CITY OF LEBANON
Storm Drainage Master Plan

CHAPTER 2

2.0 WATERSHED

This chapter describes the drainage characteristics of the City of Lebanon and the watersheds which drain through the City. These characteristics include location, climate, topography, soil conditions, existing and future land use conditions, and an overview of existing drainage facilities. This information will be used in this master plan to evaluate the performance of the existing drainage facilities and to identify future drainage requirements. Figure 2.1, "Aerial Map," is an aerial photograph showing the lands within the Lebanon Urban Growth Boundary (UGB) and the waterways draining these lands.

2.1 LOCATION

The City of Lebanon is located in Linn County and is situated within the northern Willamette Valley on the west slope of the Cascade Mountain Range. It is approximately 90 miles south of Portland and 26 miles northwest of Sweet Home. Figure 1.1, "Vicinity Map," shows this location in detail. The City of Lebanon is located along the portion of the South Santiam River 27 miles downstream from Foster Dam. The Santiam River flows into the Willamette River 16.5 miles northwest of Lebanon.

There are three major waterways which drain the City of Lebanon: the South Santiam River, Oak Creek and Cox Creek. There are also four minor drainageways within the UGB that collect local drainage. These minor waterways are the Lebanon-Albany Canal which generally bisects the City east and west, Little Oak Creek which collects a small portion southwest of the City Center, Marks Slough and Crown Creek which are both diversions off of the Lebanon-Albany Canal and outfall into the South Santiam River to the east.

Lebanon's Urban Growth Boundary encompasses approximately 10.5 square miles of the approximately 711 square mile watershed draining through the UGB. Of these 711 total square miles, 687 square miles drain to the Santiam River, 17 square miles drains to Oak Creek and 7 square miles is drains to Cox Creek.

Figure 2.2, "Watershed Map" shows the watershed boundaries of the major and minor drainageways within the UGB. Figure 2.3, "Oak Creek Drainage Basin Map", shows the boundaries of the entire Oak Creek watershed, including the large portion of the watershed outside the UGB.

The majority of the land within the existing City Limits is developed with a few exceptions to the west and north. Most of the undeveloped land in the UGB is also to the west and north of the City with some undeveloped land to the east across the South Santiam River on Ridgeway Butte.

2.2 STUDY AREA DELINEATION

While this master plan considers the runoff impact from the entire watershed which drains through the City, the specific "Study Area" for this plan is the Lebanon Urban Growth Boundary. The UGB is delineated in the City's Comprehensive Plan and is approximately 6,700 acres in area. Approximately three-quarters of the UGB is currently incorporated by the City of Lebanon. This remainder of the Urban Growth Boundary is expected to be annexed by the year 2002. Significant deviation from this projection would affect the recommended phasing of improvements as recommended by this plan. The "Aerial Map", Figure 2.1, shows the boundaries of the study area (identical to the UGB) and the major drainage basins. This map provides a visual indication of the limits of existing development and of areas within the UGB which are generally not yet developed.

There are two known developments that are not shown on this aerial map but are expected in the near future. The largest of the two is an industrial development near Hansard Avenue at the northern edge of the existing City Limits. This industrial development is expected to begin construction within the next two years and will be approximately 50-60 acres of light industrial use. One other local development is on Airport Road near 3rd Avenue. The development is a small 5 acre supermarket. These developments are included as existing developments in this study.

There are four streets within the study area that have been used in this Plan as locational references: Tangent Street (Highway 34), Main Street (Highway 20), Airport Road and Oak Street. The South Santiam River is also used as an easterly border to current development.

2.3 CLIMATE

Since the City of Lebanon is located within the Willamette Valley west of the Cascades the climate is typically mild. It is generally marked by long wet winters and short warm dry summers. Its climate results from moist maritime air masses moving from the Pacific Ocean inland over the Coastal Range. Agricultural growing season is 160 to 200 days. The following sub-sections describe the precipitation and temperature patterns of the Lebanon area.

Average annual precipitation is approximately 40 inches. The effect of snowmelt on drainage conditions within the city's drainage system is minimal, other than the South Santiam River, and will not be considered in this study. Precipitation is considered in detail in Chapter 5, "Rainfall Analysis".

During the winter months, the temperature averages about 40 degrees F. with an average daily minimum temperature of about 34 degrees. During the summer months, the average temperature is about 65 degrees with an average daily maximum temperature of around 76 degrees.

2.4 SOILS

Knowledge of local soil conditions and their response to precipitation is essential for evaluating a drainage system. There are various disposal paths possible for precipitation. Besides creating runoff, precipitation may evaporate, collect in depressions, be intercepted by plants, or infiltrate into the soil. When precipitation exceeds the capacity of these disposal paths, storm water runoff results.

Runoff rates and total runoff volumes are increased as the amount of impervious ground cover such as rooftops and pavements increases. Runoff rates are also increased by the existing degree of soil saturation and by the slope of the watershed. Runoff potential is based on the soil's capacity to absorb precipitation. The lower the soil's infiltration capacity, the higher its runoff potential. Sandy soils generally have higher infiltration capacity and lower runoff potential, while impervious surfaces have limited infiltration capacity and very high runoff potential.

Soils within the Lebanon watershed are listed in Table 2.1, "Hydrological Classification of Soils". This information was compiled from the U.S. Soil Conservation Service's Soil Survey of Linn County, Oregon (1983). There are four major geologic formations within the area. Three of these consist of unconsolidated rocks of predominantly fluvial origin. The fourth, the Little Butte Formation, is consolidated rock of volcanic origin. The unconsolidated rocks are Quaternary lower terrace deposits, Quaternary alluvium, and Quaternary middle terrace deposits.

The soils in the Lebanon area range from clay and silty clay in flood prone areas along some of the streams, to stony mountainous land for part of Ridgeway Butte. Between these two extremes are clay, silt, sand and gravelly loam. Most of central Lebanon is located on clay loam or silty clay loam. Most of the surrounding agricultural lands are loam and silty loam soils. Areas around the river and some streams are sandy and sandy loam or gravelly and stony loam.

The Lebanon area is within the Willamette River Basin which is generally very fertile agricultural soils. These silty loams and clays have moderate to high runoff potential. Each of the soil types are classified by runoff potential. Based on runoff potential, the soils are grouped into Soil Conservation Service (SCS) hydrologic groups A, B, C, or D.

Soils in hydrological group A have good infiltration and low runoff potentials, while those in group D have poor infiltration and high runoff potentials. The location of these hydrologic soil groups within the study area are shown in Figure 2.4, "Hydrologic Soil Group Map".

Within the study area, approximately 40% is Group D (high runoff potential) and located around Cox Creek and through the center of the City. Approximately 45% is Group C

(moderate runoff potential), and only 12% is considered to be Group B (moderately low runoff potential) located along the South Santiam River. 3% is considered to be Group A (low runoff potential) in the northeast section of the City near Crown Creek.

2.5 TOPOGRAPHICAL FEATURES

Although the City of Lebanon is at the base of the Cascades, the majority of the City's topography is relatively flat to gently rolling, dipping to the northwest. The east side of the South Santiam River in the Ridgeway Butte area has some very steep slopes, while the rest of the City on the west side of the City has very little slope.

The major waterways within Lebanon generally have less than a .5% channel slope and flow slowly under normal conditions and very slowly under summer low flow conditions.

In many areas of the City the flat terrain causes local ponding and swampy areas. These areas include swampy regions along the railroad tracks northeast of the Santiam Highway near the east end of Market Street, just north of Russell Street between Mill Street and Franklin Street, east of the Lebanon-Albany Canal between the Santiam Highway and Park Street. Several old drywells exist in this area. Local ponding exists throughout the City because of the flat terrain, the undersized local collector pipes (usually 8" to 10" in diameter) and condition of some of the residential streets.

The drainageways within the north and west agricultural lands are primarily open manmade ditches dug to drain marshy areas for agriculture or to define and straighten indistinct surface drainage patterns. These open ditches tend to wander across the open fields until they reach either Cox Creek or Oak Creek. Many of these drainageways change directions with each heavy rain.

2.6 EXISTING DRAINAGE FACILITIES

Stormwater runoff within the Lebanon watershed is generally collected at several locations throughout the City by open channel systems. Although Lebanon is located adjacent to the South Santiam River much of the UGB drains not into the South Santiam but into a series of small tributaries of the Willamette which flow in a northwesterly direction. The majority of the inner City's drainage is collected and transported by a network of pipes which outfall into one of the major open channel systems draining the City.

The eastern portion of the watershed generally drains into the South Santiam River by overland flow with little or no formal piped systems. Most of the drainage on the west side of the South Santiam River and east of the Lebanon-Albany canal is collected by piped systems and either discharged into the canal at various points, or connected to drywells. Some flows overland into the South Santiam River.

The portion of the watershed directly west of the Lebanon-Albany canal consists of commercial and residential developments which are collected by several separate piped systems which generally drain west into Cox Creek. A large trunk system was recently constructed in Main Street by the Oregon Highway Department which collects some of the local drainage along Main Street and its surrounding commercial areas. This trunk line drains north to Dodge Street and then east until it eventually discharges into the Marks Slough near Had Irvine Park. This trunk was constructed to accept the flow which is currently collected by the combination sanitary/storm system which will be eliminated within this study period. It has been oversized for future growth and expansion of the basin.

The area west of Main Street is generally older residential land from Main Street to approximately 12th Street. This area has local drainage systems which are discharged into Cox Creek at various locations.

Cox Creek originates in the southern part of the City near Main and Market Street by Weldwood Park. This open channel drainageway is constricted throughout the study area by channel obstructions at inadequate road crossings and unmaintained channel reaches. Cox Creek collects the majority of the drainage from within the City limits and is a critical element in the planning for drainage within the UGB. Figure 2.2, "Watershed Map" shows the boundaries of the Cox Creek watershed.

2.7 LAND USE

Knowledge of local land use practices is also essential for developing a successful drainage master plan because as a watershed urbanizes, impervious areas within the drainage basin typically increase. This increase in impervious area can often dramatically increase the amount and rate of runoff within the watershed. Increases in impervious area also decreases the peak runoff time of concentration. Time of concentration refers to the time it takes for runoff from the most distant point in the basin to reach the basin's point of discharge. Lag time is a function of the time of concentration and is defined as the difference in time between the peak in precipitation and the peak in flow at the discharge point of the basin. These parameters are explained in more detail in Chapter 4.

To minimize the risk of flooding and to protect against the loss of property, a drainage system is typically designed to accommodate both existing flows and anticipated future flows for some frequency of occurrence commensurate with the potential for loss.

The present extent of land development in the watershed was determined from 1988 aerial photography (shown in Figure 2.1) and known development which has taken place since that time or is expected to take place in the immediate future. The land use designations were compiled from the Comprehensive Plan for the City of Lebanon. Figure 2.5 "Land Use Map" shows the land uses within the UGB designated by the Comprehensive Plan and the extent of current development.

Presently zoned and ultimate land use acreages are summarized in Table 2.2, "Existing and Future Land Use Areas". These estimates are based on the current City Comprehensive Plan, on recent aerial photographs, and on ground reconnaissance.

Approximately 80% of the study area is currently within the incorporated limits of the City of Lebanon. The remaining areas generally lying north and west are agricultural lands within unincorporated Linn County. The following sections describe the currently zoned and ultimate development (full buildout within the UGB) for residential, commercial, Special Development, Public Usage and industrial land uses within the study area.

Residential Land Use

Land designated as residential in the Lebanon Urban Growth Boundary (UGB) provides for significant future expansion. While early development was located around the central business district (CBD) of the City, more recent development has occurred west of the central business district near the airport and near Highway 34. Additional recent development has occurred south of the CBD, between Walker Road and Vaughan Lane. Housing density in the developed areas has varied dependent upon zoning, whether single-family residential or mixed-density residential.

A significant amount of the land available for residential development lies west and primarily south of the UGB.

Industrial

Industrial zoning accounts for 28% of the area within the UGB. A majority of these industrial lands are located in the northern portion of the UGB, and are included in the Northwest Lebanon Urban Renewal Area. The Northwest Lebanon Urban Renewal Plan has outlined infrastructure improvements in this area and phased these improvements for construction throughout the next 15 years. Development in the Hansard Avenue portion of the Urban Renewal Area is phased for immediate construction and was considered as existing development for the purposes of calculating runoff.

Other industrial areas are located along the western and eastern boundaries of the UGB. Along the eastern boundary, the industrial lands are currently occupied by the Lebanon Sewage Treatment Plant settling ponds, Willamette Industries and Champion Building Products. Each of these developments contains less pervious areas than most industrial developments. While little increase in impervious surface is expected in the treatment plant area, increases in impervious surface at both the Champion Building Products property and Willamette Industries property are possible. Lands zoned for industrial use along the western boundary near the Lebanon Airport are currently occupied by undeveloped pasture and agricultural lands. New developments are expected within the study period.

Commercial

Only 3% of the lands within the Urban Growth boundary are zoned for commercial development. Nearly all of the commercial land within the study area is located adjacent to the Santiam Highway, with only a few scattered one and two acre properties elsewhere in the city. The largest segment of commercial lands occurs in the mid-town region adjacent to the Santiam Highway between Oak Street and Rose Street.

The lands currently zoned for commercial use are 96% developed. Some minor commercial development is possible along the Lebanon Highway near 10th Street and in the eastern portion of the UGB along Grant Street, near River Park.

Special Development District

The zoning designation of "Special Development District" is very flexible, allowing developments ranging from single family residential to light industrial. "Special Development District" designation requires only that new developments be compatible with surrounding land uses.

Special Development Districts (SDD) comprise 5% of the UGB. Currently only one-fourth of the area zoned as SDD is developed. SDD lands are typically located adjacent to industrial or commercial areas, and for the purposes of this study, these areas were assumed to contain the impervious areas associated with commercial and industrial developments.

Public Usage

Lands zoned for Public Usage include city parks, the Lebanon Airport, the Sewage Treatment Plant main offices, the cemetery and schools. This study assumes that impervious areas on Public Usage lands will not change significantly during the study period.

TABLE 2.1

HYDROLOGICAL CLASSIFICATION OF SOILS

SOIL CLASSIFICATION	RUNOFF POTENTIAL	HYDROLOGICAL GROUP
Amity silt loam	High	D
Bashaw silty clay	High	D
Bellpine silty clay loam 12 to 20 percent slopes	Moderate	C
Briedwell silt loam 0 to 7 percent slopes	Low	B
Camas gravelly sandy loam	Very Low	A
Chapman loam	Low	B
Chehalis silty clay loam	Low	B
Clackamas gravelly silt loam	High	D
Clackamas Variant silt loam	Moderate	C
Cloquato silt loam	Low	B
Coburg silty clay loam	Moderate	C
Conser silty clay loam	High	D
Courtney gravelly silty clay loa	High	D
Dayton silt loam	High	D
Dixonville silty clay loam 30 to 50 percent slopes	Moderate	C
Fluvents	Very Low	A
Hazelair silty clay loam 7 to 20 percent slopes	High	D

TABLE 2.1

(continued)

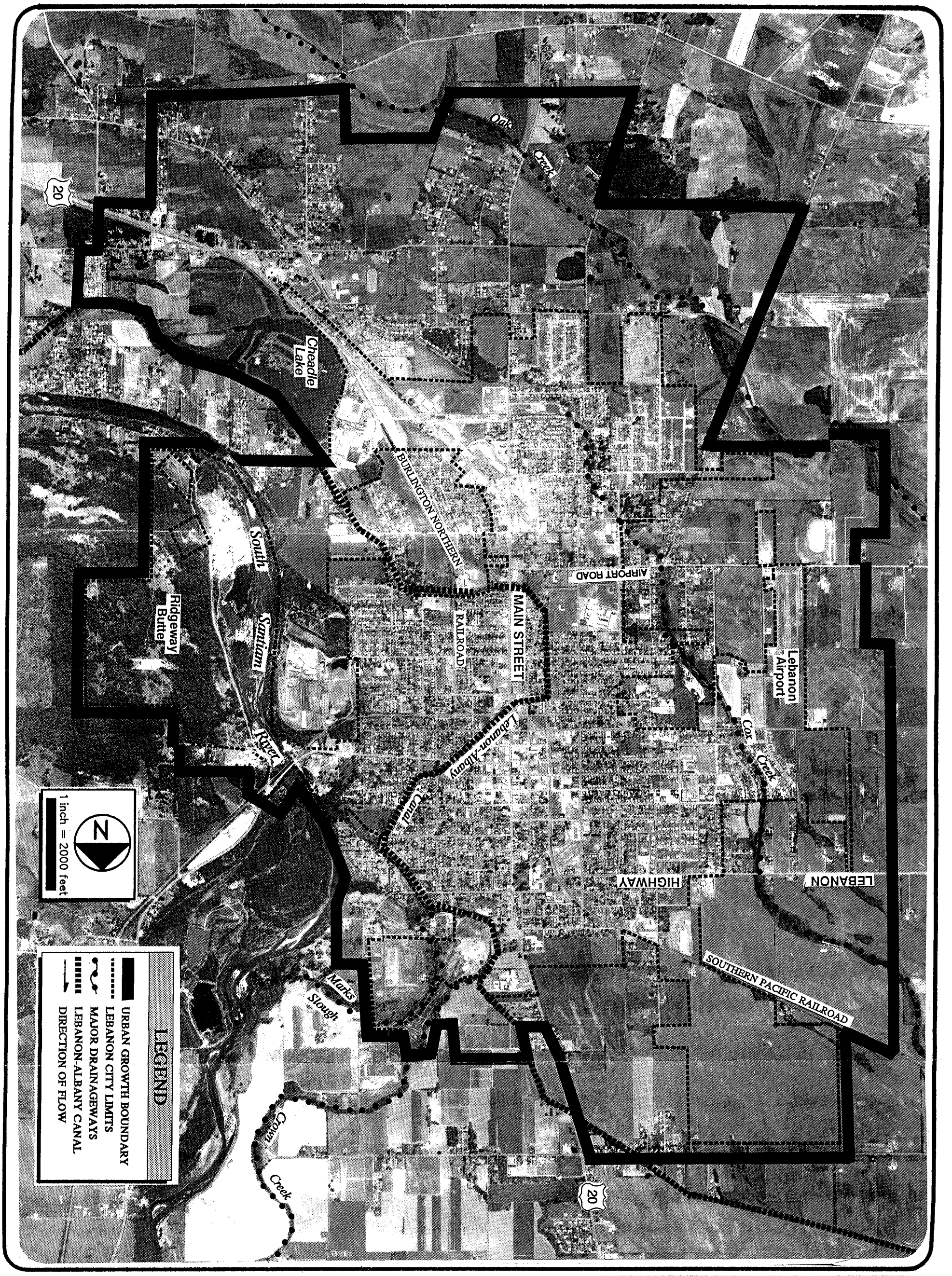
HYDROLOGICAL CLASSIFICATION OF SOILS

SOIL CLASSIFICATION	RUNOFF POTENTIAL	HYDROLOGICAL GROUP
Holcomb silt loam	High	D
Malabon silty clay loam	Moderate	C
Newberg fine sandy loam	Low	B
Ochrepts	Very Low	A
Philomath cobbly silty clay 3 to 12 percent slopes	High	D
Philomath cobbly silty clay 12 to 45 percent slopes	High	D
Pits	Low	B
Riverwash	Very Low	A
Salem gravelly silt loam	Low	B
Salkum silty clay loam 8 to 15 percent slopes	Low	B
Witzel very cobbly loam 3 to 70 percent slopes	High	D

TABLE 2.2

EXISTING AND FUTURE LAND USE AREAS

LAND USE	AREA ZONED (acres)	% OF UGB	AREA OF EXISTING DEVELOPMENT (acres)	% OF ZONING DEVELOPED
INDUSTRIAL	1758	28%	215	12%
Light	1357	21%	112	8%
General	401	6%	103	26%
COMMERCIAL	192	3%	184	96%
RESIDENTIAL	3742	59%	1426	38%
Mixed Density	3084	49%	886	29%
Single Family	658	10%	540	82%
SPECIAL DEVEL. DISTRICT	319	5%	86	27%
PUBLIC USAGE	327	5%	163	50%
TOTAL	6,338	100%	2,074	33%



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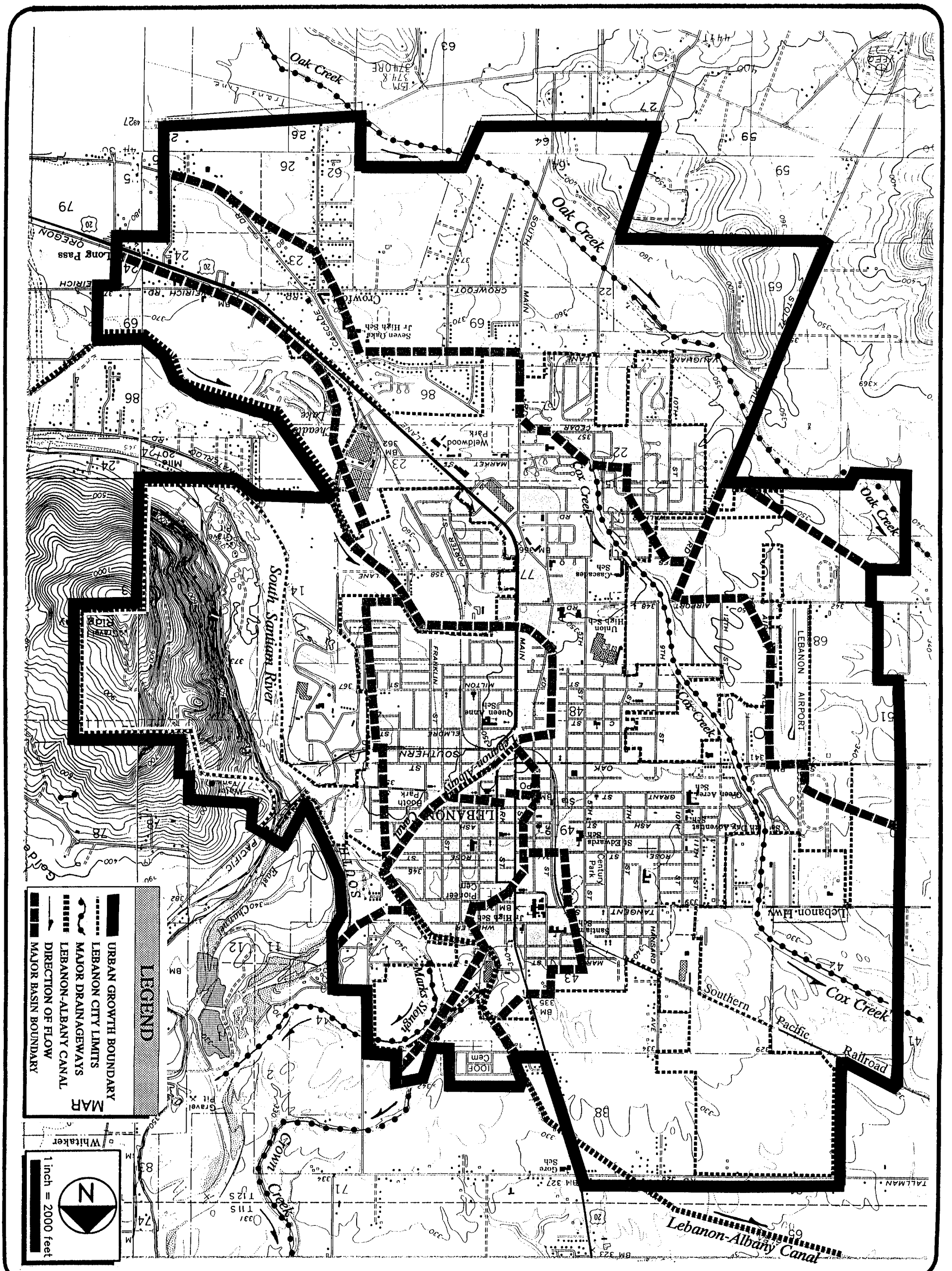
CIVIL & GEOLOGICAL ENGINEERING
1201 SW 12TH AVENUE SUITE 620
PORTLAND, OREGON (503) 228-7718

AERIAL MAP

CITY OF LEBANON
Storm Drainage Master Plan

FIGURE 2.1



PROJECT NO. 292 DP 11	DATE MAR 1991	**DAVID J. NEWTON ASSOCIATES** INCORPORATED CIVIL & GEOLOGICAL ENGINEERING 1201 SW 12TH AVENUE SUITE 620 PORTLAND, OREGON (503) 228-7718	**WATERSHED MAP** CITY OF LEBANON Storm Drainage Master Plan

FIGURE 2.2

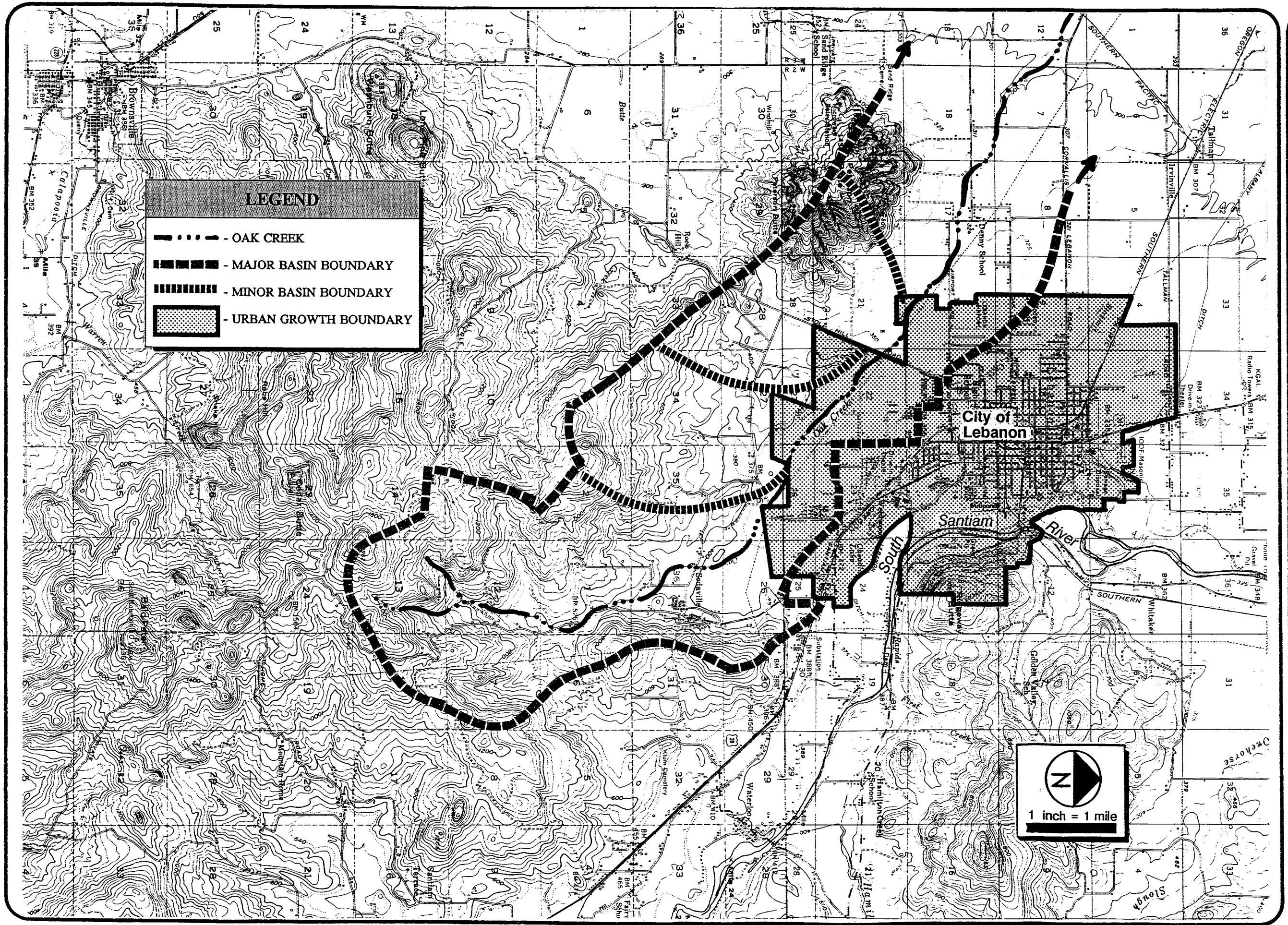


FIGURE **2.3**

OAK CREEK DRAINAGE

CITY OF LEBANON
Storm Drainage Master Plan

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CIVIL & GEOLOGICAL ENGINEERING
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PORTLAND, OREGON (503) 228-7718

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FIGURE **2.4**

HYDROLOGIC SOIL GROUP MAP

CITY OF LEBANON
Storm Drainage Master Plan

1 inch = 2000 feet

Oak Creek

Cox Creek

South Santiam River

Crown Creek

RIDGEWAY BUTTE

A

B

C

D

LEGEND

- URBAN GROWTH BOUNDARY
- LEBANON CITY LIMITS
- MAJOR DRAINAGEWAYS
- LEBANON-ALBANY CANAL
- DIRECTION OF FLOW

- HYDROLOGIC SOIL GROUP A
- HYDROLOGIC SOIL GROUP B
- HYDROLOGIC SOIL GROUP C
- HYDROLOGIC SOIL GROUP D

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FIGURE 2.5

LAND USE MAP

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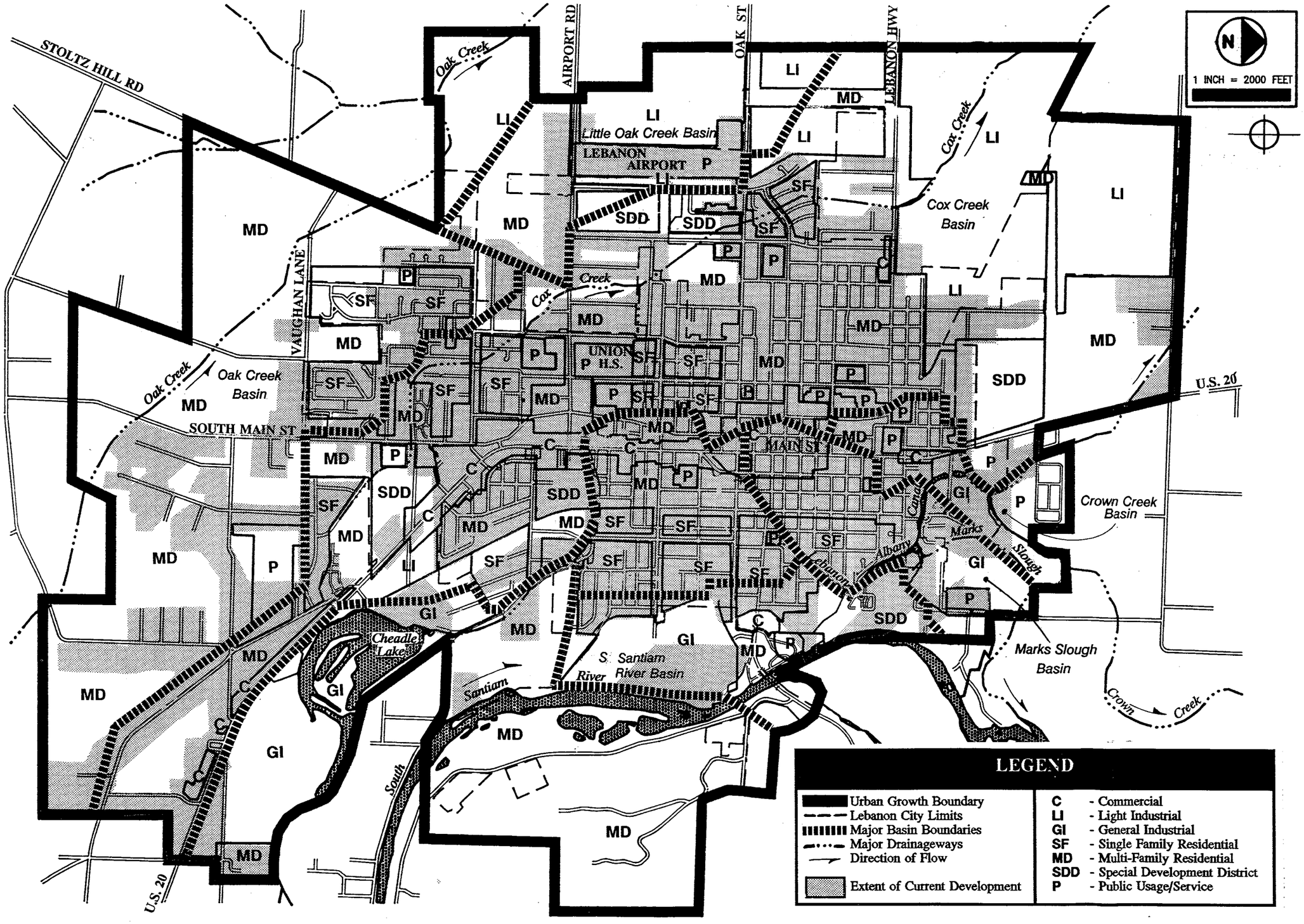
Storm Drainage Master Plan



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PORTLAND, OREGON (503) 228-7718

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