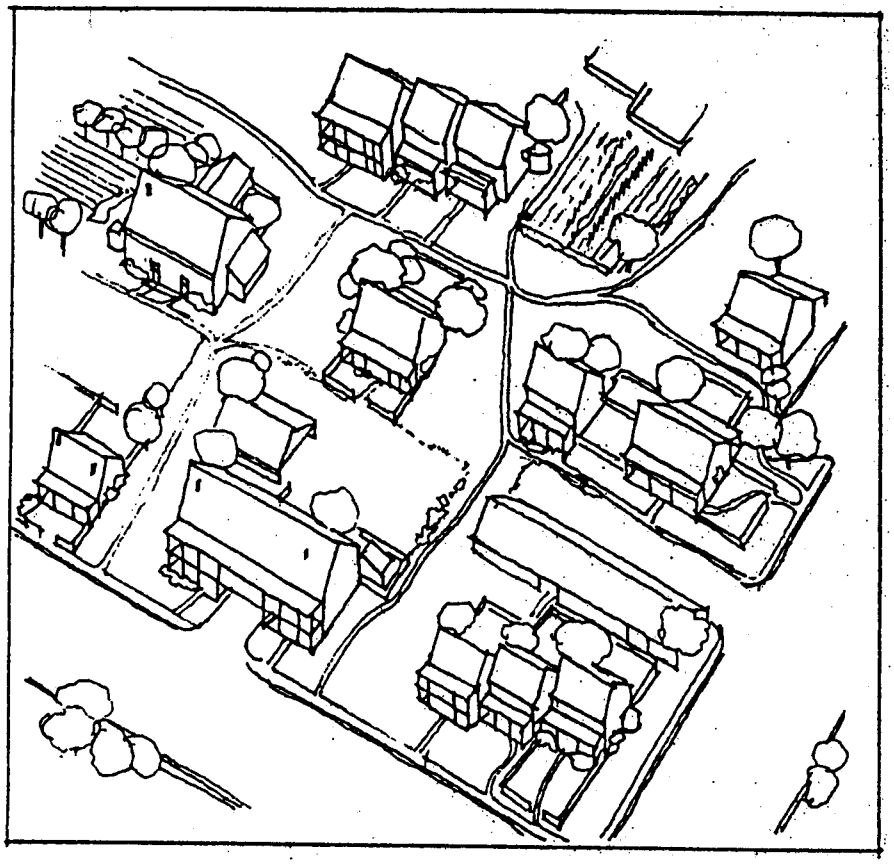


ECOLOGICAL LAND PLAN

PASSIVE SOLAR ARCHITECTURE

FOR

GRIFFIN-WEST RESIDENTIAL COMMUNITY

THE CENTER FOR
MAXIMUM POTENTIAL
BUILDING SYSTEMS

AUSTIN, TEXAS

GRIFFIN-WEST -RESIDENTIAL
TEAKWOOD PLAZA #8
PRINCETON, TEXAS 75077
214-736-3546

May 22, 1986

Mr. Pliny Fisk
Center for Maximum Potential Building Systems
8604 FM 969
Austin, Texas 78724

Gentlemen:

Pursuant our discussion and as an extension of the work already preformed by your office on behalf of Griffin West Residential, we find it necessary to enter into a contractual relationship with you for future services.

We would like you to consider a 2% overall fee related to the construction of the project. This will encompass architectural design, site planning, including landscaping, site development as well as design and floor plans for the multi-family buildings. We estimate the construction cost to be approximately $8 million.

If the above items meet with your approval, we would like to enter into negotiations at this time.

Sincerely yours,

Gabriel Ponce
Managing Partner

Princeton Parks Philosophy

Ike Griffin, Developer

There is a rapidly growing school of thought concerning the economics of communities and nations stemming from the frustrations of the last forty years' experience and based on self reliance. It is fast growing because it is so basicly honest. The Gurus of this thought are Ian McHarg, Jane Jacobs, Paul Hawken, Hazel Henderson, and Wendell Berry. Between them, they have written a truckload of books on their individual subjects. The proof of their genius is that you know instinctively the truth of what they are telling you though you have long since put it aside for something more expedient.

These truly great thinkers certainly deserve more than one line synopsis of their thesis but for the sake of brevity, here is what they talk about:

McHarg: We are an extension of the flora and fauna of the land we live on. If we manage those things better, we enrich ourselves.

Jacobs: Import substitution is the key to guarding and increasing our wealth. This is true in Nations and Communities.

Hawken: The world is finally tired of and is rejecting the throw away economy.

Henderson: Even the poorest community has wealth which can be built upon through self reliance.

Berry: The Metropolis is too wasteful of resources and energy to justify its' own existence. The most obvious justification is ego gratification. Society cannot afford it.

Pliny Fisk is one of the few Architects in the field who puts all this thought into workable situations. His Center for Maximum Potential Building Systems is guiding our Princeton Parks Development. What does all this mean for Princeton Parks? (emphasis added)

1. We will build with as many local products as possible. We are looking for a building material that comes out of this area. We would like to have a brick or tile made from this clay fired locally. Failing that, it would be good to find our building form, (Thermal Wall) filled with local building materials. We would like to manufacture Thermal Wall here. Most of our lumber comes from far off places and we feel that is a shame.

2. We will favor local sub-contractors and suppliers. Princeton has a good supply of competent trades and we want to use them. We won't subsidize local trades but we will award contracts locally if everything else is about equal.

3. We will landscape with native plants indigenous to the area. These plants should survive in drought and winter freeze without any unusual care. Ground cover of wildflowers and prairie grasses do not require mowing or watering. That saves on tools, time, water and fuel. Of those, time is the only one we produce here in Princeton. Native plants that are started in California or Florida have no appeal for us. We would rather have plants started within a few miles of here.

4. Buildings will be so positioned to take advantage of passive solar heating and cooling summer breezes. Landscaping will be done with the same goals in mind. Early Texas style architecture lends itself well to this theme. Higher ceilings and porches add to the natural comfort of dwellings. This costs something in planning and landscaping but it saves 40% of the energy cost immediately and forever. Energy is an import, so by substituting design for import, we conserve wealth locally.

5. Many of our houses will have cisterns to catch rain water from the roof to use on landscaping during periods of heavy drought. We will favor low volume plumbing fixtures to further conserve water.

6. There will be areas set aside for personal gardens in both the single family and multi-family units. Princeton is already a heavy gardening community and we want to encourage that in the new areas.

7. Paving will be minimized and natural drainage maximized. We all recognize our dependency on the auto but we don't want to be reminded of it too often. We want to hide all the cars possible.

8. Walking and bicycle trails will be connected to green belts and all parts of the development to encourage walking.

9. Useable porches on all the dwelling units will serve to encourage community and discourage crime.

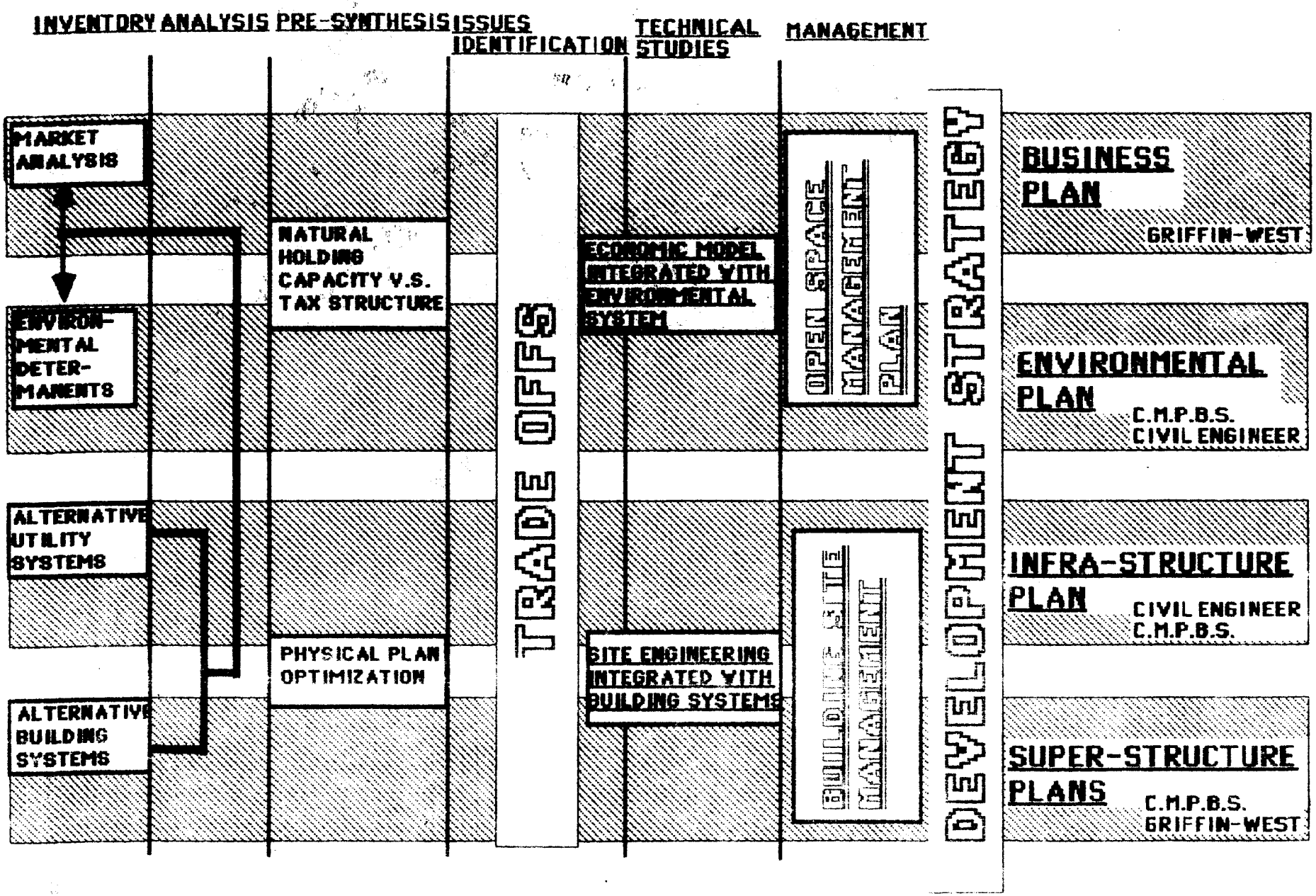
10. Our homes will be over built by today's standards. We want lending institutions to know that there will still be a structure there long after the mortgage is paid. They will be made affordable to our targeet market by downsizing the inside living area even though we are adding outside porch space.

11. Appliances like compactors, washers, dryers and refrigerators should be left off the mortgage. They usually wear out in about 10 years so they should not be paid for over 25 or 30 years. People should be free to use an appliance that Grandmother gave them if they care to. Even heating and air conditioning should be addressed as a variable option. A central system is not the only nor the most economical way to make your living space comfortable.

12. We would like to see the Princeton Planning and Zoning Board re-think some regulations to allow some home industries in residential areas. Home industry is the fastest growing segment of new business right now. Of course much of that is caused by the wide acceptance and use of the home computer, but there are other clean and residentially oriented businesses which add a lot of texture to a community. It also keeps a bedroom community from becoming a desert from 9 to 5 daily. There are hoards of social implications involved with this. Many sociologists now feel that the strict separation of business from residential by zoning which became popular in the 60's has been a disaster for society. It is hard to undo. Fortunately, it has not really effected Princeton yet.

We want to be a good and positive influence on an already good community. We want to be good neighbors. It is not always easy to see what is best and impossible to not step on some toes. Please know that our intentions are the best and actions will not be unstudied. I am not ashamed to ask that you pray for our proper guidance and for our comunity.

GENERAL DEVELOPMENT PROGRAM - GRIFFIN WEST



ENVIRONMENTAL PLANNING PROGRAM -GRIFFIN WEST

INVENTORY

EXISTING & PROPOSED REGIONAL LAND USE
- 3 SCALES

SITE BOUNDARIES
EXISTING AND PROPOSED
- R.O.W.S
- SETBACKS
- UTILITY EASE.

PHYSIOGRAPHY
- SEASON SOLAR AZIMUTH
- HILL (VIEWS)
- VALLEY (PRIVA)

CLIMATE
- DEGREE DAYS
- COMFORT ZONE CHART
- GROUND TEMP.

SOILS
- EROSION POT.
- DEPTH OF CLAY

HYDROLOGY
- FLOOD PLAIN
- DRAINAGE PAT.

LIMNOLOGY
- SURFACE WATER QUALITY
- SEASONAL/ STANDING WAT.

VEGETATION
- WILDLIFE HABIT.
- VEG. PATTERN
- VEG. HEIGHT
- VEG. TYPE

ANALYSIS

TIME/DISTANCE STUDIES REGIONAL & COUNTY PLANNING AGENCIES

HIGHWAY DEPT UTILITY DIST. CITY PLAN COMPILATION

CONTOUR ANALYSIS

SITE INSPECT. PHOTOGRAPHIC

U.S. WEATHER BUREAU INTERP.

CMPBS LIBRARY

SOIL CONSERV SERVICE INTERPRETATION SLOPE ANALYSIS

U.S. CORP OF ENGINEERS TEXAS DEPT. WATER RESOU.

WATER SAMPLE VIA HEALTH DEPT.

NICH OR POT. NICH IDENT. VIA HEARD NAT. SCIENCE MUSIUM

PRE-SYNTHESIS

SITE LAND USE COMPATABILIT WITH REGION

TOTAL LAND PARCEL DEVELOPABLE

ACCESS/ COMMUNITY FOCAL POINTS

EROSION CONDITIONS

POTENTIAL SOLAR INPUT/ USE OF GROUND AS HEAT SINK

POTENTIAL GREEN BELT

USEFUL PONDS AND WATER CONTACT RECREAT. AREAS

VEGETATIVE PRIORITIES

PRELIMINARY LAND USE PLA

ISSUES IDENTIFICATION (examples)

POSSIBLE ZONING ADJUSTMENTS

PHYSICALLY DEVELOPABLE LAND AND ITS RELATION TO FINANCIAL ANALYSIS

SUPER-STRUCTURE/INFRA-STRUCTURE OPTIONS

COST OF ENVIRONMENTAL IMPROVEMENT

TECHNICAL STUDIES

IMPACT OF PROPOSED GROWTH ON SITE

SUN/SHADE/ WATER USE OPTIMIZATION IN RELATION TO PHYSICAL LAND

VEGETATIVE SPECIES MISSING FOR COMPLETE WILDLIFE HABITAT

MANAGEMENT

HOLDING CAPACITY OF SITE AS DETERMINING FACTOR FOR GROWTH

SUPERSTRUCTURE/INFRASTRUCTURE LEAST COST STRATEGIES TOWARDS LONG TERM ENVIRONMENTAL ISSUES

LEAST COST MANAGEMENT PLAN FOR OPEN SPACE

RESIDENTIAL DEVELOPMENT PROPOSAL

FOR PRINCETON, TEXAS

Collin County has experienced a remarkable growth over the past few years. In McKinney there has been a population growth of 19% between 1980 and 1985. Land values have soared while the number of residential and commercial projects being executed or on the drawing board continues to rise. This growth is beginning to spill over into adjacent population centers as employment opportunities become available by the relocation of several manufacturing facilities - E.D.S., Frito-Lay, Fisher Electronic, Texas Instrument, etc.

Housing development along the North Central Expressway between Plano and McKinney continues with housing costs already beyond the affordable range for the middle and low income population. This has created a market opportunity for the development of single and multi-family housing in Princeton, Texas. A population survey done for the city of Princeton (attached) indicates a 97% rate of occupancy which is very high. The following chart shows a similar rate of occupancy in surrounding communities (see page 2). It is interesting to note that Princeton had a negative rate of growth during 1980-1984, and a positive rate of growth of 19% in 1985. This would appear to reflect the increasing cost of land and housing cost which has pushed buyers and renters further out, but within reasonable commuting distance of the Dallas area.

City	Distance from Princeton	Occupancy Rate	Household Size	1980-1984 Growth Rate
McKinney	8 miles	94%	2.7	3.5%
Farmersville	9 miles	95%	2.6	2.35%
Lucas	14 miles	95%	3.3	8.5%
Wiley	15 miles	96.7%	2.85	8.7%
Allen	16 miles	94.6%	3.05	7%
Princeton		97%	2.95	-4.5%*

* +19% in 1985 alone

Further growth is expected in the area. The student population for the Princeton school district is forecast to be 2,796 students for the school year 1990-91, an increase of 53% over 1984-85 enrollment. (See projection attached.) A new high school in Princeton will be completed by the fall of 1986, and a Bond issue already approved for 2 million dollars for a new elementary school to house 700 students within two years. All multi-family units in Princeton are 100% occupied, and 68 units in a trailer park opening in December of 1985 have been sold.

The Project: The development here proposed is based on the premise that the communities to be built in the 80s and 90s and beyond should not be designed with the social and environmental conditions of the 70s. Rather, they must be designed anticipating land use policies, water availability, energy resources, transportation modes, work patterns and life styles that may prevail in the years from now.

The scale and potential impact of the changes forecast indicate that alternative strategies and new ideas are required

for future human settlements. These would have to reflect the changing socio-economic, legal and financial aspects of community development, as well as significiant technological response to the problems of resource scarcity and environmental concerns.

This community development project will strive to mitigate resource and environmental constraints by establishing stringent criteria and performance standards to provide the maximum possible levels of energy conservation, energy self-sufficiency and passive energy design. The urban development will be structured for medium density concentration to allow for surrounding open spaces and green belts for common use.

Social considerations such as rising divorce rates, dwindling birthrate, a growing tendency to postpone or omit marriage, the increasing number of women in the labor force must be taken into account as development factors. Thus, this project intends to provide housing for single occupancy, including ambulatory elderly, as well as extensive day care facilities for divorced parents and working couples. Thus the average unit size will be markedly reduced.

The use of "defensive space" will reduce the incidence of crime while encouraging social interaction and neighborliness. Community layouts and designs of individual units will reflect personalized living environments to economize the use of space, conserve energy, and provide employment.

Escalating land values, construction costs and the resultant shortage of affordable housing suggest the very real need to reduce the cost of housing. The use of technology utilizing prefabricated techniques and passive energy design will be introduced in this project. Buildings will be oriented to maximize energy savings and solar collectors will supplement on site power availability.

Considerable attention has been paid to the quality of the proposed urban development in terms of environmental land planning . The project has retained Mr. Pliny Fisk of the Center for Maximum Potential Building Systems in Austin, Texas. As an environmental architect and land planner (resume attached), Mr. Fisk will undertake the ecological urban plan and site development to take advantage of the vegetation and topography of the site. To assist in the process, we have retained the Heard Museum of Natural Science to provide the vegetation and habitat analysis.

The Development Concept: The total development acreage available to the project is 210 acres of which 18 acres will be used for multi-family residential units, 2 and 3 bedroom duplexes and quadruplexes. This 18 acre development will be of medium density with up to 9 units per acre for a total of 162 rental units.

Of the 210 acres, approximately 42 acres have been allocated as green belts along the flood plain of Tickey Creek

and on the south central portion of the development where there are natural grasses and substantial wildlife habitats. These acres will be converted into natural trails for hiking, park areas, and the general use of the community. The remaining 150 acres will be allocated for detached single family housing.

The project will be developed in phases. Phase I will supply the local market with much needed rental units. Building nodes of 4 units each will be erected along or connecting to green belt areas until a cluster of 12 has been achieved. As an ammenity, an extensive day care center will be built that can function as a community building.

The architectural style will be Early Texan, properly oriented to utilize and harness solar heating in the winter and wind currents for ventilation in the summer. The extensive use of porches and exterior staircases will permit social intercourse, neighborliness and security.

It is hoped that this development of multi-family units will provide a stepping stone into the single family development and aid in the presale of the same. Tenants can watch as the development takes place with the expectation and confidence that the homes will be as good a quality as the rental units, thus bridging our marketing effort with the sales plan.

PRINCETON PARKS

MARKET ANALYSIS

Princeton Parks multi-family development is located in Princeton, Texas on the southwest corner of Highway US 380 and Farm to Market Road 982.

Princeton is approximately 30 miles from Dallas and eight miles east from McKinney in Collin County.

The population of Princeton did not grow as rapidly as did the rest of the county during 1980-1984. However, between 1984 and 1986, Princeton grew by 19%. It would be difficult to categorically state that a growth trend has been set based upon last year's dramatic growth, but one could deduce several possibilities.

One, the demographic expansion of the Dallas metroplex area has pushed housing prices up, thus forcing people further out to seek affordable housing. Secondly, the growth registered in Collin County of 7.45% per year from 1980 to 1985 has created a demographic immigration into the county following the rapid growth of Plano, McKinney, Wylie, Allen, Frisco and other communities as a consequence of business and industry relocations into the county. Some of these companies are: Texas instrument, Electronic Datas System, Firto-Lay, and Fisher Electronics.

The Texas Employment Commission reports that in 1985 the county registered only 3.9% unemployment. As of February 1986 Collin County has a 4.1% unemployment as compared with Dallas County which shows 5.8% unemployemnt and 8.8% for the state of Texas for the same period.[1] The Employment Commission report shows that approximately 2,000 new jobs were created in Collin County during 1985.

The economic development has created a growing, strong economy independent of the energy situation prevailing throughout the state at this time.

Thirdly, the economic expanison of the county has accellerated the effective income per household. In Collin County the effective buying income registered a 12% rate of growth from 1975 to 1983. In absolute terms, the EBI for Collin County is $34.00 as compared $26.00 for Dallas and $23.40 for the state of Texas.

In Princeton it could be stated that there is almost full employment. The Census Bureau reports that the number of people over 16 years of age that file for unemployment is 1.6% of the labor force.

The income level of Princeton is substantially below that of the county at $21,000. This reflects the composition of the labor force, mostly blue collar workers who depend on employment in job markets outside Princeton e.g. McKinney, Plano, and North Dallas. It is this market segment Princeton

[1] Texas Employment Commission, 1985 Employment Report.

Parks plans to target in its residential development of rental units and single family homes of several price ranges to accomodate expected rise in income.

EXISTING RENTAL UNITS & COMPETITIVE ANALYSIS

There are 200 rental units in Princeton with an occupancy rate of 97%.

40 of these units are elderly housing and 60 are subsidized Farmers Home Administration rental units.

Of the units surveyed (see attached), the quality of construction was poor, and there are no 3 bedroom units available.

Occupancy rate in McKinney is running at 94% with 200 units already being built and more on the drawing board.

There are no rental units available in Farmersville, 9 miles away.

Rentals run between $380 to $330 for a single bedroom, 1 bath, to $320 to $375 for a 2 bedroom, 1 bath.

PRINCETON PARKS
SITE DESCRIPTION

Griffin-West residential properties is located within commuting distance to Dallas, Plano and McKinney on U.S. Highway 380 and off Central Freeway. It is also connected to Dallas/Fort Worth further north through Farm to Market Road 121 which is programmed to be a 4 lane freeway from Princeton to the Dallas/Fort Worth International Airport (see chart).

The project is located in rolling hills with large wooded areas and crossed by Tickey Creeks and other smaller creeks, thus providing the site with superior environmental attributes

The City of Princeton's long range development plans all benefit the project. The city promises to finish a 12 inch water main to supply C Water District. The project has 900 foot frontage on this route. A 14 inch distribution line is planned to supplement the existing 12 inch line that is already there on Highway 380.

The drainage and sanitary sewers encircle the property insuring it long term development potential and the economical cost of its development.

There are several areas with large trees and virgin grass which we will enhance to create nature trails. We will transplant vegetation to landscape building sites with the use of wild flowers.

The natural setting together with the early Texas architecture will create a unique environment at affordable cost since the proposed ammenities are economical to implement and will improve the quality of life of the development.

PRINCETON POPULATION STRATIFICATION

BY AGE - 1986: 1986-91 PROJECTION

Age Group	Actual	Projection
1 - 4	131	293
5 - 9	327	843
10-14	337	326
15-19	98	228
20-24	213	264
25-29	261	325
30-34	360	446
34-44	533	660
45-54	268	332
55-59	95	118
60-64	78	97
65-74	450	558
		4,202

1. U.S. Bureau of Census 1980 population, stratification by age groups.

2. Princeton Independent School District, Student Population Projection 1986-1991

3. Non student population projection based on 7% annual rate of growth for Collin County.

HOUSING ANALYSIS [1]

% of Dwellings with	0 Bedrooms	0
	1 Bedroom	14%
	2 Bedrooms	43%
	3 Bedrooms	35%
	4 Bedrooms	5%
	5 Bedrooms	1%

[1] U.S. Bureau of Census 1980 Census, Collin County Housing Classification

MULTI-FAMILY UNIT SURVEY[2]

Units	Bedrooms	Rent	% Occup.	Comments
Colonial Apts	1	344-190	100%	Subsidized
	2	360-216	100%	
Hazelwood Apts.	1	330	100%	Medium to
	2	375		poor quality
Boi D'Arch Apts	1	300	98%	Average
	2	350		quality
U.S. Hwy 380 Apts	1	280	98%	Poor
	2	320		quality
Elderly Housing			100%	Subsidized

[2] Griffin-West Survey, March 1986

COMMUNITY ACCEPTANCE

Griffin-West has returned to Princeton, the place where the Griffins and the Wests were born.

We have erected our first building, a commercial venture. It has passive solar characteristics and has the Early Texas architectural look with clay roof tile and floors. All opposition to our rezoning the first multi-family project vanished once the town saw the quality of construction and the care we have taken to minimize the ecological and urban impact this project will have in the community.

Further rezoning requests for the same purpose encounter no opposition, but rather we have received favorable comments on our efforts in Princeton to develop an ecological, affordable housing project.

In order to renew the ties with the community, a series of articles called "Griff-O-Grams" has been published in the local newspaper. These articles provide the common bond between the community and Griffin-West enterprise. A copy is attached to the report.

PROGRAMMING

2.1 DESCRIPTION

Residential development programming is a very complex activity. The program must respond creatively to two major forces: the needs and desires of a multitude of participants who are either directly or indirectly involved and the influences of the site and project context. The program must also respond to issues that are much broader in scope, the most important being adaptability to population and physical change through time.

Five participant groups can be identified with unique, overlapping, and often conflicting sets of objectives.

1. USERS The principal users of the programmed environment are the residents. Within many architectural programs, the principal users and the client may be the same, which eases the problem of clearly defining the needs of the user. But in most residential problem situations the specific character of the users will become known only upon project completion. User characteristics and needs, therefore, must be simulated (based upon observation of individual and group behavior and previous experience). User needs determined through simulation pose the potential danger of being overly simplistic and deterministic, but they can only be reasonably accommodated in this fashion.

2. PROJECT NEIGHBORS Project neighbors form a group of secondary users who are directly affected by action occuring within their territory. Potential conflict of goals and objectives exists which, if not resolved, may form a formidible barrier to program implementation. The adjacent community is impacted either positively or negatively in physical, social, and economic ways. Often its goals and objectives are not well articulated until issues of conflict arise. However, through negotiation and trade-offs effective programming solutions can be attained which take the neighbor's concern into account.

3. MUNICIPALITY The municipal body usually does not operate as a client; nevertheless it is a strong ratification force. Most of the interests within a politically defined boundary are arbitrated at this level and are funnelled through municipal mechanisms. Ideally the municipal body expresses goals and objectives based on the values of the larger community. Ratification of any program is based upon a broad set of social goal satisfactions and municipal service impact criteria. A broad area of negotiation is centered upon the public cost/benefit balance.

4. DEVELOPER Ultimate implementation of a project depends upon the skills of the developer acting in his own interest or as an agent for another party. His participation brings project economics to bear upon implementation feasibility. Generally the developer is operating on a restricted budget which limits his objectives. Maximization of profit, financial leverage, and liquidity as well as the minimization of risk, operating expenses, construction time and costs place constraints upon the program. The developer's objectives cannot be met without the ability to market a package of physical, social and environmental products which are based on a set of predictions of uncertain market behavior; thus he must be an anxious advocate of the project and be willing to negotiate with all participants.

5. STATE/FEDERAL GOVERNMENT The fifth participant is the state and/or Federal government. Their participation can involve direct or indirect subsidies to the project in the form of various aid programs. The governmental role is usually that of a ratifier and is contingent upon the objectives, policies, and standards of the applicable programs.

The particular issues that must be responded to in residential programming affect the components of the program and the process of programming. The major influences include:

1. Ecological conditions of the land. The program must respond to ecological determinants for determining suitable uses and developing adaptive strategies.

2. Market determinants. The effective and non-effective demands of the housing market, capture rate, and absorption rates are major determinants of the program. But this data

must be weighed against the additional demand that the development itself may create and against the potential for altering the market forces.

3. Social objectives. Each project has either implicit or explicit social objectives in terms of what population or what part of the market is desired and how that population can be attracted and how their needs can be met.

4. On-site/off-site factors. The level of services in the surrounding area offers opportunities for attaching or detaching the project from its surroundings. An over-sufficient program in terms of services provided may be appropriate in order to meet unfulfilled demand or reduce the impact of the project in the surrounding area. An under-sufficient program may be appropriate where existing levels of service is high.

5. Type of developer. Public and private developers have very different objectives in providing housing and this will affect the content of the program and the method of programming.

6. Construction process. An industrialized or systems development may require a vastly different program than conventional construction and development processes.

7. Timing. The timing and pace of development determined by the market influences the program due to its effect on costs and the critical mass of housing required to support ancillary services.

2.2 IMPLICATIONS FOR PROGRAMMING METHODS

These influences suggest that programming is highly political in nature and that the issues involved are heavily value laden. This fact, coupled with the necessary interdisciplinary nature of residential problem solving, suggests that an appropriate method is not a decision-making model but a framework for organizing and displaying information that exposes the critical issues from which creative decisions can be made.

An examination of trade-offs is the major requirement for a method of programming. This is a device for carrying out actual or simulated negotiations between the participants and their needs and the influencing conditions of the specific problem at

hand. The dimensions of the possible trade-offs are difficult to determine but this is a necessary task for effective problem solving.

The method must also interface with the design process and allow opportunities for early design decisions such as responding to the condition of the land, circulation requirements, service networks, and critical edge conditions. A graphic component, therefore, seems to be necessary. But since rapid construction and evaluation of alternatives are required, a calculating component is also demanded which can keep an accurate account of program quantities and their costs.

These are the basic issues which have framed our approach in formulating a flexible modular programming process.

MODULE PROGRAMMING METHOD

3.1 CONCEPT

Module programming is an information packaging and display model rather than a decision model; it is essentially a method of establishing an environment for creative problem solving. It is a graphic tool that effectively interfaces programming and design activities, and it is a calculating tool that allows rapid aggregation and manipulation of program quantities. Module programming can be applied to a broad range of residential programming scales, it possesses sufficient flexibility to respond to most residential problem situations, and it can be used for general or very detailed examinations.

Manipulating units of pre-aggregated and pre-defined quantities and relationships is the major operational feature of the method. These units are of two basic types:

1. Density/Planning Modules: A density module is an information block relating a population group to a particular level of environment at a specific residential density. Applying area dimensions to the density module coefficients result in a Planning Module which can be physically applied to the site, and the demands for supporting functions can be quantified. Thus, the planning module allows manipulation of sets of dwelling units and relationships rather than individual units.

2. Thresholds: A threshold is a construct which describes the scale and nature of demand necessary to support a given type and environmental level of a service, amenity, infrastructure technology, construction process, etc.

Using these two concepts not only allows rapid and accurate development of a residential program but also provides opportunities for examining

alternative levels of environmental quality which are possible and trade-offs which determine how the particular level can be achieved. Being able to clearly conceptualize trade-offs allows more sophisticated decision-making and, therefore, provides opportunities for increasing the quality and variety of planned residential environments.

A third unit outside the spatial module defines area wide community amentities such as community park, daycare center, churches, community center, etc. These have been summarized with typical planning ratios. Some of these ratios are as follows:

Facility	**Acres/1,000 Pop.**
Playground	1.5
Neighborhood Parks	2.0
Playfields	1.5
Community Parks	3.5
District Parks	2.0
	10.5

3.2 DENSITY/PLANNING MODULE

A density module is a non-area defined vector which relates a population group and a quality of environment to a specific residential density. The quality of environment and the characteristics of the population served are the most significant dimensions of the module; density is used only to relate these relationships to a possible range of dwelling unit types and to determine ranges of spatial quantities. For any given density many different modules can be developed. A change in population profile or a change in the level of environment will alter the spatial coefficients in the module and the demand or ability to supply threshold quanitites for support functions.

The module is essentially an information block with two major components: a population profile and its coefficients and spatial coefficients which are designed in response to population needs at particular densities.

The population profile is determined by making assumptions about the probable occupation of the units through time. The coefficients in the module should respond to the housing market conditions for the specific problem situation. The following information is required:

1. Household income range: This information is required for determining the spatial needs of the socio-economic classes involved. Provisions for private and public open space, recreation facilities, and other services vary significantly across income groups.

2. Household type/size distribution: This describes the character of the probable population in terms of household type: elderly, singles, married couples; small families and large families. From this information dwelling unit sizes can be broken down into age groups.

3. Age group distribution: This information provides a basis for determining the demand for certain services, such as recreation facilities, schools, and daycare centers.

4. Dwelling unit size distribution: This provides a bedroom count mix for the module which determines the floor area ratio, a key to determing spatial coefficients.

The information above is required for determining the spaces for each module and for quantifying demands or potentials for threshold testing.

The spatial coefficients included in the density module are those which are intimately related to the dwelling and do not vary significantly through different project scales. Parking, private open space, attached public open

space, and recreation space are included. Other needs which vary by project scale are carried as thresholds. The coefficients within the module should contain sufficient flexibility to allow for creative design freedom for determination of housing types and spatial arrangements. Open space in paticular should be flexible because of the potential trade-offs between private and public open space, public space that is attached to the units, and space that is aggregated into larger units at some distance from the dwelling.

We have used FHA's Land Use Intensity Standards for our initial module formulations. The relationships between densities/floor area ratios vary relatively consistently and they supposedly represent comparable environmental qualities, at least in simple spatial terms. Although we are not familiar with the biases which underlie their formulation and possible would disagree if we were, they do form a real administrative minimum on many projects.

The spatial coefficients that are included in the module are:

1. Floor Area Ratio (total residential floor area/land area). The F.A.R. is determined by the dwelling unit size distribution and forms the basis for the remainder of the coefficients.

2. Open Space Ratio (land area-building coverage/floor area). Maximum coverage is determined by the O.S.R. If less than the maximum allowable is used this space can be translated within the module to livability or recreation spaces.

3. Livability Space Ratio (open space-circulation and parking/ floor area). The maximum amount of circulation can be determined by subtracting the total livability space from total open space. The livability space itself includes recreation space, private open space, and passive public open space contiguous to the unit or building. Excess livability space can be distributed into recreation space

or non-contiguous public open space.

4. Recreation Space Ratio. For our purposes this includes adjacent recreation space that is located close to the dwelling in relatively small quantities (2,000 sq. ft. to 7,000 sq. ft.) for tot lots and recreation areas for other age groups and local recreation space which is aggregated into one to two acre increments at a farther distance (generally 1/8 mile maximum) from the dwelling. Recreation space is included in livability space. Their quantitative relationships for various densities can be seen in Figure 3-1.

5. Parking Ratio. This includes both resident's and visitor's parking.

Density modules are multiplied by area factors to form program modules which can be applied to the site as spatial aggregates. The population characteristics are also transformed into aggregates for threshold testing. Program modules can vary in size according to the level of detail which is desired or the scale of the problem. A one acre module is sufficient for most work and provides an opportunity for finely detailed programming.

The format of the density module and illustrations of the program modules developed for Princeton, Texas are presented.

3.3 THRESHOLDS

Residential developments occur at many scales and often scale is a key determinant of what environmental support can be provided to the dwelling units themselves. Thresholds are the scalar quantities that must be achieved to provide various facilities, services, amenities, etc., which are the major determinants of environmental quality. The concept of thresholds is not new; it is the basis for most standards and rules of thumb

L.U.I. OUTDOOR SPACE/D.U.

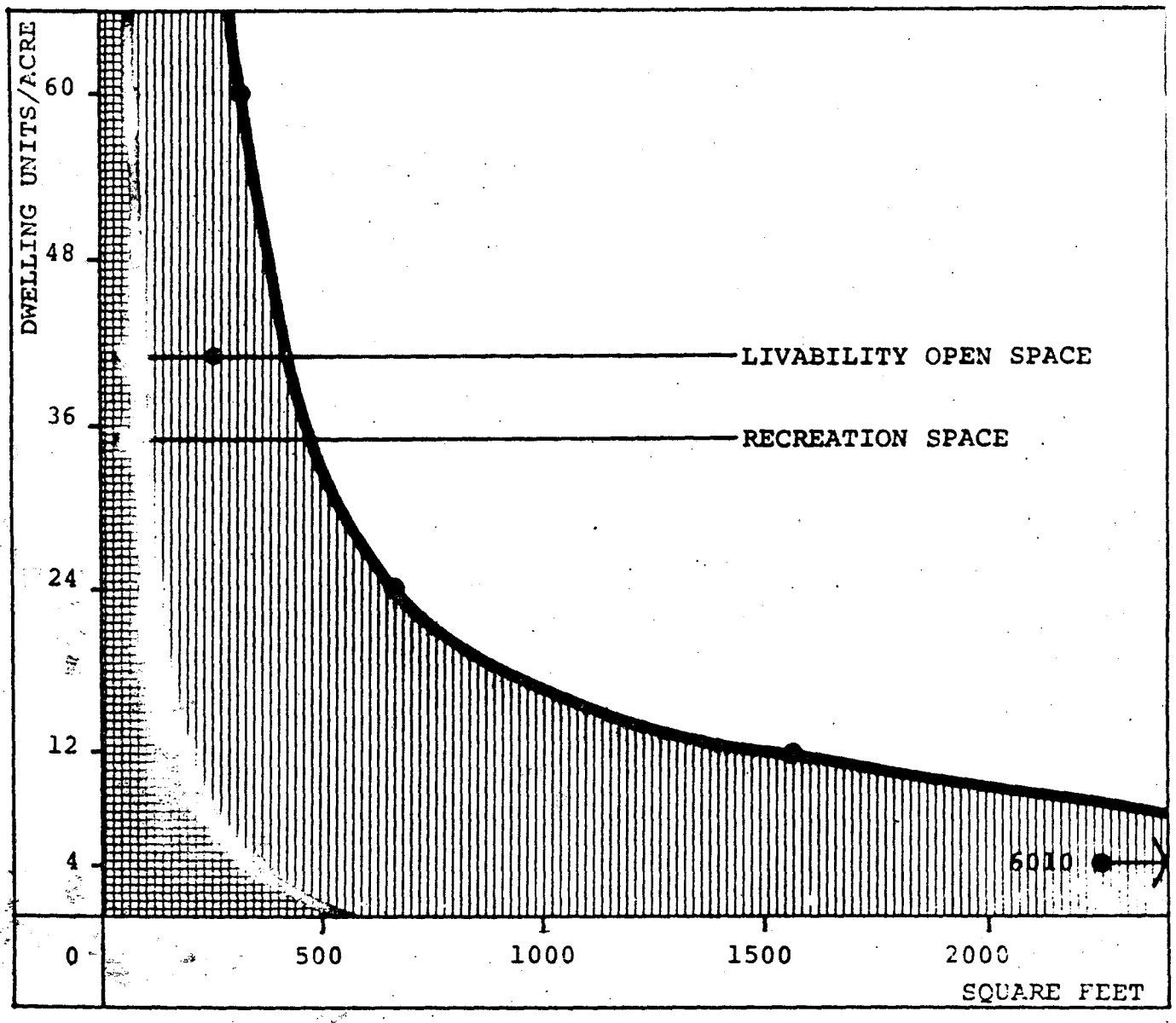


Figure 3-1

in residential programming. An elementary school of 600 students typically requires 900 dwellings, etc. However, the threshold concept can be used in a much more sophisticated manner as a means for programming, defining levels of environmental quality, and providing a framework for examining trade-offs.

There are many components of residential development to which the threshold concept can be applied. Some of these are:

1. Residential support services such as recreation, schools, shopping facilities, etc.

2. Infrastructure technologies such as water supply, sewage, solid waste disposal, elevators, etc.

3. Transportation technologies.

4. Socio-economic mixes for scales of homogeneity and heterogeneity (i.e. minimum social groups that should be homogeneous, etc.).

5. Amenities such as lakes or ponds, protection of natural vegetation, etc.

6. Construction process for industrialized building and for conventional construction.

We have chosen to deal only with service thresholds in demonstrating the programming method; however, the other types could be treated in the same manner with this model. The remainder of the discussion will deal primarily with services but the issues discussed are equally applicable to other threshold types.

Service thresholds relate to various types of demand. The typical basis of total population or total dwellings for determining services is not adequate.

Thresholds are functions of the following:

1. Total dwelling units or demand related to the number of households. This type is not sensitive to household size, density variations or particular sub-groups. The major examples are utility systems and some commercial facilities which depend upon disposable household income.

2. Total dwelling units of a particular housing type or density. Household types and, therefore, family sizes vary with residential density. Recreation space and transportation facilities are examples of dependent thresholds.

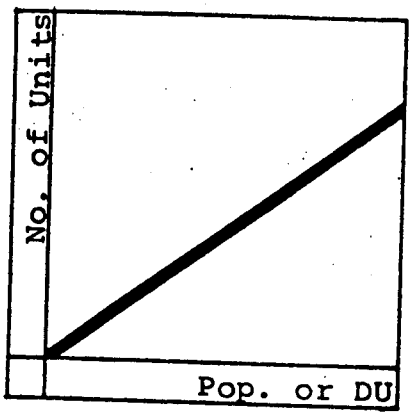
3. Total population or demand varying by household size. Many standards are expressed in these terms. Possible examples are certain recreation facilities and some infra-structure technologies.

4. Population by sub-group. This includes age groups and socio-economic class or ethnic groups. Examples include schools, daycare centers, special recreation facilities, etc.

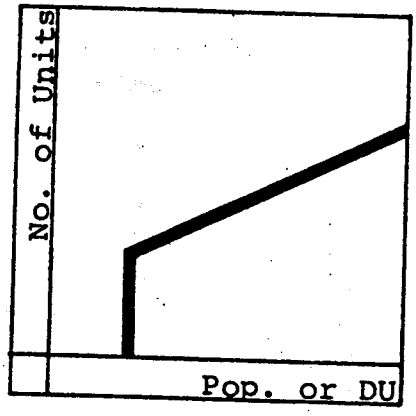
5. Time. This type is related primarily to construction processes and the ability to spend more for site services with savings in construction costs.

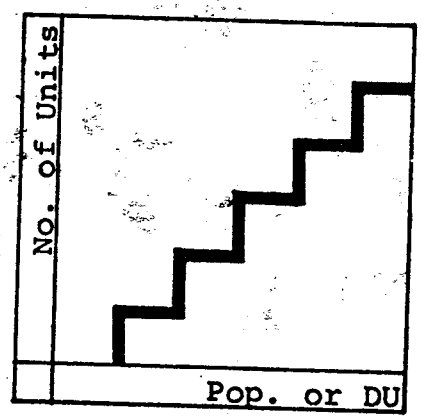
6. Area size. This is also a construction process function where economies of scale might allow spending more for housing quality or services.

The nature of the service itself determines the threshold function. Various threshold functions include:

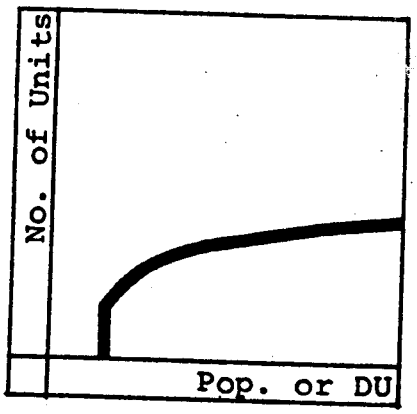


1. Linear or slope function. This relates to a service, such as public open space, that can continuously increase. A variation of this is a step-slope function which requires an initial critical mass for providing a service, but it can then expand linearly until another unit can be developed.

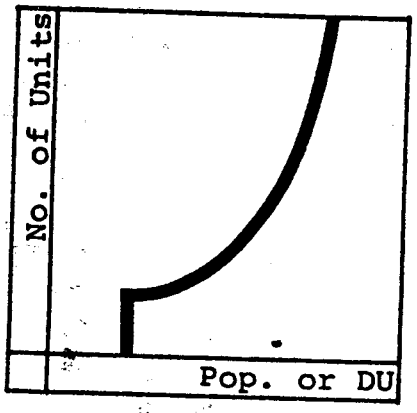




2. Step function. This indicates a facility which has a fixed size; a second facility cannot be supplied until a second level of demand is reached. Examples include swimming pools, corner stores, etc.



3. Curve function (such as a logarithmic curve) which indicates that a service can achieve economies of scale. Maintenance services and elevators are examples.



4. Curve function (such as an exponential curve) which indicates that as demand increases at a greater rate than provision of facilities. A regional shopping center is an example.

Many combinations of these are possible. For the purposes of illustrating the model, we have only dealt with two types: step-slope and step function.

The information required for threshold testing includes the following:

1. The size, space, equipment and personnel required for the service in terms of alternative environmental levels.

2. The nature of operation and maintenance.

3. Total development cost.

4. Annual operating cost.

5. Description of the threshold function.

6. Identification of the type of demand.

7. The amount of support required.

8. The minimum initial quantity that can be supported.

The services thresholds for Princeton, Texas are illustrated.

3.4 MODULE PROGRAMMING PROCESS

The overall programming process is diagrammed in Figure 3.2. Its major feature is the ease with which a designer can place the program modules and the related supporting services on a site plan; and make adjustments according to site specific design criteria and objectives for environmental quality. The technique of graphic display along with a computerized threshold calculator program make the adjustment of spatial quantities a relatively fast operation. Hence, the number of adjustment cycles is determined by the level of program detail desired.

The first step in the process is to assemble site and project context information including physical conditions of the site and surrounding area, existing services and housing quality, demographic and market data. This information must then be interpreted and formulated into working assumptions or objectives for programming. Alternative gross programs and mixes are put together by hand using density modules constructed or adjusted to the specific problem situation.

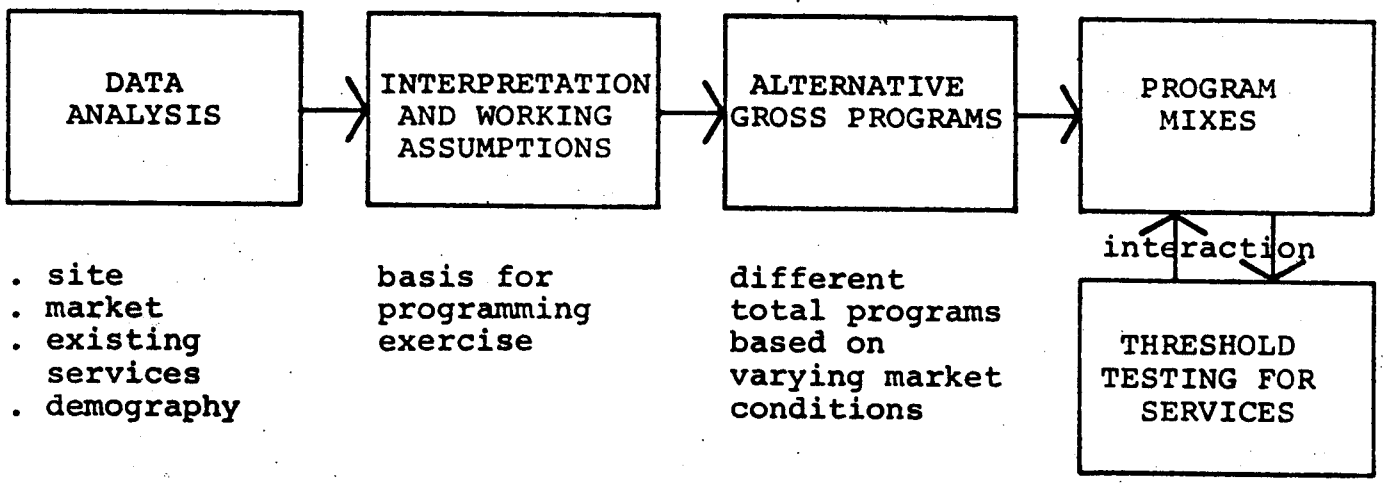
The modules are then graphically displayed and the first threshold tests

run for the program modules. The program mixes can then be adjusted to respond to the quantity and quality of service and their spatial distribution. For each program mix option, different levels of environmental quality can be constructed. The process of examining trade-offs can begin then by weighing the thresholds in combination, by examining the relationships between the modules and thresholds, and by examining partial aggregations of modules. The trade-offs can also be examined in terms of timing and phasing strategies. Total costs and costs per dwelling for various environmental levels can be examined in order to determine cost quality trade-offs and threshold combination trade-offs.

Recycling the process in greater levels of detail can continue well into physical design activities. In fact design issues will be raised during the first graphic display and design decisions can be constantly built-in in successive levels of refinement.

In order to test and evaluate the module programming process as a conceptual technique the following Section describes our application of the method on a real site using current data.

MODULE PROGRAMMING PROCESS



- site
- market
- existing services
- demography

basis for programming exercise

different total programs based on varying market conditions

adjustment between dwelling unit modules and services provided - alternative levels of environment

Figure 3-2

APPLICATION OF METHOD

4. PRINCETON, TEXAS DENSITY/PROGRAM MODULES

For demonstration of the method on the Princeton, Texas project, we developed two modules which relate to the apparent market demand:

1. 4 MODULE - 4 dwelling units/acre:
   single family detached

2. 11.5 MODULE - 11.5 dwelling units/acre:
   multi-family attached & detached

Each module was assigned a household and family size distribution, family sizes were estimated, and age group distributions generated. We had little local data on which to base our assumptions; the family size and age group estimates are derived from data for Princeton, Texas.

Each of the modules are presented below with their respective population profiles, spatial coefficients and minimum square footage standards for a two acre planning module. Each module is presented graphically in two variations to illustrate the range of design flexibilities. Generally one variation retains a maximum amount of private or attached open space and the minimum recreation space; the other variation reduces private and attached open space to a minimum and expands the recreation space portion. The second variation is the only one presented in this preliminary report because we are dealing with multi-family. Although not illustrated, many other flexibilities exist: savings in circulation space, building coverage or utilization of horizontal building surfaces can significantly increase the amount of attached open space or recreation space in each module. The first illustration for each variation presents spatial quantities first for a two acre module and secondly for a single dwelling unit or a vertical section of units. Following the spatial diagrams are: illustrative plans and isometrics for the two variations.

POPULATION STRATIFICATION

AGE	1985	1991	% CHANGE
0-4	131	293	55.3%
5-9	327	843	61.2%
10-14	337	326	‹3.37%›
15-17	98	228	57%
18-19	98	228	57%
20-24	213	264	19.3%
25-29	261	325	19.7%
30-34	360	446	19.3%
35-44	533	660	19.2%
45-54	268	332	19.3%
55-59	95	119	20.2%
60-64	78	97	19.6%
65-74+	450	558	19.4%

PLAN TYPES

SI	MI	LI
400 SQ. FT.	480 SQ. FT.	560 SQ. FT.
EFF.	1 BDRM.	1 BDRM.
1 PARK. SP.	1.5 PARK. SP.	1.5 PARK. SP.
S1.5	**M1.5**	**L1.5**
560 SQ. FT.	672 SQ. FT.	784 SQ. FT.
1 BDRM.	2 BDRM.	2 BDRM.
1.5 PARK SP.	2.0 PARK SP.	2.0 PARK SP.
S2	**M2**	**L2**
800 SQ. FT.	960 SQ. FT.	1120 SQ. FT.
2 BDRM.	2 BDRM.	3 BDRM.
2.0 PARK SP.	2.0 PARK SP.	2.5 PARK SP.
S2.5	**M2.5**	**L2.5**
960 SQ. FT.	1125 SQ. FT.	1344 SQ. FT.
3 BDRM.	3 BDRM.	4 BDRM.
2.5 PARK SP.	2.5 PARK SP.	3.0 PARK SP.

MODULE 23

11.5 DU/AC MULTI-FAMILY ATTACHED/DETACHED

ASSUMPTIONS

LAND AREA - 90,169 SQ. FT

LAND USE INTENSITY FACTOR (OUTDOOR SPACE / DWELLING UNIT)

4.01

RESIDENT HOUSEHOLD INCOME

AGE GROUPS

AGE GROUPS	POP/DU	POP/MOD
0-4		
5-9		
10-14		
15-17		
18-19		
20-24		
25-29		
30-34		
35-44		
45-54		
55-59		
60-64		
65-74		
TOTAL SCHOOL CHILDREN		
TOTAL POPULATION		

HOUSEHOLD TYPES

HOUSE HOLD TYPE	HOUSE HOLD SIZE	% DIST
ELDERLY		
SINGLE		
COUPLE		
FAMILY (3-4)		
Family (5+)		

AVERAGE POP/D.U. -

AVERAGE POP/MODULE -

D.U. SIZES

NO. BDRMS	FL. AREA	% DIST.
0		
1 (4)	2960	13.2%
2 (8)	9136	40.6%
3 (15)	5285	23.5%
4+ (6)	8064	35.9%

AVERAGE FL. AREA/D.U. - 977.6 sq. ft.

AVERAGE FL. AREA/MODULE - 22,485 sq. ft.

MODULE 23

11.5 DU/ACRE MULTI-FAMILY ATTACHED/DETACHED

MODULAR SPACES

	RATIO	SPACE SQ. FT.
LAND AREA TOTAL		90,169
FLOOR AREA TOTAL		22,485
OPEN SPACE TOTAL		67,684
PUBLIC		
PRIVATE		
RECREATION SPACE PLAYGROUNDS		

MODULAR COMMUNITY PARTS (AMENITIES)

PARKING SPACE	SHADE TREES	(10x15)x(41)	6,150
RESIDENT			
VISITOR	LOW HEAT ABSORPTION PAVING		
SIDEWALKS			
PATHS			
FENCING			
SHRUBBERY			

MODULAR BUILDING ENVELOPES

	SM	MED	LRGE
ONE STORY COTTAGE			
TWO STORY COTTAGE			
ONE STORY DOG RUN			
TWO STORY DOG RUN			
ONE STORY DUPLEX			
TWO STORY DUPLEX			
ONE STORY TRIPLEX			
TWO STORY TRIPLEX			
ONE STORY QUADPLEX			
TWO STORY QUADPLEX			
ONE STORY APARTMENT BL			
TWO STORY APARTNEBT BL			

MODULAR UTILITIES

FOUNDATION DITCHING		
HEAT PUMP DITCHING	750ft²/ton	14,990
HEAT PUMP WELL		2,998 ver. ft.
CISTERNS		
WATER LINES		
ELECTRIC LINES		
TELEPHONE		
SEWAGE		
CABLE		

MODULAR PLANS

S-1	L-1
S-1.5	L-1.5
S-2	L-2
S-2.5	L-2.5
M-1	
M-1.5	
M-2	
M-2.5	

MODULAR BUILDING PARTS

SPATIAL	UTILITIES	
NORTH PORCHES	ROOF VENTS	BREEZEWAY
E-W PORCH	MOVABLE SHUTTERS	TRELLISES
BALCONIES	SOLAR WATER HEAT	SOUTH PORCH
DECKS	HEAT PUMP	OVERHANG
BAYWINDOWS	SUN RFLECT. CURT.	
OUTSIDE STAIRS	LOW WATER TOILET	
STORAGE SHED	LOW FL. SHOWER	
	ENERGY EFF. LT. BLBS	
	FOUND. HEAT ISLAND	

MODULE

3) COMMUNITY AMENITIES EXTERNAL TO MODULAR PROGRAMING UNIT

ROADS
- MAJOR ARTERIAL
- MINOR ARTERIAL

PATHS
HIKE AND BIKE TRAILS

RECREATION
- COMMUNITY PARKS
- REGIONAL PARKS

RELIGIOUS FACILITIES

GOVERNMENT BUILDING
- POST OFFICE

EDUCATIONAL FACILITIES
- DAYCARE
- ELEMENTARY
- HIGH SCHOOLS

MODULE

ASSUMPTIONS

LAND AREA - 90,169 SQ. FT

LAND USE INTENSITY FACTOR
(OUTDOOR SPACE / DWELLING UNIT)

RESIDENT HOUSEHOLD INCOME

AGE GROUPS

AGE GROUPS	POP/DU	POP/MOD
0-4		
5-9		
10-14		
15-17		
18-19		
20-24		
25-29		
30-34		
35-44		
45-54		
55-59		
60-64		
65-74		

TOTAL SCHOOL CHILDREN

TOTAL POPULATION

HOUSEHOLD TYPES

HOUSE HOLD TYPE	HOUSE HOLD SIZE	% DIST
ELDERLY		
SINGLE		
COUPLE		
FAMILY (3-4)		
Family (5+)		

AVERAGE POP/D.U. -

AVERAGE POP/MODULE -

D.U. SIZES

NO. BDRMS	FL. AREA	% DIST.
0		
1		
2		
3		
4+		

AVERAGE FL. AREA/D.U. -

AVERAGE FL. AREA/MODULE -

MODULE

MODULAR SPACES

	RATIO	SPACE SQ. FT.
LAND AREA TOTAL		
FLOOR AREA TOTAL		
OPEN SPACE TOTAL		
PUBLIC		
PRIVATE		
RECREATION SPACE PLAYGROUNDS		

MODULAR COMMUNITY PARTS (AMENITIES)

PARKING SPACE
RESIDENT
VISITOR
SIDEWALKS
PATHS

FENCING
SHRUBBERY

SHADE TREES

LOW HEAT ABSORPTION PAVING

MODULAR BUILDING ENVELOPES

	SM	MED	LRGE
ONE STORY COTTAGE			
TWO STORY COTTAGE			
ONE STORY DOG RUN			
TWO STORY DOG RUN			
ONE STORY DUPLEX			
TWO STORY DUPLEX			
ONE STORY TRIPLEX			
TWO STORY TRIPLEX			
ONE STORY QUADPLEX			
TWO STORY QUADPLEX			
ONE STORY APARTMENT BL			
TWO STORY APARTMENT BL			

MODULAR UTILITIES

FOUNDATION DITCHING
HEAT PUMP DITCHING
HEAT PUMP WELL
CISTERNS
WATER LINES
ELECTRIC LINES
TELEPHONE
SEWAGE
CABLE

MODULAR PLANS

S-1
S-1.5
S-2
S-2.5

M-1
M-1.5
M-2
M-2.5

L-1
L-1.5
L-2
L-2.5

MODULAR BUILDING PARTS

SPATIAL	UTILITIES	
NORTH PORCHES	ROOF VENTS	BREEZEWAY
E-W PORCH	MOVABLE SHUTTERS	TRELLISES
BALCONIES	SOLAR WATER HEAT	SOUTH PORCH
DECKS	HEAT PUMP	OVERHANG
BAYWINDOWS	SUN RFLECT. CURT.	
OUTSIDE STAIRS	LOW WATER TOILET	
STORAGE SHED	LOW FL. SHOWER	
	ENERGY EFF. LT. BLBS	
	FOUND. HEAT ISLAND	

MODULE

3) COMMUNITY AMENITIES EXTERNAL TO MODULAR PROGRAMING UNIT

ROADS
- MAJOR ARTERIAL
- MINOR ARTERIAL

PATHS
HIKE AND BIKE TRAILS

RECREATION
- COMMUNITY PARKS
- REGIONAL PARKS

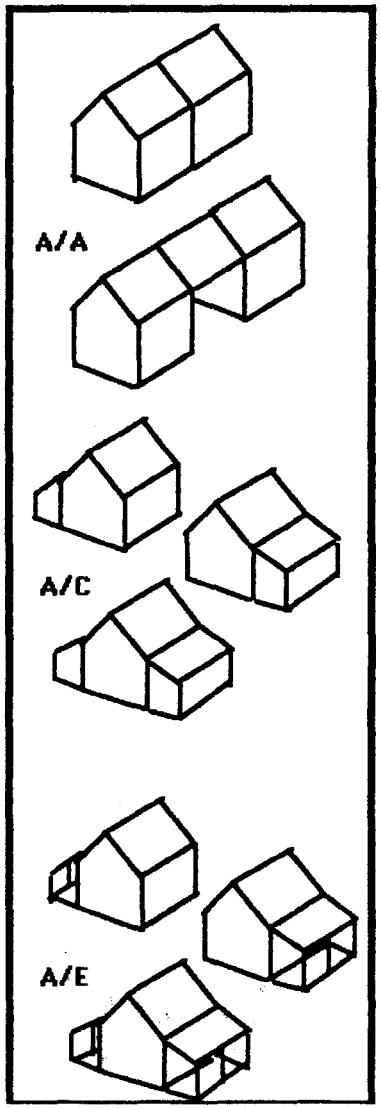
RELIGIOUS FACILITIES

GOVERNMENT BUILDING
- POST OFFICE

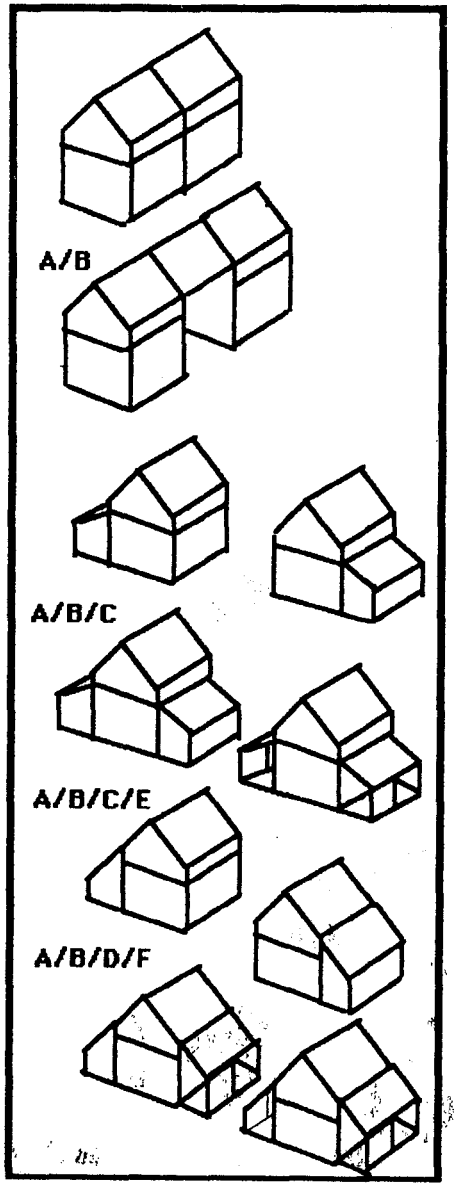
EDUCATIONAL FACILITIES
- DAYCARE
- ELEMENTARY
- HIGH SCHOOLS

LOPE PATTERN

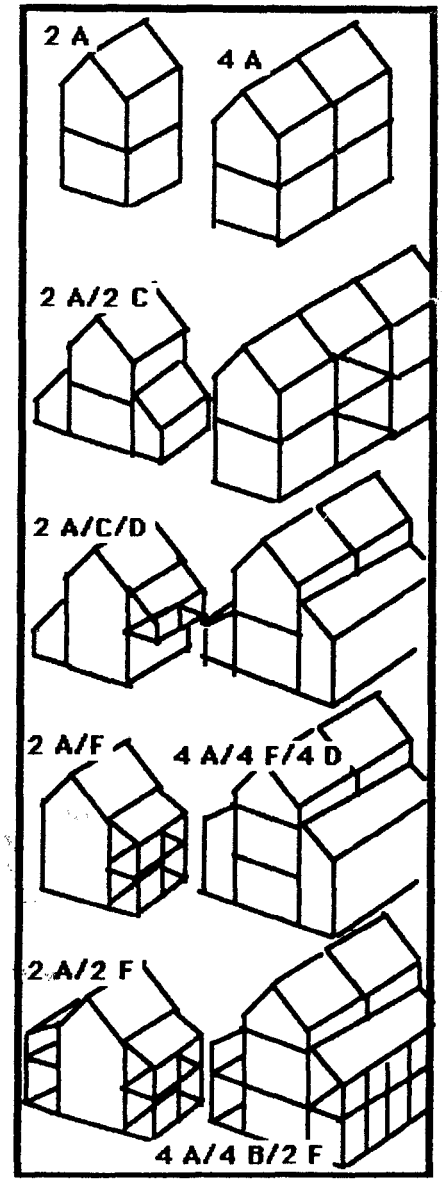
SINGLE STORY PATTERNS



ONE AND ONE HALF STORY PATTERNS

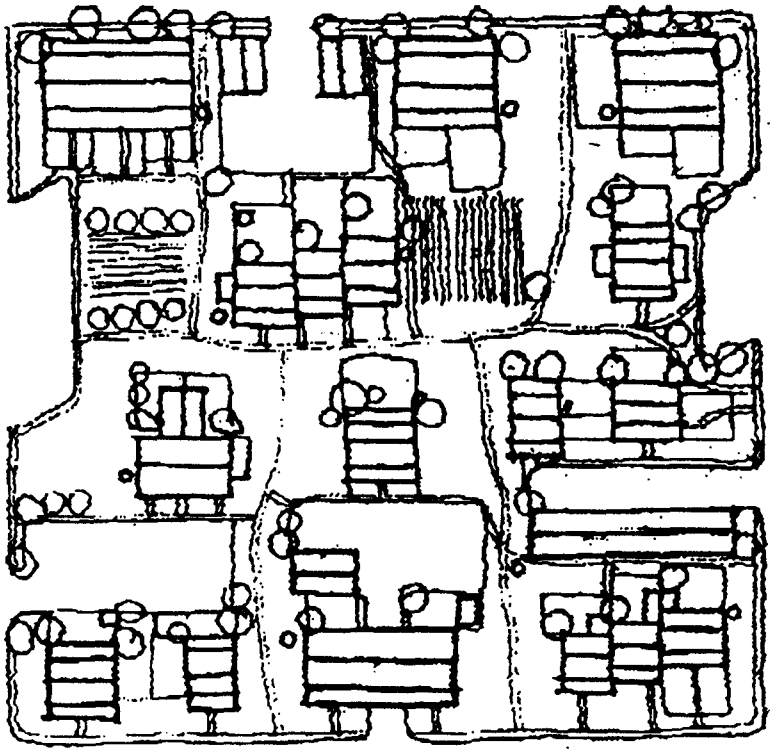


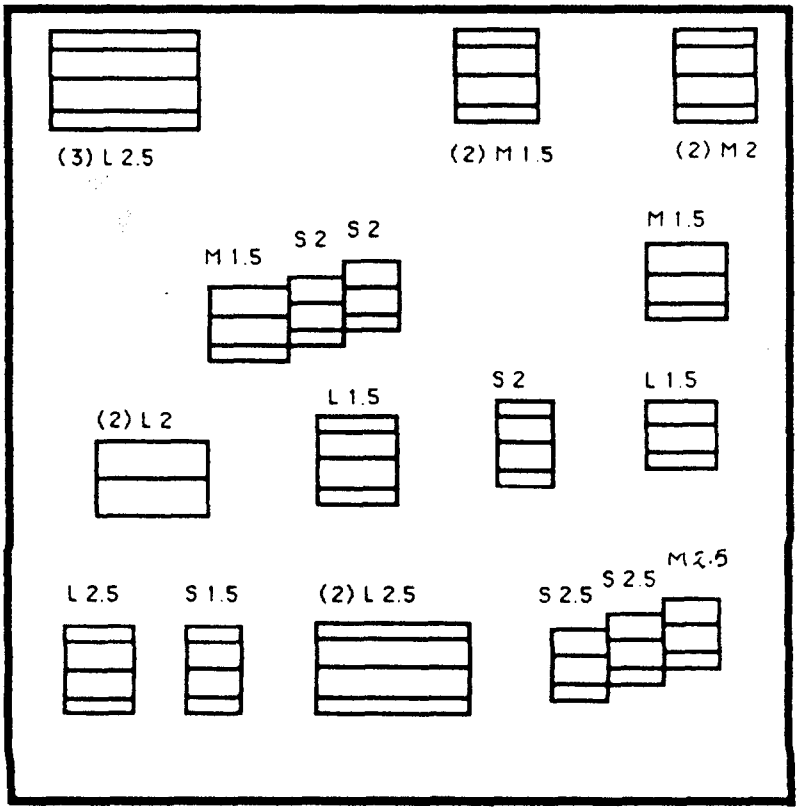
TWO STORY PATTERNS



MODULAR SITE PLAN

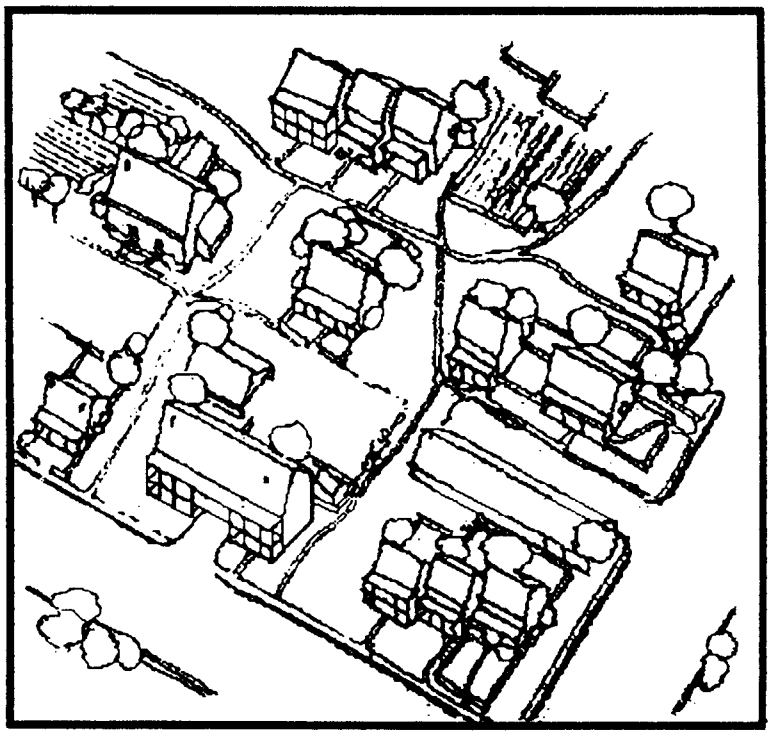
2 AC MODULE





PERSPECTIVE

2 AC MODULE



GRIFFIN-WEST RESIDENTIAL
PHASE ONE

POPULATION TOTAL ON-SITE:

MULTI-FAMILY:

8 BLOCKS X 75 PERSONS/BLOCK (with each block representing 23 D.U.) — 600 people (184 D.U.)

SINGLE-FAMILY:

38 D.U. X 2.5 PERSONS/D.U. — 95 people (38 D.U.)

TOTAL POPULATION SERVED: **695 PEOPLE** (222 DU)

* * * * * * * * * *

MULTI-FAMILY BEDROOM BREAKDOWN PER BLOCK:

Bedrooms/Unit	Units/Block	Persons/DU	Total Pop.
1 bedroom	4 units	1.5 people	6 people
2 bedroom	8 units	2.5 people	20 people
3 bedroom	5 units	4 people	20 people
4 bedroom	6 units	5 people	30 people

Total Dwelling Units: 23

Total Population: 75

PARKING PROGRAM:

PARKING PLACES:

- Princeton Code for Apartments = 1.5 DU + 4/10 DU Loading

  At 23 DU/2 Acre Block = 34.5 parking places

  Plus loading factor (34.5 + 4) = 38.5 parking places **40 TOTAL**

- Austin Code for Apartments

	#	Parking Pl/DU	Total Parking Pl
S 1.5	1	1.5	1.5
S 2	2	2	4
S 2.5	3	2.5	7.5
M 1.5	2	2	4
M 2	2	2	4
M 2.5	3	2.5	7.5
L 1.5	2	2	4
L 2	3	2.5	7.5
L 2.5	4	3	12

TOTAL PARKING UNITS PER BLOCK: 52

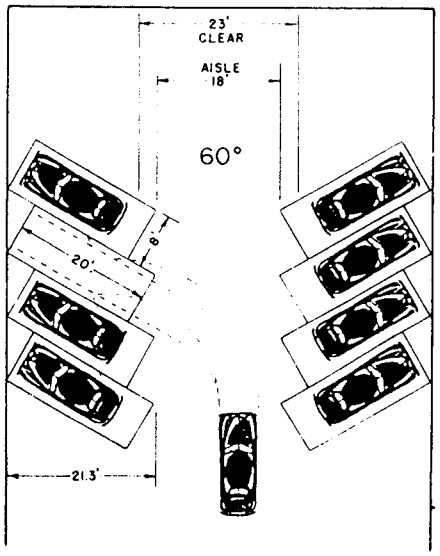
PARKING BARN SPACE:

A. At 60' Angle Parking:

ONE WAY

GARAGE

PARKING



60-DEGREE ANGLE
is most popular method. Parks a lot of cars with easy access.
Cars per 100 lineal feet of double bay . . . 20
Area required per car in double bay . . . 330 sq. ft.

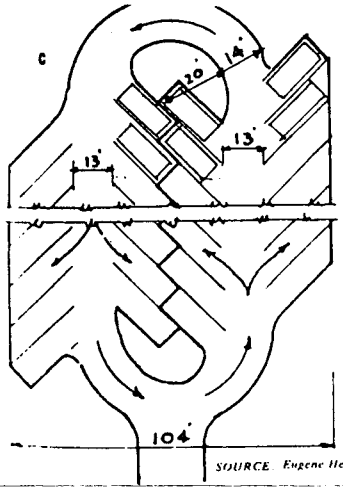
B. One Way Loop

Two Way Entrance

GARAGE

PARKING

AT 45' ANGLE



Four-wide one-way parking court for easy short-time parking

SOURCE: Eugene Henry Kluber, Housing Design, Reinhold Publishing Corp. -19

* * * * * * * * *

STREETS (HAMMOND 1977, p. 43)

	WIDTH	UNITS SERVED	ONE/TWO WAY	STREET PRKG.	SIDE-WLK.	SEP. PATH	MAX. LGTH.
ACCESS C-1	24'	>40	2	NO	NO	YES	600'
ACCESS C-1M	31'	>40	2	NO*	NO	YES	600'
COLLEC-TOR ST. C-S	34'	1000/ HR CAP	2	1 SIDE	YES	NO	------

* = BIKE LANE

ACCESS C-1 - GARAGE CUL-DE-SAC, SINGLE FAMILY COLLECTOR

ACCESS C-1M - MODIFIED, EAST-WEST CUL-DE-SAC

COMMUNITY FACILITIES:

RECREATION:

		Actual On-Site
Small Playground Areas	.5 ac/1000 pop.	.5 acre
Field Play Area for Young Children	1.5 ac/1000 pop.	1.0 acre
Sports Field	1.5 ac/1000 pop.	1.0 acre
Tennis/Basketball	1 ac/5000 pop.	1.0 acre
Picnicking	4 ac/1000 pop.	3.0 acres
Passive Water Sports (fishing/rowing/canoeing)	1 ac/25,000 pop.	1 lake/develop. = 1,500 pop.
Parking @ Recreation Areas	1 ac/1000 pop.	.75 acre

TOTAL RECREATION AREA: 7.25 ACRES + 1 LAKE

LAUNDRY FACILITIES:

- 1 Washing Machine/5 DU = 15 washing machines/2 acre block

- 1 Dryer/7 DU = 10 dryers/2 acre block

SPACE REQUIREMENT: 450 SQ. FT./BLOCK

* * * * * * * * *

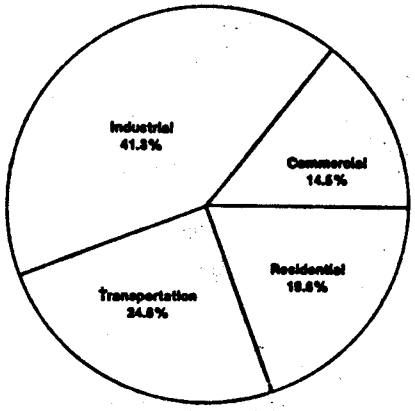
EDUCATION:

	Distance	Assumed Site Area
Nursery/Day Care - 60 children/1000 pop.	1/8 - 1/4 mile	4000 sq. ft./40 children

* * * * * * * * *

ENERGY USE SUMMARY
GRIFFIN-WEST RESIDENTIAL

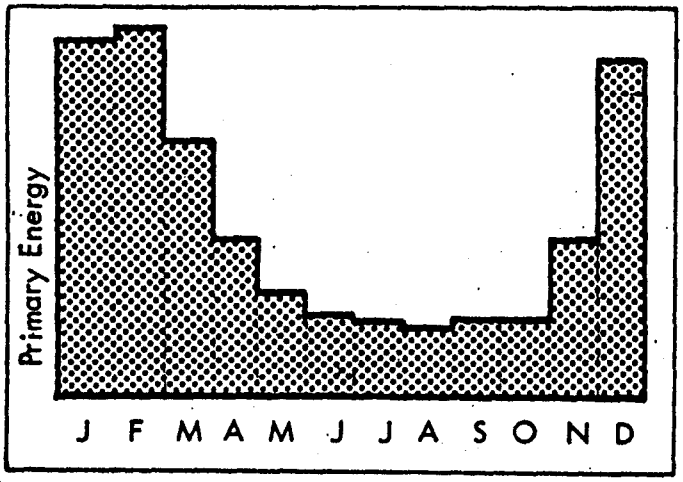
In attempting to derive energy conservation strategies for development purposes, it is essential to understand basic energy use patterns and relationships for the proposed land uses. Residential and commercial land uses offer the greatest potential for passive energy conservation strategies since energy loads here are directly related to heating and cooling loads and lighting. Industrial and transportation energy uses are basically fixed quantities related to given production requirements and basic travel needs and therefore will not be addressed herein.



TOTAL U.S. PRIMARY ENERGY CONSUMPTION, 1970 — 67 QUADRILLION BTU

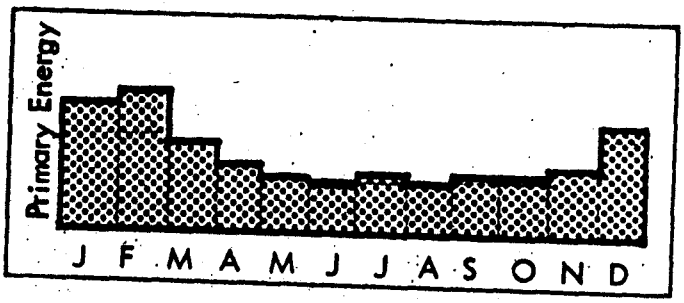
Residential and commercial energy use in Texas has been analysed by Reed. Reed's findings illustrate the basic energy use pattern of both residential and commercial development.

Residential Natural Gas



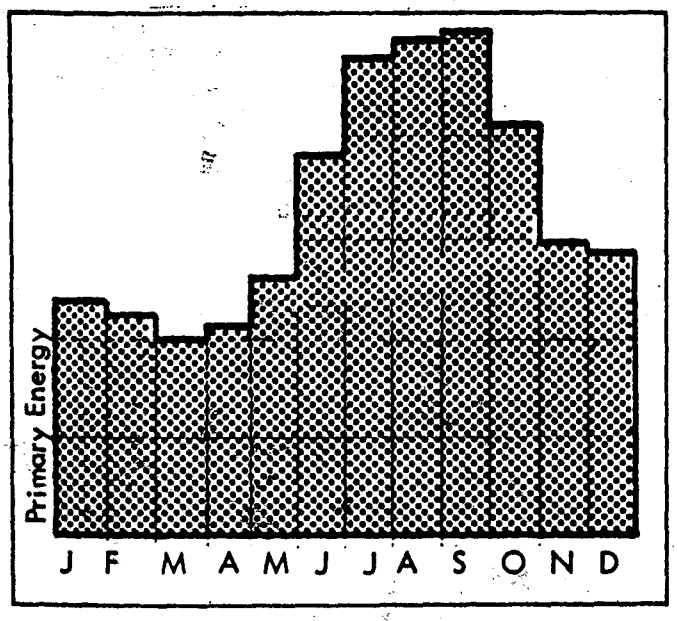
Comfort Heating	55.9%
Hot Water Heating	27.2%
Cooking	9.0%
Comfort Cooling	2.9%
Other	5.0%
	100.0%

Commercial Natural Gas



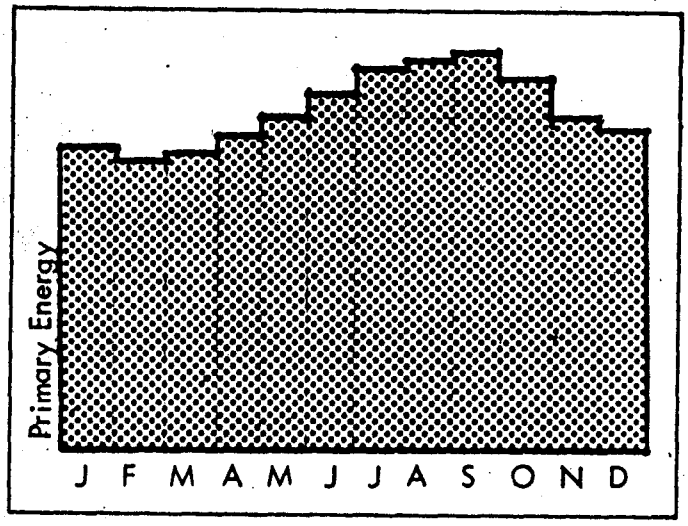
Comfort Heating	28.6%
Hot Water Heating	33.2%
Cooking	16.9%
Comfort Cooling	10.6%
Other	10.7%
	100.0%

Residential Electric



Lighting	20.1%
Comfort Cooling	32.9%
Comfort Heating	10.5%
Cooking	5.4%
Water Heating	5.4%
Other	25.7%
	100.0%

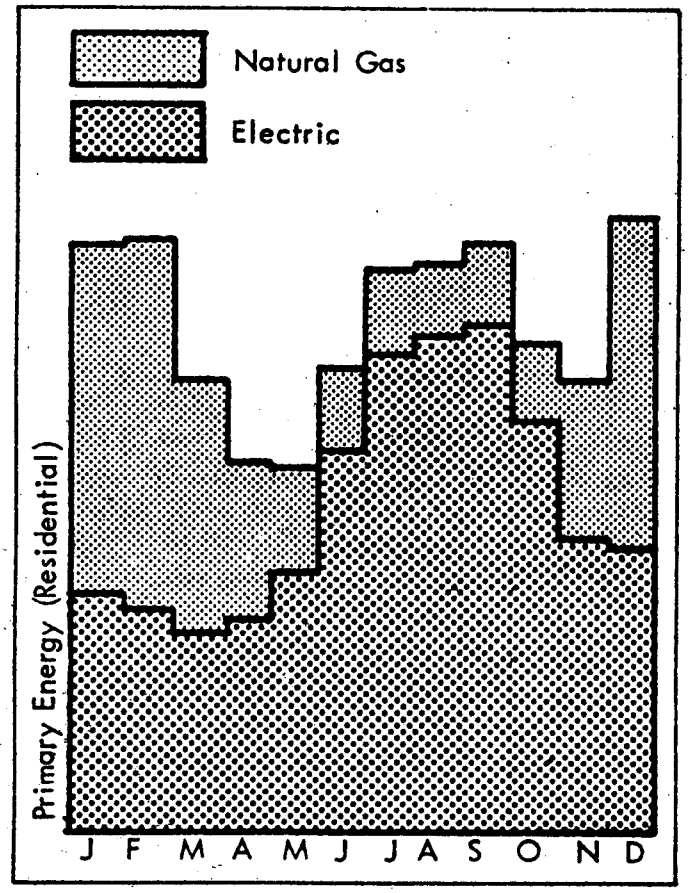
Commercial Electric



Lighting	45.4%
Comfort Cooling	35.0%
Comfort Heating	5.5%
Cooking	2.9%
Water Heating	1.5%
Other	9.7%
	100.0%

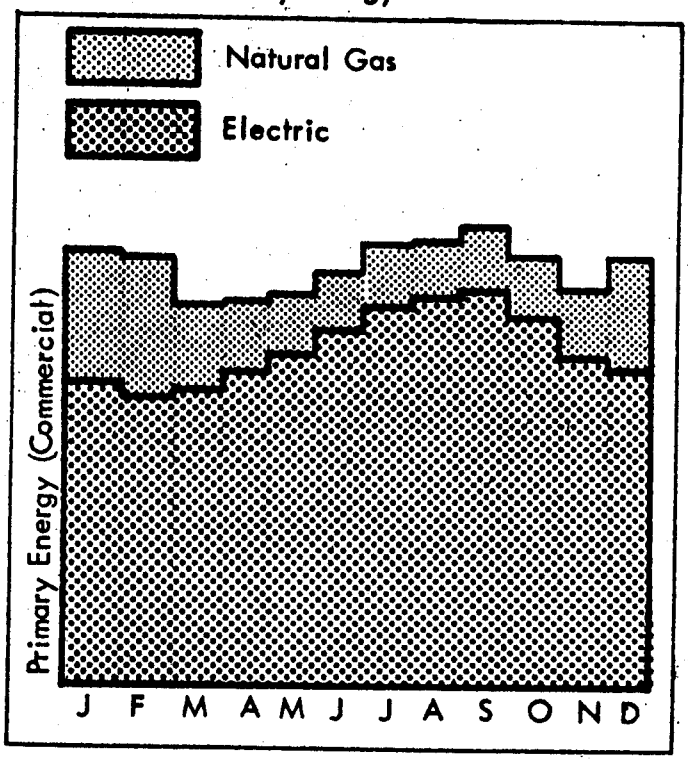
COMPOSITE ENERGY USE

Residential Primary Energy



Heating	25.3%
Cooling	23.3%
Hot Water Heating	12.4%
Lighting	13.7%
Cooking	6.6%
Other	18.7%
	100.0%

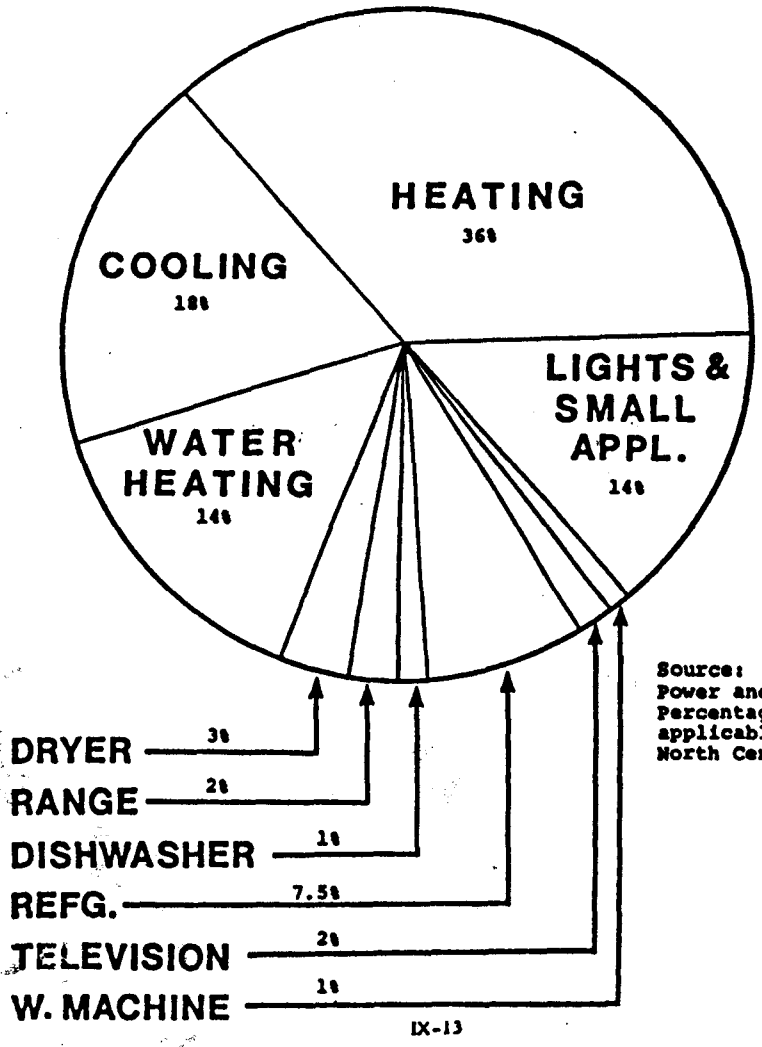
Commercial Primary Energy



Lighting	34.0%
Cooling	28.9%
Heating	11.3%
Hot Water Heating	9.4%
Cooking	6.4%
Other	10.0%
	100.0%

The data clearly shows the bulk of residential energy usage, about two-thirds, is devoted to space heating and cooling and water heating. This finding is confirmed by a study by Texas Power and Light Company for all electric homes in North Central Texas.

AVERAGE ANNUAL KWH BY APPLIANCE



Source: Texas Power and Light Co. Percentages are applicable to North Central Texas

These findings imply that significant residential energy savings can occur if solar water heating and low cost passive solar design strategies (both site planning and architectural) are utilized. By analyzing the bioclimatic attributes of the site and applying these to reduce the summer and winter energy consumption peaks, substantial energy cost savings can be provided for the residential consumer. The methodology for achieving these savings will be outlined below.

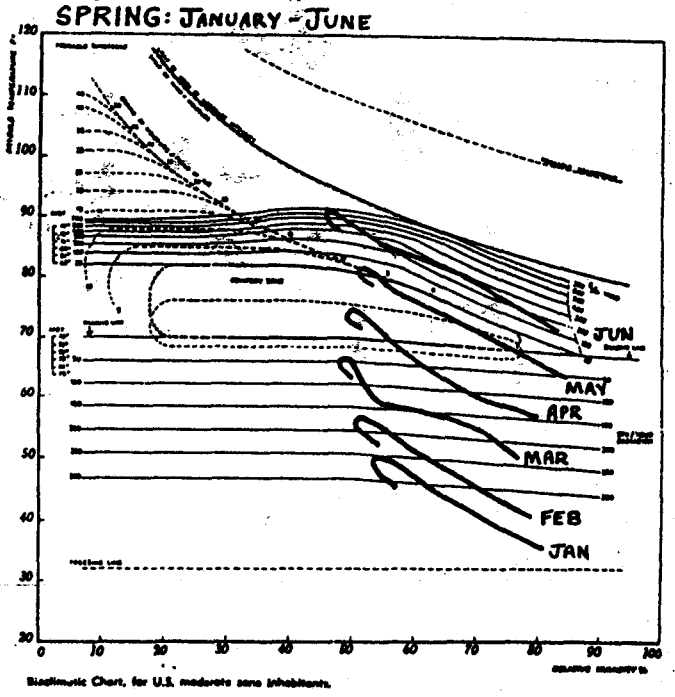
Read's data also imply a potential for energy use reduction in the commercial sector; however, this situation is more complicated than its residential counterpart. Commercial energy consumption is dominated by demands for lighting and cooling, a full two-thirds of the energy total. Hot water and space heating account for an additional twenty percent (20%) of energy usage. Solar water heating and passive solar space heating will provide viable benefits in the commercial sector, but it is obvious the real savings will result from reducing cooling and lighting loads.

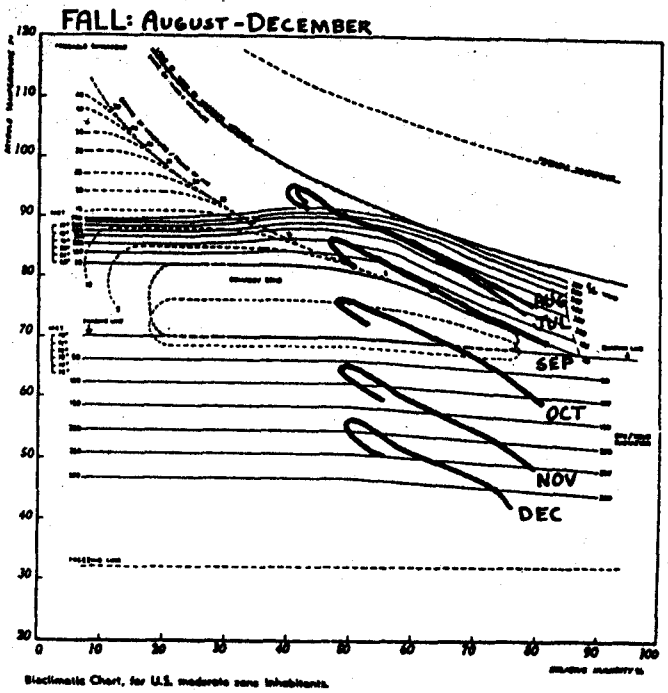
The relatively low commercial heating load is a result of excess heat production by the concentration of people in this use and by lighting. The most efficient lamp converts only 25% of incoming energy into light; the remaining three-quarters is given off as excess heat. Thus, while heating loads are reduced, cooling loads increase. (This accounts for the less pronounced seasonal peaks in commercial energy use.) By emphasizing

daylighting (especially from April through September) and task oriented/low voltage lighting standards in commercial buildings, substantial energy savings can be achieved here as well. Thus, energy efficient commercial development mandates careful architectural planning.

BIOCLIMATIC SITE ANALYSIS

The climatic analysis performed by CMPBS for GRIFFIN-WEST is based on Olgyay's bioclimatic chart and Sol-Air approach. Temperature and relative humidity data were averaged on a monthly basis (over a 16-year period) for five times a day; 6:00 AM, 9:00 AM, Noon, 3:00 PM, and 6:00 PM. These monthly averages were then plotted on the bioclimatic chart. (See Figure)





From this information, passive solar design strategies can be formulated for each condition indicated by the chart. Before continuing, a brief explanation of the chart should be given.

The bioclimatic chart is a graph which relates temperature (vertical axis) to relative humidity (horizontal axis). Within a given range of temperatures and relative humidities a person located in the shade will be comfortable; that is, not too hot or too cold. This range of temperature and humidity is the comfort zone (see chart above). You will notice below the comfort zone depicted as a series of parallel lines. These lines represent the amount of solar radiation required to push one back into the comfort zone if the temperature is below 70' F. Above the comfort zone you will notice two more sets of lines; one set dashed, the other set solid. It is the set of solid lines that concern us, as the dashed set refers to a need for humidification -- a need rarely encountered in Princeton. The solid lines above the comfort zone indicate levels of air movement required to drop one back into the comfort zone.

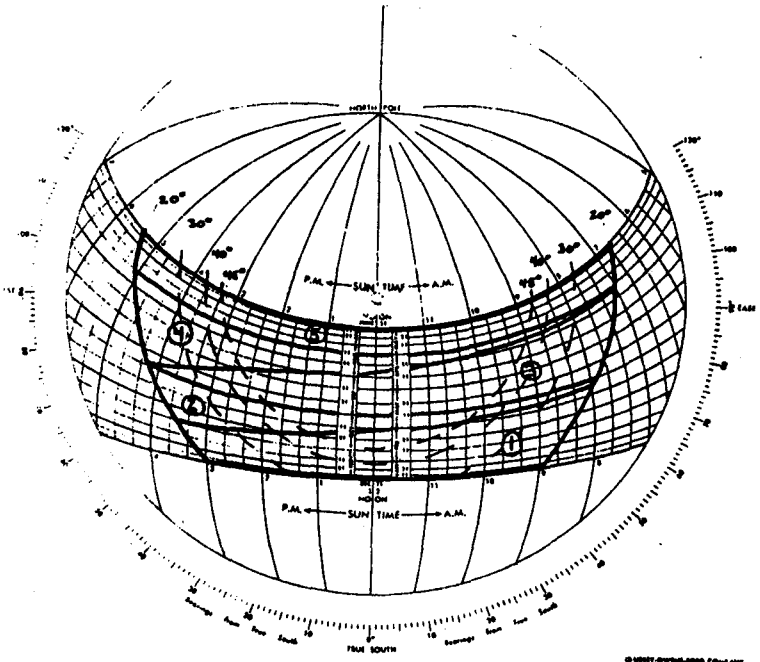
With this understanding of the bioclimatic chart, we can now begin to see the actions required to reduce winter heating and summer cooling loads. During the months of November, December, January, February, and March, full access to sunlight must be provided. In April and October, only the morning hours are below the comfort zone, thereby indicating a need

for morning sunlight and afternoon shading. The month of May appears to lie squarely in the comfort zone as long as shade is provided. During the months of June, July, August, and September, it is apparent that as long as a sufficient quantity of air movement is provided, one will remain in the comfort zone. It should be noted, however, that due to the nature of averaging, certain days in any given month will not correspond with these charts. Therefore, it is imperative that flexibility be incorporated into the passive solar design strategies to allow for use adjustment in response to anomalous conditions.

With the information gleaned from the bioclimatic chart, we now need to examine the actual building site to determine which areas offer the most and least potential for achieving the actions called for by the chart. Since solar radiation and air movement are the remedial actions dictated, sun angles and prevailing breezes were evaluated in relation to on-site features, notably vegetation.

Using a sun angle calculator with attached sun chart and the solar radiation data from the bioclimatic chart, a set of sun angles which refer to periods of full solar exposure to full shading were generated. (See Fig.)

32° SUN CHART
(32° N. Lat.)



AREA 1 - FULL ACCESS
AREA 2 - SPRING ACCESS
AREA 3 - SPRING ACCESS/FALL SHADE
AREA 4 - FALL SHADE
AREA 5 - FULL SHADE

The sun chart allows one to read off solar altitude and azimuth angles for any given time on any given day. Azimuth angles are read by extending a radius to the outer scale which intersects the desired time and day. Altitude angles are read off this same intersection point by the concentric arcs. The sun chart herein shows an area divided into five sub-areas. This area is bounded top and bottom by the summer and winter solstice lines and left and right by a 20° altitude angle. The five sub-areas represent five different solar conditions based on requirements from the bioclimatic chart.

Area 1 describes the period of full solar access (winter). Area 2 describes the period of spring solar access; Area 3, the period of both spring solar access and fall shading; Area 4, the period of fall shading. Area 5 describes the period of full shading (summer).

For our current purposes, that of locating prime climatic conditions on-site, only the lower corners of Area 1 are of concern. These corners give us the altitude and azimuth angles of sun at 9:00 AM and 3:00 PM on December 21. These angles, 20° and 43.3° respectively, allow the longest (thus most restrictive) shadows of the year to be mapped. This map combined with wind maps will define areas of prime climatic condition. It should be noted here that the other areas indicated on the sun chart should be used to determine building fenestration (window) strategies and vegetative types and locations for landscaping.

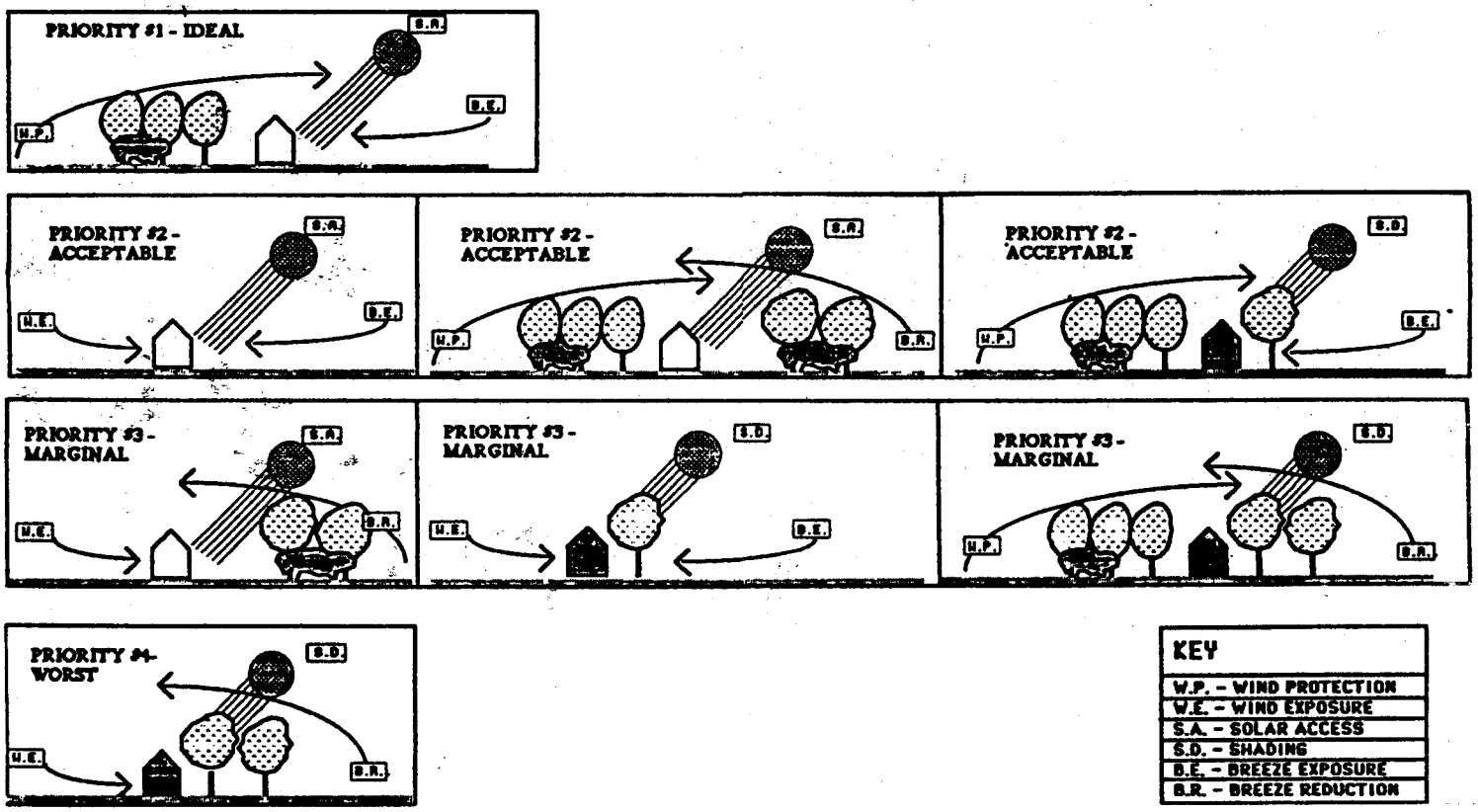
According to the requirements of the bioclimatic chart, summer breeze exposure should be maximized. Wind roses (graphic summaries of percentage wind direction and speed for a given season) were obtained for the Dallas area and analyzed to determine the predominate summer breeze direction of south by south-southeast (S-SSE). Using this prevailing wind direction and the knowledge of the effects of vegetation on wind speeds, a wind use map was generated. This map illustrates areas where substantial breeze reduction can occur.

Although not indicated by the bioclimatic chart, it is common knowledge that it is best to be sheltered from cold winter winds. Indeed, it has been shown that 20 mile per hour winds can double the heating load of a building (LDZ pg. 127). For this reason wind rose data was also analyzed

to determine the prevailing winter wind direction of north by northwest (N-NW). Thus, a wind protection map was also generated showing areas of substantial wind protection.

The three climatic variables of solar access, wind protection, and breeze exposure, produce eight distinct climatic conditions depending on whether each variable is positive or negative. The eight climatic conditions can be arranged in a descending order of ideal to worst conditions (see Climatic Conditions).

CLIMATIC CONDITIONS



KEY
W.P. - WIND PROTECTION
W.E. - WIND EXPOSURE
S.A. - SOLAR ACCESS
S.D. - SHADING
B.E. - BREEZE EXPOSURE
B.R. - BREEZE REDUCTION

By overlaying and combining the winter shadow, wind use, and wind protection maps, a composite climatic map was generated (see map). This map shows the existing pattern of climatic conditions and begins to indicate the spatial arrangements which will maximize the occurrence of the ideal climatic condition. It should be noted that for every area of ideal microclimate, there is generally a corresponding area of worst microclimate (i.e. shaded, no breeze, and winter winds). Areas of poor microclimate should be allocated to non-living space uses such as roadways, parking and setback areas, utility easements, and limited pathways and open spaces.

Every effort should be made to site residential uses in areas of prime microclimate. Detached single family units are in most need of ideal climatic conditions due to the high surface-to-volume ratio of such units. The table below indicates the energy intensity factors for various residential densities. (This data was interpolated from northeastern U.S. data and is only shown for illustrative purposes).

ENERGY INTENSITY FACTORS FOR DWELLING UNITS

(10 BTU/UNIT/YEAR)

ENERGY FACTOR	SINGLE FAMILY DETACHED	ATTACHED	LOWRISE	HIGHRISE
HEATING	49	35	30	21
COOKING, LIGHT, REFRIGERATION	11	11	11	11
AIR CONDITIONING	25	17	15	12
MISCELLANEOUS	7	6	5	5
TOTAL	**92**	**69**	**61**	**49**

Even though this data is roughly interpolated, it clearly shows the effect of massing on overall energy consumption. Given these reductions for heating and cooling loads in multi-family development, it would be possible to save ideal microclimates for single family development, while placing multi-family in areas of acceptable microclimate. Careful site design and landscaping to channel or restrict wind as needed could effectively upgrade the climatic condition of a given area.

NET EFFECTS OF PASSIVE CLIMATE STRATEGY

Having developed the basic framework and concepts for a passive climate development strategy, an effort was made to relate the energy saving effects of this strategy to the residential energy use patterns discussed at the beginning of this report. The pie chart of average annual energy consumption for North Central Texas was modified to include the contributions of the passive design strategies (as developed by Donald Watson in Climatic Design). Certain base assumptions were made to facilitate the analysis, as follow:

1) Buildings are sited to maximize summer shading and ventilation, minimize winter wind exposure while allowing full winter solar access.

2) Building structures are properly insulated, maximize winter solar gain potential, and facilitate summer breeze usage.

3) Percentage of yearly heating and cooling hours can be directly related to percentage of Kilowatt hours (Kwh) of annual energy use for heating and cooling.

The results of the analysis show that passive cooling could account for 60% of annual cooling costs while passive heating could account for 70% of annual heating costs. According to the manufacturer's information on the heat pump system under study, the remaining 40% of cooling and 30% of heating could easily be absorbed by that system. In addition, the heat pump could also reduce water heating requirements.

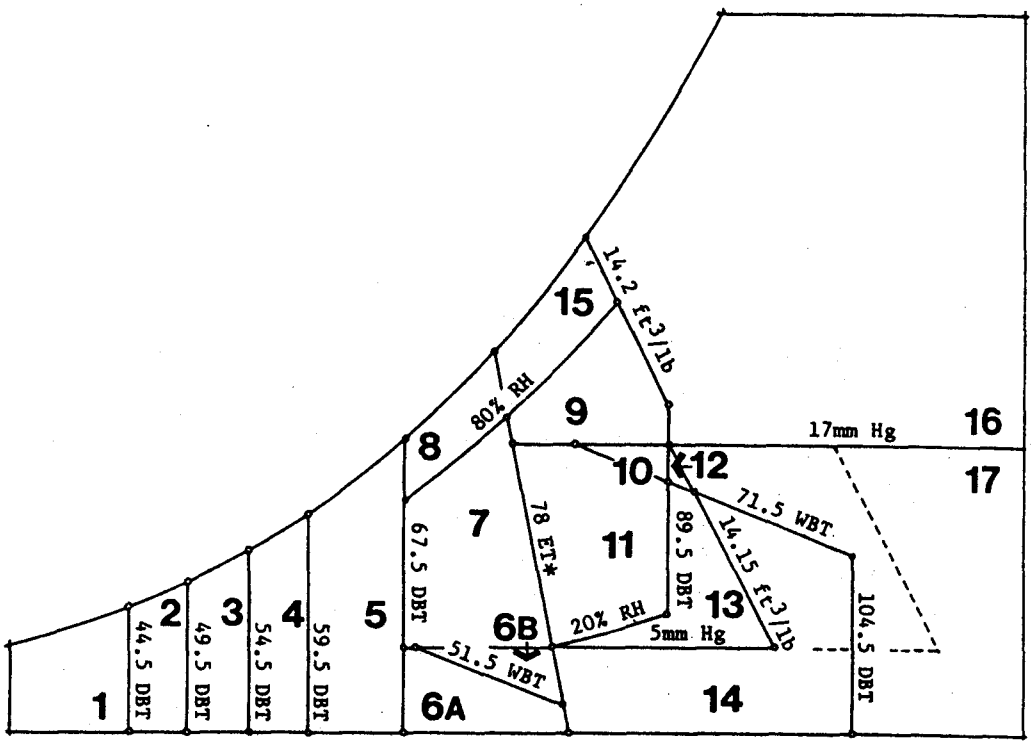


Figure 1. Building Bioclimatic Chart (after Givoni), showing psychrometric limits used for analysis reported in *Tables 11-39*.

Table 1	Control Strategies
Identification of climate control strategies on the Building Bioclimatic Chart (adapted after Givoni).	
BIOCLIMATIC NEEDS ANALYSIS	
Total heating (< 68F)	1-5
Total cooling (> 78ET*)	9-17
Total comfort (68F – 78ET*, 5mm Hg – 80% RH)	7
Dehumidification (> 17mm Hg or 80% RH)	8-9, 15-16
Humidification (< 5mm Hg)	6A, 6B (14)
STRATEGIES OF CLIMATE CONTROL	
Restrict conduction	1-5; 9-11, 15-17
Restrict infiltration	1-5; 16-17
Promote solar gain	1-5
Restrict solar gain	6-17
Promote ventilation	9-11
Promote Evaporative cooling	11, 13-14 (6B)
Promote radiant cooling	10-13
Mechanical cooling	17
Mechanical cooling & dehumidification	15-16

Dallas, TX

DALLAS, TX — TEMPERATURE (F) ON 21ST DAY OF:

	J	F	M	A	M	J	J	A	S	O	N	D
DAILY MAX DBT	53.3	55.9	67.1	77.1	86.4	93.4	95.7	92.7	88.4	77.1	62.3	54.5
DAILY AVE DBT	42.8	47.1	55.5	68.0	76.9	83.5	86.5	82.5	78.1	66.8	52.5	44.9
DAILY MIN DBT	33.5	38.5	44.6	59.8	67.4	73.0	78.0	72.7	68.7	56.1	43.0	35.8
DAILY MAX DPT	40.8	39.4	48.6	61.8	65.9	70.6	72.1	69.8	68.6	57.4	45.2	40.5
DAILY AVE DPT	33.5	32.7	39.6	57.5	61.5	67.4	68.5	65.9	63.2	51.8	38.9	34.6
DAILY MIN DPT	27.2	26.4	32.1	52.2	57.3	63.4	64.4	61.4	57.8	45.2	31.6	28.5
DAILY MAX WBT	46.6	46.9	55.1	66.2	70.5	75.1	76.6	74.4	73.3	63.7	52.2	47.1
DAILY AVE WBT	39.1	41.0	47.8	61.7	67.1	72.6	74.0	71.3	68.5	58.4	46.3	40.6
DAILY MIN WBT	32.3	34.8	39.8	56.4	62.5	69.2	71.5	68.3	63.4	51.8	39.6	33.4

NORMAL DAILY SOLAR RADIATION (MONTHLY AVG) BTU/SQ FT(DAY)

	J	F	M	A	M	J	J	A	S	O	N	D
HORIZONTAL	821.	1071.	1422.	1627.	1888.	2135.	2122.	1950.	1587.	1276.	936.	780.
SO VERTICAL	1164.	1218.	1195.	942.	843.	870.	893.	992.	1146.	1308.	1250.	1168.

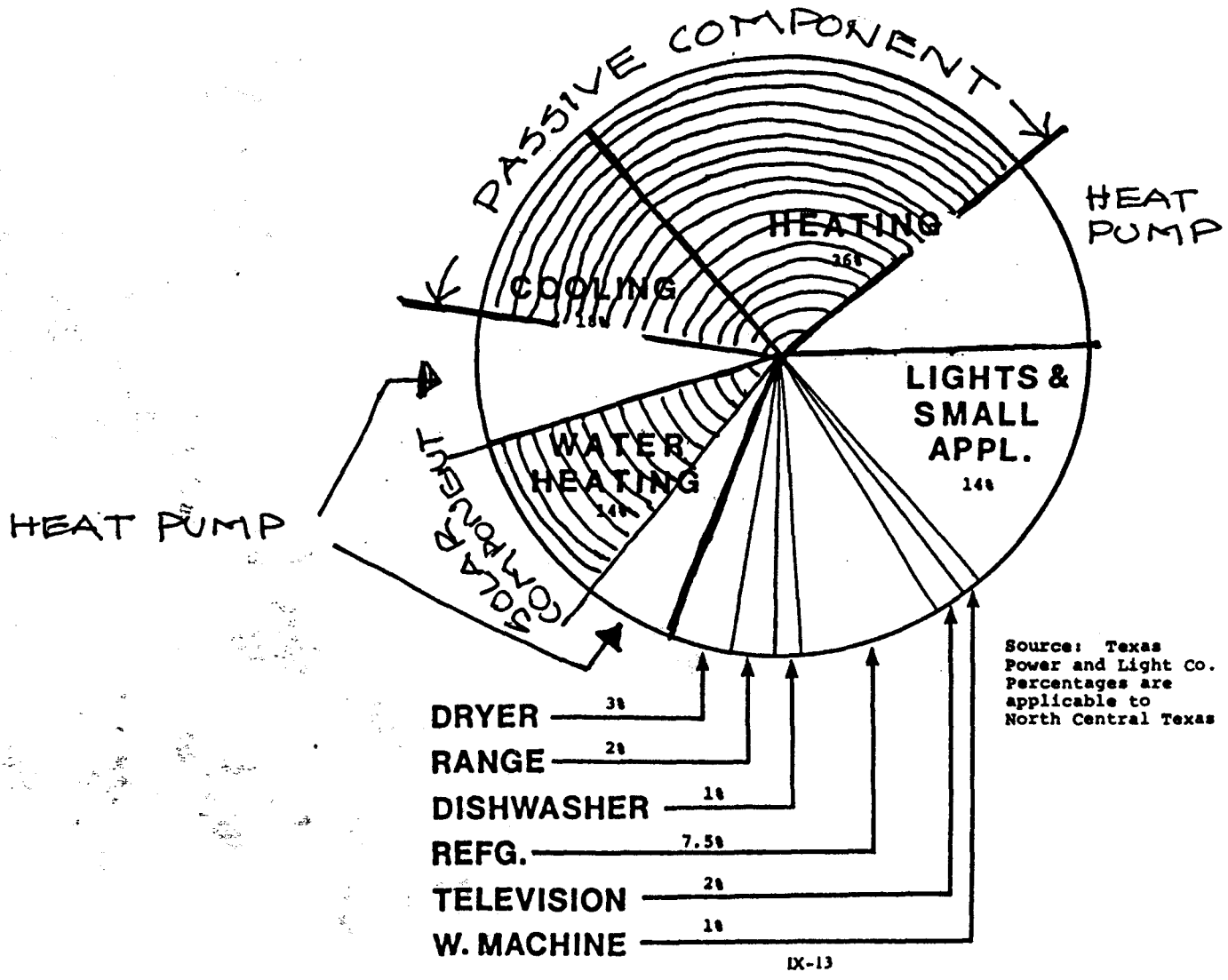
HEATING DEGREE DAYS BASE 65F	2567.0
COOLING DEGREE DAYS BASE 65F	2967.1
COOLING DEGREE DAYS BASE 78F ET*	1051.1

WINTER DESIGN DBT	99.0%	18.0
	97.5%	22.0
SUMMER DESIGN DBT / COINCIDENT WBT	1%	102.0 / 75.0
	2.5%	100.0 / 75.0
	5%	97.0 / 75.0
SUMMER DESIGN WBT	1%	78.0
	2.5%	78.0
	5%	77.0

% TOTAL HEATING HOURS (LESS THAN 68F) I-V		48.8
HEATING I	14.3	
HEATING II	7.0	
HEATING III	6.5	
HEATING IV	8.0	
HEATING V	13.0	
% HUMIDIFICATION HOURS VI.A + VI.B		0.7
% TOTAL COMFORT HOURS (SHADING REQUIRED) VII		12.7
% DEHUMIDIFICATION HOURS VIII		5.9
% TOTAL COOLING HOURS (GREATER THAN 78F ET*) IX - XVII		31.9
% PASSIVE COOLING HOURS IX - XIV		26.7
COOLING IX	11.1	
COOLING X	2.6	
COOLING XI	7.8	
COOLING XII	4.2	
COOLING XIII	1.0	
COOLING XIV	0.1	
% VENTILATION EFFECTIVENESS HOURS IX + X + XI		21.5
% MASS EFFECTIVENESS HOURS X + XI + XII + XIII		15.6
% EVAPORATIVE COOLING EFFECTIVENESS HOURS XI + XIII + XIV + VI.B		9.2
% HOURS BEYOND PASSIVE EFFECTIVENESS VIII + XV + XVI + XVII		11.1
DEHUMIDIFICATION VIII	5.9	
DEHUMIDIFICATION AND COOLING XV	2.2	
DEHUMIDIFICATION AND COOLING XVI	2.9	
COOLING XVII	0.1	

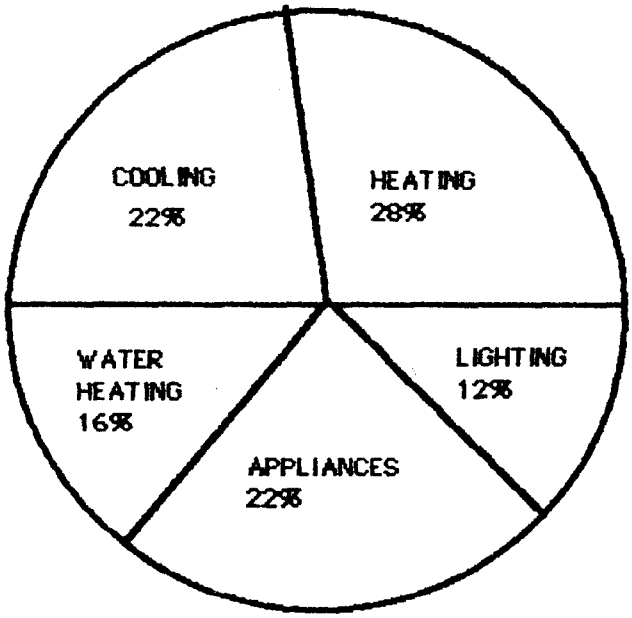
Climatic Need	Restrict Conduction	Restrict Infiltration	Promote Solar Gain	Restrict Solar Gain	Promote Ventilation	Promote Evaporative Cooling	Promote Radiant Cooling	Mechanical Cooling	Mechanical Cooling and Dehumidification	Percentage of Yearly Hours
Total Heating I-V	X	X	X							48.8
Heating I	X	X	X							14.3
Heating II	X	X	X							7.0
Heating III	X	X	X							6.5
Heating IV	X	X	X							8.0
Heating V	X	X	X							13.0
Humidification VI A,B				X		X(5)				0.7
Comfort VII				X						12.7
Dehumidification VIII				X						5.9
Total Cooling IX-XVII				X						31.9
Passive Cooling IX-XIV				X						26.7
Cooling IX	X			X	X					11.1
Cooling X	X			X	X		X			2.6
Cooling XI	X			X	X	X	X			7.8
Cooling XII				X			X			4.2
Cooling XII				X		X	X			1.0
Cooling XIV				X		X				0.1
Ventilation IX-XI				X						21.5
Mass X-XIII				X						15.6
Evaporative Cooling XI, XIII, XIV				X						9.2
Beyond Passive VIII, XV-XVII				X						11.1
Dehumidification VII				X						5.9
Dehumid + Cooling XV	X			X					X	2.2
Dehumid + Cooling XVI	X	X		X					X	2.9
Cooling XVII	X	X		X				X		0.1

AVERAGE ANNUAL KWH BY APPLIANCE

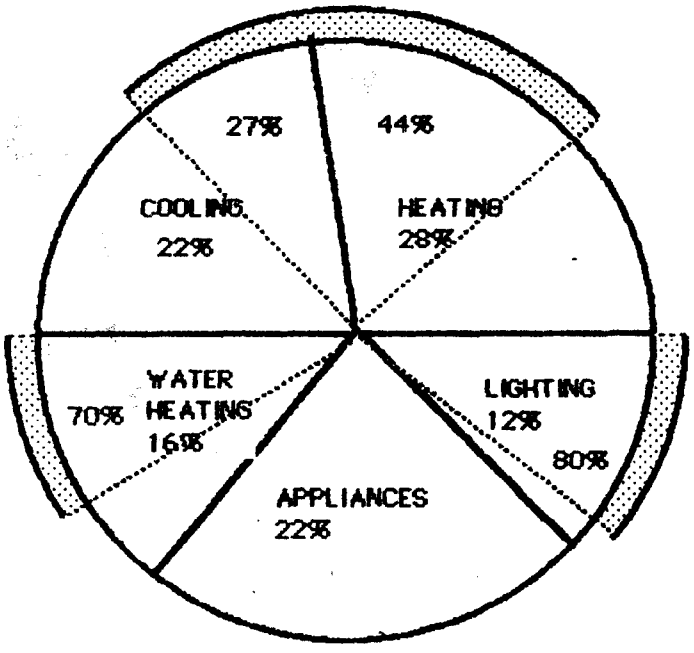


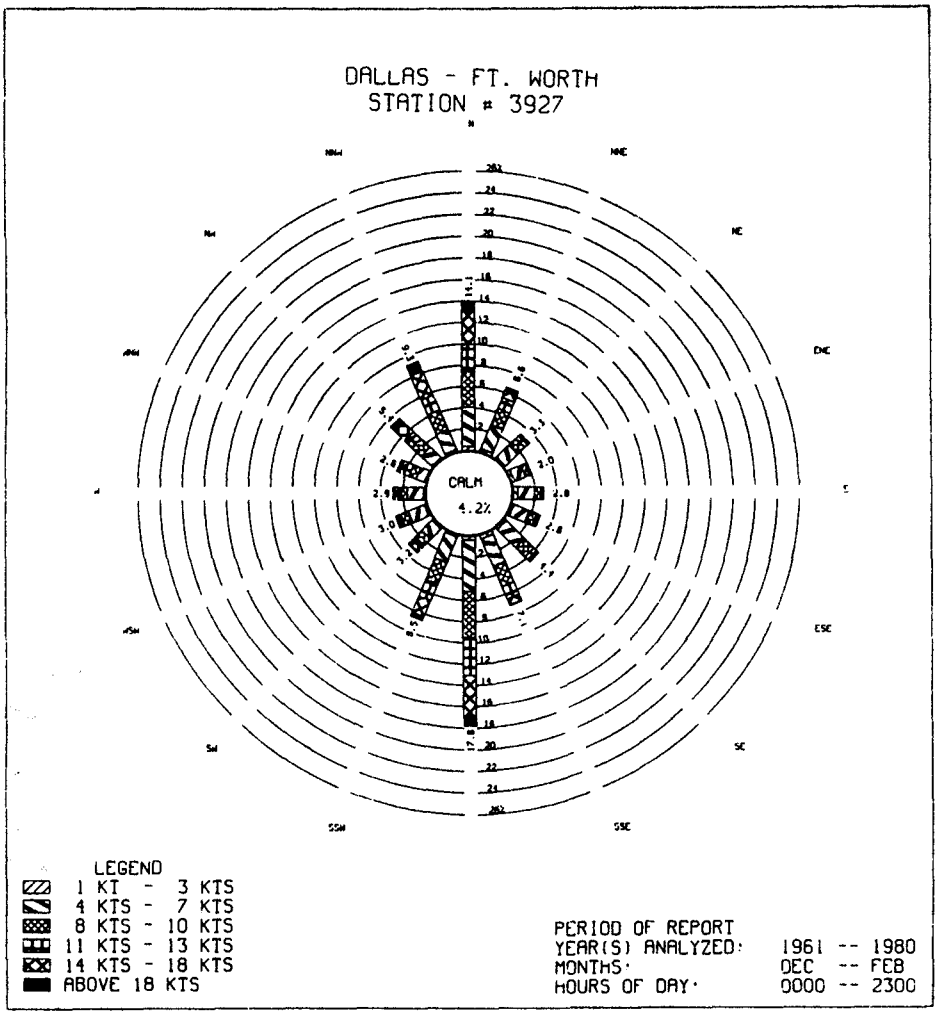
Source: Texas Power and Light Co. Percentages are applicable to North Central Texas

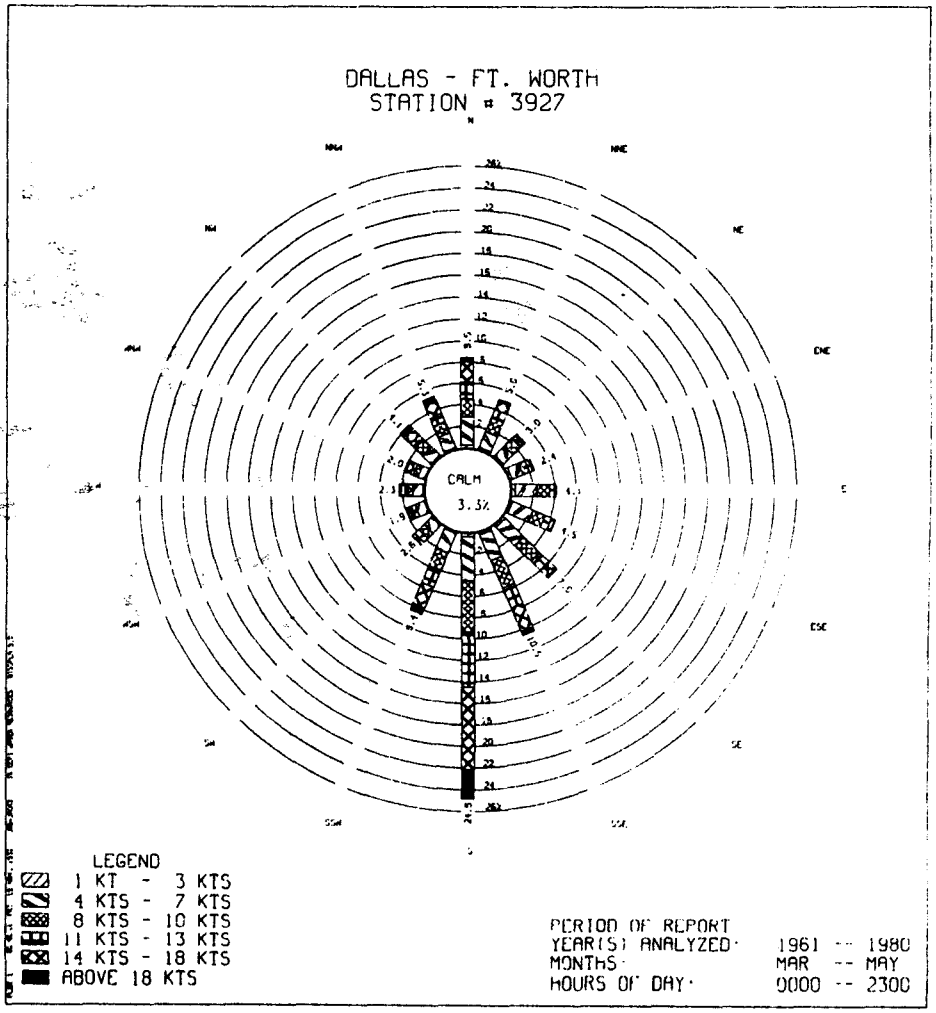
EXISTING AVERAGE ANNUAL HOUSEHOLD ENERGY DISTRIBUTION

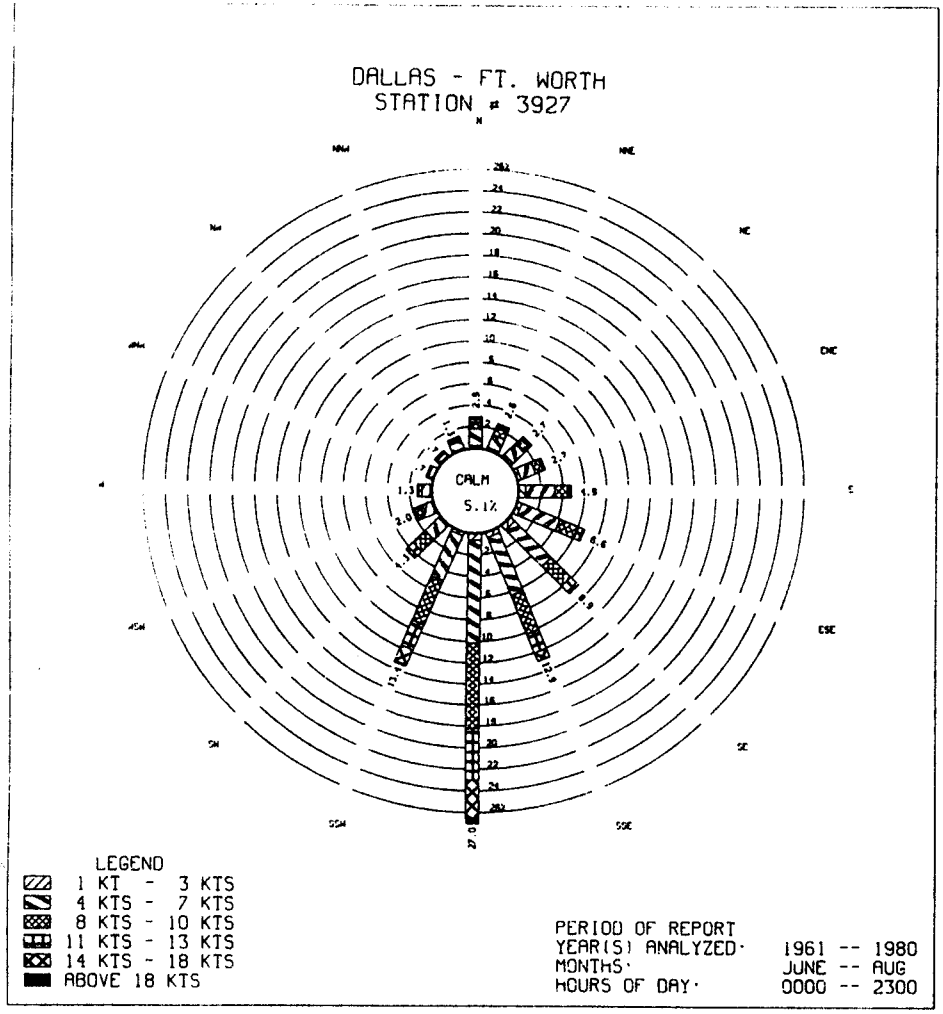


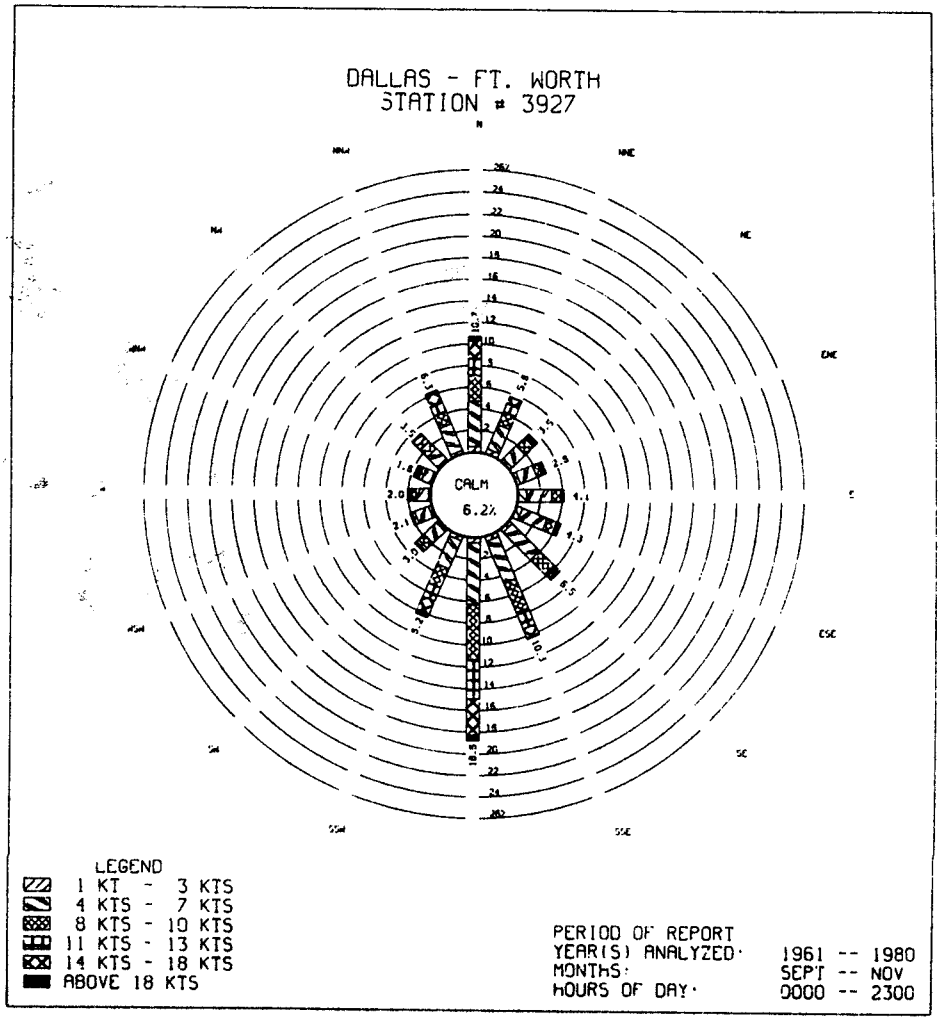
PROPOSED AVERAGE ANNUAL HOUSEHOLD ENERGY DISTRIBUTION RESIDENT COMMONS




DALLAS - FT. WORTH
STATION # 3927
CALM
4.2%
LEGEND
1 KT - 3 KTS
4 KTS - 7 KTS
8 KTS - 10 KTS
11 KTS - 13 KTS
14 KTS - 18 KTS
ABOVE 18 KTS
PERIOD OF REPORT
YEAR(S) ANALYZED: 1961 -- 1980
MONTHS: DEC -- FEB
HOURS OF DAY: 0000 -- 2300


DALLAS - FT. WORTH
STATION # 3927
CALM
3.3%
LEGEND
1 KT - 3 KTS
4 KTS - 7 KTS
8 KTS - 10 KTS
11 KTS - 13 KTS
14 KTS - 18 KTS
ABOVE 18 KTS
PERIOD OF REPORT
YEAR(S) ANALYZED: 1961 -- 1980
MONTHS: MAR -- MAY
HOURS OF DAY: 0000 -- 2300


DALLAS - FT. WORTH
STATION # 3927
CALM
5.1%
LEGEND
1 KT - 3 KTS
4 KTS - 7 KTS
8 KTS - 10 KTS
11 KTS - 13 KTS
14 KTS - 18 KTS
ABOVE 18 KTS
PERIOD OF REPORT
YEAR(S) ANALYZED: 1961 -- 1980
MONTHS: JUNE -- AUG
HOURS OF DAY: 0000 -- 2300

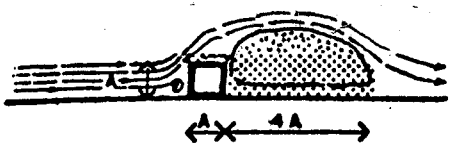

DALLAS - FT. WORTH
STATION # 3927
CALM
6.2%
LEGEND
1 KT - 3 KTS
4 KTS - 7 KTS
8 KTS - 10 KTS
11 KTS - 13 KTS
14 KTS - 18 KTS
ABOVE 18 KTS
PERIOD OF REPORT
YEAR(S) ANALYZED: 1961 -- 1980
MONTHS: SEPT -- NOV
HOURS OF DAY: 0000 -- 2300

AIR FLOW AND BUILT FORM

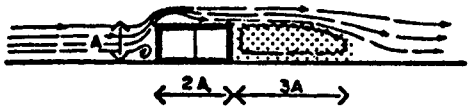
This section combines most of the information available on air flow and buildings. The sections are divided up into there generic characteristics.
A refers to a basic height unit and all distances and heights are measured in terms of A.

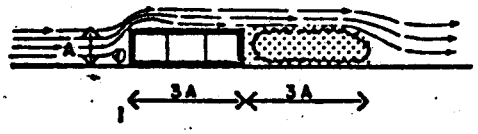
CHARACTERISTICS

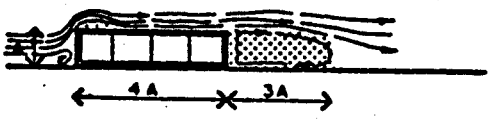
1 Length
2 Height
3 Plan
4 Roof shape
5 Plan
6 Ventilation

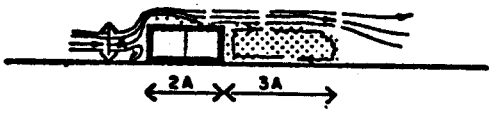


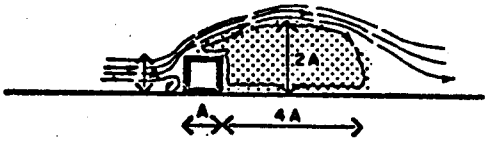
1

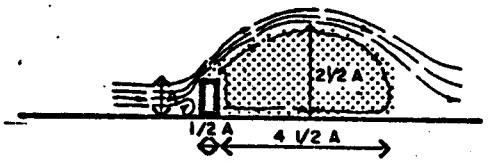




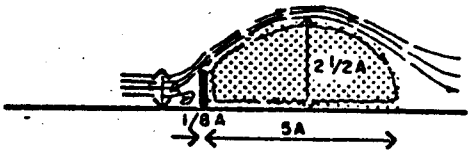


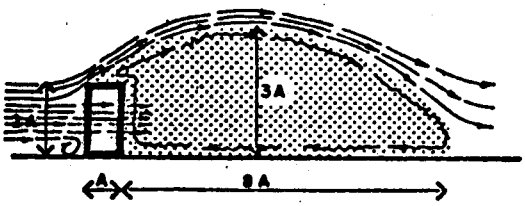


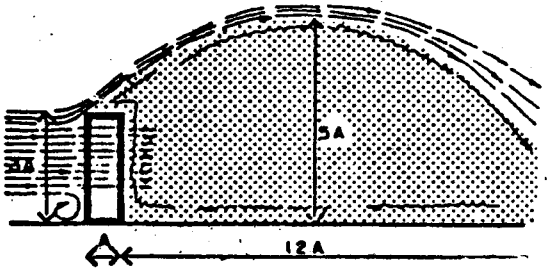




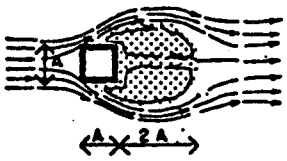
2

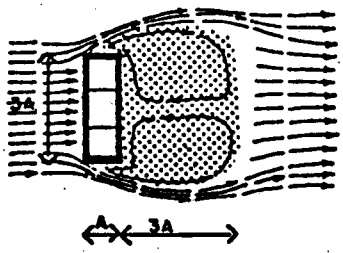


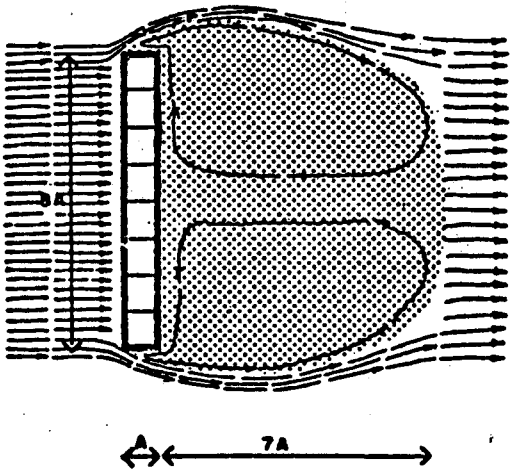


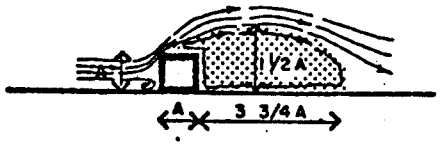


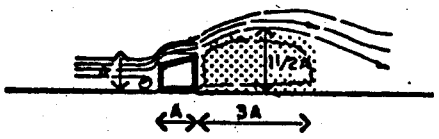
3

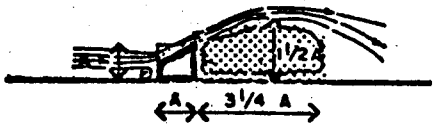

A
2A

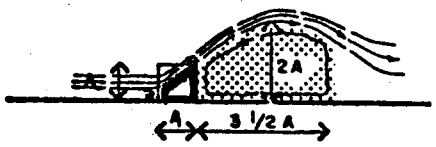

3A
A
3A


7A
A
7A


1 1/2 A
A
3 3/4 A

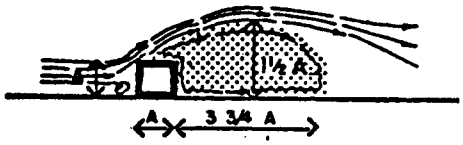

1 1/2 A
A
3A

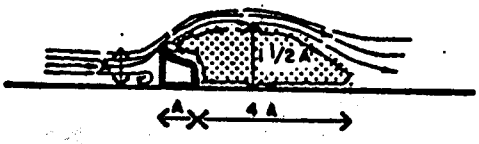

1 1/2 A
A
3 1/4 A

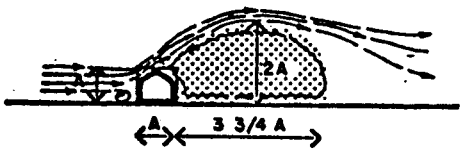

2A
A
3 1/2 A

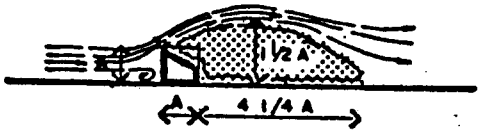
4

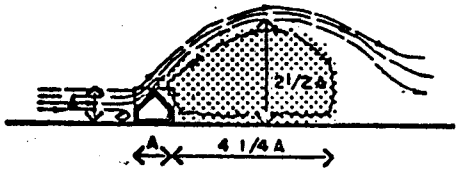

1 1/2 A
A
3 3/4 A

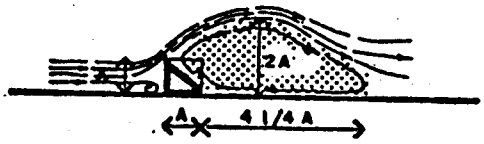

1 1/4 A
A
3 3/4 A

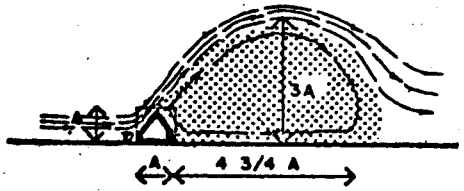

1 1/2 A
A
4 A

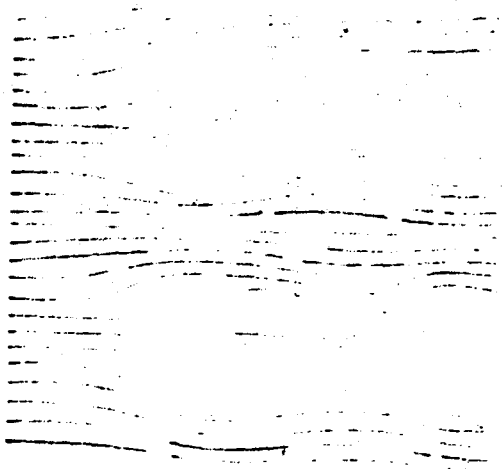

2A
A
3 3/4 A


1 1/2 A
A
4 1/4 A

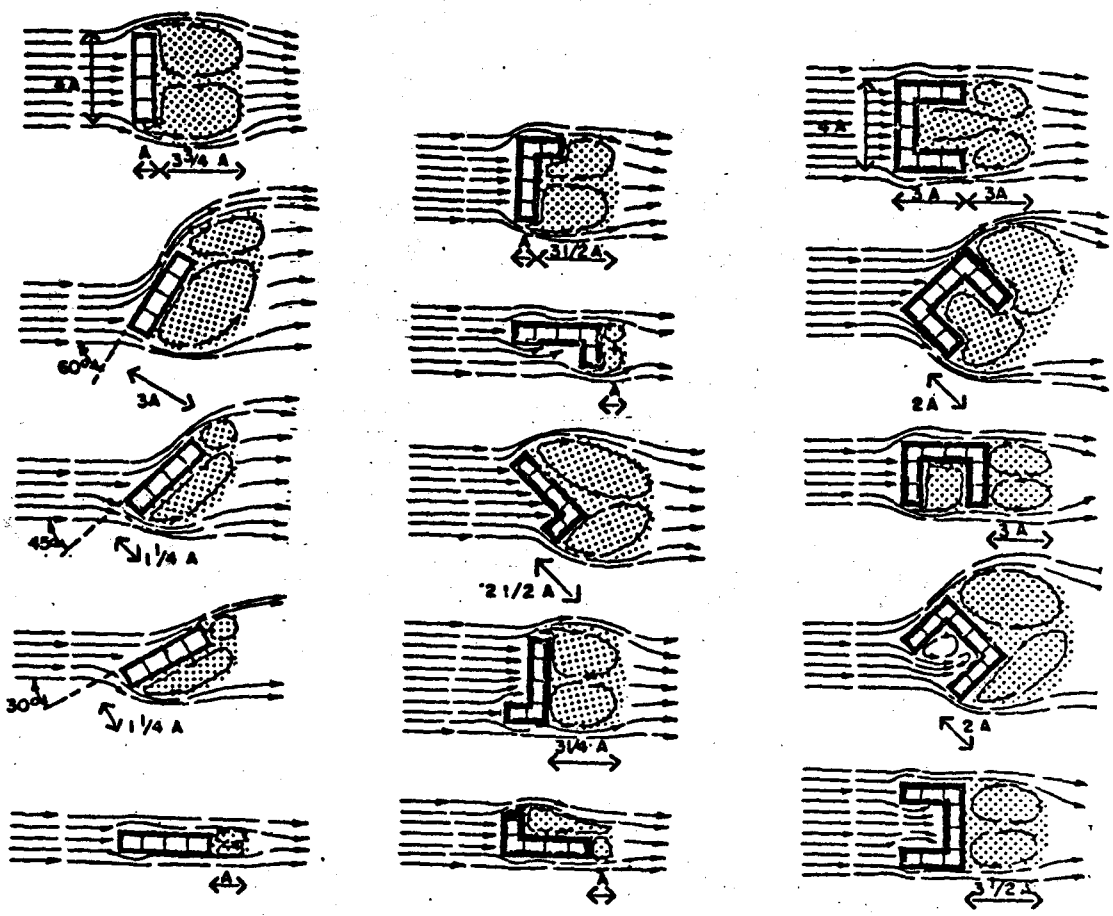

2 1/2 A
A
4 1/4 A


2A
A
4 1/4 A


3A
A
4 3/4 A

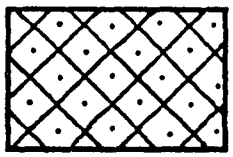


5



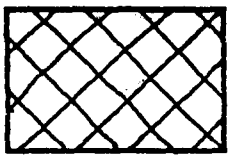
GRIFFIN-WEST RESIDENTIAL

PREPARED BY :
THE CENTER FOR MAXIMUM POTENTIAL BUILDING SYSTEMS
8604 F.M. 969
AUSTIN TEXAS



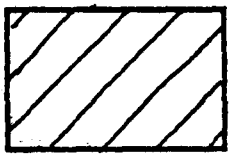
IDEAL

SOLAR ACCESS, SUMMER BREEZE EXPOSURE,
WINTER WIND PROTECTION



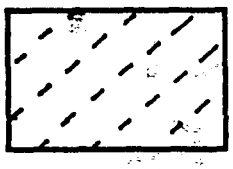
ACCEPTABLE

1) SOLAR ACCESS, SUMMER BREEZE EXPOSURE, WINTER W. PROT.
2) SOLAR ACCESS, SUMMER BREEZE REDUCTION, WINTER W. PROT.
3) NO SOL ACCESS, SUMMER BREEZE EXPOSURE, WINTER WIND PRO.



MARGINAL

1)SOLAR ACCESS, SUMMER BREEZE REDUCTION, WINTER WIND EXP.
2) NO SOLAR ACCESS, SUMMER BREEZE, WINTER WIND EXPOSURE
3)NO SOLAR ACCESS, SUMMER BREEZE RED.,WINTER WIND PROT.



POOR

.SHADED DURING WINTER, POOR BREEZE IN SUMMER, WIND EXPOSURE IN WINTER

CLIMATIC SYNTHESIS

SCALE
1"= 200'

GRIFFIN-WEST

VEGETATION MANAGEMENT PLAN

PREPARED BY:

CENTER FOR MAXIMUM POTENTIAL BUILDING SYSTEMS, INC.
AUSTIN, TEXAS

TABLE OF CONTENTS

I.	INTRODUCTION	Page 1
II.	GOAL DEFINITION	Page 2
III.	THEME DEVELOPMENT	Page 4
	A. Single Family Theme	Page 5
	B. Multi-Family Theme	Page 7
	C. Commercial Theme	Page 9
	D. Industrial Theme	Page 11
	E. Recreation Area Theme	Page 13
	F. Park/Plaza Theme	Page 15
	G. Natural Area Theme	Page 17
IV.	A Note on Natural Area Management	Page 18

GRIFFIN-WEST
VEGETATION MANAGEMENT PLAN

The purpose of this document is to establish landscaping strategies and development policies which will achieve long term goals of climatic design, water conservation, enhancement of natural ecology, provision of visual interest and diversity, and minimalization of management and maintenance costs for the **Princeton Parks** development project.

Contained herein are: (1) a description of plan goals; (2) delineation of landscaping themes; and (3) detailed data on available native plant material.

This document should set the stage for detailed design by the landscape architect.

Goal Definition

The five vegetation management goals discussed herein are derived from the concept of developing **Princeton Parks** in an ecologically sound manner which stresses resource economy and quality of the built environment. These goals are the foundation of the vegetation management plan and are used with various vegetative, physical, and management tools to develop the theme structures associated with different land uses. The main objectives of each goal are outlined as follows:

Climatic Goals aim to maximize the occurence of ideal microclimatic conditions (winter solar access and wind protection with summer shading and breeze exposure)

Water Use Goals aim to maximize available water for landscape purposes as well as user needs inside dwelling units. This can be achieved by use of native vegetation, drip and soaker irrigation, effluent recycling, rainwater catchment systems, and runoff retention and absorption strategies.

Ecological Goals aim to enhance and respect the natural ecosystem inherent to the development site. Wildlife values (i.e. forage and cover) will be upgraded, and existing natural areas will be carefully protected. In addition, vegetation which can provide food for humans will be encouraged.

Sensory Goals aim to develop a landscape which is diverse and sensuous, providing visual focal points to aid in orientation and identification within the built environment. Careful selection and placement of colorful, fragrant and/or visually dynamic vegetation will facilitate this goal.

Maintenance Goals aim to ensure the long term economy of the landscape plan. Here, guidelines are established to prevent the wrong plant from being placed in the wrong location. (A situation which would create long term maintenance problems due to invasive roots, size problems, messy trees, etc.) Recommendations for efficient landscape management strategies will also be made herein.

These goals are inherently interrelated providing mutual conditioning to some degree. Climatic goals will aid in providing visual interest and identification as certain planting schemes will manifest a spatial coherence to the development (i.e. east/west trellage, solar setbacks, etc.). Thus, climatic and sensory goals overlap to a certain degree.

Water use and ecological goals exhibit a similar overlap. Low water use plants naturally exist in the given environment; thus, use of native vegetation in landscaping satisfies goals not only of water conservation but also of habitat renewal. Water use and ecological goals have contrasting effects on management strategies and sensory goals.

By stressing ecological and hydrological concepts in the design phase, certain management issues are addressed and resolved early in the development process. For example, management of urban runoff is greatly simplified by the extensive use of rainwater cisterns which will reduce the total volume of stormwaters, and by the use of specialized native plants with high absorption and evapo-transpiration rates in stormwater detention areas.

While ecological and water use goals tend to accent management goals, they tend to limit sensory goals. Use of high water demand, non-native decorative plant material could provide an extremely dynamic visual environment; however, such plants would defeat water use and ecological goals in most cases.

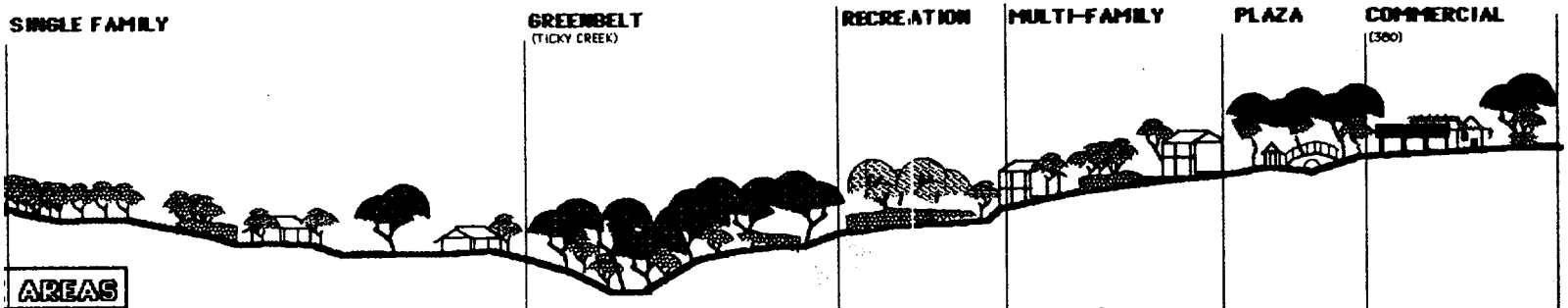
In a similar manner, the importance of realizing climatic goals, especially in the housing sector, far outweighs and therefore limits the scope of ecological goals. (Full restoration of native habitat is not suited to the intended housing densities; thus, "natural areas" must be segregated from areas of climatically designed buildings.) An emphasis on maximizing ideal microclimate and providing a visually dynamic landscape will also cause an inherent increase in maintenance. Such maintenance intensity (i.e. occasional pruning, raking, sweeping, etc.) is an acceptable cost given the long term benefits of reduced energy usage and an articulated, focus-oriented landscape scheme.

Theme Development

The relationships between the objectives stated in each goal are also effected by land use. The varying intensity and purposes of different land uses cause the relative importance of each goal to shift. Single family detached housing entails a different set of conditions than higher density apartments, which both differ from industrial or commercial activities. Land use therefore conditions the priority of landscape objectives, thereby altering the framework under which each goal must operate. By varying the utilization of specialized vegetation, physical improvements, and management strategies in order to accomodate the needs of and conditions set by each land use, **landscaping themes** were developed for each land use type.

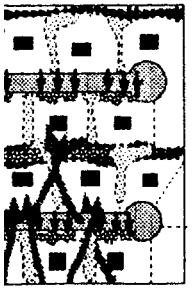
The **Theme Development Matrix** shows the basic structure of each theme (land use) related to climatic, water use, ecological, sensory, and maintenance issues. The following section details the specific methods utilized to satisfy goals for each land use category.

VEGETATIVE PLAN

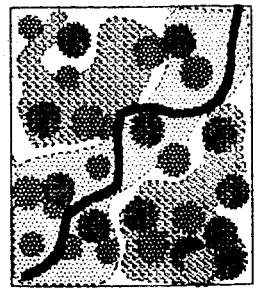


SINGLE FAMILY	GREENBELT (TICKY CREEK)	RECREATION	MULTI-FAMILY	PLAZA	COMMERCIAL (380)
AREAS					
1,2,3,4,5	2	2,3,4	3,4,5	1,2,3,4	4,5
1,3,4,5,9,10	6,8	1,2,7	1,2,3,4,5,6,9 10	1,2,3,5,6 7	1,2,3,6,8
1,2	1,2,3,4	1,2,3,4	2	1,3,4	---------
2,3,4,5	--------	1,2,3,4,5,6	1,2,3,4,5	1,2,3, 4,5,6	1,2,3,4,5,6
1,2,3	--------		1,2,3,4,5	1,2,3, 4,5	1,2,3,4,5

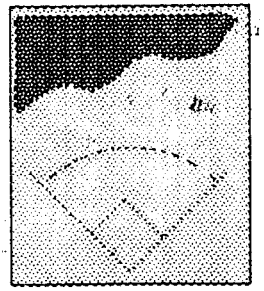
F. RESIDENTIAL



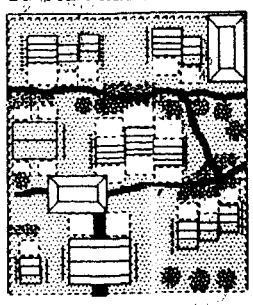
3. NATURAL AREAS



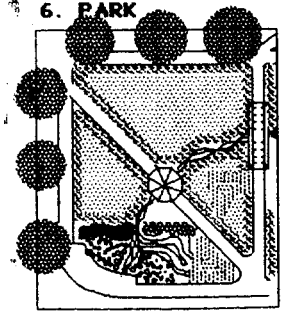
4. RECREATION



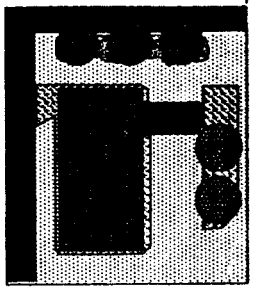
5. M.F. RESIDENTIAL



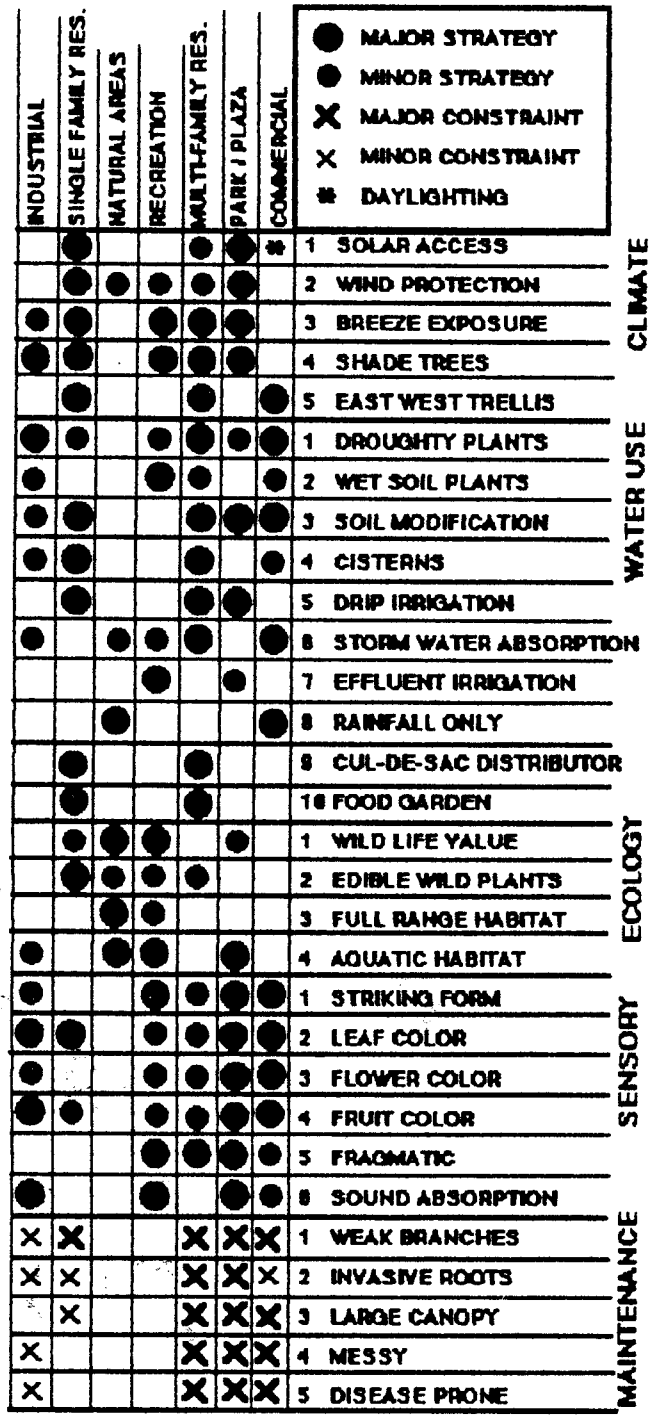
6. PARK



7. COMMERCIAL



THEME DEVELOPMENT MATRIX



Single Family Theme

Climatics:

The following criteria must apply not only within each lot but also for all single family lots in toto (i.e. adjacent lots must not compromise each other). It may be necessary to include deed restrictions to ensure long term compliance especially with regard to solar access.

Solar Access - south lot unobstructed by buildings or vegetation
Wind Protection - windbreaks (hedges) to north-northeast
Breeze Exposure - clear breeze channels to south
Shading (summer) - shade trees for yard & street in combination with trellis/espalier on east & west walls

Water Use:

- native ornamentals (not to exceed 50' in height) for landscaping
- buffalo grass lawn areas
- soil modification to increase absorption (compost)
- garden areas to act as major absorption areas
- rainwater catchment from roofs (cistern) to provide drip/soaker irrigation source for gardens and ornamentals
- pathway stormwater collection
- cul-de-sac stormwater distribution to absorber areas

Ecology:

- selective use of edible (human) plant materials (i.e. nuts, fruits)
- food producing gardens
- selective use of bird attracting plant materials
- native ornamentals

Sensory:

- limited use of colorful, fragrant vegetation (owner discretion) (trellis areas ideal for this purpose)
- heavier use of accent vegetation at entries to greenbelt system, community center, neighborhood parks, tot lots, etc.

Maintenance:

- avoid plant material with weak limbs, disease susceptibility
- keep trees with invasive roots clear of utility gangways
- avoid rapidly spreading plant material
- street trees should be maintained by homeowners

Multi-Family Theme

Climatics:

Solar Access - keep areas south of buildings unobstructed by either structures or significant vegetation where possible

Wind Protection - large windbreaks on north & northeast edge of multi-family site

Breeze Exposure - maintain open breezeways to south-southeast

Shading - use compact, low maintenance trees for shading paved areas, streets, lawn areas in combination with vines, trellis and espalier on east and west facing walls

Water Use:

- specify droughty native ornamentals
- buffalo grass turf areas (walk-on)
- soil modification to increase absorption/retention
- rainwater catchment from roofs (dwelling unit cisterns to irrigate private areas, car barn cisterns to irrigate common areas)
- community garden areas to facilitate water absorption
- drip irrigation/soaker hose systems
- cul-de-sac stormwater distributors
- minor wetland absorber areas with associated wet soil plant material
- absorber beds at juncture of paths and parking, also between streets and parking

Ecology:

- limited use of edible ornamentals (nuts, fruits)
- specify native plants
- food producing gardens

Sensory:

- ornamentals selected should offer a variety of color displays (leaf, flower, fruit) over the year
- selective use of fragrant plant materials

- "pocket prairie" areas for groundcover accents
- use of small hedges and vegetative barriers for space delineation
- trellis area should exploit colorful vines

Maintenance:

Maintenance of multi-family landscaping will undoubtedly be handled through the project manager with costs being subsidized by rent payments. In the interest of minimizing those costs, maintenance-intensive plant materials should not be used here. Thus, **avoid plants** which:

- have weak branches
- have vigorously invasive roots
- tend to spread rapidly (space constraints)
- drop messy fruits and/or large quantities of leaves
- are highly susceptible to disease or insect damage

Commercial Theme

Climatics:

Solar Access - emphasis here should focus on daylighting rather than space heating; however, access for solar water heating should be protected

Wind Protection - north-northeast windbreaks should be provided where possible - not an absolute necessity

Breeze Exposure - maintain breeze channels to the south if possible (again, not a necessity)

Shading - shade trees for parking areas and streets
- trellis and vines for east and west walls

Water Use:

- native ornamentals
- soil modification to create deep absorber beds
- direct absorption of rainwater from roofs into high absorption beds
- stormwater detention and absorption system to drain parking area and filter runoff prior to discharge into creek or impoundment (wetland absorber)
- absorber beds at juncture of paths and parking, also between streets & parking

Ecology:

- native plant material
- wetland absorbers associated with permanent impoundment

Sensory:

Commercial properties as public use areas and entry points for the entire development should display a combination of plant materials which provide year-round color. Use of color and dynamic plant forms should be used to create focal points and draw one both physically and visually into the development. Use of fragrant and sound generating (due to slight breeze) plants will reinforce the attraction and quality of these properties as well.

- stress showy displays of color (leaf, flower, fruit)

- provide focal points with plant massing
- use "pocket prairie" and wildflowers as groundcover scheme
- "hide" parking areas with berming and/or low hedges

Maintenance:

The commercial project manager will be responsible for landscape maintenance which is again paid for via lease payments. Higher levels of maintenance will be required due to the emphasis on colorful landscaping (leaf and flower drops, etc.); however, this will more than pay for itself in terms of the quality of the commercial property being offered. However, plants with inherent maintenance problems should be avoided. These are plants with weak limits or aggressive roots which spread rapidly, have messy fruits, or are abnormally susceptible to disease, insects, or pollution.

Industrial Theme

Climatics:

Generally, climatic design does not yield great savings in the industrial sector; however, this is largely dependent on the nature of the industrial activity. Solar water heating can be provided from rooftop collectors so solar access conditions can be relaxed to provide rooftop protection only. Otherwise,

- protect from winter winds if possible
- allow free passage of southerly breezes
- provide shade trees for parking and paved areas as well as east and west facing walls

Water Use:

- emphasize droughty native plants
- modify soil as needed to increase absorption
- cisterns and drip/soaker irrigation as needed
- stormwater detention and absorption system to drain parking areas and catch runoff from saturated soil and/or cisternless structures
- include wetland plant materials to increase absorption of stormwater

Ecology:

- utilize a good range and mix native materials to provide a "garden industrial" type setting (link to greenbelt)
- wetland absorbers associated with permanent impoundments (aquatic habitat) to enhance wildlife value
- utilize native perennials (wildflowers) and prairie grasses for groundcovers

Ecology of interior environments should also be addressed for industrial properties. Poor air quality inside an industrial building can be upgraded with the use of odor-giving/odor-eating plants as well as by plants which acutally purify air by removing air-borne contaminants and producing large quantities of oxygen (i.e. spider plants). The creation of interior greenbelts or courtyards for industrial buildings by using rainwater catchment strategies, water features (noise generating) and walls of air modifying plant materials to separate large industrial interiors should be explored in greater detail.

Sensory:

- provide interesting plant massing with some color displays to reinforce garden industrial concept
- "pocket prairie" and wildflowers for accent and visual quality
- utilize highly fragrant indoor plants

Maintenance:

Again, maintenance will be the responsibility of the lessor; thus, every effort should be made to design a low-maintenance, naturalist setting. (As an aside, many maintenance/management issues could be resolved by the presence of a commercial composting operation. The composter could have an exclusive contract for maintaining **Griffin-West** properties (commercial, multi-family, recreation areas, etc.) and "recycle" tree and grass trimmings through the compost operation). In general, industrial landscaping should avoid the previously described maintenance intensive plants whenever possible. (However, spreading plants could be acceptable under the proper conditions.)

Recreation Area Theme

Climatics:

Solar Access - no special provisions

Wind Protection - windbreaks of various sizes (based on needs) to reduce northerly winds

Breeze Exposure - maximize free movement of south-southeasterly breezes

Shading - provide ample park-scale (height >50') trees with wide canopies

Water Use:

- emphasize drought tolerant vegetation
- provide flood tolerant vegetation in low-lying areas
- buffalo grass for playing fields
- utilize treated effluent for irrigation of playing fields and specimen areas

Ecology:

- provide ample wildlife forage and cover
- provide some edible vegetation types
- use the fullest range and mix of native vegetation as feasible
- include aquatic habitat with associated wetlands (stormwater feed)

Sensory:

- use hedge forms and plant massing to delineate spaces, separate areas, and provide privacy
- make optimum use of colorful and interesting vegetation to indicate pathways, activity centers, and focal points
- surround picnic areas with fragrant plants (beware of drawing excessive bees and ants)
- utilize cottonwoods (*populus deltoides*) for their sound and shade value (also good for wildlife cover)
- utilize large trees with dynamic forms as specimens (i.e. bur oak, pecan, sycamore, juniper)

Maintenance:

Other than picnic areas and playing fields, maintenance of recreation areas will be very low. However, these two exclusions can account for large maintenance costs. This situation lends itself well to a commercial/composter contracting for trimmings, etc. as previously mentioned. Several options are available for transfer of management responsibilities from the developer to some other authority:

(1) homeowners association;
(2) dedication of area to city or county; or
(3) transfer to a private operator.

These options need to be explored by the developer to determine the best long term alternative-based economics and assets to the development.

Park/Plaza Theme

The combination park and plaza area will be a major focal point and entry feature for **Princeton Parks**. This area will be the first element visitors and buyers will notice upon coming to **Princeton Parks**. The design of this area therefore should employ most if not all of the landscaping concepts applied throughout the development in order to serve as demonstrative example and to set the tone for the entire project. The plaza area must be designed to allow people to gather and relax within its confines. It should enjoy areas of ideal microclimatic conditions to ensure year-round usage and comfort.

The major component of the adjoining park area (lower section park, upper section plaza) will revolve around runoff control strategies. Wetland absorber areas alongside a permanent water impoundment will establish the aquatic habitat necessary to support waterfowl, crayfish, and aquatic vegetation. Overall, the park/plaza area will utilize native specimens for an interplay of color, form, and texture, and will be kept lush and vigorous using a combination of composting techniques, drip or soaker irrigation, and treated effluent recycling.

Climatics:

Solar Access - provide areas of unobstructed access to winter sunlight

Wind Protection - tall hedges on north-northeast edges of plaza area

Breeze Exposure - provide clear breeze channel(s) to the south

Shading - utilize decorative shade trees with taller, denser varieties to western edge to reduce afternoon insolation

Water Use:

- emphasize droughty, showy native plants
- modify soil to optimum condition with compost
- irrigation with combination of drip/soaker system, treated effluent and absorber beds
- utilize "pocket prairie" and wildflower groundcover scheme
- water feature supplied by rainwater and/or recycled water

Ecology:
- emphasize true native plant species
- selective use of bird attracting plant material (i.e. *Ilex s*, hawthorns, sugarberry)
- introduce aquatic vegetation type to encourage aquatic habitat

Note: It will be critical from an ecological viewpoint to develop and perfect the wetland absorber/water impoundment techniques in the park/plaza area during this first phase of the development. The success of these techniques in terms of sizing, layout, and reaction to drought will make or break the efforts to provide diverse and viable wildlife habitat in the natural areas. Careful analysis and modification of techniques developed in the first phase (which will have limited wildlife value due to its proximity to high intensity use areas) will ensure the effectiveness of wetlands/watering areas in subsequent phases of the project.

Sensory:
- provide year-round color display
- introduce fragrant plant material
- optimize interplay of shape, form, color, and texture
- provide small, semi-private areas

Maintenance:

Responsibility for the park/plaza would best be handled by the manager of the commercial properties as this area will be integral to commercial activities. In general, high maintenance plants (i.e. weak limbs, invasive roots, unusually messy, rapid spreading and/or disease or insect prone) should be avoided, especially in the upper section of the area (plaza). It is important to demonstrate here that a lush natural environment can occur with little associated maintenance.

Natural Area Theme

Climatics:

No special considerations here, other than pathways and nodes should be laid out to capitalize on **existing** microclimatic opportunities.

Water Use:

Area should be able to rely on rainfall alone with existing soil conditions. Soil modification should only occur as needed to establish wetland absorbers receiving runoff from other areas of the development (i.e. housing and streets).

Ecology:

- introduce species which are currently absent from the native plant regime
- emphasize enhancement of wildlife values of forage, cover, and drought-resistant watering areas
- establish wetland and aquatic habitat areas supplied by urban runoff strategies (rainfall based)

Sensory:

- utilize specimen material for focal points at entryways and nodes on a limited basis

Maintenance:

- occasional clearing of pathways (best performed by interested individuals)
- generally a "hands-off" policy should exist

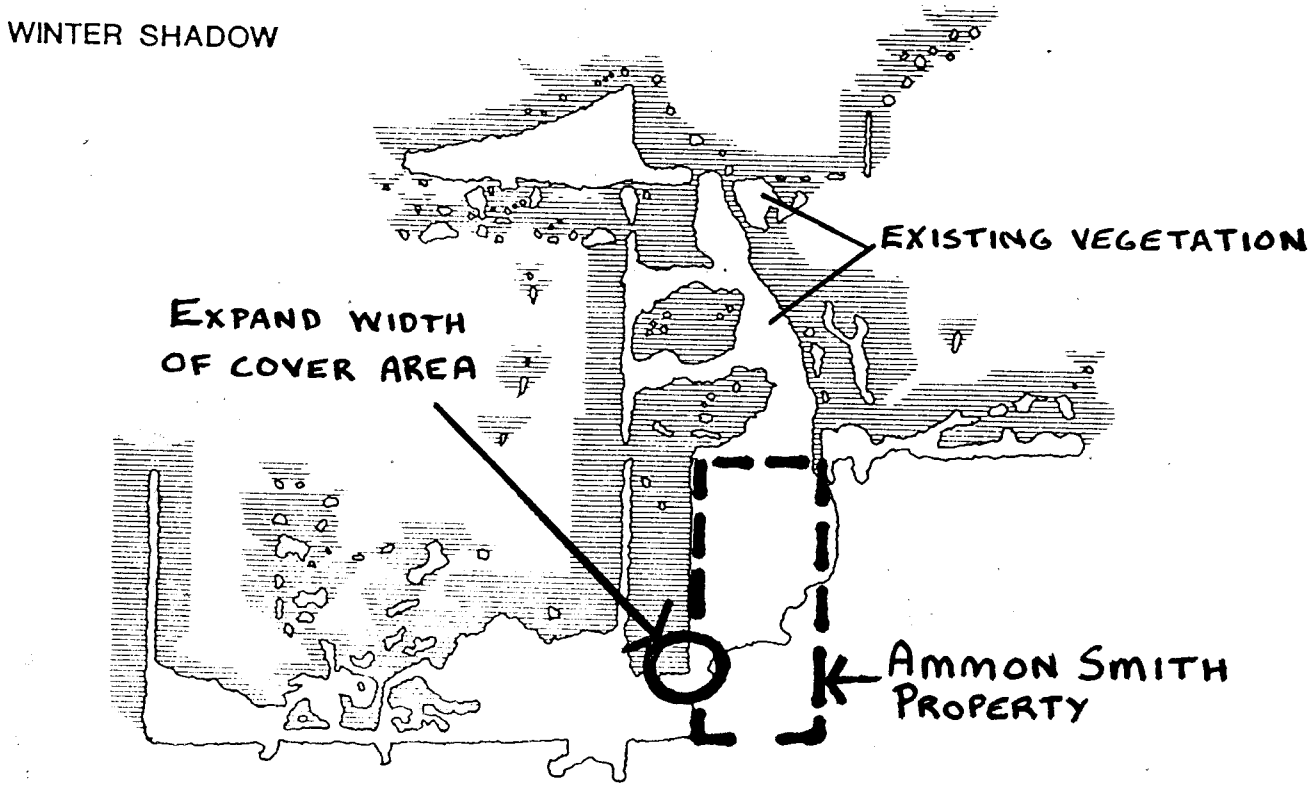
A Note on Natural Area Management

Conversations with the Texas Parks and Wildlife Department regarding the establishment of natural areas which will support a diverse wildlife population have brought to light some very important management issues. In order for such an area to become a viable habitat, two needs **must** be satisfied.

First, year-round watering areas must exist. The urban runoff strategies currently being proposed should be able to meet this requirement if properly implemented. Water impoundments should have littoral edges (i.e. gently sloping areas subject to flooding by stormwater and exposure during drought periods). The impoundment should also have a rather deep portion (greater than 4') to ensure drought resistance and to maintain the needed dissolved oxygen content.

The second requirement presents a more difficult problem. If wildlife habitat is to be seriously promoted, natural areas must in reality be one continuous area and, obviously, the larger, the better. Economic constraints will of course dictate a compromise as our primary purpose is not to establish a wildlife preserve. Nonetheless, every effort should be made to provide the largest, most cohesive natural area possible.

According to state officials, the miminum width a natural area can reach and still remain as "connected" habitat is 20'-30' of **cover** (i.e. exclusive of undeveloped open space). Looking at the existing vegetation condition on-site (see map below; disregard shadow patterns), we can see that **Griffin-West** property currently does not meet this requirement. However, if the area of vegetation indicated by the dashed rectangle is included as a portion of the natural area, the requirement is almost satisfied. Full satisfaction would occur if the area circled were planted to widen this juncture point.



Unfortunately, the property indicated by the rectangle is not in the hands of **Griffin-West**; thus, the long term status of this property is uncertain. An effort must be made to ensure this property remains as it is if **Princeton Parks** is to have realistically viable wildlife habitat. If this land were cleared or stripped for any purpose, the natural areas of **Princeton Parks** would be severely compromised.

Several options exist to achieve the preservation of the area in question. Outright purchase of the property from Ammon Smith would give the most control. However, since the area would be preserved in its natural state, paired with the fact that it lies almost totally within the floodplain, there would be no way for the property to generate the level of income required to cover the purchase cost. Other options of protecting the area would be to establish a **conservation easement**.

A conservation easement would preserve the area in its natural state while retaining current ownership and would not have to include public access. The easement could be granted to (read as purchased by) **Griffin-West,** or the owner could dedicate the area to the Texas Nature Conservancy Board. Dedication to the Conservancy Board is the most cost-effective option available. In fact, the State Legislature is currently considering the approval of major tax incentives for landowners who so dedicate their properties. In light of this information, perhaps the best option for the establishment of a native habitat area would be a joint dedication of property by Ammon Smith and **Griffin-West** to the Nature Conservancy Board. Not only would both parties benefit from tax advantages, but they also would reap the benefits of a mutually-shared and state-managed amenity to their own properties.

RECOMMENDED VEGETATION USES

CLIMATIC

Solar Control: Trees that provide summer shade and allow acceptable levels of winter solar access with *proper pruning*. Both trees listed are somewhat messy.

Pecan	Honey Locust

Shading:

Shade Trees:

Black Walnut (park scale)	Honey Locust (light shade)
Black Willow (natural areas)	Juniper (dense shade)
Bur Oak (park scale)	Pecan (open shade)
Cedar Elm	Redbud (small)
Cottonwood (park scale)	Shumard Oak
Eve's Necklace (small, open shade)	Soapberry
Green Ash (natural areas)	Sycamore (park scale)
Gum Bumelia (dense shade)	Slippery Elm (natural areas)
Hackberry	White Ash (natural areas)

Espaliers/Trellis: shade for east and west walls

Rusty Blackhaw	Prairie Rose (trellis)
Possum Haw	McCartney Rose (trellis)
Mexican Plum	Carolina Jessamine (trellis/evergr)
Deciduous Holly	Crossvine (trellis/evergreen)
Virginia Creeper	Trumpet Vine (trellis)

Wind Breaks: see also Hedges

Bur Oak
Bois d'arc
Juniper
Soapberry
Hackberry
Gum Bumelia

DROUGHTY PLANTS: significantly drought-tolerant plants

Juniper
Cottonwood
Hackberry
Bois d'arc
Hawthorns
River Plum
Redbud
Honey Locust
Eve's Necklace
Soapberry
Gum Bumelia
Rusty Blackhaw

WILDLIFE VALUE (Ecology)

Native plants with high forage and/or cover value:
*** - indicates edible (human) plant**

Hackberry
Mexican Plum*
River Plum*
Deciduous Holly
Rusty Blackhaw
Ashes
Prairie Rose
Pecan*
Cottonwood (cover)
Black Walnut*
Elderberry*
Coral berry
Oaks
Hawthorns

SENSORY

Specimen/Focus Plants: (showy form or color)

Eve's Necklace
Deciduous Holly
Gum Bumelia (fragrant)
Hawthorn (fragrant)
Rusty Blackhaw
Redbud (fragrant)
Shumard Oak
Texas Red Oak
Juniper
Carolina Jessamine
Elderberry
Dogwood (fragrant)
Hog Plum
River Plum (fragrant)
Coral berry
Prairie Rose
McCartney Rose
Smooth Sumac
Spring Herald
Trumpet Vine

Hedges/Barriers:

Bois d'arc (large)
Hawthorn
Elderberry (large)
Possum'haw
Rusty Blackhaw
Smooth Sumac
Hog Plum
Dogwood
MacCartney Rose
Hercules-Club
Texas Red Oak
Coral Berry (low)
Juniper (large)

GRIFFIN WEST RESIDENTIAL
PHASE ONE

XERISCAPE PLANT LIST

CLASSIFICATION KEY:

The following sheets categorize the characteristics of a given plant. Pages are headed by scientific name and common name(s). General propagation information follows, along with notes on plant vulnerability. **SIGNIFICANT ATTRIBUTES** lists positive characteristics of the plant. **RECOMMENDED USES** indicates the uses most suited to a particular plant and general notes as to optimum placement (i.e. in Parks, Natural Areas, Residential Areas, etc.). **AVOID** indicates specific situations to be avoided in utilizing the plant. These situations are based both on plant vulnerability and adverse effects of the plant itself. NOTE: A few pages (8) have NFOS in the upper right corner; this indicates a Plant Not Found On-Site (NFOS), but indigenous to Collin County according to the Collin County-Open Landscape Plan. These plants were analyzed in addition to those identified by the Heard study to determine their merit in upgrading the Property's natural habitat.

The lower section of each sheet provides the actual categorization of the plant. A darkened rectangle marks the appropriate category. Lack of a rectangle indicates an inappropriate category or absence of data. Groundcovers are analyzed according to height and ability to bear foot traffic. Shrubs are analyzed by relative size. (Note: large shrubs are often indicated as small trees as well.) Trees are broken into categories of similar height and spread ranges at maturity. Neither on-site nor indigenous vines have been identified, thus information here is limited. Vines are categorized by ability to climb and appropriate support (fence or trellis). The espallier category indicates the relative wall area a single

plant could cover by being tied back.

The remaining categories are applicable to all plants, although branch texture relates more to trees. Leaf texture indicates the relative size of individual leaves. Branch texture indicates the relative size and spacing of branches. Plant armament indicates whether or not thorns are present. Root structure is noted where possible and tagged if type is invasive. (Note: Tap root trees are generally difficult to move.) Leaf color is categorized according to fall color. The phase chart indicates general periods of foliation, blossom, and fruit bearing (by month). The eleven characteristics listed in the lower left portion of the page are categorized on a scale of high (filled circle), medium (half-filled) and low (empty circle). Further explanation of each category as follows:

- WILDLIFE VALUE relates to the number of users (foragers)

- POLLUTION EFFECT indicates tolerance to pollutants (notably ozone)

- FLOOD TOLERANCE indicates tolerance to flooding

- WATER USE relates to average water requirements

- HARDINESS indicates ability to withstand low temperatures

- DISEASE PRONE relates to disease susceptibility

- MAINTENANCE refers to levels of cleaning, pruning, spraying required

- GROWTH RATE is self-explanatory

- LONGEVITY indicates life span of plant: low is less than 100 yrs.; medium is 100-200 years; high is greater than 200 years

- DENSITY indicates the relative openness of the crown. High indicates a closed crown; low indicates an open crown.

NOTE: Lack of a circle, filled or unfilled, indicates an absence of data.

PRELIMINARY VEGETATION MANAGEMENT STUDY

Preliminary investigation of vegetation characteristics indicates the following recommended use groupings:

Good Solar Trees: period of foliation and branching pattern appear to provide required access to solar radiation.

Pecan	Honey locust

Good Shade Trees:

Honey locust (light shade)	Juniper (dense shade)
Soapberry	Gum Bumelia (dense shade)
Pecan	White Ash
Shumard Oak	Bur Oak
Cedar Elm	Black Walnut
Cottonwood	Black Willow
Hackberry	Redbud (small)
Eve's Necklace (small)	Sycamore
(Slippery Elm)	(Green Ash)

Windbreaks:

Juniper*
Hackberry
Bois'd'arc
Soapberry
Gum Bumelia
Bur Oak

Park Scale Trees:

Black Willow
Cottonwood
Pecan
(Hackberry)
Cedar Elm
Honey locust
Soapberry
Bur Oak
Shumard Oak
Black Walnut

Hedge/Barrier Plants:

Bois d'arc
Hawthorn*
Elderberry
Possum Haw
Texas Red Oak
Coral Berry (?)
Spring Herald (?)
MacCartney rose
Hercules Club
Smooth Sumac
Hog Plum
Juniper (large)
Rusty Black Haw

Possible Espallier:

Rusty Black Haw
Possum Haw
Mexican Plum
Prairie Rose (trellis)
MacCartney Rose (trellis)

Good Specimen/Accent Plants: (showy form or color)

Juniper*
Shumard Oak
Hawthorn*
Redbud
Deciduous holly
MacCartney rose
Gum bumelia
Rusty Black haw
Hog Plum
Mexican Plum
Rough-leafed Dogwood
Elderberry
Coralberry
Pink prairie rose
Eve's necklace
Smooth sumac
Spring Herald
Texas Red Oak

Edible Plants: edible fruits or berries

Pecan
Elderberry
Black Walnut
Chinkapin Oak
River plum
Coral berry(?)
Mexican plum (?)

Street Trees: for lining streets

Juniper*
Cedar Elm (large)
Shumard Oak (large)
Hackberry
Bois d'arc
Hawthorn
MacCartney rose (roadside)
Bumelia (?)
Soapberry (large)
Honey locust (messy)
Smooth sumac
Texas Red Oak (small)

Plants not highly recommended:

Slippery elm
B. Willow
Green ash

* Junipers and hawthorns subject to cedar/apple rust.

Cedar-apple rust could cause a real problem in the vegetation management scheme. Currently there are few junipers on-site and an abundance of healthy hawthorns. This fact could be related as junipers are host to cedar-apple rust which attacks hawthorns (apple family) as well. Junipers have been considered for large-scale plantings as windbreaks. Such an action could inadvertantly trigger a decline in the hawthorn population. If hawthorns are to be exploited for a landscaping and marketing theme, this would be a critical error. A plant pathologist (Texas A&M?) should be consulted to address this management issue with regard to potential impact of juniper introduction and possible cedar-apple rust management strategies.

Also, we should be considering general landscaping themes which can further "tie-together" the entire development. Such themes revolve around choosing a limited pallet of plant material which is heavily used throughout the development. There could be separate residential and commercial themes with a unifying overlap of certain materials, or a simple unifying pallet for the entire project. However, since plant moving and propagation may begin soon, it would be wise to firm up the plant material list so the most suitable species may be propagated in sufficent quantities.

Residential Scale:

Multi-trunk Shumard Oak
(Bumelia)
(Honey locust)
Hawthorn
Texas Red Oak
Smooth Sumac
Rosa S.
Mexican Plum
Rough Leafed Dogwood
Redbud
(Pecan)
Rusty Black haw
Eve's Necklace
Rosa B.
Spring Herald
Possum Haw
(Soapberry)

JUNIPERUS VIRGINIANA
EASTERN RED CEDAR

PROPAGATION BY SEED AND GRAFTING
TRANSPLANTING SOMEWHAT DIFFICULT,

CEDAR-APPLE RUST, SPIDER MITES

SIGNIFICANT ATTRIBUTES
DENSE EVERGREEN, DROUGHTY
WILDLIFE VALUE

RECOMMENDED USES
WINDBREAK, AVENUES (ENFRAMEMENT)
SPECIMEN, LARGE HEDGE/SCREEN
PARK, NATURAL AREAS
AVOID

GROUNDCOVERS	WALK-ON	SHRUBS	SMALL	TREES	20-35'
	NON WALK-ON		MEDIUM	HEIGHT	35'-50'
	UNDER 12"		LARGE ■		50'-75' ■
	12"-18"		FOUNDATION		75'-100'
	OVER 18"		HEDGE ■		20'-35'
VINES	SELF-CLIMBING	ESPALLIER	SMALL	SPREAD	35'-50' ■
	FENCE		LARGE		50'-75'
	TRELLIS				75'+
		LEAF TEXTURE	FINE ■	BRANCH TEXTURE	FINE
			MEDIUM		MEDIUM ■
			COARSE		COARSE

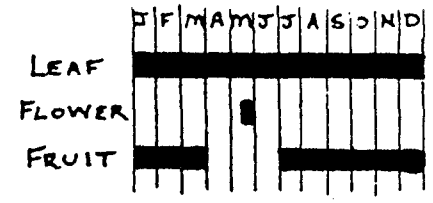
	HIGH ●	MEDIUM ◑	LOW ○
WILDLIFE VALUE	●		
POLLUTION EFFECT			○
FLOOD TOLERANCE			○
EXPOSURE	●		
WATER USE		◑	
HARDINESS	●		
DISEASE PRONE		◑	
MAINTENANCE		◔	
GROWTH RATE			○
LONGEVITY	●		
DENSITY	●		

ARMAMENT

ROOT STRUCTURE **TAP**

COLOR LEAF **D. GREEN**
FLOWER **RED PURPLE**
FRUIT **PALE BLUE**

PHASES



SALIX NIGRA
BLACK WILLOW

EASILY PROPAGATED BY SEED AND CUTTINGS

SUBJECT TO WIND/ICE DAMAGE

SIGNIFICANT ATTRIBUTES
WILDLIFE VALUE, FAST GROWTH

RECOMMENDED USES
FLOODPLAIN, LOW AREAS

AVOID WATER LINES, SEPTIC FIELDS

GROUNDCOVERS: WALK-ON; NON WALK-ON; UNDER 12"; 12"-18"; OVER 18"

SHRUBS: SMALL; MEDIUM; LARGE; FOUNDATION; HEDGE

TREES — HEIGHT: 20-35'; 35'-50' ■; 50'-75'; 75'-100'

VINES: SELF-CLIMBING; FENCE; TRELLIS

ESPALLIER: SMALL; LARGE

TREES — SPREAD: 20'-35' ■; 35'-50'; 50'-75'; 75'+

LEAF TEXTURE: FINE; MEDIUM ■; COARSE

BRANCH TEXTURE: FINE ■; MEDIUM; COARSE

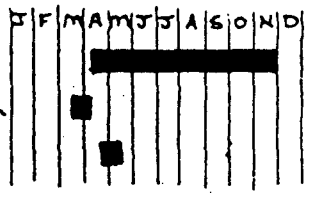
	HIGH ●	MEDIUM ◑	LOW ○
WILDLIFE VALUE	●		
POLLUTION EFFECT		◑	
FLOOD TOLERANCE	●		
EXPOSURE	●		
WATER USE	●		
HARDINESS	●		
DISEASE PRONE		◑	
MAINTENANCE		◑	
GROWTH RATE	●		
LONGEVITY			○
DENSITY			○

ARMAMENT

ROOT STRUCTURE: SHALLOW LATERAL; INVASIVE

COLOR: LEAF GREEN-YELLOW GREEN; FLOWER YELLOW GREEN; FRUIT GREEN-YELLOW

PHASES



POPULUS DELTOIDES
COTTON WOOD, ALAMO

PROPOGATED BY SEED AND SUCKERS
TRANSPLANTS WELL

DROPS BRANCHES

SIGNIFICANT ATTRIBUTES
FLUTTERING SOUND, DROUGHTY, WILDLIFE VALUE

RECOMMENDED USES
SHADE

PARK SCALE

AVOID WATER LINES, SEPTIC FIELDS
PARKING

GROUNDCOVERS: WALK-ON; NON WALK-ON; UNDER 12"; 12"-18"; OVER 18"

VINES: SELF-CLIMBING; FENCE; TRELLIS

SHRUBS: SMALL; MEDIUM; LARGE; FOUNDATION; HEDGE

ESPALLIER: SMALL; LARGE

LEAF TEXTURE: FINE; MEDIUM ■; COARSE

TREES — HEIGHT: 20-35'; 35'-50'; 50'-75'; 75'-100' ■

SPREAD: 20'-35'; 35'-50'; 50'-75'; 75'+ ■

BRANCH TEXTURE: FINE; MEDIUM; COARSE ■

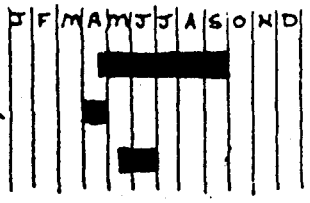
	HIGH ●	MEDIUM ◑	LOW ○
WILDLIFE VALUE	●		
POLLUTION EFFECT			○
FLOOD TOLERANCE	●		
EXPOSURE	●		
WATER USE	●		
HARDINESS	●		
DISEASE PRONE		◑	
MAINTENANCE	●		
GROWTH RATE	●		
LONGEVITY			○
DENSITY			○

ARMAMENT

ROOT STRUCTURE: SHALLOW FIBROUS INVASIVE

COLOR: LEAF YELLOW; FLOWER RED; FRUIT YELLOW/COTTON

PHASES



CARYA ILLINOENIS
PECAN

PROPAGATION BY SEED, GRAFT, CUTINGS
SOMEWHAT DIFFICULT TO TRANSPLANT
MANY VARIETIES AVAILABLE
SUBJECT TO WIND/ICE DAMAGE
SUBJECT TO BARK BEETLE ATTACKS

SIGNIFICANT ATTRIBUTES
EDIBLE NUT

RECOMMENDED USES
SOLAR (PRUNED), SHADE, FOOD

RESIDENTIAL, NATURAL AREAS
AVOID PARKING AREAS, HIGH USE AREAS

GROUNDCOVERS: WALK-ON; NON WALK-ON; UNDER 12"; 12"-18"; OVER 18"

VINES: SELF-CLIMBING; FENCE; TRELLIS

SHRUBS: SMALL; MEDIUM; LARGE; FOUNDATION; HEDGE

ESPALLIER: SMALL; LARGE

LEAF TEXTURE: FINE; MEDIUM ■; COARSE

TREES: 20-35'; 35'-50'; 50'-75'; 75'-100' ■

HEIGHT CAN REACH 150'

SPREAD: 20'-35'; 35'-50'; 50'-75'; 75'+ ■

BRANCH TEXTURE: FINE; MEDIUM; COARSE ■

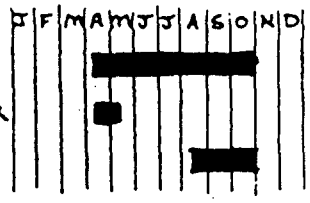
	HIGH ●	MEDIUM ◑	LOW ○
WILDLIFE VALUE	●		
POLLUTION EFFECT			○
FLOOD TOLERANCE		◑	
EXPOSURE	●		
WATER USE	●		
HARDINESS	●		
DISEASE PRONE	◕		
MAINTENANCE	●		
GROWTH RATE		◔	
LONGEVITY	●		
DENSITY			○

ARMAMENT

ROOT STRUCTURE: TAP

COLOR: LEAF YELLOW-BROWN; FLOWER YELLOW-GREEN; FRUIT GREEN → BLACK

PHASES



QUERCUS SHUMARDII
SHUMARD OAK

PROPAGATE BY SEED (MUST BE FRESH)
EASILY MOVED

SIGNIFICANT ATTRIBUTES
FALL COLOR, LIKES CLAY SOILS

TOLERATES RESTRICTED AREAS
CAN BE MULTI-STEMMED

RECOMMENDED USES
EXCELLENT SHADE TREE
SPECIMEN

AVOID WATER LINES

GROUNDCOVERS: WALK-ON; NON WALK-ON; UNDER 12"; 12"-18"; OVER 18"

VINES: SELF-CLIMBING; FENCE; TRELLIS

SHRUBS: SMALL; MEDIUM; LARGE; FOUNDATION; HEDGE

ESPALLIER: SMALL; LARGE

LEAF TEXTURE: FINE; MEDIUM; COARSE ■

TREES: 20-35'; 35'-50'; 50'-75'; 75'-100' ■

HEIGHT — CAN REACH 120'

SPREAD: 20'-35'; 35'-50'; 50'-75' ■; 75'+

BRANCH TEXTURE: FINE; MEDIUM ■; COARSE

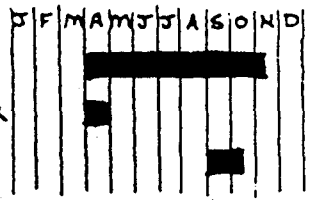
	HIGH ●	MEDIUM ◑	LOW ○
WILDLIFE VALUE	●		
POLLUTION EFFECT			○
FLOOD TOLERANCE			○
EXPOSURE		◑	
WATER USE		◑	
HARDINESS	●		
DISEASE PRONE			◔
MAINTENANCE		◑	
GROWTH RATE			◔
LONGEVITY	●		
DENSITY	●		

ARMAMENT

ROOT STRUCTURE: DEEP; LATERAL?; INVASIVE

COLOR: LEAF RED-ORANGE; FLOWER YELLOW-BROWN; FRUIT BROWN

PHASES



CELTIS LAEVIGATA

HACKBERRY, SUGAR BERRY

PROPAGATE BY SEED

EASILY MOVED

CORKY GROWTHS ON BARK (TRUNK)

SIGNIFICANT ATTRIBUTES

WILDLIFE VALUE, DROUGHTY

FAVORED BY BIRDS

RECOMMENDED USES

WINDBREAK, STREET TREE

NATURAL AREAS

AVOID HIGH WATER TABLE

GROUNDCOVERS: WALK-ON; NON WALK-ON; UNDER 12"; 12"-18"; OVER 18"

VINES: SELF-CLIMBING; FENCE; TRELLIS

SHRUBS: SMALL; MEDIUM; LARGE; FOUNDATION; HEDGE

ESPALLIER: SMALL; LARGE

LEAF TEXTURE: FINE; MEDIUM; COARSE

TREES: 20-35'; HEIGHT: 35'-50'; 50'-75'; 75'-100'

SPREAD: 20'-35'; 35'-50'; 50'-75'; 75'↓

BRANCH TEXTURE: FINE; MEDIUM; COARSE

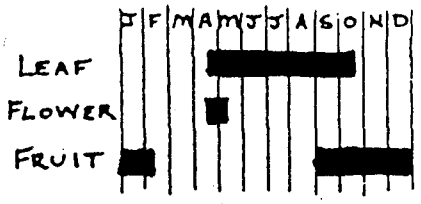
	HIGH	MEDIUM	LOW
WILDLIFE VALUE	●		
POLLUTION EFFECT			○
FLOOD TOLERANCE		◑	
EXPOSURE		◑	
WATER USE		◑	
HARDINESS	●		
DISEASE PRONE	◕		
MAINTENANCE			○
GROWTH RATE		◑	
LONGEVITY		◑	
DENSITY		◑	

ARMAMENT

ROOT STRUCTURE: FIBROUS

COLOR: LEAF YELLOW; FLOWER; FRUIT DARK PURPLE

PHASES



ULMUS CRASSIFOLIA
CEDAR ELM

PROPAGATION BY SEED

VIGOROUS TREES SOMEWHAT RESISTANT TO DUTCH ELM DISEASE

SIGNIFICANT ATTRIBUTES

GOOD TREE IN HEAVY CLAYS

DOMINANT ON-SITE SPECIES

IRRELUGAR SHAPE (INDIVUALISTIC)

TAKES REFLECTED HEAT

RECOMMENDED USES

SHADE TREE, STREET TREE

AVOID

POTENTIALLY INVASIVE

GROUNDCOVERS	WALK-ON	SHRUBS	SMALL	TREES	20-35'
	NON WALK-ON		MEDIUM	HEIGHT	35'-50'
	UNDER 12"		LARGE		50'-75'
	12"-18"		FOUNDATION		75-100' ■
	OVER 18"		HEDGE		20'-35'
VINES	SELF-CLIMBING	ESPALLIER	SMALL	SPREAD	35'-50' ■
	FENCE		LARGE		50'-75'
	TRELLIS				75'+
		LEAF TEXTURE	FINE ■	BRANCH TEXTURE	FINE
			MEDIUM		MEDIUM ■
			COARSE		COARSE

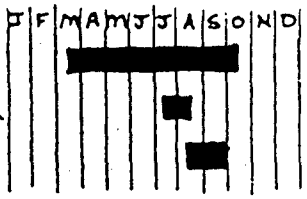
	HIGH ●	MEDIUM ◑	LOW ○
WILDLIFE VALUE		◑	
POLLUTION EFFECT			○
FLOOD TOLERANCE		◑	
EXPOSURE		◕	
WATER USE		◑	
HARDINESS	●		
DISEASE PRONE		◕	
MAINTENANCE			○
GROWTH RATE		◑	
LONGEVITY		◑	
DENSITY		◑	

ARMAMENT

ROOT STRUCTURE: SHALLOW TO DEEP LATERALS; INVASIVE

COLOR: LEAF YELLOW TO GOLD; FLOWER; FRUIT TAN

PHASES



ULMUS RUBRA

SLIPPERY ELM, RED ELM

SIGNIFICANT ATTRIBUTES

SHORT LIVED, SUBJECT TO INSECT DAMAGE

RECOMMENDED USES

NOT HIGHLY RECOMMENDED

AVOID

GROUNDCOVERS: WALK-ON; NON WALK-ON; UNDER 12"; 12"-18"; OVER 18"

VINES: SELF-CLIMBING; FENCE; TRELLIS

SHRUBS: SMALL; MEDIUM; LARGE; FOUNDATION; HEDGE

ESPALLIER: SMALL; LARGE

LEAF TEXTURE: FINE; MEDIUM; COARSE ■

TREES: 20-35'; 35'-50'; HEIGHT 50'-75' ■; 75'-100'

SPREAD: 20'-35'; 35'-50'; 50'-75' ■; 75'+

BRANCH TEXTURE: FINE; MEDIUM ■; COARSE

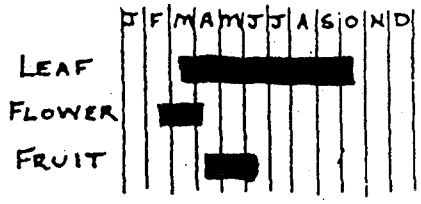
	HIGH	MEDIUM	LOW
WILDLIFE VALUE	●		
POLLUTION EFFECT		◑	
FLOOD TOLERANCE			○
EXPOSURE		◑	
WATER USE		◑	
HARDINESS	●		
DISEASE PRONE	●		
MAINTENANCE			
GROWTH RATE			
LONGEVITY			○
DENSITY		◑	

ARMAMENT

ROOT STRUCTURE

COLOR: LEAF; FLOWER; FRUIT TAN

PHASES



MACLURA POMIFERA

BOIS D'ARC, OSAGEORANGE

PROPAGATE BY SEEDS, WOOD AND ROOT CUTTINGS
EASILY MOVED

SIGNIFICANT ATTRIBUTES

DROUGHTY, TRUE TEXAS NATIVE
DOMINANT ON-SITE SPECIES

MALES DO NOT FRUIT

RECOMMENDED USES

WINDBREAK, ROADSIDES, BARRIER

AVOID PLANTING IN HIGH MAINTENANCE SITUATIONS

GROUNDCOVERS: WALK-ON; NON WALK-ON; UNDER 12"; 12"-18"; OVER 18"

VINES: SELF-CLIMBING; FENCE; TRELLIS

SHRUBS: SMALL; MEDIUM; LARGE; FOUNDATION; HEDGE ■

ESPALLIER: SMALL; LARGE

LEAF TEXTURE: FINE; MEDIUM ■; COARSE

TREES — HEIGHT: 20-35'; 35'-50' ■; 50'-75'; 75'-100'; MAY REACH 60'

TREES — SPREAD: 20'-35'; 35'-50' ■; 50'-75'; 75'+

BRANCH TEXTURE: FINE; MEDIUM; COARSE ■

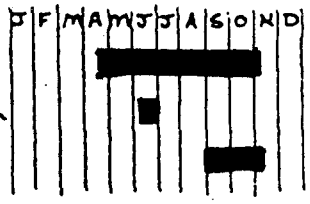
	HIGH	MEDIUM	LOW
WILDLIFE VALUE			○
POLLUTION EFFECT			○
FLOOD TOLERANCE		◑	
EXPOSURE	●		
WATER USE		◑	
HARDINESS	●		
DISEASE PRONE			○
MAINTENANCE	●		
GROWTH RATE	●		
LONGEVITY	●		
DENSITY	●		

ARMAMENT: YES

ROOT STRUCTURE: SHALLOW FIBROUS; COMPETITIVE

COLOR — LEAF: YELLOW; FLOWER: YELLOW-GREEN; FRUIT: GREEN-YELLOW → ORANGE

PHASES



CRATAEGUS MOLLIS?

DOWNY HAWTHORN, RED HAW

EASILY MOVED?

SIGNIFICANT ATTRIBUTES

CEDAR/APPLE RUST

SHOWY BLOSSOMS, DROUGHTY

RECOMMENDED USES

ACCENT, POTENTIAL THEME

SOLID BARRIER WITH CLOSE SPACING

NATURAL AREAS

AVOID JUNIPERS

GROUNDCOVERS: WALK-ON; NON WALK-ON; UNDER 12"; 12"-18"; OVER 18"

VINES: SELF-CLIMBING; FENCE; TRELLIS

SHRUBS: SMALL; MEDIUM; LARGE ■; FOUNDATION; HEDGE ■

ESPALLIER: SMALL; LARGE ■

TREES — HEIGHT: 20-35'; 35'-50' ■; 50'-75'; 75'-100'

TREES — SPREAD: 20'-35'; 35'-50' ■; 50'-75'; 75'+

LEAF TEXTURE: FINE; MEDIUM ■; COARSE

BRANCH TEXTURE: FINE; MEDIUM; COARSE ■

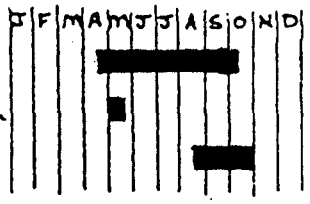
	HIGH ●	MEDIUM ◑	LOW ○
WILDLIFE VALUE		◑	
POLLUTION EFFECT			○
FLOOD TOLERANCE		◑	
EXPOSURE	●		
WATER USE		◑	
HARDINESS	●		
DISEASE PRONE	●		
MAINTENANCE		◑	
GROWTH RATE			○
LONGEVITY			○
DENSITY	●		

ARMAMENT: YES

ROOT STRUCTURE: TAP

COLOR — LEAF: YELLOW-BROWN; FLOWER: WHITE; FRUIT: RED

PHASES



ROSA BRACTEATA
MACARTNEY ROSE

EASILY TRANSPLANTED, PROPAGATED BY CUTTINGS

SIGNIFICANT ATTRIBUTES

WILDLIFE VALUE, EVERGREEN, SHOWY FLOWERS, SPREADS READILY

CLUMP FORMING SHRUB

RECOMMENDED USES

BARRIER, ROADSIDE, EROSION CONTROL (BANKS), SCREEN

NATURAL AREAS

AVOID TIGHT AREAS

GROUNDCOVERS	WALK-ON	SHRUBS	SMALL	TREES	20-35'
	NON WALK-ON	MAY REACH 20'	MEDIUM	HEIGHT	35'-50'
	UNDER 12"		LARGE ■		50'-75'
	12"-18"		FOUNDATION		75'-100'
	OVER 18"		HEDGE		20'-35'
VINES	SELF-CLIMBING ■	ESPALLIER	SMALL	SPREAD	35'-50'
	FENCE ■		LARGE ■		50'-75'
	TRELLIS				75'+
		LEAF TEXTURE	FINE	BRANCH TEXTURE	FINE
			MEDIUM		MEDIUM
			COARSE		COARSE

	HIGH ●	MEDIUM ◑	LOW ○
WILDLIFE VALUE	●		
POLLUTION EFFECT			
FLOOD TOLERANCE			
EXPOSURE		◑	
WATER USE			
HARDINESS	●		
DISEASE PRONE			○
MAINTENANCE		◑	
GROWTH RATE	●		
LONGEVITY			
DENSITY	●		

ARMAMENT YES

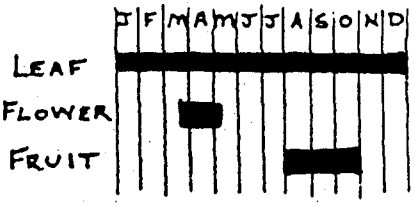
ROOT STRUCTURE SPREADING

COLOR LEAF

FLOWER WHITE

FRUIT RED

PHASES



ROSA SETIGERA

PINK PRARIE ROSE

PROPAGATED BY CUTTINGS
EASILY MOVED

SUCKERS,

SIGNIFICANT ATTRIBUTES

WILDLIFE VALUE, SHOWY FLOWERS
DISEASE FREE, CLIMBS VIGOUROUSLY

ONCE ESTABLISHED-DIFICULT TO REMOVE

RECOMMENDED USES

TRELLIS, FENCES, ACCENT

RESIDENTIAL, NATURAL AREAS
AVOID TIGHT AREAS - SEEK PERMANEN LOCATION

GROUNDCOVERS
- WALK-ON
- NON WALK-ON
- UNDER 12"
- 12"-18"
- OVER 18"

VINES
- SELF-CLIMBING ■
- FENCE
- TRELLIS ■

SHRUBS
- SMALL ■
- MEDIUM
- LARGE
- FOUNDATION
- HEDGE

ESPALLIER
- SMALL ■
- LARGE ■

LEAF TEXTURE
- FINE
- MEDIUM
- COARSE

TREES

HEIGHT
- 20-35'
- 35'-50'
- 50'-75'
- 75'-100'

SPREAD
- 20'-35'
- 35'-50'
- 50'-75'
- 75'+

BRANCH TEXTURE
- FINE
- MEDIUM
- COARSE

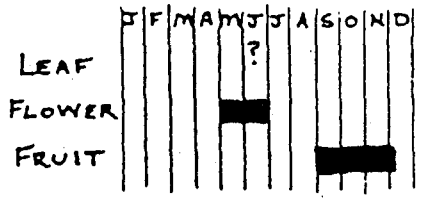
	HIGH ●	MEDIUM ◑	LOW ○
WILDLIFE VALUE	●		
POLLUTION EFFECT			
FLOOD TOLERANCE			
EXPOSURE		◑	
WATER USE			
HARDINESS	●		
DISEASE PRONE			○
MAINTENANCE			
GROWTH RATE		◑	
LONGEVITY			
DENSITY			

ARMAMENT YES

ROOT STRUCTURE

COLOR
- LEAF REDISH
- FLOWER PINK
- FRUIT ORANGE

PHASES



PRUNUS MEXICANA
MEXICAN PLUM

PROPAGATE BY SEED, CUTTINGS
EASILY MOVED

SIGNIFICANT ATTRIBUTES
SHOWY, FRAGRANT FLOWERS, DROUGHTY
DOES NOT SUCKER, GOOD CONTRAST
TO REDBUD (SPRING COLOR)
WILDLIFE VALUE

RECOMMENDED USES
ACCENT, SMALL AREAS
MAY ESPALIER
RESIDENTIAL, EDGES of NATURAL AREA
AVOID

GROUNDCOVERS: WALK-ON; NON WALK-ON; UNDER 12"; 12"-18"; OVER 18"

VINES: SELF-CLIMBING; FENCE; TRELLIS

SHRUBS: SMALL; MEDIUM; LARGE ■; FOUNDATION; HEDGE

ESPALLIER: SMALL; LARGE ?

TREES — HEIGHT: 20-35' ■; 35'-50'; 50'-75'; 75'-100'

TREES — SPREAD: 20'-35' ■; 35'-50'; 50'-75'; 75'+

LEAF TEXTURE: FINE; MEDIUM ■; COARSE

BRANCH TEXTURE: FINE; MEDIUM; COARSE

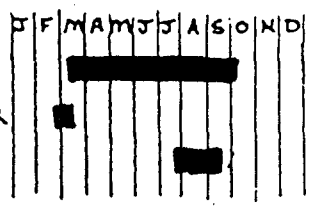
	HIGH ●	MEDIUM ◑	LOW ○
WILDLIFE VALUE	●		
POLLUTION EFFECT			
FLOOD TOLERANCE			
EXPOSURE		◑	
WATER USE		◔	
HARDINESS	●		
DISEASE PRONE			
MAINTENANCE			
GROWTH RATE		◕	
LONGEVITY			
DENSITY		◑	

ARMAMENT

ROOT STRUCTURE

COLOR — LEAF: YELLOW; FLOWER: WHITE; FRUIT: PURPLISH-RED

PHASES



PRUNUS RIVULARIS

RIVER PLUM, HOG PLUM

SELF PROPAGATING

EASILY MOVED

THICKET FORMING

SIGNIFICANT ATTRIBUTES

EDIBLE FRUIT, SHOWY FLOWERS

WILDLIFE VALUE

WHITE THICKETS IN SPRING

RECOMMENDED USES

ACCENT

NATURAL AREAS

AVOID TIGHT AREAS

GROUNDCOVERS: WALK-ON; NON WALK-ON; UNDER 12"; 12"-18"; OVER 18"

VINES: SELF-CLIMBING; FENCE; TRELLIS

SHRUBS: SMALL; MEDIUM ■; LARGE; FOUNDATION; HEDGE

ESPALLIER: SMALL; LARGE

TREES — HEIGHT: 20-35'; 35'-50'; 50'-75'; 75'-100'

TREES — SPREAD: 20'-35'; 35'-50'; 50'-75'; 75'+

	HIGH	MEDIUM	LOW
WILDLIFE VALUE			●
POLLUTION EFFECT			
FLOOD TOLERANCE			
EXPOSURE		◑	
WATER USE			
HARDINESS			
DISEASE PRONE			
MAINTENANCE			
GROWTH RATE			
LONGEVITY			
DENSITY			

LEAF TEXTURE: FINE; MEDIUM; COARSE

BRANCH TEXTURE: FINE; MEDIUM; COARSE

ARMAMENT

ROOT STRUCTURE

COLOR — LEAF

FLOWER: WHITE

FRUIT: BRIGHT RED

PHASES

CERCIS CANADENSIS
REDBUD

PROPAGATE BY SEED, GRAFTING
EASILY MOVED

SUBJECT TO WIND/ICE DAMAGE
LEAF SPOT CAN DEFOLIATE

SIGNIFICANT ATTRIBUTES
SHOWY FLOWERS, DROUGHTY

TEND TOWARDS EARLY LEAF DROP

RECOMMENDED USES
EXCELLENT SPECIMEN/FOCUS
SMALL OPEN SHADE TREE

RESIDENTIAL SCALE

AVOID

GROUNDCOVERS: WALK-ON; NON WALK-ON; UNDER 12"; 12"-18"; OVER 18"

VINES: SELF-CLIMBING; FENCE; TRELLIS

SHRUBS: SMALL; MEDIUM; LARGE; FOUNDATION; HEDGE

ESPALLIER: SMALL; LARGE

TREES: 20-35' ■

HEIGHT: 35'-50'; 50'-75'; 75'-100'

20'-35' ■

SPREAD: 35'-50'; 50'-75'; 75'+

LEAF TEXTURE: FINE; MEDIUM; COARSE ■

BRANCH TEXTURE: FINE; MEDIUM ■; COARSE

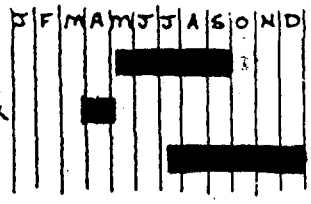
	HIGH ●	MEDIUM ◑	LOW ○
WILDLIFE VALUE		◔	
POLLUTION EFFECT	●		
FLOOD TOLERANCE		◑	
EXPOSURE		◑	
WATER USE		◑	
HARDINESS	●		
DISEASE PRONE		◔	
MAINTENANCE		◑	
GROWTH RATE		◕	
LONGEVITY			○
DENSITY		◑	

ARMAMENT

ROOT STRUCTURE: SHALLOW FIBROUS

COLOR: LEAF: GOLDEN-YELLOW; FLOWER: PINK/LAVENDER; FRUIT: PURPLE BROWN

PHASES



GLEDITSIA TRIACANTHOS

HONEY LOCUST

PROPAGATE BY SEED, GRAFTING

EASILY MOVED

SIGNIFICANT ATTRIBUTES

OPEN CROWN, DROUGHTY, QUICK GROWTH

RECOMMENDED USES

SOLAR (PRUNED), STREET TREE

GOOD LIGHT SHADE

AVOID

GROUNDCOVERS: WALK-ON; NON WALK-ON; UNDER 12"; 12"-18"; OVER 18"

VINES: SELF-CLIMBING; FENCE; TRELLIS

SHRUBS: SMALL; MEDIUM; LARGE; FOUNDATION; HEDGE

ESPALLIER: SMALL; LARGE

LEAF TEXTURE: FINE ■; MEDIUM; COARSE

TREES

HEIGHT: 20-35'; 35'-50'; 50'-75' ■; 75'-100'

SPREAD: 20'-35'; 35'-50' ■; 50'-75'; 75'+

BRANCH TEXTURE: FINE; MEDIUM; COARSE ■

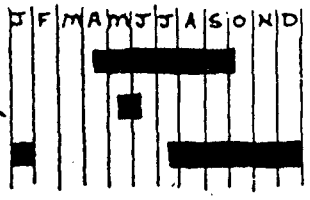
	HIGH ●	MEDIUM ◑	LOW ○
WILDLIFE VALUE		◔	
POLLUTION EFFECT		◐	
FLOOD TOLERANCE		◑	
EXPOSURE		●	
WATER USE		◑	
HARDINESS		●	
DISEASE PRONE		◔	
MAINTENANCE		◑	
GROWTH RATE		●	
LONGEVITY		◑	
DENSITY			○

ARMAMENT: YES

ROOT STRUCTURE: VARIABLE

COLOR: LEAF: L. GREEN → YELLOW; FLOWER: YELLOW GREEN; FRUIT: PURPLISH BROWN

PHASES



SOPHORA AFFINIS

EVE'S NECKLACE, SHOESTRING TREE, TEXAS SOPHORA

PROPAGATION BY SEED

EASILY MOVED

YOUNG PLANT MAY FREEZE TO GROUND, THEN SUCKER

SIGNIFICANT ATTRIBUTES

NICE FLOWERS, VERY DROUGHTY

FRAGRANT

RECOMMENDED USES

GOOD ACCENT PLANT

LIGHT SHADE

PARK, RESIDENTIAL

AVOID

GROUNDCOVERS: WALK-ON; NON WALK-ON; UNDER 12"; 12"-18"; OVER 18"

VINES: SELF-CLIMBING; FENCE; TRELLIS

SHRUBS: SMALL (UP TO 25'); MEDIUM; LARGE; FOUNDATION; HEDGE

ESPALLIER: SMALL; LARGE

LEAF TEXTURE: FINE; MEDIUM; COARSE

TREES — HEIGHT: 20-35' <; 35'-50'; 50'-75'; 75'-100'

TREES — SPREAD: 20'-35' <; 35'-50'; 50'-75'; 75'+

TREES — BRANCH TEXTURE: FINE; MEDIUM; COARSE

	HIGH	MEDIUM	LOW
WILDLIFE VALUE			○
POLLUTION EFFECT			
FLOOD TOLERANCE			
EXPOSURE		◕	
WATER USE			
HARDINESS		◑	
DISEASE PRONE			
MAINTENANCE			
GROWTH RATE		◕	
LONGEVITY			
DENSITY			○

ARMAMENT

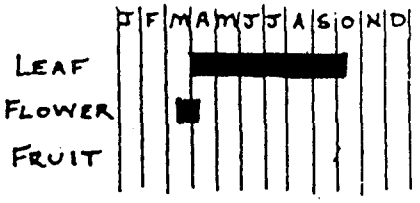
ROOT STRUCTURE

COLOR — LEAF

FLOWER: PALE PINK

FRUIT: BLACK

PHASES



ZANTHOXYLUM CLAVA-HERCULIS
HERCULES CLUB, PRICKLY ASH

PROPAGATED BY SEED, ROOT CUTTINGS
EASILY MOVED

DEFOLIATED BY SUMMER INSECTS

SIGNIFICANT ATTRIBUTES

RECOMMENDED USES
BARRIER

NATURAL AREAS
AVOID

GROUNDCOVERS — WALK-ON; NON WALK-ON; UNDER 12"; 12"-18"; OVER 18"

VINES — SELF-CLIMBING; FENCE; TRELLIS

SHRUBS — SMALL; MEDIUM; LARGE ■; FOUNDATION; HEDGE ■

ESPALLIER — SMALL; LARGE

TREES — HEIGHT: 20-35' <; 35'-50'; 50'-75'; 75'-100'; SPREAD: 20'-35' ≤; 35'-50'; 50'-75'; 75'↓

LEAF TEXTURE — FINE; MEDIUM ■; COARSE

BRANCH TEXTURE — FINE; MEDIUM; COARSE

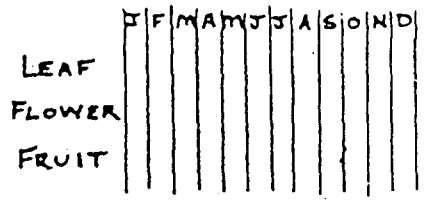
	HIGH	MEDIUM	LOW
WILDLIFE VALUE	●		
POLLUTION EFFECT		◑	
FLOOD TOLERANCE			○
EXPOSURE		◑	
WATER USE			
HARDINESS	●		
DISEASE PRONE			
MAINTENANCE			
GROWTH RATE			○
LONGEVITY			○
DENSITY			

ARMAMENT — YES

ROOT STRUCTURE

COLOR — LEAF; FLOWER Yellow Green; FRUIT Brown

PHASES



RHUS GLABRA
SMOOTH SUMAC

PROPAGATE BY SEED, CUTTING, DIVISION
EASILY MOVED

ENTIRE PLANT MAY BE BLOWN DOWN, SUCKERS

SIGNIFICANT ATTRIBUTES

DROUGHTY, GREAT FALL COLOR
WILDLIFE VALUE

RECOMMENDED USES

EROSION CONTROL, SPECIMEN
ROADSIDE, SCREENING
NATURAL AREAS

AVOID TIGHT AREAS

GROUNDCOVERS: WALK-ON; NON WALK-ON; UNDER 12"; 12"-18"; OVER 18"

VINES: SELF-CLIMBING; FENCE; TRELLIS

SHRUBS: SMALL; MEDIUM ■; LARGE; FOUNDATION; HEDGE ■

ESPALLIER: SMALL; LARGE

LEAF TEXTURE: FINE; MEDIUM ■; COARSE

TREES: 20-35' <

HEIGHT: 35'-50'; 50'-75'; 75'-100'; 20'-35' ■

SPREAD: 35'-50'; 50'-75'; 75'+

BRANCH TEXTURE: FINE; MEDIUM; COARSE ■

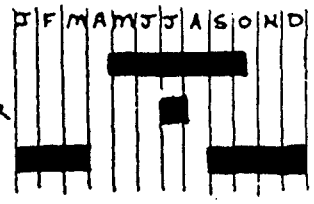
	HIGH ●	MEDIUM ◑	LOW ○
WILDLIFE VALUE	●		
POLLUTION EFFECT			○
FLOOD TOLERANCE			○
EXPOSURE	●		
WATER USE		◑	
HARDINESS	●		
DISEASE PRONE			○
MAINTENANCE			○
GROWTH RATE	●		
LONGEVITY			○
DENSITY			○

ARMAMENT

ROOT STRUCTURE: SHALLOW SPREADING

COLOR: LEAF SCARLET RED; FLOWER YELLOW GREEN; FRUIT RED

PHASES



ILEX DECIDUA

DECIDUOUS HOLLY, 'POSSUM HAW

PROPAGATE BY SEED; CUTTINGS RECOMMENDED

EASILY MOVED

SIGNIFICANT ATTRIBUTES

HIGH WILDLIFE VALUE, RED FRUIT IN WINTER, SOMEWHAT DROUGHTY

ONLY FEMALES BEAR FRUIT

RECOMMENDED USES

GOOD ACCENT AGAINST DARK BACKGROUND

NATURAL AREAS

AVOID

GROUNDCOVERS: WALK-ON; NON WALK-ON; UNDER 12"; 12"-18"; OVER 18"

VINES: SELF-CLIMBING; FENCE; TRELLIS

SHRUBS: SMALL; MEDIUM; LARGE ■; FOUNDATION; HEDGE ■

ESPALLIER: SMALL; LARGE ■

LEAF TEXTURE: FINE ■; MEDIUM; COARSE

TREES: 20-35' ■

HEIGHT: 35'-50'; 50'-75'; 75'-100'; 20'-35' ≤

SPREAD: 35'-50'; 50'-75'; 75'+

BRANCH TEXTURE: FINE; MEDIUM; COARSE ■

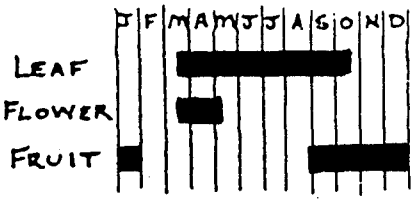
	HIGH ●	MEDIUM ◑	LOW ○
WILDLIFE VALUE	●		
POLLUTION EFFECT			
FLOOD TOLERANCE		◑	
EXPOSURE		◑	
WATER USE		◑	
HARDINESS	●		
DISEASE PRONE			○
MAINTENANCE			○
GROWTH RATE		◑	
LONGEVITY		◑	
DENSITY			○

ARMAMENT

ROOT STRUCTURE

COLOR: LEAF BRONZE; FLOWER WHITE; FRUIT RED or ORANGE

PHASES



SAPINDUS DRUMMONDII
SOAPBERRY

PROPAGATES EASILY BY SEED, CUTTINGS
FAIRLY EASILY MOVED

SIGNIFICANT ATTRIBUTES
DROUGHTY, FALL COLOR, SOMEWHAT SHOWY, WINTER BERRIES

RECOMMENDED USES
WIND BREAK, SHADE, EROSION CONTROL

AVOID

GROUNDCOVERS — WALK-ON; NON WALK-ON; UNDER 12"; 12"-18"; OVER 18"

SHRUBS — SMALL; MEDIUM; LARGE; FOUNDATION; HEDGE

TREES — HEIGHT: 20-35', 35'-50' ■, 50'-75', 75'-100'; SPREAD: 20'-35' ■, 35'-50', 50'-75', 75'+

VINES — SELF-CLIMBING; FENCE; TRELLIS

ESPALLIER — SMALL; LARGE

LEAF TEXTURE — FINE ■; MEDIUM; COARSE

BRANCH TEXTURE — FINE; MEDIUM ■; COARSE

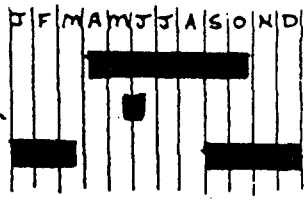
	HIGH	MEDIUM	LOW
WILDLIFE VALUE			○
POLLUTION EFFECT			
FLOOD TOLERANCE			
EXPOSURE	●		
WATER USE		◔	
HARDINESS	●		
DISEASE PRONE			○
MAINTENANCE			○
GROWTH RATE		◕	
LONGEVITY	●		
DENSITY		◑	

ARMAMENT

ROOT STRUCTURE — SPREADING

COLOR — LEAF: YELLOW-GOLD; FLOWER: WHITE; FRUIT: GOLD

PHASES



CORNUS DRUMMONDII
ROUGH-LEAF DOGWOOD

PROPAGATE BY SEED, CUTTING, DIVISION
EASILY MOVED

SIGNIFICANT ATTRIBUTES

FRAGRANT, WILDLIFE VALUE, FALL COLOR
TOLERATES WET SOILS / SHADE

RECOMMENDED USES

ACCENT PLANT for SHADY AREAS
SCREEN, BARRIER

GOOD for NATURAL AREAS, RESIDENTIAL

AVOID

GROUNDCOVERS: WALK-ON; NON WALK-ON; UNDER 12"; 12"-18"; OVER 18"

VINES: SELF-CLIMBING; FENCE; TRELLIS

SHRUBS: SMALL; MEDIUM; TO 15' LARGE ■; FOUNDATION; HEDGE ■

ESPALLIER: SMALL; LARGE

LEAF TEXTURE: FINE; MEDIUM ■; COARSE

TREES: 20-35' <

HEIGHT: 35'-50'; 50'-75'; 75'-100'

SPREAD: 20'-35' <; 35'-50'; 50'-75'; 75'+

BRANCH TEXTURE: FINE; MEDIUM ■; COARSE

	HIGH ●	MEDIUM ◑	LOW ○
WILDLIFE VALUE	●		
POLLUTION EFFECT			
FLOOD TOLERANCE			
EXPOSURE		◔	
WATER USE		◑	
HARDINESS		●	
DISEASE PRONE			○
MAINTENANCE			○
GROWTH RATE		●	
LONGEVITY			○
DENSITY		◕	

ARMAMENT

ROOT STRUCTURE: SHALLOW

COLOR: LEAF ORANGE-RED; FLOWER WHITE; FRUIT WHITE

PHASES

BUMELIA LANUGINOSA

CHITTAMWOOD, GUM BUMELIA, WOOLYBUCKET

PROPAGATED BY SEED, CUTTINGS
DIFFICULT TO MOVE ESTABLISHED PLANTS
EXISTING PLANTS SHOULD BE UNDISTURBED

LEAVES FAVORED BY INSECTS

SIGNIFICANT ATTRIBUTES

DROUGHTY, FRAGRANT, WIND RESISTANCE
POTENTIALLY EVERGREEN, DEEP SHADE
BIRD FORAGE

RECOMMENDED USES

POTENTIAL WINDBREAK, SPECIMEN
GOOD for NARROW/TIGHT AREAS

AVOID TURF AREA (DEEP SHADE)

GROUNDCOVERS: WALK-ON; NON WALK-ON; UNDER 12"; 12"-18"; OVER 18"

VINES: SELF-CLIMBING; FENCE; TRELLIS

SHRUBS: SMALL; MEDIUM; LARGE; FOUNDATION; HEDGE

ESPALLIER: SMALL; LARGE

LEAF TEXTURE: FINE; MEDIUM; COARSE

TREES — HEIGHT: 20'-35'; 35'-50'; 50'-75'; 75'-100'

TREES — SPREAD: 20'-35'; 35'-50'; 50'-75'; 75'+

BRANCH TEXTURE: FINE; MEDIUM; COARSE

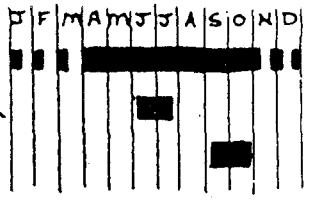
	HIGH	MEDIUM	LOW
WILDLIFE VALUE		◑	
POLLUTION EFFECT			
FLOOD TOLERANCE			
EXPOSURE		◑	
WATER USE		◔	
HARDINESS	●		
DISEASE PRONE		◔	
MAINTENANCE		○	
GROWTH RATE			○
LONGEVITY			
DENSITY	●		

ARMAMENT: YES

ROOT STRUCTURE: TAP

COLOR — LEAF: —
FLOWER: WHITISH-YELLOW
FRUIT: BLUE-BLACK

PHASES



FRAXINUS AMERICANA
WHITE ASH

PROPAGATED BY SEED

TRANSPLANTING SOMEWHAT DIFFICULT

SUBJECT TO WIND/ICE DAMAGE

SIGNIFICANT ATTRIBUTES

FALL COLOR

RECOMMENDED USES

SHADE

PARK, NATURAL AREAS

AVOID

GROUNDCOVERS: WALK-ON; NON WALK-ON; UNDER 12"; 12"-18"; OVER 18"

VINES: SELF-CLIMBING; FENCE; TRELLIS

SHRUBS: SMALL; MEDIUM; LARGE; FOUNDATION; HEDGE

ESPALLIER: SMALL; LARGE

LEAF TEXTURE: FINE; MEDIUM ■; COARSE

TREES

HEIGHT: 20-35'; 35'-50'; 50'-75'; 75'-100' ■

SPREAD: 20'-35'; 35'-50'; 50'-75' ■; 75'+

BRANCH TEXTURE: FINE; MEDIUM; COARSE ■

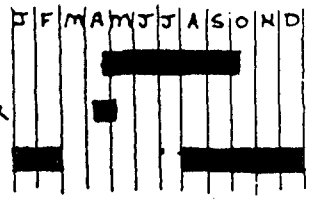
	HIGH ●	MEDIUM ◑	LOW ○
WILDLIFE VALUE		◔	
POLLUTION EFFECT	●		
FLOOD TOLERANCE		◑	
EXPOSURE			○
WATER USE		◕	
HARDINESS	●		
DISEASE PRONE		◕	
MAINTENANCE			○
GROWTH RATE		◑	
LONGEVITY		◑	
DENSITY		◑	

ARMAMENT

ROOT STRUCTURE: SHALLOW FIBROUS

COLOR: LEAF — YELLOW w/ PURPLE; FLOWER — PURPLE; FRUIT — TAN

PHASES



SAMBUCUS CANADENSIS
ELDERBERRY

PROPAGATE BY SEED; CUTTINGS BEST

EASILY MOVED

THICKET FORMING IN WET AREAS

SUBJECT TO WIND/ICE DAMAGE, SUCKERS.

SIGNIFICANT ATTRIBUTES

WILDLIFE VALUE, SHOWY FLOWERS, EDIBLE

LIKES WET SOILS

RECOMMENDED USES

EROSION CONTROL, ACCENT

BARRIER,

NATURAL AREA (esp. by STREAM OR POND)

AVOID

GROUNDCOVERS: WALK-ON; NON WALK-ON: UNDER 12", 12"-18", OVER 18"

SHRUBS: SMALL; MEDIUM; TO 12': LARGE ■; FOUNDATION; HEDGE ■

TREES — HEIGHT: 20-35', 35'-50', 50'-75', 75'-100'

VINES: SELF-CLIMBING; FENCE; TRELLIS

ESPALLIER: SMALL; LARGE

SPREAD: 20'-35', 35'-50', 50'-75', 75'+

LEAF TEXTURE: FINE; MEDIUM ■; COARSE

BRANCH TEXTURE: FINE; MEDIUM; COARSE

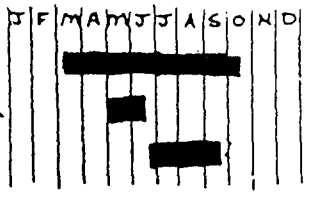
	HIGH ●	MEDIUM ◑	LOW ○
WILDLIFE VALUE	●		
POLLUTION EFFECT			
FLOOD TOLERANCE	●		
EXPOSURE		◑	
WATER USE		◑	
HARDINESS	●		
DISEASE PRONE			
MAINTENANCE		◑	
GROWTH RATE	●		
LONGEVITY			
DENSITY			

ARMAMENT

ROOT STRUCTURE: AGGRESSIVE COMPETITOR

COLOR — LEAF; FLOWER: WHITE; FRUIT: DEEP PURPLE

PHASES



SYMPHORICARPOS ORBICULATUS

CORAL BERRY, TURKEY BERRY, INDIAN CURRANT

PROPAGATION BY SEED DIFFICULT; CUTTINGS RECOMMENDED

EASILY MOVED, DIVIDED

SHOUD BE CUT BACK EACH WINTER TO PROMOTE MORE BERRIES, BUSNIER LOOK

SIGNIFICANT ATTRIBUTES

WILDLIFE VALUE, DROUGHTY

RECOMMENDED USES

EROSION CONTROL, BORDER AREAS

ATTRACTIVE ACCENT

NATURAL AREAS

AVOID

GROUNDCOVERS: WALK-ON; NON WALK-ON; UNDER 12"; 12"-18"; OVER 18"

VINES: SELF-CLIMBING; FENCE; TRELLIS

SHRUBS: SMALL ■; MEDIUM; LARGE; FOUNDATION; HEDGE

ESPALLIER: SMALL; LARGE

LEAF TEXTURE: FINE ■; MEDIUM; COARSE

TREES — HEIGHT: 20-35'; 35'-50'; 50'-75'; 75'-100'

TREES — SPREAD: 20'-35'; 35'-50'; 50'-75'; 75'+

BRANCH TEXTURE: FINE; MEDIUM; COARSE

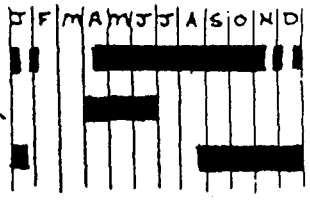
	HIGH ●	MEDIUM ◑	LOW ○
WILDLIFE VALUE	●		
POLLUTION EFFECT			
FLOOD TOLERANCE			
EXPOSURE			
WATER USE			
HARDINESS	●		
DISEASE PRONE			
MAINTENANCE		◔	
GROWTH RATE			
LONGEVITY			
DENSITY			

ARMAMENT

ROOT STRUCTURE

COLOR — LEAF: CRIMSON ACCENT; FLOWER: WHITE - PINK; FRUIT: RED to PINK

PHASES



QUERCUS MUHLENBERGII
CHINKAPIN OAK

NFOS

PROPAGATE BY SEED (MUST BE FRESH)
DIFFICULT TO TRANSPLANT

PREFERS WELL DRAINED, DRY SOILS

SIGNIFICANT ATTRIBUTES

VERY HIGH WILDLIFE VALUE, DROUGHTY
EDIBLE NUT, HANDSOME TREE

RECOMMENDED USES

NATURAL AREAS

AVOID

GROUNDCOVERS: WALK-ON; NON WALK-ON; UNDER 12"; 12"-18"; OVER 18"

SHRUBS: SMALL; MEDIUM; LARGE; FOUNDATION; HEDGE

TREES — HEIGHT: 20-35'; 35'-50' ■; 50'-75'; 75'-100'

VINES: SELF-CLIMBING; FENCE; TRELLIS

ESPALLIER: SMALL; MEDIUM

TREES — SPREAD: 20'-35'; 35'-50' ■; 50'-75'; 75'+

LEAF TEXTURE: FINE; MEDIUM ■; COARSE

BRANCH TEXTURE: FINE; MEDIUM ■; COARSE

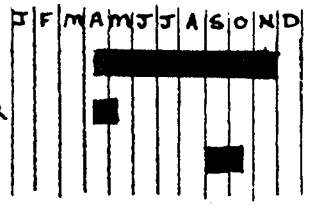
	HIGH ●	MEDIUM ◑	LOW ○
WILDLIFE VALUE	●		
POLLUTION EFFECT			
FLOOD TOLERANCE			○
EXPOSURE	●		
WATER USE			○
HARDINESS	●		
DISEASE PRONE		◔	
MAINTENANCE		◑	
GROWTH RATE		◔	
LONGEVITY	●		
DENSITY			○

ARMAMENT

ROOT STRUCTURE: DEEP; LATERALS; INVASIVE?

COLOR: LEAF — YELLOW-BROWN; FLOWER — YELLOW-GREEN; FRUIT — TAN BROWN

PHASES



QUERCUS TEXANA
TEXAS RED OAK

NFOS

PROPAGATED BY SEED

SIGNIFICANT ATTRIBUTES

FALL COLOR, OFTEN MULTI-TRUNK

WILDLIFE VALUE, SMALL OAK

RECOMMENDED USES

NATURAL AREAS, RESIDENTIAL

AVOID

GROUNDCOVERS: WALK-ON; NON WALK-ON; UNDER 12"; 12"-18"; OVER 18"

SHRUBS: SMALL; MEDIUM; LARGE; FOUNDATION; HEDGE

TREES — HEIGHT: 20-35' ■; 35'-50'; 50'-75'; 75'-100'

VINES: SELF-CLIMBING; FENCE; TRELLIS

ESPALLIER: SMALL; MEDIUM

TREES — SPREAD: 20'-35' ■; 35'-50'; 50'-75'; 75'+

LEAF TEXTURE: FINE; MEDIUM; COARSE

TREES — BRANCH TEXTURE: FINE; MEDIUM; COARSE

	HIGH ●	MEDIUM ◑	LOW ○
WILDLIFE VALUE	●		
POLLUTION EFFECT			
FLOOD TOLERANCE			
EXPOSURE	●		
WATER USE		◑	
HARDINESS	●		
DISEASE PRONE			
MAINTENANCE			
GROWTH RATE			
LONGEVITY	●		
DENSITY			

ARMAMENT

ROOT STRUCTURE

COLOR — LEAF: SCARLET; FLOWER; FRUIT

PHASES

	J	F	M	A	M	J	J	A	S	O	N	D
LEAF												
FLOWER												
FRUIT												

QUERCUS MACROCARPA

BUR OAK

NFOS

PROPAGATE BY SEED

DIFFICULT TO TRANSPLANT

SIGNIFICANT ATTRIBUTES

VERY HIGH WILDLIFE VALUE, DROUGHTY

WILL GROW ANYWHERE

RECOMMENDED USES

VERY LARGE SHADE TREE

NATURAL AREAS, PARK SCALE

AVOID SMALL SPACES/SCALE

GROUNDCOVERS: WALK-ON; NON WALK-ON; UNDER 12"; 12"-18"; OVER 18"

SHRUBS: SMALL; MEDIUM; LARGE; FOUNDATION; HEDGE

TREES — HEIGHT: 20-35'; 35'-50'; 50'-75'; 75-100' ■

VINES: SELF-CLIMBING; FENCE; TRELLIS

ESPALLIER: SMALL; MEDIUM

TREES — SPREAD: 20'-35'; 35'-50'; 50'-75'; 75'+ ■

LEAF TEXTURE: FINE; MEDIUM; COARSE ■

BRANCH TEXTURE: FINE; MEDIUM; COARSE ■

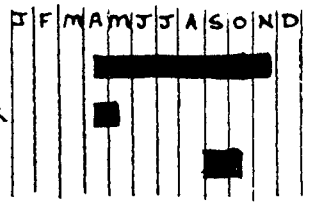
	HIGH ●	MEDIUM ◑	LOW ○
WILDLIFE VALUE	●		
POLLUTION EFFECT			○
FLOOD TOLERANCE		◑	
EXPOSURE	●		
WATER USE		◑	
HARDINESS	●		
DISEASE PRONE		◑	
MAINTENANCE		◑	
GROWTH RATE		◑	
LONGEVITY	●		
DENSITY			○

ARMAMENT

ROOT STRUCTURE: TAP

COLOR — LEAF: YELLOW-BROWN; FLOWER: YELLOWISH GREEN; FRUIT: TAN-BROWN

PHASES



VIRBURNUM RUFIDULUM
BLACK HAW (RUSTY)

NFOS

PROPAGATION BY CUTTINGS, SEEDS

TRANSPLANTS EASILY

SIGNIFICANT ATTRIBUTES

SHOWY, DROUGHTY, SLIGHTLY FRAGRANT

NEW LEAVES BRONZY RED, WILDLIFE VALUE

RECOMMENDED USES

SPECIMEN, SCREEN

RESIDENTIAL, NATURAL AREAS

AVOID FLOOD PLAIN

GROUNDCOVERS: WALK-ON; NON WALK-ON; UNDER 12"; 12"-18"; OVER 18"

VINES: SELF-CLIMBING; FENCE; TRELLIS

SHRUBS: SMALL; MEDIUM; LARGE ■; FOUNDATION; HEDGE ■

ESPALLIER: SMALL; MEDIUM ?

TREES: 20-35' ■; 35'-50'; 50'-75'; 75'-100'

HEIGHT MAY REACH 40'

SPREAD: 20'-35' ■; 35'-50'; 50'-75'; 75'+

LEAF TEXTURE: FINE; MEDIUM ■; COARSE

BRANCH TEXTURE: FINE; MEDIUM ■; COARSE

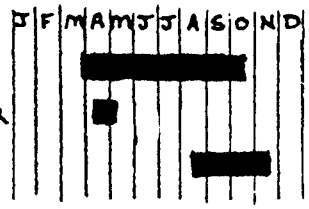
	HIGH ●	MEDIUM ◑	LOW ○
WILDLIFE VALUE	●		
POLLUTION EFFECT			
FLOOD TOLERANCE			○
EXPOSURE		◑	
WATER USE		◑	
HARDINESS	●		
DISEASE PRONE			○
MAINTENANCE			○
GROWTH RATE		◑	
LONGEVITY			○
DENSITY	●		

ARMAMENT

ROOT STRUCTURE: SHALLOW WIDESPREADING

COLOR: LEAF GOLD AND ORANGE; FLOWER WHITE; FRUIT BLUE to BLACK

PHASES



FORESTIERA PUBESCENS

NFOS

SPRING HERALD, DOWNY FORESTIERA
ELBOW BUSH

PROPAGATED EASILY BY SEED, CUTTINGS

EASILY TRANSPLANTED IF SEVERELY CUTBACK

THICKET FORMING

SIGNIFICANT ATTRIBUTES

HIGH WILDLIFE VALUE, DROUGHTY

GOOD for AREAS of DENSE SHADE TO FULL SUN

RECOMMENDED USES

GOOD BACKGROUND, EROSION CONTROL

NATURAL AREAS

AVOID

GROUNDCOVERS: WALK-ON; NON WALK-ON; UNDER 12"; 12"-18"; OVER 18"

SHRUBS: SMALL; MEDIUM ■; LARGE; FOUNDATION; HEDGE

TREES: 20-35' <; HEIGHT: 35'-50'; 50'-75'; 75'-100'

VINES: SELF-CLIMBING; FENCE; TRELLIS

ESPALLIER: SMALL; MEDIUM

TREES: 20'-35' <; SPREAD: 35'-50'; 50'-75'; 75'+

LEAF TEXTURE: FINE; MEDIUM; COARSE

BRANCH TEXTURE: FINE; MEDIUM; COARSE

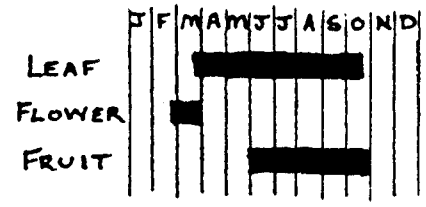
	HIGH ●	MEDIUM ◑	LOW ○
WILDLIFE VALUE			●
POLLUTION EFFECT			
FLOOD TOLERANCE			
EXPOSURE		◑	
WATER USE			
HARDINESS		●	
DISEASE PRONE			○
MAINTENANCE			○
GROWTH RATE			
LONGEVITY			
DENSITY			

ARMAMENT

ROOT STRUCTURE

COLOR: LEAF; FLOWER: GREENISH; FRUIT: PURPLE-BLACK

PHASES



JUGLANS NIGRA
BLACK WALNUT

NFOS

PROPOGATED BY SEED, GRAFTING
DIFFICULT TO TRANSPLANT

SECRETES A PLANT TOXIN (PROTECTIVE)

SIGNIFICANT ATTRIBUTES
EDIBLE NUT, DROUGHTY

RECOMMENDED USES
LARGE SHADE TREE

PARKS, NATURAL AREAS

AVOID PROXIMITY TO GARDENS

GROUNDCOVERS: WALK-ON; NON WALK-ON; UNDER 12"; 12"-18"; OVER 18"

SHRUBS: SMALL; MEDIUM; LARGE; FOUNDATION; HEDGE

TREES — HEIGHT: 20-35'; 35'-50'; 50'-75'; 75-100' ■

ESPALLIER: SMALL; MEDIUM

TREES — SPREAD: 20'-35'; 35'-50'; 50'-75'; 75'+ ■

VINES: SELF-CLIMBING; FENCE; TRELLIS

LEAF TEXTURE: FINE; MEDIUM ■; COARSE

BRANCH TEXTURE: FINE; MEDIUM; COARSE ■

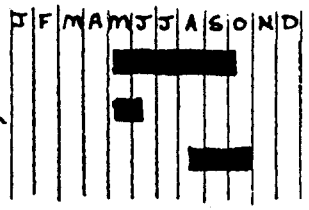
	HIGH	MEDIUM	LOW
WILDLIFE VALUE			○
POLLUTION EFFECT			○
FLOOD TOLERANCE		◑	
EXPOSURE	●		
WATER USE		◑	
HARDINESS	●		
DISEASE PRONE			○
MAINTENANCE			○
GROWTH RATE		◑	
LONGEVITY	●		
DENSITY			○

ARMAMENT

ROOT STRUCTURE: TAP

COLOR — LEAF: GOLDEN-YELLOW; FLOWER: YELLOW-GREEN; FRUIT: Y-G → BLACK

PHASES



FRAXINUS PENNSYLVANICA
GREEN ASH

NFOS

PROPAGATION BY SEED

EASILY MOVED.

SUBJECT TO WIND/ICE DAMAGE

SIGNIFICANT ATTRIBUTES

DROUGHTY

RECOMMENDED USES

NOT RECOMMENDED

AVOID HEAVY CLAYS

GROUNDCOVERS: WALK-ON; NON WALK-ON; UNDER 12"; 12"-18"; OVER 18"

SHRUBS: SMALL; MEDIUM; LARGE; FOUNDATION; HEDGE

TREES — HEIGHT: 20-35'; 35'-50'; 50'-75' ■; 75-100'

VINES: SELF-CLIMBING; FENCE; TRELLIS

ESPALLIER: SMALL; MEDIUM

TREES — SPREAD: 20'-35'; 35'-50' ■; 50'-75'; 75'+

LEAF TEXTURE: FINE; MEDIUM ■; COARSE

BRANCH TEXTURE: FINE; MEDIUM; COARSE ■

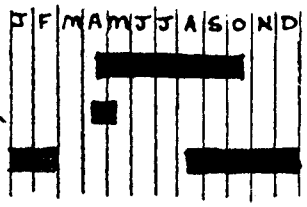
	HIGH	MEDIUM	LOW
WILDLIFE VALUE		◔	
POLLUTION EFFECT	●		
FLOOD TOLERANCE	●		
EXPOSURE	●		
WATER USE		◑	
HARDINESS	●		
DISEASE PRONE		◑	
MAINTENANCE		◔	
GROWTH RATE		◑	
LONGEVITY		◑	
DENSITY		◑	

ARMAMENT

ROOT STRUCTURE: SHALLOW FIBROUS

COLOR — LEAF: YELLOW/ORANGE; FLOWER: PURPLE; FRUIT: TAN BROWN

PHASES



PLATANUS OCCIDENTALIS

SYCAMORE, AMERICAN PLANETREE

NFOS

PROPAGATE BY SEED, CUTTING

EASILY TRANSPLANTED

SUBJECT TO WIND/ICE DAMAGE

SIGNIFICANT ATTRIBUTES

RECOMMENDED USES

PARK SCALE

AVOID WINDBREAKS, PARKING AREAS

GROUNDCOVERS: WALK-ON; NON WALK-ON; UNDER 12"; 12"-18"; OVER 18"

SHRUBS: SMALL; MEDIUM; LARGE; FOUNDATION; HEDGE

TREES — HEIGHT: 20-35'; 35'-50'; 50'-75'; 75-100' ■

VINES: SELF-CLIMBING; FENCE; TRELLIS

ESPALLIER: SMALL; MEDIUM

TREES — SPREAD: 20'-35'; 35'-50'; 50'-75'; 75'+ ■

	FINE	MEDIUM	COARSE
LEAF TEXTURE			■
BRANCH TEXTURE			■

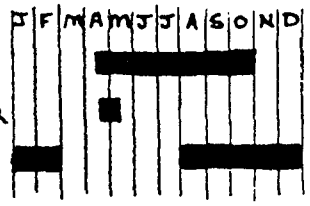
	HIGH ●	MEDIUM ◑	LOW ○
WILDLIFE VALUE			○
POLLUTION EFFECT		◑	
FLOOD TOLERANCE		◑	
EXPOSURE		◑	
WATER USE		◕	
HARDINESS	●		
DISEASE PRONE		◕	
MAINTENANCE		◕	
GROWTH RATE		◑	
LONGEVITY	●		
DENSITY			○

ARMAMENT

ROOT STRUCTURE: SHALLOW FIBROUS

COLOR: LEAF TAN-BROWN; FLOWER YELLOW-GREEN; FRUIT TAN-BROWN

PHASES



JUNIPERUS ASHEI

ASHE JUNIPER

NFOS

PROPAGATED BY SEED

SIGNIFICANT ATTRIBUTES

APPARENTLY DOES NOT CARRY THE CEDAR-APPLE RUST

RECOMMENDED USES

SMALL SHADE TREE, WINDBREAKS

SPECIMEN

AVOID SOUTH LOT AREAS

GROUNDCOVERS: WALK-ON; NON WALK-ON; UNDER 12"; 12"-18"; OVER 18"

VINES: SELF-CLIMBING; FENCE; TRELLIS

SHRUBS: SMALL; MEDIUM; LARGE; FOUNDATION; HEDGE ■

ESPALLIER: SMALL; MEDIUM

LEAF TEXTURE: FINE ■; MEDIUM; COARSE

TREES — HEIGHT: 20-35' ■; 35'-50'; 50'-75'; 75'-100'

TREES — SPREAD: 20'-35' ■; 35'-50'; 50'-75'; 75'+

BRANCH TEXTURE: FINE; MEDIUM ■; COARSE

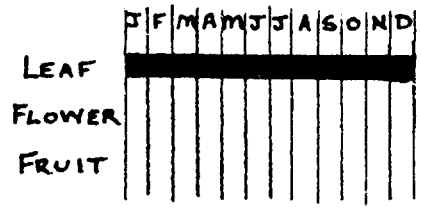
	HIGH ●	MEDIUM ◑	LOW ○
WILDLIFE VALUE	●		
POLLUTION EFFECT			○
FLOOD TOLERANCE			○
EXPOSURE	●		
WATER USE		◑	
HARDINESS	●		
DISEASE PRONE		◔	
MAINTENANCE			○
GROWTH RATE			○
LONGEVITY	●		
DENSITY	●		

ARMAMENT

ROOT STRUCTURE

COLOR — LEAF: EVERGREEN; FLOWER; FRUIT: BLUE

PHASES



BUCHLOE DACTYLOIDES
BUFFALO GRASS

LIMITED AVAILABILITY

NOT SHADE TOLERANT

SIGNIFICANT ATTRIBUTES

LOW MAINTENANCE, WATER USE

RECOMMENDED USES

RESIDENTIAL, RECREATION AREA

GROUNDCOVER

AVOID SHADE

GROUNDCOVERS WALK-ON ■
NON WALK-ON
UNDER 12" ■
12"-18"
OVER 18"

SHRUBS SMALL
MEDIUM
LARGE
FOUNDATION
HEDGE

TREES HEIGHT 20-35'
35'-50'
50'-75'
75'-100'

SPREAD 20'-35'
35'-50'
50'-75'
75'+

VINES SELF-CLIMBING
FENCE
TRELLIS

ESPALLIER SMALL
MEDIUM

LEAF TEXTURE FINE
MEDIUM
COARSE

BRANCH TEXTURE FINE
MEDIUM
COARSE

	HIGH	MEDIUM	LOW
WILDLIFE VALUE			
POLLUTION EFFECT			
FLOOD TOLERANCE			
EXPOSURE	●		
WATER USE			○
HARDINESS	●		
DISEASE PRONE			○
MAINTENANCE			○
GROWTH RATE			
LONGEVITY			
DENSITY			

ARMAMENT

ROOT STRUCTURE

COLOR LEAF
FLOWER
FRUIT

PHASES

	J	F	M	A	M	J	J	A	S	O	N	D
LEAF												
FLOWER												
FRUIT												

BOUTELOUA HIRSUTA
SIDE OATS GRAMMA

SIGNIFICANT ATTRIBUTES
LOW MAINTENANCE, WATER USE

RECOMMENDED USES
GOOD ACCENT AND BORDER
GROUNDCOVER - ALL AREAS

AVOID

GROUNDCOVERS: WALK-ON; NON WALK-ON ■; UNDER 12"; 12"-18"; OVER 18" ■

SHRUBS: SMALL; MEDIUM; LARGE; FOUNDATION; HEDGE

TREES — HEIGHT: 20-35'; 35'-50'; 50'-75'; 75'-100'

VINES: SELF-CLIMBING; FENCE; TRELLIS

ESPALLIER: SMALL; MEDIUM

TREES — SPREAD: 20'-35'; 35'-50'; 50'-75'; 75'+

LEAF TEXTURE: FINE; MEDIUM; COARSE

BRANCH TEXTURE: FINE; MEDIUM; COARSE

	HIGH	MEDIUM	LOW
WILDLIFE VALUE			
POLLUTION EFFECT			
FLOOD TOLERANCE			
EXPOSURE	●		
WATER USE			○
HARDINESS	●		
DISEASE PRONE			○
MAINTENANCE			○
GROWTH RATE			
LONGEVITY			
DENSITY			

ARMAMENT

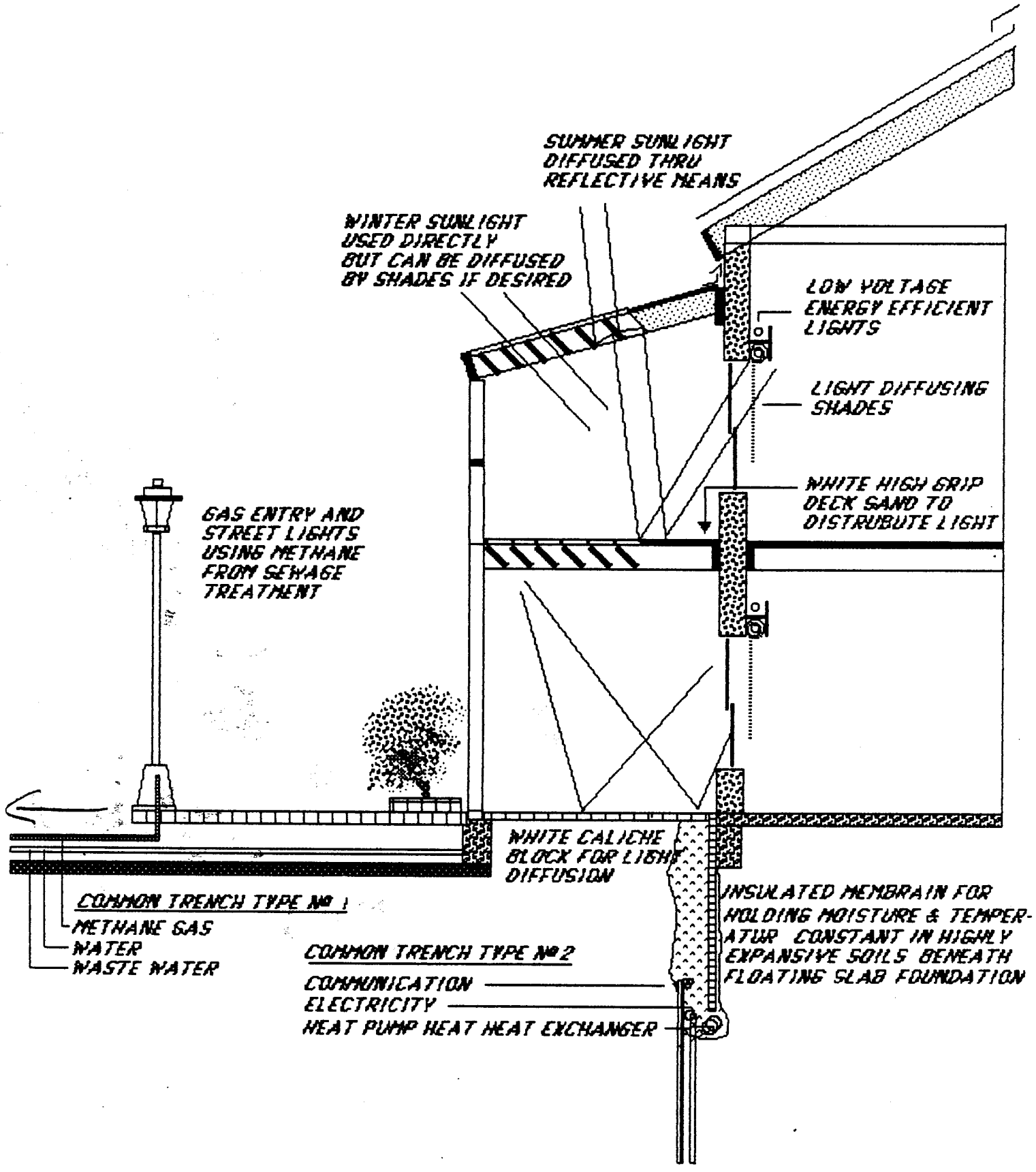
ROOT STRUCTURE

COLOR: LEAF; FLOWER; FRUIT

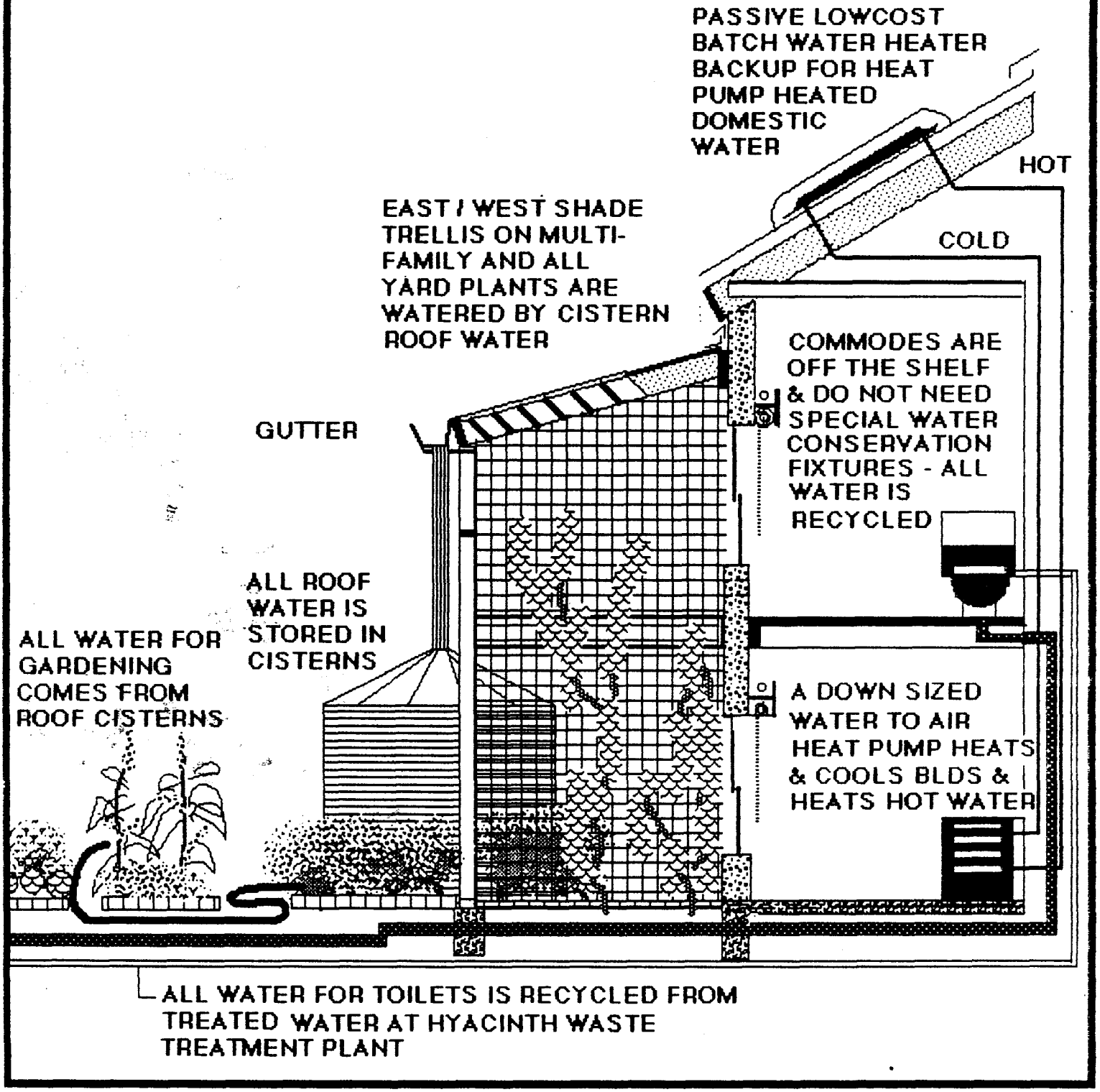
PHASES

	J	F	M	A	M	J	J	A	S	O	N	D
LEAF												
FLOWER												
FRUIT												

LIGHT/ GAS/ ELECTRICITY

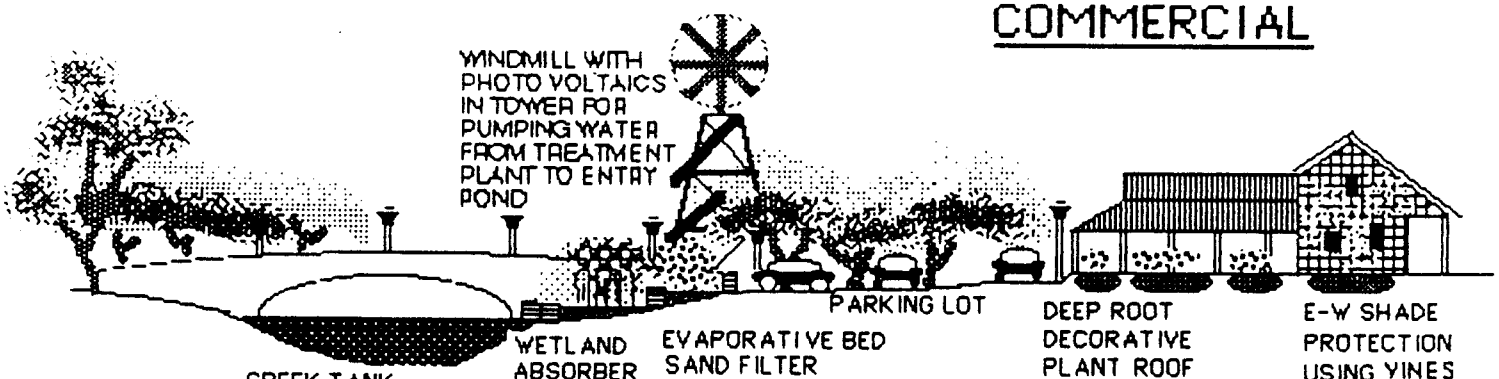


WATER / HOT WATER / WASTE WATER



HIGH CLAY SOIL URBAN RUNOFF PLAN

COMMERCIAL



MULTI & SINGLE FAMILY RESIDENTIAL

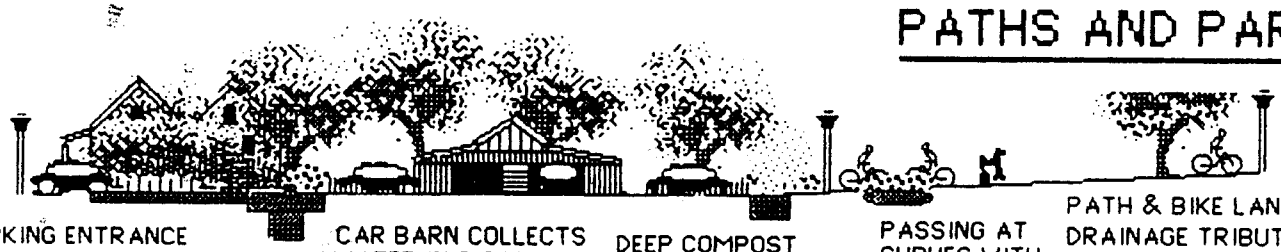
SINGLE FAMILY WITH CISTERN AND GARDEN

MULTI-FAMILY WITH CISTERNS AND GARDENS

CAR BARN WITH CISTERNS-LOWERS RUNOFF & HEAT GAIN IN PARKING AREAS

MULTI-FAMILY WITH CISTERNS AND GARDENS

PATHS AND PARKING



PARKING ENTRANCE PLANTING IN DEEP COMPOSTED ABSORBERS TO CONTROL RUNOFF INTO STREET USING OIL TOLERANT PLANTS AT EDGES

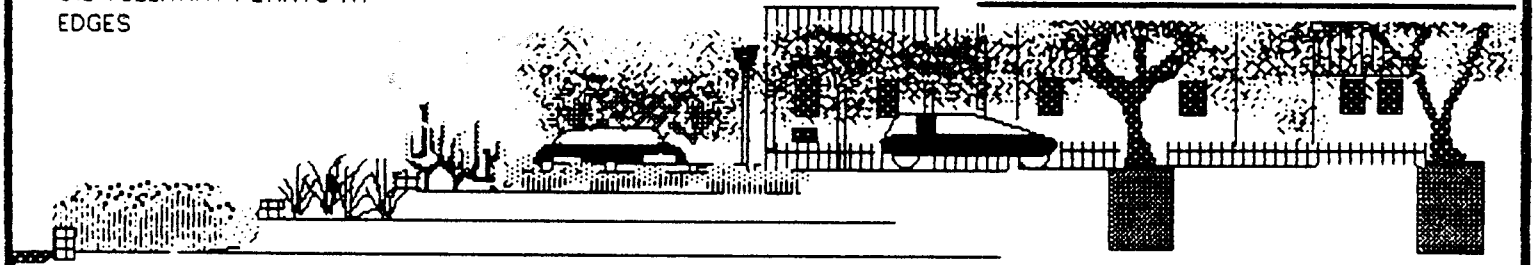
CAR BARN COLLECTS WATER IN CISTERNS THUS REDUCING RUNOFF & SAVES WATER FOR DRY PERIODS

DEEP COMPOST PLANTER ABSORBER AT JUNCTURE BETW PATH & PARKING

PASSING AT CURVES WITH SWALE ABSORBER

PATH & BIKE LANE AS DRAINAGE TRIBUTARY

STREET & CUL-DE-SAC



CREEK WITH GABIONS USED AS WETLAND BANK AND FLOOD CONTROL

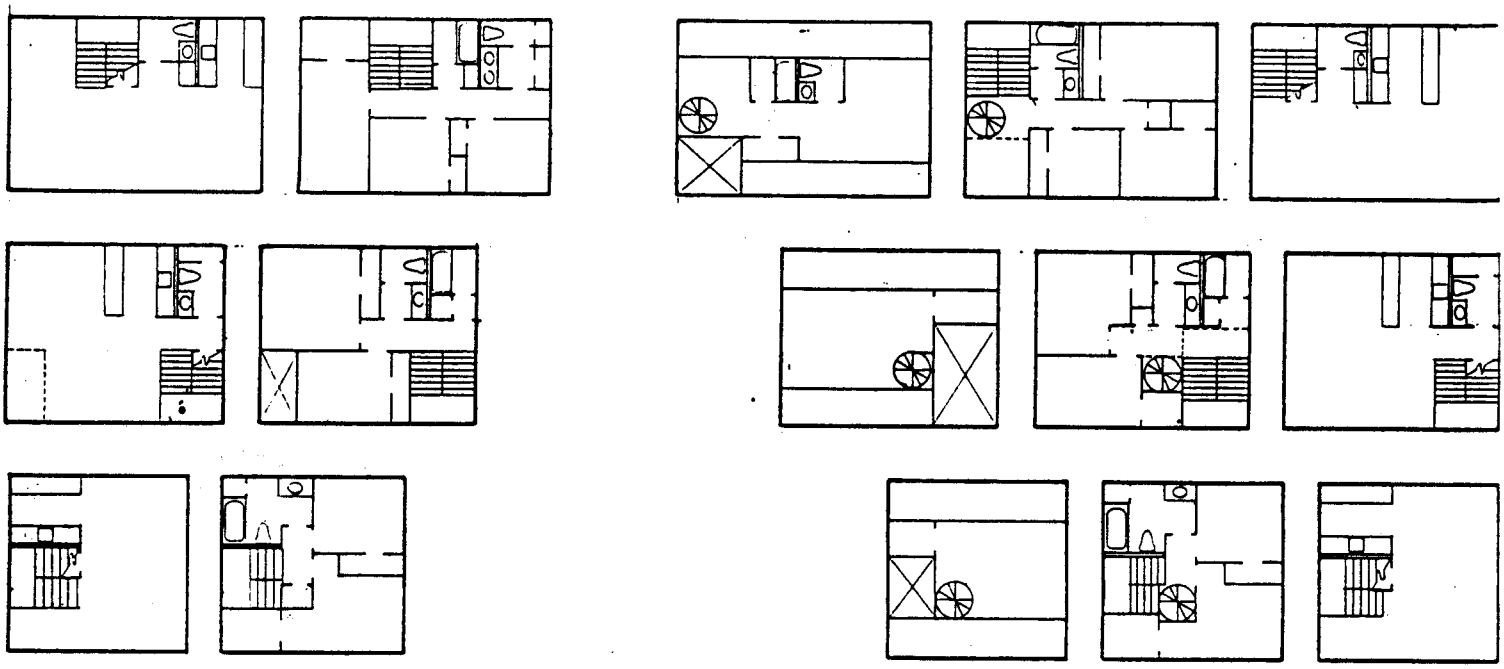
LOWER TIER WETLAND PLANT SPECIES

MIDDLE LEVEL FLOOD PRONE PLANT SPECIES

UPPER TIER GRASSES AND DRY LAND PLANT SPECIES AT CUL-DE SAC DISTRIBUTOR

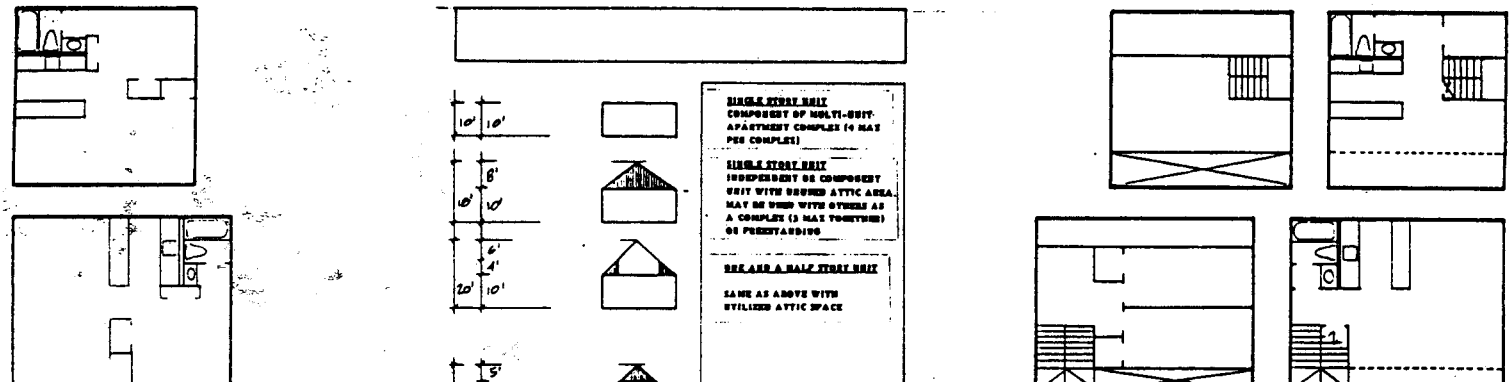
COMPOSTED ABSORBER WELL FOR FLOOD TOLERANT TREE SPECIES TOWARDS END OF CUL-DE-SAC

PLANS

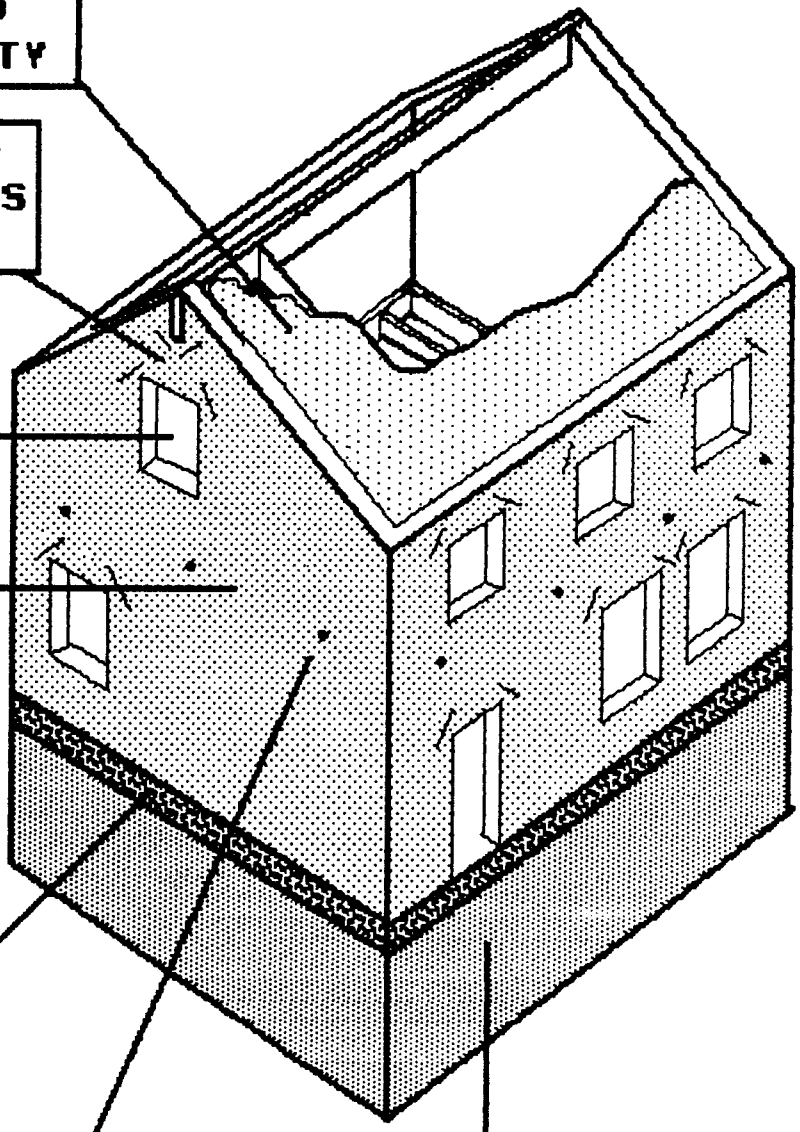


MULTI-FAMILY PLAN DESCRIPTION

- PLANS MAY BE FLIPPED ON EAST/WEST AXIS BUT NOT ON NORTH/SOUTH AXIS -- PLANS ALLOW FOR BREEZES, SOLAR ACCESS BUT ALSO ENTRY ON ANY FOUR SIDES FOR DESIGN FLEXIBILITY
- ALL PLANS ORIENTED AROUND SINGLE PLUMBING WALL (SEE KITCHENS & BATHS)
- SMALL, MEDIUM, AND LARGE PLANS RANGE FROM SINGLE STORY TO 2 1/2 STORY (400 SQ. FT. EFFICIENCY-1344 SQ. FT. 4 BEDROOM)
- EAST/WEST WALLS NEVER MORE THAN 28', NEVER LESS THAN 20'; NOTHING SEEMS BIGGER THAN 2 STORIES. LARGEST POSSIBLE UNIT IS 2 1/2 STORY 28'X60' BUILDING. SMALLEST POSSIBLE UNIT IS 1 STORY 20'X20' BUILDING.
- PORCHES ARE ADDED DEPENDING ON ORIENTATION; SMALL SHED ADD-ONS FOR STORAGE AND LAUNDRY ARE ADDED AS WELL, BUT NOT SO AS TO INTERFERE WITH BASIC ORIENTATIONS. THESE LEND CHARACTER AND DIVERSITY OF DESIGNS.
- SOME UNITS STACKABLE WITH EACH OTHER, OTHERS CAN SHARE COMMON WALLS.



STRUCTURAL AND FABRICATION SYSTEM



LIGHT WEIGHT R- 3.9/IN FLYASH CONCRETE FORMED WITHIN WOOD JOIST CAVITY

REINFORCING BAR PLACED AND TIED ONTO SPREADERS OF PERMANENT FORM

WINDOW AND DOOR OPENINGS CAN BE CUT AND TRIMMED AFTER POURING THUS REDUCING FORMWORK TIME & COST

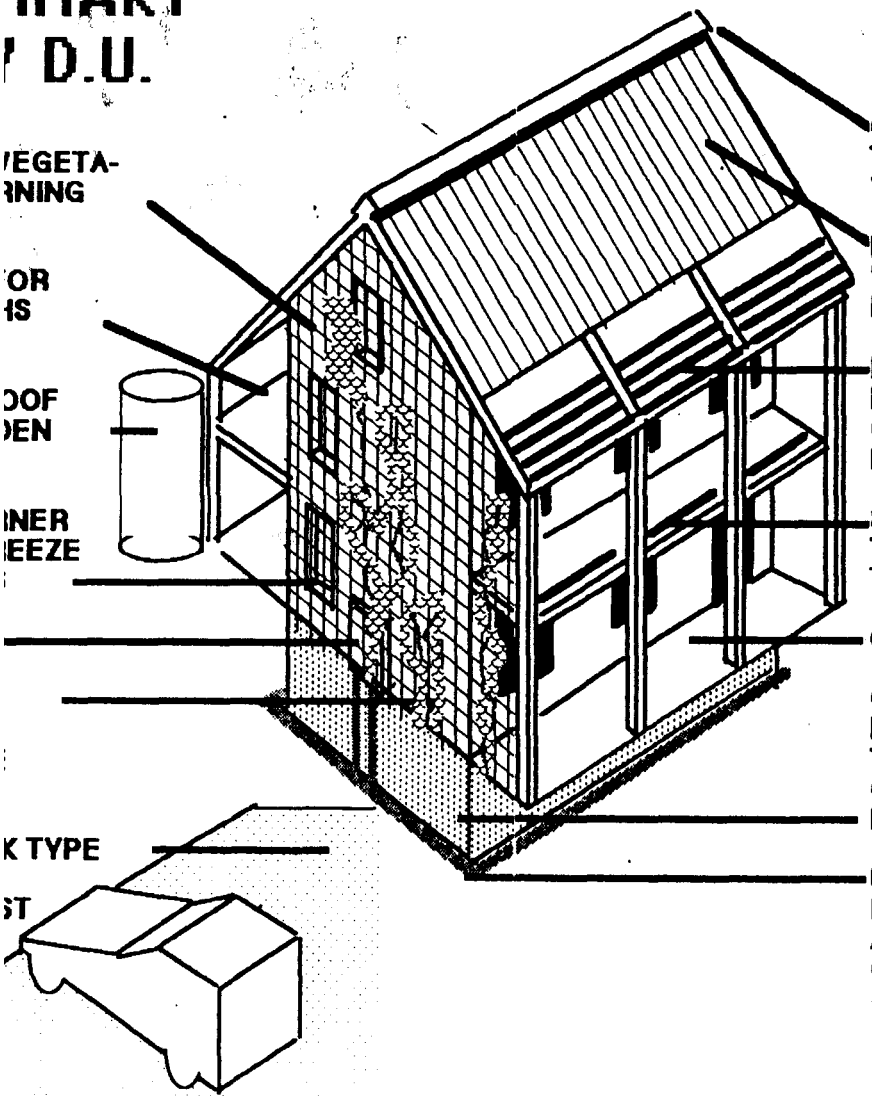
100% 40LB/FT3 FLY-ASH CEMENT, CURED IN-SIDE THERMALLY INSULATED FORM (INSIDE FORM RE-MOVED AFTER CURE FOR PROPER THERMAL PERFORMANCE)

2500 PSI FLYASH CEMENT (NON-PRE-STRESSED) FLOATING SLAB

MAIN JOIST ATTACHMENT CAN BE DRILLED AND BOLTED THROUGH LIGHTWEIGHT FLYASH BEARING WALL

HIGH SHRINK SWELL SOILS PRE-WETTED AND CONFINED INSIDE MEMBRAIN TO CONTROL POTENTIAL FOUNDATION PROBLEM

1MARY
/ D.U.



/EGETA-
RNING

OR
IS

OOF
EN

INER
EEZE

K TYPE

ST

CONTINUOUS WELL SIZED RIDGE VENT TO ENSURE ADEQUATE ROOF AND ATTIC VENTILATION

LARGE CHANNEL SIMULATED TILE ROOF WITH RADIANT BARRIER BENEATH FOR LOW HEAT GAIN IN ROOF

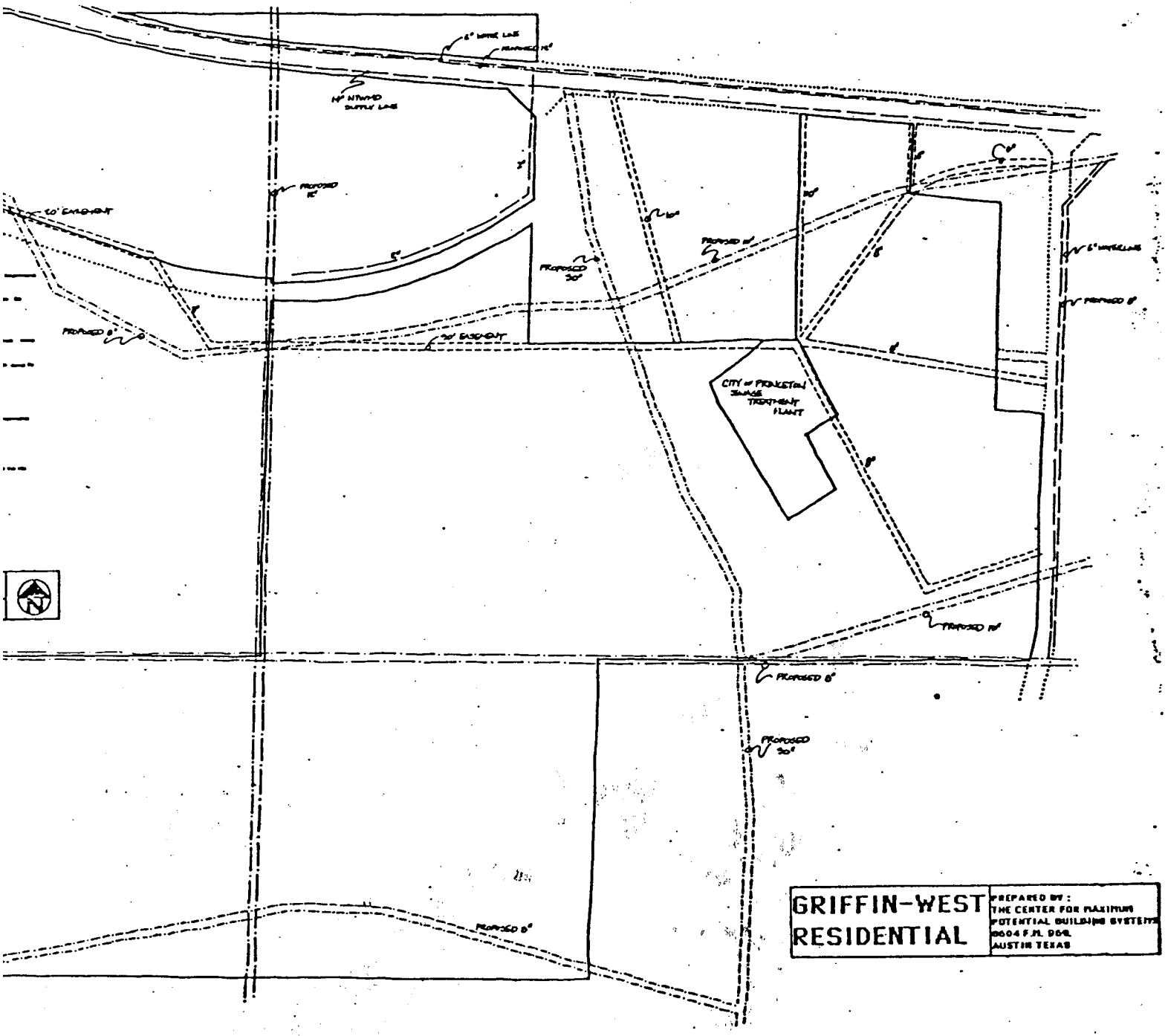
LOVERED SOUTH PORCH ROOF TO PREVENT HEAT GAIN UNDER EAVES AND TO CORESPOND TO GEOMETRY OF THE SUN FOR PROPER WINTER SOLAR ACCESS

SOUTH PORCH AS SOLAR OVER HANG TO PREVENT SUMMAR HEAT GAIN THROUGH WINDOW AREAS

CALICHE BLOCK PORCH FLOOR AND PATHWAYS

CLOSED CELL INSULATION PLACED 4-5 FEET INTO SOIL TO PRODUCE CONSTANT TEMPERATURE ISLAND FOR ENERGY CONSERVATION AND TO PRODUCE CONSTANT MOISTURE FOR LIMITED SHRINK/SWELL

USE OF BOTTOM OF MOISTURE/HEAT BARRIER TRENCH AS DITCH FOR LIQUID TO AIR HEAT PUMP THUS TRTIPPLING THE USE OF THIS DITHING EFFORT AND REDUCING COSTS


CITY OF PFLUGERVILLE
SEWAGE
TREATMENT
PLANT
GRIFFIN-WEST
RESIDENTIAL
PREPARED BY :
THE CENTER FOR MAXIMUM
POTENTIAL BUILDING SYSTEMS
8604 F.M. 969
AUSTIN TEXAS

TECTION JANUARY

1:200'

- WIND REDUCTION

/IND ACCELERATION

F WIND DIRECTION FOR JANUARY

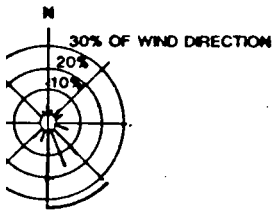
OSE

SE JULY

REEZES 1-200

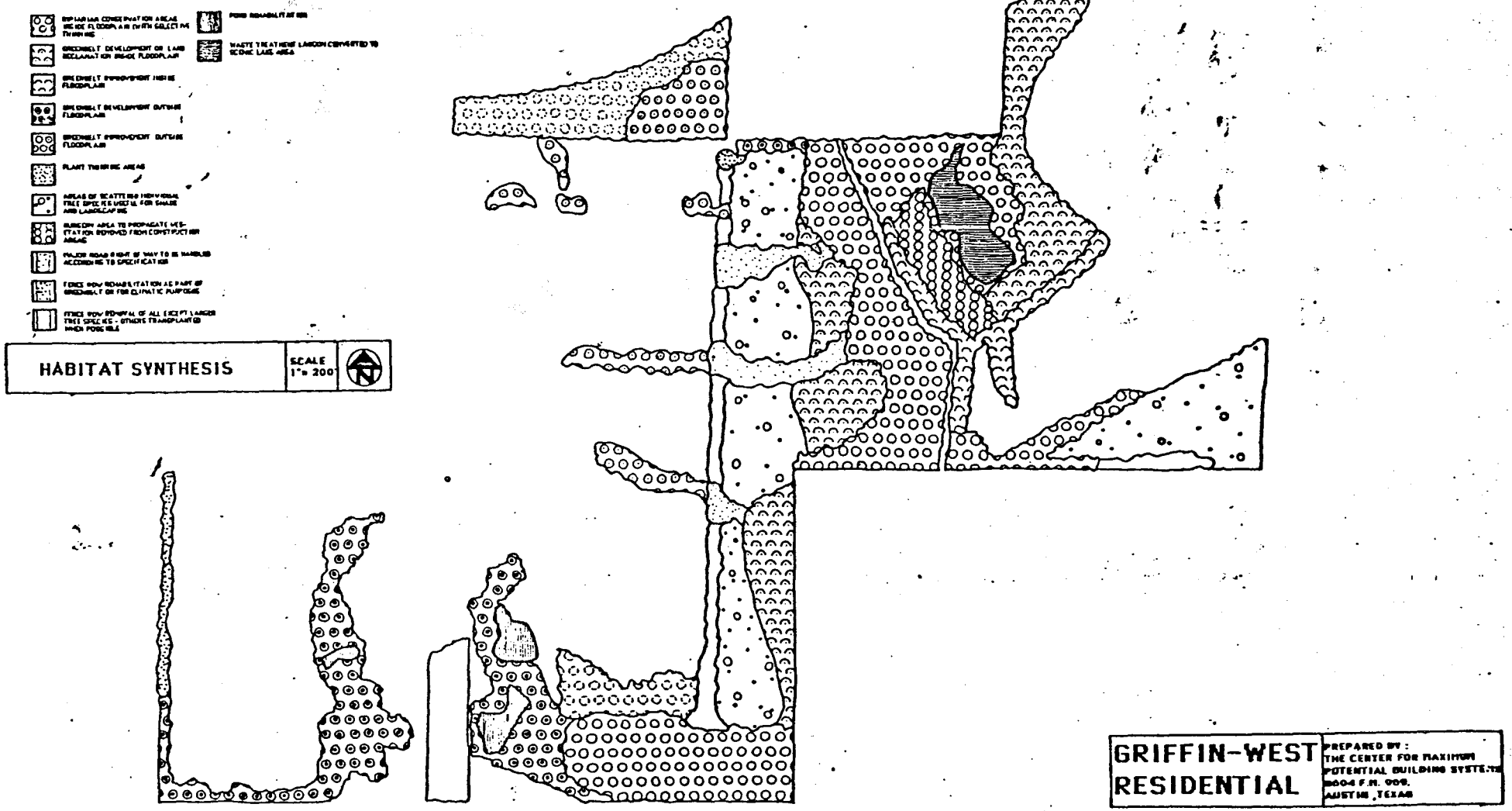
ANTIAL BREEZE REDUCTION

IAL BREEZE ACCELERATION



59% OF WIND DIRECTION FOR JULY

IOSE


HABITAT SYNTHESIS
SCALE
1" = 200'
GRIFFIN-WEST
RESIDENTIAL
PREPARED BY :
THE CENTER FOR MAXIMUM
POTENTIAL BUILDING SYSTEMS
8004 F.M. 969
AUSTIN, TEXAS

SHADOW

1"=200'

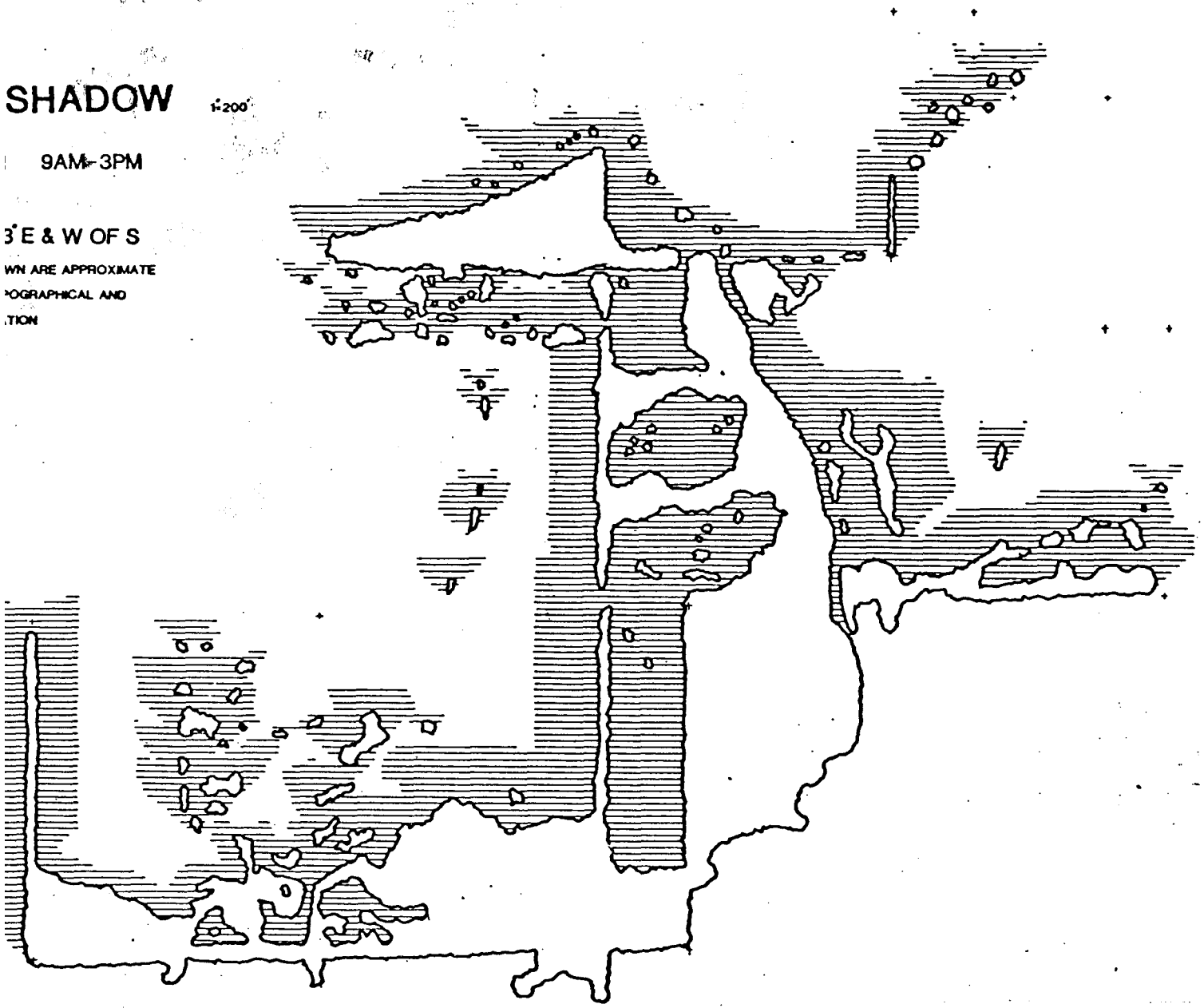
9AM-3PM

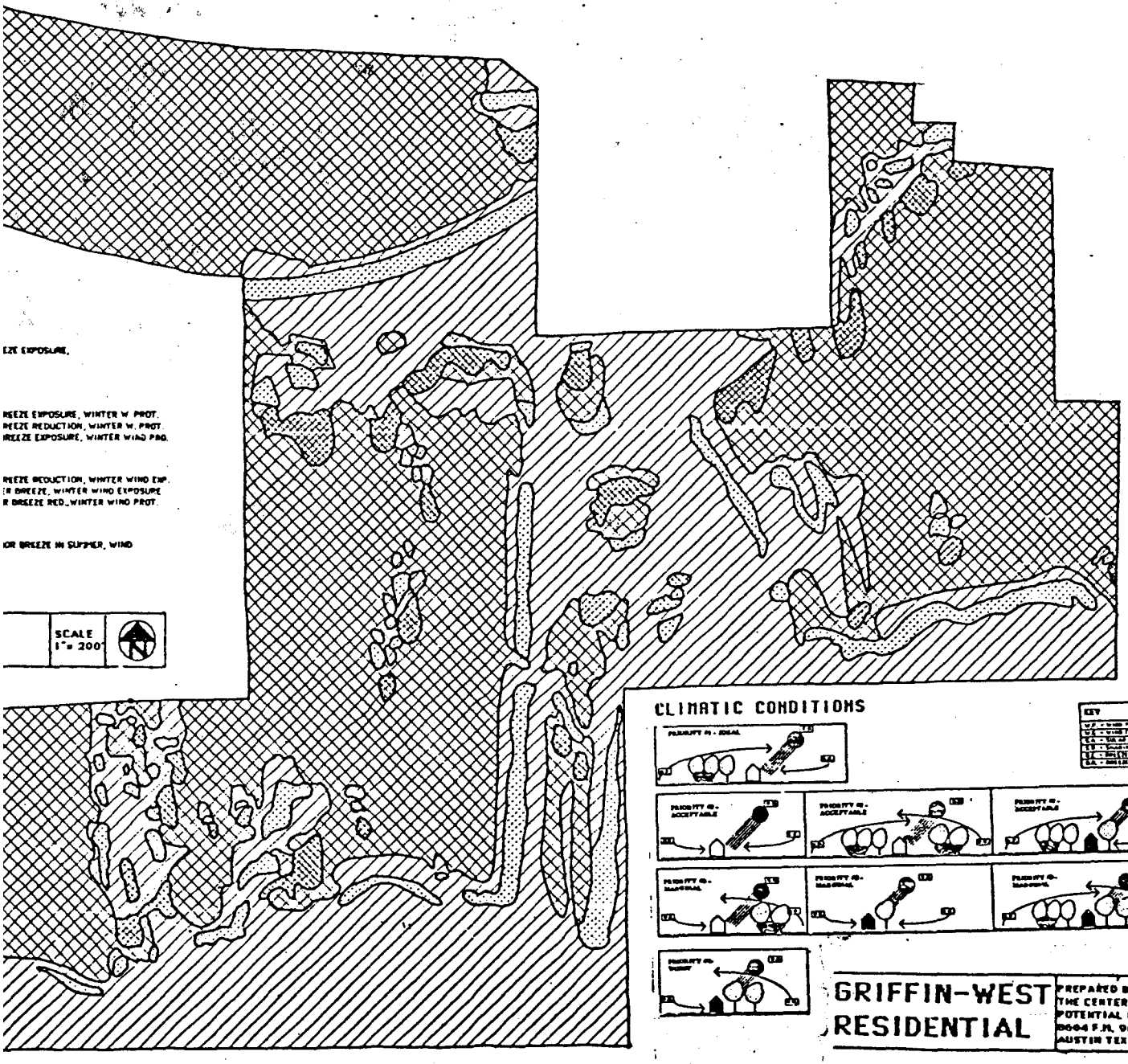
3° E & W OF S

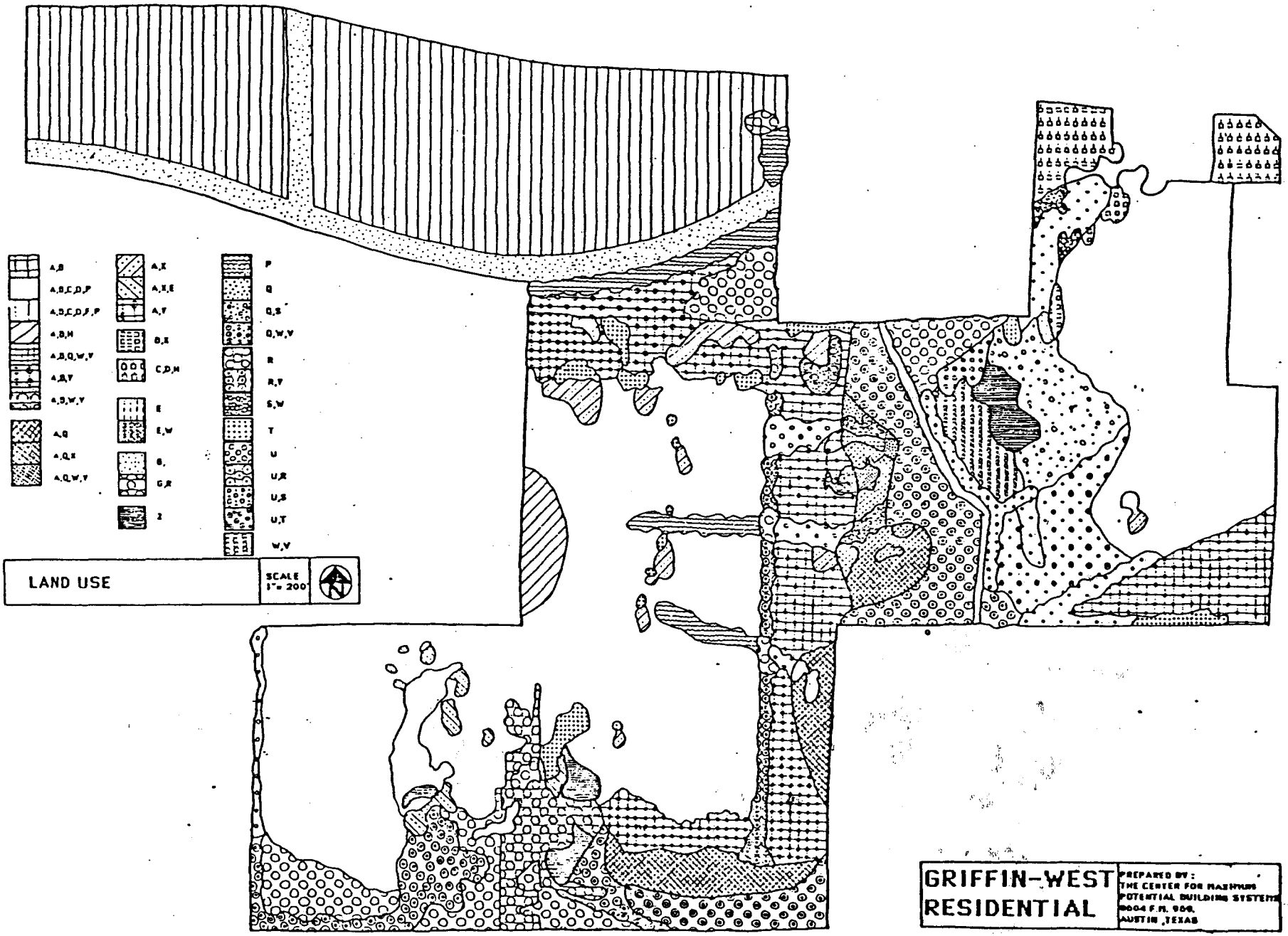
WN ARE APPROXIMATE

OGRAPHICAL AND

TION

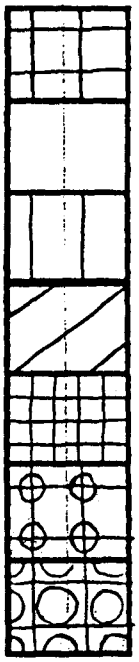



EZE EXPOSURE,
REEZE EXPOSURE, WINTER W. PROT.
REEZE REDUCTION, WINTER W. PROT.
REEZE EXPOSURE, WINTER WIND PRO.
REEZE REDUCTION, WINTER WIND EXP.
R BREEZE, WINTER WIND EXPOSURE
R BREEZE RED., WINTER WIND PROT.
OR BREEZE IN SUMMER, WIND
SCALE
1"= 200'
CLIMATIC CONDITIONS
KEY
GRIFFIN-WEST
RESIDENTIAL
PREPARED BY :
THE CENTER FOR MAXIMUM
POTENTIAL BUILDING SYSTEMS
8604 F.M. 969
AUSTIN TEXAS


A,B
A,B,C,D,P
A,B,C,D,F,P
A,B,H
A,B,Q,W,V
A,B,V
A,B,W,V
A,Q
A,Q,X
A,Q,W,V
A,X
A,X,E
A,Y
B,X
C,D,H
E
E,W
G,
G,R
Z
P
Q
Q,S
Q,W,V
R
R,Y
S,W
T
U
U,R
U,S
U,T
W,V
LAND USE
SCALE 1"= 200'
GRIFFIN-WEST RESIDENTIAL
PREPARED BY :
THE CENTER FOR MAXIMUM POTENTIAL BUILDING SYSTEMS
8604 F.M. 969,
AUSTIN ,TEXAS

GRIFFIN-WEST RESIDENTIAL

PREPARED BY :
THE CENTER FOR MAXIMUM POTENTIAL BUILDING SYSTEMS
8604 F.M. 969.
AUSTIN ,TEXAS



A,B

A,B,C,D,P

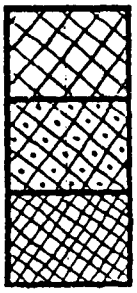
A,B,C,D,F,P

A,B,H

A,B,Q,W,Y

A,B,Y

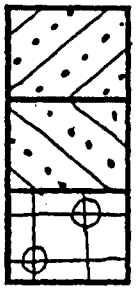
A,B,W,Y



A,Q

A,Q,X

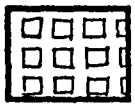
A,Q,W,Y



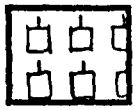
A,X

A,X,E

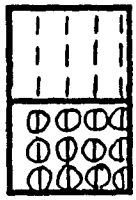
A,Y



B,X

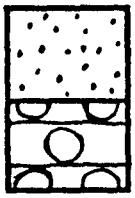


C,D,H



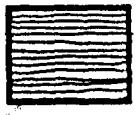
E

E,W

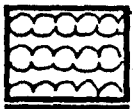


G,

G,R



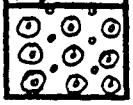
Z



P

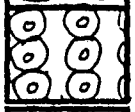
Q

Q,S

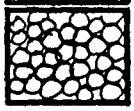


Q,W,V

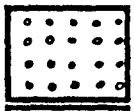
R



R,Y

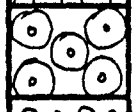


S,W

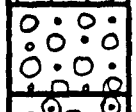


T

U

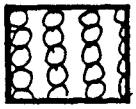


U,R



U,S

U,T



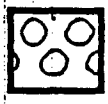
W,V

LAND USE

SCALE
1"= 200'

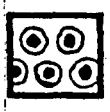
GRIFFIN-WEST RESIDENTIAL

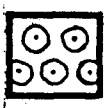
PREPARED BY :
THE CENTER FOR MAXIMUM POTENTIAL BUILDING SYSTEMS
8604 F.M. 969.
AUSTIN ,TEXAS


RIPIARIAN CONSERVATION AREAS INSIDE FLOODPLAIN (WITH SELECTIVE THINNING

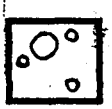

GREENBELT DEVELOPMENT OR LAND RECLAMATION INSIDE FLOODPLAIN

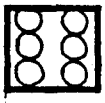

GREENBELT IMPROVEMENT INSIDE FLOODPLAIN


GREENBELT DEVELOPMENT OUTSIDE FLOODPLAIN


GREENBELT IMPROVEMENT OUTSIDE FLOODPLAIN


PLANT THINNING AREAS


AREAS OF SCATTERED INDIVIDUAL TREE SPECIES USEFUL FOR SHADE AND LANDSCAPING


NURSERY AREA TO PROPAGATE VEGETATION REMOVED FROM CONSTRUCTION AREAS


MAJOR ROAD RIGHT OF WAY TO BE HANDLED ACCORDING TO SPECIFICATION


FENCE ROW REHABILITATION AS PART OF GREENBELT OR FOR CLIMATIC PURPOSES


FENCE ROW REMOVAL OF ALL EXCEPT LARGER TREE SPECIES - OTHERS TRANSPLANTED WHEN POSSIBLE

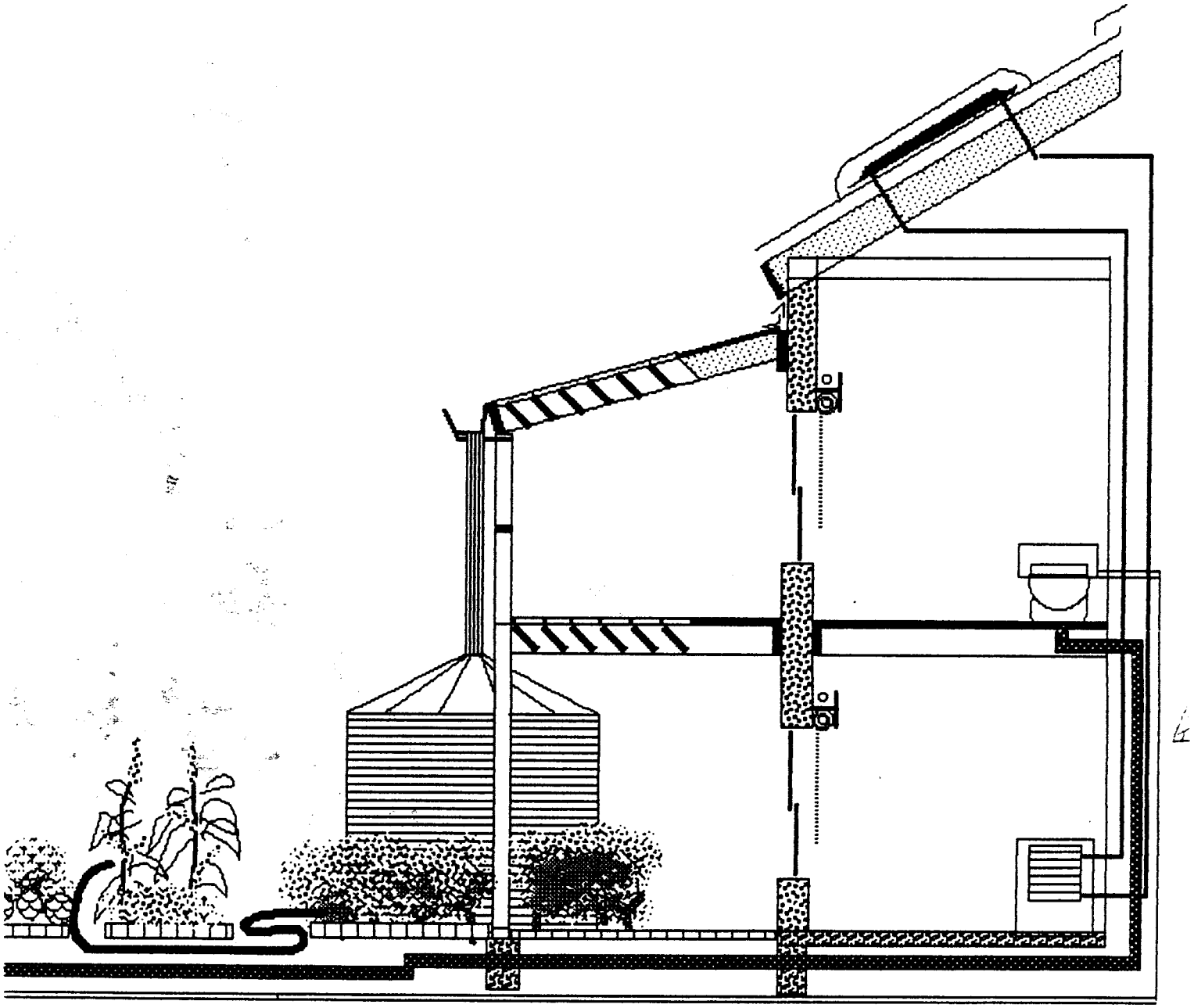

POND REHABILITATION

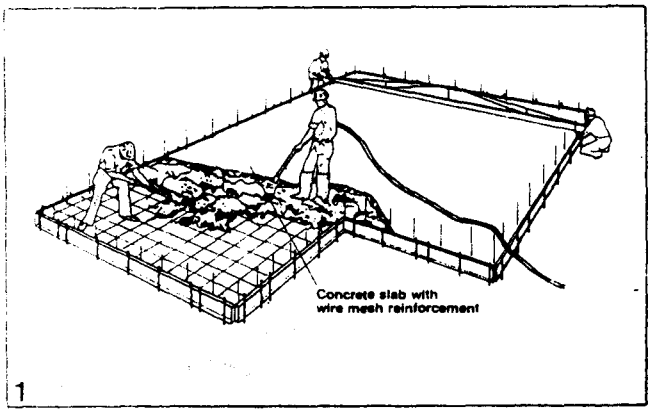

WASTE TREATMENT LAGOON CONVERTED TO SCENIC LAKE AREA

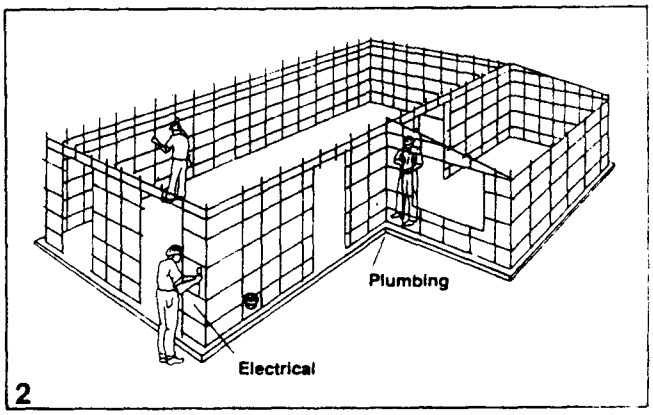
HABITAT SYNTHESIS

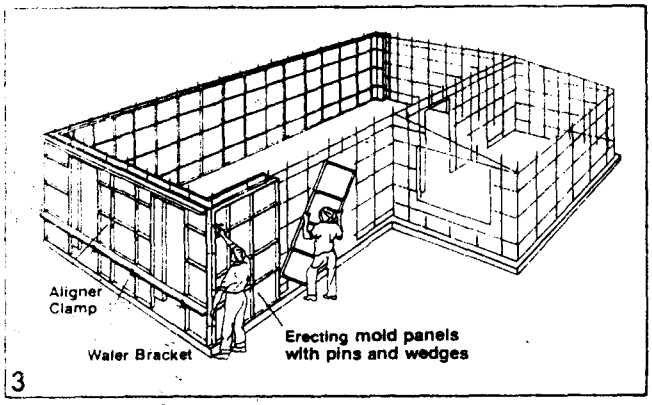
SCALE
1" = 200'

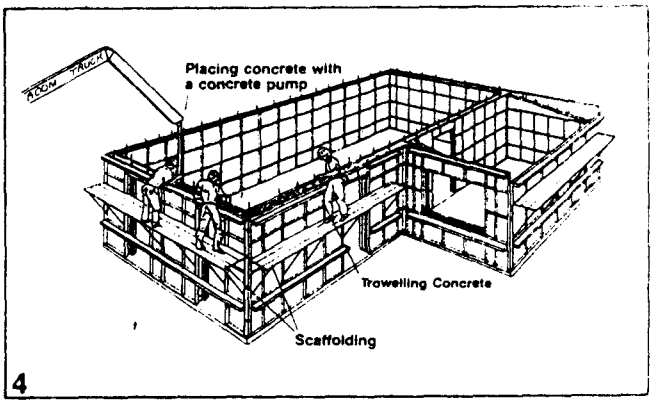
WATER / HOT WATER / WASTE DISPOSAL

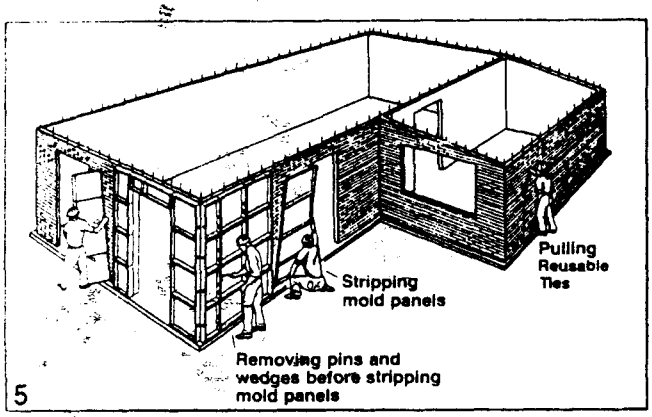


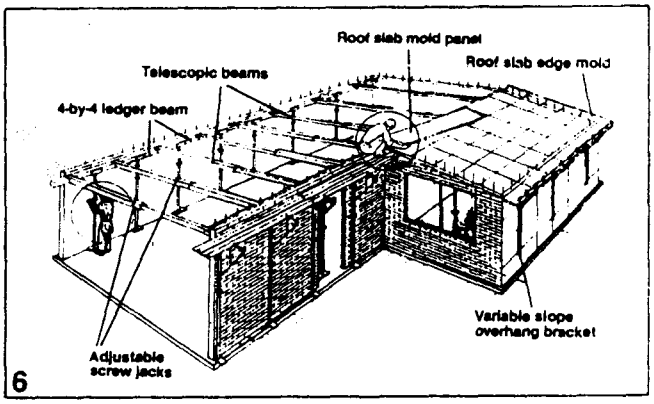




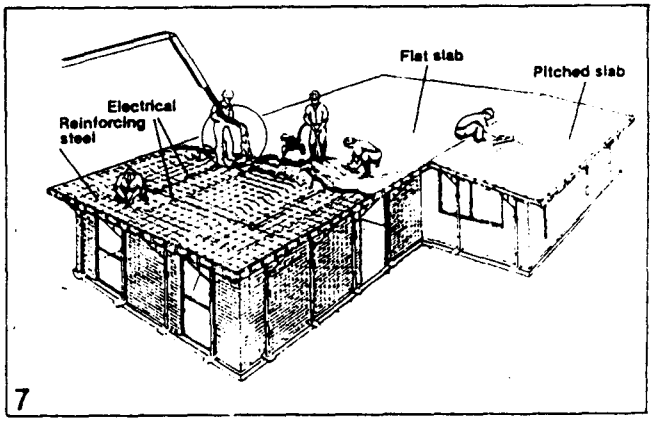








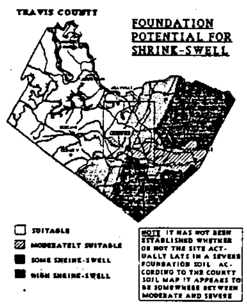
CONSTRUCTION SEQUENCE

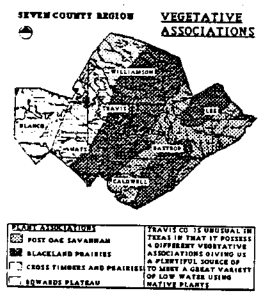


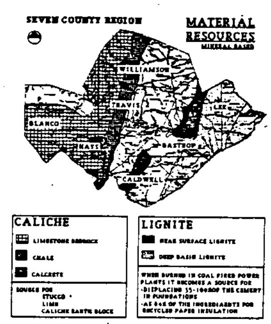
PLANNING PROCESS

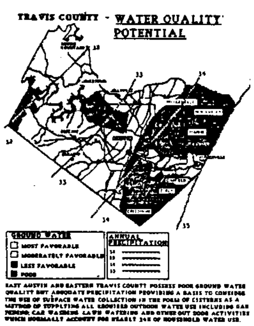
ECOLOGICAL LAND ANALYSIS

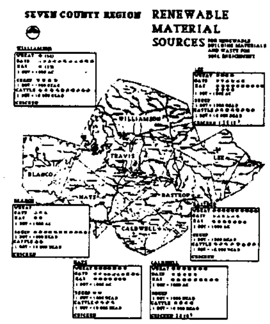
AREA RESOURCES

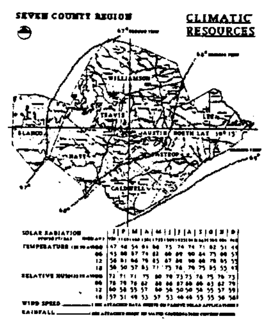




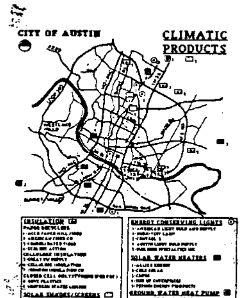


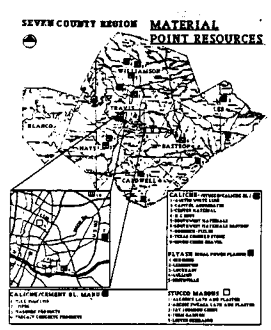


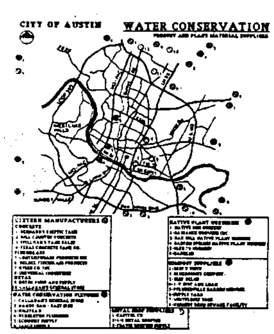




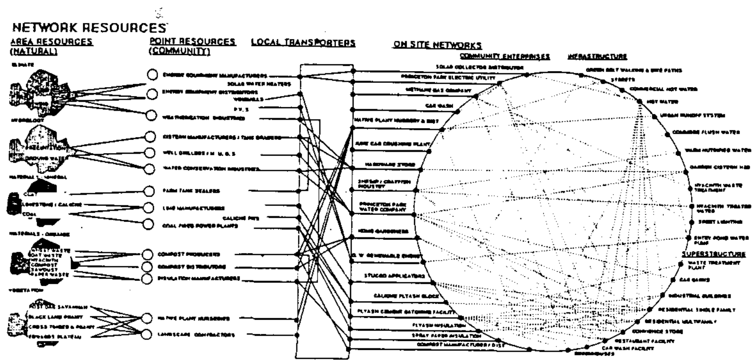
POINT RESOURCES

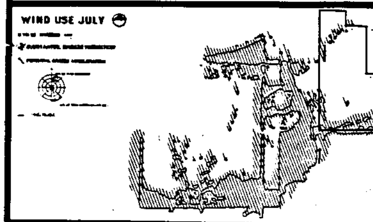


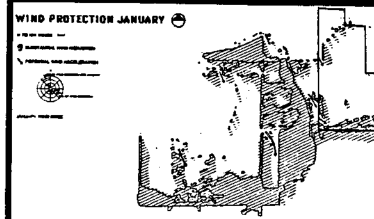


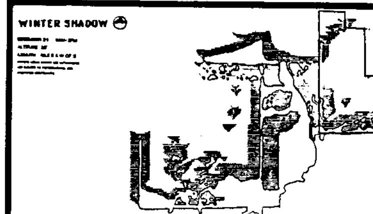


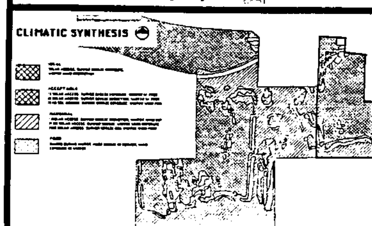
NETWORK RESOURCES

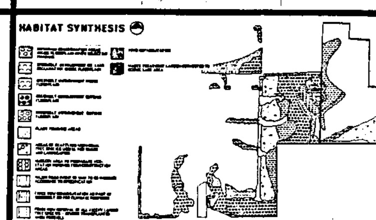


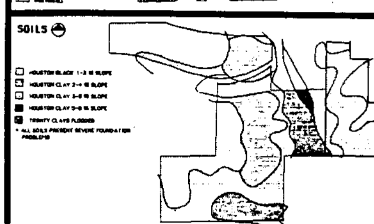


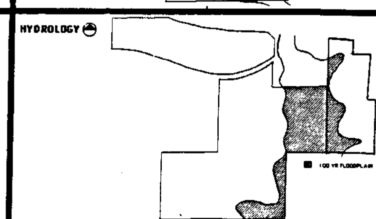


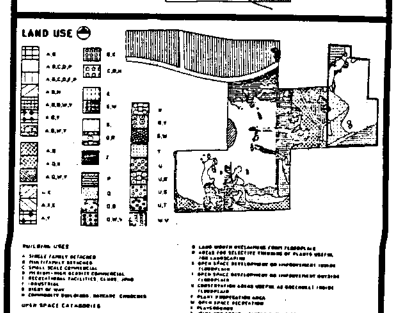




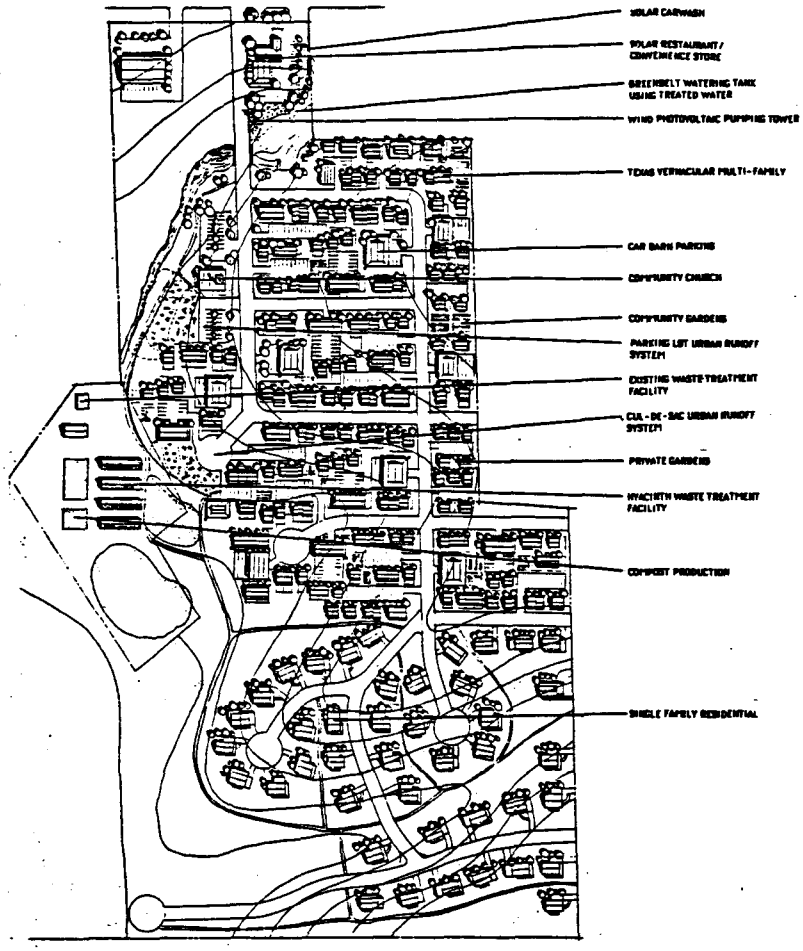








SITE PLAN



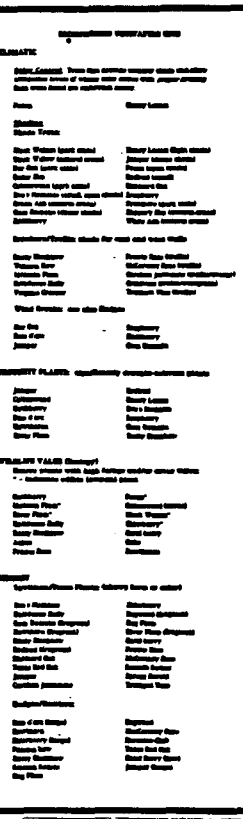
PLAN STATISTICS

SUPER-STRUCTURE

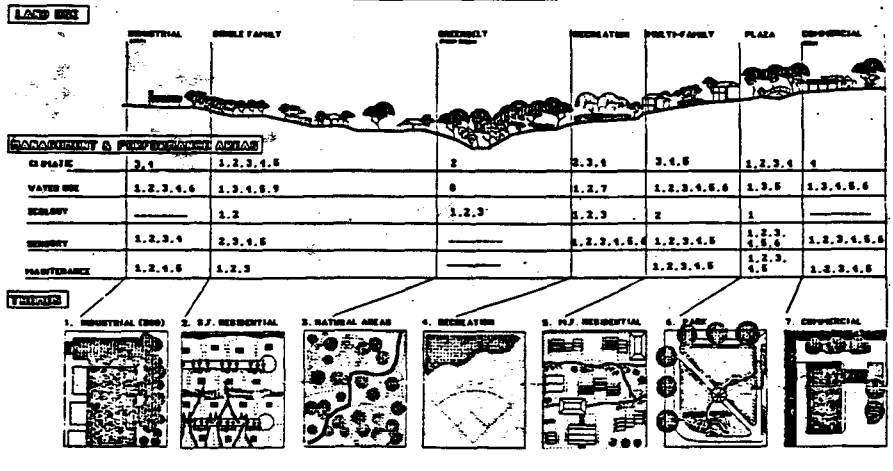
MULTI-FAMILY ——— 184 DWELLING UNITS
(48 BARNS ——— 10 BARNS
SINGLE FAMILY ——— 45 DWELLING UNITS
COMMERCIAL ——— 15,000 SQ. FT.

MICRO-STRUCTURE

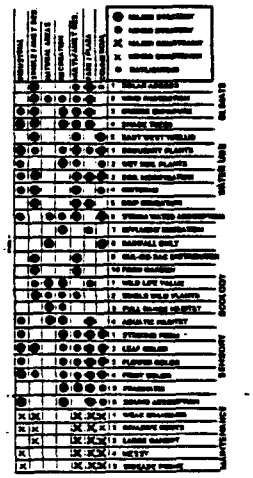
229 CISTERNS
229 SOLAR WATER HEATERS
11 5KW WIND/PV WATER PUMP TOWER
3 ACRES RUNOFF ABSORPTIVE WETLANDS
2 ACRE COMMODE WATER FLUSHING POND
120 METHANE OPERATED GAS STREET LIGHTS
11 24,000 CUBIC FT. METHANE SYSTEM
11 50 TON/YEAR WORMROW COMPOST FACILITY



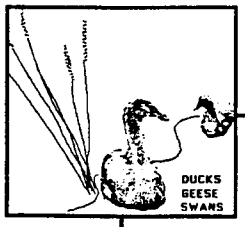
VEGETATIVE PLAN



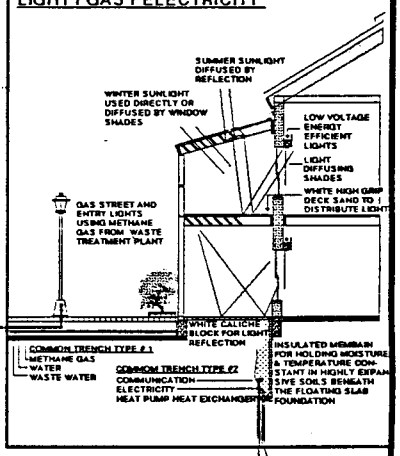
THEME DEVELOPMENT MATRIX

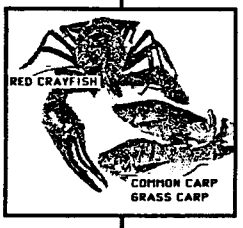


UTILITY SYSTEM

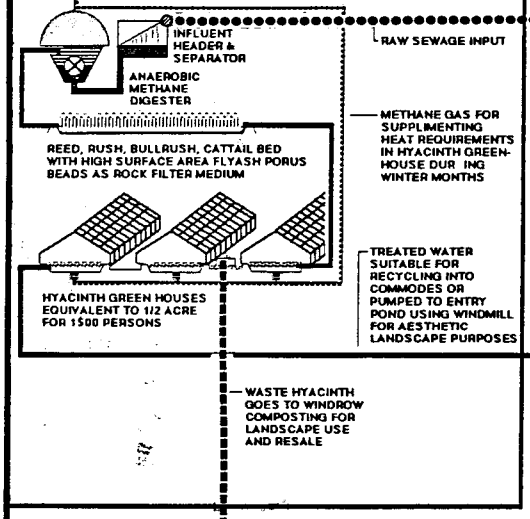


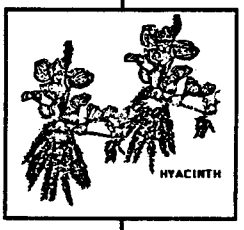
LIGHT / GAS / ELECTRICITY



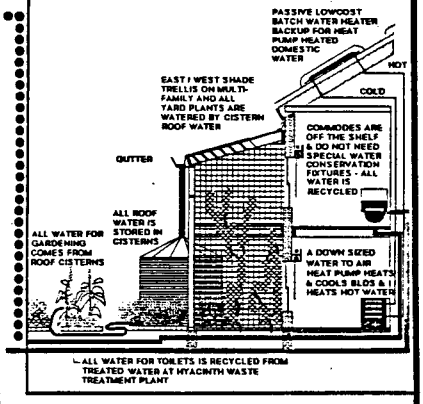


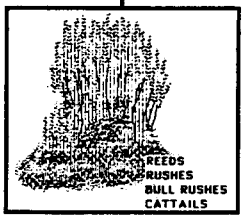
WASTE TREATMENT SYSTEM



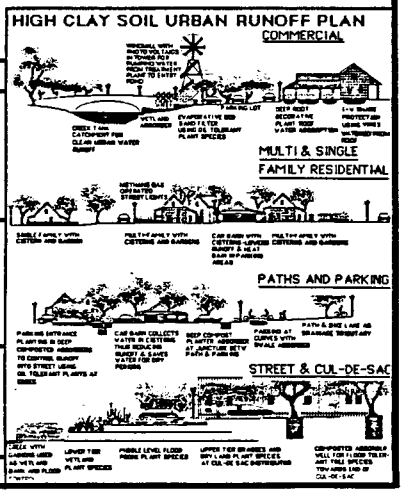


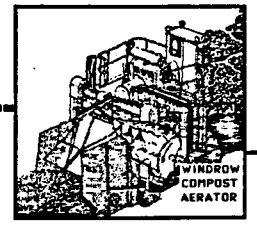
WATER / HOT WATER / WASTE WATER





HIGH CLAY SOIL URBAN RUNOFF PLAN

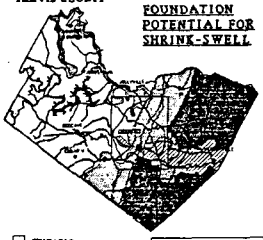




PLANNING PROCESS

AREA RESOURCES

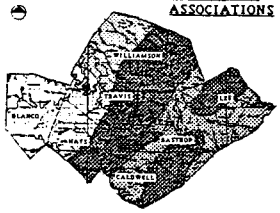
TRAVIS COUNTY — FOUNDATION POTENTIAL FOR SHRINK-SWELL



SUITABLE
MODERATELY SUITABLE
SOME SHRINK-SWELL
HIGH SHRINK-SWELL

NOTE: IT WAS NOT BEEN ESTABLISHED WHETHER OR NOT THE SITE ACTUALLY LAYS IN A SEVERE FOUNDATION SOIL ACCORDING TO THE COUNTY SOIL MAP IT APPEARS TO BE SOMEWHERE BETWEEN MODERATE AND SEVERE

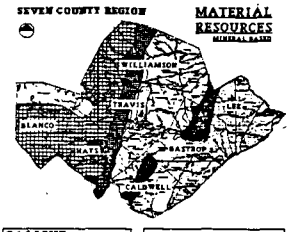
SEVEN COUNTY REGION — VEGETATIVE ASSOCIATIONS



PLANT ASSOCIATIONS
POST OAK SAVANNAH
BLACKLAND PRAIRIES
CROSS TIMBERS AND PRAIRIES
EDWARDS PLATEAU

TRAVIS CO IS UNIQUE IN TEXAS IN THAT IT POSSESS 4 DIFFERENT VEGETATIVE ASSOCIATIONS GIVING US A PLENTIFUL SOURCE OF TO MEET A GREAT VARIETY OF LOW WATER USING NATIVE PLANTS

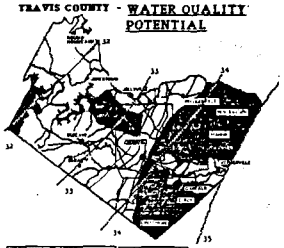
SEVEN COUNTY REGION — MATERIAL RESOURCES



CALICHE
LIMESTONE SUBGRADE
CHALK
CALCRETE
SOURCE FOR STUCCO, LIME, CALICHE EARTH BLOCK

LIGNITE
NEAR SURFACE LIGNITE
DEEP BASIN LIGNITE
WHEN BURNED IN COAL FIRED POWER PLANTS IT BECOMES A SOURCE FOR -BEDPLACING 35-100 BOP THE CEMENT IN PANHANDLE -AS 25% OF THE INGREDIENTS FOR RECYCLED PAPER INSULATION

TRAVIS COUNTY - WATER QUALITY POTENTIAL

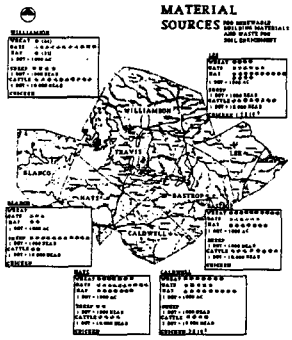


GROUND WATER
MOST FAVORABLE
MODERATELY FAVORABLE
LEAST FAVORABLE
POOR

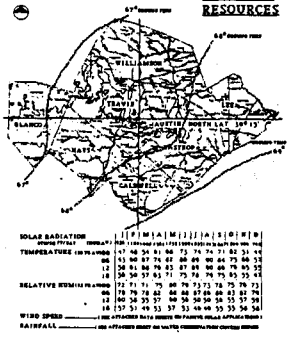
ANNUAL PRECIPITATION

SALT AUSTIN AND EASTERN TRAVIS COUNTY POSSESS POOR GROUND WATER QUALITY BUT ADEQUATE PRECIPITATION PROVIDING A BASIS TO CONSIDER THE USE OF SURFACE WATER COLLECTION IN THE FORM OF CISTERNS AS A METHOD OF SUPPLYING ALL NON-POTABLE OUTDOOR WATER FOR INCLUDING CAR WASHING CAR WASHING LAWN WATERING AND OTHER OUTDOOR ACTIVITIES WHICH NORMALLY ACCOUNT FOR NEARLY 1/4 OF HOUSEHOLD WATER USE.

SEVEN COUNTY REGION — RENEWABLE MATERIAL SOURCES



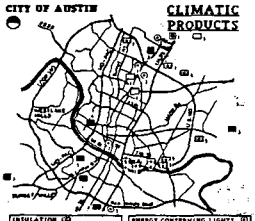
SEVEN COUNTY REGION — CLIMATIC RESOURCES



SOLAR RADIATION
TEMPERATURE
RELATIVE HUMIDITY
WIND SPEED
RAINFALL

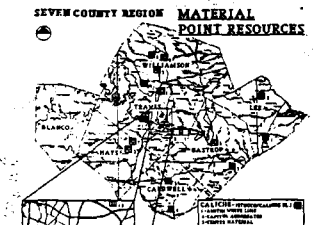
POINT RESOURCES

CITY OF AUSTIN — CLIMATIC PRODUCTS



INSULATION
BUILDING INSULATION
SOLAR GRADE/ACCESS
ENERGY CONSERVING LIGHTS
SOLAR WATER HEATERS
GROUND WATER HEAT PUMP
SOLAR VENTS

SEVEN COUNTY REGION — MATERIAL POINT RESOURCES



CALICHE/CEMENT BL. MASS
CALICHE
FLYASH
STUCCO MASS

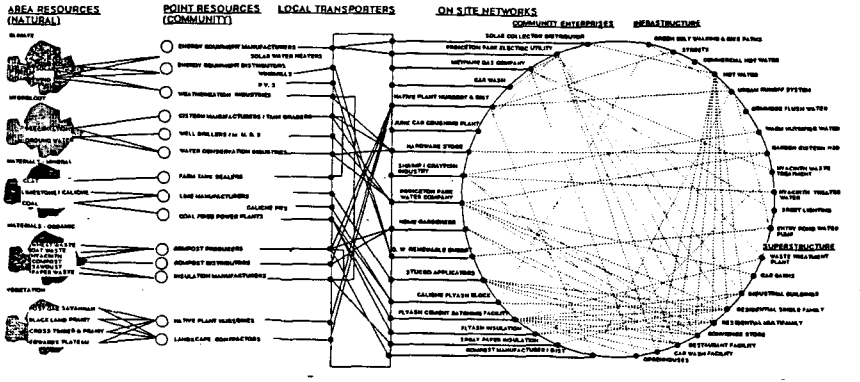
CITY OF AUSTIN — WATER CONSERVATION

CISTERN MANUFACTURERS
WATER CONSERVATION FIXTURES
NATIVE PLANT NURSERIES
XERISCAPE INSTALLATION

NETWORK RESOURCES

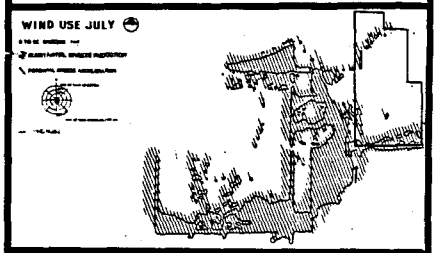
NETWORK RESOURCES

AREA RESOURCES (NATURAL) | POINT RESOURCES (COMMUNITY) | LOCAL TRANSPORTERS | ON SITE NETWORKS

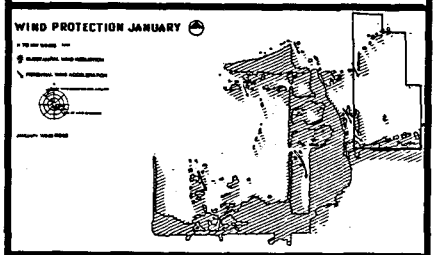


ECOLOGICAL LAND ANALYSIS

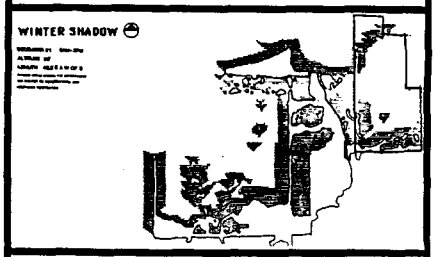
WIND USE JULY



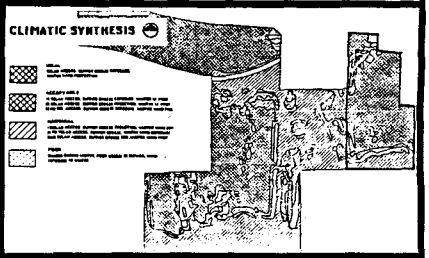
WIND PROTECTION JANUARY



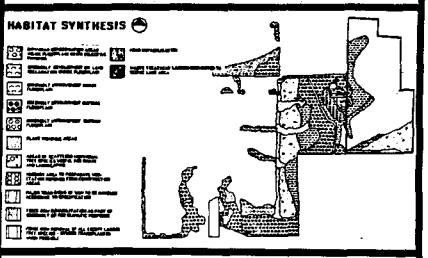
WINTER SHADOW



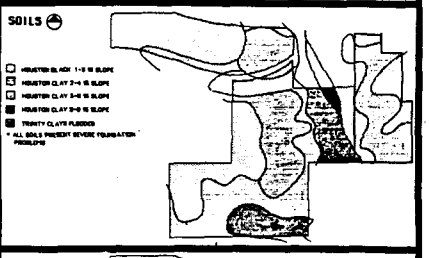
CLIMATIC SYNTHESIS



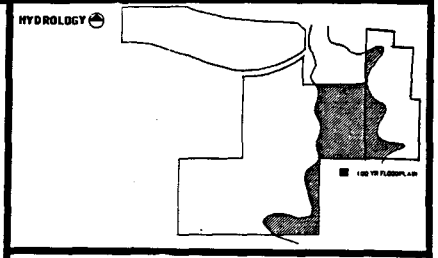
HABITAT SYNTHESIS



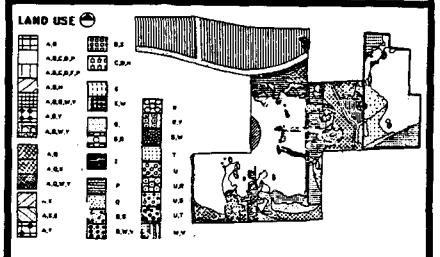
SOILS



HYDROLOGY



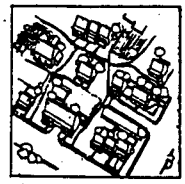
LAND USE



ARCHITECTURE

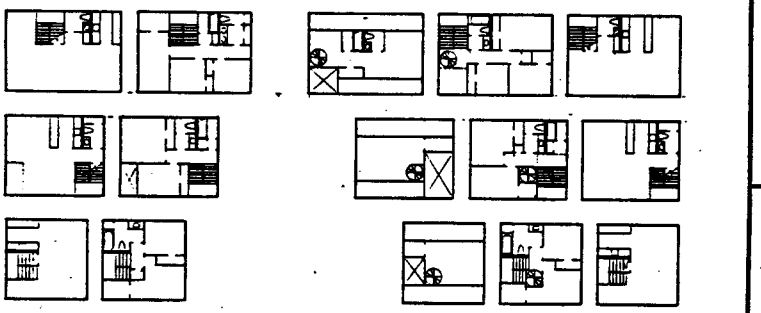
TEXAS VERNACULAR

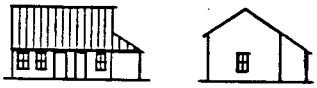
PATTERN GENERATION

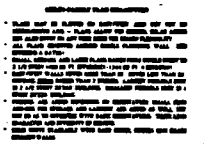


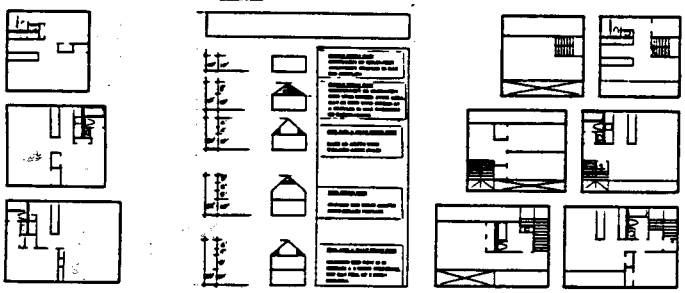
ELEVATIONS

PLANS

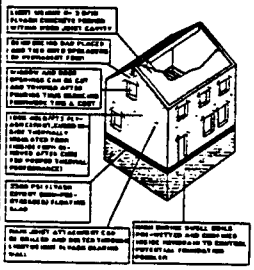




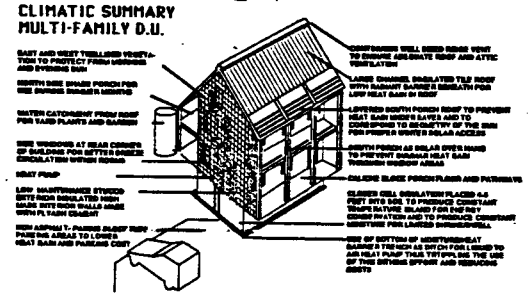




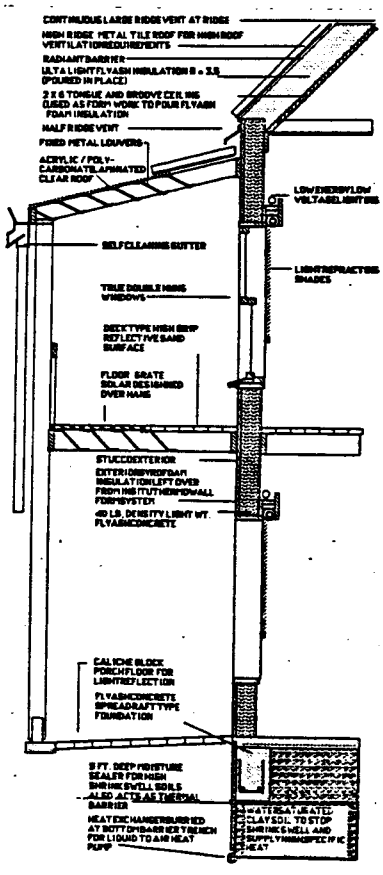
STRUCTURAL AND FABRICATION SYSTEM



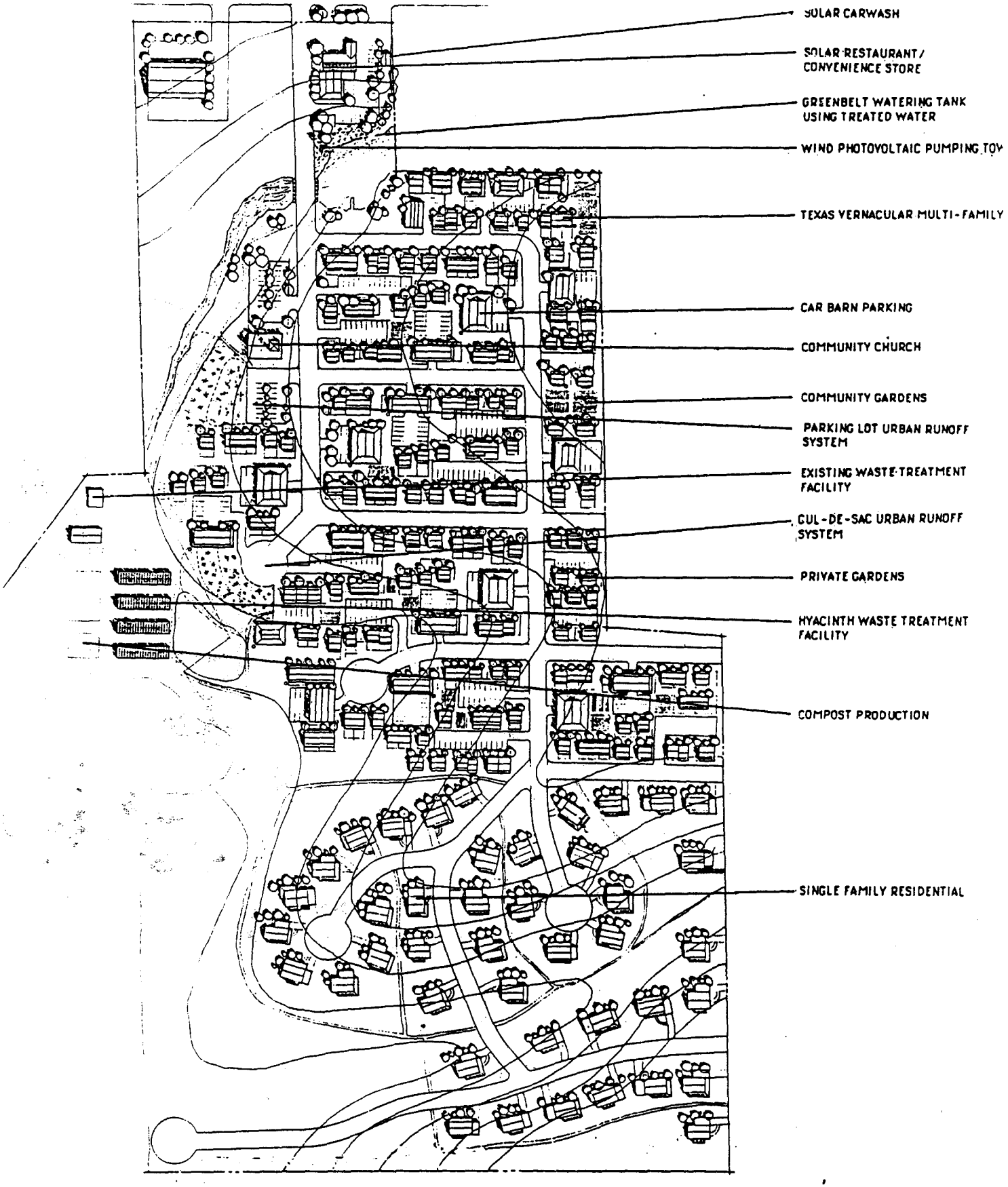
CLIMATIC SUMMARY MULTI-FAMILY D.U.



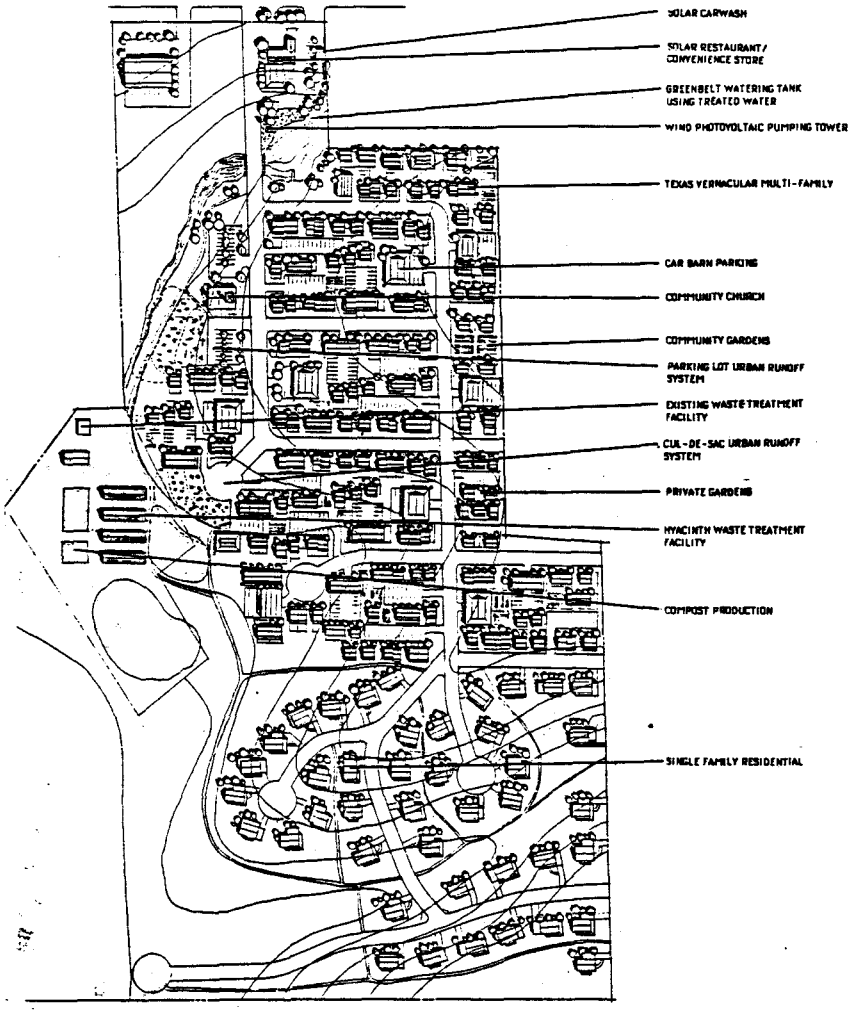
TYPICAL WALL SECTION



PRINCETON PARK – PHASE 1 DEVELOPMENT PLAN



SITE PLAN



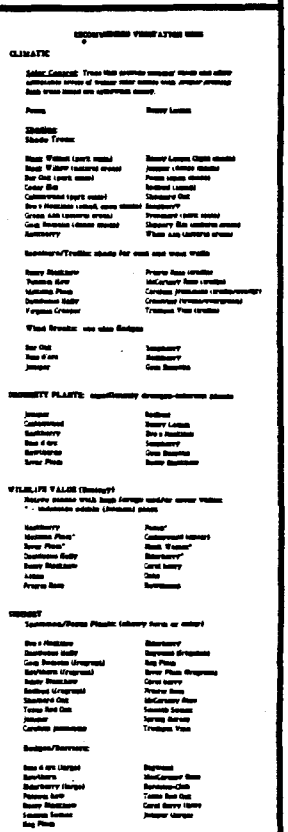
PLAN STATISTICS

SUPER-STRUCTURE

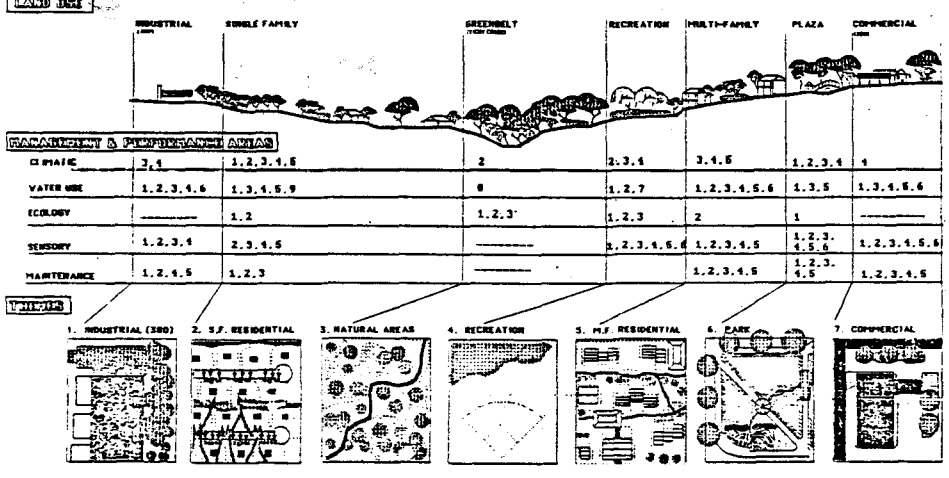
MULTI-FAMILY ——— 184 DWELLING UNITS
CAR BARNS ——— 10 BARNS
SINGLE FAMILY ——— 45 DWELLING UNITS
COMMERCIAL ——— 15,000 SQ. FT.

INFRA-STRUCTURE

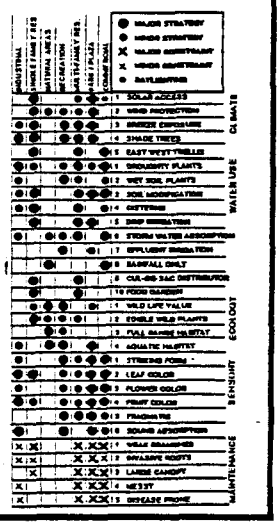
229 CISTERNS
229 SOLAR WATER HEATERS
11 SKY WIND/PV WATER PUMP TOWER
3 ACRES RUNOFF ABSORPTIVE WETLANDS
2 ACRE COMMODE WATER FLUSHING POND
120 METHANE OPERATED GAS STREET LIGHTS
1) 24,000 CUBIC FT. METHANE SYSTEM
1) 50 TON/YEAR WINDROW COMPOST FACILITY



VEGETATIVE PLAN

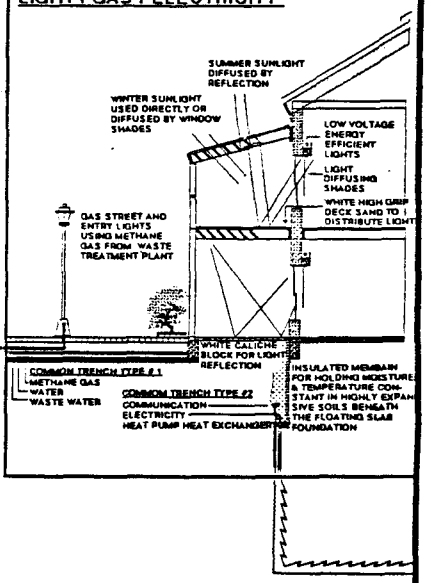


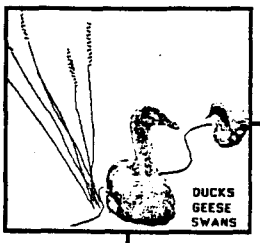
THEME DEVELOPMENT MATRIX



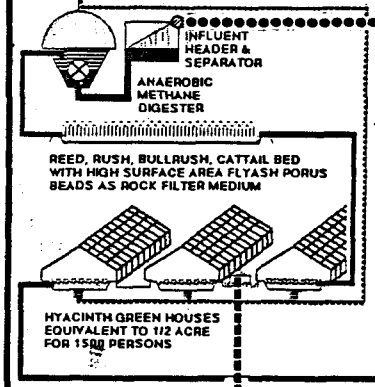
UTILITY SYSTEM

LIGHT / GAS / ELECTRICITY

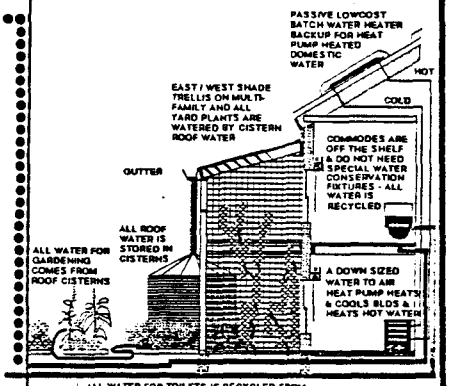


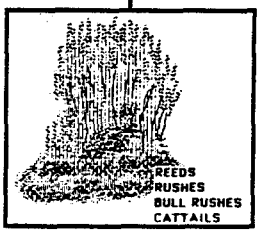


WASTE TREATMENT SYSTEM



WATER / HOT WATER / WASTE WATER





HIGH CLAY SOIL URBAN RUNOFF PLAN