ENVIRONMENTAL POWER CORPORATION

2920 N. ACADEMY BOULEVARD, SUITE 201
COLORADO SPRINGS, COLORADO 80917
(719) 591-4800, TELECOPIER (719) 591-4804

September 23, 1988

Ms. Dianne R. Nielson
Director
Department of Natural Resources
Division of Oil, Gas & Mining
355 West North Temple
3 Triad Center, Suite 350
Salt Lake City, Utah 84180-1203

RE: Sunnyside Fuel Corp Reclamation Permit

Dear Dianne:

We have enclosed the "DRAFT" revised copies of Chapter 9 through 12 of the permit documents for your review and comment.

Sincerely,

ENVIRONMENTAL POWER CORPORATION

Robert L. Neill, Jr.

RLN:smh/SS8-70544

Enclosures

cc: Ed Barton
Steve Ellinwood

CHAPTER IX

DRAFT

Rec DOGM 9-26-86

VEGETATION RESOURCES

TABLE OF CONTENTS

RLN:smh/SS8-6068

CHAPTER IX

9.1 SCOPE

The objective of this study was to map and quantify the vegetation communities of the Sunnyside Fuel permit area which were disturbed. The information is presented to satisfy the Utah Division of Oil, Gas and Mining (DOGM) and the U.S. Office of Surface Mining requirements.

The vegetation of the permit area has been mapped and one vegetation type has been disturbed by coal waste disposal operations. The only disturbed community is Pinyon-Juniper/Grass. Vegetation sampling was conducted from late June into September 1981 by qualified Kaiser Coal Corporation personnel. All vegetation types previously disturbed or scheduled for future disturbance during the permit period were sampled. This sampling analysis and reference area will be used to help evaluate reclamation success.

9.2 Methodology

Vegetation types were determined in the field from reconnaissance, and plotted on a 1:12000 topographic map. Vegetation types were finalized on a 1:24000 topographic map (Plate IX-1) and include all areas within the permit area and contiguous areas within 1 km of the disturbed sites. The assumed vegetation of previously disturbed areas was mapped on a 1:6000 topographic map (Plate III-1).

Vegetation mapping units may contain inclusions of other vegetation types. The number of inclusions within any mapped area depends upon the local variations in topography. Drainage and aspect changes are common in this region, and several changes may occur on a single slope. This region is generally included within the appropriate vegetation dominated mapping unit and not delineated separately.

The species list for each vegetation type was compiled from plants collected during reconnaissance and collected during field measurements. All species were collected according to Harrington and Durrell (1957) and identified according to Welsh and Moore (1973) and Harrington (1964). Botanical nomenclature generally follows Welsh and Moore (1973). Difficult specimens were annotated by Dr. Stanley Welsh, Brigham Young University Herbarium, Provo, Utah. Some plants lacked structure needed for complete identification and were designated as unknowns. The collected plants are retained in the Kaiser Coal Corporation

Herbarium, Raton, New Mexico. All vegetation types were physically examined for threatened and endangered species. Welsh (1977) and the USFWS (1980) were consulted to determine which critical habitats to examine.

Vegetation cover was estimated using two different and independent sampling techniques. Initially, the quadrant and line intercept method was used after being approved in a meeting with Mary Ann Wright of DOGM (Figure IX-5). The quadrant method estimated the herbaceous understory layer, while line intercept estimated only tree & scrub canopy cover. The DOGM later requested a method that would combine understory and canopy cover as one value, so the point line method was used. This method was approved by Lynn Kunzler of DOGM (personal communication, 1981).

Point line transects, which measured total first hit cover, were laid out in all vegetation types. Transects were sampled at 0.5 meter intervals for the species first encountered by a descending point. All point transects were 25 meters long, and 50 points were taken on each transect at every 1/2 meter except on Pinyon-Juniper vegetation. In the Pinyon-Juniper types, half of the transect (12.5m) was parallel to the contour and the other half (12.5m) was perpendicular to the contour. Fifty points were split between the two sides.

The quadrant method was used to estimate herbaceous cover, by species, for all types. A $0.25m^2$ (79cm x 32cm) quadrant was used in the three Pinyon-Juniper types. In the Mountain Brush and Sagebrush/Grass a $0.10m^2$ (20cm x 50cm) quadrant was used because of the high density of the shrubs. Quadrants in all types were located randomly along 30 m line transects.

The tree and shrub canopy cover over 12 inches tall was estimated along a line-intercept transect. When less than 12 inches tall, trees and shrubs were considered part of the herbaceous layer. The 12 inch delineation is an arbitrary one selected to avoid duplication of shrub and tree cover values. Thirty meter lines were appropriate in all types except Mountain Brush, where a 50 meter transect was necessary because of the large openings between shrub clumps.

Tree density in the Pinyon-Juniper types was estimated using 0.02 ha macroplots. These macroplots were in the shape of an elbow (Figure IX-5) with two 3 x 30 meter plots at a right angle to each other (H.E. Woodin and Lindsey 1954). This shape helps to account for the great variabilities found within the Pinyon-Juniper zone. Tree seedlings (less than 4 1/2 feet tall, i.e. dbh) were counted to help determine population trends but were not included in the three density estimates.

Shrub density for each species was estimated by counting each shrub stem greater than 12 inches tall within either a 0.004 ha (33' x 13.2') or 0.02 ha area (two 3 x 30m). The 0.004 ha area was used in Sagebrush/Grass and Mountain Brush; and the same 0.02 ha area as for tree densities was used in all Pinyon-Juniper types. The different plot sizes were selected on the basis of what was most appropriate for the vegetation type being sampled (Mueller-Dombois and Ellenberg, 1974). The shrubs less than 12 inches tall were counted as seedlings and were not included in the shrub stems per unit area estimates.

Annual primary productivity estimates were made by Mr. George Cook, District Range Conservationist, USDA Soil Conservation Service according to Standard SCS procedures. This information is contained in Figure IX-1.

The range conditions at the time of productivity estimations by the SCS were fair and good (Figure IX-3). Precipitation records are maintained on site at Sunnyside, Utah (Table IX-10) and the 1981 precipitation was well above average. Effective precipitation has been graphed against precipitation for comparison (Figure IX-4).

A recent study relating standing crop and precipitation demonstrated that all the significant regression equations across a number of sites throughout the Intermountain Region, as well as the Northern Great Plains, illustrated similar vegetation precipitation relationships (Joyce 1981). If precipitation was greater than average, but within one standard deviation, standing crop averaged 117 percent of the long term mean and if it was greater than one standard deviation above, standing crop averaged 160 percent of the mean. Therefore, it may be deduced the productivities estimated in 1981 averaged about 160 percent of the mean standing crops.

The sampling intensity was determined by using the following sampling adequacy formula (Cook and Bonham 1977). This formula was recommended by the DOGM (Mary Ann Wright) and approved by Lynn Bunzler (figure VIII-2).

$$n_{min} = \frac{(t)^2 (s)^2}{[(.1)(x)]^2}$$

Where n min = the minimum number of samples needed,
t = two-tailed t-value with appropriate alpha level and degrees of freedom,
s = sample variance, and
x= sample mean

Sample intensity information is contained in Table IX-1

All sampling techniques were reviewed and discussed with DOGM personnel, and were found to be appropriate and acceptable (Figure IX-5) (Mary Ann Wright, Lynn Kunzler, personal communications).

Copies of all vegetation data is maintained on file at Kaiser Coal Corporation at the Sunnyside Mines. It is available for inspection and verification. One Copy has been provided to the DOGM for filing as requested.

9.3 Existing Resources

9.3.1 General Site Description

The Sunnyside Fuel permit area is located in the Book Cliffs area. This is rugged mountainous region, deeply dissected by narrow valleys and box canyons cut by intermittent or ephemeral streams. Rock outcrop, mesas, cliffs and pediments arise from the canyons. Altitude ranges from 5,900 to 9,500 feet (1,798 to 2896m) in elevation.

Whitmore Canyon is the primary valley affected by mine facilities. The canyon is headed by Grassy Trail Reservoir. The section of Grassy Trail Creek below the dam has an intermittent flow. Further downstream a small, perennial flow is created by mine water discharge (see Sections 7.1.5 and 7.2.2.2). The drainage is narrowly lined with fragmented riparian vegetation.

The mines have been in operation since the 1880's. The area has been extensively grazed by sheep, goats, horses and cattle (Cook, personal communication). The vegetation of some areas indicated previous forest fires and tree removal. A small town was once located at the mine site in Whitmore Canyon and, thus, the area has a long history of pertubation which has affected most of the vegetation.

9.3.2. Vegetation Types

The vegetation within the permit area consists of pinyon/juniper/grass habitat type. Only one vegetation type has been disturbed by the waste disposal activities. The disturbed vegetation is comprised of the following community:

Community	Acres
Pinyon-juniper/grass	310

It should be noted that all Riparian vegetation disturbances were made prior to 1977 and were also revegetated prior to that date. Because no future redisturbances are planned along Grassy Trail Creek, riparian data are not required and have not been included.

9.3.2.1 Cover Data
9.3.2.2 Production Data
9.3.2.3 Tree Data
9.3.2.4 General Description
9.3.2.5 Species List

The general descriptions of each vegetation type to be disturbed are presented in Appendix IX-1. Cover data, production data, species lists, and tree data are given, when appropriate, in Tables or text within each description.

9.3.2.6 Total Acres in Mine Plan Area

The total permit area includes 310 acres.

9.3.2.7 Total Acres of Vegetation Types to be Disturbed

Vegetation Type	Acreage	Relative % of Permit Area
Pinyon-Juniper/Grass	175.42	100

9.3.2.8 Reference Area Supporting Data

Reference areas were selected for the vegetation type that has been disturbed within the permit area. Because the vegetation was disturbed or removed prior to enactment of the 1977 law, baseline vegetation data cannot be collected on these areas. Consequently, the potential vegetation of these disturbed sites has been deduced from the soils, slope, aspect and adjacent communities. The reference area was selected based on the potential vegetation type. Comparisons cannot, therefore, be made between reference area and the disturbed site original vegetation; however, the reference area is compared to the corresponding disturbed areas within the permit area based on site characteristics (Tables IX-11 and IX-12). These reference areas (and the backup data) will serve as the standard to determine the success of reclamation.

The location of the reference area is illustrated on Plate IX-1. The site was inspected and approved by Tonia Torrence, DOGM, on February 19, 1981 (Figure IX-6). As noted by Tonia Torrence, there is no way to statistically compare the plant cover and productivity of the reference areas with the disturbed sites. (This is because the disturbances are very old and no baseline vegetation data for the disturbed sites is available).

The reference area has been permanently marked in the field (Plate IX-1). This area will not be disturbed during the life of the facility, or at any time during the performance bond responsibility period. After revegetation is completed, the comparison will be at the statistical levels stated in the DOGM regulations. Reclamation may also be deemed successful when the reclamation is equivalent to local and regional recommendations set for fish and wildlife land use, and when the ground cover is determined by DOGM to be adequate to control soil erosion.

9.4 Threatened and Endangered Species

None of the species on the official federal threatened and endangered plant list were found in the permit area.

9.5 Effects of Disposal Operations on Vegetation

The Sunnyside Mines have been in operation for over ninety years. Most disturbed areas have been in existence for long periods.

Disturbed land surfaces will be largely lost from vegetation use during the life of the facility. Disturbed ground immediately surrounding all facilities and construction sites will be revegetated during the life of the mine.

9.6 Mitigation and Management Plans

9.6.1 Mitigation

Areas adjacent to construction sites which have been disturbed during the life of the facility will be seeded during the first appropriate season. All disturbed areas will be minimized.

If feasible, the Sagebrush-grass vegetation type will be interseeded with perennial grasses found adjacent to the disturbed area. Use of specially designed seed mixtures (Chapter III) should improve the range condition for wintering deer. Agrophyron smithii and Agropyron spicatum are excellent spring forage species, and Bouteloua gracilis is a good forage and winter supplement. The livestock allotments should be slightly reduced to adjust for the decrease in available acreage for grazing, however, this is the responsibility of the land management agencies.

Dust control plans (Chapter III) should minimize any effect of increased dust and the potential for a reduction of the photo-synthetic process.

Management of wildlife, grazing and recreation by the appropriate agencies will continue for the life of the mine. Sunnyside Fuel Corporation will appropriately manage revegetated

areas for establishment until bond release. Any necessary management practices, including accepted or experimental techniques, may be used to assure the establishment and development of revegetated areas. At the time of bond release it will be the responsibility of the land owner or management agency to properly implement the post-mine land uses.

Plant species used for revegetation which are adapted to the permit area soils will help mitigate vegetation losses during the period of post-mine succession. The use of species important for support of natural wildlife populations (Sections 9.7) and others suitable for secondary plant succession will temper habitat losses and enhance the natural successional process.

9.7 Revegetation Methods and Justification

Areas disturbed by coal waste disposal operations will be prepared for revegetation as particular sites are withdrawn from active service Experience and site conditions may occasionally modify these methods.

Methods for revegetation of the permit area follow established and proven techniques for critical area stabilization (Currier 1973). The basic considerations are:

Use adapted species considering the post-mine land use.

Reduce plant competition and prepare a good seedbed.

Cover seed to proper depth.

Provide sufficient plant nutrients.

Modify moisture regiment to supply adequate water.

(a) Use of Adapted Species

Lack of availability, economics and practicality makes replacement of all plant species virtually impossibly. It is not realistic to expect to be able to plant climax plant communities on soils which are not in an equivalent state of development (Curry 1975).

The seed mixtures have been designed to provide a diverse, permanent and effective cover of vegetation for stabilization, range and wildlife use. Seed mixtures are included in Table III-5. The wildlife value of each species is contained in Table IX-12 and cultural characteristics in Table III-6.

All but two of the species included in the mixtures are natives. Non-natives include Kentucky Bluegrass (Poa pratensis) and Redtop (Agrostis alba). These species are widely naturalized in the western United States (USFS 1937) and are a common component of the present vegetation at Sunnyside. Although Poa pratensis is frequently considered an introduced species, it is comprised of apomictic races, one of which is a far ranging native of the western Unites States (Boivin and Love 1960). Since it is widely naturalized and a common component of the Sunnyside flora, it is not considered to be an introduced species. Although redtop is an introduced species, it is also widely naturalized. Use of introduced species is not planned at this time, except perhaps in the revegetation test plots.

The amount of seed mixture to be applied will range from 15 to 30 pounds pure live seed (PLS) per acre, depending upon aspect and method of application (Cook et al. 1974). When possible seed will be drilled, otherwise, it will broadcast at double the drill rate.

(b) Reduce Plant Competition and Prepare a Good Seedbed

Areas to be seeded will be cultivated on the contour when possible by disc plowing or other means, to turn under competitive species present before seeding (Cook et al. 1975). The cultivation will present the seed with a loose friable surface, optimal for successful seeding (Vallentine 1971).

(c) Cover Seed to Proper Depth

Seed has little chance of survival in an arid climate unless covered by mineral soil (Currier 1973). Following seeding, areas otherwise covered will be dragged with a section of chainlink or chain to cover the seed.

(d) Seed at Proper Time

Late fall seeding is best in the mountains and valleys of the intermountain region, where 45 to 65 percent of the precipitation comes in the winter months (Vallentine 1971, Cook et al. 1974). Seeding will generally be performed in late fall, as also recommended by the SCS. However, because of the precipitation regime, grasses and forbs may also be successfully seeded in the spring.

(e) Provide Sufficient Available Nutrients

Most soils are enhanced for plant production by application of chemical fertilizer (EPA 1975, Vallentine 1971, Cook et al. 1974, Bauer et al. 1978). Although soil tests

performed at the Utah State Soil Testing Laboratory indicated the need for an application of nitrogen and phosphorus, these recommendations are based on agronomic crops. Phosphorus is important for seed establishment (Berg 1979). The phosphorus and ammonium nitrate will be applied and disked into the soil before seeding because it does not leach into the soil. Any necessary nitrogen fertilization will be based on interpretation of the analyses in site specific teems considering species and soil materials to be seeded and the results of revegetation testing.

(f) Modify Soil Moisture Regimen to Supply Adequate Water

The Sunnyside area is characterized by hot summers, cool winters and an average annual precipitation of sixteen inches. At this site, available moisture is often deficient due to excessively high evapotranspiration rates, well-drained soils, and erratic precipitation. The lack of plentiful, dependable moisture is the principal impediment in this region (Cook et al. 1974).

All revegetated areas will be mulched with hay at a rate of 2 tons/acre. Tackified woodfiber at a rate of 105 pounds/acre will be applied over the hay. Mulch will decrease moisture loss, increase site stabilization, moderate soil surface temperature and reduce wind velocity at the soil surface.

(g) Transplants

Shrubs and trees shown on Table IX-8, except rabbitbrush, will be transplanted on revegetated areas to provide food and cover for wildlife. In the arid west, nursery-grown transplants provide a much higher degree of success than attempts to grow similar species from seed (Packer and Aldon, 1978). Hardened seedling stock will be utilized and will be planted during the spring or summer rainy season.

9.8 Revegetation Monitoring

Reclaimed areas not subject to future disturbance will be monitored at intervals recommended by DOGM during the bond period. Ground cover, i.e. vegetation, litter, rock and bare ground will be estimated. The sampling will be consistent and comparable across the years.

During the last two years of the responsibility period the reclaimed sites and the reference areas will be sampled to help determine revegetation success. The sampling will be comparable and statistically adequate. Parameters to be sampled include vegetation cover, productivity, and shrub density.

CHAPTER IX

Bauer, A., W.A. Berg and W.L. Gould. 1978. Correction of nutrient deficiencies and toxcities in strip-mined lands in semi arid and arid regions, Pp. 451-466. In F.W. Schaller and P. Sugtton (eds.) Reclamation of Drastically Disturbed Lands. American Society of Agronomy. Madison, Wisconsin.

Berg, W.A. Unpublished notes. 1979. Colorado State University. Fort Collins, Colorado.

Borin and Love. 1960. Nat. Can. 87:173-180.

Christensen, E.M. and H.B. Johnson. 1964. Presettlement vegetational change in three valleys in central Utah. Brigham Young Univ., Sci. Bull., Biol. Ser. 4:1-16.

Cook, C.W. and C.D. Bonham. 1977. Techniques for revegetation measurement and analysis for pre- and post-mining inventory. Range Science Series No. 28 Colorado State University. Fort Collins, Colorado.

Cook, C.W., R.M. Hyde and P.L. Sims. 1974. Revegetation Guidelines for Surface Mining. Range Science Series No. 16. Colorado State University. Fort Collins, Colorado.

Currier, W.F. 1974. Basic Principles of Seed Planting. Pp. 225-232. In Proc. 1st Research and Applied Technology Symposium on Mined-land Reclamation. NCA/BCR Coal Conference, Pittsburgh, Pennsylvania. BCR. Monroeville, Pennsylvania.

Dittberner, P.L. 1978. Rehabilitation of Western Wildlife Habitat: A Review. U.S. Fish and Wildlife Service. Bilogical Services Divisiionl. Fort Collins, Colorado.

Driscol, R.S. 1964. A relict area in the central Oregon Juniper zone. Ecology 4J:345-353.

Environmental Protection Agency. 1975. "Methods of Quickly Vegetating Soils of Low Productivity, Construction Activities." EPA 440/9-75-006. EPA., Washington D.C.

Harrington, H.D. 1954. Manual of the Plants of Colorado. The Swallow Press, Inc. Chicago, Illinois.

Harrington, H.D. and L.W. Durrell. 1957. How to Identify Plants. The Swallow Press, Inc. Chicago, Illinois.

Harris, G.A. 1967. Some competitive relationships between Agropyron spicatum and Bromus tectorum. Ecol. Monogr. 37:89-111.

Hubbard, John. 1983. Personal communication. Endangered species specialist. New Mexico Department of Game and Fish. Santa Fe, New Mexico.

Johnson, James R., and J.T. Nichols. 1970. Plants of South Dakota Grasslands: A Photographic Study. South Dakota Agr. Exp. Sta. Bull. 566. South Dakota State Univ., Brookings, South Dakota.

Joyce, Linda. A. 1981. Climatic/vegetation relationships in the Northern Great Plains and the Wyoming North Central Basins. PhD thesis. Colorado State University, Fort Collins, Colorado.

Martin, Alexander C., H.S. Zim and A.L. Nelson. 1951. American Wildlife and Plants: A Guide to Wildlife Food Habitats. Dover Publications, Inc. New York.

Mueller-Dombois, Dieter and Heinz Ellenberg. 1974. Aims and Methods of Vegetation Ecology. John Wiley and Sons. New York.

Packer, P.E. and E.F. Aldon. 1978. "Revegetation Techniques for Dry Regions." Pp. 425-450, in F.W. Schaller and P. Sutton (eds.) Reclamation of Drastically Disturbed lands. American Society of Agronomy. Madison, Wisconsin.

Pearson, L.C. 1965. Primary production in grazed and ungrazed desert communities of eastern Idaho. Ecology 46:278:285.

Plant Information Network. Computer printout for selected species. PIN, Colorado State University. Fort Collins, Colorado.

Plumner, A. Perry, D.R. Christensen and S.B. Monsen. 1968. Restoring Big-Game Range in Utah. Utah Division of Fish and Game Publication No. 68-3.

Taylor, Walter P. (ed). 1956. The Deer of North America: The History and Managment. A Wildlife Management Institute Book. Stackpole Books. Harrisburg, Pennsylvania.

Thomas, Jack Ward and D.E. Toweill (eds.) 1982. Elk of North America: Ecology and Management. A Wildlife Management Institute Book. Stackpole Books. Harrisburgh, Pennsylvania.

USFWS. 1980. Federal list of threatened and endangered species.

U.S. Forest Service. 1937. Range Plant Handbook. USDA Forest Service. Pp. 168-589.

Vallentine, J.F. 1971. Range Developments and Improvements. Brigham Young University Press. Provo, Utah.

Welsh, S.L. 1977. Endangered and threatened species of the central coal lands, Utah. Brigham Young University. Provo, Utah.

Welsh, S.L. And G. Moore. 1973. Utah Plants - Tracheophyta. Brigham Young University Press. Provo, Utah.

Woodin, Howard E. and Elton A. Lindsey. 1954. Juniper pinyon east of the continental divide as analyzed by the line strip method. Ecology 35:474-489.

CHAPTER IX

List of Exhibits

CHAPTER IX

United States Department of Agriculture
Soil Conservation Service
350 N. 400 E.
Price, UT 84501

November 4, 1981

John Abbott
Kaiser Steel Corporation
Sunnyside, UT 84539

Dear John;

This letter confirms the findings of George Cook when he visited your Sunnyside operation on September 30, 1981. The rangeland productivity estimates by site are listed below:

Site #1 (upper portal) - Mountain brush community
800 lbs/acre air dry

Site #2 (Bear Canyon bottom) - Sagebrush/grass community
1000 lbs/acre air dry

Site #3 (cottonwood area) - Riparian community
understory production 2500 lbs/acre air dry
(willow area) - 3000 lbs/acre air dry

Site #4 - Pinyon-juniper grass community
understory - 300 lbs/acre air dry
Pinyon/juniper - 400 lbs/acre

Site #5 - (Fan Canyon) - Pinyon-juniper /Rock community
understory - 200 lbs/acre

If we can be of further assistance, please contact us in Price.

Sincerely,

Gary D Moreau

Gary D. Moreau
District Conservationist
Price/Castle Dale Field Office

GDM/lhb

Figure IX-1, Rangeland Productivity Estimations

KAISER STEEL

KAISER STEEL CORPORATION
SUNNYSIDE COAL MINES
SUNNYSIDE, UTAH 84539
TELEPHONE 801-888-4421

November 21, 1980

Mary Ann Wright
Reclamation Biologist
Division of Oil, Gas & Mining
1588 West North Temple
Salt Lake City, Utah 84116

Dear Ms. Wright:

This letter is a formal request for a determination from the Division of the adjacent areas which may be required for a vegetation survey concerning the proposed underground mine on the "South Lease" owned by Kaiser Steel Corporation.

Enclosed for your study are two maps of the area. Exhibit I illustrates the entire mine plan area (green and purple lines) and proposed right of ways (blue, orange and yellow lines). Exhibit II shows a close-up of the general area of typical surface disturbances.

If you have any questions, please feel free to call me at York Canyon - 505-445-5531, extension 274. My mailing address is P. O. Box 1107, Raton, New Mexico 87740.

Thank you for your assistance.

Sincerely,

KAISER STEEL CORPORATION

Marcia J. Wolfe
Reclamation Engineer

MJW:dm

Enclosures - 2

Figure IX - 2 Request for determination of adjacent areas

United States Department of Agriculture
Soil Conservation Service
350 North 4th East
Price, Utah 84501

August 8, 1983

Marcia H. Wolfe
Reclamation Engineer
Kaiser Coal Properties
P. O. Box 1107
Raton, New Mexico 87740

Dear Marcia:

I went to East Carbon and checked the condition of the sites that were listed in the letter dated November 4, 1981, from Gary.

Sites #1, 2, and 3 are in fair condition. Sites #4 and 5 are in good condition.

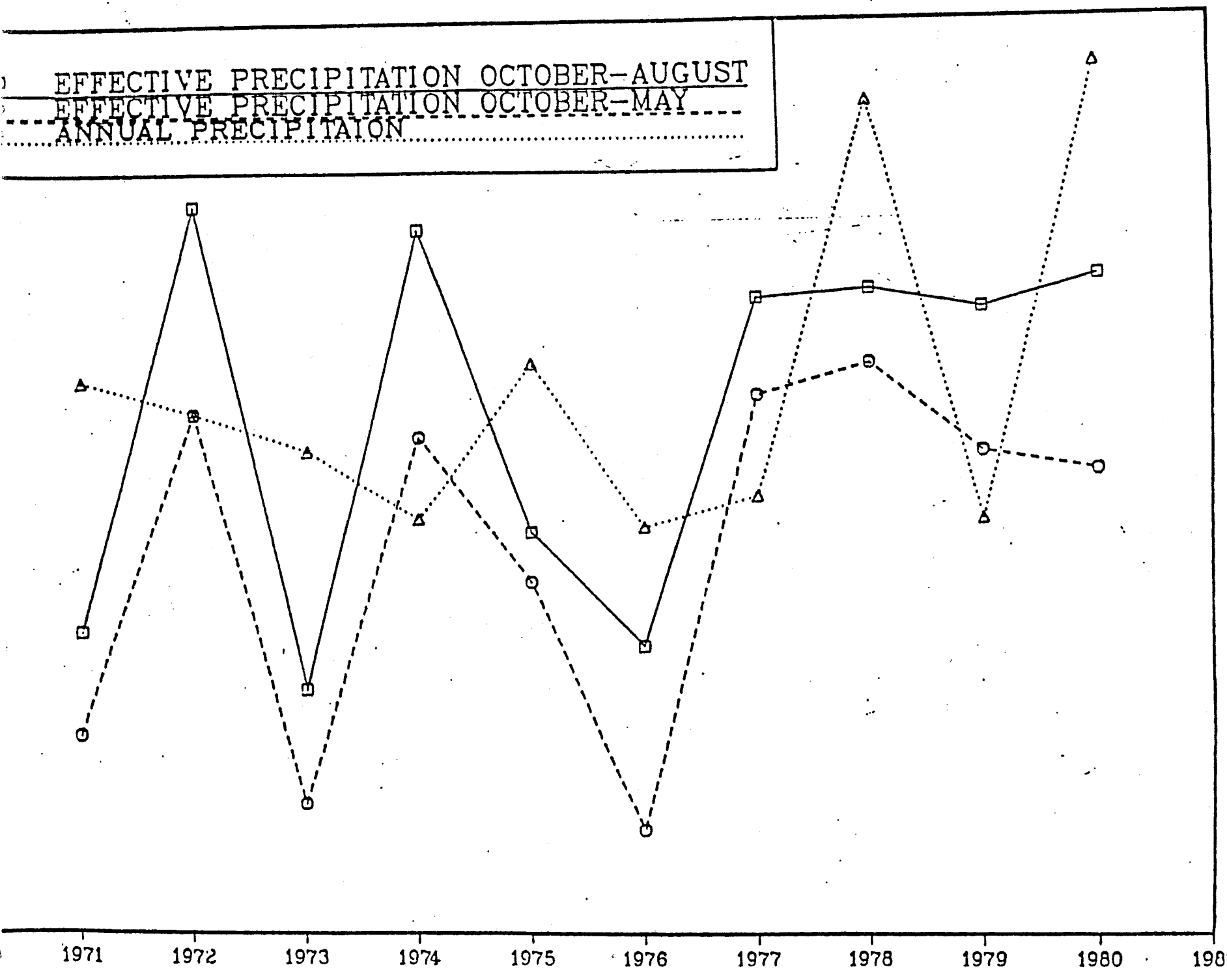
The potential soil productivities are still not available. We will get the draft copy of the information sometime this fall. When it comes, I will send it to you.

George S Cook

George S. Cook
Range Conservationist

Figure IX-3
Range conditions at time of SCS productivity estimations.

URE IX EFFECTIVE 10 YEAR SUNNYSIDE PRECIPITATION



KAISER STEEL
KAISER STEEL CORPORATION
WESTERN COAL OPERATIONS
SUNNYSIDE, UTAH 84539
TELEPHONE 801-888-4421

13 July 1981

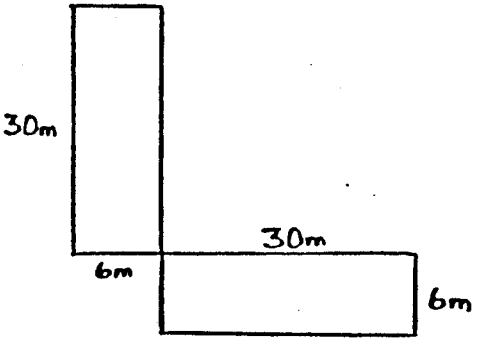
Ms. Mary Ann Wright
Dept. of Natural Resources
Division of Oil, Gas and Mining
1588 West North Temple
Salt Lake City, UT 84116

Dear Mary Ann:

I am writing to confirm our conversation in your office on Wednesday, June 10, 1981. The vegetation sampling plan we agreed upon for Kaiser's Sunnyside and South Lease permits is described in the following:

Type: Pinyon-Juniper

Modified Lindsey's Elbow



Parameters Collected:

1. Herbaceous cover in 1% increments from 40 randomly located 20 x 50 cm quadrats.
2. Shrub cover from two (2) 30 meter line intercepts.
3. Tree cover from two (2) 30 meter line Intercepts.
4. Tree basal diameter for each tree in the elbow.
5. Tree density from no. 4.
6. Frequency (generated from cover data).
7. Species list

Figure IX - 5
Confirmation of DOGM approval of vegetation survey methods.

Type: Shrub and Grass Communities

Line transects with randomly located quadrats.

Parameters collected:
1. Herbaceous cover in 1% increments from 20 randomly located quadrats along a 50 meter line.
2. Frequency generated from cover data.
3. Species list.

Type: Grass dominated communities (cover less than 30% shrubs or trees).

Line transects with randomly located quadrats.

Parameters collected:
1. Herbaceous cover in 1% increments from 20 randomly located quadrats along a 50 meter line.
2. Frequency generated from cover data.
3. Species list.
4. Production will be double sampled (1 quadrat clipped to 5 quadrats estimated).

Type: Riparian areas

Line transects with randomly located quadrats.

Parameters collected:
1. Herbaceous cover in 1% increments from 20 randomly located quadrats along a 10 meter line.
2. Frequency generated from cover data
3. Shrub cover from 10m line intercept.
4. Species list.

Sample Adequacy as per cook and Bonham (1977) formulat

$$\frac{(\text{t-value})^2 (2) (s^2)}{\left[(\%\text{change})(\bar{x})\right]^2} = n_{min}$$

with the t-value being two tailed and the % change in accord with the Regulations Pertaining to Surface Effects of Underground Coal Mining Activities.

These methods cover the types of vegetation present in the disturbed areas of the Sunnyside Mine and the potential disturbed area of the South Lease.

Thanks for your help and clarification.

Yours truly,

John P. Abbott

John Abbott
Range Scientist

JA:sp

Figure IX-5 Cont.

April 16, 1981

Memo to Coal File:

RE: Sunnyside Complex
Kaiser Steel Corporation
ACT/007/007
Carbon County, Utah

On February 19, 1981, Tonia Torrence accompanied Sandy Pruitt and Tom Portle, inspectors for DOGM to the Sunnyside Mine. Tom and Sandy conducted an inspection; see Kaiser memo dated March 3, 1981.

Tonia Torrence was accompanied by Marcia Wolfe the environmental engineer for Kaiser Steel Corporation on a tour of proposed reference areas for the permit area. All reference areas seemed to be valid representations of disturbed areas. As the area is already disturbed, there is no way to verify the similarities between areas statistically.

TONIA TORRENCE
RECLAMATION BIOLOGIST

TT/btb

Statistics:

See Blazon memo dated March 2, 1981.

Figure IX-6
Approval of reference area

Table IX-1. Sampling intensities for measured vegetation parameters. Sunnyside Mines, Utah. August through September 1981.

Vegetation Type	Parameter	$n_{sampled}$	$n_{minimum}$
Mountain Brush	Cover quadrats	220	202
	Point-lines	12	9
	Shrub density	20	13
	Line intercept	13	12
Pinyon-Juniper	Cover quadrats	240	914
	Point-lines	26	26
	Shrub density	30	28
	Line intercept	20	19
	Tree density	22	19
Pinyon-Juniper/Grass	Cover quadrats	360	168
	Point-lines	28	19
	Shrub density	19	222
	Line intercept	19	19
	Tree density	17	11
Pinyon-Juniper/Sagebrush	Cover quadrats	13	13
	Point-lines	11	10
	Shrub density	10	9
	Tree density	10	8
	Line intercept	21	16
Riparian	Point-lines	10	1
	Shrub density	7	5
Sagebrush-Grass	Cover quadrats	120	100
	Point-lines	6	1
	Shrub density	15	10
	Line intercept	14	8

Table IX-2 . Vegetation cover by species from 30 m line-intercept transects. Pinyon-Juniper/Grass vegetation type. Sunnyside Mines, Utah. August 1981.

Species	Common Name	Total Cover (%)
Shrubs:		
Cercocarpus montanus	True mountain mahogany	.59
Trees:		
Juniperus osteosperma	Utah juniper	17.93
Pinus edulis	Pinyon pine	13.47
Total		31.99

Table IX-3 . Shrub stem and tree density by species. Pinyon-Juniper/ Grass vegetation type. Sunnyside Mines, Utah. August 1981.

Species	Common Name	Stem Density per acre	Stem Density per hectare
Shrub:			
Artemisia nova	Black sagebrush	20	50
Cercocarpus montanus	True mountain mahogany	520	1300
Chrysothamnus nauseosus	Rubber rabbitbrush	61	150
Xanthocephalum sarothrae	Broom snakeweed	951	2350
Shrub Total		1558	3850
Tree:			
Juniperus osteosperma	Utah juniper	149	368
Pinus edulis	Pinyon pine	102	253
Tree Total		241	621

Table IX-4 . Tree basal area by species. Pinyon-Juniper/Grass vegetation type. Sunnyside Mines, Utah. August 1981.

Species	Common Name	Basal Area ft^2/A	Basal Area m^2/ha
Juniperus osteosperma	Utah juniper	6325	1451
Pinus edulis	Pinyon pine	2423	556
Total		8748	2007

Table IX-5 . Tree seedling density by species. Pinyon-Juniper/Grass vegetation type. Sunnyside Mines, Utah. August 1981.

Species	Common Name	Seedling Density per acre	Seedling Density per hectare
Juniperus osteosperma	Utah juniper	107	265
Pinus edulis	Pinyon pine	210	519
Total		317	784

Table IX-6. Vegetation cover from 0.25 m^2 quadrats. Pinyon-Juniper/Grass vegetation type. Sunnyside Mines, Utah. August 1981.

Parameter	Cover (%)	Relative Vegetation Cover (%)
Forb	4.77	53.72
Grass	3.73	42.00
Shrub	0.0*	0.0
Tree	.39*	4.28
Vegetation Cover	8.89	
Bare ground	24.60	
Litter	55.04	
Rock	20.54	
Total	100.00	100.00

* Only individuals <12 inches in height (33 cm) are included in herbaceous data.

TABLE IX-7. PERCENT COVER AND CONSTANCY BY SPECIES

FOR PINYON-JUNIPER/GRASS VEGETATION TYPE.

SUNNYSIDE MINES, UTAH. JULY-AUGUST, 1981.

) NUMBER	1	2	3	4	5	6	7	8	9	10
NUMBER	19	19	19	19	19	19	19	19	19	19
ATION IN FEET	6380	6390	6400	6380	6390	6380	6360	6390	6400	6400
ET	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW
IN PERCENT	1	1	1	1	1	1	1	1	1	1
MAPPING UNIT	IEE	IEE	IEE	IEE	IEE	IEE	IEE	IEE	IEE	IEE
SES:										
rpyron smithii	•	•	•	•	•	•	•	•	•	•
isrido spp.	0.4	+	•	0.2	•	•	•	+	4.2	•
wrightii	•	•	•	•	•	•	•	•	•	0.1
onus tectorum	•	•	0.1	•	•	•	•	•	+	•
ysopsis hymenoides	9.6	2.4	5.9	4.7	6.4	2.1	2.4	4.6	1.1	2.0
tanion hystrix	0.2	•	0.3	+	0.2	•	+	•	•	0.1
ipo scoparia	•	•	•	0.2	•	•	•	•	•	•
known grass	•	•	•	•	•	•	•	•	•	•
S:										
rassicaceae spp.	0.1	0.2	0.5	•	0.1	•	+	•	•	•
ulanthus crassicaulis	0.3	•	•	•	0.1	0.2	0.2	0.2	0.2	0.1
enopodium album	•	•	0.1	+	•	•	•	+	•	+
yptantha spp.	0.7	0.1	1.4	0.2	0.2	0.2	0.3	0.1	0.9	0.6
riogonum spp.	0.3	0.2	0.1	+	•	+	0.1	0.1	0.4	0.1
phorbia fendleri	0.4	0.1	0.1	•	•	•	0.1	+	0.3	+
dwarsia boreale	•	•	•	•	•	0.3	•	•	•	•
wncaya richardsonii	0.5	•	0.8	0.3	0.1	0.3	0.2	0.1	0.2	0.1
antia sp.	•	0.5	1.5	•	•	•	0.3	•	0.4	•
. *on subplaber*	2.6	1.0	2.4	1.0	2.4	2.1	3.3	1.7	4.0	2.7
neomexicana	•	•	•	+	•	•	•	•	•	•
hys. *s acutifolia*	•	•	•	•	•	•	•	•	0.6	•
.necio multilobatus	0.7	1.0	1.0	0.4	0.7	0.7	1.8	0.7	1.0	0.8
ymenoxys incana	0.3	0.1	0.3	0.1	0.1	0.3	0.1	1.1	0.1	0.2
thoospalum carothrae	•	•	•	•	•	•	•	•	0.1	•
known forb	•	+	•	•	+	+	•	•	•	•
ES:										
ina edulis	•	•	•	•	•	0.1	0.4	•	0.3	•
niper osteosperma	•	•	•	0.4	0.3	+	1.4	•	•	•
ryptogam	0.5	0.1	•	•	•	0.2	•	•	•	0.3

TABLE IX-7 (CONT.)

AND NUMBER	11	12	13	14	15	16	17	18	CONSTAN
ID NUMBER	19	19	19	19	19	19	19	15	
E IN FEET	6380	6380	6380	6380	6360	6360	6400	6490	
PE	SW	SW	SW	SW	SW	SW	SW	SW	
OPE IN PERCENT	1	1	1	1	1	1	1	1	
IL MAPPING UNIT	IEE	IEE	IEE	IEE	IEE	IEE	IEE	IEE	
ASSES:									
Agropyron smithii	•	0.1	•	•	•	•	•	•	17
Aristida spp.	•	•	•	•	0.3	•	•	•	44
A. wrightii	•	•	•	•	•	0.2	•	•	17
Bromus erectorum	•	•	•	•	•	•	•	•	11
Oryzopsis hymenoides	2.2	2.0	4.7	3.6	0.8	0.7	2.3	2.2	100
Sitanion hystrix	0.1	•	0.1	•	0.1	•	0.4	•	61
Stipa comata	•	•	•	•	•	•	•	•	6
Unknown grass	•	•	•	•	•	•	•	•	11
RBS:									
Brassicaceae spp.	•	•	0.1	•	0.1	•	•	•	39
Coulterthus crassicaulis	0.2	•	0.1	0.1	0.1	0.2	•	0.1	78
Chenopodium album	•	•	•	•	•	•	0.1	•	33
Cryptantha spp.	1.2	0.6	0.6	0.3	0.9	0.6	0.7	0.8	100
Eriogonum spp.	•	0.3	0.1	0.1	0.1	0.1	0.1	•	83
Euphorbia fendleri	0.1	•	•	0.2	0.1	•	•	•	78
Hedysarum boreale	•	•	•	•	•	•	•	•	6
Hymenoxys richardsonii	•	0.5	•	•	•	•	•	•	61
Opuntia sp.	0.6	0.1	0.2	•	•	•	•	0.5	50
Penstemon eriantherus	4.1	1.9	2.5	0.8	3.4	1.2	2.6	2.9	100
Phacelia neomexicana	•	0.1	•	•	0.1	0.1	•	0.6	28
Physaria acutifolia	•	•	•	•	•	•	•	•	6
Senecio multilobatus	0.9	0.3	0.9	0.3	1.1	0.3	1.3	0.9	100
T[illegible]dia inoana	0.2	•	0.5	0.1	•	•	•	•	83
[illegible]phalum sarothrae	•	•	•	•	•	•	•	•	6
Unknown forb	•	•	0.1	•	•	•	•	•	39
REES:									
Pinus edulis	0.5	•	1.0	0.3	0.1	•	1.0	•	50
Juniper osteosperma	0.3	0.1	•	0.1	•	•	•	•	44
Cryptogam	•	•	•	•	•	•	•	•	39

Table IX-8 . Comprehensive species list for the Pinyon-Juniper/Grass vegetation type. Sunnyside Mines, Utah. June through September 1981.

Scientific Name	Abbreviation	Common Name
Forbs		
Astragalus mollissimus	ASMO	Woolly milkvetch
Astragalus spp.	ASTRA	Milkvetch
Caulanthus crassicalis	CACR	Thickstem wildcabbage
Chorispora tenella	CHTE	Blue mustard
Cryptantha fulvocanescens	CRFU	Beggarlice hiddenflower
Cryptantha spp.	CRYPT	Cryptantha
Erigeron pumilus	ERPU	Low fleabane
Erysimum asperum	ERAS	Plains erysimum
Euphorbia fendleri	EUFE	Fendler euphorbia
Gilia aggregata	GIAG	Skyrocket gilia
Haplopappus armerioides	HAAR	Thrifty goldenweed
Hedysarum boreale	HEBO	Northern sweetvetch
Hymenoxys acaulis	HYAC	Stemless hymenoxys
Hymenoxys richardsonii	HYRI	Pinque hymenoxys
Lappula echinata	LAEC	European stickseed
Lathyrus lanzwertii	LALA	Thickleaf peavine
Lepidium montanum	LEMO	Mountain pepperweed
Leptodactylon pungens	LEPU	Prickly phlox
Lesquerella intermedia	LEIN	Bladderpod (var.)
Lesquerella ludoviciana	LELU	Silver bladderpod
Lygodesmia spp.	LYGOD	Skeletonweed
Machaeranthera grindelioides	MAGR	Aster (var.)
Opuntia spp.	OPUNT	Pricklypear
Penstemon spp.	PENST	Beardtongue
Penstemon subglaber	PESU	Penstemon (var.)
Physaria australis	PHAU	Twinpod (var.)
Physaria spp.	PHYSA	Twinpod

Table IX-8 Cont.

Scientific Name	Abbreviation	Common Name
Forbs		
Senecio multilobatus	SEMU	Lobeleaf groundsel
Sisymbrium altissimum	SIAL	Tumblemustard
Stanleya viridiflora	STVI	Princesplume
Tragopogon dubius	TRDU	Yellow salsify
Grasses		
Aristida spp.	ARIST	Three-awn
Aristida wrightii	ARWR	Wright three-awn
Bromus tectorum	BRTE	Cheatgrass brome
Elymus salina	ELSA	Salina wildrye
Oryzopsis hymenoides	ORHY	Indian ricegrass
Sitanion hystrix	SIHY	Bottlebrush squirreltail
Stipa comata	STCO	Needle-and-thread
Shrubs		
Cercocarpus montanus	CEMO	Mountain mahogany
Chrysothamnus nauseosus	CHNA	Rubber rabbitbrush
Chrysothamnus spp.	CHRYS	Rabbitbrush
Eurotia lanata	EULA	Winterfat
Xanthocephalum sarothrae	XASA	Broom snakeweed
Trees		
Juniperus osteosperma	JUOS	Utah juniper
Juniperus scopulorum	JUSC	Rocky Mountain juniper
Pinus edulis	PIED	Pinyon pine

Table IX-9 . Vegetation cover from 30 m point-line transect. Pinyon-Juniper/Grass vegetation type. Sunnyside Mines, Utah. August 1981.

Parameter	Cover (%)	Relative Vegetation Cover (%)
Forb	3.58	10.22
Grass	4.00	11.42
Shrub	.50	1.43
Tree	26.95	76.93
Vegetation Cover	35.03	
Bare ground	25.09	
Litter	20.16	
Rock	19.72	
Total	100.00	100.00

CHAPTER IX

Table IX - 10 Annual precipitation records (in inches) for Sunnyside.

Sunnyside	
Year	Amount
1959	13.54
1560	10.74
1961	13.56
1962	11.12
1966	9.59
1967	11.95
1968	14.96
1969	19.16
1970	10.23
1971	12.1
1972	11.36
1973	10.62
1974	9.09
1975	12.46
1976	8.86
1977	9.62
1978	18.16
1979	9.1
1980	19.02
1981	17.64
$\bar{x}$ =	12.64
s =	3.42
Range =	9.09 - 19.16

Table IX-11 Comparison of Actively Disturbed Site to Proposed Reference Site

Parameter	Disturbed Site	Proposed Reference Site (3)
Vegetation type	Pinyon/Juniper/Grass	Pinyon/Juniper/grass
Location	Mouth of Whitmore Canyon	Mouth of Whitmore Canyon
Secetion	NE¼SE¼, Section 6, T15S, R14E	NE¼NW¼, Section 7, T15S, R14E
Elevation, Ft./M	6525/1989	6480/1975
Geologic Formation	Mesa Verde and Mancos Shale	Mesa Verda and Mancos Shale
Soils Mapping Unit	Ildefonso Very Stony Loam Shingle-Ildelfonso-Badland complex	Ildefonso Very Stony Loam
Slope (percent)	0-5	0-5
Aspect (degrees)	260	247
Species composition	Assumed to be similar*	Juniperus/Oryzopsis
Plant cover		
Quadrat data (Herbaceous only)	**	3.49
Point Line data	**	8.89
Productivity	**	300lb/acre

*This actively disturbed site appears to be in the pinyon/juniper/grass habitat type as deduced from old aerial photographs.

**No vegetation data is presented because the sites are already disturbed, therefore no statistical comparisons can be made.

Table IX- 12 . Value of revegetation species to deer and elk for the Sunnyside mine, Utah.

Plant Species	Animal Species	Usage[1,2]	Comments[2,3]
TREES			
Juniperus spp.	Deer Elk	****Su **W,Sp,Su	
Pseudotsuga menziesii	Deer Elk	****W ****W	
Populus augustifolia	Deer Elk	*F *W,Sp	
SHRUBS			
Acer glabrum	Deer Elk	** *W	Leaves, twigs, sprouts are fair in palatability
Amelanchier spp.	Deer Elk	***Su,F ##W,Sp,Su,F	1) Good cover 2) L-M elk forage value
Artemisia spp.		---	Fair to good winter browse
Cercocarpus spp.	Deer Elk	***F,W,Sp ##F,W,Sp	1) Good cover 2) M-H elk forage value
Chrysothamnus nauseosus	Deer ELK	*F,W ##W #Sp	L-M elk forage value
Cowania mexicana		---	Good winter browse
Ephedra viridis		---	1) Exc. Su & W browse 2) Good Sp browse
Eurotia lanata	Deer Elk	--- ##W	1) Good Sp, Su, W browse 2) Low elk forage value
Potentilla fruticosa	Deer Elk	--- #W	L-M deer & elk forage
Rhus trilobata	Deer Elk	+ ---	Poor to fair deer and elk forage

(Continued on Next Page)

Table IX- 12 . (Continued).

Plant Species	Animal Species	Usage[1,2]	Comments[2,3]
Rosa woodsii	Deer	---	1) Sp, Su & F browse
	Elk	##Su,F	2) Med. elk forage value
		#Sp	
Salix spp.	Deer	+	L-M elk forage value
	Elk	**W,Sp	
		###W,Su,F	
Symphoricarpos spp.	Deer	---	1) Important deer Su forage
	Elk	#S,F,W	2) L-M elk forage value
GRASSES			
Agropyron spp.	Deer	**Sp,Su	Fair winter forage
	Elk	*W,Sp	
Agropyron spicatum	Deer	---	
	Elk	##W,Sp,Su,F	L-M elk forage value
Agrostis alba		---	1) Poor deer forage
			2) Good elk forage
Bouteloua gracilis	Deer	---	1) Poor to fair deer forage
	Elk	##Su,F	2) Low elk forage value
		#W	
Elymus spp.	Deer	---	1) Fair Sp,F,W forage
	Elk	+	2) Good Su forage
Hilaria jamesii	---	---	---
Koeleria cristata	Deer	**Sp,Su	Fair deer and elk forage
	Elk	+	
Oryzopsis hymensides	Deer	**Sp,Su	
	Elk	###F	
		##W	L-M elk forage value
Poa pratensis	Deer	---	1) Good Sp,F,W forage
	Elk	---	2) Poor Su forage

(Continued on Next Page)

Table IX-12 . (Continued).

Plant Species	Animal Species	Usage[1,2]	Comments[2,3]
Sitanion hystrix	Deer Elk	--- #Su	1) Good Sp forage 2) Poor Su,F,W forage 3) Low elk forage value
Sporobolus cryptandrus		---	1) Exc. Su forage 2) Poor F,W,Sp forage
Stipa comata	Deer Elk	--- ###F ##S #W	1) Fair deer forage 2) L-H elk forage value
FORBS			
Achillea lanulosa		---	poor for deer and elk
Artemisia ludoviciana		---	1) Fair F,W forage 2) Good Sp,Su forage
Balsamorhiza sagittata		---	Exc. Sp forage
Castilleja spp.		---	Fair deer and elk forage
Gaillardia aristata	Deer Elk	--- #Su	1) Low deer Su usage 2) Low elk forage value
Gilia aggregata		---	Low deer usage all year
Hedysarum boreale		---	1) Good Sp, Su forage 2) Fair F,W forage
Medicago sativa	Deer Elk	+ ---	1) Good Sp,Su forage 2) Poor F,W forage
Melilotus officinalis		---	1) F-G forage 2) winter hardy
Oenothera pallida		---	Poor forage value
Penstemon spp.		---	1) Fair summer forage 2) Occassional winter use
Petalostemon purpureum		---	---

(Continued on Next Page)

Table IX-12 . (Continued).

Plant Species	Animal Species	Usage[1,2]	Comments[2,3]
Solidago canadensis		---	1) Poor F,W forage 2) Good Sp,Su forage
Sphaeralcea coccinea		---	Moderate deer fall usage

1 From Martin et al (1951).
- = Use to an undertermined extent
+ = 1/2 to 2% of diet
* = 2 to 5% of diet
** = 5 to 10% of diet
*** = 10 to 25% of diet
**** = 25 to 50% of diet
W = Winter; Sp = Spring; Su = Summer; F = Fall

2 From Thomas and Toweill (1982).
# = light use; ## = moderate use; ### = heavy use
L = low forage value; M = moderate; H = high

3 Other information obtained from: Dittberner (1978), Johnson and Nichols (1970), Kufeld (1973), Plant Information Network, Plummer et al (1968), Taylor (1956) and Martin (1951).

CHAPTER IX

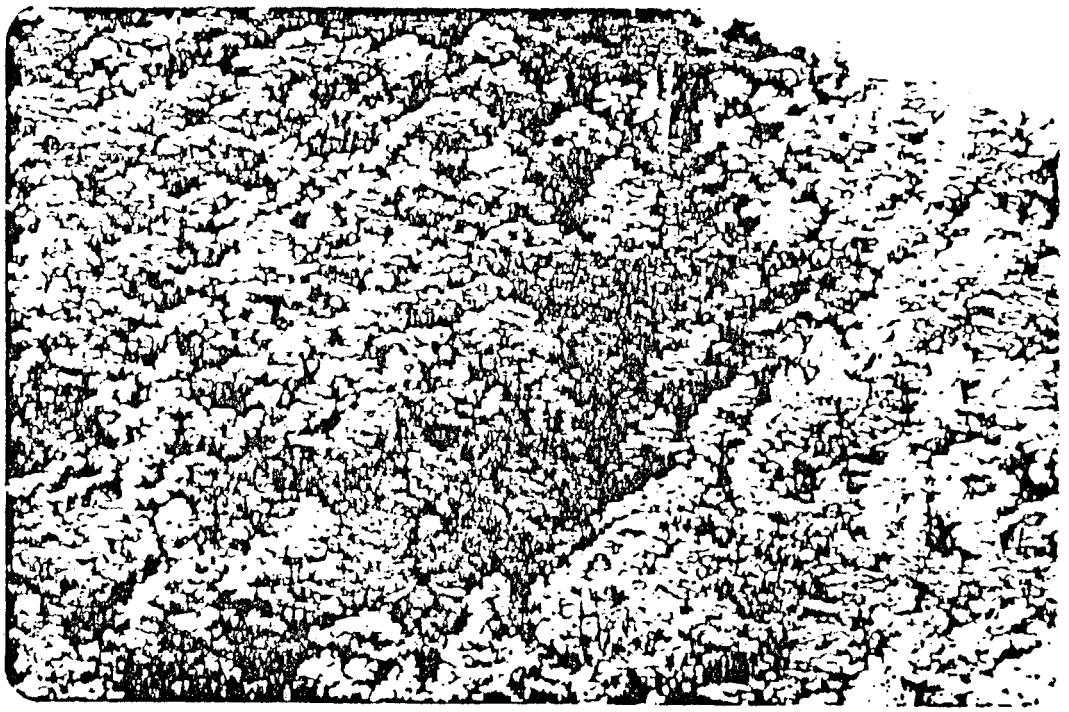
PHOTOGRAPHS AND PLATES

Vegetation Type

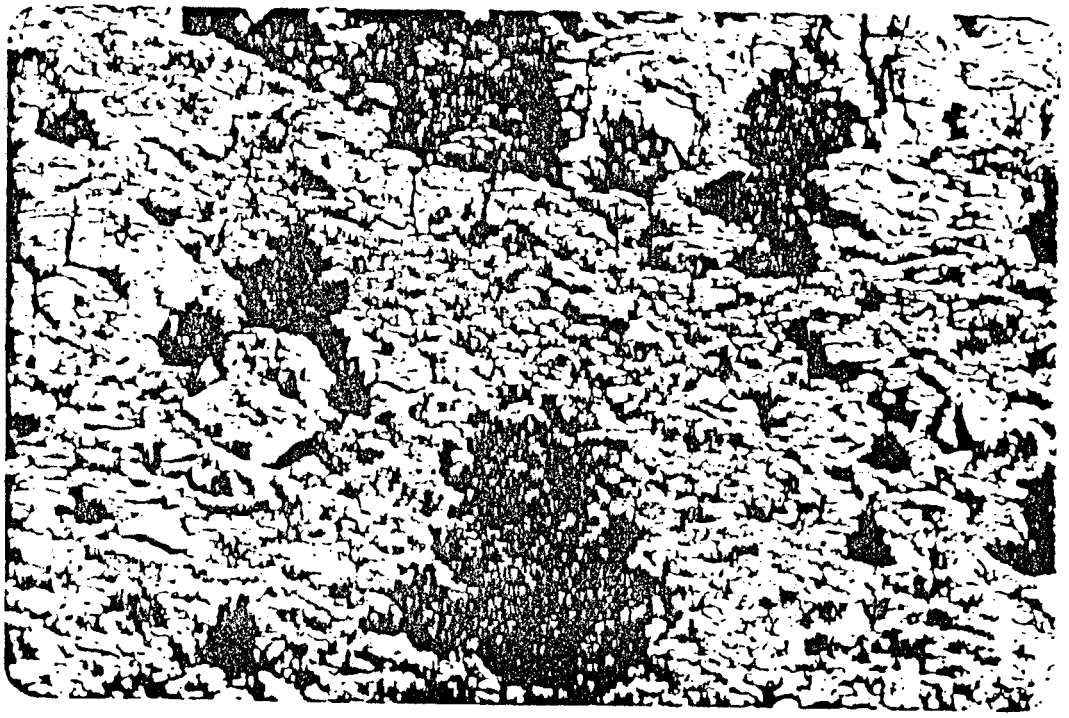
Pinyon/juniper

Pinyon/juniper-grass

REVISED 09/22/1988
RLN:smh/SS8-6067



Pinyon/Juniper



Pinyon/Juniper-Grass

Pinyon-Juniper/Grass

The Pinyon-Juniper/Grass vegetation type is found at elevations of 6400 to 6500 feet (1949 to 1980 m) in the Sunnyside Mines permit area. The land is largely level and rarely exceeds 3 percent slope. The aspect is southwestern.

The Ildefonso very stony loam soil lies beneath this vegetation type. The surface horizon (A1) is very stony loam, 5 inches (12.5 cm) deep. The C horizons beneath the A1 are very cobbly coarse sandy loam to very stony loam and extend to a depth of more than 60 inches (150 cm). Runoff is medium and erosion hazard potential is moderate.

The Pinyon-Juniper/Grass vegetation type lies on the dissected outwash plains and shallow toe slopes of the Book Cliffs. The vegetation is dominated by pinyon pine and Utah juniper. These two species contribute 31 percent of the line-intercept transect cover (Table IX-16). Tree densities are 102 pinyon pine per acre (252/ha) and 149 Utah junipers per acre (368/ha). Complete tree and shrub densities are given in Table IX-17. Utah juniper has the greater amount of basal area per acre (Table IX-18), while pinyon pine produced far more seedlings per acre than the juniper (Table IX-19).

The dominant shrub component is true mountain mahogany (*Cercocarpus montanus*) while the dominant understory components are Indian ricegrass (*Oryzopsis hymenoides*), penstemon (*Penstemon subglaber*) and lobeleaf groundsel (*Senecio multilobatus*). Understory vegetation cover, estimated from quadrat data, is 9 percent (Table IX-20). Complete cover and constancy information for understory vegetation is included in Table IX-21.

A comprehensive species list is contained in Table IX-22.

Vegetation measurements from point-line transects indicated a first-hit total vegetation cover of 35 percent (Table IX-23). Annual primary production was estimated by the SCS to be 300 pounds per acre (336 kg/ha) for understory and 400 pounds per acre (448 kg/ha) for the tree overstory.

This vegetation type has been disturbed by haul roads and preparation plant refuse disposal areas. Approximately 247.0 acres (100.0 ha) are disturbed in the Pinyon-Juniper/Grass Vegetation Type.

CHAPTER X

DRAFT

Rec DOGM 9-26-84

FISH AND WILDLIFE RESOURCES

TABLE OF CONTENTS

CHAPTER X

10.1 Scope

Kaiser Coal's Sunnyside Mines has been in continuous operation for over ninety years. During the course of operation, approximately 169 acres was disturbed in the Sunnyside Fuel permit area.

The focus of this chapter is the existing wildlife resources within the permit boundary, wildlife affected or potentially affected by the waste coal operations, and mitigation/management plans.

10.2 Methodology

The existence of Sunnyside Mines predates 30 CFR, 741 and the performance standards of 30 CFR, 817.97, the regulations pertaining to mining permits and wildlife information respectively. Thus, there are no pre-mine baseline data available for the permit area. Impact assessement is therefore subjective. Impacts to wildlife populations began eighty years ago with the first mining operations in Whitmore Canyon. Since that time, the welfare of wildlife has varied with changing climatic, seral economic, social and technical conditions. The populations in and near the permit area have survived these changing conditions and are adapted to the present environment. Inventory type studies would provide data on status of these populations, but in view of the fact that no disturbance is planned during the five year permit period, the value of such studies is questionable. The goal of Sunnyside's wildlife program is to conserve wildlife through sound management techniques and monitoring methods. A recent aquatic study (Winget 1980) is the only information relevant to existing wildlife resources (aquatic fauna) within the permit boundary.

The purpose of the aquatic study was to collect adequate data to: 1) describe the condition of aquatic resources in Grassy Trail Creek; and 2) provide the baseline for preparing a management plan for said resources.

Aquatic macroinvertebrates were collected with a modified Surber sampler on three dates from selected stations above and below suspected impact points (see Figure VII-2, Chapter VII-Hydrology). Sediment sizes, chemical composition and water quality were determined for each stream section. Comparisons between physical/chemical measurements and aquatic macroinvertebrate community conditions were used to indicate environmental impacts on aquatic resources.

The information sources for the discussion of other wildlife resources are publications of the Utah Division of Wildlife Resources (UDWR), Final Environmental Statement, Development of Coal Resources in Central Utah, Department of the Interior, and UDR report submitted to Kaiser on November 15, 1979 (see Appendix X-1).

10.3 Existing Fish and Wildlife Resources

Wildlife is a rather broadly defined term that includes many vertebrate as well as invertebrate species. For practical and economic reasons, it becomes necessary to concentrate on the most "important" species, which can be identified by using a predetermined set of criteria. The UDWR has defined high interest wildlife as 1) all game species, 2) any economically important species, 3) any species of special aesthetic, scientific or educational significance, and 4) all federally listed threatened or endangered species. Unless otherwise noted, the wildlife discussed in the following sections have been classified as high interest.

10.3.1 Wildlife Habitats in Coal Waste Disposal Area

The habitats of major concern are those of high interest species. Because most terrestrial species use a variety of habitats during a lifetime, the discussion will begin with a general description of habitats found on the permit area.

Vegetation in the permit area include pinyon-juniper/grass (see the vegetation Sections 9.3.2 and 9.3.2.5 for a description of vegetation types and scientific names of plants respectively).

The UDWR has developed a classification system for habitat based primarily on two criteria, 1) the dependency of one or more species of wildlife on a habitat (The UDWR uses the phrase "wildlife use area") and 2) the amount of habitat available. The values from high dependency, limited habitat to low dependency, unlimited habitat are: crucial-critical, high-priority, substantial value, and limited value. The corresponding aquatic habitat value system is crucial-critical - Class 1 or 2, high-priority - Class 3, substantial value - Class 4 and limited value - Class 5 or 6.

Areas within the permit boundary have been designated by UDWR as high-priority for high interest species. Mule deer are most stressed during winter months when forage availability is low, thus winter habitat is high-priority.

High interest species whose habitat requirements are found on the permit area are listed in Table X-1.

10.3.2 Wildlife

Many of the species that potentially occur on the permit area have some or all of the habitat requirements in the adjacent riparian zones associated with drainage bottoms, seeps, springs, wetlands and flood plains. Adjacent to the permit area, the canyon bottomlands provide most of the riparian habitats and are most productive in terms of herbage produced and wildlife use. Historically, the bottomlands have also been the areas preferred for human land use activity.

The major land use activity has been coal waste disposal. Forage available for grazing on the permit area is limited because of the steep canyon slopes. Therefore, grazing occurs primarily in the canyon bottoms.

Post-mining land use will continue to be wildlife. The sites disturbed by mining activity will be reclaimed to wildlife uses.

10.3.2.1 Aquatics

No stream or reservoir occurs in the permit area.

10.3.2.2. Mammals

There are seventeen high interest species listed in Table X-1 that potentially occur on the permit area. The total is comprised of three small game, six furbearers, four big game, one endangered, and three with none of the above classifications.

The permit area is a year-round habitat for cottontail rabbits and snowshoe hare. Generally, 7,000 feet is an elevational boundary with mountain cottaintail preferring habitats above and desert cottontail preferring habitats below. The habitat requirements of the snowshoe hare are provided by the spruce-fir vegetation type. The population trends of the cottontails are stable while the trend of the snowshoe hare is cyclic.

There are six beaver dams on Grassy Trail Creek in the Left Fork of Whitmore Canyon above the reservoir. One beaver dam was observed in Water Canyon. Some of the dams appear in an active state of repair. Habitats of the other furbearers occur on the permit area, but population densities are unknown. According to the UDWR (1978), the population trends of the beaver and striped skunk are increasing while that of mink is unknown and those of the furbearers are stable.

CHAPTER X

The permit area is part of deer herd unit 27B - Range Creek. Herd unit 27B occupies the east half of Carbon County, part of the north side of Emery county, and the south side of Duchesne County for a total land area of 1,169,408 acres (Utah State Department of Fish and Game 1967). Whitmore Canyon is on the south side of the unit.

Unit 27B was included in range inventory investigations conducted in 1966 by the UDWR (then the Utah State Department of Fish and Game) to determine winter distribution patterns, range condition information and land ownership status. The distribution pattern observed was summer range on the West Tavaputs Plateau in the center of the unit and winter range at lower outlying elevations. The unit is 19 percent summer range and 49 percent winter range, during severe winters the range decreases to 31 percent. The permit area is in the Pinyon-Juniper-Mountain Brush-Grass vegetation type which comprises 34 percent of the normal winter range and 42 percent of the severe winter range (Utah State Department of Fish and Game 1967). The optimum winter range population of deer in unit 27B is 29,885 (Table X-2).

Deer summer range is on West Ridge, Patmos Ridge and high country to the north and east. Winter range is at lower elevations than summer range. With severe winters, deer move down into Whitmore Canyon and west of West Ridge to the adjacent flat, P-J country.

According to UDWR, winter ranges are inhabited between November 1 and May 15 each year, depending on weather conditions. Snow accumulation at high elevations force deer to habitat where pediment slopes east of the permit area are considered winter range. Climatological information provided in section 783.18 (Chapter XI) supports this statement. Records at the Sunnyside NOAA weather station located at the engineering building, elevation 1982 (6,500 feet), show the greatest mean daily snow accumulation, 10.2 (4.01 inches), occurring in January. This is far below the reported 46 cm (1.5 feet) accumulation which precludes use of the range by deer (Gilbert et al, 1970; Hosely, 1956).

The chained areas on the pediment slopes east of the permit area have had a serious impact on wintering deer. Chaining was conducted by the Bureau of Land Management (BLM) using two caterpillar tractors pulling a 41 kg (90 pound) link chain between them. Two areas, Mud Springs, No. 88 and Mud Springs, No. 10 were chained in 1966. No. 88 was 778 ha (1922 acres) and No. 10 was 658 ha (1962 acres). Both areas were seeded with crested wheatgrass (Agropyron cristatum), fourwing saltbus (Atriplex canescens), and alfalfa (Medicago sativa).

According to David Mills, Wildlife biologist with the BLM (personal communication, August 18, 1983), the chaining was a negative impact for the following fifteen years because no cover was left for escape or thermoregulation. Vegetation is now providing suitable cover and deer utilization is increasing. Data from pellet transect established in the chained area in 1976 show that winter deer use from 1976-77 to 1979-80 has trended upwards (UDWR 1980).

Published data are available on big game management units. The permit area is approximately 0.02 percent of unit 27B and it may not be representative of the unit in terms of deer density. However, for the purposes of this discussion, it is assumed that data published on unit 27B is more representative of the permit area than data published on any other unit.

The health of a deer herd is largely dependent on the quality of habitat relative to animal density (carry capacity). An approximation of the status of 27B can be discerned by comparing selected data of certain management units (Table X-3). Unit 27A adjoins 27B, unit 19 had a high buck harvest, success ratio and above average fawn-doe ratio, unit 30B had a low buck harvest and has a comparatively small deer range and unit 29B has a comparatively large deer range. A comparison of these data requires that all variables relative to the hunt be held equal, i.e. weather conditions, hunter access to unit, hunter distribution on unit, etc.

Fawns per 100 does are an indicator of herd health. The Density Index (DI) as used here is an indicator of carrying capacity. The carrying capacity is proportional to the DI value. The log of the range area was used to make the index more sensitive to hunter success. The most productive unit, 19, also has the highest DI. Unit 27A was the least productive and has the lowest DI. The second lowest DI was unit 27B, which would indicate that the region has a relatively low carrying capacity for deer.

Since 1976, both the hunter success and the fawn/100 doe ratio have declined in unit 27B, although the latter ratio was lower in 1978 than 1979 (UDWR 1980a).

The nearest elk management unit is the Book Cliffs-Unit 21, which is 40 miles east of the permit area. This unit has a low population of elk and considerable forage availability. The UDWR recognized the opportunity for herd expansion and released 50 animals during the winter of 1979-80. An additional 50 animals were to be released during the 1980-81 winter period (UDWR 1980b).

Although the permit area contains habitat suitable for elk, no elk have been observed, there is potential for elk in the Book Cliff herd to expand their range to the permit area, but this would take many years and favorable conditions.

The cougar received protection as a game animal on February 15, 1967. Harvest data has been reported by deer management units and unit 27B ranks fourth with a total harvest of 51 animals for the years 1972 to 1979 (UDWR 190c). This indicates that the permit area probably contains habitat suitable for cougars and that cougars may be present.

The black bear received protection as a game animal at the same time as the cougar. The total harvest reported by the UDWR (1980d) for the years 1969-79, also for deer management unit 27B, was 25 animals, the third highest reported. It is also probable that there is suitable black bear habitat.

The muskrat, kit fox, and bobcat are other high interest species that could occur on the permit area. Because of the lack of suitable habitat, the kit fox is the least likely to be found. The endangered black-footed ferret is discussed in Section 10.3.3.1.

10.3.2.3 Birds

Of the 244 bird species that potentially occur in the region , 51 are high interest species with preferred habitat on or near the permit area. The 51 are comprised of 29 species of migratory game birds, 13 raptors, 5 small game (upland birds) and 4 migratory birds of high federal interest. Eight of the raptors are also of high federal interest. The 51 species are listed and classified in Table X-1.

The 29 species of migratory game birds are comprised of 27 waterfowl, the American Coot, and the Mourning Dove. Grassy Trail Reservoir provides habitat for waterfowl and American Coot. The lack of agriculture land in the vicinity precludes use by geese or dabbling ducks on a yearlong basis.

Mourning Doves nest in pinyon-juniper and riparian habitats near water sources. These components are found in any canyon bottomland. Hunting of Mourning Doves occurs on a very limited basis.

Five species of small game bird species are listed as occurring on or near the permit area, however probability of occurrence varies because of availability of key habitat components. Blue Grouse utilize Douglas fir habitat types during winter months. During spring and summer months they migrate to sagebrush, pinyon-juniper or shrubland habitat.

Ruffed Grouse generally prefer habitat within 0.25 miles of water. Aspen forests are important during winter months, because staminate buds are a food source.

The occurrence of California Quail is marginal while sage grouse are improbable. Chukar prefer open, rocky areas associated with desert scrub or shrubland habitats but have been observed at the mouth of Slaughter Canyon and near the refuse dump. Sage grouse require open expanses of low growth-form sage brush for leks. These habitat characteristics are generally lacking on the permit area.

The Great Blue Heron, Long-billed Curlew, Black Swift and Western Bluebird are migratory birds of high federal interest. According to UDWR, there are no rookeries of the Great Blue Heron due to the absence of preferred nesting habitat. However, Grassy Trail Reservoir is a feeding habitat so Heron are occasional visitors.

Long-billed Curlews prefer grasslands as breeding habitat and thus would probably not be found on the permit area. Grassy Trail Reservoir provides feeding habitat during migrations.

The Black Swift is a summer resident of West Tavaputs Plateau. Cliffs and tallus slopes are preferred habitat, but nesting is usually associated with moist ledges or crevices near or behind waterfalls. No nesting habitat occurs on the permit area.

The Western Bluebird is an uncommon summer resident of the region. It is a cavity nester with no particular preference for habitat type. Any cavity trees on the permit area is potential nesting habitat.

10.3.2.4 Reptiles

The Utah milk snake is a year long resident of the permit area. Riparian habitat found along Grassy Trail Creek and side canyon bottomlands are preferred habitat. The milk snake is furtive due to is nocturnal habitats. No milk snakes or their dens have been observed on the permit area.

10.3.3 Species of Special Significance

10.3.3.1 Threatened and Endangered Species

Mammals: The black-footed ferret is on the Federal List of Endangered and Threatened Wildlife and Plants (50 CFR 1711). There is a strong association of ferrets with prairie dog towns

because the prairie dog is a primary prey species and its burrows are used as ferret dens.

A potential range of the ferret is the pediment slopes southwest of the permit area (Hinkley 1970, Scott et al 1977, both cited in USDI 1979). Two whitetailed prairie dog towns are known to occur on the permit area, Section 6 (R14E, T15S) in the southwest corner. The town on the southwest-southeast quarter section boundary is in an abandoned cemetary and contains ten active burrows. No ferrets or ferret signs have been observed, but only reconnaissance surveys have been conducted. The nearest probable ferret sighting was about two miles northwest of Woodside on Highway 6, about eighteen miles south of the permit area (Scott et al 1977, cited in USDI 1979). The date of this sighting is not known.

A recent unconfirmed sighting of a black-footed ferret is documented in Carbon County, eastern 1/2 section 10, T15S, R13E, according to Phil Garcia, conservation office, Utah Division of Wildlife Resources on 02-10-80.

The applicant will notify the Division of any future occurrence of threatened or endangered species or golden eagles on the permit area.

10.3.3.2 Raptors

Raptors are considered species of special significance because of their rareness and because they are indicators of toxicants in the environment. The permit area contains nesting and/or hunting habitat of thirteen raptors. The bald eagle and peregrine falcon are on the Federal List of Endangered and Threatened Wildlife and Plants (50 CFR 17.11).

The permit area is considered winter range of bald eagles (UDWR 1979). Food supply is probably the most critical feature of the biology of wintering bald eagles (Steenhof 1978). The feeding habitats vary with the season and region; eagles in the Great Basin rely mostly on avian and mammalian carrion (Murphy 1975, cited by Steenhof 1978). Eagles prefer fish (including fish carrion) when it is available.

Roost trees are an important part of bald eagle habitat. There are no known roost trees on the permit area. The nearest roost tree observed by Boner et al (1977, cited in UDSI 1979) was three miles southwest of Mounds, which is about seventeen miles southwest of the permit area.

The peregrine has been sighted in the region, but no active eyries have been identified (USDI 1979). The sighting nearest the permit area was about two miles north of Mounds

(Boner et al 1977, cited in USDI 1979). The peregrine usually lives in open country around rock cliffs overlooking or at least within one mile of streams or rivers; an abundance of birds for food supply must be within hunting range.

The burrowing owl is a raptor that has special nesting requirements. They commonly use prairie dog burrows as nest sites.

10.4 Effects of Mining Operation on Fish and Wildlife

Development of Sunnyside Waste Coal Disposal Area has resulted in the disturbance of approximately 169.2 acres (see Section 9.3.2.7 for a break down of vegetation types). Disturbed areas are indicated on Plate III-1. The construction and present use of roads and bridges causes sedimentation of Grassy Trail Creek. The species that have been potentially impacted by mine development and continued operation are listed in Table X-1. The list includes 9 fish, 4 amphibians, 12 reptiles, 63 birds and 33 mammals. Although each species listed was potentially affected, the number of species actually affected is probably a small percentage of the total, because of the relatively small area disturbed.

The ongoing mining operations have altered the environments of local aquatic and terrestrial faunal communities. Impacts of operations include noise pollution, air pollution, vehicular collisions on roads, and sedimentation on Grassy Trail Creek.

The results of aquatic resource analysis study (Winget 1980) show that water quality in Grassy Trail Creek above the mine discharge is adequate for most aquatic species, except for questionable levels of nickel, zinc and oil and grease. Water quality below the mine discharge show considerable degradation: increases in conductivity, TDS, alkalinity, chloride, nitrate, phosphate, sulfate, sodium and oil and grease. There was an increase in sediment fines proceeding downstream; however, there was not evidence of toxicity type impacts chemical analysis nor biological community investigations provided any data that indicated a heavy metal problem in Grassy Trail Creek (see Section 7.2.4).

Generally there was very little biotic community difference between Stations UPGTR, GTC-02: Station GTC-AP showed moderate impact related changes, caused more by physical stress than chemical; Station GTC-03 showed severe stress reactions with indications of both physical and chemical stresses; and Station GTC-05 community exhibited similar responses as at Station GTC-03 but with evidence of limited recovery (see Figure

VII-2). Fine sediments and oil and grease were apparently the major factors affecting Grassy Trail Creek.

It should be pointed out that mine waters contribute greater than 90 percent of total stream flow. Without mine water, Grassy Trail Creek would be near intermittent part of the year during most years.

10.5 Mitigation and Management Plans

Some impacts of the operation of the disposal area are unavoidable. Where possible, mitigations will be achieved by minimizing these impacts and after the impacts, restoration to pre-impact conditions.

Dozing will be restricted to the minimum amount necessary for the road upgrading. Upgrading the roads will be carried out according to current road building standards.

All disturbed sites no longer needed for disposal operations are being reclaimed according to current reclamation standards. The reclamation techniques and seed mixtures used are designed to achieve a post-mining land use of wildlife and grazing. The Sunnyside topography consists of steep canyon slopes and undulating bottomlands. Revegetation of small areas in this rugged topography will create natural, scattered plant groupings which will optimize edge effects. No special plant groupings are planned for small acreages. Reforestation will occur by natural succession and shrubs will be broadcast or drill seeded.

All revegitated areas will create induced and/or inherent edges. Induced edges are a result of various adjacent successional stages of the same community. Inherent edges occur where two different communities meet, e.g., where mountain brush on a slope abuts sage/grass vegetation on a valley floor. On the largest areas of disturbance, a mosaic of induced edges will develop where revegetated areas adjoin non-mined areas and older reclaimed areas planted with crested wheatgrass.

The potential for optimizing the edge effect through vegetation groupings at Sunnyside is limited. The amount of edge is determined by lengths, width and configuration. Although boundaries of many disturbed areas are long, they are also very regular and narrow, thus restricting the potential to create more edge. Additionally, because most areas are small in size, habitat richness and variation of is restricted (Thomas et al, 1979). The value to wildlife of plant species being used for reclamation is discussed in Section 9.7.

For the most part, Sunnyside disposal operations have developed without consideration of potential impacts on wildlife. However, impacts on wildlife have been avoided during the course of operations even though wildlife may not have been the motivation. For example, during the early stages of operations, when mining was under lower cover near Grassy Trail Creek, pillars were left to protect surface structures and streams (Section 3.3.2.2 for further discussion of subsidence see Sections 3.4.8 and 6.6.3.3).

The ongoing operations have altered the environments of local aquatic and terrestrial faunal communities. Unless problems arise, the environments will continue in their altered state until mining operations cease.

The riparian habitat along Grassy Trail Creek is a primary concern for wildlife protection. During the course of mine development, facilities were constructed within 100 feet of the stream. Most of the construction occurred at the mine site in Section 32. The riparian habitat that remains is marked with buffer zone sign (4) posted between the upper mine entrance to a point below the lower mine workings (SW1/4 Section 32).

Water discharged into Grassy Trail Creek must meet NPDES effluent criteria. Different water quality parameters are being monitored on a monthly, quarterly and semi-annual basis at six check points along the creek (Chapter VII, Permit Application).

All mine employees will receive the UDWR wildlife educational program during annual refresher safety training. The program consists of slides and a tape explaining wildlife value and how the individual can help protect wildlife resources.

The applicant will avoid the use of persistent pesticides in the permit area during reclamation activities unless approved by the Division.

10.6 Fish and Wildlife Monitoring

The water quality of Grassy Trail Creek will be monitored during the life of the mine. Corrective measures will be undertaken if parameters exceed limits set in National Standards if the cause is due to mining activity.

No other active monitoring programs are planned at this time.

CHAPTER X

10.7 Bibliograpy

Boner, T.C., A.W. Heggen, C. McAda, C. Phillips, C.R. Berry and R.S. Wydroski. 1977. A survey of endangered, threatened, and unique terrestrial and aquatic wildlife in Utah's coal planning area; Salt Lake City, Utah Division of Wildlife Resources. USDI. 62 pp.

Gilbert, P.F., O.C. Walmo, R.B. Gill, 1970, Effect of snow depth on mule deer in Middle Park Colorado. J. Wildl. Manage 34(1):15-22.

Hinckley, D.K. 1970. A progress report on attempts to locate black-footed ferret, Mustella nigripes, in Utah. USDI Fish and Wildlife Service. 10 pp.

Hosely, N.W. 1956. Management of the white-tailed deer in its invironment. Pp. 187-259. (IN) the deer of North American, W.P. Taylor (Ed). The Wildlife Management Institute, Washington, D.C. 668 pp.

Murphy, J.R. Status of Eagle populations in the western United States. Pages 57-63 in Proc. World Conf. on Birds of Prey. Vienna, Austria. 442 pp.

Scott, R.W., T.C. Boner and R. Smith. 1977. Ranking of wildlife values on Federal coal lands. Utah Division of Wildlife Resources.

Soil Conservation Service. 1983. Soil and water conservation plan. Kaiser Steel Corporation.

Steenhoff, K. 1978. Management of wintering bald eagles. USDI Fish and Wildlife Service. 59 pp.

Thomas, J.W., C. Maser and J.E. Rodiek, 1979. Wildlife habitat in managed forests of Blue Mounts of Oregon and Washington USDA Forest Service, Ag. Handbook No. 553.

Utah State Department of Fish and Game. 1967. Big game range inventory. Bull. No. 67-1. 171 pp.

UDWR. 1978. Species list of vertebrate wildlife that inhabit southeastern Utah. Pub. No. 78-16. 68 pp.

UDWR. 1979. Report on Kaiser Steel-Sunnyside Mines wildlife. Unpub.

UDWR. 1980a. Big game harvest report. Pub. No. 80-5. 74 pp.

UDWR. 1980b. Utah big game investigations and management recommendations, 1979-80. Pub. No. 80-6.

UDWR. 1980c. Utah cougar harvest, 1978-79. Pub. No. 79-9. 17 pp.

UDWR. 1980b. Utah black bear harvest, 1978-79. Pub. No. 79-10. 14 pp.

UDWR..1981. Revised report on Kaiser Steel-Sunnyside Mine wildlife. Unpub.

USDI. 1979. Development of coal resources in central Utah. Final ES. Parts 1 and 2.

Winget, R.N. 1980. Aquatic resource analysis of Grassy Trail Creek, Carbon County, Utah. 27 pp. Unpub.

CHAPTER X

LIST OF EXHIBITS

Figure	X-1	USFWS raptor information letter and map key.
Table	X-1	High interest species that potentially occur on the permit area and species that were potentially impacted by mine development and operation.
Table	X-2	Optimum deer population on winter range in Unit 27B.
Table	X-3	Selected data from deer management units - 1979.
Appendix	X-1	UDWR cover letter and report.

United States Department of the Interior
FISH AND WILDLIFE SERVICE
ECOLOGICAL SERVICES
1311 FEDERAL BUILDING
125 SOUTH STATE STREET
SALT LAKE CITY, UTAH 84138-1197

IN REPLY REFER TO:

August 23, 1983

Mr. Curt Jansen
Intermountain Scientific Associates
1322 Webster Avenue
Fort Collins, Colorado

Dear Mr. Jansen:

Enclosed are the raptor nest maps and index you requested for the Sunnyside mine Area. All the data was collected from U.S. Fish and Wildlife Service (FWS) raptor inventories in 1981. If you have any questions concerning this information, please contact the FWS Energy Operations division in Salt Lake City, Utah (801) 524-5649.

Sincerely yours,

Robert D. Jacobsen
Field Supervisor

Enclosure

FIGURE X-1

36. 1 In Buteo
37. 1 In Raven
38. 1 In Raven
39. 1 In GE
40. 1 ISN; 1 Pos. Buteo (In)
41. 4 In GE
42. Potential Prairie
43. 2 Buteo, 1 Act. Red tail (2^+ young), 1 In
44. 1 LISN
45. 4 GE, 1 active (2 young), 1 other tended, 2 alternates
46. 1 ISN
47. 1 ISN
48. 1 Raven, poss. occ.
49. 1 ISN, 1 In Buteo
50. 1 stick nest possible occ. (GHO?)
51. 1 Act. GE (2 young)
52. 1 In Raven
53. 1 In Raven
54. 1 Act GE (1 young)
55. 1 In Buteo
56. 1 In GE
57. Obs. pair of eagles
58. 1 In GE
59. 2 In GE both very old
60. AO GE obs.
61. 1 ISN very old
62. VOIL number
63. 1 SISN prob raven
64. 1 But/Raven old
65. Obs. Gos (Ad) with prey
66. 4 Raven nest
67. 1 Act Red Tail (3 young)
68. 2 In Buteo
69. 2 Buteo, 1 Act RT (3 young); 1 In
70. 1 In Buteo
71. 1 In Raven
72. 1 In Raven
73. I ISN old
74. 1 Act RT (2^+ young)
75. 2 Buteo, 1 Act RT (2 young); 1 In
76. 1 In Buteo
77. 1 In Buteo
78. 1 In Buteo old
79. 1 In Buteo old
80. 1 InButeo old
81. 1 But/Raven In
82. Obs. Ad. Eagle
83. 1 Buteo ? Greenery occ.
84. 1 Buteo (In)
85. 1 In GE
86. 1 Raven, poss occupied
87. 1 Raven
88. 1 In GE

89. 1 Act GE (2 young)
90. Obs. 2 Ad. GE
91. 1 In GE
92. 5 In GE
93. 1 Raven (In)
94. 3 In GE
95. 1 In GE old
96. Ad. Prairie obs.
97. 2 In GE
98. Ad. Ge obs
99. Prairie obs (Ad.)
100. 1 Act Prairie eagly - young fledged (one seen)
101. 1 Act Prairie - 2 young seen fledged
102. 2 GE 1 tenden/occ; 1 inactive
103. 1 GE, inact
104. 1 GE inact very old
105. 1 Buteo nest very old
106. 1 GE inactive

Key

ISN - inactive stick nest
SISN - small inactive stick nest
LISN - large inactive stick nest
IN - inac - inactive
GE - golden eagle
TV - turkey vulture

Figure X-1 Cont.

Table X-1 High Interest Species that Potentially Occur on the Permit Area and Species that were Potentially Impacted by Mine Development and Operation

	Status	Population Trend
Fishes		
Family Salmonidae		
Cutthroat Trout (*Salmo clarki*)	C-P-GF	Stable
Rainbow Trout (*Salmo gairdneri*)	C-P-GF	Stable
Brown Trout (*Salmo trutta*)	C-P-GF	Stable
Family Cyprinidae		
Utah Chub (*Gila atraria*)	L-P-I	Abundant
Roundtail Chub (*Gila robusta*)	C-P-I	Stable
Red Shiner (*Notropis lutrensis*)	C-P-I	Increasing
Fathead Minnow (*Pimephales promelas*)	C-P-I	Stable
Colorado Squawfish (*Ptychocheilus lucius*)	E-P-I	Decreasing
Speckled Dace (*Rhinichtys osculus*)	C-P-I	Stable
Redside Shiner (*Richardsonius balteatus*)	C-P-I	Stable
Family Catostomidae		
Bluehead Sucker (*Catostomus discobolus*)	C-P-I	Stable
Flannelmouth Sucker (*Catostomus latipinnis*)	C-P-I	Stable
Amphibians		
Family Ambystomatidae		
Tiger Salamander (*Ambystoma tigrinum*)	C-P-I	Unknown
Family Pelobatidae		
Great Basin Spadefoot Toad (*Scaphiopus intermontanus*)	C-N-I	Unknown
Family Bufonidae		
Woodhouse's Toad (*Bufo woodhousei*)	C-N-I	Unknown
Family Ranidae		
Leopard Frog (*Rana pipiens*)	C-N-I	Unknown
Reptiles		
Family Iguanidae		
Collared Lizard (*Crotaphytus collaris*)	C-N-I	Unknown
Leopard Lizard (*Crotaphytus wislizenii*)	C-N-I	Unknown
Eastern Fence Lizard (*Sceloporus undulatus*)	C-N-I	Unknown
Sagebrush Lizard (*Sceloporus graciosus*)	C-N-I	Unknown

	Status	Population Trend
Order Galliformes		
Family Phasiandiae		
California Quail (*Lophortyx californicus*)	C-P-SG-I resident	Stable
Chukar (*Alectoris chukar*)	C-P-SG-I resident	Stable
Order Gruiformes		
Family Rallidae		
American Coot (*Fulica americana*)	C-P-MG resident and transient	Stable
Order Charadriiformes		
Family Charadriidae		
Mountain Plover (*Charadrius montanus*)	R-P-I transient	Stable
Family Scolopacidae		
Long-billed Curlew (*Numenius americanus*)	U-P-X summer resident and transient	Declining
Order Columbiformes		
Family Columbidae		
Mourning Dove (*Zenaida macroura*)	C-P-MG-I summer resident and transient	Stable
Order Strigiformes		
Family Strigidae		
Great Horned Owl (*Bubo virginianus*)	C-P-I resident	Stable
Pygmy Owl (*Glaucidium gnoma*)	K-P-I resident	Unknown
Burrowing Owl (*Speotyto cunicularia*)	L-P-X resident	Declining
Long-eared Owl (*Asio otus*)	C-P-I resident	Stable
Order Caprimulgiformes		
Family Caprimulgidae		
Poor-will (*Phalaenoptilus nuttallii*)	C-P-I summer resident	Stable

	Status	Population Trend
Order Apodiformes		
Family Apodidae		
Black Swift (*Cypseloides niger*)	U-P-I-X summer resident	Unknown
White-throated Swift (*Aeronautes saxatalis*)	C-P-I summer resident	Unknown
Family Trochilidae		
Black-chinned Hummingbird (*Archilochus alexandri*)	C-P-I summer resident	Unknown
Broad-tailed Hummingbird (*Selasphorus platycercus*)	C-P-I summer resident	Unknown
Order Piciformes		
Family Picidae		
Common Flicker (*Colaptes auratus*)	C-P-I resident	Stable
Order Passeriformes		
Family Tyrannidae		
Cassin's Kingbird (*Tyrannus vociferans*)	U-P-I summer resident	Unknown
Ash-throated Flycatcher (*Myiarchus cinerascens*)	C-P-I summer resident	Stable
Says Phoebe (*Savornis sava*)	C-P-I resident	Unknown
Dusky Flycatcher (*Empidonax oberholseri*)	C-P-I summer resident	Unknown
Gray Flycatcher (*Empidonax wrightii*)	K-P-I summer resident	Unknown
Family Alaudidae		
Horned Lark (*Eremophila alpestris*)	C-P-I resident	Unknown
Family Corvidae		
Scrub Jay (*Aphelocoma coerulescens*)	C-P-I resident	Unknown
Black-billed Magpie (*Pica pica*)	C-P-I resident	Unknown
Pinion Jay (*Gymnorphinus cyanocephala*)	C-P-I resident	Unknown
Family Paridae		
Plain Titmouse (*Parus inornatus*)	C-P-I resident	Unknown
Bushtit (*Psaltriparus minimus*)	C-P-I resident	Unknown

	Status	Population Trend
Family Sittidae		
White-breasted Nuthatch (Sitta carolinensis)	C-P-I resident	Unknown
Family Troglodytidae		
Bewick's Wren (Thryomanes bewickii)	C-P-I resident	Unknown
Family Mimidae		
Gray Catbird (Dumetella carolinensis)	U-P-I summer resident	Unknown
Sage Thrasher (Oreoscoptes montanus)	C-P-I resident	Unknown
Family Muscicapidae		
Western Bluebird (Sialia mexicana)	U-P-I-X summer resident	Unknown
Townsend's Solitaire (Myadestes townsendi)	C-P-I resident	Unknown
Family Sylviidae		
Blue-gray Gnatcatcher (Polioptila caerulea)	C-P-I summer resident	Unknown
Golden-crowned Kinglet (Regulus satrapa)	U-P-I resident	Unknown
Family Laniidae		
Northern Shrike (Lanius excubitor)	U-P-I winter resident	Unknown
Family Vireonidae		
Solitary Vireo (Vireo solitarius)	U-P-I summer resident	Unknown
Family Parulidae		
Orange-crowned Warbler (Vermivora celata)	C-P-I summer resident and transient	Unknown
Virginia's Warbler (Vermivora virginiae)	C-P-I summer resident	Unknown
Black-throated Gray Warbler (Dendroica nigrescens)	C-P-I summer resident	Unknown
Family Embarizidae		
Black-headed Grosbeak (Pheucticus melanocephalus)	C-P-I summer resident	Unknown
Lapland Longspur (Calcarius lapponicus)	R-P-I winter resident	Unknown
Lazuli Bunting (Passerina amoena)	C-P-I summer resident	Unknown
Green-tailed Towhee (Chlorura chlorura)	C-P-I summer resident	Unknown

	Status	Population Trend
Family Embarizidae (Continued)		
Rufous-sided Towhee (Pipilo erythrophthalmus)	C-P-I resident	Unknown
Lark Bunting (Calamospiza melanocorys)	O-P-I transient	Unknown
Vesper Sparrow (Pooecetes gramineus)	C-P-I summer resident	Unknown
Lark Sparrow (Chondestes grammacus)	C-P-I summer resident	Unknown
Sage Sparrow (Amphispiza belli)	U-P-I summer resident	Unknown
Gray-headed Junco (Junco caniceps)	C-P-I summer resident	Unknown
Brewer's Sparrow (Spizella breweri)	C-P-I summer resident	Unknown
White-crowned Sparrow (Zonotrichia leucophrys)	C-P-I resident	Unknown
Song Sparrow (Zonotrichia melodia)	C-P-I resident	Unknown
Black-throated Sparrow (Amphispiza bilineata)	U-P-I summer resident	Unknown
Family Fringillidae		
House Finch (Carpodacus mexicanus)	C-P-I resident	Unknown
Lesser Goldfinch (Carduelis psaltria)	C-P-I resident	
Mammals		
Order Insectivora		
Family Soricidae		
Merriam Shrew (Sorex merriami)	U-N-I	Unknown
Order Chiroptera		
Family Vespertilionidae		
Fringed Myotis (Myotis thysanodes)	U-N-I	Unknown
Western Big-eared Bat (Plecotus townsendii)	C-N-I	Unknown
Pallid Bat (Antrozous pallidus)	C-N-I	Unknown
Order Lagomorpha		
Family Leporidae		
White-tailed Jackrabbit (Lepus townsendii)	C-N-I	Stable
Snowshoe Hare (Lepus americanus)	C-P-SG	Cyclic
Black-tailed Jackrabbit (Lepus californicus)	C-N-I	Stable

	Status	Population Trend
Family Leporidae (Continued)		
Mountain Cottontail (Sylvilagus nuttallii)	C-P-SG-I	Stable
Desert Cottontail (Sylvilagus audubonii)	C-P-SG-I	Stable
Order Rodentia		
Family Sciuridae		
White-tailed Prairie Dog (Cynomys leucurus)	C-N	Stable
Golden-mantled Ground Squirrel (Spermophilus lateralis)	C-N-I	Stable
Least Chipmunk (Eutamius minimus)	C-N-I	Stable
Uintah Chipmunk (Eutamius umbrinus)	C-N-I	Stable
Cliff Chipmunk (Eutamius dorsalis)	U-N-I	Stable
Family Geomyidae		
Valley or Botta Pocket Gopher (Thomomys bottae)	C-N-I	Unknown
Ord Kangaroo Rat (Dipodomys ordii)	C-N-I	Unknown
Family Castoridae		
Beaver (Castor canadensis)	C-P-F	Increasing
Family Cricetidae		
Canyon Mouse (Peromyscus crinitus)	C-N-I	Unknown
Deer Mouse (Peromyscus manicalatus)	C-N-I	Unknown
Brush Mouse (Peromyscus boylei)	C-N-I	Unknown
Pinion Mouse (Peromyscus truei)	C-N-I	Unknown
Desert Wood Rat (enotoma lipida)	C-N-I	Unknown
Muskrat (Ondatra zibethicus)	C-N-I	Stable
Mountain Vole (Microtus montanus)	C-N-I	Unknown
Longtail Vole (Microtus longicaudus)	C-N-I	Unknown
Order Carnivora		
Family Canidae		
Coyote (Canis latrans)	C-N-I	Stable
Red Fox (Vulpes fulva)	C-N-I	Stable
Kit Fox (Vulpes macrotis)	U-N	Stable
Gray Fox (Urocyan cinereoargenteus)	C-N-I	Stable
Family Ursidae		
Black Bear (Ursus americanus)	C-P-BG	Increasing
Family Procyonidae		
Ring-tailed Cat (Bassariscus astutus)	C-N-I	Stable

	Status	Population Trend
Family Mustelidae		
Short-tailed Weasel (Mustela erminea)	R-P-F-I	Stable
Long-tailed Weasel (Mustela frenata)	C-P-F-I	Stable
Mink (Mustela vison)	L-P-F	Unknown
Black-footed Ferret (Mustela nigripes)	E-P	Unknown
Striped Skunk (Mephitis mephitis)	C-P-F-I	Increasing
Spotted Skunk (Spilogale gracilis)	C-P-F-I	Stable
Family Felidae		
Bobcat (Lynx rufus)	C-P-I	Declining
Cougar (Felis concolor)	C-P-BG	Stable
Order Artiodactyla		
Family Cervidae		
Mule Deer (Odocoileus hemionus)	C-P-BG-I	Increasing
Rocky Mountain Elk (Cervus canadensis)	C-P-BG-I	Increasing

STATUS KEY:

K Status unknown - It is believed that these species are present, but little is known of their population dynamics.
C Common - These species are widespread and abundant.
U Uncommon - These species are widespread, but not abundant.
R Rare - These species are seldom identified during any one year.
O Occasional - These species are periodically identified during a long term period - 10-50 years.
E Endangered - These species are endangered with extinction or extirpation from wildland in Utah
T Threatened - These species are threatened with becoming endangered in Utah.
L Limited - These species are common but restricted to a particular use area or habitat type in Utah.
P Protected - These species are protected by state or federal laws in Utah
N Nonprotected - These species are not protected by any laws in Utah.
F These species are classified as furbearers.
I These species were potentially impacted by mine development and operation.
X A migratory bird of high federal interest
GF These species are classified as game fish.
SG These species are classified as small game.
BG These species are classified as big game.
MG These species are migratory game birds.

The following terminology is used to describe the seasonal status for avian species.

Transient - These species pass through southeastern Utah twice a year during their migratory travels.

Resident - These species occur yearlong in southeastern Utah.

Summer Resident - These species breed in southeastern Utah and migrate elsewhere for the winter.

Winter Resident - These species breed elsewhere but winter in southeastern Utah.

Reference: Utah Division of Wildlife Resources (1978)

Table X-2 Optimum Deer Population on Winter Range in Unit 27B.*

Vegetation Type	Acres Available: Normal Winter	Acres Available: Severe Winter	Optimum Deer Population
Total winter range	573,824	364,864	29,885
Pinyon-juniper-mountain brush-grass	195,584	157,760	10,893
Grassland	14,208	14,208	1,133

*Utah State Department of Fish and Game 1967, and written communication, L.J. Wilson 1977, both cited in USDI 1979.

Table X-3 Selected Data from Deer Management Units - 1979.[1]

	Fawns per 100 Does[2]	Bucks Harvested	Hunter Success-%(A)	Range-Acres[3](B)	Density Index A/Log B
All Units-$\bar{x}$[4]	81	743	30	401,432	5.4
27B	76	468	26	793,700	4.4
27A	37	78	13	267,500	2.4
19	93	3,673	49	331,100	8.9
30B	-	29	25	94,100	2.4
29	52	87	29	1,737,000	4.6

[1] UDWR 1980a, 1980b.

[2] Preseason.

[3] Includes total of winter and summer range available to deer.

[4] Desired data was not available for some units.

APPENDIX X-1

UDWR Cover Letter and Report

state of utah

DIVISION OF WILDLIFE RESOURCES

DOUGLAS F. DAY
Director

1596 West North Temple/Salt Lake City, Utah 84116/801-533-9333

Reply To SOUTHEASTERN REGIONAL OFFICE
455 West Railroad Avenue, Box 840, Price, Utah 84501
(801) 637-2310

November 15, 1979

Mr. Lynn Huntsman, Chief Engineer
Kaiser Steel Corporation
P. O. Box D
Sunnyside, UT 84539

ATTENTION: John S. Huefner, PE

Dear Mr. Huntsman:

I want to take this opportunity to extend thanks for the assistance John Huefner, provided Larry Dalton in becoming familiar with surface facilities on the mine plan area encompassed by Kaiser Steel's project. I believe that you will find the enclosed information helpful at filing a mine and reclamation plan.

In response to your request for wildlife resources information (30 CFR, part 783.20) and the Division's recommendations concerning a wildlife plan (30 CFR, part 784.21) to accompany your permit application, the attached map delineating high value habitats for wildlife and supporting narrative for those use areas and other high interest wildlife species are provided. Since the primary or secondary premining and assumed postmining use of the mine plan area was and will be wildlands inhabited by wildlife, suggested vegetative species (seed list along with potential material supply sources for seed and seedlings) for use in enhancement and/or reclamation work that would benefit wildlife are included (30 CFR, parts 817.97 d 4, 817.97 d 5, 817.97 d 9, part 817.116 b 3 IV and part 817.117 c 2). Also, note that Utah's Division of Oil, Gas and Mining is the regulatory authority for approval of the mining and reclamation plan.

Thank you for an opportunity to assist Kaiser Steel in complying with OSM's permanent regulatory program for surface coal mining and reclamation and the resultant protection of Utah's wildlife resources. If the scientific name or other information relative to status of any wildlife

species referenced is needed, please consult the Division publication 78-16 "Species List of Vertebrate Wildlife that Inhabit Southeastern Utah" that is enclosed.

If we can be of any further service, please contact Larry Dalton as appropriate.

Sincerely,

Larry J. Wilson, Supervisor
Southeastern Region

LJW:LBD:ah

cc: Darrell Nish, Chief Resource Analysis
Phil Garcia, East Carbon Conservation Officer
Clark Johnson, Coal Coordinator, US Fish and Wildlife Service
Leon Berggren, Area Manager, Bureau of Land Management

state of utah

DIVISION OF WILDLIFE RESOURCES

DOUGLAS F. DAY
Director

EQUAL OPPORTUNITY EMPLOYER

1596 West North Temple/Salt Lake City, Utah 84116/801-533-9333

March 30, 1981

Reply To SOUTHEASTERN REGIONAL OFFICE
455 West Railroad Avenue, Box 840, Price, Utah 84501
(801) 637-3310

Mr. Joe Taylor, Director of Coal Operations
Kaiser Steel Corporation
Kaiser Center/300 Lakeside Drive
P.O. Box 58
Oakland, California 94604

Attention: Hon Lee

Dear Joe:

I want to take this opportunity to extend thanks for the assistance John Huefner has provided Larry Dalton in becoming familiar with existing and planned surface facilities on the area encompassed by Kaiser Steel's Sunnyside mining project. I believe that you will find the enclosed information helpful at filing a mine and reclamation plan. Note, this information represents an update of materials provided to Mr. Lynn Huntsman on November 15, 1979. The maps provided at that time remain adequate, however, the enclosed narrative supercedes that provided earlier.

In response to your request for wildlife resource information (UMC 783.20) the attached data and comments are provided. The wildlife resource information is consistent with the formal guidelines for acquisition of fish, wildlife and habitat information that should have been provided your Company by Utah's Division of Oil, Gas and Mining. In instances where your Company was required to provide for study beyond existing information, such findings need be included alongwith our report.

Please note that the enclosed wildlife plan (UMC 784.21) represents our recommendations; Utah's Division of Oil, Gas and Mining is the regulatory authority for approval of the mining and reclamation plan. Implementation of the recommended wildlife plan should assist the Company in compliance with performance standards UMC 817.97.

Thank you for an opportunity to assist your Company in complying with the State's permanent program for coal mining and reclamation and the resultant protection of Utah's wildlife resources. If the Division can be of any further service, please coordinate with our Regional Resource Analyst (Larry Dalton, phone 801-637-3310) as appropriate.

Sincerely,

John Livesay

John Livesay, Supervisor
Southeastern Region

JL:LBD:gp

Attachment

cc: Darrell Nish
Clark Johnson
Cleon B. Feight

UMC 783.20; FISH AND WILDLIFE RESOURCE INFORMATION
KAISER STEEL CORPORATION, SUNNYSIDE MINING PROJECT

General Wildlife Resource Information--All Species of Vertebrate Wildlife

The mine plan area encompasses a portion of the West Tavaputs Plateau in Carbon County, Utah. This area drains into Grassy Trail Creek and on to the Price River, which flows into the Green River and ultimately into the Colorado River at a point upstream from Lake Powell. Generally speaking, the West Tavaputs Plateau is encompassed by cold desert (upper Sonoran life zone), submontane (Transition life zone) and montane (Canadian life zone) ecological associations. These life zones could be inhabited on occasion and during different seasons of the year by about 363 species of vertebrate wildlife--20 fish species, 5 amphibian species, 14 reptile species, 244 bird species and 80 mammal species. It is interesting to note that 84 percent of these species are protected.

The mine plan area itself is represented by the Transition and Canadian life zones and probably provides habitat for approximately 296 species of wildlife--4 fish species, 5 amphibian species, 14 reptile species, 196 bird species and 77 mammal species. Ninety-five of these species are of high interest to the State of Utah.

The Division Publication No. 78-16 "Species List of Vertebrate Wildlife that Inhabit Southeastern Utah" is appended (Appendix A) to this report since it represents a low level of study for the wildlife species listed. It identifies those species having potential to inhabit the region (Biogeographic Area B) as well as those inhabiting the environs of the mine plan area (!). Appendix A also identifies which species are considered to be of high interest (*) for the habitats and local area represented.

High interest wildlife are defined as all game species; any economically im-

portant species; and any species of special aesthetic, scientific or educational significance. This definition would include all federally listed, threatened and endangered species of wildlife.

A ranking and display of wildlife habitats and use areas relative to high interest species of vertebrate wildlife has been developed (Table 1 and 2 and the map provided November 15, 1979). Critical wildlife use areas followed in respective importance by high-priority, substantial value and limited value wildlife use areas require various levels of protection from man's activities and developments. Wildlife habitats and use areas ranked as being of critical or high-priority value to wildlife should be protected from surface disturbance, subsidence impacts and human or industrial disturbance. This can be accomplished through development and implementation of a wildlife plan.

For purposes of clarification, the classification of waters in Utah that will be referenced in the following narrative represents a Division of Wildlife Resources system developed and applied to all of the State's waters in 1970. The classification system determined a numerical rating for each of the stream sections or lakes within Utah. (Insofar as possible, each stream section represents an ecologically and physically uniform stream segments.) The numerical values were developed through an evaluation at each water of esthetics, availability of the water to sportsmen and production of fish. Class 1 waters are the best and Class 6 are the poorest.

Critical wildlife use areas are "sensitive use areas" necessary to sustain the existence and perpetuation of one or more species of wildlife during crucial periods in their life cycles. These areas are restricted in area and lie within high-priority wildlife use areas. All stream sections, reservoirs, lakes and ponds identified by Utah Division of Wildlife Resources as Class 1 or 2 are classified as being critical. Biological intricacies dictate that significant disturbances cannot be tolerated by the members of an ecological assemblage on critical sites. Professional opinion is that disturbance to critical use areas

or habitats will result in irreversible changes in species composition and/or biological productivity of an area.

High-priority wildlife use areas are "intensive use areas" for one or more species of wildlife. "Intensive use areas" are not restricted in area and in conjunction with limited value use areas form the substantial value distribution for a wildlife species. All stream sections, reservoirs, lakes and ponds identified by Utah Division of Wildlife Resources as Class 3 are classified as being of high-priority. In addition, wildlife use areas where surface disturbance or underground activities may result in subsidence that could interrupt underground aquifers and result in a potential for local loss of ground water and decreased flows in seeps and springs should be considered as being of high-priority to wildlife.

Substantial value wildlife use areas are "existence areas" for one or more species of wildlife. "Existence areas" represent a herd or population distribution and are formed by the merging of high-priority and limited value wildlife use areas for a species. All stream sections, reservoirs, lakes and ponds identified by Utah Division of Wildlife Resources as Class 4 are classified as being of substantial value.

Limited value wildlife use areas are "occasional use areas" for one or more species of wildlife. "Occasional use areas" are part of the substantial value wildlife use area for a species. All stream sections, reservoirs, lakes and ponds identified by Utah Division of Wildlife Resources as Class 5 or 6 are classified as being of limited value.

MAPPING

Vegetation and Wildlife Habitats

It is recommended that the Company's primary effort be placed on identifying species of vegetation in each wildlife habitat within the various wildlife use areas for purposes of reclamation. The Division does not have site specific information relative to vegetation types at the mine plan area. However, there are

11 wildlife habitats present--riparian or wetland types, agricultural, urban or park, cliffs and tallus, sagebrush, pinion-juniper forest, shrubland, aspen forest, ponderosa forest, parkland and spruce-fir forest. The Company should identify each of these habitat associations on appropriately scaled maps.

It is believed that if satisfactory reclamation is achieved and man's disturbance does not continue or become a factor, that most species of wildlife displaced from the mine plan area will return. Without doubt, the key to success for enhancing or restoring wildlands will be development of habitats so that the postmining condition as compared to the premining condition will have similar species, frequency and distribution of permanent plants in each vegetative type. This will allow for natural plant succession. Additionally, other habitat features that represent the various life requirements for local wildlife must be provided.

Wildlife Use Areas

The map provided earlier displays mapable, high value use areas for high interest wildlife on or adjacent to the mine plan area. This display includes stream sections and bodies of water, if any, utilized by high interest fish species. Also displayed are known seeps, springs, wetlands, and riparian zones. Note that there are high interest wildlife distributions that are so broad that they cover the entire map and therefore are not illustrated. However, all vertebrate species of high interest wildlife and their distributions are discussed in the following narrative.

Water

Due to demands of state and federal coal mining regulations, the Company will probably be required to identify and appropriately monitor all surface waters for potential impacts from subsidence. This information should be correlated with the wildlife use area information due to the value of water to wildlife.

FISH AND WILDLIFE INVENTORY

Aquatic Use Areas

trout were introduced as a biological control for salamanders, since the amphibians have represented a nusiance by plugging water lines.

Brown trout from Grassy Trail Reservoir do not utilize the left and right forks of Grassy Trail Creek for spawning and nursery activities. Flows from these two tributary waters are not suitable for the fall spawning activities of the brown trout. Possibly, speckled dace and redside shiner inhabit this stream section.

Grassy Trail Creek below the reservoir (stream section 2) is ranked as being of high-priority to Utah's cold water fishery management program and is a Class 3 fishery. It can support a catchable sized rainbow trout population. It may also be inhabited by speckled dace and redside shiner. Note, that the trout population results from a "put and take" management scheme and is only practicable during the best of water years.

If project operations are planned or develop that would alter, destroy or discharge polluting effluents into any perennial waters, appropriate state and federal permits, a mitigation plan and results from high level studies of the fishery resource would be required of the Company. Achievement of mitigation would demand detailed studies of stream velocity correlated to flow, representatives of the stream channel profile, gradient, pool-riffle ratio, substrata types identifying percent representation of each type and surface water information required for SMC 779.16.

If modification of flows is anticipated, instream flow requirements must be considered to meet the needs of the existing fisheries, "biological community" and maintenance of existing riparian or wetland zones. Such baseline information would allow for development of mitigation or reclamation plans that would allow for avoidance, lessening or mitigation of impacts to the fishery and maintenance or re-establishment of unique habitat types. This baseline information is not generally available and would necessitate the services of a qualified private consultant and/or contracting Utah's Division of Wildlife Resources since special per-

mits would be required.

It is important to note that no species of fish having relative abundances so low as to have caused them to be federally listed as threatened or endangered inhabit the mine plan or adjacent areas. The endangered humpback chub, bonytail chub and Colorado squawfish inhabit the Green and Colorado Rivers. Additionally, the humpback (razorback) sucker also inhabits those rivers; it is likely that this species will one day be federally listed as threatened. It is not believed that implementation and operation of the Company's project will impact any of these species.

Terrestrial Use Areas

Wildlife Habitat Types

Of the eleven wildlife habitat types present on the mine plan area wetlands and riparian habitats are ranked as being of critical value to all wildlife. They are normally associated with drainage bottoms (ephemeral or intermittent), or perennial streams (SMC 700.5 and UMC 700.5), seeps and springs within the upper Sonoran, Transition and Canadian life zones. Cliffs and their associated tallus areas that lie within the upper Sonoran and Transition life zones are ranked as being of high-priority value to all wildlife. When compared to all other wildlife habitats the aforementioned situations are considered to represent unique habitat associations (Table 1).

Riparian and wetland areas are highly productive in terms of herbage produced and use by wildlife as compared to surrounding areas. Experience has shown that as much as 70 percent of a local wildlife population are dependent upon riparian zones. Cliffs and tallus are of special importance to many high interest wildlife. These unique habitat types must be identified in the permit application and protected due to their high value for all wildlife.

Quantitative (acreage) and qualitative (condition, successional stage and trend) data concerning the wildlife habitats in each ecological association should be included as part of the mine permit application. It is important to note that

each legal section of land represented by the mine plan and adjacent areas has been ranked as to its value for the total wildlife resource. Section 33 of Township 14 South Range 14 East has been ranked as being of critical value to wildlife. Sections 1, 12, 13, 24, 25 and 36 of Township 14 South Range 13 East have each been ranked as being of high-priority value to wildlife. This is also true for sections 4 through 9, 16 through 21 and 28 through 32 of Township 14 South Range 14 East, and sections 4 through 9 of Township 15 South Range 14 East. These rankings were developed through an analysis of cumulative values for use areas of individual wildlife species inhabiting each legal section of land (Table 2).

Amphibians—Species Occurrence and Use Areas

Five species of amphibians, all of which are protected, are known to inhabit the biogeographic area in which the mine plan and adjacent areas are located. It is probable that all of these species inhabit the project area (reference the Division Publication No. 78-16). Only one species of the amphibians inhabiting the project area has been determined to be of high interest to the State of Utah (Appendix A).

The tiger salamander is a yearlong resident animal of the project area. The substantial value use area for the adult form is represented by any moist underground site or any similar habitat such as inside rotten logs, cellars or animal burrows. Such sites can be found within any wildlife habitat extending from the cold desert (upper Sonoran life zone) through the submontane (Transition life zone) and into the montane (Canadian life zone) ecological association. The larva form, often referred to as a mud-puppy, is a gilled animal that must remain in water within the above described ecological associations. It is interesting to note that the larva may fail to transform into an adult, even after their second season, and they can breed in the larva condition.

Once the larva is transformed into the adult form the animal is primarily terrestrial. Salamanders do migrate to water in the spring for breeding and

may remain there during much of the summer. Such an intensive use area would be ranked as being of high-priority value to the animal. In September the newly transformed animals leave the water to find suitable places to spend the winter.

The tiger salamander breeds from March through June and is sexually mature after one year. The male deposits a small tent-shaped structure containing a myriad of sperm on the pool bottom. During courtship the female picks up this structure in her cloaca; then the eggs are fertilized internally before or just at the time they are laid. The eggs, singly or in small clusters, adhere to submerged vegetation; after 10 to 12 days they hatch. Obviously, a critical period for maintenance of the population is when breeding salamanders, eggs or their larva are inhabiting a water.

Post-embryonic development of a salamander's larval form progresses at a pace somewhat controlled by water temperature; in some cold waters the larva may not transform into an adult and drying up of a pool may hasten the process.

Migration to or from water usually occurs at night, during or just after a rain storm. When inhabiting terrestrial sites the tiger salamander is most active at night, particularly on rainy nights, from March through September.

Larva, when small feed on aquatic invertebrates and become predacious to the point of cannibalism when they are larger. Food items for adults include insects, earthworms and occasionally small vertebrates.

No amphibians have relative abundances that are so low to have caused the animal to be federally listed as a threatened or endangered species.

Reptiles--Species Occurrence and Use Areas

Fourteen species of reptiles, all of which are protected, are known to inhabit the biogeographic area in which the mine plan and adjacent areas are located. It is probable that all of these species inhabit the project area. Only one species of the reptiles inhabiting the project area has been determined to be of high interest to the State of Utah (Appendix A).

The Utah milk snake is a yearlong resident animal of the project area. Its

substantial value use area encompasses all wildlife habitats extending from the upper Sonoran (cold desert life zone) through the submontane (Transition life zone) and into the montane (Canadian and possibly Hudsonian life zone) ecological associations. Although its use area spans a multitude of habitats, the animal is extremely secretive, mostly nocturnal and is often found inside or under rotten logs, stumps, boards, rocks or within other hiding places. At night they can be found in the open where they hunt for small rodents, lizards and other small snakes. Occasionally, the milk snake may take small birds or bird eggs.

The milk snake may live beyond twenty years and it becomes sexually mature during its third spring season. After mating, which occurs during spring or early summer when they are leaving the den, female milk snakes produce clutches which average seven eggs. The eggs are secreted in a moist warm environ and then abandoned; incubation lasts 65 to 85 days. The site where an individual snake has deposited its clutch of eggs is of critical value to maintenance of the species.

To date snake dens, which are protected and of critical value to snake populations, have not been identified on or adjacent to the project area. It is important to note that inventory for such has not been attempted. If the Company at some later time discovers a den it should be reported to the Utah Division of Wildlife Resources. If a den(s) is currently known, its location must be included with the permit application.

No reptiles have relative abundances that are so low to have caused the animal to be federally listed as a threatened or endangered species.

Birds-Species Occurrence and Use Areas

Two hundred fourty-four species of birds, all of which are protected, are known to inhabit the biogeographic area in which the mine plan and adjacent areas are located. It is probable that one hundred ninety-six of these species inhabit the project area. Sixty-four species of the birds inhabiting the project area have been determined to be of high interest to the State of Utah (Appendix A).

The western grebe is a summer resident of the environs associated with the project. Its substantial valued use area is always associated with large lakes or ponds where it feeds on fish. This bird builds a floating nest which is usually located in emergent vegetation at some backwater where wind-wave action is not severe. Usually the western grebe nests in a colony. The nest is a critical site while occupied for survival of the grebe population.

The double-crested cormorant is a summer resident of the environs associated with the project. Its substantial valued use area is always associated with large lakes or ponds where it feeds on fish. This bird may nest on the ground at islands or other features that are nearly surrounded by water such as dikes. They also nest in trees along the waterways where they fish. They normally nest in colonies and the nest is a critical site while occupied for survival of the cormorant population.

The great blue heron is a yearlong resident of the environs associated with the project. The bird's substantial valued use area is always associated with open water where it feeds on aquatic wildlife. The great blue heron normally nests in rookeries that are often coinhabited by snowy egrets and black-crowned night herons. The nest may be placed high in a tree along a lake or stream edge, however, they will nest on the ground. The rookery, none of which are known to be located on the project area, is ranked as being of critical value to herons; it is normally a traditional site and utilized year after year by a nesting colony. It is important to note that rookeries are abandoned if they become vulnerable to predation or experience continual disturbance.

Swans, geese and ducks commonly known as waterfowl are represented by twenty-three species that may on occasion or during different seasons of the year inhabit the mine plan area. All of these species are of high interest to the State of Utah (Appendix A). Generally speaking, the riparian and wetland habitats encompassed by the project and adjacent areas provide substantial valued habitats for waterfowl. Each species has different life requirements and makes various uses

of the riparian and wetland environs associated with the project.

For those waterfowl that nest locally, the period March 15 through July 15 is ranked as being of crucial value to maintenance of the population. Following incubation, which dependent upon the species may vary between 20 and 28 days and extend up until mid-August, the riparian and wetland habitats represent a high-priority brooding area. Additionally, the wetland habitat (large open water areas or dense marshland) is of high-priority for seclusion and protection of adult waterfowl during their flightless period when they moult. Males may begin the moult in early June and both sexes and the young are capable of flight by mid-August.

It is important to note that agricultural lands producing corn or other small grain crops are of critical value to geese and dabbling duck species on a yearlong basis. All wetlands and open water areas can become locally important as high-priority use areas for waterfowl during peak migration periods in the spring (March 15 through May 15) and fall (August 15 through October 15).

The project and adjacent areas provides substantial valued habitat for a multitude of raptors--turkey vulture, bald and golden eagles, five species of falcons (prairie, American peregrine and arctic peregrine falcons; Merlin and American kestrel), seven species of hawks (goshawk, sharp-shinned, Cooper's, red-tailed, Swainson's, rough-legged and marsh hawks), osprey and eight species of owls (barn, screech, flammulated, great horned, pygmy, long-eared, short-eared and saw-whet owls). Many of these species are of high federal interest pursuant to 43 CFR, 3461.1 (n-1). All of these species are of high interest to the State of Utah (Appendix A).

Realistically, nesting habitat does not exist on the project or adjacent areas for many of these species. However, if a species were to nest on or adjacent to the project area, it would have a specific crucial period during which the aerie would need protection from disturbance; this period of time lies between February 1 and August 15. Generally speaking, aeries represent a critical valued site and need protection from significant or continual disturbance within

a one-half kilometer radius of the nest. This consideration need only be implemented during the period of time that the nest is occupied. Species specific protective stipulations for aeries are available from the Utah Division of Wildlife Resources and the U.S. Fish and Wildlife Service.

The current level of data relative to site specific use of the area by raptors is unsatisfactory. Likely, there are aeries that have not been identified. Many of these species are highly sensitive to man's disturbances. Therefore, it is recommended that intensive surveys be initiated on the mine plan and adjacent areas only in proximity to planned surface disturbed areas for determination of locations for raptor aerie territories. Such data may be merged with information provided within this report.

Golden eagles are a common yearlong resident of the mine plan area. To date there are no known active aerie territories associated with the project area. (Note, an aerie territory is utilized by one pair of eagles but may contain several nest sites.) It is believed that golden eagle aerie territories may exist on the project area. This belief is based upon the fact that suitable nesting habitat is widespread on the mine plan area and throughout the local area. It is important to note that the regularity of golden eagle observations and the fact that status is common has resulted in documentation of mostly opportunistic observations of aerie territories.

An active golden eagle nest site is extremely sensitive to disturbance within a one-half kilometer radius. This buffer zone is ranked as being of critical value to maintenance of the eagle population when the bird is actually utilizing the aerie; that period of time is normally between April 15 and June 15. The radius for a buffer zone may need to be increased to one kilometer if a disturbance were to originate from above and within direct line of sight to the eagle aerie.

To date there are no known high-priority concentration areas or critical roost trees for golden eagles on the project area. The mine plan and adjacent areas have been ranked as being of substantial value to golden eagles.

The northern bald eagle is an endangered winter resident (November 15 to March 15) of the local area. To date there are no known high-priority concentration areas or critical roost trees for this species on or adjacent to the project. The mine plan area has been ranked as being of substantial value to wintering bald eagles. Note that no bald eagles are known to nest in Utah, however, historic data documents nesting activity by these birds in the State. There is no known historic evidence of the northern bald eagle nesting on the mine plan or adjacent areas.

The American peregrine falcon (status is endangered) and the prairie falcon (status is common) are yearlong residents of the mine plan and adjacent areas. Each of these species utilized cliff nesting sites. To date there are no known aerie sites for cliff nesting falcons on the project area. However, suitable nesting habitat for the prairie falcon is widespread. Suitable nesting habitat for the American peregrine falcon cannot be found on the mine plan and adjacent areas. The project area has been ranked as being of substantial value to the prairie falcon but only of limited value to the peregrine falcon.

For each falcon their aerie site while being utilized and a one-half kilometer radius would be ranked as being of critical value to maintenance of their populations. The falcon's period of use at the aerie site spans the spring and early summer period--prairie falcon, April 15 to June 30; peregrine falcon, March 1 to June 30.

The level of data relative to site specific use of the project area by cliff nesting falcons (not including the kestrel) is unsatisfactory and there could be aeries that have not been identified. Therefore, it is recommended that intensive surveys be initiated on the area for determination of locations for cliff falcon aerie sites.

The endangered arctic peregrine falcon is a winter resident (November 15 through March 15) of the local area. This species has not been observed to utilize the environs on or adjacent to the mine plan area, however, its occa-

sional presence would not be likely. Therefore, the project area is ranked as being of limited value to this species.

The blue grouse is a yearlong resident of the project area. Adult birds prefer open stands of conifers. During winter the blue grouse feeds exclusively upon needles and buds of douglas-fir and spruce trees. Thus, this wildlife habitat (spruce-fir forest) is ranked as being of critical value to over-winter survival of the population during the crucial period of December through February.

Blue grouse annually exhibit what has been termed a reverse vertical migration. That is, during the spring months, they migrate from the high elevation spruce-fir habitat to lower elevation sagebrush, pinion-juniper or shrubland habitats. This movement is caused by a need of the birds to feed on early developing vegetation. Such movement also facilitates successful breeding, nesting and brooding of their young. Then as the year progresses, they move to the higher elevations.

The males are polygamous and will set up and defend territories for booming and breeding activities against other breeding males. Such territories are critical to maintenance of the population during the crucial period of mid-March through mid-June.

After breeding the female develops a nest site which is secreted on the ground; the nest is of critical value to maintenance of the blue grouse population. Upon hatching, which occurs in late May and early June, the young accompanied by the hen immediately leave the nest. The young blue grouse while being brooded rely heavily on insects for their protein needs during the first several months of development. The adult bird also shifts its diet during this period to include a high proportion of insects. Brooding areas are ranked as being of high-priority value to blue grouse. The crucial period extends from hatching into mid-August.

As summer progresses into the fall season the grouse consumes large quantities of berries.

The ruffed grouse is a yearlong resident of the project area. These grouse are usually found in the continum of habitats extending from aspen to shrubland types. But, during winter they often roost in dense stands of conifers. Generally speaking ruffed grouse prefer habitats lying with 0.25 mile of a stream course; such areas are ranked as being of high-priority value to their population. During winter the ruffed grouse feeds exclusively upon staminate aspen buds. Thus, this wildlife habitat (aspen forest) is ranked as being of critical value to over-winter survival of the population during the crucial period of December through February. During the remainder of the year their diet shifts to include a wide variety of plant and insect material.

Ruffed grouse do not exhibit any type of seasonal migration.

The males are polygamous and will set up and defend territories against other breeding males. The focal point for breeding activity is the drumming log; all such logs are ranked as being of critical value to grouse since they represent sites of historical use. Such territories are critical to maintenance of the population during the crucial period of early March through May.

After breeding the female develops a nest site which is secreted on the ground and deep within an aspen grove; the nest is of critical value to maintenance of the ruffed grouse population. Upon hatching, which occurs in late May and early June, the young accompanied by the hen immediately leave the nest. The young ruffed grouse while being brooded rely heavily on insects for their protein needs during the first several months of development. The adult bird also shifts its diet during this period to include a high proportion of insects. Brooding areas are ranked as being of high-priority value to ruffed grouse. The crucial period for brooding extends from hatching into mid-August.

Agricultural areas and adjoining wildlands associated with the project and adjacent areas may provide yearlong, substantial valued habitats for ringnecked pheasants. Due to the pheasants complete dependency on agricultural systems, all cultivated fields are ranked as being of critical importance to this species.

Pheasants depend primarily on waste grain, corn and other crops for food. They utilize wild grains and insects to a lesser extent. Croplands can provide for all the life requirements of pheasants. High quality habitat must retain adequate cover and food for the birds use throughout the year.

Pheasants initiate nesting as early as mid-April and continue into mid-July. This period of time and successful nesting activities is of crucial importance to the maintenance of the pheasant population.

The chukar is a yearlong resident of the project area. It is important to note that they are an exotic species introduced from Asia during the 1950's. These birds prefer open rocky areas in the cold desert and submontane ecological associations. During summer chukars feed on grass shoots and insects, but during winter their diet is primarily seeds. Their substantial valued habitats are the cliff and tallus type and the associated desert scrub or shrubland types.

The winter season is a crucial period (early December through mid-February) for chukars; the birds concentrate on selected areas. Winter range has been ranked as being of critical value to over-winter survival of the chukar populations. Disturbance on winter range must be avoided when chukars are present.

Chukars are monogamous; the pairs nest between early April and late May. Nest sites are critical to maintenance of the population during the crucial nesting period.

It is important to note that all sources of water within the substantial valued use area for chukars are critical to maintenance of their populations on a yearlong basis.

The American coot may be a summer resident of the project area. Transient individuals are also present during spring and fall migration. The discussions earlier provided for waterfowl also apply to this specie.

The snowy plover is only a transient in the project area during spring and fall migration periods. Since the environs associated with the project would be inhabited only on occasion, they have been ranked as being of only limited value to the snowy plover.

The common snipe is a summer resident of the project area. It may inhabit the project area on a yearlong basis by utilizing wetland habitats along running streams or at seeps that do not freeze over. This specie breeds in late May and early June and nests on the ground in wetland areas. The nest while being utilized is of critical value to maintenance of snipe populations.

Mourning doves normally inhabit the project and adjacent areas, which represents a substantial valued use area for these birds, between May 1 and September 15 each year. They nest throughout most of this period and each pair produces two clutches. The pinion-juniper and riparian habitats are ranked as being of high-priority value for nesting. Locally, mourning doves show two peaks in on-nest activity--early July and early August. Successful nesting activities and any water sources are critical to maintenance of the mourning dove population.

The yellow-billed cuckoo is a summer resident of the project area. This bird only nests in the riparian wildlife habitat, therefore, such areas are of critical value to maintenance of this species. Little is known concerning the yellow-billed cuckoo. Its nest is represented by a frail, saucer shaped structure of twigs and is always placed in bush or tree.

The black swift is a summer resident of the West Tavaputs Plateau. The montane ecological association represents the swift's substantial valued use area. Normally, the bird is associated with a small flock that represents a colony. Black swifts are usually observed soaring as pairs and they feed upon flying insects. A colony's nests are scattered along percipitous terrain where the nest is often secreted behind a waterfall. Such a moist habitat is not known to exist on the project area. Cliff and tallus wildlife habitats are ranked as being of high-priority value to the black swift. There is evidence that pair bonds are long lasting and that a nest may be utilized in successive years.

The belted kingfisher is a yearlong resident of the project area. It is found only along riverine systems and its substantial value use area extends from the cold desert through the submontane and into the montane ecological associations.

Therefore, the riparian wildlife habitat represents a high-priority valued use area for this bird. If feeds exclusively upon fish. The kingfisher's nest is always secreted within a burrow along stream banks, thus, dirt bank habitats along riparian areas are of critical value to this bird.

The pileated woodpecker is a species having high federal interest pursuant to 43 CFR 3461.1 (n-1). The spruce-fir and aspen wildlife habitats of the montane ecological association represent this birds substantial valued use area. It is important to note that the pileated woodpecker has never been documented to utilize the environs of the biogeographic area that surrounds the project site. In areas of the State where the bird is known to exist, it is a yearlong resident with a relative abundance considered to be rare.

The Williamson's sapsucker is another species having high federal interest pursuant to 43 CFR 3461.1 (n-1). Typically, the substantial valued use area for this species is the spruce-fir habitat of the Hudsonian life zone in the montane ecological association. Therefore, the spruce-fir habitat of the Canadian life zone on the project site would only represent the substantial valued use area for the yellow-bellied sapsucker. The yellow-bellied sapsucker is a yearlong resident of the environs associated with the project area and it has a relative abundance considered to be common. Where as the Williamson's sapsucker has never been documented to utilize the environs of the biogeographic area that surrounds the project site. In areas of the State where the Williamson's sapsucker is known to exist, it is a summer resident with a relative abundance considered to be uncommon.

The Lewis woodpecker is also another species having high federal interest pursuant to 43 CFR 3461.1 (n-1). Its substantial valued use area is represented by riparian habitats characterized by cottonwood stands and ponderosa forests. These habitats do not exist on the project site. It is important to note that the Lewis woodpecker has never been documented to utilize the environs of the biogeographic area that surrounds the project site. In areas of the State where the bird is known to exist, it is a summer resident or only a transient. Its relative abundance is unknown.

The purple martin is a summer resident known to inhabit the environs of the biogeographic area that surrounds the project site. In Utah its substantial valued use area is represented by open spruce-fir, aspen or ponderosa forest habitats of the montane ecological association. The purple martin feeds on flying insects and may secret its nest within any suitable above-ground cavity.

The western bluebird is an uncommon summer resident known to inhabit the environs of the biogeographic area that surrounds the project site. Where as the mountain bluebird is a common yearlong resident of the area. Both birds are cavity nesting species. The western bluebird nests from the pinion-juniper habitat of the submontane ecological association up into the lower forest habitats within the Canadian life zone of the montane ecological association. The mountain bluebird utilizes the same continum of habitats for nesting, but also extends its nesting use across the Canadian and Hudsonian life zones and into the Alpine life zone. During winter both species show elevational and longitudinal migrations; they then utilize all habitats associated with the cold desert ecological association. Therefore, the substantial valued use area for each species spans a broad continum of habitats. It is important to note that trees with cavities located on the project area can be of critical value to bluebirds.

Grace's warbler is a species having high federal interest pursuant to 43 CFR 3461.1 (n-1). Its substantial valued use area is shrublands and associated ponderosa forest habitats of the submontane and montane ecological associations. This bird's nest is built twenty or more feet above ground in a ponderosa tree. It is important to note that the Grace's warbler has never been documented to utilize the environs of the biogeographic area that surrounds the project site. In areas of the State where it is known to exist, it is a summer resident with a relative abundance considered to be uncommon.

Scott's oriole is also a species having high federal interest pursuant to 43 CFR 3461.1 (n-1). Its substantial valued use areas are riparian habitats characterized by cottonwood stands and the continum of habitats extending from

the pinion-juniper forest into shrublands of the submontane ecological association. The oriole's nest is characterized as a grassy pouch and is hung in a tree. It is important to note that the Scott's oriole has never been documented to utilize the environs of the biogeographic area that surrounds the project site. In areas of the State where it is known to exist, it is a summer resident with a relative abundance considered to be uncommon.

The grasshopper sparrow is a rare transient species known to inhabit the environs of the biogeographic area that surrounds the project site. It normally frequents dry grassland areas in the desert scrub habitat of the cold desert ecological association during spring and fall migration periods. The project area borders sites that could attract this specie. Since its use of such sites is best described as "occasional", those habitats in the region are only ranked as being of limited value to the bird.

Mammals--Species Occurrence and Use Areas

Eighty species of mammals, of which 22 percent are protected, are known to inhabit the biogeographic area in which the project and adjacent areas are located. It is probable that seventy-seven of these species inhabit the project area (reference the Division Publication No. 78-16). Twenty-seven species of the mammals inhabiting the project area have been determined to be of high interest to the State of Utah (Appendix A).

The dwarf (least) shrew is a yearlong inhabitant of the biogeographic area that surrounds the project site. This animal's substantial valued use area is characterized as open grass covered areas of any wildlife habitat in the submontane and montane (Canadian life zone) ecological associations. Since this shrew has a relative abundance determined to be limited, its use areas should be ranked as being of high-priority value to the animal.

The red bat is a summer resident of the biogeographic area that surrounds the project site. The animal roosts in wooded areas (riparian woods and pinion-juniper forests) of the submontane ecological association. Such areas represent this

animals substantial valued use area. An occasional individual has been known to utilize caves; those individuals could hibernate and remain over winter.

The western big-eared bat is a yearlong resident of the biogeographic area that surrounds the project site. This animal roosts and hibernates within caves, mine tunnels or suitable buildings located in the pinion-juniper, shrubland and low elevation spruce-fir habitats of the submontane and montane (Canadian life zone) ecological association. Such areas represent this bat's substantial valued use area.

The spotted bat may inhabit the environs of the project area. To date, little else is known of this specie.

The snowshoe hare is a yearlong resident of the biogeographic area that surrounds the project site. Its relative abundance has been determined to be limited, since its substantial valued use area is restricted to the spruce-fir and nearby aspen and riparian habitats of the montane (Canadian and Hudsonian life zones) ecological association. Such areas are ranked as being of high-priority value to the animal during its breeding season which spans the period between early April and mid-August.

The cottontail rabbit (mountain cottontail inhabits sites lying between 7,000 and 9,000 feet in elevation and the desert cottontail inhabits sites lower than 7,000 feet in elevation) is a yearlong resident of the biogeographic area that surrounds the project site. The entire project area represents a substantial valued use area for cottontails. Their young are born between April and July. This is a crucial period for maintenance of the cottontail population.

The northern flying squirrel is a yearlong resident of the biogeographic area that surro-nds the project site. Currently, its relative abundance is unknown. Its substantial valued use area is restricted to spruce-fir or other mixed conifer habitats of the montane (Canadian and Hudsonian life zones) ecological association. This specie is the only nocturnal squirrel in Utah. The flying squirrel may build its nest within an old woodpecker hole or it may build an outside nest of leaves,

twigs and bark. Mating occurs twice in each year--February through March and June through July. Afterwhich, two to six young are born after a gestation period of 40 days--April through May and August through September. These periods are of crucial value to maintenance of their populations. During winter flying squirrels are gregarious; 20 or more have been known to den together.

Beaver are yearlong inhabitants of the biogeographic area that surrounds the project site. Their substantial valued use area is restricted to riparian and adjacent aspen habitats (those located within 100 meters of the riparian zone) in the cold desert, submontane and montane (Canadian life zone) ecological associations. These animals construct a conical shaped lodge in which a family group lives throughout the year. The lodge is of critical value to maintenance of the beaver population. One litter of kits is produced each year; they are born between late April and early July after a gestation period of 128 days. Kits and yearlings coinhabit the lodge with the adult pair. When they attain 2 years of age they are forced to leave; females can breed at 2.5 years of age. Due to the animals dependency upon flowing water and the associated riparian vegetation, the riparian wildlife habitat is ranked as being of critical value to beaver populations.

The red fox and kit fox are yearlong inhabitants of the biogeographic area that surrounds the project site. The substantial valued use area for the red fox would include all wildlife habitats extending from the cold desert through the montane (Canadian life zone) ecological associations. The substantial valued use area for the kit fox is restricted to all of the habitats of the cold desert ecological association and extends into the sagebrush and pinion-juniper habitats of the submontane ecological association. Almost nothing is known of their population dynamics. Without doubt a crucial period for both species is when they are caring for young in the den. Dens while being inhabited are a critical use area.

The gray wolf is a historic inhabitant of the biogeographic area that surrounds the project site. Currently its relative abundance is so low that the animal is listed as endangered with extinction. The wolf's substantial valued

use area would be represented by any remote habitat in any ecological association.

Black bears are inhabitants of the biogeographic area that surrounds the project site. Their substantial valued use area is represented by all natural wildlife habitats (excluding the pasture and fields and urban or park types) extending from the submontane into the montane (Canadian and Hudsonian life zones) ecological associations. These animals go into a semi-hibernation during winter. During this crucial period, which may last from December through March, the animal secrets itself in a den in order to conserve body energy reserves. The young are born in the den during January or February. Dens while being inhabited represent a critical valued use area for bears.

Many of the members of the family mustelidae are known to inhabit the biogeographic area that surrounds the project site. They are all protected and classified as furbearers--short-tailed and long-tailed weasels, mink, wolverine, black-footed ferret, marten, badger, striped and spotted skunks and the river otter. Additionally, raccoon and muskrat, although not furbearers, are also inhabitants of the biogeographic area that surrounds the project site. All of these species are of high interest due to their value in the fur market.

The substantial valued use area for short-tailed and long-tailed weasels, mink, river otter, muskrat and raccoons is the riparian habitat. Weasels, which are inhabitants of the project site, do make some use of other habitats that are proximal to riparian zones. Muskrats and raccoons are restricted to riparian habitats of the cold desert and submontane ecological association; thus, they are not found on the project area. The long-tailed weasel can be found from the cold desert up into the montane (Canadian and Hudsonian life zones) ecological associations. The short-tailed weasel, river otter and mink populations extend their use from the submontane into the montane ecological association. It is important to note that the weasel is restricted to the Canadian life zone; where as the river otter and mink utilize the Canadian and Hudsonian life zones. The river

otter is not known to inhabit the environs of the project area, but mink are present.

The substantial valued use area for marten and wolverine is the montane ecological association. The marten does not utilize the Alpine life zone but the wolverine can be found at that elevation. The wolverine may be found in the environs of the project site, but it is unlikely that the marten is present.

The black-footed ferret is a species primarily dependent upon prairie dogs as a prey source. Currently, the ferret's relative abundance is so low that the animal is endangered with extinction. Utah lies on the western edge of the black-footed ferrets historic range. The substantial value use area for this specie is restricted to prairie dog colonies. Prairie dog colonies are found within a multitude of wildlife habitats within the cold desert, submontane and montane (Canadian life zone) ecological associations. It should be noted that the project site does not provide habitat for prairie dogs; thus ferrets would also be absent.

The substantial valued use area for badger and skunks span all wildlife habitats other than dense forests in the cold desert, submontane and montane (Canadian life zone) ecological associations. Skunks show some afinity for habitats proximal to water. Skunks and badgers are dependent upon a suitable prey source.

A crucial period for maintenance of all furbearers, raccoons and muskrat populations is when they have young in a nest, den or lodge. Such sites are critical for reproductive success.

Bobcat, Canada lynx and cougar are known to inhabit the biogeographic area that surrounds the project site. For all of these species a crucial period for maintenance of their population is when the female has her young secreted at a den site. Such sites are of critical value when being utilized. It is also crucial to their survival that a female accompanied by young not be killed or harassed.

The substantial valued use area for bobcats extends from the cold desert through the submontane and into the montane (Canadian life zone) ecological as-

sociation. The bobcat is normally associated with percipitous terrain, but has been observed in every wildlife habitat within the aforementioned ecological associations. Their primary prey source is represented by small mammals and birds or any other small animal they can catch. It is important to note that bobcats occasionally do kill the young of big game animals.

The substantial valued use area for the Canada lynx is restricted to the Canadian and Hudsonian life zones of the montane ecological association. Normally, this cat would only be expected to utilize riparian and forested wildlife habitats. The lynx is similar in predation habits to the bobcat.

The substantial valued use area for the cougar (locally known as mountain lion) extends from the submontane into the montane (Canadian and Hudsonian life zone) ecological association. Due to the dependency of the cougar upon mule deer as a prey source, a ranking of the lion's seasonal distribution parallels that of the deer.

Mule deer are inhabitants of the biogeographic area that surrounds the project site. Their substantial valued use area spans all wildlife habitats extending from the cold desert through the submontane and montane ecological associations. In some situations deer show altitudinal migrations in response to winter conditions. There are, however, habitats where deer reside on a yearlong basis.

Migration of mule deer from summer range to winter range is initiated during late October; probably, the annual disturbance of the fall hunting season coupled with changing weather conditions is the initial stimulus. The onset of winter weather reinforces the deer's urge to migrate and continued adverse weather keeps the deer on the winter range.

A portion of the project site represents winter range for mule deer herd unit 27b. Winter ranges for mule deer are all ranked as being of high-priority value to the animal; these areas are usually inhabited between November 1 and May 15 each year. During winters with severe conditions the higher elevation portion of the winter range becomes unavailable to deer due to snow depth. Tradi-

tionally, some restricted portions of the winter range have shown concentrated use by the deer; these sites are ranked as being of critical value. Critical valued sites must be protected from man's disturbance when the deer are physically present on the range.

Deer begin their migration back to summer range during mid-May and remain there throughout October. Summer ranges on the project area represent deer herd unit 27b. They are ranked as being of high-priority value to mule deer. In instances where extent of summer range is the major limiting factor for a deer herd, those summer ranges are ranked as being of critical value.

There are ranges lying southwest of the project area that support mule deer on a yearlong basis. Most of these ranges are of limited value to deer. However, there are some areas supporting yearlong use that are ranked as being of high-priority value to deer. Within the yearlong range all riparian habitats are ranked as being of critical value to mule deer.

Mule deer fawn during the month of June. The continum of wildlife habitats extending from the pinion-juniper through the shrubland and into the aspen type probably represents the fawning area. All riparian areas are of critical value for fawning and maintenance of the deer population. To date no specific areas showing annual use for fawning are known. It is probable that such areas exist; they would be ranked as being of critical value to deer. It is important to note that June represents a crucial period for maintenance of deer populations.

Agriculture areas nearby to the project area are utilized yearlong by mule deer. Their use is sometimes intensified during the winter and spring periods.

Rocky mountain elk are inhabitants of the biogeographic area that surrounds the project site. Their substantial valued use area spans all wildlife habitats extending from the submontane through the montane ecological association. Elk do not show as strong of altitudinal migration as mule deer do in response to winter conditions, but they do migrate to wintering areas.

Migration of elk from summer range to winter range is initiated during late

October; probably, the annual disturbance of the fall hunting seasons coupled with changing weather conditions is the initial stimulus. The onset of winter weather reinforces the elk's urge to migrate and continued adverse weather keeps elk on the winter range.

A portion of the project site represents winter range for the Range Creek elk herd. Winter ranges for elk are all ranked as being of high-priority value to the animal; these areas are usually inhabited between November 1 and May 15 each year. During winters with severe conditions some portions of the winter range becomes unavailable to elk due to snow depth. Traditionally, some restricted portions of the winter range have shown concentrated use by the elk; these sites are ranked as being of critical value. Note, that critical valued wintering sites have not yet been identified for the Range Creek herd. Critical valued sites must be protected from man's disturbance when the elk are physically present on the range.

Elk begin their migration back to summer range during mid-May and remain there throughout October. Summer ranges on the project area support the Range Creek elk herd; they are ranked as being of high-priority value.

Elk calf during the month of June. Their preferred calving areas are best described as aspen forests with lush understory vegetation. All riparian areas on the summer range are of critical value for calving and maintenance of the elk population. To date no specific areas showing annual use for calving are known. It is probable that such areas exist; they would be ranked as being of critical value to elk. It is important to note that June represents a crucial period for maintenance of elk populations.

Pronghorn antelope representing the Icelander herd are inhabitants of the biogeographic area immediately west of the project site. Their substantial valued use area spans all wildlife habitats except urban and park areas in the cold desert and extends up into the pinion-juniper forest of the submontane ecological association. It is unlikely that antelope would extend their use on the project area. In some situations antelope show longitudinal migrations in response to winter

conditions. There are, however, habitats where antelope reside on a yearlong basis.

During winter and at times of severe snow conditions the portion of the range inhabited by antelope is ranked as being of critical value. During such a crucial period antelope must be protected from man's disturbance.

Within the yearlong range all riparian habitats are ranked as being of critical value to antelope.

Antelope kid during the month of June. This activity takes place in the area they happen to be when the time for birth occurs. The doe secrets herself from disturbance and predators and drops her kid. The young animal is capable of following the female in a few hours. Protection of the kid antelope from disturbance during the first day following birth is critical for maintenance of antelope populations.

Rocky mountain and desert bighorn sheep are inhabitants of the biogeographic area that surrounds the project site. The substantial valued use area for the rocky mountain subspecies spans all wildlife habitats (except the urban and parks habitat) extending from the submontane through the montane ecological association. The substantial valued use area for the desert subspecies spans all wildlife habitats (except the urban and parks habitat) in the cold desert and submontane ecological associations. In some situations bighorns show altitudinal migrations in response to winter conditions. There are, however, habitats where they reside on a yearlong basis.

Migration of bighorn sheep from summer range to winter range, in locals where this phenomenon exists, is initiated during the rut. Probably the change of weather conditions is the initial stimulus. The onset of winter weather reinforces the sheep's urge to migrate and continued adverse weather keeps them on the winter range; at which time that weather conditions allow, the bighorns then begin to migrate back to the summer range.

The environs associated with the project area support low numbers of the Range Creek rocky mountain bighorn herd on a yearlong basis. Desert bighorns

have not and will likely never extend their range onto the project area. Generally speaking, about 70 percent of the yearlong range is of limited value to sheep; such areas represent the less precipitous terrain within their substantial valued use area. The remaining 30 percent of the bighorn's yearlong use area is ranked as being of high-priority value; such areas are represented by precipitous terrain and adjacent habitats. Note, all riparian habitats within the bighorn's substantial valued use area are ranked as being of critical value.

Bighorns annually rut between November 1 and December 31. This is a crucial period for maintenance of their population.

Bighorn sheep lamb during the months of May and June. The cliff and tallus wildlife habitats represents a critical valued lambing area during the crucial period of mid-May through mid-June. To date no specific areas showing annual use for lambing are known. It is probable that such areas exist. It is important to note that May and June represents a crucial period for maintenance of sheep populations.

Currently, there are no other known high interest wildlife species or their habitat use areas on or adjacent to the project area. It is not unreasonable to suspect that in the future, some additonal species of wildlife may become of high interest to the local area, Utah or the Nation. If such is the case, the required periodic updates of project permits and reclamation plans can be adjusted and appropriate recommendations made.

Table ...ing of value per ecological association ... ...bitats of vertebrate species having high... to ...state of Utah. Crucial-critical (C) habitat... ...highest valued followed in respective order ... ...gh-priority (H), substantial value (S) and limited valued (L) habitats.

Ecological Association	Wildlife Habitats											
	Riparian and Wetland	Desert Scrub	Pasture and Fields	Urban or Parks	Cliffs and Talus	Sagebrush	P-J Forest	Shrubland	Aspen Forest	Ponderosa Forest	Parkland	Spruce-fir Forest
					LOWER SONORAN LIFE ZONE							
Warm Desert	This ecological association does not exist in the Southeastern Region											
					UPPER SONORAN LIFE ZONE							
Cold Desert	C(H^1,S^2)	S	S	S	H							
					TRANSITION LIFE ZONE							
Submontane	C(H^1,S^2)		S	S	H	S	S	S				
					CANADIAN LIFE ZONE							
Montane	C(H^1L^2)		S	L	S				S	S	S	S
					HUDSONIAN LIFE ZONE							
Montane	H(S^1,L^2)				S							S
					ALPINE LIFE ZONE							
Montane	This ecological association does not exist in the Southeastern Region											

This Table represents a summation of effort where by numerical values were assigned as a ranking per high interest specie to each wildlife habitat. The numerical values were as follows: critical, 1; high-priority, 2; substantial, 3; and limited, 4. Once the individual values were assigned they were then summed and a mean calculated, for each wildlife habitat. A mean value lying between 1.0 and 1.8 was ranked as critical; a value between 1.9 and 2.3 was ranked as high-priority; a value between 2.4 and 3.4 was ranked as substantial; and a value between 3.5 and 4.0 was ranked as limited.

1. Habitat ranking value for species associated with the riparian-wetland type that represents just the wet meadow situation.
2. Habitat ranking value for species associated with the riparian-wetland type that represents just the dirt bank situation.

Table 2. Ranking of wildlife value per legal section of land on coal producing lands in Utah. Crucial-critical (1), sections are the highest valued followed in respective order by high-priority (2), substantial value (3) and limited valued (4) sections.

BOOK CLIFFS

T.	R.	Section	Rank
12	8	1-36	1
12	9	2,4-12,14,16-18,31-35	1
		1,3,13,15,19-30,36	2
12	10	2-11,13-17,19-27	1
		1,12,18,28-36	2
12	11	16-28,33-35	1
		1-15,29-32,36	2
12	12	19,27-30,32-34	1
		1-18,20-26,31,35,36	2
13	8	1-3,5-16,19,20,22-24,28-31	1
		4,17,18,21,25-27,32-36	2
13	9	1-11,14,15,17,18,28,29,31-35	1
		12,13,16,19-27,30,36	2
13	10	1,2,6	1
		3-5,7-36	2
13	11	14-16,21-28,34-36	1
		1-13,17-20,29-33	2
13	12	4,19,30,31,[illegible]	1
		1-3,5-18,20-29,32-35	2
13	13	1-36	2
14	13	1-36	2
14	14	33	1
		1-32,34-36	2
15	14	1-21,23-26,28-36	2
		22,27	3
16	14	24-26,35,36	1
		1-23,27-34	2
16	15	3,10,11,14,23-25,29-33	1
		1,2,4-9,12,13,15-22,26-28,34-36	2
17	14	1,12,13,24,25,36	1
		2,3,10,11,14,15,22,23,26,27,34, 35	2
17	15	4-9,16-22,27-34	1
		1-3,10-15,23-26,35,36	2
18	14	1,27	1
		2,3,10-15,22-26,34-36	2
19	15	4-10,15-18	1
		1-2,11-14,19,21-25,30-32	2
		3,20,26-29,33-36	3

HENRY MOUNTAINS

T.	R.	Section	Rank
27	9	1-36	1
30	9	25,32-36	3
		19-24,26-31	4
30	10	20-29,32-36,	1
		19,30,31	3
31	8	1,7,12,13,18,19,24,25,30,31,36	3
		2-6,8-11,14-17,20-23,26-29,32-35	4
31	9	4-9,16-21,28-33	3
32	8	30,31	2
		1,6,7,10-15,18,20-29,33-36	3
		2-5,8,9,16,17,19,32	4
32	9	1,12,13,24,25,35,36	1
		2-11,14-23,26-34	3
33	8	6-8,12-14,17-20,22-36	2
		1-4,9-11,15,16	3
		5,21	4
33	9	1-3,9-17,20-28,34-36	1
		7,18,19,29-32	2
		4-6,8,33	3
34	8	1-3,10-13,15	2
		14	3
34	9	3	1
		2,5-11,13,14,16-19	2
		1,4,12,15,20-24,26-28	3
		25,29-36	4
34	10	1-23,26-30,32-34,36	2
		24,25,35	3
		31	4

KAIPAROWITS PLATEAU

T.	R.	Section	Rank
34	1	26,27,34-36	1
		25,33	2
		19-25,29-32	3
34	2	28,31-33	1
		19-21,29-30	3
34	3	1-3,10-14,24	1
		4-9,15-23,25-36	2
34	2	4-7,17,18,20,21,28,29	1
		8,9,16,19,30-33	2
35	2W	3-10,16-19	1
		2,11,14,15,20-23,27-32	2
		1,12,13,24-26,33-36	3

KAIPAROWITS PLATEAU (CONTINUED)

T.	R.	Section	Rank
35	1	1-34	2
		35-36	3
35	2	4-9,16-20,25	2
		21-24,26-36	3
35	3	30-32	2
		19-29,33-36	3
36	3W	1-3,10-12,14,15	2
		13	4
36	2W	1-6,8-12	3
		7,13-18,22-27,34-36	4
36	1W	36	1
		1,24-26,35	2
		2-23,27-34	3
36	1	4-9,19-36	2
		1-3,10-18	3
36	2	30,31	2
		1-29,32-36	3
36	3	5,8,17,20,21,27,28,33-35	2
		1-4,6,7,9-16,18,19,22-26,29-32, 36	3
37	1W	1,2,11-14,23-26,35,36	2
		3-10,15-22,27-34	3
37	1	1-36	2
37	2	6,7,12,13,17-20,24,25,29-32,36	2
		1-5,8-11,14-16,21-23,26-28, 33-35	3
37	3	1,2,6-9,12,15-23,25-36	2
		3-5,10,11,13,14,24	3
37	4	20,21,28-33	2
		19	3
38	1W	1-3,11-14	2
		4-10,15-18	3
38	1	1-18,22-27,34-36	2
38	2	17	1
		1,4-9,12,13,16,18-21,24,25,28-33, 36	2
		2,3,10,11,14,15,22,23,26,27,34, 35	3
38	3	1-36	2
38	4	2-36	2
		1	4
38	5	19-22,26-36	2
		23-25	4
39	1	1-18,22-27,34-36	2
39	2	1,2,4-9,11-20,22-36	2
		3,10,21	3
39	3	1-36	2
39	4	1-36	2
39	5	1-36	2
40	2	1-36	2
40	3	1-36	2
40	4	1-36	2
40	5	1-36	2
40	6	4-9,16-21,28-33	2
41	2	1-30	2
		31-36	3
41	3	31-36	1
		1-21,29,30	2
		22-28	3
41	4	31-36	1
		1-17,20-28	2
		18,19,29,30	3
41	5	31-33	1
		1-9,11-14,18,23-26,35,36	2
		10,15-17,19-22,27-30,34	4
42	1W	13-36	1
		4,9	2
		1-3,5-8,10-12	4
42	3	1-36	1
42	4	1-36	1
42	5	2-36	1
		1	2
43	3	1-11,14-18	1
		12,13	4

WASATCH PLATEAU NORTH

T.	R.	Section	Rank
12	6	1-26,29,31,34-36	1
		27,28,30,32,33	2
12	7	1-15,17-36	1
		16	3
12	8	1-36	1
13	6	1,2,5-8,10,13,17-20	1
		3,4,9,11,12,14-16,21-36	2
13	7	1-4,9-17,19,22-26,31,32,35,36	1
		5-8,18,20,21,27-30,33,34	2
13	8	1-3,5-16,19,20,22-24,28-31	1
		4,17,18,21,25-27,32-36	2

WASATCH PLATEAU NORTH (CONTINUED)

T.	R.	Section	Rank
14	6	28-33	1
		1-27,34-36	2
14	7	1,4-6,9,12,13,16	1
		2,3,7,8,10,11,14,15,17-36	2
15	6	4-6,10-15,22-24	1
		1-3,7-9,16-21,25-36	2
15	7	32-36	1
		1-31	2
15	8	9,15,20-22,27-29,32,33	1
		1-8,10-14,16-19,23-26,30,31,34	2
16	6	11,13,14,16,20-26,28,29,31-33, 36	1
		1-10,12,15,17-19,27,30,34	2
16	7	1-5,9-16,21-28,34-36	1
		6-8,17-20,29-33	2
16	8	4,7,9,17-21,28-31	1
		1-3,5,6,8,10-16,22-27,32-36	2
17	6	4-9,11-14,16-22,24-35	1
		1-3,10,15,23,36	2
17	7	1,2,7,12,18,19,25,30	1
		3-6,8-11,13-17,20-24,26-29,31-	2
17	8	5,6,16,19	1
		4,7-9,17,18,20,21,28-33	2
18	6	1-3,10,11,13-15,22-27,34-36	1
		12	2
18	7	4,5,7-11,13-17,19-27,29-32,34-	1
		1-3,6,12,18,28,33	2
19	6	1-3,10-15,22-27,34-36	1
19	7	1-3,5,23,27-34	1
		4,24-26,35,36	2

WASATCH PLATEAU SOUTH

T.	R.	Section	Rank
20	5	20-29,31-36	1
		19,30	2
20	6	19-36	1
21	4	1-3,10-15,19-36	1
		4-9,16-18	2
21	5	1-36	1
21	6	4-9,16-21,28-33	1
22	3	1-3,10-15,22-27,34-36	1
22	4	1-4,9-16,21-28,33-36	1
		5-8,17-20,29-32	2
22	5	1-20,22-24,29-30	1
		21,25-28,31-36	2
23	3	1,12,13	1
		2,3,10,11,14,15,22-27	2
		34-36	3
23	4	2-4,6-11,14-18,20-29,31-36	1
		1,5,12,13,19,30	2
24	4	2,4-9,16-18	1
		1,3,10-15	2

This Table represents a su
mation of work published i
1977 as a "Ranking of Wild
life Values on Federal Coa
Lands". Robert W. Scott
performed the work as a Di
sion of Wildlife Resources
ployee under contract (No.
14-16-006-3125) for the U.
Fish and Wildlife Service.
Scott's procedure ranked h
itat use areas as critical
high-priority, substantial
and limited value for sele
individual species of high
interest. Afterwhich the
dividual values were evalu
ated per legal section of
land and a cummulative val
was determined.

UMC 784.21; FISH AND WILDLIFE PLAN
KAISER STEEL CORPORATION, SUNNYSIDE MINING PROJECT

Mitigation and Impact Avoidance Procedures General to All Wildlife

Utah Division of Wildlife Resources provides the following recommendations in order to minimize disturbances and impacts on wildlife and their habitats that could be impacted during developmental, operational and reclamation operations at the Company's mining project. The recommendations address how enhancement of the wildlife resource and their habitats as discussed in UMC 783.20 can be achieved. They are also consistent with the performance standards of UMC 817.97. In instances where it would be necessary to restore or could be beneficial to enhance or develop high value habitats for fish and wildlife, recommended plant materials and rates of application are provided as "Appendix B" (UMC 817.97 and UMC 817.111 through 817.117). This list should prove useful in meeting the additional requirements to be imposed upon the operator if the primary or secondary land use will be for wildlife habitats (UMC 817.97 d 9). Additionally, "Appendix C" represents a list of commercial sources for plant materials.

The project and adjacent areas are represented by eleven basic wildlife habitats which are inhabited on occasion and during different seasons of the year by about 296 species of vertebrate wildlife. The wildlife habitats and use areas for the "high interest" species from this group of wildlife have been ranked into four levels of importance. The most valuable to an individual species or ecological assemblage are the critical sites followed in respective importance by high-priority, substantial value and limited value sites. Each type of use area requires various and specific levels of protection from man's activities. Additionally, due to the variability of vegetation communities in each use area, various and specific technologies in site development will need to be evaluated for possible

mitigations, enhancements of wildland habitats or the required level of reclamation. It is recommended that all land clearing impacts be designed so that irregular shaped openings are created in contrast to openings that would have straight edges.

It is recommended that the Company make significant efforts to educate all employees associated with their coal handling operation of the intricate values of the wildlife resource associated with the project and adjacent areas and the local area. Each employee should be advised not to unnecessarily or without proper permits harass or take any wildlife. (Apprehension of wildlife violators has increased by nearly 250 percent during recent years in the region). It is especially important that wildlife not be harassed during winter periods, breeding seasons and early in the rearing process. Exploration should be limited as much as possible during these crucial periods.

During winter wildlife are always in a depleted condition. Unnecessary disturbance by man causes them to use up critical and limited energy reserves which, often times, results in mortality. In less severe cases, the fetus being carried by mammals may be aborted or absorbed by the animal, thus reducing reproductive success of a population.

During breeding seasons, disturbance by man can negatively affect the number of breeding territories for some species of wildlife. Disturbance can also interrupt courtship displays and preclude timely interactions between breeding animals. This could result in reduced reproductive success and ultimate reductions in population levels.

Early in the rearing process, young animals need the peace and tranquility normally afforded by remote wildlands. It is also during this crucial period that young animals gain the strength and ability to elude man and other predators. This allows the young animal to develop in relatively unstressed situations and to utilize habitats that are secure from predators. Disturbance by man can compromise

this situation and result in abandonment of the young by the female, increased accidents that result in mortality to young animals or increased natural predation. It is recommended that employees be cautioned against disturbing young animals or females with young if accidentally located.

Employees associated with coal handling operations should be instructed that when wildlife are encountered during routine work that they not stop vehicles for viewing purposes. Moving traffic is less disturbing to wildlife than traffic that stops or results in out-of-the-vehicle activities. If viewing is desirable, the vehicle should only be slowed, but not stopped.

Hunting and other state and federal wildlife regulations must be adhered to by sportsmen utilizing the project area.

Mitigation and Impact Avoidance Procedures for Aquatic Wildlife

There are no recommendations for a wildlife plan that would enhance the fisheries associated with the Company's operation.

If ultimate operations are planned or occur that could physically or chemically impact any perennial stream beyond the impact of mere crossings, detailed reclamation plans will be required. Permanent culvert crossings exceeding a width of eight feet must have a natural bottom and may need devices for reducing stream velocity so that fish migration will not be blocked. A reclamation plan for a stream or lake would have to provide for measurement of the physical characters of the water prior to disturbance. Such measurements should consider surface water information required in SMC 779.16, data on stream velocity, gradient, width, depth, pool-riffle ratio and substrata types.

Reclamation that would achieve development of a lake bed or stream channel similar in character to that which existed prior to disturbance should result in natural re-establishment of macroinvertebrates, macrophytes and a fish population. If merited, the Division could then introduce desired fishes into those waters. This would adequately mitigate for disturbance and temporary loss of aquatic resources. There would be no mitigation for displacement and possible loss of other

wildlife species dependent upon the aquatic wildlife as a prey source. It is believed that impacts on such species would not be significant.

It is also recommended that adequate precautions be taken to keep all forms of coal or other sediments from being inadvertently deposited along or within perennial stream channels. Similar precautions should be taken to preclude deposition of coal particles or sediments in or along other drainages from which the material could be transported during a precipitation event into a perennial stream. This would include blow-coal from haulage trucks, railroads or other transportation systems and storage piles. Control of larger coal particles from the above sources is equally important to control of fugitive dust. If needed, haulage vessels or storage sites should be covered, or the surface of the coal appropriately sprayed in order to solidify it against wind movement. Travel speeds of haulage vessels could be reduced so that coal is not allowed to leave the transportation system. The impacts of coal or other sediments on aquatic ecosystems are many and varied; therefore, sediments must be kept out of those systems.

Utah Division of Wildlife Resources reaffirms all of the recommendations in UMC 817.41 through 817.57 and UMC 817.126 for protecting the State's waters and their associated riparian and wetland zones along with the aquatic wildlife resource.

Mitigation and Impact Avoidance Procedures for Terrestrial Habitats

It is recommended that all wetland and riparian habitats be maintained. Roads and other facility developments should not destroy or degrade these limited, highly productive and unique habitats. Roads crossing through those areas should do so in a manner that is least damaging to the habitat. Wetlands and riparian habitats are ranked as being of critical value and are the most productive sites in terms of herbage and biota produced as compared to other local habitat types. It is probable that a majority of the vertebrate wildlife that inhabit the project area make some use of riparian or wetland areas.

It is important to note that roads and other surface facilities to be constructed should as far as practicable be placed at sites where they will not

compromise wildlife or their use areas. Also, surface facilities, including roads, should be screened if possible from wildlife use areas by vegetation or terrain.

In situations where wildland habitats have been or will be disturbed, reclamation is required. Also, there are sites where development or enhancement of wildland habitats through vegetation treatments and/or seedings and transplants of seedlings could benefit wildlife. "Appendix B" depicts the Division's recommendation for plant materials to be utilized for various wildlife habitats on wildland treatments that are intended to benefit wildlife. If circumstances arise where seed or seedling transplants for a recommended plant species are not available, suitable alternates are also recommended.

Seedling transplants from nursery stock as well as nearby rangelands would also be acceptable for some wildland treatments.

Appendix C represents an exhaustive list of commercial sources for plant materials for use in wildland treatments.

Temporary control of rodents may be required to ensure a successful rangeland treatment. It is recommended that the county agent be consulted in this area of concern. Poisoned oats are the most common and acceptable method for rodent control; however, only licensed persons may apply the treatment.

Currently, there are some new concepts in methodology for revegetation that are being successfully implemented in other parts of the nation and world. One promising method is a procedure where a large scoop removes, from a natural and stabilized site, a small area of earth intact with vegetation and subsurface soils for placement on a site to be restored. This same procedure can be utilized when disturbing pristine sites, except that the native vegetation is stored for use in latent reclamation. Another meritorius method for stimulating natural revegetation, in combination with other reclamation techniques, is to plan facility developments so that islands of natural, native vegetation remain. This will allow for natural vegetation to spread from the islands. These techniques can also be useful for

enhancement of poor quality sites that currently exist on the mine plan area.

Encapsulation of seed and fertilizer for several releases over a period of years after a single application is a new and possibly advantageous procedure. This technique along with soil stabilizing structures has been successfully used in South Africa. Dr. J. Van Wyk in the Department of Botany at Potchetstroom University in South Africa could provide additional information on this new technique.

There are also new specialized techniques coming to the forefront for stabilization of problem sites such as roadbanks and steep slopes. It is important that these sites be promptly and permanently revegetated in order to reduce siltation into local riverine systems. This will mitigate for damage to aquatic wildlife populations and habitats from siltation. Enhancement of existing problem sites or reclamation of disturbed sites can mitigate for salt loading of local river systems. It is believed that natural, nonpoint sources represent 50 percent of the salinity in the upper basin of the Colorado River system into which this mine plan area drains.

It is recommended the Company make numerous contacts with appropriate agencies, institutions and persons to ensure that enhancement or reclamation projects achieve the required degree of permanency, plant diversity, extent of cover and capability of regeneration to ensure plant succession. Generally speaking, seeding should be accomplished as late in the fall as possible. Seedling transplants need to be coordinated with local soil moisture conditions which are usually at optimum in the early spring just as the snow melts.

It is paramount that suitable vegetation be maintained and/or re-established if the life requirements of wildlife are to be satisfied in the postmining period. Success in this area of concern along with cessation of man's disturbances will likely result in a natural reinvasion and the resultant inhabitation by most wildlife species of an impacted site.

It is important to note that enhancement or reclamation projects that are

to benefit wildlife must be properly designed so that all the life requirements of the target species are considered in conjunction with forage. Water must be provided or be present and thermal cover along with escape and hiding cover has to be in abundance. Loafing areas and travelways between the many types of use areas must also be provided. In order to meet these goals, a considerable degree of consultation will be required between the Company and Utah Division of Wildlife Resources.

As a service and also to ensure that the needs of wildlife are met, the various expertism within the Division of Wildlife Resources are available to the Company for consultation. For the most part, Larry Dalton, Resource Analyst, for the Southeastern Regional office at 455 West Railroad Avenue in Price, Utah 84501 (phone 637-3310) will coordinate any needed contacts. Richard Stevens, Wildlife Biologist, at the Great Basin Research Center, Box 704, in Ephraim, Utah 84627 (phone 283-4441) is available for consultation and site specific analysis concerning species for vegetation plantings, timing and techniques to achieve the best results.

In instances where revegetation projects are to be planned over coal waste areas, heavy metal uptake by the plants must be evaluated. It is recommended that the Company initiate an appropriate long-term monitoring program to determine the magnitude and resolutions, if needed, for this problem.

It is recommended that persistent pesticides not be utilized on the project area. Other alternate pesticides or forms of control should be utilized.

All hazards associated with the project operation should be fenced or covered to preclude use by wildlife; of special concern would be sites having potential to entrap animals or toxic materials.

Mitigation and Impact Avoidance Procedures for Amphibians and Reptiles

Enhancement or development of habitats that provides a diversity of vegetation will benefit amphibians and reptiles. It is important to note that all of these species are protected by Utah law. Due to the myriad and myths that

surround these animals, it is urged that individual specimens not be destroyed. This is especially true for snakes since they are a valuable component of the ecosystem.

Snake dens are ranked as being of critical value to the population and are protected by law. If a den is located, it should be reported to the Utah Division of Wildlife Resources. Snake dens can be moved, but only with intensive efforts that may take a year or more (snakes are caught and removed in the spring and fall). Thus, construction of facility developments may take place in denning locations if there is sufficient lead time to relocate the occupants.

Mitigation and Impact Avoidance Procedures for Avifauna

It is recognizable that development and operation of a mining project will in some cases negatively impact many avian species through physical destruction of habitats and continual disturbance that makes other habitats unavailable or less desirable to an individual bird. It is also true that impacts that are negative to one species may be beneficial to another species. It is recommended that the Company plant native and/or ornamental berry producing shrubs around surface facilities. When mourning doves are a target species, sunflowers or blazing star should be planted. This will provide food and cover for many of the smaller species of birds, resulting in enhancement of their substantial value and high-priority habitats. This action would also mitigate for disturbances and destruction of avifauna habitats at other sites associated with project operations.

It is important to note that the nests of all avifauna (except the house sparrow, starling and ferral pigeon) when active and their eggs are protected by federal (Federal Migratory Bird Treaty Act) or state laws (Utah Code 23-17-1 and 23-17-2). All avifauna utilize a nest during their reproductive process. Dependent upon the species, some nests are well developed while others may be represented by only a scrape on the ground. These sites when being utilized are critical to maintenance of individual bird populations; each species has a

specific crucial time period in which the nest is occupied. It is during this crucial period that the nest must be protected from disturbance.

Riparian and wetland areas need to have complete protection from disturbance between mid-March and mid-June due to the crucial nesting season of waterfowl. Disturbance should be significantly limited from mid-June through mid-October in order to protect the high-priority habitat values for brooding, moulting and migrating waterfowl.

Several species of raptors frequent the project area. Their nests when active should not be disturbed and abandoned stick nests are never to be damaged. Every effort should be made to eliminate man's disturbance within visual sight or one-half kilometer radius of an active raptor nest. This distance would have to be increased to a one kilometer radius if the cause for disturbance were to originate within view and from above the nest. This effort is demanded in the instance of golden eagles and cliff nesting falcons since they are sensitive to disturbance and could abandon the nest. Termination of man's use of a site would not be required if eagles or falcons constructed their nest after mining had been initiated, since it would demonstrate the individual bird's willingness to tolerate mining activities and the associated disturbance by man.

Roost trees for eagles, if located, must not be disturbed or destroyed. Similarly, activities planned for high-priority concentration areas of eagles must be designed and implemented so that they are not of significant disturbance to the birds.

As a general comment, whenever active raptor nests are observed or roost trees for eagles located, they need to be reported to the Utah Division of Wildlife Resources and the U.S. Fish and Wildlife Service.

Design and construction of all electrical powerlines and other transmission facilities shall be designed in accordance with guidelines set forth in "Environmental Criteria for Electric Transmission System" published by the USDA and USDI in 1970 and/or the REA Bulletin 61-10 "Powerline Contacts by Eagles and Other

Large Birds". It is also recommended that placement of utility poles over flat or rolling terrain be planned so that they are out of view of roads or at least 300 meters away from any roads. This will lessen opportunity for illegal killing of these valuable birds, since the poles can serve as suitable hunting perches for raptors. In some instances poles can result in an extension of raptor hunting territories, which would represent a beneficial impact.

During the crucial period of December through February spruce-fir forests and aspen forests need to be protected from man's disturbance so that blue grouse and ruffed grouse will not be impacted. Destruction of these wildlife habitats at any time of the year need be minimized due to their value to wildlife.

During the spring period (mid-March through mid-June) care needs to be taken that male blue grouse are not disturbed or precluded from establishing breeding territories. Similar precautions need be taken for male ruffed grouse (March through May) in the area of drumming logs.

Agricultural lands associated with the project should be maintained under traditional agricultural practices and not converted to other uses. These lands are of critical and high-priority value to avifauna and a myriad of other wildlife dependent upon agricultural systems.

Mature trees with natural cavities and dead snags need to be protected for use by cavity nesting birds. Trees with such a character are ranked as being of critical value to cavity nesting birds. The project should be planned so that three such trees are left standing per acre within 500 feet of forest openings or water and two such trees per acre in dense forested areas.

Mitigation and Impact Avoidance Procedures for Mammals

The lodges, nests and dens of all mammals or roosts in the instance of bat like mammals represent a critical use area for maintenance of their individual populations. The crucial period for any species is when the lodge, den, nest or roost is occupied. Therefore, such sites for any mammal must be protected from disturbance during that period when it is being utilized.

Many species of mammals develop food caches in order to carry individual animals or family groups through period when they cannot forage. Such sites are of critical value to maintenance of their populations and if located should not be destroyed or subjected to regular disturbance by man.

It is important to realize that within natural ecosystems there exists a predator-prey relationship. One species of animal may represent a prey source for other species. Therefore, it is important that project operations be designed and implemented so as to not unnecessarily disturb or destroy any wildlife or their habitats.

Big game ungulates--mule deer, elk and bighorn sheep--each have seasonal use areas ranked as being of critical value to an individual herd. Such sites need to be protect-d from any of man's activities or developments that could result in destruction, loss or permanent occupancy of the site by man or has facility developments. If these types of impacts cannot be avoided the site must ultimately be reclaimed and revegetated. Also, critical valued areas need protection from disturbance during their appropriate crucial period.

High-priority valued use areas for all wildlife and particularly big game ungulates need to be protected from man's activities or facility developments. Actions that would result in loss or permanent occupancy of significant acreages (25 or more acres) of habitat are of special concern. In any event impacts to high-priority valued areas should be limited and ultimate reclamation planned. Many impacts can be avoided simply by precluding exploration, developmental or other activities during the period of time when a high interest specie is present.

Haulage of coal between the various mine projects and distribution points should be planned so that impacts to wildlife are lessened; of special concern is haulage of coal through wintering areas for big game. It is recommended that the Company develop coal haulage contracts that require personnel involved with coal haulage to use extreme caution so that accidental collisions between motor vehicles and big game are reduced. Without doubt, a reduction in speed across winter ranges would aleviate this problem during the period between November 1

and May 15 each year.

At present the most successful and cost effective technique for reducing deer-highway mortality is a system of warning reflectors. This system (manufactured by Strieter Corporation, 2100 Eighteenth Avenue, Rock Island Illinois 61201 and known as "Swareflex") is only of value at night time, but it is during darkness that most deer-highway mortality occurs. Strieter Corporation describes the effect of the reflector system as follows: "The headlights of approaching vehicles strike the wildlife reflectors which are installed on both sides of the road. Unnoticeable to the driver, these reflect red lights into the adjoining terrain and an optical warning fence is produced. Any approaching wildlife is [are] alerted and stops or returns to the safety of the countryside. Immediately after the vehicle has passed, the reflectors become inactive, thereby permitting the animals to cross safely".

Installation of a wildlife warning reflector system, a reduction in speed of coal-haulage trucks and other mine related traffic and increased awareness of wildlife values by mine associated employees should result in a reduction of deer-highway mortality problems. Such a reduction would represent satisfactory mitigation.

In instances where conveyors, slurry lines or any other structure having potential to be a barrier to big game movement is to be developed, passage structures must be provided. Generally speaking overpass and underpass type structures are recommended in order to allow passage of big game to habitats either side of any barrier. These crossings should be placed at the points to be identified from intensive study of big game movements in relation to the mine plan area. Such study would not be required if the structure was adequately elevated to allow uninhabited passage of big game along its entire length.

Underpasses should have a minimum clearance of three meters maintained across a span of at least five meters. Overpasses should be designed as a circular earthen ramp with the barrier bisecting the ramp into two equal halves as follows:

CHAPTER XI

DRAFT

Rec Doc m
9-26-88

CLIMATOLOGY AND AIR QUALITY

TABLE OF CONTENTS

CHAPTER XI

11.1 Scope

Regional and local climatology data has been derived respectively from governmental sources and from the Sunnyside weather station maintained by Kaiser Coal Corporation.

The effect of the mining operation on air quality, if any, is confined to the surface operations. Most parking areas and roads are paved. The unpaved roads are treated with calcium chloride, potassium chloride or sprayed with water as required to control fugitive dust. No air quality monitoring devices are in use. There has not been any violation of air quality laws at the Sunnyside Mines to date.

11.2 Methodology

The U.S. Geological Survey's "Final Environmental Statement, Development of Coal Resources in Central Utah" (1979) (1) provides much useful climatological information for the region as well as for the mine property adjoining the Sunnyside Fuel permit area.

Kaiser Coal set up a weather station at the Sunnyside Mines in March 1974. Climatological records have been subsequently kept.

Some climatological data was obtained from the National Weather Service in Salt Lake City.

11.3 Existing Environment

11.3.1 Precipitation

The precipitation in the Sunnyside Fuel permit area consists of occasional winter snows, with average annual accumulation of about one foot, and summer rains which generally occur during July, August, and September. Figure XI-1 shows the mean annual precipitation for the Sunnyside area to be about sixteen inches.

Snow accumulation over the permit area varies greatly due to elevation and topographic exposure. At the mouth of Whitmore Canyon (elevation 6,750) snow accumulates from 0 to 21 inches during October through March. During the same period of time at the upper bathhouse (elevation 7,280) the snow depth ranges from 0 to 50 inches (personal observation by D.C. Pearce, 1982, 1983, 1984). Significant daily snow accumulations are recorded at the Sunnyside NOAA weather station maintained by Kaiser Coal Corporation. Maximum monthly, mean maximum monthly and mean daily snow accumulations have been collected and calculated for years 1973 through 1983 todate and are presented below:

Snow Accumulation 1973-1983 (Inches)

	Maximum	Mean Maximum	Mean Daily
October	6.50	1.35	0.73
November	6.00	1.69	0.28
December	14.00	4.42	1.73
January	21.00	9.86	4.01
February	21.00	6.44	2.84
March	15.00	5.30	0.60

Ground accumulations of snow are characterized by short duration due to melting or sublimation. This is shown by the mean daily snow accumulation values under 1 inch for October, November and March.

The nearest NOAA station with similar conditions is in Price, Utah. A climatology summary with thirty year averages for precipitation is included as Table XI-3. Table XI-4 shows a summary with twenty-two year averages for the Sunnyside NOAA station. Sunnyside shows 2.21 inches more precipitation on average than the Price station. This is the result of higher elevation and closer proximity to the Book Cliffs. Table XI-1 has been updated and included in this section.

Table XI-1 is a compilation of precipitation data from the Sunnyside Mines weather station which covers the only period on record, from April 1974 through May 1980.

11.3.2 Temperature

The temperature at the Sunnyside disposal area and surface facilities is typical of the semi-arid, western locales at surface elevation of 6,500 to 7,000 feet. Colder temperatures than those recorded would be encountered at the 9,000 elevations in the mountains above the mine.

CHAPTER XI

Temperature data is available from general government studies and also from more detailed site observation at the Sunnyside weather station.

Significant average temperatures are shown below:

		Temperature ^{O}F	
		Sunnyside Records	Govt. Rep. (Generalized)
Monthly Average	- January	22	25
	- July	69	70
Yearly Average		44 (5 years)	
Extremes	- High	96	90
	- Low	-15	0

Table XI-2 gives monthly figures from the Sunnyside weather station for the period of record (April 1974 through May 1980). The accompanying government charts, Figures XI-2 and XI-3, illustrate regional mean January minimum and July maximum temperature.

Table IX-3 gives twenty-two year temperature averages for the Sunnyside, Utah NOAA station. From the Sunnyside data the average start and end of the frost free growing season was found to be June 1 through October 17. This gives a mean frost free growing season of 141 days having a standard deviation of 22.2 days. Average monthly precipitation is shown on Figure XI-5.

11.3.3 Evaporation

The potential evaporation rates are shown in Table XI-5. The pan coefficient in this area to convert pan evaporation to lake as extracted from Technical Paper #37 of The National Weather Service is 0.69.

11.3.4 Relative Humidity

Data on relative humidity variations is unavailable. The area is considered semi-arid and the relative humidity is usually quite low.

11.3.5 Wind

The Sunnyside property lies near the intersection of the "Book and Roan Cliffs" and the "Castle Valley" air sub-basins of the Upper Colorado River Air Basin.

Nighttime airflow in the region is primarily drainage in character and generally follows river drainage systems (see Figure XI-4). Wind speeds induced by the descent of dense cold are generally light. The daytime flow is strongly influenced by surface heating effects which result in mixing between the surface and upper flows. In the subject area there is a general air flow toward the north and northeast during the day and toward the southwest away from the high surface elevations during the night. Winds are light to moderate (below 20 MPH), although occasional high winds do occur.

Upper level winds, 1,600 feet or more above ground level, are generally from the southwest during most of the year. During the winter, air flow from the northeast is common.

Site specific wind data is not available in the Sunnyside area. Canyon topography dominates both wind direction and speed and would make any available data very site specific and not applicable to the total permit area. The winds high in the atmosphere tend to be strong but decrease toward the surface where obstructions and surface friction come into play. Thus, in the area, winds will tend to increase with increasing elevation. High ridges and plateaus will generally have stronger winds than the valleys and desert areas (E.A. Richardson 1980).

11.4 Effects of Disposal Operations of Air Quality

Most of the region around the Sunnyside Mines permit area has been designated a Class II area for purposes of determination of significant air quality deterioration. Deterioration of the air quality is not expected during the permit period with the exception of short high wind periods when sand and smaller grained particles are picked up outside of the permit area and added to the air in the permit area.

The haul road used by the refuse trucks is paved to the beginning of the disposal area. There are several access roads to portal and/or fan locations which receive limited usage, mainly for inspection purposes. Roads around the main complex are treated with calcium chloride, potassium chloride or sprayed with water to control fugitive dust as required during dry periods.

Sunnyside Fuel Corporation will continue its programs in the permmit area to comply with the requirements of the Clean Air Act and other applicable air quality laws and regulations as well as health and safety standards. There has not been any violation of air quality laws at this operation to date and it is expected to remain so in the future.

11.5 Climatological and Air Quality Monitoring

Climatological monitoring is facilitated by the weather station installed by Kaiser Coal at the Sunnyside Mines during March 1974. It is located at 6,780 feet in elevation.

No air quality monitoring devices are in use at this operation.

CHAPTER XI

11.6 Bibliography

(1) "Final Environmental Statement, Development of Coal Resources in Central Utah." Part 1 - Regional Analysis. Part 2 Site Specific Analysis (Chapter on the B-Canyon Mine). Department of the Interior, U.S. Geological Survey (1979).

(2) E.A. Richardson, South Lease Permit Application, Chapter XI, Climatology and Air Quality (1982).

(3) Personal communication, Monte Keller, Bureau of Air Quality, Division of Environmental Health, Utah State Board of Health

CHAPTER XI

LIST OF EXHIBITS

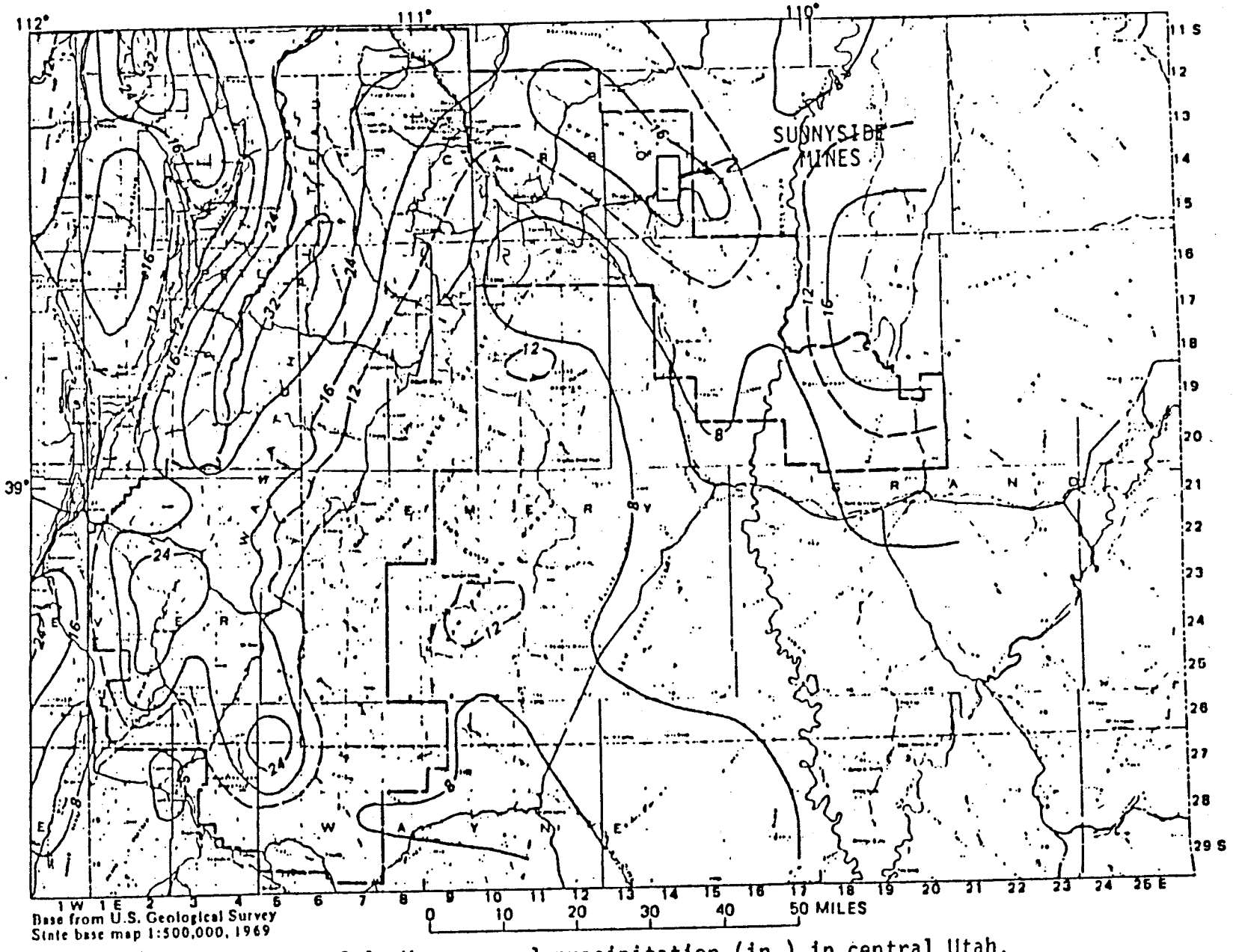


Figure XI-1 Mean annual precipitation (in.) in central Utah.

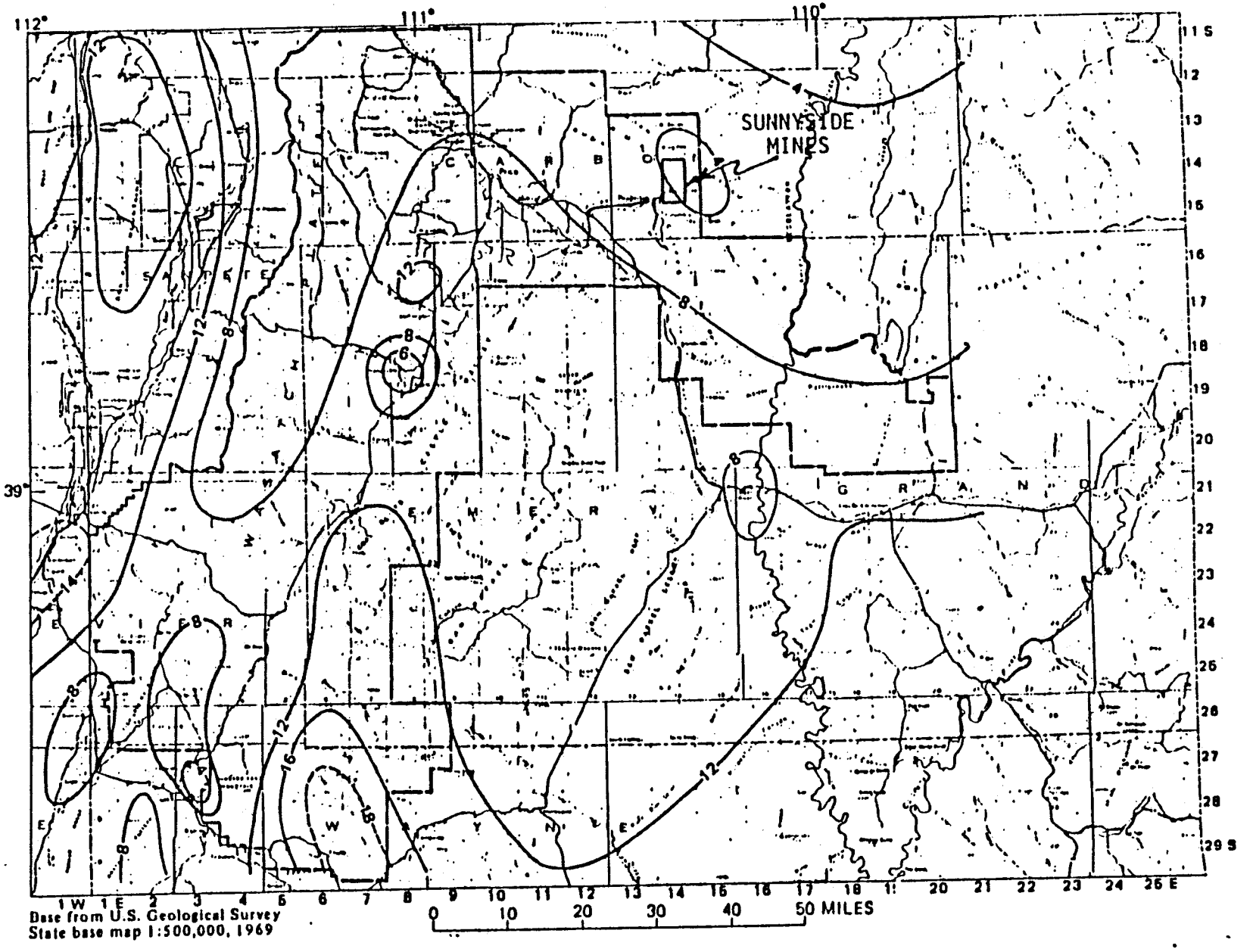


Figure XI-2 Mean minimum temperatures (°F) in January in central Utah.

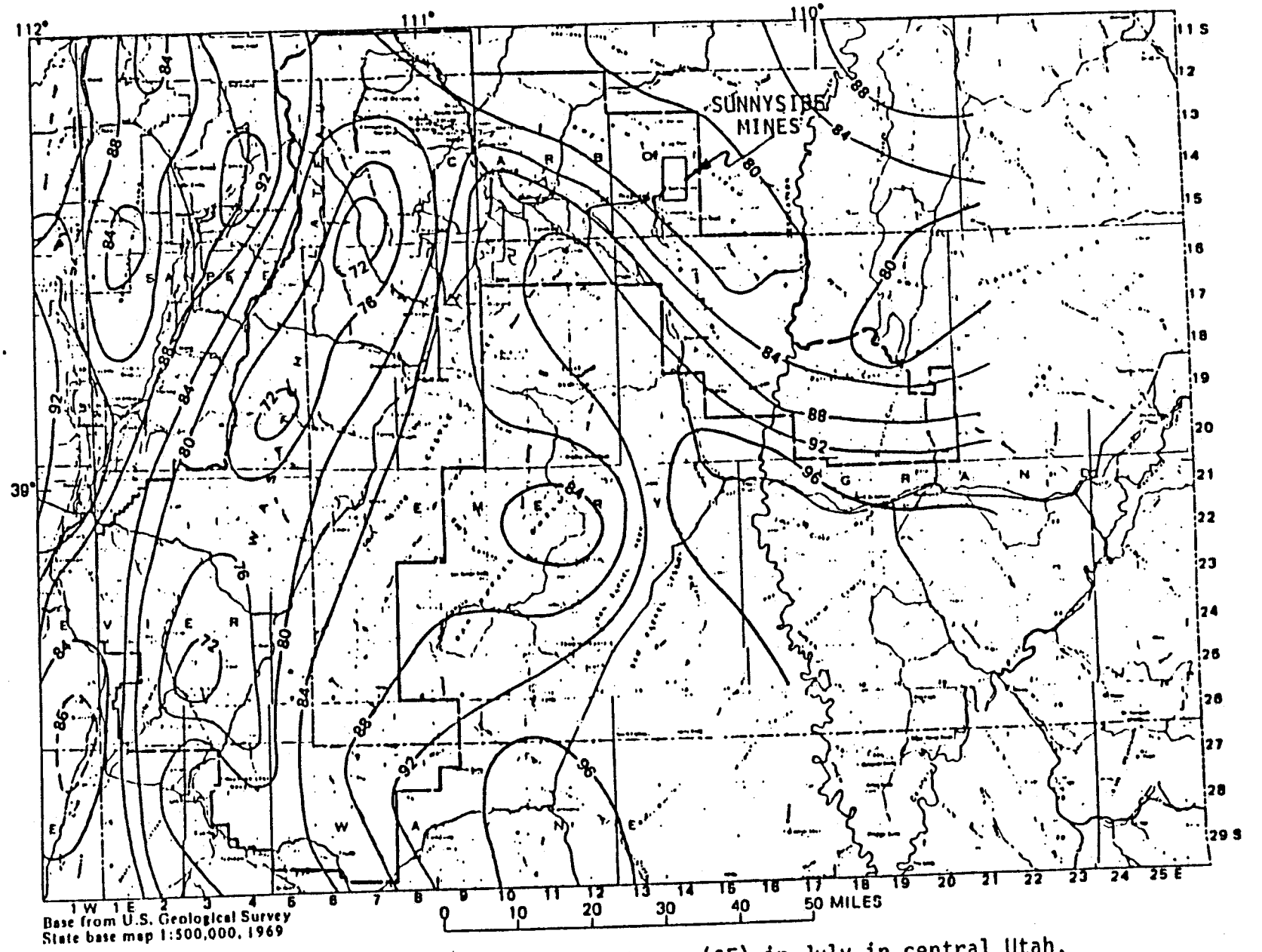


Figure XI-3 Mean maximum temperatures (°F) in July in central Utah.

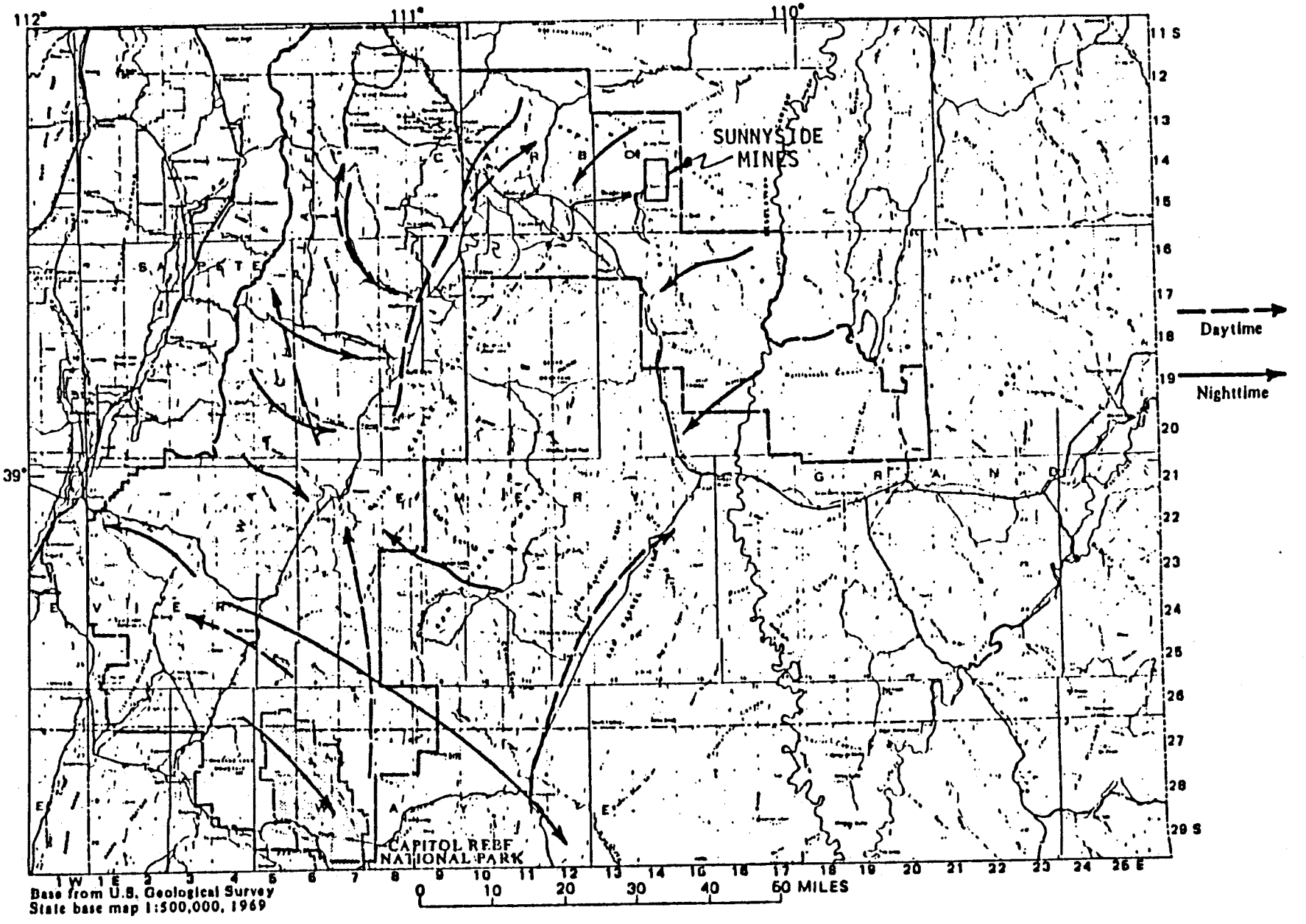


Figure XI-4 Streamlines for nighttime drainage air flow and typical daytime surface flow in central Utah (modified from AeroVironment, 1977).

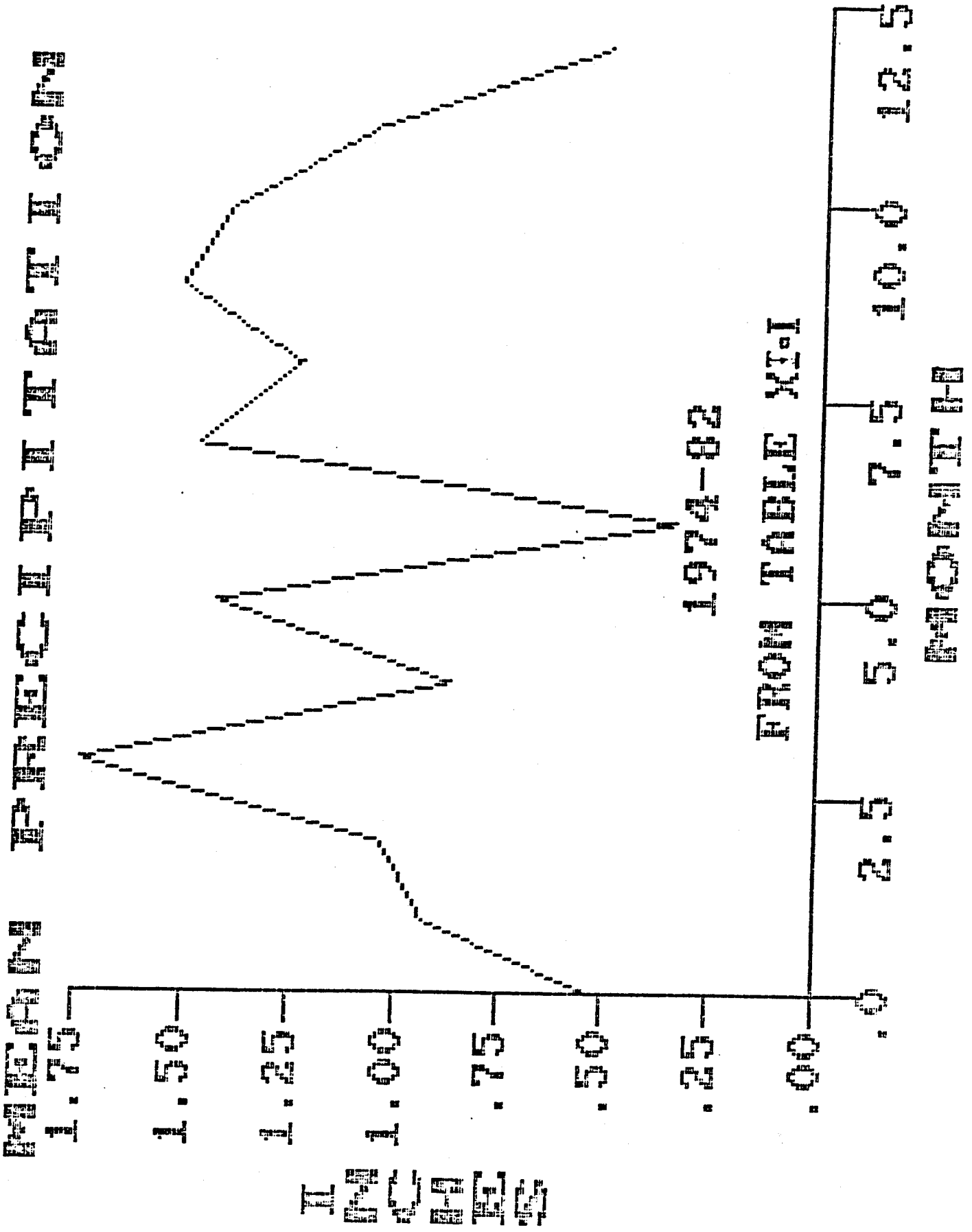


Figure XI-5. Average monthly Sunnyside precipitation.

Table XI-1

Precipitation - Sunnyside, Utah NOAA Station (Updated) (Inches)

Month	1974	1975	1976	1977	1978	1979	1980	1981	1982
January		0.76	0.07	0.58	2.07	1.05	1.67	0.10	1.23
February		0.59	1.21	0.13	1.55	0.00	4.21	0.63	0.14
March		2.22	0.75	0.06	2.80	2.90	1.25	1.55	2.46
April	0.56	0.61	2.02	0.05	1.79	0.58	0.40	1.85	0.02
May	0.00	1.84	2.08	1.49	0.91	0.83	1.50	2.95	1.35
June	0.04	1.44	0.10	0.50	0.17	0.00	0.00	0.33	0.66
July	2.12	3.05	0.43	2.09	0.89	0.00	2.49	1.46	0.73
August	0.35	0.06	0.53	1.40	1.01	1.68	0.64	2.47	3.07
September	0.21	0.32	1.67	0.64	0.59	0.03	3.58	2.21	4.55
October	4.03	0.40	0.00	1.58	0.90	0.65	1.99	2.07	0.92
November	0.82	0.51	0.00	0.67	3.95	0.10	1.08	0.46	2.07
December	0.53	0.66	0.00	0.43	1.33	0.57	0.01	0.56	0.74
Water Year		16.32	10.43	6.94	14.46	13.25	17.06	16.63	18.30
Annual	8.71	12.46	8.36	9.62	17.96	8.39	18.82	15.69	17.90

Table XI-2

Temperature - Sunnyside, Utah Weather Station (°F)

		1974	1975	1976	1977	1978	1979	1980	AVG.
JAN	Avg. High		31	34	34	34	21	33	31
	Avg. Low		11	12	12	16	6	15	12
	Mean		21	23	23	25	14	24	
FEB	Avg. High		35	42	45	36	34	38	38
	Avg. Low		14	21	20	15	9	19	16
	Mean		24	32	32	26	22	28	
MAR	Avg. High		42	45	43	48	40	40	43
	Avg. Low		21	18	18	27	21	21	21
	Mean		32	32	30	37	30	30	
APR	Avg. High	55	47	55	60	53	55	52	54
	Avg. Low	26	25	31	34	32	29	30	29
	Mean	41	36	43	47	43	42	41	
MAY	Avg. High	70	59	67	61	61	64	59	64
	Avg. Low	40	34	41	38	36	39	36	38
	Mean	55	46	54	50	48	51	47	
JUN	Avg. High	83	70	76	82	75	77	77	77
	Avg. Low	51	43	44	53	47	47	46	48
	Mean	67	56	60	67	61	62	62	
JUL	Avg. High	82	83	81	82	83	85	83	83
	Avg. Low	54	56	53	56	54	54	54	54
	Mean	68	70	67	69	68	70	68	
AUG	Avg. High	82	81	80	81	80	78	80	80
	Avg. Low	51	51	52	55	52	51	50	52
	Mean	66	66	67	68	66	65	65	
SEP	Avg. High	73	73	72	73	71	73	71	73
	Avg. Low	44	45	48	44	44	44	46	45
	Mean	58	59	60	58	58	58	58	
OCT	Avg. High	61	60	59	62	64	60	58	61
	Avg. Low	39	32	33	37	39	33	36	35
	Mean	50	47	46	49	51	47	47	
NOV	Avg. High	44	45	50	46	44	36	47	44
	Avg. Low	25	21	26	25	26	17	27	23
	Mean	34	33	38	36	35	27	37	
DEC	Avg. High	33	36	39	39	27	36	45	35
	Avg. Low	12	16	15	19	9	16	26	14
	Mean	22	26	27	29	18	26	35	
Yr. Avg. Temp.			43	43	47	45	43	45	
Temp. Extremes	High		89	91	89	92	96	90	
	Low		- 7	- 4	- 7	-12	-15	15	

Table XI-3

Climatological Summary Price, Utah 1936-1965

Month	Temperature (F)		Precipitation Totals (Inches)	
	Daily Maximum	Daily Minimum	Greatest Daily	Mean
January	37.1	11.0	0.67	0.68
February	42.3	17.4	0.80	0.68
March	51.6	25.2	0.97	0.78
April	63.8	34.2	0.66	0.57
May	74.1	42.9	1.45	0.68
June	83.6	50.0	1.47	0.80
July	90.6	56.7	1.05	0.82
August	88.2	55.3	1.03	1.19
September	80.0	47.2	1.67	1.13
October	67.6	36.6	1.75	0.99
November	50.5	23.7	1.97	0.56
December	40.6	15.9	1.07	0.89
Annual				9.77

Table XI-4

Climatological Summary Sunnyside, Utah 1958-1980

Month	Temperature (F)		Precipitation Totals (Inches)	
	Daily Maximum	Daily Minimum	Greatest Daily	Mean
January	34.3	13.1	1.46	0.80
February	41.3	19.3	1.63	0.90
March	45.4	22.1	0.85	1.08
April	55.0	29.7	1.09	0.94
May	65.7	39.6	1.10	1.07
June	77.6	48.4	1.60	0.84
July	85.5	56.3	0.89	1.08
August	82.7	53.6	1.20	1.27
September	73.5	45.7	1.24	1.34
October	60.9	35.6	1.25	1.26
November	47.0	24.6	0.91	0.76
December	37.3	16.2	0.84	0.64
Annual				11.98

Table XI-5

Estimated Normal Months Pan Evaporation Totals

Month	Price 5500'	Sunnyside 6750'	Hiawatha 7230'
January	0.8	0.7	0.6
February	1.7	1.5	1.4
March	3.3	2.9	2.7
April	6.0	5.2	4.9
May	9.4	8.1	7.6
June	10.9	9.4	8.8
July	12.3	11.1	9.9
August	10.9	9.4	8.8
September	8.2	7.1	6.6
October	5.0	4.3	4.0
November	1.7	1.5	1.4
December	1.0	0.9	0.8
Annual	71.2	62.1	57.5

CHAPTER XII

GEOTECHNICAL INFORMATION

TABLE OF CONTENTS

CHAPTER XII

12.1 Scope

The Sunnyside Mines coal property has been in continuous operation for over ninety years. During that time more than 55 million tons of coal have been produced.

The slurry impondments are the only earthen structure within the permit area. Appendix III-5 contains a geotechnical evaluation of these impoundments.

#15 ACT/007/007 ACT/007/007-86F copy cover letter to #2 #15 w/map

RECEIVED
MAR 03 1987
DIVISION OF
OIL, GAS & MINING

KAISER COAL

KAISER COAL CORPORATION
Sunnyside Coal Mines
P.O. Box 10
Sunnyside, Utah 84539
Telephone (801) 888-4421

February 26, 1987

Mr. Lowell P. Braxton, Administrator
Mineral Resource Development & Reclamation Program
Utah Division of Oil, Gas & Mining
355 W. North Temple
3 Triad Center, Suite 350
Salt Lake City, Utah 84180-1203

Re: NPDES Discharge Point 015
Sunnyside Mines
ACT/007/007

Dear Mr. Braxton:

As requested in Mr. John Whitehead's letter of January 7, 1987, please find fourteen copies of Drawings D4-0152 (NPDES Discharge Locations) and A4-0195 (Hydrologic Flow Diagram) enclosed. Drawing D4-0152 is the requested map depicting all NPDES discharge point locations; extra copies are provided to replace the map submitted December 15, 1986. Drawing A4-0195 is an updated edition of Figure VII-3 from Book 6 of the Sunnyside Mines Permit.

Sincerely,

Carl W. Winters

Carl W. Winters
Senior Mining Engineer

encl

cc: B. J. Bourquin

FILE COPY

CHAPTER VII

DWG. NO. A4-0195

KAISER COAL — SUNNYSIDE MINES

FIGURE VII - 3
SUNNYSIDE MINES HYDROLOGIC
FLOW DIAGRAM

DWG. BY: K. HOUSKEEPER DATE: 2/25/87 SCALE: NONE

MANSHAFT & TWIN SHAFTS (160 GPM)

WHITMORE & POLE CYN. SHAFTS (75 GPM)

DRILL HOLES (200 GPM)

GOBS, FAULTS & FRACTURES (105 GPM)

NO. 1 SUMP (540 GPM)

TO DISCHARGE

001 PIPE UP TWIN SHAFTS (0-600 GPM)

002 PIPE UP WHITMORE RETURN (0-540 GPM)

015 PIPE FROM TANKS (0-1000 GPM)

WATER TANKS

FIELDS IRRIGATION LINE TO FIELDS (0-400 GPM)

DRILL HOLES (100 GPM)

NO. 3 SUMP (200 GPM)

GOBS, FAULTS & FRACTURES (80 GPM)

PALEOCHANNEL (10 GPM)

NO. 2 CANYON SHAFT (10 GPM)

(0-240 GPM)

PREPARATION PLANT

GRASSY TRAIL

SLURRY DITCH (0-300 GPM)

ICELANDER 004

LEGEND

- JUNCTION
- DISCHARGE
- MINE SUMP
- WATER TANKS
- PREPARATION PLANT

ACT/007/007 Folder # 2 Corr. Letter + 15 w/maps

KAISER COAL

KAISER COAL CORPORATION
Sunnyside Coal Mines
P.O. Box 10
Sunnyside, Utah 84539
Telephone (801) 888-4421

February 17, 1987

Mr. Lowell P. Braxton, Administrator
Mineral Resource Development & Reclamation Program
Utah Division of Oil, Gas & Mining
355 W. North Temple
3 Triad Center, Suite 350
Salt Lake City, Utah 84180-1203

Re: Diversion Ditch Repair
Sunnyside Mines
ACT/007/007

Dear Mr. Braxton:

A diversion ditch is in place from the main parking lot at the Sunnyside Mine site, around the main buildings area, past a storage area, and terminates near the preparation plant. As improved efforts have been made to direct surface runoff through this ditch, some erosion of the channel has occurred. Kaiser desires to rectify this matter in a proper, but cost containing, manner.

Organizational changes over the last few months have left Kaiser without fully qualified hydrology design personnel. To date, Division staff personnel have been very cooperative in providing limited assistance in this area. Although Kaiser personnel are becoming better qualified, periodically help is still desired. This letter is to request the assistance of Mr. James Fricke in the solution of the erosion problem described above.

Attached is a map and other information about the diversion ditch. Mr. Fricke, on a recent partial inspection, observed the situation and is, therefore, familiar with it. The help which is requested is in the design of check dams in the ditch - including the number of dams, their locations, their height, and the construction materials to be used.

Kaiser will appreciate the assistance and, once a proper design is reached, will promptly install the structures. Should you or Mr. Fricke have any questions on this, please do not hesitate to contact me.

Sincerely,

Carl W. Winters

attach

KAISER COAL CORPORATION
SUNNYSIDE COAL MINES
DIVERSION DITCH CALCULATIONS

1-15-87

STATION	STATION	RELATIVE BANK ELEVATION	SLOPE OF GROUND	RELATIVE DITCH ELEVATION	SLOPE OF DITCH	DEPTH OF DITCH	WIDTH OF DITCH
0+00	0+00	98.55		97.10		1.45	4.3
			-6.9		-2.0		
0+22	0+22	97.03		96.67			2.9
			-5.0				
0+32	0+32	96.53					
					-6.4		
0+36	0+36			95.77			7.0
			-5.5		-7.3		
0+65	0+65	94.71		93.64		1.07	2.1
			-2.5		-2.7		
1+00	1+00	93.84		92.71		1.13	2.8
			-2.2		-2.6		
1+50	1+50	92.75		91.40		1.35	2.9
			-3.7		-2.6		
2+00	2+00	90.88		90.11		0.77	1.7
					-71.0		
2+01	2+01			89.40			2.2
			-4.7		-5.1		
2+50	2+50	88.51		86.89		1.62	1.1
			-2.9		-4.0		
3+00	3+00	87.04		84.87		2.17	1.8
			-5.0		-4.2		
3+50	3+50	84.52		82.76		1.76	1.8
			-2.4		-3.8		
4+00	4+00	83.30		80.86		2.44	1.5
			-4.2		-1.8		
4+50	4+50	81.20		79.95		1.25	2.8
			-3.6		-2.0		
5+00	5+00	79.42		78.93		0.49	4.5
			-2.7		-3.9		
5+50	5+50	78.07		76.98		1.09	3.3
			-3.2		-3.7		
6+00	6+00	76.46		75.12		1.34	2.8
			-4.9		-3.6		
6+50	6+50	74.01		73.34		0.67	3.4
			-2.7		-3.8		
7+00	7+00	72.64		71.46		1.18	3.3
			-2.9		-2.4		
7+50	7+50	71.20		70.24		0.96	3.8
			-2.8		-3.0		
8+00	8+00	69.78		68.76		1.02	3.8

			-3.8		-4.1		
8+50	8+50	67.90		66.71		1.19	3.4
			-3.5		-3.3		
9+00	9+00	66.14		65.06		1.08	3.3
			-3.8		-3.0		
9+50	9+50	64.26		63.56		0.70	3.2
			-2.3		-3.3		
10+00	10+00	63.13		61.92		1.21	3.0
			-4.0		-3.8		
10+50	10+50	61.11		60.03		1.08	2.8
			-4.7		-3.9		
11+00	11+00	58.77		58.06		0.71	3.6
			-2.6		-3.0		
11+50	11+50	57.45		56.54		0.91	2.5
			-2.6		-2.5		
12+00	12+00	56.13		55.31		0.82	5.3

#15

ACT/007/007-86B
copy cover letter to #2
plan to #15 w/map

KAISER COAL

KAISER COAL CORPORATION
Sunnyside Coal Mines
P.O. Box 10
Sunnyside, Utah 84539
Telephone (801) 888-4421

February 25, 1987

Mr. Lowell P. Braxton, Administrator
Mineral Resource Development & Reclamation Program
Utah Division of Oil, Gas & Mining
355 W. North Temple
3 Triad Center, Suite 350
Salt Lake City, Utah 84180-1203

Re: Coarse Refuse Toe Pond
Sunnyside Mines
ACT/007/007

Dear Mr. Braxton:

Please find attached fourteen (14) copies of the revised Coarse Refuse Toe Pond calculations and maps (D4-0117 and D4-0142). This material is provided in response to Mr. John Whitehead's letter of January 5, 1987. Also, fourteen copies of a guide to parts replacement in the Sunnyside Permit is attached.

The assistance and cooperation of the Division with this work is appreciated.

Sincerely,

Carl W. Winters

Carl W. Winters
Senior Mining Engineer

attach

cc: B. J. Bourquin

1614

February 25, 1987

COARSE REFUSE TOE POND

PARTS REPLACEMENT GUIDE

REMOVE:

All pages pertaining to Coarse Refuse Toe Pond in Appendix III-1, Book 2

Frontpiece for Railcut Pond in Appendix III-1, Book 2

Drawings in Book 4, found as Plate III-5
- C4-0060 (Control Plan Map)
- D4-0078 (Sediment Pond Plan Map)
- D4-0114 (Elevations)
- D4-0115 (Cross-sections)

RETAIN:

Drawing in Book 4, found as Plate III-5
- C4-0006 (Refuse Area)

INSERT:

Attached calculation pages, including frontpiece, for Coarse Refuse Toe Pond in Appendix III-1, Book 2

Frontpiece for Railcut Pond in Appendix III-1, Book 2

Drawings in Book 4, identified as Plate III-5
- D4-0117 (Borrow Area)
- D4-0142 (Coarse Refuse Toe Pond - Revised)

COARSE REFUSE TOE POND

See Plate III-5

COARSE REFUSE TOE SEDIMENT POND
(REVISED 2/25/87)

The Coarse Refuse Toe (CRT) drainage area is located at the base of the West Slurry Cell embankment. The drainage area covers the disturbed area between the bottom collection ditch and the first terrace. Soil type in the drainage area is NJF2 which is described and located on Plate VIII-1. Soil conditions were assumed to be poor (CN = 86).

The earthen dam was designed to contain the runoff from a 100-year 24-hour storm with SCS Type 2 distribution. Side slopes on the structure are 3h:1v for the upstream side and 2h:1v for the downstream side slope which yields a combined upstream and downstream side slope of 5h:1v. Width of the crest is 20 feet which exceeds the quotient (H+35)/5(10.2') where H, in feet, is the height of the embankment (16') as measured from the upstream toe of the embankment. Water will be removed from the structure after a 24-hour period with a 2-inch decant pipe. Material in the embankment fill will be compacted in 6" lifts using a rubber-tired loader. The construction elevation (6,186) is 1 foot or 5% higher than the design elevation of 6,185 feet.

Borrow material in the embankment will come from the pond site and from a borrow area located 50 feet northeast of the site or alternately, a borrow area approximately 400 feet northeast of the site. Approximately 3,400 cy of borrow will be used constructing the dam. The primary borrow site was previously approved by the Division. The alternate borrow area will be covered by the expanded refuse pile and will have no permanent environmental effects. Should the alternate borrow area be used but not covered by the refuse pile by December 31, 1988, it will be permanently reclaimed.

Twelve inches of top soil will be removed from the dam and borrow site (if used) prior to consruction and stored in a top soil pile drawn on Drawing D4-0142 (Plate III-5). The top soil will be protected from water erosion by building a ditch around the pile and seeding the soil. After the useful life of the sediment pond, the borrow material will be returned to the borrow site and the approximate original contour as shown on Drawing D4-0117 (Plate III-5). Rip rap will be buried under the material covering the borrow site. The top soils will then be redistributed. Vegetation will be planted as outlined in Section 3.5 of the Sunnyside Permit, Book 1.

Sediment control for the borrow area will be affected by a total containment berm surrounding the borrow area. Water and sediments will remain on site. The berm will be two feet high and five feet wide at the base. The site will be contained as depicted on Drawing D4-0117 (Plate III-5) to prevent runoff.

In the event the alternate borrow area is used, no topsoil will be removed from it. This is due to the steep slopes on which the borrow area is located. As previously stated, this borrow area will be buried

by the expanded coarse refuse pile so no lasting environmental effects will occur by its use. No additional sediment control will be required for this borrow area.

Runoff was calculated using a storm hydrograph computer program written by Richard H. Hawkins and Kim A. Marshall at Utah State University, Logan, Utah. The following information was used in the calculation:

Area	7.53 Acres (See Drawing D4-0142-Plate III-5)
Slope	20.01%
Channel Length	1,320 Feet
Curve Number	86
Storm	10 Year 24 Hour - 1.86 Inches
	25 Year 24 Hour - 2.20 Inches
	100 Year 24 Hour - 2.66 Inches
Distribution	SCS Type 2
Soil	NJF2 (See Plate VIII-1 for Description-Location)
Type	B-D (Use C)
Condition	Poor
Curve Number	86 (Table 9.1, National Engineering Handbook, Hydrology: Section 4)

INPUT SUMMARY
FOR W. S.: C. R. TOE AREA 1

STORM: 100 YR 24 HR			WATERSHED:		
DISTRIBUTION	=	SCS TYPE 2	LAND SLOPE	=	20.0010 PCT
			CURVE NUMBER	=	86.00
PRECIP. DEPTH	=	2.66 IN	CHANNEL LENGTH	=	1320 FT
			TIME OF CONC.	=	.1210 HR
DURATION	=	24.00 HR	AREA	=	7.53 AC
NUMBER OF LINES	=	1503	D	=	.0161 HR

OUTPUT SUMMARY

RUNOFF DEPTH	=	1.3697 IN	
INITIAL ABSTRACTION	=	.3256 IN	
PEAK FLOW	=	10.44 CFS	(1.3745 IPH)
AT T	=	12.52 HRS	

Runoff Volume -

43560 Ac. X 1.3697 In. X 7.53 Ac. - 12 In./Ft. = 37,447 $Ft.^3$

Sediment Load -

Using the Universal Soil Loss Equation $A = RKL_sC_p$ where:

R = 20
K = 0.22; % OM = 1.22, % Sand = 62.33; % Silt = 27.78; % Clay = 9.87
L_s = 12; Slope = 28%; Length = 280 Ft.
C_p = 0.54 Barfield, Appendix 5A, Seed and Fertilize After 6 Months

Gives a Loss of 28.5 Tons Per Acre or 3,904 $Ft.^3$ Per Year.
Volume of Sediment for a Three-Year Period is:

3,904 $Ft.^3$ X 3 Years = 11,712 $Ft.^3$

Maximum sediment level has been set at elevation 6,176. When sediment reaches 60% of allowed height (as indicated by a wooden stake as shown on Drawing D4-0142-Plate III-5, Typical Dam Section), the pond will be cleaned.

Volume of the pond is calculated by measuring the horizontal cross sections at five-foot intervals and then finding an equation which meets those conditions.

1. $\text{Area} = Ah^2 + Bh + C$

Cross-Sectional Area As A Function Of Height

0	=	3,825 $Ft.^2$
5	=	8,575 $Ft.^2$
10	=	14,500 $Ft.^3$

Substituting the known values into Equation 1 for h = 0,5 and 10 yields 3 equations which are:

2. 0, $C = 3,825$

3. 5, $25A + 5B + 3,825 = 8,575$

4. 10, $100A + 10B + 3,825 = 4,156$

Solving Equation 4 for A gives:

5. $A = 107.25 - .1B$

Substituting the value from Equation 5 into Equation 3 gives:

6. $B = 827.5$

Substituting the value from Equation 6 into Equation 5 gives:

7. $A = 24.5$

Equation 1 can then be expressed as:

$$8.\quad \text{Area} = 24.5h^2 + 827.5h + 3{,}825$$

Integrating Equation 8 gives the volume as a function of height h. (Calculus and Analytic Geometry, George B. Thomas, Section 5-4, p. 238.)

$$9.\quad \int_c^h \text{Area} = V = 8.37\,h^3 + 413.75\,h^2 + 3{,}825\,h$$

Height of sediment can then be calculated using Equation 9 at h = 1', V = 4,243 ft.^{3} which is greater than the expected yearly sediment volume of 3,904 ft.^{3}.

Height of the decant pipe is calculated by adding 3 feet to the maximum sediment level (1 foot) which yields h = 4 feet. Volume at 4 feet is 22,443 ft.^{3}.

Height of the 100-year 24-hour storm runoff volume is calculated by adding the volume at 4 feet (22,443 ft.^{3}) and the runoff volume (37,439 ft.^{3}) and then using Equation 9 at h = 8 ft., V = 61,263 ft.^{3} which is larger than the required volume of 59,887 ft.^{3}.

The course refuse toe ditch collects runoff from the bottom slope of the refuse pile as shown on the 1" = 200' drainage area insert on Drawing D4-0142 (Plate III-5).

Using the following information and the methodology presented in Summary of Ditch Design Calculations in Appendix III-1 of the Sunnyside Permit, the flow characteristic of the ditches shown on Drawing D4-0142 (Plate III-5) can be calculated:

	New	Existing
Slope	2%	28%
Width	6'	6'
Channel Side Slope	2h:1v	2h:1v
Depth of Water Flow	0.42 ft.	0.19 ft.
Velocity	3.59 ft./sec.	8.40
n	.03	.03

Headwater depth (1.6') was taken from a 1962 Portland Cement Culvert Capacity Chart for Circular Concrete Pipe (Figure 7A.1b., Page 9 of Culvert and Pond - Size and Outlet Protection in Appendix III-1, Sunnyside Permit). Assumptions used were as follows:

Slope	4.3%	$\frac{L}{100\ So} = 16.3$
Diameter	2.0'	
Discharge (CFS)	10.44 CFS	
Length	70'	

Two feet of freeboard will be used 100' upstream of the culvert to allow for headwater conditions.

Exit velocity (6.7 ft./sec.) was calculated using the methodology presented in Appendix III-1, Culvert and Pond - Size and Culvert Protection, Page 1, Sunnyside Permit). Assumptions used were as follows:

Slope	4.3%
Diameter	2.0'
Discharge (CFS)	10.44 CFS

Erosion protection for the culvert exit, pond entrance, emergency spillway, and decant outlet will be grouted rip rap. The rip rap will be dry set using mortar mix or wet set using a premixed slurry grout. This will prevent rolling of rip rap and erosion under the rocks. The decant outlet will use the stilling basin of the emergency spillway for protection. The grouted rip rap will be keyed in place with 12" deep by 12" wide keyways across the spillway, pond entrance, and culvert exit as indicated on Drawing D4-0121 (Plate III-35). Keyways will be every 10 linear feet.

Using the following information and the methodology present in Summary of Ditch Design Calculations in Appendix III-1 of the Sunnyside Permit, the flow characteristic of the emergency spillway crest section and side slope section can be calculated:

	Crest	Side Slope
Slope	0%	28%
Bottom Width	2	2
Channel Side Slope	2h:1v	2h:1v
Depth of Water Flow	1.49' ✓	0.34' ✓
Velocity	1.41 ft./sec.	11.3 ft./sec.
n	.03	.03

Channel flow was designed for the 100 year-24 hour event. The Manning's n value of 0.03 was used because the grouted rip rap surface is left rough with protruding rock faces.

The splash basin was designed using the following methodology:

$V = 11.3$ ft./sec.

$$A = \frac{Q}{V} = \frac{10.5 \text{ CFS}}{11.3 \text{ ft./sec.}} = 0.9292 \text{ ft.}^2$$

$$d = A^{\frac{1}{2}} = 0.964 \text{ ft.}$$

$$F = \frac{V}{(gd)^{\frac{1}{2}}} = 2.03$$

$\frac{W}{d}$ = 4.25 from Figure 6-10, small channel structures, p. 310

$$W = d\left(\frac{W}{d}\right) = 0.964\ (4.25) = 4.09 \quad 4.0'$$

Splash basin size is 4 ft. X 5.5 ft. X 1.5 ft. with a 6-inch adverse slope. Dimensions of the splash basin are after the installation of the rip rap.

RAILCUT POND

See Plate III-6