

REVIEW OF THE MINING AND RECLAMATION PLAN  
FOR THE EMERY DEEP MINE

**BIO/WEST, Inc.**

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Aquatic and Terrestrial  
Resource Management and Problem Solving

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REVIEW OF THE MINING AND RECLAMATION PLAN  
FOR THE EMERY DEEP MINE

Submitted to

Utah Department of Energy and Natural Resources  
Division of Oil, Gas and Mining  
4241 State Office Building  
Salt Lake City, Utah 84111

Submitted by

BIO/WEST, Inc.  
P. O. Box 3226  
Logan, Utah 84321

March 18, 1983

Technical Proposal  
to  
Division of Oil, Gas and Mining

Submitted by

BIO/WEST, Inc.  
Logan, Utah

Title of Proposed Project

Review of the Mining and Reclamation Plan  
for the Emery Deep Mine

Desired Starting Date

April 15, 1983

Completion Date

March 15, 1984

  
Thomas M. Twedt, Principal

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## INTRODUCTION

The Request for Proposal (Req. No. 584202) from the State of Utah involves technical assistance in the review of a mining and reclamation plan for the Emery Deep Mine. To provide this assistance, BIO/WEST, Inc., of Logan, Utah, and Richardson Associates are submitting this proposal which defines their unique qualifications to accomplish the statement of work. This proposal is divided into several sections which discuss the technical approach, personnel qualifications, management, and cost. BIO/WEST and Richardson Associates provides a team of highly qualified individuals who have extensive experience in mine plan reviews. Most of the staff have reviewed over 25 mining and reclamation plans for the Office of Surface Mining (OSM) in the states of Utah, Colorado, Arizona, New Mexico, Wyoming, Kentucky, and Georgia. Both BIO/WEST and the staff of Richardson Associates completed the apparent completeness review which was done in 1981 for the Emery Deep Mine and the Preparation Plant Modification.

In addition to mining and reclamation plan review for OSM, the staff of Richardson Associates recently prepared an Apparent Completeness Review for the Price River Mine in Helper, Utah. This required a meeting in the offices of the Division of Oil, Gas and Mining (DOGGM) to discuss deficiencies in the mine plan with the applicant. BIO/WEST has been involved in permitting, reclamation planning, and revegetation of U.S. Fuel Company's mines near Price, Utah. This also included meeting with DOGM personnel to discuss deficiencies in the mine plan and regulatory compliance.

The proposed team offers experience in mine plan reviews, familiarity with the Emery Deep Mine, understanding of the Utah Permanent Program, and an established working relationship with DOGM. We feel that the proposed team is uniquely qualified to provide DOGM with the expertise which they require.

## TECHNICAL APPROACH

The review of a mining and reclamation plan for compliance with the State of Utah Permanent Regulatory Program requires technical expertise from several disciplines. Specialists must be brought together for analysis of impacts to water, air, fish and wildlife, and public welfare. To accomplish this task efficiently; that is, to obtain a high quality product at a reasonable cost; an approach must be utilized which optimizes the use of each specialist's time. This requires a very effective management system and development of a sound technical approach prior to start-up of the review process. This section discusses the approach which BIO/WEST, Inc., and Richardson Associates intends to utilize for the proposed scope of work. The management approach is discussed in a following section of this proposal.

### Phase I - Preparation of an Apparent Completeness Review

An Apparent Completeness Review (ACR) requires a thorough review of the mining and reclamation plan to determine if the applicant has provided information sufficient to determine compliance with the regulatory program. It is not sufficient to find that there is or is not information in the application pertaining to each regulation; instead, the reviewer must quickly evaluate the quality of that information to insure that it will be possible to later proceed with a technical analysis. Thus, the better the job at the ACR phase, hopefully the less work at the Technical Analysis (TA) phase.

The team of BIO/WEST, Inc., and the staff of Richardson Associates reviewed the Emery Deep Mine Plan and the Preparation Plant Modification in 1981 for OSM. At that time, an ACR was prepared. Essentially, the same staff will be utilized in this effort. As such, this phase can be completed much more efficiently due to the existing familiarity with the mine plan. In addition, to lessen the level of effort in Phase II, information in the mine plan required by the regulations, will be noted on a master copy of the regulations. This was done for the ACR completed in 1981 by BIO/WEST and the staff of Richardson Associates on a large copy of the regulations which left room for notations on the right hand column of the page (Figure 1). Information in the mine plan could thus be readily accessed. During Phase II then, it will be only necessary to fill in areas where deficiencies occurred, and a Determination of Completeness (DOC) will be readily made.

It is extremely important in this phase to prepare an ACR which will facilitate the applicant's efforts to respond to the questions which are prepared. Often, it is useful to indicate why information is required and to suggest an approach for responding to the question. In this way, delays during Phase II can be minimized. The better the applicant understands the question, the better the response will be, and the technical analysis will be made much easier.

#### Phase II - Determination of Completeness

After the applicant has responded to the questions in the ACR, a Determination of Completeness (DOC) can be made. This phase is the

§ 724.15 Reclamation plan: Postmining land uses.

Note: An interpretative rule will be published to the effect that an operator

may apply through the permit revision or renewal procedures of 30 C.F.R. 724.12-724.15 for regulatory authority approval of an alternative postmining land use towards the end of the life of an underground mine rather than obtaining such approval in the original permit, if the original permit demonstrates that the land will be returned to its pre-mining land use capability as required by 30 C.F.R. 817.133(a).

(a) Each plan shall contain a detailed description of the proposed use, following reclamation, of the land to be affected within the proposed permit area by surface operations or facilities, including a discussion of the utility and capacity of the reclaimed land to support a variety of alternative uses, and the relationship of the proposed use to existing land use policies and plans. This description shall explain--

(1) How the proposed postmining land use is to be achieved and the necessary support activities which may be needed to achieve the proposed land use;

(2) Where a land use different from the pre-mining land use is proposed, all materials needed for approval of the alternative use under 30 CFR 817.133; and

(3) The consideration given to making all of the proposed underground mining activities consistent with surface owner plans and applicable State and local land use plans and programs.

(b) The description shall be accompanied by a copy of the comments concerning the proposed use from the legal or equitable owner of record of the surface areas to be affected by surface operations or facilities within the proposed permit area and the State and local government agencies which would have to initiate, implement, approve, or authorize the proposed use of the land following reclamation.

Describe the proposed postmining land use and discuss means by which the postmining land use will be achieved. If same uses, brief. If different, justification required.

Figure 1. An example of the master copy of the regulations used for reviewing the Emery Deep Mine ACR.

precursor to the TA phase. As such, it is important that the applicant's responses to the ACR are complete. The completeness of the responses hinges upon the quality of the ACR and the effectiveness of the meeting which is held during this phase. The staff of Richardson Associates has held several meetings with applicants including a recent meeting at DOGM with the Price River Coal Company. It is important during these meetings to not only understand what the regulatory requirements are, but also understand that the applicant is often under budgetary constraints and may not be thoroughly familiar with the need for the information that is required. More often than not, these meetings require a great deal of patience and perseverance.

The completion of this phase, the DOC, can be easily made by completing the previously discussed copy of the regulations. Once a response for each regulatory requirement is identified and is found to be reasonably adequate (technically), a DOC can be made, and the technical analysis phase can begin.

### Phase III - Technical Analysis

The outcome of this phase is to determine whether or not the applicant's proposal actually complies with the regulatory requirements. Calculations must be checked, impacts to the environment from the operation are evaluated, and a recommendation made as to whether or not to approve the mine plan. If the previous phases were done well, minimal problems should arise at this point. However, there is always the possibility that the analysis phase will uncover more concerns and, thus, more questions.

To optimize efforts at this point, the best approach is to combine the sections from each portion of the TA dealing with the description of the existing environment into one chapter. Also, the introduction should adequately describe the proposed operation. This way, the stage is immediately set for the reader to evaluate each area of regulatory compliance. The staff of Richardson Associates suggested this approach to the OSM in early 1981.

Given that a TA has already been completed for the preparation plant modification to the mine plan, it is expected that substantial portions of the description of the existing environment, and possibly the description of the applicant's proposal, will be transferable from that document.

In summary, BIO/WEST and the staff of Richardson Associates are very familiar with the regulatory requirements and will be able to prepare a quality product for DOGM most efficiently. We have reviewed over 25 mine plans in seven states using federal and state regulations. We are extremely familiar with the review process and will be able to assist DOGM to a great extent.

## PERSONNEL QUALIFICATIONS

The state of Utah Coal Mining and Reclamation Permanent Program requires that a mining operator submit a detailed mine plan showing how he intends to comply with all aspects of that program. This includes analyses in the areas of ground and surface water, soil science, agronomy, fish and wildlife, blasting, subsidence, slope stability, road construction, cost estimation and coal refuse disposal. To review a mine plan, the regulatory authority must have technical experts in all of these areas to make a determination of compliance. To provide these personnel, which covers a wide spectrum of disciplines, BIO/WEST and Richardson Associates have developed a team of qualified specialists which are very familiar with the regulatory processes involved in reviewing a mining and reclamation plan. The qualifications of the proposed team are discussed below. Management of this team is discussed in the following chapter of this proposal.

Figure 2 summarizes the qualification of the technical experts which will be working on this project. The list of the areas of technical expertise was developed by reviewing "Introduction to OSM Technical and Environmental Analyses of Mine Plans." For each major compliance determination that had to be made for the Analysis, an area of technical expertise was defined. As can be seen, the staffs of BIO/WEST and Richardson Associates have the necessary qualifications to make the required determinations. It is important to note that the staffs of BIO/WEST and Richardson Associates have worked together before on mine plan reviews, including the work on the review which was done on Emery Deep Mine.

	Rice	Albee	Richardson	Kimball	Jewett
Soil Stability	x				
Soil Handling			x		
Soil Amendments	x				
Surface Water Control				x	
Pond Design				x	
Ditch Design				x	
Channel Reconstruction				x	
Stream Impacts				x	
Groundwater Impacts					x
Groundwater Monitoring				x	x
Toxic Overburden			x		x
Explosives Handling			x		
Flyrock Control			x		
Control of Ground Vibration			x		
Control of Air Blast			x		
Waste Disposal			x		
Fish and Wildlife Surveys		x			
Fish and Wildlife Protection		x			
Approximate Original Contours			x		
Slope Stability			x		
Overburden Handling			x		
Excess Spoil Handling			x		
Vegetation Surveys	x				
Revegetation Success	x				
Planting Requirements	x				
Road Construction			x		
Protection of the Hydrologic Function of AVF's					x
Prime Farmland Investigation	x				
Prime Farmland Protection	x				
Land Use Evaluation	x				
Air Resources Protection			x		
Cost Estimation for Reclamation			x		

Figure 2. Areas of technical expertise of the project team.

## Bio/West, Inc.

BIO/WEST was incorporated in the state of Utah in March 1976. During the last two years, BIO/WEST has worked with the staff of Richardson Associates reviewing six different mining and reclamation plans for the Denver Regional Office of Surface Mining. These reviews were for mines in Utah and Colorado, and include the Emery Deep Mine, along with the modification for the preparation plant and disposal area. In addition to mining and reclamation plan review, BIO/WEST's staff has been involved in permitting, reclamation planning, and revegetation of U.S. Fuel Company's mines near Price, Utah. BIO/WEST's staff is quite familiar with mine plan review and the regulatory requirements of Utah's Coal Mining and Reclamation Permanent Program. The related qualifications of each staff member are discussed below.

### Dr. Thomas M. Twedt, Water Resources Section Manager

Dr. Thomas M. Twedt manages BIO/WEST's Water Resources Section. Dr. Twedt received his Ph.D. in Water Resources Engineering and Aquatic Ecology (1975) and his M.S. in Fishery Biology (1973) from Utah State University. His graduate studies focused on the effects of weather modification on biological and physical subsystems of mountain watersheds, and the extent and cause of movements of newly-stocked trout in small mountain streams.

Dr. Twedt joined BIO/WEST in 1979. As a Principal at BIO/WEST, he has been involved in numerous water resource studies for mining; oil and natural gas production and transmission; power generation and

transmission; and facility siting projects. Dr. Twedt was the Water Resource and Aquatic Biology Specialist for a project to assist the Denver Regional Office of Surface Mining (OSM) in reviewing and evaluating mining permit applications. Dr. Twedt has reviewed the following mine plans: ACR/TEA for Colorado Westmoreland's Orchard Valley Mine, Delta County, Colorado; ACR for Pittsburg and Midway's Edna Mine, Routt County, Colorado; ACR for Utah International's Trapper Mine, Moffat County, Colorado; TEA for Consolidation Coal's Emery Deep Mine, Emery County, Utah; and TEA for Wyoming Fuel's Canadian Strip Mine, Jackson County, Colorado. A summary of related experience follows; however, for more complete detail, see the attached resume.

#### Summary of Related Experience

- 1979-Present - Semi-annual aquatic system monitoring for AMAX Coal Company, near Gillette, WY. AMAX Coal Company.
- 1980 Water Resources Specialist for the Draft Environmental Impact Statement for the proposed White River Dam, Utah. Bureau of Land Management.
- 1980 Water Resources and Aquatic Biology Specialist for review and evaluation of mining permit applications for the Denver Regional Office of Surface Mining. Fred C. Hart Associates.
- 1981 Water Resources Specialist for the Environmental Assessment for correction of safety problems with Jackson Lake Dam. Water and Power Resources Service.
- 1981-83 Hydraulic data collection on the Yakima River System, south-central Washington. U.S. Fish and Wildlife Service.
- 1981-83 Water Resources Specialist for an Environmental Impact Statement for Western Area Power Authority's Liberty to Coolidge, Arizona transmission line upgrade. Willdan Associates.
- 1981-Present - Hydrology Specialist for several environmental assessments of oil and gas exploration by Mobil and Sohio. Land Management Services and Rio Verde Engineering.

1982-Present - Study of the surface water hydrology on the Navajo Nation Trust Lands in New Mexico as part of an Indian water rights litigation. Bureau of Indian Affairs.

1982-Present - Study to evaluate the potential impacts of reservoir development on the Gila and San Francisco Rivers, New Mexico and Arizona. Bureau of Reclamation.

Dr. John Rice, Vegetation/Soils Section Manager

Dr. John Rice manages BIO/WEST's Vegetation/Soils Section. Dr. Rice received his Ph.D. in Range Science (1981) from Colorado State University. His graduate research focused on energy flow in rangeland ecosystems, emphasizing plant-animal interactions. In 1978, Dr. Rice was an Instructor for the Ecosystem Management Short Course sponsored by the College of Natural Resources, Colorado State University. While a graduate student at Colorado State University, Dr. Rice was employed by Uniscale Corporation to conduct baseline vegetation inventories of the Alton Coal Field, Utah, and the Kemmerer Coal property in southwestern Wyoming.

Dr. Rice joined BIO/WEST in 1981. As Vegetation/Soils Section Manager, he has been involved in numerous studies for mining; oil and natural gas production and transmission; power generation and transmission; and facility siting projects. Dr. Rice was the Reclamation/Vegetation Specialist for a project to assist the Denver Regional Office of Surface Mining (OSM) in reviewing and evaluating mining permit applications. He has reviewed the following mine plans: ACR for Pittsburg and Midway's Edna Mine, Routt County, Colorado; TEA

for Consolidation Coal's Emery Deep Mine, Emery County, Utah; and TEA for Wyoming Fuel's Canadian Strip Mine, Jackson County, Colorado. A summary of related experience follows; however, for more complete detail, see the attached resume.

#### Summary of Related Experience

- 1981 Reclamation Specialist for review and evaluation of mining permit applications for the Denver Regional Office of Surface Mining. Fred C. Hart Associates.
- 1981 Project Manager for a third order soil survey of approximately 70,000 acres and geomorphological survey of potential pipeline and rail routes. Northwest Pipeline Company.
- 1981 Vegetation/Soils Specialist for an Environmental Impact Statement for Western Area Power Authority's Liberty to Coolidge, Arizona transmission line upgrade. Willdan Associates.
- 1981 Inventory and population study of threatened, endangered, and rare plant species on approximately 290,000 acres of federal land in Uintah County, Utah. Bureau of Land Management.
- 1982 Reclamation Specialist for the Revegetation and Topsoil sections of the King VI Coal Mine permit. U.S. Fuel Company.
- 1982 Interim revegetation of the King VI Coal Mine. U.S. Fuel Company.

Mr. Michael H. Albee, Wildlife Section Manager

Mr. Michael H. Albee manages BIO/WEST's Wildlife Section. Mr. Albee received his B.S. in Wildlife Biology (1972) from Utah State University. From 1972-1974, Mr. Albee was a Research Assistant in the Department of Wildlife, Utah State University. His research focused on the estimation of populations of mule deer on winter range. The study was designed to obtain the lowest sampling variance with a minimum of observation.

In 1974, Mr. Albee joined the Bureau of Land Management, Platte River Resource Area, Casper, Wyoming. Mr. Albee was responsible for wildlife habitat management on approximately 1.5 million acres of public land. In addition, he participated in inventories of terrestrial and aquatic wildlife, the writing of eight environmental analysis reports, and assessment of natural gas lease applications. In 1976, Mr. Albee moved to the Rock Springs District where he served as a team member on the Southwest Wyoming Coal Environmental Impact Statement. He also was responsible for reviewing mine plans for technical adequacy in terrestrial and aquatic wildlife.

Mr. Albee joined BIO/WEST in 1980. As Wildlife Section Manager, he has been involved in numerous wildlife studies for mining; oil and natural gas production and transmission; power generation and transmission; and facility siting projects. Mr. Albee was the Wildlife Specialist for a project to assist the Denver Regional Office of Surface Mining (OSM) in reviewing and evaluating the mining permit application (ACR/TEA) for Colorado Westmoreland's Orchard Valley Mine, Delta County,

Colorado. A summary of related experience follows; however, for more complete detail, see the attached resume.

Summary of Related Experience

- 1980 Wildlife Specialist for the Draft Environmental Impact Statement for the proposed White River Dam, Utah. Bureau of Land Management.
- 1980 Wildlife Specialist for a study of large and small mammal populations in western Utah and south-central Nevada and analysis of potential impacts related to the proposed MX Missile System. HDR Sciences.
- 1980-Present - Wildlife Specialist for several environmental assessments of oil and gas exploration by: Mobil, Sohio, Chevron, Dome Oil, and Amarada Hess. Land Management Services and Rio Verde Engineering.
- 1980 Wildlife Specialist for a baseline wildlife inventory of the Chaco Strippable Coal Area, New Mexico. Bureau of Land Management.
- 1980 Project Manager for a vegetation baseline inventory of the U.S. Fuel Company property near Price, Utah. U.S. Fuel Company.
- 1981 Wildlife Specialist for the Environmental Assessment for correction of safety problems with Jackson Lake Dam. Water and Power Resources Service.
- 1981-82 Wildlife Specialist for an Environmental Impact Statement for Western Area Power Authority's Liberty to Coolidge transmission line upgrade. Willdan Associates.
- 1981-82 Wildlife Specialist for a study to classify and evaluate the wetlands of the Malad Valley, Idaho, and assessment of potential impacts of irrigation projects. Soil Conservation Service.
- 1981-82 Wildlife Specialist for review and evaluation of mining permit applications for the Denver Regional Office of Surface Mining. Fred C. Hart Associates.

## Richardson Associates

Although Richardson Associates is a newly-formed business, the staff of Richardson Associates has been working together for over two years reviewing mining and reclamation plans for the Office of Surface Mining. These reviews were for mines in the states of Utah, Colorado, New Mexico, Arizona, Wyoming, Kentucky, and Georgia. The mines that the staff of Richardson Associates worked on in Utah are the Emery Deep Mine, the subject of this proposed contract, along with the modification for the preparation plant and disposal area, and the Price River Mine. For the Price River Mine plan review, the staff of Richardson Associates developed an Apparent Completeness Review (ACR), and met with the applicant at DOGM's offices to discuss the ACR. The staff of Richardson Associates is extremely familiar with mine plan reviews and the regulatory requirements of Utah's Coal Mining and Reclamation Permanent Program. The related qualifications of each staff member are discussed below.

Deborah L. Richardson, Principal, Richardson Associates

Ms. Richardson is a mining engineer with a strong background in geology and environmental sciences. She has worked on many projects involving the review of mining and reclamation plans, and has worked on many other projects related to mining environmental issues. Projects that she has worked on related to the scope of work on this proposed project are:

- . Apparent Completeness Review for the Energy Deep Mine and Preparation Plant Modification for the Office of Surface Mining. This review involved determination of deficiencies in the application and preparation of an ACR. Issues of concern centered on stability of the proposed waste pile and impoundment structure for coal waste, subsidence impacts on the waste structures and irrigation structures above the underground workings, bonding, and road construction. The review required the use of the state of Utah regulations.
- . Apparent Completeness Review for the Price River Coal Mine in Helper, Utah. This review required an assessment of deficiencies in the applicant's response to a previous ACR and development of additional questions concerning portions of the mine plan that were still deficient. A meeting was held with the applicant in the Utah State Offices of the DOGM to discuss the deficiencies and suggest how the applicant could best respond to the questions. The review was conducted using the state of Utah

regulations. Areas which were reviewed included stability of the coal waste pile, subsidence impacts, bonding concerns, and road construction.

- . Project Manager and technical expert for the review and preparation of over 25 additional ACR's and technical analyses for mining and reclamation plans in the western U.S. These reviews involved the analysis of backfilling and grading issues, approximate original contour assessments, stability analyses for spoil material and refuse, determination of special handling needs for toxic materials, control of flyrock and ground vibrations from blasting, and bonding requirements.
- . Development of a manual for estimating bonding costs for mining operations. Unit costs were developed to facilitate in the development of bonding requirements for rough and smooth grading, topsoil handling, revegetation, and removal of structures.

Ms. Richardson has the following experience related to the technical requirements of the scope of work:

- . Evaluation of underground mining techniques
- . Evaluation of stability of coal refuse and spoil material
- . Determination of bond amounts
- . Assessment of road construction requirements
- . Evaluation of backfilling and grading requirements for reclamation

- . Evaluation of overburden characteristics and the formation of toxic mine drainage
- . Familiarity with the Utah State regulations pertaining to surface effects of underground coal mining activities

Ms. Richardson has a B.S. in Geology and a M.S. in Mining Engineering from the Pennsylvania State University. For more complete detail, see the attached resume.

Connie R. Kimball, Engineering Geologist

Ms. Kimball is an engineering geologist specializing in the areas of surface water hydrology and water control plans. She has reviewed many mining and reclamation plans to determine the adequacy of the design and construction of surface water control structures to assess surface water impacts. Projects she has worked on related to the scope of work include:

- . Apparent Completeness Review for the Price River Coal Mine in Helper, Utah. This review required an assessment of deficiencies in the mine plan and development of questions for an ACR explaining to the applicant what the additional information requirements were. In addition, a meeting was held with the applicant at the offices of DOGM to discuss the application. Issues of concern centered on the design capacity of the surface water control structures, plans for mitigation of impacts to surface waters, and adequate design of outlet structures.

The review was conducted using the state of Utah Permanent Program.

- Project Manager and technical expert for the review and preparation of over 25 additional ACR's and technical analyses for mining and reclamation plans in the western U.S. These reviews required the analysis of surface water control structures, assessment of surface water impacts, meetings with the applicant to discuss deficiencies in the mine plans and coordination of review efforts with the regulatory authority.
- Evaluation of permit applications for construction in floodways in the state of Indiana. The review of the applications entailed calculation of drainage areas and peak runoffs for flood events to delineate floodplains and floodways, sizing drainage structures, and evaluating the adequacy of runoff and stream channel diversions for mining operations.
- Technical assistance for surface water availability studies in Indiana. Surface water resources for the state were evaluated using historic precipitation and flow data for hydrograph separation and flow duration curves.

Ms. Kimball has the following expertise related to the technical requirements of the scope of work:

- . Determination of peak flow calculations
- . Floodplain and terrace mapping
- . Evaluation of sediment pond adequacy
- . Channel construction, capacity and reclamation
- . Evaluation of water control plans for protecting surface water quality
- . Familiarity with the state of Utah Permanent Program.

Ms. Kimball has a B.A. in Geology from Hanover College in Indiana and has completed the majority of requirements for a M.A. in Geology from Indiana State University. For more complete detail, see the attached resume.

Mark A. Jewett, Hydrologist

Mr. Jewett is a hydrologist with a strong background in water chemistry and environmental impact evaluation. Projects which he has worked on related to the scope of work include:

- . Apparent Completeness Review for the Energy Deep Mine and Preparation Plant Modification for the Office of Surface Mining. This review involved determination of deficiencies in the application and preparation of an ACR. Issues of concern centered on the impacts of subsidence on a significant aquifer above the mine, high TDS discharges from the mine, and evaluation of potential alluvial valley floors in the area which could be affected by mining. This review was done using the state of Utah Regulatory Program.

- . Apparent Completeness Review for the Price River Coal Mine in Helper, Utah. This review required the determination of deficiencies which existed in the mine plan related to groundwater studies. This section of the mine plan was particularly deficient and extensive suggestions were made on how to complete the application. The evaluation was particularly complex due to the number of seams being mined and the discontinuity of the strata. This review was conducted using the state of Utah Permanent Program.
  
- . Project Manager and technical expert for the review and preparation of over 25 additional ACR's and technical analyses for mining and reclamation plans in the western U.S. These reviews involved the analysis of premining groundwater conditions, impacts to the hydrologic system from mining, and the evaluation of alluvial valley floors.
  
- . Evaluation of methods available to evaluate impacts to groundwater systems subsequent to mining in the western U.S. Over ten mine plans and procedures utilized for the evaluation of groundwater impacts were evaluated for their adequacy to predict post-mining conditions.
  
- . Technical review and evaluation of uranium mill tailings disposal plans in Colorado. The impact of the proposed disposal plan

was evaluated for impacts to the hydrologic system. Permeability of the confining strata was assessed and transport of contaminants to aquifers evaluated.

Mr. Jewett has the following expertise related to the technical requirements of the scope of work:

- . Development of hydrologic monitoring requirements and installations
- . Assessment of toxic overburden characteristics and the potential for groundwater contamination
- . Evaluation of aquifer characteristics
- . Determination of alluvial valley floor characteristics and assessment of impacts to designated AVF's
- . Familiarity with the state of Utah Permanent Program.

Mr. Jewett has a B.S. in Hydrology from the University of Montana and a M.S. in Water Resources Management from the University of New Hampshire. For more complete detail, see the attached resume.

## CORPORATE EXPERIENCE AND REPUTATION

### Qualifications

BIO/WEST was established in 1976 to conduct research, inventories, and assessments of natural resource systems in the western United States. BIO/WEST operates with a permanent core of senior scientists and supporting staff, and is organized to bring together additional support personnel that are geared to individual project requirements.

The corporation takes an interdisciplinary, service oriented approach to problem solving, and thus affords organizations a broad range of creative solutions to problems in resource management. BIO/WEST is flexibly structured to provide an individual scientist or a team of resource specialists for short or long-term projects. The corporation provides expertise in all phases of environmental assessment, including biological, physical, and human resources. It is especially qualified in the assessment of impacts due to environmental manipulation of western resources. BIO/WEST has the capability and expertise to research and/or assess any resource system in the western United States.

### Capabilities

BIO/WEST structures projects around key scientists with extensive experience in applied research and management of all components of resource systems. BIO/WEST has available a broad, multidisciplinary corporate experience by virtue of its core professionals, supporting

technical staff, and top level support personnel. This experience has diversified and expanded as different corporate projects are staffed specifically around their needs, i.e., each project determines the staffing, rather than immediately available staff dictating key personnel. Thus, a number of experienced professionals, at both the senior and junior level, have been/are involved in BIO/WEST's past and on-going projects. This degree of participation is especially significant to resource development industries and their mandated compliance to environmental regulations. The depth and continuity of relevant professional experience that is held by BIO/WEST's environmental analysts provides corporate clients a cost effective approach to problem solving.

In regard to environmental impact analysis and regulation compliance programs, BIO/WEST can offer expertise in most of the resources to be investigated, as well as the management structure to integrate these individual areas of expertise into an interdisciplinary environmental task force. Our areas of expertise and experience are centered in the firm's seven technical sections: Aquatics, Engineering, Recreation/Visual, Socio-economics, Vegetation/Soils, Water Resources, and Wildlife. We also provide support personnel in the areas of Cultural Resources, Paleontology, Air Quality and Meteorology, and Land Use. In addition to offering comprehensive discipline-specific expertise in the major areas of resource analysis through our technical sections, BIO/WEST has considerable experience in utilizing the sections to form interdisciplinary teams. These interdisciplinary teams have been used to conduct major environmental analyses, including complete Environmental Impact Statements and Environmental Assessments, for a variety of private industries

and governmental agencies. Our interdisciplinary capabilities are best emphasized by the projects we have conducted which are summarized later in this statement.

### Support Facilities and Equipment

BIO/WEST's offices and laboratory facilities are located in Logan, Utah, a geographical nucleus for much of the ecological research and energy development in the western United States. The firm's location is centralized in terms of travel distance and accessibility, allowing for highly cost-effective operations.

BIO/WEST maintains an extensive inventory of field equipment for terrestrial and aquatic research, including: physical characterization of aquatic environments; basic water quality and quantity assessments; fish and macroinvertebrate sampling and taxonomic analysis; mammalian and avian assessments; and vegetative and soil surveys. In addition, the company has large river rafts, Jon boats, outboard motors, 4-wheel drive vehicles, and a Cessna 182 fixed-wing aircraft.

Our in-house cartographic expertise includes the normal black and white and color separation techniques for maps, charts, figures, etc. required of scientific reports, as well as aerial photography interpretation for resource analysis.

Utah State University, located in Logan, is utilized for various support facilities, including: Merrill Library, the Intermountain Herbarium, the Intermountain Regional Depository Library for Federal Documents, the Utah Water Research Laboratory (with a certified water

quality laboratory), and the Utah State Computer Center (with complete computer capability). BIO/WEST has an in-house terminal with linkage to the University Computer Center and various other computer systems, providing on-location computer services.

### Clients

Alcan Pipeline Company  
AMAX Coal Company  
Battelle Memorial Institute  
Burns and McDonnell  
Cleveland Cliffs Iron Company  
Don Chapman Consultants  
Ecology Consultants, Inc.  
Fred C. Hart Associates  
Gulf Interstate Engineering Company  
HDR Sciences  
Klohn Leonoff Engineering  
Land Management Services  
National Park Service  
Northern Coal Company  
Northwest Pipeline Company  
Soil Conservation Service  
U.S. Bureau of Land Management  
U.S. Bureau of Reclamation  
U.S. Fish and Wildlife Service  
U.S. Forest Service  
U.S. Fuel Company  
U.S. Geological Survey  
Western Area Power Administration (DOE)  
Western Energy and Land Use Team (FWS)  
Western Fuels Association, Inc.  
White River Shale Oil Corporation

## Summary of Selected Projects

Liberty-Coolidge Transmission Line Environmental Impact Statement, Arizona - Served as subcontractor to Willdan Associates of Phoenix with responsibility for all biological and physical analysis, portions of project management, and public involvement program. Project involves the selection of preferred alternative line corridors and the evaluation of impacts resulting from each. Western Area Power Administration, Boulder City, Nevada.

Malad Valley Wetlands Assessment - Determination of the effects of irrigation efficiency changes upon natural wetland area via water budget modeling and quantitative habitat evaluation techniques. Includes historical and field habitat analyses, water quality and quantity monitoring, hydrologic modeling, irrigation analyses, and geologic surveys. Soil Conservation Service, Boise, Idaho.

Draft Environmental Impact Statement on White River Dam Project - Served as prime contractor for a multi-discipline environmental impact analysis of a proposed dam on the White River in eastern Utah. Approximately 12 specialized support personnel and a large in-house staff were utilized on the project. Bureau of Land Management, Richfield, Utah.

Jackson Lake Dam Environmental Assessment - Preparation of an Environmental Assessment relative to correcting safety problems with Jackson Lake Dam near Jackson, Wyoming. The study involves using an

interdisciplinary team of 12 resource specialists, and integrating their analysis into a comprehensive environmental statement. Bureau of Reclamation, Boise, Idaho.

Schell Resource Area Grazing Environmental Impact Statement, Nevada - Preparation of a major environmental study of alternative grazing management systems for the 4,000,000 acre Schell Resource Area in eastern Nevada. The study involves the use of in-house as well as supporting resource specialists in 14 separate disciplines. It requires the interpretation and analysis of considerable data, as well as the integration of that material into a concise Environmental Impact Statement. Bureau of Land Management, Ely, Nevada.

Baseline Fishery Data for Cache Creek EIS, Wyoming - Collection of fishery data from both the field and the literature on several streams near Jackson, Wyoming. The information was provided to the U.S. Forest Service for use in an EIS.

Evaluation of Alternative Access Roads and Drill Sites to Exploratory Oil and Gas Wells, Wasatch National Forest and Bridger-Teton National Forest, Wyoming - An assessment of impacts to aquatic and terrestrial ecosystems associated with oil and gas exploration and possible methods for mitigation of those impacts. A number of well sites have been examined for a variety of oil and gas firms.

Wildlife Resource Inventory of the Chaco Strippable Coal Area, New Mexico - A long-term inventory and habitat analysis on 500,000 acres of

land underlain by strippable coal. The study included sampling of avian, mammalian, herpetological, and vegetative resources during each season of the year, as well as an in-depth evaluation of pronghorn and scaled quail habitat. The data will be used to assess the impacts of coal stripmining, set a baseline for future monitoring studies and develop plans for reclamation and mitigation of the wildlife resources. Bureau of Land Management, Farmington, New Mexico.

Large Mammal Population Studies - Wildlife studies to establish numbers, densities, distribution, and behavioral responses of the larger, more conspicuous mammals in valleys of western Utah and southcentral Nevada. Methods of data gathering included intensive aerial surveys, pellet group counts, and ground observations to record behavioral responses to human activities. The study also included extensive small mammal trapping and lagomorph population estimates using flushing transects. The purpose of the study was to help predict the impacts of construction of the MX missile system upon the native and exotic fauna within disturbed and undisturbed valleys of Nevada and Utah. HDR Sciences, Santa Barbara, CA.

N.E. Wyoming Wildlife Inventory - This project involved extensive collection and analysis of background ecological data on aquatic and terrestrial wildlife as part of a preoperational inventory. Data will be used for impact assessment, long-term monitoring programs, and reclamation and mitigation planning. This program was an in-depth evaluation of existing wildlife and habitat on 500 square miles of uranium

lands in eastern Wyoming, involving both quantitative and qualitative sampling. Close association with federal and state monitoring agencies was required. Threatened or endangered species and economically significant species were emphasized in the program. Cleveland Cliffs Iron Company, Casper, Wyoming.

Impact of Coal Mine Operation On Stream Biology - An ongoing, biannual survey of the biological condition of two streams in northeast Wyoming relative to coal mine development and operation. This is a long-term study of instream (vertebrate and invertebrate fauna) and riparian biology that includes monitoring, impact assessment, reclamation, and mitigation strategies. The monitoring process includes natural, bypass, and reconstructed channels. AMAX Coal Company, Gillette, Wyoming.

Utah Oil Shale Wildlife Monitoring Program - A long-term predevelopment environmental baseline data collection and monitoring program of terrestrial vertebrates on the Utah oil shale tracts along the White River. This study involved extensive seasonal sampling of terrestrial wildlife species over a potential resource development area. Should development take place, data accumulated will be used to determine potential impact, reclamation procedures and mitigation strategies. White River Shale Project, Vernal, Utah.

Investigation of Physical and Certain Biological Components of a Large River - A detailed field and laboratory study involving the collection

and analysis of seasonal samples from the San Juan River, New Mexico and Utah. The study required definition of the current condition of the river system in terms of its physical and biological components and projection of its response to varied flow regimes resulting from further water resource development. Analysis involves the extensive use of hydraulic and ecological computer models in conjunction with various statistical techniques. U.S. Bureau of Reclamation, Amarillo, Texas.

Assessment of Impacts of Intake Modification of Flaming Gorge Dam on Downstream Fishes and Macroinvertebrates - An assessment of changes in distribution, abundance, and reproductive success of native and introduced fishes and macroinvertebrates in the Green River following warming of tailwater summer releases. This is a three-year study, designed primarily for evaluating effects on the endangered Colorado squawfish. Field samples are taken four times per year. The data will be used to evaluate similar intake modifications on other dams. U.S. Bureau of Reclamation and U.S. Fish and Wildlife Service, Salt Lake City, Utah.

Utah and Colorado Baseline Aquatic Survey for a Proposed Power Plant and Coal Mine - A one-year survey of the Green River of eastern Utah and the White River of western Colorado. Fish, macroinvertebrates and periphyton were sampled and analyzed. Endangered fishes were of special concern. The study evaluated the species present and the potential impact of the proposed project on them. Also included are appearances at public meetings to answer questions of both governmental authorities and

private individuals. Burns and McDonnell, Inc., Kansas City, Missouri, and Western Fuels, Inc., Cheyenne, Wyoming.

Mine Plan Permit Review - Under subcontract to the Office of Surface Mining through Fred C. Hart and Associates, we reviewed and performed technical analyses on mine plan permit applications in the fishery, wildlife, vegetation and soils areas. Fred C. Hart and Associates, Denver, Colorado.

Vegetation Survey of U.S. Fuel Company Property near Hiawatha, Utah - Baseline survey to determine the species composition, density, cover, productivity, and diversity of vegetation for an underground coal mine in central Utah. U.S. Fuel Company, Salt Lake City, Utah.

Riley Ridge Project Soil Survey - A third order soil survey of approximately 70,000 acres and geomorphological survey of potential pipeline and rail routes. Northwest Pipeline Company, Salt Lake City, Utah.

Threatened and Endangered Plant Inventory, Utah - An inventory of threatened, endangered, and rare plant species on approximately 290,000 acres of federal land in Uinta County, Utah. U.S. Bureau of Land Management, Vernal, Utah.

Snow Surveys for the State of Utah - Collection of monthly snow survey data by helicopter at 112 sites throughout Utah. Data to be utilized

for developing water supply forecasts. Soil Conservation Service, Salt Lake City, Utah.

Collection of Substrate and Flow Data on Yakima River - Collection of all necessary physical data on the Yakima River for operation of the US FWS Instream Flow Incremental Methodology models. Involved sampling 30 stations at three different flow levels over a wide range of stream types. Results of analysis to be used in Indian water rights litigation. U.S. Fish and Wildlife Service, Portland, Oregon.

Navajo Surface Water Hydrology - An investigation to determine surface water availability on the Eastern Navajo Trust lands in New Mexico. Involves river system modeling, drainage analysis, water quality sampling and analysis, recharge basin evaluation, water rights analysis, diversion mapping, and litigation coordination. Bureau of Indian Affairs, Gallup, New Mexico.

Upper Gila River Water Quality - Collection of water quality and benthic invertebrate data from four potential reservoir sites on the Gila and San Francisco Rivers, New Mexico and Arizona. Correlation of field and a variety of existing comparable data to predict water quality and effects upon invertebrate communities of reservoir operations. Involves reservoir trophic modeling and prediction techniques. Bureau of Reclamation, Boulder City, Nevada.

## MANAGEMENT

Dr. Thomas M. Twedt will serve as principal-in-charge for the proposed project. Dr. Twedt is President of BIO/WEST and provides considerable experience and expertise in mine plan review, impact analysis, and management. His role in the project organization will be to oversee the project efforts and provide input based on his practical experience.

Dr. John Rice will serve as Project Manager and Life Science Team Leader. Dr. Rice is BIO/WEST's Vegetation/Soils Section Manager and Coordinator of Mining Services. Dr. Rice has served in both management and technical capacities for numerous projects. In his role as Project Manager, Dr. Rice will have overall responsibility for completion of the project, including coordination and monitoring of the budget, and quality control. He will also have responsibility for Lead Reviewer contacts.

Ms. Deborah Richardson will serve as Assistant Project Manager and Earth Sciences Team Leader. Ms. Richardson is a principal owner of Richardson Associates and provides considerable experience in review of mining and reclamation plans. She has reviewed over 25 mining and reclamation plans and has worked on many projects related to mining environmental issues. Ms. Richardson will work closely with the Earth Sciences Team, insuring that management procedures are followed and that problems are solved as soon as they are evident.

Figure 3 shows the level of effort (man-hours) proposed for each discipline during each phase of the project. Figure 4 summarizes each team member's effort during each phase of the project.

Figure 3. Level of effort (man-hours) for each discipline during each phase.

PHASE I (approximately 35% of the effort)

<u>Discipline</u>	<u>Hours</u>
Mining and Civil Engineering (D. Richardson)	20
Blasting (D. Richardson)	6
Geology (D. Richardson)	6
Surface Water Hydrology (C. Kimball)	32
Groundwater Hydrology (M. Jewett)	16
Soil Science (J. Rice)	16
Fish and Wildlife Biology (M. Albee)	24
Plant Ecology/Reclamation (J. Rice)	16
Management (T. Twedt)	8
Secretary (N. Hubbard)	<u>18</u>
Total	162

PHASE II (approximately 10% of the effort)

<u>Discipline</u>	
Mining and Civil Engineering (D. Richardson)	4
Blasting (D. Richardson)	2
Geology (D. Richardson)	2
Surface Water Hydrology (C. Kimball)	8
Groundwater Hydrology (M. Jewett)	6
Soil Science (J. Rice)	6
Fish and Wildlife Biology (M. Albee)	4
Plant Ecology/Reclamation (J. Rice)	4
Management (T. Twedt)	8
Secretary (N. Hubbard)	<u>6</u>
Total	50

Figure 3. Continued

PHASE III (approximately 55% of the effort)

<u>Discipline</u>	<u>Hours</u>
Mining and Civil Engineering (D. Richardson)	32
Blasting (D. Richardson)	4
Geology (D. Richardson)	8
Surface Water Hydrology (C. Kimball)	40
Groundwater Hydrology (M. Jewett)	32
Soil Science (J. Rice)	24
Fish and Wildlife Biology (M. Albee)	32
Plant Ecology/Reclamation (J. Rice)	28
Management (T. Twedt)	12
Secretary (N. Hubbard)	<u>36</u>
Total	248

Figure 4. Manning chart; level of effort (man-hours) during each phase.

	Phase I	Phase II	Phase III	Total
T. Twedt	8	8	12	28
J. Rice	32	10	52	94
M. Albee	24	4	32	60
D. Richardson	32	8	44	84
C. Kimball	32	8	40	80
M. Jewett	16	6	32	54
Secretary	<u>18</u>	<u>6</u>	<u>36</u>	<u>60</u>
Total	162	50	248	460

At the onset of Phase I, a briefing will be held in the DOGM office in Salt Lake City. A site visit at the mine will be conducted in conjunction with this meeting. During Phase II, a meeting will be held in Salt Lake City to discuss and clarify deficiencies in the mining and reclamation plan with the applicant and DOGM personnel. A third meeting will be held in Salt Lake City during Phase III to discuss any remaining deficiencies and to provide direction from DOGM for the TA. For each of these meetings, the contractor will be represented by Dr. John Rice, Project Manager and Life Sciences Team Leader, Ms. Deborah Richardson, Assistant Project Manager and Earth Sciences Team Leader, Mr. Michael Albee, Wildlife Specialist, and Ms. Connie Kimball, Hydrologist.

Throughout the course of the project, the Project Manager, Dr. John Rice, will contact the DOGM Lead Reviewer, Mr. Lynn Kunzler, on a weekly basis to review progress and discuss problems encountered. Copies of the telephone logs will be forwarded to the Lead Reviewer at the end of each week.

A projected time frame for the review process is given in Figure 5. Eight copies of each report will be submitted to DOGM with one of the copies unbound and not on corporate letterhead.

Figure 5. Projected time frame for the review process.

		Days Post Contract Award
Phase I    ACR		
	Contractor prepares and submits report to DOGM	30
	DOGM reviews and transmits to applicant	15
Phase II    DOC		
	A. Applicant reviews ACR and attends meeting	60
	B. Applicant responds to ACR; contractor reviews response and prepares DOC	120
Phase III    TA		
	Contractor prepares TA and draft stipulations	60
	DOGM reviews draft TA and stipulations	15
	Contractor prepares final TA report and stipulations	30

RESUMES OF KEY PERSONNEL

THOMAS M. TWEDT

Water Resources and Ecology

Date and Place of Birth

November 25, 1945            Algona, Iowa

Education

- 1963-67    Iowa State University, Ames, Iowa, B.S. Fishery and Wildlife Biology
- 1971-73    Utah State University, Logan, Utah, M.S. Fishery Biology
- 1973-75    Utah State University, Logan, Utah, Ph.D. Water Resources Engineering and Aquatic Ecology

Professional Experience

- 1979-Present - Principal and Water Resources Section Manager, BIO/WEST, Inc., Logan, Utah.
- 1965        Fishery Aide, Alaska Department of Fish and Game, King Salmon, Alaska. Basic data collection and analysis pertaining to management of Bristol Bay salmon resource.
- 1966-67    Fishery Research Aide, Division of Fishery Services, U.S. Fish and Wildlife Service, Department of Interior, Vernal, Utah. Data collection and analysis, including stream and lake surveys, creel census, fish stocking, and report preparation.
- 1971-73    Graduate Research Assistant, Utah Cooperative Fishery Research Unit, Utah State University. Research relating to extent and cause of movements of newly-stocked trout in a small mountain stream.
- 1973-75    Graduate Research Assistant, Utah Water Research Laboratory, Utah State University. Responsible for hydrologic portion of an interdisciplinary investigation of the effects of weather modification on biological and physical subsystems of mountain watersheds, funded by the Office of Water Resources Research, Department of the Interior. Involved design and installation of watershed instrumentation, supervision of data collection and analysis, development of computer simulation models for hydrology and water temperature, and linking of physical and biological subsystem models.

## Professional Experience - Continued

- 1975-76 Research Hydrologist, Hydrologic Research Laboratory, National Weather Service, Silver Spring, Maryland. Conducted research pertaining to development of improved hydrologic models for river forecasting. Primary emphasis on development of a procedure for providing long-range predictions of future streamflow via hydrologic simulation models and probability analysis. Functioned as Project Leader on several major research projects, involving project design, development, and presentation of results.
- 1977-79 Procedure Development Hydrologist, Sacramento River Forecast Center, National Weather Service, Sacramento, Calif. Involved in numerous facets of a functional river forecasting operation, including development of new and improved procedures for river forecasting with hydrologic models, probabilistic analyses of hydrologic and meteorological events, and preparation of computer software and hydrologic analysis techniques in connection with the development of real-time data collection and forecasting procedures via self-reporting remote precipitation gages and minicomputer processors at various locations throughout the state. Organized national-level conference on flash floods and response systems.
- 1979 Assistant Project Manager and Director of Qualitative Analysis for BIO/WEST on a Bureau of Reclamation study analyzing the potential impacts of projected alternative flows on the physical and biological components of the San Juan River, New Mexico and Utah.
- 1979 Project Leader for BIO/WEST on a survey and analysis of the biological components of several streams located in a coal mining vicinity. Project continues to present with a semi-annual monitoring program.
- 1979 Member of an interdisciplinary team organized by the Utah Water Research Laboratory to study the development of use indexes for high mountain watershed planning. Responsible for ecological implications on all phases of the project, including data compilation, coordination, analysis, and report preparation.
- 1979 Principal Investigator for BIO/WEST on a project funded by the California Center for Water Policy, U.S. Fish and Wildlife Service, to evaluate and define the historical and unimpaired flow regime of California's Central Valley. The results of the study are to be used eventually for defining habitat and flow requirements.

Professional Experience - Continued

- 1980 Water Resources Team Leader for BIO/WEST for a study preparing a Draft Environmental Impact Statement for the Proposed White River Dam, Utah, for the Bureau of Land Management.
- 1980 Project Manager for BIO/WEST on a large-scale data collection effort on 6 Pacific Northwest salmonid streams under contract to Don Chapman Consultants and the Bureau of Indian Affairs.
- 1980 Principal Investigator for BIO/WEST on a project to analyze habitat availability for Colorado squawfish in the lower San Juan River for the Water and Power Resources Service, utilizing a computerized physical/biological modeling system.
- 1980 Project Manager for BIO/WEST on an on-going project to assist the Denver Regional Office of Surface Mining (OSM) in reviewing and evaluating mining permit applications from the region under agreement with Fred C. Hart Associates.
- 1981 Principal Investigator and Project Manager for BIO/WEST for the preparation of an Environmental Assessment and subsequent Environmental Impact Statement for the Proposed Modification of Jackson Lake Dam, Grand Teton National Park, Wyoming, under contract with the Water and Power Resources Service.
- 1981 Water Resources Team Leader and Assistant Project Manager for BIO/WEST for the preparation of an Environmental Impact Statement on the Schell Resource Area, Ely, Nevada, for the Bureau of Land Management.
- 1981 Project Manager for BIO/WEST on an analysis of the potential impacts of irrigation system efficiency improvement on native wetlands in the Malad River Valley for the Soil Conservation Service. The project includes wetland characterization, hydrologic analysis, geologic sedimentation surveys, irrigation analyses, and water quality/quantity data collection and analysis.
- 1981 Project Manager for BIO/WEST for a hydraulic data collection effort at 30 locations on the Yakima River system in south-central Washington for the U.S. Fish and Wildlife Service.
- 1981 Project Manager for BIO/WEST for the preparation of an Environmental Impact Statement on the Proposed Liberty to Coolidge (Arizona) 230 kv Transmission Line, under contract with Willdan Associates and the Western Area Power Administration, Department of Energy.

Professional Experience - Continued

- 1981-Present - Hydrologic consultant for several environmental assessments of oil and gas exploration wells in the Overthrust Belt.
- 1982 Project Manager for a BIO/WEST project to collect snow survey data over the entire state of Utah for the Soil Conservation Service. Data to be utilized in generating water supply forecasts.
- 1982 Project Manager for BIO/WEST on a surface water hydrology study on the Navajo Nation Trust Lands in New Mexico as part of an Indian water rights litigation for the Bureau of Indian Affairs.
- 1982 Project Manager for a BIO/WEST project to evaluate the potential impacts of reservoir development on the Gila and San Francisco Rivers, New Mexico and Arizona, for the Bureau of Reclamation.

## Publications and Reports

- 1973 Trout movements in a small mountain stream. Master's Thesis, Utah State University, Logan, Utah.
- 1975 Simulation of the physical subsystem of a mountain stream ecosystem by digital computer. Doctoral Dissertation, Utah State University, Logan, Utah.
- 1975 A technique for predicting the aquatic ecosystem response to weather modification. PRWG 138-1, Utah Water Research Laboratory, Utah State University, Logan, Utah. (with E. K. Isrealson, D. R. Bernard, and H. M. Runke)
- 1976 An all-weather two-way fish trap for small streams. California Fish and Game 62(1):21-27; January. (with D. R. Bernard)
- 1977 National weather service extended streamflow prediction. Proceedings Western Snow Conference, Albuquerque, New Mexico; April. (with J. C. Schaake, Jr. and E. L. Peck)
- 1978 Extended streamflow prediction during the California drought. Proceedings Western Snow Conference, Otter Rock, Oregon; April. (with R.J.C. Burnash and R.L. Ferrel)
- 1978 Event-reporting instrumentation for real-time flash flood warnings. Preprints, American Meteorological Society Conference on Hydrometeorological Aspects of Flash Floods (Los Angeles), AMS, Boston; May. (with R.J.C. Burnash)
- 1980 A biological inventory of streams adjacent to active coal mines near Gillette, Wyoming. AMAX Coal Company. BIO/WEST PR-24-2. (with D. A. Selby)
- 1980 Mining impacts and environmental baseline data on northeastern Wyoming streams - A literature review. AMAX Coal Company. BIO/WEST PR-24-3. (with D. A. Selby)
- 1980 Unimpaired flow study, Sacramento and San Joaquin Rivers, California. U.S. Fish and Wildlife Service. BIO/WEST PR-30-1.
- 1980 An investigation of the benthic, planktonic, and drift communities and associated physical components of the San Juan River, New Mexico and Utah. Water and Power Resources Service. BIO/WEST PR-20-1. (with P. B. Holden and C. Richards)

Publications and Reports - Continued

- 1980 A biological inventory of streams adjacent to active coal mines near Gillette, Wyoming. AMAX Coal Company. BIO/WEST PR-24-4.
- 1980 The development of habitat suitability curves and estimation of available habitat for Colorado squawfish in the San Juan River, New Mexico and Utah. Water and Power Resources Service. BIO/WEST PR-46-1. (with P. B. Holden).
- 1981 A biological inventory of streams adjacent to active coal mines near Gillette, Wyoming. AMAX Coal Company. BIO/WEST PR-24-5.
- 1981 Draft Environmental Assessment for the Proposed Modification to Jackson Lake Dam, Grand Teton National Park, Wyoming. Bureau of Reclamation. BIO/WEST PR-51-1.
- 1982 Portions of Preliminary Draft Environmental Impact Statement for the Liberty-Coolidge Transmission Line. BIO/WEST PR-67-1.
- 1982 Malad Valley Wetlands Assessment. Soil Conservation Service. BIO/WEST PR-65-2.

JOHN A. RICE

VEGETATION/SOILS SECTION MANAGER

Date and Place of Birth

August 18, 1952

El Paso, Texas

Education

1970-74 University of Texas, El Paso, B.S. Biology

1975-81 Colorado State University, Ft. Collins, Ph.D. Range Science

Professional Experience

Present Vegetation/Soils Section Manager, BIO/WEST, Inc., Logan, Utah.

1975-76 Teaching Assistant, Department of Range Science, Colorado State University.

1976-79 Research Assistant, Department of Range Science, Colorado State University. Conducted research to evaluate energy partitioning for the cow-calf unit and the energetic efficiency of three cow biological types. The study included evaluation of the standing crop of herbage available for cattle grazing, the amount of forage consumed by cattle and the quality of the cattle diets.

1978 Participated in a baseline vegetation inventory and evaluation of reclaimed areas on a coal mine near Kemmerer, Wyoming. Uniscale Corporation for Kemmerer Coal Company.

1978 Participated in a study to determine utilization of a crested wheatgrass seeding by cattle under different grazing systems.

1979 Participated in a baseline vegetation inventory of the Alton Coal Field, Utah. Uniscale Corporation.

1979-80 Worked as a ranch hand for a cow-calf operation in northern Nebraska.

## Professional Experience - Continued

- 1980-81 Research Associate, Animal Science Division, University of Wyoming. Conducted research to evaluate the utilization of important forage plants and the nutritional status of wild horses and cattle grazing rangeland in southwestern Wyoming. Responsibilities included coordinating research, directing collection of data, supervising field crews and hiring personnel. The study included range site mapping and baseline vegetation inventory of the study area.
- 1981 Assistant Project Manager, BIO/WEST. Preparation of a grazing Environmental Impact Statement for the Schell Resource Area, BLM, Ely District, Nevada. Duties included preparation of existing vegetation, soils and livestock reports and evaluation of impacts under alternative management systems. Bureau of Land Management.
- 1981 Prepared Apparent Completeness Review and Technical Environmental Analysis for mine plans. Responsible for Vegetation, Soils, Land Use, Prime Farmland, and Reclamation reports. Fred C. Hart Associates, for the Office of Surface Mining.
- 1981 Project Manager. Riley Ridge Project Soil Survey. A third order soil survey of approximately 70,000 acres and geomorphological survey of potential pipeline and rail routes. Northwest Pipeline Company.
- 1981 Vegetation-Soils Team Leader. Preparation of an Environmental Impact Statement for the Liberty to Coolidge, Arizona Transmission Line Upgrade. Willdan Associates, for Western Area Power Authority.
- 1981 Project Manager. Threatened and Endangered Plant Inventory: Utah. An inventory and population study of threatened, endangered and rare plant species on approximately 290,000 acres of federal land in Uintah County, Utah. Bureau of Land Management.
- 1982 Project Manager. King VI Mine Reclamation Plan. Responsible for Revegetation and Topsoil sections of the permit, and regulatory compliance. U.S. Fuel Company.
- 1982 Project Manager. Interim revegetation of the King VI Mine. U.S. Fuel Company.

## Publications and Reports

- 1979 Energetic efficiency of three range cattle biotypes. Page 59 in 32nd Annual Meeting of the Society for Range Management, Casper, Wyoming (Abstract). (with P. L. Sims).
- 1981 Energetic efficiency of three range cattle biological types. Ph.D. Dissertation, Colorado State University, 84 pp.
- 1982 Revegetation plan for the King VI coal mine. U.S. Fuel Company. BIO/WEST PR 69-82-1.
- 1982 Topsoil plan for the King VI coal mine. U.S. Fuel Company. BIO/WEST PR 69-82-2. (with W. Glenn)

## Publications Contributed To

- 1982 Draft and Final Schell Resource Area Grazing EIS, BLM, Nevada.
- 1982 Preliminary Draft EIS for the Liberty-Coolidge Transmission Line, Arizona. BIO/WEST PR 67-82-1.

## Teaching

- 1978 Instructor, Ecosystem Management Short Course, Colorado State University, Fort Collins.
- 1975-76 Teaching Assistant, Department of Range Science, Colorado State University, Fort Collins.

## Activities

- 1982-83 Chairman of the Information and Education Committee, Utah Section, Society for Range Management.
- 1978-79 Graduate Student Representative, Department of Range Science and Graduate Student Council, Colorado State University, Fort Collins.

## Organizations

Society for Range Management, Colorado Mining Association, American Society of Animal Science, Beta Beta Beta (Biological Honor Society), Xi Sigma Pi (Natural Resources Honor Society), Phi Kappa Phi (National Honor Society, top 10% of graduating class).

MICHAEL H. ALBEE  
Wildlife Biologist

Date and Place of Birth

July 10, 1946                      Pocatello, Idaho

Education

1972            Utah State University, B.S. Wildlife Biology

1972-74        Utah State University, Graduate Research

Professional Experience

1979-Present - Wildlife Section Manager, BIO/WEST, Inc., Logan,  
Utah.

1972-74        Research Assistant, Utah State University. Completed a  
population study of mule deer winter range using pellet  
group transects. The study was designed to obtain the  
lowest sampling variance with a minimum of observations.

1974-76        Field Biologist, Platte River Resource Area, Bureau of  
Land Management, Casper, Wyoming. Responsible for wild-  
life habitat management on approximately 1.5 million acres  
of public land. Participated in inventories of all ter-  
restrial and aquatic wildlife, writing of eight environ-  
mental analysis reports, assessment of natural gas lease  
applications, and analyzing various potential impacts on  
public lands.

1976-78        Biologist, Bureau of Land Management, Rock Springs,  
Wyoming. Served as a team member on Southwest Wyoming  
Coal Environmental Statement. Was responsible for all  
terrestrial and aquatic sections. Primarily reviewed  
information supplied by contract and incorporated it into  
the EIS. Reviewed mine plans for technical adequacy in  
terrestrial and aquatic wildlife.

1978-79        Field Biologist, Salt Wells Resource Area, Bureau of Land  
Management, Rock Springs, Wyoming. Responsible for habi-  
tat monitoring, maintenance and improvement of all  
terrestrial and aquatic wildlife on 1.5 million acres of  
public land. Developed annual work plans, conducted photo  
trend studies of elk and deer habitat, conducted antelope  
and endangered species surveys.

1980            Assistant Project Manager for BIO/WEST on the preparation  
of an Environmental Impact Statement on the proposed White  
River Dam in Utah.

## Professional Experience - Continued

- 1980 Principal Investigator for BIO/WEST on a study of large and small mammal populations in western Utah and south-central Nevada.
- 1980 Terrestrial wildlife consultant on an evaluation of alternative access roads to an exploratory oil and gas well, Big Piney District, Bridger-Teton National Forest.
- 1980 Project Manager and Principal Investigator on a baseline wildlife inventory of the Chaco Strippable Coal Area, New Mexico.
- 1980 Terrestrial Wildlife Consultant on an interdisciplinary team to assess the impacts of proposed access roads and exploratory drilling in the Mountain View Ranger District, Wasatch National Forest.
- 1980 Terrestrial Wildlife Consultant on an interdisciplinary team to assess the impacts of proposed access roads and exploratory drilling in the Gros Ventre and Hoback Ranger Districts, Bridger-Teton National Forest.
- 1980 Project Manager on a vegetation study of U.S. Fuel Company Mining property, Hiawatha, Utah.
- 1981 Terrestrial Wildlife Consultant on an interdisciplinary team to assess the impacts of alternative exploratory drill sites in the Quaking Aspen Hollow area of the Grey Rivers Ranger District, Bridger-Teton National Forest.
- 1981 Terrestrial Wildlife Consultant on an interdisciplinary team to assess the impacts of an exploratory drill site in the Fall Creek area of the Hoback Ranger District, Bridger-Teton National Forest.
- 1981 Wildlife Biologist for BIO/WEST on the Jackson Lake Dam Modification Environmental Analysis. Responsible for assessing the impacts of modification of the Jackson Lake Dam which includes the possible use of several alternative construction material borrow areas near critical wildlife habitat.
- 1981 Wildlife Biologist for BIO/WEST on the Schell Grazing Environmental Impact Statement. Responsible for analyzing the impacts of livestock grazing and several land use alternatives upon wildlife resources of eastern Nevada.
- 1981 Terrestrial Wildlife Consultant on an interdisciplinary team to assess the impacts of alternative exploratory oil and gas drill sites on the Poker Hollow Creek area of the Kemmerer Ranger District, Bridger Teton National Forest.

## Professional Experience - Continued

- 1981 Terrestrial Wildlife Consultant on an interdisciplinary team to assess the impacts of alternate exploratory oil and gas drill sites and access roads in the Gannett Hills area of the Greys River Ranger District, Bridger Teton National Forest.
- 1981 Terrestrial Wildlife Consultant on an interdisciplinary team to assess the impacts of alternate exploratory oil and gas drill sites and access roads in the Rock Creek area of the Bridger-Teton and Caribou National Forests.
- 1981 Wildlife Biologist, BIO/WEST, on the Liberty-Coolidge Transmission Line Environmental Impact Statement. Responsible for analyzing impacts of various alternate routes on the existing wildlife.
- 1982 Wildlife Biologist, BIO/WEST, on the Malad Valley Wetlands Assessment. Responsible for classifying and evaluating 12,000 acres of wetlands in southern Idaho and assessing potential impacts of irrigation projects.
- 1982 Terrestrial Wildlife Consultant on an interdisciplinary team to assess the impacts of alternative exploratory oil and gas drill sites and access roads in the Pruess Creek drainage of the Caribou National Forest.
- 1982 Terrestrial Wildlife Consultant for the Teton County Planning Commission. Responsible for identifying critical wildlife habitats in the South Park area of Jackson Hole and insuring that those habitats are protected and maintained when planning for new housing developments.

## Publications and Reports

- 1975 Habitat Management Plans, Goldeneye Wildlife and Recreation Area, Railroad Grade Reservoir, 33-mile Reservoir, Teal Marsh Reservoir, Casper District. U.S. Bureau of Land Management.
- 1980 Large mammal population studies. Final Report to HDR Sciences, Santa Barbara, CA. BIO/WEST PR-35-1.
- 1981 Wildlife Resource Inventory of the Chaco Strippable Coal Area, New Mexico. Final Report to Bureau of Land Management, Farmington, New Mexico. BIO/WEST PR-40-1.

## Reports Contributed To

- 1976 Management Framework Plan. Platte River Resource Area, Casper District. Bureau of Land Management.
- 1976 Unit Resource Analysis. Platte River Resource Area, Casper District. Bureau of Land Management. "
- 1978 Final Environmental Statement, Development of Coal Resources in Southwestern Wyoming. U.S. Department of the Interior.
- 1980 Draft Environmental Impact Statement, White River Dam Project. Bureau of Land Management, Richfield, UT.
- 1981 Draft Environmental Assessment, Jackson Lake Dam Modification. Bureau of Reclamation, Boise, ID.
- 1982 Draft Environmental Impact Statement, Liberty to Coolidge Power Transmission Line. Western Area Power Administration, Golden, CO.
- 1982 Draft and Final Schell Grazing Environmental Impact Statement. Bureau of Land Management, Ely, Nevada.
- 1982 Malad Valley Wetlands Assessment, Final Report. Soil Conservation Service, Boise, ID.
- 1974-79 A large number of environmental analysis reports, environmental statements, habitat management plans and other reports while employed with BLM.
- 1980-82 Eleven environmental analysis reports concerning exploratory oil and gas drilling in western Wyoming.

DEBORAH L. RICHARDSON

Ms. Richardson is a mining engineer and has worked in the environmental field for five years. For three years she worked for a consulting firm and was involved in a variety of projects dealing with the environmental concerns surrounding the opening or expansion of coal mining operations, synfuel projects and solid and hazardous waste projects. In addition, she evaluated the economic impact of regulatory programs on mining operations across the U.S. As a research assistant, Ms. Richardson evaluated the cause and treatment of acid mine drainage in the eastern U.S. In addition, effectiveness of coal preparation techniques in the removal of pyrite were evaluated. Discussions of some of the projects she has managed and/or worked on follow.

- o Completeness reviews for over 25 mining and reclamation plans to ensure the adequacy of the plans to show compliance with the applicable state and federal regulations. This work required the evaluation of several areas of a mine plan, including back-filling and grading, blasting, refuse disposal, slope stability and bonding. Plans were reviewed to determine if the submitted designs were adequate to show compliance with the regulatory requirements. Meetings with the mine operator were held to discuss deficiencies and to identify additional information needs. Mines were evaluated in the states of Utah, Wyoming, Colorado, New Mexico, Arizona, Georgia, and Kentucky.
- o Technical and environmental assessments of mining and reclamation plans for operations in the states of Colorado, Arizona, and Georgia. These assessments included the evaluation of volumetric analyses utilized to substantiate that approximate original contour requirements were met, assessment of analyses showing that ground vibration limits could be met during blasting, review of designs for refuse disposal piles and post-mining slopes for stability, and assessment of bond amounts for adequacy and completeness.
- o Evaluation of methods available to evaluate impacts to groundwater systems subsequent to mining in the western U.S. Over ten mine plans and procedures utilized for the evaluation of groundwater impacts were evaluated for their adequacy to predict post-mining conditions. Methods utilized by several major researchers in the western U.S. were reviewed and their applicability to the particular environmental setting assessed. The usefulness of each of the techniques to the prediction of groundwater impacts was determined and limitations studied. Methods utilized in sampling overburden strata and laboratory procedures in determining the potential for groundwater contamination were also assessed.
- o Evaluation of the economic impact of the surface mining regulations on mine operators within eleven regions of the U.S. Eleven mining operations were designed in compliance with the federal surface mining program, and the cost of environmental

DEBORAH L. RICHARDSON - Continued

compliance determined. The eleven operations provided the basis for further analysis of the proposed surface mining regulations published in 1982. The operations included area strip mines, contour strip, open pit, mountaintop removal, and surface facilities associated with underground operations.

- o Compilation of permit requirements to open a mining operation in seven states. This project required the evaluation of permit requirements for opening a mining operation. Factors such as permit content, time for obtaining a permit, regulatory review process and relationships between permits such as similar content requirements were determined for all state permits which could possibly be required by a mining operation. This information was inputted to a computer scheduling program to determine the most efficient strategy for acquisition of permits.
- o Review of methods available to treat mine drainage in the eastern U.S., and methods to abate the formation of poor quality mine drainage. Treatment of acid mine drainage and drainage with a high suspended solids content was evaluated and available options reviewed. In addition, emphasis was placed on the benefits of preplanning in mining operations to minimize the formation of poor quality drainage. These included minimizing the contact of in-pit water with pyritic material and the need for efficient collection of in-pit water to a sump area.
- o Evaluation of uranium mill tailings disposal sites for potential groundwater impacts. Two sites in western Colorado were reviewed to determine if the proposed design and construction methods would adequately control the movement of water from the tailings to aquifers located below the disposal site.
- o Risk assessment for the long-term disposal of hazardous waste disposed with low-level radioactive waste. Evaluation of impacts to surface and groundwater, air, vectors, and subsequently to human receptors at various locations were determined. Scenarios for the accidental release of the waste were developed and the potential risks to the receptors identified.

Ms. Richardson has a B.S. in Geology and a M.S. in Mining Engineering from the Pennsylvania State University. She received her Engineering-in-Training Certificate in 1979 in Pennsylvania. Publications she has authored include:

Richardson, D.L., "Assessment of Impacts to Surface Coal Mine Operators Due to Changes in Surface Mining Regulations", 1982 Symposium on Surface Mining Hydrology, Sedimentology, and Reclamation, Lexington, Kentucky, December, 1982.

DEBORAH L. RICHARDSON - Continued

Richardson, D.L. and H.L. Lovell, "Pyrite Liberation in Coal - Key to Sulfur Reduction During Beneficiation", Coal Conference and Expo V, Louisville, Kentucky, October, 1979.

Richardson, D.L., A Study of the Occurrence of Pyrite in Coal and its Relationship to Liberation in Coal Preparation and Acid Mine Drainage Formation, M.S. Thesis, Pennsylvania State University, 126 pages, 1979.

CONNIE R. KIMBALL

As an engineering geologist, Connie Kimball has accumulated five years of experience in hydrology in both the eastern and western U.S. During three years with the Indiana Department of Natural Resources, Division of Water, she participated in an evaluation of the state's water needs, coordinated research on shoreline erosion hazards along Lake Michigan and conducted the engineering review of proposals for construction along streams. Subsequent work in Colorado included the review of all aspects of surface water hydrology appurtenant to mining operations, including the evaluation of alluvial valley floors and the interaction between the groundwater and surface water regimes. Additionally, she has participated in the assessment of hydrologic impacts projected from the disposal of hazardous waste. Previous projects she has worked on include the following.

- o Completeness reviews of approximately 25 mining permit applications to ensure that the plans were sufficiently complete for a subsequent technical and environmental assessment in accordance with state and federal regulations. Specifically, this work required a thorough knowledge of regulatory requirements for hydraulic structures and water quality, and an understanding of necessary engineering plans and calculations that should accompany a permit application. Conferences were held with the mining company and regulatory authority to explain deficiencies in the application and defend requests for additional information. Mine plans were reviewed for the states of Utah, Wyoming, Colorado, New Mexico, Arizona, Indiana, Georgia, and Kentucky.
- o Technical and environmental assessments of seven mining permit applications in Colorado, Arizona, and Georgia, as well as the assessment of specific hydraulic structures, such as diversions and dams, for several mines in Indiana. This work required expertise necessary to complete peak flow calculations, floodplain and terrace identification, calculation of sediment inflow and evaluation of water quality data for probable hydrologic impacts. Additionally, this work demanded the geotechnical assessment of embankment construction, evaluation of reservoir and spillway capacities, evaluation of drainage structures, such as culverts and bridges, and review of channel construction and reclamation.
- o Prepared study plan for a site in Montana that was suspected of contaminating the local groundwater supply with substances used in wood-treating processes. Involved planning the steps needed to verify the source of contamination, basing the plan on available information about local well data, history of industry in the area, chemical characteristics of the contaminants and known characteristics of groundwater flow.

CONNIE R. KIMBALL - Continued

- o Prepared a closure plan for a hazardous waste disposal site in Maryland. Required familiarity with EPA-RCRA regulations for closure of such sites and expertise necessary for projecting needs for a clay liner and cap, diversion of surface water flow away from the area, protection against intruders and familiarity with the potential for migration of groundwater contaminants.
- o Evaluated and proposed alternatives to the Environmental Protection Agency for immobilization and disposal of radioactive sludge generated from treatment of a town's drinking water supply contaminated with naturally-occurring radium. Involved assessment of radium concentrations in sludge and projection of potential hazards from the radioactive material during generation and after disposal.
- o Conducted the engineering review of proposals for construction along streams in Indiana. Projects included commercial buildings, residential developments, dams, levees, diversions, fills and excavations. Required expertise to perform hydraulic studies using HEC-II computer modeling to identify constriction of the floodway, as well as hydrograph development and research of historical flow data for input into these studies. Additionally required the use of reservoir routing, geotechnical evaluation of embankments and levees, field inspections of structures and meeting with the public to discuss violations or project specification.
- o Coordinated two studies for the federally-sponsored Coastal Zone Management Program. Researched and documented industrial and governmental records to reconstruct the history of land created from the in-filling of Lake Michigan. Determined the extent of shoreline erosion along Indiana's Lake Michigan coast via field inspections and historical records and identified and documented hazard areas for subsequent inclusion in state policy for that area.
- o Researched portions of the surface water hydrology aspect for publication of the Indiana Water Resource: Availability, Uses and Needs. Determined the availability of surface water utilizing historic precipitation and flow data for hydrograph separation and flow duration curves.

Connie Kimball's education includes a B.A. in Geology from Hanover College and graduate work toward a M.A. in Geology from Indiana University. Short courses include:

- o Corps of Engineers Dam Safety Evaluation, 1980.
- o Applied Hydrology and Sedimentology of Surface Mined Lands, 1981.
- o Research Institute on Fluvial Process, Colorado State University, 1982.
- o Groundwater Modeling, NWWA, 1982.

MARC A. JEWETT

Mr. Jewett is a hydrologist and for the past five years has worked in the environmental field. The projects that he has been involved with have primarily dealt with the evaluation of mining operations on waste disposal sites and their impact on hydrologic systems. While with an environmental consulting firm for three years, he evaluated over 40 mining operations and waste disposal sites for the potential for degradation of the environment. As a research assistant prior to working in the consulting business, Mr. Jewett was involved researching the formation of toxic chlorinated hydrocarbons during the disinfection of drinking water by chlorination. Discussions of projects that he has managed and/or worked on follow.

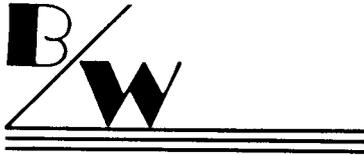
- o Completeness reviews for over 25 mining and reclamation plans to ensure the adequacy of the plans to show compliance with the applicable state and federal regulations. This work required evaluation of several areas of a mine plan, including groundwater baseline studies, groundwater impact assessments, cumulative hydrologic impact assessment, alluvial valley floor studies and groundwater monitoring programs. Meetings with the coal mine operator were held to identify additional information needs and discuss the information requirements. Mines were evaluated in the states of Utah, Wyoming, Colorado, New Mexico, Arizona, Georgia, and Kentucky.
- o Technical and environmental assessments of mining and reclamation plans for operations in the states of Colorado, Arizona, and Georgia. These assessments included the evaluation of pre-mining aquifer conditions, toxic overburden characteristics, the potential for contaminant migration, impacts of aquifer discharges on surface water bodies, and the evaluation of the effect of mining on the hydrologic functions of an alluvial valley floor.
- o Evaluation of methods available to evaluate impacts to groundwater systems subsequent to mining in the western U.S. Over ten mine plans and procedures utilized for the evaluation of groundwater impacts were evaluated for their adequacy to predict post-mining conditions. Methods utilized by several major researchers in the western U.S. were reviewed and their applicability to the particular environmental setting assessed. The usefulness of each of the techniques to the prediction of groundwater impacts was determined and limitations studied. Methods utilized in sampling overburden strata and laboratory procedures in determining the potential for groundwater contamination were also evaluated.
- o Evaluation of the economic impact of the surface mining regulations dealing with surface and groundwater issues on mine operators within eleven regions of the U.S. Eleven mining operations were designed to comply with the Federal Permanent Program, and the cost of environmental compliance was determined. Surface

MARC A. JEWETT - Continued

water control structures, and ground and surface water monitoring systems were designed and costs developed for the construction of those facilities. The operations included area strip mines, contour strip, open pit, mountaintop removal, and surface facilities associated with underground operations.

- o Evaluation of uranium mill tailings disposal sites for potential groundwater impacts. Two sites in western Colorado were evaluated to determine potential environmental impacts. The design and the construction of the sites were evaluated to determine the potential of migration of contaminants through the liner and impounding structures. The stability of the impounding structures was reviewed along with reclamation feasibility.
- o Site-assessment studies for over 10 toxic waste disposal sites. These evaluations were done for various sites located in Tennessee, Michigan, New Hampshire, Utah, Colorado, Missouri, Arizona, and Maryland. The studies primarily involved the identification of the wastes, site characterization, development of preliminary mitigation plans, and design of monitoring programs to further define waste migration.
- o Preparation of the EPA Groundwater Monitoring Manual. This manual was to be utilized as a guideline to developing a groundwater monitoring plan for a hazardous waste disposal site. Factors such as aquifer characteristics potential for contaminant migration, and facility location and design were considered.

Mr. Jewett has a B.S. in Hydrology/Watershed Management from the University of Montana and a M.S. in Water Resources from the University of New Hampshire. He has also completed the Groundwater Pollution and Hydrology training course offered through the Water Resources Program at Princeton University.



BIO/WEST, Inc.

P.O. Box 3226  
Logan, Utah 84321  
(801) 752-4202

March 21, 1983

Ms. Mary Boucek  
Department of Energy and Natural Resources  
Division of Oil, Gas and Mining  
4241 State Office Building  
Salt Lake City, UT 84111

Dear Ms. Boucek:

Enclosed please find three copies of BIO/WEST's Technical and Cost proposals for mining and reclamation plan review for the Emery Deep Mine (Req. No. 584202). The team of BIO/WEST, Inc., and Richardson Associates provides highly qualified individuals who have extensive experience in mine plan reviews. The last two years, BIO/WEST and the staff of Richardson Associates have worked together on six mine plan reviews for the Denver Regional Office of Surface Mining, including the 1981 apparent completeness review for the Emery Deep Mine and the preparation plant modification. Each staff member of Richardson Associates has reviewed over 25 mining and reclamation plans for the Office of Surface Mining. Both BIO/WEST and Richardson Associates have worked for the mining industry in Utah and, thus, have in-depth understanding of the Utah Permanent Program and an established working relationship with the Division of Oil, Gas and Mining.

In summary, the proposed team offers the unique combination of experience in mine plan review, familiarity with the Emery Deep Mine, understanding of the Utah Permanent Program, and an established working relationship with the Division of Oil, Gas and Mining. Please feel free to contact me if you have any questions or need any additional information.

Sincerely,

A handwritten signature in cursive script that reads "John Rice".

John Rice  
Vegetation/Soils Section Manager

JR/nh

Enc.



Cost Proposal  
REVIEW OF THE MINING AND RECLAMATION PLAN  
FOR THE EMERY DEEP MINE

Submitted to  
Utah Department of Energy and Natural Resources  
Division of Oil, Gas and Mining  
4241 State Office Building  
Salt Lake City, Utah 84111

Submitted by  
BIO/WEST, Inc.  
P. O. Box 3226  
Logan, Utah 84321

March 18, 1983

Cost Proposal

to

Division of Oil, Gas and Mining

Submitted by

BIO/WEST, Inc.  
Logan, Utah

Title of Proposed Project

Review of the Mining and Reclamation Plan  
for the Emery Deep Mine

Desired Starting Date

April 15, 1983

Completion Date

March 15, 1984

  
\_\_\_\_\_  
Thomas M. Twedt, Principal

The following cost proposal includes a completed Department of Finance Bid Proposal Form. This proposal is based on the level of effort proposed in the Technical Proposal.

The contract will be a firm, fixed-price type. Invoices will be submitted monthly to the Lead Reviewer and the Department of Finance. Written progress reports will accompany the invoices and invoiced amounts will be based on services and costs accrued to the date of the invoice.

## COST PROPOSAL

### Labor

#### BIO/WEST

T. Twedt	28 hrs. @ \$19.20	\$ 537.60
J. Rice	94 hrs. @ \$16.94	1,592.36
M. Albee	60 hrs. @ \$14.93	859.80
N. Hubbard	60 hrs. @ \$8.32	<u>499.20</u>

Total BIO/WEST Labor - \$ 3,524.96

#### Richardson Associates

D. Richardson	84 hrs. @ \$14.00	\$ 1,176.00
C. Kimball	80 hrs. @ \$14.00	1,120.00
M. Jerrett	54 hrs. @ \$18.00	<u>972.00</u>

Total Richardson Associates' Labor - \$ 3,268.00

Overhead - (0.25 on BIO/WEST Labor) \$ 881.24

### Travel

Airline (3 round trips, Denver to Salt Lake City  
and return for two people @ \$100/trip) \$ 600.00

Per diem - 10 man-days @ \$25/day 250.00

Mileage - 600 mi. @ \$0.25/mile 150.00

Total Travel - \$ 1,000.00

### Other Direct Costs

Telephone	\$ 150.00
Photocopy	120.00
Postage	<u>50.00</u>

Total Other Direct Costs - \$ 320.00

Total Labor, Overhead, Travel, and Other Direct Costs - \$ 8,994.20

STATE OF UTAH  
BID PROPOSAL FORM

BID RESULTS AVAILABLE  
THURSDAYS 1:00 P.M. TO 4:30 P.M.  
533-4615

DEPARTMENT OF FINANCE

DIVISION OF PURCHASING

Date March 7, 1983

Req. No. 584202

Dept. NATURAL RESOURCES AND ENERGY

All inquiries and correspondence to be addressed to the attention of:

Finance Department  
Division of Purchasing  
147 State Capitol Building  
Salt Lake City, Utah 84114

Bids must be submitted on this proposal form.

Proposal to be returned in enclosed self-addressed envelope, not later than 10:30 a.m. March 22, 1983 at which time all proposals will be publicly opened and read.

Quote Prices F.O.B. 4241 State Office Building, Salt Lake City UT 84114

ITEM NO.	QUANTITY	DESCRIPTION	UNIT PRICE	TOTAL
		<p>Brand names and model numbers must be furnished with bid.</p> <p>Technical assistance in permit review related to Coal Mining and Reclamation Permanent Program.</p> <p>See attached Statement of Work</p>	\$8994.20	\$8994.20

Cash discounts of less than 30 days will not be considered in awarding.

IMPORTANT: PLEASE READ  
FAILURE TO SIGN THIS PROPOSAL IN INK WILL RESULT IN THIS BID BEING REJECTED.

Cash discount terms \_\_\_\_\_

Company BIO/WEST, Inc.

Requested Delivery Date See Attached

Address P. O. Box 3226

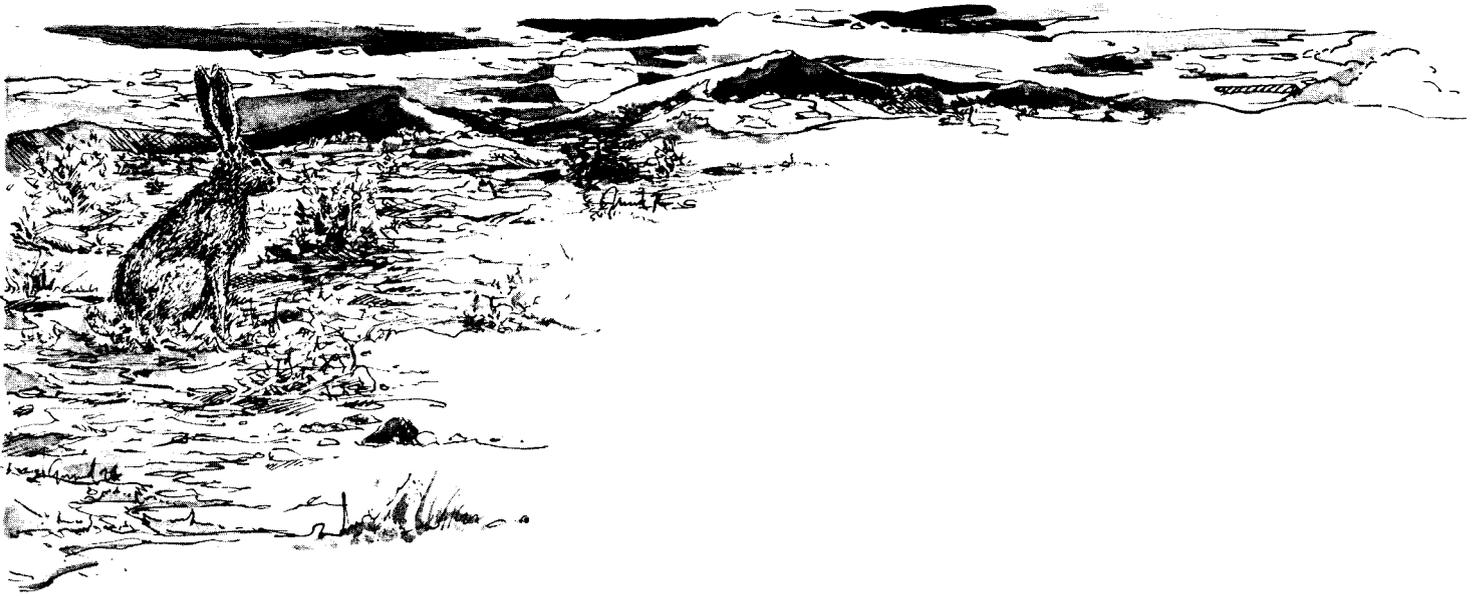
Please quote number of calendar days required for delivery after receipt of purchase order. \_\_\_\_\_

Logan, Utah 84321  
Zip Code

Signature [Signature]

Title President

NOTE: See terms and conditions governing bids and sales to State on Reverse side.



## BIO/WEST, Inc.

1063 West 1400 North  
P.O. Box 3226  
Logan, Utah 84321  
(801) 752-4202

Art  
by  
Scott Greenwood

