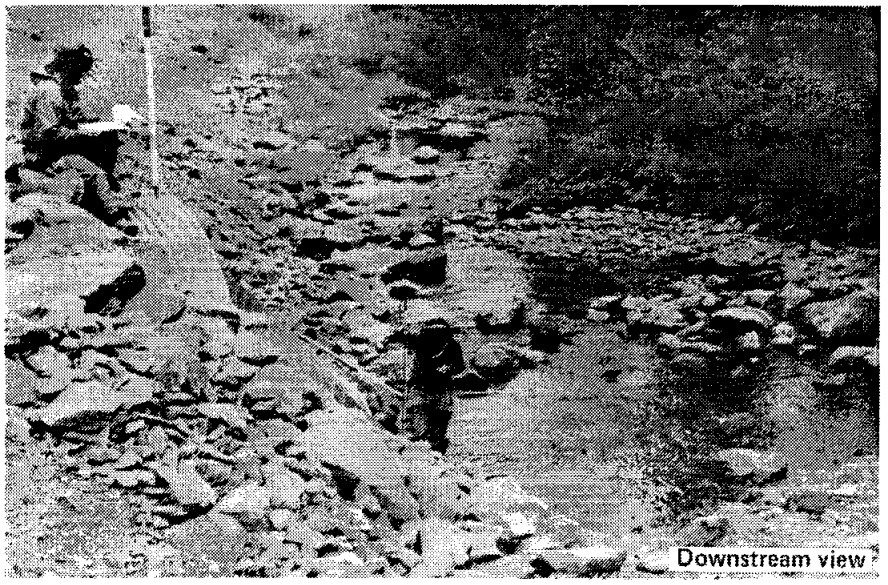




Culvert inlet



Culvert outlet



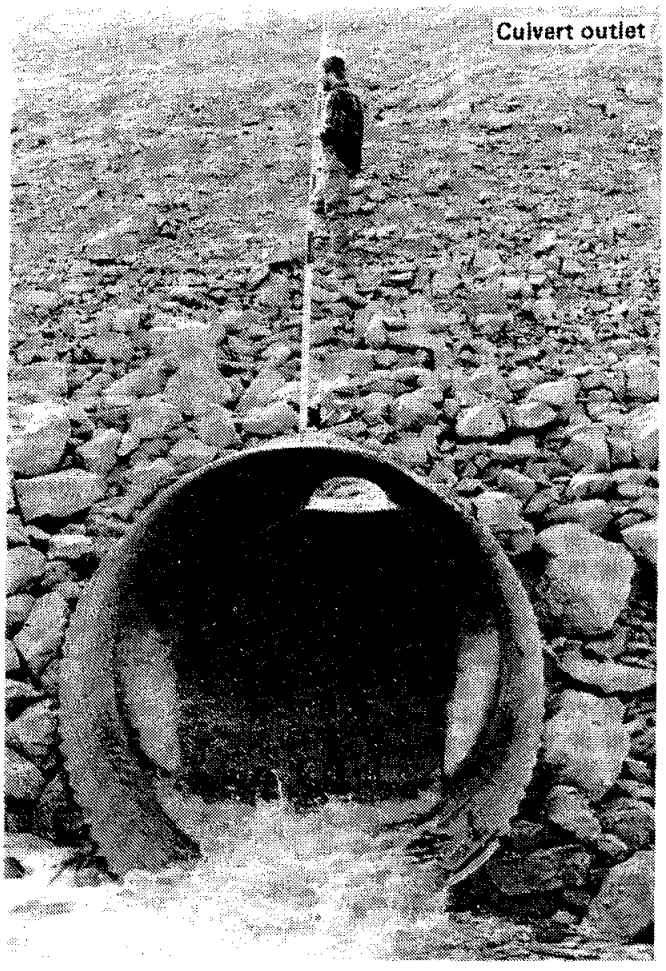
Downstream view

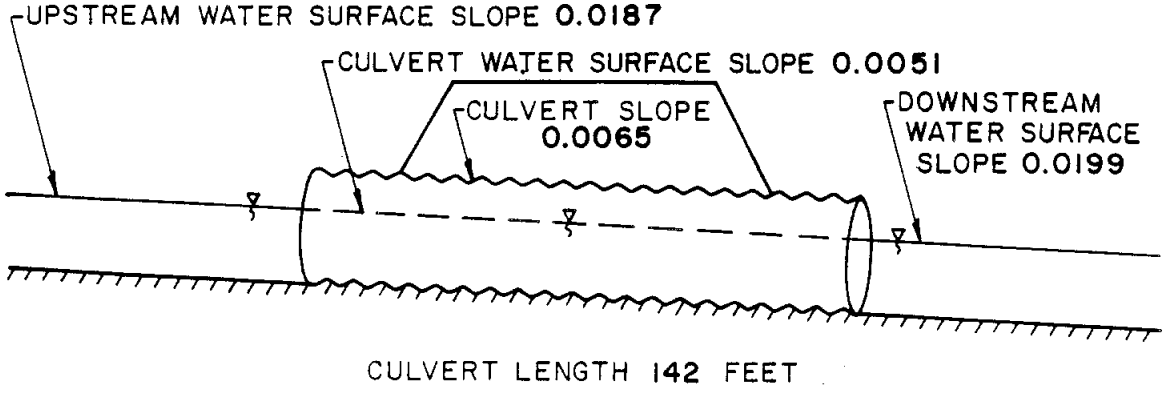
Site No. E-003 Globe Creek (South Crossing)

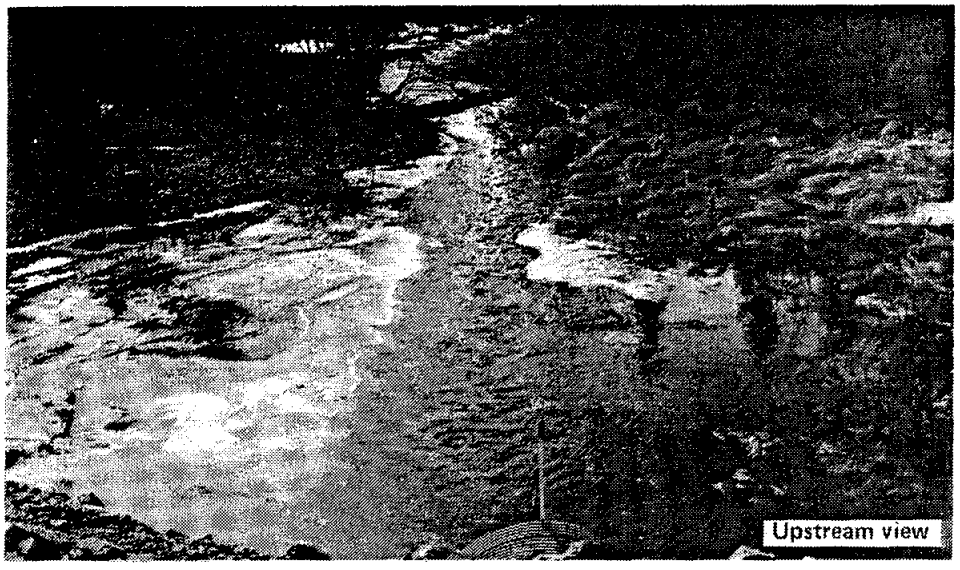
Location: Mile 35 Elliott Highway

Map: Livengood A-3, T5N, R3W, Sec. 22

Measurements were taken a second time at Globe Creek on May 9, 1983. The measured flow was 15.6 cfs. The survey results of the water surface profile are shown in the diagram. Ice in the culvert acted like a weir: there was a large pool at the culvert inlet and an ice spillway at the culvert outlet. After exiting from the culvert, the water flowed at a 90° angle from the culvert.






Upstream view


Dia 8'
Culvert inlet

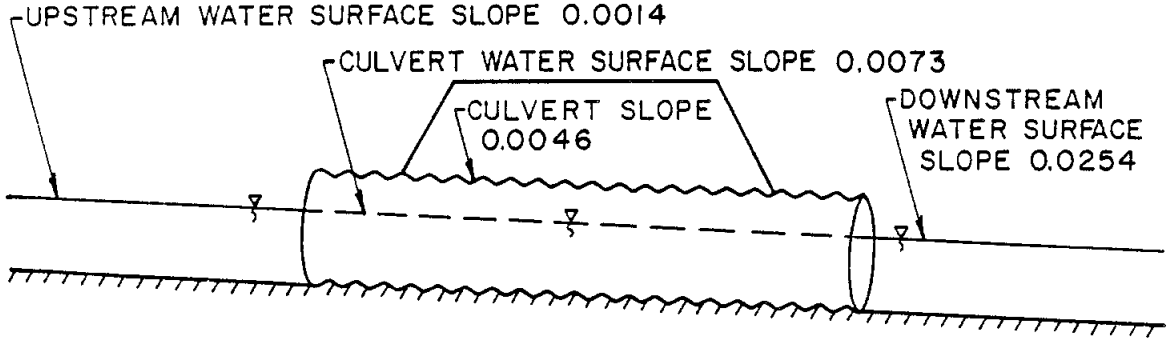

Downstream view

Site No. E-004 Globe Creek (North Crossing)

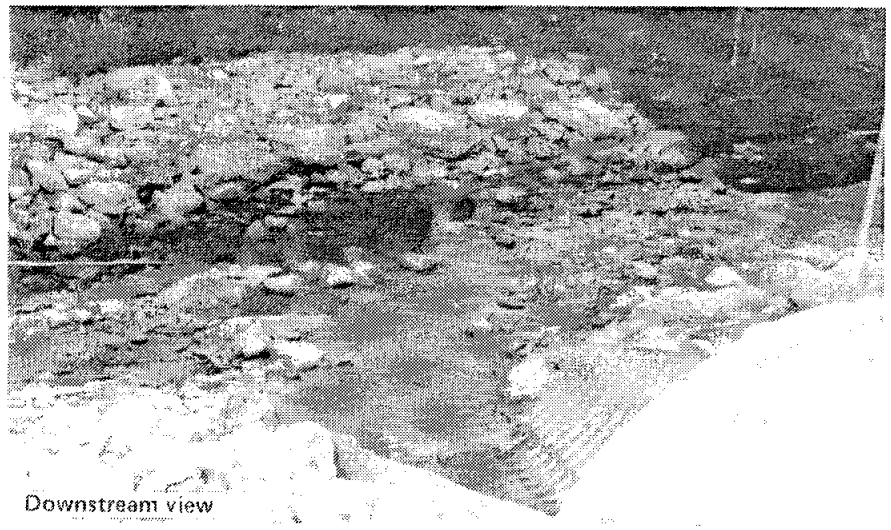
Location: Mile 38 Elliott Highway

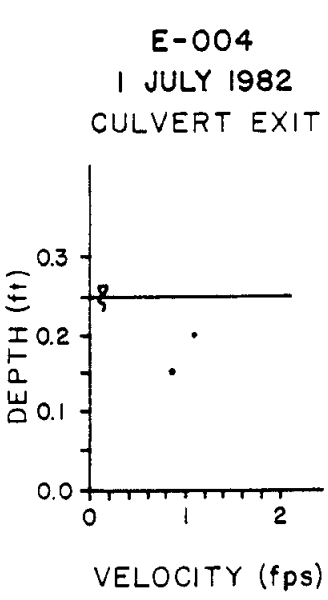
Map: Livengood B-3, T5N, R3W, Sec. 3

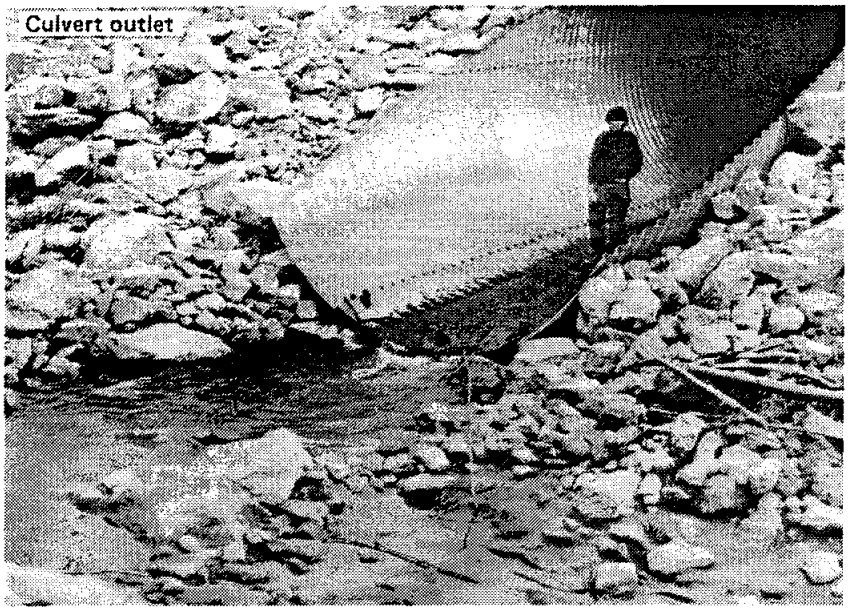
This creek was visited on July 1, 1982 and the total flow was 0.6 cfs. The water depths at the entrance and exit of the main (south) culvert were 0.30 and 0.25 ft, respectively. At this flow, no pools were observed. The culvert barrel was mostly clean although a few rocks up to 9 in in diameter were in the barrel. The stream made a 90° bend upon exiting from the culvert; riprap was placed to induce this bend. The water surface profiles for the creek and main (south) culvert are shown in the diagram. There was a beaver dam 148 ft upstream from the culvert that produced a 2.8 ft water surface drop. The upstream slope was measured below this drop. At this flow, there was no well defined channel downstream of the culvert. The creek flowed through the trees, blocking possible fish passage. An overflow culvert to the north also contained some flow. The measured slopes for this culvert were: culvert crown, 0.0039; culvert water, 0.0053; and the drop at the outlet was 2.21 ft. The watershed area was 28.0 sq mi.

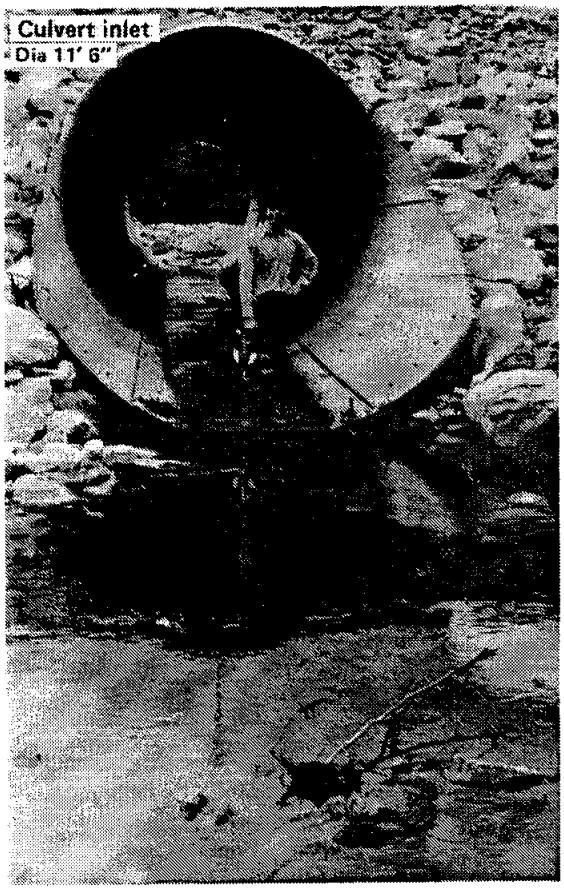


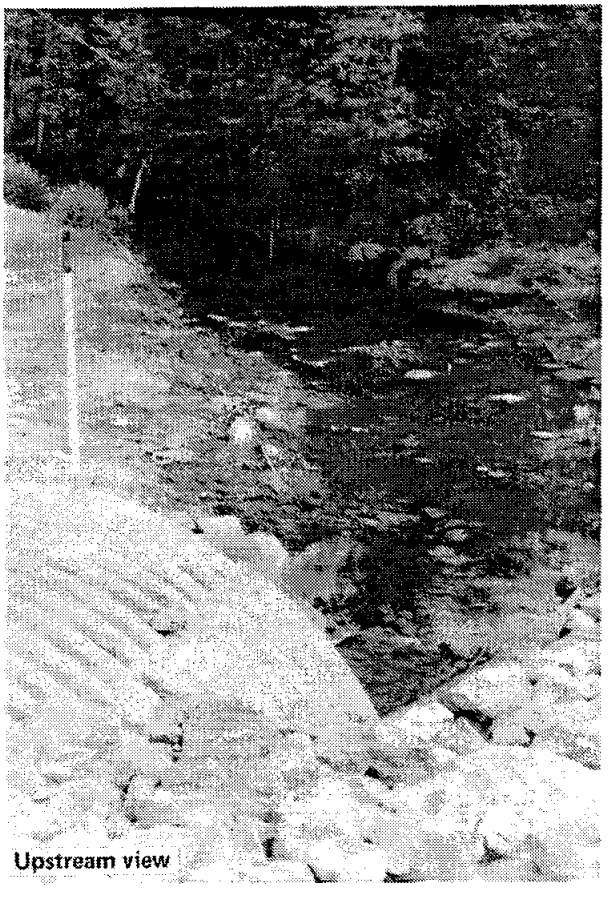
CULVERT LENGTH 113 FEET




E-004
1 JULY 1982
CULVERT EXIT
DEPTH (ft)
0.3
0.2
0.1
0.0
0
1
2
VELOCITY (fps)


Culvert outlet


Culvert inlet
Dia 11' 6"

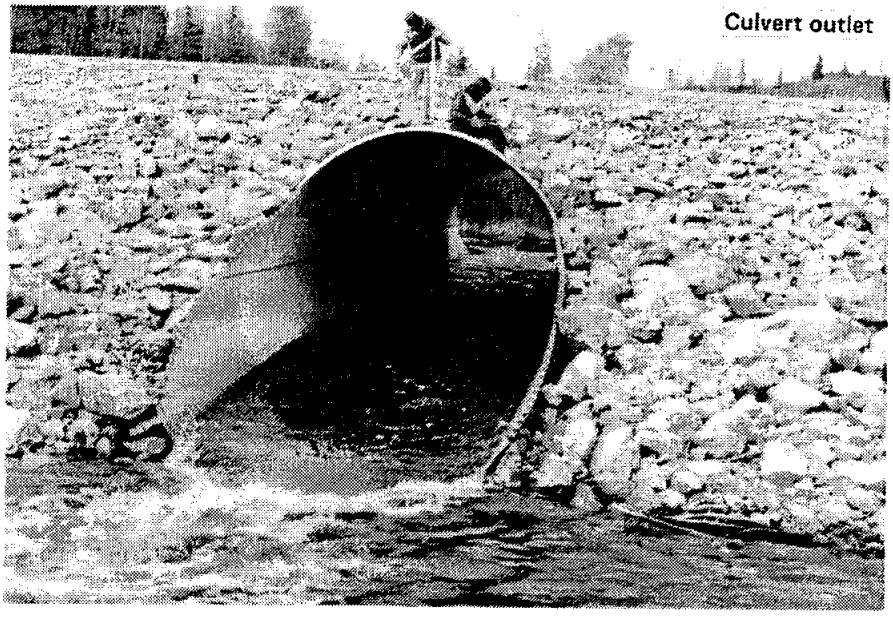

Upstream view

Site No. E-004 Globe Creek (North Crossing)

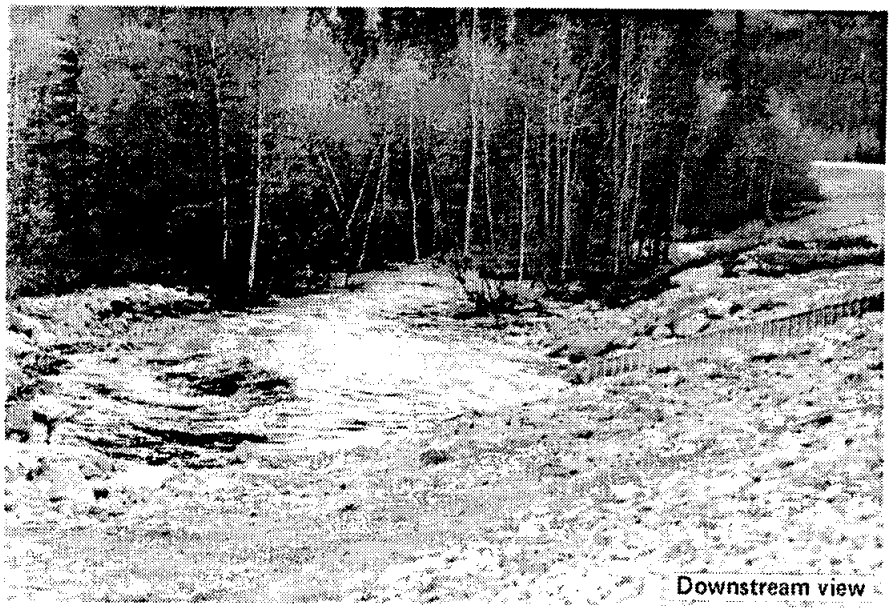
Location: Mile 38 Elliott Highway

Map: Livengood B-3, T5N, R3W, Sec. 3

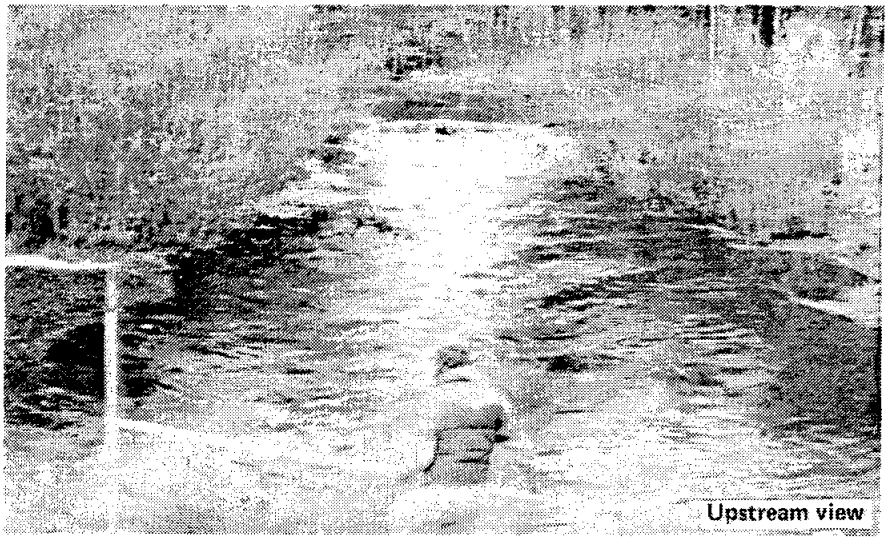
Higher flow conditions were encountered at this site on June 3, 1982. The depth of flow in the main culvert was about 2.5 ft. The overflow culvert (7 ft diameter by 182 ft long) had an outlet water depth of 2.6 ft. High flow conditions were due to a recent rainfall event.



Culvert outlet

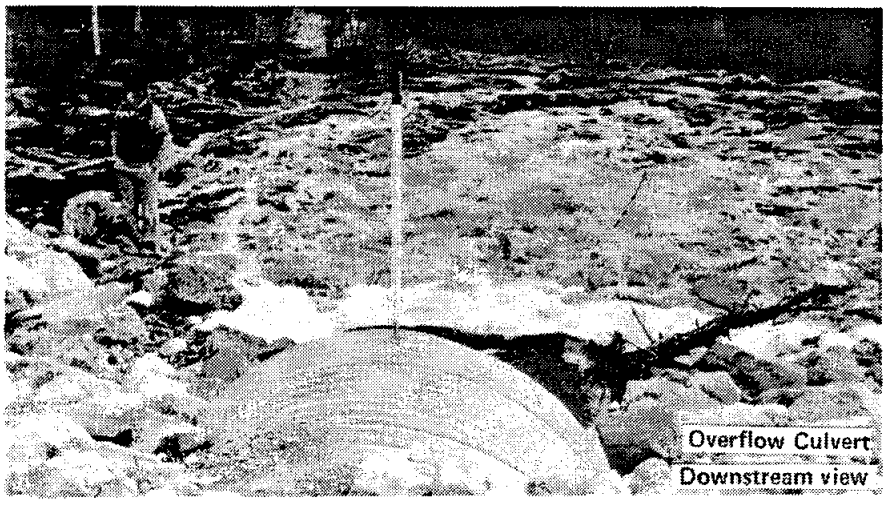


Downstream view



Upstream view

Overflow Culvert
Culvert outlet



Overflow Culvert
Downstream view

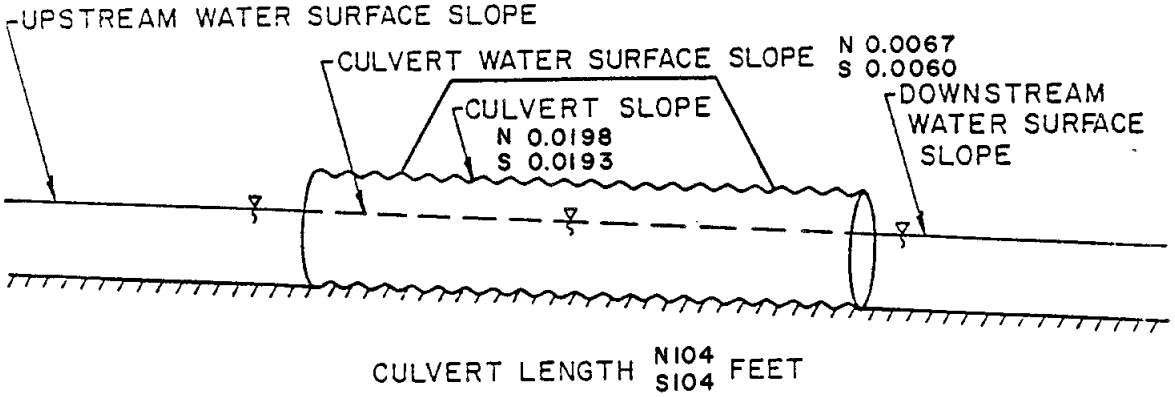
Site No. E-005 Unnamed Tributary to the Tatalina River

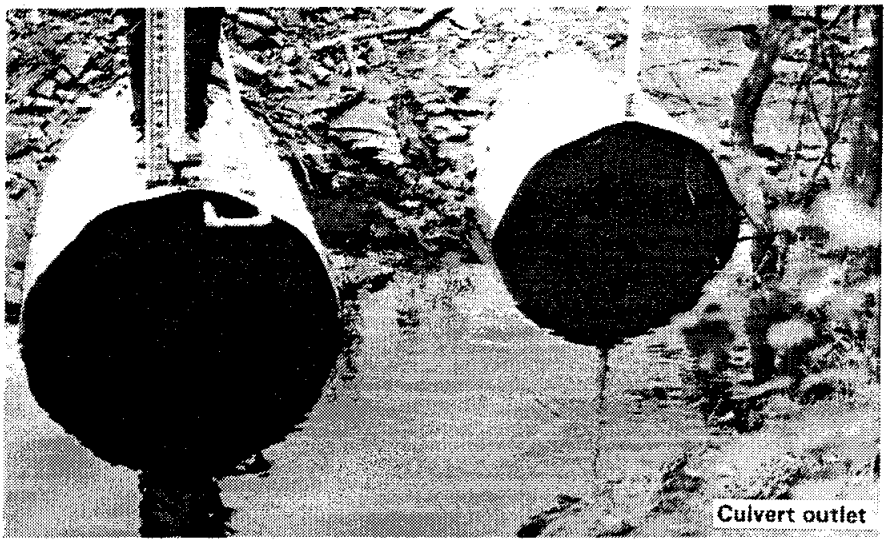
Location: Mile 46 Elliott Highway

Map: Livengood B-3, T6N, R4W, Sec. 13

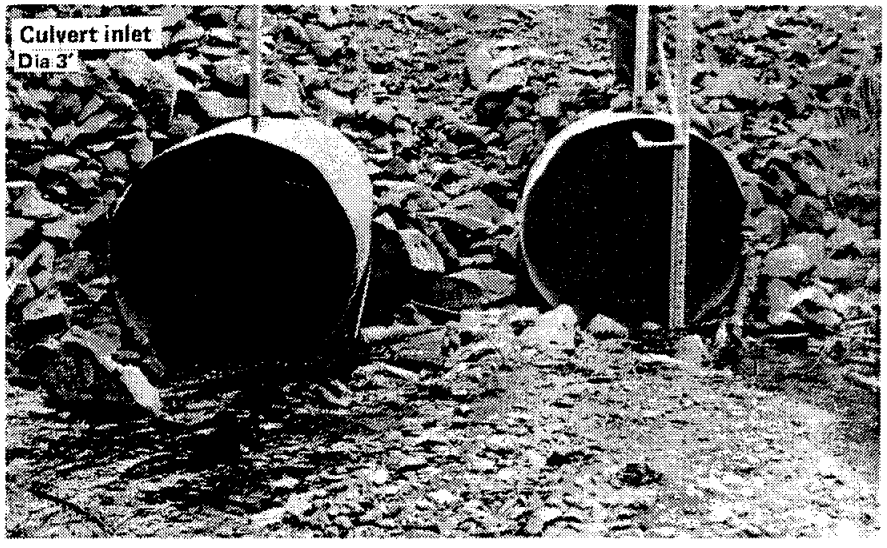
This unnamed creek was observed on July 1, 1982. The measured discharge was 0.65 cfs and was contained by two identical culverts. Inlet depths for the north and south culverts were 0.25 and 0.10 ft, respectively. The outlet depth was 1.00 ft for both culverts. Culvert slopes were measured (see diagram), however, there was too much vegetation to obtain the up and downstream slopes. The bedload was silt; thick deposits of fine grained material were observed at the culvert entrances.

High flows were observed during a visit to this site on June 2, 1982: one of the culverts was 3/4 full of silt and the other culvert was flowing almost full. The watershed area was 4.0 sq mi.

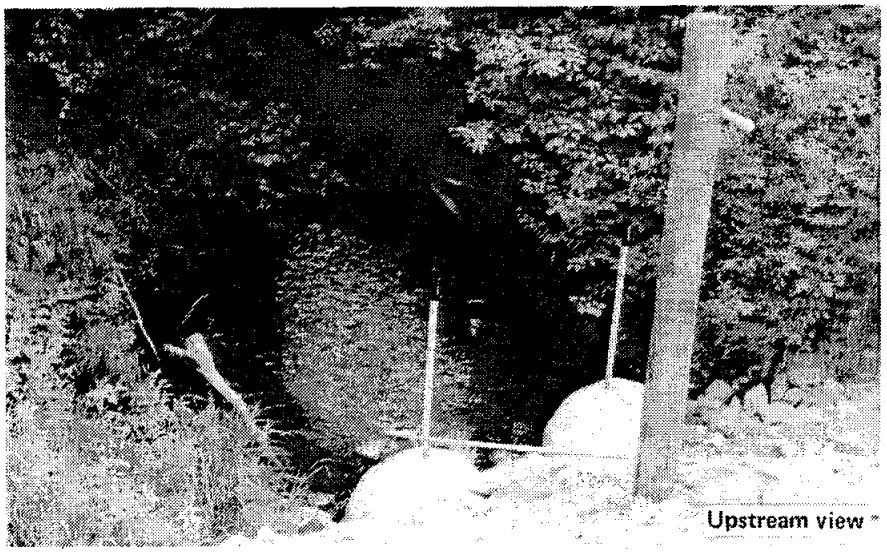




Culvert outlet



Culvert inlet
Dia 3'



Upstream view

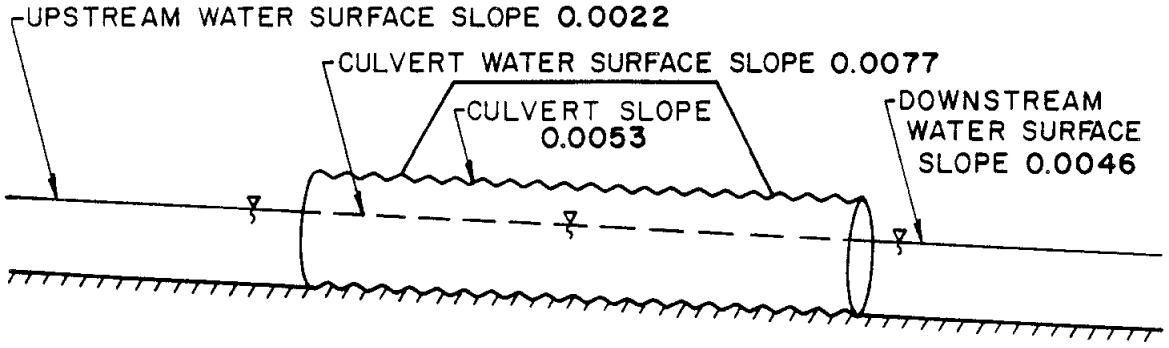
Site No. E-007 Bridge Creek (North Channel)

Location: Mile 56 Elliott Highway

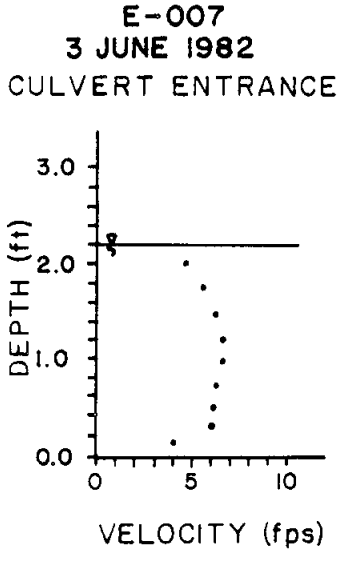
Map: Livengood B-3, T7N, R3W, Sec. 6

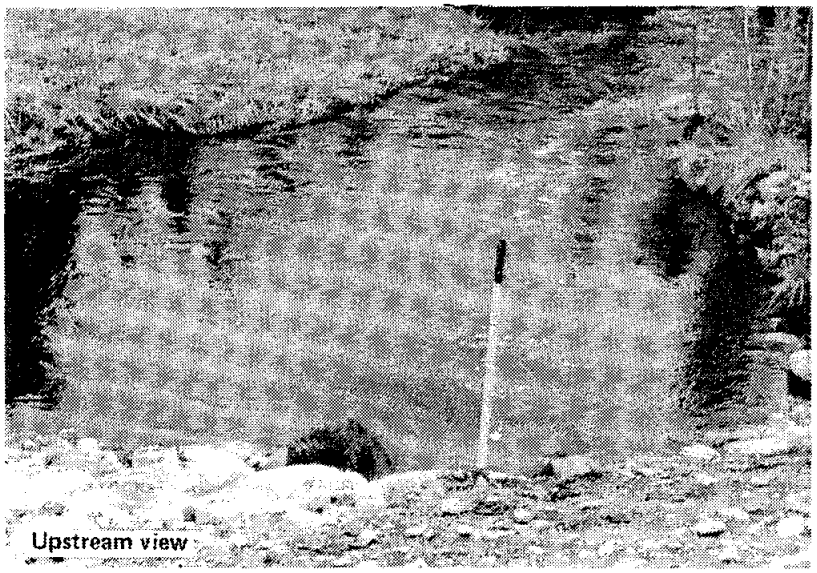
Bridge Creek was observed on June 3, 1982. The measured flow was 56.8 cfs from a watershed area of 8.2 sq mi. This was a relatively high flow due to a recent precipitation event. The water surface profiles for this creek and culvert are shown in the diagram. The depth of flow at the culvert entrance was 2.20 ft and at the culvert exit was 2.80 ft. The outlet water velocities were lower than the inlet water velocities. No drift was noted in the culvert barrel. A 30 by 50 ft pool was located at the culvert exit; the stream left this pool at a 90° angle from the flow through the culvert. Upstream of the culvert was a small pool that only existed at higher flows. The velocity profile at the culvert entrance was taken with an electromagnetic flowmeter.

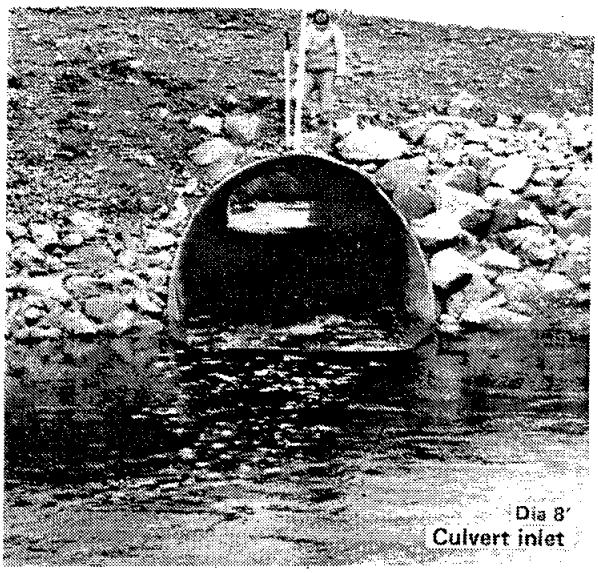
On June 6, 1983, Bridge Creek was visited again. The surveyed slopes were: upstream, 0.0001; culvert crown, 0.0052; culvert water, 0.0048; and downstream, 0.0071.



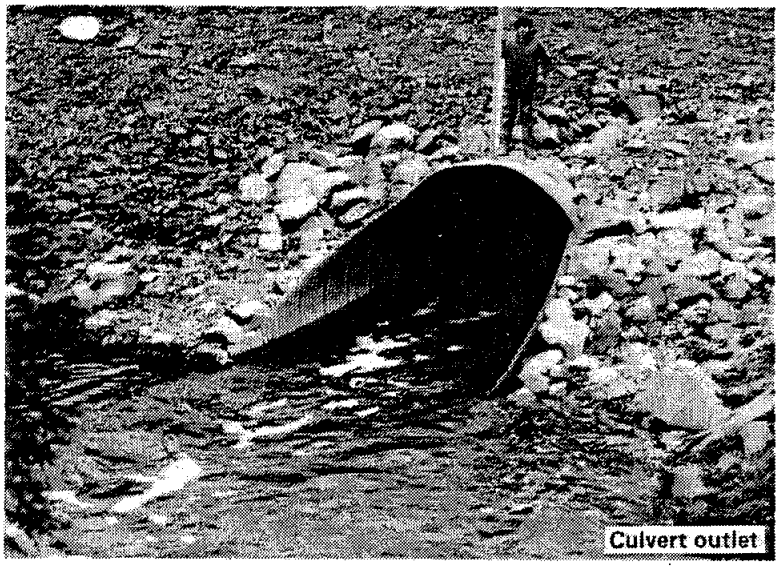
CULVERT LENGTH 110 FEET



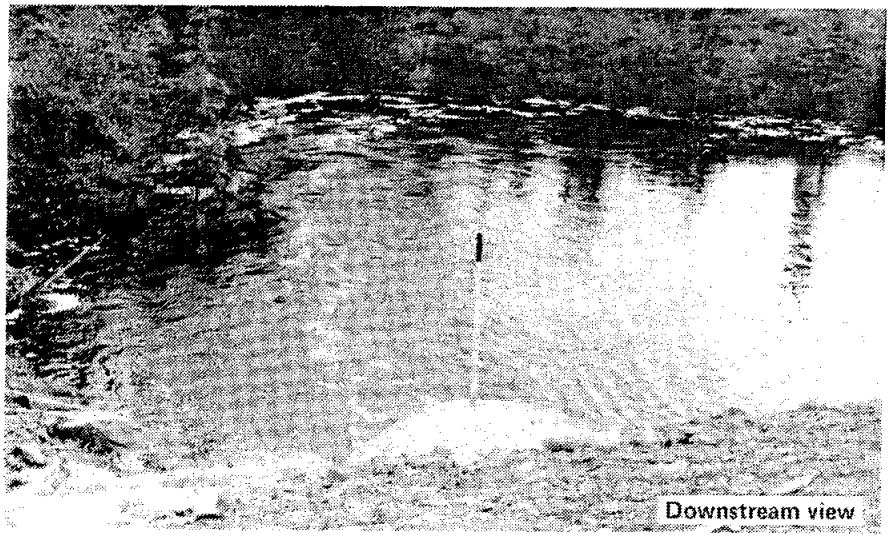




Dia 8'
Culvert inlet



Culvert outlet



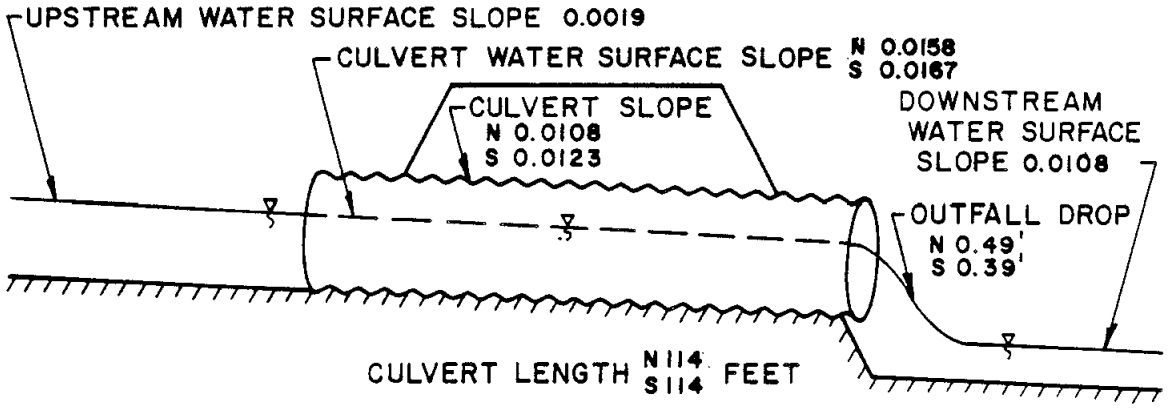
Downstream view

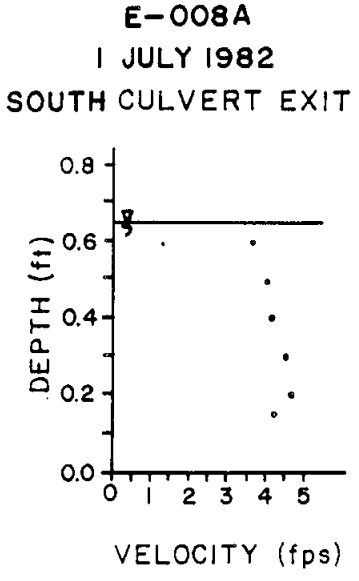
Site No. E-008A Livengood Creek Slough

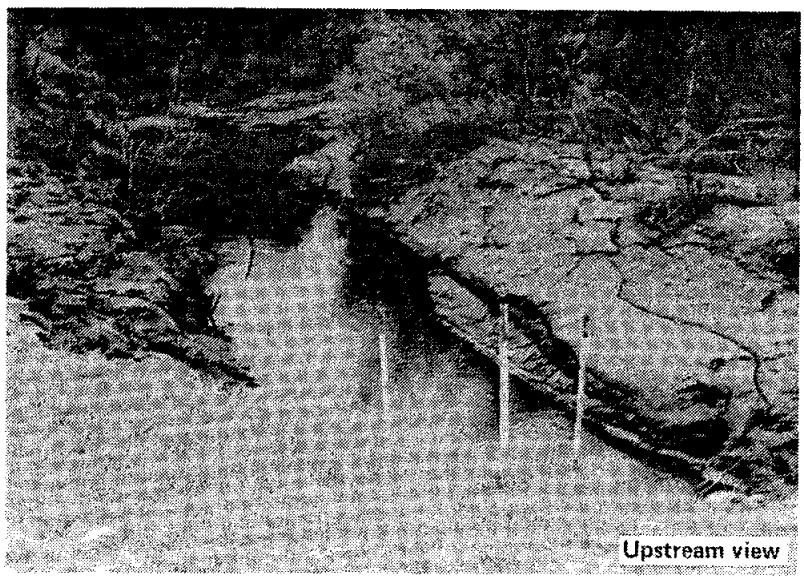
Location: Mile 70 Elliott Highway

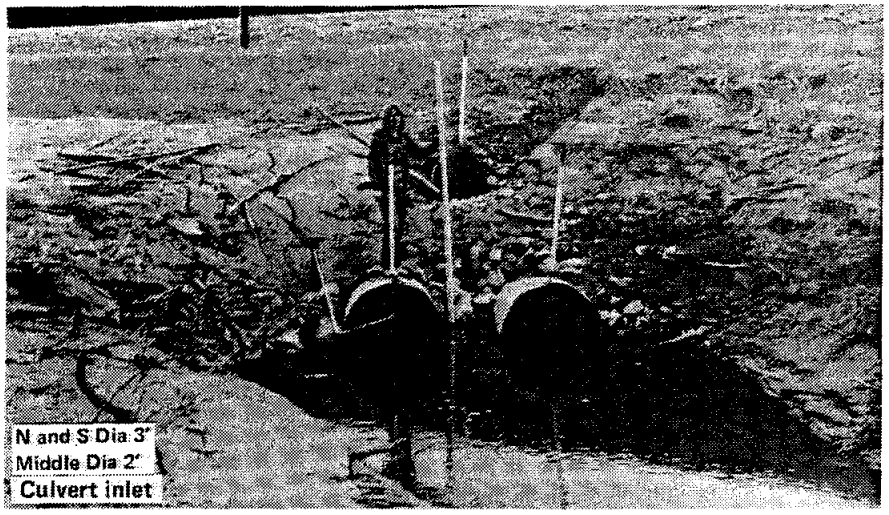
Map: Livengood C-4, T8N, R5W, Sec. 21

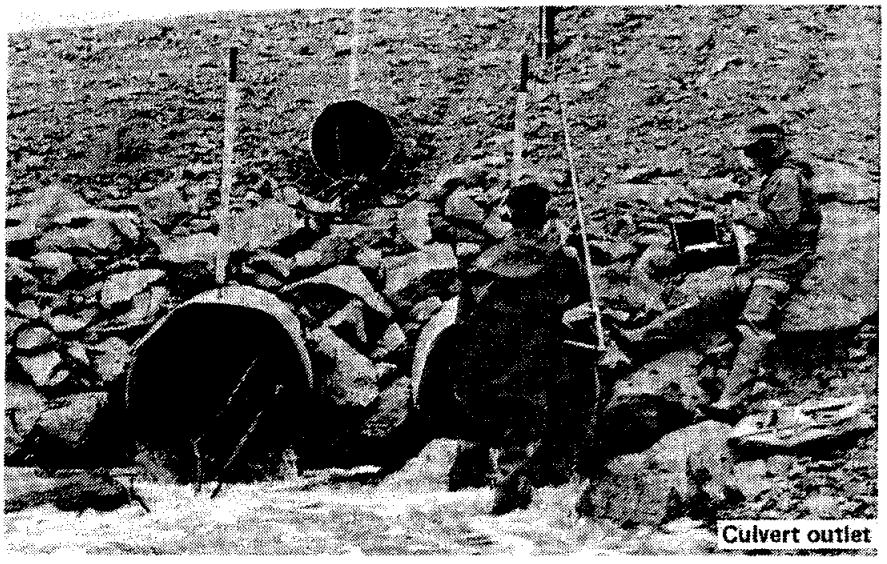
The flow in Livengood Creek Slough was 30.7 cfs on July 1, 1982. Two identical circular culverts contained the flow; an overflow culvert was dry. The surveyed profiles for the culverts and stream are shown in the diagram. A high water mark was surveyed on the north bank above the inlet, 4.59 ft above the water surface. Both main culvert barrels were clean. The estimated bedload was silt and fine grained material. A 25 ft diameter pool was located just downstream of the culverts; no pool was noted upstream. The culverts were perched at the downstream end, and the water depth at the outlet of the south culvert was 0.65 ft. The watershed boundaries were insufficiently defined, therefore, no watershed area was obtained.

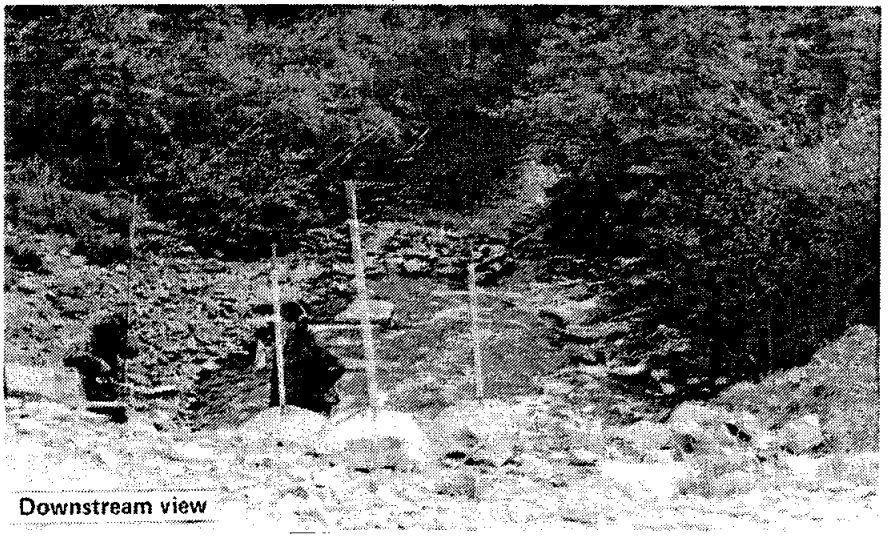







N and S Dia 3"
Middle Dia 2"
Culvert inlet


Culvert outlet

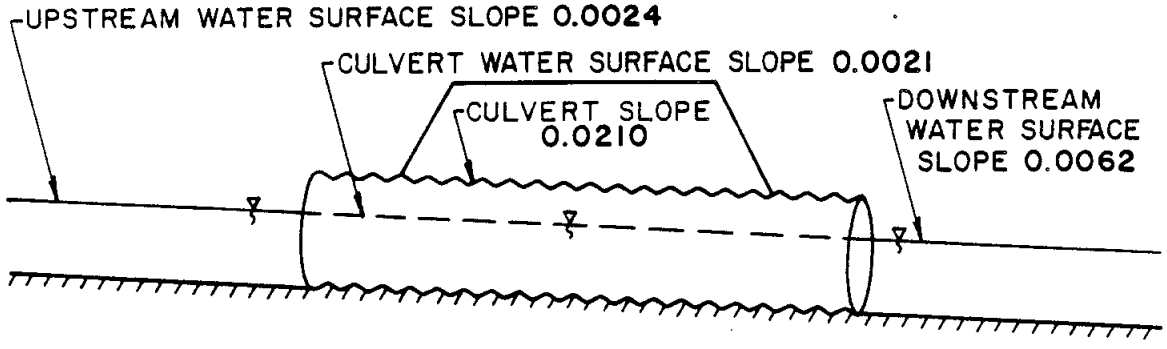

Downstream view

Site No. E-009 Lost Creek

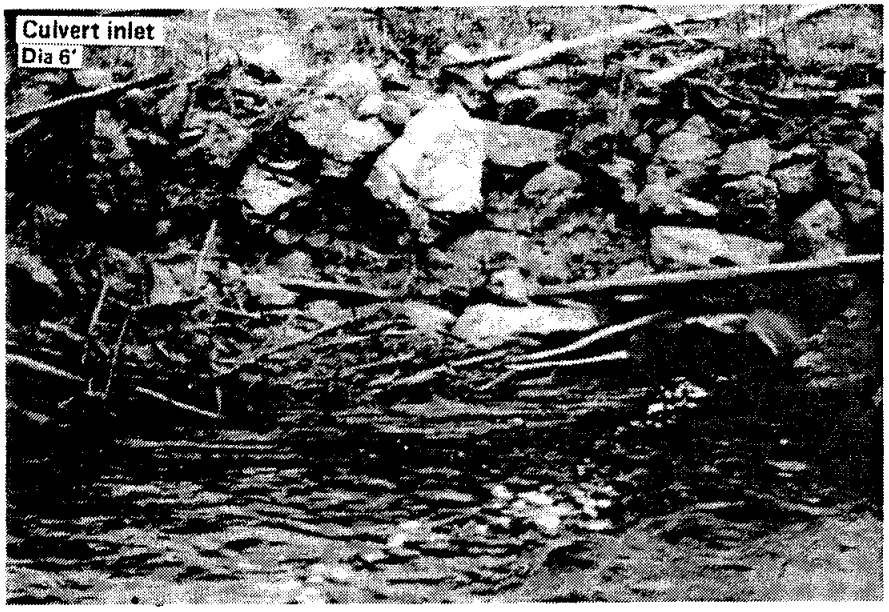
Location: Dalton Highway

Map: Livengood C-4, T8N, R6W, Sec. 16

The flow in Lost Creek (58.5 cfs) was contained by two culverts when visited on June 2, 1982. The south culvert was blocked at the inlet. The north culvert contained debris and the inlet was damaged; the outlet was totally submerged. The water depth at the north culvert inlet was 4.5 ft; the water velocity was not inordinately high. Slopes for the north culvert are shown in the diagram. Four overflow culverts were dry or contained standing water. Mud and organic matter on trees 6 ft above the present water surface indicated higher water levels. Large gravel was observed in the streambed. A 50 by 30 ft pool was located at the culvert outlet and a beaver dam was situated 105 ft downstream of the highway. The drop through the beaver dam was 0.80 ft and was included in the downstream slope measurement. The watershed area was 54.9 sq mi.



CULVERT LENGTH 120 FEET


Culvert inlet
Dia 6'


Culvert outlet

Site No. E-010 West Fork Erickson Creek

Location: Mile 12 Dalton Highway

Map: Livengood C-4, T9N, R7W, Sec. 26

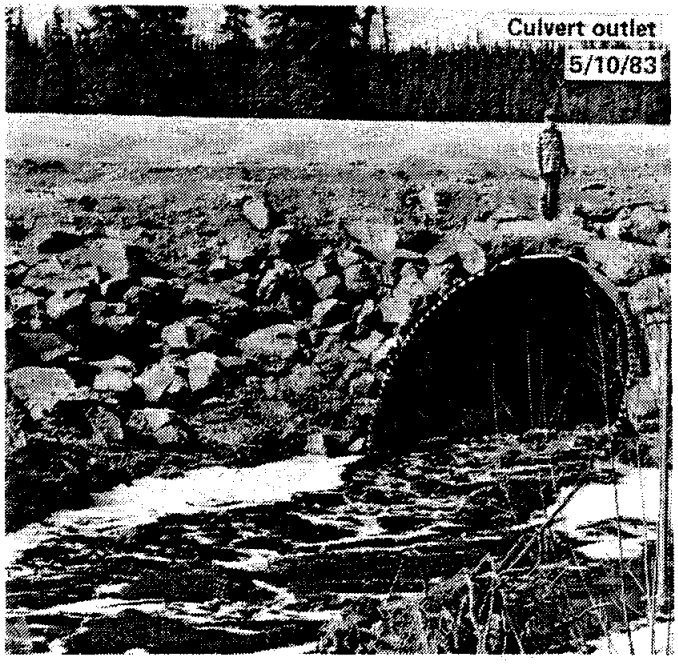
The west fork of Erickson Creek was first visited on June 2, 1982. The discharge on this date was 34.2 cfs; the water surface profile is shown on the diagram. At this stage there was an upstream pool (40 by 60 ft) and a downstream pool (30 by 40 ft). The barrel was clean and the bedload size was estimated at 3 to 4 in in diameter. At the culvert inlet the depth was 2.80 ft. The culvert at this location was placed perpendicular to the streamflow, resulting in the stream making two 90° bends at the inlet and outlet of the culvert. The watershed area was 27.5 sq mi.

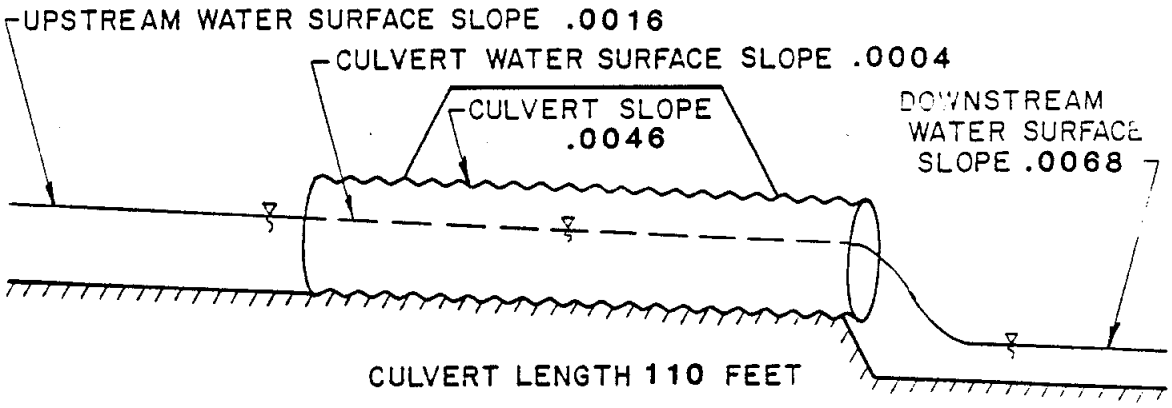
On May 10, 1983, the flow at this location was 41.9 cfs. The measured slopes on this date were:

upstream	0.0022
culvert crown	-0.0009
culvert water	0.0269
downstream	0.0068

Considerable anchor ice was in the streambed at this time, which may have accounted for the unusually high water surface slope through the culvert. The photos on the following pages were taken on May 10, 1983.

The west fork of Erickson Creek was again visited on June 1, 1983. The discharge was 53.4 cfs. The water depths at the inlet and outlet were 2.75 and 2.50 ft, respectively.




UPSTREAM WATER SURFACE SLOPE .0016
CULVERT WATER SURFACE SLOPE .0004
CULVERT SLOPE .0046
DOWNSTREAM WATER SURFACE SLOPE .0068
CULVERT LENGTH 110 FEET


5/10/83
Upstream view


Dia 10'
5/10/83
Culvert inlet

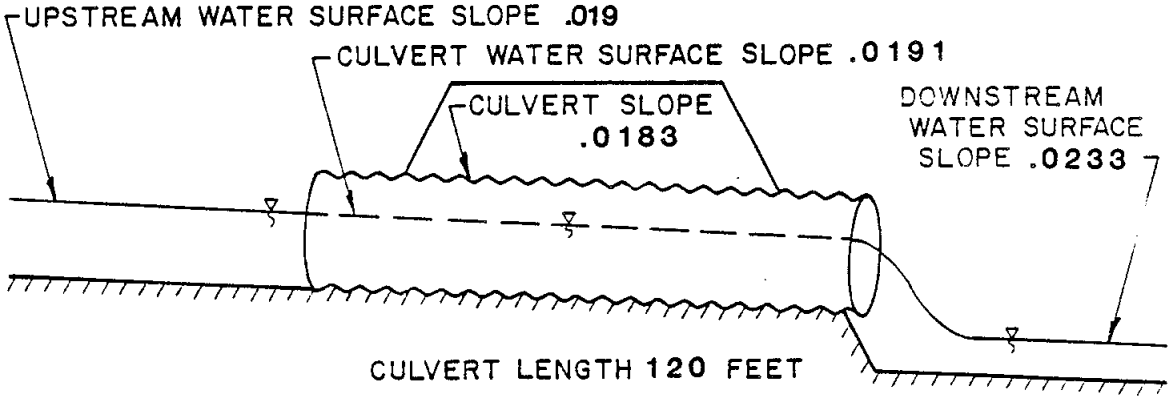
Site No. E-011 Unnamed Creek

Location: Dalton Highway, just south of Hess Creek

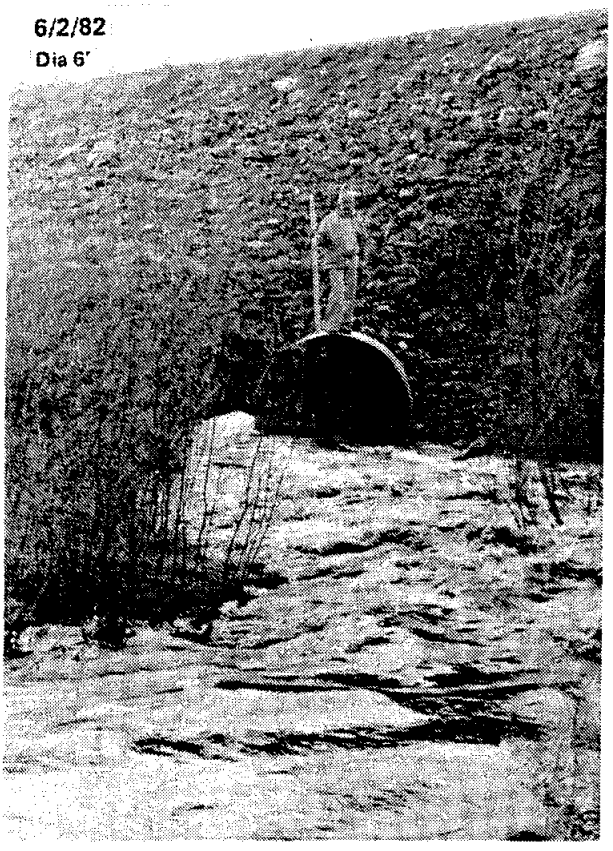
Map: Livengood C-5, T10N, R7W, Sec. 31

A single corrugated metal pipe culvert contained the flow (34.9 cfs) from this creek on June 2, 1982. Slopes were measured on this date and are shown on the diagram. The total water depth at the culvert inlet was 2.10 ft. The bed material was rocks up to large cobbles; a very small amount of sediment was deposited at the barrel entrance. There was a large amount of suspended sediment in the stream. A small pool, 30 by 10 ft, was noted at the downstream end of the culvert. This pool was due mainly to the culvert not being aligned with the streamflow; the stream left the pool 90° from the direction of flow through the culvert. The culvert slope was not uniform throughout the length of the barrel; the slope decreased toward the downstream end. This resulted in lower outlet velocities. The watershed area was 4.0 sq mi.

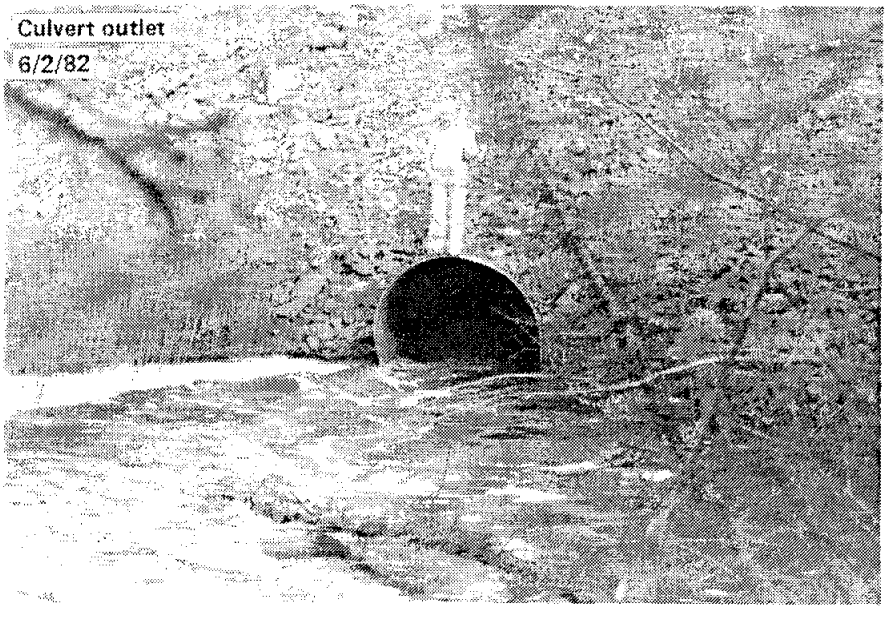
Inlet and outlet water depths were again measured on July 23, 1982. The inlet depth was 0.10 ft (taken on top of a log at the entrance) and the outlet water depth was 0.80 ft.



Culvert inlet
6/2/82
Dia 6'



Culvert outlet
6/2/82



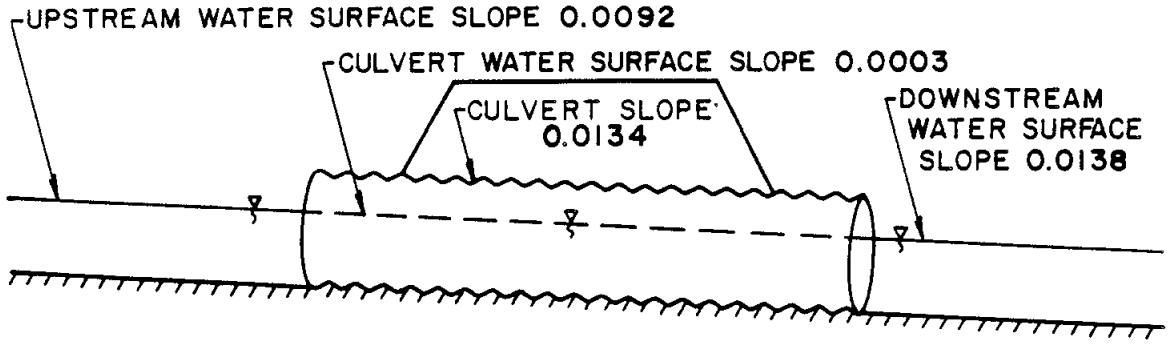
Site No. E-012 Hot Cat Creek

Location: Mile 34 Dalton Highway

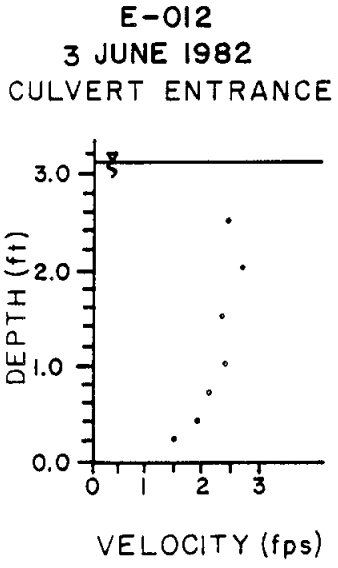
Map: Livengood C-5, T11N, R8W, Sec. 31

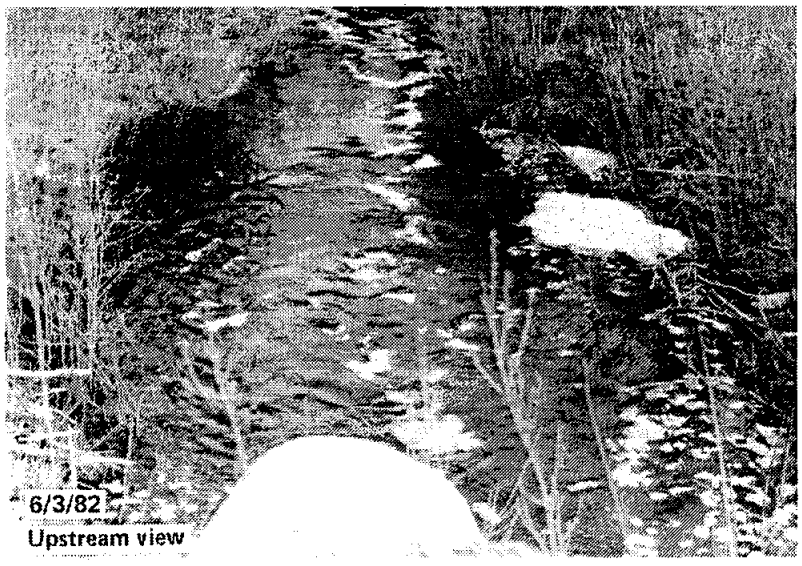
The flow in Hot Cat Creek was 42.9 cfs on June 3, 1982. This flow was higher than normal due to a rainfall event; the water surface profile is presented in the diagram. The culvert inlet depth at this discharge was 3.10 ft, while the outlet depth was about 5 ft. A backwater pool downstream of the culvert was 25 ft long by 10 ft wide. The culvert barrel was clean, although fine sediment was being transported at this flow. Downstream of the culvert, the water had topped the channel banks and flowed through trees and bushes. The watershed area above the culvert was 11.0 sq mi.

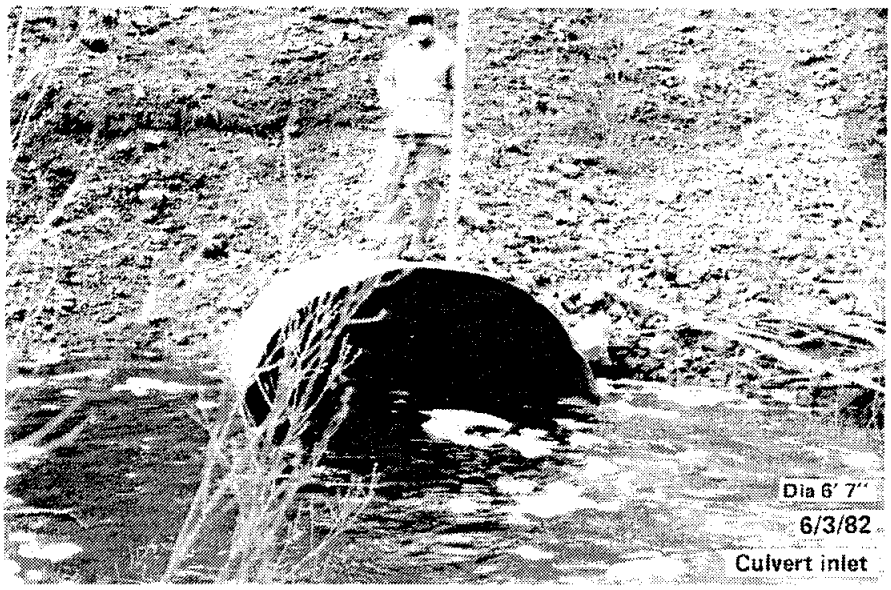
Hot Cat Creek was again observed on May 31, 1983, when the flow was 20.7 cfs. The measured slopes were: upstream, 0.0090; culvert crown, 0.0141; culvert water, 0.0002; and downstream, 0.0121. The culvert inlet and outlet depths were 2.70 and 3.75 ft, respectively.

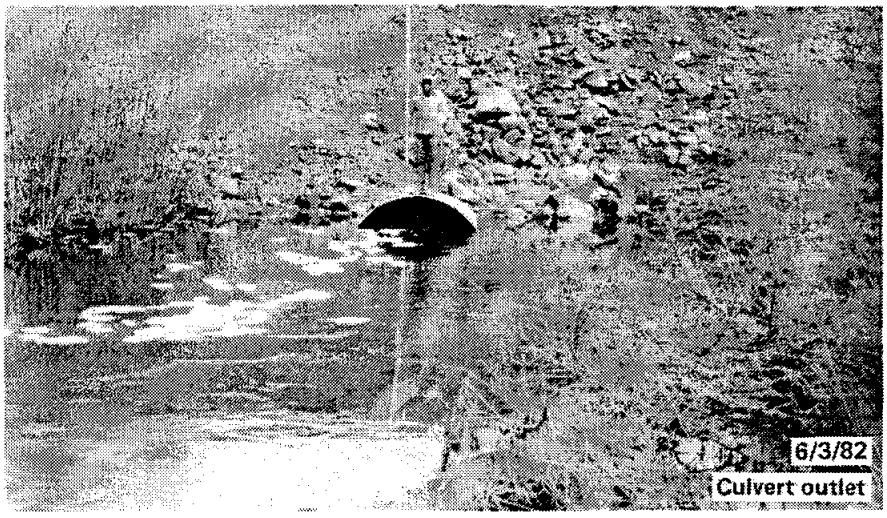


CULVERT LENGTH 90 FEET






Dia 6' 7"
6/3/82
Culvert inlet


6/3/82
Culvert outlet

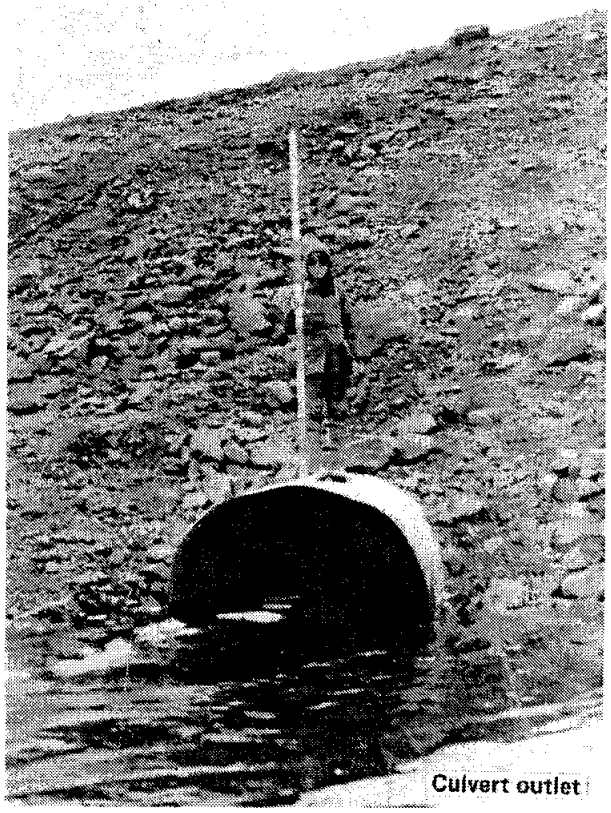

6/3/82
Downstream view

Site No. E-013 Isom Creek

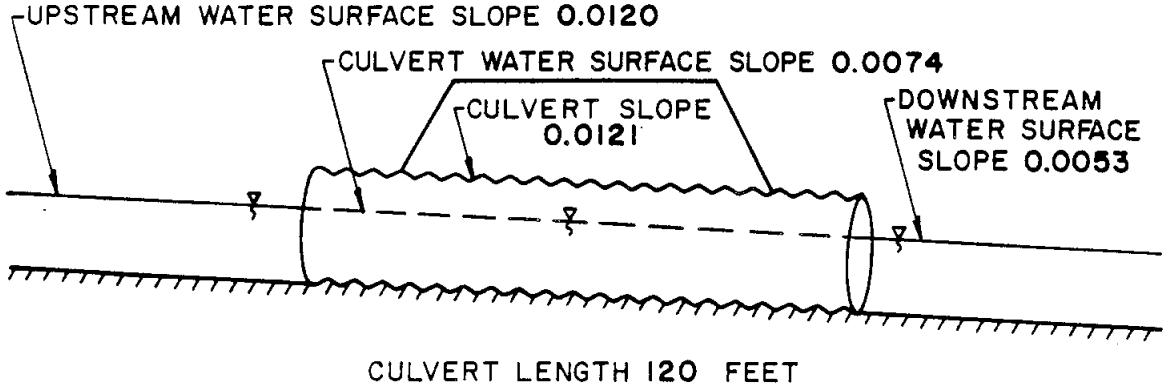
Location: Mile 39 Dalton Highway

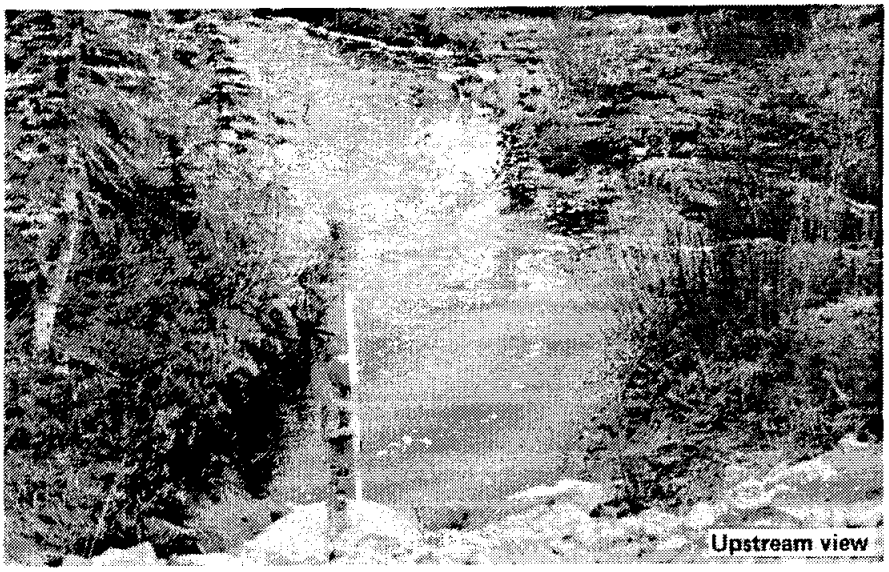
Map: Livengood D-5, T11N, R9W, Sec. 9

Isom Creek was observed on June 3, 1982. The discharge (33.7 cfs) was contained by a single corrugated metal pipe culvert. The higher than normal flow was due to a rainfall event. The stream profile is shown in the diagram. At this flow, some suspended sediment was being transported. The bedload was estimated to be medium sized gravel downstream of the culvert; the barrel contained no drift. A few large pieces of riprap at the culvert entrance produced higher velocities than occurred at the culvert exit. The riprap at the inlet also caused a large drop in the water surface at the culvert entrance. The depth of flow at the culvert entrance on top of the riprap was 1.00 ft. At the culvert outlet, the stream widened to 10 ft for about 40 ft, providing a possible rest area for fishes. The watershed area was 5.8 sq mi.

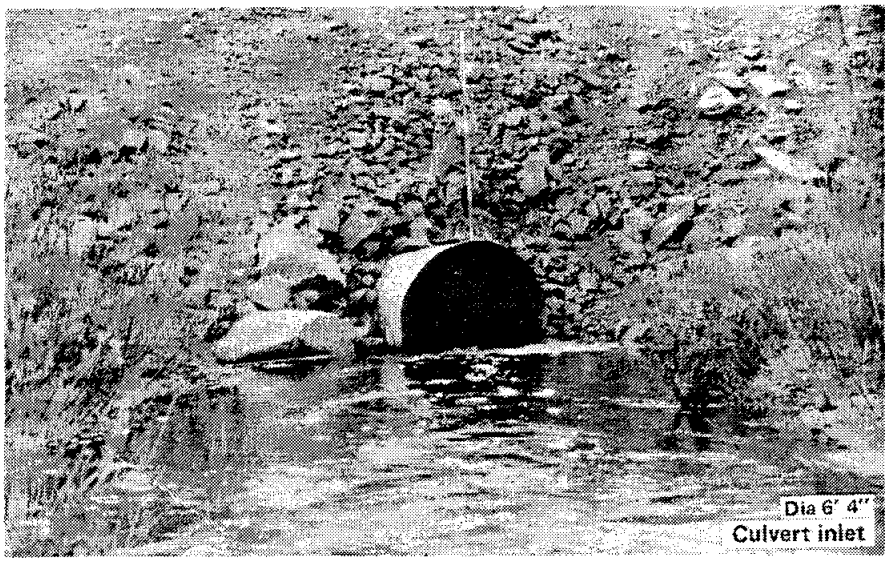


Culvert outlet





Upstream view



Dia 6' 4"
Culvert inlet

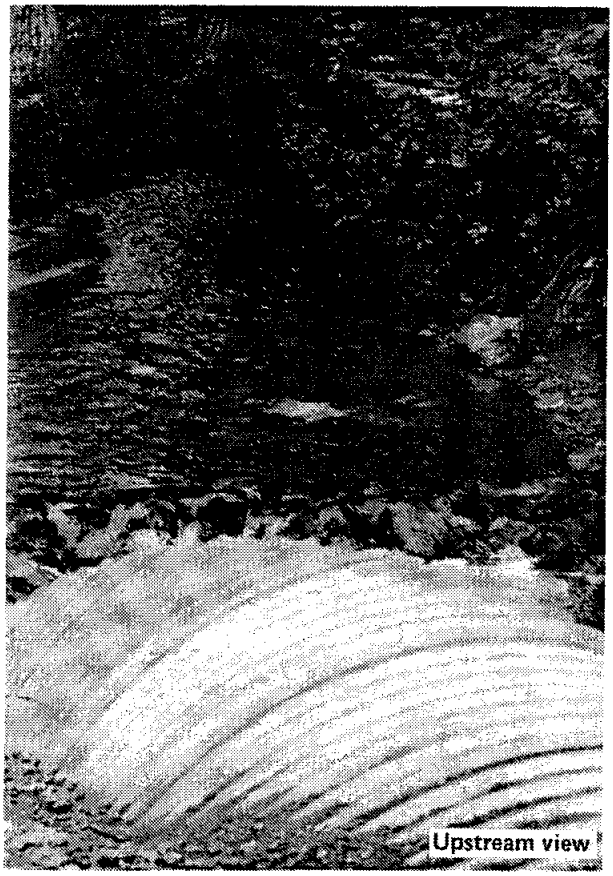
Downstream view

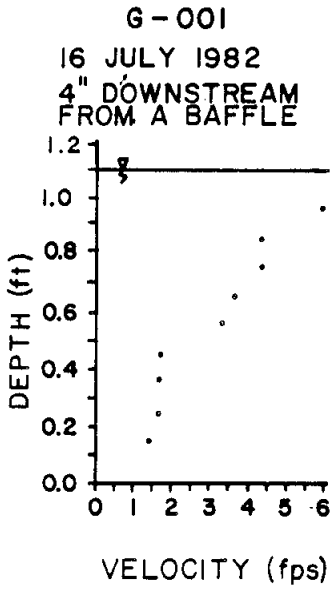
Site No. G-001 Meadow Creek

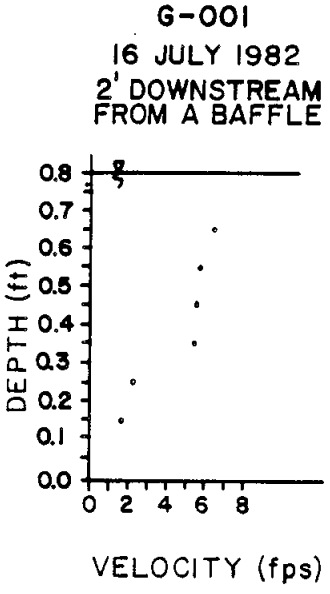
Location: Eagle River Loop Road off Glenn Highway

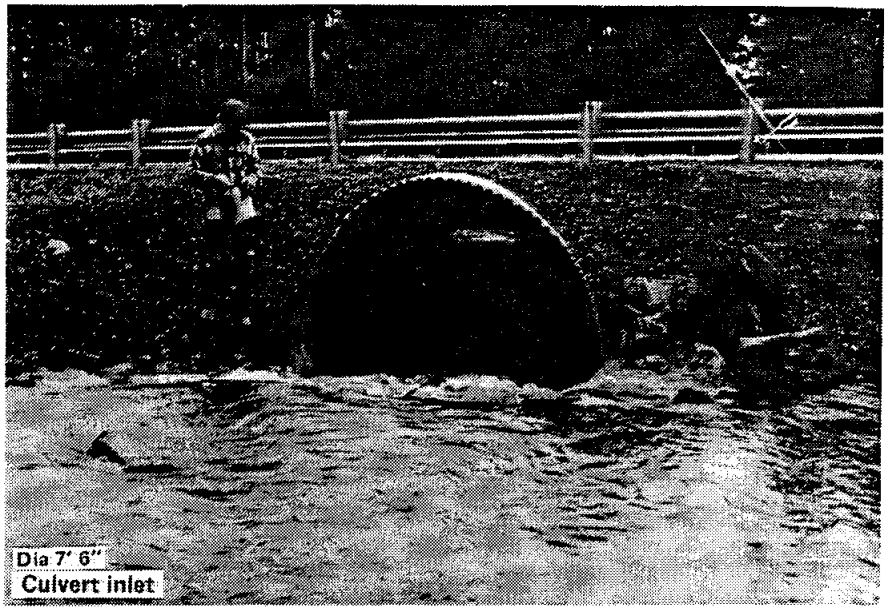
Map:

This creek was visited on July 16, 1982. The discharge at that time was 12.8 cfs from a watershed area of 7.4 sq mi. Baffles were installed in the Meadow Creek culvert barrel. The baffles were 0.60 ft tall and spaced 6 ft apart. The top edge of the baffles were notched to channel the flow back and forth across the culvert. Rocks, up to 8 in in diameter, were trapped behind the baffles. This, combined with the high discharge, caused the water to flow straight through the culvert over the baffles. Two velocity profiles were measured inside the culvert barrel 30 ft from the exit. One was taken 4 in downstream from a baffle, and the other was measured 2 ft downstream from a baffle.








Dia 7' 6"
Culvert inlet


Culvert outlet

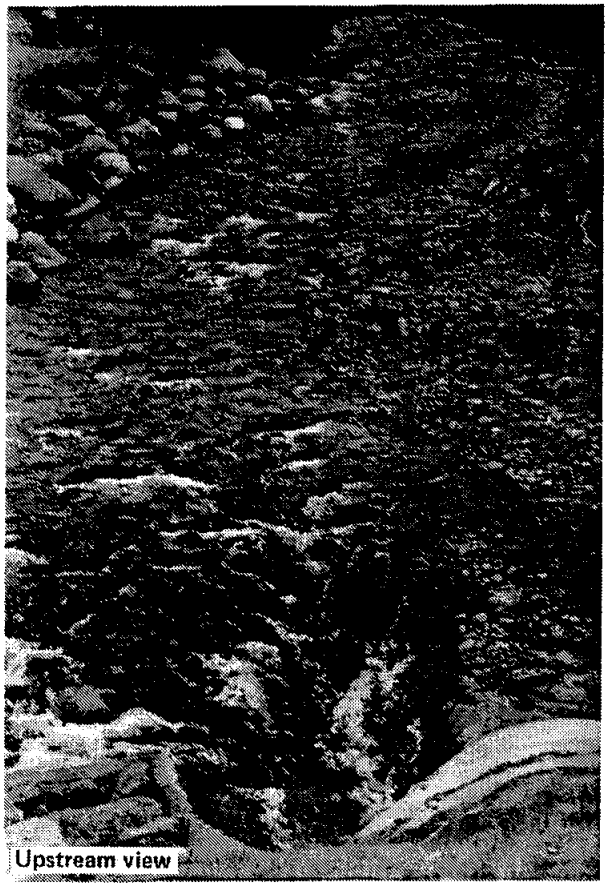

Downstream view

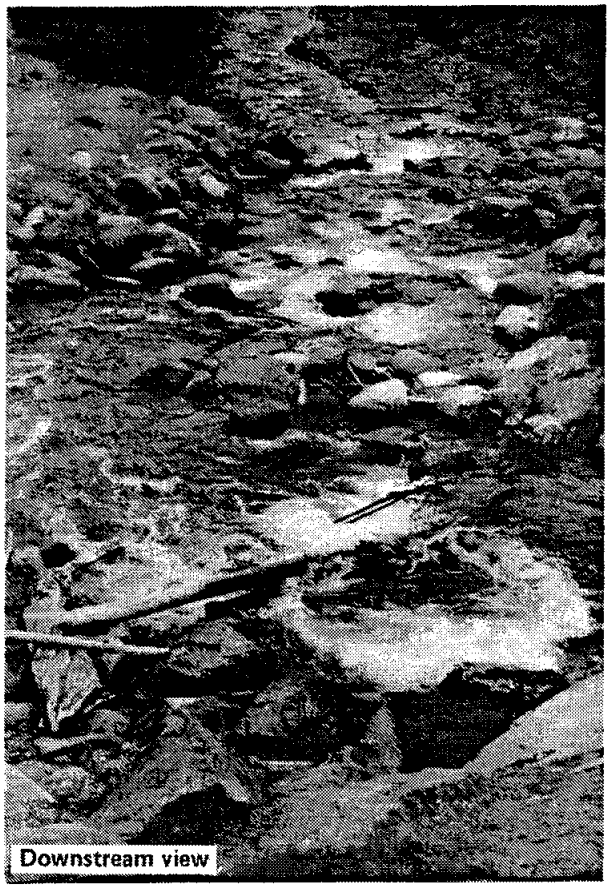
Site No. SW-001 Rabbit Creek

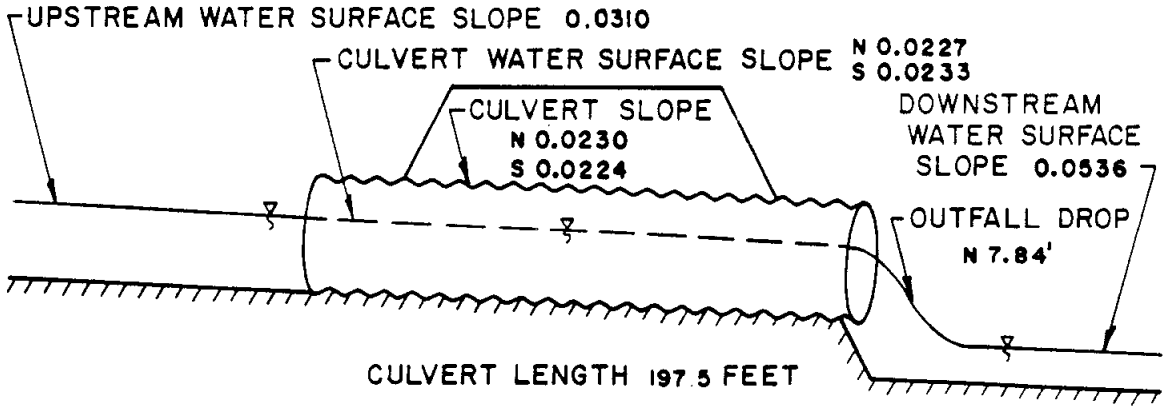
Location: Old Seward Highway

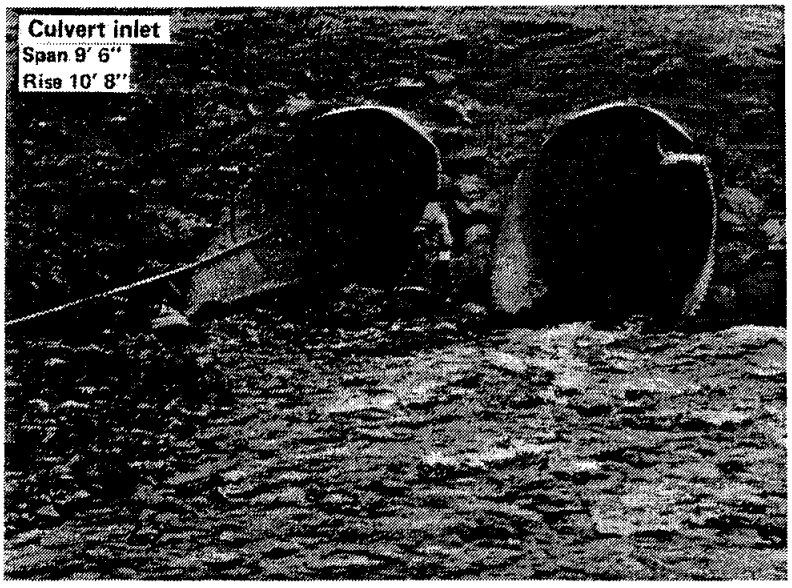
Map: Anchorage C-6, T17N, R1E, Sec. 27

Two similar culverts contained the discharge from Rabbit Creek on July 15, 1982. The north (or right culvert, facing downstream) contained most of the 22.7 cfs flow. Inlet and outlet water depths for the two culverts were: 1.20 ft (inlet, right culvert); 1.35 ft (outlet, right culvert); 0.30 ft (inlet, left culvert); 0.35 ft (outlet, left culvert). The bedload ranged from small gravel to material 8 in in diameter. The left culvert contained rocks up to 6 in in diameter; deposits up to 1.5 ft thick were observed in some places. Larger rocks in the lower reach of the right culvert were also noted. Concrete baffles were installed in both culvert barrels. They had mostly been destroyed or were missing from the right culvert and were not visible in the left culvert. The downstream slope noted in the schematic was measured over a 200 ft distance, however, most of the drop occurred within 100 ft of the culvert exit (7.84 ft/100 ft). The watershed area was 13.3 sq mi.

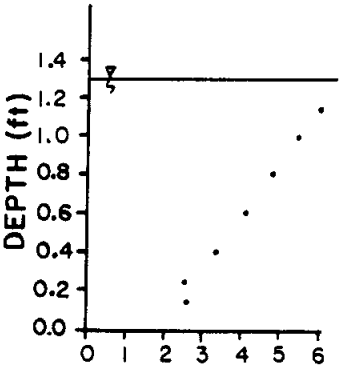

Upstream view


Downstream view

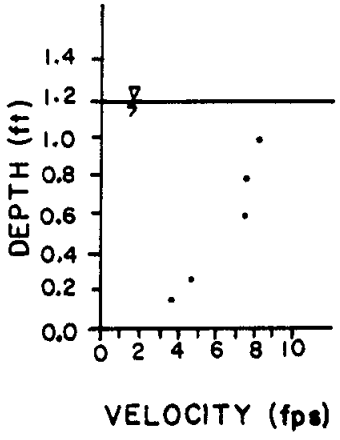


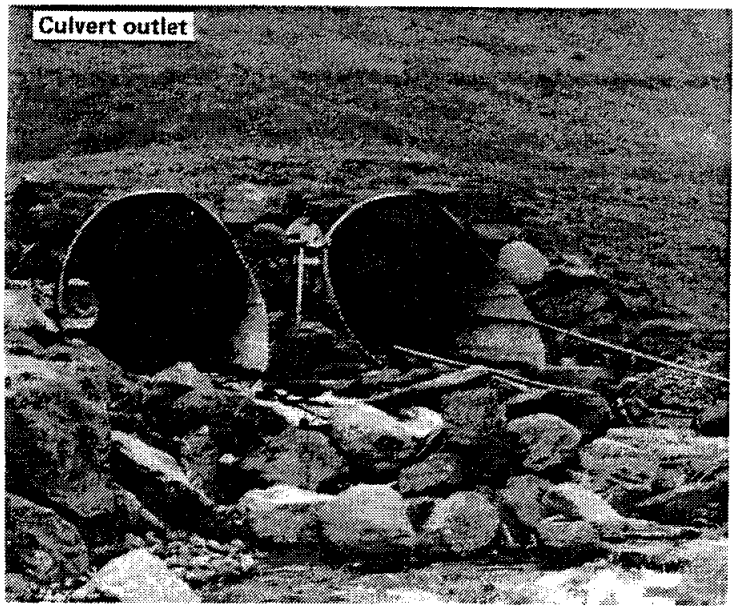


SW-001
15 JULY 1982
CULVERT EXIT



SW-001
15 JULY 1982
5' DOWNSTREAM FROM
RIGHT CULVERT ENTRANCE



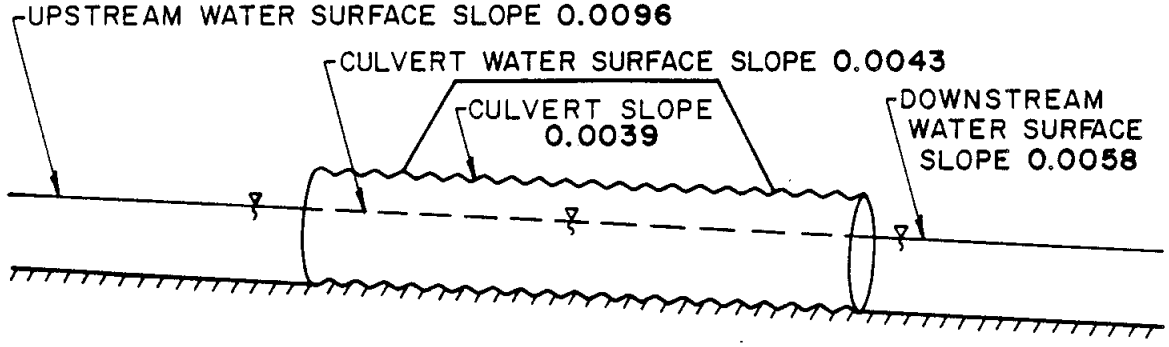


Site No. P-002 Alder Creek

Location: Mile 350.2 Parks Highway

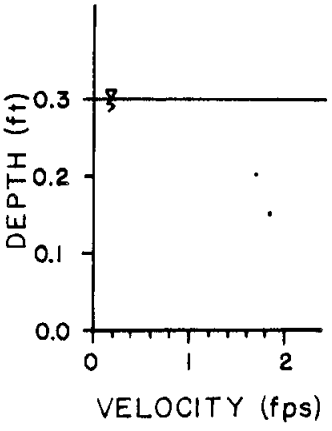
Map: Fairbanks D-3, T1S, R2W, Sec. 7

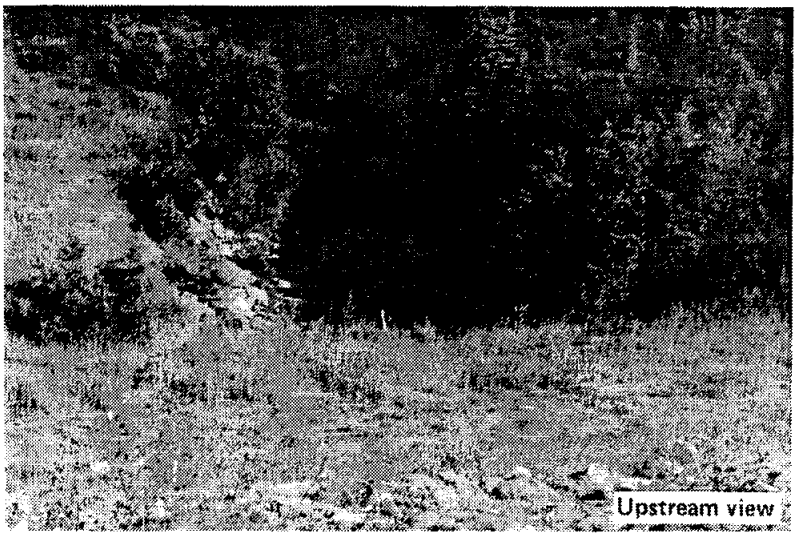
A single 10 ft diameter culvert carried all of the 1.2 cfs observed on July 6, 1982 at this site. The water surface profile surveyed on this date appears in the diagram. A slope stability problem blocked the entrance to the overflow culvert and caused the upstream channel banks to slump. The culvert barrel was bent upwards at the entrance, creating a small pond at the inlet. At the culvert entrance the water depth was 1.10 ft just outside of the culvert and 0.30 ft just inside. Due to changes in the culvert slope, the water depth increased from 0.30 to 2.5 ft inside the culvert. There was a large amount of silt and mud debris in the culvert with some larger rocks up to 8 in in diameter. At the exit, the water depths were 0.35 and 0.95 ft just inside and outside of the culvert, respectively. At this discharge the culvert was slightly perched. There was a large scour pool at the exit about 20 by 50 ft. A high water mark was surveyed 15 ft downstream of the outlet at 1.80 ft above the present water surface. The watershed boundaries were insufficiently defined to determine the watershed area.

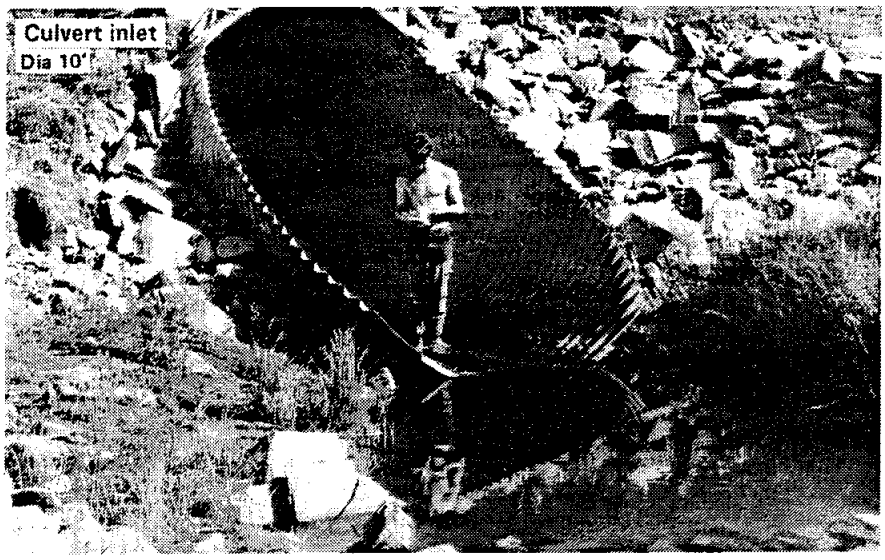


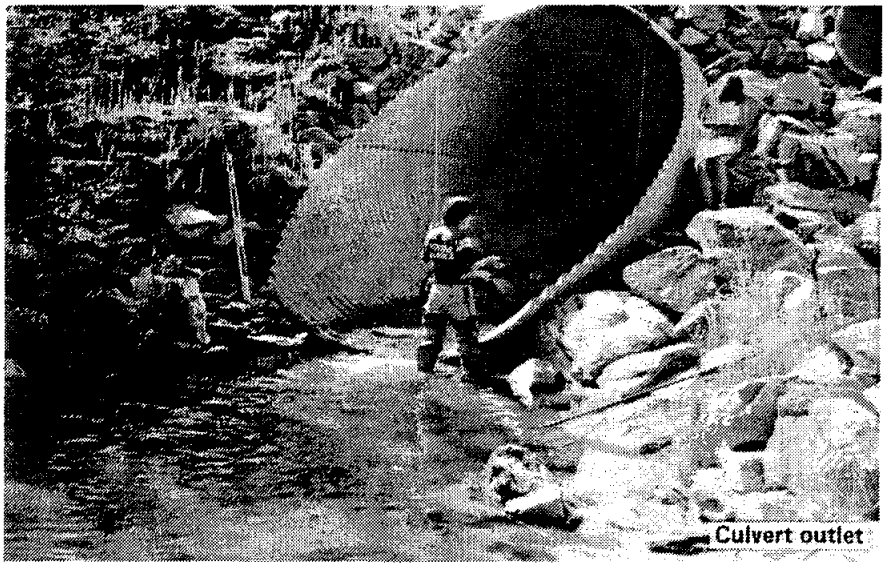
CULVERT LENGTH **253** FEET

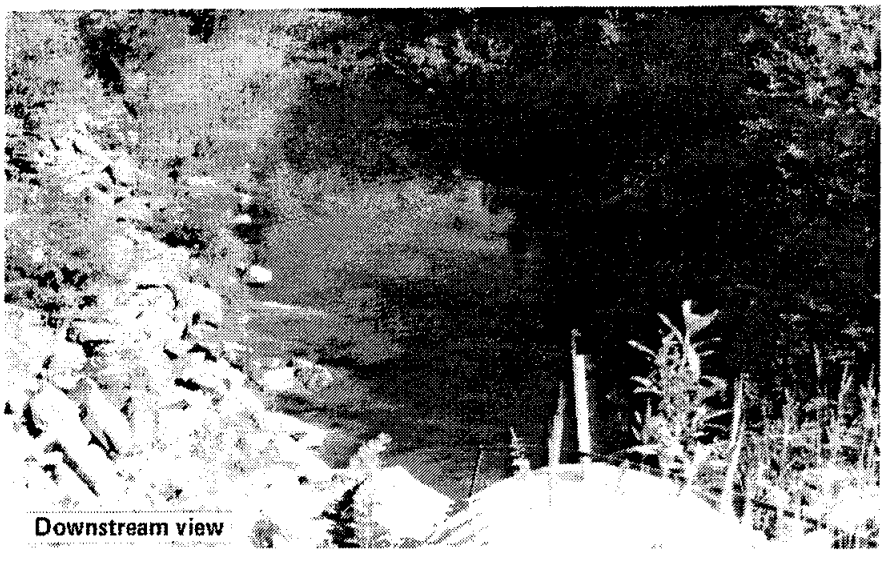
P-002
6 JULY 1982
CULVERT ENTRANCE






Culvert inlet
Dia 10'


Culvert outlet

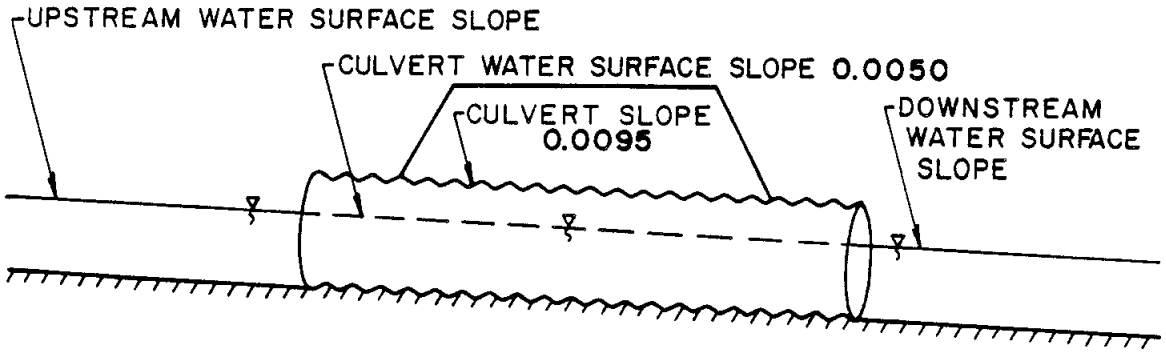

Downstream view

Site No. P-005 Unnamed Creek

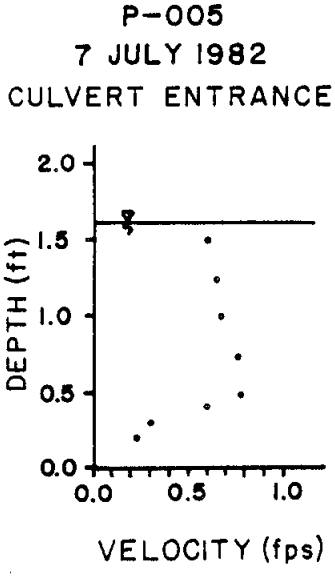
Location: Mile 288.5 Parks Highway

Map: Fairbanks B-5, T6S, R8W, Sec. 36

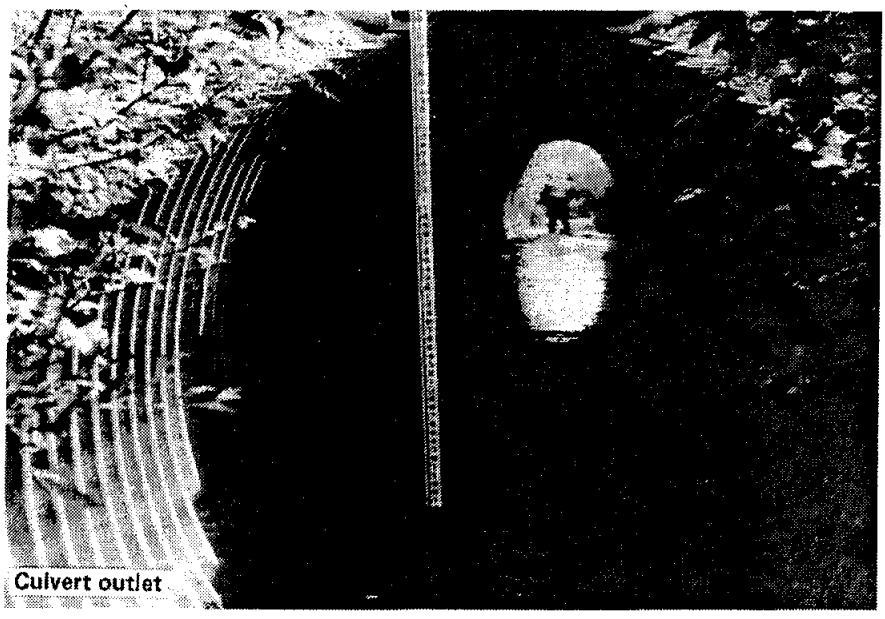
The discharge from this creek on July 7, 1982 was contained in one main culvert barrel; two overflow culverts were dry. Upstream of the culvert was a 25 by 15 ft pool; downstream was a 100 ft diameter pool. No slope measurements were taken up or downstream because of the ponded water and marshes. The other surveyed slopes appear in the diagram. Some riprap from the highway embankment was in the culvert entrance and the barrel contained rocks and gravel up to 6 in in diameter. The culvert was bent upwards at the entrance; the water depth was 0.49 ft. At the culvert outlet the water depth was 0.95 ft. Fish fry were observed in the pool at the culvert outlet. The watershed area was 14.4 sq mi.



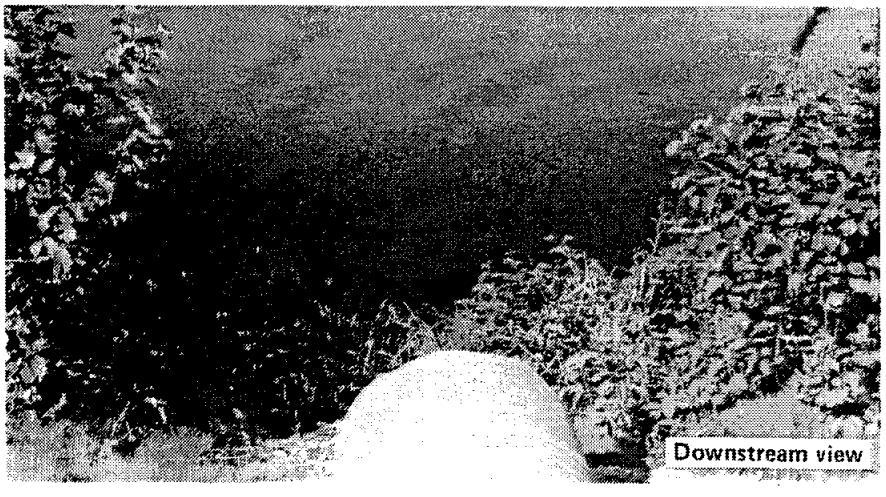
CULVERT LENGTH 105 FEET



Span 6' 4"
Rise 7'
Culvert inlet



Culvert outlet



Downstream view

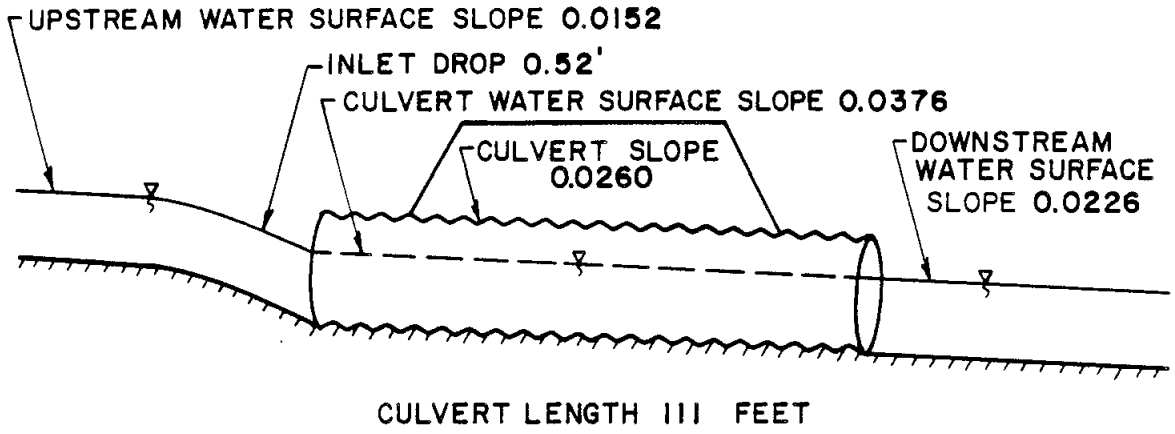
Site No. P-008 June Creek

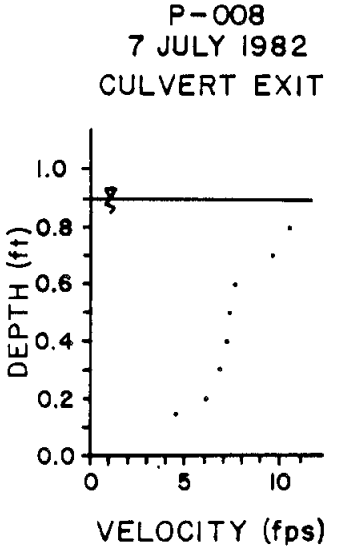
Location: Mile 269 Parks Highway

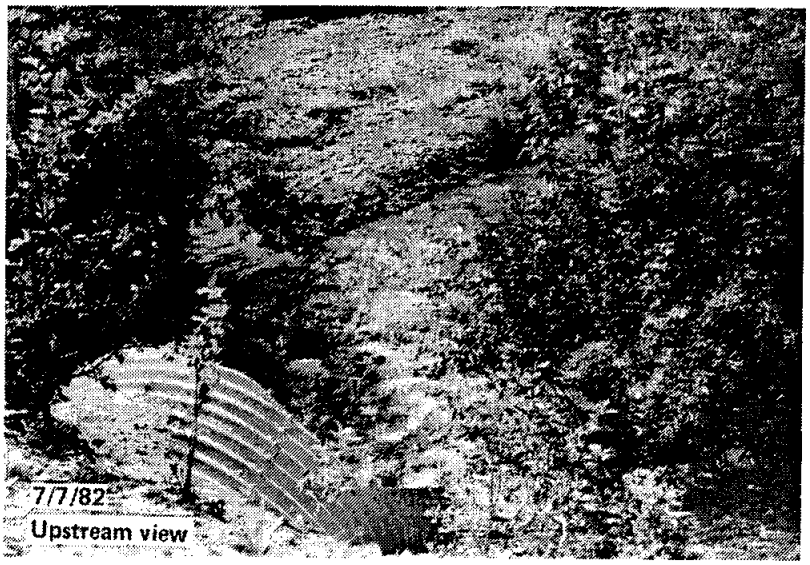
Map: Fairbanks A-5, T9S, R9W, Sec. 14

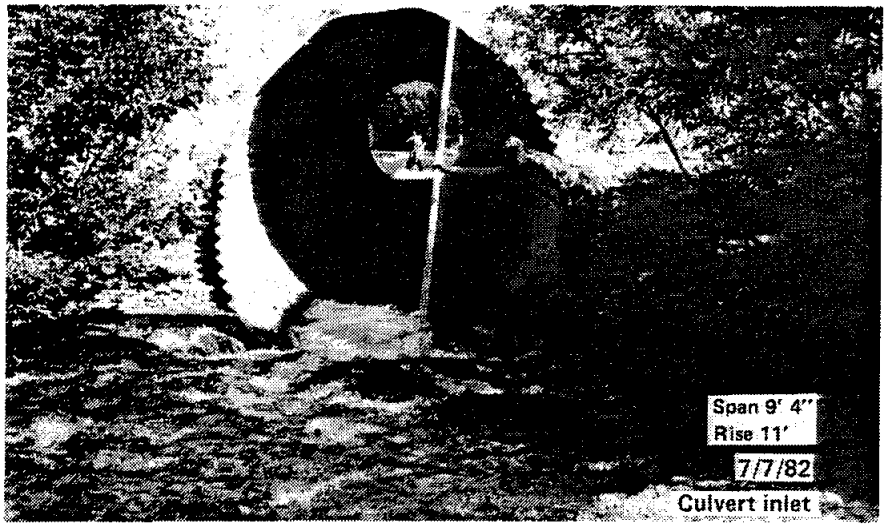
June Creek was visited on July 7, 1982. At that time a single culvert contained the observed discharge of 20.0 cfs. The culvert was slightly perched at the outlet and relatively high velocities were observed at the culvert exit; the water depth was 0.90 ft. There was a scour pool about 20 by 20 ft at the downstream end of the culvert. The barrel was clean; no drift was observed. Bedload size was estimated to be 4 to 5 in in diameter. The watershed area was 6.4 sq mi.

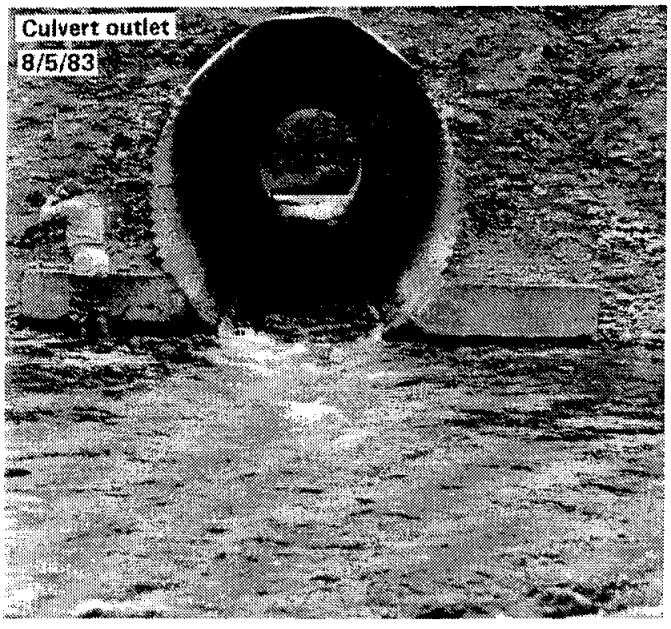
The June Creek site was visited again on August 5, 1983. Velocity profiles were taken at the culvert outlet and at a location 100 ft downstream of the culvert. This data is not graphically displayed here, but is contained in Section III of this report.



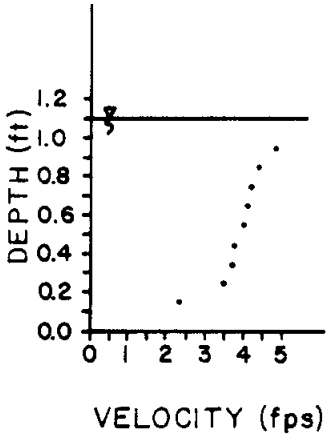


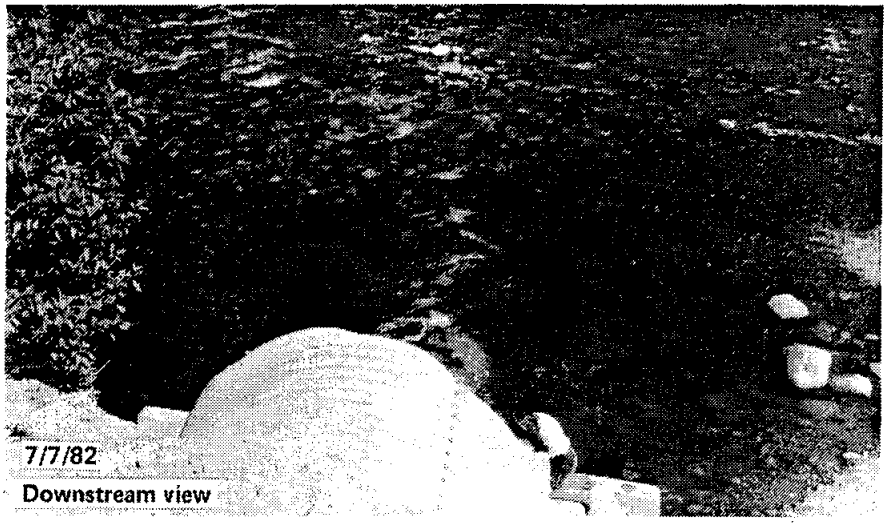






P-008
5 AUG 1983
100' DOWN-
STREAM FROM
CULVERT EXIT



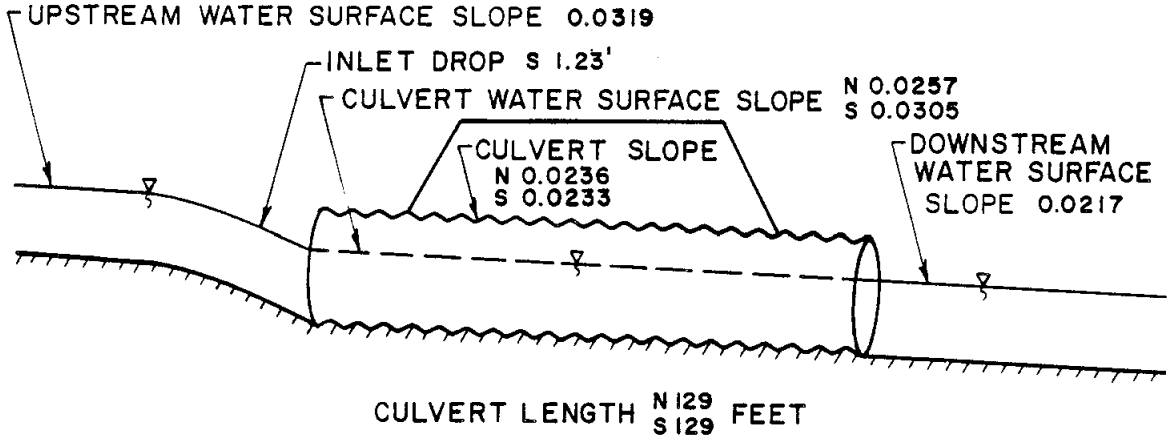


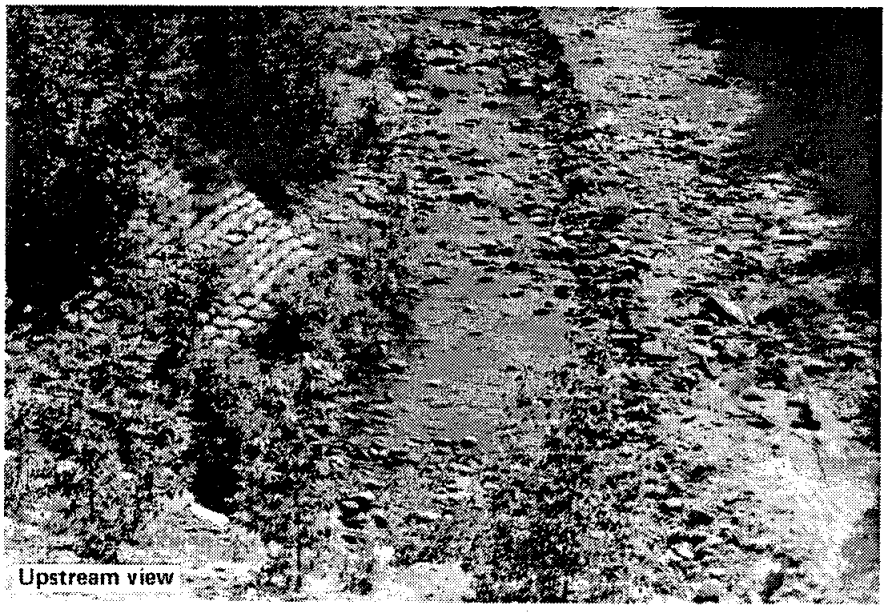
Site No. P-011 Slate Creek

Location: Parks Highway

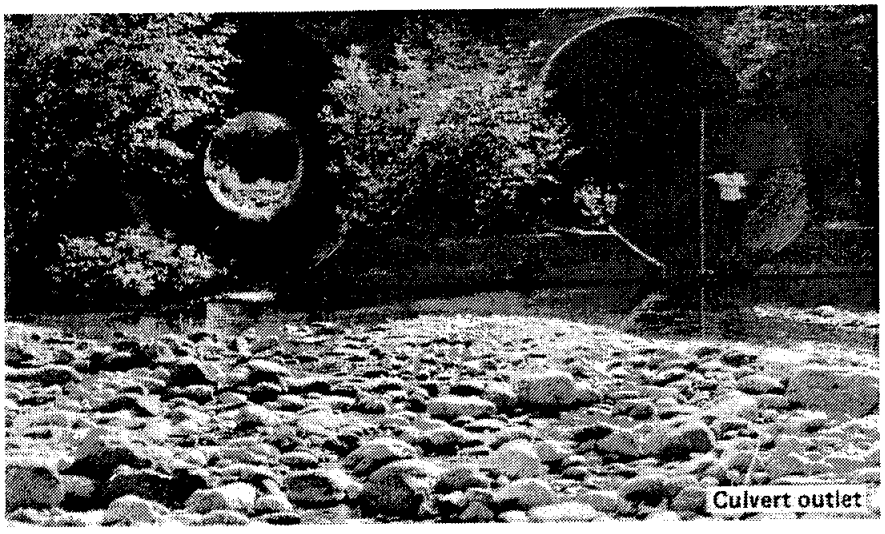
Map: Healy D-5, T11S, R8W, Sec. 4

Slate Creek was contained by two identical arched culverts. The majority of the 2.9 cfs discharge flowed through the southern culvert on July 7, 1982. The water surface profile for this date is shown in the diagram. No velocity profiles were taken due to the shallow depths: the water depth at the outlet of the southern culvert was 0.25 ft. Bed material consisted of rocks up to 9 in in diameter. The barrel contained silt and sand and some larger rocks. Both culverts had downstream scour pools 10 by 10 ft. Fish passage was obstructed at this stage due to the low discharge and shallow depths in the culvert. The watershed area was 10.9 sq mi.




Upstream view


Dia 11' 7"
Culvert inlet


Culvert outlet

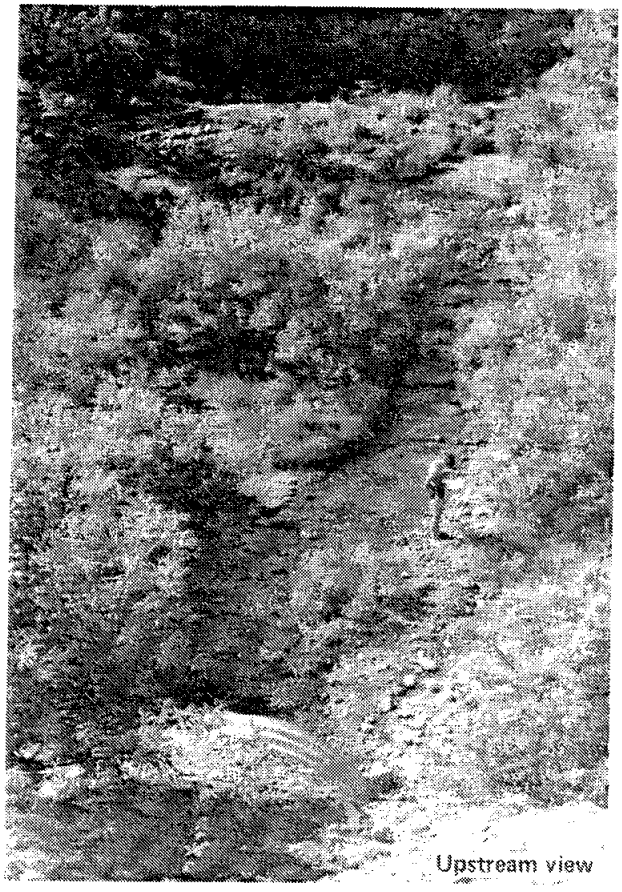

Downstream view

Site No. P-014 Little Panguingue Creek

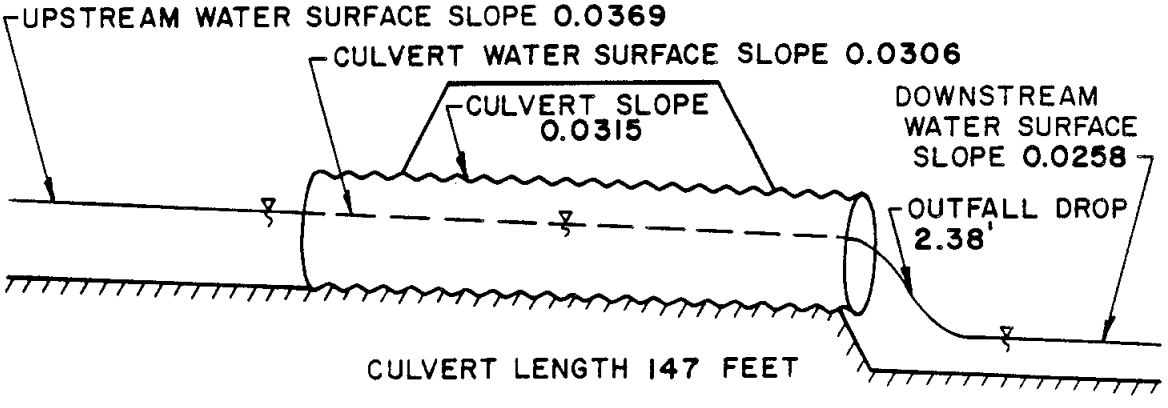
Location: Mile 254 Parks Highway

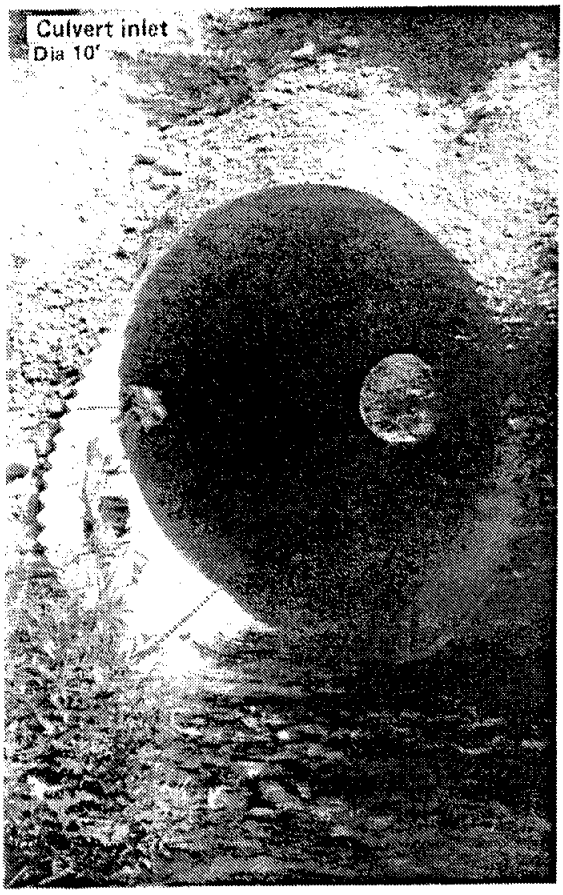
Map: Healy D-5, T11S, R8W, Sec. 27

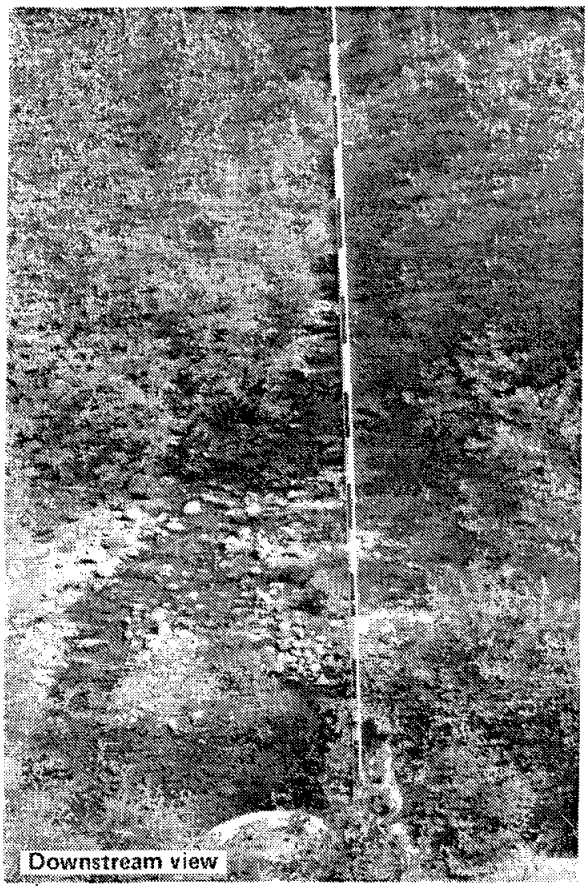
Little Panguingue was visited on July 8, 1982 when the discharge was 1.5 cfs. Large cakes of mud were noted in the culvert 3 ft above the culvert invert, indicating higher flows had occurred. The crest-stage indicator gave a high water mark reading of 2.85 ft. The estimated bed-load size was 3 to 4 in in diameter; the barrel was mostly clean except for a few rocks of this size. The water depth at the culvert outlet was 0.25 ft. A large scour pool 25 ft in diameter was at the culvert exit. The water-shed area was 4.1 sq mi.

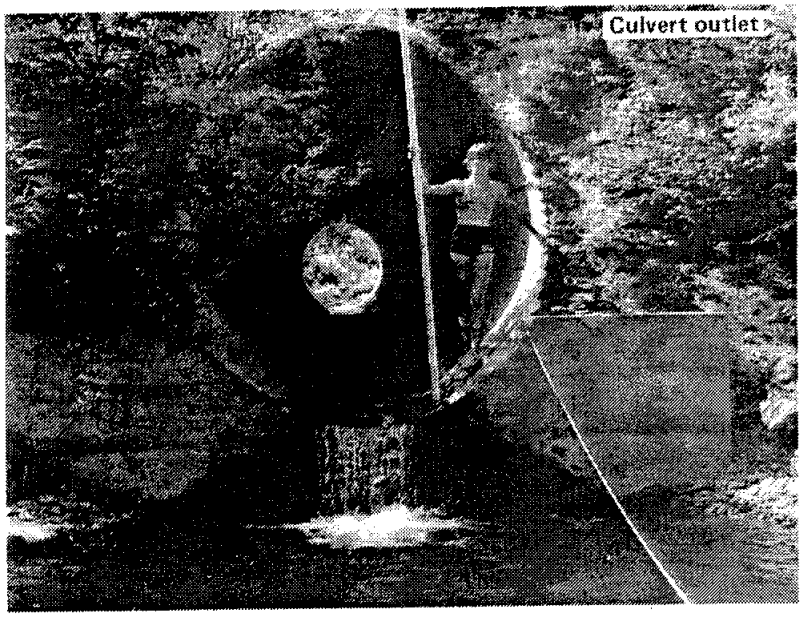


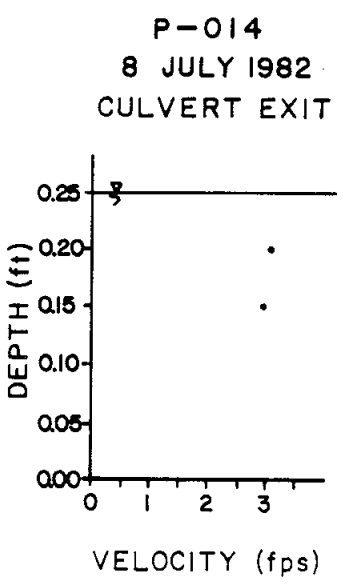
Upstream view




Culvert inlet
Dia 10'


Downstream view


Culvert outlet


P-014
8 JULY 1982
CULVERT EXIT
DEPTH (ft)
0.25
0.20
0.15
0.10
0.05
0.00
0
1
2
3
VELOCITY (fps)

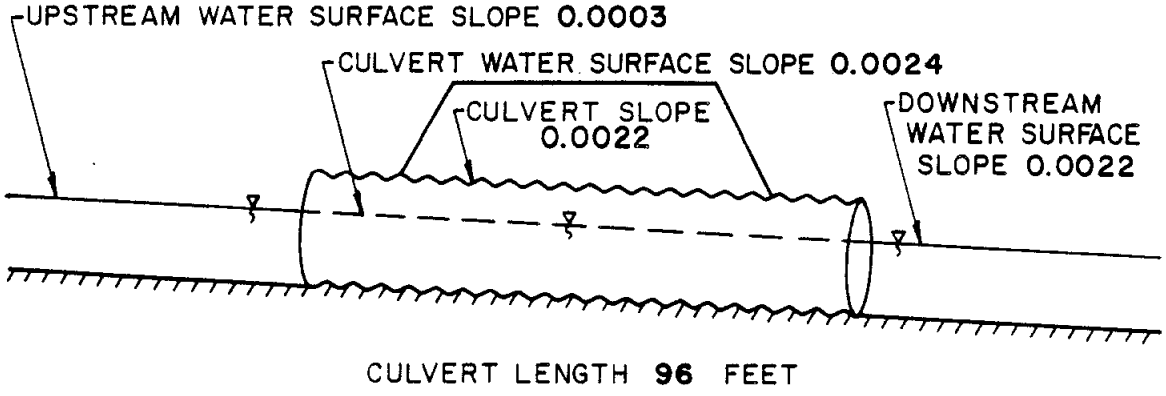
Site No. P-015 Unnamed Creek

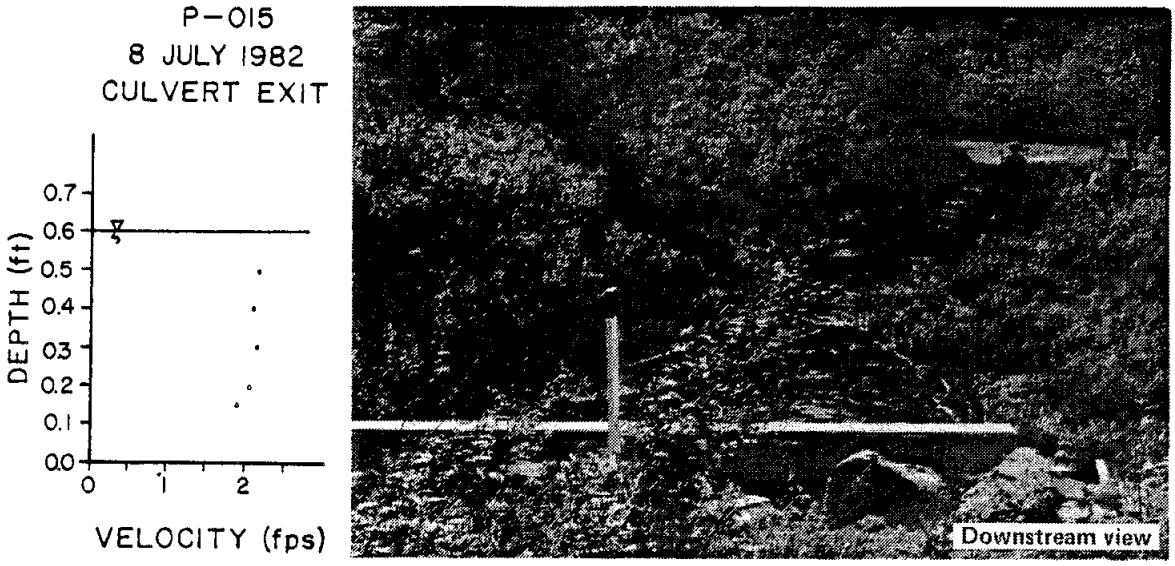
Location: Mile 222.5 Parks Highway

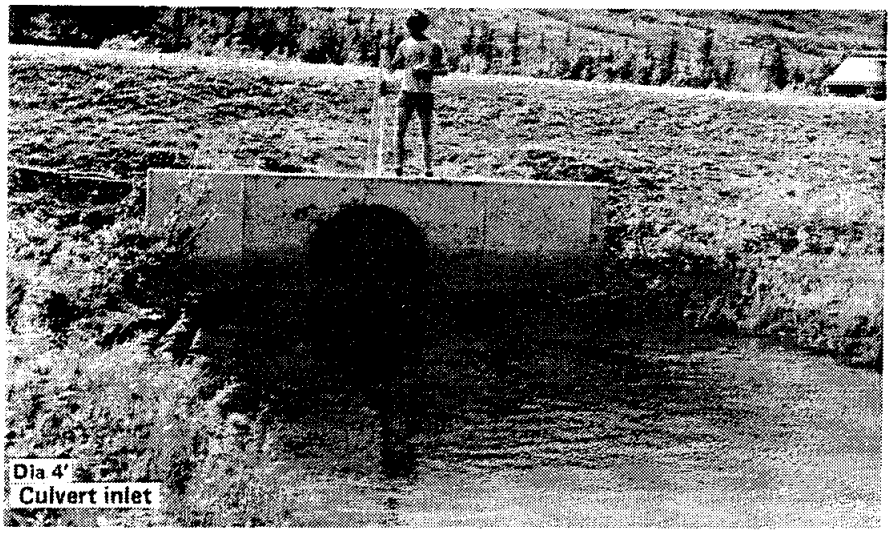
Map: Healy C-4, T16S, R7W, Sec. 13

This unnamed creek site along the Parks Highway was observed on July 8, 1982 when the flow was 2.44 cfs. The surveyed slopes for the culvert and creek are shown in the diagram. The creek emptied into the Nenana River 97 ft below the culvert exit. The watershed area was 2.6 sq mi. The bedload size was estimated to be fine sands and silts, and the barrel was clean. A high water mark was surveyed at 0.49 ft above the present water surface (on the south bank downstream of the culvert). Inlet and outlet water depths were 1.10 and 0.60 ft, respectively.

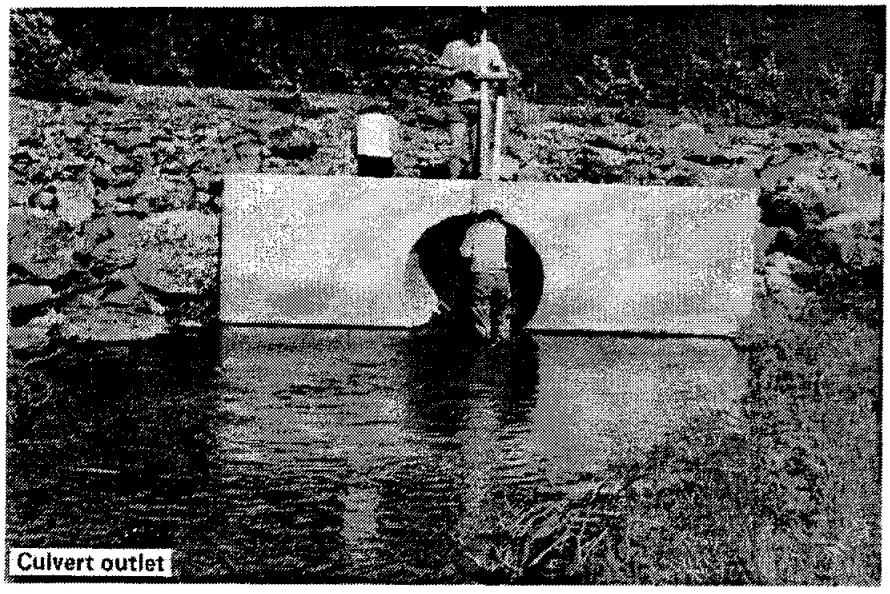
The creek contained excellent fish habitat areas. A school of grayling (up to 10 in long) was observed upstream of the culvert in a pool (50 by 15 ft). A smaller 10 ft diameter pool was at the culvert outlet.



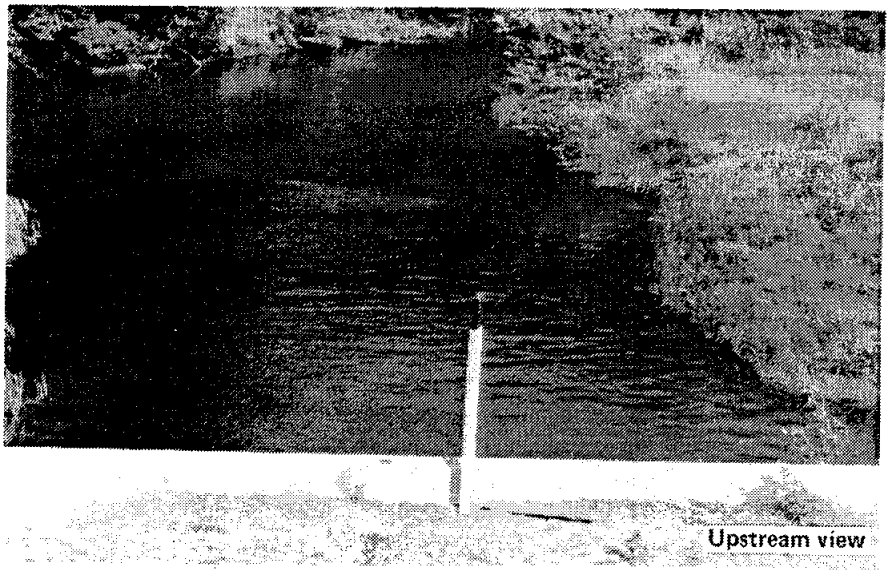




Dia 4'
Culvert inlet



Culvert outlet



Upstream view

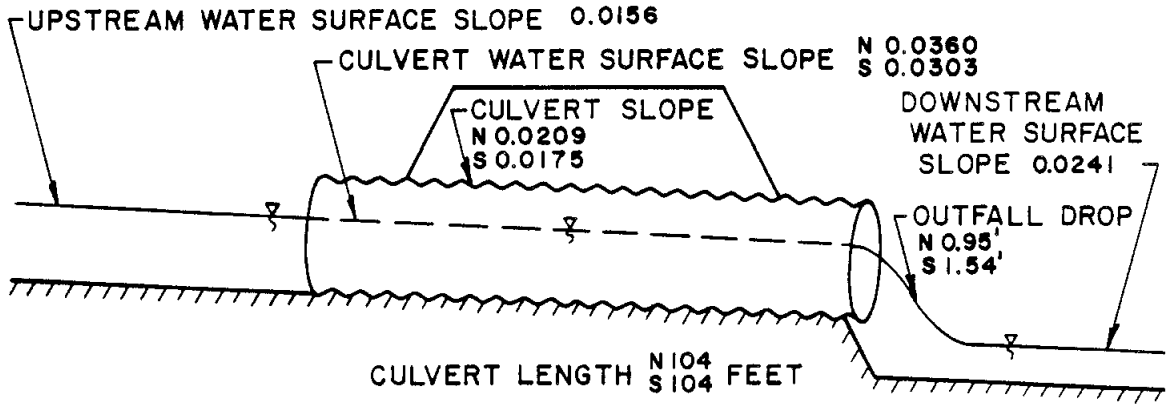
Site No. P-016 Slime Creek

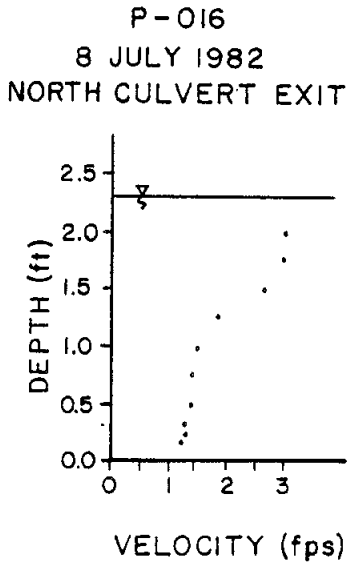
Location: Mile 220 Parks Highway

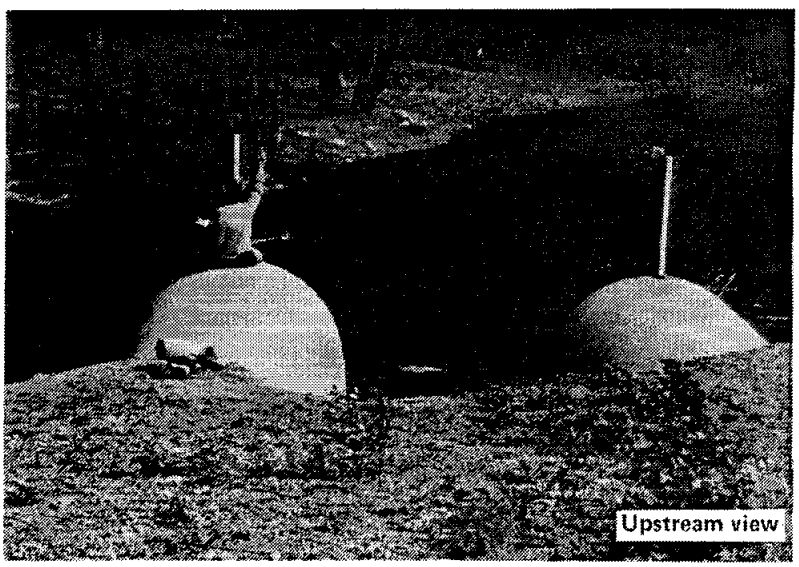
Map: Healy C-4, T16S, R7W, Sec. 24

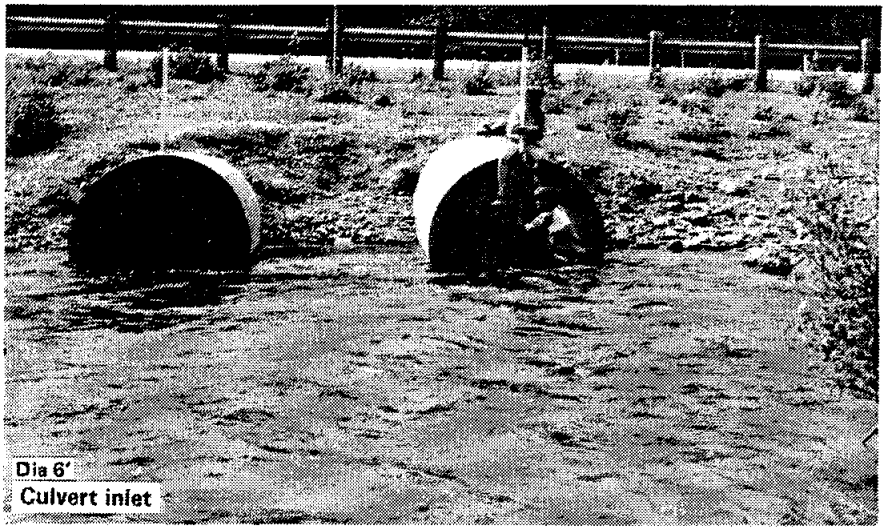
Two identical perched culverts contained the flow from the 6.9 sq mi Slime Creek watershed. The discharge was 58.1 cfs on July 8, 1982. The slopes for the two culverts and the creek are presented in the diagram. Both barrels were clean. A 30 ft diameter scour pool below the culverts, a smaller 15 ft diameter pool above the culverts, and calm water between the culvert inlets provided potential rest areas for fishes. The crest stage indicator at this site was washed out. The outlet depths were 0.80 and 1.30 ft for the north and south culverts, respectively. The inlet depth for the north culvert was 2.30 ft.

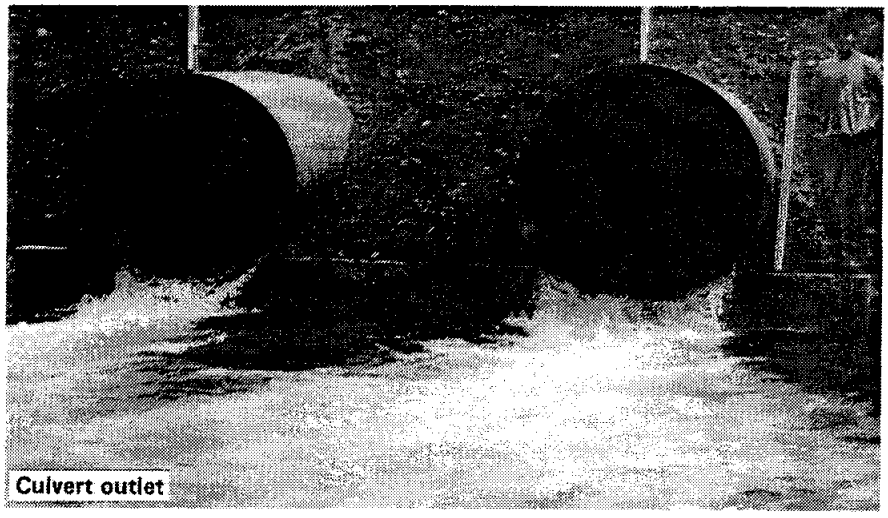
Slime Creek was visited again on August 5, 1983. Velocity profiles were obtained at the culvert inlet and 25 ft upstream of the inlet. This velocity data appears in Section III.

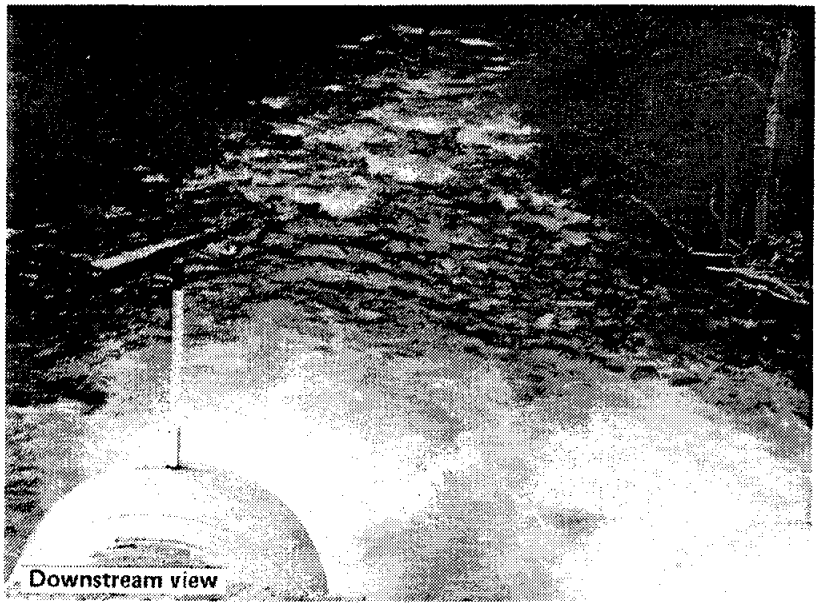




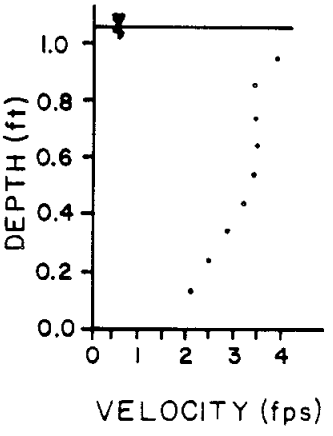








P-016
5 AUG 1983
25' UPSTREAM FROM NORTH
CULVERT ENTRANCE

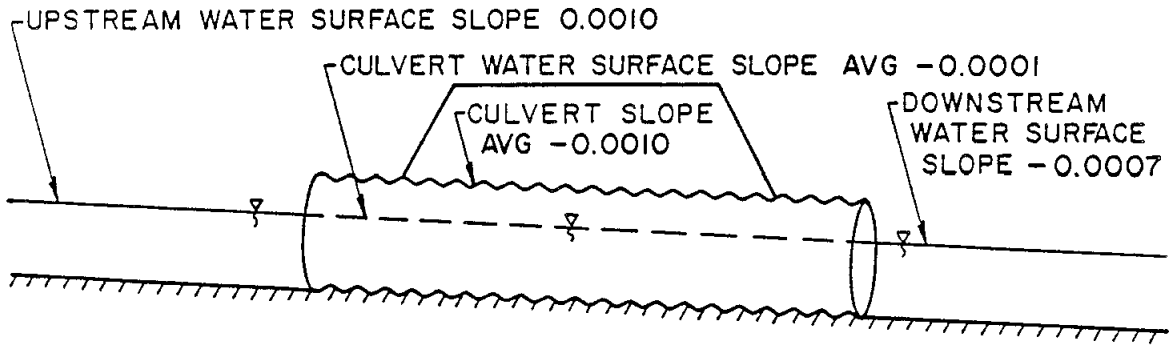


Site No. R-001 Unnamed Creek

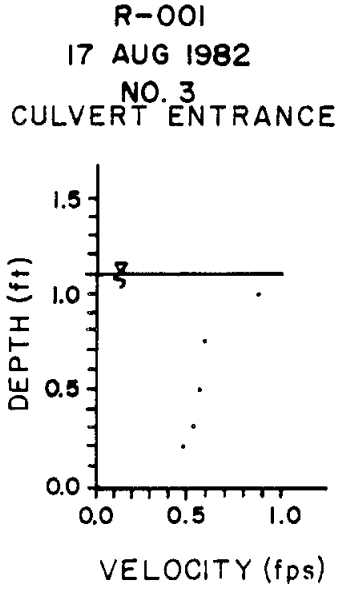
Location: Richardson Highway at Badger Road

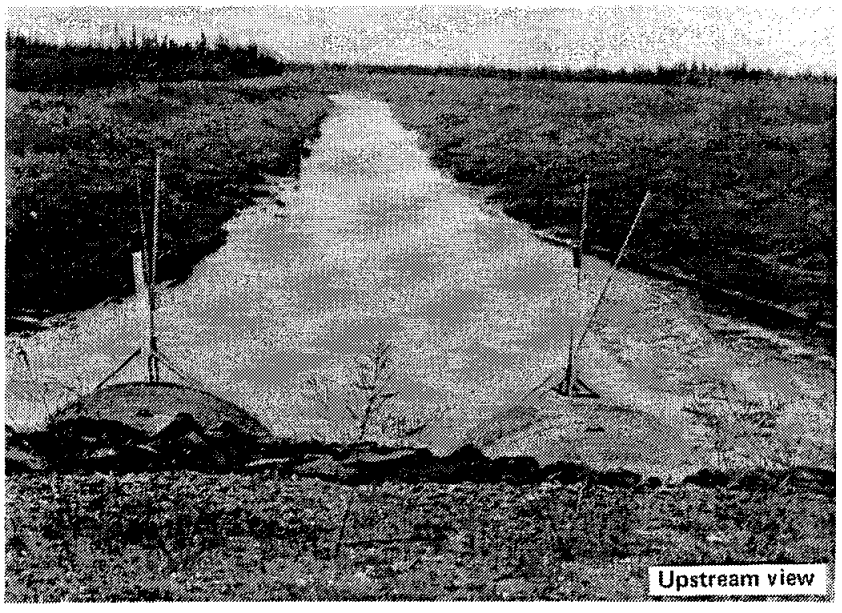
Map: Fairbanks D-2, T1S, R1E, Sec. 20

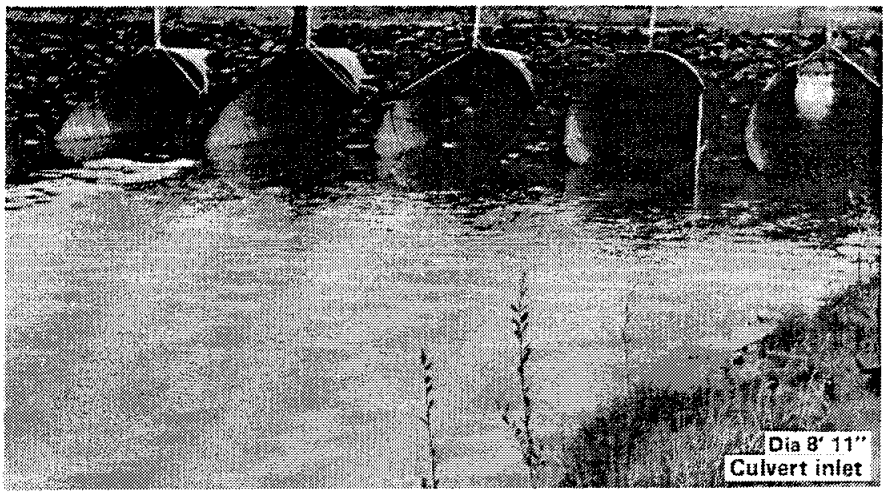
This creek, a drainage channel of the Chena Flood Project, was observed on August 17, 1982. Five culverts, numbered 1 to 5, north to south, contained the flow. The surveyed slopes are shown in the diagram. The five crown slopes were averaged: -0.0016, -0.0009, 0.0002, 0.0003, and -0.0028 (north to south). The bed material was sand and silt, and drift was observed in all five barrels. A velocity profile was measured at the inlet of the middle culvert. The watershed boundaries were insufficiently defined so the area was not determined.

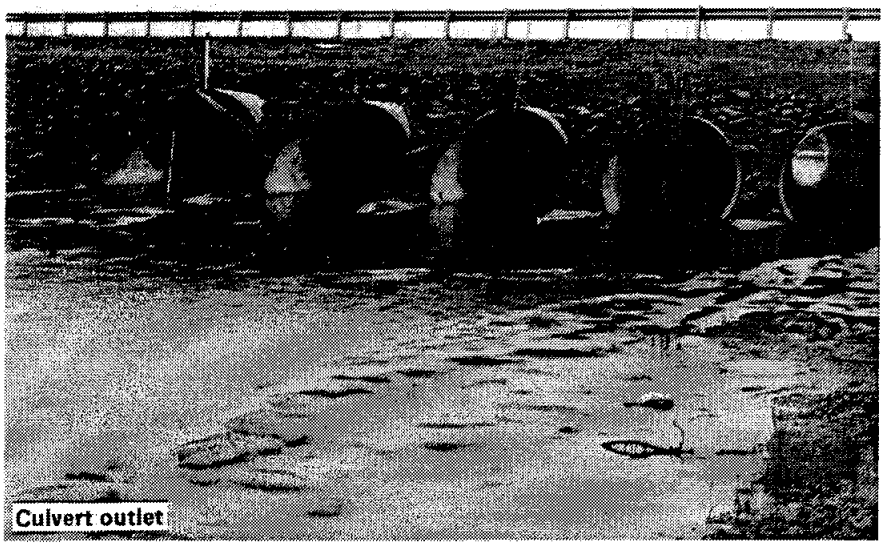


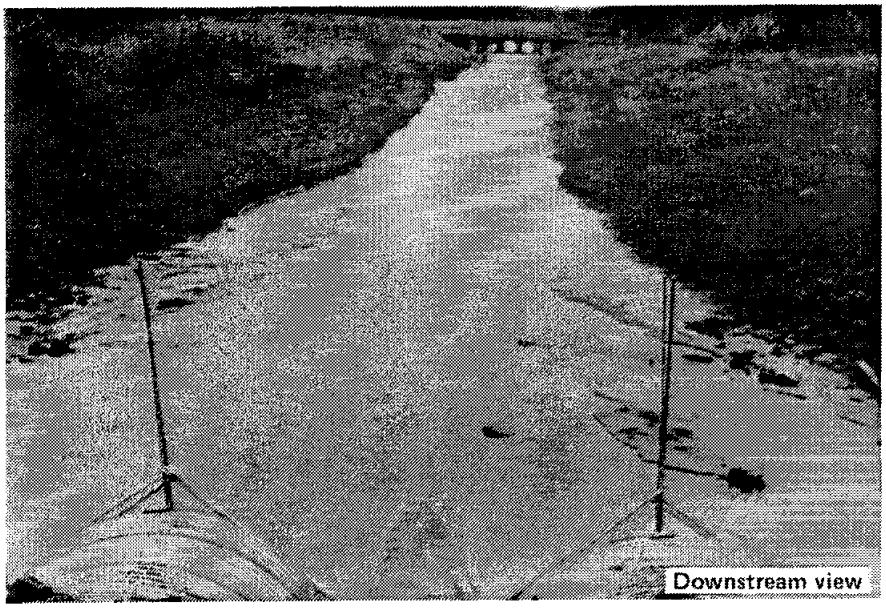
ALL CULVERT LENGTHS 219 FEET






Dia 8' 11"
Culvert inlet


Culvert outlet

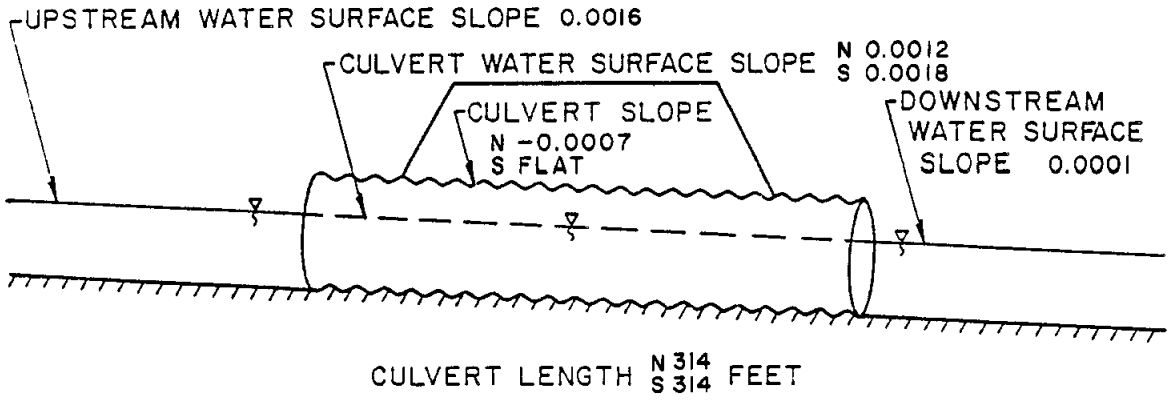

Downstream view

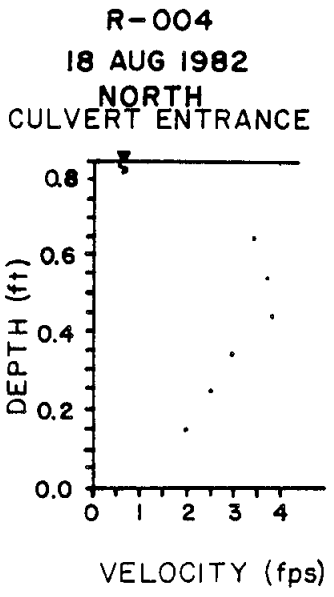
Site No. R-004 Chena Slough Tributary

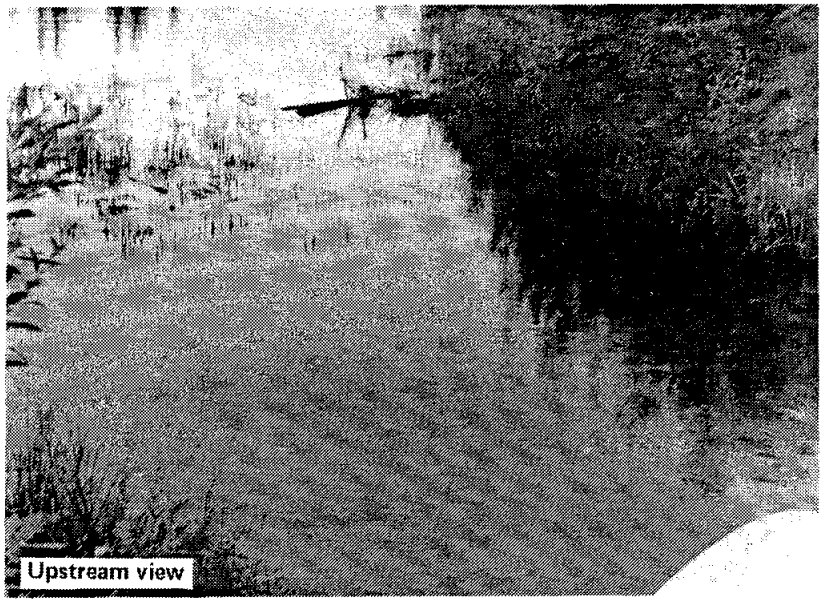
Location: Richardson Highway at Badger Road

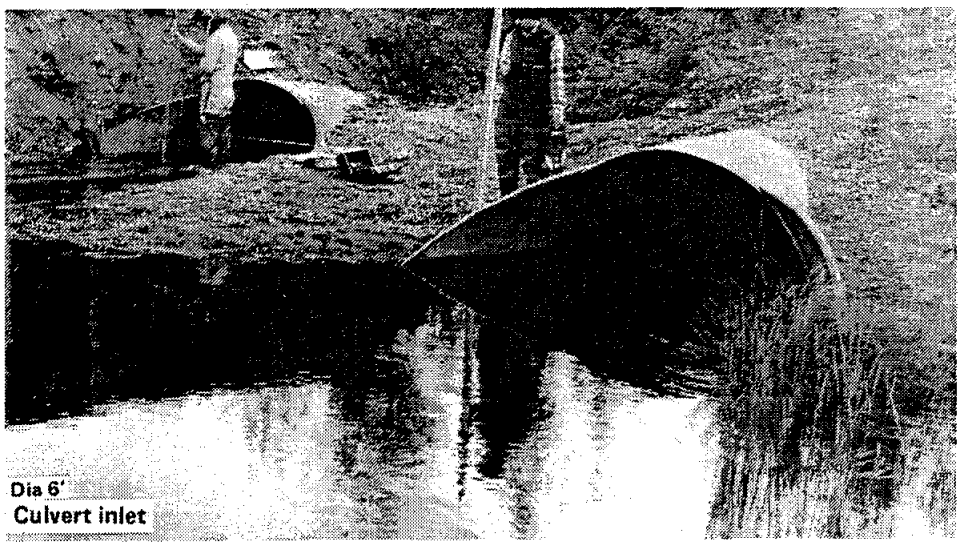
Map: Fairbanks D-1, T1S, R2E, Sec. 9

Two culverts accommodated the 10.5 cfs flow observed at this site on August 18, 1982. The north culvert carried 8.3 cfs; inlet and outlet water depths for the north culvert were 0.85 and 2.40 ft, respectively. The south culvert had lower velocities and contained 2.2 cfs; inlet and outlet depths for the south culvert were 1.95 and 2.10 ft, respectively. The south barrel contained some fine silt; the north barrel had up to 4 in diameter rocks at the entrance. The water surface profiles for both culverts and the slough appear in the diagram. The small slopes observed at this site were the result of large ponds both upstream and downstream of the culvert installation. Small fishes (up to 4 in long) were observed in these ponds on both sides of the highway. The watershed boundaries were insufficiently defined, so no watershed area was determined.



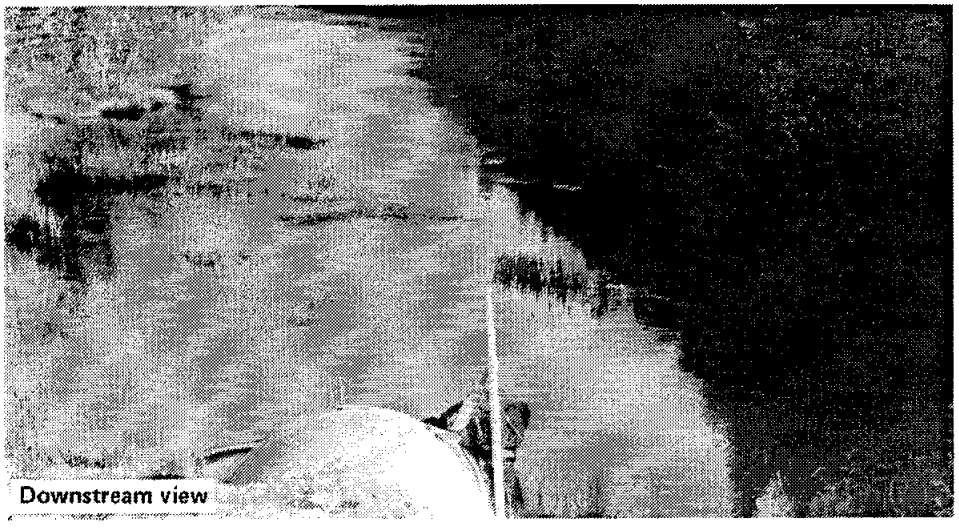






Dia 6'
Culvert inlet

Culvert outlet



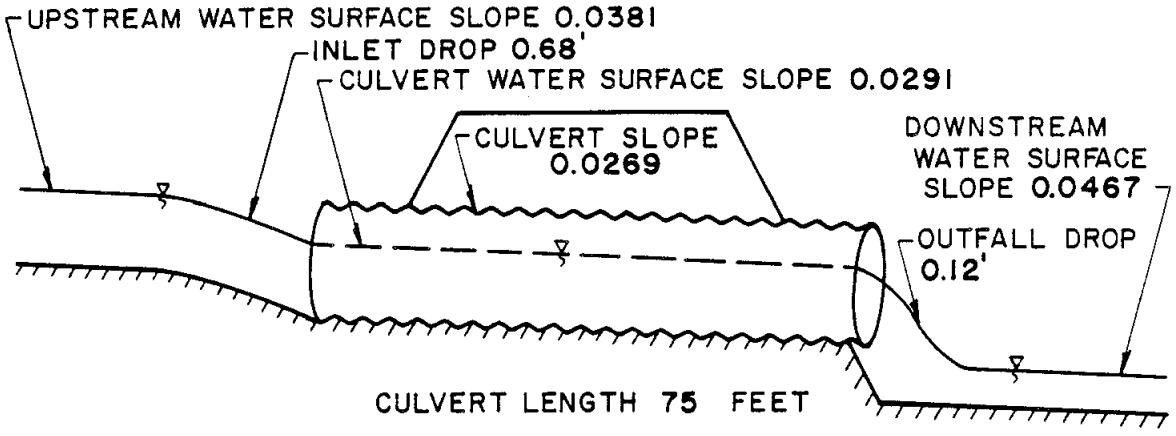
Downstream view

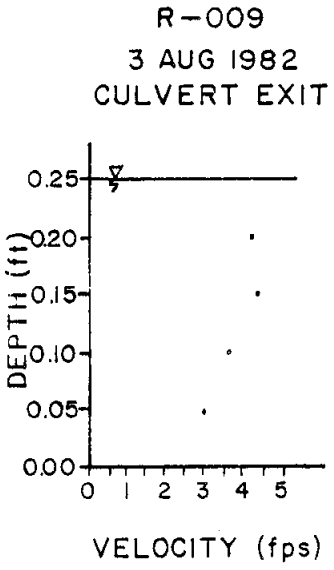
Site No. R-009 Unnamed Creek

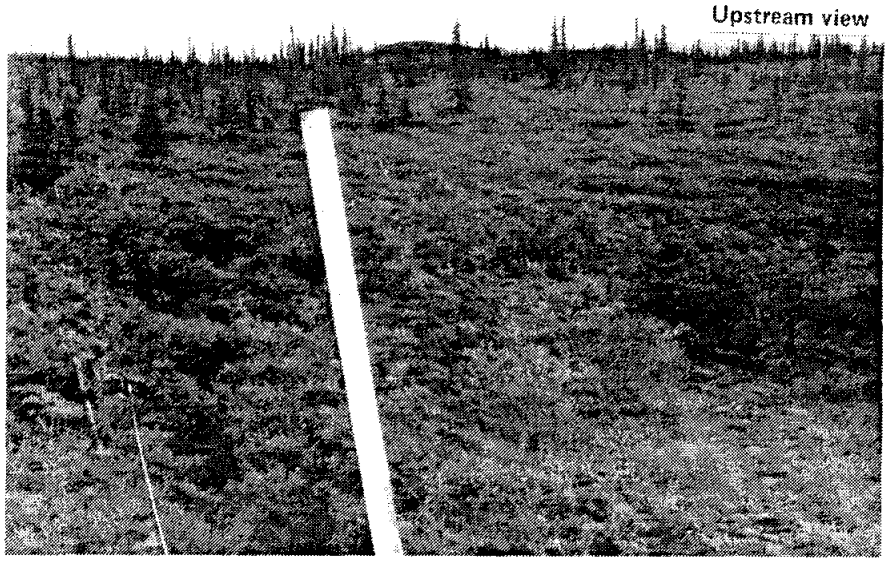
Location: Mile 242.3 Richardson Highway

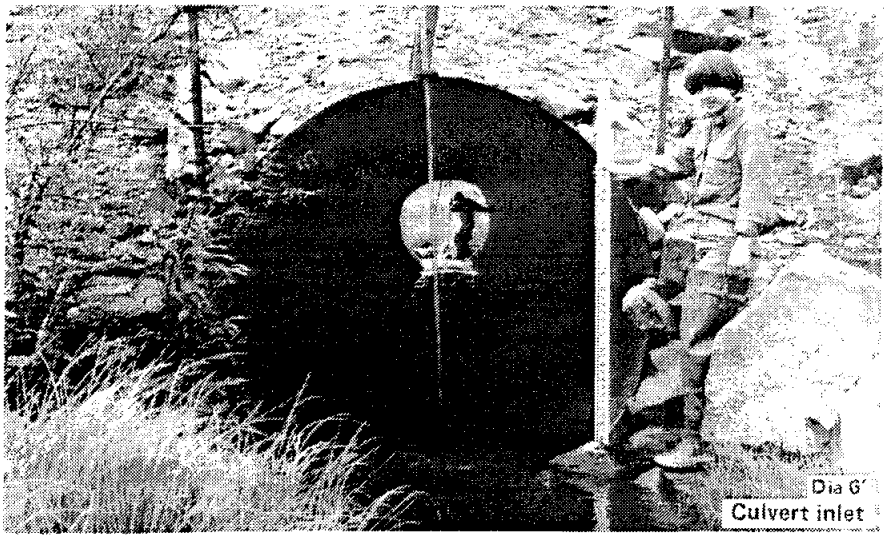
Map: Mt. Hayes C-4, T14S, R10E, Sec. 5

This unnamed creek along the Richardson Highway was observed on August 3, 1982. The discharge was 1.7 cfs and the surveyed slopes are shown in the diagram. A water surface drop at the culvert inlet measured 0.68 ft. The culvert barrel was clean; no drift was observed. The total water depth at the culvert outlet was 0.25 ft, and the drop out of the culvert was 0.12 ft. Large pieces of riprap were noted in the channel at the culvert outlet. These pieces of riprap provided the only resting areas for fishes as no pools were observed upstream or downstream of the culvert. The bedload size was estimated at 4 in in diameter. The watershed area was 3.3 sq mi.

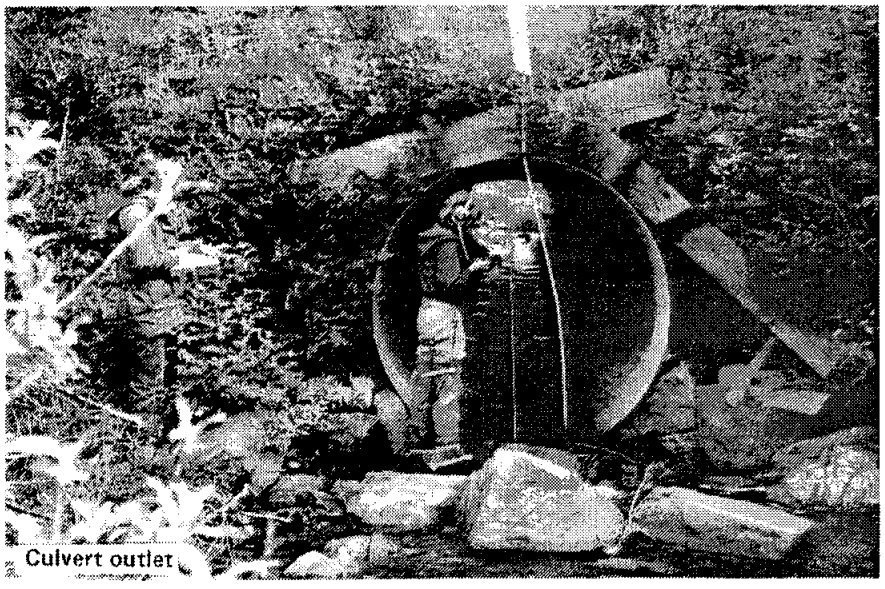




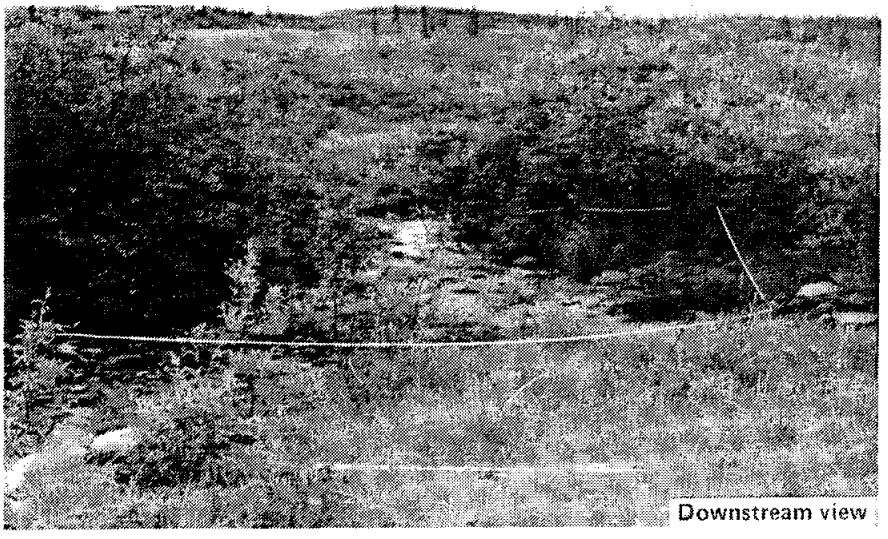




Dia 6'
Culvert inlet



Culvert outlet



Downstream view

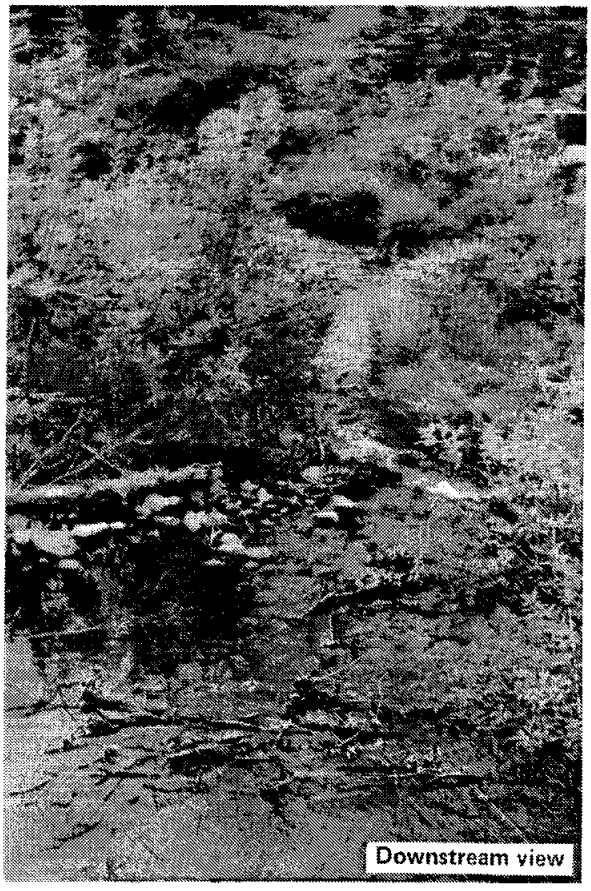
Site No. R-010 Unnamed Creek

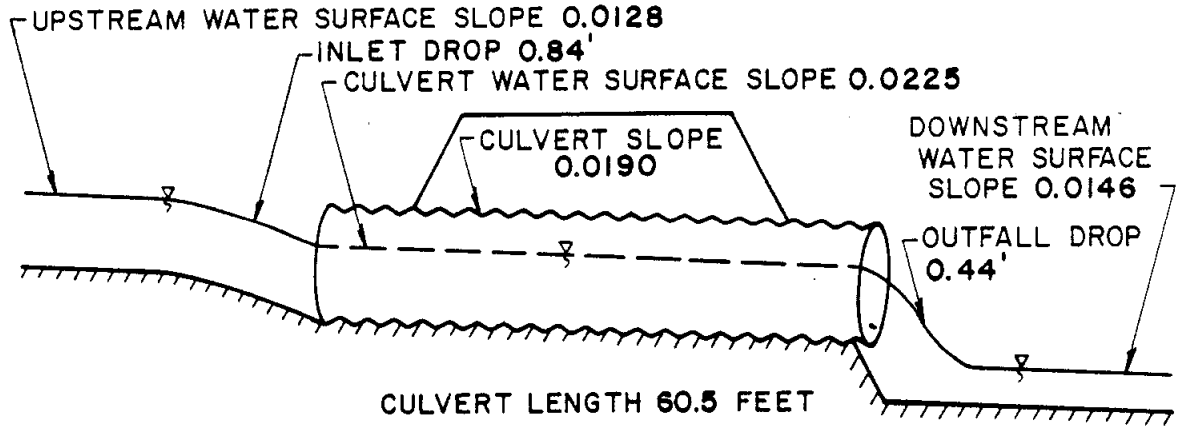
Location: Richardson Highway

Map: Mt. Hayes C-4, T14S, R10E, Sec. 18

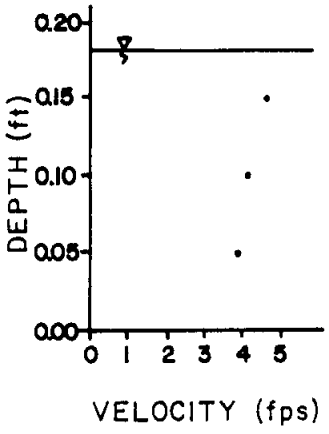
A rectangular wooden culvert contained the 3.1 cfs discharge at this unnamed creek on August 3, 1982. The water depth at the culvert inlet was 0.13 ft; the water depth at the culvert outlet was 0.18 ft. A beaver pond was located upstream and south of the culvert. The upstream slope was measured along another channel upstream and to the north of the culvert. The surveyed slopes for this site appear in the diagram. Two 7 inch grayling were observed above the culvert installation. A 10 ft diameter scour pool was noted below the culvert outlet. The barrel was clean from sediments and drift but there was a dam of branches and twigs at the culvert entrance causing a measurable water surface drop. The watershed boundaries were insufficiently defined to obtain a watershed area.


Upstream view

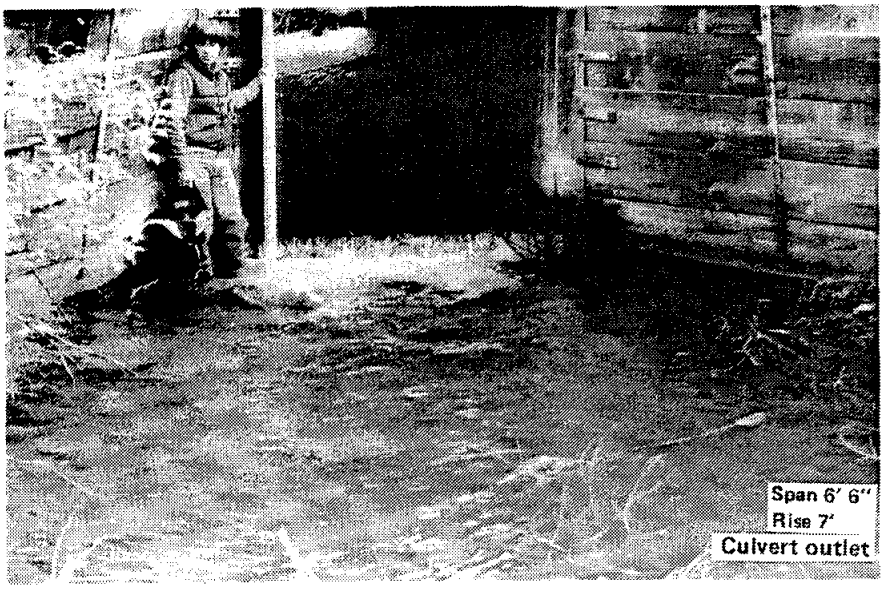

Downstream view



R-010
3 AUG 1982
CULVERT EXIT




Culvert inlet

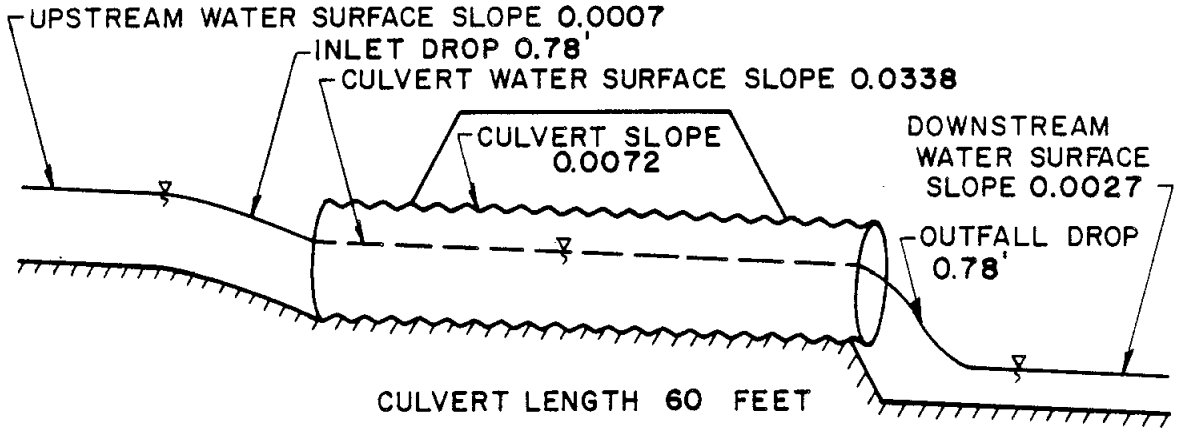

Span 6' 6"
Rise 7'
Culvert outlet

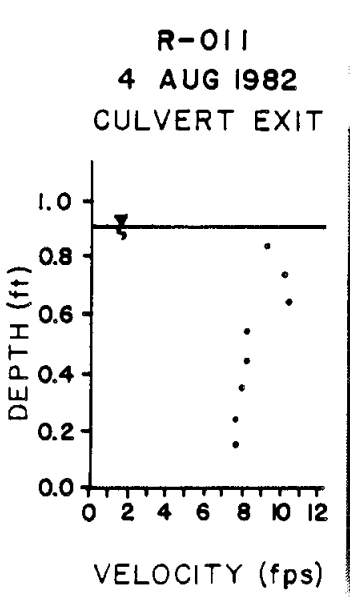
Site No. R-011 Donnelly Creek

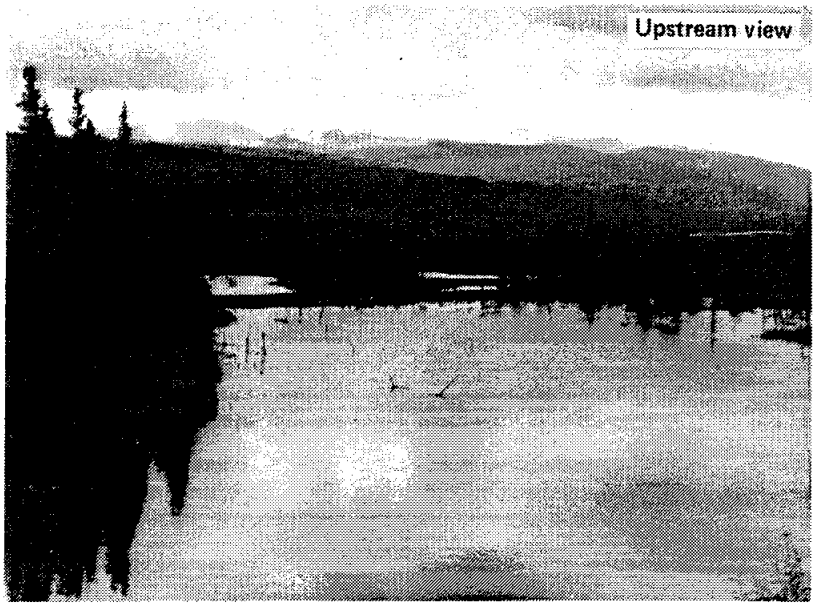
Location: Richardson Highway

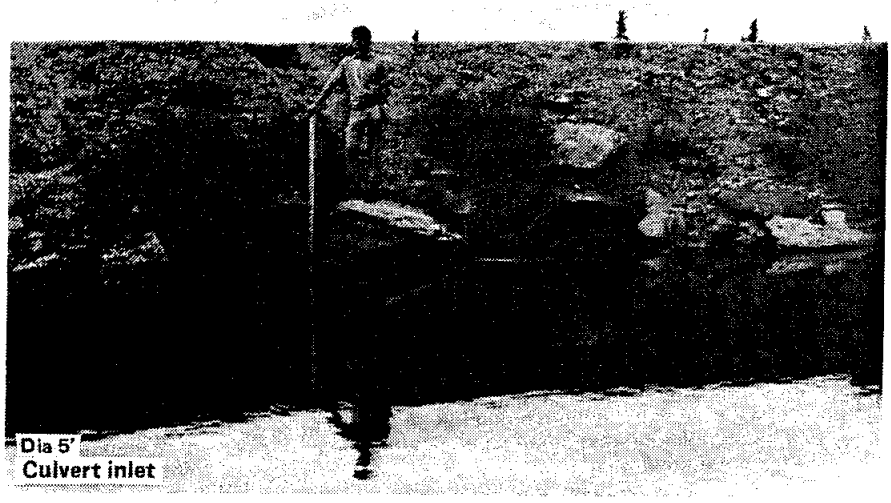
Map: Mt. Hayes C-4, T14S, R10E, Sec. 30

Donnelly Creek contained a discharge of 19.8 cfs on August 4, 1982. The surveyed water surface profiles for the creek and culvert are shown in the diagram. The bed material downstream of the culvert was rocks 5 in in diameter and smaller. The outlet of the barrel was clean; at the culvert entrance were large boulders. Upstream of the culvert was a large flooded area (see picture below). Downstream of the culvert was a 20 ft diameter backwater pool. The water depth at the culvert inlet was 1.30 ft; at the culvert outlet the water depth was 0.90 ft. The watershed area was 5.0 sq mi.

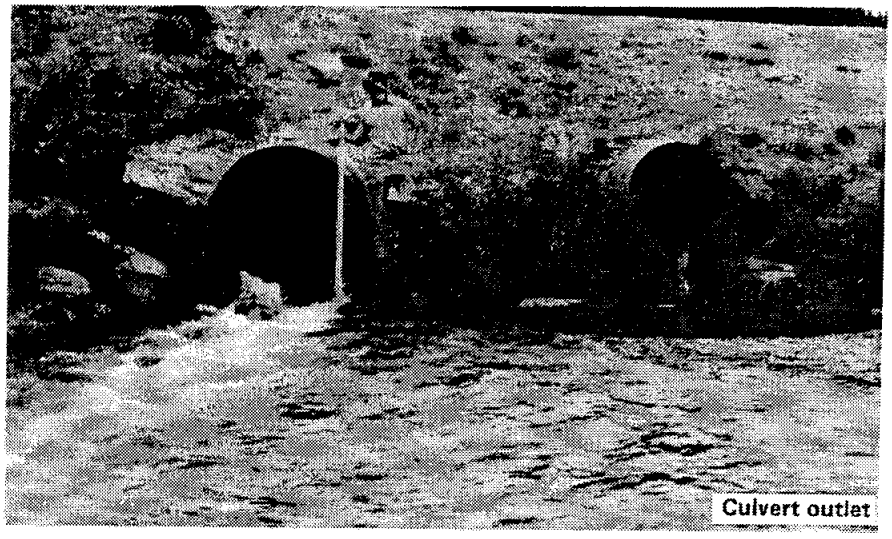




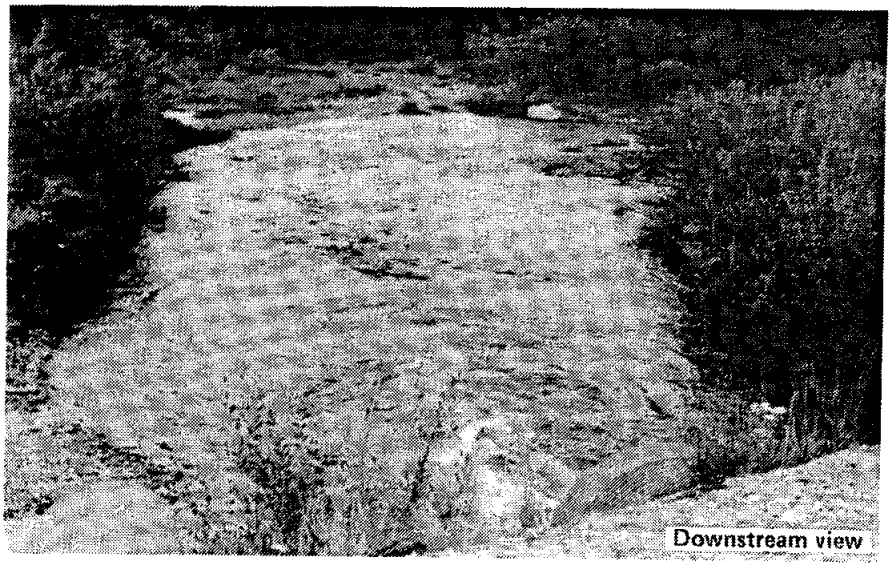




Dia 5'
Culvert inlet



Culvert outlet



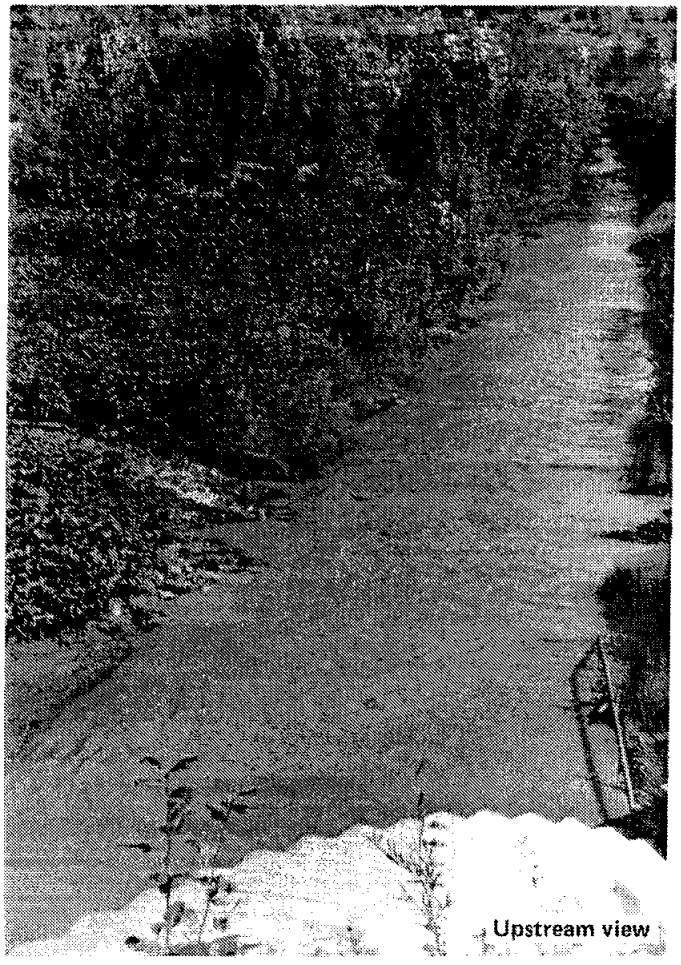
Downstream view

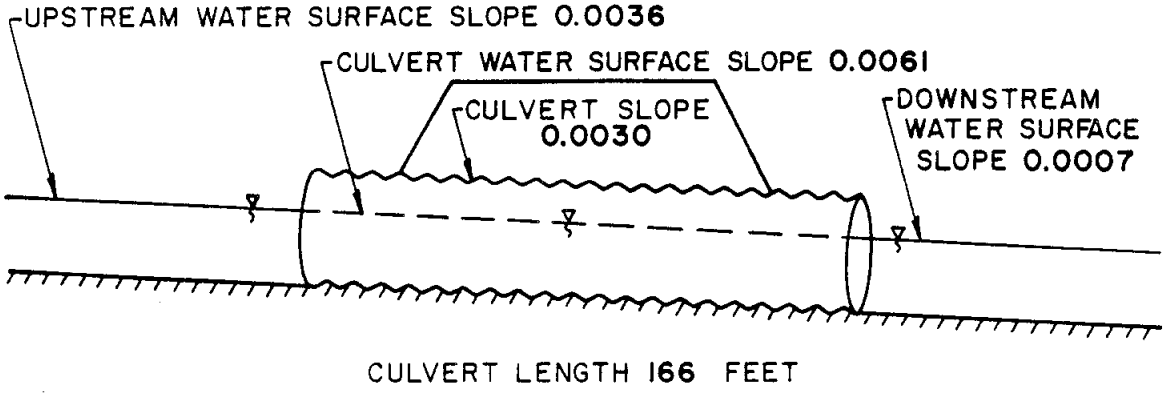
Site No. S-002 Goldstream Creek

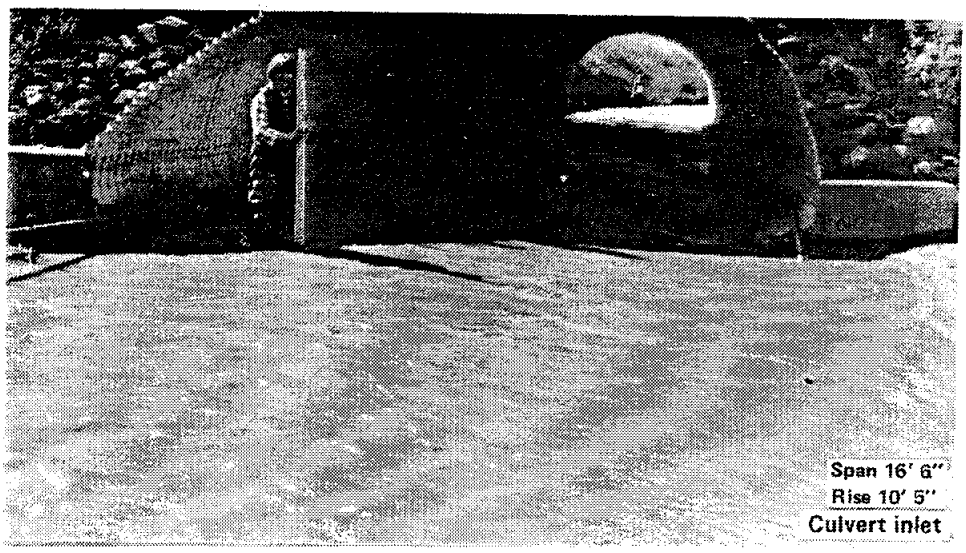
Location: Steese Highway-Elliott Highway intersection

Map: Fairbanks D-2, T2N, R1E, Sec. 31

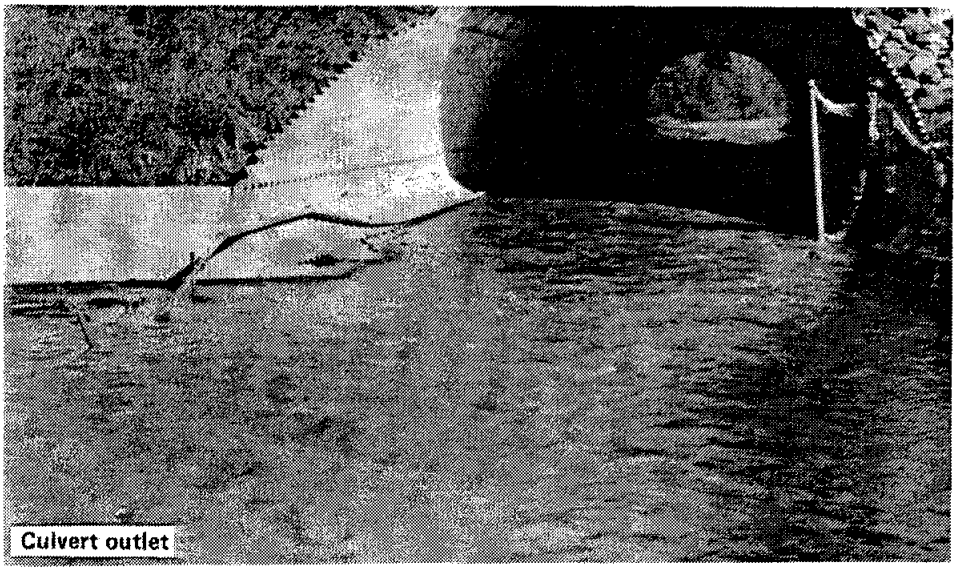
This channelized stream near Fox, Alaska was observed on August 18, 1982. The surveyed slopes are shown in the diagram. The recorded discharge was 20.9 cfs and the creek carried a high suspended sediment load. Angular riprap (up to 5 in in diameter) was observed in the culvert barrel. The water depth at the culvert entrance was 1.05 ft; at the culvert outlet the water depth was 0.85 ft. The watershed area was 31.6 sq mi.







Span 16' 6"
Rise 10' 5"
Culvert inlet



Culvert outlet

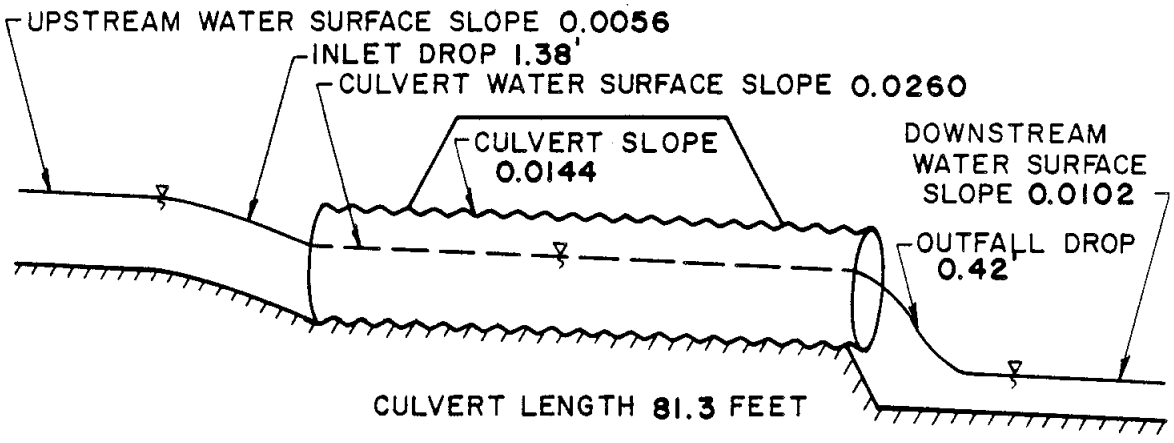
Downstream view

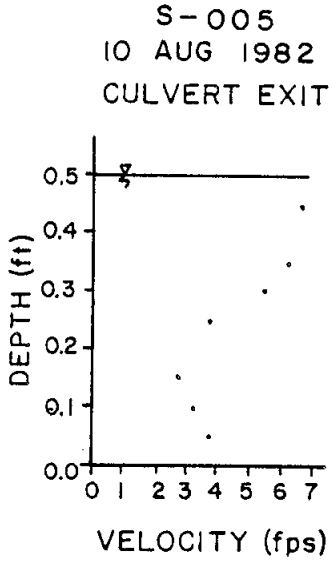
Site No. S-005 Dora Creek Tributary

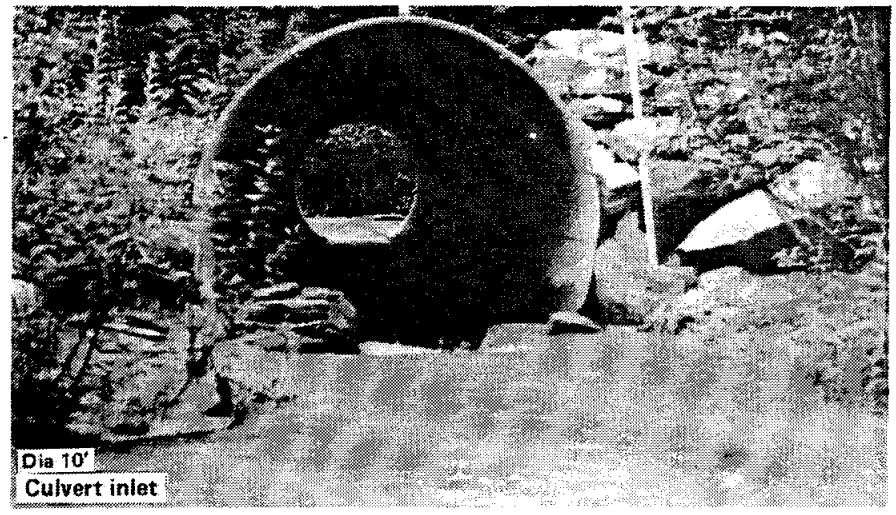
Location: Mile 25.5 Steese Highway

Map: Livengood A-1, T3N, R2E, Sec. 19

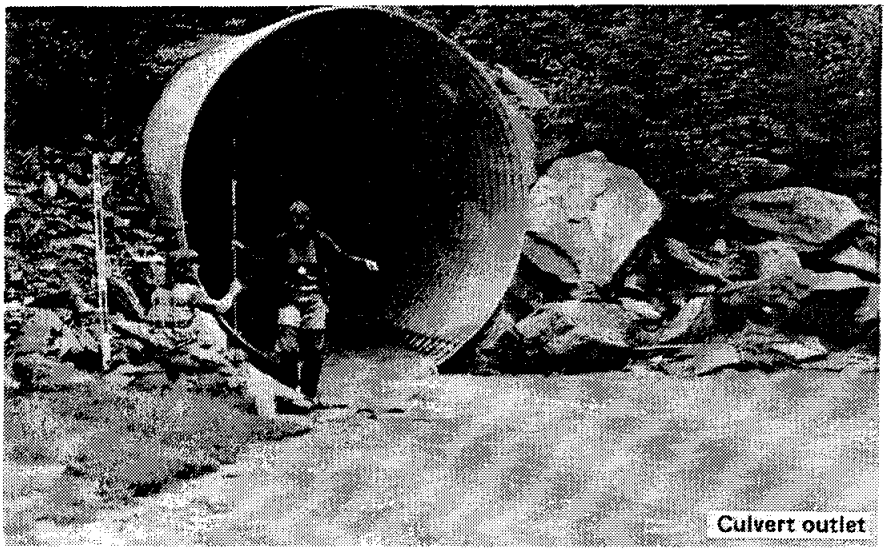
This site was observed on August 10, 1982 when the recorded flow was 4.9 cfs. The measured water surface profiles for the creek and culvert are shown in the diagram. Water depths at the culvert entrance and exit respectively were 0.65 and 0.50 ft. Several large pieces of rip rap were seen in the first half of the culvert, otherwise the barrel was clean. A 20 ft diameter pool was at the culvert outlet and the stream made a 90° bend leaving this pool. Bedload was estimated to be silt sized. The watershed boundaries were insufficiently defined to obtain a watershed area.



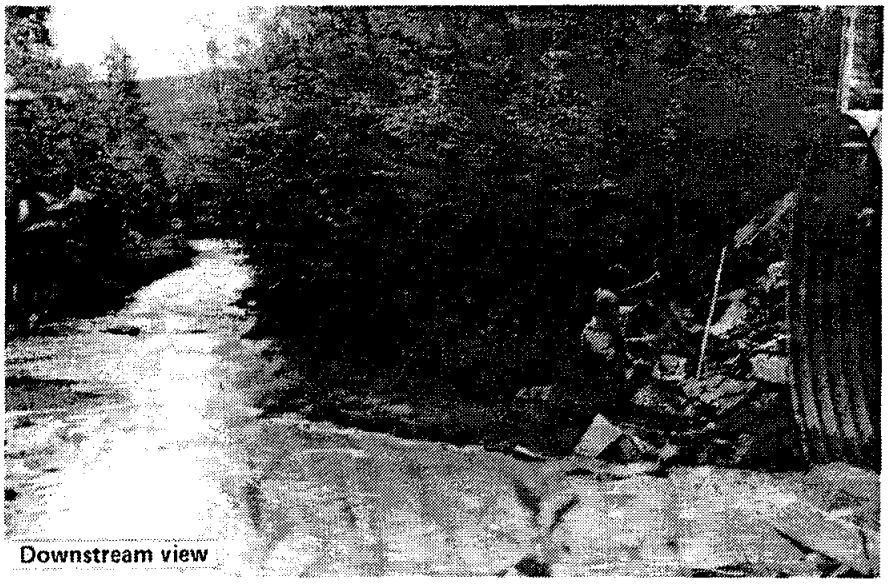




Dia 10'
Culvert inlet



Culvert outlet



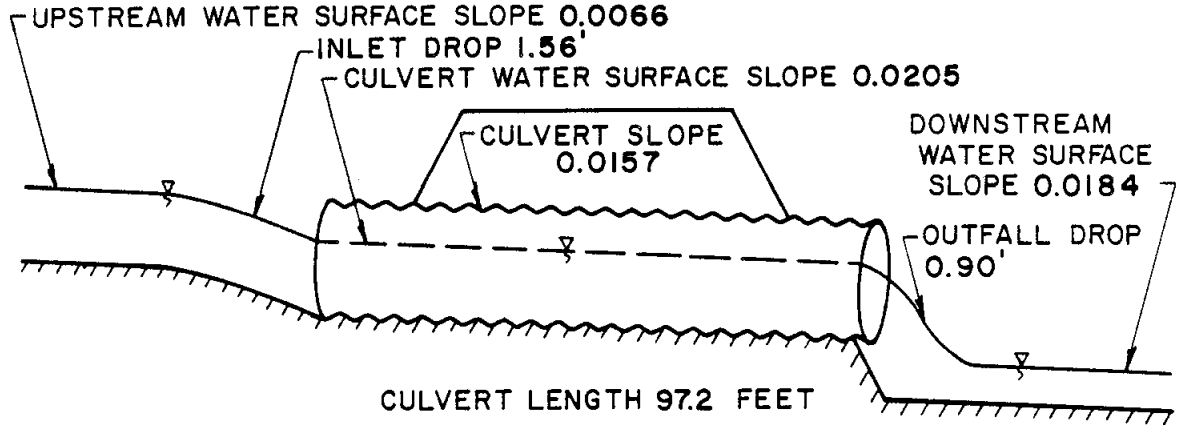
Downstream view

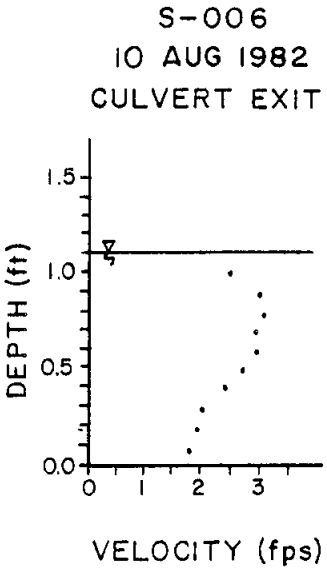
Site No. S-006 Boston Creek

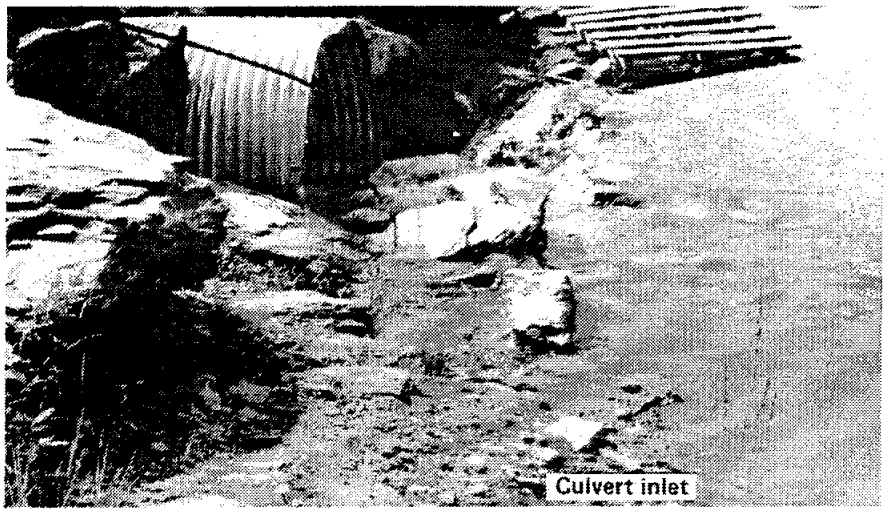
Location: Steese Highway

Map: Livengood A-1, T5N, R3E, Sec. 28

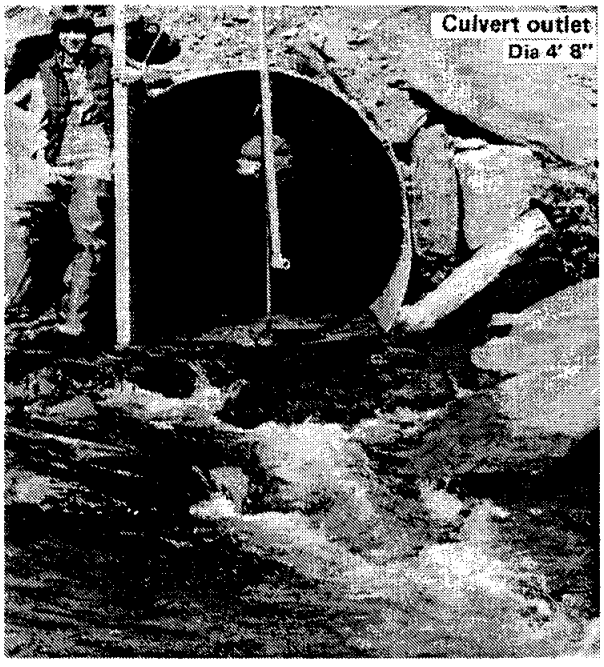
The surveyed water surface profiles for Boston Creek appear in the diagram, below. Significant drops into and out of the culvert were observed, due to large pieces of riprap at both ends of the culvert. A 25 ft diameter pool upstream of the culvert was silt laden and contained minnows. A deep 25 ft diameter scour pool downstream of the culvert was rocky and contained large pieces of riprap. Other than some large pieces of riprap in the culvert, the barrel was clean. Bed material was silt upstream of the culvert and 5 in diameter (maximum) material downstream of the culvert. Total depth at the culvert outlet was 1.10 ft. The watershed area was 7.1 sq mi. The observed flow on August 10, 1982 was 4.5 cfs.



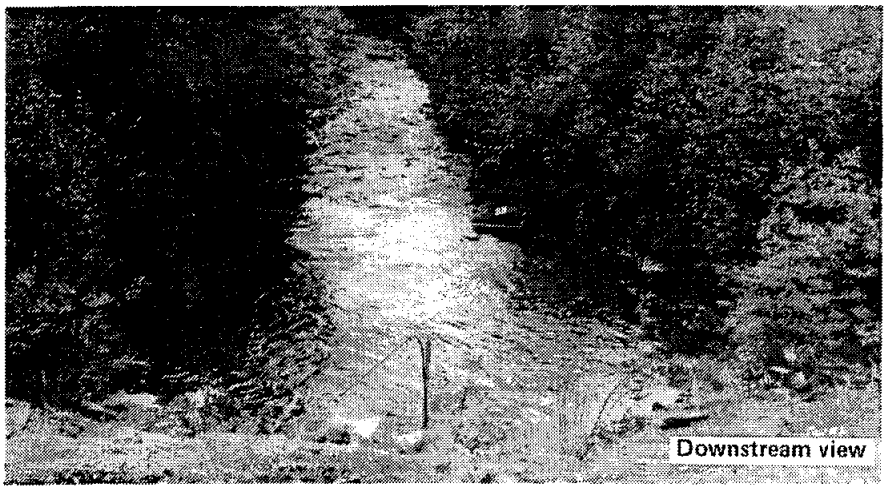




Culvert inlet



Culvert outlet
Dia 4' 8"



Downstream view

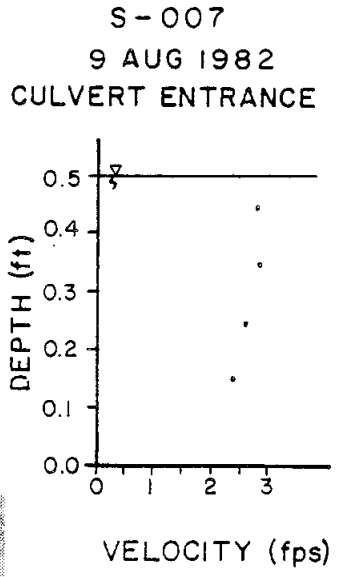
Site No. S-007 Unnamed Creek

Location: Steese Highway

Map: Circle A-6, T5N, R4E, Sec. 26

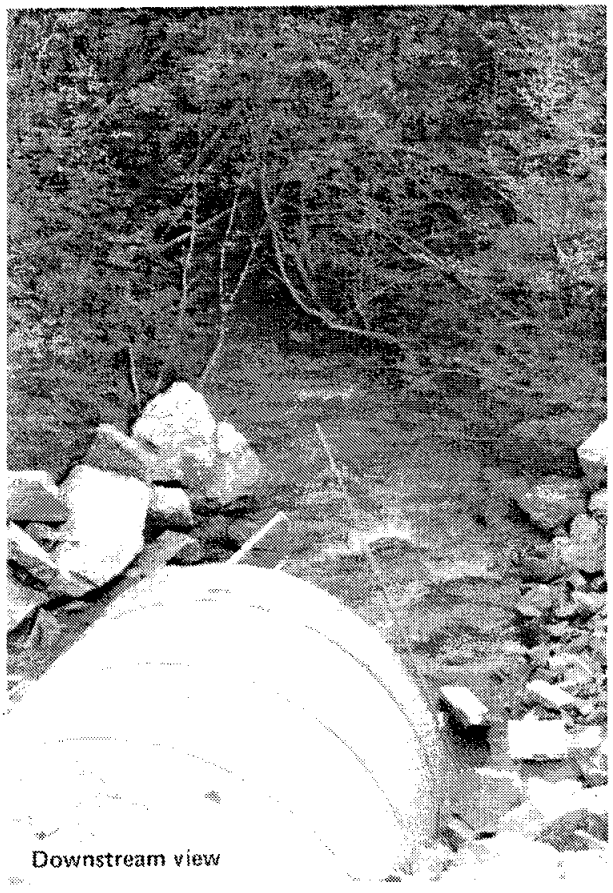
This unnamed creek site along the New Steese Highway was visited on August 9, 1982. The flow was 4.4 cfs, and the culvert inlet and outlet depths were 0.50 and 0.85 ft, respectively. No slopes were surveyed. The barrel had riprap in it at the entrance and sand and small gravel at the downstream end. The watershed area was 3.3 sq mi.

The creek crossed the Old Steese Highway about 3/4 mi upstream from the New Steese Highway crossing. The culvert at the Old Steese Highway was in poor condition; the first section at the inlet was broken and pushed up. This caused high inlet velocities and was a potential problem for fish passage.




Culvert outlet


Upstream view

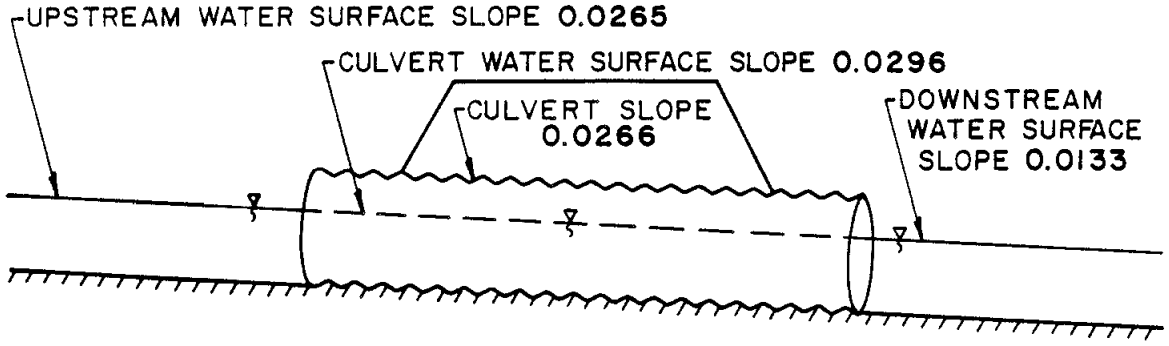

Downstream view

Site No. S-009 Grouse Creek

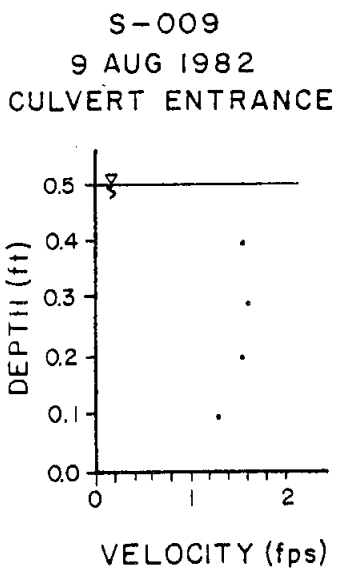
Location: Mile 52 Steese Highway

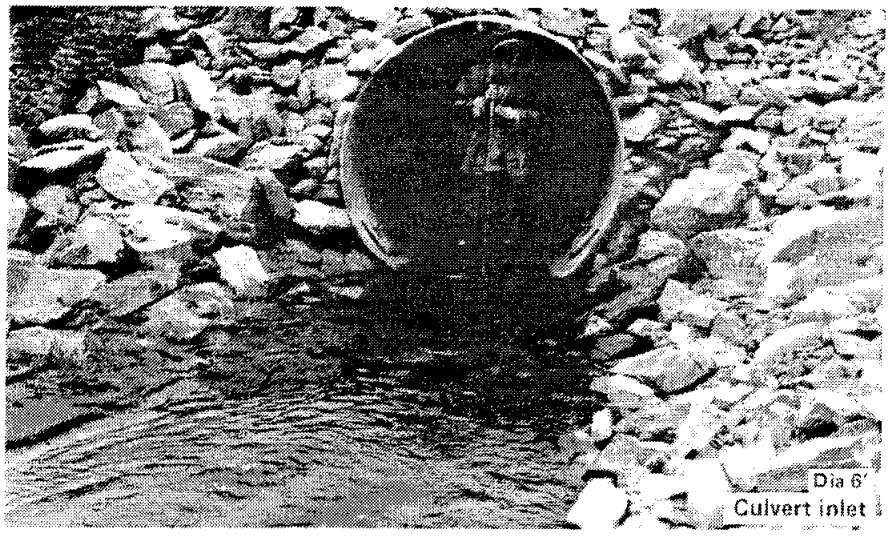
Map: Circle A-6, T5N, R4E, Sec. 26

The measured discharge at Grouse Creek was 2.3 cfs on July 9, 1982. The surveyed slopes for the culvert and creek are shown in the diagram. The culvert slope flattened out for the last 1/3 of the barrel. This resulted in a thick deposit of sand size material in the last part of the culvert, and low outlet water velocities. No drift was observed in the first part of the culvert. The total depth at the culvert inlet was 0.50 ft. The watershed area was 8.0 sq mi. No pools or rest areas for fishes at the inlet or outlet were observed.



CULVERT LENGTH 108.7 FEET




Dia 6'
Culvert inlet


Culvert outlet


Downstream view

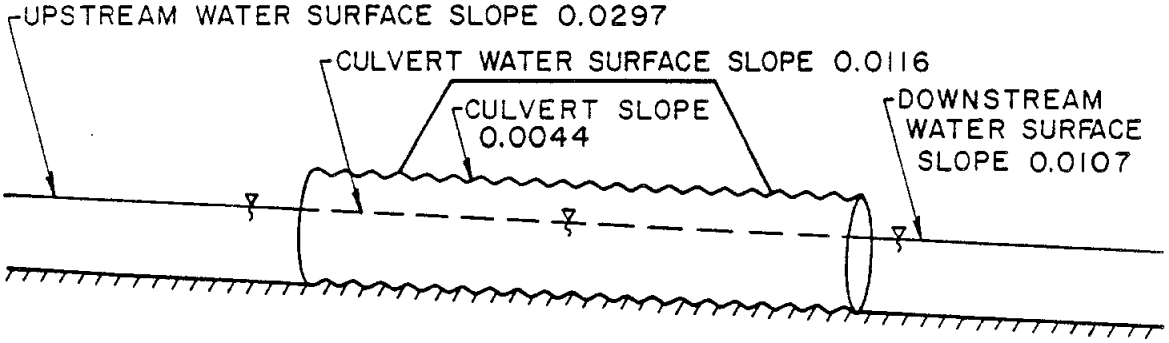
Site No. S-010 Ptarmigan Creek

Location: Mile 53.5 Steese Highway

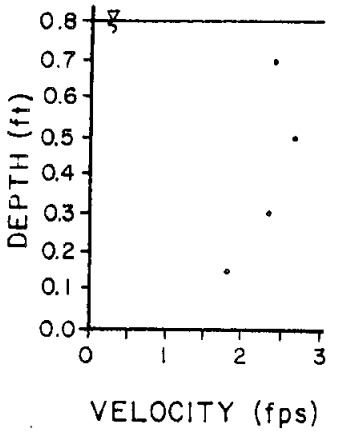
Map: Circle A-6, T5N, R4E, Sec. 24

This stream crossing on the Steese Highway had a discharge of 4.5 cfs on August 9, 1982. The total water depth at the culvert inlet was 0.75 ft and at the outlet was 0.90 ft. The water depth increased to about 2 ft in the middle section of the culvert. The first half of the culvert barrel contained drift, while the last part was clean. At the culvert outlet, there was a 15 ft section of riprap in the streambed, below which was a small pool. The overflow culvert was dry. The watershed area was 0.4 sq mi. Bedload size was estimated at up to 8 in in diameter.

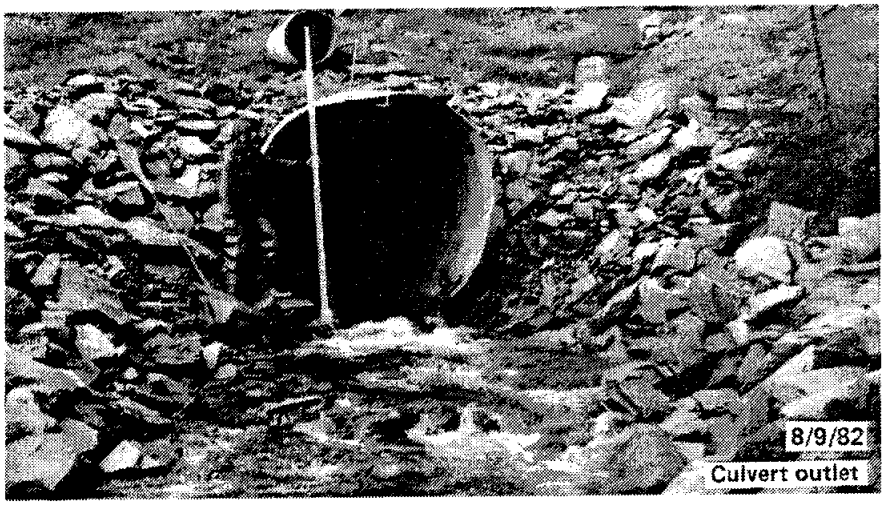
On July 27, 1983 the measured discharge was 4.8 cfs. The inlet and outlet water depths were 0.60 and 0.40 ft, respectively. Again, gravel (up to 5 in in diameter) was found in the first half of the barrel. The water velocity increased towards the downstream end of the barrel. No pools were noted above or below the culvert.

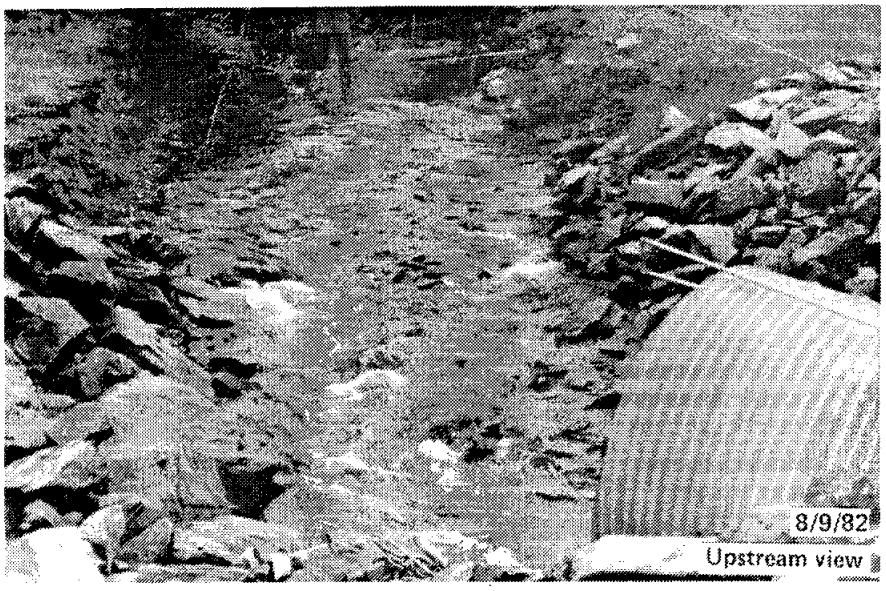


CULVERT LENGTH 219 FEET




Dia 7'
8/9/82
Culvert inlet


8/9/82
Culvert outlet

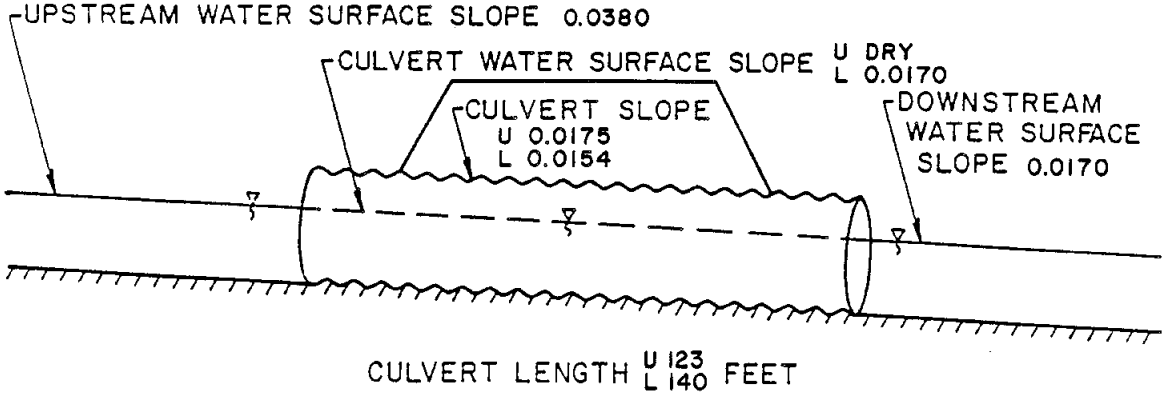

8/9/82
Upstream view

Site No. S-011 US Creek

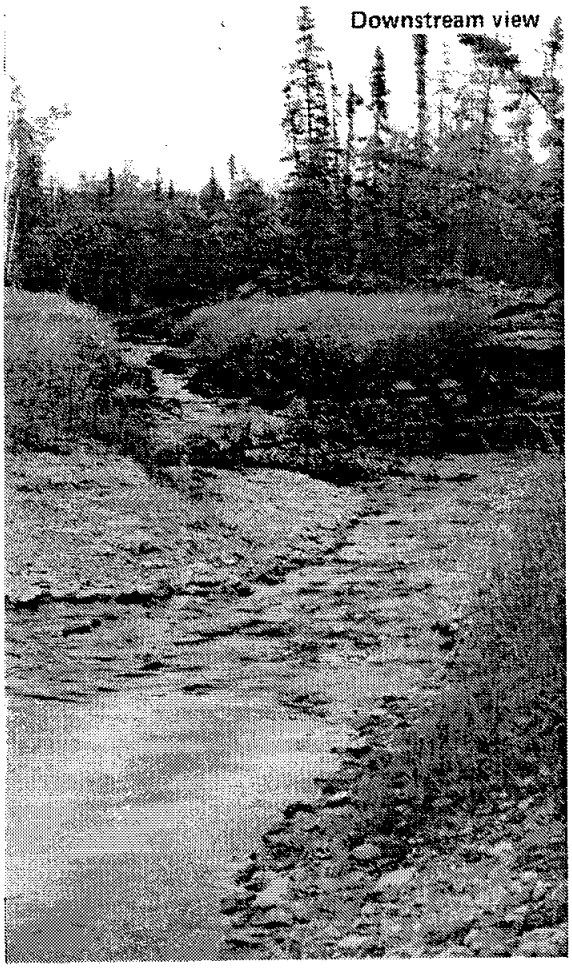
Location: Mile 58 Steese Highway

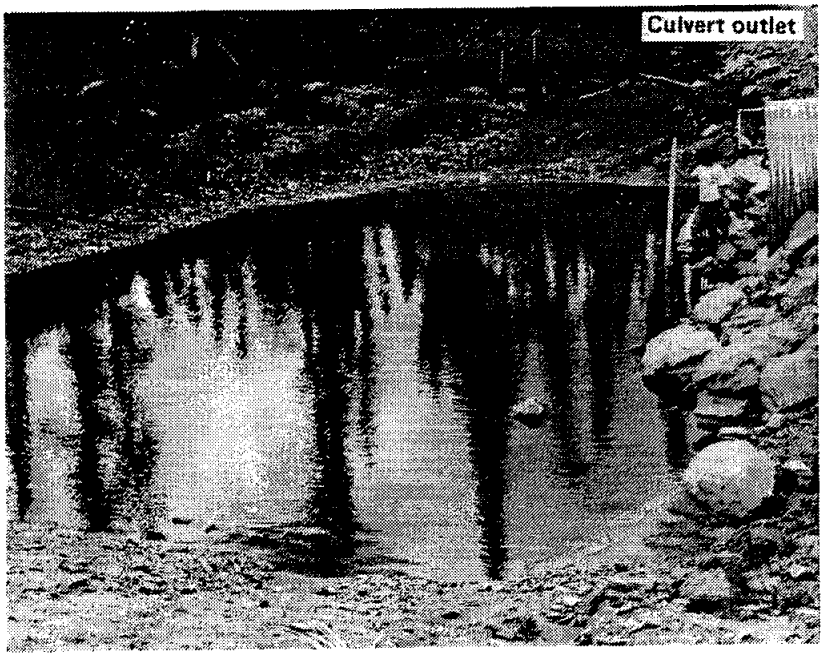
Map: Circle B-6, T5N, R5E, Sec. 9

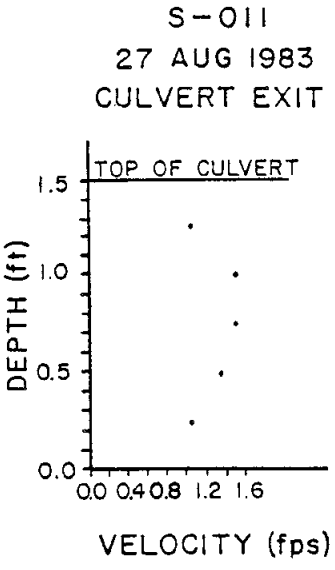
US Creek was observed on July 27, 1983; the measured discharge was 7.67 cfs. A single 18 in diameter culvert (flowing full and totally submerged at both ends) contained the flow. A 6 ft diameter culvert above the smaller culvert was dry. The surveyed water surface profile for this installation is shown in the diagram. A pool, 50 by 25 ft was noted at the culvert outlets; numerous grayling (up to 12 in long) were sighted in this pool. The outlet channel was man-made and the culverts were not aligned with the new channel. A large pool was excavated at the upstream end of the culverts, but the water level was low. A large water surface drop was noted from the natural upstream channel to the culvert entrance where the pool had been excavated. The watershed area was 5.01 sq mi.




Culvert inlet
Dia 6'


Downstream view


Culvert outlet

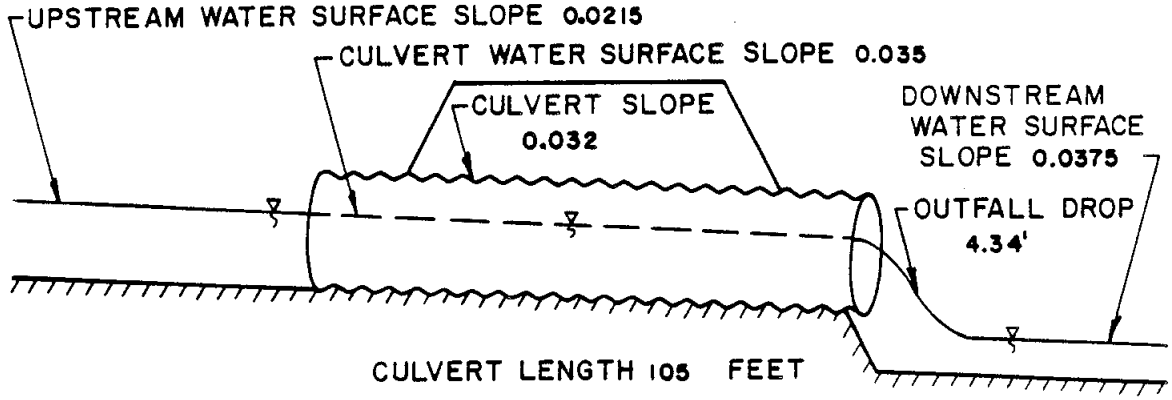

S-011
27 AUG 1983
CULVERT EXIT
TOP OF CULVERT
1.5
1.0
0.5
0.0
DEPTH (ft)
0.0 0.4 0.8 1.2 1.6
VELOCITY (fps)

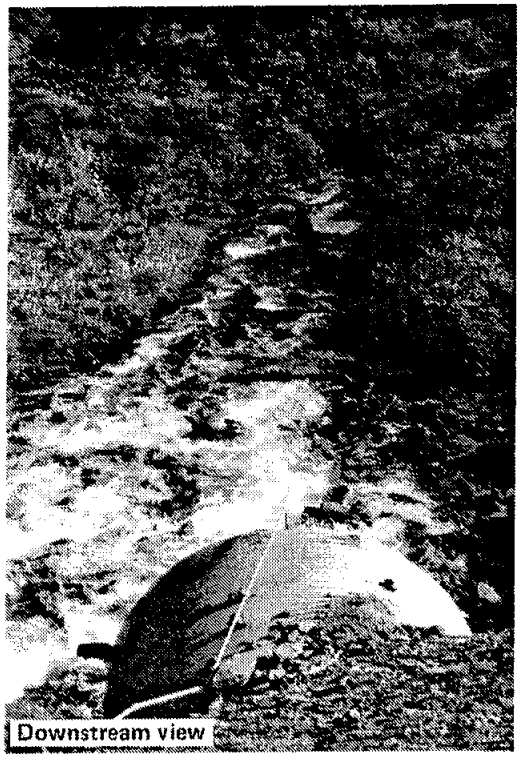
Site No. S-029 Montana Creek

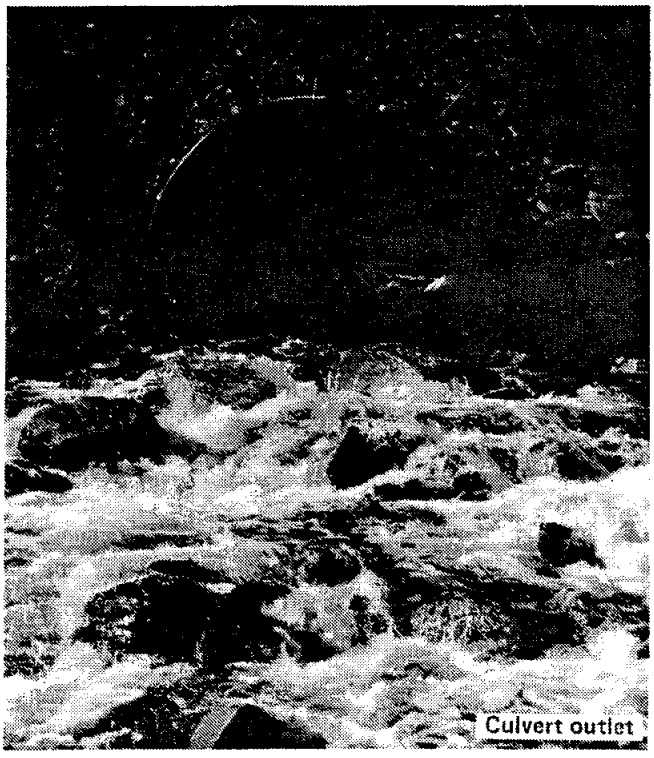
Location: Mile 80 Steese Highway

Map: Circle B-5, T6N, R8E, Sec. 10

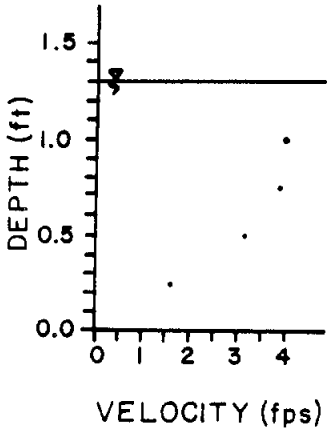
The culvert and stream at this location were measured on September 2, 1983. The discharge on this date was 24.4 cfs; the water surface profile is shown in the diagram. A 3 ft diameter overflow culvert was nearby but contained no flow. There was drift in the last 10 ft of the culvert near the outlet. The bed material was rocks up to large cobbles (3 to 10" in diameter). The channel upstream was not the natural one and there was a drop in the culvert just below the entrance. The outlet depth was 1.4 ft and the watershed area was 3.6 sq miles.

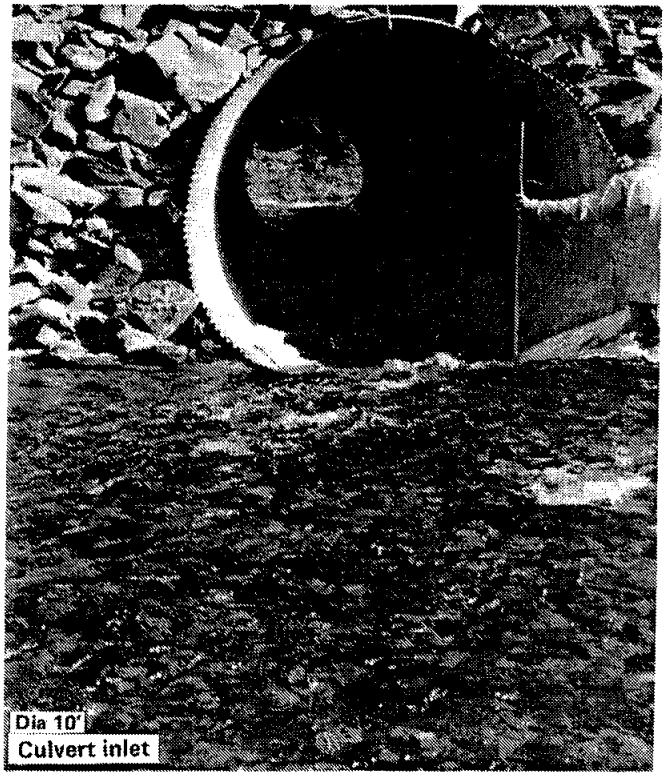



Downstream view

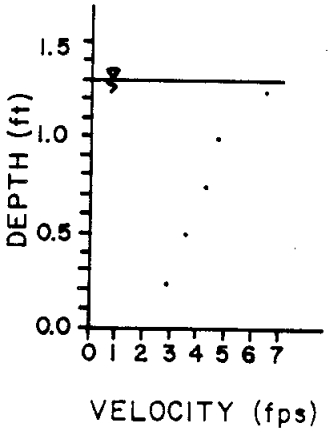

Culvert outlet

S-029
2 SEP 1983
CULVERT ENTRANCE





S-029
2 SEP 1983
5' UPSTREAM
FROM CULVERT EXIT



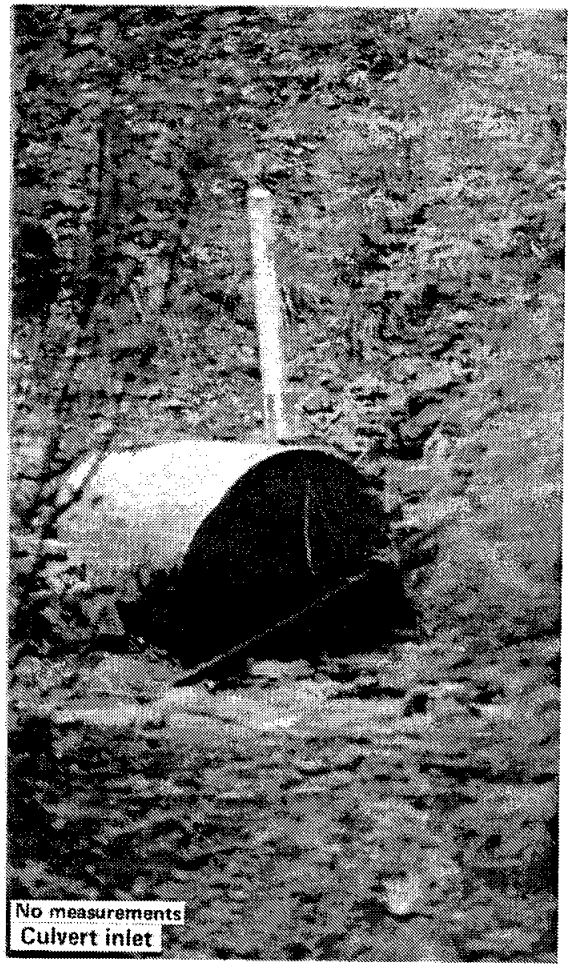
Site No. S-034 Stack Pup Creek

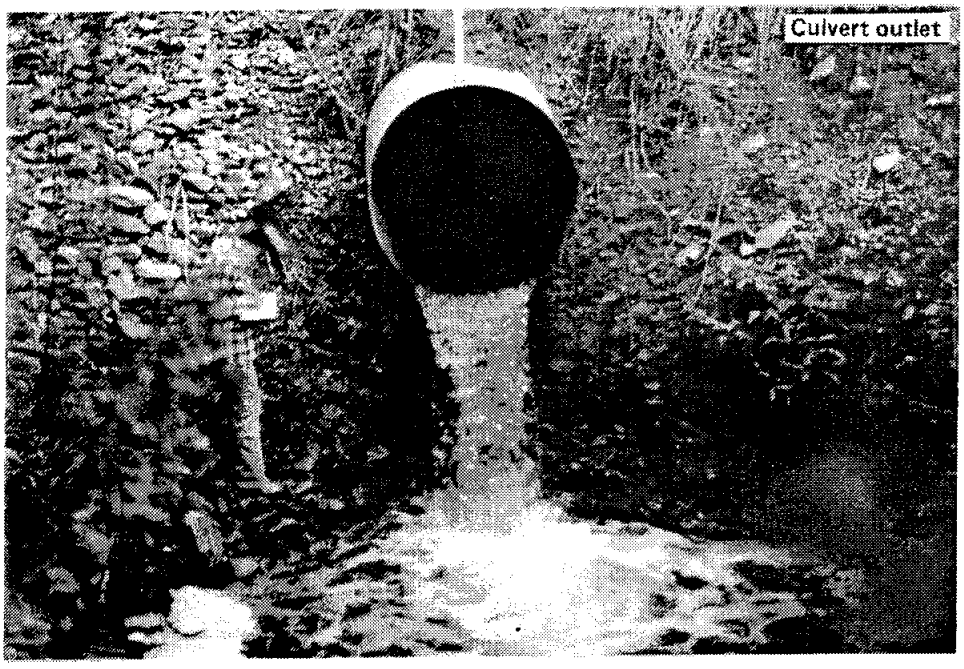
Location: Mile 117 Steese Highway

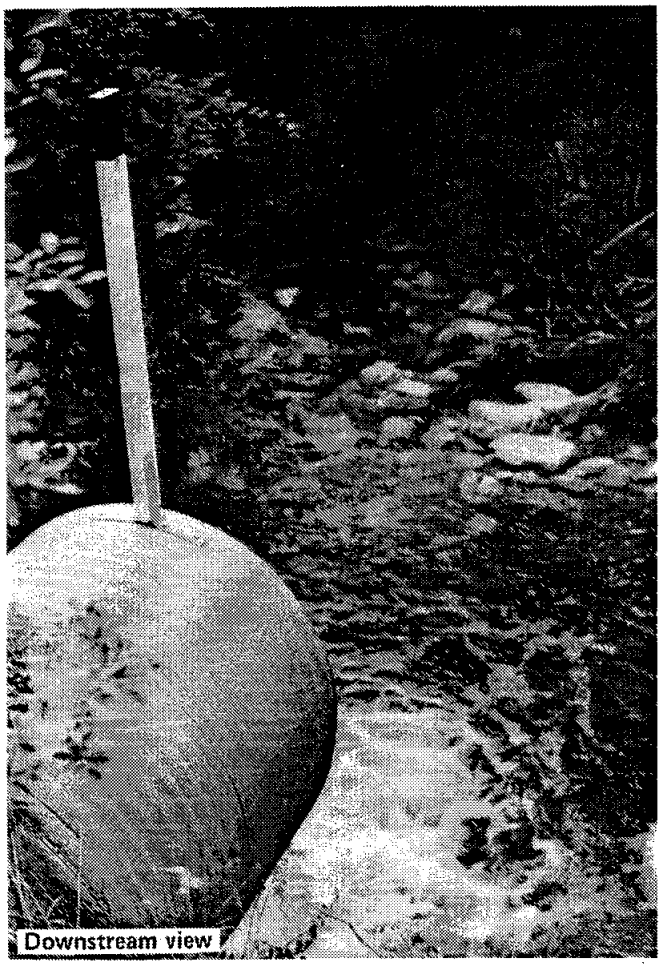
Map: Circle C-3, T8N, R13E, Sec. 6

The Stack Pup Creek site was observed on August 23, 1983. The perched culvert (4 ft drop) had created a 10 ft diameter scour pool at the outlet. The creek appeared to be a small, high gradient headwater stream. No slopes were surveyed. The bed material was rocks up to 1 ft in diameter. The stream water was colored with tannic acid. The watershed area was 3.0 sq mi.


Upstream view


No measurements
Culvert inlet


Culvert outlet

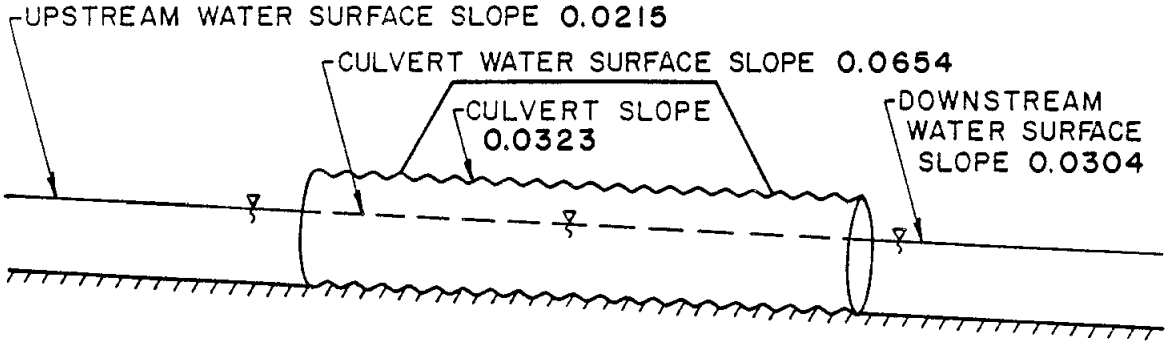

Downstream view

Site No. S-035 Bedrock Creek

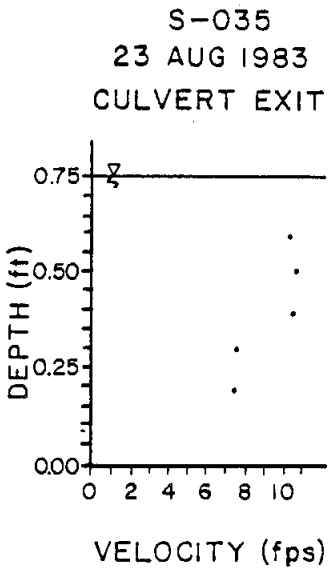
Location: Steese Highway

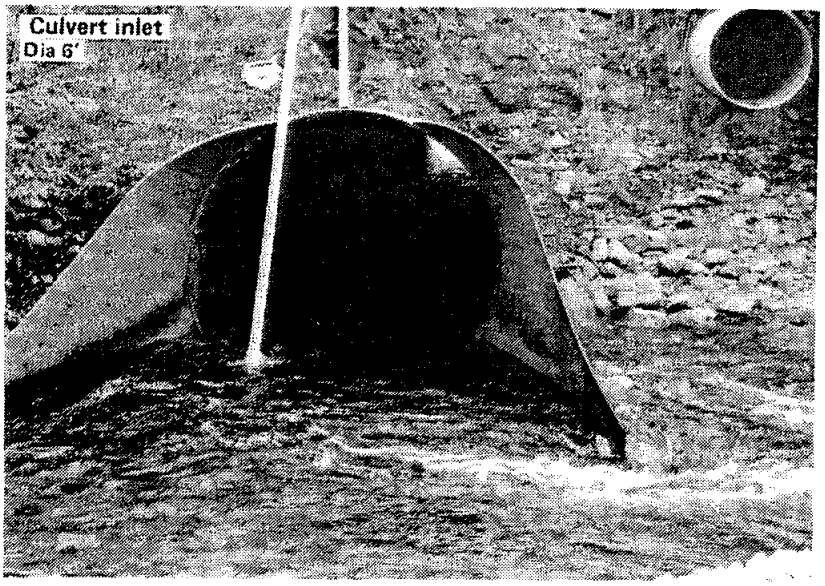
Map: Circle C-3, T9N, R13E, Sec. 32

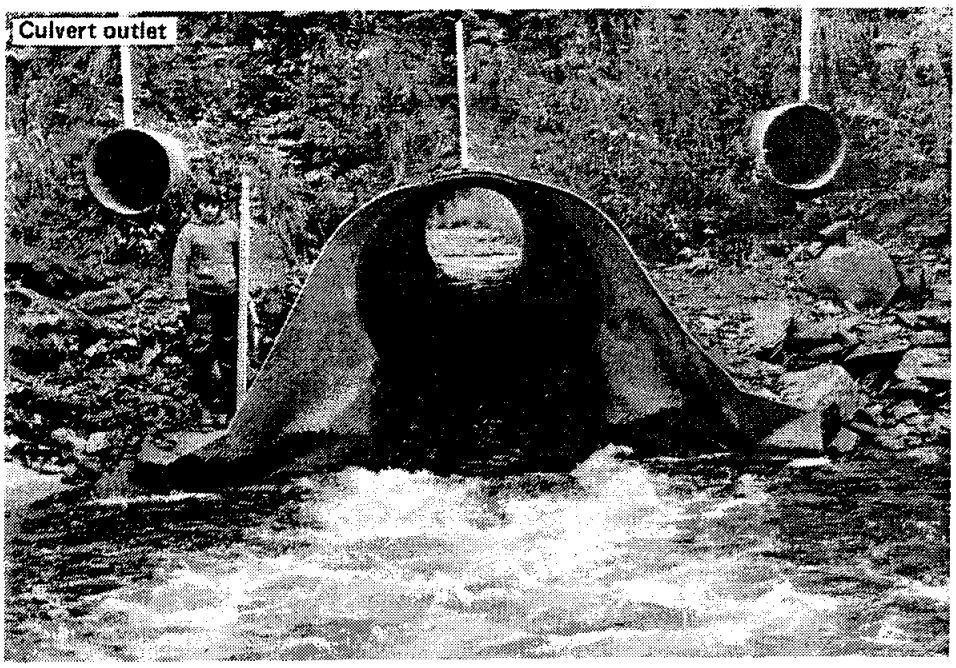
Measurements were made at Bedrock Creek on August 23, 1983. The discharge (16.6 cfs) was contained by one 6 ft diameter culvert while two smaller overflow culverts were dry. The water surface profiles for the culvert and creek are shown in the diagram. The larger culvert had aprons at both ends of the barrel. The water depth at the culvert inlet was 1.00 ft, at the culvert outlet it was 0.75 ft, and at the lip of the downstream apron it was 0.30 ft. The aprons greatly increased the water velocity, especially at the culvert outlet. A pool 30 ft in diameter was noted downstream of the culvert, and the barrel was clean. The stream had migrated to the north after the culvert was emplaced; the stream was not aligned at the culvert entrance. The watershed area was 10.1 sq mi.

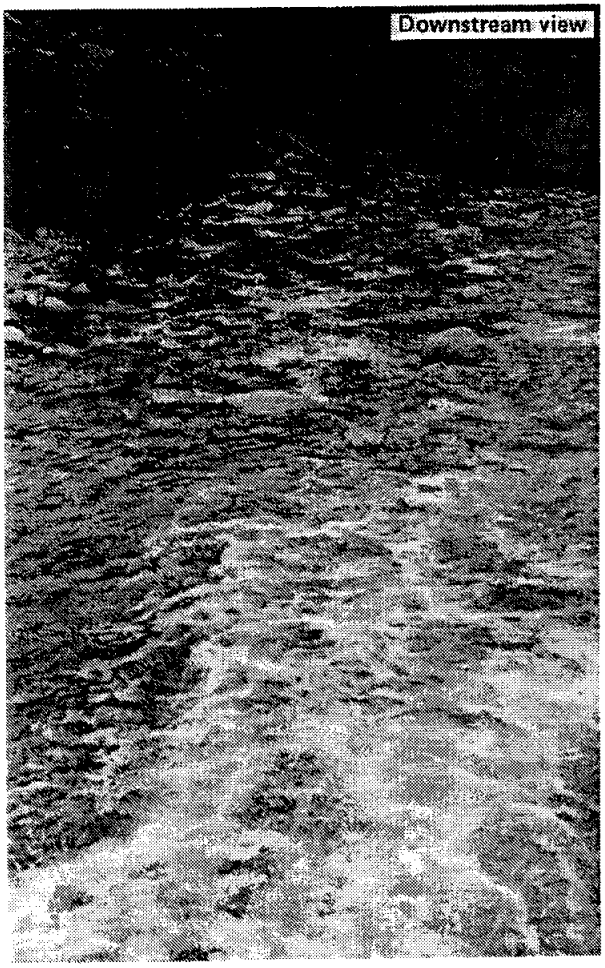


CULVERT LENGTH 56 FEET






Culvert outlet


Downstream view

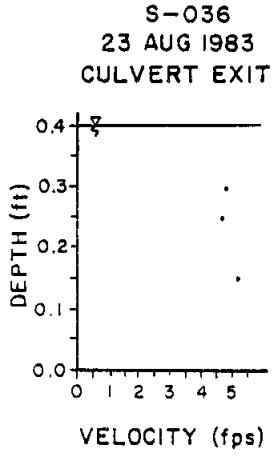

Upstream view

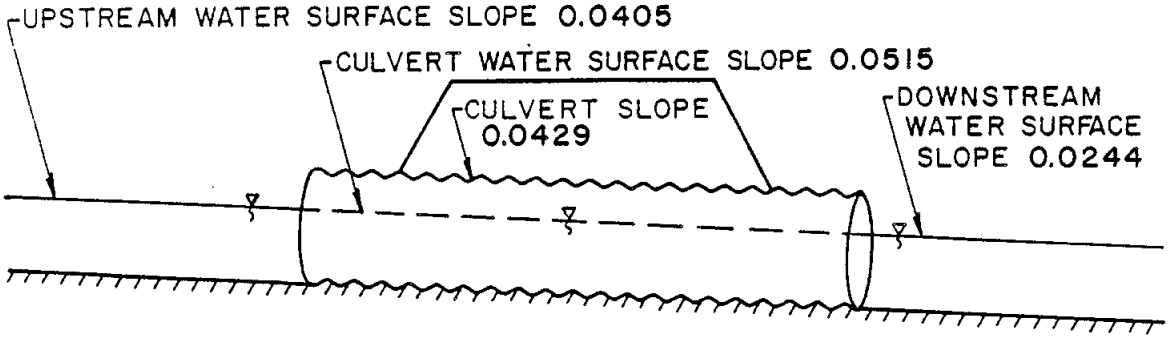
Site No. S-036 Sawpit Creek

Location: Mile 121 Steese Highway

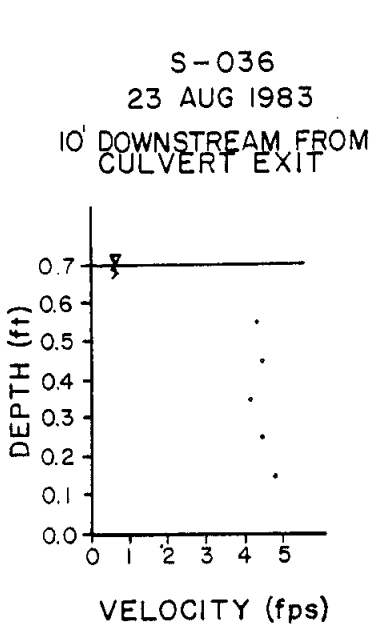
Map: Circle C-3, T9N, R13E, Sec. 34

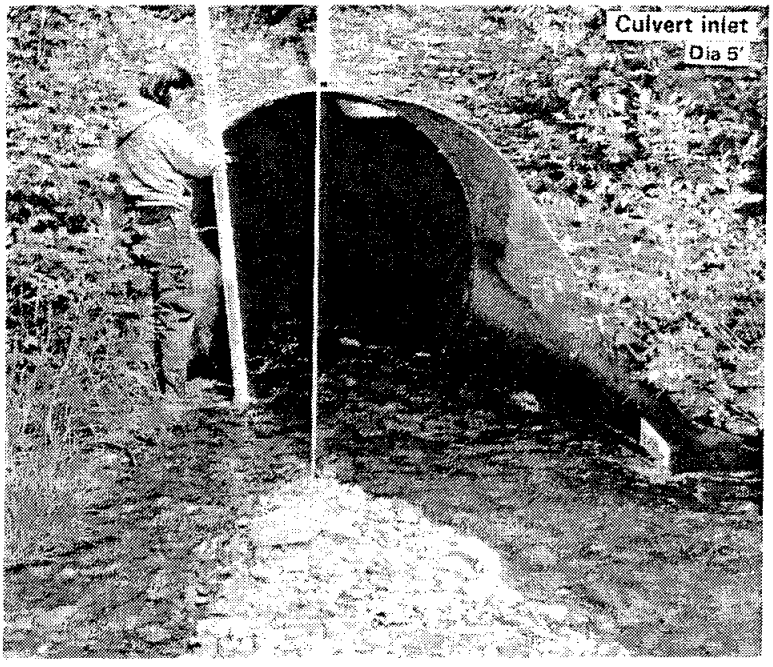
This location was visited on August 23, 1983, and the measured discharge was 4.8 cfs. The surveyed slopes appear in the diagram. Large cobbles in the streambed resulted in a poor discharge measurement. Sawpit Creek was a high gradient clear headwater stream. No pools or other rest areas for fishes were observed. The culvert barrel was clean except for a very small amount of drift at the entrance. The inlet and outlet water depths were 0.50 and 0.40 ft, respectively. The watershed area was 5.2 sq mi.



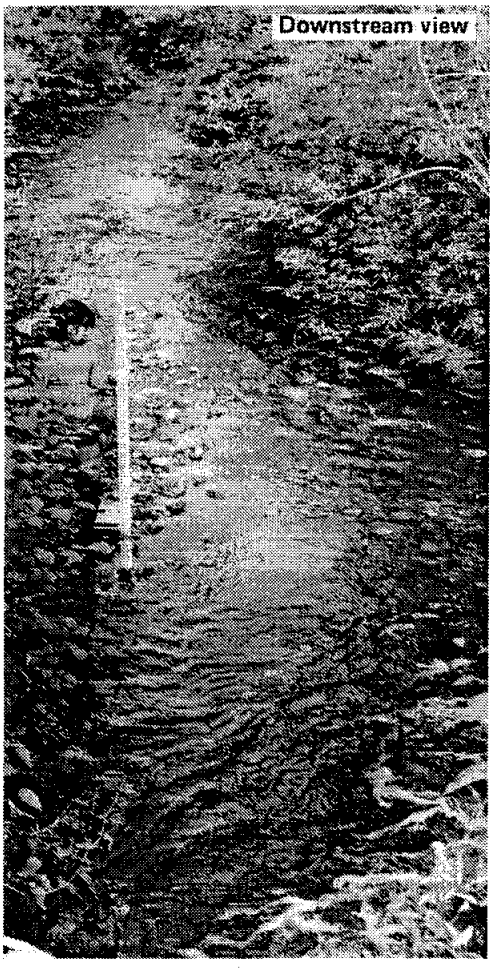


CULVERT LENGTH 82 FEET


S-036
23 AUG 1983
10' DOWNSTREAM FROM
CULVERT EXIT
DEPTH (ft)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0 1 2 3 4 5
VELOCITY (fps)


Culvert inlet
Dia 5'


Culvert outlet

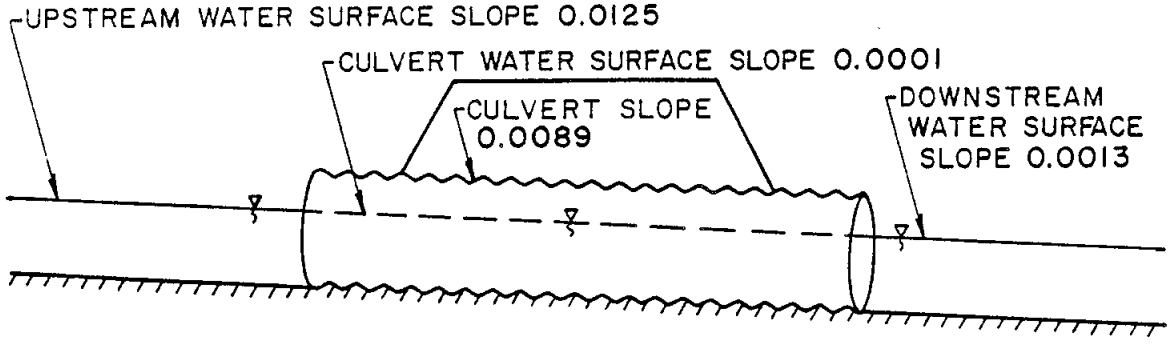

Downstream view

Site No. S-037 Quartz Creek

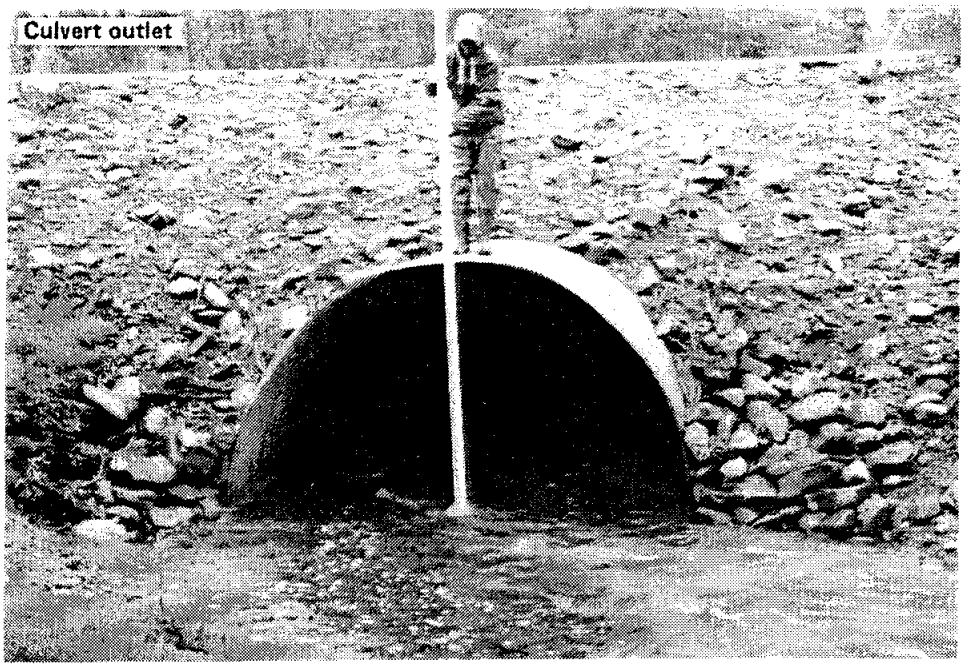
Location: Mile 138.5 Steese Highway

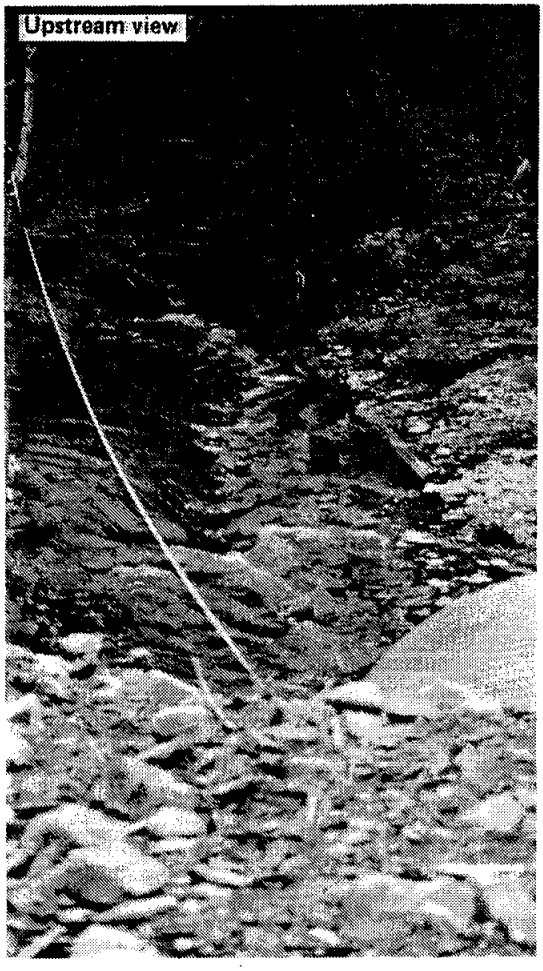
Map: Circle C-1, T9N, R16E, Sec. 7

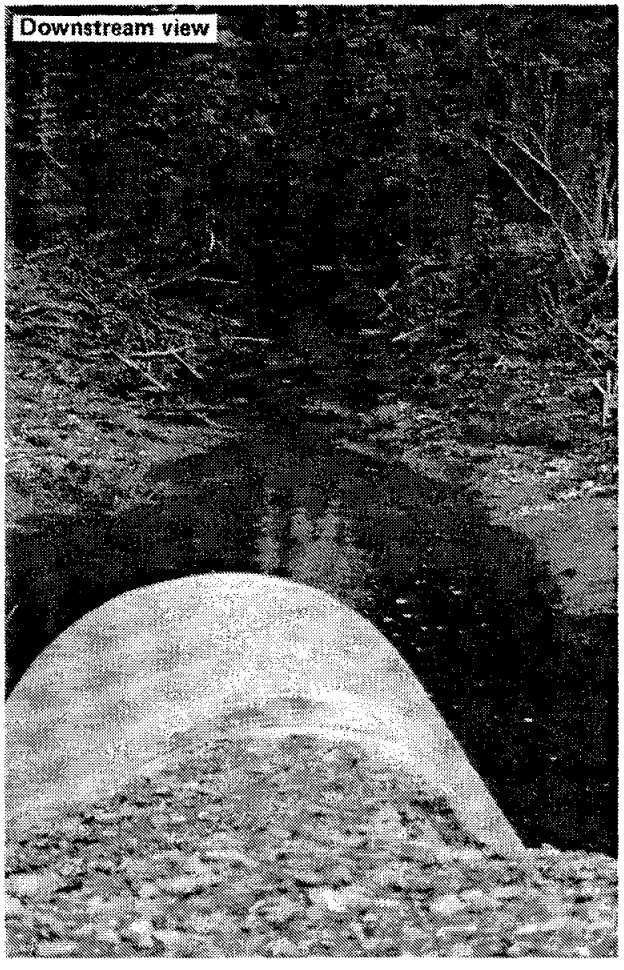
This stream site was measured on August 22, 1983 when the discharge was 13.3 cfs. The culvert inlet and outlet water depths were 2.6 and 3.1 ft, respectively. These depths were measured on top of 2 to 3 ft of gravel, placed in the culvert at the time of construction to aid in fish passage. The surveyed water surface profile for the stream and culvert is shown in the diagram. The stream carried a high suspended sediment load and was stained with tannic acid. The watershed area was 16.3 sq mi.



CULVERT LENGTH 71 FEET


Culvert outlet


Upstream view

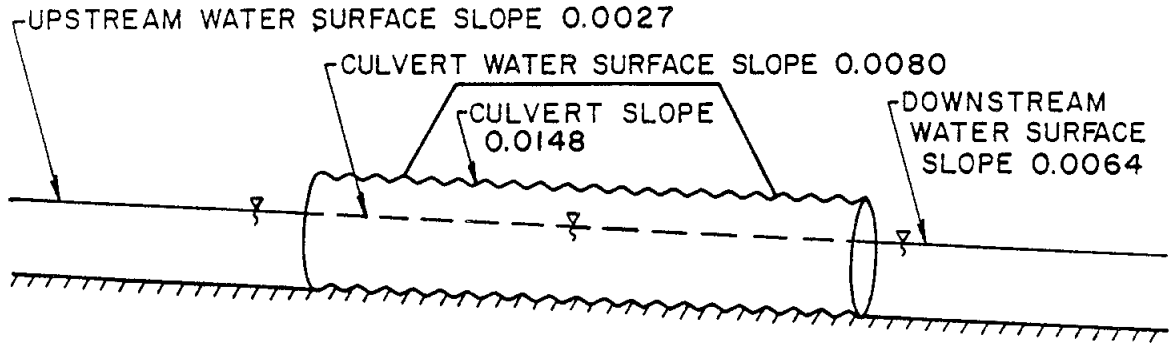

Downstream view

Site No. S-040 Crazy Creek

Location: Mile 144.5 Steese Highway

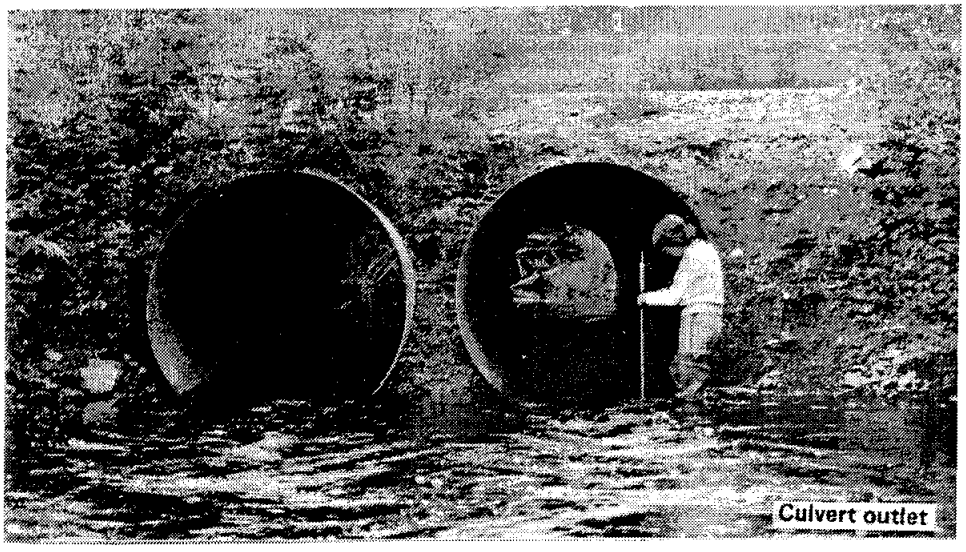
Map: Circle C-1, T10N, R16E, Sec. 15

Crazy Creek was visited on August 20, 1983. A double culvert installation contained the observed 15.9 cfs discharge. The water surface profiles for the culverts and creek are presented in the diagram. The inlet water depths for the north and south culverts were 2.00 and 1.30 ft, respectively. The outlet water depths were 0.80 and 0.95 ft, respectively. There was a 30 by 30 ft pool downstream of the culverts and deep calm water upstream of the culverts. Very little drift was observed in the culvert barrels. The watershed area was 20.7 sq mi.



CULVERT LENGTH 50 FEET

Downstream view



Culvert outlet

Dia 6'
Culvert inlet

Section III
NUMERICAL DATA OF VELOCITY PROFILES

The following tables present in a numerical format all of the velocity profile data. In the previous section some of these data were presented graphically, but where multiple profiles were collected it was not possible to present all of the data in that section. The depth measurement in the table is measured from the bottom of the stream and not from the surface. The velocity profiles were obtained using various current meters. There is a superscript next to the velocity heading that indicates the type of current meter used: number 1 is used for Gurley current meter, number 2 is used for pygmy current meter, and number 3 is used for electromagnetic currrent meter. The velocity data are arranged according to highways:

Alaska Highway	Site Prefix A
Chena Hot Springs Road	Site Prefix C
Dalton Highway	Site Prefix B
Denali Highway	Site Prefix D
Elliott Highway	Site Prefix E
Glenn Highway	Site Prefix G
Old Seward Highway	Site Prefix SW
Parks Highway	Site Prefix P
Richardson Highway	Site Prefix R
Steese Highway	Site Prefix S

Date	Site #	Creek Name	Highway	Location
19 May 1982	A-001	Unnamed Creek	Alaska Highway	Culvert Exit

DEPTH (ft)	0.1	0.2	0.35	0.5	0.8	1.05
VELOCITY (fps)[3]	5.6	5.8	5.8	6.0	5.6	5.0

Date	Site #	Creek Name	Highway	Location
16 August 1982	C-001	Steele Creek	Chena Hot Springs Road	Culvert Exit

DEPTH (ft)	0.1	0.2
VELOCITY (fps)[2]	3.5	4.2

Date	Site #	Creek Name	Highway	Location
26 May 1982	B-001	Woodchopper Creek	Dalton	Culvert Exit

DEPTH (ft)	0.15	0.3	0.5	1.0	2.0	1.5	2.5
VELOCITY (fps)[1]	1.1	1.6	1.6	2.0	2.5	2.3	2.6

Date	Site #	Creek Name	Highway	Location
10 May 1983	B-002	Fort Hamlin Hills Creek	Dalton	Culvert Exit

DEPTH (ft)	0.2	0.5	0.7	0.9
VELOCITY (fps)[1]	2.9	5.2	5.7	5.7

Date	Site #	Creek Name	Highway	Location
26 May 1982	B-003	Fed Creek	Dalton	Culvert Exit

DEPTH (ft)	0.15	0.3	0.5	1.0	2.0	3.0
VELOCITY (fps)[1]	2.6	2.8	2.8	3.2	3.3	2.7

Date	Site #	Creek Name	Highway	Location
26 May 1982	B-003	Fed Creek	Dalton	Culvert Exit

DEPTH (ft)	0.15	0.3	0.5	1.0	2.0	3.0
VELOCITY (fps)[3]	2.6	2.9	3.1	3.2	2.8	2.5

Date	Site #	Creek Name	Highway	Location
27 May 1983	B-005	Olson Lake Creek	Dalton	Culvert Exit

DEPTH (ft)	0.2	0.3	0.5
VELOCITY (fps)[3]	0.75	0.9	1.2

Date	Site #	Creek Name	Highway	Location
5 May 1982	B-006	Caribou Mountain Creek	Dalton	Culvert Entrance

DEPTH (ft)	0.15	0.3	0.5	0.7	0.9	1.5	2.0	2.5
VELOCITY (fps)[3]	1.0	1.2	1.2	1.15	1.25	1.9	2.2	2.1

Date	Site #	Creek Name	Highway	Location
5 May 1982	B-008	Pung's Crossing	Dalton	at discharge measurement

DEPTH (ft)	0.15	0.3	0.6	1.0	1.35	1.8
VELOCITY (fps)[3]	1.3	3.5	4.0	5.0	5.5	4.9

Date	Site #	Creek Name	Highway	Location
27 May 1982	B-008	Pung's Crossing	Dalton	North Culvert Exit

DEPTH (ft)	0.15	0.3	0.5	0.75	1.0	1.25	1.5	1.75
VELOCITY (fps)[3]	1.4	1.7	1.8	1.9	1.8	2.3	2.3	2.3

Date	Site #	Creek Name	Highway	Location
27 May 1982	B-009	South Fork of the Little Nasty Creek	Dalton	South Culvert Exit

DEPTH (ft)	0.2	0.4	0.6	1.0	1.5	2.0
VELOCITY (fps)[3]	2.3	2.8	3.2	3.4	3.0	2.8

Date	Site #	Creek Name	Highway	Location
11 June 1982	B-012	Douglas Creek	Dalton	North Culvert Exit

DEPTH (ft)	0.2	0.3	0.5
VELOCITY (fps)[1]	4.5	6.3	6.5

Date	Site #	Creek Name	Highway	Location
8 June 1982	B-016	Abba Dabba Creek	Dalton	Near culvert exit 1' behind a baffle

DEPTH (ft)	0.15	0.25	0.35	0.45	0.55
VELOCITY (fps)[3]	0.6	0.4	0.6	1.5	1.9

Date	Site #	Creek Name	Highway	Location
8 June 1982	B-016	Abba Dabba Creek	Dalton	20' upstream from culvert exit 1' behind a baffle

DEPTH (ft)	0.25	0.35	0.45	0.55	0.65	0.75
VELOCITY (fps)[3]	0.1	0.9	1.8	2.9	2.9	0.8

Date	Site #	Creek Name	Highway	Location
8 June 1982	B-030	Nugget Creek	Dalton	Culvert Exit

DEPTH (ft)	0.15	0.3	0.5	0.75	1.0	1.25	1.5	1.75
VELOCITY (fps)[3]	3.3	4.1	4.5	4.8	5.2	5.4	5.9	5.9

Date	Site #	Creek Name	Highway	Location
9 June 1982	B-033	Linda Creek	Dalton	Culvert Exit

DEPTH (ft)	0.15	0.3	0.5	0.75
VELOCITY (fps)[3]	2.4	3.8	4.6	5.4

Date	Site #	Creek Name	Highway	Location
9 June 1982	B-034	Sukapak Creek	Dalton	Culvert Entrance

DEPTH (ft)	0.15	0.3	0.5	0.75	1.0	1.25
VELOCITY (fps)[3]	2.7	3.1	3.2	3.1	3.1	3.0

Date	Site #	Creek Name	Highway	Location
19 July 1982	B-036	Brockman Creek	Dalton	Culvert Exit

DEPTH (ft)	0.15	0.25	0.35	0.45
VELOCITY (fps)[1]	2.3	3.6	3.9	4.7

Date	Site #	Creek Name	Highway	Location
20 July 1982	B-042A	Unnamed Creek	Dalton	Culvert Exit 10' upstream

DEPTH (ft)	0.05	0.1	0.15	0.2	0.25
VELOCITY (fps)[2]	1.7	1.9	2.5	2.7	3.8

Date	Site #	Creek Name	Highway	Location
20 July 1982	B-042	Nutirwik Creek	Dalton	Culvert Entrance 15' downstream

DEPTH (ft)	0.15	0.3	0.45	0.6	0.75	0.9
VELOCITY (fps)[1]	2.1	3.1	3.6	4.3	4.9	6.0

Date	Site #	Creek Name	Highway	Location
10 June 1982	B-045	Spike Camp Creek	Dalton	South Culvert Exit

DEPTH (ft)	0.15	0.3	0.5
VELOCITY (fps)1	3.2	4.6	5.2

Date	Site #	Creek Name	Highway	Location
20 July 1982	B-048	Trevor Creek	Dalton	Culvert Exit

DEPTH (ft)	0.15	0.25	0.35	0.45	0.55	0.65	0.75
VELOCITY (fps)[1]	5.1	5.4	5.8	6.1	6.6	8.4	11.1

Date	Site #	Creek Name	Highway	Location
20 July 1982	B-048	Trevor Creek	Dalton	Culvert Exit

DEPTH (ft)	0.15	0.25	0.35	0.45
VELOCITY (fps)[1]	6.1	8.2	10.9	10.6

Date	Site #	Creek Name	Highway	Location
22 July 1982	B-049	Tyler Creek	Dalton	Culvert Exit

DEPTH (ft)	0.15	0.25	0.35	0.45	0.55	0.65	0.75	0.85
VELOCITY (fps)[1]	1.1	1.3	1.5	1.6	1.6	1.8	1.7	1.5

Date	Site #	Creek Name	Highway	Location
10 June 1982	B-050	Roche Moutonee	Dalton	Culvert Exit

DEPTH (ft)	0.15	0.3	0.5	0.75	0.85
VELOCITY (fps)[1]	6.4	8.0	8.0	10.0	10.0

Date	Site #	Creek Name	Highway	Location
21 July 1982	B-055	Dan Creek	Dalton	100' downstream from culvert exit

DEPTH (ft)	0.05	0.15	0.25	0.35	0.45	0.55
VELOCITY (fps)[2]	0.9	1.0	1.3	1.3	1.4	1.2

Date	Site #	Creek Name	Highway	Location
21 July 1982	B-055	Dan Creek	Dalton	10' downstream from culvert exit

DEPTH (ft)	0.05	0.15	0.25	0.35
VELOCITY (fps)	2.3	2.7	2.9	3.2

Date	Site #	Creek Name	Highway	Location
22 June 1982	D-003	Unnamed Creek 18.5 mile	Denali	West Culvert Exit

DEPTH (ft)	0.15	0.3	0.5	0.75
VELOCITY (fps)[1]	5.9	6.4	6.6	6.5

Date	Site #	Creek Name	Highway	Location
22 June 1982	D-003	Unnamed Creek 18.5 mile	Denali	West Culvert Exit (1' from water's edge)

DEPTH (ft)	0.15	0.3	0.5
VELOCITY (fps)[1]	4.8	5.2	5.2

Date	Site #	Creek Name	Highway	Location
22 June 1982	D-006	Osar Creek Tributary	Denali	Culvert Exit

DEPTH (ft)	0.15	0.25	0.35	0.45	0.55
VELOCITY (fps)[1]	2.7	3.0	3.3	3.2	3.0

Date	Site #	Creek Name	Highway	Location
22 June 1982	D-007	Osar Creek	Denali	Culvert Entrance

DEPTH (ft)	0.2	0.3	0.5	6.5	.75	1.0	1.25
VELOCITY (fps)[1]	2.1	2.4	3.0	3.6	3.5	3.3	3.3

Date	Site #	Creek Name	Highway	Location
22 June 1982	D-007	Osar Creek	Denali	Culvert Exit

DEPTH (ft)	0.2	0.4	0.6	0.8	1.0
VELOCITY (fps)[1]	4.0	5.6	6.9	7.5	10.3

Date	Site #	Creek Name	Highway	Location
23 June 1982	D-014	Unnamed Creek 87.7 mile	Denali	Culvert Exit

DEPTH (ft)	0.15	0.2	0.3
VELOCITY (fps)[1]	8.6	9.0	10.5

Date	Site #	Creek Name	Highway	Location
23 June 1982	D-015	Unnamed Creek 89.9 mile	Denali	Culvert Exit

DEPTH (ft)	0.15	0.2	0.3	0.4
VELOCITY (fps)[1]	4.9	6.0	8.2	7.4

Date	Site #	Creek Name	Highway	Location
23 June 1982	D-017	Unnamed Creek 99.4 mile	Denali	Culvert Exit

DEPTH (ft)	0.15	0.2	0.3	0.4	0.5	0.6
VELOCITY (fps)[1]	6.2	6.9	7.5	8.1	10.8	10.6

Date	Site #	Creek Name	Highway	Location
24 June 1983	D-018	Stixkwan Creek	Denali	Culvert Exit

DEPTH (ft)	0.15	0.2	0.3	0.4	0.5	0.6	0.7
VELOCITY (fps)[1]	4.0	4.5	5.8	6.0	7.4	9.6	10.3

Date	Site #	Creek Name	Highway	Location
24 June 1982	D-020	Unnamed Creek 117.3 mile	Denali	Culvert Exit

DEPTH (ft)	0.15	0.2	0.3	0.4	0.5	0.6	0.7	0.8
VELOCITY (fps)[1]	7.3	7.5	7.6	8.8	9.8	12.2	12.2	12.2

Date	Site #	Creek Name	Highway	Location
23 June 1982	D-021	Unnamed Creek 118.2 mile	Denali	Culvert Exit

DEPTH (ft)	0.15	0.2	0.3	0.4	0.5
VELOCITY (fps)[1]	9.4	12.2	13.0	13.5	13.8

Date	Site #	Creek Name	Highway	Location
24 June 1982	D-022	Edmonds Creek	Denali	Culvert Exit

DEPTH (ft)	0.3	0.5	0.75	1.0	1.25
VELOCITY (fps)[1]	9.6	9.6	9.8	10.5	12.3

Date	Site #	Creek Name	Highway	Location
24 June 1982	D-023	Unnamed Creek 123.7 mile	Denali	Culvert Exit

DEPTH (ft)	0.15	0.2	0.3	0.4	0.5	0.6	0.7
VELOCITY (fps)[1]	6.1	6.2	6.6	9.4	9.8	9.6	9.2

Date	Site #	Creek Name	Highway	Location
25 June 1982	D-024	Unnamed Creek	Denali	Culvert Exit

DEPTH (ft)	0.15	0.2	0.3	0.4	0.5	0.6
VELOCITY (fps)[1]	1.7	1.7	1.7	1.9	1.8	1.6

Date	Site #	Creek Name	Highway	Location
30 June 1982	E-001	Dome Creek	Elliott	Culvert Exit

DEPTH (ft)	0.15	0.2	0.3	0.4	0.5
VELOCITY (fps)[1]	1.8	2.1	2.1	1.9	1.9

Date	Site #	Creek Name	Highway	Location
30 June 1982	E-002	Cushman Creek	Elliott	Culvert Entrance

DEPTH (ft)	0.15	0.2	0.3
VELOCITY (fps)[1]	5.0	5.9	6.9

Date	Site #	Creek Name	Highway	Location
30 June 1982	E-002	Cushman Creek	Elliott	Culvert Exit

DEPTH (ft)	0.15	0.2	0.3	0.4	0.5
VELOCITY (fps)[1]	1.6	1.8	2.2	2.0	1.8

Date	Site #	Creek Name	Highway	Location
9 May 1983	E-002	Cushman Creek	Elliott	Culvert Exit

DEPTH (ft)	0.2	0.3	0.5	0.7	1.0
VELOCITY (fps)[1]	2.2	2.2	2.6	2.7	2.4

Date	Site #	Creek Name	Highway	Location
1 July 1983	E-003	Globe Creek	Elliott	Culvert Exit

DEPTH (ft)	0.15	0.2	0.3
VELOCITY (fps)[2]	2.2	2.0	1.9

Date	Site #	Creek Name	Highway	Location
1 July 1982	E-004	Globe Creek (north crossing)	Elliott	Culvert Exit

DEPTH (ft)	0.15	0.2
VELOCITY (fps)[1]	0.83	1.1

Date	Site #	Creek Name	Highway	Location
3 June 1982	E-007	Bridge Creek (north channel)	Elliott	Culvert Entrance

DEPTH (ft)	0.15	0.3	0.5	0.75	1.0	1.25	1.5	1.75	2.0
VELOCITY (fps)[3]	4.0	6.0	6.1	6.2	6.6	6.5	6.1	5.5	4.6

Date	Site #	Creek Name	Highway	Location
1 July 1982	E-008A	Livengood Creek Slough	Elliott	Culvert Exit

DEPTH (ft)	0.15	0.2	0.3	0.4	0.5	0.6
VELOCITY (fps)[1]	4.3	4.6	4.5	4.2	4.1	3.6

Date	Site #	Creek Name	Highway	Location
3 June 1982	E-012	Hot Cat Creek	Dalton	Culvert Entrance

DEPTH (ft)	0.2	0.4	0.7	1.0	1.5	2.0	2.5
VELOCITY (fps)[3]	1.5	1.9	2.1	2.4	2.3	2.6	2.4

Date	Site #	Creek Name	Highway	Location
31 May 1983	E-012	Hot Cat Creek	Dalton	Culvert Entrance

DEPTH (ft)	0.3	0.5	0.8	1.0	1.5	2.0	2.5
VELOCITY (fps)[1]	1.0	1.3	1.3	1.3	1.3	1.5	1.4

Date	Site #	Creek Name	Highway	Location
16 July 1982	G-001	Meadow Creek	Glenn	4" downstream from a baffle

DEPTH (ft)	0.15	0.25	0.35	0.45	0.55	0.65	0.75	0.85	0.95
VELOCITY (fps)[1]	1.5	1.7	1.6	1.7	3.3	3.6	4.4	4.4	6.0

Date	Site #	Creek Name	Highway	Location
16 July 1982	G-001	Meadow Creek	Glenn	2' downstream from a baffle

DEPTH (ft)	0.15	0.25	0.35	0.45	0.55	0.65
VELOCITY (fps)[1]	1.8	2.2	5.3	5.4	5.8	6.4

Date	Site #	Creek Name	Highway	Location
15 July 1982	SW-001	Rabbit Creek	Old Seward	5' inside culvert from entrance

DEPTH (ft)	0.15	0.25	0.6	0.8	1.0
VELOCITY (fps)[1]	3.6	4.7	7.4	7.4	8.2

Date	Site #	Creek Name	Highway	Location
15 July 1982	SW-001	Rabbit Creek	Old Seward	Culvert Exit

DEPTH (ft)	0.15	0.25	0.4	0.6	0.8	1.0	1.15
VELOCITY (fps)[1]	2.6	2.5	3.3	4.2	4.7	5.4	6.1

Date	Site #	Creek Name	Highway	Location
6 July 1982	P-002	Alder Creek	Parks	Culvert Entrance

DEPTH (ft)	0.15	0.2
VELOCITY (fps)[2]	1.8	1.7

Date	Site #	Creek Name	Highway	Location
7 July 1982	P-005	Unnamed Creek 288.5 mile	Parks	Culvert Entrance

DEPTH (ft)	0.2	0.3	0.4	0.5	0.75	1.0	1.25	1.5
VELOCITY (fps)[1]	.24	.31	.60	.78	.76	.68	.67	.60

Date	Site #	Creek Name	Highway	Location
7 July 1982	P-005	Unnamed Creek 288.5 mile	Parks	Culvert Entrance 1' north of center line

DEPTH (ft)	0.2	0.3	0.4	0.5	0.75	1.0	1.25
VELOCITY (fps)[1]	0.6	0.50	0.46	0.45	0.43	0.27	0.16

Date	Site #	Creek Name	Highway	Location
7 July 1982	P-008	June Creek	Parks	Culvert Exit

DEPTH (ft)	0.15	0.2	0.3	0.4	0.5	0.6	0.7	0.8
VELOCITY (fps)[1]	4.6	6.2	7.0	7.3	7.4	7.8	9.7	10.4

Date	Site #	Creek Name	Highway	Location
5 August 1983	P-008	June Creek	Parks	Culvert Exit 100' downstream

DEPTH (ft)	0.15	0.25	0.35	0.45	0.55	0.65	0.75	0.85	0.95
VELOCITY (fps)[1]	2.3	3.5	3.7	3.7	4.0	4.1	4.2	4.4	4.8

Date	Site #	Creek Name	Highway	Location
5 August 1983	P-008	June Creek	Parks	Culvert Exit 100' downstream

DEPTH (ft)	0.15	0.25	0.35	0.45	0.55	0.65	0.75	0.85
VELOCITY (fps)[3]	2.9	3.4	3.8	3.8	4.0	3.9	4.0	3.9

Date	Site #	Creek Name	Highway	Location
5 August 1983	P-008	June Creek	Parks	Culvert Exit 100' downstream

DEPTH (ft)	0.15	0.25	0.35	0.45	0.55	0.65	0.75	0.85	0.95
VELOCITY $(fps)^2$	3.0	3.3	3.8	3.9	4.1	3.8	4.0	4.0	4.0

Date	Site #	Creek Name	Highway	Location
8 July 1982	P-014	Little Panguingue	Parks	Culvert Exit

DEPTH (ft)	0.15	0.2
VELOCITY $(fps)^2$	3.0	3.1

Date	Site #	Creek Name	Highway	Location
8 July 1982	P-014	Little Panguingue	Parks	Freefall

DEPTH (ft)	0.15	0.2
VELOCITY $(fps)^2$	3.1	3.1

Date	Site #	Creek Name	Highway	Location
8 July 1982	P-015	Unnamed Creek 222.5 mile	Parks	Culvert Exit

DEPTH (ft)	0.15	0.2	0.3	0.4	0.5
VELOCITY $(fps)^2$	1.9	2.1	2.2	2.1	2.2

Date	Site #	Creek Name	Highway	Location
8 July 1982	P-016	Slime Creek	Parks	North Culvert Exit

DEPTH (ft)	0.15	0.2	0.3	0.5	0.75	1.0	1.25	1.5	1.75	2.0	2.25
VELOCITY (fps)[1]	1.3	1.3	1.3	1.4	1.4	1.6	1.8	2.6	2.9	3.0	2.7

Date	Site #	Creek Name	Highway	Location
5 August 1983	P-016	Slime Creek	Parks	Culvert Entrance

DEPTH (ft)	0.15	0.25	0.5	0.75	1.0	1.25	1.5	1.75	2.25
VELOCITY (fps)[3]	0.7	0.6	0.9	1.3	1.6	1.9	2.2	2.3	2.6

Date	Site #	Creek Name	Highway	Location
5 August 1983	P-016	Slime Creek	Parks	Culvert Entrance

DEPTH (ft)	0.15	0.25	0.5	0.75	1.0	1.25	1.5	1.75	2.25
VELOCITY (fps)[1]	1.0	1.0	1.1	1.1	1.5	1.8	2.1	2.3	2.4

Date	Site #	Creek Name	Highway	Location
5 August 1983	P-016	Slime Creek	Parks	Culvert Entrance 25' upstream

DEPTH (ft)	0.15	0.25	0.35	0.45	0.55	0.65	0.75	0.85	0.95
VELOCITY (fps)[1]	2.1	2.5	2.9	3.1	3.3	3.6	3.6	3.5	3.8

Date	Site #	Creek Name	Highway	Location
5 August 1983	P-016	Slime Creek	Parks	Culvert Entrance 25' upstream

DEPTH (ft)	0.15	0.25	0.35	0.45	0.55	0.65	0.75	0.85	0.95
VELOCITY (fps)[3]	2.4	2.8	3.1	3.2	3.5	3.6	3.7	3.7	3.4

Date	Site #	Creek Name	Highway	Location
5 August 1983	P-016	Slime Creek	Parks	Culvert Entrance 25' upstream

DEPTH (ft)	0.15	0.25	0.35	0.45	0.55	0.65	0.75	0.85	0.95
VELOCITY (fps)[2]	2.1	2.4	2.6	2.9	3.2	3.3	3.3	3.4	3.8

Date	Site #	Creek Name	Highway	Location
17 August 1983	R-001	Unnamed Creek at Badger Road	Richardson	Culvert Entrance culvert #3

DEPTH (ft)	0.2	0.3	0.5	0.75	1.0
VELOCITY (fps)[1]	0.46	0.50	0.54	0.57	0.84

Date	Site #	Creek Name	Highway	Location
18 August 1982	R-004	Chena Slough Tributary	Richardson	North Culvert Entrance

DEPTH (ft)	0.15	0.25	0.35	0.45	0.55	0.65
VELOCITY (fps)[1]	2.0	2.5	2.9	3.8	3.6	3.4

Date	Site #	Creek Name	Highway	Location
18 August 1982	R-004	Chena Slough Tributary	Richardson	North Culvert Entrance

DEPTH (ft)	0.15	0.25	0.35	0.45	0.55	0.65
VELOCITY (fps)[3]	2.3	3.2	3.0	3.5	3.5	3.5

Date	Site #	Creek Name	Highway	Location
3 August 1982	R-009	Unnamed Creek 242.3 mile	Richardson	Culvert Exit

DEPTH (ft)	0.05	0.10	0.15	0.20
VELOCITY (fps)[2]	3.0	3.5	4.3	4.1

Date	Site #	Creek Name	Highway	Location
3 August 1982	R-010	Unnamed Creek	Richardson	Culvert Exit

DEPTH (ft)	0.05	0.1	0.15
VELOCITY (fps)[2]	4.0	4.0	4.5

Date	Site #	Creek Name	Highway	Location
4 August 1982	R-011	Donnelly Creek	Richardson	Culvert Exit

DEPTH (ft)	0.15	0.25	0.35	0.45	0.55	0.65	0.75	0.85
VELOCITY (fps)[1]	7.6	7.6	8.0	8.2	8.2	10.4	10.1	9.3

Date	Site #	Creek Name	Highway	Location
10 August 1982	S-005	Dora Creek Tributary	Steese	Culvert Exit

DEPTH (ft)	0.05	0.10	0.15	0.25	0.30	0.35	0.45
VELOCITY (fps)[1]	3.7	3.3	2.6	3.8	5.4	6.2	6.5

Date	Site #	Creek Name	Highway	Location
10 August 1982	S-006	Boston Creek	Steese	Culvert Exit

DEPTH (ft)	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
VELOCITY (fps)[2]	1.83	1.9	2.1	2.4	2.7	3.0	3.0	3.1	3.1	2.5

Date	Site #	Creek Name	Highway	Location
9 August 1982	S-007	Unnamed Creek	Steese	Culvert Entrance

DEPTH (ft)	0.15	0.25	0.35	0.45
VELOCITY (fps)[1]	2.3	2.6	2.8	2.7

Date	Site #	Creek Name	Highway	Location
9 August 1982	S-009	Grouse Creek	Steese	Culvert Entrance

DEPTH (ft)	0.1	0.2	0.3	0.4
VELOCITY (fps)[2]	1.3	1.6	1.6	1.6

Date	Site #	Creek Name	Highway	Location
9 August 1982	S-010	Ptarmigan Creek	Steese	Culvert Exit

DEPTH (ft)	0.15	0.25	0.35	0.45
VELOCITY (fps)[1]	2.1	2.4	2.4	2.2

Date	Site #	Creek Name	Highway	Location
9 August 1982	S-010	Ptarmigan Creek	Steese	Culvert Exit

DEPTH (ft)	0.15	0.25	0.35	0.45	0.55	0.65	0.75	0.85
VELOCITY (fps)[1]	1.9	2.5	2.6	3.0	3.0	3.4	3.2	3.2

Date	Site #	Creek Name	Highway	Location
27 July 1983	S-010	Ptarmigan Creek	Steese	Culvert Exit 5' upstream

DEPTH (ft)	0.15	0.3	0.5	0.7
VELOCITY (fps)[1]	1.8	2.3	2.6	2.4

Date	Site #	Creek Name	Highway	Location
27 July 1983	S-010	Ptarmigan Creek	Steese	Culvert Exit 5' upstream

DEPTH (ft)	0.15	0.3	0.5	0.7
VELOCITY (fps)[3]	2.1	2.5	3.0	2.0

Date	Site #	Creek Name	Highway	Location
27 July 1983	S-010	Ptarmigan Creek	Steese	Culvert Exit 5' upstream

DEPTH (ft)	0.15	0.3	0.5	0.7
VELOCITY (fps)[2]	2.1	2.4	2.7	2.8

Date	Site #	Creek Name	Highway	Location
27 August 1983	S-011	U.S. Creek	Steese	Culvert Exit
DEPTH (ft)	0.25	0.5	0.75	1.0	1.25
VELOCITY (fps)[1]	1.1	1.4	1.5	1.5	1.1

Date	Site #	Creek Name	Highway	Location
27 August 1983	S-011	U.S. Creek	Steese	Culvert Exit
DEPTH (ft)	0.25	0.5	0.75	1.0	1.25
VELOCITY (fps)[3]	1.3	1.5	1.5	1.5	1.2

Date	Site #	Creek Name	Highway	Location
27 August 1983	S-011	U.S. Creek	Steese	Culvert Exit
DEPTH (ft)	0.25	0.5	0.75	1.0	1.25
VELOCITY (fps)[2]	1.1	1.5	1.6	1.5	1.2

Date	Site #	Creek Name	Highway	Location
2 September 1983	S-028	Idaho	Steese	Culvert Exit
DEPTH (ft)	0.25	0.5	0.75	1.0	1.25
VELOCITY (fps)[1]	7.8	8.9	9.5	10.6	11.2

Date	Site #	Creek Name	Highway	Location
2 September 1983	S-029	Montana Creek	Steese	Culvert Entrance
DEPTH (ft)	0.25	0.5	0.75	1.0	
VELOCITY (fps)[1]	1.7	3.2	3.9	4.0	

Date	Site #	Creek Name		Highway	Location
2 September 1983	S-029	Montana Creek		Steese	Culvert Entrance
DEPTH (ft)	0.25	0.5	0.75	1.0	
VELOCITY (fps)[3]	3.3	4.4	4.6	4.4	

Date	Site #	Creek Name		Highway	Location
2 September 1983	S-029	Montana Creek		Steese	Culvert Entrance
DEPTH (ft)	0.25	0.5	0.75	1.0	
VELOCITY (fps)[3]	3.7	4.4	4.8	4.6	

Date	Site #	Creek Name		Highway	Location
2 September 1983	S-029	Montana Creek		Steese	Culvert Exit 5' upstream
DEPTH (ft)	0.25	0.50	0.75	1.0	1.25
VELOCITY (fps)[1]	3.0	3.6	4.5	4.8	6.5

Date	Site #	Creek Name		Highway	Location
2 September 1983	S-029	Montana Creek		Steese	Culvert Exit 5' upstream
DEPTH (ft)	0.25	0.50	0.75	1.0	1.25
VELOCITY (fps)[3]	2.9	4.8	4.3	5.6	4.0

Date	Site #	Creek Name	Highway	Location
2 September 1983	S-029	Montana Creek	Steese	Culvert Exit 5' upstream

DEPTH (ft)	0.25	0.50	0.75	1.0	1.25
VELOCITY (fps)[3]	2.6	4.1	4.5	5.0	3.4

Date	Site #	Creek Name	Highway	Location
23 August 1983	S-035	Bedrock Creek	Steese	Culvert Exit

DEPTH (ft)	0.2	0.3	0.4	0.5	0.6
VELOCITY (fps)[1]	7.4	7.4	10.6	10.6	10.3

Date	Site #	Creek Name	Highway	Location
23 August 1983	S-036	Sawpit Creek	Steese	Culvert Exit

DEPTH (ft)	0.15	0.25	0.3
VELOCITY (fps)[2]	5.1	4.7	4.8

Date	Site #	Creek Name	Highway	Location
23 August 1983	S-036	Sawpit Creek	Steese	Culvert Exit 10' downstream

DEPTH (ft)	0.15	0.25	0.35	0.45	0.55
VELOCITY (fps)[2]	4.8	4.5	4.2	4.5	4.4

SECTION IV

A list of streams alphabetized by highway that are included in Data Section with an indication of whether discharge and velocity measurements were made.

Site #	Stream	Discharge measurement	Velocity profile(s)
	ALASKA HIGHWAY		
A-001	Unnamed Creek (mile 1365)	Y	Y
A-002	Unnamed Creek (mile 1369)	Y	N
	CHENA HOT SPRINGS ROAD		
C-001	Steele Creek	Y	Y
	DALTON HIGHWAY		
B-001	Woodchopper Creek	Y	Y
B-002	Ft. Hamlin Hills Creek	Y	Y
B-003	Fed Creek	N	Y
B-004A	Mid. B. of the West F. of the Dall River	Y	N
B-005	Olson Lake Creek	Y	Y
B-006	Caribou Mountain Creek	N	Y
B-007	Alder Mountain Creek	Y	N
B-008	Pung's Crossing	Y	Y
B-009	SF of the Little Nasty Creek	Y	Y
B-012	Douglas Creek	Y	Y
B-016	Abba Dabba Creek	Y	Y
B-023	Rosie Creek	Y	N
B-030	Nugget Creek	Y	Y
B-033	Linda Creek	Y	Y
B-034	Sukapak Creek	Y	Y
B-035	Eva's Alv	Y	N
B-036	Brockman Creek	Y	Y
B-037	Disaster Creek	Y	N
B-038	Snowden Creek	Y	N
B-039	Numbers Lake Creek	Y	N
B-040A	Steep Creek #1	Y	N
B-041	Tracey's Trickle	Y	N
B-042A	Unnamed Creek (1 mile North of Chandalar Camp)	Y	Y
B-042	Nutirwik Creek	Y	Y
B-043	WF of the NF of the Chandalar River	Y	N
B-044A	Upper Atigun River	Y	N
B-045	Spike Camp Creek	Y	N
B-048	Trevor Creek	Y	Y
B-049	Tyler Creek	Y	Y

SECTION IV (Continued)

Site #	Stream	Discharge measurement	Velocity profile(s)
B-050	Roche Moutonee	Y	Y
B-051	Holden Creek	Y	N
B-055	Dan Creek	Y	Y
	DENALI HIGHWAY		
D-002	Unnamed Creek (mile 17.9)	Y	N
D-003	Unnamed Creek (mile 18.5)	Y	Y
D-006	Osar Creek Tributary	Y	Y
D-007	Osar Creek	Y	Y
D-012	Unnamed Creek (mile 79.1)	N	N
D-013	Unnamed Creek (mile 83.0)	Y	N
D-014	Unnamed Creek (mile 87.7)	N	Y
D-015	Unnamed Creek (mile 89.9)	N	Y
D-017	Unnamed Creek (mile 99.4)	Y	Y
D-018	Stixkwan Creek	Y	Y
D-019	Lily Creek	N	N
D-020	Unnamed Creek (mile 117.3)	N	Y
D-021	Unnamed Creek (mile 118.2)	N	Y
D-022	Edmonds Creek	N	Y
D-023	Unnamed Creek (mile 123.7)	N	Y
D-024	Unnamed Creek (mile 130.7)	Y	Y
	ELLIOTT HIGHWAY		
E-001	Dome Creek	Y	Y
E-002	Cushman Creek	Y	Y
E-003	Globe Creek	Y	Y
E-004	Globe Creek (North Crossing)	Y	Y
E-005	Unnamed Trib. to the Tatalina River	Y	N
E-007	Bridge Creek (North Channel)	Y	Y
E-008A	Livengood Creek Slough	Y	Y
E-009	Lost Creek	Y	N
E-010	WF Erickson Creek	Y	N
E-011	Unnamed Creek (South of Hess Creek)	Y	N
E-012	Hot Cat Creek	Y	Y
E-013	Isom Creek	Y	N
	GLENN HIGHWAY		
G-001	Meadow Creek	Y	Y
	OLD SEWARD HIGHWAY		
SW-001	Rabbit Creek	Y	Y

SECTION IV (Continued)

Site #	Stream	Discharge measurement	Velocity profile(s)
	PARKS HIGHWAY		
P-002	Alder Creek	Y	Y
P-005	Unnamed Creek (mile 288.5)	N	Y
P-008	June Creek	Y	Y
P-011	Slate Creek	Y	N
P-014	Little Panguingue Creek	Y	Y
P-015	Unnamed Creek (mile 222.5)	Y	Y
P-016	Slime Creek	Y	Y
	RICHARDSON HIGHWAY		
R-001	Unnamed Creek (at Badger Road)	N	Y
R-004	Chena Slough Tributary	Y	Y
R-009	Unnamed Creek (mile 242.3)	Y	Y
R-010	Unnamed Creek	Y	Y
R-011	Donnelly Creek	Y	Y
	STEESE HIGHWAY		
S-002	Goldstream Creek	Y	N
S-005	Dora Creek Trib.	Y	Y
S-006	Boston Creek	Y	Y
S-007	Unnamed Creek	Y	Y
S-009	Grouse Creek	Y	Y
S-010	Ptarmigan Creek	Y	Y
S-011	U.S. Creek	Y	Y
S-029	Montana Creek	Y	Y
S-034	Stack Pup Creek	N	N
S-035	Bedrock Creek	Y	Y
S-036	Sawpit Creek	Y	Y
S-037	Quartz Creek	Y	N
S-040	Crazy Creek	Y	N

SECTION V

FIELD EVALUATION FORM
DRAINAGE STRUCTURES

DATE _____ SITE NO. _____

BY _____ _____ _____ _____

LOCATION _____

_____

DIMENSIONS SPAN _____ RISE _____ DIAM. _____

LENGTH _____

SLOPE CULVERT _____

UPSTREAM _____

DOWNSTREAM _____

VELOCITY PROFILE METER _____

LOCATION _____

DEPTH (FT)	COUNTS	VELOCITY (FPS)	DEPTH (FT)	COUNTS	VELOCITY (FPS)

TOTAL DEPTH DOWNSTREAM _____

TOTAL DEPTH UPSTREAM _____

SITE NO. __________

CHANNEL AND FLOW MEASUREMENTS

METER __________

LOCATION __________

STA	DEPTH (FT)	DIST. (FT)	---COUNTS----		VEL. (FPS)	AREA (SQ FT)	Q (CFS)

DEPTH OF VELOCITY COUNTS ____ ____ ΣQ = ____

BED LOAD SIZE __________

HIGH WATER MARKS __________

PICTURES COLOR: ROLL __________ NUMBERS __________

B&W: ROLL __________ NUMBERS __________

SITE NO. _____

FISH FACILITIES

BAFFLES IN BARREL _____

TYPE _____

WIDTH _____ SPACING _____

BAFFLES IN OUTLET CHANNEL _____

NUMBER _____ TYPE _____

POOL DIMENSIONS _____ DEPTH _____

BARREL LOWERED INTO STREAMBED _____

GRAVEL INVERT-STAYED WITH BAFFLES _____

REDUCED GRADIENT _____

UPSTREAM END LOWERED _____

DOWNSTREAM END RAISED _____

RIPRAP FOR DOWNSTREAM POOL _____

REST AREAS _____

OTHER _____

_____

CULVERT CONDITIONS

DRIFT INTO BARREL _____

BAFFLES BROKEN OR DESTROYED _____

RIPRAP LOST _____

BARREL DISTORTION OR MISALIGNMENT _____

MAINTENANCE PROBLEMS _____

OTHER _____

_____

COMMENTS _____

_____

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16. Abstract

Culverts are a very simple hydraulic structure. However, because the engineer must design for peak flows passing through the culvert while fish are trying to move upstream serious problems arise. Almost all culvert installations in interior and northern Alaska were casually examined, with approximately 100 examined in detail where hydraulic problems existed that may retard fish passage. Data from the field program are included in an appendix to this report. The two major hydraulic problems in regard to fish passage were high velocities and perching; inlet drops caused by deposited sediment, aufeis, alignment of culvert with stream, and non-uniform culvert slopes are some of the other fish passage deterents that were observed. Also, all known baffled structures were evaluated. Numerous recommendations were made that should improve the hydraulic conditions that exist at a culvert relative to fish passage. Also, it is recommended that further studies be carried out to evaluate the swimming performance of the native fish. Present design criteria are based on very limited studies. Lastly, it is recommended that the concept of the velocity in the occupied zone (area in culvert where fish swim) be considered as the culvert design velocity for fish passage in place of the presently used average cross-sectional velocity.

17. Key Words	18. Distribution Statement
Culverts, Alaska, Fish Passage, High velocities, Perching, Field conditions	UNRESTRICTED

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