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THESIS
PLAN B OPTION

Written by:
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Michigan State University
Urban & Regional Planning Program
Land & Mine Reclamation Specialization

Summer 1997

-Project Site-
Oakland Sand and Gravel Operation
Oakland and Washington Townships, Michigan
Edward C. Levy Corporation

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Abstract

Material extraction from the earth is essential for the productivity of our very existence. Aggressive standards for living demand the supply of countless natural resources. The extraction of sand and gravel is one of the many resources that support our industrialized nation through the construction of buildings and roadways. The quantity of sand and gravel extracted in Michigan averages 8.5 tons per capita. These massive amounts of material are essential to support our growing population. Where there is growth, there is a need for sand and gravel extraction. It is this method of sand and gravel extraction which is the basis of this project thesis.

This thesis is built upon the foundation of two trends. First, there is an increase in land value due to an increase in population and housing needs. Second, mining operations are, by nature, temporary. Therefore, through proper planning the land upon which a mining operation rests can be managed today to support, both, mining and post-mining land uses. The first harvesting of the land is the extraction; the second harvesting is redevelopment. Reclamation is the key to this second harvesting. Reclamation is defined as the reformation of the land into the desired end use. (Merriam Webster)

I believe that the days have past for accepting the abandonment of mining pits. A new philosophy for land management is on the horizon. The mining industry should be expected to pro-actively manage their land, accordingly. This land management demands a responsible caretaker: one willing to leave the land in an usable condition, just as it was found. This expectation must be established through strict, yet empathetic, reclamation regulations and improved attitudes of stewardship within the industry.

Until more rigid regulations are consistently established throughout communities, I feel that the most productive manner in which to change attitudes towards reclamation lay within the responsibilities of individual mining companies.

The Levy Corporation of Dearborn Michigan is taking the process of reclamation seriously. On-staff developer and landscape architect promote a second harvesting of the land above and beyond the

legally required standards. The driving force behind their efforts is the enhancement of the land to support post-mining residential, commercial, and civic needs of their community.

The Oakland Sand and Gravel operation of the Levy Corporation is the study area for my project thesis. Oakland Sand and Gravel is currently mining a 378.86 acre parcel in the counties of Oakland and Macomb, Michigan. The operation has been in existence since 1970 and is permitted to mine and reclaim the site through 2008. The company anticipates a maximum of two years worth of reserves remaining. At this time, Mr. Steve Weiner, developer, and Mr. Robert Doyle, landscape architect, of the Levy Corporation have agreed to participate in my study by providing information and professional expertise. My study shall include an inventory, analysis, and recommendations concerning the site's reclamation potential.

The conditions of this mining operation are advantageous to reclamation because of the on-site resources, such as earth-moving equipment. This study shall show specific examples of how reclamation provides efficient and effective alternatives to increasing the land value of this disturbed site.

Introduction

Oakland Sand and Gravel is an aggregate mining division of the Levy Corporation of Dearborn, Michigan. The Oakland Sand and Gravel (OSG) operation is located within Oakland Township of Oakland County and Washington Township of Macomb County in Southeast Michigan. OSG has been operating on the 378.86 acre site since 1970 and is permitted to mine through 2007; all reclamation must be completed by 2008. OSG foresees approximately 2 years worth of reserves remaining. This narrow time frame makes plans for reclamation increasingly urgent. Reclamation planning shall be the focus of this project thesis. To successfully study the site's reclamation potentials sufficient data must be gathered. Backgrounds in Oakland and Washington comprehensive planning and OSG's current and future land use visions must be coordinated.

With the site resting within both Oakland and Washington Townships, it is necessary to acquire permit approval from both municipalities. These differences in township standards complicate site development and reclamation processes. Each municipality's master plans must be understood independently in order to effectively develop the site.

OSG is a subsidiary of the Levy Corporation. The Levy Corporation desires to develop the site residentially. The type of housing, however, is dependent upon the regional growth trends which will ultimately support this development. The site is located within one of the most prosperous regions in Michigan. Population growth and, as a result, construction is continually rising. This is a key factor in projecting the success of the development.

It is important to the Levy Company to work with Oakland and Washington Townships as closely as possible to ensure a successful development. To do this, it is essential for OSG to become familiar with the municipalities' comprehensive plannings. Just as it is crucial for the municipalities to realize OSG's efforts to reclaim the site above and beyond all expectations and regulations. Oakland and Washington townships have the opportunity to work with OSG to create the best possible development solution within existing zoning

regulations. With these relationships in mind, the topics of this study are as follows:

PART I

REGULATORY, ZONING, AND TOWNSHIP PLANNING ISSUES

Part I includes those local plans and regulations which most effect the reclamation and development processes. Some of these issues include: demographic information, community master planning, zoning, and wetland protection.

PART II

INVENTORY AND ANALYSIS

Part II of this study reviews the features on and off of the site. Both regional growth patterns and site specific conditions shall be discussed. In addition, a review of two case studies shall be discussed to analyze related reclamation concepts.

PART III

RECLAMATION AND DEVELOPMENT PROGRAM

Part III shall include two distinct reclamation design alternatives. Both alternatives are designed to support residential end uses. The major distinction being the intensities of reclamation implemented.

This study shall include maps showing on-site inventory and analysis, reclaimed earth, and two alternatives in residential design. The goal of this study is to identify how different levels of reclamation impact the end land use. The two design alternatives demonstrate how varying intensities of reclamation impact the OSG Site.

The focus of this study is on immediate and site-specific reclamation opportunities for OSG. Most reclamation plans evolve over time, due to the lengthy lifespan of mining operations. This, however, is not the case with OSG. The OSG Site requires immediate action. All activity on the site shall cease within the next decade. The success of this short term reclamation project relies upon effectively contouring land forms and water bodies in support of a secondary land use. The

challenge lies in creating significant spaces with the resources that remain on the site. These resources take the form of manpower, machinery, overburden materials, and creative planning.

Part I

REGULATORY, ZONING, AND TOWNSHIP PLANNING ISSUES

The aggregate mining industry exists for the extraction of sand and gravel from the earth. This excavation of materials results in serious impacts on the land. For example, mineral extraction destroys existing vegetative, habitat, and topographic patterns on the earth's surface. Therefore, it is important to protect the natural areas whenever possible, for as long as possible, and to restore the disturbed areas as soon as possible. Mine reclamation is the restoration of land which has been altered or disfigured through the excavation process. Reclamation can take on two forms. One, the reclamation process can occur simultaneous with the mining process. Two, the reclamation process can be ignored until a later, post-mining date. Delaying the reclamation process, however, only magnifies potential difficulties and costs. Likewise, when the mining and reclamation processes co-exist, time and costs are drastically reduced. This increased the end land-use potentials significantly. For example, earth moving can be accomplished in phases. After an area is mined the reclamation process begins, before moving on to the next proposed mining area. Consideration for reclamation allows for suitable slopes and vegetative re-establishment according to municipal regulation or plans future development. This method drastically reduces the costs of labor and equipment. The most valuable benefit of the simultaneously mining and reclamation processes is the ability to mold the earth's surfaces to a specified end land form. In long term mining operations, the goal of reclamation shall be to create usable land. However, in short term operations, reclamation can actually structure the land to suit a specific need, such as a waterbody, wetland, rolling hill, or savanna. The earth moving process has proven its worth to designers and developers of virgin lands. However, earth moving for the sake of the development of mined sites is a relatively recent approach. Despite an increasing number of mining companies beginning to adopt this reclamation philosophy, there remains feeble attempts at legislative guidance.

Currently, the aggregate mining industry is sporadically regulated. The only extractive legislation at the federal level pertains to coal mining. Surface mining is regulated at the state and, most

commonly, the local levels. As a result, inconsistencies are widespread. This complicates the permitting process, because it leaves the reclamation success stories to the individual mining companies and developers who take it upon themselves to create usable spaces above and beyond regulated standards.

The focus of this study is to determine reclamation potentials for the OSG Site. With only a few years of operation remaining, the timing of this study is critical. The goal is to produce two conceptual alternatives with residential end uses. This section shall discuss the community visions and regulations of Oakland and Washington Townships within which the site exists.

The community visions and current regulations are based upon the demographics of the region. Current and projected growth patterns for the townships of Oakland and Washington must be identified to determine the success of this proposed development. The following demographics are provided by the Southeast Michigan Council of Governments (SEMCOG). From 1990 to 1995, both Oakland and Washington Townships demonstrated much growth. The population of Oakland County is ranked number one in absolute growth, with a 6.4 percent growth rate. Macomb County has increased in population, also, with a 2.3 percent growth rate. Perhaps of greater importance is the growth rate of households. once again, Oakland County ranks first in growth, with an increase of 30,000 residences from 1990 to 1995. Macomb County ranks second, only to Oakland. (SEMCOG, Population and Occupied Housing Units Report, pg. 3) These growth trends reflect positively on Oakland and Macomb Counties and, ultimately, lower the risks involved in developing the OSG Site. In addition to these current growth rates, it is important to review the forecasts for the region. According to SEMCOG, the rates of growth will continue to rise through the year 2020. "With the forecasted 22 percent growth in households, the region will need to build over 400,000 new housing units between 1990 and 2020". (SEMCOG, pg. 1) Within this region, Oakland and Washington Townships have been forecasted to be among the largest growth rates for population, household, and employment. Population rates of growth in Oakland County are to increase by 25.5 percent; Macomb County increase in population by 23.3 percent. This is particularly significant because many of the adjacent counties shall

experience a decrease in population growth. The reason for this decline is the down-sizing of families from an average of 2.66 to 2.47 per household for the entire region. The household forecasts project Oakland and Washington Townships as having a large increase of more than 2,000 through 2020. Also, employment rates for both townships are projected to have moderate increases from 1,001 to 5,000. (SEMCOG, 2020 Regional Development Forecast Report)

In addition to the current and projected township characteristics, listed above, are the regulations which mold this residential development. The standards for reclamation are stated within the county ordinances for Oakland and Washington Townships. Oakland Sand & Gravel, a subsidiary of the Levy Corporation, intends to surpass the minimum standards of township reclamation in order to develop the site into a fine residential community. This shall be accomplished by creating functional and aesthetically pleasing spaces for residential units, as well as adhering to the municipal requirements. The regulations affecting the residential development include slope reconstruction, natural resource protection, and land use zoning. Slope reconstruction is part of Oakland and Washington Townships' mining reclamation regulations. To illustrate, according to Oakland Township's Mining Ordinance, slopes must meet natural grade no further than the property lines. Also, where there is no presence of water, the slopes are not exceed one vertical foot to four horizontal feet (25 percent); likewise, where water is present, slopes are not exceed one foot vertical to seven feet horizontal for a distance of ten to 50 feet. In addition, permanent water depths must exceed ten feet below the low water mark for a minimum of 80 percent of the entire water area. The ordinance, also, requires the water quality to be tested through the County Health Department. (Oakland, pg. 17) The protection of natural resources is critical to reclamation and development of the site. Of particular importance to the OSG Site is the regulation of wetlands. The State of Michigan protects wetlands over five acres in size. Consequently, portions of the OSG Site are undevelopable and are noted as sensitive areas requiring special care. The Levy Corporation desires to work closely with Oakland and Washington Townships to ensure a successful development. Therefore, it is important for OSG to be familiar with the municipalities' comprehensive planning. In addition to OSG's efforts, it is important for the municipalities to realize OSG's

opportunity to reclaim the site above and beyond all expectations and regulations. Oakland and Washington Townships have the opportunity to work with OSG to create the best possible development solution within current zoning regulations. This process shall be accomplished through OSG's right to apply for a Planned Residential Development (PRD). A PRD allows the mining company to ask for leniency without altering existing zoning regulations. For example, OSG can be granted the privilege of increasing density, allowing for more units per acre without permanently altering current zoning. Each township has their own standards for a planned residential development such as this; regardless, it is much more common for a township to permit an PRD rather than alter current zoning regulations. Current zoning for the western portion of the site in Oakland County is Very Low Residential Density, or VLRD. The eastern portion of the site, Macomb County, is zoned a Rural Residential District, R-1. The regulated density for Oakland County's VLRD is one unit per 75,000 square feet, without sewer. In Macomb County, R-1 is defined as one unit per two acres or more. There are, however, variances to these ordinances to improve upon the proposed development. As stated in Section 190.2138 of the Washington Township Zoning Ordinance,

> "(PRDs) are also intended to encourage innovation in land use and variety in design, layout and type of structures constructed; achieve economy and efficiency in the use of land, natural resources, energy and the provision of public services and utilities; encourage useful open space; and provide better housing." (pg. Z-208.18 to Z-208.19)

In this case, the PRD provides the opportunity to adjust the required densities of the townships. For example, current zoning in Oakland Township regulates density at one unit per 75,000 square feet, without sewer. The density required if the units had access to public sewers is 56,250 square feet. The proposed residential development is designed to support a community sewer system. One system south of Inwood Road and one system north of Inwood. Therefore, the extra square footage required through zoning is not necessary to support a septic tank. A proposal for one unit per 56,250 square feet shall be the basis for the Planned Residential Development.

The following points highlight the regulations that most effect the OSG reclamation process:

- where water is present, there shall exist no slope greater than an one to seven ratio for a distance of 10 to 50 feet
- where there is no presence of water, slopes shall not exceed an one to four ratio, or 25 percent
- wetlands five acres and larger in size are not to be disturbed
- the property is zoned for residential land usage; the proposed PRD density shall be 56,250 square feet

The focus of this study is to determine reclamation potentials for the OSG Site. Therefore, it is important that these regulations are considered to achieve the highest levels of reclamation and development. The inventory, analysis, and implementation to follow are based upon the guidelines of the Oakland and Macomb Townships.

PART II

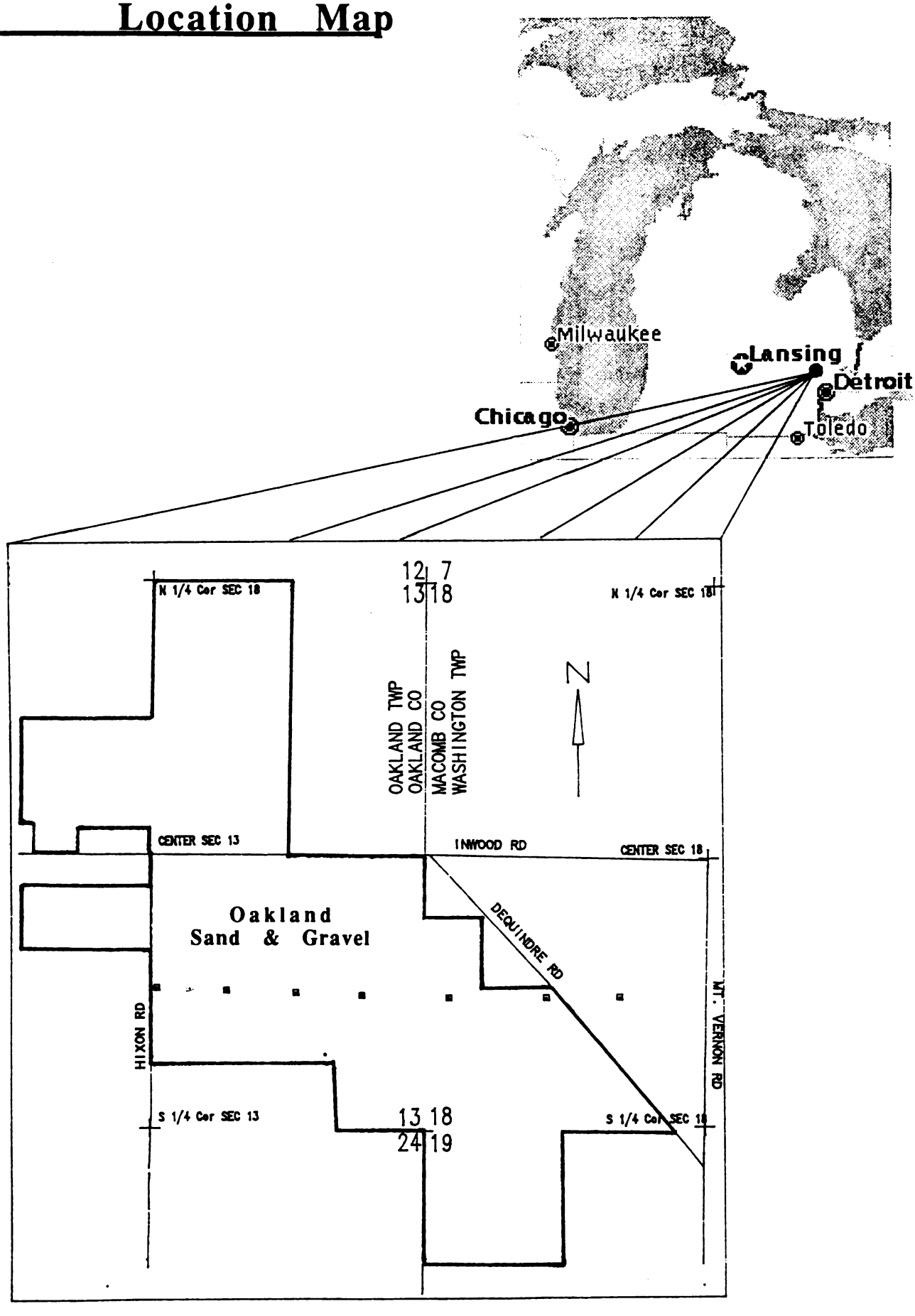
Inventory and Analysis

The inventory and analysis of the OSG Site elements are crucial to site development. The more familiar the site elements and features are to the designer, the more successful the designs. This study shall focus on the site's physical inventory, site analysis, and an investigation of comparable residential developments.

This 378.86 acre site is located in Oakland and Washington Townships, off of highway M-59. Inwood Road intersects the northern and southern portions of the site. The site's boundaries rest along Dequindre Road to the east and Hixon Road to the west. The site is best accessed from Inwood and Dequindre roads because of their higher traffic volumes. Trends in population growth show this region as high in population and employment. (SEMCOG) The surrounding land is zoned, currently, for very low residential densities. Correspondingly, the primary land use adjacent to the site is low density residential, with the exception of a small subdivision to the south of the site and a sand and gravel operation to the east. Due to the rapid growth rates of both Oakland and Macomb Counties, the townships are becoming more conservative with their permit approval processes. This is relevant to this site's development because it informs us that a Planned Residential Development (PRD) approval is much more realistic than an alteration to current zoning regulations. This affects OSG's proposed densities. For example, in Oakland Township, the PRD shall propose an increase in density from one unit per 75,000 square feet to one unit per 56,250 square feet. The difference in square footage is the difference between the required area for lots with and without septic. The site shall be developed with community septic. As a result, the proposed PRD shall suggest less acreage per lot than the zoned 75,000 square feet for a lot without public sanitary sewer.

For site development, it is crucial to identify the infrastructure available to the property. Without sufficient infrastructure, the site would be nearly impossible to develop. The OSG property has sufficient road systems to support future traffic. Utilities, such as electric and cable shall be provided as needed. Each residence will rely on propane tanks. There shall be individual or community

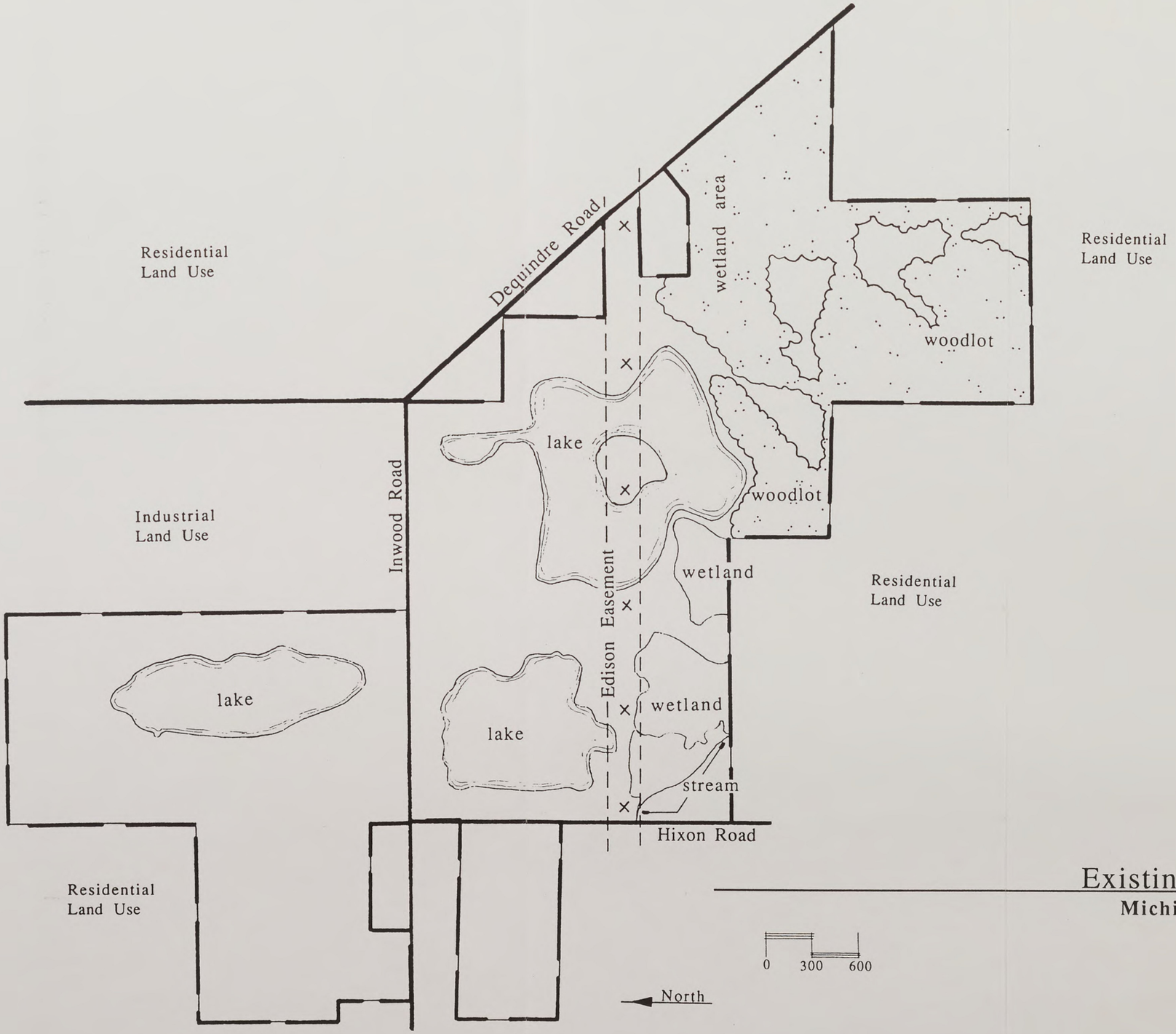
Location Map



water wells and common septic tanks. The site shall possess two common septic fields: a three to four acre site to the north of Inwood Road and a three to four acre site to the south. Despite the proposed westward expansion by the Detroit Water and Sewerage Department (DWSD) within the next 10 years in Washington Township, "this area of the Township is not intended to be served with public utilities". (Washington Master Plan, pg. 138-141)

Adjacent land uses are an important part of the development process. The current land uses have given character to the area and may suggest future growth trends. The land uses adjacent to the site are residential and industrial. The majority of the western, northern, and eastern property lines juxtapose very low density dwellings. The site's southern property line abuts Hidden Hills, a one unit per one acre residential subdivision. The northern portion of the eastern property line borders the formerly owned American Aggregate sand and gravel operation. The American Aggregate parcel has recently been purchased by the Levy Corporation. Although, this study shall not incorporate this additional parcel in the reclamation process it is important to recognize the potential relationship between the Oakland Sand and Gravel Site and this adjacent American Aggregate Parcel.

The inventory of the site's natural or existing features, listed below, illustrates those site characteristics that potentially effect the reclamation process. Included among these features are: geology, topography, vegetation, and water table. The site's soil composition is, primarily, sand and gravel. This combination is very suitable for residential development. There are areas where clay is existent. The soil is unlikely to perk enough to support wells and septic tanks. However, this issue is avoided with community water and septic systems. The post-mining topography of the site varies from 875' to 960' above sea level. The higher elevations exist to the south. The mining process has created slopes exceeding reclamation standards, both, south and north of Inwood Road. Slopes as steep as 90% border the lake north of Inwood. There are three lakes on the site: a ten acre lake north of Inwood Road, and a ten acre and a 20 acre lake south of Inwood. The on-site lakes have been created through the mining process. There is, however, a stream entering and exiting at the southwest corner of the property. This stream is connected with



Existing Site Features

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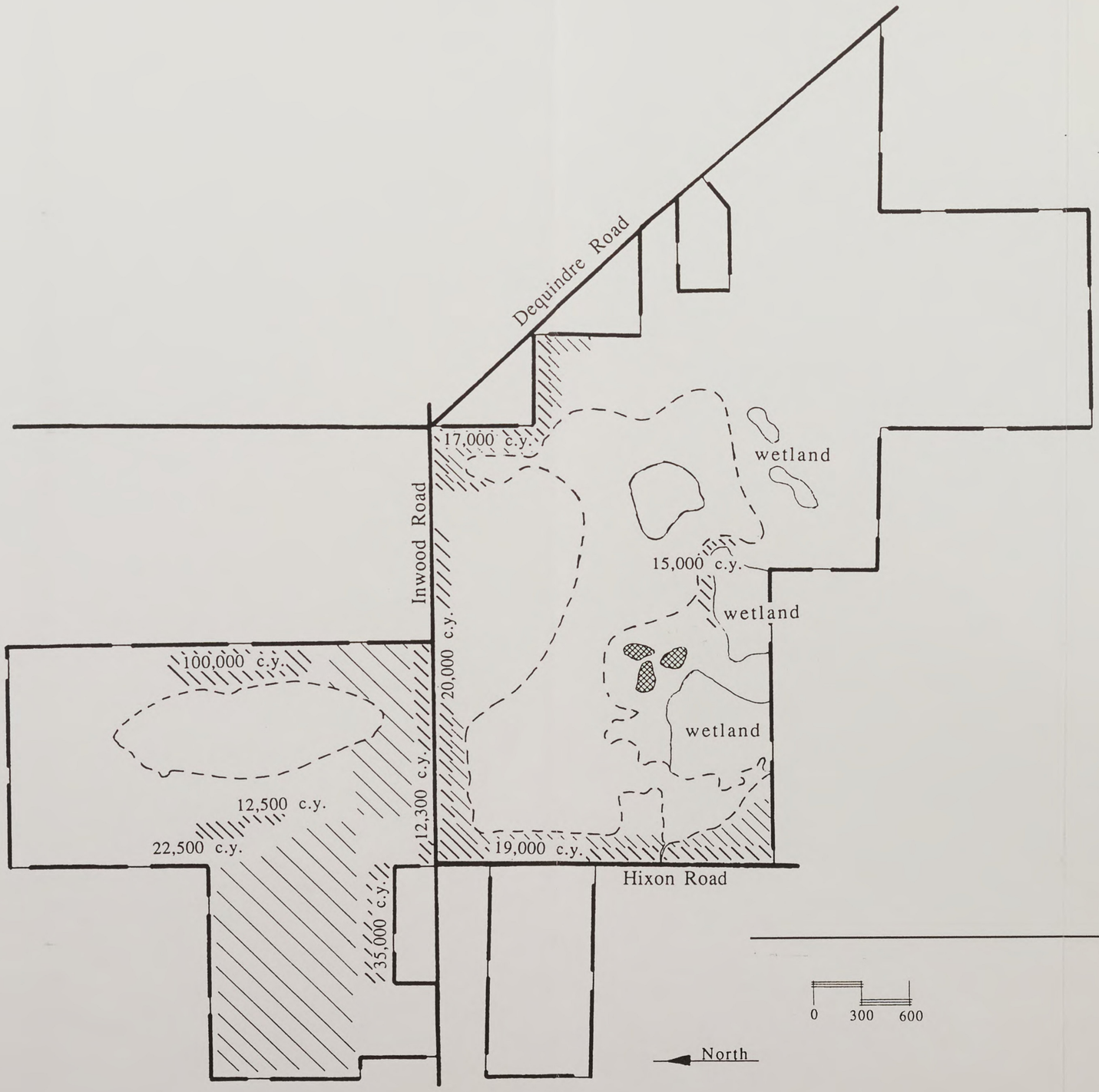
a mining-created lake. In addition, there are pre- and post-mining wetlands to the south and east of the southern lake which are regulated by the State of Michigan. The northern and western portions of the site have been cleared of all vegetation. However, the eastern and southern portions of the site remain entirely natural, as there are no plans to mine these areas. The water table slopes significantly from west to east across the site. This is demonstrated with the different lake elevations. The characteristics of the water table are important because without proper forethought, the stream cutting through the southwest corner of the site could be destroyed. Hence, the mining limits have been altered to protect this stream. Another site feature, although not natural, is the Edison Easement. This 200' wide easement, owned by Detroit Edison, runs east and west across the site. The overhead electrical transmission lines easement includes six towers. Parallel to Inwood Road is the Michcon Easement. This underground pipeline easement is 25 feet wide, south of Inwood. In addition, rights-of-way for Hixon, Inwood, and Dequindre Roads are 120 feet.

In addition to these naturally occurring or existing features are those site features that have been produced as a result of the mining process. These features include: tailing ponds, ground water condition, and overburden storage. The importance of inventorying these mining-induced features is to analyze and, ultimately, determine the best ways for these features to be included into the final design. The tailing ponds are to be redistributed over the soil where they are currently located. In concentrated quantities, the tailings ponds have little or no value. However, when the materials are combined with sand and top soil, the mixture has enough fines to support grass. Ground water conditions are to be tested by local authorities and financially supported by OSG, according to local ordinance. There is, however, little risk of contamination because, unlike coal mining, there are no contaminants in sand and gravel. Overburden storage locations and quantities are inventoried and redistributed throughout the site. It is this overburden that opens the doors to creative land forming. The key to effective reclamation is the ability to grasp a presumably negative condition and generate a positive alternative.



Mining Site Features

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The analysis of these features is the foundation of the reclamation process. This analysis of their potentials in site development play an important role in reclamation. For example, it is important to realize the potential value of the created lakes. An analysis of these water features tell us that land values increase with the presence of water. Therefore, the proposed residential community shall be oriented toward and benefit from the presence of these water bodies. Other site features that are of particular value are the existing woodlots on the southeast portion of the property. Due to the destructive nature of the mining process, special attention must be given to the preservation of the remaining natural features. A study was done of these wooded areas in 1986 by Smith, Hinchman & Grylls Associates, Inc. (SHG). The results of this study show that the "forested communities are all second growth woods with evidence of cutting and harvesting in the past". (SHG, pg. 1) The dominant species of the forested communities are cottonwood and large-toothed poplar, and oak and hickory. White pine, beech, sassafras, and birch can be found at the higher elevations. At the lower elevations, red maple, box elder, and elm are present. "The mixture and diversity of the species reflects the past history of disturbance and the topographic diversity on the site". (SHG, pg. 1) The type of vegetation present on the site aids in determining the type of wildlife present. The Smith, Hinchman, & Grylls Report indicates the following species as observed:

White-tailed deer	Raccoon
Red Fox	Fox Squirrel
Cottontail Rabbit	Chipmunk
Morning Dove	Black-capped Chickadee
Red-tailed Hawk	Starling

Other species not observed but potentially existent based on existing vegetation include:

Woodchuck	Opossum
Skunk	White-footed Deermouse
Meadow Vole	Common Shrew
Sparrow Hawk	Garter Snake
Leopard Frog	Wood Frog

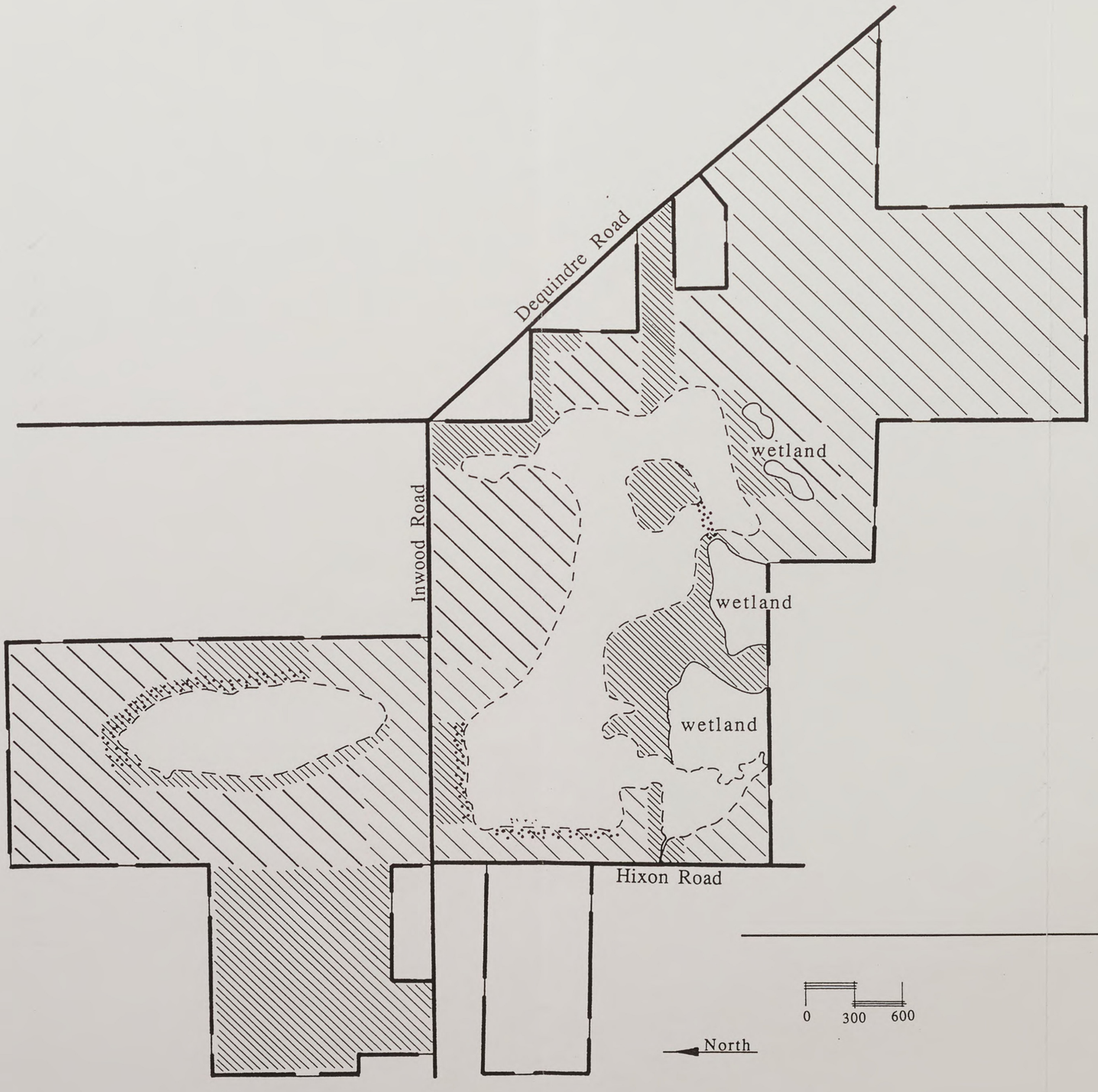
Songbirds (i.e. Robin, Cardinal, Tufted Titmouse, and Downy Woodpecker)

Again, residential lots shall benefit from the existence of these wooded areas and the rolling topography upon which they rest.

Another site feature which requires special treatment is the Edison Easement. No construction can occur with this 200 foot easement, nor can the towers be isolated from vehicular access. This means that backfilling will have to occur near the base of one of the towers, on the island in the southern lake. Aside from these easement regulations exists the need for special design considerations. The Edison Towers detract from the overall aesthetics of the site. Although complete masking of these towers is unrealistic, an attempt has been made to minimize the visual and physical intrusion.

Determining the locations of disturbed soils is another important site characteristic. The construction of a home requires a firm base upon which to build. As noted earlier, the overall geology of the site is adequate for construction. There are, however, less suitable areas due to the mining process. Areas have been mined for valuable materials and then backfilled with the overburden. This top layer of disturbed soil cannot support a residential structure without pylons reaching to the undisturbed soils below. The use of pylons increases the cost of constructing a home by as much as $30,000. Therefore, construction of such an area of land can only be justified if the lot can be sold at a high price. For example, the value of a lake-front lot may be worth the extra $30,000 in construction costs. The cost of pylons is absorbed into the value of the lakefront lot which may be sold at three or four times the cost of a non-lake-front lot. The remaining stockpiles of overburden materials totals 182,300 cubic yards, on the parcel north of Inwood Road and 71,000 cubic yards south of Inwood Road. These 253,300 cubic yards of material are to be distributed throughout the site to enhance existing conditions. These, and the features listed throughout this section are illustrated within the Existing Site Features and the Mining Site Features Map.

Areas have, also, been analyzed for their development potentials, based upon existing conditions of slope, area of land, soil suitability, and orientation to water. Moreover, the question was asked: could these development potentials be improved with the additional deposition of overburden materials and, if so, to what extent. To answer this, a matrix was formed to analyze low, moderate, and high development potentials, according to the above site characteristics. A slope that was between 2 percent and 15 percent is considered ideal for development. Land areas wide enough to support



Development Potentials

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residential lots and roadways are also considered to have high development potentials. Soil history, also, determines the development capacities. Property that has not been backfilled is considered to have the highest capacity for development. Finally, an area's orientation to water is analyzed for development potentials. An area within 300 feet, or more, of the shoreline has the highest potential. The land within the Edison Easement is assumed to have very little development potential.

DEVELOPMENT POTENTIALS MATRIX

DEVELOPMENT POTENTIALS	PERCENT SLOPE	AREA OF LAND	SOIL STABILITY	ORIENTATION to WATER
Low	0% to 1%	<100' wide	Backfilled & No Lakefront	<100'
	& 33%+			
Moderate	16% to 32%	100' to	Backfilled & Lakefront;	100' to 300'
		300' wide	No Backfill & No Lakefront	
High	2% to 15%	>300' wide	No Backfill & Lakefront	>300'

This matrix is an important part of site analysis. By ranking the development potentials, it is possible to determine the locations that would benefit the greatest from topographical regrading. This regrading includes the alteration of existing topography and the placement of overburden materials. The Development Potentials Map illustrates the low, moderate, and high development potential zones throughout the OSG property. These zones are based upon the rankings of the site characteristics described in the matrix. The ranking process depends upon all four elements being met for an area of land to have a high potential for development. A lack in any of the four elements decreases the overall potential of the area. It must be noted that the entire site is considered to have much potential for development because each proposed lot is oriented toward an amenity, be it water, woodlot, or access to open space.

Mining Site Case Studies

Two examples of successful mining and reclamation practices can be found within the following case studies. Spring Lake (photo 1) and Blue Heron Pointe (photo 4) are residential subdivisions that have

been reclaimed from previous mining practices. Evidence of past excavation can be seen in the following photographs; this is most apparent with the shoreline topography (photos 3 & 5). Spring Lake is an older single family residential development. Blue Heron Pointe is a multi-family development.

Spring Lake is located in Oakland County, Michigan, near Dequindre Road. This single family development has incorporated the basic principals of reclamation. Slopes have been regraded to support residential structures around the community lake. The Spring Lake development should be commended for its attempts at restoration. However, Spring Lake lacks a creative landscape architectural layout (photo 2). The value of the Spring Lake development can be seen most in its textbook reclamation design.

Blue Heron Pointe, located off of Beck Road, Novi, Michigan, takes reclamation and design principals a step further. In addition to textbook reclamation practices, Blue Heron Pointe has incorporated the mining site features into the final land use development. A pedestrian bridge connects the mainland to a mining-created island, which now holds a gazebo (photo 6). Another successful usage of existing mining features is the nature trail. The nature trail incorporates wildlife and natural features with the jogging path featuring bird identification charts and the boardwalk raised over the wetland area (photo 7).

The basic reclamation principals seen in, both, Spring Lake and Blue Heron Pointe are utilized within this OSG site reclamation project. This principals include: slope reconstruction, lake access, and the incorporation of existing site features. The purpose of these case studies is to provide examples of reclamation, either positive or negative, and to further encourage the creation of reclaimed spaces of greater quality.

Inventoring and analyzing the site and sites similar to OSG are essential to developing sound reclamation practices. The information represented above is the foundation upon which this study is built. Part III begins the reclamation and development processes.

Photo 1.

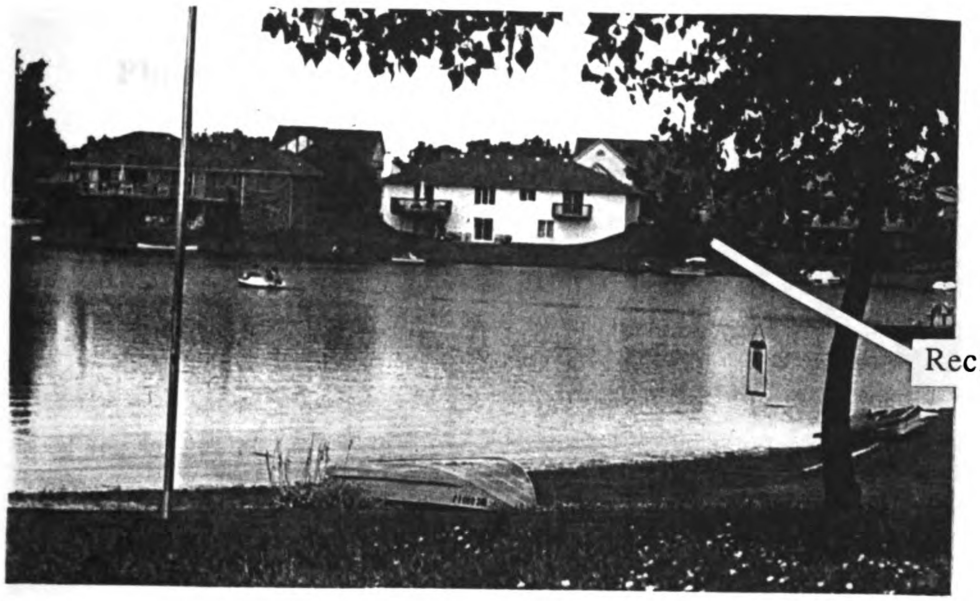


Photo 2.

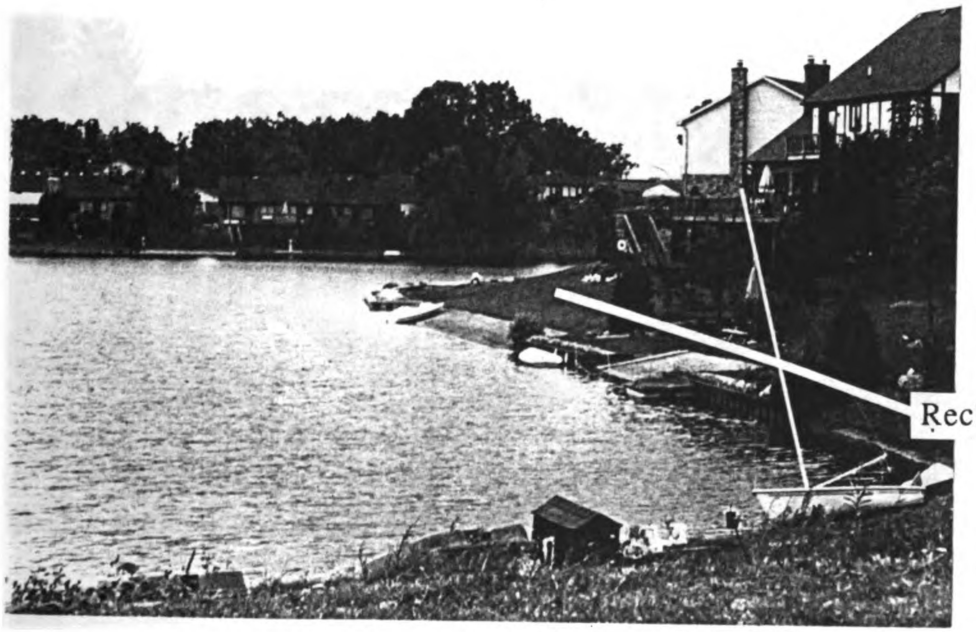


Photo 3.

Photo 4.

Photo 5.

Reclaimed Slope

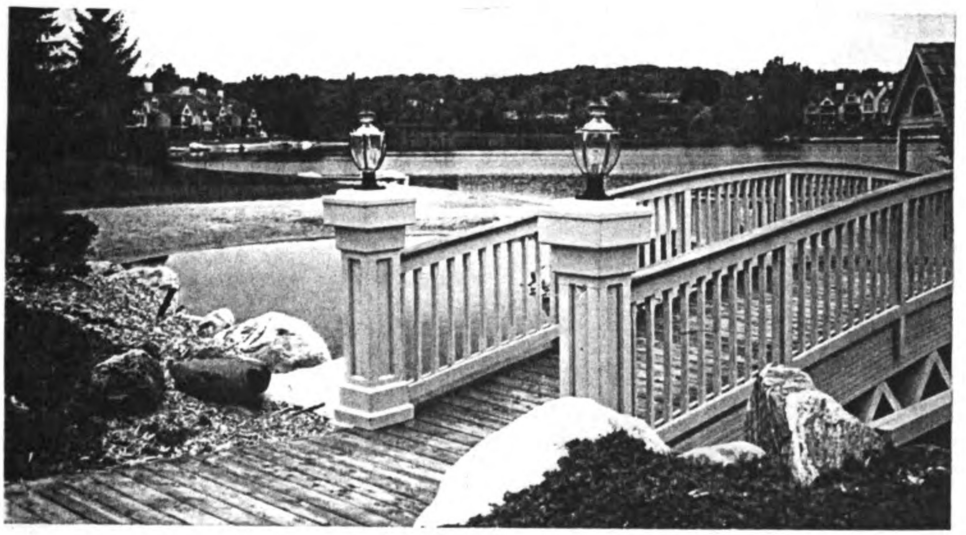


Photo 6.

Photo 7.

Part III

Reclamation and Development Program

The site is to be reclaimed to provide the most usable land for the proposed residential land use. There is, however, a delicate balance between the quantity of earth to be moved, the cost of moving that earth and the amount of usable land gained. Therefore, assuming the redeposited overburden creates a suitable foundation for development, this reclamation process has been divided into two categories. These categories are moderate reclamation and extensive reclamation. Each reclamation category possesses an alternative site plan to create usable land.

In outline form, the reclamation and development program shall be composed of the following:

Alternative One Reclamation Plan Alternative One illustrates the most cost efficient method of site reclamation. This alternative is strictly dependent upon post-mining site conditions. Essentially, this alternative shows the redeposition of overburden stock-piles to create the highest land values.

Alternative Two Reclamation Plan Alternative Two explores the possibilities of planned reclamation. Planned reclamation is defined as providing sufficient forethought to the final deposition of overburden. This occurs throughout the entire mining process in order to take advantage of the existing earth moving processes. The focus of Alternative Two is placed on the possibilities of creating effective land forms without the cost constraints of unnecessary handling of materials. The significance of Alternative Two lies within the realization of what *could have* been accomplished through simultaneously planned mining and reclamation.

Master Plan The Master Plan illustrates the end land uses on the site. In addition, an illustration is made of the differences in land formations and related costs of alternative one versus alternative two.

Alternative One Site Plan This site plan is an expansion of the designed land forms created in Alternative One Reclamation Plan.

This Alternative One Site Plan maps out the roads, easements, residential lots, and other land uses pertinent to this residential development.

Alternative Two Site Plan This plan is based upon the land forms created in the Alternative Two Reclamation Plan. This site plan illustrates the end land uses, as described above for the Alternative One Site Plan.

Alternative One Reclamation Plan

Alternative One is a study of the most cost efficient means to site reclamation. The purpose of Alternative One is to examine the existing mining conditions and determine the most appropriate locations for the stockpiled overburden. The goal is to enhance existing topographical grades to increase suitability for development. The primary design constraint is the lack of reclamation forethought during the stages of mining. If sufficient forethought was given, the reclamation process would have already been occurring. This, however, does not mean that simultaneous mining and reclamation would complicate the process. The desire for a residential development does not have to alter the mining and reclamation plans to a large degree. The purpose of reclamation is to create usable land. The damages of the mining practices have done little to prepare the land for future use. An example of this destruction is seen along the shoreline of the lake north of Inwood Road. The northern lake boundary has slopes as steep as 90 percent. Township regulations demand slopes no greater than 20 percent along shorelines. Furthermore, overburden materials available for backfilling the shoreline to acceptable slopes have been stockpiled along the eastern shoreline of the lake. This means that earth moving equipment must return to move the stockpiled material, a second time, to its final resting place. This earth moving process is an added cost to the company that could have been avoided. Earlier, plans, as shown in Alternative Two, should have been arranged to deposit the overburden directly along the shoreline, eliminating the 100,000 cubic yard stockpile. These issues shall be further analyzed in the Master Planning process, which shall compare the created land and cost issues of this Alternative One and Alternative Two.

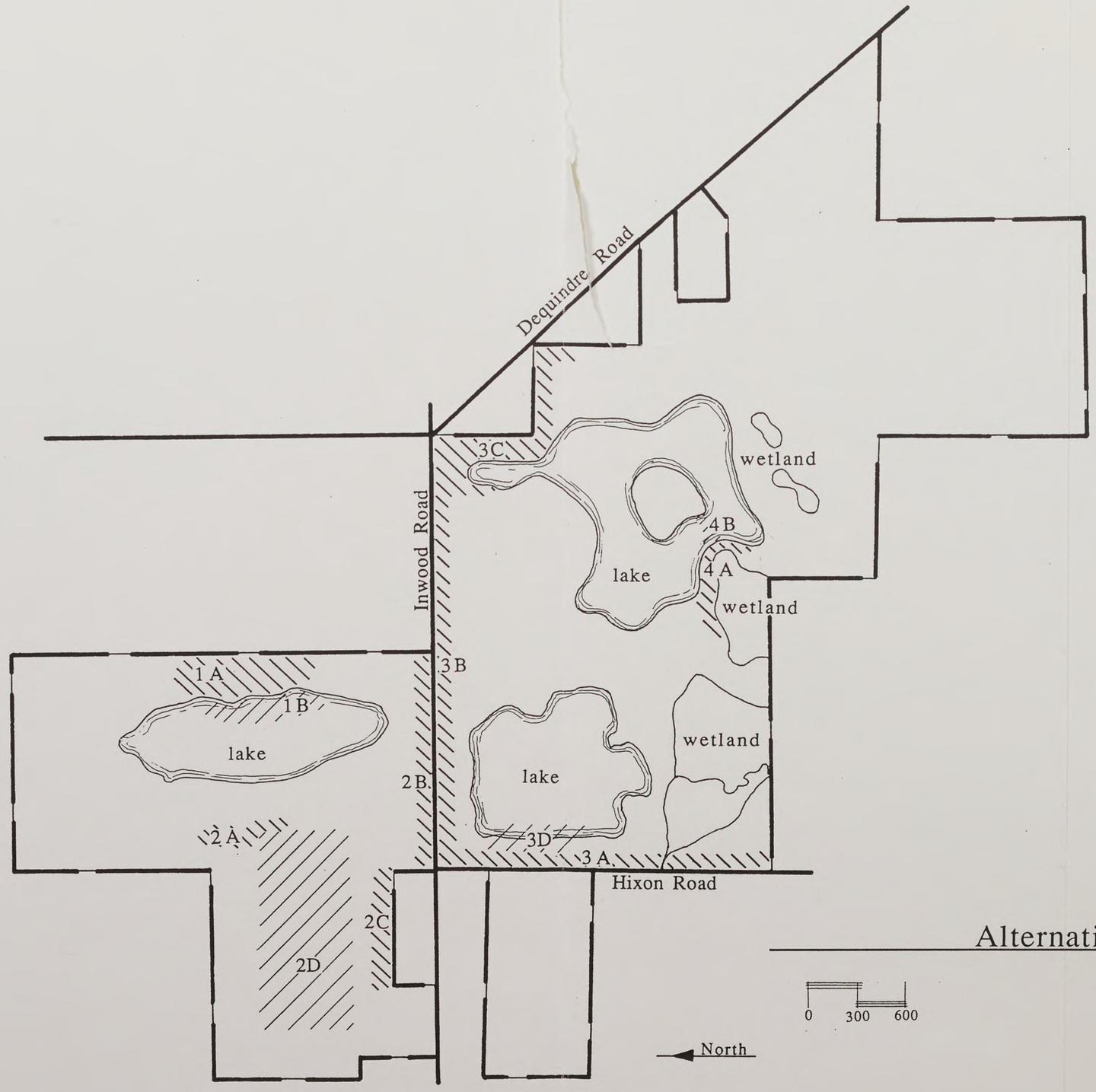
Without sufficient forethought to reclamation, Alternative One is bound to the constraints of simply redistributing the overburden materials throughout the site to create the most useful land possible. Cost constraints prohibit the redistribution of overburden from the parcel north of Inwood to the parcel south of Inwood. Thus, the 182,300 cubic yards north of Inwood remain north of Inwood. Basic regrading of berms shall occur south of Inwood Road.

Reclaimed as a separate entity, the parcel north of Inwood Road requires regrading of slopes along the north and east shorelines of the lake. These portions of shoreline require the most attention, as they are well below township standards. To meet reclamation standards, 100,000 cubic yards are backfilled along the shoreline. The remaining 82,300 cubic yards are deposited to the west and to the south of the lake. The deposition of material over these areas adds interest and fluidity to the topography. South of Inwood Road, 71,000 cubic yards is to be redistributed. To comply with Edison Easement regulations, backfilling must occur at the base of the isolated tower, located in the center of the eastern lake. The mining-created island, upon which the tower rests, is not compliant with regulation. Regulation requires land access to the tower. Fifteen thousand cubic yards of material must be backfilled to turn this island into a peninsula. The remaining overburden is deposited along the shoreline of the western lake to create areas wide enough to support residential lots. The primary costs of earth moving have been minimized by shortening the hauling distances. As much as possible, the overburden materials have been deposited nearest to their existing locations.

The Alternative One Reclamation Map shows the areas of overburden materials, the areas where the overburden materials are to be deposited, and the existing areas of land whose development potentials increase because of the adjacent land created through the reclamation process. The placement of the overburden materials is dependent upon the development potentials of an area of land. The overburden stockpile labeled 1A on the Alternative One Map is deposited at the 1B location because the most land is created for the least hauling costs. In addition, area 1B possesses slopes as steep as 90 percent. Under township regulation, these slopes must be reclaimed to suitable and safe percentages. Because Alternative One is restricted in reclamation by the cost of moving materials, 2A, 2B, and 2C overburden piles remain north of Inwood Road. The materials are distributed over the 2D area. South of Inwood Road, 3A, 3B, and 3C materials are deposited along the shoreline of the western lake. This creates additional lakefront lots for greater profit. The 4A stockpiled material is deposited at 4B to provide vehicular access to the Edison Tower. The Alternative One Reclamation Map indicated those areas of land that are not, themselves, reclaimed but

benefit from adjacent reclamation. Adjacent lands north of Inwood have in increase in land value because they can be sold as lakefront lots with the deposition of materials to the 1B area. South of Inwood, the existing land is not wide enough to support a roadway and residential lot. However, lakefront backfilling at the 3D area transforms the low development potential area into high development potential, lakefront lots.

The reclamation process of Alternative One effectively illustrates an increase in land values for residential development. Despite the constraints of the existing mining conditions, this reclamation process succeeds in increasing development potentials. This increase in development potentials results in financial gain for OSG.



Alternative One Reclamation Plan

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Alternative Two Reclamation Plan

As with Alternative One, Alternative Two plans for the redeposition of overburden materials to prepare for the end land use, residential. The Alternative Two Reclamation Plan, however, needs not address many of the constraints of Alternative One. Alternative Two assumes that there are no unnecessary costs involved with the reclamation process. This reclamation plan explores the land shaping possibilities as if sufficient forethought had been given during the stages of mining. The disadvantage of this alternative is this plan is of little use to OSG, this late in the game. The advantage of Alternative Two is it demonstrates the development potentials that have been forced to remain unseen because of careless mining practices. These potentials are revealed in this chapter and the master planning chapter to follow.

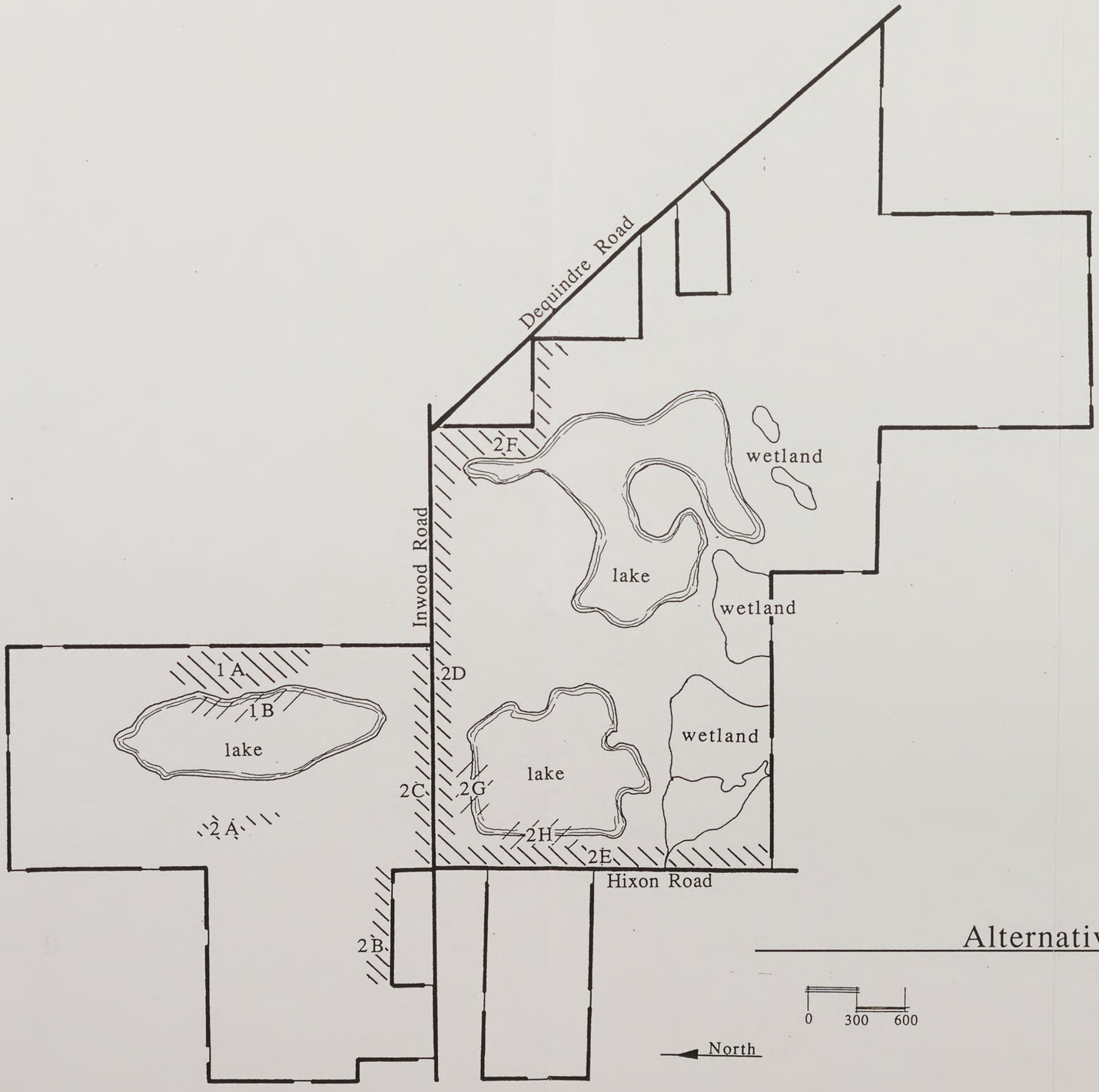
The motivation for the placement of the overburden materials is to create the most valuable additional land for the proposed residential development. The 100,000 cubic yards east of the lake north of Inwood Road has been distributed along the shoreline. This shoreline backfilling creates suitable slopes and allows for eight additional residential lots. All other overburden materials are taken south of Inwood to create additional shoreline land. The combination of 82,300 cubic yards from north of Inwood and 56,000 cubic yards south of Inwood, totaling 138,300 cubic yards, creates enough land to support four additional residential lots.

The significant cost reductions of a planned reclamation process makes it financially possible to move overburden materials from the north of Inwood Road to the south. Alternative Two's reclamation plan eliminates the need for stockpiling large quantities of material. Alternative Two assumes that the designated deposition areas are available to the mining company at the time of excavation. Resulting in overburden materials that are excavated from one area and immediately deposited in another, final, location. If this procedure had been followed with the OSG Site, there would not have been a need to redeposit 135,000 cubic yards of stockpiled materials; the bulk of the reclamation planning would be to relocate existing berms, totaling 103,300 cubic yards. The difference in reclamation is the handling of 103,300 cubic yards or 238,300 cubic yards. Of course,

there are instances when stockpiling is necessary. However, to demonstrate the differences in cost, it is assumed that all 135,000 cubic yards of stockpiled materials could have been relocated at the time of excavation.

Creating the most potential for residential development was the number one consideration in the redepostion of the stockpiled materials. The 100,000 cubic yards of material shown in 1A are to be placed at the 1B location. Just as in the Alternative One Reclamation Plan, the backfilling of the shoreline meets township standards for reclaimed slopes and creates additional lakefront lots. Overburden materials from locations 2A, 2B, and 2C are hauled south of Inwood Road to create additional lakefront lots. All of the overburden from locations 2A, 2B, 2C, 2D, 2E, and 2F are deposited at the 2G and 2H locations. No materials need to be moved from the Edison Tower Peninsula because Alternative Two suggests that no mining take place at this location.

The reclamation process of Alternative Two demonstrate a large increase in land values for OSG and the proposed residential development. The value of the land and the financial gain which results is proof that reclamation practices such as this benefits all users of the property.



Alternative Two Reclamation Plan

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Master Plan

The Master Plan is based upon the Alterantive One and Alterantive Two Reclamation Plans. The primary end land use is residential. The Master Plan illustrates the distribution of residential land and other land uses, such as: open space, community septic facility, and wetland. In addition to these end uses, the Master Plan highlights those areas of land that have been created through the Alternative Two Reclamation Plan that differ from the Alternative One Reclamation Plan. As a result of the Alternative Two Reclamation Plan's overburden deposition, eight additional lakefront residential lots have been created at no added cost to OSG. Seven of these eight lots are also shown in the Alternative One Reclamation Plan; however, they are at a reclamation cost of $1 for every cubic yard of material moved. Assuming that one lakefront lot, approximately 56,000 square feet, sells for $100,000, the OSG reclamation process already produces an added $800,000 for the Levy Corporation. It is important to note that the entire $800,000 is profit for OSG because the deposition of materials is a cost already incurred during the mining process. The reclamation plan has, simply, designated where to place these materials to create the most valuable land. In this case, the deposition of all overburden materials, 238,300 cubic yards, is most valuable along the shorelines of the northern and western lakes.

The value of this Alternative Two Master Plan can be shown through further cost analysis. There are three comparisons that can be made between Alternative One and Alternative Two that specifically illustrate the economical benefits of planned reclamation.

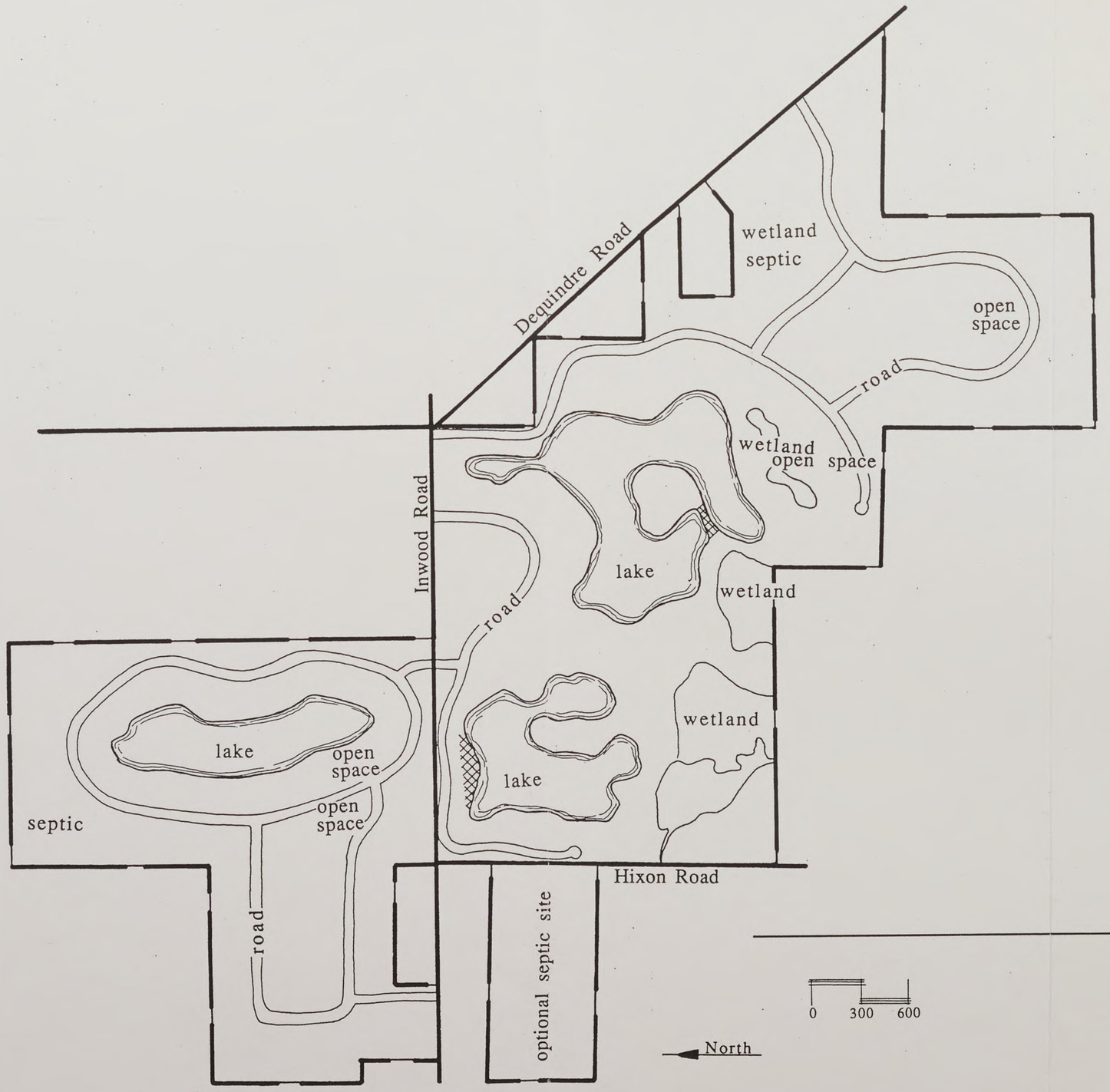
First, the 100,000 cubic yards stockpiled to the north is to be deposited along the shoreline. It is important to realize that this act is the second handling of these materials; the first being the stockpiling. The cost of handling these materials is, roughly, one dollar per one cubic yard. At one dollar per one cubic yard, the added cost of redepositing this overburden is $100,000. This is $100,000 that must be spent in the Alternative One Reclamation Plan but was not spent in the Alternative Two Reclamation Plan.

Second, a comparison can be drawn between Alternative One and Alternative Two concerning the Edison Tower island. Alternative One is responsible for backfilling a portion of the lake to bridge the gap for vehicular access. Fifteen thousand cubic yards of material is necessary to backfill this area. This results in an additional $15,000 to reclaim this area, according to regulations. Alternative Two steps back to the time prior to the excavation that created this island. An analysis must be made to determine whether it is more economical to mine the area for profits or whether it is more profitable to not mine the area. The argument for not mining the area is the lack of profit made through extracting these materials. Alternative Two proposes that these materials are not to be excavated. Although, $15,000 in sand and gravel profits disappear, the $15,000 in reclamation costs disappear along with them. OSG gains nothing by mining this area of earth.

Third, Alternative One is forced to handle all berms and overburden stockpiles and berms because it is dependent upon the existing mining conditions. Alternative Two, however, can more freely select how the site is to be reclaimed. The total quantity of post-mining overburden material to be reclaimed in the Alternative One Reclamation Plan is 253,300 cubic yards. The total post-mining overburden material in Alternative Two is 103,300 cubic yards. This is based on the elimination of unnecessary stockpiling, as discussed earlier. By directly depositing the bulk of the overburden to a final resting point, Alternative Two needs only to handle existing berms in the reclamation process. There is a difference of 150,000 cubic yards to be handled in Alternative One and Alternative Two's reclamation plans. The reclamation costs demonstrate this drastic difference. To reclaim the site, according to Alternative One, the earth moving cost is $253,000. The cost to reclaim Alternative Two is $103,300; a difference of $150,000.

The following cost analysis is proof of the value of the planned reclamation of Alternative Two. Two hundred fifty-three thousand three hundred dollars are spent on reclaiming the berms and stockpiles of Alternative One. Alternative Two requires $103,300 to reclaim the berms. Alternative Two creates enough additional land to support eight more lakefront lots at no additional cost than Alternative One. For simplicity sake, let's assume that one lakefront

lot sells for $100,000. Alternative Two produces an added profit of $800,000 in lot sales. In total, Alternative Two accumulates $950,000 for OSG. These figures are rough estimates and do not take into account the additional, unforeseen reclamation costs or the costs of manpower and time. Clearly, the planned reclamation process demonstrated in the Alternative Two Reclamation Plan increases the financial and development potentials of this OSG Site.



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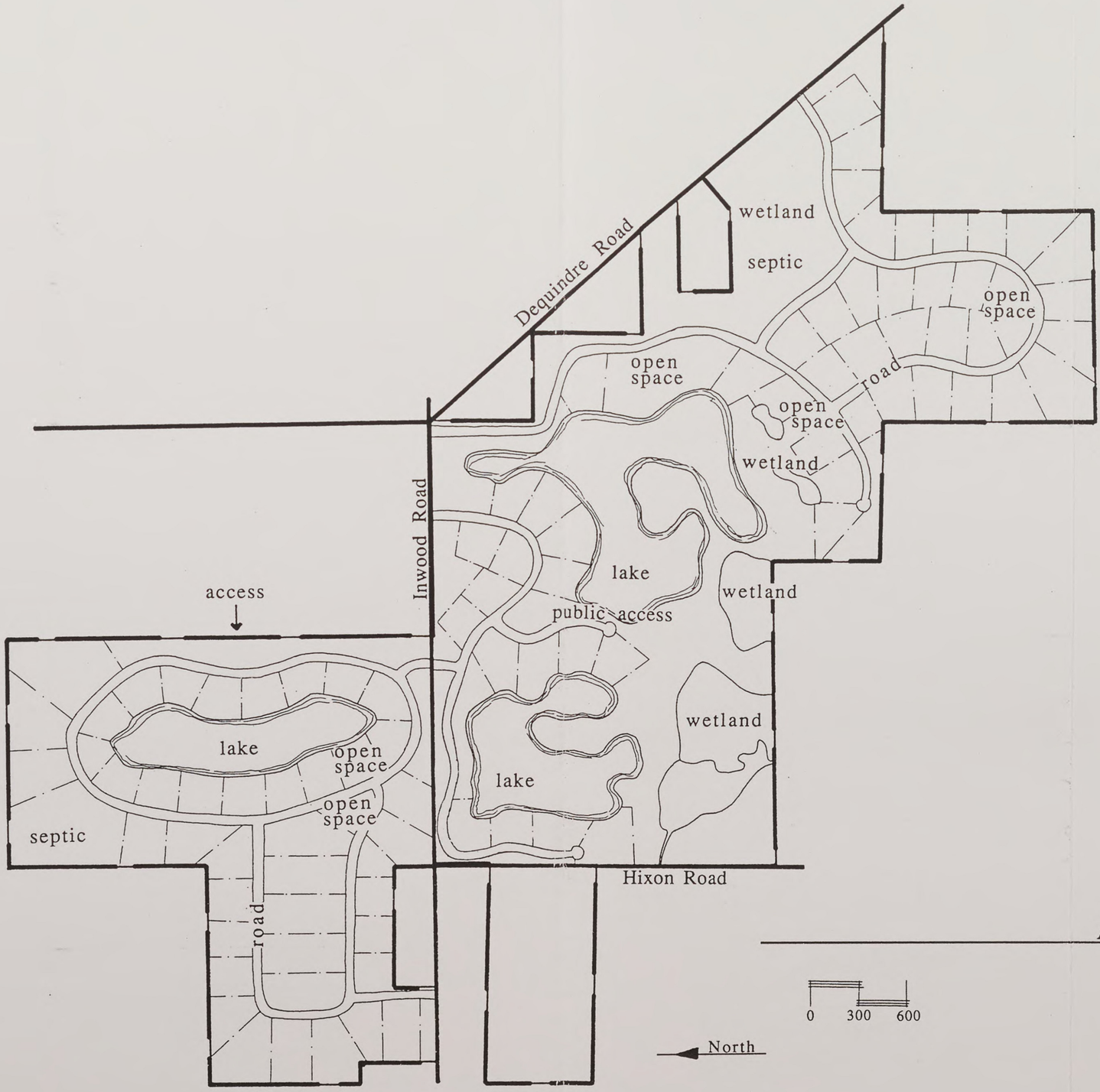
Alternative One Site Plan
&
Alternative Two Site Plan

Alternative One and Alternative Two Site Plans are detailed designs of the land uses proposed in the Master Plan. The purpose of the plan is to demonstrate how a residential development can fit within this reclaimed landscape. The lot densities parallel those discussed in the Parts I and II of this study. A proposed Planned Residential Development (PRD) suggests 56,000 square foot lots, with community septic systems. All lakefront lots are 56,000 square feet and all lots with no lakefront are approximately 80,000 square feet. Where ever possible, residential lots are oriented towards the waterbodies: lakes and wetlands. These developments also take advantage of the existing woodlots to the southeast. Homes are tucked into the wooded hillsides, with fewer lots and existing wetlands for buffering. In addition to orienting lots towards aesthetically pleasing views, lots are oriented away from the Edison Towers running east and west through the site. The wetlands to the south of the lake buffer the lots, southeast of the easement. The lots most affected by the towers are those nearest to Hixon and Inwood Roads. The far eastern portion of the property is left undeveloped. Existing wetlands, proposed community septic facility, and buffer zones maintain the natural visual quality of the area. Likewise, the far northwest corner of the site shall house the second community septic facility and buffer zone. Both locations have vegetative growth for visual barriers and suitable soil to support the two to four acre facilities. Throughout the lot layouts, areas have been designated as open spaces. The most important functions of the open spaces are, one, to add interest to lot layout and, two, to provide lake access to the residences without. In addition to access within the property, access is planned for adjacent properties. The parcel newly purchased by OSG, to the east, is accessible from the residential roadway running parallel to the property line. This adjacent parcel provides an exciting opportunity for residential development expansion. Another opportunity to expand this development is to connect with the existing residential development, Hidden Hills, along the southern property line.

The designs of Alternative One and Alternative Two are similar to one another. The text above tells of the design intent for both alternatives. The differences, however, lie in the methods of reclamation. Part III's Alternative One and Two Reclamation Plan describes in detail the differences in reclamation methodology. The variation in this methodology results in the creation of one additional lot in the Alternative Two Site Plan. Other variations between the two plans are seen in the cost analysis discussed with Part III's Master Plan. Aside from this one additional lot, Alternative One and Alternative Two possess similar physical characteristics.

To further represent the reclaimed surfaces, the Alternative Two Site Plan shows two section lines cut through the property. The following sections illustrate the development possibilities of the land. The land has been reclaimed to support lakefront residential units which would be nonexistent without the reclamation process. Section A shows an area of land north of Inwood Road that supports a larger wooded lot and a lakefront lot. Section B shows a lakefront residential unit south of Inwood Road. The disturbed soil is reclaimed into a foundation capable of supporting development.

The Alternative One and Two Site Plans take advantage of the existing natural features as much as possible. This is of particular important because the mining process has eliminated much natural topography and vegetation. On the other hand, the mining process has preserved and created many water features which are of great value to this development, both aesthetically and financially. The Site Plans are an illustration of how site characteristics and reclamation practices can work together towards a successful development.



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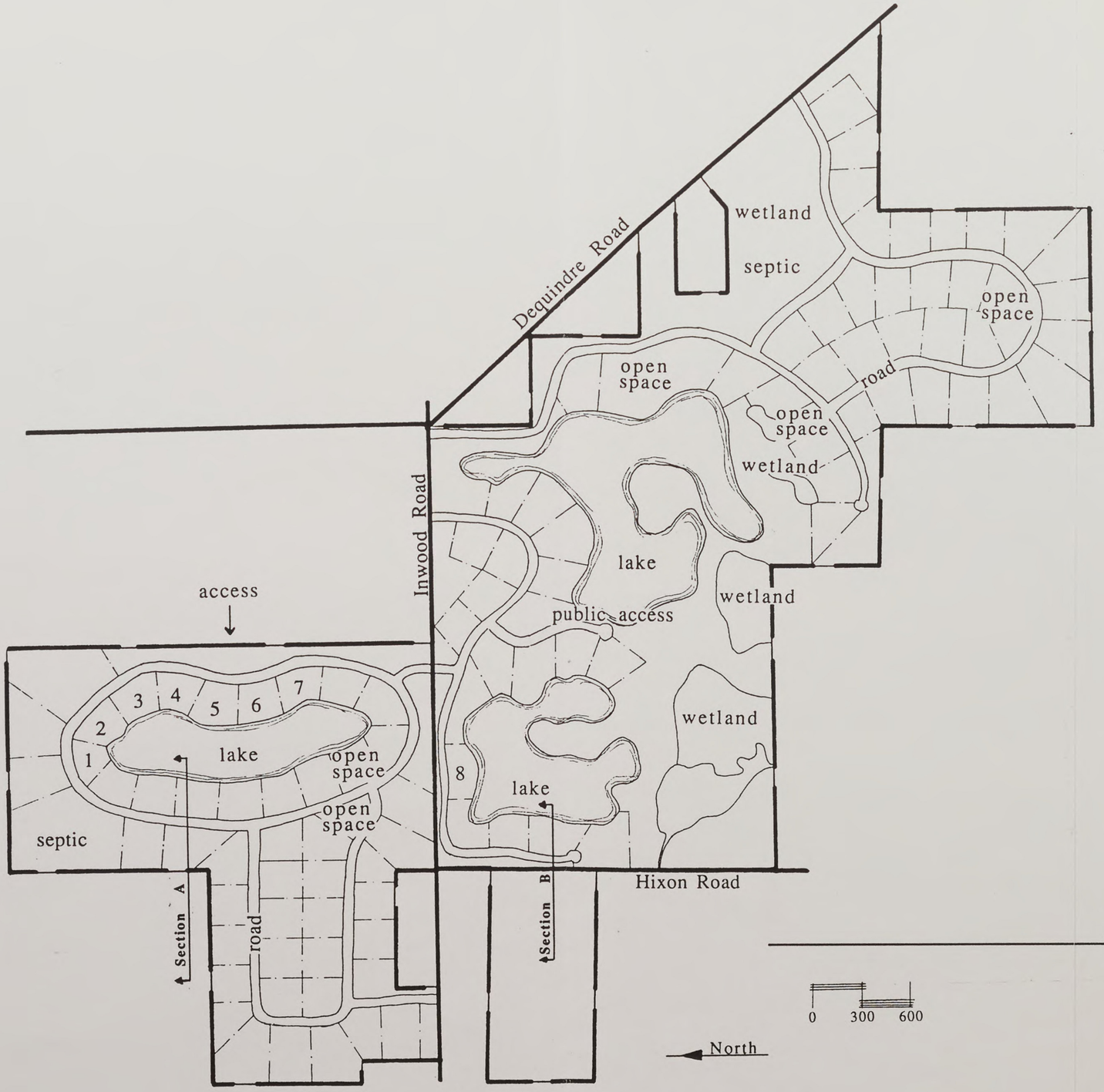

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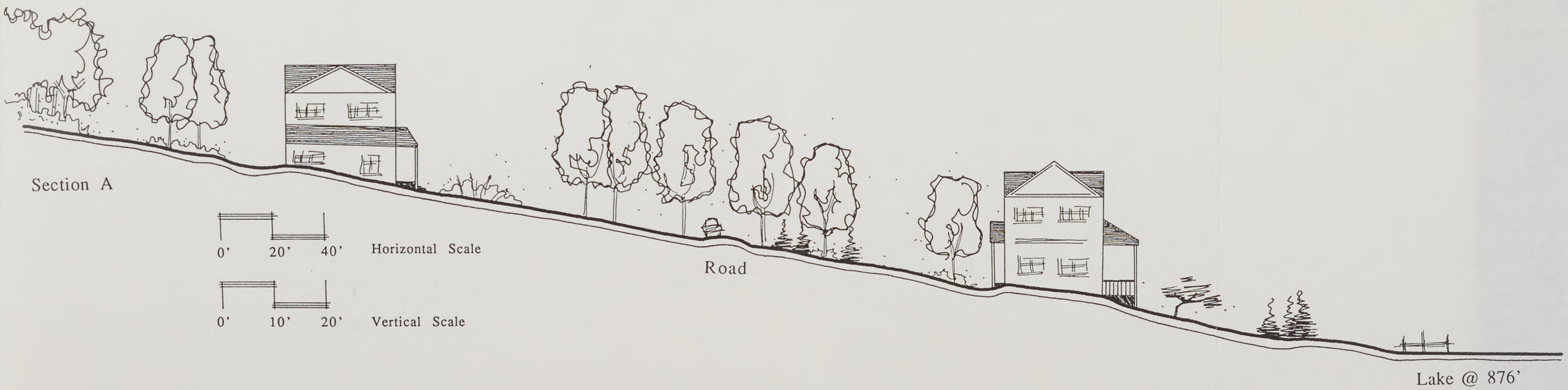

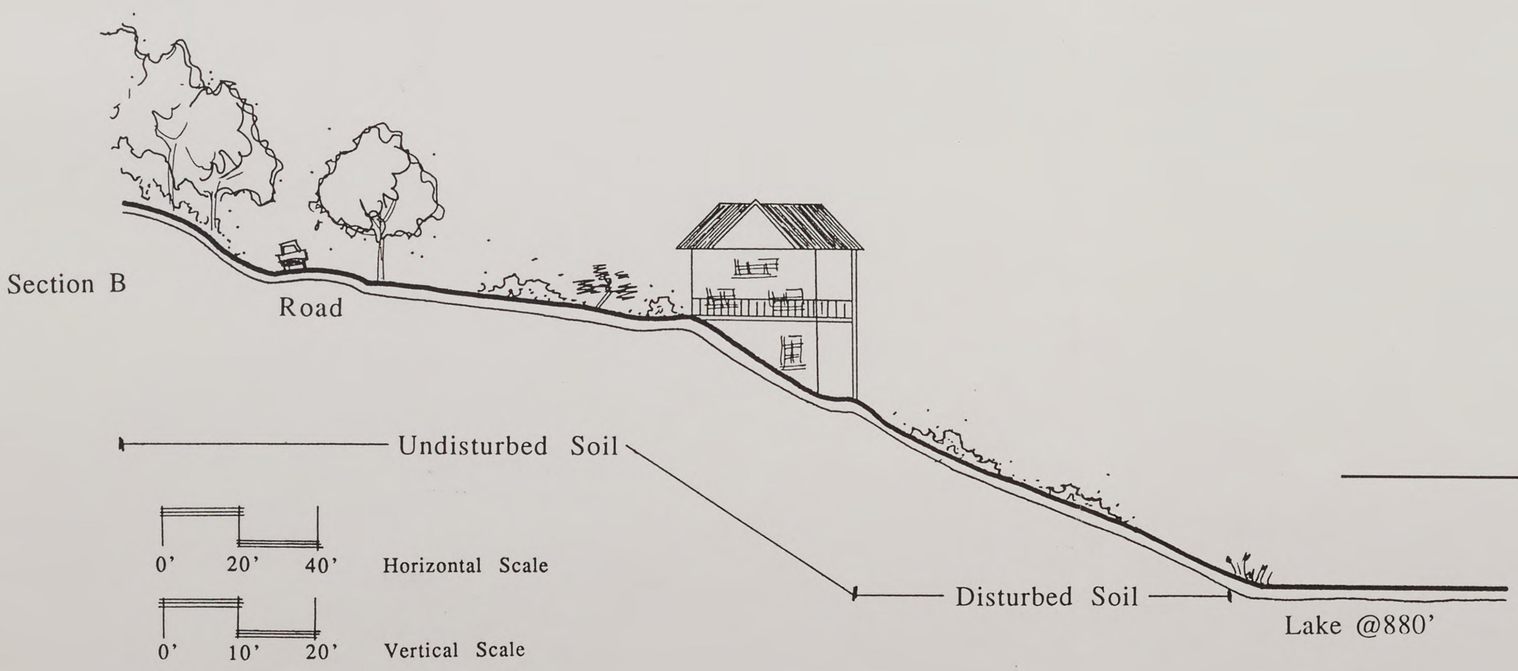

Sections A & B

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Conclusion

The mining industry is an essential part of our society. However, the goal of this project thesis has been to demonstrate that proper reclamation of the mining sites is of equal importance. Land is an increasingly valuable commodity and demands to be treated with great care. Reclamation practices are the key to this land conservation.

Discussed within this thesis are reclamation guidelines illustrating the values of land reclaimed for residential development purposes. There are, however, additional issues to be addressed beyond the scope of this study. Understanding the technical aspects of the earth moving process determines the success of the reclamation. When reclaiming, measuring the degree of soil compaction is critical. This can be very difficult to determine. At what point is the land considered stable enough for future development? A key component is the length of time allotted for the settling of soil. Another consideration is the type of fill material used. An understanding of the soil's structure and composition provides insight to the land's capabilities. There is, also, a strong correlation between the type of material and the method of depositing that material. Depositing materials by spreading thin seams across the land and then compacting the soil with machinery is the most effective method. An exploration as to the degree and type of machinery used is imperative. The availability of suitable soils and compaction machinery are the factors most affecting this process. These are some of the additional factors influencing the earth moving process and, significantly, determining the success of the reclamation.

The goal of mine reclamation is to create usable land. This is applicable for, both, long term and short term mining operations. For long term operations, reclamation planning provides a general guideline that enhances the developmental carrying capacity of the land. For short term operations, reclamation planning provides a specific alternative for land use. By way of illustration, this project thesis transforms the OSG Mining Site into a residential development.

Reclamation planning is the incontestable positive alternative for land transformation. The success of reclamation planning is apparent in the mining industry and the community within which it operates.

The mining industry profits through societal acceptance. Many communities do not welcome extractive industries. Much of the opposition exists because of a fear of the land demolition involved with extraction. Guaranteed restoration of the land by the mining company minimizes community objections. Acceptance by the community opens doors for the mining industry. Commitment to reclamation and environmental consciousness is the key to this acceptance. Another opportunity for the mining industry is financial gain. When planned reclamation is consistently practiced as a part of the mining process the land values drastically increase. The goal of planned reclamation should be to create usable land above and beyond municipal standards. As demonstrated throughout this thesis and the Spring Lake and Blue Heron Pointe Case Studies, land restoration increases the productivity and profitability of the land immensely.

Communities benefit from effective reclamation through a proper understanding of the mining industry. Communities demand the products that the industry provides and must, therefore, partake in the extractive processes. The community must demand a high standard of reclamation. This is accomplished by a realistic understanding of the earth moving practices. Reclamation is the link between the industry and the community for establishing goals towards effective land stuardship. The common goal must be land restoration and reuse. The standards are set by the community; the methods are accomplished by the mining industry.

In conclusion, mine reclamation promotes the care of our most valuable resource: land. It is the responsibility of the mining industry and the community to conserve this resource for present and future use. It is my hope that this study will be serviceable in the process of effective land and mine reclamation.

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