ENVIRONMENTAL IMPACT STATEMENT

draft

ENVIRONMENT

KAIPAROWITS

ENERGY

United States
Department of the Interior

CHAPTER I

ERRATA SHEET
CHAPTER I
KAIPAROWITS E.I.S.

On June 2, 1975, after the draft E.I.S. had been sent to the printers, officials of Salt River Project notified Arizona Public Service Company, San Diego Gas and Electric Company and Southern California Edison Company that they had elected to terminate their participation in the Kaiparowits power project. Staff representatives from the remaining three participants are formulating a mutually agreeable disposition of the Salt River Project's 10 percent interest. When a decision is reached, the Bureau of Land Management will be notified. The effects of this withdrawal will be discussed in the final environmental impact statement.

Additional air-quality limitations were published by EPA in December 1974 for prevention of significant deterioration in air quality. The proposed Kaiparowits site is in a Class II area, as defined by these regulations, in which the deterioration of air quality normally accompanying moderate, well controlled growth can be considered insignificant.

Because of the proximity of the proposed site to national forest, parks and recreation lands, with their potential for redesignation as Class I areas, in which practically any change in air quality is considered significant, the probability exists that the plume from the proposed project would violate the Class I limitations of these areas. Should these areas be designated as Class I, then the final environmental impact statement will discuss the implications of significant air quality deterioration.

Kaiser Engineers is presently developing a mining plan for operation of the coal mine. This mining plan will be subject to review by U.S. Geological Survey and the Bureau of Land Management. Details related to the mining operation, such as the tailing pond and the coarse refuse dump will be part of the mining plan (See Page I-129).

Page i, Table of Contents: Design criteria used for power plant is on Page I-54, not I-48.

Page I-36: Seventh word, third line, second paragraph under "Projected customer use" should read "utilities" instead of "utilizing."

Page I-119: First word, last sentence, fourth paragraph should read "Siting."

Page I-237: Second sentence, first paragraph, delete "in one lift complete" after "helicopter."

Page I-284: Add to last sentence, first paragraph, " . . ., which would supply a portion of the demand. Information on additional aggregate sites that may be needed is not available from the participants at this time."

Page I-287. After last word on the first line of page, insert "Kaiparowits."

Page I-301: After last sentence of second paragraph add, "Types of cleaning agents to wash the insulators have not been identified by the participants."

Page I-313: In the eleventh line of the last paragraph, delete "and limestone."

Page I-316: In the second line from the top of the page, change "with concurrence" to read "after approval."

Page I-331: After the last sentence of the third paragraph, add "But no exact site for solid waste disposal has been nominated."

DRAFT

ENVIRONMENTAL IMPACT STATEMENT

Proposed

KAIPAROWITS PROJECT

Bureau of Land Management

Department of the Interior

( )

Paul L Howard

State Director

Prepared by Inter-agency Team

Department of the Interior

Bureau of Land Management - Lead Agency

Geological Survey

Bureau of Mines

Bureau of Outdoor Recreation

Bureau of Reclamation

Fish and Wildlife Service

National Park Service

Bureau of Indian Affairs

Department of Agriculture - Forest Service

Federal Energy Administration

SUMMARY

(X) Draft ( ) Final Environmental Statement

Department of the Interior, Bureau of Land Management - Lead Agency

1. Type of Action: (X) Administrative ( ) Legislative

2. Brief description of action: Four participating companies (Southern California Edison - 40.0 percent of output; San Diego Gas & Electric Company - 23.4 percent; Arizona Public Service Company - 18.0 percent; Salt River Project - 10.0 percent; with 8.6 percent uncommitted) propose to construct and operate a 3,000 mw, coal-fired, electricity generating station and related facilities on Kaiparowits Plateau in southern Utah. Twelve million tons of raw coal would be taken annually from four underground mines. A 500 kv transmission system and supporting communication system would span almost 1,460 miles in four states and deliver power to market areas in Arizona and southern California. A limestone quarry approximately 20 miles north of Bryce Canyon National Park would produce 237,000 tons of limestone annually.

   Private industry and local governments are cooperating to plan and build a new town. The State would construct a new highway approximately 67 miles long between Glen Canyon City, Utah, and Cannonville, Utah. Federal actions would include transfer of Federal land to State ownership for the plant site and new town and granting of rights-of-way across Federal land for the transmission system, new highway, and water pipeline. Coal leases and a water delivery contract already exist with the Department of the Interior. Additional Federal actions would include authorization of disposition of aggregate and limestone, supervising the mining operations, enforcing both safety standards and environmental standards concerning ambient air and water.

3. Summary of environmental impacts and adverse environmental effects: The generating plant, mine and all support facilities--including new town, new highway, limestone quarry and access roads--would occupy 6,040 acres of land. The transmission system would occupy 1,765 acres of land.

   If air pollution control equipment is operated at design levels, the plant would emit 34 tons of sulfur dioxide, 12 tons of particulates, and 250 tons of nitrogen oxides per day. These stack emission levels are equal to or better than applicable ambient air quality standards. Small amounts of radioactive elements, as well as other trace elements, would be released to the atmosphere. Modeling studies indicate that plume opacity would be less than the existing 20 percent opacity limitations. Stack emission could result in a reduction in visibility and an evident yellow discoloration under certain meteorological conditions. Salt deposition would affect more than 930 acres of vegetation and soils. Sixty million cubic yards of solid waste would be produced in 35 years which would permanently occupy 450 acres at 90 feet in depth. The plant and mine would consume approximately 50,000 acre-feet of water annually.

   The proposed project would create a peak employment of 5,235 construction workers and would ultimately employ 3,135 persons during full operation. The total population increase would be approximately 14,000 people, of which probably 9,500 would live in Kane County, Utah, 500 in Garfield County, Utah, and 4,000 in Page, Arizona. The most heavily impacted would be Kane County, present population 2,700 (est.). If adequate housing and services are provided as proposed, very significant social impacts may be avoided. Taxes and royalties by industry, employment and the new town are expected to reach $65 million per year. The indirect impact of the increased population would cause environmental effects on other resource values, e.g., increased recreational use, which would cause soil erosion, destroy vegetation, disturb wildlife, etc. Direct impacts by the project itself on soil, water, vegetation and wildlife would be less significant.

   The proposed project has the potential of deferring use of 80,000 barrels of oil per day. It also would allow the utilities to maintain what they consider to be acceptable reserve margins. Availability of additional power to the market areas would facilitate continued growth.

4. The following categories of alternatives are covered: (a) Design or Administrative Alternatives: for example, alternative cooling systems, voltage levels and alternative actions by government agencies; (b) Site Alternatives: examples are Nipple Bench and sites outside Utah as alternative power plant sites, alternative new town sites, and alternative transmission routes; (c) Alternative Ways to Meet Project Objectives: examples are transporting Kaiparowits coal, or use of nuclear power; (d) Alternative Uses of Resources: an example is alternative uses of water; (e) Delay or Denial.

5. Comments have been requested from the following: Attached is a list of Federal, State and local entities with jurisdiction and expertise receiving copies of the draft statement.

6. Date Draft Statement made available to CEQ and the public:

FEDERAL

- Department of Transportation
- Department of Agriculture
  - Forest Service
  - Soil Conservation Service
- Environmental Protection Agency
- Department of the Interior
  - Bureau of Reclamation
  - Bureau of Outdoor Recreation
  - Fish and Wildlife Service
  - U.S. Geological Survey
  - National Park Service
  - Bureau of Indian Affairs
  - Bureau of Mines
  - Mining Enforcement and Safety Administration
  - Office of Oil and Gas
  - Office of Coal Research
  - Office of Land Use and Water Planning
  - Office of Water Resources Research
  - Office of the Solicitor
- Federal Power Commission
- Department of Health, Education and Welfare
- Atomic Energy Commission

STATE

- State of Utah Offices
  - Governor's Clearing House
  - Attorney General

Community Affairs

Natural Resources

State Lands

Wildlife Resources

Agriculture

Parks and Recreation

Water Resources

Oil and Gas Conservation

Environmental Health

Geological and Minerals Survey

Highways

Historical Society

Travel Development Council

Public Service Commission

Air Quality

Development Services

State of Arizona

Governor's Clearing House

State of Nevada

Governor's Clearing House

State of California

Governor's Clearing House

County Commissioners for

Garfield County

Kane County

LOCAL

Advisory Council on Historic Preservation

Sierra Club

Utah Audubon Society

Izaak Walton League - Utah Division

Rocky Mountain Center on Environment

National Stock Growers Association

Utah Wool Growers Association

Utah Mining Association

The Wilderness Society

Environmental Defense Fund, Rocky Mountain/Great Plains

The Institute of Ecology

Natural Resources Defense Council, Inc.

Enchanted Wilderness Association

Escalante Wilderness Committee

Utah Environment Center

Wasatch Mountain Club

Utah Water Users Association

Rocky Mountain Federation of Mineralogical Societies

Women's Conservation Council of Utah

Utah Nature Study Society

Archaeological Society of Utah

Rocky Mountain Sportsman Association

Utah Wildlife and Outdoor Recreation Federation

Mineralogical Society of Utah

Pro-Utah, Inc.

Utah Sportsman Association

Defenders of the Outdoor Heritage

Utah Cattlemen's Association

Issue?

Save Our Canyons Committee

Advisory Commission on Arizona Environment

Arizona Archaeological Society, Inc.

Colorado Plateau Environment Advisory Council

Arizona Cattle Growers Association

Arizona Conservation Council

Arizona Desert Bighorn Sheep Society, Inc.

Arizona Environmental Education Council, Inc.

Arizona Mining Association

Arizona Wildlife Federation

Arizona Wool Growers Association

Arizonans in Defense of the Environment, Inc.

Common Cause

Environmental Awareness

Environmental Council of Arizona

Defenders of Wildlife

Good Earth

Mearns Wildlife Society

National Wildlife Federation

Nature Conservancy

Western Rockhound Association

Friends of the Earth

Arizona Wildlife Federation

Tucson Wildlife Unlimited, Inc.

SWRCC Wilderness Society

Nevada Wildlife Federation

Wild Horse Organized Association

Nevada Conservation Forum

Conservancy Resource Center

Desert Protective Council

California Wildlife Federation

Society of Conservation of Bighorn Sheep

Inland Com. Conservation Clubs

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FOREWORD

Four companies propose to build a 3,000 megawatt, coal-fired electric generating plant on the Kaiparowits Plateau in southern Utah. By megawatt size comparison, there is now about 1,300 megawatts total generating capacity in the State of Utah. Coal would come from four underground mines. Electricity would be consumed in the companies' service areas in southern California and Arizona.

The federal government would have to take several actions to allow the project to be completed. Coal leases and a water contract with the Department of the Interior already exist. The proposed site for the power plant is now federal land. Major actions that would be required in the future include transfer of this land to state or private ownership. Also, the transmission system would require rights-of-way across federal land.

Traditionally, for proposals such as Kaiparowits, our society has based decisions for or against development almost singly on dollar value, costs and benefits. On January 1, 1970, however, the President signed into law the National Environmental Policy Act. Purposes of the Act are to declare a national policy which will encourage productive harmony between man and the environment, and to promote efforts which will prevent damage to the environment. Under this law all agencies of the federal government shall develop procedures which will insure that presently unquantified environmental values may be given appropriate attention in decision-making along with economic and technical considerations. To do that, all agencies of the federal government are required to prepare a detailed statement for every major action that would significantly affect the quality of the human environment. The statement shall include environmental impact of the proposed action, adverse effects which cannot be avoided and alternatives.

This statement is being prepared to fulfill requirements of that law. Therefore, it sets out environmental values that would be damaged or benefited so they may be considered by decision-makers.

All impacts caused by the proposed project are analyzed wherever they are expected to occur. No geographic limits are possible. For example, some impacts occur directly where the project would be built. Other impacts are widespread by virtue of the greater number of people who would reside and travel in the area.

In summary, this statement sets out facts about the proposed Kaiparowits Project, and environmental consequences of that project in the detail necessary for decision-making. It also makes the facts available to the public.

The following explanation is to help the readers of the statement:

Chapter I locates and describes the proposed action.

Chapters II, III, and V are divided according to the resource impacted, such as air quality, wildlife, recreation values, and socio-economic values.

Each resource is further divided into Kaiparowits Plateau impact area, transmission system impact area, and limestone quarry impact area. These are geographically separate areas. The Kaiparowits Plateau impact area includes all areas impacted by the coal mines, power plant, new highway, new town, and all support facilities. The transmission system impact area includes all areas impacted by the transmission system, communications system, substations, and all support facilities, such as roads. The limestone quarry impact area includes all areas impacted by the limestone quarry and all support facilities. No geographic boundaries are established for these areas since impacts must be analyzed wherever they occur. The impacts from these areas are added together only in Chapters VI and VII, because they do not have greater impacts together than they have separately.

The result is that if a reader is interested in one resource he need only read the sections on that resource. For example a reader interested in archaeology could learn of the total impact on that resource by reading only that section in each chapter. On the other hand, if a reader is interested in a specific area, he need only read the subsections about that area under each resource. For example, a reader interested in the Kaiparowits Plateau could learn the total impact on all resources in that area by reading each subsection on that area.

Chapter IV sets out mitigating measures for each of the three impact areas.

Chapters VI and VII summarize short-term uses of the environment versus long-term productivity, and irretrievable and irreversible impacts for the entire proposal.

Chapter VIII describes and analyzes impacts of alternatives.

Chapter IX is a summarization of coordination and consultation.

The appendices contain glossary, abbreviations, bibliography, and detailed technical data and some supporting studies.

CHAPTER I

DESCRIPTION OF PROPOSED ACTION

SUMMARY

The Kaiparowits Project would involve construction and operation of a 3,000 megawatt coal-fired electric generating station which would provide power to southern California and Arizona. In addition to the power plant, the proposal includes construction of a 500 kv single circuit transmission system, four underground coal mines, a limestone quarry, and aggregate sources. A new town and highway are also proposed. Illustration 1 shows the proposed location of the project in Utah.

The project would be a joint venture by four utility companies: Southern California Edison Company (40.0 percent of output), San Diego Gas & Electric Company (23.4 percent of output), Arizona Public Service Company (18.0 percent of output), and Salt River Project (10.0 percent of output). Of the total output, 8.6 percent is uncommitted, but would ultimately be made available to other utilities.

Generating station

The generating station would consist of four 750 megawatt steam electric turbine generating units. The present schedule envisions operation of the first unit in 1980, the second in 1981, and full operation by 1982.

The generating station would consume approximately 9,000,000 tons of washed coal each year and 41,400 acre-feet of water per year from Utah's allocation of Colorado River water. The generating station and mines would be supplied with water by a pump station on the north shore of Lake Powell at Warm Creek Bay through a 30-mile buried pipeline.

Each unit of the generating station would have a concrete stack 600 feet high. Electrostatic precipitators would remove particulate matter

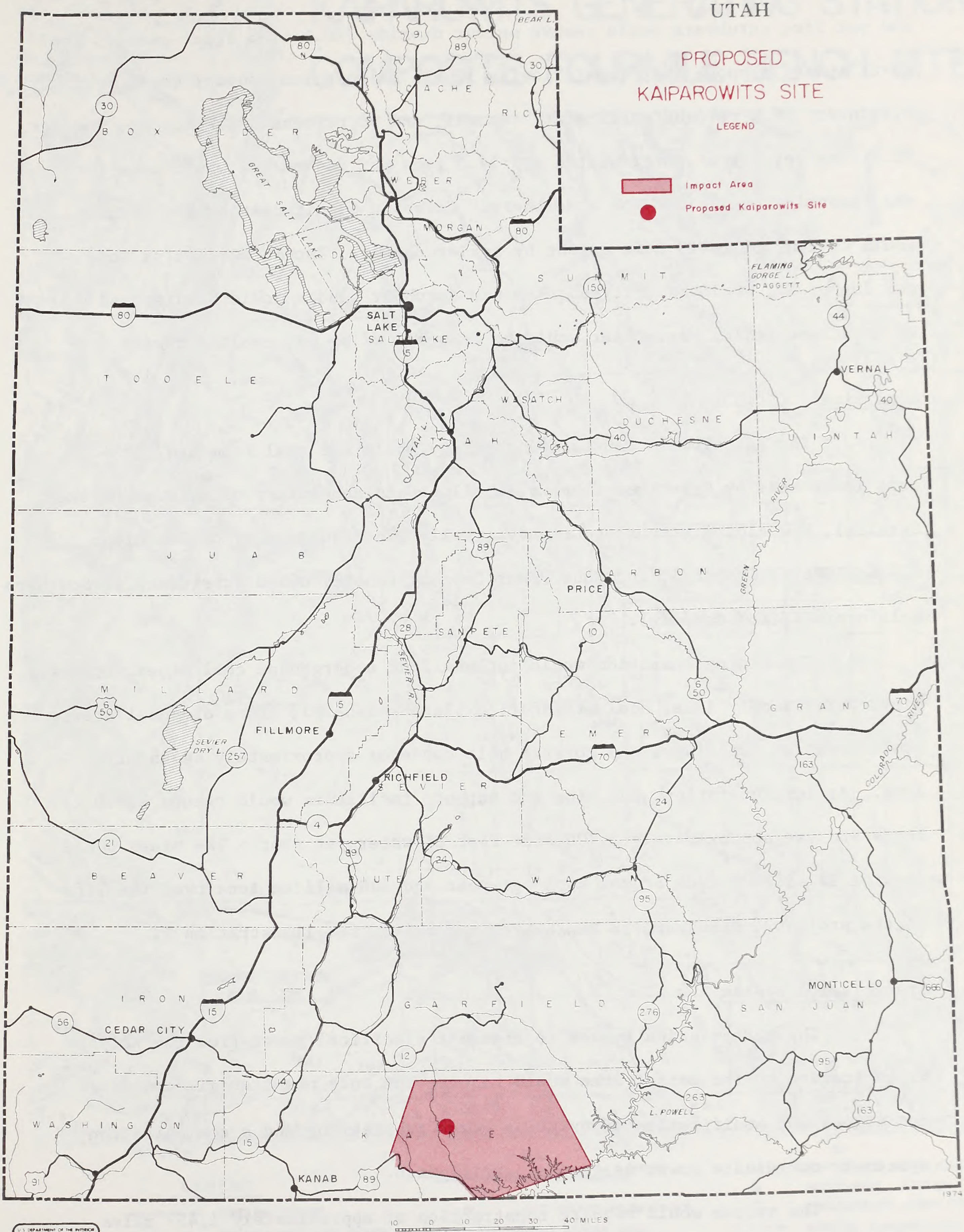


ILLUSTRATION I

and wet lime scrubbers would remove sulfur dioxide (SO_2) from stack gases. The participants propose that the following levels of emission control would be attained: 99.5 percent particulate removal, and 90 percent SO_2 removal. However, 12.2 tons per day of particulates and 34.3 tons per day of SO_2 would pass through the removal systems into the atmosphere. Emission of nitrogen oxides (NO_x) would be controlled to some extent by boiler design. Two hundred fifty tons per day of NO_x would be emitted. Ash and scrubber sludge would be disposed of in a land fill. Waste heat would be disposed of by wet cooling towers.

Coal mine

The Kaiparowits generating facility would use coal from a 47,128-acre lease held by Resources Company (wholly-owned subsidiary of Arizona Public Service), New Albion Resources Company (wholly-owned subsidiary of San Diego Gas & Electric Company), and Mono Power Company (wholly-owned subsidiary of Southern California Edison Company).

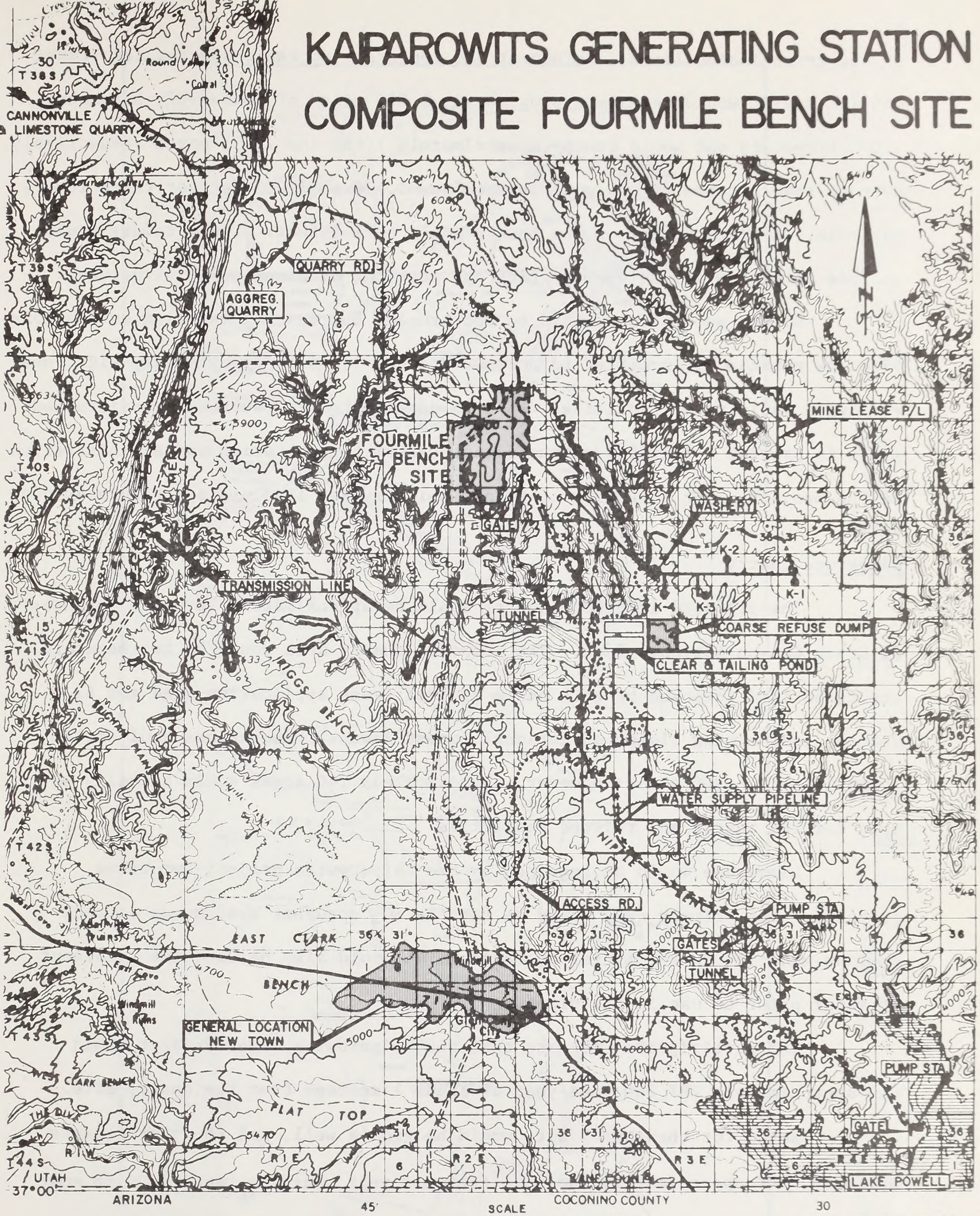
The mining operation would include four underground coal mines, training mine, water supply line, coal preparation plant (washery), waste disposal areas, administration buildings, and covered belt conveyor approximately seven miles long. At full operation, the mine and support facilities would occupy 1,710 acres and use approximately 3,100 acre-feet of water per year. The mines would provide 12 million tons of raw coal per year and 420 million tons over the life of the project. For Fourmile Bench Site composite, see Illustration 2.

Transmission system

The transmission system to transmit electrical power from the Kaiparowits station to the market area would require not only new transmission lines and towers but modification of existing power substations and a communication system to coordinate power use among participants.

The system would require construction of approximately 1,457 miles

KAIPAROWITS GENERATING STATION
COMPOSITE FOURMILE BENCH SITE



LEGEND

— — —	PIPELINE ROUTE
	TRANSMISSION LINE ROUTE
	PROPERTY LINE
	CONVEYOR LINE
●	WASHERY
	MINE LEASE P/L
■	LAKE INTAKE-WARM CREEK
	PLANT ACCESS ROAD (& HEAVY HAUL ROUTE)
	CONSTRUCTION ACCESS RD (INTERIM-SITE PREP.)
	MINE ACCESS ROAD
● K1-4	MINE PORTALS
	13.8 kV SINGLE WOOD POLES
▲	MICRO-WAVE STATION
□	INTERMEDIATE PUMP STA
	PIPELINE CONSTRUCTION & MAINT. ROAD
	QUARRY ROAD

ILLUSTRATION 2

of new transmission lines. Permanent and temporary access roads for the transmission system would require approximately 1,900 miles of roads--870 permanent, 1,030 temporary and would occupy approximately 1,480 and 1,755 acres respectively. Average span between towers would range from 1,500 to 1,700 feet or three towers per mile. Average height of the towers would be 140 feet. These towers would include lattice steel self-supporting and steel or aluminum guyed structures.

No new substations would be constructed but several existing substations would be expanded or modified to accommodate new lines. Approximately eight new microwave radio relay facilities would be constructed at previously undisturbed sites to provide a reliable communication system for operation and administration of the project. For a summary of transmission system land use see Figure 40 page I-248.

Limestone quarry

The proposed limestone quarry would be approximately 16 miles northwest of Bryce Canyon National Park. The proposed quarry area would be two separate tracts of land composed of both state mineral lease application land and 62 federal lode mining claims on national forest land. These tracts would total approximately 1,900 acres; however, approximately 240 acres would actually be used for the quarry and related facilities.

Limestone would be required by the Kaiparowits project for three purposes. The primary uses would be for the SO_2 scrubber system and as rock dusting material in the mining operation. It would also be used for treatment of water prior to use in the plant.

The participants estimate that the Kaiparowits Power Project would use approximately 237,000 tons/year of crude limestone from the quarry site.

Water for the quarry site would be from a well, and the participants estimate that approximately two acre-feet per year would be required with most of this used for dust suppression. All limestone produced at the quarry

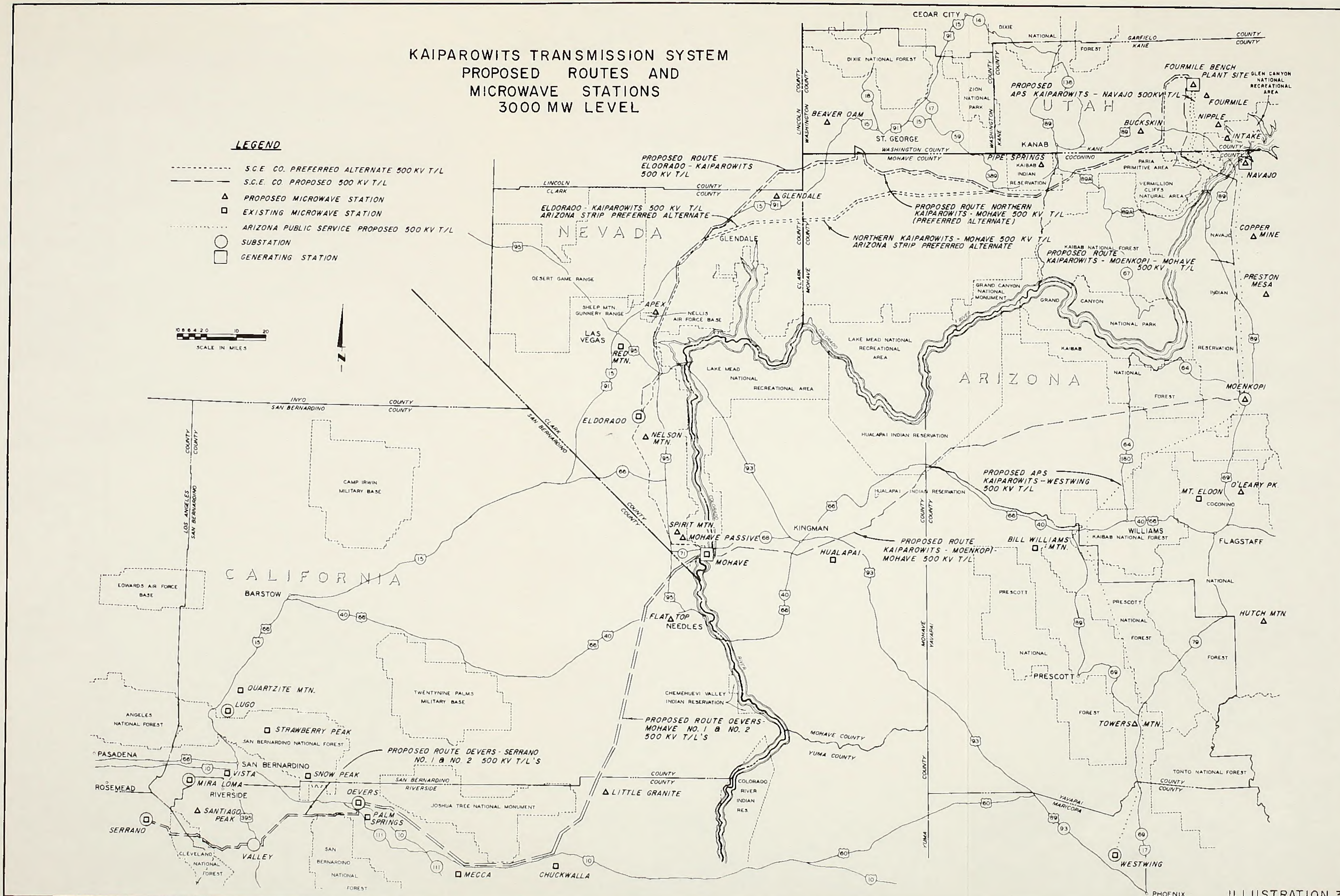


ILLUSTRATION 3

(approximately 650 tons/day) would be transported approximately 60 miles to the power generating facility by 25-ton trucks making approximately 30 round trips/day.

Aggregate

Large quantities of sand and gravel would be needed as aggregate for concrete in construction of the power plant, mine, and transmission system. Aggregate would also be necessary for roads, landfill, evaporation ponds, and dams.

The upper Wahweap Creek stream bed near Fourmile Bench is the proposed source for aggregate materials for the power plant. The aggregate from Wahweap would be hauled by truck approximately 18 miles to the power plant site and placed in a storage pile. An aggregate processing facility would process the material at the power plant site to support the batch mixing plant. Aggregate processing and batch plants would be removed after completion of the power plant. Total available aggregate would be approximately 200,000 cubic yards to be taken from an area in Wahweap Creek of about 70 acres. 15.2' dep.

Further aggregate needs could total an additional 1.4 million cubic yards for construction of the proposed town, highway system, and mine facilities. Sources for this additional aggregate are not known at this time. Possible sites include the proposed Wahweap Site, the Glen Canyon City bench areas, along major washes, and along Highways 89 and 12.

Aggregate sources for transmission system construction are also unknown at this time. For a summary of quantities of resources used for the Kaiparowits Project, see Figure 1 page 13.

Actions required of government agencies

Federal

Key actions already taken by the Federal Government include issuance of water contract and coal leases. The participants have executed agreements with the State of Utah and the U. S. Bureau of Reclamation for the right to use Lake Powell as a source of water for the facility. the State of Utah and Bureau of Reclamation have agreed to provide up to 102,000 acre-feet of water per year to the applicants. Other key actions that would have to be taken by the government before the project can be started include a favorable classification by the Secretary of the Interior and approval of the transfer of ownership of the land upon which the generating station and new town are proposed. The State of Utah has applied for the generating station land under its State Indemnity Lieu Selection rights. The state, if the selection is allowed, proposes to sell the land to the participants. Actions required by the government before the project could be initiated also include: transfer of title to land, granting of rights-of-way, issuance of leases and permits, selling Federal minerals (sand, gravel and limestone), supervision of mining operations, ensuring that safety standards are met, and requiring compliance with environmental laws and regulations pertaining to air and water quality and solid waste disposal.

State and local

On August 7, 1974, Utah Governor Calvin L. Rampton established the Kaiparowits Planning and Development Advisory Council (PDAC), representing state and local agencies, to "guide and coordinate activities related to energy development in Kane and Garfield Counties."

New town

The PDAC selected a townsite from four sites examined by a consultant. The preferred townsite is on East Clark Bench, on Highway 89, 20 miles from the proposed mining area and 27 miles from the plant site over a proposed new highway. The Consultant's plan included 8,960 acres, although only about 3,000-4,000 acres would ultimately be selected. Most of the area is federal land, which would be acquired through State of Utah land selection procedure. If

FIGURE 1

Quantities -- Summation

	Power Plant	Coal Mine	Transmission System	Limestone Quarry	New Highway	New Town	Total
Land	4,160 acres of state and federal land transferred to private ownership of companies. 930 acres permanently occupied by improvements. 225 acres permanently occupied by waterline R/W 30 miles long	47,128 acres of state & federal land leased. 1,710 acres would be occupied with improvements.	95 acres occupied by towers (all types). 1,480 acres occuped by permanent roads. 140 acres occupied by substations & microwave sites.	1,900 acres of state & federal land leased. 240 acres permanently occupied	280 acres included in R/W, 67 miles long.	8,960 acres of state & federal land transferred to private ownership. 2,240 acres permanently occupied by facilities.	62,148 acres of state & federal land leased or transferred. 7,245 acres permantly occupied by roads, improvements, etc.
Coal		12,000,000 tons/year mined. 9,000,000 tons/year washed coal burned in power plant. 420 million tons mined over 35 year life of plant. 315 million tons washed coal burned over life of plant.					420 million tons mined over 35 year life of plant. 315 million tons washed coal burned over 35 year life of plant.
Water	41,400 a/f/year lost by cooling tower & other plant uses	3,100 a/f/year used for coal washery & mine operation.	1 a/f for concrete 120 a/f/ for dust control	2 a/f/year used for dust suppression & quarry operations		5,900 a/f/year	50,400 a/f/year
Solid Waste	Over the 35 year life of the plant; 40 million cu. yds. ash, 16 million cu. yds. scrubber sludge, 2.5 million cu. yds. excavated material & 1.5 million cu. yds. limestone kiln waste to be disposed of in area 450 acres, 90 ft. deep.	Over the life of the coal mine; 26 million cubic yards of coarse refuse to be disposed of in an area 550 acres, 29 ft. deep 43 million cu. yds. of fine refuse to be disposed of in an area 550 acres, 50 ft. deep	-	53,425 cu.yds./year waste rock mined. 4,619 cu.yds./year top soil removed. 5,657,534 cu.yds. waste rock over 35 year life. 161,904 cu.yds. topsoil over 35 year life Waste material to be placed back in quarry area.			134.8 million cu. yds. of waste material over 35 year life of plant.
Aggegate	200,000 cubic yards	71,000 cubic yards	32,000 cubic yards for T/L 400 cubic yards for microwave stations		780,00 cubic yards	549,000 cubic yards	1,632,400 cubic yards
Limestone	82,000 cubic yards /year for SO_2 scrubber	26,000 cu. yds./year for rock dusting		108,000 cu. yds./yr. mined. 3.8 million cu. yds. over 35 years			3.8 million cu. yds. over 35 year life of plant
People	Peak construction - 2,405 @ year 4 Peak Operation - 510 @ year 8	Peak construction - 700 @ year 4 Peak Operation - 2,560 @ year 8		Peak construction - 36 @ year 1 Peak Operation - 65 @ year 4		Peak pop. of 10,928 @ year 7	Total population increase due to power plant 16,000 & mine

the plan were implemented, a developer would construct and manage the new town, in accordance with planning, zoning, and building requirements established and administered by Kane County. The plan includes mobile home parks, a variety of permanent housing styles, commercial and community services, and light industry. It suggests flexibility in design and certain measures during construction to facilitate development and minimize disturbance.

The plan is based on an assumed eventual population of 15,324. (Note that the BLM estimates new town population resulting from this project to be 9,400.) Total water needs, to come from deep wells, are expected to be 5,900 acre-feet per year. The sewage system would be designed to meet state health standards, and treated effluent would be used to irrigate pasture crops or a golf course.

Highway

The PDAC selected one of several possible highway routes studied by the Utah State Department of Highways. The proposed route would extend from a junction with State Route 12 at Cannonville, on the north, to a junction with U.S. Highway 89 at Glen Canyon City, on the south. The highway would be about 67 miles long, including a short spur to the mining area. The highway would be two lanes, 34 feet wide, paved, and designed to carry traffic at moderate to high speeds.

Need for proposed action

After individual utility needs of the participants were determined, overall size and timing of the joint project were identified. The result was a generation plant and transmission system capable of meeting a portion of the needs of the participating utilities. After the anticipated completion in 1982, the proposed Kaiparowits Power Plant would supply approximately 13.8 percent, 8.3 percent, 23.4 percent and 7.7 percent of the projected peak mw demand for Arizona Public Service, Salt River Project, San Diego Gas & Electric and Southern California Edison respectively.

Following is an analysis by each participant of its need for power from the Kaiparowits Project.

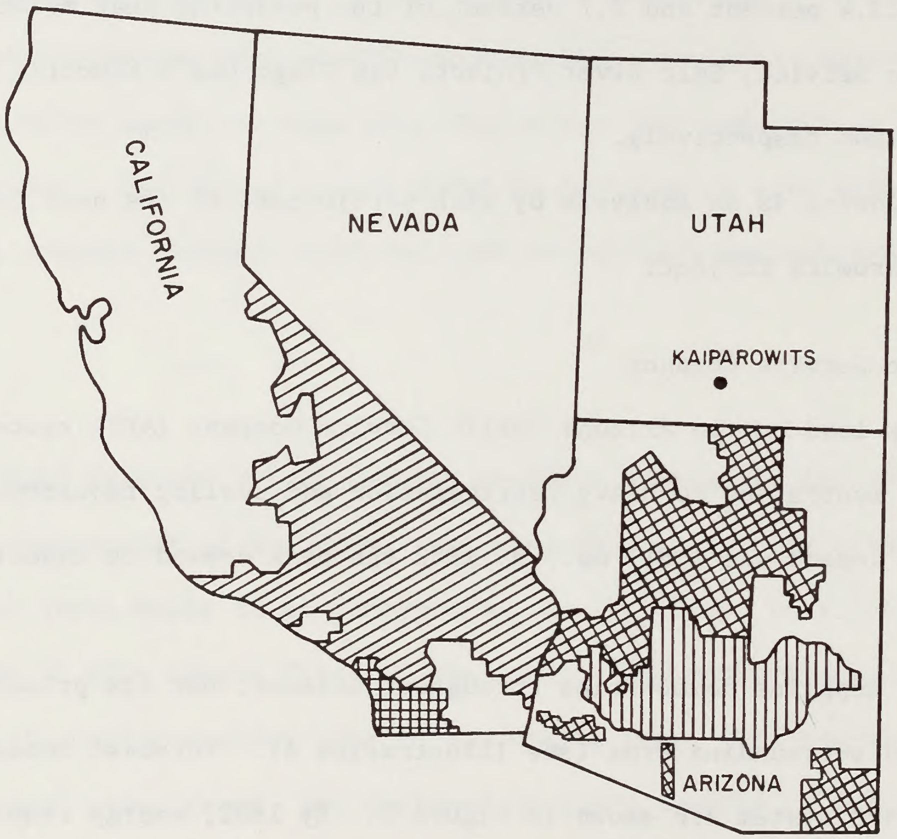
Arizona Public Service Company

Peak load on the Arizona Public Service Company (APS) system occurs in the summer months due to heavy refrigeration and cooling requirements. In 1973 the peak demand was 1,811 mw. By 1982 the peak demand is expected to reach 3,903 mw.

APS supplies communities throughout Arizona, but its primary load is in Phoenix and surrounding area (see Illustration 4). Forecast loads through 1982 for the APS system are shown in Figure 2. By 1982, energy requirements are projected to be more than twice those existing at present (see Figure 3, "Projected Peak Demand vs Projected Generating Capacity").

The expected increase in residential energy use is due not only to more customers, but also to higher use per customer as higher standards of living are attained (see Figure 4). In central and southern Arizona, residential air-conditioning is becoming common rather than the exception. It is estimated that about 95 percent of new dwellings have central, refrigerated air-conditioning. In Maricopa County about 5,000 customers per year convert from evaporative cooling

KAIPAROWITS PROJECT PARTICIPANTS SERVICE TERRITORIES



ARIZONA PUBLIC SERVICE CO.

SALT RIVER PROJECT

SAN DIEGO GAS & ELECTRIC CO.

SOUTHERN CALIFORNIA EDISON CO.

ILLUSTRATION 4

FIGURE 2

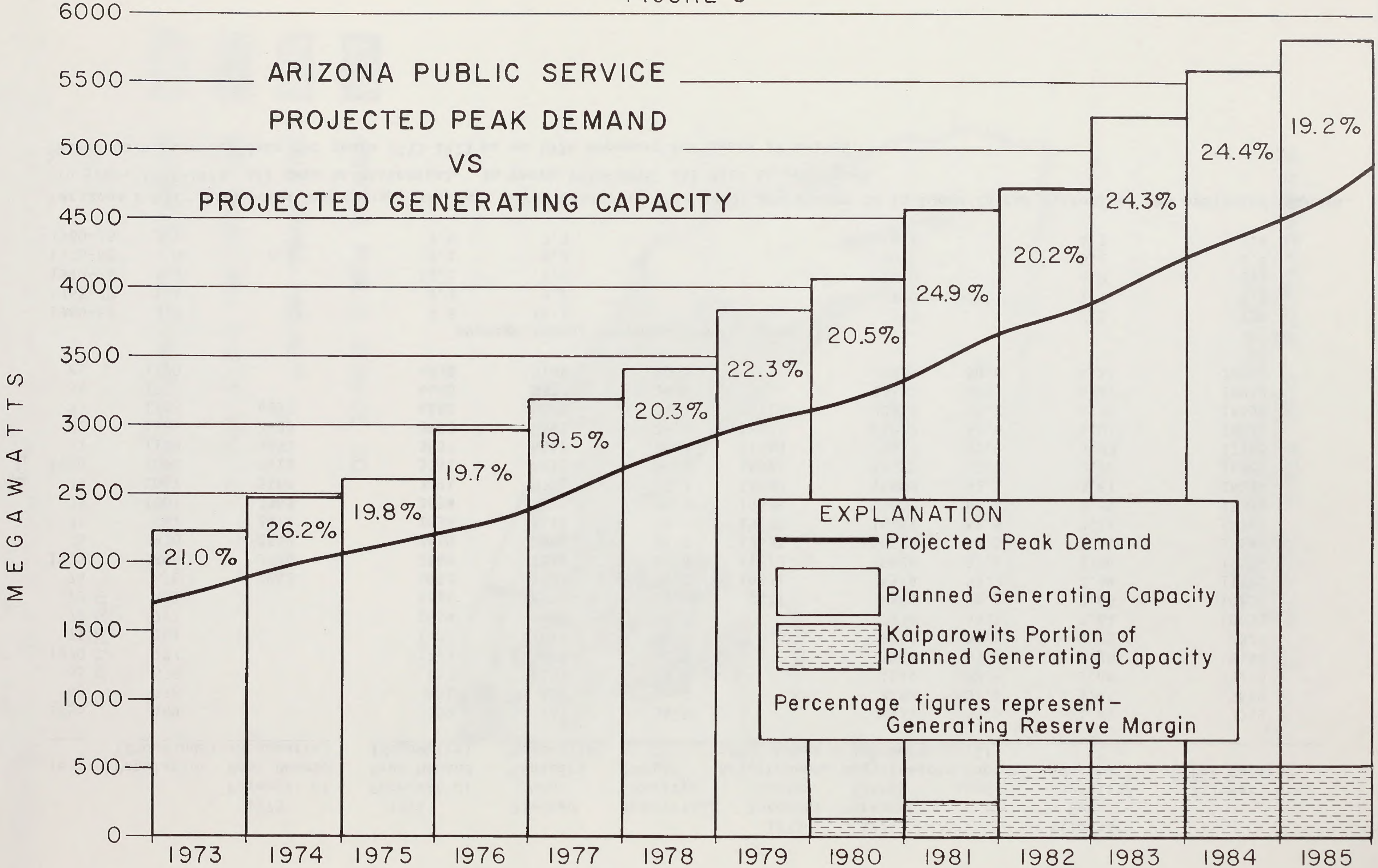
Arizona Public Service[a]

Year	Population (Thousands)	1973 Forecast Of Peak Demand (Megawatts)	1974 Forecast Of Peak Demand (Megawatts)	Planned Gen. Capacity (Megawatts)	Generating Reserve Margin[b] (%)	1973 Forecast Energy Requirements (10^6 kwhr)	1974 Forecast Energy Requirements 10^6 kwhr	Load Factor[b] (%)	Kilowatt Gen Capacity/ Capita[b]	Kilowatt hrs. Per Capita[b]
HISTORICAL										
1955	469		359	483	34.5		1744	55.5	1.03	3719
60	578		651	836	28.4		3288	57.5	1.45	5689
65	678		817	1413	72.9		4214	58.9	2.08	6215
1970	727		1273	1655	30.0		5918	53.1	2.28	8140
71	761		1407	1698	20.7		6752	54.8	2.23	8873
72	791		1659	2085	25.7		7938	54.5	2.64	10035
73	821		1811	2191	21.0	8427	8888	56.0	2.66	10826
74	856	2042	1962	2477	26.2	10271	9574	55.7	2.89	11185
1975	896	2286	2169	2598	19.8	11272	10926	57.5	2.90	12194
76	930	2542	2410	2884	19.7	12655	12593	59.5	3.10	13541
77	967	2471	2638	3148	19.5	13588	14257	61.8	3.26	14744
78	1007	2965	2838	3415	20.3	14688	15503	62.4	3.39	15395
79	1047	3184	3091	3781	22.3	15683	16805	62.1	3.61	16051
1980	1090	3415	3361	4051	20.5	16697	18322	62.1	3.72	16809
81	1128	3653	3637	4542	24.9	17740	19817	62.2	4.03	17568
82	1169	3920	3903	4692	20.2	18973	21072	61.6	4.01	18026
83	1208	4197	4182	5200	24.3	20112	22418	61.2	4.30	18558
84	1247		4480	5572	24.4		23630	60.1	4.47	18949
85	1270		4838	5768	19.2		25429	60.0	4.54	20023
Average Annual Compound Growth Rates (%)										
1960-65	3.2		4.6	11.1			5.1		7.5	1.8
1965-70	1.4		9.3	3.2			7.0		1.9	5.5
1970-75	4.3		11.2	9.4			13.0		4.9	8.4
1975-80	4.0	8.4	9.1	9.3			10.9		5.1	4.4
1980-85	3.1		7.6	7.3			6.8		4.1	3.6

[a] Arizona Public buys power and energy from Salt River Project. This power and energy is included in the historical and projected figures. In years 1955-1973, all data is historical. In years 1974-1985, all data is projected.

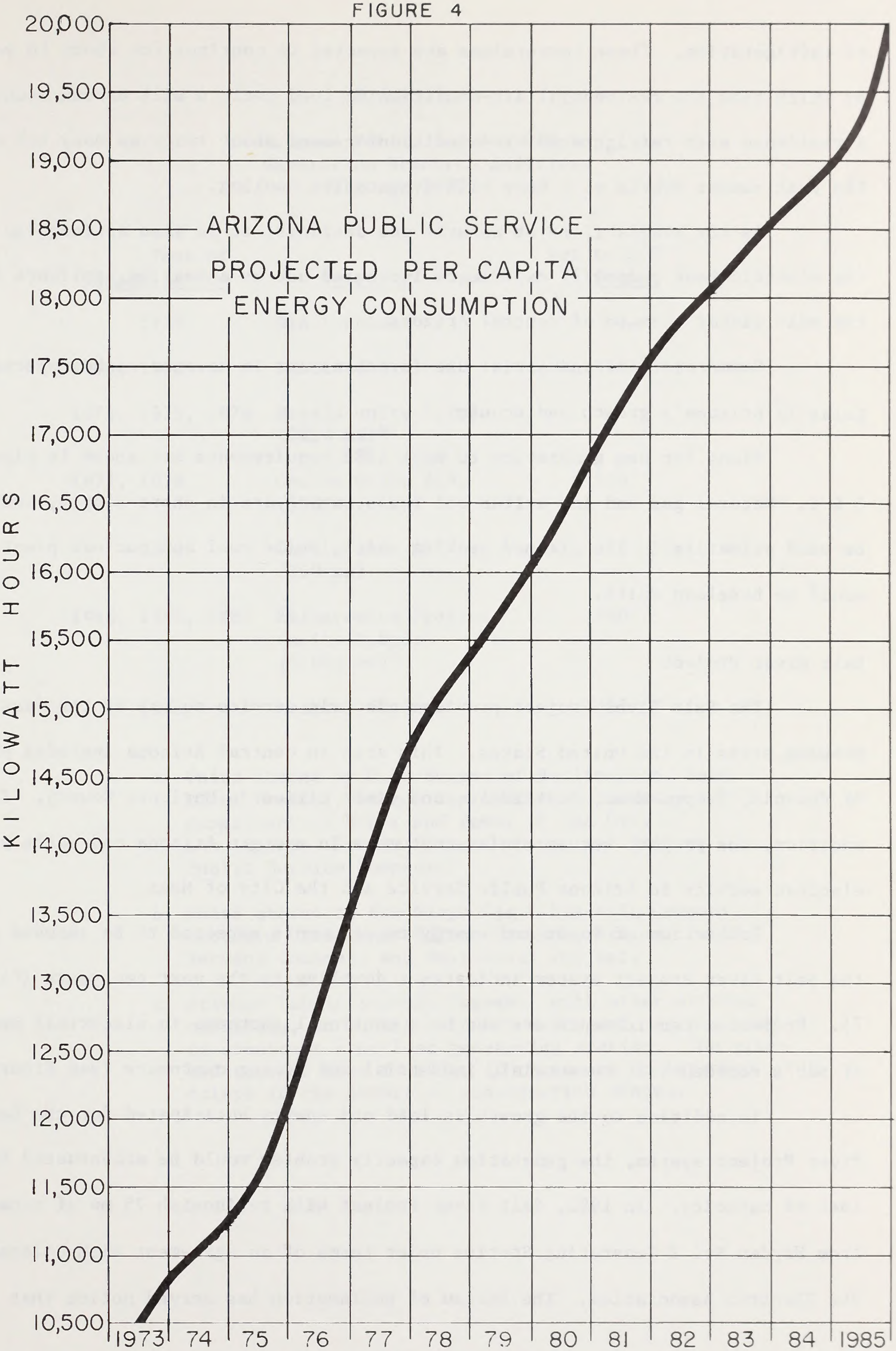
[b] Based on historical data for years 1955-1973 or on 1974 forecast for years 1974-1985.

FIGURE 3



Source: Federal Energy Administration Report 1974, appendix I-1

FIGURE 4



Source: Federal Energy Administration Report 1974, appendix I-1

to refrigeration. These conversions are expected to continue for about 10 years, by which time the residential air-conditioning load pattern will become stabilized. A residence with refrigerated air-conditioning uses about twice as many kwh during the peak summer months as a home with evaporative cooling.

As the availability of natural gas declines, it is also anticipated that the electric heat pump will experience increased use as a heating appliance in the mild winter climate of central Arizona.

Commercial and industrial use forecasts are in keeping with projected gains in Arizona's growth and economy.

Plans for new generation to meet 1982 requirements are shown in Figures 5 & 6. Natural gas and low-sulfur oil fuels, which are in short supply, would be used primarily in the planned peaking units, while coal and nuclear plants would be baseload units.

Salt River Project

The Salt River Project provides electric service to one of the fastest growing areas in the United States. This area in central Arizona includes parts of Phoenix, Tempe, Mesa, Scottsdale, and other cities in Maricopa County. In addition, the project serves mining customers in eastern Arizona and sells wholesale electric service to Arizona Public Service and the City of Mesa.

Projection of loads and energy requirements expected to be imposed upon the Salt River Project system indicates a doubling in the next ten years (Figure 7). Projected requirements are due to a continual increase in electrical needs of SRP's residential, commercial, industrial and mining customers (see Figures 8 & 9).

In addition to the growth in load and energy anticipated for the Salt River Project system, the generation capacity problem would be accentuated by loss of capacity. In 1982, Salt River Project will relinquish 75 mw of capacity from Hayden No. 2 Generating Station under terms of an agreement with Colorado-Ute Electric Association. The Bureau of Reclamation has served notice that it

FIGURE 5

Arizona Public Service Company
Generation Resource Additions
(Through 1982)

Year of Installation	Resource	Net to APS (mw)
1974	Gas turbines	60
1976, 1980	Combined cycle	370
1974, 1975, 1976	Navajo units 1,2,3 (2250 mw)[a]	315
1977, 1978	Cholla units 2,3, (500 mw)	500
1979	Cholla unit 4 (350 mw)	350
1980, 1981, 1982	Kaiparowits Project (units 1,2,3,4 (3,000 mw)[b]	540
1981	Arizona Nuclear[c]	357

a Units shared by U.S. Bureau of Reclamation, Salt River Project, Tucson Gas & Electric Company, Department of Water and Power of the City of Los Angeles, Nevada Power Company, and Arizona Public Service Company.

b Units shared by San Diego Gas & Electric Company, Southern California Edison Company, Arizona Public Service Company, and Salt River Project.

c Arizona Public Service Company, with other Arizona utilities, including Salt River Project, is planning to construct a nuclear generating station. The planned service date is 1981, if there are no extended delays in the permit or construction stages.

FIGURE 6

Generating Capacity (mw) (Envergy 10^6kwhr)

		Hydro	Oil & Gas[a]	Nuclear	Coal Less Kaiparowits	Coal Kaiparowits	Total
Capacity-12/31/73 (Energy Generated During 1973)	APS	4.9	1,272.4	-	913.8	-	2,191.1
		(33)	(2,463)	-	(5,744)	-	(8,888.3)[b]
	SRP	717	762	-	402	-	1,881[c]
		(1,728)	(3,033)	-	(2,791)	-	(7,552.6)
	SDG&E	-	2,044	86	-	-	2,130
		-	(7,199)	(453)	-	-	(7,652)
	SCE	1,000[d]	9,410	344	1,619	-	13,523
		(6,943)	(38,164)	(1,814)	(8,719)	-	(55,645)[c]
Scheduled Additions of Capacity 1974-1984	APS	-	605	1,071	1,165	540	3,381
	SRP	(-276)	489	1,071	1,439	300	3,023
	SDG&E	-	856	491	-	702	2,049
	SCE	344	2,292	2,584	219	1,164	7,087[f]
Capacity-12/31/84 (Energy Generated During 1984	APS	4.9	1,877.4	1,071	2,078.8	540	5,572.1
		(34)	(1,869.5)	(5,824.5)	(12,792.9)	(3.569.3)	(23.630)[g]
	SRP	441	1,251	1,071	1,841	300	4,904
		(1,204.4)	(1,020)	(4,479.1)	(9,742.5)	(1,117.4)	(17,563.7)
	SDG&E	-	2,900	577	-	702	4,179
		-	(9,540)	(3,942)	-	(4,625)	(18,107)
	SCE	1,463	11,702	2,928	1,838	1,164	20,610
		(6,216)	(52,790)	(21,392)	(10,727)	(7,619)	(98,744)

a Includes combined cycle and gas turbines.
b Includes purchases of 647.8 x 10^6 kwhr.
c Includes purchases of 478 mw hydro and 92 mw coal.
d Includes 277 mw of firm purchases and 119 mw due to adverse winter hydro berate.
e Includes 1218 mw of purchaes and 68 mw of off-system loses.
f Includes 94 mw of purchases and 390 mw from fuel cells installed 1979-1981.
g Includes 460.3 x 10^6 kwhr sales.

Source: FEA Report 1974, Appendix I-1.

FIGURE 7

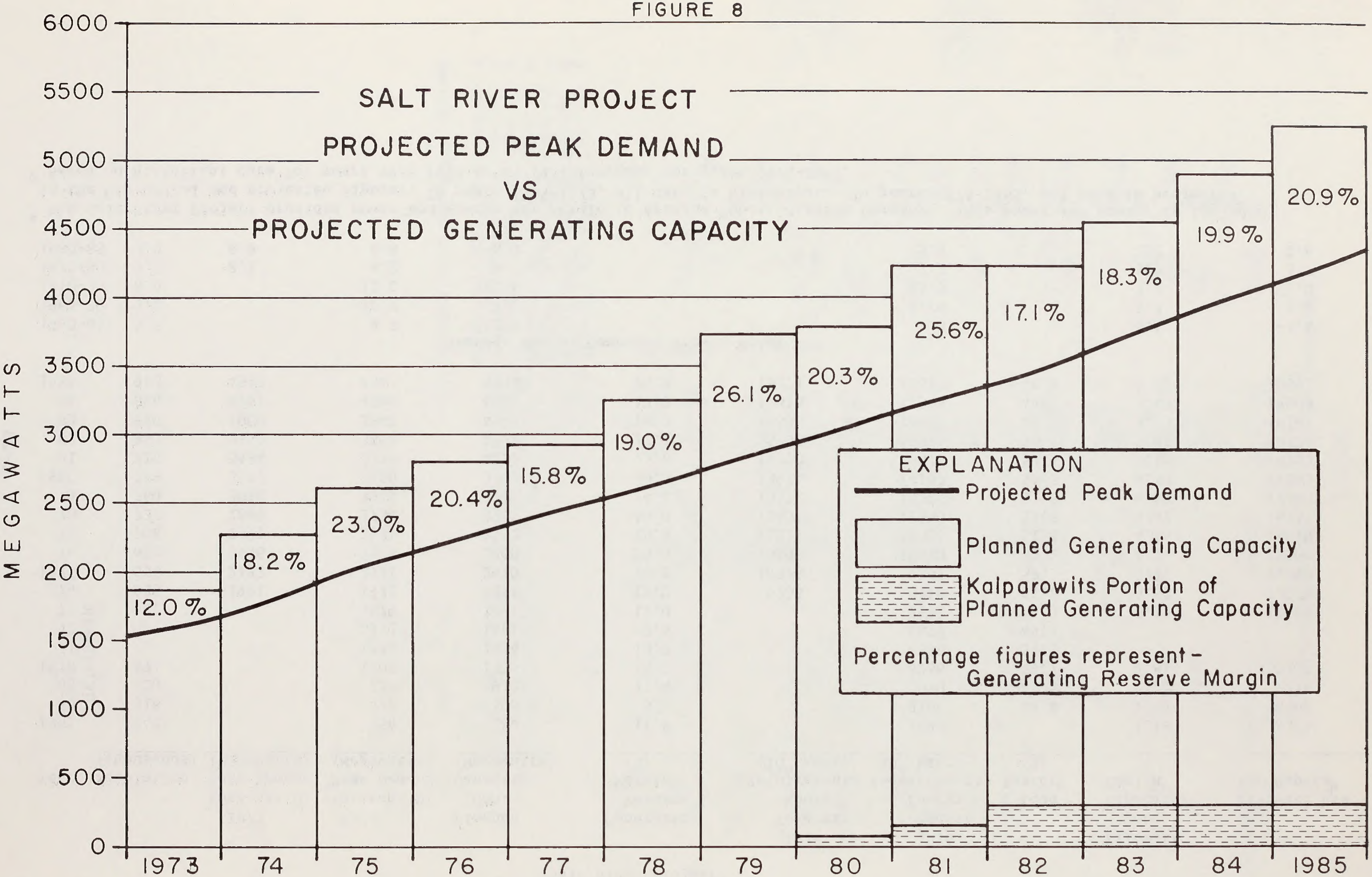
Salt River Project[a]

Year	Population (Thousands)	1973 Forecast Of Peak Demand (Megawatts)	1974 Forecast Of Peak Demand (Megawatts)	Planned Gen. Capacity (Megawatts)	Generating Reserve Margin[b] (%)	1973 Forecast Energy Requirements (10^6 kwhr)	1974 Forecast Energy Requirements 10^6 kwhr	Load Factor[b] (%)	Kilowatt Gen. Capacity/ Capita[b]	Kilowatt hrs. Per Capita[b]
HISTORICAL										
1955	240		254	284	11.8		1290		1.18	5375
60	318		479	505	5.4		2706	64.4	1.59	8509
65	420		727	912	25.4		3030	47.5	2.17	7214
1970	491		1207	1379	14.2		5256	49.7	2.81	10705
71			1276	1454	13.9		6388	57.1		
72			1533	1681	9.6		6679	49.7		
73	601		1679	1881	12.0		7552	51.3	3.13	12566
74	630	1991	1921	2271	18.2	9235	8718	51.8	3.60	13838
1975	658	2197	2121	2610	23.0	10076	9869	53.1	3.97	14998
76	682	2406	2325	2800	20.4	10500	10440	51.2	4.11	15308
77	708	2591	2531	2932	15.8	11212	11335	51.1	4.14	16010
78	737	2849	2734	3255	19.0	12404	12350	51.5	4.42	16757
79	760	3050	2944	3715	26.1	13172	13295	51.5	4.89	17493
1980	789	3237	3150	3790	20.3	13914	14157	51.3	4.80	17943
81	815	3484	3359	4222	25.6	14723	14876	50.5	5.18	18253
82	843	3752	3604	4222	17.1	15708	15824	50.1	5.01	18771
83	870	4009	3842	4547	18.3	16558	16675	49.5	5.23	19167
84	896	4261	4089	4904	19.9	17316	17564	49.0	5.47	19603
1985	913	4517	4343	5254	20.9	18271	18617	48.9	5.75	20391
Average Annual Compound Growth Rates (%)										
1960-65	5.7		8.7	12.5			2.3		6.4	-3.4
1965-70	3.2		10.7	8.6			11.6		5.3	8.2
1970-75	6.0		12.0	13.6			13.5		7.2	7.0
1975-80	3.7	8.1	8.2	7.7			7.5		3.9	3.7
1980-85	3.0	6.9	6.6	6.9			5.6		3.7	2.6

[a] The Salt River Project provides power and energy for resale to Arizona Public Service Company. This power and energy is included in the historical and projected figures. In years 1955-1973, all data is historical. In years 1974-1985, all data is projected.

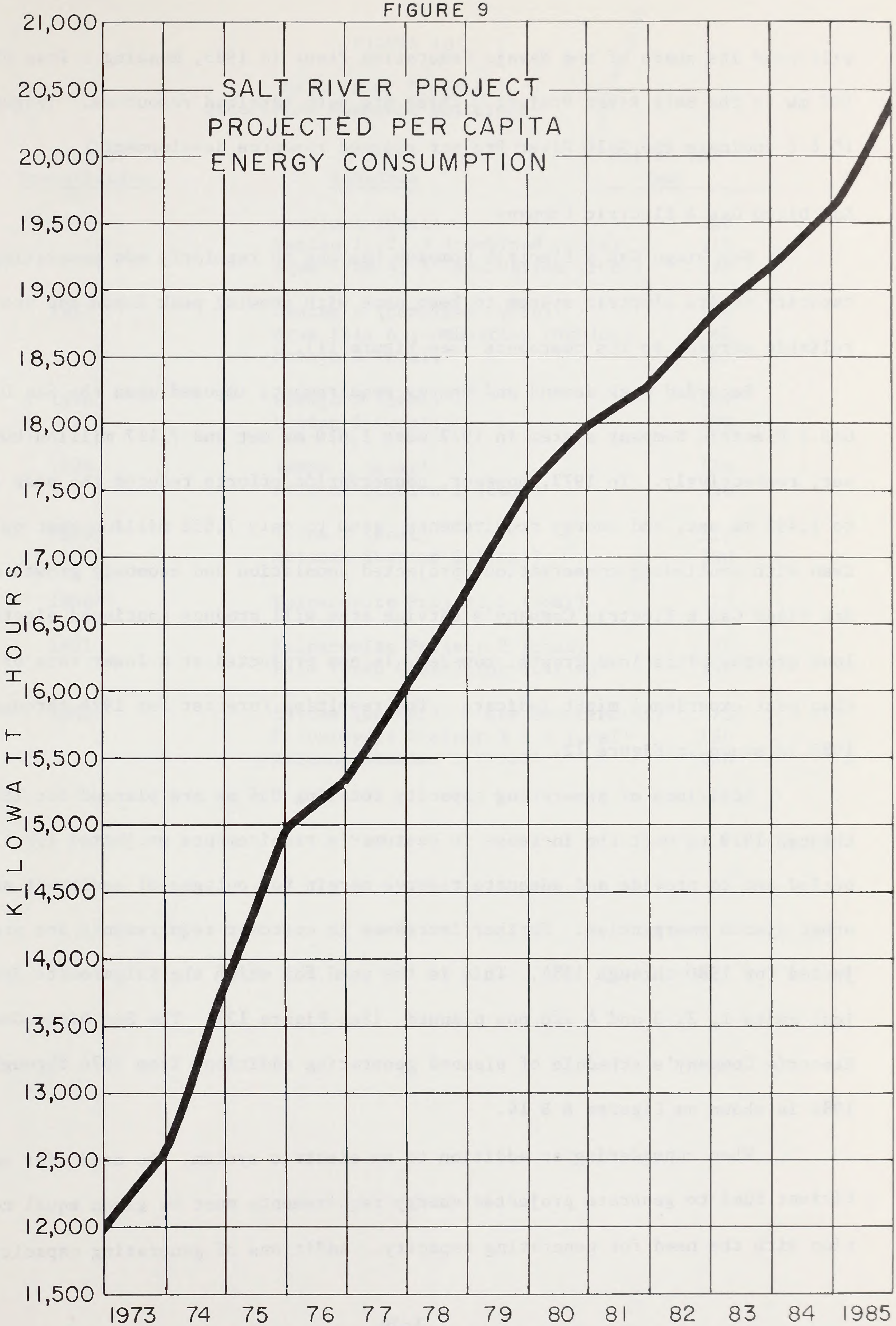
[b] Based on historical data for years 1955-1973 or on 1974 forecast for years 1974-1985.

FIGURE 8



Source: Federal Energy Administration Report 1974, appendix I-1

FIGURE 9



Source: Federal Energy Administration Report 1974, appendix I-1

will need its share of the Navajo Generating Plant in 1983, meaning a loss of 107 mw to the Salt River Project. These are both baseload resources. (Figures 10 & 6 indicate the Salt River Project planned resource development.)

San Diego Gas & Electric Company

San Diego Gas & Electric Company has had to regularly add generating capacity to its electric system to keep pace with growing peak loads and provide reliable service to its customers (see Figure 11).

Recorded peak demand and energy requirements imposed upon the San Diego Gas & Electric Company system in 1972 were 1,610 mw net and 7,417 million kwhr net, respectively. In 1973, however, conservation efforts reduced the peak load to 1,495 mw net, and energy requirements grew to only 7,652 million kwhr net. Even with continuing conservation, projected population and economic growth of San Diego Gas & Electric Company's service area will produce continued electric load growth. This load growth, however, is now projected at a lower rate of growth than past experience might indicate. The resulting forecast for 1974 through 1985 is shown in Figure 12.

Additions of generating capacity totaling 856 mw are planned for 1974 through 1979 to meet the increase in customer's requirements projected for that period and to provide and adequate reserve margin for outages of equipment and other system emergencies. Further increases in customer requirements are projected for 1980 through 1984. This is the need for which the Kaiparowits Project units 1, 2, 3 and 4 are now planned (See Figure 13). The San Diego Gas & Electric Company's schedule of planned generating additions from 1974 through 1984 is shown on Figures 6 & 14.

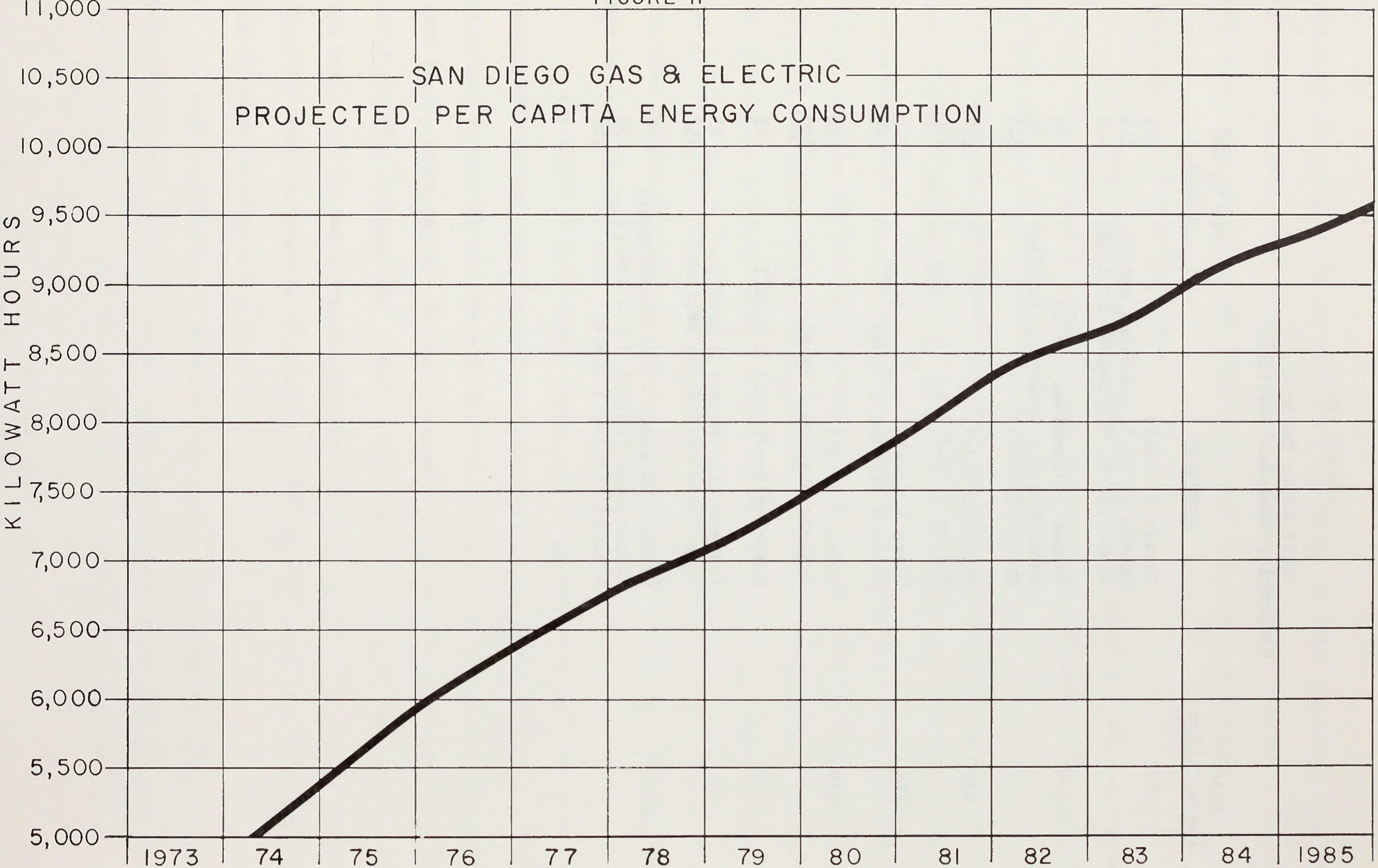
When considering an addition to an electric system, the need for sufficient fuel to generate projected energy requirements must be given equal consideration with the need for generating capacity. Additions of generating capacity

FIGURE 10

Salt River Project
Generation Resource Additions

Year of Installation	Resource	Net to SRP (mw)
1974	Navajo 1 (Coal)	248
	Santan 1, 2, 3 (combined cycle)	219
	Aqua Fria 4, 5 (combustion trub.)	128
1975	Santan 4 (combined cycle)	66
	Aqua Fria 6 (combustion turbine)	61
	Navajo 2 (coal)	241
1976	Navajo 3 (coal)	107
	Hayden 2 (coal)	200
1978	Yampa 1 (coal)	110
	Arizona Station 1 (coal)	350
1979	Yampa 2 (coal)	110
	Arizona Station 2 (coal)	350
1980	Kaiparowits Project 1 (coal)	75
1981	Kaiparowits Project 2 (coal)	75
	Palo Verde Generating Station	357
1982	Hayden (Colorado - Ute entitlement)	-75
	Kaiparowits Project 3 & 4 (coal)	150
	Arizona Station 3 (coal)	350

FIGURE II



Source: Federal Energy Administration Report 1974, appendix I-1

FIGURE 12

San Diego Gas & Electric [a]

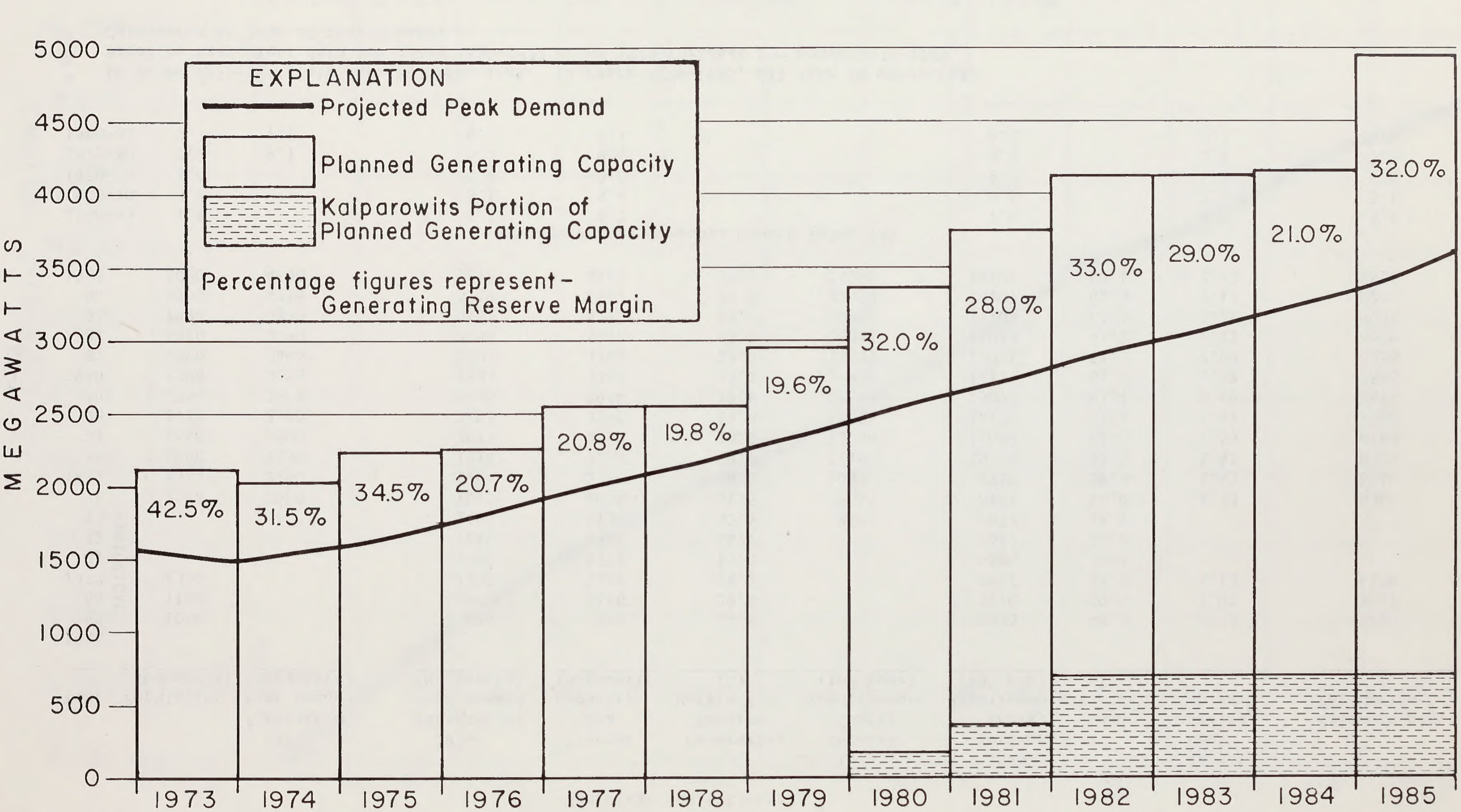
Year		Population (Thousands)	1973 Forecast Of Peak Demand (Megawatts)	1974 Forecast Of Peak Demand (Megawatts)	Planned Gen. Capacity (Megawatts	Generating Reserve Margin [b] [c] (%)	1973 Forecast Energy Requirements (10^6 kwhr)	1974 Forecast Energy Requirements (10^6 kwhr)	Load Factor [b] (%)	Kilowatt Gen. Capacity/ Capita [b]	Kilowatt hrs. Per Capita [b]
1955	HISTORICAL										
60		1050		670	769	14.8		2835	48.3	0.73	2700
65		1150		900	1166	29.6		3976	50.4	1.01	3457
1970		1350		1330	1519	14.2		5967	51.2	1.13	4420
71				1495	1719	15.0		6586	50.3		
72				1610	1846	14.7		7417	52.6		
73				1495	2130	42.5	8707	7652	58.4		
74		1528	2000	1612	2036	31.5	9663	8191	58.0	1.33	5360
1975		1564	2100	1764	2236	34.5	10933	9250	59.8	1.43	5914
76		1600	2250	1914	2254	20.7	12183	10216	61.0	1.41	6385
77		1640	2500	2077	2550	20.8	13246	11099	61.0	1.55	6768
78		1710	2700	2253	2550	19.8	14358	12124	61.4	1.49	7090
79		1750	2875	2436	2954	19.6	15566	13097	61.4	1.69	7474
1980		1790	3250	2633	3358	32.0	16979	14116	61.2	1.88	7886
81		1800	3460	2805	3761	28.0	18431	15041	61.2	2.09	8356
82		1860	3790	2988	4112	33.0	20069	16013	61.2	2.21	8609
83		1900	4000	3153	4112	29.0	20800	17107	62.0	2.16	9004
84		1950	4375	3319	4147	21.0	22400	18107	62.3	2.13	9286
1985		2000	4600	3612	4952	32.0	24200	19107	60.4	2.48	9554
				Average Annual Compound Growth Rates (%)							
1960-65		1.8		6.1	8.7			7.0		6.7	5.1
1965-70		3.2		8.1	5.4			8.5		2.3	5.1
1970-75		3.0		5.8	8.0			9.2		4.8	6.0
1975-80		2.7	9.1	8.3	8.4			8.8		5.6	5.9
1980-85		2.7	7.2	6.5	8.1			6.2		5.7	3.9

a In years 1955-1973, all data is historical. In years 1974-1985, all data is projected.
b Based on historical data for years 1955-1973 or on 1974 forecast for years 1974-1985.
c Calculated at time of peak demand.

FIGURE 13

SAN DIEGO GAS & ELECTRIC

PROJECTED PEAK DEMAND VS PROJECTED GENERATING CAPACITY



Source: Federal Energy Administration Report 1974, appendix I-1

FIGURE 14

San Diego Gas & Electric Company
Generation Resource Addition Plan

1974-1983

Planned Operating Date	Station & Unit	Type	Net to SDG&E (mw)	Remarks
Scheduled Units				
Oct 1974	South Bay GT 2	Gas Turbine	32	
	South Bay GT 3	Gas Turbine	64	
	South Bay GT 4	Gas Turbine	64	
May 1977	Encina 5	Steam	292	
Sep 1980	San Onofre 2	Nuclear	228	20% share of 1,140 mw unit
Dec 1981	San Onofre 3	Nuclear	228	20% share of 1,140 mw unit
Planned Units				
May 1979	Undetermined 1	Comb. Cycle	404	
May 1980	Kaiparowits 1	Steam-Coal	176	23.4% of 750 mw units
May 1981	Kaiparowits 2	Steam-Coal	175	
Mar 1982	Kaiparowits 3	Steam-Coal	176	
Dec 1982	Kaiparowits 4	Steam-Coal	175	
Jun 1984	San Joaquin 1	Nuclear	35	Possible share of first San Joaquin Nuclear Project Unit
May 1985	Desert #1	Nuclear	770	(expected share Of 1,160)
Dec 1985	San Joaquin 2	Nuclear	35	

* Dependable winter capability. Summer capabilities of Gas Turbines and Combined Cycle units are somewhat less.

planned by San Diego Gas & Electric Company prior to 1979 will use fossil petroleum fuels (natural gas and fuel oil) exclusively. With the exception of San Onofre Unit 1, all existing units of San Diego Gas & Electric Company system also burn fossil petroleum fuels. In recent years there has been a reduction in natural gas available for use in power plants in Southern California and the situation is expected to increase in severity. Therefore fuel for fossil-fueled electric generation must increasingly be low sulfur residual oil or, in the case of gas turbines, No. 2 diesel. Both of these fuels are in short supply.

Southern California Edison Company

Southern California Edison Company's main system net peak demand and total transmitted energy for 1973 were 10,535 mw and 58,144 million kwh, respectively. These values are projected to increase by 5,743 mw of demand through 1983 to a total of 16,278 mw, with a 1983 energy requirement of 93,554 million kwh. Edison's demand and energy forecast for the years 1974 through 1985 are shown in Figures 15 and 16. Peak demand shown in the figures is expected to occur in the summer months. Projected per capita energy consumption trend is shown in Figure 17.

As of December 31, 1973, total main system resources of Edison Company totaled 13,400 mw, including approximately 900 mw of firm capacity purchases. Planned resource additions of approximately 3,100 mw, if realized, would provide adequate reserve margins during the 1974 through 1979 period. Further discussion of the need for the Kaiparowits Project assumes that these interim resources would be installed. The lack of assurance of obtaining these resources would further emphasize the need for the Kaiparowits project.

The only source of energy reserve by the end of 1979 would be contained in the older units, which operate on oil and gas; therefore, resources installed in 1980 through 1983 should at least be capable of supplying increased energy requirements for that period. This dictates, as a practical solution, that a

FIGURE 15

Southern California Edison Company [a]

HISTORICAL

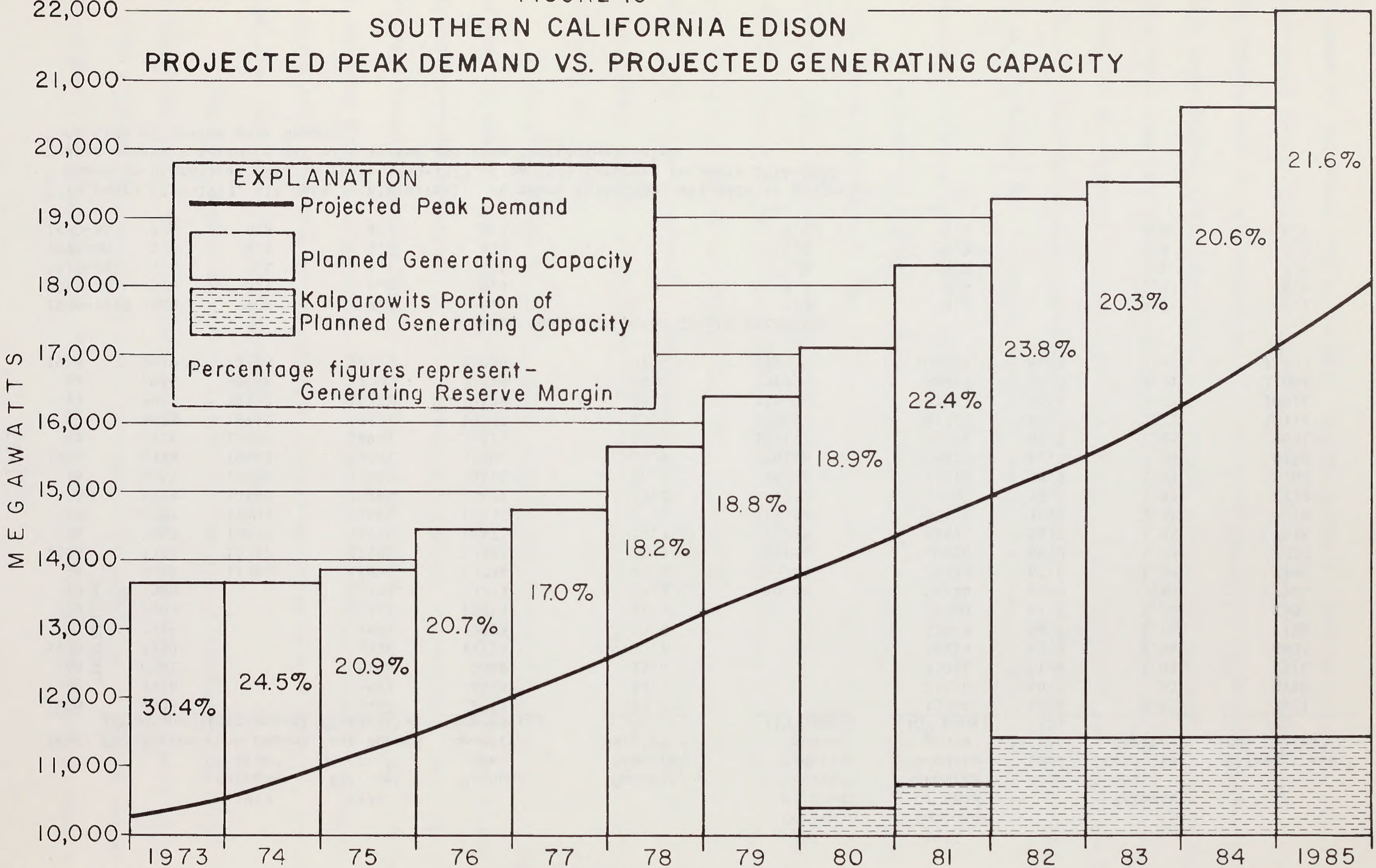
Year	Population (Thousands)	1973 Forecast Of Area[c] Peak Demand (Megawatts)	1974 Forecast Of Area[c] Peak Demand (Megawatts)	Planned Gen. Capacity[d] (Megawatts)	Generating Reserve[b] Margin[c d] (%)	1973 Forecast Of Area Energy Requirements (10^6 kwhr)	1974 Forecast Of Area Energy Requirements (10^6 kwhr)	Area Load[b] Factor[c] (%)	Kilowatt Gen.[b] Capacity/ Capita[c]	Kilowatt hrs.[b] Per Capita[c]
1955	4308		2454	2778	13.2		13404	62.4	0.65	3111
60	5406		3972	4619	16.3		21136	60.7	.85	3910
65	6581		6120	7088	15.8		33011	61.6	1.08	5016
1970	7230		8556	11129	30.1		49419	65.9	1.54	6835
71	7319		9897	12913	30.5		52667	60.7	1.76	7196
72	7403		10317	12913	25.2		55560	61.5	1.74	7505
73	7508		10535	13733	30.4	60188	58144	63.0	1.83	7744
74	7619	11365	11005	13704	24.5	64582	59384	61.6	1.80	7794
1975	7739	12217	11485	13887	20.9	69194	60650	60.3	1.79	7837
76	7867	13050	11995	14472	20.7	74295	61491	58.5	1.84	7816
77	7997	13903	12595	14733	17.0	79342	62526	56.7	1.84	7819
78	8129	14766	13265	15677	18.2	84727	67240	57.9	1.93	8272
79	8263	15689	13812	16411	18.8	90328	71919	59.4	1.99	8704
1980	8398	16683	14381	17092	18.9	96148	76927	61.1	2.04	9160
81	8536	17686	14961	18314	22.4	102177	82211	62.7	2.15	9631
82	8675	18718	15574	19287	23.8	108657	87721	64.3	2.22	10112
83	8817	19832	16278	19578	20.3	115408	93554	65.6	2.22	10611
84	8916	20956	17105	20629	20.6	121955	98948	66.0	2.31	11098
1985	9099	22123	18123	22039	21.6	128835	105027	66.2	2.42	11543
Average Annual Compound Growth Rates (%)										
1960-1965	4.0	9.0	9.0	8.9		9.3	9.3		4.9	5.1
1965-70	1.9	6.9	6.9	9.4		8.4	8.4		7.4	6.4
1970-75	1.4	7.4	6.1	4.5		7.0	4.2		3.1	2.8
1975-80	1.6	6.4	4.6	4.2		6.8	4.9		2.6	3.2
1980-85	1.6	5.8	4.7	5.2		6.0	6.4		3.8	4.7

[a] In years 1955-1973, all data is historical. In years 1974-1985, all data is projected.
[b] Based on historical data in years 1955-1973 or on 1974 forecast in years 1974-1985.
[c] Area demand = Edison's net main system and firm contractual sales.
[d] At time of system peak demand.

FIGURE 16

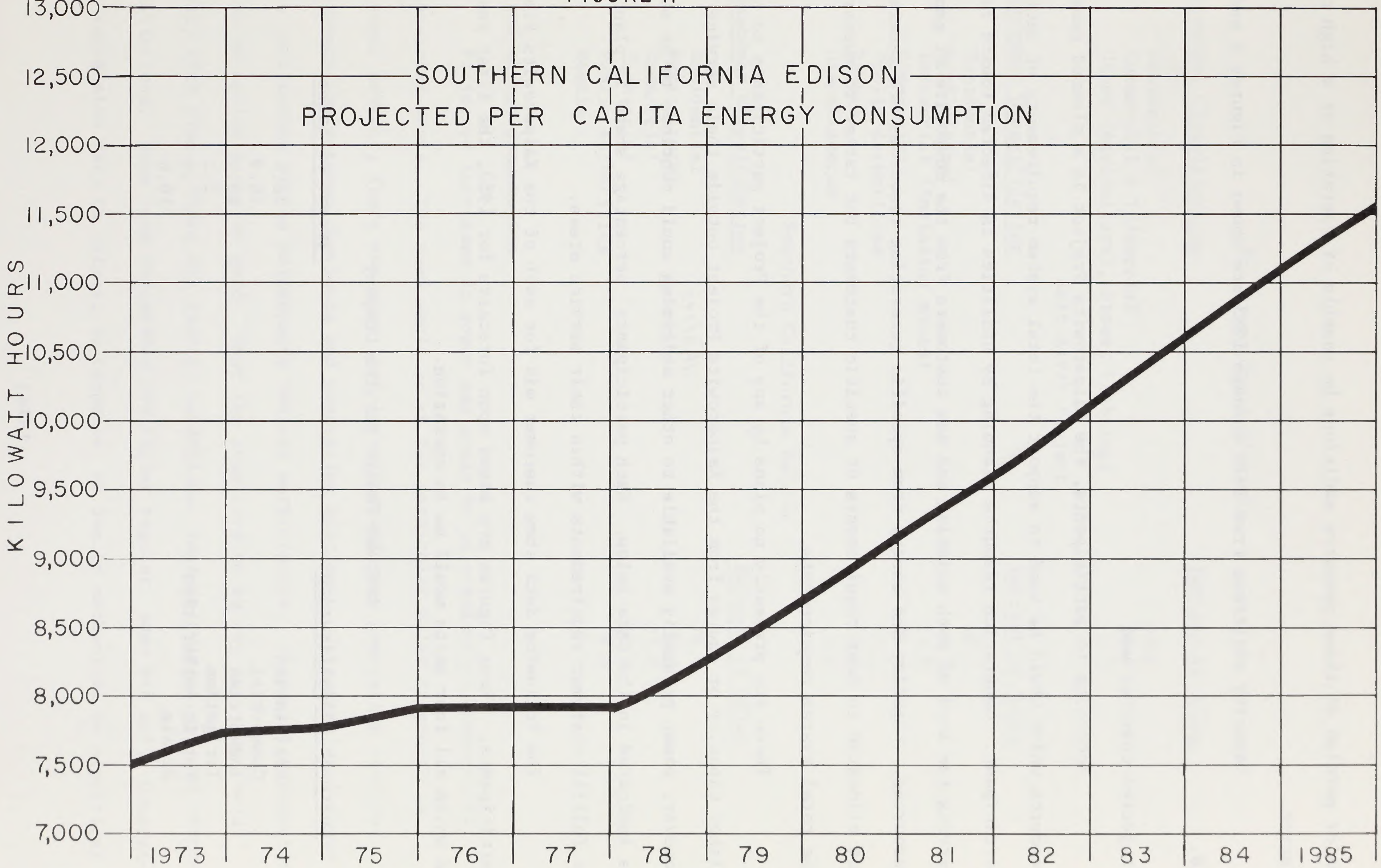
SOUTHERN CALIFORNIA EDISON

PROJECTED PEAK DEMAND VS. PROJECTED GENERATING CAPACITY



Source: Federal Energy Administration Report 1974, appendix I-1

FIGURE 17



Source: Federal Energy Administration Report 1974, appendix I-1

major portion of these resource additions be capable of operating at a high capacity factor.

Capacity additions from 1974 through 1983 are shown in Figures 6 and 18.

Projected customer use

According to participants, the Kaiparowits Project is a planned generation resource which would be used to support the total system requirements of each participant. Generation resource planning by utilities is directed toward reliably serving the load of both existing and new customers from the composite of generation resources. Capacity and energy from specific generating resources are generally not allocated to meet requirements of specific customers but rather to support the total system requirements.

There are presently no plans by any of the Project participants to sell either capacity or energy from the Kaiparowits Project outside their service area; however, power presently available to other ~~utilizing~~ utilities would continue to be sold as indicated in the data below. Each participants' percentage share is planned to fulfill customer requirements within their service areas.

The following data show customer mix for each of the Kaiparowits Project participants. These figures are based upon forecasts for 1983, the first year in which all four units would be in operation.

Arizona Public Service Company

Customer Classification	Percent of Sales
Residential	28.1
Commercial	26.9
Industrial	25.4
Irrigation	2.1
Public Authorities	.9
Resale	16.6

San Diego Gas & Electric

Customer Classification	Percent of Sales
Residential	40.0
Commercial & Industrial	58.5
Other (Agricultural, Street Lighting)	1.5

Salt River Project

Customer Classification	Percent of Sales
Residential	38.7
Agricultural	1.9
Industrial (including mines)	23.0
Commercial	24.3
Public Authorities	2.2
Resale	8.7
Miscellaneous	1.2

Southern California Edison

Customer Classification	Percent of Sales
Residential	30.0
Agricultural	1.0
Commercial	25.0
Industrial	28.0
Public Authorities	9.0
Resale	7.0

Projected energy consumption

Projected increases in power use would be in residential, commercial, and industrial users. The need would be at the particular point of growth in these uses; however, there are many load locations and many generating stations with connections between the loads and generating stations. Illustration 4 shows service territories of the Kaiparowits Project participants. These interconnections can also be called a net or grid. Over the area covered by any net, the loads will vary with time. There are diurnal variations, seasonal variations and short-term variations. Some load variations are rather regular, some are not. Generating stations also vary in output, in response, or due to mechanical or electrical

FIGURE 18

Southern California Edison Company
Generation Resource Additions
(1974-1983)

Date	Resource	Net Capacity Added to SCE (mw)
	Coal-Fired Generation	
1974-77	Rerate Mohave 1 & 2	-16
1975-77	Rerate Four Corners 4 & 5	-56
1980-82	Kaiparowits 1-4	1200[a]
	Nuclear Generation	
1979-81	San Onofre 2 & 3	1824[b]
	Combined-Cycle Generation, Fossil Fueled	
1976	Long Beach 1-7	563
1977-78	Coolwater 3 & 4	472
1978-79	Huntington Beach 6-11	1416[c]
	Oil and Gas Fired Generation	
1976	Yuma Axis	25
	Peaking Generation	
1974	Ellwood Energy Support Facility (Gas turbine)	54
1979-811	Fuel Cells 1-15	390
1981-82	Big Creek Area Development (hydro)	344
	Purchased Power	
1974	Navajo 1 Layoff (terminates in 1981)	97
1975	Navajo 2 Layoff (terminates in 1981)	104
1975	Portland General Electric Exchange (seasonal)	100
1976	Navajo 3 Layoff (terminates in 1981)	126
	Retirements and Terminations	
1974	Vernon (diesel)	-20
1981	Navajo Layoff	-327
1982	Long Beach 10 & 11	212

a Allocation of Kaiparowits Project power to each participant has not yet been finalized; however an Edison share of 40 percent is assumed.
b 80 percent share of two 1,140 mw units.
c An alternative is installation of combined cycle units at the Lucerne Valley site.

maintenance requirements or other factors. Lines of the net are also subject to outage from time to time due to line failure, need for modification, or preventive maintenance.

Power can be drawn from neighboring nets for emergency purposes without warning but if the added load exhausts the reserve of the neighboring net, interconnecting circuits will automatically be disconnected. Such measures are only for very short term emergencies since they hamper reliability of the neighboring net. Again, for short terms, the neighboring net can borrow from a more distant net but ultimately each net must be essentially independent. Of course, steady power can be purchased by pre-arrangement from neighboring nets if their reserves are adequate.

It is necessary to be able to supply shifting patterns of load on the net from shifting patterns of generating capacity on interconnections with other nets. If a transmission line is removed from service by accidental failure or for maintenance or modification, other lines must be available to carry the burden. If a generating unit drops out for any reason, other sources must be ready to make up the loss. If loads change anywhere, supply and distribution must shift accordingly.

It is not generally correct to conceive of the power generated by a particular unit as being delivered to a particular load area. Both generation facilities and load requirements are part of a complex interconnected system.

FEA verification

To verify the participating companies' forecast of power demands, the Federal Energy Administration (FEA) was asked by the Bureau of Land Management to review and comment on predicted forecast needs. The following narrative is based on the FEA report (see Appendix I-1).

The decision to undertake the project under the proposed time schedule was based on a determination that new capacity was required to maintain system reliability in light of projected demand. The 3,000 megawatts of generating capacity of the Kaiparowits Plateau would comprise approximately 28 percent of new capacity added in the 1973-82 period to the combined generating capacity of the four utilities.

Demand forecasts

Because so many intangibles are involved in the process of forecasting electric power demand, there is wide diversity of conclusions regarding the level of future demand. As a result, demand forecasts are often disputed.

Many who believe growth in energy consumption must be slowed maintain that utilities over estimate future demand in their forecasts, that forecasts, are self-fulfilling, and therefore, more generating capacity is installed and more energy consumed than is necessary to satisfy a "reasonable" level of public need. In response, utilities contend that forecasts are not self-fulfilling; that they are based on empirical and well-founded assumptions concerning growth of electric power demand.

In addition, utilities say it is in their self-interest to make accurate demand forecasts. They point on the one hand to their responsibility to have capacity sufficient to provide adequate service, and on the other hand to economic penalties of installing excess capacity. In rejecting the contention that demand forecasts are inflated and self-fulling, utilities note the difficulty of financing new facilities and increasing costs of new generating capacity.

Nevertheless, given the fact that utility demand forecasts are contested, independent predictions of future demand would be useful in assessments of the need for new generating facilities. But no such comprehensive projections have been made for the Kaiparowits market area. Those projections which have been made are either lacking sufficient detail or rest on assumptions considered too speculative as a basis for planning. Primary assumptions made by each of the Kaiparowits participants in arriving at its current demand forecast and its capacity requirement are listed in Appendix I-1.

While the utilities' forecasts were accepted as the best available for their particular service areas, deviations from these rates of growth might occur. Improved economic conditions, lower fuel prices, or unanticipated uses could bring about increased demand. More stringent government regulation of electric power use, higher fuel prices, or expanded conservation efforts by consumers could result in reduced demand. Changes in 1974 demand forecasts with respect to those made in 1973 (prior to the oil embargo) demonstrate the sensitivity of forecasts to events which seem speculative one year but materialize the next.

In comparison to 1973 estimates, 1974 forecasts for peak demand in 1985 have been reduced approximately 22 percent by San Diego Gas & Electric, 19 percent by Southern California Edison, 0.3 percent by Arizona Public Service and 3.9 percent by the Salt River Project.

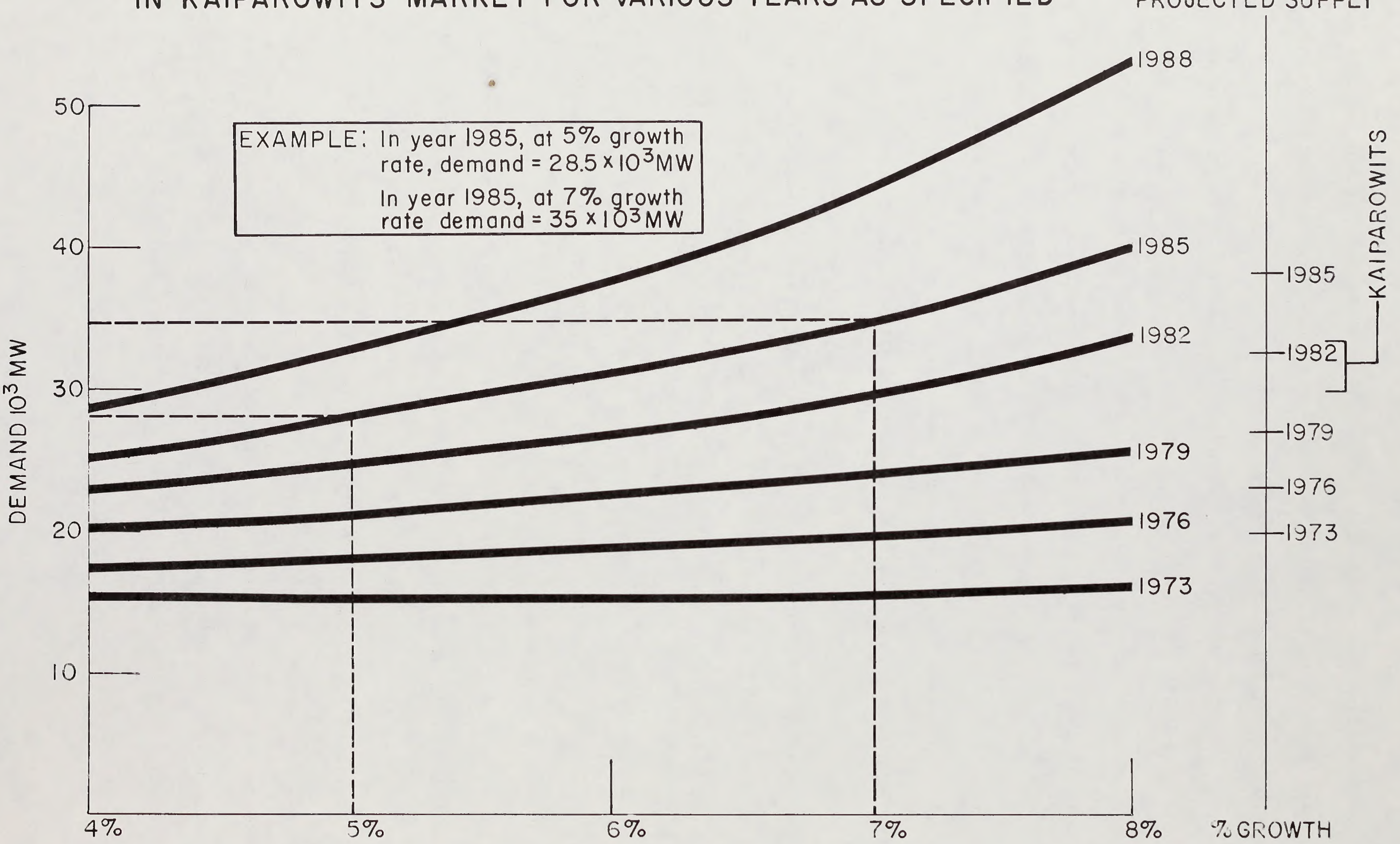
Rationale for construction

Rationales for construction of a 3,000 megawatt coal-fired generating station are as follows:

Electric power demand is increasing. Electric power consumption in the Kaiparowits market area is projected to grow from about 8.5 x 10^{10} kilowatt hours in 1974, to 15.8 x 10^{10} kilowatt hours in 1984, an annual compound rate of growth of approximately 6.8 percent (see Figure 19). Level of total generating capacity in a system must be equal to peak demand plus a reserve margin. The reserve margin, a discussion of which is presented in Appendix I-1, is required to allow for scheduled and unscheduled outages and load forecast uncertainty. To ensure that they have sufficient reserve margins, utilities install enough capacity so conditions similar to the following are satisfied:

FIGURE 19

DEMAND (10^3MW) vs. % RATE OF GROWTH IN KAIPAROWITS MARKET FOR VARIOUS YEARS AS SPECIFIED



1) Margin between installed generating capacity and peak demand equal to at least 15 percent to 20 percent of annual peak demand.

2) Generating capacity margin, after deducting for scheduled maintenance to provide sufficient capacity to allow loss of the larger of:

(a) The system's two largest generating units or interconnections with other systems.

(b) Seven percent of system demand plus largest generating unit or interconnection.

3) Reliability index of 0.95. (This means in the case of Southern California Edison that there would be a 95 percent chance of meeting demand every hour in a year.) Other utilities define the reliability index in a different, but essentially equivalent manner.

Because of increasing cost of oil and scarcity of natural gas, and in order to decrease reliance on oil imports, it becomes necessary to shift as much as practical to use of more available domestic fuels such as coal and uranium. A Kaiparowits-size oilfired station would require approximately 80,000 barrels of oil per day in comparison to Kaiparowits' 25,000 tons of coal. Assuming 1984 crude oil costs at $14.30 per barrel (Southern California Edison assumption), $11.00 per barrel or $7.00 per barrel (FEA's Project Independence Report high and low assumptions), operation of Kaiparowits could reduce the flow of dollars to foreign countries respectively by $418, $321, or $204 million per year.

Baseload generating capacity should be increased in order to minimize system operation costs. Characteristics of baseload generation are (1) operation at or near full capacity during all hours that the generating unit is available, and (2) low energy costs per kilowatt hour of generation. For example, while Southern California Edison's objective is to have 40 to 50 percent of its capacity from baseload resources (nuclear, coal, and hydroelectric), only 16 percent of its capacity in the 1974-79 period will be from baseload resources. By 1983, Edison's baseload resources will be increased to 25 percent of its total capacity of approximately 19,578 megawatts.

Site selection

Selection of a site for the proposed Kaiparowits Generating Station was initiated by the participants in January, 1964, and continued periodically until the Fourmile Bench site was selected in November, 1973. During that time, 19 sites (Illustration 5) on the Kaiparowits Plateau area were investigated. At various times during these siting activities, potential sites at Warm Creek, Nipple Bench and Fourmile Bench were studied.

The Warm creek site was the first to be studied. However, studies for this site indicated the possibility that unfavorable air quality conditions could occur in the Lake Powell air basin due to combined effects from Navajo and Kaiparowits projects. Additional sites were studied and compared with the Warm Creek site. This study concluded that Nipple Bench would be a more favorable site due to improved emission dispersion characteristics (because of higher elevation) and reduced visibility from recreational areas around Lake Powell.

Based on results of this site selection study, a determination was made in May of 1971 to concentrate site sensitive studies on Nipple Bench. In June of 1973, after discussions with his staff and others, the Secretary of the Interior denied, in principle, the applications that had been submitted for the Kaiparowits Generating station to be located at Nipple Bench. Primary concerns included (1) proximity of the site to Glen Canyon National Recreation Area, Lake Powell, and the Grand Canyon, and (2) proximity of the site to the Navajo Generating station. As a result of subsequent discussions and events, it was decided that a siting study should be performed to select an alternate to the Nipple Bench site further from these locations.

A site selection process was conducted to determine additional power plant locations in southern Utah. Four prospective sites were identified for detailed study. Based on this study, Fourmile Bench was designated as the currently preferred site for the Kaiparowits generating station. However, through

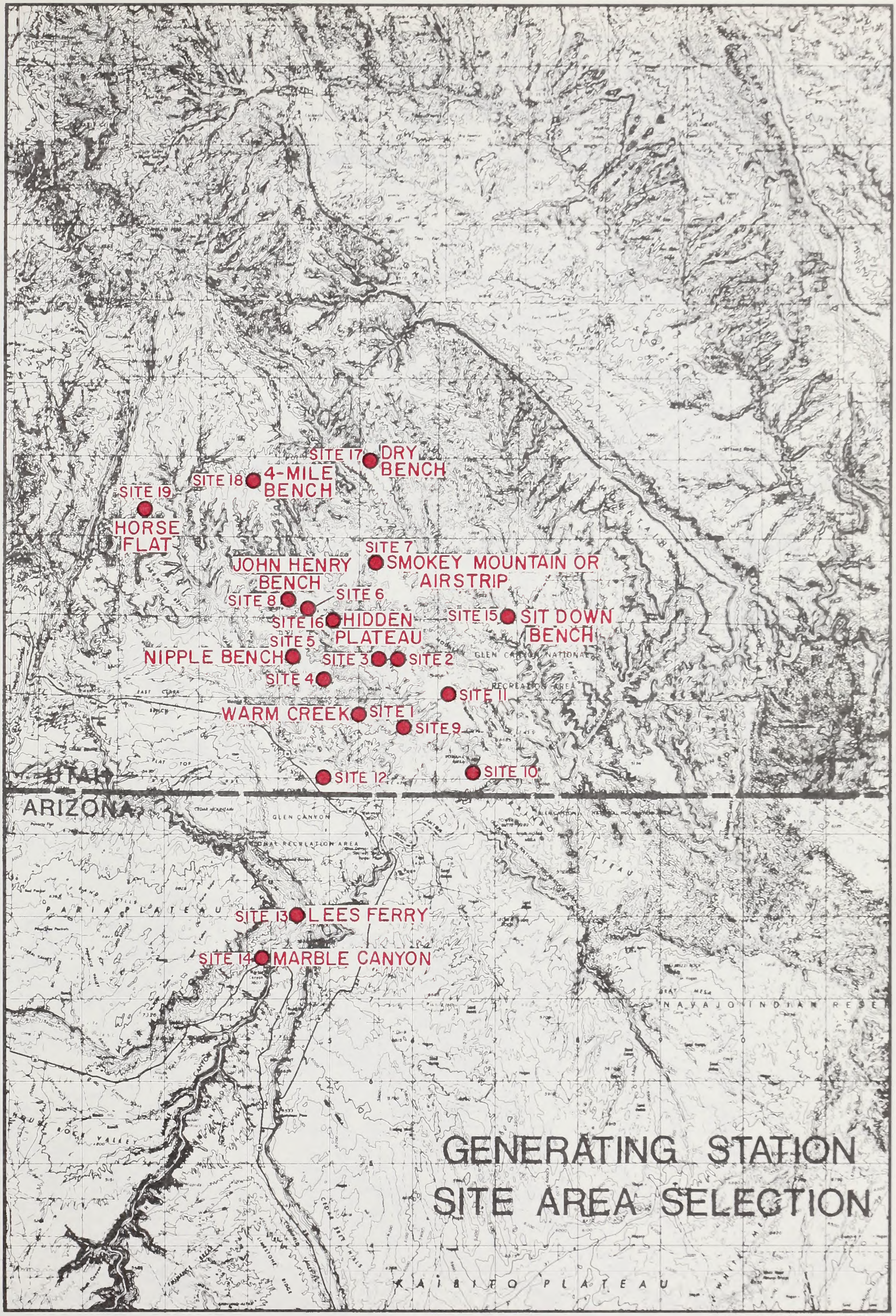


ILLUSTRATION 5

subsequent discussions, it was determined that the Nipple Bench site would remain under consideration as an alternate to Fourmile Bench. Illustration 6 shows the relative locations of both Fourmile and Nipple Bench sites.

FOURMILE AND NIPPLE BENCH SITES

ILLUSTRATION 6

Generating Plant - Fourmile Bench

Site description and arrangement

The proposed generating plant would be constructed at Fourmile Bench which is in southern Utah, approximately 16 miles north of Glen Canyon City and 18 miles northwest of Lake Powell. The proposed plant site would consist of 4,160 acres. The plant layout was determined by the participants using construction and operating constraints as well as physical and environmental considerations at the site.

Legal description of the land within the site boundaries is as follows:

Township 40 South, Range 2 East, S.L.M.

Section 9: SE 1/4

Section 10: S 1/2 and NE 1/4

Section 11: W 1/2

Section 14: W 1/2

Section 15: all

Section 16: all

Section 21: all

Section 22: W 1/2 and the W 1/2 of E 1/2

Section 27: NW 1/4

Section 28: N 1/2

The site is characterized by uneven terrain incised by two deeply cut canyons. Average elevation is approximately 6,100 feet. Slopes in the site area are as great as five percent but several rounded ridges provide suitable areas for proposed power plant facilities.

Major equipment components would be on the west portion of the site. These would include the power block, electric power switchyard, cooling towers, in-plant ash handling facilities, coal storage area, limestone preparation plant, administration building, shop and warehouse. This location would be accessible from all sides. (See Illustration 7 for site layout plans.)

In addition to vehicular access to these facilities, including for ash hauling trucks, several major systems would connect into the power block from off-site corridors. Principal transmission corridor would enter from the south and west. The switchyard would be placed so the line would exit directly into this corridor.

Water and coal supply lines would enter the site from the southeast. The water line would terminate at the reservoir from which secondary systems would supply water to plant facilities. The major amount of water would go to the cooling tower system to replace evaporation losses. The coal supply conveyor would terminate at the active and inactive coal storage areas from which the plant coal system would supply coal to the boiler units. Coal areas would be placed north of the power block where equipment would not interfere with the conveyor route.

The area immediately south of the power block is also relatively flat but access is limited on three sides by rugged canyon terrain. The participants have determined that this location would be suitable for the liquid waste evaporation ponds since little access would be required and the individual ponds could be laid out to conform roughly to land contours. These ponds would cover approximately 180 acres.

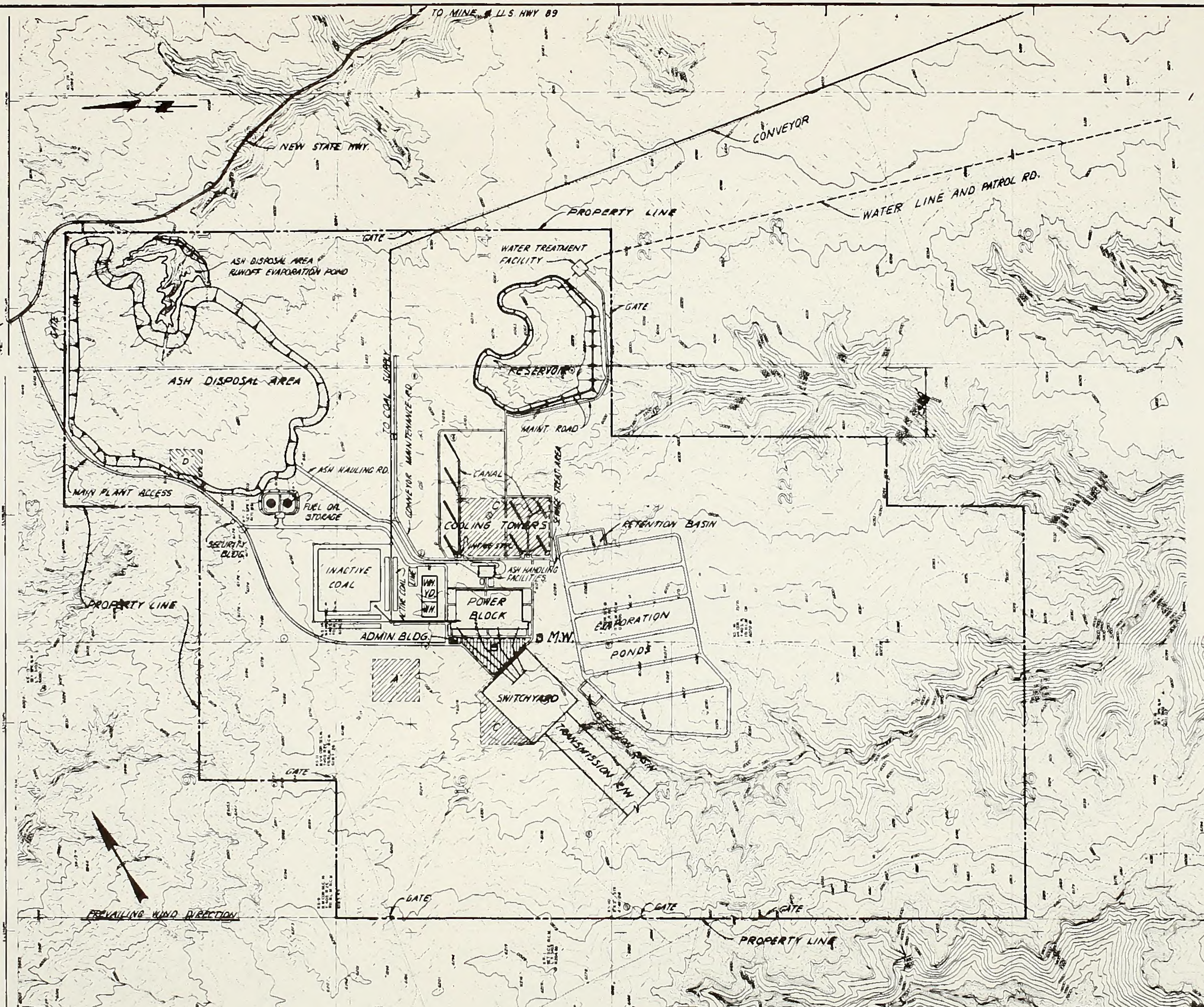
A 2,640 acre-foot reservoir and 60 million cubic yard ash and sulfur-dioxide (SO_2) sludge disposal area would be needed within the 4,160 acre site. The reservoir would be directly east of the power block, close to the entry point of the water line from Lake Powell. The disposal area would be in the northeast corner of the plant site. A 60-foot wide solid waste haul road would be out along the most direct path between ash and sludge handling facilities and the disposal area. The road would cross beneath the coal conveyor at a point where the conveyor elevates to weighing and sampling stations and would eliminate the need to construct an elaborate access crossing.

A storage facility would be required for fuel oil which would be used during unit start-up and in main coal burner ignition. Refer to fuel oil storage on page I-106. The storage area would be downwind and away from all plant facilities except the ash disposal area which would be composed of noncumbustible material.

Construction areas would be located, where possible, in areas designated for construction late in the project schedule. The cooling tower area would be used for main construction laydown. Space between the power block and switchyard would need to be graded to allow placement of transmission towers and maintain power line clearances and would provide a location for shops and offices during construction.

Participants indicate that grading of the power block and related equipment area would be accomplished as an interconnected multi-level system of essentially flat areas. The power block area would be graded entirely by cut with foundations resting on inplace material. Bearing capacities of these in-place materials are rated at 15 to 25 tons per square foot. This grading plan would result in an excess of cut material from the power block area which would be used in the ash disposal area. Following site approval and prior to actual construction, additional foundation investigation would be performed. At that time, a detailed study would be made regarding use of excavated materials as foundation subbase. If they are found suitable, a balanced cut and fill approach would be used in the power block area, eliminating a large portion of the excess material.

Elevations in areas directly related to the power block would be established largely by the power block elevation. Support buildings would be included in the power block cut to allow ready access between them. A uniform



GENERAL NOTES

1. POTENTIAL AREAS FOR USE DURING CONSTRUCTION;
   - A. CONSTRUCTION CAMP
   - B. CONSTRUCTION FACILITIES
   - C. LAYDOWN
   - D. BATCH PLANT

800 0 800 1600 2400

SCALE IN FEET
1" = 800'

SITE PLAN
FOURMILE BENCH SITE
KAIPAROWITS GENERATING STATION

ILLUSTRATION 7

grade would be established between the power block and switchyard allowing a balanced cut and fill approach in grading the switchyard. To facilitate use of open circulating water canals in the cooling tower area, some excess cut material from the power block would be used to elevate this area. The coal storage area would also be developed on a balanced cut and fill basis.

The grading design, which includes the evaporation ponds, would result in an approximate material excess of 2 1/2 million cubic yards. This material is expected to be composed mainly of sandstone rock fragments up to two feet in size and other material unsuitable for structural fill. This material would be removed to the ash disposal area and placed as a spoils pile. It would be placed with grubbed vegetation and surface blowsand that would be removed from the plant area. During plant operation, this material would be incorporated into the ash and sludge fill.

Where possible, major drainage channels would be left unimpaired by plant facilities. One major exception to this would be the channel between the power block and switchyard. The flow would be collected and carried by culvert beneath the fill and released into its natural channel on the downstream side. All plant slopes would be protected by either berms or ditches and storm waters from undeveloped site areas would, for the most part, be diverted from contact with developed areas and released. In no case would routing of storm runoff lead to an increase in runoff volume over that which existed prior to plant construction.

All rainfall runoff from material storage and construction activity area, which would include active and inactive coal storage areas would be caught in a retention basin. Other plant areas would be drained into natural channels. This plan conforms to Effluent Guidelines and Standards established by the Environmental Protection Agency. The retention basin would be equipped with an oil-water separator which would remove industrial wastes to allow release of this water to a natural watercourse once it had satisfied the Effluent Guidelines and Standards. These standards state that total suspended solids shall not exceed 50 mg/l, and the pH shall be within the range of 6.0 and 9.0. If these standards could not be met, contents of the retention basin would be pumped to the liquid waste evaporation ponds.

The retention basin would be sized on the basis of a 24-hour, 10-year recurrence interval rainfall amount (two inches in 24 hours). It would cover one acre to a depth of 15 feet including a three-foot freeboard and a maximum water level of 12 feet. A mudstone lining one foot thick would be provided to prevent degradation of ground water.

Since this basin would function only as a holding basin, it would normally be maintained at water depths of less than two feet except during or immediately following a rainfall. It would reach a maximum depth only when the previously mentioned design rainfall is met or exceeded.

A spillway would be provided in the retention basin to prevent over-topping of the containment dike in the event of rainfall exceeding the design amount. This flow would be released into a natural drainage channel.

Design criteria used for power plant

In developing quantitative data for describing design, operation and environmental impact of the Kaiparowits Project, it was necessary to employ various assumptions regarding: a) station operating conditions and b) coal characteristics. The following information is to clarify these assumed operating conditions, and quantities based on those conditions.

a) Station operation

In this document reference is made to the long-term average consumption of coal, water or some other resources. The term "long-term average" means a 35-year plant life, operating at 75 percent capacity factor. Capacity factor is the ratio between actual production and maximum production if the four units were to operate at rated full load for 24 hours per day 365 days per year. Years of operating experience with similar units has demonstrated that, because of scheduled and unscheduled equipment maintenance outages and system demand, the actual plant production over a long period of time would average approximately 75 percent of maximum potential production.

The following example may help to clarify this: "This long-term average station coal consumption would be approximately 24,730 tons of average-grade coal each day." This means if the plant were to operate for 35 years at 75 percent of maximum possible production that 24,730 tons per day of average-grade coal would be consumed (see page I-57).

The assumption that the plant would have a 35-year life does not mean that the plant would necessarily lose its usefulness at the end of 35 years. This 35 year life span is an economic consideration which means the value of the plant would be depreciated over a 35-year period. Operation of the generating station beyond this 35-year period would be dependent upon availability of coal and water resources as well as an economic assessment of continued operation.

b) Coal Analysis

The following data is abstracted from Figure 24 on Pages I-74, 75. The figure shows components of "average coal" and the "range" of sample values of low to high value coal. In describing plant operating parameters, coal quality is referred to as either average or worst-grade coal. Average-grade coal is terminology used to describe average coal and its components that could be expected to be utilized over the life of the plant. This average coal is based on samples taken from actual coal beds to be mined and takes into consideration the lowest and highest grades sampled as well as expected quantities of each grade available for extraction. As portrayed in Figure 24, it would be near a mid-range value but would not necessarily be a mean of the high and low extremes.

Worst-grade is that coal which is in the leased coal bed and which has higher amounts of impurities and lower heat value (btu's). Worst-grade coal is that lowest grade coal that would be expected to be burned for short durations.

Kaiparowits Coal Analysis (%)*

Proximate Analysis		Average	Range
Moisture		12.55	11.60 - 13.25
Ash		9.25	8.75 - 10.00
Volatile Matter		36.60	33.00 - 39.30
Fixed Carbon		41.60	38.90 - 45.45
	Total	100.00	
Sulfur		0.52	0.21 - 1.43
Heating Value btu/lb		10,800	10,600 - 11,000

* Based on 103 core samples taken from 50 bore holes during coal drilling exploration program through 1972. Results are based upon a washed coal product and are representative of actual coal to be burned at the generating station.

Emissions

When discussing emission calculations, the content of sulfur in worst-grade coal is 1.43 percent. In sizing the precipitators and other emission control facilities associated with plant operation, a value of .80 percent for sulfur content is used.

The reason for this is that 98 percent of coal found in the Kaiparowits Plateau would have a sulfur content between .20 percent and .80 percent. Less than two percent of the Kaiparowits coal would have a sulfur content between .80 percent and .85 percent and 1.40 percent and 1.45 percent. If mined at all this coal would be blended with coal in the .20 - .80 percent group, and the total would fall within the .20 - .80 percent range.

In establishing environmental and operating effects of burning Kaiparowits coal, two values must be considered: average-grade coal burned during the lifetime operation of the station; and worst-grade coal that could be expected to be burned for short durations. Use of worst-grade coal analysis is important for determining air pollution abatement systems, but average-grade coal should be used for analysis of long-term effects. (See Illustration 8.)

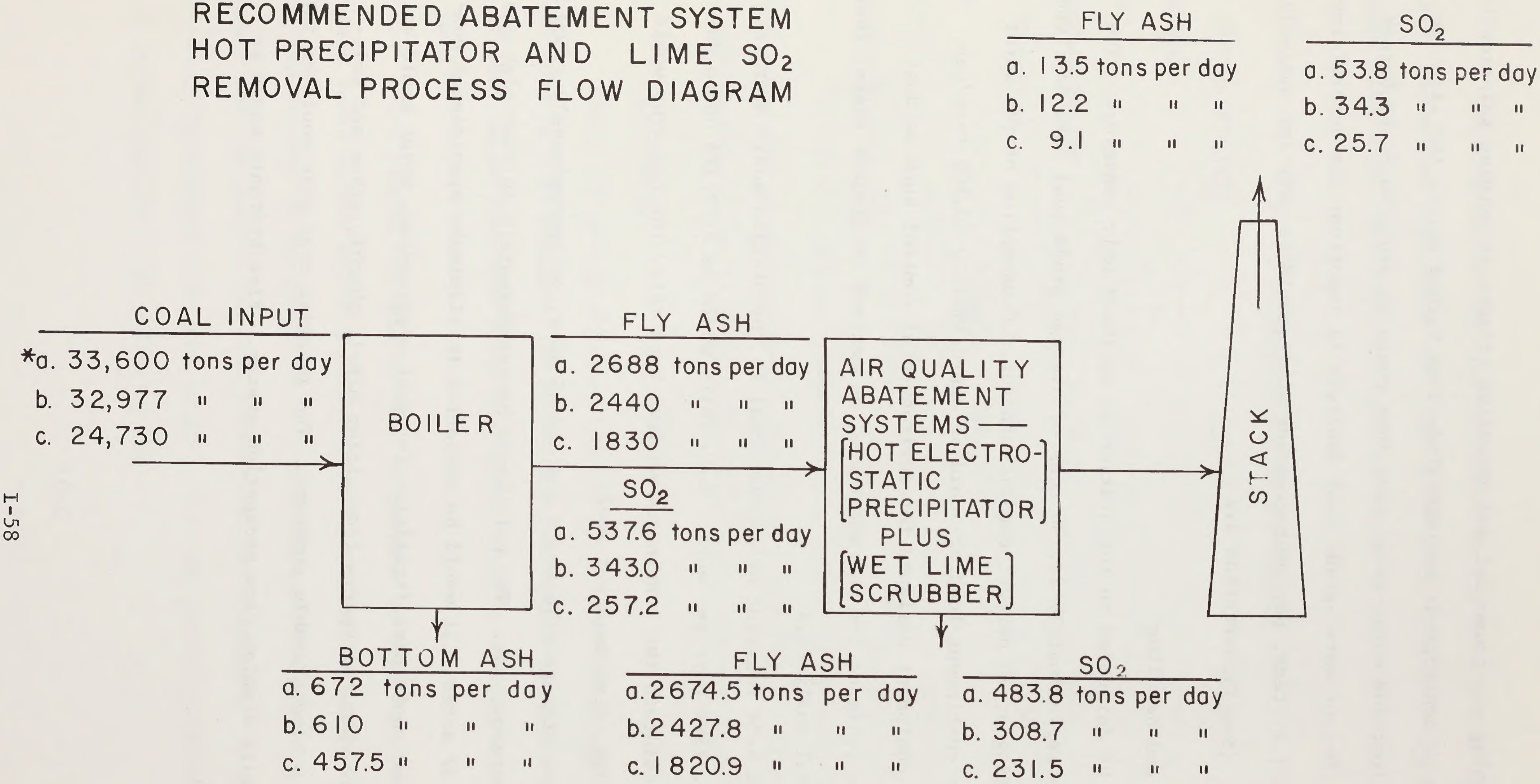
On-site coal storage and handling

Coal would be delivered to the station by enclosed belt conveyors. The station would consume approximately 24,730 tons of average grade coal each day, when all units were operating at 75 percent capacity factor. Consumption of the worst grade coal at maximum continuous loading would be approximately 33,600 tons/day. All equipment, including equipment designed for environmental control such as dust suppression, would be designed for the worst coal at maximum continuous usage. (Refer to Figure 24 for a coal analysis.)

The covered belt conveyor delivering coal to the station would operate three shifts per day, five days per week. Each shift would be of 7 1/4 hours duration. In order to maintain the continuous maximum burn rate, the conveyor would deliver 47,000 tons/day, five days per week.

The inactive storage pile would contain 45 days, or approximately 1,500,000 tons, of coal for emergency use. The pile would be approximately 40 feet high and cover approximately 32 acres. It would be compacted to eliminate spontaneous combustion potential, and would have facilities for dust suppression, which would be in the form of non-toxic chemical sparys (containing alkyl, phenol, ether and polyethylene glycol) in a biodegradable compound. The inactive coal pile would be integrated into the overall station fire protection system. Fire hydrants would be located near the pile.

RECOMMENDED ABATEMENT SYSTEM HOT PRECIPITATOR AND LIME SO_2 REMOVAL PROCESS FLOW DIAGRAM



	% ASH CONTENT	% SULFUR CONTENT	% LOAD
*a. WORST GRADE COAL	10.00	0.80	100
b. AVERAGE GRADE COAL	9.25	0.52	100
c. LIFE AVERAGE FOR AVERAGE GRADE COAL @ % LOAD	9.25	0.52	75

ILLUSTRATION 8

The active storage pile would contain approximately 200,000 tons of coal, sufficient for a six day supply. Dust suppression for the active pile would be maintained by water sprays. If this method were not successful, alternate methods would be used, such as non-toxic chemical sprays. Criteria that would determine if a particular dust suppression system were successful would be whether that system complied with the Fugitive Dust Concentration Standards. Permissible dust concentrations for working areas are stipulated by government regulations. Applicable standards are given in Figure 20.

FIGURE 20

Utah Occupational Safety and Health Rules and Regulations Regarding Fugitive Dust

Substance	Milligrams per Cubic Meter	Million Particles Per Cubic Foot
Coal Dust (respirable fraction less than 5% SiO_2*)	2.4	. . .
Coal Dust (respirable fraction more than 5% SiO_2*)	$\frac{10}{\% SiO_2+2}$	. . .
Inert or Nuisance Dust (respirable fraction)	5	15
Inert or Nuisance Dust (total dust)	15	50
Crystalline Quartz	$\frac{10}{\% SiO_2+2}$	$\frac{250}{\% SiO_2+5}$
Crystalline Quartz (total dust)	$\frac{30}{\% SiO_2+2}$	. . .

*The intent of the standard is to regulate free silica (crystalline portion, i.e., quartz.)

Coal dust would be controlled throughout the coal handling operation by using collection or suppression systems. Coal would be conveyed from the mine in a covered conveyor to the active or inactive storage areas. The open active storage would consist of two rail-mounted, combination bucketwheel stacker/reclaimers, each with a storage capacity of 100,000 tons of coal. Each stacker/reclaimer would be completely independent and have the capability of diverting varying portions of incoming coal to the plant while stacking out the rest (see Illustrations 9 and 10).

Emergency reclaim would be handled by bulldozing coal from the inactive storage pile. Coal would be pushed into the emergency reclaim hopper adjacent to the inactive storage pile. Coal would then be fed by vibratory feeders onto the station conveyor system, controlled by the level in the station surge bin.

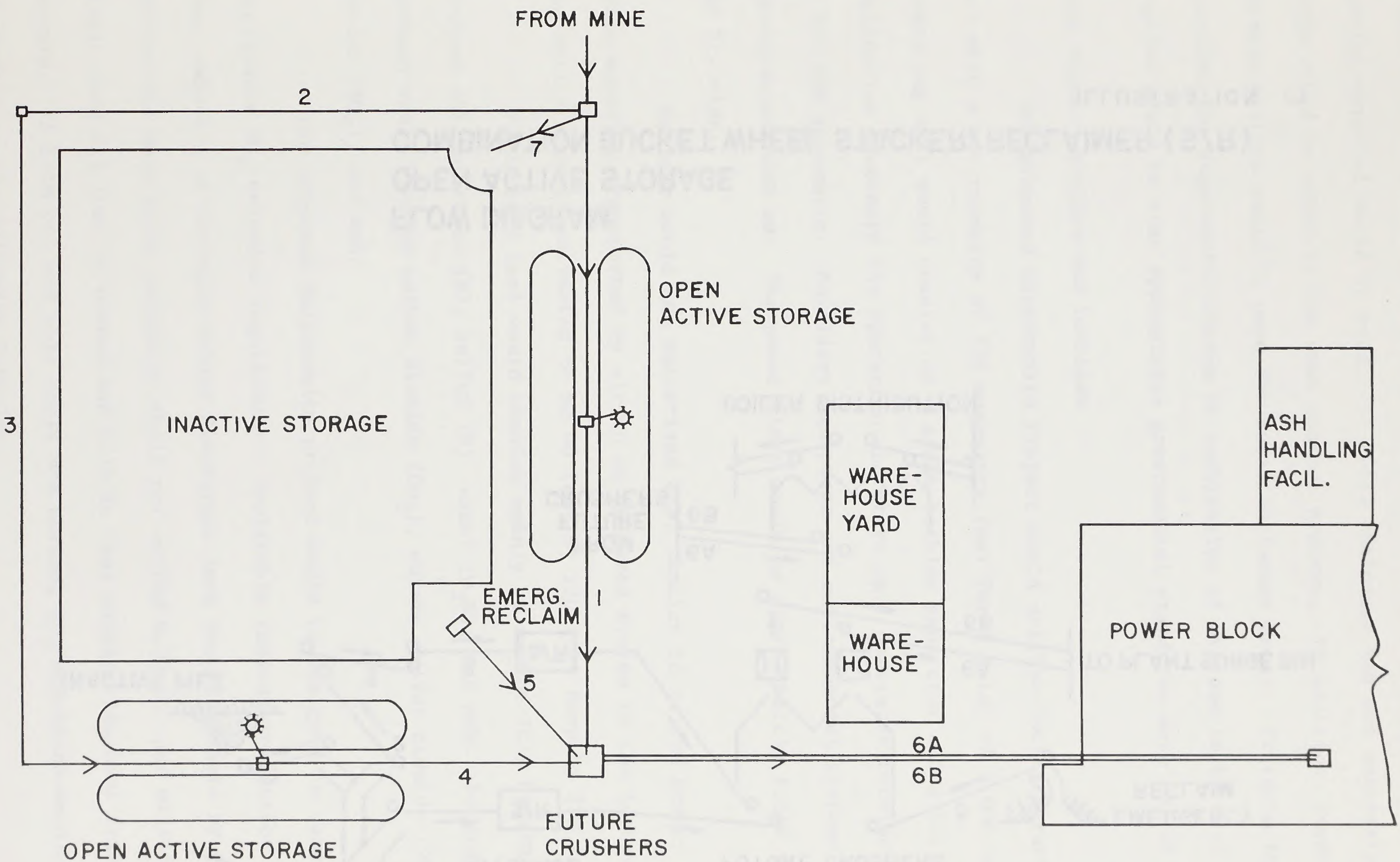
Coal reclaimed from active storage would be discharged into a splitter-diverter gate arrangement that would split the coal onto the parallel station feed belt conveyor systems as required, or fed entirely onto one system.

The fully-covered parallel station feed belt conveyor system would discharge to the station surge bin. The surge bin would be equipped with level controls that would modulate the flowrate of coal from the active or inactive storage reclaiming feeders to maintain a level in the bin within pre-set limits.

Coal would be fed from the surge bins to the conveyor system by feeders located beneath the hoppered outlets of the surge bins. The conveyor system would fill the coal storage silos. Below each silo the coal would flow through a feeder to its associated pulverizers. After the pulverizers reduce the coal to talcum-powder size, it would then be blown into the boiler and burned.

Dust suppression and/or collection systems would be used at all locations shown below in forms indicated in parentheses.

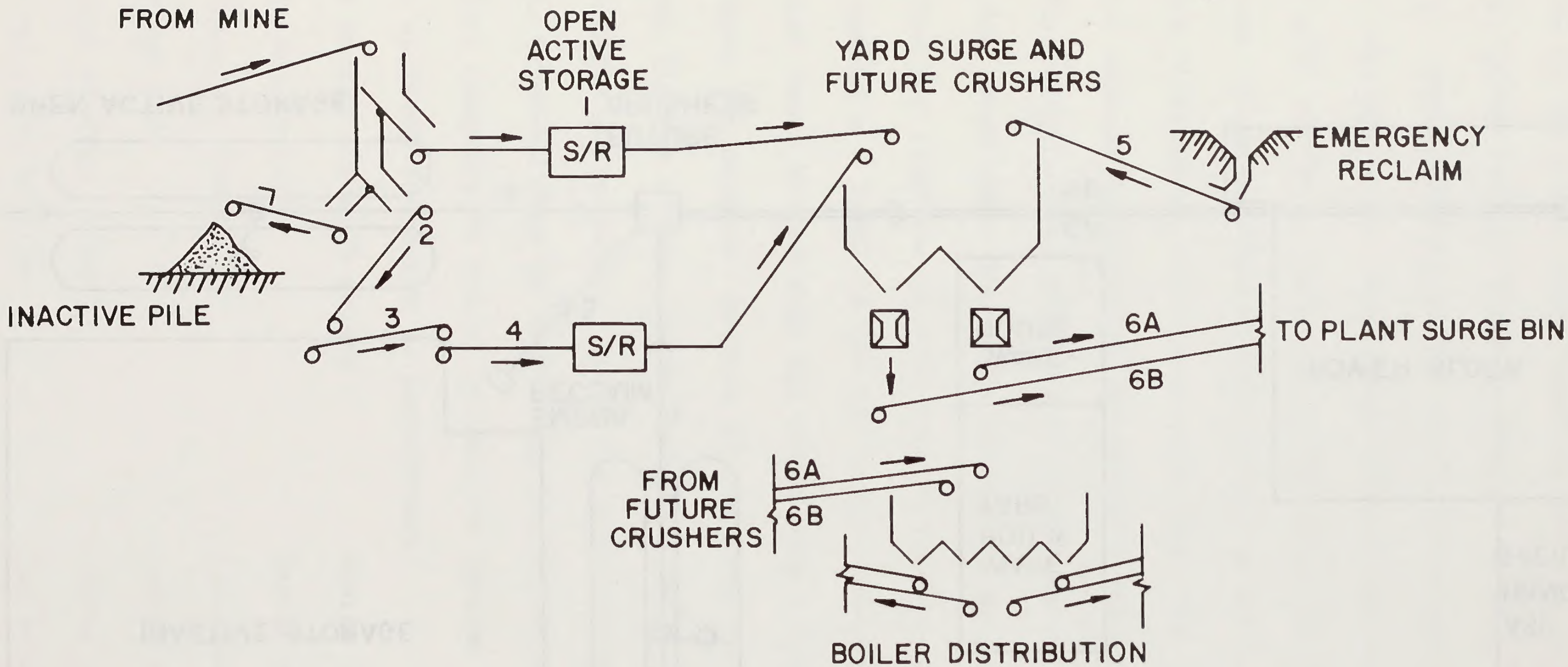
Transfer areas-25 points	(water sprays)
Active storage	(water sprays)
Inactive storage	(non-toxic chemical sprays)
Surge bins	(water sprays)
Coal storage silos	(water sprays)
Coal pulverization	(total enclosure)
Coal sampling station	(total enclosure)



SCALE: 1" = 400'

PLOT PLAN
OPEN ACTIVE STORAGE
COMBINATION BUCKET WHEEL STACKER/RECLAIMER

ILLUSTRATION 9



FLOW DIAGRAM
OPEN ACTIVE STORAGE
COMBINATION BUCKET WHEEL STACKER/RECLAIMER (S/R)

ILLUSTRATION 10

If water sprays were not successful in some area, non-toxic chemical sprays would be used. If non-toxic chemical sprays were not successful in the inactive storage a paving material would be used. If total enclosure was not successful, water sprays would be added to the dust control systems. In addition, hoods, fans and suitable filters would be used for total enclosure areas. Criteria that would determine the suppression system or combination of systems to be used at any location would be that appropriate governmental standards were met or surpassed.

Power block - boilers and turbines

The proposed Kaiparowits Project would utilize four generating units each with a net capacity of 750 megawatts (mw) for a total of 3,000 mw. Each generating unit would consist of a steam turbine generator and a boiler with all auxiliaries necessary for operation and start up. Generator terminal output would be 845,000 kilowatts. Auxiliary equipment and environmental systems load would be approximately 100 mw. The power block would be approximately 1,500 ft. long and 750 ft. wide.

Boilers would use pulverized coal similar to talcum powder in consistency, which would be transported by air in an enclosed system to the furnace and burned. The boiler size is estimated to be 90 feet by 120 feet deep by 250 feet high.

Pulverized coal would consist mainly of carbon (C), hydrogen (H), oxygen (O), nitrogen (N), sulfur (S), water (H_2O), and ash. Burning coal in the furnace would produce carbon dioxide (CO_2), water, sulfur dioxide (SO_2), nitrogen oxides (NO_x), and ash.

The proposed Kaiparowits project would be designed to comply with all applicable NO_x emission regulations. Applicable federal regulation stipulates that emission of nitrogen oxides discharged into the atmosphere by each auxiliary boiler and main steam generator shall not exceed 0.30 lb. per million btu heat input when oil fuel is burned and 0.70 lb. per million btu heat input when coal is burned. If both oil and coal fuels are burned, NO_x emissions would be limited according to the following formula:

$$\frac{x\ (0.30) + y\ (0.70)}{x + y} = lb/10^6\ btu\ (as\ NO_2)$$

where: x is the percent of total heat input derived from oil fuel, and,

y is the percent of total heat input derived from coal fuel.

According to the participants, steam generating equipment (boilers) would be supplied by Babcock & Wilcox and would be designed to reduce the formation of NO_x. This is usually done through reducing the peak combustion temperature in the furnace by promoting slow, even combustion uniformly throughout the furnace. Even with boilers designed to reduce formation of NO_x, 250 tons/day of nitrogen oxides would be emitted to the air.

In addition to meeting the above emission limit, an instrument for continuously monitoring and recording emissions of nitrogen oxides would be provided for both the main and auxiliary boilers. Proof of compliance with emission limits would be provided to regulatory agencies as required.

Number 4 or lighter weight fuel oil would be used to supply the main boiler ignition systems and auxiliary boilers during startup. For additional discussion on the fuel oil system see page I-105.

Auxiliary boilers would consist of two to four boilers with a total steam output of approximately 600,000 pounds per hour at 400 to 600 (pounds per square inch gauge) (psig) pressure and 630°F. Each auxiliary boiler would be approximately 40 to 50 feet long, 10 to 15 feet wide and 15 to 20 feet high. Each boiler would have a stack approximately 70 to 90 feet high with a bottom outside diameter of 6 to 9 feet and a top outside diameter of 6 to 8 feet. The auxiliary boilers would use approximately 200 barrels per hour of Number 4 fuel oil or a lighter weight fuel oil. Combustion would take place in each auxiliary boiler in its pressurized furnace, using forced draft fans. The auxiliary boilers would have a complete automatic combustion and flame safeguard system.

The first year of plant operation would require approximately 1,000,000 barrels of fuel oil transported to the plant by truck. The quantity is expected to be reduced to 200,000 barrels per year after five years of plant operation.

Each of the four main boilers would have its own stack. Each stack would be approximately 600 feet high with a bottom outside diameter of approximately 50 feet and a top outside diameter of 30 feet. Stack lighting would be in accordance with Federal Aviation Administration regulations and standards pertaining to "Obstruction Marking and Lighting." Strobe lighting would be used during daylight hours and red warning lights during night hours.

Plant lighting would be designed to give necessary lighting to objects for safety and operational needs on a localized basis. High intensity general lighting would be kept to a minimum. The detailed lighting design would call for warm light as produced by sodium vapor fluorescent or incandescent lamps. Fixtures producing direct lighting would be used for localized and object lighting. Flood lights would be selected for road, perimeter, and area lighting.

To provide employee protection in compliance with Occupational Safety and Health Act Requirements, working stations of employees would be monitored and noise controls applied where required. In addition, employee working schedules would be adjusted to reduce employees' exposure to high noise levels. Hearing protection would be provided when work was required in high noise areas. Noise generated by the facilities would be monitored 30, 60, and 90 days after startup of each facility to verify that projected noise levels are achieved.

The participants state that the plant would be designed to meet a minimum static seismic criteria at ground level of 0.15 gravity horizontal and 0.1 gravity vertical.

Particulate and SO_2 removal system

Participants have stated that the proposed Kaiparowits project would comply with applicable federal, state and local air quality and emission standards and would attain the following levels of emission control: 90 percent sulfur-dioxide (SO_2) removal and 99.5 percent particulate removal. Applicable federal and state regulations dealing with particulate and SO_2 emission levels are shown in Figure 21. For comparison purposes, abated and unabated emission levels are shown in Figure 22.

According to the participants' studies, the most proven and reliable particulate removal systems which would meet applicable government regulations and the project's plume opacity and emission control requirements would be a hot precipitator followed by a wet lime SO_2 scrubbing system. A brief description of these two systems which participants propose to use follows.

Hot electrostatic precipitator

An electrostatic precipitator (Illustration 11) consists of a rectangular box-type structure where a number of sections of vertical metal plates are used to form flow channels for the dust-laden flue gas. In the middle of each flow channel, metal wires are secured parallel with the plates at proper intervals along the flue gas flow direction. High direct current voltages are applied across wires and plates to form a strong electrical field.

Particles in flue gas obtain negative charges from discharge electrodes (the wires), move across the gas stream, and deposit on surfaces of metal plates (collecting electrodes). When deposited dust reaches a certain thickness, devices called rappers or vibrators are used to generate a proper magnitude of vibration on the collection plates, which removes the dust from the collecting electrodes. Dust deposits fall down to hopper areas by their own weight. At the bottom of each hopper, a valve controls the speed and manner of the dust material (fly ash in a coal-fired station) removal.

A hot electrostatic precipitator is designed to operate in a temperature range between 600° and 850° F with low sulfur coal such as that intended for use in the Kaiparowits Project. Its fly ash resistivity (this affects fly ash particle migration velocity) will fall in the ideal precipitation zone of 1.0×10^6 to

FIGURE 21

Kaiparowits Generating Station
Plume Opacity, Particulate and SO_2 Removal Requirements

Abatement Equipment Efficiency needed to meet standard for worst grade coal condition

Item	Particulate	SO_2	Plume Opacity
National (EPA, 1971)	98.7%	20.5%	20% opacity for new equipment
Utah (1972)	NA	80%	Ringelmann[a] #1
Arizona (1973)	99.4%	47.0%	Ringelmann #2
Design Criteria	99.5%	90.0%[b]	To meet Ringelmann #1 requirement

[a]Ringelmann - a chart published by the U. S. Bureau of Mines (Information Circular 7718) which illustrates graduated shades of grey to black for use in determining the light obscuring capability of particulate matter.

[b]Expected removal efficiency based on the results of approximately 5,000 hours of SO_2 scrubber testing at the Mohave Generation Station.

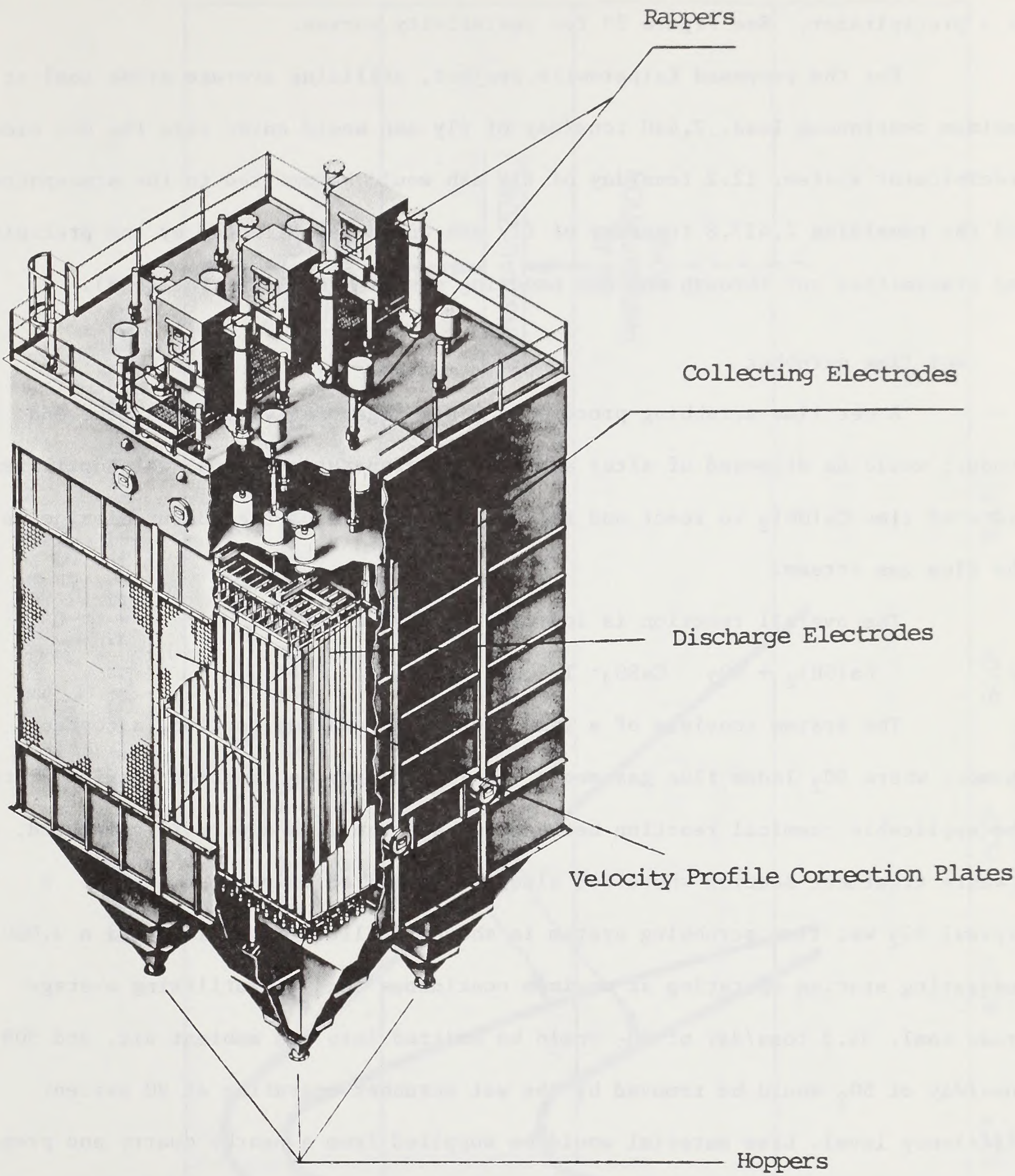
FIGURE 22

Emission Rate
(Abated Versus Unabated Conditions)
Kaiparowits Generating Station
(at full capacity, using average-grade coal)

Item			Particulate (Ton/day)	SO_2 (Ton/day)	Plume Opacity
UNABATED	Average Grade Coal @ 32,977 tons/day		2440	342.97	> Ringelmann #1 *
UNABATED	Worst Grade Coal @ 33,600 tons/day		2688	537.6	> Ringelmann #1
ABATED	Hot Precipitator @ 99.5% Particulate Removal; Scrubber 90% SO_2 Removal	Avg. Grade Coal	12.2	34.3	< Ringelmann #1
ABATED		Worst Grade Coal	13.5	53.76	< Ringelmann #1
ABATED		Lifetime Average On Daily Basis	9.1	25.7	< Ringelmann #1

> Greater than
< Less than

*Ringelmann - A chart published by the U. S. Bureau of Mines (Information Circular 7718) which illustrates graduated shades of grey to black for use in determining the light obscuring capability of particulate matter.



TYPICAL ELECTROSTATIC PRECIPITATOR

ILLUSTRATION II

2.5×10^{10} ohm-cm, which gives the highest particle migration velocity attainable by a precipitator. See Figure 23 for resistivity curves.

For the proposed Kaiparowits project, utilizing average grade coal at maximum continuous load, 2,440 tons/day of fly ash would enter into the hot electrostatic precipitator system, 12.2 tons/day of fly ash would be emitted to the atmosphere and the remaining 2,427.8 tons/day of fly ash would be collected by the precipitator and transmitted out through the ash handling system (see Illustration 8).

Wet lime scrubber

A wet lime scrubbing process is a non-regenerative process (the end product would be disposed of after a number of preparation steps) which utilizes hydrated lime $Ca(OH)_2$ to react and remove a major part of the sulfur dioxide in the flue gas stream.

The overall reaction is indicated by the equation:

$$Ca(OH)_2 + SO_2 \rightarrow CaSO_3 \cdot 1/2\ H_2O + H_2O$$

The system consists of a lime slurry preparation section, a contact chamber where SO_2 laden flue gas meets the lime slurry, a reaction section where the applicable chemical reaction between SO_2 and the lime slurry is completed, and a waste treatment section where wet sludge is prepared prior to disposal. A typical SO_2 wet lime scrubbing system is shown in Illustration 12. For a 3,000 mw generating station operating at maximum continuous load and utilizing average grade coal, 34.3 tons/day of SO_2 would be emitted into the ambient air, and 308.7 tons/day of SO_2 would be removed by the wet scrubber operating at 90 percent efficiency level. Lime material would be supplied from a nearby quarry and prepared on site. Wastes produced would consist mainly of fly ash, scrubber sludge and waste water.

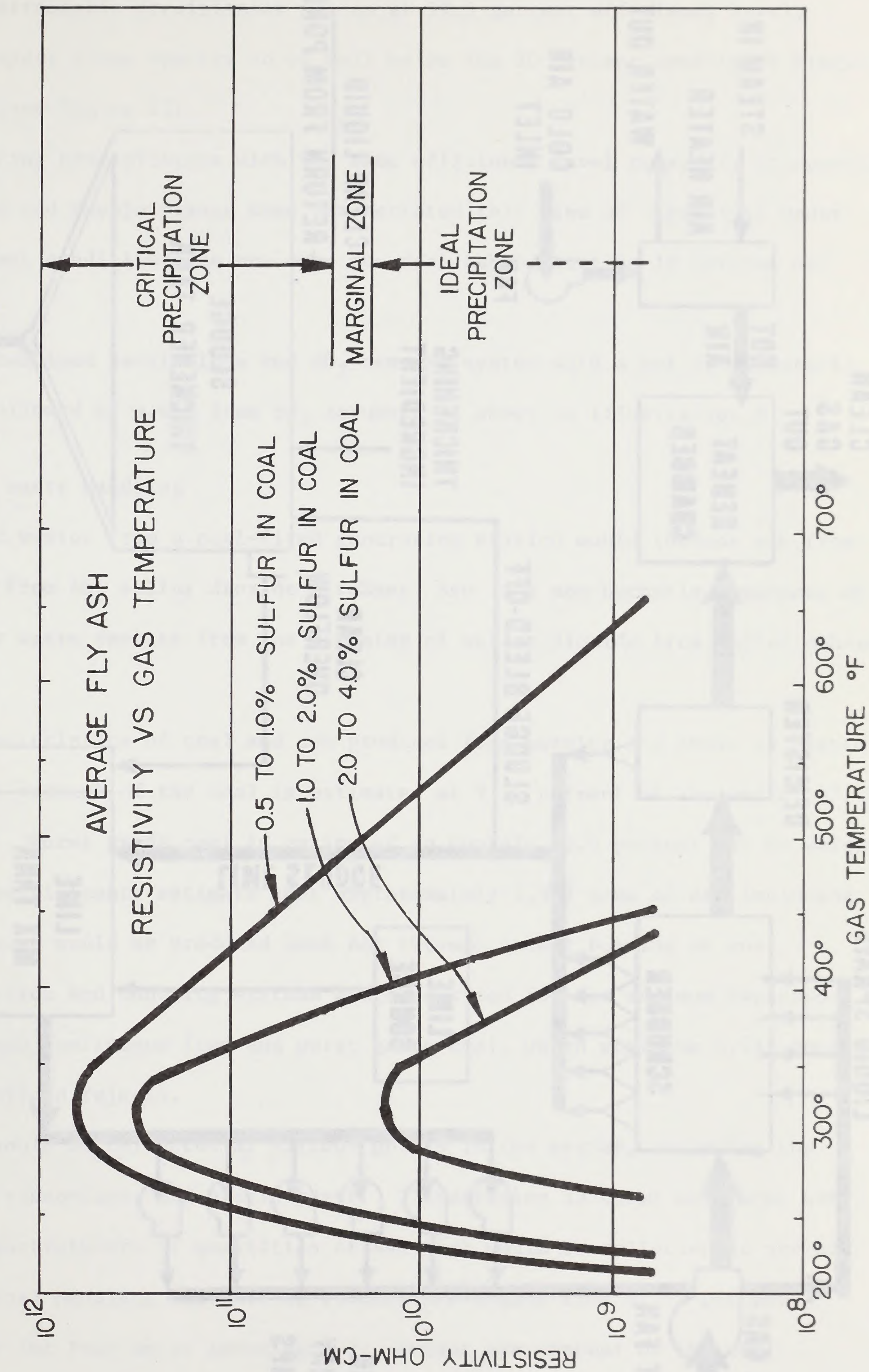
Plume opacity

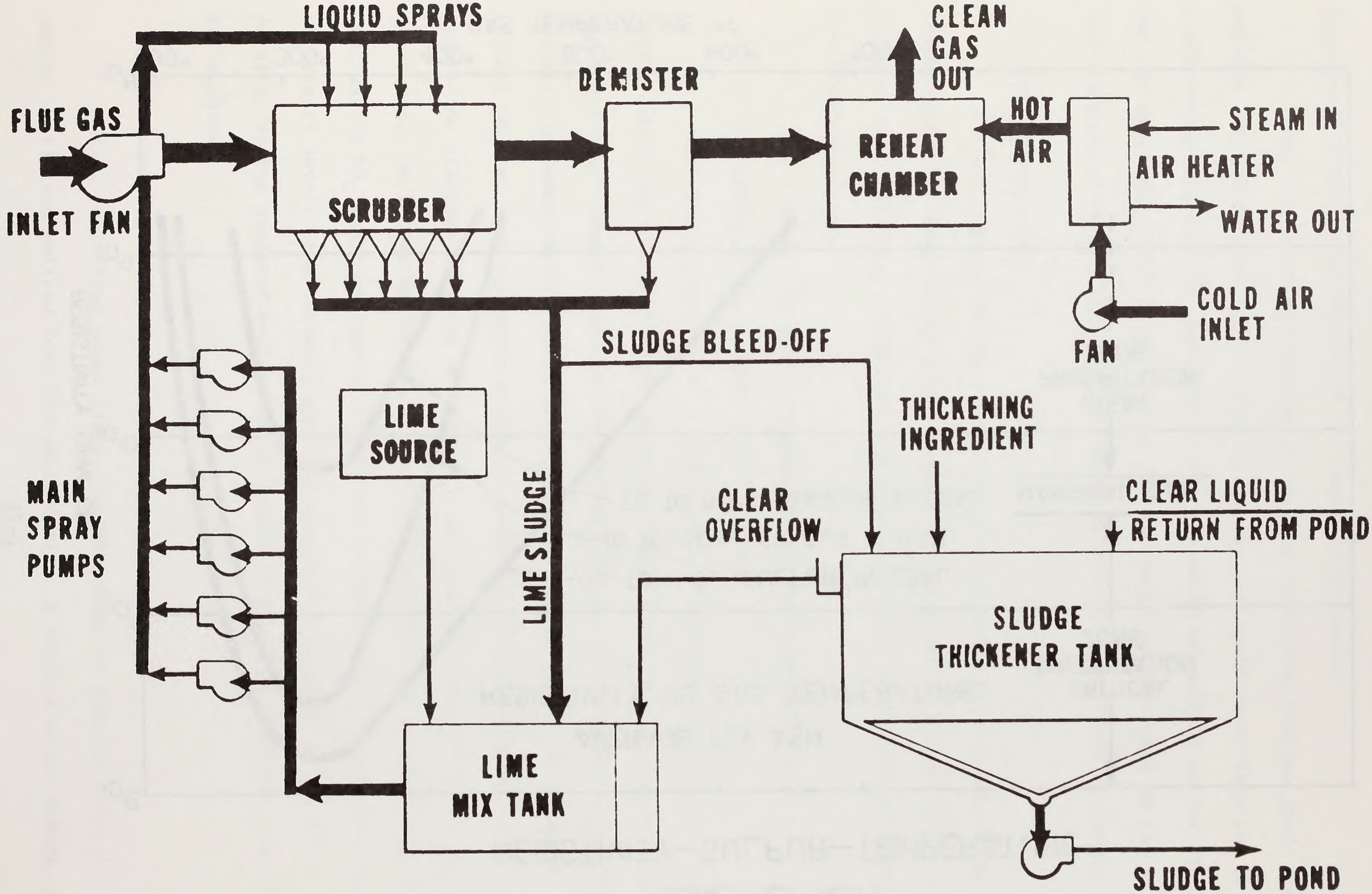
In a coal-fired power plant, visible plume is closely related to the amount of fly ash emitted into the ambient air. A visible plume usually results

FIGURE 23

COAL FLY ASH

RESISTIVITY—SULFUR—TEMPERATURE





TYPICAL WET SO_2 LIME SCRUBBING SYSTEM

ILLUSTRATION 12

when heavy particulate concentration exists in the outlet flue gas stream. However, with a hot electrostatic precipitator system at 99.5 percent efficiency level, participants expect plume opacity to be well below the 20 percent opacity or Ringelmann #1 limitation (see Figure 21).

Existing precipitators with the same efficiency level presently in operation at the San Juan and Navajo plants have demonstrated this kind of capability under more severe input conditions (in one case the coal ash content is 18 percent or greater).

The combined particulate and SO_2 removal system with a hot electrostatic precipitator followed by a wet lime SO_2 scrubber is shown in Illustration 8.

In-plant solid waste handling

Solid wastes from a coal-fired generating station would include ash from coal and waste from the sulfur dioxide scrubber. Ash is a non-burnable component of coal. Scrubber waste results from the cleaning of sulfur dioxide from boiler exhaust gases.

Characteristics of coal and ash produced from burning are shown in Figure 24. Average ash content of the coal is estimated at 9.25 percent of the weight of the coal delivered. Worst grade coal is estimated to contain 10.0 percent ash by weight.

The participants estimate that approximately 2,529 tons of ash including pulverized rejects would be produced each day through normal burning of coal. However, collection and handling systems would be sized for the maximum expected amount at maximum continuous load and worst grade coal, which would be 3,717 tons/day, including pulverized rejects.

Ash would be collected at various points in the system, including the boiler bottom, economizer, and precipitator. Illustration 13 shows estimates submitted by the participants of quantities of ash that would be collected at various points in the coal handling and burning process for a mass flow at 75 percent capacity factor for four units assuming 9.25 percent ash content of the coal.

FIGURE 24

Burned Coal Analysis by Resources Company

Proximate Analysis - %	Average*	Range
Moisture	12.55	11.60 - 13.25
Ash	9.25	8.75 - 10.00
Volatile Matter	36.60	33.00 - 39.30
Fixed Carbon	41.60	38.90 - 45.40
Total	100.00	
Sulfur	0.52	0.21 - 1.43
Heating Value, btu/lb. (as received)	10,800	10,600 11,000
Ultimate Analysis - %		
Moisture	12.55	11.60 - 13.25
Carbon	61.32	58.60 - 63.60
Hydrogen	4.33	3.90 - 4.75
Nitrogen	0.95	0.45 - 1.30
Chlorine	0.02	0.00 - 0.06
Sulfur	0.52	0.21 - 1.43
Ash	9.25	8.75 - 10.00
Oxygen (by differential)	11.06	9.72 - 12.55
Ash Fusion Temperature - °F		
Reducing - Initial def.	2235	2070 - 2700+
- Soft (H=W)	2300	2130 - 2700+
- Soft (H=1/2W)	2385	2145 - 2700+
- Fluid	2510	2155 - 2700+
Oxidizing - Initial def.	2265	2135 - 2700+
- Soft (H=W)	2360	2150 - 2700+
- Soft (H=1/2W)	2445	2210 - 2700+
-Fluid	2580	2220 - 2700+

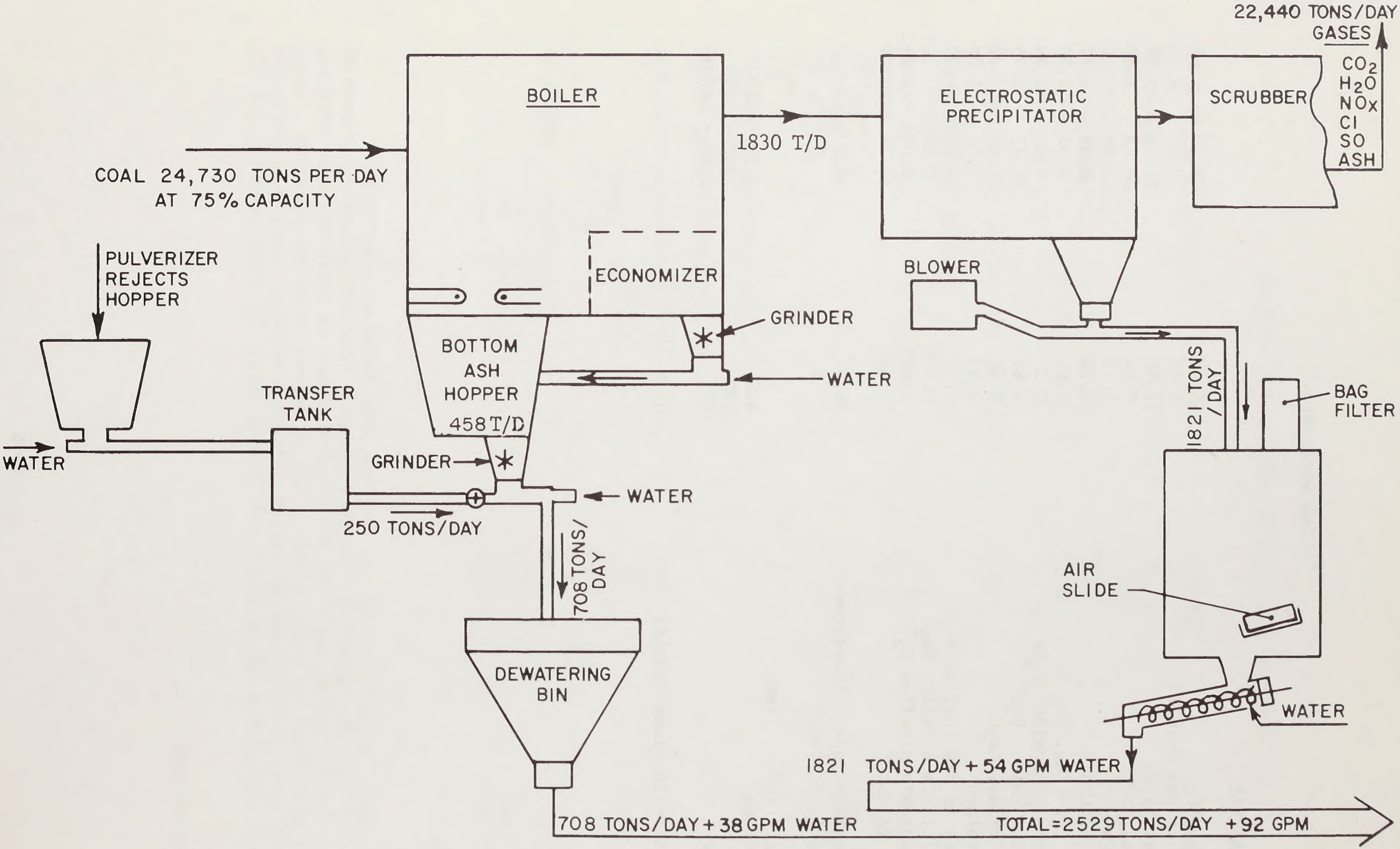
* The table is based upon analysis of 103 core samples taken from 50 bore holes during the coal drilling exploration program through 1972. Analyses were performed by Commercial Testing and Engineering Company in Denver, Colorado and were checked by the Colorado School of Mines Research Institute in Golden, Colorado. Results are based upon a washed coal product and are representative of actual coal to be burned at the generating station.

(Continued)

FIGURE 24 (contd.)

Ash Analysis

Silica, SiO_2	55.44	41.33 - 74.60
Ferric oxide, Fe_2O_3	4.97	2.20 - 9.50
Alumina, Al_2O_3	17.81	11.91 - 29.30
Titania, TiO_2	0.94	0.58 - 1.30
Lime, CaO	9.13	1.50 - 22.00
Magnesia, MgO	2.04	0.31 - 4.97
Sulfur trioxide, SO_3	6.86	0.34 - 14.90
Phosphate pentoxide, P_2O_5	0.27	0.04 - 1.94
Potassium oxide, K_2O	0.61	0.15 - 1.75
Sodium oxide, Na_2O	1.50	0.68 - 3.30
Undetermined	0.43	0.01 - 1.06
Alkalies in dry coal as Na_2O	0.17	0.03 - 0.37
Water soluble alkalies Na_2O	0.058	0.038 - 0.101
Water soluble alkalies K_2O	0.003	0.001 - 0.013
Silica Value	77.31	50.24 - 94.09
Grindability index (Hardgrove)	46.5	38.9 - 52.6
Free Swelling index	1	0 - 2
Viscosity - Crit. temp.		
Poises	640	28 - 1140
°F	2580	2360 - 2645
T_{250} °F	2655	2135 - 3000+
Disposal - in place density	60 lb./ft.^{3}	



SOLID WASTE QUANTITIES MASS FLOW AT 75% CAPACITY - TOTAL 4 UNITS 9.25% ASH

ILLUSTRATION 13

Ash handling

The three types of ash that would be collected are bottom ash, fly ash, and economizer ash. Bottom ash and economizer ash are larger in size and would be collected at the bottom of boiler furnaces. Fly ash is a very fine material that would be collected by electrostatic precipitators.

Anticipated quantities of ash that would be collected under the worst conditions (highest ash content in coal during maximum continuous load) are as follows:

Bottom Ash and Economizer ash	672	tons/day
Pulverizer Mill Rejects	370	tons/day
Precipitator Fly Ash	2,675	tons/day
	3,717	

Bottom ash

Maximum furnace-bottom ash, including economizer ash, and pulverizer rejects would be 672 tons/day and 370 tons/day, respectively. The furnace-bottom ash and pulverizer rejects would be collected and stored in multi-compartmented, water-impounded, gravity-fed type bottom ash hoppers, which would be emptied once each eight-hour shift.

Bottom ash would be flushed with water from hoppers, forming an ash-water slurry. The ash-water slurry would be passed through crushers and pumped via pipeline to dewatering bins, where it would be dewatered and stored.

Dewatering bins would be equipped with decanting and draining elements to remove residual water before unloading the bottom ash to trucks for deposit in the ash disposal area. Decanted and drained water would flow by gravity to settling tanks, where solids suspended in the water would settle and be removed by pumping back to the dewatering bins. Water in settling tanks would overflow to surge tanks where it would be recirculated in a closed-loop system for impounding furnace ash hoppers and providing water for bottom ash removal operations. Makeup to the closed loop system would be required to replenish the losses due principally to evaporation in the water-impounded furnace ash hoppers, water trapped in the furnace ash particles during truck unloading operation, and water added to the fly ash for dust minimization and compaction purposes.

The pulverizer would have a reject storage hopper with a jet pump that would convey the rejects to a transfer tank. Upon completion of the bottom ash removal operation, the transfer tank would be unloaded into the suction of the ash pumps and discharged to the dewatering bins also.

Trucks would be used to haul ash from the dewatering bins to the disposal site.

Fly ash

Fly ash collected in the precipitator hoppers would be removed by a positive pressure pneumatic system to storage silos.

A set of bag filter dust collectors would also be provided at each silo for separating the fly ash from the transport air. Ash would be removed from the silos periodically (once in each eight-hour shift). Water would be added to the dust to obtain the proper moisture content for placement and compaction in the disposal area. The addition of water at the fly ash unloader would minimize dusting problems associated with the operation of unloading ash to haul trucks. From past experience, the participants estimate that 20 percent water content by weight would be required for dusting control and compaction requirements.

Economizer ash

Ash collected in the economizer would be dry. Upon leaving the economizer hopper, the ash would enter a crusher where sufficient water would be added to form a slurry. The slurry would flow by gravity into the bottom-ash hopper where it would be handled in the same manner as bottom ash, since it would be of similar composition.

Scrubber waste handling

This waste would be formed by the wet scrubbing process that would take place in the sulfur dioxide (SO_2) scrubber unit. The scrubber is a mechanical device whereby SO_2 gas and some particulates are removed from flue gases which pass through the scrubber. The scrubber is expected to produce 1,340 tons/day of sludge from the worst grade coal at maximum continuous load.

The sludge (mainly calcium sulfate and water) would be collected in a holding tank at the end of the scrubber operation. At this point, the sludge would be in a semi-solid state containing approximately 29 percent solids. In this condition, the sludge would not harden without a significant amount of water removal. In order to improve engineering compaction properties of this material, fly ash would be added to absorb excess water from the sludge. A moisture content of approximately 27 percent would be attained for truck delivery to and placement in the ash disposal area.

Sludge and ash would be mixed, similar to a batch plant operation, at the plant prior to placement in trucks. The mixing operation would take place as sludge and ash are dumped from separate hoppers into trucks. Ash which would not be used in the mixing operation would be handled and disposed of as described previously. Dust control would occur due to the moist condition of the combined sludge and ash mix.

Ash and scrubber waste disposal

According to the participants, landfill has been selected for final disposal of ash and scrubber waste. The ash would be similar to a silty soil material, and this type of landfill would be similar to an earth embankment or large fill which has been excavated and recompacted.

The landfill site would be in the northeast corner of the plant site. This proposed location is approximately one mile from the ash storage silos and dewatering bins of the power block (see Illustration 14).

The disposal site would be in a natural drainage area at the head of Wesses Canyon, which would be in a different drainage than the evaporation ponds and reservoir. Location of the disposal area at the crest of the tributary drainage area would minimize any possibility of floodwater drainage to the ash disposal area containment dikes or retention basin structures.

Total amount of waste that would be placed in the disposal area, including contingency material, would amount to approximately 60 million cubic yards, and would consist of 40 million cubic yards of ash, 16 million cubic yards of scrubber sludge, 2.5 million cubic yards of excavated material, and 1.5 million cubic yards of limestone kiln waste. The resulting total disposal area would cover approximately 450 acres at an average depth of about 90 feet.

Ash and sludge would be transported to the disposal site by trucks. Based on previous experience at other plants, rear dump trucks have been selected. For both ash and sludge, seven diesel trucks would be used with a 69-ton payload capability. Based on four-unit operation, the 30-minute round trip haul distance would be approximately two miles with each truck making 15 trips per day. One additional truck would be available as a spare. Diesel fuel would be used to power the trucks.

The truck haul road would be paved with asphalt. Spur roads for ash placement would be constructed as needed over the ash pile and would be stabilized with a cementing agent.

According to the participants, the ash would be hauled from the plant with sufficient moisture to prevent dust from forming during unloading and spreading operations and for proper compaction. Moisture content for this condition would be approximately 27 percent.

Ash placement in the disposal area would be staged in periods of from five to ten years. A single stage would involve placing the ash by layers in a section of the total disposal area. Size of the section would depend on terrain,

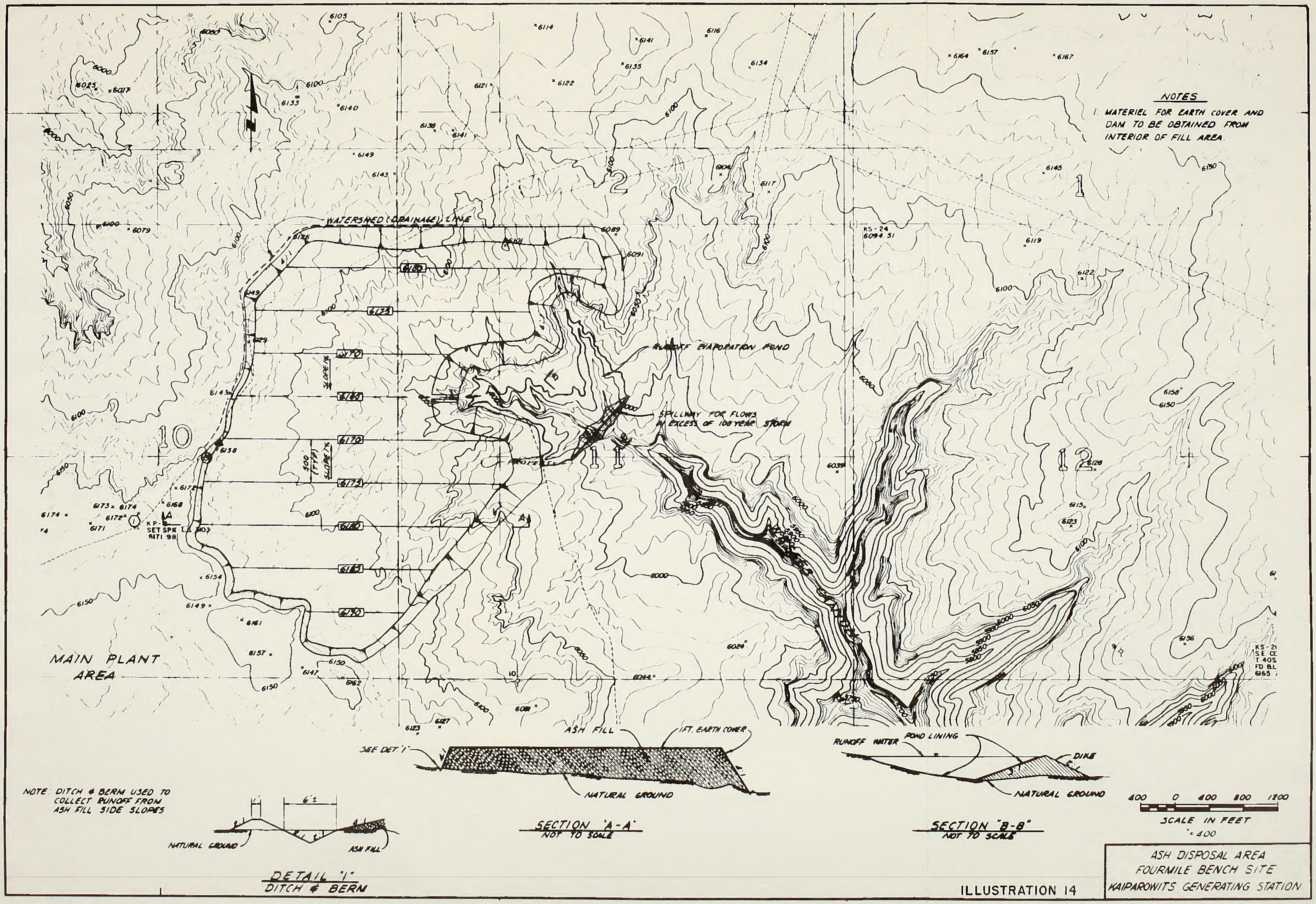


ILLUSTRATION 14

drainage and exposure conditions of the area. Basically, the section would be a single drainage area isolated by ridge lines which would tend to form a low profile fill area. Three to seven of these isolated sections would be created over the life of the plant. The staging method would eliminate preparation of the entire ash fill area during initial construction. The ash haul contractor would be responsible to clear the fill area and construct drainage structures as he proceeds with the filling operation. This procedure would be similar to normal sanitary landfill operations and, according to the participants, is currently being used successfully at the Southern California Edison Mohave Generating Station and at the Salt River Project's Navajo Generating Station. The participants also state that such staging would be highly advantageous if a commercial use of the ash were developed at some point during the life of the facility.

The ash would be spread as a compacted engineering fill by trucks which would unload while traveling across the fill section. Participants state that sufficient compaction would be obtained by the trucks traversing the ash and by tractors which would be used to spread the ash. Slopes in the ash fill would be a maximum of four horizontal to one vertical.

After the ash has been placed to its greatest depth in a section, the exposed surface would be blended with SO_2 scrubber sludge prior to placement. This mixture would set up into a mortar-like crust which would be chemically stable and relatively impervious.

According to studies by the participants, water would percolate through ash at a rate similar to that of a confined silt (about 200 feet per year). When ash and sludge are combined, the percolation rate would be about 20.0 feet per year.

The ash/sludge mixture in the waste disposal area would be about three parts ash to one part sludge. The sludge would be similar to the SCE Mohave Generating Station sludge, which consists of:

Waste Materials	Percent
Calcium sulfate	83.83
Calcium sulfite	0.02
Calcium carbonate	0.36
Sodium sulfate	2.40
Magnesium sulfate	1.04
Fly ash and inerts	10.20
Free water	1.70

An earth cover, one-foot thick, would be placed and compacted over the crust. The cover would be graded and sloped to drain to a collection pond at the downstream end of the disposal site. Faces of the fill left exposed for an extended time would also be treated with sludge, covered and compacted with earth one-foot thick. Participants propose to revegetate the fill area following installation of the earth cover.

Rainfall runoff that does not drain directly to the collection pond would be collected in peripheral drainage ditches surrounding the fill area and diverted to the collection pond.

The proposed collection pond has been sized to retain and evaporate the maximum annual 23-inch rainfall from a 100-year storm that would fall on the ash disposal area and minor tributaries adjacent to runoff areas. This pond would be approximately 28 acres in surface area.

An earth dam approximately 30-feet high would be built for the pond to retain 390 acre-feet (127 million gallons) of storm runoff. Material for the dam would come from interior of the landfill site and would require 167,000 cubic yards of excavation. Participants indicate the dam would consist of dense sandstones for ballast with both the impervious liner and the core made from mudstones in the disposal area.

Tests by participants on soils in the area of the runoff-pond indicate that the pond itself is underlain by 80-foot thick mudstones. Permeability tests show the coefficient of permeability for the mudstones is 0.05 feet per year.

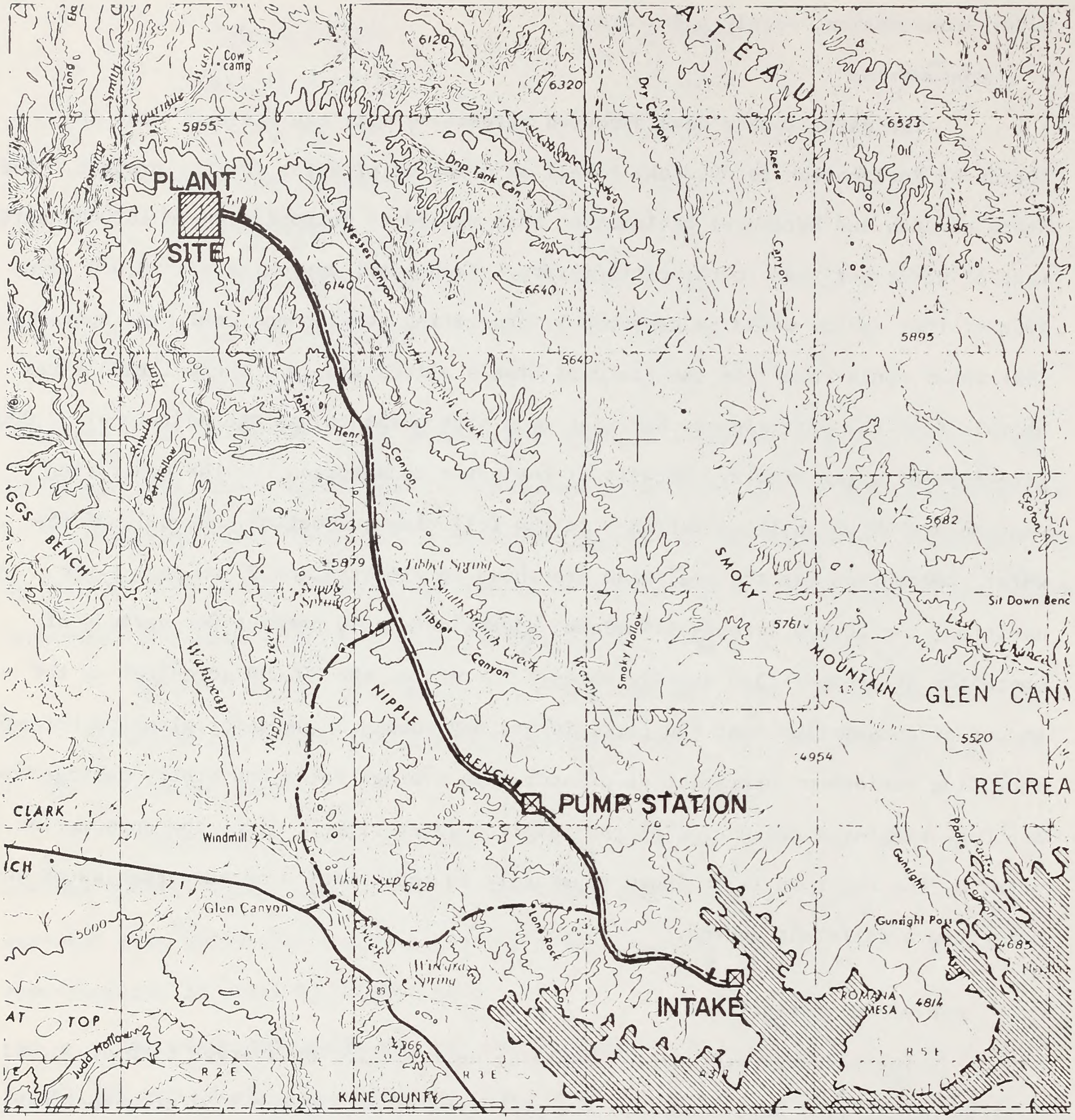
Water--Consumption, supply and storage

Consumption

The participants have executed agreements with the State of Utah and Bureau of Reclamation to use Lake Powell as a source of water for the project. The State of Utah and Bureau of Reclamation have agreed to authorize up to 102,000 acre-feet of water per year to the participants. Each year, approximately 50,000 acre-feet of that amount would be consumed by generating station and coal mine operations. That water would come from the State of Utah's allocation from the Colorado River. At this time the participants have not made a proposal to use the additional 52,000 acre-feet of water rights. Details of the water consumption for the generating station are shown on Illustration in the following subsection. Details of the water consumption for the coal mine are shown on Illustration 37 on page I-154. In addition, the 50,000 acre-feet includes approximately 10 percent for periods of operation at greater than average rates. Therefore, the 50,000 acre-feet is the amount of consumption that the participants say should be used for planning purposes including periods of operation at greater than average rates and other contingencies. See Page I-316 for a discussion of the involved water right. Also, the consumption of water by the new town is included separately in that section because that water would come from a different source.

Supply and storage

The make-up water system would be designed for an average flow of 30,961 gallons/minute (137 acre-feet/day) and peak flow of 36,739 gpm (162 acre-feet/day), taking water from Lake Powell at Warm Creek (see Illustration 15). From Warm Creek the pipeline would cross Nipple bench to follow the most direct route to the plant site. Illustration 16 (water balance) shows the expected plant water needs and how water use would be distributed throughout the plant. Illustration 17 shows the proposed service water system. The proposed intake system is shown in Illustration

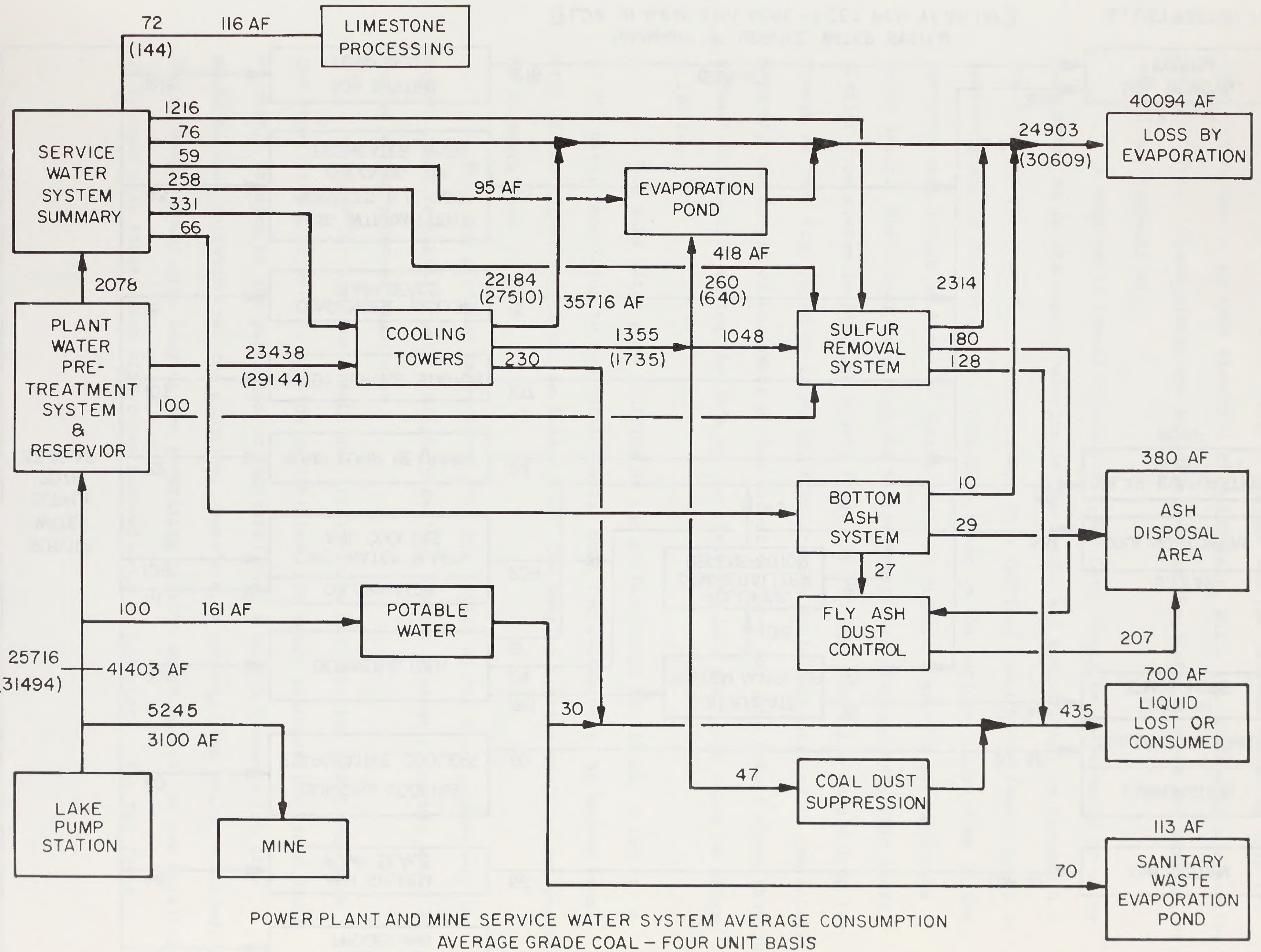


NIPPLE BENCH ROUTE
WARM CREEK INTAKE
FOURMILE BENCH PLANT SITE

LEGEND

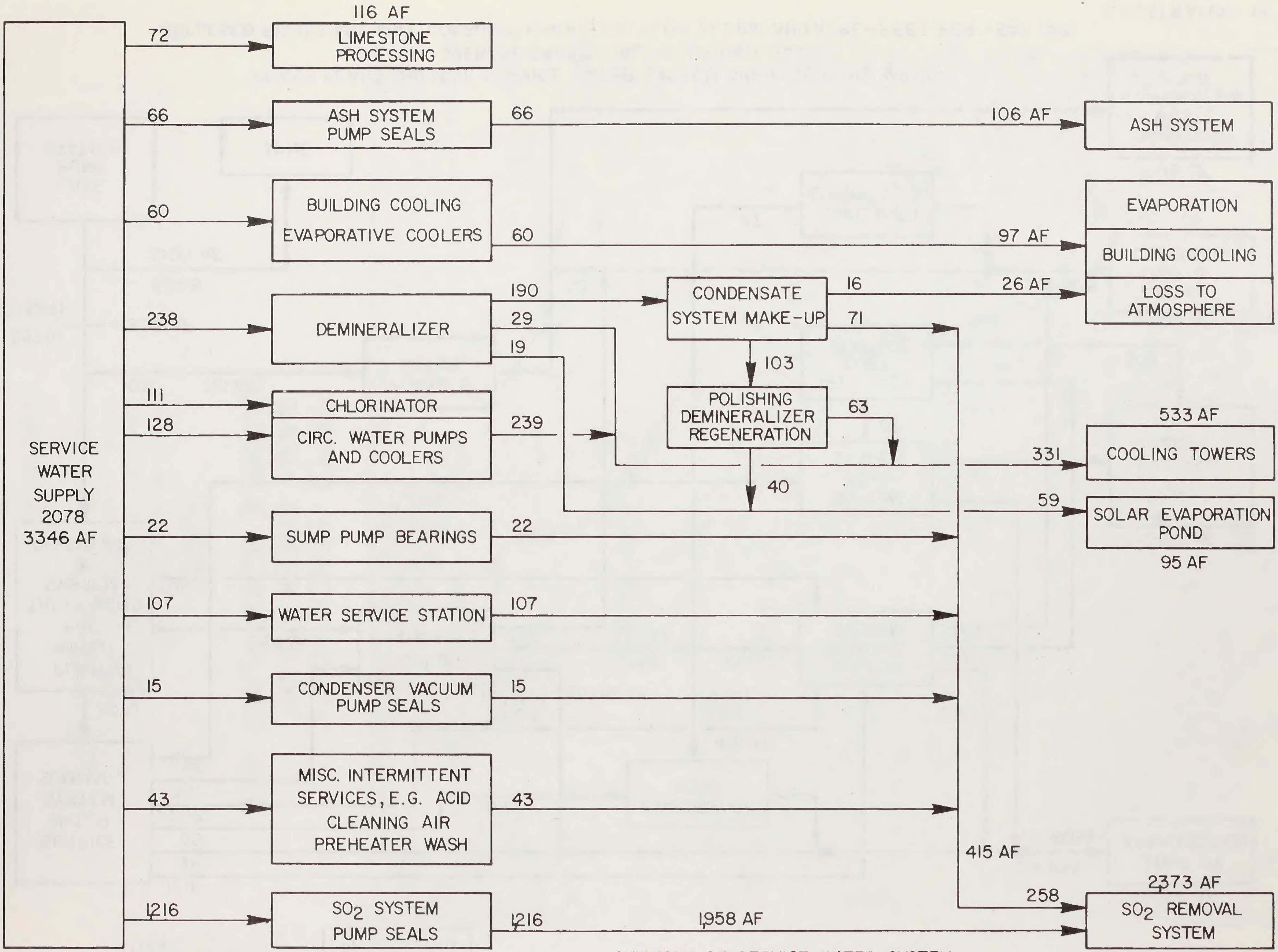
- PIPELINE
- PATROL ROAD
- ACCESS ROAD
- PATROL ROAD GATE

ILLUSTRATION 15



POWER PLANT AND MINE SERVICE WATER SYSTEM AVERAGE CONSUMPTION
AVERAGE GRADE COAL – FOUR UNIT BASIS
ENCLOSED FIGUES ARE MAX. CONSUMPTION RATES; FLOW IN G.P.M. AND ACRE–FEET PER YEAR (AF)

ILLUSTRATION 16



SUMMARY OF SERVICE WATER SYSTEM
[FLOW IN G.P.M. AND ACRE-FEET PER YEAR (AF)]

ILLUSTRATION 17

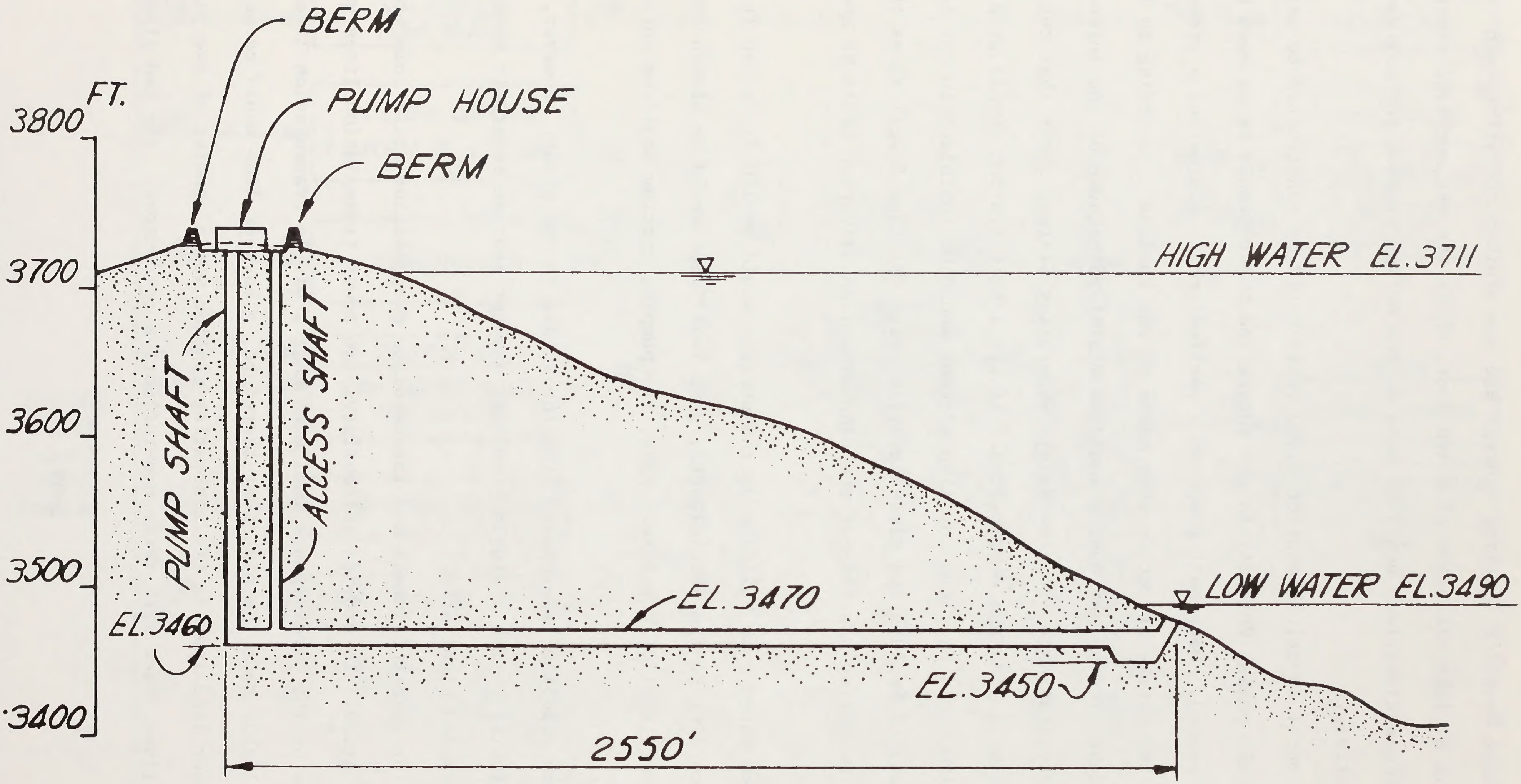
18. The top of Lake Powell's inactive storage and the minimum operating head for Glen Canyon Dam is at lake elevation of 3,490 feet, while the maximum lake elevation is 3,711 feet. These elevations would be used as the design minimum and maximum lake elevations respectively.

A horizontal tunnel (elevation 3,460 feet) would be constructed to carry lake water to intake pumps. Velocity in the intake and tunnel would be between 0.5 and 1.5 feet per second. Deep well pumps in a vertical shaft would feed a group of booster pumps in the intake structure pump house on the surface. According to the participants, intake of fish and debris would be minimized because of the intake water depth. Historical data from the Navajo Generating Station shows that their similar type system is fish and debris free. If the lake elevation should drop low enough so that fish could be taken in, fish screens would be installed in the intake. However, the Bureau of Reclamation time-elevation curve for Lake Powell shows that 90 percent of the time during the life of the plant the lake elevation would be above 3,550 feet.

The lake water pump building on the surface would be 110 ft. x 140 ft. x 15 ft. high. According to the participants, pump facilities would be hidden from view at the highest level of the lake. Also, the pumping station would be surrounded by an earth berm.

Only one pipeline is proposed from the intake to the plant. However, to assure plant reliability with a single pipeline, a water storage reservoir would be needed at the proposed plant site.

Power for both the intake and intermediate pump station would come from the generating station. To provide reliability, two power transmission lines would be used. Studies by the participants indicated that a single transmission line would be less reliable than the pipeline; therefore, a back-up line would be needed. The permanent power line leaving the generating station would consist of two parallel 69 kv wood pole lines, each with three non-reflective conductors. The two lines



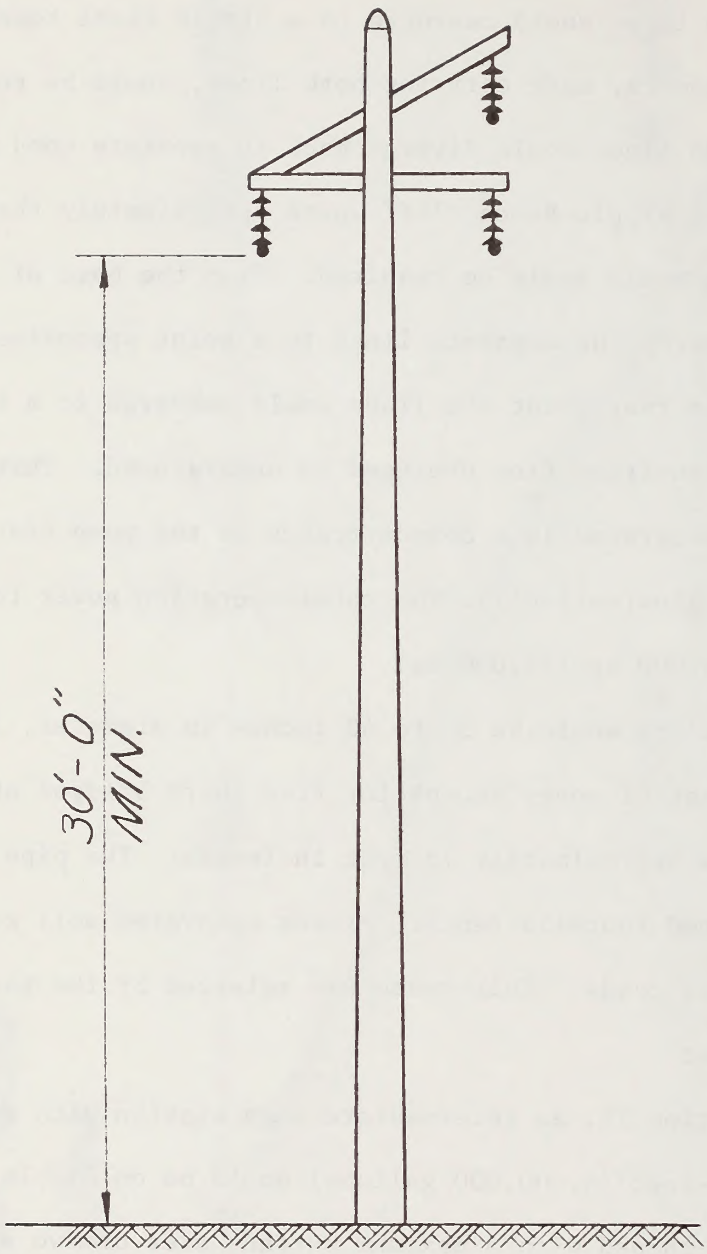
TUNNEL/SHAFT INTAKE
CROSS SECTION AT WARM CREEK

ILLUSTRATION 18

would have a separation distance of approximately 121 feet and would follow the same general route as the water pipeline. For structural considerations, it would be necessary at cliff faces to use self-supporting steel lattice towers. At the crest of Fourmile Bench cliff the two lines would converge to a single steel tower. Approximately three additional steel towers, each carrying both lines, would be required. At the base of the cliff the two lines would diverge back to separate wood pole construction to the crest of the Nipple Bench cliff where approximately three steel towers in similar configuration would again be required. From the base of the Nipple Bench cliff, wood poles would carry the separate lines to a point approximately three miles from the pump station. At that point the lines would converge to a single steel pole structure for the transition from overhead to underground. Three cables per line would be installed underground in a common trench to the pump station. A typical wood pole is shown in Illustration 19. The total operating power for the two pump stations would be about 39,000 hp (29,000 kw).

The water supply pipeline would be 30 to 40 inches in diameter, 30 miles long, and buried under three feet of cover except for five short bridges at canyon crossings. The bridges average approximately 75 feet in length. The pipe would be tunneled to both Nipple Bench and Fourmile Bench. Excess excavated soil would be used in fill areas on the access roads. This route was selected by the participants because it would be the shortest.

As shown in Illustration 15, an intermediate pump station with an associated reservoir estimated at 12 acre-feet (4,000,000 gallons) would be on Nipple Bench. The reservoir would be rectangular-shaped with a maximum surface area of two acres, a water depth of six feet and a dike height of eight to nine feet. The reservoir would act solely for surge control. A group of booster pumps would pump water from the intermediate reservoir to the plant reservoir. According to participants, an intermediate reservoir would be placed in the pipeline so transient surge pressures could be



TYPICAL WOOD POLE ARRANGEMENT

ILLUSTRATION 19

reduced and reliability increased as a result of lower pressure pipeline operation. The intermediate pump station and reservoir location was chosen because the site would require the least earthwork during construction and pump heads would be balanced between stations. The intermediate pump house would be 70 feet x 80 feet x 15 feet high.

To coordinate and control lake water and intermediate pumping stations, two microwave facilities would be needed: one at the lakeshore pumping station and one near the intermediate pumping station on Nipple Bench. The microwave facility at the lake shore would consist of a four foot diameter parabolic dish placed so it would not protrude above the pump station roofline and would be facing away from the lake and toward Nipple Bench. Any additional microwave equipment which would be needed would be placed entirely within the pump station building.

The microwave facility on Nipple Bench would be approximately 500 feet from the intermediate pumping station and would consist of a building and a tower 80 feet tall with a 6 foot diameter parabolic dish arranged so only the dish would be visible from Warm Creek. Underground cables would connect this tower with the intermediate pumping station.

The road that would be used for pipeline construction would also become the patrol road (Illustration 14). The road would be dirt, 16 feet wide. The participants anticipate that roads to the pump stations would be used at least once a day, whereas the road along the pipeline would be patroled approximately once per month. In most cases, the roads would follow existing four-wheel drive trails. However, a new access road would need to be built to the Lake Powell pump station. In the event the Lake Powell water level rises above 3,700 feet, a small temporary earth causeway or pontoon bridge would then be constructed at the pumping station to maintain access. Bureau of Reclamation studies indicate construction of such a causeway between existing ridges should never be necessary since water levels are not expected to reach levels over 3,690 feet. Such a causeway would bridge a maximum of 700 feet and would have a surface elevation of 3,715 feet.

Participants indicate patrol roads along the pipeline would be open for public use but the immediate area around pump stations would be fenced and locked.

Total right-of-way width for the pipeline alignment including pipe, road, and two power transmission lines would be a maximum of 150 feet. Maximum right-of-way width for roads to the pipeline would be 50 feet.

Water from Lake Powell would be pumped to a reservoir near the power plant, which would provide continued service to the plant in the event of an outage of the water make-up system. The reservoir would be 65 surface acres with a 35 foot average depth and contain approximately 2,640 acre-feet (860,000,000 gallons) of water, enough to supply the station for 14 days at maximum capacity during the hottest summer month.

The reservoir would be within the eastern portion of the site in a shallow basin immediately north of the rim of the east branch of John Henry Canyon (see Illustration 7). This location, according to participants, would take advantage of the topography to minimize the excavation and fill required for the reservoir. A very small tributary drainage area upstream of the reservoir would reduce the chance of a significant increase of flow to the reservoir caused by storm runoff. The reservoir would also be located so a safe drainage path would be provided for flood waters in the event some unforeseen natural or man-caused mishap should lead to a breakage in the dam.

The dam design would be developed using a dynamic stability analysis. Predominantly on-site materials would be used to construct the dam which would have an upstream slope of four horizontal to one vertical and a downstream slope of three horizontal to one vertical. Crest width of the dam would be 30 feet with a maximum 24 foot wide asphaltic concrete paved road encompassing the reservoir. The reservoir would have an inlet structure, a three foot diameter concrete encased pipeline through the dam fill and a pump structure at the downstream toe of the dam which would pump reservoir water to the power block.

The minimum freeboard--difference in elevation between crest of the dam and maximum reservoir water surface--would be equal to five feet. The normal freeboard--difference in elevation between crest of the dam and normal reservoir water level--would be equal to six feet. The reservoir would be designed so a 100-year storm can occur at the normal reservoir water level and flows would not be released through the spillway. The spillway would be designed for flows well in excess of a 100-year storm and would conform to minimum spillway capacity required for dam construction in Utah.

The reservoir would be lined with a minimum of six inches of mudstone material. Permeability of the material is 0.05 feet/year. The reservoir, with an average water depth of 35 feet, would have a seepage rate of 300 acre-feet of fresh water per year. This would amount to 0.7 percent of the total water being pumped to the reservoir. Upstream slopes of the dam and interior slopes of the reservoir would be protected against destructive wave action by placement of large stones from the crest of the dam to several feet below the minimum water level. Downstream slope of the dam would be protected against erosion by wind and rainfall runoff by a layer of rock one foot thick.

To maintain the same lake water quality at both the plant and intermediate pump station reservoirs, spot treatment with copper sulfate (bluestoning) would control algae. Bluestoning is a widespread practice and, with normal concentrations, is non toxic except to algae.

Copper sulfate would be applied to the reservoir at infrequent intervals and would have a very short life. Probability of any copper sulfate solution draining over the spillway is remote. A storm greater than a 100-year recurrence interval would have to occur simultaneously with the introduction of copper sulfate into the reservoir. If this should occur, the small amount of solution that would escape the reservoir via the spillway would become diluted with adjacent storm flows.

Cooling towers

This system would be used to reject waste heat from the plants' circulating water system through use of cooling towers. For the steam leaving the turbine to be reused in the cycle, it must be condensed to water so it may be pumped. Condensation is accomplished by transferring heat from the steam to the circulating water system.

Cooling towers selected by the participants for the Kaiparowits project are the wet cooling type. They utilize the evaporative cooling effect of water and convective heating of air.

Three basic design conditions used to calculate the cooling tower's size for the Kaiparowits project include the following:

69° F wet bulb which is that temperature to which air can be cooled adiabatically to saturation by the addition of water vapor. In a practical way, the wet bulb temperature is indicated by a thermometer, the bulb of which is kept moist by a wick, and over which air is circulated.

15° F approach which is the difference in temperature of cold water leaving the tower and the wet-bulb temperature of ambient air.

26° F cooling range which is the number of degrees at which the water is cooled in the cooling tower, or the difference in temperature between the entering (hot) and the leaving (cold) water.

Heat rejected by the power plant condensers as a result of power generation is of a very low energy level. The 15,200,000,000 btu/hr. rejected by the four generating units at 100 percent load is in the form of cooling water at 106° F. The cooling water heated by the condensers from 80° F to 106° F is then cooled by the cooling towers down to 80° F and circulated back to the condensers.

The mean maximum outdoor temperatures for the Fourmile Bench Site range from 47° F to 93° F and maximum outdoor temperatures range from 70° F to 106° F.

The maximum cooling water temperature after absorbing heat of condensation is 106° F. This relatively low temperature prevents use of this heat for any practical purpose. Circulating flow through the proposed towers is estimated to be 287,000 gallons/minute per generating unit.

Each of the four generating units would require two towers of 10 cells per tower. Dimensions of each tower would be 400 feet long, 70 feet wide, and 35 feet high (to the top of the fan deck). Base area of each tower would be approximately 28,000 square feet.

To improve air flow to the towers there would be a space of not less than 400 feet between towers. They would be approximately 1,000 feet from the turbine bay enclosure.

Operation of the cooling towers would result in evaporative losses of water, drift losses and blowdown water. Blowdown removal is necessary to prevent an increase in the concentration of dissolved solids. Dissolved solids above the allowable limit would cause scaling in the circulating water system which would have an adverse affect on the plant thermal efficiency. Dissolved solids in the circulating water are expected to be 15 times that contained in the makeup water. Drift is that portion of the cooling tower circulating water discharged to the atmosphere in droplet form after having been mechanically entrained in the cooling air stream. In order to reduce the amount of drift, drift elimination systems would be built into each tower.

Quantities of water needed to make up those losses at maximum continuous load for four units are estimated as follows:

Evaporation	27,510	gpm
Drift Losses	230	gpm
Blowdown	1,735	gpm
Total estimated makeup water for four units	29,475	gpm

Circulating water would flow from the cooling towers to a canal from which it would be pumped through the condensers and back to the top of the cooling towers. The water would flow in a combination of buried pipes and open canals. The participants anticipate that the buried pipes would be made of steel. Canals would have trapezoidal cross section, 36 to 48 feet wide, 10 to 12 feet deep and a bottom width of 6 to 12 feet, lined with 3 inches of gunite using 2 inch x 2 inch x 12 gauge wire mesh.

Evaporation Ponds

Evaporation ponds would collect and evaporate plant waste water. They would be located between the east and west branches of John Henry Canyon (see Illustration 7, Site Description and Arrangement). According to the participants, this location would eliminate the necessity for major flood control provisions.

Local storm diversion provisions would be used to return storm water to existing natural flow patterns since the only water flow would result from direct rainfall on the area. No upstream tributary areas would flow to the evaporation pond area.

Two separate pond systems would be constructed to handle service water waste from plant operation and effluent discharged by the sewage treatment plant. Service water waste and quantities, which would be routed directly to the evaporation pond, would be composed of the following:

Sources of Service Water Waste	Average Quantity (gpm)
Cooling tower blowdown in excess of scrubber requirements	260
Polishing demineralizer regeneration	40
Demineralizer waste	19
Estimated Total Flow to Pond	319

Wastes from sanitary fixtures would flow to a secondary sewage treatment facility. Effluent would be treated to reduce its biological oxygen demand (BOD) or suspended solids to 10 percent of their original values. The proposed facility effluent discharge to the sanitary effluent pond is estimated to average 70 gpm.

The six or seven ponds would be located south of the power block, and would range in size from nine to 40 acres with an average size of 25 acres. The total pond area (180 acres) would be divided as follows:

Service water waste	157 acres
Effluent from the sewage treatment plant (one separate pond)	23 acres
Total	180 acres

The ponds would be divided to provide waste water management flexibility. The average water flow to the evaporation ponds would be 389 gpm or 1.5 percent of the average water supplied to the station.

Required evaporation pond acreage was determined by the participants considerin average waste water production and a minimum evaporation rate that would be expected to occur only once in a 50-year period. To determine the required volume, calculations were performed assuming a build-up of waste water during the winter when evaporation rates would be low. Majority of the water would be evaporated in the summer. The volume of water contained by the evaporation ponds would also include the amount of rain which would be collected during a designated maximum 100-year storm.

Evaporation rates were determined by the participants from data collected on the site with standard evaporation pans. Although data collected on site was for a relatively short period it was compared with other data taken at similar installations throughout the region. By correlating results of these longer-term installations and the on-site data, an evaporation data base was developed to determine minimum, maximum and average pan evaporation data as discussed below.

Since actual pond evaporation would differ from that obtained with the experimental pan, a correlation would then be obtained between the pan evaporation rate and the rate for a pond in the same area. This correlation factor accounts for the proposed size and shape of the pond as well as the greater salinity of the water. For the Fourmile Bench area, the 50-year minimum pan evaporation was found to be 84 inches yearly with the pond evaporation rate at 70 percent of this value or approximately five feet per year. Using this value, the maximum water depth for the 180 acre evaporation ponds would be five feet.

In addition to this water depth, freeboard would be provided in the dikework to prevent wind-driven waves from overtopping or eroding the dikes. Amount of freeboard would be calculated considering the berm slopes, maximum wind velocity, and length of the pond. The participants determined that three feet of freeboard would be adequate for the evaporation ponds with a total dike height of eight feet. To prevent erosion and reduce wave run-up, the dike surface would be covered by a layer of rock, six to 12 inches in diameter and approximately a foot thick. Rock would be obtained from the aggregate site.

Evaporation ponds would be constructed along a gently sloping ridge area south of the power block. To minimize grading in this area, individual ponds would be terraced along this ridge. Grading would be developed on a balanced cut and fill basis with dikes being composed of cut material. Approximately 25 percent of the one and a half million cubic yards of excavated material would be unsuitable for dike construction, and it would become part of the other station spoil material to be removed to the ash disposal area. Interior dike slopes would be five units horizontal to one unit vertical and crest width would be 12 feet. Spillways and piping would be provided to regulate water flow from one pond to another.

To prevent degradation of ground water, ponds would be lined with a two-foot layer of mudstone obtained from the ash disposal area. The mudstone has a permeability coefficient of 0.05 feet/year and a two-foot layer would provide a lining for the projected 35 year life of the plant. A one-foot layer of on-site material would be placed over the mudstone to protect it from damage due to wetting and drying action, waves or weathering.

Since water management records would be kept for the evaporation ponds, leakage caused by a possible break in the lining would be detected through a ground water monitoring system and would be repaired if it occurs. There are several methods for determining if a leak has occurred: detection of thermal anomalies, monitoring wells, use of control ponds, and changes in conductivity.

Time required to determine if a leak had occured depends on a number of factors, including location and size of the leak, nature of the subsoil, chemical composition of wastes, depth of liquid waste over the leak and type of leak. It may be possible to detect a leak within a month. However, it could take up to a year to be absolutely certain of a small leak.

Sanitary wastes would be retained in a separate pond following primary sewage treatment. This pond would be designed using the same criteria as for previously described evaporation ponds. It would be similarly lined to assure no degradation of groundwater or return of waste water to Lake Powell.

Administration building, shop and warehouse facilities

The administration building, shop and warehouse (ASW) facilities would provide space for the personnel, equipment and materials required in administration, operation and maintenance of the generating station. These facilities include offices, storage for plant records, conference/classrooms, secretarial services, shop equipment for servicing the station, storage for parts and materials, and facilities, such as locker, shower and lunch areas for personnel involved in servicing the many areas within the station.

Intent in design of the proposed administration building, shop and warehouse facilities would be to provide the most functional human-related, building arrangement (efficient location, minimal traffic congestion, workable activity relationship), while maintaining a comfortable working environment for plant personnel and a reception area for plant visitors.

Total area within ASW facilities would be approximately 86,700 square feet. Total area occupied by other facilities, including parking and landscaping, would be approximately 345,600 square feet. A summary of the areas is given in Figure 25. Primary materials expected to be used in construction of the facilities would be concrete, metal and glass.

The warehouse/shop activities would be in one building, with required yard space adjacent to the facility and traffic controls provided as required. Administration secretarial and engineering activities would be in a building complex, which would separate noise and group activities from individual office facilities, provide a designated reception area for visitors, and incorporate landscaped areas.

The administration complex would be in the center of the station adjacent to the power block and east of the switchyard. The warehouse/shop facility would be in line with the administration complex, but to the north of the power block.

Separate parking facilities would be provided for both the warehouse/shop facility and the administration complex. A detached parking area would be designated for visitors and nonstation personnel.

Major portion of landscaping would be concentrated in and around the entry and the administration complex. Any landscaping provided would be in keeping with the character of the native vegetation.

Access roads

Construction access road - plant and mine

The proposed main construction access road would be along the same route as the new plant and mine access highway (see Kaiparowits Power Plant Access Road in appendix I-12).

FIGURE 25

Administration Building, Shop and Warehouse Facilities

Administration Complex:

Actual building area - 17,000 square feet
Administration parking
(Administration employees plus visitors) - 30,000 square feet

Total administration area
(buildings plus parking plus landscaping area (in cluding entry road from security office to adminis tration buildings) - 200,000 square feet

Warehouse/Shop/Personnel Facilities:

Actual building area - 67,000 square feet
Warehouse parking
(employees) - 70,000 square feet
Outside storage area - 1,400 square feet

Total warehouse/shop/personnel area - 140,000 square feet
(building plus parking plus outside storage plus vehicle circulation)

Security Office:

Actual building area - 225 square feet
Parking area - 820 square feet
Pull-over lanes - 900 square feet

Total security office area - 2,000 square feet
(building plus parking plus pull-over lanes plus circulation)

Relay/Battery House:

Actual building area - 2,400 square feet
Parking area - 1,250 square feet

Total relay/battery house area - 3,650 square feet
(building plus parking)

- Total actual building area - 86,700 square feet
- Total parking area - 102,000 square feet
- Total area occupied - 345,600 square feet

The construction access road would not include major bridges or drainage culverts. This first stage rough-graded road would be classified as a "fair weather" road only. Major excavation and embankment work required within main drainage crossings would be deferred until the final all-weather main access highway is constructed.

Based on the assumption the plant and mine access highway would not be completed until 18 months after start of site preparation, approximately 500 vehicles would be traveling construction access dirt roads each day. According to participants, all materials excavated through blasting would be used for embankments and rip-rapping adjacent to excavated areas, resulting in a balanced cut and fill operation.

The existing road from Cannonville to the proposed plant site would be used for transporting earthmoving equipment and personnel during the site preparation phase until rough grading was completed on the proposed main construction access road from Glen Canyon City.

Permanent maintenance and patrol roads - on-site

Existing four-wheel-drive trails would be used during construction and would be integrated into the final site maintenance and patrol roads. Roughly half of approximately three to four miles of existing four-wheel-drive trails within the site boundary would be integrated into the construction and final on-site roads. New construction roads would follow as closely as possible existing land contours. Cuts would be made only where necessary to maintain grades within established limits, with normal slopes of two feet horizontal to one foot vertical as specified in the latest edition of the "Uniform Building Code - Grading Section."

On-site roads would be of two types: those leading to outlying places, such as the reservoir, would be 16-feet wide; roads in and around the power block would be 24-feet wide. Within the power block area, roads would be asphalt-covered and would have the following geometric characteristics: maximum slopes - 10 percent; maximum design speed - 35 mph; minimum curve radius at intersections - 40 feet. The ash disposal road would be 60 feet wide as described in "Ash and Sludge Disposal" section.

Permanent maintenance and patrol roads - off-site

Off-site maintenance and patrol roads would comply with the following design standards: maximum slope - 15 percent; minimum curve radius - 150 feet; width of roadway - 16 feet, except in fill areas where they would have an additional three-foot wide berm on each side.

Maintenance roads would be of dirt similar to existing four-wheel-drive trails except at water crossings where gravel, culverts and small bridges would be utilized. Five bridges across canyons would average approximately 75 feet in length.

Fuel oil system

A system would be provided to furnish fuel oil to the burner ignition system supplied with steam generating equipment. In addition, fuel oil would fire auxiliary steam generators. Four main steam generators are the super-critical type and require a supply of auxiliary steam for start-up operation. During the start-up phase of the first steam generator, this auxiliary steam would be supplied exclusively by auxiliary boilers. Reliance on auxiliary boilers would decrease as the other three steam generators are started up because main steam generators already in operation would be able to supply auxiliary steam requirements of other steam generators as they start up. This accounts for the difference in fuel oil consumption as Figure 26 indicates.

FIGURE 26

Estimated Fuel Oil Requirements
Kaiparowits Generating Station

1980 - 82	1,000,000 bbls./yr.	(42,000,000 gals./yr.)
1983	700,000 bbls./yr.	(29,400,000 gals./yr.)
1984	300,000 bbls./yr.	(12,600,000 gals./yr.)
1985 - 2015	200,000 bbls./yr.	(8,400,000 gals./yr.)

Oil would originate with participants' regular fuel procurement program in the Los Angeles area. It would be shipped by common carrier pipeline to either Las Vegas or Phoenix. It would then be trucked to the plant. Haul route from either city would be Highway 89 to Glen Canyon City, and then to the plant on the new highway. Tank trucks would have a capacity of 155 barrels or 6,500 gallons of oil each. This would require 18 truck loads per day at peak demand periods and three to four truck loads per day during periods of average operations.

The station would require a storage capacity of approximately 300,000 barrels. The oil would be stored in two fixed-roof insulated tanks of 150,000 barrels each tentatively sized at 140 feet in diameter and 56 feet in height. According to the participants, final tank heights would be determined after further economic studies and would conform to all codes and regulations regarding tank heights. An unloading facility would be provided to unload two trucks concurrently.

Two pumps would be provided to transfer oil from tanker trucks to fuel oil storage tanks. Also, two pumps would be provided to pump oil from the tanks to the point of use. Due to low temperatures at the proposed plant site from time to time, a heating system would be provided in the storage area.

Each storage tank would be completely encircled by an earthen dike capable of retaining 110 percent of tank capacity, which would allow freeboard for precipitation or fire fighting water. This conforms to participant practice and federal regulations. The tanks would be protected against corrosion by suitable coatings or cathodic protection.

Rainwater which would accumulate in the dike would be eliminated by evaporation or pumping, when necessary. Possible oil leakage would be cleaned up by whatever means appropriate, from mopping up small leakage to using a vacuum truck for large oil leaks and fire fighting water.

Buried piping installations would have a protective coating and would be cathodically protected if soil conditions warrant. Pipe supports would be properly designed to minimize abrasion and corrosion and allow for expansion and contraction.

The truck unloading area would be graded to open catch basins which would drain through buried ducts to the impounding basin. The containment system would hold at least maximum capacity of any single compartment of a tank truck. An interlocked warning light, physical start barrier system, or warning signs would be provided in the unloading area to prevent vehicular departure before complete disconnection of flexible or fixed transfer lines.

Generating station switchyard

The switchyard would encompass a fairly level area approximately 1,250 feet by 1,100 feet and include a 500 kv switchrack, a 66 kv switchrack, a single story relay-battery house, three banks, and other related equipment and facilities.

The 500 kv switchrack would extend from northwest to southeast. According to the participants, this orientation would require a minimum number of turning towers for circuits. A five-position switchrack with spacing for three power circuit breakers and two getaway structures in each position would be installed. One position would be an unequipped space to provide for allocation of unsubscribed generating capacity. Four positions would be equipped for switching power flow to four transmission lines from the power block of four 750 mw units. To minimize bus conductor size and allow power transfer during bus outage, each position would allow through-power from generating unit to transmission line. Two operating buses would provide continuity and greater reliability during maintenance or outage of circuit breakers and other major elements. A double structure space for a line compensation bank would be adjacent to each position and in line with each transmission circuit. Three bank spaces would be equipped with automatic voltage control equipment designed to improve power stability and power transfer capacility during various levels of power unloading.

A five-position 66 kv switchrack with spacing for three circuit breakers and two line getaways for each position would be constructed and equipped for two power transformer bank sources, two feeders of an off-site makeup water pumping station and one station reserve auxiliary bank. Line dead-end structures would be 39 feet wide and 55 feet high.

Two 500-66 kv power transformer banks would be installed, one each, on the south end of each 500 kv operating bus to provide power to the 66 kv switchrack from the 500 kv switchrack via overhead conductors.

Lime/Limestone supply and handling

Limestone would be required at the power plant site to produce lime for removing sulfur dioxide from flue gases produced in the coal fired boiler and for water treatment prior to boiler use. Limestone would also be required for dusting at the coal mining site. Amounts of lime and limestone required at a 75 percent load factor of the generating units for average grade coal and at maximum continuous rating for both average and worst grade coal are given in Figure 27. Limestone needed from the quarry would amount to 4,830 tons per week or approximately 690 tons per day for average grade coal at maximum continuous rating.

Illustration 20 shows the plant site lime/limestone supply and handling flow diagram. Limestone would be unloaded from highway-type bottom dump trucks on a six-day per week basis. Limestone would be supplied through a gravity-feed hopper to jawcrushers, to reduce the limestone pieces to no larger than four inches. A non-toxic liquid chemical would be used to suppress dusting during unloading and crushing.

After crushing, the limestone would be carried by a covered belt conveyor to a surge bin which would hold approximately 2,000 tons. The conveyor would be equipped with removable covers for maintenance and would provide protection from effects of wind and rain. The surge bin would be needed to maintain continuous smooth operation in case of minor equipment failures, and to compensate for surges caused by transition from the six-day/week trucking operation to the seven-day/week lime processing operation.

Limestone would be transported by covered conveyors from the surge bin to a cone crusher and screening system to produce a more finely-ground limestone needed for the lime/limestone parallel processing systems. A cyclone dust collector would be used. The limestone, sized from one and three-quarters inch x one-quarter inch, would be carried to a six-day active limestone storage pile having approximately 6,000 tons capacity. The active storage pile would have a non-toxic liquid chemical

FIGURE 27

Amount of Lime and Limestone Required (Tons/Day)

	Limestone Required for Lime Production (7 days/week)	Lime Produced (7days/week)	Limestone Required for Coal Mine (5 days/week)	Limestone Returned to Quarry 5 days/week)
For Average Grade Coal at a 75% Load Factor	490	280	220	10
For Average Grade Coal at Maximum Continuous Rating	690	390	220	90
For Worst Grade Coal at Maximum Continuous Rating	1060	600	280	200

LIME/LIMESTONE SUPPLY AND HANDLING FLOW DIAGRAM

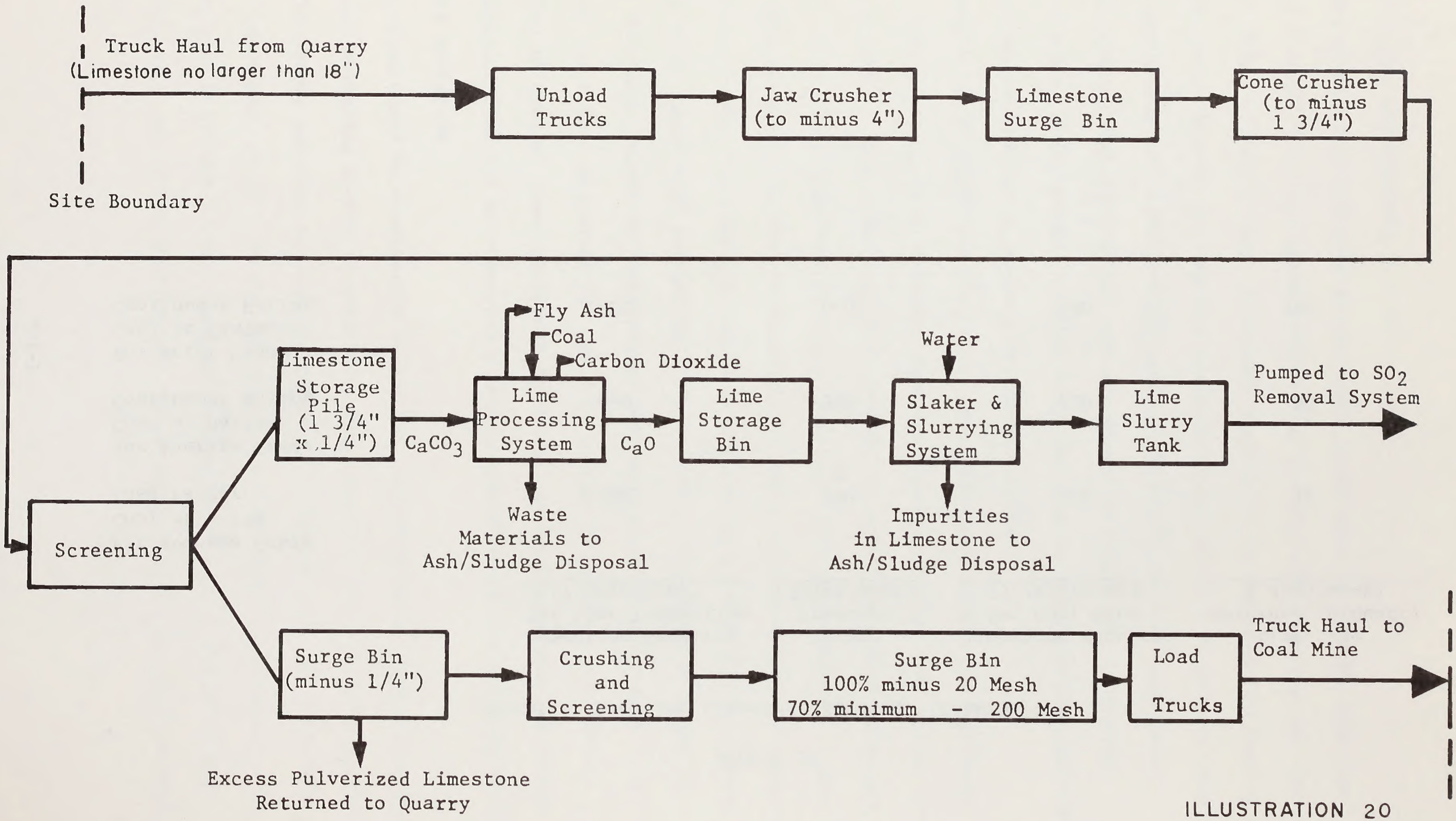


ILLUSTRATION 20

spray for dust suppression. Rain runoff from the active limestone storage pile would be channeled into the plant retention basin pond and then to the evaporation ponds if the Environmental Protection Agency water quality standards could not be met for discharge to a drainage channel.

The less than one-quarter inch product resulting from the crushing operation (which is too small to be used in the lime processing system) would be the basic source for crushed limestone required by the mine. This less than one-quarter inch limestone would be conveyed to a 1,000-ton surge bin on a five day/week basis. The surge bin would be needed to ensure continuous operation. Excess limestone less than one-quarter inch in size would be returned to the quarry by supply trucks for disposal. Useable limestone less than one-quarter inch in size would be transported by covered conveyor from the surge bins to a dry roller mill and associated screening system where it would be pulverized to the size required at the coal mine: 100 percent should pass through a 20-mesh screen and 70 percent or more through a 200-mesh screen. A baghouse would be used to collect dust generated by crushing.

Approximately 220 tons/day of limestone would be pneumatically loaded into tank-type bulk carriers and transported to the mine. Refer to page I-131 for a description of limestone use at coal mine.

Limestone which would subsequently be converted to lime for the SO_2 removal system and for plant water pre-treatment would be produced and handled in equipment operating continuously seven days per week. The one and three-quarters inch x one-quarter inch limestone would be reclaimed by apron feeders and transported by covered conveyor from the active limestone storage to a coal-fired rotary kiln.

For average grade coal at a 75 percent plant load factor, approximately 490 tons/day of limestone and 70 tons/day of coal would be converted in the kiln to 280 tons/day of lime and 220 tons/day of gaseous carbon dioxide (CO_2) and seven tons/day of ash. Gases out of the kiln would pass through a baghouse to remove fly ash prior to being discharged to the atmosphere. SO_2 produced by burning the coal would react with the lime and be removed from the gas stream. Solid waste materials produced include ash, impurities in the limestone and unreacted limestone. These impurities would be transported to the plant ash disposal area. Fuel oil from plant storage would be used for initial firing of the kiln burner. Coal required and waste material produced in this facility would be handled by the proposed systems.

Lime from the kiln would be gravity-loaded onto an enclosed conveyor and transported to an enclosed 10-day lime storage bin with an approximate 6,000-ton capacity. Approximately 13 tons/day of lime would be used for a lime-soda water pretreatment. The lime-soda softener would function as a means of partially softening (reducing calcium and magnesium) raw lake water. Chemicals (lime, soda ash and alum) would be combined in a mixing chamber in the softener. Treated water would rise and the precipitate (predominantly limestone) would settle to the base of the softener. Clarified treated water would leave the softener through launders (collection troughs) while the precipitate would be collected at the base of the softener by means of traveling rakes. The precipitate (sludge or blowdown) would consist of $CaCO_3$ (limestone) and $Mg(OH)_2$ (magnesium hydroxide) and would be routed to the SO_2 removal system. Remaining lime would be gravity-fed onto enclosed belt conveyors and transported to the slaker chamber. In slakers, approximately 72 gpm of water would be added to convert the lime (CaO) to a slaked lime $Ca(OH)_2$ slurry. Resulting slaked lime slurry would be pumped to lime slurry tanks prior to use in the SO_2 removal system.

In all crushing operations, limestone which would not meet size requirements would be recycled for recrushing until the proper mesh size was attained.

Permissible dust concentrations for working areas are stipulated by government regulations. Utah has adopted the Occupational Safety and Health Act standards, which restrict total nuisance dust concentrations to less than 15 milligrams per cubic meter.

Dust suppression or collection systems would be utilized where potential dusting may occur at transfer points, storage piles, surge bins, crushing operations, and the lime kiln operation.

Dust suppression systems would be similar to those used for coal handling, and include total enclosures, water and non-toxic chemical sprays, covers, suitable filters and baghouses.

Systems for monitoring environmental impact

An environmental monitoring program has been implemented by the participants, including meteorology, air quality, water quality and ecology. These programs have been initiated by participants prior to construction in order to establish baseline information and would be continued during operation until sufficient data had been obtained to determine environmental effects of the project. Meteorological, air quality and ecological monitoring have been conducted since 1971. Station emission monitoring would be performed continuously during start-up and operation of the generating station.

Meteorology

Meteorological data in the generating station and mine impact areas have been collected and cataloged since 1971. These data have consisted of surface and upper level wind measurements, vertical temperature soundings, plume dispersion tracer and modeling simulation studies, and surface measurements of temperature, relative humidity, precipitation, and evaporation. These data have been utilized to develop plant engineering design criteria as well as to document plume dispersion characteristics at the site.

Future meteorological monitoring studies would include continuation of surface measurements of wind speed and direction, temperature, relative humidity, precipitation, and evaporation. Surface measurements would be collected at a permanent weather station at the plant site. Periodic measurements of atmospheric stability would be taken by aircraft temperature soundings.

Air quality and visibility

Ambient air quality studies have been and will continue to be conducted by participants in the Kaiparowits area to determine background, baseline levels of key contaminants, and data suitable for use in predictive models for expected impacts of the proposed facility. Measurements of sulfur dioxide, nitrogen dioxide, oxidants, particulate matter mass concentrations, particulate number concentrations, particulate composition, and visibility have been collected since 1971 for the Navajo Project. Since measurements have been collected in the general area of the proposed Kaiparowits Generating Station, these data could be utilized in determining baseline levels of these parameters for the Fourmile Bench site. A monitoring program would be initiated prior to construction at the Fourmile Bench site to establish baseline levels of these parameters at the site and to correlate this data with the Navajo Project measurements. Monitoring of these parameters would continue during operation of the generating station.

Mobile trailers containing instrumentation to measure levels of sulfur dioxide, nitrogen dioxide, oxidants and particulate matter would be placed in the area of the generating station, at locations of expected highest ground level concentrations of these contaminants. These locations have been determined by tracer and smoke release dispersion tests.

Visibility or visual range--the maximum distance that a dark object can be seen against the horizon--has been measured in the Kaiparowits area since 1971. Three measurement techniques have been used. One method, which makes use of a camera and telescope provides a quantitative measure during daylight hours over a relatively long path using photogrammetric techniques. A second method consists of viewing distant objects by observers. The third method uses an integrating nephelometer which continuously measures the amount of light scattered by suspended particulates. A visibility or visual range monitoring program consisting of one or all of the above methods would continue during operation of the generating station to determine effects of the project on visibility in the area.

Water quality

A pre-operational program consisting of periodic sampling and analysis of surface and ground water at selected points within and near the plant area is being conducted to establish existing conditions and naturally-occurring fluctuations in these conditions. This effort would be the key activity in any monitoring program condicted after the facility has been placed in service.

At the time the facility would be put into service, a monitoring program would be initiated to ensure that the quality of ground water and surface waters of the area, as determined in the pre-operational sampling program, is not altered by waste disposal activities.

Ecology

Ecological studies have been conducted in the area of the proposed site by both Brigham Young University and Northern Arizona University since 1971. Findings have been published by the universities in annual reports. These studies have been structured to obtain baseline data on such ecological factors as soils, microclimates, terrestrial and aquatic plant and animal community dynamics, trace elements in soils, vegetation, air and animals, fumigation of vegetation, rehabilitation potentials of various plant communities, trace element effects on Lake Powell plankton, and pathology of selected animals. Data from these studies would be used in planning, design and implementation of post-operative biological study programs for measuring, detecting and determining potential or actual effects in areas determined most sensitive or ecologically critical.

Station emissions

To determine that this generating station is in compliance with federal regulations, monitoring of the flue gas for plume opacity, SO_2 and nitrogen oxide emissions would be performed using methods which are acceptable to the Environmental Protection Agency.

Coal mine - Fourmile Bench

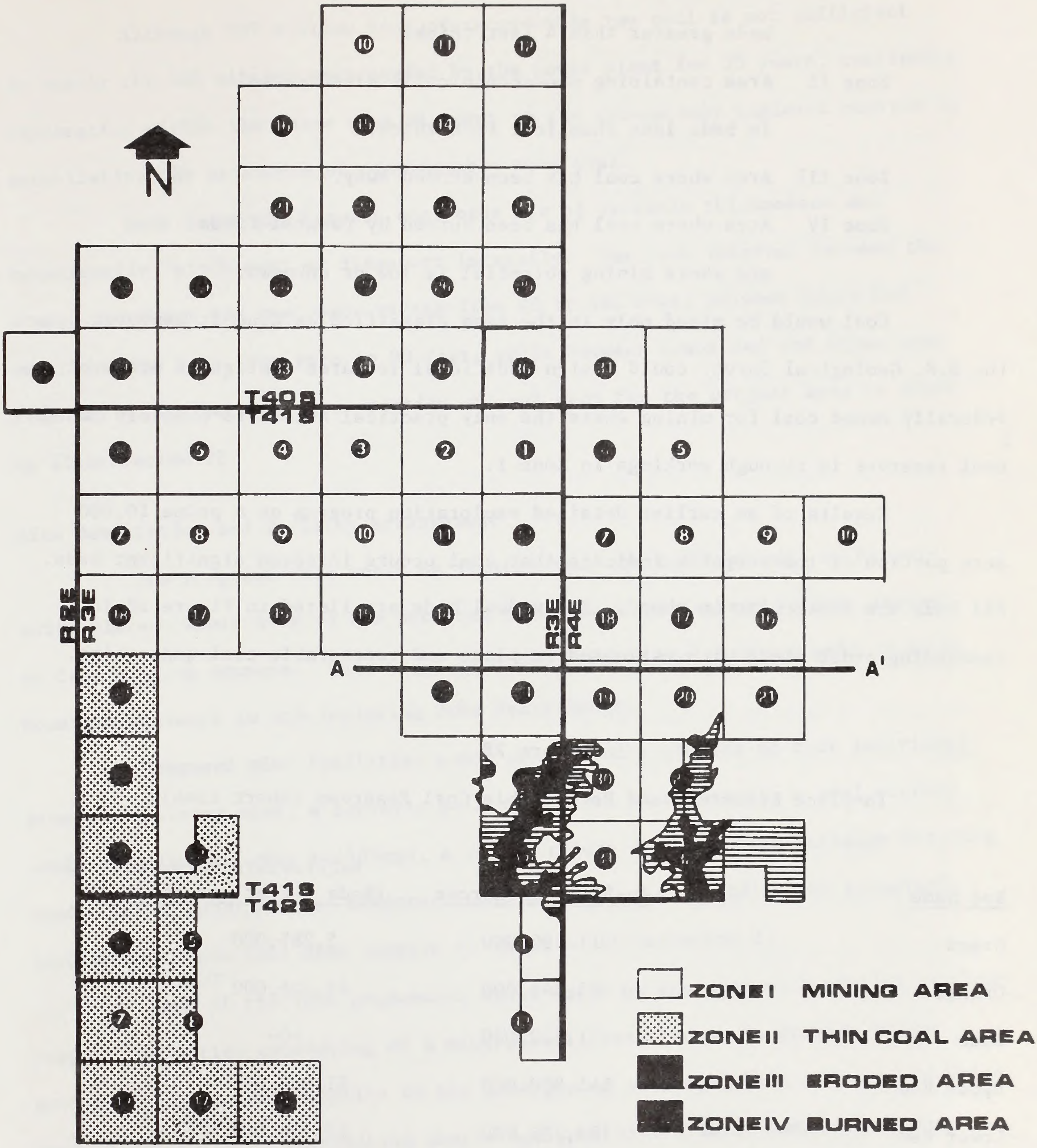
To supply fuel to the 3,000 megawatt power plant, participants propose to develop and operate four underground coal mines and a training mine, including all related facilities required for production, preparation and transportation of about 12 million tons of raw coal per year for a minimum of 35 years or a total of 420 million tons. All coal would be washed to provide nine million tons per year (tpy) of clean coal with a heating value of at least 10,800 British thermal units (BTU) per pound.

To the extent the status of the applicant's planning allows, the following discussion will detail the mine and related facilities including the coal preparation plant, coal transportation systems, waste disposal areas and all other ancillary facilities.

Coal lease area and reserves

Federal and state lands--comprising 47,128 acres and located in parts of Townships 40, 41 and 42 South, Ranges 3 and 4 East, Salt Lake Meridian, Kane County, Utah--have been leased to Resources Company of Arizona Public Service Company, New Albion Resources Company of San Diego Gas and Electric Company, and Mono Power Company of Southern California Edison Company as shown in Illustration 21. Leases represent about 21 percent of all coal land holdings on the Kaiparowits Plateau (Doelling and Graham, 1972). Total federal and state leased distribution acreage for the Kaiparowits project is in Appendix I-2. A copy of a typical Kaiparowits project federal coal lease is in Appendix I-3.

Not all leases contain equal mining potential. Only thin coal beds exist in parts of the area and in some locations the coal has been eroded away or has been burned by natural fires. Illustration 21 indicates presently known mining potential of the lease area. Four zones have been identified and are designated by participants as follows:



COAL LEASE AREA SHOWING ZONES OF MINING POTENTIAL

Zone 1 Area containing economically minable coal in beds greater than 4 feet thick.

Zone II Area containing non-econimically minable coal in beds less than four feet thick.

Zone III Area where coal has been eroded away.

Zone IV Area where coal has been burned by natural fires and where mining potential is low or unknown.

Coal would be mined only in the area classified as Zone I; however, the U.S. Geological Survey could assign additional isolated contiguous areas of federally owned coal for mining where the only practical access to publicly owned coal reserves is through workings in Zone I.

Results of an earlier detailed exploration program on a prime 10,000 acre portion of the property indicate that coal occurs in seven significant beds. All beds are lenticular in shape. Individual beds are listed in Figure 28 in descending order along with estimated in-place and recoverable coal quantities.

Figure 28

In-place Resources and Recoverable Coal Reserves (short tons)*

Bed Name	In-Place Resources	Recoverable Reserves (Beds 4 feet and thicker)
Green	11,990,000	5,285,000
Orange	65,344,000	45,705,000
Blue	31,032,000	-0-
Upper Red	141,800,000	71,052,000
Lower Red	183,136,000	82,770,000
Brown	171,705,000	98,053,000
Lilac	6,360,000	4,741,000
Total	611,367,000	307,606,000

*Bechtel Power Corporation, 1973.

Although 307 million tons of recoverable raw coal is not sufficient to supply the 420 million tons needed by the power plant for 35 years, continuing exploration within the lease area adjacent to the extensively explored portion is establishing the existence of considerably more coal.

Rock intervals between coal beds are of variable thicknesses and occasionally "pinch-out" or disappear laterally. The rock interval between the Orange and Upper Red coal beds varies from 20 to 140 feet; between Upper Red and Lower Red beds from zero to 90 feet, while between Lower Red and Brown beds from two to 85 feet. A cross section of coal beds for the project area is shown in Illustration 22.

Site description and facility arrangement

The proposed mine would be located near the southern edge of Kaiparowits plateau where erosion has produced a series of stair-step benches incised by deep winding canyons. Coal would be mined beneath the northern half of Smoky Mountain westward to and including John Henry Bench.

Proposed mine facilities would consist of a complex of four individual mines, a training mine, a conveyor belt and access road network, a coal washery, administration and shop buildings, a coarse refuse dump and fine-tailings settling ponds, and a 3,000,000-ton temporary coal storage pile. Siting for principal facilities of the coal mine complex is shown in Illustration 23.

Each of the four production mines would be equipped with similar surface-support facilities consisting of a mine portal, hoist house to provide transportation for men and supplies to the underground workings, belt conveyor to bring coal to the surface, ventilating shafts equipped with a fan, change house and mine office, paved parking lot, coal storage silo, electrical substation, rotary breaker to size the coal and separate waste, and all related utilities such as telephone, water and electrical lines. All surface facilities would be constructed on a graded area adjacent to mine openings.

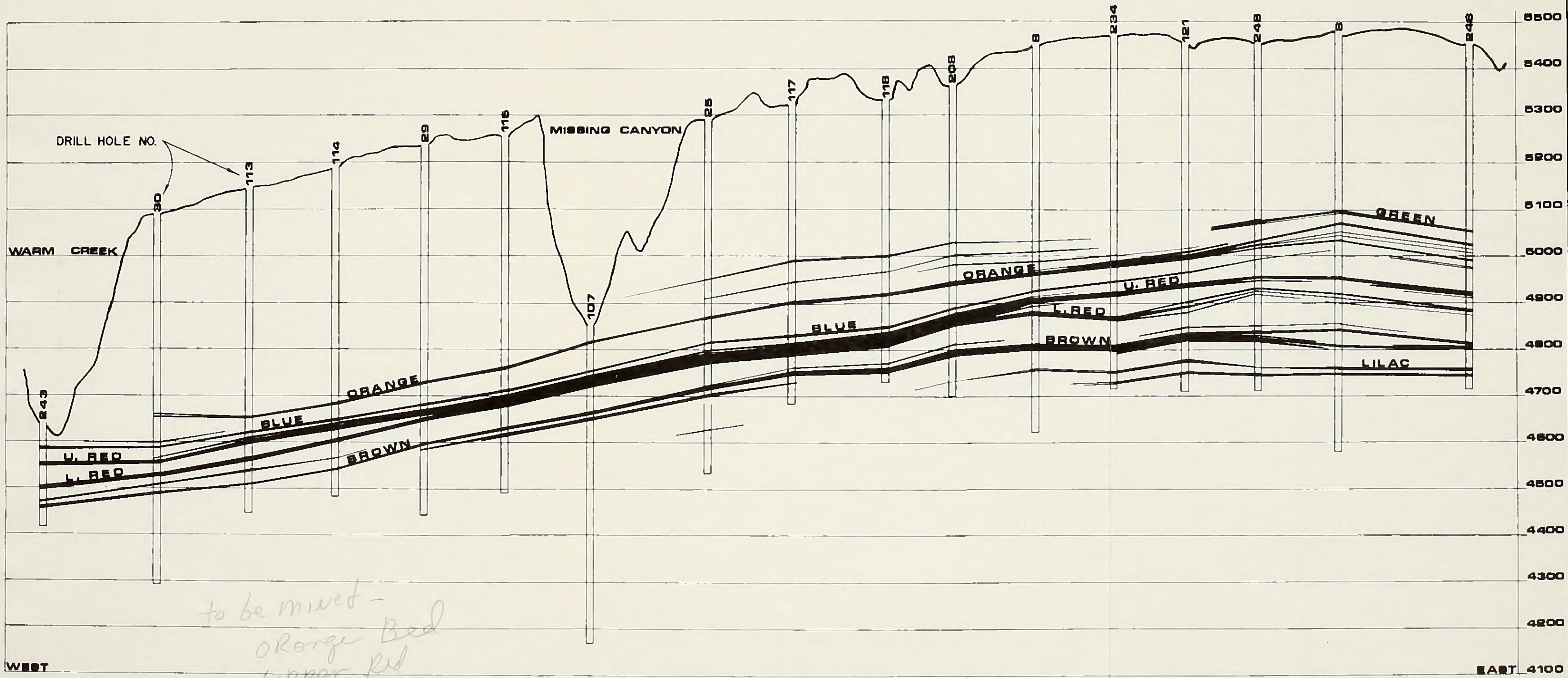
In addition to surface-support facilities at each mine, an administration building shop and warehouse complex would be constructed at a site central to all four mines. The administration building would enclose 14,000 square feet of office space. A 75,000-square foot pre-fabricated steel building to house shop and warehouse facilities, a 1,500,000-square foot open storage area, and a parking lot would be constructed in the central complex area. The proposed layout of the central complex is shown in Illustration 24.

Raw coal from the mine would not be a satisfactory fuel for the generating station. Consequently, a coal washery is proposed to remove non-coal materials from run-of-mine production. The washery, along with associated coal silos and waste bins, would be constructed at the head of the main conveyor belt leading to the power plant, as shown in Illustration 23.

Sizeable quantities of waste material would be generated by mine production. Coarse waste from both the mine and washery would be hauled to a 550-acre coarse waste dump in Section 16, Township 41 South, Range 3 East. Fine waste, in slurry form, from the washery would be piped to a 550-acre tailings and water reclamation pond in Sections 17 and 18, also shown in Illustration 23. See Page I-150 for description of these waste dump areas.

Roads, power and communication lines, water lines, and belt conveyors are proposed in a common 80-foot wide utility corridor running between project components as pictured in Illustration 25. All major access roads would be two lanes paved with asphalt. Power and telephone lines would be overhead on single-pole structures within the corridor except where conveyors pass underground, at which point, the lines would also go underground.

A total of 1,710 acres would be required for coal mine surface facilities. Acreage requirements for individual components of the complex are presented in Figure 29.

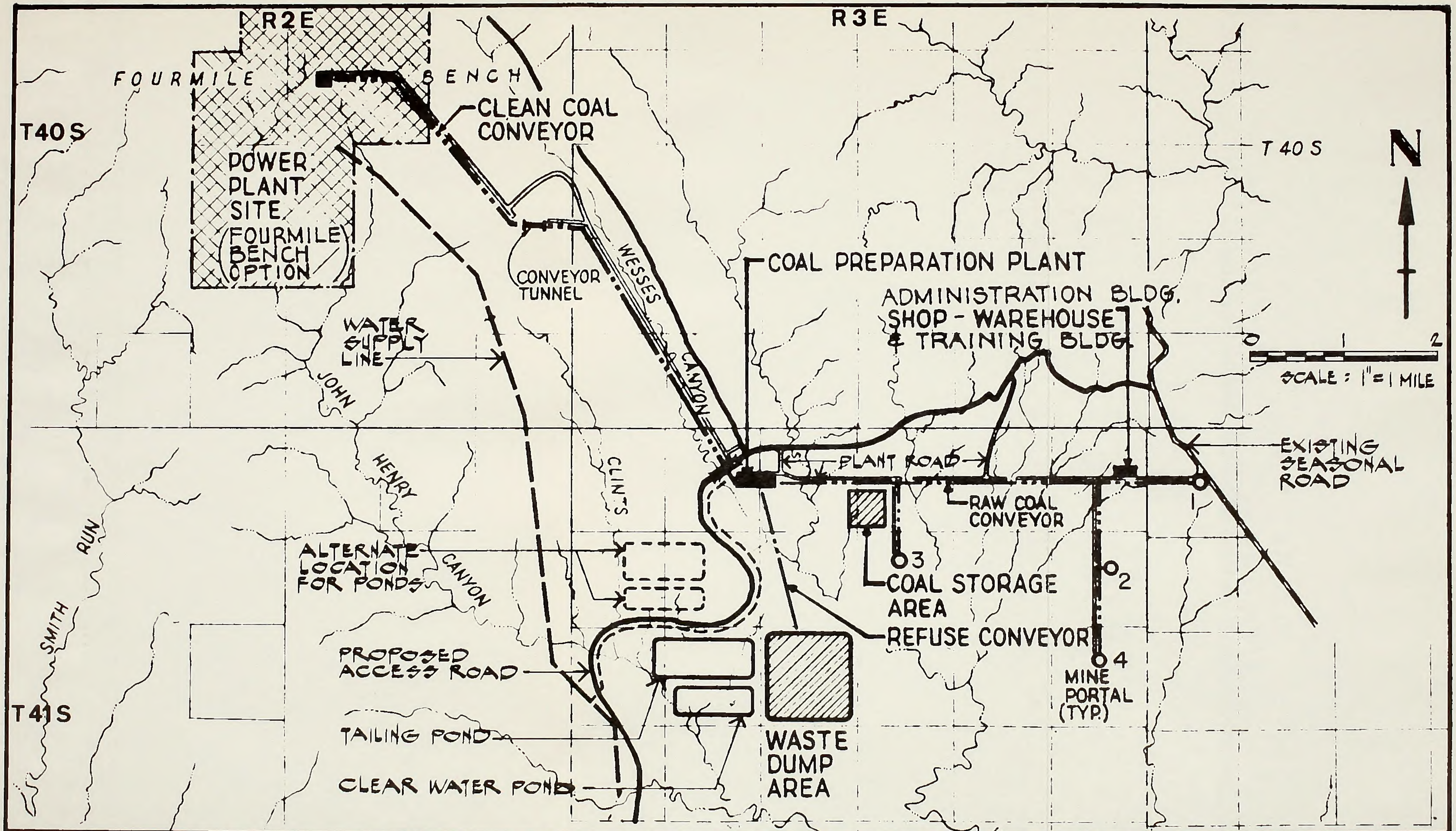


to be mined -
ORange Bed
Upper Red
Lower Red
Brown

TYPICAL SECTION OF COAL BEDS

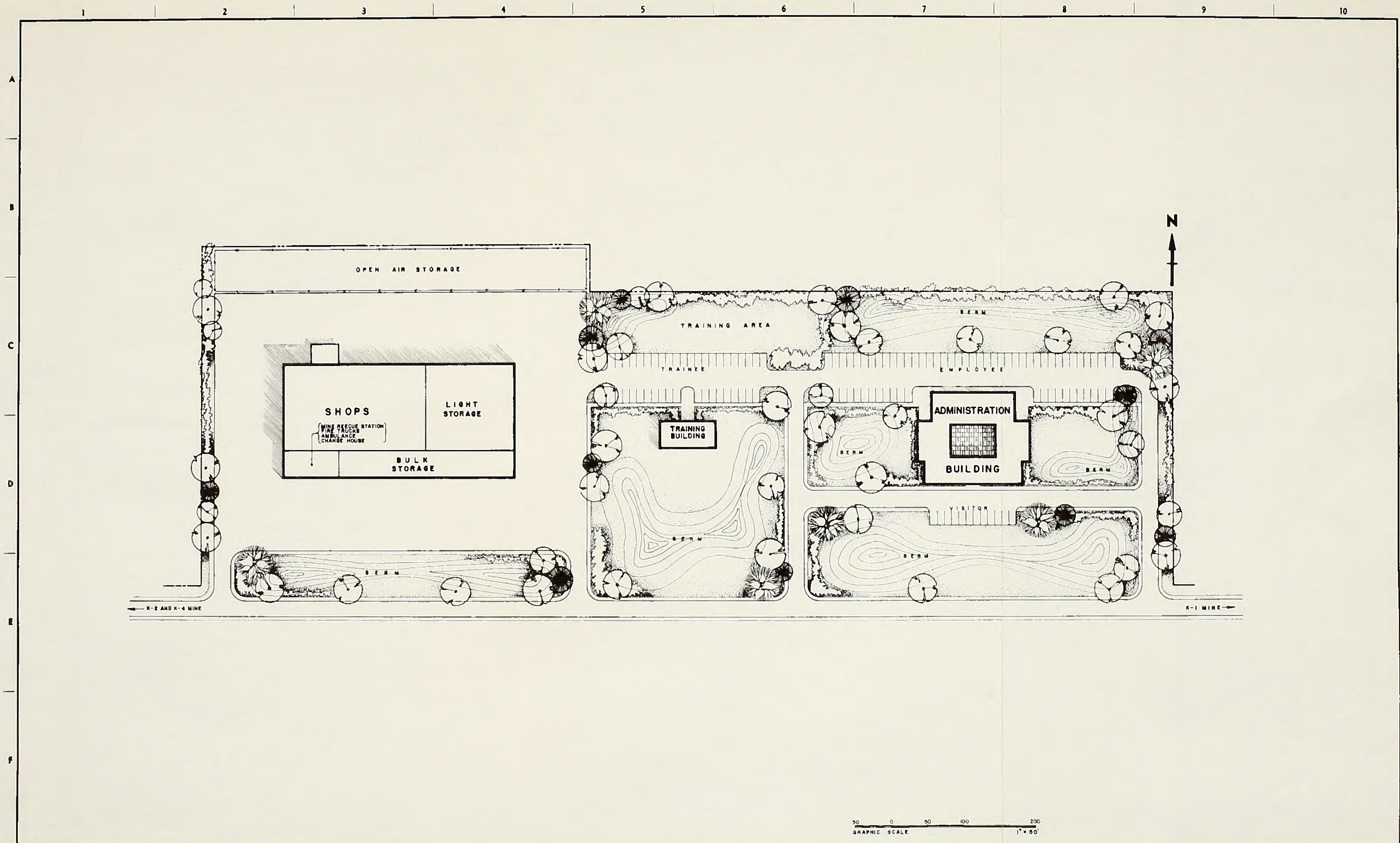
100'
800'
SCALE

ILLUSTRATION 22



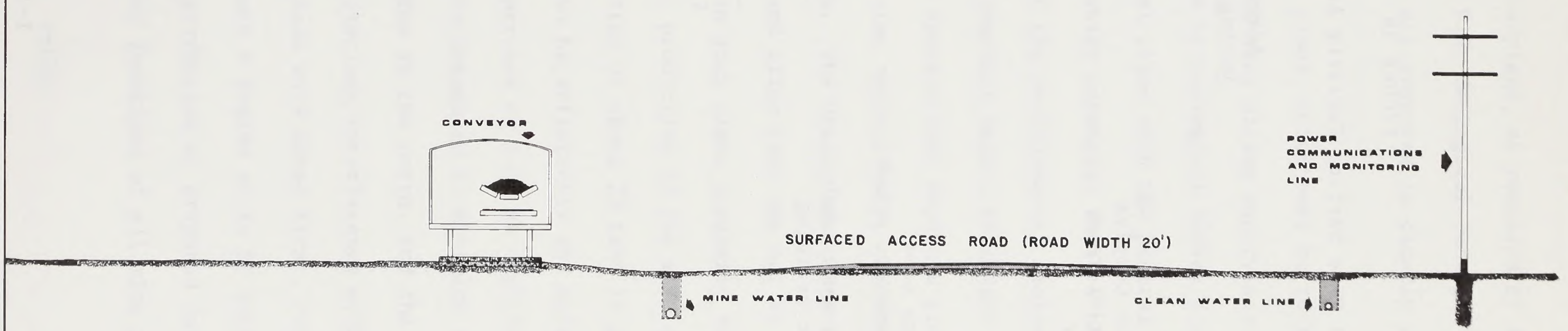
GENERAL ARRANGEMENT OF PROPOSED SURFACE FACILITIES

ILLUSTRATION 23



ADMINISTRATION BUILDING, SHOP AND WAREHOUSE AREA

ILLUSTRATION 24



TYPICAL SECTION—HAULAGE AND SERVICE CORRIDOR—WASHERY TO MINES

ILLUSTRATION 25

FIGURE 29

Coal Mine Surface Facility Area Requirements

Item	Acres Disturbed During Construction	Acres Occupied Permanently
Four mine portals	90	90
Washery & Silos	70	20
Central Administration Complex including permanent storage and water reservoir	50	50
Coarse Refuse Dump	550	550
Tailings pond	550	550
Clear water pond	25	25
Sewage pond	60	60
Ventilation fans	10	5
Temporary coal storage area	75	-
Corridors (roads, conveyor, etc.)	210	140
Main access road	150	150
Other patrol & maintenance roads including access to training mine	50	50
Training mine	20	20
Total acres	1,910	1,710

Mining plans and methods

Formal mining and reclamation plans, as required by 30 CFR 211, at this writing, have not been filed with the U.S. Geological Survey. Such a filing is anticipated however, and formal plans are expected to closely parallel the general proposal herein evaluated.

Upon receipt of such formal plans, which must be technically and administratively acceptable to the USGS area mining supervisor, an environmental analysis of the plans will be prepared by Geological Survey procedures. The analysis will include a comparison of formal plans with the general proposal herein evaluated to determine the extent to which potential impacts have been identified and evaluated in this EIS. Purpose of the environmental analysis would be to determine whether an additional environmental impact statement is required.

The participants propose to operate four separate production mines designated K-1, K-2, K-3 and K-4, to mine respectively, the Orange, the Upper Red, the Lower Red, and the Brown coal beds. The Green, Blue, and Lilac beds would not be mined. Recovery of the Green and Lilac beds may not be technically feasible or desirable. The Blue bed is often in such close proximity to coal beds above and below that mining would jeopardize production of the more significant Orange and Upper Red beds. A minimum separation of about 25 feet is generally required to enable any two adjacent coal beds to be efficiently and safely mined.

Because of multiple-bed occurrence of coal as depicted in Illustration 22, operation of the four mines must be sequenced to minimize effects of one mine on other beds to be mined. The K-1 mine in the north, and the K-3 mine in the west would be developed initially to preclude interference with development of the K-2 mine and K-4 mine. If lower beds were mined first, overlying beds would probably subside and be affected to such a degree as to be economically unminable and operationally unsafe. Lateral distribution of proposed individual operations is indicated in Illustration ~~22~~ 23. Exact locations of all mine portals and specific plans are apparently contingent upon results of an expanded exploration drilling program. Mining depths would vary between 300 and 700 feet below the plateaus and may come within 100 feet of canyon floors.

Each of the four production mines would be similar design, the only difference being the coal bed to be mined and location and orientation of access slopes, ventilation shafts, and surface facilities. In order to furnish 9,000,000 tpy of clean coal to the generating station, approximately 12,000,000 tpy of "raw" coal would be mined. Based on an operating schedule of five days per week, 230 days per year, daily raw production requirement from all mines would have to average 52,000 tons.

In areas of shallow overburden under canyon rims, floors, and cliffs, coal recovery would be sacrificed in favor of surface protection by leaving approximately 50 percent of the in-place coal in the mines as permanent pillars to support the surface and prevent subsidence.

An undeterminable quantity of coal in the project area would not be mined because coal beds are too thick or too thin to be economically and safely recovered. Coal beds up to 26 feet in thickness occur in parts of the project area. Under such conditions only about 13 to 15 feet of coal can be practically and safely mined within constraints of present coal mining technology.

Beds less than four feet thick would not be mined. Although coal beds even less than 30-inches thick are mined in some parts of the world, partings and lenticular nature of Kaiparowits plateau coal deposits make it impossible and uneconomic to mine beds less than four feet thick. In view of these factors, preliminary design of Kaiparowits Project coal mines indicates that recovery of the total in-place minable coal would be limited to about 50 percent.

Each mine would be developed by a single rock slope declining 20 to 30 percent from surface facilities to the respective coal bed and by a single vertical, concrete-lined ventilation shaft. All waste rock excavated during construction of rock slopes and ventilation shafts would be used as fill material for construction of surface facilities. If an excessive quantity of waste should be excavated, all excess would be disposed of in the coarse waste dump (See "Waste Handling and Disposal").

The rock slope would serve two purposes: coal transport from the mine to the surface and delivery of men, equipment and supplies to the active mining area. The participants propose to divide each slope into two horizontal sections separated by a concrete deck. The upper section would serve as a passageway for a belt conveyor to transport coal from the mine and the lower section would be equipped with a rail-mounted, wire-rope hoist for delivering men, equipment and supplies.

Because of the flammable nature of coal and coal dust, special precautions must be taken to minimize the hazard. The Federal Coal Mine Health and Safety Act of 1969 requires that rock dust consisting of finely ground (100 percent minus 20 mesh, 70 percent minus 200 mesh) inert material be applied to all surfaces in the mine. Rock dust must contain no more than five percent combustible material and no more than four percent of free or combined silica. Only surfaces less than 40 feet from a working face need not be dusted. Mining operations would require approximately 220 tons-per-day of rock dust.

The Participants have indicated that wherever possible, mines would be developed on the "advance and retreat" principle. This scheme of mining would entail complete development of all primary and secondary entries, including all supplementary ventilation shafts and escapeways, from the bottom of the rock slope to limits of the property. When all development work is complete, mining would commence at property limits and retreat to the bottom of rock slopes. Although such a scheme of mining is capable of consistently higher production rates and lower mining costs than advance mining, the very high capital cost of developing the entire mine prior to production and a requirement for coal production before the mine is completely developed demand that the scheme be modified.

The most common modification of full advance development and retreat mining is to commence production mining work near the bottom of the rock slope while the rest of the mine is being developed. Upon completion of development, the mine can be converted to the original scheme.

The participants have indicated that, where possible, maximum extraction mining methods, such as "long-wall", "short-wall" or "room and pillar" with pillar extraction would be proposed. However, where the surface overlying the coal must be protected from subsidence (for example, under canyon rims and floors, or cliffs), partial extraction methods such as conventional or continuous room-and-pillar without pillar extraction mining methods would be used. Partial extraction would recover no more than 50 percent of the total in-place coal, and although less desirable from a standpoint of maximum resource recovery, partial extraction is necessary for protection of the surface. Morever, in some areas where thickness of coal is non-uniform, long-wall or short-wall methods lose their advantage; therefore, room-and-pillar methods may be employed. Where subsidence of the ground above would not affect surface use or impair public safety, pillars in a room-and-pillar area can be extracted, thus permitting maximum coal recovery.

Four specific mining methods have been proposed by the participants for use in Kaiparowits coal mines. They are: (1) Conventional room-and-pillar, (2) Continuous room-and-pillar, (3) Long-wall, and (4) Short-wall. In each mine, one of the above methods or a combination of methods will be used dependent upon conditions encountered in the mines.

In room-and-pillar mining, part of the coal bed is removed by driving parallel excavations or "rooms". Coal remaining between rooms becomes the "pillar", pierced at certain intervals by breakthroughs or "crosscuts" to provide passageways for ventilating air currents. Openings are developed in a uniform pattern within a panel or block of coal (Illustration 26). Remaining columns of coal or pillars are left standing for primary support of the overlying strata. This technique is called "advance mining" and results in a "room-and-pillar" pattern.

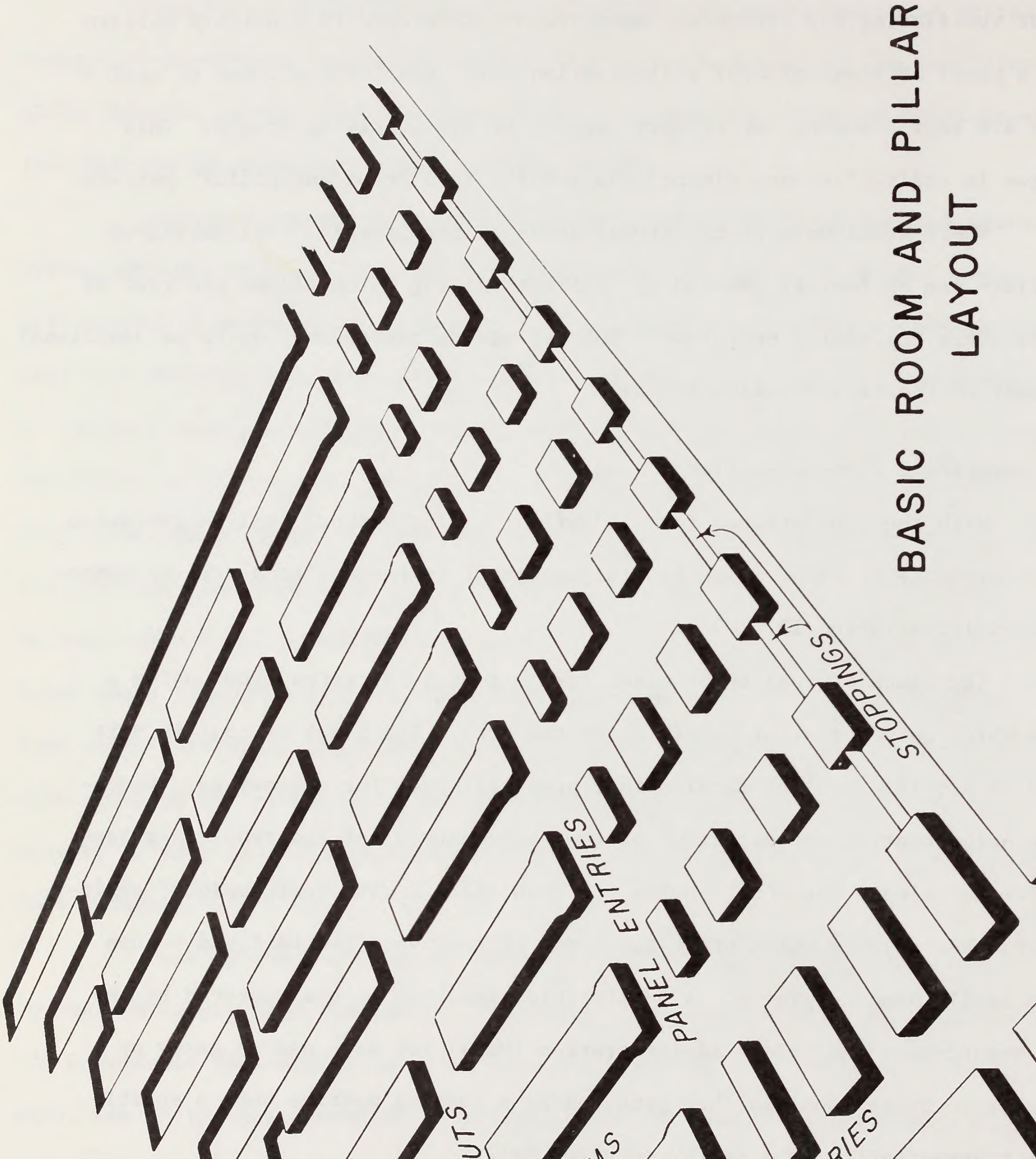
Where subsidence of the ground above is permissible, coal making-up the pillars can be further removed by "retreat" mining which allows the roof to collapse after the mining operation. Retreat mining can recover up to an additional 35 percent of the total available coal.

Conventional room-and-pillar mining

With the conventional room-and-pillar mining method, coal is extracted in a set sequence of steps using special equipment to execute each step as demonstrated in Illustration 27.

The block of coal to be mined from a room is first undercut using a machine which cuts a slot or "kerf" under the coal. The block of coal is next drilled by a self-propelled machine that prepares holes for explosives. Undercutting helps control the direction of the subsequent blast and requires a less explosive to release the coal. Holes are then charged with "permissible" explosives or other devices which break the block of coal into the kerf and reduce it into easily handled pieces. A permissible explosive is one approved by the Mining Enforcement and Safety Administration (MESA) for safe use in gassy or dusty mines. Broken coal is then gathered by a loading machine onto a shuttle car for transportation to a nearby conveyor belt.

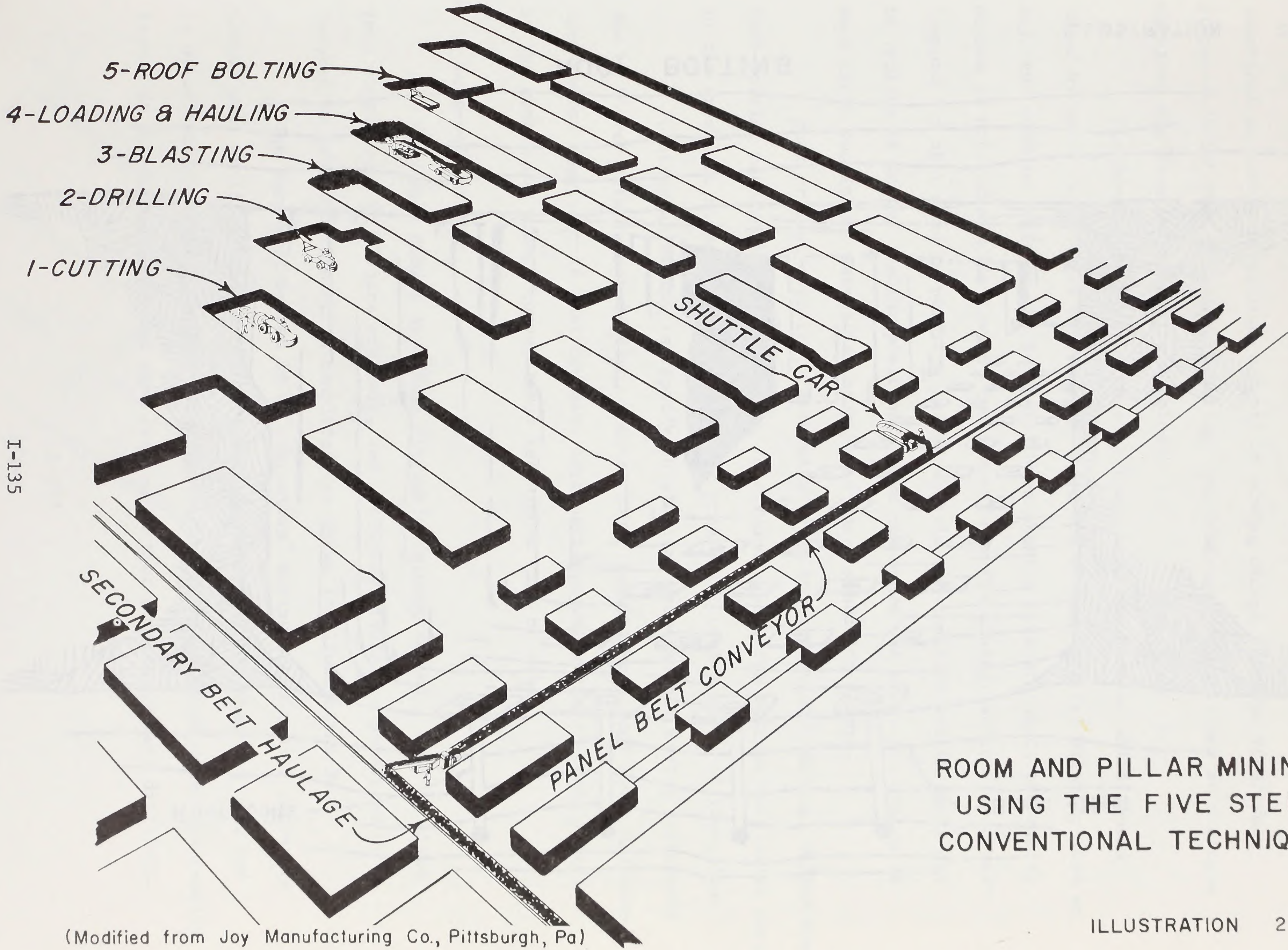
After coal is removed, the roof must be supported by using timber or steel supports, or more commonly by using "roof-bolts" which bind overlying layers of rock into a continuous beam as shown in Illustration 28. The participants propose to use timber supports only when roof-bolts provide insufficient support.



BASIC ROOM AND PILLAR LAYOUT

ILLUSTRATION 26

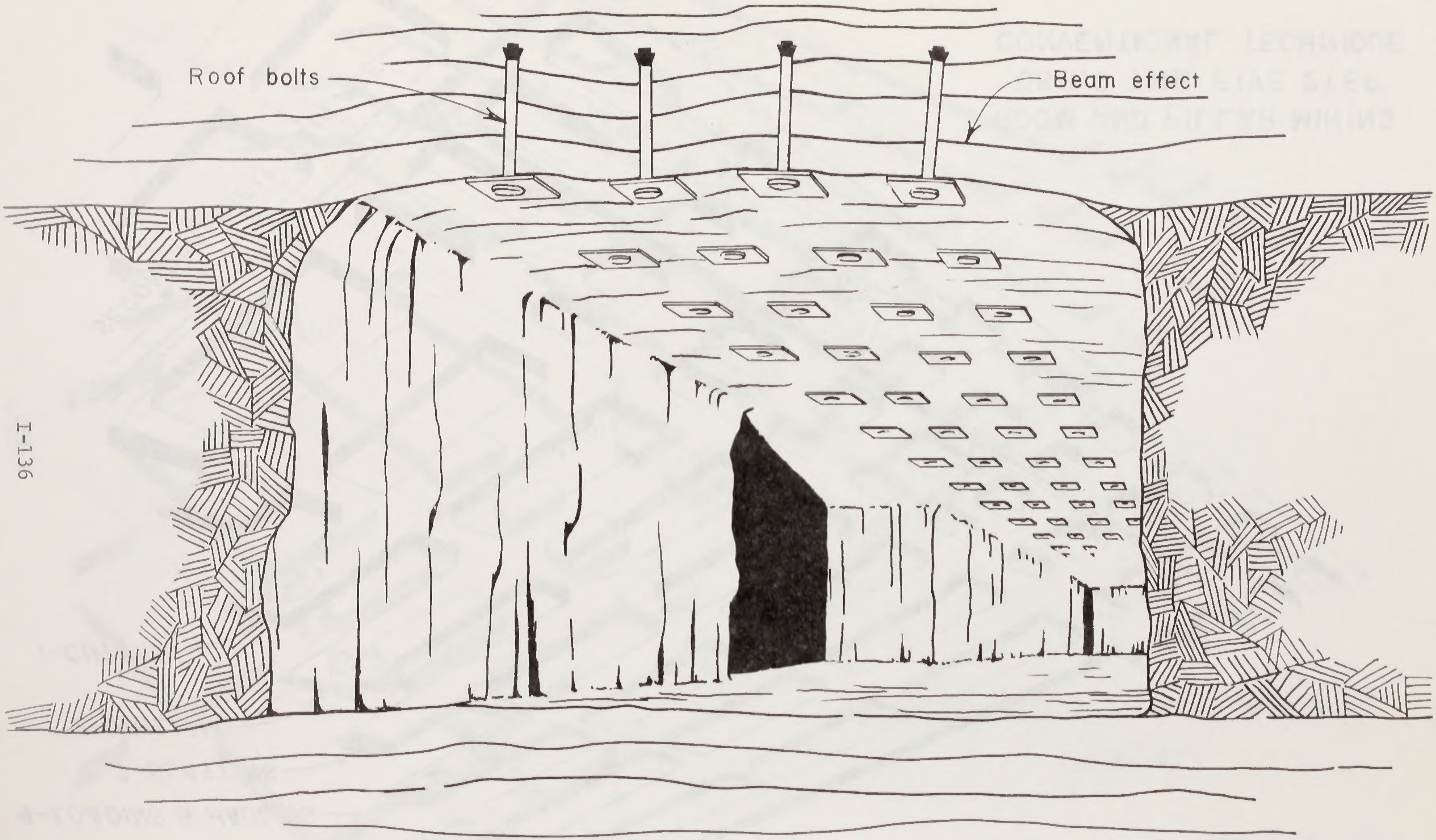
(Modified from Joy Manufacturing Co., Pittsburgh, Pa.)



(Modified from Joy Manufacturing Co., Pittsburgh, Pa)

ROOM AND PILLAR MINING
USING THE FIVE STEP
CONVENTIONAL TECHNIQUE

ILLUSTRATION 27



ROOF BOLTING

ILLUSTRATION 28

Continuous room-and-pillar mining

Continuous room-and-pillar mining depicted in Illustration 29 is identical to conventional room-and-pillar mining except that the first four steps--undercutting, drilling, blasting, and loading--are performed by a single machine, the "continuous mining machine".

The continuous miner rips coal loose from the face or solid deposit ahead by use of mechanical cutters and loads the broken material directly into an adjacent conveyor belt or shuttle car. When shuttle cars are used, the mining method is not technically always "continuous" as the mining machine often must temporarily shut down to permit a loaded shuttle car to leave and an empty one to replace it in the loading position. When conveyors are used, the system is more truly continuous except for breakdowns and unscheduled delays.

Rock or roof support is accomplished as in conventional mining. Unless the roof-bolting machine is mounted on the continuous miner, the machine must cease work in the area just mined and move to another area while roof-support is installed.

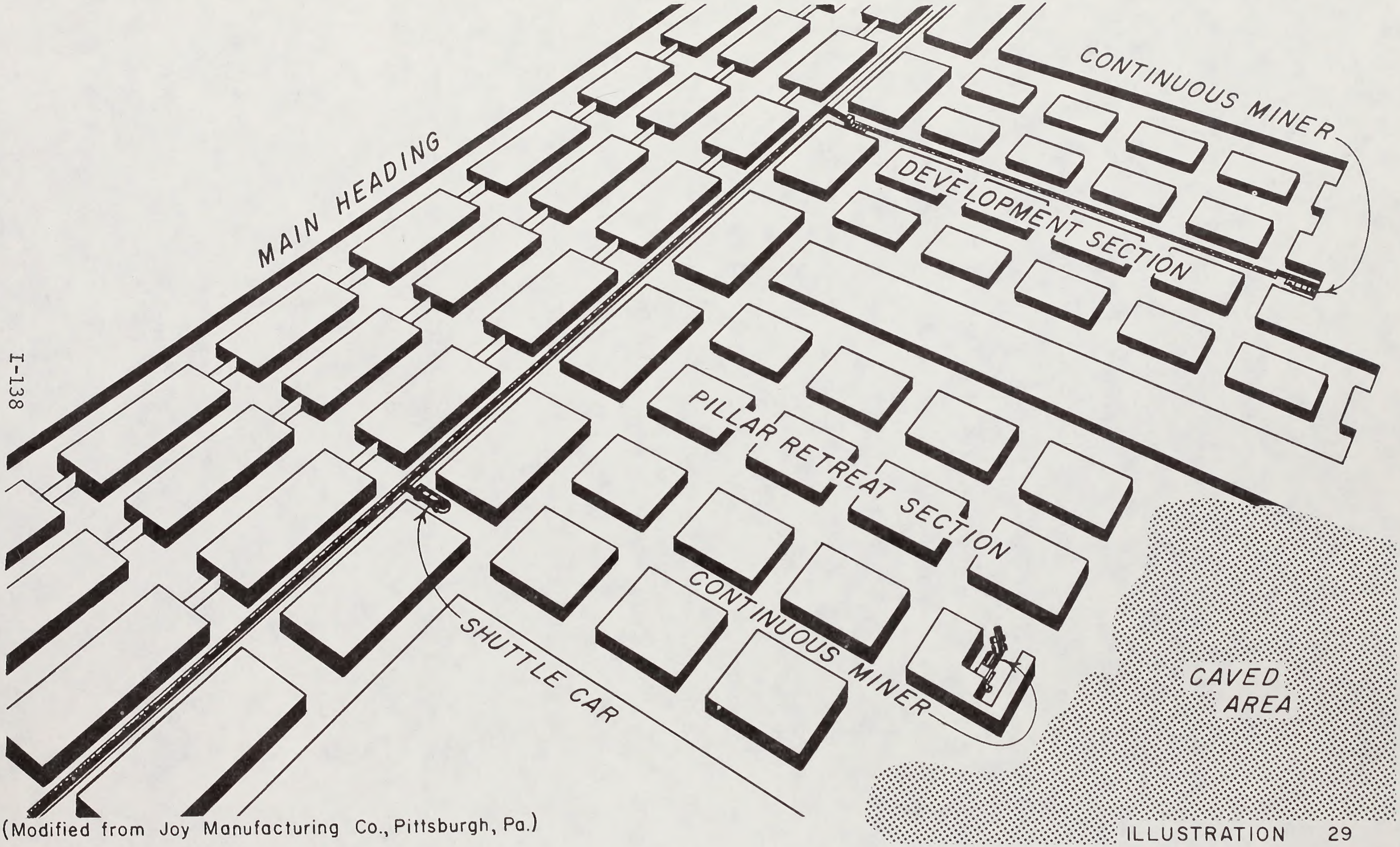
Continuous mining is rapidly supplanting conventional mining techniques due to higher rates of production, reduced labor requirements, and lower maintenance costs. However, if coal contains hard partings which cannot readily be cut by the continuous miner, conventional techniques must be used.

Long-wall mining

Long-wall mining is a full extraction mining method. Coal is mined in a single cut, no pillars are left, and overlying strata are permitted or induced to cave once mining is completed, as shown in Illustration 30.

The long-wall system is a "continuous" mining technique as conveyors remove coal as it is broken. It is particularly applicable when the coal bed is of uniform thickness, when it contains no hard partings which cannot be readily broken by mechanical means and when roof support or control is very difficult.

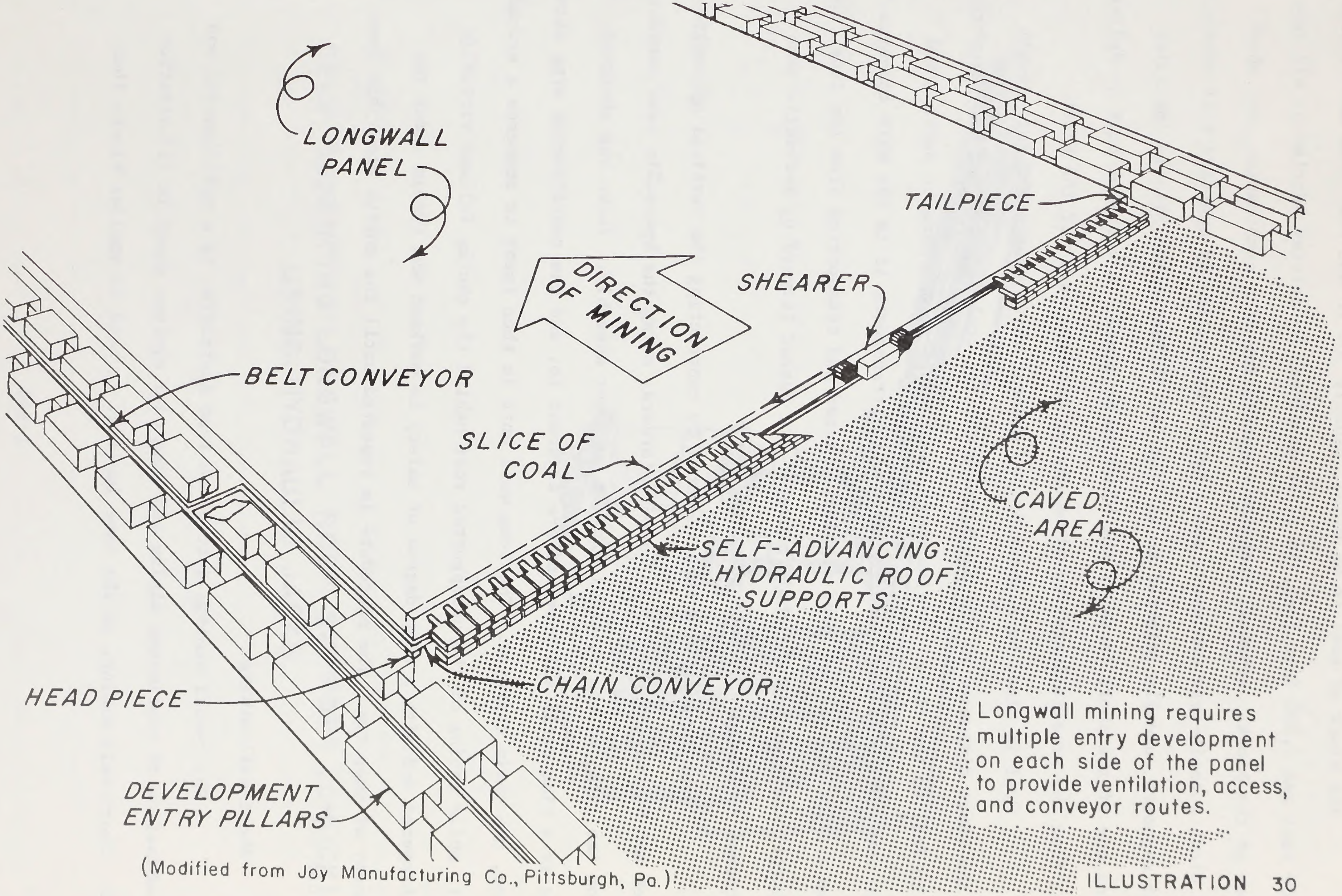
ILLUSTRATION OF ROOM AND PILLAR MINING SHOWING DEVELOPMENT AND PILLAR RECOVERY PHASES



(Modified from Joy Manufacturing Co., Pittsburgh, Pa.)

ILLUSTRATION 29

ILLUSTRATION OF LONGWALL MINING TECHNIQUE



(Modified from Joy Manufacturing Co., Pittsburgh, Pa.)

ILLUSTRATION 30

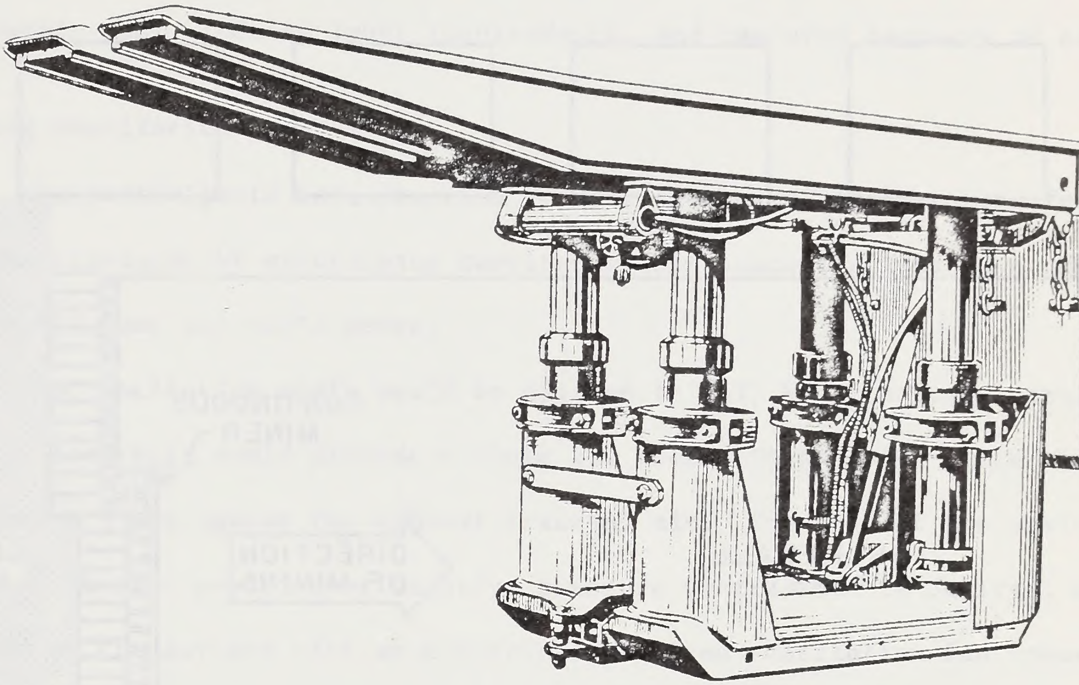
The block of coal to be mined, usually 300 to 600 feet wide and between 2,500 feet and 7,500 feet long, is first developed by driving entries on all four sides of the block. Longwall machinery--consisting of a combination coal shear and plow, a chain-type conveyor, and a set of hydraulically operated self-advancing roof supports, usually referred to as "chocks" (Illustration 31)--is installed along one of the short faces of the block to be mined. A conveyor belt to deliver coal from the area is installed along one of the long faces of the block.

Coal is mined by a chain driven shearer which passes the full length of the short dimension of the block while cutting coal from the bed and permitting it to fall to the floor. A plow which is attached to the shearer pushes coal from the floor onto the chain conveyor which transports it to the main conveyor. When a slice of coal has been completely mined and transported from the face, the shearer, the plow and the chain conveyor are pushed forward by hydraulic rams attached to legs of the roof supports.

Roof supports are then advanced by contracting the vertical hydraulic jack and by pulling the entire support forward, using the hydraulic rams connected from the jacks to the shear/plow/chain conveyor assembly. Jacks are advanced one at a time until all supports are adjacent to, and the cantilevered arms extend over, the chain conveyor. The long-wall unit is then ready to commence a second cut, while caving of the unsupported roof behind the chocks follows virtually unhampered and with a high degree of safety to workmen who remain under the canopy of supports. The procedure is repeated until the entire block has been mined out.

Short-wall mining

Short-wall mining, introduced from Australia, is a modification and combination of continuous mining and long-wall systems shown in Illustration 32. Short-wall mining, as the name implies, is used in smaller blocks than



SELF ADVANCING LONGWALL ROOF SUPPORT (CHOCK) USING HYDRAULIC JACKS

PLAN VIEW FOR A BASIC SHORTWALL MINING LAYOUT

Adapted from "Cassidy," 1973, page 376

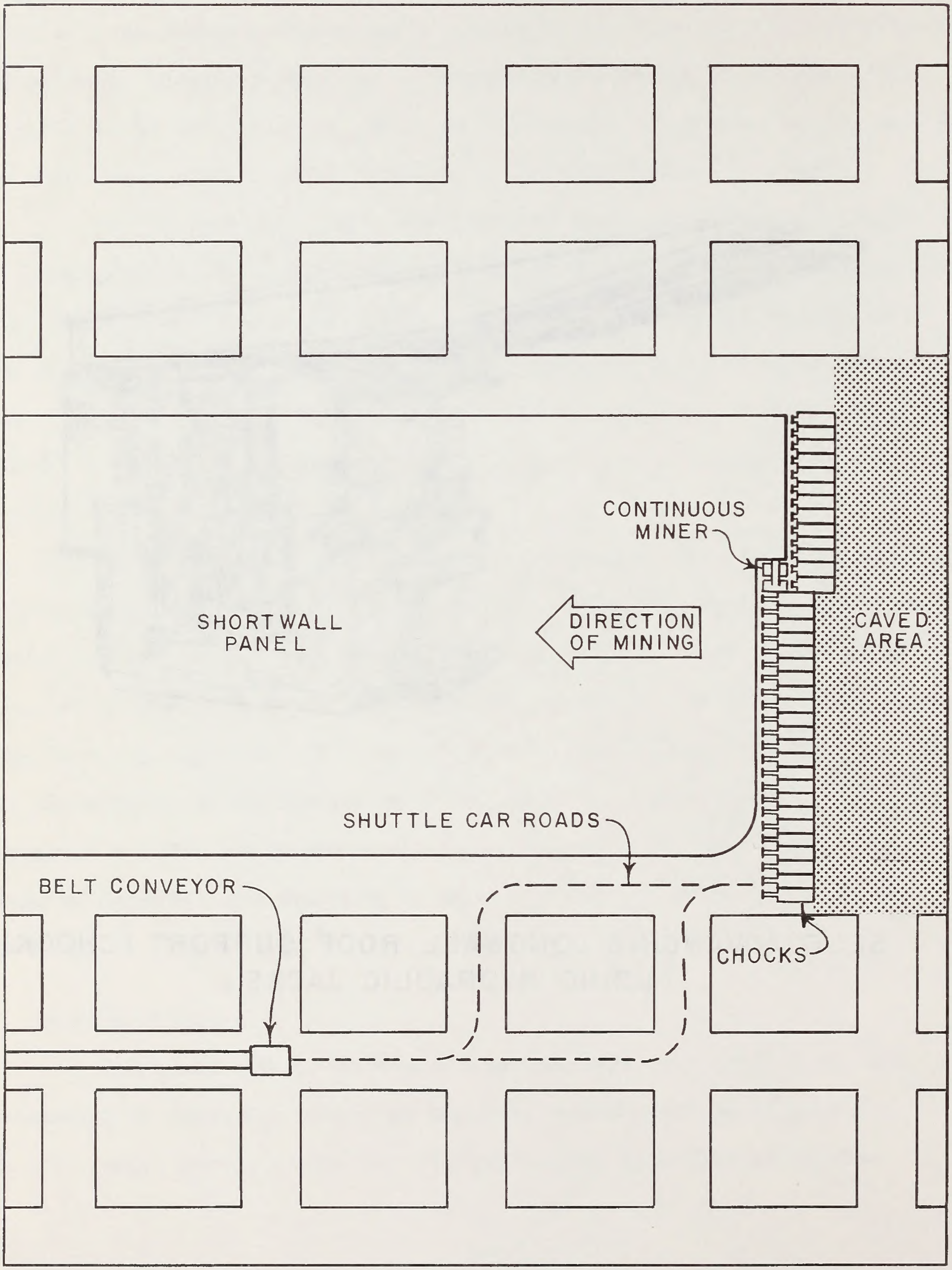


ILLUSTRATION 32

long-wall mining, usually up to about 180 feet wide and 3,000 feet long (Palowitch and Briskey, 1973).

Principles of roof support and post-mining caving are the same as in long-wall mining, except that chocks with longer arms are used to provide additional clearance for actual mining equipment. Actual mining is accomplished by utilizing continuous mining machines and shuttle cars instead of the long-wall shear/plow/chain conveyor. Advantages of the short-wall mining method include improved safety, reduced supply cost, reduced labor requirements, and improved recovery of coal.

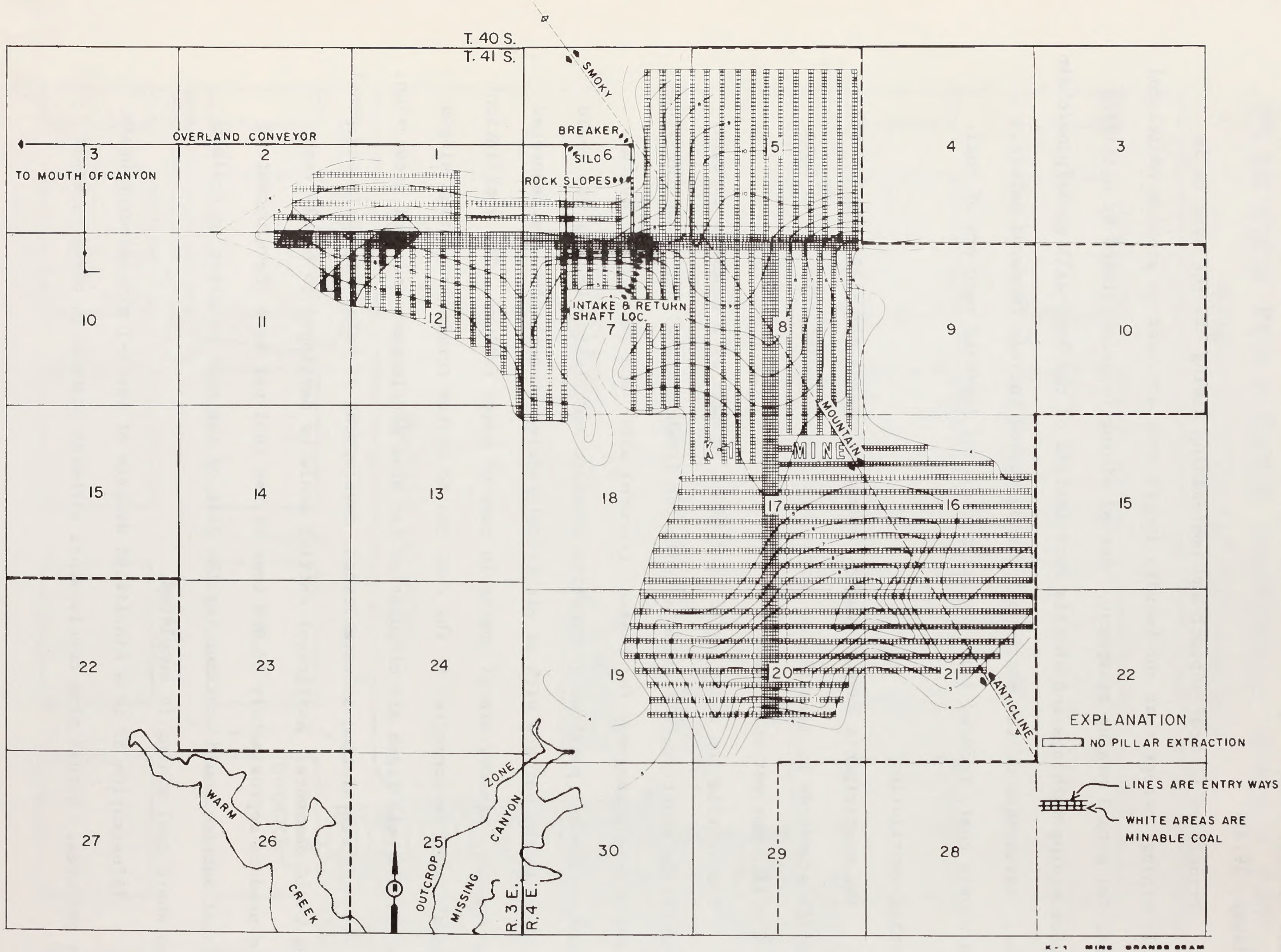
Mining ventilation

The participants have proposed to meet or exceed all state and federal ventilation standards by maintaining respirable dust concentrations at no more than 2.0 milligrams per cubic meter.

The ventilation shaft would be divided in half by a concrete curtain. One side of the shaft would provide a route for fresh (intake) air while the other would serve as a passageway for exhaust (return) air. One side of the shaft, depending on whether positive or negative pressure ventilation is desired, would be equipped at the surface with an electrically-driven ventilation fan connected to an emergency, standby diesel engine in case of power failure. The ventilation shaft would be interconnected in the coal bed to bottom terminals of rock slopes to provide adequate fresh air circulation for mine development and coal production.

Once ventilation is established, development of main, secondary and panel entries would commence. Sufficient entries would be developed to enable each mine to produce approximately 13,000 tons of raw coal per day. Development of additional entries would continue for the life of the mine in order to replace entries where coal mining is completed.

Illustration 33 is a simplified diagram of the K-1 mine showing basic design features. Actual mine development, although planned in advance, would



TYPICAL COAL MINE BASIC DESIGN

ILLUSTRATION 33

be flexible in order to adjust or compensate for specific underground conditions encountered.

Training facilities

Because of a shortage of experienced coal miners in Utah, a small training mine equipped with underground workings and surface classrooms would be developed in Missing Canyon south of the main production mining complex. It is anticipated that, to operate the four production mines and related facilities, approximately 2,560 employees would be required, the largest percentage of whom must be trained.

Classroom instruction would include first aid and mine rescue training, accident prevention, mining methods and equipment, and roof control and ventilation principles. Training in the operation and maintenance of mining equipment would be taught both on the surface and underground.

Coal recovered from the training mine would be trucked to the nearest conveyor belt for transportation to the coal washing plant.

Coal transportation and preparation

Raw or "mine-run" coal up to 12 inches in size would be delivered to the surface by a belt conveyor from each mine to a 1,500 ton-per-hour rotary breaker near the portal. The rotary breaker would reduce the size of the coal to less than four inches, providing a product more easily handled by conveyor belts. In addition, the rotary breaker would remove small quantities of rock, boney (impure coal layers), wood, paper and other foreign materials from the coal. A "tramp iron" magnet, mounted over the conveyor at the breaker inlet, would remove scrap iron which could damage the breaker or conveyor belts.

From the rotary breaker, coal would be transported by an enclosed belt conveyor to a nearby 5,000 ton capacity raw coal storage silo serving as a "surge pile" or buffer supply against periods of low mine output. From the silo, another short enclosed belt conveyor would deliver the coal to a wider belt conveyor for shipment to four 15,000 ton capacity storage silos at the coal preparation plant.

The participants propose that overland belt conveyors would be elevated wherever their route would cross a surface drainage. This would be accomplished by use of culverts and backfill or bridge-type construction.

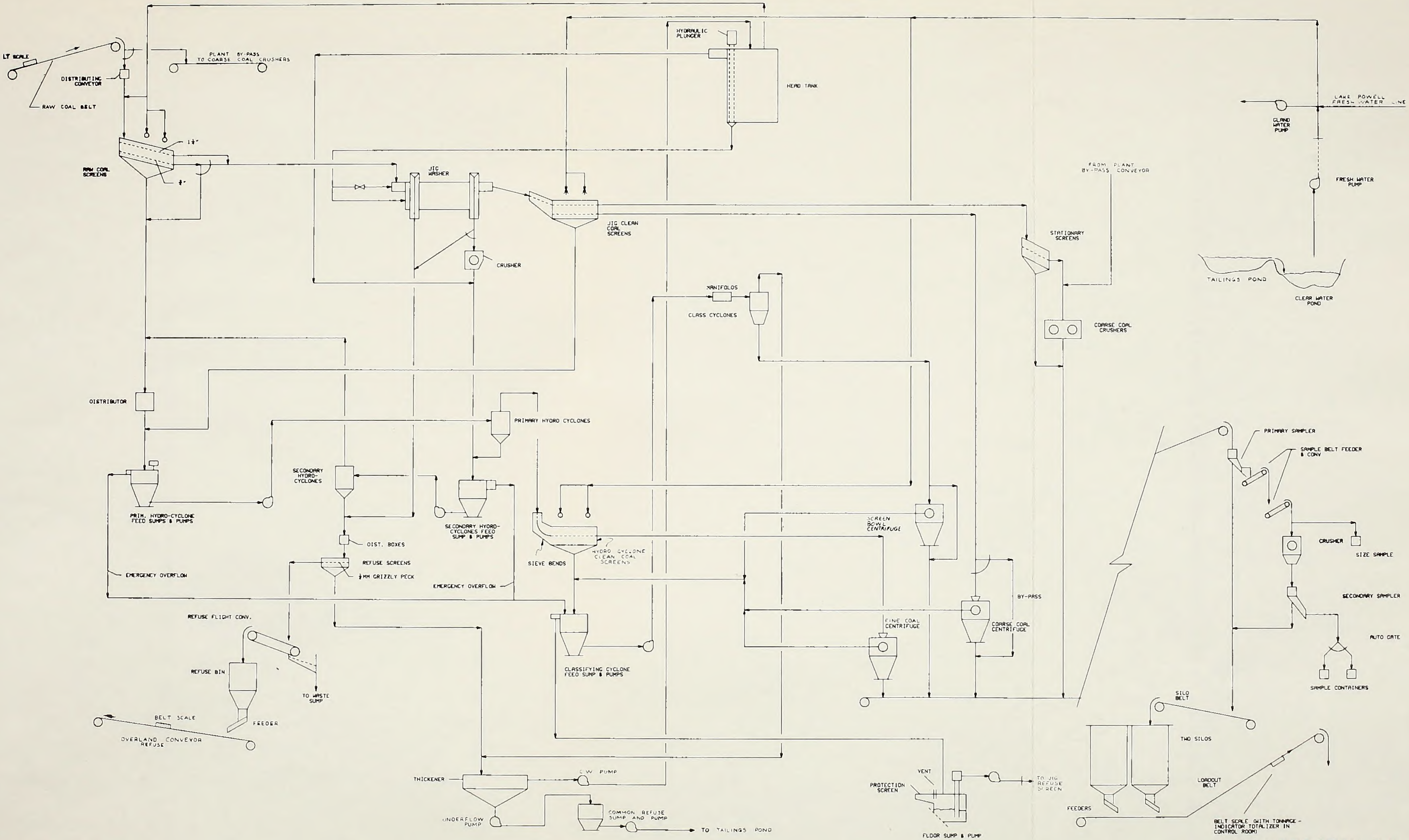
Raw coal received from rotary breakers would not be acceptable feed for the power generating station because of impurities mined along with the coal. In order to upgrade coal for power plant use and to improve mining productivity by not requiring selective mining, the coal would be washed. A flowsheet of a typical coal washery such as proposed for the project is shown in Illustration 34. The surface layout of the proposed washery is shown in Illustration 35.

Raw coal would be cleaned by "jig" washboxes using the principle of gravity separation. Pulsating action of the jigs causes lighter coal in the water bath to rise while heavier waste material sinks. Coal from the jig would be screened to separate fine (less than one-quarter inch) from coarse coal. Coarse coal would then be crushed to less than one and one-half inches and conveyed to clean coal silos. Fine coal would be mixed with water, cleaned with cyclone classifiers, dewatered by mechanical centrifuges and shipped to the clean coal silos.

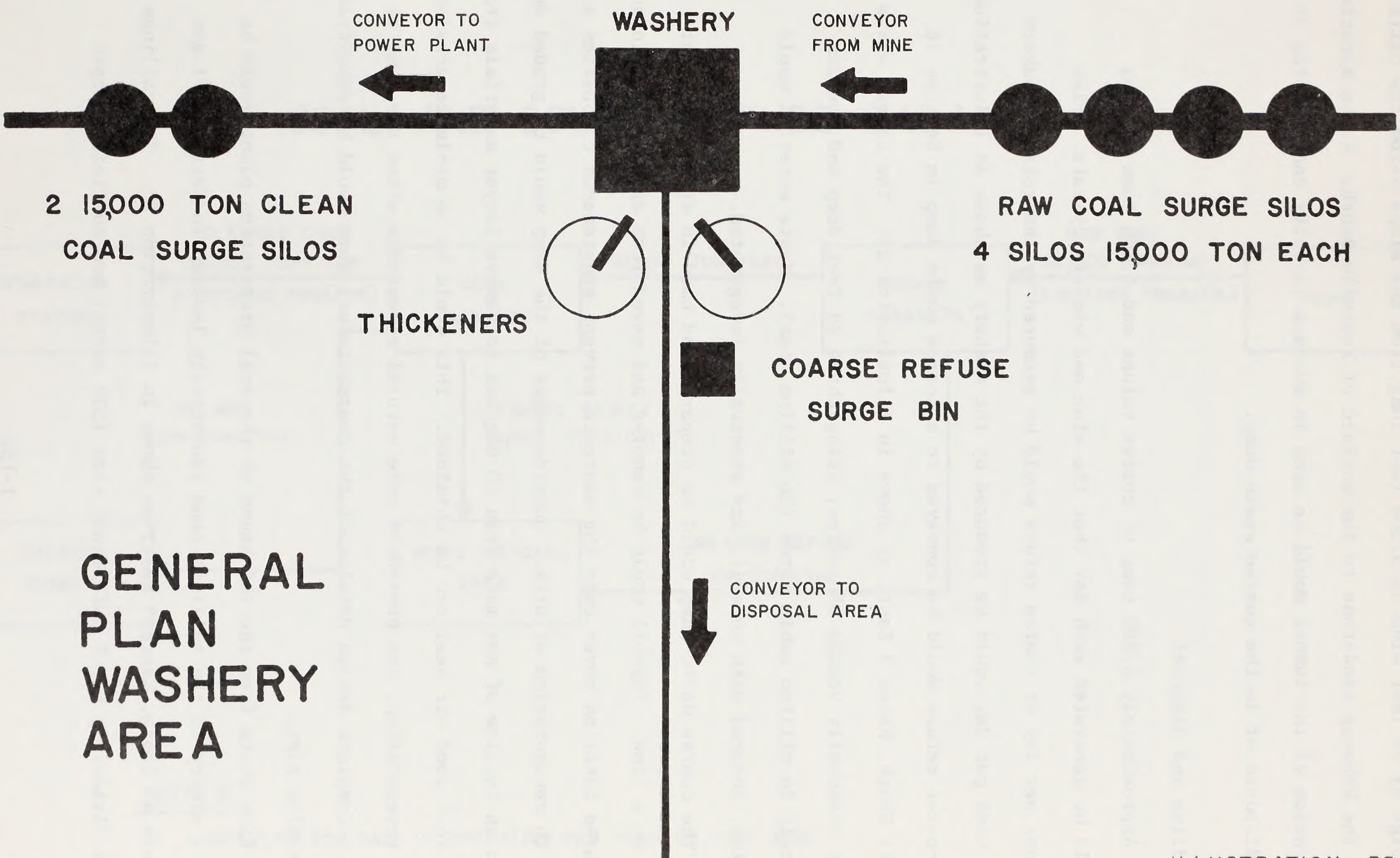
Coarse refuse from wash boxes would be transported by conveyor belt to the coarse waste dump. Fine refuse from the cyclones would be pumped to a thickener where it would be partially dewatered and pumped to tailings and clarification ponds.

From the washery's clean coal silos, coal would be delivered by a 2,400 ton-per-hour belt conveyor to the power generating plant at Fourmile Bench, 1,200 feet higher in elevation. Final segment of the main transportation network would be approximately five miles in length and would include an inclined tunnel,

PROPOSED COAL WASHERY FLOWSHEET



ILLUSTRATON 34



GENERAL
PLAN
WASHERY
AREA

ILLUSTRATION 35

ten feet high by 24 feet wide by 3,500 feet long from the slope below the cliff formed by the Wahweap sandstone to the surface of Fourmile Bench. Waste material from excavation of the tunnel would be used in surface facility construction or would be disposed of in the coarse waste dump.

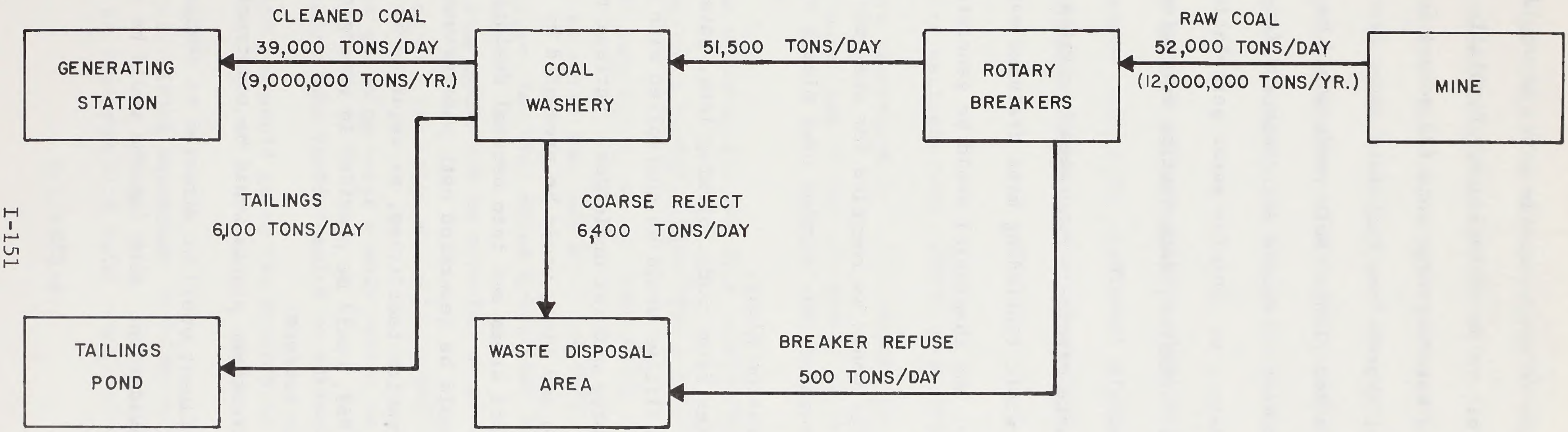
Waste handling and disposal

Approximately 6,900 tons of coarse refuse and 6,100 tons of fine waste would be generated each day that the mine and washery operate. Five hundred tons per day of coarse refuse would be produced by the rotary breakers and 6,400 tons per day would be produced by the washery as shown in Illustration 36. All coarse refuse would be conveyed to a coarse waste dump in Section 16, Township 41 South, Range 3 East, as shown in Illustration 23. The coarse waste dump would eventually occupy 550 acres, being about 29 feet deep and contain approximately 26 million cubic yards (56 million tons). Waste material would be compacted, covered with topsoil, and eventually revegetated.

The coarse waste dump would be prepared and used in stages of about ten acres at a time. Topsoil would be removed and saved from each stage. Topsoil would be used later as cover over the waste to prevent spontaneous combustion and as an aid in revegetation efforts. Outside edges of the dump would be graded and tapered to an incline of not more than 20 degrees to remove larger materials from the edges so a good air seal can be obtained. This would be to minimize erosion, assist in revegetation, and provide a more natural appearance after the dump is completed. Complete design details of the coarse refuse dump would be submitted with the mining plan.

Fine waste from the thickener of the coal preparation plant would be pumped as a slurry to the tailings pond tentatively located in Sections 21 and 22, Township 41 South, Range 3 East, as shown in Illustration 23. The tailings pond would ultimately be of sufficient size (550 acres) and sufficient depth

COAL AND SOLIDS REFUSE BALANCE



NOTES:

1. BASED ON 230 DAYS OF OPERATION PER YEAR OF COAL MINE
2. GENERATING STATION COAL REQUIREMENT BASED ON 4 UNITS AT 75% CAPACITY FACTOR FOR 365 DAYS/YEAR USING COAL WASHED TO 10,800 BTU/LB. THE AVERAGE DAILY BURN RATE IS 24,730 TONS/DAY.

ILLUSTRATION 36

(50 feet) to permit most fine refuse to settle out. It would ultimately contain approximately 43 million cubic yards of tailings. Partially clarified water would be decanted to a clean water storage pond (23 acres) for additional retention and clarification time. Water from the clean water storage pond would be recycled to the coal preparation plant. Both ponds would be impounded by tailings dams engineered to meet or exceed all state and federal standards and would be lined with mudstone to minimize water percolation. The pond would be constructed and filled in sections, each section sufficient for three years of tailings disposal (approximately 30 acres).

In addition to waste materials generated by mining and washing of the coal, five types of liquid waste (including mine drainage water, storm runoff water, sanitary waste, oils, and chemicals) would be generated by the coal mining complex.

Mine drainage water would be recycled for use underground. If excessive quantities of water are generated, any surplus over mining requirements would be piped to the coal preparation plant.

Storm runoff, water from roads, parking lots, paved and covered areas located at mine surface facilities would be controlled with peripheral drainage ditches and diverted to nearby natural drainages. Surface runoff into waste disposal areas, both course and fine, would be prevented by ditches which would divert runoff around disposal areas and into natural drainages.

Sanitary waste would be generated both underground and at surface facilities. Portable sanitation facilities, as required by the Federal Coal Mine Health and Safety Act of 1969, would be provided in underground work areas and periodically removed to the surface.

Aerobic sewage treatment plants would be constructed at kay surface installations. Treated effluent would be directed to sewage ponds or lagoons for further aeration and oxidation. Such lagoons would be separate from other bodies of water in the mine complex area, and would be lined with impervious material to prevent ground water contamination.

Oily wastes would be generated from routine maintenance of equipment and related operations. Such waste would be drained into a two-compartment, concrete, oily-waste separator where partially purified water would be separated. Oil would be stored in the separator tank pending disposal by a vacuum truck in a designated area.

Chemical waste would be generated primarily in the mine laboratories; however, some chemical waste could also be created in the maintenance shops. These wastes would be stored in drums pending disposal in an appropriate area.

Water utilization

The participants estimate total water requirements for the coal mine and coal washery would be approximately 5,245 gallons per minute (gpm) or 3,100 acre-feet per year. Illustration 37 demonstrates a water balance analysis for the entire mine complex.

Primary source of water for the mine complex would be Lake Powell. Water would be delivered via a buried, eight inch pipeline which would intersect the main water line from Lake Powell to the generating station. A possible secondary water source would be water that may be encountered in the mine. Exploration to date, however, indicates that only minor quantities could be expected.

Although the mine would not be expected to produce substantial quantities of water, if it should do so, the water would be pumped to the surface where it would be introduced into the mine water supply system or piped to the coal washery.

Coal mining operations would require an estimated 2,400 gpm of water. Of this amount, about 450 gpm would go to the washery as surface moisture on raw coal.

All conventional mining equipment, continuous miners and long-wall shearing machines must be equipped with water sprays to control dust within

COAL MINE OPERATION WATER BALANCE

FLOWS GIVEN ARE FOR 14 HRS/DAY, 5 DAYS/WEEK, 230 DAYS/YR.
EXCEPT FOR EVAPORATION WHICH IS 24 HRS/DAY, 365 DAYS/YR.

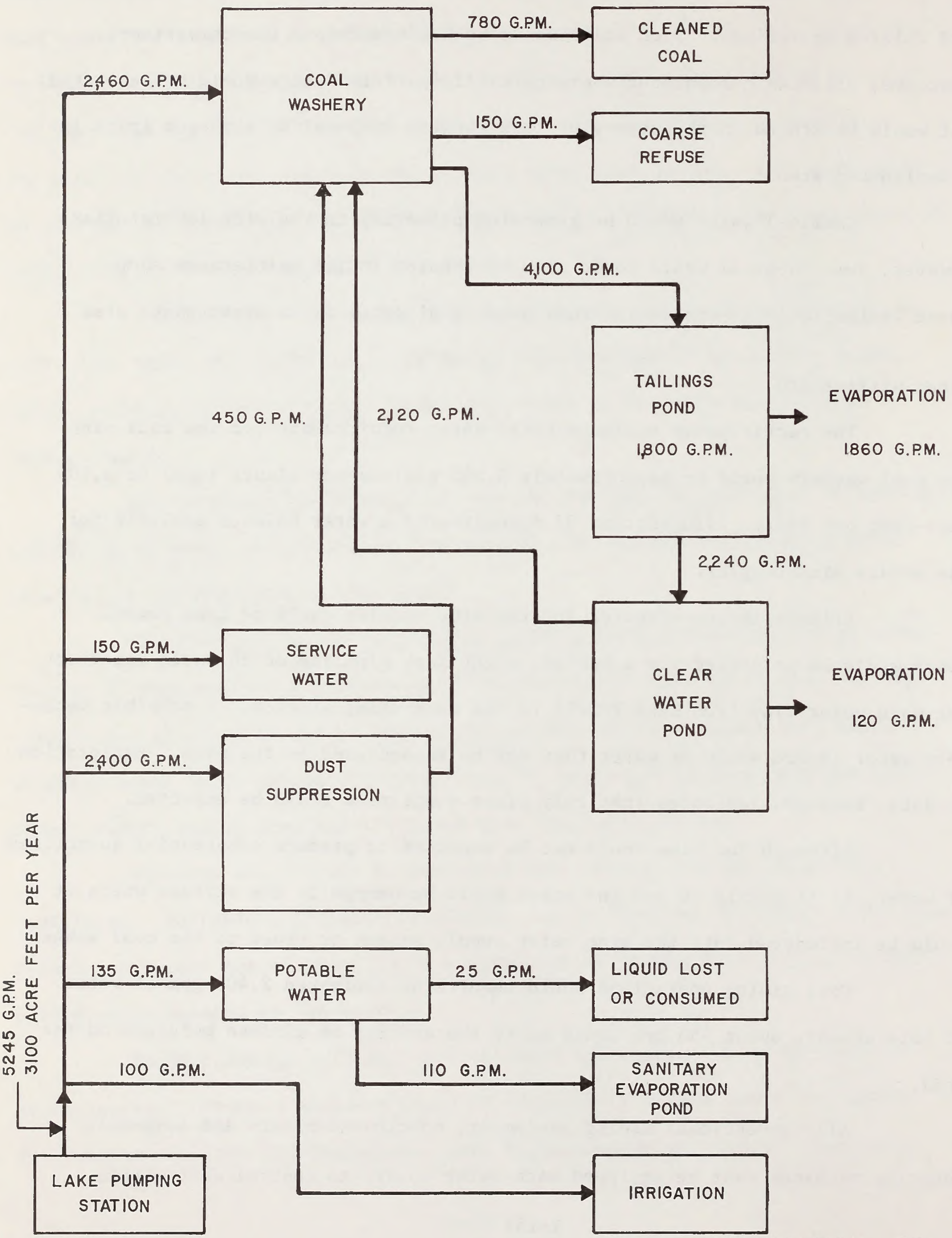


ILLUSTRATION 37

limits specified in the Federal Coal Mine Health and Safety Act of 1969. All locations, such as conveyor transfer points, which offer a possibility of creating dust must also be equipped with water sprays. Additionally, water would be required at the mine for the rotary breaker, potable and sanitary facilities, mine and haulage road dust suppression, irrigation of revegetated areas, and for emergency fire protection.

The coal washery would be the largest user of water in the coal mining complex. The washery would require 2,460 gpm (1,454 acre-feet per year) of water. Surface moisture on clean coal would account for 780 gpm of water losses. An additional 150 gpm would be lost as moisture in the coarse refuse and 4,100 gpm would be lost with fine tailings. Sources of water for the washery would be 2,120 gpm from the clear water pond, fed by decanted water from the tailings pond; and 450 gpm recovered from the dust suppression system, for a total of 2,570 gpm.

A summary of water requirements for the proposed coal mine facility is as follows:

	Gal/min.	Acre-feet/year
Coal Washery	2,460	1,450
Service Water	150	90
Mine Dust Suppression	2,400	1,420
Potable Water	135	60
Irrigation	100	60
Total	5,245	3,100

Transmission and communication system - Fourmile Bench

Transmission system

The transmission line proposed routing described above would cross the Navajo, Hualapai, Kaibab, Morongo and Aqua Caliente Indian Reservation lands. Private tribal Indian lands held in trust by the United States are not subject to usual procedures for right-of-way acquisition. Consent of the tribal governing bodies must be obtained, prior to the granting by the Secretary of Interior or his authorized representative of rights-of-way across such lands. In some cases rather lengthy negotiations between tribes and utility interests are required before consent is granted. In the past, some Indian tribes have declined to grant consent. Therefore, transmission corridor information in this statement, insofar as Indian lands are concerned, is to be considered tentative until such time as right-of-way agreements are consummated with Indian tribes.

The transmission system (500 kv) would be constructed by two of the participating companies: Southern California Edison and Arizona Public Service. SCE would construct lines that lead west into California: Kaiparowits to Eldorado Substation, Kaiparowits to Mohave generating Station Switchyard, Mohave to Devers Nos. 1 and 2 and Devers to Serrano Nos. 1 and 2. (hereafter called the western system). APS would construct lines going south into Arizona (referred to as the southern system); Kaiparowits to Navajo Generating Station and Kaiparowits to Westwing Substation. The proposed routes are shown in Illustration 38.

In the western system (Southern California Edison and its associate, San Diego Gas and Electric) one 500 kv line would be constructed from Kaiparowits Generating Station to Eldorado Substation in Clark County, Nevada, where it would interconnect with an existing 500 kv line serving California. This line would follow the corridor established by the Navajo-McCullough transmission lines. A second 500 kv circuit would start at Kaiparowits Generating Station and proceed south to the vicinity of the Moenkopi Switchyard near Cameron,

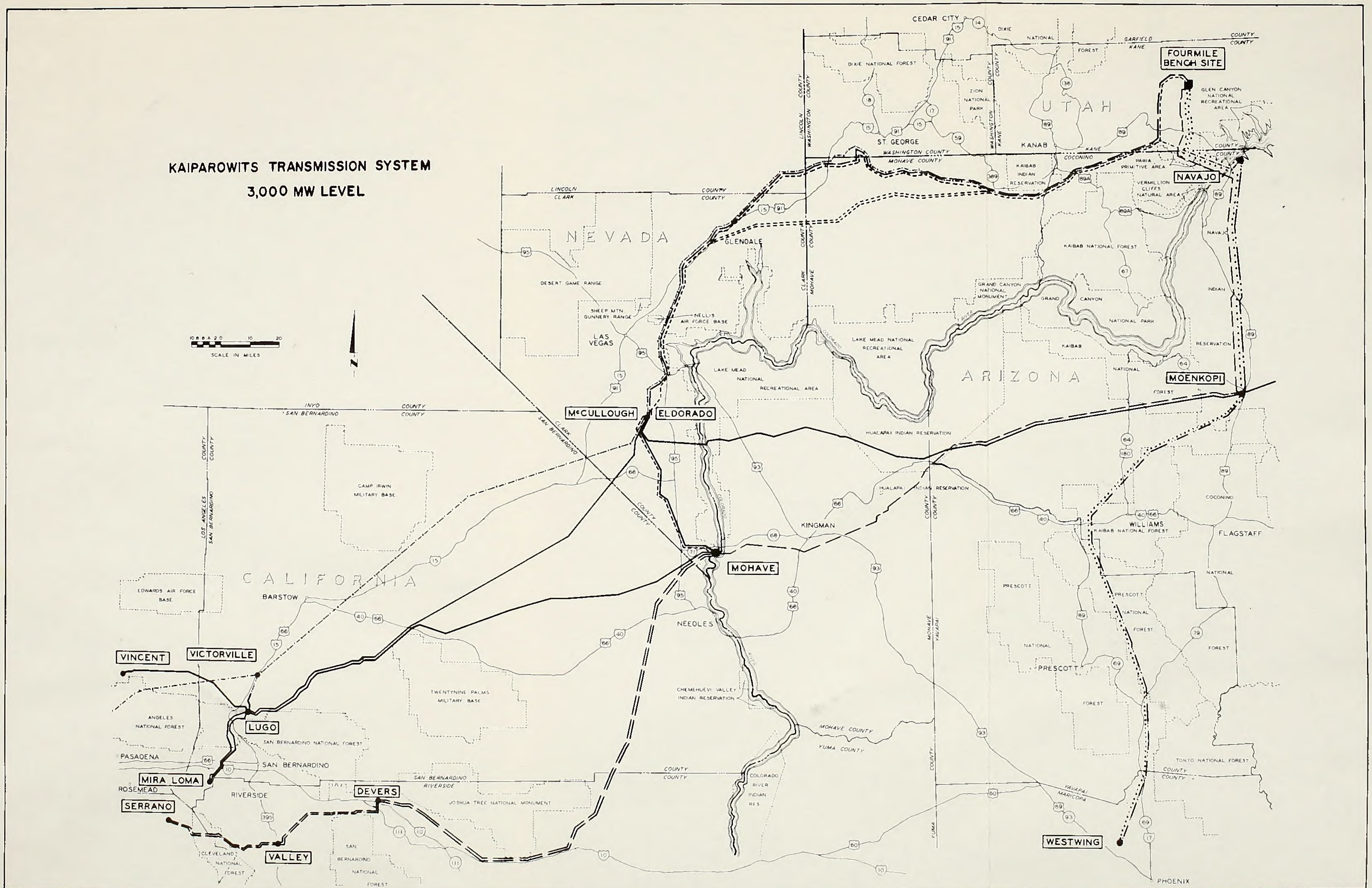


ILLUSTRATION 38

Arizona. From the Moenkopi Switchyard, this line would go west to the Mohave Generating Station in Clark County, Nevada. From the Mohave Station two 500 kv single circuit transmission lines would go west to the Devers Substation near Palm Springs and then continue to the Serrano Substation near Villa Park in Orange County, California.

In the southern system, (Arizona Public Services and its associate, Salt River Project) one 500 kv line would go south from Kaiparowits along the same general corridor as the western system line to Moenkopi Switching Station. From there it would continue south beyond Moenkopi to terminate at the Westwing Switchyard near Phoenix. A second 500 kv line would parallel the line to the Moenkopi substation as far as the Colorado River crossing. From there it would turn east and terminate at the Navajo Generating Station east of Page, Arizona.

Transmission system requirements for the Kaiparowits Project were formulated in accordance with principles and procedures of the regional Western System Coordinating Council (WSCC) which coordinates development of the bulk of power network in the western United States. In California, the California Public Utilities Commission General Order Number 95 would be adhered to. Outside California, the National Electric Safety Code will apply to design, operation and construction standards.

Participants propose that there should be no more than two 500 kv circuits on a single right-of-way. If a third line is required, it would be separated by a distance equal to or greater than the longest span length or the line sections involved (about 2,000 feet), if possible.

To provide adequate mechanical and electrical clearances, while allowing long spans to minimize visual impact, a minimum separation of 130 feet between tower centerlines of two 500 kv single circuit transmission lines on the same right-of-way is necessary. With less separation between circuits, impaired clearance problems along these longer spans may result under certain wind conditions.

In certain forest or rugged areas a 200-foot minimum separation would be required to minimize construction problems due to steep slopes. Audible noise and electrical interference under and close to these lines requires that the distance from the tower centerline to the right-of-way edge would vary from 80 to 100 feet, depending on local land use.

Communication system

The proposed Kaiparowits Project would require additions to the existing Southern California Edison Company and Arizona Public Service communications network. Communication services for the generating station would be provided by addition of new sites as well as an improvement of existing sites (see Figure 30 and Illustration 39). Purpose of such a network is to provide operational and administrative support services for the Kaiparowits Generating Station. Operational support would include automatic generator control system dispatching, pump station monitoring and control and system status monitoring to incorporate the generating station into the existing power network. Administrative support services would include installing telephone circuits for power system administration, notification of proper agencies in the event of potential danger, and to summon support from regional energy organizations as may be needed.

Existing microwave repeating facilities would be enlarged to accommodate the Kaiparowits Generating Station. The system would be under constant review to determine the degree of redundancy required to provide reliable communication service to the generating station. Access roads and commercial powerlines do not exist at some of the proposed sites selected. Helicopter access and on-site generation would be used rather than construction of roads and power lines at presently undeveloped sites. Communication buildings would be prefab structures with exterior non-reflective finishes. Fuel tanks would be surrounded by a protective wall. Towers would be of a tubular or lattice steel construction

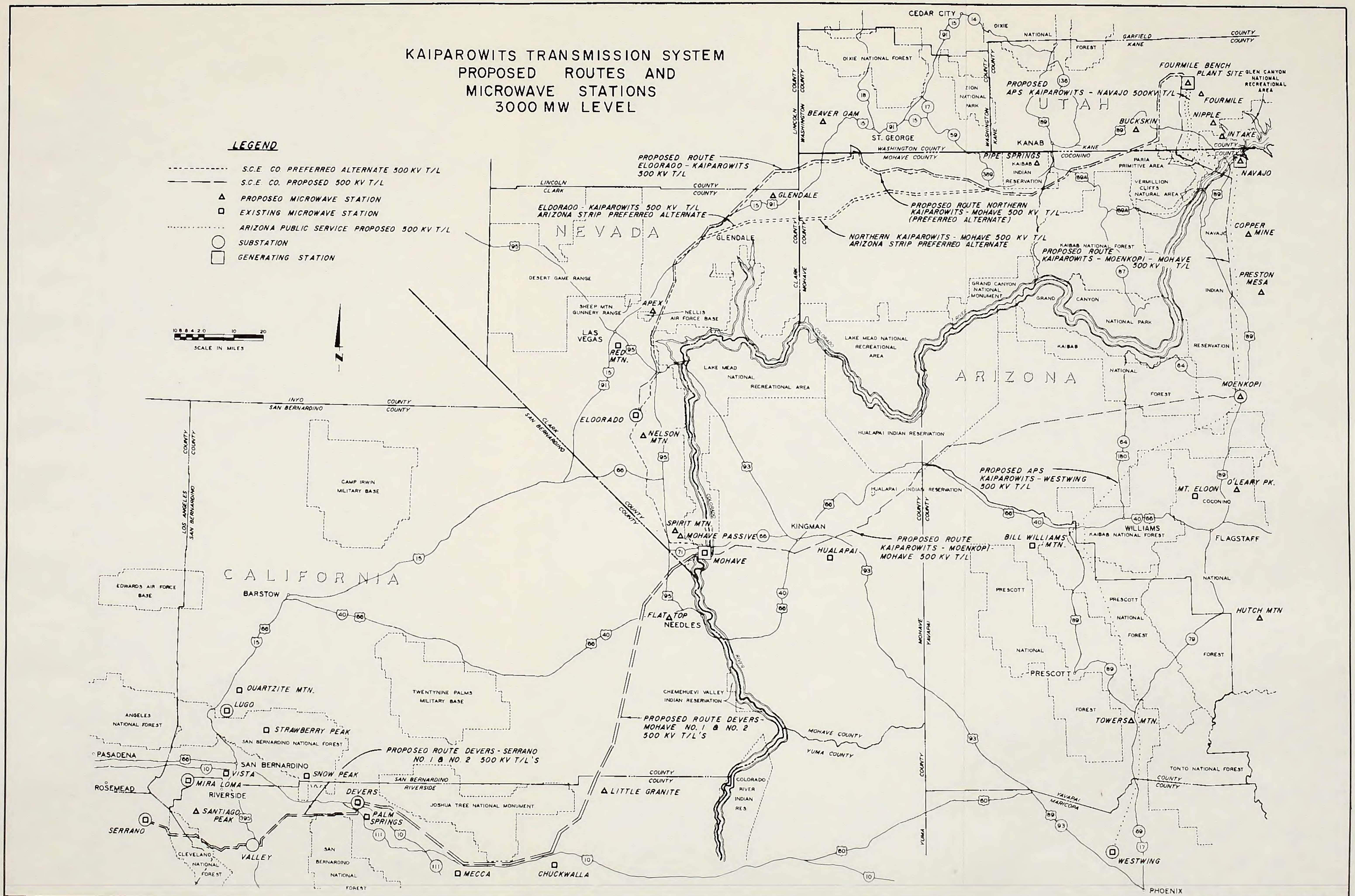


ILLUSTRATION 39

FIGURE 30

Microwave Stations

		IMPROVEMENTS							APPROXIMATE ACREAGE			
Location	Site Description	Building	Tower	Helipad	Road	Power	Fence	None	Temporarily Disturbed	Permanently Disturbed	Total Site	Present Landowner
Apex	New; adjacent to an existing communication site	X	X	--	--	X	X	--	.023	.011	.23	BLM-Nevada
Beaver Dam	New; adjacent to an existing communication site	X	X	--	--	X	X	--	.023	.011	.06	BLM-Utah
Buckskin	New; adjacent to an existing communication site	X	X	--	--	X	X	--	.023	.011	.23	BLM-Utah
Copper Mine	New; adjacent to an existing communication site	X	X	--	--	X	X	--	.023	.011	.23	BLM-Utah
Flat Top	New; undeveloped	X	X	X	--	On site generation	X	--	.023	.023	.91	BLM, California
Fourmile	New; undeveloped	X	X	--	--	X	X	--	.023	.011	.23	BLM-Utah
Glendale	New; adjacent to an existing communication site	X	X	--	--	X	X	--	.023	.011	.23	BLM-Nevada
Kaiparowits Plant Site	New; at a proposed generating station	X	X	--	--	X	--	--	.023	.011	.06	BLM-Utah

(Continued)

FIGURE 30

Microwave Stations (Continued)

		IMPROVEMENTS							APPROXIMATE ACREAGE			
Location	Site Description	Building	Tower	Helipad	Road	Power	Fence	None	Temporarily Disturbed	Permanently Disturbed	Total Site	Present Landowner
Little Granite	New; undeveloped	X	X	X	--	--	X	--	.023	.023	.65	BLM-California
Mohave Passive	New; undeveloped	--	X	--	--	--	--	--	.023	.005	.06	BLM-Nevada
Nelson	New; adjacent to an existing communication site	X	X	--	--	X	X	--	.023	.011	.011	BLM-Nevada
Nipple	New; at a proposed Kaiparowits Pump Station site	X	X	--	--	X	X	--	.023	.011	.23	National Park Service
Pipe Springs	New; adjacent to an existing communication site	X	X	--	--	X	--	--	.023	.011	.23	Kaibab Indian Reservation
Intake	New; at a proposed Kaiparowits pump station	-	Dish on Pump Bldg.	--	--	--	--	--	0	0	0	BLM-Utah
Preston Mesa	New; adjacent to an existing communication site	X	X	--	--	X	X	--	.023	.011	.23	Navajo Tribal Utility Authority

(Continued)

FIGURE 30

Microwave Stations (Continued)

		IMPROVEMENTS							APPROXIMATE ACREAGE			
Location	Site Description	Build-ing	Tower	Helipad	Road	Power	Fence	None	Temporarily Disturbed	Permanently Disturbed	Total Site	Present Landowner
Spirit Mountain	New; adjacent to an existing communication site	X	X	--	--	X	X	--	.023	.011	.23	BLM-Nevada
Moenkopi	New; at an existing substation	X	X	--	--	--	--	--	.023	.011	.06	Navajo Tribe
Mt. Eldon	Existing, no expansion	--	--	--	--	--	--	X	0	0	0	--
Bill Williams	Existing, no expansion	--	--	--	--	--	--	X	0	0	0	--
Hualapai	Existing, no expansion	--	--	--	--	--	--	X	0	0	0	--
Red Mountain	Existing, no expansion	--	--	--	--	--	--	X	0	0	0	--
Eldorado Substation	New, at an existing Substation	X	X	--	--	--	--	--	.023	.011	.06	BLM-Nevada
Mohave Generating Station	New; at an existing generating station	X	X	--	--	--	--	--	.023	.011	.06	Private
Chuckwalla	Expansion of an existing communication site	--	Tower extension	--	--	--	--	--	0	0	-	Private

(Continued)

FIGURE 30

Microwave Stations (Continued)

		IMPROVEMENTS							APPROXIMATE ACREAGE			
Location	Site Description	Build-ing	Tower	Helipad	Road	Power	Fence	None	Temporarily Disturbed	Permanently Disturbed	Total Site	Present Landowner
Mecca	Expansion of an existing Communication site	--	Tower extension	--	--	--	--	--	0	0	-	Private
Palm Springs Service Center	Existing, no expansion	--	--	--	--	--	--	X	0	0	-	--
Devers Substation	Existing, no expansion	--	--	--	--	--	--	X	0	0	-	--
Snow Peak	Existing, no expansion	--	--	--	--	--	--	X	0	0	-	--
Vista Substation	Existing, no expansion	--	--	--	--	--	--	X	0	0	-	--
Strawberry Peak	Existing, no expansion	--	--	--	--	--	--	X	0	0	-	--
Lugo Substation	Existing, no expansion	--	--	--	--	--	--	X	0	0	-	--
Quartzite	Existing, no expansion	--	--	--	--	--	--	X	0	0	-	--
Mira Loma	Existing, no expansion	--	--	--	--	--	--	X	0	0	-	--
Santiago Peak	Existing, no expansion	--	--	--	--	--	--	X	0	0	-	--

(Continued)

FIGURE 30

Microwave Stations (Continued)

		IMPROVEMENTS							APPROXIMATE ACREAGE			
Location	Site Description	Building	Tower	Helipad	Road	Power	Fence	None	Temporarily Disturbed	Permanently Disturbed	Total Site	Present Landowner
Serrano Substation	Existing, no expansion	--	--	--	--	--	--	X	0	0	-	--
Navajo Generating Station	Existing, no expansion	--	--	--	--	--	--	X	0	0	-	--
O'Leary Peak	New; undeveloped	X	X	--	--	X	--	--	.023	.011	.23	Forest Service
Hutch Mountain	New, adjacent to an existing communication site	X	X	--	--	--	--	--	.023	.011	.23	Forest Service
Towers Mountain	New; adjacent to an existing communication site	X	X	--	--	--	--	--	.023	.011	.23	Forest Service
Westwing Substation	Existing, no expansion	--	--	--	--	--	--	X	0	0	0	--
TOTALS									.483	.249	4.74[a]	[b]

[a]Total fenced area of site

[b]Summary of land ownership

Federal	Number
BLM	14
Forest Service	3
National Park Service	1
Non-Federal	6
Total	24

to minimize skyline exposure. Steel towers would be coated with a non-reflective substance (see Illustration 40).

Of the 40 sites involved in the communications system, eight would be new at undeveloped locations, 16 would be additions to developed communications sites, and 16 are a part of an existing network and would not require enlargement.

Land area necessary for communications sites is tabulated in Figure 30. The total fenced area required for the communication sites would be less than five acres, of which less than one-half acre would be temporarily disturbed during construction and about one-fourth acre would be permanently disturbed.

Proposed transmission line routing

Kaiparowits to Phoenix segment

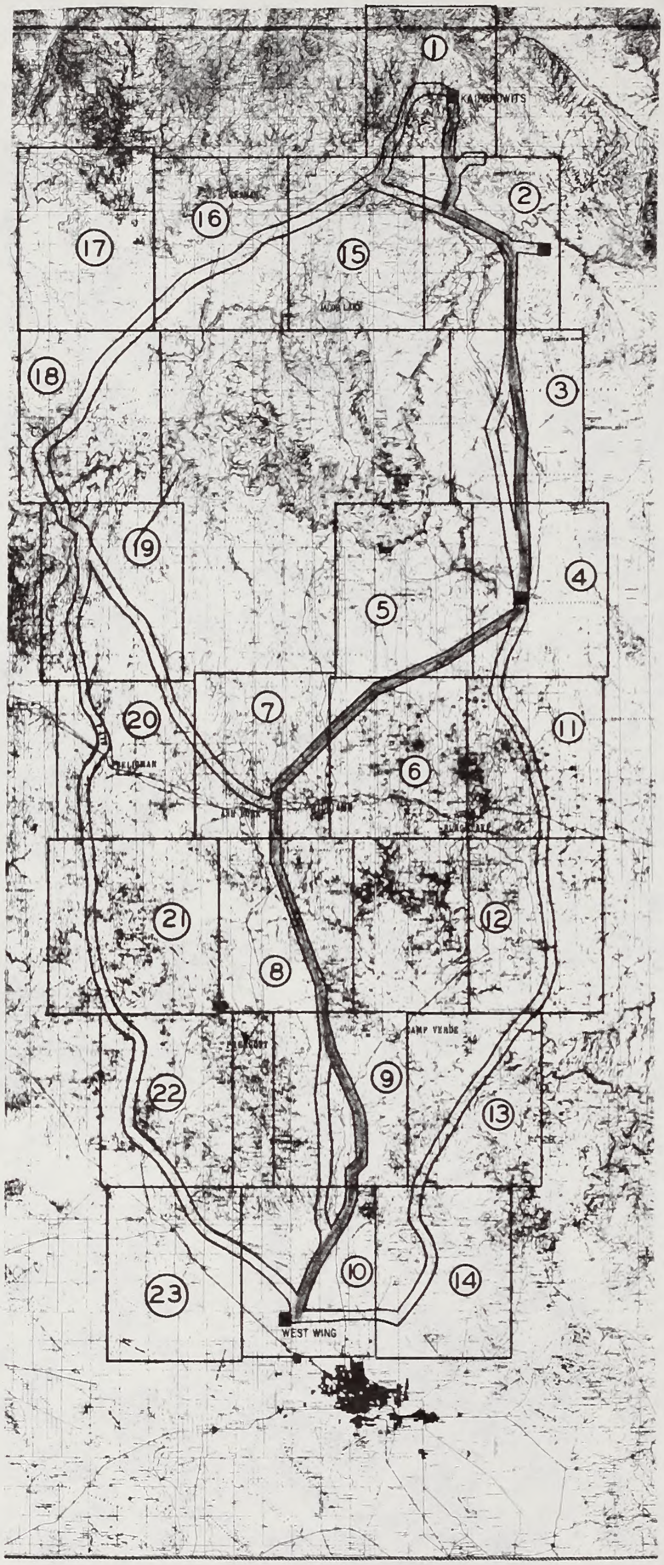
This proposed route would commence at the generating station on Four-mile Bench. It would go in a southerly direction where it would meet the 500 kv Navajo-McCullough transmission line. From there it would go to the southeast, paralleling the Navajo-McCullough line across the Colorado River, and then would head south and roughly parallel the twin Navajo to Phoenix 500 kv lines all the way to Westwing Substation. Illustration 41 consists of a set of detailed maps showing this proposed routing. Figure 31 shows distances across federal, state and local governmental or management responsibilities for this segment of the transmission system. It also indicates the numbers of roads, rivers, streams, railroads, pipelines, telephone lines, and other transmission lines crossed by this proposed segment. Detailed descriptions of this proposed route and other transmission line segments are available at Bureau of Land Management state offices in Utah: Federal Bldg., 125 South State Street, Salt Lake City, Utah.

Arizona: Federal Bldg., Room 3022, Phoenix, Arizona.

Nevada: Federal Bldg., 300 Booth Street, Room 3008, Reno Nevada.

California: Federal Bldg., 2800 Cottage Way, Room E-2841, Sacramento, California.

ILLUSTRATION 40



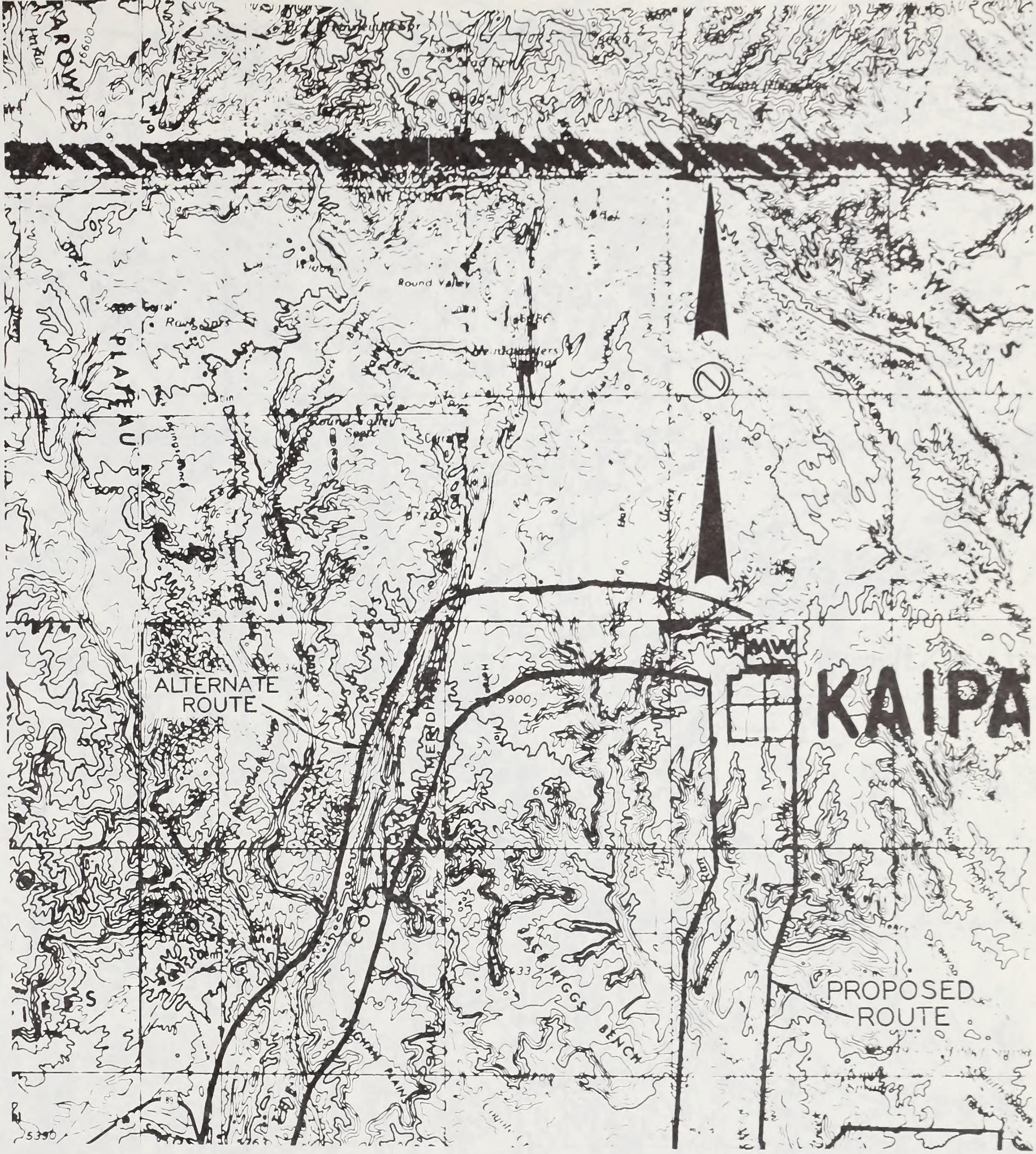
KAIPAROWITS TRANSMISSION SYSTEM

PROPOSED KAIPAROWITS - WESTWING

4-18-75

INDEX MAP

ILLUSTRATION 41



PROPOSED KAIPAROWITS - WESTWING

4-18-75

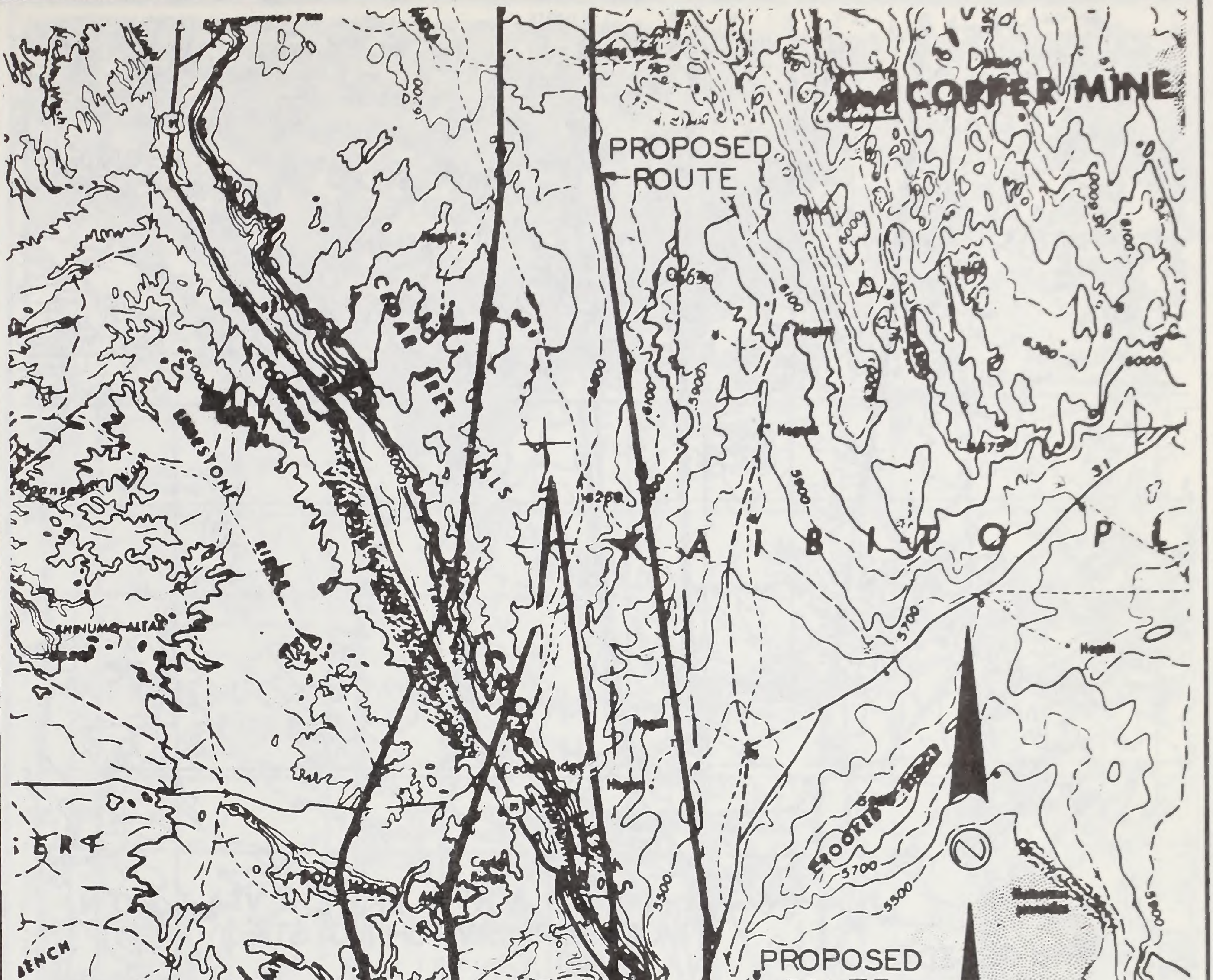
SHEET 1 OF 10

ILLUSTRATION 41a

PROPOSED KAIPAROWITS - WESTWING

4-18-75

SHEET 2 OF 10



PROPOSED KAIPAROWITS - WESTWING

4-18-75

SHEET 3 OF 10

ILLUSTRATION 41c

PROPOSED KAIPAROWITS - WESTWING

4-18-75

SHEET 4 OF 10

ILLUSTRATION 41d

PROPOSED KAIPAROWITS - WESTWING

4-18-75

SHEET 5 OF 10

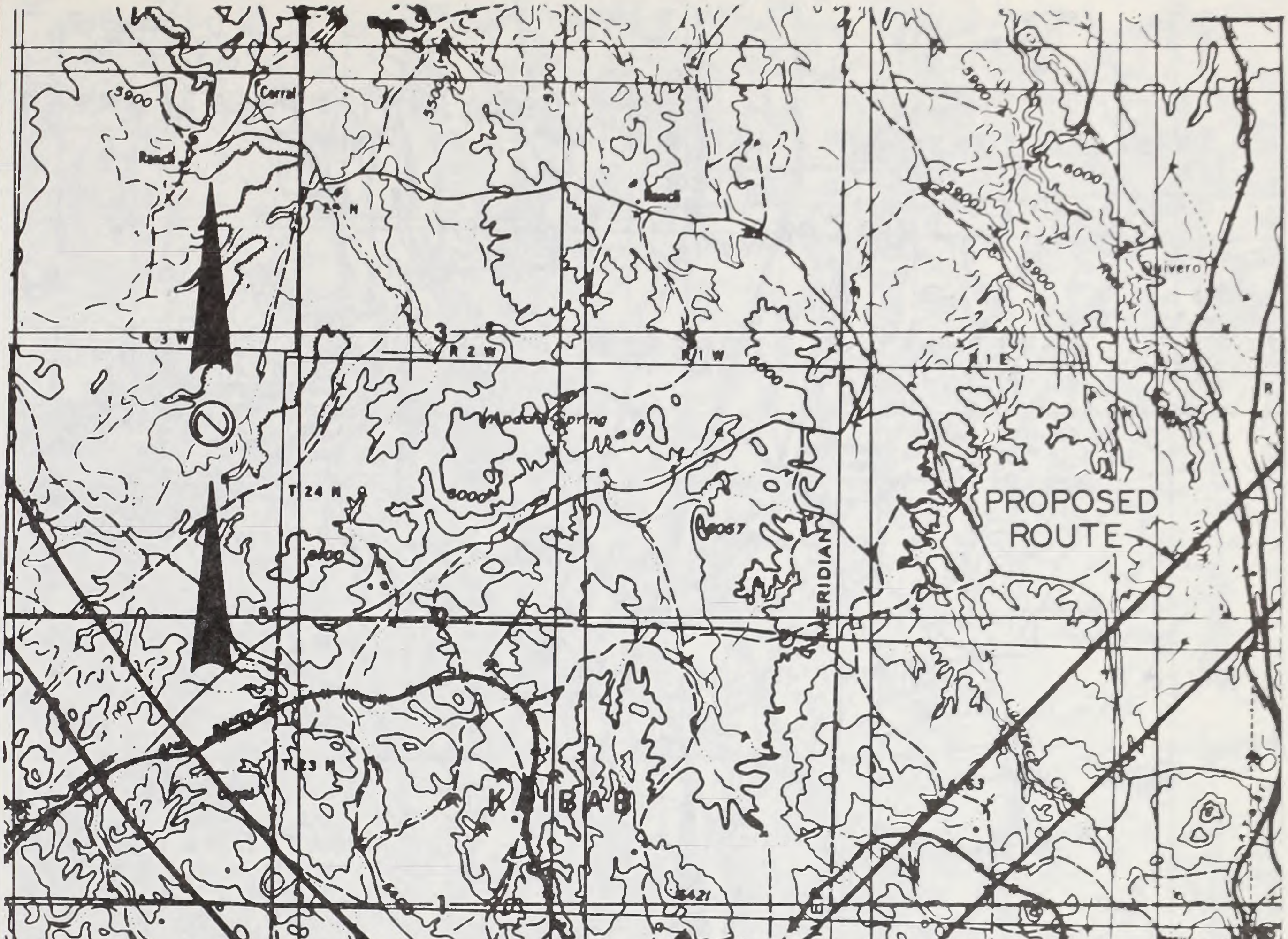
ILLUSTRATION 41e

PROPOSED KAIPAROWITS - WESTWING

4-18-75

SHEET 6 OF 10

ILLUSTRATION 41f



PROPOSED KAIPAROWITS - WESTWING

4-18-75

SHEET 7 OF 10

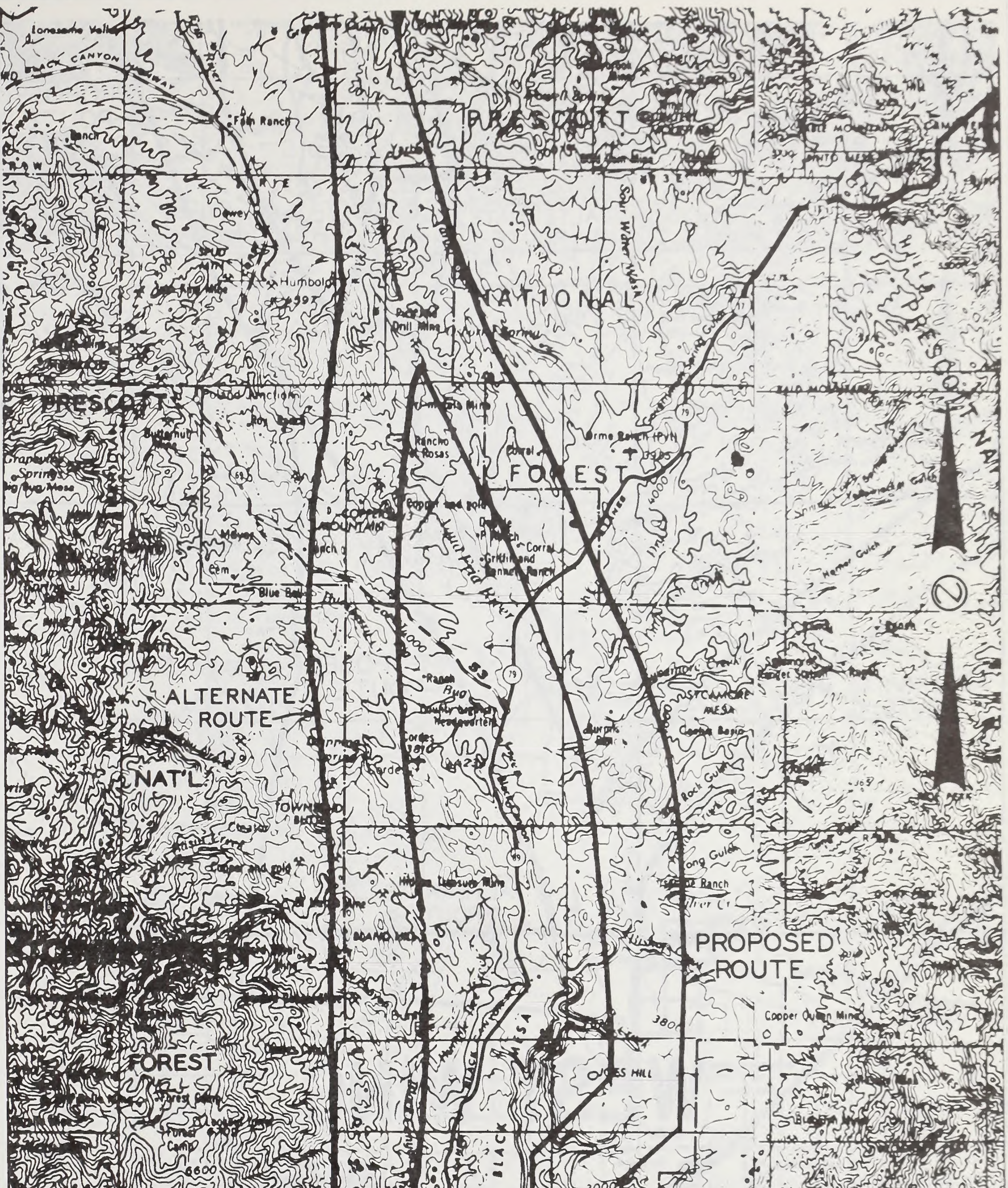
ILLUSTRATION 41g

PROPOSED KAIPAROWITS - WESTWING

4-18-75

SHEET 8 OF 10

ILLUSTRATION 41h

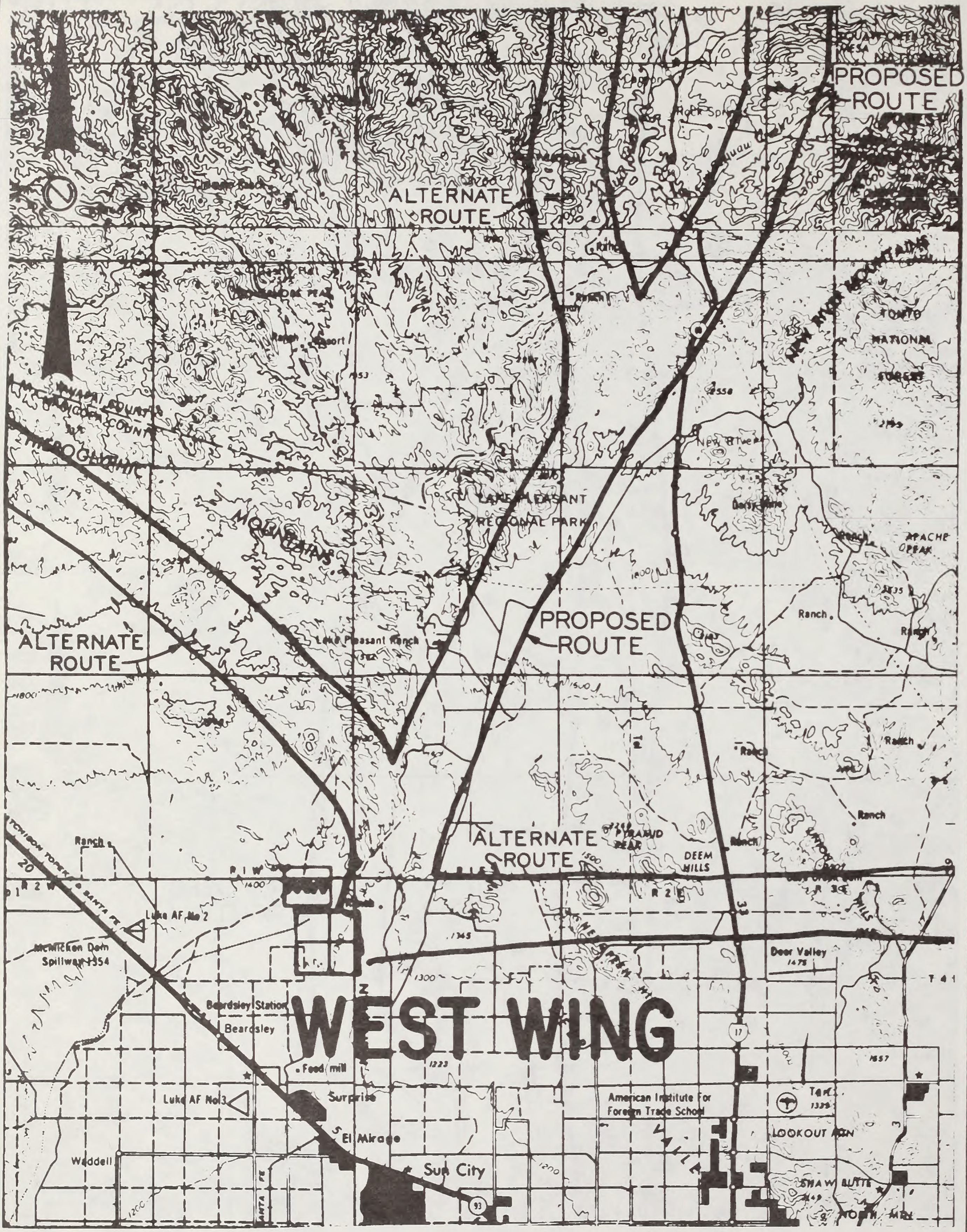


PROPOSED KAIPAROWITS - WESTWING

4-18-75

SHEET 9 OF 10

ILLUSTRATION 41i



PROPOSED KAIPAROWITS - WESTWING

4-18-75

SHEET 10 OF 10

ILLUSTRATION 41j

FIGURE 31

Route Alignment Facts for

Proposed Kaiparowits-Phoenix Segment

1. Governmental Jurisdictions	Miles of R-O-W
Utah - Kane County	24.0
Arizona - Coconino County	171.0
Arizona - Yavapai County	75.0
Arizona - Maricopa County	28.8

2. Land Ownership or Administration	Miles of R-O-W
State of Utah	5.0
State of Arizona	60.6
USDI, BLM	32.7
USDI, Glen Canyon Nat'l Recreation Area	14.0
USDA, Kaibab Nat'l Forest	26.6
USDA, Prescott Nat'l Forest	43.3
Navajo Indian Reservation	91.8
Private & Other	25.8

3. Road Crossings	No.
Interstate 17	2
Interstate 40	1
U. S. Route 89	3
U. S. Route 89 A	1
U. S. Route 180	1
State Route 64 (Arizona)	2
State Route 169 (Arizona)	1

4. Stream Crossings	No.
Colorado River	1
Little Colorado River	1
Verde River	1
Agua Fria River	1
Wahweap Wash	1
Hamblin Wash	1

5. Utility Crossings	No.
Four Corners Oil Line	1
El Paso Natural Gas Line	4
Black Mesa Coal Slurry Line	1
AT&SF Railroad	3
AT&T Communications Cable	1
Los Angeles Light & Power 500 kv T/L	1
Glen Canyon to Sigurd 230 kv T/L	1
Four Corners to El Dorado 500 kv T/L	1
USBR 230 kv T/L	1

Kaiparowits to Navajo Segment

This proposed route would parallel the route proposed for the Kaiparowits to Phoenix segment for about the first 42 miles. It would depart from the Phoenix segment after crossing the Colorado River and would parallel the Navajo to McCullough line eastward and terminate at the Navajo Generating Station. Illustration 42 consists of three maps showing the proposed route.

FIGURE 32

Route Alignment Facts For

Proposed Kaiparowits-Navajo Segment

1. Governmental Jurisdictions	Miles of R-O-W
Utah - Kane County	24.0
Arizona - Coconino County	23.7
2. Land Ownership or Administration	Miles of R-O-W
State of Utah	5.0
USDI, BLM	23.4
USDI, Glen Canyon Nat'l Recreation Area	16.3
Navajo Indian Reservation	3.0
3. Road Crossings	No.
U. S. Route 89	2
U. S. Route 98	1
4. Stream Crossings	No.
Colorado River	1
Wahweap Wash	1
5. Utility Crossings	No.
Glen Canyon to Sigurd 230 kv T/L	1
USBR 345 kv T/L	2
USBR 230 kv T/L	1

KAIPAROWITS TRANSMISSION SYSTEM

PROPOSED KAIPAROWITS - NAVAJO

INDEX MAP

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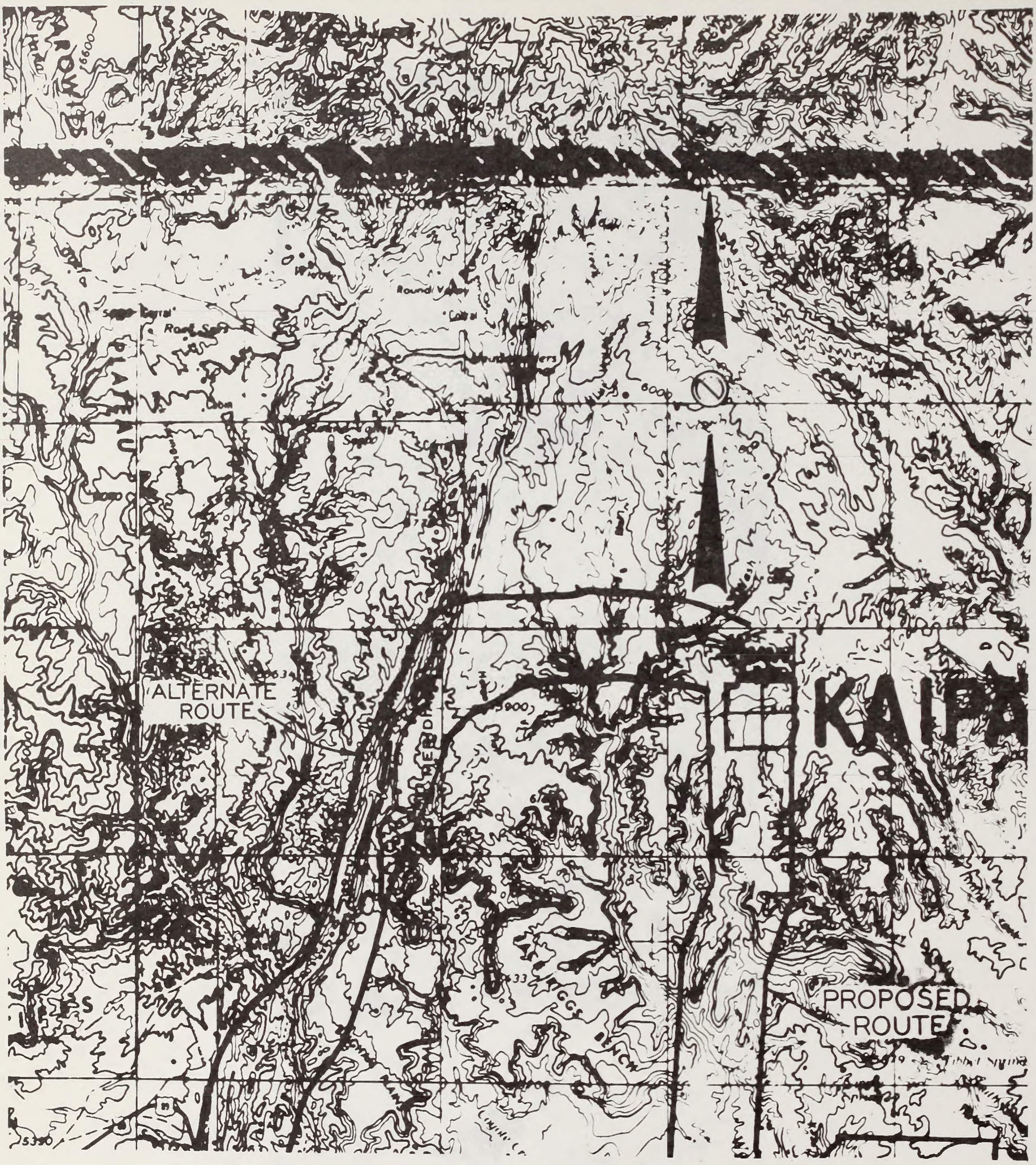
ILLUSTRATION 42

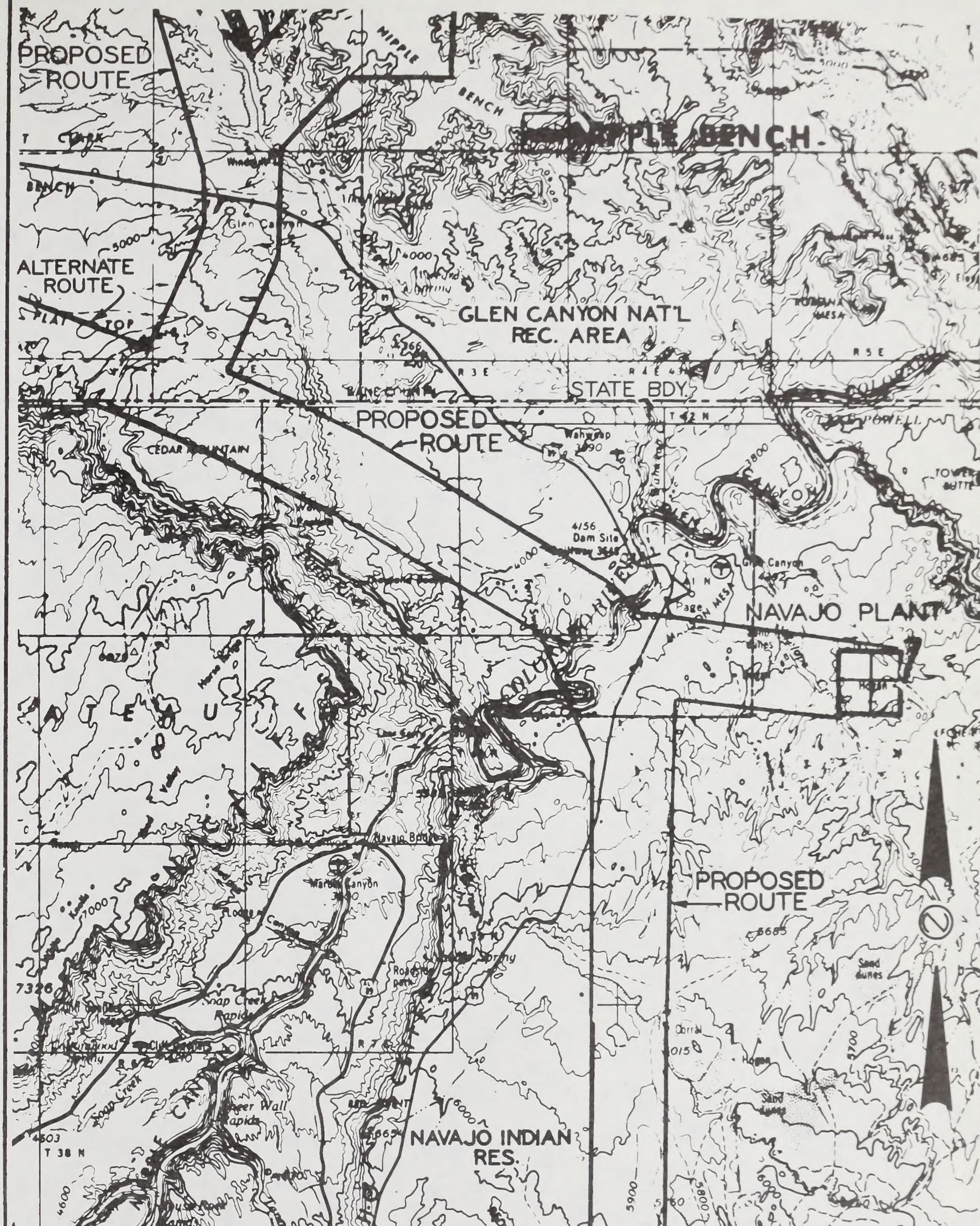


PROPOSED KAIPAROWITS - NAVAJO

4-18-75

SHEET 1 OF 2

ILLUSTRATION 42a



PROPOSED KAIPAROWITS - NAVAJO

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SHEET 2 OF 2

ILLUSTRATION 42b

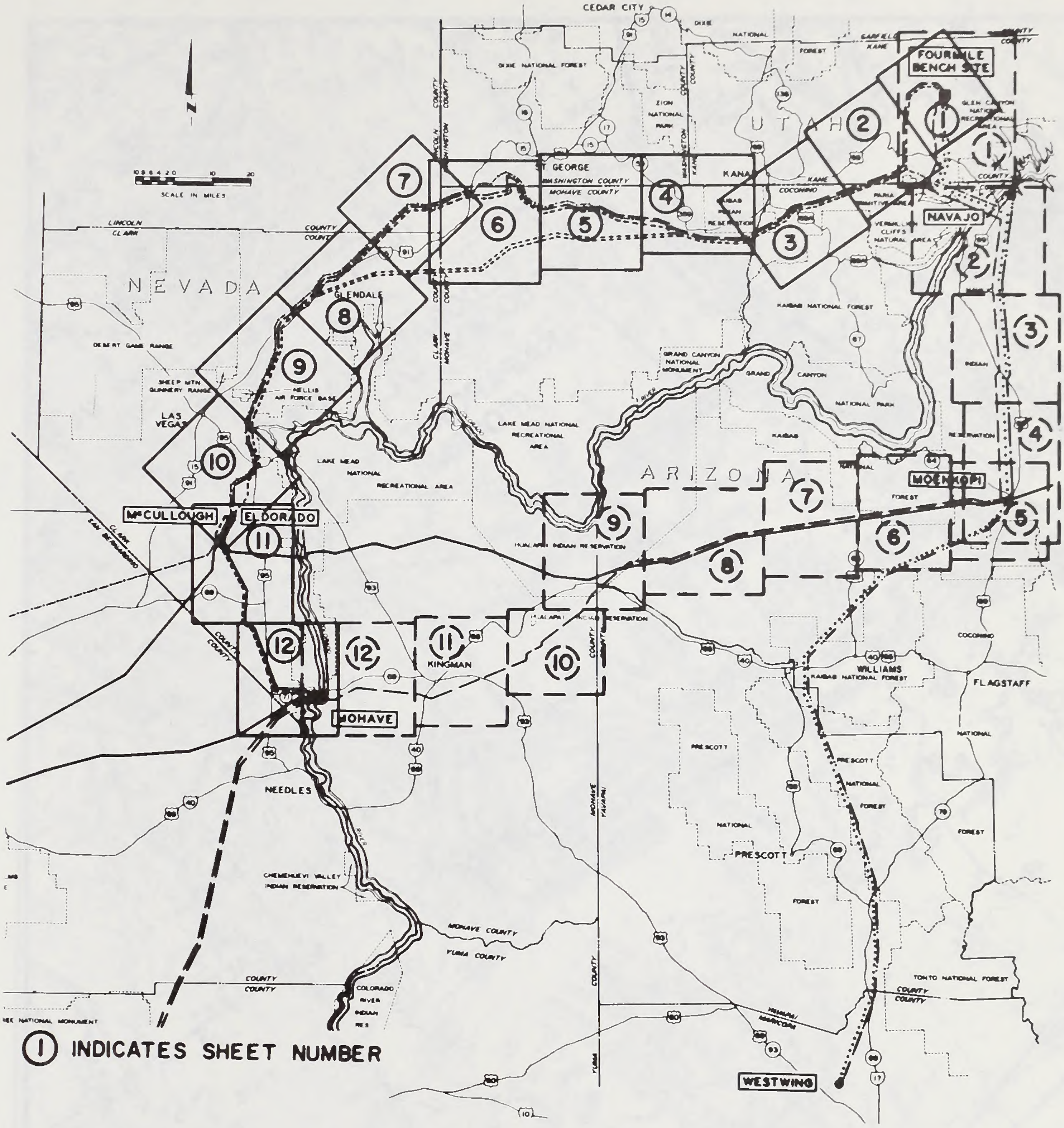
Kaiparowits to Eldorado Segment

This proposed route would go westward from the Kaiparowits Generating Station to the Cockscomb monocline where it would turn south and proceed along the monocline to the existing Navajo to McCullough 500 kv transmission line. From there it would roughly parallel this existing line to the Eldorado Substation.

Sheets 1 through 12 of Illustration 43 shows this proposed routing. Figure 33 shows distances across federal, state and local governmental or management responsibilities for this segment of the transmission system. It also indicates the numbers of roads, rivers, streams, railroads, pipelines, telephone lines, and other transmission lines crossed by this proposed segment.

Kaiparowits to Moenkopi to Mohave segment

This proposed route would begin at the Kaiparowits plantsite and would parallel the proposed route for the Kaiparowits to Phoenix segment as far as the Moenkopi Substation. At that point it would turn west to parallel a 500 kv APS line which runs between the Four Corners Generating Station and the Eldorado Substation. It would run parallel with this existing line until it reached the Hualapai Indian Reservation where it then would continue southwest to the U. S. Bureau of Reclamation Davis-Prescott 230 kv line. It then would roughly follow that corridor until it reached the Colorado River south of Bullhead City. Crossing the river, it would terminate at the Mohave Generating Station Switchyard. Illustration 44, consisting of 12 sheets, shows this proposed routing. Figure 34 shows distances across federal, state and local governmental or management responsibilities for this segment of the transmission system. It also indicates the numbers of roads, rivers, streams, railroads, pipelines, telephone lines, and other transmission lines crossed by this proposed segment.



KAIPAROWITS TRANSMISSION SYSTEM

ELDORADO - KAIPAROWITS

NORTHERN KAIPAROWITS - MOHAVE PREFERRED ALTERNATE
ARIZONA STRIP PREFERRED ALTERNATES AND
KAIPAROWITS - MOENKOPI - MOHAVE 500KV T/L'S

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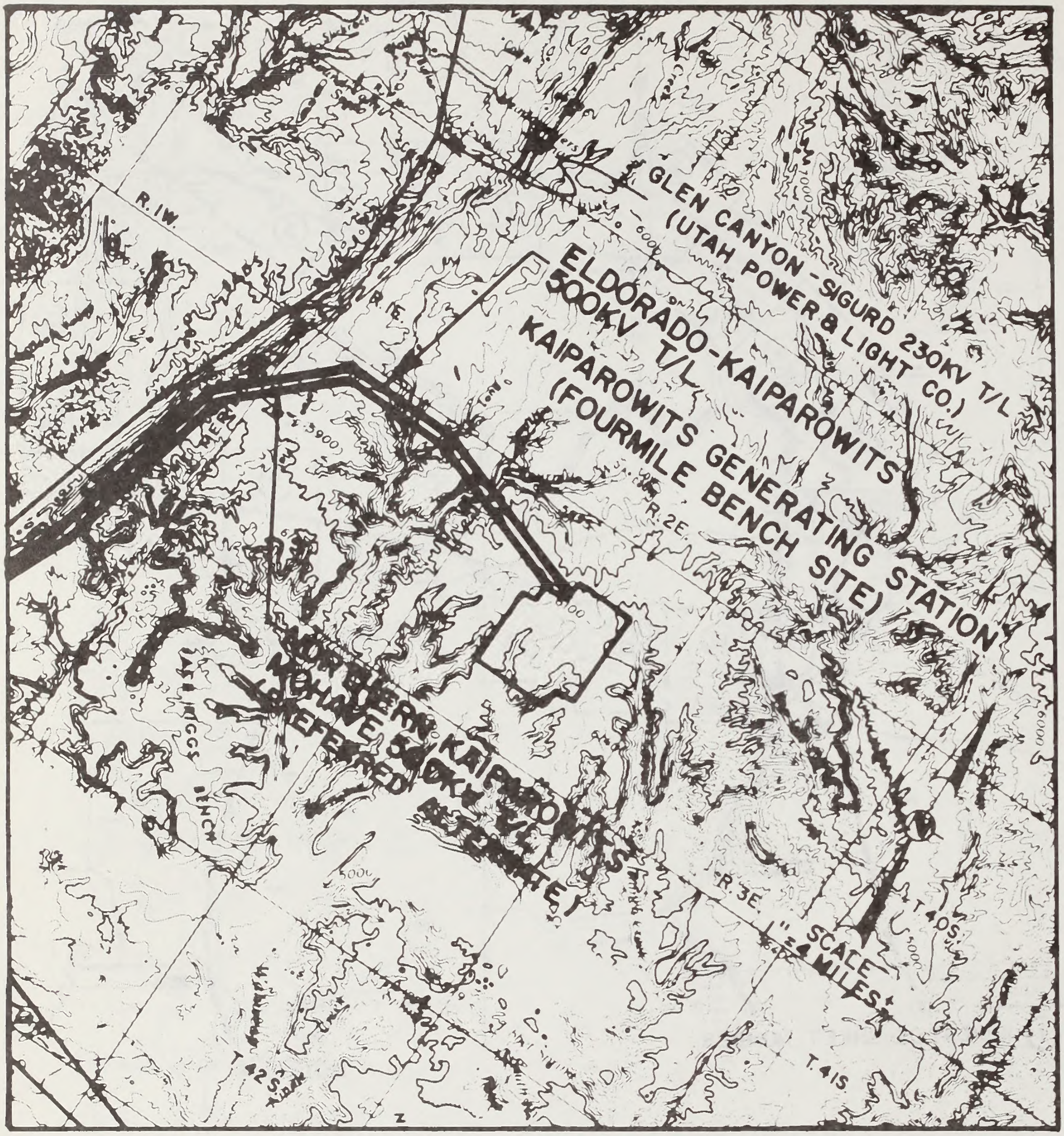
INDEX MAP

ILLUSTRATION 43



PROPOSED ELDORADO-KAIPAROWITS 500KV T/L,
NORTHERN KAIPAROWITS-MOHAVE 500KV T/L
PREFERRED ALTERNATE, AND
ARIZONA STRIP 500KV T/L PREFERRED ALTERNATES

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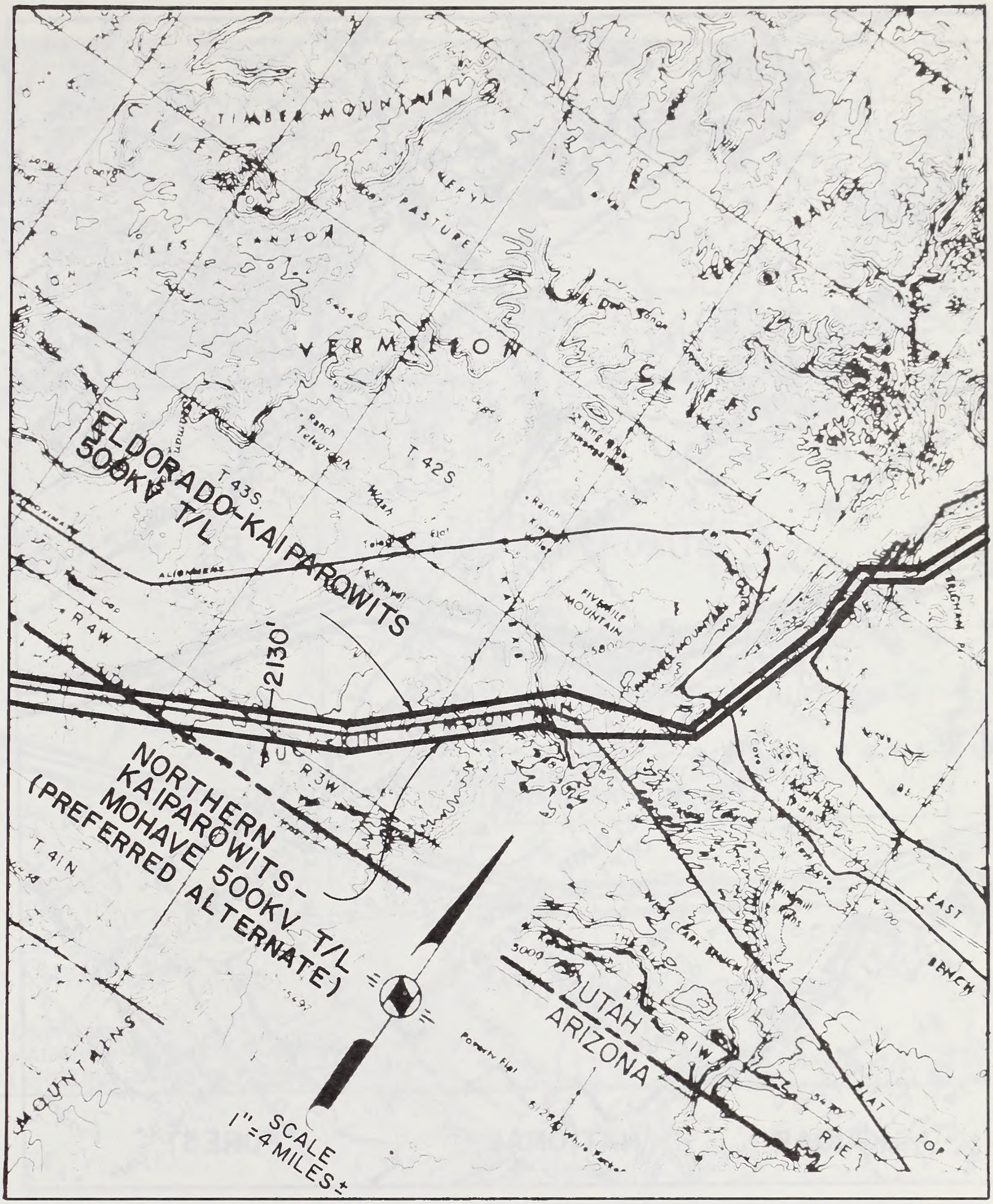
SHEET 1 OF 12

ILLUSTRATION 43a



PROPOSED ELDORADO-KAIPAROWITS 500KV T/L, NORTHERN KAIPAROWITS-MOHAVE 500KV T/L PREFERRED ALTERNATE, AND ARIZONA STRIP 500KV T/L PREFERRED ALTERNATES

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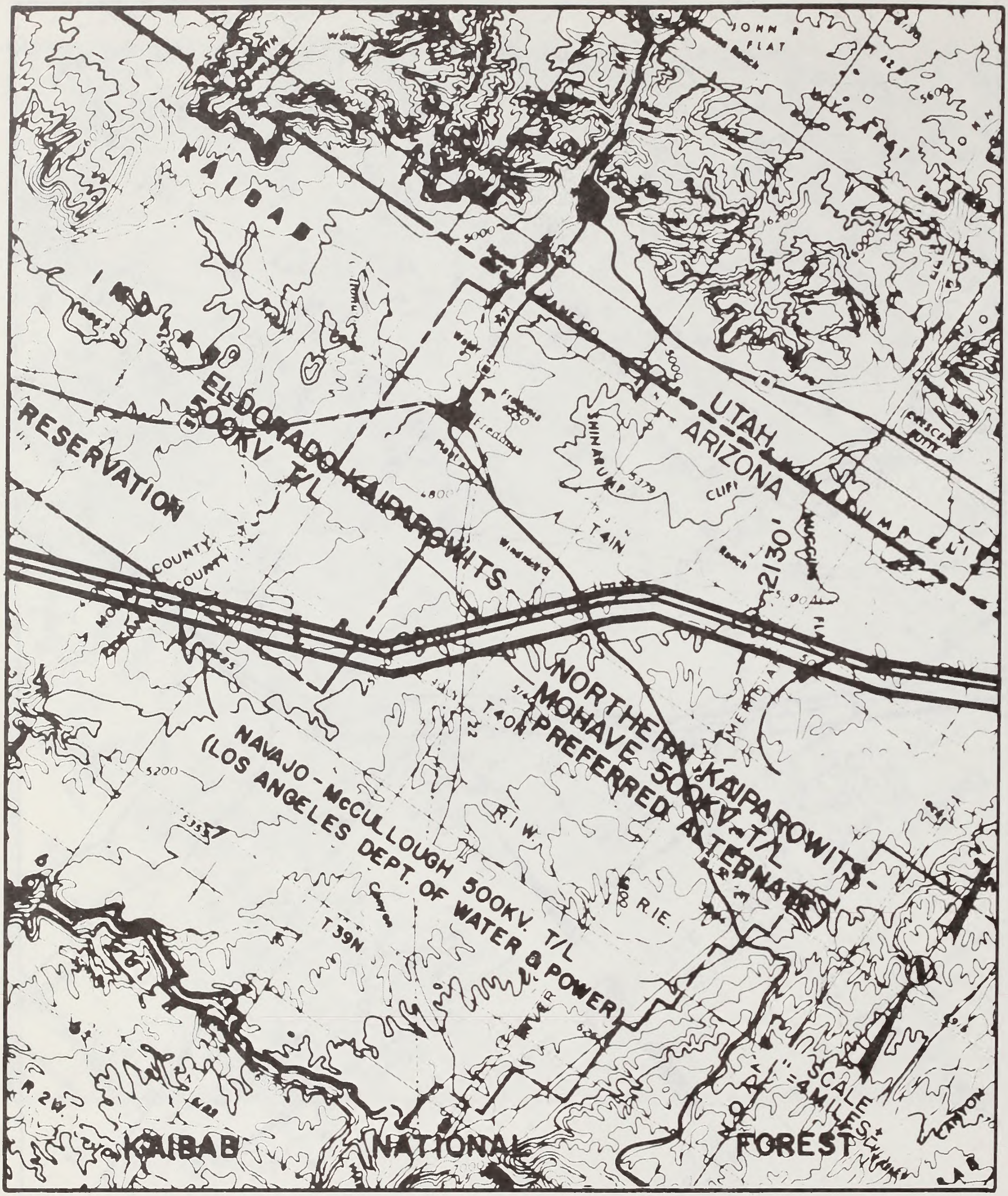
SHEET 2 OF 12

ILLUSTRATION 43b



PROPOSED ELDORADO-KAIPAROWITS 500KV T/L,
NORTHERN KAIPAROWITS-MOHAVE 500KV T/L
PREFERRED ALTERNATE, AND
ARIZONA STRIP 500KV T/L PREFERRED ALTERNATES

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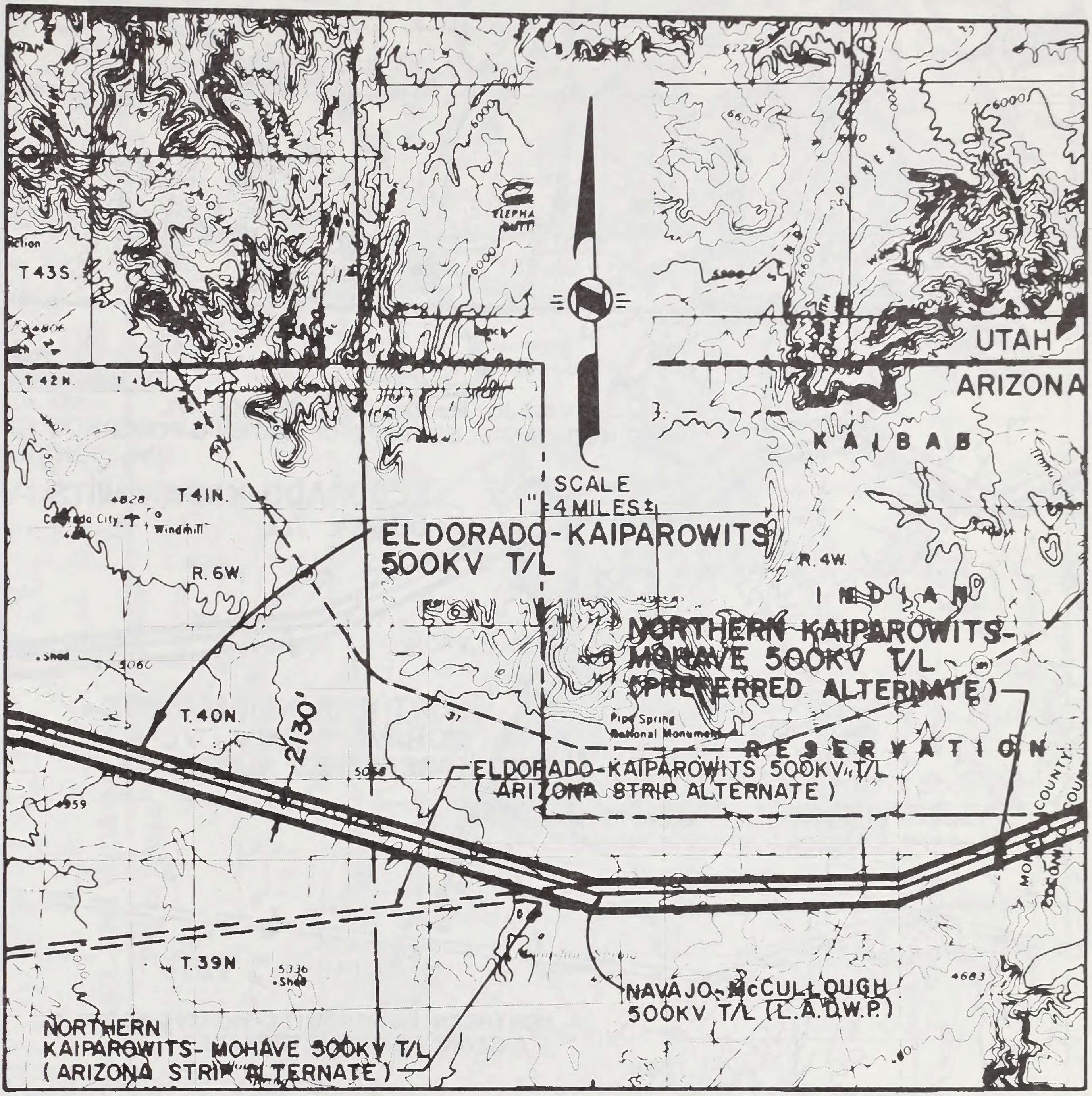
SHEET 3 OF 12

ILLUSTRATION 43c



PROPOSED ELDORADO-KAIPAROWITS 500KV T/L,
NORTHERN KAIPAROWITS-MOHAVE 500KV T/L
PREFERRED ALTERNATE, AND
ARIZONA STRIP 500KV T/L PREFERRED ALTERNATES

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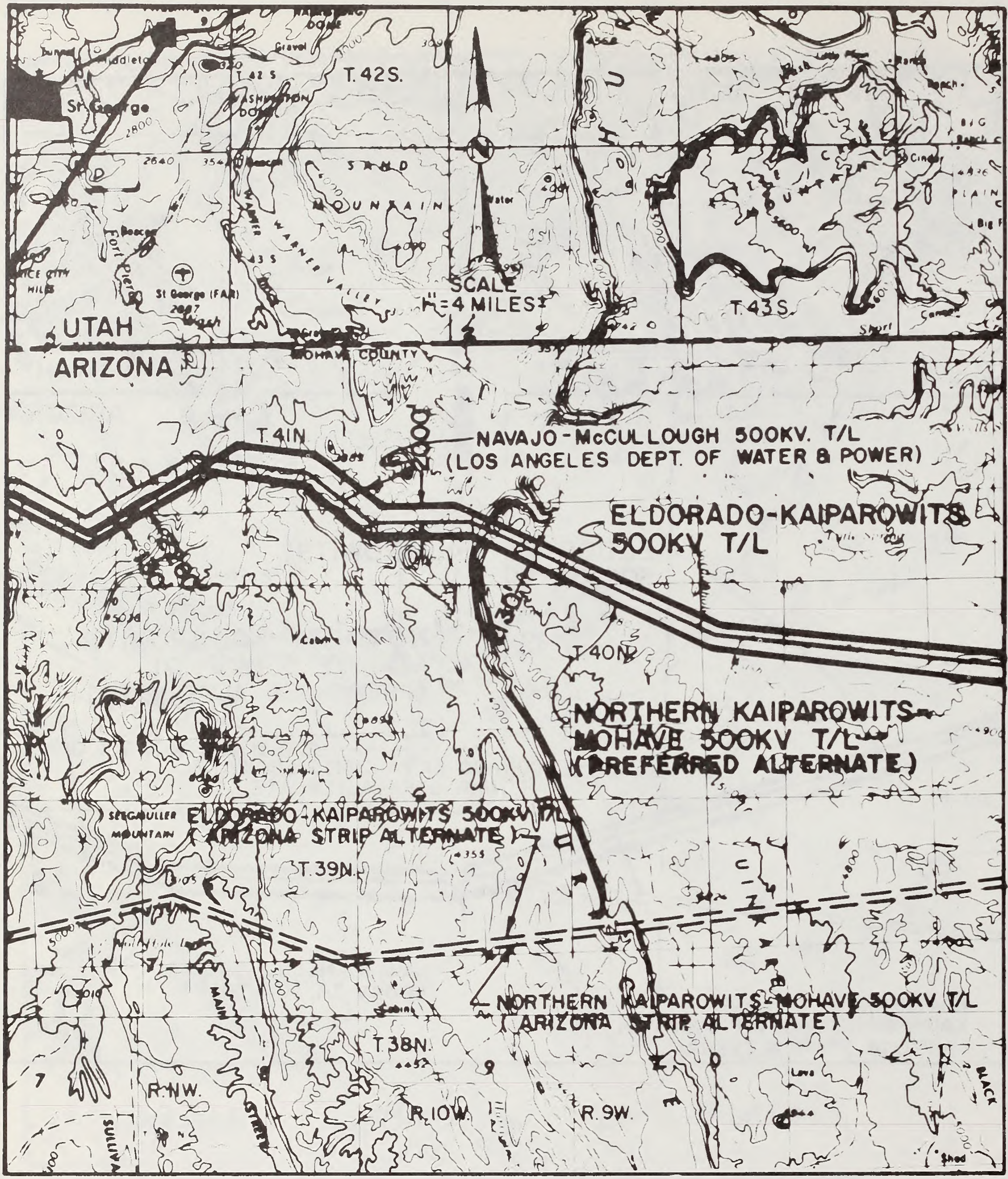
SHEET 4 OF 12

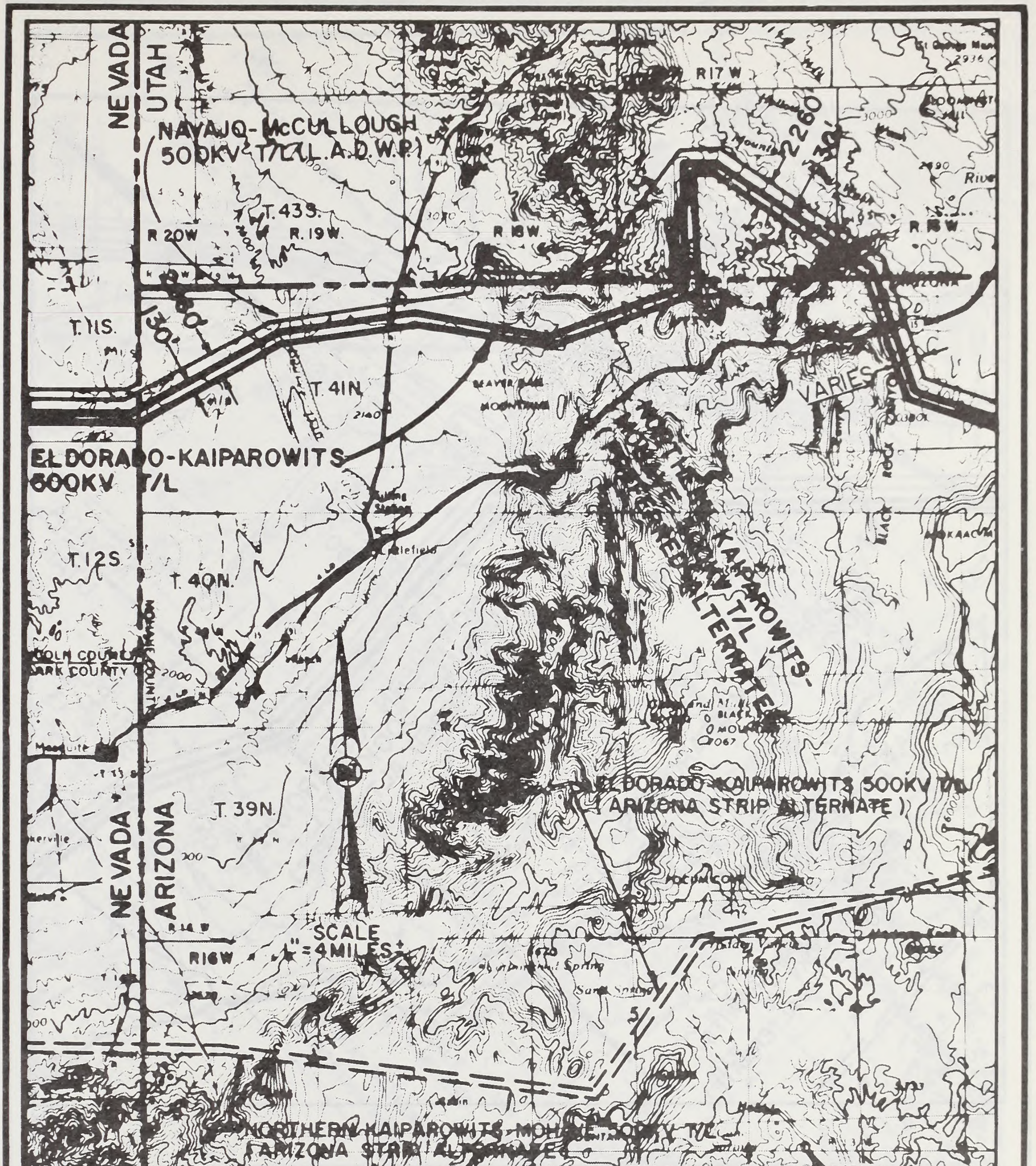
ILLUSTRATION 43d



PROPOSED ELDORADO-KAIPAROWITS 500KV T/L,
NORTHERN KAIPAROWITS-MOHAVE 500KV T/L
PREFERRED ALTERNATE, AND
ARIZONA STRIP 500KV T/L PREFERRED ALTERNATES

4-7-75 SHEET 5 OF 12

ILLUSTRATION 43e



PROPOSED ELDORADO-KAIPAROWITS 500KV T/L, NORTHERN KAIPAROWITS-MOHAVE 500KV T/L PREFERRED ALTERNATE, AND ARIZONA STRIP 500KV T/L PREFERRED ALTERNATES

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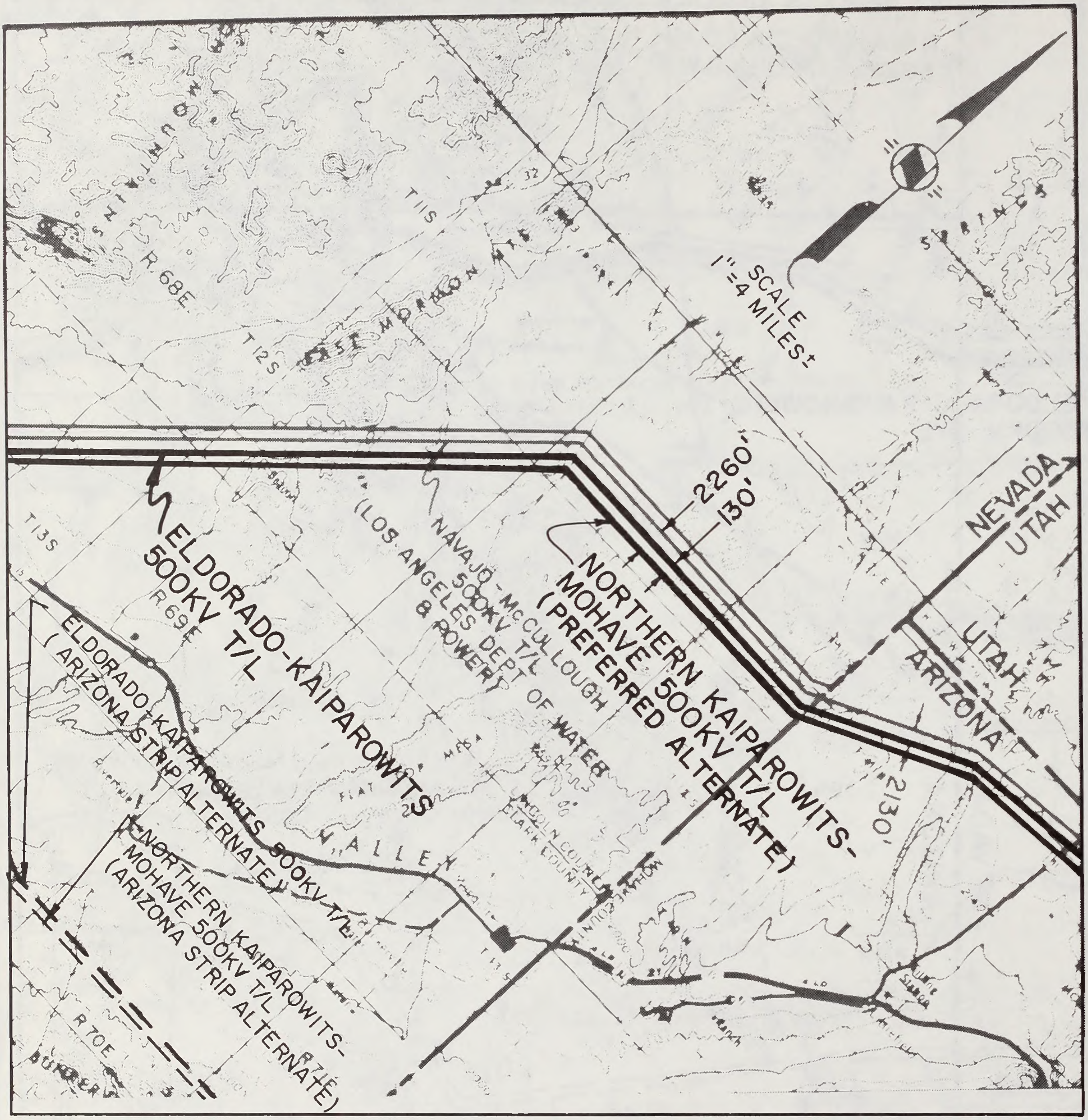
SHEET 6 OF 12

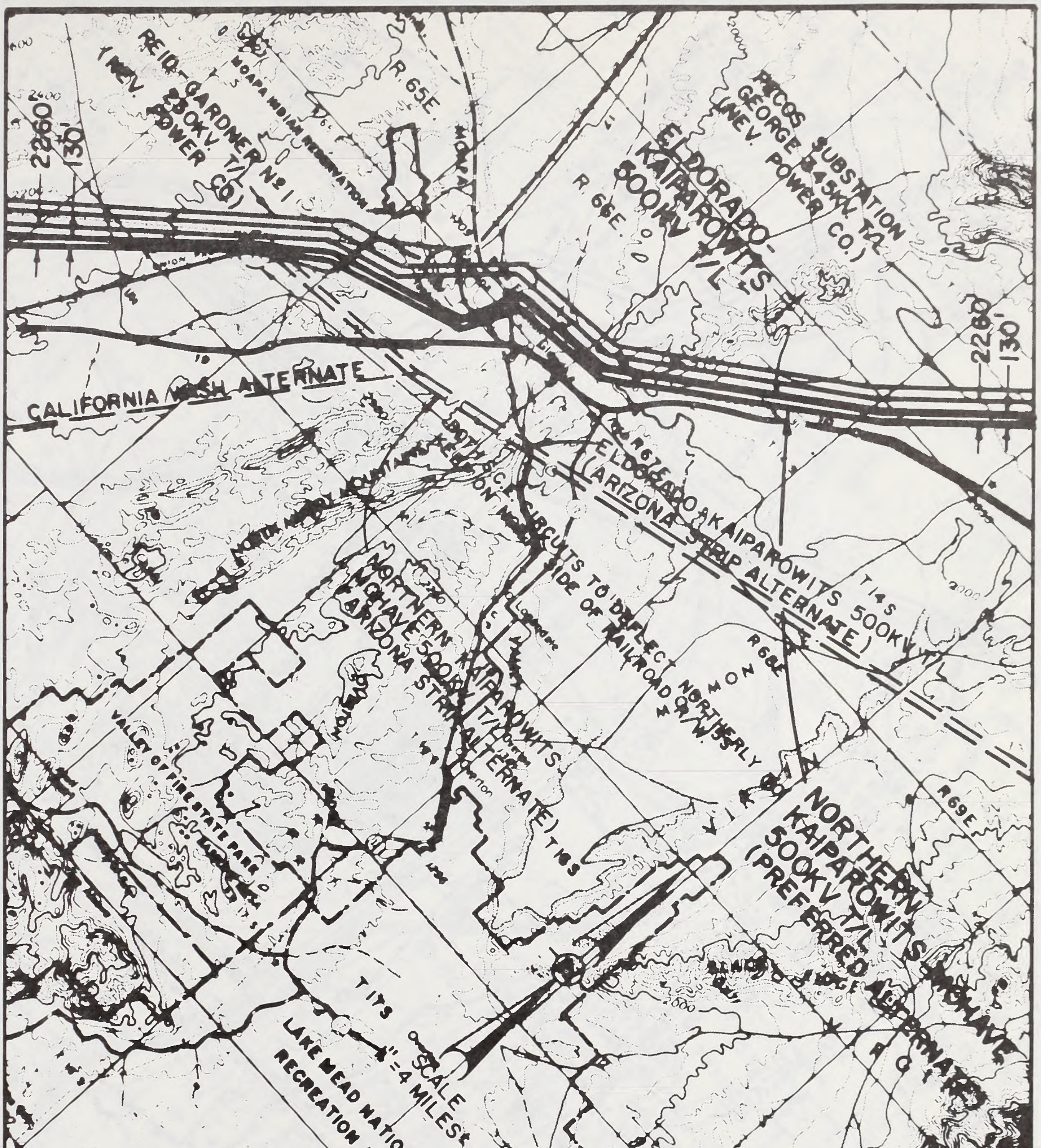
ILLUSTRATION 43f



PROPOSED ELDORADO-KAIPAROWITS 500KV T/L,
NORTHERN KAIPAROWITS-MOHAVE 500KV T/L
PREFERRED ALTERNATE, AND
ARIZONA STRIP 500KV T/L PREFERRED ALTERNATES

4-7-75 SHEET 7 OF 12

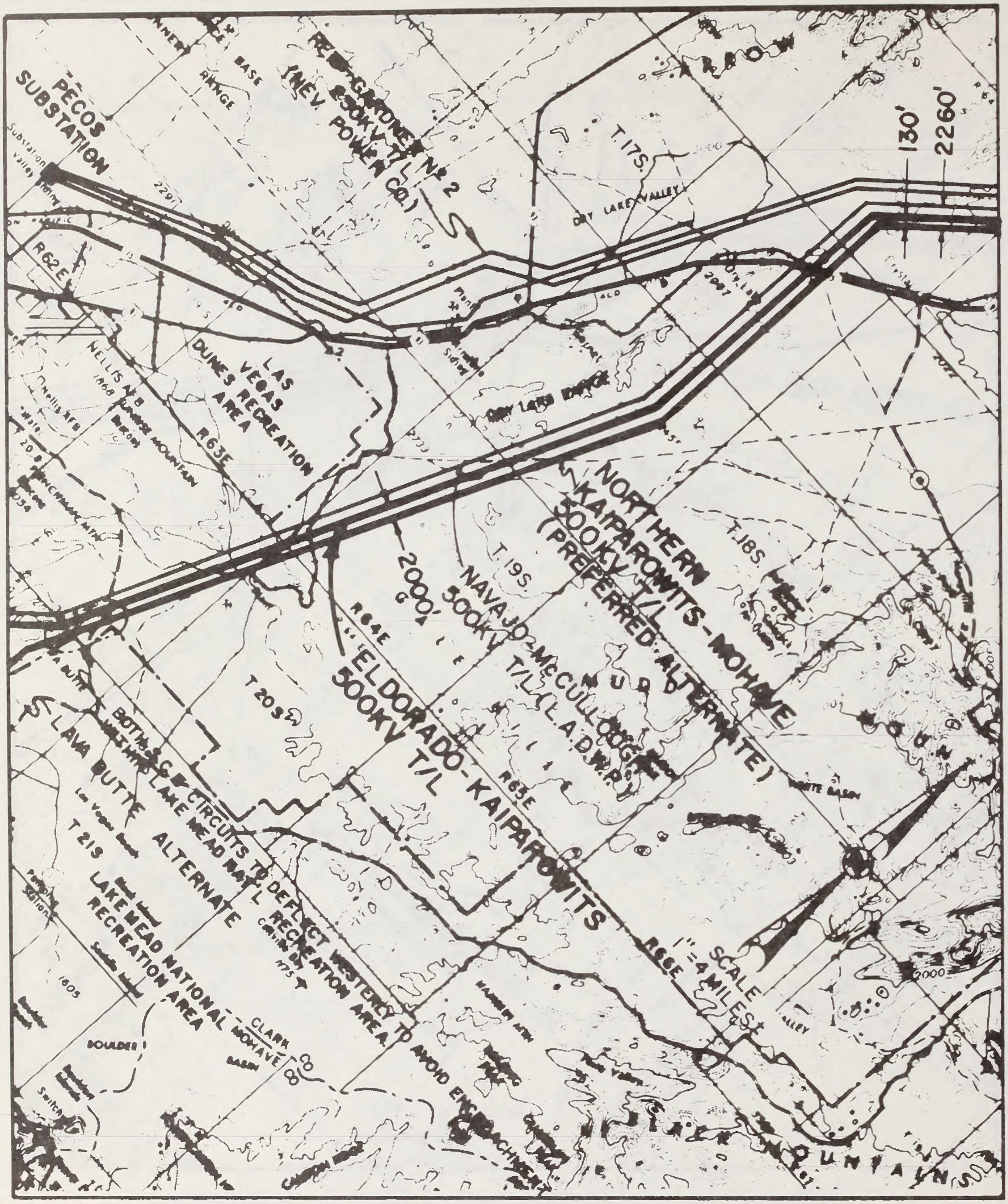
ILLUSTRATION 43g



**PROPOSED ELDORADO-KAIPAROWITS 500KV T/L,
NORTHERN KAIPAROWITS-MOHAVE 500KV T/L
PREFERRED ALTERNATE, AND
ARIZONA STRIP 500KV T/L PREFERRED ALTERNATES**

4-7-75 SHEET 8 OF 12

ILLUSTRATION 43h



PROPOSED ELDORADO-KAIPAROWITS 500KV T/L,
NORTHERN KAIPAROWITS-MOHAVE 500KV T/L
PREFERRED ALTERNATE, AND
ARIZONA STRIP 500KV T/L PREFERRED ALTERNATES

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SHEET 9 OF 12

ILLUSTRATION 43i

PROPOSED ELDORADO-KAIPAROWITS 500KV T/L, NORTHERN KAIPAROWITS-MOHAVE 500KV T/L PREFERRED ALTERNATE, AND ARIZONA STRIP 500KV T/L PREFERRED ALTERNATES

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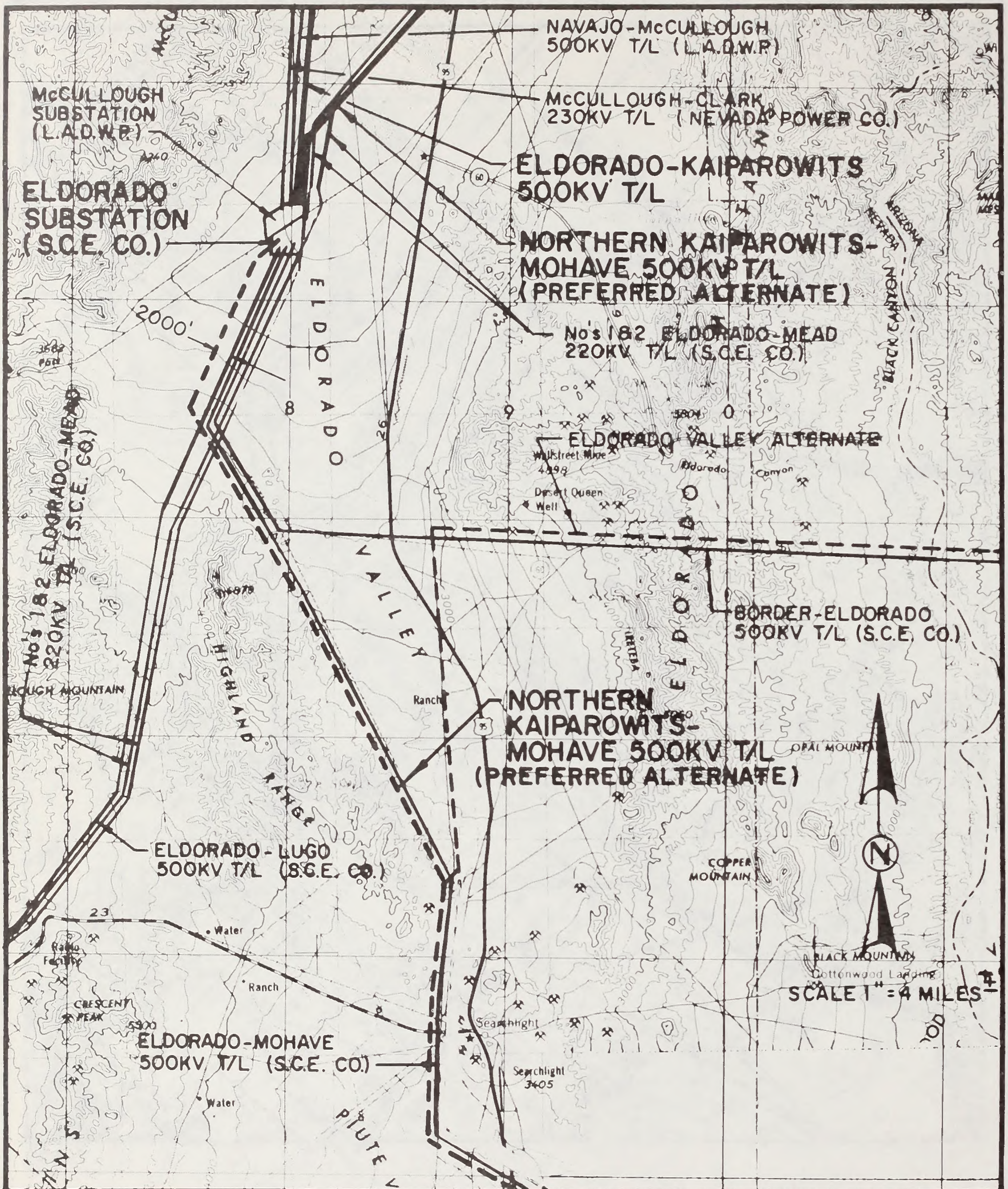
ILLUSTRATION 43j



PROPOSED ELDORADO-KAIPAROWITS 500KV T/L,
NORTHERN KAIPAROWITS-MOHAVE 500KV T/L
PREFERRED ALTERNATE, AND
ARIZONA STRIP 500KV T/L PREFERRED ALTERNATES

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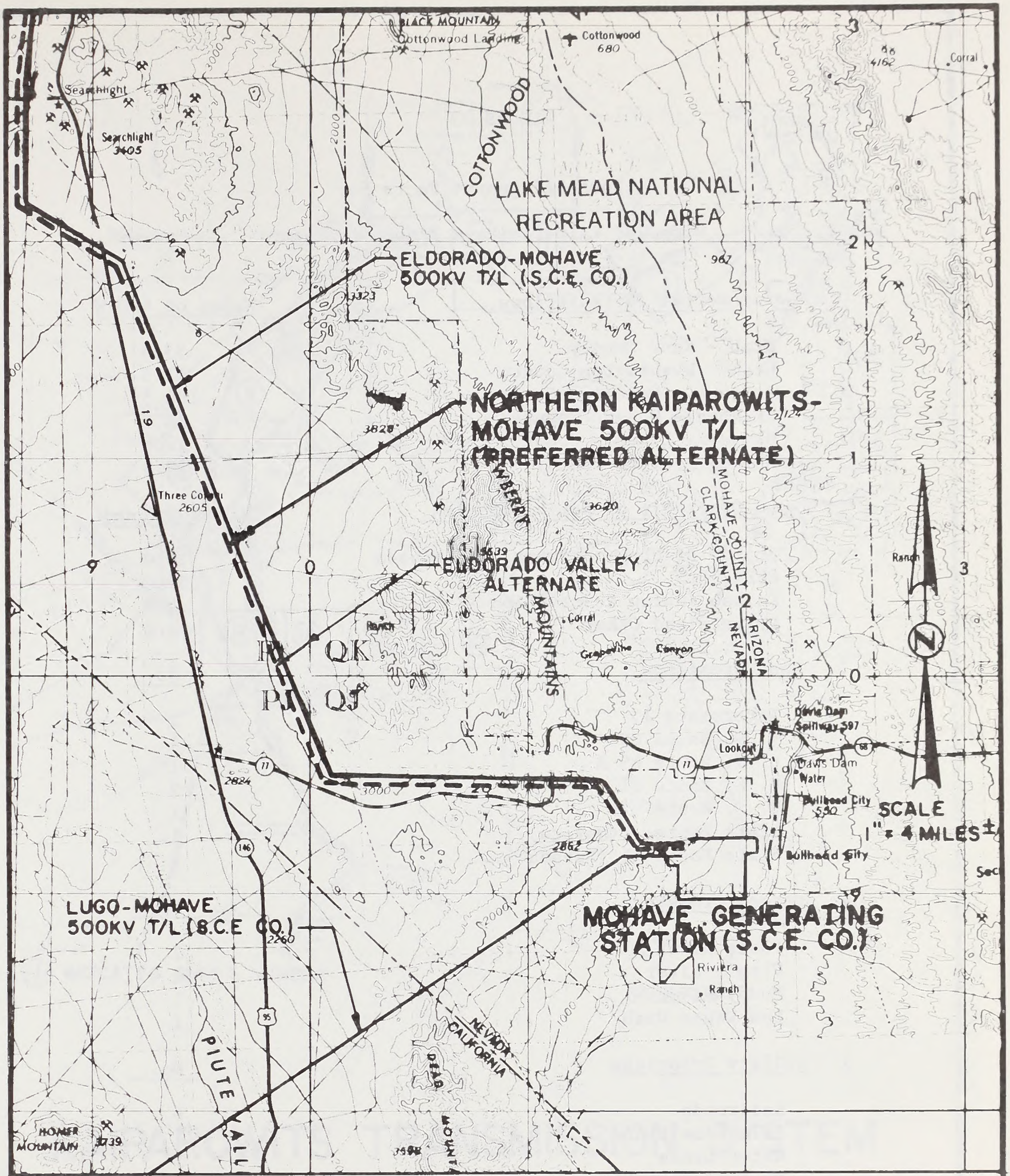
SHEET 11 OF 12



PROPOSED ELDORADO-KAIPAROWITS 500KV T/L,
NORTHERN KAIPAROWITS-MOHAVE 500KV T/L
PREFERRED ALTERNATE, AND
ARIZONA STRIP 500KV T/L PREFERRED ALTERNATES

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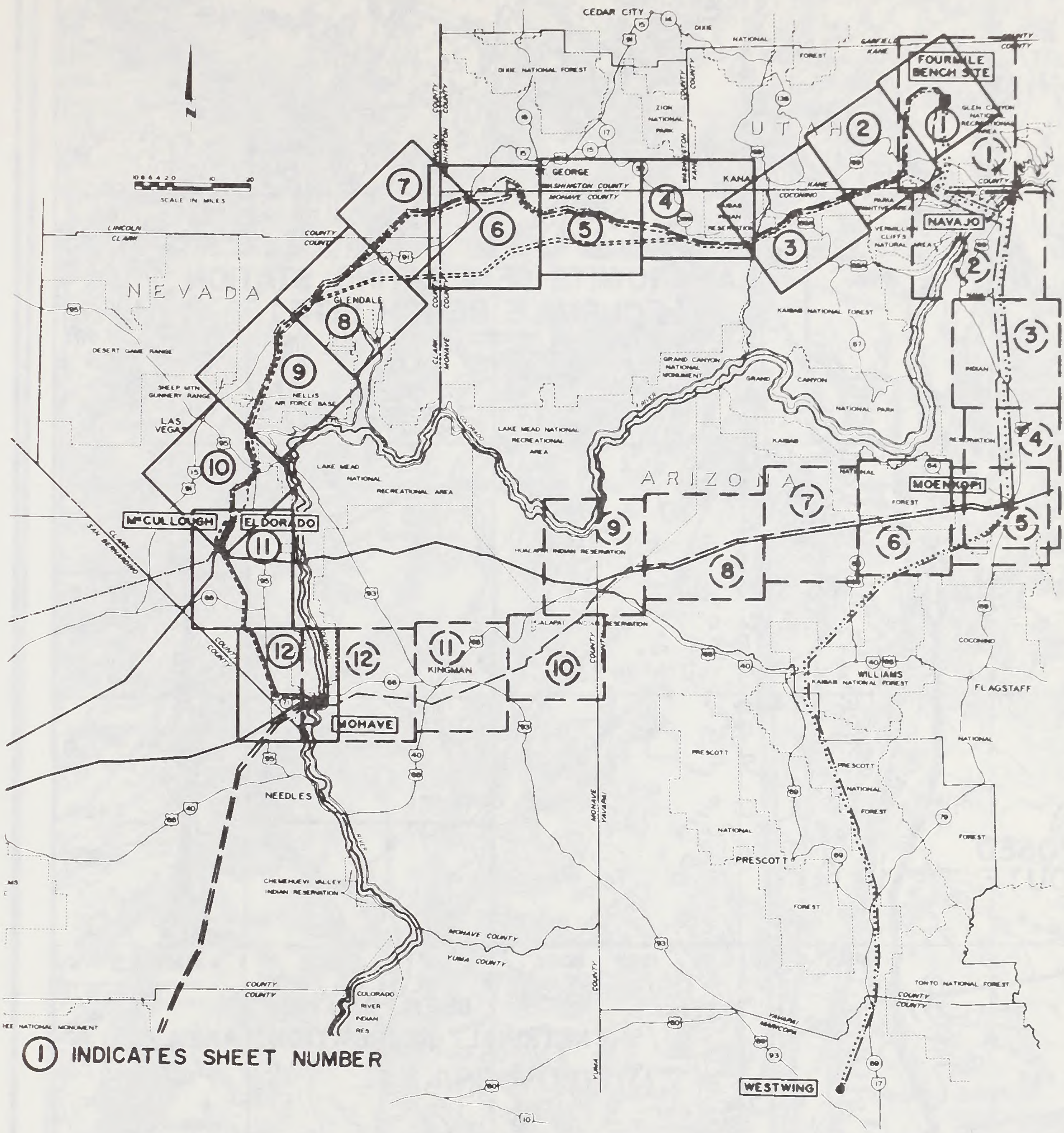
SHEET 12 OF 12

FIGURE 33

Route Alignment Facts For

Proposed Kaiparowits - Eldorado Segment

1.	Governmental Jurisdictions	Miles of R-O-W
	Utah - Kane County	53.0
	Utah - Washington County	11.5
	Arizona - Coconino County	106.5
	Arizona - Mohave County	88.9
	Nevada - Lincoln County	17.8
	Nevada - Clark County	90.8
2.	Land Ownership or Administration	Miles of R-O-W
	States of Utah, Arizona, and Nevada	16.0
	USDI, BLM	235.0
	Kaibab Indian Reservation	4.0
	Private and Other	13.0
3.	Road Crossings	No.
	Interstate 15	2
	U. S. Route 89	1
	U. S. Route 89 A	1
	U. S. Route 91	2
	U. S. Route 93	1
	State Route 7 (Nevada)	1
	State Route 41 (Nevada)	1
4.	Stream Crossings	No.
	Paria River	1
	Virgin River	1
	Muddy River	1
	Las Vegas Wash	1
5.	Utility Crossings	No.
	Railroads	6
	Telephone Lines	11
	Water Lines	1
	Transmission Lines	14
	Gas Pipelines	4



KAIPAROWITS TRANSMISSION SYSTEM

ELDORADO - KAIPAROWITS
NORTHERN KAIPAROWITS - MOHAVE PREFERRED ALTERNATE
ARIZONA STRIP PREFERRED ALTERNATES AND
KAIPAROWITS - MOENKOPI - MOHAVE 500KV T/L'S

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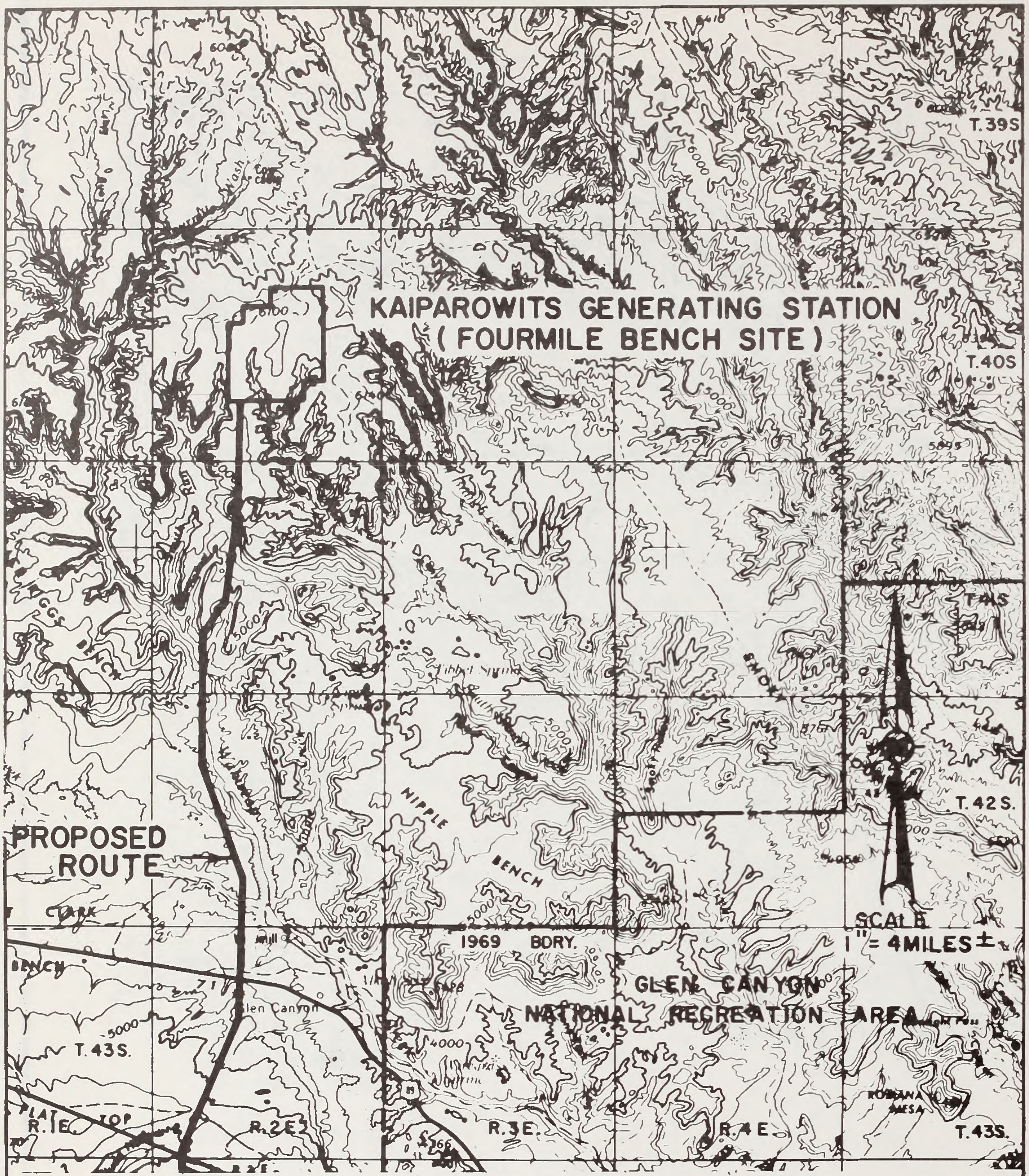
ILLUSTRATION 44



PROPOSED KAIPAROWITS-
MOENKOPI-MOHAVE 500KV T/L

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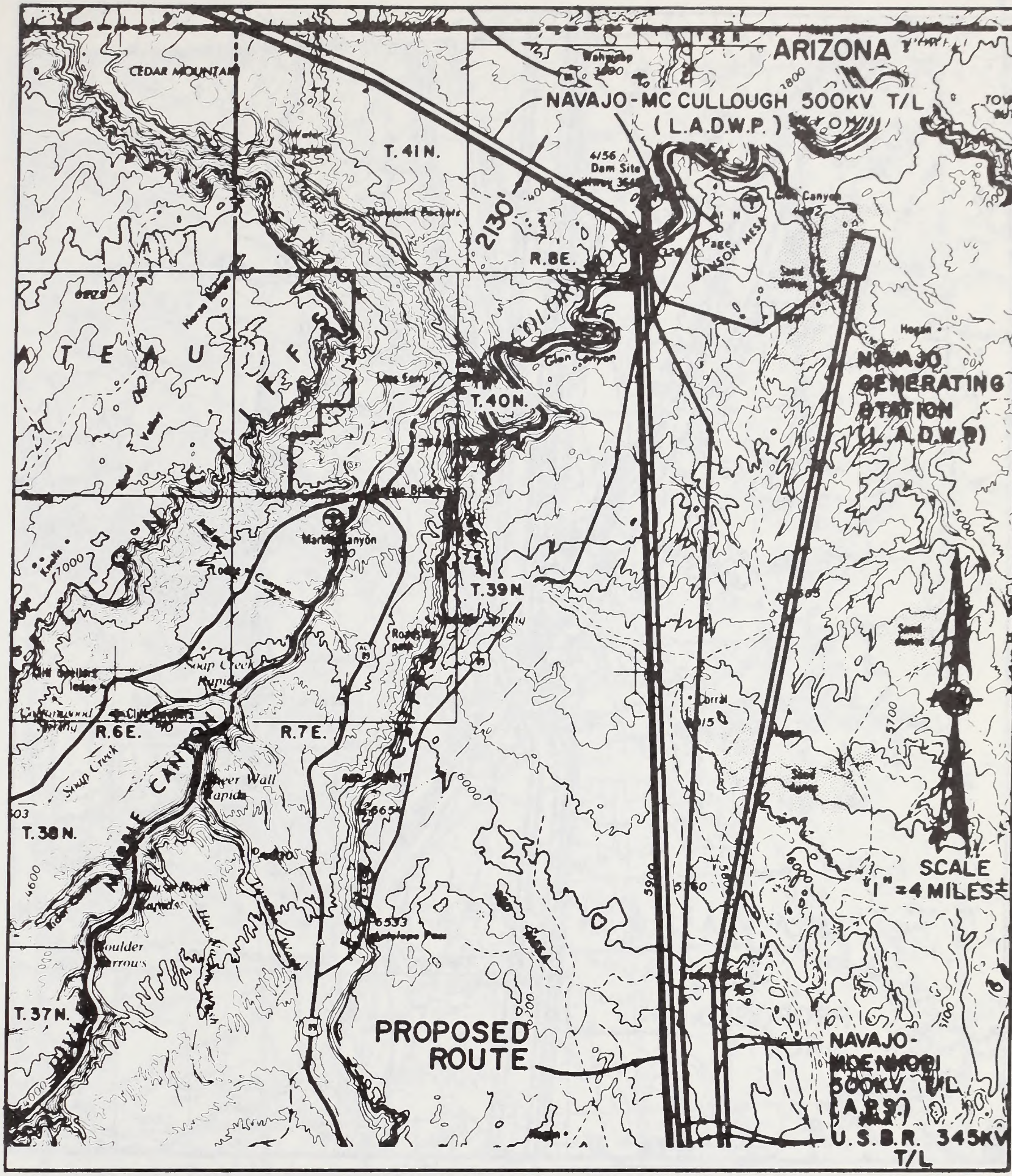
SHEET 1 OF 12

ILLUSTRATION 44a



PROPOSED KAIPAROWITS-
MOENKOPI-MOHAVE 500KV T/L

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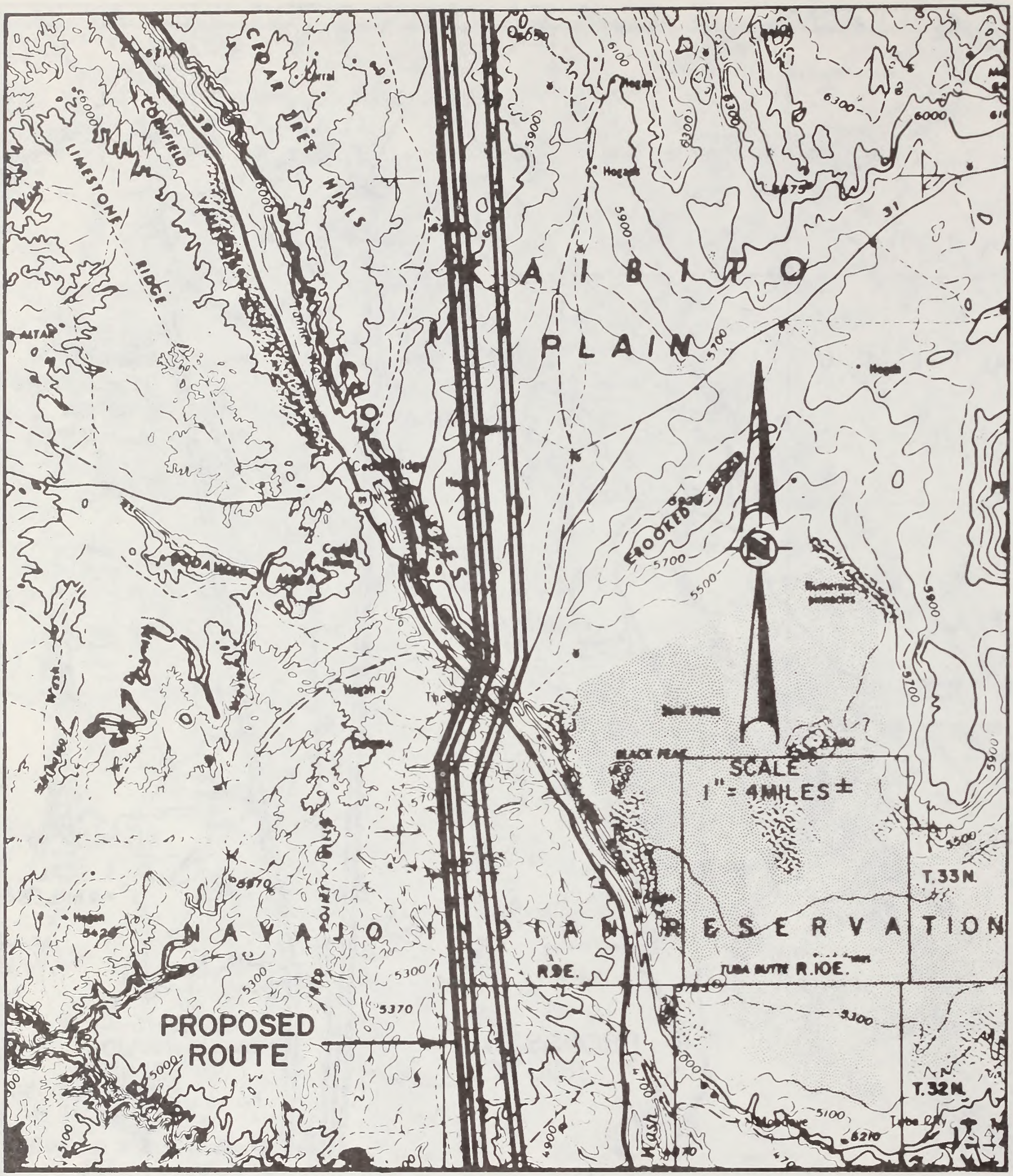
SHEET 2 OF 12

ILLUSTRATION 44b



PROPOSED KAIPAROWITS-
MOENKOPI-MOHAVE 500KV T/L

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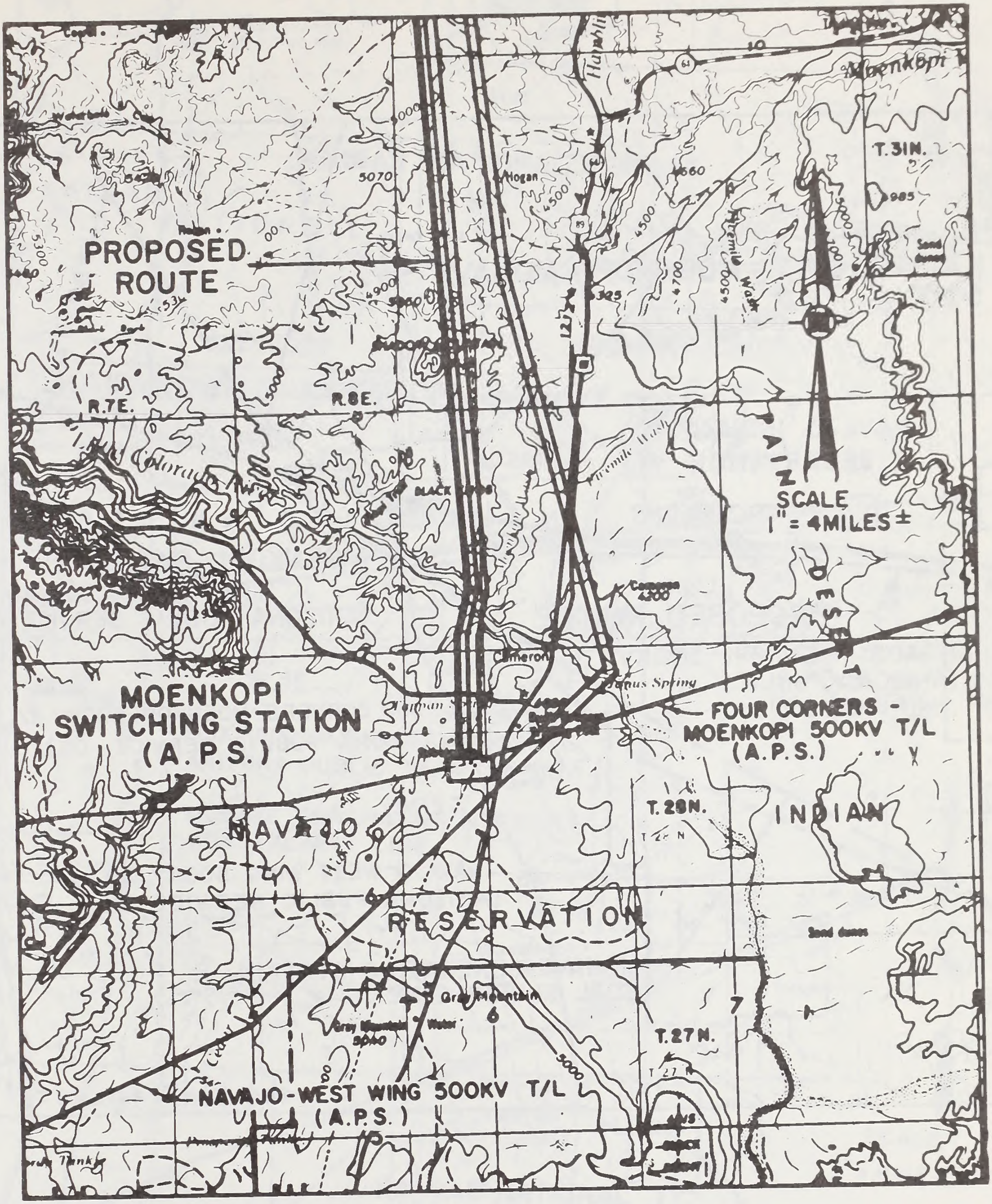
SHEET 3 OF 12

ILLUSTRATION 44c



PROPOSED KAIPAROWITS-
MOENKOPI-MOHAVE 500KV T/L

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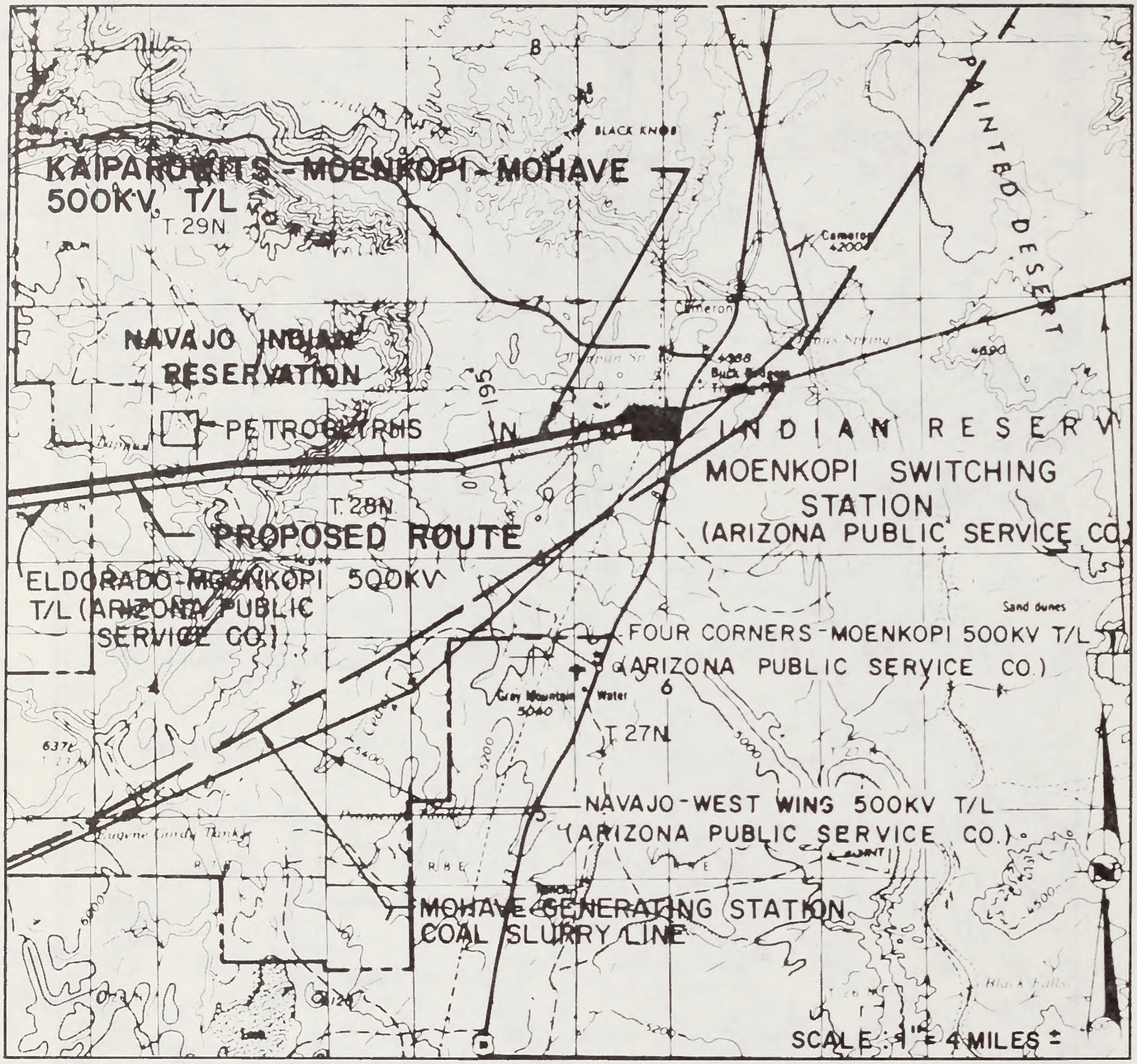
SHEET 4 OF 12



PROPOSED KAIPAROWITS-
MOENKOPI-MOHAVE 500KV T/L

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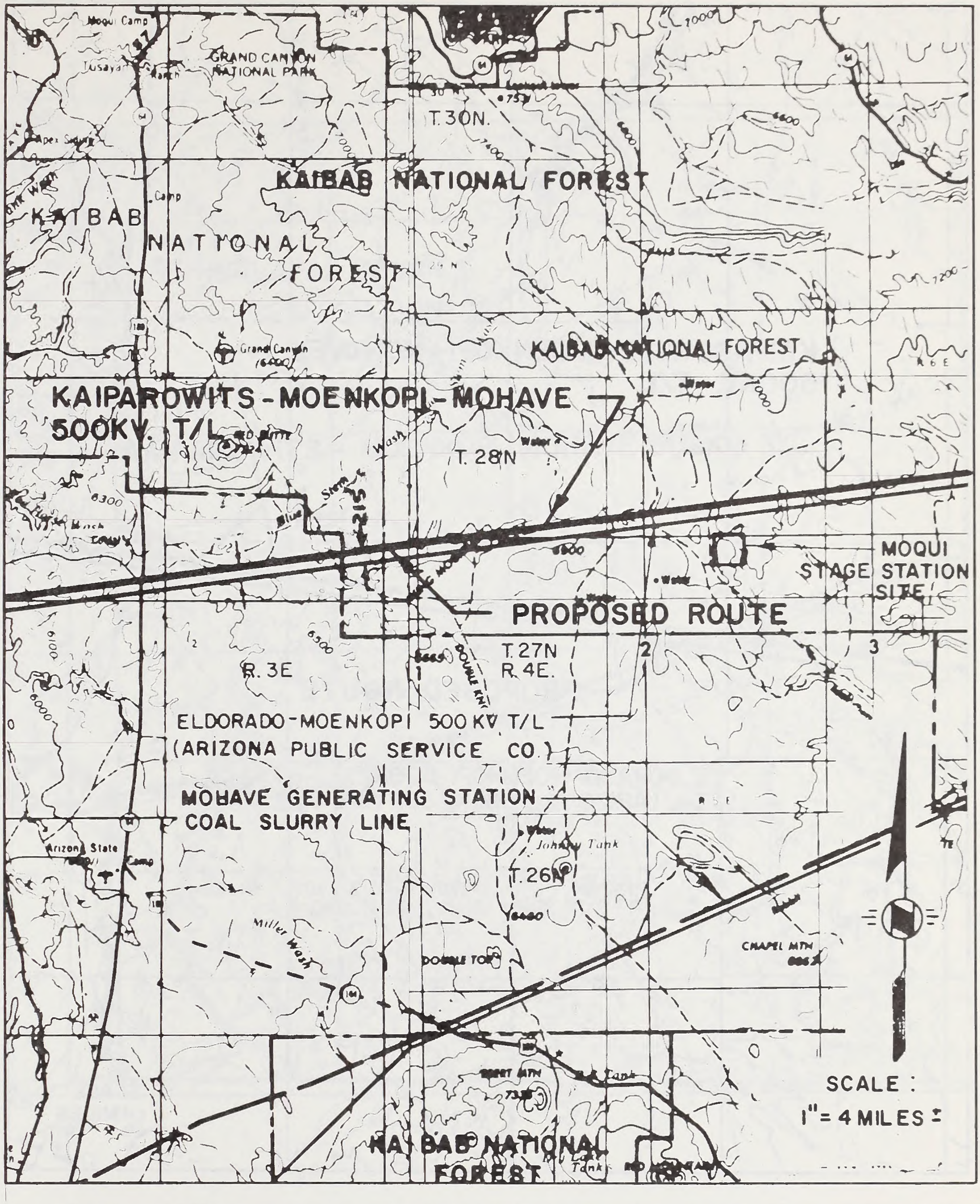
SHEET 5 OF 12



PROPOSED KAIPAROWITS-
MOENKOPI-MOHAVE 500KV T/L

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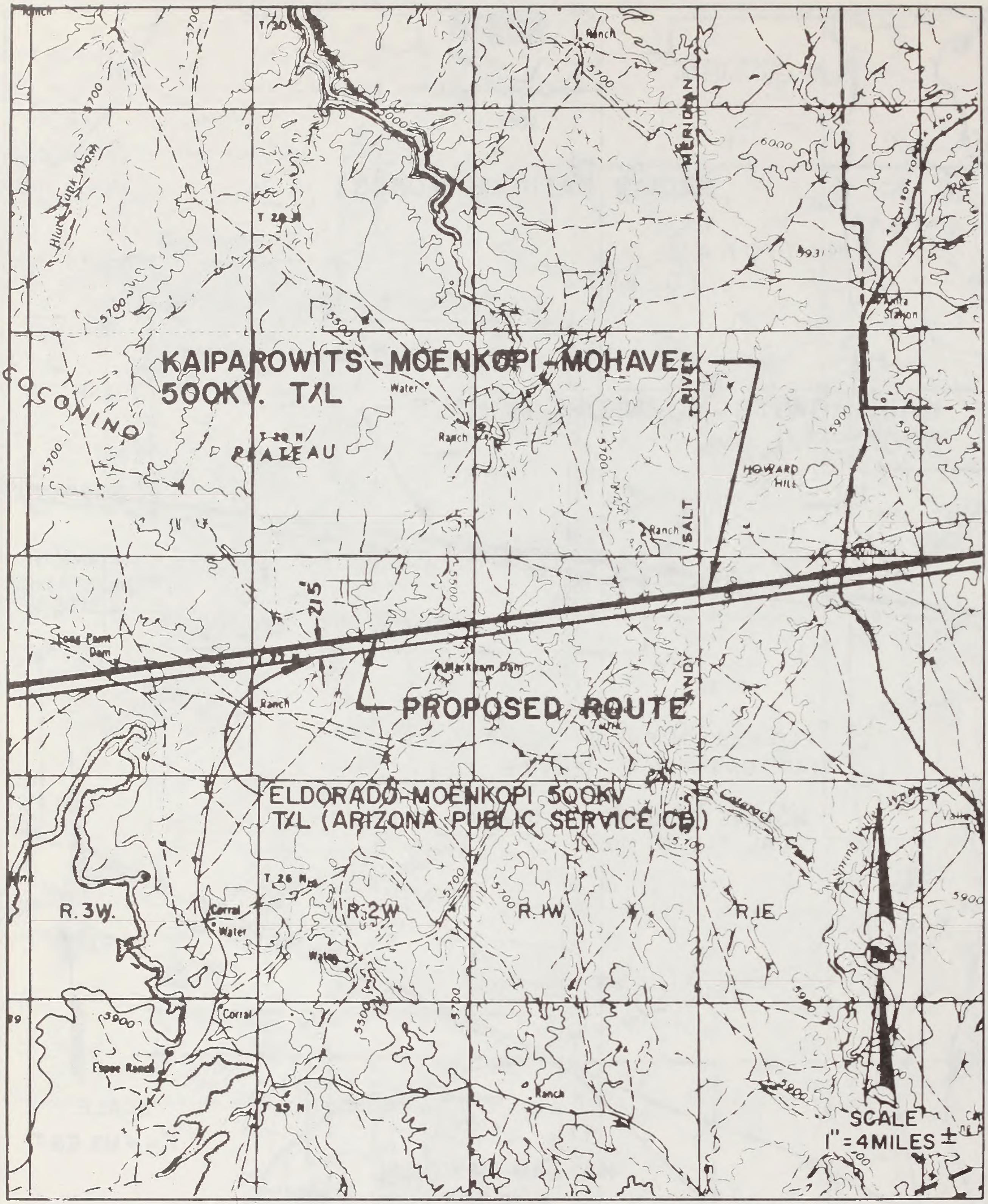
SHEET 6 OF 12

ILLUSTRATION 44f



PROPOSED KAIPAROWITS-MOENKOPI-MOHAVE 500KV T/L

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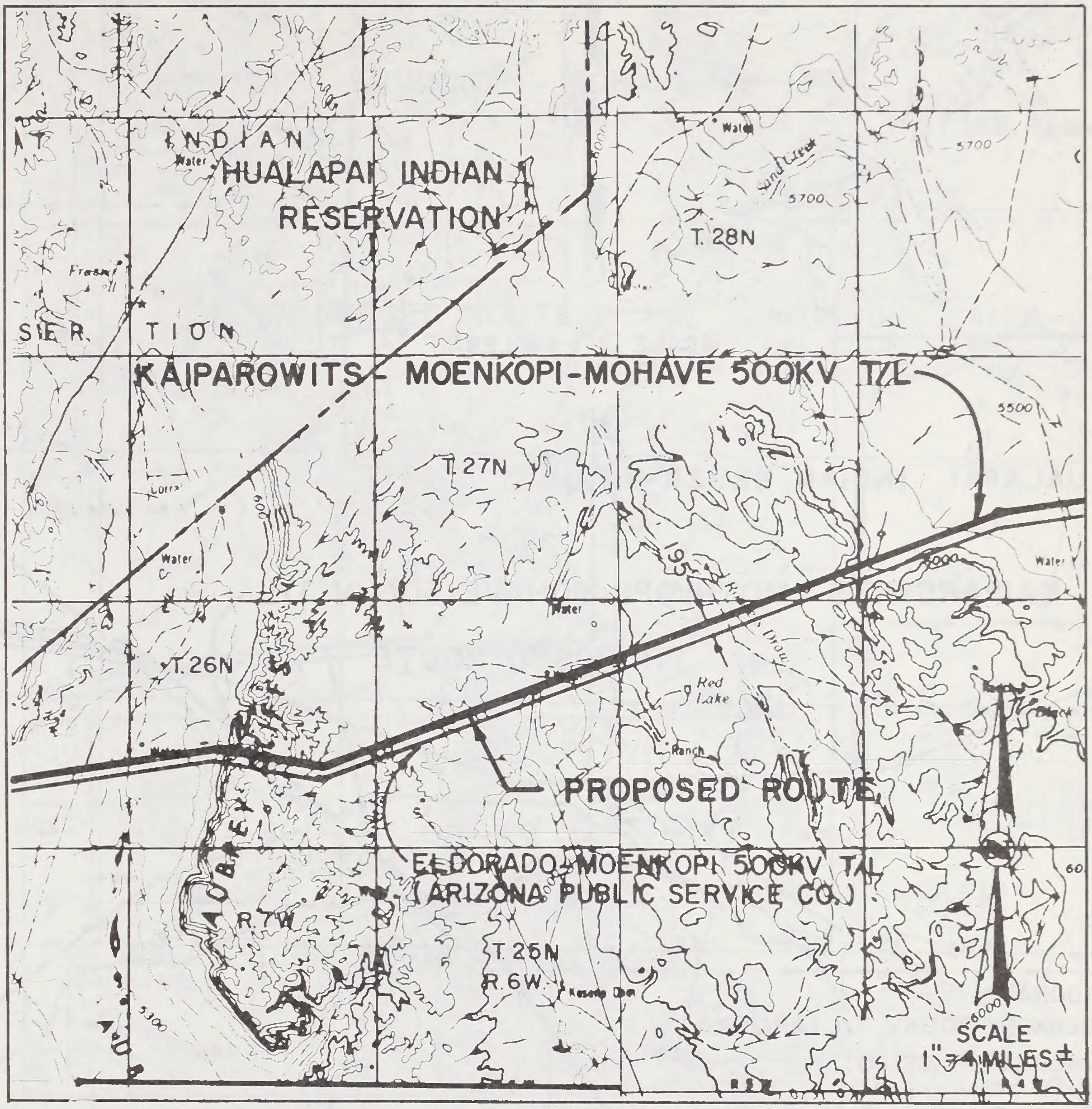
SHEET 7 OF 12



PROPOSED KAIPAROWITS-
MOENKOPI-MOHAVE 500KV T/L

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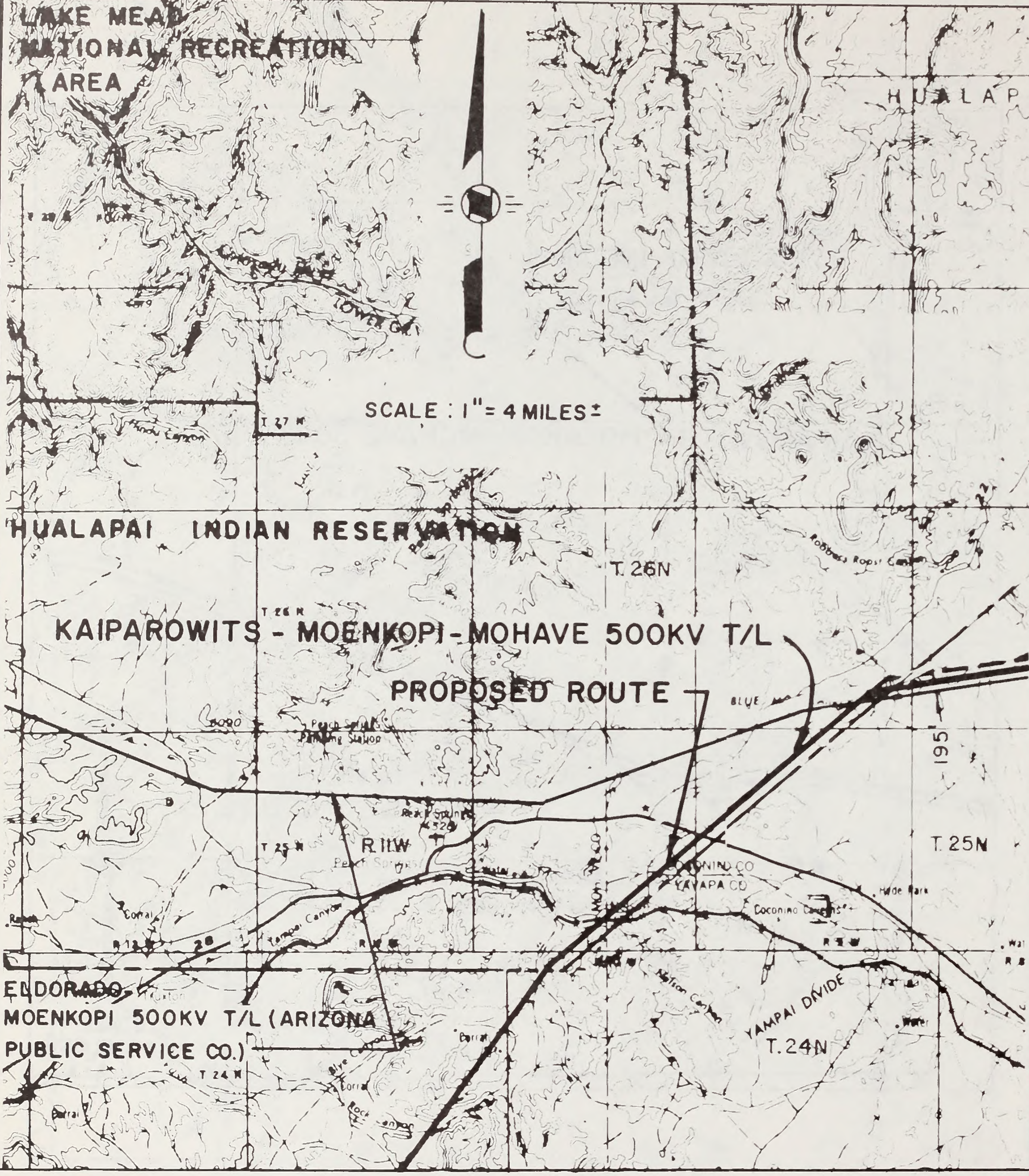
SHEET 8 OF 12



PROPOSED KAIPAROWITS-
MOENKOPI-MOHAVE 500KV T/L

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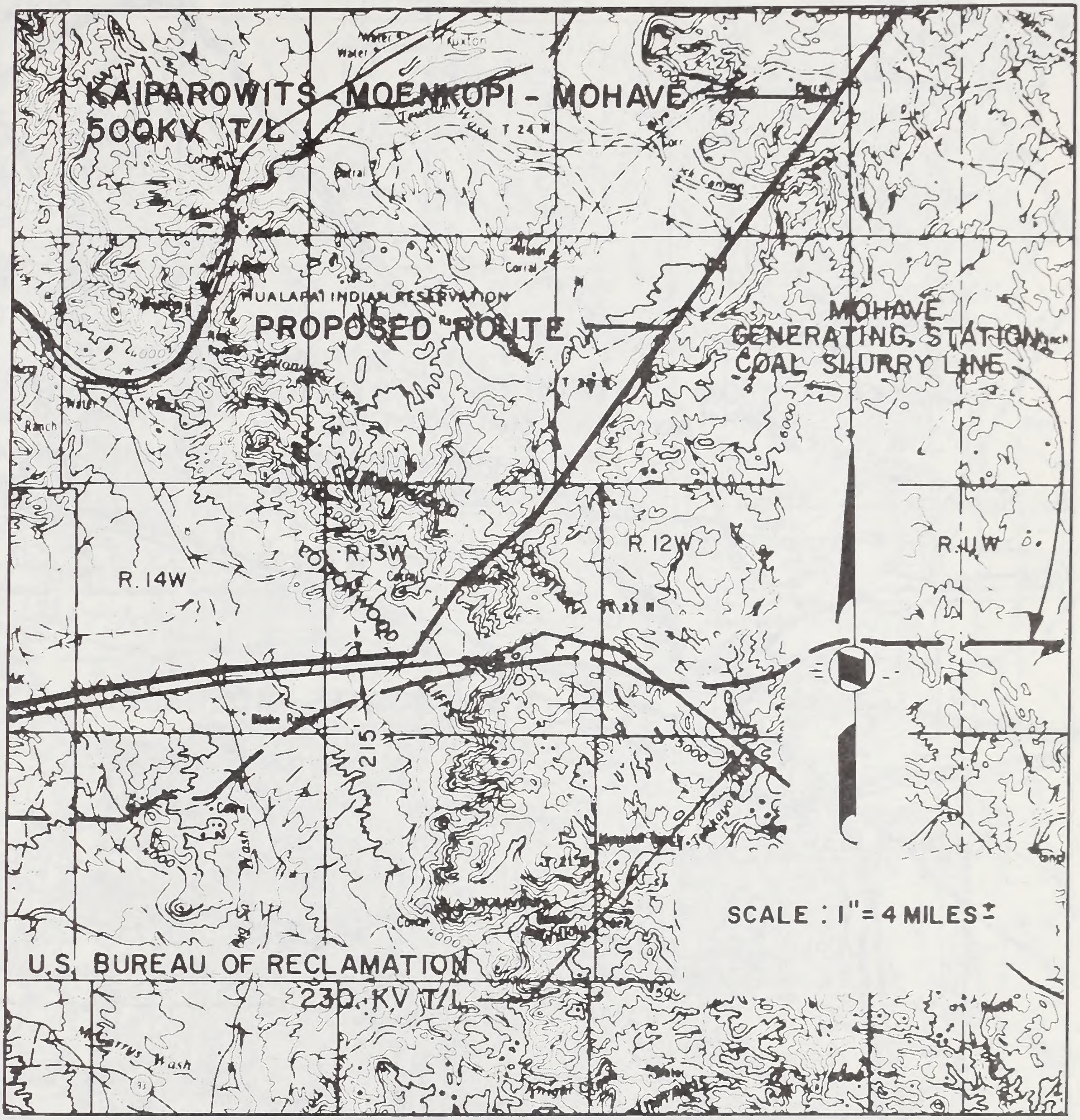
SHEET 9 OF 12

ILLUSTRATION 44i



PROPOSED KAIPAROWITS-
MOENKOPI-MOHAVE 500KV T/L

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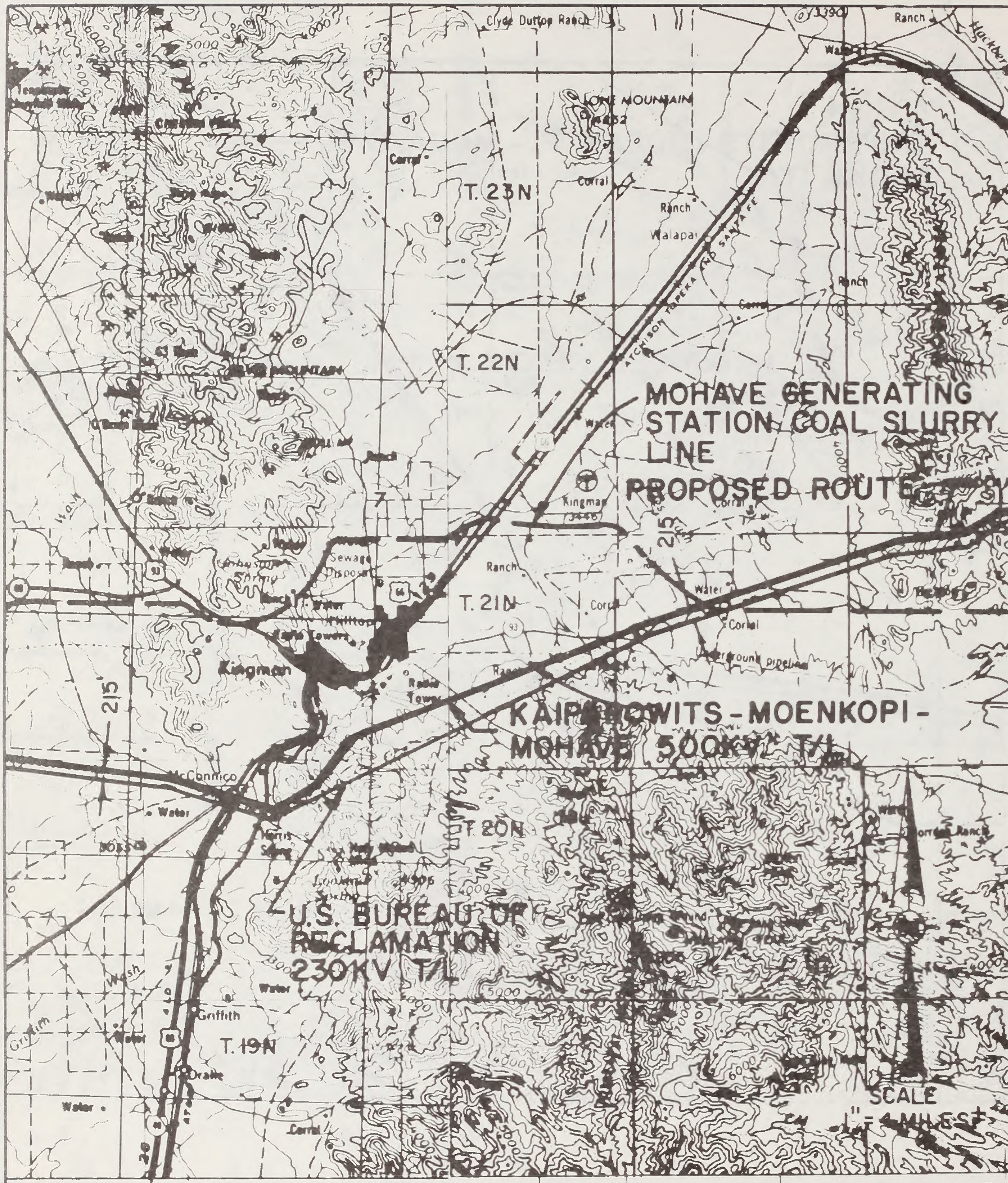
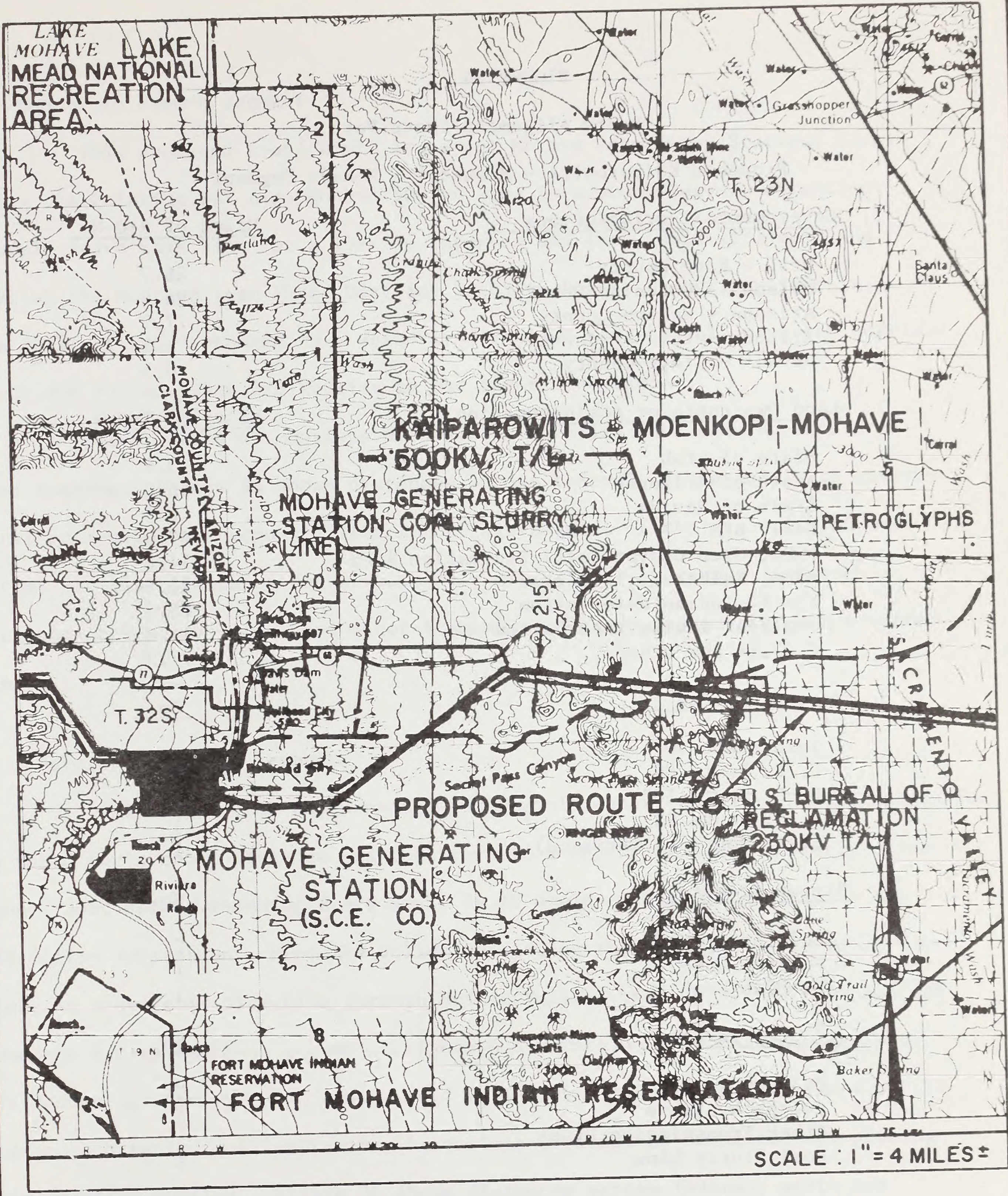
SHEET 10 OF 12



PROPOSED KAIPAROWITS-
MOENKOPI-MOHAVE 500KV T/L

4-7-75

SHEET 11 OF 12



PROPOSED KAIPAROWITS-
MOENKOPI-MOHAVE 500KV T/L

SHEET 12 OF 12

4-7-75

ILLUSTRATION 44L

FIGURE 34

Route Alignment Facts For

Proposed Kaiparowits - Moenkopi - Mohave Segment

1. Governmental Jurisdictions	Miles of R-O-W
Utah - Kane County	26.7
Arizona - Coconino County	198.6
Arizona - Mohave County	77.9
Arizona - Yavapai County	4.1
Nevada - Clark County	0.5

2. Land Ownership or Administration	Miles of R-O-W
State of Utah	3.0
State of Arizona	45.0
State of Nevada	0.5
USDI, BLM	47.0
USDI, Glen Canyon Nat'l Recreation Area	14.0
USDA, Kaibab Nat'l Forest	20.0
Navajo Indian Reservation	86.4
Hualapai Indian Reservation	14.8
Private and Other	77.2

3. Road Crossings	No.
Interstate 40	2
U. S. Route 89	3
U. S. Route 180	1
U. S. Route 93	1
State Route 64 (Arizona)	1

4. Stream Crossings	No.
Colorado River	2
Wahweap Wash	1
Hamblin Wash	1

5. Utility Crossings	No.
Railroads	3
Telephone Lines	3
Other Transmission Lines	5
Coal Slurry Line	5

Mohave to Devers segment

This proposed route would leave the Mohave Generating Station, paralleling the existing SCE Lugo-Mohave 500 kv line in a southwesterly direction. It would leave this line for a 15-mile interval and then would intersect and parallel the Metropolitan Water District lines to Desert Center, California. From there it would proceed in a westerly direction roughly following the corridor of the SCE Julian Hinds 220 kv line to the Devers Substation.

Illustration 45 consists of a set of detailed maps showing this proposed routing. Figure 35 shows distances across federal, state and local governmental or management responsibilities for this segment of the transmission system. It also indicates the numbers of roads, rivers, streams, railroads, pipelines, telephone lines, and other transmission lines crossed by this proposed segment.

Devers to Serrano segment

This segment of the proposed route would depart from the Devers Substation, go south for a short distance and then turn to a nearly straight westerly direction. Just before reaching State Route 79 it would turn southwesterly to the SCE Valley Substation. From the Valley Substation the proposed route would continue in a westerly direction through Perris Valley, then along the west side of Temescal Valley and then across the Santa Ana Mountains. On leaving the Santa Ana Mountains, the proposed route would go to the northwest and terminate at the Serrano Substation. Illustration 46 consists of a set of detailed maps showing this proposed routing. Figure 36 shows distances across federal, state and local governmental or management responsibilities for this segment of the transmission system. It also indicates the numbers of roads, rivers, streams, railroads, pipelines, telephone lines, and other transmission lines crossed by this proposed segment.

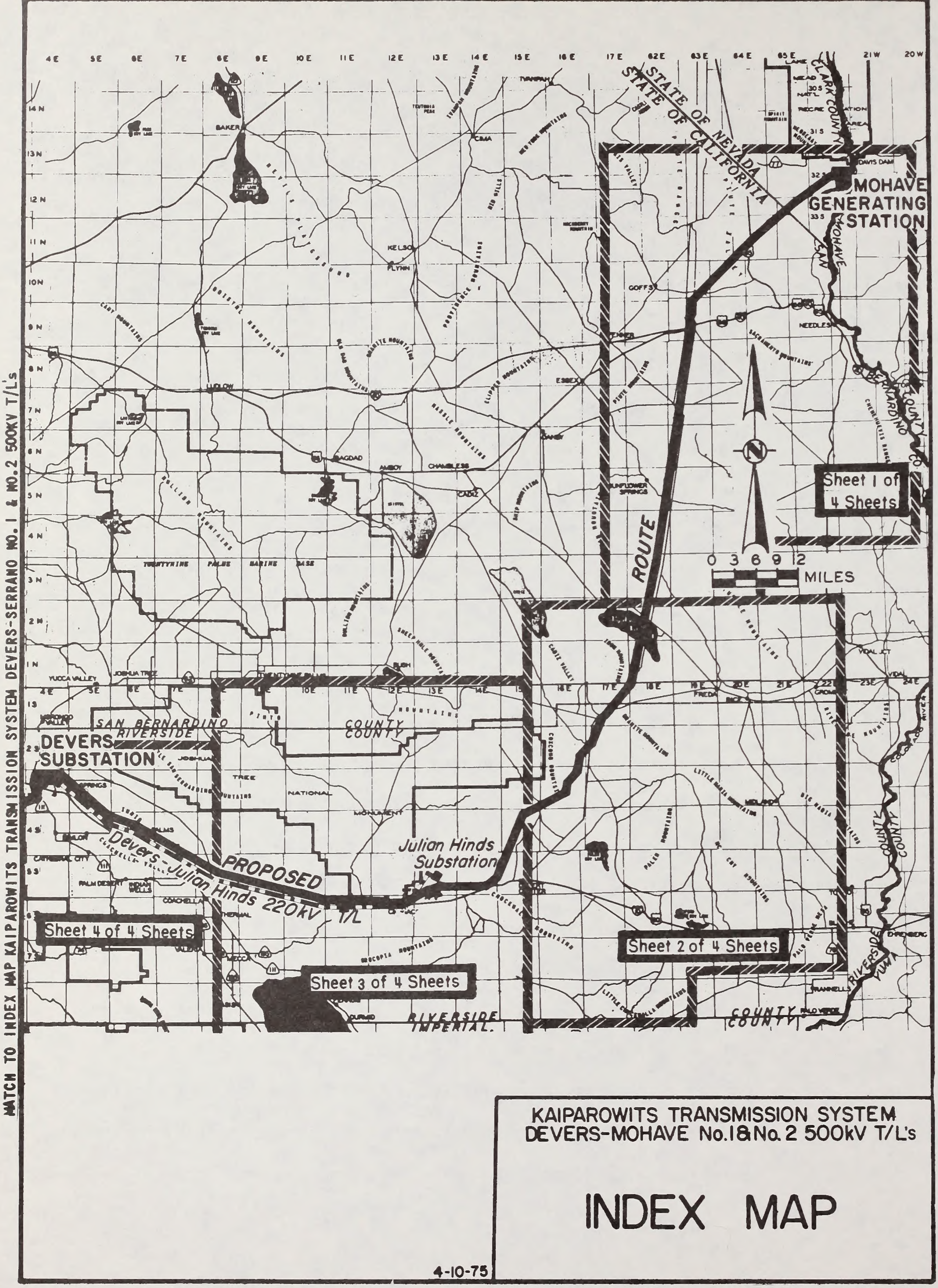
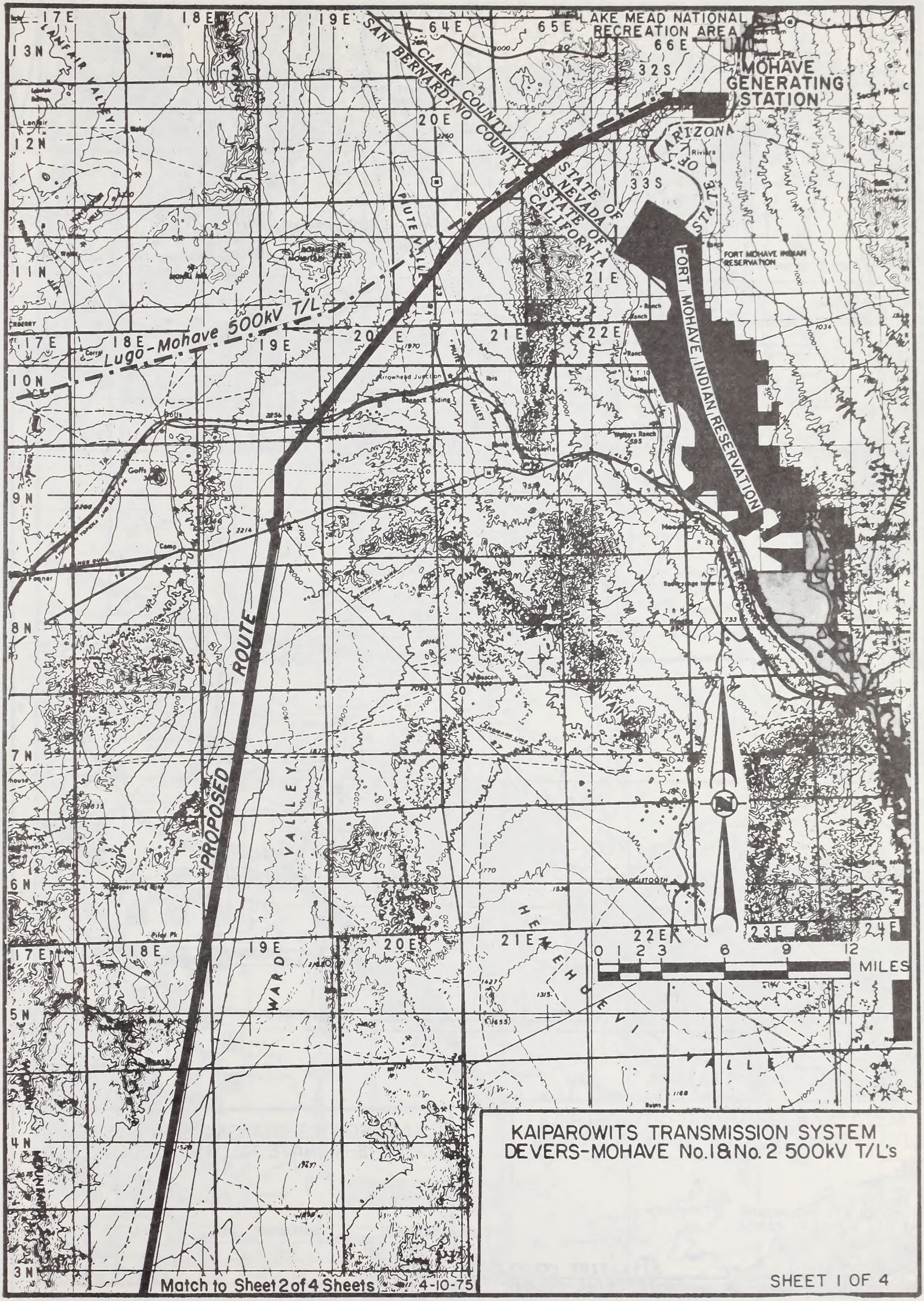


ILLUSTRATION 45


LAKE MEAD NATIONAL RECREATION AREA
MOHAVE GENERATING STATION
CLARK COUNTY
SAN BERNARDINO COUNTY
STATE OF NEVADA
STATE OF CALIFORNIA
STATE OF ARIZONA
FORT MOHAVE INDIAN RESERVATION
Lugo-Mohave 500kV T/L
PROPOSED ROUTE
WARD VALLEY
PIUTE VALLEY
LANFAIR VALLEY
17E
18E
19E
20E
21E
22E
23E
24E
64E
65E
66E
32S
33S
13N
12N
11N
10N
9N
8N
7N
6N
5N
4N
3N
0 1 2 3 6 9 12 MILES
KAIPAROWITS TRANSMISSION SYSTEM
DEVERS-MOHAVE No.1 & No.2 500kV T/L's
SHEET 1 OF 4
Match to Sheet 2 of 4 Sheets
4-10-75

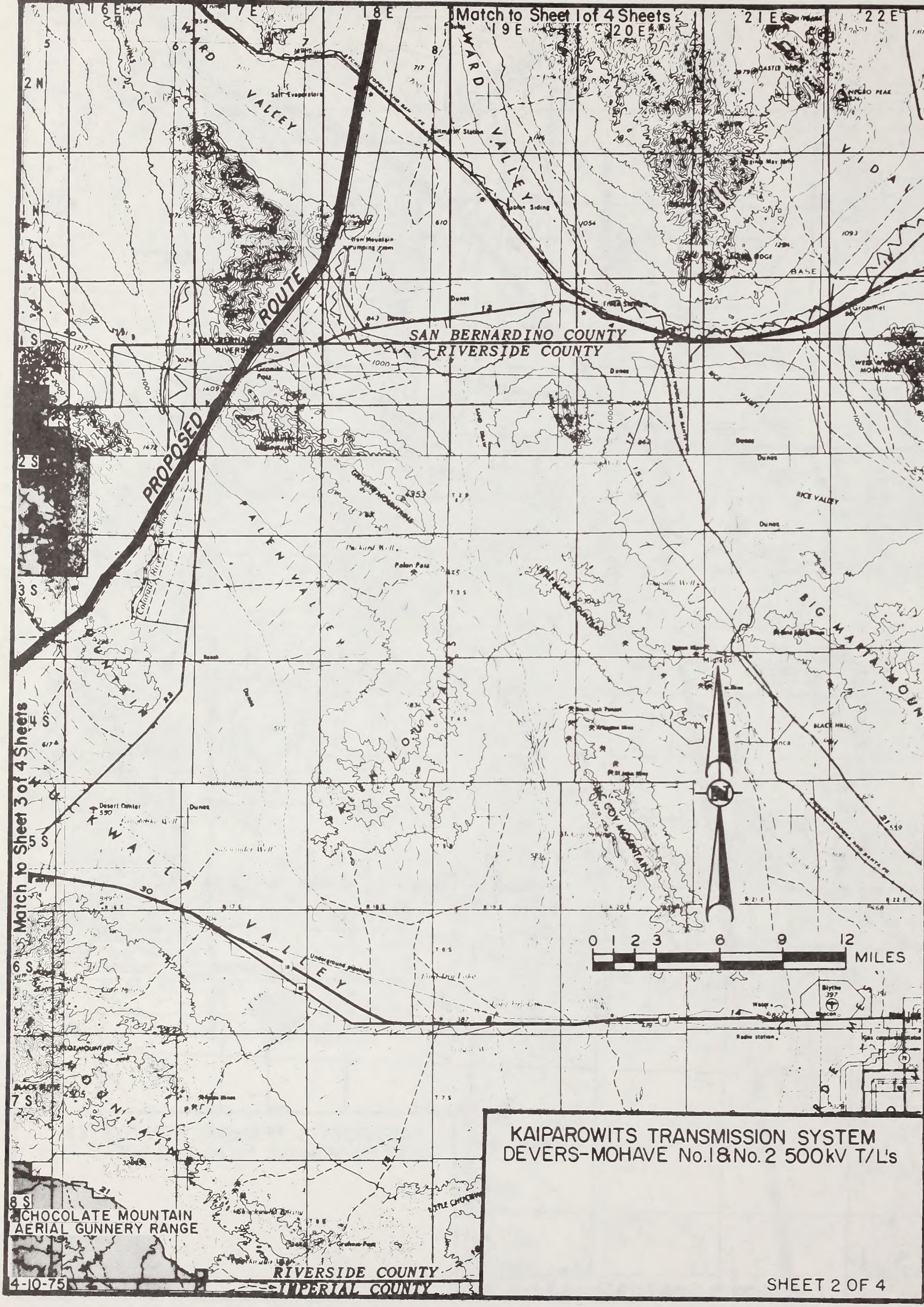
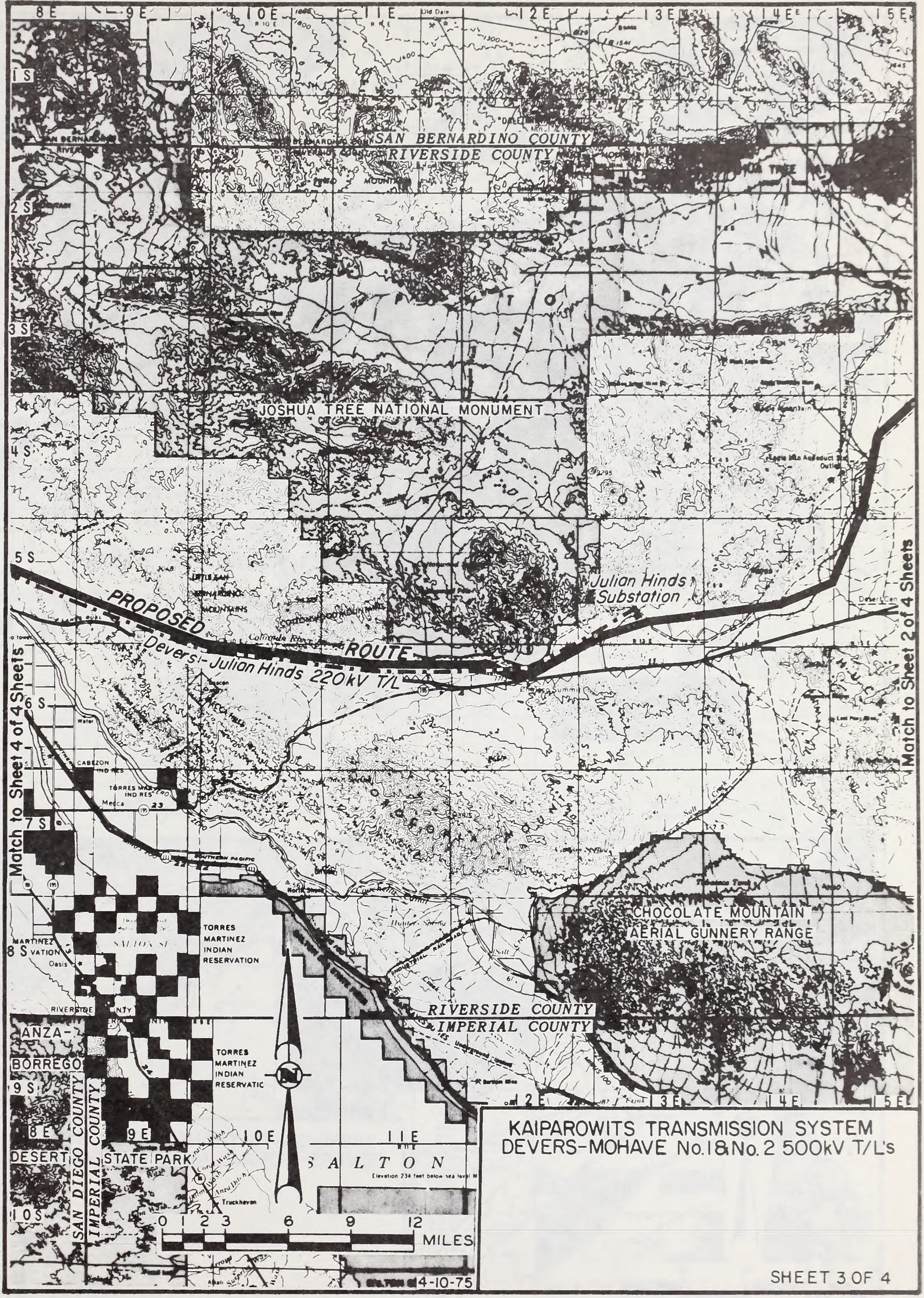


ILLUSTRATION 45b



KAIPAROWITS TRANSMISSION SYSTEM
DEVERS-MOHAVE No.1 & No.2 500kV T/L's

SHEET 3 OF 4

ILLUSTRATION 45c

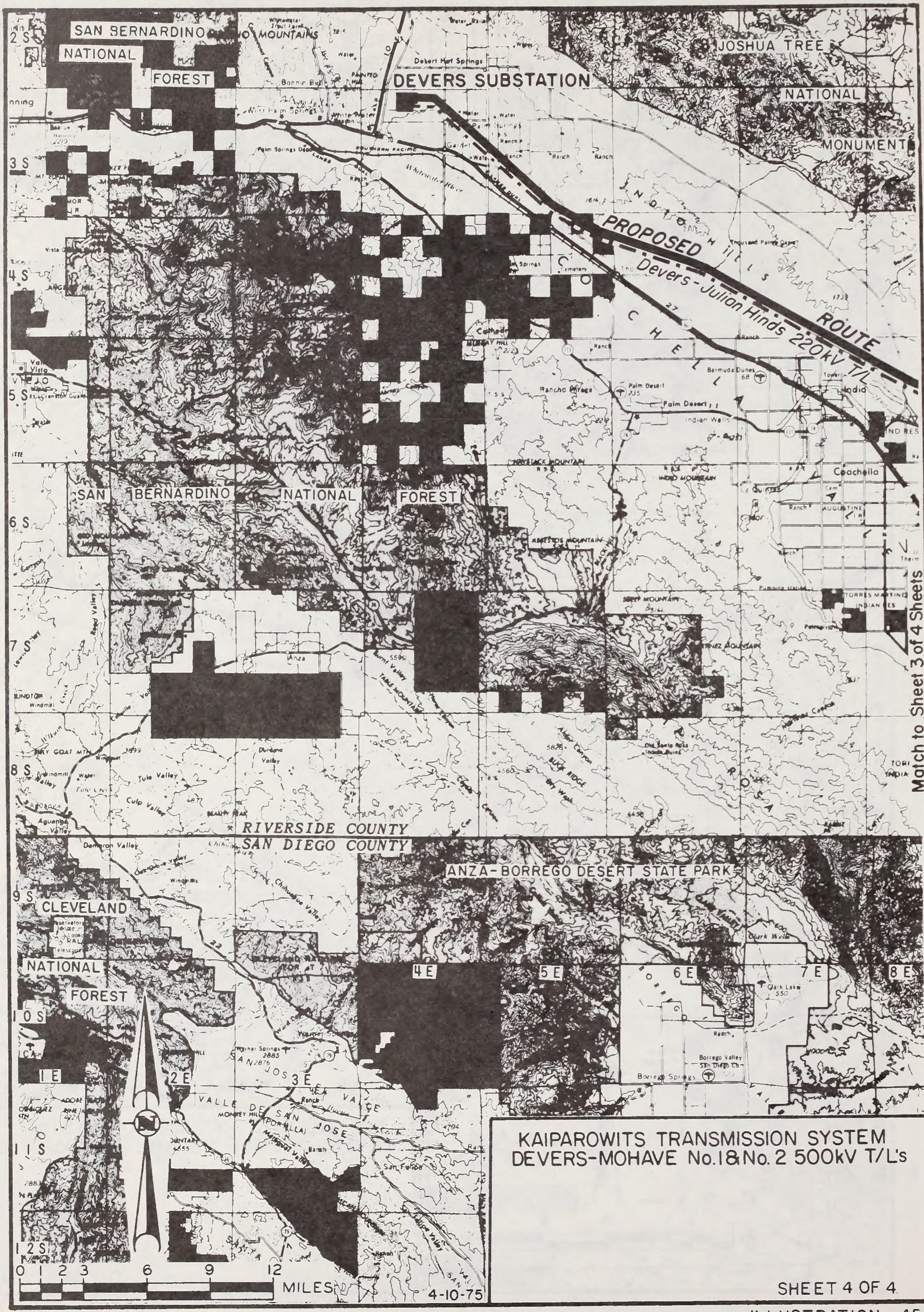


ILLUSTRATION 45d

FIGURE 35

Route Alignment Facts For

Proposed Mohave - Devers Segment

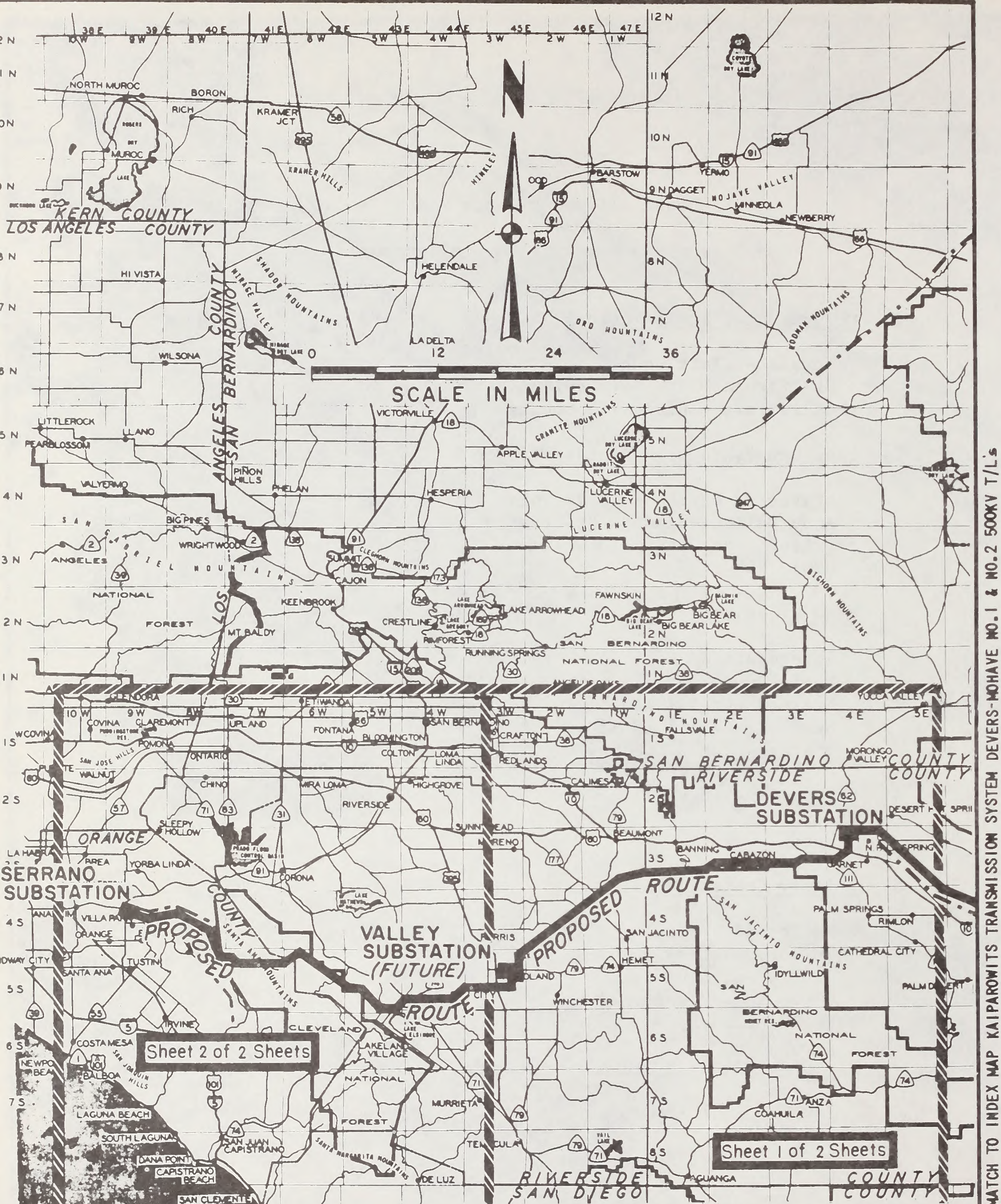
1. Governmental Jurisdictions	Miles of R-O-W
Nevada - Clark County	8.0
California - San Bernardino County	77.5
California - Riverside County	99.5

2. Land Ownership or Administration	Miles of R-O-W
States of Nevada & California	4.0
Aqua Caliente Indian Reservation	2.0
Private and Other	58.0
USDI, BLM	111.0

3. Road Crossings	No.
Interstate 40	1
U. S. Route 95	1
State Route 177 (Calif.)	1
State Route 111 (Calif.)	1
State Route 62 (Calif.)	1

4. Stream Crossings	No.
None	

5. Utility Crossings	No.
Railroads	2
Telephone Lines	4
Canals and Aquaducts	5
Other Transmission Lines	5
Gas Pipelines	6



KAIPAROWITS TRANSMISSION SYSTEM
DEVERS-SERRANO No.1 & No.2 500kV T/L's

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ILLUSTRATION 46

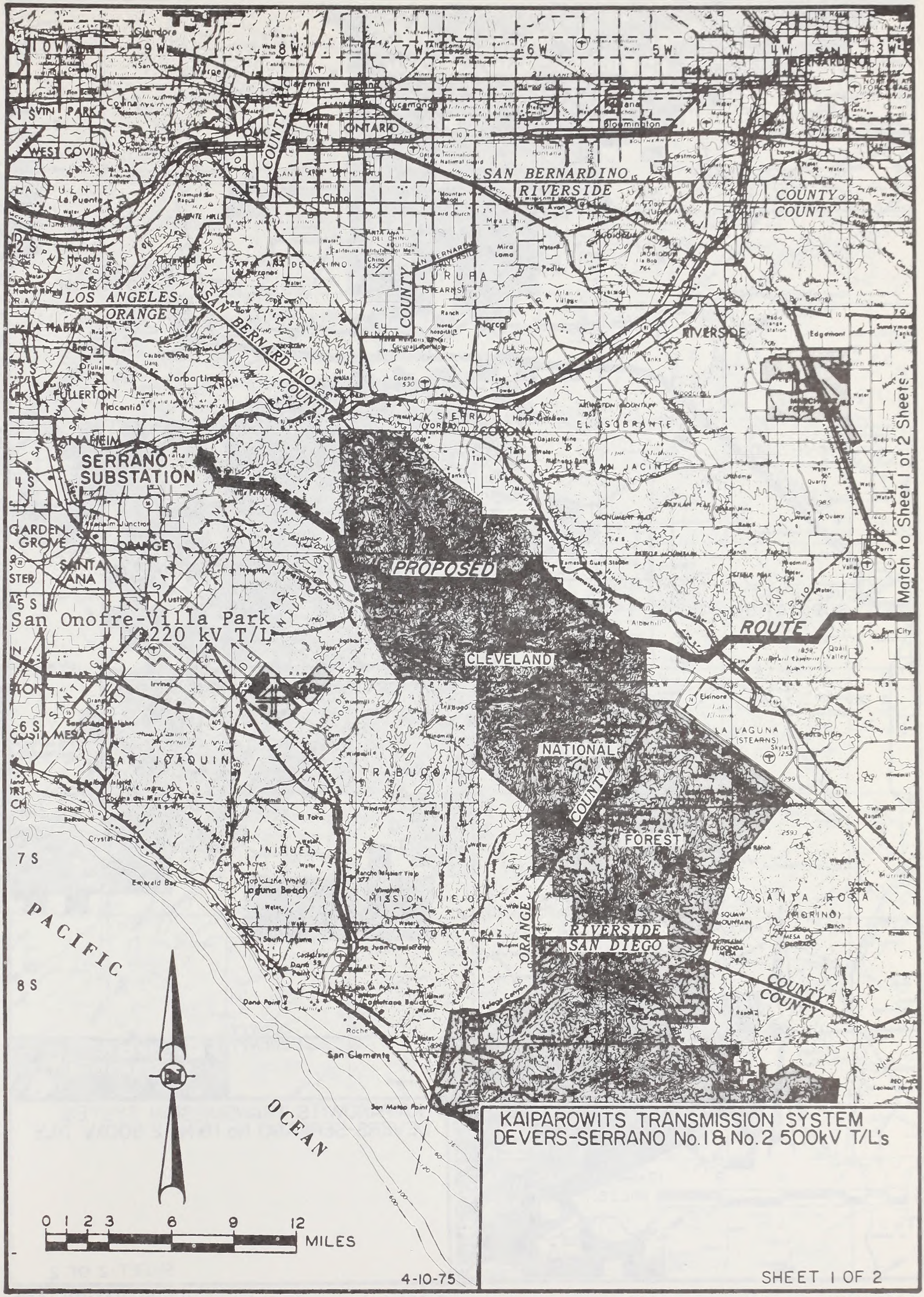


ILLUSTRATION 46a

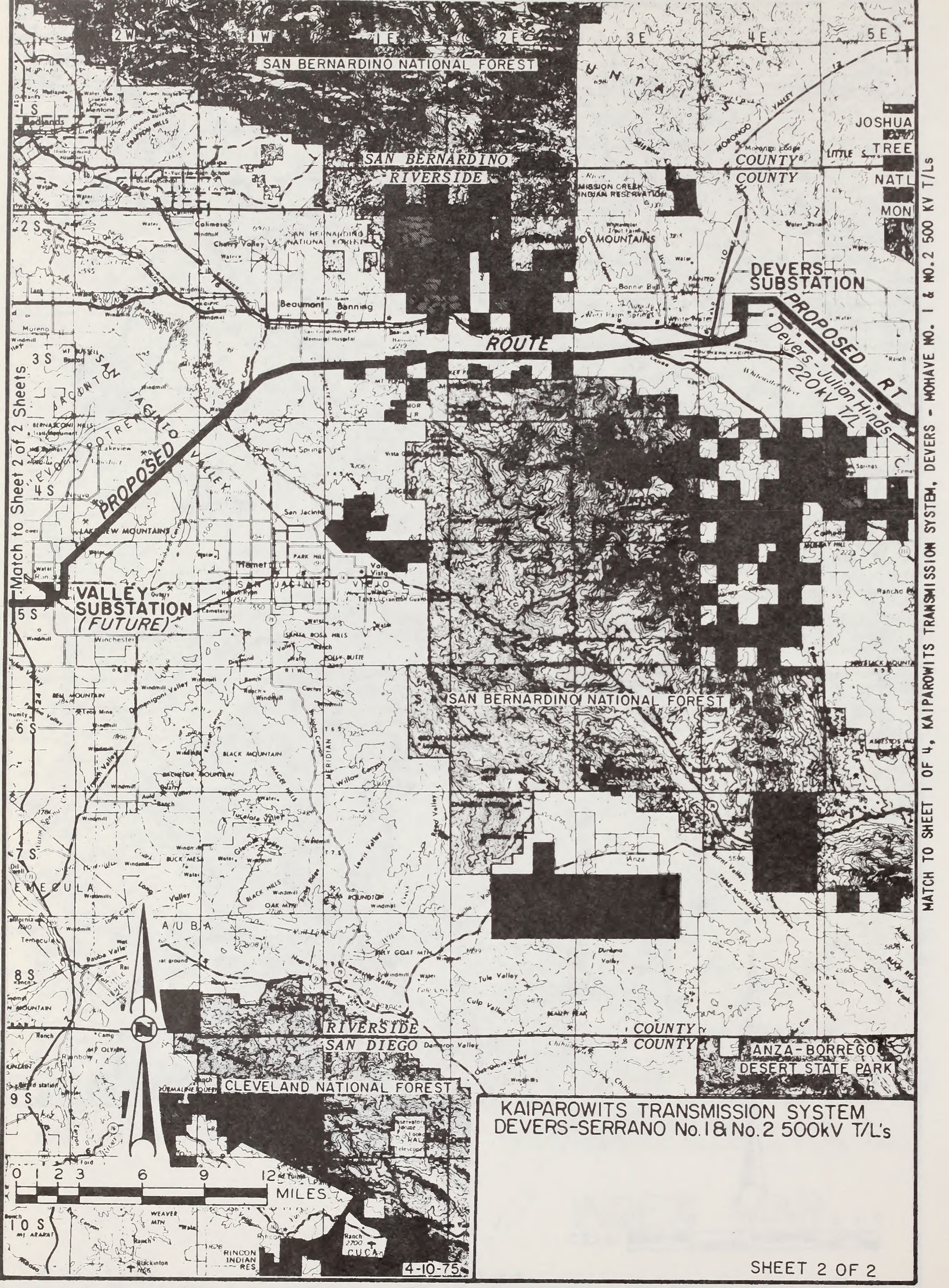


ILLUSTRATION 46b

FIGURE 36

Route Alignment Facts For

Proposed Devers - Serrano Segment

1.	Governmental Jurisdictions	Miles of R-O-W
	California - Riverside County	65.1
	California - Orange County	16.3
2.	Land Ownership or Administration	Miles of R-O-W
	USDI, BLM	3.4
	USDA, Cleveland National Forest	7.9
	Morongo Indian Reservation	3.7
	Private and Other	66.4
3.	Road Crossings	No.
	State Route 293 (Calif)	1
	State Route 79 (Calif)	1
	State Route 74 (Calif)	1
	State Route 71 (Calif)	1
4.	Stream Crossings	No.
	Whitewater River	1
	San Jacinto River	1
5.	Utility Crossings	No.
	Railroads	1
	Telephone Lines	5
	Water Lines	1
	Other Transmission Lines	2
	Gas Pipeline	3

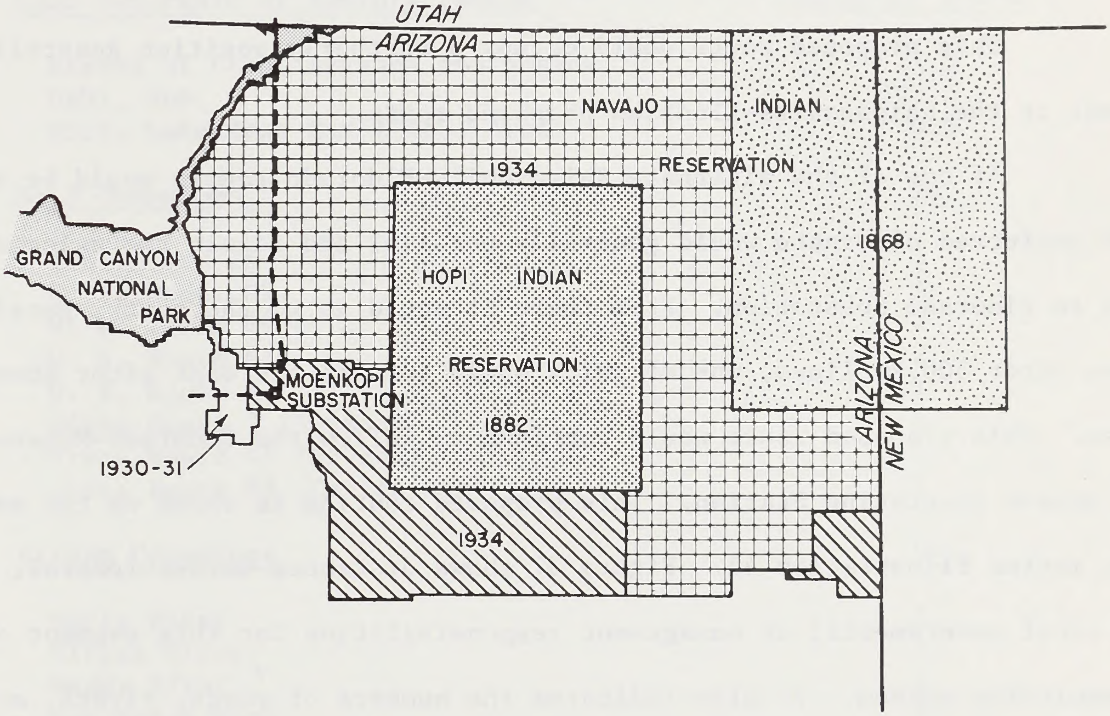
Proposed alternatives for Kaiparowits-Moenkopi-Mohave segment

Recent developments affecting the Navajo Nation could inhibit the prompt granting of a right-of-way for the Kaiparowits to Moenkopi to Mohave segment. On December 22, 1974, Public Law 93-531 was enacted by the Congress of the United States to provide for final settlemnt of conflicting rights and interests of Hopi and Navajo Tribes in lands lying within the reservation created by the Act of June 14, 1934 (approximately six million acres). This law specifically authorized either tribe to commence or defend in the District Court an action against the other tribe for the purpose of determining rights and interests of the tribes in such lands.

On December 30, 1974, the Hopi Indian Tribe filed an action against the Navajo Indian Tribe. The Hopi Tribe claimed an undivided one-half interest in certain lands in Arizona in which the Navajo Tribe claims absolute title. The proposed Kaiparowits-Moenkopi-Mohave segment would pass over a part of lands now in litigation.

It is the opinion of the western participants (SCE and SDG&E) that at the present time, neither of the litigants (Navajo or Hopi Nations) is able to convey satisfactory land rights needed for the rights of way for the segment of the Kaiparowits-Moenkopi-Mohave transmission line which would cross the land in question. Major consequence of this unsettled situation is that the resolution of the current litigation may extend beyond the critical timeframe needed for project completion. Therefore, the western participants have developed two preferred alternate routings that do not cross Indian lands in question. These alternates would be substitutes for the proposed segment of the Kaiparowits-Moenkopi-Mohave 500 kv transmission line. (Illustration 47 shows Indian lands now in litigation.)

NAVAJO AND HOPI INDIAN LANDS AND GRAND CANYON NATIONAL PARK



LEGEND

NAVAJO - HOPI DISPUTE LANDS 6-14-34 RESERVATION BOUNDARIES (12-30-74 LEGAL ACTION)

NAVAJO - HOPI DISPUTE LANDS 6-14-34 RESERVATION BOUNDARIES APPROXIMATELY EVERY OTHER SECTION IN DISPUTE (12-30-74 LEGAL ACTION)

1868 NAVAJO BOUNDARY (NOT IN DISPUTE)

1882 HOPI BOUNDARY (SEPARATE DISPUTE LANDS 12-22-74 PL 93-531)

GRAND CANYON NATIONAL PARK

PROPOSED KAIPAROWITS - MOENKOPI - MOHAVE 500 KV TL

NAVAJO LANDS FORMERLY TUSAYAN NATIONAL FOREST, (NOT IN DISPUTE) 1930-31

ILLUSTRATION 47

Should one of these proposed alternatives be selected, only 37 microwave communication sites would be necessary for the transmission system. The Copper Mine, Preston Mesa and Moenkopi microwave sites would be deleted.

The southern participants (APS and SRP) believe they have a longer timeframe in which to operate. Possibly the litigation will be resolved by the time the southern participants would be scheduled to receive their share of the Kaiparowits produced energy.

Northern Kaiparowits-Mohave segment (preferred alternate)

This proposed route would occupy a northerly position generally adjacent to the Kaiparowits-Eldorado proposed route.

If one of the alternate Kaiparowits-Eldorado routes would be selected, this preferred alternate would generally parallel and adjoin the selected alternate to Eldorado Substation. From there it would go to the south, paralleling three other 500 kv lines, one of which would turn to the east after about 10 miles. This proposed route would continue to follow the Eldorado-Mohave line to the Mohave Generating Station. This proposed routing is shown on the set of maps marked Illustration 43. Figure 37 shows distances across federal, state, and local governmental or management responsibilities for this segment of the transmission system. It also indicates the numbers of roads, rivers, streams, railroads, pipelines, telephone lines, and other transmission lines crossed by this proposed segment.

FIGURE 37

Route Alignment Facts For

Proposed No. Kaiparowits-Mohave Preferred Alternative

1. Governmental Jurisdictions	Miles of R-O-W
Utah - Kane County	41.4
Utah - Washington County	7.9
Arizona - Coconino County	27.6
Arizona - Mohave County	81.9
Nevada - Lincoln County	17.8
Nevada - Clark County	145.0

2. Land Ownership or Administration	Miles of R-O-W
States of Utah, Arizona and Nevada	21.5
USDI, BLM	292.5
USDI, Lake Mead Nat'l Rec. Area	0.5

3. Road Crossings	No.
Interstate 15	2
U. S. Route 89	1
U. S. Route 89 A	1
U. S. Route 91	2
U. S. Route 93	1
State Route 7 (Nevada)	1
State Route 41 (Nevada)	1
State Route 68 (California)	1

4. Stream Crossings	No.
Paria River	1
Virgin River	1
Muddy River	1
Las Vegas Wash	1

5. Utility Crossings	No.
Railroads	6
Telephone lines	11
Water pipelines	1
Other transmission lines	14
Gas pipelines	4

Arizona Strip segment (preferred alternative)

This proposed preferred alternative would parallel the proposed Kaiparowits to Eldorado segment to Pipe Valley. From there both the proposed Kaiparowits to Eldorado segment and this preferred alternative would swing away from the Navajo-McCullough corridor and head westward and slightly south across Pipe Valley and Unikaret Plateau to Hurricane Cliffs. It would descend the cliffs and go to a point near the south base of Seigmuller Mountain. From there it would pass south of Wolf Hole Mountain, through Hidden Valley, dip south to pass just north of Mud Mountain and take a westerly direction across the Virgin Mountains to the Virgin River. Then the two lines would go across Mormon Flat to the north slope of the North Muddy Mountains and then rejoin the Navajo-McCullough corridor. This preferred alternative would then proceed to the Eldorado Substation and to the Mohave Switchyard as described in the discussion of the North Kaiparowits-Mohave preferred alternative. This proposed route is shown on the maps marked Illustration 43. Figure 38 shows distance across federal, state and local governmental or management responsibilities for this segment of the transmission system. It also indicates the number of roads, rivers, streams, railroads, pipelines, telephone lines and other transmission lines crossed by this proposed segment.

Towers, conductors and footings

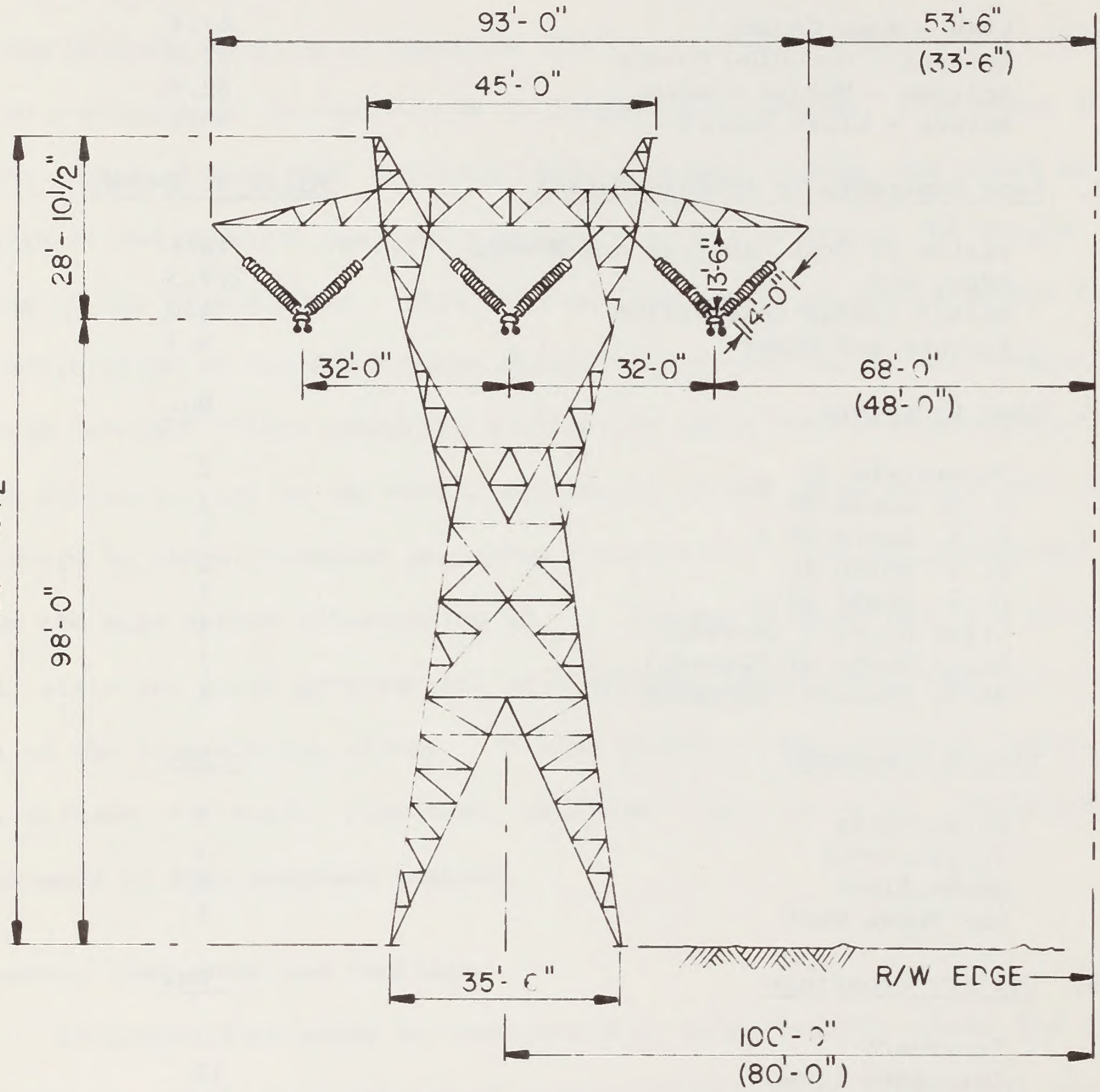
Proposed lines would be constructed by using lattice towers for the western system. Self-supporting steel towers (Illustration 48)would be used on lines constructed west of Devers Substation. Guyed steel or aluminum towers (Illustration 49) would be used on lines in the more flat and rolling terrain east of Devers. In this kind of terrain, the guy wires would not be an excessive length and could be kept within the right-of-way. West of Devers guyed towers are not planned for use due to the generally rugged terrain, where guys could not be kept within the right-of-way. Also commitments have been made to some

FIGURE 38

Route Alignment Facts For

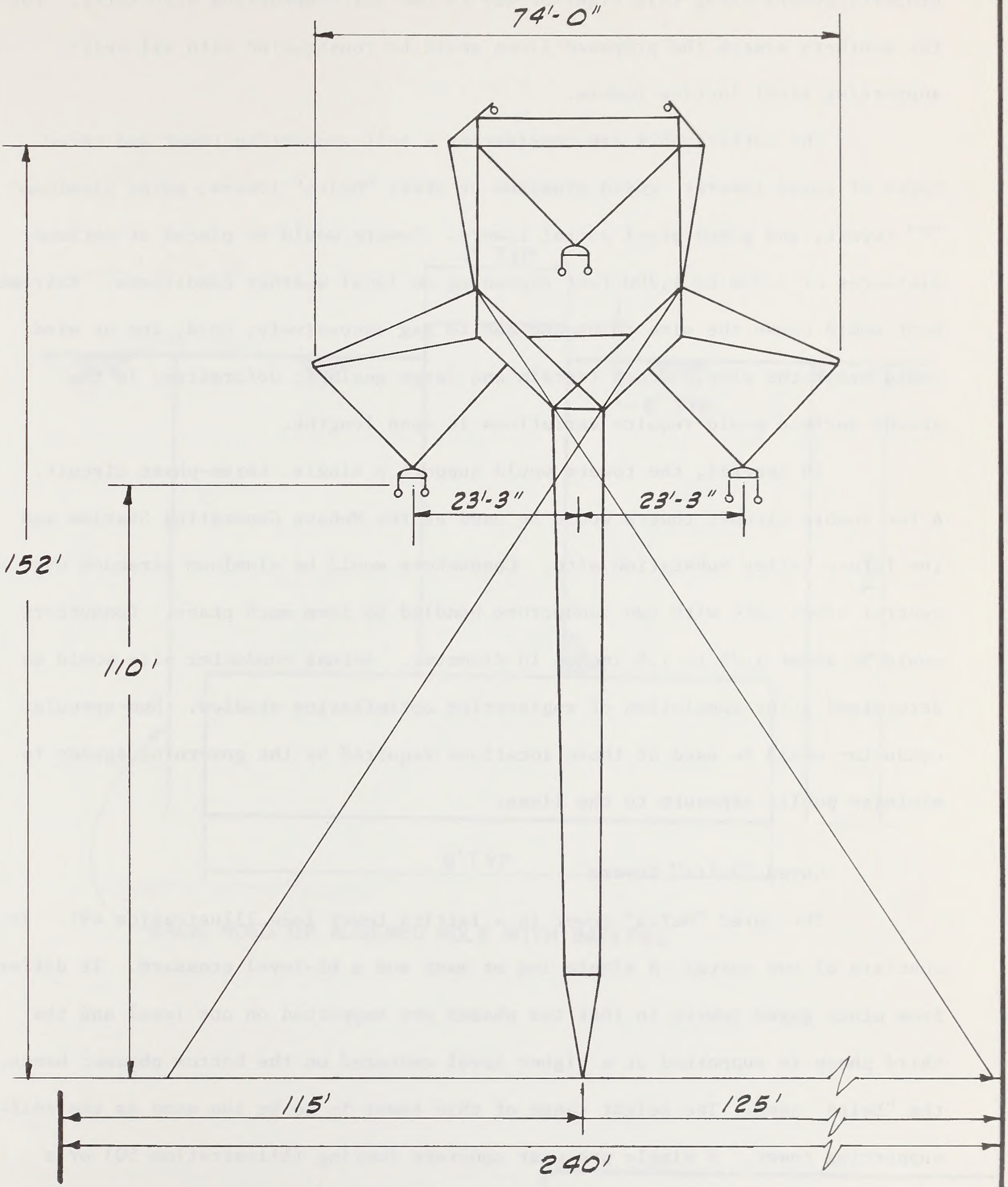
Proposed Arizona Strip Preferred Alternative

1.	Governmental Jurisdictions	Miles of R-O-W
	Utah - Kane County	41.4
	Arizona - Coconino County	27.6
	Arizona - Mohave County	82.9
	Nevada - Clark County	96.7
2.	Land Ownership or Administration	Miles of R-O-W
	States of Utah, Arizona and Nevada	10.6
	USDI, BLM	229.3
	Kaibab Indian Reservation	4.0
	Private and Other	4.7
3.	Road Crossings	No.
	Interstate 15	2
	U. S. Route 89	1
	U. S. Route 89 A	1
	U. S. Route 91	2
	U. S. Route 93	1
	State Route 7 (Nevada)	1
	State Route 41 (Nevada)	1
	State Route 12 (Nevada)	1
4.	Stream Crossings	No.
	Paria River	1
	Virgin River	1
	Muddy River	1
	Las Vegas Wash	1
5.	Utility Crossings	No.
	Railroads	7
	Telephone Lines	12
	Water Lines	1
	Transmission Lines	14
	Gas Pipelines	4



TYPICAL 500KV SELF SUPPORTED LATTICE TOWER

ILLUSTRATION 48



GUYED DELTA
ALUMINUM OR STEEL

ILLUSTRATION 49

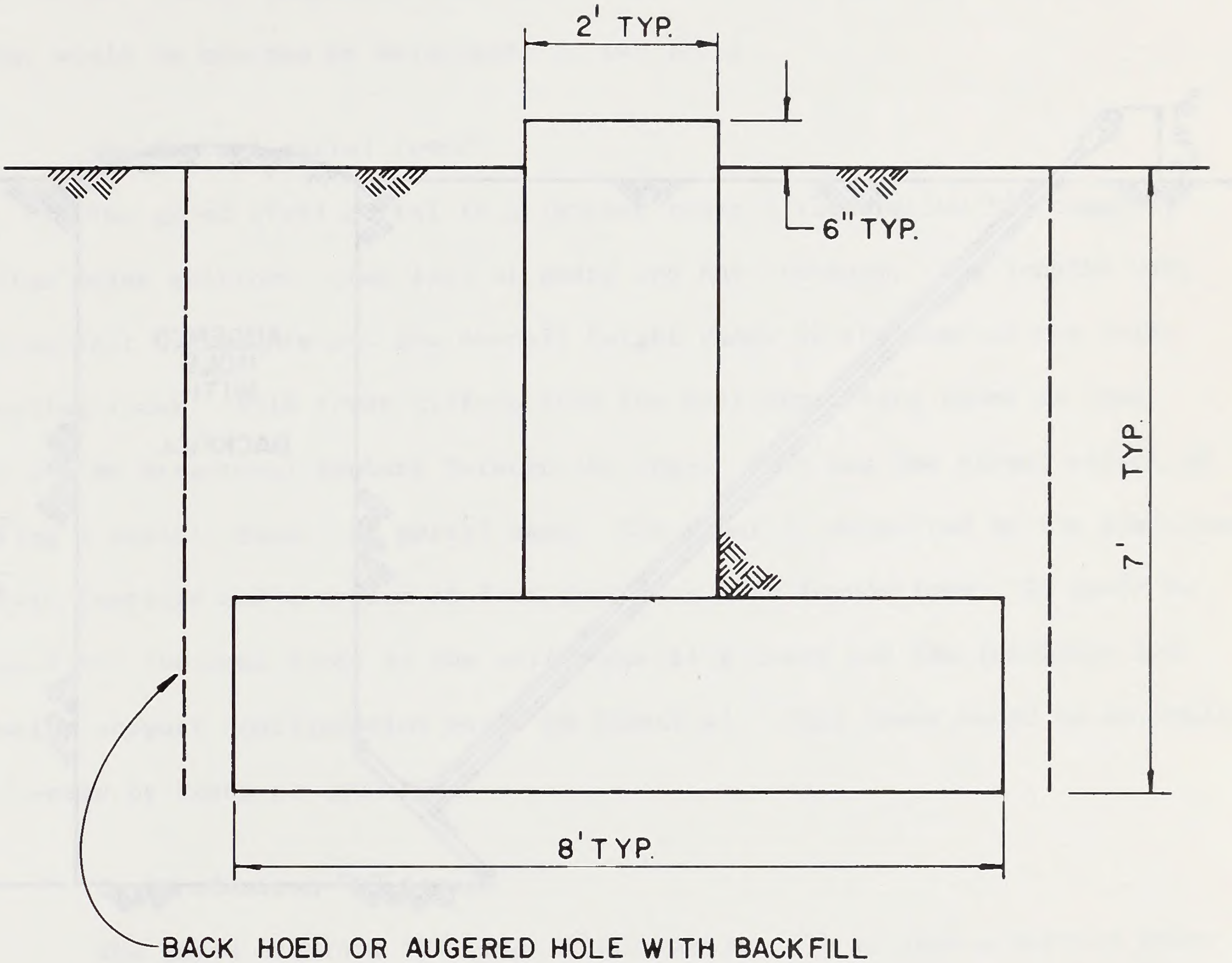
property owners along this right-of-way to use self-supporting structures. For the southern system the proposed lines would be constructed with all self-supporting steel lattice towers.

The participants are considering a self supporting tower and three types of guyed towers: guyed aluminum or steel "Delta" towers, guyed aluminum "V" towers, and guyed steel portal towers. Towers would be placed at optimum distances of 1,500 to 1,700 feet depending on local weather conditions. Extreme heat would cause the wire to expand and to sag excessively; cold, ice or wind could break the wire. Steep terrain and large geologic deformities in the ground surface would require variations in span lengths.

In general, the towers would support a single, three-phase circuit. A few double circuit towers would be used at the Mohave Generating Station and the future Valley Substation site. Conductors would be aluminum stranded over a central steel core with two conductors bundled to form each phase. Conductors would be about 1.75 to 1.8 inches in diameter. Actual conductor size would be determined after completion of engineering optimization studies. Non-specular conductor would be used at those locations required by the governing agency to minimize public exposure to the lines.

Guyed "Delta" Towers

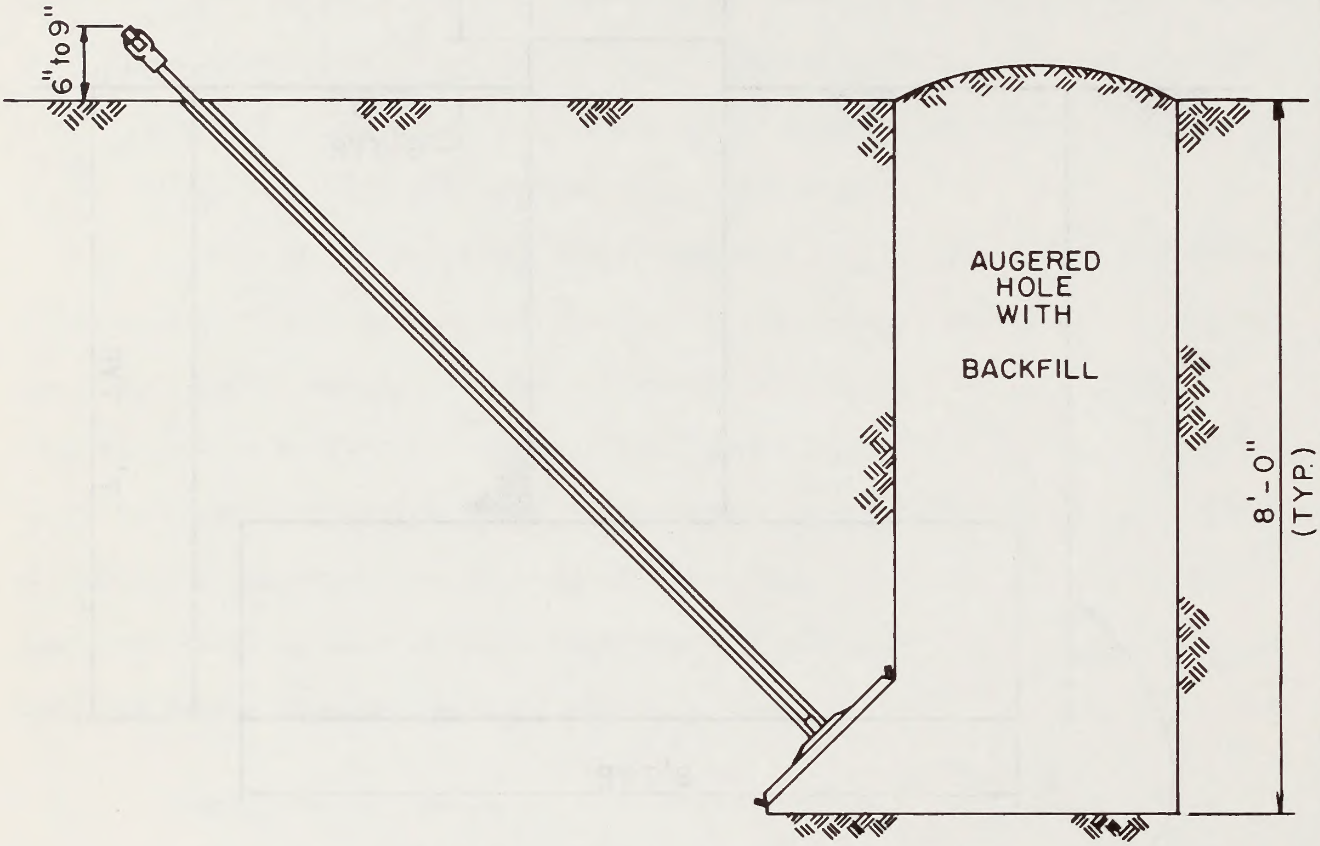
The guyed "Delta" tower is a lattice tower (see Illustration 49). It consists of two parts: A single leg or mast and a bi-level crossarm. It differs from other guyed towers in that two phases are supported on one level and the third phase is supported at a higher level centered on the bottom phases; hence, the "Delta" name. The height range of this tower is to be the same as the self-supporting tower. A single pre-cast concrete footing (Illustration 50) or a cast-in-place footing supports the tower with a system of four guy wires with foundations. (Illustration 51).



TYPICAL 500KV GUYED TRANSMISSION TOWER

PRECAST FOUNDATION

ILLUSTRATION 50



TYPICAL 500KV TRANSMISSION TOWER GUY ANCHOR

ILLUSTRATION 51

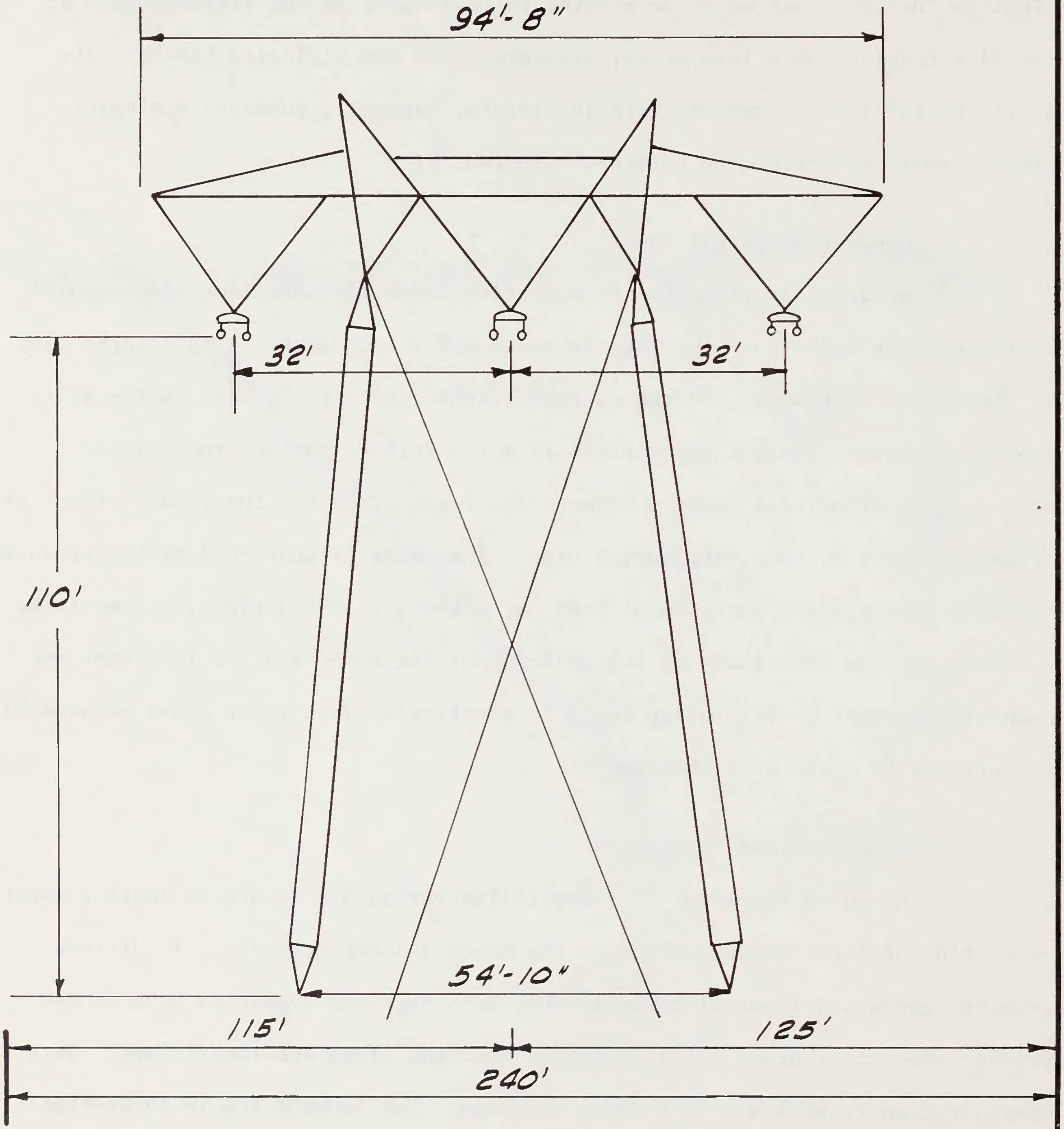
This tower would be designed to support the same loads as the self-supporting tower and would use "V" string insulators to support the conductor system. After assembly on a production line basis in a marshalling yard, the aluminum "Delta" tower would be erected by helicopter ~~in one lift complete~~ in one lift complete with insulators, hardware, guys and stringing blocks. The steel "Delta" tower, complete with insulators, hardware, guys and stringing blocks, would be erected by helicopter in two lifts.

Guyed steel portal tower

The guyed steel portal is a lattice tower (Illustration 52) composed of three major sections - two legs or masts and one crossarm. Leg lengths vary in three-foot increments and the overall height range is the same as the self-supporting tower. This tower differs from the self-supporting tower in that there are no structural members between the legs. This has the visual effect of creating a portal, thus, the portal name. The tower is supported by two preformed concrete footings and a system of four guy wires with foundations. It would be designed for the same loads as the self-supporting tower and the insulator and conductor support configuration would be identical. This tower would be assembled and erected by crane at each site.

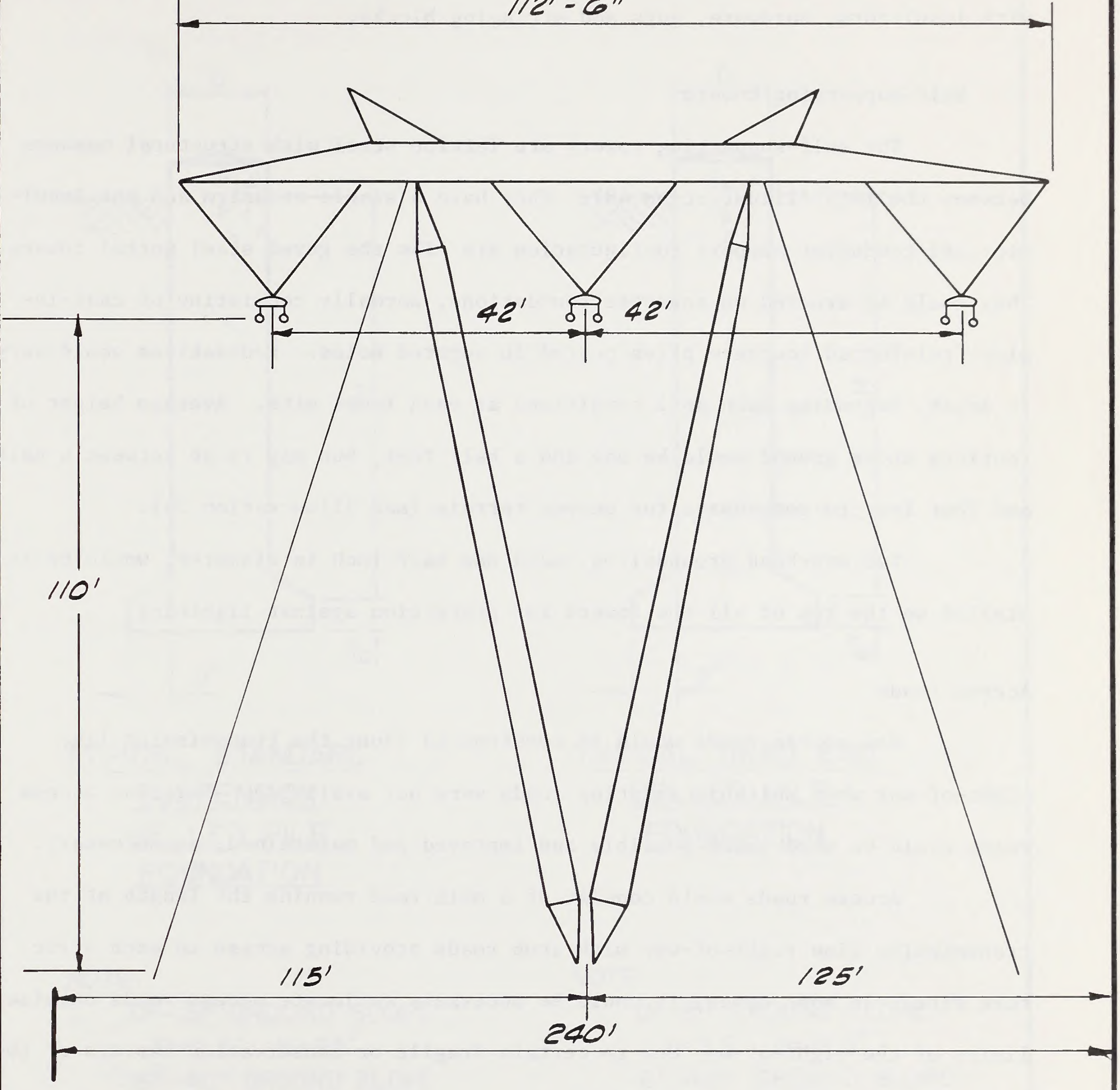
Guyed aluminum "V" towers

The guyed aluminum "V" tower (Illustration 53) is also a lattice tower consisting of three major sections - two masts and one crossarm. It differs from the guyed steel portal tower in that both legs are supported by a single precast concrete footing and a system of four guy wires and foundations. This configuration resembles a "V"; thus, the name. Leg lengths are in three-foot increments and the height range is the same as the self-supporting tower. It would be designed to support the same loads as the self-supporting tower and the insulator and conductor support configuration would be similar; however, the



GUYED PORTAL
STEEL

ILLUSTRATION 52



GUYED "V"
ALUMINUM OR STEEL

ILLUSTRATION 53

phase spacing of the guyed tower would be slightly greater because of need for clearance between conductor and tower. This tower would be assembled on a production line basis in a marshalling yard and erected by helicopter complete with insulators, hardware, guys and stringing blocks.

Self-supporting towers

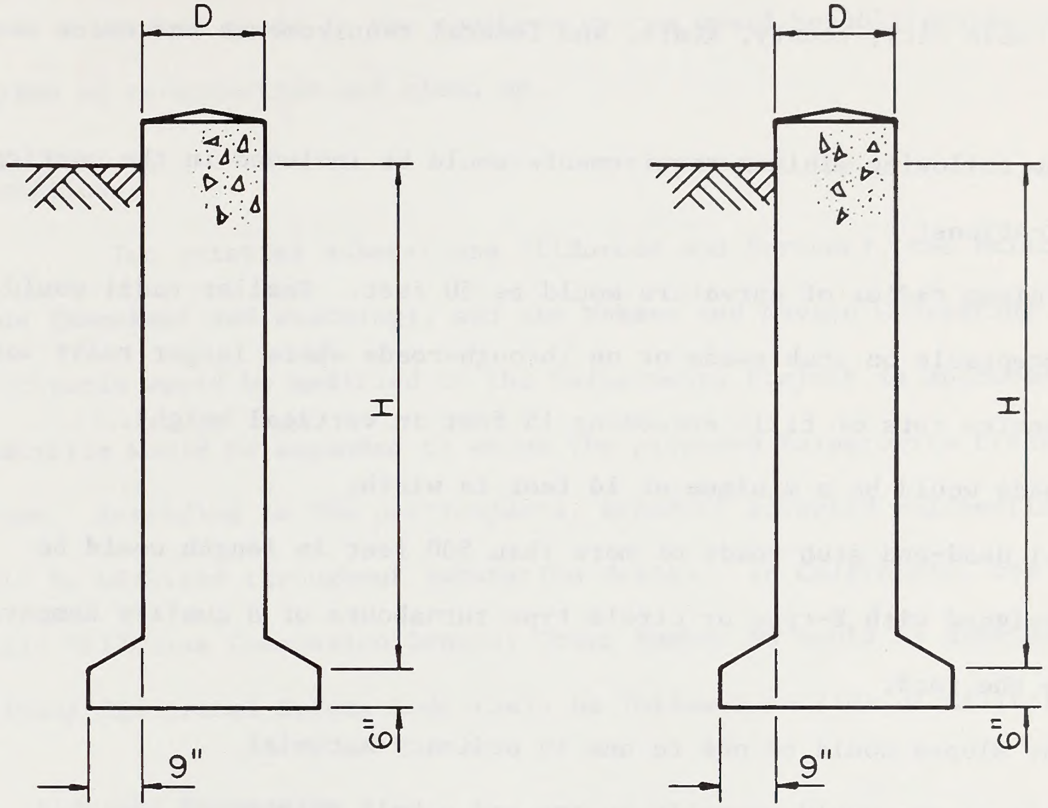
The self-supporting towers are lattice steel with structural members between the legs (Illustration 48). They have a single crossarm and the insulator and conductor support configuration are like the guyed steel portal towers. They would be erected on concrete foundations, normally consisting of cast-in-place reinforced concrete piles poured in augered holes. Foundations would vary in depth, depending upon soil conditions at each tower site. Average height of footings above ground would be one and a half feet, but may range between a half and four feet to compensate for uneven terrain (see Illustration 54).

Two overhead groundwires, each one half inch in diameter, would be installed on the top of all the towers for protection against lightning.

Access roads

New access roads would be constructed along the transmission line right-of-way when suitable existing roads were not available. Existing access roads would be used where possible and improved and maintained, as necessary.

Access roads would consist of a main road running the length of the transmission line right-of-way with stub roads providing access to each structure site. In some cases, it would be necessary to locate access roads outside limits of the right-of-way due to certain fragile or conservation aspects of the area. In these cases, the participants state that all applicable permits would be obtained and all regulations would be adhered to. It is expected that approximately 1,900 miles of new access roads would be required along the proposed transmission system rights-of-way: 870 miles of permanent and 1,030 miles of temporary.



TYPICAL STANDARD SUSPENSION BELLED PILE FOUNDATION

TYPICAL DEAD END BELLED PILE FOUNDATION

NOTE:
0°-15° GROUND SLOPE
D=2.5' H=9.5'
16°-40° GROUND SLOPE
D=2.5' H=13.5'

NOTE:
0°-15° GROUND SLOPE
D=3.5 H=19.5'
16°-40° GROUND SLOPE
D= 4.0' H=21.5'

TYPICAL 500 KV TRANSMISSION TOWER BELLED PILE FOUNDATION

ILLUSTRATION 54

Access roads for transmission lines would be designed to the participants' standards, to governmental agency requirements, to requirements of private owners where the road traverses their property or to a combination of these requirements. All designs would be in accordance with all appropriate authorities; applicable city, county, state, and federal requirements and codes would be met.

The following minimum requirements would be included in the particpants road specifications:

(1) Minimum radius of curvature would be 50 feet. Smaller radii would be acceptable on stub roads or on through-roads where larger radii would require cuts or fills exceeding 15 feet in vertical height.

(2) Roads would be a minimum of 14 feet in width.

(3) All dead-end stub roads of more than 500 feet in length would be designed with Y-type or circle type turnabouts of a quality comparable to the road.

(4) Cut slopes would be one to one in ordinary material.

(5) Fill slopes would normally be one and a half to one.

(6) Roads crossing streams or washes at grade would be per missible unless otherwise specified. Where culverts were required in fill crossings of streams, these culverts would be of adequate size to accommodate the runoff, and of sufficient strength to accomodate the contractor's equipment.

In general, road grade would be determined by centerline locations. For the western system only, no maximum sustained grade would exceed 12 percent and no individual pitch (100 - 200 feet) would exceed 16 percent. Steeper grades may be necessary on stub roads for locations where meeting this criteria would require cuts or fills exceeding 15 feet in vertical height. For the southern system only, maximum sustained grade would be seven percent, with a maximum pitch grade of 10 percent not to exceed 500 feet in length. Sections of maximum pitch grade must be separated by a minimum of 500 feet of maximum sustained grade and the total amount of maximum grade in any one mile must not exceed 1,000 feet.

Access roads in the southern system would be obliterated after completion of construction and clean up.

Substations

Two existing substations (Eldorado and Serrano), two existing switchyards (Moenkopi and Westwing), and the Mohave and Navajo Generating Stations' switchyards would be modified if the Kaiparowits Project is approved. Devers Substation would be expanded to serve the proposed Kaiparowits transmission system. According to the participants, standard accepted engineering practices would be utilized throughout substation design. In California, the California Public Utilities Commission General Order Number 95 would be adhered to. The National Electrical Safety Code would be followed outside of California.

Eldorado Substation

The proposed Kaiparowits-Eldorado line would terminate in the unoccupied side of an existing "breaker and one-half" position the other side of which is occupied by the Lugo Transmission Line. The line would require a line dead-end structure 108 feet high with an extension of 25 feet for overhead groundwires. One bank of series capacitors would be required to control and improve system stability and power transfer capability. Area required for the bank would be 190 feet by 150 feet.

Moenkopi Switchyard

One line from Kaiparowits and one from Mohave would be added. This would require modifying the ring bus configuration to a breaker and one-half arrangement. The line dead-end structure would be 108 feet high with a 25 foot extension for overhead groundwires. Two series capacitor banks would be required for control of line loading and to improve stability and power transfer capability. The area required for each bank would be 170 feet by 150 feet and would be inside existing yard.

Mohave Generating Station

This station's switchyard would be expanded and modified to accommodate three new 500 kv lines from Moenkopi and Devers (Nos. 1 and 2). These additional modifications would require four breaker and one-half positions. Each position would be equipped to accommodate two lines or one line and step-up transformer banks.

Spacing for each position would be adequate for three power breakers and two line getaways with associated disconnect switches. Line dead-end structures would be 108 feet high with a 25-foot extension for overhead groundwires.

The bus structure would be 60 feet high and 60 feet wide with a 120-foot span. Three series capacitor banks would be required for control of line loading and to improve power transfer capability on the lines. Area required for each bank would be 170 feet by 150 feet.

Devers Substation

An eight-position switchrack, two 500-220 kv transformer banks and two 220 kv switchrack positions would be constructed. Devers Substation presently has three 220 kv lines, a nine-position 220 kv switch rack, four 220-115 kv transformer banks, a 13-position 115 kv switch rack, and seven 115 kv lines. Two 500 kv lines from Mohave Generating Station and two lines from Serrano Substation would terminate on the 500 kv switchrack. Mohave 500 kv lines would have a series compensation facility north of the 500 kv switchrack. Area required for each bank would be 170 feet by 120 feet.

Dead-end structures for the 500 kv series compensation facility, line position and bank position would be 108 feet high with 25 foot extensions for ground wires. The 500 kv bus structures would be 60 feet high spanning eight 90-foot positions. The 500-220 kv transformer bank dead-end structures would be 100 feet high with 25-foot extensions for groundwires. The 220 kv bus structures would be 38 feet high and span two 45-foot positions. The structures would be constructed from wide flange steel.

Serrano Substation

Terminations for two new Devers lines would be installed. One line would terminate in a double breaker position and the other line would terminate in an existing breaker and one-half position.

Line dead-end structures would be 108 feet high with 25-foot extension for overhead groundwires. Three power circuit breakers would be needed for the modifications.

Navajo Generating Station Switchyard

The existing Navajo Generating Station breaker and one-half switchyard would be modified by adding facilities for terminating the Kaiparowits-Navajo transmission line. This line would require a dead-end structure 110 feet high with overhead groundwire extensions of 25 feet. The line would terminate in the unoccupied side of the yard position now serving the generating station alternate auxiliary power supply. Should line series capacitors or shunt reactor compensation be required, there would be ample existing space for this equipment.

Westwing Switchyard

The existing Westwing breaker and one-half switchyard would be modified to the extent of adding facilities for terminating the Kaiparowits-Westwing transmission line. This line would require a dead-end structure 110 feet high with overhead groundwire extensions of 25 feet. The line would terminate in the unoccupied side of the yard position now serving the 550/230 kv auto transformer tie No. 1. Line series capacitors and shunt reactor compensation would be required for voltage and system stability control as well as power transformer capability. The present yard area would be sufficient to accommodate spacer requirements for this equipment.

FIGURE 39

Comparison of Route and Corridor Miles

Three Proposed Systems

Proposed Routes	Miles of Corridor*	Miles of Line
Primary Proposal	1,035	1,457
Kaiparowits to Phoenix, Kaiparowits to Navajo, Kaiparowits to Eldorado, Kaiparowits to Moenkopi to Mohave, Mohave to Serrano		
Northern Kaiparowits Proposal	898	1,476
Kaiparowits to Phoenix, Kaiparowits to Navajo, Northern Kaiparowits to Mohave Preferred Alternate, Mohave to Serrano		
Arizona Strip Proposal	880	1,440
Kaiparowits to Phoenix, Kaiparowits to Navajo, Arizona Strip Preferred Alternate, Mohave to Serrano		

*A corridor is a linear area occupied by one or more lines. Because the Northern Kaiparowits and Arizona Strip proposals have more miles where two or more lines are together, the number of miles of corridor are reduced.

FIGURE 40

Transmission System Land Use Summary
Participants Primary Proposal

Line Section	Mileage	Average R/W Width	Acreage T/L R/W	New Acres Occupied: Permanently Lines[a]	Permanently Roads[c]	Temporarily Lines[b]	Temporarily Roads[c]
Kaiparowits-Eldorado	269	200'	6,485	10	570	1,210	0
Kaiparowits-Moenkopi-Mohave	308	200'	7,440	10	540	1,385	0
Devers-Mohave (1 & 2)	187 ea.	330'	7,480	10	235	840	0
Devers-Serrano (1 & 2)	80 ea.	330'	3,200	25	135	720	0
Kaiparowits-Navajo	47	200'	1,140	5	0	200	240
Kaiparowits-Westwing	299	200'	7,250	35	0	1,260	1,515
Total	1,457		32,995	95	1,480	5,615	1,755

Line Section	Tower Types: Self Supporting	Guyed	Total
Kaiparowits-Eldorado	100	900	1,000
Kaiparowits-Moenkopi-Mohave	125	1,050	1,175
Devers-Mohave (1 & 2)	150	1,300	1,450
Devers-Serrano (1 & 2)	575	0	575
Kaiparowits-Navajo	150	0	150
Kaiparowits-Westwing	950	0	950
Total	2,050	3,250	5,300

Substation

Devers 135 acres

Communication Sites

40 Sites
Total fenced area - less than 5 acres
Total temporarily disturbed - less than ½ acre
Total permanently disturbed - less than ¼ acre

Total Areas Occupied (Acres)

	Temporarily	Permanently
Transmission Lines	5,615	95
Access Roads	1,755	1,480
Substations	0	135
Communication Sites	0	5
Total	7,370	1,715

Miles of road: Temporary, 1,030; Permanent, 870; Total, 1,900.

[a] Assuming towers and foundations occupy 40 ft. x 40 ft. area for freestanding towers and 8' diameter area for guyed towers.
[b] Includes tower assembly areas, crane pads, batch plant sites, conductor pulling sites, camp sites.
[c] Assumes a 14' road width.
[d] All other substation construction will be confined within existing fence boundaries

FIGURE 40 a

Transmission System Land Use Summary
Participants Northern Kaiparowits Proposal

Line Section	Mileage	Average R/W Width	Acreage T/L R/W	New Acres Occupied Permanently Lines[a]	Permanently Roads[c]	Temporarily Lines[b]	Temporarily Roads[c]
Kaiparowits-Eldorado	269	200'	6,485	10	570	1,210	0
No. Kaiparowits-Mohave	327	130-200'	4,600	15	310	900	0
Devers-Mohave (1 & 2)	187 ea.	330'	7,480	10	235	840	0
Devers-Serrano (1 & 2)	80 ea.	330'	3,200	25	135	720	0
Kaiparowits-Navajo	47	200'	1,140	5	0	200	240
Kaiparowits-Westwing	299	200'	7,250	35	0	1,260	1,515
Total	1,476		30,155	100	1,250	5,130	1,755

Line Section	Tower Types Self Supporting	Guyed	Total
Kaiparowits-Eldorado	100	900	1,000
No. Kaiparowits-Mohave	100	1,145	1,245
Devers-Mohave (1 & 2)	150	1,300	1,450
Devers-Serrano (1 & 2)	575	0	575
Kaiparowits-Navajo	150	0	150
Kaiparowits-Westwing	950	0	950
Total	2,025	3,345	5,370

Substation

Devers 4 — 135 acres

Communication Sites

37 Sites
Total fenced area - less than 5 acres
Total temporarily disturbed - less than ½ acre
Total permanently disturbed - less than ¼ acre

Total Areas Occupied (Acres)

	Temporarily	Permanently
Transmission Lines	5,130	100
Access Roads	1,755	1,250
Substations	0	135
Communication Sites	0	5
Total	6,885	1,490

Miles of road: Temporary, 1,030; Permanent, 735; Total, 1,765

[a] Assuming towers and foundations occupy 40 ft. x 40 ft. area for freestanding towers and 8' diameter area for guyed towers.
[b] Includes tower assembly areas, crane pads, batch plant sites, conductor pulling sites, camp sites.
[c] Assumes a 14' road width.
[d] All other substation construction will be confined within existing fence boundaries

FIGURE 40 b

Transmission System Land Use Summary
Participants Arizona Strip Proposal

Line Section	Mileage	Average R/W Width	Acreage T/L R/W	New Acres Occupied Permanently Lines[a]	Permanently Roads[c]	Temporarily Lines[b]	Temporarily Roads[c]
Arizona Strip - Eldorado	251	200'	6,085	10	570	1,210	0
Arizona Strip - Mohave	309	130-330'	10,649	15	850	2,700	0
Devers-Mohave (1 & 2)	187 ea.	330'	7,480	10	235	840	0
Devers-Serrano (1 & 2)	80 ea.	330'	3,200	25	135	720	0
Kaiparowits-Navajo	47	200'	1,140	5	0	200	240
Kaiparowits-Westwing	299	200'	7,250	35	0	1,260	1,515
Total	1,440		35,804	100	1,790	6,930	1,755

Line Section	Tower Types Self Supporting	Guyed	Total
Kaiparowits-Eldorado	100	900	1,000
Arizona Strip	100	1,075	1,175
Devers-Mohave (1 & 2)	150	1,300	1,450
Devers-Serrano (1 & 2)	575	0	575
Kaiparowits-Navajo	150	0	150
Kaiparowits-Westwing	950	0	950
Total	2,025	3,275	5,300

Substation

Devers 4 — 135 acres

Communication Sites

37 Sites

Total fenced area - less than 5 acres
Total temporarily disturbed - less than ½ acre
Total permanently disturbed - less than ¼ acre

Total Areas Occupied (Acres)

	Temporarily	Permanently
Transmission Lines	6,930	100
Access Roads	1,755	1,790
Substations	0	135
Communication Sites	0	5
Total	8,685	2,030

Miles of road: Temporary, 1,030; Permanent, 1,055; Total, 2,085

[a] Assuming towers and foundations occupy 40 ft. x 40 ft. area for freestanding towers and 8' diameter area for guyed towers.
[b] Includes tower assembly areas, crane pads, batch plant sites, conductor pulling sites, camp sites.
[c] Assumes a 14' road width.
[d] All other substation construction will be confined within existing fence boundaries

Limestone Quarry

Location and general area description

The proposed quarry site is on the western flank of Johns Valley, Garfield County, Utah in Township 34 South, Range 3 West approximately 16 miles northwest of Bryce Canyon National Park (see Illustration 55).

The property is accessible from Utah State Highway 12 east from U. S. Highway 89. At Johns Valley, the state highway meets the Widtsoe Junction Road from the latter a westerly route heads toward Tom Best Spring. Several unimproved trails lead northerly to the site.

Resources Company has obtained two tracts of land along a limestone ridge. These represent both mineral lease applications on land owned by the State of Utah and 62 unpatented federal lode mining claims on National Forest lands. These lease applications and claims comprise about 1,900 acres (see Illustration 56).

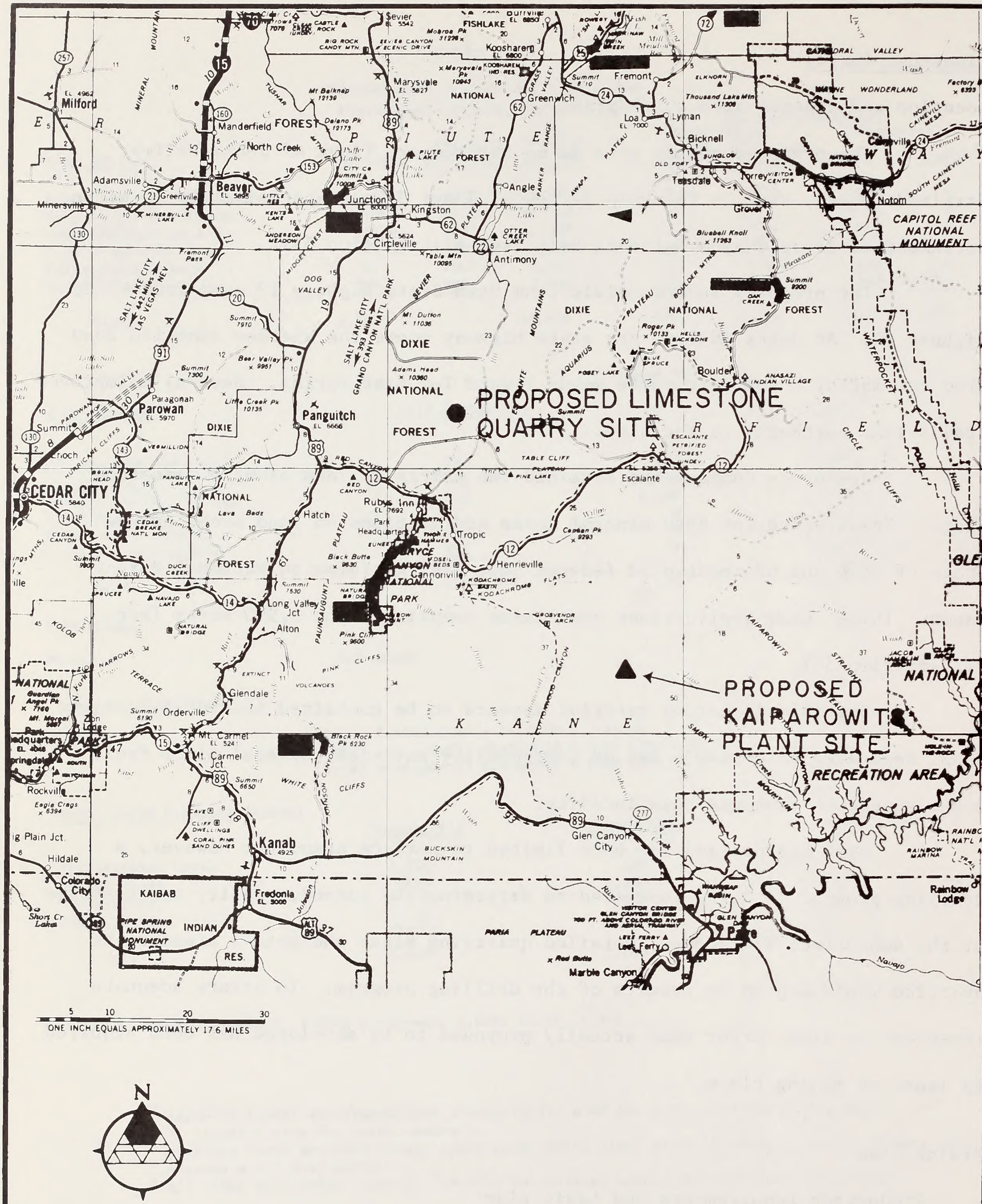
Suitable limestone material appears to be contained in two 15-foot beds, separated by a single bed of poor-quality material. Several minor fault zones appear to traverse this locality.

Past exploration has been limited to surface sampling; however, a drilling program is being conducted to determine the extent, quality and reserves of the subsurface limestone. Detailed quarrying plans and actual areas to be quarried would depend on results of the drilling program. To assure adequate reserves, an area larger than actually proposed to be developed has been acquired by lease or mining claim.

Mining plan

Production requirements and basic plan

It is estimated the Kaiparowits project would use approximately 650 tons of crude limestone per day which also involves the handling of an additional 320 tons of waste material per day. See Figure 41 for daily, yearly, and total



PROPOSED LIMESTONE QUARRY SITE

ILLUSTRATION 55

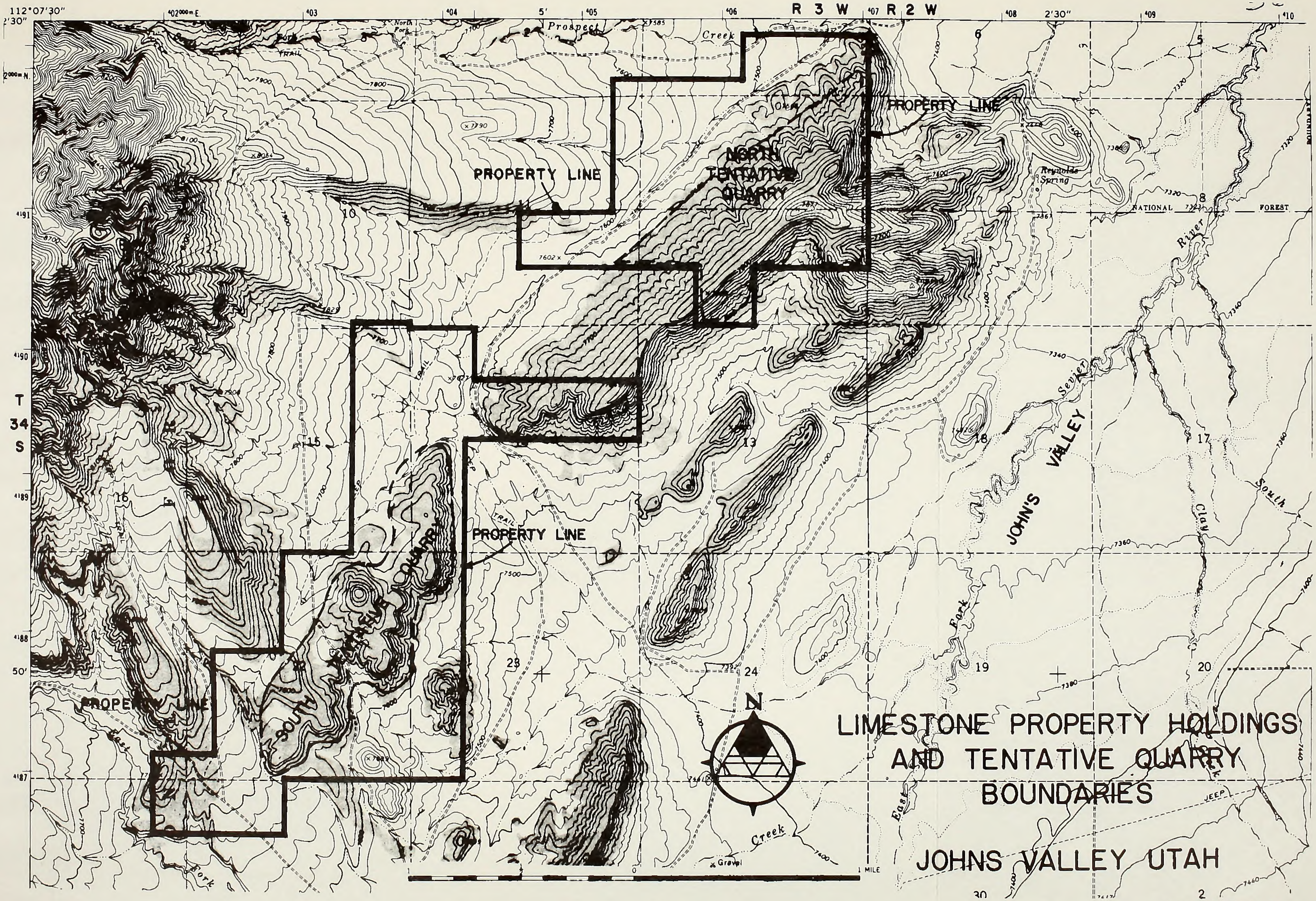


ILLUSTRATION 56

year life production requirements. Illustration 57 represents the sequence of quarry operations and material requirements involved. Limestone would be for use in the scrubbers and water treatment at the power-generating facility and for rock dusting in the underground coal mines.

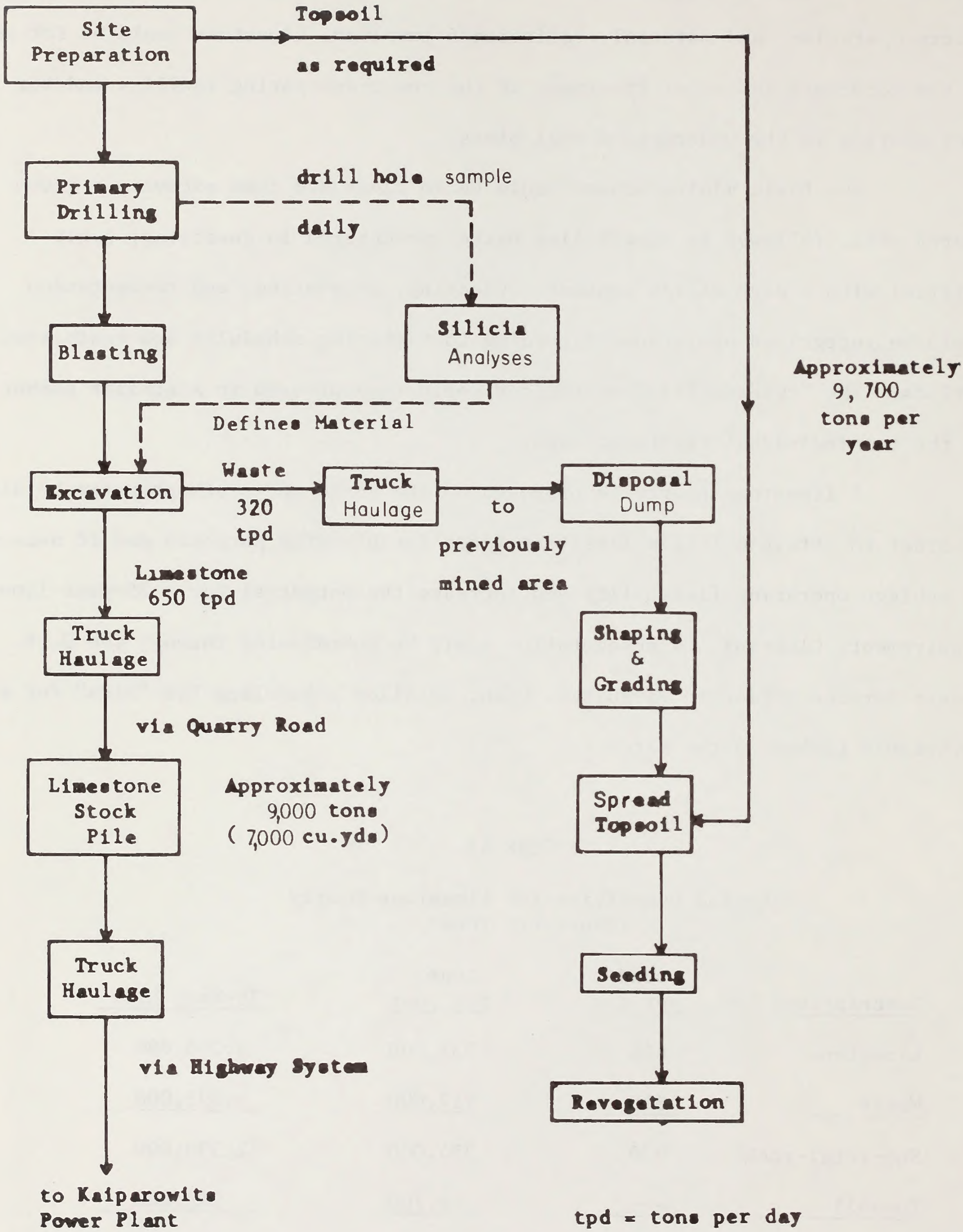
The basic mining scheme would be to clear and then excavate a given quarry area, followed by backfilling waste encountered in quarrying; e.g., material with a high silica content. Clearing, excavating, and revegetation would be integrated operations according to timbering schedules and basic growing periods. The "cut-and-fill" operations would then proceed in a similar manner on the two individual tracts of land.

A limestone quarry is proposed on the north and south property holdings in order to obtain multiple limestone faces for blending purposes and if necessary, to achieve operating flexibility and increase the potential for a 35-year limestone requirement. Clearing and revegetation would be coordinated through the U. S. Forest Service office in Panguitch, Utah, to allow scheduling for "bids" for all marketable timber on the sites.

FIGURE 41

Material Quantities for Limestone Quarry
(Short Dry Tons)

Descriptions	tons per day	tons per year	35-Year Life
Limestone	650	237,000	8,295,000
Waste	320	117,000	4,095,000
Sub-total-rock	970	354,000	12,390,000
Topsoil	---	9,700	340,000
Total-material	970	363,700	12,730,000



FLOW DIAGRAM OF QUARRY AND LIMESTONE HANDLING OPERATIONS

ILLUSTRATION 57

Surface quarrying operations would commence on the northwest or "dip" slope of the limestone ridges. A series of horizontal pit benches would be developed every 15 feet vertically as mining progresses downward. Each quarry bench would be interconnected by ramp system. Surface excavation would continue to a depth of approximately three benches or about 50 feet from the natural surface. Final pit slopes would be selected to achieve a safe pit topography for quarry operations. All quarrying would be on a selective basis to segregate limestone according to its silica content.

Assuming the Kaiparowits project would operate for 35 years, 8.3 million tons of limestone would be required. This would require approximately 130 acres of quarried area on back slopes of the ridges.

Surface mining operations would commence with blast-hole drilling, followed by loading of explosives and blasting. The next major operation would be excavation of broken material and loading into haulage units. These off-highway haulage units would then traverse quarry road systems to storage and loadout facilities. Crude limestone would be loaded into highway tractor-trailers for transportation to the Kaiparowits generating plant site (see Illustration 58).

Site preparation

Initial quarrying operations would begin with preliminary site clearing and leveling, followed by preparation by crawler-mounted tractors equipped with rippers and dozers. Bulldozing would be required in areas of rugged terrain where a drill would not be able to safely setup on a blast-hole pattern. Any topsoil would be used in the revegetation program.

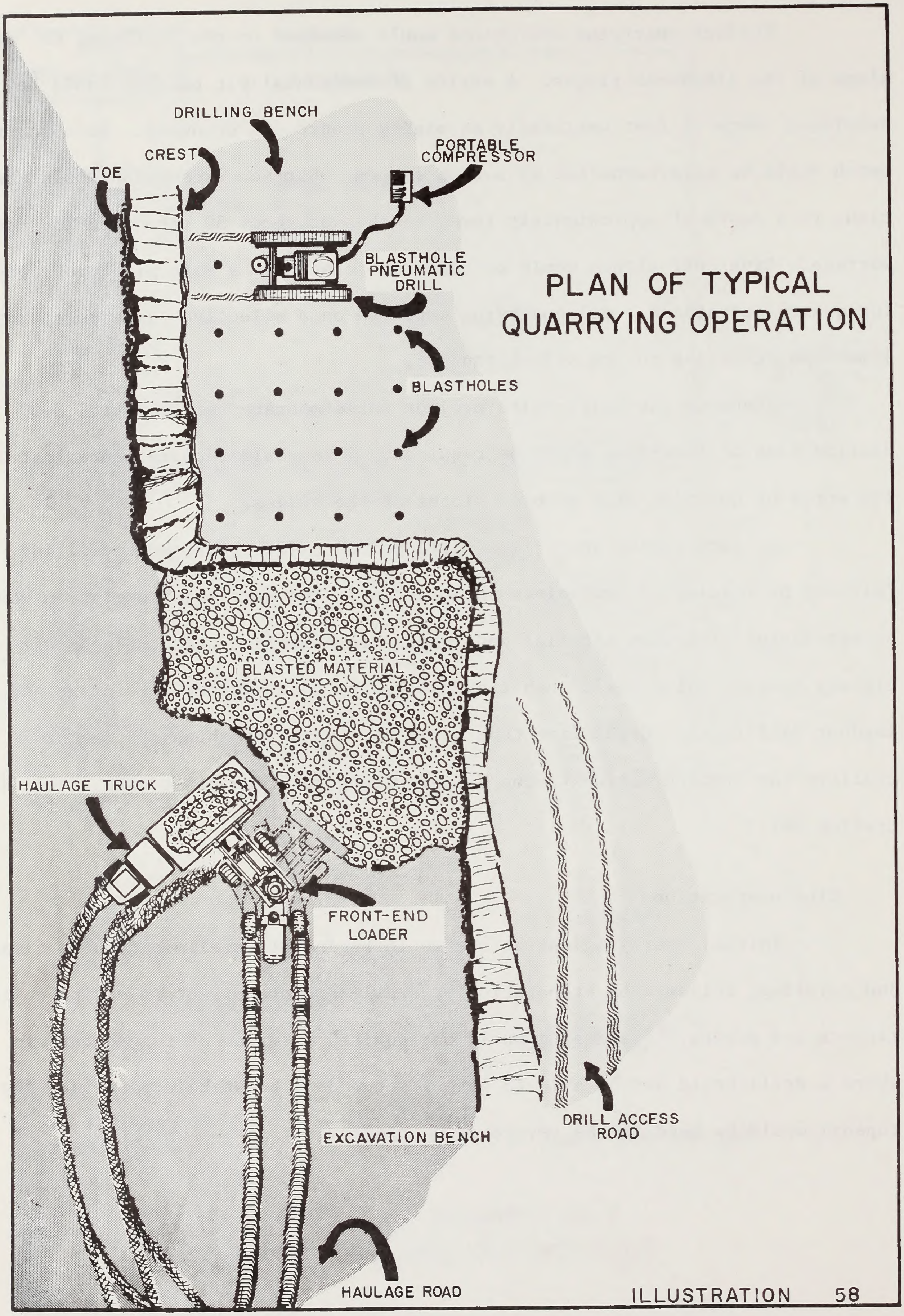


ILLUSTRATION 58

Primary drilling

Drilling operations would be conducted by crawler-mounted, self-contained pneumatic drills. Such drills would be used for a near-vertical, blast-hole pattern with holes approximately three inches in diameter. These drills would be equipped with a four and one-half inch hammer. Compressed air would be supplied by portable, diesel-powered air compressors. Approximately 600 cubic feet per minute of air would be supplied through a flexible air hose which connects the portable compressor to the drills.

Blast-holes would be in a square, multiple-row pattern and would be drilled to a depth of approximately 18 feet. Specific blast hole spacing and burdens would be adjusted according to local rock conditions encountered and type of excavation required. Silica analysis would be performed on samples taken from drill cuttings, as required, to determine whether the limestone is suitable for rock dusting use in underground coal mines.

Blasting

Blasting operations would be limited to one production blast per day (at the end of the shift) for each quarry, averaging approximately 12 blast holes per shot. Exact blast requirements would depend on the blast-holes geometry selected. Each blast-hole would be primed with a stick of high-strength semi-gelatin dynamite. The remaining powder column would consist of ammonium nitrate fuel oil (ANFO) in all dry blast holes. Should a wet blast hole be encountered, it would be loaded entirely with semi-gelatin dynamite. Each individual blast hole would be tied with detonating cord according to a pre-determined pattern for blasting.

Excavation

Excavating broken limestone would be accomplished by use of rubber-tired, front-end loaders. These units would be diesel-powered with articulated steering and equipped with a "V" type rock bucket with teeth. These units would be used for excavating blasted limestone and loading it into haulage trucks. They would also perform cleanup operations at the quarry face and along major haul roads and to dress the limestone stockpile.

Quarry haulage

Quarry haulage would be accomplished by diesel-powered, off-highway trucks. These trucks would be rear-dump models with a six-tire configuration. Haulage units, once loaded at the quarry face, would proceed along quarry truck routes via the connecting ramps. Trucks would transport limestone to a stock-pile or take waste material to a previously mined area where it would be dumped and graded.

Service roads and ramps in the quarry would be constructed as temporary installations between horizontal benches and throughout the quarries. These roads would be constructed with low-quality over-burden encountered in the operation and surfaced with finer waste material. Front-end loaders or track-mounted dozers would grade this material, and surface compaction would be accom-plished by heavy mobile equipment traversing the routes.

Stockpile and loadout

Limestone produced from the quarrying operation would be dumped into a surface stockpile. The loadout operation would involve loading stockpiled limestone. This would be accomplished by the same type loaders that were utilized for excavation in the quarrying operation. Highway-type, tractor-trailer units would be loaded for final limestone shipment to the power-generating facility.

Trailers would be bottom-dump models, and tractor-trailer units would have five axles. Loads are not to exceed 18,000 pounds per single axle or 33,000 pounds per tandem axle.

Limestone transportation from quarry to plant site

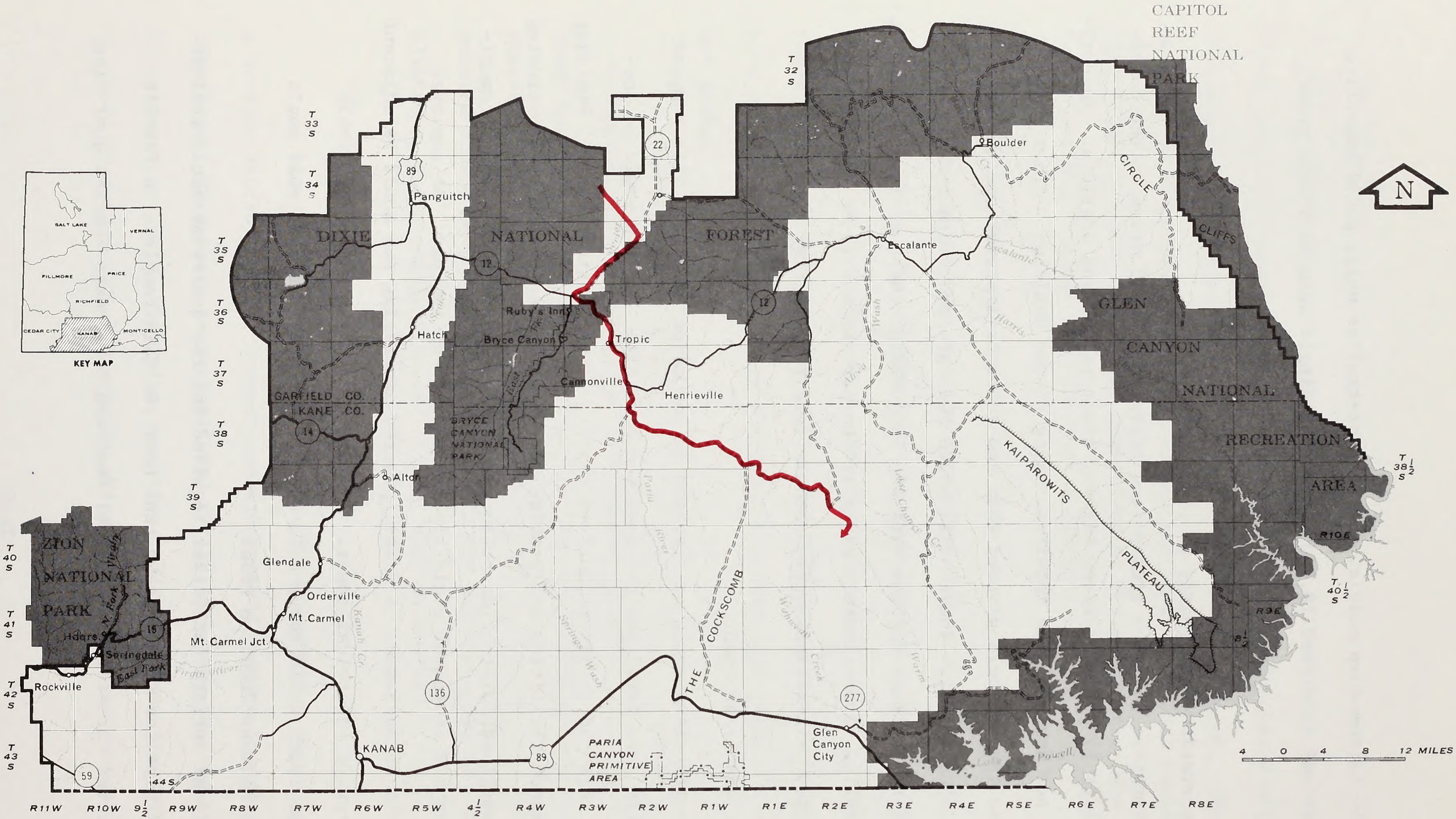
All limestone would be transported approximately 60 miles to the power-generating facility by diesel-powered highway tractors pulling trailers. Approximately 30 trips per day would be required, using 25-ton vehicles. After they are loaded, these trucks would proceed east and south on improved surface roads to the head of Johns Valley. These units would then proceed southeasterly on State Highway 54 to the intersection with the proposed northern access to Fourmile Bench at Cannonville. Approximately seven trucks per shift will be required on a two-shift-per-day, six-day-per-week schedule (see Illustration 59).

Site description and arrangement

Two quarry sites would be serviced by one major complex. This complex would be on a five-acre level pad of compacted backfill. A ditch would be constructed around this pad to divert surface runoff. A prefabricated steel building to house maintenance facilities and provide warehousing space would be constructed on the pad. A small administration building which would house emergency communications and first aid equipment would also be located on the pad. An employee parking area would be included. A diesel-powered generating van would be adjacent to the pad to provide electrical power.

Haulage roads would serve each quarry site and an access road would connect with the Widtsoe Junction road.

Additional surface facilities required for the quarrying would include a water well and pipeline to a storage tank near the main complex. A facility would be constructed for storage of diesel fuel and lubricants for the quarrying



KANAB DISTRICT
1974
UTAH

PROPOSED HIGHWAY HAULAGE ROUTE

ILLUSTRATION 59

equipment. Two magazines would be constructed at remote sites for the storage of explosives and blasting agents, and caps and delays.

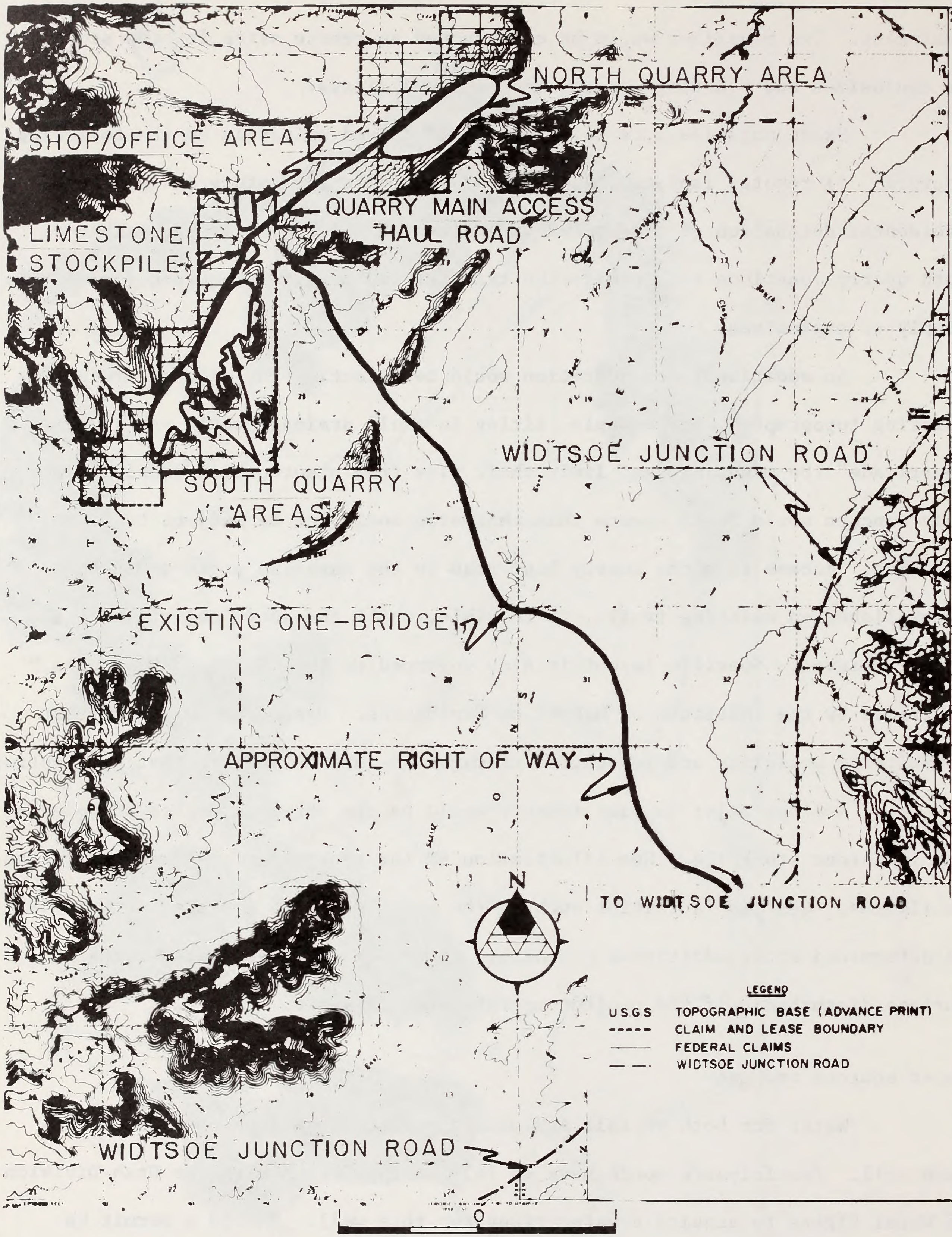
Exact magazine site selection would depend primarily on the following factors: 1) remote, isolated, and inaccessible site for safety in case of an accidental detonation of the stored explosives; 2) site readily accessible to both quarry locations to minimize the transfer and handling required for a daily supply of explosives.

An additional consideration would be selecting the site according to existing topography. For example, siting in small drainage would partially "barricade" the magazines and limit their view from unauthorized people. The only concern would be to ensure that this site would not be subject to flash flooding. Access from the quarry haul road to the magazine sites would be accomplished on existing trails, if feasible, while the above objectives are being achieved. Specific layout is also governed by the "Table of Distances," published by the Institute of Makers of Explosives. Distances to the nearest inhabitated buildings and separation of magazines are defined in that publication.

Another major surface feature would be the three-acre area occupied by the limestone stockpile. See Illustration 60 for general arrangement of surface facilities. Certain facilities such as the water well and magazine area would be determined after additional planning. Figure 42 gives estimated acres of surface disturbance if the project operates for 35 years.

Water sources and uses

Water for both potable and mining purposes would be obtained from a deep well. Participants would have to file an applicaton with the Utah Division of Water Rights to acquire a water right for this well. Should a permit be denied the participants would have to acquire an existing water right and file an application with the Utah Division of Water Rights to change the point of



JOHNS VALLEY LIMESTONE PROJECT

GENERAL ARRANGEMENT OF SURFACE FACILITIES

ILLUSTRATION 60

FIGURE 42

Estimated Surface Disturbance for Quarry and Related Facilities

Item	Acres
Highway surfacing	80
Shop/office	5
Quarry	131
Quarry access road	18
Magazines and roads	3
Limestone stockpile	3
Total	240

diversion, nature of use and location of use of water under that water right. The pump installed in this well would be powered from a diesel-driven generating facility adjacent to the well site. Water would be pumped via a small-diameter pipeline to a storage tank adjacent to the shop/office complex. It would be stored in the tank for water reserve during times of high usage or in case of fire. Total water consumption is estimated at 2,000 gallons per day in the quarry operation. (See Illustration 61 for typical water quantities and usage.)

Largest use of water in the quarry operation would be to suppress dust caused by truck haulage from the quarry face to the various dumping locations as well as that created at the excavating face, and the stockpile loading operation. Sprinkling trucks would be used to wet down quarry haulage roads when required and water would be sprinkled on broken limestone prior to excavation and loading operations. Potable water requirements for the quarrying operation would only involve small quantities of water.

Reclamation

Resources Company has proposed the following reclamation and revegetation plans:

1. Backfill all mined-out areas with waste encountered in the quarry operation;

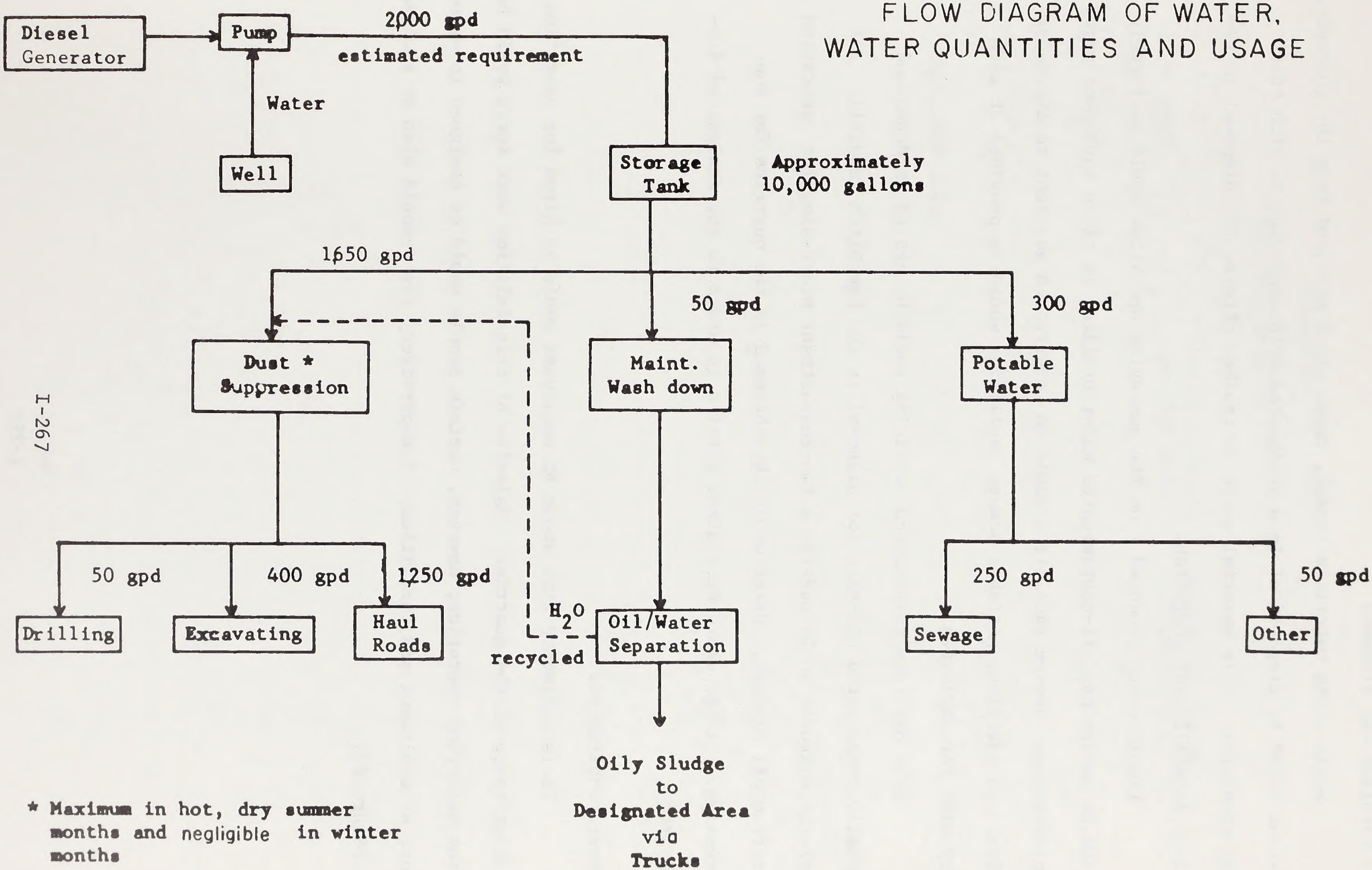
2. Grade waste material consistent with surrounding site topography.

3. Cover graded areas with a thin layer of topsoil encountered in the quarry operation;

4. Reseed all graded areas.

5. Fence newly-reseeded areas where required.

FLOW DIAGRAM OF WATER, WATER QUANTITIES AND USAGE



* Maximum in hot, dry summer months and negligible in winter months

ILLUSTRATION 61

Waste handling and disposal

Solid waste materials (trash, rags, etc.) produced from the quarrying operation would be disposed of in a designated area according to Utah State health standards. This material would be trucked offsite for disposal in the sanitary landfill near Panguitch.

Liquid waste produced from the quarrying operation would be largely limited to sewage and oil-contaminated water utilized to clean equipment prior to maintenance. Sewage facilities would be constructed adjacent to the major complex. In addition, portable sewage facilities would be provided at each quarry site for employees.

Used oil from maintenance servicing would be sealed in drums and eventually transported off-site for disposal in the Panguitch landfill. All water/oily mixtures would undergo a two-compartment processing for separation of water from oil sludges. Water would then be used in the quarries for dust suppression. Sludge would be trucked offsite in drums to the designated disposal area.

Manpower requirements

It is estimated that about 65 employees would be hired for operation and maintenance at the quarries. Majority of this fulltime work force would be for the quarrying operation; however, certain people would be assigned to maintenance of equipment and facilities. A supervisory force would also be included (see Figure 43).

FIGURE 43

Manpower Requirements

Year	Limestone Quarry Construction	Limestone Quarry Operation
1	36	30
2	0	30
3	0	30
4	0	65
Each year after	0	65

Stages of implementation - Fourmile Bench

Generating plant construction

Figure 44 shows the proposed schedule for plant construction and startup. First activities would involve minor improvements to existing northern secondary roads into the site from Cannonville. This would allow transport of earth-moving equipment and support facilities (living quarters, office trailers, etc.) to Fourmile Bench for site preparation. The site preparation phase would consist of major clearing and earth moving as well as setup of shops, warehouses, living quarters, offices, concrete batch plant and aggregate processing plant. During this phase of construction, the proposed site access road construction would begin.

Next phase of construction would be primarily structural in nature. Concrete foundations for major buildings and structures would be laid and steel support structures would take form.

Plant construction would next move into the fabrication stage with installation of a major piping system, and machinery and equipment followed by installation of electrical wiring and equipment. Final activities would involve testing and startup of individual equipment, systems, and the integrated plant.

Because testing and startup of the four generating units will not occur at the same time, laying of bulk quantities of concrete plus installation of pipe and wire would be staggered.

Although plant construction would be handled by a single 40-hour per week shift, optimum construction scheduling would require periodic use of a second shift and some selective use of premium time. This would be especially true during the startup of a unit.

Sources and quantities of labor and supervision

Figure 45 shows the project construction and operation labor force.

FIGURE 44

KAIPAROWITS
CONSTRUCTION SEQUENCE
FOR FOUR 750 MW UNITS
COAL FIRED GENERATING PLANT

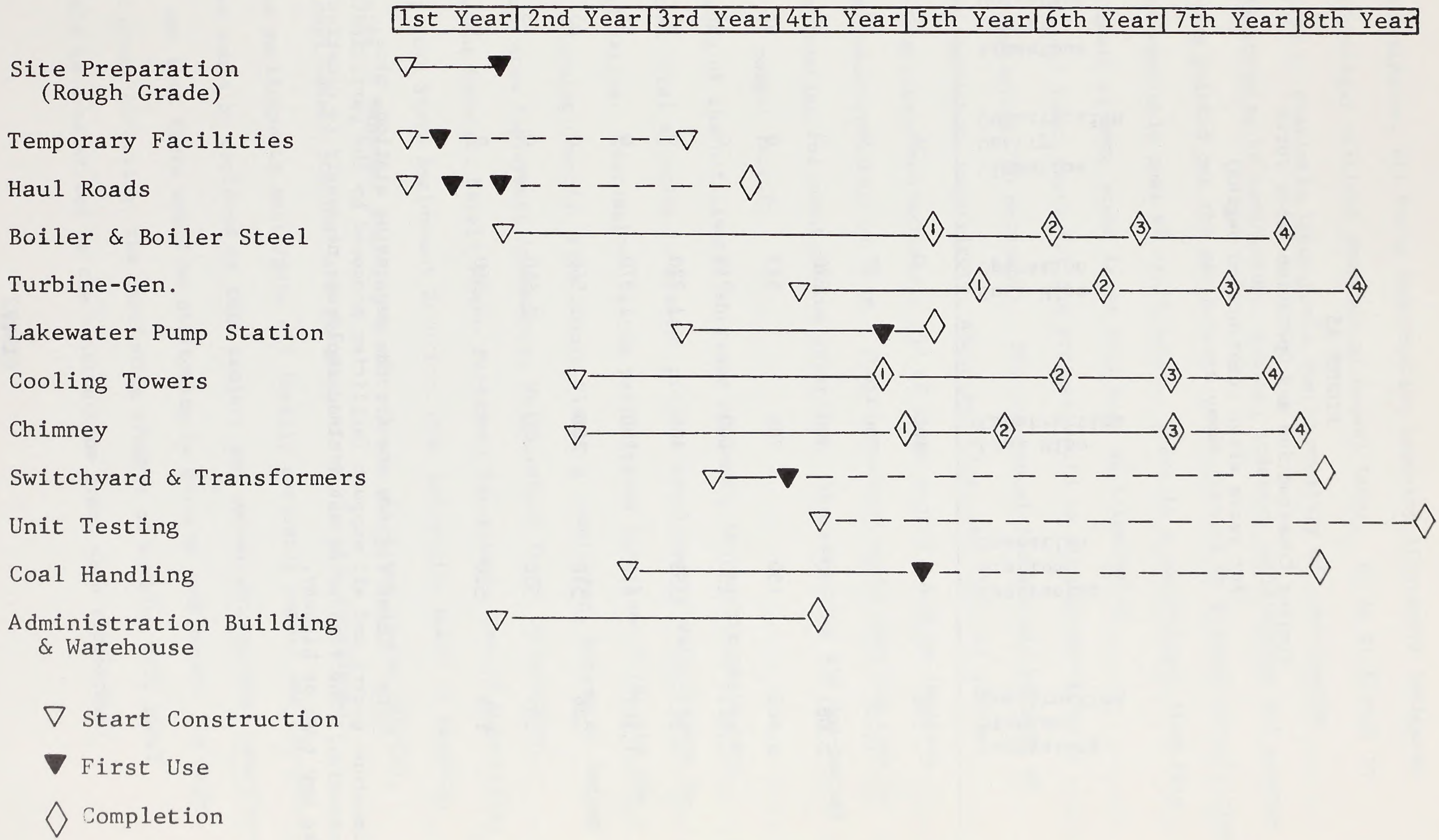


FIGURE 45

Project Construction and Operation Labor Force

(For years after construction begins)

Year	Generating Station Construction	Generating Station Operation	Coal Mine Construction	Coal Mine Operation	Limestone Quarry Construction	Limestone Quarry Operation	TOTAL
1	595	0	100	0	36	30	761
2	1,282	0	300	55	0	30	1,667
3	2,061	0	500	220	0	30	2,811
4	2,405	150	700	523	0	65	3,843
5	2,221	150	600	919	0	65	3,955
6	1,817	350	400	1,320	0	65	3,952
7	1,102	450	300	1,870	0	65	3,787
8	226	510	200	2,560	0	65	3,571
9	135	510	0	2,560	0	65	3,270
10	135	510	0	2,560	0	65	3,270

Note: These figures are for the generating station, mine, limestone quarry and all support facilities proposed by the participating companies. The figures do not include employees necessary to construct the new town or highway.

According to participants, all heavy construction industry literature indicates there is an increasingly critical shortage of manual labor. It is difficult to determine the size of available labor pools due to mobility of construction workers, but all attempts by contractors, unions, industry publications and government agencies have pointed out the gap between needs created by planned construction projects and the available pool of craft labor. There is a possibility that this labor shortage could be more acute in an area such as Kaiparowits.

Non-manual labor needs for the project would be significantly less, and peak at approximately 260 personnel. The non-manual force would be made of of professional, technical supervisory, administrative, and clerical skills. The participants estimate approximately 150 of these people would be imported by the major engineer-construction firm. Their personnel would form the core of power plant engineering and construction expertise. The remaining 110 non-manual workers would be sought locally.

Because of the anticipated shortage of labor, the participants have met with several local agencies to present project requirements with respect to quantities and skills. Discussions by the participants have been held with the Utah Manpower Planning Council, Five County Planning Commission, Bureau of Indian Affairs, Navajo Area Employment Assistance, Neighborhood Youth Corporation, Navajo Employment Service, Navajo Tribal Personnel Department, Navajo Apprenticeship Program; Utah State Employment Security, Utah University Board of Regents, Project Division of Manpower Training Center, representatives of the AFL-CIO, Adult Vocational Rehabilitation, and the Utah State Planning Coordinator.

The participants anticipate all locally available manual and non-manual labor sources would be depleted by this project and concurrent regional construction activities, and that there would be difficulty in meeting peak needs. In light of this employment situation, the continuing program of working with local agencies would be accelerated as the construction start date approaches.

Access

The proposed generating station site has secondary road access from Cannonville that would be adequate for transporting equipment used for site preparation. This secondary road would be maintained in a condition for use while the permanent road system is being constructed. A permanent highway to the generating station and mine is proposed (See Page I-335. This highway would require one year to design after the decision is made to construct it. Construction would require 18 months.

Preliminary studies by the participants indicate that the most suitable railroad for the proposed project presently extends to Sigurd, Utah. The truck haul route from Sigurd to the plant site would be via state routes 24, 62, 22, 12 and a section of road maintained by Kane, County. The length of this route would be approximately 140 miles, of which 72 miles would be two lane paved highway and 68 miles would be graded dirt roads. The participants estimate that during construction of the plant there would be 20 heavy hauls of over 125 tons (maximum 483 tons), and 200 hauls over 50 tons. In addition, approximately 6,000 commercial weight truckloads would be made from the railhead to the site.

The heavy haul route would require preparation of structures, including strengthening or replacement of bridges and other structures. Each structure has been studied by the Utah State Department of Highways and the participants. Design analysis of each structure would determine the best solution for each.

Heavy hauling would be done with special transporters. Since this equipment moves at a slow pace, assistance from state and local traffic authorities would be necessary to safely complete the movement. General hauls would be approved and regulated by the Utah State Department of Highways.

Construction power

During initial site preparation, diesel generators would be used to supply construction power. It is expected peak demand for this period would be one megavolt amp.

During final portions of site preparation, power demand would rise sharply (See Figure 46). The startup, testing, and use of on-site concrete batch plant and aggregate processing plant would result in the need for a construction powerline to the site. In addition, mine power requirements would start to increase at about the same time. The participants plan to bring a 69 kv construction powerline in from existing local transmission lines approximately 10 miles to the west in Cottonwood Canyon. Routing of the line would be along the Cannonville-to-Fourmile Bench road.

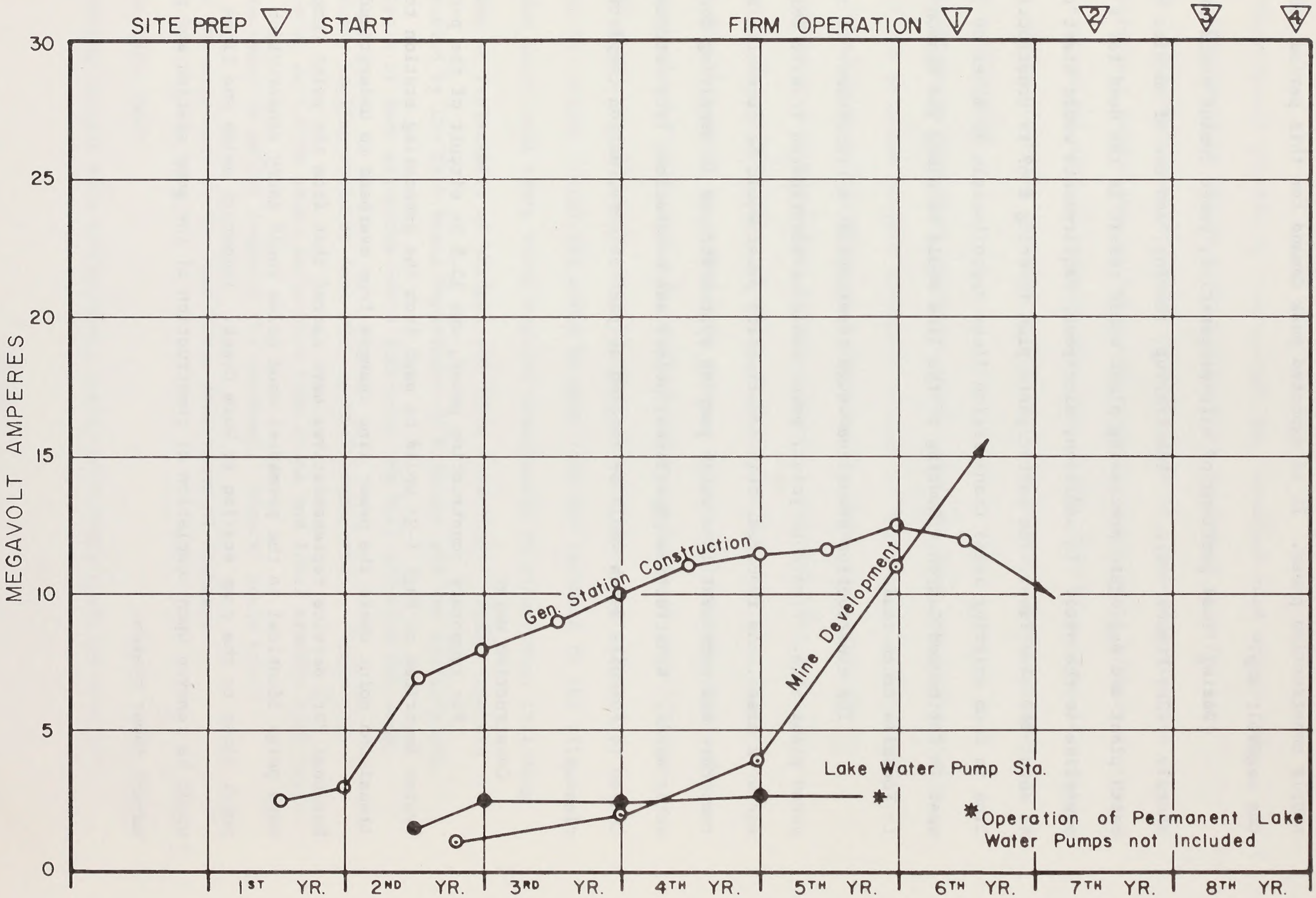
The construction powerline would terminate at a transformer at the proposed plant site. From this point, power would be distributed to site buildings and work areas. As required, this construction power would be connected to the temporary and permanent lake water pumping system for use in supplying construction water needs. Construction powerlines, poles, and substations from Cottonwood Canyon to Fourmile Bench would be removed as part of construction completion and cleanup.

Construction water

For temporary construction power, one 13.8 kv circuit of the permanent system described on Page I-82 would be used from the generating station to the transition point where the power line changes from overhead to underground. National Park Service representatives have agreed that from the point temporary wood poles identical to the permanent wood poles would carry construction power lines to the pump station at Warm Creek. Temporary poles and lines would be removed upon completion of construction of the pump station and permanent power system.

FIGURE 46

KAIPAROWITS PROJECT
ESTIMATED CONSTRUCTION POWER REQUIREMENTS



Construction water supply would be designed for a maximum flow rate of 700 gpm. Water would be taken from Lake Powell at Warm Creek and follow the plants' make-up water system pipeline routing (See Illustration 62). Also, access and patrol roads for the final make-up water supply would be used for temporary construction of water pipeline.

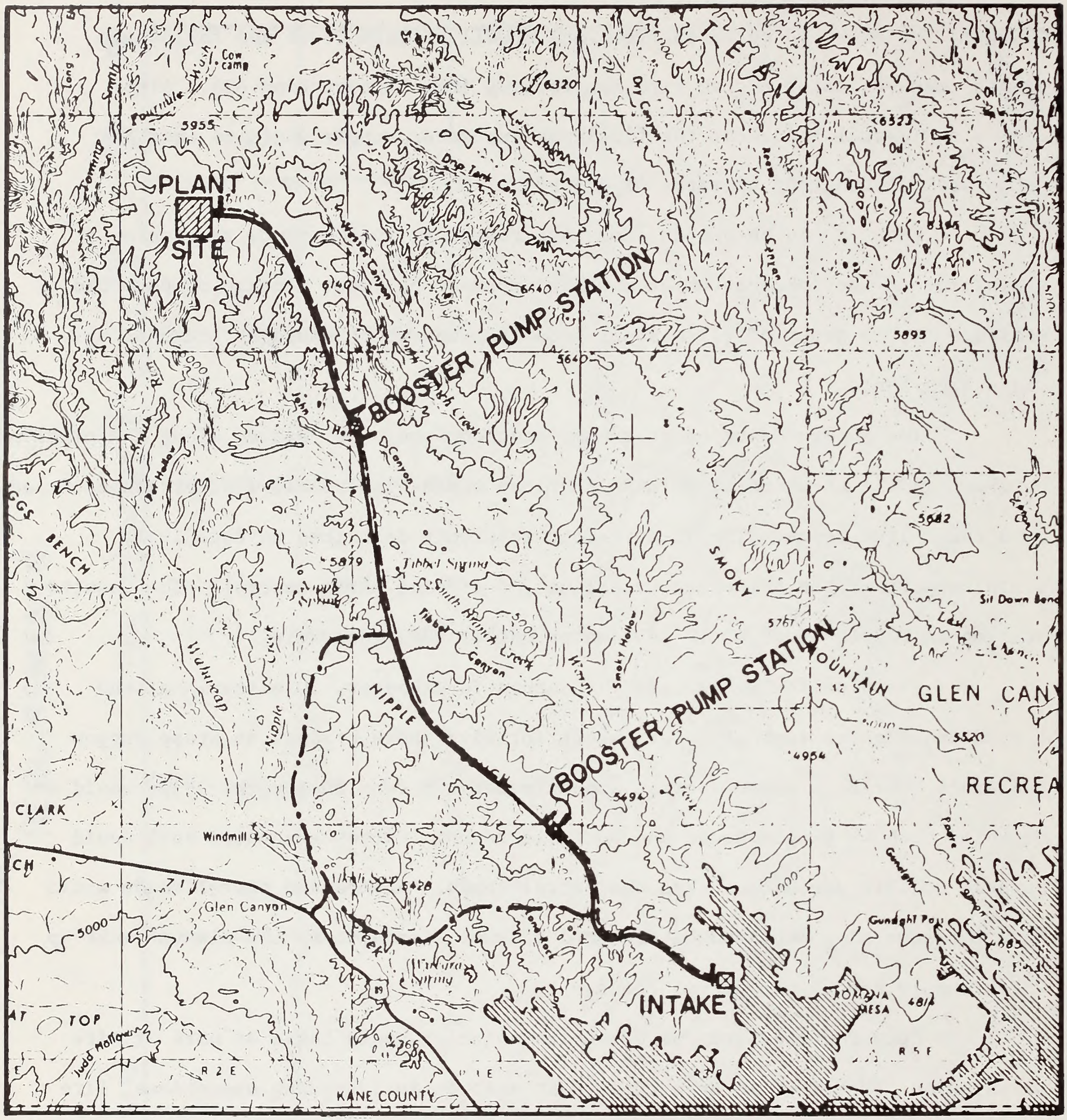
Water would be pumped from Lake Powell by intake pumps resting on a gravel mat on the lake bottom at a water depth of 60 feet. Intake pumps would manifold into a group of all-weather booster pumps which would be enclosed by a chain link fence.

Two intermediate booster pump stations would be located along the pipeline as shown in Illustration 62. These stations would also be all-weather and enclosed by a chain link fence. The 12-acre-foot reservoir described on Page I-33 would be part of the temporary waterline and provide surge control. The booster station on Nipple Bench would take water out of this reservoir.

The pipeline would be eight inches in diameter, 30 miles long, and buried under three feet of cover except for five short bridges at steep canyon crossings. Bridges would average approximately 75 feet in length. Pipe would be tunneled to both Nipple Bench and Fourmile Bench. Excess excavated soil would be used to fill areas on access and patrol roads. Access and patrol roads would have the same alignment and be designed to same standards as the plants' make-up water supply access and patrol roads.

Construction water pipeline installation would begin as part of site preparation. Water would be used in dust suppression, grading operations, fire protection, aggregate washing, concrete mixing, and personnel use. Water storage and purification would be provided at the generating site.

Expected volume and rate of usage at the generating plant are shown in Illustration 47. Average demand at maximum use would be 600,000 gallons per day



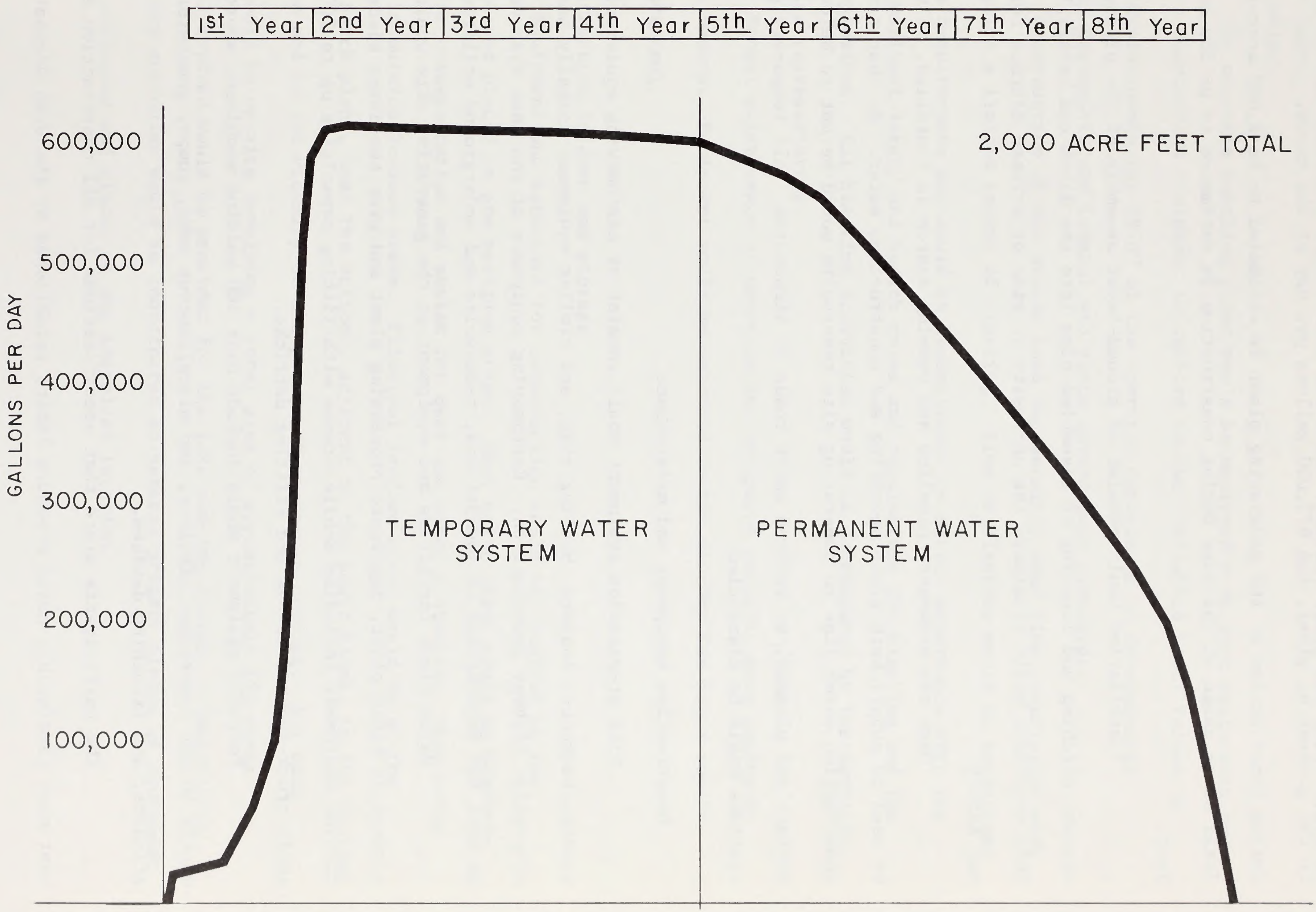
CONSTRUCTION WATER
PIPELINE
WARM CREEK INTAKE
FOURMILE BENCH PLANT SITE

LEGEND

- PIPELINE
- PATROL ROAD
- ACCESS ROAD
- PATROL ROAD GATE TO PROHIBIT PUBLIC ACCESS

ILLUSTRATION 62

FIGURE 47
KAIPAROWITS GENERATING PLANT
ESTIMATED CONSTRUCTION
WATER



at the generating plant, and 672,000 gallons per day at the mines. Total usage during construction at the generating plant is estimated to be 2,000 acre-feet. Total water usage at the mine during construction is estimated to be 500 acre-feet.

Installation would consist of ground-level assembly of the piping system, ditching and lowering of assembled pipe into the ditch and backfilling. This procedure would eliminate the necessity of wide or cribbed ditches for workman safety.

Once the permanent pipeline and pumping system is installed, it would be used to supply both plant operating and construction water. At that time, the construction water line to generating site reservoirs would be cut to below the surface and plugged, or removed under roads or structures. All temporary pump stations would be dismantled.

Construction equipment and maintenance

Site preparation equipment would consist of earthmoving equipment, water trucks, backhoes, loaders, hauling rigs, and similar equipment normally associated with major highway construction. Earthmoving equipment of the same type would be used for excavations of foundations, reservoirs and underground utilities.

Major plant facilities and equipment at the generating site would include a concrete batch plant, aggregate processing plant and over two dozen pieces of lifting equipment including mobile cranes with lifting capacities up to 200 tons, small truck-mounted cranes and stiffleg derricks.

Portable equipment would include over 100 welding machines, approximately 10 air compressor stations, and miscellaneous saws, pumps, generators, grinders, and trenching devices.

The participants state that specifications for all construction equipment meet permissible noise exposure limits established by the Utah Occupational

Safety and Health rules and regulations and other federal, state and local statutes as applicable.

The concrete batching plant would be equipped with dust collectors and other dust suppression equipment to conform to the "Threshold Limit Values of Airborne Contaminants for 1970" of the American Conference of Governmental Industrial Hygienists and federal and state environment standards.

Construction of the access road and possibly some site preparation work might require a limited amount of blasting. Time of blasting would be consistent with area requirements and would be accomplished in strict accordance with the Utah Occupational Safety and Health rules and regulations for blasting and the use of explosives. All blasting activities would be coordinated by the participants' site representative.

Normal maintenance of construction equipment would be done onsite by equipment owners. Equipment would be returned to the factory for major repair work or overhaul.

Construction laydown and storage

Equipment and materials for construction would be received at the plant site and placed in pre-assigned areas. Most major items would be weatherproofed for transportation and sealed for dust and water protection, thus being storable in outside laydown areas. Principal laydown areas would be at the concrete batch plant, near the offices, adjacent to the power block, in the cooling tower area and in the vicinity of the permanent warehouse complex. All such storage would be on-site involving a total area of approximately 155 acres. Additional laydown would be provided for the lake pumping system. Construction and delivery schedules would be coordinated so several primary pieces of equipment could be offloaded and placed at the installed location.

Storage of equipment and materials, especially major items, would be in a manner that would allow safe handling with minimum disturbance to storage areas and would provide least travel distance to the point of installation.

Temporary warehouses, consisting of industrial-type Butler buildings with steel framing and corrugated steel siding on concrete slabs, would be constructed for those items requiring weather protection and storekeeping for inventory control. Individual contractors may also provide temporary shops and craft change buildings within their assigned areas. Generally, these buildings would be prefabricated or job-built.

At their option, contractors may provide wire fence enclosures around their assigned shop, work and storage areas at the site. The participants' representative would coordinate development of the contractors' areas and ensure that all temporary structures are substantial and properly maintained.

Construction parking

Rock-surfaced, temporary, on-site parking would be provided for office and administrative staff, visitors, and craft personnel outside the fenced generating site construction area. These parking areas would involve some eight acres and accommodate approximately 900 personal vehicles. Vehicular gates into the construction areas would be for the sole use of truck deliveries and vehicles associated with construction work. Heavy equipment parking would be in an assigned area within the contractors' temporary shop and storage complex.

At the end of the construction phase, all parking requirements would be met by permanent asphalt-paved parking areas within the generating station site. Temporary construction parking areas would be eliminated during final plant grading and landscaping.

Temporary facilities

A treatment plant for water from Lake Powell, consisting of a pumping system, reservoir, and clorinator, would provide a source of potable water to be distributed by temporary piping to the temporary office areas and shop complexes. All potable water systems would conform to sanitation requirements of the Utah Occupational Safety and Health rules and regulations and the Public Health Department. All non-potable systems would be totally independent and clearly marked as required.

The construction water treatment plant would also be the permanent potable water treatment plant. As the permanent water supply becomes available at the site, it would supply the potable water system treatment plant and a new permanent distribution of treated water would be installed as the plant is erected.

Initially, sanitary requirements would be met by providing portable toilets meeting requirements of local codes. After site preparation, a sewage treatment facility meeting regional requirements, would be constructed to handle waste disposal needs of temporary construction facilities. Contractors may continue to maintain portable units in more remote work areas during construction period.

All major temporary construction buildings would be sited and erected in accordance with a master plan for the construction site and coordinated by the participants' representative. During site preparation and the very early construction phase, portable trailers would provide construction office space. Later, construction offices would be housed in temporary buildings. Offices would house the majority of all office and administrative staff personnel. Certain contractors, especially those working on systems remote from the power block, may elect to retain offices in construction trailers near work sites.

Aggregate source and transportation

Large quantities of sand and gravel would be needed as aggregate for concrete and asphalt mixes as well as road subbase, fill, borrow, and rip-rap.

The Upper Wahweap Creek stream bed near Fourmile Bench would be the preferred site to supply material for construction of the Fourmile plant (See Illustration 63). The site would provide materials along approximately one-half mile of stream bed to a depth of about 20 feet involving approximately 70 acres. Several quarries sited along the road network where materials are available could supply additional aggregate for road construction. Stream and terrace deposits near Glen Canyon City and along Highways 89 and 12 could supply some road construction needs as well as materials for residential construction. There are existing quarries in these areas which would supply a portion of the demand. Information on additional aggregate sites that may be needed is not available from the participants at this time.

Participants estimate approximately 200,000 cubic yards of sand and gravel would be needed for concrete aggregate for the proposed plant. New highway, new town, and mine construction would require approximately 1.4 million cubic yards. Total aggregate needs, therefore, would be roughly 1.6 million cubic yards.

The four-wheel-drive road in the wash approximately two miles south of the existing road to the quarry site would be improved. Drainage for both the borrow pit and access road would be provided to prevent ponding and allow all-weather operation.

Mobile loading equipment would load aggregate on gravel haul trucks. Truck route from this aggregate location to the generating plant site would be 18 miles. It is possible other sources of aggregate might be required for special structural concrete at the plant site. This aggregate would be delivered to the site as regular truck haul.

Aggregate would be stored at the construction site to allow continuous hauling in off-peak traffic hours and provide for cessation of hauling during inclement weather.

An aggregate processing plant would be constructed at the site to support the batch mixing plant. The temporary aggregate processing plant would consist

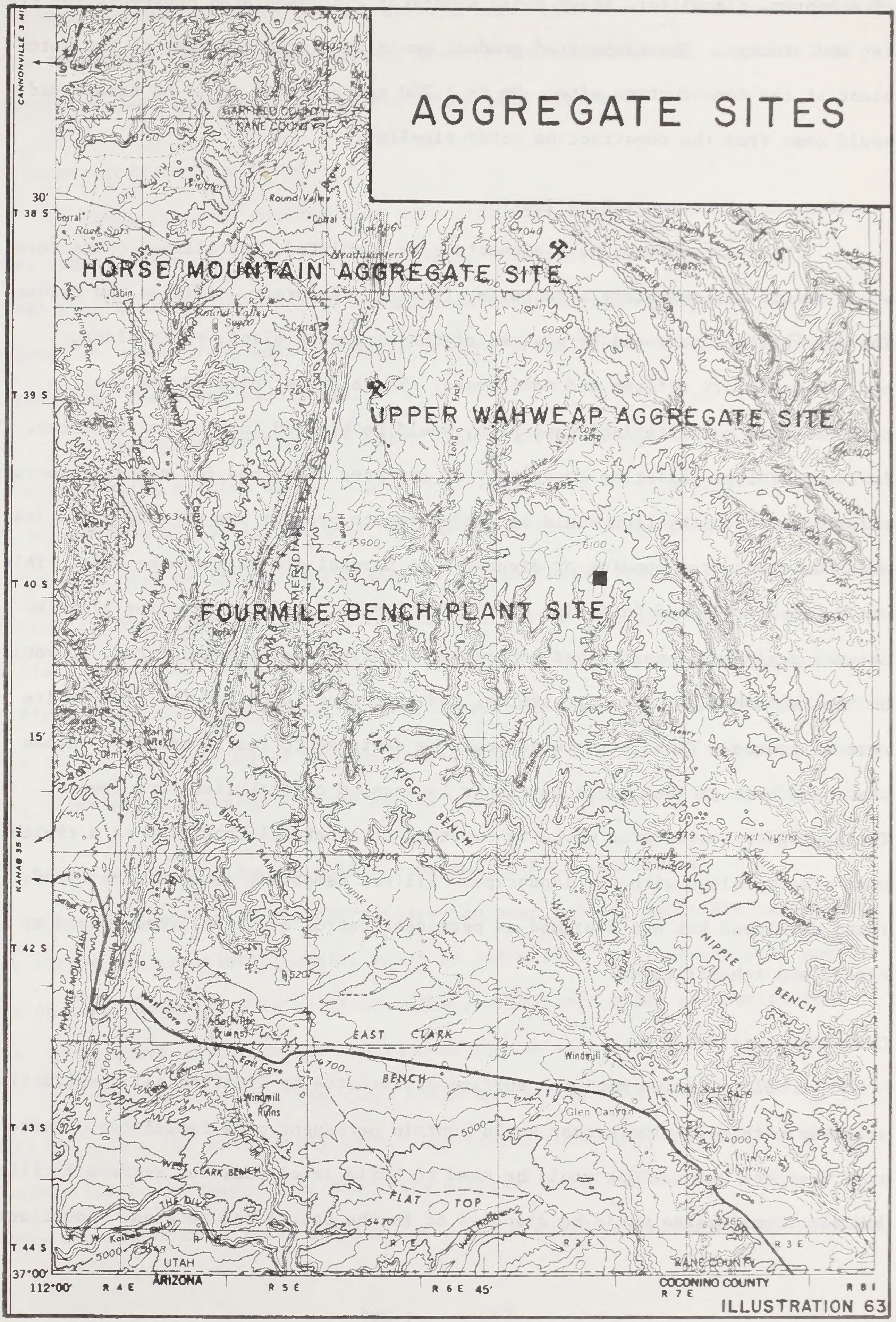


ILLUSTRATION 63

of a hopper, classifier, heavy media separator and associated conveyors for transfer and storage. The classified product would be stored adjacent to the batch plant at the construction site. Up to 1,200 gpm of water would be needed and would come from the construction water pipeline.

Post construction rehabilitation

As construction work elements were completed, installing contractors would remove all temporary structures, fencing, temporary utilities and refuse. The generation site would be cleared of the aggregate plant, batch plant, and all temporary offices and warehouses. These areas, cleared and not planted under the site landscape plan, would be blended into normal landscape in the vicinity. Existing topography of any area disturbed for either temporary or permanent construction would be landscaped to protect the structure and its area and roads from ponding or diversion of natural drainage of the area. This would be accomplished in design of the final site, road and pipeline plans so natural drainage is maintained. Whenever interference is encountered, it would be reestablished by canals, culverts, and spreading to return the flow to its natural course. These structures would be designed to resist erosion. Areas that have been grubbed would be either landscaped or stabilized and seeded. The aggregate source area would be smoothed to a natural condition as a typical wash area to blend with the landscape. All new temporary construction access roads developed but not designed as permanent patrol or access roads would be closed and rehabilitated.

Coal mine construction

Plans are to minimize surface disturbance by limiting all construction possible within corridors that would contain permanent mine facilities. Waste rock from any excavations would be used to build level pads for surface facilities. Any additional waste would be disposed of in the coarse refuse area. Additional

Additional contractors would develop service facilities that would support future Kaiparowits mining operations. Major items include power transmission lines, overland belt conveyors, water facilities, and access roads (See Figure 48).

Access roads and utilities

First phase of construction activity would involve provision for access roads, construction water and electric power. Existing access roads to the general area would be improved to accommodate construction equipment. A new construction access road would be built to mine portal areas in corridors designated for permanent roads and facilities.

A temporary construction water line would be provided from Lake Powell to the generating station site. A permanent eight-inch water supply line to the coal mine area would be tapped into the temporary line to the plant site and would later be cut over to the permanent line from Lake Powell when it becomes available. Temporary storage tanks would be provided in the mine area until the permanent tank and clear water pond became available. Water would be used for dust supression and fire protection during construction. Permanent powerline from the generating plant to the mine area would be constructed and used also as the temporary powerline, eliminating the need for any separate temporary powerline to the mine area.

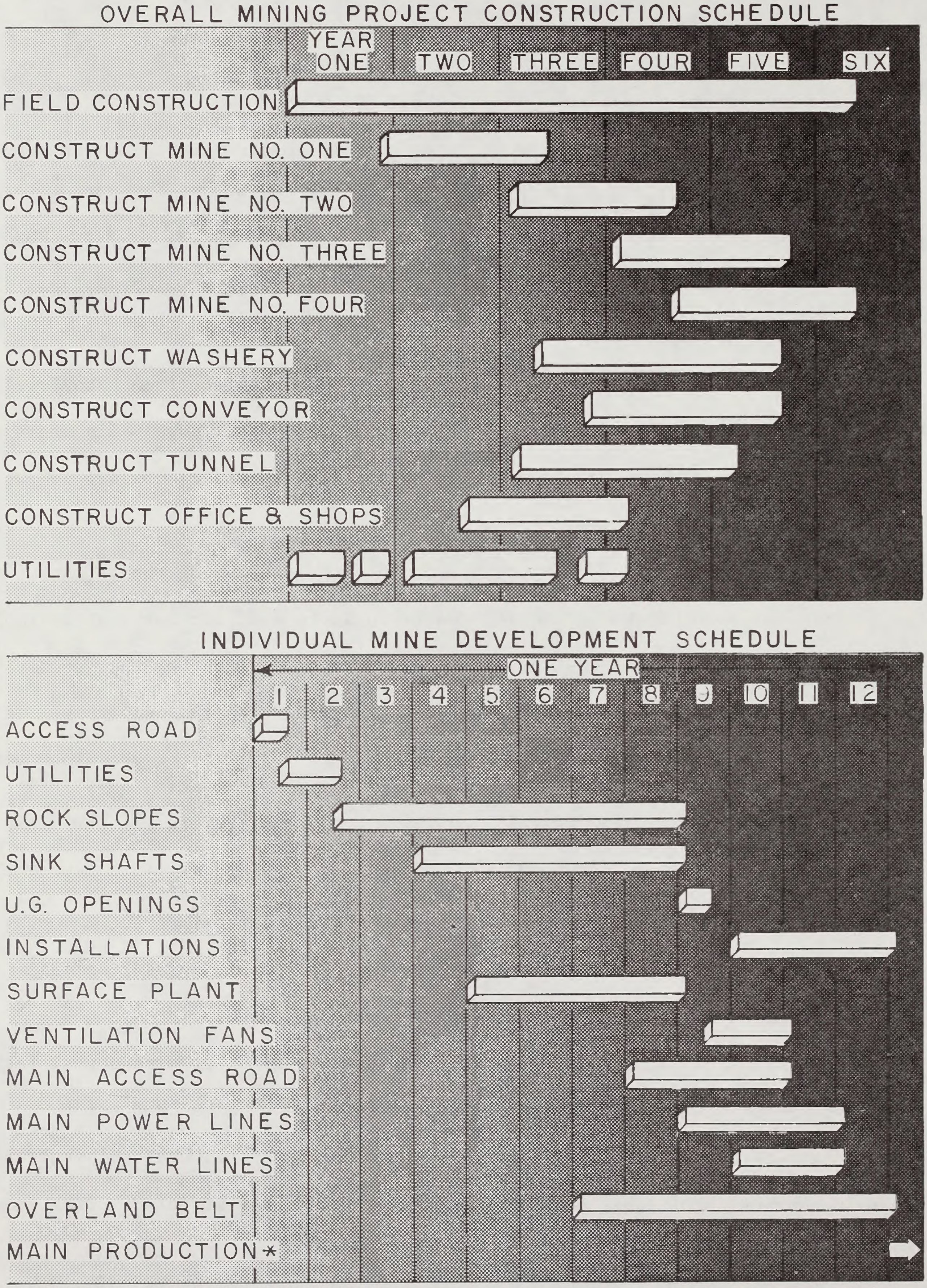
Rock slopes, ventilating shafts - portal surface facilities

After access to the portal site has been gained, machinery required to sink slopes and ventilating shafts would be assembled. Approximately 18 months to sink each slope would be required. The participants state excavation must start by December 1975, to meet the planned operating schedule.

Rock removed from the slope would be used as fill for mine portal facilities including the mine supply yard. Any excess rock would be used for road construction or disposed of in the waste disposal area. Steel and equipment laydown areas, construction offices, parking lots, etc., would be restricted to the mine

FIGURE 48

PROPOSED MINE CONSTRUCTION



* Phased into full production of 2.5 million TPY as equipment is assembled and installed underground.

supply yard.

Sinking rock slopes and ventilating shafts, which are a part of mine construction, would be continued until main coal seams to be mined were intercepted. Other portal facilities including hoists, breakers, changehouses, etc., would be scheduled for use when the coal seam was reached.

Mine surface structures

Construction of surface structures such as changehouses, administration building and warehouses would be accomplished by usual architectural construction techniques. Clearing and grading would be first steps, followed by excavation and placing of foundations for building erection. Paving of the parking area would be followed by cleanup and landscaping of the area. Construction activities would be restricted to areas adjacent to the buildings since a large laydown area would not be required.

Coal washery

The coal washery would require foundations, steel and system erection, as well as operating and control systems. The construction area would be cleared and graded after which foundations would be placed. It is planned that concrete would be obtained from the same sources used for the generating station. Steel erection and equipment installation would follow. About 50 acres would be used for construction steel and equipment laydown areas. Construction of the washery would take approximately two and one-half years.

Conveyor system

First steps in constructing the conveyor belt would be surveying and grading. Only minor grading would be necessary since access roads would have been built. The conveyor tunnel to the generating station would be constructed using conventional tunneling or construction techniques and would be started early in the construction phase.

Sources and quantities of labor and supervision

Discussion of manual labor availability for the generating station, presented earlier, would also apply to coal mine construction. The estimated manual and non-manual workers is given by years as follows:

Year	1	2	3	4	5	6	7	8	9
Number of Workers	100	300	500	700	600	400	300	200	0

An engineer-constructor would act as general contractor with responsibility for obtaining required personnel. He would utilize all available sources of craft labor, particularly within the State of Utah.

Meetings with local and state government agencies, referred to in the generating station discussion, also apply to the coal mine. Activities of these agencies in planning for manpower needs included consideration of coal mine requirements as well as the generating station.

Training facility

See "Mine Section", page I-145.

Temporary facilities

Temporary facilities to support construction and installation of mine facilities would be located at the future facility sites. Wherever feasible, it is planned to establish permanent structures as soon as possible. These structures would be utilized as much as possible by the construction work force. For example, temporary powder magazines would be in positions where permanent magazines would be constructed. Portable sanitation facilities would be replaced by permanent installations wherever practical and when mining equipment is compatible to construction projects. Such facilities would be used rather than having additional equipment brought to the project site.

Post construction rehabilitation and equipment demobilization

After construction ends at each site, the area would be policed to remove all debris. Surfaces of laydown areas which are to be returned to a natural condition would be graded to minimize erosion and conform to natural surroundings. Revegetation would be accomplished by mulching, if required, and reseeding with species suitable for the area.

All construction equipment not adaptable to the coal mining operation would be dismantled and removed from the project site at the end of the construction phase. Larger construction equipment would be disassembled and removed by highway transportation. Smaller, heavy mobile equipment would be loaded on lowboys and transported to new construction sites at the end of the project.

Transmission system construction

Within the State of California, transmission lines would be constructed in accordance with "Rules for Overhead Electric Line Construction," General Order No. 95, issued by the California Public Utilities Commission. Outside California, transmission lines would be constructed in accordance with "Safety Rules for the Installation and Maintenance of Electric Supply and Communication Lines," National Bureau of Standards Handbook No. 81.

Transmission line construction sequence

Construction of transmission lines would consist of the following phases:

Access roads and right-of-way clearing

For a new transmission line, access is necessary for construction and also for operating and maintaining the line. If the line is adjacent to or crossed by existing roads, which provide easy access, new access roads would not be constructed. However, stub roads would be required from the existing road to new tower sites.

It would be necessary to construct permanent and temporary access roads along the proposed transmission line corridors. In event of a conflict between participants' specifications and requirements of the governing agency, requirements of the governing agency would take precedence. Participants propose to construct primary access roads adjacent to or on the center line of the right-of-way where topography permits. Clearing would occur at tower sites, pulling sites, assembly sites, and batch plants.

Water used for road construction would be taken from streams and other bodies of water along the corridor.

Footing installation

It would be necessary to construct adequate foundations (footings) for towers for the proposed transmission line system. Each self-supporting structure would require four standard augered cast-in-place concrete piles; whereas, each guyed structure would require either one or two footings, depending on type used, plus guy anchors.

Concrete would be hauled in concrete transit mix trucks to the structure site from portable batch plants located every 20 miles along the right-of-way. The participants state they do not know the exact location of batch plants but they would be: (1) positioned close to public roads, (2) flat, and (3) close and along the transmission line right-of-way. Batch plants would not be near any residences or other sensitive areas.

Structure assembly and erection

Assembly and erection of structures for the proposed transmission line system would consist of three main parts: steel haul to the structure sites and storage, grading work to construct a crane pad at each site, and structure assembly and erection at the sites.

Self-supporting structures

At the tower fabrication plant, tower members would be assembled into bundles. These bundles would be shipped by rail and then by truck to individual tower sites. Steel members would be removed from the bundles and several small sub-assemblies put together, each laying flat on the ground. Also, the tower crossarm (the main horizontal portion of the structure which supports the insulators and wire) would be assembled on the ground in one piece which would usually be about 100 feet long for 500 kv structures.

A crane would erect each sub-assembly onto the footings. The same crane would then be used to place the crossarm on top of the structure. The crane could then move on to the next tower site.

For each self-supporting structure, 0.036 of an acre would be permanently occupied. The temporary crane pad would require 0.03 acre.

Guyed structures

Individual guyed tower members would be put together in bundles at the fabrication plant, then shipped by rail and truck to large marshalling yards which would be located ten miles apart along the transmission line. An access road would be built to each tower site to accommodate a small boring rig and a backhoe. They would be used to install guy anchors in the earth for the structure guying system.

The central tower foundation would be a single precast concrete unit. The footing may be precast and hauled to the site by truck. Excavation for placement and backfilling would be done with a backhoe. If the single footing is cast in place rather than precast, procedures and equipment would be the same as for free-standing towers. Helicopters may be used on occasion to carry precast foundations to the site, but this is not the intent for the whole project.

At marshalling yards, each tower would be completely assembled in a jig with insulators, conductor stringing sheaves, and guy wires attached. This complete unit would then be transported to the site by helicopter. At the site, the tower would be lowered onto the central foundation and guy wires attached to previously installed guy anchors. The helicopter would immediately return to the marshalling yard for another tower.

Each guyed structure central footing would permanently occupy 28 square feet (0.0006 of an acre). In places where it is necessary to displace an intensive use of the surface, guy wires would occupy an area of 100 feet x 100 feet, comprising 0.23 of an acre.

Although roads would be used less with helicopter erection of guyed towers, it would still be necessary to construct access roads along proposed transmission line corridors. Access roads would be used to install footings and guy anchors, enable men and equipment to get to each tower site, and string the conductor and overhead ground wire.

Conductor and overhead groundwire stringing

The stringing of conductor and overhead groundwire would commence once a suitable number of structures had been erected. Where possible, the main access road would be routed adjacent to the set-up areas to minimize additional clearing for stub roads. Set-up areas would be confined to the right-of-way and would require an area of 200 x 300 feet at intervals of approximately three miles.

During pulling and sagging operations, the sag of the conductor would be maintained at a height necessary to minimize damage to the conductor.

Post-construction cleanup

Crews would remove all excess materials from the right-of-way and dispose of all debris in a manner so the area would be returned as nearly as possible to its pre-construction appearance. Cleanup would take place during construction as needed.

Transmission line construction manpower and equipment

Men and equipment required for this project would be divided into seven groups, each group corresponding to a specific transmission line, as follows:

Kaiparowits-phoenix (299 miles)

Kaiparowits-Navajo (47 miles)

Kaiparowits-Eldorado (269 miles)

Kaiparowits-Moenkopi (114 miles)

Moenkopi-Mohave (194 miles)

Devers-Mohave (187 miles - two lines)

Devers-Serrano (80 miles - two lines)

Construction would require between 100 and 230 men during peak construction periods for each line, depending on length of the transmission line, with no more than 20 men working at a single structure site. Maximum number of men reporting to a single job shop location would be 180.

Men and equipment required for the Devers-Mohave and Devers-Serrano transmission lines would be for construction of one line only. Actually, two lines would be constructed on these rights-of-way one year apart and the men and equipment required would be approximately the same for each line.

Probably 50 to 75 percent of workers engaged in the construction of any one of these transmission lines would be domiciled in trailers personally owned or owned by contractors. The remainder would find lodging in motels nearby the work area if they are available. In instances where no commercial lodging is available, contractors would provide camps to accommodate the workers. The latter situation could arise for the Kaiparowits to Eldorado segment. At this time the western participants do not know where these camps might be located or what size they would be. It is necessary that the workers would not have to travel for longer than one hour to the work area.

Substation construction considerations

Site preparation work at Eldorado, Moenkopi, Mohave, Navajo, Serrano, and Westwing would be minimal (limited to fine grading) and confined within fenced-off perimeters of existing substations. The Devers Substation 500 kv switchrack addition would require preparation of a graded pad 2,430 feet by 2,460 feet. Preliminary design indicates an approximate balanced cut and fill operation at Devers.

All substation vehicular equipment activity would be confined within perimeters of existing substation facilities. Parking of vehicles would be within confines of substations. Grading activities and erosion control measures at Devers Substation would be limited to site preparation for the 500 kv switchrack addition.

Normal working hours for construction personnel would be a five-day work week from 8:00 a.m. to 5:00 p.m. Weekend work or work at hours other than normal would be minimal.

Participants say construction personnel would be required to utilize existing sanitation facilities at each substation. Portable construction sanitation faciliities would be provided, if necessary. Appropriate dust abatement techniques would be utilized where soil conditions or construction activities warrant.

Substation construction sequence

The construction sequence at each site would be grading (where required), installation of foundations, steel erection, equipment installation and equipment connection followed by appropriate testing prior to energizing the equipment.

Substation manpower and equipment

During peak construction, a maximum of 75 employees of varying skills would be assigned to construction of each substation. Major equipment to be used during construction would include grading and compaction equipment, concrete hauling vehicles, and cranes to erect heavy electrical apparatus.

Communications construction considerations

At sites where there are no access roads, construction and assembly would be performed by helicopter. Foundations of the communication building at each station would consist of shallow cast-in-place piles combined with deep rock anchors that extend into weathered rock. The anchors would provide resistance to uplift. Where possible, foundations would be located away from rock difficult to excavate. Under certain conditions, however, explosive charges might have to be used to loosen subsurface rock. Weathered rock footings would be excavated with pneumatic hammers and power augers. Building pads might be installed as either spread-or-slab type footings that need little excavation or grading. At sites where existing roads provide access, conventional construction methods would be used.

Communications system construction sequence

Construction of a relay station would consist of the following steps: site preparation, setting the foundations, erecting the building, tower and fuel tank enclosure, communication equipment installation, and site clean-up.

Communications system construction manpower and equipment

Approximately eight men would be employed at each site during peak construction periods. After completion of construction, the facility would normally be operated unattended. Visitations on a periodic basis are planned for preventative maintenance. Figure 49 indicates men and equipment involved in construction of these facilities.

FIGURE 49

Kaiparowits Generating Station

Communications System Construction Activities

PERSONNEL REQUIRED

(Number)

Site Preparation	Foundation Setting	Building and Walls Erecting	Communication Equipment Installation	Site Clean-up
3	5	8	6	3

EQUIPMENT REQUIRED

Site Preparation	Foundation Setting	Building and Walls Erecting	Communication Equipment Installation	Site Clean-up
Helicopter, Engine-Generator Set, Sanitary Facilities, Water Tank	Air compressor, Concrete Mixer, Engine-Generator Set, Pneumatic Hammer, Rock Drill, Sanitary Facilities, Water Tank	Engine-Generator Set, Helicopter, Sanitary Facilities, Water	Engine-Generator Set, Sanitary Facilities, Water Tank	Engine-Generator Set, Sanitary Facilities, Water Tank

Generating plant operation

The proposed units are expected to be base-loaded and would not be purposely shutdown except for maintenance. Unit overhauls would be scheduled every fourth year after the first overhaul, which would take place within one year of the startup. Barring any major equipment damage, these overhauls typically would require between eight and ten weeks. Additionally, units would be removed from service twice yearly for approximately a two-week period to accomplish minor repairs and inspections.

The number of unscheduled shutdowns would be difficult to predict and can only be based on previous experiences with similar equipment. The participants estimate that in the first year of operation, each unit would go through at least 40 unscheduled startups. As the unit matures, the number of startups would decline to 20 in the second year and ten annually thereafter. According to the participants, these unscheduled startups would not have an adverse effect on air quality. However, there would be the possibility of having off-standard emissions during the initial plant startups. These off-standard emissions might be high per unit of heat input, but their total would be much less than with the proposed plant operating under normal full-load conditions.

The estimated operating manpower for Kaiparowits would be 510 employees. Their background and education would vary greatly. This manpower would be proportionally divided into administrative, operations and maintenance classifications (Figure 50 shows the manpower breakdown).

Transmission system operation

All transmission lines would be patrolled at minimum intervals of 180 days by air and, on the western system once a year by ground vehicle to locate any damage which might adversely affect the integrity and reliability of the transmission line

FIGURE 50

Kaiparowits Generating Station
Operating Personnel, Projections and Skills

	Number Projected [a]	Approximate Generating Station Experience (Yrs.)	Journeyman	Years in Craft	Posting Required	SCE Testing	SCE Training
*Station Superintendent	1	10	No	No	Yes	Yes	Yes
*Supervisor of Plant Oper.	1	10	No	No	Yes	Yes	Yes
*Watch Engineers	10	7	No	No	Yes	Yes	Yes
*Operating Foreman	15	6	No	No	Yes	Yes	Yes
Control Operator	20	5	No	No	Yes	Yes	Yes
Asst. Control Operator	20	4	No	No	Yes	Yes	Yes
Plant Equipment Operator	70	2	No	No	Yes	Yes	Yes
Apprentice Plant Equip. Oper.	20	0	0	0	Yes	Yes	App.
*Security Officers	5	0	Special	Special	Yes		Yes
*Plant Engineer	1	5	No	No	Yes	Yes	No
*Asst. Plant Engineer	10	0	No	No	Yes	Yes	No
Supv. of Instrumentation	1	7	Test or/Inst.	10	Yes	Yes	No
Instrument Foreman	2	6	Test or/Inst.	10	Yes	Yes	No
Instrument Technician	15	5	Inst.	5	Yes	Yes	Yes
Test Electrician	6	5	Yes	5	Yes	Yes	Yes
*Clerical Supervisor	1	8	N/A	No	Yes	Yes	Yes
*Supv. Clerk	2	7	No	N/A	Yes	Yes	Yes
Jr. Clerks	5	0	No	No	Yes	Yes	No
Clerks	5	3	No	No	Yes	Yes	Yes
*Supv. Plant Maintenance	1	10	10	10	Yes	Yes	Yes
Crafts Foreman	15	8	5	5	Yes	Yes	Yes
Boiler & Condenser	50	5	3	5	Yes	Yes	No
Electrical	30	5	3	3	Yes	Yes	No
Welders	15	5	3	3	Yes	Yes	No
Machinists	30	5	3	3	Yes	Yes	No
Craft Helpers	50	0	0	1	Yes	Yes	Yes
Laborers	50	0	0	0	No	Yes	No
Ash & Fuel Handlers	50	1	0	0	Yes	Yes	Yes
Chemical Tech.	5	3	3	3	Yes	Yes	Yes
Utilityman	4	0	0	0	No	Yes	No
	510						

*NOTE: SCE Management
a Approximately 10% - 20% operation personnel will be obtained locally

system. More frequent patrol would be made during fire or storm seasons.

Transmission lines and associated right-of-way would be maintained to the participants' standards of repair and safety, acceptable to the applicable regulatory agencies.

Only non-emergency major maintenance and repair that would be necessary would be replacement of insulators. Usually when such replacement was required, it would be for damage caused by vandals or line surge and lightning-induced flashovers. The participants anticipate that insulators would not have to be washed. However, if particulate contamination did occur, insulators would be spot washed once or twice a year. Types of cleaning agents to wash the insulators have not be identified by the participants.

Access roads on the western system would be maintained as near their original state as possible. Annual grading is planned. Crews would not deviate from either the alignment or grade of these roads while performing maintenance work, and vehicles would be confined to existing access roads during routine maintenance work. Access roads on the southern system would normally be closed at the end of construction.

Eldorado Substation

Eldorado Substation is an existing 500/200 kv substation. Additional equipment required for the Kaiparowits Project would not have a significant effect on operation and maintenance of the facilities. The station is fully-manned with 23 employees providing 24-hour operation and daily maintenance of equipment and grounds.

No additional vehicles would be required for equipment added as part of the Kaiparowits Project. Existing facilities for the handling of transformer oil are adequate. It would be necessary to store some spare parts for periodic and routine repairs of substation equipment.

Moenkopi Switchyard

Moenkopi is an existing 500 kv switchyard. Additional equipment required to terminate the proposed Kaiparowits and Mohave lines would not have a significant effect on operation and maintenance of facilities. The station is not manned. Maintenance manpower requirements are furnished by the APS office in Flagstaff, Arizona.

No additional vehicles would be required for equipment added as part of the proposed Kaiparowits Project. Existing facilities are adequate for handling maintenance and spare part storage.

Mohave Generating Station

The Mohave Generating Station has an existing 500 kv switchyard. Additional equipment required for the proposed Kaiparowits Project would not have a significant effect on operation and maintenance of facilities. The station is fully manned with a 24-hour operation and daily maintenance of equipment and grounds.

No additional vehicles would be needed for the Kaiparowits Project. Adequate facilities and spare parts exist for oil handling and routine repairs of substation equipment.

Devers Substation

This station is presently operated on a 24-hour basis and is manned by approximately 21 employees. It may be necessary to include an additional six employees for maintenance and operation of facilities that would be included in the proposed Kaiparowits portion. Two would be for 24-hour operating personnel and supervision. Approximately four additional employees would be required for maintenance of equipment and grounds. It is estimated that the following additional vehicles would be required:

One pickup truck

One maintenance truck

One fork lift vehicle

The western participants say the increase in personnel and vehicles would not add significantly to traffic flow of the area.

One additional 4,000-gallon oil tank would be required for tap changer oil handling. The 500 kv installation at this location would require a new supply of spare parts to be maintained at this station for periodic and routine repairs of new equipment. Additional enclosed storage space would be necessary.

Serrano Substation

This substation is presently being constructed and would be manned and operated on a 24-hour basis. Maintenance of equipment and grounds would be a continual operation five days a week during daytime hours. When completed, the substation will be manned by approximately 22 employees. Twelve employees would be needed for the 24-hour operation plus overall substation supervision. Seven maintenance men and testmen would be needed at this substation and project landscaping would require three utilitymen.

It is estimated that the following vehicles would be required for Serrano Substation:

One compact sedan

Two pickup trucks

One one-ton van

One electric yard runabout

One maintenance truck

One utility tractor and hauling trailer

One fork lift vehicle

Two 20,000-gallon tanks and one 4,000-gallon tank would be required for oil handling during construction and maintenance periods. All participant stations of this type are provided with an adequate supply of spare parts for periodic and routine repairs and replacement of station equipment. These parts would be stored and maintained at the station during the life of the facility.

Navajo Generating Station Switchyard

Navajo Generating Station includes an existing 500 kv switchyard. Additional equipment required for the proposed Kaiparowits project would not have a significant effect on operation and maintenance of the facilities. The generating station is permanently manned by the Salt River Project. Operation and maintenance manpower requirements for the switchyards are furnished by the APS office in Flagstaff, Arizona, but it is not permanently manned.

No additional vehicles would be required for equipment added as part of the Kaiparowits Project. Existing facilities are adequate for handling maintenance and spare part storage.

Westwing Switchyard

Westwing is an existing 500 kv switchyard. Additional equipment required to terminate the proposed Kaiparowits line would not have a significant effect on operation and maintenance of facilities. The station is near Phoenix and is manned by local operation and maintenance personnel.

No additional vehicles would be required for equipment added as part of the proposed Kaiparowits Project. Existing facilities are adequate for handling maintenance and spare part storage.

Communications system

Microwave facilities would be unmanned. For those sites where no electricity is available, power would be supplied by on-site generators. Refueling for these facilities would be done by helicopter every three to five months. Where electricity was available, standby generators would be made available in the event of electrical outages.

Maintenance crews would conduct visits only as required to maintain reliable service.

Employment and housing

Construction phase of the Kaiparowits Project would reach a peak four years after construction begins. By the ninth year, construction would be nearly complete. As construction employment phases out, mine and plant operation employees would be growing in numbers. Thus, in the tenth year after construction begins, there would be a permanent labor force of 3,135 (see Figure 45, page I-272).

Permanency of this industry and labor force depends on economics of the industry. Account life of the plant -- over which facilities are depreciated and capital costs recovered -- would be 35 years. This period of time would not be the physical life of the plant.

Participants in the Kaiparowits Project would support the Kaiparowits Planning and Development Council in its work and may pay for authorized studies on a negotiated basis (with the Council) to assist in implementation of the community development process. The companies intend to participate in the planning to ensure adequate phasing-in of facilities to meet their needs. Complexity of new town development may cause some delays; therefore, if it appears that housing and service facilities would not be available as needed, the companies propose to develop the facilities. If necessary the companies propose to develop necessary housing for plant, mine and construction workers for a three-year period.

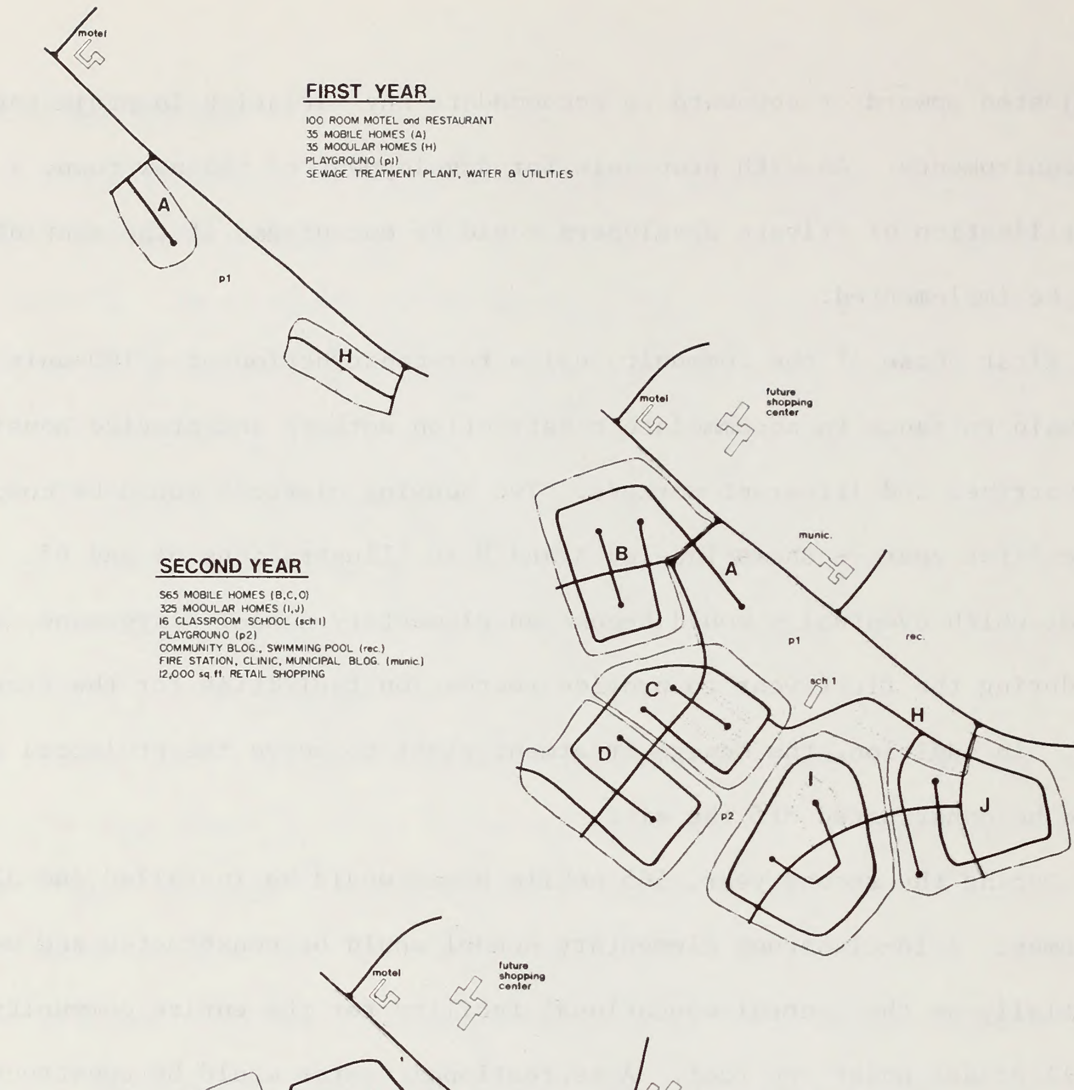
The proposed action, known as the contingency plan, would involve development of portions of the new town in a time frame to support construction workers and their families. (See Appendix I-11 for description of the new town and Appendix I-13 for Contingency Housing Plan.)

This contingency plan provides for a delay of up to three years between the start of construction of the Kaiparowits project and actual development of the new community under the direction of the Planning and Development Council. It allows for construction of more than 2,000 housing units in a framework that can be adjusted upward or downward to accommodate any variation in projected housing requirements. As with proposals for development of the new town, a maximum utilization of private developers would be encouraged if the contingency plan must be implemented.

First phase of the community calls for construction of a 100-unit motel near the main entrance to accommodate construction workers and provide housing for newly-arrived and itinerant workers. Two housing clusters would be completed within the first year -- those labeled A and H in Illustrations 64 and 65. A playground, which eventually would become an elementary school playground, would be begun during the first year to provide recreation facilities for the first residents. In addition, the sewage treatment plant to serve the projected development would be constructed off the site.

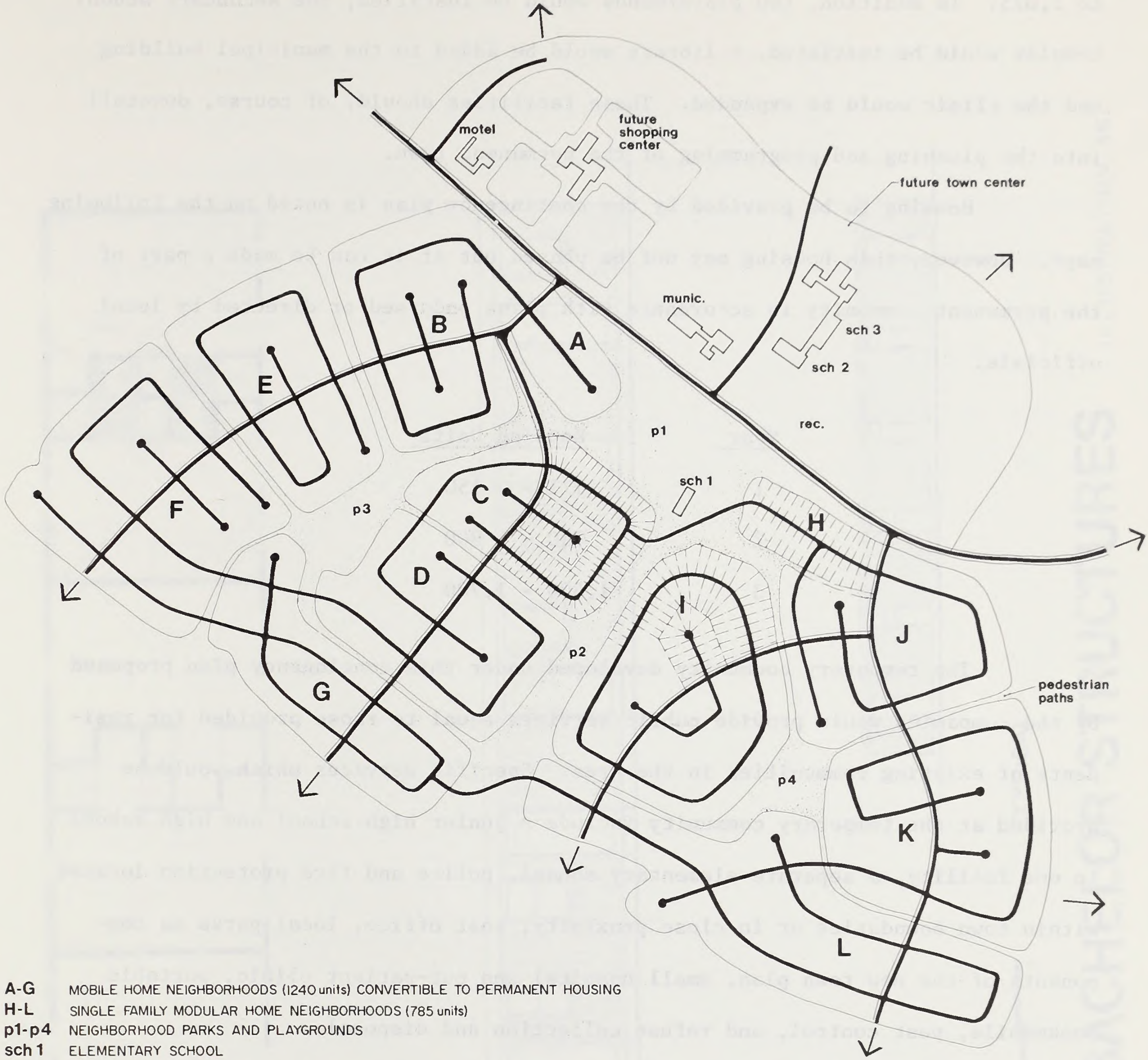
During the second year, 565 mobile homes would be installed and 325 modular homes. A 16-classroom elementary school would be constructed and would serve initially as the central educational facility for the entire community, housing all grades under one roof. A recreational center would be constructed during this year and would provide a community building, swimming pool, and areas for court games. A municipal building would be started to provide fire protection and a clinic. The first phase of a future shopping center would also be completed to provide approximately 12,000 square feet of shopping area. Altogether, 890 dwelling units would be installed during the second year, bringing the total number of units available to 960, not counting the 100-room motel. Cooperation of local and state agencies would be required in development of educational and health facilities.

During the third year, 640 mobile home units and 425 modular units would be constructed. These 1,065 units would bring the total units available



PHASING PLAN
KAIPAROWITS PROJECT
A COMMUNITY FOR CONSTRUCTION WORKERS
SOUTHERN CALIFORNIA EDISON COMPANY
TYPICAL

ILLUSTRATION 64



A-G MOBILE HOME NEIGHBORHOODS (1240 units) CONVERTIBLE TO PERMANENT HOUSING
H-L SINGLE FAMILY MODULAR HOME NEIGHBORHOODS (785 units)
p1-p4 NEIGHBORHOOD PARKS AND PLAYGROUNDS
sch 1 ELEMENTARY SCHOOL
sch 2 MIDDLE SCHOOL — master planned to become educational center
sch 3 HIGH SCHOOL
rec. RECREATION CENTER (community bldg., pool, day-care center, playfields)
munic. MUNICIPAL BUILDING; FIRE STATION; CLINIC; LIBRARY
COLLECTOR STREETS
→ POTENTIAL FOR FUTURE GROWTH

sewage treatment plant location to be determined *

CONCEPT PLAN
KAIPAROWITS PROJECT

A COMMUNITY FOR CONSTRUCTION WORKERS
SOUTHERN CALIFORNIA EDISON COMPANY

TYPICAL

ILLUSTRATION 65

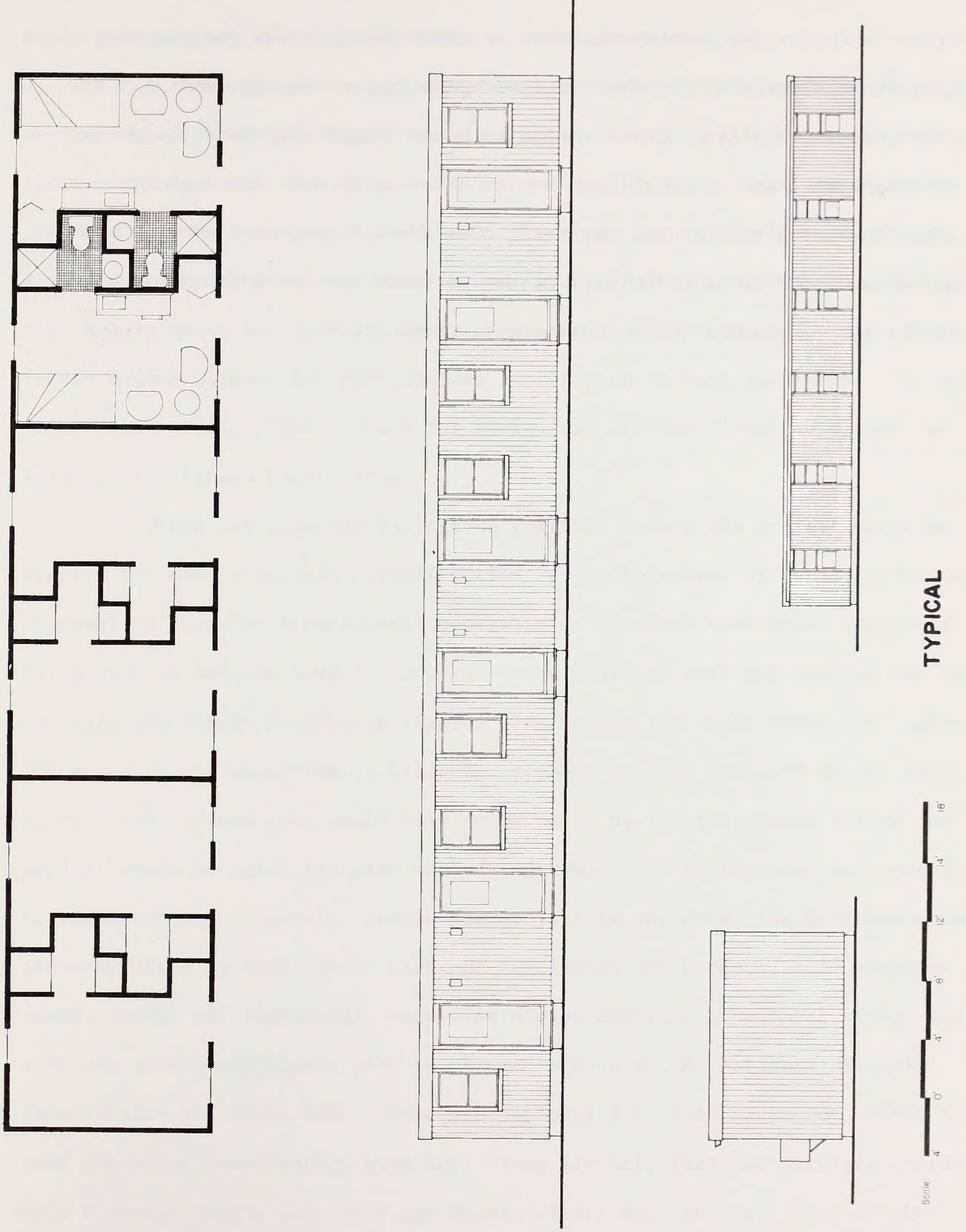
to 2,025. In addition, two playgrounds would be installed, the secondary school complex would be initiated, a library would be added to the municipal building and the clinic would be expanded. These facilities should, of course, dovetail into the planning and programming of the permanent town.

Housing to be provided by the contingency plan is noted on the following page. However, this housing may not be phased out if it can be made a part of the permanent community in accordance with plans endorsed or directed by local officials.

Year	Housing Units
1	111 - 150
2	750 - 900
3	1,500 - 1,700

The temporary community developed under this contingency plan proposed by the companies would provide public services equal to those provided for residents of existing communities in the area. Specific services which would be provided at the temporary community include a junior high school and high school in one facility, a separate elementary school, police and fire protection located within town boundaries or in close proximity, post office, local parks as components of the new town plan, small hospital and out-patient clinic, portable bookmobile, pest control, and refuse collection and disposal.

Temporary bachelor quarters may be established separate from the site for the new community, if this would expedite bachelor housing. This facility would consist of 400 - 600 individual "motel type" living quarters, a cafeteria, recreation facilities (including a game room and TV room), a lounge, a private bath in each unit, and laundry facilities. This construction camp would use modular units, which would be removed after completion of the project. Design of these units is shown in Illustration 66.



SIX ROOM BACHELOR STRUCTURES

ILLUSTRATION 66

It is anticipated that coordination among the participants, developers, state and Kane County officials would be necessary to carefully determine levels of service. Whenever new town development or other local facilities can meet the needs, the companies would defer to their planning and development. In the absence of adequate facilities, the companies would insure that such facilities would be established and would take an active interest to see that housing conditions, community recreation, aesthetic amenities, transportation services, and other needs would be supplied soon after the needs can be anticipated. See page 315 for the proposal for the permanent new town.

ACTIONS REQUIRED OF GOVERNMENT AGENCIES

It must be emphasized that the four companies are proponents of the Kaiparowits Project. However, in order to allow the project to be completed it would be necessary for the government to take several actions.

Actions by the Federal Government are actually the ones that make this environmental impact statement necessary. Key federal actions already taken include the issuance of a water contract and coal leases. Also three special land use permits have been issued. The first one was to Southern California Edison Company for a weather station and meteorological monitoring studies on both Nipple Bench and Fourmile Bench. The second permit was to Southern California Edison Company for geotechnical exploration at both locations. The third permit was to Mono Power Company for biological studies conducted within the Kaiparowits Plateau Impact Area.

Other key governmental action required before the project could be started includes favorable classification by the Secretary of the Interior and approval of transfer from federal ownership of the land upon which the generating station and new town is proposed. The State of Utah has applied for the Fourmile and Nipple Generating Station sites under its state selection rights. The state if the selection is allowed, proposes to sell the land to the participants. Key actions that would have to be taken by the government before the project could be initiated also include approval of a mining plan and granting of rights-of-way. Overall, should the project be approved, the government would transfer title to land, grant right-of-way leases and permits, sell minerals (sand, gravel and limestone), supervise mining operations, enforce safety standards and assure compliance with requirements such as the National Historic Preservation Act (Sec. 106), Endangered Species Act, Bald Eagle Act, Sikes Act, Land and Water Conservation Fund Act, Clean Air Act, Fish and Wildlife Coordination Act, Historic Trails Act, Wild and Scenic Rivers Act, and Section 4 of the Transportation Act.

Government agencies would respond to all applications as required by law and regulations. At the present time the only new applications filed with the Federal Government are state indemnity lieu selections for the two plant sites. The following governmental agencies have responsibility to take various actions should the project be approved. Citations for authority follow the listed agency.

Federal

Bureau of Land Management would:

Consider appropriate classification action under regulations contained in 43 CFR 2400. Classification would determine suitability of land described in applications from the State of Utah for disposal by state indemnity lieu selection. This classification action is fully discretionary with the secretary. of the Interior

Based on the classification action, approve or disapprove state indemnity lieu selections to transfer title of federal land to the state of Utah for subsequent transfer to private or other ownership for power plant and new town sites. --- (R.S. 2275, 2276, as amended; 43 U.S.C. 851; 43 CFR, Part 2620).

Grant rights-of-way for:

Tram roads for mine access, coal haul road, conveyor belt, etc. -- Act of January 21, 1895 (28 Stat. 635; 43 U.S.C. 956; 43 CFR, Part 2810).

Roads and Highways -- (23 U.S.C. 107, or R.S. 2477; 43 U.S.C. 932; 43 CFR, Part 2820).

Power transmission lines -- Act of March 4, 1911 (36 Stat. 1253; 43 U.S.C. 961; 43 CFR, Part 2850).

Communications sites -- Act of March 4, 1911 (36 Stat. 1253; 43 U.S.C. 961; 43 CFR, Part 2850).

Grant recreation and public purposes lease/sale for sanitary land fill area -- Act of June 14, 1926 (44 Stat. 741; 43 U.S.C. 869, 869-4; 43 CFR, Subparts 2740 and 2912).

Grant special land use permits as necessary for purposes not specifically provided for by existing law -- (R.S. 446, 453 and 2478, as amended; 43 U.S.C. 1, 2, 1201; Act of July 14, 1960 (70 Stat. 506; 43 U.S.C. 1361, 1364: 43 CFR, Part 2920).

Consider exchanges (state or private) if necessary to pass title to lands under other authority than state selection -- Sec. 8 of the Act of June 28, 1934 (48 Stat. 1272, as amended; 43 U.S.C. 315g; 43 CFR, Part 2200)

Grant permits for mineral materials disposal (sand, gravel, limestone, if appropriate, etc.) -- Act of July 31, 1947, as amended (30 U.S.C. 601, 602, 43 CFR, Part 3600).

Consider transfer of title under general mining laws of mining claims on National Forest Lands for limestone (if appropriate) -- Act of May 10, 1892 (17 Stat. 91), as ammended and supplemented (30 U.S.C., Sec. 21, et. seq.; 43 CFR, Group 3800).

Protect archaeological values -- Archaeological Preservation Act of May 24, 1974 (88 Stat. 174, P.L. 93-291, 16 U.S.C. 469) which amends the Reservoir Salvage Act of 1960, which states:

> Wherever" ... any Federal construction project of federally licensed project, activity, or program may cause irreparable loss or destruction of significant scientific, prehistorical, historical, or archaeological data, such agency shall notify the Secretary, in writing, and shall provide the Secretary with appropriate information concerning the project, program, or activity. Such agency may request the Secretary to undertake the recovery, protection, and preservation of such data (including preliminary survey, or other investigation as needed, and analysis and publication of the reports resulting from such investigation ...." (16 U.S.C. 469a-1)

It is the position of BLM that if any portion of the Kaiparowits program is approved on the basis of the EIS, and prior to initiation of such a program, full compliance with guidelines developed pursuant to the Archaeological Preservation Act will be necessary.

Bureau of Indian Affairs would:

Grant rights-of-way for power transmission lines over Navajo, Haulapai, Kaibab, Morango and Aqua Caliente Indian Reservations with concurrence of respective tribal councils -- Act of February 5, 1948 (62 Stat. 17; 25 U.S.C. 323-328).

National Park Service would:

Grant rights-of-way for:

Power transmission lines -- Act of March 4, 1911 (36 stat. 1253; 43 U.S.C. 961; 43 CFR, Part 2850), as applied to NPS in 43 CFR 2801.1-7.

Water plants, pipelines, etc. -- Act of February 15, 1901 (31 Stat. 790; 43 U.S.C. 959; 43 CFR, Subpart 2873), as applied to NPS in 43 CFR 2801.1-7 which states (emphasis added):

> "The act of March 3, 1921 (41 Stat. 1353; 16 U.S.C. 797), provides that no right-of-way for dams, conduits, reservoirs, power houses, transmission lines, or other works for storage or carriage of water, or for the development, transmission, or utilization of power within the limits as then constituted of any national park or monument, shall be approved without specific authority of congress.
>
> "Pursuant to any statute, including those listed in this subpart, applicable to reservation lands administered by the National Park Service, rights-of-way over or through such lands will be issued by the Director of the National Park Service, or his delegate, under the regulations of this subpart."

Bureau of Reclamation:

On January 15, 1964, Resources Company filed application No. 35818 with the Utah State Engineer to appropriate 200,000 acre-feet of water from Lake Powell for consumptive use and 13,500 cubic feet per second for cooling purposes. The Bureau of Reclamation and other interested parties protested granting this application. The Bureau of Reclamation protested on grounds the application would have an adverse effect upon the Central Utah Project, Juniper Project and other plans being considered, and that use of water stored in Lake Powell would require an agreement with the United States.

A hearing on the application was held by the Utah State Engineer on December 14, 1964. At this hearing, Resources Company amended the application by eliminating the requirement for 13,500 cubic feet per second and also reduced the total annual water diversion and depletion from 200,000 acre-feet to 102,000 acre-feet. Subsequent to this hearing, negotiations between the parties produced two agreements.

On May 19, 1965, an agreement was executed among the Central Utah Water Conservancy District, Resources Company, Associated Southern Investment Company, and New Albion Resources Company. This agreement concerns primarily priority use of Colorado River waters between the Kaiparowits Power Project (initial phase) and the ultimate phase of the Central Utah Project (see Appendix I-4).

The other agreement, known as the Indian Deferral Agreement, was completed on September 20, 1965, by the United States of America acting through Bureau of Reclamation and Bureau of Indian Affairs, Ute Indian Tribe and Central Utah Water Conservancy District. The Indian Deferral Agreement concerns primarily deferment of use of irrigation water on some Indian water right land until development of the ultimate phase of the Central Utah Project (see Appendix I-5).

By letter to the State Engineer dated August 31, 1965, Resources Company recognized the above agreements and stated,

> "The undersigned are willing and do hereby recognize and acknowledge the priority of the rights of the Ute Indian Tribe to use Colorado River water to the extent of the irrigation requirements of the irrigable Indian water right lands as set forth above (i.e. in the Deferral Agreement); provided that this recognition and acknowledgement of Indian water rights is conditioned upon execution of the Indian Deferral Agreement by all of the parties thereto; provided further that this recognition and acknowledgement of Indian water rights by the undersigned shall terminate upon termination of Indian Deferral Agreement."

This letter led to the State Engineer's approval of application No. 35818 in a Memorandum Decision dated September 3, 1965 (see Appendix I-6).

Priority date given the application was January 15, 1964, with proof of appropriation due November 30, 1970. Approval was made subject to the above letter and a number of other conditions as set forth in the Memorandum Decision. The letter and the two agreements were included as exhibits to the memorandum.

An extension of time to submit proof of appropriation for application No. 35818 was granted to November 30, 1975, by the Utah State Engineer. Extension was contingent upon the provision that Resources Company would make a progress report to the Utah State Engineer each year and that further extension of time would be critically reviewed.

Lake Powell was developed by the United States Department of the Interior pursuant to the Colorado River Compact, Colorado Storage Project Act of 1956, and decision of the United States Supreme Court in Arizona v. California. The United States has authority to sell water from the storage facility within compact allotments to customers within the respective states adjacent to storage facilities in cooperation with such states. Pursuant to this authority and with concurrence of the State of Utah, a Contract for Water Service from Lake Powell was executed between the United States and Resources Company on October 2, 1969 (see Appendix I-7). This contract defines terms by which water from Lake Powell would be sold to Resources Company. The item of primary interest in this contract is the Schedule of Water Service from Lake Powell which is included in the contract as Article 7, which is as follows:

Water Schedule

7. The contractor's right to water service from Lake Powell shall be in accordance with the following schedule:

Year	Water to be taken (acre-feet)
1977	3,825
1978	19,125
1979	30,600
1980	30,600
1981	30,600
1982	34,425
1983	49,725
1984	61,200
1985	61,200
1986	61,200
1987	66,300
1988	85,700
1989 and for each successive year thereafter	102,000

(a) Provided that:

(i) Commencing with the year 2011 A.D., the furnishing of water service in excess of 82,000 acre-feet per year shall be subject to and subordinant to the call upon Utah's apportionment of water from the Colorado River and its tributaries pursuant to the Upper Colorado River Basin Compact for the Central Utah Project, Ultimate Phase;

(ii) Commencing with the year 2021, the furnishing of water service in excess of 62,000 acre-feet per year shall be subject to and subordinate to the call upon Utah's apportionment of water from the Colorado River and its tributaries pursuant to the Upper Colorado River Basin Compact for the Central Utah Project, Ultimate Phase; and

(iii) Commencing with the year 2031, the furnishing of any water service shall be subject to and subordinate to the call upon Utah's apportionment of water from the Colorado River and its tributaries pursuant to the Upper Colorado River Basin Compact for the Central Utah Project, Ultimate Phase.

(b) The Contractor may from time to time increase the quantities of water to be taken from under the above schedule, up to the maximum of one hundred and two thousand (102,000) acre-feet, or up to any lesser maximum quantity as has resulted from any relinquishment pursuant to Article 7(c) or withdrawal pursuant to Article 4 hereof, by giving six (6) months written notice to the United States.

(c) The Contractor shall have the right to relinquish permanently a portion of its right to water service provided by this contract by giving two (2) years written notice to the United States stating the quantity of water service to be relinquished. In the event of such relinquishment the Contractor shall have no further payment obligation with respect to the water service relinquished."

Entitlement to the use of water from Lake Powell for the Kaiparowits Power Plant is therefore, after execution of the Water Service Contract with the United States, dependent upon retention of water right application No. 35818 in good standing with the Utah State Engineer. Every five years (1975, 1980, etc.) the contract is subject to renewal and the state has the right to cancel water entitlement not being used by the participants.

The Contract for Water Service from Lake Powell and the Utah State Engineer Memorandum Decision are on file at the Bureau of Reclamation Upper Colorado Regional Office in Salt Lake City, Utah.

Two other significant agreements relating to the Kaiparowits Power Project have been executed between the United States and the participants. These agreements are known as the Kaiparowits and Navajo Mutual Assistance Agreement and the Kaiparowits Power Coordination Contract.

The Kaiparowits and Navajo Mutual Assistance Agreement was executed between the United States, San Diego Gas and Electric Company and Southern California Edison Company (see Appendix I-8). The agreement provides for mutual assistance in times of unit outages at the Kaiparowits and Navajo projects through exchange of capacity and associated energy between the first three generating units of the Navajo Project and the first three generating units of the Kaiparowits Project.

The Kaiparowits Power Coordination Contract was executed between the United States and Arizona Public Service Company, San Diego Gas and Electric Company and Southern California Edison Company (see Appendix I-8). This agreement provides for coordination of thermal-electric systems of the companies with the Colorado River hydroelectric system of the United States (see Appendix I-9).

None of the agreements between the State of Utah or the Bureau of Reclamation and the Resources Company has given right-of-way to or special use permit for use of public land for construction of this project by the participants.

U. S. Geological Survey would:

Prepare an environmental analysis, as required by Geological Survey procedures, upon receipt of formal mining plans, which must be technically and administratively acceptable to the USGS Area Mining Supervisor. The analysis will include a comparison of the formal plans with the general proposal herein evaluated and so determine the extent to which the two are identical and the extent to which potential impacts have been identified and evaluated in this EIS. The purpose of the environmental analysis is to provide a basis for determination as to whether or not an additional environmental impact statement is required.

Administer operations of coal leases -- Sec. 32 of the Act of February 25, 1920 (41 Stat. 450; 30 U.S.C. 189); Sec. 10 of the Act of August 7, 1947 (61 Stat. 915; 30 U.S.C. 359; 30 CFR, Part 211); Secretary's (of the Interior) Order No. 2948 dated October 6, 1972; and 43 CFR, Part 23.

Mining Enforcement and Safety Administration would:

Administer safety standards for underground coal mines -- Federal Coal Mine Health and Safety Act of 1969 (83 Stat. 745; 30 U.S.C. 811; 30 CFR, Part 75).

Administer safety standards for open pit metal and nonmetalic mines (limestone) -- Sec. 6 of the Federal Metal and Nonmetalic Mine Safety Act of September 16, 1966 (P.L. 89-577; 80 Stat. 774; 30 U.S.C. 725; 30 CFR, Part 55).

Environmental Protection Agency would:

Be responsible for implementation and compliance with clean air and water requirements -- Clean Air Act of July 14, 1955, as amended (69 Stat. 322; 42 U.S.C. 1857-1857g), as amended by PL ii-206 of December 17, 1963, (77 Stat.

392; 42 U.S.C. 1857), and E.O. 11282 of May 26, 1966; and Water Pollution Control Act of June 30, 1948 (62 Stat. 1155; 33 U.S.C. 466), as amended October 18, 1972 (86 Stat. 816; 33 U.S.C. 1251-1376), and E.O. 11288 of July 2, 1966.

Federal Communications Commission would:

Grant licenses for communication stations as necessary -- Act of June 19, 1934 as amended (48 Stat. 1092; 47 U.S.C. 303; 47 CFR 1.70).

Federal Aviation Agency would:

Assure compliance of law and regulations relating to the Federal Aviation Act of 1958, P.L. 85-726, August 23, 1958 (72 Stat. 749, 797; 49 U.S.C. 1348, 1501; 14 CFR, Part 77).

U.S. Forest Service would:

Grant power transmission line rights-of-way -- Act of March 4, 1911 (35 Stat. 1253; 16 U.S.C. 523; 36 CFR 251.50 - .64); or

Grant power transmission line permits -- Acts of June 4, 1897 (30 Stat. 35, as amended; 16 U.S.C. 551), and February 15, 1901 (31 Stat. 790; 16 U.S.C. 522; 36 CFR 251.65), as appropriate.

Work with BLM in considering tansfer of title of mining claims for limestone (if appropriate) -- General Mining Laws of May 10, 1872 (17 Stat. 91), as amended and supplemented (30 U.S.C., Sec. 21 et. seq.; 43 CFR, Group 3800; and 3600 CFR, Parts 251 and 252).

Atomic Energy Commission would:

Be responsible for control of radioactive air pollution from coal burning -- Atomic Energy Act of 1954 (68 Stat. 919; 43 U.S.C., Sec. 2011, et. seq. 10 CFR, Part 20).

Corps of Engineers would:

Be responsible to assure that there will be no obstruction of navigable waters (water pipeline intake structures in Lake Powell) -- Sec. 10 of the River and Harbor Act of March 3, 1899 (30 Stat. 1151; 33 U.S.C. 403).

State, local, and intergovernmental cooperation

Utah

Kaiparowits Planning and Development Advisory Council

On August 7, 1974, Governor Calvin L. Rampton of Utah created by executive order (see Appendix I-10) a Kaiparowits Planning and Development Advisory Council (PDAC) to "guide and coordinate activities related to energy development in Kane and Garfield Counties." The council is the representative for all state and local agencies in matters pertaining to the proposed Kaiparowits Project. The council consists of an executive committee of five voting members and an advisory council of 24 members, who do not vote. These five voting members are elected state and county officials.

New town

As the basis for this environmental impact statement, the Kaiparowits Planning and Development Advisory Council submitted a preliminary master plan which "identified or established East Clark Bench as the basic action proposal." The Council has not formally acted as of this date. The East Clark Bench site and preliminary master plan are therefore a suggested proposal. Call Engineering Inc., which was acting as engineering consultant for the council, revised the plan to include additional acreage (see Appendix I-11). The revised location of the suggested town site is as follows:

Legal description	Ownership
Township 42 South, Range 2 East	
Salt Lake Meridian	
Section 32, S ½	Federal
Township 43 South, Range 2 East	
Salt Lake Meridian	
Section 3, S ½ and NE ¼	Federal
Section 4, All	Federal
Section 5, All	Federal
Section 8, N ½	Federal
Section 9, All	Federal
Section 10, All	Federal and private
Section 11, All	Federal and private
Section 13, All	Federal and private
Section 14, All	Federal and private
Section 15, All	Federal
Section 16, All	State
Section 17 E ½	Federal
Section 20, E ½	Federal
Section 21, All	Federal
Section 23, N ½	Federal
Section 24, N ½	Federal and private

Total area is about 8,960 acres but the town would occupy approximately 2,240 acres. In addition, Call Engineering has considered alternate locations (see Chapter VIII).

The following is a description of the preliminary plan. Federal land would be acquired by the State of Utah. Then land required for the new town would be acquired by a private developer selected by the utility companies, Kane County, and the Kaiparowits Planning and Development Advisory Council. Land needed for public uses would be acquired by Kane County or, if elected by the developer, and through the cooperation of Kane County, by a newly formed special service District which would assist in funding, construction, operation, and maintenance of some or all of the public facilities.

The developer would construct and manage the new town. Planning, zoning, and building requirements would be regulated by a planning and engineering staff provided by Kane County. The staff would be employed by the county or be retained as consultants and would be paid out of fee and permit revenues or general taxes. The developer may need to advance some initial permit fees to finance the staff in early years of development.

Kane County would need to obtain federal, state, or private grants to help finance review and update of codes and regulations. Public services not provided by a special service district would be provided by Kane County and the county school district. The county and school district could seek federal, state, or private grants to aid in financing public services until taxes and other revenues were sufficient.

The developer would bear all costs of planning, engineering, and construction of the new town, and may provide either temporary or permanent school facilities, as appropriate, in initial phases of the new town. These costs would be recovered through sale or rental of residential units and commercial and industrial sites or buildings.

Figure 51 shows the kinds of components, acreages, number of sites, volumes of earth to be moved, and aggregates required, according to the new town master plans. (Additional data are shown in Appendix I-11.) Illustrations 67 and 68 represent the new town site and plan, respectively.

The town plan is intended to provide a range in service prices and residence density; access within a mile or less to schools, shopping, churches, community services, transportation and highways, recreation, and medical facilities. Natural open space or greenbelt buffers are proposed around the mobile home park and light industry and between the highway and the new town. The plan is tentative, however, and adjustments could be made.

Lots would vary in size from 4,000 square feet for mobile homes to 9,400 square feet for single family dwellings. Almost 800 acres of impervious surfaces consisting of buildings, parking lots, and streets are anticipated.

Preliminary design of the storm water control system is intended to provide protection from flash floods in developed areas, and assumes that intense,

FIGURE 51

Data for Proposed New Town at East Clark Bench

Components	Gross Acres	Dwelling Units	Number of sites	Impervious Surface (acres)	Volumes of earth to be Moved in grading Operations (cubic yards)	Aggregate Required (cubic yards) (Approximate)
Residential	1,120	5,139	-	303	1,456,000	Unknown
Commercial	45	-	6	43	768,500	Unknown
Light Industrial	135	-	2	120	195,000	Unknown
Public and quasi-public	380	-	29	Approximately 40-50	Approximately 881,000	Unknown
Recreation and open space	470	-	22+	-	-	Unknown
Streets, driveways, sidewalks, curbs, gutters, storm drains	90*	-	-	280	678,600	474,000
Water and sewer facilities	-	-	-	Unknown	260,000	75,000
Total	2,240	5,139	-	Approximately 786-796	4,239,100	549,000+

* Collector and arterial streets only

Source: Call Engineering, Inc.: Kaiparowits New Town, Environmental Impact Data, December 2, 1974.

PROPOSED NEW TOWNSITE

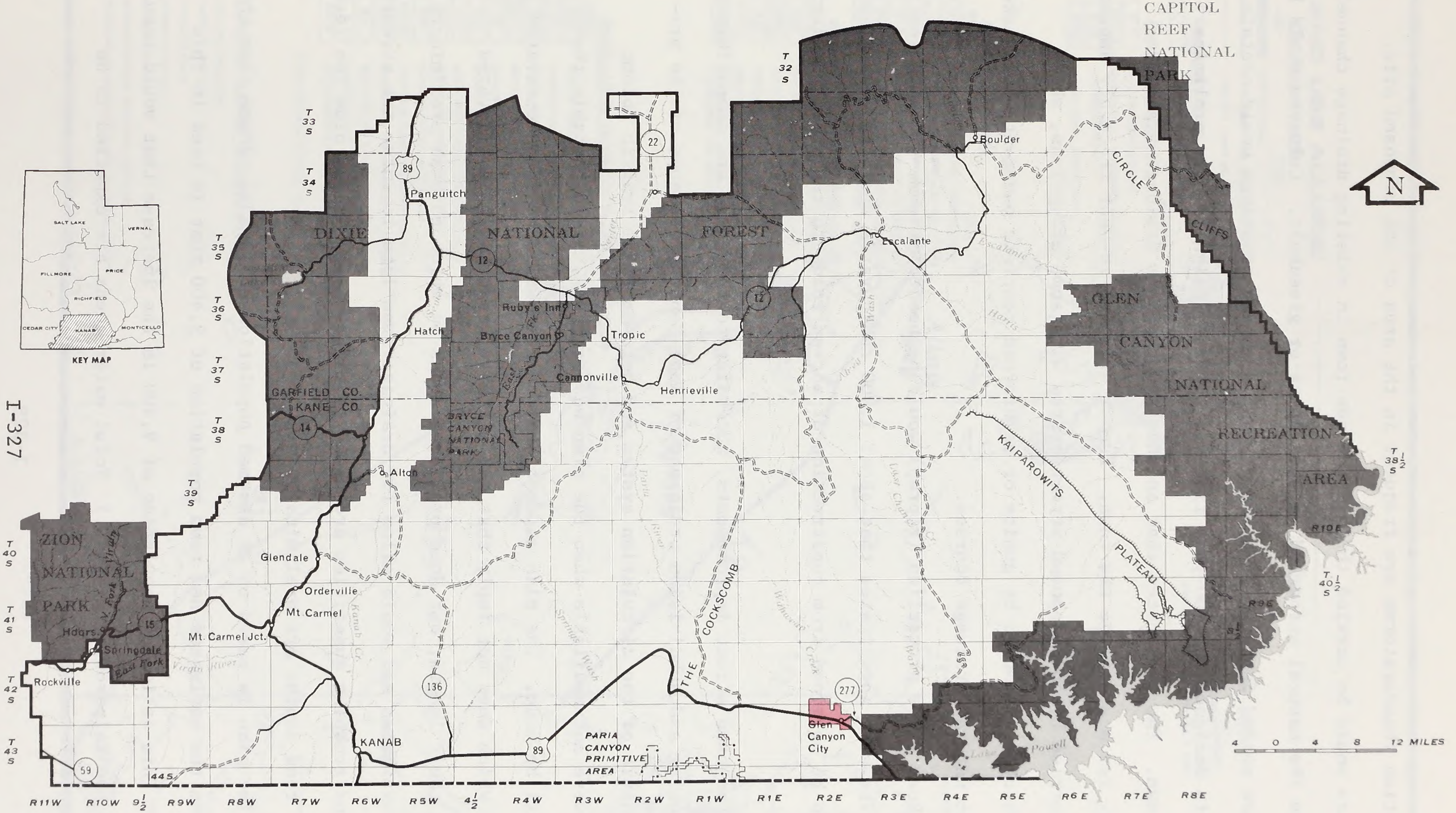


ILLUSTRATION 67

KANAB DISTRICT
1974
UTAH

short-duration thunderstorms are frequent in the area of the proposed site. Flood waters would be carried through the new town in existing drainage channels to preserve the natural streambed as open space or greenbelt. Culverts would be placed where needed for road crossings. Main drainage crossings would contain box culverts designed for 100-year floods. Culvert design is only preliminary at this stage. The plan notes that an underground storm drainage system is unnecessary for most of the new town. Runoff of up to 10-year frequency amounts could be carried by the proposed street system with some exceptions, where drainage ditches protected by gunite or reinforced concrete pavement would take the flow to natural drainage courses.

Rock slope protection (riprap) would be needed at some sites to control erosion. The plan anticipates that about 1,000 cubic yards would be needed, which could be obtained from construction of access roads to the mine and plant site.

Proposed street improvements, according to the plan, are compatible with the zoning and subdivision ordinance of Kane County. Because of the preliminary nature of the circulation system and because final traffic volume estimates were not available when the plan was prepared, it is probable that changes will be made. The plan assumes that streets would be in an excavated condition, which does not imply that all ultimate grades will be excavated throughout their length, but does provide a means on which to base preliminary earthwork estimates and would allow for drainage from lots to enter the streets. Clearing and grubbing quantities are based on right-of-way widths plus ten feet. Structural road depths are preliminary.

The plan is based on an assumed population of 15,234. (Note that this differs from the estimated new town population of 9,400 that is used in this statement. This estimated population of 9,400 is the increase that would result soley from the Kaiparowits project.) Total water needs are expected to be

PROPOSED NEW TOWN PLAN

LAND USE ALLOCATION

CIRCULATION

KEY	TYPE	GROSS ACRES
(double heavy line)	ARTERIAL	108.0 (Arterial and Collector & Industrial together)
(heavy line)	COLLECTOR & INDUSTRIAL	
(thin line)	LOCAL (NOT IN GROSS ACREAGE)	
	SUB-TOTAL	102.0

INDUSTRIAL

KEY	TYPE	GROSS ACRES
L-1	LIGHT INDUSTRIAL	162.0
	SUB-TOTAL	162.0

COMMERCIAL

KEY	TYPE	GROSS ACRES
C-1	NEIGHBORHOOD	12.0
C-1-A	MEDICAL-PROFESSIONAL	8.0
C-2	COMMUNITY	20.0
C-H	HIGHWAY SERVICES	21.0
	SUB-TOTAL	59.0

RESIDENTIAL

KEY	TYPE	GROSS ACRES	DWELLING UNITS	DENSITY (D.U./GR.AC.)
GAC	GARDEN APTS./CONDOMINIUMS	36.0	288	8.0
TDF	TOWNHOUSES/2 OR 4 PLEXES	87.0	522	6.0
SFC	SINGLE-FAMILY CLUSTER/PATIO	231.0	762	3.3
SFD	SINGLE-FAMILY DETACHED	475.0	1220	2.6
MHC	MOBILEHOME LOTS-CONVERTABLE TO SFD	343.0	1155	3.4
MHP	MOBILEHOME PARK-PERMANENT	252.0	1512	6.0
	SUB-TOTAL	1424.0	5459	3.8 AVE.

RECREATION & OPEN SPACE

KEY	TYPE	GROSS ACRES
CRC	COMMUNITY RECREATION & CULTURAL CTR.	30.0
NR	NEIGHBORHOOD PARKS	23.0
RRC	RESIDENTIAL RECREATIONAL CENTERS	11.0
GC	GOLF COURSE	133.0
(dashed lines)	GREENBELTS & BIKE/PEDESTRIAN WAYS	11.0
NOSB	NATURAL OPEN SPACE BUFFERS (INCLUDES 20 AC CEMETERY SITE)	326.0
	SUB-TOTAL	536.0

PUBLIC & QUASI-PUBLIC SERVICES

KEY	TYPE	GROSS ACRES	Nº SITES
CC	CIVIC CENTER	32.0	1
H	HOSPITAL	11.0	1
FS	FIRE STATIONS	2.0	2
MY	MAINTENANCE YARD	3.0	1
R	CHURCHES	10.0	5
ES	ELEMENTARY SCHOOLS	44.0	4
JH	JUNIOR HIGH SCHOOLS	30.0	2
SH	SENIOR HIGH SCHOOL	40.0	1
PS	PAROCHIAL SCHOOL	7.0	1
WTP	WATER TREATMENT PLANT	10.0	1-2
STP	SEWAGE TREATMENT PLANT	40.0	1-2
SL	SANITARY LANDFILL*	200.0	1
A	AIRPORT*	400.0	1
CBS	COMMUTER BUS STATIONS	12.0	8
	SUB-TOTAL	841.0	

* SEE SUPPLEMENTAL MAP

LAND USE SUMMARY

MAJOR CATEGORY	GROSS ACRES	% OF TOTAL
CIRCULATION	102	3.2
INDUSTRIAL	162	5.2
COMMERCIAL	59	2.0
RESIDENTIAL	1424	45.5
RECREATION & OPEN SPACE	580	17.0
PUBLIC & QUASI-PUBLIC SERVICES	841	27.0
	3124	100.0

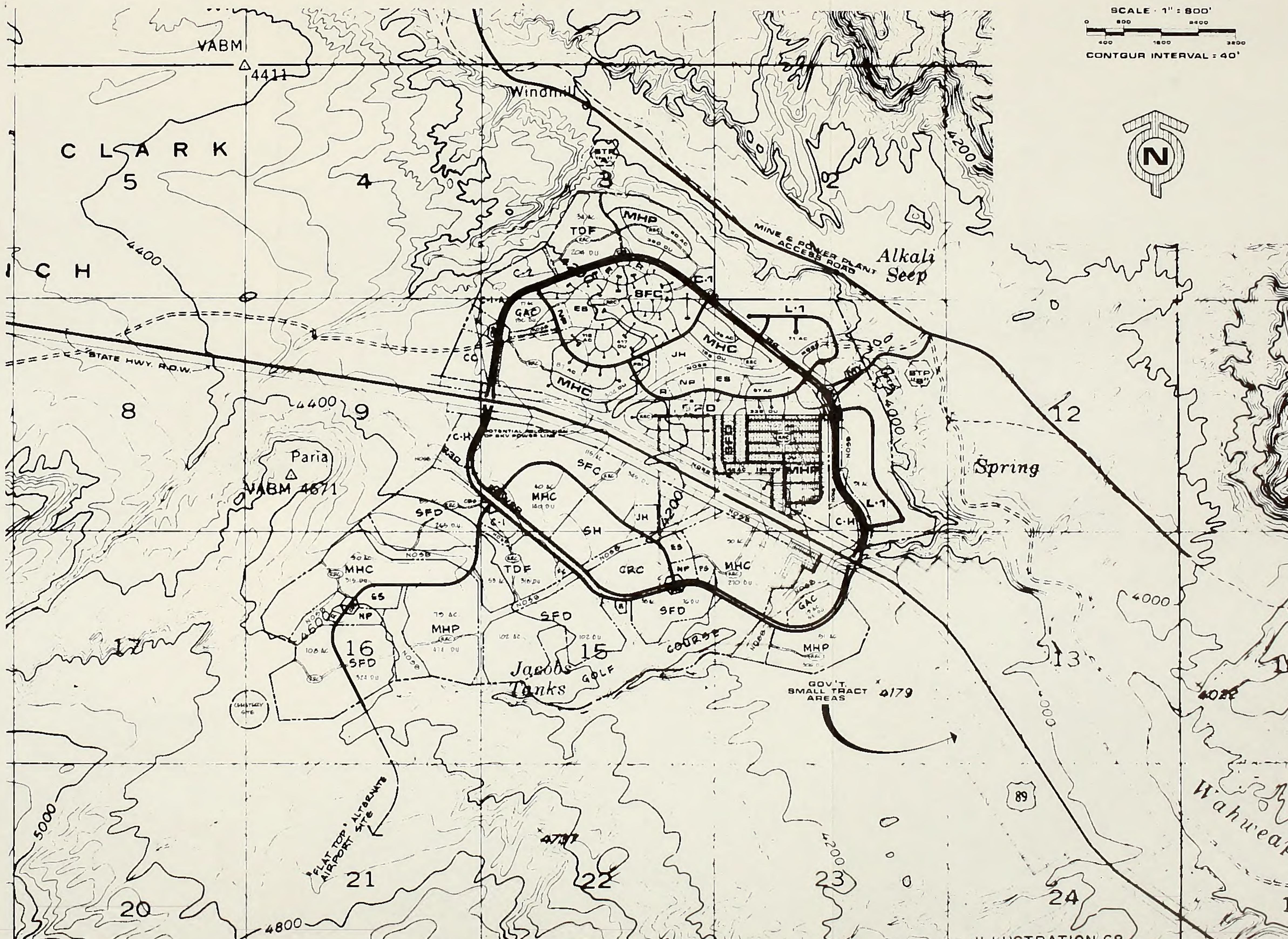


ILLUSTRATION 68

5,246,000 gallons per day (approximately 5,900 acre-feet per year). The preferred, anticipated water source would be groundwater from deep wells. Treatment facilities capable of processing 10 million gallons per day would be required. Distribution would be divided into two zones, each consisting of four to 24-inch piping systems, buried 30 to 36 inches, capable of delivering peak hour demand or live flow requirements. Each zone would have storage facilities to hold a maximum daily demand in addition to live flow requirements. Because of current shortages of some construction materials, final form and management of storage facility construction would depend on environmental and economic considerations.

The sewage system would consist of eight to 18-inch gravity mains, with one pump station to collect sewage and transport it to one or more treatment plants. Treatment would be an activated sludge process. Exact location of the treatment plant has not been determined. Treated effluent would be pumped to an area set aside for irrigation. The average daily flow is estimated at 3.5 million gallons.

Solid waste might be disposed of in a sanitary landfill. Selection of a site for sanitary landfill would require an investigation of the geology and soils of potential locations. It is estimated that about 200 acres would be sufficient.

The suggested East Clark Bench new townsite would be about 20 miles from the proposed mining area and 27 miles from the proposed Fourmile Bench plant site by the proposed highway system. Commuting time one-way would be 29 minutes to the mine site and 40 minutes to the plant site at an average speed of 45 miles per hour.

The preliminary schedule of development assumes that, prior to start of construction, a developer would be selected and contracted, land acquisition procedures would have been initiated by January 1975, and six months of detailed preparatory work would have been accomplished (see Appendix I-11). The preliminary schedule submitted by Call Engineering includes the following:

November 1, 1975	- Start of construction of mobile home spaces
February 1, 1976	- Start construction of first elementary school
April 1, 1976	- Start of construction of single and multi-family units and additional mobile home spaces.
May 1, 1976	- Initial mobile home park (200-400 permanent units) available for occupancy.
September 1976	- Elementary school available for use
November 1, 1976	- Approximately 600 housing units available
1976	- Most public and quasi-public facilities would be available.
1977 - 1979	- 700 - 1,000 housing units scheduled for construction
September 1977	- First junior high school available for use
September 1978	- High school available for use

If start of construction is after November 1, 1975, time intervals would remain the same, but the schedule would be at appropriately later dates.

Information in the preliminary master plan is the best that is presently available. Requests have been made to the participants and Kaiparowits Planning and Development Advisory Council for additional information. At present, no firm proposal as to town site or town plan has been made. The preliminary plan does not identify costs of construction or services, exactly how these needs would be met, the fact that water rights have not been attained, and that withdrawal of subsurface water from the Navajo sandstone, underlying the site, may interfere with bank storage of Lake Powell.

Utah Senate Bill 231 was passed by the 1975 Utah legislature and signed into law to permit creation of special service districts funded through issuance of tax-exempt bonds prior to creation of a tax base. Provision of these funds would depend on a guarantee of principal and interest by a taxpayer in the ditrict. Money could be used to fund water, sewage, drainage, flood control, garbage, hospital, transportation, recreation, or fire services. In the case of the proposed project, the guarantee could be made available by the participants if the proposal is approved and there is a certainty the participants are able and intend to implement the project. It would provide tax-exempt "front money" for planning, design, and development of water, sewer, hospitals, police facilities and fire protection, streets and other municipal services. Schools would not be included under this act.

Utah Senate Bill 256, passed and signed into law, declared among other things, state policy is "to encourage the development and utilization of the natural resources in this state in order to promote the economic development of this state and to provide benefits to the citizens of this state and other states." Any "person" (entity) who is now involved in, or who will be involved in development or utilization of natural resources within the state may prepay all or a part of anticipated sales and use taxes. Prepayment of sales and or use taxes may be made in installments.

Monies collected in this manner would form a special suspense account within the state general fund. This account would be used to finance state-related public improvements, principally highways and schools. Under this law, appropriations must still be made by the legislature.

From section 6 it is clear that these improvements shall be located in the vicinity of natural resource facilities (mines, power plants). The state board of education and state highway commission shall determine respectively needs "as the respective communities develop, in consultation with the school district within whose boundary the development is located ..." and the "highway needs in the area of the natural resource facility."

New state or county roads "which are necessary to provide access to areas of natural resource facilities" may be constructed from this fund.

A provision that the state pay interest to developers on the principal acquired through prepaid taxes was dropped from the bill.

Utah Senate bill 257, passed and signed into law, is concerned primarily with school building construction in districts where new industrial facilities will be located.

Districts are required to bond to their maximum capacity, to levy property taxes on not less than 18 mills, to qualify themselves for any possible state and federal funds, in order to maximize monies available for school construction. Should funds still be inadequate for anticipated needs, districts are authorized to enter into lease-purchase agreements, or lease with option to purchase arrangements with private builders. Private builders can be developers of new industrial plants "for whose need and convenience the new town shall be established"

Utah Senate bills 258 and 259, passed and signed into law, simply amend the existing Utah tax code to provide that the person or persons prepaying the use or sales taxes be responsible for collection or payment of such prepaid taxes to the state.

Utah Senate bill 260 is another in this series of energy-related laws which were passed and signed by the governor This act amends the Utah code so "roads to industrial sites and energy resource areas which are approved by the state road commission may be desigated as state highways by the commission" provided the legislature concurs.

Total effect of these bills is that it will be easier to meet school construction and other needs. Also, some highways will be provided by the state rather than the company to serve community needs, to meet equipment transportation needs, and to facilitate cross-country travel. Provisions of these bills will be listed in the Utah code in the following chapters:

Senate Bill	Utah Code Chapter
231	116
256	133
257	164
258	181
259	182
260	79

New highway

The Kaiparowits Project as proposed by the participants would require construction of a new highway for access to the generating station and mines. No adequate roads now exist in the area.

The Utah State Department of Highways under the direction of the Utah State Road Commission has prepared a location and feasibility study for several alternative routes. The entire detailed study is in Appendix I-12.

Originally the Utah State Department of Highways was acting on behalf of Kane and Garfield Counties. Since formation of the Kaiparowits Planning and Development Advisory Council, the Utah State Department of Highways is also cooperating with that council

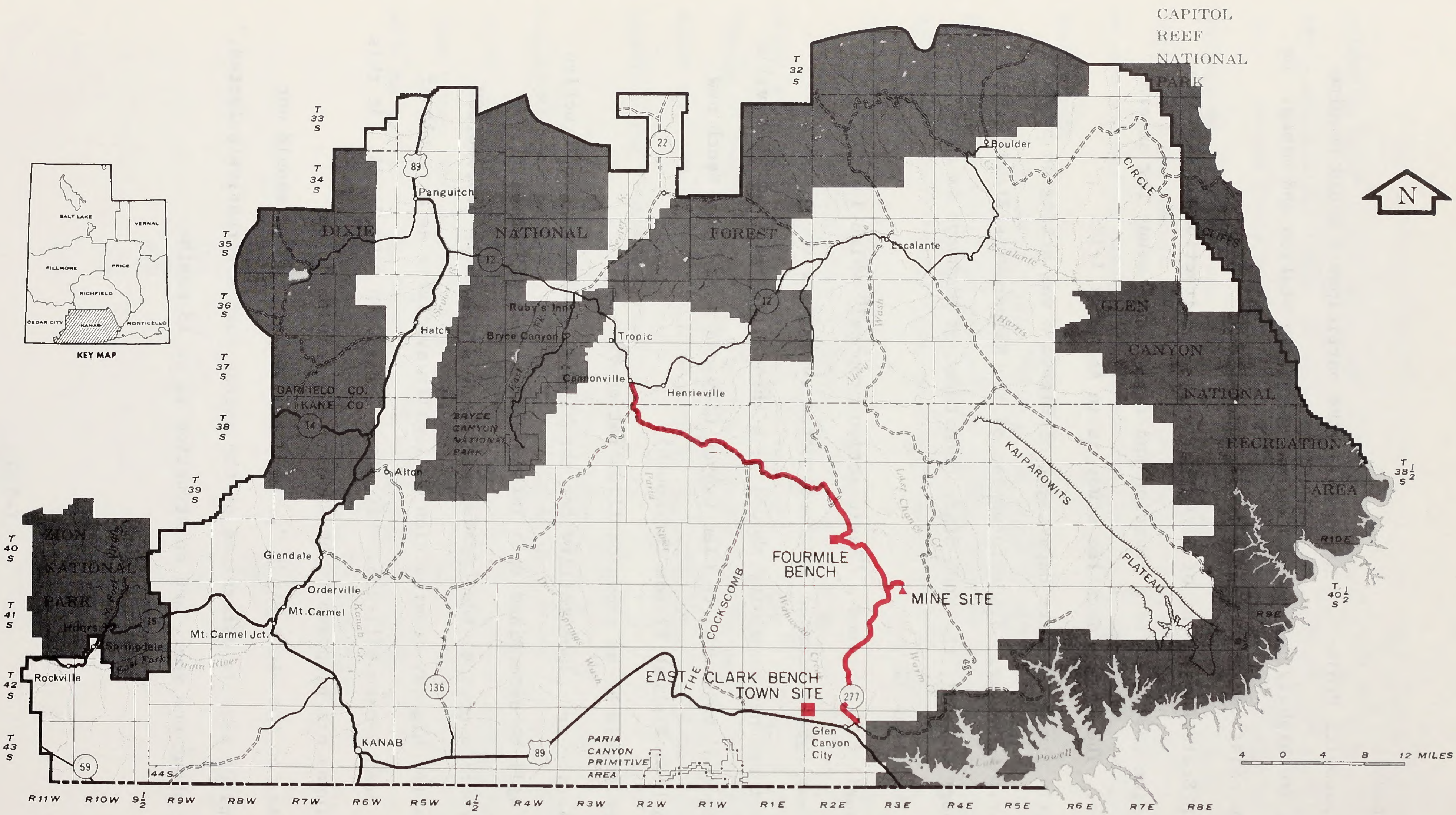
The council has approved a "basic action proposal" which is as follows:

1. The highway system planned and constructed to support the proposed Kaiparowits project and new community should be a through system from Cannonville in Garfield County (on the north) to Glen Canyon City and East Clark Bench new community site on U.S. Highway 89 (on the south).

2. The route should be as shown on Illustration 69.

Jurisdiction or responsibility for the highway, including construction and maintenance, will be determined at a later date. It is estimated by the State that construction cost of the highway will be approximately $25,000,000. A source of funds for highway construction is legally available as a result of a new state law, Utah Senate Bill-256, which is described on page I-333. At this time no federal funds are proposed to be used for the new highway.

According to the State study "...detailed roadway design should not start until the plant site is determined or the access road alternative selected." Design will take about one year, and construction 12 to 18 months.



PROPOSED HIGHWAY ROUTE FOR FOURMILE BENCH

KANAB DISTRICT
1974
UTAH

ILLUSTRATION 69

In summary, the Utah State Department of Highways has completed a location and feasibility study; the Kaiparowits Planning and Development Advisory Council has made a decision on route location; jurisdiction for the highway has not been determined; funding may be available under a new state law; design and construction would require two to two and one half years after approval is given to the project.

As stated, the proposed highway would extend from Cannonville to U. S. Highway 89 at Glen Canyon City (Illustration 63). Beginning at Cannonville on the north, the proposed highway would be on an existing, paved road and extend south to the Garfield-Kane County line, a distance of a little over one mile. The proposed highway would then follow the existing dirt road south to the junction with the road to Fourmile Bench, and then up that existing dirt road to Fourmile Bench. From the junction the other road goes down Cottonwood Creek. The existing dirt road is maintained by the State of Utah from the county line to the vicinity of Kodachrome Basin and from there is maintained by Kane County to Fourmile Bench. Only other structures in the area are two powerlines which extend from Cannonville down Cottonwood Creek. Total distance of this segment is approximately 35 miles.

Included would be some 39 stream crossings and a maximum grade of eight percent for approximately one mile of the total distance. Except for the few sections of eight percent grade, the vertical alignment would traverse gently rolling terrain with all other grades being less than six percent. One of the few areas of heavy construction on this segment of highway would be through the area known as "The Gut" which is adjacent to Grosvenor's Arch. The geologic formations are steeper at this point and would require some short sections of moderate cuts and fills. Aggregate sources could be obtained from Wahweap Creek, Paria River, the hills of Round Valley and on Horse Mountain.

From Fourmile Bench to Glen Canyon City, the road would primarily be new construction. The road would go down Wesses Canyon, past Nipple Bench, and then down Nipple Creek. This segment would be 30 miles long.

This segment would contain a 7.5 percent continuous grade of 0.7 mile in Wesses Canyon. Remainder of the vertical alignment would be four percent and less. It would be necessary to cross 13 streams on this segment. Wahweap Creek and Horse Mountain would be the best sources of aggregate. A short section in Nipple Creek contains an exposed shale layer which exhibits very poor road building characteristics. This shale would have to be kept as dry as possible and probably would be excavated to a depth such that its swelling characteristics could be controlled.

In addition a road would be required from the mouth of Wesses Canyon to the coal mine. This segment would be about two miles long, with nine stream crossings and no grades steeper than three percent. Wahweap Creek and Horse Mountain would be the best sources of aggregate.

Highest volume of traffic on each access road segment would occur during typical rush hours created by commuters going to and returning from work. An analysis of expected traffic volumes and design standards of the Utah Department of Highways indicate a 34-foot wide road (two 11-foot lanes and two 6-foot shoulders) would be adequate. (Also, see Figure 52.)

Each agency of Utah State Government would:

Comply with Governon's Executive Order dated August 27, 1974 relating to environmental impact statements.

Utah State Division of Lands would:

Acquire national resource lands by state selections to make lands available for plant site, townsite, etc. (they have already filed Indemnity School Selection Applications U-25511 for 3,680 acres for the Fourmile Bench

FIGURE 52

New Highway

Ownership or Administration	Miles of Highway
Private	4.6
State of Utah	
Division of Parks and Recreation	0.5
State Land Board	7.2
Federal	
Bureau of Land Management	54.7
Total	67.0

Acres Disturbed - 450
Acres Permanently Occupied - 780
Cubic Yards of Aggregate Needed - 780,000
Dollar Cost - $25,000,000

plant site, and U-15161 for 3,508 acres for the Nipple Bench plant site)--Utah Enabling Act of July 16, 1894, as amended (28 Stat. 107: 43 U.S.C. 851-853; Utah Code Annotated 1953, as amended, Title 65, especially 65-1-32).

Grant permits and easements on state lands for power transmission lines, roads, water pipelines, etc. (Utah Code Annotated 1953, as amended, 65-2-1).

Grant mineral leases -- on state lands -- (Utah Code annotated 1953, as amended, 65-1-18).

Utah State Department of Highways would:

Design, construct and maintain access roads and highways - (Utah Code Annotated 1953, as amended, Chapter 27-12, especially 27-12-104 to 27-12-110). See in the Appendix Utah State Department of Highways letter of October 16, 1974 and attached report on Kaiparowits Power Plant Access Road Location and Feasibility Study dated October, 1974. It is not known whether the State or Counties would build the roads.

Assure compliance with over-size and over-weight hauling restrictions -- (Utah Code Annotated 1953, as amended 27-12-146 to 27-12-157).

Utah State Division of Health, Bureau of Environmental Health:

Air Quality Section would:

Control air pollution -- Air Conservation Act (Utah Code Annotated 1953, as amended, Chapter 26-24, especially 26-24-9 to 26-24-18).

Water Quality Section would:

Control water pollution -- (Utah Code Annotated 1953, as amended, Chapter 73-14, especially 73-14-5 to 73-14-13).

General Sanitation Section would:

Control solid waste -- (Utah Code Annotated 1953, as amended, Title 26).

Occupational and Radiational Health Section would:

Control radiation -- Radiation Protection Act (Utah Code Annotated 1953, as amended, Chapter 26-25).

Work with Occupational Health and Safety Division for occupational health and safety -- Utah Occupational and Health Act of 1973 (Utah Code Annotated 1953, as amended, Chapter 35-9).

Utah State Industrial Commission:

Occupational Safety and Health Division would:

Be responsible with Occupational and Radiational Health Section for occupational and industrial health and safety -- Utah Occupational and Health Act of 1973, (Utah Code Annotated 1953, as amended, Chapter 35-9).

Work with Occupational and Radiational Health Section for radiation control -- Radiation Protection Act (Utah Code Annotated 1953, as amended, Chapter 26-25).

Mining and Safety Division would:

Assure compliance with state law on coal mine safety --(Utah Code Annotated 1953, as amended, Chapter 40-2).

Water Rights Division - Utah State Engineer

Action by the Utah State Engineer has been very closely allied with action by the Bureau of Reclamation. It should be reiterated that the water right application of Resources Company represents a water right in good standing with the State Engineer. Assuming Resources Company shows diligence in pursuing this project, further action by the State Engineer would be to grant extensions of time within which to submit proof of appropriation until the project is constructed. When the project is constructed and proof of appropriation is submitted to the State Engineer's Office, the State Engineer will be obligated to issue to Resources Company a water right certificate subject to conditions of his memorandum decision dated September 3, 1965. (Also, see Bureau of Reclamation section, page I-316. Based on the projects proposed use of 50,000 acre-feet of water, the State Engineer has the right to reduce it's 102,000 acre-feet allotment of this amount. This would make approximately 52,000 acre-feet available for other resource uses that the state may approve.

Utah State Outdoor Recreation Agency would:

Coordinate and administer recreation planning and development -- (Utah Code Annotated 1953, as amended, 63-11-13).

Participate in federal outdoor recreation programs, administration of Land and Water Conservation Funds -- (Utah Code Annotated 1953, as amended, 63-28-4 to 63-34-7).

Utah State Division of Parks and Recreation would:

Work with U. S. Bureau of Outdoor Recreation in recreation planning and development -- (Utah Code Annotated 1953, as amended, Chapter 63-11, especially 63-11-13 and 63-11-17.1).

Enforce Utah state law on recreation vehicle use -- Recreation vehicle Act (Utah Code Annotated 1953, as amended, Chapter 41-22, especially 41-22-12, 13, 15, 18, and 20).

Utah State Public Service Commission would:

Regulate public utilities -- (Utah Code Annotated 1953, as amended, Title 54).

Utah State Division of Aeronautics would:

Work with Federal Aeronautics Administration on construction of airports -- (Utah Code Annotated 1953, as amended, Chapter 2-2).

Work with Federal Aeronautics Administration on obstructions to flight -- (Utah Code Annotated 1953, as amended, 2-2-9 and 2-2-10).

Southwestern Utah Multi-County District Six would:

Encourage and assist with orderly comprehensive and functional planning and development activities, and administration of services -- Governor's Executive Order dated May 27, 1970; and Inter-local Cooperation Act of 1965 (Utah Code Annotated 1953, as amended, Chapter 11-13).

Garfield and Kane Counties, Utah would:

Encourage and assist with zoning and planning -- (Utah Code Annotated 1953, as amended, Chapter 17-27).

Encourage and assist with municipal-type services to unincorporated areas -- (Utah Code Annotated 1953, as amended, Chapter 17-34).

Take action for incorporation of cities and towns as appropriate -- (Utah Code Annotated 1953, as amended, Chapter 10-2).

Arizona

Arizona State Power Plant and Transmission Line Citing Committee would:

Regulate public utilities in Arizona -- (Arizona Revised Statues Annotated 1973, Section 40-360, especially 40-360.03, "Applications prior to construction of facilities", and 40-360.06, "Factors to be considered in issuing a certificate of environmental compatibility"

Arizona State Department of Public Health and Safety, Division of Air Pollution Control would:

Enforce State of Arizona air pollution control and air quality standards -- (Arizona Revised Statutes Annotated 1973, as amended, 36-1700 to 1720).

Coconino, Yavapai, Maricopa and Mohave Counties, Arizona would:

Enforce county planning and zoning in Arizona -- (Arizona Revised Statutes Annotated 1973 as amended, 11-801 to 808, and 11-821 to 830).

Nevada

Nevada State Public Service Commission would:

Regulate public utilities in Nevada -- (Nevada Revised Statutes, January 1957, Vol. 5, Title 58, Chapter 703.150, "General duties", and 704.780, "Enforcement").

Clark County, Nevada, would:

Grant county use permit in Nevada -- (Nevada Revised Statutes, January 1957, Vol. 2, Title 22, Chapter 278.020).

California

California State Public Utilities Commission (existing under authority of Article 12, Sec. 23 of the Constitution of California) would:

Regulate public utilities, issue certificate of public convenience and necessity in California -- (California Public Utilities Code, Sec. 1001; General Order 131).

Enforce environmental control in California -- (California Environmental Quality Act of 1970, Environmental Quality Rule 17.1).

San Bernardino, Riverside and Orange Counties, California would:

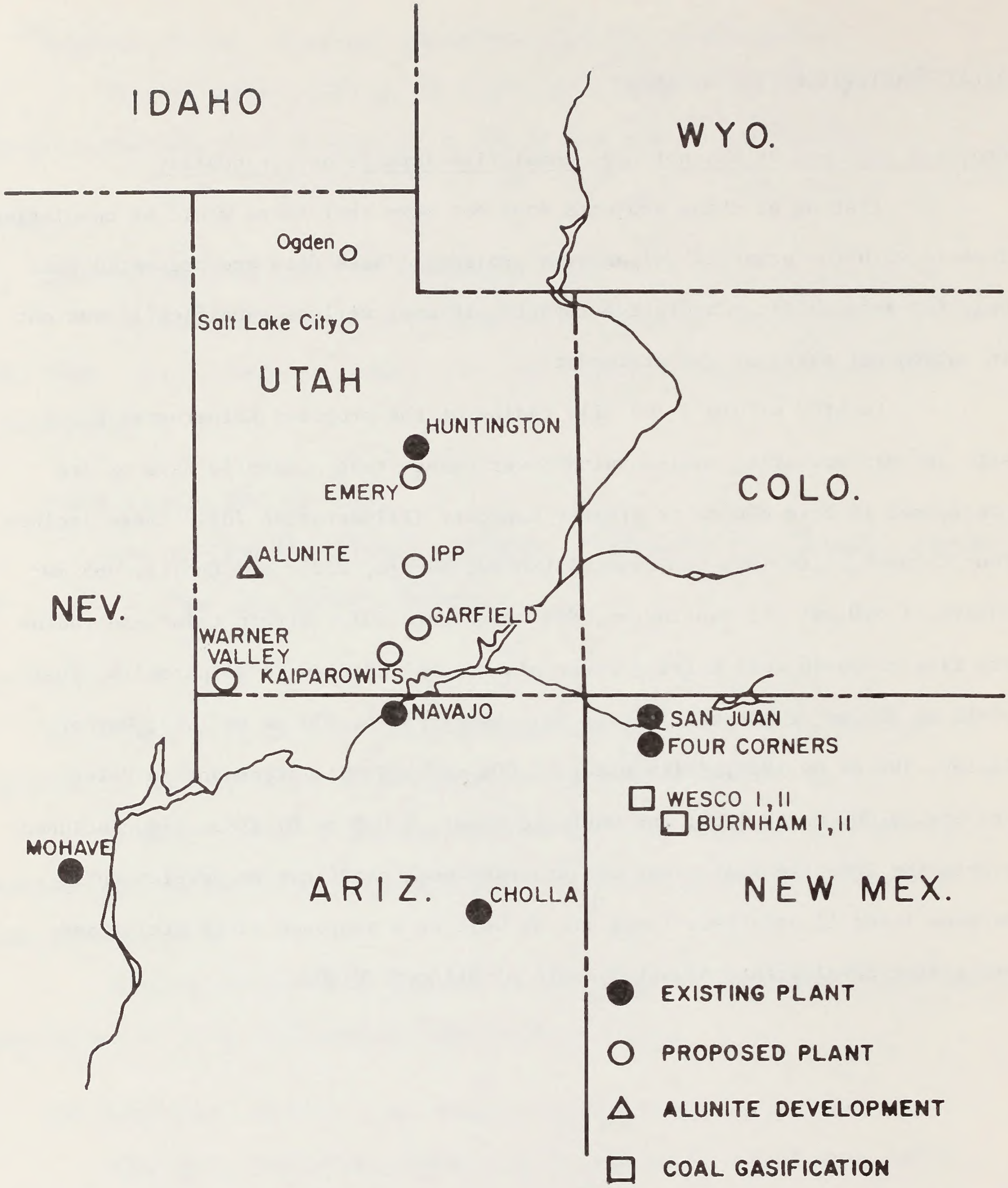
Administer franchise authority in California -- (California Public Utilities Code, Secs. 6001, 6201).

RELATED ACTIVITIES IN THE AREA

Projects that may or may not have cumulative impacts on air quality

Listing of these projects does not mean that there would be cumulative impacts with the proposed Kaiparowits project. These data are presented here only for information. Cumulative impacts, if any, will be specifically set out in subsequent parts of the statement.

Located within a 200 mile radius of the proposed Kaiparowits plant site are six operating coal-burning power plants that presently have or are programmed to have 800 mw or greater capacity (Illustration 70). These include Four Corners, 2,085 mw; San Juan, 1,690 mw; Navajo, 2,250 mw; Cholla, 965 mw; Mohave, 1,510 mw; and Huntington, 860 mw (Figure 53). Within this same radius are five proposed coal burning power plants, in addition to Kaiparowits, that would be 500 mw or greater (Figure 54): Emery plant, 830 mw by 1979; Warner Valley, 500 mw by 1980; Allen plant, 2,000 mw by 1983; Intermountain Power Project, 3,000 mw by 1984; and Garfield Plant, 2,000 mw by 1985. Also included within the 200-mile radius are two proposed coal gasification developments, Burnham I and II and Wesco I and II, as well as a proposed large mining and processing development, Alunite, south of Milford, Utah.



RELATIVE LOCATIONS OF SIX MAJOR COAL BURNING POWER PLANTS, FIVE PROPOSED COAL BURNING PLANTS, TWO COAL GASIFICATION DEVELOPMENTS, AND ONE MINERAL DEVELOPMENT.

SOURCE: Modified from the Joint Meteorological Report (September 1971)

ILLUSTRATION 70

FIGURE 53

Location, Size, and Date of Commercial Operation of Six Coal-Burning Power Plants Within Approximately 200 Miles of the Proposed Kaiparowits Plant.

Power Plant	Location	Participants		Size	Proposed Date for Commercial Operation
Four Corners	20 miles W of Farmington, New Mexico	Arizona Public Service		175 mw	1963
				175 mw	1963
				225 mw	1964
		El Paso Electric Co.	7.0%	755 mw	1969
		Tucson Gas & Electric	7.0%	755 mw	1970
		Salt River Project	10.0%		
		Public Service Co. of N.M.	13.0%		
		Arizona Public Service	15.0%		
		Southern California Edison	48.0%		
San Juan	12 miles NW of Farmington, New Mexico	Public Serv. of New Mexico	50%	345 mw	1973
		Tucson Gas and Electric	50%	345 mw	1976
				500 mw	1978
				500 mw	1980
Navajo	4 miles E of Page, Arizona	Salt River Project	21.7%	750 mw	1974
		Los Angeles Dept. of Water and Power	21.2%	750 mw	1975
		Arizona Public Serv. Co.	14.0%	750 mw	1976
		Nevada Power Company	11.3%		
		Tucson Gas and Electric	7.5%		
		U.S. Dept. of Interior Bureau of Reclamation	24.3%		
Huntington #2	29 miles SW of Price, Utah	Utah Power and Light		430 mw	1974
				430 mw	1978

(Continued)

FIGURE 53 (Continued)

Location, Size and Date of Commercial Operation of Six Coal-Burning Power Plants Within Approximately 200 Miles of the Proposed Kaiparowits Plant

Power Plant	Location	Participants		Size	Proposed Date for Commercial Operation
Mohave	Bullhead City, Nevada	Southern California Edison	51 %	755 mw	1971
		City of Los Angeles	16 %	755 mw	1971
		Nevada Power	16 %		
		Salt River Project	10 %		
		Imperial Irrigation District	7 %		
Cholla	Joseph City, Arizona	Arizona Public Service		115 mw	1962
				250 mw	1977
				250 mw	1978
				350 mw	1979

FIGURE 54

Location, Size, and Proposed Date for Commerical Operation of Coal-Fired Power Plants, Alunite Mineral Development, and Gasification Plants Within a 200 Mile Radius of Kaiparowits

Proposed Development	Location	Participants		Size	Proposed Date for Commercial Operation
Kaiparowits Coal Power Plant	Fourmile Bench or Nipple Bench	Southern California Edison	40.0%	4 (750) mw	1980, 1981, 1982
		San Diego Gas & Electric	23.4%		
		Arizona Public Service	18.0%		
		Salt River Project	10.0%		
		Uncommitted	8.6%		
Emery Coal Power Plant	2½ miles S of Castle Dale, Utah	Utah Power and Light		2 (415) mw	1978, 1979
Allen-Warner Valley					
Warner Valley Coal Power Plant	13 miles SE of St. George, Utah	Nevada Power Company Las Vegas	25.0%	2 (250) mw	1979, 1980
		City of Los Angeles, Dept. of Water and Power	50.0%		
		City of St. George, Utah	25.0%		
Allen Plant Coal Power Plant	25 miles NE of Las Vegas, Nev.	Nevada Power Co., Las Vegas	20.0%	4 (500) mw	1980, 1981, 1982, 1983
		City of Los Angeles, Dept. of Water & Power	80.0%		
Intermountain Power Project Coal Power Plant	10 miles N of Caineville, Utah	Intermountain Consumers Power Association	15.0%	4 (750) mw	1981, 1982, 1983, 1984
		City of Anaheim, Calif.	15.0%		
		City of Burbank, Calif.	2.5%		
		City of Glendale, Calif.	2.5%		
		City of Los Angeles, Calif.	50.0%		
		City of Pasadena, Calif.	5.0%		
		City of Riverside, Calif.	10.0%		

(Continued)

FIGURE 54 (continued)

Location, Size, and Proposed Date for Commercial Operation of Coal-Fired Power Plants, Alunite Mineral Development and Gasification Plants Within a 200 Mile Radius of Kaiparowits

Proposed Development	Location	Participants	Size	Proposed Date for Commercial Operation
Garfield-Escalante Garfield east	S of Escalante, Utah between the Escalante River Valley and the Kaiparowits Plateau	Utah Power and Light	4 (500) mw	1982-1985 (tentative)
or				
Garfield west	On Kaiparowits Plateau just W of Straight Cliffs in Little Valley			
Alunite (Hydrous potassium aluminum sulfate) $KAl_3 \cdot (OH)_6 (SO_4)_2$	30 miles WSW of Milford, Utah	Earth Sciences, Inc. Golden, Colorado	Mine - alunite ore Alumina plant Sulfuric acid plant Potassium sulfate plant Phosphate plant Coal power plant	(12,000 tons per day) (1,470 tons per day) (1,422 tons per day) (1,120 tons per day) (74.2 tons per hour) (70 mw)

(Continued)

FIGURE 54 (continued)

Location, Size, and Proposed Date for Commercial Operation of Coal-Fired Power Plants, Alunite Mineral Development, and Gasification Plants Within a 200-Mile Radius of Kaiparowits

Proposed Development	Location	Participants	Size	Proposed Date for Commercial Operation
Wesco I	26 miles SW of Farmington, New Mexico	Western Gasification Company	Gasification 250 MCFD	Unknown
Wesco II	33 miles SW of Farmington, New Mexico	Western Gasification Company	Gasification 250 MCFD	Unknown
Burnham I	35 miles SSW of Farmington, New Mexico	El Paso Gas	Gasification 288 MCFD	1978 1979
Burnham II	35 miles SSW of Farmington, New Mexico	El Paso Gas	Gasification 288 MCFD 172 MCFD	1980 1981

Other existing or proposed projects within the Colorado River Drainage in Utah

Water use and availability

Existing uses

State of Utah law provides for intrastate control of water use from reservoirs, lakes and streams in Utah. In addition, numerous agreement laws and regulations govern the use of water in the Colorado River Basin including the share to which the State of Utah is entitled. Together, these laws, regulations and other documents are commonly referred to as the "Law of the River". In addition to water law, some of the more important documents are the Colorado River Compact of 1922, Mexican Water Treaty of 1944, Upper Colorado River Basin Compact of 1948, Colorado River Storage Project Act of 1956 and Colorado River Basin Project Act of 1968.

Because of the close interrelationship that Utah's entitlement and use of water from the Colorado River bears to other states of the Upper Basin, data in Figure 55 compares estimated average annual depletions in Utah with the entire Upper Basin. These figures are based upon the 1974 level of development and show about 3,707,000 acre feet are being used in the Upper Basin. Of this total 825,000 acre feet are being used in Utah.

FIGURE 55
Annual Water Depletions
1974
Unit - Acre-Feet

	Upper Colorado River Basin	Utah
Irrigation and associated use	2,153,000	529,000
Municipal, industrial and livestock uses	114,000	12,000
Power and mineral production	86,000	10,000
Fish, wildlife and recreation	80,000	24,000
Evaporation from reservoirs of Colorado River Storage Project units	520,000	120,000*
Exports	757,000	133,000
Imports	-3,000	-3,000
Total	3,707,000	825,000

* Utah's share of Colorado River Storage Project Reservoirs computed as 23% of total.

It is evident from the above figures that the bulk of total present depletions in the Upper Colorado River is associated with uses for irrigated agriculture, export, and evporation from the main stem Colorado River Storage Project Reservoirs. These uses comprise about 92 percent of the total with irrigated agriculture depleting about 58 percent; transmountain diversions 20 percent and main stem storage reservoirs 14 percent. The 1974 estimated uses in Utah closely follow the overall basin pattern with about 94 percent of Utah's present uses being concentrated in the three prinicpal items.

By far the largest single consumptive use of water in Utah is associated with irrigation of approximately 333,000 acres of land. This depletion is approximately 64 percent of the total. Most irrigated lands are concentrated in the Duchesne, Price and San Rafael River Basins with only about 40,000 acres being irrigated in the Dirty Devil, Escalante, and Paria River Basins. Additional scattered tracts of arable lands are located in the Dirty Devil, Escalante and Paria River drainages but limited local water supply will probably preclude any substantial increase in irrigation in these areas.

Next largest present use by Utah from the Colorado River system consists of transmountain diversions to the Great Basin. Bulk of these exports is being accomplished through facilities built under federal reclamation projects. Strawberry and Provo River Projects divert substantial amounts of water from Duchesne River tributaries to the Bonneville Basin. Relatively small diversions are also being made from Price River headwaters to the Sevier River under the Sanpete Project. Other small diversions and private developments comprise remainder of the water actually exported. Evaporation from storage facilities involved in export is included in the export totals.

For purposes of this analysis, a 23 percent share of presently estimated long-term evaporation from Colorado River Storage Project main stem reservoirs was apportioned to Utah. These reservoirs include Lake Powell, Flaming Gorge and the Curecanti Unit.

Remaining 5 percent of present uses is scattered throughout the Utah portion of the Colorado River Basin for municipal, industrial, fish, wildlife, and recreational purposes.

Committed but presently not used

Substantial amounts of water are committed but presently not used for various federally authorized projects and private developments. The figure below lists these projects, amouts of water committed and estimated time of developments. These listed projects are covered by water rights obtained under Utah law, and other contracts and agreements. Figure 56 further summarizes remaining water available by time frames based upon availability of 5.8 maf of water for comsumptive use in the Upper Colorado River Basin and Utah's estimated share of 1,322,000 acre-feet.

FIGURE 56
Projected Colorado River Water Supply and Depletions
Unit - 1,000 Acre-feet
Utah

	1974	1980	1990	2000	2030
Present (1974)	692	692	692	692	692
Bonneville Unit, Central Utah Project	13	90	166	166	166
Upalco Unit, Central Utah Project			10	10	10
Jensen Unit, Central Utah Project		15	15	15	15
Uintah Unit, Central Utah Project		10	30	30	30
Huntington Canyon		6	6	6	6
Deferred Indian Lands				50	50
Kaiparowits Powerplant		12	102	102	0
Emery Powerplant		6	15	15	15
Total Depletion	705	831	1,036	1,086	984
Evaporation Storage Units	120	120	120	120	120
Total	825	951	1,156	1,206	1,104
State Share of 5.8 maf Level	1,322	1,322	1,322	1,322	1,322
Remaining Water Available	497	371	166	116	218

Authorized federal projects

Three units of the Central Utah Project authorized for construction including the Bonneville, Upalco, and Jensen Units. The Uintah Unit has been given conditional authorization. Since full authorization is considered to be imminent it too is a potential user of water tributary to the Colorado River. A brief description of these units follows:

Bonneville Unit is by far the most complex of the Central Utah Project. Its features are located in both the Uinta Basin and Bonneville Basin. The plan provides for increased irrigation water for land along the Duchesne River in the Uinta Basin and diversion of surplus flows of Duchesne River tributaries to the Bonneville Basin.

The unit has been under construction for eight years. Principal completed features are Starvation Dam, Soldier Creek Dam, Water Hollow Tunnel and Layout Tunnels. Currant Creek Dam is under construction.

Upalco Unit will develop waters of Lake Fork and Yellowstone Rivers in the Uinta Basin for irrigation, recreation, fish and wildlife, and flood control. Area redevelopment also will be benefited. Principal project features include Taskeech Dam, Boneta Diversion Dam, Taskeech Feeder Canal, Taskeech Service Canal and others that will benefit fish, wildlife and recreational purposes. No project works have been constructed.

Jensen Unit is in northeastern Utah in the Uinta Basin, in the vicinity of Jensen. It will provide municipal and industrial water to augment existing supplies throughout the project area and water for irrigation in the vicinity of Jensen. It is proposed to provide fish and wildlife, recreation, and flood control benefits. Main project feature will be Tyzack Reservoir to be constructed on Big Brush Creek, Tyzack Pumping Plant and Aqueduct, Burns Pumping Plant and recreational features and measures to benefit fish and wildlife. Construction is scheduled to begin in FY 1976.

The Uintah Unit is in Duchesne and Uintah Counties in northeastern Utah in the Uinta Basin near Roosevelt, Utah. It will develop flows of the Uinta and Whiterocks Rivers for irrigation of both Indian and non-Indian land, municipal and industrial use, recreation, and fish and wildlife purposes. Flood control also would be benefited.

Principal project features include Whiterocks Reservoir, Uinta Reservoir and distribution facilities. This unit has not been authorized fully for construction.

Other developments

Deferred Indian Lands

Under the Indian Deferral Agreement of 1965 among the Ute Indian Tribe, Central Utah Water Conservancy District and the Uinted States, acting through the Bureau of Indian Affairs and the Bureau of Reclamation, the Tribe agreed to defer irrigation of 15,242 acres until not later than the year 2005. Water is thus considered to be reserved for this purpose.

Huntington Canyon Powerplant

One unit of this Utah Power and Light Company plant in the vicinity of Huntington, Utah is now in operation and a second is projected for 1977.

Emery Powerplant

Two units of this plant near Ferron, Utah are under active consideration by Utah Power and Light Company. Production is scheduled in 1978 and 1980.

Kaiparowits Powerplant

The present contract, other agreements and water right application to the State of Utah provide for 102,000 acre-feet of water for this development. Any lesser development could release a portion of this water for other purposes.

New Uses

Water for energy development

Competing uses for water within the Upper Colorado River Basin in Utah include energy industries of oil shale, thermal-electric generation, coal gasification, and tar sand development. The July, 1974 report on Water for Energy in the Upper Colorado River Basin, prepared by the Department of Interior's Denver management team, presented an inventory of authorized, planned, and projected energy development projects in the basin for thermal-electric generation, oil shale plants, and coal gasification plants. Some of these developments have been mentioned in the previous discussion, including water requirements. Additional discussion is presented below.

Oil shale

Final Report of the Project Independence Interagency Oil Shale Task Force dated November, 1974 indicated there are some 4,900,000 acres of oil shale land within Utah. About 2,160,000 acres are of known higher grade reserves and contain oil shale at least 10 feet thick with over 25 gallons of oil per ton of shale. It was estimated the oil shale resource is at least 280 billion barrels, located within the higher grade area in Utah.

Because most of the land is in Federal ownership, the Department of the Interior intiated a program in 1974 known as the Prototype Oil Sahle Leasing Program designed to stimulate oil shale development. Under the program two federal tracts within the White River Basin in Utah have been leased to Phillips Oil Corp. - Sun Oil Corp. (tract Ua) and the White River Oil Shale Corp. (Phillips-Sun-Sohio) (tract Ub). It is expected that first commercial production of shale oil in Utah will result from development of these prototype tracts. Water requirements for the joint operation at these two adjacent locations are estimated to average 36,000 acre-feet annually for production of 100,000 barrels of oil per day. Additional development will of course require greater amounts of water.

Thermal-electric generation

Competition is very keen among several large companies for water for steam generation near coal fields of southeastern Utah. The Utah State Engineer listed 37 unperfected rights for water for steam generation, totaling 1,368,500 acre-feet and 208 second-feet in the basin in Utah. Some of these applications have been approved by the State Engineer, but most have not. The State Engineer has not approved any large application for power generation for several years. It is, of course, impossible at this time to forecast how much of the water under these applications will be developed.

Coal gasification

Conversion of coal to gas has been technically feasible for many years. Products from such operations have, however, been too expensive to be competitive with natural gas. Past and present ongoing research, aimed at improving economics of the gasification processes, appears to have been successful. Little information is presently available for production in Utah except that an 864 MCFD plant, requiring approximately 52,000 acre-feet of water annually, is projected in the Colorado River Basin in Utah.

A water right application for this plant has been filed with Utah State Engineer. No water right has as yet been established.

Tar Sands

Of known tar sand deposits in the Colorado River Basin about 98 percent are in Utah. One of the major and best known deposits is on what is known as Asphalt Ridge in Ashley Valley near Vernal, Utah. There are two other major deposits, one in Carbon County near Sunnyside, Utah and the other in the southern part of Uinta Basin, part being in Grand County and part in Uintah County. Other deposits in Utah are being investigated. There is little available technology to draw upon to make these tar sand deposits petroleum producers. There have been several techniques tested. Engineering studies and preparations are now being made for further pilot studies for the mining and extraction of petroleum products from tar sands.

Due to the lack of technology in this area, total water required to produce a finished petroleum commodity from tar sand is rather indefinite. Sources close to the industry indicate, however, that total water requirements would approach a ratio of one to one. In other words a barrel of water would be required to produce a barrel of petroleum product.

A number of water right applications have been filed with the Utah State Engineer to appropriate water for mining and refining bituminous material from tar sand deposits. These applications, totaling 55 cubic feet per second, all seek to appropriate water from the Green River. As yet, none of the applications has been approved. Therefore, no water right has been established.

Indian water rights

The Uintah and Ouray Indian Reservation was established by executive order issued by President Abraham Lincoln on October 3, 1861. Indians had undisturbed possession of the reservation until 1905 when the United States Government opened the reservation to non-Indian land filings, and some of the Indian lands were acquired by non-Indian owners. Original Indian lands, however, retained water rights priorities regardless of present ownership. This priority antedates October 3, 1861. Seocndary water rights were also acquired under Utah State law by non-Indian settlers. Controversy over use of water between Indian and non-Indian users resulted in an adjudication suit covering Lake Fork and Uinta Rivers, tributaries of the Duchesne River. Although there are Indian water rights on the Duchesne River itself, it was not included in the suit. Basis for the claims by the United States Government, acting for the Indians in the suit, was the "Winters Doctrine". In 1923 the United States District Court in Utah issued two decrees, Dockets No. 4418 for the Lake Fork River and Docket No. 4427 for the Uinta River. These decrees gave the first right to water in the rivers to the Uintah Indian Irrigation Project lands. The decrees delineated lands entitled to water from the two streams, limited the use to ". . . that which is needed for economical and beneficial use . . .," defined the irrigation period, limited irrigation use to no more than three acre-feet per acre per year, and limited the diversion rate to no more than one-seventieth of a second-foot of water for each acre.

During investigations for the Central Utah Project the Ute Indian Tribe submitted to the Bureau of Reclamation and Utah State Engineer a report, "Water Right Claims - Uintah and Ouray Indian Reservation," by E.L. Decker, dated December, 1960 (revised). The report lists seven groups of lands for which water is claimed. Definition of the groups as given in the report is as follows:

> Group 1: Lands included in the Uintah Indian Irrigation Project, the water right to which has been certified by the State and decreed by the Federal Court. This includes all of that part of the project served from the Lake Fork, Yellowstone, Uintah and Whiterocks Rivers, totaling 59,222 acres. Of the total 24,577 acres are served from Lake Fork River, 493 acres from Yellowstone River, 19,701 acres from Uintah River and 14,451 acres from Whiterocks River.
>
> Group 2: Lands included in the Uintah Indian Irrigation Project, the water right to which has been certified by the State. This includes all of that part of the Uintah Project served from the Duchesne River and townsite of Duchesne, consisting of 18,613 acres. Although certified by the State, a water right for this land is claimed under the Winter's Doctrine.
>
> Group 3: Lands that are or can be served from the Duchesne River through the facilities of the Uintah Indian Irrigation Project, a water right for which is claimed under the Winter's Doctrine. These lands have been placed in two classes: (1) lands certified by the State of Utah for which a supplemental right to the area certified is claimed consisting of 450.32 acres, and (2) lands not having a State certificate but designated as irrigable. A water right for this land is claimed under the Winter's Doctrine and included in the Uintah Irrigation Project by Secretarial designation, consisting of 665.00 acres.

Group 4: Lands which have been found to be productive and economically feasible to irrigate from privately constructed ditch systems diverting from the Duchesne River or its tributaries above the Pahcease Canal, now in operation or to be constructed, a water right for which is claimed under the Winter's Doctrine, consisting of 1,480 acres.

Group 5: Lands which have been found to be productive and economically feasible to irrigate and are proposed to be included in the ultimate phase of the Central Utah Project, the water right to which attaches by the principal of law annunciated in the Winter's Doctrine. While a water right for these lands is claimed under the Winter's Doctrine, if included as participating units in the ultimate phase of the Central Utah Project, under the Colorado River Storage Act. The Uinta Basin water required would be more than offset by exchange water that could be supplied by gravity flow to the presently constructed Uintah Irrigation Project from the Flaming Gorge Aqueduct. It has been estimated that 63,000 acres of the 78,841 acres now comprising the ultimate area of the Uintah Irrigation Project can be supplied by gravity flow from the proposed Flaming Gorge Aqueduct. It has also been estimated that 4,000 acres of the 29,118 acres now being proposed as participating units in the Central Utah Project, can be supplied by gravity flow from the proposed Flaming Gorge Aqueduct. If the remaining area of 25,118 acres now proposed for inclusion in the Central Utah Project is deducted from the 63,000 acres of exchange water, there would remain a net of 37,882 acres of Uinta Basin exchange water that would be available for transmission by the Central Utah Project, to the Bonneville Basin.

Group 6: Lands lying east of Green River for which applications numbered 4,356, 712 and 577 were filed with the State of Utah, to be served from White River. Although application was filed with the State, a water right for this land is claimed under the Winter's Doctrine, consisting of 4,360 acres.

Group 7: Lands lying east of Green River which have been found to be productive and economically feasible to irrigate from privately constructed ditch systems diverting from the various streams enumerated under this group, now in operation or to be constructed. A water right for this land is claimed under the Winter's Doctrine, consisting of Green River, 3,597 acres; Willow Creek, 954 acres; Bitter Creek, 267 acres; Sweet Water Creek, 92 acres; Hill Creek, 154 acres and White River 1,273 acres.

By agreement among the United States (acting through the Bureau of Reclamation and Bureau of Indian Affairs), the Central Utah Water Conservancy District, and the Ute Indian Tribe, development of the Group 5 land is to be deferred until the ultimate phase of the Central Utah Project is constructed, or until the year 2005.

Origin of the Winters Doctrine is the case of Winters v. United States, 207 U.S. 564, 52 L. Ed. 340, 28 S. ct. 207, (1908). This was followed by the same court in the United States v. Powers, 305 U.S. 527, 83 L. Ed. 330, 59 S. ct. 344, (1939), and most recently, in Arizona v. California, 373 U.S. 546, 10 L. Ed. 2 d 542, 83 S. ct. 1468, (1963). The Supreme Court of the United States referred to the Winters case and said:

> "We follow it now and agree that the United States did reserve the water rights of the Indians effective as of the time the Indian Reservations were created."

There would appear to be no question concerning the right to water for irrigation pursuant to the Winters Doctrine; however, there is no known case which has adjudicated the reservation of water for industrial development on an Indian reservation. The amount of rights claimed by the Indians in Utah has not been adjudicated in the courts.

U.S. DEPARTMENT OF THE INTERIOR

MARCH 3, 1849