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APPENDIX I

Detailed Descriptions:

Climate
Topography
Geology
Hydrology
Soils
Vegetation
Range Management on US Forest Service Allotments
Fisheries
Wildlife
Scenic and Recreational Resources
Archeological and Historical Resources
Socio-Economic

Climate

The Big Lost River has cool, semiarid, continental type climate regime, characterized by warm, relatively dry summers and cold, polar type winters. Seasonal and daily temperatures, wind directions, wind velocities and precipitation can all be highly variable. The elevation and rugged topography combine to produce dramatic changes in micro-climatic characteristics and weather.

NOAA National Weather Service Stations are located at Chilly Barton Flat, Mackay Ranger Station and Mackay 4NW. The Chilly Barton Flat Station is closest to the project area and is used as a reference point for the following discussion.

The mean annual maximum and minimum temperatures are 52.8°F. and 22.4°F., respectively. The mean monthly maximum temperature is 82.0°F. and occurs in July, while the mean monthly minimum temperature is 2.8°F. and occurs in Janauary. Temperatures tend to decrease slightly with elevation up the valley and increase slightly going down the valley towards Mackay. The lowest recorded daily maximum and minimum temperatures are -6°F.and -34°F., respectively and occurred in January and February. The highest recorded daily maximum and minimum temperatures are 94°F. and 66°F., respectively and occured in July and August. Elevation comparisons for temperature extremes are similar to mean annual and mean monthly elevation comparisons.

Mean annual precipitation is 8.07 inches at Chilly Barton Flat to 9.30 inches at Mackay Ranger Station. At Chilly, the mean monthly maximum and minimum precipitation is 1.58 inches in June and 0.19 inches in February, respectively. Mean annual snowfall is 18.1 inches at Chilly and 36.6 inches at Mackay Ranger Station. The mean monthly maximum snowfall that exceeds 0.10 inches is 7.59 days at Chilly Barton Flat and 15 days at Mackay Ranger Station. The average depth of snow at Chilly Barton Flat is 0.36 inches on December 1, 0.25 inches on January 1, 0.55 inches on Feburary 1, and 0.09 inches on March 1, while average depths for those dates at Mackay Ranger Station are 0.88, 4.95, 6.67, and 4.57 inches respectively. Snowfall and precipitation data indicate that elevation characteristics give the interior portion of the intermountain basin,

that is, Chilly Barton Flat and Thousand Springs Valley, a much more polar and semiarid climate than that found in the mountainous valley sections. The frost-free period at Chilly Barton Flat is 82-90 days and increases down the valley to 95-108 days at Mackay Ranger Station.

Topography

The Big Lost River Valley is one of three major structural intermountain basins of central eastern Idaho. It is located at the boundary between the northern portion of the Great Basin and the southern most section of the Northern Rocky Mountains and shows the characteristics of both. The watershed above the downstream boundary of the project area at Mackay Dam has an area of 788 square miles and is somewhat pentagonal in shape. The basin is oriented and flows in a northwest to southeast direction. Watershed boundaries consist of the Lost River Range on the northeast to southeast, the Boulder Mountains to the west-northwest, the Pioneer Mountains to the west-southwest, and the White Knob Mountains to the south-southwest.

Elevations in the project area range from 6,000 feet at Mackay Reservoir to 6,620 feet at Bartlett Point Bridge. The three major mountain passes of the watershed include Willow Creek Summit at 7,161 feet, Doublesprings Pass at 8,318 feet and Trail Creek Pass at 7,800 feet. Ridgetop elevations tend to exceed 9,000 feet. There are five mountain peaks between 9,000 and 11,000 feet and twelve peaks greater than 11,000 feet in elevation with Mount Borah, the highest peak in the state, standing at 12,656 feet in the Lost River Range.

The mountains of the upper watershed are of very high relief (4,000-5,000 feet), are steep, rugged and moderately dissected. Valleys in the headwater regions are often V-shaped from Pleistocene glaciation. Deposits of Quaternary age occup the upland valley bottoms. The boundary between treeline and alpine tundra is at about 9,500 feet. About 10% of the watershed is above 9,000 feet with the remaining 90% between 9,000 and 6,000 feet.

The mainstem of the Big Lost River is formed about 29 river miles upstream of the Mackay Reservoir by the confluence of the East Fork and North Fork of the Big Lost River. Major tributaries of the East Fork include Wild Horse Creek, Fall Creek, the West Fork of the East Fork, Star Hope Creek and the East Fork of the East Fork. Major tributaries of the North Fork include Summit Creek and the North Fork itself with its numerous small tributary streams.

The 208 project area begins on the mainstem of the river just below the confluence of the North and East Forks. Several small tributary streams enter the mainstem between the confluence of the forks and the Bartlett Point Bridge Crossing, where the river enters the intermountain basin of Thousand Springs Valley. No tributaries enter this eastward flowing section until Thousand Springs Creek joins the mainstem near Elkhorn Creek. The river turns south here and intermittently receives flows from the Lost River tributaries of Elkhorn Creek, Lone Cedar Creek, Pete Creek and Upper Cedar Creek. On the west side of the river, Warm Springs Creek and Parsons Creek flow out of Barton Flat and out of floodplain springs in the alluvium of the valley bottom and join the river at the upstream and west side of the Mackay Reservoir.

Mackay Reservoir, located 5 to 6 miles north and west of the town of Mackay in Custer County, was created following construction of the Mackay Dam in 1917. The reservoir has a surface area of 1,341 acres and a full capacity of 45,050 acre feet. When filled to spillway elevation, it has a maximum depth of 65 feet.

Geology

The geology of the Big Lost River is quite complex. Types of rocks are highly varied in terms of age, arrangements, and structure in each of the five major mountainous areas.

The main Big Lost River Valley is an area formed by large-scale downfaulting between the two upfaulted blocks of the White Knob and Lost River Mountains. The major faults parallel the valley axis on both sides and are located very near the break in slope at the mountain front. The northern portions of the White Knob Mountains (south of the river study area) are composed of rocks of the Challis Volcanic formation and are underlain by complexly folded and faulted marine sedimentary rocks. Bartlett Point, located adjacent to the river in the upper-third of the project area, is composed of calcareous limestone quartzite, sandstone, and conglomerate of the Wood River Formation. A major fault parallels the river on the south side of the study section above Bartlett Point cutting across several alluvial fans. Another east-west fault of the White Knobs cuts across the Big Lost River Valley at the Narrows at Mackay Dam.

The Lost River Range rises dramatically to the east of the river and is composed primarily of bedded limestone and dolomite, argillite, siltstone, and sandstone. Faults are found in the valleys of Lone Cedar Creek and Elkhorn Creek among a complex of quartzites and the argillites, dolomites, and sandstones of the Saturday Mountain Formation. The Lost River Fault runs parallel to the range along the mountain front, intersecting the valley faults and cutting across alluvial fans to the east and northeast of the river.

The northeast extension of the Boulder Range to the north and west of the project area is faulted along its base west of Thousand Springs Valley. To the north, the mountains are similar in composition to the Lost River Range and are dominated by limestone and dolomite. To the south the Sage Creek, Pinto Creek and Swenson Basin watersheds are covered by a mixture of faulted rocks of the Challis Volcanics. The western portion of the Boulder Mountains are similarly comprised of Challis Volcanics and are underlain by limestone of the Copper Basin Formation.

The Pioneer Mountains contain numerous large northwest-southwest trending, parallel and sometimes concentric, thrust and normal faults along the western and central portions of the watershed. The rocks of the mountains are very complex and are comprised of a group of undifferentiated volcanic rocks and latite-andesite of the Challis Volcanics, all covering layered beds of various calcareous rocks, some metamorphic rock of sedimentary origin, and Precambion Belt-series quartzites.

Glaciation during the Quaternary and Pleistocene eras has played a very important role in producing the surface landforms of the present. Alpine glaciers occupied valleys greater than 7,000 feet in elevation forming the great V-shaped valleys presently observable in the upper watershed. There are also innumerable patterned ground features on alluvial surfaces in Thousand Springs Valley. These are old frost heaves which have formed small sorted circles with present day relief of 6 inches to 1.5 feet. Anthills are found in the center of each of the circles.

Glacial runoff over the ages has carried enormous quantities of sediment down into the valley of the river. Huge Quaternary alluvial fans enter the valley from the outlets of tributary streams of the Lost River Range and the White Knob Mountains. Quaternary terrace gravels fill the greater portion of Thousand Springs Valley. The river presently flows across Quaternary and Holocene stream and river alluvium.

Quaternary deposits along the river vary in composition and particle size according to the parent material from which they are derived. Unconsolidated alluvial deposits include river and stream alluvium, glacial deposits, landslide debris and young alluvial fans. Stream alluvium tends to be coarse and moderately well sorted. Alluvium derived from quartzite contains a large component of angular rock fragments while those derived from limestone and dolomite contain a large proportion of rounded cobbles, rubble and small boulders. Alluvium in volcanic formation tend to consist primarily of small gravels, pebbles, sand and silt. Icy river deposits have a large component of large rounded boulders (greater than 1 meter in diameter). Holocene or recent alluvium tends to be

silt-laden with some gravel and sand, much of it derived from tributary streams.

Alluvial deposits are cemented when derived from calcareous rocks such as limestone and dolomite. Alluvium usually consists of poorly sorted sand, gravel, and rounded to angular fragments of cobble, rubble, and small and large boulders, all held together in a calcite cemented matrix. Alluvial deposits of the White Knob Mountains are primarily unconsolidated, being derived from non-carbonate volcanic parent materials. Those of the Lost River, Boulder and Pioneer Mountain Ranges are primarily cemented because of their calcareous origin. Both types of alluvium are relatively well drained, though the unconsolidated materials are more permeable than those cemented by calate. A band of volcanic ash from the Mt. Mozoma eruption of 6,600 years ago can be observed in road cuts and cut banks in alluvium at depths of 1 to 2 feet below the ground surface.

Hydrology

In the Big Lost River, the surface and ground water are so interrelated that, for the basin as a whole, they should be considered as a single system. In the main portion of the river and Thousand Springs Valley, coarse alluvial material is so permeable that rainfall on the surface almost always infiltrates and rarely flows overland. Streams lose water very rapidly after they leave the mountain front and flow across alluvial fans. Seepage losses are not confined to stream channels and can be significant wherever water is diverted, say, in ditches for irrigation.

On the Big Lost River, the surface water seepage loss is so great that at medium and low flows all of the surface flow is in the mainstem of the river sinks, that is, disappears into the alluvium in the Chilly Butte area, known as the "Sinks".

The surface water is lost to alluvium flows underground and reappears in large springs that are located in the present day floodplain along the river below the confluence of Thousand Springs Creek. A portion of the water lost to seepage supports the surface water inflow to Mackay Reservoir. Some of this inflow water comes from Thousand Springs Creek and from groundwater inflow from Lost River Range tributaries. It is not known how much water is lost from the river to the alluvium of Thousand Springs Valley or contributes to the total ground water supply of the alluvium below the surface.

Chemical Water Quality

Results from water quality analyses performed by the US Geological Survey were evaluated from six stations on the Big Lost River Watershed below the reservoir to the headwater streams. The data indicates that the chemical water quality of surface water is generally excellent and that the water neither threatens nor impairs the beneficial uses.

The waters are of calcium bicarbonate type. Temperatures vary between $0.0^{o}C.$ to $19.5^{o}C.$ Specific conductance ranged from 92 to 214 mmhos/cm^{2} in headwater tributary streams, was 424 in Thousand Springs Creek, and ranged from 898-2350 at the inflow to the Mackay Reservoir on the mainstem of the river. Specific conductance is higher when runoff is due to ground water flow at low discharges

and lower when discharge is due to channel flow during peak runoff events. The ph of water in the watershed ranges from 6.9-8.8. Bicarbonate alkalinity ranges from 101-227 in mg/L as HCO_3. Carbonate alkalinity is 0 in mg/L as CO_3. Water in the tributary streams is soft to moderately soft (less than 90 mg/L as $CaCO_3$). Along the river, the hardness increases and ranges from hard (120-180 mg/L as $CaCO_3$) to very hard (greater than 180 mg/L as $CaCO_3$). Thousand Springs Creek has a hardness of 266 mg/L as $CaCO_3$. Hardness concentrations are due to the relatively high levels of calcium (27-58 mg/L as Ca) and magnesium (7.2-15 mg/L as Mg), which are caused by the carbonate geologic parent materials of the watershed. Sodium absorption ratios vary from 0.2-0.3 and indicate that the sodium hazard for irrigation water suitability is low. Potassium values range from 0.8-1.6 mg/L as K. Chloride ranges from 0.5-6.0 mg/L as Cl. Sulfate ranges from 10-18 mg/Las SO_4. Fluoride values vary from 0.1-0.6 mg/L as F. and are dependent upon water temperature. Silica concentrations range from 8.4-13.0 mg/L as SiO_2. Boron was not found in any samples in the upper watershed, but ranged from 30-80 ug/L as B in the station on the river below the reservoir. Total dissolved solids ranged from 105-250 mg/L. Nitrogen-nitrate concentrations ranged from 0 to 1.4 mg/L as NO_3.

In 1978, four water quality monitoring stations were placed on the Summit Creek, North Fork, Wildhorse, and West Fork tributaries of the Big Lost River by the US Forest Service. These stations will detect, at an early stage, any significant changes in siltation resulting from management practices and ensure that projects comply with the State water quality standards. Due to lack of funds and data base, watershed stabilization projects are minimal at this time. As money and manpower become available, deteriorated watershed areas will be inventoried and prioritized for improvement. No soil-disturbing activities in critical watershed areas will be authorized unless designed and maintained to prevent unacceptable soil movement or degradation of water quality. Minimum stream flows will be maintained by restricting new diversions from existing streams. Timber harvesting in the upper watershed will consist of firewood, post and poles, and commercial sales for a total of three million board feet in the North Fork Big Lost and two million board feet in the East Fork Big Lost. East Fork sales will depend upon the completion and analysis of compartment exams. Exams are expected to be finished by October 1981.

Surface Water

The water characteristics of the Big Lost River vary from the upper to lower segments of the project area. There are three distinct "reaches" of river in the study zone.

Upper Reach

The upper reach begins at the confluence of the East and Middle Forks of The Big Lost River and runs to the Chilly Buttes. The channel is primarily straight to semi-meandering, with the channel corridor being bounded by Quaternary alluvial for materials on the south and calcareous Quaternary terrace alluvium on the north. The hydrograph for the Big Lost River at the Howell Ranch shows the characteristic runoff discharge pattern of typical Rocky Mountain streams. High flows occur in the spring in response to snow melt runoff. Most of the flow in the reach is supplied by the North and East Forks of the Big Lost River. These two major watersheds drain the western third of the watershed, but contribute nearly half of the total average annual water yield. Baseflow is maintained by ground water inflow through alluvial and glacial valley fill. Flows usually decrease following snowmelt runoff events until baseflow is reached in late summer or early fall. The average baseflow is 190 cfs. Annual peak flows occur between May 8 and July 1 with a median date of June 10. Freeze-up occurs in the main channel in cold years during November or December. Ground water movement continues year-round. Melt-down occurs from March to May. Spring runoff is usually 20 to 50 times baseflow. Flows can vary daily as atmospheric conditions change.

Middle Reach

The middle reach is from the Chilly Buttes narrows to the confluence of Thousand Springs Creek. This section is known as the Chilly Sinks because of the large quantity of water that filters through from the river channel into the alluvial fill of the valley. The two major "subreaches" are the smaller upper rinks and the larger lower sinks above and below the Chilly Bridge, respectively.

Measured losses range from 45 to 120 cfs (Crosswaite, 1970). The river channel through the Sinks goes completely dry about 25% of the time, containing water only during the moderate to higher flows. During extended periods of dryness, the Sinks are capable of absorbing more than 1,000 cfs.

Following periods of prolonged moderate to high flows, the river generally carries water until the flow at the Howell gauge decreases to less than 300 cfs. This section is straight to semi-meandering, tending to widen as it cuts into the poorly vegetated, highly erodible alluvial sand and gravel of the riverbed and banks. The channel splits in two at the first of five drop structures of the WPA Chilly Canal Project and then braids and meanders in numerous actively cutting channels, sometimes fanning out and spreading water and sediment across the alluvial deposits of the valley.

Lower Reach

The lower reach goes from the confluence of Thousand Springs Creek to the inflow to Mackay Reservoir. The groundwater-fed Thousand Springs Creek draws about 150 square miles of the watershed and averages 25 cfs. Downstream of the confluence the groundwater lost by the river to the Sinks re-emerges in numerous springs that lie adjacent to the river channel. These feed the mainstream as well as the meandering floodplain channels of Warm Spring Creek and Parsons Creek and the numerous flood irrigation ditches and minor floodplain channels.

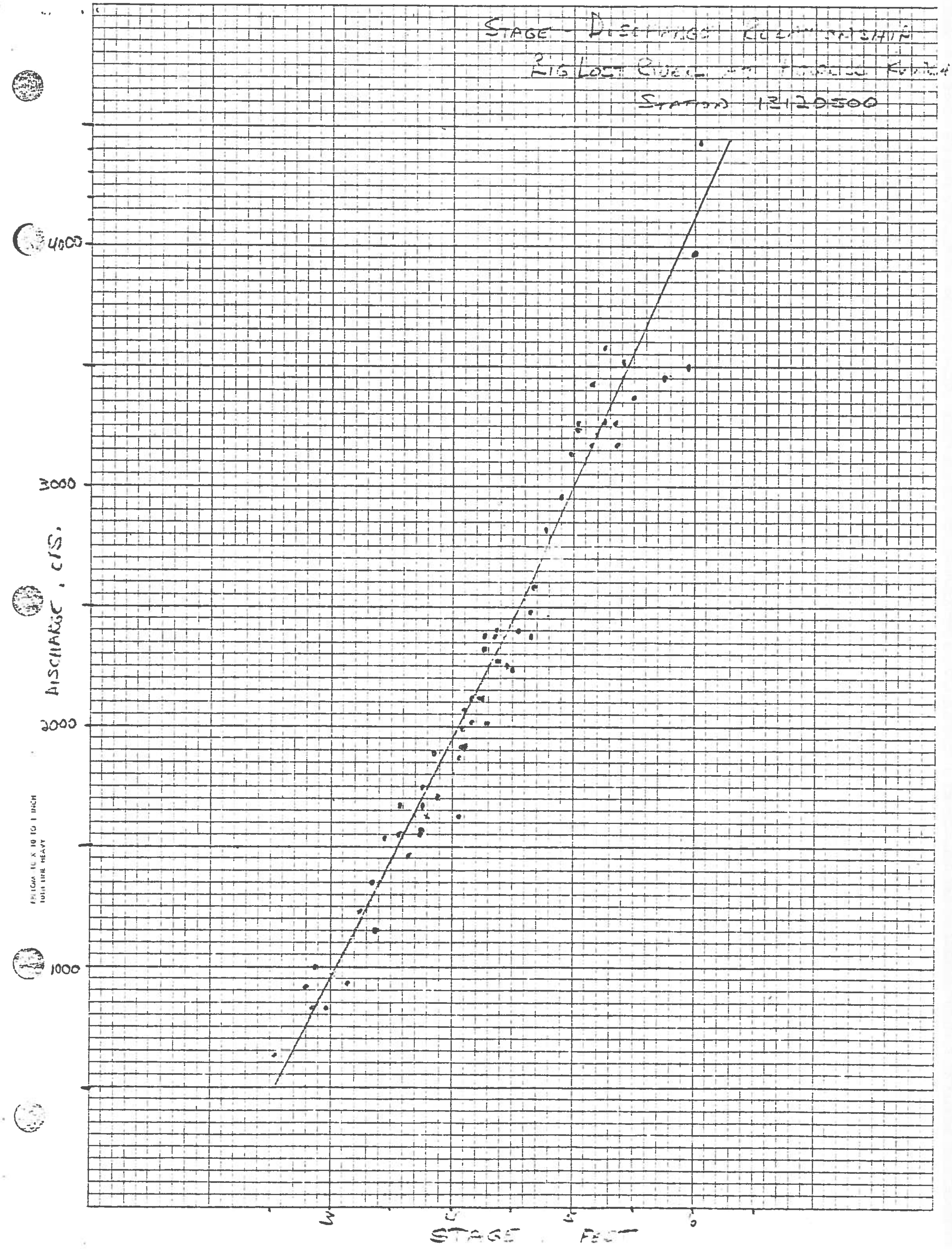
Surface flow at the Mackay Narrows below the reservoir flows an average 30 cfs more than the combined surface flow of surface streams below the Sinks, indicating that groundwater flows increase in the lower reach and from the Lost River and White Knob watersheds east and west of the reservoir. The Big Lost River at the reservoir is thus a "gaining" stream (Crosswaite, 1970).

Discharge

The largest peak flow recorded at the Howell gauge was 4430 cfs in 1967 at a stage of 6.02 feet. The smallest peak flow on record was 234 cfs in 1934. Recent significant flood events (greater than 3000 cfs) occurred in 1975, 1974, 1972, 1970, 1969, 1967, and 1965.

The average annual water yield at the Howell gauge is 321 cfs. The highest average annual water yield on record is 538 cfs in 1965. The mean one day high flow is 2264 cfs and the mean one day low flow is 60 cfs (USGS, 1980).


ANNUAL PEAK
DISCHARGE IN CFS
BIG LOST RIVER
AT HOWE RANCH
STATION 13120


STATION 13120500
4000
3000
2000
1000
DISCHARGE, CFS.
3
STAGE FEET

Soils

Soils within the project area fall mainly into four of the ten soil orders: Aridosols (dry soils), Entisols (young soils), Histosols (organic soils), and Mollisols (dark soils). A summary of the suborders within each order, their textural classification, series name, and soil series descriptions are given in the "Soil Survey Description Legend, Custer Soil Conservation District". The document is on file at the Soil Conservation Service (SCS) Office, Arco, Idaho.

These soils are formed from river alluvium originating from a large assortment of Igneous, Sedimentary, and Metamorphic rock. The predominant gravels in the soil profiles are quartzite and limestone.

The profiles are poorly developed because of low rainfall during summer months and river channel migration with its associated channel erosion.

In the river bottom, the majority of soils are shallow (10 to 20 inches to sand and gravel) and poorly drained (fluctuating water table within 20 to 40 inches of the surface). They have moderate to moderately rapid permeability (0.63 to 6.3 inches per hour) and very low or low water holding capacity (1.5 to 6 inches available water).

Broad river floodplains flank the river bottom. As the river travels northeast it is flanked on the north by a narrow lower and broad upper river floodplain. The lower river floodplain is very deep soil, but very shallow to sand and gravel. It is well drained, has moderately rapid permeability, and very low water holding capacity. The upper floodplain is made up of a very deep soil and the depth to sand and gravel is also deep. It is well drained, has moderate permeability, and medium water holding capacity (6 to 9 inches available water).

After the river turns to the east and then to the southeast, it is flanked to the south by a broad river floodplain. The soil is a very deep soil, but shallow to sand and gravel. It is well drained, has moderately rapid permeability and very low water holding capacity.

The slope, topographic location of model profiles, soils that customarily occur together in the study area, runoff percentage, and erosion hazards are described in the "Soil Survey Description Legend, Custer Soil Conservation District, October 1971".

GENERAL SOIL MAP AREA DESCRIPTIONS

A. Standhope

Nearly level, somewhat poorly or poorly drained, deep or very deep medium textured soil over sand and gravel on river terraces.

Standhope soils typically have a surface layer of dark brown to very dark gray loam or silt loam about 25 inches thick. The underlying layer is very dark gray to gray stratified loam, to gravelly loamy sand about 17 inches thick. The next underlying layer is sand and gravel.

This area is used for meadow pasture and meadow hay. It is also used for wilflife habitat.

B. Uneeda

Nearly level, well drained, very deep but shallow to sand and gravel, moderately coarse textured soil over sand and gravel on high river terraces.

Uneeda soils typically have a surface layer of brown gravelly sandy loam about 9 inches thick. The underlying layer is brown very gravelly loamy sand about 11 inches thick. The next underlying layer is pale brown sand and gravel.

This area is used for rangeland, irrigated alfalfa hay, and pasture. It is also used for wildlife habitat.

C. Lam

Nearly level, moderately well drained, somewhat poorly drained and poorly drained, very deep but moderately deep to sand and gravel, medium textured soil over sand and gravel on river floodplains.

It is about 85% Lam soils, 3% Keele soils, 5% Uneeda soils, 1% Tepete Peat soils, 2% Standhope soils, 3% Riverwash, and 1% Alluvial Land.

Lam soils typically have a surface layer of gray loam about 12 inches thick. The underlying layer is mottled dark grayish-brown fine sandy loam about 10 inches thick. The next underlying layer is loose sand and gravel.

This area is used for rangeland, meadow hay, and pasture. It is also used extensively for wildlife habitat.

D. Bartonflat

Nearly level, well drained, very deep but very shallow to sand and gravel, moderately coarse textured soil over sand and gravel on river terraces. Uneeda soils typically have a surface layer of light brownish-gray cobbly sandy loam about 3 inches thick. The underlying layer is loose sand and gravel.

This area is used for rangeland and wildlife habitat.

E. Highams

Steep, well drained, moderately deep, medium textured soils over limestone bedrock on mountain slopes.

Highams soils typically have a surface layer of very gravelly loam about 5 inches thick. The subsoil is light gray gravelly silt loam about 7 inches thick. The substratum is light gray very stony silt loam about 6 inches thick over shattered limestone bedrock below 18 inches.

This area is used for rangeland and wildlife habitat.

F. Arbone

Nearly level, well drained, very deep but shallow to sand and gravel, moderately coarse textured soil over sand and gravel on high river terraces. Arbone soils typically have a surface layer of grayish-brown gravelly loam about 11 inches thick. The underlying layer is light brownish-gray very gravelly coarse loamy sand about 3 inches thick. The next underlying layer is light brownish-gray, extremely gravelly, coarse loamy sand.

This area is used for rangeland, irrigated alfalfa hay, and pasture. It is also used for wildlife habitat.

CLASSIFICATION OF SOIL SERIES

Arbone	- Calcic Haploxerolls, coarse-loamy mixed, frigid
Lam	- Fluventic Haplagnolls, coarse-loamy over sand or sandy skeletal mixed, noncalcareous, frigid
Standhope	- Aquic Calciorthids, fine loamy mixed, frigid
Uneeda	- Calciorthidic Haploxerolls, sandy skeletal mixed, frigid
Bartonflat	- Typical Cryorthent, coarse-loamy over sand or sandy skeletal mixed, calcareous
Highams	- Lithic Xeric Torriorthents, loamy skeletal, carbonatic, frigid
Tepete Peat	- Histosols
Keele	- Pachic Haploxerolls, fine loamy over sand or sandy skeletal mixed, frigid

Vegetation

The vegetation within the project area is quite varied with numerous species being represented within four main vegetative types. The main vegetative types are conifer, sagebrush-grass, wet and semi-wet meadow, and riparian. The transition from one vegetative type to another is quite abrupt within the project area due to changes in elevation and distance from the river channel.

The upper reaches of the project area and the higher elevations of the surrounding mountainsides, ranging from 6,000 to 8,000 feet, are characterized by stands of conifer trees. The conifer areas are dominated by Douglas fir with an assortment of understory shrubs, grasses and forbs. The potential composition of these areas with a greater than 50% overstory is approximately 20-25% grasses, 30-40% forbs and 40-50% shrubs and tree reproduction.

The principle native plants comprising the conifer vegetative type within the project area are listed as follows:

Trees and Shrubs

1. Douglas fir
2. Quaking aspen
3. Mountain snowberry
4. Chokecherry
5. Oregon grape
6. Mountain big sagebrush

Grasses

1. Pine reedgrass
2. Bearded wheatgrass
3. Bluejoint reedgrass
4. Mountain brome
5. Idaho Fescue

Forbs

1. Heartleaf arnica
2. Spreading sweetroot
3. Strawberry
4. Violet
5. Sticky geranium

The most apparent vegetative type within the project area is sagebrush-grass. This vegetative type ranges from the lower elevations to over 7,500 feet. The Wyoming big sagebrush-bluebunch wheatgrass type is the most prevalent. On the north slopes, up to about 7,500 feet, Mountain Big Sagebrush-Idaho Fescue may

dominate. Other sagebrush types with various understory species and some with a mixture of other shrub species are found throughout the area.

The most common plants comprising the sagebrush grass vegetative type are listed as follows:

Shrubs

1. Wyoming big sagebrush
2. Dwarf green rabbitbrush

Grasses

1. Bluebunch wheatgrass
2. Sandberg bluegrass
3. Idaho Fescue
4. Squirreltail
5. Needlegrasses

Forbs

1. Phlox
2. Lupine
3. Penstemon
4. Milkvetch

The lower reach of the project area from the Trail Creek Road turnoff to the Mackay Reservoir is characterized by gently sloping stream bottom lands or land immediately adjacent to streams and is comprised of wet and semi-wet meadows. The soil moisture within this area is influenced more by run-off, seepage or water table than by precipitation. Seasonal fluctuations in soil moisture or depth to water table seldom become critical to plant growth in the wetter areas.

The dominant visual aspect of this area is sedge and sod wheatgrass. Composition is approximately 80% grass and grass-like plants, 15% forbs and 5% shrubs.

The primary plants making up this vegetative type are listed as follows:

Grasses and Grass-like Plants

1. Sedges
2. Sod wheatgrass
3. Mountain bromegrass
4. Tufted hairgrass
5. Kentucky bluegrass

Forbs

1. Rocky Mountain Iris
2. Geranium
3. Clover

Shrubs

1. Willows
2. Woods rose
3. Rabbitbrush
4. Shrubby cinquefoil
5. Basin big sagebrush
6. Wyoming big sagebrush

Plant species not a part of the climax plant community that are most likely to invade the site if plant cover deteriorates are cheat grass, foxtail barley, annual forbs, dandelion, sagebrush, rabbitbrush, and snake weed. If excessive grazing occurs, rushes and sedges will increase and may become dominant plants. Transition zones between this site and other sites may have plant species typical of both sites.

Paralleling the river on both sides and transecting all of the above-mentioned vegetative types is the riparian zone. The riparian zone is comprised of dense areas of vegetative growth of water-loving species that are dominated by cottonwood trees and aspen.

The riparian zone provides high quality, year-long habitat to upland game and non-game wildlife species and provides an excellent migration corridor for deer. Cattle also tend to concentrate in this area because of its close proximity to water, the protection and shade it offers, and the high quality forage provided by the riparian vegetation.

The dominant vegetation of the riparian zone is listed as follows:

Trees and Shrubs

1. Cottonwood
2. Aspen
3. Willows
4. Woods rose
5. Basin big sagebrush

Grasses and Grass-like Plants

1. Sedges
2. Basin wildrye
3. Sod wheatgrass
4. Kentucky bluegrass
5. Tufted hairgrass

Forbs

1. Geranium
2. Vetches
3. Cinquefoil
4. Clovers

Range Management on US Forest Service Allotments

The Big Lost Management Area contains three cattle and horse allotments and one sheep and goat allotment. These are Boone Creek, Copper Basin, Wildhorse, and North Fork respectively.

The Boone Creek allotment is permitted 1,337 cattle for 5,794 animal months or 7,648 Animal Unit Months. The grazing system is divided into five units: two spring-fall units and three summer units. Units are rotated or are a deferred pattern of use. The last unit is basically rested. Improvements on the allotment include fifty stock watering ponds, twelve miles of unit fence, ten miles of division fence between the Copper Basin and Boone Creek allotments and various grazing impact studies. Studies consisting of photo point transects and utilization cages are planned for Fox Creek, Ramey Creek, Rock Creek, Garden Creek, and Boone Creek as funds allow. Good salting and riding practices have helped keep cattle out of stream bottoms. Twice a year, 1,300 head of cattle cross the East Fork of the Big Lost when moving from unit to unit. Cattle become concentrated in a small area of about a $1\frac{1}{2}$ mile radius and cause damage to the watershed. The fence between the Garden Creek and Rock Creek units is located along the bottom of Big Boon Creek. Cattle move along this fenceline and beat down the area. This unit fence will be relocated out of the creek bottom and away from the riparian zone. The range analysis data and Boone Creek allotment management plan are outdated. This information will be updated and revised as funds become available. Based on 1964 analysis data, the range condition has gone from poor to fair and continues on an upward trend.

The Copper Basin allotment is permitted 2,863 cattle for 12,069 animal months or 15,931 Animal Unit Months. The grazing system is divided into seven units. Three of the units are in a rest-rotation system with the remaining four rotated on a deferred pattern of use. Improvements include 380 water developments, ten miles of division fence between Copper Basin and Boone Creek allotments, thirty-three miles of unit fence and livestock enclosures and seeding plots. There are wildlife/livestock enclosures and experimental seeding plots in the Corral Creek and Navarre units. Livestock enclosures are also present at Smelter Creek in the Swamps unit, in Basin Flat and in Lehman Basin. Based on range analysis data, range condition is in stable to upward trend with the exception of the

Navarre unit and the stream bottoms of the East Fork of the Big Lost. The Navarre unit contains shallow, unstable soils prone to erosion in the form of gullies and washes. Attempted reseeding and the present grazing system have helped improve range condition. The East Fork of the Big Lost contains eroded streambanks, sedimentation and damaged riparian vegetation. Increased or better salting and riding practices combined with a revised grazing system should lessen damage to the watershed.

Wildhorse allotment is permitted 2,123 cattle for 8,002 animal months or 10,563 Animal Unit Months. The grazing system is divided into six units: two spring units and four summer-fall units. Five units are in a deferred pattern of use and one unit is rested. All six units are basically natural drainage areas and are designed to fit with the necessary "Around the Horn" cattle movement. Improvements include water developments, unit fences, salting and riding. Each unit is planned to have four permanent bench marks established. One of these four will have a three-step trend study installed. Grazing impact studies and photo points will be set up on each bench mark as funds allow. Most of the major stream channels within the allotment show disturbed streambeds from past floods and continuing streambank erosion. Most of this damage has been and is being caused by floods from the bare rock formations adjacent to and above the allotment itself and past heavy livestock use. The grazing system and the Wildhorse allotment management plan are in the process of being re-analyzed, updated, and rewritten. Range trend has improved from poor to stable with the present grazing system. The revised system should put the range on an upward trend.

The North Fork allotment is permitted 1,252 sheep for 3,214 sheep months. The grazing system consists of five units on a four pasture rest-rotation system. Past improvements on the allotment have been quite minimal. Two 3-photo point plot studies were installed in the Blind Canyon and Hunter Creek units in 1969. Studies are planned for the other units as funds become available. The planned studies are designed to show soil condition and trend and ground cover increase or decrease to insure improved watershed condition results. There are numerous small "sore spots" scattered throughout the allotment. The largest of these are found along the old sheep driveway between the heads of Slide Canyon and Hunter Creek and in the upper two-thirds of the Hunter Creek drainage. These spots are

fairly isolated and should be brought back to more satisfactory watershed condition faster by the revised allotment management plan and revised grazing system. Range condition has progressed from poor to fair and continues on a stable trend. This allotment has the old multiple use survey on it. It is scheduled for an allotment management plan and environmental statement in 1983.

Permittees for the Big Lost Management Area Allotments are required to maintain ponds, fences and other improvements, close all gates, salt ahead of the turnout date in each unit, submit yearly grazing fees, and submit a year-end grazing report. Permittees belong to Cattlemen's Associations and must meet in their separate Associations once a year with the Forest Service.

Fisheries

The Big Lost River is a unique fishery in that it is isolated from other downstream drainages. The river sinks into the Snake River Aquifer in the lower valley and on the Snake River Plain. As a result of this situation, many nongame fish species that inhabit the upper Snake River drainage are not found in the Big Lost River.

The fish population in the Big Lost is comprised primarily of salmonids and sculpins (a small forage fish). Results of electro-shocking carried out in the project area by the Idaho Fish and Game Department in the spring of 1980 indicated a fish population made up of rainbow trout (Salmo gairdneri), brook trout (Salvenlinus fontinalis), mountain whitefish (Propopium williamsoni), and sculpin (Cottus sp.)

Overall, the Big Lost River drainage, with its many tributaries, is rated as one of the better fisheries in Idaho. Like other areas in Idaho, fishing pressure is continually increasing on the Big Lost. In 1972, use figures for the US Forest Service's management area were 37,100 fishing days.

The Big Lost River is beset by a number of problems impacting the fishery, such as sections of some streams in the upper watershed having been damaged by livestock grazing and by natural factors, i.e., heavy surface runoff caused by rapid spring snow melt and high intensity summer storms. In some localized areas of the lower reach, winter icing contributes to winter kill. The Chilly Sinks area of the water sinks underground during the summer months leaving a dry channel, thus allowing only a transitory fish population during high flows.

The US Forest Service has initiated an effective fish habitat evaluation and management plan for the improvement of the major streams in the Big Lost River drainage. (See Appendix V, "US Forest Service Fisheries Habitat Evaluation and Plan for the Big Lost Watershed".) In 1976, 30 log wiers were installed in Summit Creek to increase the amount of pool area in proportion to present riffle area of the stream. The installation of 30 wiers on the East Fork of the Big Lost have been completed. The East Fork and some of its tributaries have had 75 fish wiers installed for habitat improvement. In 1981, 22 more are planned and another 25 are planned for 1982.

Wildlife

The major large animal species found in the project area are deer and antelope. Elk are found in the higher reaches of the watershed. Bear and cougar have been spotted in the project area on rare occasions. There are also a number of small animals native to this area such as: coyote, fox, racoon, beaver, mink, muskrat, gopher, and numerous other rodents.

The Big Lost River also provides riparian habitat for many species of birds, mammals and amphibians. Cottonwood and aspen stands contribute vertical structure to the surrounding agricultural fields and sagebrush-dominated rangeland. A diversity of shrubs, forbs and grasses in the understory provides forage and cover that is not available in the adjacent, dry habitats. Some animals rely totally on the riparian area for life requirements; some others live primarily in adjacent, dry habitats; still others live primarily in adjacent habitats but are influenced by the presence of the riparian zone. The importance of this area is not restricted to animals dependent on streamside vegetation, but includes animals that visit the area only during a portion of their life cycles.

Numerous bird species visit the Big Lost River on migrations. Fewer species actually breed or nest in the area during spring and summer, but total density and diversity of species is greater than in adjacent non-riparian areas. Cavity-nesting birds use the trunks of aspen and cottonwood trees for nesting. Raptors, such as the red-tailed hawk and Swainson's hawk, build stick nests in the trees and use the upper branches for hunting perches. Water fowl, such as mallards and teal, nest in streamside vegetation and winter along the river in varying densities, depending on freezing conditions. Bald eagles have been seen wintering along the river and on the north end of the Mackay Reservoir. The bird community composition changes from season to season and organization fluctuates yearly.

Like birds, some mammals are tied to the riparian zone and would not be present without it. Fur-bearers such as beaver, mink, and muskrat are examples. These species occur all along the Big Lost River, especially in the upper stretches.

Big game animals, such as mule deer and antelope, use the riparian zone for

various habitat requirements but are not dependent on it for survival. However, the diversity of vegetation provides an excellent source of forage and cover that is not available in adjacent dry habitats. Migratory deer use the cottonwood-aspen corridor for escape cover as they move between seasonal ranges. Big game summer use includes mule deer that hide in the dense cover by day and feed in the fields by night. Quantitative deer population and distribution data for this area is limited.

Antelope winter in the lower reaches of the project area at Swenson Basin and Barton Flats. Approximately 100 to 250 animals winter in the Swenson Basin area and approximately 500 to 600 head use the upper reaches of the riparian zone where fencing does not restrict access to the river.

Management of the Big Lost River riparian zone has had, and will continue to have, profound effects on the habitat quality for wildlife. Early settlement of the valley above Mackay has resulted in many successful farming and ranching operations which are vital to the local economy. However, past management has, in some cases, resulted in some habitat deterioration. An example of this would be the efforts to channelize the river below the Chilly Bridge. This effort resulted in erosion problems and washouts that have left an area of limited value to wildlife. Cutting woodlands and subsequent farming have reduced the size of the riparian zone in many places. Grazing practices which have resulted in reduced vegetative diversity of the riparian zone have lowered the quality of habitat in some areas.

Overall, wildlife habitat within the project area is excellent. A field evaluation and consultation with the US Fish and Wildlife Service, US Forest Service, Bureau of Land Management, and the Idaho Fish and Game Department have been carried out. This process has indicated that no endangered or threatened species of wildlife exist within the areas of proposed construction activities.

Scenic and Recreational Resources

The visual character of the project area consists of magnificent views of rugged mountain ranges with spectacular cliffs and sharp peaks - Mount Borah, the highest mountain in Idaho, the Three Sisters, and Leatherman Peak being the most prominent.

The Big Lost River Valley runs in a northwest-southeast direction. The valley averages about four miles in width and extends into the Snake River Plain some 60 miles distant from the project area. Well developed alluvial aprons having gentle slopes characterize both sides of the valley floor.

Dramatic seasonal floral displays are common. This is especially true in the fall along the riparian zone of the river and its numerous tributaries. During the spring and summer, the numerous verdant meadows of the upper watershed and the lower valley display their splendor.

The Big Lost River area is an outstanding recreational attraction to local residents, visitors from other parts of Idaho, surrounding states, and the entire nation. All of the variety and quality of landforms, climate, water resources, fisheries, vegetation, wildlife, and other natural resources contribute to making this area extremely attractive for recreation. Recreational activities such as hunting, fishing, camping, hiking, picnicking, pleasure driving, snowmobiling and cross-country skiing are expected to increase. This will be especially true as mining activities in the Challis area cause regional population growth.

The US Forest Service and the Bureau of Land Management manage a number of recreational sites in the Big Lost River area. They are accessed by US Highway 20-26, Trail Creek Road, and numerous Forest Service roads. The Trail Creek Road links US Highway 20-26 with Sun Valley. This road is open on a seasonal basis only, as snow in the higher elevations make the road impassable.

Archeological and Historical Resources

There are no listed federal or State of Idaho Register archeological and historical sites within the project area.

Documentation of consultation with the State Historical Preservation Officer and State Archeologist was carried out according to CEQ guidelines.

Socio-Economic Considerations

The area effected by the project is rural with an economy based on the local livestock operations. The town of Mackay (pop. 539) is located 5 miles below the dam and provides local shopping and services. Arco (pop. 1,244) is 31 miles south and is the major community in the area. Federal Highway 93 lies on the northeast side of the reservoir and parallels the lower portion of the river in the project. The Bureau of Land Management maintains a recreation site and boat launch on the eastern side of the reservoir. The reservoir was stocked with salmon in the past. The fish have established a viable population and utilize the portion of the project area on the Big Lost River, Warm Springs, and Parson's Creek to spawn. The Big Lost River also enjoys a reputation for being a good trout fishery. During the summer months camping, boating, and fishing activities are very active (especially by tourists).

The water impounded by the Mackay Dam is used throughout the summer to irrigate fields downstream. Major production is in hay and pasture to support the livestock. Some grain is grown, chiefly for rotation purposes, and a few operators raise seed potatoes.

Land holdings along the project area include 298,240 acres of National Forest watershed, 132,502 acres of BLM watershed, 44 acres owned by the State of Idaho, and 15,693 acres of private holdings. There are 31 private landowners and one grazing association involved in the vicinity of the project area. Three or four of the private landowners have recreation homesites.

Trees along the meadow area in the upper third of the project area make it a suitable protected spot for calving in the spring. Several operators have placed diversion canals in this vicinity in order to irrigate pasture and hay ground north of the river in the Chilly area. Also, several recreation homesites have been developed on this portion of the river.

Many of the meanders in this portion of the river have high exposed banks on the outside of the curve in the channel. The high velocity water erodes the gravel base at these points and the upper portion of the bank will then slump into the stream channel. Considerable topsoil and gravel material are

carried downstream and the bank area is further eroded. Many times, just upstream from the curve, the stream forces are such that the river will flood across the neck of the meander. This can result in a new channel being cut with consequent erosion. The straightening effects maintain a higher stream velocity increasing the ability of the river to erode in downstream areas. Another effect stemming from the high velocity water flows and shifting channel is the necessity for operators to periodically move or alter their diversion canals. These changes in the stream channel often reduce or remove the effectiveness of the diversion.

The topsoil eroded from the above actions is carried into the Mackay Reservoir. Gravel and other debris tend to scour the channel, enhancing erosion capabilities and reducing feed for the fishery. The gravel is usually deposited on the lower section of the river. Approximately three to five acres of meadow bottom can be lost each year in this manner. Usually, when the river cuts off a meander, the resulting island is unusable to the operator during the time when he has most of his livestock in the river bottom for calving.

The middle portion of the project area is wider and again has meadow and pasture land. The river "sinks" here during late season when water flow is not sufficient to make it across the porous area. The river reappears downstream. During the 1930's the channel was straightened in this section. The resulting high velocity water flow during runoff adds to downstream erosion problems.

The lower third of the project area is also a river meadow area with brush and trees making it a good wintering and calving place for livestock. During high water periods much of the gravel removed upstream is deposited in this area. The stream channel is built up by these deposits to a point where the bed is higher than the banks. The river then floods across a portion of adjacent meadow eroding a new channel and leaving a gravel bar in the old stream bed. The topsoil is carried into the reservoir.

To date, the reservoir has lost 22% of its mid-season and late-season irrigation capacity. The sedimentation results from soil erosion due to the unstable river channel described above. Continued sedimentation of the reservoir will reduce

its late-season capacity to where adequate water supplies for late-season irrigation below the dam will no longer be available. At that point, either the water will no longer be available, greatly reducing crop production, or the reservoir will have to be dredged to renew its storage capacity -- an expensive undertaking.

Continued sedimentation of the reservoir will also be detrimental to recreation and fisheries in the future.

Stabilizing the river channel will have several benefits. A short-term benefit to the local economy will occur during the construction of the project phases. The work needed is of a nature that local firms can be utilized to construct riprap and other stream control measures. Some of the work can also be performed by landowners along the river. This will help reduce overall project costs.

In the longer term, several benefits will accrue to landowners along the river, downstream irrigators, and recreationists. For adjacent landowners, stabilizing the river channel will limit their loss of a needed wintering and calving area and improve irrigation for serveral ranchers who are diverting river water for that purpose.

Irrigators downstream have much to gain from the reduced sedimentation of the reservoir. This will extend the useful life of the reservoir and insure that there will be sufficient mid- and late-season water available for crop production.

Recreational use of the reservoir will be extended over more years by reduction of the silting in of the reservoir. Also, the fishery may see improvement over time if pollution is reduced and if the reduced scouring action on the stream bed enhances food availability.

APPENDIX II

Analysis of Probable Environmental Impacts Flow Chart

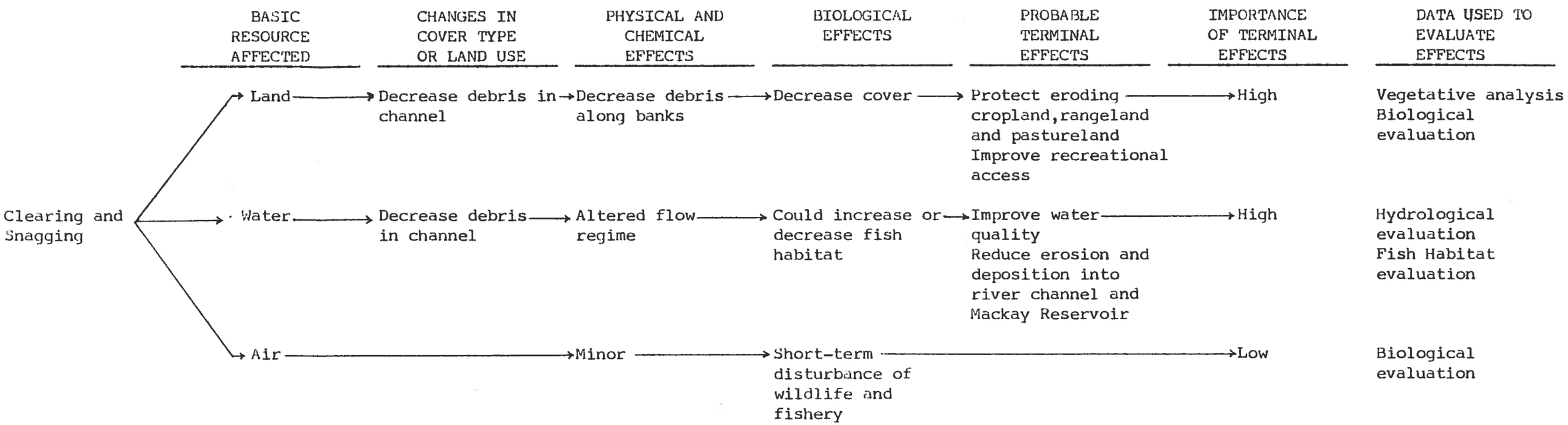
ANALYSIS OF PROBABLE ENVIRONMENTAL IMPACTS

	BASIC RESOURCE AFFECTED	CHANGES IN COVER TYPE OR LAND USE	PHYSICAL AND CHEMICAL EFFECTS	BIOLOGICAL EFFECTS	PROBABLE TERMINAL EFFECTS	IMPORTANCE OF TERMINAL EFFECTS	DATA USED TO EVALUATE EFFECTS
Gabions	Land	Eroding banks lined with gabions Banks sloped revegetated with grasses, willows and trees	Stabilize eroding banks	Increase amount and quality of Riparian Habitat	Protect eroding cropland, range-land and pasture-land	High	Biological analysis Stabilization analysis and Erosion I.D. Soils analysis
	Water	Altered cover on channel bottoms along banks	Altered flow regime of river Reduce erosional deposition into the channel	Increase quality of fishery depending upon design reconstruction and placement	Improve water quality Reduce deposition of sediment load into Mackay Reservoir Flood Prevention	High	Hydrological evaluation Fishery evaluation
	Air		Temporary during construction	Short term disturbance of wildlife and fishery		Low	Biological evaluation

ANALYSIS OF PROBABLE ENVIRONMENTAL IMPACTS

	BASIC RESOURCE AFFECTED	CHANGES IN COVER TYPE OR LAND USE	PHYSICAL AND CHEMICAL EFFECTS	BIOLOGICAL EFFECTS	PROBABLE TERMINAL EFFECTS	IMPORTANCE OF TERMINAL EFFECTS	DATA USED TO EVALUATE EFFECTS
Organic Structures	Land	Eroding banks stabilized with organic debris	Stabilize eroding banks	Increase amount and quality of Riparian Habitat	Protect eroding cropland, range-land and pasture-land	High	Biological evaluation Stability analysis Soils analysis
	Water		Altered flow regime of river Reduce erosional deposition into channel	Increase quality of fishery depending upon design, construction and placement	Improve water quality Reduce deposition of sediment load into Mackay Reservoir Flood prevention	High	Hydrological evaluation Fishery evaluation
	Air			Short-term disturbance of wildlife and fishery		Low	Biological evaluation

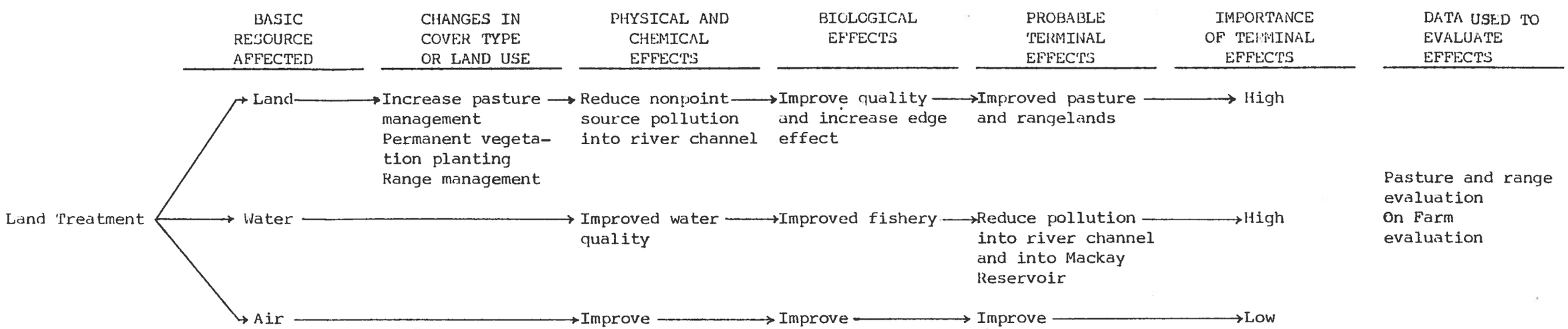
ANALYSIS OF PROBABLE ENVIRONMENTAL IMPACTS



ANALYSIS OF PROBABLE ENVIRONMENTAL IMPACTS

BASIC RESOURCE AFFECTED	CHANGES IN COVER TYPE OR LAND USE	PHYSICAL AND CHEMICAL EFFECTS	BIOLOGICAL EFFECTS	PROBABLE TERMINAL EFFECTS	IMPORTANCE OF TERMINAL EFFECTS	DATA USED TO EVALUATE EFFECTS
Channel Alteration → Land	Could increase or decrease cover type and could alter land uses depending on where applied	Alter physical character of river channel	Could increase or decrease Riparian habitat	Protect eroding cropland, pasture-land and rangeland Improve recreation-al potential Protect homes and farm buildings	High	Biological evaluation Soils evaluation Geological evaluation Stability analysis
Channel Alteration → Water		Alter flow regime of river	Could increase or decrease quality and quantity of fish habitat	Improve water quality Reduce deposition and sediment load into Mackay Reservoir	High	Hydrological evaluation Fishery evaluation
Channel Alteration → Air		Temporary during alteration	Temporary short-term disturbance of wildlife and fishery		Low	Biological evaluation

ANALYSIS OF PROBABLE ENVIRONMENTAL IMPACTS



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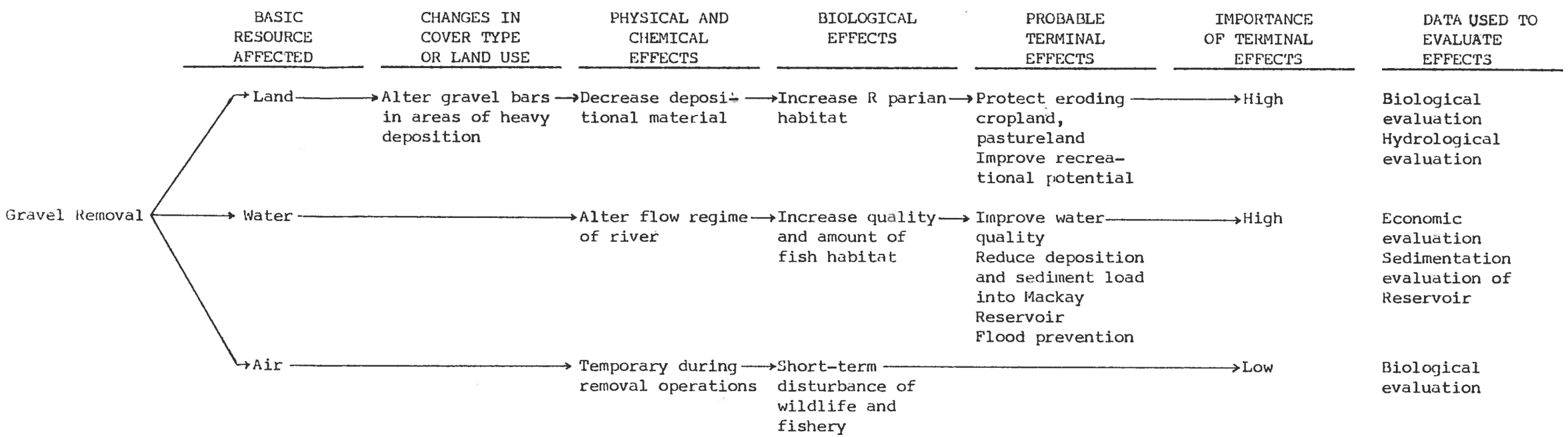

ANALYSIS OF PROBABLE ENVIRONMENTAL IMPACTS

BASIC RESOURCE AFFECTED	CHANGES IN COVER TYPE OR LAND USE	PHYSICAL AND CHEMICAL EFFECTS	BIOLOGICAL EFFECTS	PROBABLE TERMINAL EFFECTS	IMPORTANCE OF TERMINAL EFFECTS	DATA USED TO EVALUATE EFFECTS
Revegetation → Land	Establish new vegetative cover	Stabilize ending banks	Increase quality and amount of Riparian habitat	Protect eroding cropland, rangeland and pastureland Maintain and improve recreation potential Improve visual aspects	High	Vegetative analysis Soils analysis
Revegetation → Water	Increase shade along banks	Altered micro-climates along bank Reduce erosion into river channel	Provide shaded areas for fish populations	Improve water quality Reduce deposition and sediment load into Mackay Reservoir Flood prevention	High	Stream habitat analysis
Revegetation → Air		Improve	Improve	Improve	High	

ANALYSIS OF PROBABLE ENVIRONMENTAL IMPACTS

	BASIC RESOURCE AFFECTED	CHANGES IN COVER TYPE OR LAND USE	PHYSICAL AND CHEMICAL EFFECTS	BIOLOGICAL EFFECTS	PROBABLE TERMINAL EFFECTS	IMPORTANCE OF TERMINAL EFFECTS	DATA USED TO EVALUATE EFFECTS
Rock Rip Rap	Land	Eroding banks covered with rock	Stabilize eroding banks	Will maintain Riparian habitat	Protect eroding cropland, rangeland and pastureland Maintain and improve recreational potential Protect homes and farm buildings	High	Biological evaluation Stability analysis Erosion I.D. Soils analysis
	Water	Little change	Altered flow regime of river Reduce erosional deposition into the channel	Increase quality of fishery depending upon design, construction and placement	Improve water quality Reduce deposition and sediment load into Mackay Reservoir Flood prevention	High	Hydrological evaluation Fishery evaluation
	Air		Temporary during construction	Short-term disturbance of wildlife and fishery		Low	Biological evaluation