San Juan Basin Action Plan

SITE ALTERNATIVES TECHNICAL REPORT

for the
Environmental Impact Statement on Public Service Company of New Mexico's Proposed New Mexico Generating Station and Possible New Town

United States
Department
of the Interior

Bureau of Land Management
New Mexico State Office
Santa Fe, New Mexico

October 1982

Report 4 of 22

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
NEW MEXICO STATE OFFICE
P.O. BOX 1449
SANTA FE, NEW MEXICO 87501

IN REPLY REFER TO
NM30840EIS
1792.73(934A)

October 1982

Dear Interested Citizen:

Attached is one of twenty-two technical reports developed as a basis for writing the Environmental Impact Statement on Public Service Company of New Mexico's Proposed New Mexico Generating Station and Possible New Town (NMGS EIS). (A list of the technical reports is attached.)

These technical reports provide detailed information on the existing environment, methods used for the impact analysis, and related data supportive of the analysis and conclusions presented in the EIS. These reports should be retained for use with the Draft and Final EIS and other documents related to BLM's San Juan Basin Action Plan (SJBAP).

The Draft NMGS EIS will be filed with the Environmental Protection Agency and released for public review on November 30, 1982. Comments on the Draft EIS will be due by close of business February 7, 1983, at the BLM New Mexico State Office. Because of the large volume of material presented in the technical reports, the BLM is distributing these reports in advance of the Draft EIS to provide sufficient time for public review. The technical reports will be available for public review at the places indicated on the attached list. Copies will also be available from the BLM New Mexico State Office, U.S. Post Office and Federal Building, Santa Fe, for a copy fee.

Informational public meetings are scheduled for December 1982 to provide a public forum to clarify questions and concerns about the SJBAP proposals and the related environmental documents, which will all have been issued by that time. The meetings are scheduled as follows:

- December 14, Civic Center, Farmington, 3 to 9 PM
- December 14, Convention Center, Albuquerque, 3 to 9 PM
- December 15, Chapter House, Crownpoint, 3 to 9 PM
- December 16, Holiday Inn, Gallup, 3 to 9 PM
- December 16, Kachina Lodge, Taos, 3 to 9 PM

In addition, formal public hearings will be held in January 1983 to solicit public comments on the SJBAP Proposals. These meetings are scheduled as follows:

- January 10, Chapter House, Crownpoint, beginning at 1:00 PM
- January 12, Civic Center, Farmington, beginning at 9:00 AM
- January 14 (and 15th if necessary because of the number of registrants), Four Seasons Motor Lodge, Albuquerque, I-40 and Carlisle Blvd., beginning at 9:00 AM (each day)

Questions on the public meetings, hearings, and the technical reports themselves should be directed to:

Leslie M. Cone
NMGS Project Manager
BLM, New Mexico State Office
P.O. Box 1449
Santa Fe, NM 87501
(505) 988-6184 FTS 476-6184

Sincerely yours,

Charles W. Luscher

Charles W. Luscher
State Director, New Mexico

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List of Technical Reports

1. Purpose and Need
2. Project Description
3. Alternatives to the Project
4. Site Alternatives
5. Permit Reconnaissance
6. Air Quality
7. Geologic Setting
8. Mineral Resources
9. Paleontology
10. Soils, Prime and Unique Farmlands
11. Hydrology
12. Water Quality
13. Vegetation
14. Wildlife and Aquatic Biology
15. Threatened and Endangered Species
16. Cultural Resources
17. Visual Resources
18. Recreation Resources
19. Wilderness Values
20. Transportation
21. Social and Economic Conditions
22. Land Use Controls and Constraints

Availability of Technical Reports for Public Review

Individual copies of the technical reports can be obtained for a copy fee. Inquiries should be directed to:

Bureau of Land Management, New Mexico State Office
Title Records and Public Assistance Section (943B)
U.S. Post Office and Federal Building
P.O. Box 1449
Santa Fe, NM 87501
(505) 988-6107 FTS 476-6107

Copies of the reports are available for public review at the locations listed below. [Formal and informal cooperating agencies are denoted by an asterisk (*).]

BUREAU OF LAND MANAGEMENT OFFICES

New Mexico State Office

NMGS Project Staff (934A)
Room 122, Federal Building
Cathedral Place
P.O. Box 1449
Santa Fe, NM 87501
(505) 988-6184 FTS 476-6184

San Juan Energy Projects Staff (911)
Room 129, Federal Building
Cathedral Place
P.O. Box 1449
Santa Fe, NM 87501
(505) 988-6226 FTS 476-6226

Public Affairs Staff (912)
Room 2016
U.S. Post Office and Federal Building
P.O. Box 1449
Santa Fe, NM 87501
(505) 988-6316 FTS 476-6316

Division of Resources(930)
509 Camino de los Marquez, Suite 3
P.O. Box 1449
Santa Fe, NM 87501
(505) 988-6212 FTS 476-6212

Albuquerque District Office
3550 Pan American Freeway NE
P.O. Box 6770
Albuquerque, NM 87107
(505) 766-2455 FTS 474-2455

Farmington Resource Area Headquarters
900 La Plata Road
P.O. Box 568
Farmington, NM 87401
(505) 325-3581

Taos Resource Area Office
Montevideo Plaza
P.O. Box 1045
Taos, NM 87571
(505) 758-8851

Socorro District Office
198 Neel Avenue
P.O. Box 1219
Socorro, NM 87801
(505) 835-0412 FTS 476-6280

Las Cruces District Office
1705 N. Valley Drive
P.O. Box 1420
Las Cruces, NM 88001
(505) 524-8551 FTS 571-8312

Roswell District Office
1717 W. Second Street
P.O. Box 1397
Roswell, NM 88201
(505) 622-7670 FTS 476-9251

Carlsbad Resource Area Headquarters
114 S. Halagueno Street
P.O. Box 506
Carlsbad, NM 88220
(505) 887-6544

USDI, Bureau of Land Management
Division of Rights-of-Way (330)
18th and C Streets, NW
Washington, D.C. 20240
(202) 343-5441 FTS 343-5441

USDI, Bureau of Land Management
Denver Service Center (D-460)
Technical Publications Library
Denver Federal Center, Bldg. 50
Denver, CO 80225
(303) 234-2368 FTS 234-2368

NEW MEXICO STATE AGENCIES

New Mexico State Environmental Improvement Division*
725 St. Michaels Drive
P.O. Box 968
Santa Fe, NM 87503
(505) 827-5217, ext. 2416

New Mexico Energy and Minerals Department*
525 Camino de los Marquez
P.O. Box 2770
Santa Fe, NM 87503
(505) 827-3326

New Mexico Historic Preservation Bureau*
State Historic Preservation Officer
505 Don Gasper Avenue
Santa Fe, NM 87503
(505) 827-2108

New Mexico Natural Resource Department*
Villagra Building
Santa Fe, NM 87503
(505) 827-5531

New Mexico Public Service Commission*
Bataan Memorial Building
Santa Fe, NM 827-3361
(505) 827-3361

New Mexico State Engineer's Office*
Bataan Memorial Building
Santa Fe, NM 87503
(505) 827-2423

New Mexico State Planning Office*
505 Don Gasper Avenue
Santa Fe, NM 87503
(505) 827-5191

OTHER ORGANIZATIONS

Public Service Company of New Mexico
Alvarado Square
P.O. Box 2268
Albuquerque, NM 87158
(505) 848-2700

Woodward-Clyde Consultants, Inc.
3 Embarcadero Center, Suite 700
San Francisco, California 94111
(415) 956-7070

PUBLIC AND UNIVERSITY LIBRARIES

Reading copies of the NMGS EIS and associated technical reports will be available at the following public and university libraries:

State and Public Libraries

Albuquerque Public Library
501 Copper Avenue NW
Albuquerque, NM 87102

Aztec Public Library
201 W. Chaco
Aztec, NM 87401

Crownpoint Community Library
c/o Lioness Club, P.O. Box 731
Crownpoint, NM 87313

Cuba Public Library
Box 5, La Jara
Cuba, NM 87027

Farmington Public Library
302 N. Orchard
Farmington, NM 87401

Gallup Public Library
115 W. Hill Avenue
Gallup, NM 87301

Mother Whiteside Memorial Library (Public)
525 W. High Street
P.O. Box 96
Grants, NM 87020

New Mexico State Library
325 Don Gaspar Avenue
Santa Fe, NM 87503

OTHER DEPARTMENT OF THE INTERIOR AGENCIES

Bureau of Indian Affairs*
Albuquerque Area Office
123 4th Street
P.O. Box 2088
Albuquerque, NM 87198
(505) 766-3374 FTS 474-3374

Bureau of Indian Affairs*
Eastern Navajo Agency
P.O. Box 328
Crownpoint, NM 87313
(505) 786-5228

Bureau of Indian Affairs*
Navajo Area Office
Box M - Mail Code 305
Window Rock, AZ 86515
(602) 871-5151 FTS 479-5314

Bureau of Reclamation*
Upper Colorado Regional Office
125 S. State Street
P.O. Box 11568
Salt Lake City, UT 84147
(801) 524-5463 FTS 588-5463

Minerals Management Service*
South Central Region
505 Marquette Avenue NW, Suite 815
Albuquerque, NM 87102
(505) 766-1173 FTS 474-1173

Minerals Management Service*
Resource Evaluation Office
411 N. Auburn
Farmington, NM 87401
(505) 327-7397 FTS 572-6254

National Park Service*
Southwest Regional Office
1100 Old Santa Fe Trail
Santa Fe, NM 87501
(505) 988-6375 FTS 476-6375

National Park Service*
Environmental Coordination Office
Pinon Building, 1220 St. Francis Drive
P.O. Box 728
Santa Fe, NM 87501
(505) 988-6681 FTS 476-6681

U.S. Fish and Wildlife Service*
Field Supervisor, Ecological Services
3530 Pan American Highway, Suite C
Albuquerque, NM 87107
(505) 766-3966 FTS 479-3966

U.S. Geological Survey (WRD)*
505 Marquette Avenue, Room 720
Albuquerque, NM 87101
(505) 766-2810 FTS 474-2817

OTHER FEDERAL AGENCIES AND ORGANIZATIONS

Environmental Protection Agency*
Region VI
1201 Elm Street
Dallas, TX 75270
(214) 767-2716 FTS 729-2716

Navajo Tribe*
c/o Division of Resources
P.O. Box 308
Window Rock, AZ 86515
(602) 871-6592

Pueblo of Zia*
General Delivery
San Ysidro, NM 87053
(505) 867-3304

Soil Conservation Service*
424 N. Mesa Verde
Aztec, NM 87410
(505) 334-9437

U.S. Corps of Engineers*
P.O. Box 1580
Albuquerque, NM 87103
(505) 766-2657 FTS 474-2657

USDA, Forest Service*
717 Gold Avenue
Albuquerque, NM 87102
(505) 474-1676 FTS 474-1676

USDA, Forest Service*
District Ranger
Mt. Taylor Ranger District
201 Roosevelt Avenue
Grants, NM 87020
(505) 287-8833

Harwood Foundation Library
(Public)
25 LeDoux
P.O. Box 766
Taos, NM 87571

University/College Libraries

University of New Mexico
General Library
Albuquerque, NM 87131

Navajo Community College Library
Shiprock Branch
P.O. Box 580
Shiprock, AZ 87420

Northern New Mexico Community College
P.O. Box 250
Espanola, NM 87532

New Mexico State University
San Juan Campus
4601 College Blvd.
Farmington, NM 87401

University of New Mexico, Gallup Campus
Learning Resources Center
200 College Road
Gallup, NM 87301

New Mexico State University/Grants
1500 Third Street
Grants, NM 87020

New Mexico Highlands University
Donnelly Library
National Avenue
Las Vegas, NM 87701

College of Santa Fe
Fogelson Memorial Library
St. Michaels Drive
Santa Fe, NM 87501

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Environmental Impact Statement on Public Service Company of New Mexico's Proposed New Mexico Generating Station and Possible New Town

Prepared by

Woodward-Clyde Consultants

for the

U.S. Department of the Interior
Bureau of Land Management

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INTRODUCTION

In 1977, Public Service Company of New Mexico (PNM) submitted applications to the Bureau of Land Management (BLM) for rights-of-way (ROW) for ancillary facilities supportive of a 2000-megawatt (MW) coal-fired steam electric generating plant, the New Mexico Generating Station (NMGS), at the Bisti site in northwestern New Mexico. As part of its duty to identify reasonable alternatives to PNM's proposal, BLM reviewed alternative coal-fired power plant sites in New Mexico. The major source of data for this review is a siting study that PNM prepared for its own use.

This report summarizes the applicant's site selection process and findings and the results of BLM's review.

2

APPLICANT'S SITE SELECTION PROCESS

In 1973-74, PNM and El Paso Electric Company began a joint planning study to address future electric energy needs by evaluating potential areas for power plant siting. The companies hired Woodward-Clyde Consultants (WCC) to assist them with their power plant siting study. The purpose of the studies was to identify and rank site areas in the state of New Mexico and three counties in west Texas (El Paso, Hudspeth, and Culberson) that would have the potential to support a power plant meeting the specifications. The plant to be studied was specified as a coal-fired facility with up to 2500 MW of generation capacity. Both conventional wet-cooling towers and combination wet- and dry-cooling towers were to be considered as alternative plant heat rejection systems. For planning purposes, it was assumed that the first unit of the power plant would be installed and on-line sometime in the mid-1980s.

The general methodology used in this siting study and its results are described in Summary of Site Alternative Evaluations for the New Mexico Generating Station (WCC 1982). The detailed discussion of the siting study is presented in New Mexico Generating Station Site Selection Report (WCC 1980). These are available for public review at the BLM New Mexico State Office in Santa Fe.

This discussion is presented in two major parts:

- Phase One: Candidate site area screening
- Phase Two: Ranking of candidate site areas
- Phase Three: Further investigation

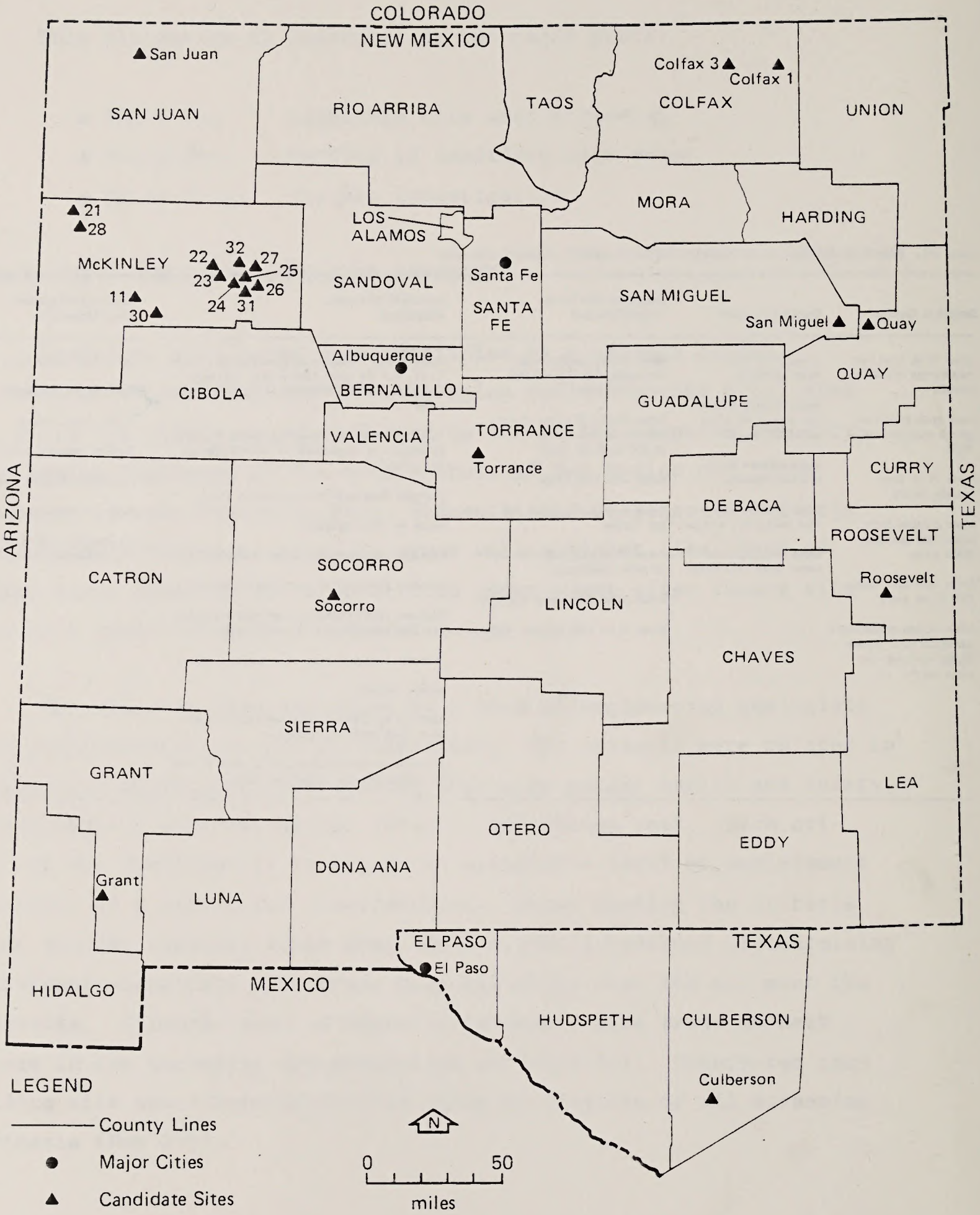
PHASE ONE: CANDIDATE SITE AREA SCREENING

Candidate site areas were identified by a process called screening. Screening began in the region defined as the total area in which the utilities were willing to locate the proposed facility. The region consisted of the entire state of New Mexico and three counties in west Texas--El Paso, Hudspeth, and Culberson. Criteria were then developed to identify areas with a higher likelihood of being found suitable for a coal-fired power plant after future site-specific evaluations were undertaken.

The criteria were developed by a team of engineering geologists and environmental and social scientists. The criteria were related to regulatory guidelines, the general issues of public health and safety, environmental effects, social effects, and system cost. Each criterion was developed to represent an acceptable level of achievement in terms of a particular consideration. Areas meeting the criteria were studied further, since they had a higher likelihood of containing acceptable candidate site areas than did areas that did not meet the criteria. Criteria used to identify candidate site areas at each phase in the screening are summarized in Table 2-1. Twenty-two candidate site areas were identified after application of all screening criteria (Map 2-1).

Table 2-1. SUMMARY OF CRITERIA USED IN SCREENING PROCESS TO IDENTIFY CANDIDATE SITE AREAS

Desirable Regions	Candidate Regions	Desirable Site Areas (Identification)	Desirable Site Areas (Selection)	Candidate Site Areas (Identification)
Areas >8 mi from Quaternary-age volcanic terrain	Areas >5 mi from major airports	Areas within ground-water subregion with 5000-20,000 ac-ft/yr (dry)	Sites within subregion of ground-water regions I, II, and IVa identified as most desirable for supplying 20,000-80,000 ac-ft/yr (wet site only)	Sites with >3000 level acres
Areas with potential ground acceleration <0.5g	Areas outside dedicated area >1000 acres and <5000 acres	Areas within 20 miles of surface-water sources with 5000-20,000 ac-ft/yr (dry)	Sites within ground-water subregions of higher potential for development of 5000-20,000 ac-ft/yr (dry)	Topography (favorable)
Areas >1 mi from capable faults	Areas outside known uranium deposits	Areas with <10% slope	Distance from surface-water sources (dry)	Plant layout (ease)
Areas outside dedicated land use area >5000 acres	Areas outside important ecological systems	Areas outside known oil and gas fields	Slope at sites (gradual)	Biology (avoid sensitivities)
Areas with less than 1000 ft/mi slope	Areas outside known karst zones (sinkholes)	Areas >3 mi from MCD with 2500 or more inhabitants	Distance from dedicated areas (farther)	Geotechnical (good foundation, soils)
Areas within ground-water subregion with 20,000-80,000 ac-ft/yr (wet sites only)		Areas >3 mi from minor airports	Distance from smaller communities (farther)	Land use (avoid conflicts)
		Areas >1 mi from primary highways	Distance from communities that have a greater need for economic development (closer)	Air quality (>50 miles from wilderness and primitive areas)
			Distance from potential labor supply (closer)	
			Access (better)	
			Distance to transportation networks (closer to primary roads and railroads)	
			Distance to identified sources of coal (closer to various sources of San Juan coal)	



Source: 1 to 500,000 U.S.G.S. Map

Map 2-1. CANDIDATE SITE AREAS

PHASE TWO: RANKING OF CANDIDATE SITE AREAS

Techniques of decision analysis were used to rank the 22 candidate site areas identified during the screening process. Ranking was undertaken in the four steps outlined below:

- Selecting measures (attributes) for comparing candidate site areas
- Describing candidate site areas in terms of measures
- Ranking candidate site areas
- Conducting sensitivity studies to assess the effect on ranking due to changes in assumptions

Step 1: Selecting Measures

To compare the candidate site areas, it was necessary to develop measures that showed the desirability of each area in terms of the general issues discussed earlier. For example, with reference to the general issues of concern, the broad objectives for the siting study were:

- To maximize public health and safety
- To minimize adverse environmental effects
- To minimize adverse social effects
- To minimize economic costs

In evaluating candidate site areas, these general objectives must be divided into considerations for which specific measures, called "attributes" in decision analysis terminology, could be developed to assess how well a candidate site area will achieve a specific objective.

Six attributes were considered adequate to compare the 22 candidate site areas. These six attributes are listed and defined below:

- First-year differential site cost
- Air quality impacts
- Transmission line impacts
- Native American impacts
- Biological impacts
- Socioeconomic impacts

First-Year Differential Site Cost. The first-year differential site cost is the difference between the estimated first-year cost to build a plant at a candidate site area and the first-year cost of building a plant at the least costly candidate site area. The least costly candidate site area has a differential cost of $0.0. First-year costs are not expected to be a precise measure of site differential costs for every year of plant operation. However, the differences between site costs in the first year and those in any subsequent year are expected to remain approximately the same. Major differences in cost among the candidate site areas in this study were due to:

- Fuel transportation cost: The farther a site is from the coal source (San Juan County), the more expensive it is to transport fuel to the site by rail. Western Coal Company's Bisti mine was assumed to be the least expensive source of coal for the major needs of a coal-fired power plant in the entire study area. The New Mexico Generating Station Site Selection Report discusses other sources of coal and their effect on coal costs.

- Wet versus wet/dry and dry cooling: The extra costs associated with being unable to use wet cooling because of

extra energy requirements are significant; wet sites have a significant cost saving over nonwet sites.

Air Quality Impacts. A concern in siting is the potential increase in air pollutants from the operation of a coal-fired power plant. The attribute used in this study was the calculated increase in the average annual concentration of sulfur dioxide (SO_2), expressed in micrograms per cubic meter. This attribute was chosen because the allowable annual SO_2 incremental concentration was considered to be the most stringent criterion used by regulatory agencies. Terrain at the candidate site area and the potential for stagnant air conditions were evaluated in assessing this attribute level for each candidate site area. Since the siting study was concerned only with the relative magnitude of the concentrations, general calculations using many simplifying assumptions were used. The results were, therefore, not quantitatively representative of the specific concentrations resulting at any one particular site, but only the relative magnitude of concentrations among all sites.

Transmission Line Impacts. This attribute reflected the potential environmental impacts from the construction of high-voltage electric transmission lines to each of the candidate site areas. The number of transmission line miles through potentially environmentally or aesthetically sensitive areas (such as wildlife management areas or previously undisturbed areas) were of more concern than the number of miles running through less sensitive areas (such as previously disturbed areas). For example, a mile of transmission line crossing the most ecologically sensitive area was considered to cause impacts equivalent to 10 miles through nonsensitive areas. Transmission routes were evaluated from each candidate site area to the Albuquerque load center, to the El Paso load center, and to the existing transmission system. These routes were plotted on maps to arrive at the number of miles through different categories of land.

Native American Impacts. This attribute measured the potential for adverse effects on the cultures of Native American groups living near each candidate site area. Cultural-religious effects are significant for the Navajo because they may find the presence of a power plant near their lands to be an intrusion. The attribute was distance in miles from a traditional Navajo community and was assessed for those candidate site areas in the vicinity of the Navajo Reservation and trust and fee lands. It was assumed for this study that the shorter the distance, the greater the potential for adverse effect. The range was from 0 to 30 miles; for this study, groups located more than 30 miles from a site were considered to experience no significant effect. The measure did not include special circumstances, such as intrusion or impact on sacred places, nor was the number of Navajo directly affected considered.

Biological Impacts. This attribute was concerned with the biological effects of site development, plant construction, and plant operation at each candidate site area. The impact of plant construction and operation was measured for each candidate site area on the basis of terrestrial biological characteristics present there. These characteristics included assessment of the impact to forests, grasslands, and habitats for threatened or endangered species.

Socioeconomic Impacts. This attribute measured the social and economic disruptions of communities caused by the influx of a large number of workers during the construction of a power plant. Disruptions could include a diminished level of public services, housing shortages, increased level of social problems, and increased costs for goods and services. The severity of the impacts depends greatly on how many new people there will be relative to the existing population. Because of the difficulty in measuring exactly what impacts are likely to occur, the socioeconomic attribute in the siting study was limited

to an assessment of the greatest annual population increase (in percent of increase) in a region associated with construction at the candidate site areas. The greater the percentage increase in population (within commute distance), the higher was the potential for socioeconomic impacts.

Step 2: Describing Candidate Site Areas

The potential impact of siting a power plant at each candidate site area was assessed in terms of the six attributes previously discussed. The differential cost estimates were supplied by PNM with WCC assistance. The other attribute assessments were developed by WCC environmental and social scientists with PNM assistance. The attribute assessments are discussed in more detail below.

First-Year Differential Site Cost. Actual values ranged from $0.0 (for the least expensive candidate site area) to $95.39 million. The McKinley County candidate site areas were significantly less expensive for two reasons: first, use of wet-cooling systems was possible, entailing lower costs than dry cooling; and second, the site areas are relatively close to the assumed coal source and therefore have significantly lower coal transportation costs.

Air Quality Impacts. Potential estimated SO_2 increment concentrations ranged from 12 to 60 micrograms per cubic meter. The Quay, Roosevelt, and Grant County candidate site areas were found to have the lowest estimated concentrations.

Transmission Line Impacts. Actual values ranged from 518.2 miles of potential impact for the Socorro 1 candidate site area to 1264.8 miles for the Colfax 3 candidate site area.

Native American Impacts. Distance from Navajo settlements ranged from 3.0 miles for the San Juan County candidate site area, which is

located near the Navajo Indian Reservation, to more than 30 miles for site areas located in regions outside northwestern New Mexico. Only the McKinley and San Juan County candidate site areas had values of less than 30 miles.

Biological Impacts. The potential biological impacts, on the scale of 0 to 11, ranged from no significant impact to the loss of 5 square miles of an area possessing significant ecological characteristics. The greatest potential for biological impacts was at the Socorro County candidate site area; the Quay County candidate site area had the lowest impact potential.

Socioeconomic Impacts. Estimated project-induced population changes ranged from a 1.0 percent increase in population associated with the Torrance County candidate site area to a 20.4 percent increase associated with the San Miguel County candidate site area.

Step 3: Ranking the Candidate Site Areas

As a result of the attribute assessments, no one candidate site area appeared better than any other with respect to all attributes. In order to evaluate preferences between candidate site areas and to rank the candidate site areas, it was necessary to determine tradeoffs between competing objectives. At this stage of the siting study, tradeoffs were developed using preferences of the project team, consisting of representatives of PNM augmented by professionals in various disciplines selected from among its consultants. The tradeoffs measure how much the siting team was willing to give up on one attribute to gain on another attribute. As an illustration of a tradeoff, one candidate site area may be more costly but have less environmental impact than another. In order to choose among candidate site areas, the siting team determined how much extra cost it was willing to accept to have less impact of another type. These

tradeoffs require value judgments, which reflect the preferences. The tradeoff analysis explicitly addressed the issues involved in comparing one candidate site area with another.

Decision analysis techniques were used to combine preferences and tradeoffs with site attribute assessments to rank the sites. It was then possible to express the relative desirabilities of the candidate site areas in terms of an equivalent cost by using the tradeoffs to convert the noncost impacts into equivalent dollar amounts. The candidate site areas with the lowest equivalent costs are the most preferred.

Results of Step 3 Ranking. The McKinley County sites had the lowest equivalent costs. There was a significant jump in equivalent costs between the McKinley County candidate site areas and all the others. The McKinley County candidate site areas are located in a region that was expected to have an adequate water supply to allow the use of a wet-cooling system. They are also located closer to San Juan Basin coals than all but one of the other candidate site areas. These cost advantages were a significant factor in the higher ranking of the McKinley County candidate site areas.

Step 4: Sensitivity Studies

In making siting decisions, there are usually differences in judgment about the relative importance of different impacts. Sensitivity analyses are conducted to evaluate the effects of changes in impact assessments and alternative preference structures (i.e., different value tradeoffs). By ranking the candidate site areas using different value tradeoffs, the highest ranking candidate site area(s) can be determined for different preferences. The value tradeoffs that determine which candidate site area ranks highest can be identified by this decision analysis approach. The results provide the basis for identifying the higher-ranking candidate site areas.

Sensitivity analyses showed that when only the environmental factors were evaluated (i.e., when cost considerations were excluded), the candidate site area in Torrance County ranked highest, but when cost considerations were also included, the McKinley County candidate site areas ranked highest. Location of the site nearer available coal (coal transportation costs) accounted for much of the higher ranking for the McKinley County areas.

PHASE THREE: FURTHER INVESTIGATION

Based on the findings of Phases One and Two, a more detailed investigation of site selection was undertaken by PNM. The first investigation involved land acquisition. Before other parts of a power plant site development program could proceed, PNM tried to determine whether sites in the candidate site areas could be acquired. Accordingly, in 1976-77, PNM turned its attention to northwestern New Mexico and Torrance County.

In 1974 PNM had expressed an interest in acquiring land in areas close to Western Coal Company's Bisti mine, since this coal was assumed to be the cheapest available source at the time. Possible means of acquiring public lands in the area were BLM sale, BLM long-term lease, and land exchange. PNM was aware that certain private land on Ute Mountain (Taos County) had been identified in the BLM planning process as desirable for improving certain programs, particularly the Rio Grande Wild River Program. PNM (with El Paso Electric) purchased a 23,000-acre ranch on Ute Mountain (Top of the World Farms), with the hope of exchanging it for public lands in the vicinity of Western Coal Company's Bisti mine. PNM, through its subsidiary, Paragon Resources, Inc., then applied to BLM for a land exchange of the Ute Mountain property for public lands in McKinley and San Juan counties (see Ute Mountain Land Exchange Final EA).

The Bisti-area lands involved were even closer to the assumed source of coal than the McKinley candidate site area, so PNM further investigated the possibility of a site in the Bisti area for economic reasons.

A new evaluation was conducted to rank the Bisti region against the Phase One candidate site areas and then to investigate whether incorporating a candidate site area from the Bisti region into the study would necessitate considering other new site areas. This new evaluation is described below.

Phase Two Ranking

The 22 identified candidate site areas and the additional site area in the Bisti region were reranked using the same methods as those used in Phase One Ranking. Environmental attributes were assessed for the Bisti site, and PNM updated the cost attribute assessment for all candidate site areas. Depending on water availability at each candidate site area, three kinds of cooling systems were analyzed: wet, wet/dry, and dry. The sources of water considered in the analysis of the Bisti site area were wells and wastewater from uranium mines in the area. The results of the Phase Two ranking analysis are presented in Tables 2-2 and 2-3.

The Bisti site area was preferred when assuming either wet- or wet/dry-cooling systems for all alternatives. Among other candidate site areas, Torrance was preferred if it could be a wet-cooling site. The next preferred group of wet-cooling sites (several McKinley County candidate site areas) were closely ranked together. Considering only environmental factors in ranking (Table 2-3), the Torrance candidate site area was preferred. The Bisti site area was very close to the average value of candidate site areas in Table 2-3.

Table 2-2. RANKING IN ORDER OF EQUIVALENT COST*: INTERIM RANKING 2

Candidate Site Area	Equivalent Cost ($ millions)	Rank	Candidate Site Area	Equivalent Cost ($ millions)	Rank
Bisti Well W	12.70	1	Mckinley 27 W/D	68.77	27
Bisti Mine W	14.49	2	McKinley 22 W/D	69.10	28
Torrance 1 W	39.36	3	McKinley 30 W/D	69.42	29
Bisti Well W/D	41.45	4	McKinley 26 W/D	70.46	30
Bisti Mine W/D	41.86	5	Torrance 1 D	76.42	31
McKinley 32 W	48.00	6	McKinley 28 W/D	78.39	32
McKinley 31 W	48.30	7	McKinley 21 W/D	80.70	33
McKinley 24 W	48.79	8	San Juan 1 W/D	82.52	34
McKinley 25 W	48.90	9	Grant 1 W	83.86	35
McKinley 23 W	48.94	10	Socorro 1 W/D	86.90	36
McKinley 27 W	49.96	11	San Juan 1/D	87.04	37
McKinley 22 W	49.98	12	Socorro 1 W/D	90.78	38
San Juan 1 W	50.24	13	Colfax 3 W	93.10	39
McKinley 26 W	51.31	14	Culberson 1 W	97.87	40
Socorro 1 W	52.42	15	Quay 1 W	102.60	41
McKinley 30 W	53.23	16	Colfax 1 W	103.47	42
McKinley 11 W	53.72	17	San Miguel 1 W	104.69	43
McKinley 21 W	61.36	18	Colfax 3 W/D	112.53	44
McKinley 28 W	64.21	19	Grant 1 W/D	114.74	45
McKinley 32 W/D	66.83	20	Colfax 1 W/D	116.15	46
McKinley 31 W/D	67.27	21	Roosevelt 1 D	118.26	47
McKinley 11 W/D	67.54	22	Colfax 3 D	126.56	48
Torrance 1 W/D	67.68	23	Culberson 1 W/D	128.63	49
McKinley 24 W/D	67.70	24	Grant 1 D	128.85	50
McKinley 25 W/D	67.84	25	San Miguel 1 W/D	138.87	51
McKinley 23 W/D	67.81	26	Quay 1 W/D	142.90	52
			Quay 1 D	142.98	53

*Includes differential site costs and environmental costs

Note: W = wet-cooling system
W/D = combination wet/dry-cooling system
D = dry-cooling system

Table 2-3. RANKING IN ORDER OF EXPECTED UTILITY:
INTERIM RANKING 2
(ONLY ENVIRONMENTAL FACTORS CONSIDERED)

Candidate Site Area	Expected Utility
Torrance 1	0.8277
Grant 1	0.7717
Roosevelt	0.7415
McKinley 32	0.7048
Quay 1	0.7029
McKinley 27	0.6864
San Miguel 1	0.6833
Socorro 1	0.6750
McKinley 24	0.6679
McKinley 25	0.6624
Culberson 1	0.6567
McKinley 23	0.6540
Bisti	0.6436
McKinley 22	0.6171
McKinley 21	0.6171
McKinley 11	0.6020
McKinley 30	0.6006
Colfax 1	0.5999
Colfax 3	0.5978
McKinley 26	0.5807
San Juan 1	0.5307
McKinley 28	0.5244

PNM then undertook a more detailed environmental and economic evaluation of candidate site areas in the Bisti region and in McKinley and Torrance counties. PNM also looked for possible site acquisition options in those candidate site areas.

SUMMARY OF APPLICANT'S SITE SELECTION PROCESS

Phase One ranking showed that candidate site areas in McKinley County ranked highest in terms of equivalent cost (noncost impacts as equivalent dollar amounts). Sensitivity analyses showed that when only environmental factors were evaluated, the ranking order changed: the candidate site area in Torrance County was highest.

Phase Two ranking updated the cost attribute and analyzed three cooling systems. In addition, the Bisti site area was included in the ranking process. The Bisti site area was preferred for the wet- and wet/dry-cooling systems.

The three highest-ranking candidate site areas (Bisti, Torrance, and McKinley) were reevaluated by PNM using more detailed site-area-specific information. Potential power plant sites within the three candidate site areas were identified. PNM selected Bisti as its proposed site for the NMGS.

3

BLM REVIEW OF SITE SELECTION PROCESS

In order to evaluate the study methods and conclusions of the applicant's site selection process, BLM decided to use the WCC decision analysis procedure, but using judgments and preferences of the BLM personnel as the decision makers. BLM considered the three highest-ranking sites--Bisti, Torrance, and McKinley--as the basis for this evaluation. The procedures used in the BLM review consisted of a field visit to each site, orientation to the issues involved for each site, the siting report, and methods. BLM then conducted a ranking. The BLM review process is described below.

MEASURES

The measures (attributes) for BLM's study were the same as those for Phase Two. The cost measure was updated to 1980 levelized dollars to compute site differential costs. The BLM developed another measure of cost difference which involved percentage increases in electricity cost to the consumer. The six attributes considered were:

- Economics (percent increase in electricity cost from least expensive site)

- Socioeconomic impact (percent increase in regional population in a single year)

- Native American impact (distance from traditional Navajo)
- Air quality impact (calculated concentration of SO_2)
- Transmission line impacts (transmission line mile equivalents)
- Biological impact (loss of 5 square miles of either agricultural land or grazed semiarid range for the sites being considered)

Levels of the noncost attributes for each site were the same as in the Phase Two ranking except for Torrance, which upon field inspection was characterized by the BLM team as agricultural rather than semiarid range.

PREFERENCES

Decision analysis methods used to assess BLM preferences consisted of two steps. First, the relative preferences for each attribute were established. Then the tradeoff judgments between attributes were determined. The sites were then ranked and the relative desirability of the three sites was shown in terms of equivalent cost. In the tradeoff evaluation, the BLM group assigned significantly less importance to economic cost than was done in Phase Two ranking.

SUMMARY OF BLM RANKING RESULTS AND CONCLUSION

The results of the BLM ranking (Table 3-1) show the Bisti site as first-ranked. The ranking is governed by the tradeoff between economic and environmental impacts, using BLM staff preferences.

Table 3-1. RANKING RESULTS FOR BLM SENSITIVITY ANALYSIS

Site/Cooling System	Value (1980 Equivalent Cost)
Bisti W	154.2
Torrance W	187.9
Bisti W/D	232.2
McKinley 22 W	232.6
Torrance W/D	259.9
Torrance D	276.9

Note: W = wet
W/D = wet/dry
D = dry

Slight differences existed for environmental ranking between Bisti and Torrance, with Torrance first. However, the cost differences between the two were great enough that Bisti ranked first overall.

Based on the review of PNM's site selection process and BLM's ranking results, the BLM determined that it was reasonable to proceed with a detailed environmental analysis of only the proposed Bisti site for the NMGS EIS.

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