Rehabilitation Potential
for the Henry Mountain Coal Field

SUMMARY

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ENERGY MINERAL REHABILITATION
INVENTORY AND ANALYSIS

HENRY MOUNTAIN COAL FIELD

Garfield County, Utah

Prepared by

Utah State University

and

Utah State University Foundation

Logan, Utah

FOREWORD

This report was prepared by staff members of Utah State University working as consultants to Utah State University Foundation. The professional team consisted of the following:

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The purpose of this report was to assemble and summarize known baseline information relative to the Henry Mountain resource area and to present findings and recommendations from specific studies on suitability of geologic overburden and soils to support a rehabilitation program should the coal resource be developed.

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I. SUMMARY

A. Introduction

This Energy and Mineral Rehabilitation Inventory Analysis (EMRIA) of the Henry Mountain Coal Field is an assembly and summary of much of the known baseline information about the resource area occupied by the coal field. Furthermore, it presents findings of specific studies on the suitability of the overburden and soils to support a rehabilitation program should the coal resource be developed. A limited study area in Garfield County, Utah (Figure 1) consisting of sections 17, 18, 19, 20 and 21 (T 31 S R 9 E) plus section 22 and 23 (T 31 S R 8 E) was assigned for detailed study. However, a more general area of study includes Wildcat Mesa, Pete Steele Bench and adjacent areas (Figures 2, 3).

B. Local Information

The general area in which the Henry Mountain Coal Field is located is one of the more remote and undeveloped regions of the United States. Until 1962 Highway 24 was not paved from Capitol Reef to Hanksville. The study site is accessible only by a seldom-graded dirt road extending 25 miles south from Highway 24. The nearest town is Hanksville with a population of 181 in 1970. Other communities in the region are also small with limited economic activity. Agriculture and recreational activities form the basis for employment.

Potential for development of recreation industries is great and is based on the outstanding scenic qualities of the region, specifically recognized by the establishment of Capitol Reef National Park, Canyonlands National Park, Glen Canyon National Recreation Area and especially the

MAP OF THE STATE OF UTAH

HENRY MOUNTAINS
COAL FIELD

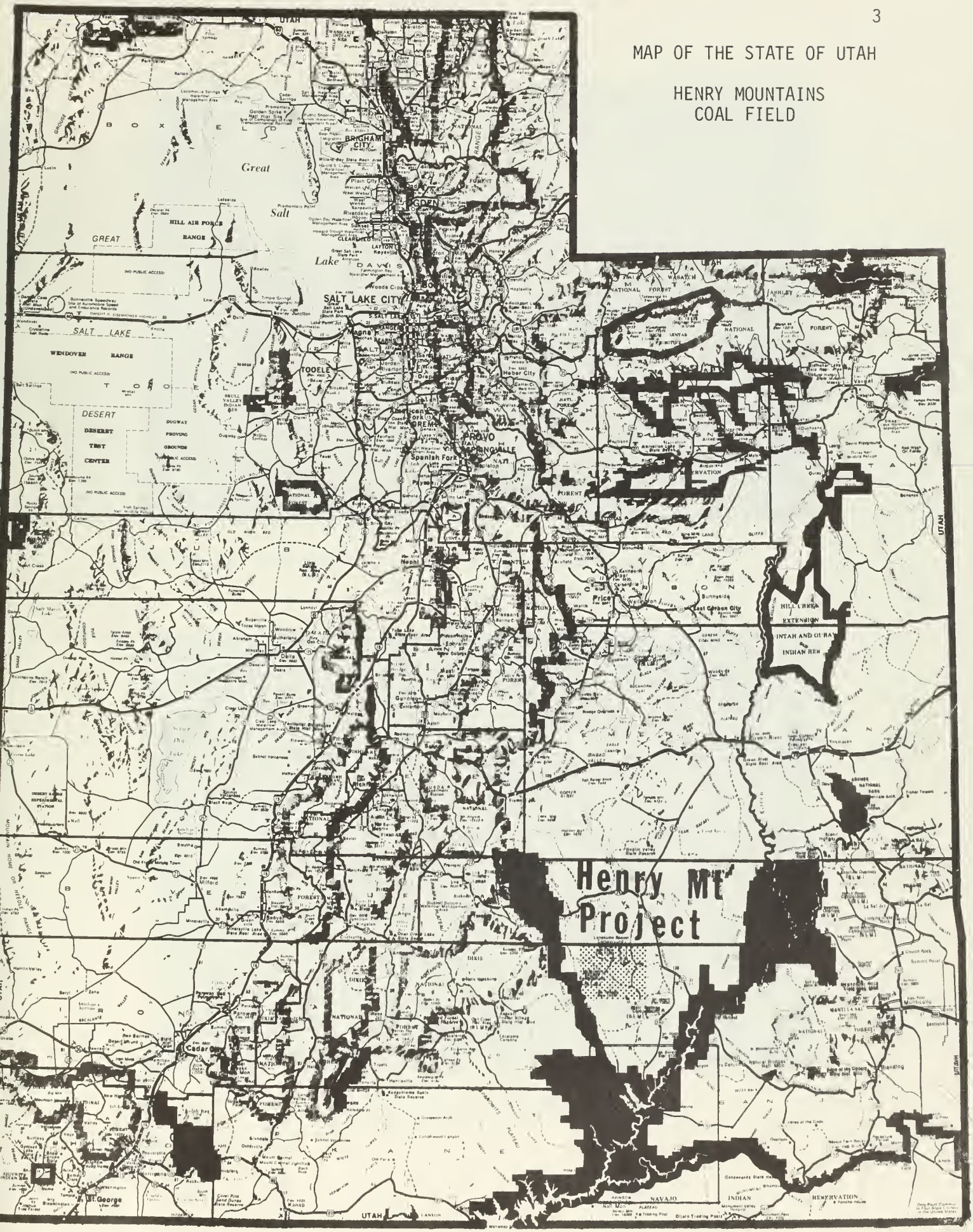


Figure 1. General Location of Henry Mountains Coal Field.

Study Site Photographs

Figure 2. View of Wildcat Mesa from the south end.

Figure 3. Looking southwestward on Pete Steele Bench.

numerous public campsites managed by state and federal agencies. Development of electric power generating facilities which may utilize coal from the Henry Mountain Coal Field or other nearby fields is also a current consideration. A new community to service a large uranium mining operation at Ticaboo Mesa is currently being planned by Ticaboo Development Co.

Most of the land in the general study area is federally administered by the Bureau of Land Management. Two state sections are on the margin of the coal field study area. The only private lands are those occupied by the Sandy Ranch and King Ranch.

C. Climate

The climate of the study area is arid. The predicted annual precipitation of Wildcat Mesa and Pete Steele Bench is between 8-9 inches and is highly variable from year to year. In the 1976-77 growing season essentially no effective precipitation occurred. Peak precipitation usually occurs during the period from July to October, a time when least effectiveness is possible. The frost-free season ranges from 120 to 150 days. Summer maximum temperatures of 100^{o}F are common while winter temperatures may be as low as -10^{o}F. Winds are usually from the west and southwest: average wind velocity is from 10 to 20 miles per hour. High wind velocities may occur in the spring and early summer. Under this harsh temperature - precipitation regime plant establishment and growth is severely limited.

D. Geology

The Henry Mountain area is located in the west central portion of the Colorado Plateau. The plateau system contains high escarpments, deep canyons, bare rocky badlands and laccolithic intrusions. Geologic

strata are essentially horizontal. The coal fields study area averaging 5800 ft in elevation lies between the Henry Mountains to the east and the Circle Cliffs upwarp farther west. Central to the study area is the shallow valley of Sweetwater Creek, a northward-flowing tributary of the Fremont River. East of the creek is Pete Steele Bench and Apple Brush Flat, and to the west is Wildcat Mesa. These plateaus are pediment surfaces developed by runoff from Mt. Ellen on whose flank these graded surfaces lie.

A generalized description of the geologic nature of eight cores through the coal overburden indicates a predominance of sandstone with minor inclusions of organic matter or claystone which make up over 70 percent of the overburden. Silt and claystone strata make up less than 30 percent. A cycle of deposition is repeated numerous times in the profile. Sandstone grades upward into siltstone, then claystone, then into carboniferous shale, and finally to coal.

A chemical analysis of the core fractions indicates that all lithotypes are extremely deficient in available nitrogen and phosphorus. Potassium contents averaged higher in clay and silt lithotypes than in the sandy ones. Values for pH were mostly near 8.0 but some extremes were noted. Electrical conductivities ranged from .3 to 12.5 mmho/cm, but the general average was between 1 and 2. Boron, iron, copper, manganese and zinc values were not in the phytotoxic range, except in an unusual situation.

A greenhouse bioassay of core samples from each lithotype showed that only 3 of 181 samples of the various lithotypes were toxic to the growth of Russian wildrye[1/]. Production decreases in the test grass were noted when the pH of a lithotype dropped below 7.0, when EC_e exceeded 4.0 mmho/cm and when boron exceeded 1.0 ppm.

1/ Scientific names of plants mentioned in this report may be found in the appendix.

E. Coal

The coal that may be mined in this area is part of the Emery Sandstone Tongue of the Mancos Shale formation; the overburden is the sandstone and shales of the Emery Tongue. Limited observations available from the 8 core holes drilled suggest that the coal overburden varies from 0 to 200 feet west of core hole 5 on Pete Steele Bench (see Figures 11, 16 in main report). At core hole 5 the overburden is 268 feet deep lying over a 2-foot coal bed. On Wildcat Mesa the overburden does not exceed 150 feet except under the butte of Masuk Shale. Thickness of various coal seams was not emphasized in the EMRIA study. Outcrops of the coal may be seen in numerous places (Figure 4).

Chemical analysis of the coal by the USGS indicates that it is medium in heat value (9,000 - 10,000 BTU/lb) and generally less than 1 percent sulfur.

F. Soil

Twelve soil classifications were identified in the soil survey of the study area. These units range in character from rock outcrops to sandy stony loams to silty clays. The most suitable soils for rehabilitation purposes in the vicinity of the study site are soil mapping units designated as FaB, HaB and HaC. These soils are deep, with little or no rock or gravel. They presently support stands of native grasses and shrubs. However they are mainly fine sandy loams which are subject to wind erosion.

The NaB, MaB and JaA soils are moderately deep but become increasingly gravelly and rocky with depth. The BaD, BbF, PaD and RaF are very shallow and/or rocky. The GaD and GaG soils are very saline, shallow, marine-shale derived soils with little potential for supporting vegetation other than species of saltbush.

Figure 4. Outcropping of 7 to 8 foot thick coal bed on Pete Steele Bench escarpment along Dugout Creek.

G. Vegetation

Seven plant communities in the general area of the study have been mapped during previous land management surveys: grass, sagebrush, pinyon-juniper, saltbush, greasewood, desert shrub and half-shrub. These plant communities have a general tolerance to soil conditions and topographic features described in the soil survey. The composition of species, their limited density, and low percent cover reflect the general aridity of the region. These characteristics also serve as a guide to rehabilitation planning. Because of the adaptation of the existing species to the drought and salinity levels of the region they should be given highest priority for use in reestablishment. There are no identified endangered or threatened plant species on the study site or surrounding area.

Plant establishment studies on three major soil types and three geologic outcrops of the Pete Steele Bench escarpment indicate wide differences in plant survival under the extremely dry conditions of the 1976-77 growing season. Best survival on the outcrop types was obtained on a sandstone outcrop which occurs just above the coal seam at the base of Pete Steele Bench. The best survival among the soil types was a sandy soil on Wildcat Mesa.

H. Hydrology

Surface water in the study area, principally Sweetwater Creek and its tributaries, is supplied by snowmelt and springs at its headwaters, but below 5,000 feet elevation, the creek flows intermittently. The streams are generally dry except for short periods of flood immediately after local storms. At the present time, South and Dugout creeks are diverted for irrigation on the King Ranch. An estimate of the flows of these two creeks is 2 cfs of good quality water during spring and summer in years of normal precipitation.

Subsurface water is postulated from eight waterbearing sandstones within the Henry Mountains area. The strata with the greatest potential is the Navajo Sandstone because of its thickness, better sorting and relatively better porosity than the other sandstones. Although there is some indication that the Navajo Formation may be saturated and under artesian pressure, the likelihood of obtaining any significant rate of flow from it is low because of a predicted slow release of water from the sandstone. Where fractures of the Navajo Formation occur, such as in the Salt Wash area proposed for use by the Intermountain Power Plant, a considerable flow volume has been tested.

Water quality may vary from a few hundred parts per million to tens of thousand parts per million of dissolved solids based on data obtained from wells in the Navajo Formation in other locations.

Sedimentation values for the study area are not available, nor are values from unreclaimed spoils. Sediment yields determined for the generalized Colorado region range from .2 to 1.0 acre feet/mile^2 per year. The generally low value for plant cover of the various plant communities, erosive nature of the soil and topographic features (slopes) of the study area may be expected to yield high sedimentation rates.

I. Wildlife

In spite of the generally dry nature of the study location and general area, topographic variation and numerous vegetation types provide for a diversity in wildlife. Important wildlife species are bison, deer, mountain lion, many species of birds, small mammals and invertebrates.

No endangered or threatened species of animals are known to exist in the Henry Mountains. The closest relevant sightings of endangered wildlife found near the study site is the black-footed ferret, 75 miles

to the north, and a possible nest of the peregrine falcon in Capitol Reef National Park (Utah Division of Wildlife Resources, 1977).

J. Visual

Visual access to areas of possible mining activity from Capitol Reef National Park would be minimal. Roads causing the generation of dust could be seen although not with significant resolution. Areas of Dixie National Forest or the Henry Mountain Peaks were not evaluated for visual access to the possible mining sites because of the topographic enclosures created by the escarpments of Wildcat Mesa on the west and Pete Steele Bench to the east, plus the distance associated with possible view sights.

K. Present Land Use

Present land uses in the Henry Mountain Coal Field area, though numerous, are at a low intensity. Grazing is the principal use and is important to the economic base of Wayne and Garfield counties. Steele Butte allotment provided 3166 animal unit months (AUM) of grazing in the year 1973-74 on an area where 34 percent of the land is judged to be in a downward range condition trend and 75 percent is in an unsatisfactory ecological condition. Range improvement practices of chaining and seeding employed on Tarantula Mesa raised range carrying capacity from 26 to 29 acres/AUM to 2 acres/AUM during favorable years and 26 acres/AUM in unfavorable years.

Recreation has a high potential for increase in future years. As a non-consumptive use it brings economic benefits into the region. Touring and sight-seeing followed by camping and hunting are typical uses in the Henry Mountains Resource Area. An average count of 100 vehicles per day going south from Highway 24 on the Notom road has been reported.

Watershed as a land use must be considered, although the water flow from Sand Creek and Sweetwater Creek to the Fremont River is very limited and intermittent. Water in the immediate study area is heavily depended upon by the Sandy and King ranches.

Wildlife use of the land, vegetation and water of the region is universal. The 200-head bison herd normally seeks the higher reaches of the Henry Mountains in summer but migrates to Tarantula Mesa and Cave Flat in winter months. They may use other areas depending on the nature of the weather and feed availability. Deer, mountain lion and numerous small mammals are residents of the various habitats in the general area of consideration.

L. Objectives of Reclamation

Objectives for land rehabilitation are covered in federal and state regulations. Applicable federal statutes include the following:

National Environmental Policy Act of 1969 (PL 91-190)

Surface Mining and Control Act of 1977 (PL 95-87)

Federal Land Policy and Management Act of 1977 (PL 94-579)

Utah State regulations for reclamation are covered in the Utah Mined Land Reclamation Act of 1975.

M. Recommendations for Reclamation

Given the harsh environment of the region, rehabilitation of disturbed land caused by surface mining would have to be accomplished with the greatest care and with appropriate methods. Existing methodologies may be inadequate to meet the harsh conditions of the area and will have to be modified. New methods or information may have to be developed through site-specific studies. The following general recommendations are provided:

1. The most suitable mix of land uses subsequent to mining should be planned as a guide to rehabilitation measures and needed research.

2. Mining activities should be conducted to permit utilization of favorable overburden strata individually or mixing of several strata for use in revegetation. Data from bioassay and chemical analyses should help to identify suitable overburden strata. Mining activities should also be kept localized and consider visibility aspects in construction and maintenance of roads.

3. Soil and overburden placement should emphasize the use of FaB HaB or HaC soils and/or overburden strata that meet specified criteria. Subsurface materials used under topsoil should not create problems of instability and toxicity.

4. Reconstitution of a soil profile for optimum plant growth should receive a high priority. Criteria for soil with favorable permeability, water holding capacity, fertility and texture characteristics should be established from existing information and/or in site studies.

5. Shaping of spoils should be compatible with surrounding topography to the extent practicable with necessary deviations to accommodate water harvesting potentials, habitat diversity, safe sites for plant establishment and aesthetic quality. Orientation of slopes to utilize favorable insolation possibilities is recommended.

6. Surface mulching with available material for improvement of soil characteristics as well as surface stabilization for water harvesting and dust control should be included in the rehabilitation plan.

7. Compaction of the soil-spoil surface should be avoided or ameliorated to promote infiltration and root penetration. Infiltration

characteristics of the reconstituted soil should be studied and specified for optimum land rehabilitation.

8. Vegetation establishment techniques should be tailored specifically for the harsh sites and climate that exist in the general area. Principal recommendations include:

a. Mulch to increase soil moisture and fertility functions.

b. Direct seed only if irrigation is used.

c. Select mixtures of native plant species adapted to area.

d. Give priority to transplanting of high quality bare-root or container grown native plants for preliminary rehabilitation phase.

e. Avoid high density plantings to reduce competition for water and, where necessary, control competing annual plants.

f. Maintain a high priority for natural aesthetics in time, space, shape and color in planning the seeding or planting arrangements.

9. Develop sources of irrigation water from the limited surface or ground water supplies. Consider the limitation imposed by inadequate water supply but develop information on the amounts of water that may be obtained from water harvesting, impoundment of surface waters (including purchase of rights) and drilling of a deep well.

10. Ameliorate impacts on wildlife by maintaining a compact mining operation, restrict travel to unused or future mining areas, provide water for wildlife, improve habitat carrying capacity for various species and seek cooperation with the Utah Division of Wildlife Resources in mitigating wildlife impacts.

11. Fertilize all areas to be seeded or planted with nitrogen, phosphorous, and potassium.

12. Avoid high structures and equipment in mining activities to reduce visual impacts.

13. Manage planted or seeded areas during establishment to avoid grazing by wildlife and livestock. Protection for an extended period may be necessary.

14. Studies to provide needed information about the site and serve as a basis for modification of current mining and reclamation techniques are recommended as follows (Priority listing is not intended):

a. Drill a test well into the Navajo Sandstone to determine flow rate and water quality.

b. Determine plant establishment methods suitable for the general area.

c. Determine methods for control of small mammals to keep them from destroying new plantings.

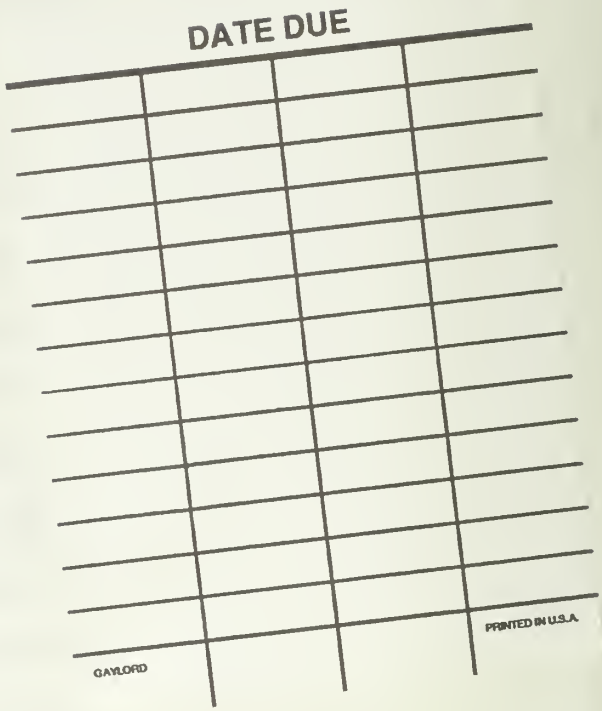
d. Assess mix of land use priorities suitable for the post-rehabilitation period.

e. Develop better ways for reconstruction of the soil profile from topsoil and geologic strata available in the area for optimal soil moisture conditions.

f. Identify critical recreational view sites in locations adjacent to the mining area.

g. Develop mining methods to improve selection and storage of desirable overburden strata or mixing of all strata.

h. Develop criteria for optimum vegetation parameters that would be used in specifying revegetation standards.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