CITY OF LEBANON
Storm Drainage Master Plan

CHAPTER 7

7.0 HYDRAULIC ANALYSIS RESULTS AND DRAINAGE IMPROVEMENTS

This chapter accomplishes the following:

A. For each sub-basin group, a description of the drainage pattern is presented, followed by a discussion of problem areas, their potential solutions, recommended improvements and any other additional requirements which are recommended for the area.

B. Existing storm drainage facilities are shown.

C. Peak flows under both existing and future development conditions are indicated.

D. Recommended drainage improvement projects are identified and summarized in the "Cost Estimate" sheets included for each recommended project. These sheets summarize the improvements required, show phasing and priority, list the quantities of materials and estimated unit costs, and show estimated total project costs. This information is further summarized into one table which is presented in Chapter 8 as Table 8.1, "Project Cost and Phasing Summary".

Figure 7.0a, "Plan Reference Map", presents an index map which can be used to reference the sub-basin group of interest and to quickly find its plan number. Figure 7.0b, "Plan View Legend", explains the symbols used in the plan views presented in this chapter as Figures 7.1 through 7.23.

The recommended improvements are identified on the plan sheets as heavy black lines superimposed on the existing drainageway and a recommended phase period shown over the symbol used to convey the existing and future flow/diameter information. The recommended improvements generally show a different size of conduit in the "future/diameter" quadrant of the symbol. The phasing periods are shown as a particular year, such as "10 YEAR", to indicate the general time frame that the improvement is expected to be needed based on the projected rate of development. Figure 7.0b explains the range of years which are meant by each of these phase categories. For example, "10 YEAR" means during the period 1997 through 2001 approximately.

In general, a 5-year capacity was judged to be adequate for smaller drainageways and for piped systems serving individual sub-basins. A 10-year design was considered to be adequate for primary piped systems unless severe damage would result from more

infrequent storms. Drainageways in floodplain area routes were generally designed for the 100 year event.

Each of the following sections in this chapter address a sub-basin group and present plan information about that group. For sub-basin groups that include recommended improvement projects, one or more cost estimate sheets will be included.

The recommended improvements are shown in the following chapter on Figure 8.1, "Drainage Improvements Projects", with costs summarized in Table 8.1, "Project Cost and Phasing Summary".

FIGURE 7.0a

PLAN REFERENCE MAP

CITY OF LEBANON
Storm Drainage Master Plan

LEGEND
- URBAN GROWTH BNDRY (UGB)
- MAJOR BASIN BNDRY
- STREETS
- CREEKS
- RAILROADS
- RIVERS/LAKES

OAK CREEK BASIN (O)
LITTLE OAK CR BASIN (LO)
COX CREEK BASIN (C)
'X' CREEK BASIN (X)
MARKS SLOUGH BASIN (M)
LEBANON-ALBANY CANAL BASIN (L)
S. SANTIAM RIVER BASIN (S)
UNMAPPED

FIG 7.1, FIG 7.2, FIG 7.3, FIG 7.4, FIG 7.5, FIG 7.6, FIG 7.7, FIG 7.8, FIG 7.9, FIG 7.10, FIG 7.11, FIG 7.12, FIG 7.13, FIG 7.14, FIG 7.15, FIG 7.16, FIG 7.17, FIG 7.18, FIG 7.19, FIG 7.20, FIG 7.21, FIG 7.22, FIG 7.23

LEBANON STATE AIRPORT
LINN – BENTON C.C. BRANCH
FIRE STA.
LEBANON UNION H.S.
SEVEN OAK MID. SCH.
CROWFOOT SCHOOL
SEWAGE TREATMENT
GILLS LANDING
CHEADLE LAKE
LAND FILL
OAK ST.
AIRPORT RD
LEBANON HWY. NO. 210
SOUTHERN PACIFIC RAILROAD CO.
COX CREEK
OAK CREEK
MAIN ST.
SANTIAM HWY.
SANTIAM HWY. NO. 16
SANTIAM CANAL
NORTHERN R.R.
ALBANY-LEBANON CANAL
MARKS SLOUGH
S. SANTIAM RIVER
E. CHANNEL
SOUTH SANTIAM RIVER
CASCADE DR.
SOUTHERN PACIFIC R.R.
LEBANON-SANTIAM CANAL

N
1 inch = 2000 feet

292 DP 11 DO - LEB-PLAN

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DATE
MAR 1991

PROJECT NO.
292 DP 11 DO

PLAN VIEW LEGEND

AREA OF INTEREST

SUB–BASIN BOUNDARY

C20 SUB–BASIN NAME

SUB–BASIS NODE AND DIRECTION OF FLOW

C20 WATER SURFACE PROFILE PROVIDED

PHASE*

Q10 / DIA. (E)	Q10 / DIA. (F)

EXISTING PIPING

EXISTING PRIVATE PIPING

PROPOSED PIPING PROJECTS

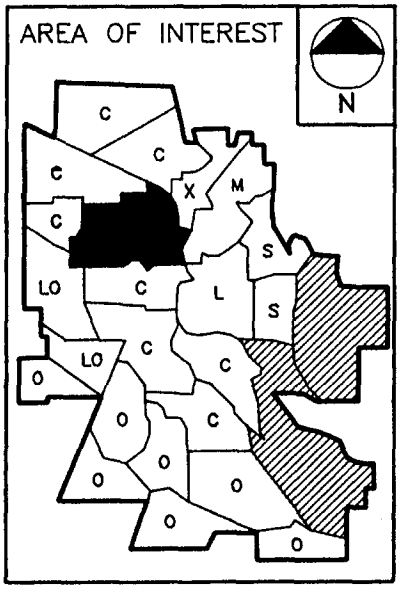
MANHOLE

CULVERT

INLET/OUTFALL

* IMM = IMMEDIATELY (1990–1993)
* 5 YR = 1993–1997
* 10 YR = 1997–2001
* 15 YR = 2001–2005

E = EXISTING
F = FUTURE
Q10 = PIPE FLOW (CFS)
DIA. = PIPE DIAMETER



AREA OF INTEREST LEGEND

PLAN VIEW AREA

UNMAPPED BASIN AREAS

C MAJOR BASIN PREFIX

MAJOR BASIN BOUNDARIES

URBAN GROWTH BOUNDARY

DATE		FIGURE
MAR 1991	PLAN VIEW LEGEND	7.0b
PROJECT NO. 292 DP 11	CITY OF LEBANON Storm Drainage Master Plan	

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CITY OF LEBANON
Storm Drainage Master Plan

Section 7.1

PLAN SHEET: Marks Slough - Had Irvine Park
SUB-BASINS: M-0, M-10, M-10L, M-20

DESCRIPTION OF DRAINAGE FEATURES:

The Had Irvine Park Basin can be subdivided into two regions with distinctive drainage characteristics. The sub-basins south of the park are nearly fully developed. These basins (M-20, M-10L, and M-10) are served by the 48" trunk main which travels along Main Street (Highway 20 South) between Grant and Dodge, turns north along Grove Street to Wheeler, and extends down Wheeler Street, underneath the Lebanon-Albany Canal, to the 60" outfall into Marks Slough at Had Irvine Park. Sub-basin M-20 contains the Highway 20 commercial developments between Rose and Grant and is adequately served by 10" and 12" collectors for both existing and future 10 year flows. Sub-basins M-10 and M-10L lie west of the Lebanon-Albany Canal, south of Wheeler Street and contain 95 percent developed single family and mixed density residential areas. Eight inch collector pipes convey runoff from this area to the Main Street trunk line. The terrain in this region is quite flat. Consistent ground slope on the order of .5 percent is available from south to north in Main Street, Park Street, Grove Street, Williams Street and Hiatt Street. Little to no slope is available in east-west curb and gutter systems.

The single sub-basin north of the park includes the area within the northeast corner of the UGB near the Sewage Treatment Plant and drains directly to the slough. This area is largely undeveloped. Future industrial developments are expected within the scope of this plan. Marks Slough has adequate capacity to carry the 100 year flows generated from industrial development in this area. Adequate topographic relief is available to drain these lands directly to Marks Slough or to the Santiam River to the east.

PROBLEM AREAS:

The 8" collector pipes in sub-basins M-10 and M-10L are inadequate for any future or existing peak flows and could cause periodic ponding in the residential areas east of Park Street, along Sherman Drive, Ash Street, Vine Street, Rose Street and Isabella Street. The 15" collector system along Grove Street is also under capacity for all peak events and could cause periodic ponding in the commercial areas adjacent to Park Street (Highway 20 north).

SOLUTIONS:

The trunk line serving M-20, M-10L and M-10 has adequate capacity for events exceeding the future 100 year event. Because of the flat terrain in this area, during events exceeding the capacity of this line, a majority of the excess flow will be ponded in parking lots and ponded at street intersections. Limited ground slopes should prevent excessive channel feed. Because flows exceeding this trunk line's capacity are not expected to result in significant property damage, but only nuisance ponding, a 10 year design is adequate. The trunk main can carry an additional 40 cfs and still be adequate for the future 10 year event. Since the trunk line invert elevation at Vine Street is lower than the invert of the Grove Street collector at Vine Street, this excess capacity can be utilized to offload the undersized Grove Street system.

The existing collector line along Grove Street must be relieved of 10 cfs in order to carry the future 10 year event. This can be most effectively accomplished by constructing 12, 15, and 18 inch interceptor pipes along Hiatt Street. A 24" pipe designed to carry 10 cfs flowing full along Vine Street from Hiatt to Main Street will convey the diverted flow to the oversized trunk main. The 24" diversion system is designed to maintain a 10 year water surface elevation of 343.0 at the intersection of Vine and Hiatt. The ground surface elevation at Hiatt and Isabella, the lowest point in the system, is 344.5. The resulting 1.5 feet of headloss is sufficient to force 5 cfs back through the 15 and 18 inch interceptor pipes as the undersized 8" lines are surcharged. An additional 5 cfs is intercepted in a similar manner from the storm lines along Ash Street.

It is also possible to divert flow to the Lebanon Canal, if the canal is discontinued as a source of drinking water for the City of Albany. However, existing grade favors the diversion toward Main Street and diversion to the Lebanon Canal would require deeper pipe systems, and therefore be more costly. Since the Main Street system is capable of carrying the extra flow, this option is recommended.

RECOMMENDED PROJECT:

7.1A VINE STREET DIVERSION

Replace the 8" pipes along Vine Street between Hiatt and Grove with a 24" pipes and extend this 24" line to the trunk main at the intersection of Vine and Main Street. The 24" line should be constructed with a .200 percent slope, holding the trunk line invert of 337.0 at Vine Street. The resulting invert elevation in the diversion system is 340.2 at Vine and Hiatt. A 12" pipe should be constructed along Hiatt Street between Ash and Vine holding the invert of the new 24" line at Vine and the existing 8" line at Ash Street. North of Vine Street along Hiatt a 15" pipe is required between Carolina Street and Rose Street and an 18" pipe is required between Rose and Vine. These pipes should be constructed with a minimum pipe slope of .0010 in order to maintain minimum cover.

CITY OF LEBANON
STORM DRAINAGE MASTER PLAN
PROJECT COST ESTIMATES

COST ESTIMATE 7.1A

Major Basin: MARKS SLOUGH BASIN
Sub-Basins: M-10L, M-20
Project Name: Vine Street Diversion

Phasing: IMMEDIATE
Priority Within Phase: HIGH

ITEMS	QUANTITY (APPROX)	UNIT	$/UNIT*	$ EXTENDED*
PIPE (INCH)				
12	325	LF	$38	$12,350
15	300	LF	$44	$13,110
18	325	LF	$48	$15,568
24	1,600	LF	$58	$92,480
MANHOLE (M.H.)				
48"	7	EA	$1,800	$12,600
SUB-TOTAL				$146,100
MOBILIZATION, ENGR, ADMIN, & CONTINGENCY				$51,100
TOTAL				$197,200

* 1991 DOLLARS

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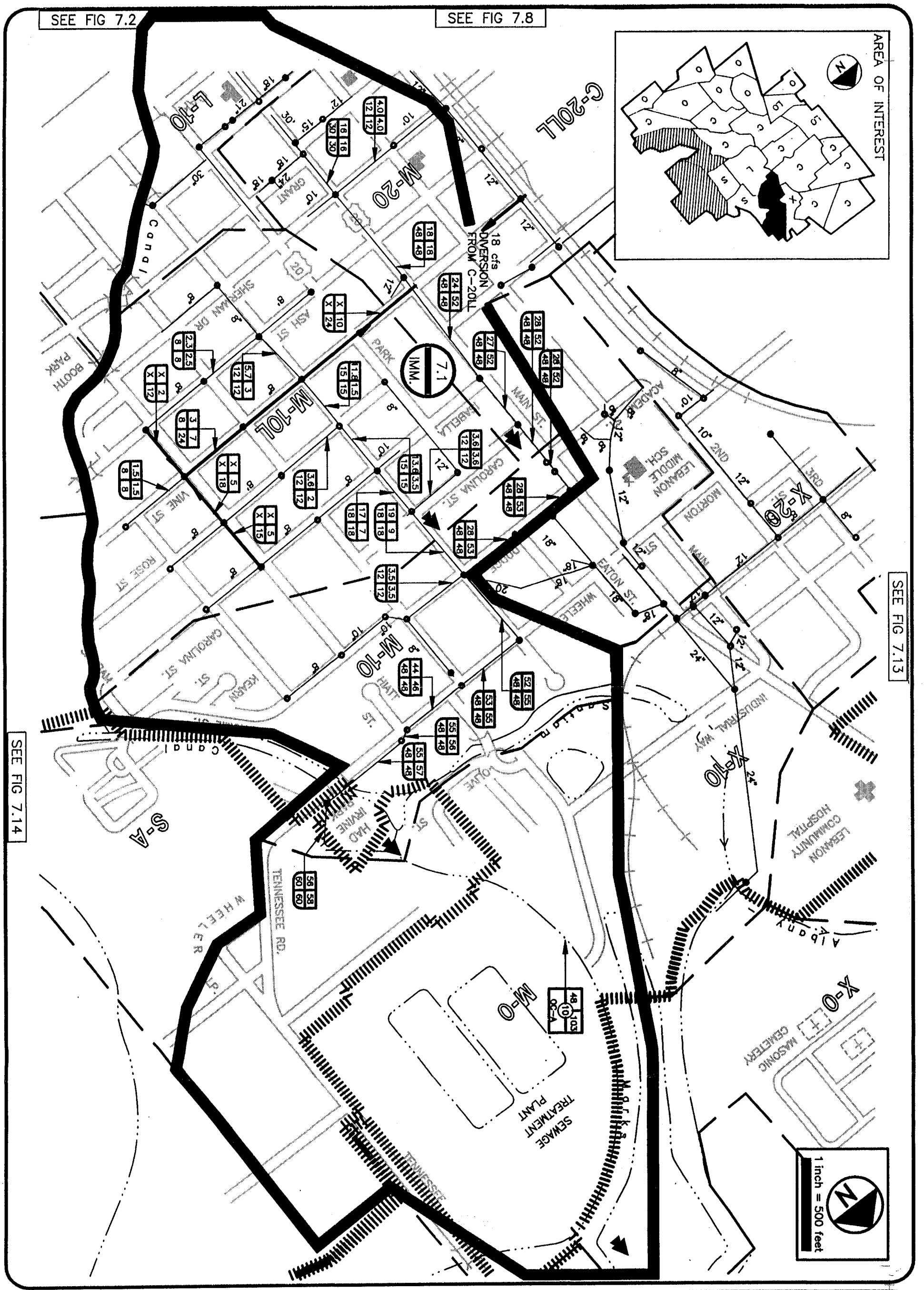
PLAN 7.1
MARKS SLOUGH - HAD IRVINE PARK

ROAD CROSSINGS		
Culvert	Existing	Future
NONE		

OPEN CHANNEL REACHES					
Reach	Bottom Width (ft)	Side Slope (ft/ft)	Channel Slope (ft/ft)	Manning's N	Channel Depth (ft)
OC-A	35	5:1	.0013	.035	5



DATE MAR 1991 PROJECT NO. 292 DP 11 DO	**DAVID J. NEWTON ASSOCIATES** INCORPORATED CIVIL & GEOLOGICAL ENGINEERING 1201 SW 12TH AVENUE SUITE 620 PORTLAND, OREGON (503) 228-7718	MARKS SL.-HAD IRVINE PARK CITY OF LEBANON Storm Drainage Master Plan	FIGURE 7.1

CITY OF LEBANON
Storm Drainage Master Plan

Section 7.2

PLAN SHEET: Lebanon-Albany Canal - Booth Park

SUB-BASINS: L-0, L-10, L-20, L-20L, L-30, S-D

DESCRIPTION OF DRAINAGE FEATURES:

The area draining to the Lebanon-Albany Canal is located near the center of the UGB. The majority of the area is bounded to the west, south and north by the canal. The eastern drainage boundary is formed by the higher area just east of Park Drive and Eddie Street. The Booth Park Basin includes Queen Anne School, Booth Park, and the commercial region along Highway 20 between Maple Street and H Street.

With the exception of the developments along Highway 20, this basin is developed as mixed density residential west of Williams Street, and single family residential east of Williams Street. Little future development is anticipated within this sub-basin group. Some infilling of the residential areas along the southern portion of Franklin Street is expected, but this development will result in minimal flow increases.

Little to no slope is available within the existing street systems. The area north of the railroad drains to a 27" outfall into the canal along Cleveland Street. No local storm drains exist and runoff must be conveyed to the 27" outfall along the roadways. The 27" outfall is adequate for the 10 year event, though lack of an adequate collector system could result in periodic ponding throughout this area.

The area south of the east-west Southern Pacific Railroad drains to a 30" pipe which goes under the railroad and outfalls into the canal at the Highway 20 crossing. This outfall is not adequate for the two year existing storm or future storm events above normal flow. There is little to no slope in the existing street systems and street gutters are not capable of conveying excess flows when the collector systems are excessively surcharged. Three collector systems, all under capacity for the two year event, drain to the 30" outfall.

Runoff from Pine Street and Jennings Street is conveyed by a system of 8" and 10" storm drains to an 18" storm line which flowS north on Highway 20 to the 30" outfall. This 18" line also picks up flow from C Street and D Street, west of the highway. The 8" and 10" collector pipes in this system, as well as the main 18" line are undersized for all peak events.

Runoff from the property adjacent to 2nd Street, west of the highway are conveyed to the 30" outfall by an 18" storm line from Cox Street, passes under the Highway 20 storm line and "bubbles up" at Park Street. This 18" line is surcharged during peak events. Adequate

head is available for the 10 year event. Currently, there is no connection between this line and the Highway 20 storm line, where the two cross Milton Street.

Sub-basin L-20L makes up the southeastern portion of the Booth Park Basin. Runoff in this sub-basin is collected by 8" and 10" collectors and conveyed to a 15" line from Williams to Grove Street just south of Milton Street. A 15" pipe continues down Grove Street to Elmore Street. An 18" pipe collects additional runoff from 8" storm drains north of Elmore Street and continues to the 30" outfall. The 8" and 10" storm drains as well as the 15" and 18" main collectors are all undersized, and not adequate for any peak event.

PROBLEM AREAS:

The pipe system draining the highway area has insufficient capacity for all existing or future design events, and consequently frequent ponding in parking lots and at street intersections is expected. Since no development is anticipated along these pipe reaches, existing problems are not expected to worsen. Extreme events cause no significant property damage but frequent ponding could become a nuisance to commercial establishments.

The collector pipes draining the residential areas south and west of the railroad, near Jennings and Pine Streets, are undersized for all existing and future events and could cause frequent ponding in low areas and at street intersections. However, no increase in flows due to development is anticipated and existing problems will not increase in magnitude. Since no significant property damage is expected during peak events and ponding causes only a minor nuisance to well established residential areas, no improvements to this system are necessary.

The undersized pipe system along Milton, Williams and Grove Streets serving sub-basin L-20L could result in minor flooding of residential areas when capacity is exceeded. In addition frequent ponding is expected throughout sub-basin L-20L due to undersized 6", 8" and 10" collector pipes.

The residential areas adjacent to Park Drive are served by failing dry wells and experience frequent flooding, primarily along Glenwood and Garvord Streets. These areas are also shown in Plan 7.15 and discussed further in that section. However, the required improvements for this problem will be discussed in conjuction with improvements for the adjacent problems in Sub-basin L-20L in this plan view.

SOLUTIONS:

There are three proposed solutions (7.2A, 7.2B, 7.2C) for the problems discussed above. For each solution, there are two alternatives (7.2A1 and A2, 7.2B1 and B2, 7.2C1 and C2),

depending on the status of the Lebanon Canal. In each case, alternative 1 assumes that the canal *is* available for drainage discharge. These solutions are shown in Plan 7.11A. Alternative 2 assumes that the Lebanon Canal *is not* available for drainage discharge. These solutions are shown in Plan 7.11B.

Alternative "2" assumes that stormwater discharge into the canal must be discontinued, existing discharges abandoned, and all flow must re-routed to other discharge locations. This has the greatest impact on solution A, intended to solve problems in the commercial area along the Santiam Highway. Discontinued use of the Canal as a discharge point will require approximately 5000 feet of 42", 48" and 54" pipe, and boring under the railroad will be required in two locations. In addition, backwater in the Santiam River will result in a very flat hydraulic grade line and lower velocities. When the alternatives are compared, hydraulic and economic factors greatly favor using the Canal as a stormwater discharge.

The solutions for each alternative scenario are discussed below.

ALTERNATIVE 1 - CANAL *IS* AVAILABLE

Improvement "A1"

The higher flows and greater activity associated with commercial areas warrants high priority drainage improvements. Immediate improvements to the commercial area include replacing the existing pipes along the Santiam Highway between Berry Street and Elmore Street and constructing a new outfall conveying flow north of Elmore Street to the Santiam Highway crossing of the Lebanon-Albany Canal. The existing 30" outfall north of Grove St. should be allowed to reach its capacity. The existing 24" pipe connecting the 30" outfall to the pipes along the highway has capacity to convey the excess flow due to surcharge in the 30" outfall and need not be replaced.

South of Elmore, along the Santiam Highway, a 30" pipe system is required between Berry Street and D Street. In order to offload the under capacity "bubbler system" at Park Street, these pipes should be connected to the 18" pipe crossing under the highway. The 18" bubbler system at Park Street should be abandoned. South of Park Street, the existing 18" pipes through the Queen Anne School property can be left in place to carry local drainage. A 36" pipe system is required between D Street and Elmore Street. At the intersection of Elmore Street and the Santiam Highway, the 24" pipe along Elmore Street should be connected to the proposed 30" pipe system along the highway. This pipe will adequately convey surcharged flow from the existing 30" outfall to the proposed outfall along the highway, this assumes that the hydraulic grade line at the intersection of Elmore and Highway 20 is approximately 2 feet lower than the ground surface. A 42" outfall along the Santiam Highway is needed to maintain the appropriate hydraulic grade line during the 10 year event.

In addition to the improvements discussed above, Section 7.3 "Cox Creek - Mill Pond Area," recommends replacing the 18" pipe along Main Street between Russell Drive and Oriole Drive (see Plan 7.3) with a 24" concrete pipe. This portion of Main Street is only 5 blocks to the south of the project area and drainage improvements area of high priority. Consequently, the required replacement should be included in the Santiam Highway project group.

Improvement "B1"

Solution "B" is designed to alleviate flooding and ponding due to insufficient capacity in the Grove Street drainage system in addition to relieving flooding in areas along Glenwood, Garvord and Park Drive which, as discussed in Section 7.15, currently drain to failing dry well systems. Service to these areas requires routing a pipe to the Santiam River. Due to the severity of the problems in this area, the discharge into the Santiam and service to Garvord, lower Park Drive and Glenwood Streets should be provided during an early phasing period.

This discharge will need to be constructed with extra capacity to allow for upstream improvements scheduled for later phasing periods. Capacity should consider service to developable lands to the south of Garvord Street (portions of sub-basins S-H and S-D). If the canal is available for discharge, then improvement "C1" (discussed below) will also need to be discharged into the Santiam at this location since a trunk line along Elmore will not be constructed. Improvement C is discussed below.

Improvement B should begin at Glenwood Street, continue south along Park Drive to the rear property lines of properties on the south side of Garvord Street and east along this property line to an outfall into the Santiam River. This alignment should provide adequate service to future developable lands as well as simplify construction by going through currently undeveloped areas. 36", 42" and 48" pipe is required to provide capacity for future development and routing of flows due to Improvement "C1" (below). A 15" line shown along Gavord Street is required to serve flooding areas as discussed in Section 7.15.

Improvement "C1"

Improvement C is designed to offload the Williams Street system and provide service to residential areas along Milton Street and Park Drive currently served by undersized or failing systems. This improvement should be phased for construction during a later period. If the canal is available for discharge (ie. Elmore Street Trunk Line will *not* be constructed) this flow should be routed to the system described in Improvement "B1". A 24" diversion pipe connected to the Grove Street system at the intersection of Milton and Hiatt can be used to divert flow from the existing system to a proposed trunk line joining the system proposed for Improvement B, above. This trunk line extends east along Milton Street from

Franklin Street to Park Street, and south along Park Street to Glenwood. At Glenwood it should be connected to the Improvement "B1" trunk line, phased for earlier construction.

ALTERNATIVE 2 - CANAL *IS NOT* AVAILABLE

This alternative assumes that the canal is not available for use as a stormwater discharge. Therefore, new outfalls cannot be constructed and existing outfalls be abandoned. Without being able to construct new outfalls into the canal, even on a temporary basis, solutions to this areas drainage problems are quite costly.

Improvement "A2"

Improvement A2 requires identical replacement of the pipes along the Santiam Highway, the portion of Main Street as discussed in Alternative A. This alternative differs in that a large trunk line is required to convey flows from the intersection of Elmore Street and the Santiam Highway to the Santiam River. This trunk consists of 36", 48" and 54" pipes along Elmore between the Santiam Highway and the City Limits, and continuing north following existing topography and eventually discharging into the Santiam River (See Plan 7.14, "Santiam River- River Park) near Gills Landing.

Runoff currently discharging into the canal in the existing 27" outfall at Clevenland Street could be diverted to the Elmore Street trunk line by constructing a 27" CSP diversion line along Cleveland Street connecting the existing 27" line at the Oak Street intersection to the proposed trunk line along Elmore. The existing 27" line should be plugged at the outfall but the remainder of the line should be left in place to serve sub-basin L-0. While this line is sloped toward the canal, sufficient head is available to convey flow under surcharged conditions to the Elmore Trunk line without flooding Cleveland Street or upstream areas. While the resulting system will have standing water in the pipes under normal conditions, it will adequately convey surcharged flow and is much less expensive than replacing the entire line.

Improvement "B2"

If the Lebanon Canal is not available for discharge and a trunk line along Elmore is required, then it is more costly to route Improvement C to the Elmore Trunk Line. Service to Glenwood and Garvord Streets is still best obtained by building a system discharging into the river, but this line can be downsized since Improvement C will not be connecting in the future. The alignment for this Improvement is identical as described for Improvment B1, but only 15", 18" and 36" pipes are required. The 15" line shown along Gavord Street is identical as in Improvement B1.

Improvement "C2"

If the trunk line along Elmore needs to be constructed, then problems along Williams and Milton Street are most economically relieved by routing water to the Elmore Trunk Line. As in Improvement C1, a 24" diversion is required at the intersection of Grove and Hiatt. In addition, 18" and 21" pipe should be constructed along Ralston and Park Drive to serve these areas. A 36" line along Filbert Ave. is required to route this flow to the Elmore Trunk Line.

RECOMMENDED PROJECTS:

ALTERNATIVE 1 - CANAL *IS* AVAILABLE

7.2A1 Santiam Highway Improvements

Construct 30" pipes along the Santiam Highway between Berry Street and D Street, replacing the existing 18" pipes. Between Berry Street and Milton Street, connect the 18" pipe crossing under the highway to the new system. Abandon the portion of this 18" pipe between Highway 20 and Park Street.

Replace the existing pipes along Highway 20 between D Street and Elmore Street with 36" pipes. At the intersection of Elmore Street and the Santiam Highway, construct a 42" pipe outfalling into the Lebanon Canal at the highway crossing. Maintain the connection with the existing 24" pipe along Elmore Street.

Replace the existing 18" pipe along Main Street between Russell Drive and Oriole Drive (see Plan 7.3, "Cox Creek - Mill Pond Area") with 24" concrete pipe.

7.2B1 Glenwood Discharge - Canal Available

At Glenwood, construct a 36" trunk line along Park Drive to Garvord St. Construct a 42" line extending about 200 feet to the south in order to avoid existing developed properties. Install 48" pipe east along existing property lines and outfall into the Santiam River. A 15" line should be constructed south toward Garvord along Glenwood, connecting to the trunk line as shown.

This system is also shown on Figure 7.15A.

7.2C1 Park Drive Trunk Line - Canal Available

Construct 24" CSP diversion pipe along Milton Street between Hiatt and Franklin. Connect this pipe to the existing manholes at Hiatt Street and Franklin Street. Between Franklin

Street and Park Drive, remove the existing 8" CSP along Milton Street and construct a 30" trunk line. At Park Street install 30" CSP south to Ralston and 36" CSP from Ralston to Glenwood. Connect to 36" system constructed during earlier phasing period as Improvement B1.

ALTERNATIVE 2 - CANAL *IS NOT* AVAILABLE

7.2A2 Elmore Street Trunk Line

Construct 30" pipes along the Santiam Highway between Berry Street and D Street, replacing the existing 18" pipes. Between Berry Street and Milton Street, connect the 18" pipe crossing under the highway to the new system. Abandon the portion of this 18" pipe between the highway and Park Street.

Replace the existing pipes along the highway between D Street and Elmore Street with 36" pipe. At the intersection of Elmore Street and the Highway construct a trunk line consisting of 36" pipe east along Elmore Street between the Highway and Burlington Street, 42" pipe between Burlington Street and Franklin Street and a 48" pipe between Franklin Street and the City Limits. At the City Limits, construct a 54" pipe north the railroad and then east along railroad right of way to an outfall into the Santiam River near Gills Landing.

Replace the existing 18" pipe along Main Street between Russell Drive and Oriole Drive (see Plan 7.3, "Cox Creek - Mill Pond Area") with 24" concrete pipe.

Construct a 30" CSP diversion pipe along Cleveland Street connecting the existing 27" line at Oak Street and the proposed trunk line along Elmore Street.

7.2B2 Glenwood Discharge - Canal Not Available

At Glenwood, construct a 15" line along Park Drive to Garvord St. Construct an 18" line extending about 200 feet to the south in order to avoid existing developed properties. Install 36" pipe east along existing property lines and outfall into the Santiam River. This 36" line is intended to serve future developments to the south. A 15" line should be constructed south toward Garvord along Glenwood, connecting to the trunk line as shown.

This system is also shown on Figure 7.15B.

7.2C2 Park Drive Trunk Line - Canal Not Available

Construct 24" CSP diversion pipe along Milton Street between Hiatt and Franklin. Connect this pipe to the existing manholes at Hiatt Street and Franklin Street. Between Franklin

Street and Filbert, continue in 24" CSP. At Filbert construct a 36" line north, connecting to the proposed trunk line along Elmore Street.

At Ralston Street, construct an 18" line between Post and Park Drive. Construct a 21" line along Park north to Milton. Along Milton, remove the existing 8" CSP and continue the 21" line west to the 36" trunk line along Filbert.

CITY OF LEBANON
STORM DRAINAGE MASTER PLAN
PROJECT COST ESTIMATES

COST ESTIMATE 7.2A1

Major Basin: LEBANON CANAL - BOOTH PARK
Sub-Basins: L-0, L-10, L-20, L-20L, L-30
Project Name: Santiam Highway Improvements

Phasing: IMMEDIATE (1990-1993)
Priority Within Phase: HIGH

ITEMS	QUANTITY (APPROX)	UNIT	$/UNIT*	$ EXTENDED*
PIPE (INCH)				
24	1000	LF	$58	$58,000
30	300	LF	$72	$21,600
36	760	LF	$90	$68,096
MANHOLE (M.H.)				
48"	3	EA	$1,800	$5,400
60"	4	EA	$2,400	$9,600
MISC	1	LS	$1,000	$1,000
OUTFALL	1	LS	$2,000	$2,000
SUB-TOTAL				$165,700
MOBILIZATION, ENGR, ADMIN, & CONTINGENCY				$58,000
TOTAL				$223,700

* 1990 DOLLARS

CITY OF LEBANON
STORM DRAINAGE MASTER PLAN
PROJECT COST ESTIMATES

COST ESTIMATE 7.2A2

Major Basin: LEBANON CANAL - BOOTH PARK
Sub-Basins: L-0, L-10, L-20, L-20L, L-30
Project Name: Elmore Street Trunk Line

Phasing: 15 YEAR (2001-2005)
Priority Within Phase: HIGH

ITEMS	QUANTITY (APPROX)	UNIT	$/UNIT*	$ EXTENDED*
PIPE (INCH)				
24	600	LF	$58	$34,800
30	700	LF	$72	$50,400
36	1,300	LF	$90	$116,480
42	1,000	LF	$98	$97,800
48	350	LF	$125	$43,750
54	1,400	LF	$154	$215,600
60	1,850	LF	$170	$314,500
MANHOLE (M.H.)				
48"	4	EA	$1,800	$7,200
60"	4	EA	$2,400	$9,600
72"	11	EA	$3,400	$37,400
MISC	1	LS	$2,500	$2,500
RR CROSSING	1	LS	$3,500	$3,500
SUB-TOTAL				$933,500
MOBILIZATION, ENGR, ADMIN, & CONTINGENCY				$326,700
TOTAL				$1,260,200

* 1991 DOLLARS

CITY OF LEBANON
STORM DRAINAGE MASTER PLAN
PROJECT COST ESTIMATES

COST ESTIMATE 7.2B1

Major Basins: LEBANON CANAL - BOOTH PARK, SANTIAM R.- WILLAMETTE IND.
Sub-Basins: L-20L, S-D
Project Name: Glenwood Discharge- Canal Available

Phasing: 5 YEAR (1993-97)
Priority Within Phase: HIGH

ITEMS	QUANTITY (APPROX)	UNIT	$/UNIT*	$ EXTENDED*
PIPE (INCH)				
15	950	LF	$44	$41,800
36	300	LF	$90	$26,880
42	750	LF	$98	$73,350
48	2,450	LF	$125	$306,250
MANHOLE (M.H.)				
48"	3	EA	$1,800	$5,400
60"	2	EA	$2,400	$4,800
72"	5	EA	$3,400	$17,000
MISC	1	LS	$3,000	$3,000
OUTFALL	1	LS	$3,500	$3,500
SUB-TOTAL				$440,200
MOBILIZATION, ENGR, ADMIN, & CONTINGENCY				$154,100
TOTAL				$594,300

* 1991 DOLLARS

CITY OF LEBANON
STORM DRAINAGE MASTER PLAN
PROJECT COST ESTIMATES

COST ESTIMATE 7.2B2

Major Basins: LEBANON CANAL - BOOTH PARK, SANTIAM R.- WILLAMETTE IND.
Sub-Basins: L-20L, S-D
Project Name: Glenwood Discharge- Canal Not Available

Phasing: 5 YEAR (1993-97)
Priority Within Phase: MEDIUM

ITEMS	QUANTITY (APPROX)	UNIT	$/UNIT*	$ EXTENDED*
PIPE (INCH)				
15	1,250	LF	$44	$55,000
18	750	LF	$48	$36,000
36	2,450	LF	$90	$220,500
MANHOLE (M.H.)				
48"	8	EA	$1,800	$14,400
60"	2	EA	$2,400	$4,800
MISC	1	LS	$3,000	$3,000
OUTFALL	1	LS	$3,500	$3,500
SUB-TOTAL				$337,200
MOBILIZATION, ENGR, ADMIN, & CONTINGENCY				$118,000
TOTAL				$455,200

* 1991 DOLLARS

CITY OF LEBANON
STORM DRAINAGE MASTER PLAN
PROJECT COST ESTIMATES

COST ESTIMATE 7.2C1

Major Basin: LEBANON CANAL - BOOTH PARK
Sub-Basins: L-0, L-10, L-20, L-20L, L-30
Project Name: Park Drive Trunk Line - Canal Available

Phasing: 15 YEAR (2001-05)
Priority Within Phase: MEDIUM

ITEMS	QUANTITY (APPROX)	UNIT	$/UNIT*	$ EXTENDED*
PIPE (INCH)				
18	1,350	LF	$48	$64,800
24	250	LF	$58	$14,450
36	1,850	LF	$90	$165,760
MANHOLE (M.H.)				
48"	5	EA	$1,800	$9,000
60"	3	EA	$2,400	$7,200
MISC	1	LS	$3,000	$3,000
SUB-TOTAL				$264,200
MOBILIZATION, ENGR, ADMIN, & CONTINGENCY				$92,500
TOTAL				$356,700

* 1991 DOLLARS

CITY OF LEBANON
STORM DRAINAGE MASTER PLAN
PROJECT COST ESTIMATES

COST ESTIMATE 7.2C2

Major Basin: LEBANON CANAL - BOOTH PARK
Sub-Basins: L-0, L-10, L-20, L-20L, L-30
Project Name: Park Drive Trunk Line - Canal Not Available

Phasing: 15 YEAR (2001-05)
Priority Within Phase: MEDIUM

ITEMS	QUANTITY (APPROX)	UNIT	$/UNIT*	$ EXTENDED*
PIPE (INCH)				
18	1,350	LF	$48	$64,800
21	930	LF	$54	$50,220
24	550	LF	$58	$31,790
36	880	LF	$90	$78,848
MANHOLE (M.H.)				
48"	5	EA	$1,800	$9,000
60"	3	EA	$2,400	$7,200
72"	1	EA	$3,400	$3,400
MISC	1	LS	$3,000	$3,000
SUB-TOTAL				$248,300
MOBILIZATION, ENGR, ADMIN, & CONTINGENCY				$86,900
TOTAL				$335,200

* 1991 DOLLARS

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PLAN 7.2
LEBANON CANAL - BOOTH PARK

ROAD CROSSINGS		
Culvert	Existing	Future
NONE		

OPEN CHANNEL REACHES					
Reach	Bottom Width (ft)	Side Slope (ft/ft)	Channel Slope (ft/ft)	Manning's N	Channel Depth (ft)
NONE					

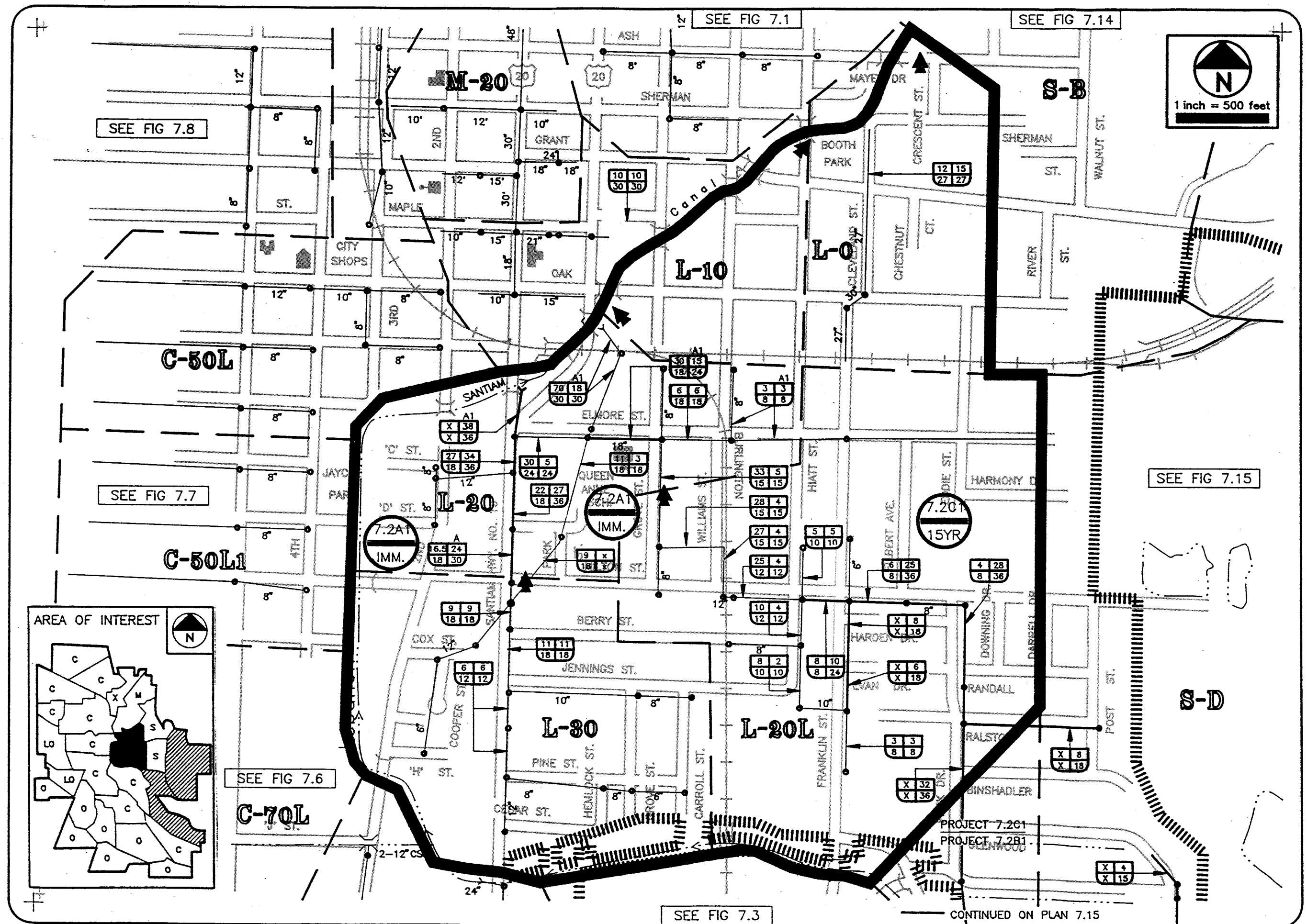

FIG 7.2A

LEBANON CANAL-BOOTH PARK CANAL AVAILABLE FOR DRAINAGE

CITY OF LEBANON
Storm Drainage Master Plan

DAVID J. NEWTON ASSOCIATES INCORPORATED
CIVIL & GEOLOGICAL ENGINEERING
1201 SW 12TH AVENUE SUITE 620
PORTLAND, OREGON (503) 228-7718

DATE
MAR 1991

PROJECT NO.
292 DP 11 DO

SEE FIG 7.1

SEE FIG 7.14

SEE FIG 7.8

SEE FIG 7.7

SEE FIG 7.6

SEE FIG 7.3

SEE FIG 7.15

CONTINUED ON PLAN 7.15

M-20

L-10

L-0

L-20

L-30

L-20L

C-50L

C-50L1

C-70L

S-B

S-D

7.2A2
15YR

7.2C2
15YR

7.2B2
5 YR

PROJECT 7.2C1

PROJECT 7.2B1

1 inch = 500 feet

AREA OF INTEREST

ASH ST.

SHERMAN ST.

GRANT ST.

MAPLE ST.

OAK ST.

CITY SHOPS

BOOTH PARK

CRESCENT ST.

WALNUT ST.

CHESTNUT ST.

CLEVELAND ST.

RIVER ST.

Canal

SANTIAM HWY. NO. 1

ELMORE ST.

'C' ST.

'D' ST.

'H' ST.

'J' ST.

QUEEN ANNE SCH.

GROVE ST.

WILLIAMS ST.

HUNTINGTON ST.

HYATT ST.

ABBEY ST.

HARMONY DR.

DOWNING DR.

HARDEN DR.

EVAN DR.

RANDALL

POST ST.

BERRY ST.

COX ST.

JENNINGS ST.

COOPER ST.

PINE ST.

HEMLOCK ST.

CEDAR ST.

CARROLL ST.

FRANKLIN ST.

BINSHADLER

GLENWOOD

JAYCEE PARK

2-12" CS

24"

LEBANON CANAL–BOOTH PARK CANAL NOT AVAILABLE FOR DRAINAGE

CITY OF LEBANON
Storm Drainage Master Plan

FIG 7.2B

DAVID J. NEWTON ASSOCIATES INCORPORATED
CIVIL & GEOLOGICAL ENGINEERING
1201 SW 12TH AVENUE SUITE 620
PORTLAND, OREGON
(503) 228-7718

DATE
MAR 1991

PROJECT NO.
292 DP 11 DO

292 DP 11 DO – LEB–F21

CITY OF LEBANON
Storm Drainage Master Plan

Section 7.3

PLAN SHEET: Cox Creek - Mill Pond Area

SUB-BASINS: C-70L1, C-70L2, C-70L3

DESCRIPTION OF DRAINAGE FEATURES:

The Mill Pond Area drains to the upper section of the Cox Creek tributary ditched along J Street and later piped through the Lebanon High School Property. This area includes the Burlington Northern Railroad between Russell Drive and the Santiam Highway, the old mill pond area adjacent to the railroad on the north side of Russell Drive, the low lying swamp area south of Russell Drive which drains residential and industrial lands east of the railroad, the older residential area west of the railroad in the vicinity of Alder, Taylor and Russell Street and the commercial section of Main Street north of Dewey and south of Airport Road.

The existing residential neighborhoods in this area are well established. These areas have poorly defined storm drain systems and runoff is conveyed primarily by overland flow and along uncurbed roadways. Infrastructure improvements in this area are not expected to occur within the next 20 years. Any infilling of vacant lots will have negligible impact on predicted flows. The area near Main Street was treated as fully developed commercial land. Impervious areas in this region are not expected to increase in the future.

North of Russell Drive, development of existing agricultural and undeveloped areas could occur. The area near the old mill pond is zoned as a special development district and is mostly undeveloped, though some industrial development has occurred. The area east of the railroad is zoned single family residential. Additional development in this area is possible within the next 20 years.

The commercial area along Main Street drains to a series of 15",18" and 24" pipes along Main which outfall into the J Street tributary just south of the Lebanon Canal. Runoff from the older residential area south of Russell Drive and west of McKinney Street eventually drains into this pipe system as well. Since the McKinney Street area does not contain a well defined curb and gutter system, runoff travels overland and in shallow swales. Because the impervious areas do not drain to defined drainageways, flow from this area arrives at the Main Street pipe system well after the peak from the commercial area has passed.

The 24" pipe north of Oriole Drive is adequate for the 10 year event as are the 15" and 18" pipes south of Russell Drive. The 18" pipe between Russell Drive and Oriole Drive is adequate for only the 2 year event.

At Main Street near the Lebanon-Albany Canal, the 24" pipe system draining Main crosses the road and outfalls into a ditch. Also at this location, flow from the poorly defined portion of the J Street tributary draining the lands in sub-basins C-70L2 and C-70L3 near the mill pond and the railroad is conveyed across Main Street in a 20" and a 24" culvert system. This crossing has adequate capacity for the existing and future 10 year event. Flows exceeding the capacity of the system are expected to flood Main Street north of Oriole Drive. Below Main Street, the ditch has depths of 2 to 3 feet and is suitable for the future 100 year event. Two 12" culverts at 2nd Street, however are unsuitable for even the existing 2 year event.

South of Russell Drive, a natural detention storage area adjacent to the railroad drains the residential areas near Center Street on the west side of the railroad and the residential lands along Fuller Lane on the east side of the railroad. During the 5 and 10 year events, a single 14" culvert under the railroad restricts flow, forcing detention storage in the lands east of the railroad and west of May Lane. During larger events, the Russell Drive crossing, consisting of a 36" and 14" culvert, further restricts flow accessing available storage in the low lands west of the railroad below McKinney Street as well as the primary storage area east of the railroad between the railroad west of May Lane.

During the 100 year event, adequate storage is available to prevent overtopping of either the railroad or Russell Drive. The maximum water surface elevation near May Lane is 356.5 during the 100 year event and 356.0 during the 10 year event. The 10 year event floods a portion of May Lane. Even during the 100 year event, however, no property damage occurs. Since no upstream development is expected, conditions in this area will not worsen and the periodic ponding at the low spot in May Lane is not considered a problem.

The existing areas providing detention are hatched in Figure 7.3. These areas currently are located primarily within natural marshy areas and were assumed to be undevelopable. The detention provided is necessary to avoid overloading downstream systems and if development is to occur in these areas, sufficient detention facilities should be required to limit the future 25 year outflow under Russell Drive to the existing detained 10 year outflow should be required.

The undeveloped region north of Russell Drive and east of the railroad currently drains to poorly defined ditches and is conveyed under the railroad at the low area north of the mill pond. This area is quite flat and under existing conditions a majority of the flow is ponded in surrounding fields and at the railroad crossing. West of the railroad, a defined drainage path is not evident and flow appears to travel along the low areas adjacent to the railroad and the Lebanon-Albany Canal.

The special development area near the mill pond currently drains overland to poorly defined ditches. The water level in the mill pond is maintained by 24" and 16" culverts, which convey flow under the existing gravel road and outfall into a poorly defined section of the

main tributary. These culverts limit the outflow for all events. Adequate storage is available for the 5 year event, however the 10 year flows overtop the existing gravel road at a low point north of the culverts. This flow travels overland through an undeveloped area for a short period before it is collected by the main channel. This mill pond need not be preserved as a detention site since it provides no detention value during the 10 year event.

PROBLEM AREAS:

Flooding during design storm events is expected along Main Street between Russell Drive and the 24" culvert north of Oriole Drive due to the undersized 18" pipe north of Russell Drive. Because this region is very flat, flow is ponded in parking lots and low areas near existing commercial buildings within the problem reaches. Undersized culverts at 2nd Street present the risk of periodic overtopping of the roadway, inhibiting traffic flow and flooding upstream lands.

Under existing conditions, few problems occur in sub-basins C-70L2 and C-70L3. However, insufficient drainage results in high water tables that inhibit development in the special development district near the mill pond and the mixed density residential area east of the railroad. Drainage improvements east of the railroad will overload the poorly defined drainageways west of railroad, putting the existing buildings and possible future developments near the mill pond at risk. In addition, flows due to development in the region near the railroad will worsen existing problems and complicate solutions within this tributary downstream of Main Street.

SOLUTIONS:

Flooding along Main Street between Russell Drive and the existing culvert south of Oriole Drive can be alleviated by replacing the portion of 18" pipe between Russell Drive and Oriole Drive with 24" concrete pipe. The 24" pipe system between Oriole and the existing Main Street crossing need not be replaced. In addition, 36" pipe is required to replace the 12" culverts under 2nd Street and the poorly defined ditch between Main and 2nd.

Replacement of the 18" pipe can be most efficiently implemented in conjunction with Project 7.2A1, "Santiam Highway Improvements," discussed previously in Section 7.2, "Lebanon Canal - Booth Park." The Santiam Highway improvements recommended by Section 7.2 occur only 5 blocks north of Russell Drive and are of equal priority.

The property along Airport Road between Main Street and 2nd Street is currently under construction. Under existing conditions, this land is at risk of flooding. Consequently, construction of the required 36" pipe reach, the 2nd Street culverts and the open channel

reach should be required as a condition of development. This pipe reach will adequately drain the developed property in addition to conveying existing upstream drainage.

Problems due to development in sub-basin C-70L2 can be best mitigated by requiring on-site detention of future developments and by maintaining existing detention storage at the railroad crossing north of Russell Drive. On site detention should be required such that the future 25 year flow is equivalent to the existing 10 year flow.

RECOMMENDED PROJECTS:

The required 36" pipe between Main and 2nd Street should be constructed as a condition of development of the Airport Road property.

The recommended pipe replacement between Russell Drive and Oriole Drive along Main Street should be included in Project 7.2A1.

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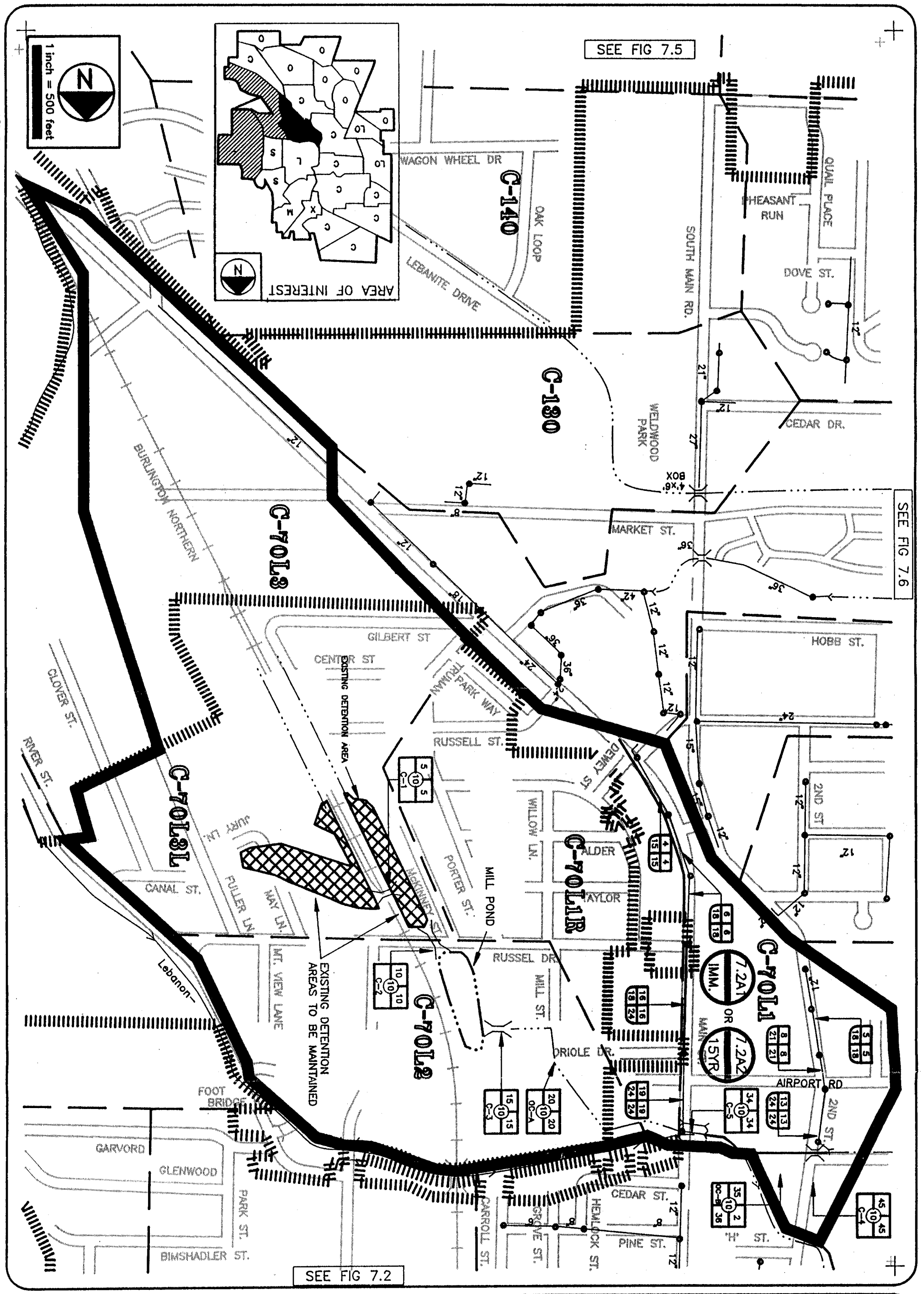
PLAN 7.3
COX CREEK - MILL POND AREA

ROAD CROSSINGS		
Culvert	**Existing**	**Future**
C-1	1 - 14" CMP	*Unchanged*
C-2	1 - 36" CMP 1 - 14" CSP	*Unchanged*
C-3	1 - 24" CSP 1 - 16" CSP	*Unchanged*
C-4	2 - 12" CSP	36" CSP (Pipe Reach)
C-5	3 - 24" CSP	

OPEN CHANNEL REACHES					
Reach	**Bottom Width (ft)**	**Side Slope (ft/ft)**	**Channel Slope (ft/ft)**	**Manning's N**	**Channel Depth (ft)**
OC-A	2.5	1.5:1	0.0012	0.040	2
OC-B (existing)	2.5	1.5:1	0.0020	.035	2
OC-B (future)	36" PIPE REACH				



PROJECT NO. 292 DP 11 DO	DATE MAR 1991	**DAVID J. NEWTON ASSOCIATES** INCORPORATED CIVIL & GEOLOGICAL ENGINEERING 1201 SW 121 AVENUE SUITE 620 PORTLAND, OREGON (503) 228–7718	**COX CREEK – MILL POND AREA** **CITY OF LEBANON** **Storm Drainage Master Plan**

FIGURE 7.3

CITY OF LEBANON
Storm Drainage Master Plan

Section 7.4

PLAN SHEET: Cox Creek - Santiam Highway

SUB-BASINS: C-130L

DESCRIPTION OF DRAINAGE FEATURES:

The Santiam Highway Basin is in the southeast corner of the UGB and drains Cascade Drive, the Santiam Highway, Sturtevant Road and Crowfoot Road. This area contains a commercial developments along the highway and developed residential areas along Cascade Drive, Sturtevant Road and Crowfoot road. The remainder of the basin is zoned for residential development and currently consists of open fields.

The developed portions of this basin drain to well defined, culverted ditches along the major roadways. These ditches contain 18" to 30" concrete culverts and adequately convey the existing and future 10 year flows due to local runoff. The roadway ditches along Sturtevant and Crowfoot Road drain primarily to Cascade Drive. Roadway ditches along Cascade Drive are adequate for the existing 10 year flows. As this area develops, the ditches along Cascade Drive will be reduced to a 5 year capacity. Five year adequacy is sufficient since overtopping of the ditches along Cascade Drive will result in minimal property damage.

A concrete culvert at the intersection of Cascade Drive and the Santiam Highway, approximately 24" in diameter, conveys the total flow from this basin to poorly defined ditches through the open fields near the Drive In Theater and the Forest Nursery in sub-basin C-30 (See Plan 7.5). This culvert is adequate for the existing 5 year and no future peak events.

PROBLEM AREAS:

Since little development exists in this area, no existing problems were observed. However, as full buildout occurs the culvert at the intersection of Cascade Drive and the Santiam Highway will cause frequent flooding of Cascade Drive and surrounding commercial properties. In addition, flows due to full buildout in this area will worsen existing drainage problems in the lower reaches of Cox Creek.

SOLUTIONS:

Cheadle lake is located to the northeast of the problem areas near the intersection at Cascade Drive and Santiam Highway. Rather than replace the culvert heading west at this intersection and create problems with downstream drainage facilities in Cox Creek, a culvert underneath the Santiam Highway to Cheadle Lake would solve the local problems. Cheadle Lake is well drained and even during large events is maintained at lower elevations than the lands south of the Santiam Highway. The normal water surface elevation at Cheadle Lake is approximately 357.6. Assuming a maximum water surface in the lake during peak events of approximately 359.0, 4 feet of head is available between the peak lake elevation and the maximum tolerable water surface at the intersection at Cascade Drive and Santiam Highway.

In order to maintain a pipe outfall invert elevation at Cheadle Lake of 357.6, and allow for adequate cover under the highway, a maximum culvert height of 3' is tolerable. A 3'x5' box culvert will convey the 25 year flow and prevent year around ponding in the culvert depression at the highway intersection. The 100 year flows will cause overtopping of Cascade Drive and backwater flooding of a few low lying houses. The minimal property damage incurred does not warrant a 100 year design.

RECOMMENDED PROJECTS:

7.4A Cheadle Lake Diversion

Construct a 3'x5' box culvert starting at the existing 36" culvert inlet at the intersection of Cascade Drive and the Santiam Highway, extending approximately 400 feet under the highway and discharging into Cheadle Lake. The outlet invert into Cheadle Lake should be above the summertime water surface level of 357.6. This will require excavating under the railroad.

Plug the existing 36" culvert heading northwest from the intersection at Cascade Drive and Santiam Highway and reroute existing drainage systems to the new box culvert.

CITY OF LEBANON
STORM DRAINAGE MASTER PLAN
PROJECT COST ESTIMATES

COST ESTIMATE 7.4

Major Basin: COX CREEK - SANTIAM HIGHWAY
Sub-Basins: C-130L
Project Name: Cheadle Lake Diversion

Phasing: 15 YEAR (2001-2005)
(10 YR, Lebanon Canal Not Available)
Priority Within Phase: MEDIUM

ITEMS	QUANTITY (APPROX)	UNIT	$/UNIT*	$ EXTENDED*
3'X5' Box Culvert (Jacked Under RR)	400	LF	$800	$320,000
Plug Existing Culvert	1	LS	$1,500	$1,500
SUB-TOTAL				$321,500
MOBILIZATION, ENGR, ADMIN, & CONTINGENCY				$112,500
TOTAL				$434,000

* 1991 DOLLARS

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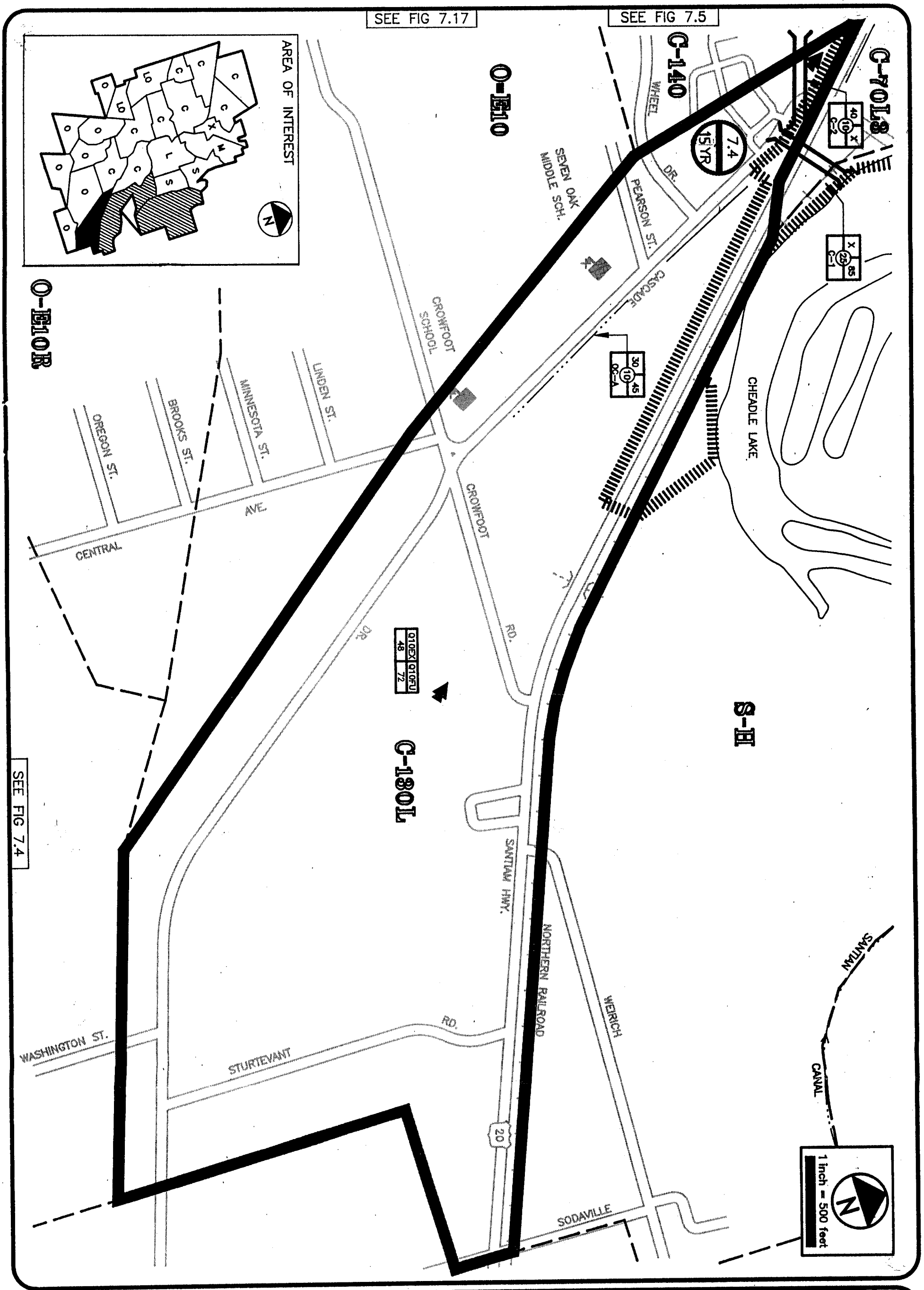
PLAN 7.4
COX CREEK - SANTIAM HIGHWAY

ROAD CROSSINGS		
Culvert	Existing	Future
C-1	X	5'x3' Conc. Box
C-2	24" CSP	*Abandoned*

OPEN CHANNEL REACHES					
Reach	Bottom Width (ft)	Side Slope (ft/ft)	Channel Slope (ft/ft)	Manning's N	Channel Depth (ft)
OC-A	1	1.5:1	0.0012	0.040	2



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

FIGURE 7.4

CITY OF LEBANON
Storm Drainage Master Plan

Section 7.5

PLAN SHEET: Cox Creek - Market Street

SUB-BASINS: C-120, C-130, C-140

DESCRIPTION OF DRAINAGE FEATURES:

This sub-basin is bordered on the north and east by the Santiam Highway, on the north by Hobb Street, on the south by the north edge of the Oak Creek Basin, and on the west by residential developments just west of South Main Street at the trailer park north of Cedar Drive. The area is primarily undeveloped with the exception of developed residential area which is mostly comprised of the Twin Cedars Mobile Home Park. This area includes Weldwood Park and the Forest Nursery in sub-basin C-130 east of Main Street. A developed commercial area along the Santiam Highway in the vicinity of Walker Road and Main Street. The southern boundary of the commercial area is bounded by Division Way.

The headwaters of Cox Creek are located within this area with poorly defined swales and ditches east of Main Street and more defined channels west of Main Street. This area receives drainage from sub-basin C-130L via a culvert under Cascade Drive. The commercial areas drainage is served by a local system that discharges in the trunk line in Walker Road which outfalls into Cox Creek. This system is adequate for serving this area for peak events.

Santiam Highway has a 12" to 36" storm system paralleling the highway to Russell Street where is directed west into Division Way and discharges into a ditch just east of Main Street. This system has a 25-Year capacity which is adequate to serve the existing and future developments in this area.

The storm system north of the trailer park is a combination of small open ditches and culverts. A 36" CMP pipe outfalls into the ditch system where it meanders through the residential neighborhood to Hobb Street and then Arlene Street and eventually to Cox Creek near Walker Road.

PROBLEM AREAS:

Most of the area is susceptible to local ponding during peak events but no significant damage is anticipated.

At present, the drainage system serving the trailer park is inadequate for any peak events. While the 36" CMP pipe along the north side of the trailer park has adequate capacity, the

open ditch and culvert system downstream of this pipe is restricted due to periodic infilling of the ditch with yard debris, garbage, waste and overgrowth. This restriction results in frequent overtopping of the roadways and flooding of backyards. Of additional concern is the limited life span of the 36" CMP pipe. This pipe is located underneath mobile homes and will not be easy to replace in the case of failure.

The trailer park also has a history of flooding which appears to be caused by poor construction and maintenance of existing on-site drainage systems. The system currently in place should take the majority of the drainage without any backwater effects to the trailer park.

SOLUTIONS:

Eventually, due to the potential failure of the 36" CMP pipe through the trailer park, this drainage system will need to be relocated to be within the City's right of way along South Main Road and Hobb Street. However, this improvement is costly and need not be done immediately. Improvements to the drainage system north of the trailer park can be most economically implemented by separating the improvements into a short and long term solution.

To alleviate immediate problems due to the open ditch and culvert system north of the trailer park a 30" pipe should be constructed in place of the open ditch to Hobb Street then west on Hobb Street to Birch Street then north on Birch Street to an existing 30" pipe in Birch Street that discharges into Cox Creek at Walker Road. During a later phasing period, the 36" CMP pipe south of Hobb Street should be abandoned and an alternate 30" CSP system constructed along South Main Road to Hobb Street and along Hobb Street to the confluence with the main system at Arlene Avenue. When this later improvement is implemented, the section of 30" CSP south of Hobb Street will be available for local drainage from the trailer park.

RECOMMENDED PROJECTS:

7.5A Hobb Street Piped System, Short Term

Construct a 30" pipe from the 36" outfall north of the trailer park to the existing 30" pipe in Birch Street at Walker Road.

7.5B Hobb Street Piped System, Long Term

Replace the existing 36" CMP inlet at South Main Road with a 30" CSP inlet and construct a 30" CSP pipe line along South Main Road to Hobb Street and along Hobb Street to

Arlene Avenue. At Arlene Avenue connect this new line to the 30" CSP trunk line constructed during an earlier phasing period as project 7.5A. Abandon the 36" CMP south of Hobb Street. Reroute existing inlets to the 30" CSP line south of Hobbs and maintain this line to serve local trailer park drainage.

CITY OF LEBANON
STORM DRAINAGE MASTER PLAN
PROJECT COST ESTIMATES

COST ESTIMATE 7.5A

Major Basin: COX CREEK - MARKET STREET
Sub-Basins: C-120, C-130, C-140
Project Name: Hobb Street Ditch Replacement

Phasing: 5 YEAR (1993-1997)
(IMMEDIATE, Lebanon Canal Not Available)
Priority Within Phase: MEDIUM

ITEMS	QUANTITY (APPROX)	UNIT	$/UNIT*	$ EXTENDED*
PIPE (INCH)				
30	1,000	LF	$72	$72,000
MANHOLE (M.H.)				
48"	4	EA	$2,400	$9,600
MISC	1	LS	$1,000	$1,000
SUB-TOTAL				$82,600
MOBILIZATION, ENGR, ADMIN, & CONTINGENCY				$28,900
TOTAL				$111,500

* 1991 DOLLARS

CITY OF LEBANON
STORM DRAINAGE MASTER PLAN
PROJECT COST ESTIMATES

COST ESTIMATE 7.5B

Major Basin: COX CREEK - MARKET STREET
Sub-Basins: C-120, C-130, C-140
Project Name: Hobb Street Piped System, Long Term Solution

Phasing: 15 YEAR (2001-2005)
Priority Within Phase: LOW

ITEMS	QUANTITY (APPROX)	UNIT	$/UNIT*	$ EXTENDED*
PIPE (INCH)				
30	1,050	LF	$72	$75,600
MANHOLE (M.H.)				
48"	5	EA	$2,400	$12,000
MISC	1	LS	$1,000	$1,000
SUB-TOTAL				$88,600
MOBILIZATION, ENGR, ADMIN, & CONTINGENCY				$31,000
TOTAL				$119,600

* 1991 DOLLARS

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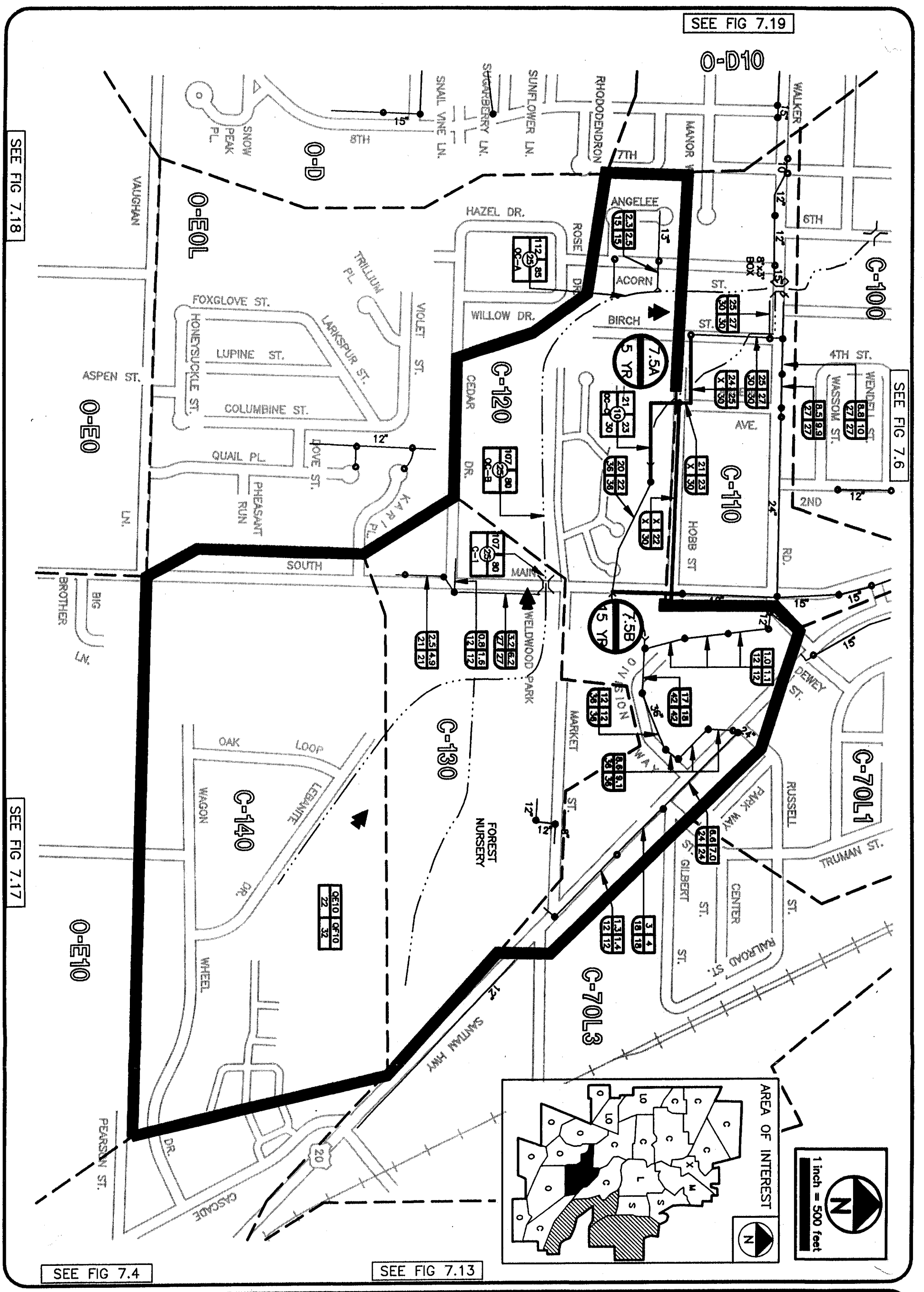
PLAN 7.5
COX CREEK - MARKET STREET

ROAD CROSSINGS		
Culvert	Existing	Future
C-1	4'X6' Conc. Box	*Unchanged*

OPEN CHANNEL REACHES					
Reach	Bottom Width (ft)	Side Slope (ft/ft)	Channel Slope (ft/ft)	Manning's N	Channel Depth (ft)
OC-A	10	5:1	0.0013	.035	3
OC-B	5	2:1	0.0012	.035	3
OC-C	3	2:1	0.0013	.035	3.5



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

FIGURE 7.5

CITY OF LEBANON
Storm Drainage Master Plan

Section 7.6

PLAN SHEET: Cox Creek - Lebanon High School

SUB-BASINS: C-70, C-70L, C-80, C-90, C-100, C-110

DESCRIPTION OF DRAINAGE FEATURES:

Significant drainageways within the Lebanon High School Basin include the portion of Cox Creek between F Street and Walker Road, the lower portion of the main tributary which is open channel along J Street and piped through the high school property and the piped systems along Kees Street and 3rd Street draining the residential area in the southern portion of the basin.

The residential area in the vicinity of 5th Street, Kees Street and Walker Road is well established and contains single family residences. Little development is expected in these neighborhoods. Throughout the remainder of this sub-basin group, existing lands contain sparsely developed single family and mixed density residential developments. Infilling of these partially developed neighborhoods is possible within the next 20 years.

Cox Creek is fairly shallow in this area, with depths of 2 to 3 feet. Road crossings occur at F Street, Airport Road, 7th Street, Kees Street, 6th Street and Walker Road. At Walker Road, an 8'x3' concrete box culvert adequately conveys the existing 100 year and future 25 year flows. The remaining road crossings consist of multiple 24" and 36" pipes and are undersized for reasonable existing and future events. Specifically, F Street, 6th Street and Kees Street have only a 5 year existing and no future capacity. The Airport Road and 7th Street crossings have only a 2 year existing and no future capacity. Larger pipes cannot be added at these crossings due to the limited depth of the creek and insufficient cover. Flows exceeding the capacities of these culverts cause overtopping of the roadways and significant flooding of existing mixed density residential developments.

Storage within the flood plain is available upstream of Airport Road. During existing conditions undersized culverts cause overtopping of the road before this storage is utilized. Large tracts of undeveloped land provide possible detention areas upstream of F Street. These lands, however, are higher than the elevation of the roadway and currently provide no detention value.

The high school tributary joins Cox Creek 300 feet upstream of F Street. This tributary has an adequate depth of 3 feet between its confluence with Cox Creek and 7th Street and will convey the future 25 year event. A Three 24" culverts at the end of 9th Street adequately convey the existing and future 25 year event. This tributary is piped through the high school

property in a private system consisting of multiple 18" CMP pipes and an 18"x29" cmp arch pipe outfalling just west of 7th Street. This small arch pipe is the sole outlet the tributary along "J" Street, which as discussed in Section 7.3, drains the large partially developed area comprised of sub-basins C-70L1, C-70L1R, C-70L2, C-70L3 and C-70L3L. Given the size of the drainage area, this arch pipe is not adequate for any design storms. The open channel reach along J Street is adequate for the existing and future 25 year event.

Runoff from the residential area in sub-basin C-100 is collected by 12" pipes and conveyed via an 18" pipe down 3rd Street to a 24" line which heads west across country at the intersection of 5th and Kees. This system outfalls into Cox Creek just upstream of the 7th Street culvert. This system has existing and future 5 year capacity, which is sufficient for this area.

PROBLEM AREAS:

The pipe system conveying the J Street tributary through the high school property is under capacity and expected to cause frequent ponding on the high school grounds and along 5th Street. During large storms when flows greatly exceed the capacity of the high school system, excess flow from the open channel tributary along J Street is expected to overtop 5th Street and pond in the high school area. While little ponding is expected at 7th Street under existing conditions, the existing culvert at 7th Street will cause ponding throughout this area if the arch pipe through the high school is replaced.

The lands south of Airport Road between 5th and 7th are at risk from extensive flooding due to the insufficient capacity of the 7th, Kees and 6th Street crossings. This area is quite flat; overtopping at any of these three crossings results in flooding of the Cascades School, some existing residences and considerable developable land.

The lands along 9th Street north of Airport Road are at risk from extensive flooding for both existing and future events due to insufficient capacity at Airport Road. Shallow sheet flow is expected to flood existing residences and developable areas if Airport Road is overtopped.

At F Street, overtopping floods downstream residences along E Street, west of 7th. As development occurs within this basin and in the upstream watershed, these properties will be at increased risk of frequent flooding during annual winter storms.

SOLUTIONS:

A 48"x84" arch pipe is required to replace the existing undersized system through the high school property. The invert of the open channel reach below 7th Street limits the available depth for this pipe. In order to limit upstream water levels and meet minimum cover requirements, an arch pipe is required. This arch pipe collects flow at 5th and J Street with

an inlet structure, replaces the existing multiple 18" culverts under 5th, replaces the undersized arch through the high school property, and replaces the multiple 18" culverts under 7th Street.

In order to prevent frequent flooding of the areas near the Cascades School south of Kees Street, the existing crossings at 7th Street, Kees Street and 6th Street must be replaced. Limited depth at 7th, Kees, and 6th limit the available culvert height to 3 feet. Even after upstream flows are diverted to Cheadle Lake (see Section 7.4, Santiam Highway) box culverts in excess of 10 feet wide are required to carry either the future 25 year or future 100 year events. Since this area is quite flat and the creek channel is not excessively wide, pre-cast concrete slab bridges provide a more cost effective option. These bridges can be constructed at $45 a square foot. In order to provide adequate flow area for the 100 year event, a minimum bottom width of 15 feet and depth of 3 feet must be maintained in the vicinity of the bridge. This will require constructing the bridges so that the top of bridge is approximately one foot higher than the existing top of road.

At Airport Road, in order to protect both downstream and upstream properties and utilize the available detention storage, the existing culverts should be replaced. While sufficient depth is available between the top of road (elevation 350.2) and the creek invert (approximate elevation 344.5) to construct a 3.5 foot high culvert, low lying upstream residences (elevation 346.5 to elevation 347.8) limit the maximum culvert height to 3.0 feet. Since Airport Road is higher than the upstream lands, considerable natural storage is available. However, if the ponding depth is utilized during the 100 year event, numerous upstream residences are flooded. The most cost effective design maintains water surface elevations upstream of Airport Road of 346.5 during the 10 year event, 347.0 for the 25 year event and 347.5 during the 100 year event. With this design, no houses are flooded during the 10 year event. During the 25 year event minor backwater flooding affects one house and during the 100 year event minor backwater flooding affects 3 houses. A majority of the existing upstream residences and developable land as well as downstream properties are protected from backwater flooding and roadway overtopping for the 100 year event. An 8'x3' box culvert will maintain the required water surface elevations during the future 10, 25 and 100 year events, assuming the proposed Cheadle Lake Diversion (see Section 7.4, Cox Creek- Santiam Highway) is completed.

After upstream improvements create detention storage at Airport Road, overtopping of F Street during the future 100 year event can be prevented by constructing 7.5 acre-ft of detention storage and adding a single 36" pipe to the existing crossing. This storage can be obtained by the excavation of 3 acres of land adjacent to F Street. The lands to the west of F Street lie at elevation 346.0 The maximum water surface elevation is 344.0 and the normal wintertime water level is at 341.5 Therefore excavation of these lands to 341.5 will allow for 7.5 acre-ft of detention.

Without this storage area, a 12'x4' box culvert would be required to convey the 25 year peak flow through F Street. A 100 year design would not be feasible. While this would be less expensive than constructing the detention area, downstream improvements would be both more costly and reduced to only a 25 year instead of 100 year design capacity. With the required detention at F Street, the downstream residential and industrial lands can be cost effectively protected from flooding for the future 100 year event.

RECOMMENDED PROJECTS:

7.6A High School Arch Pipe Replacement

At the intersection of 5th and J Street, construct an inlet structure for a 48"x84" arch pipe. Replace the existing culverts under 5th Street with 48"x84" arch pipe. Replace the existing 18"x29" arch pipe through the high school property with 48"x84" arch pipe. Extend this arch pipe under 7th Street and construct an outfall structure replacing the existing multiple 18" culverts. The new arch pipe should be designed to maintain minimum cover and slope.

7.6B Upper Cox Creek Bridges

Construct concrete slab bridges replacing the existing culvert crossings at 6th Street, 7th Street and Kees Street. These should be constructed approximately one foot above the existing top of road such that the bottom of the bridge is a minimum of 3 feet above the creek invert. Widen Cox Creek underneath bridge to maintain a minimum 15' bottom width.

7.6C F Street Detention

Replace the existing culverts at Airport Road with a single 8'x3' box culvert.

Excavate approximately three acres of land in the marked region east of Strawberry Lane (see plan view) approximately 4.5 feet deep to elevation 341.5. This storage area must provide 7.5 acre-ft. of volume below elevation 344.0 and above 341.5.

Add a single 36" concrete pipe to the existing 36" culverts under F Street.

CITY OF LEBANON
STORM DRAINAGE MASTER PLAN
PROJECT COST ESTIMATES

COST ESTIMATE 7.6A

Major Basin: COX CREEK - LEBANON HIGH SCHOOL
Sub-Basins: C-70, C-70LC-80, C-90, C-100, C-110
Project Name: High School Replacement

Phasing: 10 YEAR (1997-2001)
Priority Within Phase: MEDIUM

ITEMS	QUANTITY (APPROX)	UNIT	$/UNIT*	$ EXTENDED*
48'x84" Arch	1,600	LF	$150	$240,000
Inlet/Outlet Structure	2	EA	$3,500	$7,000
Junction Structure	3	EA	$3,500	$10,500
SUB-TOTAL				$257,500
MOBILIZATION, ENGR, ADMIN, & CONTINGENCY				$90,100
TOTAL				$347,600

* 1991 DOLLARS

CITY OF LEBANON
STORM DRAINAGE MASTER PLAN
PROJECT COST ESTIMATES

COST ESTIMATE 7.6B

Major Basin: COX CREEK – LEBANON HIGH SCHOOL
Sub-Basins: C-70, C-70LC-80, C-90, C-100, C-110
Project Name: Upper Cox Creek Bridges

Phasing: IMMEDIATE
Priority Within Phase: MEDIUM

ITEMS	QUANTITY (APPROX)	UNIT	$/UNIT*	$ EXTENDED*
Bridge Crossings	3	EA	$60,000	$180,000
SUB-TOTAL				$180,000
MOBILIZATION, ENGR, ADMIN, & CONTINGENCY				$63,000
TOTAL				$243,000

* 1991 DOLLARS

CITY OF LEBANON
STORM DRAINAGE MASTER PLAN
PROJECT COST ESTIMATES

COST ESTIMATE 7.6C

Major Basin: COX CREEK - LEBANON HIGH SCHOOL
Sub-Basins: C-70, C-70LC-80, C-90, C-100, C-110
Project Name: 'F' Street Detention

Phasing: IMMEDIATE
Priority Within Phase: LOW

ITEMS	QUANTITY (APPROX)	UNIT	$/UNIT*	$ EXTENDED*
36 Inch Pipe	60	LF	$90	$5,376
8'X3' Box Culvert	60	LF	$400	$24,000
Excavation	22000	CY	$6	$132,000
Land Aquisition	2.6	AC	$25,000	$65,000
SUB-TOTAL				$226,400
MOBILIZATION, ENGR, ADMIN, & CONTINGENCY				$79,200
TOTAL				$305,600

* 1991 DOLLARS

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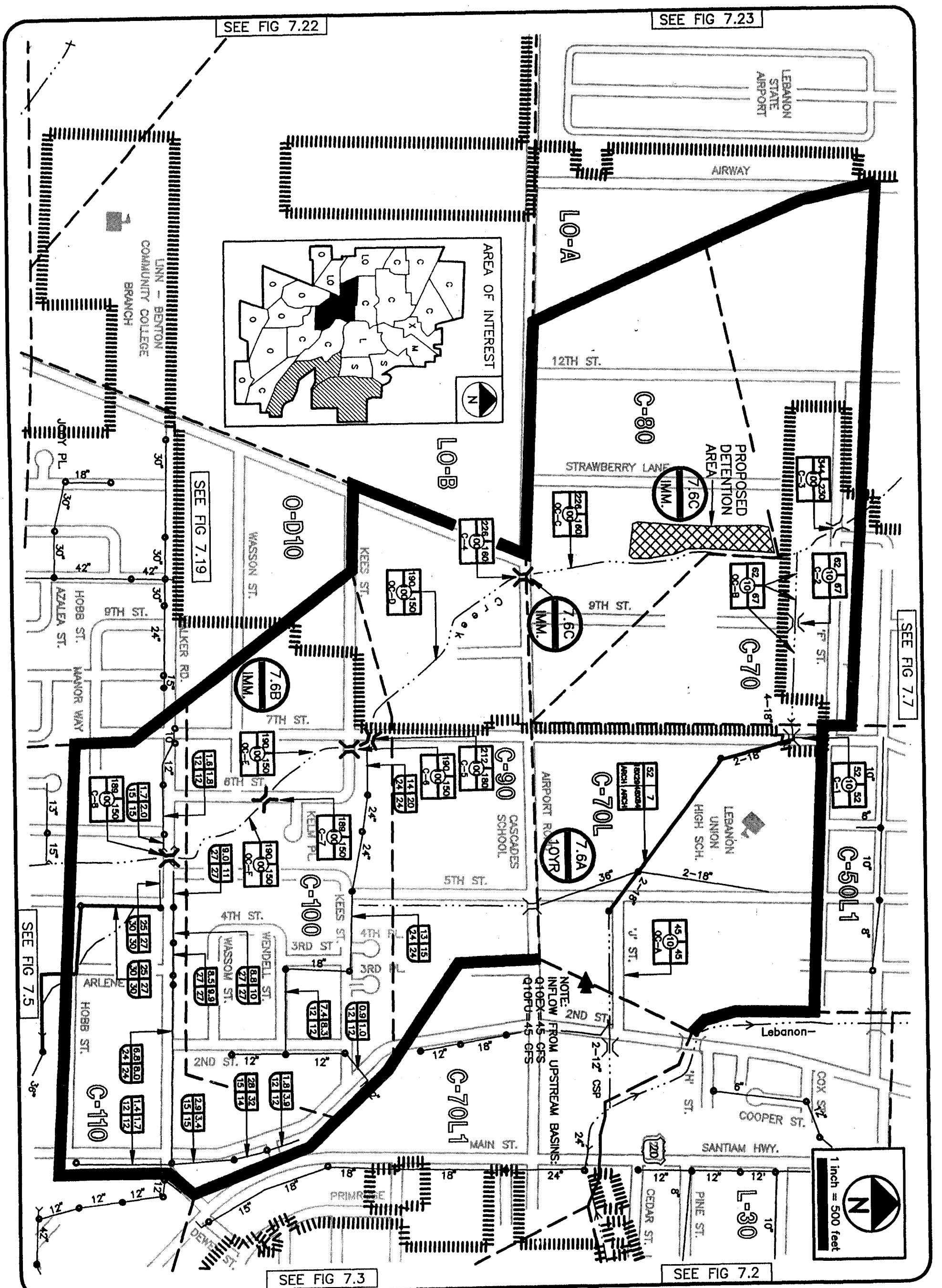
PLAN 7.6
COX CREEK - LEBANON HIGH SCHOOL

ROAD CROSSINGS		
Culvert	Existing	Future
C-1	4 - 18" CMP	48"X84" Arch Pipe
C-2	3 - 24" CMP	*Unchanged*
C-3	3 - 36" CSP	4 - 36" CSP
C-4	2 - 24" CSP	8'x3' Conc. Box
C-5	2 - 24" CSP 1 - 30" CSP	Concrete Slab Bridge
C-6	1 - 24" CSP 1 - 30" CSP	Concrete Slab Bridge
C-7	1 - 24" CSP 1 - 27" CSP	Concrete Slab Bridge
C-8	8'x3' Conc. Box	*Unchanged*

OPEN CHANNEL REACHES					
Reach	Bottom Width (ft)	Side Slope (ft/ft)	Channel Slope (ft/ft)	Manning's N	Channel Depth (ft)
OC-A	8	1.5:1	0.001	0.025	5
OC-B	12	10:1	0.0032	0.03	2.5
OC-C	8	5:1	0.0032	0.03	2.5
OC-D	8	5:1	0.0008	0.04	2.5
OC-E	3	2:1	0.0008	0.03	3
OC-F	10	5:1	0.0008	0.04	2



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

FIGURE 7.6

CITY OF LEBANON
Storm Drainage Master Plan

Section 7.7

PLAN SHEET: Cox Creek - Oak Street

SUB-BASINS: C-50, C-50L, C-50L1, C-60

DESCRIPTION OF DRAINAGE FEATURES:

These sub-basins drain to Cox Creek between Oak Street and F Street. They are bounded to the east by the Lebanon-Albany Canal and to the west by Airway Road. This area includes the Fire Station, Jaycee Park, and the residential area west of 7th Street, south of Oak Street and north of the Lebanon High School.

Runoff from the fully developed residential area west of 7th Street (sub-basins C-50L and C-50L1) drains to an 8" and 10" east-west storm drain system and is conveyed in a 12" to 24" collector line along 7th to Oak Street. There is not adequate slope along the streets in this area to support significant gutter flow. Flows exceeding the pipe capacity are ponded in the gutters and at street intersections. All of the east-west storm drains are not adequate for any future or existing peak events. The 7th Street collector line is adequate for the 2 year existing and future events north of B Street and not adequate for any peak events south of B Street.

At Oak Street, a trunk line consisting of a 36" pipe between 7th and 9th Street and 42" pipes below 9th Street conveys the flow collected along 7th to the 42" outfall near 12th and Oak Street. The 42" pipes along Oak are adequate for the existing 50 year and future 25 year events. The 36" pipe, from 7th to 9th Street, is adequate for the existing and future 10 year peak events.

The portion of the Oak Street Basin west of 7th Street is partially developed at this time. Existing runoff drains overland and along roadways either directly to Cox Creek or to the trunk line along Oak Street. Piped collector systems are not present in this area. This area is zoned for mixed density residential development. Future flows assume vacant lots are infilled with mixed density residential development.

Cox Creek passes through primarily undeveloped lands in this area. An existing 9'x6' box culvert conveys flow for Cox Creek under Oak Street. This box culvert is adequate for the existing 100 and future 25 year events. A combination of three 36" pipes and one 30" pipe conveys flow at the 12th Street crossing. The 12th Street culverts will carry the existing 10 year and future 2 year flow, without any upstream detention.

PROBLEM AREAS:

Frequent ponding occurs throughout the residential areas in sub-basins C-50L and C-50L1. This ponding is a result of surcharged conditions due to the undersized collector line along 7th Street combined with the insufficient capacity in the 8" and 10" east-west storm drains within this system. Insufficient slope is available for excess flow to be carried in the gutter system, and excessive ponding occurs at the catch basins. This causes a considerable nuisance to area residents as well as the commercial developments near 3rd and Oak Street.

After full upstream development, unimproved future flows will result in minor flooding of 12th Street approximately once every two years. Flows exceeding the capacity of the 12th Street culverts cause a considerable nuisance, flooding portions of 12th Street south of the Fire Station with shallow flow for 1 to 3 hours during peak events. Overland flow will flood portions of a few downstream properties, causing minor damage. Backwater effects are minimal, and no upstream property damage is expected.

After future development and without upstream improvements, Oak Street will have a 25 year capacity. Failure of the Oak Street culvert results in overtopping of the roadway and considerable damage to downstream properties. Wide, shallow sheet flow floods houses along 12th and 15th Street. In addition backwater floods portions of the Fire Station. Because of this potential for damage to residential properties, a 100 year capacity is desirable.

SOLUTIONS:

Rather than replace the collector line along 7th Street, ponding in sub-basins C-50L and C-50L1 can be most cost effectively alleviated by intercepting surcharged flow with a pipe system constructed along 5th Street. During peak events, the undersized 8" and 10" pipes are surcharged. A pipe system along 5th Street designed to maintain minimum water surface elevations will intercept surcharged flow and offload the undersized pipes along 7th Street.

A diversion line along 5th Street should be designed to hold the Creek invert elevation of the trunk main at 7th and Oak Street, and maintain a minimum pipe slope. This system should intercept the 8" and 10" east-west storm drains approximately one foot lower than the existing inverts. The hydraulic grade line in the diversion line must be maintained within one foot of the existing inverts in order to allow for maximum head loss in the existing 8" and 10" storm drain systems. A system of 21" and 27" pipes designed at capacity will maintain the required hydraulic grade line.

As discussed in Section 7.6, "Cox Creek - Lebanon High School," the detention area at F Street is designed to increase the future capacity of the 12th Street and Oak Street crossings.

Proposed detention at F Street increases the capacity of the 12th Street crossing from a 2 year future unimproved adequacy to a 25 year future improved adequacy. The future capacity at Oak Street is increased from a 25 year unimproved adequacy to 100 year adequacy after the detention improvements are constructed.

RECOMMENDED PROJECTS:

7.7A 5th Street Diversion

Construct 21" pipes along 5th Street between E Street and B Street. Construct 27" pipes along 5th Street between B Street and Oak Street, and along Oak Street between 5th Street and the trunk main at the intersection of 7th and Oak Street. Connect all of the 8" and 10" systems at the intersections along 5th Street.

CITY OF LEBANON
STORM DRAINAGE MASTER PLAN
PROJECT COST ESTIMATES

COST ESTIMATE 7.7

Major Basin: COX CREEK - OAK STREET
Sub-Basins: C-50, C-50L, C-50L1, C-60
Project Name: 5Th Street Diversion

Phasing: 10 YEAR (1997-2001)
Priority Within Phase: MEDIUM

ITEMS	QUANTITY (APPROX)	UNIT	$/UNIT*	$ EXTENDED*
PIPE (INCH)				
21	925	LF	$54	$50,320
27	1,450	LF	$67	$97,150
MANHOLE (M.H.)				
48"	7	EA	$1,800	$12,600
SUB-TOTAL				$160,100
MOBILIZATION, ENGR, ADMIN, & CONTINGENCY				$56,000
TOTAL				$216,100

* 1991 DOLLARS

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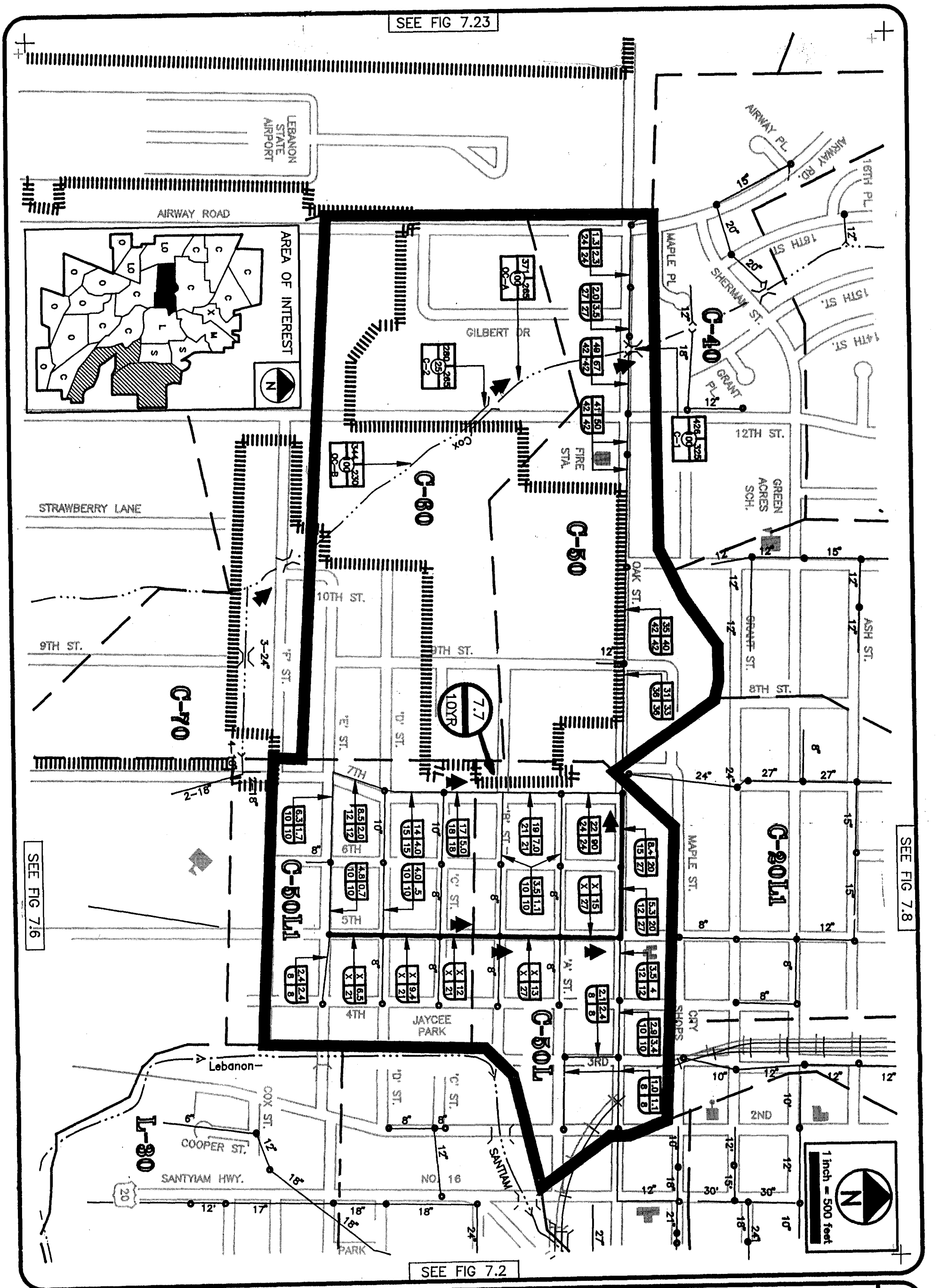
PLAN 7.7
COX CREEK - OAK STREET

ROAD CROSSINGS		
Culvert	Existing	Future
C-1	5.7'x9.5' Conc Box	*Unchanged*
C-2	3 - 36" CSP 1 - 30" CSP	*Unchanged*

OPEN CHANNEL REACHES					
Reach	Bottom Width (ft)	Side Slope (ft/ft)	Channel Slope (ft/ft)	Manning's N	Channel Depth (ft)
OC-A	15	2:1	0.0026	0.035	5
OC-B	10	5:1	0.0026	0.04	3.5



DATE MAR 1991
PROJECT NO. 292 DP 11 DO

DAVID J. NEWTON ASSOCIATES INCORPORATED
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COX CREEK-OAK STREET

CITY OF LEBANON
Storm Drainage Master Plan

FIGURE 7.7

CITY OF LEBANON
Storm Drainage Master Plan

Section 7.8

PLAN SHEET: **Cox Creek - Lebanon Highway**

SUB-BASINS: **C-20, C-20L, C-20LL, C-20L1, C-30, C-30L, C-40**

DESCRIPTION OF DRAINAGE FEATURES:

This plan area contains a group of sub-basins which drain to Cox Creek between the Lebanon Highway and Oak Street. It includes the undeveloped areas near Tucker Lane and 13th Street, the fully developed residential areas west of the railroad surrounding Green Acres School and Century Park, the commercial area adjacent to the Lebanon Highway between 13th and 10th Street and the commercial area along 3rd Street between Oak and Rose Street. The only future development expected within this sub-basin is the infilling of mixed density residential which will drain directly to Cox Creek between Tucker and 13th Street. Minimal future development is expected elsewhere within this group of sub-basins. Therefore, flows carried by existing pipe systems are not expected to increase.

Cox Creek is well maintained in this area. The channel maintains a 0.2 percent slope and is 3 to 5 feet deep throughout this reach. South of Vine Street, Cox Creek is surrounded by fully developed residential neighborhoods. The overbank areas are adequately sloped in this reach with side slopes of approximately 50:1. North of Vine Street, Cox Creek traverses through the sparsely developed lands between Tucker and 13th Streets. The overbank area to the east flattens considerably in this area, with side slopes varying from 100:1 to 500:1. Throughout this sub-basin group, the 10-year existing and 2-year future flow are conveyed by the main channel. The overbanks adequately carry the existing 100-year and future 25-year event without flooding either existing developments or developable areas.

Major road crossings over Cox Creek occur at the Lebanon Highway and Sherman Street. At the highway crossing, flow is conveyed by three 36 inch concrete culverts. The roadway is one to two feet higher than upstream ground elevations. This crossing is not adequate for any existing or future peak events. The Sherman Street crossing consists of a 5 foot by 7 foot corrugated metal arch pipe. Very little depth is available at this crossing and in order to provide adequate cover for the arch culvert, the roadway surface has been raised approximately one foot higher than the surrounding overbank areas. Flow exceeding the capacity of this culvert is forced around this raised area and down 14th Street, 15th Street and 16th Street, all of which are at a lower elevation. While a majority of the houses in this area are at elevations one to two feet higher than the roadways and are not flooded during extreme events, a few low lying residential properties along 15th Street are flooded with six inches to one foot of flow when the culvert capacity is exceeded. The Sherman Street

crossing conveys the existing 10-year flow and is not adequate for any major future peak events.

Runoff west of Cox Creek and north of the existing City Limits, drains directly to Cox Creek. Runoff from the developed residential area along 16th Street and Airway Road is collected and discharged into Cox Creek by small collector systems discharging at 16th Place and just downstream of Sherman Street. These collectors are adequate for the 10-year future and existing peak flows.

East of Cox Creek, runoff from the residential area near Green Acres School between 15th Street and 8th Street, south of Isabella Street and north of Oak Street are collected by gutter and storm pipe systems draining to a 30-inch trunk line along Vine Street. This storm system continues past the end of Vine Street and outfalls into Cox Creek. The Vine Street trunk line is adequate for the existing and future 2-year events west of 12th Street. Between 12th and 11th Street little ground slope exists and the trunk is not adequate for any existing or future peak events. Adequate slope between 11th and 10th Street gives the trunk line a 10-year existing and future capacity. The 15" collectors along 10th Street have a 2-year existing and future capacity.

A 30" and 36" storm sewer trunk travelling along 7th Street from Oak Street to the Lebanon Highway and along the Highway to a 36" outfall at Cox Creek serves a 12 inch and 15 inch collector system. This trunk drains the residential area along 5th Street south of Century Park and along 3rd Street in sub-basin C-20LL. It appears that in the past this trunk line continued up 7th Street and was connected to the storm lines along Oak Street. This connection, however, has been abandoned, and the 24" and 27" pipes between Oak and Ash Street carry only local drainage. Above Rose Street, the 7th Street portion of the trunk line is adequate for flows exceeding the existing and future 10-year peak flow. After receiving flow from the storm drain at Rose Street, the trunk line is adequate only for the 2-year event. In the flat reaches along the Lebanon Highway, the 26" trunk line is not adequate for any major peak events. The collector system serving sub-basin C-20LL is not adequate for any major events and the collector system serving the 5th Street residential areas is adequate for the existing and future 2-year flows.

PROBLEM AREAS:

At the Lebanon Highway crossing of Cox Creek, flows exceeding the culvert capacity cause backwater flooding of the upstream low lying residential areas during the existing 5-year event. These areas are currently sparsely developed but expected to be developed within the next 20-years. As development occurs both in this area and in the upstream watershed, the frequency of this flooding is expected to increase to once every 2 years. Extensive flooding due to overtopping of the highway occurs during the existing 25-year and future 10-year events.

The Sherman Street Crossing is adequate for the existing 10 year and no future unimproved events. Because a majority of the surrounding development is at elevations higher than the roadways, property damage due to flooding in this area is not as extensive as problem areas along other portions of the creek. However, some lower lying houses are flooded and 14th, 15th, 16th and Sherman Streets will be inundated for 2 to 3 hours during events exceeding the capacity of this crossing.

Ponding occurs in the residential areas near Green Acres School approximately every two years due to the under capacity pipes along 10th Street and Vine Street. Little to no slope exists along Vine Street and surcharged conditions result in ponding at the intersections and in low areas. 10th Street has noticeable slope and while some ponding will occur it will not be as extensive as the ponding along Vine Street.

Undersized pipes along the Lebanon Highway result in periodic flooding, with a majority of the storm system flooding annually. While this flooding is not expected to cause any property damage, periodic ponding due to undersized pipes causes a nuisance throughout the commercial district along the highway and at the Hansard Avenue intersection, which is expected to be heavily used by industrial traffic.

In sub-basin C-20LL, sufficient grade exists along 3rd Street so that the existing surcharged 12" collector pipes are capable of carrying the 5-year existing and future flows. Street gutters have the capacity to convey flows exceeding the 5-year event. Rose Street, however is quite flat and the under capacity 15" pipes, when surcharged, cause periodic ponding in the commercial area at the intersection of 3rd and Rose Street. The storm drain along Rose Street is not adequate for any major peak events.

SOLUTIONS:

The upstream detention and diversions suggested in the previous sections markedly decrease the 25 and 100-year flows in this portion of Cox Creek. The improved 100-year flow at the Lebanon Highway crossing of Cox Creek is 50 cfs less than the existing 100-year flow and 200 cfs less than the future unimproved flow. Upstream improvements restore the adequacy of the main channel in this area to a 100-year adequacy. However, the Sherman Street and Lebanon Highway crossings are still under capacity.

Section 7.9, "Cox Creek-UGB," recommends reconstructing the portion of Cox Creek downstream of the Highway. This improvement increases the available head loss at this culvert and reduces the size of culvert required. After reconstructing Cox Creek, the invert elevation at the Lebanon Highway is approximately 323 and the 100-year tailwater elevation is at 329. A maximum headwater elevation at the highway crossing of 331 must be maintained during the 10-year event in order to prevent flooding of existing and future residential buildings. During the 100-year event, a water surface elevation of 332 limits

flooding to only those residences within the low lying area near the creek. A 10'x6' box culvert will maintain the required water surface elevations for the future 10 and 100-year flows.

The Sherman Street crossing could be upgraded to a future 25 year capacity by the addition of another 5'x7' CMP arch pipe. However, since metal pipe has a limited life span, upgrading the crossing to future 100 year capacity with a 10'x5' concrete box culvert would be the preferable solution.

The Sherman Street and Lebanon Highway crossing replacements can be constructed most economically in conjunction with the Cox Creek ditch improvements proposed in Section 7.9. Consequently these relatively inexpensive culvert replacements are included in Project 7.9, "Cox Creek Ditch Improvements."

The Vine Street trunk line between 11th Street and the outfall would need to be replaced with 48" and 42" pipes to serve this area for the 10-year future event. A less costly alternative is to add a parallel pipe system consisting of 27", 30" and 36" pipes along Vine Street, between 11th Street and the outfall. The existing lateral storm lines should be connected to both systems in order to allow flows to balance between the two lines.

The 10th Street storm drain does not need to be replaced. 2-year adequacy along 10th Street is adequate for this area since adequate slope will prevent excessive ponding. The Vine Street improvement is of low priority, since failure of the system results in no damage and only a minor nuisance to residential neighborhoods once every two years.

Ponding in the 3rd Street commercial area can be alleviated by constructing a diversion along Vine Street to the trunk line along Main Street to the east. Diverting 16 cfs in a 30" pipe will alleviate problems at the intersection of Rose and 3rd Street. A 5" orifice constriction should be constructed in the manhole at 5th and Rose Street. This 5" low flow "trickle tube" forces surcharged flow to travel back towards the 30" diversion pipe during peak events. An additional 12" pipe along 2nd Street between Vine and Rose Street is required to convey the surcharged flow to the 30" diversion pipe. The Main Street trunk line is discussed in Section 7.1, "Marks Slough - Had Irvine Park," and has adequate capacity to carry the additional diverted 16 cfs.

The problem area along the Lebanon Highway can be alleviated by diverting 35 cfs out of the existing trunk line at the intersection of 7th and Tangent Street in addition to the 16 cfs diverted from the Rose Street collector. The diverted flow can be carried along the north side of the highway in a series of 36" pipes to the City Limits at 11th Street, where a 42" pipe carries the flow to a pipe system through sub-basin C-10. The C-10 pipe system is required to serve the industrial lands in this sub-basin and must be constructed regardless of the diversion, as discussed in Section 7.9, "Cox Creek-UGB." The Lebanon Highway diversion and the C-10 pipe system should be constructed within the same project. This

system should adequately convey the 10-year event under surcharged conditions induced by Cox Creek. Events exceeding the 10-year event will cause local ponding, but since this flow is piped, property damage is not expected.

RECOMMENDED PROJECTS:

7.8A Lebanon Highway Improvements

At the intersection of 3rd Street and Vine Street construct a 30" diversion pipe in Vine Street and connect this pipe to the existing 48" trunk line in Main Street.

At 5th and Rose, construct a 5" orifice constriction, designed to convey low flow and force peak flows back to the diversion pipe. Construct a 12" pipe along 2nd Street connecting the existing pipe system at 2nd and Rose to the 30" diversion pipe along Vine Street.

Construct a 36" pipe along the north side of the Lebanon Highway between 7th Street and the City Limits. Replace the existing manhole at the intersection of 7th Street and the highway and connect the new 36" diversion system to the existing 30" pipe.

At the City Limits, construct a 42" pipe extending north along the City Limits to the intersection with the Hansard Avenue drainage ditch. At this confluence, replace the western portion of the drainage ditch with a 54" and 60" pipe system (400' of 54", 1200' of 60") to the confluence with Cox Creek.

7.8B Vine Street Replacement

Replace the existing 30" pipe system along Vine Street, from 10th Street west to the outfall at Cox Creek, with a 42" pipe system.

CITY OF LEBANON
STORM DRAINAGE MASTER PLAN
PROJECT COST ESTIMATES

COST ESTIMATE 7.8A

Major Basin: COX CREEK - LEBANON HIGHWAY
Sub-Basins: C-20, C-20L, C-20LL, C-20L1, C-30, C-30L, C-40
Project Name: Lebanon Highway Improvements

Phasing: 5 YEAR (1993-1997)
Priority Within Phase: LOW

ITEMS	QUANTITY (APPROX)	UNIT	$/UNIT*	$ EXTENDED*
PIPE (INCH)				
12	300	LF	$38	$11,400
30	800	LF	$72	$57,600
36	1,350	LF	$90	$120,960
42	650	LF	$98	$63,570
54	400	LF	$154	$61,600
60	1200	LF	$170	$204,000
MANHOLE (M.H.)				
48"	3	EA	$1,800	$5,400
60"	7	EA	$2,400	$16,800
72"	4	EA	$3,400	$13,600
5" Orifice Structure	1	LS	$500	$500
Outfall Structure	1	LS	$2,000	$2,000
SUB-TOTAL				$557,400
MOBILIZATION, ENGR, ADMIN, & CONTINGENCY				$195,100
TOTAL				$752,500

* 1991 DOLLARS

CITY OF LEBANON
STORM DRAINAGE MASTER PLAN
PROJECT COST ESTIMATES

COST ESTIMATE 7.8B

Major Basin: COX CREEK - LEBANON HIGHWAY
Sub-Basins: C-20, C-20L, C-20LL, C-20L1, C-30, C-30L, C-40
Project Name: Vine Street Trunk Replacement

Phasing: 15 YEAR (2001-2005)
Priority Within Phase: LOW

ITEMS	QUANTITY (APPROX)	UNIT	$/UNIT*	$ EXTENDED*
PIPE (INCH)				
36	400	LF	$90	$36,000
30	620	LF	$72	$44,640
27	390	LF	$67	$26,130
MANHOLE (M.H.)				
60"	2	EA	$2,400	$4,800
48"	3	EA	$1,800	$5,400
Outfall Structure	1	LS	$2,000	$2,000
SUB-TOTAL				$119,000
MOBE, ENGR, ADMIN, & CONTINGENCY				$41,700
TOTAL				$160,700

* 1990 DOLLARS

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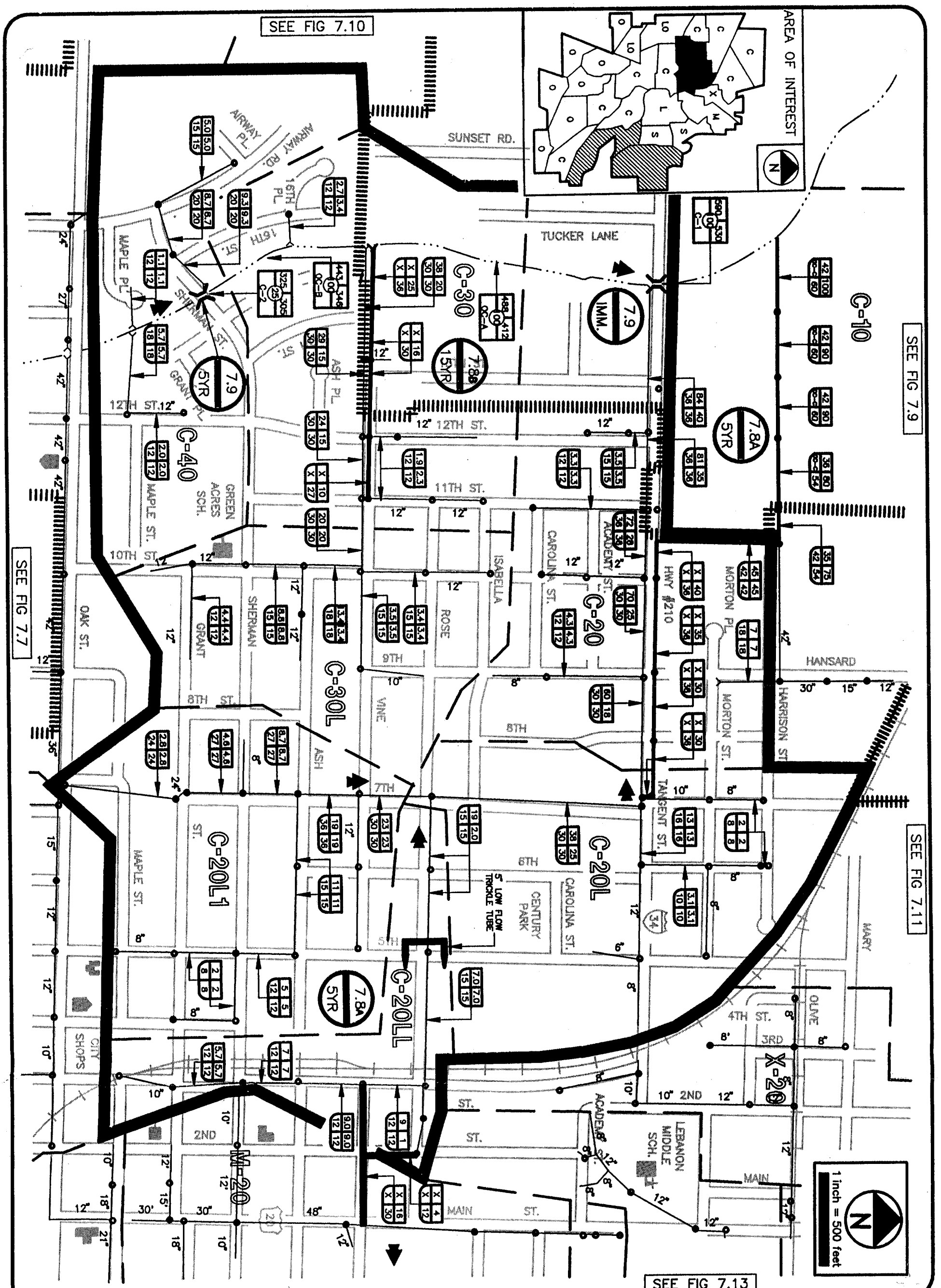
PLAN 7.8
COX CREEK - LEBANON HIGHWAY

ROAD CROSSINGS		
Culvert	**Existing**	**Future**
C-1	3-36" CSP	10'x6' Conc. Box
C-2	1 - 5'x7' CMP Arch	10'x5' Conc. Box

OPEN CHANNEL REACHES					
Reach	**Bottom Width (ft)**	**Side Slope (ft/ft)**	**Channel Slope (ft/ft)**	**Manning's N**	**Channel Depth (ft)**
OC-A	12	5:1	0.0018	.035	3.5
OC-B	15	2:1	0.0010	.030	5.0



292 DP 11 DO – LEB–F16

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

FIGURE 7.8

CITY OF LEBANON
Storm Drainage Master Plan

Section 7.9

PLAN SHEET: Cox Creek - UGB

SUB-BASINS: C-0, C-10

DESCRIPTION OF DRAINAGE FEATURES:

This sub-basin group occupies the region north of the Lebanon Highway and south of the Southern Pacific Railroad. Sub-basin C-10 is included in the Northwest Lebanon Urban Renewal Area. Sub-basin C-0 contains the undeveloped lands draining to the unimproved portion of Cox Creek north of the Lebanon Highway. Property within this sub-basin group are zoned primarily for light industrial development, though small patches of mixed residential zoning occur in the southeast portion of the area.

The lands within sub-basin C-0 consist of flat, cultivated fields with poorly defined drainage paths. An access road serving the Urban Renewal area is phased for construction between 1996 and 1999. Light industrial development in this area is expected to occur in conjunction with this improvement.

Existing drainage paths consist of flat overland areas with slopes less than .2 percent draining to shallow swales and poorly defined ditches which carry flow the to Cox Creek. Cox Creek is shallow in this area, with depths of less than two feet and channel slopes of .15 percent. The channel is adequate for the existing 10 and future 5 year flows.

The portion of sub-basin C-10 within the existing City Limits is part of the Hansard Avenue Reconstruction Project, which is scheduled for completion by 1992. This area was assumed to be fully developed for the purpose of calculating existing flows. The storm drainage system to be constructed consists of a piped system through the developed areas along Hansard Avenue and Harrison Street and an open channel reach through the undeveloped areas to the east, used to convey flow to Cox Creek.

The remaining lands within C-10 are currently undeveloped. Existing drainageways consist of flat overland reaches and poorly defined ditches and shallow swales which drain to either Cox Creek or the drainage ditch constructed in the Hansard Avenue Reconstruction Project. The lands in C-10 west of the City Limits are zoned primarily light industrial. Infrastructure improvements recommended by the Urban Renewal Plan are scheduled to begin in year 2000 and be completed by 2010.

PROBLEM AREAS:

The shallow depth of Cox Creek in this area results in excessive flooding of lands otherwise available for industrial development. During events exceeding the capacity of the channel, a majority of sub-basin C-0 is flooded. In addition, backwater effects decrease the available head loss at the Lebanon Highway crossing, limiting the capacity of this crossing. The addition of the proposed access road to the Urban Renewal Area, will further worsen the backwater flooding.

The drainage ditch conveying flows from the Hansard Avenue area to Cox Creek is not adequate for flows expected after C-10 develops. Development of this basin will depend on improving this ditch.

SOLUTIONS:

Cox Creek should be reconstructed from the Southern Pacific Railroad crossing to approximately 200 feet upstream of the Lebanon Highway. The improved ditch will lessen the expense of replacing the culvert at the Lebanon Highway (see Section 7.8, "Lebanon Highway"), and provide service to the industrial lands in sub-basin C-0. The improved ditch must be designed to provide service to surrounding lands during the future 10 year event and prevent overtopping of the bank for the 100 year event. The extensive damage that would occur to surrounding industrial developments, if Cox Creek were to overtop its banks, warrants a 100 year design. A 15 foot bottom width, side slopes of 2:1, and 6 feet of depth are required to carry the future 100 year flow after upstream improvements. As discussed in Section 7.8, "Cox Creek - Lebanon Highway," the proposed improvements at the Lebanon Highway and Sherman Street should be combined into a single project with the proposed creek reconstruction.

The ditch conveying flow from the Hansard Avenue development is not along existing property lines but crosses a single property. This flow will likely be piped as development in this area occurs. The new pipe will need to convey the 10 year flow due to industrial development in sub-basin C-10. This pipe will also need to convey flow diverted from the Lebanon Highway to offload the existing undersized pipe. A series of 54" and 60" pipes are required to convey the required flow through this area. The construction of this pipe system is included in Project 7.8A, "Lebanon Highway Diversion," discussed in Section 7.8, "Lebanon Highway."

RECOMMENDED PROJECTS:

7.9A Cox Creek Improvement

Reconstruct Cox Creek beginning at the Southern Pacific Railroad crossing and extending approximately 200 feet above the Lebanon Highway. The creek should hold the existing invert elevation of 314.0 at the railroad crossing and maintain a .12 percent slope upstream. This will ensure depths of 6 to 7 feet throughout the reach. A 15 foot bottom width and 2:1 side slopes are required.

Construct a 10'x6' concrete box culvert approximately 50 feet in length, replacing the existing multiple 36" pipes conveying Cox Creek under the Lebanon Highway.

Replace existing 5'x7' CMP arch pipe with approximately 60 feet of 5'x10' concrete box culvert.

7.9B Lebanon Highway Diversion

The required pipe serving sub-basin C-10 is included in project 7.8A, "Lebanon Highway Diversion."

CITY OF LEBANON
STORM DRAINAGE MASTER PLAN
PROJECT COST ESTIMATES

COST ESTIMATE 7.9

Major Basin: COX CREEK - UGB
Sub-Basins: C-0, C-10
Project Name: Cox Creek Improvements

Phasing: IMMEDIATE (1990-1993)
Priority Within Phase: LOW

ITEMS	QUANTITY (APPROX)	UNIT	$/UNIT*	$ EXTENDED*
Excavate Ditch	6800	LF	$27	$183,600
10'x6' Box Culvert	50	LF	$500	$25,000
10'x5' Box Culvert	60	LF	$495	$29,700
SUB-TOTAL				$238,300
MOBILIZATION, ENGR, ADMIN, & CONTINGENCY				$83,400
TOTAL				$321,700

* 1991 DOLLARS

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PLAN 7.9
COX CREEK - UGB

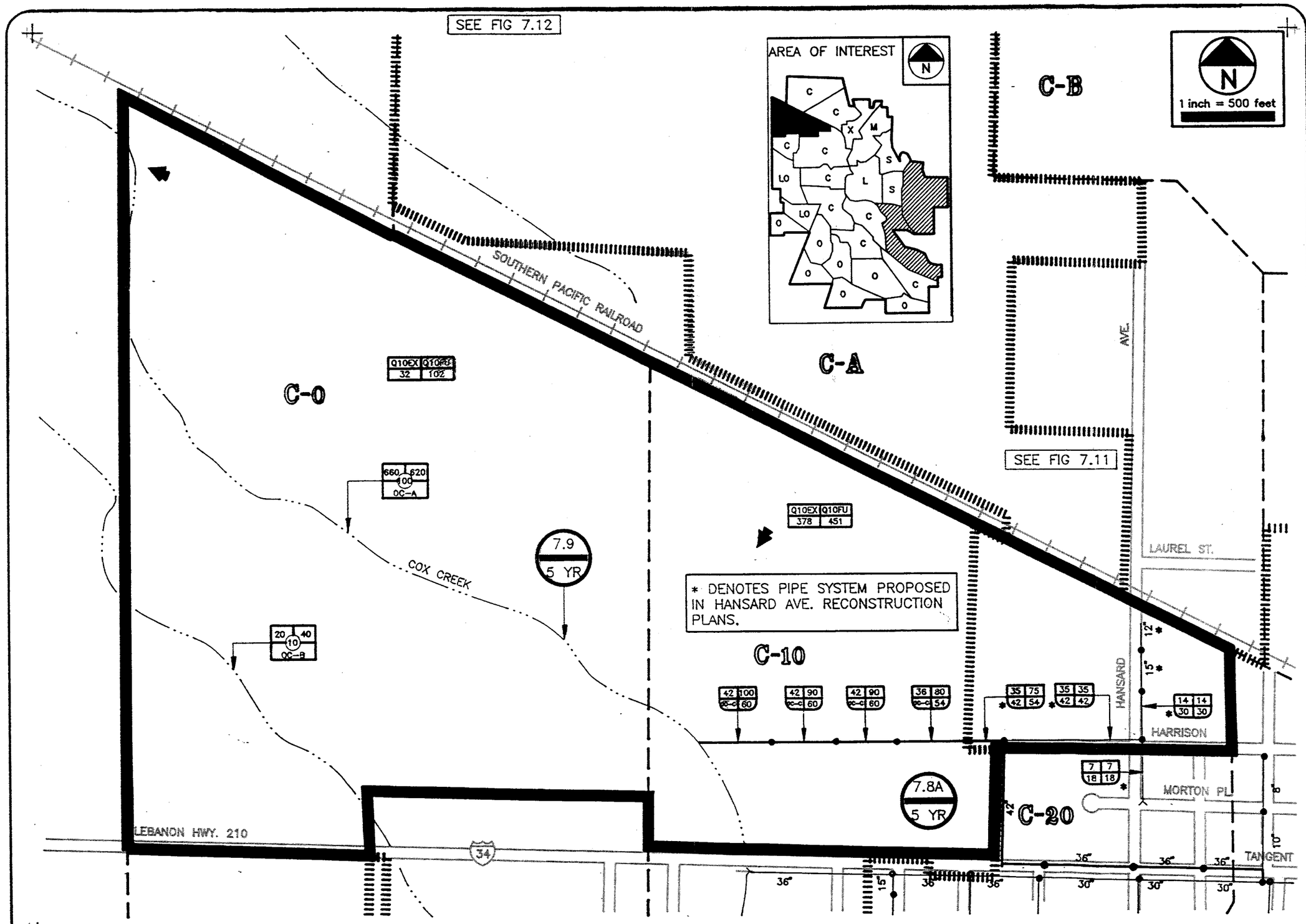
ROAD CROSSINGS		
Culvert	Existing	Future
NONE		

OPEN CHANNEL REACHES					
Reach	Bottom Width (ft)	Side Slope (ft/ft)	Channel Slope (ft/ft)	Manning's N	Channel Depth (ft)
OC-A (Existing)	3	2:1	0.0015	0.040	2
OC-A (Proposed)	15	2:1	0.0012	0.030	6
OC-B	1	2:1	0.0015	0.040	2

FIGURE 7.9

COX CREEK–UGB

CITY OF LEBANON
Storm Drainage Master Plan



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292 DP 11 DO

292 DP 11 DO – LEB–F1

CITY OF LEBANON
Storm Drainage Master Plan

Section 7.10

PLAN SHEET: Cox Creek - Sunset Road

SUB-BASINS: C-0R

DESCRIPTION OF DRAINAGE FEATURES:

This sub-basin includes the area east of Sunset Road and south of the Lebanon Highway. The area is undeveloped west of Sunset Road and consists primarily of cultivated fields. The basin is zoned primarily for light industrial development with mixed density areas along the west edge of the existing City Limits and Sunset Road. Runoff from this basin is collected in a poorly defined tributary of Cox Creek. This tributary crosses the Lebanon Highway in an 18" CMP culvert.

PROBLEM AREAS:

The existing culvert is undersized for future flows. The tributary is poorly defined and incapable of conveying flows due to industrial developments.

SOLUTIONS:

On site detention for the 10 year event will ensure adequate drainage for this design period. Storm events exceeding the 10 year event will result in ponding and gutter flow, but little property damage is expected.

RECOMMENDED PROJECTS:

None Recommended.

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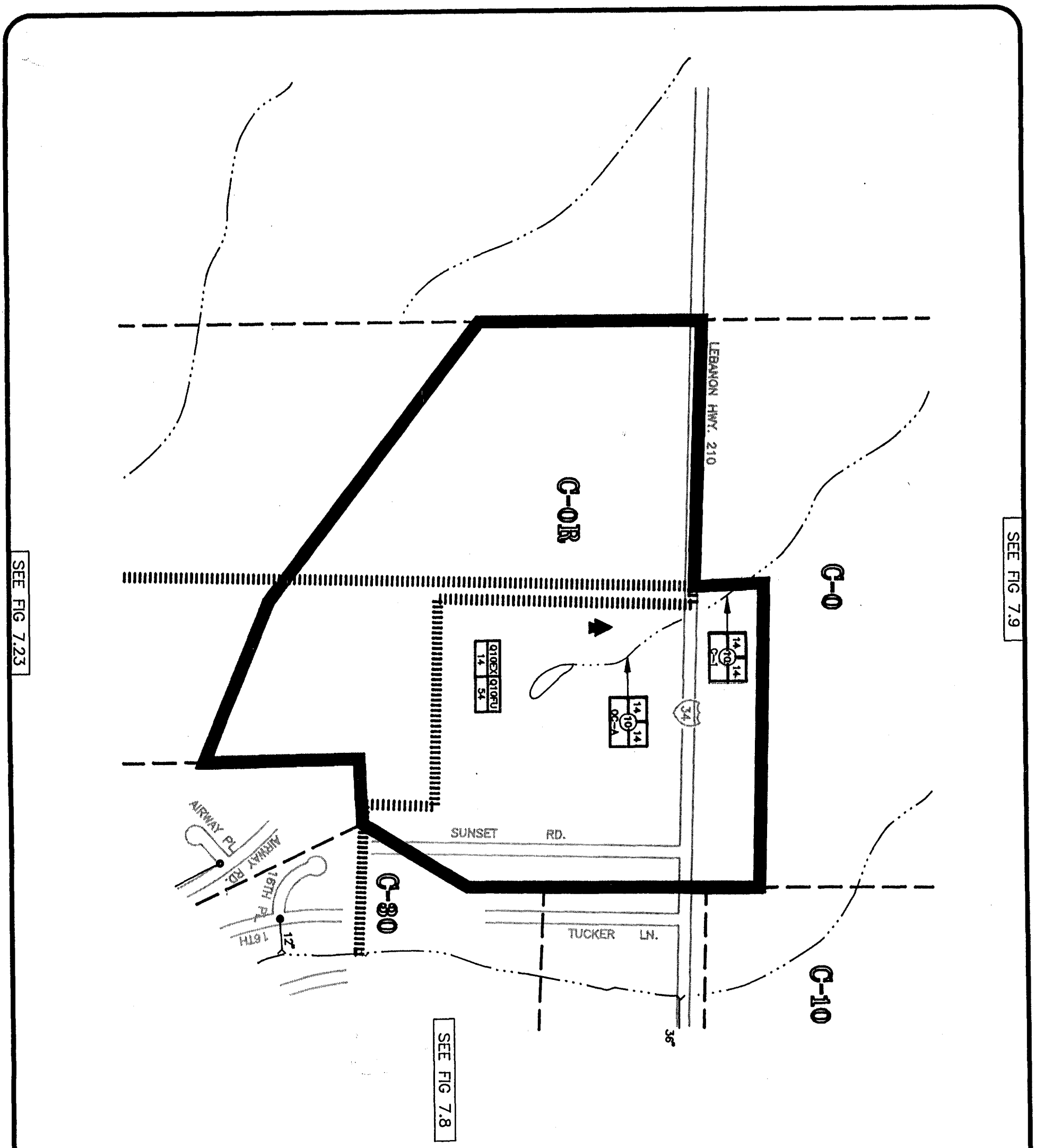
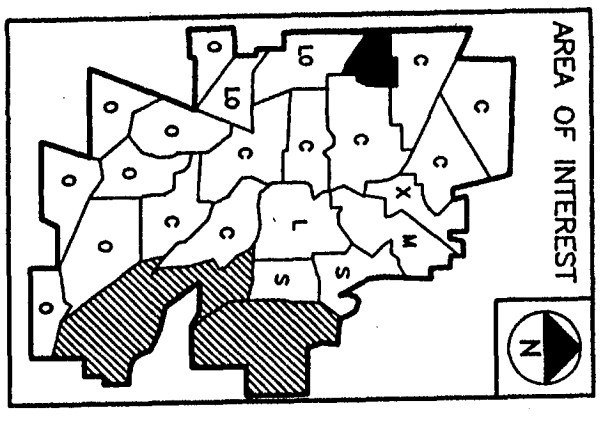
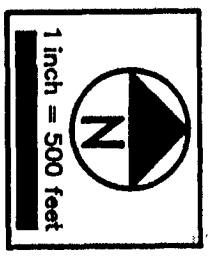
PLAN 7.10
COX CREEK - SUNSET ROAD

ROAD CROSSINGS		
Culvert	Existing	Future
C-1	18" CSP	*Unchanged*

OPEN CHANNEL REACHES					
Reach	Bottom Width (ft)	Side Slope (ft/ft)	Channel Slope (ft/ft)	Manning's N	Channel Depth (ft)
OC-A	2	2:1	0.0040	0.040	2







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DATE MAR 1991
PROJECT NO. 292 DP 11 DO

COX CREEK-SUNSET RD.

CITY OF LEBANON
Storm Drainage Master Plan

FIGURE 7.10

CITY OF LEBANON
Storm Drainage Master Plan

Section 7.11

PLAN SHEET: **Cox Creek - Hansard Avenue**

SUB-BASINS: **C-A, C-A10, C-BR**

DESCRIPTION OF DRAINAGE FEATURES:

The Hansard Avenue sub-basin group is located north of the Southern Pacific Railroad and west of the Santiam Highway. It includes the portion of the Northwest Lebanon Urban Renewal Area surrounding the north end of Hansard Avenue, the Lebanon Community Hospital and the small drainage area north of the hospital between the Santiam Highway and the Lebanon-Albany Canal.

This region is zoned for light industrial uses in sub-basin C-A, mixed density residential uses in sub-basin C-BR and as a special development district in sub-basin C-A10. A majority of the area is undeveloped at present and expected to be fully developed as the infrastructure improvements proposed by the Urban Renewal Plan are completed. The area near Hansard Avenue is currently undergoing improvements and, for the purpose of calculating existing flows, was assumed to be fully developed for light industrial uses. The remaining lands in sub-basin C-A and sub-basin C-A10 are phased for infrastructure improvements between 1996 and 1999. Sub-basin C-BR is expected to develop between year 2000 and 2010.

Existing drainage paths for the undeveloped lands of this sub-basin group consist of flat open areas with less than .2 percent slope and poorly defined swales draining to the north and to the west. Runoff from sub-basin C-A10 drains primarily toward the developed area at Hansard Avenue. This runoff will be collected by the proposed Hansard Avenue drainage improvements. These improvements consist of a piped system along Hansard Avenue designed to collect both runoff from surrounding developments and runoff from the existing undeveloped fields, and a ditch system used to convey this flow to the low lying area near the railroad. Once discharged, the runoff floods the area near the railroad and is conveyed in shallow, poorly defined swales to Cox Creek.

PROBLEM AREAS:

Since this area is largely undeveloped, no existing problem areas exist. However, lack of sufficient drainage impedes the development of sub-basins C-A10 and C-BR. The proposed Hansard Avenue improvements are not suitable for conveying future flows due to upstream developments. In addition, there is currently no means of conveyance from Hansard Avenue to Cox Creek. Discharging flow into the area near the railroad results in flooding of developable land and will not be tolerable once sub-basins C-BR and C-A10 are developed.

SOLUTIONS:

Because of the extremely flat terrain and long distance to any suitable discharge, a ditch system would be the most economical means of serving future developments in this sub-basin group. Depending on the future availability of the Lebanon-Albany Canal for stormwater discharge, two alternative ditch systems are proposed.

Alternative A1

The least expensive system requires discharge into the Canal. The required improvements for this system are shown in Figure 7.11A as improvement 7.11A1. Two sections of ditch are required. A west-east portion extending from near Hansard Avenue to the Santiam Highway would serve sub-basin C-A10 and the adjacent portion of sub-basin C-BR. This ditch should be constructed at a minimum slope of .0012 with 2:1 side slopes and a bottom width of 5 feet. Minimum depth of 4 feet should be maintained. At the Santiam Highway, this ditch should turn north along the highway and discharge into the Canal through a 60" CSP culvert. The portion of the ditch along the highway will serve the northern portion of C-BR and should maintain a minimum slope of .0012, 2:1 side slopes a 5 foot bottom width and minimum depth of 5 feet.

This alternative routes flow from C-BR and C-A10 away from the Hansard Avenue system and does not necessitate any improvements to this system. However, as discussed in Section 7.12, the Hansard Avenue system currently has no suitable discharge and a ditch is required to convey this runoff to Cox Creek and serve expected future development in sub-basin C-A10. Because sub-basin C-A10 is to be developed within the same time frame as sub-basins C-BR and C-A10, the ditch system downstream of Hansard Avenue should be constructed in conjunction with the improvements discussed above.

If alternative A1 is implemented, the ditch downstream of Hansard Avenue should have a bottom width of 7 feet, side slopes of 2:1 and minimum depth of 8 feet. Given the existing invert elevation of 314.0 in Cox Creek where it crosses the Southern Pacific Railroad, a channel slope of approximately .0012 will provide the required depth.

Alternative A2

If discharge into the Lebanon-Albany Canal is not possible, the only other discharge point available is Cox Creek. Crown Creek is located nearby, but is at too high an elevation to serve developable lands within this sub-basin group.

Improvements required to discharge runoff due to future development in C-A10 and C-BR into the Cox Creek system are shown in Figure 7.11B as Improvement 7.11A2. Improvement 7.11A2 consists of an east-west drainage ditch extending from the Santiam Highway area and draining west to the Hansard Avenue drainage system. This ditch should

be constructed at a minimum slope of .0012, have 2:1 side slopes, a 5 foot bottom width and maintain minimum depth of 5 feet. At Hansard Avenue, a 60" CSP culvert is required to convey flow under the existing road. In areas where existing development prohibits open channel drainage, 60" CSP is required.

Since this alternative directs more flow to the Hansard Avenue system, improvements to this system and the ditch required to convey flow from Hansard Avenue to Cox Creek are more extensive than in the previous alternative (A1). With the additional flow, a ditch with 15 foot bottom width, 2:1 side slopes and minimum depth of 8 feet will need to be constructed from Hansard Avenue west to the railroad and along the railroad to the confluence with Cox Creek. As discussed above, a channel slope of .0012 is sufficient to provide the required depth at Hansard Avenue.

RECOMMENDED PROJECTS:

7.11A1 Urban Renewal Area - Canal Discharge

Construct a ditch extending from 400 feet east of Hansard Avenue to the Santiam Highway, in alignment with Cemetery Road. This ditch must be a minimum of 4 feet deep, have a 5 foot bottom width, 2:1 side slopes, and a .12 percent channel slope. At the highway, continue the ditch to the north, maintaining the same bottom slope, bottom width and side slopes. This portion of the ditch should maintain a minimum depth of 5 feet. At the existing Canal dike, construct an approximately 100 foot long 60" CSP outfall, discharging flow from the ditch system into the Canal.

West of Hansard Avenue, construct a ditch from the discharge point of the proposed Hansard Avenue system west to the railroad and then along the railroad right of way to the confluence with Cox Creek. This ditch should have channel slope of .0012, a 7 foot bottom width, 2:1 side slopes and 7 foot minimum depth.

7.11A2 Urban Renewal Area - Cox Creek Discharge

Construct a ditch extending from 400 feet east of the Santiam Highway to Hansard Avenue, in alignment with Cemetery Road. The ditch should be a minimum of 5 feet deep, have a 5 foot bottom width, 2:1 side slopes, and a .12 percent channel slope. At Hansard Avenue, construct a 60" CSP culvert maintaining the invert elevation of the proposed ditch.

From Hansard Avenue, construct a drainage ditch west to the railroad (replacing the proposed Hansard Avenue ditch to be constructed during the Hansard Avenue Reconstruction Project), and then along the railroad right of way to the confluence with Cox Creek. This ditch should have channel slope of .0012, a 15 foot bottom width, 2:1 side slopes and 8 foot minimum depth.

CITY OF LEBANON
STORM DRAINAGE MASTER PLAN
PROJECT COST ESTIMATE

COST ESTIMATE 7.11A1

Major Basin: COX CREEK - HANSARD AVENUE
Sub-Basins: C-A, C-A10, C-BR
Project Name: Urban Renewal Area - Canal Discharge

Phasing: 10 YEAR (1997-2001)
(5 YR, Lebanon Canal Not Available)
Priority Within Phase: HIGH

ITEMS	QUANTITY (APPROX)	UNIT	$/UNIT*	$ EXTENDED*
Excavate Ditch (5'BW)	7500	CY	$5	$37,500
Excavate Ditch (7'BW)	37500	CY	$5	$187,500
60" CSP Culvert	100	LF	$170	$17,000
SUB-TOTAL				$242,000
MOBILIZATION, ENGR, ADMIN, & CONTINGENCY				$84,700
TOTAL				$326,700

* 1991 DOLLARS

CITY OF LEBANON
STORM DRAINAGE MASTER PLAN
PROJECT COST ESTIMATE

COST ESTIMATE 7.11A2

Major Basin: COX CREEK - HANSARD AVENUE
Sub-Basins: C-A, C-A10, C-BR
Project Name: Urban Renewal Area - Cox Creek Discharge

Phasing: 5 YEAR (1993-1997)
Priority Within Phase: MEDIUM

ITEMS	QUANTITY (APPROX)	UNIT	$/UNIT*	$ EXTENDED*
Excavate Ditch (5'BW)	6400	CY	$5	$32,000
Excavate Ditch (15'BW)	50500	CY	$5	$252,500
60" CSP Culvert	75	LF	$170	$12,750
SUB-TOTAL				$297,300
MOBILIZATION, ENGR, ADMIN, & CONTINGENCY				$104,100
TOTAL				$401,400

* 1991 DOLLARS

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PLAN 7.11 A
COX CREEK - LEBANON HOSPITAL
Alternative A-1

ROAD CROSSINGS		
Culvert	Existing	Future
C-2	X	60" CSP

OPEN CHANNEL REACHES					
Reach	Bottom Width (ft)	Side Slope (ft/ft)	Channel Slope (ft/ft)	Manning's N	Channel Depth (ft)
OC-A (proposed)	7	2:1	.0012	.030	7
(exist.)	2	2:1	.0012	.030	5
OC-B (proposed)	5	2:1	.0012	.030	4
OC-C	1	1.5:1	.0012	.030	1.5
OC-D	1	1.5:1	.0012	.030	1.5
OC-E (proposed)	5	2:1	.0012	.030	5

AREA OF INTEREST

N

1 inch = 500 feet

SEE FIG 7.12

SEE FIG 7.13

SEE FIG 7.9

SEE FIG 7.8

C-A

C-B

C-BR

C-A10

C-10

7.11A1 10YR

7.11A1 10YR

X 113 25 C-2

X 113 25 OC-F

Q10EX 5 | Q10FU 21

25 140 25 OC-A(A1)

11 10 11 OC-C

10 10 10 OC-D

11 11 30 30

A1 X 85 25 OC-B(A1)

X-0

X-10

X-20

JAMES

IOOF CEMETERY

CEMETERY RD.

SANTIAM HWY.

ALBANY

LEBANON COMMUNITY HOSPITAL

TWIN OAKS DR.

POSSIBLE 20 CFS DIVERSION FROM X-10

INDUSTRIAL WAY

LAUREL ST.

HANSARD AVE

CO.

MARY ST.

OLIVE ST.

HARRISON ST.

MORTON PL

MORTON ST.

3RD ST.

4TH ST.

MAIN ST

MORTON ST.

SANTIAM

WHEELER ST.

O'NEIL ST.

8" 12" 18" 24"

292 DP 11 DO – LEB–F17

FIG 7.11A

COX CR.–LEBANON HOSPITAL
ALTERNATIVE A1

CITY OF LEBANON
Storm Drainage Master Plan

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DATE
MAR 1991

PROJECT NO.
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PLAN 7.11 B
COX CREEK - LEBANON HOSPITAL
Alternative A-2

ROAD CROSSINGS		
Culvert	Existing	Future
C-1	X	60" CSP

OPEN CHANNEL REACHES					
Reach	Bottom Width (ft)	Side Slope (ft/ft)	Channel Slope (ft/ft)	Manning's N	Channel Depth (ft)
OC-A (proposed)	15	2:1	.0012	.030	7
(exist.)	2	2:1	.0012	.030	5
OC-B (proposed)	5	2:1	.0012	.030	5
OC-C	1	1.5:1	.0012	.030	1.5
OC-D	1	1.5:1	.0012	.030	1.5

AREA OF INTEREST

SEE FIG 7.12

C-A

C-B

C-BR

C-A10

C-10

Q10EX 5 | Q10FU 21

7.11A 5YR

7.11A2 5YR

25 140 25 OC-A(A2)

X 113 25 C-1

X 113 25 OC-B(A2)

11 10 11 OC-C

10 10 10 OC-D

11 11 30 30

X-0

X-10

X-20

SEE FIG 7.13

SEE FIG 7.9

SEE FIG 7.8

JAMES

IOOF CEMETERY

CEMETERY RD.

SANTIAM HWY.

ALBANY

LEBANON COMMUNITY HOSPITAL

LAUREL ST.

TWIN OAKS DR.

HANSARD AVE

CO.

MARY ST.

HARRISON ST.

MORTON PL.

MORTON ST.

INDUSTRIAL WAY

POSSIBLE 20 CFS DIVERSION FROM X-10

OLIVE ST.

3RD

4TH ST.

MAIN ST

MORTON ST.

WHEELER ST.

O'NEIL ST.

SANTIAM

24" 12" 12" 24" 12" 12" 8" 8" 8" 8" 12" 12" 18" 18"

N

1 inch = 500 feet

FIG 7.11B

COX CR.-LEBANON HOSPITAL
ALTERNATIVE A2

CITY OF LEBANON
Storm Drainage Master Plan

DAVID J. NEWTON ASSOCIATES INCORPORATED
CIVIL & GEOLOGICAL ENGINEERING
1201 SW 12TH AVENUE SUITE 620
PORTLAND, OREGON (503) 228-7718

DATE
MAR 1991

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292 DP 11 DO

292 DP 11 DO – LEB–F17

CITY OF LEBANON
Storm Drainage Master Plan

Section 7.12

PLAN SHEET: **Cox Creek - Industrial Park**

SUB-BASINS: **C-A, C-AL, C-B**

DESCRIPTION OF DRAINAGE FEATURES:

The Industrial Park sub-basin group is located in the northwest corner of the Urban Growth Boundary (UGB) and is contained in the Northwest Lebanon Urban Renewal Area. It includes the Southern Pacific Railroad in the vicinity of the UGB and Tallman Road west of Gore School. The area is zoned light industrial to the west (sub-basins C-A and C-AL) and mixed density residential to the east (sub-basin C-B). This area is currently undeveloped and used primarily for agriculture. Infrastructure improvements for a majority of the area, as proposed by the Urban Renewal Plan, will begin in the year 2000 and be completed by 2010. A small portion of land adjacent to the railroad is scheduled for improvement between 1996 and 1999.

The terrain is extremely flat in this area, with overland flow paths limited to slopes of less than .2 percent. Existing runoff is conveyed by poorly defined ditches and swales draining either northwest to the roadway ditch along Tallman Road or southwest to the low lying lands adjacent to the railroad. The Tallman Road ditch and railroad swale drain to the portion of Cox Creek north of the Southern Pacific Railroad crossing. In addition to drainage from the adjacent fields, the low lying area near the railroad serves the sub-basin group to the east, including the Hansard Avenue developments.

PROBLEM AREAS:

Exceedingly flat terrain results in high water tables throughout this area which causes excessive ponding during wintertime storm events. The lack of sufficient drainage prevents development of the surrounding lots, since local drainage systems will be unacceptably surcharged by the high water table conditions.

In addition, there is no existing means to convey the flow generated by developments east of the Hansard Avenue area to Cox Creek. This flow does not cause flooding of the railroad, but will flood the developable lands phased for improvement in 1996.

The existing ditch along Tallman Road can carry the existing flows, but is too shallow to lower the water table to levels suitable for development of surrounding lands.

SOLUTIONS:

The lands in sub-basin C-AL and C-B are at approximately the same elevation as the lands at the southern extreme. The head loss required to drain these lands to the railroad area is not available and reconstruction of the ditch along Tallman Road is required to serve this area. With available channel slopes of approximately .12 percent a 5 foot bottom width, 2:1 side slopes and 4 to 5 feet of depth are required to carry the future 25 year flow. This channel is required to carry flows on the order of 100 cfs. Flows exceeding the channel capacity are likely to cause significant property damage to nearby properties.

The remaining lands to the south can be served by constructing an east-west ditch along the railroad right of way. In addition to serving developable lands within sub-basin C-A, this ditch is required to convey the flow discharged by the Hansard Avenue drainage system (see Plan 7.11) to Cox Creek. As discussed in Section 7.11, the lands served by this ditch are expected to develop during the same phasing period as the lands east of Hansard Avenue, in sub-basin C-A10. Consequently, construction of this ditch can be included as part of the improvements discussed in Section 7.11. Flows in this ditch can be reduced if the Lebanon Canal is available for stormwater discharge. The required size of this ditch is discussed in conjuction with alternatives 7.11A1 and 7.11A2 in the previous section.

Local drainage in this sub-basin group can be collected in trunk lines or ditches constructed along property lines, draining either to the Tallman Road ditch or the railroad ditch. Both major drainage systems must be designed to maintain water levels during peak events that allow for adequate head loss in local systems.

RECOMMENDED PROJECTS:

7.12A Northern Ditch

Re-construct the existing ditch along Tallman Road to accommodate the future 25 year flow from developments west of the Lebanon-Albany Canal and about 1000 feet to the south of Tallman Road. The improved ditch must have an invert of 317 at the UGB, .12 percent channel slope, a 5 foot bottom width, 2:1 side slopes and 4 to 5 feet of depth.

7.11A1 & 7.11A2 Urban Renewal Area Drainage Ditch

See Section 7.11.

CITY OF LEBANON
STORM DRAINAGE MASTER PLAN
PROJECT COST ESTIMATES

COST ESTIMATE 7.12A

Major Basin: COX CREEK - INDUSTRIAL PARK
Sub-Basins: C-A, C-AL, C-B
Project Name: Northern Ditch

Phasing: 10 YEAR (1997-2001)
Priority Within Phase: LOW

ITEMS	QUANTITY (APPROX)	UNIT	$/UNIT*	$ EXTENDED*
Excavate Ditch (5' BW)	11500	CY	$6	$69,000
SUB-TOTAL				$69,000
MOBILIZATION, ENGR, ADMIN, & CONTINGENCY				$24,200
TOTAL				$93,200

* 1991 DOLLARS

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PLAN 7.12
COX CREEK - INDUSTRIAL PARK

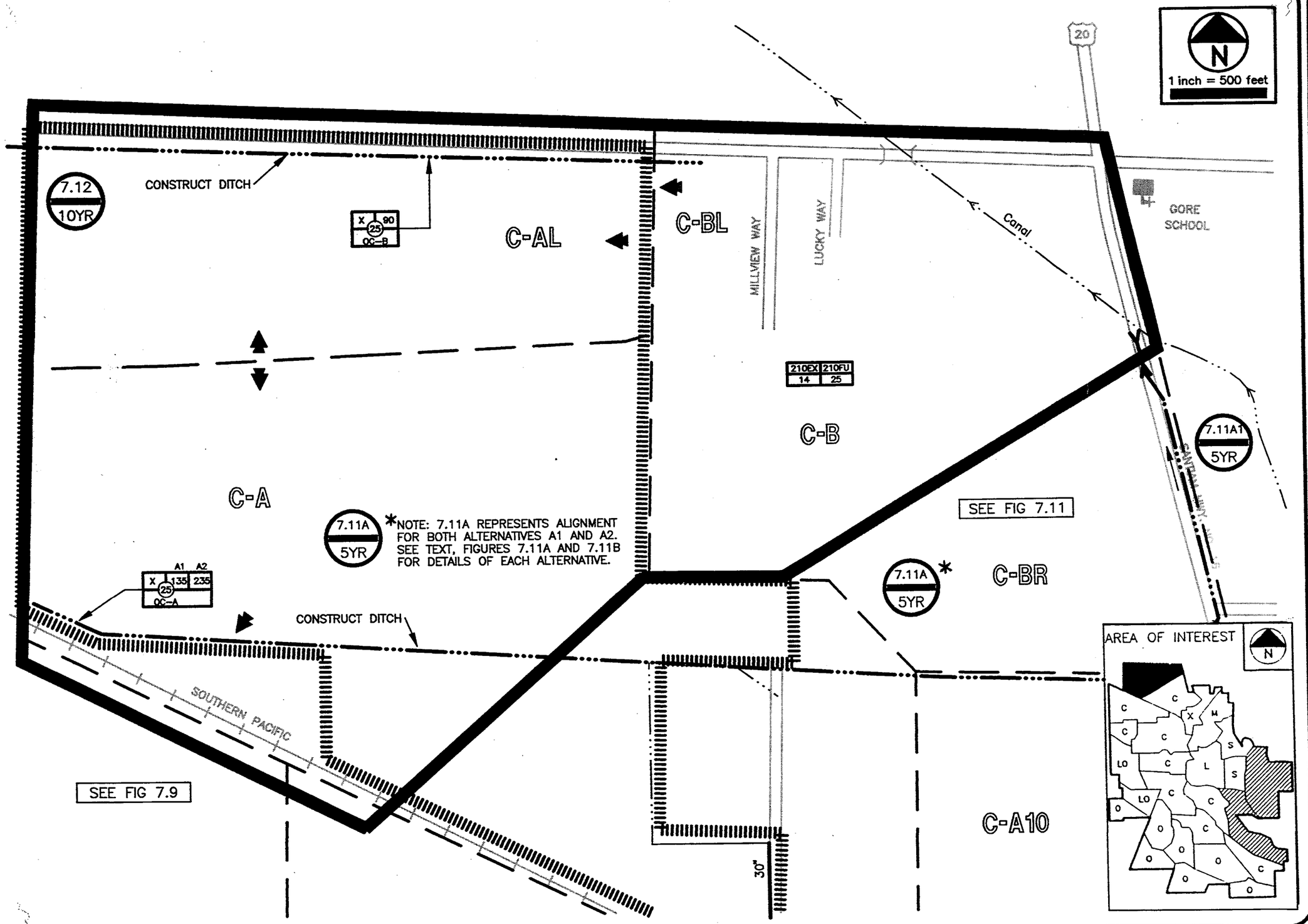
ROAD CROSSINGS		
Culvert	Existing	Future
NONE		

OPEN CHANNEL REACHES					
Reach	Bottom Width (ft)	Side Slope (ft/ft)	Channel Slope (ft/ft)	Manning's N	Channel Depth (ft)
OC-A (Existing)					
(A-1)	15	2:1	.0012	.030	7
(A-2)	7	2:1	.0012	.030	7
OC-B (Proposed)	5	2:1	.0012	.030	5

FIGURE 7.12

COX CREEK-INDUSTRIAL PARK

CITY OF LEBANON
Storm Drainage Master Plan



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292 DP 11 DO – LEB-F25

CITY OF LEBANON
Storm Drainage Master Plan

Section 7.13

PLAN SHEET: Crown Creek - Industrial Way

SUB-BASINS: X-0, X-10, X-10R, X-20

DESCRIPTION OF DRAINAGE FEATURES:

The Industrial Way basin drains to Crown Creek flowing north out of Urban Growth Boundary (UGB) originating east of the Lebanon Community Hospital where it splits off the Lebanon-Albany canal. This basin includes the Masonic Cemetery, the industrial lots adjacent to Industrial Way, a commercial area along Main Street between Wheeler Street and Industrial Way, the Lebanon Middle School and the residential areas near the school lying south of Mary Street and west of Main Street. The Lebanon-Albany Canal crosses Industrial Way in sub-basin X-10.

Little development is expected within a majority of this basin. The residential areas are fully developed. The northern portion of the sub-basin group contains the cemetery and is zoned as public open space. No development is expected in this area. The industrial lots adjacent to Industrial Way are only partially developed and expected to be infilled within the scope of this plan. The commercial area along Main Street is fully developed.

Runoff from the residential areas in sub-basins X-20 and X-10R is collected by small local systems and conveyed to a 24" trunk line that extends north from the intersection of Olive Street and the Santiam Highway to Industrial Way. At Industrial Way, the trunk line heads northeast paralleling the Lebanon-Albany Canal in the undeveloped area southeast of the Lebanon Community Hospital. It then passes under the Lebanon-Albany Canal and discharges into Crown Creek.

This trunk line is not adequate for any existing events. Industrial developments expected to infill the region near Industrial Way will further decrease the adequacy of this pipe.

The local collector system in sub-basin X-20 consists of 8", 10" and 12" storm drains along Olive Street, 2nd and 3rd Streets. The 8" and 10" storm drains along Olive, 3rd, and 2nd Streets have existing and future 2 year capacity. The 12" line along 2nd Street just south of Olive Street has a 5 year adequacy. All of the runoff collected west of 2nd Street is conveyed to the 24" trunk line in a 12" line extending along Olive Street from 2nd Street to the intersection of Olive and Main Street. This 12" line is not adequate for any existing or future peak event.

The local collector system in sub-basin X-10R consists of 8" and 12" storm drains through the Lebanon Middle School and 18" lines east of Main Street. The storm drains serving the school area have existing and future 2 year capacity. The 18" pipes collect local runoff from the residential areas east of Main Street, between Dodge and Wheeler Street and are adequate for existing and future 10 year flows. At one point these pipes were connected to the storm drain system along Grove Street to the south. This connection was abandoned when the trunk main discharging at Had Irvine Park was constructed and these pipes now carry only local drainage.

PROBLEM AREAS:

Frequent flooding of parking lots and street intersections due to the undersized 24" Industrial Way trunk line occurs in the commercial area along the Santiam Highway in the vicinity of Industrial Way and Olive Street. This flooding will not result in any property damage but will create a significant nuisance to business activity in this area. In addition, future development along Industrial Way will be inhibited by insufficient drainage.

The 12" line along Olive Street is undersized and unable to carry any peak events, regardless of conditions downstream. Flooding occurs in the commercial area at the intersection of Main Street and Olive Street. Surcharged conditions in the upstream collector pipes will result in frequent ponding in the residential areas along 2nd, 3rd and 4th Streets.

SOLUTIONS:

The most cost effective solution to the frequent flooding of Main Street and insufficient service to Industrial Way developments would be to divert flow from the 24" line at the intersection of Olive Street and Main Street into the Lebanon-Albany Canal. A 30" pipe would be required to divert the 20 cfs generated by sub-basin X-20 and X-10R during a 10 year event. The existing 24" pipe north of Industrial Way is adequate to carry the local drainage due to expected future development in this area.

If the canal is not available for use as a storm drainage system, a more costly solution is required. The 24" line between Olive Street and Industrial Way must be replaced with a 36" storm drain in order to convey the 10 year flows contributed by sub-basins X-20 and X-10R. The 24" line north of Industrial Way is adequate for local drainage. Diverting flow along the Santiam Highway to the drainage ditch serving future developments in the portion of the Northwest Lebanon Urban Renewal Area occupied by sub-basin C-A10 proves more cost-effective than reconstructing the 24" trunk main.

Replacing the trunk would require 1300 feet of 42" pipe and a 42" culvert constructed under the canal. The recommended diversion, however, requires only 180 feet of 21" pipe along

Industrial Way to the west side of the Santiam Highway, and 550 feet of 21" pipe along the highway. Once past existing developments, an open ditch with a 2 foot bottom width, 2:1 side slopes, .2 percent slope and 2 feet of depth will adequately convey the diverted flow to the proposed drainage ditch serving C-A10. Because the diverted flow is small and peaks much later than the industrial areas served by the Urban Renewal Area ditch, the ditch has adequate capacity for the diverted flow. The C-A10 ditch is discussed in Section 7.11, "Cox Creek - Hansard Avenue."

In order to alleviate problems in the residential and commercial areas near Olive Street, the existing 12" storm drain along Olive between 2nd Street and Main Street should be replaced with a 27" pipe. This pipe will ensure sufficient drainage for the 10 year existing and future flows once downstream improvements are completed.

RECOMMENDED PROJECTS:

7.13A Industrial Way Diversion- Lebanon Canal

Replace the existing 12" pipe along Olive Street between 2nd Street and the Santiam Highway with a 27" pipe. At the intersection of Olive Street and the Santiam Highway, connect the 18" pipe coming in from the south, abandon the existing connection with the 24" line heading north of the highway and construct a 30" pipe along the south side of the Southern Pacific Railroad. Construct a 30" outfall into the canal at the railroad crossing.

7.13B Industrial Way Diversion - Urban Renewal Area Ditch

Replace the existing 12" pipe along Olive Street between 2nd Street and the Santiam Highway with a 27" pipe. At the intersection of Olive Street and the Santiam Highway, construct a 36" pipe under the railroad to Industrial Way. In the manhole at Industrial Way, construct a 21" diversion pipe heading west and crossing the Santiam Highway. Continue this pipe north along the highway until past the existing developments. Construct a ditch with 2 foot bottom width, 2:1 side slopes, 2 feet of depth and .2 percent slope along the highway to the proposed ditch serving the eastern portion of the Urban Renewal Area.

CITY OF LEBANON
STORM DRAINAGE MASTER PLAN
PROJECT COST ESTIMATES

COST ESTIMATE 7.13A

Major Basin: CROWN CREEK - INDUSTRIAL WAY
Sub-Basins: X-0, X-10, X-10R, X-20
Project Name: Industrial Way Diversion - Lebanon Canal

Phasing: 10 YEAR (1997-2001)
Priority Within Phase: HIGH

ITEMS	QUANTITY (APPROX)	UNIT	$/UNIT*	$ EXTENDED*
PIPE (INCH)				
27	700	LF	$67	$46,900
30	500	LF	$72	$36,000
MANHOLE (M.H.)				
48"	4	EA	$1,800	$7,200
30" Outfall Structure	1	LS	$2,000	$2,000
SUB-TOTAL				$92,100
MOBILIZATION ENGR, ADMIN, & CONTINGENCY				$32,200
TOTAL				$124,300

* 1991 DOLLARS

CITY OF LEBANON
STORM DRAINAGE MASTER PLAN
PROJECT COST ESTIMATES

COST ESTIMATE 7.13B

Major Basin: CROWN CREEK - INDUSTRIAL WAY
Sub-Basins: X-0, X-10, X-10R, X-20
Project Name: Industrial Way Diversion - Urban Renewal Area Ditch

Phasing: 10 YEAR (1997-2001)
Priority Within Phase: HIGH

ITEMS	QUANTITY (APPROX)	UNIT	$/UNIT*	$ EXTENDED*
PIPE (INCH)				
21	670	LF	$54	$36,448
27	700	LF	$67	$46,900
36	500	LF	$90	$44,800
MANHOLE (M.H.)				
48"	7	EA	$1,800	$12,600
Ditch Excavation	500	CY	$6	$3,000
36" RR Crossing	1	LS	$10,000	$10,000
SUB-TOTAL				$153,700
MOBILIZATION, ENGR, ADMIN, & CONTINGENCY				$53,800
TOTAL				$207,500

* 1991 DOLLARS

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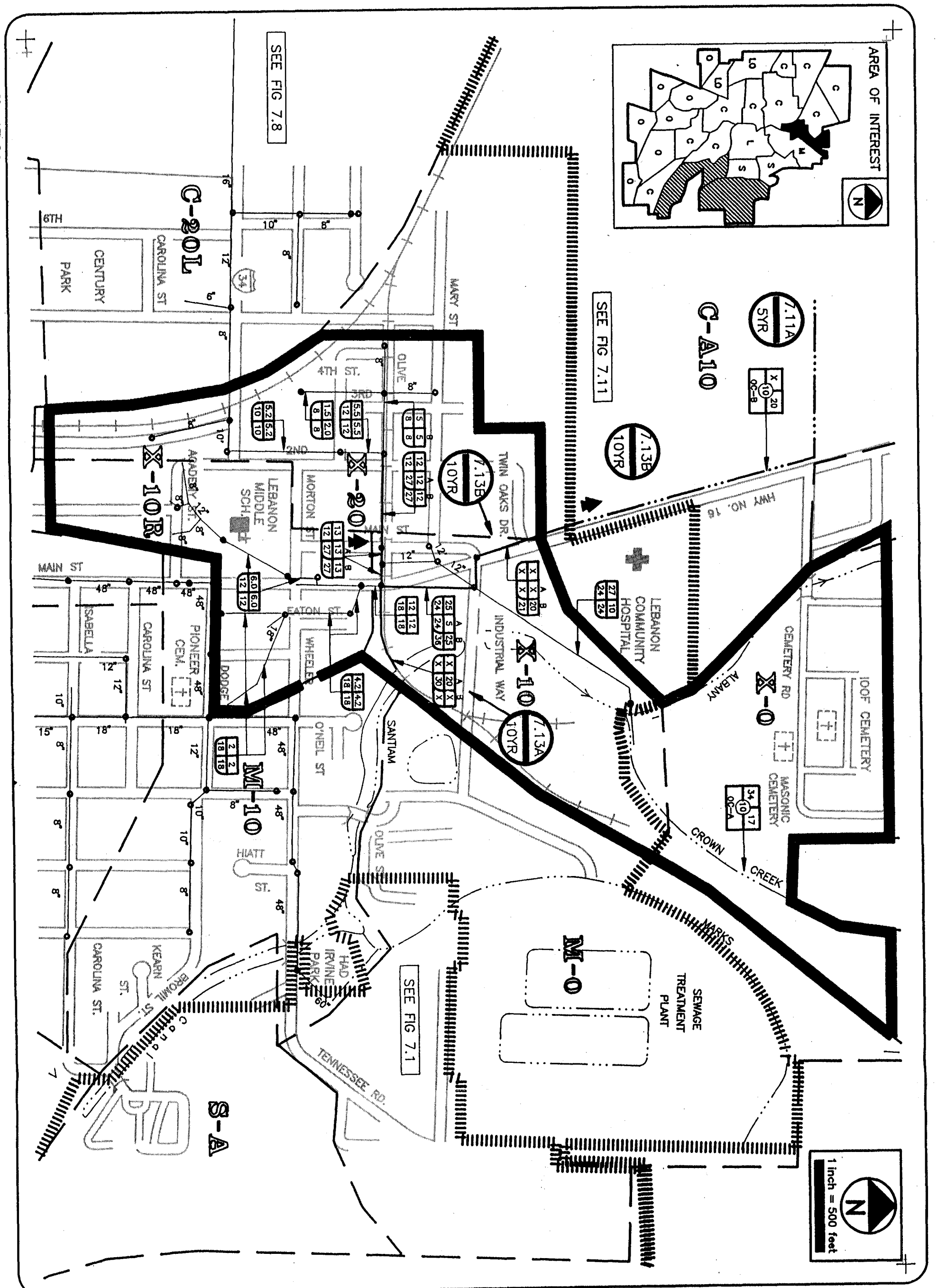
PLAN 7.13
CROWN CREEK - INDUSTRIAL WAY

ROAD CROSSINGS		
Culvert	Existing	Future
NONE		

OPEN CHANNEL REACHES					
Reach	Bottom Width (ft)	Side Slope (ft/ft)	Channel Slope (ft/ft)	Manning's N	Channel Depth (ft)
OC-A	20	5:1	.0013	.04	5
OC-B (proposed)	2	2:1	.0020	.03	2



DATE MAR 1991 PROJECT NO. 292 DP 11 DO	**DAVID J. NEWTON ASSOCIATES** INCORPORATED CIVIL & GEOLOGICAL ENGINEERING 1201 SW 12TH AVENUE SUITE 620 PORTLAND, OREGON (503) 228-7718	**CROWN CREEK – IND. WAY** **CITY OF LEBANON** **Storm Drainage Master Plan**	FIGURE **7.13**

292 DP 11 DO - LEB-F18

CITY OF LEBANON
Storm Drainage Master Plan

Sections 7.14 - 7.15

PLAN SHEET: **7.14 Santiam River - River Park**
7.15 Santiam River - Willamette Industries

SUB-BASINS: **S-A, S-B, S-C, S-D**

DESCRIPTION OF DRAINAGE FEATURES:

The majority of this group of sub-basins are bound on the east by the Santiam River and extending south to Gavord Street. The group of sub-basins includes Gills Landing and River Park as well as Willamette Industries Development. Tennessee Road and Had Irvine Park border the northern end of the area with Booth Park on the west side of the basins.

The area is generally undeveloped and consists primarily of general industrial (mill development) with some mixed density in the northern portion of the sub-basins.

Most of the existing drainage facilities consist of local systems which either drain to the Santiam River or to a small tributary of Crown Creek.

The residential area in Figure 7.15 along Glenwood Street and Gavord Street is currently drained by local drainage drywells that were constructed to alleviate any local ponding in these areas.

PROBLEM AREAS:

Throughout a majority of this area, little change to existing drainage conditions is anticipated. Any future developments discharging flow to the Santiam River or the existing Crown Creek are not expected to cause any downstream problems.

The dry wells serving residential lands within this basin group present a major problem. These dry wells currently do function adequately and result in frequent flooding of the intersection at Park Drive and Gavord Street and flooding of homes near Glenwood Street and Garvord Street. Currently, there are no available storm drainage systems in which to discharge this water.

SOLUTIONS:

A trunk line discharging into the Santiam River is required to serve this area. This trunk line can also be used to offload the undersized system along Milton and Grove Streets, as described in Section 7.2. The required trunk line should intercept the existing storm drains at Franklin and Milton Street (as described in Section 7.2), continue down Milton Street to Park, head south along Park Street to the property line of the developed lots along Garvord Street and then head east to discharge into the Santiam River. The flooded area near the intersection of Garvord and Glenwood Street should be served by a 15" storm drain, as shown in Figure 7.15. Alignment south of Garvord Street was chosen to better serve developable lands to the south in the future and because this area is currently undeveloped, which should simplify construction.

RECOMMENDED PROJECTS:

7.2B Park Drive Trunk Line

This improvement is discussed in Section 7.2, "Lebanon Canal - Booth Park."

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PLAN 7.14
SANTIAM RIVER - RIVER PARK

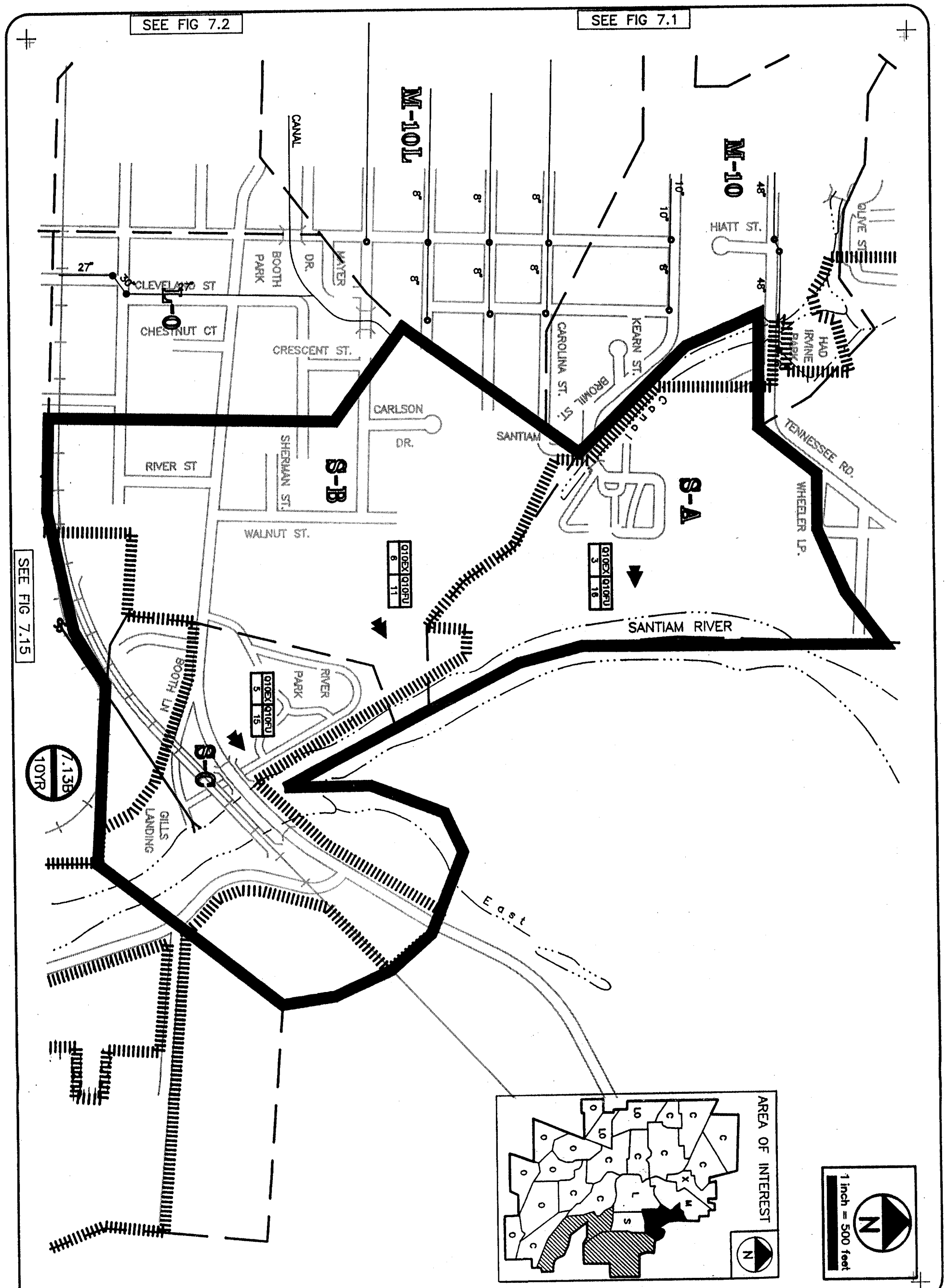
ROAD CROSSINGS		
Culvert	Existing	Future
NONE		

OPEN CHANNEL REACHES					
Reach	Bottom Width (ft)	Side Slope (ft/ft)	Channel Slope (ft/ft)	Manning's N	Channel Depth (ft)
NONE					

SEE FIG 7.2

SEE FIG 7.1

SEE FIG 7.15



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

FIGURE 7.14

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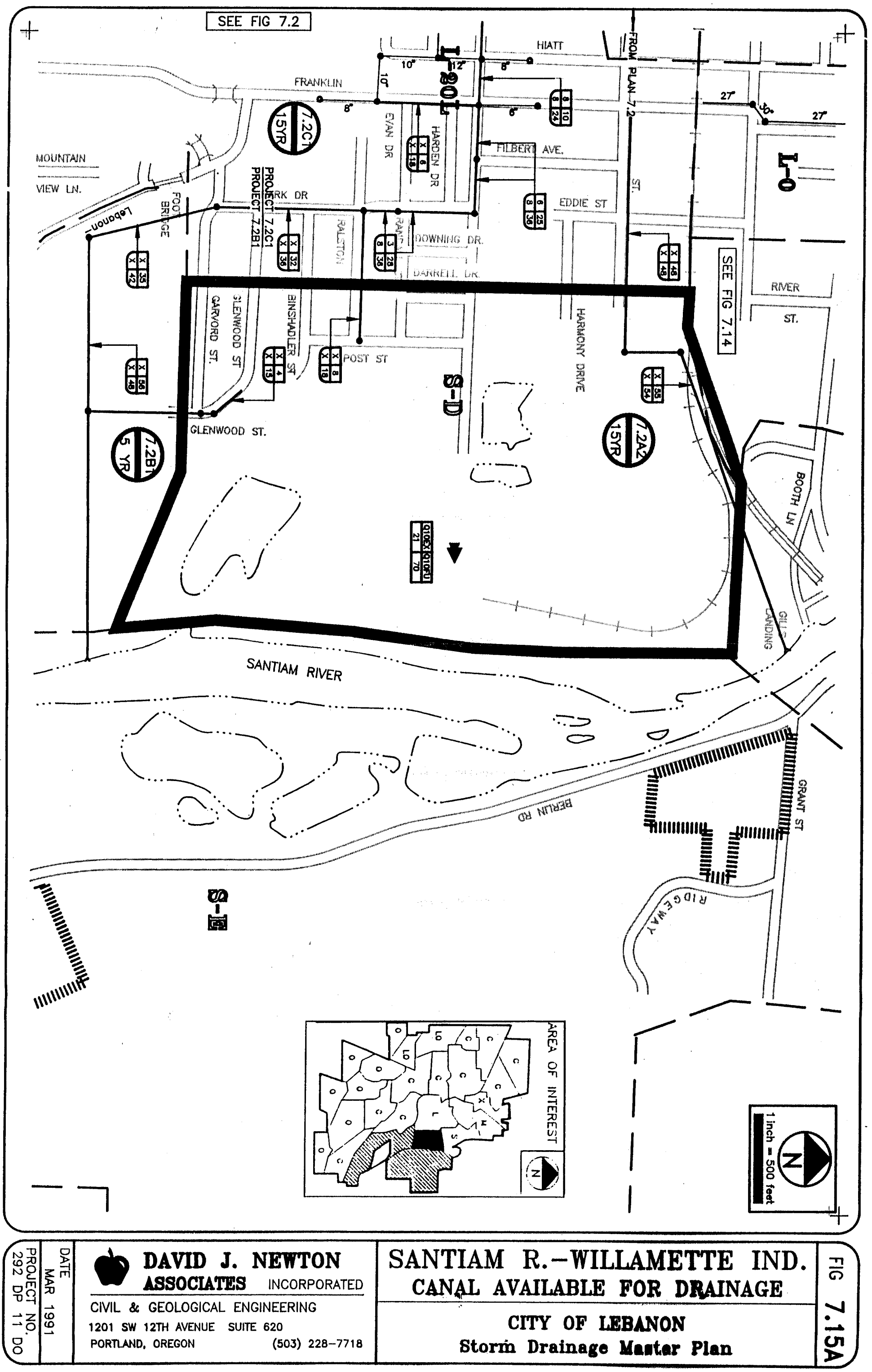
PLAN 7.15
SANTIAM RIVER - WILLAMETTE IND.

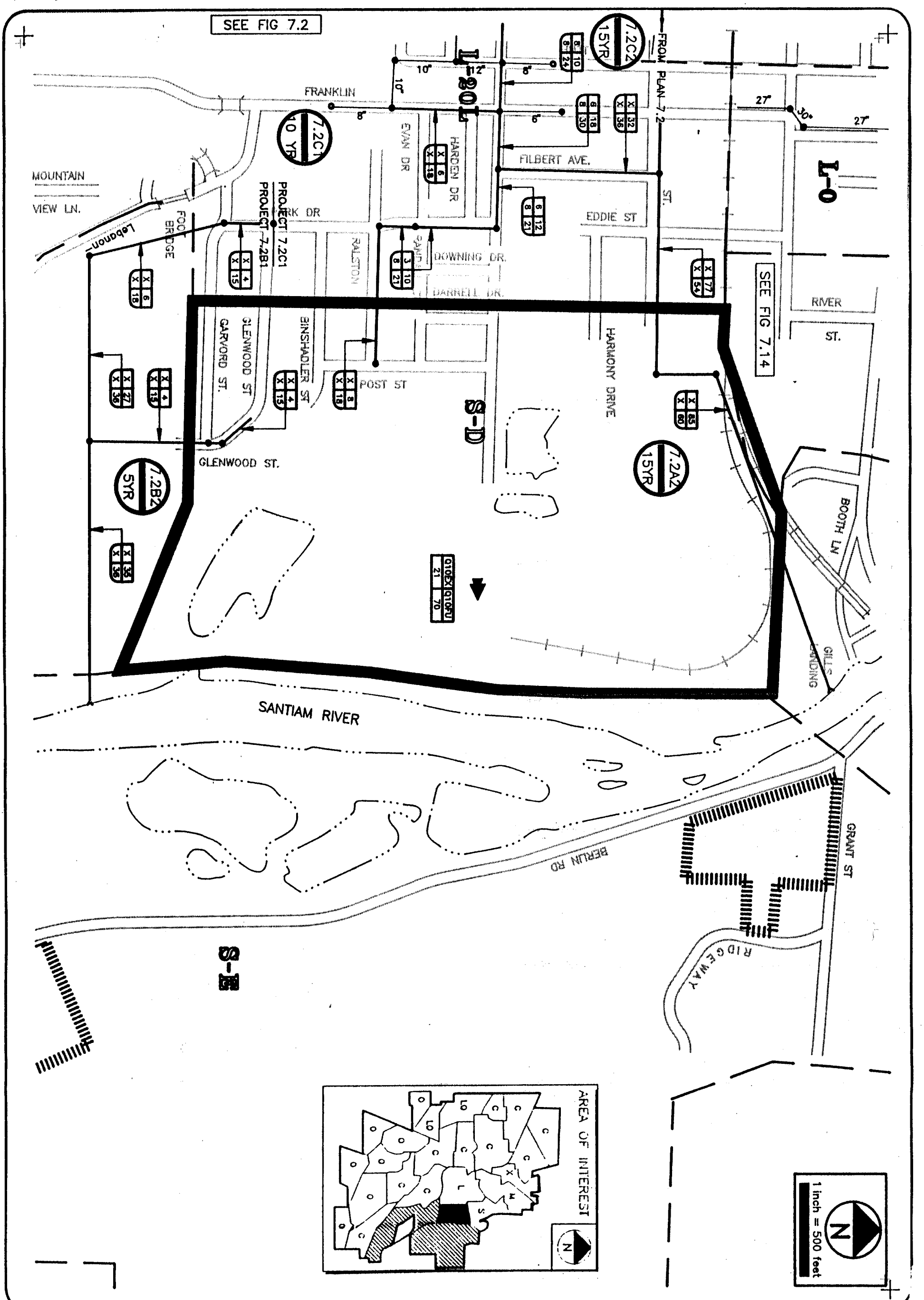
ROAD CROSSINGS		
Culvert	Existing	Future
NONE		

OPEN CHANNEL REACHES					
Reach	Bottom Width (ft)	Side Slope (ft/ft)	Channel Slope (ft/ft)	Manning's N	Channel Depth (ft)
NONE					



PROJECT NO. 292 DP 11 DO	DATE MAR 1991	**DAVID J. NEWTON ASSOCIATES** INCORPORATED CIVIL & GEOLOGICAL ENGINEERING 1201 SW 12TH AVENUE SUITE 620 PORTLAND, OREGON (503) 228-7718	**SANTIAM R.-WILLAMETTE IND.** **CANAL AVAILABLE FOR DRAINAGE** **CITY OF LEBANON** **Storm Drainage Master Plan**

FIG 7.15A



292 DP 11 DO - LEB-F22

DATE MAR 1991
PROJECT NO. 292 DP 11 DO

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

SANTIAM R.-WILLAMETTE IND.
CANAL NOT AVAILABLE FOR DRAINAGE

CITY OF LEBANON
Storm Drainage Master Plan

FIG 7.15B

CITY OF LEBANON
Storm Drainage Master Plan

Section 7.16 - 7.23

PLAN SHEET:	**7.16**	**Oak Creek - Rock Drive**
	7.17	**Oak Creek - Crowfoot Road**
	7.18	**Oak Creek - Vaughn Lane**
	7.19	**Oak Creek - 10th Street**
	7.20	**Oak Creek - South Main Road**
	7.21	**Oak Creek - Stoltz Hill Road**
	7.22	**Oak Creek - Linn Benton Community College**
	7.23	**Little Oak Creek - Airport**

SUB-BASINS: **O-F; O-E10, O-E10R; O-E0, O-EL; O-C, O-D, O-D10; O-F, O-G; O-B, O-H; LO-B, O-A; LO-A**

DESCRIPTION OF DRAINAGE FEATURES:

This group of sub-basins border the southern edge of the Urban Growth Boundary and drain mostly into Oak Creek which is traverses these basins. 7.23 drains to Little Oak Creek which is a tributary of Oak Creek in the southwest portion of the UGB.

This area is generally mixed density residential with sparse developments existing at the time of the study.

7-16: This sub-basin is zoned mixed density residential with little to no current development. Drainage is overland sheet flow collected by Oak Creek.

7-17: This sub-basin consists of some residential development along the west side of Central Avenue in the eastern portion of the sub-basin O-E10R with sparse development along Crowfoot Road, Hill View Drive, Baker Drive, and Main Road on the west side of the sub-basin. Drainage is generally overland with some road side ditches directing the stormwater runoff to Oak Creek.

7-18: The west half of this area is outside of the current City Limits and is mostly undeveloped mixed density residential. The east half of this area has an existing residential development which drains its stormwater to small tributaries of Oak Creek. This area is bordered on the east by Cedar Drive on the south by South Main Road and on the east by Oak Creek.

7-19: There are three sub-basins in this area. O-C is mostly undeveloped while the other two (O-D and O-D10) are existing residential developments. Vaughn Lane and Oak Creek are on the southern portion of this area and Hill Road borders the west side.

There are local drainage systems that are adequate to serve these developments for future peak events. There is a large 42" and 60" trunk line in 10th Street that collects most of the smaller systems within O-D and O-D10. This system conveys the storm runoff south on 10th Street to Vaughn Lane and west on Vaughn Lane to an outfall into Oak Creek just on the north side of the Vaughn Lane Bridge. The collector systems range from 15" to 30" pipes.

7-20 This area has some sparse development but little to no storm systems. Oak Creek traverses east-west through these sub-basins and South Main Street traverses north-south through the center of this area. This area is zoned mixed density residential and is not expected to develop very rapidly throughout this study period.

Most of the drainage is overland flow which is collected by Oak Creek.

7-21: This area is at the south edge of the UGB and on the south side of Oak Creek. Stoltz Hill Road is the west border and 5th Street is the east border. There is almost no development in this area at this time and therefore no storm systems. The drainage is overland flow directed to Oak Creek.

7-22: This area is located west of Linn-Benton Community College along the west side of Stoltz Hill Road. It consists of open agricultural lands with Oak Creek on the west and Little Oak Creek on the northeast. Airport Road is the norther border. There is little to no development in this area and is zoned light industrial and mixed density. The future developments will have access to either Oak Creek or Little Oak Creek to discharge increased runoff.

7-23: This area includes the Lebanon State Airport and the agricultural land west of the airport. Oak Street travels east-west through this area and does not have any existing storm drainage systems within the roadway in this area. The majority of this drainage is overland flow and is collected by Little Oak Creek.

The area is generally undeveloped and is zoned light industrial and public use (airport). The airport is expected to expand over the study period but most of the development will have adequate access for drainage to Little Oak Creek.

PROBLEM AREAS:

There are three types of areas in the above sections of lands in the southern portion of the UGB. 1) Current new development; 2) Open areas with little development expected; and 3) Readily available drainage outlets into either Oak Creek or Little Oak Creek. Of the Current new developments, most of them have existing drainage systems that are more than adequate for existing and future peak events and therefore no problems area expected. The open areas are not expected to develop within the study time and if development does occur, there is access to existing drainage discharge areas. The areas that area expected to develop are near Oak Creek or Little Oak Creek and do not present and drainage problems now or in the future.

Since the existing area is not expected to change drastically, within the study period, and the fact that the fairly large drainageways exist near these areas, there are no existing problem areas or great concerns.

RECOMMENDED PROJECTS:

Since there is no substantial development in these areas and the majority of the improvements can drain to Oak Creek directly, there are no major projects recommended during this study period.

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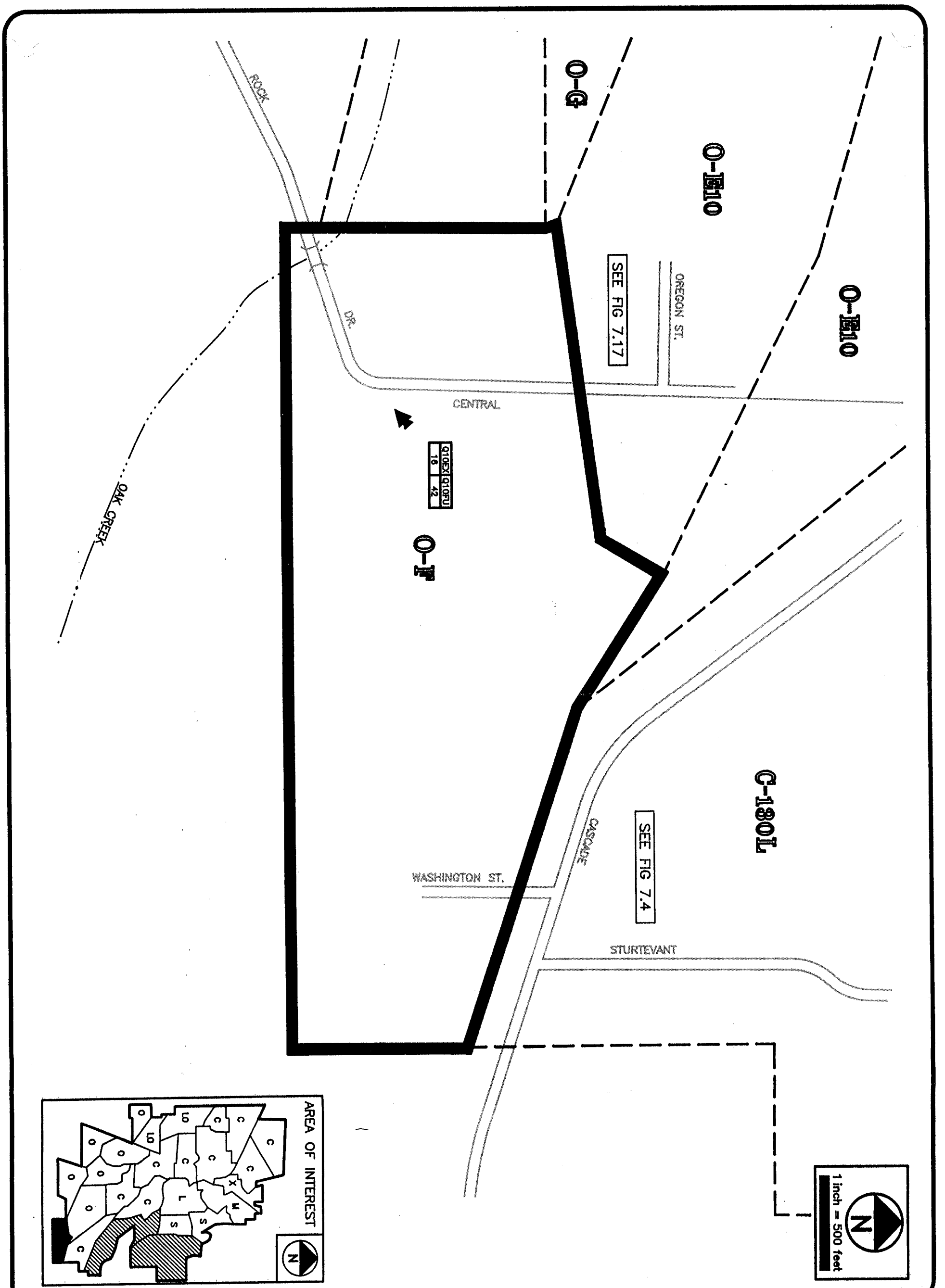
PLAN 7.16
OAK CREEK – ROCK DRIVE

ROAD CROSSINGS		
Culvert	Existing	Future
NONE		

OPEN CHANNEL REACHES					
Reach	Bottom Width (ft)	Side Slope (ft/ft)	Channel Slope (ft/ft)	Manning's N	Channel Depth (ft)
NONE					



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

FIGURE 7.16

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PLAN 7.17
OAK CREEK - CROWFOOT ROAD

ROAD CROSSINGS		
Culvert	Existing	Future
NONE		

OPEN CHANNEL REACHES					
Reach	Bottom Width (ft)	Side Slope (ft/ft)	Channel Slope (ft/ft)	Manning's N	Channel Depth (ft)
NONE					

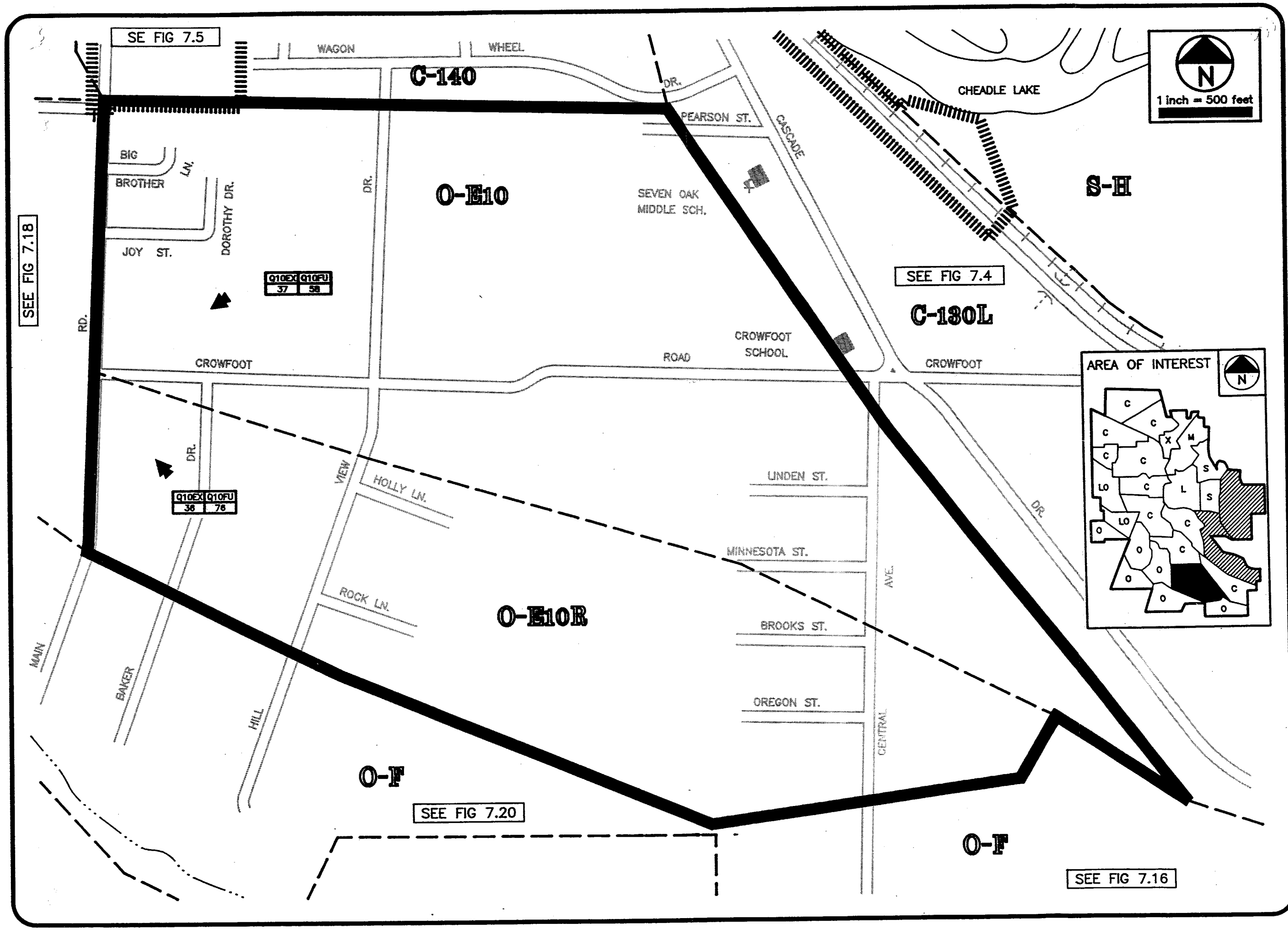

FIGURE 7.17

OAK CREEK–CROWFOOT RD.

CITY OF LEBANON
Storm Drainage Master Plan

DAVID J. NEWTON ASSOCIATES INCORPORATED
CIVIL & GEOLOGICAL ENGINEERING
1201 SW 12TH AVENUE SUITE 620
PORTLAND, OREGON (503) 228-7718

DATE
MAR 1991

PROJECT NO.
292 DP 11 DO

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PLAN 7.18
OAK CREEK – VAUGHAN LANE

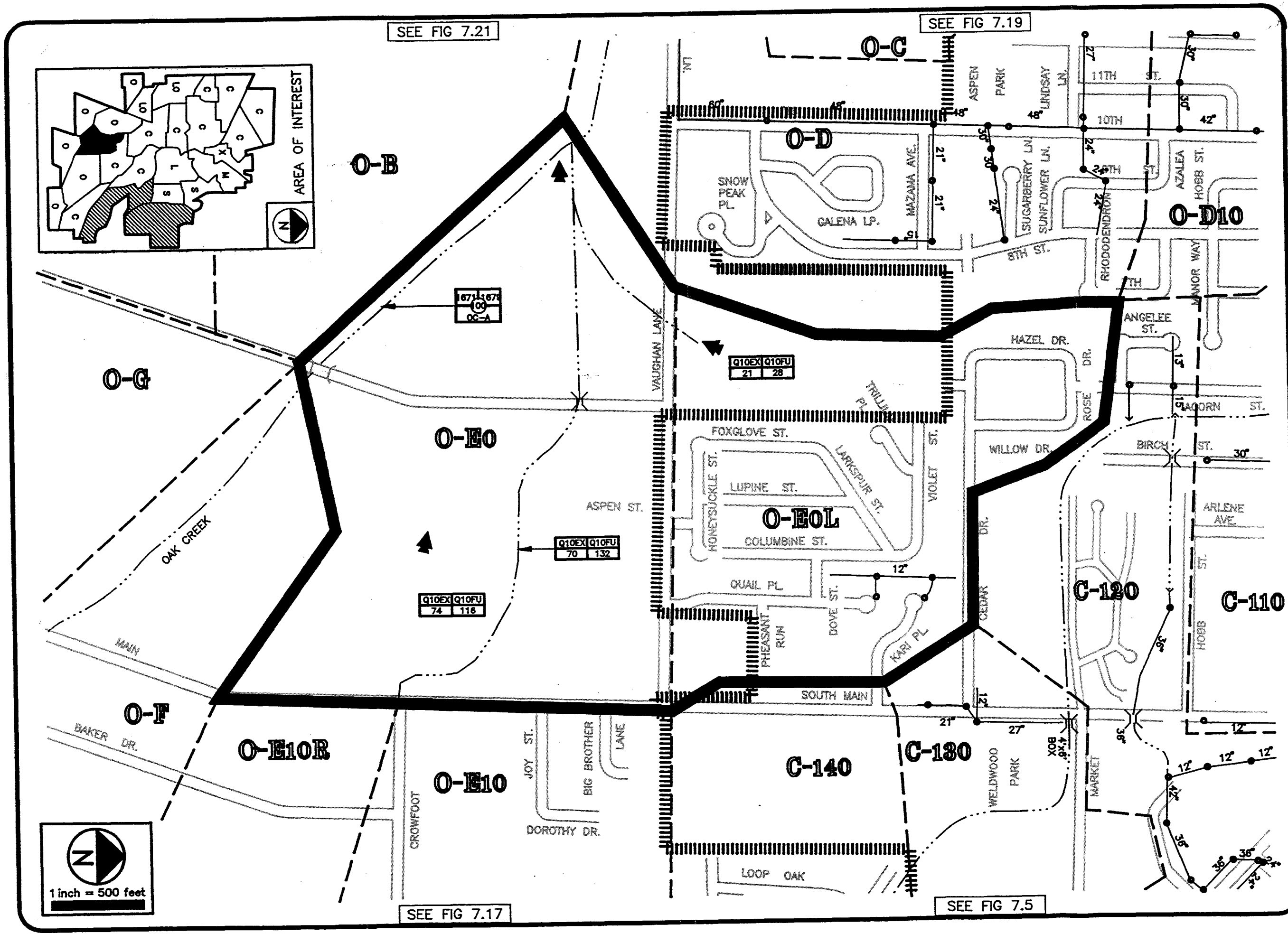
ROAD CROSSINGS		
Culvert	Existing	Future
NONE		

OPEN CHANNEL REACHES					
Reach	Bottom Width (ft)	Side Slope (ft/ft)	Channel Slope (ft/ft)	Manning's N	Channel Depth (ft)
OC-A	20	1.5:1	.0013	.030	7

FIGURE 7.18

OAK CREEK–VAUGHAN LN.

CITY OF LEBANON
Storm Drainage Master Plan



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PLAN 7.19
OAK CREEK - 10TH STREET

ROAD CROSSINGS		
Culvert	Existing	Future
NONE		

OPEN CHANNEL REACHES					
Reach	Bottom Width (ft)	Side Slope (ft/ft)	Channel Slope (ft/ft)	Manning's N	Channel Depth (ft)
OC-A	20	1.5:1	.0013	.03	7

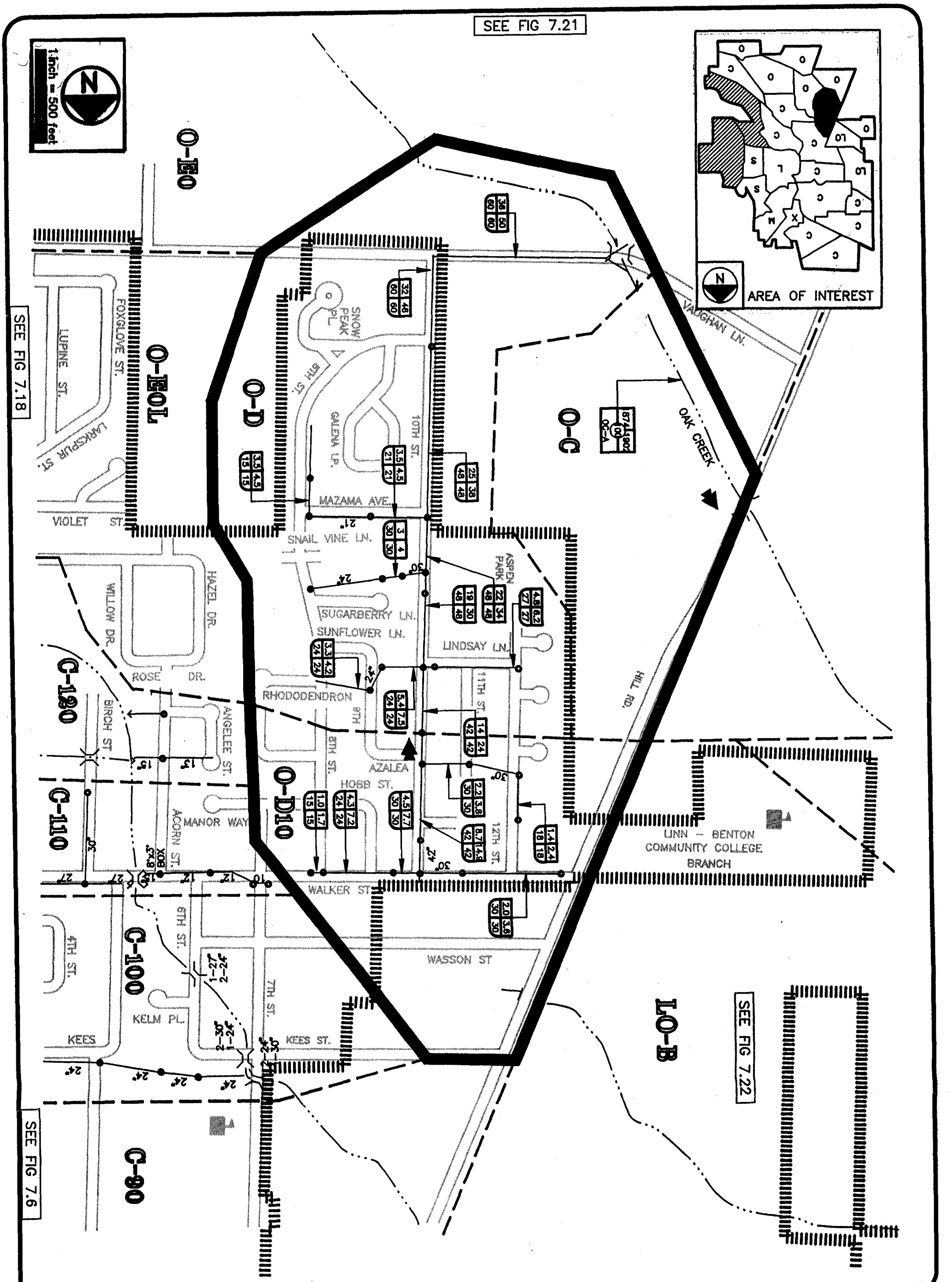

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FIGURE 7.19

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PLAN 7.20
OAK CREEK – SOUTH MAIN RD.

ROAD CROSSINGS		
Culvert	Existing	Future
NONE		

OPEN CHANNEL REACHES					
Reach	Bottom Width (ft)	Side Slope (ft/ft)	Channel Slope (ft/ft)	Manning's N	Channel Depth (ft)
OC-A	20	1.5:1	.0013	.030	7

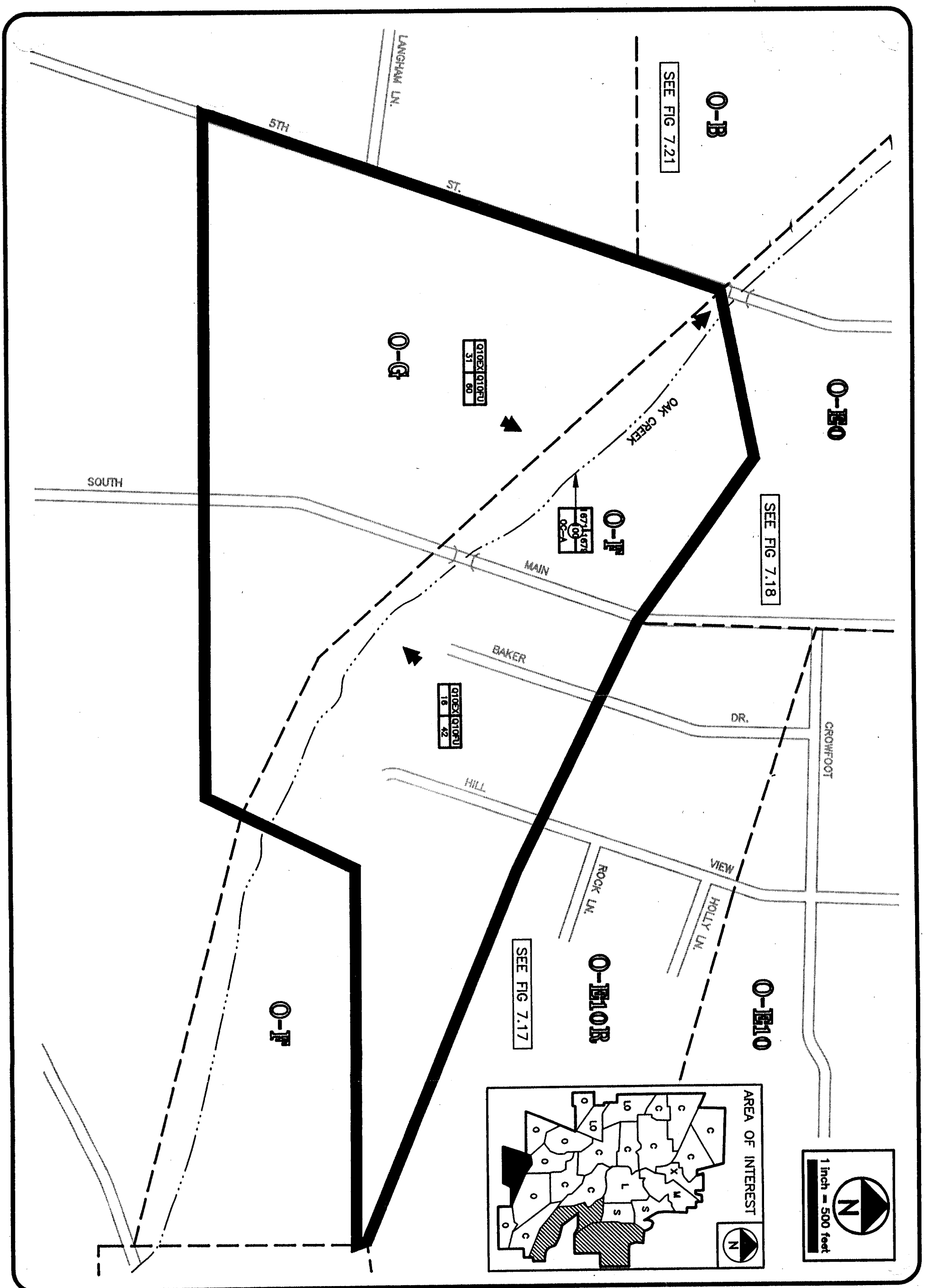

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FIGURE 7.20

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PLAN 7.21
OAK CREEK - STOLTZ HILL RD.

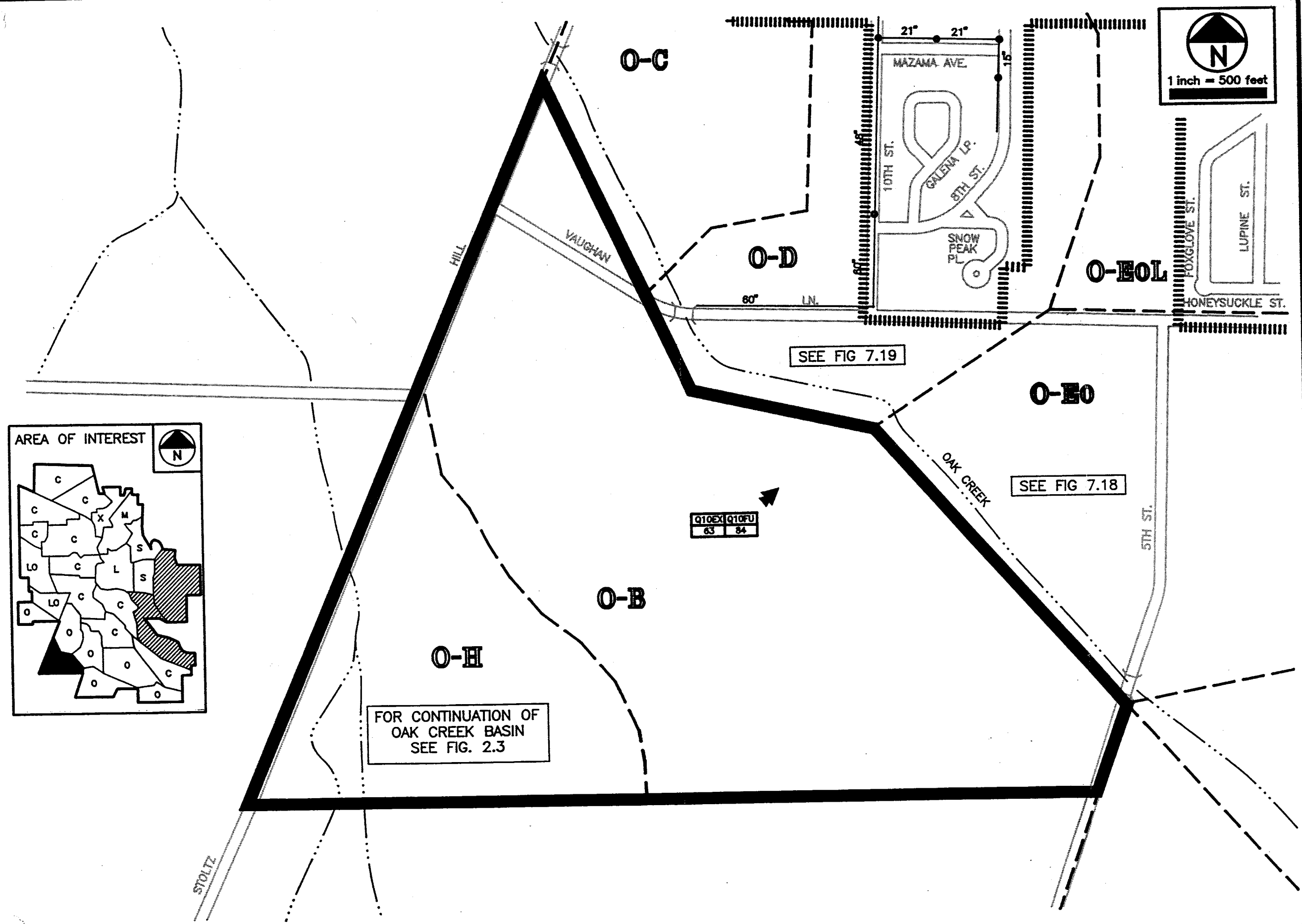
ROAD CROSSINGS		
Culvert	Existing	Future
NONE		

OPEN CHANNEL REACHES					
Reach	Bottom Width (ft)	Side Slope (ft/ft)	Channel Slope (ft/ft)	Manning's N	Channel Depth (ft)
NONE					

FIGURE 7.21

OAK CREEK-STOLTZ HILL RD.

CITY OF LEBANON
Storm Drainage Master Plan



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PLAN 7.22
OAK CREEK - LINN BENTON C.C.

ROAD CROSSINGS		
Culvert	Existing	Future
NONE		

OPEN CHANNEL REACHES					
Reach	Bottom Width (ft)	Side Slope (ft/ft)	Channel Slope (ft/ft)	Manning's N	Channel Depth (ft)
OC-A	20	1.5:1	.0013	.030	7
OC-B	8	2:1	.0015	.035	3

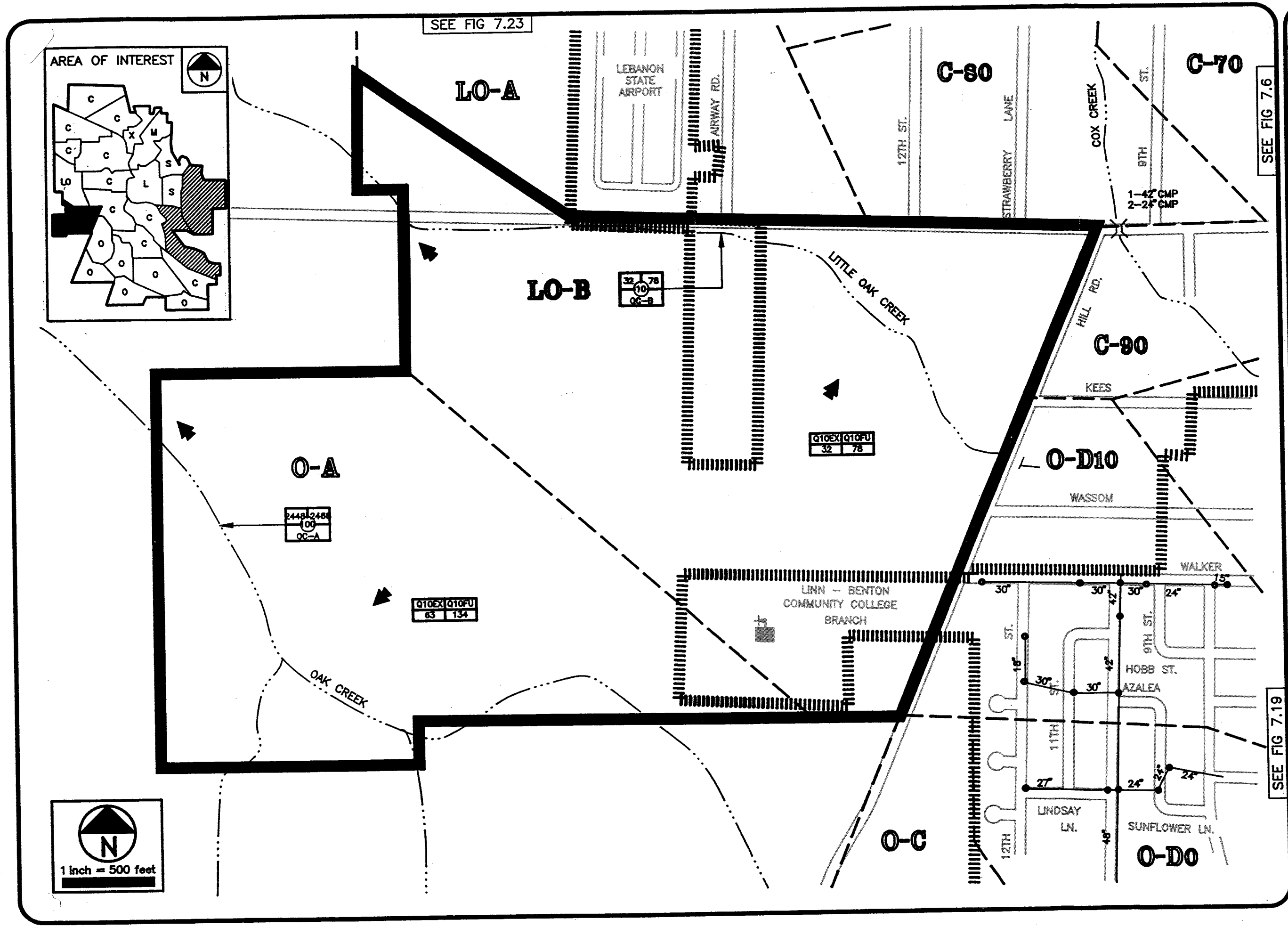

FIGURE 7.22

OAK CREEK-LINN BENTON C.C.

CITY OF LEBANON
Storm Drainage Master Plan

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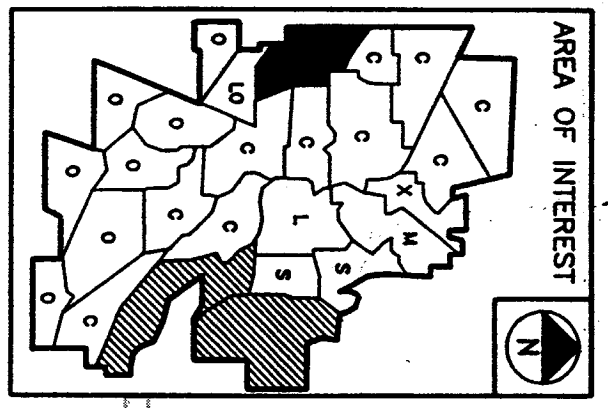
PLAN 7.23
LITTLE OAK CREEK – AIRPORT

ROAD CROSSINGS		
Culvert	Existing	Future
NONE		

OPEN CHANNEL REACHES					
Reach	Bottom Width (ft)	Side Slope (ft/ft)	Channel Slope (ft/ft)	Manning's N	Channel Depth (ft)
NONE					



N
1 inch = 500 feet

LO-A

LO-B

C-OR

OAK ST.

Q10EX 42
Q10FU 139

SEE FIG 7.22

SEE FIG 7.10

LEBANON STATE AIRPORT

AIRWAY RD.

C-40

C-50

C-80

C-70

C-60

C-30

GILBERT DR.

COX CREEK

AIRWAY PL.

SUNSET RD.

TUCKER LN.

16TH PL

16TH ST

MAPLE PL

SHERMAN

15TH ST.

14TH ST.

GRANT PL

ASH PL

13TH

12TH ST.

15"
20"
26"
24"
27"
42"
12"
18"
12"
36"
12"

SEE FIG 7.6

SEE FIG 7.7

SEE FIG 7.8

FIGURE 7.23

LITTLE OAK CREEK–AIRPORT

CITY OF LEBANON
Storm Drainage Master Plan

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