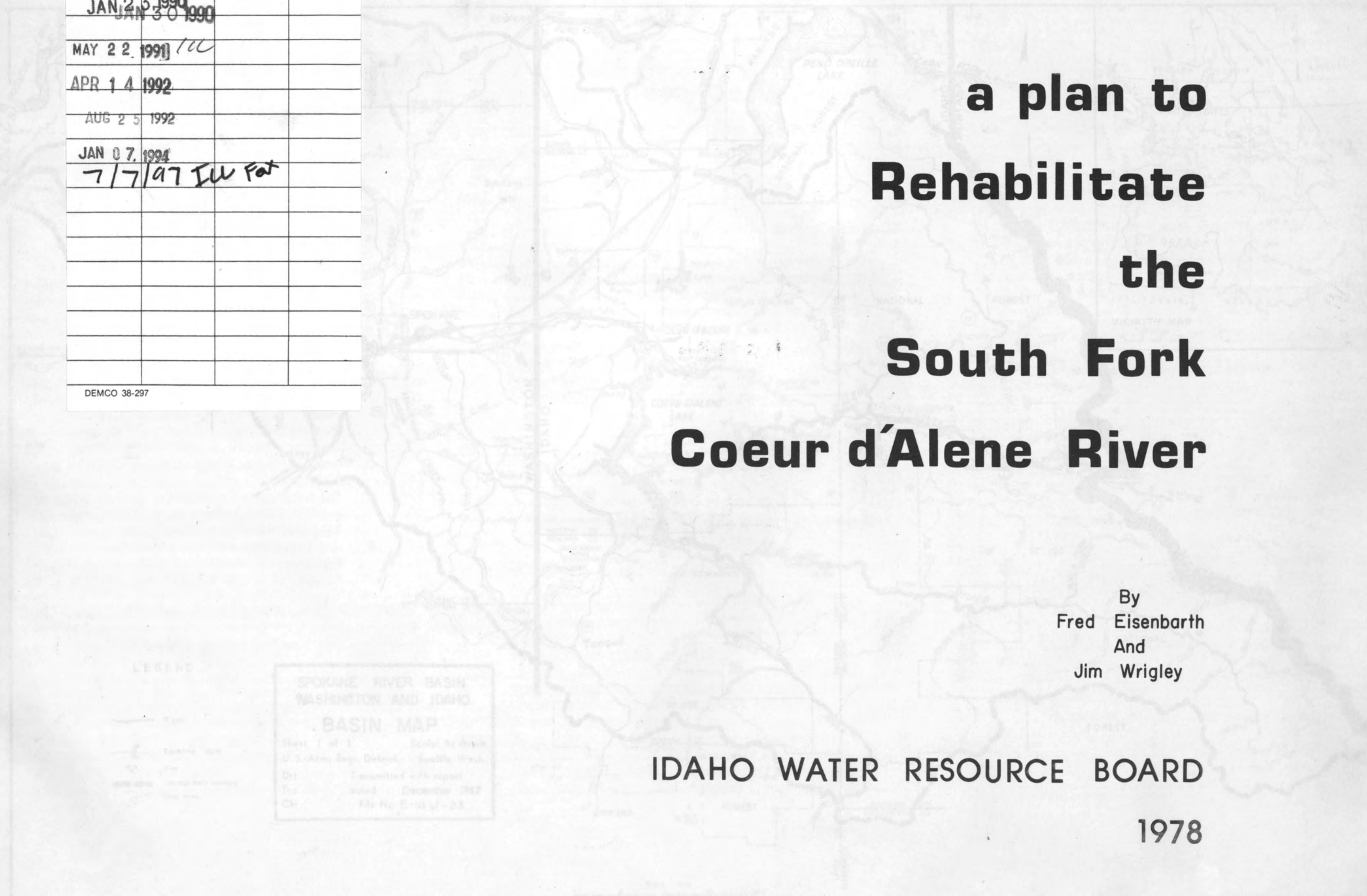
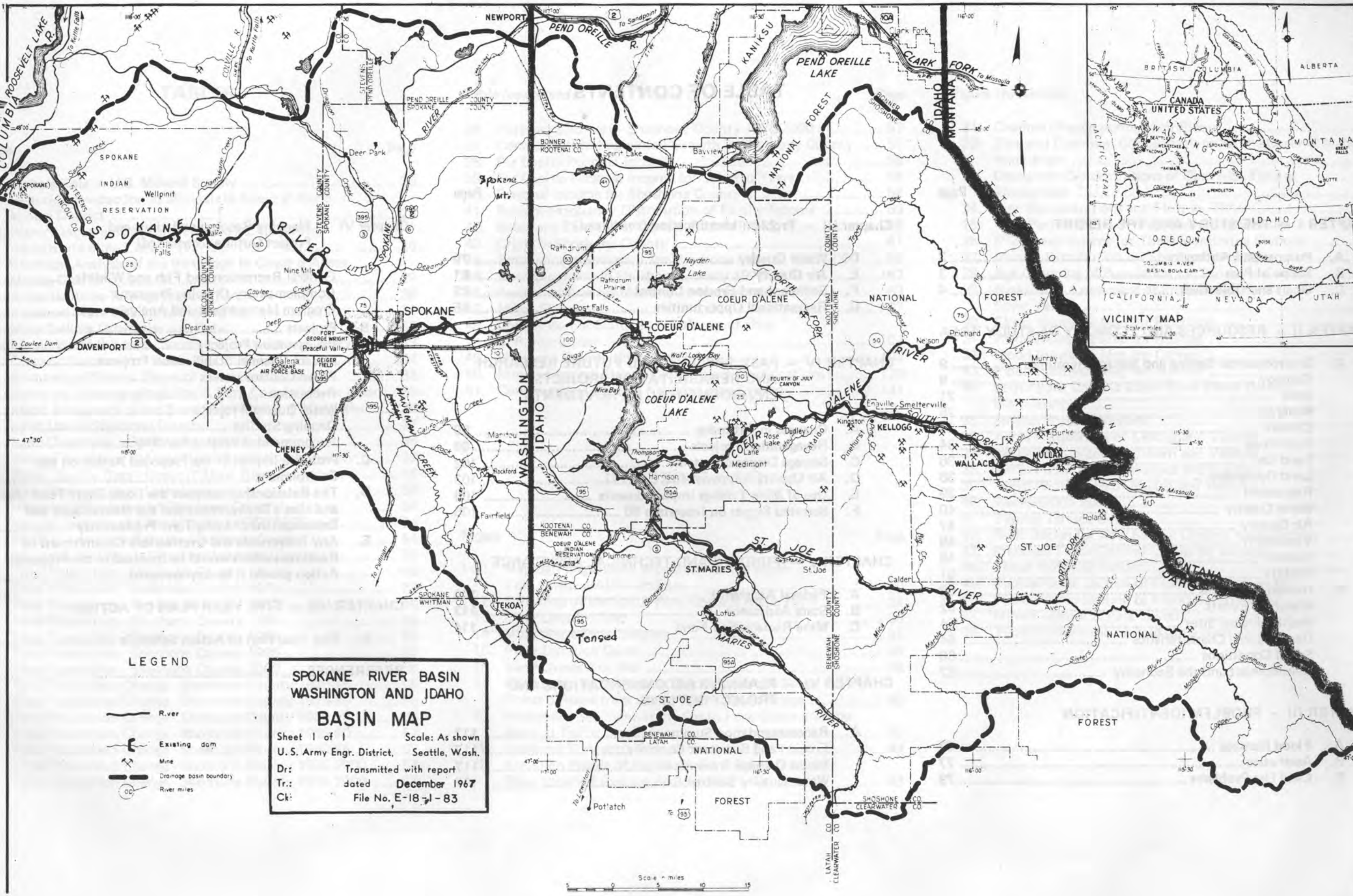


a plan to Rehabilitate the South Fork Coeur d'Alene River

By
Fred Eisenbarth
And
Jim Wrigley

IDAHO WATER RESOURCE BOARD

1978


SPOKANE RIVER BASIN
WASHINGTON AND IDAHO
BASIN MAP
Sheet 1 of 1
Scale: As shown
U.S. Army Engr. District, Seattle, Wash.
Dr: Transmitted with report
Tr.: dated December 1967
Ck: File No. E-18-1-83
LEGEND
River
Existing dam
Mine
Drainage basin boundary
River miles
VICINITY MAP
BRITISH COLUMBIA
ALBERTA
CANADA
UNITED STATES
WASHINGTON
MONTANA
IDAHO
OREGON
CALIFORNIA
NEVADA
UTAH
PACIFIC OCEAN
COLUMBIA RIVER BASIN BOUNDARY
WASHINGTON
IDAHO
MONTANA
SPOKANE RIVER
LITTLE SPOKANE
PEND OREILLE R.
PEND OREILLE LAKE
CLARK FORK
COEUR D'ALENE LAKE
COEUR D'ALENE RIVER
SOUTH FORK
NORTH FORK
ST. JOE RIVER
ST. MARIES RIVER
HANGMAN CREEK
FRANKLIN D. ROOSEVELT LAKE
COLUMBIA R.
SPOKANE INDIAN RESERVATION
COEUR D'ALENE INDIAN RESERVATION
KANIKSU NATIONAL FOREST
COEUR D'ALENE NATIONAL FOREST
ST. JOE NATIONAL FOREST
SPOKANE
NEWPORT
DAVENPORT
CHENEY
TEKOA
COEUR D'ALENE
KELLOGG
WALLACE
MULLAN
ST. MARIES
Post Falls
Rathdrum
Spirit Lake
Bayview
Deer Park
Nine Mile
Reardan
Fairfield
Rockford
Plummer
Tensed
Pot'latch
Hayden Lake
Prichard
Murray
Burke
Enaville
Smelterville
Kingston
Pinehurst
Rose Lake
Medimont
Harrison
Calder
Avery
St. Joe
Lofus
Clark Fork
To Missoula
To Coulee Dam
To Sandpoint
To Spokane
Scale - miles

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ILLUSTRATIONS

CHAPTER 1

THE STUDY AND THE REPORT

This chapter describes the authorities for preparation of the South Fork Coeur d'Alene River Rehabilitation Plan. Those policies of the Idaho State Water Plan relating to the rehabilitation of the South Fork are discussed. The "Goals and Objectives" used to formulate the recommendations and project outline are presented.

A. PURPOSE AND AUTHORITY

The purpose of this plan is to identify, evaluate, and analyze the resource management problems that exist in the South Fork of the Coeur d'Alene River area of Idaho and to develop a "five-year plan-of-action" leading to the rehabilitation and restoration of the area to a more stable state.

The basic authority to rehabilitate the South Fork of the Coeur d'Alene River is the Idaho State Water Plan as adopted by the Water Resource Board in 1976 and approved by the Legislature in 1978. The State Water Plan was authored by Article 15, Section 7, of the Idaho Constitution wherein it was stated:

There shall be constituted a Water Resource Agency, composed as the Legislature may now or hereafter prescribe, which shall have the power to formulate and implement a water plan for optimum development of water resources in the public interest; to construct and operate water projects; to issue bonds, without state obligation, to be repaid from revenues of projects; to generate and wholesale hydroelectric power at the site of production; to appropriate public waters as trustee for Agency projects; to acquire transfer and encumber title to real property for water projects and to have control and administrative authority over state lands required for water projects; all under such laws as may be prescribed by the Legislature.

The State Water Plan was approved by the Idaho Legislature in House Concurrent Resolution No. 48. This document outlined the following policies for the rehabilitation of the South Fork of the Coeur d'Alene River.

POLICY NO. 25: REHABILITATION PROGRAM

A program should be established to identify and evaluate rehabilitation of abandoned mineral extraction and byproduct storage areas and other abandoned projects which currently or potentially affect the yield or quality of the state's watersheds, streams and stream channels.

This program would identify hazardous or troublesome areas and recommend solutions. Current mining practices and storage areas would not be evaluated. Problems occur when mines and storage areas are abandoned and no upkeep or maintenance work is performed.

Some areas have deteriorated so much that structural failure is occuring causing erosion, sedimentation and heavy metals to enter the state's streams. In years past the mining companies, government agencies and general public tolerated a neglect of environmental quality as a tolerable cost of economic gain. Recently the mining industry has reversed this pattern of neglect and has made substantial and visible progress in controlling water and air pollution incident to its mining operations. The industry has made very substantial expenditures for treatment facilities which have resulted in major reductions in the discharge of pollutants. Leaders in the mining industry have taken the initiative with local government officials to pass bond sewage treatment facilities for control of water pollution throughout the South Fork of the Coeur d'Alene River. The discharge of raw sewage and of mining wastes have ceased. However, the problems of the past remain. Funding for study and rehabilitation work would come from the Rehabilitation Fund.

POLICY NO. 28: TAILING PONDS

Encourage the mining industry to work with federal and state agencies to achieve uniform safety standards for the construction of tailing ponds and other similar mine waste storage facilities. If agreement cannot be reached under existing laws and policies then legislation should be adopted placing tailing ponds and other similar mine waste storage facilities under jurisdiction of the Dam Safety Act. (I.C. 42-1714 et seq.)

House Bill No. 628 by the State Affairs Committee received approval by the Second Regular Session of the Forty-fourth Legislature which amends Section 42-1709 of the Idaho Code providing that "mine tailings impoundment structures" be included in the inspection procedures of the "dam safety act", and requires approval by the Department of Water Resources of the construction, maintenance and operation of new mine tailings impoundment structure.

POLICY NO. 31: FUNDING PROGRAM

The State of Idaho should establish a major water resource funding program to supplement private and federal monies to develop, preserve, conserve and restore the water and related land resources of Idaho and to implement the State Water Plan. The recommended funds are Water Management Fund, Rehabilitation Fund and Energy Development and Study Fund as approved by the Legislature.

The Rehabilitation Fund should receive annual appropriations. These monies would be used to evaluate and rehabilitate abandoned mines and by-product storage areas and other abandoned projects that adversely affect the state's water resources.

The Water Management Fund and Rehabilitation Fund would be administered by the Department of Water Resources as prescribed by the Legislature and consistent with the State Water Plan.

POLICY NO. 37: SOUTH FORK COEUR D'ALENE RIVER REHABILITATION

The State of Idaho should sponsor a joint federal-state-private stream channel stabilization and revegetation projects(s) in the South Fork Coeur d'Alene River drainage. Funds should be provided from the Rehabilitation Fund, discussed in Policy 31 for this project(s).

The South Fork Coeur d'Alene River drainage has produced a tremendous volume of minerals and contributed greatly to the development of the state and to the Emerald Empire-Panhandle area. However, this has caused significant environmental degradation. The South Fork, due to its location and the severity of environmental problems, should receive immediate attention. Monies should be appropriated from the Rehabilitation Fund as outlined in Policy 31 to insure state participation and be in the amount of $200,000 per year for a period of ten years. This revenue should be used as matching funds for federal, local and private efforts.

B. SCOPE OF PLAN

This plan includes all the study area located within the South Fork of the Coeur d'Alene River drainage beginning at Mullan downstream to Cataldo Flats. Approximately 31 miles long and 8 miles wide at its widest point, the majority of the area lies within Shoshone County with only a small portion located in eastern Kootenai County. A map of the area is shown below.

The South Fork of the Coeur d'Alene River and its tributaries drain approximately 270 square miles of mountainous-forested land with very steep slopes. The South Fork flows in a relatively narrow canyon for approximately 30 miles within the Coeur d'Alene Mountains from its headwaters in the Bitterroot Mountains on the Idaho-Montana border. The river with its extremely unstable channel wanders throughout the valley floor and is usually contained between the Interstate 90 and the Burlington grade railroad.

The area was first settled when gold was discovered in the Coeur d'Alene River in the Murray-Prichard area. As large ore bodies were found and developed, communities were formed near the mines. Today, mining is the largest industry in the area. The population of Shoshone County was 19,000 in 1975.

C. GOALS AND OBJECTIVES

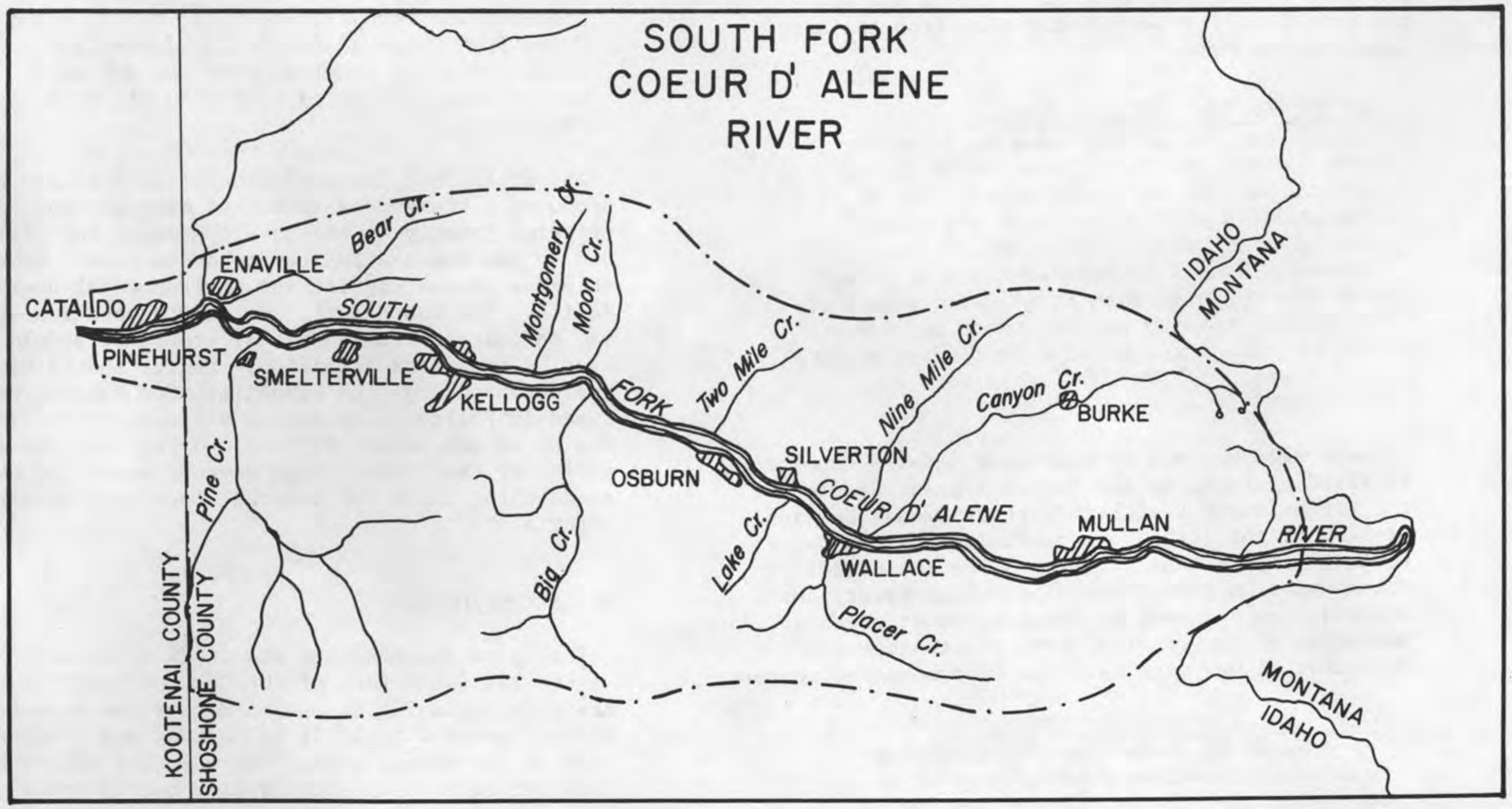
Efforts to rehabilitate the South Fork resulted in the formation of a South Fork Steering Committee in 1974. The Steering Committee, composed of various technical representatives of state, federal and local agencies plus Greater Shoshone Inc. who represented the mining industry, developed and adopted a set of "goals and objectives". These same goals and objectives form the basis for this plan and are listed below.

Objective 1: Flood Damage Reduction

Land and water management over structural alternatives is recognized as a better alternative in reducing or preventing flood damage.

In recognizing this preference, elements of the South Fork restoration program will consider the following needs:

1. Land use regulation and management in the identifiable flood plain to prevent uses which are incompatible with known flood potentials.
2. Improvement in the watershed to increase the water retention capacity of the area and to slow the runoff which occurs in the spring.
3. Improvement in mine waste and tailings storage to prevent their contribution to bedload and eventual deposition in the river channel.
4. Improvement in the river channel to provide lower velocities and increase channel storage.
5. When other alternatives do not exist or fail to provide sufficient protection to existing developed areas, construction of structural measures will be considered.



Objective 2: Future Land Use

Orderly and planned use of the existing land base in the Silver Valley area is needed to protect and to insure wise use of the limited resource. Future land use will be determined as directed in the Shoshone County comprehensive plan.

In recognizing this policy, elements of the South Fork restoration program will consider the following needs:

1. Additional housing development is vitally important to insuring the continued economic growth and social well-being of the South Fork area. However, priority should be given to planned housing developments which are constructed away from the flood plain and which utilize a high rise or other low land intensity concept.
2. Priority should be given projects and programs which provide for utilization of land located out of the flood plain area; subject, however, to the individual characteristics of the soil, slope, etc.
3. Priority should be given to projects and programs utilizing more efficient storage of mining wastes in areas away from the flood plains. Short term solutions should be avoided where possible.

Objective 3: Recreation

Recreational enhancement in the Silver Valley is needed to expand and enrich upon the existing opportunities for both the resident and non-resident user.

Elements of the restoration program will consider the following needs:

1. Improvements in water quality in the South Fork drainage have been occurring in the past few years and are expected to increase further in the future. This continued improvement will create a need in the South Fork area to develop high user density recreation which is both safe and inexpensive in terms of travel cost. Water contact sports and fishing are a preferred form of recreation and deserve support through long-range planning and development.

Objective 4: Aesthetics

A policy of seeking the development of an aesthetically pleasing river corrider and surrounding watershed environment is recommended.

Elements of the total restoration plan will consider the following needs:

1. Remove the debris, etc., from over 90 years of mining, wildfire, highway and railroad construction, etc. from the immediate river area.
2. Revegetate the slopes along the Kellogg-Smelterville front. Various forms of greenery would have a stabilizing effect upon the land and promote a more aesthetic environment.
3. Priority should be given to ending any further degredation throughout the Silver Valley area. Protection should be given to the resources that still remain in a natural state.

Objective 5: Fish and Wildlife

A policy of giving top priority consideration to the needs of fish and wildlife in the restoration program and in any other program or project to be undertaken in the South Fork area is recommended. The restoration program recognizes that fish and wildlife are important elements of Shoshone County's economy and the overall quality of life.

The following needs will be considered in the restoration program:

1. Big game winter range is in critical supply in certain areas of Shoshone County and there is a need for additional development. The Wallace to Smelterville front could provide the range, if given proper revegetation.
2. Waterfowl nesting, feeding, and resting areas are in short supply in the South Fork area. Additional supply could be constructed throughout the drainage with the Mission Flats area and the Pinehurst to Kellogg airport reach being the most notable.
3. It is recognized that fish propogation in the South Fork area can occur only in the distant future. However, vast improvements to habitat can be accomplished in the present time period to accomplish this. Priority will be given to the construction of non-structural habitat (i.e. meanders, pools, riffles, etc.) over structural types.
4. There is a need for protection of the remaining fishery habitat. The South Fork restoration program will give priority to this protection and will oppose channel alterations in stream reaches which still remain in a natural state.

Objective 6: Erosion and Sedimentation Control

A policy of promoting adequate control of erosion and sedimentation is recommended.

The following needs will be considered in the restoration program:

1. Identify expected rates of erosion or deposition of soils and include management programs to minimize losses in any new mining, road construction, logging, etc., activities in the South Fork area.
2. It is recognized that old tailings piles contribute significantly to the total bedload of the South Fork. There is a need to stabilize these piles and make adequate provision for sedimentation and erosion control in any new tailings storage area.
3. Initiate an erosion and sedimentation control plan for the entire South Fork watershed. These needs should be accomplished prior to extensive reconstruction of the South Fork channel.

CHAPTER 2

RESOURCES AND THE ECONOMY OF THE STUDY AREA

This chapter describes the physical, biological, and cultural resources within the study area. Resource data is inventoried and analyzed to aid in identifying problems relating to the South Fork Coeur d'Alene River. Various data was collected over a period of years permitting the planner to make judgments as to both the severity and the direction of the problem.

A. ENVIRONMENTAL SETTING and NATURAL RESOURCES

Section I - Geology

The South Fork of the Coeur d'Alene River drains a portion of the Coeur d'Alene Mountains which are part of the Bitterroot Range dividing Idaho and Montana. Flowing generally westward, South Fork waters are eventually discharged into Coeur d'Alene Lake.

Except for some igneous rocks of granitic character the rocks underlying the South Fork basin are part of the Belt Supergroup which consist of thousands of feet of fine grained marine sediments which were deposited in shallow seas over 570 million years ago. These rocks have subsequently been metamorphosed, uplifted, eroded, faulted, and folded. The Belt Supergroup rocks have been only gently folded on a regional scale, with local intense deformation being a relatively rare event. However, faulting has been wide-spread with the Osburn Fault and its related structural features controlling the drainage development of the South Fork Coeur d'Alene River.

In Mesozoic time, beginning perhaps 225 million years ago with the intrusion of large masses of igneous rock into the Belt rock, the implacement of many of the mineral deposits for which the area is famous occurred. These deposits include ores of zinc, silver, lead, and gold. Mining of these ores is the largest industry in the basin and has caused major impacts.

Most streams in the area are deeply entrenched in narrow, steep-walled canyons. The Coeur d'Alene River valley is the main exception. The river is presently aggraded with Coeur d'Alene Lake as the base level. West of Cataldo Mission the valley reaches a maximum width of about 1-1/2 miles.

A period of aggradation represented by a series of terraces and gravel deposits about 700 feet above the present valley may have resulted from damming of the ancient Coeur d'Alene River by Columbia River basalts. These basalts form the plateaus on either side of the river at its mouth on the east end of Coeur d'Alene Lake. The course of the river prior to the stage represented by these gravels and terraces lay south of the present valley from about Big Creek to Cataldo. The river may have followed a course north of its present channel between Silverton and Osburn and between Cataldo and Rose Lake.

Evidence for shifting of the course of the river includes the numerous places where the present valley is narrow and steep walled but still aggraded. This condition results from the superposition of the stream along a new channel prior to the present period of aggradation. Examples can be found 1.75 river miles west of Cataldo Mission, between Kingston and Cataldo and between Pinehurst and Kingston.

Unconsolidated sediments in the restoration project area include recent alluvium, glacial deposits, and older gravels and terrace gravels. Logs of wells, as well as numerous exposures of alluvium in the valley, indicate that the sediments are fairly coarse grained in the eastern end of the valley and in the valley of Canyon Creek. To the west, the sediments become finer grained with a large increase in the silt-size and smaller fractions. Near Wallace, the alluvium consists of unconsolidated sand and gravel with a considerable percentage (10 to 20 percent) of rounded to subrounded cobbles and boulders. Well drillers' logs near Smelterville report about 25 feet of sand and gravel overlying approximately 45 feet of "blue mud" with 10 feet or more of gravel below this. The sediments become better sorted and finer grained to the west. Below Cataldo they consist predominately of very fine sand, silt, and clay.

The by-products of milling and concentration of ore consists mainly of finely ground rock (mostly quartz grains) called tailings. During the early years of mining, the particle size of the tailings ranged from microscopic to one-fourth inch. Large piles of these old tailings (termed "jig tailings" after the method of concentration) accumulated in the valley of the south fork and in the valleys of Canyon Creek, Ninemile Creek, and Big Creek. In addition, some jig tailings were discharged directly to streams and subsequently deposited over much of the valley floor along the south fork of the Coeur d'Alene River.

With the introduction of flotation concentration methods in the 1930's, the average grain size of tailings was greatly reduced to silt size and smaller particles. As a result, the streams of the area could carry tailings much farther before they settled out.

The increased efficiency of flotation concentration made it profitable to rework jig tailings. From 1943 to 1948, the Osburn Tailings Plant reworked several million tons of jig tailings from a large dump at Osburn. During this period, most of the mills in the district were processing tailings from deposits along Canyon Creek, Ninemile Creek, Big Creek, and along the south fork near Mullan, Wallace, Osburn, Kellogg, and Smelterville. This resulted in the removal of much of the early tailings. The equipment used in the removal operation caused the remaining jig tailings to be extensively intermixed with the upper layer of alluvium.

Fine silts have been deposited over the valley floor at Cataldo Flats during periods of high water.

FIGURE 1

NOTES:
1. Date of Aerial Photograph 6 Aug 75.
2. For Index see Sheet I.

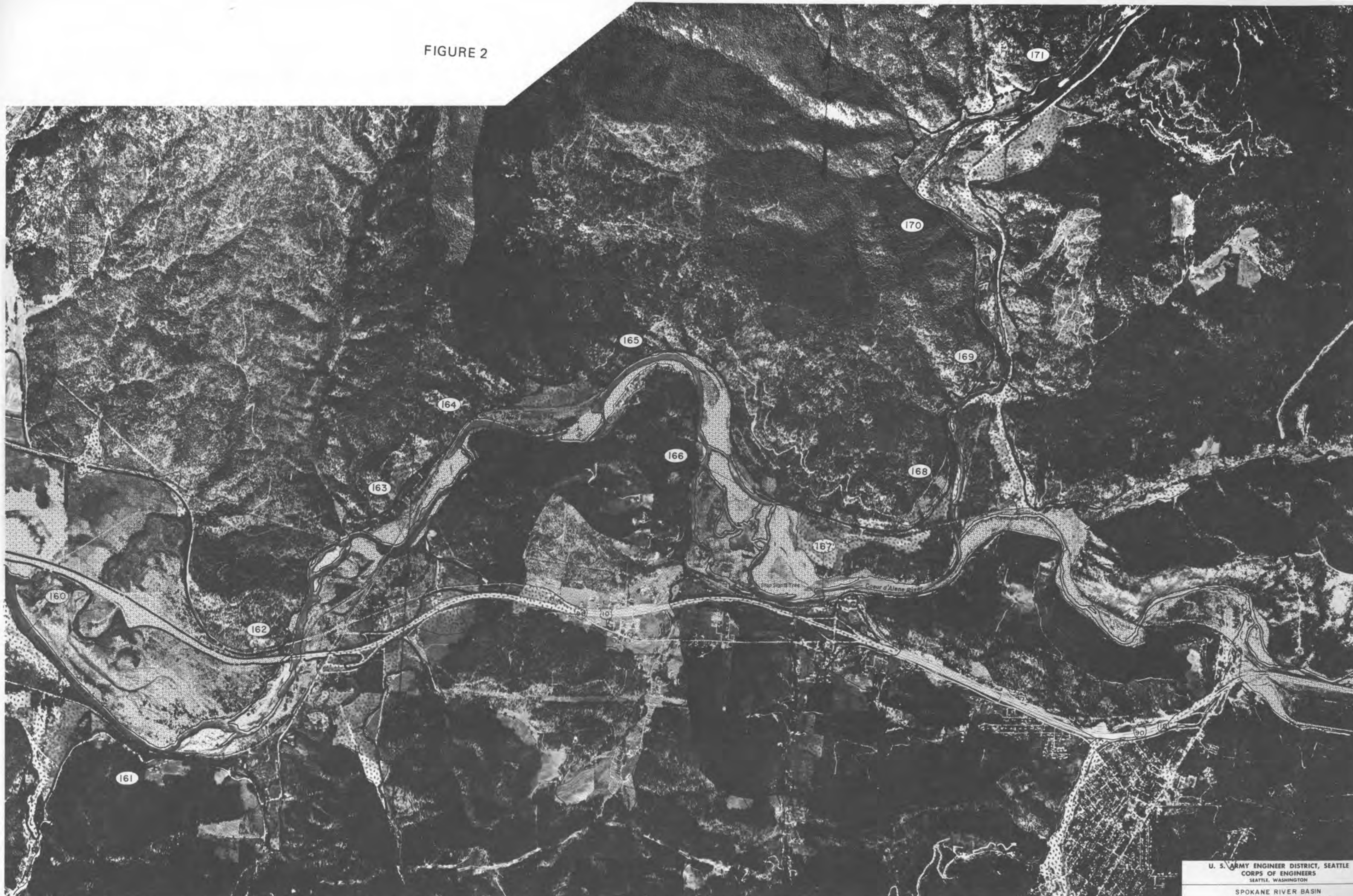
SCALE: 1" = 1000' (APPROXIMATE)

U. S. ARMY ENGINEER DISTRICT, SEATTLE
CORPS OF ENGINEERS
SEATTLE, WASHINGTON

SPOKANE RIVER BASIN
COEUR D'ALENE RIVER, IDAHO
RIVER MILE 153.4 TO RIVER MILE 161.0
100 YEAR FLOODING LIMITS

SIZE F | DATE | FILE NO E-18-2-126 | PLATE

FIGURE 2



SCALE: 1" = 1000' (APPROXIMATE)

For Legend and Notes, see Sheet 2.

U. S. ARMY ENGINEER DISTRICT, SEATTLE
CORPS OF ENGINEERS
SEATTLE, WASHINGTON

SPOKANE RIVER BASIN
COEUR D'ALENE RIVER, IDAHO
RIVER MILE 161.0 TO RIVER MILE 169.0
100 YEAR FLOODING LIMITS

SIZE	DATE	FILE NO.
F	OCT 1975	E-18-2-126

DSGN | CHK | SHEET 3 of 4

FIGURE 3

SOUTH FORK
RIVER
2.3
0.0
90
10
1
2
3
LEGEND
Alluvial Deposits
Channel And Terrace Gravels Older Than Alluvial Deposits
Mill Tailings
River Miles from Mouth
Approx. Limits of 100 Year Flood
Mine Wastes
Existing Levees
Approximate Flood Limit if Levee Fails,

FIGURE 4

SCALE: 1" = 500' (APPROXIMATE)

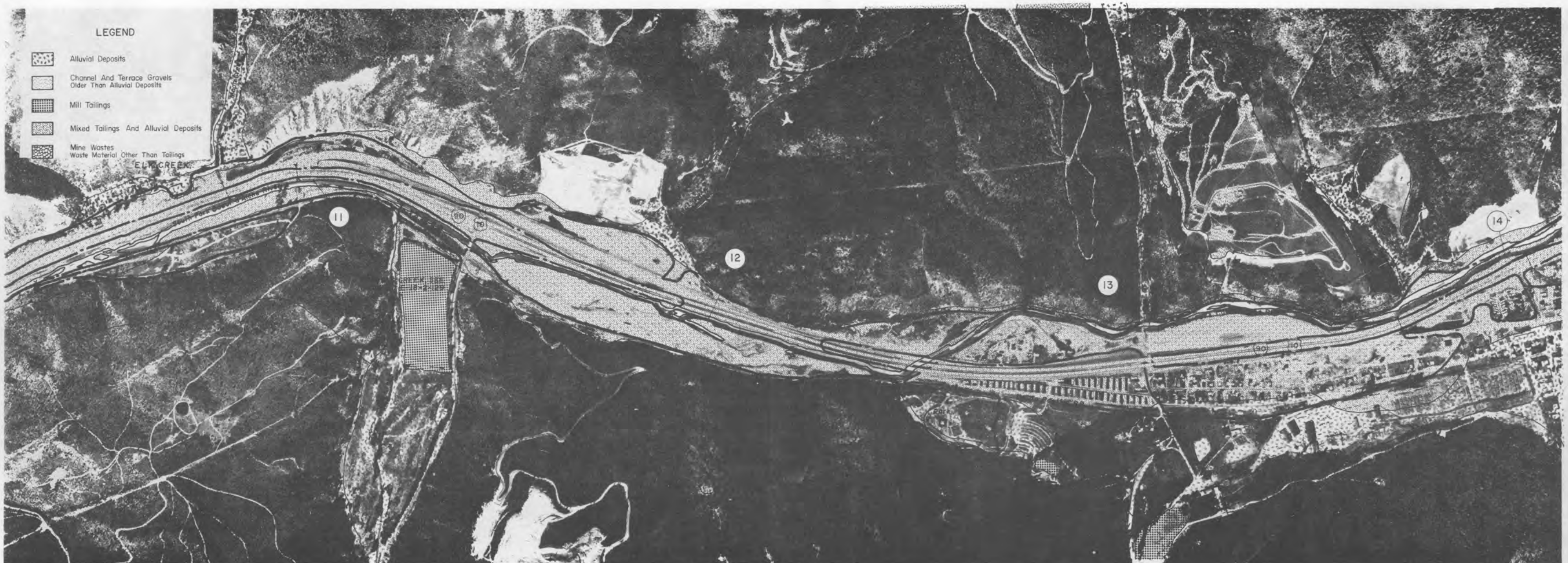
FIGURE 5


LEGEND
Alluvial Deposits
Mill Tailings
Shoshone County Airport
Union Pacific RR
USGS Gaging Sta.
90
10
4
5
6
7
SCALE: 1" = 500' (APPROXIMATE)

FIGURE 6

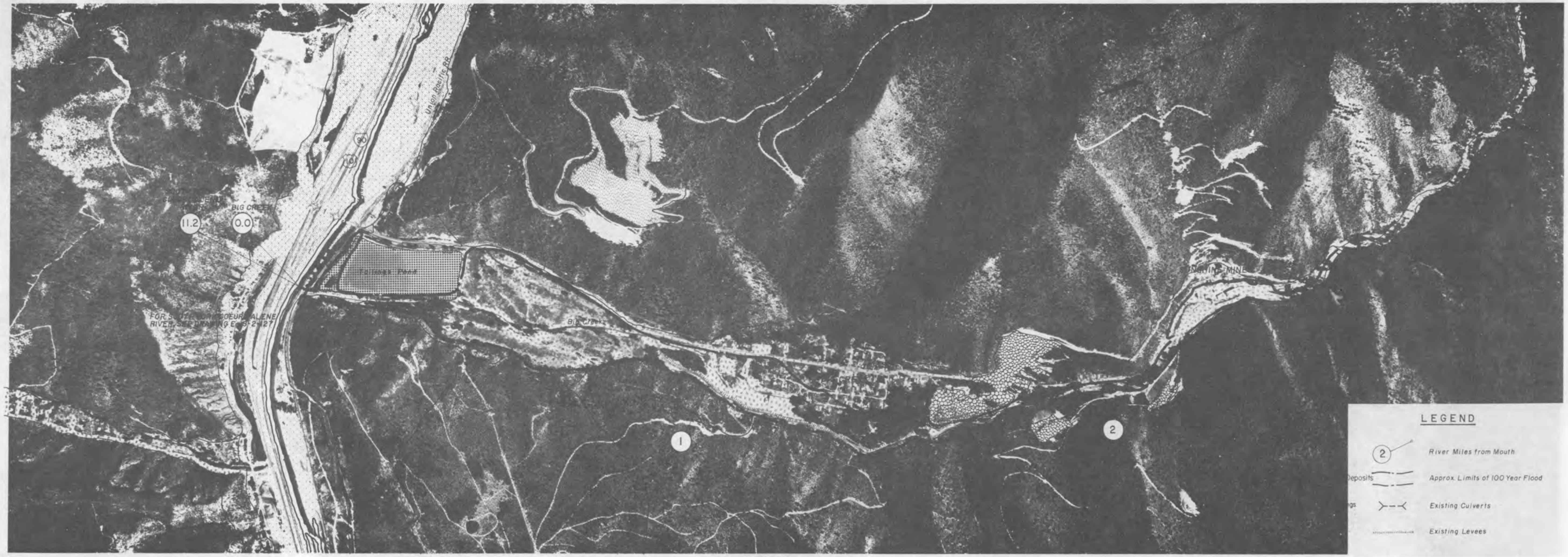
SCALE: 1" = 500' (APPROXIMATE)

FIGURE 7



SCALE: 1" = 500' (APPROXIMATE)

FIGURE 8



SCALE: 1" = 500' (APPROXIMATE)

FIGURE 9

SCALE: 1" = 500' (APPROXIMATE)

FIGURE 10

SCALE: 1" = 500' (APPROXIMATE)

FIGURE 11

SCALE: 1" = 500' (APPROXIMATE)

At some places along the south fork, deposits of jig tailings from early operations are exposed along the river banks and in places reach a thickness of about four feet. These deposits are often covered by a layer of surficial material resulting from the weathering of jig tailings and mixed with subsequent deposits which may also include tailings. These materials are often difficult to distinguish from natural alluvial deposits. Rock dust composed of finer fractions of tailings have been deposited over almost the entire floor of the valleys of the main stem and south fork during periods of high water.

Maps showing the alluvium configuration of the South Fork Coeur d'Alene River are shown in Figures 1 through 11.

Section II - Soils

An inventory and evaluation of the soils within the South Fork of the Coeur d'Alene River was conducted by the Soil Conservation Service, U. S. Department of Agriculture in August 1974. This report contained the following analysis.

1. *Introduction*

The sulfur dioxide gas from the smelter has damaged or destroyed much of the native vegetation in the survey area, and has increased acidity to intolerable levels for many plant species. Vegetation levels of most plant species, previous to the 1910 fire, were well established and tolerated the existing adverse conditions. Following the fire, natural plant invasion did not occur and young trees did not survive. A few shrub species that sprouted survived only if they could tolerate the extreme acid soil and air conditions resulting from the fumes produced by the smelters in the area. Without the protective vegetation, these highly erosive volcanic ash soils, within the area of steep slopes and high rainfall, were rapidly eroded. Annual accelerated erosion destroyed many of the few acid-resistant plants and newly established seedlings. The loss of the surface soil compounded the problem of poor plant growth by decreasing the water holding capacity and decreasing the rooting depth of the soil. Less water holding capacity caused increased surface runoff which in turn increases erosion. This process of erosion will continue until the soils are either eroded to hard bedrock or until plants are established.

2. *Description of Survey Area*

The survey area is located in Shoshone County. The survey area includes the watershed for the Kellogg and Smelterville portion of the South Fork of the Coeur d'Alene River and the floodplain of the South Fork from Pinehurst to Osburn. The mapped area includes 2,417 acres of severely eroded soils, 9,402 acres of moderately eroded soils, 6,397 acres of slightly to non-eroded soils, and 2,802 acres of mine tailings material. The total area includes 21,000 acres. Of this area, 9,305 acres of soil are extremely and very strongly acid and 2,614 acres are strongly acid.

The area is primarily steep mountainous land of metasedimentary rock covered with a thin layer of volcanic ash and wind-blown material (loess). There is a history of mountain glaciation, forming glacial outwash terraces at lower elevations. Alluvium and mine tailings occupy the floodplains and valley floors. Old faults are found throughout the area.

Elevations range from 2,200 at the confluence of Pine Creek and the South Fork of the Coeur d'Alene River to 6,300 feet at Kellogg Peak.

Conditions in the natural resource area:

Vegetative cover to adequately protect slopes from erosion was an area of consideration in this evaluation. The lack of vegetation on lower slopes and in the stream floodplain are essentially the result of four major factors. These are (1) the repeated fires during the period of 1910 to 1936 and to the present, (2) discharge of mine wastes (liquids and solids) into stream channels and ponds, (3) adverse atmospheric discharge from smelter operations, and (4) man's high intensity land use in part of the area.

The native vegetation in the South Fork of the Coeur d'Alene River floodplain from Osburn to beyond Pinehurst is nearly nonexistent. The 1910 fire first denuded the area. Tailing ponds and flushing of solids and liquids from mining operations into stream channels spread highly toxic materials over the floodplain during flood stages of the river. These sediments are/were strongly saline or in some instances extremely acid. These conditions suppressed or destroyed native vegetation. Reproduction or growth for most native species was prohibitive. The present stream channel is unstable and is subject to change during flood stage.

The present native vegetative cover on the mountain slopes within about 1.5 miles of the Bunker Hill smelter is inadequate to protect the soils from erosion. The cover ranges from near 0 to 65 percent depending upon distance and direction of prevailing wind. The original vegetation was destroyed in the 1910 fire. The establishment of the smelter and resulting atmospheric SO_2 discharge created extremely and strongly acid soil conditions. Soil erosion was and is the most severe in this area, especially in Deadwood Gulch and in adjacent Milo and Government Gulches. Very poor soil conditions and atmospheric conditions have contributed to the lack of native plant reproduction and growth. This area has contributed a very high amount of sedimentation in the streams in the past. Nearly all of the topsoil is gone.

Recent reduction in the volume of SO_2 discharge from the smelter has made the re-establishment of vegetation possible; however, the rate of natural re-establishment of vegetation is low. Soil acidity is too low for most native species. The soil is unstable and continues to shift down slope and creates an unfavorable rooting medium for seedlings. Past and present soil losses have reduced the potential for good vegetative growth and reproduction. These soils are now shallower, more acid, less fertile and have a much lower available water capacity than normal.

3. Brief Soil Descriptions

More detailed soil descriptions are found in the "Resource Data for Land Use Planning and Community Development, Soils - Kellogg-Smelterville Area, Shoshone County, Idaho-1974." USDA-SCS, Coeur d'Alene, Idaho.

Entic Cryandepts consist of well-drained soils on steep and very steep mountain slopes. They are formed in a thin mantle of volcanic ash and loess over metasedimentary rocks. Typically, the surface layer is silt loam 5 inches thick. The subsoil is gravelly and very gravelly silt loam to 21 inches. The substratum is very gravelly silt loam or loam to 47 inches. Rooting depth is 40 to 60 inches. Potential erosion hazard is high. *MAP is 40 to 60 inches. **MAST is 40 to 43°F. ***FFP is 50 to 90 days.

Fresh water marsh. This miscellaneous land type is a wet, periodically flooded area covered by grasses, cattails, rushes and other herbaceous plants.

Huckleberry consists of well-drain soils on steep and very steep mountain slopes. They are formed in a thin mantle of volcanic ash and loess over metasedimentary rocks.

Typically, the surface layer is loam or silt loam 6 inches thick. The subsoil is silt loam to about 22 inches. The substratum is very gravelly silt loam to 25 inches over fractured bedrock. It is very strongly acid and moderately eroded. Moderate permeability and available water capacity is 3 to 5 inches. Rooting depth is 14 to 22 inches. Potential erosion hazard is high. MAP is 30 to 45 inches. MAST is 44 to 46°F. FFP is 90 to 110 days.

McCrosket consists of well-drained soils on steep and very steep mountain slopes. They are formed in a thin mantle of volcanic ash and loess over metasedimentary rocks.

Typically, the surface layer is very gravelly silt loam about 4 inches thick. The subsoil is gravelly and very gravelly silt loam to about 21 inches. The substratum is very gravelly silt loam to 40 inches or more. It is strongly acid and very strongly acid. Permeability is moderate and available water capacity is 4 to 5 inches. Rooting depth is 25 to 40 inches. Potential erosion hazard is high. MAP is 25 to 35 inches. MAST is 47 to 49°F. FFP is 110 to 140 days.

Minaloosa consists of well-drained soils on steep and very steep mountain slopes. They are formed in a thin mantle of volcanic ash and loess over metasedimentary rocks.

Typically, the surface layer is gravelly loam and very gravelly silt loam about 11 inches thick. The subsoil is very gravelly or very stony loam to 30 inches. The substratum is very gravelly or very stony loam to 30 inches. It is medium acid to neutral. Permeability is moderate and available water capacity is 3 to 6 inches. Rooting depth is 20 to 40 inches. Potential erosion hazard is high. MPA is 30 to 45 inches. MAST is 44 to 47°F. FFP is 80 to 110 days.

Riverwash. This miscellaneous land type consists of stratified waterlain sand, gravel and cobbles deposited mostly in bars along and in the river channel. During periods of flooding extreme channel changes occur.

Rock outcrop. This miscellaneous land type consists of exposures of bare rock. Areas too small to be delineated on the map are shown by the symbol (√).

Shoeffler consists of well-drained soils on steep and very steep mountain slopes. They are formed in a thin mantle of volcanic ash over metasedimentary rocks.

Typically, the surface layer is silt loam about 6 inches thick. The subsoil is silt loam and very gravelly silt loam to about 21 inches. The substratum is very stoney loam to 27 inches. It is slightly acid to medium acid. Permeability is moderate and available water capacity is 4 to 6 inches. Rooting depth is 20 to 36 inches. Potential erosion hazard is high. MPA is 55 to 70 inches. MAST is 40 to 43°F. FFP is 45 to 60 days.

Slickens. This miscellaneous land type consists mainly of accumulations of medium-textured materials separated in mining operations. These deposits are mainly in the river floodplain. They vary in thickness from a few inches to many feet. Potential erosion hazard is high. Dust and sand blowing is common from these areas. Permeability is moderately rapid and available water capacity is 3 to 8 inches. Such materials are detrimental to plant growth due to salinity and concentrations of heavy metals. MAP is 30 to 40 inches. MAST is 45 to 47°F. FFP is 120 to 140 days.

Tekoa consists of well-drained soils on steep and very steep mountain slopes. They are formed mostly in residuum from metasedimentary rocks.

Typically, the surface layer is gravelly loam about 9 inches thick. The subsoil is gravelly silt loam to 20 inches. The substratum is very gravelly loam to 29 inches. It is neutral in reaction. Permeability is moderate and available water capacity is 4 to 6 inches. Rooting depth is 25 to 36 inches. MAP is 25 to 30 inches. MAST is 47 to 49°F. FFP is 110 to 135 days.

Typic Dystrochrepts consist of moderately well-drained soils on gently sloping to steep terraces. They formed in a thin mantle of volcanic ash over glacial outwash at the valley margin.

Typically, the surface layer is loam about 3 inches thick. The subsoil is silt loam and silty clay loam to 13 inches. The substratum is very gravelly silt loam, gravelly silty clay loam and very gravelly silty clay to 29 inches and is restrictive to roots in upper part. It is extremely acid to neutral in places. Permeability is moderately slow and available water capacity is 4 to 5 inches. Rooting depth is 12 to 23 inches. Potential erosion hazard is high. MAP is 25 to 35 inches. MAST is 44 to 47°F. FFP is 100 to 130 days.

Xeric Inceptic Arents consist mostly of cuts and fills in areas prepared for urban and industrial building sites. Nearly all the soil material has been disturbed by man. It is widely variable in surface texture. In many places, the soil material is very gravelly loam, loam, silt loam that is very cobbly or is very gravelly or cobbly with few or no fines. MAP is 25 to 35 inches. MAST is

43 to 46°F. FFP is 110 to 140 days.

**MAP - Mean annual precipitation*
***MAST - Mean annual soil temperature*
****FFP - Frost free period*

The following is a brief description of the soil units. For further information see the map in Figure 12 for location of the mapping units.

CA2 *Xeric Inceptic Arents, strongly acid. This soil is in the narrow stream bottoms and alluvial fans in the mountainous areas. Slopes are 0 to 5 percent. It is moderately eroded. Sparse vegetative cover.*

CA3 *Xeric Inceptic Arents, very strongly acid. This soil is in the narrow stream bottoms and alluvial fans in mountainous areas. Slopes are 5 to 15 percent. It is moderately eroded. Barren to sparse vegetative cover.*

Fm *Fresh water marsh. Medium vegetative cover.*

HR1 *Entic Cryandepts-Huckleberry association. This association consists of about 65 percent Entic Cryandepts and 25 percent Huckleberry. These soils are on 45 to 90 percent north-facing slopes. Dense vegetative cover.*

HR2 *Huckleberry-Entic Cryandepts association, strongly acid, moderately eroded. This association consists of about 50 percent Huckleberry and 40 percent Entic Cryandepts. These soils are on 45 to 90 percent north-facing slopes. Medium vegetative cover.*

HR3 *Huckleberry-Entic Cryandepts association, very strongly acid, moderately eroded. This association consists of about 60 percent Huckleberry and 30 percent Entic Cryandepts. These soils are on 45 to 90 percent north-facing slopes. Sparse vegetative cover.*

HR4 *Huckleberry-Entic Cryandepts association, very strongly acid, severely eroded. This association consists of about 60 percent Huckleberry and 30 percent of Entic Cryandepts. These soils are on 45 to 90 percent north-facing slopes. Barren to open vegetative cover.*

JS3 *Typic Dystrochrepts, extremely acid and very strongly acid, moderately eroded. Slopes are 5 to 35 percent. Sparse vegetative cover.*

JS4 *Typic Dystrochrepts, extremely acid and very strongly acid, severely eroded. Slopes are 35 to 65 percent. Barren to open vegetative cover.*

MH1 *Minaloosa-Huckleberry association, 45 to 95 percent slopes. This association consists of about 55 percent Minaloosa, on south-facing slopes, and 35 percent Huckleberry on north-facing slopes. Dense vegetative cover.*

MH2 *Minaloosa-Huckleberry association, 45 to 95 percent slopes, strongly acid and moderately eroded. This association consists of about 60 percent Minaloosa on south-facing slopes and 30 percent Huckleberry on north-facing slopes. Medium vegetative cover.*

MH3 *Minaloosa-Huckleberry association, 45 to 90 percent slopes, very strongly acid, moderately eroded. This association consists of about 60 percent Minaloosa on south-facing slopes and 30 percent Huckleberry on north-facing slopes. Sparse vegetative cover.*

MM2 *McCrosket-Minaloosa association, 45 to 90 percent slopes, strongly acid, moderately eroded. This association consists of about 50 percent McCrosket on south-facing slopes and 40 percent Minaloosa on east-facing slopes. Sparse vegetative cover.*

MR3 *McCrosket-Rock outcrop complex, 45 to 110 percent slopes, very strongly acid, severely eroded. This complex consists of about 50 percent McCrosket on south-facing slopes and 30 percent Rock outcrop. Barren and open vegetative cover.*

RO *Rock outcrop.*

Rw *Riverwash.*

S1 *Slickens, moderately saline. This miscellaneous land type is on 0 to 1 percent slopes and is gravelly loam and very gravelly sand. It occurs in the river floodplain. Open vegetative cover.*

S2 *Slickens. This miscellaneous land type is on 0 to 1 percent slopes and is very fine sandy loam or sand. It occurs in the river floodplain. Generally medium vegetative cover, primarily of grasses.*

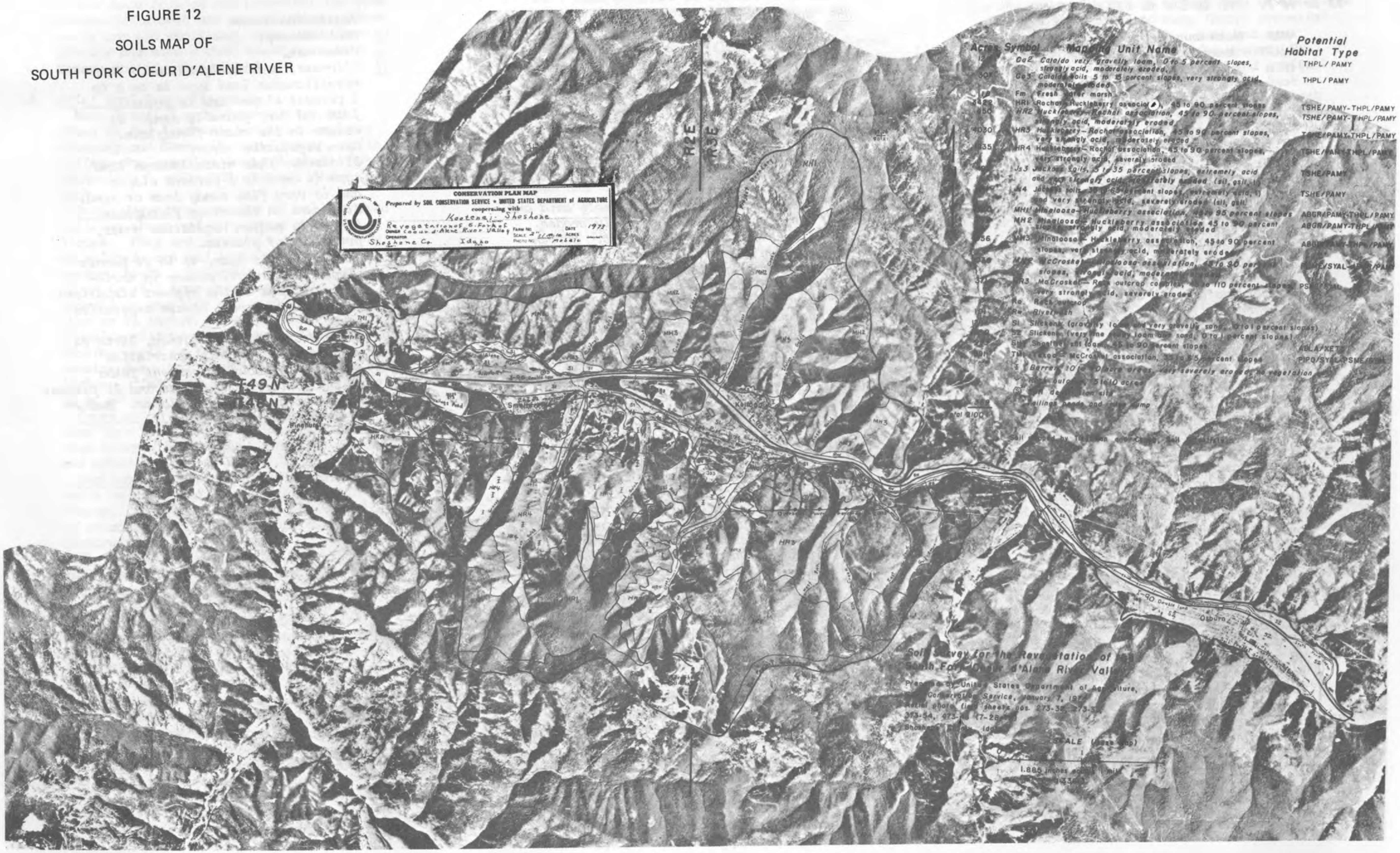
SH1 *Shoeffler silt loam, 45 to 95 percent slopes. This soil occurs in north-facing slopes at the highest elevations in the survey area. Dense vegetative cover.*

TM1 *Tekoa-McCrosket association, 35 to 65 percent slopes. This association consists of about 50 percent Tekoa on the south-facing slopes and 35 percent McCrosket on southerly slopes. Medium to dense vegetative cover.*

FIGURE 12

SOILS MAP OF

SOUTH FORK COEUR D'ALENE RIVER



Section III - Minerals

Idaho leads the nation in the production of silver and antimony with Shoshone County's eleven underground mines accounting for more than 98 percent of the state's total production. The Sunshine Mine leads the nation as a silver producer. The Sunshine, Galena, Lucky Friday, Bunker Hill, and "Coeur" project produced over 87 percent of the state's output of silver.

Silver was a byproduct in most Coeur d'Alene mines until the Sunshine Mine got into profitable production late in the 1920's. The first real bonanza ore was opened on the 1700 foot level in 1931.

Production of lead in Idaho ranks second in the nation. The Coeur d'Alene district accounted for more than 98 percent of Idaho's total output. The Bunker Hill, Lucky Friday, and Star unit mines provide approximately 92 percent of total production in Idaho.

Spurred by World War I demand, Idaho's lead production reached its all-time peak of 187,768 tons in 1917. Since then it has fluctuated widely, according to economic conditions.

Shoshone County's 12 zinc producers account for over 97 percent of the state's output of zinc making Idaho the nation's fifth largest producer. The Bunker Hill mine and Star unit are the largest producers of zinc in Idaho, accounting for over 91 percent of total production.

Zinc in the lead ores of the Coeur d'Alene was present from the earliest days, but was regarded as a nuisance. The first big spurt in zinc output came during World War I, reaching a high of 48,960 tons in 1916. By 1921, production had dropped to 909 tons despite steady improvement in metallurgy making possible the successful separation of zinc and lead in complex ores. Although an upsurge occurred in the late 1920's, zinc continued in the role of a byproduct until World War II when mines with zinc ore bodies finally came into their own. In 1944, zinc output topped lead for the first time.

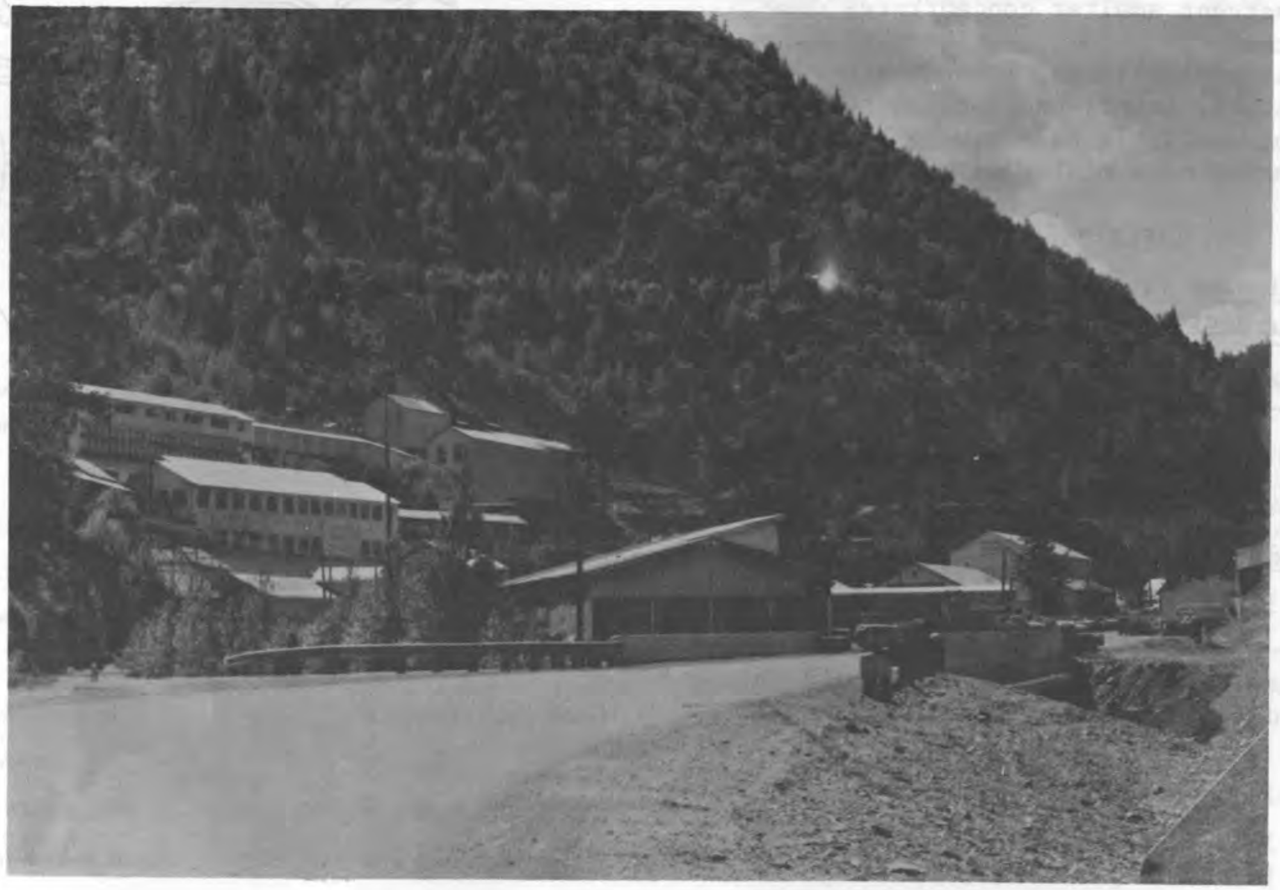
Table 1 shows Idaho's national ranking in the production of various minerals.

TABLE 1

Idaho's Role in U.S. Mineral Supply in 1977 P/

Map Symbol	Major Commodity	Production	Share of U.S. output, percent	Rank in Nation	Reserves
Sb	Antimony (sb content)....short tons..	500	61	1	Moderate.
Ag	Silver.......thousand troy ounces...	15,000	41	1	Do.
V	Vanadium............................	W	10	3	Large.
Abr	Garnet..............................	W	10	5	Moderate.
P	Phosphate rock......................	W	10	4	Large.
	Zinc...................short tons..	32,000	5	5	Do.
Pb	Lead..........................do..	46,000	5	2	Do.
Au	Gold.........thousand troy ounces...	13	1	9	Moderate

P/ Preliminary. W - Withheld to avoid disclosing individual company confidential data.



Sunshine Mining Co. The largest silver producing mine in the world located on Big Creek.

There are currently six full-time and five part-time mines operated in the Coeur d'Alene Mining District. The latest mine to come into production is the "Coeur" mine in 1974, owned by Coeur d'Alene Mines and operated by American Smeltering and Refining Company. There is currently one lead smelter, an electrolytic zinc plant, an antimony refinery, an acid plant, and eight mills in operation. Figure 13 shows the locations of the mines, mills and processing plants.

Mineral production revenue in Idaho for 1977 was about $218 million. The Coeur d'Alene Mining District accounts for 65 percent of this value or approximately $140 million. Historic production and value of gold, silver, lead, copper, and zinc in the Coeur d'Alene Mining District is presented in Table 2. Over $3,108,890,122 worth of minerals have been produced in the Coeur d'Alene Mining District since 1884.

Although major processing and manufacturing of Idaho's raw mineral production occurs out of state, metallic ores from Idaho, Washington, Montana, Nevada, Canada, and Australia are reduced from concentrates at the Bunker Hill lead and zinc smelter. Approximately 30 percent smelter concentrates come from foreign sources.

The mining industry pays taxes, leases, and royalties to the state, county and federal governments. Data is not available on a county basis. Table 3 lists revenues on a statewide basis.

TABLE 3

Idaho's Income from Mineral Bonuses, Royalties, Rentals and Mine License Tax

Source	1975	1976	1977
Federal[1]	$1,004,381	$ 856,582	[2]$1,066,823
State[3]	344,597	535,246	674,472
Mine Tax[4]	581,617	311,967	356,190
TOTAL	$1,930,595	$1,703,795	$2,097,485

[1]Mineral bonuses, royalties, and rentals paid to Idaho under Section 35 of the Mineral Leasing Act of 1920.

[2]Receipts from January through September 1977 only.

[3]Based on July-June fiscal year. Figure has been arbitrarily adjusted to place on calendar year.

[4]The mine license tax is computed on 3 percent of gross receipts minus extraction, reduction charges, and other necessary expenses.

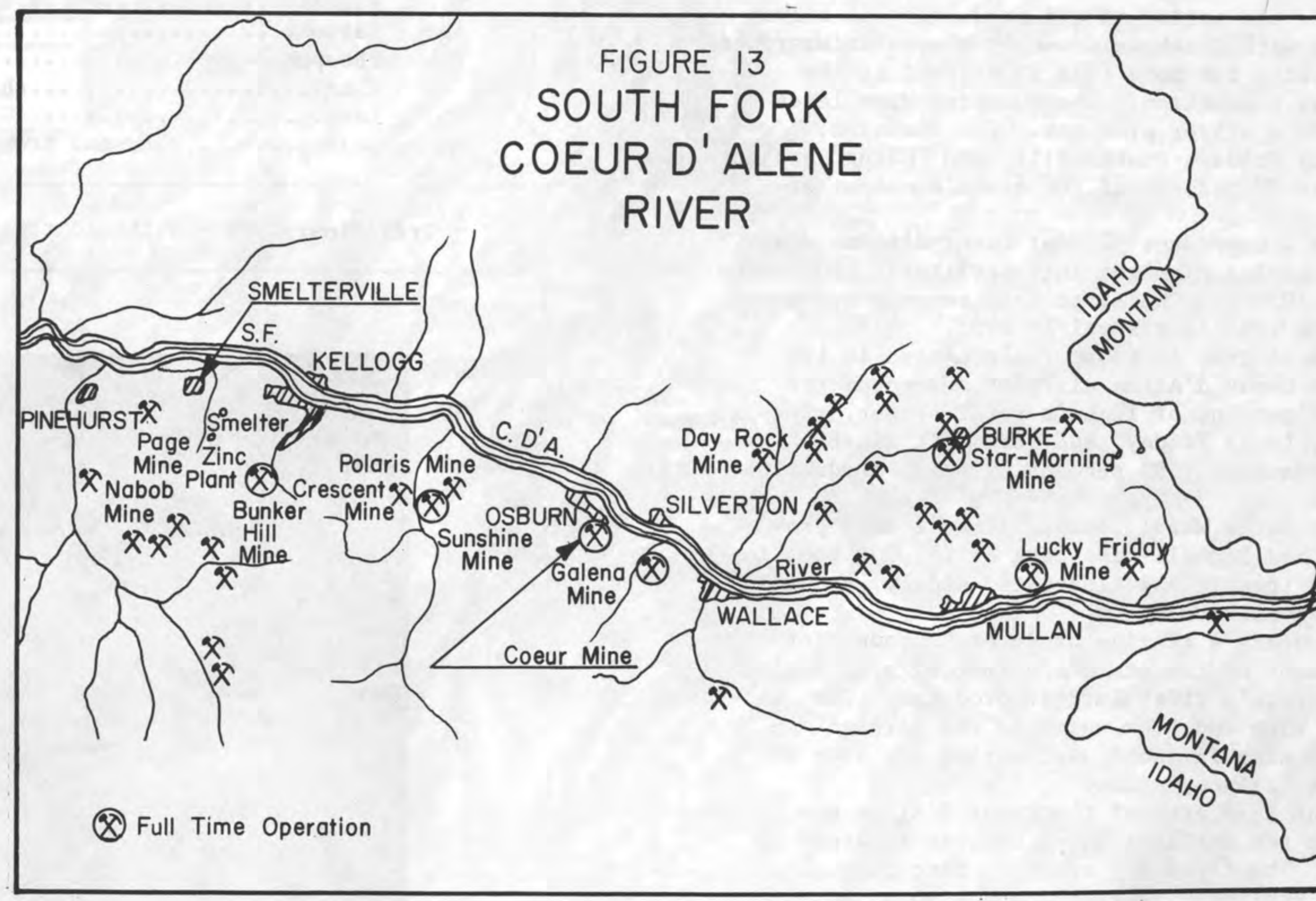


FIGURE 13
SOUTH FORK COEUR D'ALENE RIVER

LIST OF MINERAL OPERATIONS IN SOUTH FORK COEUR D'ALENE RIVER BASIN

	Name	Mine	Status	Location	Prox. to Water Bodies	Waste Material Produced	Waste Disposal Method	Specific Mineral Produced
1.	Abot Mining Company Wallace, ID	DIA	Explor	3 miles of Mullan, near Lucky Friday Mine	Listed with Lucky Friday			
2.	American Silver Mining Company Spokane, WA	Part of Coeur	Explor	2 miles south of Osburn	Listed in Coeur Project			
3.	American Smelting & Refining Co. Wallace, ID	Caladay (owner is Callahan	Active	T48N, R4E, S34	3 miles on Lake Creek	10,000 tons	Waste Rock	Pb, Zn, Ag
		Coeur Project		T48N, R4E, S19&24	1 mile on Lake Creek	500,000 tons	Waste Rock/Mill Tailing	Ag, Cu, Pb
		Galena (owner is Callahan		T48N, R4E, S28&29	On Lake Creek	2,000,000 tons	Waste Rock/Mill Tailing	Ag, Cu, Pb
		Mace (inactive)		T48N, R5E	On Canyon Creek	500,000 tons	Waste Rock	Pb, Zn
		Frisco (inactive)		T48N, R5E	On Canyon Creek	500,000 tons	Waste Rock	Pb, Zn
		Page (inactive)		T48N, R2E	2 miles S. Fork Coeur d'Alene R.	4,000,000 tons	Waste Rock/Mill Tailing	Pb, Zn
4.	Anaconda Company New York, NY	Sunset (leased to Wallace Diamond Drill Company	Leased	T49N, R5E, S28&29, 32&33	On Nine Mile Drive	390,000 tons	Waste Rock/Mill Tailing	Pb, Zn
5.	Atlas Mng. Company Spokane, WA	Atlas (leased to Noranda	Leased	T48N, R5E, S35	On S. Fork Coeur d'Alene River	50,000 tons 2,55,0000	Waste Rock	Pb, Ag
6.	Boulder Cr. Mng. Co. Wallace, ID		A. Work	2 miles of Mullan, ID	Listed with Atlas			
7.	Callahan Mng. Corp. Wallace, ID	Caladay Project Oper: ASARCO Galena-Oper: ASARCO	Explor Explor	T48N, R4E, S27 T48N, R4E, S28&29	Listed under ASARCO Listed under ASARCO			
8.	Canyon Siler Mine, Inc. Wallace, ID	Canyon Silver (Formosa)	Inactive	3 miles E. of Wallace, ID	Canyon Creek	200,000 tons	Waste Dumps	Pb, Zn, Ag
9.	Coeur d'Alene Mines, Corp. Wallace, ID	Coeur Project	Active	T48N, R3&4E, ASARCO Oper.	Listed with ASARCO			
10.	Consolidated Silver Corp. Wallace, ID	Silver Summit, Oper: Hecla	Leased	T48N, R3E, S23-26	1 mile S. Fork Coeur d'Alene River	800,000 tons	Waste Rock	Ag, Zn
11.	Day Mines, Inc. Wallace, ID	Dayrock	Active	T48N, R4E, S11&14	Nine Mile Creek	1,000,000 tons	Waste Rock/Mill Tailing	Pb, Zn
		Hercules		Burke, ID	Canyon Creek	3,500,000 tons	Waste Rock	Pb, Zn
		Tamarack		T48N, R5E, S8	Canyon Creek	60,000 tons	Waste Rock	Pb, Zn
		Monitor	Inactive	T49N, R5E, S31&32	Canyon Creek	700,000 tons	Waste Rock	Pb, Zn
		Parrot	Inactive	T49N, R5E, S29	Canyon Creek	100,000 tons	Waste Rock	Pb, Zn
		Mountain Goat	Inactive	T49N, R5E, S29	Nine Mile Creek	50,000 tons	Waste Rock	Pb, Zn
		Sherman	Inactive	T48N, R5E, S9	Canyon Creek	300,000 tons	Waste Rock	Pb, Zn
		Stanley		2 miles N. of Burke, ID	Canyon Creek	40,000 tons 14700000	Waste Rock	Pb, Zn
12.	Dix Steel Company Spokane, WA	Coeur Project Mill	Active	Osburn, ID	Construction on Coeur Project surface plant			
13.	Douglas Mining Co. Kellogg, ID	Douglas	Inactive	T47N, R2E, S3	Pine Creek			
14.	CDA Crescent Mng. Co. Wallace, ID	CDA Crescent	Explor	Big Creek E. of Kellogg, ID	Big Creek			
15.	Lovon Fausett Wallace, ID	Atlas	Active	Mullan, ID	Contractor at Atlast Project (Normanda)			
16.	Boyles Bros. Drilling Spokane, WA	Allied Silver	Explor	Mullan, ID				
17.	Gold Leaf Mining Corp.	Canyon Silver (Formosa)	Explor	Burke Canyon near Wallace, ID	Listed under Canyon Silver			
18.	Hecla Mining Co.	Lucky Friday	Active	T48N, R5E, S35	S. Fork Coeur d'Alene River	10,000,000 tons	Waste Rock/Mill Tailing	Pb, Ag
		Owner: Con. Silver Star Morning		T48N, R5E, S21&22	Star-Canyon Creek	10,000,000 tons	Waste Rock/Mill Tailing	Pb, Zn, Ag
19.	Helena Silver Mines Coeur d'Alene, ID	Wonderful	A. Work	T47N, R6E, S19,20&21	Morning-S. Fork Coeur d'Alene River	12,000,000 tons	Waste Rock/Mill Tailing	Pb, Zn, Ag
20.	Highland-Surprise Wallace, ID	Highland-Surprise	A. Work	T48N, R3E, S35&36	Trapper Creek (Pine Creek)	600,000 tons	Waste Rock	Pb, Zn
21.	Hypothek Mng. & Milling Wallace, ID	Hypothek	A. Work	T48N, R1E, S12&13	Pine Creek	100,000 tons	Waste Rock	Pb, Zn
22.	Independence Lead Co., Inc. Spokane, WA	Explor by Hecla	Explor	T48N, R5E, S22, 26&27	Listed with Lucky Friday, Hecla			
23.	Lucky Friday Extension Co. Wallace, ID	Lucky Friday Ext.	Explor	Dev. by Hecla Mining Co.	Listed with Lucky Friday			
24.	Mascot Silver-Lead Kellogg, ID	Little Pittsburg Mine	Explor	Near Pinehurst, ID	Pine Creek			
25.	Nabob Silver Lead Mines Kellogg, ID	Nabob	Active	T48N, R2E, S20,22,28&29	Pine Creek	200,000 tons	Waste Rock/Jig Tailing	Zn, Pb
26.	Nevada Stewart Mng. Co. Spokane, WA	Nevada Stewart	Explor	3 miles SW of Wardner, ID	Pine Creek			
27.	New Hilarity Mng. Co. Trentwood, WA	New Hilarity	A. Work	Pine Creek Area	Pine Creek			
28.	Sidney Mng. Co. Kellogg, ID	Sidney (leased to R. Rice)	Active	T48N, R2E, S22	Pine Creek	1,000,000 tons	Waste Rock	Zn, Pb
29.	Sunshine Mng. Co. Kellogg, ID	Sunshine	Active	T48N, R3E, S15,22	Big Creek	10,000,000 tons 58600000	Waste Rock/Mill Tailing	Ag, Sb, Cu

TABLE 2

Production of Gold, Silver, Lead, Copper and Zinc
In the Coeur d'Alene Mining District
Shoshone County, Idaho 1884-1977 Incl.
Compiled by Idaho Mining Association

	GOLD	SILVER	LEAD	COPPER	ZINC	
Year	Fine Ounces	Fine Ounces	Tons of 2000 Pounds	Tons of 2000 Pounds	Tons of 2000 Pounds	Value of Total Metallic Product
1884	12,500					$ 258,375
1885	18,220					376,607
1886	8,823	116,246	1,500			436,335
1887	7,367	340,000	5,980			1,022,996
1888	10,250	554,000	8,000			1,438,227
1889	8,433	1,095,265	17,500			2,532,978
1890	8,000	1,499,663	27,500			4,132,506
1891	10,000	1,825,765	33,000			4,868,356
1892	11,000	1,195,904	27,839			3,538,684
1893	14,748	1,963,561	29,563			4,258,621
1894	17,531	2,343,314	30,000			3,816,026
1895	18,439	2,471,300	31,000			4,016,049
1896	17,369	3,163,657	37,250			4,703,971
1897	16,404	3,756,212	57,777			6,764,010
1898	13,011	3,521,982	56,339			6,565,287
1899	8,602	2,737,218	50,006			6,263,404
1900	5,754	5,261,417	81,535			10,588,707
1901	4,915	4,399,296	68,953			8,731,662
1902	4,761	5,033,928	74,739			8,847,552
1903	7,651	5,471,620	103,691			11,885,078
1904	2,226	6,141,426	107,561			12,830,582
1905	1,886	6,690,000	123,830			15,759,907
1906	3,244	7,903,487	125,825	3,428	700	20,891,688
1907	3,435	7,317,962	114,965	3,567	4,536	19,084,434
1908	4,105	6,531,890	102,753	4,495	910	13,439,796
1909	7,155	6,203,715	107,792	3,834	800	13,723,104
1910	3,110	7,262,271	114,975	2,502	2,998	15,275,024
1911	3,054	7,784,417	127,216	973	5,044	16,375,258
1912	4,446	7,364,581	136,674	2,100	7,972	18,492,338
1913	3,510	9,510,868	147,851	2,263	14,127	21,115,808
1914	4,052	13,409,095	169,304	1,638	24,136	23,607,602
1915	4,500	12,199,000	175,528	500	46,155	35,568,987
1916	2,600	11,454,680	173,073	823	48,960	44,265,554
1917	4,753	11,715,000	187,768	1,002	46,312	51,392,348
1918	14,628	8,234,389	136,530	725	24,828	32,908,188
1919	10,191	4,598,072	84,745	477	10,207	16,742,607

Production in Coeur d'Alene District, Continued

	GOLD	SILVER	LEAD	COPPER	ZINC	
Year	Fine Ounces	Fine Ounces	Tons of 2000 Pounds	Tons of 2000 Pounds	Tons of 2000 Pounds	Value of Total Metallic Product
1920	9,000	6,639,000	128,367	54	10,966	$ 30,365,160
1921	7,217	5,132,320	101,088	80	909	14,594,399
1922	6,049	4,697,517	95,503	47	2,798	16,182,008
1923	11,873	6,109,522	120,490	315	17,345	25,032,974
1924	8,026	6,684,504	123,740	427	10,647	26,130,395
1925	6,259	6,691,658	126,664	283	18,537	30,502,217
1926	5,060	6,930,126	133,706	496	26,956	31,008,972
1927	436	8,236,341	146,864	664	31,321	28,574,888
1928	440	8,472,560	144,770	788	33,612	27,474,740
1929	637	8,786,525	148,273	918	51,952	32,030,868
1930	810	8,438,208	127,089	827	32,528	20,438,084
1931	672	7,029,130	101,569	739	20,951	12,295,656
1932	398	6,559,394	74,487	713	11,406	7,310,478
1933	1,000	6,766,162	80,107	845	22,993	10,544,975
1934	3,965	7,062,640	70,331	736	24,799	12,159,340
1935	2,740	9,894,300	78,314	988	31,054	16,369,235
1936	2,454	13,740,222	86,634	1,315	44,310	23,370,963
1937	3,659	18,457,726	96,505	1,944	47,070	32,382,311
1938	4,053	17,325,379	82,274	1,883	31,937	22,346,313
1939	5,550	15,165,000	81,438	2,050	39,750	22,805,024
1940	6,866	15,616,852	95,609	2,680	62,948	29,444,265
1941	4,800	14,600,000	94,400	3,150	67,300	35,931,860
1942	2,688	12,977,287	106,474	2,993	78,313	38,880,253
1943	2,250	10,302,840	89,813	1,987	79,634	38,594,728
1944	2,075	8,669,371	76,813	1,289	85,227	38,307,297
1945	1,898	7,115,646	63,430	1,018	78,025	34,258,050
1946	1,758	5,655,672	56,548	810	67,429	33,673,731
1947	2,808	9,234,906	73,060	1,312	79,251	49,226,932
1948	3,362	10,598,338	82,587	1,388	83,801	62,168,955
1949	2,438	9,146,146	74,152	1,171	74,370	50,699,924
1950	3,416	15,056,131	94,197	1,895	86,102	64,555,947
1951	2,684	13,639,808	70,570	1,874	74,989	65,058,887
1952	2,476	13,752,081	67,330	1,862	70,316	58,459,368
1953	2,376	13,636,680	69,885	2,100	68,650	47,729,814
1954	2,047	14,898,699	64,812	2,566	58,736	45,515,124
1955	1,777	12,984,323	59,820	2,637	50,527	44,036,867

Production in Coeur d'Alene District, Continued

	GOLD	SILVER	LEAD	COPPER	ZINC	
Year	Fine Ounces	Fine Ounces	Tons of 2000 Pounds	Tons of 2000 Pounds	Tons of 2000 Pounds	Value of Total Metallic Product
1956	2,782	12,663,214	60,221	2,889	46,738	$ 45,729,474
1957	2,225	14,464,108	66,569	3,763	55,919	47,459,665
1958	2,363	15,615,220	52,488	3,884	49,532	38,645,000
1959	2,349	16,460,825	61,155	3,678	55,454	44,058,000
1960	2,591	13,458,522	41,692	2,606	36,639	33,153,000
1961	3,282	17,369,249	70,651	3,673	58,184	46,313,000
1962	3,959	17,578,155	83,339	3,435	62,713	51,085,000
1963	3,427	16,523,143	74,794	3,332	63,118	53,980,000
1964	2,952	16,121,580	69,586	3,336	58,054	57,146,000
1965	2,713	17,917,551	63,474	3,540	56,443	62,054,000
1966	2,775	19,092,200	67,891	3,454	58,877	64,880,000
1967	2,444	16,483,477	57,587	2,714	54,807	59,008,000
1968	2,017	15,429,064	51,468	2,797	55,914	64,206,000
1969	3,046	18,405,398	62,497	3,251	53,584	70,439,000
1970	2,764	18,776,025	59,215	3,482	40,197	68,180,702
1971	2,968	18,935,732	65,413	3,404	44,297	65,254,451
1972	2,408	14,078,444	60,510	2,644	38,120	58,292,951
1973	2,477	13,449,859	60,860	2,505	45,016	76,057,170
1974	2,419	12,280,711	51,008	2,344	38,549	112,483,906
1975	2,083	13,596,486	48,899	2,510	38,946	115,060,798
1976	2,555	11,330,849	52,844	2,381	44,587	110,331,562
1977	2,646	14,273,142	47,000	3,105	30,262	120,092,785
TOTAL	485,935	892,017,167	7,595,000	145,247	2,999,153	$3,108,890,122

Colconda Mill located on South Fork Coeur d'Alene River near Interstate 90.

The mining industry has been and is expected to continue to be the major factor in the employment of Shoshone County. Approximately 66 percent of the total employment in Shoshone County is directly related to mining. Total employment of Shoshone County in 1978 was approximately 9,100 of which approximately 6,000 were related to the mining industry.

Mineral Origin and Type

The rocks of the area consist mainly of the Pre-cambrian Belt Supergroup. They are composed of fine-grained agrillites and quartzites associated with smaller amounts of carbonate-bearing dolomitic rocks. Quartz and sericite are the principle minerals within the Belt Supergroup; accessory minerals include feldspar, muscovite, magnetite, illmenite, zircon, tourmaline, rutile, and titanite. Average chemical analysis of the Belt rocks is presented in Table 4. The Belt Supergroup is an ancient siliceous sedimentary rock which has undergone metamorphism and deformation. Prevailing theory is that a prominent fault, the Osburn Fault, produced a structural deformation in the sediments into which the metalliferous ores were deposited by thermal solution emanating from igneous bodies intruded about Cretaceous time.

The ore deposits are tabular veins with a few irregular replacement bodies along or adjacent to steeply dipping fault shear zones. There are two distinct types of ore in the Coeur d'Alene district. The first consists of a mixture of lead and zinc sulfide containing subordinate amounts of tetrahedrite. In this ore, the lead and zinc are of primary commercial importance. The second type of ore consists of silver-bearing tetrahedrite in which silver and copper are commercially important. Associated with the second type of ore are commercially significant values of copper, lead, and antimony. Lead-zinc ore has been abundant north of the Osburn Fault Zone in the Wallace-Burke-Mullan area and south of the Osburn Fault area in the Wardner-Kellogg-Pine Creek area. Silver ore has been found in the central portion of the district between Wallace and Wardner, and south of the Osburn Fault.

TABLE 4

Chemical Analysis of Belt Rocks in Percent of Unaltered Rock in Coeur d'Alene District

Oxides	Percent
SiO_2	67.4
Al_2O_3	13.8
Fe_2O_3	2.4
FeO	1.28
MgO	2.78
CaO	2.11
Na_2O	1.76
K_2O	3.6
TiO_2	0.49
P_2O_5	0.12
MnO	0.05
CO_2	2.51
H_2O	1.85
	100.15

From: Hobbs, et al., 1965, p. 28

The Mining Process

The mine delivers ore of 15" maximum size pieces to the mill course ore bin, from which it is fed, by apron feeder, to the crushing plant. The crushing plant is a standard two stage procedure, with screens ahead of and in closed-circuit with the second crushing stage.

The primary crusher reduces the ore to pieces less than 3 inches. The secondary unit crushes the rock small enough to pass through the 1/2" screen cloth used on the vibrating screens.

The ore, crushed to minus 1/2", is conveyed to a fine ore bin which consists of compartments. A traveling tripper distributes the ore to any compartments desired, permitting the incoming ores to be either mixed or segregated, as desired.

Feeders on the bottom of each bin compartment discharge the ore, as needed, to the transfer system which transports it to the ball mill bins in the mill. The transfer system is equipped with a continuously recording belt scale, and an automatic sampler so that a continuous record is kept of the ore tonnage going to the mill.

Selective flotation is used in the mill to separate the valuable minerals from the waste rock. The principle of the flotation process is based on the fact that any mineral particle with an oil-type coating will adhere to an air bubble and rise to the top of the flotation cell to be collected. Gangue or waste particles do not attract the oil coating or the air bubbles, and so remain in the bottom of the flotation cell flow, separate from the floating valuable minerals. The elements needed for successful flotation are:

1. Ore ground fine enough so that each mineral particle is separated from all others.
2. An oil-like coating put on each particle of the desired minerals.
3. All other mineral particles free of such coating.

Grinding the ore to 60 percent minus 200 mesh frees most of the valuable sulfide minerals from the waste. Another product of this grinding is a large amount of middling grade particles (quartz and tetrahedrite combined), which must be floated to give a satisfactory silver recovery. Ball mills grind the ore to the desired fineness. The waste products from these flotation cells are commonly known as mine tailings. These concentrated tailings consist of pulverized quartzites and sandstones suspended in water to form a slurry. The size of the solids grains within these slurries ranges from 0.001 mm. in diameter to 0.60 mm. in diameter. The solids which are contained in these slurries have a specific gravity ranging from 2.7 to 3.11. An examination of the grains under a microscope reveals that the sand particles are sharp in nature with irregular surfaces and either round or square in shape. The smaller particles appear to be somewhat spherical while the larger particles appear to be more cylindrical.

The total mine tailings, as produced by the flotation cells, have solids concentrations of from 20 percent by weight to 35 percent by weight, depending upon the particular milling operation in question. These percentages of solids by weight in the slurries correspond to concentrations by volume of 6.5 percent to 16.5 percent, respectively. Many of the mine operations of the area separate the larger particles of solid materials from the mine tailing slurries by the use of centrifugal equipment. These larger particles, which have been separated from the mine tailing slurries, are then used in the mining operations for stope filling. The portion of the mine tailings slurry remaining after the separation of the stope filling solids is commonly known in the mining industry as "slime".

The mine tailings are valueless except as possible road fill materials. Due to the large quantities produced in the area, they are a liability to the economic picture in that the disposal of this waste is a production expense.

A flow diagram illustrating the various steps in the mining process is shown in Figure 14.

Tables 5 and 6 show the mine tailing quantities which may be expected to be produced by concentrator operations in the valley with and without sand fill. These quantities are based on information supplied by the mine operators for their existing facilities.

The liquid wastes from the mine and concentrator operations are principally from three sources:

1. The concentration slurries.
2. The mine portal waters from the underground workings.
3. Cooling waters for air compressor and other machinery cooling operations.

Table 7 shows the estimated quantities of the wastes produced from the operations of the major mines in the Coeur d'Alene Mining District.

Table 8 shows the chemical analysis of mine wastes by source for the South Fork area.

TABLE 5 *

Expected Mine Tailings
Without Sand Fill
(Total Tails)

Source	Maximum Tons/Yr	Minimum Tons/Yr	Maximum Cu. Yd/Yr	Average Cu. Yd/Yr
Star	240,000	210,000	197,000	172,000
Lucky Friday	200,000	175,000	164,000	144,000
Rex Mill	28,000	21,000	23,000	17,200
Dayrock	21,000	14,000	17,200	11,500
Galena	123,000	123,000	101,000	101,000
Polaris	94,000	63,000	77,000	51,500
Sunshine	310,000	154,000	254,000	126,000
Bunker Hill	640,000	462,000	522,000	380,000
Page	104,000	100,000	85,200	82,000
TOTALS	1,760,000	1,322,000	1,440,400	1,085,200

Note: (1) Quantities given are based on dry solids.
(2) Cubic yards are based on an estimated ponded weight of dry solids of 90 pounds per cubic foot.

TABLE 6 *

Expected Mine Tailings
With Sand Fill

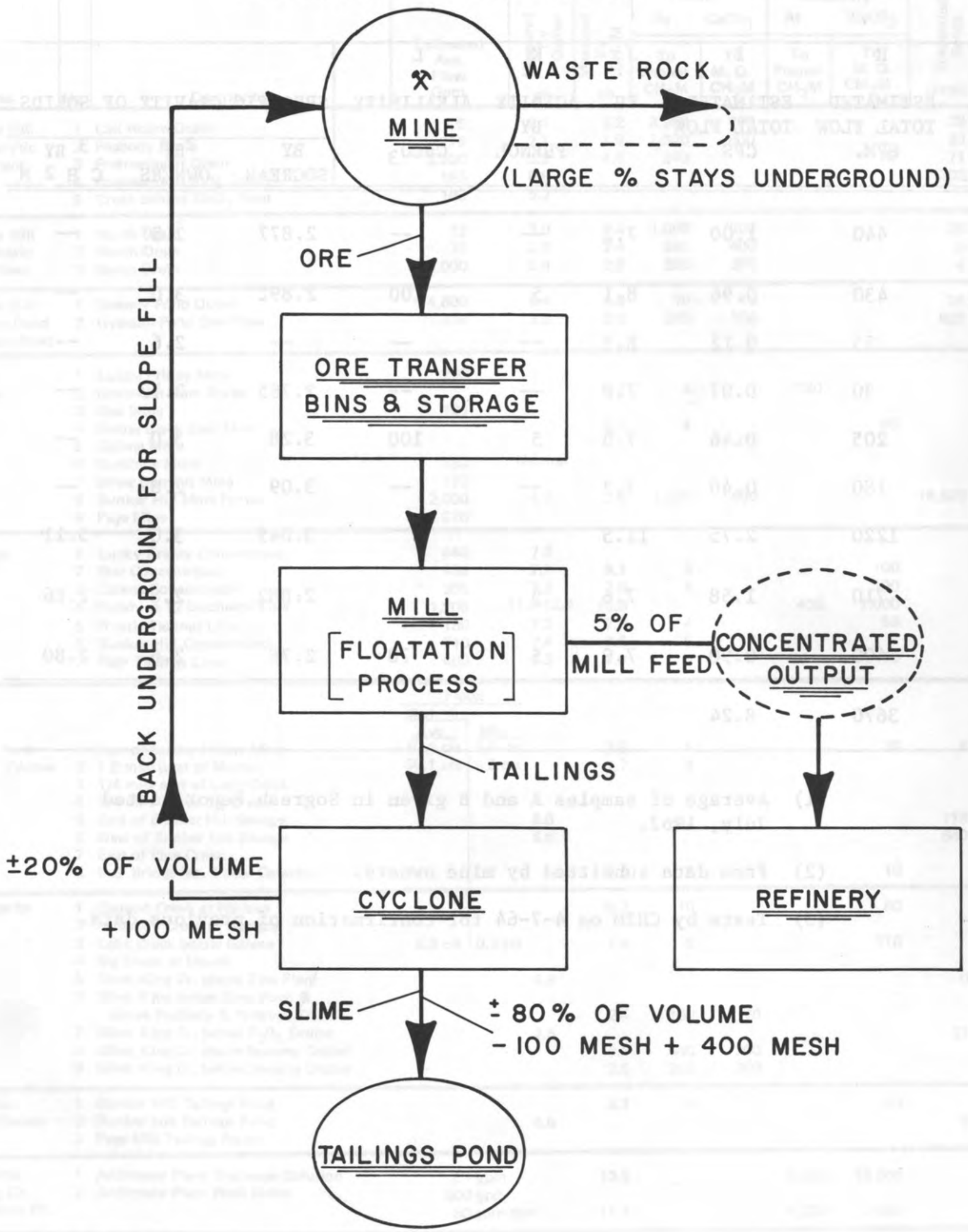
Source	Maximum Tons/Yr	Average Tons/Yr	Maximum Cu. Yd/Yr	Average Cu. Yd/Yr
Star	134,000	59,000	110,000	48,500
Lucky Friday	121,000	94,000	99,000	77,000
Rex Mill	28,000	21,000	23,000	17,200
Dayrock	21,000	14,000	11,500	11,500
Galena	47,600	47,600	39,000	39,000
Polaris	56,000	25,000	46,000	20,500
Sunshine	230,000	77,000	189,000	63,000
Bunker Hill	360,000	185,000	295,000	152,000
Page	56,000	50,000	46,000	41,000
TOTALS	1,053,600	572,600	858,500	469,700

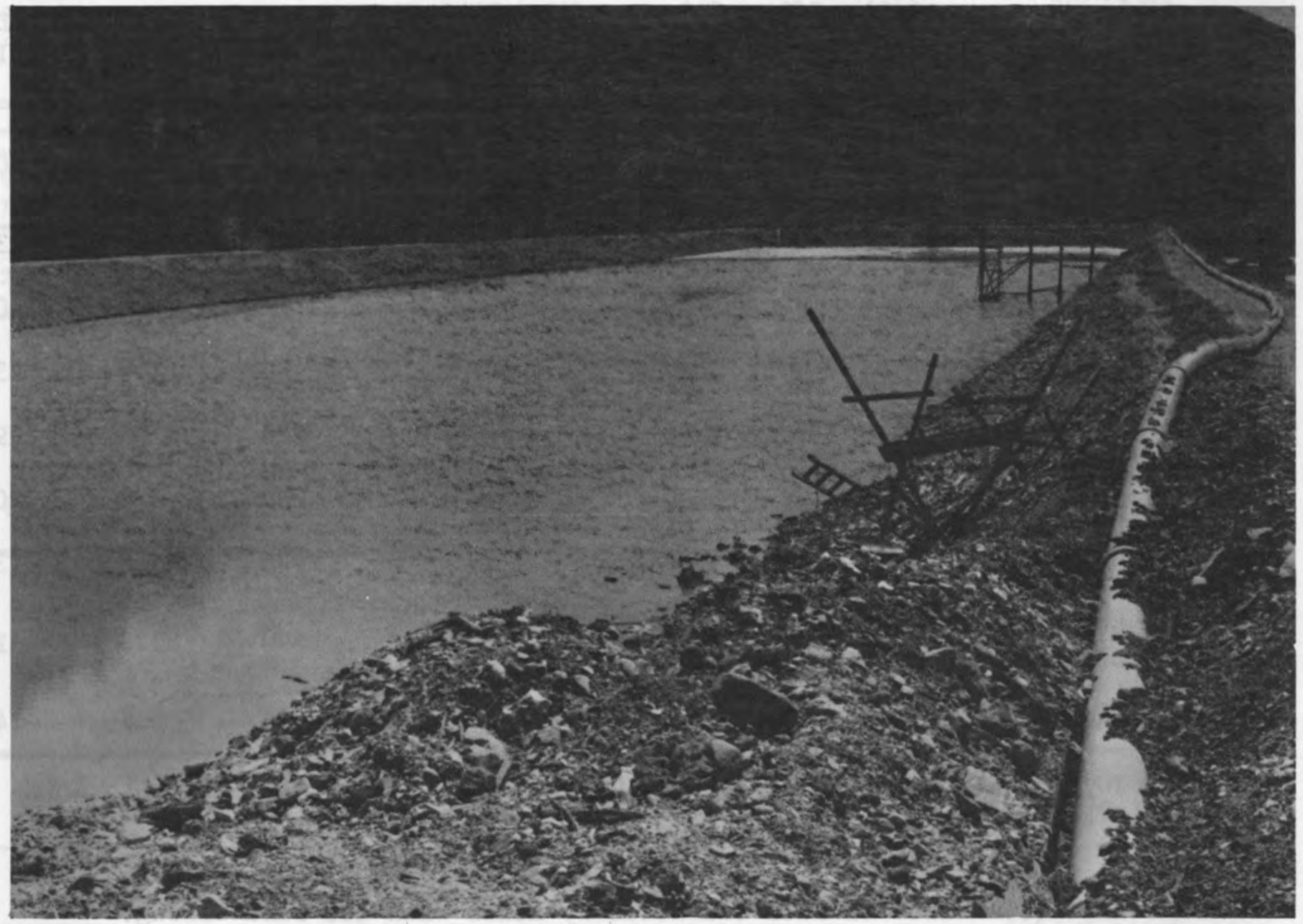
Note: (1) Quantities given are based on dry solids.
(2) Cubic yards are based on an estimated ponded weight of dry solids of 90 pounds per cubic foot.

(i.e.) 1 cubic yard = 1.215 tons

*Taken from "Mine, Industrial & Domestic Waste Disposal Study for the South Fork Coeur d'Alene River", by CH2M Hill, 1964.

FIGURE 14
MINING PROCESS





Slimes are now collected and stored in tailings impoundments.

TABLE 7 ***

Mine Tailings Quantities and Data

A	B	C	D	E	F	G	H	I	J	K	L	SPECIFIC GRAVITY OF SOLIDS		
PROPERTY	MAXIMUM TOTAL **TONS/DAY	AVERAGE TOTAL TAILS **TONS/DAY	AVERAGE TO SAND FILL **TONS/DAY	MAXIMUM SLIMES **B-D TONS/DAY	SP.GR. SOLIDS	AVERAGE SOLIDS/ LIQUID % BY WT.	ESTIMATED TOTAL FLOW GPM.	ESTIMATED TOTAL FLOW CFS	PH	ACIDITY BY PHENOL	ALKALINITY $CaCO_3$	BY SOGREAH	(2) BY OWNERS	(3) BY C H 2 M
LUCKY FRIDAY	720	625	290	430	3.0	20	440	1.00	7.3	--	--	2.877	2.8	--
STAR	860	750	380	480	2.8	23	430	0.96	8.1	5	100	2.892	3.0	--
REX MILL	100	75	38*	62	2.6	20	55	0.12	8.5	--	--	--	2.6	--
DAYROCK	75	50	25*	50	2.6	23	30	0.07	7.0	--	--	2.765	2.77	--
GALENA	440	440	270	170	3.0	29	205	0.46	7.8	5	100	3.28	3.0	--
POLARIS	335	225	135*	200	2.8	20	180	0.40	7.2	--	--	3.09	2.8	--
SUNSHINE	1100	550	275	825	3.0	13	1220	2.75	11.5			3.045	3.0	3.11
BUNKER HILL	2280	1650	990	1290	2.8	31	710	1.58	7.6	5		2.882	2.8	2.86
PAGE	370	356	175*	195	2.6	14	400	0.90	7.9	5	70	2.76	2.6	2.80
TOTALS OR AVERAGE	6300		2578	3722			3670	8.24						

(G) Based on data submitted by mines when not sandfilling.

(H) Based on item (G) and item (C). This is solids plus liquid (average production) but does not include any flows other than tailings flow.

* Estimated assuming that sand fill practiced.

** Weight of dry solids.

*** Taken from "Mine, Industrial and Domestic Waste Disposal Study for South Fork Coeur d'Alene River", by CH2M Hill, 1964.

(1) Average of samples A and B given in Sogreah Report dated July, 1962.

(2) From data submitted by mine owners.

(3) Tests by CH2M on 4-7-64 for confirmation of previous data.

TABLE 8

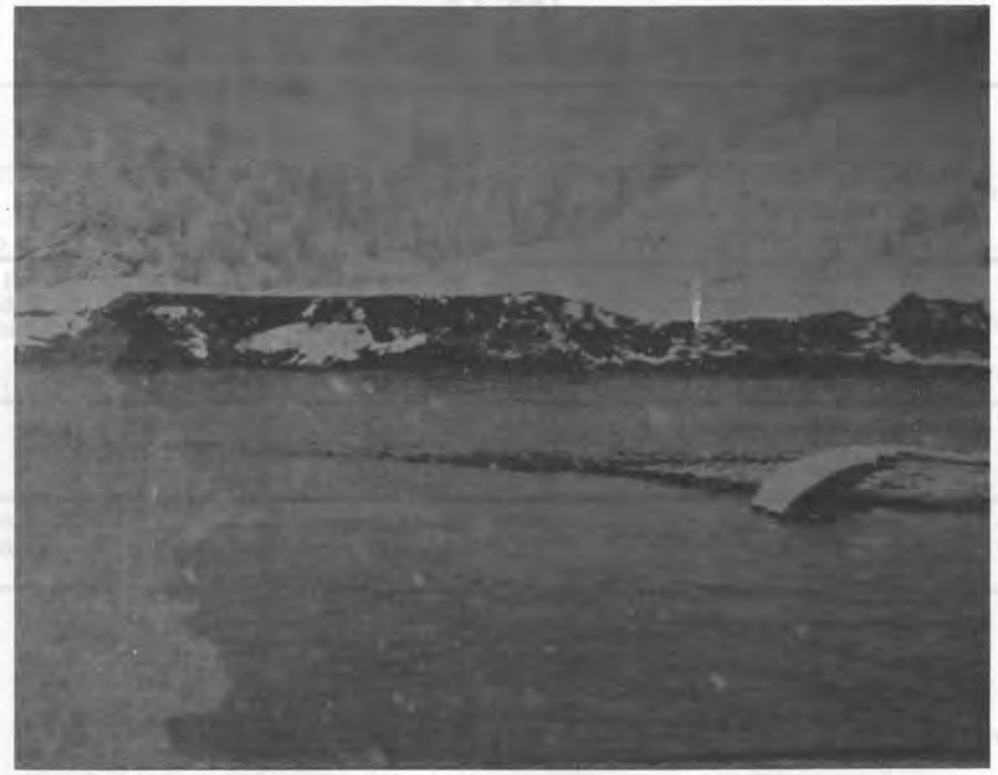
Liquid Waste Products, Sources, Quantities and Analysis

Source No.	Source	No.	Description	Estimated Ave. Flow Gpm	Measured By Owner	Measured By CH_2M	Acidity As $CaCO_3$		Alkalinity As $CaCO_3$		Suspended Solids	PPM Dissolved Solids	Chemical Analysis (PPM)												
					ph	ph	To Phenol CH_2M	To M. O. CH_2M	To Phenol CH_2M	To M. O. CM_2M	(PPM)		Fe By CH_2M	Fe By Owner	PO_4 By CH_2M	CU	PB	ZN	F	CaO	MgO	SO_2	H_2SO_4	SO_4S	P_2O_5
A	Bunker Hill	1	Cell Room Drain	5	2.1	2.2	3,200	700			29	3,200	250	18.6	0	1.88	0.6	505	1.32	93.7	124.0		213	4,313	
	Electrolytic	2	Peabody Drain	275	2.1	1.9	1,920	800			23	2,550	20	2.4	0	0.29	0.4	95	62	43.7		786	1,270	4,917	
	Zinc Plant	3	Pretreatment Drain	3,200	3.2	4.6	240			10	71	380	0	0.02	0	0.05		69	1.36	46.5	28.7		Tr.	542	
		4	Pretreatment Bldg. Drain	183	6.8						308	207						14	0.6				0		
		5	Creek behind MnO_2 Plant	188	5.2							269						943	7				408		
B	Bunker Hill	1	South Drain	12	3.0	2.4	1,080	300			29	1,630	30	0.80	8				22				125	530	Tr.
	Phosphoric	2	North Drain	75	2.5	2.4	680	400			0	1,270	12		17				320				440	52	128
	Acid Plant	3	Sump Drain	1,000	2.4	2.0	200	200			4	1,150	3	1.89	19				550	33.3			526	255	128
C	Bunker Hill	1	Sweeny Pond Outlet	4,800	6.4	5.8	10	10			16	93	0	0.02	0	0.02	0.3	43	1.44	27.9		8	0	38	
	Sweeny Pond	2	Gypsum Pond Overflow	375	3.0	3.0	300	100			809	2,500		7.3		0.69	0.6	18	380	4.7			580	4,660	168
	Gypsum Pond																								
D	Mine	1	Lucky Friday Mine	200																					
	Waters	2	Upstream from Burke			8.3	4		120				0.1		0										
		3	Star Mine	400																					
		4	Below Black Bear Mine			8.3	4			50			0.1		0										
		5	Galena Mine																						
		6	Sunshine Mine	150	Neutral																				
		7	Silver Summit Mine	170																					
		8	Bunker Hill Mine Portal	2,000	4.9	2.6	1,000	400			18,900	1,000		1.28		0.26	0.2	141	1.12	114			32	320	
		9	Page Mine	570																					
E	Tailings	1	Lucky Friday Concentrator	440	7.3																				
		2	Star Concentrator	430	7.1	8.1	5			100															
		3	Galena Concentrator	205	7.3	7.8	5			100															
		4	Sunshine 12 Discharge Line	1,200	11.5-12.0	10.3			400	1,000															
		5	Polaris Tailings Line	180	7.2	7.9	4			50			0		2.5										
		6	Bunker Hill Concentrator	710	7.4	7.6	5																		
		7	Page Tailings Line	400	7.3	7.9	5			70															
				Flows: Med. Yr. Ave. / Min.																					
F	South Fork	1	East of Lucky Friday Mine	50.1 cfs / 5.5 cfs		7.0	4			30	6		0.1		0										
	Coeur d'Alene	2	1.0 mile west of Mullan	50.1 cfs / 5.5 cfs		7.7	8								0										
	River	3	1/4 mile east of Lake Creek																						
		4	1/4 mile above Big Creek																						
		5	East of Bunker Hill Sewage		6.8						719	40	0.02			0.04	0.1	0.24	1.00				0	4	
		6	West of Bunker Hill Sewage		6.6						640	68	0.02			0.042	0.1	2.5	1.83				0	12	
		7	East of Pine Creek																						
		8	U.S. Bridge No. 1 near Cataldo			6.0	8			10			0.1		0										
G	Tributaries	1	Canyon Creek at Wallace			6.7	16			60			0.5		0										
		2	Ninemile Creek at Wallace																						
		3	Lake Creek below Galena	6.0 cfs / 0.7 cfs		7.4	5			110															
		4	Big Creek at Mouth																						
		5	Silver King Cr. above Zinc Plant		6.8						0	40						0	0.5						
		6	Silver King below Zinc Plant & above Peabody & Pretreat. Drains			2.4	160	70					5.0		0										
		7	Silver King Cr. below P_2O_5 Drains		2.5						21	720		1.2		0.08		30	131	72			467	82	52
		8	Silver King Cr. above Sweeny Outlet			2.4	840	300					30		11										
		9	Silver King Cr. below Sweeny Outlet			2.5	200	200					15		10										
H	Tailings	1	Bunker Hill Tailings Pond			8.1	4			30			0.3		0										
	Pond Outlets	2	Bunker Hill Tailings Pond		6.5						0	315		0.02		0.44		2	134	78.3			0	83	
		3	Page Mill Tailings Pond																						
I	Sunshine	1	Antimony Plant Discharge Solution	2.1 gpm		12.8			8,600	16,000															
	Mining Co.	2	Antimony Plant Wash Water	500 gpd 50 gpm rate		11.4			1,200	2,400															
	Antimony Plt.																								

Section IV - Climate

Shoshone County experiences some of Idaho's highest levels of rainfall with mean annual precipitation ranging from 30.61 inches at Kellogg to 40.53 inches at Wallace. This data is listed in Table 9. Precipitation at the higher mountain areas average over 50 inches. Total precipitation during the months of July and August average approximately two inches. Approximately 70 percent of the annual precipitation occurs between October and March. Most occurs as snow at the higher elevations although rain can occur at all elevations in the winter. At the higher elevations a snow cover several feet thick persists from late fall to late spring. The annual average snowfall at Wallace is 82.6 inches. These conditions have resulted in the area's largest floods in December and January when warm rains have fallen on melting snow.

Temperatures in the basin generally follow the seasons and range from below zero in the winter to 100°F in the summer. Elevation is a significant factor in determining the temperature. The frost-free period ranges from 86 days at Burke to 144 days at Wallace.



Shoshone County experiences some of Idaho's highest levels of precipitation.

TABLE 9

Climatic Summary - Shoshone County

Data	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
KELLOGG													
Mean precipitation ...	3.63	2.85	2.95	2.24	2.53	2.24	.88	.94	1.74	2.87	3.74	3.70	30.61
Mean temperature	26.7	31.4	37.9	46.4	54.0	60.3	67.5	65.3	57.6	47.6	36.4	29.6	46.7
Mean max. temp.	34.4	40.5	47.9	59.3	68.2	75.0	85.9	83.8	73.5	60.0	44.2	36.2	59.1
Mean min. temp.	19.0	22.4	27.8	33.4	39.8	45.6	49.0	46.8	41.5	35.3	28.5	23.1	34.4
WALLACE													
Mean precipitation ...	5.17	4.15	3.94	2.62	2.65	2.54	1.06	1.06	2.14	3.78	5.59	5.83	40.53
Mean snowfall	23.6	17.3	12.4	1.8	.2	.1	.0	T	.1	.7	7.2	19.2	82.6
Mean temperature	26.1	30.9	36.7	45.2	52.7	59.4	65.9	64.1	56.2	46.5	35.2	29.3	45.7
Mean max. temp.	32.5	38.5	46.2	57.6	66.6	74.9	83.9	81.9	71.3	57.6	42.1	34.8	57.3
Mean min. temp.	19.7	23.2	27.3	32.8	38.7	44.0	47.8	46.4	41.2	35.3	28.3	23.8	34.0

Section V - Hydrology

The South Fork of the Coeur d'Alene River, below Wallace, is a relatively shallow and swift flowing stream with a gradient of about 30 feet per mile. This compares to the gradient of the main stem of the Coeur d'Alene of about one foot per mile. Since the advent of mining, the streams in the area have received a heavy silt load composed of mine and mill tailings. This partially accounts for a significant filling of the main stems channel. There are no major reservoirs or diversions in the South Fork drainage.

As shown in Table 10, the average flows (1967-74) of the South Fork at the Smelterville gage is about 331,000 acre feet. This is approximately 18 percent of the Coeur d'Alene River flow at Cataldo. Pine Creek accounts for another 25,700 acre feet or 1.4 percent of the Coeur d'Alene River flow. In total, approximately 20 percent of the water flowing in the Coeur d'Alene River downstream from Cataldo originates in the restoration project areas. Also, as shown in Table 10, the maximum daily flow of the South Fork at Smelterville was recorded at 11,500 cfs on January 16, 1974. The minimum daily flow was 50 cfs on December 8, 1973.

The flow regime of the South Fork consists of high flows during April, May and June resulting from snowmelt. Normally, the highest average flows occur in May. The average monthly flow declines from June to October. During the fall and winter months, the average flow gradually increases. Occasionally, high flows occur in December and January. Table 11 shows the mean daily flow for the South Fork Coeur d'Alene River at Smelterville by month. Maximum, minimum and average dates are also listed.

TABLE 10

Summary of Streamflows - Shoshone County

Stream and Location	Drainage Area (Sq. Mi.)	Average Record (Wtr. Yrs.)	Average Runoff (Ac. Ft.)	Extremes of Discharge Max. (cfs)	Date	Min. (cfs)	Date
Coeur d'Alene River above Shoshone Creek. .	335	1951-76	545,000	22,000	1/15/74	34	12/26/52
at Enaville	895	1940-76	1,437,000	61,000	1/16/74	104	12/26/52
Placer Creek at Wallace	14.9	1968-76	32,100	1,200	1/15/74	2.2	12/5/72
South Fork Coeur d'Alene River							
at Silverton	103	1968-76	202,100	4,300	1/16/74	31	1/13/75
at Smelterville	202	1967-74	331,100	11,500	1/16/74	50	12/8/73
West Fork Pine Creek near Pinehurst	10.8	1967-71	25,700	505	5/13/71	2.2	9/14/69
Coeur d'Alene River near Cataldo	1,220	1921-72	1,850,000	67,000	12/22/33	122	12/4/29

TABLE 11

Idaho Department of Water Resources
Summary Hydrograph Data
South Fork Coeur d'Alene River at Smelterville

****MEAN DAILY FLOW BY MONTH****

MON.	MAX. (cfs)	YEAR	DAY	MIN. (cfs)	YEAR	DAY	AVE.	COUNT
Oct	330.	1969	12	89.	1972	31	130.	217
Nov	870.	1974	12	88.	1972	1	185.	223
Dec	851.	1974	17	64.	1973	8	226.	248
Jan	9000.	1974	16	72.	1970	5	484.	217
Feb	2600.	1968	20	133.	1973	21	466.	198
Mar	2530.	1972	18	188.	1973	8	584.	217
Apr	2780.	1969	24	230.	1973	4	722.	180
May	3900.	1972	16	448.	1970	1	1505.	186
Jun	2700.	1972	1	220.	1973	30	837.	180
Jul	762.	1971	1	139.	1968	31	278.	186
Aug	242.	1970	2	91.	1973	29	146.	186
Sep	309.	1968	18	82.	1973	6	127.	180

Figure 15 illustrates the duration of flow for the South Fork Coeur d'Alene River at Smelterville. Flow duration is the percentage of time a given flow can be expected during a specific time period. Data are presented for the months of April, May, June and July. As noted, a flow of 610 cfs could be expected in the South Fork 50 percent of the time in April. The 50 percent flow for May is 1400 cfs, 740 cfs for June, and 235 cfs for July.

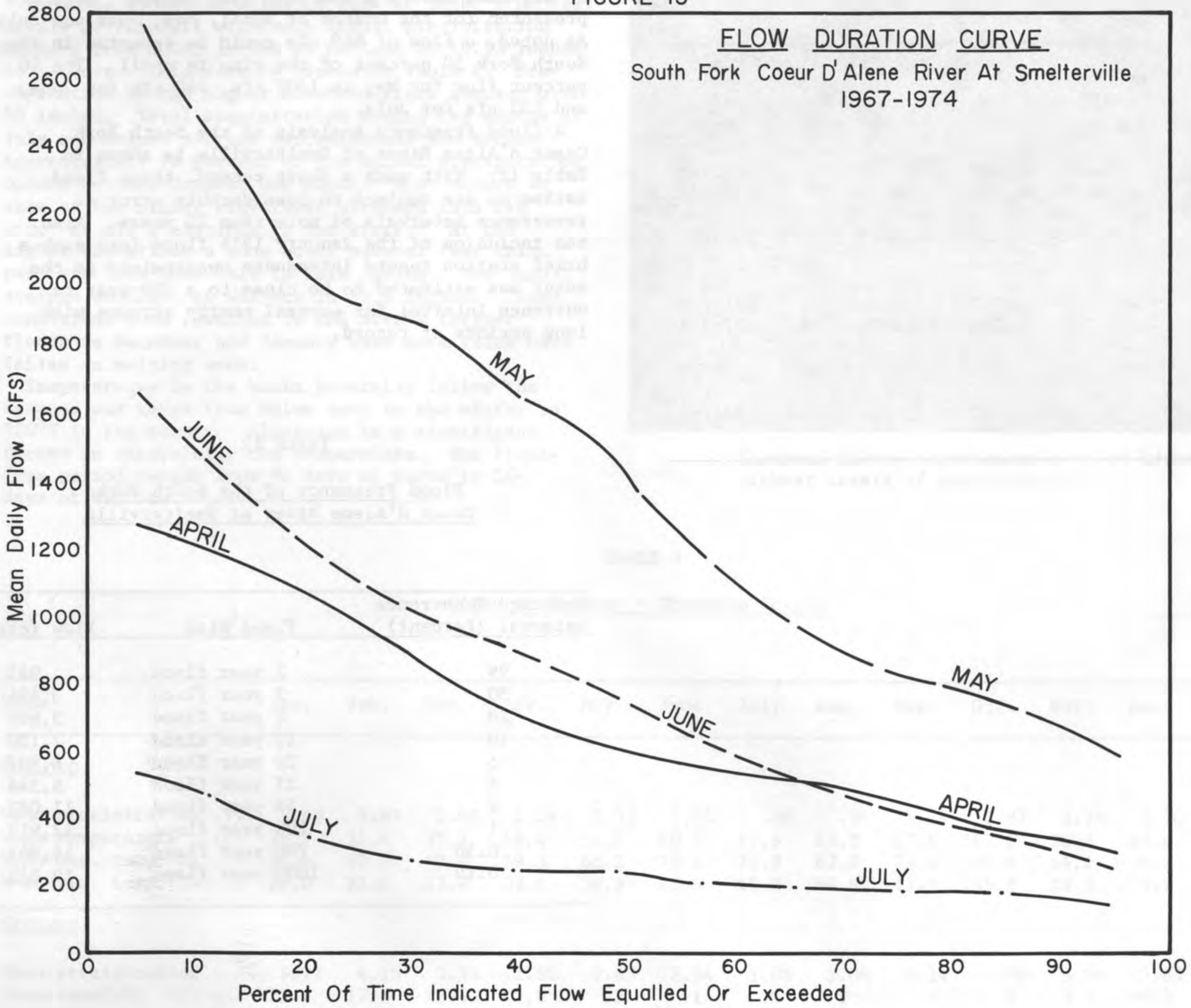
A flood frequency analysis of the South Fork Coeur d'Alene River at Smelterville is shown in Table 12. With such a short record, these flood estimates are subject to considerable error at recurrence intervals of more than 20 years. Also, the inclusion of the January 1974 flood into such a brief station record introduces uncertainty as the event was estimated to be close to a 100-year recurrence interval for several nearby streams with long periods of record.

TABLE 12

Flood Frequency of the South Fork
Coeur d'Alene River at Smelterville

Selected Recurrence Interval (Percent)	Flood Size	Flow (cfs)
99	1 year flood	945
50	2 year flood	3,494
20	5 year flood	5,607
10	10 year flood	7,180
5	20 year flood	8,807
4	25 year flood	9,346
2	50 year flood	11,082
1	100 year flood	12,917
0.50	200 year flood	14,861
0.10	1000 year flood	19,842

FIGURE 15



Section VI - Land Use

The severe topography of the region leaves a limited amount of land available for development. Soils on the hillsides and in the valley are rocky and shallow. In the Kellogg area, fire and smelter smoke have reduced the forest cover. Much of the topsoil has been lost by erosion, and the remaining soils on the valley floor do not readily support vegetation. Therefore, the efficient use of land is of vital importance to the economy of the area.

In the restoration project area, the amount of buildable land is approximately 22 square miles. This is relatively small when needs for large areas of mining operations, for tailings ponds, and industrial buffer areas is considered.

The cities of Kellogg, Wallace and Mullan are almost fully built up and any extensive development in the future will first require the removal of existing structures. Of the established communities, only Pinehurst and Osburn have any large amounts of buildable vacant land.

There has been a great deal of development outside the four incorporated cities, adding to the burden on county government to provide "city" services.

As shown in Table 13, forest land is by far the largest land use accounting for 96.2 percent of the land in Shoshone County. However, the only impact on forest land within the scope of this study is that area that has been affected by smelter smoke in the vicinity of Kellogg and Smelterville or approximately 21,000 acres.

The lack of relatively level land suitable for agriculture and the increasing demand for urban land uses have limited farming activities until it is virtually non-existant. Only 0.1 percent or 1200 acres of the total land area of Shoshone County is used for agriculture purposes.

Urban or built-up land use is the most critical in Shoshone County. A majority of the flat land within this study outside the flood plain has been developed for residential, industrial, commercial or transportational purposes. Orderly and planned use of the existing flat land is essential to insure organized future development.

TABLE 13

Land Use - Shoshone County

Land Use - 1976	Acres	% Total
Urban or Built-Up Land	23,500	1.4
Agricultural Land	1,200	.1
Range Land	39,000	2.3
Forest Land	1,669,800	96.2
Total Land Use Acres	1,669,800	100.0

Transportation

The principle highways in the area are Interstate 90 joining Pinehurst, Kellogg, Osburn, Wallace, and Mullan with Montana to the east over Lookout Pass and with Coeur d'Alene to the west. State Highway 4 is the main road between Wallace and Burke. A network of gravel roads tie the rest of the county to the main population centers along Interstate 90.

Although there is no regularly scheduled airline service, charter and private airplanes use the paved Kellogg Municipal Airport.

Union Pacific and the Great Northern Railroads serve Shoshone County. Both Greyhound and Empire provide bus service along Interstate 90.

Utilities

The Washington Water Power Company supplies electric power and natural gas to Shoshone County. Telephone service is provided by the General Telephone Company of the Northwest. Domestic water is supplied in the valley by both public and private utilities. Groundwater in the valley is highly mineralized and cannot be used for domestic purposes. For this reason, the majority of domestic water is appropriated from mountain streams. Sewage, which was once dumped directly into the South Fork, is now collected and treated by the South Fork Sewer District. Solid waste disposal services are provided by a sanitary landfill operated by Shoshone County located in the Big Creek.

Other Services

Two daily newspapers, the "Kellogg Evening News" and the "North Star Press" of Wallace, and two weekly newspapers, the "Wallace Miner" and the "Kellogg News", are published in the area. Hospital and nursing home facilities are available. There are no television stations broadcasting locally, but one radio station serves the area. Education is available through the twelfth-grade level. There are 13 post offices serving the county.

Areas for industrial uses occupy valuable flat lands.

Steep mountains with narrow valleys limits areas for development.

Much of the remaining bottom land lies within the flood plain and cannot be used for development.

Much of the valuable flat land is occupied by Interstate 90 and the railroad.

Section VII - Land Ownership

Shoshone County contains approximately 1,669,760 acres of land area of which 75 percent or 1,250,702 acres are federally owned. Another two percent or 30,512 acres is owned by the state. Twenty-three percent or 388,546 acres are privately owned. Land ownership in Shoshone County is outlined in Figure 16.

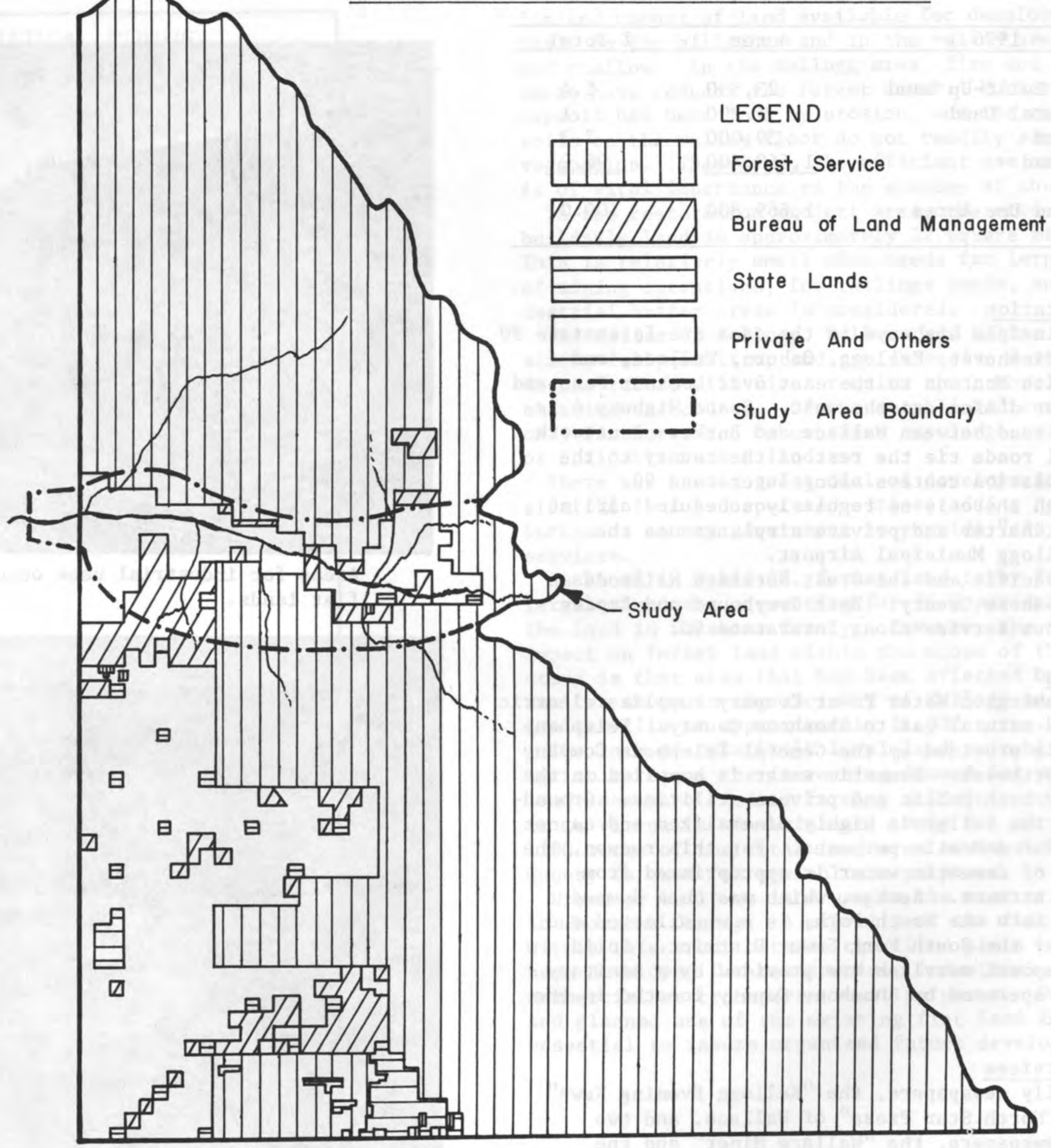
Land ownership within the restoration project area is presented in Table 14. Fifty-two percent or 69,210 acres of land within the South Fork drainage is privately owned. Approximately 25 percent or 33,280 acres is managed by the U.S. Forest Service, 19 percent or 25,600 by the Bureau of Land Management, and 4 percent or 5,120 acres by the State. The majority of land which has undergone alteration through mining activities is privately owned.

TABLE 14

Land Ownership Within Study Boundaries

Owner	Percent	
Forest Service	25	33,280
Private	52	69,120
BLM	19	16,600
State	4	5,120
TOTAL	100	133,120

FIGURE 16
SHOSHONE COUNTY LAND OWNERSHIP



Section VIII - Recreation

Approximately 1,258,286 acres of land is used for all types of recreation in Shoshone County. This total includes 26 acres of municipal, 40 acres of county, 27,001 acres of state, 302 acres of private, and 1,230,917 acres of federal land.

Recreational opportunities within the South Fork River valley are minimal. An inventory of recreational activities and facilities within the study area is outlined in Table 15. There are 10 municipal parks and playgrounds, 3 golf courses, 3 riding stables, 2 campgrounds, 1 gun range and 2 ski resorts. The majority of the facilities are used mainly by the residents living within the vicinity of the facility. With the exception of the two ski areas, the area offers little attraction for the non-resident vacationer or tourist.

The two ski areas are the Silver Horn (previously known as the Jackass Ski Bowl) and Lookout Pass. They offer a variety of slopes that provide outdoor recreation during the winter months.

Snowmobiling has grown in popularity in the area during the last few years. Numerous old logging roads in the national forest provide hundreds of miles of trails for this winter sport.

A limited amount of fishing occurs in the upper reaches of the South Fork above the city of Mullan.

Other forms of recreation such as boating, camping, hunting, backpacking, etc. are generally very limited within the study area due mainly to the area's environmental degradation.

TABLE 15

South Fork Coeur d'Alene River Recreational Inventory*

NAME	OWNERSHIP	FACILITIES	LOCATION
Silver Belt Moto-Cross Course	B.L.M.	Motorbike dirt track, 40 acres-2 mile	49N-2E, Sec. 34
Shoshone County Camping and Recreation Area	County	Campground	48N-3E, Sec. 13
Osburn Playground	City of Osburn	Playground	48N-3E, Sec. 14
Osburn Playground	School Dist. 393	Tennis, baseball, basketball, playground	48N-4E, Sec. 34
Kellogg Park	City of Kellogg	Community Park - Tennis, baseball, picnic grounds, and swimming pool	48N-3E, Sec. 6
Shoshone County Park	County	Community Park - Tennis, baseball, fishing pond, horseshoe pits, picnic tables (25), parking spaces (59)	48N-4E, Sec. 20
Kellogg City/School Park	School	Community Park - Picnic tables (5), baseball, and tennis	48N-3E, Sec. 6
Wallace Park	School Dist. 393	Community Park - Tennis, multipurpose, swimming pool, picnic ground, & playground	48N-4E, Sec. 21
Airport Fields & Track	County	Public access - 300 parking spaces - 4 acre	
Cameron Playground	Municipal	Mini-park - 1 acre	
Mullan City Ball Park	City of Mullan	Community Park - Baseball, 25 parking space	48N-5E, Sec. 34
Mullan City Park	City of Mullan	Mini-park - Swimming pool, playground, 1 acre	48N-5E, Sec. 34
Division Street Playground	City of Kellogg	Mini-park - Playground - 1 acre	48N-3E, Sec. 6
Kellogg Golf Course	City of Kellogg	Regulation 18-hole golf course - 30 acres	48N-3E, Sec. 6
Silver Valley KOA	Private	Campground - 35 sites - 5 acres	48N-2E, Sec. 5
Shoshone County Gold Course	Private	Regulation 18-hole golf course - 40 acres	48N-3E, Sec. 10
Kellogg Golf Club	Private	Regulation 9-hole golf course, driving range - 89 acres	48N-2E, Sec. 5
Silverhorn Ski Resort	Private	Ski Course - 30 acres	48N-3E, Sec. 19
Kellogg YMCA	Private	Swimming Pool	48N-3E, Sec. 6
Louis Wooley Riding Stables	Private	Horse Trails	48N-4E, Sec. 26
Wallace-Kellogg Gun Club	Private	Shooting Range	48N-4E, Sec. 20
Feid Stadium Rodeo Grounds	Private	Rodeo Grounds	48N-2E, Sec. 2
Silver Capital Riders	Private	Snowmobiling Trails	48N-5E, Sec. 18

*Idaho Statewide Comprehensive Outdoor Recreation Area Inventory.

Section IX - Water Quality

Bedload Sampling

All streams are constantly in the process of altering the channels in which they flow by erosion and deposition. The rate of change varies from stream to stream and with various physical and chemical paramenters, but at any given time there is material dissolved in, suspended in and rolled along by the water. The separation of suspended load (material suspended in the water) from bedload (sediment rolled or saltated along the bottom) is arbitrary and dependent on sampling methods. For the purposes of this restoration plan, suspended load is the portion of the total sediment load held in suspension by the turbulence of the water, and bedload is the portion of the total load moved within six inches of the river bed and retained by a 0.22mm mesh net.

Most streams change very slowly. However, man's activities can alter the natural process to the extent that the river becomes very unstable. This impact of man's activities has been carried to the extreme in the South Fork of the Coeur d'Alene River. The sediment load of the river is extremely high and the river continually alters its channel. Theoretically, the river would in time stabilize naturally if left alone, but the time frame cannot be predicted.

Bedload - Methods & Results

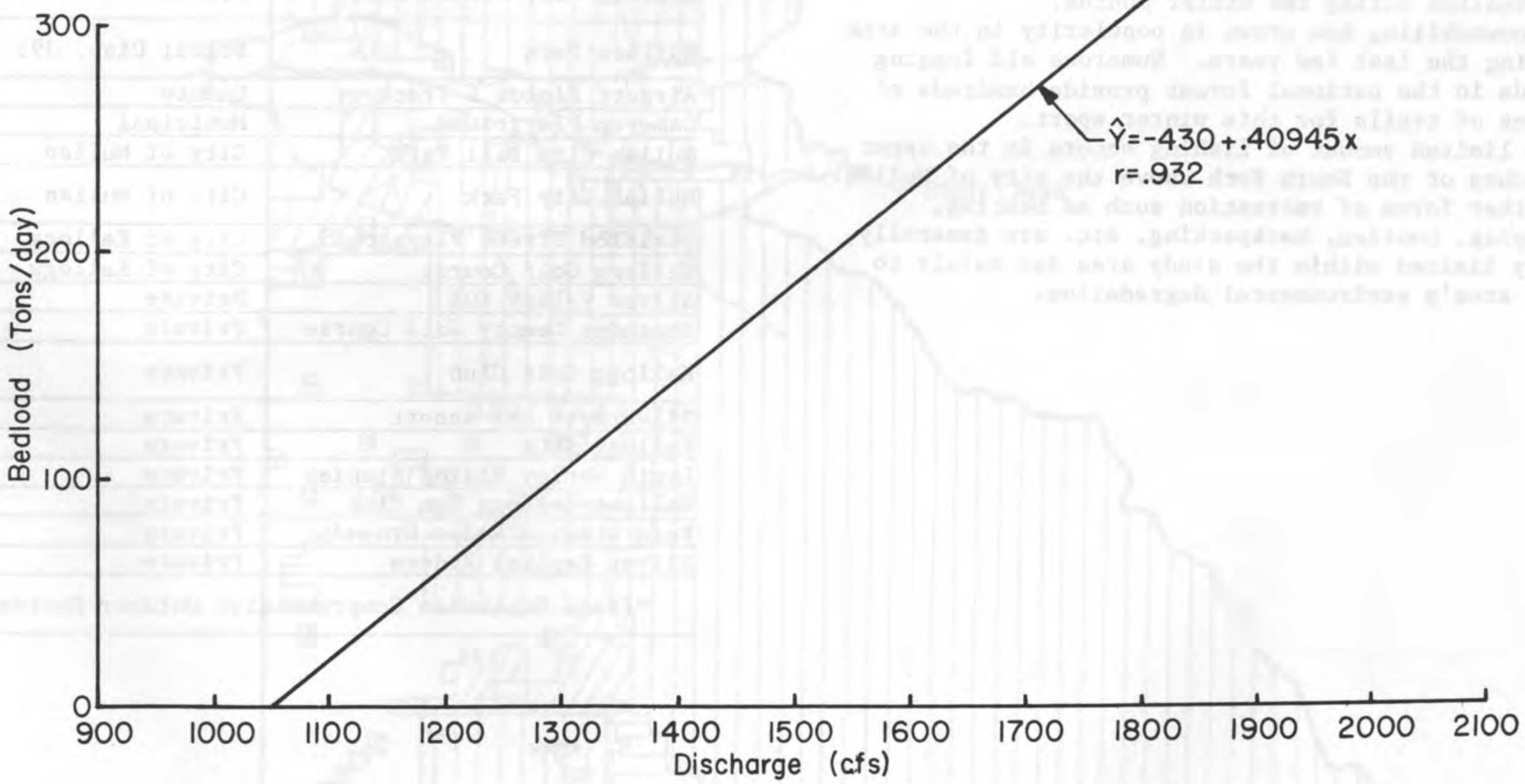
To collect estimates of bedload movement in the restoration project area, a six-inch Helley-Smith type bedload sample weighing approximately 150 pounds was used. At most sites, the stream cross-section was divided into 20 equal sections. The location of the sites is shown on the map on page 41. The sampler was lowered to the stream bed for one minute at each section by an electric winch mounted in a pickup truck. In the deeper parts of the river, it was difficult to see where the sampler was setting, but when visible no gravel was scooped up when the sampler was raised. All 20 samples were collected without emptying the sampler net when possible, but in 1975 it was necessary to shorten sampling times and empty the net after each sample. The net was cleaned and the sample placed in a labled, plastic bag. In the lab, the samples were dried, sieved and weighed.

Total bedload in Kg/hr. was calculated with the following formula:

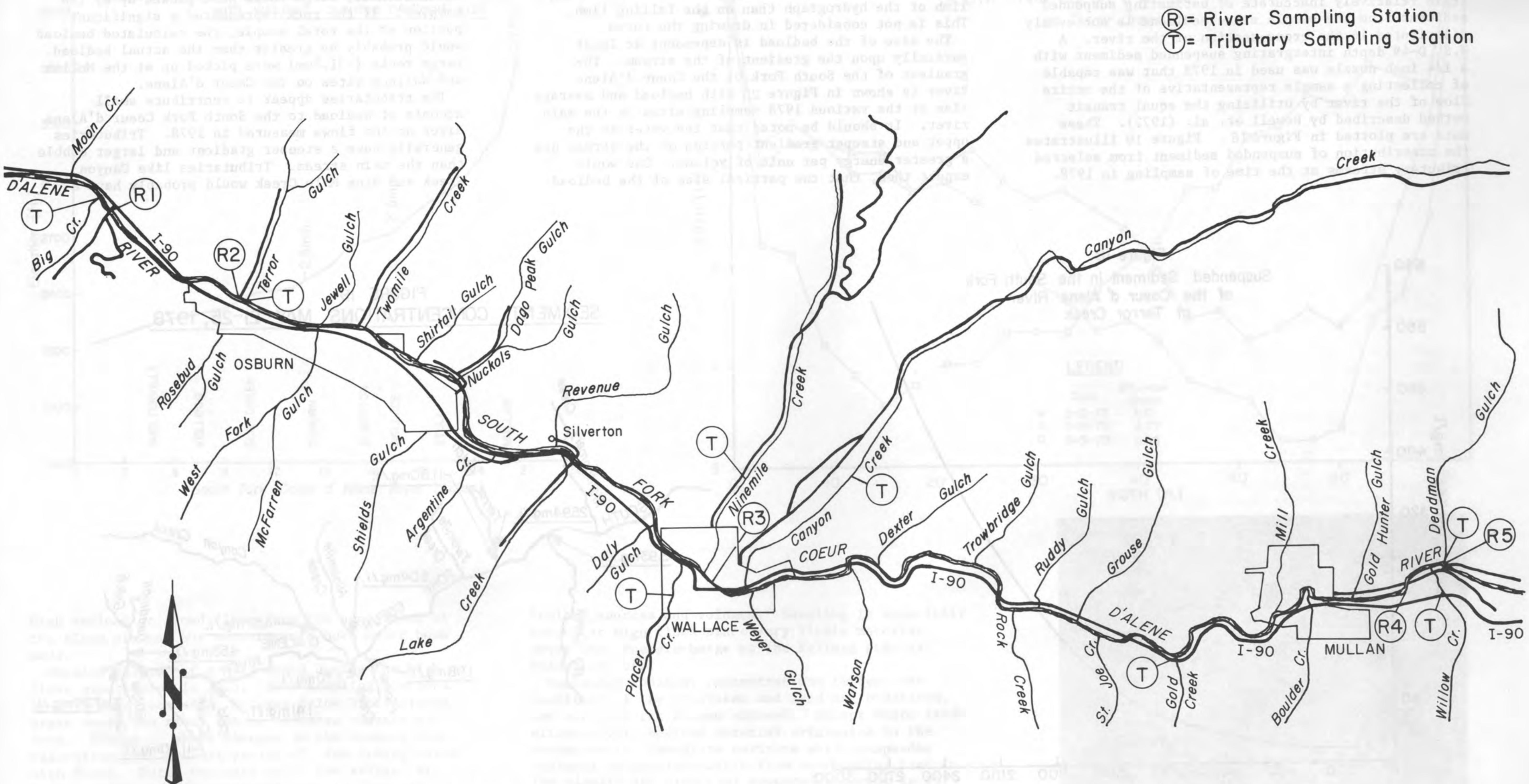
$$\frac{\text{Kg Sample}}{\text{min.}} \times \frac{\text{60 min.}}{\text{hr.}} \times \frac{\text{stream width}}{20 \times 0.5 \text{ ft.}} = \text{bedload Kg/hr.}$$

By using the data collected in 1975 and 1978, an estimate of bedload at various stream discharges can be made. This estimate for the Terror Creek Bridge site is shown in Figure 17.

Figure 17



Correlation of bedload to discharge on the South Fork Coeur d' Alene River at the Terror Creek Bridge



Study Area & Sampling Stations

Suspended Sediment

Suspended sediment data was sampled in 1975 by simply scooping up a bottle of water from the bank. It is relatively inaccurate of estimating suspended sediment from the sample since sediment is not evenly distributed in the cross-section of the river. A U.S. D-49 depth intergrating suspended sediment with a 1/4 inch nozzle was used in 1978 that was capable of collecting a sample representative of the entire flow of the river by utilizing the equal transit method described by Howell et. al. (1972). These data are plotted in Figure 18 . Figure 19 illustrates the contribution of suspended sediment from selected tributary streams at the time of sampling in 1978.

Accuracy of the bedload curve drawn in Figure 18 is questionable due to the paucity of the sampling methods. Bedload is usually greater on the rising limb of the hydrograph than on the falling limb. This is not considered in drawing the curve.

The size of the bedload is dependent at least partially upon the gradient of the stream. The gradient of the South Fork of the Coeur d'Alene River is shown in Figure 20 with bedload and average size at the various 1978 sampling sites in the main river. It should be noted that the water in the upper and steeper gradient portion of the stream has a greater energy per unit of volume. One would expect then, that the partical size of the bedload in the upper river to be large and that of the lower river to be small.

Occasionally large rocks were picked up by the sampler. If the rock represented a significant portion of the total sample, the calculated bedload would probably be greater than the actual bedload. Large rocks (>31.5mm) were picked up at the Mullan and Wallace sites on the Coeur d'Alene.

The tributaries appear to contribute small amounts of bedload to the South Fork Coeur d'Alene River at the flows measured in 1978. Tributaries generally have a steeper gradient and larger cobble than the main stream. Tributaries like Canyon Creek and Nine Mile Creek would probably have a

Figure 18
Suspended Sediment in the South Fork of the Coeur d' Alene River at Terror Creek

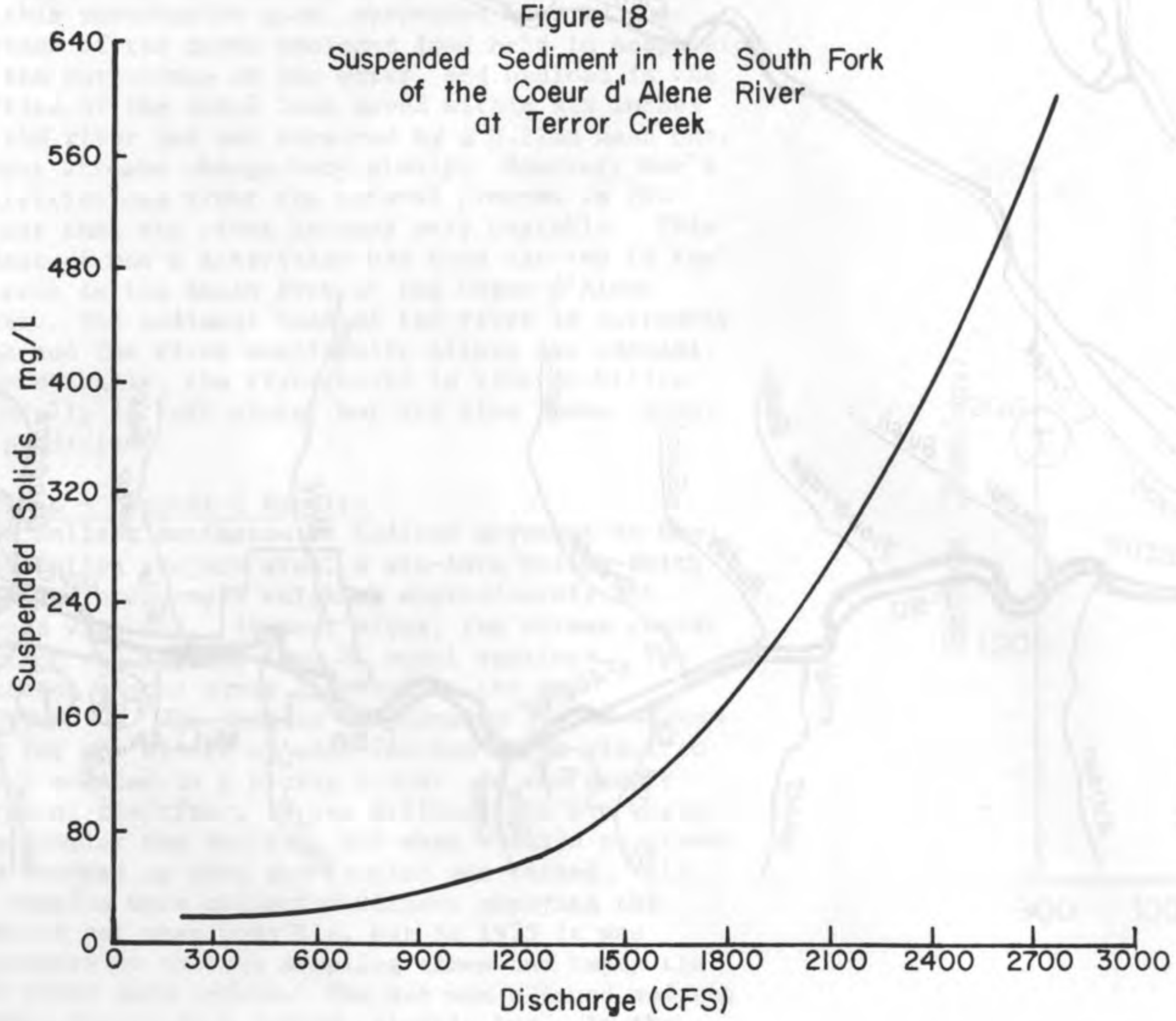


FIGURE 19
SEDIMENT CONCENTRATIONS MAY 21-25, 1978

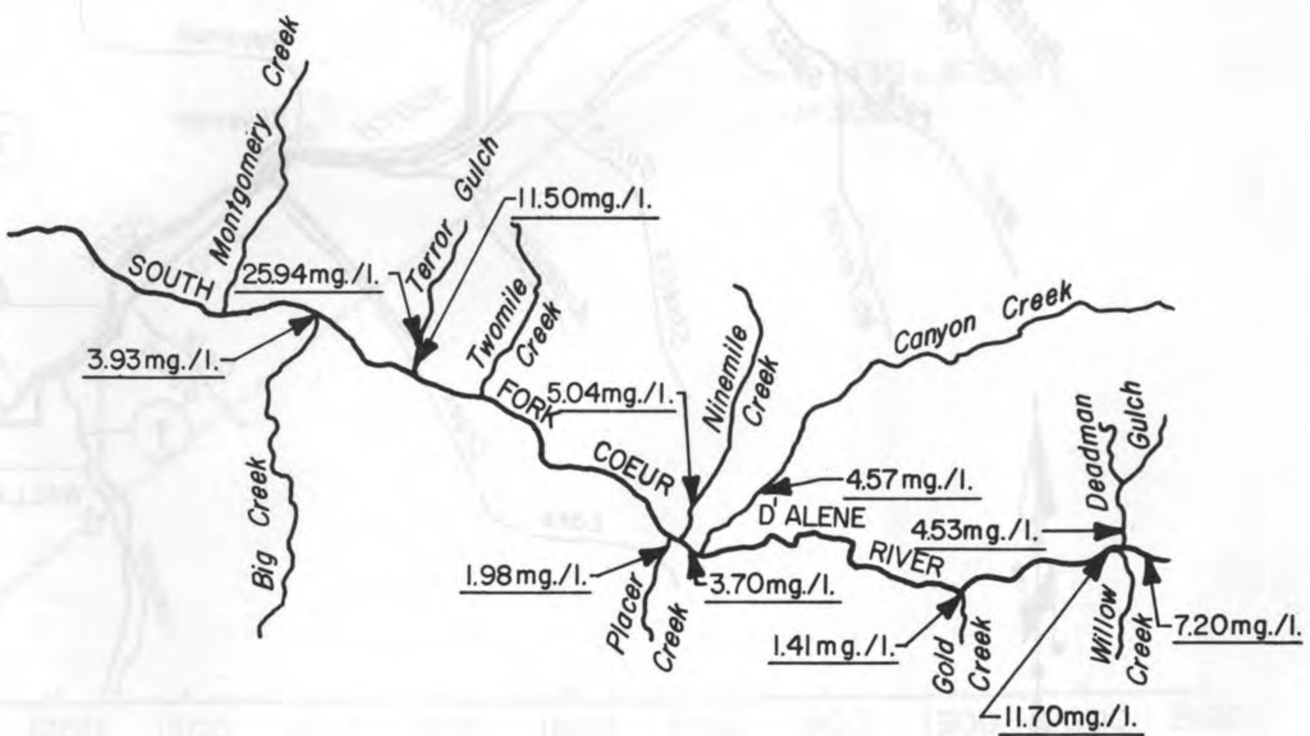


FIGURE 20
Elevation profile of The South Fork Coeur d' Alene River with weighed average bedload size

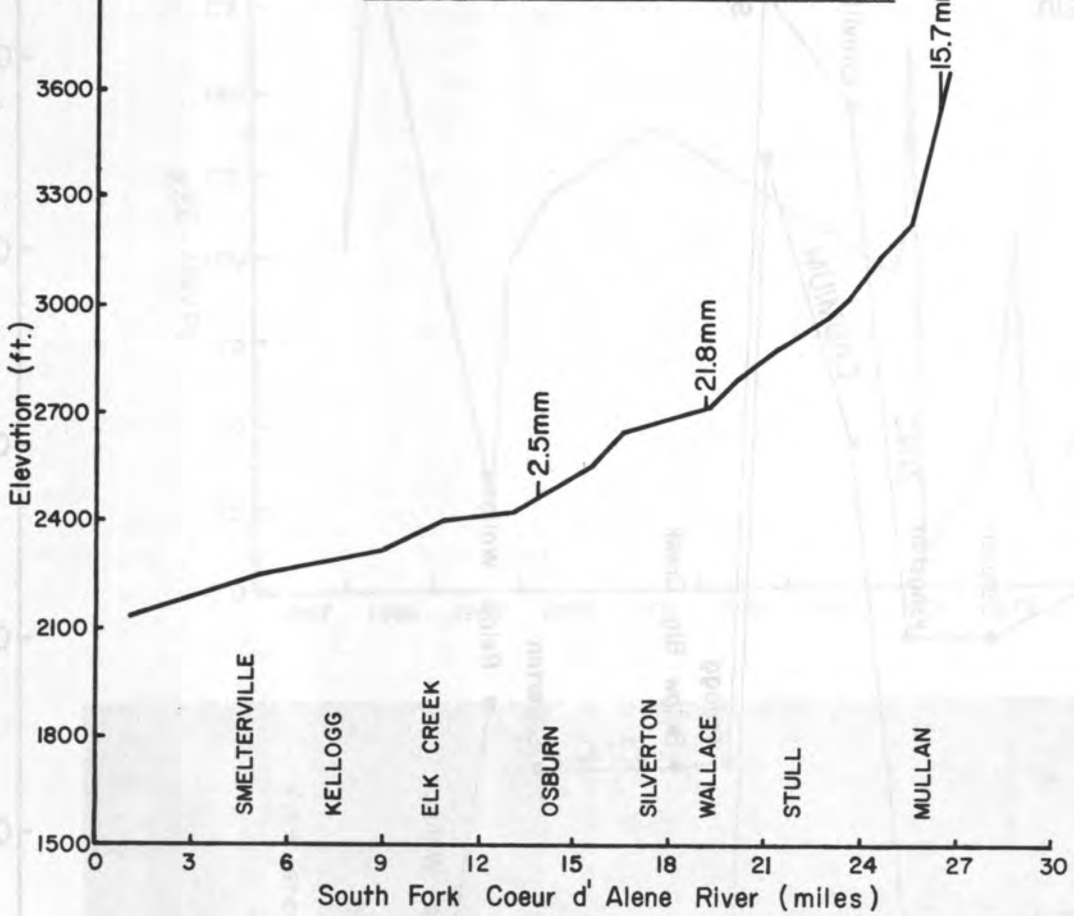
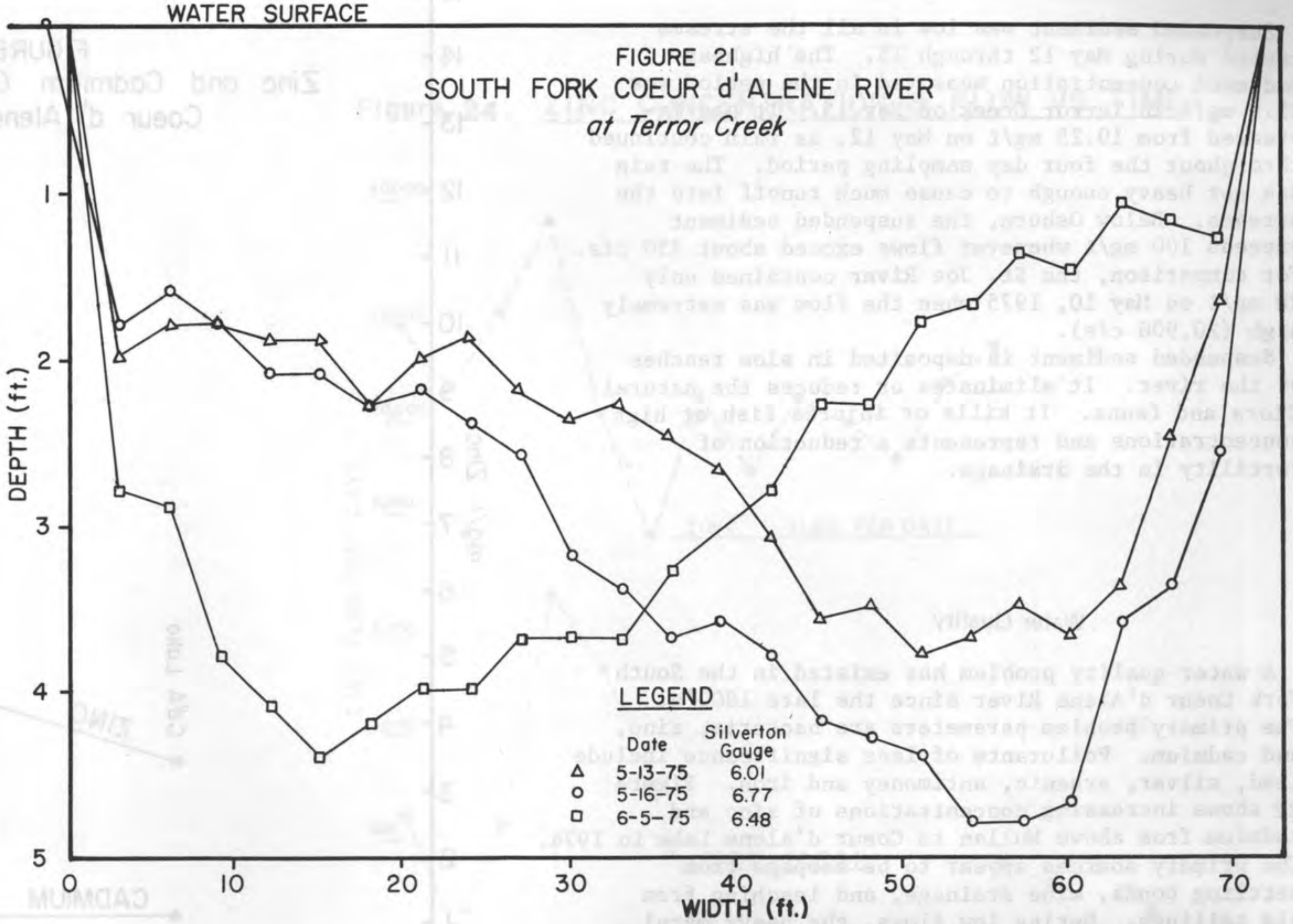


FIGURE 21
SOUTH FORK COEUR d'ALENE RIVER
at Terror Creek



high bedload at flood flows from the appearance of the flood plains, but measurements have never been made.

Massive volumes of gravel moved during the high flows experienced in 1975. Both sampling stations in 1975 were located at bridges below broad gravel areas where the river has no definite channel or form. Figure 2? shows changes in the channel configuration over a short period of time during these high flows. Water velocity under the bridges at Terror Gulch and Big Creek was near 13 feet per second.

Extensive sampling of the South Fork and its tributaries is needed to more accurately identify bedload sources and volumes. Sampling is especially needed at high flows since very little material moves when the discharge at the Kellogg gage is below 1200 cfs.

Suspended sediment concentrations reflect the condition of the watershed and land use practices, and not just the stream channel. Except where landslides occur, bedload material originates in the stream or its immediate environs while suspended sediment originates mostly from surrounding land. The significant drop that appeared to occur in 1974 is actually due to the gaging and sampling station being moved from Smelterville up to Kellogg.

Old jig tailing deposits are highly unstable and easily eroded during high flows.

Suspended sediment was low in all the streams tested during May 12 through 15. The highest sediment concentration measured in the period was 25.9 mg/ℓ in Terror Creek on May 15. It had increased from 10.25 mg/ℓ on May 12, as rain continued throughout the four day sampling period. The rain was not heavy enough to cause much runoff into the streams. Below Osburn, the suspended sediment exceeds 100 mg/ℓ whenever flows exceed about 350 cfs. For comparison, the St. Joe River contained only 28 mg/ℓ on May 10, 1975 when the flow was extremely high (20,900 cfs).

Suspended sediment is deposited in slow reaches of the river. It eliminates or reduces the natural flora and fauna. It kills or injures fish at high concentrations and represents a reduction of fertility in the drainage.

Water Quality

A water quality problem has existed in the South Fork Coeur d'Alene River since the late 1800's. The primary problem parameters are bacteria, zinc, and cadmium. Pollutants of less significance include lead, silver, arsenic, antimoney and iron. Figure 22 shows increasing concentrations of zinc and cadmium from above Mullan to Coeur d'Alene Lake in 1974. The primary sources appear to be seepage from settling ponds, mine drainage, and leaching from old tailings. During low flows, the heavy metal concentrations are toxic to all but the most tolerant plants and animals. The concentrations decrease at high flows, but the total amount of pollutants is increased. The increase of the total amount is probably due to a combination of factors. Overland runoff through tailings, runoff over land receiving dust and particulate matter from smelter and mining operations, and groundwater raising into mine waste all contribute to the problem.

All the mining companies constructed tailings ponds in the late 1960's and eliminated most of the suspended mine waste from the river. The ponds have had little effect on the dissolved pollutants, but limited data before 1970 makes a valid comparison difficult. Figure 23 shows the changes in concentrations of zinc with time at Smelterville. The data are from USGS (1969-76) and are for total zinc, not just dissolved. Variations in river discharge have a very significant effect on metal concentrations so that comparing metal concentrations in a high water year to those in a low water year may be misleading. To eliminate this effect, the absolute amount of metals was used.

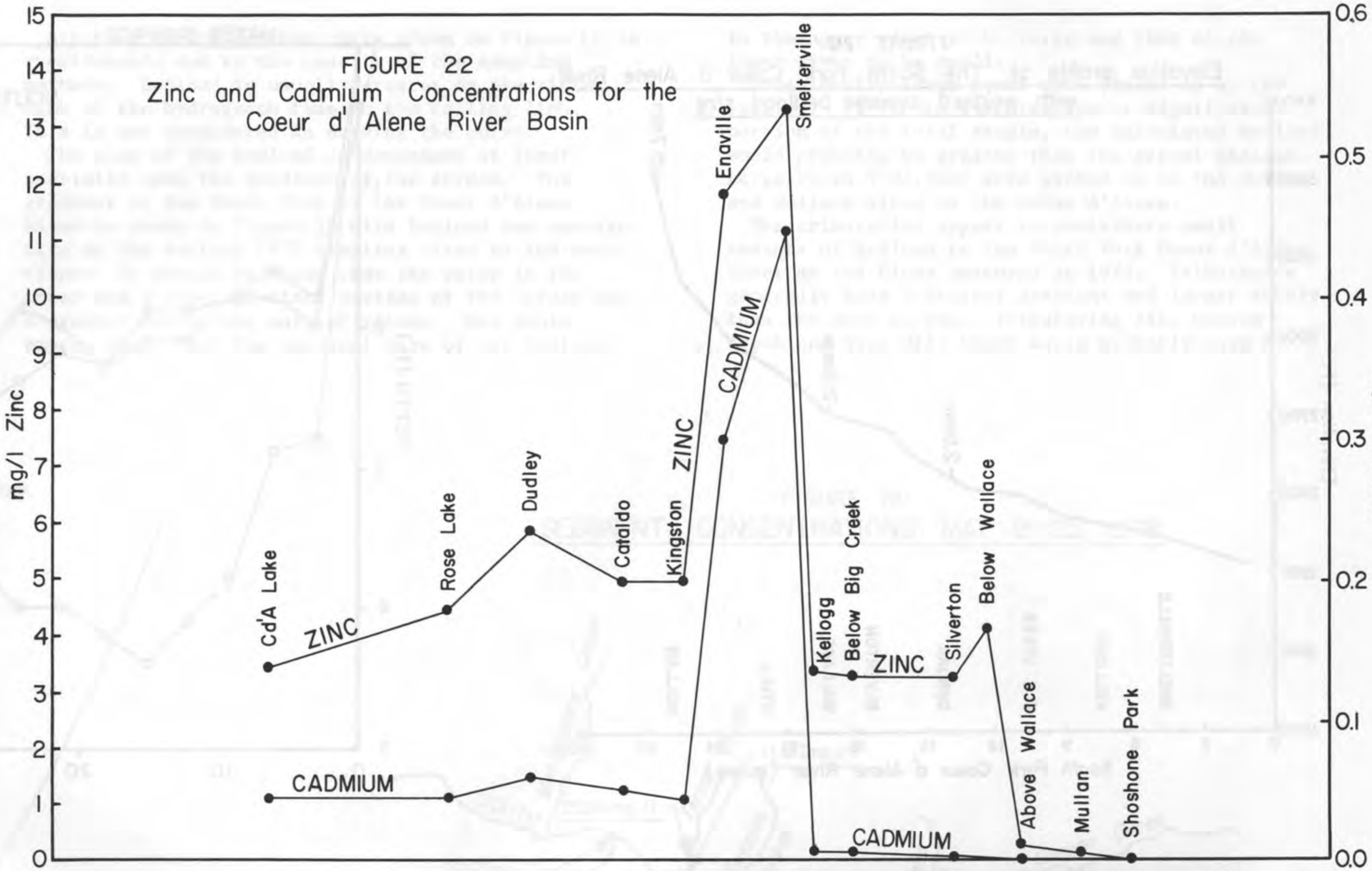


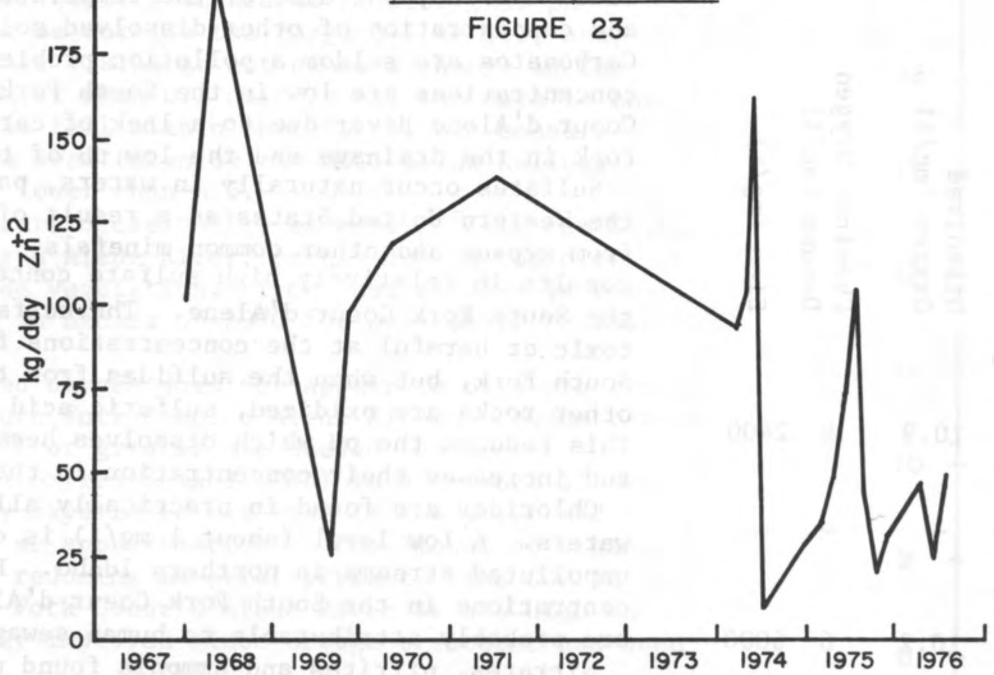
FIGURE 22
Zinc and Cadmium Concentrations for the Coeur d Alene River Basin

Figure 24 from studies conducted by Mink, Williams and Wallace (1975), shows the relationship between dissolved zinc concentrations, total zinc (tons per day), and stream discharge. During high spring flows, the zinc concentration drops to about one mg/ℓ. At this time, fish are able to migrate up the river to the tributaries. Recently, local residents have reported seeing fish in the river at other times of the year but resident fish population will not occur in the river until maximum dissolved zinc concentrations fall below 0.5 mg/ℓ.

Various layers of deposition of the eroding stream bank can be seen in this photo.

Zinc Concentrations in the South Fork Coeur d' Alene River at Smelterville-Kellogg

FIGURE 23



Discharges from tailing impoundments contain heavy metals.

Figure 24. ZINC CONCENTRATION & FLOW VS. TIME

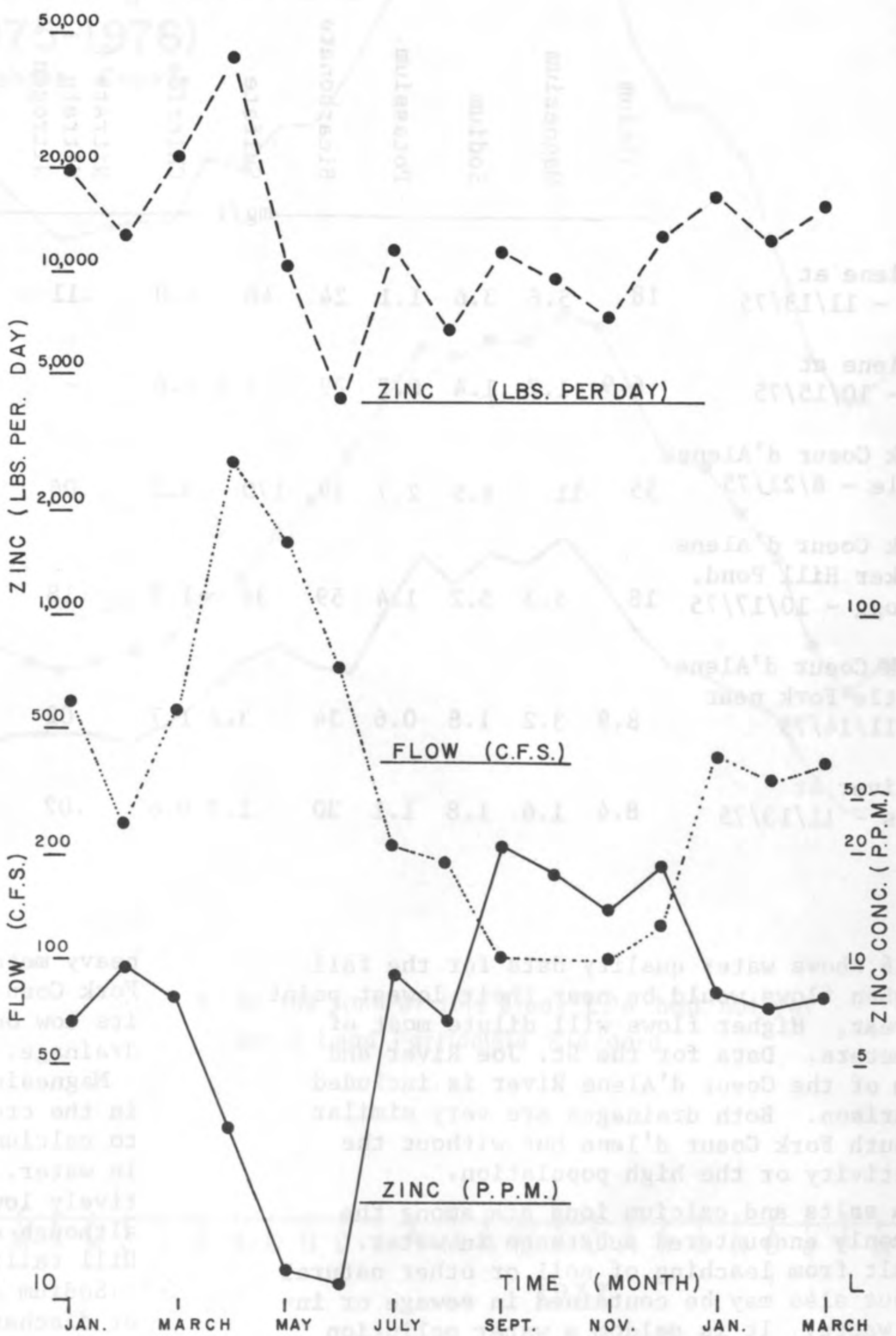


TABLE 16

Water Quality Data - Coeur d'Alene River System

	Calcium	Magnesium	Sodium	Potassium	Bicarbonate	Sulfate	Chloride	Nitrate + Nitrate Nitrogen	Ammonia Nitrogen Total	Total Phosphorus	Specific Conductance (μmhos)	pH (Units)	Temp. (°C)	Dissolved Oxygen (mg/ℓ)	Chemical Oxygen Demand (mg/ℓ)	Zinc (mg/ℓ)
	mg/ℓ															
Coeur d'Alene at Rose Lake - 11/13/75	18	5.6	3.6	1.1	24	46	1.0	.11	.11	.02	171	6.5	7.5	10.9	5	2400
Coeur d'Alene at Enaville - 10/15/75	6.9	1.7	1.4	0.7	29	2.6	0.6	-	-	.00	49	7.2	10.5	-	-	-
South Fork Coeur d'Alene at Enaville - 8/21/75	55	11	8.9	2.7	29	170	3.2	.06	.00	.84	310	6.8	12.5	10.2	6	6000
South Fork Coeur d'Alene above Bunker Hill Pond, near Kellogg - 10/17/75	18	5.3	5.2	1.4	59	34	1.3	.18	-	-	122	7.1	6.5	-	-	-
South Fork Coeur d'Alene above Little Fork near Mullan - 11/14/75	8.9	3.2	1.8	0.6	34	3.2	1.7	.02	.05	.00	71	7.1	3.5	11.7	4	.070
St. Joe River at St. Maries - 11/13/75	8.4	1.6	1.8	1.1	30	1.7	0.6	.02	.06	.01	59	6.6	5.0	11.6	4	.020

Table 16 shows water quality data for the fall of 1975 when flows would be near their lowest point for the year. Higher flows will dilute most of the parameters. Data for the St. Joe River and main stem of the Coeur d'Alene River is included for comparison. Both drainages are very similar to the South Fork Coeur d'lene but without the mining activity or the high population.

Calcium salts and calcium ions are among the most commonly encountered substance in water. They result from leaching of soil or other natural sources but also may be contained in sewage or industrial waste. It is seldom a water pollution problem. In fact, it is a diet requirement and reduces the toxicity of other pollutants including heavy metals. Calcium concentrations in the South Fork Coeur d'Alene River is relatively low due to its low occurrence in the rocks and soil in the drainage.

Magnesium is also one of the most common elements in the crust of the earth. It is chemically similar to calcium but usually found in lower concentrations in water. Like calcium, concentrations are relatively low in the South Fork Coeur d'Alene River although concentrations do increase below Bunker Hill tailings ponds.

Sodium and potassium are leached from the soil or discharged into the stream from industrial or municipal waste. Both increase in the South Fork from the headwaters to the confluence with the mainstem but are not high enough to cause problems.

Bicarbonate concentrations in natural and polluted waters is a function not only of the bicarbonates added thereto, but also of the temperature, pH, and concentration of other dissolved solids. Carbonates are seldom a pollution problem and concentrations are low in the South Fork Coeur d'Alene River due to a lack of carbonaceous rock in the drainage and the low pH of the water.

Sulfates occur naturally in waters, particularly in the Western United States as a result of leaching from gypsum and other common minerals. This leaching results in relatively high sulfate concentrations in the South Fork Coeur d'Alene. The sulfate is not toxic or harmful at the concentrations found in the South Fork, but when the sulfides from the ore and other rocks are oxidized, sulfuric acid is formed. This reduces the pH which dissolves heavy metals and increases their concentration in the river.

Chlorides are found in practically all natural waters. A low level (about 1 mg/ℓ) is common in unpolluted streams in northern Idaho. Higher concentrations in the South Fork Coeur d'Alene River are probably attributable to human sewage.

Nitrates, nitrites and ammonia found naturally in streams are usually from the decay of organic material. In well oxygenated waters, the oxydation from ammonia to nitrite to nitrate is usually rapid so that ammonia is indicative of a nearby organic pollution source. Human sewage would be the primary source of these nitrogen compounds in the South Fork Coeur d'Alene River. Excessive nitrogen can cause nuisance algal growth on the river bed and algal blooms in the Coeur d'Alene Lake. Nitrate concentrations in the South Fork are high enough to stimulate some algal growth but are greatly improved since sewage treatment in the valley was improved.

Phosphorous, usually in the form of phosphates (PO_4^{-3}), may occur in streams as a result of leaching from minerals and ores or from decay of organic material. Phosphates, like nitrates, are a major plant nutrient and concentrations over 0.1 mg/ℓ may cause nuisance algal growth. Phosphorus concentrations near Kellogg are well over that limit.

Specific conductance is an indicator of the total amount of salts dissolved in the water. The specific conductance of the South Fork Coeur d'Alene River increases rapdily at Kellogg and is high compared to the St. Joe River and the main stem of the Coeur d'Alene River. However, the conductivity would not prevent its use for agricultural purposes.

The pH of water describes its activity or basicity. Water with a pH less than seven is acidic and greater than seven is basic. Acid drainage from mines, and mine processing, causes a low pH in the South Fork Coeur d'Alene River. Idaho water quality standards require that pH values not be outside the range 6.5 to 9.0, and that a waste discharge not cause a change in the river greater than 0.5 units. All the data in the above table fall within that range, but measurements have been taken by the USGS below Kellogg which are lower than 6.5.

Temperature occasionally exceeds 20°C in the South Fork Coeur d'Alene River, partly due to the dirth of stream side vegetation. Trout can survive in temperatures in excess of 20°C for only short periods of time.

Dissolved oxygen does not appear to be a problem in the South Fork Coeur d'Alene River. Concentrations of 6.0 mg/ℓ or greater are needed for trout.

Chemical oxygen demand (COD) is a measure of the chemically oxydizable material in the water and furnishes an approximation of the amount of organic and other reducing material present. The COD in the South Fork Coeur d'Alene River is not high and has greatly improved since sewage treatment has been upgraded.

As noted earlier, zinc is the primary toxic metal found in the South Fork Coeur d'Alene River although cadmium, lead, antimony, arsenic and silver are also present. Concentrations of zinc as low as 0.01 mg/ℓ can be toxic to trout. Concentrations a thousand times greater than this have been measured in the river.

Section X - Air Quality

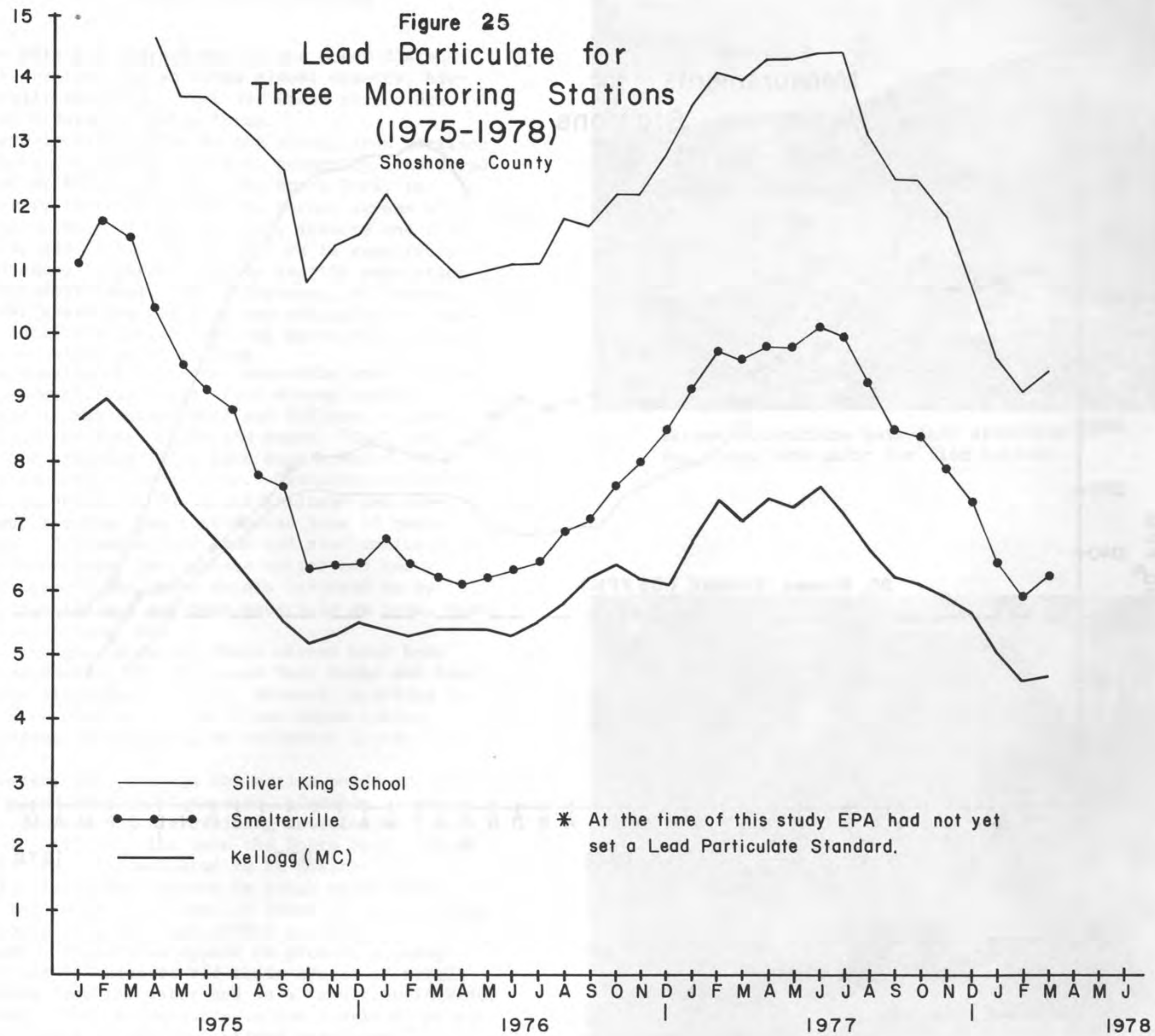
The Air Quality Bureau, Division of Environment of the Idaho Department of Health and Welfare has the responsibility for monitoring air quality throughout Idaho. There are currently eight monitoring stations in Shoshone County which measure particulates and six continuous gas monitoring stations.

As shown in Figure 25, ambient lead levels in the Silver Valley near the Bunker Hill smelter have shown a decrease from the high levels of the summer of 1977 prior to the installations of tall stacks. Data presented in Figure 26 indicates that the recorded ambient SO^2 levels near the Bunker Hill smelters have been in excess of the standards of .03 ppm, but have been decreasing since the installation and use of tall stacks in August 1977. The levels are now near or below the standard.

Figure 25

Lead Particulate for Three Monitoring Stations (1975-1978)

Shoshone County

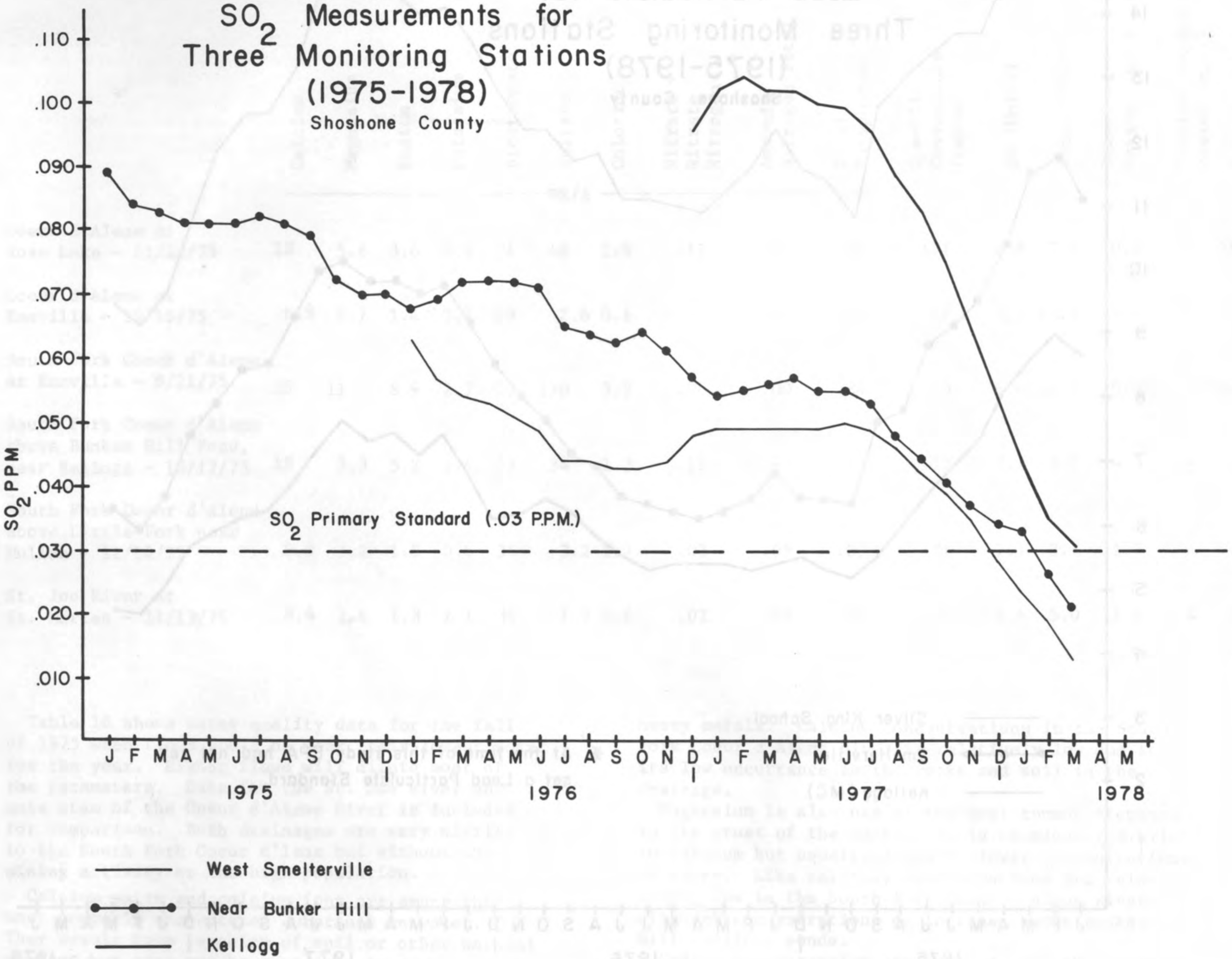


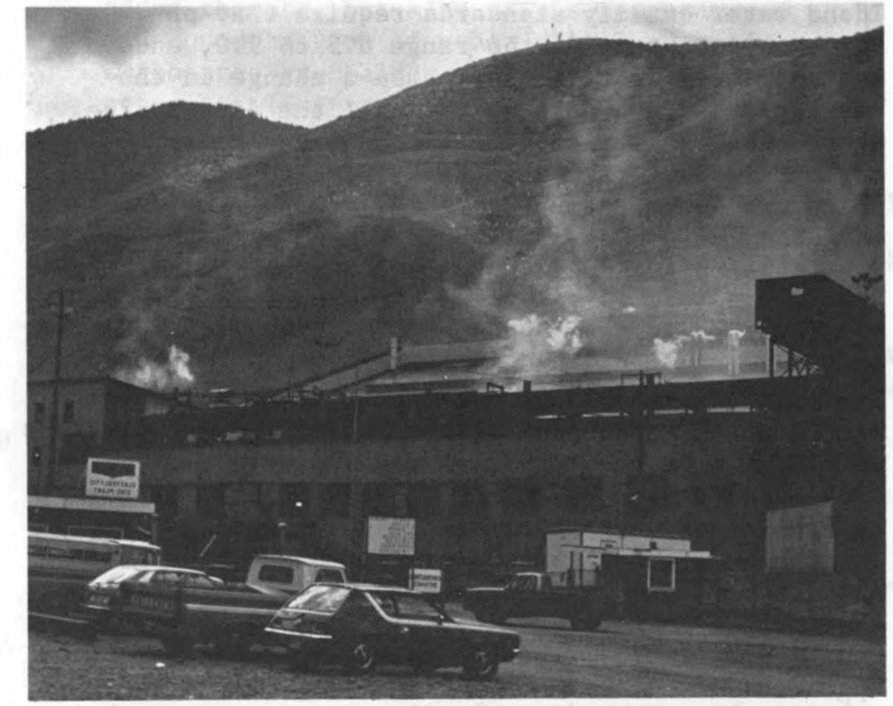
✱ At the time of this study EPA had not yet set a Lead Particulate Standard.

FIGURE 26

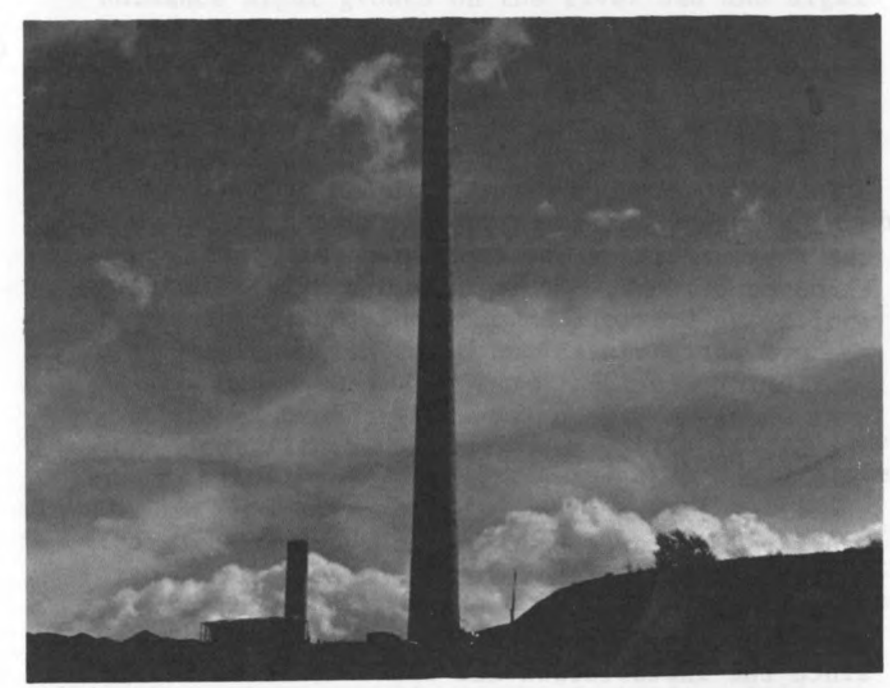
SO_2 Measurements for Three Monitoring Stations (1975-1978)

Shoshone County





Emissions from the electrolytic zinc plant prior 1977 have denuded hillsides within the vicinity.



Installation of tall smoke stacks have improved air quality within the Silver Valley.

Section XI - Vegetation

A variety of vegetation occurs throughout the project area. Some changes in the natural vegetation have occurred as a result of man's influence on the environment. Much of the original coniferous forests have been harvested for use in the mines as timber and fuel. Most of the tree population near Kellogg has been eliminated, primarily from smelter fumes but in part from the large fires of 1910. Stands of Douglas fir, the most common tree in the basin, western larch, and stumps of western red cedar are found throughout the area. The lower, dryer areas of the valley contain western yellow pine and some deciduous trees such as willow or alder. Brushy plants and grasses cover the area in uneven distribution depending on the availability of water. The brushy plants include deer brush and whortleberry. Bear grasses, the most common grass, is evident throughout the basin.

The high elevations have a much higher density of vegetation, including western white pine which grows extensively along the North Fork of the Coeur d'Alene drainage, grand fir or white fir, and some western hemlock. Along high ridges there are groves of alpine fir, mountain hemlock, and Englemann spruce. Aspen groves are scattered throughout the basin on the high open slopes. The bushy plants of the high elevations include huckleberry or whortleberry, twinberry, syringa, mountain ash, and chokecherry.

SO_2 emissions prevented the reestablishment of vegetation after the 1910 and 1934 forest fires.

Section XII - Fisheries

The Main and South Forks of the Coeur d'Alene River are regarded as being almost deserts, biologically speaking. That is, these rivers are almost devoid of living forms.

There is little life in the river, from Harrison to above the mining district, generally considered to end at Mullan, Idaho. The North Fork, in contrast, is teeming with the normal stream biota--aquatic plants of many species, insects and their larvae, and fish. The North Fork is especially known among fishermen for its healthy population of cutthroat trout. The difference, of course, is that there has not been any mining or smeltering wastes discharged into the North Fork, as in the case with the South Fork.

The dumping of left-over materials into the bed of the South Fork began after mining operations started at the Bunker Hill and Sullivan claims. As stated by Funk, Filby and Rabe: "Tailings from ore crushing mills have been a source of large amounts of rock flour. Oxidation of heavy metal sulphides in subaerial tailings and subsequent leaching has contributed ions of heavy metals. Effluents from lead and zinc smelters have contributed particulate matter and heavy metal ions." The heavy metals referred to by the investigators are such materials as lead, zinc, cadmium, copper, etc.

Massive quantities of these wastes have been carried down in the South and Main Forks and into Coeur d'Alene Lake itself. However, starting in 1968, the mining district firms began taking action to correct this dumping of sediments in the South Fork.

However, the tailings collection ponds are not proving to be a complete cure. Cadmium, lead, zinc, and mercury are draining in solution from the old tailing piles into the South Fork. These metals are not considered to be healthy for aquatic life when present in large quantities.

As far as the reactions of trout to these metals are concerned, the Funk, Filby and Rabe report states: "These fish appear to produce a heavy secretion of mucus to rid their system of metals absorbed from the water and as a result suffocation follows. Chronic exposure to low levels of metals also results in internal stress reactions."

Some tests in 1969 by Sappington, on the specific effect of zinc on cutthroat trout fingerlings, found that when the level of zinc in the water

Stream alterations have left stretches of the South Fork unfit for fish habitat.

Water quality is not conducive for maintaining fish populations.

reached 0.42 parts per million, 50 percent of the fingerlings would die if kept in this water for 24 hours. If the fish were kept in the tanks for 96 hours and the concentration of zinc were cut to 0.09, 50 percent still would be killed. Zinc concentrations as high as 21 parts per million were detected in the South Fork in 1969, according to a 1971 publication of the Idaho Bureau of Mines and Geology. Table 17 lists lethal zinc concentrations for trout as determined by various researchers.

TABLE 17

Zinc Concentrations Lethal to Trout

Mg/ℓ	Type of Water	Exposure Time	Fish
0.01	----	----	Trout ora & fry
0.01-0.04	----	----	Young rainbow
0.13	----	12-14 hrs.	Rainbow fingerlings
0.15	----	----	Trout
0.5	Soft	3 days	Rainbow fingerlings
0.5	Soft	3 days	Rainbow trout
3.0	Soft	8 hours	Rainbow fingerlings
3.0	----	48 hours	Rainbow fry
4	Hard	3 days	Rainbow
6	----	48 hours	Young trout
25-50	----	2 hours	Rainbow

One of the yardsticks by which biologists measure the health of a stream is the number of aquatic animals, such as the larvae of midges, mayflies and stoneflies, which can be collected from a certain area of stream bed. Collections were made at various spots on the South, North and Main Forks of the Coeur d'Alene River by Savage. Her findings further illustrate the differences in water quality among the three streams. The North Fork sampling stations, as well as those on the South Fork located above any mining operation waste effluents, had many species present. She also found a high density of individual specimens at those stations.

The sampling stations in the mining district proper, and on the Main Fork below the district, were a different story. For example, she found, in the fall of 1968 at a spot on the South Fork opposite Smelterville, absolutely nothing in the way of aquatic specimens. On the same day, at a point several miles downstream from the confluence of the South and North Forks, 125 individual specimens of one species were all that could be found in one square foot of bottom surface. In contrast, at a sampling station on the North Fork, Savage found 368 individual specimens comprising 27 different species.

There has been some detectable improvement in total numbers and species present at some sampling stations on the South Fork since the tailings ponds were built. However, the contrast with the North Fork still is striking.

There has been a distinct improvement, however, in the amount of sediment being carried down the South Fork to the Main Fork. The tailings ponds are reducing the turbidity of the water.

This change in sediment load has had an unexpected result. Large masses of a type of algae called periphyton have become attached to rocks in some parts of the South Fork channel. This growth can be attributed to increased light penetration, a stable substrate and moderate to high levels of macronutrients. An apparent source of these nutrients is sewage from the surrounding towns.

Studies conducted by the Idaho Fish and Game Department concluded that fish are unable to live in the South Fork from Mullan downstream to its confluence with the North Fork during periods of normal and below normal flows. This is due to the heavy concentration of zinc, copper and lead.

The 100-year flood channel on Pine Creek is not designed for fish habitat.

However, fish and game biologist believe that adult cutthroat spawners migrate up the river from Lake Coeur d'Alene during high flows. Greg Mauser, a biologist for the Idaho Fish and Game, states, "The spawners in Evans Creek, no doubt, come up from the lake because they range in length from eleven to thirteen inches. Six to nine inch fish are most commonly found as native stock in tributary streams such as Evans Creek." It may be possible that the high waters in the spring are diluted enough to counteract the metal content.

The Upper South Fork above Mullan supports a well-balanced, diverse insect community throughout the year. The Department of Water Resources, identified five species of fish in this reach during a study to evaluate the effect of a stream channel relocation. These were:

<u>Cutthroat Trout (Salmo clarkii subsp.)</u>. *The cutthroat found in the area are a subspecies called Montana westslope cutthroat, which were listed as endangered by the United States Department of Interior in 1966. Distribution is restricted to the Flathead and Kootenai River drainages in Montana and the Coeur d'Alene and St. Joe River drainages in Idaho. Reasons for decline include sediment, low flows in streams, blocking of spawning runs by culverts and dams, and introduction of exotic trout which replace or hybridized with it (USDI).*

<u>Eastern Brook Trout (Salvelimus fontinalis)</u>. *The eastern brook trout is actually a char (closely related to dolly vardin and lake trout) introduced from east of the Mississippi River. The "brookies" are found in many streams in Idaho.*

<u>Sculpin (Cottus)</u>. *Sculpins are small fish with relatively large flattened heads and large pectoral fins. They are found in most of Idaho's streams and are preyed upon by the larger trout.*

<u>Rainbow Trout (Salmo gairdnerii)</u>. *Rainbow trout are native to the area and were once abundant (Kemmerer et al. 1923) in the Coeur d'Alene River. Fish captured in the altered reach were hatchery trout, probably from the Hale Fish Hatchery a short distance upstream. One nineteen-inch and several smaller rainbow were captured in the area of the study.*

<u>Coho Salmon (Oncorhynchus kisutch)</u>. *A few coho salmon were found in the South Fork Coeur d'Alene River. They are not native to the stream nor were they intentionally planted there; the salmon apparently escaped from the Hale Fish Hatchery.*

Stream channel relocation of the South Fork Coeur d'Alene River above Mullan.

Of the many important products and values associated with lands of the South Fork area, wildlife and wildlife habitat receives high priority. This resource is of major importance and adds greatly to the quality of life experienced by residents.

Obtaining information relative to wildlife populations and habitat conditions is difficult. Wild animals are difficult to inventory compared to domestic animals. Data on area used and habitat requirements are presently limited and a better knowledge and understanding of range conditions, plant community status, and animal needs and requirements would enhance man's ability to predict the consequences of various alternative management practices for wildlife management.

Dear and elk are the most abundant big game species in the area. The <u>Idaho Environmental Overview</u> states that deer occur over the entire area. A large portion of deer habitat is on federal and state lands. However, private lands contribute significantly. The majority of habitat for elk occurs on federal land.

Because of the extensive mountainous topography of the region, summer habitat for game animals is in greater supply than winter habitat areas. Seasonal use in the summer months occurs on federal land. Winter range is more critical in the management of game animals from the standpoint of area available. More of the critical winter range areas are in private ownership.

Development of improved range conditions for winter habitat could help stabilize the condition of animal populations through more beneficial plant succession. This is especially important for the elk and deer habitat areas. Habitat areas of several wildlife species in the South Fork can be found in the 1975 <u>Idaho Environmental Overview</u>.

B. HUMAN RESOURCES

Section I - Historical Events

The first account of white men in the area was Father Pierre DeSmet who spent several days with the Coeur d'Alene Indians giving them religious instructions in 1841. In 1845, Father Anthony Ravalli constructed the "Mission of the Sacred Heart" now referred to as the Cataldo Mission. On March 17, 1853, the Washington Territory was organized with Isaac Stevens appointed as governor. The new territory included all of present day Washington and that part of Idaho north of the Salmon River. Shortly thereafter, Captain John Mullen undertook to build a road to join the headwaters of the Missouri River with those of the Columbia passing through the Coeur d'Alene Valley. Discovery of gold in the North Fork of the Coeur d'Alene River in 1880 by Andrew I. Prichard created the Coeur d'Alene rush and led to the first inhabitants in the area. Five years later, Noah Kellogg discovered an outcropping of galena in the South Fork of the Coeur d'Alene River leading to its settlement. By late 1885, every major mining claim along the South Fork had been staked.

The Cataldo Mission was constructed in 1848 by Father Anthony Ravalli and the Coeur d'Alene Indian Tribe.

Joining the Kellogg, Bunker Hill and the Sullivan were the Tiger-Poorman, Frisco, and Hecla mines along Canyon Creek. These along with Lucky Friday, Morning, and Gold Hunter along the South Fork near Mullan were all to become producing mining companies. By 1900, the Sunshine, Polaris, Last Chance, Consolidated, and Crescent mines also were producing ore. One of the first mills to operate was the Bunker Hill mill which started in July, 1886.

Mining unions played an important role in area history. The Coeur d'Alene miners were second in the nation to organize, and the great labor-management battles of 1892 and 1899 made national and international news. Military action was exerted in some cases. Governor Steunenberg's imposition of martial law in 1899 eventually led to his assassination in 1905. Accused murderer Harry Orchard implicated Big Bill Haywood, founder of the Industrial Workers of the World. The ensuing trial established the reputations of two lawyers -- Clarence Darrow and William E. Borah.

Labor disturbances in 1892 and 1899 gave a sinister frame to the Coeur d'Alene district. In 1892, growing bitterness between members of the miners union and the mine owners protective association exploded into violence during the long day of July 11. About daybreak, a pitched battle broke out between union strikers and nonunion men at the Frisco mine; after the strikers had wrecked the Frisco mill by sending giant powder down the flume into the water-wheel, the fight was continued at the Gem mine. The union forces prevailed. Five men were killed and a considerable number wounded. After their victory at the Frisco and Gem, the strikers proceeded to Wardner, took possession of the Bunker Hill mill, placed a ton of powder under it, and by threatening to blow it up, forced the management to discharge their nonunion workers. But martial law was promptly declared and many of the nonunion men returned. The strikers had won a battle but not the campaign.

In 1899, another strike was called against the Bunker Hill mill:

> *"On April 29th of that year, a group of masked men took possession of a train at Burke, compelled the engineer to back the train to the powderhouse at the Frisco mine, where 70 boxes of dynamite were loaded on a box car. By the time the train got to Wallace, there were about a thousand men on board, of whom 300 were masked and armed. They left the train near Wardner and went to the Bunker Hill mill which was then completely destroyed by dynamite....Again, United States troops were sent into the district...and about 500 men suspected of complicity in the destruction of the mill were rounded up and imprisoned all summer in a bullpen at Kellogg. The troublemakers were scattered effectively and normal conditions of productions were restored by the end of the year."*

History of the 1910 Forest Fire

The winter snowfall of 1909 was normal or above normal but was followed by a summer drought. The intense heat and drying southwest winds from the Columbia plains in July produced tinder-dry conditions ready to explode. By the first part of August, over 3,000 small fires and over 90 large ones had occurred. In mid-August, two terrible days of fires swept 30 to 50 miles across the mountain ranges and rivers in the panhandle region. Even though the nearest fire was six miles from Wallace, numerous pieces of burning bark fell in the streets setting buildings on fire and destroying a third of the town. Approximately 100 buildings were burned and two lives were lost. When the toll of losses was finally added up, 85 lives were lost. Over three million acres were burned in Montana and Idaho. It is estimated that seven to eight billion board feet of merchantable timber was destroyed including the state's most valuable white pine stands.

Remenants of the 1910 fire are still visible today.

Sunshine Mine Disaster

On May 2, 1972, fire broke out in the Sunshine Mine with carbon monoxide, heat, smoke, and gas spreading swiftly through the tunnels. One hundred seventy-eight miners were working at various levels, 85 of whom made it to safety. Seven days later, two other miners were found alive. On May 13th, the last of the 91 victims were brought out making this fire the country's worst hardrock mine disaster since 1917.

Monument dedicated to the miners who lost their lives in the 1972 mine disaster.

Historical Sites

Known historical sites are identified and evaluated by the Idaho Historical Society. Specific sites located in the study area that are currently identified in the Idaho register are as follows:

1. Deserted mining town of Burke (1884).
2. Deserted mining town of Beaver City on Beaver Creek near Murray.
3. Eagle City (1884) deserted mining town, prominent in Coeur d'Alene Gold Rush near Murray.
4. Delta--10 miles north of Wallace--(deserted mining town).
5. Various types of architectural structured houses in Wallace. Clapboard structures with Gable roofs and ornamental arches.
6. Gem--3 miles northeast of Wallace--(1886). Site of Mine Labor War of July 11, 1882.
7. Carloon City--deserted mining town near Murray.
8. Murray--an 1884 Placer Mining Camp north of Wallace. Shoshone County Seat from 1885-1898.
9. Prichard (1884)--deserted mining town near Murray.
10. Providence Hospital in Wallace.
11. Scott Building in Wallace (1939).
12. Shoshone Building in Wallace (1893).
13. Shoshone County Courthouse in Wallace.
14. St. Regis Pass (1861). Summitt of the Mullan Road through the Bitterroot Range.
15. Wallace Elks Lodge.
16. Wallace Historic District.
17. Wallace Post Office.
18. Wardner (1886)--site of the 1899 Mine Labor War.
19. Mission of the Sacred Heart (1846) at Cataldo. Opened for services in 1853. This is the oldest building in Idaho. Black-robed Jesuits founded the mission on the St. Joe in 1842, but moved in 1846 and raised an imposing building in a complete wilderness. The mission was moved to DeSmet in 1877, but Mass is still celebrated in the old church every year.
20. Mullan Tree (Fourth of July Canyon)--It was during a celebration of Independence Day that workers on the Mullan Road carved the following inscription on a white pine tree: M.R. July 4, 1861.

    In 1962, during a heavy wind storm, the top portion of the tree was blown off leaving a 15 foot stump which is presently encircled by a protective fence.

It should be noted that a more detailed search of historical sites in the South Fork of the Coeur-d'Alene River area is needed. As many sites which remain have not been identified.

A "Wallace Historic District" is currently being formed which includes a section of the town of Wallace. The Historic District is to be identified under the "National Register of Historical Places", Department of the Interior.

Cataldo Mission

Cataldo Mission, 10 miles west of Kellogg and just south of Interstate 90, is the oldest building in Idaho. It was built by Jesuit priests, lay brothers, and Indians during a five year period beginning in 1848. The mission was originally located on the St. Joe River near St. Maries in 1842, but was moved to the Cataldo site because of repeated flood trouble. The new mission cornerstone was laid in 1848 and the church was first used in the winter of 1850, finally being completed in 1853. The building of adobe construction, with 12-inch walls of mud and grass, was later covered with boards and paneling. The interior is decorated with many old religious paintings, hand-carved statues, and a hand-carved altar. No nails were used in the construction.

Section II - Archaeological Sites

There has not been a detailed systematic on-site archaeological search conducted in the South Fork of the Coeur d'Alene River drainage. Those sites which are recorded with the Idaho State Archaeologist are as follows:

1. Several old cabins related to the mining discovery in the late 1800's.
2. Prehistoric archaeological site near Cataldo Mission which consists of fire-cracked rocks of cobble and boulder size plus associations of crumbly bones and artifacts. Site location in river cot bank.
3. Indian campsite includes old native manufactured artifacts in the Mission Flats area.
4. Extensive Indian campground site near the Coeur d'Alene River includes piles of stones and artifacts.
5. Many Indian artifacts located near the Cataldo Mission area.
6. Remains of an "old homestead" including the associated barn across the river at Cataldo Mission. A few log structures are still present with scattered remnants.
7. Old townsite at Linfor founded in 1912 by two men, last names Tuttle and Fay, who built a general merchandising store. The railroad was finished in 1909, and the store was established near the railroad. A post office was started in 1914. The town was flooded in 1917 and again in 1933. It was not re-established after the 1933 flood. Linfor is on the east side of the Coeur d'Alene River approximately opposite of where the North Fork flows into the main river, three miles south of Enaville.
8. "Glory-Hole", result of the historic silver and lead mine cave-in located near Burke.
9. Pulaski Tunnel - Historic mine tunnel for the ranger who saved 42 men during the 1910 forest fire by holding them in this mine shaft. Located South of Wallace.

Section III - Demographic Characteristics

There were 19,718 persons in Shoshone County in 1970. This represents a 5.5 percent decrease from 1960. The estimated population for 1975 is 19,943 persons or an increase of 1.14 percent. The historical population for Shoshone County, the panhandle region and the State of Idaho is shown in Table 18.

Shoshone County experienced net in-migration of 1,576 persons for the 1940-1950 period and 1,930 persons for the 1950-1960 period. However, during the 1960-1970 period, the county had a net out-migration of 3,599 persons. This rate of out-migration was reduced to 1,282 persons from 1970 through 1975. Table 19 lists the natural increase and net migration for Shoshone County and the panhandle region.

Fertility and birth rates are slightly below the average rate for Idaho, but higher than the national average. These figures are shown in Table 20.

TABLE 18

Historical Population of the Shoshone County, The Panhandle, and Idaho 1890-1975

Year	Shoshone (1864)	Region Total	State
1890	5,382	9,490	88,876
1900	11,950	22,166	161,772
1910	13,693	50,028	325,594
1920	14,250	56,536	431,866
1930	19,060	62,607	445,032
1940	21,230	72,499	524,873
1950	22,806	74,687	588,637
1960	20,876	77,864	667,191
1970	19,718	82,137	712,567
1972	19,000	86,800	755,000
1973	18,400	89,800	770,000
1974	18,700	94,500	796,000
1975	18,600	99,400	820,000

TABLE 19

Natural Increase & Net Migration 1950-1975

	Shoshone	Panhandle Region
Natural Increase - 1950	494	936
Net Migration 1940-50	1,576	2,188
Natural Increase - 1960	227	819
Net Migration 1950-60	1,930	3,177
Natural Increase - 1970	2,441	6,191
Net Migration 1960-70	-3,599	-1,918
Natural Increase - 1975*	1,481	3,500
Net Migration 1970-75*	-1,282	18,000

*County estimates are shown to the nearest hundred.

TABLE 20

Fertility and Birth Rate for Shoshone County (1975)

	Live Births	Females (15-44)	Birth Rate	Fertility Rate
Shoshone County	348	4,060	17.8	85.7
Idaho Rates	16,242	176,200	20.0	92.2
U.S. Rates	--	--	14.8	66.7

The Wallace-Kellogg-Mullan area contains the majority of the population of Shoshone County. Sixty-six percent of Shoshone County's population is contained in the seven major cities within the study area. This is shown in Table 21.

The cities of Kellogg, Osburn, Wallace, and Pinehurst contain over 50 percent of the population.

TABLE 21

Populations of Major Cities In Shoshone County - 1960, 1970 and 1975

	Population			Percent of County Population		
	1960	1970	1975	1960	1970	1975
Kellogg	5,061	3,811	3,638	29	19	18
Mullan	1,477	1,279	1,187	7	6	6
Osburn	1,788	2,248	2,146	9	11	11
Pinehurst	1,432	1,996	2,162	7	10	11
Smelterville	1,127	967	860	5	5	4
Wallace	2,412	2,206	1,886	12	11	9
Wardner	577	492	415	3	2	2
TOTALS	13,874	12,999	12,294	67	66	62

The population of Shoshone County is expected to increase at a rate of 1.0 percent through the year 2000 to a total of 25,443 persons. The population distribution for 1970 is shown in Table 22 and is forecast for the period 1975-2000 in Tables 23 through 28. Total population changes are shown in Tables 29 through 34. A forecast summary for Shoshone County is shown in Table 35 and Table 36. The summary of population growth for the county is listed in Table 37. As noted, out-migration from the county is expected to continue.

TABLE 22

Total Population - Shoshone County - 1970

AGE GROUP	MALES	FEMALES	TOTAL	PCT MALE	PCT FEMALE	PCT TOTAL
0- 4	1030.	998.	2028.	10.3	10.3	10.3
5- 9	1085.	1027.	2112.	10.8	10.6	10.7
10-14	1032.	996.	2028.	10.3	10.3	10.3
15-19	919.	879.	1798.	9.2	9.1	9.1
20-24	587.	718.	1305.	5.9	7.4	6.6
25-29	664.	627.	1291.	6.6	6.5	6.5
30-34	606.	544.	1150.	6.0	5.6	5.8
35-39	489.	514.	1003.	4.9	5.3	5.1
40-44	574.	511.	1085.	5.7	5.3	5.5
45-49	583.	581.	1164.	5.8	6.0	5.9
50-54	652.	577.	1229.	6.5	6.0	6.2
55-59	608.	564.	1172.	6.1	5.8	5.9
60-64	513.	436.	949.	5.1	4.5	4.8
65-69	312.	260.	572.	3.1	2.7	2.9
70-74	167.	156.	323.	1.7	1.6	1.6
75-79	101.	157.	258.	1.0	1.6	1.3
80-84	63.	90.	153.	0.6	0.9	0.8
85+	40.	58.	98.	0.4	0.6	0.5
TOTAL	10025.	9693.	19718.	100.0	100.0	100.0

TABLE 23

Total Population - Shoshone County - 1975

AGE GROUP	MALES	FEMALES	TOTAL	PCT MALE	PCT FEMALE	PCT TOTAL
0- 4	1133.	1067.	2200.	11.2	10.8	11.0
5- 9	963.	935.	1898.	9.6	9.5	9.5
10-14	1021.	966.	1988.	10.1	9.8	10.0
15-19	972	942.	1915.	9.6	9.6	9.6
20-24	875.	833.	1709.	8.7	8.4	8.6
25-29	541.	678.	1219.	5.4	6.9	6.1
30-34	622.	592.	1214.	6.2	6.0	6.1
35-39	570.	509.	1079.	5.7	5.2	5.4
40-44	446.	478.	923.	4.4	4.8	4.6
45-49	522.	469.	991.	5.2	4.7	5.0
50-54	518.	533.	1051.	5.1	5.4	5.3
55-59	571.	523.	1094.	5.7	5.3	5.5
60-64	512.	509.	1021.	5.1	5.2	5.1
65-69	394.	369.	762.	3.9	3.7	3.8
70-74	223.	208.	432.	2.2	2.1	2.2
75-79	107.	104.	211.	1.1	1.1	1.1
80-84	52.	95.	147.	0.5	1.0	0.7
85+	34.	55.	89.	0.3	0.6	0.4
TOTAL	10077.	9866.	19943.	100.0	100.0	100.0

TABLE 24

Total Population - Shoshone County - 1980

AGE GROUP	MALES	FEMALES	TOTAL	PCT MALE	PCT FEMALE	PCT TOTAL
0- 4	1329.	1253.	2581.	12.1	11.5	11.8
5- 9	1156.	1090.	2246.	10.5	10.0	10.3
10-14	987.	959.	1946.	9.0	8.8	8.9
15-19	1040.	986.	2026.	9.4	9.1	9.2
20-24	978.	958.	1935.	8.9	8.8	8.8
25-29	883.	846.	1729.	8.0	7.8	7.9
30-34	551.	688.	1239.	5.0	6.3	5.7
35-39	626.	601.	1227.	5.7	5.5	5.6
40-44	573.	517.	1090.	5.2	4.7	5.0
45-49	448.	484.	932.	4.1	4.4	4.3
50-54	515.	471.	987.	4.7	4.3	4.5
55-59	498.	529.	1027.	4.5	4.9	4.7
60-64	523.	507.	1030.	4.7	4.7	4.7
65-69	393.	436.	829.	3.6	4.0	3.8
70-74	287.	304.	591.	2.6	2.8	2.7
75-79	147.	146.	293.	1.3	1.3	1.3
80-84	56.	60.	115.	0.5	0.5	0.5
85+	27.	57.	84.	0.2	0.5	0.4
TOTAL	11016.	10891.	21906.	100.0	100.0	100.0

TABLE 25

Total Population - Shoshone County - 1985

AGE GROUP	MALES	FEMALES	TOTAL	PCT MALE	PCT FEMALE	PCT TOTAL
0- 4	1438.	1355.	2792.	12.4	11.7	12.0
5- 9	1295.	1222.	2517.	11.2	10.6	10.9
10-14	1126.	1061.	2187.	9.7	9.2	9.4
15-19	957.	934.	1891.	8.3	8.1	8.2
20-24	1014.	964.	1978.	8.7	8.3	8.5
25-29	950.	937.	1887.	8.2	8.1	8.1
30-34	858.	827.	1685.	7.4	7.1	7.3
35-39	531.	669.	1200.	4.6	5.8	5.2
40-44	599.	580.	1179.	5.2	5.0	5.1
45-49	541.	493.	1034.	4.7	4.3	4.5
50-54	410.	457.	867.	3.5	3.9	3.7
55-59	463.	440.	903.	4.0	3.8	3.9
60-64	431.	490.	921.	3.7	4.2	4.0
65-69	402.	434.	836.	3.5	3.8	3.6
70-74	286.	363.	649.	2.5	3.1	2.8
75-79	192.	222.	414.	1.7	1.9	1.8
80-84	79.	88.	167.	0.7	0.8	0.7
85+	27.	39.	66.	0.2	0.3	0.3
TOTAL	11599.	11574.	23173.	100.0	100.0	100.0

TABLE 26

Total Population - Shoshone County - 1990

AGE GROUP	MALES	FEMALES	TOTAL	PCT MALE	PCT FEMALE	PCT TOTAL
0- 4	1475.	1389.	2865.	12.2	11.4	11.8
5- 9	1391.	1311.	2702.	11.5	10.8	11.1
10-14	1252.	1181.	2433.	10.3	9.7	10.0
15-19	1084.	1025.	2109.	9.0	8.4	8.7
20-24	925.	902.	1827.	7.6	7.4	7.5
25-29	977.	935.	1912.	8.1	7.7	7.9
30-34	917.	911.	1828.	7.6	7.5	7.5
35-39	828.	801.	1629.	6.8	6.6	6.7
40-44	498.	641.	1140.	4.1	5.3	4.7
45-49	558.	548.	1106.	4.6	4.5	4.6
50-54	491.	458.	949.	4.1	3.8	3.9
55-59	358.	419.	776.	3.0	3.4	3.2
60-64	393.	400.	793.	3.3	3.3	3.3
65-69	324.	418.	742.	2.7	3.4	3.1
70-74	293.	362.	655.	2.4	3.0	2.7
75-79	192.	269.	461.	1.6	2.2	1.9
80-84	106.	140.	246.	0.9	1.1	1.0
85+	38.	49.	87.	0.3	0.4	0.4
TOTAL	12101.	12158.	24260.	100.0	100.0	100.0

TABLE 27

Total Population - Shoshone County - 1995

AGE GROUP	MALES	FEMALES	TOTAL	PCT MALE	PCT FEMALE	PCT TOTAL
0- 4	1490.	1403.	2892.	12.0	11.2	11.6
5- 9	1403.	1322.	2725.	11.3	10.6	10.9
10-14	1323.	1247.	2570.	10.7	10.0	10.3
15-19	1188.	1124.	2312.	9.6	9.0	9.3
20-24	1037.	976.	2013.	8.3	7.8	8.1
25-29	874.	859.	1733.	7.0	6.9	6.9
30-34	930.	897.	1827.	7.5	7.2	7.3
35-39	875.	872.	1747.	7.0	7.0	7.0
40-44	777.	760.	1536.	6.3	6.1	6.2
45-49	447.	595.	1042.	3.6	4.7	4.2
50-54	493.	499.	992.	4.0	4.0	4.0
55-59	419.	406.	826.	3.4	3.2	3.3
60-64	287.	369.	657.	2.3	2.9	2.6
65-69	293.	335.	628.	2.4	2.7	2.5
70-74	233.	347.	580.	1.9	2.8	2.3
75-79	197.	268.	465.	1.6	2.1	1.9
80-84	106.	171.	277.	0.9	1.4	1.1
85+	53.	78.	131.	0.4	0.6	0.5
TOTAL	12423.	12529.	24952.	100.0	100.0	100.0

TABLE 28

Total Population - Shoshone County - 2000

AGE GROUP	MALES	FEMALES	TOTAL	PCT MALE	PCT FEMALE	PCT TOTAL
0- 4	1537.	1447.	2984.	12.1	11.3	11.7
5- 9	1399.	1317.	2716.	11.0	10.3	10.7
10-14	1317.	1241.	2558.	10.4	9.7	10.1
15-19	1243.	1175.	2417.	9.8	9.2	9.5
20-24	1129.	1063.	2192.	8.9	8.3	8.6
25-29	973.	922.	1895.	7.7	7.2	7.4
30-34	818.	812.	1630.	6.5	6.4	6.4
35-39	880.	849.	1729.	6.9	6.6	6.8
40-44	813.	821.	1634.	6.4	6.4	6.4
45-49	707.	701.	1408.	5.6	5.5	5.5
50-54	375.	534.	909.	3.0	4.2	3.6
55-59	410.	436.	846.	3.2	3.4	3.3
60-64	333.	350.	683.	2.6	2.7	2.7
65-69	203.	307.	511.	1.6	2.4	2.0
70-74	208.	274.	483.	1.6	2.1	1.9
75-79	154.	257.	411.	1.2	2.0	1.6
80-84	109.	171.	280.	0.9	1.3	1.1
85+	56.	102.	159.	0.4	0.8	0.6
TOTAL	12663.	12780.	25443.	100.0	100.0	100.0

TABLE 29

Total Population Change - Shoshone County - 1970-75

AGE GROUP	MALE CHG	FEMALE CHG	TOTAL CHG	PCT M CHG	PCT F CHG	PCT T CHG
0- 4	103.	69.	172.	10.0	6.9	8.5
5- 9	-122.	-92.	-214.	-11.3	-9.0	-10.1
10-14	-11.	-30.	-40.	-1.0	-3.0	-2.0
15-19	53.	63.	117.	5.8	7.2	6.5
20-24	288.	115.	404.	49.1	16.1	30.9
25-29	-123.	51.	-72.	-18.5	8.1	-5.5
30-34	16.	48.	64.	2.7	8.8	5.6
35-39	81.	-5.	76.	16.5	-0.9	7.6
40-44	-128.	-33.	-162.	-22.3	-6.5	-14.9
45-49	-61.	-112.	-173.	-10.4	-19.4	-14.9
50-54	-134.	-44.	-178.	-20.5	-7.7	-14.5
55-59	-37.	-41.	-78.	-6.1	-7.3	-6.7
60-64	-1.	73.	72.	-0.1	16.7	7.6
65-69	82.	109.	190.	26.2	41.8	33.3
70-74	56.	52.	109.	33.6	33.6	33.6
75-79	6.	-53.	-47.	5.8	-33.5	-18.1
80-84	-11.	5.	-6.	-17.3	5.9	-3.7
85+	-6.	-3.	-9.	-15.8	-5.0	-9.4
TOTAL	52.	173.	225.	0.5	1.8	1.1

TABLE 30

Total Population Change - Shoshone County - 1975-80

AGE GROUP	MALE CHG	FEMALE CHG	TOTAL CHG	PCT M CHG	PCT F CHG	PCT T CHG
0- 4	195.	186.	381.	17.2	17.4	17.3
5- 9	193.	154.	348.	20.1	16.5	18.3
10-14	-34.	-7.	-42.	-3.4	-0.8	-2.1
15-19	68.	44.	111.	6.9	4.7	5.8
20-24	103.	124.	227.	11.7	14.9	13.3
25-29	341.	168.	509.	63.0	24.8	41.8
30-34	-71.	96.	25.	-11.5	16.2	2.0
35-39	57.	91.	148.	9.9	17.9	13.7
40-44	128.	39.	167.	28.6	8.2	18.1
45-49	-74.	16.	-59.	-14.3	3.3	-5.9
50-54	-3.	-61.	-65.	-0.7	-11.5	-6.1
55-59	-73.	6.	-67.	-12.8	1.1	-6.1
60-64	11.	-1.	9.	2.1	-0.3	0.9
65-69	-1.	67.	66.	-0.1	18.2	8.7
70-74	64.	95.	159.	28.5	45.8	36.8
75-79	40.	42.	82.	37.4	40.1	38.7
80-84	3.	-36.	-32.	6.6	-37.3	-21.8
85+	-7.	2.	-5.	-19.4	3.5	-5.2
TOTAL	939.	1025.	1964.	9.3	10.4	9.8

TABLE 31

Total Population Change - Shoshone County - 1980-85

AGE GROUP	MALE CHG	FEMALE CHG	TOTAL CHG	PCT M CHG	PCT F CHG	PCT T CHG
0- 4	109.	102.	211.	8.2	8.1	8.2
5- 9	139.	132.	271.	12.0	12.2	12.1
10-14	139.	102.	241.	14.1	10.7	12.4
15-19	-82.	-53.	-135.	-7.9	-5.3	-6.7
20-24	36.	6.	42.	3.7	0.6	2.2
25-29	67.	91.	158.	7.6	10.7	9.1
30-34	307.	139.	446.	55.7	20.2	36.0
35-39	-95.	68.	-27.	-15.2	11.4	-2.2
40-44	26.	63.	89.	4.5	12.3	8.2
45-49	93.	9.	102.	20.8	1.8	10.9
50-54	-105.	-15.	-119.	-20.4	-3.1	-12.1
55-59	-35.	-89.	-124.	-7.0	-16.8	-12.1
60-64	-92.	-18.	-110.	-17.6	-3.5	-10.7
65-69	9.	-1.	8.	2.3	-0.3	0.9
70-74	-0.	59.	58.	-0.1	19.4	9.9
75-79	45.	76.	121.	30.8	52.0	41.4
80-84	24.	28.	52.	42.8	47.4	45.2
85+	-0.	-18.	-18.	-0.5	-31.1	-21.2
TOTAL	584.	683.	1267.	5.3	6.3	6.8

TABLE 32

Total Population Change - Shoshone County - 1985-90

AGE GROUP	MALE CHG	FEMALE CHG	TOTAL CHG	PCT M CHG	PCT F CHG	PCT T CHG
0- 4	37.	35.	72.	2.6	2.6	2.6
5- 9	96.	89.	185.	7.4	7.3	7.3
10-14	126.	120.	246.	11.2	11.3	11.2
15-19	127.	91.	218.	13.3	9.8	11.5
20-24	-89.	-61.	-150.	-8.8	-6.4	-7.6
25-29	27.	-2.	26.	2.9	-0.2	1.4
30-34	59.	84.	143.	6.9	10.1	8.5
35-39	297.	132.	429.	56.0	19.7	35.7
40-44	-101.	61.	-40.	-16.8	10.5	-3.4
45-49	18.	55.	73.	3.2	11.2	7.0
50-54	81.	1.	82.	19.7	0.3	9.5
55-59	-105.	-21.	-126.	-22.7	-4.8	-14.0
60-64	-38.	-90.	-127.	-8.7	-18.4	-13.9
65-69	-78.	-16.	-94.	-19.3	-3.8	-11.2
70-74	7.	-1.	6.	2.4	-0.3	0.9
75-79	-0.	47.	47.	-0.2	21.1	11.3
80-84	27.	52.	78.	34.0	58.5	46.9
85+	11.	10.	20.	39.5	24.6	30.7
TOTAL	502.	585.	1087.	4.3	5.1	4.7

TABLE 33

Total Population Change - Shoshone County - 1990-95

AGE GROUP	MALE CHG	FEMALE CHG	TOTAL CHG	PCT M CHG	PCT F CHG	PCT T CHG
0- 4	14.	13.	27.	1.0	0.9	1.0
5- 9	12.	11.	24.	0.9	0.9	0.9
10-14	71.	66.	137.	5.7	5.6	5.6
15-19	104.	99.	203.	9.6	9.7	9.6
20-24	112.	74.	186.	12.1	8.2	10.2
25-29	-103.	-76.	-179.	-10.6	-8.1	-9.4
30-34	13.	-14.	-1.	1.5	-1.5	-0.0
35-39	47.	71.	118.	5.7	8.9	7.3
40-44	278.	118.	396.	55.8	18.4	34.8
45-49	-112.	47.	-65.	-20.0	8.5	-5.8
50-54	2.	41.	42.	0.4	8.9	4.5
55-59	61.	-12.	49.	17.1	-2.9	6.3
60-64	-106.	-30.	-136.	-26.9	-7.6	-17.2
65-69	-32.	-83.	-115.	-9.8	-19.8	-15.4
70-74	-60.	-14.	-75.	-20.6	-4.0	-11.4
75-79	5.	-1.	4.	2.6	-0.3	0.9
80-84	-0.	32.	32.	-0.2	22.8	12.9
85+	15.	29.	44.	39.5	59.4	50.7
TOTAL	322.	371.	693.	2.7	3.1	2.9

TABLE 34

Total Population Change - Shoshone County - 1995-2000

AGE GROUP	MALE CHG	FEMALE CHG	TOTAL CHG	PCT M CHG	PCT F CHG	PCT T CHG
0- 4	47.	44.	92.	3.2	3.2	3.2
5- 9	-4.	-5.	-9.	-0.3	-0.4	-0.3
10-14	-6.	-6.	-12.	-0.4	-0.5	-0.5
15-19	55.	50.	105.	4.6	4.5	4.6
20-24	92.	87.	179.	8.9	8.9	8.9
25-29	99.	63.	162.	11.3	7.3	9.3
30-34	-113.	-85.	-197.	-12.1	-9.4	-10.8
35-39	5.	-23.	-18.	0.6	-2.6	-1.0
40-44	36.	61.	97.	4.6	8.1	6.3
45-49	260	106.	366.	58.1	17.9	35.1
50-54	-118.	36.	-82.	-23.9	7.1	-8.3
55-59	-9.	29.	20.	-2.2	7.2	2.4
60-64	46.	-19.	26.	15.9	-5.2	4.0
65-69	-89.	-28.	-117.	-30.5	-8.4	-18.7
70-74	-25.	-73.	-97.	-10.6	-20.9	-16.8
75-79	-43.	-11.	-54.	-21.9	-4.3	-11.7
80-84	3.	-1.	2.	2.8	-0.4	0.8
85+	4.	24.	28.	7.1	31.1	21.5
TOTAL	240.	250.	490.	1.9	2.0	2.0

TABLE 35

Total Population Change - Shoshone County - 1970-2000

AGE GROUP	MALE CHG	FEMALE CHG	TOTAL CHG	PCT M CHG	PCT F CHG	PCT T CHG
0- 4	507.	449.	956.	49.2	45.0	47.1
5- 9	314.	290.	604.	28.9	28.3	28.6
10-14	285.	245.	530.	27.7	24.6	26.1
15-19	324.	296.	619.	35.2	33.6	34.5
20-24	542.	345.	887.	92.4	48.0	68.0
25-29	309.	295.	604.	46.5	47.1	46.8
30-34	212.	268.	480.	34.9	49.3	41.7
35-39	391.	335.	726.	79.9	65.2	72.4
40-44	239.	310.	549.	41.6	60.6	50.6
45-49	124.	120.	244.	21.2	20.7	20.9
50-54	-277.	-43.	-320.	-42.5	-7.4	-26.0
55-59	-198.	-128.	-326.	-32.6	-22.8	-27.8
60-64	-180.	-86.	-266.	-35.1	-19.7	-28.0
65-69	-109.	47.	-61.	-34.8	18.1	-10.7
70-74	41.	118.	160.	24.6	75.9	49.4
75-79	53.	100.	153.	52.1	63.7	59.1
80-84	46.	81.	127.	73.0	89.7	82.8
85+	16.	44.	61.	40.7	76.3	61.8
TOTAL	2638.	3087.	5725.	26.3	31.8	29.0

TABLE 36

SHOSHONE COUNTY

F O R E C A S T S U M M A R Y

	1970	1975	1980	1985	1990	1995	2000
TOTAL POPULATION	19710	19940	21900	23170	24250	24950	25440
TOTAL EMPLOYMENT*	7940	8610	9260	9620	9980	10380	10810
LABOR FORCE**	8660	9630	9300	9640	9990	10380	10800
TOTAL SCHOOL ENROLLMENT	5070	5020	5400	5780	6320	6620	6690
Nursery	0	0	0	0	0	0	0
Kindergarten	290	330	400	450	480	480	480
Elementary	3350	3160	3370	3780	4140	4280	4260
High School	1300	1380	1460	1360	1520	1670	1750
College	120	140	160	170	170	180	190
HOUSEHOLD HEADS	6340	6240	6760	7030	7280	7340	7430

*Employment Base Year - 1972
**Labor Force Base Year - 1970
**Labor Force is dependent upon unemployment rate and the average number of jobs held by each worker.

TABLE 37

COMPONENTS OF POPULATION GROWTH - SHOSHONE COUNTY

S U M M A R Y

	1970-1975	1975-1980	1980-1985	1985-1990	1990-1995	1995-2000
TOTAL CHANGE	224	1964	1267	1086	693	490
NATURAL INCREASE	1481	1677	1932	1978	2008	2124
Births	2365	2582	2904	3003	3078	3207
Deaths	884	905	972	1025	1070	1083
MIGRATION	-1282	299	-677	-909	-1345	-1675
Employment	-1107	474	-502	-734	-1170	-1500
Retirement	-175	-175	-175	-175	-175	-175

Personal Economics

Personal income within the restoration project area fluctuates, in large part, with the activities in lumber and mining. Normally, per capita income falls below the national average. Table 38 compares the per capita personal income of Shoshone County with the other Panhandle counties, the U.S. and the State of Idaho.

In 1972, the Shoshone County ranked seventeenth in comparison to the rest of the state in terms of per capita income. A comparison of per capita personal income indicates that the county and region is losing ground.

By comparison, Table 38 shows that Shoshone County is the closest to the national average at 90 percent.

The Panhandle region's per capita disposable incomes and median family incomes fall well below the U.S. average. However, Shoshone County, due to its heavy mine industry employment, is near average. This not only enumerates the levels of poverty, but measures the degree of poverty against the U.S. average. As noted in Table 39, the Panhandle region's disposable per capita income was only 74 percent of the national average in 1969. The median family income was 82 percent for the same time period. However, Shoshone County has a per capita disposable income of 90 percent of the national average for the same time periods. This was equal to the state average.

The distribution of poverty level families is uneven throughout the region. As noted in Table 40, Shoshone County is significantly lower than the national average at 6.9 percent.

TABLE 38

Per Capita Personal Income, Percent of National Average for Selected Years 1959-1974

	1959	1965	1968	1969	1970	1971	1972	1973	1974
State of Idaho		88	79	82	83	83	83	87	90
Benewah County	62	75	73	73	71	73	73	78	82
Bonner County	71	69	61	61	64	66	69	67	64
Boundary County	72	67	66	66	75	75	76	79	84
Kootenai County	72	77	67	70	80	81	81	79	78
Shoshone County	102	101	94	94	85	85	83	83	90

TABLE 39

Per Capita Personal Income

For Selected Years 1950-1974

	1950	1959	1965	1968	1969	1970	1971	1972	1973	1974
TOTAL U.S.	$1,496	$2,161	$2,760	$3,422	$3,688	$3,964	$4,186	$4,560	$4,994	$5,465
TOTAL IDAHO			$2,450	$2,733	$3,062	$3,290	$3,475	$3,785	$4,435	$4,919
Benewah	$1,008	$1,334	$2,060	$2,516	$2,709	$2,819	$3,046	$3,331	$3,882	$4,504
Bonner	930	1,526	1,892	2,106	2,291	2,533	2,773	3,138	3,356	3,501
Boundary	1,090	1,556	1,844	2,261	2,425	2,982	3,147	3,452	3,931	4,607
Kootenai	1,129	1,546	2,130	2,298	2,578	3,161	3,395	3,680	3,955	4,245
Shoshone	1,897	2,172	2,785	3,229	3,451	3,352	3,570	3,776	4,153	4,930

TABLE 40

Personal Incomes for Shoshone County Panhandle Region, Idaho and the United States

	Shoshone County	Panhandle Region	United States
1969 Disposable Per Capita Income	2,901	2,318	3,130
1969 Mediam Family Incomes	8,855	8.116	9,867
Number of Families Below Poverty ($3,000)	359	2,451	
Percent of Families Below Poverty Line	6.9%	11.1%	9.3%

TABLE 41

Percent Frequency Distribution
Family Income by County

(1969 Dollars Per 1970 Families)

	Median Family Income	Total Fam. Units	Less than $1,000	$1,000 to $1,999	$2,000 to $2,999	$3,000 to $3,999	$4,000 to $4,999	$5,000 to $5,999	$6,000 to $6,999	$7,000 to $7,999	$8,000 to $8,999	$9,000 to $9,999	$10,000 & Over
Benewah	8,160	100	1.0	2.4	5.8	6.8	4.5	8.6	7.4	11.7	9.9	8.1	33.6
Bonner	7,579	100	3.3	5.1	7.5	6.2	7.4	8.0	8.6	6.9	9.9	6.8	30.4
Boundary	7,684	100	2.5	2.6	5.4	6.7	6.3	11.4	9.0	8.9	8.9	10.3	30.0
Kootenai	8,302	100	2.2	3.4	5.8	5.4	5.4	6.8	8.2	10.2	9.0	7.8	35.9
Shoshone	8,855	100	1.4	2.3	3.2	3.5	4.9	6.0	8.5	10.9	10.9	9.9	38.6
Panhandle	8,116	100	2.1	3.2	5.5	5.7	5.7	8.2	8.3	9.7	9.7	8.6	33.7

As indicated in Table 41, approximately 33 percent of the families in the Panhandle have incomes of $10,000 and greater. The cumulative income distribution in the Panhandle varies greatly. Figure 27 shows that Shoshone County income distribution is farthest from the line of absolute equality when compared to other Panhandle counties. These curves show that in Shoshone County 50 percent of the population have 12 percent of the income as compared to 26 percent for Bonner County.

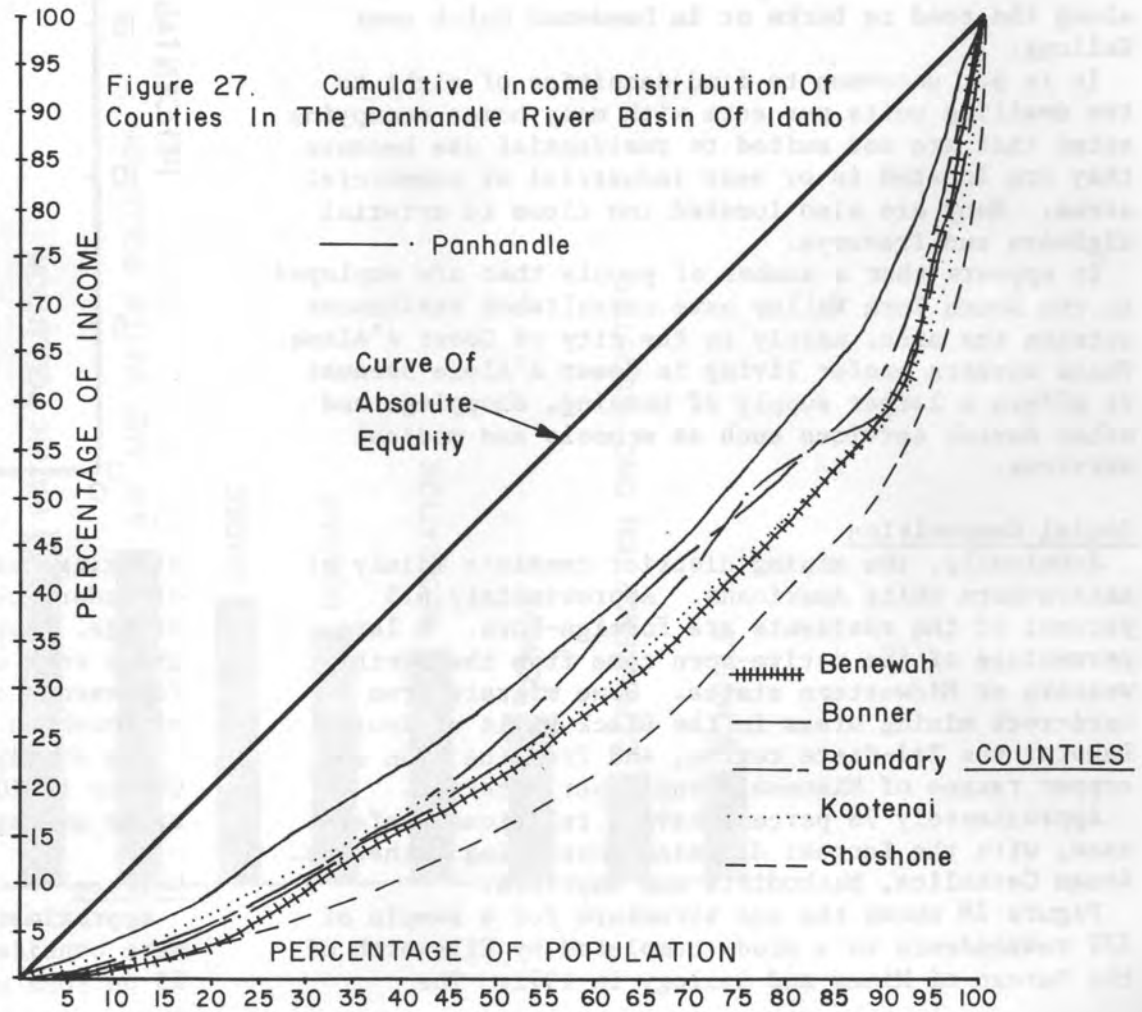
Per capita income for 1975 in Shoshone County is 5.3 percent below the national average, but 8 percent above the state average as shown in Table 42. Median family incomes for Shoshone County is $248.00 more than the state average.

TABLE 42

Shoshone County Per Capita Income
(1975)

Per Capita Income	$ 5,592
% of National Average	94.7%
% of State Average	108.0%
Median Family Income (1976)	$12,250
State Average	$12,202

Figure 27. Cumulative Income Distribution Of Counties In The Panhandle River Basin Of Idaho



Housing Conditions

There is a shortage of quality housing in the study area. Many of the incoming residents must make use of deteriorating or dilapidated dwellings due to a lack of adequate housing and building sites. Some residents are less willing to invest in better housing or have tended to be satisfied with "temporary" housing for longer periods of time due to economic uncertainties.

There are approximately 6,800 houses located in the county. Fifty-seven percent, or 3,850, of these were built prior to 1939. Nearly 29 percent of the existing houses can be classified as either "deteriorated" or "dilapidated". This rate is above the Idaho average of 21 percent. Forty-two percent of all units in Mullan fit in this combined category, as do 30 percent of Kellogg's housing units. Rundown housing is visible along Interstate 90 in Wallace and Osburn. Even more dilapidated structures are common along the road to Burke or in Deadwood Gulch near Kellogg.

It is not uncommon to find densities of eight to ten dwelling units per acre with many homes occupying sites that are not suited to residential use because they are located in or near industrial or commercial areas. Many are also located too close to arterial highways and freeways.

It appears that a number of people that are employed in the South Fork Valley have established residences outside the area, mainly in the city of Coeur d'Alene. These workers prefer living in Coeur d'Alene because it offers a larger supply of housing, shopping, and other social services such as schools and medical services.

Social Composition

Ethnically, the mining district consists mainly of native-born white Americans. Approximately 6.5 percent of the residents are foreign-born. A large percentage of the native-born come from the Northwestern or Midwestern states. Some migrate from hard-rock mining areas in the Black Hills of South Dakota, the Tri-State region, and from the iron and copper ranges of Minnesota and Upper Michigan.

Approximately 78 percent have a religious preference, with the largest denominations being Lutherans. Roman Catholics, Methodists and Baptists.

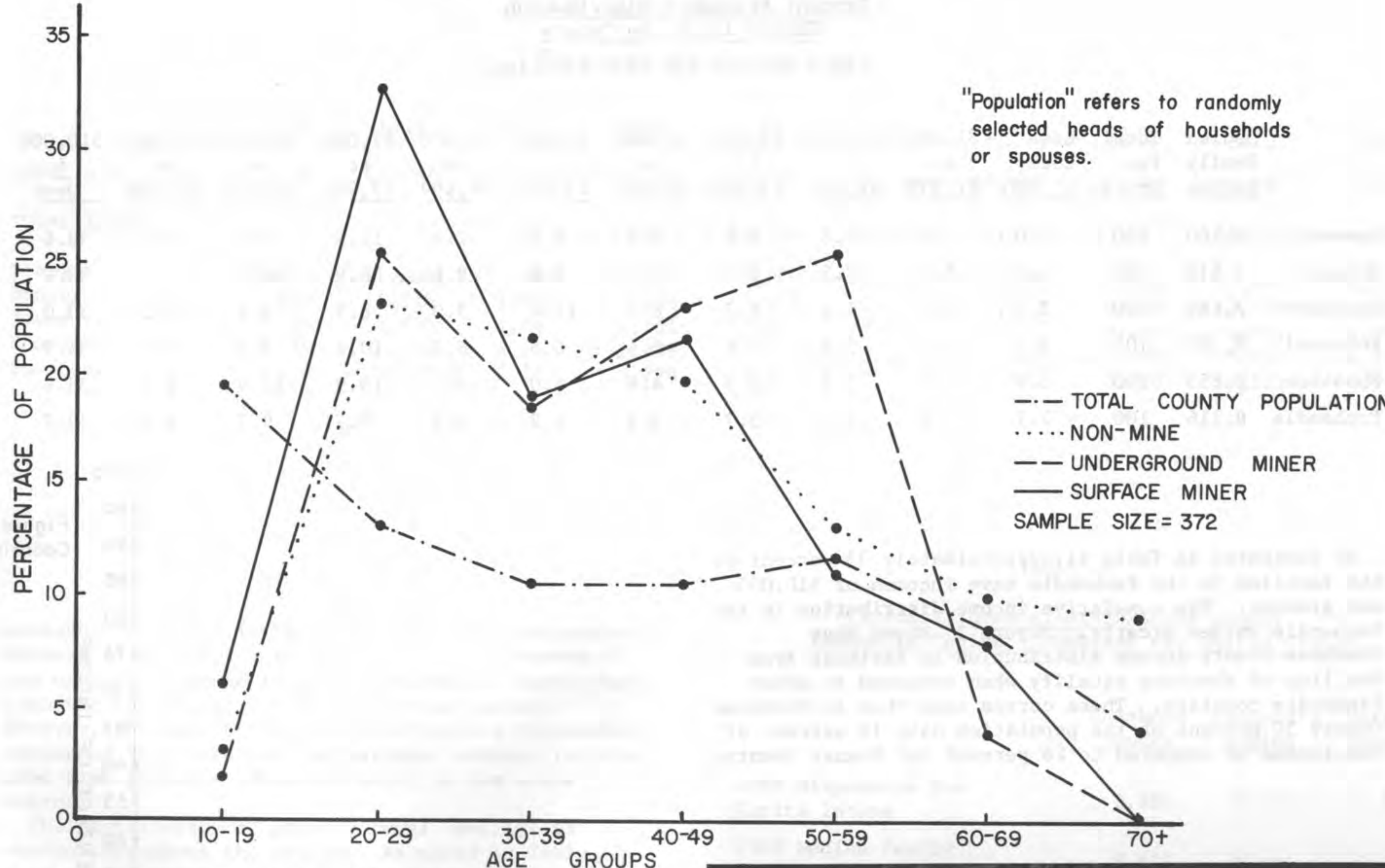
Figure 28 shows the age structure for a sample of 372 respondents to a study completed by Ellsworth of the Bureau of Mines and Geology in 1972. The striking feature in the graph is the large percentage of underground workers who are between 40 and 60 years of age. Approximately 25 percent of the 50-59 age group work underground. However, this age group represents only 12 percent of the total population of Shoshone County.

The average educational level of the Shoshone County is 10.8 years of schooling as compared to the state average of 11.8 years.

Welfare

Approximately 7 percent of the families in 1969 were considered below the poverty level. In 1975, 25 persons per month utilized old age benefits,

FIGURE 28
AGE GROUPING OF POPULATION



Run-down housing is prevalent within the Silver Valley.

585 received aid to families with dependent children, and 40 received aid to permanently or totally disabled benefits.

Health Care

In Shoshone County in 1975, there were 1,691 persons per medical doctor. This compares to the state average of 970 persons per medical doctor. There are two hospitals with a total of 96 bed-care units in the county.

Crime

Table 43 shows the number of criminal offenses in Shoshone County for the years 1973, 1975 and 1976. Aggravated assault and larceny show an increase over this time frame.

TABLE 43

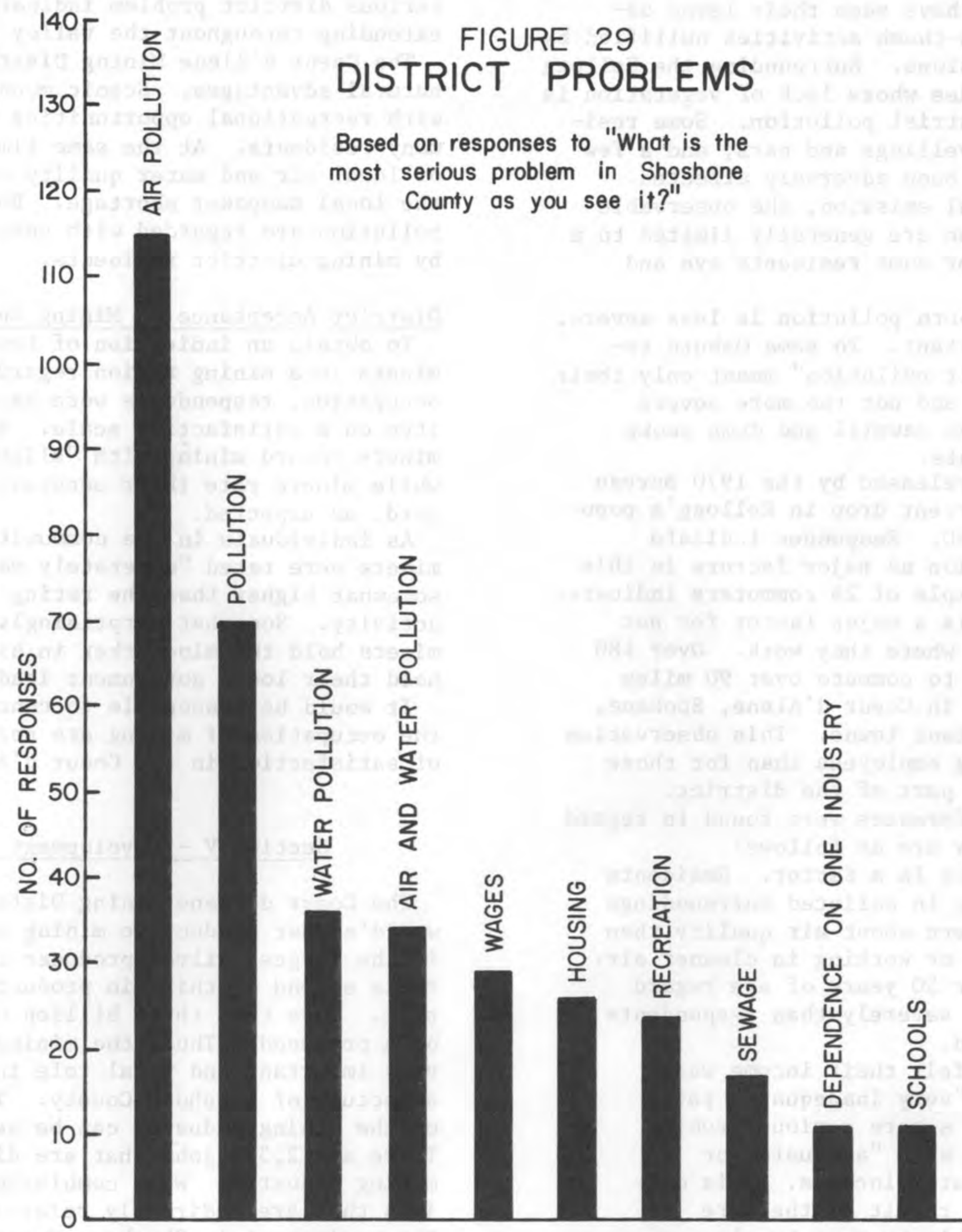
Crime - Number of Offenses

Crime	1973	1975	1976
Murder	--	1	2
Rape	2	1	2
Robbery	3	9	7
Aggravated Assault	26	22	36
Burglary	157	219	201
Larceny	208	373	385
Motor Vehicle Theft	33	23	24

The suicide rate per 100,000 persons in 1975 was 26.9 as compared to the state average of 16.4. The marriage rate per 1,000 persons was 9.7 as compared to 15.5 for the state. The county divorce rate per 1,000 persons in 1975 was 6.9 comparing to the state average of 6.3.

Residential Assessment of the Environment

The total physical environment of Shoshone County is the most important factor in creating a favorable public attitude toward living in the mining district. The majority favor the natural surroundings or climate as the main reasons for living in the area and are disturbed over the events that effect or alter their physical surroundings. Figure 29 lists areas considered by residents to be the problems in Shoshone County. Pollution of all sorts rated as the number one problem confronting the area. The major pollution



as viewed by the respondents is to the air. It should be noted that this survey was compiled prior to the installation of emission control equipment in the valley. These figures would vary if a more recent poll was taken.

Residents in Kellogg have seen their lawns destroyed and other green-thumb activities nullified by detrimental stack emissions. Surrounding the Kellogg area are barren hillsides whose lack of vegetation is blamed upon local industrial pollution. Some residents cite damage to dwellings and cars, and a few claim their health has been adversely affected. During periods of normal emission, the observable effects of air pollution are generally limited to a malodorous haze, and for some residents eye and throat irritation.

The effect of the Osburn pollution is less severe, but still locally important. To some Osburn respondents, the term "air pollution" meant only their immediate neighborhood and not the more severe problem in Kellogg. The sawmill and dump smoke irritates local residents.

Preliminary figures released by the 1970 Bureau of Census show a 26 percent drop in Kellogg's population from that of 1960. Responses indicate housing and air pollution as major factors in this population loss. A sample of 28 commuters indicates that poor air quality is a major factor for not living in the district where they work. Over 180 district workers chose to commute over 90 miles daily in order to live in Coeur d'Alene, Spokane, or several smaller distant towns. This observation applies more to Kellogg employees than for those working in the eastern part of the district.

Some attitudinal differences were found in regard to air pollution. They are as follows:

1. Place of residence is a factor. Residents living or working in polluted surroundings showed more concern about air quality than residents living or working in cleaner air.
2. Respondents under 50 years of age regard the problem more severely than respondents over 50 years old.
3. Respondents who felt their income was "inadequate" or "very inadequate" rated air pollution as a more serious problem than respondents with "adequate" or "more than adequate" incomes. This difference may be a result of the more affluent being able to move to cleaner surroundings.

Another element of the environment which received a large number of responses was water pollution. Almost all respondents live near the South Fork of the Coeur d'Alene River or one of its tributaries. Respondents who felt water pollution to be the most serious district problem indicated the problem as extending throughout the valley.

The Coeur d'Alene Mining District has striking natural advantages. Scenic mountain areas replete with recreational opportunities attract and hold many residents. At the same time, man's disturbance of local air and water quality has contributed to the local manpower shortage. Both air and water pollution are regarded with very much dissatisfaction by mining district residents.

District Acceptance of Mining and Miners

To obtain an indication of how miners and non-miners in a mining region regard mining as an occupation, respondents were asked to rate this item on a satisfaction scale. Results show non-miners regard mining with "slight satisfaction" while miners rate their occupation with higher regard, as expected.

As individuals in the communities of Shoshone County, miners were rated "moderately satisfactory" which was somewhat higher than the rating for mining as an activity. Somewhat surprisingly, both miners and non-miners hold the mineworker in higher regard than they hold their local government leaders and businessmen.

It would be reasonable to conclude that miners and the occupation of mining are accepted with some degree of satisfaction in the Coeur d'Alene mining district.

Section V - Development and the Economy

The Coeur d'Alene Mining District is one of the world's most productive mining areas. The district is the largest silver producer in the nation and ranks second or third in production of lead and zinc. More than three billion dollars in metals have been produced. Thus, the mining industry plays a very important and vital role in the economic structure of Shoshone County. The economic dependence on the mining industry can be seen from Table 44. There are 2,572 jobs that are directly related in the mining industry. When combining this figure with those jobs that are indirectly related, over two-thirds of the employment in Shoshone County are the result of the mining industry.

TABLE 44

Employment Summary

	1972	1975	1980	1985	1990	1995	2000
Agriculture	32	32	32	32	32	32	32
Mining	2290	2572	2572	2572	2572	2572	2572
Construction	216	427	531	585	638	707	783
Food and Kindred	8	2	2	2	2	2	2
Wood Products	286	259	291	320	352	380	411
Other Manufacturing	1408	1559	1728	1813	1885	1977	2074
Trans., Comm., and Utilities	200	218	240	253	267	281	297
Whsle. and Retail Trade	1356	1440	1595	1668	1742	1818	1898
Finance, Ins., and Real Estate	191	259	299	324	349	375	403
Services and Misc.	668	574	670	729	794	864	941
State and Local Government	1065	1065	1092	1116	1140	1163	1187
Federal Government	223	206	206	206	206	206	206
TOTALS	7943	8613	9261	9623	9981	10381	10811

It should be noted that the employment picture for Shoshone County will be relatively stable to year 2000.

Unemployment

Unemployment of the labor force in Shoshone County has increased from 4.8 percent in 1970 to 6.5 percent in 1976. Table 45 compares unemployment in Shoshone County to the state and national averages.

TABLE 45

Unemployment in Shoshone County

	1970	1972	1975	1976
Shoshone County	4.8	6.3	6.3	6.5
Idaho Average	5.8	6.2	7.3	6.7
National Average			8.5	7.7

Unemployment in Shoshone County for the years listed is slightly less than the Idaho average and considerably less than the national average. However, as shown in Table 46, the unemployment rate during November through April is substantially higher than that for the summer months. Highest unemployment occurs in April at 8.8 percent with the lowest in September at 4.1 percent.

TABLE 46

Shoshone County

Percent of Average Monthly Unemployment 1976

Month	Percent
January	8.7
February	8.1
March	7.9
April	8.8
May	6.5
June	5.6
July	4.8
August	4.3
September	4.1
October	5.0
November	6.7
December	7.8

In 1970, 31.3 percent of the females over 16 years of age were in the labor force.

CHAPTER 3

PROBLEM IDENTIFICATION

The South Fork Coeur d'Alene River Drainage has many problems which are related to man and his development efforts. This chapter identifies problems as they now exist so that recommendations for improvements can be made. Although there has been considerable improvements in several problem areas, further improvement is necessary before the Silver Valley can once again be physically, biologically and culturally stable.

CHAPTER III

A. FLOOD DAMAGE

Flooding constitutes a major problem within the South Fork Coeur d'Alene River drainage. It is the result of various natural conditions which include: spring snowmelt, winter or spring rains (often on frozen ground) and shifting of stream channels due to excessive bedload or accumulations of debris. Table 47 lists those streams which are considered to have flooding problems, along with their respective floods of record, discharge and damages.

Flood Damage in Shoshone County:

Flooding in Shoshone County can best be described by the flood which occurred in January 1974. The flood was classified as the "worst natural disaster" in the Gem State history.

Heavy rains, as much as 10 inches over a 4-day period, combined with unseasonally warm weather and resulting snowmelt set the stage for a flood causing damages to be in excess of $50 million. The snowpack at Mullan dropped from 23 inches to a mere 2 inches in less than 5 days. Tons of rain-loosened rock blocked Placer Creek causing the stream to overflow its banks. Worse flooding was reported in other areas of Shoshone County, particularly near Pinehurst and Silverton where waters were measured at 6 feet above flood stage. Over 700 homes were damaged in the Silver Valley and 1,000 persons displaced. No price could be placed on the disruption of normal life in the Silver Valley where schools and businesses were closed and telephone, electricity, water and natural gas services were rendered ineffective.

The mines of the region were hard hit as most operations were brought to a standstill except for efforts to keep flood waters from entering the mines.

More than 8 bridges were lost as were miles of roads. Several miles of dikes were washed away near Pinehurst. Although this flood was classified as the worst natural disaster in Idaho, no lives were lost.

TABLE 47

Major Floods

Stream	Date	Discharge (cfs)	Measured at	Damages (1967 Prices)	Frequency at which Major Damage Occurs	Avg. Annual Damage in Dollars (1967)
Coeur d'Alene River	Dec. 1933	67,000	Cataldo	2,219,000	60 Year	$ 40,000
	Apr. 1938	46,300		258,000		
	Dec. 1946	36,000		121,000		
	Dec. 1964	47,200		270,000		
	Jan. 1974	61,000		---		
Placer Creek	Dec. 1933	2,200	Wallace	1,097,000	15 Year	$105,000
	Dec. 1964	1,700		890,000		
	Jan. 1974	1,200		---		
Pine Creek	1964	4,100		38,000	10-15 year	$ 38,000
	1974	8,500		---		
South Fork Coeur d'Alene River	Jan. 1974	11,500	Smelterville	---		---

Flood damage was extensive during the 1974 flood.

This was an unusual flood caused by unusual conditions. However, flooding in the South Fork Valley is not unusual and some flood damage occurs on an annual basis. There are several reasons for this occurrence:

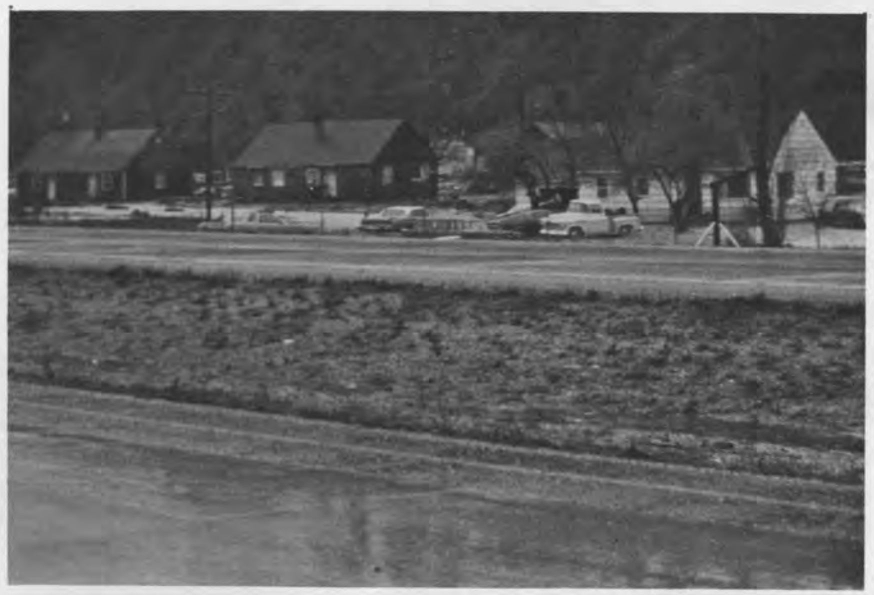
1. Quick Runoffs: Lack of vegetation on steep hillsides reduces the basin's ability to retain and retard spring runoffs. It is not rare to have heavy snowpact reduced in a very short time span due to the lack of trees for shade and thermal protection.

2. Frozen Ground: Many floods are caused by heavy rains on frozen ground resulting in large volumes of runoff in a short period of time.

3. Sedimentation and Bedload: The 1974 flood was partly the result of tremendous amounts of bedload being washed down from the steep hillsides and being transported downstream blocking culverts, bridges, and stream channels. Tributaries such as Canyon Creek, Nine-Mile, Pine Creek, etc. transport waves of gravel and bedload downstream into the South Fork.

4. Unstable Stream Channels: During periods of high flow, the South Fork wanders from side to side usually being contained between the freeway and the railroad tracks in many places. As it cuts through the old jig tailings and gravel deposits, tremendous volume is transported downstream decreasing the channel's ability to pass flood flows.

5. Floodplain Encroachment: Encroachment on flood plains, such as artificial fills, freeways, railroad embankments, and tailings ponds, reduces the flood-carrying capacity and increases flood heights, thus increasing flood hazards in areas beyond the encroachment itself. This also results in increasing flow velocities during flood stage.



Flood damage during the 1974 flood.

Existing flood control facilities in the South Fork area are as follows:

Stream	Location	Description
Coeur d'Alene River	Upstream from Coeur d'Alene Lake	Three levees totaling 10.9 miles (partly railroad embankment) along lower 13 miles of river. Levee 1/2 mile long on right bank at Dudley. Cataldo, Smelterville and Kellogg on South Fork protected by railroad and highway embankments. Provides 60-year flood protection.
Pine Creek	Pinehurst	Levee 2.25 miles long on right bank protects Pinehurst. Levee 0.2 miles long on left bank protects town of Pine Creek downstream. Old levee provided a 15-year protection. Newly constructed dike provides 100-year protection.
Placer Creek	Wallace	Partly lined channel 20 feet wide, 8 feet deep, and 3,100 feet of land. Partially protects town of Wallace.

Flood Damage to Cities:

City of Pinehurst

Pinehurst is located in a wide canyon in western Shoshone County. It is 6 miles west of Kellogg on Interstate Highway 90.

Most of the usable land within the corporate limits of Pinehurst has been developed with residential buildings, mobile homes, and some commercial establishments.

Pine Creek, from which the city obtained its name, originates in the rugged mountain terrain to the south. It enters the city at the southwest corner and flows approximately one mile along the western corporate limits, where it turns and flows east. It then flows along the northern corporate limits and joins the South Fork of the Coeur d'Alene River, approximately one mile downstream of Pinehurst.

Little Pine Creek flows through residential areas, then through a golf course near the central part of the city before entering Pine Creek near Interstate Highway 90.

Most of the incorporated areas of Pinehurst are subject to periodic flooding caused by overflow of Pine and Little Pine Creeks. Generally, floods occur between December and May as a result of heavy rain or melting snow. Intense thunderstorm activity can also cause flooding on the smaller Little Pine Creek, and affect flows also for Pine Creek.

Major flooding along the South Fork Coeur d'Alene River and tributaries occurred in 1896, 1917, 1933, 1938, 1964, and 1974. The most extensive damages in the basin occurred during the Decembers of 1933, 1964, and 1974.

Very little information for the 1933 flood on Pine Creek could be produced. However, in 1964 Pinehurst suffered one of its worst known floods. Even though the discharge was estimated at 3,800 cubic feet per second (cfs), which was approximately one-half of the estimated 1974 flood of 8,200 cfs, Pinehurst was flooded as a result of a levee failure. The community of Pinehurst was in danger of being completely cut-off due to high water. Emergency traffic only could use the bridge over Pine Creek below Shipletts service station at Main Avenue. Water had overtopped the bridge approaches and emergency crews had been trying to strengthen the bridge to keep it from washing out. Quite a number of Pinehurst homes in the lowland area had been under water, with basements being flooded and other damage prevalent. Pine Creek had broken through in the vicinity of Fourth Street and flooded much of the residential area of the town. Even though this flood did cover a large area of Pinehurst, there was very little structural damage and surface water generally did not exceed 18 inches in depth.

The 1964 flood would not have been as extensive if the levee had not failed. The flood is estimated to be approximately a 10-year event.

The 1974 flood was contained within the levee system and produced less flooding than the 1964 event. The estimated discharge of 8,500 cfs would be approximately a 50-year event. However, due to the protection of the levee, floodwaters covered only a small portion of the city's north side; water backed up at the Interstate Highway 90 bridge and its approach ramps. There were approximately 10 inches of water in a service station in this area, and water entered a KOA lodge.

Flood Protection Measures:

An old railroad grade was constructed in the early 1900's along Pine Creek. This grade, which has been reconstructed and is maintained by various agencies, acts as a levee system to protect Pinehurst from floodwaters of Pine Creek. After the levee break in 1964, the U.S. Army Corps of Engineers did extensive repairs to the levee. The levee was maintained by Shoshone County until 1970, when the City of Pinehurst was incorporated. It is capable of containing a 100-year flood. In 1974, the Idaho Division of Highways reconstructed the off-ramp bridge over Pine Creek just downstream of Pinehurst corporate limits. They also did channel alignment work near Interstate Highway 90 and Main Street. Also, a concrete floodwall was built on the right bank of Pine Creek near Interstate Highway 90. These improvements had a beneficial impact on the flooding problems and potential near the northern corporate limits of Pinehurst.

No other flood protection measures, either structural or nonstructural (zoning ordinances), are known to exist for flooding problems on Pine Creek at Pinehurst.

A detailed map delineating the 100-year flood zone for Pinehurst is located in Figure 30.

City of Kellogg

The City of Kellogg is located along the South Fork Coeur d'Alene River, in north-central Shoshone County.

The topography surrounding Kellogg is generally rough, consisting primarily of forested semi-mountainous to mountainous terrain, with comparatively narrow valleys. The high massive mountains and inter-mountain valleys are characteristic of the northern Rocky Mountain province in which Kellogg lies.

City stream patterns reflect the variations in topography. Steep slopes and severe lack of vegetative cover in the lower elevations have caused rapid runoff in Milo Creek drainage. Milo Creek watershed has been affected by development of a major ski resort just south of the city. Other small tributaries drain from mountainous terrain with very high relief. Just before joining the South Fork Coeur d'Alene River, most tributaries empty out into what is known as alluvial fan flow.

The South Fork Coeur d'Alene River flood plain contains relatively flat, highly developed urban areas, and is typical of the most usuable land throughout Kellogg.

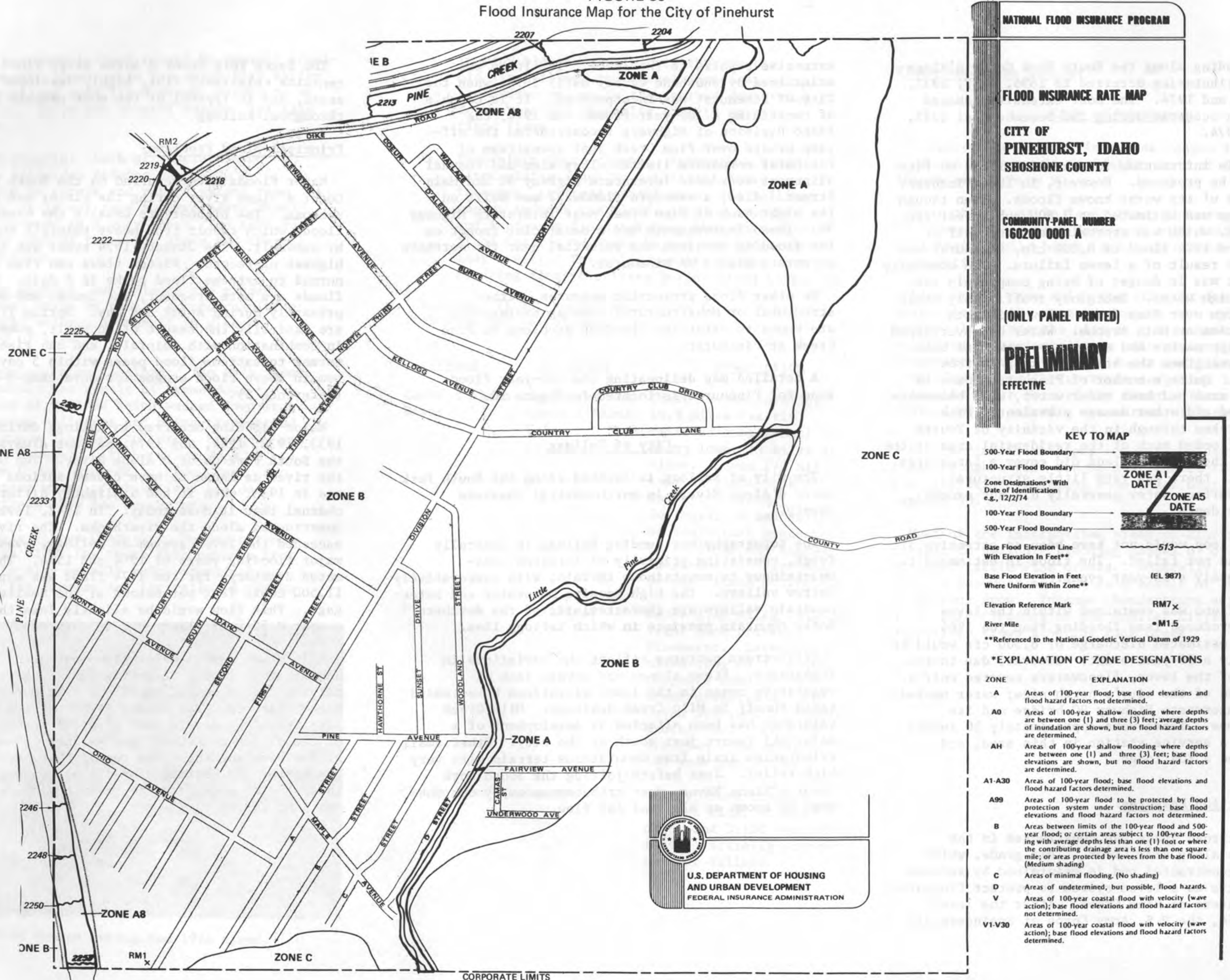
Principal Flood Problems:

Major floods have occurred on the South Fork Coeur d'Alene River during the winter and spring seasons. The highest are usually the winter floods which result from heavy rainfall augmented by snowmelt. The January 1974 event was the highest of record. Winter flows can rise from normal to extreme flood peaks in 2 days. Spring floods are more frequent, but lower, and occur primarily during April and May. Spring floods are basically the result of snowmelt, sometimes in combination with rainfall, and can rise from normal to extreme flood peaks within 5 days and remain above flood stages for more than 2 weeks (Reference 5).

Major flooding occurred in Kellogg during 1917, 1933, 1938, 1964, and 1974, but not always from the South Fork Coeur d'Alene River. The only time the river is known to have caused serious flooding was in 1933, when it had a slightly different channel than it does today. In 1942, levees were constructed along the riverbanks. The river has not exceeded the levee system in Kellogg, even in the major flooding years of 1964 and 1974. The estimated discharge for the 1974 flood was approximately 11,500 cubic feet per second at the Smelterville gage. This flow would be slightly less than the computed 50-year flood used in this study.

Milo Creek caused major flooding during the January 1974 flood. A debris jam in the existing culvert system caused overflows near Maple and Market Streets. The recent problems have been complicated by development of a ski resort south of the cities of Kellogg and Wardner. Newly groomed slopes have augmented the runoff characteristics of the basin. No estimates of discharges were made for this stream; therefore, no frequency could be assigned to the event.

FIGURE 30
Flood Insurance Map for the City of Pinehurst



Other smaller streams have caused shallow flooding in the past. Jackass Creek, approximately 20 years ago, caused problems to the newly constructed hospital and the school located along the creek. Italian Gulch flooded during 1964, but structural improvements since that time have alleviated some of the flooding potential. This area is a good example of alluvial fan flow in conjunction with a defined channel. Deadwood Creek caused some flooding to houses in 1964. These houses, however, have been purchased and removed by the Bunker Hill Mining Company.

Flood Protection Measures:

A levee system built in 1942 along the South Fork Coeur d'Alene River is the only major flood protection structure in the city. The system is augmented by the Interstate Highway 90 embankment along the right bank of the river. Water can escape the embankment into the low-lying areas along the north side of the highway by flowing through the underpasses of Division and Hill Streets. Also, there is a low area in the left bank levee just downstream of Division Street. This low area (as it now stands) would allow flows to escape southwest out of the river system during the higher events. Milo Creek flows underground in a culvert system through Kellogg. The system is in great need of repair. Flooding problems are increased by debris collection on the culvert entrances and clogging in the culverts which causes water to outcrop and flow through the city.

Since the 1964 flood, an additional 30-inch culvert, placed along an existing 48-inch culvert in Italian Gulch, has lessened the flooding potential.

No other flood protection measures, either structural or nonstructural (zoning ordinaces), are known to exist.

A detailed map delineating the 100-year flood zone for Kellogg is located in Figure 31.

City of Osburn

On fairly flat land, the City of Osburn is 4 miles northwest of Wallace. Almost all of Osburn is on the valley floor of the South Fork Coeur d'Alene River. The city land lends itself to residential and commercial development. The South Fork Coeur d'Alene River drains to the west and, beginning from the Idaho-Montana border, includes major drainages, such as Canyon Creek, Placer Creek, and Nine-Mile Creek, before passing Osburn. The river drains forested to semi-forested mountainous areas with elevations ranging up from above 6,000 feet.

Shields Gulch, McFarren Gulch, Meyers Gulch, and Rosebud Gulch all flow in the South Fork Coeur d'Alene River from the south. All have very steep drainages with heavy growths of timber upstream of the corporate limits. Elevations being as high as 5,585 feet and reach 2,550 feet in approximately 2.5 miles, thus having the potential of high bedload-carrying capability for the area. Upon reaching the South Fork Coeur d'Alene River, the gulches empty out onto alluvial fan areas. These have been developed with residential-type structures and continue to be used, as there is very little other flat land available in the South Fork Coeur d'Alene River drainage.

Surrounding the small valley and in the general river corridor, soil and slope conditions are rated very critical as the mines area of Shoshone County has denuded steep slopes.

Soil problems relate to the moderate and steep slopes in many areas, the sand-gravelly soils formed in glacial material, and restricted permeability and clayey textures typical of many soils formed in old lake sediments.

Principal Flood Problems:

The City of Osburn is in a rather unique flood prone area. Not only is it susceptible to riverine flooding from the South Fork Coeur d'Alene River, but also to fan flooding from several gulches to the south. In periods of heavy rainfall, these small gulches drain quickly and carry much alluvial soil which, when reaching the valley flood, may be deposited in one place one time and another place another time. This deposition causes flow patterns that are extremely hard to predict.

Major floods have occurred in the South Fork Coeur d'Alene River basin during the winter and spring seasons. The highest floods are usually the winter floods, which result from heavy rainfall augmented by snowmelt. The winter flood of January 1974 was the highest of record. Winter flows can rise from normal to extreme flood peaks in 2 days. Spring floods are more frequent, but lower, occurring primarily during the months of April and May. Spring floods are basically the result of snowmelt, sometimes in combination with rainfall, and can rise from normal to extreme flood peaks within 5 days and remain above flood stages for more than 2 weeks.

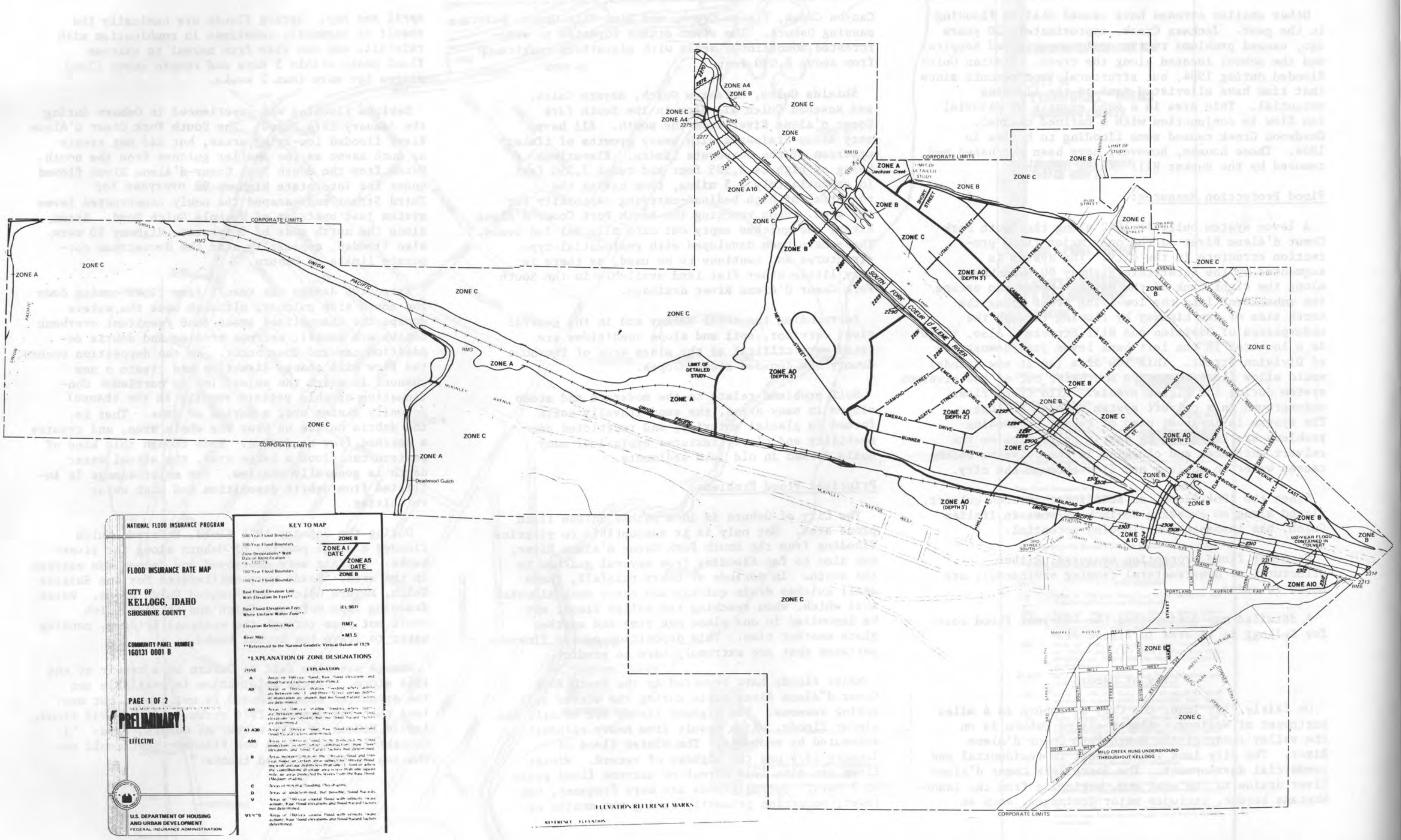
Serious flooding was experienced in Osburn during the January 1974 flood. The South Fork Coeur d'Alene River flooded low-lying areas, but did not create as much havoc as the smaller gulches from the south. Water from the South Fork Coeur d'Alene River flowed under the Interstate Highway 90 overpass for Third Street and escaped the newly constructed levee system just upstream of Nuchols Gulch Road. Areas along the north side of Interstate Highway 90 were also flooded, especially near the downstream corporate limits of Osburn.

Extensive damage can result from flows coming down the south side gulches, although once the waters escape the channelized areas (and resultant overbank depths are small), extreme erosion and debris deposition can and does occur. As the deposition occurs, the flow will change direction and create a new channel in which the major flow is carried. Continuation of this pattern results in the channel actually rising over a period of time. That is, the debris builds up over the whole area, and creates a perched flow condition. Even though this kind of pattern can flood a large area, the actual water depth is generally shallow. The major damage is inflicted from debris deposition and high water velocities.

During the January 1974 flood, McFarren Gulch flooded a large portion of Osburn along the riverbanks. Bridges were destroyed and damage was extreme in the area. Roads were obliterated for the Shields Gulch, Meyers Gulch, and Rosebud Gulch areas. Water draining from McFarren Gulch and Shields Gulch could not pass through the railroad bridges, causing water to leave the normal banks.

Damage was also felt in Osburn as a result of the 1964 storm. Little information is available and the extent of areas flooded is not known, but was less than the January 1974 storm. Of the 1933 flood, Arnold McCann, a city worker of Osburn, said: "I thought the whole town was flooded--just could see the top of the railroad tracks."

FIGURE 31
Flood Insurance Map for the City of Kellogg



The January 1974 event, however, is the greatest of those remembered. Flows in the South Fork Coeur d'Alene River reached approximately a 50-year frequency flood. No flow information is available on the small gulches. Therefore, no frequency could be assigned to the flooding events. Other major floods in the area occurred in 1896, 1917, and 1938.

Flood Protection Measures:

Three structural improvements were installed within the City of Osburn to protect low-lying areas in the community.

A levee system along the South Fork Coeur d'Alene River, upstream of Nuchols Gulch Road, was constructed by ASARCO. Also, the Interstate Highway 90 embankment acts as a levee on the left bank. However, the floodwaters can flow into the low-lying areas of Osburn through culverts and overpasses which were not designed to contain the higher floodflows.

The U.S. Army Corps of Engineers installed an impoundment area on Meyers Gulch just upstream of the Osburn corporate limits. This impoundment collects the smaller frequency floodflows which are then removed by a culvert system installed by the city.

A channel alteration of McFarren Gulch directs flows from this area straight through the city, to join the South Fork Coeur d'Alene River. Dikes have been constructed for this area along Jefferson Street.

No other flood protection measures, either structural or nonstructural (zoning ordinances), are known to exist on streams studied within Osburn which would have an effect on the base flood elevations.

A detailed map delineating the 100-year flood zone for Osburn is located in Figure 32.

City of Wallace

The City of Wallace is located in northeastern Shoshone County along the South Fork Coeur d'Alene River. The City of Kellogg is approximately 10 miles west, while Missoula, Montana, is 125 miles east.

Wallace, which was first settled as a placer mining camp in 1864, was incorporated in 1888 and became the county seat of Shoshone County in 1898.

Wallace is inhabited by approximately 2,200 residents, with housing located along the canyon floor and up the steep slopes. Smaller, unincorporated communities nearby are Woodland Park, Nine-Mile, and Silverton; the communities share many of the same characteristics and services.

Canyon Creek, Nine-Mile Creek, and Placer Creek join the South Fork Coeur d'Alene River within the corporate limits of Wallace. The South Fork Coeur d'Alene River, and its tributaries near Wallace, are all reflective of mountainous streams.

They all have high relief. The South Fork drainage has elevations as high as 6,800 feet, Placer Creek as high as 6,400 feet, and Canyon Creek up to 6,800 feet. The mean elevation at Wallace is approximately 2,750 feet.

The South Fork Coeur d'Alene River flows east to west and drains approximately a 50-square mile area upstream of Canyon Creek. Canyon Creek adds 22 square miles and flows north to south. Placer Creek drains approximately a 16-square mile area to the south of the river and flows south to north approximately 7.5 miles before discharging into the South Fork Coeur d'Alene River.

The Bitterroot Mountains have a pronounced influence on the climate of Wallace, Idaho. The lifting of air over these mountains is a triggering mechanism for instability which results in the intensifying and lengthening of storm systems. In Wallace, precipitation normally amounts to approximately 40 inches annually. July is the driest month and December is the wettest, with averages of 1 inch and 6 inches, respectively.

Principal Flood Problems:

Major floods occur in the South Fork Coeur d'Alene River basin during the winter and spring seasons. The largest floods are ususally the winter floods, which result from heavy rainfall augmented by snowmelt. Winter flows can rise from normal to extreme flood peaks in 2 days.

Spring floods are more frequent, but smaller, and occur primarily during the months of April and May. Spring floods are basically the result of snowmelt, sometimes in combination with rainfall, and can rise from normal to extreme flood peaks within 5 days and remain above flood stages for more than 2 weeks.

From 1896 to present, 6 major floods have been experienced at Wallace. These floods occurred in 1896, 1917, 1933, 1938, 1964, and 1974.

Flood problems in Wallace result from inadequate channel capacity, restrictions at bridges and culverts which catch debris and dam the channel during floods. Inadequately constructed channel walls become undermined and add to the debris load and damming of the streams during floods. High velocity overbank flows cause damage through inundation and the movement and deposition of debris.

In 1933, floodwaters from the South Fork Coeur d'Alene River inundated a large area of the city. However, the damage resulting from this flood was minor due to shallow overbank depths.

In 1938, the South Fork Coeur d'Alene River channel contained the high-water flows, causing only minimal local flooding.

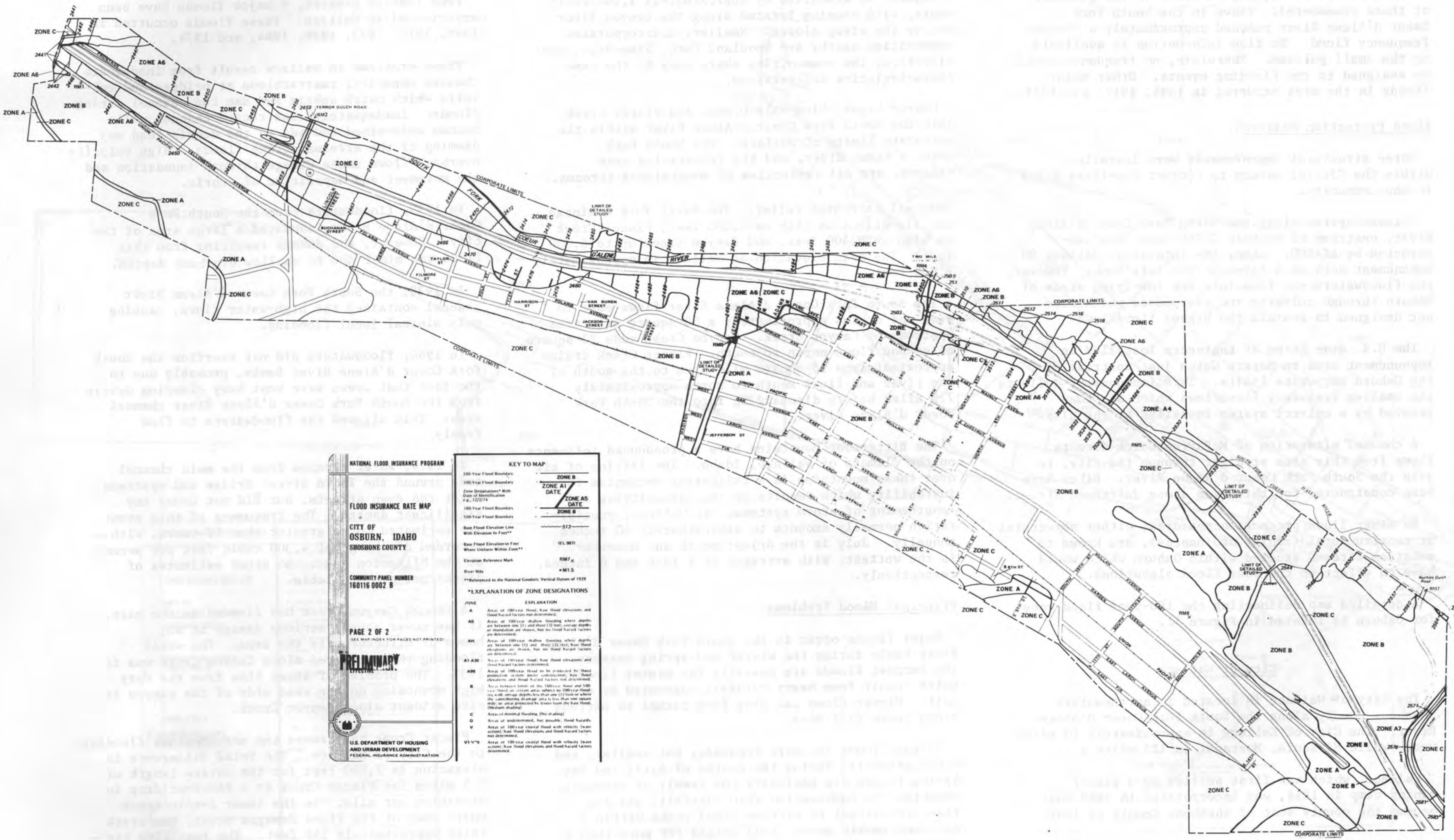
In 1964, floodwaters did not overflow the South Fork Coeur d'Alene River Banks, probably due to the fact that crews were kept busy cleaning debris from the South Fork Coeur d'Alene River channel area. This allowed the floodwaters to flow freely.

In 1974, water escaped from the main channel area around the Third Street Bridge and upstream. Water ran down streets, but did not cause any significant damage. The frequency of this event was estimated to be greater than 10 years, with a recorded discharge of 4,300 cubic feet per second at the Silverton gage. No other estimates of discharges are available.

Although Canyon Creek has flooded in the past, it has never caused serious damage to any homes or structures in the area. The worst flooding that occurred along Canyon Creek was in 1933. The problem of sheet flow from the very high mountains on the west side of the canyon is also evident along Canyon Creek.

Placer Creek has caused the most serious flooding to the City of Wallace. The total difference in elevation is 1,800 feet for the entire length of 7.5 miles for Placer Creek or a 240-foot drop in elevation per mile. In the lower 1-mile reach where most of the flood damages occur, the creek falls approximately 140 feet. The resulting high-velocity floodflows in this reach are extremely

FIGURE 32
Flood Insurance Map for the City of Osburn



turbulent, undermining and destroying existing channel walls, causing debris jams and overbank flows.

Once the waters escape the channelized areas, extreme erosion and debris deposition occurs. As this deposition occurs, flows change direction and create new channels in which the major overbank flow is carried. Continuation of this pattern results in the channel actually rising over a period of time. That is, the debris builds up over the whole area, and creates a perched flow condition. Even though this kind of pattern can cause flood damage to a large area, the actual water depth is generally shallow. The major damage is inflicted from debris deposition and high velocities of water.

During 1917, Wallace felt the ravages of Placer Creek leaving heavy losses along its banks. The heavy snows were followed by steady rain for more than a week, which culminated in a terrific downpour. As a result, homes were wrecked along the stream, houses were carried down intact with contents, and some of the most beautiful homes in the city were undermined.

Flooding in 1933 was more damaging in the lower reaches of the stream, but less damaging than the 1917 flooding in the upper reaches. Newspaper accounts reveal that the lower one-mile reach of the channel was filled with logs, boulders, and debris composed mainly of destroyed channel structures and material from burned-over forest land in the upper reaches of the basin. The stream overflowed its banks and inundated the western section of Wallace on both sides of the creek. This flood was the worst flood on record for Placer Creek, with a computed frequency greater than 50 years and an estimated discharge of 2,200 cubic feet per second.

The December 1964 flood was caused by a combination of heavy rainfall and warm weather resulting in a thawing of the snowpack. In a 24-hour period, approximately 2.5 inches of rain fell, and the temperature rose to 48°F. Placer Creek reached an estimated peak flow of 1,700 cubic feet per second at its mouth. During this flood, high flows severely eroded the channel, undermining the timber cribbing and concrete walls. Debris from the damaged log crib and concrete channel structures aggravated the flood problem.

During the 1974 flood, Placer Creek again severely damaged several homes in Wallace. Floodwaters along Placer Creek eroded the constructed concrete channel in several places. An earth barrier placed across King Street kept the stream from washing out several more homes and inflicting more serious erosion and damage. The danger of flooding caused the evacuation of the residents of King Street. The estimated peak discharge for Placer Creek during 1974 was 1,200 cubic feet per second which would make this event less than a 10-year flood.

<u>Flood Protection Measures</u>:

The City of Wallace has intermittently improved the channels of both South Fork Coeur d'Alene River and Placer Creek. The lower 4,000 feet of Placer Creek has been cleared, straightened, and enlarged. In addition, concrete and log crib walls have been constructed. A concrete flume approximately 550 feet long was constructed at the downstream end of the creek by the Works Progress Administration during the early 1930's.

Many of the remaining improvements were severely damaged during the 1964 and 1974 floods. Following these floods, the U.S. Army Corps of Engineers, aided by the City, repaired damaged areas of Placer Creek under the authority of Public Laws 875 and 99.

The improvements are now in good condition, but are of a temporary nature and would not withstand a flood the magnitude of the 1964 event. The safe carrying capacity of the channel is estimated to be approximately 1,000 cubic feet per second, comparable to a 3-year flood event.

A proposed improvement by the U.S. Army Corps of Engineers would consist generally of construction of a reinforced concrete channel in the lower 5,000-foot reach of Placer Creek, with a debris barrier upstream of the concrete channel.

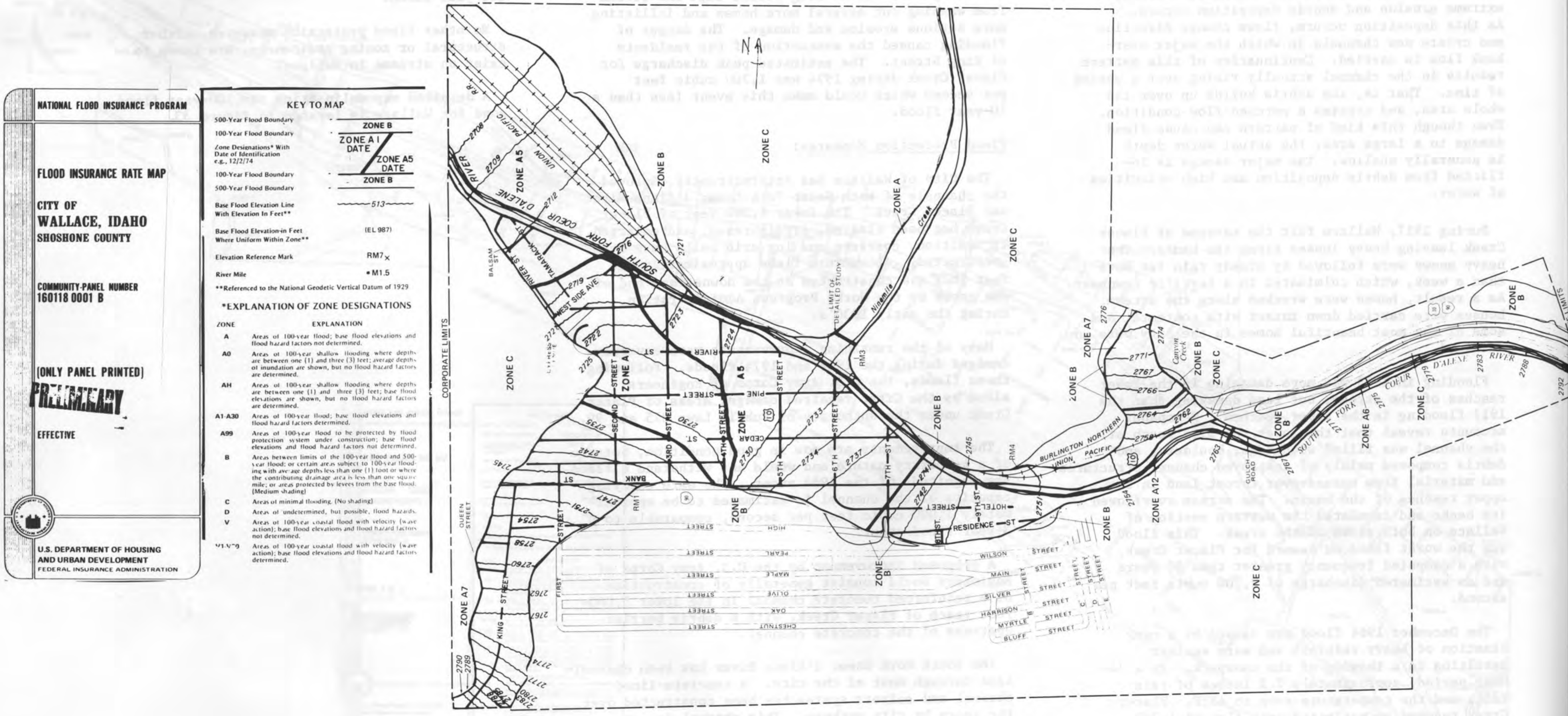
The South Fork Coeur d'Alene River has been channelized through most of the city. A concrete-lined channel and culvert system has been constructed over the years by city workers. This channel is, at present, in good condition but does not provide capacity for the 100-year flood.

The lower portion of Canyon Creek also has been channeled to provide usable land near the mouth of the creek. This area is actually an old alluvial fan. The channelization created a delta area on which houses and some industry have been constructed which are not protected from flows produced by the 100-year flood.

No other flood protection measures, either structural or zoning ordinances, are known to exist on streams in Wallace.

A detailed map delineating the 100-year flood zone for Wallace is located in Figure 33.

FIGURE 33
Flood Insurance Map for the City of Wallace



B. AESTHETICS

The term aesthetics may not convey the same meaning to each individual, but it does relate in most cases to a person's general perception and appreciation of nature and its beauty. Aesthetics play a very real and important role in everyone's lives. The aesthetic impact of an area can be determined by assessing two components--public visibility and visual quality.

Visual degradation within the study area can readily be seen while traveling via Interstate 90. This is due to the relatively narrow valley with steep slopes which are easily noticeable from the time one first enters the valley at Cataldo until he leaves the area at Mullan.

Numerous activities and events have transpired throughout the last century which have turned a once beautiful region into an area that resembles a hard-fought battle field. To better describe how man's past and present activities have affected the visual quality of the area, this section is broken into three areas--air, water and land.

Air

While the aesthetic value of air may not be considered a major attractive force to an area, it is most certainly a contributary factor for overall consideration. It is difficult to speak of aesthetics without simultaneously discussing air quality.

Generally, the atmospheric quality in the study area has been improving since the installation and use of the two tall smelter stacks within the Kellogg-Smelterville area. Emissions from these stacks still dispense a noxious aroma throughout the area, but to a lesser degree. The smelter smoke generally leaves a noticeable haze hanging in the air which is magnified during periods of temperature inversions.

Water

Large deposition of mine waste have accumulated in the floodway, resulting in a highly unstable channel which wanders throughout the valley and prohibits the establishment of vegetation. Streambank erosion can be seen in many places from the freeway.

The effects of past flooding has left its mark, leaving piles of rock and debris scattered upon the flood plain.

The use of tailings impoundments in the Silver Valley has contributed to the overall visual degradation. Many have been seeded with minor success, but overall appearance in many cases still resemble large piles of earth and rock.

The entire stream channel has at one time or another been dredged, bulldozed, channelized, and encroached upon.

Piles of debris lie within the floodplain.

The unstable banks degrade the aesthetics of the valley.

Land

The most basic aspect of aesthetic quality for an area is man's impact upon the land and land-related resources.

Discovery of galena in 1885 led to the digging, blasting and tunneling into the slopes above the South Fork and tributaries resulting in millions of tons of waste rock which has been scattered in the vicinity of the mine openings. Remnants of this activity are very prominent throughout the project area.

Along with the development of the mining industry came the construction of roads, railroads, bridges and later a freeway, all located within the narrow confines of the valley. Construction of these facilities not only encroached upon the river, but left ugly scars on the steep hillsides. Construction of industrial buildings, smoke stacks, mills, storage dumps, railroad yards, gravel pits, etc. all detact from the aesthetics of the valley.

Remenants of the 1910 and 1934 forest fires are still visible.

Construction of Interstate 90 above Mullan left scars on the hillsides as shown on the upper half of this photo.

Remnants of the 1910 and 1934 forest fires still exist with burnt stumps and logs visible in many areas. In addition, air pollution from the smelter has denuded the hillsides for several miles in each direction. Excessive soil erosion of the steep slopes in the vicinity of the smelter has left deep ruts and rills on the barren hillsides.

As with any mining community which was developed early in the statehood of Idaho, many old and abandoned buildings are still in existence. Rundown housing is visible along Interstate 90 in Wallace and Osburn. Even more delapidated structures are common along the road to Burke or in Deadwood Gulch near Kellogg.

Abandoned mine areas can be seen from Interstate 90.

C. LAND USE PROBLEMS

Land use problems have been identified along with recommendations in the "County of Shoshone Comprehensive Plan", a joint planning effort by the Shoshone County Planning and Zoning Commission and the Joint City-Council Planning Council of Shoshone County. Land use problems as identified in this report are as follows:

The severe topography of the region leaves a limited amount of land available for urban development. In the entire area, the amount of buildable land is approximately 22 square miles. Large areas are needed in connection with the mining operations, particularly for tailings ponds. The nature of the industrial activities in the area is such that a buffer area of open space is desirable around industrial areas.

The cities of Kellogg, Wallace, and Mullan are almost fully built up, and any extensive development in the future will first require the removal of existing structures. Only Pinehurst and Osburn have any large amounts of buildable vacant land.

The land use problem which has the largest impact upon the area is the encroachment upon the floodway of the South Fork Coeur d'Alene River. A narrow valley with extremely steep slopes have limited the original flood plain to area which in itself was not adequate to pass flood flows. This inability has been expanded further with the construction of the Interstate 90 and the railroad. The advent of tailings ponds adds further to the problem. In many cases the only available sites suitable for these impoundments are located within the flood plain. The problem occurs when the site is selected without considering the hydrologic criteria for that area. Some failures have resulted during floodflows causing damage to water quality, fish habitat and vegetation.

D. WATER QUALITY

Following Noah Kellogg's discovery of galena in 1885, waste products from the mining industry were deposited directly into the South Fork and its tributaries. This continued until 1968.

Early equipment used in processing the ores were stamp mills using mechanical hammers for crushing the ore to a fine powder. These early mills utilized gravity type jigs and tables for ore separation. Jigging is a mechanical gravity concentration process which is used to separate heavy and light grains resulting from the crushing of ore. In its simplest form, a jig consisted of a box without a top and with a perforated bottom. A shallow bed of grains was formed by fluctuating water currents. The heavy grains passed to the bottom, intermediate mixtures remained in the middle, and the lightest rose to the top of the bed. These operations contributed large volumes of waste pulverized rock along with some particles of ore which escaped the horizontal grooves on the jig tables. Zinc was not recovered during the process. The tremendous mass of mill tailings from this period was high in zinc and lead sulfides.

In 1928, a more efficient selective floatation method for processing ores was instituted, resulting in the nearly complete extraction of all metals of economic importance. The waste slimes from this process were high in various residues of metals and chemical additives and were discharged for the most part directly into the river.

Due to these past mining practices, tremendous amounts of mill tailings have been deposited throughout the valley floor and, when mixed with river gravels, compose the upper 8 to 10 feet. It has been estimated that approximately 500,000 tons were discharged into the river annually. Spring runoff works through these deposits and the old jig tailings from year to year. Therefore, water quality problems will exist until the stream channel can be stabilized.

Subaerial oxidation of heavy metal sulfides in exposed tailings ponds and subsequent leaching has contributed ions of heavy metals to the streams and groundwater. Groundwater from the South Fork Valley is unsuitable or of low quality for domestic use, due to high concentrations of calcium, cadmium, magnesium, manganese, and zinc. Groundwater data obtained from the Smelterville Flats showed zinc concentrations as high as 60 to 100 ppm. The

Confluence of the South Fork with the main Coeur d'Alene River. Notice difference in water quality.

Mine with acid drainage effects water quality in the South Fork.

sediments in the vicinity of those wells contain deposits of jig tailings mixed with alluvium of the valley and could be subject to the leaching effects. The amount of zinc carried by groundwater through a valley cross-section at Smelterville was computed to be approximately 330 pounds/day in 1974. The polluted groundwater discharges into the Coeur d'Alene River and effects the water quality of the river.

Precipitated materials from mine wastes deposited in the river and streams throughout the years have cemented cobble and stones to the river bottom and covered them with a crust which is not conducive to the support of aquatic intervertebrate communities. Toxic concentrations of lead as high as 19 mg/ℓ in the vicinity of the smelters have been measured. As a result, the South Fork supports no growths of aquatic vegetation or organisms. Live-box tests conducted by the Idaho Department of Fish and Game in the summer of 1973, demonstrated the effect of the river's environment on supporting fish. All rainbow trout placed in boxes at 11 points along the South Fork were dead within 72 hours. Trout put in boxes at Smelterville died within 5 hours.

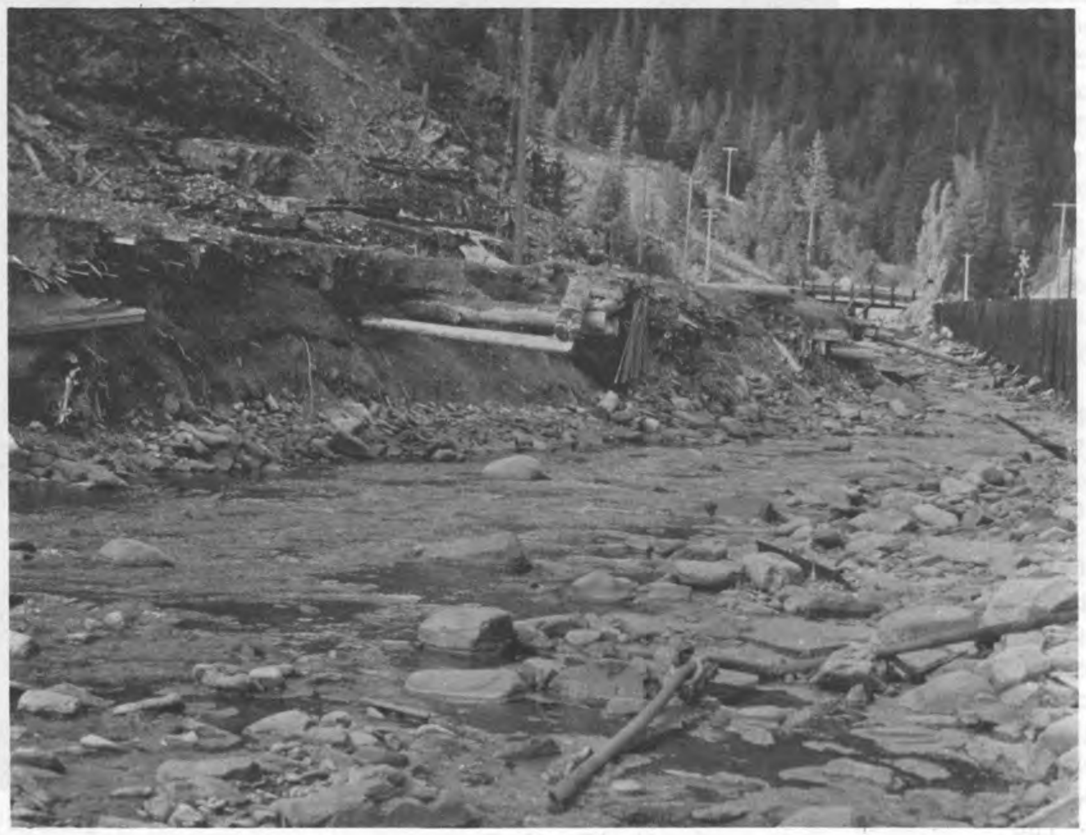
Until recently, raw sewage from approximately 10,000 residents was dumped directly into the river causing high coliform bacterial counts. In 1972, the citizens voted to approve a sewer bond issue and the South Fork Sewer District was formed. It should be noted that the sewage from the community of Kellogg was being treated along with mine wastes in the Bunker Hill Company's tailings pond.

Lack of vegetation on the steep hillsides lessens the ability of the land to retain moisture thus creating soil erosion. This results in large quantities of bedload material during periods of excessive rainfall and spring runoff.

All of the above conditions have created water quality problems in the South Fork from the town of Mullan downstream to Coeur d'Alene Lake. Samples of water taken from the Spokane River (Coeur d'Alene Lake's outlet river) had indicated the presence of zinc. Core samples obtained from Coeur d'Alene Lake, just off from Harrison, indicated that significant amounts of metal extend into the lake bottom down to 31 to 32 inches. The metal content was found at more shallow points in sediment cores taken farther out in the lake.

In addition, heavy metal concentrations have been measured in water, sediments, and fish in 9 small lakes located along the main stem of the Coeur d'Alene River.

In 1968, settling ponds for mining and milling waste waters were installed. These measures reduced the suspended solids entering the river and decreased some of the dissolved elements, such as nickel and lead. However, dissolved zinc and cadmium remained above toxic limits for most aquatic organisms.



Eroding jig tailings adversely effect water quality.

Mine waste silts are dumped into the South Fork.

E. AIR QUALITY

Air quality has been a problem within the Silver Valley since the lead smelter was built in 1917 and a zinc smelter in 1928. Both smelters operated without emission controls until 1954 when a sulfuric acid plant was established to recover sulfur from stack gases.

Air quality problems within the valley are greatly magnified due to the meteorological location of the smeltering plants in a narrow valley that has frequent inversions and poor ventilation. During periods of stagnation, it is difficult to disperse the emissions.

Bunker Hill converted their system from wedge to flash roasting in 1954. The wedge system used a slow process of heating and burning which produced a weak concentration of sulfur dioxide gas. The flash roasting process quickly burns off the sulfur, producing a much stronger gas which then became feasible to convert into sulfuric acid.

Sulfur present in the ore materials is released by heat in the smeltering process and reacts with oxygen in the air to form sulfur dioxide (SO_2). Sulfur dioxide is an invisible gas which is heavier than air and has a very noticeable pungent odor. Its effects on animal life are not fully known, but it does have an adverse effect on vegetation. Dispersed SO_2 enters the leaves of the plant through open etomata. Inside the leaf, large surface areas of moist cells that are oxygen-rich during daylight hours are exposed to this gas. Thus, plants exposed to sublethal concentration of SO_2 will develop chronic sulfate injury.

Plants vary widely in their sensitivity to SO_2. Trees such as Aspen, Jack Pine, White Pine, White Birch, Larch, Willow, Alder, Austrian Pine, Douglas-Fir, and Ponderosa Pine are very sensitive while Cedar and Maple are more tolerant.

Particulates

Another problem source of air quality results from particulates (lead, zinc and cadmium) being dispersed into the air and onto the surroundings. Prior to emission control, the stacks dispersed as high as 100 lbs./hour of particulates within a three-mile radius. As a result, surrounding soils have concentrations of heavy metals including lead, zinc and cadmium and are very acidic (pH 4.0 to 4.8). Several thousand acres near the lead and zinc processing plants are completely or nearly devoid of any kind of vegetation. The highly acidic soil is now required to be neutralized with lime before revegetation can be accomplished.

Blowing sand during wind storm degrades air quality.

Sulfur dioxide released during the smeltering process is lethal to vegetation.

Lead Health

Large volumes of lead emissions have created another environmental concern for those living in the Kellogg-Smelterville area.

Initial blood tests of children in the Silver King School in 1974 indicated that extensive absorption of lead was evident. The Shoshone Lead Project was created in October as a cooperative joint effort between the State of Idaho and the Bunker Hill Company to assess and eliminate a potential lead health problem in the community surrounding the Bunker Hill mining/smelting complex near Kellogg. The long-term four-fold objectives of the Project included: First, to immediately assure that those children with blood lead levels over 80 micrograms per 100 mℓ of blood received medical attention and that the level be reduced below 80 as quickly as possible, even if relocation of the family was required. Secondly, to evaluate all children in the 40 to 80 range and with the combined use of personal hygiene and environmental manipulation of the home and surrounding environment, reduce these levels below 40 within a reasonable time period (18 months to 4 years according to lead metabolism experts). Third, to develop a lead protocol or monitoring program that will lead to a long-term acceptable solution to the environmental lead health problem in the Silver Valley community which will reduce blood lead levels below 40 and provide assurance that they will remain there. Fourth, to determine if there were any long-term health problems generated by the existence of elevated blood lead levels.

The joint effort produced the following statement:

Upon careful review of the extensive medical and environmental data collected in the Shoshone County area in follow-up to reports of excessive exposure to lead, particularly in 1973-74, we, the members of the Technical Advisory Committee, have concluded that extensive increased absorption of lead was evident in 1974. Abatement procedures undertaken since that time have proven effective in substantially reducing blood and environmental lead levels.

A. Our advice and counsel to both the involved health professionals and to parents of all of the area's children in the age range wherein clinical and laboratory testing took place is that, at the present time and in our best judgments, we do not feel any permanent clinical impairment or illness has occurred. Further, it is not likely to occur in the future due to this particular exposure; however, monitoring efforts should be maintained under "C." below to make sure that no clinical impairment is encountered. On the other hand, the data do indicate that the group of children with highest exposure to lead had a higher than expected prevalence of mild anemia and had minimal degrees of slowing in nerve conduction. There is no evidence to date that these effects will in any way be permanent. Naturally, these children, as with all children, will show much individual variation in their physical and behavioral characteristics. We do feel these are not now, nor in the future, attributable to the acute lead exposure of 1973-74.

B. Our advice and counsel to the involved health professionals and to the region's parents of children currently in the 1 to 3 age range, none of whom have been extensively tested, is that again at the present time, in our best judgment, we feel no clinical impairment or illness is likely to be seen attributable to the lead exposure. Nonetheless, to assure that optimum consideration is afforded to all these children, we would recommend that periodic screening be offered to all these children--Pb and FEP as well as physical examinations--via the State Health Department, its agents, and the region's health professionals.

C. Our advice and counsel to the Idaho State Department of Health is that they continue to provide leadership among all involved parties in monitoring the environmental and medical situations in the Kellogg area--with particular attention to:

1. item B;
2. parents of young children moving into the area;
3. periodic selective sampling of all inhabitants--especially children-- for blood Pb levels, FEPs, etc.; and
4. appropriate follow-up of promising research opportunities.

D. Our recommendation to the Project itself is to seek publication of all the accumulated data, and the probable contrasting professional inferences drawn therefrom. First, via a monograph with extensive distribution and subsequently via traditional publications and then to move forward toward termination of the project or its transition to an "on call status" indicating to all potentially interested parties that as far as we are concerned, on-going observations of those factors which prompted the creation of the Project have reassured us that the responsible causes have, in large measure, been adequately ameliorated and steps instituted to assure their nonrecurrence.

E. Our collective opinion is that the resultant data confirms the value of periodic Pb screening programs. It suggests a correlation between elevated blood lead levels and impairment of hemoglobin synthesis and anemia. The data does not substantiate, yet does not rule out, a detrimental effect on intellegence due to elevation of blood lead levels. However, the data does demonstrate that if a reduction of I.Q. does exist, it is too small to be of known clinical significance so far as individual children are concerned.

F. Finally, we would go on record as urging all responsible parties--industry and government in particular--to continue to do their utmost to avoid a replication of the precipitating events.

F. SEDIMENT and EROSION CONTROL

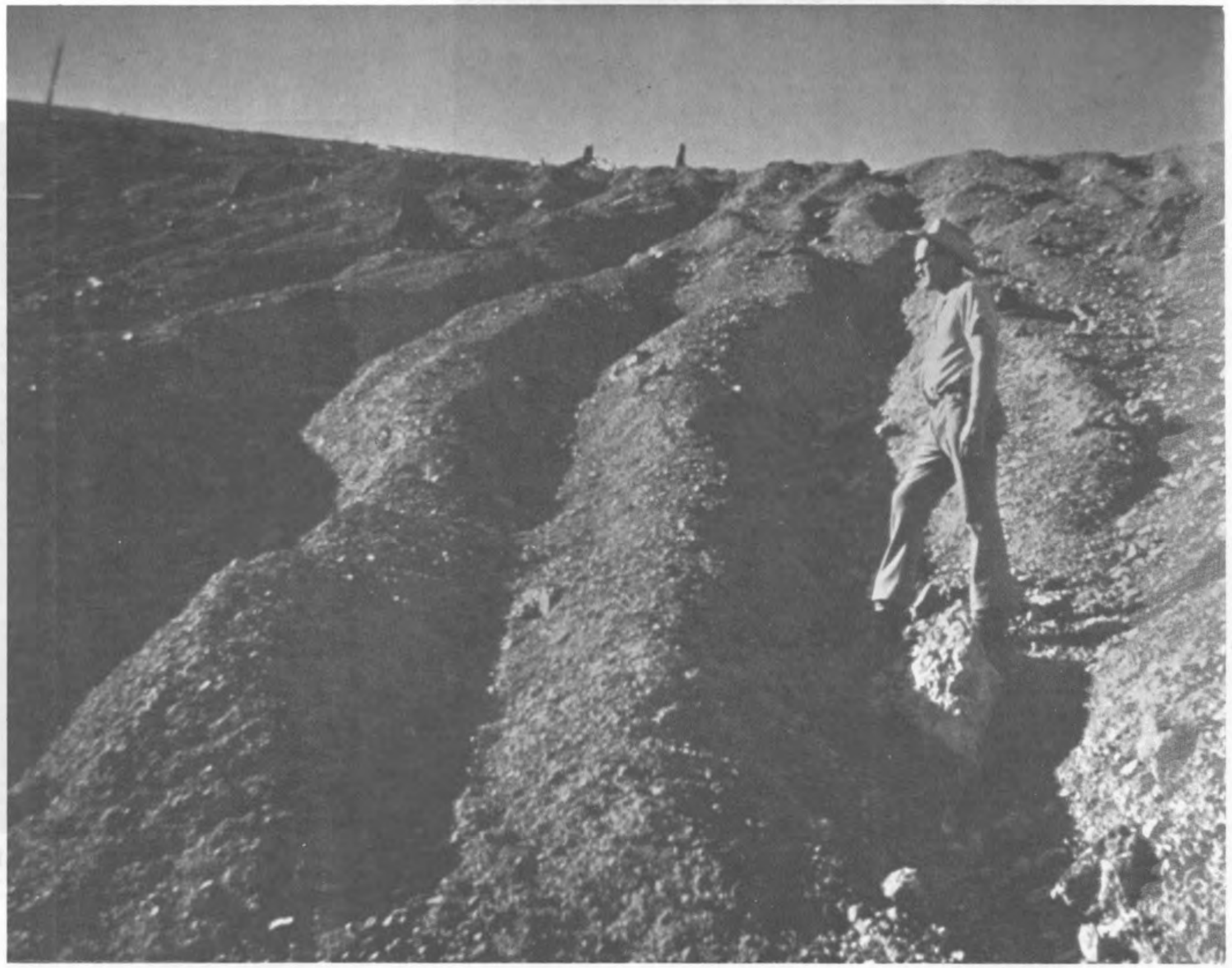
Erosion has been prominent with the South Fork drainage for many years and stems mainly from two sources. These are hillside erosion and stream-bank erosion.

Lack of vegetation on steep slopes has resulted in severe soil erosion within the Kellogg-Smelterville area. The fires of 1910 and 1936 destroyed most of the trees, shrubs and grasses. Evidence of these fires can still be seen in recent photos. Emissions from the smelter operations prohibited the return of vegetation within a 3-mile radius of the smoke stacks.

During periods of high rainfall or quick spring runoffs huge volumes of soil is eroded from the hillsides as shown in the following series of photographs. Approximately 2,400 acres are prone to severe erosion, 9,400 acres to moderate erosion, and 6,400 acres to slight erosion.

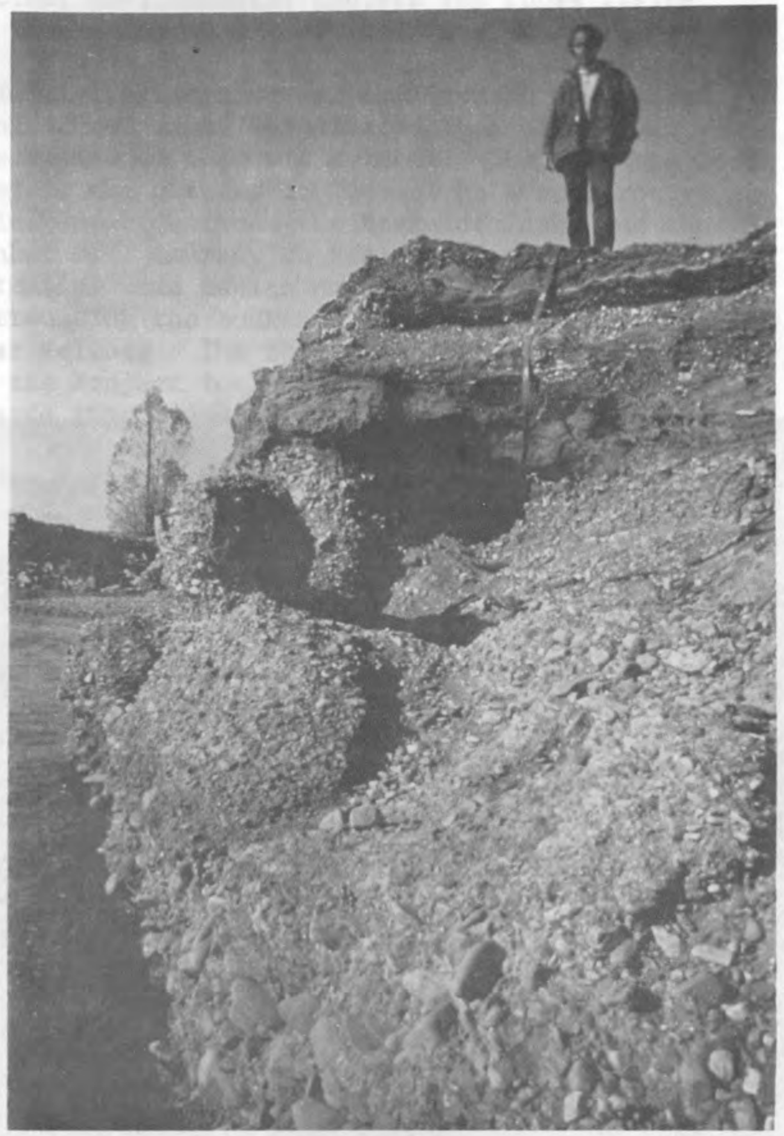
Much of the steep barren slopes have been terraced and identified for a large scale future revegetation project by the Bunker Hill Mining Company.

Lack of vegetation on steep slopes cause severe soil erosion.

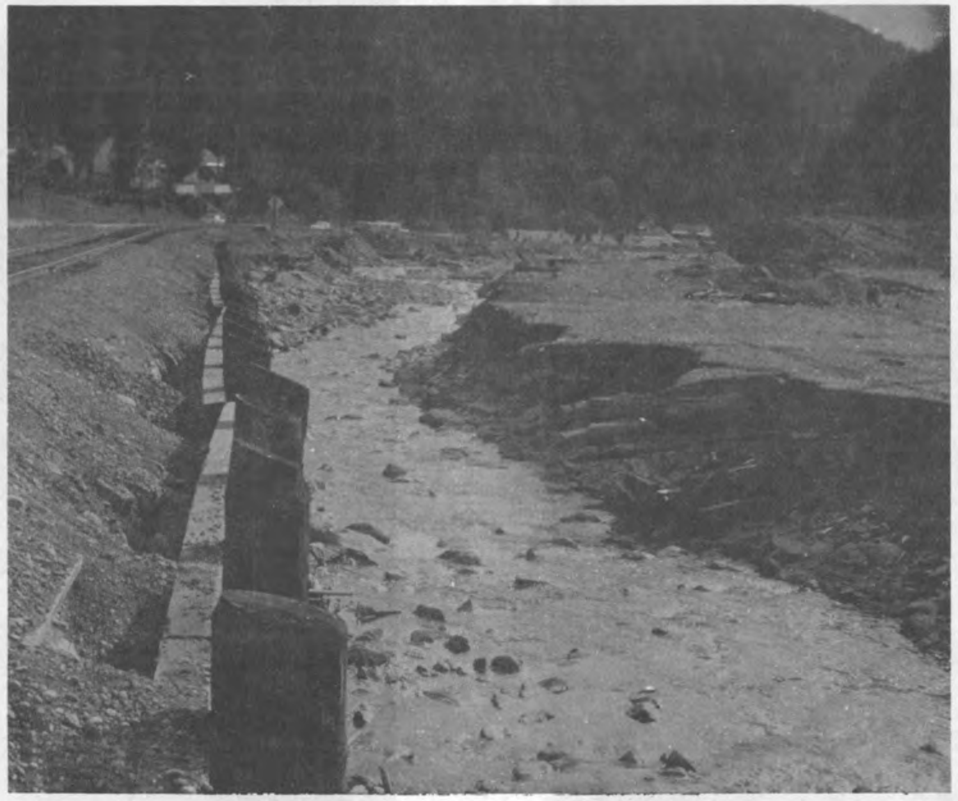


Huge volumes of soil are eroded from the hillsides during periods of high rainfall.

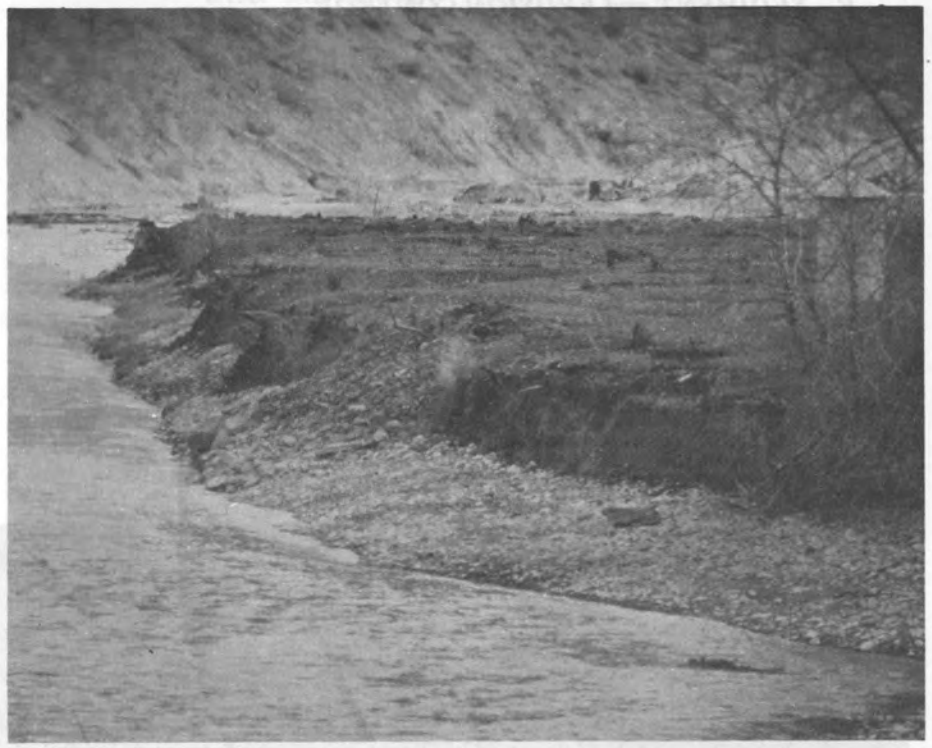
Stream bank erosion is prevalent along the entire stretch of the South Fork, much of Canyon Creek, and parts of Nine-Mile Creek. A large percent of these channels have at one time or another been dredged, channelized and contained in an unnatural state. These have led to a highly unstable channel. Stream bank erosion is most severe at those areas where the channel cuts through old jig tailings. It is vital that these areas be stabilized or have the tailings removed. The following photos illustrate soil erosion in the South Fork area.



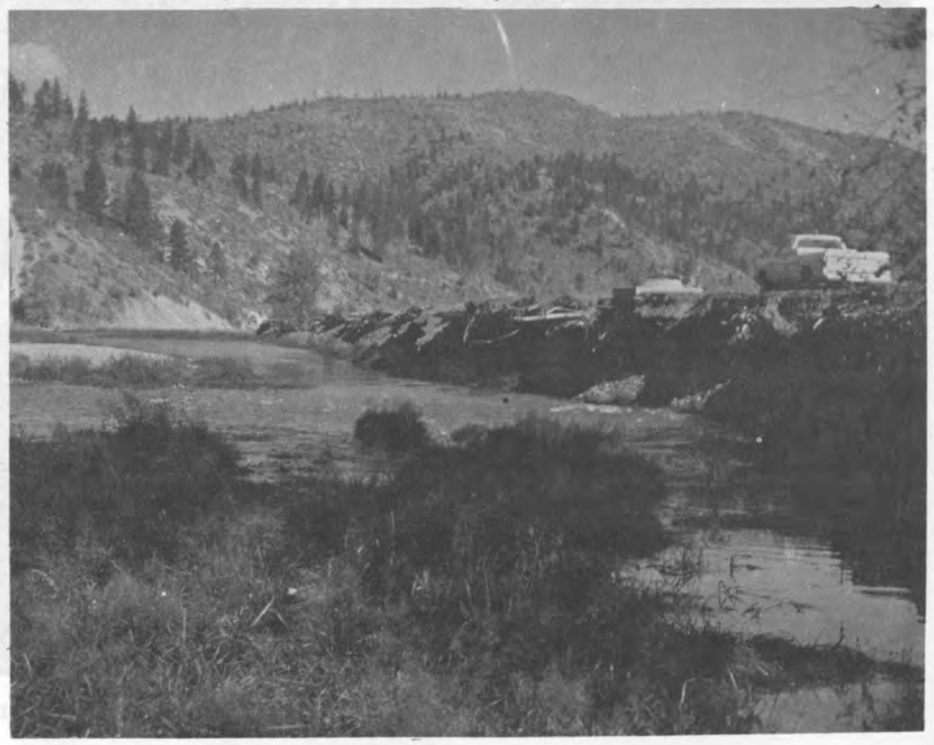
Stream bank erosion is prevalent along stretches of the South Fork.



Nine Mile Creek is highly unstable as it cuts through old jig tailings.



These two photos illustrate how the South Fork wanders. The top photo was taken in 1975 and the bottom photo in 1978. Using the gage station as a reference, the channel has moved approximately 30 feet in two years.



G. RECREATIONAL OPPORTUNITIES

Shoshone County and the Idaho Panhandle contains an abundance of recreation areas in uncrowded and unspoiled settings. These facilities provide recreational opportunities rich in climatic, geographic and seasonal variety. Due to this abundance, the recreational needs of South Fork area residents centers around day use facilities in close proximity to population centers.

Studies conducted for the Idaho Department of Parks and Recreation by Idaho State University in 1975 noted that 40 percent of all recreation activity involved travel distances averaging 25 miles or less. Another 50 percent involves travel distances of 25 to 100 miles. Only about 10 percent of recreation activity involves an average travel distance of over 100 miles. These distances can be easily exceeded by South Fork area residents in a search for quality recreational areas. The development of local recreation areas for multiple activities within or adjacent to city limits is of paramount importance. Early development of expanded local park facilities should be considered as an integral benefit of the South Fork restoration program.

CHAPTER 4

IDENTIFICATION OF PAST, PRESENT, AND FUTURE REHABILITATION PROJECTS & ENVIRONMENTAL IMPROVEMENTS

Valuable information has been gained through prior research and studies conducted within the South Fork Drainage. This now enables large scale projects to be undertaken with a high degree of success. This chapter summarizes and coordinates past, present, and ongoing research appurtenant to the rehabilitation of the Silver Valley.

Millions of dollars and countless hours have been dedicated by the mining industry within the past five years toward improving the environmental quality. These efforts along with other projects have been identified in this chapter.

A. CHANGES in ATTITUDES

Significant changes have occurred within the Silver Valley within the last ten years. Not only has noticeable progress been made in improving air and water quality, but great changes have occurred in the attitudes of concerned individuals and mining companies towards environmental affairs. It is now a recognized fact that minerals cannot be removed from beneath the earth's surface and processed into usable commodities without affecting the immediate surroundings in some way. The nation's economy requires that precious metals continue to be processed. The economy of Shoshone County relies upon the extraction of minerals. It should be recognized that many of the present day environmental problems have resulted from the old mining practices and techniques of yesteryear. The mining industry has dedicated millions of dollars and countless hours to correct and improve upon the environmental quality which was degraded many years ago. Companies such as Bunker Hill have already spent over $23 million in programs to control gases, dusts, and mists and to reprocess or neutralize industrial waste waters. Even when using the latest technology in the area of pollution control equipment, certain environmental impacts will result.

The answers to the mineral industry's problems are not quickly, easily, or inexpensively found. Due to an increased awareness, dedication and attitude, the mining industry is making progress and will continue to do so in the future.

Projects and programs which have been undertaken in the South Fork area are as follows:

B. REVEGETATION PROJECTS

Ed Pommerening, forester for the Bunker Hill Company, has described the research conducted on revegetating mine tailings impoundments, barren hillsides, and an underground greenhouse in the restoration project area. As rated by Pommerening studies:

Disturbances of two types are present within the district: tailings deposits from the concentrators and denuded mountain slopes. The original vegetation on the mountain slopes was destroyed by forest fires. Reforestation was prevented by high concentrations of SO_2 in gaseous emissions from The Bunker Hill Company's lead smelter and electrolytic zinc plant. Control of SO_2 emissions was initiated in 1954 when the first sulfuric acid plant began operation at the zinc plant. Two additional acid plants, one each at the smelter and zinc plant have reduced the levels of sulfur dioxide to the lowest level in the area since 1918 when the lead smelter began operation.

Pommerening's work on revegetating the sides of Tailings Ponds has established a basis for revegetation programs in the area. He stated that:

The initial research work was aimed at establishing vegetation on the sides of the tailings ponds within the district. Tailings pond embankments were constructed from waste mine rock, and, where practical covered with tailings. Since the origin of the rock and tailings is deep in the mines, organic matter and plant nutrients are naturally absent.

After soil tests were performed greenhouse experiments were conducted to determine which species of grasses and legumes and which fertilizer application would produce the best ground cover. After the results of greenhouse experiments were evaluated, field test plots were established on the tailing dams. Intermediate wheatgrass, Canada bluegrass and hard fescue were the grasses found most adaptable, and crown vetch was selected as the legume. Four hundred pounds per acre of 16-20-0 fertilizer was applied at the time of seeding. A pelletized organic mulch, straw and a bark mulch were tested to determine which one would hold the seed on the steep dam wall and provide the best germination rates. The test plots were fertilized throughout the summer and an additional 200 pounds per acre of 16-20-0 was added in the fall.

Small sub plots were randomly chosen from a grid of each plot to enable accurate counting and growth measurements of the plants. These measurements were taken in the fall after the spring planting and in the following spring and fall.

Analysis of the data revealed that a mulch which would adhere to the surface was necessary. The control test plots had completely failed and where straw had been windblown or slipped down the dam wall, seedling establishment was poor. The bark mulch gave good results but was difficult to apply on a large scale, and seeding could not be mechanically applied on the dam walls. The test plots which utilized organic mulch had an excellent and even stand of grass. The organic mulch provided the added advantage of allowing a combined hydromulching-seeding operation which is probably the best method of seeding steep terrain.

Once the seed and mulch were applied, care had to be taken in the method of irrigating. Since mine waste is usually coarse and has a low water-holding capacity, water must be added periodically in order to insure germination and seedling establishment. The application of water at too great a volume or pressure results in the washing of the seed from the dam. Consequently, water must be applied in shorter and more frequent applications.

The slopes surrounding the town of Kellogg, vary greatly in the amount of vegetation present. Vegetation is completely lacking on the slopes adjacent to the lead smelter and electrolytic zinc plant. As distance is increased from the processing activities, vegetation cover increases in varying degrees. Shrubs are the first to appear followed by conifer trees. The Bunker Hill Company's revegetation program was developed to take into account different environmental conditions. Major considerations were: degree of slope, aspect, depth of soil, temperature, vegetative cover present, and pH of the soil.

Aspect is one of the more important considerations in any vegetation plan because of the different species of trees and shrubs found on a North slope, compared to a South-facing slope.

Pommerening stated that The Bunker Hill plan utilized shrub cover observations together with soil pH to determine the harshness of the site. He observed that:

Little or no native vegetation was present where the pH was lowest on the slopes adjacent to the lead smelter and zinc plant. Initial plantings showed that the traditional bare root type trees had no chance of survival on the completely barren slopes.

After the initial failures with bare root plantings, a more thorough soil sampling was taken. The results indicated that the soils had a very low pH in the upper levels of the stratum. Below fourteen inches, the pH rose to 6.0 - 6.5 from

3.7 in the upper levels. With the low pH concentrated in the upper 14 inches, bare root type trees had little chance of surviving since their root systems would be planted within the upper 14 inches of soil. Trees which had been grown in containers where the roots could be planted with the same soil in which they had been grown showed promise. The container soil was located in the upper stratum and root growth occurred in the lower and better soils. The major problem with container-grown tree stock is availability since this technique is relatively new and only a small number of nurseries can supply these trees.

Initial containerized trees were obtained from the University of Idaho greenhouse and at the U.S.F.S. greenhouse in Coeur d'Alene, Idaho. The trees were planted on all sites within the district. Survival of the conifer trees was very encouraging, ranging from 80% to 100% in the plots compared with 60% survival of bare root trees on the favorable sites and no survival on the harsh sites.

Growth of the containerized trees during the first growing season surpassed the bare root planted trees. The containerized trees did not have to expend all of their energy in producing a root system damaged by digging and pruning as is the case with the bare roots plantings. A major factor is that there seems to be little transplant shock with the containerized trees since the soil around the roots is undisturbed, thus allowing the tree to continue to grow. Observation revealed that when bare roots had their buds growing prior to planting, they would seem to lose all of the planting year's growth because of dieback from transplant shock.

The better survival of containerized trees on the more favorable sites permitted the planting of fewer trees per acre. With their faster initial growth, they attained a noticeable size two to three years before the bare roots planted trees. Since containerized trees are grown under greenhouse conditions, their initial growth involves high operating and capital costs. Hence, containerized trees are expensive and difficult to obtain.

The Bunker Hill Company's revegetation plan called for an accelerated planting program. Considering the superiority of the containerized trees and their lack of availability, a greenhouse capable of growing 200,000 trees annually would be needed to meet the company's objectives. The Coeur d'Alene Mining District is located in steep mountainous terrain creating several problems for operating a greenhouse in the narrow valleys. These problems included a need for primary and secondary heating systems for the severe winters, lights for the short day length found in the valleys, and CO_2 generators to produce CO_2 necessary for plant growth.

The idea of raising trees in an underground greenhouse was considered and investigated. An underground ventilation drift was located where the temperature was a constant 77°F. and the CO_2 content in the air was 0.3%; this was ideal for plant growth.

A pilot project was initiated in July, 1974. Eight high-intensity, mercury-vapor discharge lamps were purchased and installed in the ventilated drift in such a way as to utilize the greatest amount of available light as possible. A roof was built to support the lamps and shield the trees from dripping acid mine water.

For this pilot effort: *Ponderosa pine seeds were planted in 4,000 containers and taken underground on September 1, 1975. Simultaneous with the pine tree planting, 250 containers of crown vetch were planted. The initial concern was that with the acid mine water present in the drift, air entrainment of the dripping acid water would cause damage to the young seedlings. Crown vetch, which is susceptible to sulfuric acid mist, acted as an indicator in that spots on the leaves or death of the plants would occur. After four months of growth with the plants growing out of their 30-cubic inch containers, no spots or death had occurred.*

The pine seeds began to germinate within ten days. Elongation of the stem began within 7 days after germination. At this point, it was realized that one important factor had been overlooked. Fungus and insect problems usually kill several plants in each tray of 100 in a normal greenhouse; however, there are no insects or fungus typical of plant life that exist underground. All that seemed necessary was care in not introducing any of the undesirable species distinctively harmful to the delicate young plants. Fungicide treatments were continued, however, to prevent an outbreak from spores being carried in on the clothes of workers and visitors. Insecticide treatment was eliminated because of the complete lack of insects.

After twelve weeks of growing, 3-needled fascicles typical of Ponderosa pine species started to replace the juvenile needles. At eighteen weeks, the young trees had filled the 30-cubic-inch-container with roots and averaged seven inches in height.

The medium used to grow the seedlings was a 60 - 40 mixture of peat moss and vermiculite. Fertilizer was added to promote growth of the young seedlings since the medium mixture is low in nutrients. Addition of fertilizer presented a problem since the young seedlings are very sensitive to nitrogen. The needles were burnt on several occasions. The College of Forestry at the University of Idaho overcame this problem by carefully mixing a prescribed amount of fertilizer with the medium prior to planting (pre-fertilizing).

The first trees are not being grown underground which have been prefertilized. The trees are two months old and are growing rapidly with neither nutrient deficiency symptoms nor burning of the needles since the fertilizer does not come in contact with them.

With the underground greenhouse, The Bunker Hill Company can collect and grow seeds not only of conifers but also native shrubs. Native shrubs are difficult to obtain and when found is not likely to be collected from an ecotype similar to that where they will be planted. This ecotype factor is very important in conifers and is present in many native type transplantings.

Native shrubs are important to the revegetation effort. Pommerening notes:

> *Native shrub interest has increased in the last ten years. They are used as a first step in reforesting warm south-facing slopes prior to establishing conifers under the cool canopy of the shrubs. Earlier thinking was against planting of shrubs because of competition with conifers for water. However, newer thinking is returning back to plant succession where shrubs are followed by conifers in nature.*

In the revegetation program proposed commitment from the company and other organizations is necessary. Although this greenhouse operation is an expensive program, The Bunker Hill Company has taken a responsible and leadership position. In addition, credit must also be given to the University of Idaho College of Forestry and Agriculture and the U.S. Forest Service.

C. University of Idaho Projects

Before large scale revegetation projects can be accomplished within the South Fork drainage, more information is needed. Questions of what, how, when, where etc. need to be answered. The College of Forestry, Wildlife and Range Sciences, University of Idaho, has played a vital role in answering these questions.

University activities in the area are as follows:

"1972 Research"

The College of Forestry, Wildlife, and Range Sciences at the University of Idaho began revegetation research in the Mining District in 1972 with funds from the University, Greater Shoshone County, Inc. (a non-profit organization within the Mining District, supported primarily by mining companies), and the U.S. Bureau of Mines. Initial studies were directed toward determining the factors limiting revegetation and finding species capable of surviving under the existing conditions. Two College of Forestry graduate students established species screening research plots and tested soils in various locations that were determined to be representative of the types of problems found within the Mining District. Greenhouse studies were also conducted at the University, using soils from the District.

In 1974, The College of Forestry received a grant under the U.S. Department of Agriculture's Surface Environment and Mining (S.E.A.M.) program to continue and expand its research and demonstration efforts in the Coeur d'Alene Mining District. The grant provided $57,000 to be used over a three-year period.

The areas within the Mining District that have been adversely affected by mining activities can be broadly divided into two categories: the hillsides in the Kellogg-Smelterville area and the valley floor throughout the District. These broad categories can be further subdivided into several more specific types of problems. Results of the University's work is as follows:

HILLSIDES

1. Barren Areas

Several thousand acres near the land and zinc processing plants are completely, or nearly devoid of any kind of vegetation. Most of the affected land is very steep (up to 80 percent slope), and erosion is severe. Some of the slopes have developed an "erosion pavement" due to sheet erosion; other slopes have deep rills and gullies. No A horizon soil remains, and erosion is continuing at a rapid pace. Some terracing has been done where erosion was endangering roads or plant equipment. The soils are very acidic (pH 4.0 - 4.8) and have high concentrations of heavy metals, including lead, zinc, and cadmium. Sulfur dioxide from zinc plant and lead smelter emissions is most heavily concentrated in these areas.

Several smaller areas as far as two miles downwind from the processing plants are also barren. They are similar to the larger barren areas, except that the soils are not as acidic or as contaminated by heavy metals.

Some widely scattered vegetation does grow in these areas. A few stunted elderberry can be found on all but the worst of the barren slopes, and further from the metal processing plants, mountain maple, black hawthorn, and snowberry can also be found.

Previous Research:

Prior to the S.E.A.M. project, research plots of bare-rooted tree and shrub seedlings had been planted at 10 locations. Most of the seedlings died during the first or second years, and none survived more than 3 growing seasons, with the exception of one plot where several Austrian and Scotch pine are still alive after 5 growing seasons. A greenhouse study conducted at the University of Idaho with soil taken from the barren hillside near the zinc plant demonstrated that if the pH of the soil was raised to 6.0, using lime, Austrian pine and black locust seedlings survived and grew well, while others grew very little or died.

Research Program:

1977: Research plots of container-grown ponderosa and Austrian pine were planted in 14 locations. Three types of containers were used: Leach pine cells, Leach fir cells, and Hillson. All of the seedlings were raised in the University of Idaho greenhouse. The Leach seedlings were 4 1/2 months old at the time of planting, and the Hillson seedlings were 5 1/2 months old. The plots were designed to permit statistical comparisons of species and types of containers.

Plots of European white birch and black locust were planted in 15 locations. The seedlings were 1-0 bare roots.

Plots of container-grown native shrubs were planted in 12 locations. Black hawthorn, elderberry, chokeberry, and mountain ash were grown from locally collected seed in the Forest Service's Coeur d'Alene Nursery greenhouses. Three types of containers were used: Tinus, Woods, and Leach supercells.

The plot locations varied in slope, aspect, elevation, and distance from the lead smelter and zinc plant.

Results:

Survival data for each plot can be found in the Appendix, along with information on plot location, slope and aspect, species and types of containers, number of seedlings planted, and year of planting.

The survival of the container grown pine was excellent; the overall survival for both species was greater than 99 percent. In September the seedlings on all of the plots had good color and well-developed terminal buds. Because the seedlings had such high survival and uniform growth, at this point no conclusions can be drawn concerning species or types of containers.

Several factors may cause increased mortality in the future. Frost heaving has been a critical problem on barren slopes in the past. The seedlings' root systems must develop in highly acidic soils which have many times the normal levels of heavy metals and low nutrient content. Most of the plots are located where they could be affected by zinc plant emissions; the plant was not operated during the spring and summer of 1977 due to a strike.

As these factors and others affect the survival growth of the seedlings, differences between species, types of containers, and plot sites may become more evident. Large scale plantings should not be attempted until these plots can be further evaluated.

The survival of the container grown native shrubs was also excellent. Many of the shrub plots were located adjacent to container grown pine plots. Because the same numbers of seedlings were not available for all of the species and types of containers, the plots were designed to use the seedlings that were available. Hawthorn in both Woods and Tinus containers were planted in 13 plots at 12 locations. Mountain ash in Tinus containers were planted on 11 of those plots, elderberry in Tinus containers were planted on 5, and chokeberry in Leach supercells were planted on 2. Their overall survival is shown below.

Hawthorn, Tinus	-	99.7%
Hawthorn, Woods	-	97.0%
Mountain ash, Tinus	-	95.5%
Elderberry, Tinus	-	90.3%
Chokecherry, Supercells	-	65.0%

Hawthorn in Tinus containers had a slightly higher survival rate than Hawthorn in Woods containers, but the difference is not significant. Although the chokecherry survival is relatively low, only 20 seedlings (10 in each of 2 plots) were planted, so the results are not necessarily a good indication of what might be expected of a larger population.

The growth of the shrubs is difficult to evaluate, since little information is available concerning normal rates of growth for native shrubs. Most of the hawthorn, mountain ash, and elderberry seedlings grew several inches and appeared to be very healthy. Like the container pine, more time is needed before definite conclusions can be made regarding the performance of species and types of containers. Research plantings which include a greater variety of species and types of containers are needed. Additional plots should be planted on undisturbed "control" sites to provide a basis for comparison of survival and growth.

Bare-rooted European white birch and black locust seedlings were planted side by side at 15 locations, and black locust was planted alone at 4 additional locations. The birch had better survival than the locust on 14 of the 15 plots. Birch survival was also much higher overall (95.5 percent compared to 47.0 percent) and was more consistant from plot to plot than was that of the locust. European white birch had not been planted previously, and it appears to have good potential on a variety of sites. The seedlings were obtained from the University of Idaho Forest Nursery.

Black locust survival ranged from 12 percent to 94 percent, but averaged less than 50 percent overall. This inconsistent survival has been noted in previous research as well. The seedlings that do become established usually grow very well, but survival is unpredictable. Locust seedlings could be extraordinarily sensitive to site variations or the seedlings themselves could vary physiologically. Because of its rapid growth and ability to fix nitrogen black locust should not be disregarded, but more research is needed to achieve more consistant success.

2. Brush-covered areas on the south side of the valley.

Several thousand acres on the south side of the valley between Page and Elizabeth Park have varying densities of native shrub and grass cover, but no conifers. These areas vary in slope from very steep to nearly level. Severe erosion, both sheet and gully, is occurring. In places, the established vegetative cover is being lost due to exposure of the root systems by gully erosion and by partial or complete covering of the vegetation by soil creep. The unstable soil conditions also discourage the natural spread of the vegetation.

The soils are very acidic and are high in heavy metals, although in general these problems decrease as distance from the lead smelter and zinc plant increases. In areas where erosion has not occurred, a thick duff layer is present.

The vegetative cover ranges in density from sparse to heavy, depending on slope, aspect, moisture, soil erosion, and distance from the metal refining complexes. Changes in density are gradual, and the brush-covered hillsides grade into the barren areas discussed previously.

The shrubby vegetation is comprised primarily of Rocky Mountain maple, black hawthorn, service berry, elderberry, snowberry, bitter cherry, mountain ash, pachistima, and dogwood. Some areas have considerable bracken fern and native grasses, primarily redtop.

Previous Research:

Species screening plots of bare root conifers and deciduous trees had been planted at six locations prior to the S.E.A.M. project. These plots demonstrated that in the more favorable areas (moderate slopes, more shrub cover, greater distances from the metal refining complexes), bare rooted ponderosa, lodgepole, Austrian, and Scotch pine could be planted with a reasonable chance for success. Austrian pine was also shown to be the most resistant to sulfur dioxide damage. Black locust was the only deciduous species to show potential, and its success was somewhat irregular. Conifer seedlings grown in soil plugs were planted without success at several locations. Fall plantings of bare-rooted and container-grown conifer seedlings were unsuccessful due to severe frost heaving. Frost heaving also affected spring plantings, but to a lesser extent.

Research Program:

1975: Research plots of container-grown ponderosa pine were planted in 11 locations, and container-grown Douglas-fir were planted in 3 locations. Two types of containers were used. Bare rooted seedlings were planted with the container grown seedlings in several of the plots to provide a comparison. The plot locations varied in slope, aspect, elevation, vegetative cover, and distance from the lead smelter and zinc plant.

1977: Research plots of ponderosa and Austrian pine were planted in 2 locations at opposite ends of the brush-covered area. The seedlings were in 3 types of containers. Favorable sites were selected for both plots. They are on moderate north or northeast facing slopes with no active erosion and good soil moisture. Neither site is likely to be adversely affected by smelter or zinc plant emissions. Bracken fern and scattered native shrubs are growing at both locations.

Results and Conclusions:

Specific information for each plot can be found in the Appendix. 1975 plantings: The overall survival and growth of container grown seedlings were very good. With the exception of one plot on a harsh site near the lead smelter, ponderosa pine averaged over 93 percent survival and Douglas-fir averaged 84 percent. On most of the plots, there was little difference in survival between the Tinus seedlings and Hillson seedlings, but the Tinus trees had the best growth initially and have maintained that advantage through 3 growing seasons. The survival and growth of bare-rooted seedlings planted adjacent to container grown seedlings at several locations were uniformly poor (about 10 percent survival).

The plot near the lead smelter is atypical, both in terms of site conditions and results. The site is nearly barren, and erosion has removed all of the surface soil. Although the soil has not been analyzed, the plots' proximity to the smelter would indicate contaminated soil similar to that on the barren areas discussed earlier, and high levels of sulfur dioxide in the air. The survival of container grown Douglas-fir was 70 percent, while that of both ponderosa and lodgepole pine was less than 50 percent. Growth has been minimal for all species, and many of the trees classified as alive are barely surviving.

Container grown ponderosa pine on 3 other plots are not growing as well as those on the remaining plots, although their survival continues to be good. The seedlings have less growth and shorter needles than typical seedlings on other plots, and are not as erect. Most have not retained their first and second year needles. These 3 plots are closer to the lead smelter than the others (with the exception of the atypical plot just discussed), and may be more subject to the effects of the lead smelter. They are also less steep than most of the other plots, which may relate to levels of soil contamination in two ways. First, less soil erosion has occurred than on steeper sites, so the surface soil has been in place to receive fallout from smelter emissions over a longer period of time. Second, material precipitating vertically from the smelter smoke has been concentrated on a smaller surface area.

Additional research is needed to determine why growth is being adversely affected on these plots. Soil analysis will be necessary to find if the soils do in fact differ chemically from those on the other plots. If so, the specific factors limiting growth should be determined and techniques developed to overcome their effects. Other environmental factors, including high sulfur dioxide levels, should also be investigated. Large scale plantings on these sites should be postponed until better growth can be assured.

1977 plantings: The performance of both container grown pine plots was excellent. One plot had 100 percent survival and the second had 98.7 percent survival. The seedlings grew well and are very uniform. Because of their favorable locations, it is anticipated that both plots will continue to have good survival. They will be most valuable in helping to determine how container type and size affect growth rates.

The results of this work and previous research indicate that successful large-scale plantings of container grown pine could be made on most of the brush covered hillsides on the south side of the valley. Although less research has been done with container grown Douglas-fir, they could also be planted, particularly on moister sites.

Previous research indicated that bare root seedlings could be planted on brush covered areas where smelter and zinc plant emissions are not a significant problem.

Based on these findings, two of the local mining companies have sponsored large scale planting programs on company land. In 1976, the Sunshine Mining Company planted 30,500 bare root Douglas-fir on brush covered hillsides on the west side of Big Creek. A power auger was used for planting, and overall survival exceeds 80%.

The Bunker Hill Company has planted a total of 244,000 bare root and container grown conifers on brush covered hillsides on the south side of the valley as part of an ongoing revegetation program that began in 1975. Species planted include Douglas-fir, ponderosa, lodgepole, Austrian, Scotch, and white pine. The bare root seedlings were planted on areas not severely affected by smelter and zinc plant emissions, and the container grown trees were planted on more difficult sites.

3. South-facing slopes:

The slopes on the north side of the valley between Pinehurst and Osburn are steep and predominantly south-facing. They have shallow soil, and rock outcrops occur frequently. Sheet erosion has removed much of the A horizon on the steeper slopes, leaving an erosion pavement. Gully erosion occurs in several locations, especially where motorcycle trails and roads have disturbed the surface and concentrated runoff. In general, these soils are less affected by lead smelter and zinc plant emissions than those on the south side of the valley.

The vegetative cover consists primarily of native shrubs. It varies in density from heavy to sparse; the heaviest cover occurs in the small, moist draws, and vegetation is widely scattered on the points of ridges and on slopes with rock outcrops. The most common shrub species are Rocky Mountain maple, snowberry, service berry, chokecherry, black hawthorn, and Oregon *grape. Quaking aspen and black birch (water birch) are found on a few moist sites. Widely scattered ponderosa pine are growing between Pinehurst and Kellogg and between the mouth of Big Creek and Osburn. Natural pine reproduction is negligible.*

<u>Previous Research</u>:

No research had been done prior to the S.E.A.M. project.

<u>Research Program</u>:

<u>1975</u>: Research plots of container grown and bare root ponderosa pine were planted at 7 locations. Two sizes of containers were used. The plot locations varied in slope, aspect, vegetative cover, and distance from the lead smelter and zinc plant.

<u>1976</u>: Plots of container grown ponderosa and lodgepole pine and Douglas-fir were planted in 11 locations. Most of the sites were similar in slope and aspect; there was some variation in vegetative cover. All of the plots were too far away from the metal refining complexes for them to be considered a significant factor.

<u>Results and Conclusions</u>:

Research plots on the south-facing slopes, originally considered to be some of the harshest sites in the Mining District due to their steepness, aspect, and poorly developed soils, have given very encouraging results. Several plots of container grown pine have 100 percent survival after 3 growing seasons, and most of the remaining plots (where animal damage has not occurred) have more than 90 percent survival. Seedlings on 6 plots were killed or damaged by being nipped off by animals. Some of the seedlings were severed at, or just above, ground level. Others were cut off above lateral branches, and in most cases those seedlings are still alive. Deer browsing is thought to be the most likely cause for the damage.

No mortality has occured directly because of erosion, but seedlings on several plots where soil and rock movement have taken place have been partially covered. On some sites, erosion could be a significant factor in the survival of large-scale plantings. No serious frost heaving has been observed.

Bare root ponderosa pine seedlings planted on the same sites as a plot of container grown ponderosa pine had only 11 percent survival, compared with the 100 percent survival for the container grown seedlings. The growth of the container grown seedlings was also much greater. Container grown seedlings are considered to be essential for south facing slopes, except on exceptionally favorable sites such as small draws.

The results indicate that container grown Douglas-fir and ponderosa, Austrian, and lodgepole pine can be planted successfully on all of the south facing slopes between Pinehurst and Osburn. Bare root pine and Douglas-fir can be planted in areas of greater moisture and more favorable aspect. If possible, seedlings should be planted where shade from nearby shrubs will protect them from the direct rays of the sun during part of the day. Planting should be done as early as possible in the spring to take maximum advantage of soil moisture. Full stocking would not be necessary to achieve a natural appearance, but where planting is possible, a relatively close spacing should be used for increased erosion control.

Based on research findings, the Bunker Hill Company planted 8,000 container grown Austrian pine on south facing slopes in 1976. The following year, the company planted an additional 8,000 container grown Austrian pine, ponderosa pine, and Douglas-fir, as well as 7,000 bare root Douglas-fir. The survival of all of the plantings has been excellent.

<u>VALLEY FLOOR</u>

1. <u>Nine-Mile Creek</u>

Nine-Mile Creek is one of the major tributaries of the South Fork, with its mouth at Wallace. The Nine-Mile drainage was mined extensively during the early 1900's, and some small scale mining and exploration work is still being carried on there. The entire watershed is steeply mountainous and heavily timbered. Most of the stream channels and the narrow valley floor have been disturbed by mining activities.

The ore milling and concentrated methods used during the early mining period were crude, and the tailings that resulted, referred to as jig tailings, were highly acidic and had significant concentrations of heavy metals. Because the valley was narrow, the tailings were often piled along the creek. Some of the tailings were eroded by the stream during spring runoff and were deposited downstream. The high demand for zinc during World War II made it feasible to rework some of the deposits of jig tailings to recover additional metals. The reworked tailings were redeposited where the jig tailings had been removed.

The area selected for revegetation research lies downstream from the past and present mining activities. It is relatively level and is adjacent to the stream. Originally a cedar swamp, the area is now a heterogeneous mixture of jig tailings, reworked tailings, river bedload, and original soil. Most of the material is course in texture, and has a low moisture-retention capacity; moisture during the summer is dependent upon the level of the water table. The chemical properties of the material are variable, but in general the pH is less than 4.0 and concentrations of zinc and lead range from several hundred to several thousand ppm. No woody vegetation is growing on the area, but where moisture is relatively constant herbaceous species, primarily red top grass, are growing.

Previous Research:

Prior to the S.E.A.M. project, research plots of container grown and bare root coniferous and deciduous trees were planted in 3 locations. Both fall and spring plantings were made. Very few bare root or container grown conifers survived more than 2 growing seasons, and after 5 growing seasons, only one bare root ponderosa pine, 3 bare root Douglas-fir, and 2 container grown ponderosa pine are still alive. Several container grown sitka alder and one container grown golden willow are alive after 4 growing seasons.

Research Program:

1975: A research plot containing 9 species of container grown native shrubs was planted. Container grown grand fir, englemann spruce, and Douglas-fir were also planted. The shrubs were in Tinus containers and the trees were in Woods containers.

1977: Three research plots of container grown dogwood and sitka alder in Tinus and Woods containers were planted.

Results and Conclusions:

Of the 180 seedlings planted on the container grown shrub plot, only 9 green ash are still surviving. They have grown less than 3 inches in 3 growing seasons. Moisture is not a critical problem on the plot; the most probable cause of the high mortality is the chemical makeup of the material the shrubs were planted in. To establish vegetation on the site, the toxic properties of the material must be counteracted or plant materials must be found that are capable of growing on the material. Both approaches will require extensive research.

The survival of the container grown grand fir, Douglas-fir, and Englemann spruce was somewhat better (33.3 percent, 80 percent, and 40 percent, respectively) but nearly all of the seedlings show signs of severe nutrient deficiencies and/or toxicities. Most of the seedlings have grown very little.

The survival of the container grown dogwood was very good. No significant difference was noted between the Tinus seedlings and those grown in Woods containers; both average 87 percent survival overall.

The performance of the container grown alder was more erratic. The Woods seedlings averaged 61 percent survival, while the Tinus seedlings averaged only 27 percent.

Considerably more research is needed on this area. The chemical nature of the soil material is not fully understood, and methods of overcoming the toxicity problems must be developed. Irrigation may be necessary to establish vegetation on the drier sites.

2. Osburn Gun Club

Near Osburn, a level area of about 30 acres lies between the South Fork channel and Interstate 90. The area is within the flood plain of the stream, but is somewhat higher than the stream channel and is rarely flooded. The soil is a mixture of native gravel, mine waste rock, mine tailings, and reworked tailings. The material is porous and does not retain moisture readily. No chemical analysis of the material has been made, but the presence of mine waste rock and tailings would indicate relatively high levels of heavy metals.

Previous Research:

Greater Shoshone County, Inc. and the Soil Conservation Service established a grass research area near the Gun Club. Four species of grass--intermediate wheatgrass, alpine timothy, orchard grass, and hard fescue--were planted with a brillion drill. The seeding was not successful; only a few widely scattered grass seedlings emerged and grew. Extremely dry conditions were blamed for the failure.

Research Program:

1975: A research plot of 10 species of container grown native shrubs was established. The seedlings, obtained from the Coeur d'Alene Nursery, were all in Tinus containers.

Results and Conclusions:

After 3 growing seasons all 10 species have less than 10 percent survival, and 4 species have no survival at all. Most of the shrubs still alive have grown very little since they were planted and are in poor condition.

Extensive research will be necessary before this site can be revegetated. The lack of moisture is a critical problem, and irrigation may be necessary to establish vegetation.

3. Spring Gulch:

Between Osburn and Big Creek, the South Fork is bordered by Interstate 90 on one side and a railroad right-of-way on the other. The result is a "flood plain" which varies in width from several hundred feet to several hundred yards. During normal flow periods, the stream is confined to a fairly well-defined channel. Spring runoff and flood waters often exceed the capacity of the channel, however, and the stream occupies part or all of the flood plain. A major flood in 1974 destroyed the vegetation on the area and washed away the surface deposits of soil and mine tailings. It left a surface comprised primarily of river bedload, with scattered remnants of finer textured materials. The pH of the finer textured surface material is slightly acidic. High concentrations of lead and zinc indicate the presence of jig tailings.

Natural vegetation is slowly becoming re-established on the area. Two small patches of sitka alder are growing on moist sites, a few scattered willow are growing along the stream, and stands of native red top are beginning to appear on some of the deposits of finer textured material. Black cottonwood seedlings can be found near the railroad right-of-way.

Previous Research:

Prior to the S.E.A.M. project, no revegetation research had been done at this location or any similar to it.

1975: A research plot of 10 species of container grown native shrubs was planted near Spring Gulch. The surface was rocky, primarily river bedload and sand, and planting was difficult. Although the material has a low moisture holding capacity, the water table at that location is relatively high and is supplemented during spring runoff by flow from an intermittent stream in Spring Gulch. The pH of the finer textured surface material is slightly acidic. High concentrations of lead and zinc indicate the presence of jig tailings.

Results and Conclusions:

The overall survival of the native shrubs was 38 percent. Only 4 species had greater than 50 percent survival: rose, 65 percent; sumac, 70 percent; green ash, 80 percent; lead plant, 85 percent. Most of the surviving shrubs have grown very little in 3 growing seasons.

The shrub species planted are clearly not well suited to the site conditions. Future work should include research with the tree and shrub species that are found growing naturally on similar sites: alder, black cottonwood, willow, and dogwood. Growing the seedlings in small containers would make planting easier. Methods of establishing grass cover should also be investigated.

4. Airport

The valley of the South Fork widens to more than 3/4 of a mile near Smelterville. The area between the stream and what is now Interstate 90 was originally a cedar swamp. Over a period of years, the low land was covered by deposits of mill tailings--first jig tailings and later the floatation tailings that resulted from more advanced milling and concentrating methods. Part of the tailings were reworked during the 1920's using a floating dredge. During World War II, additional tailings were reworked in a stationary mill that was constructed near the area.

Deposits of tailings and reworked tailings, mixed with river gravel, accumulated to depths of 15 to 20 feet and created a level area of approximately 120 acres that is elevated about the stream channel. The material varies somewhat in chemical and physical composition, but in general it is slightly acidic to slightly basic and has moderately high to very high levels of heavy metals. Organic matter and plant nutrients are negligible. The material is course textured, and moisture is poor. The surface material is easily blown when dry. The Shoshone County Airport is located on the area, and blowing dust reduces visibility on the runway and damages aircraft. Much of the area has wood debris: old lumber, timbers, tree trunks, stumps, and branches.

Very little vegetation is growing on the area. Small black cottonwood, water birch, and willow can be found in a few locations, and scattered patches of red top are growing on moist sites.

Previous Research:

Prior to the S.E.A.M. project, College of Forestry researchers and the Soil Conservation Service established a 25 acre grass research area. Various combinations of 12 grass species were planted in 26 plots with a brillion seed drill. All of the seed combinations failed to produce stands; the researchers attributed this to a critical lack of moisture and the "sandblasting" of emerging seedlings by wind blown surface material.

The researchers also planted 36 varieties of hybrid poplar to evaluate the performance of individual genetic lines under the harsh conditions. Six of the lines demonstrated significantly better survival and growth than the others.

Research Program:

1975: A 1/2 acre grass research plot was established near the west end of the airport runway. Soil analysis of the surface material disclosed extreme deficiencies of nutrients (including a critical boron deficiency), low organic matter, a pH of 8.0, 676 ppm lead, and 110 ppm zinc. The material is course textured, and no vegetation is growing on the site.

The plot was divided into 8 subplots, and half of each subplot was rototilled. Four subplots were irrigated by a sprinkler system and 4 were not. The seed mixture used was 50 percent Reubens Canada bluegrass, 25 percent intermediate wheatgrass, and 25 percent hard fescue by weight. The fertilizer was 16-20-0, applied at the rate of 200 pounds per acre, and the mulch was Jacklin Organic Mulch. One irrigated and one non-irrigated subplot of each of the following seed/fertilizer/mulch combinations were planted:

1. *seed, fertilizer, and mulch, broadcast with a hand seeder.*
2. *seed, fertilizer, and mulch, applied with a hydroseeder.*
3. *seed, fertilizer, and 4 pounds per acre of boric acid, broadcast with a hand seeder.*
4. *seed and fertilizer, broadcast with a hand seeder.*

The plot was planted in May and the 4 irrigated subplots were watered throughout the summer. In late August, 200 pounds per acre of 18-10-10-7 plus micronutrient fertilizer was broadcast on all 8 subplots. No additional fertilizer was applied and no irrigation was provided during the second and third growing seasons.

Results:

Only a few scattered grass seedlings survived on any of the 4 non-irrigated subplots. Most of the plants which are still growing are located on the subplot where the seed mixture fertilizer and mulch were broadcast.

The most complete cover was established on the irrigated subplot where the seed mixture fertilizer and mulch were broadcast. An excellent stand of Canada bluegrass and hard fescue developed during the first growing season, and the grass is still vigorous after 3 growing seasons. Only a few plants of intermediate wheatgrass grew to maturity. During the first growing season, the grass on the rototilled half of this subplot was slightly taller, but the difference became much less apparent during the second and third years.
The irrigated subplot where the seed, fertilizer and mulch were applied with a hydroseeder developed very slowly during the first growing season; the seedlings what did emerge never approached the height or maturity of those on the other three irrigated subplots. After three growing seasons the overall stand is sparse and irregular, but the individual Canada bluegrass and hard fescue plants are as vigorous as those on the other irrigated subplots. No intermediate wheatgrass is present. No differences were noted between the rototilled and non-rototilled halves of the subplot.

The two remaining irrigated subplots are nearly identical in stand density and vigor. The seed mixture and fertilizer were broadcast on both, and one was treated with boric acid. The addition of boric acid did not produce an apparent response. A good stand of Canada bluegrass and hard fescue developed on the rototilled halves of both subplots, while the stands on the non-rototilled halves are very sparse and irregular. The grass developed at roughly the same rate as that on the irrigated subplot where mulch was applied, and is still as vigorous after three growing seasons.

Conclusions:

The results indicate that a good stand of grass can be established on the area in spite of the chemical and physical limitations. Irrigation appears to be mandatory during the first growing season, and mulch is highly desirable. Rototilling produced mixed results; it was beneficial on subplots that were not mulched but had no effect on the mulched subplots.

The relatively high levels of heavy metals did not seem to be detrimental. This could be due to the high pH, which limits the availability of most heavy metal ions. Since all of the subplots received the same fertilizer applications, no conclusions can be drawn regarding the necessity for fertilization or optimum rates of application. The extremely low nutrient levels of the surface material, the coarse texture, and the lack of organic matter would all indicate that at least some fertilizer would be necessary for the establishment and growth of a stand of grass.

Because the use of mulch might be too expensive or otherwise impractical for a large scale planting program, other methods of providing protection for the seed and retaining moisture during germination and emergence should be considered. Using a seed drill and/or a rapid growing cover crop might help to accomplish those objectives. Rototilling or disking would provide an improved seedbed, but it should be noted that loosening the surfact material by tillage would cause faster drying of the material, thereby increasing the need for frequent irrigation. Although some general conslusions can be drawn concerning the 3 species of grass used in this study, the plot was not designed for species screening and the results should not be interpreted as though it was. A species screening study should be carried out before a large scale planting program is undertaken. Based on previous research and this study, grass species to be considered should include Canada bluegrass, hard fescue, red top, orchard grass, smooth brome, and timothy.

Research Program:

1976: Most of the principle population centers in the Mining District are connected to a central sewer system, which has its treatment facility west of Smelterville. The chlorinated effluent resulting from secondary treatment of the sewage flows by gravity from the treatment plant to the airport area, where it is discharged into the South Fork.

The potential exists for using the treated effluent to irrigate a large portion of the airport area. Effluent irrigation has been used elsewhere, primarily on agricultural and forested land, with good success. A greenhouse experiment was set up to determine if effluent irrigation would be beneficial in establishing vegetation on the deposits of mine tailings and gravel.

Surface material taken from the same general area as the 1975 grass research plot was used to fill 36 1-quart plastic pots. Three species of grass were used: Reubens Canada bluegrass, intermediate wheatgrass, and red top. Half of the pots were fertilized with 18-10-10-7 plus micronutrient fertilizer, applied at the equivalent of 400 pounds per acre. Half of the pots were not fertilized. Treated sewage effluent, obtained at the point of discharge on the South Fork, was used to water half of the pots, and water from an industrial well on the airport area was used to water the remaining half. The result was a total of 12 possible combinations of grass species, fertilizer, and water. Three replications of each combination were planted.

A commercial greenhouse in Osburn donated space for the pots, which were planted in April. The pots were watered as required with either effluent or well water. In August the grass in each pot was clipped at ground level, measured, oven dried, and weighed. The average height for each pot was determined by measuring 20 randomly selected seedlings.

Results:

The following chart summarizes the results of the greenhouse effluent study. The figures shown are averages of the 3 replications of each of the 12 combinations.

Species and Fertilizer	Watered with	Oven Dry weight	Average Seedling Height
Red Top	Effluent	2.013 gm	4.715 cm
	Well water	1.103	2.795
Red Top Fertilizer	Effluent	3.186	7.357
	Well water	2.434	5.530
Reubens Canada bluegrass	Effluent	1.542	6.508
	Well water	0.141	1.705
Reubens Canada bluegrass Fertilizer	Effluent	1.551	7.445
	Well water	1.052	5.743
Intermediate Wheatgrass	Effluent	4.081	16.837
	Well water	1.943	8.895
Intermediate Wheatgrass Fertilizer	Effluent	4.505	14.778
	Well water	2.475	11.360

Conclusions:

Watering with effluent produced significantly more grass, as evidenced by both total weight and average height, than watering with well water. For Canada blue-grass and intermediate wheatgrass, the no fertilizer/effluent combination produced more grass than the fertilizer/well water combination. This indicates that the bluegrass and wheatgrass were able to obtain considerable amounts of nutrients from the effluent. The implications of this are very important; effluent irrigation could reduce or eliminate the need for fertilizer in a large-scale planting program, and subsequent fertilization to maintain the vigor of the stand might not be necessary. In addition, the suspended solids in the effluent would increase the level of organic matter in the material, which would result in better retention of nutrients and moisture.

Although all 3 grass species performed well in this study, an on-site species screening trial using effluent irrigation should be considered before selecting one or more grasses for a large-scale planting project.

A University of Idaho College of Mines research team, headed by principal investigators Dale Ralston and Roy Williams, is currently studying the airport area as part of a research project dealing with abandoned mine tailings deposits. The project, which is funded by the Environmental Protection Agency, through the Idaho Department of Health and Welfare, is aimed at determining the physical and chemical characteristics of the tailings deposits and the ground water associated with those deposits. Their results will be of great importance in planning and implementing future revegetation projects on the airport area. The ground water data will provide important base line information for determining the effects of sewage effluent applications. A better understanding of the characteristics of the layers of tailings deposits will help in selecting plant species and tillage methods.

5. Mission Flats

To the west of the Mining District, the North Fork and the South Fork merge to form the main stem of the Coeur d'Alene River. From that point downstream, the river valley widens and the stream flows less swiftly. Approximately five miles west of Pinehurst, a level area of roughly 200 acres lies adjacent to the river. The area is known locally as Mission Flats after the nearby Cataldo Mission. Early settlers used the area for pasture and native hay. After mining operations began upstream, however, floods left deposits of mine tailings on the area and it became unsuitable for agricultural use. It was subsequently purchased by a group of mining companies that were operating in the Mining District.

The gradient of the river decreases near Mission Flats, and over a period of years deposits of mine tailings began to fill the river channel. In the early 1930's, a dredge was set up to remove the tailings from the river and deposit them on Mission Flats. The tailings were viscous, and flowed several hundred yards from the point of discharge. The coarse fraction settled out first, and the finer material was carried for some distance. Near the discharge point, the dredged material accumulated to a depth of 40 to 50 feet; the deposits decreased in depth toward the outlying areas.

Interstate 90 was built through the center of Mission Flats in the early 1960's, and considerable dredged material was used in its construction. Most of the material used was taken directly from the dredge discharge; the material lying in place was not disturbed. The dredge continued to operate until the late 1960's, when tailings impoundments became mandatory within the Mining District and mine tailings were no longer deposited in the streams.

Except for research plantings, the area nearest the dredge discharge is barren. Approximately 20 acres in size, the area is characterized by an unstable sandy surface, limited moisture retention in the upper several inches, and low fertility. No organic matter is present, and the material is structureless. The pH ranges from slightly acidic to slightly basic, and concentration of heavy metals are high. Moisture increases with depth, as does the percentage of silt and clay size particles. The surface material is easily blown when dry, reducing visibility on Interstate 90 and "sandblasting" vegetation.

The remainder of Mission Flats has some degree of vegetative cover. Much of the outlying area is dominated by dense stands of common reed, a tall grass that spreads aggressively by root runners and stolons. Other areas have light to heavy stands of native red top grass.
Chemically the outlying area does not differ significantly from the barren area, although the deposited material has a finer texture. The vegetation has contributed organic matter, but the material remains largely structureless. The surface retains more moisture than that of barren area, and much less wind erosion occurs.

Previous Research:

Considerable research had been done on the Mission Flats area prior to the S.E.A.M. project. University of Idaho College of Mines researchers conducted chemical analyses of the dredged deposits, plant materials found growing on the deposits, and the ground water underlying the deposits.

College of Forestry research concentrated primarily on the barren area. Surface material was potted and used in a greenhouse study to compare grass species and types and rates of fertilizers. Methods of establishing common reed were investigated. Bare root and container grown conifer seedlings were planted on the barren area and within a patch of common reed. Several grass and legume species were planted with a grain drill, and a plot of container grown Volga wild rye was established.

Preliminary results indicated that the dredged material was not toxic to most plant species, but deficiencies of moisture and nutrients were serious problems. Researchers found that common reed could be established by planting 3-node segments of rhizomes; spacing and fertilization were not determined to be significant. Bare root ponderosa pine seedlings survived and grew fairly well within the reed patch; they also survived on the barren area, but growth was reduced and some sand blasting injury was noted. Several species of grass and legumes became established where seed was drilled at exceptionally heavy rates. The container grown Volga wild rye survived and grew, but did not spread as rapidly as anticipated. Bare root hybrid poplar and golden willow planted in a windbreak near Interstate 90 had excellent survival and grew well.

Research Program:

1975: A research plot containing 7 species container grown native shrubs was planted on a site with a sparse cover of red top. The site had adequate moisture and was not subject to wind erosion. A row of ponderosa pine in Tinus and Hillson containers was planted across the barren area. The 2 types of seedlings were alternated within the row; 62 of each type were planted.

1976: Bare root golden willow, black locust, and hybrid poplar were planted in 3 windbreaks across the barren area.

1977: A plot of bare root European white birch and black locust was established at the same general location as the 1975 native shrub plot. European white birch was also added to 2 of the 1976 windbreaks.

Two grass plots were planted on the barren area. Each consisted of 5 grasses--Reubens Canada bluegrass, Durar hard fescue, Tegmar intermediate wheatgrass, commercial red top, and native red top collected nearby the preceeding fall--planted individually on 4 foot by 10 foot subplots. All subplots were seeded by hand broadcasting, fertilized with the equivalent of 400 pounds per acre of 18-10-10-7 plus micronutrient fertilizer, and mulched with straw. To hold the straw in place, a tree planting scalper was used to "disk" the straw 2 to 3 inches into the ground.

Results and Conclusions:

1975: The overall survival of the container grown shrub plot has decreased steadily: from 85.7% to 62.7% to 26.4%. Most of the surviving shrubs have had only minimal growth. Additional research is needed to determine the cause of the mortality and poor growth and develop methods of dealing with the problems.

The survival of the container grown ponderosa pine has decreased each year, but is still over 70%. The larger seedlings (Tinus) have slightly better survival and growth, but the differences are not significant. The growth of both types of seedlings is much less than that of identical seedlings planted on most of the brush covered hillside plots. The needles of most of the seedlings are shorter than normal, and many seedlings have not retained their first and second year needles. Several of the seedlings have been damaged by motorcycles or 4-wheel drive vehicles.

The results indicate that container grown pine seedlings can survive on the barren areas, but additional research is needed to improve survival and increase growth. The low nutrient levels found in the dredged material would indicate that fertilization might be required. Protecting the seedlings from blowing and sand and vehicle damage would also improve their performance.

1976: The windbreak trees have good overall survival; nearly 93% of the hybrid poplar are still alive, and the golden willow and black locust have approximately 70% survival. In general their growth is much slower than normal (all 3 species grow rapidly on good sites), and several more years of growth will be required for the trees to act as a windbreak. The high survival rate of the hybrid poplar indicates that it is compatible with the site, but fertilization may be necessary to achieve better growth. More research will be necessary prior to large scale plantings of these deciduous species.

1977: First year results of the bare root birch and locust plot indicate that the European white birch, with 100% survival and good growth, has excellent potential for use on the outlying areas. The black locust had 76% survival, and in general the locust seedlings did not grow as well or appear as healthy as the birch seedlings. The survival of the European white birch planted in the windbreak was considerably lower than that of the birch in the plot, but was comparable with that of the golden willow and black locust. Most of the surviving seedlings had good growth.

The grass plots were planted May 15, and by mid-June all of the grasses had germinated and the emerging seedlings were 1 to 3 inches high. During the last 2 weeks in June, however, the surface of the barren area dried and began to blow. The straw mulch caused the blowing material to collect on the grass plots, and by the first week in July all of the grass seedlings had been covered. Only a few scattered wheat plants that grew from seed in the mulch survived.

The results of this and previous research indicate that grass cover can be established and maintained on the barren area under favorable conditions. The period of emergence is critical; the seed and seedlings must be kept moist and protected from blowing sand. A large seeded, rapid growing cover crop such as oats or wheat might provide the necessary protection; grasses or legumes could be planted at the same time as the cover crop, or the cover crop could be disked and the grasses or legumes planted on the stubble. With either procedure, the entire area should be planted at the same time to minimize wind erosion and the resulting deposition of the windblown material on emerging seedlings. Adding fertilizer might be helpful in establishing vegetation, but previous research plantings were partially successful without fertilization. Because of its coarse texture and lack of organic matter, the dredged material would not retain fertilizer readily; frequent applications would be necessary to maintain a high nutrient level. A more economical approach would be to use only grass and legume species with low nutrient requirements.

Vegetation used in the university work are as follows:

TREES

A. Coniferous

1. Ponderosa pine
2. Austrian pine
3. Scotch pine
4. Lodgepole pine
5. Western white pine
6. Douglas-fir
7. Grand fir
8. Engelmann spruce

B. Deciduous

1. Black locust
2. European white birch
3. Hybrid poplar
4. Green ash
5. Water birch
6. Black cottonwood
7. Willow
8. Quaking aspen
9. Golden willow

SHRUBS

1. Rocky Mountain maple
2. Black hawthorn
3. Service berry
4. Elderberry
5. Bitter cherry
6. Choke cherry
7. Mountain ash
8. Dogwood
9. Sitka alder
10. Thin leaf alder
11. Sumac
12. Red stem ceanothus
13. Golden current
14. Snowberry
15. Wood rose
16. Pachistima
17. Oregon grape
18. Lead plant
19. Buffalo berry

HERBACEOUS SPECIES

A. Grasses

1. Red top
2. Reubens Canada bluegrass
3. Intermediate wheatgrass
4. Hard fescue
5. Common reed
6. Volga wild rye
7. Alpine timothy

B. Other

1. Bracken fern

A thesis entitled "Amelioration and Revegetation of Smelter-Contaminated Soils in the Coeur d'Alene Mining District at Northern Idaho," Bradley (1977) was designed to determine which of the species planted was most tolerant to the adverse soil characteristics of the area, to quantify the role of the various metals in seedling mortality, to determine the value of lime as a means to rehabilitate smelter-affected soils, and to assess the value of containerized tree seedlings as a tool for revegetation of polluted soils.

The study indicated that of four species planted, Austrian pine (Pinus nigra) was most tolerant of the harsh soil conditions, that black locust (Robinia pseudoacacia) produced the greatest growth, that liming the acidic, polluted soils was significant in improving growth and survival of all tree species, that seedling mortality was function of high concentrations of Zn and other heavy metals in soils and plant tissues, and that containerized seedlings of all species were superior to bareroot seedlings in both survival and growth.

In other work, a greenhouse study was conducted to determine: (1) the effects of differential liming rates upon the survival of two tree species, (2) levels of labile heavy metals in the soil as a function of soil pH, and (3) the relative importance of heavy metal species in causing seedling mortality.

Results showed positive correlations between the survival rates of black locust (Robinia pseudoacacia) and Scotch pine (Pinus sylvestris), and the pH level of a smelter-contaminated soil (r = .915 and .802, respectively). Soil content of Zn, Mn, Pb, and Al were negatively correlated to soil pH. Therefore, seedling survival was determined to be a function of heavy metal content of the soil as modified by pH.

In order to better understand the soil properties that inhibit grass establishment, a greenhouse experiment was conducted to evaluate the effects of Pb, Zn, and Cd on emergence, growth, and uptake of metals by intermediate wheatgrass. An uncontaminated soil collected near Kellogg was used to ensure exact control over addition of heavy metals.

This greehouse study demonstrated that emergence of intermediate wheatgrass was not affected by any level of Pb, Zn, or Cd applied, but that both yield and grass height were reduced with Cd addition. The reduction in yield and height with increasing concentrations of Cd was inconsistent, however, as the highest Cd level reversed the decline. For weight, this reversal took place only in the presence of added Zn while for height, only in the presence of added Pb. Intermediate wheatgrass tolerated neutral LN NH_4O Ac-exchangeable Pb, Zn, and Mn levels of 3140, 30, and 138 ug/g, respectively, with corresponding tissue concentrations of 122, 412, and 2040 ug/g. An exchangeable Cd level of 8.8 ug/g was associated with 19 and 17% reductions in yield and height, respectively, with a corresponding tissue Cd concentration of 33 ug/g.

Dwarf intermediate wheatgrass (agropyron intermedium) was seeded to pots containing volcanic-ash soil amended with four levels of Pb,Zn, or Cd as acetate salts. Two metals were applied to each pot to investigate all two-factor interactions. Soil solution concentrations of 0, 35, 70, and 105 ug/ml Pb; 0, 40, 80, and 120 ug/ml Zn; and 0, 4, 8, and 12 ug/ml Cd were produced using sorption isotherms calculated for each metal. Emergence was unaffected by Pb, Zn, or Cd. Yield and height were decreased by 17 and 19%, respectively, by 4 ug/ml Cd, but neither Pb nor Zn had a main effect. In the presence of applied Zn, 12 ug/ml Cd increased yields over 8 ug/ml Cd. A similar increase in height occurred in the presence of applied Pb. Tissue uptake of Pb, Zn, and Cd was highly correlated with levels added, calculated to be in soil solution, and exchangeable with 1N NH_4O Ac. All three measurements predicted tissue metal uptake equally well. Shoot-tissue concentrations of Zn and Cd exceeded exchangeable levels by average factors of 23 and 4, respectively, while Pb accumulation was only 3% of soil exchange levels. This reduced Pb uptake is attributed to Pb-immobilization in roots.

The Role of Terraces and Soil Amendments in Revegetating Steep, Smelter-Affected Land was investigated. This study encompasses the use of both terraces and natural slopes for revegetation on the steep, barren hillsides near Kellogg. The alteration of soil properties caused by terracing and the response of planted trees and grasses to soil properties caused by terracing and the response of planted trees and grasses to soil amendments on the slopes and terraces was investigated.

The revegetation study on a denuded smelter site evaluated the influence of terracing and soil treatments on alteration of soil properties and success of vegetation establishment. Study sites were located on two aspects and elevations to represent different intensities of previous exposure to smelter emissions. Native and introduced trees and grasses were planted on amended plots. As a separate experiment, four grass species or mixtures were seeded directly on untreated soil. Terracing did not affect grass establishment or tree growth, survival, or vigor, but lowered extractable P, total N, organic matter, cation exchange capacity, and available water content. Base saturation and pH were increased by terracing on less eroded areas, where exchangeable levels of Pb, Zn, Cd, and Mn were reduced. Lime increased grass emergence, but P was necessary for successful growth and spread. Introduced grasses had better growth and spread than the native grass, but grass establishment was minimal or non-existent without soil amendments. Tree survival or vigor were unaffected by any soil treatment, nor was a relationship found between weekly tree mortality and soil water content. Application of 4750 kg lime/ha, 135 kg n/ha, 115 kg P/ha, and 135 kg K/ha did abate Zn toxicity on the study sites closest to the zinc smelter.

A factorial arrangement of study sites was designed to evaluate two aspects, two elevations, and two positions, the natural slope and constructed terraces, in terms of suitability for vegetation establishment and alteration of toxic soil properties.

In one experiment, native and introduced bunch and rhizomatous grasses were seeded directly on the barren slopes and terraces to find an adaptable species. In another experiment a native bunchgrass, Idaho fescue, and a mixture of introduced grasses were seeded on plots receiving different combinations of lime and fertilizers. Two tree species, Douglas-fir and Austrian pine, were also painted on the fertilized plots.

None of the grasses in the screening trial successfully established on the untreated soil, although there was scant survival on the upper elevation terraces which were least toxic. In the soil amendment experiment, both the introduced mixture and Idaho fescue emergence, herbage yield, and second year cover and height were greatly increased by liming and fertilizing, especially with P. Liming alone increased emergence, but was ineffective in promoting vigorous growth. The effect of terracing on grass establishment was minimal. The mixture outperformed Idaho fescue in all categories of growth measurement.

Neither tree species responded to terracing or soil amendments, except that a combination of lime and N increased Douglas-fir growth somewhat. Austrian pine had better over-winter survival than Douglas-fir (76 v. 64%). The high concentrations of Zn and possible injury from SO_2 killed all the trees and grasses on the study sites in closest proximity to the zinc smelter.

Terracing generally reduced AWC, total N, organic matter, CEC, and exchangeable acidity, and on all but one area reduced extractable P, exchangeable Cd, Zn, and Pb and H_2O-soluble sulfates. An increase in pH was realized only at the upper elevation. The addition of lime and P greatly increased pH and extractable P levels tested one year after application. Of the heavy metals, only exchangeable Pb was consistently reduced by liming.

The anomalous increase in exchangeable Zn and Cd brought about by liming on the lower elevation sites could have been due to the variability within these sites or the use of inadequate soil testing methods.

The negligible difference in tree and grass performance between the slopes and terraces demonstrated that terracing was not effective in creating a more favorable medium for plant growth. The attenuation of heavy metals and soil acidity by terracing was limited to the upper elevation, as the lower terraces were still considerably toxic. Terracing diminished the adjusted AWC, but an unusually wet growing season precluded observing the effects of potentially xeric conditions on tree and grass performance.

Terracing does function to reduce surface runoff and erosion and can be utilized to aid in amending soil and reseeding.

Based on studies at Kellogg and elsewhere, application of lime and fertilizers has effectively aided the establishment of grass cover on steep, denuded sites. Devising effective and economical methods of applying soil amendments to rocky, steep terrain should be a major consideration of further work.

"MINING INDUSTRY"

Significant progress has been made in the area of pollution control by the mining industry within the past decade. Considerable amounts of money and manpower has been expended in the effort of cleaning up the air, water and surrounding environment. The following describes the past, present, and future projects undertaken by the mining companies.

Bunker Hill

Bunker Hill has been a pioneer in the development and installation of environmental control equipment. Over $23 million has been spent, throughout the years, in programs to control gases, dusts, and mists, and to reprocess or neutralize waste waters. Bunker Hill is currently spending an additional $2 million to achieve further pollution control. Since the installation of their smeltering plant, sulfur dioxide gas has presented an air quality problem in the valley. By using the latest technology, a 72 percent control of sulfur dioxide can be achieved. Location of the plant in an area with frequent inversions and poor ventilation makes it difficult to improve the percentage. In order to minimize the effect of the remaining sulfur dioxide emissions on the ambient (ground level) air in Kellogg, the company installed a $40,000 weather and air monitoring system. By monitoring key weather indicators and SO_2 levels, the system permits the minimizing of emissions during stagnate air conditions and increased emissions during favorable venting periods. Since the installation of this equipment, sulfur dioxide levels in Kellogg have decreased permitting native vegetation to reestablish in the area.

In May, 1974, Bunker Hill completed construction of a unique water treatment system which has become a model for the metals industry. The 1.3 million plant treats waste water from the company's operations by means of line neutralization, aeration, coagulation, sedimentation, and solids recycling. The new facility, which can treat 6.5 million gallons of water per day, uses technology never before used in a treatment plant for removal of heavy metals from the waste water of metallurgical operations. This process can effectively remove 95 percent of the zinc contained in the water entering the treatment plant.

Bunker Hill has begun a long-term program to revegetate over 18,000 square acres of near-bald hillsides and barren plains in the Silver Valley. The program calls for over 11 million trees to be planted. Many of the trees to be planted under this program will be grown in an underground greenhouse located in Bunker Hill's mine. A detailed description of Bunker's revegetation program is located in the Recommendations and Project Outline portion of this plan.

Hecla Mining Company

Hecla is actively involved in a revegetation program on their company owned lands. This program involves vegetating some barren hillsides and the banks of their tailing ponds. An extensive research program has been initiated to determine which species of native "site invader" will best adapt to the conditions that exist on the banks and surfaces of abandoned tailing ponds. Several native species have proven to be successful and are invading naturally.

Results of this research can be found in a report entitled "An Analysis of Procedures, Soil Mediums and Plant Types in North Idaho Tailings Embankments and Tailing Ponds" by Walter W. Weid, Environmental Quality Engineer, Hecla Mining Company. This report contains information on fertilization, hydroseeding, irrigation, planting procedures, success rate for individual species, mulching and costs.

Hecla's Star Mine maintenance department has an ongoing project of cleaning up the Burke Canyon area. Delapidated buildings have been demolished and burned. The cleanup of debris along Canyon Creek following high water has been routine with the company.

Sunshine Mining Company

The Sunshine Mining Company has installed sprinkler systems at their tailings pond and the dikes have been mulched and seeded. Barren hillsides above Sunshine's mine, resulting from a fire, has been replanted.

Sunshine is presently developing a new tailings pond located at the former site of the Shoshone Golf Course. The golf course is presently being relocated on a plateau west of the original site. The course is scheduled for completion in 1979.

American Smeltering & Refining Company

The American Smeltering and Refining Company built four stepped tailings impoundment areas in Lake Gulch below the Galena Mine in 1968. Another larger impoundment was constructed in 1972 located on the flats east of Osburn. The site of the impoundment area is the former site of the Wallace-Osburn city dumps that were visible from the highway. Planting of grasses and shrubs on the banks of these tailings ponds has been quite successful. A new site located just west of this area has been identified as the site of ASARCO's future tailings pond. Construction of the impoundment will begin in the near future. Bare slopes in the vicinity of the shaft at the Coeur d'Alene project have been seeded, thus preventing soil erosion.

ASARCO contributed their idle Page Mine tailings area to the South Fork Sewage District for use as a treatment plant.

ASARCO has worked closely with the University of Idaho in research projects experimenting with vegetation of tailing ponds and deposits on the valley floor.

C. SEWAGE DISPOSAL SYSTEMS

Prior to 1974, sewage was collected in Mullan, Wallace, Silverton, and Osburn and dumped directly into the South Fork without any type of treatment. Many other residents living adjacent to streams also disposed of their sewage directly into the streams. Sewage from the City of Kellogg was treated in the Bunker Hill tailings pond but did not meet state and federal standards.

The South Fork Coeur d'Alene River Sewer District was formed in 1966. Bond elections were held in 1967 and 1968 but were defeated by a majority vote. A third bond election was held on January 11, 1972, and passed with a 71 percent favorable vote.

To date, $7.6 million has been invested to provide needed sanitary service to the majority of the communities adjacent to the South Fork Coeur d'Alene River. Main Sewer trunklines collect wastewater from communities between Wallace and Pinehurst to the treatment facility below Page, and the City of Mullan is serviced by a treatment facility located west of town. In addition, the Kingston-Cataldo Sewer District is presently constructing a sanitary sewer system which will transport its wastewater to the Page treatment site. Completion of this system will eliminate the health hazard conditions which have existed in those communities. Figure 34 outlines the boundaries of the South Fork Sewer District.

Sewage collection and treatment has greatly improved water quality of the South Fork Coeur d'Alene River as indicated in Table 48. However, there remain at least ten communities which are located near, or are on tributary gulches to, the South Fork Coeur d'Alene River which continue to have inadequate or no sanitation services. The communities which presently are considered to have the most serious sewage service needs are Page, Ross Ranch, Moon Gulch, Big Creek, Terror Gulch, Two-Mile Gulch, Nine-Mile Gulch, Placer Creek, Burke Canyon, and Larsen.

A need has been identified to provide adequate sewage sanitation service to the remaining unsewered communities in the gulches tributary to the South Fork Coeur d'Alene River. Serious public health hazard conditions still exist in many of these gulches due to remaining direct discharges of raw sewage and other inadequate means of sewage disposal near tributary creeks.

TABLE 48

COMPARISON OF SOUTH FORK COEUR D'ALENE RIVER BEFORE AND AFTER STP INTERCEPTOR

		TOTAL COLIFORMS PER 100/ml				FECAL COLIFORMS PER 100/ml			
STATION	RIVER MILE	12-71[4]	12-75[1]	5-76[2]	8-76[3]	12-71	12-75	5-76	9-76
Below Hatchery	29		--	--	126		--	--	6
Above Mullan	27.3	600	183	60	683	150	104	5	124
Below Mullan	26.0	106,000	5,100	150	134	55,000	TNTC	8	20
Above Wallace	19.4	5,000	1,770	275	178	1,700	TNTC	4	6
Above Silverton	17.3	22,000	650	900	2	6,500	140	71	0
Above Silverton	16.4	280,000	1,600	150	--	21,500	152	5	--
Below Osburn	12.6		433	40	266		95	9	0
Above Kellogg	8.3	5,600	346	15	476	500	117	2	0
Below Kellogg	6.1	4,200	393	30	286	300	142	2	0
Smelterville		1,900		110		200		1	
Enaville	.2	Nil	83	30	152	Nil	15	4	0
Cataldo			5	30	150		1	2	0
Rose Lake			13	45	50		4	6	0

1 December 15-16, 1975
2 May 18, 1976. Values average of two samples.
3 September 9, 1976. Single sample.
4 Data from EPA, December 1971.
--Data not available.

The inadequacies of sewage service, as well as its associated water quality and public health significance, have been documented by the Panhandle Health District through Shoreline Surveys performed during the summers of 1975-76, and through continuing water quality monitoring by the Department of Health and Welfare. A summary of that information is found in Table 49.

All ten of the communities listed are faced with similar sewage service difficulties; steep canyon walls, narrow valley floors, slight soil cover over porous river rock, high groundwater, and most homes are within 10 to 150 feet from the tributary creeks. As can be seen from Table 48, a significant percentage of the homes in these areas discharge raw sewage directly into the tributary creeks. The dwellings in these areas are full-time residences.

In addition to the elimination of existing health hazard conditions, extension of sewage service to these communities will open up additional building sites in a valley in which the majority of the land is either in public ownership or is held by various mining interests.

The South Fork Coeur d'Alene River gulches have received a priority rating from the State of Idaho/ Environmental Protection Agency Construction Grant Program. This could provide grant assistance for a facilities planning study, and design and construction assistance for communities in this area.

This Plan of Study is being presented to the Shoshone County Board of Commissioners. It proposes that the County sponsor the Facilities Planning effort and provide the 10 percent local matching share to a 90 percent grant, in order to allow these communities to "get off the ground" in correcting their sewage problems. One of the important conclusions of this study will be the institutional arrangements which should be implemented in order for the communities to pay their share of the non-grant eligible design and construction costs.

TABLE 49

SHOSHONE COUNTY
SHORELINE SURVEY

	#R	D*	H*	S
Big Creek	60	615.0'	5.0'	2°
Burke Canyon	92	103.7'	9.0'	3°
Fern Creek	19	98.3'	8.5'	5°
French Gulch	36	103.8'	8.0'	5°
Hunt Gulch	31	126.0'	8.6'	6°
Larson	19	108.8'	3.0'	6°
Latour Creek	29	131.7'	4.0'	2°
Montgomery Gulch	12	94.5'	3.4'	4°
Moon Gulch	57	94.6'	6.1'	2°
Nine-Mile Gulch	51	124.1'	9.3'	3°
Nuckols Gulch	17	263.4'	7.3'	4°
Page	62	56.0'	5.5'	7°
Pine Creek-North of West Fork Bridge	102	224.6'	3.3'	2°
Pine Creek-South of West Fork Bridge	101	125.2'	4.0'	2°
Placer Creek	11	67.3'	7.8'	7°
Ross Ranch	16	184.5'	7.0'	2°
Terror Gulch	23	67.9'	3.6'	4°
2-Mile Gulch	28	71.6'	3.5'	4°

*Does not include direct discharges or residences over 400' away.

R - Number of residences
D - Average distance from residence to creek
H - Elevation above creek
S - Slope

D. AIR QUALITY IMPROVEMENTS

The quality of air within the vicinity of Smelterville and Kellogg has improved significantly since the installation of emission control devices and associated tall smoke stacks by Bunker Hill Mining Company. It is now possible to capture over 70 percent of the sulfur dioxide emissions. As shown in Figure 35, main stack particulate emissions have been reduced from 100 pounds per hour in 1974 to 20 pounds per hour in 1975. Use of the latest emission control devices coupled with Bunker's "early warning" system has permitted maximum operations during optimal weather conditions and curtailment during periods of temperature inversions.

Inversions occur when cold air near the valley floor is trapped under a canopy of warmer air. They ususally begin in the early morning hours and disperse around noon. Unless emissions are reduced during inversions, concentrations of sulfur dioxide build up in the valley. When an inversion is developing, operation of the smelter's sintering machine, blast furnace, or other equipment is then curtailed until the inversion ceases.

The success of this operation involves predicting inversions in order to anticipate operation curtailment. Bunker Hill employs the use of a weather station equipped with meteorological devices. Additional equipment includes two stack monitors for determining concentration and flow rate of sulfur dioxide from the main smelter stack and zinc plant stacks, plus three additional weather data collecting stations. This combination has led to an improvement in air quality to a level that now permits the regrowth of vegetation on the once barren hillside.

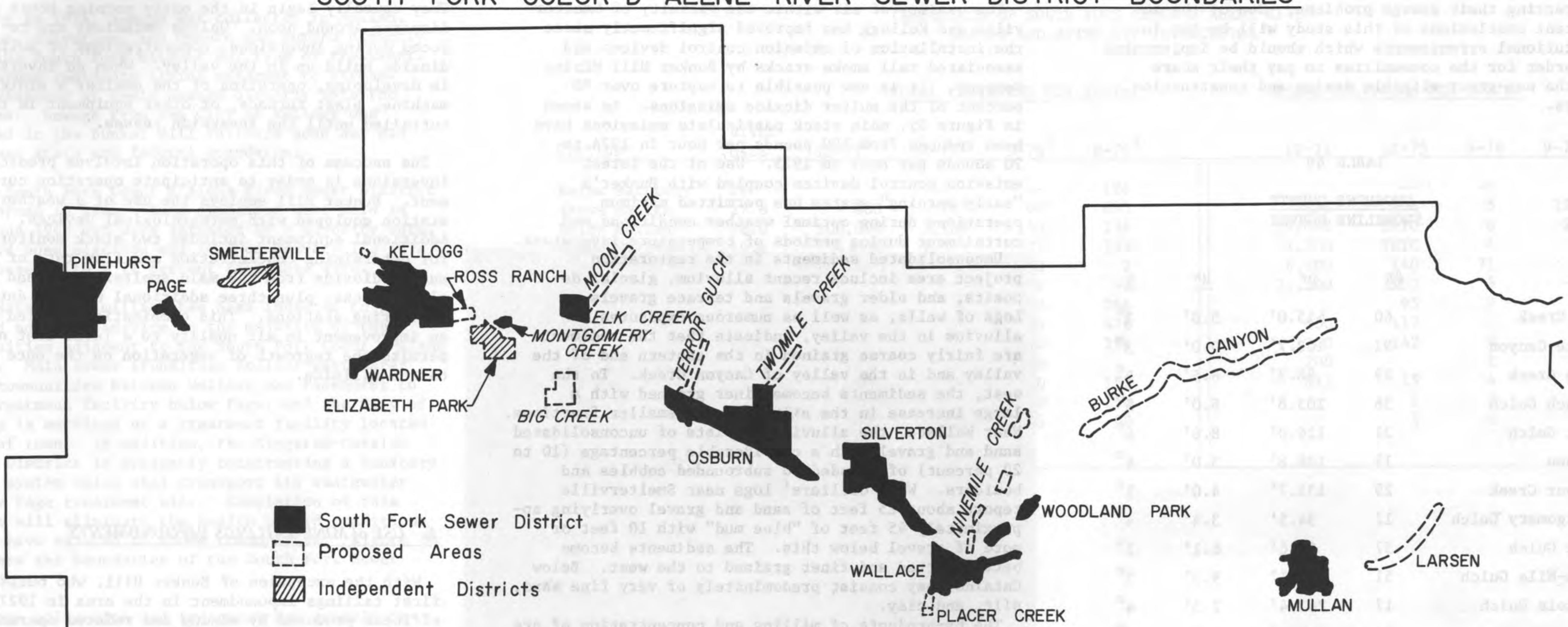
E. USE of MINE TAILINGS IMPOUNDMENTS

With the exception of Bunker Hill, who built the first tailings impoundment in the area in 1927, the effluent produced by mining and related operations was discharged directly into nearby streams. In the fall of 1968, the mining companies employed the use of settling basins as a treatment facility for their wastes.

A study to examine the effectiveness of tailing ponds as a treatment for mine wastes was conducted from 1969-71. The objective of this study was to determine the types of mineral wastes which can be adequately treated in settling ponds. Wastes from seven major mining operations were studied during the two-year period. Temperature, pH, conductivity, suspended solids, and 13 elements were analyzed from samples of inflow, outflow and seepage. The settling basins were categorized into two major types 1) settling ponds receiving effluent from the concentrating process only and 2) settling ponds receiving effluent from the concentrating process, mine drainage, sewage, and smeltering or refining process.

FIGURE 34

SOUTH FORK COEUR D' ALENE RIVER SEWER DISTRICT BOUNDARIES



The five ponds receiving only tailings were found to reduce suspended solids by 99+ percent when properly managed. The outflows of these ponds did not contain toxic elements in dangerous concentrations, provided some dilution is available. The settling ponds receiving other types of wastes were not effective in adequately reducing concentration of antimony, cadmium, iron, manganese, lead, zinc, and fluoride. These elements in the effluents were above recommended toxic limits. The pH of one pond was very low due to mine drainage and industrial effluent while the pH of a second pond was above recommended limits as a result of industrial effluent (i.e., an inflow other than tailings).

Quality of water in streams receiving effluent from the two ponds receiving effluents other than tailings was adversely affected due to settling pond discharge. Quality of water in one location was poor due to leaching of jig tailings deposited below the settling pond. The associated settling pond acted as a groundwater recharge source due to inefficient sealing of the settling pond dike and is in part responsible for the quality of water below the pond.

The improper design of settling ponds and their mode of operation was a cause of groundwater contamination in several cases where problems were observed. For example, a peripheral discharge system for settling ponds would prevent or minimize leakage and resulting groundwater contamination. Most settling ponds have switched to peripheral discharge systems, and with continued proper management may be able to minimize seepage and concomitant groundwater contamination problems.

More research is needed on methods to minimize seepage from ponds that have been in operation for long periods of time. Many such ponds were not designed with mining seepage in mind. Corrective measures may not be simple. In addition, metallurgical processes need to be optimized with respect to water use so that waste water production rates can be minimized.

Use of the tailing ponds have greatly improved water quality of the South Fork. Prior to the use of tailing ponds, the river ran a milky white and was virtually void of any resemblance of life. Settling ponds can be effective in treating the effluent received under certain conditions. The major function of these ponds has been the reduction in suspended solids. As a result, these ponds enhanced the establishment of benthic life in the South Fork of the Coeur d'Alene River. The ponds also stabilize the temperature of the effluent from the mining operation to either equal or nearly equal the temperature of the receiving waters. The ponds have also reduced the pH slightly to a range close to that of natural surface water in the area. Electrical conductivity, potassium, and magnesium were reduced in all ponds, and copper content was reduced from 40 to 50 percent.

Although more research is needed on their effectiveness, the use of tailings ponds has greatly improved water quality of the South Fork Coeur d'Alene River.

F. SERRATED SLOPES on INTERSTATE 90

The West Project of Interstate 90 (I-90) started in 1970, involved the excavation and removal of approximately 5.5 million yards of material. This activity has left barren scars on the steep slopes of the hillside. Construction of I-90 also created three large rock quarries used for borrow material. To provide better conditions for re-establishing vegetation of these areas, project plans included "serrated" or "mini-benched" cut slopes. These slopes were then seeded and planted with trees, shrubs, and grasses.

The results of the mini-benching and planting have met with favorable success. Further information on this project can be found in a report entitled "Use of Serrated Slopes and Revegetation of Interstate 90 Projects in Shoshone County" prepared by Idaho Department of Highways, June 1972.

Serrated slopes help reestablish vegetation on highway cuts.

CHAPTER 5

FUNDING AND TECHNICAL ASSISTANCE

Implementation of the recommendations and project outline is dependent upon adequate financing. This chapter inventories sources of funding and technical assistance available through the various state and federal agencies. In general, federal funding is contingent upon local support, responsibility and cost sharing and is most important that an active interest and involvement be pursued by the public, private industry, and special groups.

Recommendations on amending the current "Mine Licensing Tax" to provide funds for mine reclamation is also a part of this chapter.

FUNDING & TECHNICAL ASSISTANCE

One purpose of this plan is to identify the various sources of financial and technical assistance available for reclaiming lands which have been disturbed by mining and related activities. This section is designed to identify sources of combined effort, manpower, technical and financial assistance which can be used to revegetate the Silver Valley.

A. *FEDERAL ASSISTANCE*

Various methods of financial and technical assistance are available from the U.S. Government. However, the lead time required to secure assistance from most agencies is quite long. Equally important, most reclamation projects originate at the local level and local office should be contacted to arrange for assistance. Specific areas of federal assistance are as follows:

U.S. Department of Interior

The Interior Department lists as a policy the following:

"It is the policy of the Department of Interior to restore for useful purposes the lands which lie blighted from previous mining operations. Lands will be protected and restored for planned future uses such as industrial or commercial development, wildlife habitat, or recreational opportunities."

Organizations within the Interior and the assistance which may be obtained are as follows.

U.S. Geological Survey:

The activities of the Geological Survey's Water Resource Division related to surface mining consist of basic data collection and areal investigations in mined areas, and research on hydrologic processes affected by mining. These activities provide background information on the magnitude and extent of erosion, sedimentation, and acid drainage resulting from surface mining activities, the geologic and hydrologic setting in which these processes occur, and an explanation of the observed conditions in terms of the influence of mining on hydrologic processes.

Principal emphasis has been directed toward the effects of acid drainage on water quality in the Appalachian Region and site investigations of mined areas. The Water Resources Division is authorized to cooperate with state or local government agencies on a 50-50 cost-sharing basis in the collection of basic data and in conducting areal investigative programs designed to provide planning and management information. Reports resulting from these programs can be utilized to provide the hydrologic information essential for planning mined land reclamation projects.

Many of the Geological Survey's basic mapping and research projects, including application of remote sensing techniques, supply information that is necessary for making wise decisions regarding uses of land.

USGS maintains extensive programs involving collection analysis of data on quantity and quality of surface and groundwater that are applicable to utilization of surface-mine areas. The survey has produced up-to-date large-scale topographic maps (1:24,000 and 1:250,000) of most of the areas involved in surface mining.

Bureau of Land Management:

Committed to the principle of multiple use, the Bureau of Land Management provides a basis for management of resources and uses on the national resource lands through its Planning System. The process followed in this system requires a physical inventory and analysis of the natural resources in terms of their current use and future potential; an analysis of the social and economic significance and implications of the resource use; the identification of community, state, and other federal governmental organizations, as well as interested private groups, for the purpose of coordination and cooperation; the description and analysis of all the major alternative use options; and finally, within the framework of full public participation, selection of the "best" allocation of resources.

It is within the context of this process that developments for recreation use on mined land reclamation areas on national resource lands are made. Funding for approved recreation developments is provided through the regular budgetary process. Agreements with cooperators for operation and/or maintenance may enhance development schedules.

Bureau of Mines:

Bureau of Mines effort in mined land restoration may be categorized broadly according to the Bureau's mineral resource, research, and demonstration activity areas. Studies of methods and costs of mining near-surface minerals and solid fuels naturally include consideration in recent years of methods and costs of reclamation. Research activities in the field of mined land reclamation and disposal of liquid and solid wastes from mining and mineral processing include consideration in recent years of methods and costs of reclamation. Research activities in the field of mined land reclamation and disposal of liquid and solid wastes from mining and mineral processing include deposition of surface materials and stabilization of the surface using a variety of chemical and vegetative methods. Demonstration reclamation projects funded through the Appalachian Regional Commission have permitted the Bureau to develop practical experience in reclaiming surface-mined land for a variety of purposes. Although primarily concerned with cost projections of coal utilization processes in the past, the Bureau's Process Evaluation Group has expanded its capability in recent years to include mining cost evaluations that include costs of reclamation for different purposes. The Bureau of Mines is cooperating with the Bureau of Outdoor Recreation in engineering evaluation of selected mined areas included in the Surface-Mined Lands for Recreation Program.

The Bureau of Mines maintains contact and administers its programs cooperatively through Liason Officers in many of the states. These and the Field Operation Centers are sources of information and assistance available under state and local conditions.

National Park Service:

The National Park Service is authorized to extend technical assistance in park and recreation facility planning to state and local governments and to other federal agencies, as constrained by available funds, personnel, and existing workload. Such assistance would be applicable to specific areas of mined land being reclaimed for park and recreation use.

Heritage Conservation and Recreation Service - The Heritage Conservation and Recreation Service administers the Land and Water Conservation Fund. Grants are made on a 50-50 matching basis to states and local political subdivisions under project priorities determined by State Liason Officers appointed by the Governor. Financial assistance is provided for acquisition and development projects and for state comprehensive outdoor recreation planning. Mined land reclamation projects deemed suitable for outdoor recreation and found to be in conformity with the state's outdoor recreation plan can be eligible for fund sharing. Project proposals must be submitted to the Services Regional Offices through the state agency or official designated by the Governor. The service, formally the Bureau of Outdoor Recreation, in cooperation with the states has funded a limited number of mined land reclamation demonstration projects. One of the Bureau of Outdoor Recreation's projects, located in Idaho, was the Kellogg City School Park. The City of Kellogg developed 26 acres of mine tailings with two baseball/softball fields, tennis courts, picnic shelters, a comfort station, and a concession building at a total cost of $138,334.00.

Bureau of Reclamation:

Through its program activities which are related to water resources development, the Bureau of Reclamation has involved the capability of conceptualizing environmental and human needs and providing for them by project formulation and implementation. Using a wide variety of disciplines, engineering skills, and other technical services, the Bureau can contribute significantly to reclaiming surface-mined land for recreation.

The disciplines which may be brought to bear to restore such areas include: (1) all aspects of on-site appraisal of the location and its geologic condition, project planning including coordination and local and state participation and input of other agencies as may be needed for repayment of cost, and continued operation and maintenance of the restored area; (2) the preparation of economic analyses of costs and benefits; (3) preparation of typical engineering, architectural, etc., plans, and guidelines for the facilities and other work needed to restore such an area; (4) complete construction management from recommending standards that should be established and maintained in the building and associated construction and/or grading work to preparation of schedules showing sequences by stages of work, time, and funds required to gathering of advanced preconstruction data, preparation of designs and specifications, contract administration, and inspection; and (5) the establishment of designers' operating criteria, and operation and maintenance standard operating procedures.

The Bureau of Reclamation can obtain the assistance, as appropriate, and coordinate the efforts of other Interior agencies in such phases as restoration of fish and wildlife habitat, processes for water treatment, restoration of appropriate vegetation, watershed management, and recreation facilities. The Bureau has other disciplines necessary to implement projects for reclaiming surface-mined land for recreation. The Bureau has extended services of this type to others for many years and memoranda of agreements are in force with several Interior sister agencies. Assistance of this nature is also extended to outside agencies, and state and local governments as provided for under the Intergovernmental Cooperation Act of 1978.

Bureau of Sport Fisheries and Wildlife:

The Bureau of Sport Fisheries and Wildlife administers the Federal Aid in Wildlife Restoration Act of 1937 (50 Stat. 917, as amended; 16 U.S.C., Sec. 669-669i) and the Federal Aid in Sport Fish Restoration Act of 1950 (64 Stat. 40, as amended; 16 U.S.C., Sec. 777-777k). These acts provide that the Federal Government may pay up to 75 percent of the cost of the work performed by the states on approved projects. Mined land reclamation projects deemed suitable for fish and/or wildlife restoration may be eligible for fund sharing. Project proposals may be submitted by state fish and game departments to appropriate Bureau regional offices.

U.S. Department of Agriculture

Department of Agriculture assistance is as follows:

Agricultural Research Service:

The Agricultural Research Service, in cooperation with other federal and state agencies and private organizations, is conducting research on methods to stabilize, revegetate, and reclaim surface-mined areas. Work is underway on widely differing soil and topographic conditions which vary from relatively level mined land to steep mountain sides. Soil conditions vary from highly acid to highly alkaline. Research approaches emphasize fertility and management practices to overcome adverse conditions resulting from the mining operation. Results to date look promising; a number of recommendations are presently being utilized.

Extension Service:

The Extension Service is the educational arm of the U.S. Department of Agriculture and provides educational programs based upon the needs of local communities. The Extension Service operates through state land-grant institutions and their state and county Extension Service personnel. The organization provides educational and technical assistance to recreation and tourism interests, both public and private, on how to apply new developments emanating from research. It assists community and business organizations in developing recreational programs and resources and in working with 4-H and youth in such programs as camping, use of leisure time, and developing skills in recreation activities.

Farm Home Administration:

The Farmers Home Administration administers Section 304 of the Consolidated Farm and Rural Development Act. This provides assistance to eligible farm or ranch owners or tenants in converting all or portions of their farms to outdoor recreation income-producing enterprises for the purpose of supplementing or supplanting farm income and permit sound and successful operations. Funds may be used to develop land and water resources, repair and construct buildings, purchase land, equipment and livestock, and related outdoor recreation items and pay necessary recreation operating expenses. Application forms for loans are available in local Farmers Home Administration county offices.

Forest Service:

The Forest Service and the cooperating Forestry Agencies in each state provide direct assistance for rehabilitating mined areas. This aid concerns both private forest land in general, and application of forestry techniques for surface stabilization, revegetation, and environmental restoration/enhancement. A series of Federal-State Cooperative Forestry Programs provides a wide range of services to private owners and operators, including:

--Technical assistance in designing and installing multipurpose vegetative treatment for mined lands.
--Advance layout consultation to minimize mining impact so as to facilitate recreation development and other future uses. This activity will be further advanced as a result of research and demonstrations being conducted under the USDA's Surface Environment and Mining (SEAM) Program which has just been completed.
--Provision of moderate cost young trees for rehabilitation planting.

Considerable forestry rehabilitation and critical sediment source work are performed under Forest Service guidance in flood prevention projects and the PL-566 Small Watershed Program.

The National Forest System has a special interest in the rehabilitation of surface-mined land as a part of its administration of the National Forest and Grasslands for outdoor recreation, range, timber, watershed, wildlife and fish purposes. The exploitation of the mineral resources associated with these lands is an integral part of their overall management. Where Forest Service lands are intermingled with privately owned lands, management is coordinated to provide maximum public and private benefits.

The National Forests have a long history in the rehabilitation of the nation's surface-mined lands. Each year, Forest Service crews from 154 National Forests and 19 grasslands treat and stabilize several hundred acres of federally owned lands disturbed by surface mining, prospecting, and associated access roads. These measures, usually applied on a watershed basis, are designed to enhance a quality forest environment, beautification of the countryside, and water pollution abatement.

The Forest Service has a long background of research on the rehabilitation of damaged watersheds in the Western United States. Several watershed research projects have recently reoriented efforts to deal with problems on mined lands. The Intermountain Forest and Range Experiment Station at Ogden, Utah, has recently begun studies on rehabilitation of five surfaced-mined areas in Montana, Idaho, and the Nevada-California border. The Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado, has scientists beginning studies on mined lands in the Four-Corners area of New Mexico. These research projects are studying the adaptability and suitability of a large number of grass, forb, shrub, and tree species to surface-mined environments. Various spoil-bank treatments such as topsoiling, fertilizing, mulching, and watering are also under study.

In addition to these western studies, the Forest Service has a major research project in surface-mine rehabilitation in the Eastern United States at Bereau, Kentucky. This unit has developed much information and expertise helpful to mined land rehabilitation. Field testing of grasses, shrubs attractive to wildlife, and trees has determined which species can grow on various types of spoil. Other studies have developed methods of spoil handling and placement to reduce slides, prevent drainage of toxic chemicals, and to enhance rehabilitation.

The Surface Environment and Mining (SEAM) was a 5-year research, development and applications program designed to provide land managers, the mining industry, and the states with an innovative array of economical planning and reclamation alternatives which satisfy both environmental and mineral needs. It is an on-the-ground, problem solving effort initially concentrated in the West where large-scale mining operations are already underway or are being planned. SEAM addressed three concurrent problems. These were:

1. Quickly assembling facts so that delays in the administration of mineral applications would be minimized.
2. Advancing knowledge and techniques for successfully rehabilitating mine areas.
3. Developing methods for planning mining operations in advance so as to harmonize eventual utilization with rural development and environmental stewardship. This includes consideration of mineral deposits as integral parts of greater economic, social, and biological entities.

SEAM is a partnership undertaking with all land managers, the mining industry, and political jurisdictions at all levels and is only loosely coordinated with on-going federal and state programs. The Forest Service has been assigned leadership and coordination with USDA. The end product of SEAM is to be several demonstration areas where new techniques in preliminary design of mining operations, new methods of rehabilitation, new mining technologies, and environmental stewardship criteria can be simultaneously evaluated and displayed.

An excellent opportunity exists for a coordinated program involving federal, state, and private research organizations, industry, universities, and land-management agencies to ameliorate the impacts of surface mining on the environment.

SEAM has six goals. Each has subgoals that require specific actions.

Goal No. 1 - Develop organizationl, legal, physical, and economic criteria for use by land managers in administering mineralized lands.

Subgoals - Improve means of coordinating federal, state, local, and industry authorities and responsibilities. Develop criteria for determining the impact of mining on other resources, uses and activities.

Goal No. 2 - Develop alternative land rehabilitation treatments to enhance or return disturbed areas to beneficial use.

Subgoals - Conduct physical and biological inventories. Plan mining activities with concomitant reclamation activities. Develop plant selection, seedbed preparation, seedling-care techniques, and establish plant nutrition requirements.

Goal No. 3 - Develop alternative engineering systems to prevent or reduce future environmental damage.

Subgoals - Develop or improve systematic approaches for prospecting and exploration. Examine, develop, and test innovative transportation systems. Test alternative methods of earth movement and placement, including costs and benefits. Determine the most economic environmentally acceptable surface treatments.

Goal No. 4 - Evaluate the influence of mining developments on surrounding rural area development.

Subgoals - Design and conduct mining to maintain visual landscape quality. Devise plans to ameliorate the impact of mining developments of local communities. Plan for community stability following cessation of mining.

Goal No. 5 - Synthesize, test, monitor and evaluate systems and practices on demonstration areas to identify alternatives, costs, benefits, and environmental consequences of mineral utilization.

Subgoals - Develop or adapt analytical techniques for modeling potential systems. Establish and manage demonstrations under a variety of conditions and constraints. Evaluate alternative systems.

Goal No. 6 - Provide land managers, industry, and regulatory authorities with skills and recommendations needed to apply finding to future area developments.

These goals relate to the proper husbandry of surface environmental values concomitant with utilization of minerals and energy sources.

Soil Conservation Service:

The Soil Conservation Service is the Department of Agricultural's action agency with leadership in the development of income-producing recreation enterprises. SCS provides technical and financial assistance of up to 50 percent of the costs of construction, land rights, and basic facilities on water-based recreation areas for public use in Watershed Protection and Flood Prevention Programs and Resource Conservation and Development Projects.

The SCS works through local conservation districts and gives priority to assisting conservation districts and other local and state agencies in preparing and implementing reclamation programs.

SCS assistance in surface mine reclamation includes:

1. Providing soil surveys as a basis for preparing and implementing reclamation plans.
2. Preparing guidelines and standards for planning and establishing conservation practices.
3. Providing assistance to operators and landowners in preparing plans for the use and treatment of land and water resources during and after mining operations.
4. Providing on-site assistance for implementing the conservation including the stockpiling of topsoil and subsoil, disposing of toxic materials and rocks, and designing reservoirs for water storage and silt retention.
5. Assisting conservation districts in the review of reclamation plans submitted by operators to regulatory agencies for approval.

U.S. Department of Defense

Department of Defense assistance activities are as follows:

U.S. Army Corps of Engineers:

The Corps of Engineers has completed a study of the effects of surface mining on the navigable rivers and their tributaries. An inventory of significant problem stream reaches and surface-mined source areas will be presented together with possible solutions to the water resources problems. The study included the investigation of Cabin Creek Basin, West Virginia, to determine the feasibility of a pilot demonstration project to solve surface mining problems and develop the water resources and related land on a comprehensive basis. Hydrology and engineering technical assistance is available on a request basis.

Other federal agencies assistance is as follows:

Environmental Protection Agency

The Environmental Protection Agency's program for mine reclamation is based upon Public Law 92-500, Federal Water Pollution Control Act Amendments of 1972. This legislation permits the Agency to perform in-house and extramural research, development, and demonstration in mine-drainage pollution control.

The extramural program is conducted primarily through matching grants to the various states. Surface mining reclamation research, development, and demonstration activities represent a significant area of concern by EPA. Over 20 projects have been associated with mine land reclamation. Although the principal criteria for award of current grants is the demonstration of new technology, those projects which have a residual benefit, such as those on lands to be reclaimed for recreation are more favorably considered.

General Services Administration

The Property Management and Disposal Service disposes of real property surplus to the needs of the Federal Government and Federal Property and Administrative Services Act of 1949, as amended, and other related statutes. The Administrator of General Services may assign such property, including any land which may have been surface-mined, to the Department of Interior for subsequent transfer at a discount from fair market value of up to 100 percent to any state, political subdivision, instrumentality, or municipality for park and recreation uses.

The Administrator of General Services also deposits the proceeds of surplus property sales in the Land and Water Conservation Fund.

U.S. Department of Housing and Urban Development, Community Planning and Management

Comprehensive Planning Assistance (701), The Department of Housing and Urban Development, Office of the Assistant Secretary for Community Planning and Management, administers the 701 Program authorized by Public Law 83-560. Grants are made to strengthen the planning and decision making capabilities of chief executives of state, area-wide, and local agencies, and thereby promote more effective use of the nation's physical, economic and human resources.

A broad range of planning and management activities may be supported by these grants, including improving the chief executive's capability to develop goals, allocate resources, and manage programs; to build or strengthen governmental institutions and area-wide structures that address and respond to community development issues; to improve governmental systems; and to improve intergovernmental planning and coordination.

Eligible applicants are state agencies designated by state law or the Governor, area-wide planning agencies, including councils of government, counties, cities, local development districts, economic development districts, Indian tribal bodies, localities or groups of adjacent localities with populations of less than 50,000. Localities under 50,000 population, counties, nonmetropolitan area-wide agencies, and Indian reservations apply through the state agency designated by state law or by the Governor. Other applicants apply directly to the HUD area office.

Grants are normally for two-thirds (2/3) of the cost of the assisted project. Grants for three-fourths (3/4) of project cost may be given in cases involving redevelopment areas, economic development districts, areas with a substantial reduction in federally related employment, and local development districts within the Appalachian Regional Commission area.

B. STATE ASSISTANCE

PUBLIC SERVICE BUREAU (STATE RECREATION DIVISION)

Technical Assistance:

The Public Service Bureau of the State Recreation Division provides technical assistance to political subdivisions and others involved in making recreational opportunities available to the public.

Assistance with planning, design of park and recreation facilities, application for the Grants-in-Aid program for acquisition and/or development of public outdoor recreation facilities, and other aspects of programs and services may be obtained by contacting the Bureau.

Other assistance services available include: help in developing community park and recreation plans; information on the formation of recreation districts; materials on equipment, facility design, operation and maintenance, and access to the Division's professional library.

Public Information:

The Public Information Section of the Public Service Bureau provides information about the entire Department to the mass media, other government agencies, and directly to the public. Printed materials, audio-visual presentations, and information-gathering services are available. The section edits Leisure Times, a quarterly publication of park and recreational news in Idaho, and maintains a color slide library and black-and-white photo file.

Financial Assistance: (The Federal Land and Water Conservation Fund Program)

Congress established the Land and Water Conservation Fund program in 1965 to provide a continuing source of money to expand federal, state and local outdoor recreation facilities for the benefit of the general public.

Funds apportioned to states under the program finance 50% of total allowable project costs on a reimbursable basis. All costs incurred prior to federal project approval are non-fundable except planning costs.

Administration: The Director of the Idaho Department of Parks and Recreation acts as State Liason Officer and is responsible for administering the L&WCF program in Idaho. The State Parks and Recreation Board establishes policy guidelines and approves projects for funding. The Bureau of Outdoor Recreation, U.S. Department of Interior, administers the program at the federal level.

Funding: Funds for the program come from federal recreation fees, sales of federal surplus real property, federal motorboat fuels tax, and outer continental shelf mineral receipts. This nationwide fund is intended to be at least $300,000,000 annually.

Applications for project approval are accepted from:

1. State Agencies
2. Counties
3. Cities
4. Recreation Districts
5. Other public agencies authorized by law to provide recreation services.

Projects eligible for federal assistance include:

1. Statewide Comprehensive Planning (state's function);
2. Acquisition of lands to be used for outdoor recreation;
3. Development of outdoor recreation facilities.

EXAMPLES

Picnic facilities
Boating areas
Playgrounds
Camping facilities
Riding and Hiking trails
Ballfields
Swimming facilities
Winter sports facilities
Renovation and redevelopment of time-worn facilities

Combination projects for acquisition and development are considered also.

After the funds are appropriated by Congress, the Secretary of Interior announces the apportionment for each state. Idaho's cost of administering the program and a 15% contingency fund are deducted from the state's annual apportionment. The balance is divided 50% to local agencies and 50% to state agencies. The contingency fund is used to finance outstanding projects of an urgent nature after the remainder of the state's apportionment has been obligated.

Application Procedure: Six steps are necessary to complete the application procedure:

1. The applicant notifies the Idaho Department of Parks and Recreation of intent to make application.
2. A representative of the Department meets with the applicant to explain the L&WCF program and help prepare applications.
3. The applicant then presents the proposed project to the Technical Review Committee, which reviews it for technical adequacy.
4. The project is rated on the basis of established priorities.

5. The project is submitted to the Idaho Parks and Recreation Board for review and qualification. When monies are insuffficent to fund all projects presented, the highest-rated projects are normally submitted first to the Bureau of Outdoor Recreation for approval.
6. Projects qualified by the Board are submitted to the Bureau of Outdoor Recreation for federal approval.

C. MINE RECLAMATION FUND (Proposed)

Currently there are no other state funds available for restoration of mine impacted lands. The success of implementing the plan to rehabilitate the South Fork Coeur d'Alene River is dependent upon receiving adequate funds. To ensure this success, it is recommended that a State Mine Reclamation Fund be established. A further discussion of the proposed fund is described in Chapter VI.

CHAPTER 6

PLANNING RECOMMENDATIONS & PROJECT OUTLINE

This chapter outlines the recommendations that are necessary for improving and stabilizing the resources of the South Fork Coeur d'Alene River Drainage. Recommendations include flood damage reduction, fish and wildlife enhancement, sediment and erosion control, aesthetic improvements, recreation opportunities, and water quality improvements.

A. RECOMMENDATION SUMMARY

To meet the goals and objectives established earlier for the stabilization of the South Fork Coeur d'Alene River, several projects are recommended. The following is a summary of the recommended South Fork program. A more detailed description of the project features is provided later in this chapter.

Erosion and Sediment Control

In terms of measures that have been selected, several levels of reclamation are recommended. Remedial or basic reclamation designs to alleviate stream channel deposition and water pollution have been assigned high priority for early action in the recommended plan.

Six major areas, encompassing about 18,100 acres of unstable outslope, will be treated. Early action is recommended for the repair of major disturbances which are causing gross pollution and are threatening cultural improvements by both erosion and landslides into streams.

Treatment methods will vary with bench and slope conditions. Where possible, slopes greater than 66 percent will be graded back to at least 66 percent which available data indicates to be maximum practical slope for long-term land stabilization. Terracing of the slope will be accomplished wherever practical. Runoff will be controlled by diversion ditches, drains and water checks. Water outlets will be located at undisturbed topographic lines if the former discharge areas are impractical. Discharging at topographic points will effect a spreading of runoff, permitting increased infiltration and decreased erosion. Prior to revegetating, the soil in all major areas will be conditioned and mulching provided. Secondary treated effluent and digestive secondary liquid sludge may be utilized to enhance and accelerate reclamation efforts. Initial application will be on a carefully controlled and monitored trial basis.

Similar, but less extensive treatment will be given to approximately 3,000 acres of minor outslope disturbances. Early action is recommended for repair of disturbances downstream of the proposed bedload trap structures.

Treatment of mine refuse banks will be initiated in Burke and Nine-Mile canyons. Early action is recommended for the lands located adjacent to waterways and the South Fork channel. Treatment of refuse banks will require grading outslopes, covering with a layer of soil or other suitable material, mulching, and vegetating.

Partial sediment control will be provided by bedload trap structures located in the channel of Pine Creek above Pinehurst and the South Fork above Kellogg. The structures will consist of steel sheet-pile weirs, primarily designed to trap course-grained bedload. An upstream basin would be excavated, capable of holding about 10,000 cubic yards of materials. Access will be provided for cleanout of the basin. Dredged materials will be available for use in road maintenance, other reclamation efforts, or sold on a concession basis.

Land stabilization measures for the major and minor slopes are to be accomplished in three-year cycles to permit a continued evaluation of project efficiency and to provide the opportunity to abort or amend the measure if it is proving to be unsuccessful. Bedload control will be initiated early in the program. Measures for refuse banks will be accomplished on a continual basis.

Flood Damage Prevention

Flood control measures selected for inclusion in the recommended plan include channel rehabilitation, flood plain management guidelines, and supplemental flood proofing to collectively provide a comprehensive flood damage prevention program. The selected channel rehabilitation measure is considered to be the optimum feasible measure that provides a reasonable degree of protection, yet minimizes disturbances to the stream and also minimizes relocation of area residents.

Channel Rehabilitation - Channel rehabilitation will extend from the mouth of the South Fork to a point approximately 2.5 miles upstream from Mullan, a distance of about 30 miles. Implementation of the selected plan will require the clearing and grubbing along the present channel, the excavation of spoil material, the selective placement of stone slope protection, and the seeding of about 2,000 acres. The channel would be widened where necessary to a bottom width of 60 feet and realigned only where major obstacles to the passing of high flows are present or where banks are unstable. Sediment will be controlled during construction by use of silt traps. The channel will be designed to reduce damages resulting from a 100-year frequency of occurrence flood.

In terms of relocations, construction of the project will necessitate the replacement and modification of two vehicular bridges. Implementation would be on a sequential basis commensurate with the progress attained in erosion and sediment control. Channel rehabilitation would be closely coordinated with other plan elements.

Other Flood Damage Prevention Measures - Other components of the flood damage prevention program would include the development of flood plain management guidelines to provide for the efficient use of flood plain lands and supplemental flood proofing of selected improvements.

Provision flood plain management guidelines will be accomplished by extending and supplementing data evolving from detailed design of the channel rehabilitation measures. Such guidelines would be oriented toward existing and future development.

Implementation of the flood plain management guidelines program will be accomplished concurrently with the design of the channel. Application of such guidelines for local land use regulation would precede construction of channel rehabilitation measures.

In conjunction with the channel rehabilitation and flood plain regulations, the flood plain management program would include flood-proofing structures which would be subjected to damaging inundation by residual flooding. The flood proofing would consist of either raising in place or moving the structures.

Implementation of the non-structural flood plain management program would be concurrent with the channel rehabilitation program and have the accumulative effect of providing 50-year flood protection.

Water Quality Control

Acid Mine Drainage - It is proposed to initiate exploratory investigations in the South Fork water shed as a basis for a more comprehensive abatement program. An exploratory program estimated at $225,000 would consist of locating the acid producing sources, ascertaining the magnitude of water reaching the sources, and evaluating the feasibility of implementing corrective projects on a permanent basis. The objective would be to design a cost-effective overall abatement program and to identify and avoid potential abatement actions which might be counter productive.

Several instream neutralization devices composed of limestone would be investigated for installation on the South Fork. The devices would be located next to major acid drainage sources and would neutralize water flowing from drain systems installed in the acid source. Initially, only one neutralization device would be installed on a pilot test basis. This initial device would be installed on Bunker Creek and utilize the effluent of Bunker Creek, including drainage from, and jig tailings not removed.

Local interests indicate that regional waste treatment should be available in a time frame compatible with the South Fork Rehabilitation program. Accordingly, domestic sewage components of the program are limited to the least amount of disruption to the collection system. In this context, concurrent design construction of channel rehabilitation and wastewater collection facilities is essential because of the constructed and congested nature of the South Fork flood plain.

A typcial South Fork valley section contains an interstate highway, a railroad, a constricted stream channel, and extensive private developments. Under these conditions, any construction activity is difficult and implementation of an array of measures could result in extreme disruption and inefficiencies. Design and implementation of additional sewage collection facilities as a basic program feature will minimize such adverse effects and will insure that the potential health hazards associated with untreated domestic wastes are alleviated at the earliest practical time.

Adequately treated wastewater by-products such as treatment plant sludge would be regionally available for use as an organic agent in the slope stabilization and other reclamation programs. Such use of treatment plant by-products would be for the primary objective of enhancing reclamation efforts and would include appropriate safeguards to avoid adverse effects on surface and groundwater resources.

General Recreation and Fish and Wildlife

Recreational Development - General recreation recommendations include the establishment of one community park in the watershed to provide needed day-use recreation opportunities. The community park will be tentatively located near the mouth of Big Creek and designed to serve all area residents. The park would contain the usual playground equipment, picnic facilities, and drinking fountain.

In addition, the community park would be 56 acres in size and contain a comfort station. A protected walkway into the area is envisioned utilizing easement areas acquired during the channel rehabilitation construction. This will facilitate a safe entry and exit from parks. Landscaping will be accomplished during construction of the park to provide area residents with a pleasing setting as well as a functional unit.

Fish and Wildlife Enhancement - A wildlife enhancement demonstration area is proposed on 1,500 acres east of Smelterville utilizing a disturbed area. The program would be three-fold, consisting of a pre-project baseline ecological survey to determine the present status of the area for the post-project comparison and evaluation purposes. The second phase would be the actual reclamation of the six major revegetation areas and revegetation of river channel area and other disturbed land. The revegetation areas to be corrected are components of the erosion and sediment control program. Revegetation would be designed to allow natural vegetation succession to occur on the disturbed areas. The third phase would consist of an evaluative study to determine the successfulness of the corrective measures and to determine potential future uses for the demonstration area, and other like areas.

The recommended element encompasses basic reclamation of the six land areas and other disturbed lands with seeding modified to induce growth of certain species of vegetation known to provide food and cover to wildlife. The vegetation also will be seeded onto the other identified disturbed areas. Where physical conditions permit, ponds primarily for wildlife enhancement will be established.

Dredge mine areas such as the Cataldo Flats, which offer potential for wildlife habitat enhancement, would be reclaimed with annual plants. The annual plants will serve to provide soil enrichment while providing food for small animals and birds. Thus, some limited small game habitat would also be enhanced throughout the watershed where disturbed areas are reclaimed. The annuals will provide cover until native annuals and perrenials can be established. In addition to seeding disturbed areas, selected plantings will also include trees and shrubs known to be of value as wildlife food.

While fishery enhancement is not a formal program feature, beneficial effects are envisioned through an improvement in both the physical condition of the South Fork and its major tributaries and improvement in water quality. Erosion and sediment control is also expected to improve the capability of the watershed's streams to support game fish. Where practicable, fish rock, bank, overhangs and other fish habitat will be included in the channel design.

Implementation of the general recreation and wildlife enhancement features is scheduled for accomplishment during mid and later phases in the total program. Prior to establishment of the park, channel rehabilitation will be completed to avoid conflicts in construction activity. The success of the wildlife enhancement program is dependent in part on the successful reclamation of the revegetation areas within the bounds of the wildlife enhancement area. The areas are scheduled for early action under the Erosion and Sediment Control Program.

Complementary Ongoing Programs

While the aforementioned program features provide for amelioration of water and land resource-related problems, realization of a major level of economic, social and environmental betterments will be dependent upon the intensity and effectiveness of complementary ongoing programs and activities by state and local agencies, industry, other organizations and individuals. Such governmental programs and activities include highway improvements, enforcement of water and land use regulations, removal of dilapidated and abandoned buildings and other similar measures. The recommended South Fork program embodies a long-term continuation of such programs and an intensification of key activities during the ten years life of the program.

Similar efforts by industry, other organizations, and individuals will be of critical importance. Key efforts include improved operating practices by the mining, timbering, and transportation industries. Ultimately such actions as community and individual residential improvement programs will be a measure of success of the overall program.

Program Management and Analysis

Data Collection - In order to monitor the effects of the reclamation program, and to quantify parameters to be used as the measures of effectiveness with respect to both consequent physical and social improvements, comprehensive data collection systems are recommended. Due to the limited existing data in the watershed, a program of rainfall, stream gaging, and sedimentation data acquisition will be initiated by federal and state agencies prior to plan implementation. Existing state and industry programs that are currently monitoring chemical and biological water quality would be continued. A program for monitoring and, where necessary, enhancing vegetative growth on reclaimed areas is also recommended.

<u>Program Coordination</u> - Effective implementation of the plan is dependent upon fully coordinated actions by federal, state, and county government, the mining industry, and the citizens of the Silver Valley. In order to provide for phasing and integration of all projects features, a program for continued coordination of interrelated design and construction activities is recommended. This program should be maintained through project construction.

<u>Program Analysis</u> - A program analysis component of the recommended plan should provide for the evaluation of implemented project features. A primary function of program analysis will be to make information on effective program features available to 11 interested parties and thus encourage application in other similar problem areas.

Location of the various proposed projects is shown on the photographs in Figure 36 through Figure 39.

Over 18,000 acres will be revegetated with approximately 11 million evergreens.

FIGURE 36


Cataldo Flats Area
Stream Channel Stabilization
C-2 (2.48 miles)
Removal of Jig Tailings
(if feasible)
Stream Channel Stabilization
C-1 (5.0 miles)
Neutralization
Project
Stream Channel Stabilization
C-3 (2.7 miles)
KELLOGG
SMELTERVILLE
Construct 100-Year Dike
Floodplain Study
on Pine Creek
PINEHURST
Bedload Trap
Revegetate 18,100 Acres within Boundary
with 11 Million Evergreens
Floodplain Study
on Milo Creek

FIGURE 37


Stream Channel Stabilization
C-2 (2.1 miles)
Stream Channel Stabilization
C-1 (1.1 miles)
Miners' Memorial Park
Site for Sunshine Mining Company's
New Tailings Impoundment
Relocation Site for
Golf Course
Stream Channel Stabilization
C-2 (1.8 miles)
Bedload Trap
OSBURN

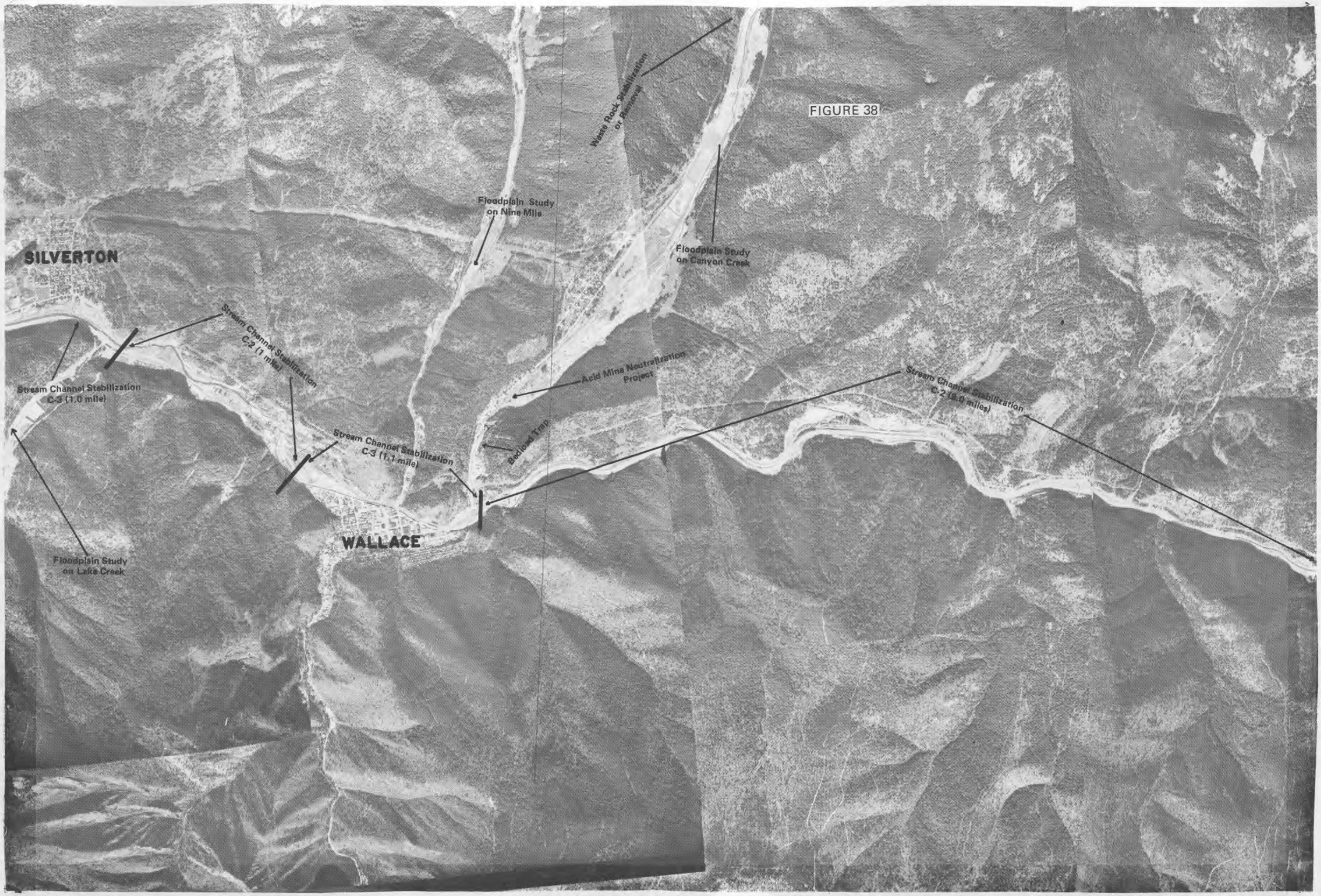


FIGURE 38
SILVERTON
WALLACE
Waste Rock Stabilization or Removal
Floodplain Study on Nine Mile
Floodplain Study on Canyon Creek
Stream Channel Stabilization C-2 (1 mile)
Stream Channel Stabilization C-3 (1.0 mile)
Acid Mine Neutralization Project
Stream Channel Stabilization C-3 (1.1 mile)
Bedload Trap
Floodplain Study on Lake Creek

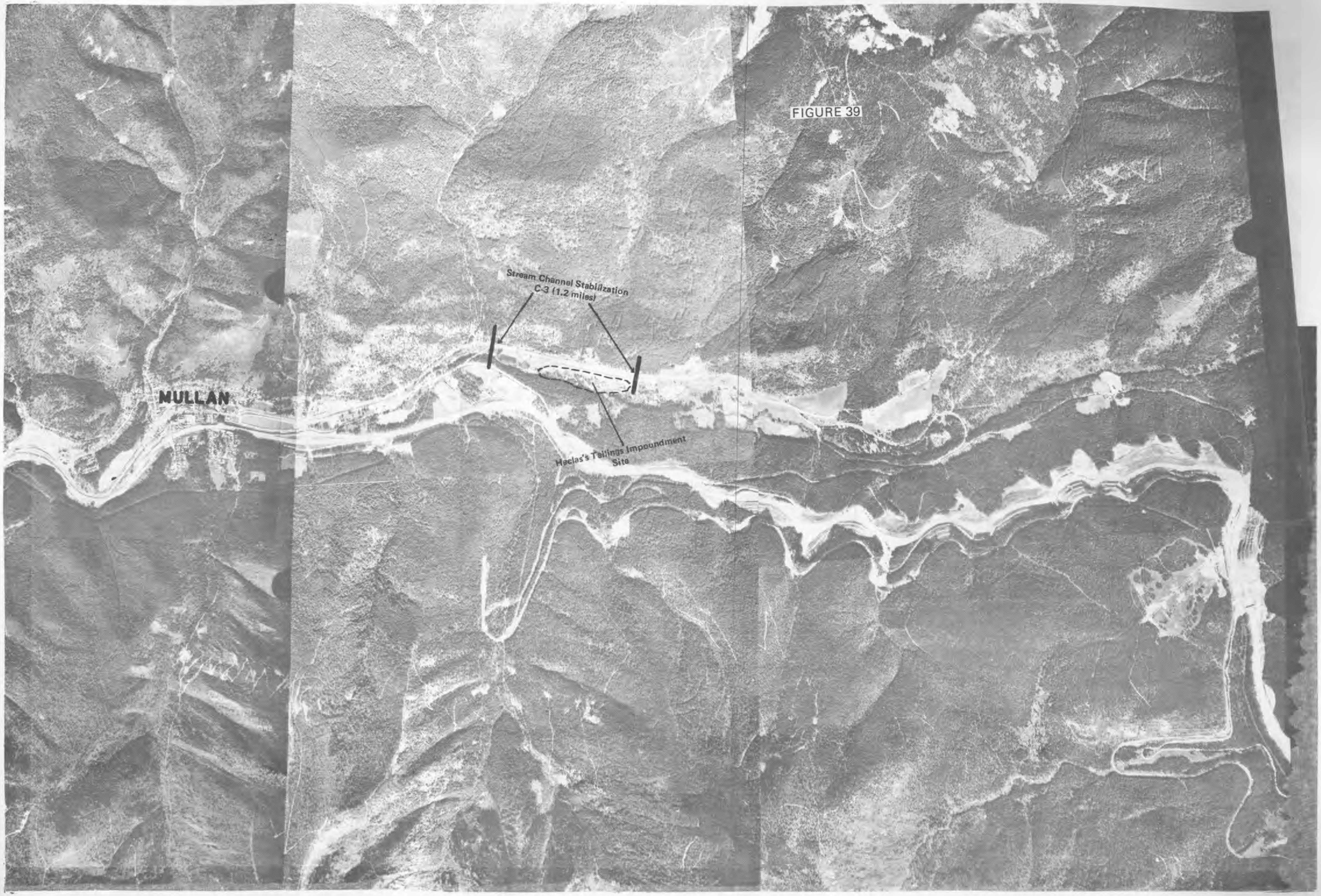


FIGURE 39
Stream Channel Stabilization
C-3 (1.2 miles)
MULLAN
Hecla's Tailings Impoundment
Site

B. PROJECTS

Revegetation Projects

A comprehensive revegetation program has been implemented by the Bunker Hill Mining Company. This program, to be included as the integral part of the South Fork rehabilitation project, calls for planting over 18,100 acres with 11 million evergreens and shrubs. A description of the work to be accomplished on a year-by-year basis is shown in Figure 40. As noted, the project began in 1975 and is to continue for approximately 10 years. The land to be revegetated is segregated into six classifications. The majority of this project is centered around revegetating the steep, barren hillsides between Smelterville and Kellogg.

On steep slopes, terraces will be constructed to reduce erosion and create conditions more favorable for plant growth.

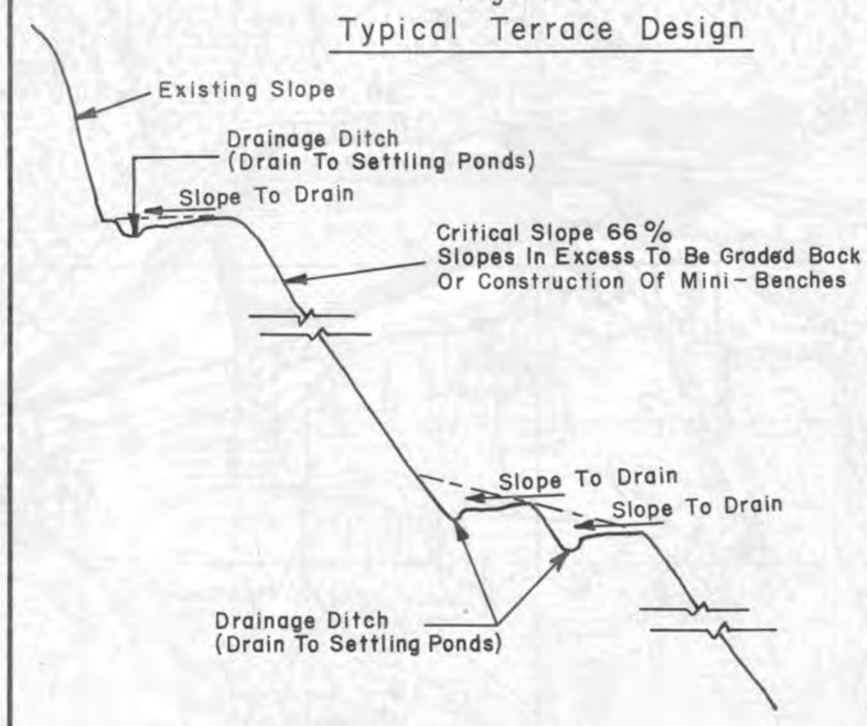
Figure 41 illustrates the typcial design for construction of terraces. Prior studies indicate that slope in excess of 66 percent are most critical. Therefore, where needed slope modification will be utilized by grading or through use of mini-benches terracing. The terraces will be constructed to slope toward the hillside and into drainage ditches. Drainage ditches located at the bottom of the terrace will collect and divert runoff downhill to drainage collection systems and settling ponds. Terraces and slopes will then be planted with grasses and other suitable vegetation. Soil amendments (lime and fertilizers) will be added to promote better growth in toxic soil areas. Sludge from the South Fork Sewer District will also be used.

Reestablishment of vegetation will dramatically reduce erosion and help alleviate the existing sediment problem in the South Fork. The rapid runoffs which is a common occurrence will be slowed and severe erosion will be reduced as the vegetation is established. Flooding problems of the Silver Valley will also be reduced. Aesthetic values along with wildlife habitat will be improved as the trees, shrubs, and grasses mature.

Another area of significant value to be revegetated is the flood plain and flat bottom land of the South Fork. Leveling, shaping, adding topsoil where needed, fertilizing, planting, and irrigation where needed will be employed. Effluent from the South Fork Sewer District is a possible source for irrigation. To establish humus in the soil, saw dust, bark, and wood chips from the proposed sawmill as well as sewer sludge will be added. This will also help to retain moisture during dry periods. Lime will be added to those areas with highly acidic soils to make the area tolerable for vegetation. The ongoing project of vegetating the sandy soils at Cataldo Flats with reeds and grasses will be continued and expanded.

Revegetation coupled with stream channel stabilization will partially fulfill the goals and objectives listed earlier in Chapter I.

Figure 41
Typical Terrace Design



Stream Channel Stabilization Projects

Past events have left the South Fork Coeur d'Alene River in a very unstable condition. In many places, the river wanders and some locations are only constrained between the railroad and freeway. This unstable condition effects water quality, fish and wildlife, aesthetics, recreation, vegetation, land use, and flood control. It is very critical that a project be undertaken to stabilize those areas of the river which pass through old jig tailings and dredged sites. It is also important that any river channel work be designed for multiple purposes and responsive to the "goals and objectives" outlined in Chapter I of this plan.

Steep barren hillsides will be terraced and revegetated with grasses and evergreens.

The Reclamation Project recommended herein contains five basic categories of programs to rehabilitate the watershed and alleviate the major water and related land resources problems in a coordinated, time-phased manner. These are erosion and sediment control, flood damage prevention, water quality control, general recreation and fish and wildlife enhancement, and program management and analysis. In addition, complimentary ongoing programs are recognized as being essential for a fully effective program. Central to the plan is the rechanneling of the South Fork Coeur d'Alene River to facilitate this work, then stream channel will be classified into three groups. These are:

(1) new channel construction,
(2) stabilization of existing channels, and
(3) improving those stretches that have previously been channelized and stabilized.

Classification No. 1 - New Channel Construction

Those segments of the South Fork and tributary streams that are predominently unstable as verified by past movement and relocation through natural process, need to have a stable channel defined and then routed to an area to provide and insure continuous stability. These segments are found in areas where the stream passes through old jig tailings and

FIGURE 40
REVEGETATION PLAN

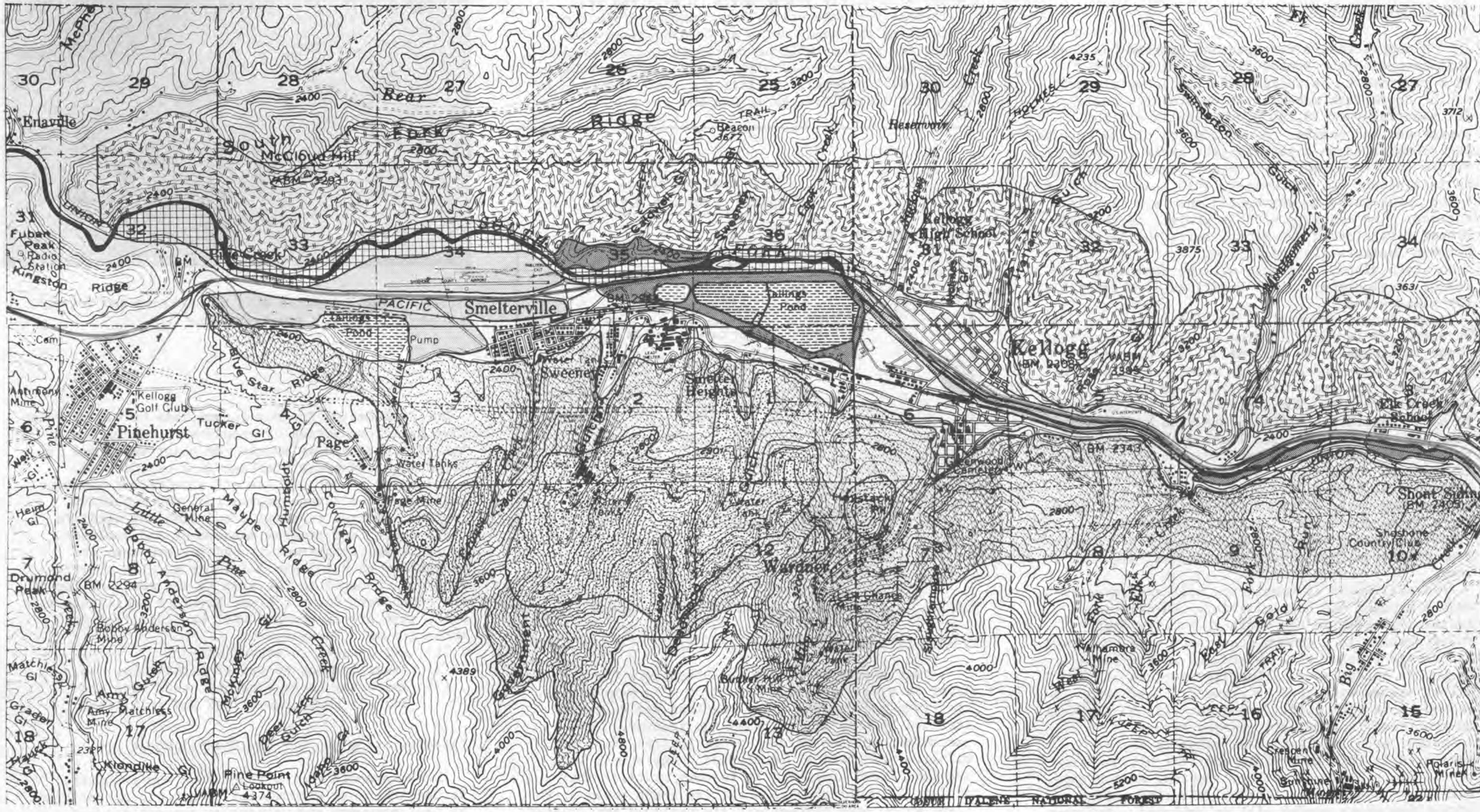


FIGURE 40 (Cont'd.)
REVEGETATION PLAN

AREA	TYPE AREA	AREA DESCRIPTION	RESULTS OF PRIOR RESEARCH	1975 OBJECTIVES	1976 OBJECTIVES	1977 OBJECTIVES	1978 OBJECTIVES	1979 OBJECTIVES	1980 OBJECTIVES	Estimated Completion Date
	Ever-green 7000 Acres	North facing slopes with shrub invasion. Soils high in heavy metals and strongly acidic. 40-90% slopes.	25% of the area tested to date. 7 evergreen species were planted and observed in 1972-1974. 5 species showed excellent results. As a result, best species were identified for each site tested. Additional test plots are needed for the remaining 75% of the area.	1. Research: a) Test 25% of the area (2000 evergreens) with experimental plots to determine best species. b) Investigate usage of containerized ever-greens and/or additional shrub plantings on harsher sites.	1. Research: a) Test 25% of the area (2000 evergreens) with experimental plots to determine best species. b) Evaluate container test plots planted in 1975.	1. Research: Test remaining 25% of the area (2000 evergreens) to determine best species.	1. Research: Evaluate previous plantings to determine if additional plots are needed for specific micro sites within the total area.	1. Research: Complete.	1. Research: Complete.	1978
				2. Revegetate: 50 acres—28,000 evergreens.	2. Revegetate: 150 acres—100,000 evergreens.	2. Revegetate: 150 acres—100,000 evergreens.	2. Revegetate: 500 acres—350,000 evergreens.	2. Revegetate: 500 acres—350,000 evergreens.	2. Revegetate: 500 acres—350,000 evergreens.	1989
	Shrubs and Ever-greens 4,000 Acres	South facing slopes with shrub invasion and some evergreens in the cooler watersheds. Outslopes are hot with shallow acidic soil. 40-90% slopes.	Shrubs are needed to provide shade. Evergreen plantings will survive only in shrub thickets and in water sheds. Species have been selected, however more work is needed to establish planting methods.	1. Research: a) Plant test plots of bareroot and con-tainerized evergreens in thickets and water-sheds to select best planting method. (2000 trees). b) Plant test plots of bareroot and container shrubs on outslopes to determine best method. (2000 shrubs).	1. Research: Plant test plots utilizing technique found to be best in 1975. (2000 trees and 2000 shrubs).	1. Research: Plant test plots of 2000 trees and 2000 shrubs.	1. Research: Evaluate previous plant-ing to determine if additional research is needed.	1. Research: Complete.	1. Research: Complete.	1978
				2. Revegetate: None.	2. Revegetate: 50 acres—34,000 trees and shrubs.	2. Revegetate: 50 acres—34,000 trees.	2. Revegetate: 50 acres—34,000 trees.	2. Revegetate: 100 acres—68,000 trees and shrubs.	2. Revegetate: 150 acres—102,000 trees and shrubs.	1988
	Shrubs 5,000 Acres	Completely denuded area. Strongly acidic, high in heavy metals, and severely erroded soils. Hot, dry 40-90% slopes.	Shrubs are needed to provide shade prior to evergreen planting. Terracing is needed on the steeper, severely erroded slopes to provide a micro-climate for shrub establishment and to stabilize the slope. Soil has a wide variance of acidity, metal and nutrient content. This dictates that sites within the area be classified and species for each site be selected.	1. Research: a) Establish 10 shrub plots of different species on sites where soil testing is complete. b) Plant 1500 shrubs on existing 5 miles of terrace. c) Develop a terracing program. d) Complete a soil map.	1. Research: Establish shrub plots on terraces constructed in 1975. (2,500 shrubs).	1. Research: Establish test plots of shrubs on new terraces and in areas where terraces are not required. (5000 shrubs).	1. Research: Establish shrub test plots on new terraces and in areas where terraces are not required. (10,000 shrubs).	1. Research: a) Establish shrub test plots on new terraces and in areas where terracing is not required. (15,000 shrubs). b) Plant 5,000 evergreens under successful 4-year old shrubs.	1. Research: Complete.	1979
				2. Revegetate: Construct 5 miles of terracing.	2. Revegetate: Construct 5 miles of new terraces.	2. Revegetate: Construct 10 miles of new terraces.	2. Revegetate: Construct 10 miles of new terraces.	2. Revegetate: Construct 10 miles of new terraces.	2. Revegetate: Establish shrub and evergreen plots on new terraces. (20,000 trees and shrubs).	1995
	Grass and Shrubs 1,500 Acres	River Flood Plane area completely denuded. Area protected from annual flooding but low in nutrients with low water holding capacity due to sand size particles. High dusting in dry summer months.	Tree and shrub establishment is feasible for wind breaks. Grass establishment requires irrigation on dry sites away from river. Nutrients must be supplied upon seeding and again at end of first growing season. Species have been selected.	1. Research: a) Establish experimental grass plots for species selection, rate of fertilizer application and best planting time. b) Determine which sites need irrigation.	1. Research: a) As results of 1975 test plots dictate, continue research plots where further research is needed. b) Establish 20 acres of grass utilizing sewer lagoon water for irrigation.	1. Research: Complete.	1. Research: Complete.	1. Research: Complete.	1. Research: Complete.	1976
				2. Revegetate: Clean up and remove debris where needed.	2. Revegetate: Plant 10,000 shrubs along the river bank where channel is protected.	2. Revegetate: a) Plant grass on 20 acres where irrigation is needed. b) Plant 10,000 shrubs along river bank where channel is protected.	2. Revegetate: a) Plant 20 acres to grass where irrigation is needed; and 20 acres where irrigation is not needed. b) Plant 10,000 shrubs along river bank where channel is protected.	2. Revegetate: a) Plant all areas where irrigation system is not needed. b) Plant 10,000 shrubs along river bank where channel is protected.	2. Revegetate: Plant 10,000 shrubs along river bank where the channel is protected.	1982
	Grass and Shrubs 500 Acres	River flood plane where annual flooding occurs.	Trees, shrubs, and grass can be grown on these sites but due to annual flooding, cannot survive the first 5 years of growth.	1. Research: Complete.	1. Research: Complete.	1. Research: Complete.	1. Research: Complete.	1. Research: Complete.	1. Research: Complete.	1976
				2. Revegetate: a) Establish a demon-stration area from Big Creek east to Osburn Park. A 10 year channel will be constructed establishing 45 acres of protected land for planting trees, shrubs and grasses. b) Plant 10,000 shrubs in this area.	2. Revegetate: a) Plant additional 40,000 shrubs and 15 acres of grass on area protected in 1975. b) Use the completed demonstration area as an example to state and federal agencies of what can be done by a channelization program.	2. Revegetate: Channel river from Kellogg to Pinehurst and Big Creek to Elizabeth Park.	2. Revegetate: Plant 40,000 shrubs on the protected areas established in 1977.	2. Revegetate: Plant 40,000 shrubs, and 50 acres of grass on protected area established in 1977.	2. Revegetate: Replace any shrubs which did not survive in all protected channels.	1982
	Grass and Shrubs 100 Acres	River flood plane with deposits of jig tailings, highly acidic, high in heavy metals, low nutrient content with low water holding capacity due to gravel-like particles.	Containerized shrubs have been successful on one site, conventional bareroot plantings failed.	1. Research: a) Establish experimental plots to determine proper species, fer-tilizers and planting techniques. b) Establish demonstration sites where organic compounds have been added to enhance plant growth.	1. Research: Establish experimental plots of grasses, trees and shrubs. (2000 trees and shrubs).	1. Research: Review previous research to determine whether additional testing is necessary.	1. Research: Complete.	1. Research: Complete.	1. Research: Complete.	1977
					2. Revegetate: None.	2. Revegetate: None.	2. Revegetate: Plant 20,000 shrubs along river bank of protected channel.	2. Revegetate: Plant 40 acres to grass (area near Smelterville exit).	2. Revegetate: Plant 40 acres to grass (area near Elizabeth Park).	1982
General and Summary	Total 18,100 Acres 11 Million Ever-greens		Major research complete. Species and planting methods have been selected for most areas. More work is required in the most difficult planting sites.	1. Establish nursery. 2. Order trees for 1975 planting. 3. Review plan with Forest Service, BLM, and SCS. Enlist their support in revegetation. 4. Establish P.R. program to show need for S.E.A.M. renewal in 1977, and to obtain maximum public involvement in revegetation efforts.	1. Maintain nursery. 2. Order trees for 1978 planting. 3. Obtain Federal commit-ments to channel river from Kellogg to Pinehurst and Big Creek to Elizabeth Park.	1. Maintain nursery. 2. Order trees for 1979 planting. 3. Complete 1981 work plan.	1. Maintain nursery. 2. Order trees for 1980 planting. 3. Complete 1982 work plan.	1. Maintain nursery. 2. Order trees and shrubs for 1981. 3. Complete 1983 work plan.	1. Maintain nursery. 2. Order trees and shrubs for 1982. 3. Complete 1984 work plan.	

areas of past dredging. Approximately 6.7 miles of South Fork channel fall under this classification. The 5,500 feet of channel at the proposed "Miners' Memorial Park", located above the confluence of Big Creek, is under this designation.

New Channel Design Criteria - Figure 42 illustrates a basic design that will be used for the construction of any new channel designed under Classification No. 1, where practicable.

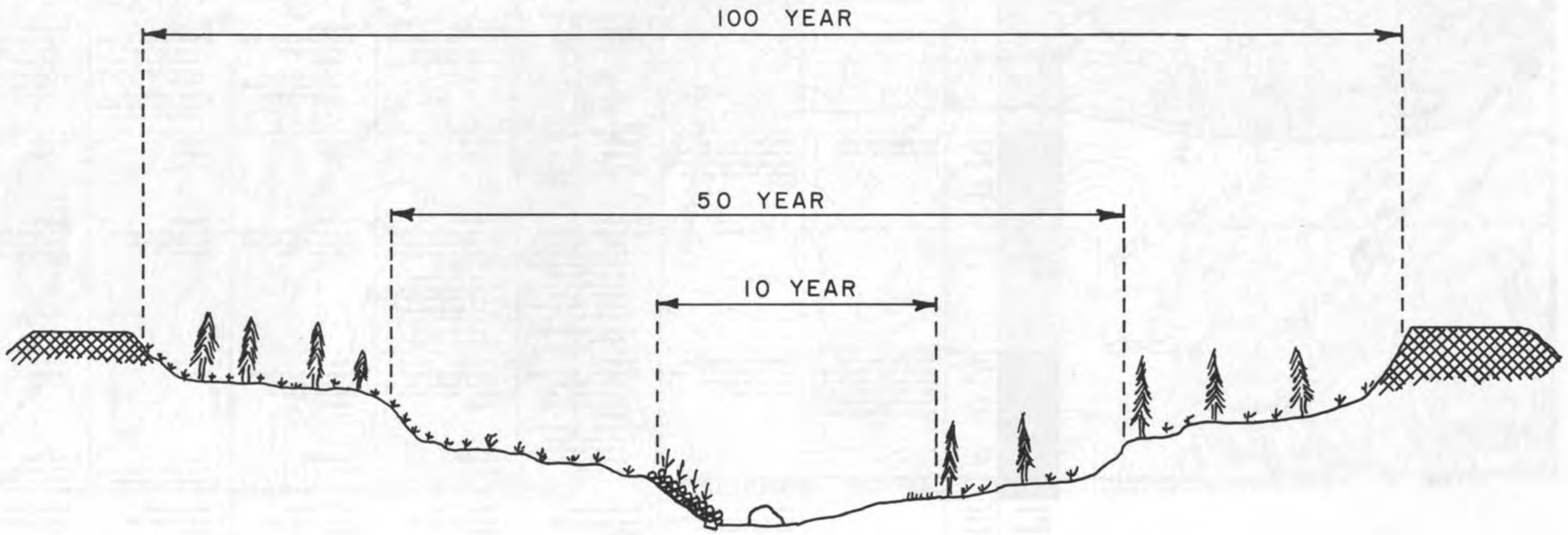
The new channel will contain meanders of the approximate length and frequency that exists in the present channel. The outside meander will be protected with clean, angular rock riprap of sufficient size to offer bank protections, yet not be obtrusive. Gravel bedding will be required under riprap placed on silty soils, but not for riprap placed on gravel embankments. Riprap extending into the stream would be protected from under-cutting by constructing a toe trench under the water line. Whenever possible, the new channel will be constructed in the dry before diverting water into it. Where possible, the stream channel will be allowed to armor itself naturally. Selective revegetation will be used to allow natural bank stabilization to occur where practicable. As a means of encouraging the growth of vegetation, sandy soil will be placed within the pockets of the riprap and sprigged with willows and other native plants. The channel bottom will be sloped toward the rock riprap to provide deeper pools of water during periods of low flow.

Large rock boulders will be placed at strategic points in the channel to provide shelter, resting areas, and eddies for fish. These boulders will also act as velocity dissipators during high flows. Drop structures composed of large sized boulders strung across the channel on steel cable secured to the bank will also act as velocity dissipators while providing pools for fish and habitat.

Location and distances of those sections of the South Fork under Classification No. 1 can be found in Table 50 and Figures 36, 37, 38 and 39.

The above photo is an example of these stretches of the river discussed under Classification No. 1 Guidelines.

Figure 42 BASIC DESIGN FOR NEW STREAM CHANNEL CONST.



Classification No. 2 - Stabilization of Existing Channels

Much of the channel of the South Fork is slowly experiencing natural stabilization. The time required by this process is determined by the reestablishment of vegetation. Water quality improvements now permit the regrowth of willows and grasses which are vital for stream channel stabilization. Vegetation is also necessary for establishing wildlife habitat for a productive fishery. However, several areas of stream channel need assistance in stabilization to permit vegetation to reestablish. These areas are mainly located on the outside meander. Most stretches can be adequately stabilized by planting willows and grasses.

It is recommended that those stretches of the South Fork designated Classification No. 2 be stabilized under the following guidelines. Only those areas that are experiencing rapid movement of the channel be protected and stabilized with clean rock riprap of sufficient size to remain in place during maximum expected velocities. All riprap should be carefully placed using a toe trench. Sandy topsoil should be used as fill between gaps of riprap and planted with willows. Those areas showing relatively stable conditions should be reinforced by planting grasses, willows and trees.

Fish habitat and scenic values will be considered in all sections during the stabilization process.

Location and distances of those stretches of the South Fork under Classification No. 2 are listed in Table 50 and Figures 36, 37, 38 and 39.

This photo is an example showing the type of stream channel falling under Classification No. 2 Guidelines.

Classification No. 3 - Improvements of Previous Channel Stabilization Projects

Protection of Interstate 90, the railroad, and residential areas from flooding has resulted in approximately 5.5 miles of the South Fork being channelized to handle 100-year flood flows. Many sections of the river now contain channels with large flat bottoms and large riprap for banks. Most channels were designed to pass flood flows of high velocities using the rectangular channel approach. This design is effective for flood control but has little value for fish habitat or scenic beauty.

It is recommended that special features be added to these stretches of the South Fork. These include such amendments as pooling devices, bank covers, flow deflectors, fish rocks, velocity dissipators and various forms of vegetation such as trees, willows, grasses, and shrubs. Special attention should be given to maintaining the channel ability to pass flood flows yet produce fish habitat and scenic values.

Location and distances of those section of the South Fork under this Classification are listed in Table 50 and Figures 36, 37, 39 and 39.

It should be recognized that these are only recommendations for stabilization of stream channels and that more research is required prior to final design and implementation. Further data is needed on the magnitude and source of bedload and sediment transport, channel hydraulics, and overall channel design.

Previously altered stream channels need to be adapted for fish habitat and aesthetic values and fall within Classification No. 3 Guidelines.

TABLE 50

South Fork Coeur d'Alene River Classification for Stream Channel Stabilization Projects

Classification No. 1			Classification No. 2			Classification No. 3		
Location (River Mile)	Distance (Ft.)	(Mi.)	Location (River Mile)	Distance (Ft.)	(Mi.)	Location (River Mile)	Distance (Ft.)	(Mi.)
2.8 to 5.6	21,050'	3.99	0.0 to 2.8	13,100'	2.48	9.2 to 11.4	11,200'	2.12
11.4 to 12.5	5,450'	1.03	6.6 to 9.2	14,200'	2.69	16.5 to 17.4	5,000'	0.95
14.4 to 16.1	9,200'	1.74	12.5 to 14.4	9,550'	1.81	18.3 to 19.4	6,200'	1.17
			16.2 to 16.5	3,250'	0.62	28.2 to 29.4	6,300'	1.20
TOTALS	35,700'	6.76	17.4 to 18.4	4,800'	0.91			
			19.4 to 28.2	47,250'	8.95	TOTALS	28,700'	5.44
			TOTALS	92,150'	17.45			

Flood Control Levees

Major flooding has occurred at Kellogg many times in the past with the most recent serious flooding occurring in January 1974. To provide protection from a 100-year flood event, the South Fork river channel and levees need upgrading.

In 1942, a levee system was built along the South Fork to provide flood protection for the city. Recently, Interstate Highway 90 was constructed along the north bank of the river. However, water can inundate the low lying areas north of the freeway by flowing through the underpasses of Division and Hill Streets. There is also a low area in the levee system on the south bank immediately up and downstream of Division Street which would allow water to flow southward out of the river channel.

The proposed project consists of increasing the height of the existing levee where possible to obtain adequate freeboard. In areas where there is not room for a levee or the value of existing improvements is great, a concrete wall would be constructed to contain the flood flows. Due to inadequate width between the river and the freeway, a wall would have to be constructed on the north side of the river from Hill Street to Division Street. Figure 43 shows the proposed area of construction.

Flood profiles shown in Figure 44 indicate that the 100-year flood will nearly overtop the Division and Hill Street bridges. Previous hydraulic analyses has not taken into account any debris jam or failure of bridges or levees. It is probable that some debris would block a portion of the bridges causing water to overtop them. In this event, water would flow into low lying areas behind the levees. This could possibly be prevented by sandbagging the bridge approaches. However, the bridges should be analyzed to determine their structural integrity in the event overtopping should occur and measures needed to flood proof them and stabilize them against flood flows.

The construction costs for the proposed work is summarized in Table 51. Typical cross-section to be used in the design of the levees are shown in Figure 45 and Figure 46.

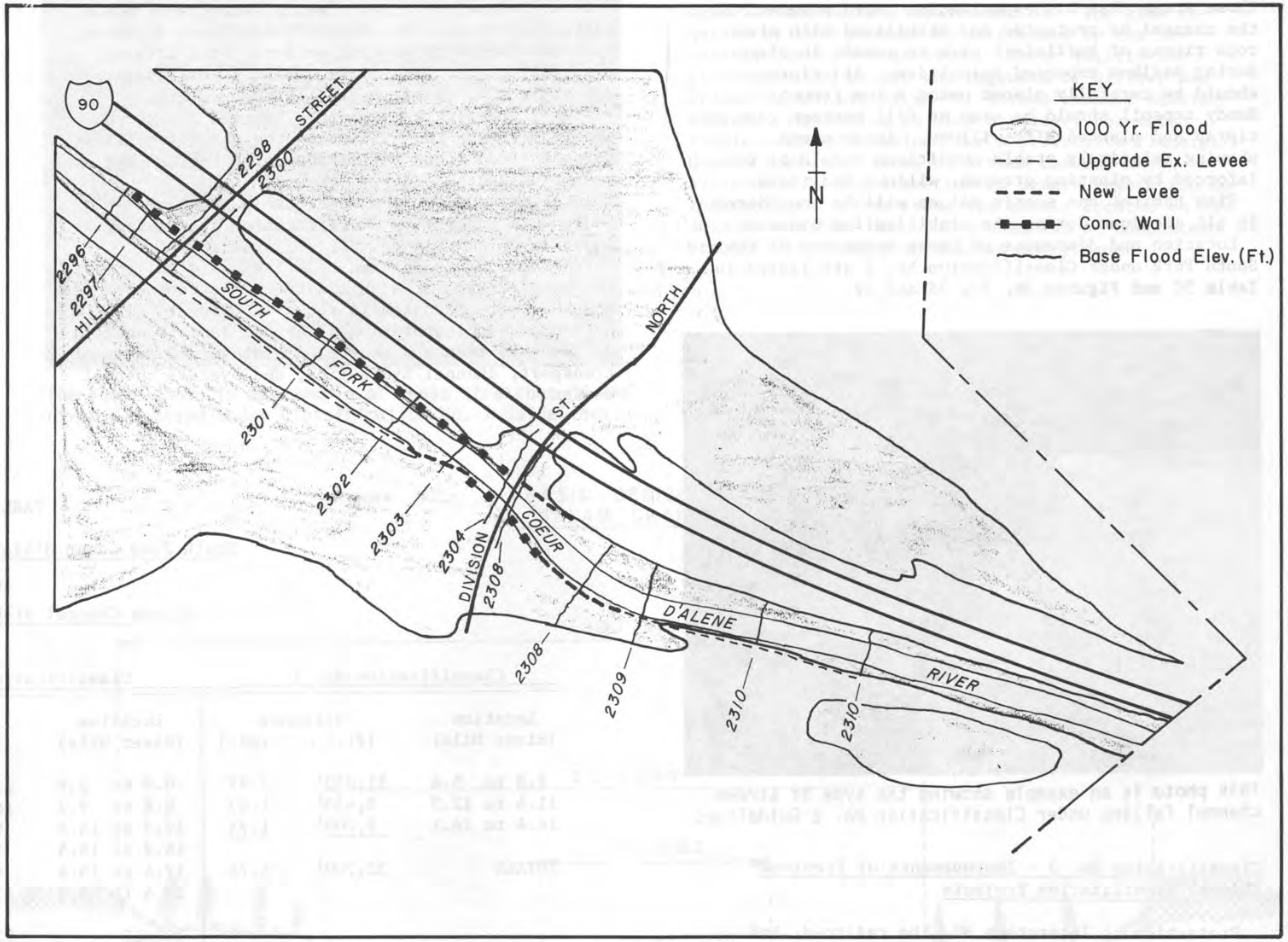


FIGURE 43 SOUTH FORK COEUR D'ALENE, FLOOD CONTROL, KELLOGG, IDAHO

Scale 1" = 400'

In addition, the following studies are recommended:

1. The tributary drainages should be analyzed to determine their ability to convey flood flows. It appears that tributaries are a major source of flooding in the community and should receive some attention as part of an overall flood control proposal for the area.
2. The existing levee system should be analyzed for structural integrity and adequate freeboard to prevent overtopping during a 100-year event. The system should be upgraded as determined by this analysis and as proposed in this report.

TABLE 51

Construction Costs for the Kellogg, Hill-Division Street Levee System

Item	Quantity	Unit Cost ($)	Item Cost ($)
Excavation	1,770 cu. yd.	2.50	$ 4,425
Concrete (in place)	503 cu. yd.	160.00	80,480
Earth fill (levee)	4,425 cu. yd.	2.50	11,060
Compacted backfill	1,770 cu. yd.	3.00	5,310
Right of Way	60,000 sq. ft.	1.00	60,000
Buildings	2,000 sq. ft.	25.00	50,000
Road Repair	7,350 sq. ft.	L.S.	14,700
Riprap	1,500 cu. yd.	10.00	15,000
		Subtotal------	$240,975
		Contingencies (20%)------	48,195
		Subtotal------	$289,170
		Engineering (15%)------	43,375
		TOTAL------	$332,545

FIGURE 44

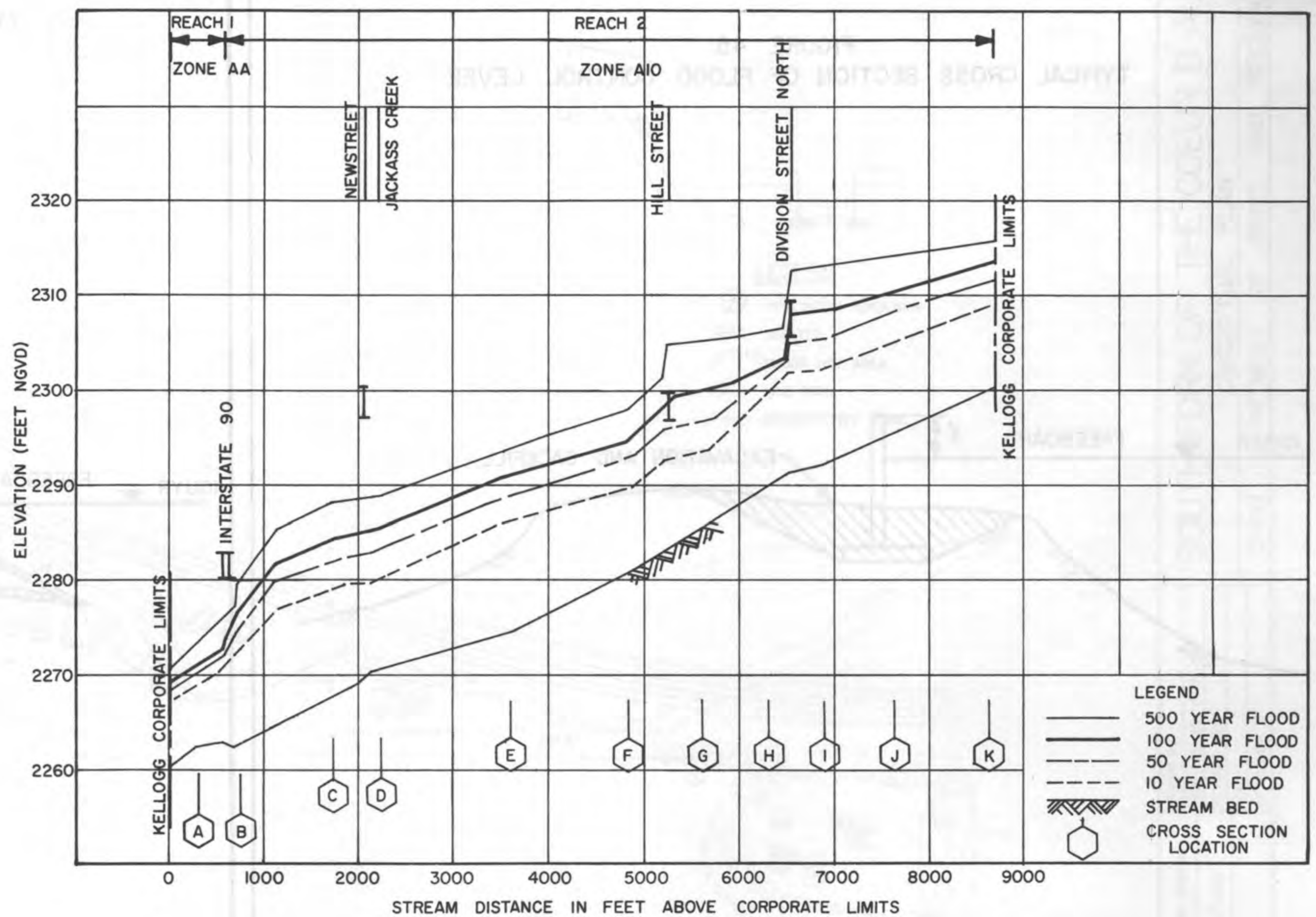


FIGURE 45

TYPICAL CROSS SECTION OF FLOOD CONTROL LEVEE

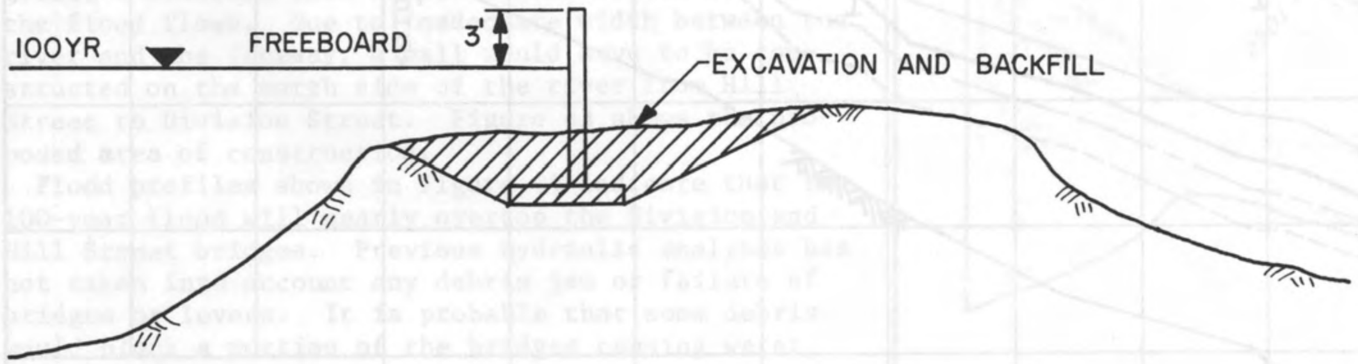


FIGURE 46

TYPICAL CROSS SECTION OF FLOOD CONTROL LEVEE

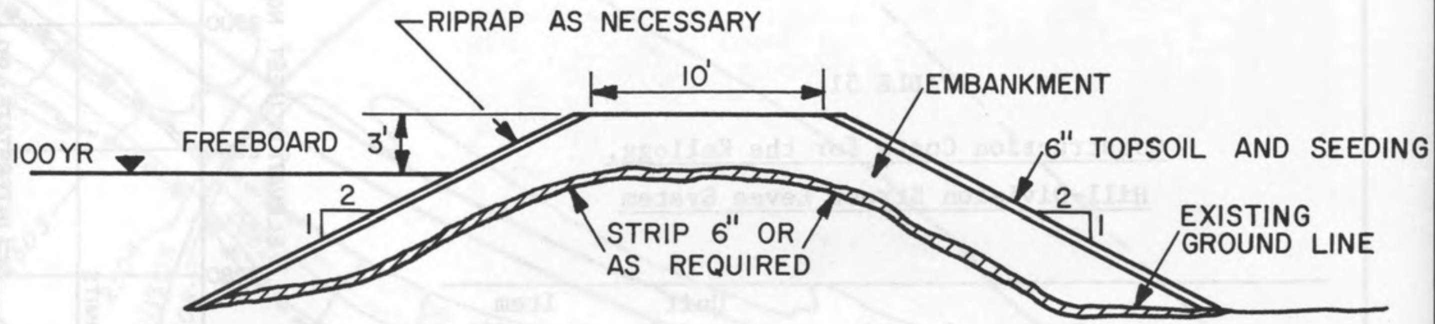
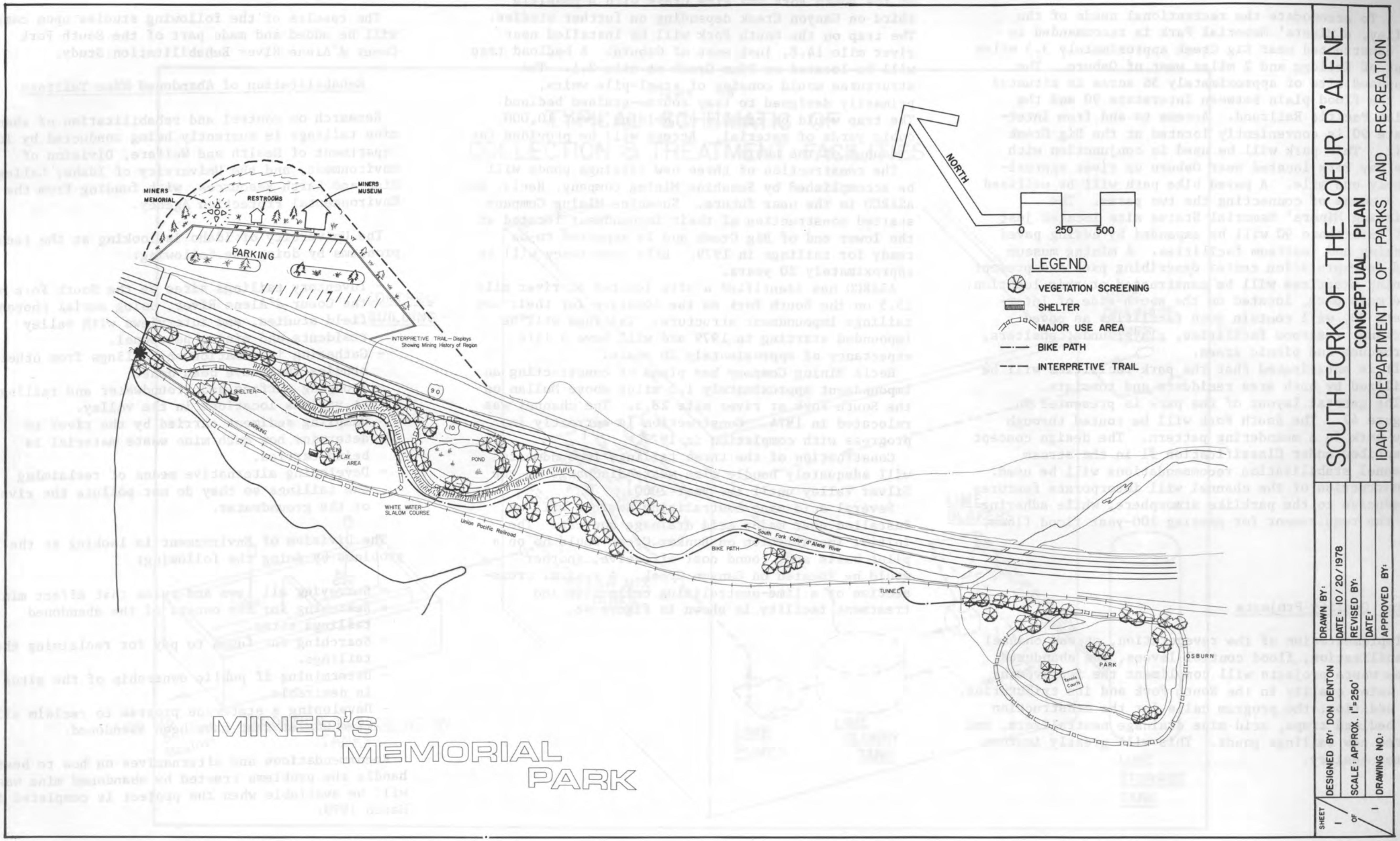


FIGURE 47



MINERS MEMORIAL
MINERS MUSEUM
RESTROOMS
PARKING
SHELTERS
INTERPRETIVE TRAIL – Displays Showing Mining History of Region
90
10
PARKING
PLAY AREA
POND
WHITE WATER SLALOM COURSE
Union Pacific Railroad
South Fork Coeur d'Alene River
BIKE PATH
TUNNEL
PARK
OSBURN
NORTH
0
250
500
LEGEND
VEGETATION SCREENING
SHELTER
MAJOR USE AREA
BIKE PATH
INTERPRETIVE TRAIL
MINER'S
MEMORIAL
PARK
SOUTH FORK OF THE COEUR D'ALENE
CONCEPTUAL PLAN
IDAHO DEPARTMENT OF PARKS AND RECREATION
DRAWN BY:
DATE: 10/20/1978
REVISED BY:
DATE:
APPROVED BY:
DESIGNED BY: DON DENTON
SCALE: APPROX. 1"=250'
DRAWING NO:
1
SHEET
1
OF
1

Recreation

To accomodate the recreational needs of the valley, a Miners' Memorial Park is recommended to be constructed near Big Creek approximately 3.5 miles east of Kellogg and 2 miles west of Osburn. The proposed site of approximately 56 acres is situated in the flood plain between Interstate 90 and the Union Pacific Railraod. Access to and from Interstate 90 is conveniently located at the Big Creek exit. This park will be used in conjunction with the Day Park located near Osburn up river approximately one mile. A paved bike path will be utilized as a means of connecting the two parks. The existing Miners' Memorial Statue site located just off Interstate 90 will be expanded by adding paved parking and restroom facilities. A mining museum and interpretation center describing past and present mining practices will be constructed at this location. The main park, located on the south side of Interstate 90, will contain such facilities as paved parking, restroom facilities, playgrounds, shelters, barbecues and picnic areas.

It is anticipated that the park facilities will be utilized by both area residents and tourists.

The general layout of the park is presented in Figure 47. The South Fork will be routed through the park in a meandering pattern. The design concept described under Classification #1 in the stream channel stabilization recommendations will be used. Construction of the channel will incorporate features conducive to the parklike atmosphere, while adhering to the requirement for passing 100-year flood flows.

Water Quality Projects

Implementation of the revegetation, stream channel stabilization, flood control levees, and abandoned mine waste projects will compliment the improvement of water quality in the South Fork and its tributaries. In addition, the program calls for the construction of bedload traps, acid mine drainage neutralizers, and three new tailings ponds. This will greatly improve water quality.

Two bedload traps are recommended to be installed on the South Fork and Pine Creek with a possible third on Canyon Creek depending on further studies. The trap on the South Fork will be installed near river mile 14.8, just east of Osburn. A bedload trap will be located on Pine Creek at mile 2.1. The structures would consist of steel-pile weirs, primarily designed to trap course-grained bedload. The trap would be capable of holding about 10,000 cubic yards of material. Access will be provided for cleanout of the basin.

The construction of three new tailings ponds will be accomplished by Sunshine Mining Company, Hecla, and ASARCO in the near future. Sunshine Mining Company started construction of their impoundment located at the lower end of Big Creek and is expected to be ready for tailings in 1979. Life expectancy will be approximately 20 years.

ASARCO has identified a site located at river mile 15.5 on the South Fork as the location for their new tailings impoundment structure. Tailings will be impounded starting in 1979 and will have a life expectancy of approximately 20 years.

Hecla Mining Company has plans of constructing an impoundment approximately 1.5 miles above Mullan on the South Fork at river mile 28.3. The channel was relocated in 1974. Construction is currently in progress with completion in 1979.

Construction of the three tailings impoundments will adequately handle mine waste discharge in the Silver Valley until the year 2000.

Several acid mine neutralizing devices will be installed near major acid drainage sources. The initial installation on Bunker Creek would be on a pilot basis and, found cost effective, another would be located on Canyon Creek. A typical cross-section of a lime-neutralizing collection and treatment facility is shown in Figure 48.

Ongoing Studies

The results of the following studies upon completion will be added and made part of the South Fork Coeur d'Alene River Rehabilitation Study.

Rehabilitation of Abandoned Mine Tailings

Research on control and rehabilitation of abandoned mine tailings is currently being conducted by Idaho Department of Health and Welfare, Division of Environment, and the University of Idaho, College of Mine and Earth Resources, with funding from the Environmental Protection Agency.

The University of Idaho is looking at the technical problems by doing the following:

- Inventory tailings sites on the South Fork of the Coeur d'Alene River, using aerial photos, field studies, and interviews with valley residents and mining personnel.
- Gathering information on tailings from other studies that have been done.
- Studying surface and groundwater and tailings at various locations in the valley.
- Sampling sediment carried by the river to determine how much mine waste material is being carried.
- Developing alternative means of reclaiming the tailings so they do not pollute the river or the groundwater.

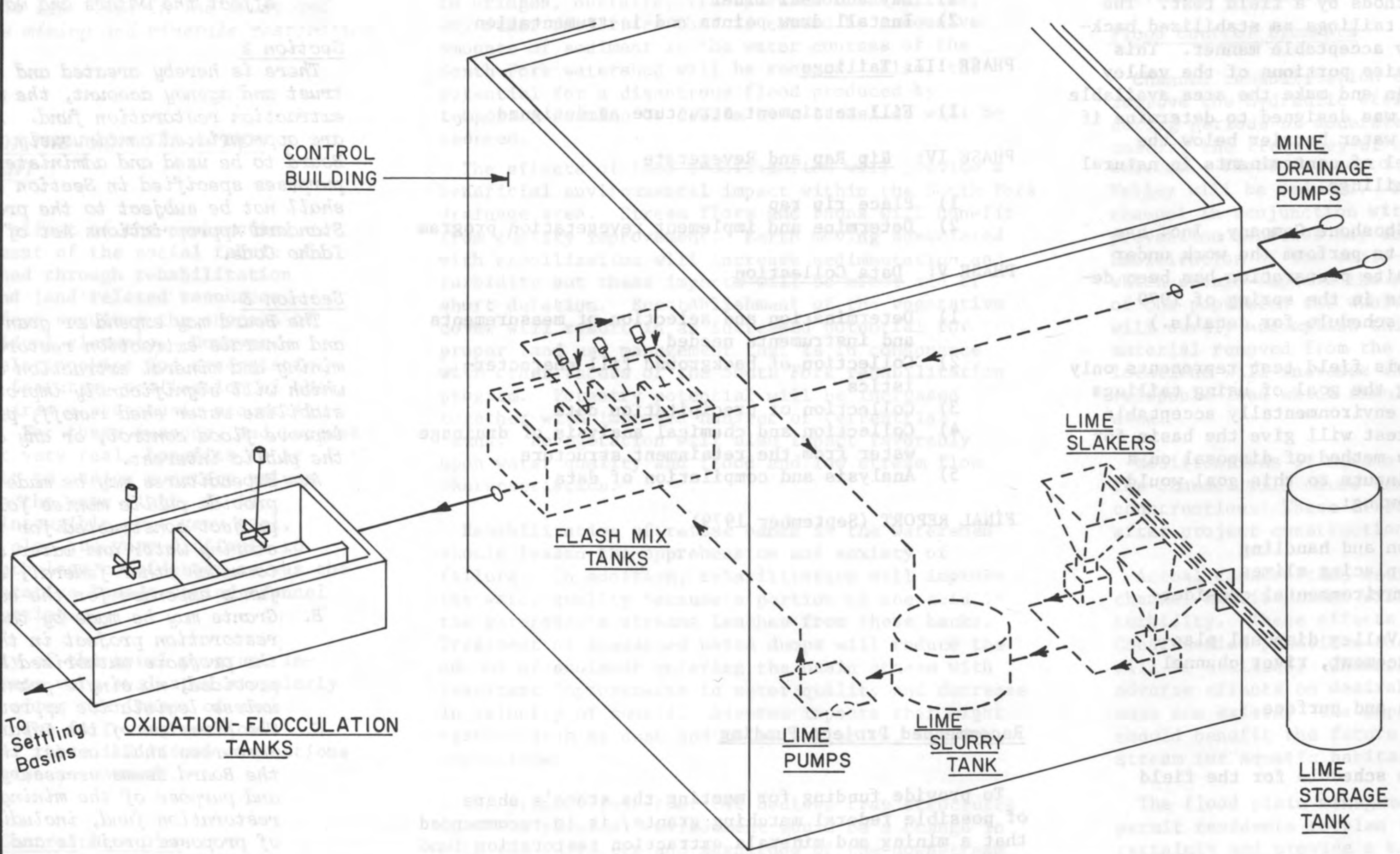
The Division of Environment is looking at the legal problems by doing the following:

- Surveying all laws and rules that affect mining.
- Searching for the owners of the abandoned tailings sites.
- Searching for funds to pay for reclaiming the tailings.
- Determining if public ownership of the sites is desirable.
- Developing a statewide program to reclaim all mine wastes that have been abandoned.

Recommendations and alternatives on how to best handle the problems created by abandoned mine wastes will be available when the project is completed in March 1979.

Figure 48

TYPICAL SCHEMATIC OF COLLECTION & TREATMENT FACILITIES



Field Test for Environmental Disposal of Mill Tailings

Another research project to determine the best method for mine waste disposal is presently being funded by the U.S. Department of Interior, Bureau of Mines (Spokane Mining Research Center).

Scope of Work - The Coeur d'Alene Mining District is becoming increasingly short of suitable sites for traditional types of tailings impoundments. For this reason the mining companies (represented by Greater Shoshone County, Inc.) propose to begin study on alternate waste disposal methods by a field test. The goal is to dispose of the tailings as stabilized backfill in an environmentally acceptable manner. This method could be used to raise portions of the valley floor above the flood plain and make the area available for other uses. The test was designed to determine if slimes could be used as a water barrier below the tailings and show the level of contaminants in natural runoff from and through tailings.

Current Status - Greater Shoshone Company, Inc. has been funded by the Bureau to perform the work under this contract. The test site preparation has been delayed until weather permits in the spring of 1979. (See the attached program schedule for details.)

Potential Development - This field test represents only the first step in reaching the goal of using tailings for valley backfill in an environmentally acceptable manner. Results of this test will give the basis for a practical design of this method of disposal on a production basis. Other inputs to this goal would include study of the following:

- tailings transportation and handling
- methods of drying and placing slimes
- monitoring needs for environmental considerations.
- overall Coeur d'Alene Valley disposal plan--depth and areas of placement, river channel design
- backfill stabilization and surface reclamation.

The following is a program schedule for the field test:

PHASE I: Site Preparation

1) Obtain legal agreement
2) Obtain necessary permits
3) Make construction agreement
4) Final cross-section and instrumentation design
5) Selection of materials
6) Construction of retainment structure

PHASE II: Liner Installation and Water Collection System

1) Lay and seal liner
2) Install draw points and instrumentation

PHASE III: Tailings

1) Fill retainment structure as designed

PHASE IV: Rip Rap and Revegetate

1) Place rip rap
2) Determine and implement revegetation program

PHASE V: Data Collection

1) Determination and selection of measurements and instruments needed
2) Collection of background fill characteristics
3) Collection of precipitation data
4) Collection and chemical analysis of drainage water from the retainment structure
5) Analysis and compilation of data

FINAL REPORT (September 1979)

Recommended Project Funding

To provide funding for meeting the state's share of possible federal matching grants, it is recommended that a mining and minerals extraction restoration fund be established. This fund will utilize 50 percent of the existing mine license tax. Legislation to create this fund is as follows:

Be it enacted by the legislature of the State of Idaho:

Section 1
This act shall be known as the "mining and minerals extraction restoration fund act."

A. *It is hereby declared to be the policy of the state of Idaho that it is in the public interest, safety and welfare to provide for the comprehensive restoration, stabilization and rehabilitation of the mining and mineral extraction areas of Idaho which significantly effect the waters and water sheds of the state.*

Section 2
There is hereby created and established in the trust and agency account, the mining and minerals extraction restoration fund. All monies in the fund are appropriated continuously to the Water Resources Board to be used and administered by it for the purposes specified in Section 3 of this act, and shall not be subject to the provisions of the Standard Appropriations Act of 1945 in Section 67-3516, Idaho Code.

Section 3
The Board may expend or grant monies from the mining and minerals extraction restoration fund for all mining and mineral extraction area restoration projects which will significantly improve water quality, stabilize water shed runoff, prevent soil erosion, improve flood control, or any other purpose deemed in the public interest.

A. *Expenditures may be made from the fund to provide public monies for participation in a project constructed for the purpose of restoring water and water shed mining damage and to match other federal, state and private funds expended for the same purpose.*
B. *Grants may be made by the Board for any restoration project in the public interest for the projects authorized by this section; provided, no single grant shall exceed $100,000 unless legislative approval has been obtained.*
C. *The director of the Department of Water Resources shall assist the Board in any way the Board deems necessary to fulfill the policy and purpose of the mining and minerals extraction restoration fund, including technical evaluation of proposed projects and coordination in state and federal agencies and with local governments.*

Section 4

Section 47-1206, of the Idaho Code, be and is hereby amended as follows:

Payment of mine license tax. -- The license tax imposed herein shall be paid to the state tax commission on or before the due date of the return and the commission shall receipt therefore and promptly turn same over to the state treasurer, as other receipts of its office, and the state treasurer shall place same to the credit of the general fund of the state; provided that fifty percent of the funds generated shall be deposited in the trust and management account, the mining and minerals restoration fund.

C. PROBABLE IMPACT OF THE PROPOSED ACTION ON THE ENVIRONMENT

The desired overall effect of the reclamation project is the betterment of the social fabric of the South Fork watershed through rehabilitation of the area's water and land related resources. Attainment of this effect requires the success of the recommended individual elements. However, because of the interrelationships and synergistic nature of the program features, realization of the program's success requires a systematic accomplishment of each element. For these reasons, and because of the intangible, but very real, benefits to be derived it is difficult to assign monetary values to those benefits. In the same light, it is recognized that some intangible, but very real, losses may occur that also are very difficult to quantify but were nonetheless considered; as was the case in assessing vegetative losses during channel rehabilitation construction.

Due to the complexity of the total program, individual program elements were evaluated singularly and then collectively after the impact of each feature was assessed. The following section presents the results of those individual evaluations as well as the collective assessment.

Erosion and Sediment Control Measures

Erosion and sediment control for the South Fork watershed includes stabilization of unstable and disturbed outslopes, rehabilitation of refuse banks, and treatment of disturbed land areas earlier associated with timber and mineral exploitation.

Stabilization of the outslope areas will reduce the amount of material entering the water courses of the South Fork drainage area as well as the sediment that remains in suspension and eventually reaches Coeur d'Alene Lake. The natural hydrologic efficiency of the South Fork drainage system will be improved. Such improvement will result in a reduced frequency of overbank flooding. The damage to bridges, outfalls, transportation facilities, and other facilities that is caused by excessive amounts of sediment in the water courses of the South Fork watershed will be reduced. Also, the potential for a disastrous flood produced by temporary damming of debris by a landslide will be reduced.

The effects of land stabilization will provide a beneficial environmental impact within the South Fork drainage area. Stream flora and fauna will benefit from quality improvement. Earth moving associated with stabilization will increase sedimentation and turbidity but these impacts will be minor and of short duration. Reestablishment of the vegetative cover will result in an increased potential for proper land use management that is in consonance with other facets of the South Fork rehabilitation program. Forestry potential will be increased together with improved habitat or terrestrial fauna. Revegetation will also impact favorably upon water quality and flood and low stream flow characteristics.

Rehabilitation of refuse banks in the watershed should lessen the apprehension and anxiety of failure. In addition, rehabilitation will improve the water quality because a portion of the acid in the watershed's streams leaches from these banks. Treatment of abandoned waste dumps will reduce the amount of sediment entering the basin stream with resultant improvements in water quality and decrease in velocity of runoff. Adverse impacts that might result, such as dust and noise pollution, would be negligible.

The primary impact of the bedload trap structures upon the physical environment would be a change in both the character and magnitude of the downstream sediment load. Course sediment, presently responsible for much of the channel restricting bar deposits, would be reduced and thereby partially unloading the stream. The result of this is to increase the streams' erosive ability and sediment carrying (transporting) capacity. One of the physical consequences is a change in focus of erosion, with the new sediment loading coming from below the structures. Another effect associated with the placement of the structures would be related to the "barrier effect" created in the stream during periods of low and moderate flow, thereby restricting natural flows and entrapping floating debris. The structure would also necessitate frequent cleanouts, with associated disruption of the stream bottom and temporarily increased turbidity.

Flood Control Elements

Channel rehabilitation of the South Fork will improve the hydraulic efficiency of the stream during periods of moderate and high flow and, as a result, the frequency of overbank flooding will be reduced. Flood damage to improvements in Silver Valley will be reduced. Rehabilitation of the channel in conjunction with other flood damage prevention measures may act as a catalyst for rehabilitation of the socio-economic environment which should improve the morale and the aspirations of the populace; the whole program, as recommended, will surely accomplish this goal. Placement of material removed from the channel in judicious locations will increase the availability of developable land which should aid the economy of the area.

Modifications of stream banks necessitated by the channel will cause temporary inconvenience during construction. These effects will cease to exist after project construction.

Actual construction activities associated with channel modifications will temporarily increase turbidity. These effects will be of short duration. Construction practices that minimize these effects will be utilized. Channelization will have no adverse effects on desirable aquatic fauna, for none now exists. The improved channel conditions should benefit the future productivity of the stream for aquatic habitat.

The flood plain management guidelines will permit residents to plan for the future with more certainty and provide a basis for selective flood proofing programs. A knowledge of potential risks due to flooding will contribute to more orderly living patterns by basin residents.

Water Quality Control Elements

A study of water quality of the South Fork watershed discloses acid mine drainage problems. Abatement features of the demonstration project will generate significant environmental and economic benefits, especially if conducted with effective sediment control and waste collection and treatment measures. These benefits include improved water quality, reduced corrosion of existing facilities, improved recreation potential and improved fish and wildlife habitat. Community morale and the visual appearance of the locality will be improved. Additionally, results from the project will provide data and methods that have applicability to other watersheds afflicted with acid mine drainage.

Installation of limestone neutralization devices may provide significant benefits for a comparatively small investment. A trial application is recommended for a few areas with generally moderate but multiple source acid pollution problems. Beneficial effects would be similar to other forms of acid abatement. The elimination of acidic stream conditions, however, may create an adverse impact. Raw sewage enters streams within the watershed either from privies or inadequate septic tanks. The acidic conditions of the water have thus far prevented a major public health problem resulting from this sewage. Reduction of acid in the streams may result in extremely high coliform counts and septic stream conditions. Provision of domestic waste treatment for the watershed will generate beneficial impacts for basin residents. A public health and nuisance problem, caused by seepage from privies and septic tanks, will be eliminated. Water quality in basin streams will be improved, thereby improving the habitat for fish and wildlife, recreation potential and visual appearances. Further, it is important as a demonstration effort to show that a recycling of domestic waste through collection, treatment and dispersion on stripped lands can be effective in reclamation of such lands. Potential utilization of available regional sludge and effluent will be carefully controlled to minimize any potential adverse effects.

Although provision of water treatment facilities is desirable from a public and general welfare point of view, many individuals in the South Fork area would view a treatment system as an adverse impact. Existing facilities in some areas, while not adequate from a public health viewpoint, appear to be acceptable to some basin residents.

General Recreation and Fish and Wildlife Elements

Provision of a day-use park for basin residents will contribute to satisfying a widespread need expressed by local interests. Children will have a safe place in which to play with the potential hazard of death or injury from vehicular traffic being significantly reduced. The park may also serve as a focal point of community interest and pride and could create a feeling of community cohesion and spirit. Use and maintenance of the park will serve as an outlet for excess energy for children and adults and could reduce tension, delinquency and vandalism. Landscaping of the park would improve community aesthetics.

The recommended establishment of a demonstrational wildlife enhancement area will provide needed habitat in the basin and provide a data base for future applications elsewhere. Primary impact of the plan element will be the improvement in carrying capacity on the affected acreage for small game and browsers. Secondary effects will occur where erosion is reduced and aesthetics are improved by vegetating of the disturbed areas. A productive fishery could be restored to the stream through acid mine drainage abatement and a reduction in sediment leads and bedload movement.

Complimentary Ongoing Programs

A system of solid waste disposal and general cleanup will also contribute to the appearance of the area. Removal of junk cars and other debris that is scattered helter-skelter should improve community pride and perhaps generate a feeling of optimism for the basin populace. However, some residents will view the cost as an unnecessary economic burden and serving no useful purpose.

Actual construction and repair will probably create nuisance problems associated with noise, air, and water pollution, but these will be of short duration and will cease after construction. The creation of potential development areas may create significant environmental impacts. Potential flood damages will be reduced and the land can be used for greenbelts and other uses more compatible with the land's capability. Community identification will become stronger giving people a sense of belonging and participating.

Overall Plan Effects

While the recommended program is not the complete remedy for the South Fork, without it, the total environment of the watershed will continue to experience degradation. Erosion and massive sedimentation, flood damages, degraded water quality, improper sewage treatment, lack of recreation and hunting opportunities, and economic and social ills will remain as burgeoning problems.

The South Fork reclamation plan provides for comprehensive development to rehabilitate the social, economic and natural environments. Elements of the plan are not in themselves unique and would singularly accomplish, in some measure, an improvement in conditions. But, by combining and implementing the elements in a carefully coordinated plan, the end result will be a radical, though far from complete, amelioration of the watershed's problems and thereby providing its residents with an improved private environment for living.

D. *THE RELATIONSHIP BETWEEN THE LOCAL SHORT-TERM USES AND MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY*

Implementation of the plan will decrease the productivity of the land to produce minerals. Although this may be interpreted as a short-term use of the land, reserves are available for a period of years. The decrease in productivity, however, will be slight as the amount of the land that will be removed from production is minor relative to that which will not be removed. The long-term productivity of basin residents should be improved. The environment for living will be improved and consequently output per unit time should rise. The capability of the land to generate increased output of flora and fauna will change.

The trade-off between local and short-term uses of the environment relative to long-term productivity will be in favor of increased productivity of basin residents and the natural environments. Increased productivity of the natural environment will occur where lands are reclaimed from their barren state and developed to support vegetation and wildlife communities. Increased productivity in the long-term would also occur as a result of improved water quality. A fishery could be reestablished in the South Fork. The trade-off between short-term and long-term uses relative to mineral extraction will be deleterious relative to increased productivity.

E. *ANY IRREVERSIBLE AND IRRETREIVABLE COMMITMENT OF RESOURCES WHICH WOULD BE INVOLVED IN THE PROPOSED ACTION SHOULD IT BE IMPLEMENTED*

Committed resources include any unknown variants of biota which may be lost as a result of the program as would any archaeological artifacts or historical records which are not documented. Natural attributes irretrievably committed would be the existing stream channel and banks to be excavated including what little vegetative cover that now exists. Natural contours of the land would be permanently altered where spoil materials are deposited.

If the acquisition of restrictive easements on land involved in the reclamation of land in the Erosion and Sediment Control program is necessary, it could prevent the future extraction of remaining mineral resources on those lands by surface mining. However, this will likely not be necessary, appearing that it would be ecnomically feasible in the near future to extract those remaining reserves.

Channel rehabilitation may cause the forfeiture of any relationships which may have developed between the land and those who have become associated with the area due to relocation of affected structures. Change in the socio-economic and natural environment will occur if the project is implemented and would be irreversible in the present economic and social organization of the area. Factors of production used in construction activity would be irreversibly committed.

CHAPTER 7

FIVE-YEAR PLAN OF ACTION

A five-year plan of action for implementation of the recommendations discussed in Chapter IV is outlined in this chapter. All activities and individual projects are listed on a year-by-year basis.

A. *FIVE YEAR PLAN OF ACTION SCHEDULE*

FEATURE	DESCRIPTION
1 Erosion and Sediment Control:	
A) Major outslopes	Major grading, drainage and revegetation of 18,100 acres.
B) Minor outslopes	Drainage and revegetation of 3,000 acres.
C) River channel	Revegetation of 2,000 acres along 29.65 miles of South Fork Channel; 600 acres along 6.0 miles of Pine Creek Channel; 1,000 acres along 10.0 miles of tributary streams.
D) Bedload	Construct bedload traps as the following locations:
	a) South Fork near Osburn
	b) Pine Creek above Pinehurst
	c) Canyon Creek above Wallace
E) Waste rock dump sites	Remove material or remove cribbing and grade to stable slope of waste rock dump sites in Canyon's tributary to South Fork. Riprap stream channels near dumps and back fill with waste rock.
F) Tailings deposits	Remove tailings where economically feasible. Where not feasible, drainage systems around the deposits will be installed. Topsoil added and revegetated. Where necessary, water will be drained into an acid neutralizer.
G) Cataldo Flats	The ongoing revegetation of this area will continue at an increased rate.
H) Organic matter	Use sludge from South Fork Sewer District on a regional basis for fertilizer and organic matter for acid neutralization and revegetation.
II Flood Control:	
A) Flood channel	Major redesign and channelization of 6.7 miles Class 1; 17.4 miles of Class 2; 5.4 miles of Class 3 to 100-year capacity on South Fork
	Canyon Creek
	Nine-Mile Creek
	Pine Creek
	South Fork - Mile 29.5 to Mile 8
	South Fork - Mile 8 to confluence with main Coeur d'Alene
B) Dikes	
1) Kellogg	Construct 2,455 feet of levee and 800 feet of concrete flood wall between Hill and Division Streets to 100-year elevation.
2) Pinehurst	Raise dike on Pine Creek to 100-year elevation.
C) Bridges	Raise Hill and Division Street bridges to pass 100-year flow. Conduct flood routing and back water studies on all other bridges.
D) Flood plain studies	Conduct studies to determine flood hazard on:
	1) Milo Creek - CH2M
	2) Pine Creek - HUD
	3) Lake Creek
	4) Canyon Creek
	5) Nine-Mile Creek
E) Flood control information	Provide data as available to local officials to be used for planning and non-structural measures and development of flood plain management.

IMPLEMENTATION TIME PHASING: 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990

FEATURE	DESCRIPTION	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
III Water Quality:													
A) Acid drainage	Construct limestone acid neutralizers in areas as needed. Develop a demonstration site near Bunker Creek or the Star Mine.		●	—	●								
IV Mine Waste:													
A) Tailing ponds	Construct tailing ponds at Wallace Gun Club, Shoshone County Golf Course, and above Mullan with capacity to last until the year 2000.	●	●										
V Recreation:													
A) Park	Construct Miners Memorial Park near Big Creek on 56 acres of reclaimed channel. Develop day-use recreation facilities.								●	—	—	●	
VI Fish & Wildlife													
A) Fishery	Construct velocity dissipater, fish rocks, pools, eddies, overhanging banks, etc. in all suitable areas on the South Fork and tributaries.				●	—	—	—	—	—	—	●	
B) Wildlife	Develop winter range on 1,500 acres near Smelterville. Construct water fowl habitat on Cataldo Flats.	●	—	—	—	—	—	●					
VII Program Management and Analysis	Monitor the effects of the reclamation program and where necessary enhancing stabilization efforts.	●	—	—	—	—	—	—	—	—	—	—	●

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