BUREAU

OF

LAND MANAGEMENT

ORIG.

DRAFT

ENVIRONMENTAL DESCRIPTION

AND IMPACT ANALYSIS

of the

OIL SHALE SITE NOMINATIONS
WYOMING

Submitted March 8, 1972

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Part 1 - ENVIRONMENTAL DESCRIPTION

I. Purpose

This report on a description of the environment has been prepared by a Wyoming task force committee of the U. S. Department of the Interior - Bureau of Land Management in accordance with the provision of Section 102 (2)(c) of the National Environmental Policy Act of 1969, Public Law 91-190, January 1, 1970.

The purpose of the oil shale nominations and proposed complex is to meet the critical energy needs of the United States. The oil produced will meet the requirements of the producers to sustain and meet increased demands on that industry.

II. Introduction

The Washakie and adjoining Green River Basin oil shale lands possess significant recreational and wildlife values along with their value for grazing with livestock and mineral development. See Figure 1 for aerial view of Kinney Rim. High quality game habitats consist- of varied associations of browse, forb and grass species provide forage requirements for significant populations of deer, elk and antelope. Wild horses are quite numerous throughout the range areas and a number of threatened species including the mountain lion, bald eagle and golden eagle are dependent upon the habitat within adjoining basin and periphery of the proposed impacted area. These two basins, the Green and Washakie, are straddled by the nominated oil shale sites on Kinney Rim.

Flaming Gorge Reservoir on the Green River which flows 50 miles west of the nominated sites is a major sport fisheries area with excellent fishing in some of the smaller drainages. Numerous elk and deer habitats lie between the nominated sites and the Reservoir and eastward to the Baggs, Wyoming area and south into Colorado.

III. Description

A. Legal Description & Location

Site #1 - W-a
T. 14 N., R. 99 W., Sixth Principal Meridian, Sweetwater County, Wyo.
Sec. 17, All;
Sec. 18, Lots 1, 2, 3, 4, $E\frac{1}{2}$, $E\frac{1}{2}W\frac{1}{2}$;
Sec. 19, $NE\frac{1}{4}$;
Sec. 20, 21, 22, 27, 28, All;
Sec. 29, $E\frac{1}{2}$, $NW\frac{1}{4}$

containing 5,111.24 acres

Site #2 - W-b
T. 13 N., R. 99 W., Sixth Principal Meridian, Sweetwater County, Wyo.
Sec. 1, Lots 1, 2, 3, 4, $S\frac{1}{2}$, $S\frac{1}{2}N\frac{1}{2}$;
Sec. 2, Lots 1, 2, 3, 4, $S\frac{1}{2}$, $S\frac{1}{2}N\frac{1}{2}$;
Sec. 3, Lots 1, 2, 3, 4, $S\frac{1}{2}$, $S\frac{1}{2}N\frac{1}{2}$;
Sec. 4, Lot 1, $SE\frac{1}{4}NE\frac{1}{4}$;
Sec. 10, $E\frac{1}{2}$, $E\frac{1}{2}NW\frac{1}{4}$;
Sec. 11, 12, All;

T. 14 N., R. 99 W., Sixth Principal Meridian, Sweetwater County, Wyo.
Sec. 33, $E\frac{1}{2}E\frac{1}{2}$;
Sec. 34, 35, All

containing 5,123.47 acres

The two subject sites are adjacent to each other and lie in southern Wyoming approximately eight miles north of the Colorado state line. Both sites are on the northeastern exposure of Kinney Rim, a large hogback ridge. Lot 2 of Section 1, T. 13 N., R. 99 W., has been patented with no reservation of minerals.

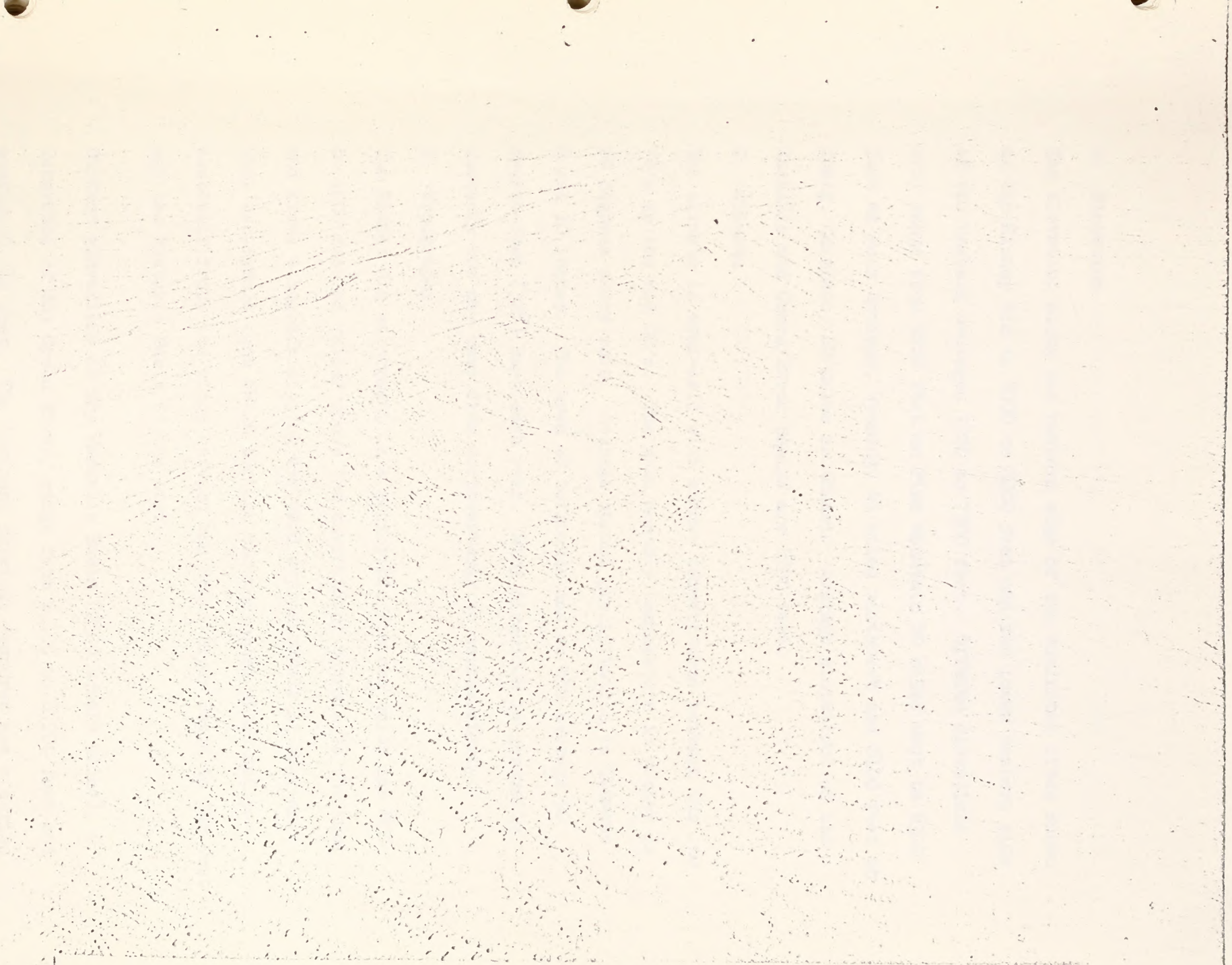


Figure 1. Aerial Photograph-Kinney Rim. Looking [illegible] NM ¼ Sec. 2, T. 14 N., R. 10? W.

B. Elevation

The elevation along the western edge of the nominated sites known as the Kinney Rim is 8000 to 8200 feet and the lower eastern side of the hogback averages 7200 to 7300 feet. Offsite elevations will range from 9720 feet on Pine Mountain 20 miles west to 6300 feet at Rock Springs, Wyoming, 45 miles northwest and 6100 feet at Craig, Colorado, 60 miles southeast. Average elevations of the Washakie and Green River Basins are 6700 feet.

C. Climate

The climate is semi-arid with summer temperatures between the low 70's to the mid 80's. The mean monthly temperature in winter is 20 degrees above zero. Average annual precipitation is between 8 and 10 inches. The area of influence has on the average 90 freeze-free (32°) days each year. Wind direction is generally westerly but may vary from northwesterly to southwesterly.

D. Topography

The Kinney Rim escarpment is a geomorphic feature which has 800 to 1000 feet of relief above the surrounding terrain to the west and froms a hogback dipping eastward approximately 12 degrees. This escarpment runs NW-SE through the nominated sites and essentially froms the ridge between the Green River Basin to the west and the Washakie Basin to the east.

Surface elevations in the Washakie Basin (2500 square miles), a watershed of the Green River, range from 6,100 to 8,700 feet and average 6,700 feet. The dominant physical features are a series

of concentric, gently basinward-dipping hogback ridges that rise above relatively flat valleys. Geologic formations are will exposed in the steep faces and on the crests of ridges, but interjacent valleys are commonly covered by sagebrush and thin veneers of alluvium. Higher named ridges are Kinney Rim (site nominations) along the west edge of the basin, and Laney Rim along the north edge of the basin. Haystack Mountain forms a high, crescent-shaped ridge of terraced badland slopes in the north-central part of the basin.

The Green River Basin, an area of 6000 square miles lies to the west of the Washakie Basin and Kinney Rim. This basin is transected north and south by the Green River and the Flaming Gorge Reservoir. The topography consists of rim-like escarpments, mesas, and mountain-like features such as White Mountain and Pine Mountain (9720 ft.). Average elevations in the Green River Basin are 6700 feet.

E. Access

Primary physical access to the subject site is provided by paved state highway 430 extending southeasterly from Rock Springs, Wyoming to Hiawatha Camp in extreme northern Colorado. A bladed dirt road extends northeasterly from Hwy. 430 about 14 miles to the subject site and across Kinney Rim to the Eversole Ranch. This dirt road is considered seasonal, as blowing and drifting snow precludes use at times during winter months.

Additional access is provided by a bladed county road extending south from Interstate Highway 80 approximately 36 miles through Bitter Creek to the Eversole Ranch.

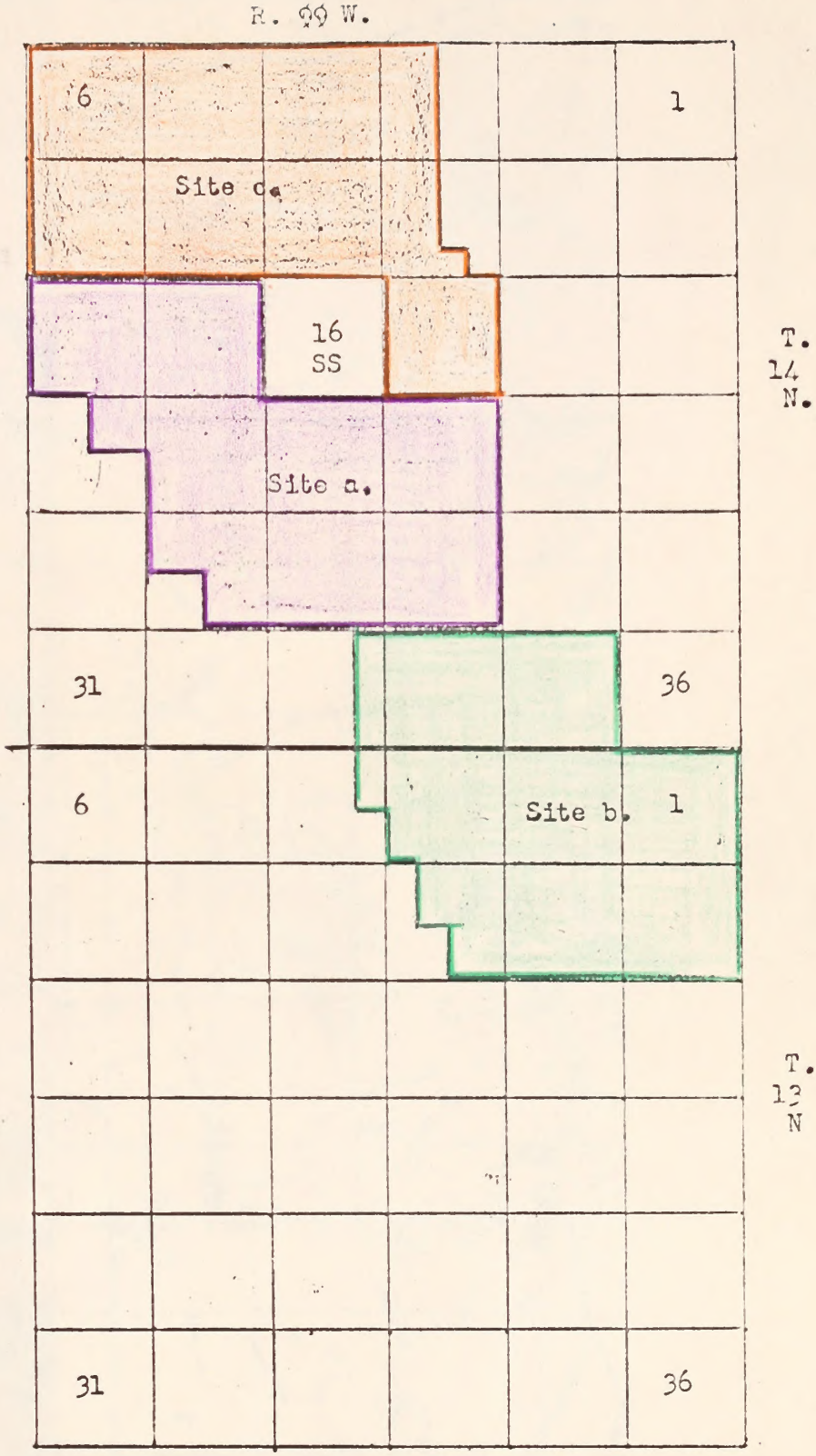
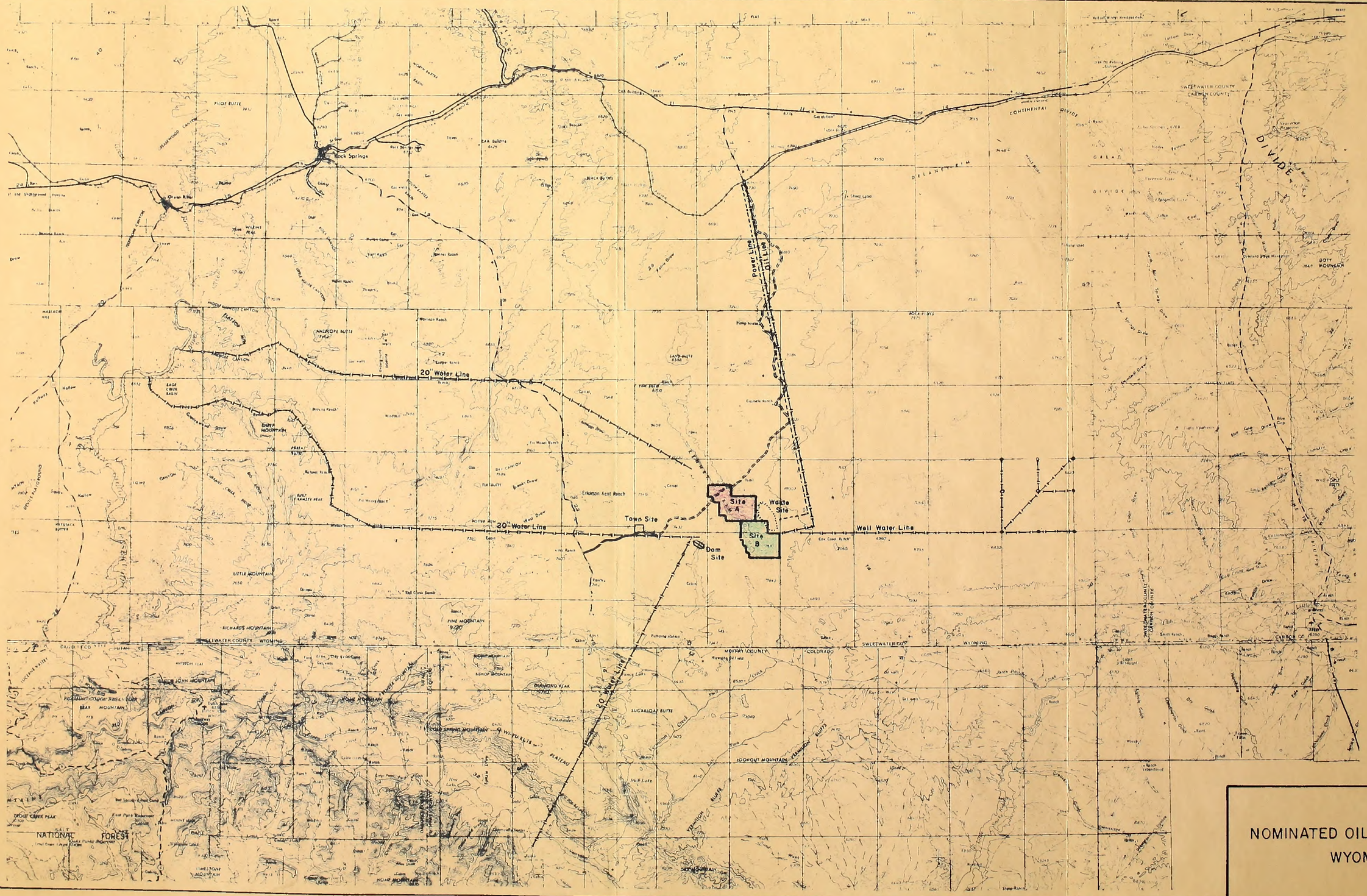


FIGURE . WYOMING OIL SHALE NOMINATIONS, SWEETWATER COUNTY



NOMINATED OIL SHALE SITES
WYOMING

Access from Colorado is provided via approximately 75 miles of good gravel county road (Powder Wash Road) extending west from paved state highway 789 between Baggs, Wyoming and Craig, Colorado.

IV. Geology

A. Surface Geology

Within the prototype area shown on Figure 2, the surface topography is supported entirely by the poorly consolidated shales and sandstones of the Eocene Green River Formation and overlying Uinta and Bridger Formations. The Laney Shale Member of the Green River Formation consists of 600 to 1000 feet of oil shale, siltstone, sandstone, and dolomitic marstone, with some thin limestones and tuff. These beds form the prominent Kinney Rim and dip northeast at an average rate of 12°. The base of the Laney was intercepted by the Cabot oil and gas exploration well at a depth of about 1250 feet. The Laney is underlain by the Cathedral Bluffs tongue of the Wasatch Formation, also the Wilkins Peak and Tipton Shale Members of the Green River Formation. The beds dip uniformly and there is no evidence of significant faulting or folding except in the extreme southwest corner of the township.

B. Oil Shale Zones

Three dill holes have penetrated the Laney Shale as shown on Figure 2. The two oil well test holes by Cabot and Forest were both deep tests. Uneconomic gas flows were encountered and both wells were plugged and abandoned. The U. S. Bureau of Mines drill core test in Section 17 penetrated the entire section to the Wasatch

Formation. It penetrated 650 feet of Laney Shale. Assays[1/] of this drill core were made by the Bureau of Mines. They show that the uppermost 200 feet of Laney in the cored section is mainly sandstone with no oil yield, the next 100 feet is lean oil shale averaging less than 10 gallons per ton. The Laney Shale contains two sequences of oil shale, each about 47 feet thick, that had an average yield of about 20 gallons per ton. These oil shale layers were intercepted from 336 ft. to 383 ft., and from 495 ft. to 542 ft. A third sequence 38 feet thick between the depths of 395 ft. and 433 ft. had an average yield of 17 gallons per ton. Collectively these three sequences, totaling 132 ft., appear to be capable of yielding 180,000 barrels of oil per acre.

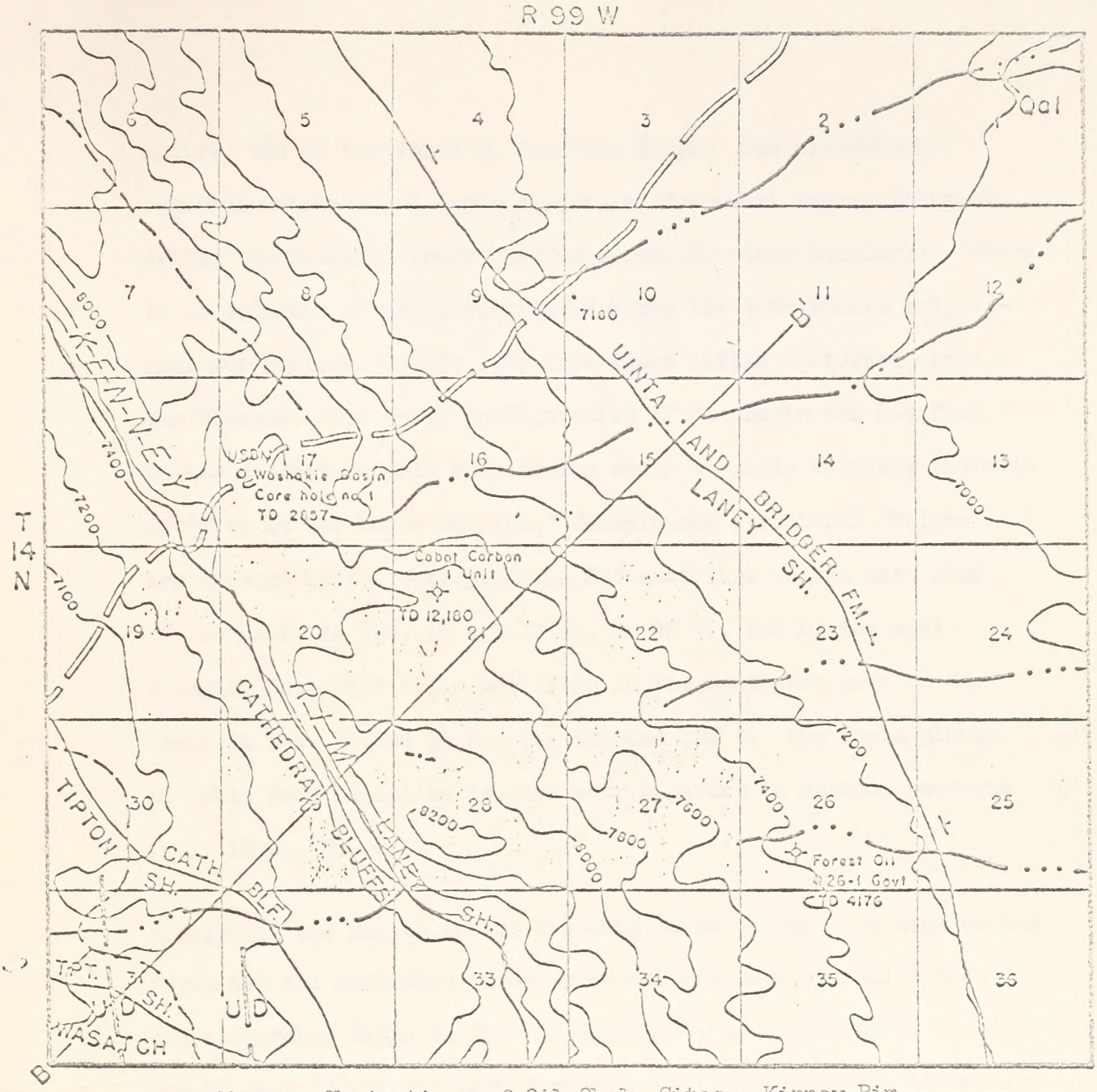
Specific assay recoveries and details regarding the geology can be found in the Open File Report of the U. S. Bureau of Mines for Washakie Basin Corehole No. 1.

The Laney Shale contains only traces of pyrite. No other minerals are known to occur that might pose pollution problems in mine waste.

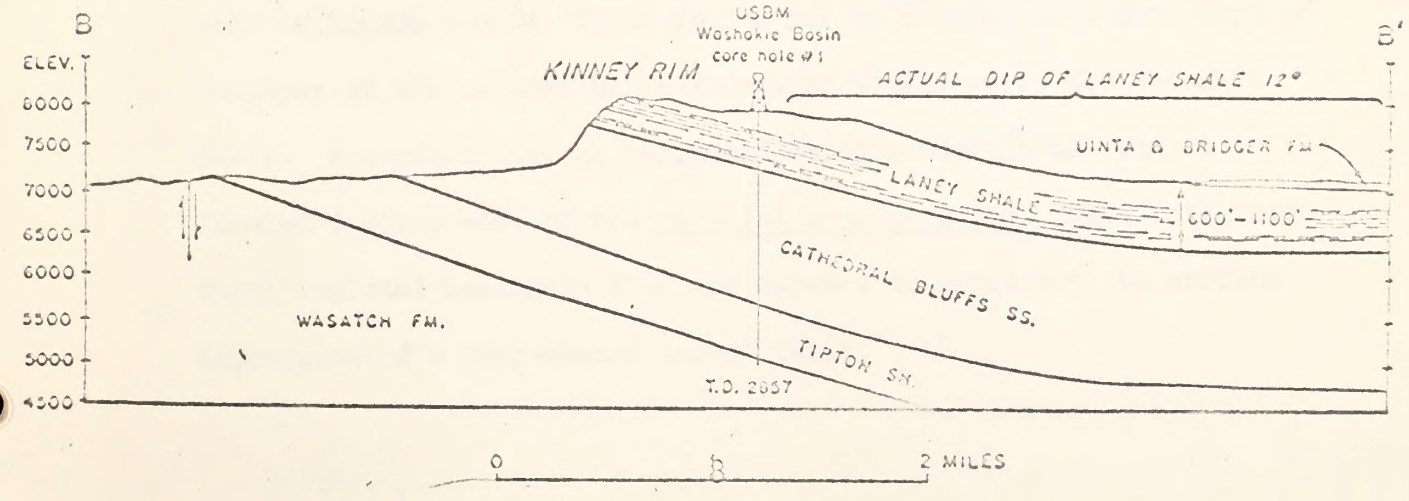
C. Geologic Setting

Roehler, H. W.[1/] reports that the Washakie Basin is a structural and topographic basin bounded on the east by the Sierra Madre Mountains on the north by the Wamsutter Arch, on the west by the Rock Springs

1/Stratigraphy and Oil-Shale Deposits of Eocene Rocks in The Washakie Basin, Wyoming by Henry W. Roehler - 21st Ann. Field Conf. 1966 Wyo. Geol. Ass'n. Guidebook



Wyoming Nominations of Oil Shale Sites - Kinney Rim



DIAGRAMATIC CROSS SECTION

Figure 2. General Geology, Topography, and Cross Sections of Wyoming Sites

uplift, and on the south by Cherokee Ridge. The present-day regional mountain and basin structural framework was established during the Laramide (near the Cretaceous-Tertiary boundary). There is no evidence of basin subsidence after the late Eocene and, except for regional uplift, the area seems little disturbed since the Miocene. The early configuration of the basin was modified to its present roughly rectangular shape by early Tertiary tectonic activity at the basin margins. Conspicuous structural "bulges" are created by the west-plunging Dad anticline on the east edge of the basin in Tps. 16 and 17 N., R. 92 W., and by the east-plunging East Salt Wells anticline in the southwest part of the basin in Tps. 14 and 15 N., Rs. 101 and 102 W. The south plunge of Table Rock anticline is also very apparent in outcrop patterns in T. 18 N., R. 98 W.

Nearly all the faults in the Washakie Basin dip at very high angles. Northeast and northwest trending normal and reverse faults that cross Cherokee Ridge in Tps. 12 and 13 N., Rs. 92 to 98 W. postdate the Miocene (?) Browns Park Formation, which there rests unconformably on Eocene rocks. These faults may be related to a late Tertiary collapse of the eastern Uinta Mountains southwest of the Washakie Basin. A north-trending, basinward-dipping monoclinal fold is located 2 miles east of and parallel to Kinney Rim. This fold interrupts regional basinward dips and appears to represent the surface expression of a deep-seated thrust fault.

Roehler, H. W.[1/] reports that about 80 percent (more than 2,000 square miles) of the Tertiary rocks exposed in Washakie Basin are of Eocene age. Rocks other than Eocene include outcrops of the Paleocene Fort Union Formation at the east and west margins of the basin, small outcrops of the Miocene (?) Browns Park Formation on Cherokee Ridge, and scattered surficial Quaternary deposits. The thick, well-exposed Eocene section comprises one of the most complete records of continental deposition for this epoch in the United States.

Eocene rocks in the Washakie Basin are assigned to the Wasatch Formation, Green River Formation, and to unassigned fluviatile rocks of Bridger and Unita age in ascending order. No major hiatuses are apparent, and the fossil record suggests continuous deposition during early, middle, and late Eocene time. Rather accurate provincial ages and subages (Wood and other, 1941) have been determined from vertebrate fossils, but these time planes do not conform to stratigraphic boundaries. Recent erosion and shifting of Eocene depositional centers make the estimate for a maximum thickness of Eocene rocks deposited difficult to ascertain. Isopach maps indicate a possible maximum thickness of about 12,300 feet near T. 14 N., R. 98 W. A detailed, composite section of Eocene rocks, 7,970 feet thick, was measured in the southwest part of the basin.

D. Mineral Resources

Roehler, H. W.[1/] states that mineral resources in Eocene rocks in the Washakie Basin include oil, gas, coal, oil shale, and uranium. The presence of various clays, zeolites and low-grade phosphate

deposits has also been reported. Except for oil, gas, and uranium, these resources are unexploited. Bedded evaporites such as trona, mahcolite, and halite, which are common in the Green River Formation in other parts of Wyoming and in Colorado and Utah, are not known in the Washakie Basin. Gilsonite beds reported in the upper part of the Niland Tongue in the Shell Oil Company Pine Butte well in Sec. 35, T. 15 N., R. 99 W. (McIntyre, 1955) are now believed to be canneloid coals.

E. History of discovery and development[1/]

Following World War I there was a flurry of oil shale activity in the western part of the Washakie Basin. More than 60 square miles of oil shale claims were staked, mostly on outcrop areas of the Laney Shale Member along Laney and Kinney Rims and in the Tipton and Wilkins Peak Members in Tps. 12 and 13 N., Rs. 99 and 100 W. None of these claims were patented, and their legality is now being contested by the U. S. Bureau of Land Management.

The presence of oil shales[2/] in the Green River Formation in the Washakie Basin was noted by Schultz (1920, P. 49.50), Winchester (1923, p. 124), and Bradley (1945), but until the last 2 years little precise information was available concerning oil yields. Formerly, most information was derived from assays of poor quality drill cuttings from scattered oil and gas test wells. In 1968, several detailed sections of the Green River Formation were measured and sampled by the writer. About 400 Fischer assays were made of oil shale samples, but the oil yields are consistently low because of near-surface weathering. The assay

2/ The term "oil shale" in this report refers to all kerogenaceous rocks regardless of the amount of oil yield by Fischer assay.

results are nonetheless helpful in locating and evaluating oil shale beds. More reliable assay information is now available from recent core sampling by the U. S. Bureau of Mines Petroleum Research Center in Laramie, Wyoming.

In November, 1968, the U. S. Bureau of Mines began drill coring operations at the Washakie Basin No. 1 Corehole located on Kinney Rim in the NW¼SW¼ Sec. 17, T. 14 N., R. 99 W. Before the hole was abandoned in February, 1969, a total depth of 2,857 feet was reached. Most of the Green River Formation was cored; however, the hole was lost in the upper part of the Niland Tongue of the Wasatch Formation. The core was still being studied in June, 1969, but an open file report giving the assay values and lithologic description of the core will be available to the public (J. W. Smith, oral communication, May 1969). A second hole, to be located 2 miles southwest of the Washakie Basin 1, will core from near the top of the Wilkins Peak Member to the base of the Luman Tongue and complete testing to the top of the main body of the Wasatch Formation.

F. Leached Zone

A leached zone is not present in the Wyoming oil shale within the nominated sites.

V. Hydrology

The proposed sites are drained by Sand and Shell Creeks, tributaries of Vermillion Creek which drains directly into the Green River. Sand and Shell drains the western portion of the Washakie Basin. The Washakie and Green River Basins are subwatersheds of the Green River

which forms part of the Colorado River drainage system.

A. Surface Water

Of the several small springs in the area, the best known is Carson Spring which lies in the NW¼SE¼ of Section 9, T. 14 N., R. 99 W. These springs surface between 7180 and 7280 feet in elevation and following the dip drain to the east. In general, water from these springs is of poor quality because of its alkali content.

B. Ground Water

Two hydrologic basins are affected by the proposed development; these are (1) the Washakie Basin and (2) the Green River Basin.

The Kinney Rim which forms the western edge of the Washakie Basin is also the western edge of the proposed sites and the area where the development will take place. Mining operations will be more likely to affect ground water quality in this basin than the Green River Basin.

> "Water[3/] in the basinward-dipping strata in the Washakie is almost entirely under artesian pressure. Water-table conditions exist locally in some alluvial valleys and where saturated rocks are near the surface. The movement of water in the Laney Shale Member of the Green River Formation and in the Bridger and Uinta Formation is probably controlled by the topography of the basin. Ground water from these formations undoubtedly moves out of the basin as underflow beneath the Bitter Creek valley and the other drainage streamways. The direction of movement in the deeper formations probably is both down dip and upward into the overlying formations. Recharge to the aquifers in the Washakie Basin is principally from the percolation of rainfall and melting snow. Much of the

3/ Ground-water Reconnaissance of the Great Divide and Washakie Basins and some adjacent areas, Southwestern Wyoming by George E. Welder and Lawrence J. McGreevy

precipitation, however, leaves the area as surface runoff before it can seep into the ground. Ground-water discharge from the basin is principally by evaporation, but some ground water leaves the area as underflow along the stream-ways that have dissected the basin. Discharge to wells and to the atmosphere by plants is not significant.

"Sandstone, the principal water-bearing medium in the aquifers of the Washakie Basin, generally is very fine to medium grained, but locally is coarse grained. Individual sandstones vary in distribution and character, as in the Great Divide Basin, and much more information is needed before their aquifer properties can be determined. The Wasatch and older aquifers in the Washakie Basin generally are deeper and less accessible to wells than in the Great Divide Basin. Relatively impermeable beds of claystone and shale in the Green River, Bridger, and Uinta Formations overlie the Wasatch Formation in most of the Washakie Basin.

"Water wells are not known to produce from the Lance and Fort Union Formations in the interior of the Washakie Basin. Electric logs of oil test holes show numerous sandstones in the Lance and Fort Union Formations that probably bear some water. About 20 water wells tap the Wasatch Formation in the vicinity of the outcrop, but none are known to penetrate the formation in the interior of the basin. The wells tapping the Wasatch have yields that are reported to range from 1 to 67 gpm; maximum yields at favorable locations probably would not exceed 400 gpm. Larger yields might be obtained from deep wells penetrating several formations, and artesian flows might occur in topographically low areas. Ten wells tapping the Laney Shale Member of the Green River Formation have reported yields ranging from 0 to about 200 gpm. The maximum yield of wells tapping the Laney probably is not much greater than 200 gpm in the south and west parts of the basin, and only a few gallons per minute elsewhere in the basin. One hole penetrating the lower part of the Laney was dry. Wells drilled in the Tipton Tongue of the Green River Formation and the Bridger and Uinta Formations can be expected to have very low yields.

"The quality of the water in the various geologic formations underlying the Washakie Basin ranges from poor to good. Stock water from a Wasatch well in Sec. 12, T. 13 N., R. 94 W. has a dissolved-solids content of about 4,000 ppm. On the other hand, the water from a Laney well in Sec. 10, T. 15 N., R. 99 W. has a dissolved-solids content of about 450 ppm."

VI. Mining Potential

A. Surface

The potential for an open cut operation does not appear favorable since an average of 336 feet of overburden would need be removed to obtain 47' of 20 gal/ton shale or 448' of average overburden removed to obtain 94' of 20 gal shale. This stripping ratio over 4:1 for such low grade shale does not appear feasible at this time.

B. Underground

Underground mining by inclined or vertical shaft appears to be the most reasonable mining method for this deposit. Vertical separation of the two beds indicates both can be mined without unusual problems. Since bed heights are the same all mining equipment should be interchangeable. The low grade of the oil shale may present economic barriers to production by underground mining above.

C. In Situ

The relative shallow depth of the deposit plus its moderage grade of 20 gal/ton indicate that production by some in situ method may be the best chance for economic success.

D. Comments on Proposed Development

The proposed extraction method outlined by the lease nominator is underground mining insitu. A very small (5%) of the orebody would be brought to the surface for retorting while the balance of the deposit would be produced by in situ methods offer chemical

explosive breaking. The proposed extraction method appears reasonable and may well be the only known current method having economic potentials.

E. Waste Disposal

The U. S. Bureau of Mines in their assumed movel of the industrial complex for the nominated sites in Wyoming state that 5 percent of the oil shale will be mined and retorted on the surface. This method of recovery would require the disposal of a large quantity of spent shale. A waste disposal of this volume of material and its compaction and subsequent plan for reclamation will require further study.

Studies have indicated that surface disposal includes cooling and wetting, conveyor transport to the waste area, spreading and compaction. The placement procedure is similar to that used to form large earthen dams. Surface disposal also requires construction of the necessary conduits, retaining dikes and terraces to prevent erosion, to contain surface runoff water and prevent downstream contamination and provide a satisfactory path for normal water flow. The disposal pile can be contoured and revegetated to support natural flora. The vegetation and water diversion systems are designed to prevent wind and water erosion of the completed pile. It was estimated that the residue from a 20-year operation mining 125,000 tons per day would cover eight acres of material 250 feet deep.

Reclamation procedures of the disposal area for the spent shale from the retorting process would be provided for under the "Open Cut Reclamation Act" in accordance with Chapter 192, Session Laws of Wyoming, 1969. Regulations for this act are attached as appendix 2.

VII. Air and Water Quality Considerations

Prevailing winds are from the west-southwest. Velocities average approximately 12 miles per hour at the sites. Peak wind gusts probably reach about 100 miles per hour on occasion during winter months.

Air quality control is difficult to assess because the actual processes to be used are as yet undetermined. Regardless of the processes used, however, air quality control must fall within the limits, provided for by the Wyoming Air Quality Control Act and Standards. (See Appendix I).

It appears the the major problems associated with air quality would be dust suppression and control of retort emissions.

The Air Quality Act for Wyoming, signed on March 3, 1967, empowers the State Department of Health to enforce the policy of the State -- to maintain a reasonable degree of purity of the air resources. To date no known monitoring programs to determine ambient air quality of the Rock Springs vicinity have been initiated by the State. It should be noted, however, that five western Colorado communities

that have been tested (including the town of Rifle - 140 miles south of Rock Springs) failed to meet both Federal and State recommended levels of particulates in 1968 and 1969.[4/] Whether this pattern holds up in Wyoming is not known. The visibility range almost always approaches the unlimited in the vicinity of the sites. One exception is during the frequent periods of high winds when dust (and larger) particles are airborne.

Current estimates call for the diversion of about 5½ million gallons of water daily from Flaming Gorge Reservoir which is approximately 50 miles west of the subject sites. Since the proposed methods of oil shale processing are undeveloped, there is no firm measures for the quality of water discharged.

The following quotation is the most recent comprehensive discussion of current water quality available:

> "Physical and chemical quality monitoring is done continuously through a joint program of the U. S. Geological Survey, the Wyoming Department of Agriculture, and the Wyoming State Engineer's Office. Twelve sampling stations (ten for chemical, two for sediment) are located within the (Green River) Basin.
>
> "Due to the adoption of water quality standards, the Wyoming Department of Public Health has initiated a monitoring program at selected sites to detect serious bacteriological contamination in Green River Basin streams from May to September. Bacteriological contamination is an important indicator, and if excessive, the indicated pollution is relatively easy to correct through conventional water treatment such as chlorination.

4/ Upper Colorado Region, Comprehensive Framework Study, Water Quality, Pollution Control and Health Factors.

"The Wyoming Department of Public Health has established radiological monitoring stations on the Green River at Daniel, Green River, the Fremont Lake outlet, and also on the New Fork River near Pinedale and Big Piney. The monitoring program is to collect background data for an historical base reference period.

"The availability data generally indicate that the waters of the Green River Basin are of excellent bacteriological, radiological, chemical, and physical quality, although salinity from natural sources and return flows increases in the lower reaches of some streams. Salinity is the most difficult water quality problem to trace and is the most costly to treat.

"There are two basic causes of salinity increases in a stream, and they need to be distinguished. These are the 'salt loading' and 'salt concentrating' effects. Salt loading is produced by the discharge of additional minerals from municipal, industrial, agricultural, or natural sources into a stream. The salt concentrating effect occurs as a result of the diversion and consumptive use of water. In this case, the salt load diverted and returned to the stream is the same, but there has been a consumption of pure water and a loss of this water from the system which increases the concentration.

"Few irrigation return flows are monitored in the (Green River) Basin, and therefore it is difficult to quantify the salinity contribution. Observations since 1955 by the U. S. Bureau of Reclamation at the Eden Project in Sweetwater County show salt yields ranging from two to six tons per irrigated acre per year. ....

"At present, most area industries use 100 percent of their diversions. Except for the fact that this reduces the capability of the stream to dilute other salinity sources, this has no effect on salinity."5/

The Colorado River Basin states have worked out an agreement for control of salinity and salt loading of the river system. This agreement states:

"...Basic Principles 1. The States served by the Colorado River System recognize that answers to important questions regarding total dissolved solids, chlorides, sulfates and sodium are lacking or are based on factors that are not

5/ State Engineer's Office, Wyoming Water Planning Program Report No. 3 Water & Related Land Resources of the Green River Basin, Wyoming: September 1970.

yet well defined. In respect of this recognition the States agree that pending the development of acceptable answers to enable the setting of criteria for total dissolved solids, chlorides, sulfates and sodium for the interstate waters of the Colorado River System, such criteria should be stated in qualitative terms. At the same time it is agreed that all identifiable sources of water pollution will be managed and controlled to the maximum degree practicable with available technology in order to provide water quality suitable for present and potential future uses of the System's interstate waters."

Standards for air and water and their quality considerations will require the consultation and expertise of the Environmental Protection Agency. Study will be required to determine effects on both surface waters and ground water aquifers.

VIII. Land Status (W-a)

All the subject lands are federally owned and have been classified for multiple use management per W-6227 and W-12688. A P.L. 167 determination, W-0309697, was completed 2/4/1966 providing for all surface management by the Bureau of Land Management. All the subject lands are included in an oil shale withdrawal, Public Land Order 4522 of 9/13/1968.

In addition, the subject lands in Sections 19 and 29 are included in a withdrawal for coal lands, EO of 7/13/1910.

Land Status (W-b)

The following privately owned lands are within Site #2:

T. 13 N., R. 99 W., Sixth P.M., Wyoming
Section 1, Lot 2

containing 40.23 acres

All remaining lands in Site #2 are federally owned. Of the federal lands, all have been classified for multiple use management per W-6227 except the $W\frac{1}{2}$ of Section 3, Lot 1 and the $SE\frac{1}{4}NE\frac{1}{4}$ of Section 4, and the $E\frac{1}{2}NW\frac{1}{4}$ of Section 10, all in Township 13 North, Range 99 West.

A P.L. 167 determination, W-0309697, was completed 2/4/1966 providing for all surface management by the Bureau of Land Management.

The subject lands in T. 14 N., R. 99 W. are included in an oil shale withdrawal, Public Land Order 4522 of 9/13/1968. In addition the lands in Section 33 are within a withdrawal for coal lands, Executive Order of 7/13/1910.

The subject federal lands in T. 13 N., R. 99 W. are all in an interpretation for oil shale lands by Secretarial Order of 5/29/1930, however, these lands are not withdrawn for oil shale. The land in Section 4, T. 13 N., R. 99 W. are included in a withdrawal for coal lands, E.O. of 7/13/1910.

Both Sites

Numerous oil and gas leases affect the lands in both sites. The county records have not been abstracted, but mining claims probably affect the subject lands.

There are no rights-of-way affecting any of the subject lands in either site.

IX. Transportation

A. Roads

1. Existing - Access to the proposed site is southeasterly 40 miles via Wyoming State Highway 430 from Rock Springs. The site is easterly 14 miles over an improved dirt road which joins this highway in Section 17, T. 13 N., R. 101 W.

ACCES VIA county road from I-80, 37 MILES to North.

B. Railroads

1. Existing - The nearest rail transportation is the Union Pacific line 30 miles north of the site. This is a major transcontinental line between the east and west coast.

C. Pipelines

No oil pipelines are known to exist on or near the proposed sites. A 20" Mountain Fuel Supply gas pipeline runs south of the site approximately 12 miles. This line connects onto the lines near Rock Springs.

X. Power Sources

A. Electric

A major power source would be the Jim Bridger plant (P.P.L) under construction 40 miles to the north. This plant will have three 345 KV transmission lines. This plant is expected to be completed by September 1976. It is assumed that power needs for an oil shale industrial complex can be provided by this plant. Transmission lines for a proposed oil shale installation would be provided through a corridor running north and south in line from

the town of Bitter Creek south to a point east of the Kinney Rim sites. From Bitter Creek the line would run slightly northwest to the Bridger Plant site. Rights-of-way would necessarily have to be acquired forthe power lines. The Bridger plant will be interconnected with the Northwest power network.

A second source of power would be from the Hayden plant 18 miles east of Craig, Colorado.

B. Other Utilities

No other utilities exist near the property except oil and gas lines servicing the nearby oil and gas fields.

The nearest utilities are in Rock Springs, Wyoming 40 miles northwest.

XI. Surface Resources

A. Land Use

Present land use consists of rock and fossil collecting, grazing of livestock, hunting and fishing, and mineral development. It is an important habitat for such wildlife as antelope, deer, horses, sage grouse, coyotes, raptors, rabbits and other small animals primarily during the winter but in some cases year long.

B. Vegetation and Soil

1. Soil Type

The majority of the soils in the area fall within the friable grayish brown loams and fresh water shales group.

These soils are typically brownish gray in color and generally are underlain by free lime at a depth of 5 to 12 inches. The depth of the weathered layer varies from 6 to 50 inches but overall are quite shallow.

2. Plan Species

The plant species within the site areas are generally described a desert shrub complex. While within the zone of influence are included not only the desert shrub complex but also the montane shrub - montane forest complex.

3. Plant composition

(a) Desert shrub complex - shrubs dominate the vegetation. Low growing, salt tolerant shrubs such as salt bush, shadscale and bud sage, occupy the lower, drier sites, while big sagebrush with a mixed mid-grass understory characterizes the higher, more moist sites.

(b) Mountain Shrub - mountain forest complex.

Shrub species of juniper, sagebrush, mountain mahogany, bitter brush, and service berry with a grass understory are quite representative of the mountain shrub complex. With increasing precipitation, the shrub zone grades into a forest overstory of Lodgepole pine with a shrub-grass understory. High meadows and groves of quaking aspen are common throughout the higher elevations.

4. Conditions:

(a) The east sloping portion of the site has an adequate, dense vegetative cover which presently has little or no erosion occurring. However, because of the thin mantle of soil on this slope and high intensity storms which occur periodically throughout the summer, any reduction in the vegetative cover will result in accelerated erosion and the removal of the top soil.

(b) The west facing slope of the site is presently eroding and is in a severe to critical classification. The steeper slopes have no topsoil and sparse vegetation, consequently almost all precipitation runs off carrying with it soil particles some of which are deposited on the lower flatter slopes. Any disturbance of the upper or lower slopes will increase erosion.

(c) Within the area of influence, erosion condition classes run from slight to critical with the bulk of the lands being classified as moderate. There is a badland area, Adobe town, located northeast of Kinney Rim in which severe geologic erosion is occurring. Also located just east of Kinney Rim is a fairly extensive active sand dune area.

5. Susceptability to revegetation

Revetation of mined areas or spoil areas will be difficult to establish because of the thin topsoil layer.

C. Watershed

1. Yield and Use

Two watersheds are generally involved in the site area and both drain into the Vermillion Creek which is a tributary of the Green River. Alkali Creek, west of Kinney River and Shell Creek to the east are empheral streams which run only in the spring from snowmelt and after the high intensity storms which cross the area during the summer months. There is no yield data available for Alkali Creek. The average annual yield from Shell Creek is estimated to be 4260 acre feet.

2. Condition

The Shell Creek watershed is generally in good condition with 72,067 acres classified as slight or stable erosion out of 91,830 total acres. The Alkali watershed is generally good for the site.

D. Wildlife

1. Species Using Site

A variety of wildlife species are supported by the desert shrub zone characteristic of the site area. Of immediate significance are the game animals such as antelope, deer, sage grouse, cottontail rabbit and fish (Vermillion Cr.). A variety of other species, including birds and mammals, also occur within the area.

The "wild horse," though not classified as wildlife, frequents this area throughout the year. The recent act of

December 15, 1971 placed the wild horse under protection. The act states, "It is now the policy of Congress that wild free-roaming horses and burros shall be protected from capture, branding, harassment, or death...."

2. Species Using Impacted Area

When considering the area of potential impact, the habitat of other species of wildlife, as well as additional populations of the aforementioned species, becomes involved. Elk, blue grouse, ruffed grouse, chukar partridge, and waterfowl are added game species. Habitat for these species is contained in the ecological zones--Mountain Forest (includes Pine Mountain, Little Mountain, and Aspen Mountain to the west and the Sierra Madre Mountain to the east) and Mountain Shrub (includes areas of lower elevation immediately adjacent to the Mountain Forest zones and typically includes such shrub species as junipers, sage brush, mountain mahogany, and bitterbrush with a grass understory).

Additional population of the game animals such as antelope, deer, sage grouse, cottontail rabbit, as well as a variety of non-game birds and mammals, occur within the Desert Shrub zone. Habitat for rare and endangered species such as black-footed ferret, spotted bat, and prairie falcon, as well as the bald eagle, greater sandhill crane, Colorado River squawfish,

Colorado River cut-throat, and tule-while fronted goose is included. However, no colonies are known to exist in the area.

3. Critical Habitat Area and Waters

a. Within Site Area

Within the initial site area, critical habitat exists in the form of winter range for antelope, deer and sage grouse as well as a variety of non-game birds and mammals. Records show that the areas immediately west and east of Kinney Rim are used extensively by wintering antelope and deer.

Wild horse use during the winter months within this area is believed intensive. However, no actual use information is currently available.

b. Within Potentially Affected Area

Critical habitat in the form of year-long range exists in the Sage Creek and Firehole areas for chukar partridge. Critical habitat in the form of winter range exists along the proposed and alternate water pipeline for elk, deer, antelope, sage grouse, and wild horses as well as a variety of non-game wildlife species. The proposed oil pipeline will cross winter use areas of antelope, sage grouse and wild horses.

Critical waters, from the standpoint of fish habitat, occur in Vermillion Creek, Sage Creek, Trout Creek, Currant Creek and Flaming Gorge Reservoir.

4. Wildlife Use Patterns

a. Within the Site Area

Wildlife use within the site area and its immediate vicinity is year long by all species indicated under 1a including wild horses. However, during the winter months, numbers of antelope, deer and to some extent sage grouse and wild horses increase in the area as the result of migrations prompted by winter snows.

b. Within the Potentially Affected Area

Wildlife use along the proposed and alternate water and oil pipelines is both year long and seasonal.

5. Hunting and Other Use

a. Within the Site Area

Huntable game species within the site area and its immediate vicinity are antelope, deer, sage grouse and cottontail rabbit. Current hunter use within the area is low relative to other areas. This is primarily due to the remote nature of this area. Use, however, is increasing since word has spread of the trophy antelope and deer occurring in this area.

b. Within the Potentially Affected Area

Huntable game species within the area of potential impact

are elk, deer, antelope, sage grouse, ruffed grouse, blue grouse, chukar partridge, waterfowl and cottontail rabbit. In total, over 7000 hunter days were spent by the hunter in 1970.6/

6. Habitat Condition

a. Within Site Area

Though no habitat evaluation studies have been conducted within this area, the following ratings are considered representative: antelope - good, deer - marginal, sage grouse - good, cottontail rabbit - good.

The trend within the area is stable with good potential for improvement.

b. Within Potential Impact Area

Wyoming Game and Fish reports indicate habitat conditions as follows: elk - good, deer - good, antelope - good, sage grouse - good, ruffed and blue grouse - fair, chukar - fair (species introduced, population now holding its own), waterfowl - fair, and cottontail rabbit - good to excellent.

Generally trends are static with some species showing increases.

E. Archeology

Structures and/or related forms of antiquity are unknown on the nominated sites. However, Indian cultures are known to exist

6/ Area of consideration is bounded by I-80 on the north, Flaming Gorge on the west, Utah-Colorado line on the south and Bitter Creek road on the east.

from the unearthing of fire pot areas existing near the nominated sites. Folsom and Yuma culture have been unearthed in the area.

Fossils are abundant in the area of influence. Popular are the turritella agate lands on the Laney Rim on the north side of the Washakie Basin. The different geologic formations such as the members of the Wasatch formations contains numerous fossil remains of mammals particularly turtles, crocodiles, lizards, snakes, fish, and gastropods. The Green River formation which blankets vast areas near the nominated sites is prolific with fish fossils. Cursory examinations of the published literature, that is, U. S. Geological Survey publications and Wyoming Geological Association guidebook can provide an initial inventory of fossil localities.

F. Recreation

1. Present Use

Present recreational uses within the immediate area of the proposed site include: hunting, fishing (Vermillion Cr.) signtseeing and rock collecting.

Within the area of potential impact present recreational activities and use are estimated as follows:

Activity	Visitor Days
Hunting	7,000 +
Fishing	100
Camping (excluding that incidental to hunting)	200
Hiking	100
Rock Collecting	200
Snowmobiling (estimate based on observed activity)	1,000
Sightseeing	10,000
TOTAL	18,000

2. Potential Use

Based on the publication "An Outdoor Recreation Plan For Wyoming," prepared by the Wyoming Recreation Commission, an overall increase of 15 percent is anticipated in the selected outdoor recreation activities indicated by 1985. This would suggest a recreation use of over 22,000 visitor days by 1985.[6]

3. Aesthetics

The area as a whole does have a "wide open space" aspect which may be psychologically fulfilled upon standing on the Kinney Rim. Adobe Town (T. 15 N., R. 96-97-98 W.) has been considered unique to the area for its bare adobe badland formations. Pine Mountain, Little Mountain, Aspen Mountain and Black Butt, rising between 900 and 2200 feet above the surrounding country, form prominent features on the landscape. Firehole, a unique juniper badland, consists of highly varigated mudstones which have been eroded into spires and isolated buttes in round or conical forms with vivid hues of red, orange, mauve, etc. These and many other untold features of this area provide aesthetic features of great value.

G. Wild Horses

1. Present Use

a. Within Site Area

Use of the immediate site area by wild horses does occur,

[6] Ibid

however, the extent and intensity of this use is unknown. The Wyoming Game and Fish Commission, while conducting aerial wildlife trend surveys have noted small bands of horses in this area, both east and west of Kinney Rim.

b. Within the Potential Impact Area

Wild horse use is scattered throughout the potential impact area. Greatest concentrations are immediately northeast of the proposed oil shale site. Approximately 900 horses use the range northeast of the proposed site.

2. Past Use and Potential

Wild horse use within the area of the proposed site as well as adjacent areas was in existence even in the late 1800's. In most areas in the west during the last four decades, as development has advanced, the number of wild horses has rapidly declined. However, wild horses within the subject area may not have experienced sharp declines since present numbers are considered near potential.

H. Livestock Grazing

Sheep graze the area during the late fall, winter and early spring. Some cattle and horses (domestic) also make grazing use during the summer and fall.

The general aspect of the range is predominately sage brush, with a grass-forb understory and localized areas of salt bush and shadscale.

Major livestock forage producing plants are big sagebrush, black sagebrush, shadscale, saltbush, western wheatgrass, bluebunch wheatgrass and various blue grasses. The grazing capacity is approximately 8 acres/AUM.

There is very little potential for additional livestock forage production except through 1) water development to improve distribution and 2) limited vegetative manipulation by seeding or sagebrush spraying.

The major livestock-oriented problem is lack of water for proper distribution. There are several springs in the immediate area, primarily along the east slope of Kinney Rim. Stockwater reservoirs are thinly scattered throughout the surrounding area.

I. Range and Watershed Improvements

One reservoir and several springs are located within the boundaries of the selected sites. Other stockwater reservoirs are scattered throughout the outlying area.

Water for both livestock and wildlife is in short supply, especially during the dry months of the year during summer, fall, and winter. Therefore, the existing water throughout the area is considered to be highly important.

Any damage to this water source as a result of oil shale development, either to the ground water supply or contamination of the surface water, would result in serious effects on livestock and wildlife use.

XII. Disruptive Influences

Existing oil and gas leases blanket the two sites. Oil and gas leases have been issued for exploration purposes over approximately 95 percent of the surrounding area. The Trail and Canyon Creek Field[7] abut the nominated site and trend toward the southwest whereas the Hiawatha Field lies south on the Colorado border. Other producing oil and gas fields are situated throughout the Washakie and Green River Basins. Potential for further exploration exists at deeper strateographic sedimentary rock levels in both basins and near the nominated sites.

Coal development possibilities exist in the Baggs, Wyoming area in the Little Snake River Coal Field which includes 1500 square miles in an area encompassed by Ts. 12-20 N., Rs. 87-95 W. This field extends from the Colorado state line on the south to the Union Pacific Railroad on the north.

Locatable minerals within the area of influence of the nominated oil shale site include uranium and minor amount of selenium and molybalenum. Abundant claims by prospecting companies and individuals have been recorded particularly south of the Union Pacific Railroad Grant.

7/ Soda Ash Production, Fuel Requirement and Natural Gas Supply, Green River Basin, Wyoming January 1971, Barlow & Haun, Inc., Casper, Wyoming

XIII. Settlement Patterns

The Union Pacific Railroad with its need for manpower, not only to build and operate the railroad but also to mine coal for fuel, dominated other factors that determined the population makeup of southwest Wyoming. Underground mines centered around Rock Springs attracted people because work was available. The railroad also offered an easy route to market for large ranches. Ranch headquarters are typically found scattered along the rivers and larger streams where irrigation water is available. Between the water courses, mile upon mile of unpopulated land is found. Well over two thirds of the population now live in towns and communities.

XIV. Economy and Cultural Patterns

The social, economic, and cultural patterns of Wyoming are interrelated. A brief description of Sweetwater County, Wyoming follows because it is by far the area most heavily affected by this type of proposed project.

With a projected growth in population from 18,391 in 1970 to 27,700 in 1980, this county is one of the fastest growing areas in Wyoming. The county's trona industry, oil and gas production, and coal mining dominate the basic industries of the Green River Basin in Wyoming. The Basin had an industrial employment of 2.186 in 1967 and a projected growth to almost 5,000 for 1980. The payroll is expected to grow from 19 million to 44 million

in the same period. (All data[8])

Rock Springs and Green River are the trade centers of the region. A combined service and retail employment sector of 3,599 people is expected to grow moderately as the Government and recreational service elements increase.[9] Interstate 80 traffic supports motel and restaurant services beyond that expected in a town the size of Rock Springs.

Agriculture, with its 250 employees[9] and 5½%[8] of the county's assessed valuation, is not expected to exhibit a large growth in the next decade.

Sweetwater County exhibits a diverse ethnic and cultural makeup because of the employment available during the different period of immigration. Because mining and power production will not change traditional employment patterns, cultural values will not be disrupted by implementation of the proposal.

XV. Future Trends

The social and economic trends exhibited are not expected to change. Oil shale development should add to the existing trends. All of the developments discussed can be easily accommodated in Sweetwater County's six and one-half million acres of land without materially changing present extensive land use patterns.

8/ State Engineer's Office, Wyoming Water Planning Program, Report No. 3, Water and Related Land Resources of The Green River Basin, Wyoming, September 1970.

9/ Unpublished data made available by the Rock Springs school system.

Part 2 - ENVIRONMENTAL IMPACTS

I. Plant and Related Facilities

Because of the complexity involved, the impacts on the plant will be analysed somewhat differently than the rest of the project components. Plant emissions such as SO_2, NO, NO_2, CO, CO_2, and particulates have an across-the-board effect on several of the environmental categories. These are more easily described under one heading. After the following discussion of stack emissions, the format returns to an analysis of each environmental characteristic.

A. Stack Emissions

The portion of the proposed plant complex identified as having the greatest interaction and affecting the listed environmental characteristics most often is stack emissions. In fact these emissions are potentially as significant as all other environmental impacts combined.

In the absence of precise design criteria, it is difficult to adequately assess these emissions. As soon as the lessee is able to provide meteorological data and their final designs, an independent analysis and predictive model should be prepared. The results should be submitted as an addendum to this report.

1. Lessee should plan for Air Pollution Abatement Equipment.

The lessee should plan to use electrostatic precipitators or scrubbers to remove particulates. Bids for the precipitators or scrubbers must meet a design criteria falling between a "clear stack" and an opacity rating of No. 1 on the Ringelmann Chart; in other words, nearly

invisible except for water vapor. It is maintained that such a standard is considerably more stringent than the State of Wyoming's requirement of not to exceed 0.18 lbs. of particulates per million BTU per hour. It should be expected to meet the more demanding Federal New Source Emission Standards which were to be issued in the fall of 1971.

Because of the low sulphur content of the oil shale, plans for installing sulphur dioxide removal equipment should be in the physical design of the stacks and related equipment.

The lessee should adopt final design of emission stacks and air pollution abatement equipment after meteorological studies are completed and flue type gases are tested from representative samples of oil shale from the mine site in a pilot or semi-pilot plant.

2. Assumed Plant Emissions

Emissions should be based upon analysis of extensive sampling. The maximum concentrations of all deleterious substances should not occur at the same time since the extreme of each substance from different samples in different parts of the oil shale beds. Similarly, minimum concentrations will not occur simultaneously.

Particulate emissions should decrease as loads on the retort decrease, but at something less than a direct proportion. SO_2 emissions should be expected to decrease

in direct proportion to load reduction. The SO_2 emissions listed above are based on an assumption that all of the sulphur in the oil shale is converted to SO_2. In fact, only the organic sulphur is oxidized and emitted as SO_2, while the sulphates remain in the spent shale and the pyritic sulphur is largely discarded in the waste. Thus actual SO_2 emissions will be less, and may be substantially less, than assumed.

Nitrogen oxide emissions should decrease with load reduction due to lower flame temperatures. NO_X control provisions to be installed in the furnaces by the lessee are expected to reduce nitrogen oxide emissions below a critical level.

Carbon monoxide data has been taken from Public Health Service Publication No. 999-AP-35. Carbon dioxide and water vapor emissions are directly proportional to the amount of fuel consumed and are thus proportional to plant loads. Water vapor is also dependent on the humidity of the ambient air.

Spectrochemical analysis of selected samples should be made for mercury, fluorine, and lead in the samples.

3. Disbursement of Emissions

Most emissions, if present, are expected to drift eastward over the Washakie Basin and into Colorado because of prevailing strong winds from the west, and any sub-micron size of particulates that escape. There, differing

portions of the emissions, depending upon local weather, are expected to mix into the Denver-Cheyenne regional airsheds. The ultimate fate of the emissions cannot be predicted with information currently available. They probably will add to other emissions resulting from combustion in the Denver-Craig, Colorado, Fort Collins area.

4. Effects Upon Visibility and Esthetics

One consequence of releasing stack gas type emissions from fuel combustion into the atmosphere is to reduce visibility and esthetic quality. The following information included in the Interior Department Environmental statement for the Huntington Canyon (Utah Power & Light) plant would have general application to the lessee's plant:

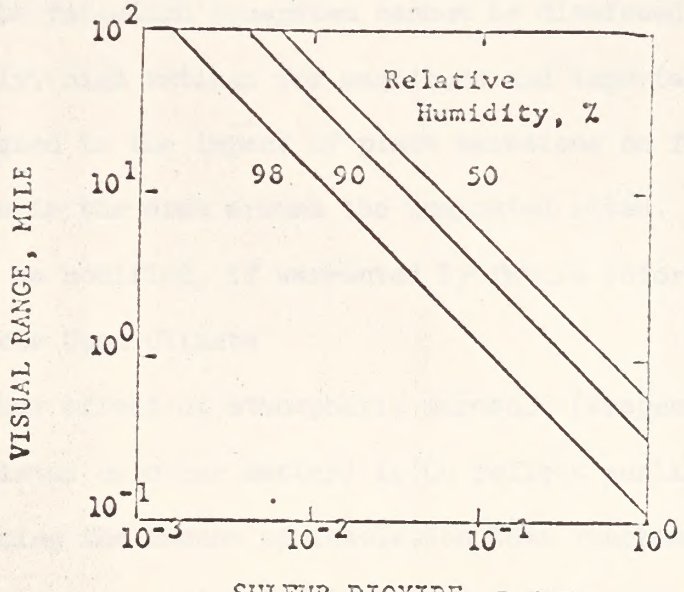
"'The First Annual Report of the Council on Environmental Quality'[1] comments on visibility effects of air pollution to this effect:

> ". . . Particulates, however, are the major villain in reducing visibility. Particles (ash, carbon, dust, and liquid particles) discharged directly to the air scatter and absorb light, reducing the contrast between objects and their backgrounds. Particles are also formed in the atmosphere by photochemical reactions and by the conversion of sulfur dioxide to sulfuric acid mist. Wherever sulfur pollution is significant -- which is wherever large amounts of coal and oil are burned -- visibility diminishes as relative humidity rises.

1/ Pacific Northwest River Basin Commission, Columbia-North Pacific Region Comprehensive Framework Study, Appendix XV Electric Power, 1970.

"The DHEW publication ' Air Quality Criteria for Particulate Matter,' states under the conditions set forth in the studies referenced therein that: '. . . With a typical rural concentration, such as 30 ug/m^3, the visibility is about 25 miles; for common urban concentrations, such as 100 ug/m^3 and 200 ug/m^3, the visibility would be 7.5 miles and 3.75 miles, respectively.'

"With respect to sulfur dioxide concentrations, the DHEW publication ' Air Quality Criteria for Sulfur Oxides' states that 'Visibility reduction to about 5 miles was observed at 285 ug/m^3 (0.10 p.p.m.). However, this does not appear to be a typical case. The following graph taken from the same publication probably gives the more typical results of SO_2 concentrations on visibility, and illustrates the effect of relative humidity which would be low at the site of the Huntington Canyon Plant:



Calculated Visibility (Visual Range) in Miles at Various Sulfur Dioxide Concentrations and at Different Relative Humidities in New York City.

5. Effects Upon Range Ecology

Unfortunately, little is known about the effects of retort plant emissions on rangeland ecology. The University of Utah is studying this in conjunction with proposed fossil fuel plants in Utah but to date has published no conclusions. A check with University of Wyoming sources revealed no research has been conducted on ecological effects of plants such as Naughton Steam Electric Plant near Kemmerer, Wyoming or the Dave Johnston Plant near Casper, Wyoming. Given the known effects of the components of plant emissions on human health and on domestic crops,[2/] the chance for damage to the rangeland ecosystem cannot be dismissed. Initially, high ratings for magnitude and importance are assigned to the impact of plant emissions on frail lands in the area around the nominated sites. This will be modified, if warranted by future information.

6. Effects Upon Climate

Another effect of atmospheric aerosols (suspended particulates or other matter) is to reflect sunlight, thus reducing the amount of insolation that reaches the earth. Concerned scientists are stating that man-caused

2/ See the example "The First Annual Report of the Council on Environmental Quality" and DHEW's Air Quality Criteria for sulfur oxides.

aerosols which are continuously being released into the atmosphere, added to those from natural sources such as volcanoes, are beginning to have sufficient cumulative effect that they have caused a slight lowering of average global temperatures. They speculate that a fourfold increase would trigger an ice age.[3/] Concern is also being expressed that particulates may "seed" storms and alter weather patterns, generally downwind from urban areas or other large source of atmospheric contaminants. The carbon dioxide produced from all fuel combustion has been accumulating in the atmosphere and in the seas.

The total amount of CO_2 in the atmosphere has increased at least 10% since 1890. The amount released by any proposed plant will add a small increment to the global total. Atmospheric CO_2 causes a "greenhouse" or warming effect upon global climate. A projection of present global exponential increases in fossil fuel combustion would cause a further increase of 20-25% in atmospheric CO_2 by the year 2000. If not offset by other factors such as atmospheric aerosols, the increase is calculated to cause an increase in average global temperatures from 0.5 to 3° F.[4/]

3/ S. I. Rasool and S. H. Schneider, Atmospheric Carbon Dioxide and Aerosols: Effects of Large Increases on Global Climate. Science, July 1971.

4/ B. Bolin, The Carbon Cycle, Scientific American, Sept. 1970. Also Mass. Inst. of Tech., Man's Impact Upon The Global Environment - A Study of Critical Environmental Problems, August 1970.

B. Generating Plant Impacts Other Than Emissions

1. Construction Material--The proposed plant will require sand and gravel in large quantities. The only source of quality material is the bench land adjacent to Alkali Creek. Removing and transporting the material will have a low impact, but it is important that conservation practices be employed because of the proximity to the creek.

2. Water Quality--A project of this magnitude offers two major threats to water quality. One occurs during the construction period when a large surface area is subject to erosion and the other involves disposal of liquid wastes. Erosion and subsequent deposition of silt particles in live streams impact water quality by limiting its usability for irrigation, fisheries, etc. The impact of Plant construction (including access roads) is deemed to be moderate both in magnitude and importance. This conclusion is reached after considering the Plant's proposed location three miles from the nearest live stream, the low annual rainfall and the availability of conservation practices to control erosion during high intensity storms. The Plant's location away from live water also reduces the likelihood of pollution from a malfunction of any sewage system serving the complex.

The open cooling system assumed, whereby a portion of the water is either dissipated into the atmosphere or possibly some recycled and wetting waste piles extend the possibility of surface water pollution from large quantities of water used in the cooling process and waste wetting process. The disposal of water highly charged with minerals by the process of wetting the spent shale or waste offers a more serious threat to surface water quality. This type of liquid effluent has the potential for killing aquatic life and surface vegetation. It could, if allowed to run off, reach the Green River in Colorado via the Alkali and Vermillion Creek drainages. Contamination of ground water is not expected, due to the low rainfall and consequent negligible percolation.

All effects on surface water are judged to have a low magnitude. The importance, however, is considered somewhat higher because of the serious consequences of water pollution should liquid effluents reach the Green River via either Alkali or Shell and Vermillion Creeks.

3. Atmosphere--The prevailing westerly winds can pick up dust particles from surfaces distrubed during construction, from uncovered tailings or spent shale or from dried cooling and combustion process type residues. The addition of particulates from these sources to the ambient air is judged to be of low magnitude. When considered as an

addition to the adverse impact of any type of stack emissions, it gains somewhat in importance.

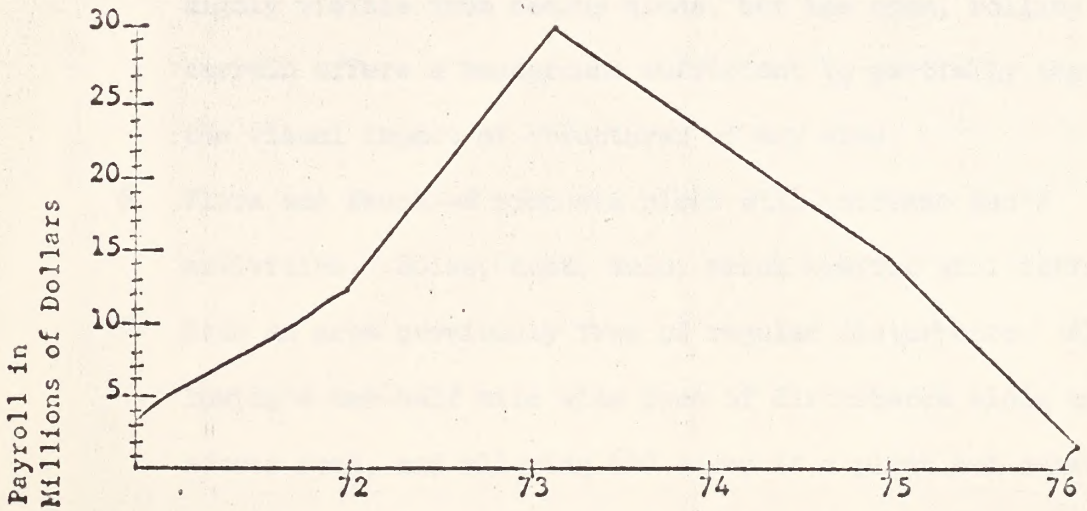
4. Land Use--Because of the nominated site's low grazing capability, changes in land use from grazing to industrial are insignificant at the plant site. The plant will generate significant changes in residential and commercial land use at two locations -- Rock Springs and secondarily Green River and Baggs, Wyoming. Because rapid growth without adeuate land use and other planning usually results in environmental degradation, the planning efforts of each unit of government will be discussed. By far the greatest impact is expected in the town of Rock Springs (pop. 11,490). In July 1970, the town hired Midwest Planning and Research to prepare a comprehensive plan. The federally aided planning contract calls for a comprehensive land use plan covering housing, transportation, sewage, etc., and preparation of a zoning ordinance and subdivision standards. The results of the planning effort were due in August of 1971.

   The town of Green River (1970 pop. 4,196) will also feel the impact of growth generated by a plant. Green River is presently awaiting completion of a master plan prepared by Wyoming Department of Economic Planning and Development. Sweetwater County has an appointed planning commission that advises the county commissioners. The County has

spot-zoned several small areas as needs become evident. It has the authority to assist unincorporated towns with planning and zoning.

The major impact will be on housing, transportation and schools. This impact is already felt in the construction of the Bridger Power Plant. Preliminary information from the Rock Springs planning consultant indicates a heavy impact on all three from 1971 to 1975. All sources indicate some problems in accommodating construction forces; a permanent work force can be absorbed without too much difficulty.

The following table graphically portrays the expected construction force buildup from the construction of the Bridger Power Plant and a similar impact may be expected for an oil shale plant.



Construction "Boom" as Indicated by Payroll 5/

5/ See Idaho Power Co. and Pacific Power & Light Co. Environmental Impact Study Report Supplement No. 2, July 1971.

Land is available for mobile home parks to accommodate construction crews. Several are now under construction in or near Rock Springs. This will continue a present trend that has seen the number of mobile homes in Sweetwater County more than double in the 1960-1970 decade.[6/] With proper planning and zoning, land can be obtained from the public domain managed by the Bureau of Land Management for residential and commercial uses.

With a construction peak in 1973-1974 in the Bridger Power Plant effort and planning only partially complete, moderate adverse impacts on land use and population density can be predicted.

5. Scenic Views, Vistas and Wilderness - Open Space Qualities--The vicinity of the plant site will be visibly disturbed by man-made structures. Moderately tall structures will be highly visible from nearby areas, but the open, rolling terrain offers a background sufficient to partially absorb the visual impact of structures of any size.

6. Flora and Fauna--A proposed plant will increase man's activities. Noise, dust, auto, truck traffic will intrude into an area previously free of regular disturbance. Allowing a one-half mile wide zone of disturbance along an access road, and allowing 640 acres of a plant and related facilities, about 4500 acres will be affected.

6/ Information obtained from Wyoming Department of Economic Planning and Development.

7. Archeological and Historic Values--Additional cultural factors include the potential effects on historic and archeological values. A contract with an institution, such as the University of Wyoming Department of Archeology, to survey construction sites may be undertaken. Opportunities to salvage any archeological information prior to construction will be allowed.

II. Rights of Way

Although the locations of various required facilities have not yet been proposed, the oil shale developments will necessarily require power transmission lines, an oil transmission pipeline system, a water supply transmission system, and an all-weather road system to the proposed sites.

For purposes of this environmental impact analysis, the logical approximate location of each required system has been determined and the corresponding potential impact assessed.

A. Power Transmission Line and Oil Transmission Pipeline

A potential corridor has been identified which extends northward from the subject sites to Bitter Creek just south of Interstate Highway 80 and the Union Pacific Railroad. Both the required power transmission line and the oil transmission pipeline would probably be located in this corridor.

The impact of transmission line construction and operation relates to the linear corridor affected. Adverse impacts can be reduced by intensive route analysis on specific locations. Although

the general route is identified, the exact location of transmission lines from Bitter Creek to the subject sites has not been determined. Precise location must be based on a cooperatively undertaken route analysis to avoid unnecessary adverse impact.

1. Soil Erosion and Deposition

Adverse impacts of soil erosion and deposition have been identified with regard to the road and trail system required to construct and maintain the approximate 30 miles of powerlines and pipelines. Removal of natural vegetation and modification of landscape tend to concentrate natural runoff in the roadway, thereby accelerating erosion. While these soils do not typically have a high productivity in the agricultural sense, serious erosion represents a permanent loss of the resource base. Present and future generations would lose the potential of the affected site for grazing, wildlife habitat, recreation and efficient functioning of the hydrologic cycle. The importance of this impact is considered moderate. Adverse effects can be reduced by implementing comprehensive erosion prevention and site rehabilitation measures during all stages of road system planning, construction and operation. Specific areas of high concern are:

a. Arid, erodible soils where revegetation is difficult (entire route).

b. Roads and trails crossing natural drainages (throughout entire route).

c. Construction and use of roads and trails in steep, broken topography (various sections, but specifically near the subject sites).

2. Flora and Fauna

Vegetation will be removed or disturbed on tower construction sites, roads and trails, and on certain R/W sections to achieve necessary clearance for powerlines, and along the entire pipeline route.

Wildlife and wild horses will be disturbed and temporarily displaced during periods of actual construction. Improved access to big game winter-use areas and year round wild horse habitat areas may be detrimental because of increased traffic disturbing the populations. Harassment of game and horses by snow machine users is a critical impact likely to occur. The magnitude for big game is small but very important because of the serious impact on a big game herd. The magnitude on wild horses is moderate due to the large herd concentrations in the area and the existing scarcity of the animals.

Potential electrification of eagles in the area (powerline impact only) is of slight magnitude, but very important because of the national significance of the birds. The

overall impact on flora and fauna is rated slight; however, impacts such as that of traffic on big game and wild horses must be considered critical and resolved if they occur.

3. Land Use

The right-of-way for the power transmission line and oil pipeline will encompass approximately 360 acres. It will restrict other space-occupying uses such as buildings, etc., on this acreage, but traditional uses such as grazing domestic livestock and wildlife can continue on all but the fraction of the right-of-way needed for towers and roads. Therefore, the lines are expected to have very slight adverse impact on the existing extensive land uses. Other potential industrial development along the route (primarily mineral development) will be beneficially affected by the increased availability of power and the oil transmission pipeline.

4. Scenic Views and Vistas

Adverse impacts by the powerlines and associated roads and pipeline on scenic views can be expected. Approximately 30 miles of prairie or rolling hills with long vistas will be affected. The low-growing vegetation in these areas does not provide screening potential to reduce visual impacts. However, no transportation routes will be crossed by the lines and views of the traveling public will not be adversely affected.

Some open space qualities exist. Transmission lines and roads are a man-made feature foreign to the natural landscape. Adverse effects will be moderate considering present land uses and the relative quality of scenery in the area.

Historical and archeological sites and artifacts are common throughout the area. The possibility of damage is limited but any values destroyed are irreplaceable. The adverse effect is, therefore, judged to be significant.

5. Road System

Both highway 430 and the dirt road would have to be improved by realigning and installing new base and surface before being used to haul heavy equipment to the site.

Intensive investigation will probably reveal that a new road from the site north to Bitter Creek on the railroad would be the most feasible route for hauling heavy equipment to the site. This route would also parallel or nearly so the powerline to the site.

The distance from the site to Bitter Creek would be 30 miles over relatively flat terrain and then another 7 miles to I-80 plus another 36 miles to Rock Springs. The disadvantage to this route would be its greater distance to Rock Springs for persons commuting to the site.

6. Other

Construction of the powerline, water pipeline and pumping plant, and oil pipeline will generate some temporary employment in the area. Permanent jobs and lasting effects on the economy will be minor. The beneficial impact of jobs created is partially offset by the demands a "construction boom" places on the existing public facilities and services, such as the area school systems. Long-term beneficial impact is considered to be of little importance.

B. Water Supply System

Probable source of water are Flaming Gorge Reservoir approximately 50 miles west of the subject sites, or pumping directly from the Green River southwest of the proposed site above Vermillion Creek in Colorado. Either source will require at least a 20 inch water transmission pipeline to provide the required quantities of water at the development sites. The following environmental characteristics will be effected by the water supply system:

1. Water Quality and Quantity

   Approximately 17 acre feet of water per day will be pumped out of the Green River from Flaming Gorge Reservoir. Withdrawal of this water may have slight adverse effects on downstream water uses, primarily because the water consumed will not be available to dilute downstream salt accumulations. This impact may be increased when considered in conjunction with the impact recently imposed by diverting an estimated 30,000 acre feet per year from the Jim Bridger Power Plant.

2. Soil Erosion and deposition

   Pipeline and road construction will result in the removal of vegetative cover on a corridor approximately 50 feet wide and 50 miles long. Several miles of the pipeline traverse highly erodible soils of 20% or greater slope. Numerous side drainages are also crossed at nearly right angles. The erosion hazard would be high during the following construction until a vegetative cover is

reestablished. A leak or rupture in the pipeline, although not at all likely, would cause serious washing and possible damage from deposition. The magnitude and importance of total impact is rated moderate to high because of, (1) the 4500 acres affected, (2) the presence of physical characteristics which tend to accelerate the erosion process, and (3) the difficulty anticipated in revegetation of disturbed areas because of low fertility soils and arid climate.

3. Flora and Fauna

Shrubs and Grass--Vegetation in the pipeline right-of-way construction corridor would be destroyed. Rehabilitation efforts plus natural healing may revegetate this area except for access and maintenance roads. The required dam and water impoundment at the surge pond site will inundate approximately 80 acres which at present has a cover of native shrubs and grasses. The importance of this impact is rated low.

Aquatic Plants--Growth of aquatic plant life in the proposed surge pond could be beneficial to a fisherly or to waterfowl populations. The beneficial impact is rated slight because the quality of the water and future uses for fisheries, etc., are unknown.

Other Animals--The surge pond would provide a permanent water supply beneficial to all wildlife in the area. The impact is rated high in importance because of the present scarcity of water supplies in the immediate area.

4. Scenic Views and Wilderness - Open Space Qualities

The required pumping plant and power supply line would be located in an area substantially undeveloped and free of man-made facilities which adversely effect aesthetics (railroad, highways, substations, powerlines, etc.). Any development within the Flaming Gorge National Recreation Area would have significant adverse environmental impact. The pipeline (to be buried) and associated roadway will adversely effect scenic quality. The 50-foot construction scar will span the entire 50 miles from Flaming Gorge to the development site. Due to poor soils and arid climate, revegetation of disturbed areas will be slow unless intensive effort is directed to rehabilitation.

The area of highest scenic impact will likely be in Firehole Canyon or an alternate approach to Flaming Gorge Reservoir. This area represents an important scenic backdrop for the Flaming Gorge. The scar resulting from construction would be visible to recreationists using the area for camping, picnicking, sightseeing, etc. Because the scar would degrade this area within view of a large general public, the impact is rated high in importance.

The proposed surge pond will introduce an element of diversity into a landscape which is somewhat monotonous. The impact is rated a moderate benefit because of general improvement to the future landscape in the plant site area.

C. Road Access System

The probable road system will include improvement of State Hwy. 430 from Rock Springs southeastward to a point approximately 12 miles west of Kinney Rim and the subject site. The remaining portion of the road east to the site will be substantially new construction. Adverse impacts associated with improvement of the existing state highway are considered minimal. Location of the portion of new road must be based on a cooperatively undertaken route analysis to avoid unnecessary adverse impact. Although the general route is identified, the exact location of the new road required from Hwy. 430 to the development site has not been determined.

An alternate location for a road would be north from the proposed site to Bitter Creek.

1. Soil Erosion and Deposition

Adverse impacts of soil erosion and deposition have been identified with regard to the road system required to construct and maintain the approximate 12 linear miles of access road. Removal of natural vegetation and modification of landscape tend to concentrate natural runoff along the roadway, thereby accelerating erosion. While these soils do not typically have a high productivity in the agricultural sense, serious erosion represents a permanent loss of the resource base. Present and future generations would lose the potential of the affected site for grazing, wildlife habitat, recreation and efficient function of the hydrologic cycle.

The importance of this impact is considered slight. Adverse effects can be reduced by implementing comprehensive erosion prevention and site rehabilitation measures during all stages of road system planning, construction and operation.

2. Flora and Fauna

Vegetation will be removed to achieve necessary clearance for the roadway.

Wildlife will be disturbed and temporarily displaced during periods of actual construction. Improved access to big game winter-use areas may be detrimental because of increased traffic disturbing the game populations. The overall impact on flora and fauna is rated slight; however, impacts such as that of traffic on big game must be considered critical and resolved if they occur.

3. Land Use

The right-of-way for the new road encompass approximately 36 acres. It will restrict other space-occupying uses such as buildings, etc., on this acreage, but traditional uses such as grazing domestic livestock and wildlife can continue on adjacent lands. Other development along the route (primarily commercial business development) will be beneficially affected by the improved access.

4. Scenic Views and Vistas

Adverse impacts by the road system on scenic views can be expected. Approximately 12 miles of prairie or rolling hills with long

vistas will be affected in Wyoming and Idaho. The low-growing vegetation in these areas does not provide screening potential to reduce visual impacts. Views of the traveling public will be adversely affected from Hwy. 430, but this impact is considered slight.

Roads are a man-made feature foreign to the natural landscape. Adverse effects will be slight considering present land uses and the relative quality of scenery in the area.

Historical and archeological sites and artifacts are common throughout the area. The possibility of damage is limited but any values destroyed are irreplaceable. The adverse effect is, therefore, judged to be significant.

III. Oil Shale Mine Operation

The following environmental characteristics will be affected by the oil shale mine and retort operations.

A. Soil Erosion and Deposition

The oil shale operation will disturb an average of about 20 acres of the surface annually. Haul roads will be one to three miles long. Topsoil stripped from the waste area will be susceptible to wind erosion between the time it is removed and the time it is replaced as part of the rehabilitation of the spoil piles. The imposed Federal and State rehabilitation requirements should make the time period of soil vulnerability to wind erosion temporary in nature, thereby minimizing the erosion impact. Erosion should be confined to the site and to the haul roads, with wind deposition of large particles within 2-3 miles. Wind erosion will also add particulate matter to the ambient air which will drift much further.

B. Water

Drill hole data to date indicates that the mine operations are not expected to encounter underground water. Surface water sources are present in potential waste pile areas. Because of the low precipitation, the impact on water will be slight to moderate due to the short distance to live streams and major water courses.

C. Atmosphere

The primary impact of the retort and spent shale disposal operation will be on atmospheric quality. Soil disturbance from the operation and the haul roads are subject to the prevailing westerly high winds

and will add a continuous source of dust to the air. Winds average 12 miles per hour year-round. "Strong winds of 20 to 40 mph with higher gusts will prevail for a few days..."[7/] In order to physically accommodate the heavy ore trucks, the haul roads will have to be surfaced, minimizing dust from this source. The retort and spent shale disposal operation is expected to have a low to moderate impact on the area's atmosphere.

D. Flora and Fauna

A moderate impact is expected on birds, wild animals and domestic livestock in the immediate area of retort, waste disposal and mining activity. Short term displacements will occur. However, a significant impact is anticipated on the wild horses immediately northeast of the proposed site. Revegetation called for in Federal and State imposed reclamation standards for mined areas should offset detrimental impacts.

E. Scenic Views

During waste disposal operations and pending reclamation of the area, the scenic value of the natural landscape of the site will impacted. Over the life of the assumed project about 1,000 acres are estimated disturbed. The mine and retort area is not visible from great distances (generally less than a mile) and will have impact on the scenery of slight magnitude and importance.

7/ State Engineer's Office, Wyoming Water Planning Program Report No. 3, Water & Related Land Resources of the Green River Basin, Wyoming. September 1970.

F. Other

The area's economy is based primarily on mining, ranching and railroad services. The additional proposed operation will not change cultural patterns of this area. It is expected that the operation will provide in excess of 200 additional permanent employees to the area. This is a moderate increase in relation to the size of the local labor force. It is of high importance because they will be permanent employees.

Interpretive-Educational--The type of mine and retort operation and other plant facilities provide the opportunity for interpretive and educational tours for local residents and tourists.

IV. Watershed Effect of Oil Shale Development

The quantative effect of the proposed operation on the watershed cannot be ascertained this time. However, some basic assumptions can be made from the meager information available.

A. Waste material disposal

1. Siltation will increase in run off from severe storms
2. Some smothering of vegetation will occur both from water moved material and wind borne material.
3. Sludge pit design must be large enough to accommodate flood flows from high intensity storms.

B. Waste water disposal

1. Assuming 10% waste - water will be used to sprinkle waste piles. Waste water will reach chemical residual from waste

material and will enter either ground water or if there is sufficient water will drain into Little Snake River.

C. Human element:

1. People driving in townsite will need recreation and will use surrounding area with four-wheel drive vehicles and motor bikes. The sand dune area east of Kinney Rim which was isolated and not used by dune buggies will now receive use, reducing plant cover and increasing both wind and water erosion.

2. People in area will increase fire hazard and will start range fires which will effect watershed.

D. Retort emissions

Emission analysis is not known but can be assumed will contain SO^2 and nitrous oxides which if in sufficient concentrations will effect plant community downwind of site.

V. Cumulative Impacts

While a project of this size must be separated into components to facilitate analysis, this approach can result in missing potential total impacts. There is also the possibility of a synergistic effect developing from a combination of effects working together that would increase the total impact.

The wind-borne soil and spent shale particles from the mining and retort operation will add a predictable, but at present unquantifiable, amount to the particulates from the stack emissions. All of the project components have a potential of causing soil erosion. The

linear nature of the project -- 45 miles of transmission lines, 80 miles of pipeline, and fourteen miles access road -- diffuse the impact over a broad area.

Synergistic combinations might occur in the activities associated with the mine, retort and tank form. This possibility should be explored as the analysis of the pollution factors continues and will be discussed in an addendum to this report.

VI. Accidents and Catastrophes

Any mine and retort operation would present the possibility of injury or death from vehicle or equipment accidents, from falling materials and unexpected mine gas explosion, and from the use of explosives within the underground mining operation. If the public is invited to view the retort operation, injuries could occur from falls from overlook areas.

Transmission line or tower failure would pose a serious hazard in the right-of-way area. Records indicate the number of wild fires being caused from broken powerlines is very small; therefore, the threat from fire is not considered significant. The possibility of animals coming in contact with a broken line is also considered to be very remote. The primary possibility of human contact would occur where the lines cross the public roads.

VII. Unknown or Partially Understood Impacts

The preceding impact summary reveals four areas where continued research and monitoring is needed before the impacts can be fully understood. (1) The effect of any type of retort stack emissions on regional air quality, (2) the total effects of the plant on range-land ecology, (3) mine operations are not expected to affect ground water in the Green River Basin; however, a small town of approximately 200-400 people may have some impact on the southeastern edge of the basin, (4) the affect on downstream salinity as a result of diverting 17 acre feet daily from Flaming Gorge needs further study.

The Wyoming Air Resources Council, may require conducting an air quality surveillance program. The Environmental Protection Agency will review any proposed monitoring program. Monitoring of meteorology and air quality should be included as part of the environmental study.

PART 3 - MEASURES WHICH SHOULD BE TAKEN TO ENHANCE, PROTECT OR MITIGATE IMPACTS

I. Water Pipeline Pumping Plant and Surge Pond Location

The location of the development site would have the effect of establishing the terminus of the water pipeline and the general location of the surge pond complex. A field examination and review of the U.S.G.S. Topographic maps by the Bureau of Land Management indicates that a dam on the upper Alkali Creek would provide a site for a surge pond. Topographic relief maps and site examination indicate that lands in Section 11, T. 14 N., R. 99 W. would permit a deeper surge pond utilizing a proportionately smaller land surface area. This proposed surge pond site would reduce surface evaporation to the large extent compared to a site on Sand Creek in T. 14 N., R. 98 W. and would also permit the development of more suitable fish habitat if a plan-design would permit use of the water for this purpose.

Should the lessee contract for unadjudicated water from Flaming Gorge Reservoir a pumping station and inlet structure would be required at the mouth of Firehole Canyon or Sage Creek. A proposal would require the line to follow either drainage with impairment to aesthetic values at the mouth and along the rights-of-way of such a line. Either proposal would necessarily require consideration for recreation developments, that is, boat ramps and campgrounds. The line would transect established ranches and cross several drainages and highway 430.

Concerning the route from the proposed pumping station site to the retort site, the following observations are made:

A. The proposed pipeline will cross Highway 430. The lessee will have to take extreme caution during construction and during the period of rehabilitation to maintain and preserve the aesthetic qualities of the area bordering Highway 430. This can be accomplished by diligent efforts to prevent erosion and to revegetate the disturbed area after construction.

B. The lessee would be required to exercise extreme diligence during construction of the pumping station and line in the Flaming Gorge area. Coordination with the Bureau of Reclamation would be imparative to preserve aesthetic and scenic qualities.

II. Revegetation of Spoil Piles and Other Disturbed Areas

Environmental impacts clearly indicate the necessity of restoration of areas where the existing vegetation has been removed. Stipulations requiring revegetation will be included in all rights-of-way granted. In an arid area, revegetation is often difficult, but it can be accomplished.

Dr. Morton May of the University of Wyoming's Plant Science Division has stated,

> "The University is wrapping up negotiations for two research contracts with the Companies involved in Jim Bridger. One contract will finance a study of how to revegetate the spoil piles at the mine; the other will sponsor an evaluation of the continuing impacts of the plant on the surrounding ecology. Our studies at the Kemmerer Coal Co. strip mine indicate that revegetation of woody and grass species is possible".

Information learned from these studies can be applied to the sites considered in this report.

PART 4 - CONSULTATION AND COORDINATION

A series of meeting should be held with representatives of Federal, State and local agencies and with other interested parties to discuss environmental aspects of the oil shale complex.

Following is a listing of Federal, State and local agencies who should be consulted in connection with environmental aspects of the oil shale complex:

Federal Agencies

U.S. Forest Service, Dutch John, Utah

Bureau of Reclamation, Salt Lake City, Utah

Bureau of Reclamation, Cheyenne, Wyoming

Bureau of Sport Fisheries & Wildlife, Albuquerque, New Mexico

Bureau of Sport Fisheries & Wildlife, Green River, Wyoming

Bureau of Sport Fisheries & Wildlife, Sale Lake City, Utah

Soil Conservation Service, Rock Springs, Wyoming

Environmental Protection Agency, Denver, Colorado

State Agencies

Public Service Commission - Wyoming

Department of Economic Planning & Development - Wyoming

Air Resources Council - Wyoming

Department of Anthropology, University of Wyoming

Highway Department - Wyoming

Wyoming Game & Fish Commission

Department of Health and Social Services - Wyoming

State Archives & Historical Department - Wyoming

University of Wyoming

Local and Private Entities

Pacific Power & Light Company, Portland, Oregon

Union Pacific Railroad, Omaha, Nebraska

Sweetwater County Planning & Zoning Board - Wyoming

Sweetwater County Commissioners - Wyoming

State Multiple Use Advisory Board - Wyoming

City of Rock Springs, Wyoming

Local School District - Rock Springs, Wyoming

PART 5 - ADVERSE IMPACTS WHICH CANNOT BE AVOIDED

Construction of the plant will introduce a man-made industrial feature into an area which now exhibits an open space, desert character. While the remote location and undulating topography will shield the major part of the complex from view combustion by products and other emissions from spent shale may be visible for many miles. Stack emissions are expected to have some adverse impacts on the environment; however, a more accurate delineation is not possible until studies are undertaken and data is available for analysis.

The proposed waste disposal area will disturb the surface soil and vegetation at the rate of 20 acres per year for the life of the project. While the plan will be to reclaim and restore the disturbed surface to the same general topography that existed before disturbance, it is reasonable to assume that 50 to 100 acres may be in the process of stripping, mining, backfilling, and early stages of reclamation at any given time.

Dust from disturbed areas is, to a certain extent, unavoidable. Because of wind velocities averaging 12 miles per hour and the mechanized equipment necessary to operate the mine, dust problems will exist in varying degrees throughout the life of the project.

Construction of the water and oil pipeline will result in disturbance of approximately 600 acres of right-of-way lands. A certain amount of erosion hazard will exist for a period of time even though intensive reclamation and rehabilitation measures are adopted.

The scenic quality of the face of Kinney Rim will unavoidably be impaired by a scar as will the area adjacent to the Flaming Gorge Reservoir where the water pipeline leaves the reservoir.

Duration of the impact is not easily predicted. Re-establishment of similar vegetation may screen these scars within a two to five year period. Conversely, exposure of different colored subsoils may make the disturbance a relatively permanent feature of the landscape.

Installation of the transmission lines will cause some unavoidable intrusion on the aesthetic values of the area. Since the lines pass through open range most of their distance, points of impact to significant number of people are limited.

A town of 400-500 people will also have an adverse affect on the surrounding area. Their influence will be felt not only on the area they occupy with their dwellings but for many miles surrounding the townsite because of the increased use of motor bikes and 4-wheel drive vehicles and the desire of people who own this type of vehicle to get off the "beaten trail."

PART 6 - IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Resources that will be consumed include (1) 1,000 million tons of oil shale over a 20 year period (2) 6,200 acre feet of water annually (3) energy required to raise 6,200 acre feet of water 1725 feet in elevation (4) land upon which the plant and administration buildings are built.

Appendix I

Proposed

Wyoming Air Quality Standards and Regulations

Chapters 1 - 18

Appendix II

STATE OF WYOMING

RULES AND REGULATIONS

Promulgated under the

OPEN CUT LAND RECLAMATION ACT

by

The Commissioner of Public Lands

Effective August 7, 1969

A. E. King
Commissioner of Public Lands
113 State Capitol Building
Cheyenne, Wyoming