URBANIZATION OF UPPER OAK CREEK BASIN
CORVALLIS, OREGON

by

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URBANIZATION OF UPPER OAK CREEK BASIN

CORVALLIS, OREGON

ABSTRACT: The annual growth rate for the Corvallis-Benton County area has traditionally been higher than the growth rate for the State of Oregon. Corvallis is considered to be one of the most densely settled communities in the state. Since 1972, Corvallis has experienced a drastic decline in the number of housing units built each year. This decrease in housing construction coupled with the increase in population has created a near 0% vacancy rate in the city and an exceptionally high demand for housing. Future population projections indicate that Corvallis will continue to grow faster than the State of Oregon, creating a problem of where to channel that growth. The most logical area to channel future urbanization will be into a number of drainage basins surrounding Corvallis. Of these, Oak Creek Basin is one of the most logical basins which will urbanize. This paper will determine the amount of urbanizable land in Oak Creek Basin, identify existing physical constraints to development within the basin, relate problems to the provision of urban services in the basin, determine the number of dwelling units and people that can be supported in the basin based upon the physical limitations and the provision of future urban services.

INTRODUCTION

Why Plan?

Land-use planning is a controversial and often misunderstood process. Many people fail to envision the urgency of the problem which is confronting society. The problems associated with lack of adequate planning have drastically altered the land as a resource base in many parts of the country. Without planning, future population growth will expand and result in unregulated and uncontrolled urban sprawl. The reverse would be to channel the population growth and expansion in urbanization with a regulated, controlled and efficient planning methodology.

The environment in which we live is a fragile system of interrelated, natural life processes. These processes should have a high degree of compatibility between the use of the physical resource base and the needs of the human resource base. Stated differently, natural processes, i.e., wildlife, rivers and forests, should have a definite correlation with human economic activities. Our lives and livelihoods depend upon the availability of land to meet our growing needs and demands. It is imperative that one necessary use of land not conflict and contest for area with another land use. If we are to continue our current standard of living and life-styles, a balance between open areas and urbanization must be maintained.

The responsibility of maintaining a livable and desirable environment rests on society at this point in time. Once we have abused the resource base we are currently utilizing, we can no longer move to another pristine area and start anew. Responsibility and commitment must be accepted here and now.

Purpose

The purpose of this paper is to examine the urbanization of upper Oak Creek Basin. In the process of this examination, this paper will conduct a three-fold analysis of the basin. The analysis will include:

1. Background material which will help determine a recommended population density for upper Oak Creek Basin will include past growth trends in population and housing for Benton County and the City of Corvallis. Future estimated projections of urban expansion, based on alternative levels of population growth and housing demand, will leave no doubt as to the reality of future urbanization in upper Oak Creek Basin. The sole remaining question will be the process or rate of urbanization.

2. Since population growth and urbanization will occur over a period of time, some semblance of planned expansion and/or urbanization must be undertaken within the upper portion of the basin. The second part of this paper will examine plans by the City of Corvallis to provide urban services for, and probable future annexation of, the upper portion of Oak Creek Basin. This part of the paper will deal with which particular urban services are to be extended into the basin, as well as the timetable for the provision of these services. At this time, a new increased figure of urban density will be recommended for the basin. This higher density will reflect the difference of the basin when the degree of urbanization was dependent on the natural carrying capacity of the land and higher urban density based upon the installation of urban services.

3. The recommendation of a population density, stated in terms of houses per acre, in upper Oak Creek Basin, based upon physical constraints to urbanization which exist within the basin. These constraints include, among others, soil, slope, erosion, groundwater, and drainage problems.

BACKGROUND

General Description of the Study Area

Geographic Location

The City of Corvallis is situated within the west-central portion of the Willamette Valley (mid-Willamette Valley), in Benton County, Oregon. The city is located approximately 80 miles southwest of Portland, 40 miles north of Eugene, and 55 miles east of Newport on the Oregon coast (Figure 1). Corvallis also serves as the county seat for Benton County (Figure 2). [1]

Topography

Benton County contains two distinct physiographic units, the Willamette Valley, including the Willamette River and the Coastal Mountain Range. Corvallis is situated on the west bank of the Willamette River in the midwestern portion of Benton County (Figure 3).

The Willamette River Drainage Basin, in and around Corvallis, is comprised of numerous sub-drainage basins, including: Marys River, and Oak, Squaw, Dixon, Frasier, Lewisberg, and Jackson Creeks. Elevations range from the flood plains of these basins at 190 feet (MSL) to more than 1,500 feet. Marys Peak, located in the Coastal Mountain Range west of Corvallis, is the highest point in Benton County at 4,097 feet. [2]

Slopes in the Corvallis area range from the flat land of the flood plains to areas in the foot hills of the Coastal Mountain Range where the slopes are in excess of 30%. Soils include the deep alluvial lands of the flood prone and adjacent areas to the rocky, shallow soils covering the steeper slopes of the Coastal Mountains. [3]

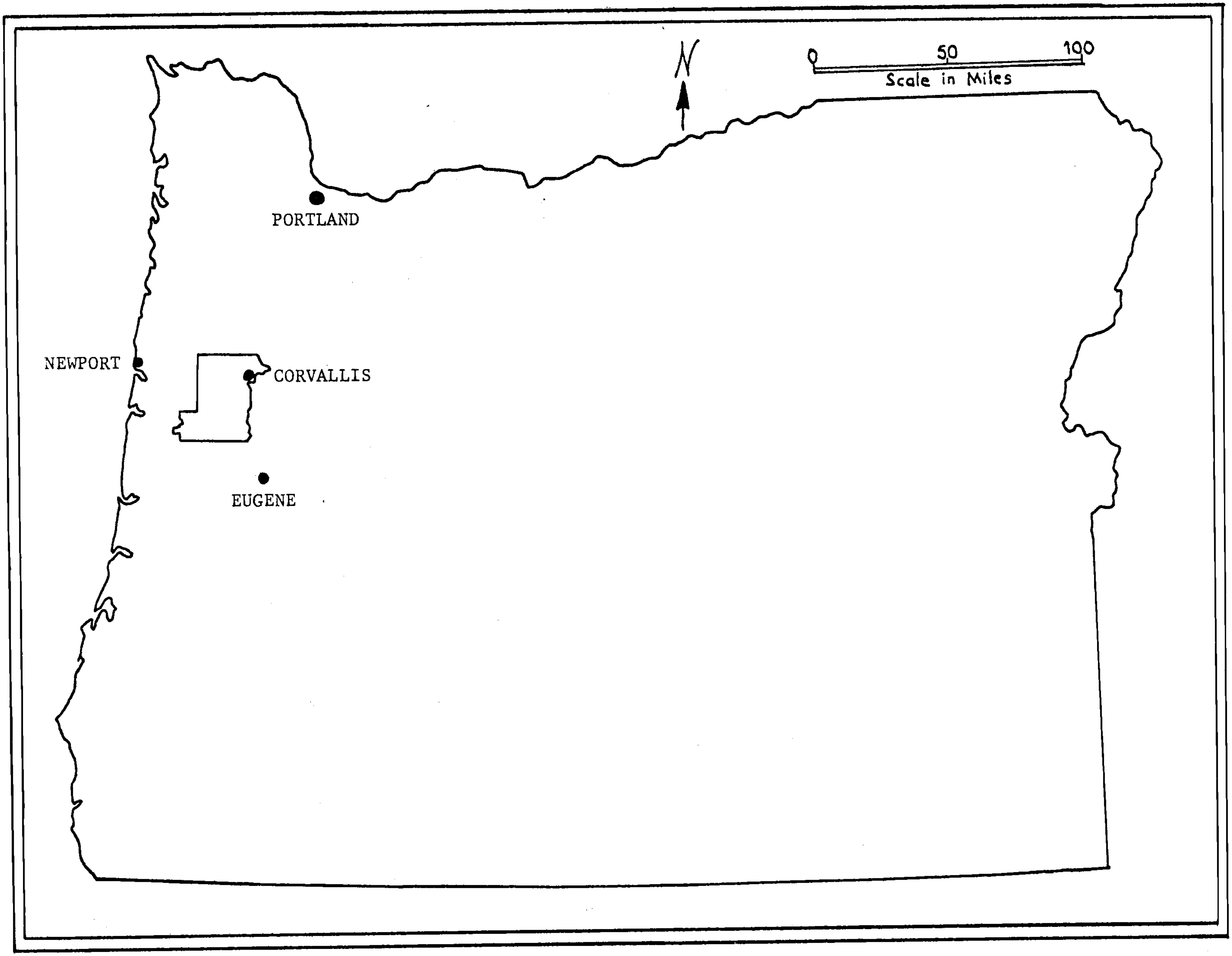
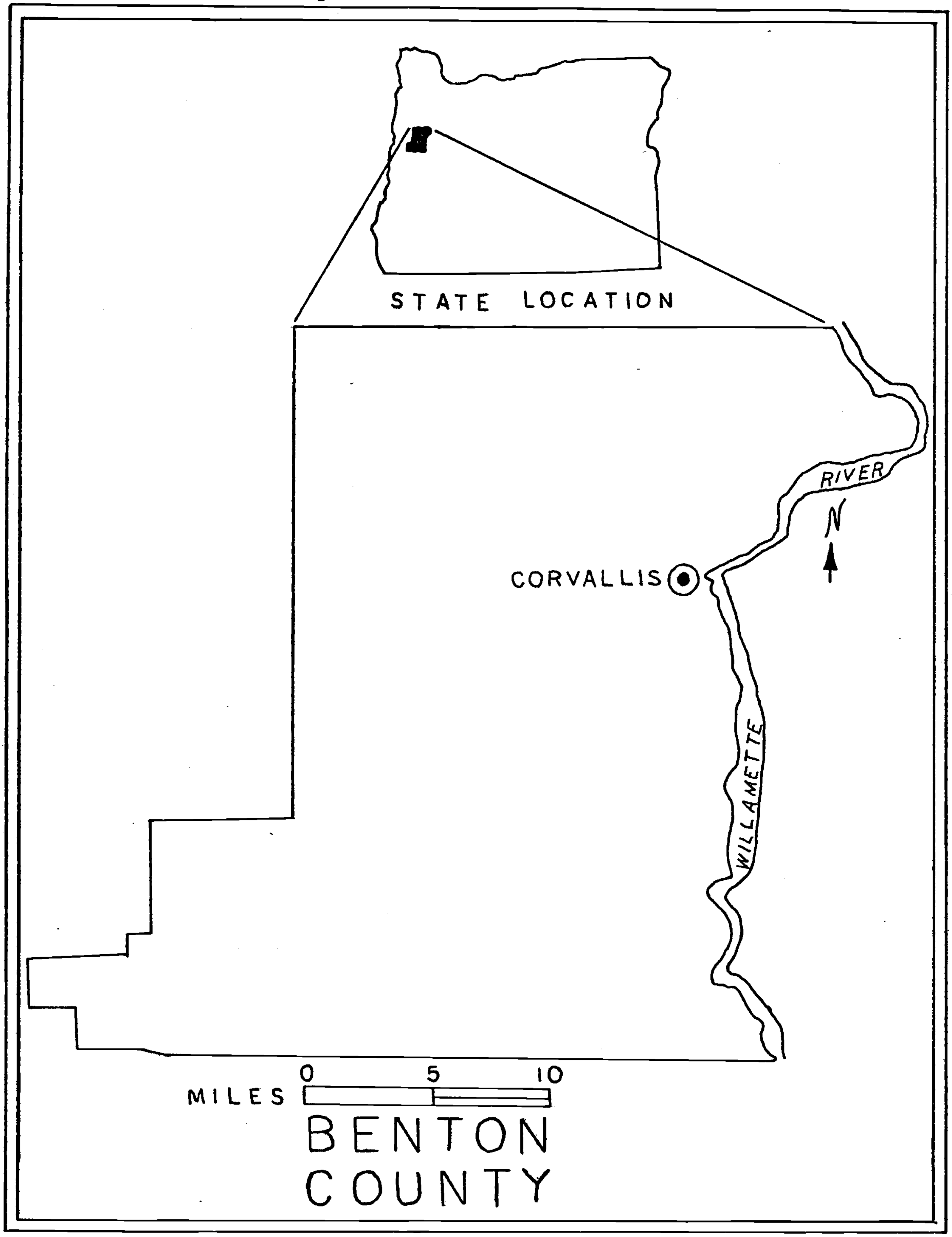


Figure 1. LOCATION MAP--BENTON COUNTY--CORVALLIS IN OREGON

Figure 2. LOCATION MAP--BENTON COUNTY



Climate

The Corvallis-Benton County area has a modified marine (temperate) climate that varies locally from east to west. Westward from the valley floor, precipitation increases from 40 to 120 inches a year, temperature decreases, and the growing season shortens. The main valley and low foothills are used mainly for cultivated crops. The steeper uplands and the Coast Range are mostly in timber.

POPULATION

Growth Trends

Historical Perspective

From 1900 to 1958, Corvallis grew at an annual rate of 4.2%. In 1958, the population of Corvallis was approximately 19,600 people. Since that time, the population of Corvallis has more than doubled to 39,750 people, an average annual growth rate of 5.0% (Figure 3). [4]

Recent Growth

To attain their recent growth rates, both the City of Corvallis and Benton County grew through natural increase, i.e., the difference between births and deaths, and net migration, the difference between people moving into and out of the area. From 1960 to 1970, Benton County, including Corvallis, grew by some 14,611 persons, 38.7% of which was attributable to natural increases, and 61.3% of which was due to net migration. This average annual growth rate, at 5.4%, was more than three times the State's rate, and exceeded the City's historical growth rate of 4.2% (Figure 3; Tables 1 and 2).[5]

From April 1, 1970 to July 1, 1973, the Bureau of Census at Portland State University estimated that the City of Corvallis has grown by some 4,597 persons--from 35,153 to 39,750. At the same time, the remainder of Benton County increased by 2,527 people. The net result has been that Corvallis' "share" of the total county population has declined slightly--from 65.4% of the total to 65.3%.[6]

Future Growth

Corvallis and the surrounding area are presently in a state of transition which will alter the orientation from a predominantly University-oriented community to a community with a more balanced economic base in manufacturing. The impact of this change on the primary and tertiary sectors of the economy are difficult, if not impossible, to precisely define over the next 20 to 25 years. Therefore, a wide range of future population projections is presented (Figure 4), which will include the growth rate which will most likely occur. (Also refer to Tables 1 and 2.)

TABLE 1

POPULATION PROJECTIONS

Corvallis 1950-1970

Year	2.0%	3.0%	3.6%	4.4%
1950	16,207			
1960	20,669			
1970	35,056			
1980	44,000	46,700	48,300	50,600
1990	53,600	62,700	68,900	77,900
2000	65,000	84,300	97,000	120,000

Source: Statistical Data Base. Oregon District 4 Council of Governments, Corvallis, Oregon. 1974.

Toward the Year 2000. Planning Department, City of Corvallis, Oregon, July, 1975, p. 1-14.

TABLE 2

Historic Growth Rates

	Corvallis	Albany	Benton County	Linn County	Oregon	OSU
1. Average Annual % Change in Population						
1900-1958	4.2%	3.5%	3.0%	2.0%	2.5%	----
1959-1973	5.0%	3.4%	3.2%	2.3%	1.7%	4.5%
1940-1950	6.8%	6.0%	5.4%	5.9%	3.4%	2.2%
1950-1960	2.4%	2.5%	2.2%	0.8%	1.5%	3.0%
1960-1970	5.4%	3.5%	3.2%	2.0%	1.7%	5.8%
2. Population Growth						
1950 Total	16,207	10,115	31,570	54,317	1,521,341	5,887
40-50 Change	93.1%	78.9%	69.5%	78.2%	39.6%	23.9%
1960 Total	20,669	12,926	39,165	58,687	1,768,687	7,899
50-60 Change	27.5%	27.8%	24.1%	8.4%	16.3%	34.2%
1970 Total	35,153	18,181	53,776	71,914	2,091,385	13,838
60-70 Change	70.1%	40.7%	37.3%	22.2%	18.2%	75.2%
1973 Total	39,750	21,440	60,900	78,100	2,224,900	15,488

3. Selective Population

Population	1900	1950	1960	1970
Corvallis as a % of Benton County	27.1%	51.3%	52.8%	65.4%
Benton County as a % of Oregon	1.6%	2.1%	2.2%	2.6%
Corvallis as a % of Oregon	0.4%	1.1%	1.2%	1.7%

Source: U. S. Bureau of the Census: Census of Population: 1970 General Population Characteristics Final Report PC(1)-B1, U. S. Summary, Washington, D. C., U.S.G.P.O., 1971.

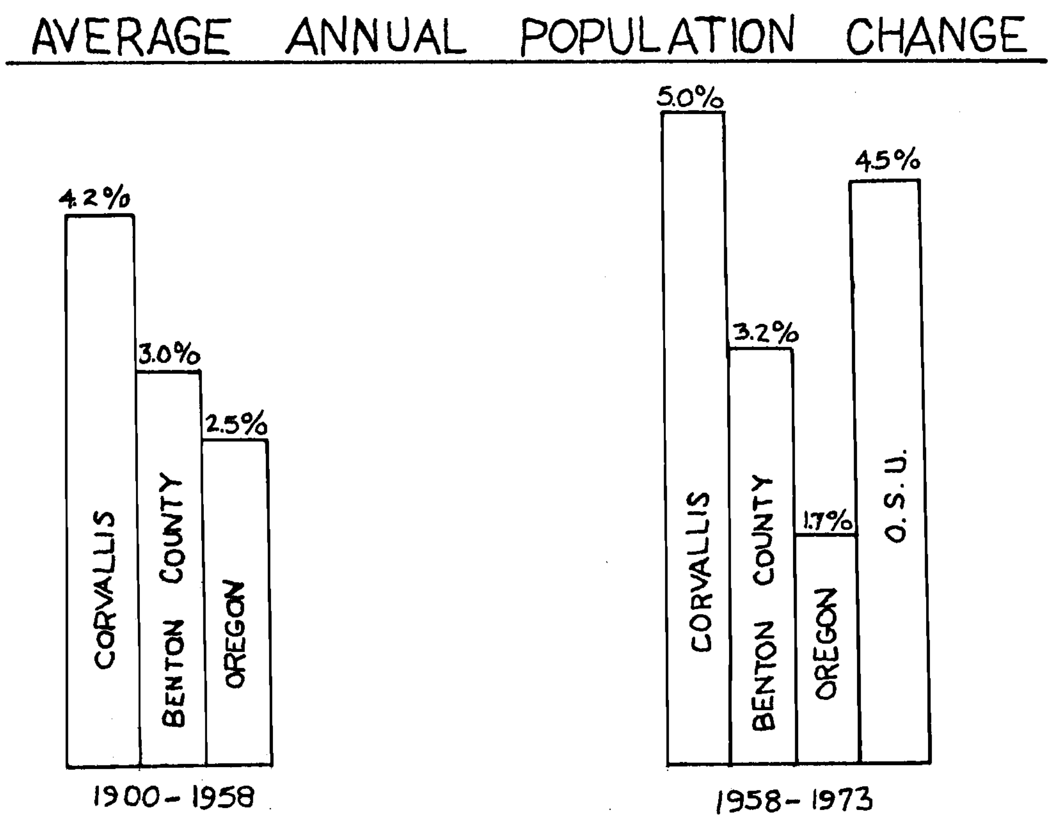


Figure 3. ANNUAL POPULATION CHANGE

Each estimated growth rate is based on a different set of assumptions. They are:

1. 2.0% - Generally this would represent "normal" growth for the community with a stable University population. It would result in an annual average population increase of 1,000 persons over the next twenty-five years.

2. 3.0% - A mid-point projection based upon the assumption that Corvallis' growth rate, without any change in its economic base, would be between 1.5% and 2.0%. Added to that is an estimate of 1.0% to 1.5%, the change the community's economic base would generate. This rate of growth would add some 1,800 persons a year for the next twenty-five years.

3. 3.6% - Another mid-point projection. It would reflect the upper end of the assumptions used to generate the 3.0% increase. Also, it is the population estimate used by the Oregon District 4 Council of Governments to project the "maximum" growth rate for Corvallis and Benton County. Finally, it is the population estimate adopted by the firm of Parametrix, Inc., in quantifying the impact of Hewlett-Packard on the Corvallis community. [7]

4. 4.4% - The approximate rate estimated by the State Housing Division in its Housing Market Analysis for the next three years of growth. The rate is slightly higher than Corvallis' historic growth rate of 4.2% for the century which saw the community change from 1,800 people to 40,000. The rate of growth would add some 3,200 persons a year to the community over the next twenty-five years. [8]

It appears unlikely that either extreme growth rate will accurately reflect the future size of the Corvallis community. Based upon the projections, a growth rate of 3.0% to 3.6% seems most likely. Such a rate would cause the planning area to grow by some 45,000 to 55,000 persons over the next twenty-five years.

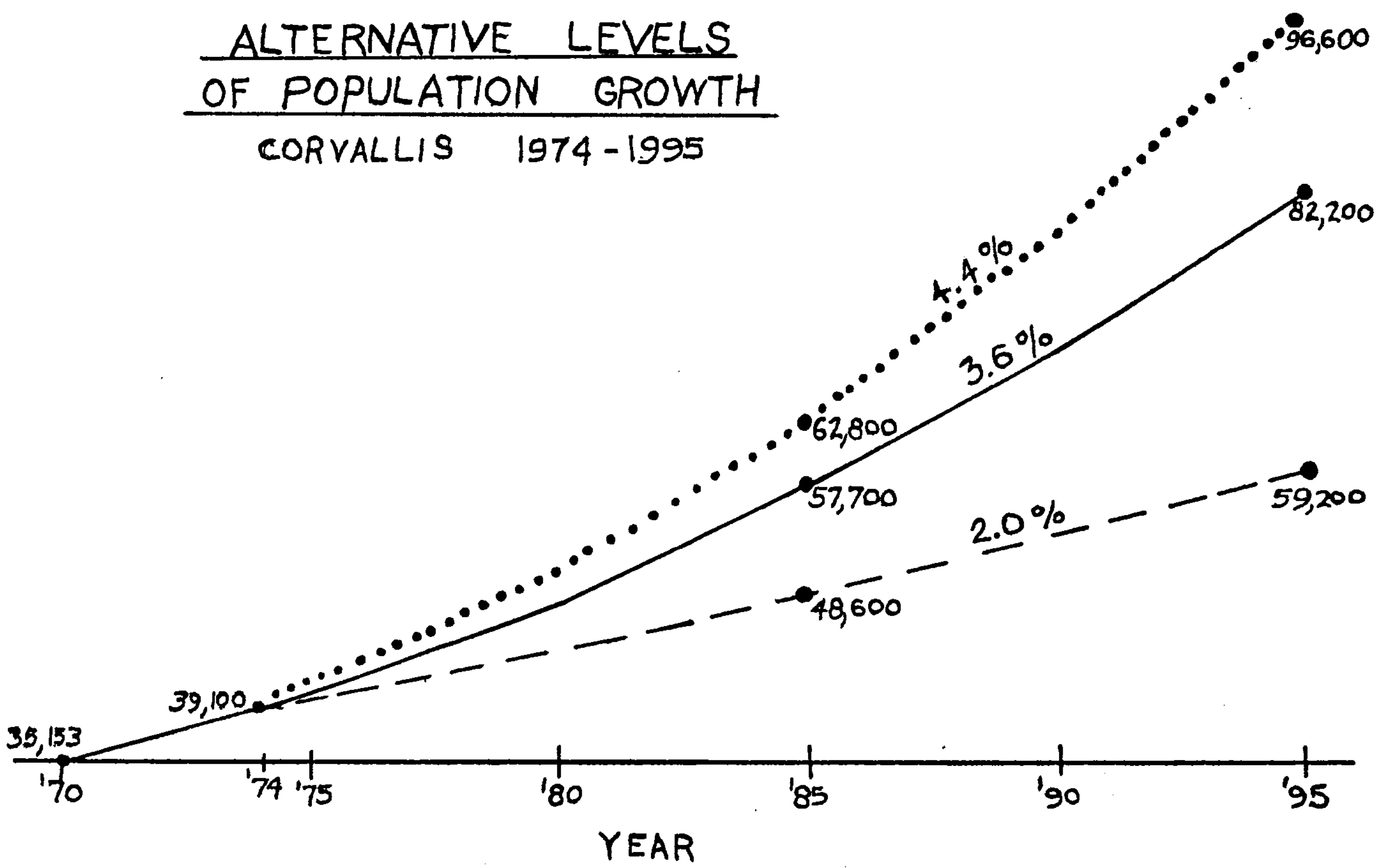


Figure 4. ALTERNATE POPULATION PROJECTIONS

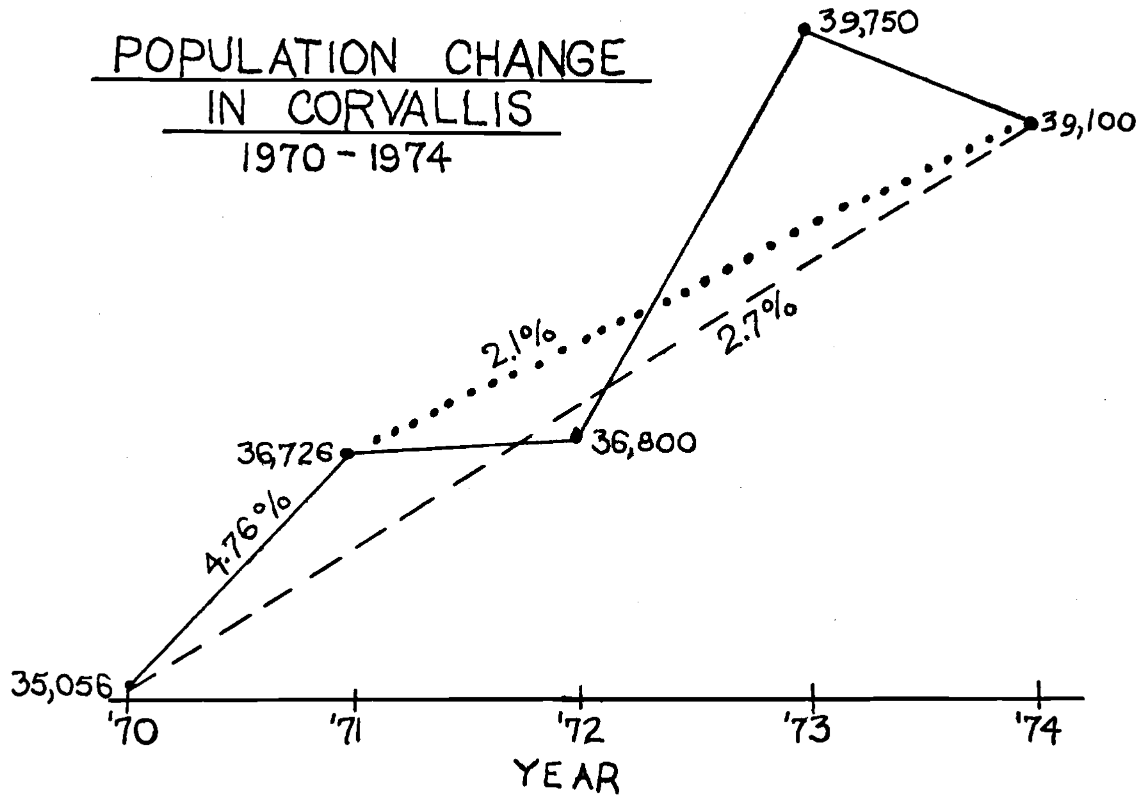
HOUSING

Needs

Future housing needs are dependent upon the growth of the community as well as the type and character of that growth. For the Corvallis area's housing needs, it would be sufficient to state that the level of building activity required over the next ten years will be greater than during the rapid growth of the 1960's. The character of the structures built will also change with the incoming population being composed of families and not the students of previous years. These are the people who have traditionally demanded the single family detached home. Yet, the State Housing Division estimates that only 40% of them will be able to afford this type of structure. This potential shortage indicates a major policy question for the community's decisionmakers. Their decision will greatly affect the type of dwelling constructed on the urbanizable land in Oak Creek Basin.

Total housing demand in the community is primarily a function of population growth. But many other factors also affect total demand and the character of that demand including vecancy rates, land availability, and housing costs.

The State Housing Division, in its market analysis, estimates that the future housing needs of the households in the Corvallis area will be met by 40% single family homes, 50% multi-family units, and 10% by mobile homes. This is a substantial change from the



Source: Line 1 - Annual P.S.U. Population Estimates

Line 2 - Straight Line Estimate Average Annual Change of 2.7%

Line 3 - Based on 1970 Census of 35,056 and 1971 Census of 36,726 by P.S.U. From 1971 to 1974 (3 years) the rate of change is 2.11%

Figure 5. CORVALLIS POPULATION CHANGES

housing character in the community since 1970. At that time, the city's housing supply was 60% single family homes, 37% multi-family units, and 3% mobile homes.[9]

Building Permits

The total number of residential dwelling building permits issued by the City of Corvallis has exceeded that issued by Benton County since 1970, although Benton County issued more permits in both 1973 and 1974 (Figure 6). Building permit activity has shown a steady decline since 1972. The vast majority of the community's growth--88%--occurred during the first 31 months of the decade, while in the last 21 months--through April 1975--growth has fallen to less than 1%.[10]

Building permit activity through August 31, 1975 shows a definite upward swing for both the City of Corvallis and Benton County. The 1975 building permit totals show a dramatic increase over the 1974 totals, even to the extent of predictions that 1975 will be a record year for the issuance of building permits. This should put an end to the construction slump in housing dominant in the Corvallis area during the past two years.

Resolutions

Acceptance of various population ranges and housing mixes mentioned previously will permit the Corvallis community to estimate the amount of land which will be required for shopping facilities, types of schools, as well as other public services necessary to support the future population and the accompanying housing mixes. Based on the various population projections, the City of Corvallis will need an average increase of between 370 to 830-970 units a year to meet the anticipated future population demands. [11]

In planning for the future population and housing mixes, with Oak Creek Basin especially in mind, the local government entity must assure that adequate land exists for urban development as well as for alternative uses, while also assuring that the total amount of land provided is not excessive. The local government can work with the building industry, i.e., contractors and developers, to provide development regulations which encourage diverse neighborhoods with no diminution in the quality of development. It may be that site plan review, coupled with density zoning, should be used to replace existing land use regulations in Oak Creek Basin.

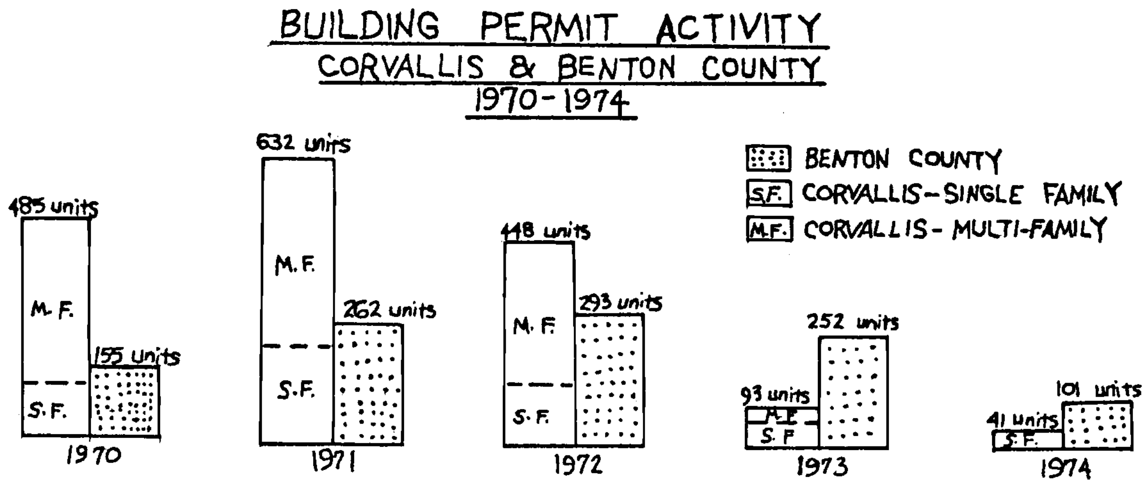


Figure 6. CORVALLIS BUILDING PERMITS

TABLE 3

Building Permit Activity
(April 1, 1970 to August 31, 1975)

1970

Corvallis (April 1, 1970 through December 31, 1970)

120	Single Family Units
365	Multiple Units
485	Total Units

Benton County (April 1, 1970 through December 31, 1970)

155	Residences

1971

Corvallis

212	Single Family Units
420	Multiple Units
632	Total Units

Benton County

262	Residences

1972

Corvallis

138	Single Family Units
310	Multiple Units
448	Total Units

Benton County

285	Residences
108	Duplexes
293	Total Units

1973

Corvallis

63	Single Family Units
30	Multiple Units
93	Total Units

TABLE 3

1973 (continued)

Benton County

252	Residences

1974

Corvallis

51	Single Family Units

Benton County

101	Residences

1975

Corvallis (January 1, 1975 to August 31, 1975)

139	Single Family Units
55	Multiple Units
194	Total Units

Benton County

143	Residences

TOTALS (April 1, 1970 to August 31, 1975)

Corvallis

723	Single Family Units
1,180	Multiple Units
1,903	Total Units

Benton County

1,055	Single Family Units (Residences)
8	Multiple Units (4 Duplexes 1972)
1,063	Total Units

Source: Unpublished figures in the Building Department, Corvallis, Oregon.
Planning for Housing and People in Oregon, Salem, Oregon, 1974.

TABLE 4

Housing Supply - Corvallis, Oregon - 1970

	Corvallis	Oregon	Corvallis	Oregon
Total Housing Units	10,637	744,602	10,637	744,602
Total Occupied	10,215	691,631	10,215	691,631
Owner	4,846	457,016	47.4%	66.1%
Renter	5,369	234,615	52.6%	33.9%
Vacancy				
Total Units	421	43,612	421	43,612
For Sale	44	5,112	10.5%	11.7%
For Rent	321	18,557	76.2%	42.6%
Vacancy Rate				
Owner	0.9%	1.1%		
Renter	5.6%	7.3%		

Source: (1) U. S. Bureau of the Census, Census of Housing: 1970 Detailed Housing Characteristics Final Report HC(1)-B39, Oregon Tables 32, 35, 53.
(2) General Housing Characteristics Final Report HC(1)-A39, Tables 18-22.

General Housing Characteristics - 1970
Corvallis, Oregon

	Oregon	Benton Less Corvallis	Corvallis	Albany
Total Units	744,616	5,980	10,637	6,402
Occupied	92.88%	95.03%	96.03%	94.42%
Owner	61.37%	71.20%	45.55%	56.01%
Renter	31.50%	23.82%	50.47%	38.40%
Vacancy Rate				
Owner	1.1%	1.3%	0.9%	1.4%
Renter	7.3%	3.0%	5.6%	8.7%

Source: (1) U. S. Bureau of the Census - Census of Housing: 1970 General Housing Characteristics Final Report HC(1)-A39. Oregon Tables 2-6, 18-22.
(2) U. S. Bureau of the Census - Detailed Housing Characteristics Final Report HC(1)-B39, Oregon Tables 33-42, 53-57.

OAK CREEK BASIN

Analysis of Constraints

Implication

In 1970 Corvallis was one of the most densely settled communities in the State of Oregon. There is considerably less undeveloped land in Corvallis than in comparable Oregon communities.[12] This relative shortage of land is a contributing factor in the relatively high cost of housing in the city, as well as a factor in the low vacancy rates which have been common in the community during periods of high housing demand. According to the State Housing Division, as of September 1975, the vacancy rate in Corvallis was essentially zero, i.e., there was not a significant number of apartments or homes in Corvallis that were not occupied. This zero vacancy rate was caused by the drastic cutback in the number of both single-family and multi-family units constructed in the Corvallis-Benton County area since 1972. Not enough units were being built in the city and county to replace those that were torn down.

Therefore, with the expected high annual increase in population, this present population density of the community, and the small amount of developable land within the city, it is only logical to assume that future urbanization will spill into several of the smaller drainage basins surrounding the City of Corvallis. One of the most logical of the basins which is expected to absorb part of this urbanization is the Oak Creek Basin. The primary reason why this basin is expected to become an important factor in future urbanization is its location and accessibility in respect to the City of Corvallis.

Location

Oak Creek Basin is situated one mile west of the present urban service boundary of Corvallis, Oregon (Figures 7-9, pages 33-35). Oak Creek flows from a northwest to southeast direction. The Basin is bordered on the north by McDonald State Forest; on the south by the intersection of Oak Creek and the Marys River; on the east by the urbanizing fringe and urban service boundary of Corvallis; and on the west by the ridgecrest which forms the western boundary of Oak Creek Basin. This ridgecrest also marks the future limit or boundary of potential urban services for the western portion of the Corvallis Planning Area, and the south and western portions of Oak Creek Basin. (For definitions of the Corvallis Planning Area, the Urban Service Area, and the Urban Fringe, see Appendix I, page 37.)

Elevations in Oak Creek Basin range from a low of 220 feet in the southern part of the Basin to elevations in excess of 1,600 feet in the northern portion of the Basin. Oak Creek is the Planning Area's largest drainage basin, containing slightly over 8,200 acres.

Study Area

The purpose of this paper is not to analyze the urbanization of the entire basin. Rather, the intended purpose is to examine that portion of the basin which lies north and west of the intersection of Harrison Boulevard and Fifty-third Street (Figures 7-9, pages 33-35). This comprises the study area for this paper.

That part of the basin which lies below the intersection of Harrison Boulevard and Fifty-third Street is currently under land use and property ownership patterns that are not expected to change in the future. These land use and property ownerships include:

1. The extreme southeastern portion of the basin near the junction of Oak Creek and Marys River, and that area in the basin along Highway 20-34 (U.S. 20 and Oregon 34) that has already been converted to private urban-residential and commercial land use.

2. Just beyond this area, to the northwest, lies that portion of the Oregon State University campus within Oak Creek Basin. Land use in this part of the basin includes athletic fields and facilities, laboratories, and departmental buildings.

3. Farther to the northwest, between the actual campus area and Harrison Boulevard and Fifty-third Street, lies extensive Oregon State University property. This property is used for the cultivation of experimental crops and orchards, raising livestock, and the location of feed and veterinary buildings.

It is evident that these land uses and/or property ownerships are not likely to change for future urbanization. Therefore, the only part of the basin that will accommodate any form of increased urbanization in the future is that portion of the basin to the north and west of Harrison Boulevard and Fifty-third Street, and south of the McDonald State Forest boundary.

<u>Traditional Land Use</u>

The upper portion of Oak Creek Basin forms a cul-de-sac. Only one road extends into this part of the basin. The road is a narrow two-way thoroughfare, which divides in the upper extremeties of the basin to serve various rural-residential dwellings and small developments. Traditionally, the upper part of the basin was held in farms and ranches of varying sizes. Residents either commuted to work in Corvallis or worked their own land, or both. Productive land was farmed, held in pasture, or in timber. There was scarcely any urbanization in the basin until the early 1970's when portions of productive or inactive land was sold to developers, who turned the land into three to five acre parcels of rural-residential developments. The upper part of Oak Creek Basin has become very popular and attractive to area-residents and urbanization is expected to steadily increase.

A great deal of the attraction of Oak Creek Basin stems from the cul-de-sac nature of the basin, as well as the easy accessibility to Corvallis and surrounding communities via main arterial highways. There are two main collector streets that form the junction of the study area, Harrison Boulevard and Fifty-third Street. From Fifty-third street, it is possible to connect with Highway 20-34 to Philomath or the coast, or via 20-34 connect to 99W and travel south to Eugene. Harrison Boulevard would bring potential shoppers of the various main streets in Corvallis, or lead across the Willamette River to Highway 34 and to Interstate 5, or to Highway 20 with connections north to Albany or 99W traveling north to Salem and Portland.

Future proposed arterial and connector streets within Corvallis, the extension of Circle Drive and Walnut Boulevard, would decrease travel time either to areas in Corvallis, or to connecting roads which lead to major highways out of town.

Physical Restrictions

In the planning of land use for urban purposes, one of the most logical areas is the drainage basins. Basins are discrete, natural areas and form logical units for the extension of urban services. Sewage collection in Corvallis will be extended in basins because of collection being carried out by gravity. In addition, the natural drainageways of the area are becoming more important for storm-water disposal.

Even though Oak Creek is the largest drainage basin in the Planning Area, and especially because it is one of the more desirable residential areas of the community, public policy should be directed toward determining the level of urbanization that can be supported in this basin, without urban services. In the immediate planning period (1975-1985), it appears unlikely that even if it were desired, the community could provide services to the north and western portions of this basin.

As the community grows, the recognition of natural limitations will permit areas not suitable for urbanization to be identified and avoided, or at least only urbanized to the holding or carrying capacity of the land. Oak Creek possesses many physical limitations which will limit intensive urbanization. A few of these limitations include:

1. Slopes: Slopes in excess of 20% are common throughout upper Oak Creek Basin.

2. Shallow soils: Soils with bedrock within 20 inches of the surface are found in the middle of upper Oak Creek Basin.

3. Shrink-swell potential: Soils with severe and very severe shrink-swell potential are found in the middle of upper Oak Creek Basin.

4. Water Table: Soils with the water table within twenty inches of the surface are found in the drainageway of Oak Creek Basin.

5. Permeability: Fully over a third of the soils in upper Oak Creek Basin have poor permeability characteristics.

6. Drainage: Soils which have poor and very poor drainage characteristics have water sitting on them during wet periods. These are the same soils which have high water tables and poor permeability.

The limitations just listed are but a small part of the considerations necessary when examining the carrying capacity or natural limitations of upper Oak Creek Basin. For more extensive definitions of additional limitations found in this basin, as well as the limitations for each soil type found in the basin, refer to Appendix II, page 40.

Based on the physical limitations found in Oak Creek Basin, it is only logical to conclude that these limitations will greatly reduce the amount of urbanizable land in the basin. The vast majority of restrictions present in the basin range from moderate to severe or very severe, making construction difficult if not impossible in much of the basin.

Besides the actual physical limitations in the basin, there are two planning-technical decisions which are influenced by the physical constraints to urbanization present in the basin. These include:

1. 527-foot contour level: The Planning Department for the City of Corvallis advocates an active policy of discouraging any types of development above the 527-foot level in Oak Creek Basin. This would eliminate 2,100 acres of land from being classified as urbanizable land.

At the present time, the water system in Corvallis is dependent on service of three levels: the first, second, and third. The fourth level water system, as of now and to some future point in time, will remain one of speculation. The fourth level water system will service development that occurs above the 527-foot level. At this time, there is not sufficient development above the 527-foot level to warrant the addition of a fourth level water system, besides the fact that the City Planning Department actively discourages development above this level. If the fourth level water system was seriously considered, a significant amount of expansion of the first, second, and third level water systems would have to be undertaken to support the increased demands placed on them by the construction of a fourth level system.

2. Slope: In that portion of upper Oak Creek Basin where the slopes are in excess of 20%, future urbanization is considered undesirable. Urbanization is considered undesirable for several reasons. This more rugged area of upper Oak Creek Basin would present problems involving the fourth level water system, and the soils in this portion of the basin are classed as severe or very severe in physical limitations to urbanization. Future planning policy would suggest that these areas above the 527-foot level be restricted from further urbanization and that the land remain in its natural condition or left in its present production capabilities.

An examination of the remaining urbanizable land in the basin is necessary in order to realize the dominant role that physical constraints play in the determination of the intensity of future development in upper Oak Creek Basin. Oak Creek Basin contains 8,200 acres of land, 7,630 acres of which are within the Planning Area and therefore are capable of consideration as potentially urbanizable land. Of this 7,630 acres, 2,100 acres are essentially not urbanizable because they are above the 527-foot level; 1,200 acres are in public ownership (Oregon State University ownership; refer to Figure 9, page 35), and are not considered to be urbanizable at any time in the future. This leaves 4,330 acres in upper Oak Creek Basin that are potentially urbanizable.

Physical constraints determine the actual amount of urbanizable land within Oak Creek Basin by the severity of the limitations found in each soil type. Most of the limitations for the upper portion of Oak Creek Basin range in severe, with extremes in moderate to very severe. Using the number of "severe" limitations in each soil type, it is possible to eliminate 1,500 acres of land as having limitations which will not support any level of urbanization. Therefore, based solely on the physical limitations found within Oak Creek Basin, there are 2,830 acres of land which will support future levels of urbanization.

According to the Benton County Health Department, any development that occurs on land that does not have either urban water or sewer services must locate one housing unit (home or dwelling) on at least one acre of land. This is necessary in order to install an efficient septic tank and drainfield. With 2,830 acres of urbanizable land and the above county ordinance, the number of dwellings that could be constructed in upper Oak Creek Basin would be 2,830. Taking the possible 2,830 homes and multiplying by 3.0 persons per household, it is possible to estimate the number of people the basin could support.[13] The basin will support approxima tely 8,500 additional persons.

It is important to keep in mind that this level of urbanization (2,830 acres of urbanizable land, 2,830 homes, and 8,500 people) is based solely on the natural carrying or holding capacity of Oak Creek Basin.

Provision of City Services

Time Period

The immediate planning period considered in this paper is from 1975 to 1985. It is assumed that any definite planning goals made for the period 1985 to the year 2000 would be subject to constant review and modification, and could be kept abreast of changing population and housing demands. But, on the other hand, it is difficult to make contingent plans frr a seven-to-ten-year period and not keep within the short-term planning goals and guidelines. It is with this in mind that reference is made to the fact that between 1975 and 1985 the City of Corvallis does not expect to extend urban services (sewer and water) into Oak Creek Basin. Presently, there are sewer lines which extend to the junction of Harrison Boulevard and Fifty-third Street. These lines, beyond the urban service boundary, are not utilized because of the need for additional pumping stations necessary for the distance involved. However, they are in place awaiting that future time when additional urbanization and the provision of additional pumping stations make them fully operational.

At the present time, there are three areas outside the urban service boundary and inside the Planning Area Boundary, in Oak Creek Basin, but which receives urban water service. These areas include: the Timian subdivision, the County Fairgrounds and the Corvallis Mobile Home Park, and a ranch further west of the intersection of Harrison Boulevard and Fifty-third Street. The rest of the basin acquires its water from wells in the basin. Other than the special water lines serving these three areas, there are no water lines installed within Oak Creek Basin, and which could supply urban water service to future developments in the basin.

Urban Service Problems

A number of problems are encountered when considering the future time period involved for the extension of urban services into the upper part of Oak Creek Basin. The eventual establishment of urban services in the basin will be dependent on the rate of urbanization in the basin over the next five to seven years. One of the strongest drawbacks to the extension of urban services into the basin will be the initial cost of that installation. There will also be the possibility of the basin not having the density of urbanization necessary to justify the cost of that installation. The city will also be concerned about the time required in the amortization of installation costs. These costs would have to be recovered long before it became necessary to consider repair costs and services to the water and sewer systems.

Even with the eventual provision of urban services, the only portion of upper Oak Creek Basin which will urbanize, to any level of intensity, will be that portion below the 527-foot level. Urbanization above this level will encounter the previously mentioned physical constraints, e.g., poor soil, excessive slope, erosion, shrink-swell, etc. These physical constraints will not only limit the degree of urbanization, but also the installation and maintenance of urban services.

Urban Service Density

With the addition of urban services, the intensity of urbanization in upper Oak Creek Basin will increase. Urbanization of the basin considering physical limitations was 2,830 acres of land, 2,830 homes, and 8,500 people. Urbanization of the basin dependent upon the provision of urban services would essentially double. If either water or sewer service is extended to any type of development, that development could increase to one dwelling unit on each half-acre of urbanizable land. Therefore, with the 2,830 acres of urbanizable land, the number of homes would increase to 5,660, and the number of people that could be accommodated in the basin would rise to 16,980 or approximately 17,000 persons.

Density Zoning

The urbanizable land in upper Oak Creek Basin may be subjected to a form of performance standard zoning entitled density zoning. If five acres of land are open to urbanization, according to the physical limitations in the basin, five single family units (homes, dwellings) could be erected on each acre. If the same five acres were developed with the provision of urban services, the five acres could support ten dwelling units, each built on a half-acre. Under the density zoning application, it would be possible to mix single family and multi-family dwelling units provided the total acreage developed did not exceed county zoning ordinances. On the above five acres, instead of five single family units of one acre each, or ten single family units of one-half acre each, a multi-family complex with eight dwelling units could be built on two acres, leaving three acres in open space. It would also be possible to combine the location of single family and multi-family units on the above acreage as long as the five-acre limitation was observed.

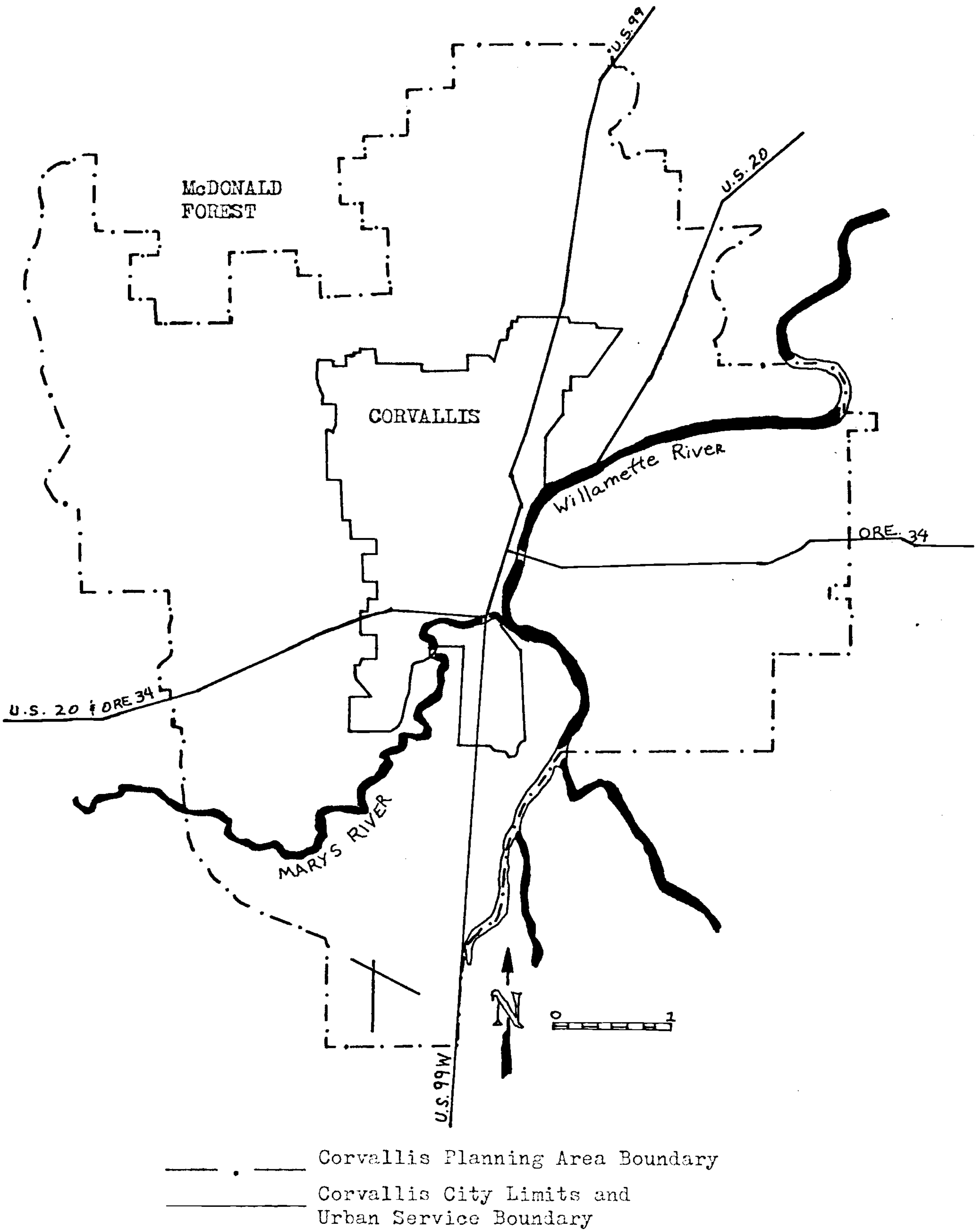
SUMMARY

Urbanization of upper Oak Creek Basin will steadily increase in the future. The rate of urbanization will be dependent on the physical limitations within the basin, and the future extension of urban services into the basin.

This paper has identified the various physical limitations to urbanization in Oak Creek Basin and related the problems involved in considering the future provision of urban services in the basin. An analysis of urban density was established for urbanization based on the physical carrying capacity of the basin, as well as urbanization based on the installation of city services.

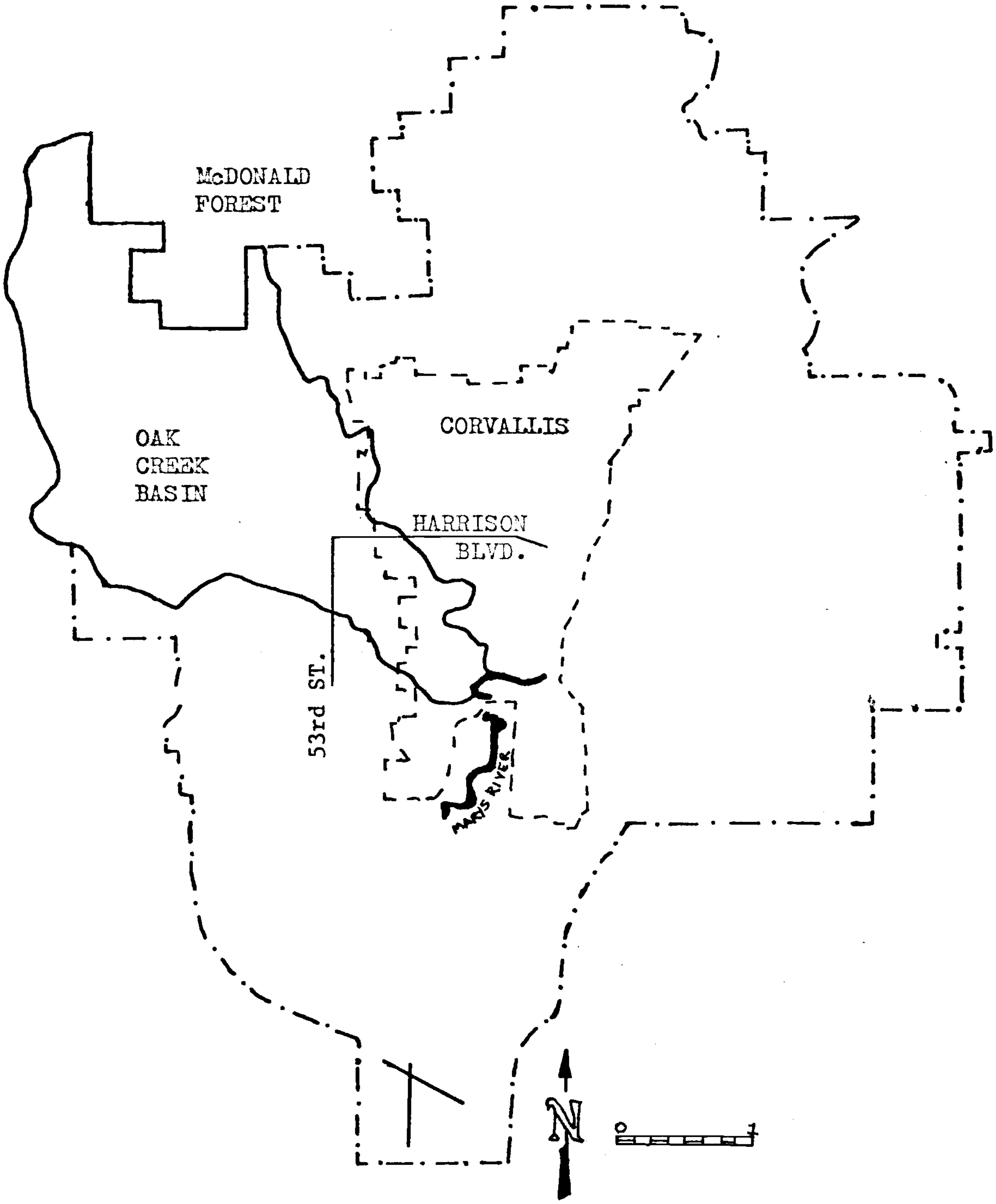
This paper does not wish to imply that the Oak Creek Basin is the only basin capable of absorbing future urbanization. Future urbanization will be spread throughout a number of basins surrounding Corvallis, including Oak Creek Basin. This paper has attempted to provide a model by which the urbanization of the additional basins in the Corvallis area might more easily be determined. This would enable more efficient planning goals and decisions be made by the City Planning Department, the citizens of Corvallis, and by the residents of the basins in question.

Figure 7.



CORVALLIS PLANNING AREA

Figure 8.



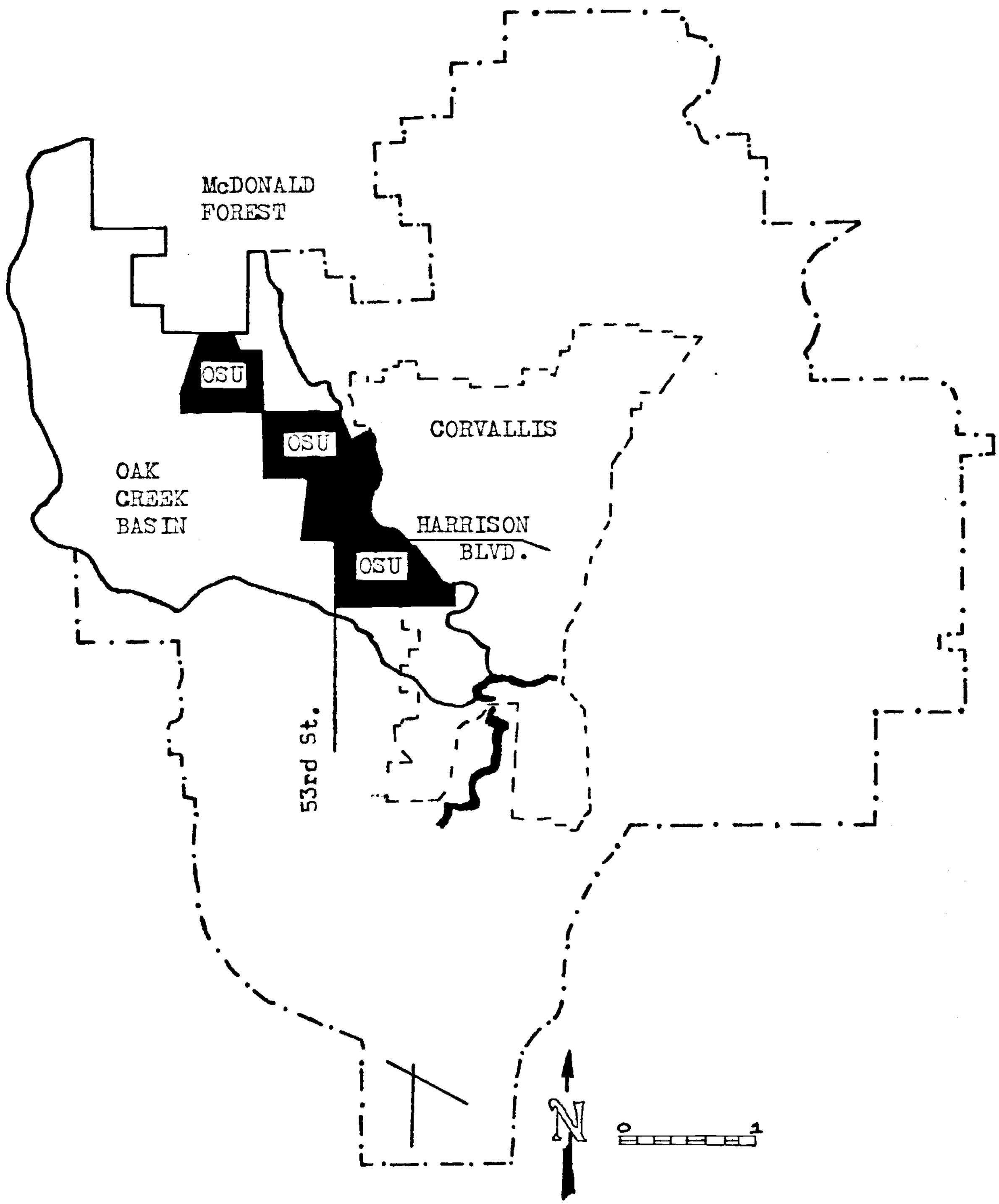
Corvallis Planning Area Boundary

Corvallis City Limits and Urban Service Boundary

Oak Creek Basin Boundary

STUDY AREA

Figure 9.



Corvallis Planning Area Boundary

Corvallis City Limits and Urban Service Boundary

Oak Creek Basin Boundary

OSU - Oregon State University Property Ownership in Oak Creek Basin (Public Ownership)

PUBLIC LAND IN OAK CREEK BASIN

APPENDICES

APPENDIX I

Corvallis Planning Area Definition

Surrounding the City of Corvallis is an additional area closely tied to the city physically, socially and economically. The developing portion of this area is referred to as the city's urbanizing fringe. In addition, there are outlying areas which are presently undeveloped or in the process of development, which may be subject to pressures to develop more intensively in the future. Oak Creek would fit both of the above descriptions.

Inclusion of any area within the city's urban planning boundaries does not presume an urbanized land use or future city limit lines, but rather attempts to provide a rationally defined area within which the community can review alternatives to guide its future. The City of Corvallis has a number of options it uses to delineate its planning area boundaries. Presently, there are a number of man-made (political) or natural boundaries surrounding the city which are applicable to urban planning. They include:

1. The Urban Service Area drawn by CH_2M Hill's 1970 Sanitary Sewer Plan for the Corvallis Urbanized Area. This boundary line represents the outer limits of the Planning Area based on physical service capabilities of the area to be served by a future sewage treatment plant. This portion of the Planning Area Boundary borders on the north and west portions of Upper Oak Creek Basin.[14]

2. The boundary for the 509J School District. Portions of the school district's boundaries represent the outer limits of the planning area for the City of Corvallis for two major reasons. First, the primary and secondary school system represents a strong social orientation for a large portion of the area's families. Secondly, it represents an economic

orientation in that the school district accounts for a large portion of the property owner's tax bill. In utilization of the 509J boundary for the planning area, only portions of the eastern, southern, and western boundaries are applicable.

3. In addition to these major boundaries, which are included in the Corvallis Planning Area boundary, there are a number of other boundaries which partially encircle the City of Corvallis. To the south is McDonald State Forest and the North Albany (Northeast Benton County) Planning Area. To the east is the Albany City Urban Service Area. To the west is the eastern boundary of the Philomath Planning Area.

Each of the above boundaries will have a differing degree of impact on the development of the city and its surrounding area. The McDonald State Forest provides an effective physical barrier to urban growth north of Corvallis. The CH_2M Hill Urban Service Area indicates the potential limits of intensive urban development. Those areas that will not be or cannot be served with city water and sewer cannot develop intensely primarily because of public health danger. Nor, should it be presumed that because an area is physically capable of being served, the community will decide that services will be provided. Based on other considerations, such as natural capabilities of the land, the community may decide its needs are best met by guiding intensive development elsewhere.

The Corvallis Urban Service boundary should not be confused with the above mentioned definition and delineation of the Corvallis Planning Area boundary. The Corvallis Urban Service boundary, for all practical purposes, is that area which is confined in the corporate limits of the City of Corvallis. The Corvallis Urban Service Area has city services provided by the City of Corvallis.

These services include police and fire protection, street installation and pavement assessments, as well as sewer and water lines provided by the city. There are a few areas outside the corporate limits of Corvallis which receive city water, but no areas outside the city limits receive both city water and sewer services without annexation to the City of Corvallis. Therefore, in essence, the Urban Service Area includes those incorporated areas which pay for and receive essential city services. (Refer to Figure 7-9, pages 33-35 for a map of the Urban Service Area vs. the Corvallis Planning Area.)

Source: Corvallis Planning Area Definition for the Corvallis Comprehensive Plan, Gerald Hart, Corvallis Planning Department, Corvallis, Oregon, June 1974.

APPENDIX II

Definition of Physical Constraints to Urbanization of Upper Oak Creek Basin

Slopes:

The slope of the land is measured by determining the rise (or fall) of the land over a certain specified area and is usually expressed in terms of percentage. The major urban limitation related to slopes is erosion which controls the intensity of development. In addition to erosion, areas with steep slopes frequently have very shallow soils overlaying the bedrock. As slope increases, the intensity of use should decrease. Shopping centers and industrial activity must locate on essentially 0% slopes, while single family homes, on large acreages, can locate on slopes in excess of 30%. When combined with areas of "thin" soils, the steep slope also create impediments to the provision of urban services.

Soils:

On-site inspections are required for accurate information concerning individual sites and soil properties. (Refer to Appendix V, page 52 ; Appendix VI, page 55 , for individual soil capability descriptions) Existing engineering technology can be used to minimize the adverse limitations imposed on certain land uses by unfavorable soil capabilities. For the purpose of this paper, the desired result is to identify those lands which can absorb urbanization with the least cost.

Depth to Bedrock:

Problems associated with bedrock being near the surface are related to the cost of installing underground services and the inability of these shallow soils to be used for septic tanks. All types of bedrock restrict the movement of water, and when bedrock is less than 48 inches below the surfact it has severe impact on septic tanks. When bedrock is hard, it creates severe problems for roads and streets when it is within 20 inches of the surface; when soft the limitation is downgraded to moderate. Hard bedrock located within 40 inches of the surface create severe problems for dwellings with basements while for dwellings without basements, severe problems do not occur until bedrock is within 20 inches of the surface. Softer bedrock, those rippable even by hand tools, cause moderate problems for dwellings with basements when they are located within 40 inches of the surface and for dwellings without basements when they are located within 20 inches of the surface. Generally, soils which have bedrock near the surface are also located on slopes; the steeper the slope, the thinner the soil. This condition represents "moderate" to "severe" limitations for all urbanization.

Shrink-swell potential:

The shrink-swell potential of a soil indicated that the volume of the soil changes based upon the amount of moisture within it. Soils that are predominantly composed of plastic clays have a high potential. Soil experts estimate that building foundations, roads, and other structures will be effected by these properties with the degree of limitation based upon the severity of the shrink-swell potential. The majority of the soils in Upper Oak Creek Basin have severe shrink-swell potential (Appendix V, page 52 and Appendix VI, page 55).

Drainage:

Perhaps the most significant limitation to urbanization in Upper Oak Creek Basin is the inability of most the basin's soils to percolate water, which may be the result of poor drainage or high water table. This frequently leads to sheet runoff or water under houses caused by rising water tables. Because Corvallis gets the majority of its rain (72%) [15] during the period from November to March, it is during this time that the area has the most serious drainage problems. Water tables are highest during this period and evaporation is limited. Hence, the only way for water to be moved off the land is by natural or man-made drainage. In areas where either of the above drainage systems do not exist, the water table is at the surface of the ground during the winter months.

Depth to Water table:

The depth to the seasonally high water table indicates that the soil is saturated below the indicated level for at least one month during the year. The major means to overcome this limitation are either the raising of the land level, e.g., a gravel building pad, or a lowering of the water table. Where the water table is within ten inches of the surface, it represents a significant natural limitation to urbanization. Also, a high water table represents a barrier to the purifying action of a septic tank drainfield because it prevents the flow of effluent through the field. This causes both lateral seepage of the effluent as well as pollution of the ground water as it contacts the effluent in the drainfield. A high water table creates severe problems when it is within 48 inches of the surface for septic tanks; and when it is within 30 inches of the surface for dwellings without basements. Additional problems can be created when the natural contour of the land is changed by cuts or fills as these alternations frequently change the relative location of the water table to the surface, divert drainage water to new drainageways, and cause erosion.

Drainage:

The drainage characteristics of a soil are related to the location of the water table under natural conditions. Those soils with high water tables have poor drainage characteristics. Conversely, few soils with water tables below 30 inches have drainage problems. Well drained soils are saturated with water within the root zones for very brief periods of time. Poorly drained soils have a water table at or near the surface for a considerable part of the year. Moderately drained soils usually correspond to having the water table within 10-20 inches of the surface. Soils with poor drainage characteristics affect urban suitability by limiting and restricting excavation and septic tank drainfields unless extensive drainfields are installed. The need for artificial drainage systems in these soils which have poor drainage characteristics represent a severe economic limitation to urbanization.

Permeability:

Soils with fairly rapid permeability are necessary for the proper operation of septic tanks. Permeability is the rate at which water moves downward through undisturbed soils. Rapid permeability is not necessarily the best condition for a soil, as a rapid permeability rate may cause pollution of the ground water. It would appear that those soils with the best percolation rates for septic tanks would be those with moderate permeability. These are usually the soils which are well drained, have low water tables, and which are without excessive slopes. For Upper Oak Creek Basin, very few of the soils in the basin meet these criteria.

Source: Soil Survey of Benton County, Oregon, U. S. Department of Agriculture, Soil Conservation Service, July 1975, pp 90-94.

Toward the Year 2000, Planning Department, City of Corvallis, July 1975, pp III-4 - III-12.

APPENDIX III

Soil Characteristics for Oak Creek Basin

AbB - Abiqua Clay

Abiqua soils consist of well-drained, silty clay loam over silty clay soils. They occupy nearly level terraces or greatly sloping alluvial fans. Depth to bedrock is commonly many feet but may be as shallow as 40 inches. There may be 0-15% gravel or cobbles within 40 inches, and up to 50% below 40 inches. Permeability is moderately slow. Surface runoff is slow and the erosion hazard is slight. This soil is used for woodland and most agricultural crops adapted to Willamette Valley climatic conditions. Other uses include wildlife, recreation, and homesites.

Ba - Bc - Bashaw Clay

Bashaw soils consist of poorly drained, very fine textured soils. They occupy nearly level depressional areas and drainageways. The permeability of this soil is poor, with slow runoff and a slight erosion hazard. The natural fertility is moderate and the workability is poor. This soil is used mainly for grass seed, hay, pasture and wildlife.

Cn - Coburg Soils

Coburg soils consist of moderately well drained soils. They occupy nearly level low stream terraces. This soil is poorly drained, permeability is slow, with a slight erosion hazard. The soil is used mainly for grass seed and cereal grain production, pasture and wildlife.

Co - Concord Soils

Concord soils consist of poorly drained soils of silt loam. They occur on nearly level to slightly concave terraces and drainageways. The permeability of this soil is slow, surface runoff is slow and erosion is slight. The soil us used for grass seed, cereal grain production, pasture and wildlife.

Da - Dayton Soils

Dayton soils consist of poorly drained silt loam over clay soils. They occupy sloping to nearly level terraces and drainageways. Permeability is slow, runoff is slow and erosion hazard is slight. Rooting is restricted by a seasonable water table at 12 to 24 inches. These soils are mainly used for ryegrass seed production and pasture.

DnC - DnD - DnE - DnF - Dixonville Soil Series

The Dixonville soil series consists of well drained, silty clays. They occur in foothills in tributary valleys. Permeability is slow, runoff is medium and erosion hazard is moderate to severe. The soils are used for pastures, some grain and row crops (cherries, blackberries) and filberts. They occur on slopes ranging from 3 to 45%.

HaC - HeC - HeD - Hazelair Soils

Hazelair soils consist of moderately well to somewhat poorly drained silty clay loam over clay soils. They occur on slightly concave footslopes. Permeability is slow. Runoff is medium and the erosion hazard is moderate to rapid and severe. These soils are used mainly for native pasture, improved pasture, hay, small grain, wildlife and water supply.

PhC - PhE - Philomath Soils

Philomath soils consist of well drained, fine textured soils. They occur on slopes of 2 to 45%, mostly on the foothills of the Willamette Valley. Permeability is slow, runoff is medium and erosion hazard is moderate to severe. These soils are used for pasture, wildlife, water supply, recreation and homesites.

PrC - PTE - PTF - Price Soil Series

The Price soil series consists of deep, well drained soils. This soil lies on slopes ranging from 3 to 60%. On slopes of less than 20% runoff is slow to medium and the erosion hazard is slight. But on slopes from 20 to 60%, where the soil lies on the sides of the Coastal Mountain Range, runoff is rapid and the erosion hazard is high because of the steepness. These soils have severe limitations for cultivated crops. The soils are used mainly for pasture, timber, water supply and wildlife habitat, with small areas in cereal grain, hay and pasture.

RPE - RPG - Ritner Soil Series

The Ritner soil series consists of moderately deep, well drained soils. These soils are on foothills that merge into mountainous topography. The soils lie on slopes from 12 to 75%. Runoff is rapid and erosion hazard is moderate to high. A few areas are in natural grass and are used for grazing, with the main uses for timber production, unimproved pasture, water supply and wildlife habitat.

Wa - Waldo Soils

Waldo soils consist of poorly drained silty clay. They occupy nearly level or depressional floodplains or terraces. In some areas bedrock may be as shallow as 4 to 5 feet. Rooting depth is limited by a seasonal water table near the surface. Permeability is slow, runoff and erosion hazard are slight. Natural fertility is moderate and workability is fair. This soil used mainly for pasture, hay, grass seed and small grains.

WeA - WoA - WoC - Woodburn Soil Series

The Woodburn soil series consists of moderately well drained silt loam over heavy silt loam formed in silty alluvial deposits on slopes from 0 to 20%. Permeability is moderate in the upper subsoil and slow in the lower part. Runoff is slow to rapid, erosion hazard none to moderate. These soils are used for small grain, grass seed, orchards, vegetable crops, berries, hay and pasture. Other uses include recreation, wildlife, and homesites.

WeC - WkB - Willamette Soil Series

The Willamette soil series consists of well drained loam. They occupy nearly level to sloping valley terraces, and occur on slopes ranging from 0 to 7%. Permeability is moderate, runoff is slow, and erosion hazard is slight to moderate. These soils are used for all agricultural products adapted to the Willemette Valley climatic conditions. Other uses include wildlife, recreation and homesites.

WLG - Witzel Soils

The Witzel soils consists of shallow, well drained soils. This soil lies on sides of hills with slopes ranging from 30 to 75%. Runoff is very rapid and the erosion hazard is high. Permeability is moderately slow, with root penetration limited to a depth of about 12 to 20 inches by the underlying basalt bedrock. This soil is used for timber production, grazing, water supply and wildlife habitat. It has severe limitations to use because of shallow depth, a high content of coarse fragments, and very steep slopes; and is unsuitable for cultivation.

Source: Soil Survey of Benton County, Oregon, U. S. Department of Agriculture, Soil Conservation Service, July 1975.

APPENDIX IV

Definitions for Oak Creek Basin Soil Limitations

Since the population of Corvallis and of Benton County is increasing rapidly, and urbanization is steadily expanding into areas formerly used for farming, the demand for housing, shopping centers, schools, parks and other community developments is drastically rising. In selecting a site for a home, a highway, an industry, recreational use, or other purposes, the suitability of the soils in each site should be determined. Some of the more common properties affecting the use of soils for these purposes are soil texture, shrink-swell potential, steepness of slope, permeability, depth to bedrock and to water table, and the hazard of flooding.

On the basis of these and other related characteristics, the soils of Benton County have been rated for specific land uses. The ratings are shown in the following tables. The ratings used in the tables are slight, moderate, and severe. If the rating is slight, little or no adjustments are needed in use and no limitations are shown. A moderate rating means that the soil has limitations that can be overcome. A severe rating means that the soil has serious limitations that are costly to overcome and that the use of the soil for the intended purpose is questionable.

Definitions for Table Engineering Properties for Oak Creek Basin Soils

Tests to determine liquid limit and plastic limit measure the effect of water on consistence of the soil material. As the moisture content of a clayey soil increases from a very dry state, the material changes from a semi-solid to a plastic state. As the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material passes from a semi-solid to a plastic state. The liquid limit is the moisture content at which the soil material passes from a plastic to a liquid state.

Shrink-swell potential is the relative change in volume to be expected of soil material with changes in moisture content, i.e., the extent to which the soil shrinks as it dries out or swells when it gets wet. The extent of shrinking and swelling is influenced by the amount and kinds of clay in the soil. Shrinking and swelling of soils causes much damage to building foundations, roads, and other structures. A high shrink-swell potential indicates a hazard to maintenance of structures built on, in, or with material having this rating.

Corrosivity pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such soil proportion as drainage, texture, total acidity, and electrical conductivity of the soil material. Corrosivity for concrete is influenced mainly by the content of sodium or magnesium sulfate, but also by soil texture and acidity. Installations of uncoated steel that intersect soil boundaries or soil horizons are more susceptible to corrosion than installations entirely in one kind of soil or in one soil horizon. A corrosivity rating of low means that the probability of soil-induced corrosion damage is low. A rating of high means that the probability of damage is high, and protective measures for steel and more resistant concrete should be used to avoid or minimize damage.

Soil suitability is rated by the terms good, fair, and poor, ratings which have, respectively, meanings approximately parallel to the terms slight, moderate, and severe.

Topsoil is used for topdressing an area where vegetation is to be established and maintained. Suitability is affected mainly by ease of working and spreading the soil material, as in preparation of a seedbed; by natural fertility of the material or the response of plants to it when fertilizer is applied; and by the absence of substances toxic to plants. Texture of the soil material and its content of stone fragments are also characteristics that affect suitability. In addition, suitability ratings consider what damage will result at an area from which topsoil is taken.

Local roads and streets have an all-weather surface expected to carry automobile traffic all year. The roads have a sub-grade of underlying soil material stabilized with lime or cement; and a flexible or rigid surface commonly asphalt or concrete. These roads are graded to shed water and have ordinary provisions for drainage.

They are built mainly from soil at hand, and most cuts and fills are less than six feet deep. Soil properties that most affect design and construction of roads and streets are load-supporting capacity and stability of the sub-grade and the workability and quantity of cut and fill material available. Wetness and flooding affect the stability of the material. Slope, depth to hardrock, content of stones and rocks and wetness affect ease of excavation and amount of cut and fill needed to reach an even grade. Soil limitations are indicated by the ratings slight, moderate and severe. Slight means that soil properties generally are favorable for the proposed use; i.e., limitations are minor and can be easily overcome. Moderate means that some soil properties are unfavorable but can be overcome or modified by special planning and design. Severe means that soil properties are so unfavorable and so difficult to correct or to overcome as to require major soil reclamation, special designs, or intensive maintenance.

Embankments, dikes and levees require soil material resistant to seepage and piping and of favorable stability, shrink-swell potential, shear strength, and compactibility. Unfavorable factors include the presence of stones and organic materials.

Drainage of cropland and pasture is affected by such soil properties as permeability, texture, and structure; depth to claypan, rock or other layers that influence the rate of water movement; depth to the water table; slope and stability of ditchbanks; and susceptibility to stream overflow.

APPENDIX V

TABLE

Oak Creek Basin Soil Limitations

Soil	Dwellings	Septic Tank Absorption Fields	Sewage Lagoons
Abiqua: AbB	Severe: high shrink-swell potential	Severe: moderately slow permeability	Moderate: slopes 3-5%; gravel below 40 inches
Bashaw Clay BA - Bc	Severe: seasonal high water table at depth 0-6 inches, high shrink-swell potential	Severe: very low permeability	Severe: seasonal high water table 0-6 inches
Coburg: Cn	Severe: seasonal high water table, high shrink-swell potential	Severe: moderately slow permeability, seasonal high water table	Severe: seasonal high water table
Concord: Co	Severe: seasonal high water level	Severe: slow permeability, seasonal high water table	Severe: seasonal high water table
Dayton: Da	Severe: seasonal high water level, poorly drained	Severe: seasonal high water table, very slow permeability	Severe: seasonal high water table
Dixonville:			
DnC	Severe: basalt bedrock below 20-40 inches	Severe: slow permeability bedrock below 20-40 inches	Severe: bedrock below 20-40 inches
DnD	Severe: becrock below 20-40 inches, slopes of 12-20%	Severe: excessive slope, slow permeability, bedrock below 20-40 inches	Severe: excessive slope
DnE	Severe: excessive slope	Severe: excessive slope, slow permeability	Severe: excessive slope

Soil	Dwellings	Septic Tank Absorption Fields	Sewage Lagoons
(Dixonville)			
DnF	Severe: excessive slope	Severe: excessive slope, slow permeability	Severe: excessive
Hazelair:			
HaC	Severe: seasonal high water table	Severe: very slow permeability	Severe: seasonal high water table below 12-30 inches
HeC	Severe: seasonal high water table	Severe: very slow permeability	Severe: seasonal high water table below 12-30 inches
HeD	Severe: seasonal high water table	Severe: very slow permeability	Severe: seasonal high water table below 12-30 inches
Philomath: PhC-PhE	Severe: bedrock below depth of less than 20 inches	Severe: bedrock below depth of less than 20 inches, high shrink-swell potential	Severe: bedrock less than 20 inches
Price:			
PrC	Moderate: slopes of 3-12%, moderate shrink-swell poten-tial	Severe: moderately slow per-meability	Moderate to severe: slopes of 3-12%
PTE	Severe: excessive slope, basalt bedrock below depth of 30-40 inches, slopes of 12-30%	Severe: excessive slope, basalt bedrock below depth of 30-40 inches, slopes of 12-30%	Severe: excessive slope
PTF	Severe: excessive slope; basalt bedrock below depth of 30-40 inches, slopes of 12-30%	Severe: excessive slope, basalt bedrock below depth of 30-40 inches, slopes of 12-30%	Severe: excessive slope

Soil	Dwellings	Septic Tank Absorption Fields	Sewage Lagoons
Ritner:			
RPE	Moderate to severe: basalt bedrock below depth of 30-40 inches, slopes of 12-30%	Severe: basalt bedrock below depth of 30-40 inches, slopes of 12-30%	Severe: excessive slope
RPC	Severe: excessive slopes	Severe: excessive slope	Severe: excessive slope
Waldo: Wa	Severe: seasonal high water table, poorly drained	Severe: seasonal high water table, slow permeability	Severe: seasonal high water table at depth of 0-6 inches
Woodburn:			
WoA	Moderate to severe: seasonal high water table at depth of 18-36 inches	Severe: seasonal high water table, slow permeability	Severe: seasonal high water table at depth of 18-36 inches
WoC	Moderate to severe: seasonal high water table at depth of 18-36 inches	Severe: seasonal high water table, slopes of 3-12%, slow permeability	Severe: slopes of 3-12%, seasonal high water table at depth of 18-36 inches
Willamette:			
WeA	Moderate: moderate shrink-swell potential	Slight	Moderate: moderate permeability
WeC	Moderate: moderate shrink-swell potential	Slight	Moderate to severe: slopes of 3-12%, moderate permeability
Witham: WkB	Severe: high shrink-swell potential	Severe: very slow permeability, seasonal high water table	Severe: seasonal high water table at depth of 12-30 inches

Soil	Dwellings	Septic Tank Absorption Fields	Sewage Lagoons
Witzel: WLG	Severe: excessive slope	Severe: excessive slope	Severe: excessive slope

Source: Soil Survey of Benton County, Oregon, U. S. Department of Agriculture, Soil Conservation Service, July, 1975, Table VIII.

Soil Limitations and Suitabilities for Corvallis Area, Oregon, Oregon State University Extension Service, August, 1974.

APPENDIX VI

TABLE

Engineering Properties

of Oak Creek Basin Soils

Soil	Topsoil	Limitations for Roads & Streets	Embankments, Dikes, and Levees	Artificial Drainage	Winter Grading
Abioua: AbB	Fair: silty clay loam	Severe: high shrink-swell potential	Low shear strength, low permeability, good to fair resistance to piping	Well drained, ditched banks stable	Plastic when when wet, difficult to excavate
Bashaw: Ba - Bc	Poor: poorly drained	Severe: high shrink-swell potential	Low permeability, good resistance to piping	Poorly drained, very slow permeability, perched water table, ditch-banks unstable	Seasonal high water table, plastic subsoil
Coburg: Cn	Fair: silty clay loam	Severe: high shrink-swell potential	Low permeability, good to fair resistance to piping	Moderately well drained, moderately slow permeability, seasonal high water table	Plastic when wet, difficult to excavate
Concord: Co	Poor: poorly drained	Severe: poorly drained	Moderate to low permeability, fair to poor resistance to piping	Poorly drained, slow permeability, seasonal high water table	Seasonal high water table, plastic when wet, difficult to excavate

Soil	Topsoil	Limitations for Roads & Streets	Embankments, Dikes, and Levees	Artificial Drainage	Winter Grading
Dayton: Da	Poor: poorly drained	Severe: high shrink-swell potential, poorly drained	Low permeability, good resistance to piping	Poorly drained, very slow permeability, seasonal high water	Seasonal high water table, plastic clay subsoil
Dixonville: DnC, DnD, DnE, DnF	Poor, silty clay below depth of 5 inches	Severe: high shrink-swell potential	Low permeability, good resistance to piping	Well drained, slow permeability	Plastic when wet, difficult to excavate
Hazelair: HaC, HeC, HeD	Fair: silty clay loam	Severe: high shrink-swell potential, hazard of seepage	Low permeability, good resistance to piping	Moderately well drained & somewhat poorly drained, very slow permeability, hazard of seepage, perched water table, ditch-banks unstable	Seasonal high water table, plastic subsoil
Philomath: PhC, PhE	Poor: silty clay or clay	Severe: high shrink-swell potential, slopes of 3-45%	Low permeability, good resistance to piping	Well drained, slow permeability	Very plastic when set, difficult to excavate
Price: PrC, PTE, PTF	Poor: silty clay & gravelly clay	Fair to poor: slopes slopes of 3-60%, moderate shrink-swell potential	Low permeability, fair to poor resistance to piping	Well drained, moderately slow permeability	Plastic clay when wet, difficult to excavate
Ritner: RPE, RPG	Poor: gravelly	Poor: slopes of 12-75%	Low permeability, fair resistance to piping, many cobblestones	Moderately slow permeability, well drained	Gravelly, slopes of 12-75%

Soil	Topsoil	Limitations for Roads & Streets	Embankments, Dikes, and Levees	Artificial Drainage	Winter Grading
Waldo: Wa	Poor: poorly drained	Severe: high shrink-swell potential, seasonal high water table, poorly drained	Low permeability, fair resistance to piping	Poorly drained, slow permeability, ditchbanks unstable	Seasonal high water table, plastic when wet, difficult to excavate, poor surface drainage
Woodburn: WoA, WoC	Good	Moderate: moderate shrink-swell potential	Low to moderate permeability, fair to poor resistance to piping	Moderately well drained, slow permeability	Plastic when wet; difficult to excavate
Willamette: WeA, WeC	Good to fair, slopes of 0-12%	Moderate to severe: slopes of 0-12%, moderate shrink-swell potential	Low to moderate permeability, fair to poor resistance to piping	Well drained, moderate permeability	Plastic when wet, difficult to excavate
Witzel: WLC	Poor, cobbly	Severe: bedrock below depth of 12-20 inches, slopes of 30-75%	Low permeability, good resistance to piping, many cobblestones	Well drained, moderately slow permeability	Very cobbly

Source: Soil Survey of Benton County, Oregon, U. S. Department of Agriculture, Soil Conservation Service, July, 1975, Table VI.

Soil Limitations and Suitabilities for Corvallis Area, Oregon, Oregon State University Extension Service, August, 1974.

FOOTNOTES

1. Extension Service Oregon State University, Resource Atlas, Benton County, Oregon. March 1974, p. 2.

2. U. S. Department of Agriculture, Soil Conservation Service, Soil Survey of Benton County, Oregon. July, 1975, p. 1.

3. U. S. Department of Agriculture, Soil Conservation Service, op. cit., foot note 2, p. 3.

4. Planning Department, City of Corvallis, Toward the Year 2000, Corvallis, Oregon. July, 1975, p. I-1.

5. Planning Department, City of Corvallis, op. cit. footnote 4, p. I-2.

6. Oregon District 4 Council of Governments, Statistical Data Base, Corvallis, Oregon, 1974.

   Center for Population Research and Census, Population Estimates of Counties and Incorporated Cities of Oregon, Portland State University, July, 1974, pp. 17-18.

7. Development for Hewlett-Packard will take place in four stages, the first of which should be completed in the fall of 1975. This initial phase would employ 500 people. Three more phases would follow. Phase two would be completed by 1977, and would employ 1300 people. Phase three would be completed by 1985, employing 3500 people. And Phase four would be completed to 1991, with employment of 4900 persons. It is estimated, by the Oregon Housing Division, that each new Hewlett-Packard job will result in 1.5 secondary jobs, and over a longer period accelerates to a one-to-four ratio. This would translate by 1978 into 22,250 new jobs.

8. Housing Division, Department of Commerce, Planning for Housing and People in Oregon, Salem, Oregon, June 1975, p. 20.

9. Housing Division, op. cit. footnote 8, p. 32.

10. Planning Department, City of Corvallis, op. cit. footnote 4, p. II-27.

11. Planning Department, City of Corvallis, op. cit. footnote 4, p. II-28.

FOOTNOTES

12. In 1970 Corvallis had the highest density of population per square mile of any community in Oregon - 4450 persons per square mile. Larger cities were not as intensively developed, e.g., Portland had a density of 4294 persons per square mile, Eugene had 2925, and Salem 2776.

    U. S. Bureau of the Census: Census of Population: 1970 General Population Characteristics Final Report PC (1)-B1, U. S. Summary. Washington, D. C., U.S.G.P.O., 1971.

13. The U. S. Bureau of the Census uses the fiture 2.97 as the average number of persons considered to occupy a dwelling unit. For this paper, this figure was rounded to 3.0.

14. Cornell, Howland, Hayes, and Merryfield (CH_2M Hill), Water Plan for the Corvallis Urbanized Area, Corvallis Regional Office, January 4, 1971, Figure II-6, Table II 4, and p. II-9.

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