PART IV

ANALYSIS OF PROPOSED ACTION

CARTER OIL COMPANY

CHAPTER I

DESCRIPTION OF THE PROPOSED ACTION

Background and History

The Carter Oil Company, a subsidiary of Exxon, proposes to mine coal by strip mining methods from federal coal lease W-5036 located north of Gillette, Wyoming, in the Powder River Basin (Figure 1).

Current projections call for mining to begin in 1976 and for production to reach five million tons of coal per year by 1978. The coal mined will be transported by unit trains to electric power generating plants in the Midwest where it will be consumed. Capacity of the mine will be such that it can supply a possible coal gasification plant.

Federal coal lease W-5036 was awarded to Humble Oil and Refining Company following a competitive lease sale held August 18, 1967. Humble submitted the high bid of $165.86 per acre or $905,176.00 for the 5,457.47-acre lease. The lease was issued to Humble effective December 1, 1967, and assigned to Carter Oil Company effective July 1, 1969. Carter holds in fee simple title the surface rights to 5,217 acres of land within the federal lease area and 120 acres of land adjacent to the lease. Forty acres of land in section 11 of T51N, R72W, are national resource land. The remainder of the surface within the lease is held in fee simple title by private interests. All coal within the boundaries of the federal lease is owned by the United States Government, except for that which occurs in a 40-acre portion of section 6, T51N, R72W, which is leased by Carter from private interests.

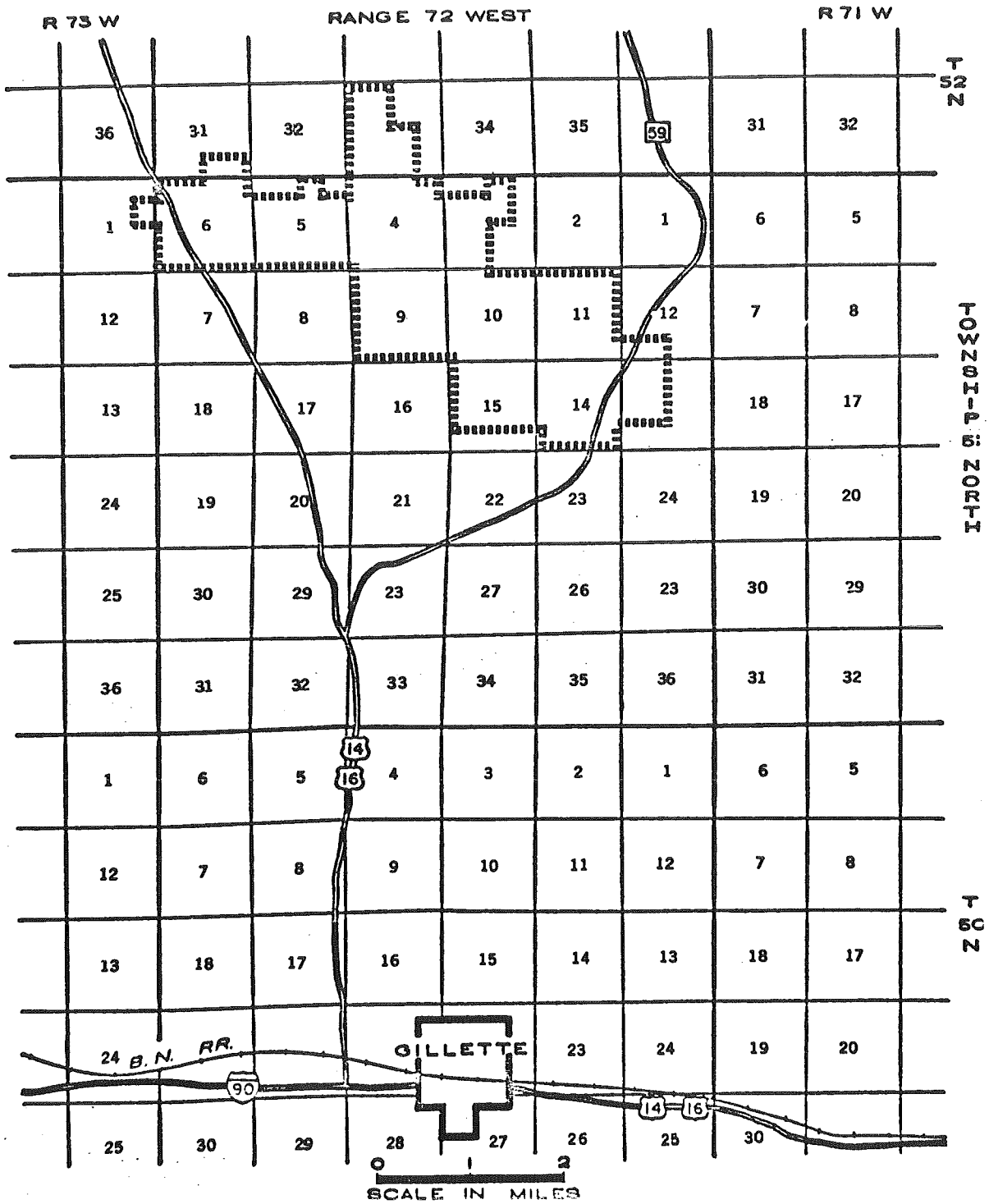


Figure 1

Location of the North Rawhide Coal Property of the Carter Oil Company

Campbell County, Wyoming

The lease area surface and coal ownership in acres is tabulated below.

	Surface	Coal
United States	40*	5,417
Carter	5,217	0
Other private	200	40
Total	5,457	5,457

*Bureau of Land Management

Carter has conducted development drilling programs every year since 1969 to further delineate character and extent of the coal reserves. As a result of this drilling program, a preliminary plan to extract the coal resources from the federal lease was submitted to the area mining supervisor (USGS) on April 3, 1973, with additional data, information, and supplements filed on May 17, May 25, and August 17, 1973.

These plans, along with all supporting data, are being reviewed by the U.S. Geological Survey and the Bureau of Land Management to determine if any additional requirements or stipulations are necessary. The plans are also available for public inspection at the office of the area mining supervisor in Billings, Montana.

The plan submitted constitutes the first proposed development of federal coal on this lease. It is anticipated that mining will ultimately encompass a major portion of the lease. At a production rate of five million tons, mining will disturb an estimated 30 acres per year and an equal amount will be reshaped and planted.

The plan, submitted in accordance with 30 CFR 211, coal mining operating regulations, is intended to maximize recovery of the coal resources

and to provide for successful reclamation and revegetation of the disturbed land area. Pursuant to departmental policy, the plan must comply with the reclamation requirements of the Wyoming Environmental Quality Act of 1973.

Purpose of proposed project

Development of the North Rawhide mine is planned to meet low sulfur coal supply commitments. On January 17, 1974, Carter Oil Company signed a 30-year coal purchase contract with Indiana and Michigan Electric Company, a subsidiary of the American Electric Power Company, Inc., for five million tons per year of low sulfur western coal. Deliveries of coal are scheduled to begin in mid 1976. This coal will be used at a new power plant to be constructed at a location to be selected within the State of Indiana from a number of sites currently owned by Indiana and Michigan Electric Company. Two 1,300-megawatt fossil fuel generating units will be constructed.

Sufficient coal production capacity will be available at the mine to supply additional purchase contracts for power generation or coal gasification.

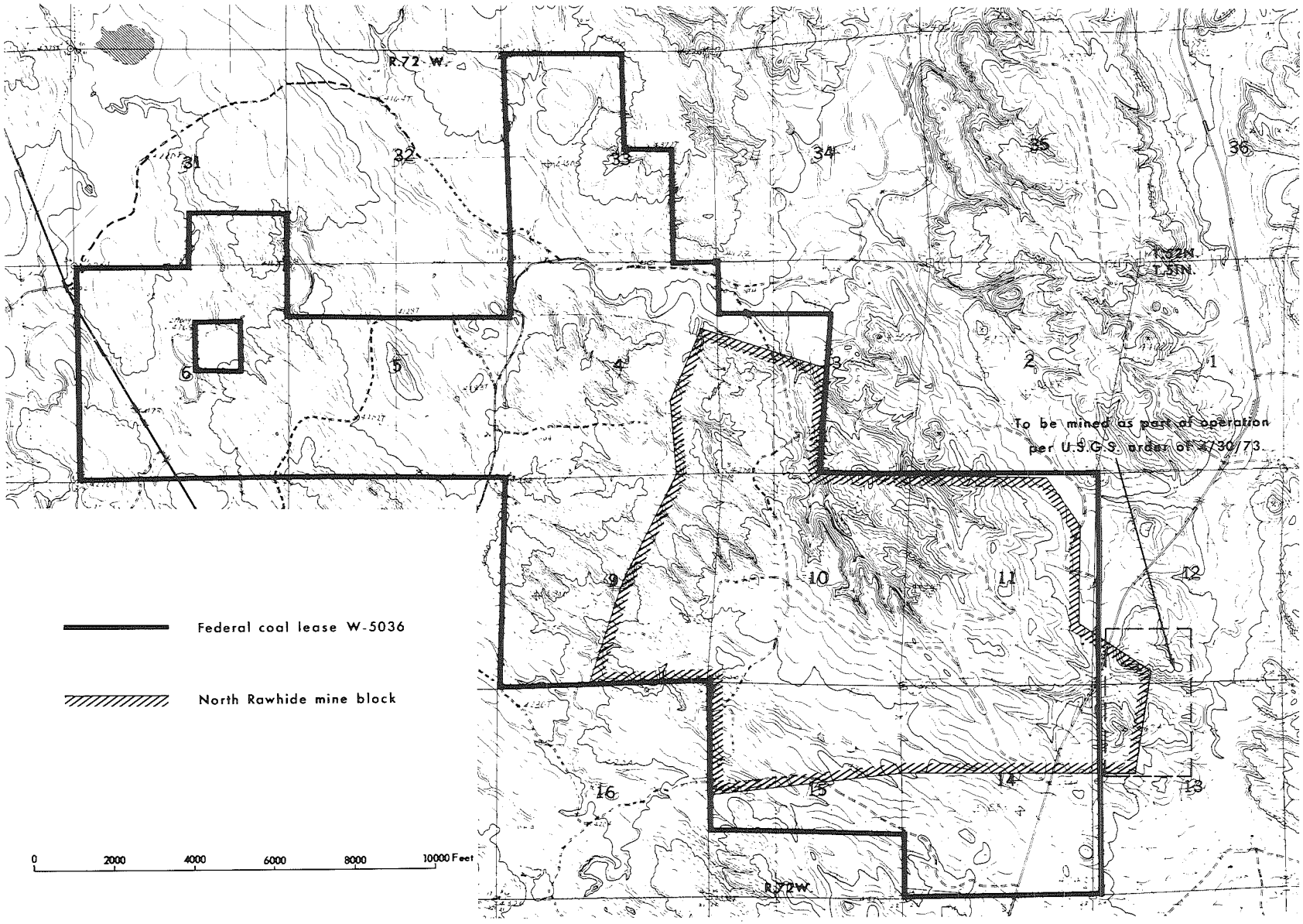
Site location

The Carter Oil Company's North Rawhide block is located 8 to 10 miles due north of the Town of Gillette in Campbell County, Wyoming (Figure 1). The North Rawhide block is designated as the area covered by federal lease W-5036, which includes 5,457 acres, with minor modifications relating to the absence of mineable coal and non-federal ownership. The lease includes all of sections 4, 6, 9, 10, 11, and 14, and parts of sections 3, 5, 12, 15, and 16, T51N, R72W; parts of sections 31 and 33, T52N, R72W; and part of section 1, T51N, R73W.

State Highway 59 provides access to the east side of the lease, and U.S. Highways 14 and 16 provide access to the west side of the lease. The North Rawhide mine block consists of an irregularly shaped area in the eastern portion of the lease bounded by the limits of mineable coal as designated in Figure 2.

Figure 2

Location of North Rawhide Mine Block in Relation to Federal Coal Lease W-5036



Stages of Implementation

Proposed mining procedures and equipment

The mining and reclamation procedures and equipment described in this section are taken, with modification, from the mining and reclamation plans submitted by the Carter Oil Company.

The mining methods and equipment Carter Oil Company proposes to use on their North Rawhide mine were selected by the company based on the economics of earth moving, coal mining, and land grading and reclamation. The methods should also aid in preventing contamination of the coal by spoil material.

The coal reserves to be mined consist of two beds separated by a clay parting ranging in thickness from 2 to 20 feet. The upper bed (Roland) averages 25 feet in thickness while the lower bed (Smith) averages about 82 feet in thickness. These two beds differ chemically and to obtain a uniform product they will be mixed in the pit prior to loading. To accomplish this mixing, a staggered or offset bench system of strip mining will be used once mining has progressed to a point where both beds are present. A schematic of the coal production system is shown in Figure 3.

The company proposes to begin operations to the east of State Highway 59 at the outcrop along the east margin of the lease area in sections 12 and 13 (Figure 4) and advance in a southerly direction until the coal thins and pinches out (facies change). At the start of mining, a boxcut approximately 1,100 feet long (east-west) and 400 feet wide (north-south) will be excavated to uncover about 530,000 tons of coal. Only the Smith bed coal is present in the initial cut because the Roland bed has been removed by erosion in this area. The overburden from the boxcut will be placed outside the area underlain by any strippable coal.

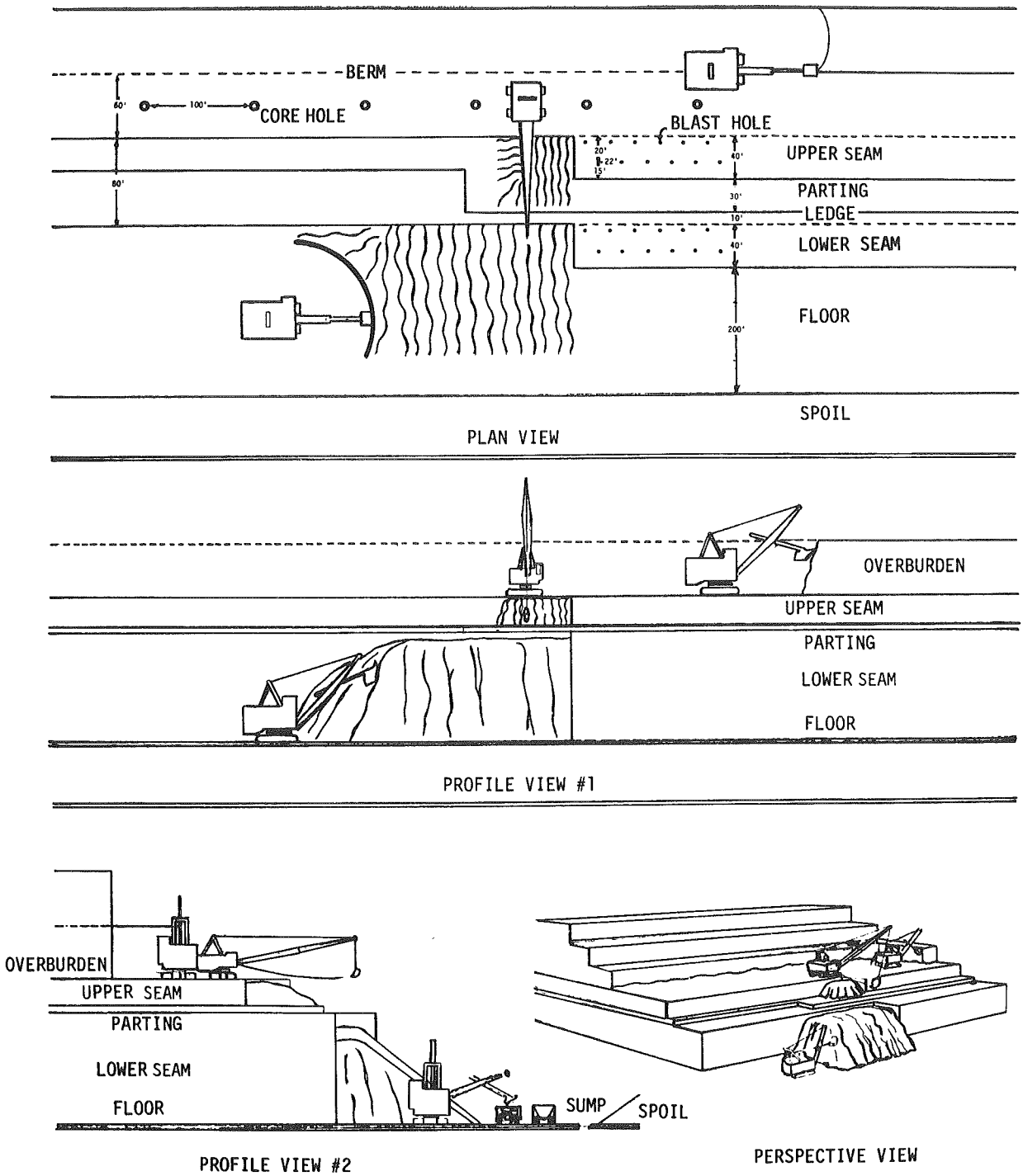


Figure 3
Schematic of Truck and Shovel Overburden Removal and Coal Production Operations Proposed for the North Rawhide Mine.

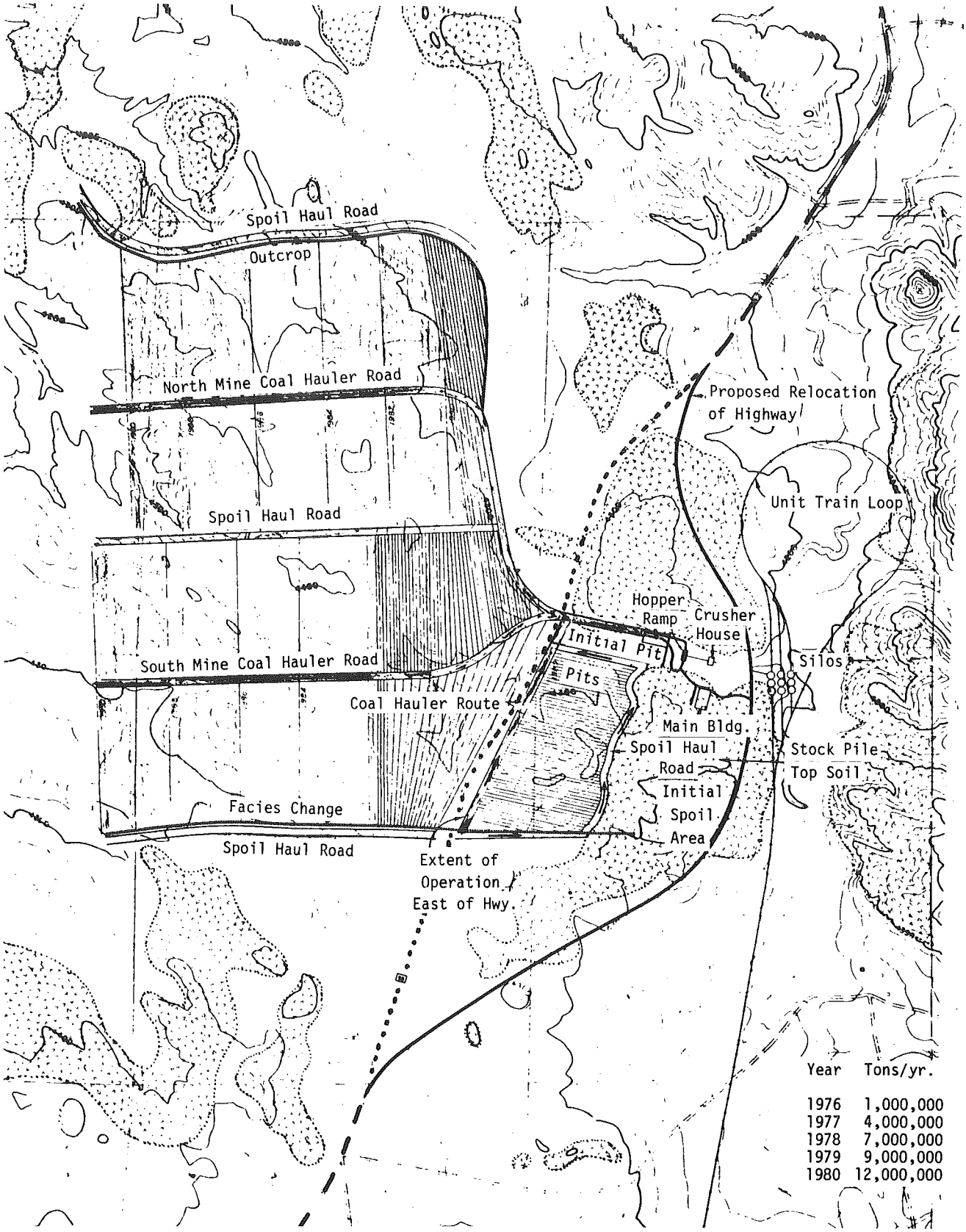


Figure 4

Mine Plan Showing Layout of Surface Facilities for North Rawhide Mine

Overburden from the second cut will be placed in the initial boxcut and that from the third cut will be placed in the second cut. This sequence of mining will continue until mining reaches the facies change line which limits mining to the south. At that time, mining will start toward the west and will continue until the reserves have been depleted. In working to the west, pits will be established north and south of the main coal haulage road so that the company will have two separate pits in which to conduct operations. The coal from the north and south pits will be blended in order to meet EPA standards for utility use.

Coal from the north mine, when mined separately, will not meet EPA standards unless a portion of the upper bed is discarded. As a conservation measure, rather than discard any of the upper bed, it is planned to blend south coal with north coal in such proportions that the product will qualify for utility sales.

When coal demands exceed the capacity of the preparation facilities, Carter proposes to construct additional plant facilities east of the north mine, adjacent to the main haul road. With additional excavation equipment to be purchased at that time, the production capacity of the total mining operations could be increased to 22 million tons of coal per year.

Once sufficient coal has been removed from the initial boxcut to enable equipment to maneuver in the pit, backfilling and concurrent reclamation will begin. As overburden material is dumped on the spoil piles it will be leveled and pushed over the advancing face of the spoil. Motor graders will be used to finish-grade the surface of the spoils prior to redistribution of topsoil and planting. Final highwalls will not be formed

until operations have been underway for many years. The company proposes to reduce highwalls to a slope of 2:1 or less or to whatever degree is required by the operating regulations in force at that time.

All graded and topsoiled areas will be gouged or scarified prior to planting to aid in retaining precipitation and to help reduce wind erosion.

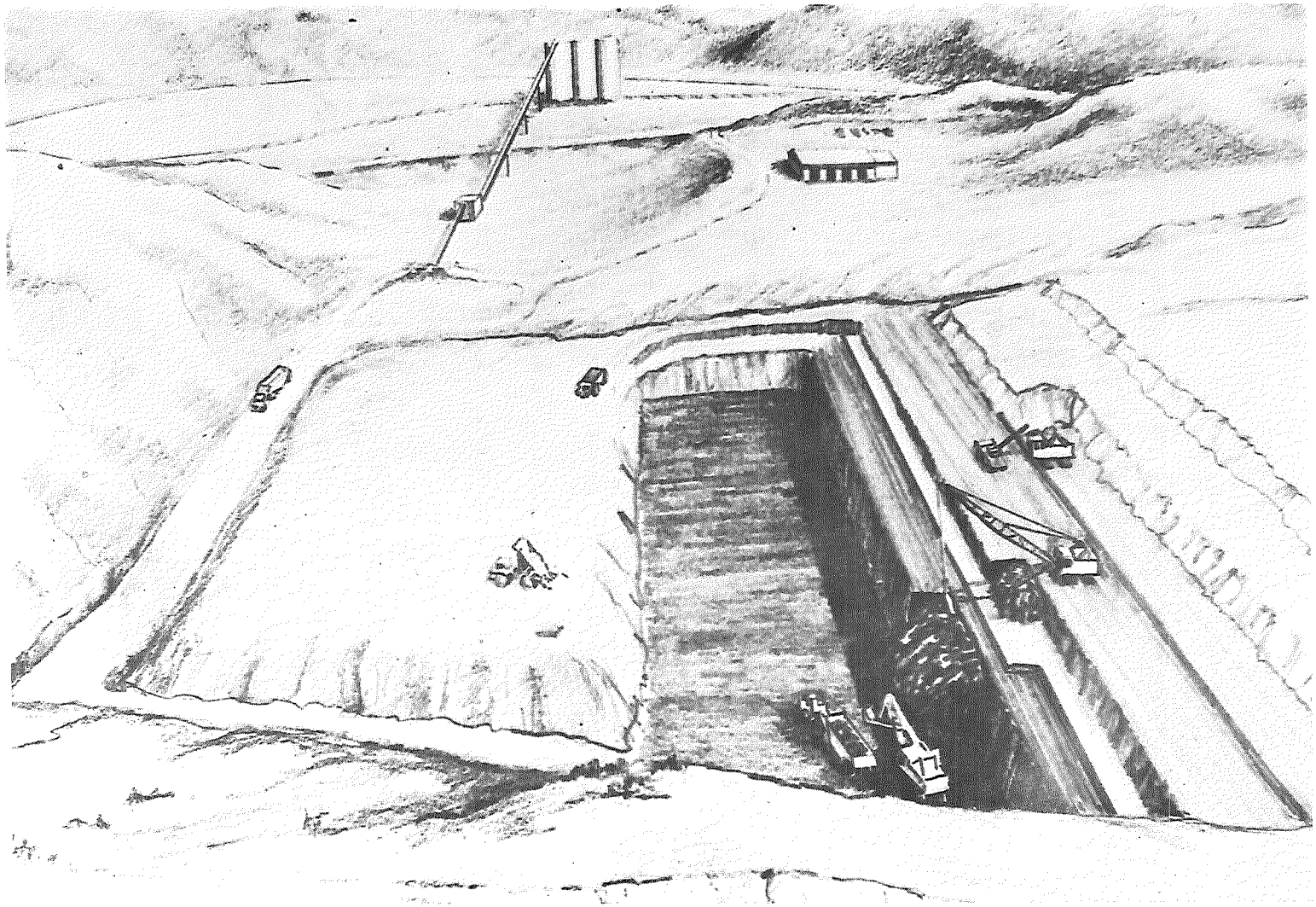
Artists' concepts of the mining and reclamation activities in the initial pit and in the combined north-south pits are shown in Figures 5 and 6, respectively.

Soil material removal

Prior to mining the initial boxcut, all topsoil from the boxcut area and from the initial spoil disposal area will be removed and stockpiled separately adjacent to the initial spoil disposal area (Figure 4). Stockpiled topsoil will be used to cover the initial boxcut spoil after it has been shaped. Once mining has progressed to the point where spoil is being dumped into the initial boxcut, topsoil from the unmined area ahead of the highwall will be removed and placed directly on the graded spoil. The topsoil will be distributed over the graded spoil using a scraper. A large motor grader will complete distribution of the toposil and dressing of the spoil area. Studies are underway by the University of Wyoming, Plant Sciences Division, to determine whether or not a surface layer of topsoil is necessary for the successful establishment of vegetation. It is proposed that the initial spoil area from the boxcut be used for a series of experimental test plots to test vegetation growth with and without toposil over the spoil.

Figure 5

Mining and Reclamation in Initial Pit Showing Adjacent Facilities, Roads, Silos, and Offices (after Carter Oil Company)



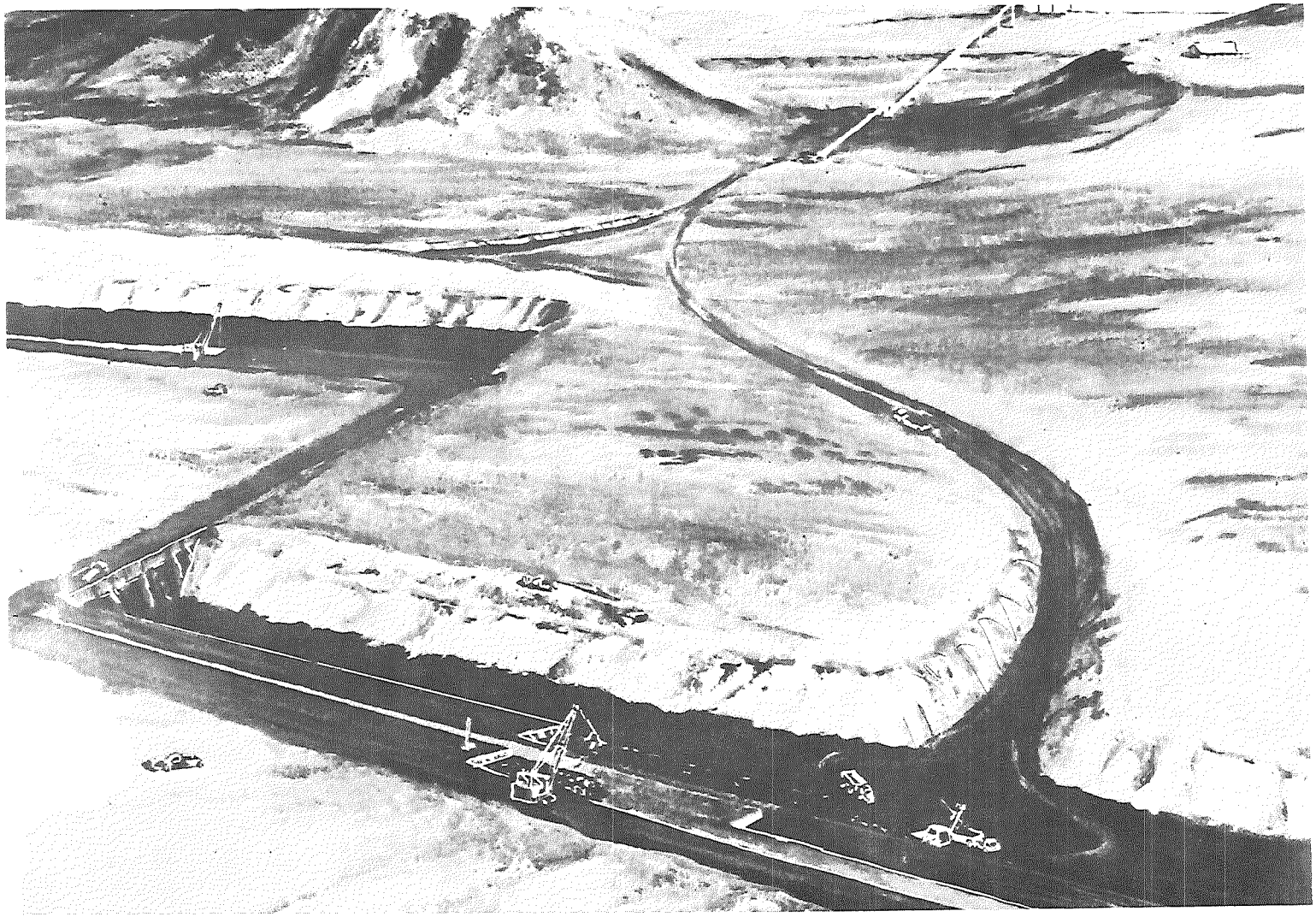


Figure 6

Two Pit Operation of Proposed North Rawhide Mine (after Carter Oil Company)

The Plant Sciences Division is also carrying out a survey of surface soil types within the lease area. They are preparing a map showing the distribution of the soils and are providing data on the nature and fertility characteristics of each soil type.

Overburden removal

After the topsoil is removed strata or overburden overlying the coalbed will be excavated from the first cut and placed on land outside the mine area from which the topsoil has been removed, but which is otherwise undisturbed (Figure 7). Overburden from subsequent cuts will be used to backfill the pit created by the previous cut.

Overburden removal will be accomplished using electric powered crawler-mounted shovels with 20-cubic yard capacity buckets and 150- to 175-ton capacity off-road rear-dump trucks.

After sufficient coal has been mined from the boxcut, trucks carrying overburden will begin filling the mined-out areas. Once this procedure is established, the backfilling operations will follow the mining operations at a regular distance, allowing approximately 200 feet from the toe of the spoil pile to the coal face.

Based on exploration drilling by the company, overburden above the coal consists mainly of sands and clays of the Wasatch Formation, with some clinker, mainly in the vicinity of the projected coal outcrop line, and alluvial deposits in the valley floors. The Wasatch Formation sediments consist of sands and clays which, unlike the coal seams, are lenticular in cross section and cannot be correlated over wide areas.

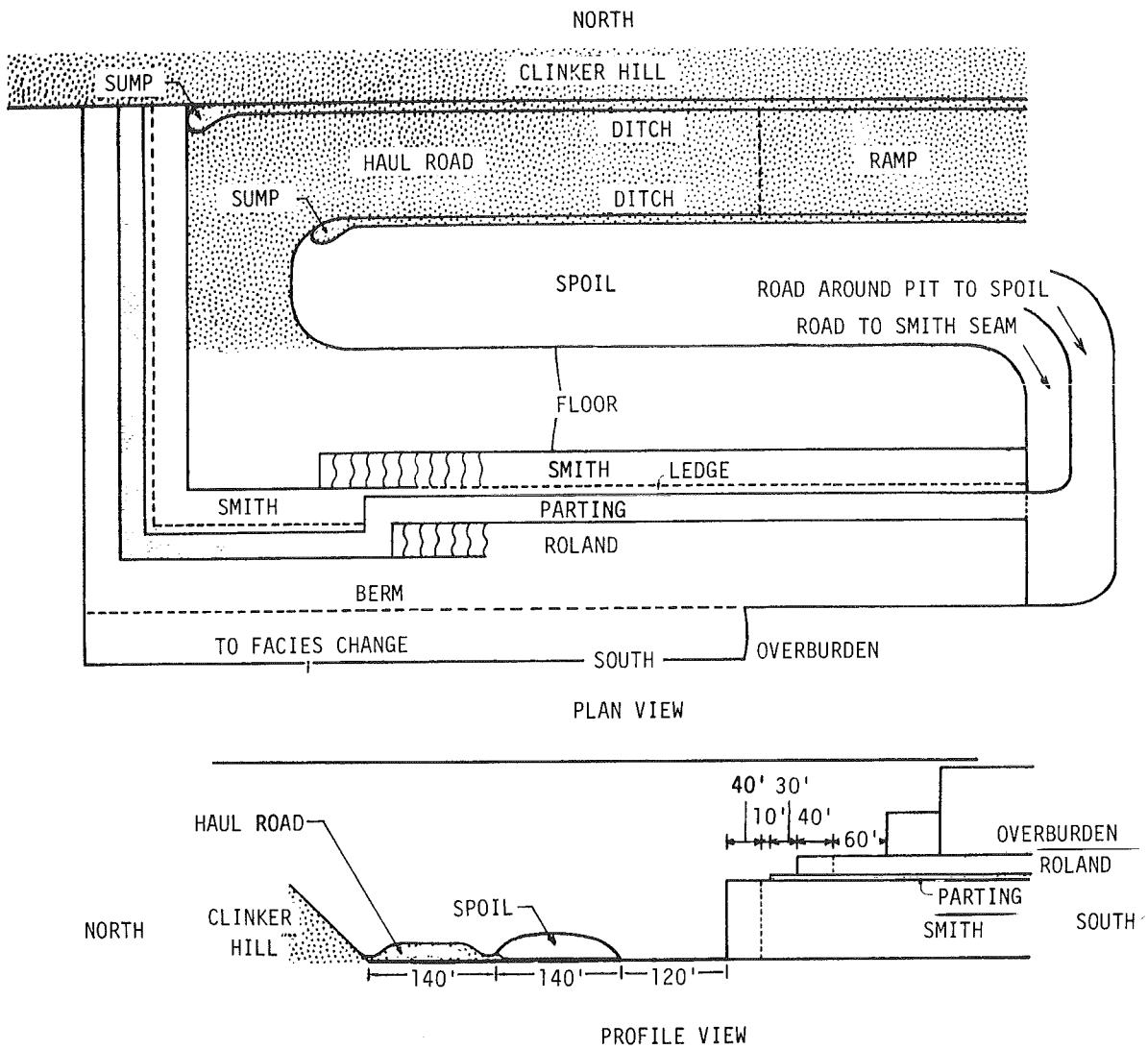


Figure 7

Schematic of the Initial Box Cut Showing Layout of Pit for Truck-Shovel Operation

Overburden materials range in thickness from 20 to 240 feet in the lease area. Figure 8 consists of an isopach map showing the overburden thicknesses throughout the lease area.

At the present time it is not anticipated that blasting will be necessary to loosen overburden material prior to its being loaded by shovels into trucks for disposal in the spoil area.

The company proposes to deposit approximtely 650,000 cubic yards of overburden from the initial boxcut in a ravine between clinker hills to the east of the mineable coal (Figure 4). Commencing at the 4,300-foot elevation, spoil will fill the ravine and blend into the adjacent terrain. The outslope of the spoil will be graded to a slope not exceeding 2:1 (26.6 degrees) and will blend into the adjacent, undisturbed terrain.

Any strata that are particularly suitable for plant growth will be placed on top of the spoil area; any strata containing materials which inhibit plant growth will be deeply buried within the spoils. Preliminary tests on core materials suggest that the only sedimentary layer which is likely to be deleterious to plant growth is the parting between the coalbeds. If further testing, now underway, confirms this, the parting material will be deposited at a low level within the spoil and covered with more desirable spoil materials.

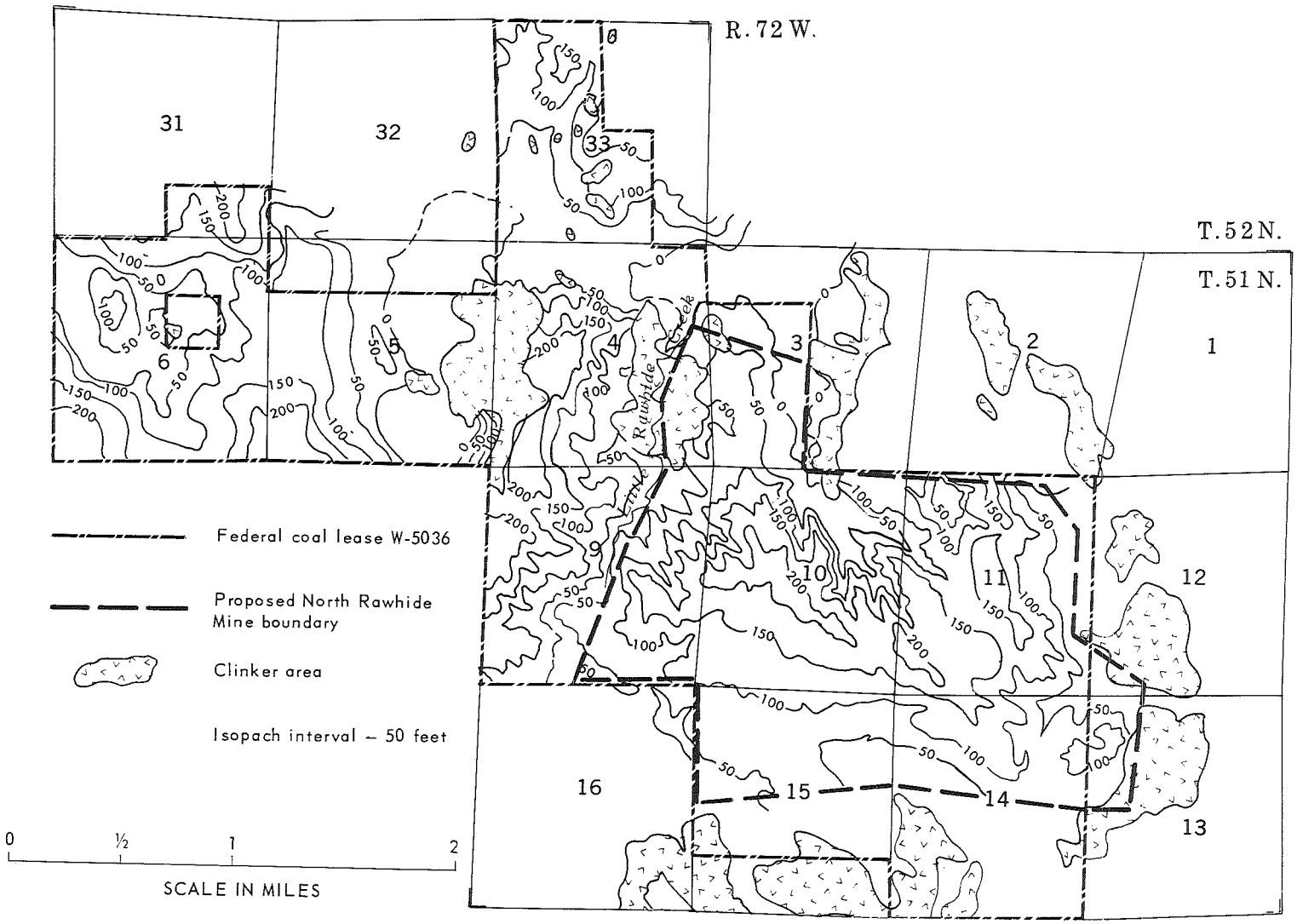


Figure 8

Thickness Map of the Overburden on the North Rawhide Federal Coal Lease W-5036, Carter Oil Company, Campbell County, Wyoming

Carter plans to operate overburden shovels and trucks on two shifts per day, allowing the third shift for preventative maintenance. Only a few overburden trucks will be required for the first three years of operation due to the small tonnage and shallow overburden. With increasing overburden thickness and production requirements, demand for overburden trucks and shovels will increase substantially.

Coal removal

Once the north and south pits have been established, coal production from each pit will begin near the main haul road in the center of the pit and advance outward. This is necessary in order to provide access for equipment to operate on top of the Smith seam.

After the overburden has been removed from above the coalbed the top of the coal will be cleaned by bulldozer or motor grader. Any dirt or slack coal will be pushed off the coal to the floor of the pit and placed against the base of the spoil piles for burial by spoil material as mining progresses.

To provide necessary flexibility in coal production, benches 40 feet in width will be offset between the coalbeds to enable a dragline to operate from on top of the Roland coalbed to remove this coal and the parting between the two beds.

Blasting will be carried out on each bench using two staggered rows of 6-inch diameter holes drilled on 22-foot centers. The rows will be located 15 feet and 35 feet from the free face. Holes will be charged with a high-density ammonium nitrate-fuel-oil mixture (ANFO) packaged in poly waterproof bags. The holes will be connected with detonating cord and detonated using one electric blasting cap with a 20-pound primer. The

powder factor will vary, depending on the thickness of coalbeds, but will typically range from 0.25 to 0.3 pounds of explosives per ton of coal. All applicable safety regulations will be followed in blasting.

After both beds have been shot, crawler-mounted dragline with a 14- or 15-cubic yard bucket and minimum operating radius of 100 feet will remove the Roland bed from the parting and place it on top of the broken Smith bed. Both beds will then be loaded by electric crawler-mounted shovels with 31-cubic yard capacity buckets into 150- to 180-ton capacity off-road drop-bottom coal haulers. The dragline will remove the exposed parting, casting it to the highwall side of the pit where it will be loaded by the overburden shovels and hauled to the spoil area. As an additional precaution to avoid the loading of parting with the Roland bed coal, a 30-foot-wide berm of parting will be retained to contain the shot Roland bed coal. This will enable the dragline operator to see the surface of the parting at all times while loading the coal. The procedure for excavation of the coal and parting is depicted in Figure 3.

Loaded trucks will move out of the pit along an inclined ramp to the main haul road and thence to the materials handling system for crushing and unit train loading.

Reclamation

Reclamation is the subject of comprehensive studies currently being conducted on behalf of the Carter Oil Company by the University of Wyoming, Plant Sciences Division. The following reclamation plans are preliminary in nature, based on the results of these studies to date, and are subject to revision according to results from further studies. It is anticipated that further revisions and changes in reclamation procedures will

be developed when the results of the initial reclamation efforts have been reviewed.

All reclamation activities will be conducted in accordance with the stipulations and requirements set forth in federal coal lease W-5036, applicable coal mining operating regulations, and any applicable federal, state or local reclamation laws. As more knowledge is gained about reclamation of strip mines in the Powder River Basin, the stipulations and requirements will be modified and expanded to reflect the latest laws, technology changes, and research results. In general, federal lease stipulations require that the mine operator "...take all reasonable steps for the protection and restoration of the non-mineral resources that might be disturbed as a result of his strip mining operation..." and that "the lessee...comply with all state laws and regulations...pertaining to the protection and reclamation of surface resource and the protection of the air and water environment."

The land throughout the leasehold is presently used for livestock grazing. Reclamation of mined lands will be directed toward the restoration of the surface to a condition consistent with this use.

The University of Wyoming, Plant Sciences Division, is currently conducting extensive studies to determine optimum methods for reclamation of the mined areas. These studies include laboratory tests on overburden materials to assess availability of nutrients, soil texture, and presence of toxic elements.

Thirteen typical samples of core materials from exploration drill holes were analyzed by Agricultural Consultants Laboratory of Brighton, Colorado. The results of these analyses are shown on Table 1. Each sample

Hole No.	Depth of Sample (ft)	Sample Description	ph H_2O	ph Salt	CEC (Meg/ 100 g)	Salt (Mmhos/ cm)	Na (Meg/ 100 g)	Lime (%)	Org. Matter (%)	Available Nutrients (ppm) NO_3	NH_4	P	K	Ca	Mg	S	B	Zn	Fe	Mn	Cu
NRH-45C	24-34	Silty Clay (overburden)	8.1	7.7	25	1.3	0.9	6.7	0.8	29	1.2	2.0	210	2500	1000	180	0.6	1.7	13	7.0	2.1
NRH-46C	7-14	Clay (overburden)	8.2	7.5	20	0.7	0.5	0.3	0.9	1.0	0	68	150	2100	720	62	1.3	1.7	50	0.5	6.6
NRH-76C	111.5-119.5	Silty Clay Loam (overburden)	8.3	7.8	15	1.0	0.5	3.1	0.6	9.0	0.3	1.0	140	1700	410	160	0.4	3.3	16	3.2	0.7
NRH-76C	119.5-121.4	Silty Clay	8.7	8.0	15	0.7	0.5	3.7	0.6	11	0.3	1.0	130	1700	410	180	0.6	3.9	15	3.5	0.3
NRH-76C	204-212.4	Silty Clay (Parting between coal seams)	4.9	4.7	73	2.4	1.1	0	5.5	3.0	0.8	1.0	270	2600	790	200	4.8	7.8	50	7.0	8.2
NRH-79C	51-59	Silty Clay Loam (overburden)	7.5	7.4	31	4.2	0.6	2.4	0.8	10	0.4	1.0	160	3900	1100	200	0.3	0.6	18	2.1	0.4
NRH-79C	59-62	Silty Clay Loam (overburden)	7.6	7.5	33	4.2	0.6	1.7	1.3	16	1.0	1.0	160	3800	1400	200	0.2	3.0	10	0.6	1.2
NRH-92C	31-43	Sandy Clay (overburden)	8.1	7.9	24	2.4	0.6	7.9	0.5	4.0	0.1	1.0	160	3200	630	2.0	0.3	0.9	8.8	2.9	0.2
NRH-98C	30-40	Silty Clay (overburden)	8.0	7.8	25	2.4	1.2	5.0	1.6	4.0	0.3	1.0	270	2900	790	200	0.3	2.2	14	6.3	2.2
NRH-99C	120-130	Silty Clay Loam (overburden)	8.3	7.9	19	1.3	1.1	7.7	1.5	10	0.8	2.0	270	2000	620	200	0.3	2.5	37	4.8	1.1
NRH-112C	45-55	Silty Clay (overburden)	8.5	7.9	21	0.8	1.6	5.8	2.2	4.0	0.4	3.0	340	2000	660	62	0.2	3.8	40	11	0.7
NRH-112C	129-137.3	Clay (overburden)	7.4	7.1	13	1.7	1.2	0.5	4.6	1.0	0.2	1.0	280	1300	460	200	0.5	20	46	10	3.2
NRH-126C	171-178.5	Silty Clay Loam (parting between coal seams)	6.8	6.2	11	0.8	1.0	0	4.1	1.0	0.2	1.0	240	860	380	39	0.7	1.6	31	2.0	1.6

Table 1

Analyses of Overburden Materials

was obtained by blending the material from several linear feet of drill core. Samples were selected from several different holes, and at different depths, to represent the different lithologic types present in the overburden and parting. Eleven of the samples represent overburden materials, and two samples are from the parting between the coal seams.

The 11 overburden samples were basic in reaction, having pH values between 7.4 and 8.7. The two samples of parting were acid in reaction; one having a pH of 6.8, and the second having a pH of 4.9. Most core samples appeared to be low in both nitrogen and phosphorus; but from a chemical standpoint, they appear to present no particular toxicity problem. Because of the relatively acidic nature of the clay parting, it is proposed to bury the material in the spoil.

In an attempt to determine stability of the overburden materials under conditions of weathering, samples of each core were subjected to alternate cycles of freezing and thawing, and wetting and drying. Decomposition studies are still in progress but the results so far have ranged from one-cycle decomposition of a silty clay sample to practically no change after three complete cycles on hard sandstone samples.

In addition, representative samples of overburden material are being subjected to biological testing in greenhouse studies at the University of Wyoming to determine their ability to support rangeland vegetation. For these studies, Nordan crested wheatgrass and alfalfa were planted at a rate of 10 seeds per sample of overburden material. All samples studied to date have proven capable of growing Nordan crested wheatgrass and alfalfa. At the end of three weeks, the percentage germination of Nordan crested wheatgrass varied from 31.7 to 93.3 percent while alfalfa varied from 33.3 to

88.3 percent. Further studies will be made to determine appropriate kinds and rates of fertilization.

Because of inherent environmental differences between greenhouse conditions and actual field conditions, the above studies will be supported by experimental test plots at the mine site. The initial spoil area from the boxcut (Figure 4) will be used for a series of trial plots. Some plots will be topdressed with topsoil while others will be seeded without topdressing. These study plots will also be used to experimentally determine optimum rates at which fertilizer should be applied. Design for these experiments calls for one-acre plots with each test repeated four times.

Spoil reclamation

Once sufficient coal has been extracted from the initial boxcut to enable equipment to maneuver in the pit, backfilling will proceed concurrently with mining. Shovels and trucks will remove overburden in front of the advancing highwall and transport it via overburden haul roads to the spoil disposal areas. The spoil will be dumped on top of the spoil pile and pushed by dozers over the advancing face of spoil behind the shovel. In order to provide sufficient room for the operation of equipment, the toe of the spoil will be maintained at least 200 feet behind the highwall.

Most of the shaping of spoil areas will be done by bulldozers moving the spoil into the pit. Any debris and slack coal left by the mining operation will be moved to the base of the spoil piles to be buried beneath the graded spoil. Graders will be used to finish-grade the surface of the spoil prior to topsoil replacement and seeding.

Topsoil, being removed in advance of mining, will be spread over the graded spoil using trucks or scrapers, bulldozers, and graders.

The spoil material must not be allowed to remain in a smooth condition at any time, since a smooth surface is subject to rapid wind and water erosion. Consequently, after the spoil material is shaped and the topsoil spread, the area will be treated with a range pitter or some similar machine to create a rough surface. Such a pitting operation will greatly reduce wind erosion and will allow water to accumulate and infiltrate the surface material. Moisture retained by this treatment will contribute to establishment and maintenance of seedlings from native seed which is in the topsoil. Maintaining a rough surface condition while spoil material is weathering will also eliminate need to stabilize the material by seeding of annual plant species. The seeding of annuals should be avoided because of competition with perennial seedlings which are native or will be introduced. Seeding of annuals, consequently, would reduce the probability for establishment of the more desirable perennial species.

Much of the spoil material is relatively high in clay. If heavy machinery is used on the spoil piles, the clay will generally pack to such a degree that the establishment of vegetation is prohibited. Consequently, it is planned to bury high clay spoil and place more sandy material near the surface. If the spoil material should become severely compacted, it will be ripped prior to application of topsoil.

At the conclusion of mining, the highwall of the final cut will be reduced to a slope not greater than 2:1. Reduction will be accomplished by blasting the highwall and grading spoil back against the highwall. Material from the highwall and the adjacent spoil bank will cover the face of the coalbed and fill the cut. Final grading, distribution of topsoil on the spoil and highwall, and seeding will complete highwall reclamation.

These highwall reclamation procedures are specified to control generation of acid water from the coal and parting clay and to prevent spontaneous or accidental ignition of the coalbeds. If possible, the company would like to construct a lake in the final pit to the west which they visualize as being fed by Little Rawhide Creek and, if necessary, from Big Rawhide Creek. The Carter Oil Company will consult with officials of the Bureau of Land Management, Wyoming Department of State Lands, and with the U.S. Geological Survey to determine where further reclamation of the final cut and other mined areas will be needed.

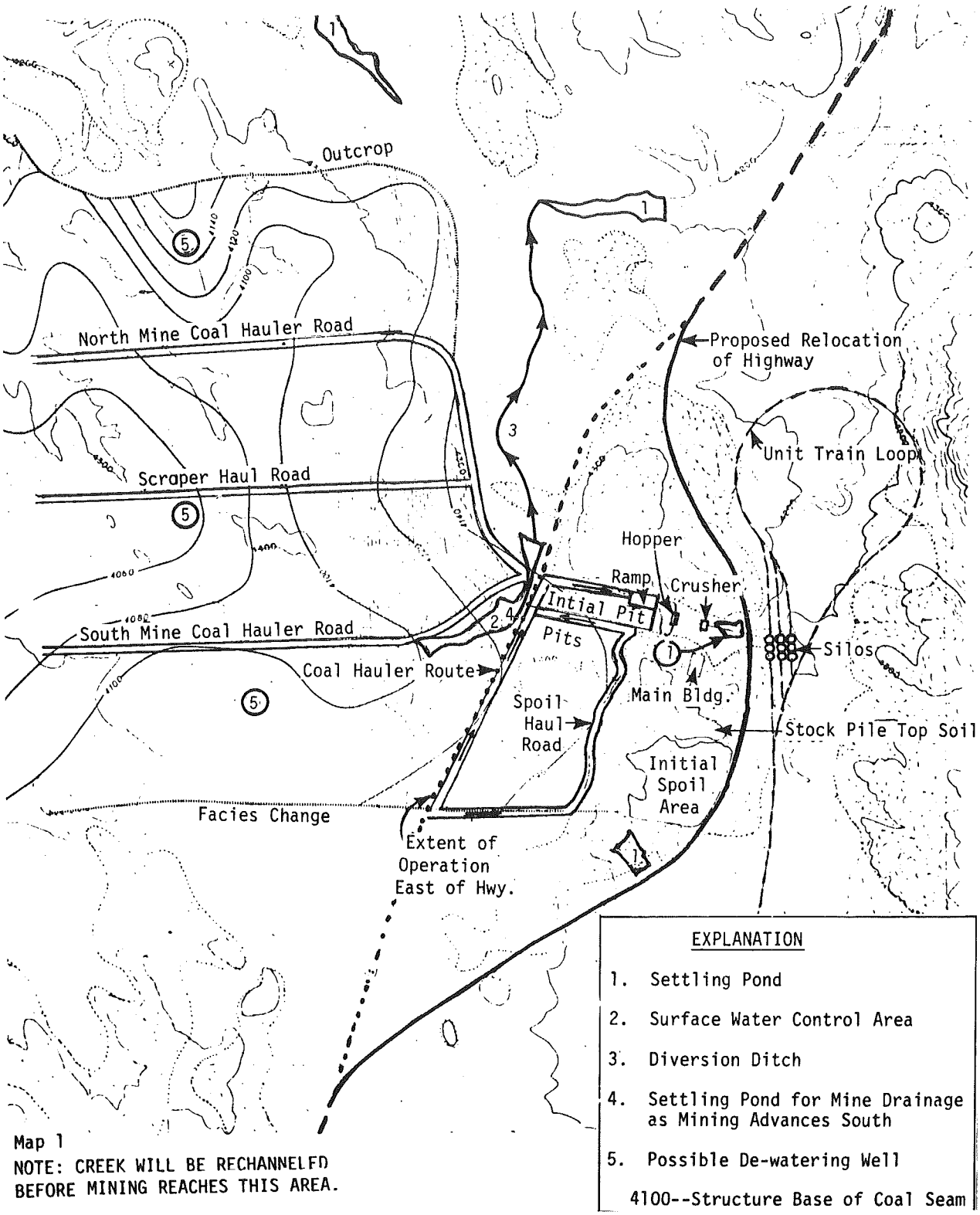
Drainage control

To protect the initial mine area as it advances to the south, a settling pond for surface runoff collection will be constructed at the location shown on Figure 9. Water from this collection pond will move by diversion ditch north to a settling pond where any suspended material will settle out. Other settling ponds are proposed for other drainage areas (Figure 9). A series of coal dewatering holes may be drilled in advance of mining in an area to reduce water inflow into the pit.

The dams to be built for runoff collection and settling ponds will be constructed of compacted earth and will be located down drainage from the mine to help prevent silt from leaving the mine area during periods of heavy runoff.

Diversion ditches and dams will be constructed to the specifications given in Figure 11, Chapter III, Part I.

Spoil piles will be graded to a gently rolling configuration and will be treated when necessary by a range pitter or some similar machine to roughen the surface to improve water infiltration and reduce runoff.



Map 1
NOTE: CREEK WILL BE RECHANNELED BEFORE MINING REACHES THIS AREA.

Figure 9

Surface and Subsurface Water Control and Monitoring Structure at the North Rawhide Mine

Seeding and planting

The objective of the reclamation program at the North Rawhide mine will be to return the area to a condition that will sustain livestock grazing and provide a habitat for wildlife indigenous to the area.

With this in mind, University of Wyoming Professor Robert L. Lang's preliminary recommendations are that the area be seeded with Nordan crested wheatgrass (Agropyron desetorum) where grazing will be restricted to the spring and fall seasons, and that Russian wildrye grass (Elymus junceus) be planted where grazing will be restricted to the summer. The Russian wildrye grass has a less vigorous seedling and is harder to establish than the Nordan crested wheatgrass, but is more palatable year round. Mixing the two species is not recommended because the greater palatability of the Russian wildrye grass would result in selective grazing by livestock at inappropriate times of the year, making it nearly impossible to establish. The vigorous seedling of Nordan crested wheatgrass allows spring and fall grazing without endangering its establishment and continued growth.

Optimum fertilization rates will be determined experimentally by means of onsite study plots. Preliminary recommendations of Professor Lang are that areas with topsoil be treated initially with 40 pounds per acre of phosphate and nitrogen be applied annually at the rate of 40 pounds per acre for 2 to 3 years. In the event that the use of topsoil should prove to be unnecessary, these fertilizers would probably be applied at the same rates, but applications will be made over a greater length of time.

The greatest amount of precipitation occurs prior to the middle of May in this area, and moisture is crucial to establishment of the above grasses. Consequently, seeding must be done early in the spring (prior to

April 15) or late in the fall (after the end of October but before the ground freezes). The chances of successful revegetation are poor if seeding is done at other times of the year. Lang has recommended that both species of grass be seeded at a rate of eight pounds per acre, regardless of soil material used. Seeding will be done with a grain drill having press wheels.

Adequate fencing will be constructed to allow proper control of grazing until rangeland vegetation is satisfactorily established.

Haul road side slopes will be graded to 1.5:1, which is somewhat less than the natural angle of repose of the spoil materials. These slopes will be revegetated in the same manner as the remainder of the mined area. Special techniques, including contour furrowing or pitting and mulching as required, will be used to minimize runoff on these slopes. The company does not plan to revegetate the surface of some haul roads, so that they can provide access to the area for the grazing that will follow the mining activities.

Surface facilities

The Carter Oil Company has developed plans and schedules for development of surface facilities based on the assumption that coal shipments will commence in mid-1976.

They propose to construct the following: access roads to the proposed plant site and initial mine area; a preparation and loading plant; administration block; all necessary facilities for electrical power; water and explosives storage; and a railroad spur from the main Burlington Northern railroad line at Gillette to the site, a distance of approximately 12 miles.

Roads

Roads will be constructed to provide access to the proposed plant site and the initial mine area. Access roads will be constructed on the natural land surface. Leveled roadbed will be surfaced with crushed clinker. Ditches and culverts will provide drainage. All haul roads will be constructed by using compacted overburden material surfaced with crushed clinker. They will be from 60 to 70 feet in width and will be elevated one to three feet above the adjacent ground level to provide good drainage and to minimize snow drifting. Active roads will be continuously maintained by a motor grader. Culverts will be provided where roads cross natural surface drainage channels. Haul road side slopes will be graded to 1.5:1, which is somewhat less than the natural angle of repose of the spoil material, and will be revegetated. Special techniques, including contour furrowing or pitting and mulching will be used as required to minimize runoff on these slopes.

To control dust, which is not only environmentally unacceptable but also damaging to equipment, active haulage roads will be wetted as necessary through the work day by a water spray truck. The water will be pumped from seepage pools in the active mine pit. The porous road material readily absorbs water and runoff will be negligible.

The company proposes to reroute State Highway 59 to the east of the mine area during the initial mining activity. The proposed route is shown in Figure 4.

The company has no plans to revegetate the surfaces of most main haul roads at the completion of mining as they intend to leave these roads for access to the area for post-mining and livestock grazing activities.

Railroad spur

A railroad spur will be constructed from the main Burlington Northern railroad at Gillette to the mine site, a distance of approximately twelve miles. The railroad spur will terminate in a unit train loop located to the east of the plant site (Figure 4). Railroad construction is scheduled to be completed by mid-1976.

If it is determined that weed species should be controlled along railroad rights-of-way by the use of herbicides, applications and formulations will be in accordance with existing state and federal regulations.

Power

Electric power is needed at the mine for operation of draglines, coal-loading and overburden shovels, drill rigs, coal preparation and unit train loading facilities, rock crusher, office, and shop use. Power will be supplied by a Pacific Power and Light Company 69,000-volt feeder line. Voltage will be reduced at a substation to 4,160 volts. Power will be carried to the mine pits by pole-supported service lines. Near the pits, power is fed to the draglines, shovels, and drills through a series of air-brake disconnects, oil circuit breakers, and trailing cables attached to each item of equipment. The location of substations and powerlines has not been determined but when built will be in accordance with acceptable standards to minimize raptor electrocution.

Office and shop

The mine administration block, consisting of offices, shop, warehouse, and change room and bath facilities will be housed in a single one-story steel frame building located between the initial mine area and the

train loading silos. The building will be served by an extension of the mine access road, which also serves as a haulage road for coal going to the dump hopper. Water for domestic and sanitary use will be pumped from shallow wells located near the building. Sewage and other liquid wastes will be treated in a waste disposal system in a manner that conforms to governmental requirements.

Mining equipment

The mining and reclamation equipment for the North Rawhide mine had not been decided upon as of September 25, 1973, but will probably consist of the following types and sizes:

Equipment	Major Use
150-175 ton capacity rear dump trucks	Overburden removal
150-180 ton capacity drop-bottom trucks	Coal hauling
Electric crawler mounted shovel with 20 cu. yd. bucket	Overburden removal
Electric crawler mounted shovel with 31 cu. yd. bucket	Coal loading
Marion Model 195 M electric walking dragline with 14 or 15 cu. yd. bucket	Move upper coal bed to bottom of pit and remove interburden
Rotary drills	Drilling coal
Scrapers	Removal and distribution of topsoil
Bulldozers	Prepare overburden for loading, move and level spoil, clean off coalbeds
Motor graders	Shape spoil, maintain haul roads
Self-propelled water truck	Water haul roads

Loading equipment

Coal will be hauled from the mine to the crushing facility by 150- to 180-ton capacity off-highway trucks. The bottom-dump trucks will discharge the coal into two 300-ton capacity surge hoppers which will feed the primary crushers by reciprocating feeders.

Storage facilities

Crushed coal will be conveyed from the secondary crushers to nine 12,000-ton drive-through silos for gravity loading into rail cars. The gravity loading system will be capable of loading at the rate of 2,400 tons per hour. Outside storage of crushed coal is not planned.

Crushing and processing equipment

Primary crushers will reduce the coal from mine-run size to minus eight inches. Primary crushers will be located beneath the surge hoppers that receive the haul unit discharge. Coal from the primary crushers will be transported by conveyor to a crusher house where secondary crushers will reduce the coal to minus two inches in size, the size specified in the coal purchase contracts.

The crushing areas and transfer points in the coal handling system will be equipped with vacuum dust collectors or water sprays for suppression of dust.

Mining Sequence

The Carter Oil Company proposed to begin operations at the outcrop along the east margin of the lease area and to advance west to fully exploit the coal reserves within the lease. Initial development will consist of a boxcut, the location of which is shown on Figure 4.

An artist's conception of the boxcut mining operation is shown in Figure 5. The initial cut will be approximately 1,100 feet long (east-west) and 400 feet wide (north-south) and will provide 530,000 tons of Smith seam coal as the Roland seam has been removed in this area by erosion. When sufficient coal has been exposed to provide adequate operating clearances for the shovel and haulers, the coal will be drilled and shot. The shovel operator will commence loading coal and ramping the shovel to the base of the Smith seam. Coal haulers will be positioned on top of the coal for loading until sufficient clearance is established at the base of the seam for both shovel and haulers.

When the shovel has loaded all of the boxcut coal, stripping shovels and trucks will have removed the overburden from pits to the south. The coal shovel will begin loading coal from pits in a west to east direction, while advancing the mine to the south. When loaded, the coal haulers will move in a westerly direction to the end of the pit; north along the western margin of the mined area; and then turn east up a ramp out of the pit to the hopper. When the mine has advanced south to the point where a full section of coal is exposed, the proposed coal-loading system, using staggered or offset benches, will be employed. As the mine advances toward the southern limit of mineable coal, benches will be established in the Roland and Smith beds on the western highwall, in preparation for the next phase of mining.

When all of the mineable coal has been loaded in pits to the south, coal-loading operations will transfer to the pre-established offset benches to the west. Loading will commence directly in front of the haul road coming off the ramp into the pit, and move south to where the coal thins and splits. After pits have been established north and south of the main coal haul road and additional production is required, the company plans to purchase other coal-loading and overburden shovels and draglines and operate from two pits. The artist's conception of the mine at this stage of development is shown in Figure 6. Present plans are to operate one coal shovel per shift. The advantage of operating two pits will be that coal-loading operations in one pit will not interfere with the preparation of the other pit for production during the following shift. During the shift, when the shovel is not operating, there will be sufficient time to:

(1) Provide preventative maintenance to the shovel;

(2) Drill, load, and shoot both seams of coal;

(3) Remove the upper seam with the dragline; and

(4) Use a dozer in conjunction with the dragline to remove the parting from the top of the Smith seam.

The south mine will advance to the west until an area is reached where the quality of coal, when blended with north mine coal, will meet fuel standards. With the procedure for mining offset benches and exposing the coal, auger samples for coal analysis can be obtained a day ahead of mining and analyzed to determine the quality of the coal prior to loading. Sulfur isopleth maps can be updated on a day-to-day, pit-to-pit basis for future planning. Depending on the volume of coal required when mining is commenced

at the north mine, one shovel and dragline will be moved from the south mine or additional equipment will be purchased.

When coal demands exceed the capacity of the preparation facilities, Carter proposes to construct additional plant facilities east of the north mine, adjacent to the main haul road. Additional excavation equipment purchased at that time will increase the production capacity of the total mining operations to 22 million tons of coal per year.

Development of the coal in the western part of the lease has not been scheduled. It is anticipated that development procedures and mining methods will be similar to that outlined for the eastern area. If another system for removing overburden is desirable at that time, Carter will resubmit detailed mining plans for review and approval in accordance with regulations then in effect.

Monitoring

In March 1973, a program was initiated to obtain data on surface water in the area of Carter's federal lease. Six staff gauges were installed in various locations on streams passing through or near the lease. These gauges are read by a local rancher on a monthly basis and also during periods of high runoff. Water samples are collected each time the gauges are read and are analyzed for the following: calcium, magnesium, sodium, bicarbonate, chloride, sulfate, silicon dioxide, hardness, pH, turbidity, total solids, total dissolved solids, total suspended solids, and total volatile solids.

Carter also has a continuing program to monitor ground water levels in a series of 11 observation holes within the lease area. Additional holes will be drilled and monitored as part of the program.

The company proposes to carry out two pump tests. Samples will be collected and analyzed for calcium, magnesium, sodium, bicarbonate, chloride, sulfate, silicon dioxide, hardness, pH, total soluble salts, and total dissolved solids. Carter also proposes to carry out an inventory of all springs, wells, and surface impoundments within two miles of the lease area.

Data from all these tests and observations will be used to evaluate the effects on the surface and groundwater as a result of the mining operations.

Two meteorological stations will be installed near the east edge of the lease in the area of the initial mining activity. These stations will be low elevation (15 to 60 feet) installations and will provide a record of wind, precipitation, and air quality.

Auger samples of coal will be taken daily to maintain quality control of the shipped product. Automatic weighing equipment will be installed at the rail loading facility to obtain accurate weights for royalty payments.

Such additional monitoring equipment as may be required to maintain environmental quality will be installed as conditions warrant.

Transportation and Marketing

Coal will be shipped by unit trains via the proposed Douglas to Gillette rail line to electrical generation plants in Indiana. Additional coal contract commitments may be made for the remaining uncommitted reserves on the lease. Transportation to additional markets would most likely be via railroad.

Utilization

The Carter Oil Company has a contract with Indiana and Michigan Electric Company, a subsidiary of the American Electric Power Company, Inc., for five million annual tons of low sulfur coal for 30 years with deliveries commencing in mid-1976.