CHAPTER 3
ENVIRONMENTAL IMPACTS OF PROPOSED ACTION

3. Environmental Impacts of the Proposed Action

3.1 Impacts on the Physical Environment

3.1.1 Air

3.1.1.1 Climate

The proposed project should not significantly alter the temperature or humidity of the general area, although some minor changes could occur in the microclimate of the immediate plantsite. Heat emitted by the gasification plant would consist of heat exchanged in water cooling towers, heat from the flue gases, heat dissipated in air coolers, and heat dissipated from individual process units. Overall, the heat discharged into the atmosphere would be insignificant compared to the absolute heat content of the surrounding air.

Water vapor released from the evaporative cooling towers and other processes could cause a cloud to form over the site on cold mornings and perhaps localized ground fog. The generally low humidity of the ambient air, however, should adequately absorb the water vapor during most of the year. Thus, the climate of the area would not be significantly impacted by the proposed project.

3.1.1.2 Air Quality

a. Dust

The major sources of fugitive dust during construction of the plant and mine would be from handling loose dirt and fine aggregates, vehicular travel, blasting, grading, and wind erosion of disturbed areas. Major sources of fugitive dust during operations would be from mining activities such as vehicular travel, mining, blasting, coal loading, wind blowing over disturbed land and spoil piles, and reclamation.

There would be an increase in ambient dust levels due to the proposed project. Generally, the sources of fugitive dust above would be localized and largely intermittent. With proper dust abatement practices (Section 4.2.1.2), ambient dust levels should not be significantly greater than current levels that might occur during periods of heavy agricultural activity.

b. Emissions

(1) Construction

Combustion sources of air pollutants during construction of the plant and mine include heavy and light duty engines in equipment, space heaters, boilers, dryers, and some open burning of debris. The number and types of equipment to be used during construction are unknown at this time and would vary during different stages of construction. However, tentative onsite emissions (Table 3-1) and downwind ground concentrations of pollutants (Table 3-2) were calculated assuming that diesel engines consume 200 gallons of fuel in a 16-hour workday and gasoline engines would consume 20 gallons; also, that 20 of each type of engine ran continuously for the entire 16-hour workday (Appendix I). The estimated ground-level concentrations (0.5 and 1.5 miles downwind) associated with construction are within Federal and State ambient air standards; possible impacts associated with these pollutants are discussed in Section 3.1.1.3.

Air pollution during construction of the product pipeline would result from the generation of fugitive dust and emissions from construction vehicles. Construction activities at any one point would be completed in a 30-day period so impacts would be limited to this time period. Construction at the Missouri River crossing would last about 50 days.

Estimated emissions from construction equipment per mile of pipeline construction are shown in Table 3-3. The overall impact of these emissions on existing air quality would be small.

Fugitive dust is likely to be generated during all phases of construction along the product pipeline route, but two portions of the route (between Beulah and Stanton and between Kief and Balta) are particularly susceptible to wind erosion due to sandy and

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TABLE 3-1

Probable Maximum Onsite Engine Emissions
During the Plant Construction Phase

Pollutant	Probable Maximum Onsite Engine Emissions lbs/hr	lbs/16-hr day
Suspended Particulates	3.43	54.88
Sulfur Oxides (as SO_2)	6.83	109.28
Carbon Monoxide	57.25	916.00
Hydrocarbons	9.38	150.08
Nitrogen Oxides (as NO_2)	92.68	1,482.88
Fugitive Dust	1,025.80	16,412.80

TABLE 3-2

Estimated Ground-level Pollutant Concentrations During Construction

Pollutant (ug/m^3)	Averaging Time (hrs)	Maximum Estimated Concentration I[1]	Maximum Estimated Concentration II[2]	North Dakota Standard	Federal Standards Primary	Federal Standards Secondary	Federal Standards Class II Deterioration
SO_2	1	18.2	12.0	715[3]	–	–	–
	3	2.0	1.1	–	–	1300[4]	700[5]
	24	0.8	0.4	260[3]	365	–	100[5]
NO_x	1	100.2	65.8	200	–	–	–
CO	1	0.3	0.2	40[4]	40[4]	40[4]	–
	8	0.2	0.1	10[4]	10[4]	10[4]	–
HC	3(6-9AM)	2.7	1.5	160[4]	160[4]	160[4]	–
TSP	24	27.8	15.6	150[5]	260	150	30

1 0.5 mi. downwind of plantsite boundary.
2. 1.5 mi. downwind of plantsite boundary.
3. Maximum concentration.
4. Maximum concentration to be exceeded more than once per year.
5. Maximum increase not to be exceeded more than once per year.
6. Maximum concentration not to be exceeded 1 percent of the time in any 3-month period.

TABLE 3-3

Engine Emissions per Mile of
Pipeline Construction

Pollutant	Emissions (lbs/mile) Diesel Engines	Gasoline Engines
Suspended Particulates	83.2	12.0
Sulfur Oxides	172.8	4.8
Carbon Monoxide	1440.0	64.0
Hydrocarbons	236.8	8.0
Nitrogen Oxides	2368.0	11.2

silty soils. Dust control measures would be used during pipeline construction with particular attention given to the two problem areas (See Section 4.2.1.2 for dust control measures).

(2) Mining

An itemized list of equipment to be used in mining was shown in Table 1-3. The diesel powered equipment would be the major source of emissions. The estimated hourly emissions from the various equipment types are shown in Table 3-4. The concentration of pollutants from these vehicles should decrease rapidly with distance from the active mining area and haul roads, and should not in themselves significantly affect ambient air quality.

(3) Railroad Operations

The estimated emissions (tons/year) from two trains/week traversing the railroad spur during normal operations would be as follows:

NO_x	SO_2	TSP	CO	HC
0.39	0.34	0.57	0.36	0.26

These emissions would be dispersed over the length of the spur and in themselves should not significantly affect ambient air quality.

(4) Product Pipeline Operations

During operations, fugitive dust would be created during periodic inspection and maintenance activities and at daily shift changes. Maximum emissions from the two compressor stations would be:

TABLE 3-4

Expected Vehicle Emissions from Mining Operations

Code	Item	Total Fuel Consumption Per Hour (gal)	Emissions NO_x lb/hr	HC lb/hr	CO lb/hr	Particulates lb/hr	SO_x lb/hr
A	STRIPPING EQUIPMENT	17.7	6.54	0.65	3.98	0.23	0.48
B	LOADING EQUIPMENT	34.5	12.76	1.28	7.76	0.45	0.94
C	COAL AND ASH HANDLING EQUIPMENT	49.9	18.46	1.85	11.22	0.65	1.34
E	ROAD CONSTRUCTION AND MAINTENANCE	110.3	40.79	4.08	24.82	1.44	3.00
F	SUPPLY AND MAINTENANCE	30.0	11.10	1.11	6.75	0.40	0.80
I	PERSONNEL TRANSPORT	5.0*	0.38	0.29	2.66	0.05	0.02
K	RECLAMATION EQUIPMENT	50.7	18.76	1.87	11.40	0.66	1.37
	TOTAL		108.76	11.13	68.59	3.88	7.95

*Gasoline only. All others diesel.

NO_x (as NO_2)	54.6 lbs/hr
SO_2	Trace
CO	12.2 lbs/hr
HC	4.9 lbs/hr

Since the two compressor stations would be 100 miles apart and the first station would be over 100 miles from the plantsite, the emissions from the compressor stations would not be cumulative and their effect on overall air quality would be minor.

(5) Gasification Plant Emissions

The gasification process is, for the most part, an enclosed and pressurized system. There are, however, two basic catagories of atmospheric emissions associated with the gasification plant: (1) those associated with normal plant operations and (2) those that occur intermittently during startup or emergency conditions. During startups, shutdowns, or emergencies, crude process gas would be burned in the startup incinerator or a separate flare system and be vented into the atmosphere. Emissions would consist of water vapor, CO_2, SO_x, and small quantities of NO_x. Such releases would be at high rates, but of a temporary duration, and would have a short-term negative impact on ambient air quality (Appendix I).

Maximum emission rates for the startup incinerator are listed in Appendix B. The scenario used to calculate these emission rates involves the startup of five gasifiers at the same time; three on air and two on oxygen. Initial startup of each phase would probably involve no more than three gasifiers at the same time. Each gasifier would produce at least 15 to 30 percent of its capacity for 2 to 3 days. Initial startup of the entire plant could involve several months before smooth operation was achieved.

Gasifier startups following maintenance shutdowns would occur on an intermittent but regular basis. Starting single gasifiers after these shutdowns would produce emissions as much as 9 percent of the operating time. The maximum amount of crude gas flared during these periods would be 1.3 percent of plant capacity.

The duration and frequency of emergency situations cannot be predicted. All equipment which could become overpressurized during emergencies would be equipped with pressure relief valves connected to the flare system. Maximum emissions from the emergency flares are shown in Appendix B. The most severe emergency situation would involve flaring 50 percent of the crude gas for 5 to 10 minutes; other situations would involve flaring smaller quantities of crude gas. The effect of all types of intermittent flaring on ground-level concentrations of the major pollutants is discussed in Appendix I.

Total gasification plant emissions of the primary pollutants from all sources except the startup and emergency flares are estimated to be as follows:

NO_x (as NO_2)	1,100 lbs/hr
SO_2	2,825 lbs/hr 1/
TSP	265 lbs/hr
CO	364 lbs/hr
HC	140 lbs/hr

Gaseous streams containing hydrocarbons would be incinerated, but combustion may be incomplete. All of the above values assume full operation of all pollution control equipment at their design levels and an outside power source from the proposed Basin Electric powerplant.

The results of various trace element analyses for the coal to be mined for operation of the gasification and powerplant plants were shown in Table 1-3. In the gasification process most of the arsenic and mercury ends up in the sludge from the evaporators and almost all of the beryllium, boron, fluoride, and lead remains in the ash, and thus, would be buried in the mine (see Section 3.1.2.2).

Maximum ground-level concentrations of pollutants from the gasification plant emissions alone are shown in Table 3-5. The project would meet all applicable Federal and State ambient air standards (see Section 4.1.2.1). Again, it was assumed that the plant would have outside power provided by the Basin Electric powerplant. If the Basin Electric powerplant were not built, it is possible that ANGCGC would have to provide some of their own power by burning coal fines in steam boilers. If this were the case, the ground-level concentrations of many pollutants would be higher than those shown in Table 3-5.

(6) Basin Electric Powerplant

The estimated emissions of the major pollutants for the 880 MW Basin Electric powerplant alone are as follows:

NO_x (as NO_2)	4,934 lbs/hr
SO_2	11,832 lbs/hr
TSP	424 lbs/hr
CO	1,135 lbs/hr
SO_3	438 lbs/hr

These emissions represent 0.5 lb. NO_x, 1.2 lbs. SO_2, and 0.1 lb TSP per MMBtu input. The powerplant would have a 600-foot stack for dispersion of emissions compared to a 400-foot stack for the gasification plant.

1/ Assumes the maximum of 1.7 percent sulfur in the coal.

TABLE 3-5

Maximum Ground-level Pollutant Concentrations Attributable to the ANGCGC Project (ug/m^3)

Pollutant	Averaging Period	Maximum Estimated Concentration 1/ — Existing Point Sources	ANG	Subtotal	Current Background Level	National Standards — Ambient Air — Primary	Secondary	Deterioration Class II	North Dakota Standards[4]
SO_2	1-Hour	6.0	152.8	158.8		-	-	-	715[4]
	3-Hour	4.0	61.8	65.8		-	1300[5]	700[6]	-
	24-Hour	3.0	26.0	29.0		365[5]	-	100[6]	260[4]
	Annual	2.3	2.4	4.7	<5.0[2]	80	-	15	60
NO_x	1-Hour	3.0	32.5	35.5		-	-	-	200[7]
	Annual	1.5	0.5	2.0	8.0[2]	100	100	-	100
TSP	24-Hour	8.0	12.7	20.7		260[5]	150[5]	30[6]	150[5]
	Annual	0.8	0.1	0.9	24.0[3]	75	60	10	60

1 The dispersion analysis prepared by ANGCGC is presented in Appendix I; more detailed data are available in the analysis.
2 Seven-month average, September 1975 through March 1976. Monitoring instrument does not detect SO_2 levels below 5 ug/m^3 (56).
3 1975 Annual Average (56).
4 Maximum concentration.
5 Maximum concentration not to be exceeded more than once per year.
6 Maximum allowable incremental increase.
7 Maximum concentration not to be exceeded 1 percent of the time in any 3-month period.

In addition to the major pollutants, various volatile trace elements in the coal also escape with the flue gases from the powerplant into the atmosphere. Several of these elements are known to be harmful to plants and animals at certain concentrations--arsenic, cadmium, fluorine, lead, mercury, and selenium. The proposed powerplant would be equipped with an electrostatic precipitator and a wet-lime scrubber which would reduce the emissions of these elements into the air. Although the exact quantities of trace elements to be emitted by the proposed powerplant are not yet known, the following estimates based on EPA studies of powerplants with similar control devices (108) would be reasonable approximations:

Element	Emission Rate From EPA Study (%)	Emission Rate From Proposed Powerplant (lbs/hr)
Arsenic	5	7.50
Cadmium	4	0.02
Fluorine	8	9.60
Lead	8	8.00
Mercury	98	0.24
Selenium	28	1.40

(7) Total Emissions

Total emissions from all of the above sources are summarized in Table 3-6. The proposed ANGCGC and Basin Electric developments would emit about 6,143 lbs of NO_x, 14,665 lbs of SO_2, and 1,693 lbs of particulates into the atmosphere every hour. In addition, smaller amounts of hydrocarbons, carbon monoxide, and various trace elements would also be emitted. Potential impacts from these various pollutants are discussed in the next section.

3.1.1.3 Cumulative Impact on Ambient Air Quality-ANGCGC and Basin Electric

a. Ambient Air Quality

The estimated maximum ground-level concentrations of major pollutants from the joint operation of the proposed ANGCGC gasification plant and Basin Electric powerplant, along with existing ambient air concentrations, are shown in Table 3-7. Isopleths for SO_2, NO_x, and TSP are shown in Figures 3-1, 3-2, and 3-3, respectively.

These calculations do not include any changes in the existing ambient air concentrations that might occur due to the mining operations (which could be considerable at times) or due to the construction of other coal-related developments in the area such as the Coyote coal-fired powerplant proposed for construction 3.5 miles south of Beulah.

TABLE 3-6

Total Emissions from Proposed ANGCGC and Basin Electric Projects
Near Beulah, North Dakota (lbs/hr)

Developments	NO_x	SO_2	TSP
Construction			
Gasification Plant	61.8	4.6	2.4
Product Pipeline 1/	148.7	11.1	6.0
Railroad 2/	.4	.3	.6
Operation			
Mining	108.8	8.0	3.9
ANGCGC Gasification Plant	1,100.0	2,825.0	265.0
Basin Electric Powerplant	4,934.0	11,832.0	424.0
Subtotal 3/	6,142.8	14,665.0	692.9

1/ Assumes 1 mile/day of construction and a 16-hour work day.
2/ Given in tons/year of railroad construction.
3/ Excludes construction and railroad emissions.

The frequency of occurrence of the meteorological conditions at the plantsite that would produce the maximum concentrations in Table 3-7 has been estimated by ANGCGC to be 0.21 percent. This was based on meteorological records gathered at the plantsite between February 1974 and March 1975. The frequency of similar conditions, based on 10 years of records gathered at Bismarck, was 0.74 percent.

b. Visibility

In North Dakota, clear air and unrestricted visibility are considered to be important environmental attributes. Particulate emissions from the ANGCGC and Basin Electric projects would be small and no direct visible plumes from the plants would be noticeable except during periods of startup and equipment malfunction. Nonvisible emissions, however, could affect visibility through the scattering of light and photochemical reactions thus causing a visible haze in the plant vicinity.

The reduction of visibility due to the increase in the ambient particulate and sulfate aerosol levels is summarized in Table 3-8.

TABLE 3-7

Maximum Ground-level Pollutant Concentrations Attributable to the ANGCGC and Basin Electric Projects (ug/m³)

Pollutant	Averaging Period	Maximum Estimated Concentration[1]: Existing Point Sources	Basin	ANG	Subtotal	Current Background Level	National Standards[4]: Ambient Air Primary	Ambient Air Secondary	Deterioration Class II	North Dakota Standards[4]
SO_2	1-Hour	6.0	328.5	152.8	487.3		-	-	-	715[4]
	3-Hour	4.0	127.6	61.8	193.4		-	1300[5]	700[6]	-
	24-Hour	3.0	50.2	26.0	79.2		365[5]	-	100[6]	260[4]
	Annual	2.3	5.2	2.4	9.9	< 5.0[2]	80	-	15	60
NO_x	1-Hour	3.0	136.9	32.5	172.4		-	-	-	200[7]
	Annual	1.5	2.1	0.5	4.1	8.0[2]	100	100	-	100
TSP	24-Hour	8.0	10.9	12.7	23.6		260[5]	150[5]	30[6]	150[5]
	Annual	0.8	0.4	0.1	1.3	24.0[3]	75	160	10	60

1 Concentrations from ANGCGC and Basin Electric would not be strictly additive, but are added here to present the worst possible case. ANGCGC's more detailed dispersion analysis is presented in Appendix I.

2 Seven-month average, September 1975 through March 1976. Monitoring instrument does not detect SO_2 levels below 5 ug/m^3 (56).

3 1975 annual average (56).

4 Maximum concentration.

5 Maximum concentration not to be exceeded more than once per year.

6 Maximum allowable incremental increase.

7 Maximum concentration not to be exceeded 1 percent of the time in any 3-month period.

FIGURE 3-1

ISOPLETHS OF ANNUAL AVERAGE SO_2 CONCENTRATION (μGM/M³)
FROM METEOROLOGICAL DATA FOR BISMARCK, NORTH DAKOTA
ISOPLETH INTERVAL 0.5μGM/M³

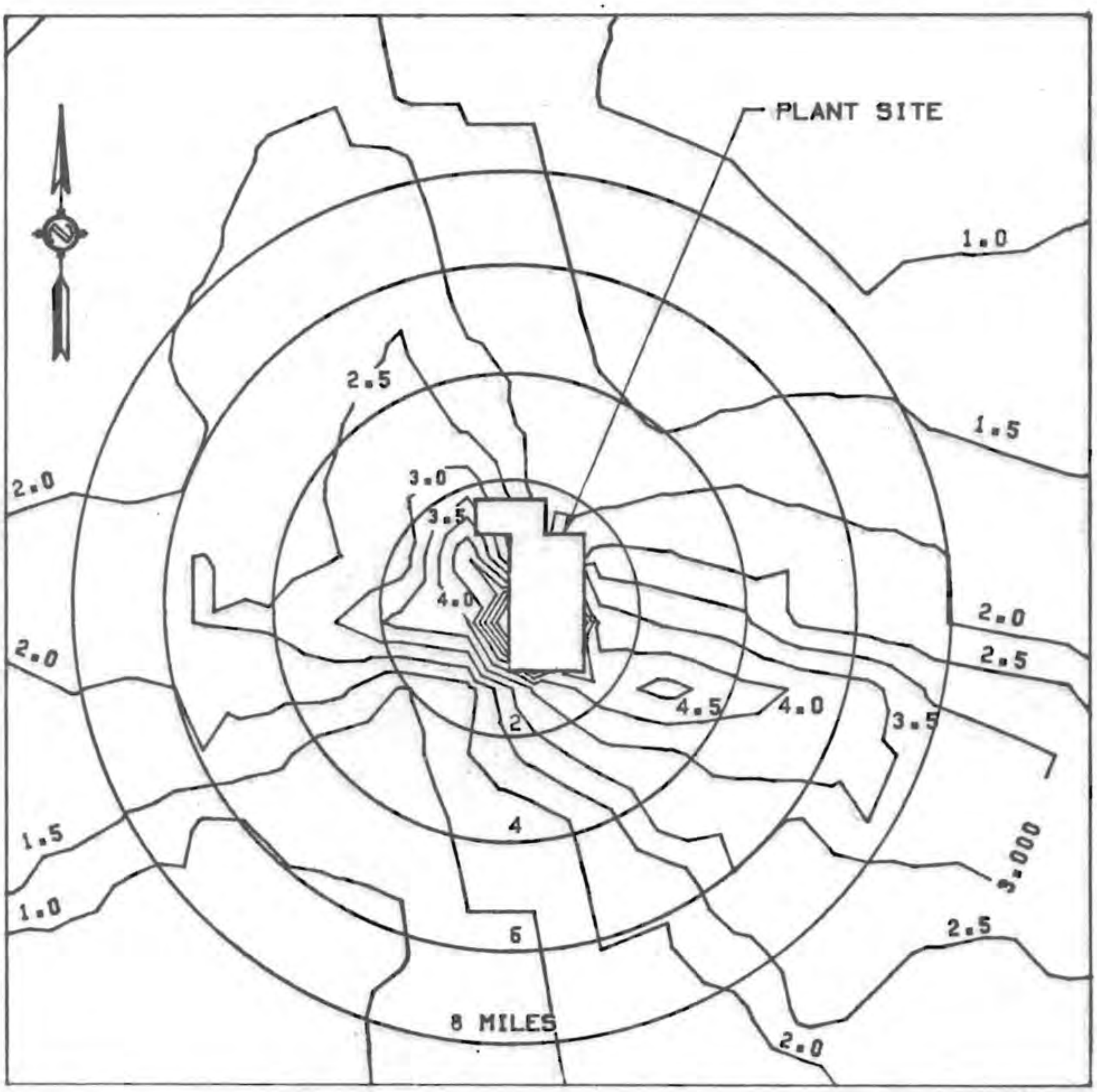


FIGURE 3-2

ISOPLETHS OF ANNUAL AVERAGE NO_x CONCENTRATION ($\mu GM/M^3$) FROM METEOROLOGICAL DATA FOR BISMARCK, NORTH DAKOTA
ISOPLETH INTERVAL 0.5$\mu GM/M^3$

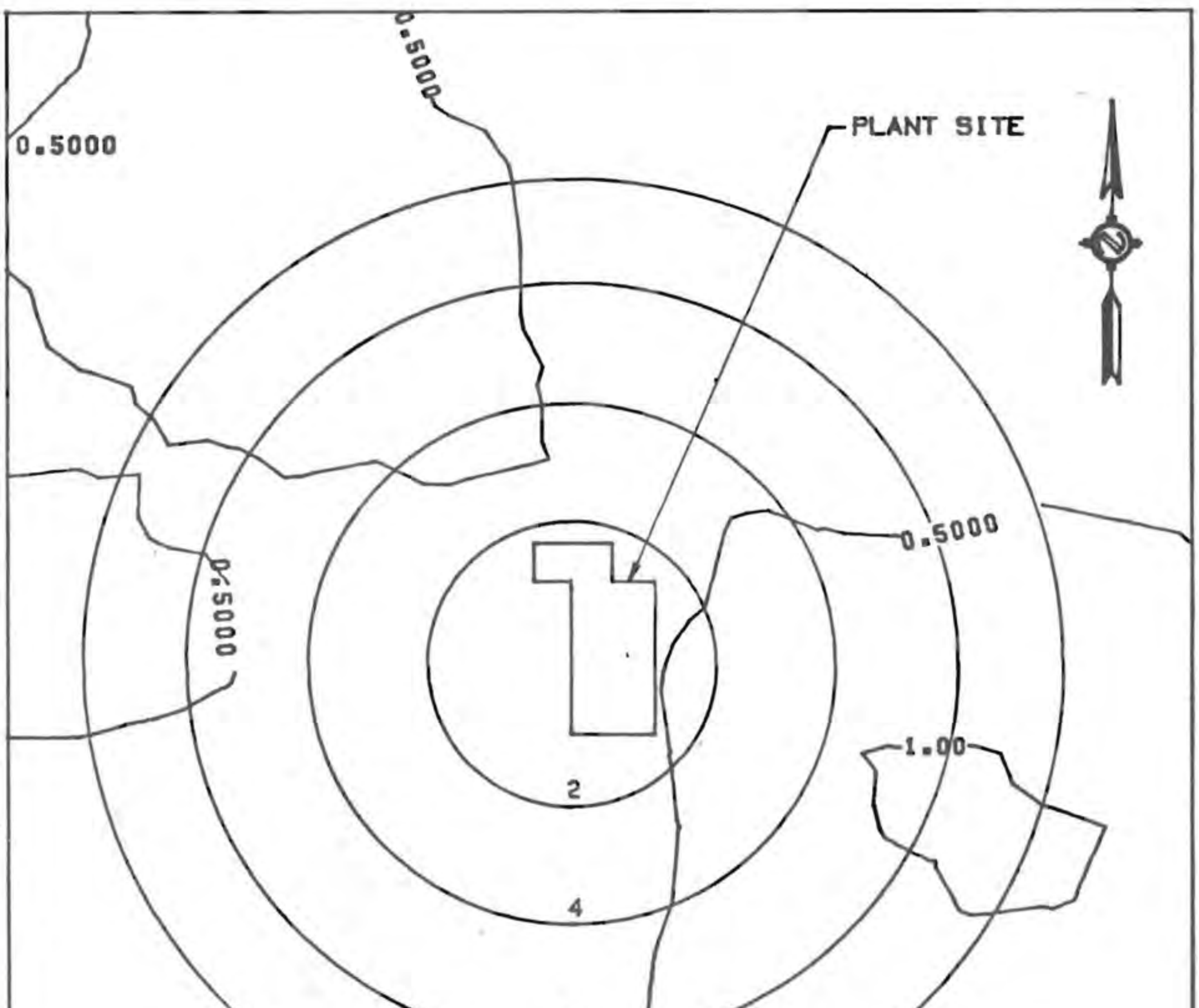


FIGURE 3-3

ISOPLETHS OF ANNUAL AVERAGE TSP CONCENTRATIONS (μGM/M³)
FROM METEOROLOGICAL DATA FOR BISMARCK, NORTH DAKOTA
ISOPLETH INTERVAL 0.5μGM/M³

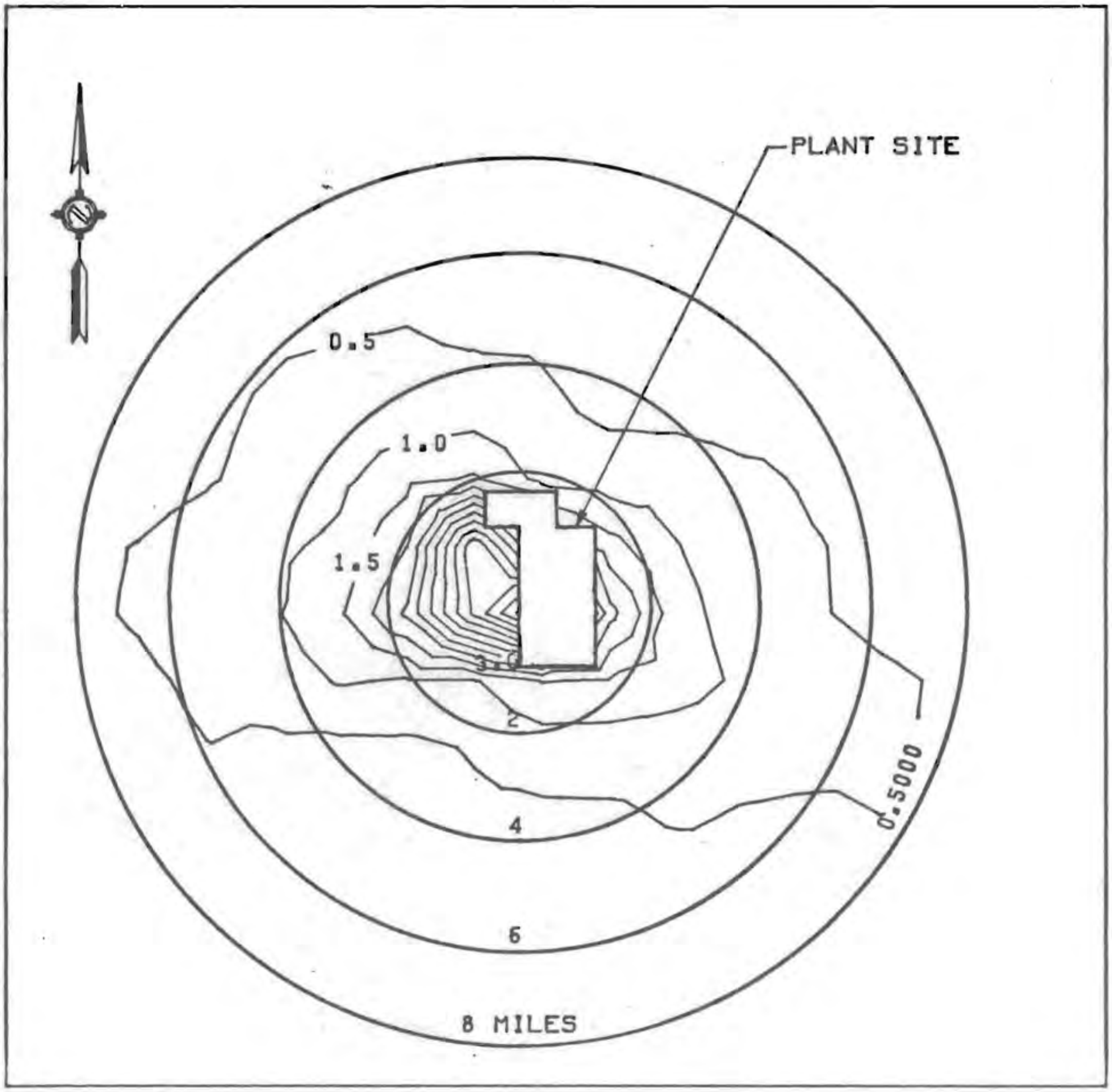


TABLE 3-8

Summary of Visibility Reductions from the ANGCGC and Basin Electric Projects

Meteorological Conditions	Maximum Increase in TSP + Sulfate Concentration (ug/m^3)	Downwind Distance (km)	Visibility Reduction (%) I 1/	II 2/	% Frequency of Occurence
Short-Term 3/					
Neutral, 12 m/sec	9.2	21	23	8	1.1
Plume Trapping, 1 m/sec	13.8	16	31	12	0.1
Fumigation, 1 m/sec	63.9	34	68	39	0.2
Long-Term					
24-Hour	23.9	-		15 4/	-
Annual Average	2.4	-		4 5/	-

1/ Based on TSP background of 30 ug/m^3
2/ Based on TSP background of 100 ug/m^3
3/ One-hour averages
4/ TSP background of 132 ug/m^3, based on maximum 24-hour sample reported from North Dakota air sampling network
5/ TSP background of 53 ug/m^3, based on the 1973 annual average reported for Bismarck.

The maximum long-term percentage reduction in visibility resulting from the joint project would range from 4 percent on an annual basis up to 15 percent for 24 hours. For short-term worst-case conditions, the combination of particulates and sulfate aerosols could reduce visibility 68 percent for baseline TSP concentrations of 30 ug/m^3 and 39 percent for baseline TSP concentrations of 100 ug/m^3. The worst-case conditions would occur about 0.3 percent of the time.

c. Potential Impacts of Emissions

Simply because all Federal and State air pollution standards would have to be met by the proposed ANGCGC and Basin Electric projects does not mean that there will be no impacts. For some pollutants, no standards exist because insufficient studies have been done to determine what concentrations can be tolerated. Other standards are based upon extensive study, but are a compromise between impacts and abatement costs.

Although it is difficult to precisely isolate the effects of air pollution on human health, medical research has shown that acute respiratory infections, chronic bronchitis, pulmonary emphysema, bronchial asthma, and lung cancer can be caused or aggrevated by air pollution. No studies are available that have shown exactly what health effects might be expected from long-term exposure to the calculated ground-level concentrations (Table 3-7) of the proposed projects, but the levels at which air pollution is hazardous to human health is reflected in the air quality standards. These standards are designed to protect that element of the population (about 15-20 percent) that is particularly sensitive to pollutant induced respiratory problems. However, the air quality standards are not absolute because very little is known about pollution induced illness related to new technologies. Research is underway to more clearly define the health aspects of air pollutants from coal conversion processes (107), and some of the standards will undoubtedly be changed as new information becomes available.

The impacts to the plants and animals that might result from the emissions of the ANGCGC and Basin Electric projects are also largely unpredictable because few studies have been done on damage resulting from the concentrations that would result from the proposed projects. However, laboratory tests of SO_2 and NO_2 have established preliminary injury threshold values for various plant species. For many plants the injury threshold for an 8-hour exposure of SO_2 alone is about 800 ug/m^3; for conifers the injury threshold was lower, about 715 ug/m^3 (93). For NO_2 the injury threshold for a 4-hour exposure was about 4,700 ug/m^3. The maximum 8-hour SO_2 concentrations that would be reached due to the proposed projects would be 114 ug/m^3; the maximum 4-hour NO_x concentrations would be 58 ug/m^3.

When SO_2 and NO_2 are both present, as will occur near the proposed projects, vegetation may be injured at much lower concentrations because of syngergism of the two gases. For example, the injury threshold for tobacco for SO_2 and NO_2 together is 252 ug/m^3 SO_2 and 188 ug/m^3 NO_2 for a 3-hour exposure (94). Plant pathologists regard tobacco as being the middle range of plant sensitivity to air pollutants. The above values are somewhat higher than the estimated maximum 3-hour or less ground-level concentrations for the proposed projects (Table 3-7); thus, acute plant damage should not occur except to particularly sensitive species.

There may be some damage from an initial shock phenomenon which sometimes occurs with the introduction of phytotoxic gases into a relatively clean or pristine area (61). In addition, chronic damage may be caused by constant, low-level exposure to air pollutants, but this aspect of air pollution damage is subtle and not well understood at the present time.

The chief hazard to terrestrial animals near the proposed projects would be the ingestion of vegetation contaminated with fallout from the plume. Pathologically, ingestion of SO_2 (from gaseous uptake by plants used as food) depresses immunubiological responses and lowers the Vitamin C content of the blood (95). Thus, some animal populationsmay be reduced by way of natural disease as a result of eating vegetation contaminated with SO_2. Moreover, sulur taken up by alfalfa has been reported to result in selenium deficiencies in cattle near the Stanton, North Dakota, powerplants, resulting in stillborn calves (comment by Dr. Hastings, Public Hearing Record, May 11, 1977). Selenium injections are reported to alleviate the problem. However, the extent of the overall hazard to terrestrial animals is not predictable at this time.

Effects from trace element emissions (i.e. arsenic, cadmium, fluoride, lead, mercury, and selenium) are likewise difficult to predict because of the wide variance of the three trace element analyses shown in Table 1-3. For example, these analyses indicate that for flouride, the trace element present in highest amounts, concentrations in the coal may range from 24 to 83 ppm (by weight). Therefore, flouride emissions from the proposed projects could run between 9.6 and 26.6 lbs/hr. However, even assuming the worst case condition, it does not appear likely that trace element emissions from the proposed project would cause acute plant or animal damage. Drift from the process water cooling tower would be composed of about 300 lbs/hr. acetate salts, 50 lbs/hr phenolic salts, and 50 lbs/hr inorganic salts. These compounds are rapidly degraded by micro-organisms, but should the drift settle on vegetation, productivity could be temporarily reduced.

The remainder of the pollutants that would result from the proposed projects would be emitted in amounts too small to be likely to, in themselves, cause any acute damage. However, as two of several coal-related developments proposed for the general area, ANGCGC and Basin Electric would contribute to an overall reduction in air quality in the region and any resulting impacts. Possible impacts of coal development in the region are discussed briefly in Section 3.6; more detailed analyses can be found in the Bureau of Reclamation's Water for Energy EIS (102) or will soon be available in BLM's West-Central North Dakota Energy Development EIS.

3.1.1.4 Odor

a. Construction

Odors associated with the construction of the gasification plant and pipelines would be from combustion sources, evaporation of fuels, and fugitive dust. Combustion gases which have perceptible odor characteristics would include (63, 64):

Material	Odor	Perception Level
SO_2	pungent, sharp	1200 ug/m^3
NO_2	strong, pungent, sweetish	7600 ug/m^3
HC	gasoline smell	variable

The sources of combustion emissions during construction are diesel and gasoline engines, space heaters, dryers, boilers, and open burning. Projection of odor perception in terms of distance from source would not be possible because of the difficulty in quantifying the pollutant concentrations leading to odor perceptions. However, ground concentration levels shown in Table 3-2 are below the above threshold values. Most of the fugitive dust would be fine soil which would have a natural odor when detectable.

There would be an increase of odors on the plant-mine site. The smell of SO_2, NO_2, and hydrocarbons would be detectable in the vicinity of operating diesel engines. These odors should not be perceptible offsite. Natural type dust odors may occasionally be detected offsite due to increased particulate levels during construction.

b. Operation

The SO_2 and NO_x emissions from the stack should not cause any detectable offsite odors because estimated ground concentrations (Tables 3-5 and 3-7) are below perception levels. Other primary sources of potential odors are routed through various control processes (Section 4.2.1.3) in an enclosed piping system. However, no system is completely leak-proof, thus small leaks may cause slight sulfur odors in the immediate vicinity of the piping.

Odors produced by the mining operations would be those of diesel exhaust and dust. Operation of coal haulers and various pieces of smaller equipment would be the cause of both odors. The largest pieces of equipment (draglines, coal loaders) would be electric powered and thus produce only dust emissions in removing overburden.

Odors should not be detected during construction of the product pipeline except in the immediate vicinity of operating equipment.

3.1.1.5 Noise

a. Construction

Plant-Mine Site: Noise levels during plant construction would be significantly higher than the existing rural conditions. Because the distances from the construction areas to the optioned land boundary are as short as 100 feet, there frequently would be high noise levels (up to 92 dBA) at the site boundary and beyond. Noise levels would be increased at residences near the plantsite if the residences continue to be inhabited. Increased noise levels would also cause many species of wildlife to avoid the immediate area.

Typical construction activity noise levels at sites with ambient noise levels of 50 dBA are shown in Table 3-9 as derived by EPA (65). Although the ambient noise levels at the proposed plantsite are less than 50 dBA, the difference for noise impact assessment is minimal due to the much higher levels emanating from the equipment. Combining an ambient level of 50 dBA with construction levels of 80 dBA would only cause a 0.2 dBA increase in noise over that determined by using lower ambient levels.

The L_{10} parameters in Table 3-9 are the noise levels which would be exceeded 10 percent of the time. Noise levels for individual construction vehicles and equipment are shown in Table 3-10.

Normal noise attenuation is 6 dBA for each doubling of distance from the source (66). The approximate distances to lower noise levels starting with the highest average and L_{10} levels (Table 3-9) are:

	50 feet	400 feet	½ mile	1½ miles	5 miles
Average	89	71	55	45	35
L_{10}	98	80	64	54	44

The approximations given do not consider any background noise and are provided as a general guide. Since the existing noise environment is rural, primarily due to wind, and averages about 40 dBA (Section 2.1.2.3), residents who live within about 1½ miles of the site would experience increased noise levels as shown above. Those living from 1½ to 5 miles away would occasionally detect construction noise, but the population centers (Beulah, Zap, etc.) should not be affected.

The railroad would also increase noise levels, both during construction and operations. The noise level of a typical freight train is about 75 dBA at 50 feet; thus, persons residing near the railroad tracks would experience increased noise levels from the increased rail activity associated with the project.

Product Pipeline: Since pipeline construction would be done by various crews and equipment along a given spread, noise sources would move along the route as different spreads perform their duplicate functions. Noise levels associated with various equipment are shown in Table 3-11.

In communities along the pipeline route, the more congested conditions would expose more persons to noise impacts than in rural areas. Noise levels from construction would be significantly above normal background levels for these small urban areas. The period of impact should not be more than 30 days in urban areas except

TABLE 3.-9

TYPICAL RANGES OF NOISE LEVELS IN dB(A) AT CONSTRUCTION SITES WITH AN AMBIENT LEVEL OF 50 dB(A)

Activity	Office Bldg. Hospital School	Industrial Buildings	Roads Sewers Trenches	
Ground clearing	84	84	84	Energy Average dB(A)
	7	9	8	Std Deviation
	93	95	94	L_{10} Level
Excavation	89	89	88	Energy Average dB(A)
	6	6	7	Std Deviation
	97	97	97	L_{10} Level
Foundations	78	77	88	Energy Average dB(A)
	3	4	8	Std Deviation
	82	82	98	L_{10} Level
Erection	87	84	79	Energy Average dB(A)
	6	9	9	Std Deviation
	96	95	90	L_{10} Level
Finishing	89	89	84	Energy Average dB(A)
	7	7	7	Std Deviation
	98	98	93	L_{10} Level

Source: U.S. Environmental Protection Agency, NTID 300.1. 1971.

TABLE 3.-10

NOISIEST EQUIPMENT TYPES AT CONSTRUCTION SITES

Activity	Vehicle	Noise Level per Vehicle at 50 feet [dB(A)]
Ground clearing	Truck	91
	Scraper	88
Excavation	Rock Drill	98
	Truck	91
Foundations	Jack Hammer	88
	Concrete Mixer	85
	Pneumatic Tools	85
	Scraper	88
Erection	Derrick Crane	88
	Jack Hammer	88
	Scraper	88
Finishing	Rock Drill	98
	Truck	91
	Paver	89

Source: U.S. Environmental Protection Agency, NTID 300.1. 1971.

TABLE 3-11

Peak Noise Levels of Equipment Used During Pipeline Construction (at 50 feet)

Equipment	Noise Level (dBA)	Degree of Use
Chain Saws	97	Occasional
Dozer	105	Frequent
Rock Drilling	120	Occasional
Ripper	105	Occasional
Trencher, Backhoe, etc.	105	Frequent
Haulers	110	Frequent
Hoists	100	Frequent
Compactor	116	Occasional
Blasting	87 (250 feet)	Occasional

perhaps for Devils Lake, the largest city along the proposed route, where construction might take up to 45 days.

b. Operation

Major producers of noise during operation of the proposed gasification plant would include compressors and coal handling equipment such as crushers and screens; fans, blowers, and burners; steam lines; flares; and air coolers and cooling towers. Much of the equipment would be in buildings and the noise level outside would be reduced somewhat. Flare valves, steam valves, and escaping steam are also major producers of noise. Flare noise would result from high velocity steam injection into the hydrocarbon streams to reduce smoke. If emergency flaring occurs, the noise level around the flare may exceed OSHA standards. This should occur infrequently and be of short duration. Normal gasifier and general startup flaring would be at lower flaring rates and therefore at lower noise levels.

Typical noise levels from mining operations were determined by taking measurements near operating equipment at NACCO's Indian Head Mine:

Coal hauler at full power	- 50 feet	93 dBA
Coal hauler idling	- 150 feet	70 dBA
Coal shovel loading coal	- 150 feet	70 dBA
Coal tipple loading railroad cars	- 150 feet	74 dBA
Electric dragline	- 300 feet	65 dBA

Much of the equipment (such as coal haulers and draglines) to be used in the mining operation for ANGCGC, however, would be considerably larger than those used at the Indian Head Mine, so somewhat higher noise levels could be expected. Equipment operating in the pit may be shielded somewhat; thus, reducing ambient noise. The coal haulers shuttling back and forth between the mines and plant have the greatest potential for causing noise. Also, blasting during the evening shift would disturb nearby residents during a normally relaxing period of the day. Overall, the impact of the proposed project would be to increase, and change the nature of, noise in the area. (Noise suppression measures are discussed in Section 4.2.2).

3.1.2 Water

3.1.2.1 Surface Water

a. Gasification Plant

Plant construction activities would alter the topography and land surface characteristics in the plantsite vicinity. The area is within the Antelope Creek drainage basin and construction could locally alter the direction and intensity of overland flow, its sediment load, and hence the water quality. Water flow in Antelope Creek is seasonally intermittent but construction would occur during the period of flow. Impacts upon the surface water would result from increased localized runoff from new paved surfaces and plant buildings, and erosion of excavated materials. The amount of sediment and dissolved constituents transported downstream from excavated material during plant construction would depend on the amount and intensity of rainfall.

Substances emitted during plant operation may enter area waters upon being returned to the surface and raise the concentrations of these elements in solution. Rates of possible contamination are not quantifiable; but because of the alkaline nature of soils and waters in the area, many elements may become chemically inert and thus would not pose a hazard to biological systems.

Runoff water from plant process areas would be routed to a storm-water retention pond and reused in the plant. This should minimize degradation of surface waters by contaminated runoff from the process areas. Extensive reuse of wastewaters within the plant would lessen the possibility of stream contamination by plant waters.

b. Mining

Assuming revegetation of strip-mined lands within 3 to 4 years after initial mining, about 1,500 to 2,000 acres of land would be exposed at any given time. The primary impacts to surface waters from mining would include (1) local alteration of the direction and intensity of surface flow, (2) local alteration of sediment load, and (3) changes in water quality.

Due to the altered topography from mining, each mine pit would alter surface drainage patterns. As a result, a combination of runoff entrapment in mine pits and altered surface flow routing would occur. Based on the total area to be mined in each subbasin and assuming no runoff from reclaimed land, the approximate decrease in runoff, and hence, streamflows, for each subbasin can be estimated. Annual runoff in the west and east tributaries of Antelope Creek would be decreased about 13.3 and 14.3 percent, respectively. The decreased flow in the Lower Spring Creek-Upper Knife River at Hazen would be about 0.6 percent; any decrease in runoff in the Lake Sakakawea basin is too small to calculate.

The decreased streamflows in the Lower Spring Creek-Upper Knife River subbasin could cause an immeasurable increase in downstream TDS levels. In both tributaries of Antelope Creek downstream TDS levels would be increased during the summer months and the periods of no-flow would also be increased. The above estimates do not take into account placement of mine pits, which if placed at low elevations would entrap some overland runoff uphill from the pit. Increased evaporative losses would also result from entrapment further reducing downstream flows.

During mining, some erosion of stockpiled topsoil would take place in the time between its removal and the time that it is adequately protected by vegetative cover. However, the greatest potential for erosion is through the valleys between spoil piles. The nature of overburden materials, its unconsolidation during excavation, and its placement in a steeply graded pile renders these materials highly erodable. The erosion potential varies seasonally; the spring and summer storm season represents the period of greatest concern. Because an increase in sediment load and turbidity would occur, an increase in chemical concentrations in the affected streams would result due to the leaching of spoils.

When compared to surface water quality, water in existing mine pits generally exhibits more than twice the hardness and total dissolved solids, and more than twice the concentration of bicarbonate, sodium, calcium, magnesium, potassium, chloride, iron, and boron (4) (Appendix E; Analyses of Water Samples, Lignite Aquifers). In addition, sulfate concentrations are 10 times greater in mine pit waters and nitrate concentrations are increased as a result of the use of ammonium nitrate explosives.

As a part of the normal mining operation, water may be removed from the mine pits by pumping. This water would be disposed of by: (1) spraying roads for dust control, (2) pumping into adjacent pits, (3) experimental irrigation of revegetated areas, (4) pumping into constructed impoundments, and (5) pumping into existing streams.

Spraying roads or pumping the water into other pits would have little effect on surface waters. Use of the mine pit water for irrigation would be tested, but due to the high concentrations of dissolved ions, irrigation is not likely to be feasible. Pumping the contaminated water into impoundments may adversely affect the indigenous biota and also increase the surface area for evaporation thus reducing surface runoff. The impoundments would also act as ground-water recharge sources and some of the materials might leach into various shallow aquifers used for domestic and stock watering purposes. Finally, pumping mine pit water into existing streams would affect water quality. The amount of such pumping that might occur is variable and would depend on precipitation amounts, leakage rate into pits, etc. If this pumping occurs, the pH of the affected stream would be lowered and the mineral content increased.

Effects of mining on the drainage patterns of surface water basins are partly based upon the final configuration of the reclaimed land surface. It is possible that local changes in the direction of drainage in the Antelope Creek basin could occur as a result of regrading the mined land. This may alter the size of the drainage subbasins making some slightly larger and some slightly smaller. Although some individual subbasins may be affected, surface flow patterns within the Missouri River drainage basin would not be changed.

Infiltration capacities of reclaimed land would be greater than that of the present land surface since the original topsoil would be replaced and no special effort made for step-wise compaction. The breaking up of consolidated layers during draglining, bulldozing, dumping, and spreading of topsoil would result in the surface of the reclaimed land having a higher permeability than before mining. Therefore, runoff and thereby downstream flows of affected surface waters would be decreased. Differences in the chemical quality of the runoff might occur during reclamation, prior to the establishment of vegetation, and in areas where sediment and leachate from new soils have ready access to surface water channels.

c. Water Intake

The maximum withdrawal of water from Lake Sakakawea for use in the proposed gasification plant and powerplant would be about 36,000 acre-feet/year (17,000 for ANGCGC and 19,000 for Basin Electric) or 22,500 gpm. The impact of operating the water intake would be controlled primarily by the intake design and its placement on the bottom of Renner Bay. Modification in bay water quality might result from changes in circulation patterns adjacent to the intake possibly causing increases in turbidity in the same area. No impact on main-stem Missouri River water quality is anticipated.

The withdrawal of 22,500 gpm (about 50 cfs) would alter the circulation patterns within Renner Bay in that there would be a greater exchange of water between the bay and Lake Sakakawea. The effects of water withdrawal would tend to be uniform with depth throughout the bay during all seasons when the lake and bay are not stratified. During the summer, however, the bay stratifies with the formation of a thermocline. The intake would draw water from the hypolimnion during periods of stratification and may deepen the depth of the thermocline near the intake or, during drought periods, disrupt the stratification in the bay. Either case might allow warm-water fish to range nearer the intake increasing their chances for impingement.

The intake would be located several feet above the floor of Renner Bay to reduce scouring. Any material stirred from the bottom should be drawn towards the intake, thus having a minimal effect on overall bay water quality.

d. Product Pipeline

The major water quality impacts of the product pipeline would be increased construction-induced sediments resulting primarily from the 86 surface water crossings, but also from overland runoff from disturbed soils. The greatest impact on water quality would be increased sediment loads in rivers during stream crossings; the quality of water in ponds and lakes would also be degraded as they are crossed. The increased sediment load would reduce existing dissolved oxygen concentrations and increase the total dissolved solids in solution. The increased turbidity warrants concern along the Forest and Red Rivers since their waters are used for municipal supply by the cities of Minto and Oslo, respectively. Impacts of increased sedimentation on aquatic organisms are discussed in Section 3.2.3.

Other pipeline construction activities such as trench dewatering and flood plain clearing with subsequent erosion problems could result in short-term local reductions in water quality. No significant alteration of water quality is expected as a result of hydrostatic testing; test water would be released in accordance with North Dakota water quality standards and in such a manner to minimize scour, channel erosion, or flooding of adjacent lands.

3.1.2.2 Ground Water

The construction of the gasification plant would locally alter the recharge mechanism of the Antelope Creek aquifer which underlies the plantsite. The largest plantsite excavation would be on the order of 45 x 90 x 70 feet; the water level in the Antelope Creek aquifer in the vicinity of the plantsite is about 60 feet deep. Some perched water also occurs locally in near-surface sediments. Hence, for construction, excavations penetrating the aquifer would require dewatering. Excavations which do not penetrate the aquifer may also require some dewatering of perched water. No plant foundation problems are expected because of the presence of the aquifer.

Localized near-surface saturated strata exist in the mining areas. Mining would result in removal of these surficial water bearing materials. The amount of water in these patchy alluvial and glacial deposits of sand and gravel is not known. In areas where such deposits are located, saturated thickness is about 5 to 20 feet. These aquifers are discontinuous; thus, the effect of their removal should not extend much beyond the actual mine area.

The purpose of the proposed mining is to remove lignite from the Beulah-Zap bed. Coincidentally, the lignite aquifer would be destroyed. Gradual removal of about 12,500 acres of aquifer area would probably result in lower water levels in other lignite aquifers throughout much of the adjacent areas. The average water content of the lignite aquifer is estimated to be about 1 foot/acre and the average content of the overburden is about 2 feet/acre. Assuming these figures as reasonable approximations, the total amount of water displaced from the Sentinel Butte aquifer units during mining would average about 1,600 acre-feet/year. This could cause decreased water levels in wells near (within 1-mile) the mining activity.

Removal of permeable alluvium, overburden, and lignite would affect the source material of springs within the area. Two springs which may be destroyed (F03 and F04) were located during the baseline study. This would result in a loss of water supply by the users (human and animal) of these springs.

Infiltration of mine pit effluent would locally increase the mineralization of various shallow aquifers, and may affect the quality of the water from wells penetrating these aquifers (depending on flow patterns). Dewatering of the mine pit would cause a locally steeper hydraulic gradient and increased local in-seepage from adjacent ground-water sources.

a. Effects on Recharge Rates of Shallow Aquifers

Some recharge to the Antelope Creek aquifer takes place via flow from the Sentinel Butte aquifer complex. As a result of decreases in water levels in the Sentinel Butte complex (as well as stripping of near-surface aquifers), ground-water recharge into the Antelope Creek aquifer would be reduced during mining. On the basis of head differential between the Beulah-Zap bed and the Antelope Creek aquifer, it appears unlikely that large scale recharge reversals would take place (i.e., that the Antelope Creek aquifer would recharge the Beulah-Zap bed). However, this could occur locally where perched water occurs within the Beulah Trench.

Reduction in recharge to the Antelope Creek aquifer could also result from altered surface drainage patterns within the mine area. Runoff from the minesite would be prevented from reaching Beulah Trench, resulting in reduced infiltration to the Antelope Creek aquifer and a consequent decline of water levels in the aquifer. If net recharge to Beulah Trench is considered, a potential loss of about 40 acre-feet/year could result.

b. Effects on Recharge Rates of Lower Aquifers

The displacement of water-bearing overburden and dewatering of mine pits would probably result in a reduction in recharge to aquifer segments beneath the Beulah-Zap bed. Therefore, water levels within these lower aquifers may also be decreased to some extent.

A pair of twin lignite seams are located beneath the Beulah-Zap bed at 50- to 100-foot depths. These are separated from the shallow seam by highly impervious clays. Thus, it seems doubtful that the effects of either increased or decreased recharge would be noticeable. Likewise, because of the lithologic similarity between the Beulah-Zap bed and the underlying twin lignite seams, it is unlikely that any alteration in water quality in the twin seams would take place. The potential effects on the deep, high-pressure Fox Hills-Basal Hell Creek-Cannonball-Ludlow aquifers should be small because of their high head and vertical separation from the base of the Beulah-Zap bed (Section 2.1.3.1).

Contamination of lower aquifers from salts disposed of via the deep well should not occur due to highly impervious clays separating the strata and the distance between strata. Such contamination is remotely possible, however, should operator error (e.g., hole in casing or accidental injection into casing) allow the disposal brine to enter an aquifer.

c. Effects of Reclamation on Ground Water

Although the Beulah-Zap aquifer and certain water-bearing overburden would be removed from the mined area, the overall permeability of the replaced material would probably be greater than that of the original strata due to sediment disaggregation during replacement and the consequent increase in volume due to soil bulking. The relative homogeneity of the replaced soil could increase the ground-water movement through the mined area. Thus, the reclaimed land could cause an overall increase in ground-water levels and recharge to areas adjacent to the mines. The reclaimed land itself (which would eventually include the entire mine) could not be used as a shallow ground-water source area in the foreseeable future because leachates from the buried ash and sludge would make the water unusable.

Potential contamination of adjacent shallow aquifers could result from the leaching action of water moving through the ash and sludge buried under the reclaimed soil. Thick, impermeable strata separating the Beulah-Zap bed from deeper water-bearing units should prevent movement of leachate into underlying aquifers. Over the long-term, lateral movement of leachate into adjacent aquifers could occur by either transport of leached ions if saturation conditions exist, or by diffusion and dispersion under partial wetting of the ash. Increased ground-water levels due to increases in soil permeability could create a higher ground-water gradient forcing the leachate to move faster and farther than would occur under existing ground-water conditions.

ANGCGC has indicated that, based upon preliminary studies by Woodward-Clyde Consultants, they believe a mine pit sealing process is not necessary to prevent leachate movement into adjacent aquifers (97). However, the possibility of leachate contamination will be studied further by ANGCGC as part of an extensive drilling and hydrologic study of the project area over the next 2 years. If these studies, or other studies being conducted by the State, show that leachate contamination will occur, then ANGCGC has said they will take appropriate steps to prevent such contamination--including consideration of various methods of sealing the mine pits (97).

The main components expected in the leachate from the ash are the following salts (85):

K_2O	9 ppm
Na_2O	6,000 ppm
CaO	21 ppm
MgO	3 ppm
Al_2O_3	16 ppm
Fe_2O_3	4 ppm

In addition, the leachate would contain the trace elements that are found in the ash and the sludge from the evaporators. The estimated quantities of these trace elements buried in the mine per stream day would be:

	Sludge (lbs/day)	Ash (lbs/day)	Total (lbs/day)
Lithium	1.4	230.0	231.4
Beryllium	0.4	19.6	20.0
Boron	157.0	5766.0	5923.0
Fluorine	23.5	977.0	1000.5
Vanadium	--	269.0	269.0
Chromium	1.7	155.0	156.7
Cobalt	1.4	39.1	40.5
Nickel	8.4	78.6	87.0
Copper	14.0	161.0	175.0
Zinc	13.0	1.3	14.3
Arsenic	157.0	231.0	388.0
Selenium	33.2	1.7	34.9
Molybdenum	7.2	10.3	17.5
Silver	2.6	0.7	3.3
Cadmium	1.0	3.5	4.5
Tin	1.4	46.1	47.5
Antimony	1.0	2.4	3.4
Barium	--	46,300.0	46,300.0
Mercury	1.3	0.3	1.6
Lead	9.1	685.0	694.1
Thorium	--	23.1	23.1
Uranium	8.4	18.5	26.9

Since the mined areas will probably not be used as a ground-water source, alternative sources would have to be found for postreclamation use. Pumping from the Antelope Creek aquifer and from deeper aquifers would be feasible. Changes in ground-water use patterns would result in certain shifts in the hydrologic cycle, though no overall increase in ground-water depletion need be implied.

Twenty-eight wells and two springs are within 1 mile of the proposed plant- and minesites. Nine of these wells are too deep to be affected by the proposed action. Mining could result in water level declines in the remaining 19 wells and consequent interruption in their use, as well as reduction in the flow of the spring. Following reclamation, water levels could return to premining levels or higher making the 19 wells usuable again if no reduction in water quality occurs. Postreclamation increases in water mineralization and/or contamination of these wells could result from ground-water inflow from replaced spoil and ash deposits within the mined areas. North Dakota law provides that if a landowner experiences decreases in water yield or quality, ANGCGC must construct a new well at no cost to the landowner. This law would only be effective during the life of the plant; well problems occurring after this time may remain unmitigated.

3.1.3 Physiography

a. Soils

The operation and construction of the mines and plant would have a major impact on the soils. Although part of the top horizon would be removed and saved during mining, the stratification of the remaining horizons would be totally disrupted. This could bring closer to the surface very highly mineralized strata less able to produce vegetation. Changes in overburden permeability due to mining have already been discussed (Section 3.1.2.2).

Soils that must be stockpiled for future use in reclamation may become biologically sterile, requiring mixing with fresh topsoil when used. Some soil microorganisms can become dormant and will survive stockpiling, but the extent of this adaptation in the soil microcommunity is not known.

Soils in or close to roads that are watered for dust suppression with mine pit water would experience a buildup of minerals over a long period of time. This increased mineralization could eventually reach the point where the soils could no longer support vegetative growth. The time required to reach mineral levels inhibiting plant growth would depend on a variety of factors (e.g., salinity of mine pit water, frequency of watering, soil composition, sensitivity of vegetation, etc.) and cannot be determined at this time.

A small coal seam about 3 feet thick and covering 3 square miles would be totally destroyed. It would be uneconomical to recover the coal from this seam; thus, the coal would be mixed into the overburden and returned to the mine pit.

Land would be mined at a rate of about 500 acres/year. Assuming 25 years of operation, about 12,500 acres of soils would be disturbed. An additional 1,400 acres of soil could be altered on property used for the gasification plant, coal preparation facilities, roads, etc.

Due to the disturbance and exposure during mining and construction, soil erosion would increase. This erosion would continue until such time as adequate vegetative cover has been reestablished. The amount of soil lost would be variable, depending on the severity of the weather.

Product Pipeline: Construction impacts related to soils would occur as a result of disturbing the vegetative cover and soil profile. The level of impact would be related to the difficulty in revegetating the disturbed area and the susceptibility of the site to erosion and mass movement. Some alteration of soil productivity could result if the soil profile is not restored over the trench area, resulting in secondary impacts to wildlife habitat or agricultural production. Soil types and revegetation difficulties were shown in Table 2-6. Sensitive soil types, the portion of the proposed route in which they occur, and the degree of the potential erosion impact to the soils are summarized in Table 3-12.

b. Topography

The operation of the mine would cause a change in the appearance of the landscape. In actively mined areas the piles of spoil would rise steeply from the present gently undulating terrain. Reclamation may result in the landscape being flattened somewhat from the original topography as landowners may ask that the land be sloped to allow for cropland uses. The final highwall cuts may be graded into relatively large water impoundments where none now exist. There would be an overall increase of about 25 to 30 feet in the average elevation of the graded spoil piles. Before the piles were regraded they would resemble knobby ridges with numerous valleys.

The topography of the approximately 1,400 acres to be used for the gasification plant and associated facilities would be leveled to serve these functions. The topography of the unused portion of the property lease area would remain essentially unaltered. The overall effect on topography would be a flatter landscape with a large coal pile rising from it.

TABLE 3-12

Potential Soil Hazard Problems of Proposed Pipeline Route

Route	Sensitive Soil Types Encountered 1/	Potential Impact
Plantsite to Beulah	Bainville, Zahl	Large
Beulah to Stanton	Lihen, Parshall, Valentine	Large
Stanton to Washburn	Bainville, Wade	Moderate
Washburn to Falkirk	Zahl	Small
Falkirk to Max	Zahl, Oahe, Sioux	Moderate-Small
Kongsberg to Butte	Exline, Cavour	Small
Kief to Balta	Solonetz	Small
Balta to Filmore	Buse	Small
Filmore to Fordville	Solonetz	Small
Fordville to Ardoch	Gravel	Small
Ardoch to Morais River	Bearden	Small
Viking to Compressor Station	Peat	Small

1/ Those that by their composition are particularly subject to erosion when disturbed.

c. Land Use

The construction of the gasification plant and development of the mine would change the present land use from agricultural to industrial for the short term. The land use of the 1,400 acres used for the plantsite would change from agricultural to manufacturing; land used for the access road and railroad would change from agricultural to roadbed ROW. In the mine area, the land use would vary according to the stage of mine development. Some of the land would remain in agricultural use until mined. After reclamation the land would be returned to its existing use or altered for a different use at the option of the landowner (who retains surface ownership unless he sells it to the company).

About 2,500 acres would be out of agricultural use at any one time. The cumulative loss to annual agricultural sales over the 25-year projected life of the plant would be about $8.4 million (assuming no reclamation). Successful reclamation could lower this figure to $3.4 million. The loss in grazing would be about 60,000 animal unit months, assuming a 10-year reclamation period for pastureland and 7 months of grazing per year. In dollars, this would amount to a $1.78 million loss in cattle production over the life of the plant. The remainder of the $3.4 million loss in agricultural sales would be from lost cropland production.

Approximately 2,960 acres of prime farmland would be disturbed by the proposed project; 78,010 acres of land within Mercer County has been designated as prime farmland by the Soil Conservation Service (SCS). Prime farmlands are those whose value derives from their general advantage as cropland due to soil and water conditions (103). About 380 acres of prime farmland occurs at the proposed plantsite and would be lost to agricultural uses for the life of the plant. The remaining 2,580 acres of prime farmland would be disturbed temporarily by mining and construction activities. Since the mining to reclamation cycle would average about 5 years, about 515 acres of prime farmland would be disturbed at any one time. Most of this land would be returned to good quality cropland after reclamation, but whether or not the reclaimed cropland would constitute "prime" farmland as defined by the SCS has yet to be determined. No unique farmland would be affected by the proposed project.

Over the long term it is likely that existing prairie, currently used for grazing purposes and as wildlife habitat, would be converted to cropland if reclamation is successful. This would occur because many landowners would probably prefer to have the land restored for cropland uses rather than returned to grazing uses due to the greater cash yield from cropland. The result would be a change in current land use to more intensive agriculture and a significant loss of habitat for those forms of wildlife closely associated with prairie habitat.

The influx of persons into the area associated with the proposed project would cause a large increase in urban area and an attendant impact on land use. Agricultural land would be needed for schools, roads, homes, parks, etc. This would be a major change in present use of the land.

d. Geological Hazards

Deep-well disposal of plant wastes (Section 2.1.3.1) does have the potential of causing earthquake activity. Potential mechanisms of creating earthquakes would be lubrication of an existing fault (as happened at Rocky Mountain Arsenal) or creation of a new fault by high underground pressures. However, 437 deep injection wells (132 low pressure wells in the Dakota Formation and 325 high pressure wells deeper than 5,000 feet) have been placed in operation in North Dakota since 1954 with no known earthquake problems.

Most of the potential landslide and sand blowout areas identified along the proposed product pipeline route (Section 2.1.4.4) could be reactivated as a result of construction. Intrusion of surface water and vibrations caused by blasting or the operation of heavy equipment could further contribute to causing slope failure. The major impact of potential landslides and sand blowouts would involve the loss of the integrity of the railroad embankments which would affect railroad operations resulting in an economic loss to the railroads and inconvenience to users.

Construction near the banks of the Red River of the North could cause bank slumping, although construction activity would be perpendicular to the streambank.

3.2 Impacts on the Biological Environment

3.2.1 Terrestrial Flora

(Within this section impacts are quantified first and an impact analysis presented at the end.)

3.2.1.1 Plantsite

a. Construction

Construction of the proposed gasification plant would require about 535 acres. This acreage would be lost as wildlife habitat and agricultural acreage for the life of the plant, estimated to be a minimum of 25 years. About 95 percent of the proposed plantsite area (498 acres) is agricultural, of which a large portion (378 acres) is cropland (Table 3-13). Prairie communities comprise 5 percent (27 acres), wetland communities 0 percent, and woody communities less than 1 acre of the area to be covered by the plant. The remaining 905 acres of the 1,440 acres purchased by ANGCGC for the plantsite would be allowed to remain in and/or revert to a natural state, and act as a "buffer zone" between the plant and the surrounding land (57).

b. Operation

During plant operation, vegetation near the plantsite would be subject to various air pollutants including sulfur dioxide (SO_2) and nitrogen oxide (NO_x). Also, small amounts of hydrogen sulfide (H_2S) and carbonyl sulfide (COS) would be released into the atmosphere. Even though it is anticipated that all Federal and State air quality standards would be met, the plant community as far as 10.5 miles downwind of the site would be subjected to low levels of airborne contaminants over a long period of time. SO_2 and NO_2 have been known to cause physical injury to plants in ambient air concentrations below the Federal standards (44, 54, 67). However, the potential impacts of such exposure due to projected emissions from this project are not quantifiable at this time as very few studies have been done on this aspect of air pollution.

3.2.1.2 Surface Mining

Coal supply for the gasification plant and powerplant would require the mining of about 500 acres/year for the life of the facility, or a total of about 12,500 acres (Table 3-14). The time required to reestablish nonagricultural plant communities or to return mined land to productive agricultural use is not definitely known; however, 3 to 5 years for cropland and 10 years for rangeland is assumed for this statement (111, 112). Projected long-term impacts on plant communities are based on current reclamation procedures.

Fugitive dust would be raised by the constant flow of trucks on roads. Localized settling of large amounts of dust on vegetation near the roads would alter photosynthetic rates and, hence, plant growth.

a. Agricultural Communities

About 7,260 acres of agricultural communities would be affected by mining. Postmining rehabilitation efforts would undoubtedly be directed toward establishing as much agricultural land as possible

TABLE 3.-13

HABITATS TO BE AFFECTED BY CONSTRUCTION OF THE
PROPOSED COAL GASIFICATION FACILITY

Habitat	Approximate Acreage[1]	
Agricultural communities	498	
Cropland		378
Domestic haylands		111
Abandoned farmstead		5
Gravel pit		4
Prairie communities	27	
Overflow range site		13
Closed depression range site		2
Silty range site		5
Thin upland range site		2
Shallow range site		1
Very shallow range site		T
Thin claypan range site		4
Wetland communities	0	
Seasonal ponds (wetland range site)		0
Woody plant communities	T	
Natural woody plant communities		T
Tree plantings		T
Total	535	

[1]Acreages less than one acre listed as trace (T).

Source: Woodward-Envicon, Inc. Analysis, 1974.

TABLE 3.-14

HABITAT ACREAGES WITHIN THE AREA EXPECTED TO BE MINED DURING THE FIRST 25 YEARS OF OPERATION OF THE PROPOSED COAL GASIFICATION FACILITY

Habitat	Acreage[1]	
Agricultural communities	7,260	
Cropland		~1864
Domestic hayland		~5305
Farmsteads		90
Gravel pit		1
Prairie communities	5,153	
Subirrigated range site		T
Overflow range site		75
Saline lowland range site		T
Closed depression range site		T
Sandy range site		522
Silty range site		2299
Clayey range site		100
Thin upland range site		695
Shallow range site		1156
Claypan range site		61
Shallow to gravel range site		4
Very shallow range site		35
Thin claypan range site		206
Rock outcrops		T
Wetland communities	50	
Wet meadow swales (wet meadow range site)		14
Seasonal ponds (wetland range site)		16
Semipermanent ponds (marsh)		7
Stock ponds		13
Woody plant communities	46	
Natural woody plant communities		29
Tree plantings		17
Total	12,509	

[1]Acreages less than one are listed as trace (T).

Source: Compiled by WEI. 1974.

through the construction of smooth topography. The ultimate acreage of agricultural land would depend on the extent that soils now containing prairie and wetland communities can be converted by redistribution and concentration of topsoil and the success of reclamation.

b. Prairie Communities

About 5,160 acres of present prairie plant communities would be affected by mining. Because the existing soil structure would be altered, the return of mined land to premining natural prairie would be difficult. After topsoil return, areas which are not converted to agricultural use would pass through a long period of secondary succession. Succession to a near-natural condition could take 20 to 40 years. Reclamation studies at NACCO's Indian Head Mine have resulted in substantial vegetative cover in as little as 3 years; however, natural communities resembling premining conditions may never be reestablished.

c. Wetland Communities

Wetland communities comprise about 50 acres of the area scheduled for mining. Wetland soils, due to their fertility and depth, would almost certainly be converted to agricultural use. However, increases in wetland habitat may result from mining. Impoundments are planned to confine drainage to the mine area and final cuts (which are not filled) would probably hold water. Proper grading of these areas to provide shallow water may provide conditions conducive to the establishment of wetland communities. In addition, the replaced overburden would settle unevenly over a long period of time creating shallow surface depressions that would also hold water.

d. Wooded Communities

About 46 acres to be mined are occupied by woody vegetation. The majority (29 acres) consists of native woody plant communities; tree plantings account for the remainder (17 acres). Native woody communities are irreplaceable, although such communities may develop over the long-term after reclamation. Woody habitat could increase after mining in the form of tree plantings at the discretion of the landowner. Woody species can often survive directly on spoil materials, particularly where spoil banks are not leveled. If soils are concentrated for agricultural use, the areas left without much topsoil can be made useful by development of woody stands for wildlife habitat.

3.2.1.3 Water Intake and Pipeline

The proposed pump station on Renner Bay is on U.S. (Corps of Engineers) property, which is actively managed by the North Dakota Department of Game and Fish as the Hille State Game Management Area. The pumping facility would occupy about one-fourth acre, currently prairie habitat, which would be lost.

Construction of the water intake would involve excavation of about 10,000 yds^3 of overburden. Part of this overburden would be used to raise the grade of the pumphouse site; the remainder would be deposited in low lying areas near the site that are currently supporting relatively undisturbed prairie vegetation. Before spreading the spoil, existing topsoil would be removed and stockpiled for reclamation. After the deposition of the spoil, the topsoil would be replaced and disturbed areas seeded with species of grass similar to those already present. Thus, the existing habitat would be lost temporarily during construction of the facilities.

The water pipeline, 7.6 miles long, was aligned to avoid areas underlain by coal. The proposed route transverses 4.0 miles of agricultural lands (2.0 miles of croplands and haylands and 2.0 miles of road ROW) and 3.6 miles of prairie habitat. Based on a construction zone width of 150 feet, about 72 acres of agricultural land and 66 acres of prairie would be affected.

Effects in agricultural areas would likely be temporary, although reductions in soil productivity may occur due to the redistribution and mixing of soil horizons. Changes in prairie communities would be more permanent since excavation and backfill would alter the soil. Bared areas would be seeded to help stabilize soils, and in time some of the more adaptable native species may become reestablished. Until revegetation is adequate, water and wind erosion would occur. Water erosion problems should be small, however, since steep, long slopes are not present.

Operational impacts of the water intake system on the flora should be minor and related to maintenance and repair of the pumping facilities and pipeline.

3.2.1.4 Railroad Spur

The distance from the Burlington Northern mainline west of Hazen to the plantsite boundary is 12.1 miles. About 7.0 miles of agricultural, 1.5 miles of prairie, 3.1 miles of weedy ROW, and 0.5 miles of woody habitat will be traversed. Assuming an affected 150-foot width, about 127 acres of agricultural, 27 acres of prairie, and 9.1 acres of wooded lands would be lost. The railroad embankments would revegetate to the weedy habitat characteristic of the existing railroad ROW.

3.2.1.5 Product Pipeline

a. Farmlands

A short-term impact would result where construction of the pipeline passes through productive cropland. These are areas where the railroad has leased land for agricultural use, or where the route deviates from the railroad ROW. Some encroachment on land adjacent to the railroad ROW would be necessary for construction space or access. Most of the agricultural land affected would be planted in small grains or used as pasture/rangeland and would be lost for the season.

Construction through farmlands would result in the loss of the crop in the area disturbed for one growing season. A decline in soil productivity over the trench area could affect crop production for several additional growing seasons. Rangelands, pasturelands, and hayfields would require several seasons to become fully reestablished. Almost the entire route would be on existing railroad ROW with about 262 miles of cropland and 15 miles of hayland bordering the ROW. The 79 acres of new ROW would also be disturbed for one growing season but would revert back to its previous use after pipeline construction.

b. Woodlands

Most of the natural woodlands along the proposed route are stands of bottomland hardwoods along the perennial drainages. These hardwood stands are extremely important wildlife habitat. There are also scattered woodlots near the terminus at Thief River Falls and on the beach ridges of glacial Lake Agassiz. Where construction adheres to railroad ROW, woodlands would normally be avoided. However, woodlands may be encountered at stream crossings, where the route leaves the Soo Line ROW to link with the Thief River Falls Compressor Station, or where construction does not adhere to railroad ROW.

The impacts resulting from clearing the ROW or work space in woodlands include a loss in aesthetic quality, a loss of woodland habitat, loss of stream shading and bank stabilization, and loss of wind protection. There could also be localized loss of wildlife nesting and denning sites. Areas of woodland on or near the proposed route are shown in Table 3-15.

c. Wetlands

Significant, long-term impacts on wetlands could result if water levels were affected by trenching, spoil disposal, or backfilling. Where the rate of drainage was increased, communities adapted to dryer conditions would result. Most of the potholes along the proposed route are underlain by deep layers of clay till; trenching

TABLE 3-15

Woodland Areas Along Proposed Product Pipeline Route

Area	Area Length (miles)	Woodland Types
Knife River	3.6	Bottomland Hardwoods
Missouri River	5.5	Bottomland Hardwoods
Missouri Plateau, Drift Prairie, Red River Valley	6.4	Bur-oak Savannah, Shelterbelts
Forest, Morais, Snake, and Red River of the North	?	Bottomland Hardwoods
Glacial Lake Agassiz	7.2	Jack Pine, Aspen, Tamarack
Total	22.7	

should not increase permeability. In these situations, plugging the trenches where it enters and leaves the pothole and restoring the original contour would be done to ensure that the hydrologic characteristics would not be altered. In some cases trenching may increase the permeability of the bottom profile where the trench strikes outwash deposits. In these cases, the bottom would be sealed.

Even though measures would be taken to maintain the integrity of affected wetlands, one season's production would be lost in those wetlands or portions of wetlands disturbed during the spring months. Production would not be lost on wetlands affected during summer (after July 15) and fall if normal precipitation occurs after construction.

Another long-term impact may result if the productivity of the peripheral community was altered. Pothole sites are commonly farmed as close to the wetland as possible, so natural plant communities (Section 2.2.2.3) are normally restricted to narrow bands. Generally, two soil conditions prevail in the potholes: (1) ephemeral and intermittent potholes have soils similar to adjacent areas and (2) permanent potholes have an accumulated upper layer of peat or muck. Disruption of soil profiles would have an impact on revegetation of these natural communities. Wetlands comprising approximately 7,200 acres are contiguous to railroad ROW; about 115 acres of these wetlands lie within the 50-foot construction width.

3.2.1.6 Analysis of Impacts to Terrestrial Flora

The total approximate acreage of the main habitat types to be disturbed by the different associated facilities of the gasification complex is summarized in Table 3-16. Agricultural land that is disturbed by the mining and pipeline functions would be removed from production temporarily for a period of 3 to 5 years for cropland and 10 years for pastureland. Agricultural land removed from production by the plant and railroad spur would be lost for the life of the facilities, and probably for the indefinite future. The loss of the crops produced on affected land is not a significant loss on a State or national scale. Since an undetermined but large portion of existing prairie and wetland would be converted to agricultural use through reclamation, the eventual effect of the proposed project on total agricultural acreage would probably be a net gain.

Much of the native prairie habitat to be disturbed by the proposed project is likely to be lost or irreversibly altered. During reclamation much of the land currently covered by prairie would be converted to agricultural use; that designated to return to

TABLE 3-16

Habitats to be Affected by the Construction and Operation of the ANGCGC Coal Gasification Complex

Function	Agricultural	Prairie	Wetland	Woodland	Existing ROW 1/
	Acreage Affected				
Plantsite	461	27	0	1	0
Mining	7,260	5,153	50	46	0
Water Intake & Pipeline	72	66	0	0	0
Railroad Spur	127	27	0	9	56
Roads	31	13	0	0	29
Product Pipeline	79	0	0	0	2,111
TOTALS	8,030	5,296	50	56	2,196

1/ Existing ROW contains some acreages of prairie, wetland, and woodland; the extent of disturbance to these communities are discussed in Section 3.2.1.5.

prairie would require decades to approximate its original condition. The amount of prairie involved in this project is in itself not significant on a regional scale. However, the cumulative effect of man's activities has resulted in the steady decline of prairie over the years and may eventually reach the point where even small encroachments into the existing prairie would be considered significant.

The net effect of the proposed project on wetlands is not well established. Most of the 50 acres to be lost is prime wetland, currently heavily used by ducks and other waterbirds for breeding and feeding areas. New water areas would be created by mining, particularly in the area of the last highwall cuts (which are not filled). The degree that wetland vegetation can become established in these new water areas would largely determine their value as wetlands, and this cannot be accurately predicted at this time. Overall, the net effect of the proposed project on wetland habitat is apt to be a short-term decrease and a negligible long-term impact.

The net effect of the proposed project on woodland habitat is also not well established. Replacement trees would be planted in accordance with the landowner's wishes which may or may not equal the 56 acres of trees removed. However, tree plantings in North Dakota almost never reproduce naturally; thus, tree plantings provide only partial mitigation for the loss of native woodlands.

Part of the difficulty in accurately predicting what kinds of habitats, and in what amounts, would result from reclamation is the fact that North Dakota reclamation law provides that the mined land must be reclaimed according to the desires of the landowners. The desires of the landowner regarding reclamation are not obtained until just prior to the mining on his land, thus it is the wishes of the various landowners that would determine what the overall impacts to the various habitat types would be.

3.2.2 Terrestrial Fauna

(Within this section impacts are quantified first and an impact analysis presented at the end.)

3.2.2.1 Plantsite

The estimated numbers of animals that would be lost or displaced as a result of plant construction (based on 1974 populations) are shown in Appendix H.

A group of 21 pronghorn antelope was observed wintering on the plantsite in October 1974. The loss of winter habitat could reduce the number of pronghorn which the area can support. Pronghorn populations in the area are not high and winter habitat does not appear to be a major limiting factor, however; thus it is probable that the herd would find adequate winter habitat away from the plantsite.

Local populations of nongame species which might sustain significant losses as a result of plant construction would include the sora, Wilson's phalarope, and black-billed cuckoo. Other nongame species would also sustain losses, but because they are relatively common or losses relatively small, impacts to these species should not significantly reduce existing populations.

3.2.2.2 Surface Mining

Both short- and long-term habitat losses due to surface mining would result in proportional decreases in the numbers of animals present in the area. Resident species known to inhabit the 12,500-acre area scheduled for mining (1974 estimates) are also listed in Appendix H.

Waterfowl present on 50 acres of typical wetland during the 1974 breeding season included 32 mallards, 22 pintail, 5 gadwalls, 39 shovelers, and 14 blue-winged teal. Based on an average breeding success of about 50 percent for ducks in southwestern North Dakota (45), mining would result in an annual production loss of about 127 young.

Only a portion of the numbers listed in Appendix H for each species would be lost or displaced at any one point in time. Depending on the rapidity and success of reclamation, those species able to tolerate nearby human activity could reinhabit reclaimed areas as soon as 3 to 5 years after mining. Species intolerant of human activity or requiring native prairie habitat would take much longer to reinvade mined areas if they return at all.

The North Dakota Game and Fish Department has provided data on the densities of some game and predator species that differ significantly from those found during the Woodward-Clyde field study and shown in Table 2-17 and 2-20. Based upon several years of censuses in the project area, Game and Fish Department estimates for the following species are:

Species	Population Density	
Sharp-tailed grouse	6.0 birds/mi^2	(spring)
Ring-necked pheasant	10.0 hens/mi^2	(spring)
White-tailed deer	0.5 - 1.5/mi^2	(fall)
Mule deer	0.5/mi^2	(fall)
Coyote	0.3 - 0.5/mi^2	(fall)
Red fox	1.0 - 1.3/mi^2	(fall)

Using these data, the number of animals of these species that would be displaced or lost due to the proposed project would be:

Species	Plantsite	Minesite	Total
Sharp-tailed grouse	5	117	122
Ring-necked pheasant	10	234	244
White-tailed deer	1	20	21
Mule deer	0	5	5
Coyote	0	8	8
Red fox	1	23	24

3.2.2.3 Water Intake and Pipeline

Decreases in animal populations due to habitat loss from the pump station and water pipeline construction should be relatively small because of the small amount of acreage involved. Depending on the timing of construction, disturbance and/or destruction of nesting waterfowl and game birds would result.

The operation of the pumping station would cause a constant, low-intensity noise. As a result, resident wildlife may avoid the area near the pumping station for an undetermined distance around it.

3.2.2.4 Railroad Spur

Response of animal populations to construction of the railroad spur would be a temporary loss or displacement of individuals followed by reinvasion of the ROW by those species able to use the weedy vegetation that would become established and able to tolerate the rail activity. The weedy habitat would be the relatively wide, permanent fence-row type which a variety of wildlife species often utilizes. Movement patterns of some species may be altered by railroad operation. Some accidental mortality may also occur.

3.2.2.5 Product Pipeline

Long-term impacts to waterfowl because of product pipeline construction would depend on the amount of wetland area lost. Careful attention to reestablishing disturbed wetland areas would minimize any long-term effects. Any permanent loss of wetlands caused by construction would result in a proportional reduction in the existing waterfowl population.

Short-term pipeline construction impacts to waterfowl would be disturbance of habitat, disturbance to waterfowl nesting and brood rearing, and nest destruction. Impacts to nesting waterfowl would be greatest in the latter part of May, in June, and most of July. In addition, total site disturbances may be greatest during this period as this is the time when the wetlands will have standing water and peripheral areas would be waterlogged. Greater work space may be required at this time.

Impacts to upland game during construction would result from temporary habitat loss and nest destruction. Throughout much of the Drift Prairie and the Red River Valley, the brome and mixed grass associations of the railroad ROW are heavily used by birds and small mammals because virtually all of the surrounding lands are used for agriculture. Impacts to ground nesting populations of sharp-tailed grouse and gray partridge would again be greatest during the spring nesting season. Construction during late summer and fall would result mainly in a dispersion of upland game, but local population reductions may occur the following winter where adequate cover has not yet redeveloped.

In some permanent potholes and marshes, destruction of muskrat houses and dens would occur during construction if they are present on the ROW. Long-term population reductions would result if existing water levels are not maintained, or if peripheral habitat was altered significantly.

Other predators and furbearers, such as fox, coyotes, and weasels would be temporarily displaced from portions of the ROW during construction to areas of unsuitable or already occupied habitat. Other birds and mammals which use old trees for dens, such as owls and raccoons, would be forced to permanently relocate where trees were removed and their populations would be reduced accordingly.

Construction should not have much impact on big game except for temporary movement of the animals away from construction activity.

Construction would result in the destruction of songbird and small mammal nestsites and dens, loss of habitat, and killing of some individual animals unable to run out of the path of construction equipment. Long-term impacts should not be significant after vegetation has been reestablished.

No adverse impacts to endangered species from the product pipeline are anticipated because the route would be surveyed prior to construction. However, it is unlikely that any endangered species would occur within the railroad ROW.

3.2.2.6 Analysis of Impacts to Terrestrial Fauna

Animals displaced from the plantsite and areas of mining activity would immigrate into adjacent habitat that is probably at or near its carrying capacity for many species. The result would be a temporary overcrowding of adjacent habitat and a reduction in habitat quality until such time as death, reduced birth rates, or other natural population control factors returned populations to preinvasion levels. The net effect would still be a loss of individuals equal, or nearly equal, to the original number displaced.

Noise and human activity associated with operation of the coal gasification plant and associated facilities would result in avoidance of adjacent areas by some species of wildlife. The effects of noise on wild animals are not well understood. Animals with large home ranges, such as most predators, are not expected to nest or rear young near activity centers, but it is not known whether the causes for this are due to noise or to human activity. Movements of some species, particularly antelope and white-tailed deer, would likely be adversely affected by increased traffic (rail and auto) and human activity related to plant and mine operation. Increases in the highway and railroad mortality rates of some animals such as the thirteen-lined ground squirrel and Eastern cottontail could also be expected.

Direct bird mortality may occur from the stacks that would be constructed as a part of the gasification and powerplants. Birds that migrate at night, such as warblers and vireos, have been known to die in large numbers from collision with this type of tall structure. Any bright lights on the stacks would serve to increase the number of birds killed (46). (Potential impacts of plant emissions on animals were discussed in Sections 3.1.1.3 and 3.6.)

Long-term changes in animal populations would occur due to mining activity because postmining habitats would differ considerably from premining habitats. Species which rely on prairie habitats during all or part of their life cycle would be reduced in overall numbers after mining because of the probable conversion of existing prairie to agricultural uses. Species such as upland plover, western meadowlark, grasshopper sparrow, lark bunting, chestnut-collared longspur, Northern grasshopper mouse, prairie vole, pronghorn antelope, and smooth green snake would likely decrease in numbers.

The post-mining acreages of wetlands and woodlands to be established in the area are not known at this time. For the reasons discussed in Section 3.2.1.2., there is apt to be a slight increase in wetland area as a result of mining; the suitability of these areas for waterfowl and shorebirds would depend on the development of aquatic plant communities and macroinvertegrates to serve as food supplies. The amount of post-mining woody cover is largely at the discretion of the various landowners; any woody cover established would probably be exotic species that does not reproduce naturally in North Dakota.

Woody cover provides important winter cover for many upland game birds; thus, any decreases in woody areas would cause a corresponding decrease in upland game bird populations. However, the sharp-tailed grouse requires native prairie vegetation for nesting cover, so populations of this species will likely decrease even if woody cover were reestablished.

Repopulation of the mined area by predators would depend in part on availability of prey. Since many of the small bird and mammal prey species are well adapted to agricultural land use, they should readily repopulate reclaimed land and a majority of the predators should also. There are some exceptions. Burrowing owls nest most often in prairie habitats and a decrease in the amount of prairie after mining would reduce the amount of nesting cover for this species. The great-horned owl, Swainson's hawk, and Cooper's hawk nest in trees; repopulation by these species may depend upon the amount of post-mining nesting cover present in tree plantings.

Songbirds which utilize wetland habitats, such as yellow-headed and red-winged blackbirds, may benefit slightly from mining if appropriate communities become established in post-mining wetlands. Increases in agricultural habitat may also benefit those songbirds adapted to agricultural land use such as the horned lark, house sparrow, and starling.

Amphibians and reptiles which use wetlands may also increase slightly if the appropriate communities become established. The smooth green snake is found most often in prairie habitat and would not be able to adapt to postmining agricultural conditions.

The influx of workers into Mercer County would cause an approximate 30 percent increase in males between 18 and 54 years old. As a result, the number of hunters afield, particularly in public hunting areas such as the Hille State Game Management Area, would increase. This increase may be sufficient to cause local overharvest of some game animals.

No endangered species should be effected directly by the proposed project because it is located outside the usual range of the endangered species resident in the State (Section 2.2.5.2).

Overall, the impact of the proposed project on existing animals would not be of State or national importance except that it would be one of numerous small activities continuing to rapidly convert the remaining prairie and wetland (and its associated wildlife) to other uses (See Section 3.2.2.6 for habitat impacts). Unless mined land is reclaimed specifically for wildlife values, the reclaimed land actually provides very little for wildlife compared to minimal or, in some cases, no reclamation. Unreclaimed or partially reclaimed land from previous mining operations in North Dakota often supports native vegetation, much of it woody, wetland areas, and is relatively unaccessible to humans. Such areas currently provide important winter cover and relatively undisturbed refuges for wildlife.

3.2.3 Analysis of Impacts to Aquatic Ecosystems

a. Lake Sakakawea

Construction of the water intake and pipeline to the pump station would temporarily increase turbidity, displace benthic communities, and release nutrients from the sediments within an estimated 30-yard radius of the intake. Fish may temporarily avoid the construction area and plankton levels may fluctuate because of turbidity and nutrient release. The potential impact of construction on fish spawning and nursery areas is not fully known; however, initial studies by the North Central Reservoir Investigations Team (a joint EPA and Fish and Wildlife Service project) indicate that spawning is probably limited to a very few warmwater species in the area of the proposed intake.

During operation of the water intake structure the probability of entrainment of larvae and young warmwater fish would be low when lake elevations are at or near normal levels (1,838 feet). Losses could be significant, however, during low water periods (1800 feet elevation or less) which might occur an average of 1 out of 8 years (74). Most adult and fingerling fish should be able to avoid the relatively low intake velocities (0.5 cfs at peak demand). Macroinvertebrates and plankton would also be subject to entrainment.

The loss of cold hypolimnetic waters may make an undetermined area around the intake unsuitable for cold-water fishes. Runoff of ground and surface waters from mining areas could increase siltation and mineralization in Renner, Beaver Creek, and Beulah Bays. Attempts would be made through impoundments to divert runoff to the Knife River Basin. However, runoff diversion does not solve the problem of increased siltation and mineralization but only changes its area of influence. Antelope Creek, which may be affected by such diversion, has recently been classified as a critical stream by the North Dakota Game and Fish Department because it provides excellent forage fish production, northern pike reproduction, and a sport fishery near its mouth with the Knife River for Northern pike, channel catfish, and walleye.

The influx of workers and their families would increase fishing pressure on Lake Sakakawea. This should not affect the reservoir fishery since present sport fishing is light in relation to reservoir size.

b. Knife River, Spring Creek, and Antelope Creek

Construction and operation of the gasification facility and associated mine may increase siltation and mineralization of Knife River Basin waters, particularly during periods of high-intensity storm runoff. The impacts associated with increased siltation might include reduction of both the kinds and numbers of organisms present, a limitation of habitat for macroinvertebrates, the smothering of fish eggs, and a reduction in the primary productivity of the ecosystem. Increased mineralization may also reduce the numbers and kinds of organisms present. In addition, some taxa of macroinvertebrates and fish eggs may be susceptible to plasmolysis induced by osmotic pressure changes.

The proposed plant is designed not to discharge liquid waste into surface waters. However, airborne emissions from the gasification plant which would be deposited on the ground downwind from the plant may enter surface waters and accumulate in aquatic organisms. This impact cannot currently be quantified but represents a possible long-term impact that may have important ecological significance by introducing such hazardous materials as arsenic, mercury, zinc, lead, and selenium into the various food chains.

c. Product Pipeline

The major impacts on aquatic ecosystems from the product pipeline would result from construction across waterways including the transport of equipment and discharge of hydrostatic test water. An additional factor would be the upland erosion from the construction. The impact of pipeline construction on water quality was discussed in Section 3.1.2.1; this section is concerned with the potential impact upon aquatic organisms.

Silt-loading impacts would be temporarily detrimental to the maintenance and propagation of aquatic biota. The benthic community would be disturbed at the point of crossing and for some distance downstream because of increased sedimentation. Similarly, construction induced sediments may be discharged to surface waters via overland runoff, affecting the receiving waters at the point of discharge and for some distance downstream. Primary productivity of the affected waters would be reduced by the increased sediment loads; however, these disruptions would be short-term, and repopulation of affected areas would begin after construction is completed.

The primary impact to fish populations would be a temporary reduction in reproductive success. Any spawning areas at the crossing sites would be destroyed and spawning areas some distance downstream may be inundated by siltation. Most concerned fish species spawn from early spring through early summer and water-crossing construction at other times would reduce the impact. An added impact would be the destruction of fish by blasting during stream crossings.

Potential biological impacts to the various groups of aquatic ecosystems defined in Table 2-16 are summarized in Table 3-17. Many of the potential impacts would be avoided by scheduling construction around wildlife and fishery reproductive and migration periods whenever possible.

3.3 Cumulative Impacts on the Socioeconomic Environment: ANGCGC-Basin Electric

This section discusses the social and economic impacts of the joint construction and operation of the proposed ANGCGC and Basin Electric Projects. The project impact area has been chosen to be that portion of Mercer, Dunn, and Oliver Counties within a 30-mile easy commute radius of the plantsite. The northern and eastern portions of McLean County were excluded from the population in-migration analysis because of the limited access across Lake Sakakawea to the project site. Although workers would commute from areas greater than the 30-mile radius, the major effects would occur within that area, where the employment positions are created.

TABLE 3-17

Projected Biological Impacts to Aquatic Ecosystems
Product Pipeline

Group		Potential Impacts
I.	Drainage Ditches and Canals	Minor fisheries impact
II.	Intermittent Streams	Reduced fish reproductive success if crossed during spawning
III.	Intermittent Potholes	Disruption of waterfowl production
IV.	Perennial Potholes	Disruption of waterfowl production and impairment of any fishery
V.	Rivers and Creeks	Disruption and siltation of spawning beds; the Knife River is of particular concern
VI.	Major Rivers	Disruption and siltation of spawning beds and disruption of fish migration. Of particular concern would be disruption of migrating Coho salmon in Missouri River
VII.	Major Lakes	Disruption of 600 feet of potential shoreline spawning grounds in Lake Sakakawea

Due to the recent and continuing influx of persons into the impact area related to other coal development in the region, it was assumed for this statement that the impact area would have little surplus social and economic infrastructure capacity to absorb socioeconomic impacts associated with the expected new population influx. Thus, new facilities and service capacity would be needed to accommodate most needs of the new population.

3.3.1 Economic Factors

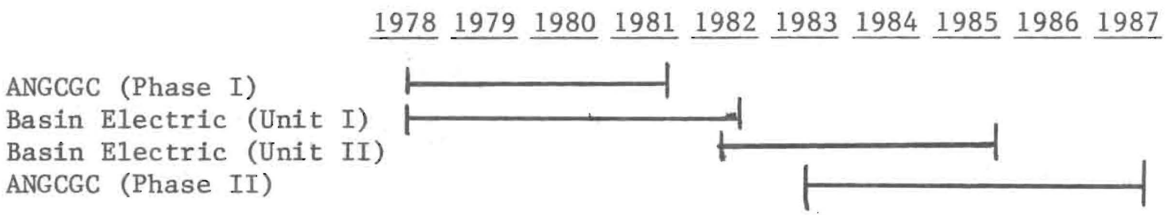
3.3.1.1 Anticipated Worker Requirements

a. Direct Employment

The average annual number of workers needed for the construction and operation of the proposed gasification plant and associated facilities, powerplant, and both projects combined is projected in Table 3-18. Workers migrating to the impact area would be largely limited to those associated with construction and operation of the plants and mine; railroad and pipeline construction crews are highly mobile and rarely migrate to the project area for projects of this size, and the pipeline operations crews would be based out of the impact area.

Construction is scheduled to start with 442 workers in 1978 and a peak of 3,049 construction and operation personnel (excluding product pipeline construction crews) would be reached in 1980. A second peak of 2,257 construction and operation workers is tentatively scheduled to be reached in 1984 due to the construction of the second phase of the gasification plant overlapping with the completion of the second unit of the powerplant. The rapid and large influx of workers could create an inflated local economy in peak construction years.

A tentative construction schedule is shown below:



The figures presented in Table 3-18 are the annual averages of the number of workers employed each year. During the year, the number of workers needed, especially for construction, could vary considerably. For example, the average number of workers needed for construction of the Basin Electric powerplant in 1979 is 582. However, quarterly estimates of manpower needs for that year are as follows:

1st Quarter (DJF)	424
2nd Quarter (MAM)	505
3rd Quarter (JJA)	621
4th Quarter (SON)	780

Thus, the actual number of employed workers could vary either above or below the values in Table 3-18 depending upon the manpower requirements for a particular time period. Estimates of operations personnel are less subject to variation.

Many of the construction workers needed for construction of the first phase of the gasification plant could find employment at other energy-related construction projects in the nearby area after completion of the proposed facilities, or they could be rehired by ANGCGC for the second phase of plant construction, now scheduled to start in 1983. Many of the construction workers and their families, therefore, could reside in the area for up to 9 years or more.

The annual average number of construction workers needed for both projects, by skill, for the peak construction period is presented in Table 3-19. The total number required in the peak year is somewhat less than the sum of the catagories because peak uses of the various skills do not necessarily coincide with one another.

TABLE 3-18

Estimated Average Annual Employment of the Gasification Plant, Powerplant, and Associated Facilities

Construction:	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Mine	130	320	250	240	30	200	200	200	0	0
Gasification Plant	312	1077	1796	812	300	267	808	1121	1136	313
Product Pipeline	0	0	1680 1/	0	0	0	0	0	0	50
Railroad Spur	50	0	0	0	0	0	0	0	0	0
Powerplant	195	582	799	478	486	752	397	52	0	0
Subtotal	687	1979	4525	1530	816	1219	1405	1373	1136	363
Operation:	**1978**	**1979**	**1980**	**1981**	**1982**	**1983**	**1984**	**1985**	**1986**	**1987-2015**
Mine	47	81	147	278	278	278	278	278	310	360
Gasification Plant	0	0	0	414	414	414	414	414	414	640
Product Pipeline	0	0	0	10	10	10	10	10	10	12
Railroad Spur	0	5	5	5	5	5	5	5	5	5
Powerplant	5	5	57	95	108	108	160	160	160	160
Subtotal	52	91	209	802	815	815	867	867	899	1177 1160 3/
Total Direct Work Force in Impact Area 2/	689	2065	3049	2317	1616	2019	2257	2225	2020	1473

1/ Construction will occur simultaneously in four spreads; each spread will require a maximum of 420 workers.
2/ Excludes product pipeline and railroad spur workers because it is unlikely they will migrate into the three-county impact area.
3/ Operations base for impact area.

TABLE 3-19

Annual Average Number of Construction Workers, by Skill, Required for Peak Utilization Period

Skill	ANGCGC	Basin Electric
Boilermakers	135	108
Carpenters	125	73
Electricians	331	99
Asbestos Workers	51	38
Iron Workers	113	79
Laborers	174	88
Masons	70	10
Millwrights	113	31
Operating Engineers	70	48
Painters	32	18
Pipefitters	586	138
Teamsters	51	21
Others	13	73

After construction, about 1,160 workers would be used for gasification plant, powerplant, and mine operations. Most of the occupations would be classified as either maintenance or operations. Skills needed for maintenance work would vary greatly; the operatives are those persons who will actually handle the gasification and power generation processes, thus some technical expertise and training will be necessary. Most of the skilled labor would probably not be available locally.

Table 3-18 highlights three important aspects of the employment impact of the ANGCGC and Basin Electric projects. First, peak direct employment would exist for only a short time and in two separate time periods. Two time periods (1979-1980 and 1983-1985) have the largest numbers of temporary workers and would also be the most demanding on public and semipublic resources. Demands for these resources would decrease significantly between 1980 and 1983, and by 1988. If the public and private service sectors overreact to the short term high demand, consequent investment and development projects may be overstated or inefficient upon return to a more normal economic base. Second, the phased construction of both plants should help lessen some of the socioeconomic impacts--compared to simultaneous construction of both plants. And third, even with the phased construction program, the sharp decrease in the construction employment (about 1987) would have a considerable impact on the total economy. Facilities and services designed for the high demand periods would have to be readjusted to the more normal operational base.

b. Indirect Employment

Indirect employment (new employment caused by the influx of direct workers and their families) generated by the proposed ANGCGC and Basin Electric projects would also be significant (Table 3-20). Indirect employment would average about 1,272 workers between 1978 and 1987 and would peak at about 1,660 workers in 1987. Peak indirect employment does not coincide with peak direct employment because the number of indirect jobs generated by operational workers is several times above those created by construction workers.

c. Total Employment

The total new employment in the impact area, both direct and indirect, which would result from the ANGCGC and Basin Electric projects is also shown in Table 3-20. A peak total employment of about 4,178 workers would be reached in 1980 before declining to an operational phase employment of about 2,726. The same patterns discussed previously in sections a. and b. above appear in the total employment estimates.

TABLE 3-20

Average Annual Indirect Employment and Total New Employment in Impact Area Attributable to the ANGCGC and Basin Electric Projects

Year	Indirect Employment 1/ Construction	Operation	Subtotal	Direct Employment	Total New Employment
1978	191	70	261	689	950
1979	594	116	710	2065	2775
1980	854	275	1129	3049	4178
1981	459	1062	1521	2317	3838
1982	245	1080	1325	1616	2941
1983	366	1080	1446	2019	3465
1984	422	1150	1572	2257	3829
1985	412	1150	1562	2225	3787
1986	341	1193	1534	2020	3554
1987	94	1566	1660	1523	3183
1988-2015	0	1566	1566	1160	2726

1/ Multipliers (ratios) used to generate the indirect employment data are: Construction 0.30; Operation 1.35 (68).

3.3.1.2 Population Impacts

Construction and operation of the proposed facilities would cause a significant and rapid influx of workers and their families into the three-county impact area. The projected annual new population based on the total employment generated by the proposed projects, and one possible distribution among area cities are shown in Table 3-21. It should be emphasized that the distribution of the population among the area cities is only one hypothetical scenario and that the actual population distribution could vary significantly from that presented. The scenario is presented here as a reasonable possibility on which the magnitude of the social and economic impacts can be assessed. The population distribution scenario was based on such factors as the size of the city, distance from project site, existing recreational facilities, etc. Percentages of in-migrating workers allocated to the various communities were: Beulah-34, Hazen-32, Golden Valley-4, Pick City-1, Stanton-9, Zap-7, Center-5, Dodge-1, and Halliday-7.

In-migrant population peaks of about 6,194 and 6,131 persons will be reached in 1980 and 1984, respectively. A more normal operational population of about 4,743 persons would be attained in 1988. This population increase is in addition to that from the 440-MW Coyote powerplant.

TABLE 3-21

Estimated Average Annual New Population Attributable to the ANGCGC and Basin Electric Projects and One Possible In-Migration Scenario to Impact Area Cities

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988-2015
Total New Employment	950	2775	4178	3838	2941	3465	3829	3787	3554	3133	2726
Construction	637	1979	2845	1530	816	1219	1405	1373	1136	313	0
Operation and Indirect	313	796	1333	2308	2125	2246	2424	2414	2418	2820	2726
Total New Population 1/	1412	4080	6194	6100	4809	5568	6131	6070	5755	5333	4743
Beulah	480	1387	2106	2074	1635	1893	2085	2064	1957	1813	1613
Hazen	452	1305	1982	1952	1539	1782	1962	1942	1842	1707	1518
Golden Valley	56	163	248	244	192	223	245	243	230	214	190
Pick City	14	41	62	61	48	56	61	61	58	53	47
Stanton	127	367	557	549	433	500	552	546	518	480	427
Zap	99	286	434	427	337	390	429	425	402	373	332
Center	71	204	309	305	240	278	307	303	288	267	237
Dodge	14	41	62	61	48	56	61	61	58	53	47
Halliday	99	286	434	427	337	390	429	425	402	373	332

1/ Based on 25 percent local hire rate and 15 percent of workers commuting from further than a 30-mile radius of the industrial site. Multipliers used to generate total population data were: In-Migrant Construction Workers - 2.27; In-Migrant Operations and Indirect Workers - 2.90. These values take into account single workers and workers who do not relocate families (69, 70) and assume that single workers would make up 24.6 percent of the total worker force.

By 1980, it appears that the population of most area cities could more than triple from 1970 levels as a result of coal-related development. For example, by combining the values in Table 3-21 with projections of the manpower requirements for the Coyote powerplant (71), it appears the population of Beulah could grow from 1,344 in 1970 to about 4,685 in 1980. A more stable population in Beulah of about 3,426 would be reached in 1990. This same pattern would apply to the other impact area cities near the plantsite such as Hazen and Zap.

3.3.1.3 Income and General Economic Conditions

a. Personal Income

The labor force required to complete the ANGCGC and Basin Electric projects would generate additional personal income in all phases of construction and operation. Income estimates for a future population are made with considerable uncertainty. Major causes of this uncertainty are inflation, labor demand/supply, and the permanent residence of the transient or temporary labor force. However, certain data can provide an insight into the impact that these developments might have on the purchasing power in the impact area. The following annual wage rates per worker (1976 dollars) were based on Bureau of Reclamation estimates for the pertinent trades:

1.	Construction	$21,500
2.	Operation and Indirect	$15,000

Using the above data and the tentative construction and operational schedule, rough estimates can be made of the direct personal income resulting from the two projects (in 1976 dollars). During the peak activity periods of 1980 and 1984 about $81.2 million and $66.6 million of personal income would be generated, respectively (Table 3-22). In disposable income (income after taxes) these values would yield $69.5 million and $57.1 million of additional disposable income in the impact area resulting from the proposed projects.

Not all of the disposable income would be spent or remain in the impact area. Aside from that which would go into savings, etc., a significant amount of the disposable income may end up in the Bismarck-Mandan area because the closest large wholesale and retail trade centers are located there. Also, a significant portion would be sent by workers to those families residing outside the region.

It is important to note the impact resulting from the termination of construction employment. Personal income associated with plant

TABLE 3-22

Estimated Income Generated in Impact Area by the ANGCGC and Basin Electric Projects in 1976 Dollars (Millions of Dollars)

Personal Income	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988-2015
Construction	13.7	42.5	61.2	32.9	17.5	26.2	30.2	29.5	24.4	3.7	0.0
Operation and Indirect	4.7	11.9	20.0	34.6	31.9	33.7	36.4	36.2	36.3	42.3	40.9
Total	18.4	54.4	81.2	67.5	49.4	59.9	66.6	65.7	60.7	46.0	40.9
Disposable Income (.856)											
Construction	11.7	36.4	52.4	28.2	15.0	22.4	25.9	25.3	20.9	3.2	0.0
Operation and Indirect	4.0	10.2	17.1	29.6	27.3	28.8	31.2	31.0	31.1	36.2	35.0
Total	15.7	46.6	69.5	57.8	42.3	51.2	57.1	56.3	52.0	39.4	35.0

construction would drop to zero from an average of $28.2 million received during the construction period. Another drop in personal income would occur in 1982 to $49.4 million from the 1980 peak $81.2 million. Post-1988 operations related income would be about $40.9 million annually.

Two major economic impacts to individuals would result from the proposed projects. The first would be in the form of job opportunities and increased income for some. Construction activities, mining operations, plant operations, and new indirect employment would all be sources of these increased opportunities and incomes. However, not all persons in the impact area would benefit. There would be people whose occupational skills would not be utilized. In addition, the increase in local buying power would rapidly inflate the cost of living. Thus, those persons living on fixed incomes, or those with relatively low-paying jobs, would experience a significant decrease in their buying power.

Families on the 25 farmsteads (about 100 persons) to be affected by the proposed project would receive compensation (See Section 4.1.4.4). Those who retain surface ownership can designate how they wish to have the land reclaimed. Thus, these families would experience a temporary loss of employment (but perhaps not income) and could benefit economically in the long-term by acquiring cropland via the reclamation process from present grazing land.

b. Labor Force and Wage Structure

The number of jobs created represents a major addition to the existing blue collar and farm labor force of about 15,000 within 75 miles of the plantsites. Even with extensive immigration of workers, changes in the occupational structure of the existing population would result. Most of the new construction workers would have to be recruited from other jobs. This would create an increased demand for blue collar labor which may, in the short run at least, drive up wages. Firms facing a shortage of labor would either recruit over a wider area, improve productivity, or reduce business activity.

Many farmers may find new part-time employment (particularly under the area of new indirect employment opportunities) to supplement farm income. In 1969, 17 percent of North Dakota farmers worked 100 or more days off the farm. This is significantly lower than the 40 percent average for all U.S. farmers and may have been due partly to the absence of opportunities.

Upon termination of construction, surplus labor would exist to a degree dependent upon the availability of other employment opportunities in the area. Some of the construction workers might seek operational jobs in the plants; others would leave the area and seek employment elsewhere.

North Dakota average wages for manufacturing production workers ($4.75/hr) are lower than national wages ($5.17/hr) based on 1976 figures. An influx of high-wage jobs into a low-wage area could escalate the wage rates of nonproject employees such as seasonal farm labor. Increased income per capita in the area would increase demands for goods and services and prices would rise.

In short, economic forces can serve to increase wage rates in some sectors and not in others. This would cause a redistribution of income toward those persons employed or associated with employment in energy related sectors. Persons living on fixed incomes or not engaged in energy related endeavors would be especially disadvantaged as inflation occurs.

Termination of construction could result in a significant amount of excess labor in the area which would lead to reduced demand for goods and services. This could add to the possible unemployment problem within the impact area. It is possible that other developments under construction could absorb some of the unemployment; how much excess labor they could absorb would depend on the number of developments and their timing, and this cannot be predicted at this time.

c. General Business

One critical factor associated with the construction and operation of the proposed facilities would be the rapid increase in demand and services that would arise. Retail trade facilities, amusements, services, motels, housing, etc., would all be in short supply during construction. False impressions of rapid prosperity could lure some entrepreneurs into starting businesses during the construction phase only to see them fail once the construction force leaves. Conversely, in view of the experiences associated with other inflated economies in the Upper Missouri Region, some businesses may be reluctant to expand and insufficient market capacity would exist.

d. Product Pipeline

In general, the product pipeline construction period would cause some disruption within the area of the railroad ROW in urbanized areas. Construction should not permanently affect land use adjacent to the ROW in these urban areas. The proposed pipeline would cross primary roads, collector roads, and some major highways. Some of the roads to be crossed, primarily located in urban areas, have public utilities within their ROW; some of these utilities (e.g., sewers, water lines, gas lines, and telephone and electric conduits) may be temporarily disrupted.

Facilities located in the railroad ROW, such as grain elevators, graineries, and warehouses, have driveways and parking areas that are utilized rather extensively during the harvest season. If these areas are crossed during the harvest season, some inconvenience would result. If necessary, alternate access could be provided. The proposed pipeline would also cross the various railroad tracks (e.g., mainline, spurs, etc.) as required and may cause some temporary disruptions in service.

The proposed pipeline would avoid all existing major structures and no major facilities would be demolished or relocated as a result of the proposed construction. Some smaller structures within the railroad ROW (i.e., tool sheds, storage sheds, etc.) may be relocated or demolished if necessary.

Materials such as fencing, wire, cable, tile, tile support, gravel, concrete, repair parts, and small tools would be purchased locally when feasible. Materials such as gasoline, diesel fuel, oil, and grease would likely be purchased through contracts with local suppliers; materials such as welding rods and pipe would not be available locally and would be purchased elsewhere.

Pipeline spread crews are primarily specialized work forces requiring special skills and experience but some unskilled workers would be required. Most of the work force hired from the local area would be of the unskilled category, and would be about 30 percent of the work force.

The average weekly payroll per construction spread (300 workers) would be about $125,000; about 40 percent of this would be spent by workers in the local communities. This amounts to a total expenditure by workers of about $4.5 million during the 6-month construction period. The local tax base would also be benefited by the capital improvement within its taxing jurisdiction.

3.3.1.4 Summary and Analysis of Economic Impacts

The establishment of the proposed ANGCGC and Basin Electric projects in the impact area would have a significant impact on the regional economy. This impact would be focused primarily on the cities, towns, and commercial areas located near the development site. Stanton, Center, Zap, and particularly Beulah and Hazen would experience a period of rapid growth. This type of short-term economic growth is characterized by a shift in the regional employment-occupational structure to a predominantly construction-industrial labor base. This shift would increase population, wages, and economic opportunity in the area.

Increased population would stimulate the demand for housing, phones, power, water, sewage services, police and fire protection, education and other public facilities (see next section). Increased wages would stimulate the expansion of the service industries such as dry cleaners, barbers, theaters, fast foods, restaurants, bars, bowling alleys, etc. More money circulating in the regional economy would increase retail sales, investments, savings, and bank deposits, thus stimulating the growth of financial-banking institutions in the region.

The influx of the transient labor force associated with the product pipeline would also increase demands for commercial goods and services in local communities near the pipeline construction, and some local public and semipublic services. These public and semipublic services would include water and sewer facilities, recreation, health services, utilities, and fire and police protection. The transient work force on a mainline spread would be in excess of 300 workers. This work force and their family members could place a temporary strain on the services of smaller communities. In this case, short-term (on the order of 90 days) adverse impacts could occur.

Increased demand for goods and services, increased wages, and increased capital in circulation would inflate the local economy. Selected portions of the local economy would realize monetary benefits; others would experience decreases in their buying power directly proportional to the rate of inflation. Welfare enrollments could increase as a result.

Increased economic opportunity in the region would necessitate training or retraining much of the unemployed labor force. In the short term, new skills and training would increase the standard of living of the general population. However, in the long term the region would be characterized by a specialized economy with a skilled, technically-oriented labor force. This type of regional specialization is particularly sensitive to cyclical changes in demand for products or in the substitution of other resources to meet energy needs. Fluctuations in the local economy may also occur with a depletion of the more accessible coal reserves.

3.3.2 Impacts on the Socioeconomic Infrastructure

3.3.2.1 Housing

There would be a significant influx of in-migrating workers seeking housing accommodations in the nearby towns within the impact area. Table 3-23 summarizes the number of housing units required in the three-county major impact area based on the assumption that one dwelling would be required for every in-migrating worker (both

TABLE 3-23

A Scenario of the Number and Distribution of Housing Units Required in the Impact Area to House New Direct and Indirect Employment Population Resulting from the ANGCGC and Basin Electric Projects 1/

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988-2015
Total Units Required	950	2775	4178	3838	2941	3465	3829	3787	3554	3133	2726
Beulah	323	943	1421	1305	1000	1178	1302	1288	1208	1065	927
Hazen	304	888	1337	1228	941	1109	1225	1212	1137	1003	872
Golden Valley	38	111	167	154	118	139	153	151	142	126	109
Pick City	9	28	42	38	29	35	38	38	36	31	27
Stanton	85	250	376	345	265	312	345	341	320	282	245
Zap	67	194	292	269	206	242	269	265	248	219	192
Center	48	139	209	192	147	173	190	189	178	157	136
Dodge	9	28	42	38	29	35	38	38	36	31	27
Halliday	67	194	292	269	206	242	269	265	249	219	191

1/ Assumes one housing unit required for each in-migrating worker.

direct and indirect workers). It should be remembered that the distribution of workers among the area cities is only one possible distribution and thus, housing needs for a particular city could vary considerably from that shown in Table 3-23.

The new housing can consist of single-family dwellings, multiple-family dwellings, or mobile homes. If the proportion of the new units is assumed to be 25 percent single-family units, 25 percent multifamily units, and 50 percent mobile homes (4), the approximate housing needs for each of the impact area cities for the peak population year (1984) are listed in Table 3-24.

The actual distribution of housing among cities could vary considerably from the hypothetical scenario in Table 3-24. For example, if housing and land prices are excessively high in cities near the plantsite, large mobile home parks or new subdivisions could develop in communities farther from the plants but still within reasonable commuting distance. Other factors that could also influence the distribution of housing needs would be the size of the town, presence of shopping centers, quality of schooling, availability of fuel, availability of recreation facilities, etc.

At an average of $35,000 per new permanent dwelling unit (72)[1/], a total of about $96 million would be spent on permanent housing for the operational level of employment.

A construction camp would be provided by ANGCGC to house about 20 percent of the peak construction force plus seasonal peaks. The camp would accommodate mostly single workers, short-term workers, and workers living in the impact area during the work week but commuting to their homes outside the area on weekends. The camp would lessen the need for new temporary housing in area cities during peak construction by about 400 units. The 60 percent in-migrant worker projection takes into account the presence of the construction camp.

No construction camps are planned for product pipeline construction; therefore, nonlocal workers would either provide their own living quarters in the form of mobile homes and rent space for their mobile homes, or would procure temporary housing in the area. Table 3-25 lists the total number of temporary housing units available, and the vacancy rate for 1970 for each of the counties involved. Although these figures indicate the general availability of housing, they may not be representative of the more rural areas affected by the proposed route. Nonlocal pipeline workers could take up much of the available temporary housing in local areas resulting in a short-term (60-day) shortage of temporary housing for other purposes. Many nonlocal workers would own mobile homes

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1/ Includes a 40-percent inflation factor for the 10-year construction period.

TABLE 3-24

A Scenario of New Housing Unit Needs of Impact Area Cities During the Peak Population Year (1980) 1/

City	Total New Housing	Single-Family	Multiple-Family	Mobile Home
Beulah	1421	355	355	711
Hazen	1337	334	334	667
Golden Valley	167	42	42	83
Pick City	42	11	11	20
Stanton	376	94	94	188
Zap	292	73	73	146
Center	209	52	52	105
Dodge	42	11	11	20
Halliday	292	73	73	146

1/ Assumes 25 percent single-family units, 25 percent multiple-family units, and 50 percent mobile home. Includes workers living in construction camp.

and would only require temporary trailer spaces. In the Mercer-McLean County area these workers may take up trailer spaces desired by vacationers, but this should not be a problem elsewhere along the route. Local workers would have their own existing housing.

3.3.2.2 Education

The large influx of new employees and their families would exert considerable pressure on existing educational facilities and result in overcrowding. Crowding would, temporarily at least, decrease educational quality. Each of the nine cities in the impact area falls within a separate school district. On the short term, taxes in these districts could lag behind the need for expansion of the area schools. Over the long term (i.e., after the plant begins operation), taxes would increase the funds available for educational needs and could eventually increase educational quality.

Assuming that the new population would be comprised of 19 percent students enrolled in elementary schools and 7 percent students enrolled in high schools (72), the projected annual increase in student enrollment in each of the affected school districts is shown in Table 3-26. Again it should be emphasized that the

TABLE 3-25

INVENTORY OF TEMPORARY HOUSING FOR NORTH DAKOTA COUNTIES[a]

COUNTY	YEAR ROUND UNITS[b]	VACANCY RATE[c]
MERCER	2,161	19.2
OLIVER	767	20.3
MC LEAN	3,917	8.0
WARD	14,361	5.0
MC HENRY	3,169	17.9
SHERIDAN	1,178	ZERO
PIERCE	2,046	9.7
BENSON	2,596	12.3
RAMSEY	4,313	8.9
NELSON	2,196	12.7
GRAND FORKS	18,074	5.3
WALSH	5,174	5.5

[a]ADAPTED FROM: U.S. DEPT. COMMERCE, 1972. COUNTY AND CITY DATA BOOK. A STATISTICAL ABSTRACT SUPPLEMENT.

[b]TOTAL YEAR ROUND UNITS EXCLUDE SEASONAL OCCUPANCY OR MIGRATORY LABOR.

[c]PERCENT OF TOTAL RENTAL UNITS AVAILABLE YEAR ROUND.

figures are based upon a hypothetical distribution of the incoming population and that the actual new student population in a given district could vary significantly from that shown in Table 3-26. Also, the figures do not include any increase in population in the impact area due to other coal-related developments in the region.

The addition of about 1,600 school children to impact area schools by 1980 imposes significant problems. Based on a teacher:student ratio of 1:30, some 54 new classrooms and related facilities would be required by 1980. After the population stabilizes in 1988, about 41 of these classrooms would still be needed; any excess could be of a temporary nature. At 140 ft.^{2}/student and \$40/ft.^{2}, school facilities for the additional students could require expenditures of about \$9 million by 1980.

3.3.2.3 Health Services and Safety

a. Health

Health care facilities in the area would be significantly impacted by the population influx. Assuming the need for one hospital bed

TABLE 3-26

A Scenario of the Annual Increase in Student Population in Each of the Impact Area School Districts Due to the ANGCGC and Basin Electric Projects

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988-2015
Total New Students	367	1016	1610	1586	1250	1449	1595	1579	1495	1387	1231
Beulah	124	345	547	539	425	493	542	536	509	472	419
Elementary	91	252	399	393	310	360	396	392	372	345	306
High	33	93	148	146	115	133	146	144	137	127	113
Hazen	117	325	515	508	400	464	510	505	479	444	394
Elementary	85	237	376	371	292	339	373	369	350	324	288
High	32	88	139	137	108	125	137	136	129	120	106
Golden Valley (Juzeler)	15	41	64	63	50	58	64	63	60	55	49
Elementary	11	30	47	46	37	42	47	46	44	40	36
High	4	11	17	17	14	16	17	17	16	15	13
Pick City	4	10	16	16	12	15	16	16	15	14	12
Elementary	3	7	12	12	9	11	12	12	11	10	9
High	1	3	4	4	3	4	4	4	4	4	3
Stanton	33	92	145	143	112	130	144	142	134	125	111
Elementary	24	67	106	104	82	95	105	104	98	91	81
High	9	25	39	39	30	35	39	38	36	34	30
Zap	26	71	113	111	88	101	112	111	104	97	86
Elementary	19	52	82	81	64	74	82	81	76	71	63
High	7	19	31	30	24	27	30	30	28	26	23
Center	18	51	81	79	63	72	79	79	75	69	62
Elementary	13	37	59	58	46	53	58	58	55	50	45
High	5	14	22	21	17	19	21	21	20	19	17

TABLE 3-26 (Con't)

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988-2015
Dodge	4	10	16	16	12	15	16	16	15	14	12
Elementary	3	7	12	14	9	11	12	12	11	10	9
High	1	3	4	2	3	4	4	4	4	4	3
Halliday	26	71	113	111	88	101	112	111	104	97	86
Elementary	19	52	82	81	64	74	82	81	76	71	63
High	7	19	31	30	24	27	30	30	28	26	23

1/ Assume 19 percent of new population enrolled in elementary schools and 7 percent enrolled in high schools.

for each increment of 200 persons, about 24 new beds would be required to accommodate the stabilized population and operational labor force in 1988. This could be done either by expanding the present 39-bed hospital in Hazen or building a new facility. Over the peak construction period an additional eight beds would be needed for the temporary personnel peak.

If the present U.S. doctor-patient ratio of 1 doctor/700 persons is used, about nine additional doctors would be needed by 1980, with one additional doctor by 1984. About seven physicians would be required for the operations-related population after 1988. Because of the rural nature of the impact area, it is considered difficult to recruit the physicians necessary for adequate health care.

Initially, at least, existing medical facilities would be overcrowded. It is possible that hospital emergency room facilities would be particularly stressed because as people find it difficult to obtain a family doctor, they would use the emergency room for routine treatment (73). ANGCGC would have a nurse at the plantsite to provide emergency first-aid and to handle minor health problems of workers.

It is possible that rates of alcoholism, suicide attempts, divorce, and mental health problems would increase in the impact region (73) (See also Section 3.5.2.8). Since both the mental health outreach worker in Hazen and the mental health care center at Mandan are currently working at capacity, additional mental health services would be needed.

The likelihood of having adequate medical facilities and personnel available during the construction period is low because existing facilities are already near capacity and funding would lag behind growth. Also, it is extremely difficult to recruit medical personnel for rural areas in the region.

b. Safety

Plant and mining operations would have a direct effect on local safety conditions since a necessary corollary of any industrial development is the introduction of new and different safety hazards for people employed in the operation. Increased risks to the health and safety of residents and employees would be associated with many aspects of the operations of the plants, especially coal handling and blasting, the presence of flammable materials, and increased truck and automobile traffic. Some significant amounts of coal dust may be produced during blasting, loading, hauling, coal stacking, and reclaiming operations. This could have an effect on the respiratory health of the employees. The companies involved would be required to obey applicable regulations on employee health.

The primary potential safety hazard associated with the gasification process equipment and process streams would be from potential leaks or spills of liquids or gases. Oxidizing agents would be present within the gas processing system. Also, there is a low possibility of an explosive mixture occurring inside the process components. Should a leak occur in any of the system's piping, vessels, etc., a combustible mixture could develop outside the process units. The likelihood of such a leakage is extremely small.

Other safety hazards would be associated with the presence of flammable materials at the plantsite. Many gasification process byproducts and chemicals, such as oils, tars, naphtha, methanol, and phenols are flammable. The probability of accidents from handling these substances should be very low as the petrochemical industry has considerable experience handling these substances. Additional hazards are associated with the possible leakage of toxic materials, such as hydrogen sulfide and ammonia, which can be lethal in high concentrations. For both fire and toxic gas hazards, the distance of the plant from populated areas should prevent injury to persons or property off the plantsite.

The considerable increase in local traffic may affect local health conditions, both with respect to increased traffic accidents and air pollution. Traffic on some local highways would increase many times over. Because miles traveled are positively correlated with the number of accidents, this too would be a negative safety impact of the proposed projects.

The product gas pipeline would be close to the shoulder of the roadway where the route crosses the Snake Creek embankment. Although the possibility of an explosion or rupture of the pipeline at this location is remote, if such an explosion or rupture did occur, it could have serious negative effects on public safety.

3.3.2.4 Government Services

The police and fire departments in the impact area would require additional personnel to provide adequate protection. Using the national average of 1.9 police officers per 1,000 people, about 12 additional officers would be needed by 1980 in the impact area. About 8 additional officers would be needed for the post-1988 operational level. Based on 1 additional fireman per 1,000 persons 6 additional firemen would be needed by 1980; this would drop to 5 by 1988. The rapid population growth may require not only additional firemen, but a change from volunteer to paid forces.

In organized communities adequate police and fire protection could be made available; however, it is unlikely that either adequate fire or police protection would be available to any unregulated development in the area. Widespread unregulated development is unlikely because of strict zoning regulations in the affected counties, but some development outside the organized communities would occur (See Section 2.1.4.5 for current land use regulations).

3.3.2.5 Utilities

Facilities for such items as telephones, gas, electricity, water, and sewer service would also be stressed by the development associated with the population influx. Each new dwelling unit would require electricity, water, and sewer service. The existing water distribution and treatment would have to be expanded in most impact area cities as would many existing sewage treatment and disposal systems.

It may take several years for these services to catch up with the population growth unless adequate capacity is constructed in advance. The impacts that would be associated with inadequate services include possible drinking water contamination, water rationing, substandard dwelling units, possible increase in water-borne diseases, and inconvenience to the consumer. Expenditures would have to be made for storm drains, water distribution, and sewage collection facilities.

3.3.2.6 Transportation

The main effect of the proposed gasification and powerplants on local transportation will be increased traffic. Employment of 3,049 workers during the peak construction period and an average of 1,160 during operations would have significant effects on existing roads. Added to this would be an increase in vehicle ownership brought about by wages paid to employees.

ANGCGC and Basin Electric would provide a rail spur to transport supplies and products to and from the plants. The majority of heavy freight would be carried by rail due to convenience and economic considerations. However, local truck traffic would be increased due to small commodity shipments to the area.

The project work force would require automobile access to the plantsites. Due to the increased traffic on the major traffic routes of Mercer County, many roads would require resurfacing once or twice during project construction. Taxes paid on the plant facilities, vehicles, and fuel would provide some additional revenues, but they would not defray all such costs (113).

Some disruption of existing secondary, unpaved roads would result from the proposed development (Figure 3-4). County Road 13 would be blocked by the gasification plant and County Road 14, west of the plantsite, may be excavated due to surface mining. Alternate roads would be constructed around the plant and through the mine; thus, inconvenience to users of these roads should be small. Coal haul trucks from Mine 2 would cross County Road 11 and an overpass would be constructed to separate mine and county road traffic. These local county roads generally carry only small amounts of local traffic and some recreational traffic to Lake Sakakawea. There may be increased traffic by commuters on secondary roads between the plant and Pick City if the project is constructed.

There should be a moderate increase in passenger traffic at the Bismarck Airport due to the proposed projects. Beulah's general aviation airport would experience a significant increase in air traffic.

All product pipeline construction activities, including the movement of equipment, would be coordinated with the railroad. However, public roads would be used to provide access to the construction site and this would result in a short-term increase in local traffic levels. It is not likely that the increase in local traffic would require additional public funds for public highway construction or maintenance.

3.3.2.7 Recreation

It is expected that the proposed development would cause a significant increase in demand on existing recreational facilities in the region, and that recreational demands would be greatest on nearby Lake Sakakawea and for indoor recreational facilities. Table 3-27 shows minimum recommended recreational standards for North Dakota (109) and the additional facilities that would be required to accommodate the population increase associated with the proposed projects.

Lake Sakakawea, especially that portion directly north of Beulah, would receive a large influx of persons seeking swimming, boating, fishing, and hunting opportunities. Access to the lake is provided at three points north of Beulah near the Hille State Game Management Area. These access points will probably become overcrowded during the summer thus creating such problems as a decrease in the quality of the recreational experience, litter, vegetative damage to the Game Management Area, and increased possibility of recreational accidents.

Visitation of Lake Sakakawea State Park would also increase compounding already overcrowded conditions. Demands might also

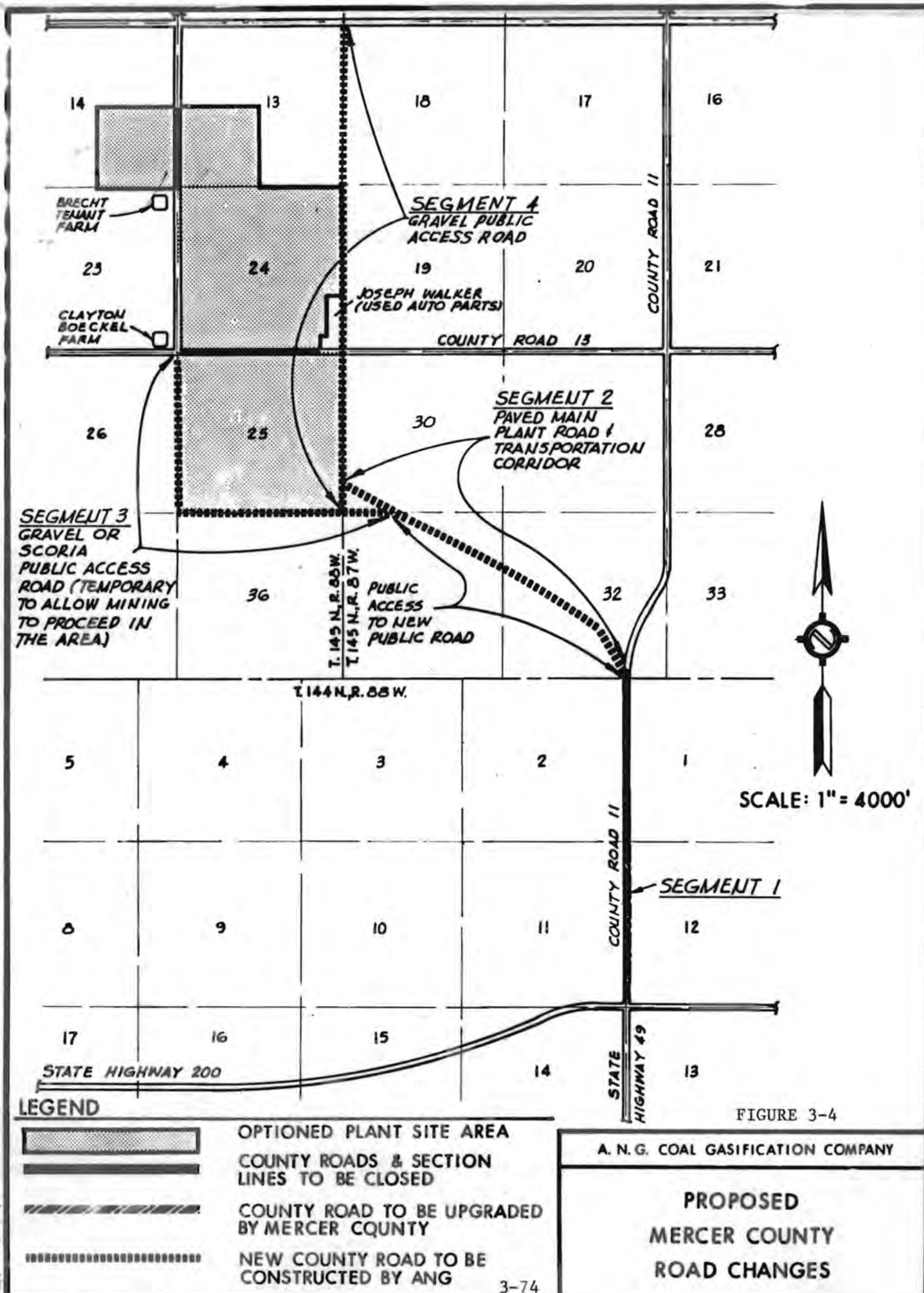
14
13
18
17
16
BRECHT TENANT FARM
SEGMENT 4
GRAVEL PUBLIC ACCESS ROAD
23
24
19
20
21
JOSEPH WALKER (USED AUTO PARTS)
CLAYTON BOECKEL FARM
COUNTY ROAD 13
COUNTY ROAD 11
SEGMENT 2
PAVED MAIN PLANT ROAD & TRANSPORTATION CORRIDOR
26
25
30
28
SEGMENT 3
GRAVEL OR SCORIA PUBLIC ACCESS ROAD (TEMPORARY TO ALLOW MINING TO PROCEED IN THE AREA)
36
T. 145 N., R. 88 W.
T. 145 N., R. 87 W.
PUBLIC ACCESS TO NEW PUBLIC ROAD
32
33
T. 144 N., R. 88 W.
5
4
3
2
1
SCALE: 1" = 4000'
SEGMENT 1
8
9
10
11
12
17
16
15
14
13
STATE HIGHWAY 200
STATE HIGHWAY 49
LEGEND
OPTIONED PLANT SITE AREA
COUNTY ROADS & SECTION LINES TO BE CLOSED
COUNTY ROAD TO BE UPGRADED BY MERCER COUNTY
NEW COUNTY ROAD TO BE CONSTRUCTED BY ANG
A. N. G. COAL GASIFICATION COMPANY
PROPOSED MERCER COUNTY ROAD CHANGES

FIGURE 3-4

TABLE 3-27

North Dakota Recommended Minimum Recreation Standards
and Facilities Required in Impact Area
During Peak Construction Year (1980)

Facilities	Recommended Standards	Additional Facilities Needed
Park Space	1 acre/75 persons	83 acres
Picnicking	3 acres/1,000 persons	18 acres
	7 tables/acre	126 tables
Campgrounds	15 campsites/1,000 persons	90 campsites
Baseball	1 diamond/2,000 persons	3 diamonds
Tennis	1 court/2,000 persons	3 courts
Basketball	1 court/1,000 persons	6 courts
Track	1 field/8,000 persons	1 field
Volleyball	1 court/2,000 persons	3 courts
Horseshoe	1 court/1,000 persons	6 courts
Swimming Pools	1/7,500 persons	1 pool
Wading Pools	1/8,000 persons	1 pool
Archery, Trap, Skeet	1 range/7,500 persons	1 range
Golf	1 hole/800 persons	8 holes
Playground	at least 1	1 playground

increase significantly at Theodore Roosevelt National Park and the Little Missouri Grasslands.

Current indoor recreational facilities in impact area cities are not adequate to meet the projected increased demand. However, it is likely that private entepreneurs would take advantage of opportunities by opening new facilities to satisfy some of the demands that would result from the increased population.

New parks and other public recreation facilities would be needed. At an average annual per capita cost of $9 (72), about $45,000 would have to be spent annually to provide adequate public park facilities for the post-1988 population. It is expected that recreation facilities would be crowded during peak construction activity.

3.3.2.8 Summary and Analysis of Infrastructure Impacts

The infrastructure in the impact area would experience increased pressure from the anticipated population influx. The most severe pressures would be experienced during the first 8 years of development. After that time the influx would have begun to level off, and a more stable population would be reached by about 1988. In many cases, there could be a lag time between the need for a service and the provision of that service. Facilities requiring tax revenues would be especially sensitive to this time lag.

The severity of the socioeconomic impacts discussed above depends, in part, on the degree that local communities plan for, and construct in advance, the facilities necessary to accommodate the population influx. Some monies needed for the construction of the facilities could be obtained from coal severance tax funds and other sources; if these sources are utilized, many of the impacts would be lessened accordingly.

A Mercer County Task Force has been organized to bring county citizens together to assess socioeconomic impacts from energy development and to advise the County Commission as to possible methods of preventing or lessening these impacts. Chairmen of committees working on specific problems are appointed by the County Commission. The Task Force would coordinate planning activities, serve as a clearinghouse, and seek Federal and local assistance. Such a body could serve to effectively lessen impacts if it is able to function properly but the planning process in Mercer County is complicated by the scope of the proposed energy projects, long established municipal rivalries, and limited economic resources and expertise. Prevention or reduction of socioeconomic impacts in Mercer County could depend on the effectiveness of this Task Force.

Front-end funding for facilities and services needed to prevent or reduce socioeconomic impacts in the involved counties is a serious problem that needs solution. Some funding from coal severance tax funds was received in 1976 for expansion of educational facilities in the Stanton ($251,000), Beulah ($185,000), and Hazen ($456,000) school districts. Also, the cities of Beulah, Hazen, and Zap have received $275,800, $184,000, and $104,000, respectively, for water system, sewage disposal, and other improvements. In addition, Mercer County received about $225,000 in 1976 from their share of the severance tax, but all of these monies are only a small part of what would be needed to substantially reduce impacts resulting from energy development. Coal conversion and other taxes on the ANGCGC and Basin Electric plants would more than double Mercer County's current tax revenues after the plants are in operation, but there is no provision in State law for prepaying these taxes to provide front-end financing.

The 1976-1977 Legislature made several changes in the allocation of coal severance and conversion taxes (see Section 2.3.2); it now seems probable that after a few years of plant and mine operation that adequate monies for community services would be available.

It does not appear, however, that the legislative changes will solve the problem of front-end financing. Impacted counties, cities, and school districts can borrow front-end monies from the Trust Fund but such borrowing incurs a long-term debt at 6 percent interest and is a last resort funding source (i.e., entities wishing to make loans must have explored private sources and been unable to find adequate money at reasonable interest rates or be bonded to capacity). Moreover, the fund is only expected to have about $4 million available for loans before 1980.

The area's rapid growth, if the projects are implemented, would cause a considerable amount of internal strain. New residents of the area would bring in new ideas and some of the conservative values of the present community would be threatened by these new ideas. This internal stress could cause considerable controversy relating to education, public health, tax, zoning, and land use issues.

A population increase requires elaboration and differentiation in the social structure to accommodate new participants in the system. As new positions within the existing social structure are created, new roles, role expectations, and role behaviors emerge. Communications become more complex and the possibility of misunderstanding increases. Existing in-groups may be strengthened by the sudden appearance of newcomers who, because of their transient nature, may have difficulty in joining existing community groups, both formal and informal. Some resentment and polarization of groups is typical. Existing systems, which have regulated behavior between and within established groups in a community, become strained as the necessity for dealing with new residents emerges.

A population decrease produces effects within the social structure as well. A declining population causes a consolidation in the social structure and an accompanying concentration of position functions in fewer participants. During the transitional period, functions which had been routine may not occur because of ambiguity in role functions. Some social disruption is inevitable under such conditions.

A secondary effect of population increases and declines occurring within a short time frame is a decrease in the effectiveness of existing norms. Norms are the shared definitions of appropriate and inappropriate behaviors. Sociologists use the term "anomie" for a state of relative deregulation or normlessness in a social system where a consensus of norms no longer exists. Such a condition is experienced by participants variously as feelings of alienation, powerlessness, meaninglessness, estrangement, being controlled by powerful outside sources, and isolation. Such a decline in the effectiveness of normative regulation can be expected as a result of population changes associated with the proposed projects. Anomie is closely associated with increased suicide, criminality, alcoholism, and other social problems.

The increases and declines in population projected for the study area over the next 11 years, and the primary and secondary social effects of development, are substantial. Effects of the kinds noted above can be expected to occur as a result. However, such changes would occur in any existing social system, but at a much slower rate and allowing some time for readjustment of personal norms.

In the existing community, success, upward mobility, status, and economic development are dominant cultural values. Attitudes favoring maintenance of small-town life are present. Current access to goals associated with values among residents of the impact area is reasonably high.

Future conditions without the developments would likely be perceived as adverse among residents in the impact area. The perceived likelihood of improving access in the economic structure depends largely upon increased development of coal in the area. Residents of the area are well aware that plans for such development exist. Expectations for economic advancement have developed accordingly. Thus, a continuance of existing economic conditions due to the lack of development would occur within the context of rising expectations. The resulting disparity between what was valued and expected versus that which would occur without development would be very large. Substantial frustrations and disappointment could result.

Perceived future conditions with the proposed development would not result in this kind of disparity. On the contrary, the perceived access to economic goals implied by the current value structure would be enhanced with the development. The number of positions in the opportunity structure would increase, affording more choice and a wider variety of ways of attaining valued economic goals.

The social control structure--the institutional structures which collectively sanction behaviors--would be affected by the proposed developments. As the number of participants in any social system increases, there is increased pressure upon the sanctioning institutions. The population changes projected for the impact area would require substantial expansion of local authorities who are responsible for maintaining social control. Under the social conditions anticipated, it would be more difficult to maintain regular, predictable, and fairly distributed sanctions for normative violation. It would, however, be more important to sustain orderly social life than regularity, predictability, and fairness of sanctions produced.

3.4 Impacts on the Sociocultural Environment

3.4.1 Impacts on Indian People

Because the Fort Berthold Reservation is 8 miles from the proposed gasification complex at its closest point, some direct impacts to the reservation would be inevitable. The largest potential environmental impact would be an intermittent reduction of air quality and visibility on the reservation from the proposed plant. The reservation is on the upwind side of the plant, but about 30 percent of the time winds from the southeast quadrant. This would cause some occasional reduction in visibility and increase in pollutants on portions of the reservation.

Economically, the construction and operation of the plant and mine could provide some jobs for Indians, either by direct employment at the plant or mine or through some of the indirect jobs created due to the influx of workers.

The population increase in the area could cause many problems for the Indian people and increase the burdens on the tribal Government. Because the tribes are a sovereign entity, many jurisdictional questions could arise from the non-Indians in the area which would occasionally enter the reservation. The presence of more non-Indians on the reservation would be an increased burden to tribal law enforcement and regulatory agencies.

It is possible that with the increased employment opportunities, some of the Indians now living off the reservation will return and commute to the jobsite. This would put increased stress on an already tight housing situation on the reservation. It would also mean increased burdens on the reservation agencies providing medical, social, and other services. The reservation would not be expected to realize any substantial amount of impact monies since Fort Berthold is located in portions of five counties, each of whom would be having problems funding necessary programs.

The ANGCGC gasification project by itself would not have a large impact on the traditional Mandan, Hidatsa, and Arikara cultures. However, as one of several planned industrial developments for the area, the ANGCGC project will contribute to the conflict these tribes will experience to maintain their traditional cultural identities in the face of increasing social interactions with other Americans.

3.4.2 Impacts to Historical and Archaeological Features

The eight archaeological sites in the area of the plant and mine may be disturbed; however, mitigation of effects on these sites would be carried out in cooperation with the North Dakota State Historical Society.

The Boeckel and Saron cemeteries, two German-Russian mud houses, and unique plant community on top of the flat-topped butte will be outside the areas slated for construction or mining. Since release of the draft EIS, studies by the North Dakota State Historical Society, financed by ANGCGC and Basin Electric, have located 140 cultural resource sites in the general area of activity of the proposed plant and mine. ANGCGC is working with the State Historical Society to avoid or mitigate impacts to these sites (see State Historical Society letter pages J-96 to J-98). The increased population associated with the proposed project would increase the potential for vandalism of these and other nearby sites.

The construction of the proposed product pipeline may disturb undiscovered extensions of 20 known archaeological areas but it would also provide the opportunity for discovering new areas. Four sites are currently crossed by the railroads along the proposed route, and 16 more are known to occur in close proximity (Table 2-39). Some of the latter sites could extend into the railroad ROW. It is unlikely that any remains are left in the ROW itself but if they do, the impact to 6 particularly valuable sites could be major; impacts to the 16 remaining site would be either unknown (7) or medium (7) (Table 2-39). The proposed route would cross the Fort Clark Historic site in North Dakota along the existing railroad ROW and pass close to the Knife River Indian Villages National Historic Site (but would not disturb it). Since the existing ROW goes through an Indian burial ground at the Fort Clark Site and since the Knife River Indian Villages Site could extend onto the ROW, any remaining archaeological material may be disturbed.

All studied archaeological sites occur in North Dakota. There have been no major studies of the six sites in Marshall County, Minnesota, so the significance of impacts to these unique features in this portion of the route are largely unknown.

3.5 Impacts in Market Area

Impacts in the market area (i.e., Michigan, Wisconsin) from the proposed project would be associated with the use of the product gas.

The purpose of the proposed project is to keep a constant supply of gas available to residential and light commercial customers. The impact of this constant gas supply would be to lessen the possibility of gas service curtailments and the resulting inconveniences and increased expenses to existing customers.

The provision of a continuing supply of natural gas would reduce the need of customers to switch to other, less clean burning fuels. The air pollutants produced by the consumption of SNG in the market area would be less than those produced by the use of oil or coal for the same purposes.

The increase in gas costs due to the addition of SNG to the American Natural Resource system would raise the price of gas in the entire system. Thus all system gas customers would experience an incremental increase in their gas costs due to this project.

3.6 Cumulative Impacts of Coal-Related Development

This section is designed to discuss in a general way the major impacts that could accrue to the impact area from the currently proposed projects within a 30-mile radius of Beulah (listed in Section 1.3.4.1). More detailed analyses of the impacts may be found in the Bureau of Reclamation and BLM North Dakota regional environmental statements discussed in Section 1.3.4.2.

The total estimated emissions from all of the currently proposed projects are summarized in Table 3-28. The estimates for NGPC were based on the fact that NGPC is proposing to generate some of the electrical power needs of their plant by burning coal fines. Thus, the estimates are slightly higher than those of ANGCGC who would receive their power from the Basin Electric powerplant.

The proposed coal-related developments in the vicinity of Beulah would emit about 22,640 lbs of NO_x, 38,937 lbs of SO^2, and 2,107 lbs of particulates into the atmosphere every hour. The NO_x emissions are higher than necessary with existing technology because coal-fired boilers are available for powerplants that only emit 0.5 lbs NO_x per MMBtu of input (56, 82). In addition, smaller amounts of hydrocarbons, carbon monoxide, and various trace elements would also be emitted.

TABLE 3-28

Total Emissions from Proposed Coal-Related Developments Near Beulah, North Dakota (lbs/hr)

Development	NO_x	SO_2	TSP
ANGCGC	1,100	2,825	265
Basin Electric	4,930	11,832	424
Coyote 1/	7,820	11,000	912
NGPC 2/	1,870	2,840	255
MPC 3/	6,920	10,440	251
Total	22,640	38,937	2,107

1/ Two 440-MW units. Emissions represent 0.86 lbs NO_2, 1.2 lbs SO_2, and 0.1 lb TSP per MMBtu of coal consumed.

2/ One 250-MMcf/day plant.

3/ One 440-MW and one 235-MW unit. Emissions represent 1.03 lbs NO_2, 1.2 lbs SO_2, and 0.1 lbs TSP per MMBtu of coal consumed.

In southwestern North Dakota where the existing ambient pollutant concentrations are much lower than Federal and State standards, the proposed developments could meet all pollution standards (which allow for some air quality depradation) yet significantly degrade existing air quality. If all of the proposed developments are built, further development could be curtailed by the Federal and State Significant Ambient Air Deterioration limits. The following discussion relates the kinds of effects that have been noted to result from industrial air emissions in other regions; the degree of impact in North Dakota will depend on local physical and biological conditions.

Acid rains can result from SO_2 emitted into the atmosphere. Normal rainwater has a pH value in the range of 5.5 to 5.7 due to the dissolution of CO_2 in water and thus is already slightly acidic. The presence of SO_2 decreases the pH of rainwater because it is soluble in water and forms sulfurous acid (H_2SO_3). This acid dissociates in two stages to produce hydrogen ions. This dissociation is significant in polluted atmospheres and increases the acidity of the rainwater. NO_2 emissions can also increase the acidity of rainwater by formation of nitric acid, but on a smaller scale than SO_2 emissions. Acid rains can increase the acidity of lakes and/or streams beyond the tolerance of aquatic plants and animals, or inflict physical damage to terrestrial plants (58).

Most North Dakota waters are presently alkaline; thus, little or no impact on North Dakota waters from increased rainwater acidity is expected. However, emissions from the proposed developments could travel large distances, and when combined with those from other industrial sources, contribute to acid rains elsewhere (i.e., Minnesota) where some waters are already acidic.

The various pollutants emitted into the atmosphere such as SO_2, NO_x, fluoride, and heavy metals have the ability to singly and/or in combination cause visible and measurable adverse effects to the surrounding flora and fauna. Coniferous plant species in an area are generally the first plants to visibly manifest symptoms because of exposure to SO_2 and NO_x (dwarf needles, abnormal cellular arrangement, etc.). Few conifers occur naturally in the area of concern and it is not known what prairie plants might be sensitive to low-level emissions. However, almost all plants concentrate the pollutants in their tissues to some degree (54, 67) and the materials are then passed on to animals who consume the vegetation. A monitoring program should be established in the impact area to determine the effect of these emissions on prairie plants.

The best documented impacts of various trace elements on animals are those from fluoride and mercury. High fluoride accumulations in mammals are directly correlated with the contamination of the vegetation ingested. In extreme cases, excess fluoride is stored in the bone structure to the extent of causing varying degrees of disfiguration and structural bone damage to the animal. Fortunately, little if any fluoride is stored in soft tissues or fluids thus decreasing the hazard to human health.

Aquatic organisms concentrate mercury within their bodies when the intake rate exceeds the elimination rate (59). The resultant buildup of mercury may become toxic to both the organisms themselves and humans who may consume them. For example, methylmercury concentrations in fish in Navajo Lake, New Mexico, and in Lake Michigan are near the lower range of mercury concentrations noted in fish thought to have caused human deaths (60). In North Dakota, the alkaline waters may "tie up" much of the mercury by precipitating it out, thus reducing the hazards to humans and animals.

Ambient concentrations of SO_2, NO_x, and particulates are known to be among the factors involved in the formation of photochemical smog. Other factors include nonmethane hydrocarbon concentrations, moisture, and ultraviolet light. The chemical and physical mechanisms in smog formation are not well understood; thus, it is not possible to predict whether or not smog episodes would result if all the proposed projects are built. However, the normally good dispersion characteristics of the region would lessen the possibility of smog formation.

If all of proposed developments are built, about 29,600 acres of land would be disturbed (Table 1-2). Prairie grasses, forbs, and brush form the basis of the natural energy system on these lands which serve as wildlife habitat of varying degrees of quality. Long-term reductions in the wildlife habitat base would result from the proposed developments. Areas where structures and urban developments occur would be entirely lost, at least during the life of the developments. Strip-mined lands would also be permanently affected because of reclamation of mined land to cropland or pasture grasses rather than restoration of the entire spectrum of native vegetation. Gullies and ravines with patches of brush and trees, which provide food and shelter for wildlife, would be almost entirely absent from reclaimed lands.

Populations of some wildlife species (e.g., pronghorn antelope and sharp-tailed grouse) in the areas used for mining, industrial, and support facilities would be permanently reduced because of the loss of suitable prairie habitat. Competition for limited habitats would temporarily increase mortality rates of certain species.

Secondary effects of the proposed developments would be to increase air pollutants and surface fogs, which can reduce the photosynthetic rates of plants. The productivity of the affected areas would therefore be reduced. Direct physical damage to plants from SO_2 and NO_x could also result, further reducing productivity. Trace elements can fall onto plants which are eaten by animals whose bodily condition can be adversely affected.

Erosion, habitat destruction, and construction leading to the siltation of surface waters may reduce populations of aquatic organisms (including fish). Indiscriminate use of chemicals and pumping mine-pit water into surface waters could affect aquatic plant and animal communities. Other possible impacts to the flora and fauna from the proposed developments would be similar to those discussed in Section 3.2 for the proposed project.

The estimated annual worker requirements for the five proposed developments are shown in Table 3-29. It should be emphasized that these are only preliminary estimates based on the best information available as of October 1976 and are subject to change as the various companies revise and reevaluate their plans. Also construction workers could work on more than one project thereby reducing the total number of new construction workers needed.

Based on an average of 3.5 persons moving into the area for each direct worker to account for indirect employment and worker families, the approximate total in-migrating population associated with the proposed developments would be as follows:

1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
4,950	10,650	16,300	21,350	20,700	21,300	14,400	13,900	11,700	9,800	8,700

The existing population in the region of the proposed developments would be approximately quadrupled by 1981 from the influx of the construction and operations related population. The magnitude of the above increases and the subsequent decline of the construction population by 1988 would change the existing rural social structure of the impact area.

The costs to local governments could require increased long-term debt to expand community facilities to accommodate the increased population if adequate front-end financing is not provided. Educational, health, recreational, and other public service facilities would be overcrowded and stressed. Physical infrastructures such as utility, transportation, and communication facilities would also be overburdened by the rapid population influx. Persons with a limited ability to profit from the developments, such as those on fixed incomes, would be most severely affected. Once the construction phase is completed and the temporary segment of the population moves out, surpluses in housing and public facilities would also occur with attendant financial

TABLE 3-29

Approximate Annual Average Worker Requirements of the Proposed Coal-Related Developments
Near Beulah, North Dakota

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Construction											
ANGCGC	442	1,397	2,016	1,052	330	467	1,008	1,321	1,136	313	0
Basin Electric	195	582	799	478	486	752	397	52	0	0	0
Coyote	677	921	1,000	1,002	609	784	837	430	0	0	0
NGPC	0	0	350	2,500	3,400	3,000	200	0	0	0	0
MPC 1/	0	0	0	0	0	0	0	0	0	0	0
Subtotal	1,314	2,900	4,165	5,032	4,825	5,003	2,442	1,803	1,136	313	0
Operation											
ANGCGC	47	81	147	692	692	692	692	692	724	1,000	1,000
Basin Electric	5	5	57	95	108	108	160	160	160	160	160
Coyote	0	0	231	231	231	231	261	271	271	271	271
NGPC 2/	0	0	0	0	0	0	500	1,000	1,000	1,000	1,000
MPC	50	50	50	50	50	50	50	50	50	50	50
Subtotal	102	136	489	1,068	1,081	1,081	1,663	2,173	2,205	2,481	2,481
TOTAL	1,416	3,036	4,654	6,100	5,906	6,084	4,105	3,976	3,341	2,794	2,481

1/ Construction would be completed by 1977.

2/ Estimate based upon ANGCGC operational worker needs.

problems for local governments, institutions, and commercial establishments.

Although adequate community planning and development of new housing, recreational, and other public and private services could lessen impacts, there is no clear cut strategy by either industry or governments to finance the short-term needs of local governments to accommodate a rapid population increase. Without the proper financial and technical resources, many of the local communities could be severely affected if the proposed developments actually occur.