# RECLAMATION OF SAND AND GRAVEL MINES IN DALLAS AND TARRANT COUNTIES, TEXAS, FOR RECREATIONAL USE

by

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# CHAPTER I

## INTRODUCTION

Stated in simplest terms, basic reclamation of mined lands means returning the land to approximately its original condition. In general, basic reclamation procedures include grading or topping of spoil banks, re-establishing vegetational cover, supplying nutrients necessary for sustained plant growth, and applying chemicals needed to stabilize soil pH.[1]

In many cases, " . . . the feasibility of reclaiming mined lands is no longer an academic question."[2] Mined land often can be returned to approximately its original condition. Farmland can be re-established, forests regrown, and natural landscapes repaired.

However, basic reclamation alone is not always in the best interest of the general public. A specific mine site might more often meet the needs and desires of the

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[1]Eugene P. Pfleider, ed., Surface Mining (New York: American Institute of Mining, Metallurgical, and Petroleum Engineers, Inc., 1968), pp. 250-251.

[2]Kenneth D. Ratliff, Kentucky State Reclamation Inspector, Frankford, Kentucky, personal letter, March 12, 1971.

people if it were reclaimed for a more utilitarian use. One such re-use would be as open space or parkland for active or passive recreation.

The Department of the Interior asserts, "There is no doubt that strip or surface mining operations blight the landscape."[3] The general land form is changed, the vegetation is destroyed, and the soil structure is altered to the degree that natural reformation of soils capable of supporting plant life may take many years. Meanwhile, erosion from spoil banks goes unchecked, and runoff waters may add great amounts of silt and noxious chemicals to the watershed, and possibly to the ground-water table.

In addition to these problems, depleted mine sites often invite the non-regulated dumping of garbage, construction materials, junked cars, and so forth. Such misuse endangers public health and safety, as well as promoting a condition of ugliness. Never has the American landscape changed so rapidly, " . . . never have we exploited our irretrievable natural resources more ruthlessly."[4]

The need for reclamation of mined lands in Texas is obvious. The 166,000 acres of land disturbed by strip

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[3]U.S., Department of the Interior, Surface Mining and Our Environment (Washington, D.C.: U.S. Government Printing Office, 1967), p. 52. Hereinafter referred to as Mining and Environment.

[4]Roberts Mann, "Land Policies," Parks and Recreation, January, 1968, p. 68.

and surface mining in Texas as of 1965 represents the sixth largest total of all fifty states.[5]

Much more land will be disturbed in Texas for mineral extraction in the future. The completion of the 1,150,000 kilowatt power plant near Fairfield will usher in " . . . a new era in public power supply in Texas--a switch in fuels from natural gas to lignite . . . it introduces large scale strip mining to Texas."[6] Company officials have asserted their belief that the environmental degradation associated with strip mining operations elsewhere will not occur in Texas. Unfortunately, mining-related environmental degradation is already occurring in Texas. According to a special report by the Department of the Interior, of the total 166,000 acres of land disturbed by strip or surface mining operations in Texas as of 1965, 136,400 acres were in need of reclamation.[7]

By far the largest portion of the total land mined in Texas is exploited for the extraction of sand and gravel. Texas leads the nation in lands disturbed for sand and gravel production. Of the total lands disturbed for mineral

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[5]U.S., Department of the Interior, Mining and Environment, Appendix I, Table 1, p. 110.

[6]Editorial, Houston Post, April 4, 1971, sec. A, p. 3.

[7]U.S., Department of the Interior, Mining and Environment, Appendix I, Table 2, p. 111.

extraction in the state, about 70 per cent or over 122,000 acres has been mined for these materials.[8]

While the usefulness of land is being diminished for the extraction of minerals, the need for more park and open space land is increasing rapidly. This is especially true around urban centers, where competition for land is keen, and where millions of Americans spend a large portion of their leisure time. Park planners are now faced with the problem of how to provide adequate recreation areas for a rapidly expanding, leisure-oriented population.

Dallas and Tarrant Counties are not exempt from this problem. In 1959, the Dallas Park and Recreation Department recommended doubling the city park acreage by 1980, based on the predicted doubling of the county's population over the same period of time.[9] From 1960 to 1970, the population of Dallas County increased 39.5 per cent, and even if the present rate of increase remains constant the population will double by 1980.[10] Fort Worth

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[8]U.S., Department of the Interior, Mining and Environment, Appendix I, Table 1, p. 110.

[9]Department of City Planning and Department of Parks and Recreation, Dallas, Texas, Parks and Open Spaces--A Master Plan Report (Dallas, Texas: Department of City Planning and Department of Parks and Recreation, 1959), p. iv.

[10]U.S., Department of Commerce, Bureau of the Census, United States Census of Population: 1970, Vol. I, Final Population Counts, pt. 45, Texas.

city planners, in 1963, recommended the acquisition of over 1,200 acres of community, neighborhood, and sub-community parks by 1980, along with the acquisition of larger park-lands.[11]

Of considerable interest to city park planners in Dallas and Tarrant Counties is the fact that the production of sand and gravel is usually located on the urban fringes. At the present time, "The major sand and gravel supply sources for the Dallas-Fort Worth area are the nearby Grand Prairie and Seagoville deposits. . . . "[12] Both these areas are located very near the metropolitan areas: the Seagoville deposit directly south of Dallas, and the Grand Prairie deposit between the two cities.

Because of their general size, location, and terminal site characteristics, many mined sites could provide excellent park or open space land if they were reclaimed concurrent with extraction operations or immediately upon abandonment. As parks and open space they would tend to increase the value of adjacent lands and improve the quality

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[11]Department of City Planning, Fort Worth, Texas, Preliminary Plan for the 1980 Urban Area--Fort Worth, Texas (Fort Worth, Texas: Department of City Planning, 1965), p. 76.

[12]U.S., Congress, House, Trinity River and Tributaries, Texas, letter from the Secretary of the Army on the Re-evaluation of the Navigation Features of the Project for the Trinity River, H. Doc. 364, 90th Cong., 1st sess., 1968, I, 17. Hereinafter referred to as Trinity River, H. Doc. 364.

of life as they were enveloped by the city.[13] They could also serve to partially guide or direct the growth of the city.

Unfortunately, little thought is given to the concurrent or subsequent use of these areas prior to extraction operations. All too often the deposit is depleted and the site neglected until it is surrounded by the growing city, and rising land values make reclamation more feasible.

## Objectives

This study was conducted to point out the recreational potential of sand and gravel mines in Dallas and Tarrant Counties. The objectives of this study were: (1) to determine the feasibility of reclaiming sand and gravel mines in Dallas and Tarrant Counties, Texas, for recreational use and (2) to review existing legal controls and to present alternatives applicable to the reclamation of mined areas in Texas.

## Methodology

An inventory was made to determine the location and size of active and depleted sand and gravel mines in Dallas

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[13] The Sociological and Economic Impact of Urban Parks in Dallas, Texas, in 1966, E.J. Urbanovsky, project director (Lubbock, Texas: Texas Technological College Press, 1967), pp. 18-36.

and Tarrant Counties. Mined areas were located by the use of high altitude photography (see Plate I). Acreages were computed with the use of a dot grid containing 100 dots per square inch (see Table 1). Computations were based on the procedure recommended by Avery.[14]

A parcel of land was selected to illustrate the various planning considerations which would have to be analyzed to determine the recreation potential of a mine area. Maps were developed which served to point out the recreational attributes and limitations of the site. Data on these maps illustrates the following:

1. Regional location significance
2. Area location significance
3. Access
4. Present land use
5. Future land use
6. Site physiography
7. Site soils and limitations.

This data was verified by personal inspection and formed the basis for a conceptual plan of development for the study site.

An inventory of existing and proposed federal and state reclamation laws was made. Comparisons were made

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[14]T. Eugene Avery, Interpretation of Aerial Photographs (Minneapolis, Minnesota: Burgess Publishing Company, 1968), pp. 37-40.

# SAND and
# Dallas an

PLATE I

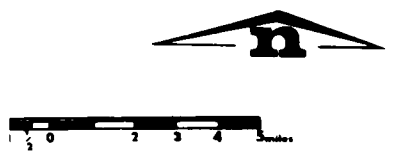

## L E G E N D

**Gravel Sites**

- ■ wet active
- □ dry active
- ● wet depleted
- ○ dry depleted

**Population Distribution**

- rural-low density
- urban-medium density
- urban-high density




Data from National Aeronautical and Space Administration high altitude photos 1970

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 17 | 54 | 39 | 43 | 61 | 217 | 83 | 22 | 105 | 54 |
| 18 | 98 | 40 | 98 | 62 | 130 | 84 | 22 | 106 | 130 |
| 19 | 33 | 41 | 54 | 63 | 22 | 85 | 98 | 107 | 43 |
| 20 | 65 | 42 | 43 | 64 | 152 | 86 | 119 | 108 | 11 |
| 21 | 119 | 43 | 76 | 65 | 174 | 87 | 195 | 109 | 11 |
| 22 | 130 | 44 | 33 | 66 | 109 | 88 | 65 | 110 | 173 |
| | | | | | | | | Total Acreage: | 9,199 |

[a]Computed from National Aeronautical and Space Administration high altitude photography, 1970, with the use of a dot grid system, according to Avery's Interpretation of Aerial Photographs.

[b]Number as listed on Plate I.

between these laws and similar legislation introduced in the 62nd Texas Legislature. Based on the problems related to reclamation laws encountered in other states, suggestions were made for improvement in the legislation proposed for Texas.

## CHAPTER II

## LITERATURE REVIEW

In Dallas and Tarrant Counties, sand and gravel extraction comprises the bulk of all mining activities. As of October, 1970, over 9,000 acres of land which had been mined for sand and gravel were in need of reclamation.[15] The very nature of the mining operation, as it is currently employed, has left these sites highly undesirable for nearly all types of use. This land does not lack the potential for development for a wide variety of secondary uses. Unfortunately, " . . . developers seldom consider a depleted sand and gravel site as arable land even though the same can be transformed into a finely graded and pleasantly green site which would be readily acceptable."[16] Included in this chapter is a summary of the reclamation considerations which could be used to determine the feasibility of

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[15]Computed by use of a dot grid system from National Aeronautical and Space Administration high altitude photos, 1970.

[16]David R. Jensen, Selecting Land Uses for Sand and Gravel Sites (Silver Spring, Maryland: National Sand and Gravel Association, 1967), p. 12.

developing a given sand and gravel mine for a specific re-use, as well as a review of some of the secondary uses which are possible at depleted sites.

## Basic Reclamation Considerations

### The Nature of the Deposits

Typically, the sand and gravel deposits in Dallas and Tarrant Counties are in one of two locations. The larger deposits are located in the floodplain of the Trinity River and its many tributaries. Gravel from these deposits is usually clean, well sorted, and nearly devoid of impurities.[17] These deposits are shallow, ranging in depth from five to fifteen feet.[18] The average thickness of the deposits ranges from ten to twenty feet.[19] Gravel from these deposits is used mainly in the production of concrete.

The second type of deposit is located on the second or T-2 terrace, usually fifty to seventy feet above the stream grade (see Fig. 1).[20] Gravel from these deposits

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[17]Bob H. Slaughter, Director of Vertebrate Paleontology, Southern Methodist University, Dallas, Texas, personal letter, August 6, 1971.

[18]Robert Woodliff, General Manager in Charge of Operations, Trinity Gravel Division of Portland Cement, private interview, Dallas, Texas, August, 1971.

[19]Ibid.

[20]Slaughter, letter.

is usually poorly sorted and may contain a high percentage of clays, chalks, and other cementing agents which necessitate a crushing operation.[21] Gravel of this type is used primarily for road construction.

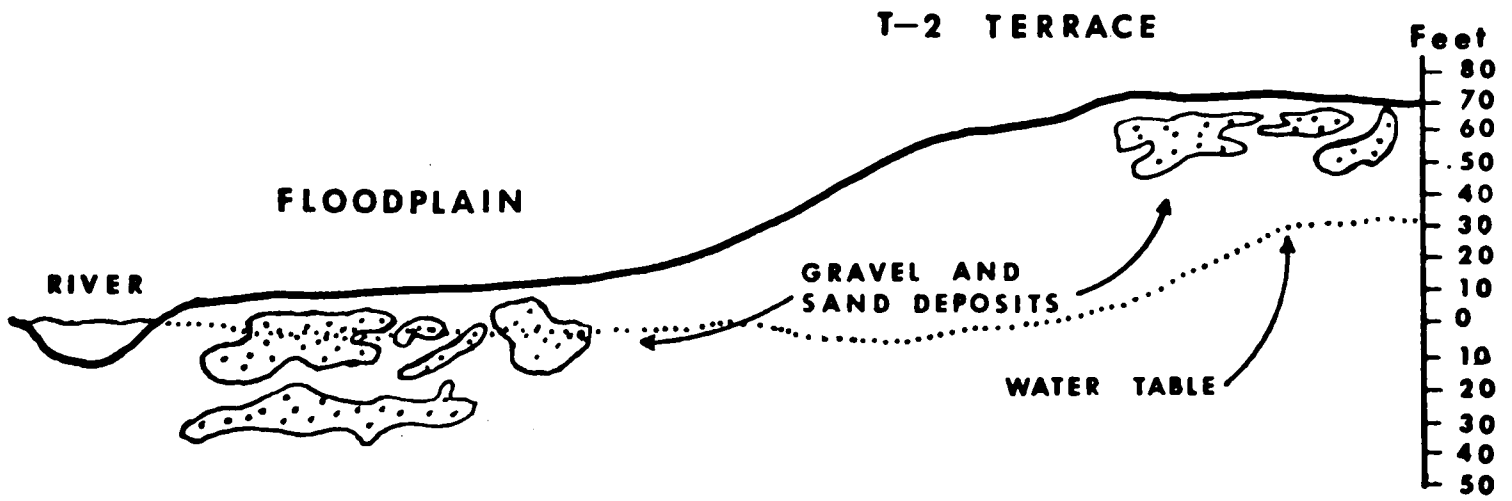


Figure 1.--Relationship of sand and gravel deposits to floodplain and T-2 terraces.

## The Mining Process

One of the foremost considerations which will affect the reclamation of a mined area is the type of mining operation employed. Also, the equipment used in any particular phase of the operation--stripping overburden, excavating, transporting, and processing--may, in part, determine the feasibility of reclaiming the land for a particular use.

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[21]Slaughter, letter.

In Dallas and Tarrant Counties, most sand and gravel deposits are mined by a process known as area strip mining, a practice commonly used on relatively flat terrain.[22] Usually a single trench, or "box cut," is made through the overburden to expose the deposit. This first cut may extend to the limits of the property or the deposit. As succeeding parallel cuts are made, the overburden (spoil) from each new cut is deposited in the previous cut from which minerals have been extracted. The final cut leaves an open trench as deep as the thickness of the overburden plus the thickness of the deposit; it is bound on one side by the last spoil bank and on the other side by the undisturbed high wall. Frequently the final cut may be more than a mile from the starting point.

## Stripping Overburden

Technically, overburden refers to the materials located directly above a deposit which must be removed before the deposit can be mined. Most commonly, these materials are the trees and associated floral cover, the topsoil, and the subsoils. Trees are usually removed with a bulldozer and piled along the edges of the deposit. Topsoil may be removed with a bulldozer, front end loader,

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[22] U.S., Department of the Interior, Mining and Environment, p. 34.

scraper, dragline, or a combination of equipment. The same equipment may be used to remove subsoil, although if the deposit is deep, the use of a bulldozer or scraper may be less feasible than the use of a dragline. When a dragline is used, the deposition of overburden may be limited to windrows near the excavation point, on adjoining unexcavated areas, or in the excavated area itself.[23] However, the use of trucks, carryalls, and other transporting vehicles in combination with the dragline, permits a greater hauling distance and therefore more choice in the deposition of overburden. In the Dallas-Fort Worth area, the dragline is most commonly used for stripping overburden.

## Excavation

The type of equipment used for excavation depends, to a large extent, upon whether a site is wet, dry, or both, and upon the depth, thickness, and quality of the deposit.

The dredge is one of the most common pieces of equipment used in a wet excavation, especially where the area is large and the deposit is deep and fine textured.[24]

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[23] Anthony M. Bauer, Simultaneous Excavation and Rehabilitation of Sand and Gravel Sites (Silver Spring, Maryland: National Sand and Gravel Association, 1965), p. 19. Hereinafter referred to as Simultaneous Excavation.

[24] Ibid.

The dredge can normally excavate to a depth of sixty feet.[25] The main reclamation advantage of a dredge operation is the relative ease with which land forms can be manipulated with the use of a desander and floating pipeline. Another advantage is that the end result of a dredge operation is a large, open body of water. Usually this lake is enclosed by steep banks which would require cut and fill procedures to eliminate safety hazards and make the banks more usable.

In a dry site, the power shovel or tractor-scraper may be used quite successfully to remove the deposit. The major advantage of these units of equipment is their considerable freedom of movement.

Draglines and slack line cableways are commonly used where the site may be both wet and dry. The dragline is more flexible than the cableway and usually operates to a depth of forty feet.[26]

Transporting

The method used in transporting the material depends on site conditions and the operator's preference. Belt conveyers, carryalls, trucks, pipelines, and even trains can be used to move the material from the pit to the

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[25]Woodliff, interview.

[26]Leon D. Allard, Vice-President in Charge of Operations, Gifford-Hill Company, Inc., private interview, Dallas, Texas, August, 1971.

processing area. A combination of transportation equipment is not uncommon. For example, material piped from a dredge may be deposited in a surge pile on the shore, and conveyed to the processing plant by a beltline or by a front end loader and truck combination.

Transportation of materials from the plant to market points is accomplished by truck, rail, or water. Where long distances are involved and barge transportation is available, this method is preferred due to its relatively low cost.[27]

Processing

The processing plant is a collection of equipment forming a unit that will achieve a specific output and separate specific grades of material. It may contain a network of screens, crushers, desanders, stackers, hoppers, washers, and loading and unloading equipment.[28] There is little uniformity of plant design, since plant design is adapted to each situation. The plant may range in size from two to ninety acres, but is usually ten to twenty acres.[29]

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[27]U.S., Congress, House, Trinity River, H. Doc. 364, p. 473.

[28]Bauer, Simultaneous Excavation, p. 22.

[29]Ibid., p. 24.

Resultant Land Form

The land form resulting from area strip mining resembles the ridges of a giant washboard, unless the overburden is graded following excavation. Normally no effort is made to separate topsoil from subsoil, and the two are usually intermixed in the spoil banks. In Dallas and Tarrant Counties, excavation almost always proceeds below the water table. Thus, the spoil banks, generally from ten to twenty feet high, are often separated by narrow fingers of water from ten to fifty feet wide and from five to twenty feet deep. Such a situation makes normal grading procedures difficult, especially if the site is allowed to become overgrown with dense vegetation.

It may be from ten to twenty years before the city develops around a particular site and rising land values make highly profitable reclamation feasible. In the meantime, undergrowth and trees may completely overtake the water separated spoil banks, necessitating their removal before reclamation procedures can proceed. If the excavation penetrated the water table, the resulting water features must either be drained prior to grading, or if the volume of water will support a dredge operation, a dredge

and desander can be used to enlarge the water features and form functional land areas.[30]

When reclamation occurs years after excavation, much of the same type of equipment must be transported back to the site at added cost. Once the trees have been removed and the final land forms completed, vegetative cover must be re-established and landscaping completed. Thus, a loss of vegetative growth is experienced which is exactly equal to the time lapse between abandonment and reclamation. Even when the site is finally reclaimed, several years may be needed for land forms to settle and for vegetative growth to conceal cuts and fills.

## Type of Site

The particular type of re-use for which a site is best suited often depends on whether or not the excavation penetrated the water table. A wet site can usually be reclaimed more easily and at less cost than a dry site.[31] The major basic reclamation needed at a dry site would be bank stabilization, grading, and revegetation. The land area needing reclamation is reduced proportionately with the amount of land submerged.

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[30]Harold Biggs, Assistant General Manager, Gifco, Inc., private interview, Dallas, Texas, October, 1971.

[31]W.I. Thieme, Chairman, American Aggregates Corporation, Greenville, Ohio, personal letter, June 26, 1971.

In both the Seagoville and Grand Prairie deposit areas, the water table varies from a depth of about five feet to fifteen feet below the ground level surface. For purposes of this study, a wet site is considered by the author to be one where over thirty per cent of the surface area is submerged following excavation.

If the area is to be developed for industrial use, the lakes may serve as a source of processing or cooling water. If the site is to be developed as a residential area, the water features may serve to increase lot values by providing an esthetically pleasing, easily accessible recreation base. A lake in a depleted site has the advantage of being constantly replenished by fresh water from the water table.[32]

## Separation and Stockpiling of Soils

Unless a mined area is to be converted to a parking lot or extensive industrial or commercial development, topsoil adequate to support healthy vegetative cover will be needed following the mining process. Vegetative cover is needed to prevent erosion which may lead to heavy siltation of ground water supplies. Stockpiling of topsoil during the stripping process would be much cheaper than transporting topsoil in from another area following excavation.

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[32]Thieme, letter.

If the secondary use desired at a particular site requires extensive land forming operations, it would also be wise to stockpile the needed amount of subsoils for that purpose. Less grading and land forming would be required if topsoil and subsoils were separated and strategically placed during the mining operation.

## Bank Stabilization and Bottom Treatment

Depending on the type of operation and the use desired following excavation, the banks of the pit may require extensive stabilization work. Where banks are steep, cuts and fills may be required to reduce safety hazards or to provide for a particular shoreline use. Slightly sloping shores would be required for wading and swimming, while a deeper bottom would be needed for boating. Fishing, nature study, and skin diving are uses which would benefit most from a varied bottom.[33] Bank stabilization also would be needed to prevent excessive runoff and to provide a slope suitable for plant growth. In addition to cuts, fills, and revegetation practices, bank stabilization can be achieved through the use of terraces and drainage structures.

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[33]George Pickles, Realizing the Recreation Potential of Sand and Gravel Sites (Silver Spring, Maryland: National Sand and Gravel Association, 1970), p. 19. Hereinafter referred to as Realizing Potential.

## Obtaining Fill

The problem of obtaining fill is often reduced when subsoils are stockpiled during the stripping process for later redistribution. When the site is wet, the soils removed by the stripping process may be sufficient to provide the necessary shoreline land forms. The cost of reclamation and the time involved can be greatly reduced if soils are separated and stockpiled during the stripping process.

The type of fill used at different sites may exhibit varied settlement rates. Settlement rates that could be expected from various types of fill are presented in Table 2.

## Revegetation Practices

A basic part of any reclamation program is that phase dealing with revegetating and landscaping the site. The natural vegetative cover common to the lowlands of Dallas and Tarrant Counties serve several important functions: (1) they help to prevent flooding and excess erosion by retaining rainfall and inhibiting runoff, (2) they provide organic materials and humus needed for the formation of new soils, (3) they retain chemicals needed for sustained plant growth, (4) they provide

TABLE 2

SETTLEMENT RATES OF VARIOUS TYPES OF FILL WITH AND WITHOUT THE ADDED WEIGHT OF BUILDINGS[a]

| Type of Fill | State of Fill | Settlement From Original Height | Settlement With Added Weight |
|---|---|---|---|
| Well-graded gravel | Well-compacted | Not available | Negligible |
| Sand | Well-compacted | 0.5% in two years | Very low |
| Sand | Uncompacted | 3.0% in three years | Low |
| Clay | Lightly-compacted | 1.0% in three years | Medium |
| Clay | Uncompacted | 10.0% in four years | Very high |
| Mixed refuse | Compacted | Not available | Medium |
| Mixed refuse | Uncompacted | 29.0% in five years | Very high |

[a]G.G. Meyerhof, "Buildings on Fill with Special References to the Settlement of a Large Factory," The Structural Engineer, Vol. 29, No. 2, February, 1951, pp. 46-47.

excellent wildlife habitat, and (5) they enhance the esthetic value of an area.

When a given site is cleared of its protective vegetative cover, several adverse situations may arise. Heavy rainfall may cause excessive erosion of soils, and consequently heavy siltation of surface waters. Flood situations become more likely. Chemical nutrients are leached out and humus is not produced. Wildlife habitat is destroyed and the general appearance of the site is degraded.

Clearing of vegetation, however, is a necessary part of the mining process. Normally, the first dominant species to revegetate the mined areas in Dallas and Tarrant Counties are the fast-growing but short-lived willows and cottonwoods. Undergrowth varies, but viney plants such as greenbriar (Smilax bona-nox), Carolina moonseed (Cocculus cardinus), poison ivy (Rhus taxicodendron), and many species of noxious weeds are not uncommon.[34] These species often dominate a mined site within a period of five to ten years, so thickly covering the site that eventual reclamation requires their removal prior to grading or land forming activities. Thus, the cost of reclamation is increased.

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[34]Museum of Natural History, Dallas, Texas, Elm Fork Nature Area--Guidebook (Dallas, Texas: Museum of Natural History, n.d.), pp. 3-11.

Fortunately, the same conditions that encourage the growth of desirable species often discourage the growth of obnoxious species. Topsoil, distributed evenly over a damp but well-drained site, will provide a suitable seed bed for several excellent tree species such as black walnut (Juglans nigra), pecan (Carya illinoiensis), bur oak (Quercus macrocarpa), red oak (Quercus shumardii), green ash (Fraxinus pennsylvanica), and American elm (Ulmus americana).[35]

Replacing the topsoil also will encourage the growth of ground cover species which will quickly check erosion and reduce the possibility of flooding. The area can thus be restored to productive use. With adequate ground cover, chemicals will be retained and humus will be formed, thus developing soil conditions favorable for sustained plant growth.

## Additional Reclamation Considerations for Recreational Use

There are several considerations in addition to those discussed relating to basic reclamation which are important in the consideration of mined lands for recreational use. These considerations relate to various site

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[35]W.M. Harlow and E.S. Harrar, Textbook of Dendrology (New York: McGraw-Hill Book Company, Inc., 1958), pp. 272, 290, 338, 359, 390, 501.

determinants and characteristics which play a role in determining the recreational use adaptable to the area.

## Site Determinants

Three site determinants individually or collectively influence the selection and hence the potential success of a recreation development at a sand and gravel mine. These are the location and access, size and configuration, and the type of resources available.

### Location and Access

The location of a recreation area can greatly affect the success of the development. Urban or suburban recreation facilities that are relevant to the needs and desires of a community will be heavily utilized if they are readily accessible. Recreation areas located within a city are usually accessible from several streets. Access by foot, however, may present a problem due to the safety hazard associated with heavy traffic. Pedestrian access can best be achieved with traffic lights and crosswalks, tunnels, and overpasses. Sufficient parking must be provided for those commuting from farther distances.

Larger recreation areas are often located some distance from the population center, not within walking distance, and beyond the limits of public transportation

services. In 1969, Dallas Mayor Erik Jonsson recognized the need for easily accessible neighborhood parks in Dallas. "I want a playground accessible to a kid in any neighborhood," Jonsson said, "without the child having to ride a bus or in a car to get there."[36]

Because of the cost involved in transporting sand and gravel from processing plant to market point, most mined sites are ideally located on the urban fringe near a major access route. Thus, as the city grows, these mined areas are ideally located for development as neighborhood parks or larger recreation areas.

## Size and Configuration

The size and configuration of a recreation area is dependent upon several different factors. Length and width requirements, for example, may determine the location of particular types of developments, especially court and field games. Irregularly shaped parcels are often more conducive to development as passive recreation areas or as supportive facilities such as parking areas, buffer zones, and concessions.

The factor most responsible for the size and configuration of a sand and gravel site is the nature of the

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[36]The Dallas Morning News, January 14, 1969, sec. D, p. 3.

deposit. The depth and thickness of the deposit, and the area underlain by the deposit are good indications as to the appearance of the site following excavation. Considering the nature of the deposit prior to excavation may aid in the formation of usable land areas concurrent with the mining process. Such a practice would enable the final reclamation procedures to be conducted at less cost and in less time.

## Resource Potential

All potential recreation areas exhibit some physical features which suggest how the site could best be utilized. These features may be topographic, vegetative, or aquatic in nature. Adjacent land uses may also help to determine the success of a particular development.

Annoyance factors, such as noise, dust, water and air pollution, and unsightly views may limit the development of a site for a particular use. These problems can be partially or completely eliminated by using vegetative materials, earthen berms, and other materials to conceal unsightly views, filter dust from the air, and disseminate noise.

## Characteristic Physical Features

Recreation planners have singled out three physical characteristics that are desirable in a recreational development; vegetation, varied topography, and water features. These resources offer a diversified populace the setting necessary for the development of varied recreational activities. Many abandoned sand and gravel mines exhibit these physical features in a way that makes the site readily adaptable to recreational use.

### Vegetation

From a functional standpoint, vegetation serves to provide a habitat for wildlife, to control erosion, and to act as a barrier to noise and dust. It also provides shade and acts as a windbreak.

### Topography

Land forms of varying height and configuration can define space, reduce or enlarge visual scale, provide for privacy and solitude, suggest natural circulation patterns, and define use areas. Topographic features may also suggest certain types of recreational uses which would be best suited at a specific site. Hills suggest hiking or climbing, while level areas suggest camping or building facilities. Variation in topography is an extremely important

consideration when the proposed site is in or near the floodplain and may be subject to periodic flooding.

Water Features

Generally, water features that result from sand and gravel operations are of two types: (1) shallow and segmented and (2) extensive and open.[37]

Most shallow, segmented bodies of water are somewhat isolated and hidden from view by intervening overburden and encroaching vegetation. Without reclamation, these water features may be unsafe for many types of recreational use. Extensive and open bodies of water, on the other hand, are readily adaptable to a wide variety of water-based recreational activities including boating, swimming, and water skiing.

As a physical resource, water is unique in that it can be made to flow, gurgle, gush, seep, slide, or stand still, depending on the effect one desires to achieve. In combination with vegetative features, water can be made to portray moods of serentiy, strife, anger, or anticipation.

Since sand and gravel operations do not produce toxic substances, the water features are not health hazards and can be used in their natural state. Water can be a

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[37]Pickles, Realizing Potential, p. 13.

primary asset to a recreation development, depending on the amount and configuration of the shoreline, and the depth and quality of the water.

The water features found in depleted sites in the Dallas-Fort Worth area usually are of a shallow and segmented nature. Typically, the steep-banked parallel mounds of overburden are separated by fingers of water which may vary from ten to fifty feet in width and from five to twenty feet in depth.

## Soils

The soils within a given area are an important consideration in planning for the secondary use of a mined site.

The following soil associations are common to those areas in Dallas and Tarrant Counties where sand and gravel operations are prevalent. The descriptions and limitations given are those listed by the Soil Conservation Service.

> Konawa-Bastrop Association. This is an area of nearly level to sloping, slightly to medium acid, well drained soils. The soils in this association are used mostly for pasture and small estate-size home sites. The Konawa soils on slopes and ridges make up about 35 per cent of the association. They have a brownish fine sandy loam surface layer and a yellowish red medium acid sandy clay loam lower layer over yellowish or reddish loamy sand. The Bastrop soils on nearly level low terraces and gently sloping ridges make up about 25 per cent of the association. They have a brownish fine sandy loam surface and a reddish, slightly acid, sandy clay loam lower level several feet thick.

> The remaining 40 per cent of the association consists of similar soils except they have more sandy surface layers or more clayey lower layers.[38]

The Konawa-Bastrop Association is fairly well suited for the building of dwelling units, low cost roads, septic tanks and filter fields, light industries, and playgrounds. It is also well suited for landscaping and gardening, or as open land or forests, and may be easily graded or leveled. Soil limitations for the development of pond reservoirs, farmland, or pastureland, include permeability, erosion hazards, and low fertility, respectively.[39]

> Trinity Association. This is an area of nearly level, moderately well to somewhat poorly drained calcareous clayey bottomland soils of flood plains of the Trinity River and its larger tributaries. The soils in this association are used mostly for pasture and cropland with a few levee protected areas in industrial and urban use. The Trinity soils which are calcareous make up about 95 per cent of the association. They have a very dark grey clay surface layer and dark grey clayey lower layers. Some areas of these soils are underlain at 6 to 20 feet by sand or gravel. The remaining 5 per cent of this association consists of crumbly soils of bottomlands and loamy and sandy soils of low terraces.[40]

The Trinity Association is best suited for open land or forests, although limitations are not extremely severe for development into cropland, pasture, or pond reservoirs.

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[38] U.S., Department of Agriculture, Soil Conservation Service, General Soil Map for Dallas County, Texas (Temple, Texas: U.S. Department of Agriculture, 1970), 8-71, 4-R-30700. Hereinafter referred to as Soil Map.

[39] Ibid.

[40] Ibid.

Development for other uses is severely restricted by either the shrink-swell nature of the soil or flood hazards.[41]

> Frio Association. This is an area of nearly level, well drained, calcareous, crumbly clay loam bottomland soils. The soils in this association are used mainly for pasture. The Frio soils of the floodplains of both large and small streams make up about 60 per cent of this association. They have a dark greyish brown clay loam or silty clay loam surface layer and brown silty clay or clay loam lower layer. They are crumbly and calcareous throughout. The remaining 40 per cent of this association consists of soils of bottomlands that are similar but noncalcareous, and loamy soils of low terraces.[42]

The Frio Association is well suited for open land or forests. Frio soils are easily graded and can support playground facilities, pond reservoirs, sewage lagoons, low cost roads, and landscaping and gardening activities, where severe flooding does not occur.[43]

These associations are of general soil types only. For a specific development at a certain site, a detailed soil analysis is indispensable as a planning tool.

When topsoils and subsoils are stripped from an area, mixed together, and later redeposited as fill materials, that topsoil is lost forever. Consequently, revegetation practices on the site will be severely inhibited unless topsoil is obtained from another area. Topsoils

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[41] U.S., Department of Agriculture, Soil Conservation Service, Soil Map, 8-71, 4-R-30700.

[42] Ibid.

[43] Ibid.

should be separated from subsoils and stockpiled during the stripping operation for eventual redistribution.

Substrata

In addition to deposit and soils data, the geologic substrata may be an important planning consideration, especially if large and heavy buildings are desired. Underlying the entire West Fork of the Trinity River at varying depths is the Eagle Ford shale formation, a blue shale of good bearing capacity capable of supporting almost any type of building structure.[44]

## Potential Types of Secondary Use

Because of their size, proximity to the urban environment, and terminal site characteristics, depleted sand and gravel sites often qualify for a large number of secondary uses. Basically, the potential secondary uses of a depleted site can be classified into seven categories: agricultural, residential, commercial, industrial, institutional, recreational, and special uses. The selection of a particular secondary use depends upon the physical features of the site, various site determinants and operational

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[44]Schrickel, Rollins, and Associates, A Planned Industrial District (Dallas, Texas: Schrickel, Rollins, and Associates, n.d.), p. 1. Hereinafter referred to as Industrial District.

considerations, and the projected demand market for the specific use. In most cases, reclamation for industrial and commercial uses will secure a higher dollar value for the developer than will reclamation for residential, recreational, or special uses.[45] On the other hand, reclamation for recreational use is less costly than for other uses.

Summarized below are some potential uses for which depleted sites would often qualify. The list is not meant to be exhaustive, but the secondary uses enumerated here appear to be those most likely applicable to depleted sites in Dallas and Tarrant Counties.

### Agricultural Use

The friable nature of alluvial soils makes them highly desirable for agricultural use. The rapidly expanding urban population situation leaves little doubt that in the future this country will be called upon to produce more food than it ever has produced before. It is essential that prime farmland be preserved for the production of this food, at least until such time as food can be produced abundantly by artificial means. Mined lands can be easily and quickly converted to agricultural use when topsoils are stockpiled and are later redistributed. Settlement of fill

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[45] Thieme, letter.

is of little concern since buildings would usually not be needed.

## Residential Use

Many mined sites are located on the fringes of the metropolitan area, where the existing land use is primarily low density residential. Additional single family residential developments may be a logical extension of the land use. The presence of water features and unusual topography existing in many depleted areas gives these sites a high potential for development as premium, exclusive suburban properties. Cedar Lake, near Richmond, Indiana, is such a development. The area features 1.25 miles of shoreline which has been beautifully reclaimed for waterfront homesites.[46]

The rough topography and small acreages common to many depleted sites may limit residential development to a vertical, rather than a horizontal orientation--that is, multi-story apartment complexes. In the past, these developments have been more common in the city where there is usually a high demand for apartments. However, the increasing number of complexes located on the urban fringes indicates a desire for suburban apartment living, especially

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[46]American Aggregates Corporation, Project Parklands (Greenville, Ohio: American Aggregates Corporation, n.d.), p. 5.

on sites where varied topography and water features enhance the scenery. Such locations are ideal for luxury, executive living, " . . . especially if the development includes recreational facilities, such as tennis courts, swimming pools, and posh landscaping."[47] Related development, such as grading, road networks, and utility lines for a multi-story development would be less extensive and thus less expensive than for a single family dwelling development.

Where the site exists some distance from the urban setting, a seasonal cottage or summer home development might be better suited than an apartment or single family residential development. Access to water areas is highly desirable in such a development. Adjoining land farther from the water could be developed in the form of a game preserve, golf course, woodland, or other complementary facilities.

## Commercial Use

Commercial facilities, such as regional, community, and local shopping centers could advantageously use depleted sand and gravel sites. Motels and motor hotels might also

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[47]David A. Rogier and Kenneth L. Shellie, Site Utilization and Rehabilitation Practices for Sand and Gravel Operations (Silver Spring, Maryland: National Sand and Gravel Association, 1963), p. 17. Hereinafter referred to as Site Utilization.

find depleted sites attractive, especially if located near a major thoroughfare. In all these cases, considerable grading would be necessary which would add substantially to the cost of development.

## Industrial Use

The cost of grading and site preparation may make the utilization of mined sites for industrial purposes economically prohibitive. The outlay for needed improvements could be minimized if reclamation was carried out concurrent with extraction operations. Adequate amounts of surface water would enhance the suitability of these areas for industrial plants which need water for cooling or processing.

A study for a planned industrial district in east central Tarrant County has recently been completed by Schrickel, Rollins, and Associates.[48] A large portion of the proposed development is located on land which has been mined for sand and gravel. Considering the rapid growth of the Dallas-Fort Worth area, it is likely that more industrial sites will be needed in the future. Many depleted sand and gravel mines could be reclaimed for future industrial development.

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[48]Schrickel, Rollins, and Associates, Industrial District, p. 1.

## Institutional Use

Because of their location in relation to pupil residence, depleted sand and gravel mines may lend themselves for development as school sites. If the depleted area can be converted and economically improved, it might be ideal for this purpose. School area requirements vary from ten to fifty acres, depending upon the type of school desired.[49]

Research centers are usually located in a suburban or rural area, often in an open setting which may include woods, lakes or streams, and other scenic amenities. Depleted sites with rolling topography, impounded waters, and potential for landscaping development are especially suited for research centers. In such a setting, " . . . the atmosphere for creative research and development is fostered."[50]

As basic field research areas, depleted sites offer a great potential in terms of the studies of geology, ecology, biology, and paleontology. Southern Methodist University, for example, has engaged in studies dealing with gravel pit geology, under the direction of Bob H. Slaughter,

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[49] Rogier and Shellie, Site Utilization, p. 21.

[50] Ibid., p. 22.

Director of Vertebrate Paleontology.[51] Elray S. Nixon, Associate Professor of Biology at Stephen F. Austin State University, has recently concluded a research project dealing with plant succession on gravel pit areas adjacent to the Trinity River just south of Dallas.[52] As nature study areas, sand and gravel mines are often unique. The rough topography, coupled with the availability of abundant water features, provides a wildlife habitat area that is attractive to a wide range of species.

Fossil remains are often plentiful in gravel deposits. The presence of the water table tends to impede the decomposition of organic remains and allows for the fossilization of boney tissues. Black Water Draw near Clovis, New Mexico, for example, is a site where a gravel dredge operation uncovered a large fossil bed containing the remains of many extinct mammals.[53] The historic Malakoff stone images were found in a gravel deposit.[54]

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[51]Slaughter, letter.

[52]Elray S. Nixon, Associate Professor of Biology, Stephen F. Austin State University, Nacogdoches, Texas, personal letter, n.d.

[53]H.M. Wormington, Ancient Man in North America (Denver, Colorado: Denver Museum of Natural History, 1949), p. 40.

[54]Curtis E. Tunnell, Texas State Archeologist, private interview, Lubbock, Texas, October, 1971.

In summary, depleted sand and gravel mines offer a high potential for study of many of the sciences which form the basis of a concrete understanding of the environment.

## Public Recreational Use

Size may directly affect the type of recreational use suitable at a given site. Large areas located on the fringe of, or near, a metropolitan area may be ideally situated for development as state or regional recreation areas. Such is the case with Kickapoo State Park, west of Danville, Illinois, where a strip mine was developed for camping, fishing, and picnicking.[55] Smaller areas could be converted into various types of play areas or municipal parks as the city grows around them.

A public golf course might be ideally situated on a depleted sand and gravel site because of the typically rough topography and abundant water areas. The water features would provide a constant source of water for irrigation, since the lakes in mined areas are constantly replenished by ground water supplies. One advantage of this kind of development is that it can be privately operated and open to the public on a fee basis.

Swimming is one of the favorite summer sports enjoyed by Americans today. Meeting this demand by

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[55]Pickles, Realizing Potential, p. 7.

constructing swimming pools is expensive. A convenient natural body of water which could be maintained pollution free would be an excellent substitute. The long, narrow bodies of water common to many depleted sand and gravel sites, although unsuitable for many water-oriented sports such as boating or water skiing, are often ideal for swimming and beach developments. Waste sands could be used in forming the beaches, and the only major facilities needed would be a bath house and comfort station with connections to sanitary sewer facilities. Zilker Park in Austin, Texas, provides an example of such a development where an outdoor swimming pool was developed in an old creek bed. The pool draws a near capacity crowd throughout the summer months.

Smaller depleted sites offer a high potential for development as garden developments. Such is the case at Botanical Gardens in Fort Worth where a six-acre pit is being developed into a Japanese tea garden. The garden will feature three separate levels of flowing water surrounded by thousands of exotic and native plantings. The pleasant and relaxed atmosphere of the garden, in the midst of the fast-moving city, will provide the citizens of Fort Worth with one of the most interesting public gardens in Texas.

## Private Recreational Use

Private recreation developers will continue to play an increasingly important role in supplying recreation facilities for the rapidly expanding population. There are many depleted sand and gravel sites for which private recreation developments are ideally suited.

Country club facilities, generally located some distance from the city, could make excellent use of depleted sites. The land could be developed in stages, as extracted areas became available for redevelopment. For example, the golf course could be built in successive stages of nine holes, with the clubhouse, swimming facilities, game courts, parking lots, and final landscaping being completed later, as mining operations were completed.

Conservation clubs may find depleted sites ideal for recreation purposes. Capitol Lake, for example, located within the city limits of Indianapolis, Indiana, has been the home of the Capitol City Conservation Club since 1934. The American Aggregates Corporation leases the 290 acre parkland for the club which continually restocks the lake on the area and maintains the grounds.[56]

A site that has considerable water area and little land area, but that is well located and easily accessible,

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[56]American Aggregates Corporation, Project Parklands, p. 4.

may be ideally suited for development as a motor boating area. The only land needed would be for boat launching ramps, parking areas, and supportive buildings. If the extraction operations are geared toward this ultimate use, the development costs are not likely to be excessive, while the investment returns might be quite high. Power Boat Lake in Dayton, Ohio, has gained the reputation as one of the finest race courses in the country. The lake is being developed by the American Aggregates Corporation, and doubles in function as a ground water recharge reservoir.[57] The noise generated by a number of power boats operating simultaneously would suggest that such an activity be located some distance from existing or planned residential complexes.

The use of an exhausted site for development into riding club facilities would provide a recreational activity at nominal expense in that little grading or landscaping would be required. Although monetary returns from such an activity would be low, such a use would be suitable until the redevelopment could be upgraded to a more profitable development. As is the case with many possible uses, a riding club could be developed in conjunction with other recreational developments, such as a country club or park.

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[57]American Aggregates Corporation, Project Parklands, p. 12.

## Special Uses

### Water Reservoir

The increasingly acute shortage of water experienced by many municipalities has created a sizable demand for all available sources of water supply and areas for water storage. Although the water areas of a given pit may not be extremely large, they could be used as secondary sources of municipal water supply, or as primary sources of supply for various industries.

### Sanitary Landfills

With the rapid increase in the consumer market of disposable, non-returnable packaging materials, cities are now faced with severe solid waste disposal problems. Dry sand and gravel pits, if favorably located, have a high potential as sanitary landfill areas. In the Dallas-Fort Worth area, most of the excavations reach a depth of from thirty to forty feet, and are of a size adequate for the disposal of large amounts of solid wastes. For example, the City of Arlington is now disposing of solid wastes in a mined area which was excavated during the Second World War.[58]

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[58]B.L. Walker, Landfill Superintendent, City of Arlington, Texas, private interview, August, 1971.

Re-use of a sanitary landfill is usually limited to those uses which do not require a stable foundation base. Compaction techniques have not been perfected to the degree that shifting problems always can be avoided. Noxious gases may be produced from the decomposing fill materials. In a depleted site where excavations have penetrated the water table, extreme caution must be taken to insure that the water table is not subject to pollution from chemicals which may be produced from decomposing fill materials.

Vehicle Test Course

As a race or test course for motor bikes, jeeps, and other similar vehicles, depleted sites offer a high potential. Very little redevelopment would be necessary since rough topography is the essential item for a test course. Use of depleted sites for this purpose is quite common in the Dallas-Fort Worth area, as is evidenced by the myriad of bike trails which exist on many depleted sites.

Fish Hatchery

Both public agencies and private individuals may be attracted to depleted sites for their potential as a fish hatchery or rearing station. Areas where excavations have penetrated the water table are especially well suited

for this use, due to the continuing movement of fresh water through the resulting lakes.

## Other Uses

There are, of course, many other potential uses of depleted sand and gravel sites, some of which have been listed below as a means of suggesting the wide range of possibilities that exist.

1. Amphitheater
2. Archery range
3. Campground
4. Drive-in theater
5. Fishing camp
6. Game preserve
7. Hunting resort
8. Nursery
9. Open space
10. Rifle or skeet range
11. Sewage disposal plant
12. Tree farm
13. Water-ski tow area
14. Wildlife photography area
15. Yacht or sailing club
16. Zoo

# CHAPTER III

# IMPLEMENTATION

## The Importance of a Plan

The importance of formulating a plan prior to excavation cannot be over-emphasized, regardless of what secondary use is projected for a particular sand and gravel site. A planned sand and gravel development " . . . is primarily concerned with progressively developing the highest and best use concurrently with the extraction operation."[59] A good plan considers the site advantages, the operation characteristics and their impacts on adjacent lands, and directs the excavation process into the dual role of extracting material and creating preconceived land forms.

For any particular mined area being considered for redevelopment, an inventory and analysis of influencing factors should be completed prior to the mining activities. This will help to determine the most appropriate secondary land use and the action needed to implement the plans.

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[59]Bauer, Simultaneous Excavation, p. 40.

There are several advantages in designing a plan prior to mining activities. One is that plant materials can be established early and given time to develop into visual screens. These plantings can be arranged so as to offer esthetic advantages to the proposed secondary use. Early planning may show the need for the acquisition of additional land needed to facilitate the ultimate development of the site, or to provide buffers between the operations and adjacent land uses where possible conflicts exist.

Perhaps the greatest value of planning prior to mining relates to the concept of the "highest and best use" of the land. Although planning offers no guarantee of achieving such an objective, it does insure that guesswork will not govern the development of the site.

If an appropriate re-use of the land is included as an integral part of the plan of mining operations, the operator is not likely to experience much opposition from ecologists or pressure groups concerned with environmental values. The good public relations a company can establish through such an approach will be severely damaged if redevelopment according to the original plan is not carried out. Although there are different ways to implement the same plan, progressive reclamation offers more benefits to both the public and the producer than any other method.

## Progressive Reclamation as a Working Approach

Progressive reclamation refers to the development of a site for its secondary use concurrent with mining operations. The objectives of this approach are to reduce the cost of reclamation and to prepare the site for its ultimate use in such a way that few alterations are needed once mining has ceased. The success or failure of such an approach depends on the ability of the operator to gear all phases of the operation--clearing, stripping, extracting, processing, and transporting--toward the ultimate use of the area.

## Benefits of Progressive Reclamation

Several benefits accrue directly to the public when mined lands are reclaimed: the land is returned to productive use (often to a use which may not have been possible prior to excavation), esthetic qualities are restored, safety hazards are eliminated, and erosion is controlled. Reclamation also means that financial benefits may accrue to the public as a direct result of the chosen secondary development. The advantage of progressive reclamation is that these benefits will be realized much earlier than if the site were reclaimed years after the completion of the mining operation.

Progressive reclamation also affords many benefits to the sand and gravel industry. Reclamation concurrent with operations is much cheaper than reclamation years later. As the land is restored to productive use, its value may rise considerably, making resale a profitable venture. Although the progressive approach necessitates planning prior to excavation, fewer problems will be encountered in achieving the secondary use.

Perhaps the most important benefit to the company which practices progressive reclamation is the immeasurable good will and improved public image which results from such a practice. Advanced planning for land rehabilitation will reassure a concerned public that the land will be restored to productive use, thereby easing the tensions so often prevalent between political subdivisions and industry.

## Ownership and Financing

The ownership of a particular piece of real estate and its sand and gravel resources may have great implications as to how the land may be developed. The company that owns the property to be excavated has the final authority as to the disposition of the land, subject, of course, to local zoning regulations or state reclamation laws. The company which leases the land or the mineral rights, on the other hand, may not necessarily retain such a right.

The actual cost of reclaiming sand and gravel sites varies considerably. The U.S. Department of the Interior estimates an average cost of from 100 to 200 dollars per acre.[60] The American Aggregates Corporation asserts that " . . . reasonably good reclamation can be achieved for a cost of under 500 dollars per acre."[61] The Trinity Gravel Division of Portland Cement estimates an average cost of 200 to 300 dollars per acre for sound basic reclamation practices.[62]

As stated earlier, the actual cost of reclamation depends primarily on three variables: (1) what is to be done with the site, (2) the condition of the site following excavation, and (3) the time lapse between final excavation and reclamation.

Reclamation of a site for recreation use will usually cost much less than reclamation for industrial, commercial, or residential uses. Less grading and fewer facilities would be required for recreational development.

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[60] U.S., Department of the Interior, Mining and Environment, Appendix I, Table 5, p. 113.

[61] Thieme, letter.

[62] Woodliff, interview.

# CHAPTER IV

# A SITE STUDY

The specific site study included in this chapter serves to illustrate the concepts developed earlier in the study, as well as to suggest a possible plan of recreational development for the site. The study site is one of many in the Dallas-Fort Worth area, and the conceptual development would also be applicable in other locations. The study also serves to indicate problems of development common to most of the sand and gravel sites in the area.

## Site Description

The specific sand and gravel site chosen for purposes of illustration is part of the Cloudy Plant operation and is owned and operated by the Gifford-Hill Company, Incorporated, of Dallas, Texas. The site includes the processing plant and several mined areas.

### Site Location and Access

The study area is located between Dallas and Fort Worth, Texas, and immediately south of Irving in Dallas

County (see Fig. 2). From the south, the site is readily accessible from the Dallas-Fort Worth Turnpike, via Belt-line and Hunter-Farrell Roads, a distance of about four miles (see Fig. 3). Meyers Road provides direct access from Grand Prairie, about one and one-half miles south of the site. Several roads, including Senter, Nursery, and Balleywood, provide access from the City of Irving, located immediately north of the site. Access is gained from the Dallas area from Loop 12 via Irving Boulevard and Nursery Road, a distance of about two and one-half miles. All access roads from Loop 12, the Dallas-Fort Worth Turnpike, and Irving Boulevard are paved, two-lane roads.

## Acreage

The site is 581.6 acres in size, and is divided in an east-west direction by Hunter-Farrell Road (see Fig. 4). The north portion of the site is 273.7 acres in size, of which approximately 184 acres have been mined in four separate areas of five, ten, seventy-seven, and ninety-nine acres in size. The south portion consists of 307.9 acres, 198 acres of which are included in mined land and process-ing plant space.

Figure 2.--Location of the Cloudy Plant site in relation to metropolitan areas.

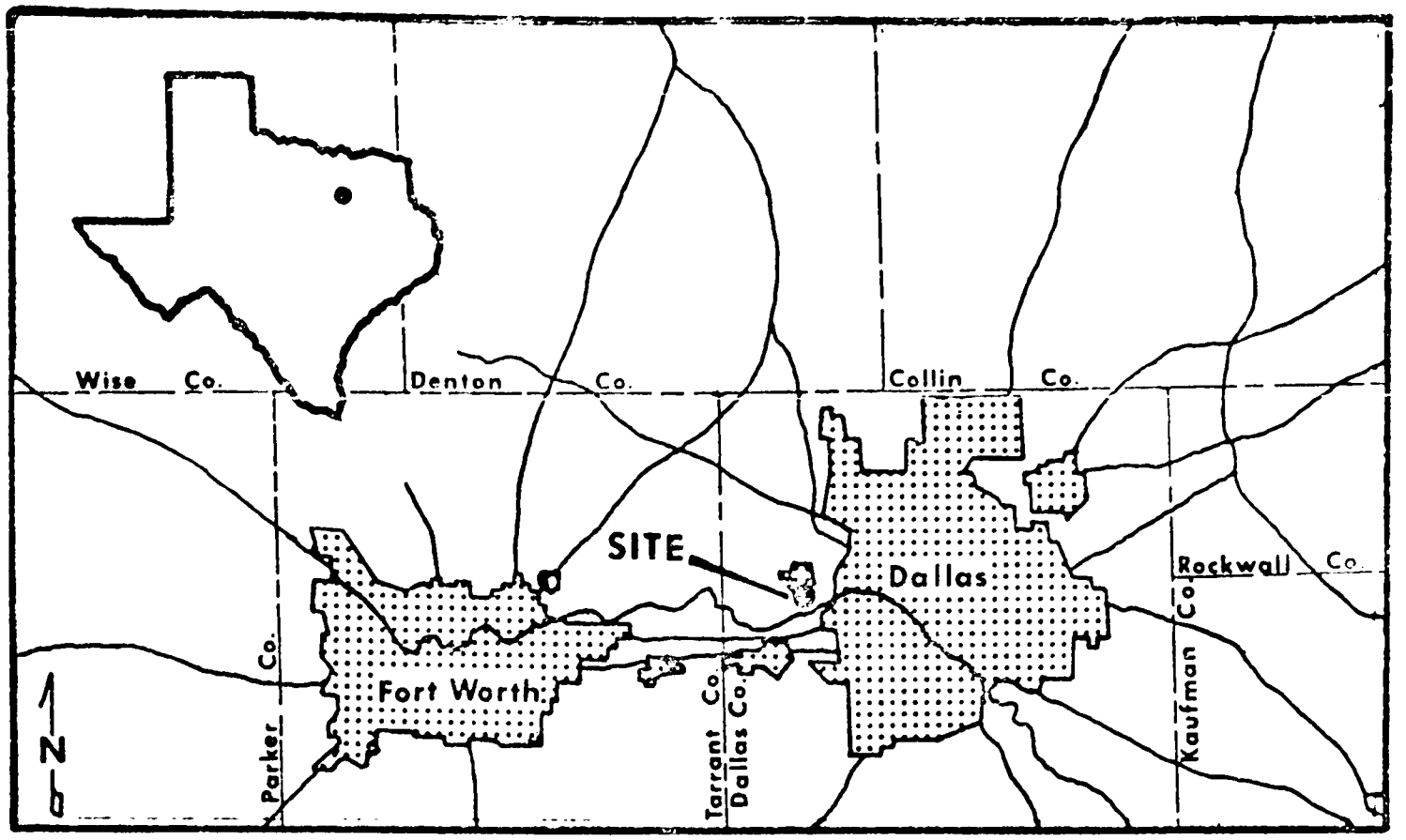
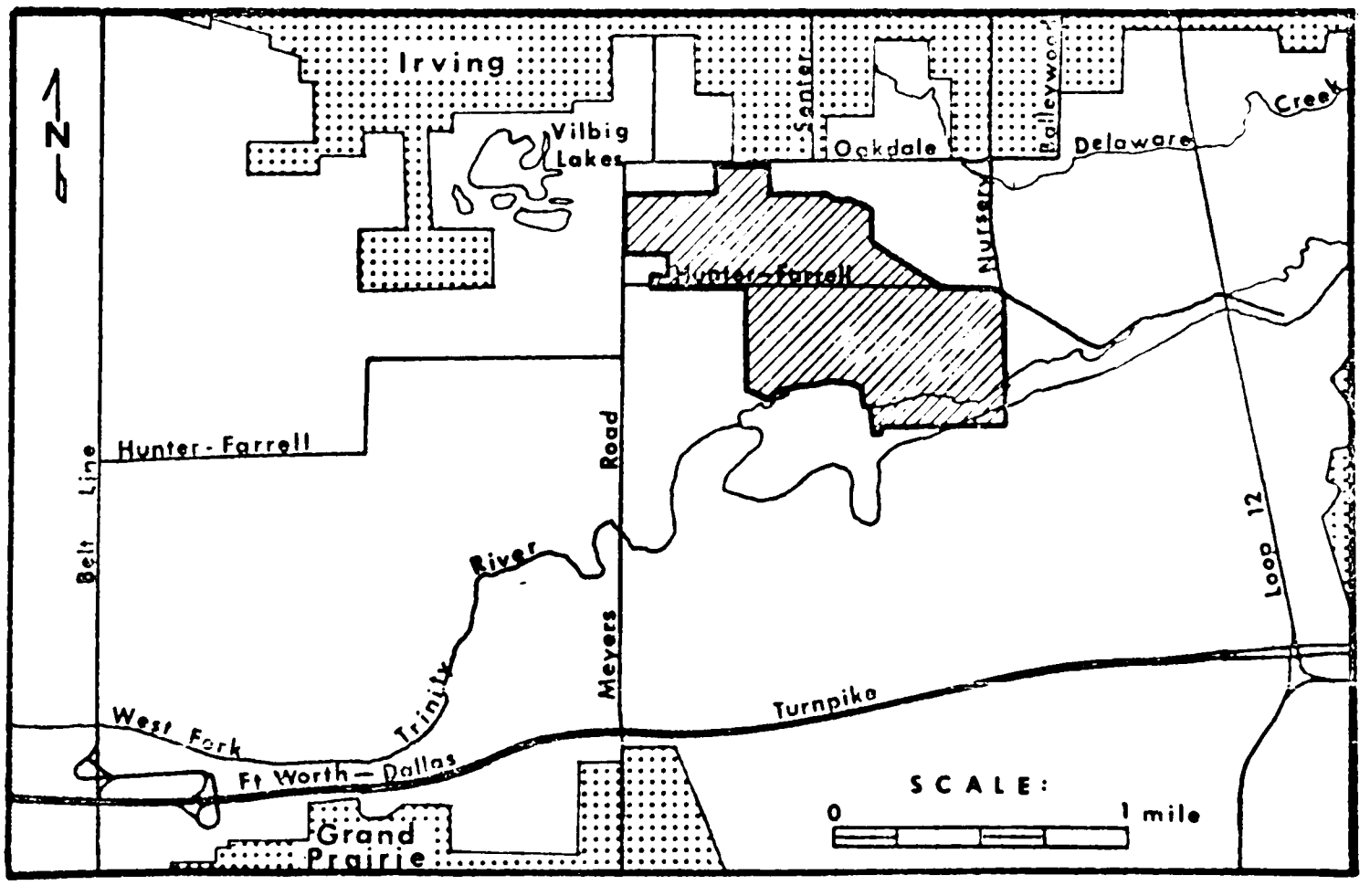



Figure 3.--Accessibility and location of the Cloudy Plant site to the surrounding area.



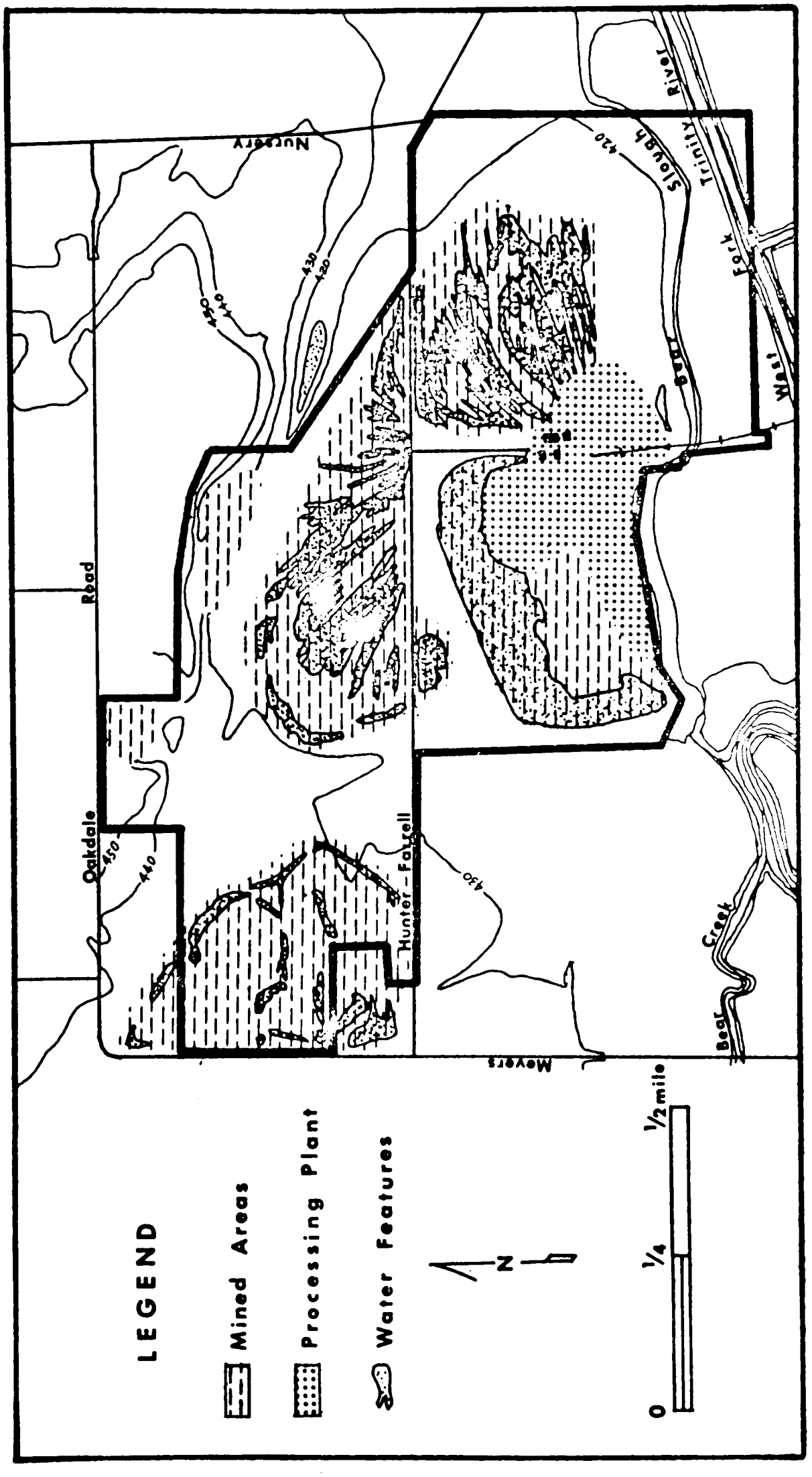



Figure 4.--Physiography of the Cloudy Plant site

## Topography

The natural topography varies from a high of just over 450 feet above mean sea level in the extreme portion, to a low of slightly less than 410 feet along the West Fork of the Trinity in the southern portion. The land is gently sloping from north to south. Extremely rough topography characterizes the mined areas. The parallel overburden banks vary in height from ten to twenty feet above the ground level, and are separated by water filled depressions from five to fifteen feet deep and from ten to fifty feet across.

## Soils

The soils series on or adjacent to the area are typical of the area. Six series are represented in or near the study site: Frio, Galey, Konawa, Wilson, Bastrop, and Dougherty (see Fig. 5). Four of these, the Galey, Konawa, Bastrop, and Dougherty series are primarily fine textured, sandy loam soils, while the Frio and Wilson series are primarily clay loam soils.[63]

Development would be most restricted by the soils nearest the river, where the land is subject to frequent

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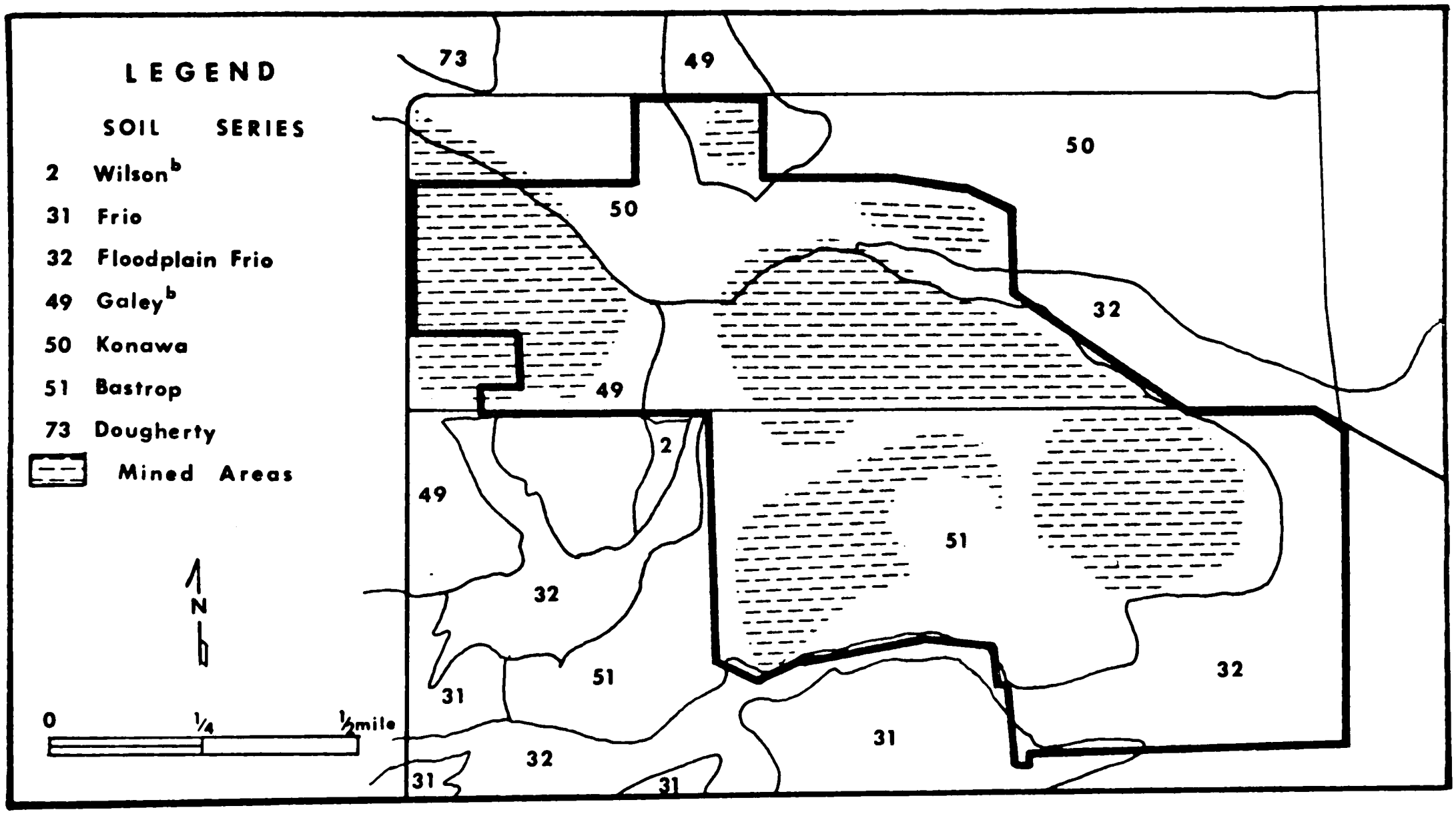
[63]U.S., Department of Agriculture, Soil Conservation Service, Fort Worth, Texas, Soil Series Description Sheets.

Figure 5.--Soil Analysis of the Cloudy Plant site




[a]U.S.D.A., S.C.S. Preliminary Soil Series Maps, Dallas County, 1971.

[b]Proposed series designations.

flooding (see Fig. 6). Most of the soils would place only slight or moderate limitations on recreational developments. They are slightly acid to moderately alkaline, well-drained soils.[64]

## Site Analysis

The general character of the mined areas conforms to the description of mined lands in Chapter II, page 19. The water-separated ridges of overburden are completely grown over with water tolerant species (see Fig. 7). This vegetation serves to screen the site from all outlying points, with the exception of the high point of Oakdale Road, and the mid-section of Hunter-Farrell Road. The unmined land in the northern portion of the site is predominantly grassland, while that in the lower section primarily supports bottomland forest.

The northern portion of the site is moderately well-drained, with the exception of the mined areas, while the southern portion is moderately to poorly drained. The site is partially bound on the south by Bear Slough, and is about 500 feet from the West Fork of the Trinity River.

Several hard-packed dirt roads exist within the site which could be used for on-site access and parking space.

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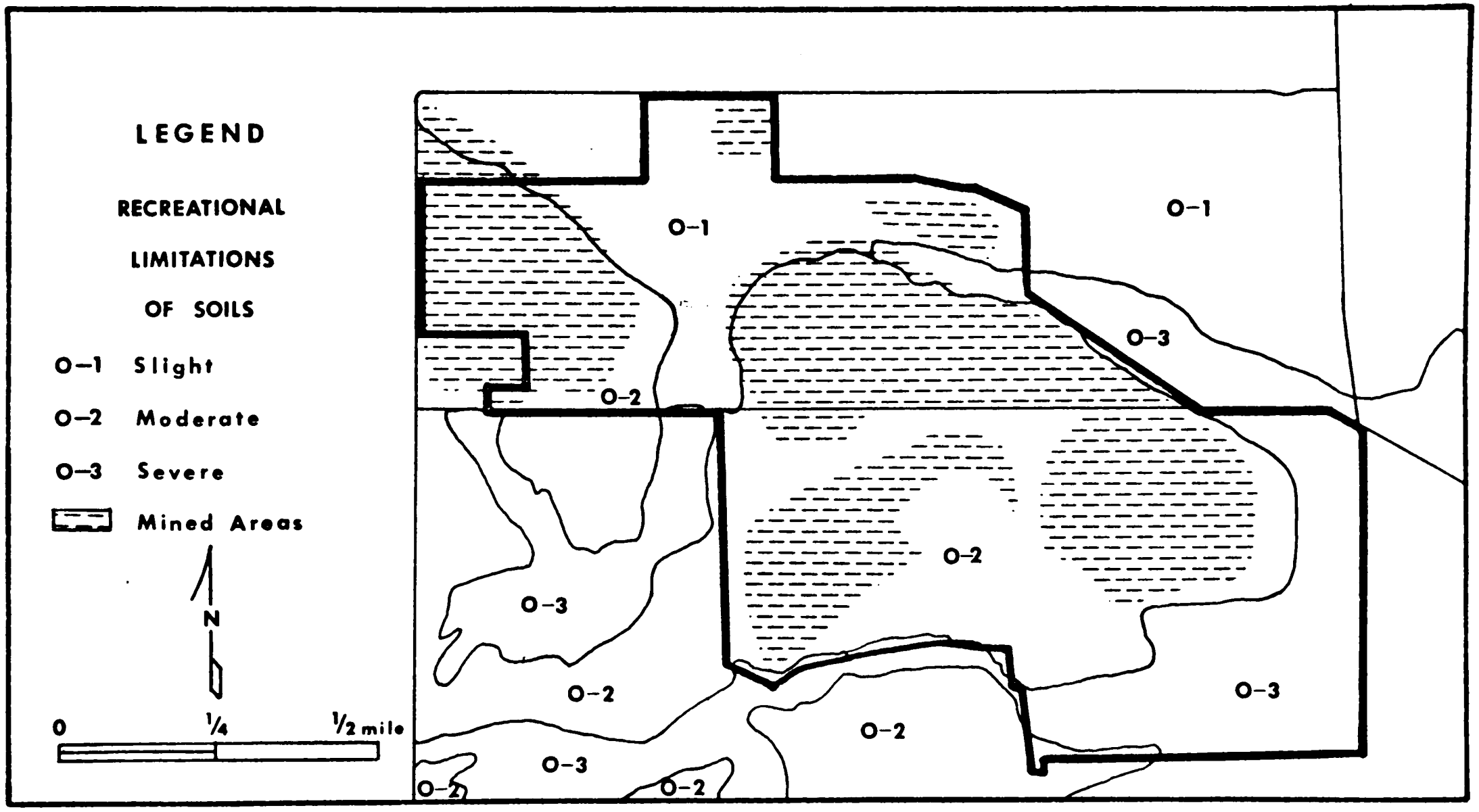
[64] U.S., Department of Agriculture, Soil Conservation Service, Fort Worth, Texas, Soil Series Interpretation Sheets.

Figure 6.--Recreational limitations of soils at the Cloudy Plant site




[a]U.S.D.A., S.C.S. Soil Series Limitation Sheets, n.d.

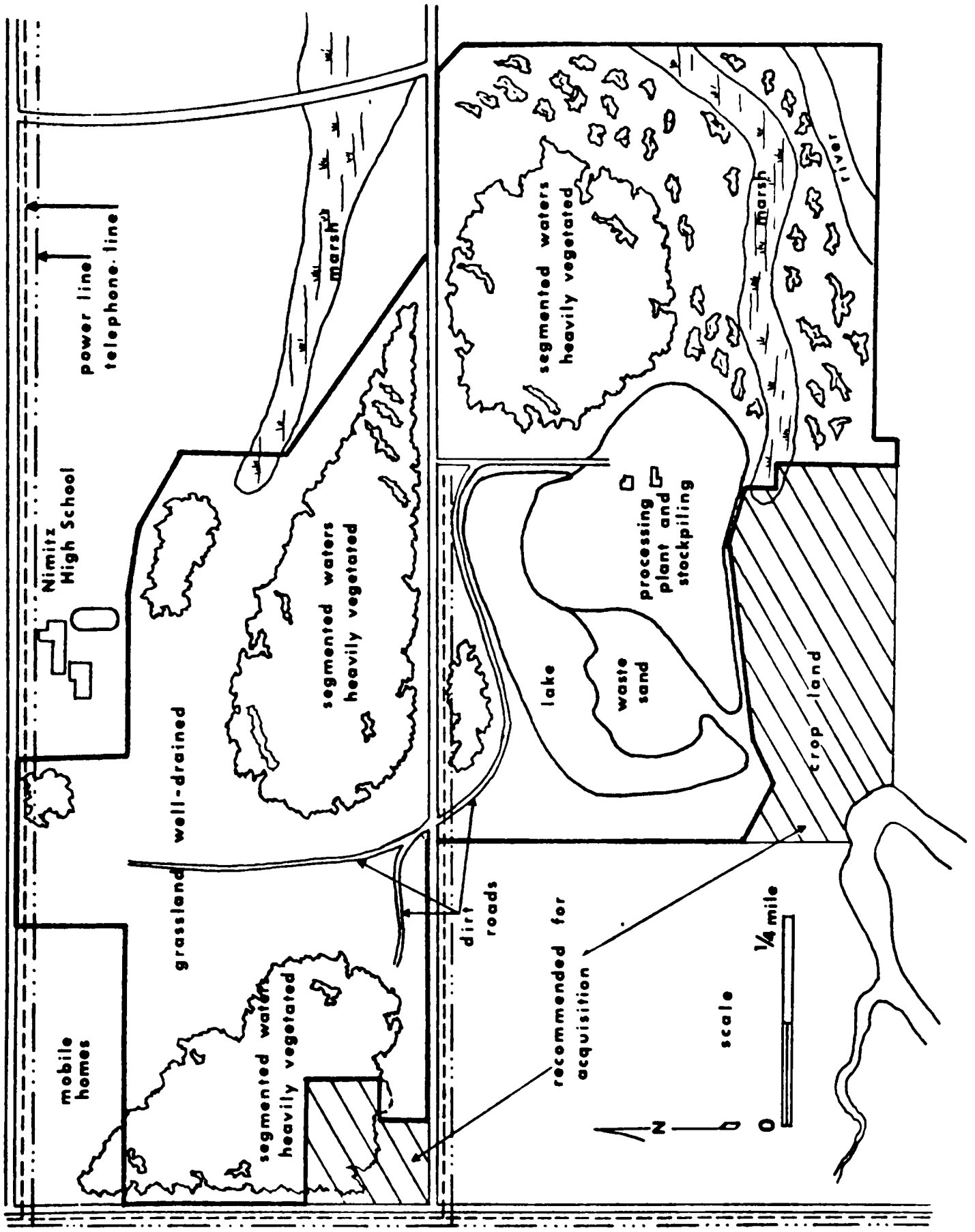



Figure 7.--Analysis of the Cloudy Plant site

Connections to water, natural gas, and sewage lines are all available within the Irving city limits, immediately north of the site. Telephone and power lines are located adjacent to the site.

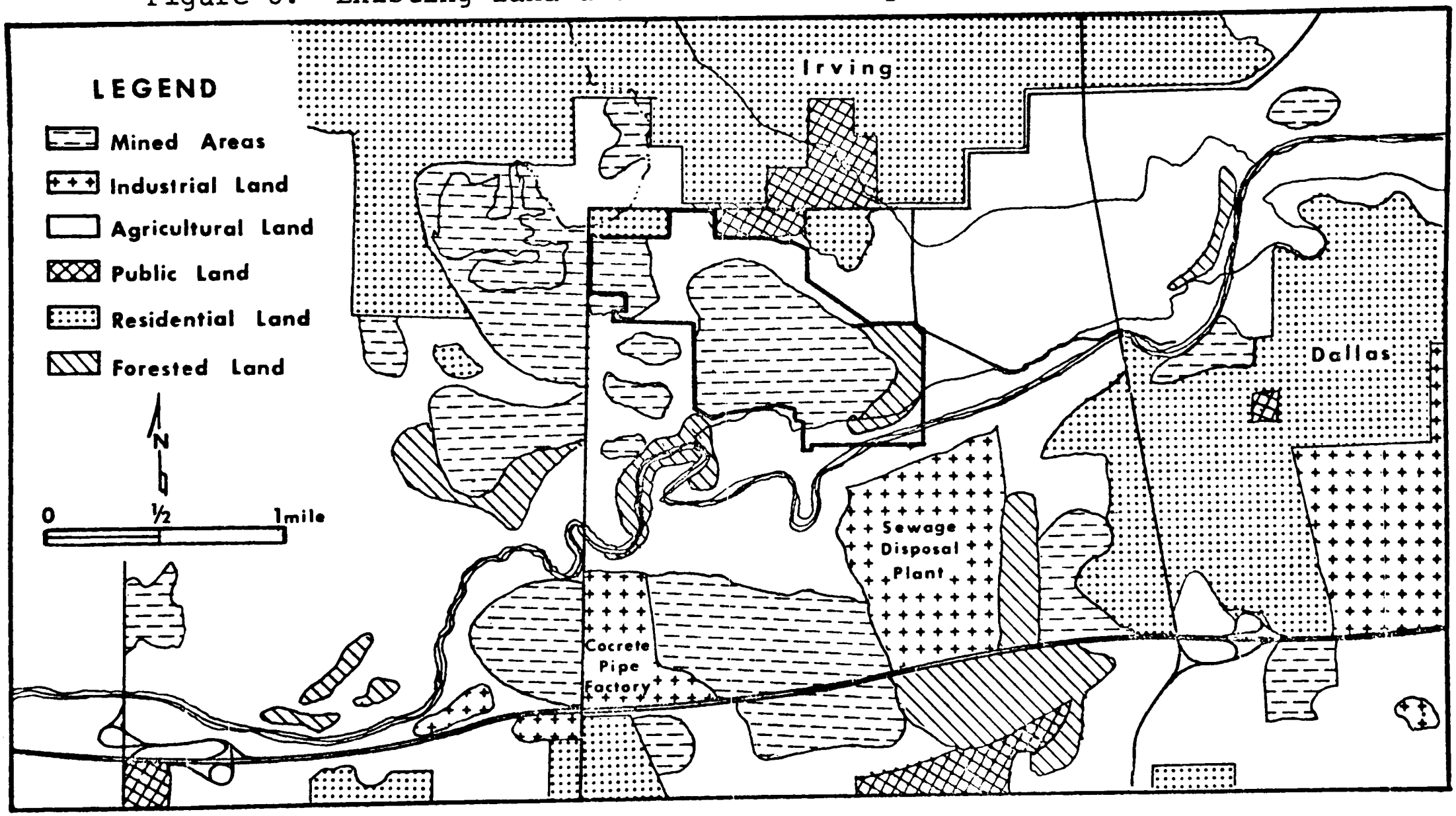
## Adjacent Land Uses

The land uses adjacent to the study area are predominantly agricultural in character (see Fig. 8). Two small residential areas and one public school adjoin the area on the north. Much of the land to the south and the west has been mined and is similar in character to the study area. A large sewage plant and a concrete pipe plant are located across the river to the south. Development of the site as a recreational area would not conflict with adjacent land uses.

## Projected Land Uses

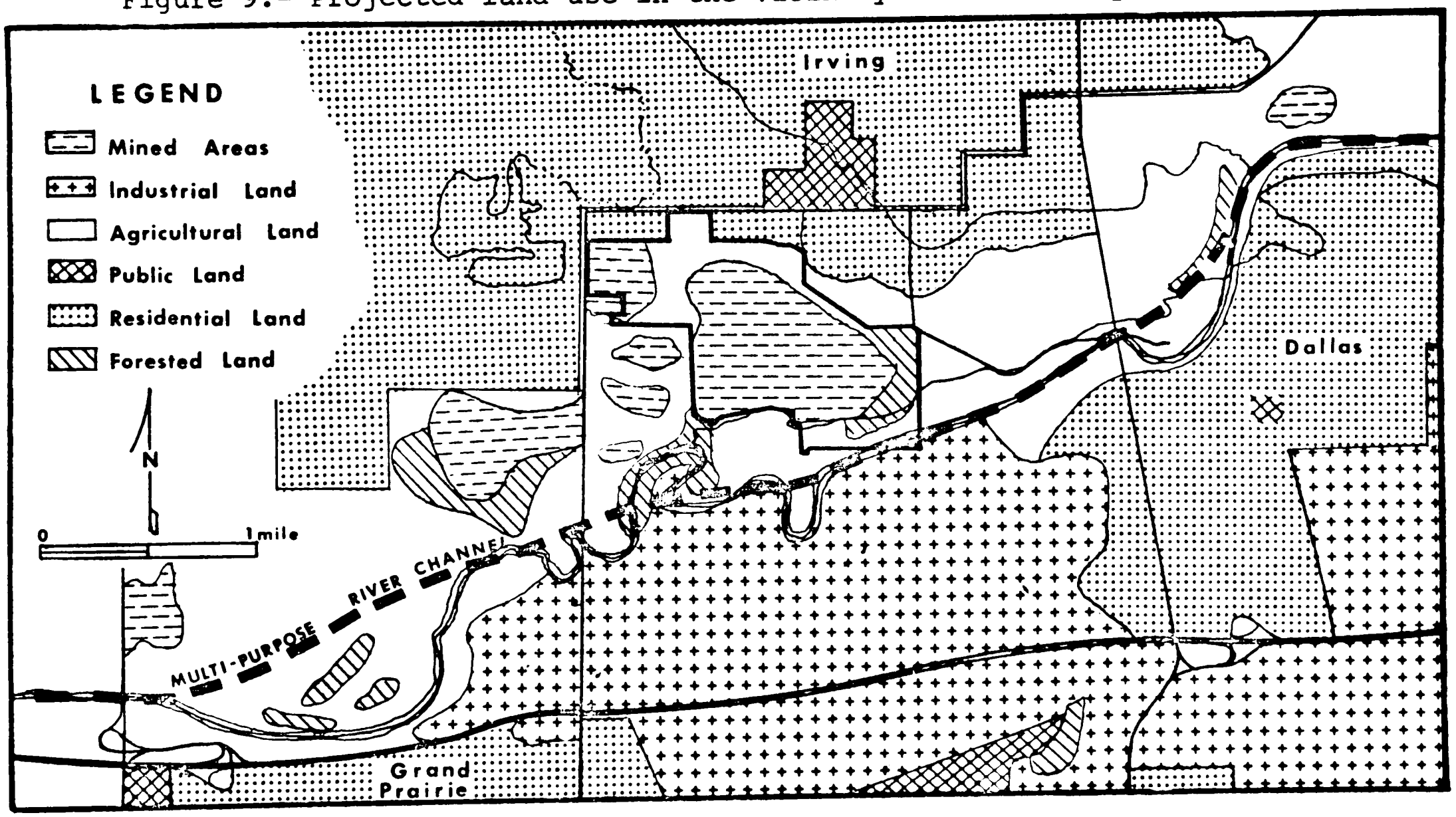
The areas immediately west and northeast of the study site are expected to be developed as residential areas by 1980 (see Fig. 9). South of the site and across the river, the land is expected to be developed eventually for industrial purposes. The multi-purpose river channel, proposed by the Corps of Engineers, is likely to stimulate the demand for both recreational and industrial use of the lands near the river. Development of the study site for

Figure 8.--Existing land use in the vicinity of the Cloudy Plant site




[a]N.A.S.A. High Altitude Photography, 1970.

Figure 9.--Projected land use in the vicinity of the Cloudy Plant site




[a]Texas Highway Department, Dallas-Fort Worth Regional Transportation Study, 1967, p. 47.

recreation would be complementary to the expected residential development and would serve to provide a buffer between the residential and industrial developments. Portions of the area could also be utilized by nearby schools as an outdoor science classroom.

## A Conceptual Development

The site encompasses most of the necessary ingredients for a successful recreational development. It is easily accessible and contains forested land, open space, and abundant water features. The mined areas provide excellent habitat for wildlife and a unique setting in which the study of the interaction between man and his environment could be undertaken.

One particular use for which the site is well suited is as a river-lake marina with related recreational developments for passive and active recreation (see Fig. 10). The multi-purpose river channel projected by the Corps of Engineers is expected to create a sizable demand for pleasure cruising on the Trinity River.[65] These recreationists will create a demand for marina facilities strategically

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[65]U.S., Congress, House, Trinity River and Tributaries, Texas, letter from the Secretary of the Army on the Navigation Features of the Trinity River, H. Doc. 276, 89th Cong., 1st sess., 1965, II, 29. Hereinafter referred to as Trinity River, H. Doc. 276, II.

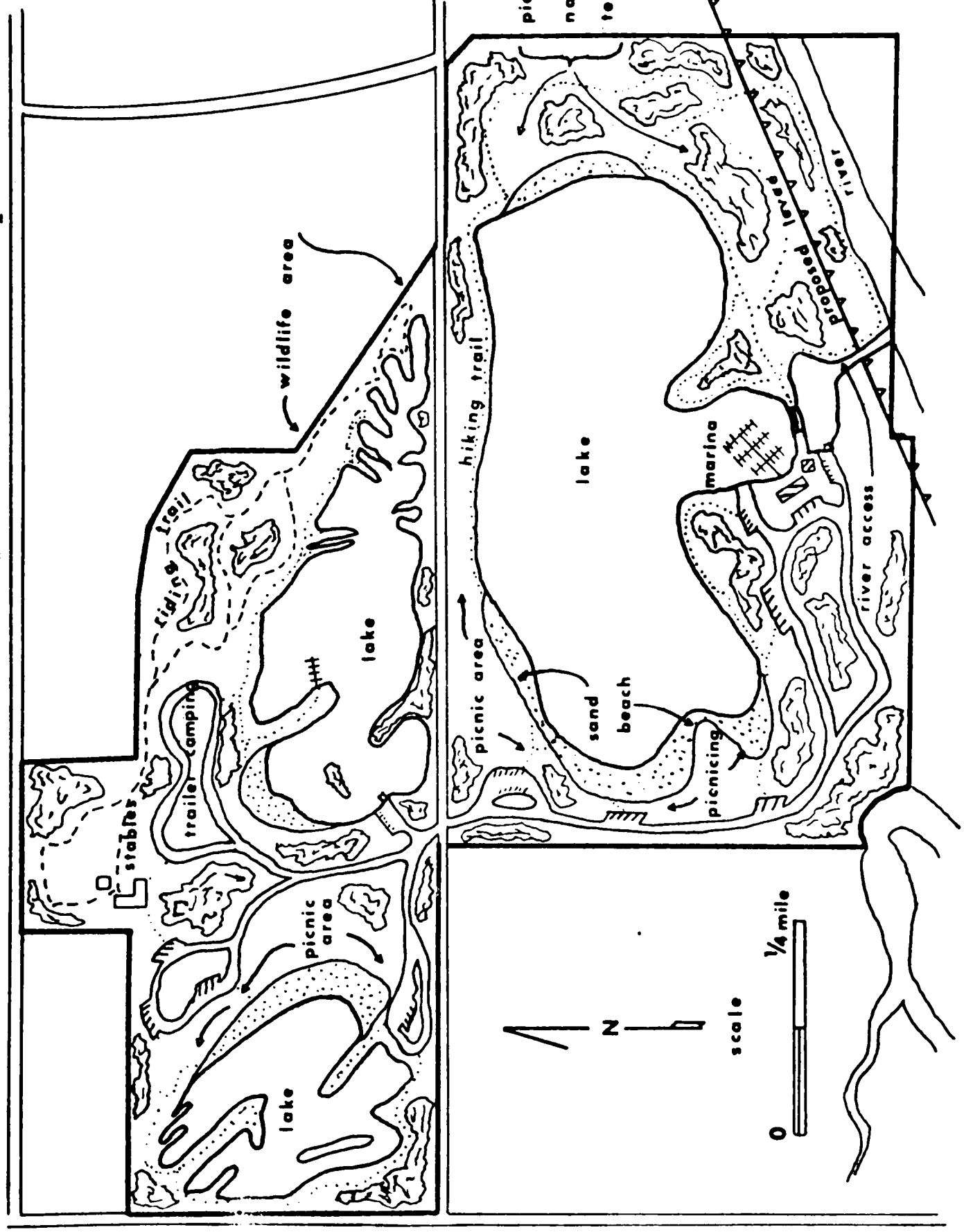


Figure 10.--A conceptual plan of development for the Cloudy Plant site

located along the river, as well as overnight camping and related recreational facilities. The Corps has projected the need for a minimum of twelve recreational use areas along the river channel, capable of servicing an annual visitation of 1,200,000 persons.[66]

Once processing operations have been concluded on the southern part of the site, and all processing plant equipment removed, the water features could be enlarged to form a lake capable of supporting a marina. Dredge from the lake could be used to construct functional and esthetic land forms, islands and peninsulas, and an elevated site for the marina. Waste sands, in abundant supply around the processing plant, could be used in the formation of swimming beaches. Picnicking, hiking, and fishing facilities could also be incorporated into the development. Because of the soils' limitations, poor drainage, and periodic flooding of the lower portion of the site, it is suggested that all other major facilities be constructed on the northern portion of the site.

The northern portion could be developed into a recreation area complementary in character to the marina development. The two large mined areas could be developed into lakes around which facilities for camping, nature

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[66]U.S., Congress, House, Trinity River, H. Doc. 276, II, 29.

study, picnicking, fishing, hiking, and swimming could be installed. The site could accommodate both trailer and tent camping, a much needed facility in the Dallas-Fort Worth area.

The bottomland forest surrounding Bear Slough should be preserved in a natural state as a wildlife habitat area. Development in this area should be limited to trails, picnicking facilities, and a comfort station. This area should be accessible by boat and foot, but not by motor vehicle (except maintenance vehicle).

## Problems of Development

The difference in elevation between the mined areas and the river would prohibit the connection of the southernmost lake directly to the projected multi-purpose channel. A connecting water access channel would drain the lake faster than the underground aquifer could replenish the supply. The marina facilities should be located at a point which would allow boat access to either the lake or the river (see Fig. 10). Thus, the marina would be a dual purpose development, serving both lake-oriented and river-oriented recreationists. This alone would not solve the problem of boat access directly from the lake to the river. The riverside access route could be designed so that a boat hoist could be installed between the lake and the

river. The hoist would allow for a relatively quick transfer of pleasure craft from lake to river, or the reverse, eliminating the inconvenience of boat loading and unloading.

The lowland flood plain between Dallas and Fort Worth is subject to flooding about once every eight years.[67] The lower one-third of the site is located in this flood-plain and normally would be subject to flooding. The flood control levees, projected to be built in conjunction with the multi-purpose river channel, would eliminate this hazard. In the event that the channel is not built, levees would need to be constructed around that portion of the site which is subject to flooding. Small levees now exist on the south side of the processing plant area, and could be easily enlarged.

The heavy growth of trees on the mined areas might somewhat inhibit the enlargement of the water areas. Their removal would be necessary before the lakes could be expanded. This probably would call for the draining of the lakes, and periodic pumping during the redevelopment of the site.

Fill work and grading would be required to eliminate the safety hazard presented by the steep slopes of all

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[67] U.S., Congress, House, Trinity River and Tributaries, Texas, letter from the Secretary of the Army on the Navigation Features of the Trinity River, H. Doc. 276, 89th Cong., 1st sess., 1965, V, 29.

overburden mounds left intact. The dredge from the lakes should be sufficient for all necessary fill work or land forming.

No problems would be expected in the enlargement of the lake which would be located where the processing plant is now situated. Vegetation has not overtaken the site, and once all processing equipment has been removed, the enlargement of that portion of the lake would pose no special problems.

In extremely dry years, the lakes may be subject to a small degree of fluctuation. This would cause no major problems for the upper lakes, but might affect the capacity of the lower lake to support boating activities.

Storm runoff waters from the streets of Irving would be expected to cause no problems. Most of the water is currently channeled into the river via Delaware Creek, or into Vilbig Lakes (see Fig. 3).

In order to provide adequate space for development and to facilitate the operation of the area, it is suggested that the land directly south of the processing plant and the land immediately northeast of the junction of Meyers and Hunter-Farrell Roads be acquired and incorporated into the site development.

## Conclusions

1. The study site is well-suited for development as a water-oriented recreational area. Users would be drawn from the entire Dallas-Fort Worth metropolitan area.

2. The water features in the mined areas should be enlarged to form lakes capable of supporting swimming, boating, and fishing activities. The limited size of the resulting lakes would prohibit water skiing and would necessitate the establishment of a regulation designating the maximum allowable motor size for all boats.

3. Dredge from the proposed lakes should be used to build land forms such as peninsulas and islands, and for all necessary fill work.

4. Waste sands should be used in the formation of beaches for swimming.

5. A portion of the two upper lakes should be retained in their present condition as wildlife habitat areas. Trails should be developed in these areas to facilitate hiking, nature study, and photography.

6. Facilities for trailer camping should be developed north of the middle lake.

7. Stables should be constructed on the northernmost portion of the site.

8. Separate trail systems should be developed for hiking and horseback riding.

9. Picnicking facilities (including comfort stations) should be located around the lakes.

10. A river-lake marina should be built on the southern edge of the lower lake. A channel should be constructed to link the river to the marina. Boat launches to both the lake and the river should be constructed. A craft transfer hoist should be built between the lake and the channel leading to the river.

11. The bottomland forest in the southern portion of the site should be made accessible only by foot or boat. This area should be developed for picnicking, hiking, nature study, and primitive camping. No land motor vehicles (except maintenance vehicles) should be allowed in the area.

12. A planting program should be undertaken to provide for adequate visual screens between the proposed development and the adjacent land uses.

The site could be developed in a number of ways. Gifford-Hill Company, Incorporated, could complete the basic reclamation with on-site equipment at less cost and in less time than federal, state, or local agencies. The improved site could then be leased or sold to either the state or a local municipality. Construction of recreation facilities could be completed gradually, with the marina facilities being developed last. Since the improved site

would be, for all practical purposes, a city park, the operation and maintenance of the area would be best achieved by the City of Irving.

# CHAPTER V

## STRIP MINING AND THE LAW

Strip mining is, and will continue to be, an important part of the American industrial economy. It provides the highest efficiency in mineral recovery, and is usually less costly than other methods of mining. It is, by far, the safest method of mining for the mine-workers.

Strip mining, however, involves costs which may not appear in the market transaction of the product. These hidden costs arise with the diminishing availability of useful land; with pollution which is hazardous to human life, property, and wildlife; with the destruction of natural beauty; and with the degradation of other natural entities to which a dollar value cannot always be assigned.

As is the case with water and air pollution, the destruction of the landscape has reached the point where controls are necessary to safeguard, promote, and preserve a quality living environment. Former Secretary of the Interior Stewart Udall recognized this when he said, "It

appears that surface mine reclamation is a policy issue whose time for resolution has arrived."[68]

## Existing Federal Legislation

### Federal General Mining Laws

The provisions of the general mining laws are basically those of the Act of May 10, 1872. These laws outline the required procedures for prospecting and establishing claims on vacant and unappropriated public lands and on national forests. Nothing in the general mining laws provides for the authority to control mining operations or to require the reclamation of land surfaces disturbed for prospecting or mining.[69]

### Federal Mineral Leasing Statutes

Deposits of coal, phosphate, sodium, potassium, oil, oil shale, native asphalt, solid and semi-solid bitumen, bituminous rock, and gas in the public lands and on national forests are not subject to the general mining laws. These

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[68]U.S., Congress, Senate, Committee on Interior and Insular Affairs, Hearings, before the Senate Committee on Interior and Insular Affairs, Senate, on S. 3132, S. 3126, and S. 217, 90th Cong., 2d sess., April 30, 1968.

[69]U.S., Congress, Act of May 10, 1872, 30 U.S.C., 17 Stat. 91, sec. 21-50.

minerals are covered by the Mineral Leasing Act of February 25, 1920.[70]

This Act provides for the disposition of the minerals mentioned by means of leases issued by the Secretary of the Interior and gives the Secretary the authority to require land reclamation following the conclusion of mining operations.[71]

## Indian Lands

The Act of May 11, 1938, stipulates the conditions under which Indian lands can be leased for mining activities. The lesee is required to return the land to approximately its original condition following the conclusion of mining activities.[72]

## Miscellaneous Federal Laws

Several other federal statutes exist which cover mining in specific situations. No federal statutes exist which control mining or reclamation of mined lands on a broad scale.

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[70] U.S., Congress, Mineral Leasing Act of February 25, 1920, 30 U.S.C., secs. 181-263, 281-287.

[71] Ibid.

[72] U.S., Congress, Act of May 11, 1938, 25 U.S.C., sec. 3962.

## Proposed Federal Legislation

The apparent lack of concern on the part of the states and the mining industry in relation to mined land reclamation, has prompted the recent introduction of several bills in Congress relating to strip mining and reclamation. The three most recent bills, introduced in the first session of the 92d Congress, are summarized below.

### Senate Bill No. 77

On January 25, 1971, Senate Bill No. 77 was introduced by Senator Nelson of the Committee on Interior and Insular Affairs. This bill, if signed into law, would provide for the regulation of present and future surface and strip mining, and for the conservation and reclamation of surface and strip mined areas. It would establish national standards for reclaiming surface or strip mined areas, and would provide financial assistance for reclamation to those states that adopted standards which were at least equivalent to national standards. It would allow the Federal Government to acquire surface or strip mined lands, where necessary, to achieve their reclamation and conservation.[73]

The Act would be administered by the Secretary of the Interior and the Secretary of Agriculture, with the

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[73] U.S., Congress, Senate, S. Res. 77, 92d Cong., 1st sess., secs. 1-26 (1971).

help of a national advisory committee. It would require planning prior to excavation, licensing, the posting of a performance bond, penalties for failure to comply with the regulations included in the Act, time limits on reclamation activities, periodic progress reports by the operator, and provide for adequate enforcement. Failure to comply with the provisions of the proposed Act could result in a fine of from $5,000 to $10,000, or imprisonment up to six months, or both, and all money obtained from penalties would be placed in a general reclamation fund.[74]

The Bill was read twice and referred to the Committee on Interior and Insular Affairs.

Senate Bill No. 993

In February, 1971, Senate Bill No. 993 was introduced by Senators Byrd (for Senator Jackson), Allot, and Cooper. If passed, the Act would provide for the cooperation between the Federal Government and the states, with respect to environmental regulations for mining operations.[75]

The Bill provides for a framework of controls similar to that provided for in Senate Bill No. 77. In

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[74]U.S., Congress, Senate, S. Res. 77, 92d Cong., 1st sess., secs. 101b-101i (1971).

[75]U.S., Congress, Senate, S. Res. 993, 92d Cong., 1st sess. (1971).

addition, the operator would be required to submit a mine reclamation plan prior to mining activities, and to file and maintain engineering maps of all operations. The Act would provide for the establishment of training programs for persons engaged in mining operations and in the enforcement of environmental regulations. It would be administered by the Secretary of the Interior, with the aid of an advisory committee.[76]

Failure to comply with the regulations of the proposed Act could result in cessation of the mining operation, and a fine up to $1,000 for each day of violation. Persons who knowingly violate the regulations would be subject to a fine of not more than $10,000, or imprisonment for not more than one year, or both.[77]

The Bill was read twice and referred to the Committee on Interior and Insular Affairs, where it is now being reviewed.

House Bill No. 4967

Representative Harsha introduced House Bill No. 4967 on February 25, 1971. If signed into law, the Act would provide for the cooperation between the Federal Government

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[76]U.S., Congress, Senate, S. Res. 993, 92d Cong., 1st sess., secs. 201-207 (1971).

[77]Ibid., sec. 207.

and the states with respect to environmental regulations for mining operations. The Act would require the states to submit environmental regulations, subject to review by the Secretary of the Interior, who would be responsible for the administration of the Act. If a state had not submitted these regulations within two years after the enactment of the Bill, the Secretary would be authorized to issue regulations for the state.[78]

The Act would allow the Attorney General, at the request of the Secretary to institute a civil action for an injunction for the cessation of mining operations which did not meet the requirements of the Act.[79]

If a person failed to comply with any of the regulations of the Act, he would be notified of his failure to comply, and after fifteen days could be ordered to cease operations. He would then be subject to a fine of $1,000 for each day of continuance of his failure to comply. A fine, not to exceed $10,000, or imprisonment for up to one year, or both, are provided for the person who knowingly violates any of the regulations of the Act.[80]

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[78] U.S., Congress, House, H.R. 4967, 92d Cong., 1st sess., secs. 201-206 (1971).

[79] Ibid., sec. 206.

[80] Ibid., secs. 207a-207b.

The Bill was referred to the Committee on Interior and Insular Affairs. It was reintroduced on March 8, 1971, in the form of House Bill No. 5689.[81] It was again referred to the Committee on Interior and Insular Affairs.

### Summary of Proposed Federal Legislation

Because these bills are tailored to the needs of the entire nation, they must be general in character. Although they specifically would require the states to adopt reclamation standards, the specific licensing, bonding, penalty, and administrative requirements would be at the discretion of the states. The only specific penalties which have been recommended in the bills relate to failure to comply with, or willful violation of, the regulations within the bills.

The bills are oriented toward controlling future mining activities. Once this goal is achieved, attention would be focused on the reclamation of lands damaged in the past.

## Existing State Legislation

The increase in environmental degradation stemming from mining activities has prompted the adoption of mining

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[81] U.S., Congress, House, H.R. 5689, 92d Cong., 1st sess. (1971).

regulations in twenty-two states. Each statute has been tailored to fit the needs of the state involved, but all include similar provisions for the reclamation of mined lands.

In some states, the regulations apply to all minerals, while in other states only certain minerals are included in the regulations. They are all administered by a specific state agency or a representative of a state agency. License requirements and bonding procedures vary from state to state, as do penalties for violations. Summary comparisons of the existing legislation are presented in Table 3.

## Proposed Legislation for Texas

As was discussed in Chapter I of this study, the need for mining and reclamation controls in the State of Texas is obvious. Of the total acreage disturbed in Texas for surface or strip mining as of 1965, over 80 per cent was in need of reclamation (see Chapter I, p. 3).

Public pressure for such legislation has rapidly increased with the coming of lignite-stripping operations to Texas, and on March 8, 1971, House Bill No. 945 was introduced in the legislature by Representative Ben Grant. The bill was read and referred to the Committee on Oil,

TABLE 3

SUMMARY OF STATE MINING LEGISLATION[a]

| State & Citation | Coverage | License Requirements | | Penalty for Failure to Obtain License | Bond Requirements | |
|---|---|---|---|---|---|---|
| | | Basic Fee | Additional Fee per Acre | | Minimum | Additional Fee per Acre |
| Alabama--Surface Mining Act of 1969 | All except limestone, marble & dolomite | $250 | None | $500-$5,000 | $150/acre | None |
| Arkansas--Act 236, 1971 | All minerals | Variable | None | $50-$1,000 per day | $500/acre | None |
| Colorado--Revised Stat. 1963 sess. Laws-1969 Ch. 242 | All minerals | None | None | $25-$300 per day | Variable | None |

TABLE 3--Continued

| State & Citation | Coverage | License Requirements | | Penalty for Failure to Obtain License | Bond Requirements | |
|---|---|---|---|---|---|---|
| | | Basic Fee | Additional Fee per Acre | | Minimum | Additional Fee per Acre |
| Georgia--Laws 1968, pp. 9-19 | All minerals | $100-$500 Depends on No. of Employees | None | $100-$1,000 per day for each provision not complied with | $100-$500 per acre | $100-$500 |
| Illinois--H.B. 306, Engrossed as amended | All minerals | $50 when over 10 ft. overburden is removed | Variable | $50-$1,000 per day | $1,000 | $200/acre over 5 acres |
| Indiana--Ch. 334 Acts of 1967 | Coal, clay, & shale | $50 | $15/acre | $1,000-$5,000 | $2,000 | $300-over 5 acres |

TABLE 3--Continued

| State & Citation | Coverage | License Requirements | | Penalty for Failure to Obtain License | Bond Requirements | |
|---|---|---|---|---|---|---|
| | | Basic Fee | Additional Fee per Acre | | Minimum | Additional Fee per Acre |
| Iowa--Senate File 279 | All minerals | $50 1st year. $10/year thereafter | None | $50-$500 per day and/or 30 days imprisonment | $100/acre | None |
| Kansas--Stat. Ann. 49-401 | Coal | $50 | None | $250/day | $2,000 | $200-$500/acre |
| Kentucky--Revised Stat. 350 | Coal & clay | $50 | $25/acre | $100-$1,000 fine plus $100-$1,000 per day | $2,000 | $100-$500/acre |

TABLE 3--Continued

| State & Citation | Coverage | License Requirements | | Penalty for Failure to Obtain License | Bond Requirements | |
|---|---|---|---|---|---|---|
| | | Basic Fee | Additional Fee per Acre | | Minimum | Additional Fee per Acre |
| Maine--Revised Stat. 1969, Ch. 472 | Clay, peat, stone, mineral ores, except sand & gravel | $50 | $25/acre not to exceed $500 | $100/day | $100-$1,500/acre | None |
| Maryland--Code Ann. Art. 66C | Coal | $100 plus $10 fee per yr. | $30/acre | $5,000-$10,000 or 6 mos. imprisonment or both | $1,600 | $200 |
| Minnesota--Acts of 1969 Ch. 774 | Metallic Minerals | $200 | None | Injunction or restraining order | Variable | None |

TABLE 3--Continued

| State & Citation | Coverage | License Requirements | | Penalty for Failure to Obtain License | Bond Requirements | |
|---|---|---|---|---|---|---|
| | | Basic Fee | Additional Fee per Acre | | Minimum | Additional Fee per Acre |
| Montana--Ann. Stat. 224 | All minerals where over 10,000 cu. yds. of over-burden is removed | $50 | None | $500-$1,000 per day of operation | $200-$1,000 | None |
| North Dakota--State Law 1969 Ch. 332 | All minerals where over 10 ft. over-burden is removed | Variable | None | $50-$1,000 per day of operation | $200/acre | None |

TABLE 3--Continued

| State & Citation | Coverage | License Requirements | | Penalty for Failure to Obtain License | Bond Requirements | |
|---|---|---|---|---|---|---|
| | | Basic Fee | Additional Fee per Acre | | Minimum | Additional Fee per Acre |
| Ohio--Revised Code 1513 | Coal | $75 | $15/acre | $300-$1,000 fine | $2,000 | $300-$650 per acre |
| Oklahoma--H.B. 503 Engrossed | All minerals | $50 | None | $50-$1,000 per day of operation | $5,000 | $350-$650 per acre |
| Pennsylvania--Stat. Ann. PL 1198 | Coal | $300 | None | $5,000-$10,000 or 6 mos. imprisonment or both | $5,000 | $500-$1,000 per acre |

TABLE 3--Continued

| State & Citation | Coverage | License Requirements | | Penalty for Failure to Obtain License | Bond Requirements | |
|---|---|---|---|---|---|---|
| | | Basic Fee | Additional Fee per Acre | | Minimum | Additional Fee per Acre |
| Tennessee--Stat. Ann. 43 | All minerals except marble, lime-stone, dimen-sion stone | $250 | $25/acre not to exceed $750 | $100-$5,000 per offense per day of operation | $100-$200 per acre | None |
| Texas--H.B.945[b] | Coal, iron ore lignite | Variable | Variable | $100-$5,000 per day of operation | $1,000 for 0-5 acres $3,000 + $600 per acre for gob disposal unless covered | $200/acre in excess of 5 acres |

TABLE 3--Continued

| State & Citation | Coverage | License Requirements | | Penalty for Failure to Obtain License | Bond Requirements | |
|---|---|---|---|---|---|---|
| | | Basic Fee | Additional Fee per Acre | | Minimum | Additional Fee per Acre |
| Virginia--Acts of Assembly Ch. 734 | All minerals | $6/acre not to exceed $150 | None | Max. $1,000 or 1 yr. in jail or both for any violation of provisions | $1,000 | $50/acre |
| Washington--S.B. 139 Engrossed | All minerals + 10,000 T. produced or 2 acres disturbed | $25 | $5/acre over 10 acres | $100-$1,000 | $100-$1,000/acre | None |

TABLE 3--Continued

| State & Citation | Coverage | License Requirements | | Penalty for Failure to Obtain Fee | Bond Requirements | |
|---|---|---|---|---|---|---|
| | | Basic Fee | Additional Fee per Acre | | Minimum | Additional Fee per Acre |
| West Virginia--Art. 6A 1931 | Coal, clay, manganese, iron ore, sand, gravel, shale, lime-stone | $100 | $30/acre | $100-$1,000 fine or 6 mos. imprison-ment or both per violation per day | $3,000 | $100-$500/acre |
| Wyoming--Sess. Laws Ch. 192 as amended | All minerals | $50 | None | $1,000 maximum per day of operation | Variable | None |

[a]Data compiled from individual state laws.

[b]Proposed legislation.

Gas, and Mining. The following sections constitute a summary of the major portions of the Bill.

## Coverage

If signed into law, the Act would cover the mining activities related to coal, lignite, and iron ore, as well as any materials removed from beneath the surface of streams, rivers, lakes, or other bodies of water.[82]

## Administration

The administration and enforcement of the Act would be delegated to the Commissioner of the General Land Office, with the aid of a six man State Reclamation Land Rehabilitation Advisory Committee.[83]

## Licensing

The operator would be required to apply for and obtain a permit for mining. The suggested fee for this permit varies with the number of acres to be disturbed. For ten acres or less, a $50 fee would be imposed, plus $11.50 per acre for each acre between two and ten acres.

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[82] Texas, H.R. 945, 62d Leg., 1st sess., sec. 3 (1971).

[83] Ibid., secs. 3, 7.

Permits for the mining of between eleven and fifty acres would cost $153.50, plus $6.50 per acre for each acre between eleven and fifty acres. Permits for the mining of over fifty acres would cost $413.50, plus $5.50 per acre for each acre over fifty acres.[84]

Application for licensing would require the submission of a site description, an estimate of the acreage to be disturbed, and maps showing the location of the site in relation to existing natural and man-made physical features. Permits would be good for one calendar year, and would be required for all operations which exceeded the original acreage estimation by more than 25 per cent.[85]

Duties of the Operator

The proposed law specifies the requirements for grading procedures, water impoundments, the disposition of toxic materials, the use and disposition of slurry and gob, and the construction of access roads. It also provides standards for right-of-way and set-backs, for the submission of maps and reclamation plans, for revegetation practices,

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[84]Texas, H.R. 945, 62d Leg., 1st sess., sec. 5b (1971).

[85]Ibid., secs. 5a-5e.

and for substitution of land which has been mined and reclaimed in the past.[86]

## Bonding Requirements

The Bill provides for a surety bond of $1,000 plus $200 for each acres of disturbed land in excess of five acres to be disturbed during the permit year. Areas to be used for gob disposal which could not be revegetated would require bonding of $3,000 plus $600 for each acre of land disturbed for that purpose. The bond security would remain in effect until the land had been reclaimed, approved, and released by the Commissioner of the General Land Office.[87]

## Penalties and Forfeiture of Bonds

Violations of the provisions of the proposed Bill would result in fines of from $100 to $4,000 for each offense for each day of continued operation. Willful misrepresentation of facts submitted in any application or report would subject the violator to a fine of from $100 to $500 for each offense. The Commissioner would have the right to revoke a permit and refuse the issuance of further

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[86]Texas, H.R. 945, 62d Leg., 1st sess., secs. 6b-6n (1971).

[87]Ibid., secs. 6k-9a.

permits if the operator did not comply with the provisions included in the Bill.[88]

The Attorney General, upon the request of the Commissioner, would be authorized to institute proceedings for the forfeiture of the bond of an operator for violations of the provisions of the Bill. The Commissioner would be required to notify the operator of these violations prior to requesting the instituting of injunction proceedings. The operator would then have thirty days in which to appear before the Commissioner and plead his case. Following the hearing, the Commissioner might withdraw his notice of violation, or he could request the Attorney General to institute bond-forfeiture proceedings. All fees and forfeitures would be deposited in the State Treasury and credited to a Strip Mine Reclamation Fund.[89]

## Exemptions

The proposed legislation would not apply to those counties which receive less than twenty inches of annual

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[88]Texas, H.R. 945, 62d Leg., 1st sess., secs. 14a-14d (1971).

[89]Ibid., secs. 10-12.

rainfall, based on the rainfall averages over the ten year period immediately prior to the enactment of the Bill.[90]

## An Analysis of the Proposed Legislation for Texas

### Coverage

By definition of the proposed legislation, "'Surface Mining' relates to the mining of coal, iron ore, or lignite by removing the overburden lying above the natural deposits and mining directly from the natural deposits thereby exposed."[91] According to the Department of the Interior, as of 1965, 12,500 acres of land, or less than 8 per cent of all the land disturbed for strip or surface mining in Texas, could be attributed to coal, iron ore, or lignite operations.[92]

Sand and gravel operations accounted for over 70 per cent of all lands disturbed in the State of Texas by strip or surface mining operations. Except for the relatively few dredging operations in the state, sand and gravel operations are not included in the proposed

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[90]Texas, H.R. 945, 62d Leg., 1st sess., sec. 15 (1971).

[91]Ibid., sec. 3.

[92]U.S., Department of the Interior, Mining and Environment, Appendix I, Table 1, p. 110.

legislation, nor are clay, stone, or other types of mining operations which accounted for 30,500 acres of disturbed land by 1965.[93]

It seems that a Bill, which deals with a policy issue as important as reclamation of mined lands, should include provisions for the operations which are responsible for the vast majority of mined lands within the state. The Bill allows for unfair economic advantage for those mining industries not involved in surface or strip mining, as it is presently described. It is suggested that the Bill be amended to include provisions relating to the mining of all minerals by any method.

## Administration and Enforcement

The placing of the administration of the proposed legislation within the jurisdiction of the General Land Office is a logical choice, as is the formation of an advisory committee. Unfortunately, no provisions or recommendations have been included in the Bill to provide for the funding that would be required for that office to undertake a program of effective enforcement. It is suggested that the Bill be amended to provide funds for that purpose.

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[93] U.S., Department of the Interior, Mining and Environment, Appendix I, Table 1, p. 110.

## Surety Bonds

The basic bond requirements of $1,000 plus $200 for each acre in excess of five acres of disturbed land, would not be adequate to cover the cost of reclamation at every site. Some operators are likely to forfeit bond rather than invest as much or more for adequate reclamation. A more flexible bond requirement, say from $200 to $600, the exact amount dependent on the site conditions, problems of reclamation, and the past performance of the operator would be more realistic. Bonding should not be limited to sites of over five acres in size. All disturbed lands should be subject to the same regulations. It is suggested that the proposed legislation be amended to this effect.

## Exemptions

The Bill does not now apply to counties which now receive less than twenty inches of rainfall during the calendar year. Reclamation of mined lands in dry regions of the state is extremely important. Without reclamation, mined lands in dry climates are subject to severe erosion. Good vegetative cover can be established in many areas which receive less than twenty inches of rainfall per year. It is suggested that rainfall alone should not be used as a basis for exclusion of land from reclamation practices.

The site physiography, availability of water for irrigation, and other potentially limiting factors should also be considered.

## County Zoning

Impairment to the environment by strip or surface mining is but one of many problems which could be partially corrected with the passage of General County Zoning Laws. Special purpose or single use zoning legislation at the state level is a cumbersome and time consuming approach to solving problems within the counties. The passage of legislation which would allow the counties within the state to enact multiple effect zoning ordinances would give the counties the authority they desperately need to insure quality and harmonious development. Such a law would eliminate the need for the time consuming process of single purpose state legislation being enacted on a county by county basis. It is suggested that legislation be enacted to this effect.

## Municipal Jurisdiction

Most mining operations in Texas are located outside city limits, and therefore are not subject to city zoning ordinances or controls. Where ordinances do exist, the variation in them from city to city promotes a good deal

of confusion to those in the mining industry. City reclamation ordinances can seldom affect the reclamation of lands that were mined before the mined area was incorporated into the city, due to the unconstitutionality of making the law retroactive.

## Summary

Controls for the reclamation of mined areas are best effected at the state level of government. If the states' failure to act continues, it is probable that the Federal Government will eventually require all states to maintain reclamation laws comparable to Federal legislation. The need for legislation governing mining and reclamation activities in the State of Texas is more than apparent. The urgency of the situation demands immediate enactment of and provisions for the enforcement of such legislation.

# CHAPTER VI

# CONCLUSIONS AND RECOMMENDATIONS

## Summary and Conclusions

The demand for outdoor recreation in the highly populated areas of the state, coupled with the need for construction aggregates, has focused attention on the possibility of reclaiming sand and gravel sites for recreational use. Although they are adaptable to other types of uses, most sand and gravel sites exhibit qualities which give them a special potential for recreational use. They are well located, easily accessible, and often contain abundant water features and varied topography. Redevelopment of these sites for recreational use usually would be less costly than redevelopment for commercial, industrial, or residential use.

The progressive approach to reclamation of mined lands is suggested because:

1. It utilizes already available personnel and equipment.
2. The site is opened to secondary use sooner than other methods would allow.

3. A concerned public is assured that the land will be reclaimed.
4. Progressive reclamation is usually the most economical method of development.

It should be emphasized that non-reclaimed sites often contribute favorably to outdoor recreation and may be considered superior to developed sites by many naturalists, hunters, boaters, and fishermen.

The apparent lack of concern on the part of the industry, coupled with the increased demands of a concerned public, has prompted the passage of reclamation laws in many states. Federal legislation is now pending which would require all states to adopt reclamation laws. Texas has no state laws regulating mining or reclamation. In Texas, most mined areas do not fall within the jurisdiction of municipal governments, and only a limited number of counties--Val Verde, Willacy, and Cameron--have any legal zoning authority. Thus, in Texas, control of mining and reclamation procedures would best be effected at the state level of government.

## Recommendations

1. A complete inventory of all mined lands in the state should be compiled. Individual sites should be mapped and maps should be updated on a regular basis. Records

should be kept by the General Land Office of all information relating to mined lands which may be useful to state, regional, and local planning agencies or private individuals.

2. The various city parks and recreation departments in the Dallas-Fort Worth area, as well as in other areas of the state, should consider the development of nearby sand and gravel sites as recreational areas.

3. The North Central Texas Council of Governments should assume the position of leadership in instigating and coordinating planning between the various parks and recreation departments, private industry, and other concerned persons, regarding the reclamation of mined lands in or near the Dallas-Fort Worth area.

4. The Texas Parks and Wildlife Department should consider sand and gravel sites, which are ideally located and are of adequate size, for development as State Recreational Parks under the jurisdiction of the Texas Parks and Wildlife Department.

5. The mining operators throughout the state should adopt progressive reclamation as an integral part of all future mining activities.

6. The operator should be held responsible for the reclamation of lands surface mined in the future.

7. Legislation should be adopted for the State of Texas which would insure the reclamation of mined lands.

This legislation should not be limited to coal, iron ore, or lignite mining, but should apply to all types of mining operations which have a negative effect on the environment during or following operations.

8. Adequate funding should be provided for the administration and enforcement of the proposed legislation.

9. The Texas State Legislature should adopt legislation which would give the counties more meaningful and effective zoning powers, for the purpose of controlling patterns of development, where necessary, to insure the perpetuation of a quality environment.

## SELECTED REFERENCES

### Public Documents and Reports


American Aggregates Corporation. Project Parklands. Greenville, Ohio: American Aggregates Corporation, n.d.

Bauer, Anthony M. Simultaneous Excavation and Rehabilitation of Sand and Gravel Sites. Silver Spring, Maryland: National Sand and Gravel Association. 1965.

Department of City Planning and Department of Parks and Recreation, Dallas, Texas. Parks and Open Space--A Master Plan. Dallas, Texas: Department of City Planning and Department of Parks and Recreation, 1959.

Department of City Planning, Fort Worth, Texas. Preliminary Plan for the 1980 Urban Area--Fort Worth, Texas. Fort Worth, Texas: Department of City Planning, 1965.

Jensen, David R. Selecting Land Uses for Sand and Gravel Sites. Silver Spring, Maryland: National Sand and Gravel Association, 1967.

Pickles, George. Realizing the Recreation Potential of Sand and Gravel Sites. Silver Spring, Maryland: National Sand and Gravel Association, 1970.

Rogier, David A., and Shellie, Kenneth L. Site Utilization and Rehabilitation Practices for Sand and Gravel Operations. Silver Spring, Maryland: National Sand and Gravel Association, 1963.

Schrickel, Rollins, and Associates. A Planned Industrial District. Dallas, Texas: Schrickel, Rollins, and Associates, n.d.

Texas Highway Department. Dallas-Fort Worth Regional Transportation Study. Austin, Texas: Texas Highway Department, 1967.

Texas. Legislature. House. H.R. 945, 62d Leg., 1st sess., 1971.

The Sociological and Economic Impact of Urban Parks in Dallas, Texas, in 1966, E.J. Urbanovsky, project director. Lubbock, Texas: Texas Technological College Press, 1967.

U.S. Congress. Act of May 10, 1872, 30 U.S.C., 17 Stat. 91, secs. 21-50, 1872.

_____. House. H.R. 4967, 92d Cong., 1st sess., 1971.

_____. House. H.R. 5689, 92d Cong., 1st sess., 1971.

_____. House. Trinity River and Tributaries, Texas. Letter from the Secretary of the Army on the Navigation Features of the Trinity River. H. Doc. 276, 89th Cong., 1st sess., 1965, Vol. II.

_____. House. Trinity River and Tributaries, Texas. Letter from the Secretary of the Army on the Navigation Features of the Trinity River. H. Doc. 276, 89th Cong., 1st sess., 1965, Vol. V.

_____. House. Trinity River and Tributaries, Texas. Letter from the Secretary of the Army on the Re-evaluation of the Navigation Features of the Project for the Trinity River. H. Doc. 364, 90th Cong., 2d sess., 1968, Vol. I.

_____. Mineral Leasing Act of February 25, 1920, 30 U.S.C., secs. 181-263, 281-287, 1920.

_____. Senate. Committee on Interior and Insular Affairs. Hearings before the Committee on Interior and Insular Affairs, Senate, on S. 3132 and S. 217, 90th Cong., 2d sess., 1968.

_____. Senate. S. Res. 77, 92d Cong., 1st sess., 1971.

_____. Senate. S. Res. 993, 92d Cong., 1st sess., 1971.

U.S. Department of Agriculture. Soil Conservation Service. General Soil Map for Dallas County, Texas. Temple, Texas: Soil Conservation Service, 1970.

_____. Preliminary Soil Series Maps, Dallas County, Texas. Dallas, Texas: Soil Conservation Service, n.d.

_____. Soil Series Description Sheets. Fort Worth, Texas: Soil Conservation Service, n.d.

_____. Soil Series Interpretation Sheets. Fort Worth, Texas: Soil Conservation Service, n.d.

_____. Soil Series Limitation Sheets. Fort Worth, Texas: Soil Conservation Service, n.d.

U.S. Department of Commerce. Bureau of the Census. United States Census of Population: 1970, Vol. I, Final Population Counts, pt. 45, Texas. Washington, D.C.: U.S. Government Printing Office, 1971.

U.S. Department of the Interior. Surface Mining and Our Environment. Washington, D.C.: U.S. Government Printing Office, 1967.

U.S. National Aeronautical and Space Administration. High Altitude Photography, 1970.

## Books

Avery, T. Eugene. Interpretation of Aerial Photographs. Minneapolis, Minnesota: Burgess Publishing Company, 1968.

Clawson, Marion. Land for Americans. Chicago, Illinois: Rand, McNally and Company, 1963.

Harlow, W.M., and Harrar, E.S. Textbook of Dendrology. New York: McGraw-Hill Book Company, Inc., 1958.

Museum of Natural History, Dallas, Texas. Elm Fork Nature Area--Guidebook. Dallas, Texas: Dallas Museum of Natural History, n.d.

Pfleider, Eugene P., ed. Surface Mining. New York: American Institute of Mining, Metallurgical, and Petroleum Engineers, 1968.

Wormington, H.M. Ancient Man in North America. Denver, Colorado: Denver Museum of Natural History, 1949.

## Articles and Periodicals

Dallas Morning News. January 14, 1969.

Houston Post. Editorial, April 4, 1971.

Mann, Roberts. "Land Policies." Parks and Recreation, January, 1958, p. 68.

## Unpublished Material

Allard, Leon D. Assistant Vice-President in Charge of Operations, Gifford-Hill Company, Inc. Private interview held in Dallas, Texas, August, 1971.

Biggs, Harold. Assistant General Manager, Gifco, Inc. Private interview held in Dallas, Texas, October, 1971.

Nixon, Elray S. Associate Professor of Biology, Stephen F. Austin State University. Personal letter, n.d.

Ratliff, Kenneth D. Kentucky State Reclamation Inspector. Personal letter, March 12, 1971.

Slaughter, Bob H. Director of Vertebrate Paleontology, Southern Methodist University. Personal letter, August 6, 1971.

Theime, W.I. Chairman, American Aggregates Corporation. Personal letter, June 26, 1971.

Tunnell, Curtis E. Texas State Archeologist. Private interview held in Lubbock, Texas, October, 1971.

Walker, B.L. Arlington Landfill Superintendent. Private interview held in Arlington, Texas, August, 1971.

Woodliff, Robert. General Manager in Charge of Operations, Trinity Gravel Division of Portland Cement. Private interview held in Dallas, Texas, August, 1971.