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INTEGRATED MINED-AREA RECLAMATION AND LAND-USE PLANNING

Mineral Resources and Land-Use Planning: The Watkins, Colorado Case— A Workshop Synopsis

Prepared for the
Resource and Land Investigations (RALI) Program
of the U. S. Geological Survey, U. S. Department of the Interior,
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MINERAL RESOURCES AND LAND USE PLANNING THE WATKINS, COLORADO CASE -- A WORKSHOP SYNOPSIS

by

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Sponsored and Conducted by
USGS Resource and Land Investigations (RALI) Program
and the U.S. Department of Energy's
Argonne National Laboratory

September 1978

*USGS, Reston, Virginia
**Denver Regional Council of Governments

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PREFACE

This workshop synopsis is one in a series prepared by the Reclamation and Land Use Planning Program and the Land Reclamation Program at Argonne National Laboratory, together with the Resource and Land Investigations (RALI) Program of the U.S. Department of the Interior. These workshops are designed primarily to familiarize land use and resource planners with the problems and opportunities to be confronted in existing or potential surface mining areas.

The Reclamation and Land Use Planning Program is sponsored jointly through the U.S. Geological Survey's RALI Program and the U.S. Department of Energy's Land Reclamation Program to provide guidance materials and technical services to mining industry and public sector planners concerned with planning for effective land use in surface mine areas. The Program integrates reclamation planning with land use planning to assure maximum benefits to the public from both the reuse of mined areas and the efficient utilization of surface resources.

Argonne's Land Reclamation Program is a joint effort of the Laboratory's Energy and Environmental Systems Division and Environmental Impact Studies Division. The Program is conducting coordinated applied and basic research on the physical and ecological problems of land reclamation related to surface mining and is developing cost-effective techniques for reclaiming/rehabilitating mined land to productive end uses. The Program conducts integrated research and development projects focused on near- and long-term reclamation problems in major minerals resource areas throughout the U.S., and is responsible for coordinating, evaluating, and disseminating the results of coal mine reclamation studies conducted at other research institutions.

Chaired by James R. LaFevers of Argonne's Energy and Environmental Systems Division and Thomas F. Bates of the U.S. Geological Survey, this workshop addressed issues of critical importance relating to the potential development of lignite deposits in the vicinity of Denver, Colorado. This synopsis recaps the issues, discussions, and planning efforts of the workshop participants and the expert "faculty" who helped make the workshop a success.

Ralph P. Carter, Director
Land Reclamation Program

1 INTRODUCTION

The workshop described in this synopsis is one in a series addressing the problems and opportunities confronting public-sector land use planners in existing or potential surface mining areas. These workshops are conducted as part of the Land Reclamation Program and the Reclamation and Land Use Planning Program at Argonne National Laboratory. Funding and technical assistance are provided by the Resource and Land Investigations (RALI) Program, Land Information and Analysis (LIA) Office of the U.S. Geological Survey, and the U.S. Department of Energy. Each workshop is cosponsored by local mining companies, appropriate county, state, and federal agencies, and citizen groups. For this workshop, cooperators included the Colorado Department of Natural Resources, the Colorado Department of Local Affairs, the Denver Regional Council of Governments, Adams and Arapahoe County Planning Departments, the Colorado Geological Survey, and Cameron Engineers. In addition, advisers from a number of organizations, agencies, and private companies were available to provide expertise before and during the workshop. Their contributions are acknowledged in the following sections of this synopsis.

1.1 WORKSHOP DESIGN

This workshop had several goals, including:

1. Promotion of constructive interaction between representatives of the mining industry, government, and citizen groups which are concerned with the problems of integrating surface mining and mined area reclamation into local and regional land use plans;

2. Familiarization of workshop participants with the implications to land use planners of the "Surface Mining Control and Reclamation Act of 1977" (P.L. 95-87);

3. Introduction of participants to the principles and practices of minerals preservation planning and the designation of areas as unsuitable for surface mining; and

4. Definition of the roles of minerals preservation planning and designation of areas unsuitable for mining within the local planning process.

To achieve these goals, the workshop agenda included a work session in which the participants were required to construct a series of long-range land use plans for the case study area, the "Watkins District" (Fig. 1), under the constraints of a changing data base. Before, and during this exercise, a series of presentations on pertinent physical properties and cultural elements of the Watkins area was made and a field trip was conducted through the region (see attached Workshop Agenda).

The workshop was conducted at the Holiday Inn in downtown Denver, Colorado, on May 10, 11, and 12, 1978. It was organized and conducted by Dr. James R. LaFevers (Co-Chairman and Program Manager) Argonne National Laboratory; Dr. Thomas F. Bates (Co-Chairman) USGS/LIA Denver; Dr. J. Lee Guernsey, Argonne; and William Toner, Consultant to Argonne. Edgar A. Imhoff, USGS/RALI, organized and conducted the "Background Sessions in Laws, Programs, and Methods."

1.2 WELCOME AND ORIENTATION

Approximately 60 people from the scientific, planning, political, environmental, and industrial communities participated in the workshop. The workshop included an in-depth study of the potential impacts on land use, population, and environment that could occur in the small rural Adams County community of Watkins, Colorado, if lignite mining, gasification, and/or related development were to occur (see list of participants). The participants were welcomed first by Dr. Bates. Jim Monaghan, Assistant for Natural Resources to the Governor of Colorado, also welcomed the group on behalf of the State of Colorado. Dr. LaFevers then presented a brief description of the workshop and gave some of the history and status of Argonne's Reclamation and Land Use Planning Program.

The final orientation speech was made by Pete Mirelez, Chairman of the Board of County Commissioners in Adams County. Mr. Mirelez noted that there are many concerns about future land use in the eastern portion of Adams County. Among the many conflicting potential developments in the county are proposals for an industrial park, a local or regional airport, additional residential development and their associated water and sewer districts, a dewatering site for liquid sludge from the Denver Metropolitan Sewage District, and a strip mining operation that would include an associated lignite gasifica-

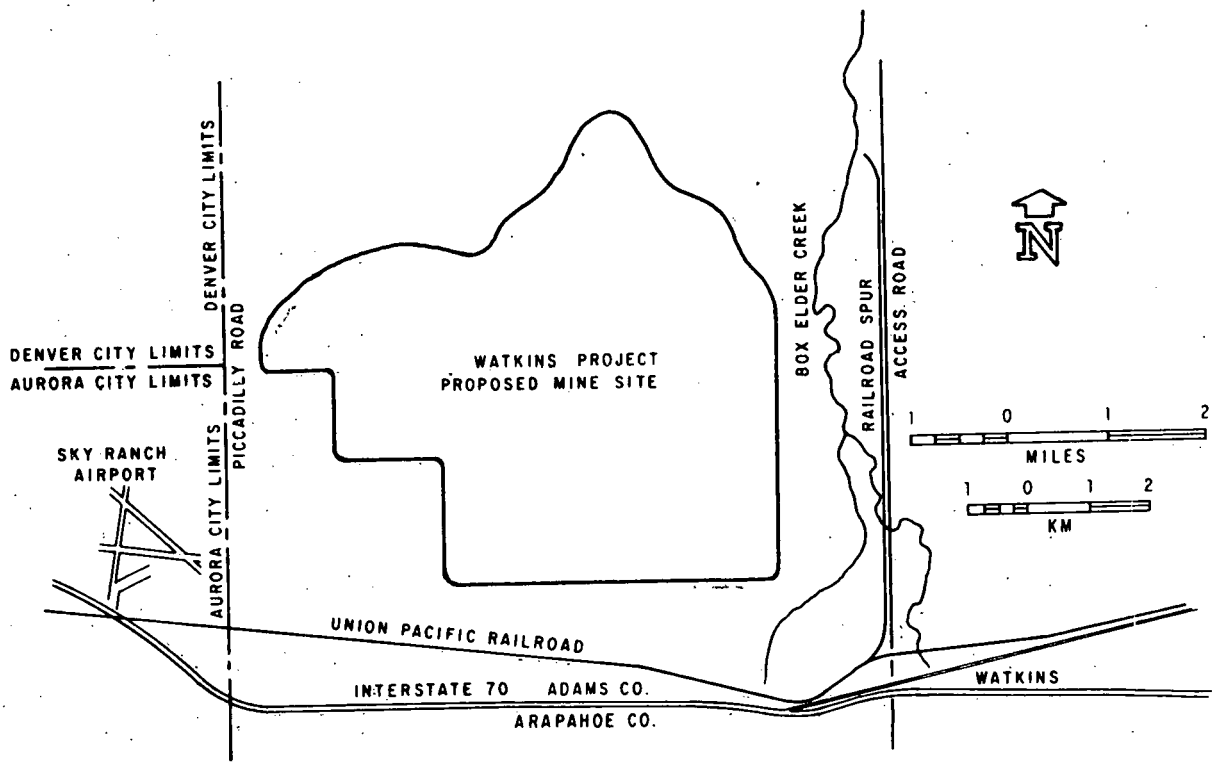

Fig. 1. The Watkins Lignite District

tion plant according to Mr. Mirelez. Adams County has been faced with many other problems including rapidly increasing land prices and a strong demand for additional rural subdivisions in open areas in the county's eastern portion. Adams County would like to be able to accommodate the most beneficial combination of these potential land uses.

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2 BACKGROUND SESSIONS IN LAWS, PROGRAM, AND METHODS

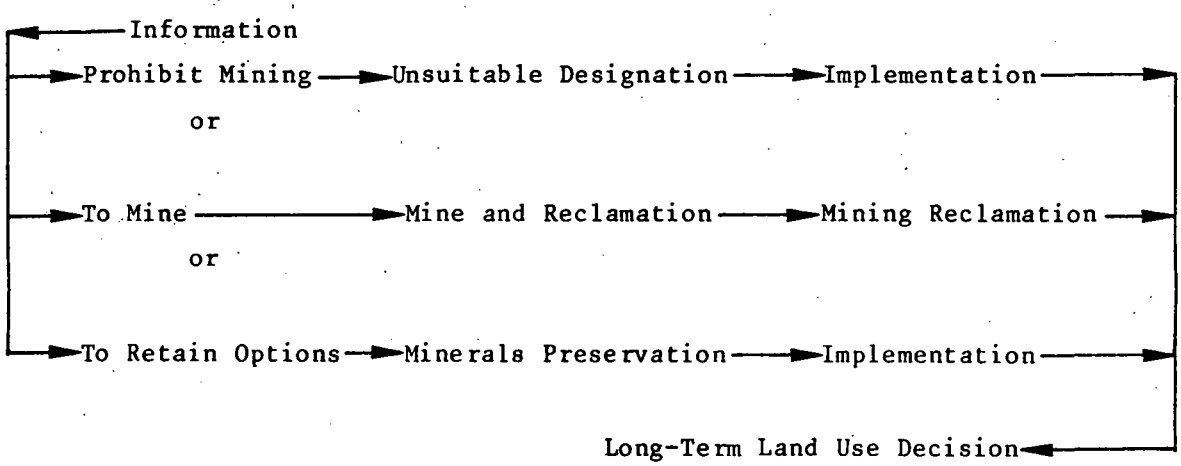
Background information for use during the workshops was presented in three initial sessions. Session I was titled "Designating lands unsuitable for mining: A role for planners in Section 522 of P.L. 95-87." Session II covered "Integrated planning for mining and mined areas reclamation." The third session was concerned with "Preventing the preemption of valuable minerals: mineral resource planning."

Ed Imhoff, leader for all three sessions, presented a brief summary of Public Law 95-87, and a flow chart on land use decision pathways (Fig. 2).

2.1 SESSION I: DESIGNATING LANDS UNSUITABLE FOR MINING: A ROLE FOR PLANNERS UNDER SECTION 522 OF SMCRA (P.L. 95-87)

During this first session, presentations were made by representatives of the Colorado Department of Natural Resources, the Federal Office of Surface Mining Reclamation and Enforcement, the Environmental Policy Institute in Denver, Colorado, and the Division of Reclamation of the North Dakota Public Service Commission. Some of the main points brought out during this session were that, in Colorado, a great deal of analysis and study must be completed to determine the adequacy of existing federal, state, and local laws that regulate

Fig. 2. Land Use Decision Pathways



mining and mined land reclamation. The viewpoint indicated by the State of Colorado's representative was that a study on designating lands as "unsuitable" would have to be undertaken and that it was important that such studies be comprehensive and far-sighted so that land use options for the future could be retained rather than lost as a result of haphazard, hurried commitment to land uses, which would conflict with future mining.

Janie Markley of the Federal Office of Surface Mining Reclamation and Enforcement (OSM) stated that "unsuitable designations" were under her purview. She presented an overview of P.L. 95-87, and how it relates to state and local governments and land use planners. The "key" to SMCRA is performance standards and procedures. Final performance standards will be promulgated sometime in October, 1978, at which time the states must enact equivalent or more stringent standards. At the same time, OSM will promulgate separate standards for federal lands which the states may enforce, if the various state laws meet federal requirements. Fifty percent of the funds realized from coal severance will be returned to the states to reclaim abandoned coal mined lands. After all such coal lands have been reclaimed, states may then apply the funds to the reclamation of other abandoned mineral lands. Ms. Markley also discussed the provisions for returning prime agricultural land to its original productivity after mining.

The main discussion in her presentation focused on Section 522 of Public Law 95-87, which deals with designating private lands as "unsuitable" for surface coal mining. Under the provisions of Section 522, a local government or a citizen may petition the state Department of Natural Resources to designate an area as unsuitable for certain types of mining. Such petitions may be submitted even if prospecting and/or mining permits have already been granted. Within 10 months of the petition, a public hearing will be conducted. An unsuitable designation may be made for a variety of reasons, including reclaimability and the protection of special resources.

Ms. Markley stated that an "unsuitable" designation of land is not a designation that is permanent for that particular parcel of land. As new data that would substantiate a change in the unsuitable designation become available, petitions could be made to alter the designation and allow mining in the area that had been previously designated as "unsuitable". Examples were

provided of the types of areas designated as "unsuitable" for mining in Montana. Such areas included unique biological areas, breeding grounds for wildlife habitat, ecologically fragile areas, and areas with exceptional historic, scenic, or recreational values.

The next speaker, C.C. McCall, of the Colorado Department of Natural Resources, noted that each state has the "opportunity" to legislate equal or more stringent laws than those promulgated by OSM. Montana has such legislation. With respect to mining, Colorado wants to delete areas that are special or unique, such as: wildlife areas; ecologically fragile areas; areas of tremendous ecological importance; areas of exceptionally scenic, historic, archeologic, or cultural value and, exceptional recreation areas. No definitions of these terms were presented. Mr. McCall indicated that Colorado's policy will be to upgrade its reclamation laws so that the state can administer its own strip mining reclamation program rather than have the program administered through OSM.

Carolyn Johnson, of the National Environmental Policy Institute, addressed the following criteria which, she noted, may possibly generate a petition for an unsuitable designation:

1. Areas (not sites) with no mining taking place, and where no mining is contemplated in the future.

2. Areas where some coal mining is now taking place and that, where, it may be felt, more mining might exceed the carrying capacity of the area in the whole ecologic system.

3. Reclaimability of an area. This will present some problems in the west. Very little hard data exist. Information from companies may exist, but it may be insufficient for the needs of land use planners.

In any of the petitions, coal must exist under the land. There is no provision for preventing the filing of successive petitions for the same area. Larry Lopez, Solicitor for OSM, stated that if OSM receives a subsequent petition with the same information, and if the petition has once had a decision made on it, then it does not require another decision. Ms. Markley gave the following definition for petitioner: an individual, partnership, company, etc., but not a federal agency. Rules are currently being drafted for Section 522 and will be out in draft for promulgation prior to printing.

Workshop participants then heard examples of similar mining concerns and relationships to Public Law 95-87 from Allen Klein, Deputy Chief, Division of Reclamation, North Dakota Public Service Commission (NDPSC), who stated that the situation in North Dakota is very similar to that being studied in the Watkins case study. North Dakota has rural areas that contain large deposits of lignite covered by highly productive agricultural soil. The main concerns of the NDPSC are about the level of reclamation that should be required in these areas. The performance bonds being required of mining companies in North Dakota presently vary from $2,500 per acre to $4,500 per acre to cover the reclamation costs. These figures represent a reclamation cost of approximately 1¢ to 5¢ per ton of coal that is extracted. Mr. Klein stated that North Dakota has very stringent reclamation laws. He said that there were several questions and/or points which need to be discussed in regard to a designation of unsuitability:

1. Is mining the land use? Can the land be reclaimed? Is there a more beneficial land use? These three questions entail a very large accumulation of data; evaluations of coal seams; mining methods; soil and vegetation characteristics; and others.

2. Economics, from the standpoint of technical feasibility.

The major emphasis of this initial session on "designating lands unsuitable for mining" focused on the need for integrated mining and reclamation planning. It was pointed out that initial consideration should be given to aesthetics, stability of the slope and vegetative cover, and potential erosion on the site. In addition, consideration must be given to soil productivity, groundwater resources beneath the mineral, the root zone of the topsoil and overburden that will be replaced. It was emphasized that mining and mine reclamation is not only a site-specific problem, but that there is a vital need to assess the cumulative impacts of mining operations on watersheds and other environmental and social characteristics within a region.

This session was devoted primarily to the planner's role in helping control mined area reclamation, and covered many of the mandates outlined in P.L. 95-87, most of which are included in Table 1.

Table 1. Public Land Use Planning or Plan Implementation Issues in P.L. 95-87

Reference	Requirement or Guide (Paraphrased)
201(c)(8)	Technical information on mining and reclamation will be provided to local land use planning agencies.
505(b)	States can enact land use controls more stringent than those required by the federal law.
508(a)(3)	In reviewing and acting on reclamation plans, the regulatory authority will evaluate the selected land use policies and plans, including comments of authorized local planning bodies.
513(a)	Planning agencies shall be notified of application for mine permits and related opportunities for hearings.
515(b)(2)	The proposed postmining land use shall be consistent with applicable land use policies and plans.
515(c)(3)(A) 515(c)(3)(C)	Certain variances from performance standards may be allowed in mountaintop removal, provided there is consultation with the appropriate land use planning agencies (if any) and certification that the proposed land use is consistent with local land use plans and programs.
522(a)(3)(A)	A specific land area may be designated unsuitable for certain types of coal mining operations if such operations are found to be incompatible with existing public land use plans or programs.
522(a)(5)	Determinations of the unsuitability of land for surface mining shall be integrated with present and future land use planning and regulation processes at the federal, state, and local levels.

2.2 SESSION II: INTEGRATED PLANNING FOR MINING AND MINED AREA RECLAMATION

Presentations were made by representatives of the RALI Program and the planning divisions of the USGS, and also by the Colorado Department of Natural Resources, the Soil Conservation Service of the U.S. Department of Agriculture, and a planner with experience in mine reclamation in Fulton County, Illinois. Key points made during this session were that P.L. 95-87 is not a substitute for local or state planning. P.L. 95-87 will help those local areas and states that have plans or will be preparing them, but it still cannot substitute for the need for involvement with the regulation of reclamation at the local and state level. The local level analysis is needed for many reasons, including: (1) protection of known mineral deposits, (2) regulation of mineral extraction, and (3) assurance of both adequate site reclamation of and a compatible eventual land use. Resources are a local concern; because they are in set locations and cannot be moved, they must be dealt with at the local level.

Bill Kockelman, Environmental Planner, U.S. Geological Survey, stated that there are inherent limitations to state and local planning. P.L. 95-87 will aid those areas for which there are land use plans, but will not aid those where no plans exist. Land use planners either don't know or tend to forget that:

1. Scarce or unique materials can be lost.
2. There is a lack of mineral location flexibility.
3. Bulky, abundant materials require short distances to markets in order for mining to be economical.

The mining industry tends to forget that:

1. Extraction of minerals creates hazards to adjacent areas.
2. Surface mining temporarily precludes other land uses.

Land use planners must therefore consider the following:

1. The protection and conservation of known mineral deposits need to be fully assessed in terms of the deposit; this may require rezoning of an area to designate it a mineral (mining) district.
2. Regulations which cover extractive operations.
3. Reclamation and land use after a completion of a mining operation.

This session also included a discussion of past reclamation experience in Fulton County, Illinois. In that county, strong reclamation efforts have existed only since 1975. Charles Sandberg, Planning Administrator, Fulton County, Illinois, stated that Illinois has "zoning" as a land use control. Therefore, various reclamation projects can be dealt with separately (e.g., reclamation of a sludge operation vs. mined area reclamation). Fulton County contains some of the most highly productive farmland in the country. The average yields of corn from this farmland are up to 150 bushels per acre. Presently, there are 60,000 acres in need of reclamation in the county, with an additional 1,000 to 1,200 acres per year being mined. Experience with reclamation in this area has indicated that efforts to return the topsoil to equivalent levels of pre-mining agricultural productivity, through reclamation, have not been totally successful. Fulton County planners have searched unsuccessfully for any studies or explanations of cases where the original soil productivity was regained after reclamation. The application of treated sewage sludge to some of the reclaimed soils in the county has helped increase productivity. That sludge had been treated to secondary or tertiary levels and then injected into the soil rather than sprayed on the surface.

Ellis Sedgley, Soil Conservation Service, U.S. Department of Agriculture, stated that the U.S. Secretary of Agriculture has designated SCS to handle P.L. 95-87 in:

1. Providing resource information to state agencies which are developing plans, and

2. Providing resource information to industry.

Such resource information will consist of information on soils, reclamation practices, and vegetation guidelines for erosion controls. Under P.L. 95-87, Prime Agricultural Lands (PAL) are required to be reclaimed to pre-mine equivalent or better productivity. USDA defines PAL (August 23, 1977, Federal Register), but the definition applies nationally, not geographically. Therefore, less than two percent of the lands in Colorado can satisfy the definition. The definition is specifically limited by temperature regimes, precipitation, and soil characteristics. The State of Colorado has very little farmland that meets the criteria of "prime" on a national basis. Soil Conservation Service estimates indicate that only two percent of Colorado's land

would be classified as prime farmland. In general terms, most of the land in Colorado in excess of 8,000 feet elevation will be eliminated from classification as prime farmland on a national basis, as will all non-irrigated soils since most of the state is in a zone that obtains less rainfall than is needed to meet the national classification for prime farmland.

C.C. McCall, Administrator, Mined Land Reclamation, Colorado Department of Natural Resources, mentioned some general guidelines for land use planners to consider:

1. What is the reclaimed site going to look like?
   a. Aesthetics (color, texture, shadowing, etc.),
   b. Productivity,
   c. Compatability and continuity with adjacent areas,
2. Cumulative impacts:
   a. Carrying capacity of streams,
   b. Soils: depths, texture, chemical characteristics; groundwater.

He emphasized that preplanning and tailor-designed reclamation plans are most important.

Tim Smith, RALI Program, U.S. Geological Survey, posed two questions:

1. What are the informational and analytical techniques necessary for integrated planning?
   a. Impacts -- types
   b. Elementary calculations: these can be performed with a relatively simple computer program
   c. Physical facilities and their impacts
2. What can the planner do to cope?

2.3 SESSION III: PREVENTING THE PREEMPTION OF VALUABLE MINERALS: MINERAL RESOURCE PLANNING

This session included presentations by the Director of the Colorado Geological Survey, a planner in Weld County, Colorado, who prepared that county's mineral resources plan, and the President of the Flatiron Sand and Gravel Company of Boulder, Colorado.

John Rold, Director and State Geologist, Colorado Geological Survey, stated that Colorado in 1974 passed legislation requiring all counties with

greater than 65,000 population prepare and adopt a process of identification of economically feasible mineral deposits in a plan which protects those deposits from land uses which would preclude their future extraction. This law (P.L. 1529) was endorsed by a coalition of sand and gravel operators, counties, and environmentalists. It has two main thrusts: (1) the identification and preparation of a mineral preservation plan, and (2) discussion of mined land reclamation. In late 1977 and early 1978, an investigation on the effectiveness of this law in various counties in Colorado was undertaken. According to Mr. Rold, this investigation indicated that the law has been somewhat ineffective, since not even one county had met the deadline of July 1, 1975, for preparing and adopting a mineral extraction plan. Weld County, however, was very close to meeting that deadline. Presently, in the Denver region, Adams County has prepared a plan; however, it has not yet been adopted. Boulder, Pueblo, Weld, and El Paso Counties have prepared and adopted mineral extraction plans. Arapahoe County has not adopted such a plan, nor has Larimer County. Larimer County says that because gravel is not a limited resource in their county, they have not prepared a mineral preservation plan. Since only a very small amount of land is affected in Denver County, a plan was never adopted, even though prepared. One of the weaknesses of P.L. 1529 is that there were no provisions for enforcement, according to Mr. Rold.

There have, however, been several benefits as a result of P.L. 1529. One benefit was that the law resulted in the generation of a useful data base of existing sand and gravel deposits that may be economically feasible to extract. This data base is in the form of a report and inventory prepared by the Colorado Geological Survey. A second benefit is that some local governments are getting involved in sand and gravel conservation in their land use planning considerations. An additional benefit is that the Colorado Geological Survey will perform additional technical identification of resources in those Colorado counties that have a population of less than 65,000.

Ray Jost, Weld County Planner, stated that the Weld County Mineral Resources Plan stressed the need to integrate the protection of valuable mineral resources with the protection of agricultural land within the county. Weld County is almost totally zoned for agricultural uses, with a permitted density in much of the county of either one dwelling unit per 80 acres or one dwelling unit per 160 acres. This zoning, in effect preserves the mineral

resources, since no development is allowed at densities that could preclude future extraction of the resources. There is a conflict in Weld County between the irrigated farmland and sand and gravel resource according to Jost. If the sand and gravel are extracted along streams, he says, the source of irrigation water may be disrupted, since the sand and gravel deposits serve as aquifers. This potential conflict has been dealt with in Weld County's comprehensive plan by discouraging sand and gravel mining in areas where it would affect irrigation. In addition, water resources are examined in detail at the time the applications for mining permits are reviewed by the county.

Ed McDowell stated that his company has been involved in reclamation and redevelopment after mining. Such redevelopment has generally been to industrial uses. His firm's primary means of preempting the high quality gravel resources from conversion to other uses is to actually buy the land itself. The company feels that the conservation attempts by the state are good, but they do not work in an area where there are many governmental entities potentially involved in regulation. McDowell indicated that there will be a potential for a shortage of sand and gravel in the Boulder Metropolitan Area in approximately 20 years. As far as he was aware, there was no other agency, either private or public, that was buying sand and gravel deposits with the idea of preservation for future use. Indeed, some municipalities were zoning the deposits for preservation, but there were no real visible examples of purchase of land for preserving minerals. Mr. McDowell also indicated that his company's long range planning efforts for the reuse of mined-out areas for the benefit of the local community had repeatedly been thwarted by local or federal agencies. A recent case described in the Argonne/RALI report entitled "South Boulder Creek Park Project, Sand and Gravel Operations, Boulder, Colorado," copies of which were distributed at the workshop, was an example in which hundreds of thousands of dollars were spent on planning the site reclamation for recreational use. After the local agencies and concerned environmental groups were satisfied with the plan, the U.S. Internal Revenue Service negated the effort by refusing to allow the company to donate the land to the city and take a deduction for the gift.

The opening day of the workshop concluded with an evening social hour and banquet. The banquet speaker, Charles Margolf, Director of Western Coal Operations for W.R. Grace and Company, presented a speech entitled "The Four

"E's" and the "T" In Freedom," in which he stressed concern over increasing governmental red tape and the need for more freedom of individual enterprise. The four "E's" and the "T" referred to in the title were Energy, Environment, Economy, Education, and the time necessary to shift from traditional energy sources to new technologies.

Introduction to the Case Study: The Watkins District

On the second day of the workshop, the first item was an introduction to the case study of the Watkins District by Bill Toner. During this introduction, the participants heard presentations from Robert Fleming, Director of Adams County Planning; Gail Hill, Planner with the Denver Regional Council of Governments (DRCOG); and Elizabeth Wright-Ingraham of the Wright-Ingraham Institute of Ecological Studies. The purpose of these presentations was to give the participants an idea of some of the different planning viewpoints as expressed by Adams County and the region, and to let the participants use those viewpoints in their initial task.

Eleven working groups were assigned. In Task I, the working groups were asked to develop a long-term land use plan for the Watkins planning district. Each group was given basic information on current land use, projected populations, earth science information from topographic quadrangles of the region, and various economic data. No information was given as to the vast lignite reserves of the area.

The first presentation was on the viewpoints of Adams County. It was indicated that the county officials in Adams County are somewhat dubious about future mining. The officials have not yet adopted a mineral extraction/preservation plan as required by P.L. 1529. Although prepared, the plan has not been adopted because the commissioners do not want Adams County to be the principal mining source for the Denver metropolitan area for the next 25 years. Adams County would also like to be certain of what the applicable federal and state reclamation laws require before they enact any ordinances for protection of their mineral resources.

Adams County has a wealth of mineral resources, including oil, gas, coal, sand, and gravel. Within the county there are conflicts among these different mineral resource extraction uses. Representatives of the oil industry oppose a general aviation or regional airport and associated developments

in the county because of conflicts with oil industry activities. Adams County officials are concerned about the feasibility of coal extraction, but feel that they have much more to learn about it before any decisions are made. They want to be sure of any implications in terms of land use, water, and other factors that may be encountered if the area is committed to mining. It was stressed that the eastern part of the county is rural; there are only 4,000 people in the eastern 80% of the county.

Most of the area around the case study site near Watkins is owned mainly by five property owners. Most of the owners believe that they should be able to do with their land whatever will bring them the most profit. In most instances, the mineral rights ownership is separate from the surface rights ownership, and there are conflicts that have to be resolved along these lines. In past instances, the Adams County commissioners have appeared to favor the rights of the surface rights owners over those of the mineral rights owners in resolving conflicts. In Adams County near Watkins, the Union Pacific Railroad owns the mineral rights of each alternate land section along the railroad route. Most of the area around Watkins is presently in dryland agricultural use producing winter wheat. It is a relatively productive area with average yields being approximately 25 to 30 bushels of wheat per acre.

After the viewpoint of the county, a presentation was made for the viewpoint of regional planning. It was noted that the Regional Growth and Development Plan directs growth through the year 2000, to occur within defined urban service areas, and discourages scattered urban-type development within areas designated for non-urban uses.

The Denver Regional Council of Governments (DRCOG) has prepared a set of policies to deal with all environment characteristics in the region, including natural resource areas. The policies dealing with coal extraction indicate that the areas which have been defined as commercially feasible lignite deposits should be protected from any other development that would preclude the future extraction of that lignite resource.

The next item of the morning schedule was a presentation on the general environmental characteristics of the Box-Elder watershed. This presentation addressed the research done by environmentalists at the Wright-Ingraham Institute over the past several years.

Field Trip

After the participants were presented materials to familiarize them with the Watkins case study area, a field trip to the study area concentrated on viewing four study sites (Fig. 3). Eight representatives of the fields of planning, hydrology, coal geology, soils, environmental geology, economic geology, and waste disposal engineering led on-site discussions of their technical areas. The field trip began at 10:00 AM and ended about 3:00 PM, and included a lunch stop at Barr Lake State Park.

Stop 1 on the field trip emphasized the rural characteristics of the Watkins area. Robert Fleming, and Don Paul, Planning Director of Arapahoe County, commented on the land use of the Watkins area and the I-70 corridor connecting Watkins with Denver. They noted the open land and general accessibility to Denver as some of the Watkins area's special resources. Paul Soister of the USGS presented a report on the lignite deposits near Watkins, in which he discussed the characteristics of the lignite and showed geologic maps and cross-sections indicating the thickness of the lignite in relation to the amount of overburden. John Rold then showed graphics that further displayed the relationship of the lignite coal deposits to the overburden and to aquifers located beneath the lignite. The aquifers do not appear to present a strong environmental concern for strip mining of the lignite. Both Paul Soister and John Rold discussed the physical characteristics of the Denver Basin and explained its significance in providing water and lignite. Paul Soister added that the best utilization of the lignite would probably be through gasification or liquefaction because of the numerous noncoal partings and low quality of the coal.

Stop 2 was at a proposed location for a dewatering site for the Denver Metropolitan Sewage District. William Korbitz discussed proposed plans for using two sections of land for a sludge disposal site. Considerable controversy arose over the land use compatibility of disposing of Denver's sewage in these Adams County areas and the feasibility of combining Denver's sewage waste materials with the mined lignite in a gasification process. The other major topic discussed at Stop 2 was the proposed general aviation airport. The proposed site is about 8 miles north of Watkins and would require the acquisition of about 1,600 acres.

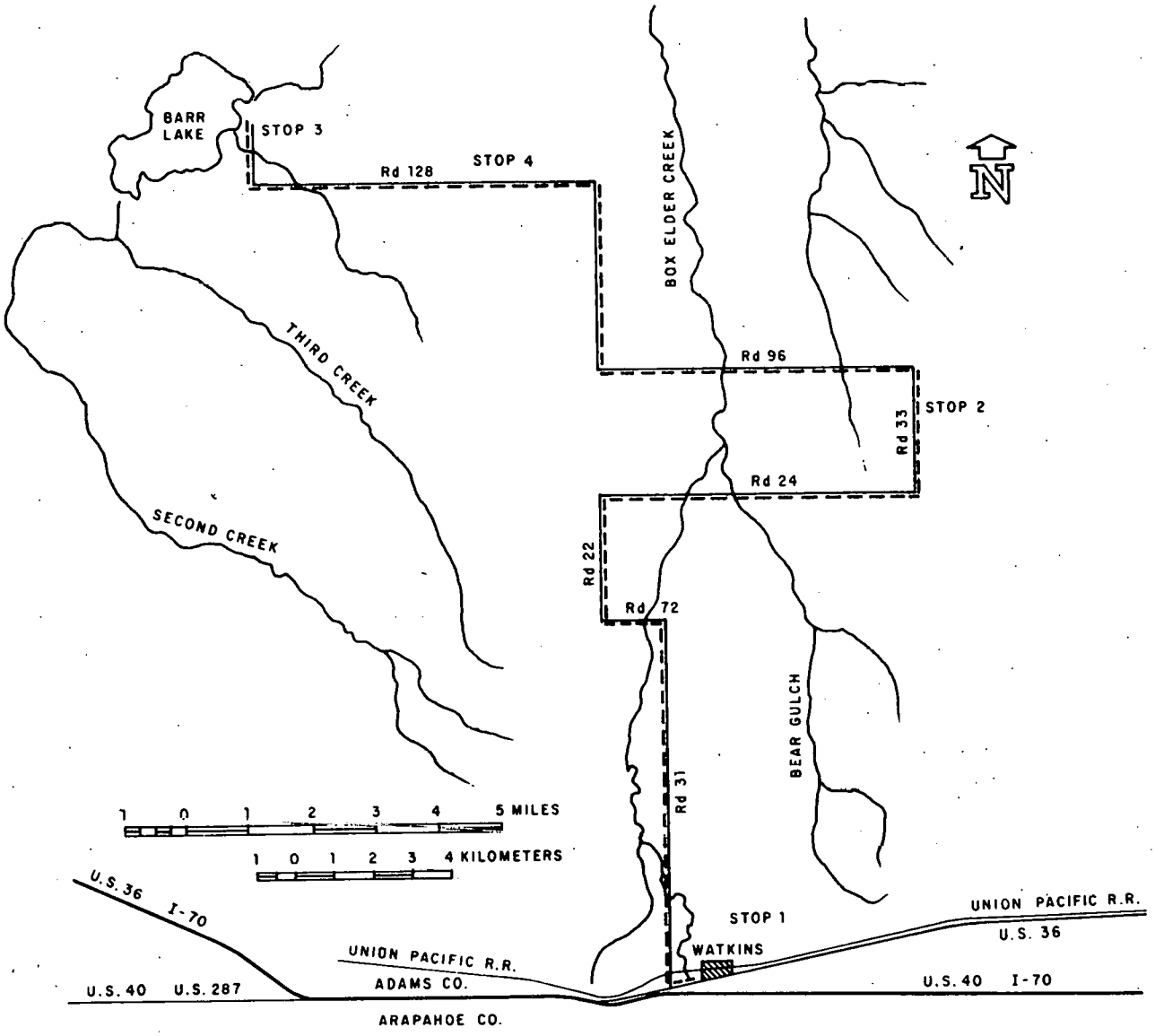


Fig. 3. The Field Trip Area

Stop 3 included a box lunch, viewing of the Barr Lake State Park recreation area, and briefings by state park personnel. Members of the Adams County Planning Department were also available for discussions concerning recreational planning efforts in the area.

At Stop 4, Richard Pearl explained the regional hydrology, John Rold reviewed oil and gas production, Ellis Sedgley reported on soils, and Don Trimble discussed the environmental geology of the Denver Basin.

The afternoon portion of the field trip showed the magnitude of the impact that the oil and gas industry has on Adams County. Presently, there are more than 470 oil and gas wells in Adams County. Discussion emphasized the potential conflicts between the oil and gas industry and residential development. The major conflicts result from traffic on access roads, the locations of pipelines, and the potential for fire.

After the oil and gas discussion, the group discussed the soils of the region. Most of these soils fall into SCS capability classification III or IV. These soils are very productive for dryland farming. One of the main problems with the soils in this area is wind erosion. Robert Fleming and Don Paul reviewed the existing land use enroute back to the Denver workshop site.

The field trip highlighted some diversities of the Watkins study area. They were viewed by many of the participants as a need for a substantial amount of discretion in determining land use plans that are most appropriate for local conditions.

Since traditional local planning has focused on matching land use activities with environmental features that support those activities, local and regional planners examine environmental settings and apply professional judgements as to desired future conditions. They prepare a land use plan which allocates land to desired activities and, at the same time, provides a land use design that is aesthetically pleasing.

Observations made at Stops 2 and 3 questioned the traditional planning approach. Participants indicated that this approach is based on insufficient data, has too limited a focus, and may not fit the diverse social and economic goals of the people of Adams County. At the proposed sludge and airport sites, diverse views were expressed and similar discussions were carried out at Stop 3.

The Case Study

After returning from the field trip, the participants began preparing a minerals conservation and development plan for the Watkins planning district. At this time, additional data on the location of the lignite deposits, maps of sand and gravel deposits in the region, and relevant sections of P.L. 95-87 were given to the participants. The participants were instructed to include a discussion of the lignite, sand, and gravel in their plan, and to consider areas suitable or "unsuitable" for mining, and areas of uncertain resource quality. The participants went back to the regional land use plan they had prepared prior to the field trip and prior to obtaining detailed maps on the areas of the lignite resource. After a suitable time for revising, certain groups presented their plans, their revisions, and the logic for their total land use plan including mineral resource preservation areas.

The task on Friday morning was to evaluate proposals for lignite mining, subdivision development, and agricultural plans for the area. The first presentation, by Bob Fleming, concerned a proposed development entitled the Box-Elder Project. The proposal was originally for a 4,000 acre development including residential, commercial, and industrial development. The development on that magnitude was denied by Adams County. Later, the development was scaled down to approximately 800 acres, and zoning for that development was again denied. At present, the county commissioners have indicated that they would approve an industrial development of approximately 100 acres.

Jack Danford, a land owner in the area of Watkins, also presented considerable information. Mr. Danford operates Danford-Champlin Farms, Ltd., and also manages property for other people in Watkins who are not able to farm their own land. He indicated that the people in Watkins desire quality development in that area. He said that several of the land owners opposed development of the new airport in their general area, but they are all amenable to some type of quality development. Many of the land owners in the area are elderly and are interested in selling their land. The main criterion for these sales is that they want the development that will bring them the most profit. Mr. Danford has owned land in the area for 11 years. It was purchased at approximately $300 per acre and he now feels that the value ranges from $2,000 to $12,000 per acre, with higher price being for that land that has the thickest lens of lignite beneath it.

Mr. Danford stated that, in the immediate future, there would not be much money in farming in a relative economic sense. That is, the value from farming the land would be much less than the value from higher intensity development or mineral extraction activities. He also pointed out that some residential developments have been approved in the area northeast of Watkins in approximately one-half section of land that has been zoned for two-acre residential lots. Immediately north of that section, an entire section has been zoned for 40-acre ranchettes and there are presently three existing ranchettes. The history of approving those developments goes back about two years, when less data on the lignite deposits were available. At that time, Adams County asked the Colorado Geological Survey (CGS) to render an opinion on whether the proposed zoning for 40-acre lots and two-acre lots was located in areas of valuable lignite. At that time, CGS indicated that there were not enough data to assuredly say that there were economically feasible deposits of lignite beneath the site. Since the time of the initial request for analysis by the CGS, additional data on the coal deposits have been provided to Adams County. Staff members from the CGS testified against zoning the property for residential use indicating there would be conflicts with minerals development. However, by that time the Adams County Commissioners had already decided the zoning issue, and the advice of the CGS was not heeded.

The third presentation of the morning session was by Mr. John Hand of Cameron Engineers, a firm that has been involved since 1969 in concept planning for the preliminary development of a lignite and solid waste gasification plant proposed for Watkins. Cameron's studies show the Watkins area as a prime site for a commercial lignite gasification project which would produce approximately 250 million cubic feet of gas per day. This gas would be pipeline quality synthetic gas. The lignite resource for the project is an indicated 337 million tons, and the overburden stripping ratios average approximately 3.8 cubic yards of overburden per ton of lignite. The average heating value of the lignite is 4430 BTU per pound. In addition to the initial site where Cameron is anticipating development, there are more deposits two miles east. At this site the primary lignite deposit is estimated to be 200 million tons.

Water will be required for the coal gasification process and cooling. It is anticipated that the source of water will be uncommitted waste water from Denver and Aurora. This source is expected to provide approximately 8,000 acre

feet of water per year as required by the proposed plant and mine. Additional high quality water will have to be provided on the site from deep groundwater aquifers.

Solid waste from the Denver Metropolitan area will supplement the lignite in providing fuel for the gasification plant. This site is presently served by the Union Pacific Railroad and Interstate 70. It is located 17 miles east of downtown Denver, 10 miles east of Stapleton Airport. Natural gas pipelines of the Colorado Interstate System of Coastal States Gas Corporation, which supply Denver and eastern Colorado, converge at the site in Watkins.

After the removal of the lignite, according to Mr. Hand, ash and incombustible solid waste from Denver will be used to fill the voids resulting from the mining. Approximately 30% of the lignite that is mined will be used for fuel immediately in transforming the lignite into gas. The basic lignite resource for the first part of Cameron's project is located to the west of Box Elder Creek. It is anticipated that this deposit would provide 10 million tons of lignite per year for 27 years of operation.

In the mining process, the topsoil would be removed in long strips. The soil reclamation would be a five-stage process. In the first stage, the mining would occur. In the second stage, the overburden and waste would be replaced in the area where the lignite had been removed. In the third stage, leveling would occur. The topsoil would be replaced in the fourth stage, and in the fifth stage, the soil would be back in production. Cameron Engineers is not sure if this process will be the final one because in future years such a process may or may not conform to new regulations.

Mr. Hand stated that a survey of public reaction to activities related to the Watkins Project was taken for Cameron Engineers. In general, the survey showed that approximately 50% of the people questioned favored the proposal. Twenty-five percent were neutral and approximately 15% of the population opposed the proposal. There was little difference in people's reactions to the Watkins proposal based on where they live, according to the survey. People from Watkins as well as from Denver had the same basic response to the proposal. The Watkins Coal Gasification Proposal can be summarized in nine points, according to Mr. Hand:

1. Lignite is available.
2. Water is available from unused sources.
3. Solid waste recycling can be involved in the project.

4. The land can be reclaimed.
5. Power is available to the area.
6. The area is supported by good transportation, i.e., highway and railroad transportation is available.
7. The site is located next to a market for the products produced by the coal gasification plant.
8. The plant will provide jobs.
9. The plant will provide clean energy.

After these presentations, the workshop participants had the opportunity to make final revisions to their proposed land use plans for the Watkins area. The basic result of the revisions in most of the groups was to allot additional areas for more industrial development. Every group indicated that lignite mining would be the main activity in the area. Adjacent commercial, residential, or industrial uses varied from plan to plan depending on the group and the composition of its members.

Implications of the Case Study

Each of the working groups was requested to submit three principles of land use/reclamation planning which they had perceived during the workshop. A total of twelve different categories of principles were given (Table 2).

Nine groups stressed the need for more data in land use and reclamation planning. They indicated that planning is too often based on insufficient information, has too limited an overview, and lacks adequate mining, economic, environmental, and social data. Mention was also made of the need to meld as many of these data together in as comprehensive a fashion as possible.

The second most frequently stated principle (8 groups) gained from the workshop was the concept of setting aside special mining districts to preserve areas significant for their mineral resources for future use. Participants stated that the Adams County commissioners should adopt a mineral preservation plan, since the area is faced with heavy development pressures.

These groups stressed the principle that surface mining is an interim or sequential land use. By the very definition of surface mining, they felt land use/reclamation must be dynamic, as the requirements of the people living in the area change. Most groups seemed to agree with Elizabeth Wright-Ingraham, who wrote in Science (1976) that "Both the approach of halting all land devel-

Table 2. Perceived Implications of the Workshop

	No. of Responses
Need adequate survey of minerals (overview) (comprehensive data).	8
Mineral preservation is an essential ingredient in planning.	9
Mining is an interim or sequential land use (include flexible land use alternatives).	3
Mineral preservation is an essential ingredient in land use planning.	3
Planning has to be consistent with public, political, and legal objectives.	3
Long-range perspective for planning needs lead time.	2
Need better information on public perceptions.	2
Need technique for compensating owner for minerals not mined.	1
More emphasis on the implementation and regulation of mining plans.	1
Need more data on designating areas unsuitable for mining.	1
Better provisions for residential and industrial areas contiguous to mining areas.	1
Need better projections of need and economic values.	1

opment and that of meeting all demands for exploitation of resources are unacceptable." The interim land use plan would likely follow a middle ground.

Three groups indicated that land use/reclamation planning has to be consistent with public, political, and legal objectives. They appeared to see the planner's role as a steward of a technical agency which integrates the land use/reclamation plans into the political process. They felt that the diversity of local conditions makes it desirable that the plans be appropriate for their local conditions. But two groups indicated that planners need more information about how the public perceives the local conditions.

Two groups indicated that long-range land use plans need considerable lead time in order to get a better picture of what the area should look like in 20 to 25 years. This long-range setting would provide a framework for short-term land use/reclamation plans, and for specific programs of public action.

Other principles, listed by only one group each, include: need techniques for compensating land owners for lands designated unsuitable for mining; need more emphasis on the implementation and regulation of mining plans; need better provisions for residential and industrial areas contiguous to mining areas; and need better projections of economic needs and values of the Adams County study area.

Evaluations

During the workshop wrap-up, Jim LaFevers asked the participants to submit a list of what they considered to be the weaknesses of the workshop, and another list of the strengths or positive aspects of the workshop. Although there was a great deal of overlap and use of various terminology to express the same or similar comments, it was possible to categorize the responses. The following lists (Tables 3 and 4) are arranged in order beginning with the most frequently stated comment and continuing to those comments stated by only one participant. Some comments were omitted from the lists if they were not relevant to the workshop and were mentioned by only one participant.

Of the total of 183 participant responses concerning both the strengths and weaknesses of the workshop, 114 responses were on the positive side and 69 responses were suggestions for improvement, as asked for by the workshop organizers. Of all the responses, the most frequent statement (17) concerned the mix of participants. It was generally agreed that there was good representation of a variety of interests, including planners, the mining industry, government, and environmental concerns. The field trip was also considered to be an important part of the workshop, with 11 positive responses, although one response stated that it was unnecessary. Ten responses applauded the completeness and usefulness of the data package presented, while one stated that too much material was included and one stated that not enough material was included.

On the negative side, ten responses concerned the need for more time for each task. This was the most frequent negative response, followed by statements concerning a need for more time for each of the speakers (6), and the desirability of receiving the data package prior to the workshop (5). There

Table 3. Positive Aspects of the Workshop

	No. of Responses
Mix of participants	17
Field trip	11
Data package provided	10
Case study approach to land use planning	9
Faculty of panelists available for reference	8
Overall workshop organization	8
Argonne and USGS staff competency	8
Opportunity for group and individual interaction	6
Real situation awareness provided for outsiders	5
Working in small groups at separate tables	5
Diversity of viewpoints presented	5
Concept and subject matter	5
Magnitude of planning problems presented	4
Banquet and speaker	4
Maps provided	3
Data interpreted for application	2
USGS getting involved in local affairs	1
No wasted time, did much work in a short time	1
Kept on schedule	1
Competency of Workshop organizers (LaFevers, Toner, Bates)	1

were also four responses each concerning the need for more introductory information on what was to be done during each stage of the workshop, the need for more informal meeting time, the desire to receive information on all of the tasks at the beginning, and the difficulty of working with some of the maps. On the other hand, three responses lauded the maps, and six responses were complimentary of the opportunity provided for individual interaction, both formal and informal. In addition, nine responses were very positive toward the case study approach and the method utilized of sequentially presenting data and tasks.

Table 4. Negative Aspects of the Workshop

	No. of Responses
Needed more time for each task	10
Too many speakers in too short a time, on the first day	6
Needed materials before the workshop began	5
Needed beginning roadmap/overview	4
Needed more time to get acquainted informally	4
Did not like receiving data and tasks a little at at time	4
Maps were hard to work with	4
Overall objective should be stated earlier	3
Needed discussion of planning concepts and procedures	3
Group assignments not good at all tables	2
Too much busy work	2
Not enough discussion of unsuitability designation	2
Needed more participation by industry people	2
Not enough mixing of participants	1
Needed more background on use of handouts	1
Needed more participation by county commissioners	1
Should have been closer to the site	1
Too much material distributed	1
Too directed by federal people	1
Watkins area too narrow	1
Not all groups were heard from	1
Too many participants left before the work was done	1
No bankers involved	1
Introduce individuals to the group	1
Should have had sessions Thursday evening	1
Needed more discussion of P.L. 95-87	1

The other frequently stated responses were positive statements concerning the competency of the Argonne and RALI staffs and of the faculty of panelists and resource persons made available for consultation and to present technical briefings. Overall, the workshop organization was considered to be excellent. The suggestions for improvement were, however, very constructive and many of them are being incorporated into the next workshop.

The workshop was adjourned at noon on Friday, May 12, by Jim LaFevers and Tom Bates.

APPENDIX A

WORKSHOP AGENDA

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MINERAL RESOURCES AND LAND USE PLANNING

A WORKSHOP FOR PRACTICING PLANNERS, ELECTED OFFICIALS AND CITIZEN LEADERS

TO MINE--NOT TO MINE--RECLAIMING LAND KEEPING OPTIONS OPEN

THE MOLLY GIBSON ROOM
HOLIDAY INN--DENVER DOWNTOWN
DENVER. COLORADO, MAY 10-12, 1978

Sponsored and conducted by:
The Resource and Land Investigations (RALI) Program
Geological Survey, U.S. Department of the Interior
and
Argonne National Laboratory
U.S. Department of Energy

With the cooperation of:
The Colorado Department of Natural Resources
The Colorado Department of Local Affairs
The Denver Regional Council of Governments
Adams and Arapahoe Counties, Colorado

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WORKSHOP SCHEDULE

May 10, Wednesday

1:00 - 1:30 PM WELCOME AND ORIENTATION

--Thomas F. Bates, U.S. Geological Survey, Co-chairman
--Malcolm Murray, Assistant for Natural Resources to the Governor of Colorado
--James R. LaFevers, Argonne National Laboratory, Co-chairman
--Pete Mirelez, Chairman, Board of County Commissioners, Adams County

1:30 - 4:45 PM BACKGROUND SESSIONS IN LAWS, PROGRAMS, AND METHODS

--Ed Imhoff, U.S. Geological Survey, Session Leader

1:30 - 2:30 PM Designating lands unsuitable for mining: a role for planners in Sec. 522 of P.L. 95-87

--C.C. McCall, Administrator, Mined Land Reclamation, Colorado Department of Natural Resources
--Janie Markley, Federal Office of Surface Mining Reclamation and Enforcement
--Carolyn Johnson, Environmental Policy Institute
--Allen Klein, Deputy Chief, Div. of Reclamation, North Dakota Public Service Commission

2:30 - 3:30 PM Integrated planning for mining and mined areas reclamation

--E. Tim Smith, RALI Program, U.S. Geological Survey
--C.C. McCall, Administrator, Mined Land Reclamation, Colorado Department of Natural Resources
--Charles E. Sandberg, Planning Administrator, Fulton County, Illinois
--William J. Kockelman, Environmental Planner, U.S. Geological Survey
--Ellis F. Sedgley, Colorado State Conservationist, Soil Conservation Service, U.S. Department of Agriculture

3:30 - 3:45 PM Break

3:45 - 4:45 PM Preventing the preemption of valuable minerals: Mineral resource planning

--John Rold, Director and State Geologist, Colorado Geological Survey
--Roy Jost, Weld County Department of Planning
--Ed McDowell, President, The Flatiron Sand and Gravel Company, Boulder, Colorado

6:00 - 7:00 PM	COCKTAIL HOUR (No Host Bar)
7:00 PM	BANQUET
	GUEST SPEAKER: Charles W. Margolf, Director, Western Coal Operations, W.R. Grace and Company

May 11, Thursday

8:00 - 9:45 AM	TASK I: INTRODUCTION TO CASE STUDY -- The Watkins District*
10:00 - 2:00 PM	FIELD TRIP: Lignite areas of Adams County**
12:00 Noon	Box Lunch
2:30 - 4:00 PM	TASK II: Minerals and plans
4:00 - 4:30 PM	TASK III: Minerals and regulations
4:30 - 5:00 PM	TASK IV: Group talks

May 12, Friday

8:00 - 9:30 AM	TASK V-A: Land use conflicts
9:30 - 10:00 AM	TASK V-B: Achieving compatibility
10:00 - 10:30 AM	TASK V-C: So what's an "Unsuitable Designation"?
10:30 - 11:15 AM	TASK VI: Principles and practices of mineral resource planning
11:15 - 12:15 PM	TASK VII: Group talks
12:15 - 12:30 PM	WORKSHOP WRAP-UP
12:30 PM	ADJOURNMENT

*Case Study Leader: William Toner
**Field Trip Director: Lee Guernsey

APPENDIX B

LIST OF WORKSHOP PARTICIPANTS

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Participants

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May 10-12, 1978
Denver, Colorado

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