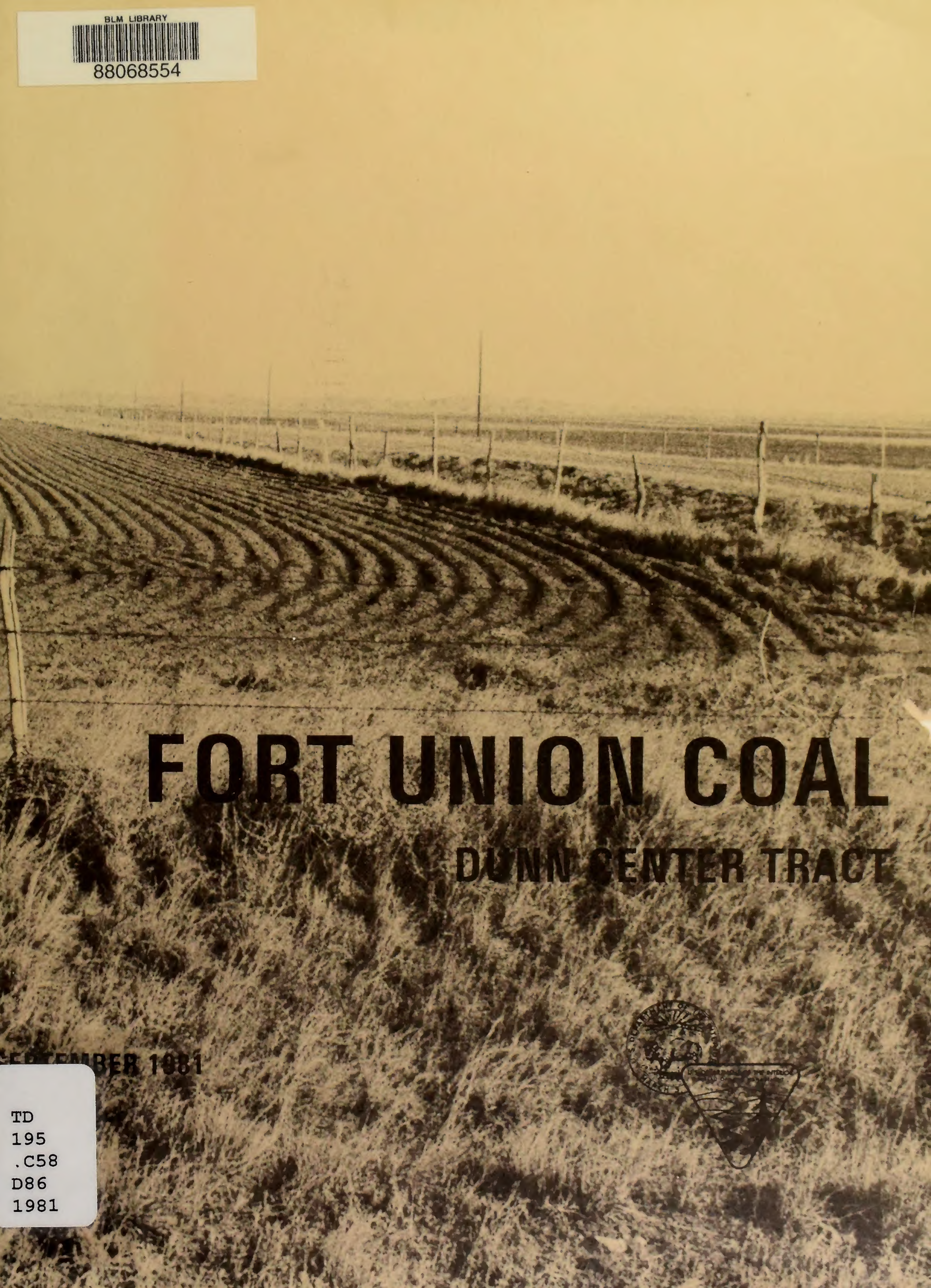


FORT UNION COAL

DUNN CENTER TRACT

SEPTEMBER 1981

FORT UNION COAL REGION

DUNN CENTER TRACT ANALYSIS

SITE SPECIFIC ANALYSIS

PRELIMINARY FACILITY EVALUATION REPORT

DUNN COUNTY, NORTH DAKOTA

September 1981

Michael J. Penfold
State Director

PREFACE

This document contains a site-specific analysis and a preliminary facility evaluation report. The site-specific analysis discusses the consequences of leasing and mining a particular tract. The preliminary facility evaluation report discusses significant issues associated with an end use coal conversion facility.

There were 24 tracts identified through a screening process under the over-all direction of the Fort Union Region Coal Team. The team consists of federal, state, and local officials. The tracts are being evaluated for potential federal coal leasing for a coal lease sale scheduled for June 1983. The evaluation, called a site-specific analysis, has been completed for each of the 24 tracts.

Historically, development of a new coal mine in the Fort Union Coal Region has been associated with a coal conversion facility power plant in the vicinity of the mine. For this reason, the Regional Coal Team directed BLM to evaluate impacts of a typical facility near each potential mine. A preliminary facility evaluation report was prepared for each facility.

The Fort Union Regional Coal Team will begin ranking and grouping selected tracts into alternative leasing patterns for the 1983 lease sale using information from these individual reports. These groupings of tracts will form the basis for alternatives and a regional environmental impact statement to be developed during 1982. The analysis in this report represents an important step in a lengthy process which takes place prior to any final decision on federal coal leasing within the region.

Of the 24 tracts currently being evaluated, 16 would require the opening of new mines. One of the 16 would be specifically earmarked for small business. The remaining eight tracts constitute coal which would be needed to maintain production or prevent the by-pass of federal coal at an ongoing mining operation.

Approximately 1.6 billion tons of recoverable federal coal lie within the areas being evaluated. Final designation of some areas as unsuitable for mining under the 1977 Surface Mining Control and Reclamation Act will likely reduce the amount of federal coal actually available for leasing and development, and could remove several of the 24 tracts from further consideration. This information will not be available until early 1982.

A major purpose of the site-specific analysis and preliminary facility evaluation reports is to acquaint the public with key issues and consequences of leasing and development of federal coal reserves so that they may (1) offer comments to the Fort Union Regional Coal Team on what areas they consider most important to be evaluated and analyzed in the ranking of the tracts and in the Regional EIS and (2) offer specific advice on what decision alternatives the Coal Team should look at more closely.

CONTENTS

SITE SPECIFIC ANALYSIS

INTRODUCTION

The purpose of this action is to offer 338.7 million tons of federal strippable coal reserves that can be further considered for coal leasing and development to help meet the energy needs of the Nation.

This site-specific environmental analysis has been prepared for the Dunn Center tract (Map 1) in accordance with federal regulations (43 CFR 3420). Similar analyses have been written for other tracts of federal coal in the Fort Union Coal Region. These documents will be used by the regional coal team in determining which tracts to recommend for leasing in 1983. If selected and leased, the Dunn Center tract will contribute 338.7 million tons of federal coal to the regional leasing target. A regional leasing target will be selected in October 1981.

BACKGROUND

In September of 1980, the Dickinson District Bureau of Land Management (BLM) Office completed the West-Central North Dakota Management Framework Plan (MFP) for Oliver, Mercer, McLean, Stark, and Dunn counties, and a small part of Billings County. The land use planning process included identification of high or moderate potential coal areas, application of unsuitability criteria, identification of resource trade-offs, and consultation with surface owners. As a result of that work, areas were identified that could be further considered for coal development. These areas are available for consideration for new competitive leasing, lease exchanges, and lease modifications.

Following land use planning, the BLM requested expressions of interest from industry. These expressions, along with other information, guided the U.S. Geological Survey (USGS) in delineating this tract. Results of that work are summarized in this document.

BLM Dickinson district staff inventoried the tract to determine the site-specific resource values and then analyzed potential environmental effects of coal development on this tract. Among other things, certain of the unsuitability criteria were further considered. New findings are reflected in this report.

Information from this and other site-specific analyses (SSA) will be used by the Regional Coal Team during the tract ranking and selection process for a lease sale schedule. The proposed tracts will be cumulatively analyzed in a regional environmental impact statement. Among the alternatives addressed will be different combinations of tracts that meet a regional coal leasing target.

After reviewing the analytical documents, public comments, and the recommendations of the regional coal team, the Secretary of the Interior will select specific tracts for the lease sale. The successful lessee will be required to submit a plan for mining and reclamation to the Office of Surface Mining (OSM) for review and approval within three years after leasing. In evaluating the plan, OSM will prepare a site-specific environmental assessment or EIS.

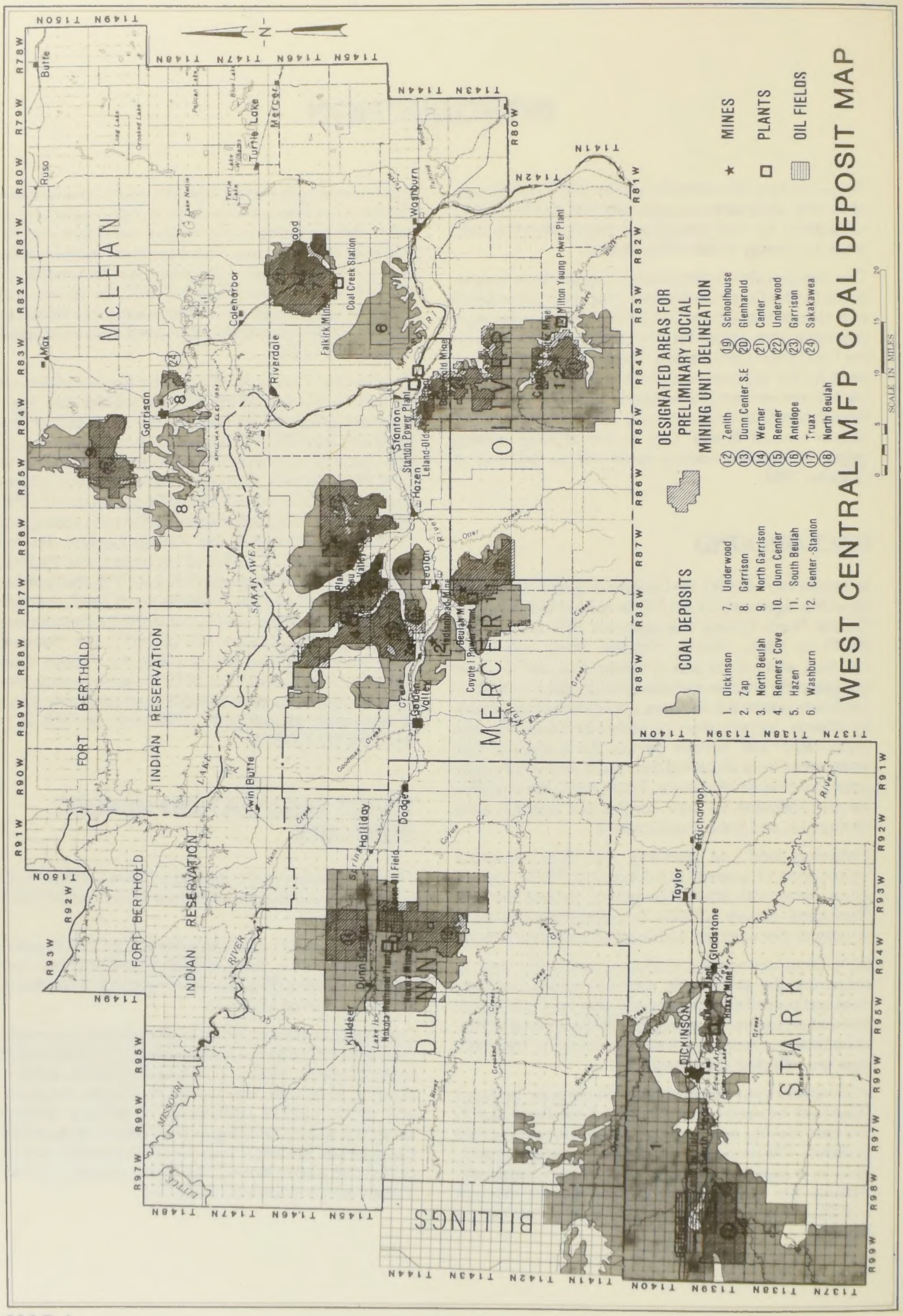
Tracts in the Fort Union Region are being considered for leasing in accordance with the federal coal management program adopted by the Secretary of the Interior in June 1979. The basis for the program was, in part, the final environmental statement for the Federal Coal Management Program. Implementation procedures are contained in Federal Regulations (43 CFR 3400). Authorizing actions are the Mineral Leasing Act of 1920, as amended; the Mineral Leasing Act for Acquired Lands of 1947, as amended; the Federal Land Policy and Management Act of 1976; the Surface Mining Control and Reclamation Act of 1977; the Multiple Mineral Development Act of 1954; the Department of Energy Organization Act of 1977; the National Environmental Policy Act of 1969; the Federal Coal Leasing Amendments Act of 1976, as amended; and federal regulations concerning federal coal leasing and development, including 43 CFR 3400, 30 CFR 211, and 30 CFR 700-899.

TRACT DELINEATION REPORT SUMMARY

The Dunn Center tract is located in Dunn County, North Dakota, about five miles southeast of the town of Dunn Center (Map 1).

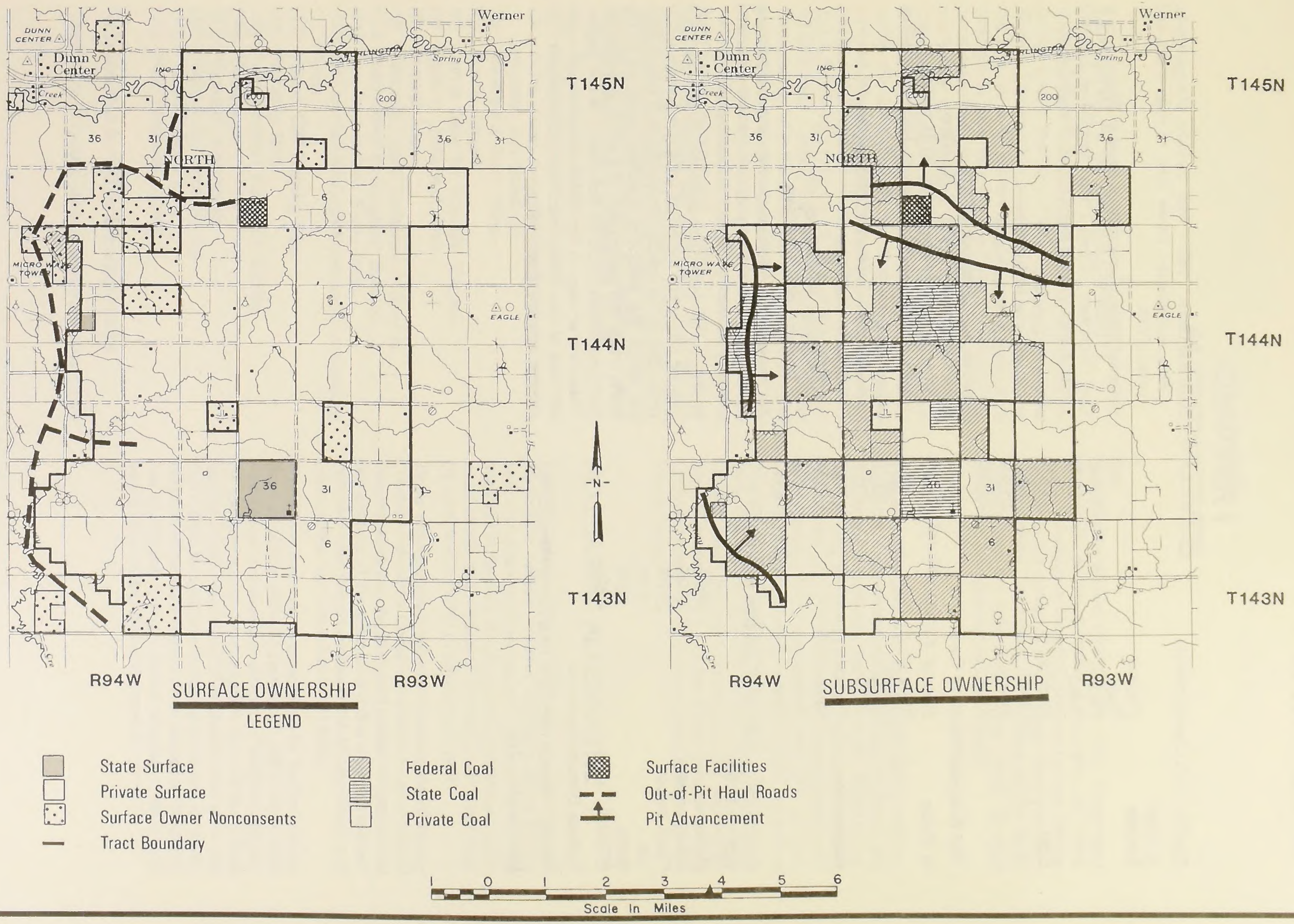
The tract is based on the Dunn Center (DC), A, B, and C beds found in the Sentinel Butte Member of the Fort Union Formation (Paleocene). No geologic hazards are known to exist on this tract.

For analytical purposes, the USGS developed a generic mine plan for the tract. This plan calls for a surface mine using draglines, electric coal loading shovels, bottom dump coal haulers, rotary drills, bulldozers, scrapers, and other support equipment. A possible mining sequence is shown on Map 2. The coal would be mined to a depth of 200 feet or until the limiting stripping ratio of 20:1 has been reached. The most probable end use of the coal would be a synfuel plant.


WEST CENTRAL MFP COAL DEPOSIT MAP
COAL DEPOSITS
1. Dickinson
2. Zap
3. North Beulah
4. Renners' Cove
5. Hazen
6. Washburn
7. Underwood
8. Garrison
9. North Garrison
10. Dunn Center
11. South Beulah
12. Center - Stanton
DESIGNATED AREAS FOR PRELIMINARY LOCIAL MINING UNIT DELINEATION
12 Zenith
13 Dunn Center S.E
14 Werner
15 Renner
16 Antelope
17 Truax
18 North Beulah
19 Schoolhouse
20 Glenharold
21 Center
22 Underwood
23 Garrison
24 Sakakawea
MINES
PLANTS
OIL FIELDS
SCALE IN MILES
McLEAN
MERCER
OLIVER
DUNN
STARK
BILLINGS
FORT BERTHOLD INDIAN RESERVATION
LAKE SAKAKAWEA
MISSOURI RIVER
Dickinson
Killdeer
Dunn Center
Halliday
Dodge
Golden Valley
Beulah
Hazen
Stanton
Washburn
Riverdale
Coleharbor
Garrison
Underwood
Turtle Lake
Mercer
Max
Ruso
Butte
Twin Buttes
Taylor
Richardton
Gladstone
Coal Creek Station
Falkirk Mine
Milton Young Power Plant
Stanton Power Plant
Coyote I Power Plant
Beulah Mine
Indianhead Mine
Nokota Methanol Plant
Nokota Mine
Husky Mine

MAP 1

DUNN CENTER S.E. TRACT



MAP 2

Specific Tract Characteristics:

Acreage:

Surface:	Federal	0
	State	800
	Private	29,045
	Total:	29,845
Coal:	Federal	11,630
	State	2,677
	Private	15,538
	Total	29,845

Coal Reserves/Millions of Tons:

In Place:	Federal	376.3
	State	64.4
	Private	485.6
	Total	926.3
Recoverable:	Federal	338.7
	State	58.0
	Private	437.0
	Total:	833.7

Coal Quality: Average of samples as received from vicinity of tract:

Moisture	34.0%
Volatile matter	27.0%
Fixed carbon	29.0%
Ash	8.0%
Sulfur	0.8%
BTU's/lb	6,800

Surface Disturbance/acres

Mining: Annual rate, 430; Total Life of Mine, 25,783

Haul Roads: 218

Mine Facilities: 160 - may include: changehouse, office, warehouses, repair shed, storage areas, and parking lots.

Stripping Ratio: Less than or equal to 20:1

Coal Thickness: C bed, 1.5 to 7 feet; B bed, 2 to 10.5 feet; A bed, 2 to 9.5 feet; DC bed, 7 to 25.5 feet

Mine Employment:
Construction Phase - 175
Production Phase - 480

Royalties and Severance Taxes:
Annual Federal Royalty, $4.26 million
Annual North Dakota Royalty, $0.74 million
Annual North Dakota Severance Tax, $12.6 million

Water Needs:
Human Consumption, 15,000 gal./day
Source: Well water

Nonpotable, 300,000 gal./day
Source: Lake Sakakawea

For more specific information on the proposed mining operation refer to the engineering, geologic, and land reports prepared by the tract delineation team.

NOTE: As the mine plans developed by USGS are of a generic nature and the actual mining sequence will be developed by the mining companies to fit their individual needs, the Resource Specialist assigned to the SSAs made the assumption that all lands within the tract boundaries would be disturbed to some degree. Therefore, acreage in the SSA may not always agree with that shown in the Tract Delineation Report concerning acreage disturbance.

CHAPTER I
ALTERNATIVES

LEASING AND DEVELOPMENT

This alternative is to offer for further consideration the federal coal in the Dunn Center tract for competitive leasing. This tract has been identified as a logical mining unit for a 14 million ton per year surface mine having a 60 year mine life. The Dunn Center tract has been delineated within areas designated as acceptable for further consideration in the West-Central North Dakota Management Framework Plan adopted in September, 1980. The tract does not include any lands for which the surface owner has filed a valid refusal to consent (to mining) prior to March 1, 1981. The tract has been fully cleared of unsuitability criteria numbers 1, 2, 4, 5, 6, 8, 10, 11, 12, 13, 17, 18, and 20 as defined in 43 CFR 3461. Criteria 7, 9, 14, 15, 16, and 19 require further study. With the exception of criteria 3 and 19 all unsuitability criteria studies will be completed and fully applied before work begins on the final regional environmental impact study; if not, this tract will be dropped from futher consideration. Criteria 3 and 19 will be deferred until mining and reclamation plans are submitted to the Office of Surface Mining and North Dakota Public Service Commission for final approval. Current unsuitability concerns are shown on Map 3. The following is a list of unsuitability criteria.

(1) Federal Land System
(2) Rights-of-Way and Easements
(3) Buffer Zones along R/W and Adjacent to Communities and Buildings
(4) Wilderness Study Areas
(5) Scenic Areas
(6) Lands Used for Scientific Studies
(7) Historic Lands and Sites
(8) Natural Areas
(9) Federally Listed Endangered Species
(10) State Listed Endangered Species
(11) Bald and Golden Eagle Nests
(12) Bald and Golden Eagle Roost and Concentration Areas
(13) Falcon Cliff Nesting Sites
(14) Migratory Birds
(15) State Resident Fish and Wildlife
(16) Floodplains
(17) Municipal Watersheds
(18) National Resource Waters
(19) Alluvial Valley Floors
(20) State Proposed Criteria

Relationship to Other Developments

The Nokota Company has announced a proposed coal to methanol synfuel plant for the Dunn Center tract expected to go into operation in the mid to late 1980s. Dunn County joins Mercer County on the east. Mercer County is the center of coal energy development in North Dakota. The closest active mines are the Husky Industry and the Indianhead mines about 30 miles south and 30 miles east of Dunn Center.

Mitigation Measures

This alternative assumes that proper mining and reclamation will be carried out according to existing state and federal regulations. These include: Office of Surface Mining Reclamation and Enforcement (OSM) regulations (30 CFR 700-899), Environmental Protection Agency (EPA) regulations (40 CFR 0-1399), Council of Environmental Quality (CEQ) regulations (40 CFR 211), Department of Interior coal management regulations (43 CFR 23 and 3400), and North Dakota Public Service Commission laws and regulations (Chapter 38-14.1 of the North Dakota Century Code and Article 69-05.2 of the North Dakota Administrative Code).

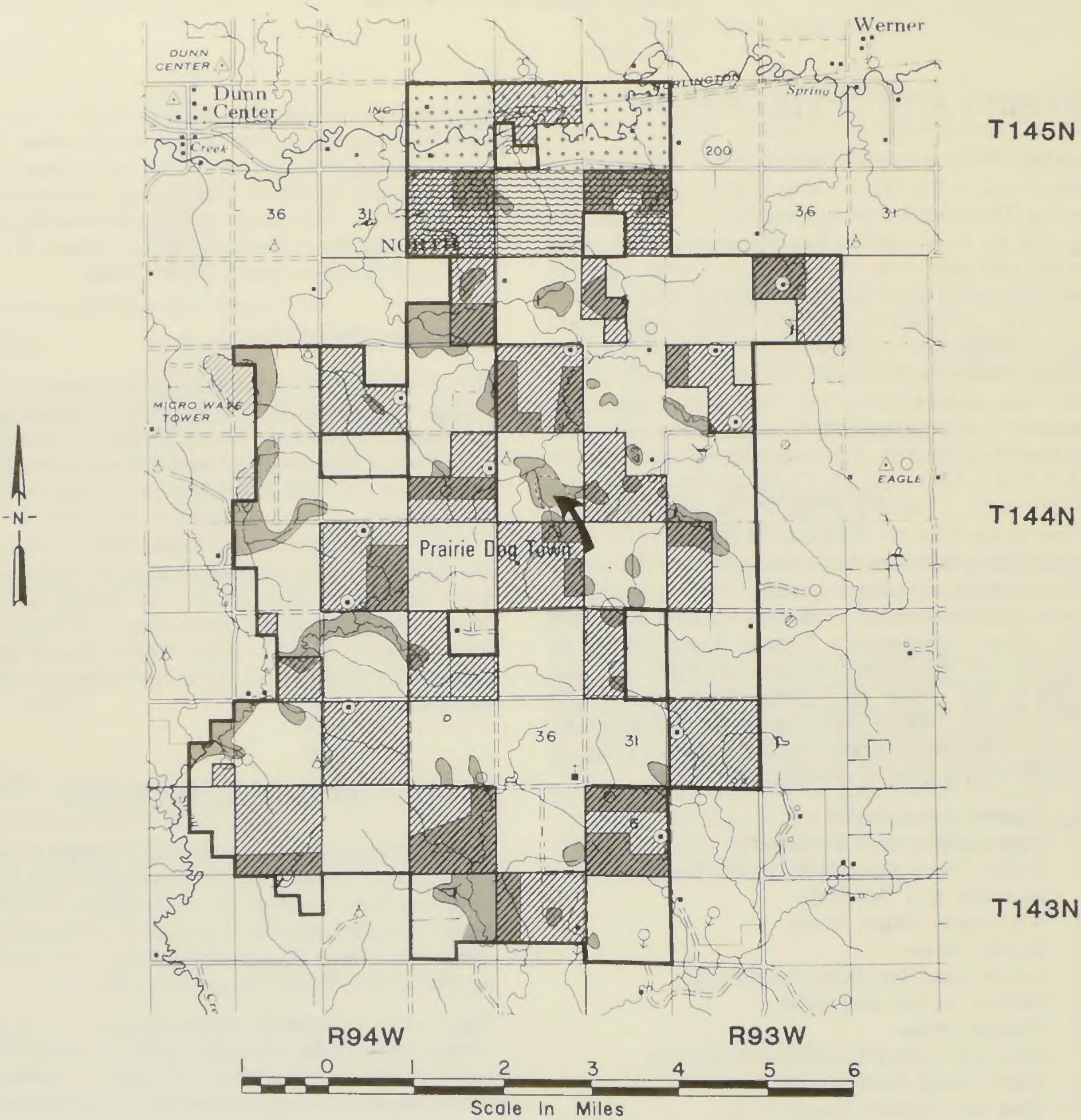
NO LEASING ALTERNATIVE

Federal coal would not be offered for leasing under this alternative. Federal reserves represent about 41 percent and state reserves about 7 percent of the coal available in the tract. If federal coal is not leased, development of a large economical mining unit is not feasible (Ref. USGS PLMU Engineering Report).

There were no small business expressions of leasing interest for the area. Considering the amount of federal coal involved, the checkerboard pattern of federal coal ownership and the apparent trend in small mine development, near future development of any small coal mines in the tract boundary is not likely.

Should the tract not be considered for further leasing, there would be about 23 percent or 338.7 million tons less federal coal available within the Fort Union Region for consideration in tract selection to meet the federal leasing target. Also about 58 million tons of state and 437 million tons of private coal would be lost for possible production in the region. As discussed in Chapter II, few significant changes to the existing environment would be expected during the next 60 years.

DUNN CENTER S.E. TRACT



LEGEND

Federal Coal

Areas being considered as unsuitable by BLM and others based on existing information.

Wildlife Habitat

Areas of Potential Archaeological Value

Potential Dwellings

Area Contains Multiple Resources — alluvial valley floor, 100-year flood plain, wildlife habitat and archaeological values.

Note: Detailed maps are available for inspection at the Dickinson BLM District Office. (Rights-of-way too numerous to show.)

MAP 3

CHAPTER II
AFFECTED ENVIRONMENT

This section is a description of the current environment with anticipated changes from ongoing trends. Within the Williston Basin there has been an increase in oil and gas exploration and this trend is expected to continue. The physical resources described in this section represent only existing conditions while the social and economic sections account for existing conditions and ongoing trends. It is recognized that the physical resource values may change due to future oil and gas exploration.

TOPOGRAPHY

This tract is located in the glaciated portion of the Missouri Plateau of the Great Plains physiographic province, and is characterized by gently rolling hills and scattered buttes. The local relief is about 200 feet. The area is drained by Spring Creek which flows eastward along the northern boundary of the tract.

GEOLOGY AND MINERALS

The Sentinel Butte Member of the Fort Union Formation (Paleocene) is the exposed bedrock in this tract. The Sentinel Butte is composed of interlayered beds of poorly consolidated sandstone, siltstone, claystone, limestone, and coal. The Sentinel Butte is overlain by scattered areas of glacial erratics.

The Dunn Center (DC) bed is the major resource in the tract with the overlying A, B, and C beds, in an upward succession, also contributing to the total reserves. Within the tract, the DC bed ranges in thickness from 7 to 25.5 feet and averages 16.5 feet thick. Interburden between the DC and A beds ranges from 2 to 96 feet. The A bed ranges in thickness from 2 to 9.5 feet and averages 5.6 feet thick. Between the A and B beds, the interburden ranges from 46 to 113 feet. The B bed ranges in thickness from 2 to 10.5 feet and averages 8.3 feet thick. The interburden between the B and C beds ranges from 6 to 43 feet. The C bed ranges in thickness from 1.5 to 7 feet and averages 3.6 feet thick.

The tract contains about 25,783 acres underlain by 926.3 million tons of reserve base lignite. There are approximately 376.3 million tons of federally owned coal, 485.6 million tons of privately owned coal, and 64.4 million tons of state owned coal.

A producing oil field overlaps this tract. As of the middle of 1980, the field was a one-well field with a cumulative production of 12,108 barrels of oil.

PALEONTOLOGY

No fossils of scientific importance are known to occur on this tract.

SOILS AND RECLAMATION POTENTIAL

Most of the soils in the Dunn Center tract have formed in residual sandstone, siltstone, and shale. The primary soils from this source are the Vebar, and to a lesser extent Amor, and Morton series. These are moderately deep, well-drained, medium and coarse-medium textured soils of moderate natural fertility.

Alluvial soils are also common in this tract. The Parshall series is associated with the Vebar soils throughout this area. Arnegard, Grail, Shambo, Farland, and Straw soils are found on nearly level to gently sloping positions of the landscape. The above soils are deep, well drained, loamy, and of high natural fertility. Rhoades and Daglum soils have formed in clayey alluvium from soft shales. They are saline, sodic, have a dense claypan in the subsoil, and are rather low in natural fertility.

There are also scattered areas of soils from glacial till (Williams) and wind blown material over the till (Flaxton). These are good quality soils generally found on gently to moderately sloping uplands.

The average slope within the tract is moderate (6-9 percent) and most slopes are between 3 and 15 percent. The water erosion potential is moderate to high on most unprotected slopes greater than six percent. Susceptibility to wind erosion is also quite high because of the sandy surface textures of soils such as Vebar, Parshall, Lihen, and Flaxton.

The quality of soil within the tract is reflected in the soil suitability for final cover of surface-mined land ratings and acreage figures for the SCS Order II county soil survey mapping units in the tract (Table 1 and 2). Of the 30,036 acres involved, 15,035 acres (50%) is in the "good" suitability category, 10,741 acres (36%) "fair," and 4,260 acres (14%) "poor." The Vebar-Parshall, Williams, Straw, Morton, Arnegard, and Amor mapping units comprise much of the acreage rated "good." Vebar fine sandy loam, Morton-Rhoades, Amor-Cabba, and Cabba units make up most of the "fair." The Daglum, Rhoades, and Harriet units compose most of the "poor."

The suitability data in Table 2 is developed by surface landowner because North Dakota law does not allow the transfer of soil material from one landowner to another unless written consent is given. Each surface owner's land must be reclaimed with soil originally removed from his holdings. The table therefore indicates the degree of difficulty to reclaim individual landowner holdings based on soil suitability as plant growth material on surface-mined land.

TABLE 1
DUNN CENTER TRACT

Map Symbol and Soil Mapping Unit Name[1/]	Percent Slope[1/]	Soil Erosion Potential[1/] Wind	Water	Overall Suitability of Soil for Use as Cover-Soil Material in Surface-Mine Reclamation[2/]	Soil Hazard Conditions[2/]
3 - Straw loam, channeled	0-1	Low	High	Good	----
4 - Arnegard loam	1-3	Low	Low	Good	----
4B - Arnegard loam	3-6	Low	Mod	Good	----
5 - Tonka silt loam	0-1	Low	Low	Good	----
7 - Straw-Phoades loams	0-1	Low	Low	Fair	Rhoades-too clayey, excess sodium & salts
8C - Cabba-Chama silt	6-9	Low	High	Fair	Too alkaline, some lime
9D - Amor-Cabba loams	9-15	Low	High	Fair	Cabba-too alkaline, some lime
9E - Cabba loam	15-45	Mod	High	Fair	Too alkaline, some lime
10D - Cabba extremely stony loam	3-25	Mod	High	Fair	Excess stones, too alkaline, some lime
11F - Cabba-Badland complex	15-120	Mod	High	Poor	Cabba-too alkaline, some lime; Badland-lack of soil
13D - Wabek gravelly loam	1-15	Mod	Low-Mod	Poor	Excess small stones, droughty, sandy subsoil
15 - Belfield-Farland silt loams	1-3	Low	Low	Fair	Belfield-clayey subsoil with excess sodium & salts
18 - Belfield-Grail silty clay loams	1-3	Low	Low	Fair	Too clayey, Belfield-sodium & salts in subsoil

TABLE 1
DUNN CENTER TRACT

Map Symbol and Soil Mapping Unit Name[1/]	Percent Slope[1/]	Soil Erosion Potential[1/] Wind	Water	Overall Suitability of Soil for Use as Cover-Soil Material in Surface-Mine Reclamation[2/]	Soil Hazard Conditions[2/]
22 - Colvin silt loam, saline	0-1	Low	Low	Fair	Excess salts in subsoil
27 - Farland silt loam	Low	Low	Good	Good	----
29B - Farland-Rhoades silt loams	1-6	Low	Mod	Fair	Rhoades-too clayey, excess sodium & salts
30E - Cohagen-Vebar fine sandy loams	9-25	High	High	Fair	Cohagen-too alkaline, droughty
31F - Cohagen-Vebar-rock outcrop complex	15-40	High	High	Fair	Cohagen-too alkaline, droughty; rock outcrop-lack of soil
32B - Flaxton-Williams complex	1-6	High	Mod	Good	----
32C - Flaxton-Williams complex	6-9	High	High	Good	----
33 - Grail silt loam	1-3	Low	Low	Fair	Clayey subsoil
33B - Grail silt loam	3-6	Low	Mod	Fair	Clayey subsoil
35 - Lawther silty clay	1-3	Mod	Low	Poor	Too clayey
41 - Heil silty clay loam	0-1	Low	Low	Poor	Too clayey, excess sodium
42B - Lefor fine sandy loam	1-6	High	Mod	Good	----

TABLE 1
DUNN CENTER TRACT

Map Symbol and Soil Mapping Unit Name[1/]	Percent Slope[1/]	Soil Erosion Potential[1/] Wind	Water	Overall Suitability of Soil for Use as Cover-Soil Material in Surface-Mine Reclamation[2/]	Soil Hazard Conditions[2/]
42C - Lefor fine sandy loam	6-9	High	High	Good	----
44B - Lihen loamy fine sand	1-6	High	Mod	Fair	Too sandy
44D - Lihen loamy fine sand	6-15	High	High	Fair	Too sandy
45B - Ruso sandy loam	1-6	High	Mod	Fair	Too sandy
45C - Ruso sandy loam	6-9	High	High	Fair	Too sandy
46B - Bowdle loam	3-6	Low	Mod	Good	----
47B - Moreau silty clay	3-6	Mod	Mod	Poor	Too clayey
47C - Moreau silty clay	6-9	Mod	High	Poor	Too clayey
49 - Morton silt loam	1-3	Low	Low	Good	----
49B - Morton silt loam	3-6	Low	Mod	Good	----
49C - Morton silt loam	6-9	Low	High	Good	----
52B - Morton-Rhoades silt loams	1-6	Low	Mod	Fair	Rhoades-clayey subsoil with excess sodium and salts
52C - Morton-Rhoades silt loams	6-9	Low	High	Fair	Rhoades-clayey subsoil with excess sodium and salts
53B - Watrous loam	1-6	Low	Mod	Good	----

TABLE 1
DUNN CENTER TRACT

Map Symbol and Soil Mapping Unit Name[1/]	Percent Slope[1/]	Soil Erosion Potential[1/] Wind	Water	Overall Suitability of Soil for Use as Cover-Soil Material in Surface-Mine Reclamation[2/]	Soil Hazard Conditions[2/]
54B - Parshall fine sandy loam	1-6	High	Mod	Good	----
55 - Pits	Highly Variable	Highly Variable	Highly Variable	Poor	Soil already removed
58 - Regent silty clay loam	1-3	Low	Low	Fair	Too clayey
58B - Regent silty clay loam	3-6	Low	Mod	Fair	Too clayey
58C - Regent silty clay loam	6-9	Low	High	Fair	Too clayey
61B - Regent-Rhoades silty clay loams	1-6	Low	Mod	Fair	Too clayey, Rhoades - excess sodium & salts
62B - Rhoades silt loam	1-6	Low	Mod	Poor	Clayey subsoil with excess sodium & salts
70C - Searing loam	3-9	Low	High	Good	----
71B - Sen silt loam	3-6	Low	Mod	Good	----
71C - Sen silt loam	6-9	Low	High	Good	----
75 - Straw loam	0-1	Low	Low	Good	----
81B - Vebar-Parshall fine sandy loams	1-6	High	Low	Good	----
81C - Vebar-Parshall fine sandy loams	6-9	High	High	Good	----

TABLE 1
DUNN CENTER TRACT

Map Symbol and Soil Mapping Unit Name[1/]	Percent Slope[1/]	Soil Erosion Potential[1/] Wind	Water	Overall Suitability of Soil for Use as Cover-Soil Material in Surface-Mine Reclamation[2/]	Soil Hazard Conditions[2/]
81D - Vebar fine sandy loam	0-15	High	High	Fair	Surface sometimes too sandy
82D - Vebar extremely stony fine sandy loam	3-15	High	High	Fair	Excess stones
86F - Brandenburg - Cabba loams	6-50	Mod	High	Poor	Brandenburg-excess rock fragments; Cabba-too alkaline, some lime
88 - Williams loam	1-3	Low	Mod	Good	----
88B - Williams loam	3-6	Low	Mod	Good	----
88C - Williams loam	6-9	Low	High	Good	----
91B - Williams-Noonan loams	3-6	Low	Mod	Fair	Noonan-excess sodium
91C - Williams-Noonan loams	6-9	Low	High	Fair	Noonan-excess sodium
93D - Zahl-Williams loams	9-15	Mod	High	Fair	Clayey subsoil, some lime
94E - Wayden silty clay	9-25	Mod	High	Poor	Too clayey
101B - Amor loam	3-6	Low	Mod	Good	----
101C - Amor loam	6-9	Low	High	Good	----
102 - Shambo loam	1-3	Mod	Low	Good	----

TABLE 1
DUNN CENTER TRACT

Map Symbol and Soil Mapping Unit Name 1/	Percent Slope 1/	Soil Erosion Potential 1/ Wind	Water	Overall Suitability of Soil for Use as Cover-Soil Material in Surface-Mine Reclamation 2/	Soil Hazard Conditions 2/
102B - Shambo loam	3-6	Low	Mod	Good	----
105 - Harriet silt loam	0-1	Low	Low	Poor	Excess sodium & salts
106B - Daglum silt loam	1-6	Low	Low	Poor	Clayey subsoil with excess sodium & salts
109B - Ekalaka fine sandy loam	1-6	High	Mod	Fair	Sodic subsoil

1/ From manuscript of "Soil Survey of Dunn County, North Dakota"

2/ Derived by applying the properties of the soils which are described in the above mentioned soil survey report and "Official Soil Series Descriptions" to the guidelines developed by BLM-Montana State Office and adapted from information by Wm. Schafer, the Soil Conservation Service (SCS) and the Office of Surface Mining (OSM).

TABLE 2
SUITABILITY OF SOIL FOR RECLAMATION
IN THE DUNN CENTER SOUTHEAST TRACT

LANDOWNER NUMBER	ACRES GOOD	FAIR	POOR	TOTAL
2a	46	113	1	160
b	90	107	123	320
3a	574	66	-	640
b	85	69	6	160
4	182	636	142	960
5	221	99	-	320
6	76	179	65	320
7a	171	60	9	240
b	12	39	29	80
c	92	17	51	160
d	82	76	2	160
8	169	134	17	320
9a	132	154	34	320
b	3	280	37	320
10a	134	26	-	160
b	76	84	-	160
11	180	70	190	440
14	197	94	29	320
15	118	31	11	160
16	131	29	-	160
17a	130	98	92	320
h	61	69	30	160
18a	459	364	457	1280
b	112	48	-	160
19a*	4	42	114	160
b	291	33	36	360
20	83	77	-	160
21	346	258	36	640
22a	23	85	52	160
b	651	437	192	1280
23	668	306	146	1120
24a	347	170	123	640
b	170	140	10	320
26	63	97	-	160
27a	433	207	-	640
b	69	18	33	120
c	57	102	1	160
28	421	514	25	960
29	59	131	50	240
30*	13	3	24	40
31	107	47	6	160
32	107	185	28	320
35a	159	153	8	320
b	31	117	12	160
36a	227	89	4	320
b	122	38	-	160
37a	112	208	---	320
b	84	200	36	320
38	359	113	8	480
40	100	30	30	160
41*	26	56	78	160
42	328	312	---	640
43	109	51	---	160
44	100	60	---	160
45	216	104	---	320
46	76	76	8	160
47	133	156	111	400
48	288	261	91	640
50	84	76	---	160
51*	62	274	304	640
54a	112	189	19	320
b	643	172	145	960
56	86	74	---	160
57a	84	76	---	160
b	91	229	---	320
58	95	170	55	320
59a	125	154	41	320
b	114	124	82	320
60	111	49	---	160
61	141	19	---	160
62	68	53	39	160
63	224	46	210	480
64	336	67	77	480
65	120	40	---	160
66*	291	116	553	960
67a	8	72	---	80
b	370	110	---	480
c	125	25	10	160
d	82	39	---	121
68	90	70	---	160
69	195	238	47	480
70	168	49	23	240
71	66	94	---	160
73	15	24	1	40
74	111	20	---	131
75	245	83	10	338
76	235	90	10	335
77	225	52	3	280
78	266	1	44	311
TOTALS	15,035	10,741	4,260	30,036
% OF TOTAL	50%	36%	14%	100%

1/ Based on Table 1. Planimetry by Bureau of Land Management. Legal description of land and owner name corresponding to landowner number available at Dickinson District Office.
*Indicates individual landowner tracts that have nearly half or more of the acreage rated "poor" for use as cover-soil material in surface mine reclamation.

HYDROLOGY

Surface water runoff drains from this tract through Slow Creek, Stray Creek, and direct tributaries to Spring Creek and Knife River. Annual runoff in this area averages about one inch. A portion of this tract has no external surface drainage and supports ephemeral and temporary wetlands. Table 3 shows the percentage of watershed areas covered by the tract plus the additional area affected by facilities, haul roads, etc. Also shown are estimates of annual surface water yield.

TABLE 3
WATERSHED AREAS ON THE DUNN CENTER TRACT

Watershed	Area (miles^2)	% of Watershed to be Disturbed	Annual Water Yield (acre-feet)
Slow Creek	30.8	75.6	1,643
Stray Creek	31.8	29.9	1,696
Direct Trib. Spring Creek	6.0	100.0	320
Direct Trib. Knife River	90.2	13.9	4,811
Closed Basin	4.7	78.7	251
Spring Cr. near Halliday	260.0	12.7	13,867

The surface water is typically a sodium sulfate type. During low flow periods, the quality of water in Spring Creek equals or exceeds the state standards for sulfate concentrations, percent sodium, and total dissolved solids. Surface water use within the affected area includes wildlife, stock water, and irrigation. Downstream on these watersheds are other stock ponds. Surface water is used for irrigation along Slow Creek and Spring Creek.

In ascending order above the Pierre Shale, the Fox Hills - Hell Creek, Ludlow, Coleharbor, and lignite and sand beds of the Tongue River and Sentinel Butte formations are aquifers that occur beneath this tract. Buried glacial meltwater channels of the Coleharbor formation and sand and lignite beds above the Dunn Center lignite of the Sentinel Butte formation form aquifers that occur within the mine disturbance zone.

The water table is below the C and B lignite beds. Both the A and Dunn Center lignites as well as other coarse textured beds near these are saturated in the tract. Buried channels of glacial origin criss-cross the tract, dissecting all of the lignite beds. Yield from the lignite and sand is generally less than 50 gallons per minute (GPM) while the channels can yield up to 1,000 GPM (Klausing, 1979).

The flow system for this aquifer network is local in extent. Recharge is from precipitation and infiltration in streams and ponds. The flow direction is down through the consolidated deposits. The buried channels generally are lower than the Dunn Center lignite and drain these shallow aquifers.

Groundwater quality is typically a sodium sulfate bicarbonate type. The water quality of the buried channels is similar to that of the Sentinel Butte aquifers. In and surrounding this tract, shallow groundwater is used for domestic, stockwater, and irrigation supplies. A primary source of shallow groundwater is the A and Dunn Center lignites.

VEGETATION AND AGRICULTURAL PRODUCTION

The Dunn Center tract is extensively used for agricultural purposes. A small part (311 acres) of the tract is irrigated. Dryland farming methods, most notably alternate-year summer fallow-cropping rotations, are widely practiced in the area. Nine percent (2,598 acres, Dunn County ASCS, 1981) is fallowed each year (Table 4).

Small grains including spring wheat, oats, corn, sunflowers, barley, winter wheat, durum, flax, and rye (in descending order of acreage grown) are grown on 24 percent (7,236 acres) of the tract. Wheat yields average 25.6 bushels per acre. Much of the cropland production, especially the crop portion, is sold as a cash crop. Oats, barley, and corn are also used as feed grains in livestock operations.

TABLE 4
AGRICULTURAL LAND USE
ON THE DUNN CENTER TRACT

Land Use:	Tract Acres	Average Production Per Acre 1/	Total Annual Production
Cropland	7,236	25.6 bu.	185,242 bu.
Hayland:			
Non-Irrigated	5,885	1.30 tons	7,651 tons
Irrigated	311	5.0 tons	1,555 tons
Range	13,818	.5 AUM	6,909 AUMs
Other	216	1.30 tons	281 tons
Fallow	2,598	n/a	n/a
Total	30,064	n/a	n/a

1/ Crop : wheat equivalent bu./acre
Hayland: tons/acre
Range : AUMs/acre
Other : tons/acre of hay equivalent

Twenty percent (6,196 acres) of the tract is used for growing hay for use in overwinter livestock feeding, 311 of which are irrigated. Approximately 1.30 tons of hay are produced per acre on non-irrigated areas, while approximately 5 tons per acre would be produced on irrigated areas.

Forty-six percent (13,818 acres) is rangeland and pastureland. Rangeland produces about .5 Animal Unit Months (AUMs) per acre. An AUM is the amount of forage needed to support a cow/calf for one month. Beef cattle are the predominant kind of livestock (North Dakota Crop and Livestock Reporting Service, 1980). There are also some dairy cattle, hogs, and sheep.

There are approximately 20 acres of shelterbelts, field windbreaks, and farmsteads per operation. There are numerous woody draws in the tract which are populated by native trees and shrubs.

Except for reseeded rangeland, the rangeland is in the widespread Mixed Grass Prairie type (Shaver, J.C. 1977). This includes species such as needle and thread, little bluestem, prairie sandreed, western wheatgrass, blue grama, side-oats grama, plainsmuhly, sedges, snowberry, fringed sagewort, and silver sage.

No threatened or endangered plant species as published on the 1980 federal list have been identified in the tract.

There are 49 operators and operator partnerships in the tract. Operations range in size from 40 acres to 2,080 acres inside the tract and from 40 acres to 9,259 acres in total (Table 5). Notably, 37 percent of the operations have 100 percent of their acreage within the tract.

TABLE 5

FARM/RANCH OPERATIONS - DUNN CENTER TRACT

	INSIDE COAL TRACT (ACRES)							OUTSIDE COAL TRACTS (ACRES)							
OPERATOR	SMALL GRAIN CROP	HAY	GRAZING	SUMMER FALLOW	OTHER	TOTAL	PERCENTAGE OF TOTAL ACRES LEASED	SMALL GRAIN	HAY	GRAZING	SUMMER FALLOW	OTHER	TOTAL	GRAND TOTAL	PERCENTAGE OF TOTAL ACRES IN TRACT
1	0	185	143	0	0	328	100	148	0	219	33	0	400	728	45
2	237	197	414	0	0	848	0	44	140	296	0	0	480	1328	64
3	0	123	37	0	0	160	0	39	394	1213	0	0	1645	1805	9
4	32	118	370	0	0	520	69	41	554	445	0	0	1038	1558	33
5	116	25	165	14	0	320	0	0	0	0	0	0	0	320	100
6	130	8	79	103	0	320	0	337	118	384	278	0	117	1437	22
7	81	181	336	30	0	628	100	919	998	6428	336	0	8631	9259	7
8	164	361	441	154	0	1120	43	0	0	0	0	0	0	1120	100
9	0	176	144	0	0	320	0	447	160	490	73	0	1280	1600	20
10	0	0	160	0	0	160	0	0	0	0	0	0	0	160	100
11	230	0	156	230	24	640	100	0	0	0	0	0	0	640	100
12	153	32	198	97	0	480	0	756	173	994	477	0	2700	2880	17
13	64	0	66	30	0	160	100	0	0	0	0	0	0	160	100
14	171	142	728	79	0	1120	100	451	213	1098	171	0	1760	2880	39
15	58	0	11	59	30	160	0	0	0	0	0	0	0	160	100

TABLE 5
FARM/RANCH OPERATIONS - DUNN CENTER TRACT

	INSIDE COAL TRACT (ACRES)							OUTSIDE COAL TRACTS (ACRES)							
OPERATOR	SMALL GRAIN CROP	HAY	GRAZING	SUMMER FALLOW	OTHER	TOTAL	PERCENTAGE OF TOTAL ACRES LEASED	SMALL GRAIN	HAY	GRAZING	SUMMER FALLOW	OTHER	TOTAL	GRAND TOTAL	PERCENTAGE OF TOTAL ACRES IN TRACT
16	480	797	419	64	0	1760	100	139	400	242	19	0	800	2560	69
17	55	214	371	0	0	640	0	0	0	0	0	0	0	640	100
18	231	310	419	0	0	960	0	474	463	783	0	0	1720	2680	36
19	0	0	40	0	0	40	0	147	26	187	0	0	360	400	10
20	0	19	90	0	0	109	100	728	493	1339	73	0	2920	3029	4
21	387	172	361	40	0	960	0	0	0	0	0	0	0	960	100
22	108	98	202	68	0	480	0	0	0	0	0	0	0	480	100
23	238	376	506	0	0	1120	100	0	0	0	0	0	0	1120	100
24	17	108	221	17	37	400	100	594	401	510	55	0	1560	1960	20
25	183	5	284	8	0	480	100	171	366	434	8	0	979	1459	33
26	720	326	933	101	0	2080	62	0	0	0	0	0	0	2080	100
27	77	189	198	16	0	480	0	155	91	283	31	0	560	1040	46
28	731	3	66	0	0	800	100	1312	601	967	432	0	3312	4112	19
29	207	290	303	0	0	800	40	0	283	197	0	0	480	1280	62
30	73	220	345	2	0	640	100	263	1673	1255	9	0	3200	3840	17

TABLE 5
FARM/RANCH OPERATIONS - DUNN CENTER TRACT

	INSIDE COAL TRACT (ACRES)							OUTSIDE COAL TRACTS (ACRES)							
OPERATOR	SMALL GRAIN CROP	HAY	GRAZING	SUMMER FALLOW	OTHER	TOTAL	PERCENTAGE OF TOTAL ACRES LEASED	SMALL GRAIN	HAY	GRAZING	SUMMER FALLOW	OTHER	TOTAL	GRAND TOTAL	PERCENTAGE OF TOTAL ACRES IN TRACT
31	319	5	38	278	0	640	50	497	20	148	415	0	1080	1720	37
32	42	86	192	0	0	320	50	0	0	0	0	0	0	320	100
33	0	163	157	0	0	320	100	470	65	677	470	78	1760	2080	15
34	0	211	749	0	0	960	0	120	129	552	79	0	880	1840	52
35	0	74	326	0	0	400	0	169	147	284	0	0	600	100	40
36	0	0	800	0	0	800	0	166	0	1091	166	408	1831	2631	30
37	271	268	282	79	0	1040	100	390	115	741	114	0	1360	2400	43
38	238	366	836	0	0	1440	0	140	300	680	0	0	1120	2560	456
39	108	0	222	108	2	440	100	533	282	1097	368	0	2280	2720	16
40	137	66	330	107	0	640	0	0	0	0	0	0	0	640	100
41	41	0	12	41	106	200	100	35	0	2	35	90	162	362	55
42	473	260	525	182	0	1440	11	0	0	0	0	0	0	1440	100
43	232	0	234	174	0	640	100	152	57	181	90	0	480	1120	57
44	205	22	133	99	0	459	100	222	0	233	184	0	640	1099	42
45	0	0	40	0	0	40	0	0	0	0	0	0	0	40	100

TABLE 5
FARM/RANCH OPERATIONS - DUNN CENTER TRACT

	INSIDE COAL TRACT (ACRES)							OUTSIDE COAL TRACTS (ACRES)							
OPERATOR	SMALL GRAIN CROP	HAY	GRAZING	SUMMER FALLOW	OTHER	TOTAL	PERCENTAGE OF TOTAL ACRES LEASED	SMALL GRAIN	HAY	GRAZING	SUMMER FALLOW	OTHER	TOTAL	GRAND TOTAL	PERCENTAGE OF TOTAL ACRES IN TRACT
46	0	0	80	0	0	90	0	0	0	0	0	0	0	80	100
47	0	0	303	0	17	320	0	0	0	0	0	0	0	320	100
48	0	0	160	0	0	160	0	0	0	0	0	0	0	160	100
49	227	0	53	200	0	480	0	995	35	246	873	0	2149	2629	18
TOTAL	7236	6196	13,818	2598	216	30,064	48	11,164	8695	23,696	4789	576	48,920	78,984	38

Overall, the tract covers 38 percent of the acreage of the operations involved.

Agriculture in the area includes crop operations, livestock operations, and mixtures of both. Most operations in the area include a balance between crops and livestock.

Forty-eight percent of the acreage within the tract is farmed by lessees, or operators who do not own the land. Fifty-two percent is farmed by owner/operators.

AGRICULTURAL ECONOMICS

This section will be forthcoming under separate cover.

LAND USE

The tract lies in an agricultural area previously unaffected by coal mining. The small town of Dunn Center, population 170 (1980 U.S. Census), is an old agricultural trade center that straddles the Burlington Northern railroad and is by-passed by the traffic on State Highway 200. It provides a local farm and ranch retail service. The town of Halliday, population 199 (1980 U.S. Census) is similar to Dunn Center. The chief trade and service town is Killdeer located nine miles west. Its population is 780 (1980 U.S. Census) and is growing rapidly due to oil and gas activity west of the town.

The tract area is used for dryland farming of small grain crops and non-croppable land is used as native pasture for livestock grazing, hay in wet seasons, and wildlife habitat. The tract has improved roads and unimproved roads which cross the project area, generally along section lines and a few miles of power and telephone distribution lines servicing farm residences.

The Burlington Northern railroad runs one mile north of the project area and a 41.6 kilovolt powerline runs adjacent to State Highway 200, the north boundary of the project area.

The tract is zoned agricultural by Dunn County. Coal mining is a use allowed within this zoning under a conditional use permit.

RECREATION

Hunting of a variety of species (deer, upland game birds, waterfowl) is the main recreation opportunity offered to the public on the tract. This opportunity, while significant to local people, has limited attraction to people outside the immediate vicinity of the proposed mining.

The communities of Dunn Center and Halliday, North Dakota offer recreation opportunities in the general vicinity of the tract. Ball diamonds and parks offer adequate opportunities at this time. Lake Sakakawea, north of the tract, offers state and federal recreational opportunities.

AESTHETICS

The existing character of the land is largely agricultural as noted in other sections of this document. The appearance of the area is constantly changing following the progression of agricultural activity through the seasons and the cycle of active cropping and fallow through periods of years. Fields are well-defined rectangles in a north/south, east/west grid divided by roads on most section lines and also by windrows, fences, and shelterbelts. Interspersed variations such as small patches of broken ground, grazed prairie and woody draws can be found in the tract area.

The tract is observed from State Highway 200 which runs in an east/west direction through the northern portion of the tract. This road is typical of much of this region, dividing views into two sorts: long range views from high places in the profile of the road and short range views from low places. Activity would be visible on both sides of this route.

Manmade features are a part of the character of the landscape. In the vicinity of this tract a gravel pit, power lines, a railroad right-of-way, and agricultural structures and facilities are evident. Coal mining in the region is evident and is accepted locally as part of the land. Whereas the aesthetic surface of the landscape may not be considered scenic or pleasing, coal mining has a "fit" with the character of the regional landscape and is thus not unexpected either to local populations or those passing through the area.

WILDLIFE

About 40 percent of the photointerpreted area is native prairie and 56 percent is agriculturally disturbed land. Woodlands are very limited (1 percent) and 3 percent of the area is wetlands. This glaciated country has been heavily farmed, but substantial native prairie remains, primarily around the streamcourses and around "pothole" wetlands. There are about 26 units of native prairie within the tract which are 320 acres or larger.

Spring Creek flows east through the northern part of the area, and the Knife River drainage lies to the south of the tract. The glaciated topography supports numerous stream courses bounded by prairie and a number of excellent wetlands. Wetlands, specifically prairie potholes, are the most productive wildlife habitat in North Dakota.

Essential wildlife habitat composes about 44 percent

TABLE 6
WILDLIFE HABITAT AND SPECIES

Woodlands	Wetlands	Native Prairie	Agriculturally Disturbed
*Sharptail Grouse	*Hungarian Partridge	*Sharptail	Sharptail
*Hungarian Partridge	Mourning Dove	Hungarian Partridge	Hungarian Partridge
*Mourning Dove	*Pheasant	Mourning Dove	Mourning Dove
*Pheasant	*Mallard	*Whooping Crane	Pheasant
*Merlin	*Gadwall	*Merlin	Whooping Crane
*Swainson's Hawk	*Whooping Crane	Swainson's Hawk	Swainson's Hawk
Marsh Hawk	*Pintail	Marsh Hawk	Marsh Hawk
Ferruginous Hawk	*Greenwing teal	*Burrowing Owl	Ferruginous Hawk
*Loggerhead Shrike	*Widgeon	*Ferruginous Hawk	Whitetailed Deer
*Whitetailed Deer	*Shoveler	Loggerhead Shrike	Red Fox
*Mule Deer	*Redhead	Whitetailed Deer	Badger
Mink	*Canvasback	*Mule Deer	No. Swift Fox
Beaver	*Ruddy	*Antelope	
Red Fox	*Sandhill Crane	Mink	
Badger	*Swainson's Hawk	Red Fox	
No. Swift Fox	*Marsh Hawk	*Badger	
*Bobcat	*Sprague's Pipit	*No. Swift Fox	
	*Whitetailed Deer	Bobcat	
	*Muskrat		
	*Mink		
	*Beaver		
	*Red Fox		
	Badger		

*Essential habitat for species

(native prairie, wetlands, woodlands,) of the tract and nonessential farmland totals 56 percent as shown in Map 3, Chapter 1.

Woodlands, wetlands, and native prairie provide essential habitat for 32 wildlife species (Table 6). Whooping crane, an endangered species, migrate through this area annually. Blackfooted ferret, another federally endangered species, historically has occupied this area, primarily in association with prairie dog colonies. There are a number of historic, but generally eradicated, prairie dog colonies in the area as well as some occupied colonies. Complete and adequate ferret inventories have not been made to date.

It is the interspersion of essential habitats that provides the greatest amount of edge, has the highest value as wildlife habitats, and the largest populations. The remnant wildlife habitats, either singly or interspersed, are the result of 60 to 70 years of intensive farming of all suitable land, with limited exceptions. These residual wildlife habitats are the best habitats left in the area.

All remaining native grasslands represent precious relics of the original prairie ecosystems. They evolved during thousands of years and, once destroyed, cannot be exactly duplicated by man. The rate of native prairie loss in North Dakota has been tremendous, and unplowed prairie is only 20 percent of the original total.

There are no sensitive fish, amphibians, or reptiles identified in this area at this time. There are sensitive fish in the Knife River downstream of the area.

CULTURAL RESOURCES

Important prehistoric resources are located on the tract. With the data that is recorded about them, their long-term effect on coal development may be predicted and some specific comments about them can be made.

Sixty-five percent of the total surface of the tract, including 68 percent of the surface over federal coal, has been the subject of intensive cultural resource survey. This effort recorded a range of sites, from large and complex Knife River flint quarries, through habitation sites, to open plains sites that are task specific and exploitative in nature. (i.e., bison kill sites; lithic scatters of varying size, density and function; seasonal and long term habitation sites).

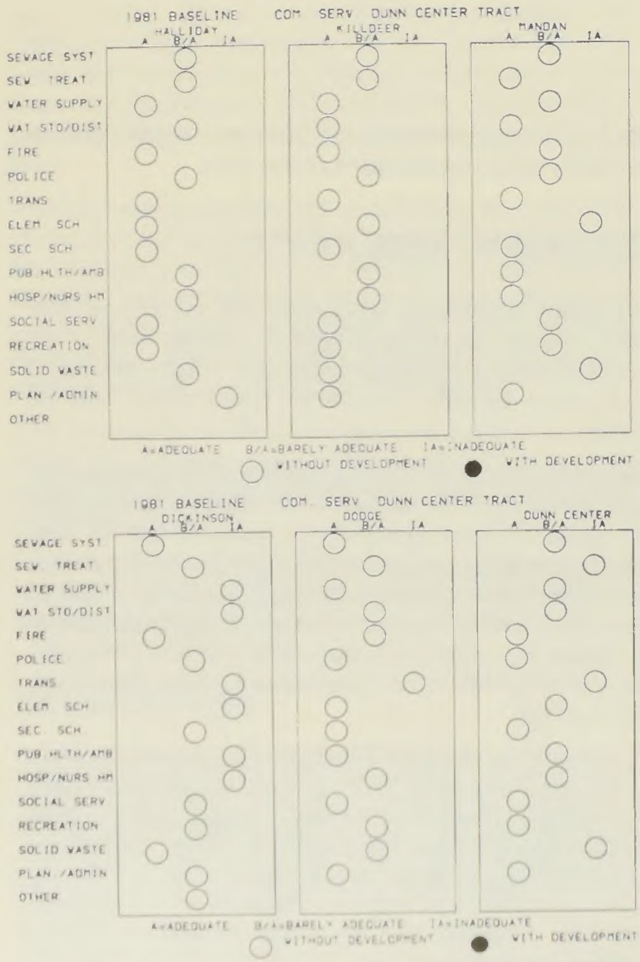
The clustering of important sites in the northern portion of the tract has made parts of it potentially unsuitable for mining. Under the present configuration 1,920 acres will be removed from the tract. These areas to be removed are clustered along Spring Creek and may reflect a relationship between the location of water and raw lithic material that governed prehistoric human activity on the tract.

Activity in the historic period has been farming and stock raising. Evidence of stock raising is not easily identified,. Activity in the historic period to the present, particularly farming, may have eradicated prehistoric features and destroyed artifacts.

ECONOMIC AND SOCIAL CONDITIONS

Existing and forecasted population and employment levels for the communities of Dickinson, Dodge, Dunn Center, Halliday, Killdeer, and Mandan, North Dakota are shown in Figure 3, Chapter III. The Mandan population is shown as a combined Bismarck/Mandan population. As the figure shows, future population levels without federal coal leasing (refer to dashed line) for Bismarck/Mandan and Killdeer are expected to increase from 1981 through 2000. Future population levels without energy development for Dickinson, Dodge, Dunn Center, and Halliday are expected to increase until the late 1980s and early 1990s and then gradually decrease through 2000.

FIGURE 1



SOURCE: Respective city/county or regional planners.

Almost all of these communities have experienced some growth in the last three to five years due to oil, gas, or coal development. The most substantial increases have been to Dickinson, Killdeer, and Mandan. This growth has contributed to some problems in providing adequate community services. As Figure 1 shows, all of the communities except Killdeer presently (1981) have one or more public services that are considered to be inadequate. For example, Dickinson currently has an inadequate water supply for its present population.

The adequacy ratings appearing in Figure 1 reflect assessments by city planners, regional planners, county planning commissions, and town councils. It should be recognized that some assessments were based on best judgment and are somewhat subjective.

Eleven Dunn County residents were interviewed by BLM representatives and identified several service problems that exist in the area. Road improvement and maintenance, along with medical care and day care for children, were service problems mentioned by Dunn County residents. In Stark County, twenty-four residents indicated that law enforcement, recreational facilities, medical care, and retail opportunities were the most serious service needs.

Support for additional mining in the area was found to be considerably stronger in Dunn County than in Stark County. Virtually every person contacted in Dunn County expressed support for mining and most of this support was not qualified. The reasons given for the position expressed include the need for local job opportunities and economic growth, the nation's need for additional energy production, and the availability of a valuable resource that should be developed.

While support in Dunn County was very high, there was considerable concern about reclamation, and the effects of surface mining on agricultural lands. Other issues attached to development in Dunn County included future availability of surface water and the ability of Dunn County communities to deal with rapid growth.

The community leaders contacted in Dunn County were also supportive of additional mining. One local official expressed opposition to mining, otherwise each official contacted was in favor of it. While leaders appear to be strongly supportive of local mining, there is concern. The effects of mining on groundwater, distribution of taxes and revenues, and the effects of population growth on communities, including crime, changed way of life, and pressure on the schools, were listed as coal-related issues.

In Stark County a highly variable pattern emerged when residents were asked how they felt about mining. While slightly more than one half of the persons interviewed expressed support (either directly or with qualification), a relatively high proportion, roughly 1/3 of the persons interviewed, expressed opposition. Reclamation, protection of surface water, and the potential for air quality degradation emerged as the major concerns of both supporters and opponents of development in Stark County.

The interviewed officials appear to be more supportive of development than the general population in Stark County. While one official expressed opposition, the others either strongly supported or supported development with qualification. The major concerns of these officials centered on both the natural and social effects of mining. Reclamation, air pollution, and surface water were those issues that emerged with regard to natural environment. Socially, the presence of newcomers, overall rapid growth effects, pressure on schools, and acquisition of tax reserves were the major issues brought up by Stark County officials.

In both Stark and Dunn counties, residents described the social atmosphere that presently exists as the best thing about living in the area. Friendliness, informality, and other community characteristics were clearly the attributes of greatest favor.

On the negative side, Dunn County residents appeared hard put to describe factors of which they disapprove. Only entertainment facilities and access to retail opportunities were mentioned in Dunn County. Stark County residents expressed disfavor with several characteristics of their respective communities. Among these were the climate, traffic, outdoor recreation opportunities, medical care, and the high cost of living.

CLIMATE AND AIR QUALITY

The climate of western North Dakota is typically continental, characterized by variable temperature and precipitation. The predominant pressure systems, out of the Gulf of Mexico and the Arctic, account for the rapid alterations of meteorological conditions common to the area. Cold polar air masses dominate the winter months, while moist Gulf air masses prevail in the spring and summer, distributing the major precipitation across the area.

Meteorological data available from surrounding stations are shown in Tables 7 and 8. The Dunn Center S.E. tract is located east of the meteorological station two miles southwest of Dunn Center and within the National Weather Service (NWS) West Central Region. The meteorological station southwest of Dunn Center will be used to establish benchmark climatology for the tract.

The annual mean temperature for the area is 40.2°F with a highest monthly mean temperature of 68.7°F (in July), and a lowest monthly mean temperature of 7.9°F (in January). The average growing season is approximately 122 days; the last spring freeze generally occurs during the third week of May, while the first fall freeze generally occurs during the third week of September (Ramirez, J.M. and T. Method 1976).

TABLE 8
REPRESENTAT[illegible] REGIONAL METEOROLOGICAL DATA

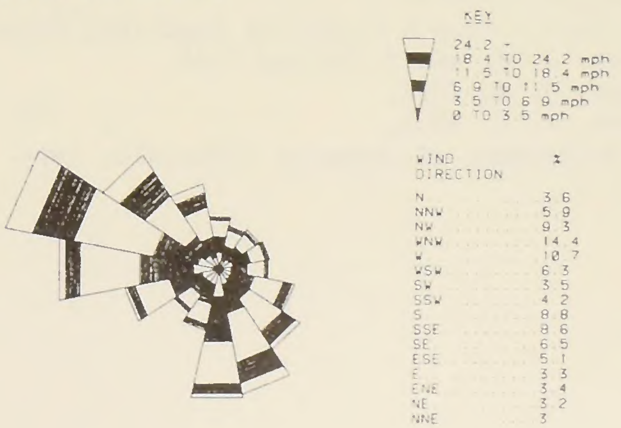
	Regional Values
Humidity (Annual Average), %	40-50
Lake Evaporation (Annual Avg.), in.	50-55
Extreme Weather	
Thunderstorms, days/year	30
Tornadoes, sightings/year	rare
Hail, days/year	2-4
Maximum recorded wind speed, mph*	72
Inversion Frequency (base 1500 ft.), %	
Annual	35
Seasonal Range	30-50
Mixing Height, ft.	
Mean Annual Morning	984-1312
Mean Annual Afternoon	4921-5249
Mean Seasonal Afternoon Range	1968-7874

*Recorded at Bismarck, North Dakota

Sources:
Brum, L.J., J.W. Enz and J.M. Ramirez 1978.
Jensen, R.E. 1974.
Ramirez, J.M. and T. Method 1976.
U.S. Department of Commerce 1974.

Precipitation in the area occurs predominately in the late spring and early summer (May to July). Annual precipitation averages 16.92 inches at Dunn Center, and 16.91 inches through the NWS West Central Region. The average annual snowfall at the Dunn Center station is 33.7 inches.

Wind data used for this analysis were obtained from the Dickinson climatological station, the nearest station to the tract with data suitable for input into the dispersion model. The wind rose in Figure 2 represents a summary of this data. Winds prevail from the W to NW at Dickinson (34 percent frequency of occurrence). Wind speeds average 13.7 mph and exceed 11.5 mph 54 percent of the time.



WIND ROSE FOR DICKINSON NORTH DAKOTA

TABLE 7*
METEOROLOGICAL DATA FOR SELECTED SITES

Parameter	Dunn Center	Fairfield	Watford City 14s	Dickinson Exp. Sta.	Dickinson (FAA)	NWS West Central Region
Temperature, °F						
$\bar{X}$ annual, °F	40.2	42	41.8	40.5	41.5	42.0
$\bar{X}$ monthly low (Jan)	9.2	12	9.9	10.4	12.1	12.8
X monthly high (July)	68.6	71	62.8	68.5	69.3	69.6
Growing season for grass (temp. 32° F), days	122	133	119	117	133	129
Precipitation, in.						
Annual average	16.96	16.45	16.27	16.56	15.58	16.20
Monthly range	0.34-4.32	.27-4.00	.46-3.74	.30-4.01	.31-3.78	.34-3.97
Annual snowfall	33.7	34	36	32	34	30
Annual stability, (by class) % occurrence						
Class A, B, C					8.9	
Class D					69.9	
Class E, F					21.2	
Wind direction, (%)					W-NW(34)	
Wind speed, mph (% of time)					0-3.5 (4) 3.6-6.9 (13.4) 7-11.5 (30.5) 11.6-18.4 (39.1) 18.5-24.2 (11.3) 24.2 (1.6)	
Average wind speed, mph					13.7	

*SOURCES:

Jensen, R. E. 1972.
North Dakota Crop & Livestock Reporting Service 1980.
Ramirez, J. M. and T. Method 1976.
Ramirez, J. M. 1972.
Ramirez, J. M. 1973.
U.S. Department of Commerce 1948-1974; 1973; 1974; 1979.

Although the terrain offers only limited obstruction to the dispersion of pollutants, the area experiences frequent temperature inversions, which reduce mixing heights and tend to concentrate pollutants (Brum L. J., J. W. Enz and J. M. Ramirez 1978).

Table 9 presents some of the available air monitoring data from ambient air monitoring stations in the general vicinity. Recorded annual geometric mean concentrations for total suspended particulates (TSP) from area rural locations have ranged from ll ug/m^3 (at Medora) to 29 ug/m^3 (at Dickinson). From 1971 to 1980, the annual geometric mean concentration of TSP at the Dickinson commercial monitoring station, ranged from 36 to 77 ug/m^3. For the purpose of the following computer analyses, the background rural TSP levels will be set at 22 ug/m^3 for the annual level and 80 ug/m^3 for the 24-hour level.

Three Class I areas, the North and South Units of Theodore Roosevelt National Park and the Lostwoods National Wilderness Area, fall within the potential impact range of the proposed tract and associated developments. Based on 1979 air quality computer modeling estimates by the North Dakota State Department of Health, the allotted 24-hour SO_2 increment for the South Unit of the Park is consumed, or nearly consumed. Visibility was observed to range from 73 to 96 miles at the Theodore Roosevelt National Park during 1979 (John Muir Institute 1980).

TABLE 9
WEST CENTRAL NORTH DAKOTA AIR MONITORING DATA*

Monitoring Site	Year	Parameter	No. Observations	Max. Observation (ug/m^3)	2nd Max. Observation (ug/m^3)	Annual Geom. Mean (ug/m^3)	Annual Arith. Mean (ug/m^3)
			State-Operated Sites:				
Dunn Center	79	TSP	4	37	17	16	19
		SO_2	1896	78	26	13	13
	80	TSP	33	58	52	22	25
		SO_2	7332	52	39	<5	<5
Halliday	76	TSP	13	55	27	18	21
	77	TSP	56	189	117	19	28
	78	TSP	33	47	42	14	16
Mandaree	76	TSP	10	61	42	23	28
	77	TSP	44	78	68	24	29
	78	TSP	54	108	91	19	24
	79	TSP	50	63	59	21	24
	80	TSP	50	95	83	27	31
TRNP-N	79	TSP	44	59	53	14	20
Watford City	80	TSP	53	534	83	20	32
(rural)		SO_2	1432	133	110	<5	<5
Grassy	76	TSP	14	49	40	13	17
Butte	77	TSP	52	126	79	19	26
	78	TSP	34	81	47	14	18
TRNP-S	74	TSP	19	88	45	11	19
Medora	75	TSP	49	72	50	13	18
(rural)	76	TSP	43	120	46	16	22
	77	TSP	49	118	115	16	23
	78	TSP	51	95	84	13	18
	79	TSP	51	48	40	14	17
	80	TSP	55	1313	442	21	54
		SO_2	7597	60	50	<5	<5
Dickinson	76	TSP	59	76	64	26	32
(rural)	77	TSP	55	421	192	26	41
	78	TSP	54	162	97	21	29
	79	TSP	30	96	96	21	28
			Privately-Operated Impact Source Monitoring Sites:				
Western Gas Fairfield	80	SO_2	2601	865	512	<5	13

*SOURCE - North Dakota State Department of Health

CHAPTER III ENVIRONMENTAL CONSEQUENCES

TOPOGRAPHY

The natural contour of the land would be modified during surface mining. Although most would be returned to its approximate original contour, difference in detail would remain, including drainage patterns and final sloped highwalls.

In general, the reshaped ground would not be steep enough to cause slope failures and related hazards. Until that natural vegetation can be reestablished, accelerated erosion and resultant unsightly scars on the land would be potential problems.

GEOLOGY AND MINERALS

The major impact of the leasing alternative would be the removal of 833.7 million tons of coal. Mineral resource conflicts may occur between development of oil and gas and mining coal since oil and gas are produced on this tract.

PALEONTOLOGY

No significant impacts would be expected.

SOILS AND RECLAMATION POTENTIAL

The types of impacts affecting the soil resource in this area have previously been discussed in Bureau of Land Management planning documents and the West Central North Dakota Regional Environmental Impact Study. The basic impacts, if mining proceeds, are the disruption of the present soil bodies with temporary loss of productivity, in addition to problems associated with erosion, compaction, and instability.

Soil erosion and compaction would not be new to the area because of dryland agricultural activity that presently exists. About 24 percent of the tract is annually cropped with 9 percent left bare of protective cover due to summer-fallowing. Therefore, these type of impacts would continue with or without the presence of an active mine.

Some instability problems are usually associated with the onset of reclamation. Area-wide settling, localized subsidence or collapse, and underground erosion called piping may occur (Groenwald, 1980). If the stipulations covering the handling of soils and overburden during surface mining operations are closely adhered to and enforced, however, instability impacts should be kept minimal.

The soils would be lost to the production of grass, forage, and grain over the short-term use (about 10 years for each annual disturbance of 500 acres) of coal mining in the tract. This loss is occurring only on the active portion of the mine at any given time. Once in full operation, the total tract area out of production in any peak mining year is estimated at 5,100 acres. Soils would be continuously replaced on mined out areas and brought back into production during the life of the mine (60 years).

Preliminary indications, from completed and ongoing research by such agencies as the Science and Education Administration-Agricultural Research (SEA-AR) of Mandan, North Dakota and North Dakota State University-Agricltural Experiment Station (NDSU-AES) of Fargo, are that agricultural productivity of mined land can be restored. Much depends, however, on the planning and implementation of a concerted reclamation effort (Power, 1974).

Successful return of agricultural productivity over the tract should be possible. Soils Table 2 in Chapter II indicates that most landowners have sufficient acreage of soil rated "good" and "fair" for supplying cover soil material in surface mine reclamation. However, there are five separate parcels that have nearly half or more of their acreage rated "poor." These may require a very intensive reclamation effort to ensure successful rehabilitation. Often a thin layer of topsoil can be salvaged from the "poor" soils. If better soils exist in the parcel of land, they can provide extra material to average over the area. Sixteen core drill holes in this tract indicate that the top portion of some of the overburden is suitable for use near the surface of reconstructed soil profiles. If enough suitable plant growth material from the above mentioned sources can be averaged over parcels with soils rated "poor," it should be possible to increase their productivity.

HYDROLOGY

During mining, all of the surface runoff from the disturbed area must be impounded and not released until it meets specified quality standards. An exception to this is when storm runoff exceeds the design capacity of the reservoir. Water that collects in open mine pits is also often pumped into these surface water reservoirs. While these runoff catchment basins are in place, total water yields would be decreased due to increased evaporation and infiltration at the reservoirs. Table 10 shows the maximum possible loss of yield for the watersheds draining this tract, assuming no surface water is released. The impact on local streams may be significant.

TABLE 10
MAXIMUM LOSS OF WATER YIELD FROM THE DUNN CENTER TRACT

Watershed	Area to be Disturbed (acres)	% of Watershed to be Disturbed	Maximum Water Yield Reduction (acre feet/yr)	% Reduction in Flow
Slow Creek	14,902	75.6	1,242	75.6
Stray Creek	6,085	29.9	507	29.9
Direct Trib to Spring Creek	3,840	100.0	320	100.0
Direct Trib to Knife River	8,024	13.9	669	13.9
Closed Basin	2,367	78.7	198	78.7
Spring Creek near Halliday	21,109	12.7	1,562	11.3

Water which is released from the impoundments would generally have less suspended solids, higher dissolved solids and higher sodium adsorption ratios. At this time, it is impossible to predict exactly how much difference there would be in these water quality constituents.

Flooding of Spring Creek, while digging or stockpiling soil or overburden within the 100-year flood recurrence zone, would significantly degrade the quality of water. This impact could be mitigated by avoiding disturbances and stockpiling within this flood zone and properly designing road crossings.

There are several basins within this tract that support ephemeral or temporary wetlands. During the mining phase these natural wetlands would be destroyed. The local groundwater system is dependent upon the wetlands for recharge. In order to maintain postmining recharge similar to the premining system, these wetlands would have to be re-created with similar water balance characteristics.

The A and Dunn Center lignite beds as well as sand beds in the overburden and interburden are aquifers. During mining, the lignite would be removed, and the sand beds would be destroyed during overburden handling. While the pits are open, water levels in the disrupted lignite and sand beds would be drawn down in the area surrounding an open pit. The lignite is missing from beneath the buried channels but drawdowns can be expected in these channel aquifers while open pits are located adjacent to them. The distance that this drawdown would occur from an open pit will vary across the tract. It is dependent upon the local aquifer characteristics and upon how far below the water level the bottom of the pit is located. This impact would affect between 30 and 40 water wells used for domestic and livestock purposes.

The flow pattern of groundwater through the area would also be disrupted. The open pit would act as a groundwater sink. During mining, this effect limits all groundwater quantity and quality impacts to the area included within this cone of depression around the open pit. Water levels over the entire tract and adjacent areas would not change everywhere at once. It would progress as mining moves across the tract.

Once the overburden is replaced in the pit, the drawdown stress would begin to subside and approach a postmining equilibrium. The flow patterns of groundwater would still be different than under premining conditions. Generally water would not be as available from the replaced overburden under postmining conditions.

The physical disturbance caused by a mining action can also result in changes in the chemical quality of the local groundwater. Increases in sodium, sulfates, and total dissolved solids concentrations have been reported by Groenwald (1979 and 1980) at other mines in North Dakota with similar overburden. These changes in water quality were variable but dependent upon overburden characteristics and reclamation practices. The quality of water in the replaced overburden and lignite down gradient would be similarly degraded. As water moves through the system away from the mined area, it would be diluted by relatively fresh recharge water from unmined areas. Studies to date have not found altered water quality further than about one or two miles away from mined areas. It is not known exactly what the area extent of this impact would be in the long term.

Any wells finished in the mined area below the Dunn Center lignite would be physically destroyed, but their water source will not be significantly altered. Wells finished in or above the Dunn Center lignite within the tract would have their water source degraded if not destroyed. Wells finished in the A or Dunn Center lignite in the area surrounding the tract could have their water source degraded. There would be between 15 and 25 water wells impacted in this manner over the life of the mine. These wells are used for domestic and stockwater supplies.

Water of similar quantity and quality is available at deeper depths. Associated with these deeper replacement wells would be higher operating and maintenance costs to the local water users. Also any additional wells needed in the future, after the mining company has fulfilled its replacement obligations and left the area, would cost more to drill. The cost of these additional wells would not be paid by the mining company.

During low flow periods, the source of discharge through Spring Creek is the shallow lignite and sand aquifer system. Mining next to the stream would cause degradation of water quality in the Creek. In order to avoid degradation of water quality in Spring Creek, a buffer zone with no mining must be established. The exact size of this buffer zone is not determinable at the present time. It will depend upon the local aquifer characteristics and also on the quality of the groundwater moving through the spoils. The former has not been inventoried in enough detail and the latter process is difficult to predict.

This impact has implications for a couple of water use related values. The Spring Creek water quality during low flow currently equals or exceeds the limitations for sulfate, percent sodium, and total dissolved solids set by the North Dakota State Health Department. Any degradation of Spring Creek will cause a violation of the standards.

Spring Creek has been determined to have good potential for being an Alluvial Valley Floor. A final determination has not been made due to a lack of detailed data. This determination would be made at the mine permit stage.

VEGETATION AND AGRICULTURAL PRODUCTION

The proposed action would progressively remove an average of 500 acres of the total tract area per year from its current uses. The major use of these lands is agricultural production. The first land taken out of agricultural operations, except for the plant site and ancillary facilities, will occur in the first year of mining. The time period of removal from agricultural production would be the time spent in mining and land reclamation. The entire tract would be progressively mined over a 60 year period.

Mining of any one location would be the land use for one to five years, depending on the type of mining. Land reconstruction to premining levels of agricultural production would require a total of approximately ten years. The land would be placed into the premining type of agricultural production or other premining uses that the landowner and Public Service Commission agree upon (wildlife habitat, woodlands, or rights-of-way). Vegetation reestablishment would occur during the first appropriate season after grading to topography and replacing topsoil.

The company would be under bond for at least ten years to as long as necessary to prove, at a 90 percent confidence level, that agricultural productive capacity has been restored (Public Service Commission, Reclamation Department, 1980). Reclamation research by such agencies as the Science Education Administration—Agricultural Research Service (SEA-AR) and North Dakota State University—Agricultural Experiment Station (NDSU-AES) indicates that some degree of optimism for the restoration of land to agricultural production is justified, although there is no certainty as to how long it would be before all mined land would be judged as fully restored as the law requires.

The leasing and development alternative would have a significant short-term impact on individual agricultural operations in the tract. By the end of the mine life, 30,064 acres of the tract would be disturbed in addition to 160 surface acres used for existing mine facilities.

An average of 125 acres of cropland, excluding 2,598 total acres of summer-fallow would be removed from production each year. This would be an average annual loss of 3,200 bushels of wheat. This 125 acres of cropland would be out of production ten years with a maximum of 1,262 acres out of production in any one peak mining year, resulting in a maximum loss of 32,307 bushels of wheat annually.

Peak mining years disturbance of 1,000 acres of non-cropped hayland would result in an annual loss of 1,300 tons of non-irrigated hay production. The annual loss from 53 acres disturbance of irrigated hayland would be an additional 265 tons.

An average of 230 acres of rangeland would also be removed from production each year, resulting in an average loss of 115 AUMs. This 230 acres of rangeland would be out of production ten years with a maximum of 2,349 acres out of production in any one peak mining year, resulting in a maximum annual loss of 1,174 AUMs.

Regionally, these losses would not pose significant reductions in area agricultural production.

Time constraints necessitated the Bureau of Land Management doing agricultural data collection on the preliminary logical mining unit instead of the later final logical mining unit. The data may not completely represent the logical mining unit in its final form.

Some of the more sensitive plants (for cropland, woodland, or rangeland use) may have difficulty in becoming established on some of the less suitable soils.

Forbs, woody plants, and trees (woodlands) must be reestablished along with grasses.

AGRICULTURAL ECONOMICS

This section will be forthcoming under separate cover.

LAND USE

Existing land use would be displaced within the project area and additional land would be consumed in nearby communities to accommodate new residences, services and facilities resulting from population increases. The displaced land use would be agricultural in both instances. Provisions of the law require reclamation of the tract and the displacement of use on the tract would be temporary, but displacement of use for urban expansion may be considered a permanent change.

Displacement of existing use, using progressive mining, would be up to ten years for any given location that would be mined. Longer time periods would be involved with some haul roads and with the mine office and associated facilities.

Inconvenience would result from relocation of power and telephone services. This inconvenience can be considered insignificant in that it is short term and reversible.

RECREATION

Habitat destruction and the resulting loss of wildlife species (deer, upland game birds, waterfowl) will damage recreational hunting. The impact of this loss has been assessed in the wildlife portions of this document. From the recreation perspective, it is likely the loss will be manageable. Social and economic studies have documented demographic changes resulting from mining which imply increased demand for recreation and would result in stress on the available recreation facilities in the communities. Increased pressure would occur on private and public land because of recreational opportunities lost to mining.

AESTHETICS

Coal mining is a visible part of the landscape as it now exists and views of this type of activity should be within the expectations of those travelling through the area. The impact of unnatural land forms and large scale operations should thus surprise no one, diminishing the effect of additional coal mining in the region. Whereas mining does not display a particularly attractive aesthetic surface, the characteristics of mining form part of the character of the landscape, minimizing its perceived adverse value. The reduction of visual amenity depends primarily upon the quality of the design of the mine related to the location from which it is seen. These views of the coal operation would be of short duration under the worst of conditions, and under the best conditions of reclamation the impact to the visual surface would be insignificant and the loss of amenity would be restricted to short periods of time and to the area of active mining.

The most visible features would be spoil piles, topsoil stockpiles, heavy equipment, buildings and other structures, and the smoke and dust associated with active mining. Of these, smoke and dust are the most undesirable from a visual standpoint. Because coal mining is a part of the character of the region, other features of mining need not seriously impair the visual surface of the area from normal observer positions.

WILDLIFE

Coal mining and attendant actions would severely disrupt and destroy significant native woodlands, and riparian wetlands interspersed with native prairie which singly and in composite constitute the essential habitats for 32 sensitive wildlife species and many other more common wildlife species (Map 3, Chapter I).

On-site effects to wildlife resources would be degradation and loss of the three essential habitats. Offsite aquatic habitats in the Knife and Missouri Rivers and Spring Creek would be the recipient of potential point and non-point pollution.

The agriculturally disturbed areas are of low wildlife habitat value but do provide spring and fall feeding and loafing habitat for migratory waterfowl and shorebirds.

The areas identified on Map 3 are those which represent the sensitive wildlife habitats of highest value. The four-mile-wide belt north of Spring Creek is the area where the least wildlife habitat losses would occur due to strip mining if full compensation is received.

There will be a significant area loss to wildlife resources if strip mining occurs in the essential wetlands, woodlands, and native prairie and they are not replaced in full (compensation) or are converted to farmland.

Mobile wildlife such as birds and large mammals may shift about the habitat losses to some degree, but nonmobile species such as reptiles and amphibians would be destroyed. The very limited availability and disruption of riparian woodlands and wetlands would restrict, and in many cases exclude, the accommodation of disturbed mobile wildlife.

Noise, presence of humans, heavy equipment, dust and affiliated disturbances cumulatively may cause wildlife to vacate unmined habitats and may preclude adoption by wildlife of those rehabilitated areas until the disturbances are eliminated. This may be for the life of the mine and rehabilitation period, which may be as long as 26 or more years.

Increased human populations resultant of mine development and operations generally reduce wildlife populations and habitat locally and offsite by poaching, road kills, increased legal harvest, disturbance or reproductive and migratory periods and habitats, harassment by recreationists, feral and uncontrolled cats and dogs, and degradation and complete loss of habitat due to housing, shopping centers, waste treatment plants, and similiar urban development. The problem is compounded in areas where shift changes coincide with feeding periods, especially big game. The same would probably occur in this area.

Actions to mitigate these impacts, available to entities other than BLM, would be to provide mass transportation of workers and adjust the times of shift changes, which would greatly reduce poaching. This has been used successfully in other mining areas. Providing funds for the North Dakota Game and Fish Department for increased law enforcement or adoption of a poaching clause in union contracts would also help.

Successful reclamation of native woodlands and natural wetlands such as "potholes" and riverine wetlands has not been demonstrated. Native prairie has not been successfully recreated, either, although some prairie plowed about 70 years ago and since left undisturbed shows some native plant species reestablishment.

Concurrent reclamation of lost wildlife habitat within 12 to 18 months after mining may reduce a few of the less negative wildlife impacts. However, disruption or loss of any of the larger wetlands and riparian woodlands is expected to become a permanent loss.

At present there is no data to suggest that natural, biologically viable wetlands (e.g., potholes) can be reclaimed from mine spoil in this country. It would be most productive and conservative to eliminate mining from the larger wetlands (e.g., 1/2 acre and greater) thereby retaining the critical soils structure of the wetlands and eliminating the extended delay proposed for wetlands recreation attempts. Destruction of natural viable wetlands would be an irretrievable commitment of wildlife resources.

An Interagency Team of Wildlife Biologists from the North Dakota Game and Fish Department, U.S. Fish and Wildlife Service and Bureau of Land Management have identified and recommended areas for the application of unsuitability criteria (Map 3). Formal recommendations have been received by BLM from the other agencies. Joint agreement among the agencies and final decisions on unsuitability, exemptions such as producing leases, and exceptions will be completed in August 1981.

CULTURAL RESOURCES

All cultural resources within the tract boundaries are subject to direct and indirect impacts. Direct impacts are those that result from ground disturbance activities and can result in damage and destruction to sites, artifacts, their environmental context and the data they contain.

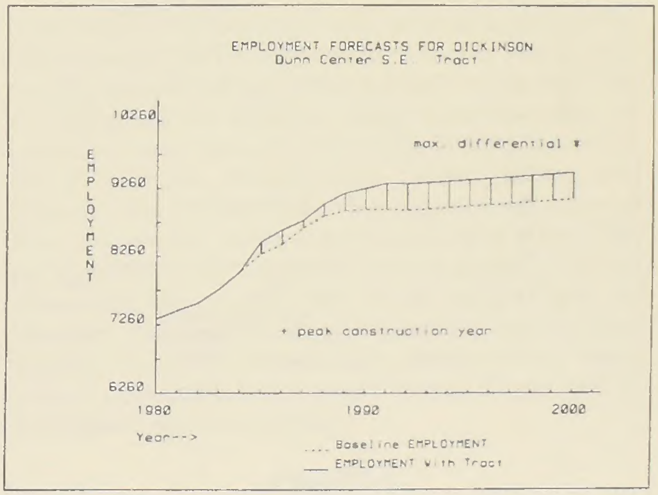
Sites not directly impacted by earth disturbance may be impacted as a result of the earth disturbance. These secondary impacts can include vandalism increased by improved access, loss as a result of erosion, or degradation resulting from disruption of natural setting.

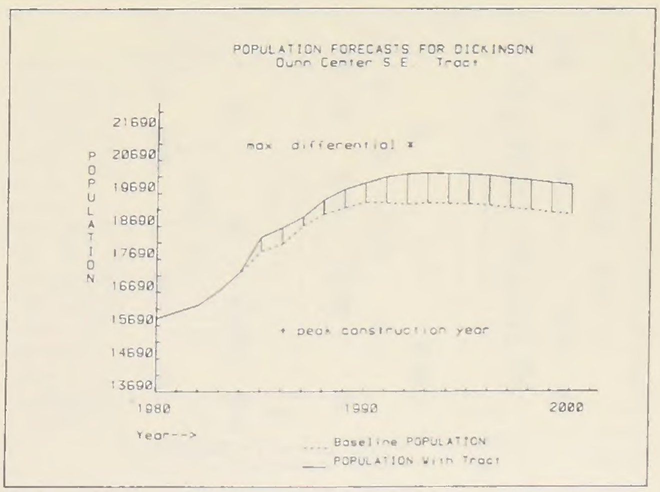
In the event of lease, stipulations covering cultural resources would need to be developed. These stipulations would need to treat both recorded and unrecorded sites. They would also need to require management plans for cultural resources that detail mitigation plans for each site to be impacted. As in any cultural resources mitigation, preservation alternatives are preferred. If these options are not viable, then scientific data recovery programs would need to be developed.

ECONOMIC AND SOCIAL CONDITIONS

Construction and operation of the Dunn Center mine would result in significant impacts upon services in some communities within the area, as a result of population growth associated with employment opportunities. Figure 3 shows forecasted community employment and population levels through 2000 both with and without development of the Dunn Center tract. As this figure shows, Dickinson, Dodge, Dunn Center, Halliday, Killdeer, and Mandan would experience a significant increase in both population and employment as a result of tract development.

FIGURE 3





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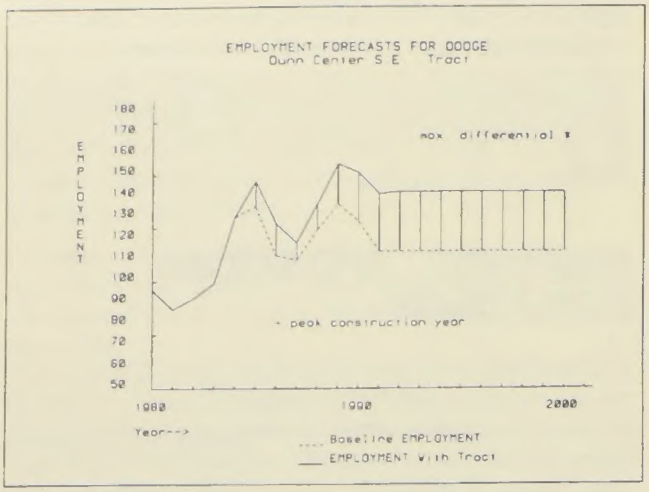

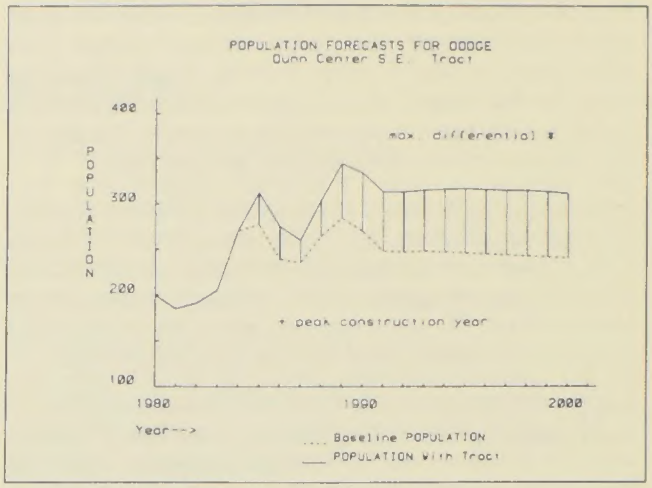

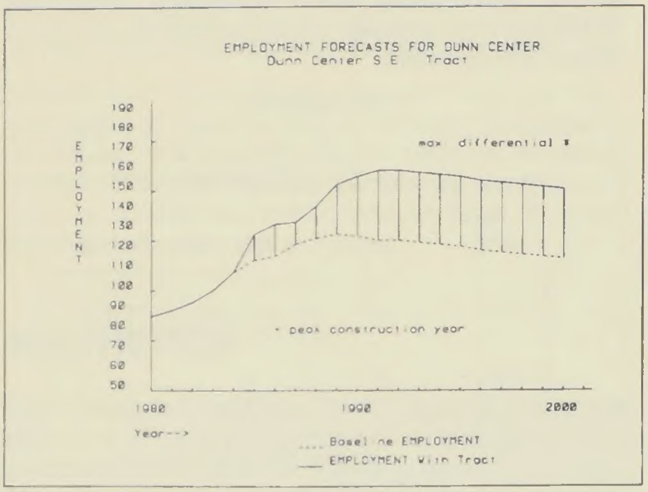

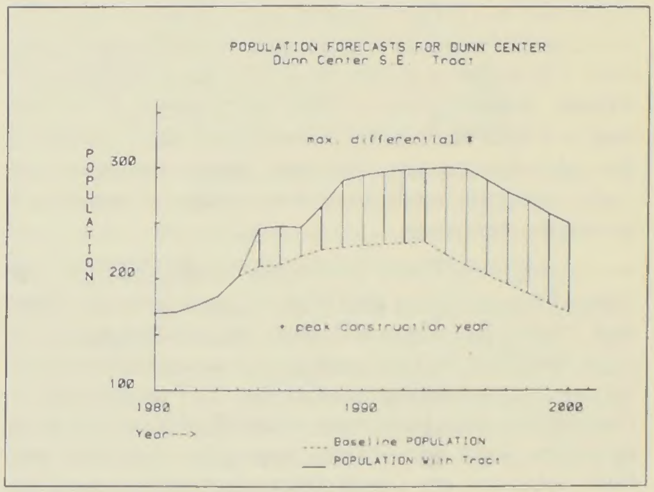

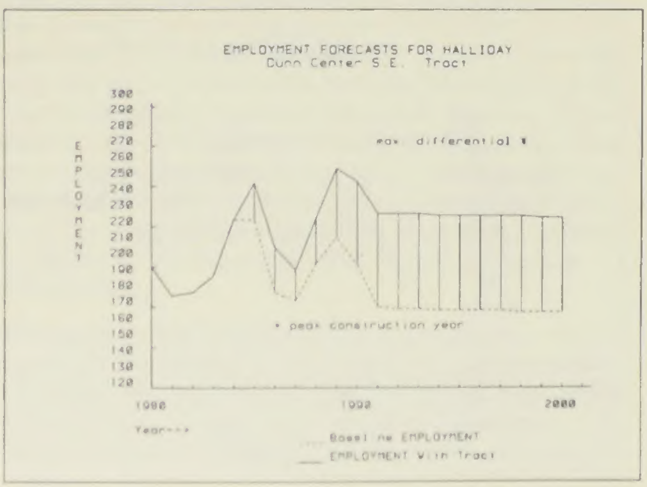

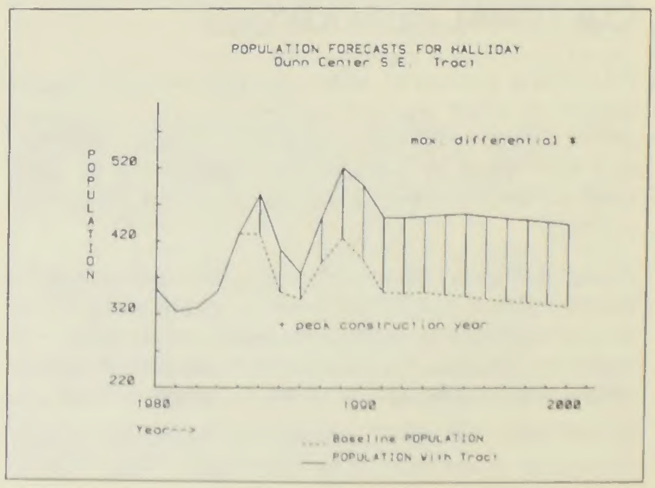

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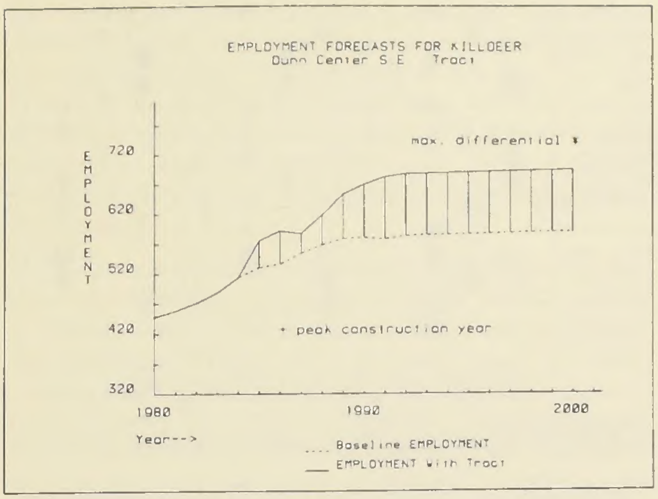
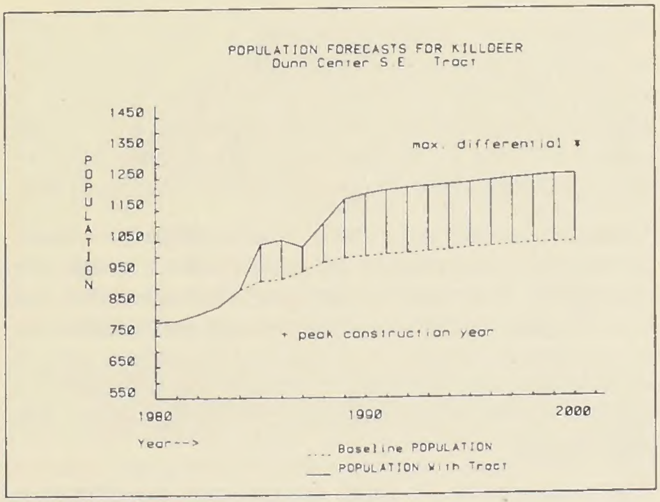
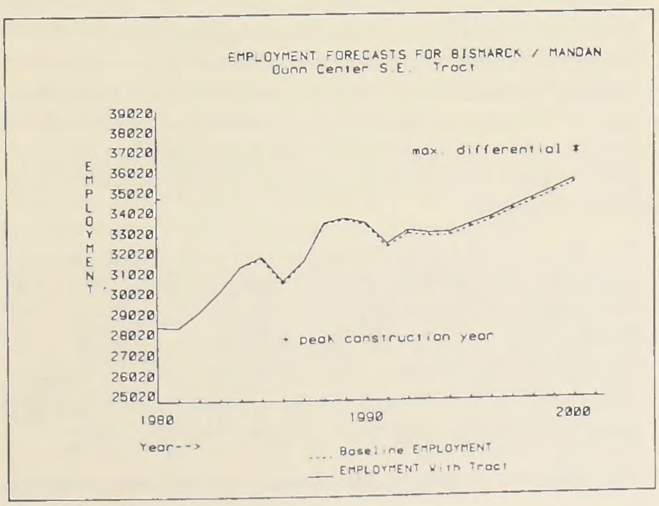
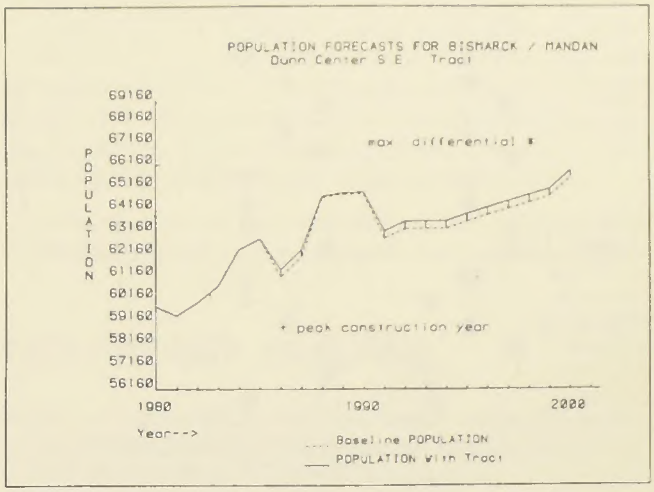








SOURCE: Mountain West Research, Inc., 1981.

Several other communities in western North Dakota would also receive population increases as a result of tract development. However, assessments by the BLM as well as city-county and regional planners show that these population increases are so small (often less than one percent of the baseline population), that they would not significantly affect community service adequacy.

Peak employment during the construction phase of the Dunn Center mine is expected to occur in 1986 at 265 employees with full operations employment expected in 1992 at 450 employees. Using these two years as primary impact dates, it is estimated that the communities of Dickinson, Dodge, Dunn Center, Halliday, and Killdeer would experience an inadequate level of one or more community services as a direct result of the 1986 peak construction employment/population levels associated with construction of the mine (Figure 4). Mandan would experience an inadequate level of social services by 1986 without tract development. Tract-related population influx would further exacerbate an inadequate service situation.

FIGURE 4

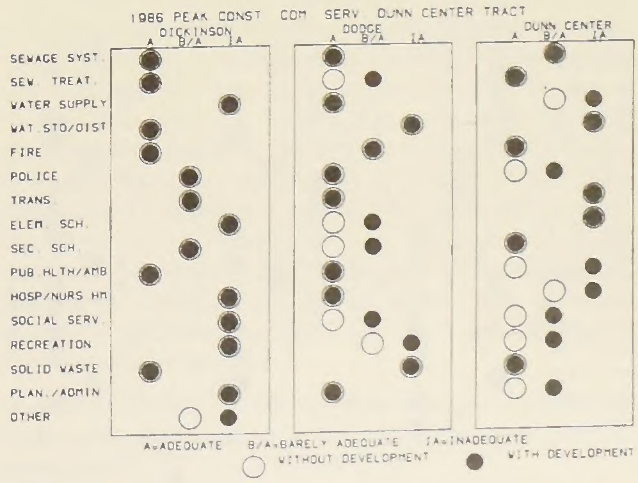
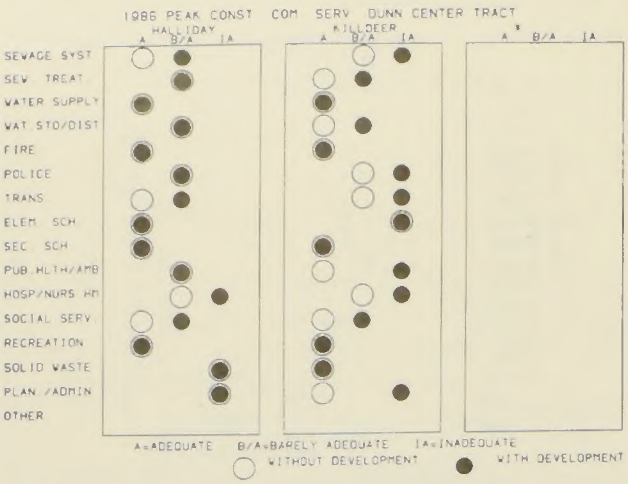


FIGURE 4 (continued)

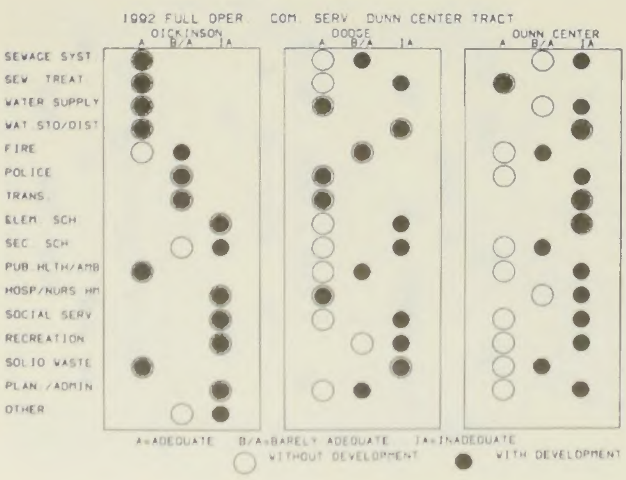


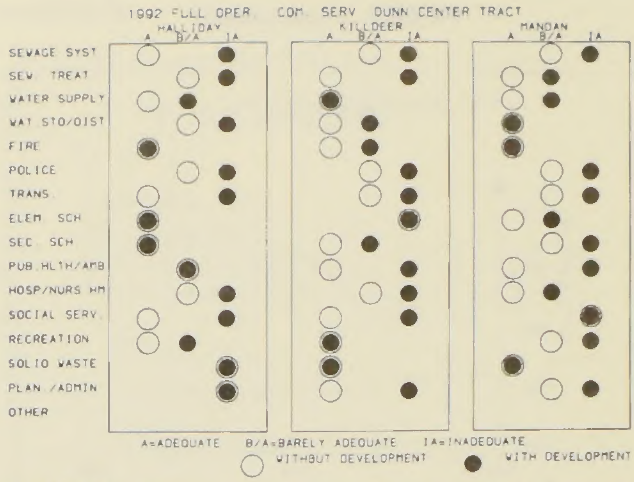
SOURCE: Respective city/county or regional planners.

Full operation of the Dunn Center mine (1992) is also expected to result in serious impacts on area communities. Figure 5 shows that Dickinson, Dodge, Dunn Center, Halliday, Killdeer, and Mandan would all have public services which would be inadequate as a direct result of the population influx resulting from tract operation.

Several of the services appearing in the community service groupings are of greater importance than others in maintaining public health and safety. Basic services such as sewage collection and treatment, water supply and water storage/distribution, health care and police/fire protection are of more immediate concern to community well-being than are non-basic services such as recreation facilities and libraries. Consequently, communities which experience impacts to these basic services would undergo somewhat greater difficulties than would a community which experiences impacts on its non-basic services. Additionally inadequacy of basic services (water and sewage systems especially) can be difficult for a community to deal with because of the relatively large capital expenditures required for upgrading these plants and services.

FIGURE 5





SOURCE: Respective city/county or regional planners.

The rural areas of Stark and Dunn Counties would also receive tract related population influx (though at a much lower level than the communities). This population growth would result in additional demands on some of the services listed in Figures 4 and 5.

The adequacy ratings appearing in Figures 4 and 5 reflect assessments by city planners, regional planners, county planning commissions, and town councils. It should be recognized that best judgments were made concerning the fiscal (revenue/cost) situation likely to be encountered by the communities in 1986 and 1992.

Changes in regional personal income from tract development are expected to be insignificant through the year 2000. The communities in which the workers and their families reside would experience some increases in economic activity as a result of employee payroll expenditure and through company expenditures for goods and services during the construction and operation phases.

There appear to be three factors that are critical in mitigating many of the adverse economic impacts due to coal related population growth. One factor is that the community have adequate lead time to prepare for the increased population before the major population influx occurs. The second crucial mitigation factor is the availability of planning expertise to assist the community in designing and implementing a planning strategy to accommodate the increased population. The third factor is adequate financial assistance to carry out the needed community service improvements in a timely manner.

The Bureau of Land Management can make recommendations regarding leasing dates to allow lead time for community planning. The Regional Coal Team and Secretary of Interior can also recommend certain leasing dates. The Bureau recommendations on leasing dates will be made during the environmental impact statement phase after tract ranking has occurred.

The affected counties and communities may also be able to obtain planning and financial assistance through state agencies such as the North Dakota Energy Impact Office and federal agencies such as the Farmers Home Administration and Department of Housing and Urban Development. At this time, it is not known if the impacted communities will actually be able to acquire the needed planning and financial assistance. This is dependent upon Congressional budgeting action and total demand for energy impact assistance.

Both Bismarck-Mandan (Burleigh and Morton counties) and Williston (Williams County) would receive some population influx due to construction and operating the Dunn Center mine. However, each of these communities is sufficiently large in population so that proportionally the population effects on social structure would be minimal both in the long term and the short term. It would not be expected that increased population levels, minimally above the baseline in these cities, would have any significant or noticeable effect on the social life in these areas.

In contrast, Dunn and Stark County communities would experience both construction and operations phase effects. The communities of Dunn Center, Killdeer, Halliday, and Dodge (Dunn County) and Dickinson (Stark County) would receive a significant number of new residents attached to the Dunn Center mine. During the construction phase Dickinson would receive the bulk of the population effects while Dunn County communities would also be significantly affected. In the long term, the pattern is very similar to Stark County attracting over 1000 new residents, (above baseline) due to the Dunn Center mine.

Proportionally, however, the major effects would be in Dunn County where the population base is much lower. The social effects of the Dunn Center mine would therefore likely be noticeable in Stark County but more profound and systematic in Dunn County for both the construction and operations phases. The addition of roughly 250 persons above baseline in Dunn County communities would, given its present social homogeneity, result in changes in political, religious, family, interaction, and organizational characteristics. These changes would likely be more observable during the short-term construction phase but would persist through the operations phase of the mine.

It is expected that the Dunn Center mine would have relatively pronounced effects on the social life and organization of communities in Dunn County.

Since both Stark and Dunn County residents strongly endorse the social atmosphere of their respective communities, it appears that the Dunn Center mine would have some negative effects on the satisfaction of Dunn County residents, in particular. The pace of life, traffic, increased social segmentation, the existence of a relatively large number of newcomers who may not share the interests and values of existing residents, and similar changes would result in a diminished satisfaction with the area for some residents. In Stark County these changes would not be as pronounced as the city of Dickinson is now experiencing many social changes due to oil and gas development. Opening and operating the Dunn Center mine would simply be an additional factor contributing to an altered community.

Technical reports are available which discuss the methodology used in the economic and social analysis.

NET ENERGY ANALYSIS

A net energy analysis was calculated using the guidance contained in BLM Washington Office Infromation Memo 80-640, July 17, 1980. Approximately 37.7 British thermal units (Btus) would be expended to produce a pound of coal. That pound of coal, in turn, would produce about 6,800 Btus. The ratio of energy produced to that expended is 180 Btus/1Btu.

CLIMATE AND AIR QUALITY

Impacts on climate from the proposed action cannot be addressed specifically. This is due to a lack of technical information and research work on the topic of potential impacts on climate. However, general climatic influences applicable to the proposed development can be discussed.

The modification of surface contours and albedo due to redistribution of soils and removal of vegetation may produce slight localized changes in wind speed and direction, temperature, and humidity. Impacts associated with the increased particulate emissions could also alter local climatic conditions. Reclamation with reestablishment of vegetation and a stable landscape should largely mitigate these impacts over the long-term.

The methodology for determining the air quality impact of particulate emissions consists of: 1) obtaining mine profiles for the tract from the Bureau of Land Management (BLM); 2) obtaining emission factors for individual surface coal mining operations; 3) using the mine profile and emission factors for calculation of total emissions; 4) entering the emission data into a modified climatological dispersion model (CDMQC) for prediction of ambient concentrations; and 5) comparing predicted concentrations to Federal and State Ambient Air Quality Standards and to Prevention of Significant Deterioration (PSD) increments. The air quality impact was analyzed for the proposed tract's peak production period.

Details about the CDMQC model, emission factors, and their application appear in the technical report (separate cover).

The results of the modeling analysis were plotted on an isopleth map. The predicted concentrations were then compared with applicable air quality standards. The 1970 Clean Air Act Amendments establish primary and secondary National Ambient Air Quality Standards (NAAQS). North Dakota established air quality standards in 1969. The present Federal and State ambient air quality standards are shown in Table 11.

All pollutant sources must be evaluated to determine if PSD regulations apply. Preliminary evaluations indicate that the proposed coal mine's product emissions (coal dust) would be less than 250 tons/year; therefore, the coal mine is not a PSD source. However, the State PSD regulations specify that if the fugitive dust emissions cause the total potential particulate emissions to be in excess of 250 tons/year, then the source consumes PSD increment (i.e., these sources do not have to meet PSD regulations, but, the emissions from these sources are counted against PSD increment). Table 12 shows Federal and State PSD standards.

During peak production of the mine an estimated 6,574 tons per year would be emitted, with the best available control technology applied. Fugitive dust sources would account for 97 percent of the peak production emissions.

Dispersion modeling was performed to predict particulate concentrations for comparison with State and National Ambient Air Quality Standards. Areas within the active mining area, such as the mine facilities, pit area, and reclamation areas, are not subject to these standards.

The isopleth lines on Figure 6 indicate annual average particulate concentrations that could result during peak production; the highest concentration at a location off the mine site could be 13.4 ug/m^3. This level would consume the allowable Class II PSD annual increment for particulates. With the annual background concentration added (22 ug/m^3), the ambient level should not exceed State or Federal Ambient Air Quality Standards.

In addition to the annual particulate standard of 60 ug/m^3, North Dakota has a 24-hour standard of 150 ug/m^3 that cannot be exceeded more than once per year off the mine site. Figure 7 shows the predicted highest particulate concentrations for 24-hour averaging times, resulting from the proposed action. The predicted highest 24-hour values associated with the proposed action during peak production could be as high as 72 ug/m^3. This level would consume the allowable Class II PSD 24-hour increment for particulates. With the estimated 24-hour background concentration added (80 ug/m^3), the ambient level would be 152 ug/m^3. This level exceeds the State Ambient Air Quality Standard and the Federal Secondary Ambient Air Quality Standard. A violation would occur if the ambient air standard was exceeded more than once per year. There is a possibility that the proposed action could violate State and Federal ambient TSP standards, but this is subject to the mine emissions and the corresponding background levels in the area.

Because the proposed action totally consumes the allowable Class II PSD increments for particulates, any associated PSD source could not contribute significantly (1 ug/m^3-annual; 5 ug/m^3-24-hour) to the PSD's Class II annual or 24-hour particulates increment.

Several small sources of gaseous pollutants are associated with surface coal mining operations.

During peak production, the relatively small gaseous emissions associated with the mining operations are not expected to violate air quality standards. Gaseous emissions from mining sources were not modeled because of their expected limited impacts to the air quality.

TABLE 11
COMPARISON OF AMBIENT STANDARDS
FEDERAL VS. NORTH DAKOTA

Pollutant	Federal Ambient Air Quality Standards (UPA): Wording of Standard	Secondary Standard	Primary Standard	North Dakota Ambient Air Quality Standards: Primary Standard	Wording of Standard
TOTAL SUSPENDED PARTICULATES	Annual geo. mean conc.	60 ug/m^3	75 ug/m^3	60 ug/m^3	Annual geo. mean conc.
	Max. 24-hr. concentration not to be exceeded more than once per year	150 ug/m^3	260 ug/m^3	250 ug/m^3	Max. 24-hr. conc. not to be exceeded more than once per year
SETTLED PARTICULATES (Dustfall)	(At present there is no federal standard.)			15 tons/ sq. mile	Max. 3-month arithmetic mean in residential areas
				30 tons/ sq. mile	Max. 3-month arithmetic mean in heavy industrial areas
COEFFICIENT OF HAZE	(At present there is no federal standard)			0.4 coh. per 1000 linear ft.	Max. annual geo. mean
SULFUR DIOXIDE	Annual arith. avg. conc.		.03 ppm (80 ug/m^3)	60 ug/m^3 (0.02 ppm)	Max. annual arithmetic mean
	Max. 24-hr. concentration not to be exceeded more than once per year		.14 ppm (365 ug/m^3)	260 ug/m^3 (0.10 ppm)	Max. 24-hr. conc.
	Max. 3-hr. concentration not to be exceeded more than once per year	.50 ppm (1300 ug/m^3)		715 ug/m^3 (0.24 ppm)	Max. 1-hr. concentration
REACTIVE SULFUR (Sulfation)	(At present there is no federal standard)			0.24 mg SO_3/100 cm^2/day	Max. annual arithmetic mean
				0.50 mg SO_3/100 cm^2/day	Max. for a 1-month period
SUSPENDED SULFATE	(At present there is no federal standard)			4 ug/m^3	Max. annual arithmetic
				12 ug/m^3	Max. 24-hr. conc. not to be exceeded over 1 percent of the time
SULFURIC ACID MIST, SULFUR TRIOXIDE OR ANY COMBINATION THEREOF	(At present there is no federal standard)			4 ug/m^3	Max. annual arithmetic mean
				12 ug/m^3	Max. 24-hr. conc. not to be exceeded over 1 percent of the time
				30 ug/m^3	Max. 1-hr. concentration not to be exceeded over 1 percent of the time

TABLE 11 (cont.)
COMPARISON OF AMBIENT STANDARDS
FEDERAL VS. NORTH DAKOTA

	Federal Ambient Air Quality Standards (UPA)			North Dakota Ambient Air Quality Standards	
Pollutant	Wording of Standard	Secondary Standard	Primary Standard	Primary Standard	Wording of Standard
HYDROGEN SULFIDE	(At present there is no federal standard)			45 ug/m^3 (0.032 ppm)	Max. ½-hr. conc. not to be exceeded more than twice in any 5 consecutive days.
				75 ug/m^3 (0.054 ppm)	Max. ½-hr. conc. not to be exceeded over twice a year
CARBON MONOXIDE	Max. 3-hr. concentration not to be exceeded more than once per year	9 ppm (10 ug/m^3)	9 ppm (10 ug/m^3)	10 ug/m^3 (9 ppm)	Max. 3-hr. conc. not to be exceeded more than once per year
	Max. 1-hr. concentration not to be exceeded more than once per year	35 ppm (40 ug/m^3)	35 ppm (40 ug/m^3)	40 ug/m^3 (35 ppm)	Max. 1-hr. conc. not to be exceeded more than once per year
OZONE	Max. 1-hr. concentration not to be exceeded more than once per year	0.12 ppm (235 ug/m^3)	0.12 ppm (235 ug/m^3)	235 ug/m^3 (0.12 ppm)	Max. 1-hr. conc. not to be exceeded more than once per year
HYDROCARBONS (Less Meth.)	Max. 3-hr. concentration (6-9 a.m.) not to be exceeded more than once per year	.24 ppm (160 ug/m^3)	.24 ppm (160 ug/m^3)	160 ug/m^3 (0.24 ppm)	Max. 3-hr. conc. (6-9 a.m.) not to be exceeded more than once per year
NITROGEN DIOXIDE	Annual arithmetic avg. concentration	.05 ppm (100 ug/m^3)	.05 ppm (100 ug/m^3)	100 ug/m^3 (0.05 ppm)	Max. annual arithmetic mean
				200 ug/m^3 (0.10 ppm)	Max. 1-hr. conc. not to be exceeded over 1 percent of the time in any 3-month period
LEAD	Quarterly arithmetic mean		1.5 ug/m^3	1.5 ug/m^3	Quarterly arithmetic mean

Sources:

National Ambient Air Quality Standards. 1978.
North Dakota Air Pollution Regulations. 1978.

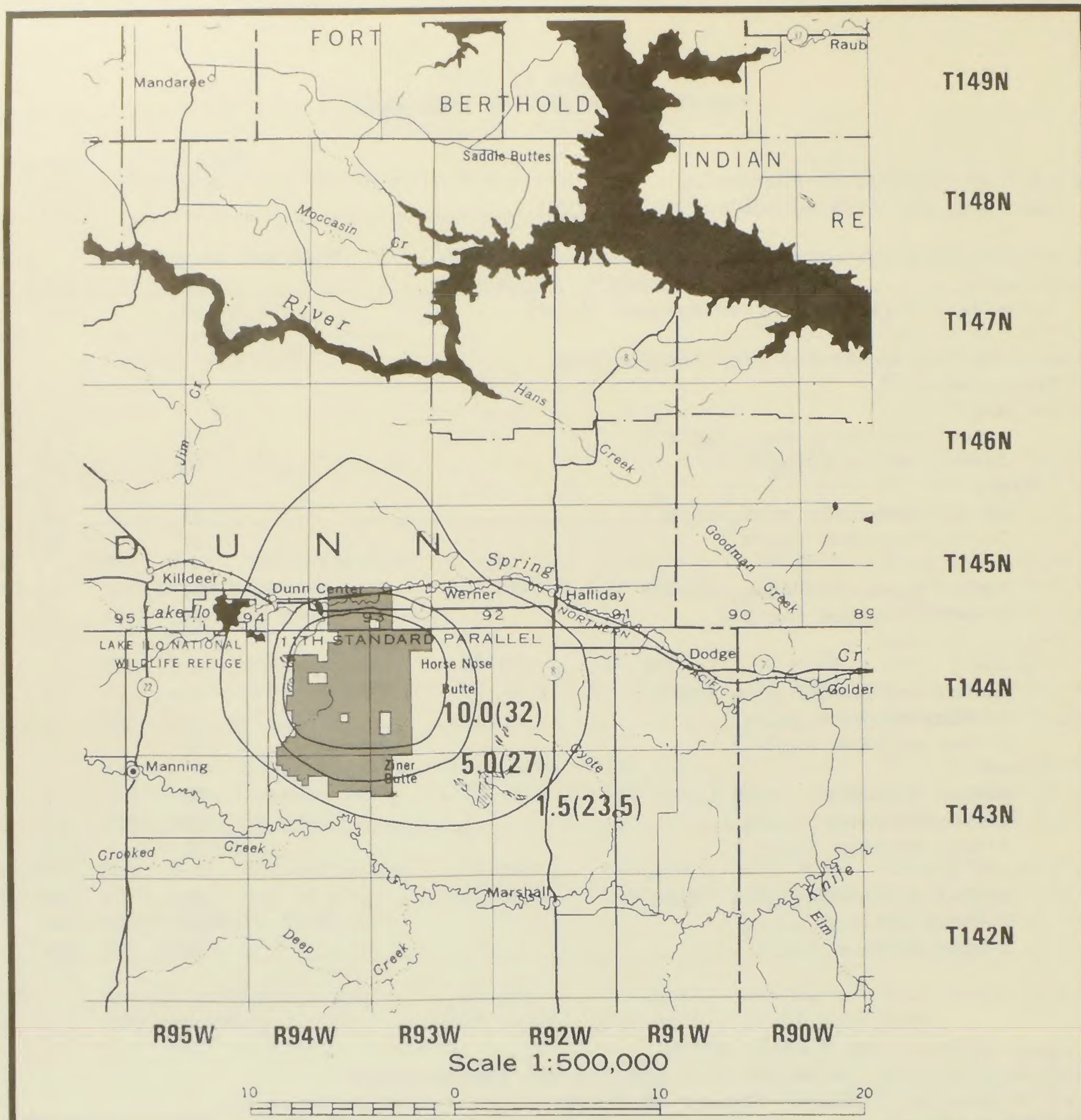
TABLE 12
FEDERAL AND STATE PSD STANDARDS

	Federal	State
Major Sources, subject to PSD review (excludes fugitive dust emissions) (t/yr)	100[1] 250[2]	100[3] 250[4]
Major Sources, not subject to PSD review-counts against PSD increment (considers fugitive dust emissions) (t/yr)	100[1] 250[2]	100[3] 250[4]
Deterioration Increments for Area Designations		
Particulates		
Class I		
annual geometric mean (ug/m^3)	5	5
24-hour maximum (ug/m^3)	10	10
Class II		
annual geometric mean (ug/m^3)	19	10
24-hour maximum (ug/m^3)	37	30
Class III		
annual geometric mean (ug/m^3)	37	37
24-hour maximum (ug/m^3)	75	75
Sulfur Dioxide		
Class I		
annual arithmetic mean (ug/m^3)	2	2
24-hour maximum (ug/m^3)	5	5
3-hour maximum (ug/m^3)	25	25
Class II		
annual arithmetic mean (ug/m^3)	20	15
24-hour maximum (ug/m^3)	91	91
3-hour maximum (ug/m^3)	512	512
Class III		
annual arithmetic mean (ug/m^3)	40	40
24-hour maximum (ug/m^3)	182	182
3-hour maximum (ug/m^3)	700	700

1. Listed sources; CFR Chapter 51:24
2. All other sources (includes coal mines); CFR Chapter 51:24
3. Listed sources; N.D.A.C. Chapter 33-15-15
4. All other sources (includes coal mines); N.D.A.C. Chapter 33-15-15

*SOURCES

Prevention of Significant Deterioration of Air Quality. 1978. Chapter 33-15-15 NDAC
Requirement for Preparation, Adaption and Submittal of Implementation Plan.
1978. Title 40 CFR, Part 51.

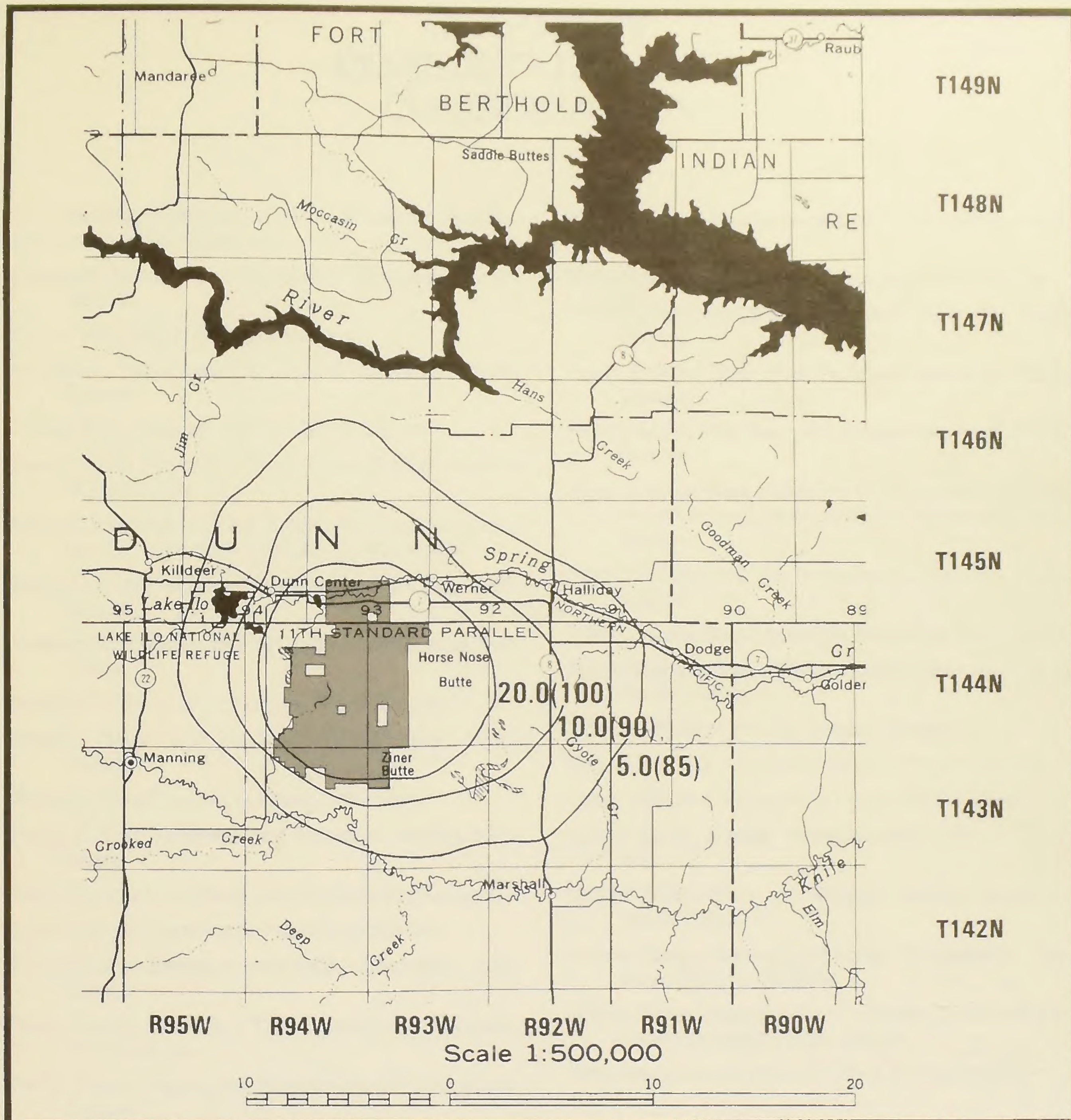


Dunn Center S.E. Tract

TSP Annual Average Concentration (ug/m³) Isopleths

Note: Number in parenthesis indicates predicted concentration plus background concentration.

FIGURE 6



Dunn Center S.E. Tract

TSP Maximum 24-hour Concentration (ug/m^3) Isopleths

Note: Number in parenthesis indicates predicted concentration plus background concentration.

FIGURE 7

CHAPTER IV
CONSULTATION AND COORDINATION

The following organizations were consulted during the production of this document.

Badlands Human Service Center; Dickinson, North Dakota.

Cumin Associates; Billings, Montana.

Dickinson Mayor and City Council; Dickinson, North Dakota.

Dodge Town Council; Dodge, North Dakota.

Dunn Center Mayor and Town Council; Dunn Center, North Dakota.

Dunn County Agricultural, Stabilization and Conservation Service Office; Killdeer, North Dakota.

Dunn County Planning Commission; Manning, North Dakota.

Eastern Montana Social and Community Services Task Force.

Halliday Town Council; Halliday, North Dakota.

Killdeer Mayor and Town Council; Killdeer, North Dakota.

Mountain West Research; Billings, Montana.

North Dakota Business and Industrial Development Board.

North Dakota Combined Law Enforcement Council.

North Dakota Community Action Association.

North Dakota Energy Impact Office; Bismarck, North Dakota.

North Dakota Game and Fish Department, Bismarck, North Dakota.

North Dakota Geological Survey; Grand Forks, North Dakota.

North Dakota Health Department; Bismarck, North Dakota.

North Dakota Job Service; Bismarck, North Dakota.

North Dakota Social Service Board; Bismarck, North Dakota.

North Dakota State Fire Marshall; Bismarck, North Dakota.

North Dakota State Historical Society; Bismarck, North Dakota.

North Dakota State Public Service Commission, Reclamation and Siting Division; Bismarck, North Dakota.

North Dakota State Tax Department; Bismarck, North Dakota.

North Dakota State University, Sociology Department.

North Dakota State Water Commission; Bismarck, North Dakota.

Office of Surface Mining; Denver, Colorado.

Soil Conservation Services; Killdeer, North Dakota.

Three Affiliated Tribes; New Town, North Dakota.

United States Bureau of Reclamation; Billings, Montana.

United States Fish and Wildlife Service; Bismarck, North Dakota.

United States Geological Survey, Conservation Division; Billings, Montana.

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SUMMARY MATRIX
DUNN CENTER TRACT
RESOURCE AND ENVIRONMENTAL CONSIDERATIONS

ELEMENT	PRESENT SITUATION	ANTICIPATED EFFECT OF LEASING/DEVELOPMENT	SIGNIFICANCE OF ANTICIPATED IMPACT	DATA RELIABILITY	COMMENTS
Topography	Rolling hills with gentle to moderate slopes	Modification of land form	Low	Cood	
Ceology and Minerals					
Ceologic Hazards	None identified	None	N/A	Cood	
Potential for Other Minerals	High - Part of this tract overlaps the Sazon Oil Field.	High - There are several oil rigs active in the area. (June 1981)	Mining would interfere with oil and gas development.	Cood	
Paleonto-logical Resources	Low - None identified to date.	Will improve knowledge of the resources near the mine.	Low	Cood	
Soils and Reclamation Potential					
Soil Erosion Potential	Wind and Water - Mod to High over most of tract.	Increase with soil handling operations but little overall change.	Minimal	Outstanding	
Toxic Elements in Soil	No problems	None	None	There has not been a need for this data.	
Chemicals to Metal or Concrete in Soil	Corrosivity of most soils to: Untreated steel - High; Concrete - Low.	None	None	Outstanding	

ELEMENT	PRESENT SITUATION	ANTICIPATED EFFECT OF LEASING/DEVELOPMENT	SIGNIFICANCE OF ANTICIPATED IMPACT	DATA RELIABILITY	COMMENTS
Highly Saline/Sodic Soil Conditions	Most of the acreage rated "poor" in Table 2 is saline/sodic, about 3,900 acres.	These areas can possibly be improved by replacing with better plant growth material from surrounding soils and/or the overburden.	Minimal - possible slight increase in productivity.	Outstanding	
Character of Subsurface Material and/or Inter-burden	Overburden composed of shale, siltstone and sandstone. A thin mantle of glacial till covers the residual material on some uplands. There is physical and chemical data from 16 core drill holes in the tract (Horse Nose Butte EMRIA Study). Often the top 10 to 20 feet and sometimes as much as 50 to 80 feet of the overburden is suitable for use in reconstructing soil profiles. The remainder has problems such as high sodium and clay content.	Some instability problems (settling, piping) may appear with the onset of reclamation. Some of the overburden could be used to improve areas with soils rated "poor" for final cover of surface-mined land.	Minimal	Outstanding	
Reclamation Potential					
Based on soil suitability for final cover of surface mined land, the chance for successful reclamation of most individual landowner's holdings and for the tract as a whole appears to be high. However, there are five separate parcels that have nearly half or more of their acreage rated "poor". These may require a very intensive reclamation effort to ensure successful rehabilitation.				Outstanding	
The breakdown of soil suitability totals from Table 2 are as follows: "Good" - 15,035 acres, 50%; "Fair" - 10,741 acres, 36%; and "Poor" - 4260 acres. 14%.					
Precipitation could be a limiting factor for reestablishing vegetative cover some years.					

ELEMENT	PRESENT SITUATION	ANTICIPATED EFFECT OF LEASING/DEVELOPMENT	SIGNIFICANCE OF ANTICIPATED IMPACT	DATA RELIABILITY	COMMENTS
Hydrology					
Drawdown of Shallow Groundwater Levels	Many wells in and surrounding the tract rely on shallow groundwater for domestic and livestock supplies.	Wells finished in the mine disturbance zone near an open pit will have lowered water levels during mining.	Between 30 and 40 wells used for domestic and stockwater supplies will be affected.	Hydrology - Outstanding Well Inventory - Good	This will be a short-term impact that will only occur to a few wells at a time.
Degradation of Groundwater Levels	Generally shallow groundwater does not meet drinking water quality standards. It is acceptable and used for domestic and stockwater purposes.	Groundwater quality will be degraded in the tract.	Between 15 and 25 wells used for domestic and stockwater purposes will be affected	Hydrology - Outstanding Well Inventory - Good	Replacement water supplies are available at deeper depths.
Degradation of Water Quality in Spring Creek	Low flows through this stream are maintained by discharge from the shallow aquifers.	Mining near Spring Creek will degrade groundwater which will discharge into Spring Creek and result in degradation of low flow water quality.	Degredation from the existing quality will violate state water quality standards The stream's usefulness as an irrigation water source will be degraded.	Hydrology - Good Impact Prediction - Acceptable	The size of the buffer zone necessary to avoid this impact is not determinable. Generally it is a minimun of one mile and a maximum of two or three miles.
			Spring Creek has been determined to have good potential for being an Alluvial Valley Floor.		Final determination of Alluvial Valley Floors will be made at the mine permit stage.
Disruption of Floodplain of Spring Creek	Vegetation and stable soils provide protection against degradation of the water quality of Spring Creek.	Digging or stockpiling within the floodplain during a flood event will degrade the quality of water in Spring Creek.	Higher suspended and dissolved solids concentrations are detrimental to most water uses and violate state water quality standards.	Good	Eliminating disturbance within the 100 year flood recurrence zone will minimize risk. Properly designed road crossings can still be built.

ELEMENT	PRESENT SITUATION	ANTICIPATED EFFECT OF LEASING/DEVELOPMENT	SIGNIFICANCE OF ANTICIPATED IMPACT	DATA RELIABILITY	COMMENTS
Vegetation					
Cropland	There are 7,236 acres of land in the tract that are currently being cropped.	Average annual loss of 125 acres excluding 2598 total acres of summer fallow. Annual production on this 125 acres would be 3200 bu. of wheat. Maximum loss in any one peak mining year would be 1262 acres and 32,307 bu. of wheat.	Moderate to high depending upon individual operation. Low to moderate for overall tract production.	Good	
Rangelend	Average annual production is 6909 AUMs.	Average annual loss of 115 AUMs. Each acre would be out of production from 10 to 15 years. Maximum loss for any one peak mining year would be 2349 acres and 1174 AUMs.	Moderate to high depending upon individual operation. Low to moderate for overall tract.	Good	
Agriculture	There are 49 operators in the tract.	The same number of operators will be affected, to varying degrees, by a long-term but temporary loss of acreage for agricultural production.	Very significant to the operators involved.	Outstanding	
	38% of the involved operators' acreage is in the tract.			Outstanding	
	48% of the acreage in the tract is operated by lessees.	Non-owners will lose the use of their leased acreage with no compensation.	Significant to non-owners.	Outstanding	
Endangered Species	There are no threatened or endangered species (on Federal List) in the tract.	None	None	Good	

ELEMENT	PRESENT SITUATION	ANTICIPATED EFFECT OF LEASING/DEVELOPMENT	SIGNIFIANCE OF ANTICIPATED IMPACT	DATA RELIABILITY	COMMENTS
Land Use	Agricultural use.	Temporary displacement of existing use.	Short term - See Vegetation and Agriculture.	Acceptable	
	Minor roads and local utilities.	Relocation or bypass of existing roads and utilities.	Minor inconvenience.		
Recreation Values	Less than 5% of tract used for recreation.	Loss of recreational areas and added stress on available recreational opportunities.	Limited recreational opportunities make impacts significant.	Good - Based on current studies.	
Aesthetics	Agricultural, dynamic of high visual quality but low scenic value observed from State Highway 200.	Short-term changes in views to less desirable scenery until after reclamation.	Short term of moderate to low significance.	Acceptable	
	Region includes coal mining.	Views are expected as they conform to visual appearance of the region.	Long-term effects insignificant.		

ELEMENT	PRESENT SITUATION	ANTICIPATED EFFECT OF LEASING/DEVELOPMENT	SIGNIFICANCE OF ANTICIPATED IMPACT	DATA RELIABILITY	COMMENTS
Wildlife					
Sensitive Wildlife and Essential Habitats	Sensitive wildlife habitat - 38% of area for 30 sensitive species, whooping crane, northern swift fox, black-footed ferret are identified with area.	Coal mining and attendant actions would severely disrupt and destroy locally significant wetlands interspersed with native prairie which singly and in composite constitute the essential habitats for 30 wildlife species and many more common wildlife. Offsite aquatic habitats in Spring Creek, Knife and Missouri Rivers would be recipients of potential point and nonpoint pollution.	There would be a significant area loss to wildlife resources if strip mining occurs in the essential wetlands, woodlands, and native prairie.	1980 CIR aerial photo interpretation by Fish & Wildlife Service, Western Energy & Land Use Team. Unsuitability Criteria Application Team (FWS, NDGF, and BLM biologists). Wildlife data quality is high.	To date there are no direct successful re-creation (compensation) of native woodlands and wetlands after strip mining in this country. Native prairie of native plant species has not been re-created from mine spoil. If some form of habitat replacement is achieved during mining and thereafter, then the negative impacts to the wildlife resources would be proportional to the successful compensation.
General					Increased poaching and disturbance would significantly reduce all wildlife populations in the region. If not controlled it would significantly reduce recreation opportunities
Cultural/ Historical Values	Specific data reveals important cultural resources that must be avoided in mining process.	Loss of sites as a result of mining activity.	Irreplaceable loss of important scientific information.	Good	Application of unsuitability is going on at this time.

ELEMENT	PRESENT SITUATION	ANTICIPATED EFFECT OF LEASING/DEVELOPMENT	SIGNIFICANCE OF ANTICIPATED IMPACT	DATA RELIABILITY	COMMENTS
Net Energy Analysis	No coal is being produced from this tract.	A total of 14 million tons of coal will be removed annually (5.6 million tons of federal coal).	Production: 6800 BTU/lb. of coal Consumption: 37.7 BTU/lb. of coal Ratio of consumption to production: 180:1	Acceptable	
Climate and Air Quality	Good	Possibility that proposed action could violate State and Federal ambient TSP standards. Totally consumes tha allowable class II PSD increment for particulates.	Significant	Fair	Any associated PSD source could not contribute significantly (1ug/m^3 - annual; 5ug/m^3-24-hour) to the PSD's class II annual or 24-hour particulates increment.
		Social and Economic Conditions			
Employment	Communities of Dickinson, Dunn Center, Dodge, Halliday and Mandan, North Dakota have one or more inadequate services with present employment populations.	Employment increases will occur in Dickinson, Dunn Center, Dodge, Halliday, Killdeer, and Mandan.	High employment changes-Dunn Center, Dodge, Halliday and Killdeer. Moderate employment changes - Mandan and Dickinson.	Outstanding	
Population	Communities of Dickinson, Dunn Center, Dodge, Halliday and Mandan, North Dakota have one or more inadequate services with present population.	Population increases will occur in Dickinson, Dunn Center, Dodge, Halliday, Killdeer, and Mandan.	High population changes - Dunn Center, Dodge, Halliday and Killdeer. Moderate population changes - Mandan and Dickinson.	Outstanding	

ELEMENT	PRESENT SITUATION	ANTICIPATED EFFECT OF LEASING/DEVELOPMENT	SIGNIFICANCE OF ANTICIPATED IMPACT	DATA RELIABILITY	COMMENTS
Regional Income	$4560 estimated regional income per capita.	Minor increases in regional per capita income.	Insignificant	Acceptable	
Infrastructure Assessment (Community Services)	Dickinson - 6 inadequate services Dunn Center - 3 inadequate services Dodge - 1 inadequate service Halliday - 1 inadequate service Killdeer - 0 inadequate services Mandan - 2 inadequate services	Full Operations - 1992 Dickinson with tract - 7 inadequate services w/o tract - 5 inadequate Dunn Center with tract - 11 inadequate services w/o tract - 3 inadequate services Dodge with tract - 7 inadequate services w/o tract - 2 inadequate Halliday with tract - 9 inadequate services w/o tract - 2 inadequate Killdeer with tract - 9 inadequate services w/o tract - 1 inadequate Mandan with tract - 8 inadequate services w/o tract - 1 inadequate	Highly significant due to the number of services becoming inadequate with tract development as well as types of services which will become inadequate (i.e., sewage collection, police, water supply, water storage, public health/ambulance, etc.)	Acceptable to good depending upon community.	Community services which are adequate without tract related population growth would experience additional strain due to increased demands on an already inadequate service situation. Based on assessment of 15 community services.

ELEMENT	PRESENT SITUATION	ANTICIPATED EFFECT OF LEASING/DEVELOPMENT	SIGNIFICANCE OF ANTICIPATED IMPACT	DATA RELIABILITY	COMMENTS
Perceptions of Community Services	Stark County - Law enforcement, recreational facilities, retail opportunities, and medical care identified as service problems. Dunn County - Road improvement and maintenance, medical care, and day care for children identified as service problems.	Not applicable	Not applicable	Acceptable	
Social Attitudes	Stark - 24 interviews Residents - slightly more than 1/2 supported mining either directly or with qualification Officials - generally supportive of coal development. Dunn - 11 interviews residents - one stated opposition to mining Officials - one stated opposition to mining. Stated Concerns - Protection of water and air quality, successful reclamation, rapid growth in communities.	Not applicable	Not applicable	Acceptable	

ELEMENT	PRESENT SITUATION	ANTICIPATED EFFECT OF LEASING/DEVELOPMENT	SIGNIFICANCE OF ANTICIPATED IMPACT	DATA RELIABILITY	COMMENTS
Quality of Life	Dunn and Stark Favorable characteristics - friendly, informal social environment. Unfavorable - climate, shortage of medical care, increased traffic and road maintenance problems, shortage of outdoor recreation opportunities.	Both Dunn and Stark - increased pace of life - increased traffic - increased social segmentation - existence of relatively large number of newcomers who may have different interests and values than existing residents.	Dunn County Pronounced decrease in satisfaction with area. Stark County Noticeable but not as pronounced decrease in quality of life.	Acceptable	

DUNN CENTER S.E.
UNSUITABILITY CRITERIA RESULTS

Criterion	Applicable to Tract	Exception Used (if applicable)	Additional Data Needed	Comments
1. Federal land systems	NO	---	NO	---
2. Rights-of-way and easements	NO	---	NO	---
3. Buffer zones	YES	NO	NO	Exception may be applied at mining plan stage.
4. Wilderness study areas	NO	---	NO	---
5. Scenic areas	NO	---	NO	---
6. Land used for scientific studies	NO	---	NO	---
7. Historic lands and sites	YES	---	NO	Unsuitability determination in process.
8. Natural areas	NO	---	NO	---
9. Federally listed endangered species	Yes, Whooping crane, northern swift fox, and black-footed ferret known to use this region.	---	Swift fox and ferret current data.	Exclusion of strip mining from wetlands and prairie dog towns would protect most whooping crane areas and ferret habitat.

Criterion	Applicable to Tract	Exception Used (if applicable)	Additional Data Needed	Comments
10. State listed endangered species	NO	---	---	---
11. Eagle nests	NO	---	NO	---
12. Eagle roosts and concentration areas	NO	---	NO	---
13. Falcon cliff-nesting sites	NO	---	NO	---
14. Migratory birds	YES	Yes, interagency team applied exceptions as suitable for mining with stipulations.	NO	7 species in combination with Criterion 15.
15. State resident fish and wildlife	YES	Yes, interagency team applied exceptions as suitable for mining with stipulations.	NO	About 30 species in combination with Criterion 14.
16. Flood plains	YES	---	NO	---
17. Municipal watershed	NO	---	NO	---
18. National resource waters	NO	---	NO	---
19. Alluvial valley floors	YES	---	YES	Final determination will be made at the mine permit stage.
20. State proposed criteria	NO	---	NO	---

PRELIMINARY FACILITY EVALUATION REPORT

PRELIMINARY FACILITY EVALUATION REPORT

GOALS AND OBJECTIVES

The Fort Union Regional Coal Team, in its consideration of leasing federal coal, will address the likely coal end-uses and their implications. The purpose of evaluating how the coal will be used is to present the most probable major impacts of development.

The end-use facility evaluations are at a reconnaissance level and the reports are presented only as general approximations of facility characteristics and impacts.

The uncertainty of actual end-use facilities and the inherent problems in defining a "typical facility" limit end-use analysis to broad generalizations. The evaluations are not meant in any way to substitute for detailed site specific evaluations, EISs, or analyses which come later when mining and facility projects are actually proposed. The end-use facility evaluations will not preclude any federal, state, local, or private decisions concerning actual end uses, facility siting, or end-use restrictions. The end-use reports are meant only to provide additional information to be used in decisions concerning the leasing of federal coal in the Fort Union Region and should not prejudice any later decisions.

End-use evaluations, referred to as preliminary facility evaluation reports, have been prepared for those tracts for which a new coal-use facility is expected to be built. One of the three proposed end-use facilities has been assigned to those tracts based on expressions of interest, tract size, or existing facilities. The typical facilities to be considered are: a 250 million standard cubic feet per day gasification plant; a 1,000 megawatt electric power generation plant; and an 85,000 barrel per day indirect coal liquefaction plant.

Part I of the report summarizes what the assigned typical end-use facility might be like. The description of the facility gives plant size, process technology, plant requirements (fuel, land, water, power), emissions, and other characteristics of facilities likely to be proposed in the Fort Union Region. The description includes ancillary facilities and a discussion of construction and operational aspects of the facility that are relevant to determining impacts that could occur in the vicinity of the tract.

The facility description is based on existing analyses, studies, environmental impact statements, and consultation with State and industry representatives. Part II of the facility report is an analysis of the facility impacts on the tract area.

The preliminary facility evaluation reports will be used by the Regional Coal Team to rank federal coal tracts with a better understanding of likely future development impacts and implications.

PART I

ASSUMPTIONS AND VARIABLES

The typical indirect liquefaction facility characteristics are based on numerous assumptions and reasonable values for important variables. Some of the assumptions and variables are based on best estimates. Others are based on existing literature, facilities, and on input from industry sources.

Facility Location, Type, and Size

Because of the economics of lignite coal, it was assumed in the early stages of the Fort Union coal leasing process that the end-use facilities would be near the tracts to be leased. The energy value of lignite coal as well as the water content make the transporting of lignite for long distances uneconomical. For purposes of issue level impact analysis, the indirect liquefaction assigned to the Dunn Center tract is not specifically located but assumed to be near the tract. Such an assumption will eliminate the problems of arbitrarily siting facilities. Facilities were sited, however, for the air quality modeling. Where specific site location information was available from potential project developers, it was used in the facility analysis.

The generic indirect liquefaction facility would produce 85,000 barrels per day of methanol. The plant would use the Lurgi gasification process. The synthetic gas would then be converted to methanol. Based on industry proposals for liquefaction facilities, this indirect liquefaction process of coal to gas to methanol will be the prevalent process used in the region for at least the next 10 to 15 years. Many of the assumptions concerning indirect liquefaction are based on the Nokota Company's proposed methanol plant.

Construction Period

The construction time span for a synfuel facility can vary greatly. A company hiring four to five thousand construction workers could complete the proposed facility in as short a time span as three years. A company could choose to lengthen the construction period or build parts of the plant capacity in two or more construction phases. This would reduce the construction work force and spread construction over as many as ten years.

The indirect liquefaction facility assigned to the Dunn Center tract will have a construction period lasting five years. Work force numbers were supplied by the Nokota Company.

Water Requirements

Water demands for an indirect-liquefaction facility depend on production technology, operation time, and water quality. The values used for water requirements are based on estimates from Nokota. The value for gallons per minute is an estimate of average water use for the facility. The yearly requirements are an approximation based on an operation factor assumed for the facilities. This operation factor indicates the time the facility will be in operation each year.

For analysis purposes, water for the methanol plant is assumed to come from Lake Sakakawea.

Emissions

The air emissions for the methanol plant will depend primarily on the facility's production process, the amount and quality of coal burned, the level of pollution control, and whether or not the facility produces its own electric power.

An important assumption is the source of a facility's electric power. The proposed generic facilities would require from 100 to 150 Megawatts of electric power for peak plant operation. It will be assumed that the indirect liquefaction facility will produce its electric power on the plant site with coal-fired boilers and steam turbines.

An assumption affecting air emissions from a generic facility is the quality of the coal. The sulfur, ash, and water content of the lignite will not only influence emissions per ton of coal burned, but will also determine the amount of coal required for a given facility. The amount of coal required for a generic indirect liquefaction facility could vary from 11 to 14 million tons per year depending on the coal quality and certain process characteristics.

The air emissions from any type of coal conversion facility will be a function of the conversion process characteristics and the emission control technology used at the facility and the level of control used. The possible variation is evident when the emission rates for the Great Plains Coal Gasification and Nokota facilities are compared. The two facilities will produce approximately equivalent amounts (Btu values) of gas and methanol. The emissions for the two facilities are expected to vary considerably, due to the difference in the level of emission control planned for each facility.

The impacts resulting from air contaminants emitted by the coal end-use facility are deduced by using established air quality standards above which deleterious effects of the contaminants are implied to occur. A facility's ability to meet air quality standards assumes there would be no significant deleterious effects to human health, animals, or vegetation. Such an assumption is the subject of continuing discussion and is disputed by certain research studies. A more detailed discussion of this issue can be found on pages 37-94 in the Final West-Central North Dakota Regional Environmental Impact Study on Energy Development (October 1978). The facilities could also emit certain pollutants for which there are no standards. The anticipated levels of air quality concentrations of contaminants are obtained by measuring existing levels of air quality and adding computer simulation of the atmosphere loading resulting from the end use facility.

The air quality impacts are considered in terms of ambient air standards and prevention of significant deterioration standards. Under authority of the Clean Air Act of 1970, the State of North Dakota has promulgated its own ambient air quality standards which are equal to or more stringent than the Federal standards. The purpose of the North Dakota Ambient Air Quality Standards is to control the quality of the air over North Dakota such that, a) the health of sensitive and susceptible segments of the population will not be adversely affected; b) concentrations of pollutants will not cause public nuisance or annoyances; c) significant damage to animals, ornamental plants, forest and agricultural crops will not occur; d) visibility will not be significantly reduced; e) metals or other materials will not be significantly corroded or damaged; f) fabrics will not be soiled, deteriorated, or have their colors affected; and g) natural scenery will not be obscured.

In May of 1977, the North Dakota State Department of Health (NDSDH) received a delegation of responsibility from the Environmental Protection Agency (EPA) for administration of the Prevention of Significant Deterioration (PSD) program and regulations adopted by EPA. The NDSDH had previously adopted PSD regulations, recognizing that the protection of the air quality resource was in the interest of preserving a quality of life and the environment both endowed to North Dakota's citizens.

During 1975, 1976, 1977, and 1978, the NDSDH received applications for and granted air quality permits to new sources in west-central North Dakota. All new sources placed into operation after January 6, 1975, are subject to the provisions of the PSD regulations of EPA and adopted by the NDSDH.

The Clean Air Act Amendments of 1977 designated three levels of allowable deterioration of air quality in regions where air quality was better than the National Ambient Air Quality Standards. All of North Dakota was defined as a Class II area with exception of four smaller areas which were defined as Class I areas. These Class I areas are the Theodore Roosevelt National Park north unit, south unit, and Elkhorn Ranch and the Lostwood National Wildlife Refuge.

The assessment analysis of proposed air quality impacts (deterioration) by proposed new sources is achieved with computer models. These models simulate the physical processes of atmospheric transport, dispersion, chemical transformation, and removal of air contaminants with resulting levels of concentrations of the contaminants. Modeling has been and remains the only tool available to determine air quality impacts of proposed sources or source modifications, since these new sources are not yet producing air contaminant emissions.

The computer modeling assessments of impacts led the NDSDH to declare in 1979 that the increment of allowable Class I area air quality deterioration for sulfur dioxide (SO_2) had been consumed and allocated to the new sources which had been granted construction permits from 1975. This decision further implied that no additional sources could construct and operate within the geographic corridor bounded by the units of the Theodore Roosevelt National Park and the sources located eastward.

An extensive, detailed discussion of the preceeding paragraphs has been published in the Final West-Central North Dakota Regional Environmental Impact Study on Energy Development (October 1978). Copies are available from the NDSDH.

Recently, several applications for permits to construct air pollution sources have been submitted to the North Dakota State Department of Health. According to the applicants' analyses, which utilize more advanced modeling techniques, compliance with all applicable standards were demonstrated.

The NDSDH is currently evaluating these applications as to the appropriateness of the air quality technique. The Department is concurrently establishing its own mesoscale air quality modeling technique in an attempt to standardize the methodology and air quality modeling input data variables. Once this has been accomplished, the actual merits review for each new application can begin.

The limiting case appears to be the question of increment consumption over the Theodore Roosevelt National Park, a Class I area. Ambient Air Quality Standards and PSD Class II increments have not previously prevented the granting of an air quality permit.

At this point in time, no new conclusion regarding the status of the Class I increment has been reached by the NDSDH. If any increment remains, permits would be granted, probably on a first-come first-serve basis, to as many of the applicants as the available increment would allow. Should the NDSDH continue to find that the increment has been consumed, no permits to construct would be granted.

If permits are not granted, the applicants may pursue the variance procedures provided by the Clean Air Act and State Regulations. Applicants may also decide to pursue an offset mechanism which would best suit their individual situation(s).

Given the above existing new source situation, the quantification of air quality impacts resulting from additional facilties associated with certain coal lease tracts is impossible. Discussion of site specific impacts without addressing the interactive and cumulative impacts would have little decision value.

For the purpose of this analysis, each end-use facility which has been assigned to a particular coal lease tract will be discussed. This discussion will contain general statements regarding facility impacts on the air quality. Impact analysis will be based on previous air quality modeling experience and past actions by the Department in permitting similar facilities. Comparisons to applicable standards can be accomplished. For example, when considering these facilities (electrical generating facility or synfuel facility) by themselves, the Ambient Air Quality Standards can be met. Also, the PSD Class II Standards can be met. This is known because these types of facilities have been permitted in the past.

The general statements will be appropriate only within the context of some qualifying conditions. A facility's impact on a given receptor is directly proportional to its distance from that receptor. Generally speaking, the closer a facility is to a receptor, the greater its impact. Therefore, considering the given type and size of facilities, a screening, modeling exercise must be undertaken in order to determine the distance a facility must be removed from the park in order to meet the Class I Standard. This distance will be compared to the distance each end-use facility associated with the coal lease tract is from the Class I area.

The approach mentioned above will only demonstrate compliance/noncompliance with the applicable standards without consideration of interaction with other sources. This analysis cannot be substituted for a detailed permit review and care must be taken to use this information with the proper qualifiers and not be taken out of context.

Solid Wastes

Estimates of solid wastes from the facility are based on figures from Nokota. Estimates for ash and sludge could vary considerably depending on the ash content of the coal and the pollution control technology used. Planned facilities are proposing to dispose of solid wastes in the nearby mines.

INDIRECT LIQUEFACTION FACILITY

Introduction

The typical lignite coal liquefaction plant would use an indirect liquefaction process to produce methanol from synthetic gas. The facility would produce an average of 85,000 barrels of methanol and 3,000 barrels of gasoline blending stock each day. The indirect liquefaction complex situated near its coal source, would consist of the following major units: 1) coal preparation, storage, and handling; 2) gasification units; 3) methanol synthesis units; 4) process facilities; 5) pollution control facilities; and 6) ancillary facilities. See Figure 1.

The plant layout for an indirect liquefaction facility would be very similar to that described for coal gasification. The only major difference would be the addition of methanol synthesis units which would require no significant additional space.

The total land area dedicated to the indirect liquefaction plant site would be about 960 acres. Major structures would include: 1) gasifiers/methanol synthesis units; 2) coal preparation facilities; 3) boiler plant; 4) boiler stack; 5) compression building; 6) other buildings—administration, shops, warehouse; 7) ponds for clarified water storage, process water, and storm water catch basin; and 8) distillation and absorption columns.

Lignite received directly from the nearby mine by truck or conveyor would be crushed, sized, and sent to storage piles. When needed, the coal would then be resized, weighed, and sent by conveyor either to the gasification unit or to the steam generation area. The supporting utilities would include steam generation and distribution, power generation and distribution, oxygen production, raw water supply and water treatment, and fire protection. The waste water treatment system would be designed for maximum reuse within the plant. No waste water would be discharged to surface waters. Gaseous waste streams would be treated prior to discharge from a 500-foot stack. Waste solids from coal processing, waste water treatment units, and from the ash handling system would be dewatered and disposed of at the mine. By-products would be recovered, stored, and either consumed in the plant or sold. Water from a nearby source would be used in the gasification process, in steam generation, in cooling, and for plant utility and sanitary purposes. There would also be a product pipeline to transport the methanol away from the facility.

Employment

The construction of an indirect liquefaction facility associated with the Dunn Center tract would be completed in five years. Construction employment would peak in the third year. Table 1 shows average yearly employment. Once the facility is in operation, it would employ approximately 1,140 workers.

TABLE 1
AVERAGE YEARLY EMPLOYMENT

Year	1	2	3	4
Construction	300	2650	5750	3400
Permanent				100
Year	**5**	**6**	**7**	**8**
Construction	400			
Employment	1140	1140		

Source: The Nokota Company for the Dunn Center Methanol Plant.

Coal Preparation, Storage, and Handling

After crushing, weighing, and sampling, the lignite coal would be conveyed to either an active or inactive storage pile. The inactive storage pile would amount to a 30-day supply and would only be used during extended shutdowns in the mine. The live storage pile would feed the plant on a day-to-day basis. The indirect liquefaction plant would require approximately 14 million tons of coal to be mined each year. See Figure 2.

Gasification Process

The gasification/methanol process uses the same gas production technology as the gasification facility. In the gas production section, coal, steam, and oxygen are reacted under conditions of controlled temperature and pressure to produce a crude gas containing methane, hydrogen, carbon monoxide, carbon dioxide, excess steam and various by-products, and impurities. Before leaving the gas production section, the hot crude gas is cooled and scrubbed to partially remove impurities. The ash is sent to disposal. The crude gas from the gas production section is split into two streams. One stream is sent to the shift conversion section. The other stream bypasses the shift conversion section and is sent to the gas cooling section. The shift conversion section adjusts the hydrogen-carbon monoxide ratio in the crude gas stream. The shifted gas is then also sent to the gas cooling section. In addition to lowering the temperature of these two gas streams before they are combined, the gas cooling section also removes more by-products and impurities from the

Figure 1

TYPICAL COAL GASIFICATION PROCESS

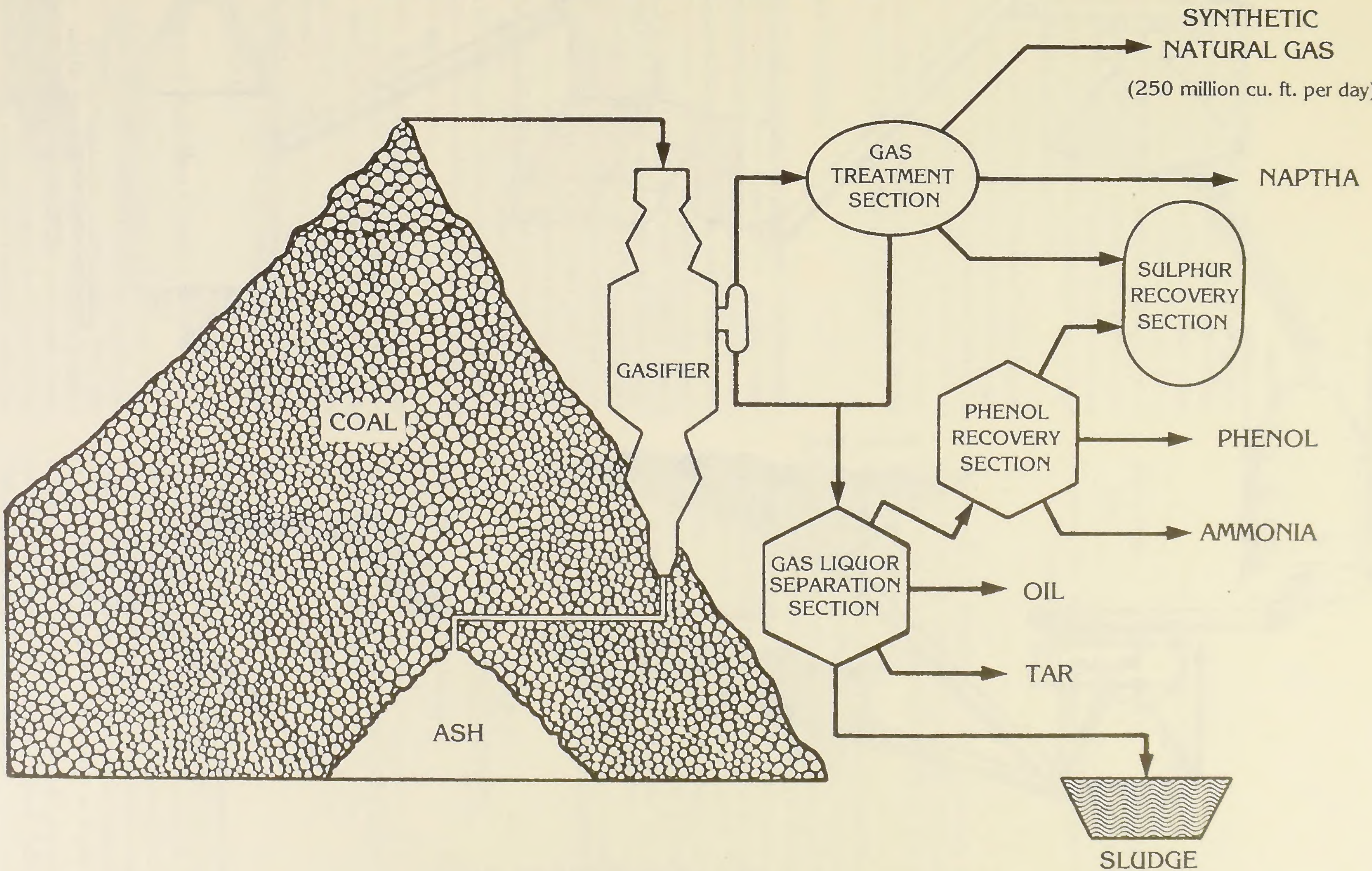
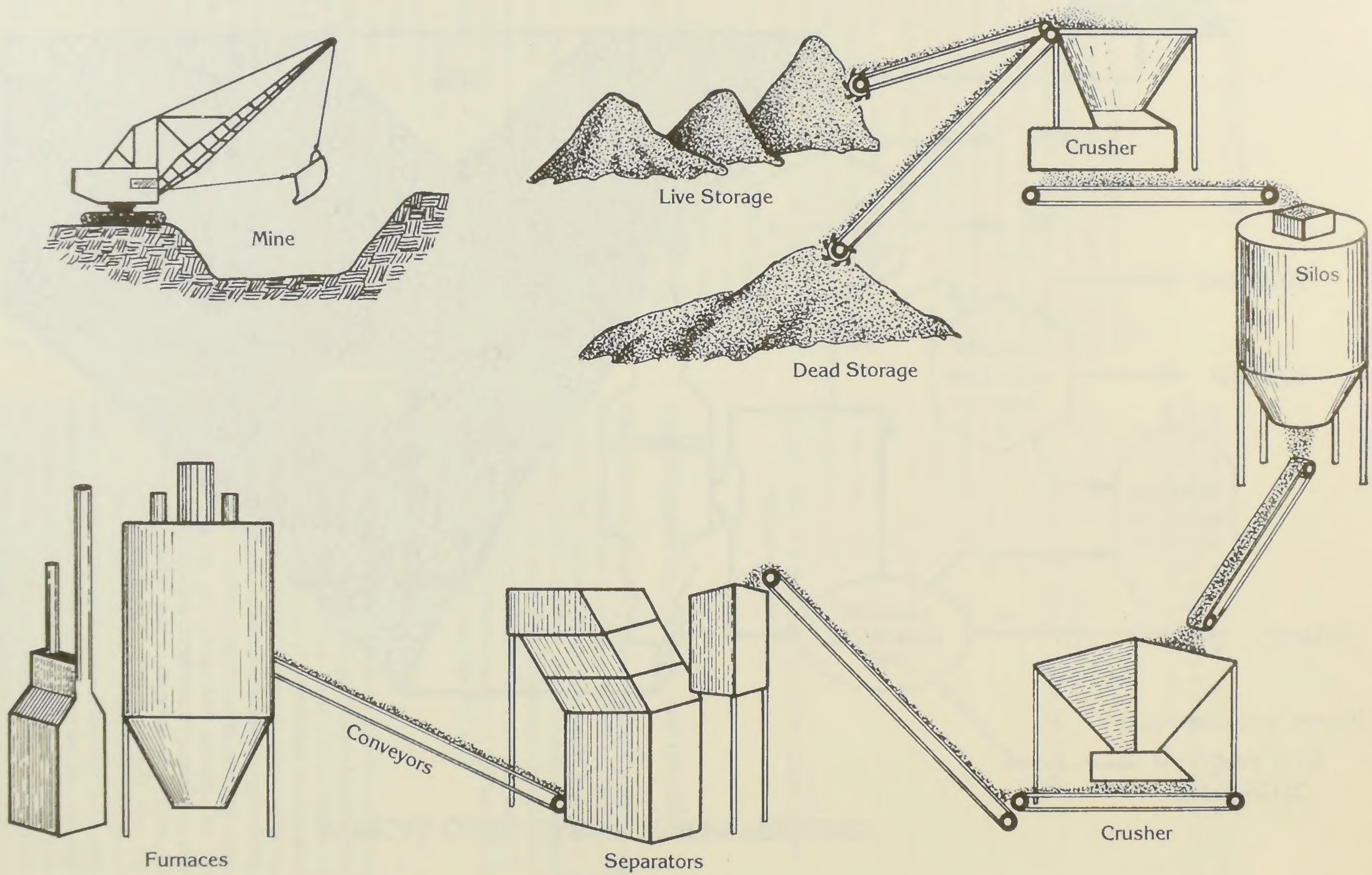


Figure 2

COAL HANDLING SYSTEM



feed streams for processing in the gas liquor section. The combined gas streams are sent to the gas purification section which removes naphtha and acid gases (carbon dioxide and hydrogen sulfide). The stream is then sent to the methanation section. The function of the methanation section is to upgrade the heating value of the gas feed stream from the gas purification section. The upgraded synthetic gas is then passed once more through the gas purification section.

The methanol synthesis unit produces 85,000 barrels per day of methanol using the Lurgi methanol process. The gas is combined with recycle gas and heated to the reaction temperature then fed to the methanol converter. The converter effluent is cooled, and the liquid methanol, separated from the gas, is sent to the drying section where the water content is reduced.

Process Facilities

The main boiler plant for the gasification facility would generate steam to drive turbines for electric power generation, to drive compressors and large pumps, and to supply process steam for coal gasification. A 500-foot stack would disperse flue gases from the steam boilers, the super heater, and other heaters. Steam generated in the high pressure boilers will power extraction condensing turbines driving the three air compressors in the oxygen plant. The steam from the air compressor turbines will be combined with steam generated in the methanation waste heat boilers. This steam will then be supplied to the gasifiers and to the turbine drivers. Average operating electric power requirements would be approximately 150 megawatts. The oxygen facilities would provide gaseous oxygen to the gasification process.

Raw water would be piped in from a nearby water source. Pump capacity would be installed to meet the normal plant operating requirements of approximately 7,800 gallons per minute. The facility would require approximately 11,500 acre-feet of water each year. Raw water entering the plant will be processed in a clarifier. Water not sent to the cooling towers will be filtered further for plant use.

Emission and Pollution Control

The two principal sources of gaseous effluents at the facility—gaseous waste streams from the gasification methanol process and the combustion flue gas streams—will be treated to reduce the concentrations of SO_2 with a scrubbing system and particulates with electrostatic precipitators. Gaseous streams containing hydrocarbons will be incinerated. The steam boiler flue gas will be treated prior to being combined with the other gas streams for discharge via the common stack (see Table 2).

TABLE 2
AIR EMISSIONS (lbs/hr)

Particulate	Sulfur Dioxide	Nitrogen Oxides
230	2600	4420

Source: The Nokota Company for the Dunn Center Methanol Plant.

Water will be recovered to the maximum possible extent for reuse. That which is not recovered will either be disposed of with the solid wastes or lost as vapor from cooling processes.

The ash contained in the coal is recovered from three sources: 1) the gasifier ash from the Lurgi gasifier; 2) the bottom ash from the steam boilers; and 3) the fly ash from the electrostatic precipitators in the steam and electric power generation section. The gasifier ash and the boiler bottom ash are conveyed to the dewatering facilities which separate the ash and water. The dewatered ash, a free flowing solid containing 20 percent water, will be disposed of at the mine. The recovered water is recycled to the ash sluiceway. The fly ash is collected by electrostatic precipitators. This ash is sprayed with water to prevent dusting as it is withdrawn from the storage silo. It will then be disposed of at the mine (see Table 3).

TABLE 3
SOLID WASTE (tons/hr)

Dry Ash	Dry Sludge	Water
117	14	44

Source: The Nokota Company for the Dunn Center Methanol Plant.

Ancillary Facilities

Suitable loading and unloading facilities would be provided to ship and receive materials by either pipeline, truck or rail. Storage would be provided in suitable closed tankage. There would be handling and storage facilities for the following major materials: methanol, caustic soda, sulfuric acid, propylene, phenols, gasoline blending stock, ammonia, sulfur, and creosotes.

A railspur would connect the facility with an existing rail system. The spur would have a 150-foot right-of-way. Rail loading and unloading facilities would be provided for by-products. The water pipeline will require a right-of-way 100 feet in width for construction and 50 feet wide permanently.

PART II

RELATIONSHIP OF TRACT AND FACILITY

The Dunn Center tract lies about five miles southeast of the town of Dunn Center in Dunn County, North Dakota. The tract consists of 29,845 acres of land with recoverable coal reserves of 833.7 million tons.

The likely use of coal mined from the tract would be for an indirect liquefaction plant. To consider the impacts of this coal facility, it is assumed that the typical indirect liquefaction plant described in Part I would be constructed adjacent to or near the tract with no specific site designated, except for purposes of air quality analysis.

Soils, Vegetation and Agriculture

In the Dunn Center tract area, the agricultural land consists of approximately 33 percent cropland, 21 per cent hayland, and 46 percent rangeland. Based on 1978-1979 county averages determined from ASCS data and from BLM grazing files annual production per acre would average 26 bushels per acre of wheat, 1.6 ton per acre for hayland, and .5 AUMs per acre for rangeland.

Assuming the same agricultural land use distribution for the 960 acre disturbance estimated for a generic indirect liquefaction facility, agricultural production lost on the facility site would be 12,500 bushels of wheat annually, in a worst case situation analysis, for the life of the facility.

A short-term disruption of 12 acres per mile would result during construction of an undetermined length of water pipeline. Roadways would disturb 14.5 acres per mile. A railroad spur, also of undetermined length until final siting of the facility would eliminate agriculture on 18 acres per mile for the entire life of the facility.

Erosion losses due to wind and water from ground disturbed during the construction phase of the facility, given State permitting stipulations, would not be significant. Regionally, the agricultural production lost on the 960 acre facility site also would not be significant. Because of the alkaline soils in the tract area and downwind, no deleterious acid-forming effects to the soil due to acid rains from the facility would be anticipated.

There is evidence documented in the literature (West-Central North Dakota Regional Environmental Impact Study on Energy Development, 1978) that there are potential negative impacts to vegetation and to livestock downwind from such a facility due to nitrogen oxides, sulfur dioxide, and particulate matter. Such negative impacts would be analyzed in detail at such a time as more specific information becomes available in conjunction with or to facility permit application with the State permitting authority.

Water

Water requirements for an indirect liquefaction facility are approximately 7,800 gallons per minute or 11,500 acre-feet per year. The likely source of water for industrial use is Lake Sakakawea. Withdrawal of water would have no significant impact upon the reservoir. Facility wastes of ash, sludge, and water disposed of in the mine do have the potential to degrade water quality if they are disposed of within the saturated zone which develops upon reclamation. Present regulations require state approval of disposal sites.

Land Use

Changes in land use include displacement of existing use, increased intensity of existing uses, and the introduction of new uses. The site of the facility is likely to displace agricultural use.

The optimum site conditions for facilities are the same as for agriculture; that is, gentle topography and soils with good drainage characteristics. The increase in population of communities results in demand for new housing, additional commercial development, and expanded public use facilities. The area of this development will likely be on off-site agricultural land. The on-site displacement of agricultural land use is discussed in the Agriculture section of this report.

Increased population would create a demand for community services as addressed in the Social and Economic Conditions section of this report. This demand implies a need to expand existing facilities and commercial establishments or to create new ones. Existing commercial establishments may suffer through the construction of new facilities outside the downtown areas. Public services would be stretched in the short-term by lack of capital to implement change due to increased population. Parking shortages, traffic congestion, and excessive wear and tear on roadways would make downtown areas less habitable. Municipal organizational structures and physical space may prove inadequate with increased population. For example: a part time mayor may be overworked, processing of permits may delay private building construction, and filing space for public records may prove inadequate.

With the influx of workers and their families, a change in the composition of the community is inevitable and demands for new forms of public and commercial facilities for shopping, recreation, and entertainment would ensue. These types of changes are likely to result in dissatisfaction by both the existing resident population and the newcomers. Conflicts are likely to occur as a result of the contrast in the lifestyles of these populations.

Existing planning varies considerably from community to community. Some are prepared for change presaged by recent oil and gas development in some areas, while others are ill prepared for the change in population anticipated.

Current perception of county residents with regard to roads, retail opportunities, recreational/entertainment facilities, and housing are discussed in detail in Chapter 2 of the Site Specific Analysis for Economic and Social Conditions.

Similarly, forecasts by city/county planners regarding likely changes in community services resulting from facility related population growth are presented in detail in the Economic and Social Conditions section of this report.

Recreation

Recreation in the tract vicinity is limited to dispersed big game hunting. Although there are some facilities in the tract vicinity, those existing recreation facilities (community camping and picnic areas, Theodore Roosevelt National Memorial Park, and Lake Sakakawea) are expected to receive the majority of recreation demand. The regional EIS will address in more detail the expected regional demand from increased population for recreation.

Wildlife/Fisheries

Impacts of an indirect liquefaction facility on wildlife around the Dunn Center tract could occur in two areas: 1) impacts from destruction of habitat and 2) direct and indirect impacts from the increase in human population.

The removal of vegetation for a 960 acre methanol facility and the expansion of urban areas, highways, and railroads would prevent or reduce the use of an area by wildlife regardless of the type of vegetation removed.

Much of the area around the tract contains native prairie, wetlands, and shrublands essential to many species. Careful siting of the facility would limit the destruction of these areas.

If powerlines, pipelines, access and haul roads are constructed in key wildlife areas, partial or total destruction of habitat would occur depending on the magnitude of development. The worst case would destroy present wildlife populations in the area. Wildlife oriented recreation such as hunting and wildlife observation would have to be sought elsewhere. Wildlife would be impacted by eagle electrocutions on powerlines, migratory bird mortality from striking power lines close to wetlands, road kills along transportation routes through important wildlife areas, harassment of wildlife by off-road vehicle use, increased poaching, and habitat destruction.

Poaching and road kills have increased dramatically in areas of North Dakota, Montana, Wyoming, and Colorado where energy development has occurred. The problem is compounded in areas where transportation corridors are located in important wildlife areas and shift changes coincide with wildlife feeding periods. This situation could occur in the Dunn Center tract area.

The impact to wildlife could be mitigated by: 1) siting the methanol plant and associated facilities with regard for essential wildlife areas, 2) adjusting work shifts to avoid feeding times of highly visible wildlife, 3) mass transportation of employees, 4) providing funds to State fish and game agencies to better control illegal shooting of wildlife, and 5) adopting a poaching clause in union contracts.

Taking water from shallow bays in Lake Sakakawea could have significant adverse impacts. These areas are prime nursery and spawning areas for sport, commercial and forage fish. Taking water from deeper noncritical areas of the reservoir could reduce or eliminate the significant impacts to fisheries. The cumulative increases in industrial, urban and other water uses will dictate the severity of the impacts on fisheries. The cumulative impact will be addressed in the regional EIS to be prepared.

Cultural Resources

The Dunn Center tract area has not been inventoried to date. Information from existing inventories (BLM unpublished data, Davis 1976; Greiser 1980) outside the Fort Union coal region suggests that the predominant prehistoric sites should be lithic scatters of varying size, density and function (ca. 70-80%). Other expected prehistoric resources include stone circles (ca. 10%-20%), ceramic-bearing sites, rockshelters, and kill sites (ca. 10% combined). Expected historic resources include homestead and ranching remains (ca. 50%), historic grafitti and rock art (ca. 20%), freight roads, dugouts, cairns, trading posts, burials and battle sites (ca. 30% combined). Further information on cultural resource occurrence, distribution and significance cannot be quantified prior to inventory.

Visual Impacts

Central North Dakota has very high but common visual quality. In the absence of other types of visual experiences, the landscape is not highly valued as scenery because of the vast distances involved in crossing this relatively uniform area. Most highways roll with the landform so views alternate between nearby features at low points and panoramas of up to thirty miles at high points in the roadway profile. The landscape is seen in terms of these short vistas of landscape elements that will not be seen again, and short duration views of distant landscapes in which any vertical object or landscape feature serves as a focal point.

Large structural features in the central North Dakota landscape contrast with the landscape both in terms of the visual surface (the character of what is seen) and in terms of function. Vertical and linear components of a facility, because of hard architectural edges of the structures, and the transitory nature of panoramic views imply a visual importance of these large objects for orientation. The aesthetic response is secondary to this visual function.

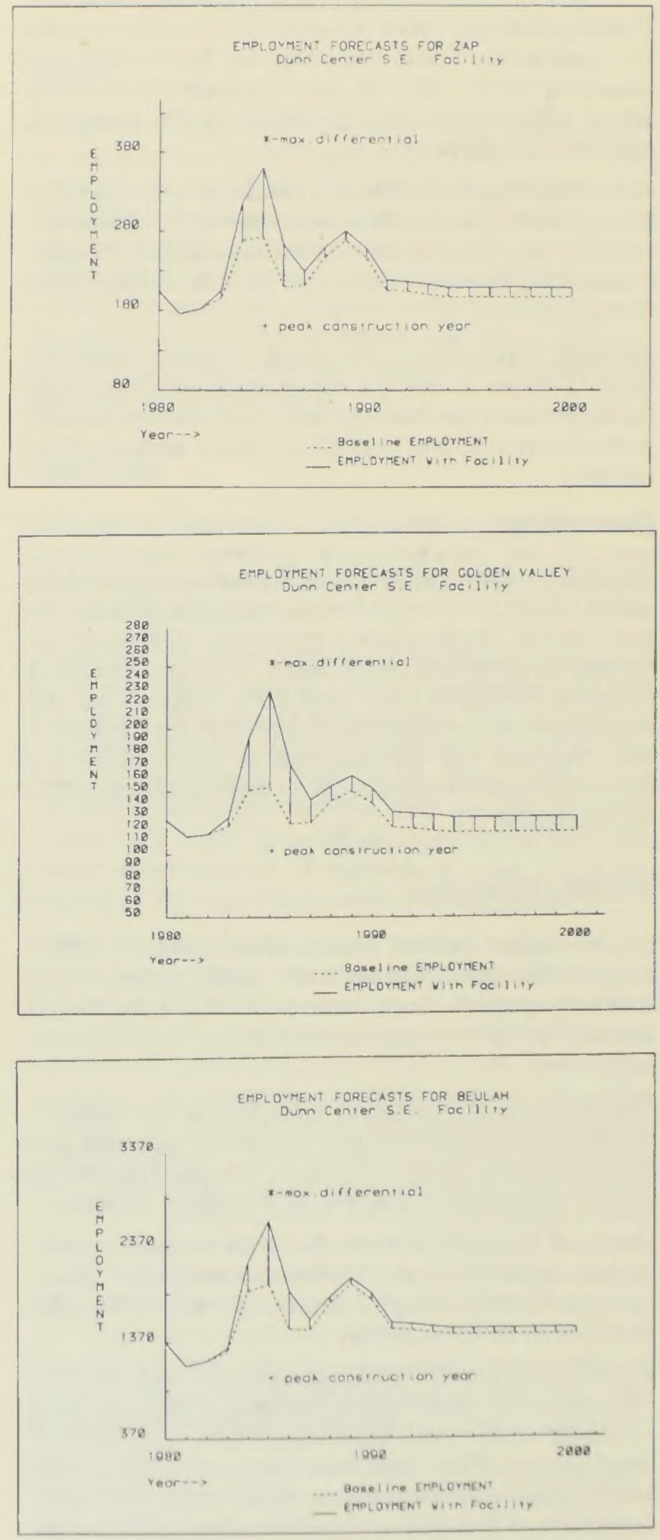
Neglecting cultural bias, the aesthetic response to stark architectural lines and pure planes of color contrasting with the simple curvilinear landforms of the countryside can be considered positive. This visual experience would be immediately comprehensible and would provide relief from a relatively uniform countryside. Beyond this initial response, however, are responses with origins in cultural bias and the individuals' relationships to the land. The greatest effect would be upon local residents with memories of the existing landscape to use as a comparative basis of judgment. If no attachment to the existing landscape is present, the facility would be judged more on its quality than on cultural bias.

The visual impact would be the penetration of the skyline by the facility in views from communities and major transportation corridors. The 500-foot stack could potentially be seen thirty or more miles away. The facility would be highly visible and would demand a response either positive or negative. The dominance of the facility in the landscape could be perceived as a loss of amenity through impairment of the landscape as it now exists for the forty years of the facility's expected life.

Economic and Social Conditions

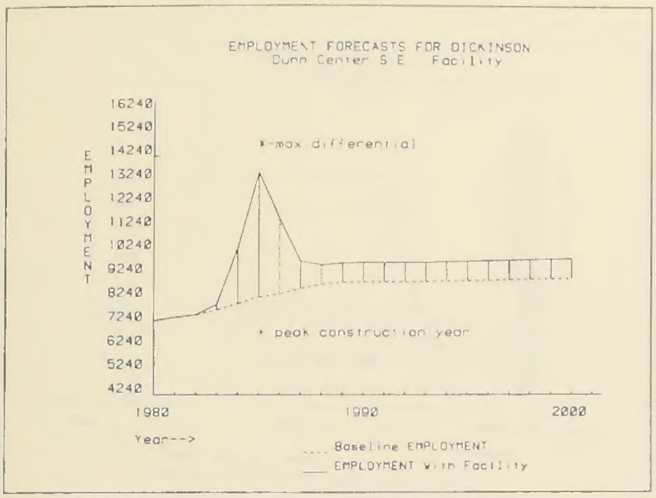
Construction and operation of the Dunn Center facility would result in significant impacts upon services in communities within the area as a result of population growth associated with employment opportunities. Figure 3 shows forecasted community employment and population levels through the year 2000 both with and without development of the facility. As this figure shows, Zap, Golden Valley, Beulah, Hazen, Mandan, Dunn Center, Killdeer, Halliday, Dodge, and Dickinson would experience significant increases in population and employment as the result of the development of the facility.

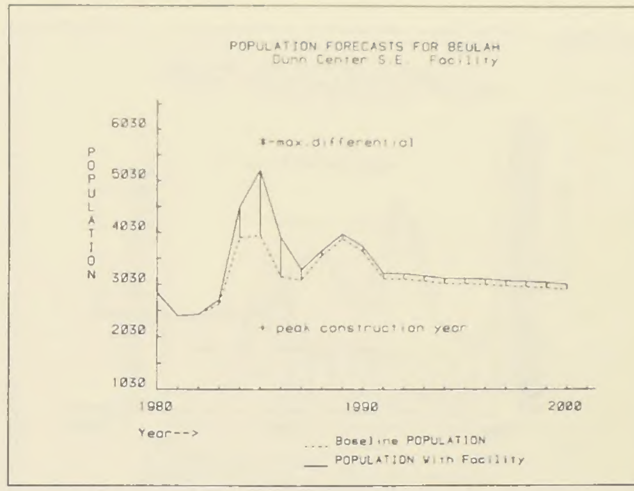
FIGURE 3

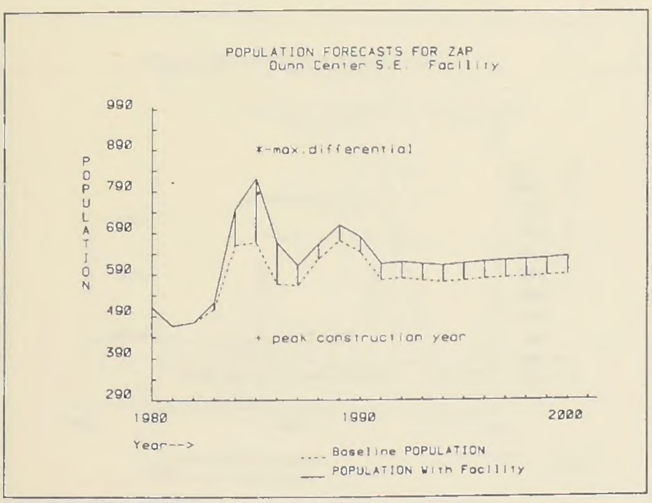


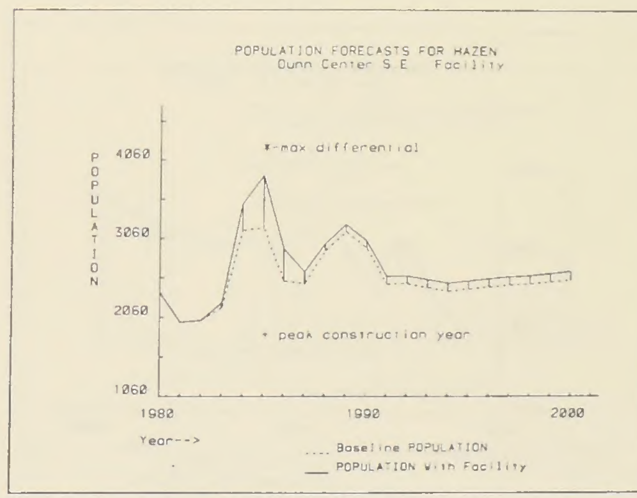
SOURCE: Mountain West Research, Inc., 1981

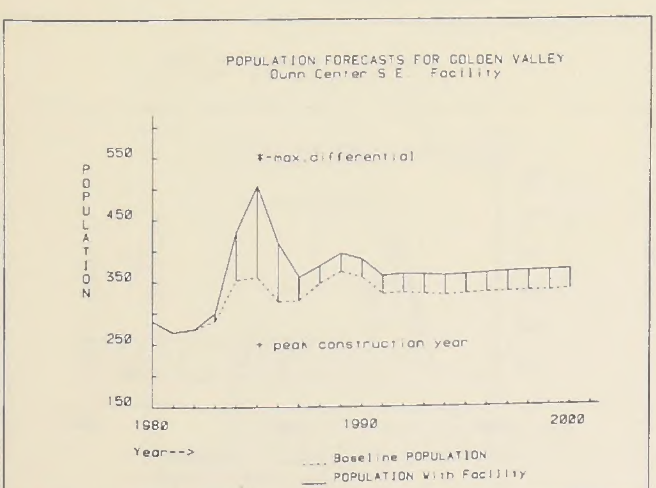
FIGURE 3 (continued)

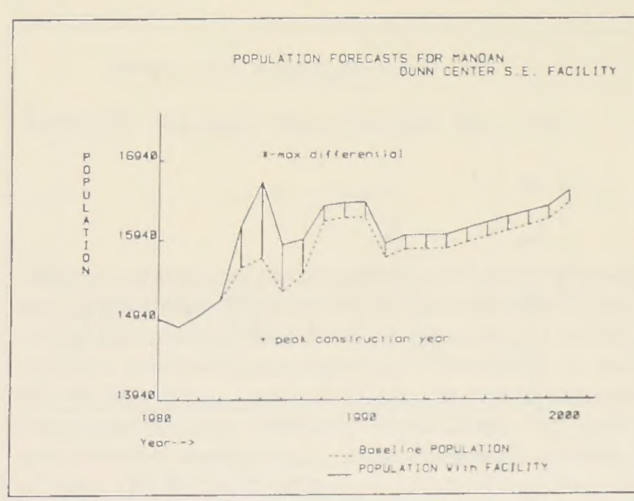












SOURCE: Mountain West Research, Inc., 1981

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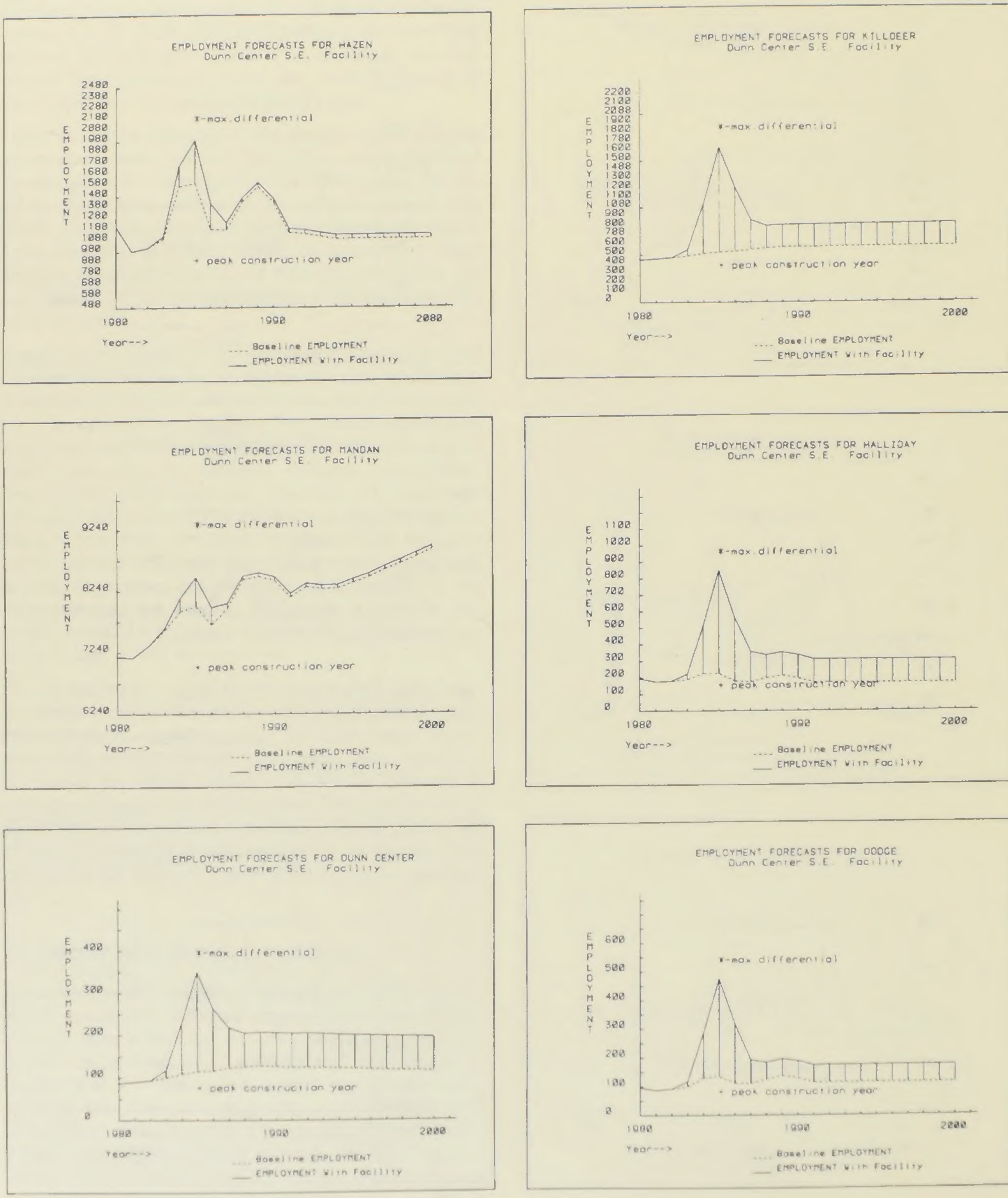

SOURCE: Mountain West Research, Inc., 1981

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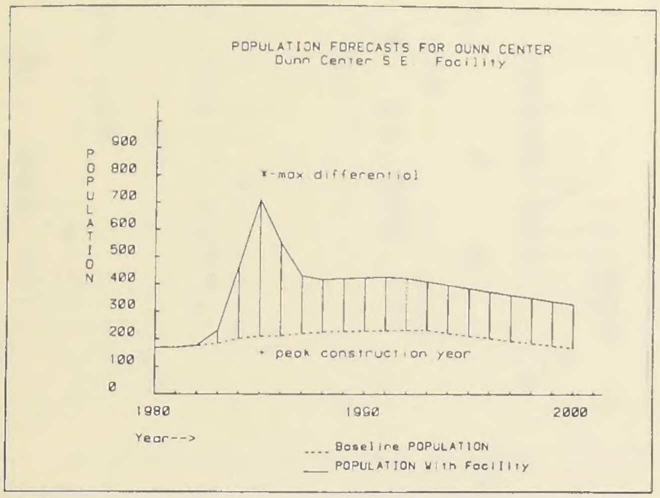
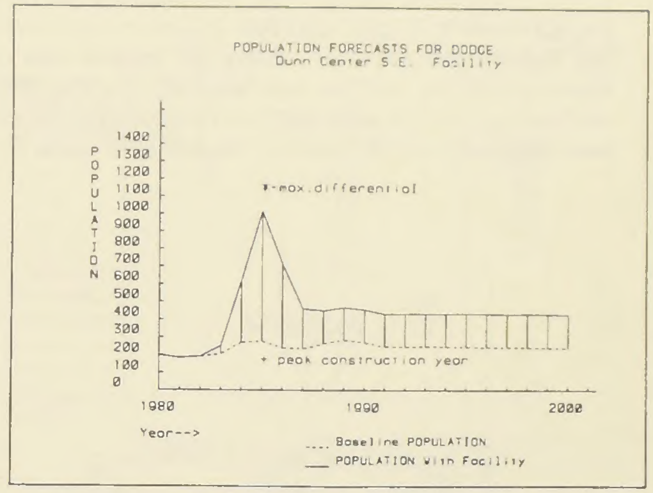
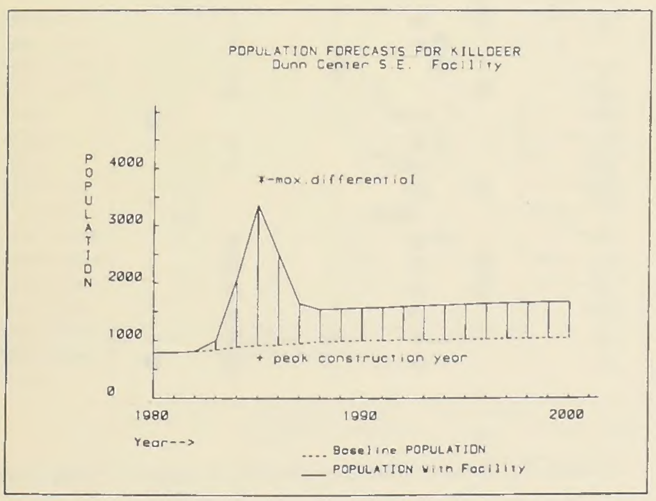
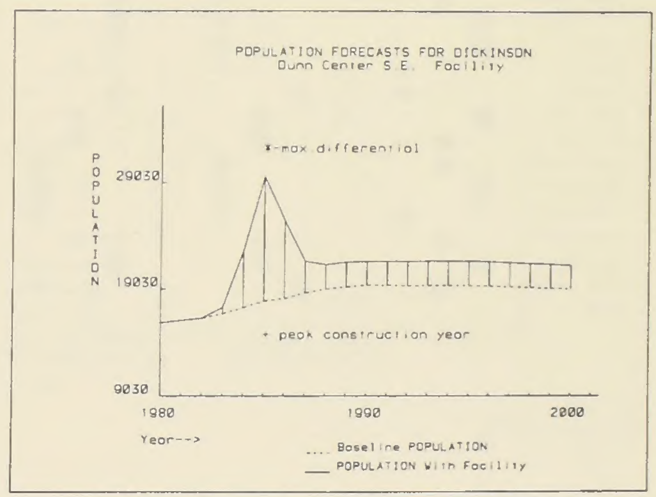
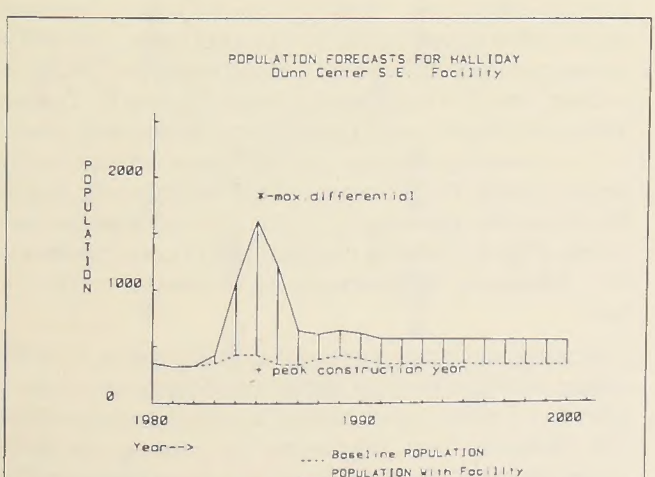










SOURCE: Mountain West Research, Inc., 1981

Changes in regional personal income from tract development are expected to be significant through the year 2000. The communities in which the workers and their families reside would experience increases in economic activity as a result of employee payroll expenditures and through company expenditures for goods and services during the construction and operation phases. The facility is forecasted to boost regional personal income by a maximum of 13.3 percent over baseline values by 1985 as a result of the expenditures associated with the peak year construction facility.

Peak employment during the construction phase of the facility is expected to occur in 1985 at 5,750 employees with full operations employment expected in 1989 at 1,140 employees. Using these two years as primary impact dates, it is estimated that the above communities would experience an inadequate level of one or more community services as a direct result of the 1985 peak construction employment/population levels associated with construction of the facility (Figure 4).

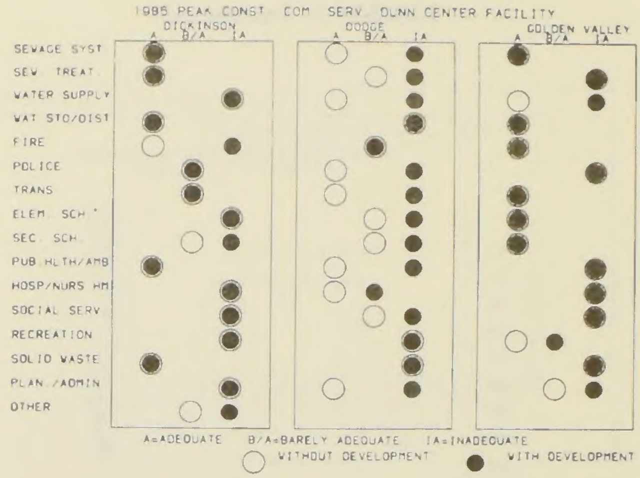
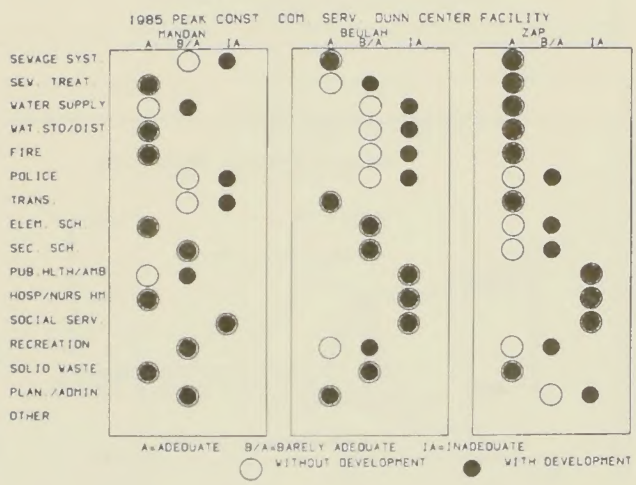
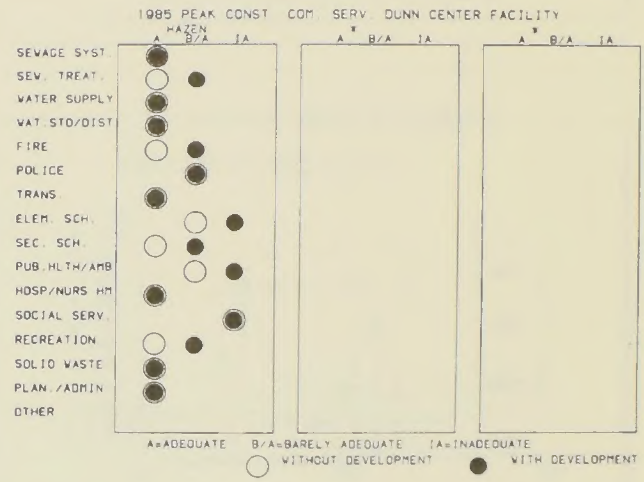
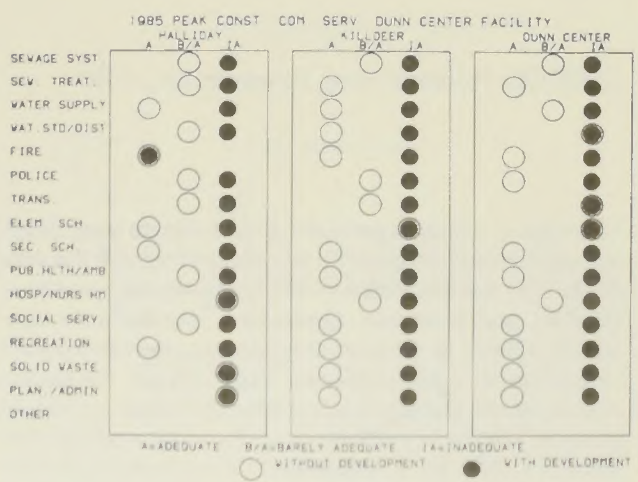


FIGURE 4





SOURCE: Respective city/county or regional planners



Full operation (i.e., 1989 and beyond) of the facility is expected to cause public service problems in all of the above communities except Golden Valley and Hazen as a direct result of tract development (Figure 5). Golden Valley and Hazen would experience inadequacy of several community services by 1989 even without facility development. Development of the facility would add to the problems expected to occur. For comparison purposes, Figure 6 shows current (1981) community service adequacy assessments for impacted communities.

The adequacy ratings appearing in Figures 4, 5, and 6 reflect assessments by either city-county or regional planners for the communities involved and constitute the planners' best judgments concerning the fiscal (revenue/cost) situation likely to be encountered by the communities in 1985 and 1989.

FIGURE 5

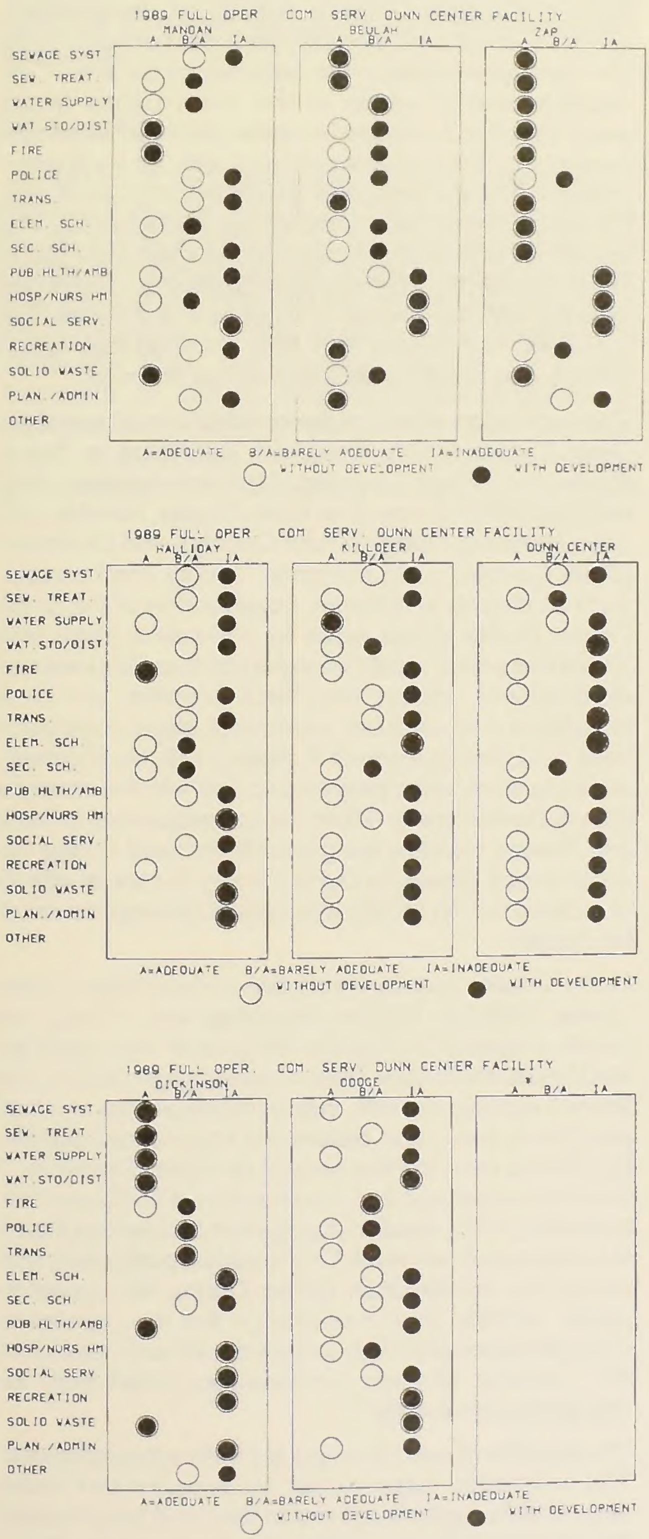
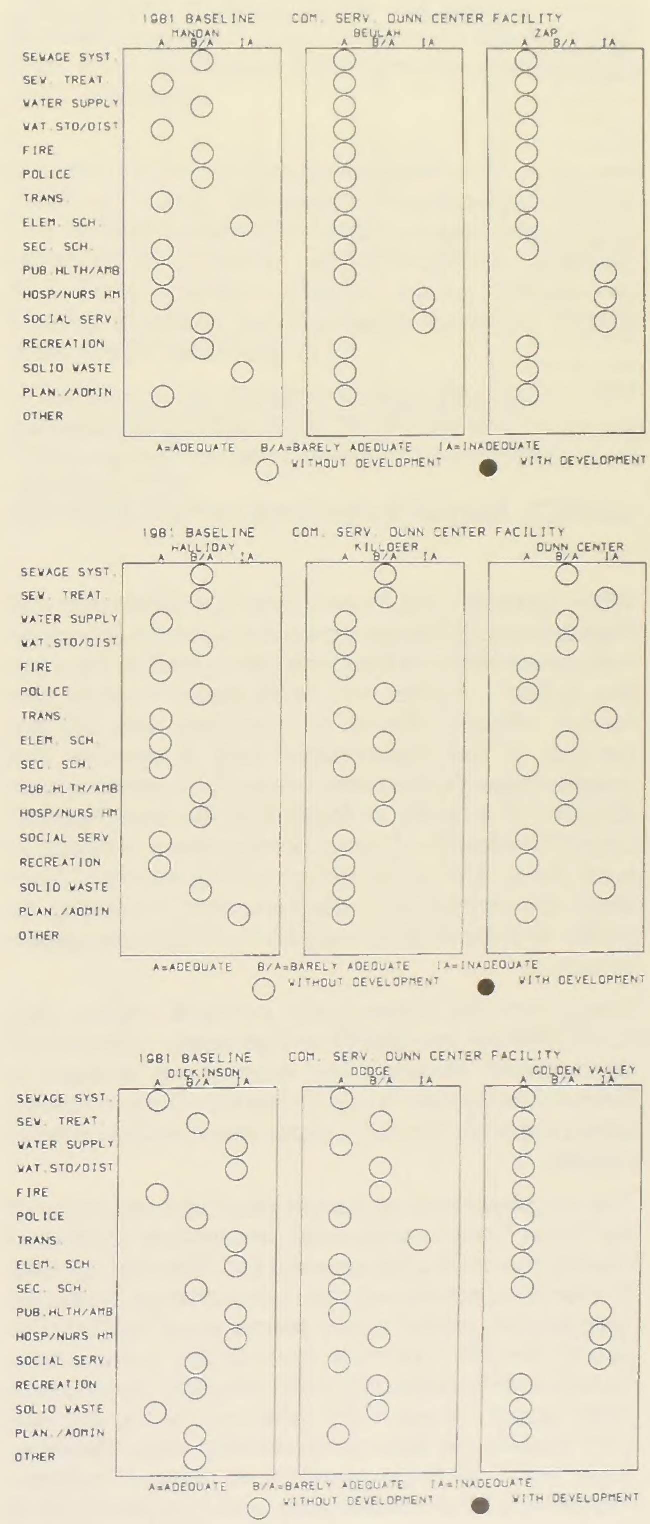
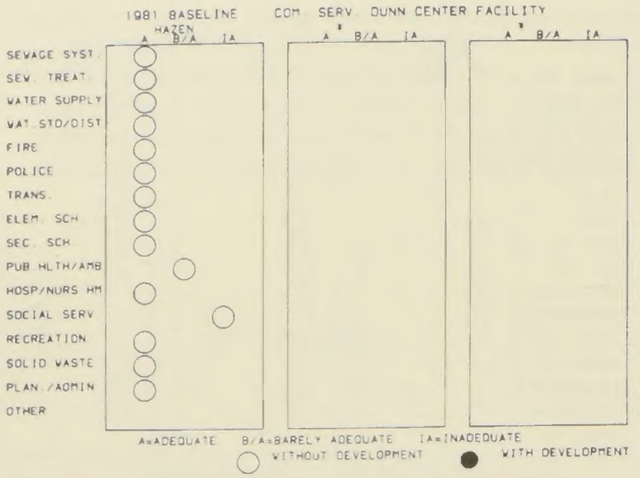


FIGURE 6



SOURCE: Respective city/county or regional planners

FIGURE 6 (continued)



SOURCE: Respective city/county or regional planners

While Burleigh and Morton counties (Bismarck and Mandan) would experience some short-term (construction phase) effects of the Dunn Center facility, the counties of Dunn, Mercer, and Stark would be most profoundly affected. Based on interviews with fifty-two persons in this three-county area, it appears that roughly three-fourths of the residents support the construction of a facility or facilities in the area. Approximately one-fourth of these persons were opposed to such plans. The major concerns that emerged from these discussions were the protection of existing air quality and the local consequence of rapid population growth.

Leaders in the three-county principal impact area (Dunn, Mercer, and Stark) were generally supportive of development. However, this support was stronger in Mercer County than it was in Stark or Dunn counties, where opposition to such plants was identified among officials.

The consequences of construction and operation of the Dunn Center plant would be unevenly distributed among present and future residents. The very high level of economic activity and population change during the construction period would permit some residents to directly benefit financially from facility construction. Included are persons with industrial skills, persons who could acquire these skills, local merchants, and persons outside the labor force desiring entry. However, there would be large numbers of persons in Dunn, Mercer, and Stark counties who would not participate in this increased economic activity but yet would experience significant social changes in their community of residence.

The major benefit of living in Dunn, Mercer, and Stark counties, according to many residents interviewed, is the small town, friendly atmosphere that presently exists. Even in a city like Dickinson, which has experienced significant growth due to oil development, many residents indicated that the aspect of community life most appreciated is the cohesion of the area. Construction and operation of the Dunn Center facility would result in a changed social environment from the present and from what would exist without such development. The communities would become more segmented, impersonal, unpredictable, and stressful. This would be particularly true during the short term but, in Dunn County, the changes would persist at a significant level through the operation phase as well. It is likely that residents' satisfaction with their communities would decline due to implementation of the proposal.

The population effects of the construction phase of the Dunn Center facility would be significant in Dunn, Mercer, and Stark Counties. The communities most radically affected would be Dunn Center, Halliday, Killdeer, Manning, Dodge (Dunn County), and Dickinson (Stark County). Even in Mercer County communities, such as Beulah and Hazen, construction of the Dunn Center facility would result in population levels well above that which would be expected (baseline) without development. Mercer and Stark counties, due to a broader economic base, somewhat larger population base, and past experience in dealing with rapid growth, are somewhat better prepared to deal with the changes than is Dunn County. While the consequences in Stark and Mercer counties are generally focused during the construction phase, in Dunn County the social effects of a Dunn Center facility would exist through the life of the facility.

Dunn County and its respective communities (Dunn Center, Halliday, Killdeer, Manning, and Dodge) are poorly prepared to manage the growth that would be attached to the facility. Dunn County is agricultural, has limited experience with industrialization, has a small population base, and historically experienced population losses over the last several decades. Therefore, it should be expected that construction of the Dunn Center facility would result in disorganized social conditions at a very significant level. This would be particularly true during the construction phase. During the operation phase, stability should re-emerge but the population changes associated with a plant are of such scale that the character of these communities would likely be changed permanently.

The benefits of such changes are fairly straightforward. The economic base would be broader and more dependable. Agricultural production and prices would be less important as sources of income and local economic activity. At the same time, industrialization would bring with it a more impersonal, segmented, stressful, and unpredictable social environment for all persons. The changes in Dunn County would be significant and long-term. The changes in Mercer and Stark County would be significant, but last only through the construction phase.

Air Quality

An Air Quality Modeling Analysis[1] of the indirect liquefaction facility assigned to the Dunn Center tract was conducted by the North Dakota State Department of Health. U.S. Environmental Protection Agency guideline models[2] (MTPER, PTPLU, PTMAX) were utilized. The projected air quality impacts were compared to applicable State and Federal Ambient Air Quality Standards as well as State Prevention of Significant Deterioration (PSD) of air quality increments. The three major air pollutants emitted from the facility—sulfur dioxide (SO_2), Total Suspended Particulates (TSP), and nitrogen dioxide (NO_2)—were compared to the applicable standards.

The assigned methanol facility was shown to comply with all State and Federal Ambient Air Quality Standards. It was also found to be in compliance with all State PSD increments.

[1]Guidelines for Air Quality Maintenance Planning and Analysis Volume 10 (Revised): Procedures for Evaluating Air Quality Impact of New Stationary Sources, EPA-450/4-77-001, October 1977, (OAQPS No. 1.2-029 R), U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina 27711.

[2]Guideline on Air Quality Models, EPA-450/2-78-027, OAQPS No. 1.2-080, April, 1978, Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina 27711.

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The Tenneco Coal Gasification Company; P.O. Box 491, Glendive, Montana 59330.

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