PROPOSED MASTER STORM DRAINAGE PLAN

City of Sweet Home

DEVCO ENGINEERING INC

DEVCO

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DEVCO ENGINEERING, INC.

CIVIL, MUNICIPAL, STRUCTURAL, LAND SURVEYING

Honorable Mayor and City Council
City Hall
Sweet Home, Oregon 97386

Gentlemen:

We have completed our study of the City's major storm drainage system and the Proposed Master Storm Drainage Plan. Authorization for this engineering investigation of the City of Sweet Home watershed drainage was given by City Manager, Mr. Robert Richardson at the direction of the City Council in accordance with an agreement between the City of Sweet Home and Devco Engineering, Inc. dated December 22, 1978. The primary objective of this study is to provide the framework for a city-wide drainage management plan to which individual sites can relate specific plans. Based on this study the City shall be able to prioritize and cost estimate a drainage capital improvement plan that satisfies Goal #11 of the Land Conservation and Development Commission which reads

> "To plan and develop a timely, orderly, and efficient, arranagement of public facilities and services to serve as a framework for urban and rural development."

The prinicipal products of the report are summarized below:

1. Seventeen (17) square miles in or draining through the City have been computer modeled.

2. Soils within the proposed urban growth boundary have been categorized with respect to their runoff potential.

3. Storm design frequencies have been recommended at:

100 years for Ames Creek
25 years for major channels carrying 100 cfs or more
10 years for all other drainage

4. Rainfall Intensity - frequency - duration curves for the 2, 5, 10, 25, 50 and 100 year rainfall have been prepared specifically for the City of Sweet Home.

5. Detention storage criteria is recommended when new development involving greater than four (4) acres creates runoff problems for downstream properties.

6. The existing watershed is broken down into 84 sections of creek, open drainage or pipe. Runoffs are calculated for each section for both today's land uses and for full development of the City's Proposed Comprehensive Plan. Existing culverts on the watershed drainages have been surveyed and their capacities calculated and compared with flows today and with flows resulting from full development of the Proposed Comprehensive Plan.

7. 1120 acres (the balance of the area within the proposed urban growth boundary previously unmapped) have been photogrammetically surveyed and 1" = 100' topographic maps prepared.

The composite findings of the study are:

1. Within the proposed urban growth boundary approximately 8 miles of creek, open drainage or pipe improvements are required to meet today's runoff at the recommended design frequencies. Approximately 10 miles of improvements are required to meet the projected runoff resulting from full development of the Proposed Comprehensive Plan.

2. 27 of the 49 culverts surveyed must be improved to meet today's runoff at the recommended design frequencies. 28 culverts must be improved to meet runoff projected from full development of the Proposed Comprehensive Plan.

Our recommendations developed from this study are included in Chapter V of this report.

We wish to express our sincere appreciation for the opportunity to furnish this engineering service and to assist in the planning for Sweet Home's future. Forwarded in separate bound workbooks are hydrographs for each drainage section, Field Notes, Data and our Calculations.

Very truly yours,

Roland P. Lavoie

Roland P. Lavoie, P.E.
Devco Engineering, Inc.

RPL/dp

ACKNOWLEDGEMENTS

The courtesy and assistance received from the many individuals who contributed valuable information and support throughout our work on this project was most helpful and is greatly appreciated. Particular recognition and sincere thanks are directed to Mr. Ozzie Shaw, Professional Land Surveyor; Mr. Ralph H. Frederick, Metorologist, National Oceanic and Atmospheric Administration; and Mr. Alan Johnson, Boeing Computer Service.

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CHAPTER I

INTRODUCTION

PURPOSE

The purpose of this report is to present a plan for basin-wide storm runoff management which provides for Sweet Home's future growth. Included in this plan are data and design criteria which provide for responsible solutions for individual developments. Secondarily, the study identifies specific existing problems and provides the design criteria (i.e. flows) for the solutions to these problems. Thirdly, it is to be a data base for the City's existing drainage. Fourthly, it is to be a flexible tool able to quickly analyze alternates to the Master Plan should they arise in the future.

SCOPE

The area of study is included within the proposed urban growth boundary plus all watershed outside the urban growth boundary which drains through the City of Sweet Home.

The prime objectives of this report are to:

1. Prepare topographic maps for all areas within the proposed urban growth boundary which are currently unmapped.
2. Survey and inventory existing pipes 18 inches and greater in diameter and open channels passing greater than 40 cfs.
3. Prepare a hydrologic soils map.
4. Prepare intensity - frequency - duration curves including the 10, 25, 50 and 100 year average return frequency rainfalls.
5. Recommend average return frequency rainfalls for the design of drainage facilities.

6. Calculate the runoff resulting from 10, 25 and 100 year rainfalls on existing land uses. Identify deficiencies.
7. Calculate the design flows based on land uses in the proposed Comprehensive Plan.
8. Develop solutions to existing problems.
9. Show the Proposed Master Drainage Plan and existing facilities on 1" - 100 topographic maps.
10. Prepare and submit to the City a report of the Proposed Master Drainage Plan including maps and calculations.

SOURCES OF INFORMATION

A topographic mosaic of a scale of one inch equals 300 feet was prepared from the City's existing topographic mapping which include orthophotographs made during the expansion of the sewage distribution system. U.S. Geological Survey maps with 40 foot contour intervals were utilized for watershed areas beyond the City's mapping.

Other sources of information included:

1. Army Corp of Engineers (now in the final phase of their Federal Insurance Agency Flood Plain Study of Wiley, Ames and Taylor Creeks).
2. Oregon State Highway Department construction drawings for U.S. 20 through Sweet Home.
3. U.S. National Oceanic and Atmospheric Administration, Maryland for precipitation records.
4. U.S. Environmental Protection Agency, Corvallis Research Laboratory for manuals and publications relating to the computer model "SWMM".

5. Soils Conservation Service, Tangent for soils data.

A bibliography of documents and reports which were reviewed and directly influenced this study is included at the end of this report.

GENERAL CONCEPTS

The following are basic concepts in storm drainage management:

1. Surface runoff is best left in its natural drainage course, i.e., natural engineering.
2. When dealing with large flows in open channels, the channel design should slow vs. speed up the water. Preferably, the channel should be shallow and wide vs. deep and narrow. ("Handbook of Hydraulic", King & Brater)
3. Detention storage close to the source is usually preferable to higher peak flows down stream. This approximates natural runoff.
4. Enclosed (pipe) systems for major drainage channels should be minimized. This keeps the major drainage pathways free of buildings, etc., thereby providing for overflow flood routing, and avoids the high cost of large pipe.

COMPUTER MODELING

The computer software considered for use included Forsgren-Perkins and Holquin and Associates, Inc. models employing the simple rational method of analysis, the Corps of Engineer's "STORM", the U.S. Geological Survey's "Distributed Routing Rainfall-Runoff Model" and the Environmental Protection Agency's, "Storm Water Management Model" or "SWMM". The EPA "SWMM" was selected because: 1) it offered considerable flexibility in discretization of the basin, 2) it was introduced in 1972, and has been successfully used repeatedly since then, 3) it is supported with periodic updates and improvements by the EPA and its wide spread use suggests it may continue to be around for some time to come, and 4) it is well documented and there is a nearby EPA library at the EPA Corvallis Environmental Research Laboratory.

Prepared originally by several well known water resource consultants and the University of Florida under grant from the EPA, "SWMM" offers Sweet the following features:

1. Continuous simulation - actual precipitation as measured locally can be input and the model generated hydrographs (flows) can be compared against observed storm flows. This means that the model can be calibrated and verified versus the deterministic approach. Calibration and verification during this coming winter storm season is recommended.
2. Not only quantity, but quality as well can be modeled. Quality modeling was beyond the scope of this study but the majority of the groundwork for quality studies is now complete.
3. Numerous options are available. The model may be used to analyze and design specific site improvements.
4. It is available at very reasonable cost by time sharing at the Boeing Computer Service in Portland.
5. Once the model has been calibrated, operations of the basic quantity features of "SWMM" are relatively easy to learn. The City may use this "tool" itself.

METHODOLOGY

Utilizing the EPA "SWMM", all creeks, open channels and pipes under study were modeled with culverts removed. Design synthetic rainfalls were input and the cross sections of creeks, channels and pipes were selectively and gradually enlarged until the design storms could be passed through the City. To advance the model to 'full development', land use was revised in accordance with the Proposed Comprehensive Plan plus select changes were made in network flow routing to solve specific problems or anticipate future streets. The same synthetic design rainfalls were input and the conduits gradually enlarged until all these 'full development' flows were passed through the City. The existing culverts were systematically surveyed and their capacities calculated. Existing culvert capacities were then compared to the unrestricted design flows (both existing and 'full development') to determine their adequacy or inadequacy.

DEFINITIONS

Watershed -- Total area which drains through any part of Sweet Home.

Basin -- Area drained by any one natural creek, i.e. Wiley Creek Basin and Ames Creek Basin.

Sub-Basin -- A portion of a basin, i.e., Taylor Creek is a sub-basin of Ames Creek Basin.

Subcatchment -- A "SWMM" term for the smallest individual area modeled.

Pipes -- Understood in this report to refer only to storm drainage pipes equal to or greater than 18 inches in diameter.

Data & Design Criteria

CHAPTER II

DRAINAGE SYSTEM

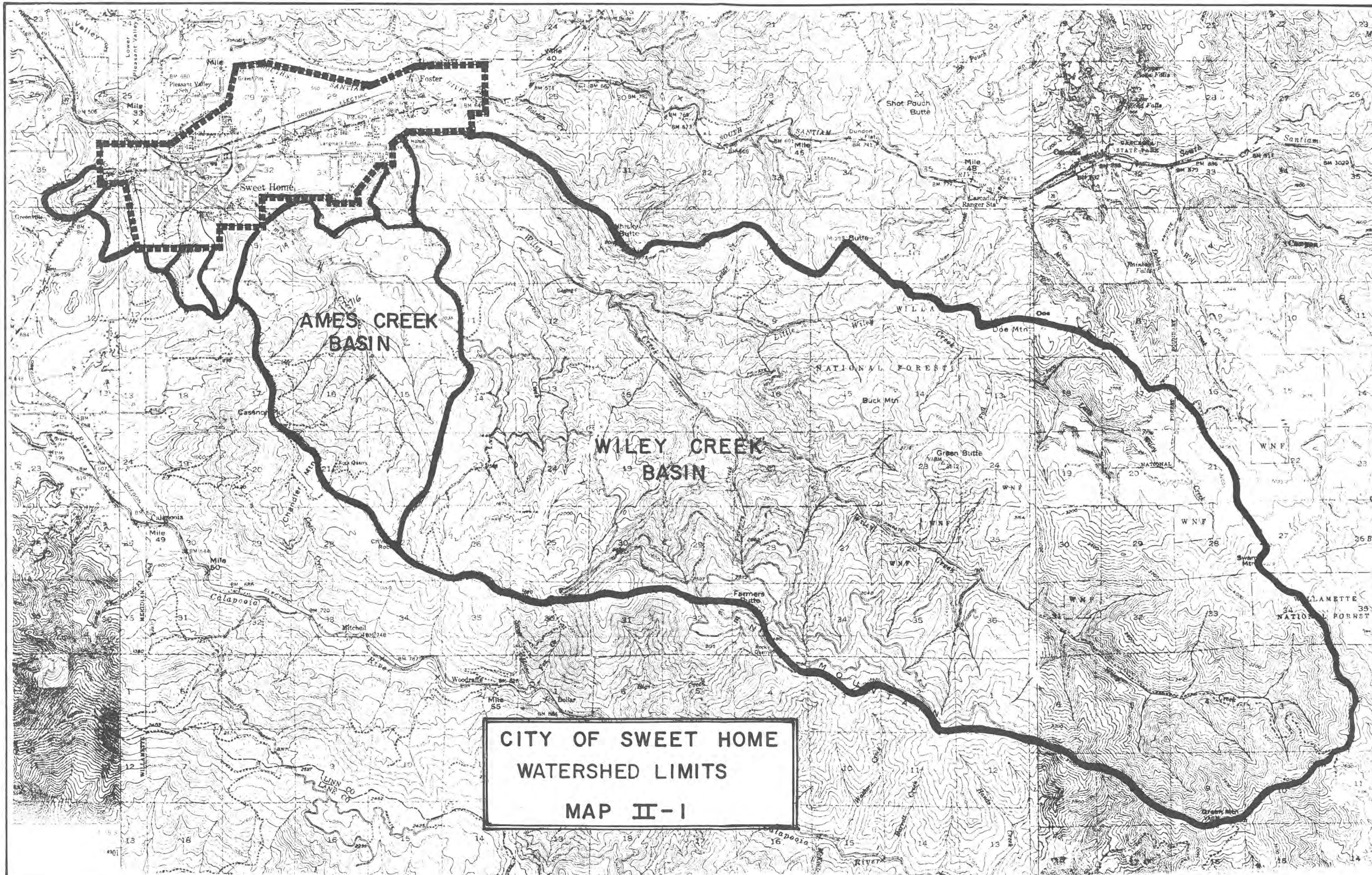
The relationship of the City of Sweet Home to the watershed it intercepts is shown on Map II-1. Although Wiley Creek Basin drains 65 square miles where Wiley Creek passes through the City of Sweet Home it is confined to a deep ravine easily capable of passing design flood peaks. For this reason Wiley Creek Basin and the small area of Foster were not modeled on the computer. All of the City of Sweet Home watershed except Wiley Creek Basin is modeled.

Ames Creek Basin above its point of entry into the proposed urban growth boundary is 9.6 square miles. The break down of Ames Creek Basin above the urban growth boundary into subcatchment is in Appendix B.

The City of Sweet Home watershed excluding Wiley Creek Basin and Ames Creek Basin above the urban growth boundary is shown on Map III-1 (Appendix C). This map shows all existing drainage patterns and assigns computer required numerical identifications to all major pipes, open channels and creeks, as well as all subcatchments.

Steps in the compilation of the existing drainage system included:

1. An initial on-site tour of drainages conducted by Mr. Ozzie Shaw, registered surveyor with considerable experience in the Sweet Home area.
2. Preparation of a 1" = 300' mosaic of all 1" = 100' topographic mapping in the City.
3. For areas beyond this mosaic, 40 foot contour interval U.S. Geologic Survey topography maps were consulted.



CITY OF SWEET HOME
WATERSHED LIMITS
MAP II-1

4. Field surveys conducted to clarify drainage questions, measure culverts, and obtain SWMM input data.

5. Oregon State Highway Department drawings for U.S. Hwy 20 through Sweet Home were researched.

6. The drainages were then overlaid onto a 1" = 800' scale drawing of the City which is the background for Map III-1.

SOILS

The U.S. Department of Agriculture, Soil Conservation Service (SCS) has categorized all soils within the City's watershed. They also provide data sheets for each soil type giving such useful information as hydrologic runoff potential and the range of saturated permeability of the near surface soil horizons.

Soil permeability as reported by the SCS is the source data for the SWMM infiltration parameters.

Saturated winter soil conditions were simulated by (1) equating the minimum infiltration to the SCS minimum saturated permeability regardless of soil horizon below the surface and (2) by inputting five hours of antecedent precipitation before the 'peak' of the synthetic design storm. The SWMM response to these measures is to treat the soil as saturated.

Hydrologic grouping of soils as reported by the SCS is shown in Map II-3.

INDEX TO MAP II-3

Hydrologic soil groups are used to estimate runoff from rainfall. Soils properties are considered that influence the minimum rate of infiltration obtained for a bare soil after prolonged wetting. These properties are: depth of seasonally high water table, intake rate and permeability after prolonged wetting, and depth to a very slowly permeable layer. The influence of ground cover is treated independently - not in hydrologic soil groups.

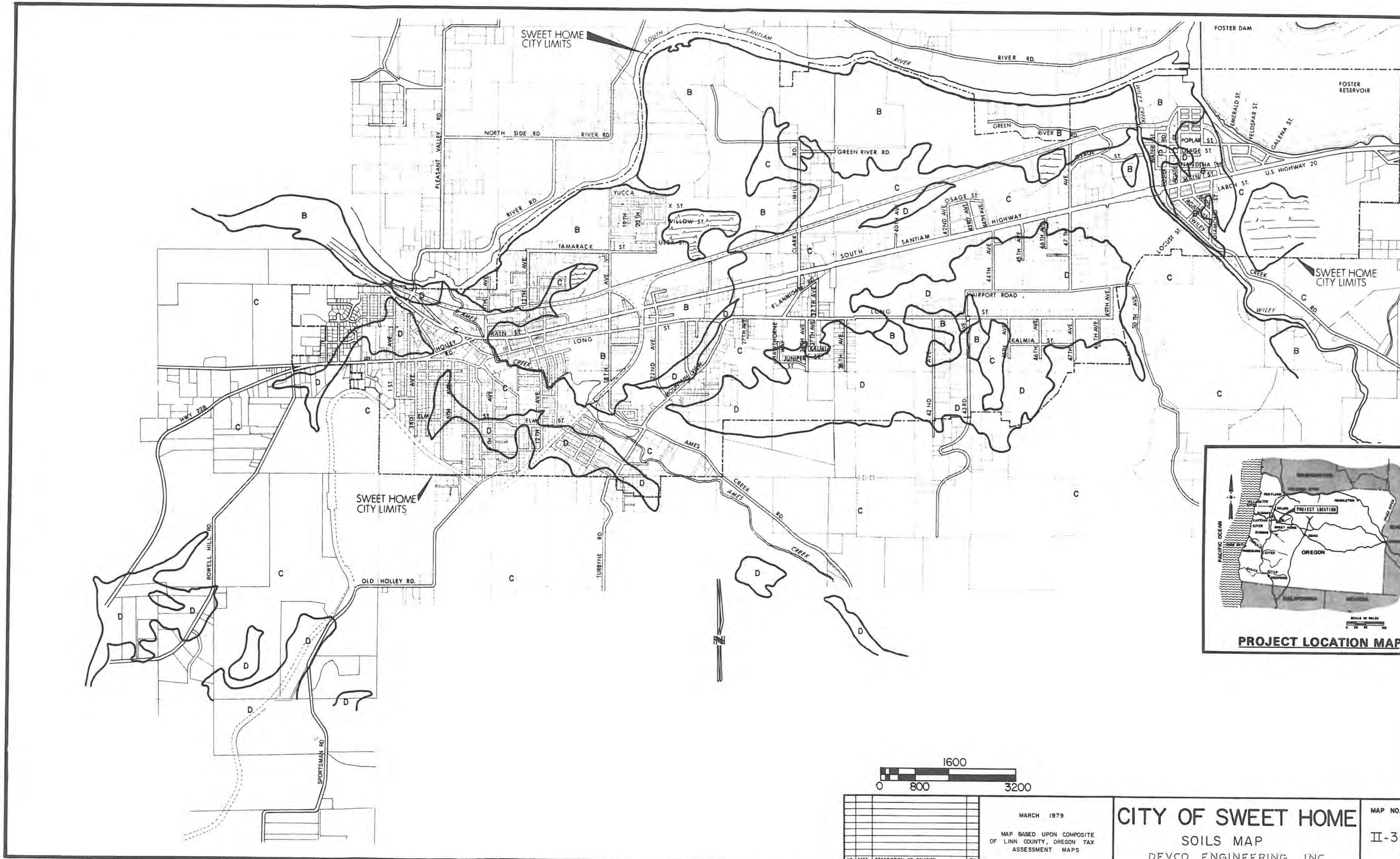
The soils are classified into four groups, A, B, C, and D with A having the lowest runoff potential and D having the highest runoff potential.

Groups A soils have low runoff potential and high infiltration rates even when thoroughly wetted. They consist chiefly of deep, well to excessively drained sands or gravel. These soils have a high rate of water transmission.

Group B soils have moderately low runoff potential and moderate infiltration rates when thoroughly wetted. They consist chiefly of moderately deep to deep, moderately to well drained soils with moderately fine to moderately coarse textures and moderately slow to moderately rapid permeability. These soils have a moderate rate of water transmission.

Group C soils have moderately high runoff potential and slow infiltration rates when thoroughly wetted. They consist chiefly of soils with a layer that impedes downward movement of water, soils with moderately fine to fine texture, soils with slow infiltration due to salts or alkali, or soils with moderate seasonal water tables. These soils may be somewhat poorly drained. They include well drained soils with slowly and very slowly permeable layers such as fragipans, hardpans, hard bedrock and the like at depths of 20 to 40 inches. These soils have a slow rate of water transmission.

Group D soils have high runoff potential and very slow infiltration rates when thoroughly wetted. They consist chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface, soils with very slow infiltration due to salts or alkali, and shallow soils over nearly impervious material. These soils have a very slow rate of water transmission.



SWEET HOME CITY LIMITS
SOUTH SANTIAM RIVER
RIVER RD.
FOSTER DAM
FOSTER RESERVOIR
NORTH SIDE RD
PLEASANT VALLEY RD
GREEN RIVER RD.
U.S. HIGHWAY 20
SOUTH SANTIAM HIGHWAY
TAMARACK ST
YUCCA
WILLOW ST.
AIRPORT ROAD
LONG ST.
KALMIA ST.
MAIN ST.
HOLLEY RD.
AMES CREEK
AMES RD.
ELM ST.
LOCUST ST.
WILEY CREEK RD.
HWY 228
ROWELL HILL RD
OLD HOLLEY RD.
TURBYNE RD.
SPORTSMAN RD.
PROJECT LOCATION MAP
PROJECT LOCATION
PACIFIC OCEAN
OREGON
WASHINGTON
CALIFORNIA
NEVADA
IDAHO
1600
0 800 3200
MARCH 1979
MAP BASED UPON COMPOSITE OF LINN COUNTY, OREGON TAX ASSESSMENT MAPS
NO. DATE DESCRIPTION OF REVISION BY
CITY OF SWEET HOME
SOILS MAP
DEVCO ENGINEERING INC.
MAP NO.
II-3

PRECIPITATION

Rainfall intensity - frequency - duration (I-F-D) curves recommended for the City of Sweet Home are shown as Figure II-5. This chart is largely constructed from NOAA Atlas 2, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, "Precipitation - frequency Atlas of the Western United States, Vol. XI, Oregon". Discussions with Mr. Ralph Fredericks[1] of NOAA, resulted in some changes to the procedures of NOAA Atlas 2 in the durations less than one hour which increased the rainfall for these durations and the results are shown in Figure II-5.

In the course of developing the I-F-D curves for the City of Sweet Home, NOAA Atlas 2 data was compared with I-F-D curves in use by the cities of Portland, Salem, Corvallis and Eugene and with I-F-D curves in the Oregon State Highway Division Hydraulics manual. On the whole, the comparisons were good to very good for durations greater than one hour and poor to good for durations less than one hour. Sources and derivation methods for the I-F-D curves in use by these other cities are quite diverse as are their curve data for durations less than one hour. NOAA Atlas 2 supersedes National Weather Service Technical Publications TP#24, 25 and 40 which were used to prepare at least two of these other Willamette Valley I-F-D curves.

The nearest U.S. National Weater Service (NWS) precipitation recording stations are located at Foster Dam and at Cascadia. The length of record at Foster Dam is only five (5) years and, therefore provided minimum support data for this study. Cascadia, on the other hand, has

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1 Co-author of NOAA Atlas 2

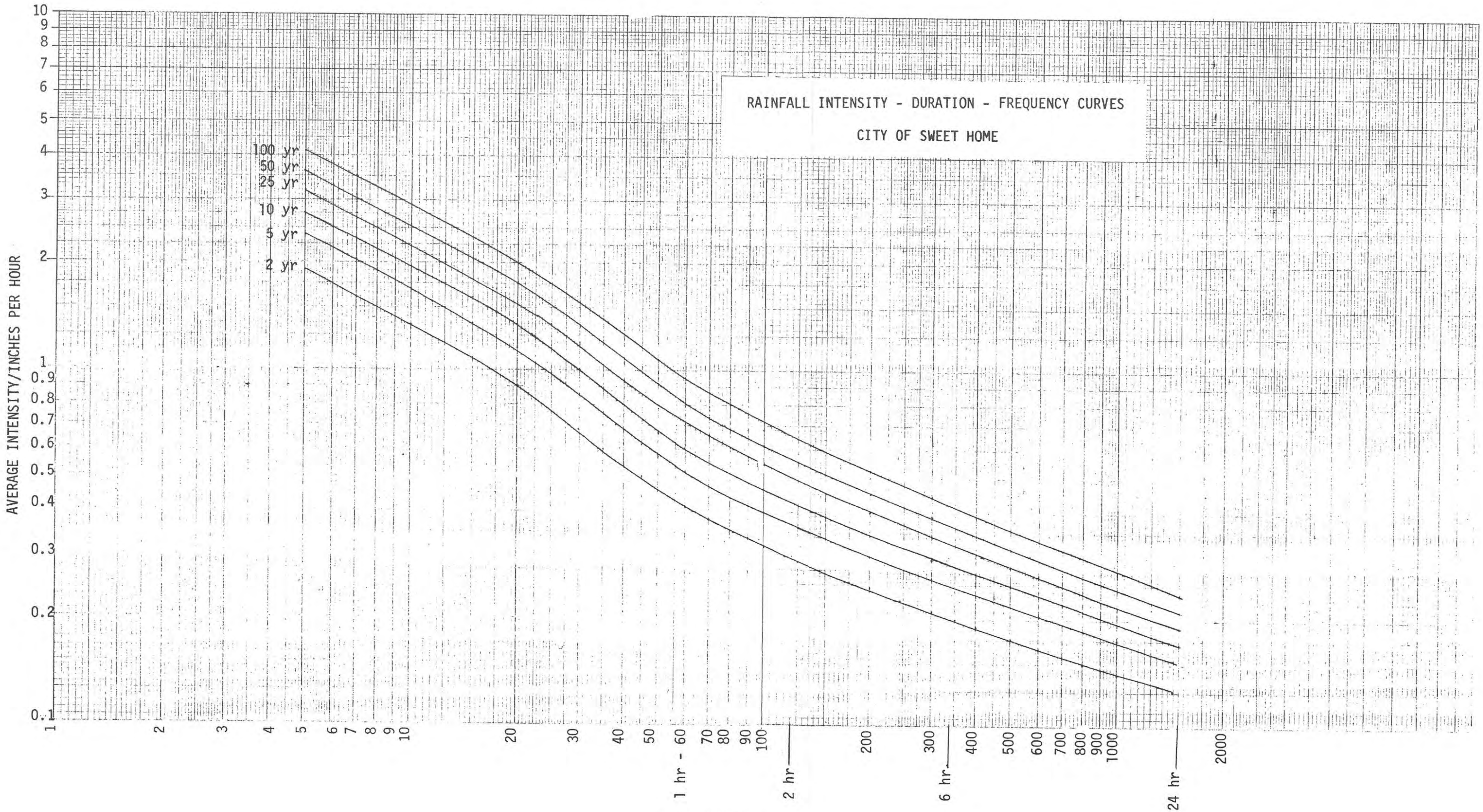
RAINFALL INTENSITY - DURATION - FREQUENCY CURVES
CITY OF SWEET HOME
100 yr
50 yr
25 yr
10 yr
5 yr
2 yr
AVERAGE INTENSITY/INCHES PER HOUR
10
9
8
7
6
5
4
3
2
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
1
2
3
4
5
6
7
8
9
10
20
30
40
50
60
70
80
90
100
200
300
400
500
600
700
800
900
1000
2000
1 hr
2 hr
6 hr
24 hr
TIME/MINUTES

FIGURE II-5

a good fifty-four (54) year record with the last thirty-one (31) years readily available on magnetic tape records at NWS in Silver Springs, Maryland. A NOAA prepared I-F-D analysis of Cascadia for the years 1948-1973 was compared against the I-F-D curve prepared for the City of Sweet Home and the correlation was good.[2]

DESIGN FREQUENCY

Development within the South Santiam and Ames Creek 100 year flood plains will be controlled by local regulations stimulated by the National Flood Insurance Program administered by the U.S. Department of Housing and Urban Development through its Federal Insurance Agency (FIA). Flood Insurance Rate Maps for the South Santiam and Ames Creek flood ways are nearing completion now. Final conversion of Sweet Home to the 'Regular Program' of the National Flood Insurance Program is expected about December 1980.

All state and county bridges, culverts and storm drains within the city limits of Sweet Home will likely be constructed or improved to design frequencies outlined in Page 1-2 of the Oregon Department of Transportation's Hydraulics Manual. (Appendix A)

The City's design frequency criteria shall be compatible with State and Federal guidelines. Setting mandatory design frequencies for urban and suburban areas requires recognition of the existence of both 'convenience' and 'overflow or flood' drainage systems. 'Convenience' systems are the

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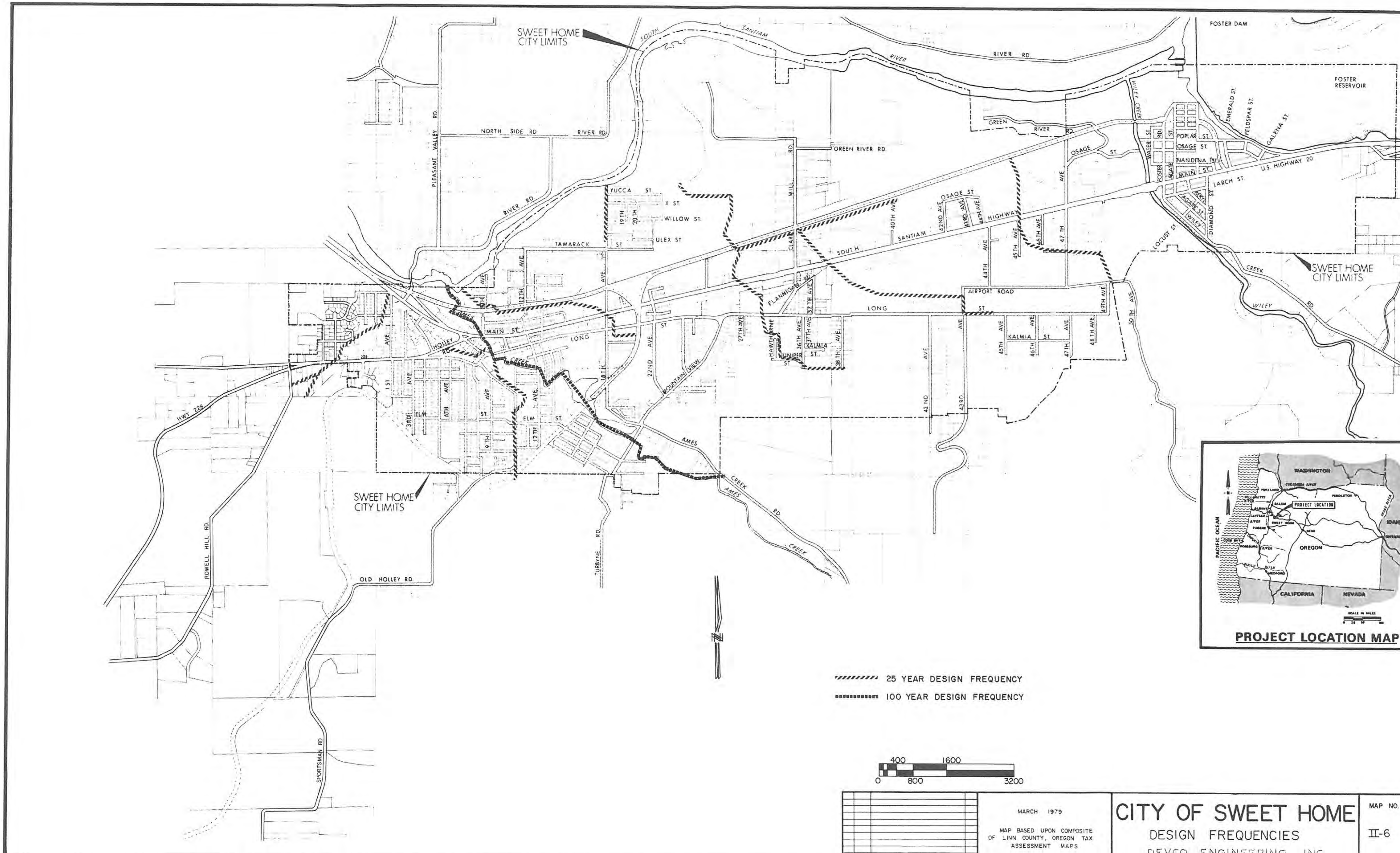
2 Cascadia I-F-D analysis is included in Appendix B.

catch basins, manhole, ditches, pipes, etc. that most people are familar with. 'Overflow or flood' drainage systems - whether planned or not - become apparent when the capacity of 'convenience' systems is exceeded. What distinguishes 'convenience' drainage from flooding, ponding, surcharging and the like is the selection of a design frequency. Design frequencies adopted by other Willamette Valley municipalities range from five (5) years to twenty-five (25) years for 'convenience' systems. The basic minimum design frequency recommended for the City of Sweet Home is ten (10) years. (A ten (10) year storm has a 10% chance of occurring in any one year.) Federal agencies such as the Department of Housing and Urban Development have established ten (10)years as the minimum storm drain design criteria for participation in their myriad assortment of financial assistance programs. The Oregon Department of Transportation is another agency which has set a minimum ten (10) year design frequency.

Outfall from 'convenience' storm drainage is accumulated in major drainages throughout the City and then routed to the South Santiam River. As the flow and velocity in these major drainages increased, the potential hazard and the degree of risk also increases. When these high and fast flows pass through areas of high occupancy density and/or areas of high property values the degree of risk is high enough to warrant additional protection which is provided by increasing the design frequency for these select reaches of major drainages.


SWEET HOME CITY LIMITS
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GREEN RIVER RD
MILL RD
YUCCA ST
X ST
WILLOW ST
ULEX ST
TAMARACK ST
SOUTH SANTIAM HIGHWAY
U.S. HIGHWAY 20
AIRPORT ROAD
LONG ST
MAIN ST
HOLLEY RD
ELM ST
KALMIA ST
JUNIPER ST
FLANNIGAN RD
MOUNTAIN VIEW
AMES CREEK RD
AMES CREEK
HWY 228
ROWELL HILL RD
OLD HOLLEY RD.
TURBINE RD
SPORTSMAN RD
WILEY CREEK RD
POPLAR ST
OSAGE ST
NANDINA ST
LARCH ST
LOCUST ST
EMERALD ST
FELDSPAR ST
GALENA ST
DIAMOND ST
25 YEAR DESIGN FREQUENCY
100 YEAR DESIGN FREQUENCY
400 1600
0 800 3200
PROJECT LOCATION MAP
WASHINGTON
OREGON
IDAHO
CALIFORNIA
NEVADA
PACIFIC OCEAN
PROJECT LOCATION
NO. DATE DESCRIPTION OF REVISION BY
MARCH 1979
MAP BASED UPON COMPOSITE OF LINN COUNTY, OREGON TAX ASSESSMENT MAPS
CITY OF SWEET HOME
DESIGN FREQUENCIES
DEVCO ENGINEERING INC.
MAP NO. II-6

A twenty-five (25) year design frequency is recommended for these selected reaches, Map II-6 identifies their locations.

It is possible that future development may propose to take advantage of land within the Ames Creek flood plain shown on FIA Flood Insurance Rate Maps through measures including realignment of Ames Creek. For this eventuality, it is recommended that any improvements, realignments, etc. to Ames Creek be based on a 100 year design frequency which is consistent with the National Flood Insurance Program.

Table IV-2, Peak Design Flows, tabulates the 'full development' design discharge for each reach of each major drainage investigated within the City of Sweet Home. Dependence on Table IV-1 will assure that all the design frequency criteria discussed above is being adhered to.

DETENTION WITH NEW DEVELOPMENT

What is detention?

> "The water falling on a given site should, in an ideal "detention" solution, be absorbed or retained on site to the extent that after development the quantity and rate of water leaving the site would not be significantly different than if the site had remained undeveloped.[3] This approach to storm drainage runoff says that temporary ponding is a solution and not a problem which in may respects is an 'about-face' from traditional design solutions which aim to remove runoff quickly.

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3 Residential Storm Water Management, ULI, ASCE, NAHB, 1975.

What are detentions 'Advantages' and 'Disadvantages':

'Advantages' include:

1. Peak discharges are reduced, thereby decreasing the necessary size of channels and pipes downstream. Lower peak flows also suggest less risk of water-related damage, less erosion, and higher water quality.

2. If downstream restrictions exist, detention design techniques may still permit upstream development which otherwise might not have been possible.

3. Key phrases in the use of detention are 'natural engineering', 'blue-green concepts', and 'economic environmental benefit'. Detention sites might double as tennis courts, picnic areas, paved parking lots, planned lakes, etc., thereby maximizing land use.

'Disadvantages' include:

1. Volume of runoff is not measurably reduced.

2. Initial development cost are usually higher, which in turn, increases the price of lots to the builders and eventually to the home buyers.

3. Appearance and/or maintenance of numerous small fully enclosed subsurface or numerous surface detention facilities may be difficult to keep up. Provision must be made for long-term operation of these facilities.

4. Detention is generally not economical where the land is already well drained and the drainage has a close outfall.

5. In the absence of mandatory basin-wide use of detention principles, a development incorporating detention to control its own runoff must still design for and be prepared to pass the increased runoff from ultimate development of sites upstream.

A comparison of existing runoff rates with projected 'full development' runoff rates which result from no detention are shown below for random locations.

Model[4] Identification	Storm Frequency (Years)	Location	Existing (cfs)	'Full Development' (cfs)
102	25	Nandina St. to Main St. west of 1st Ave.	292	308
504	10	12th Ave. just north of railroad	18	40
506	25	12th Ave. just south of railroad	128	149
530	25	18th Ave. north of Tamarack	61	126
556	25	Long St. to Main St. north of Ashbrook Subdivision	16	156
576	25	West of Clark Mill Rd. and south of railroad	189	359
586	25	43rd St. to U.S. Hwy 20 at approx. 36th Ave.	148	291
802	10	U.S. Highway 20 @ 40th Avenue	13	35
806	25	U.S. Highway 20 @ 45th Avenue	94	116

Increased runoff rates are the direct result of more streets, roofs with downspouts connected to street gutters, sidewalks, parking lots, etc. Infiltration into the soil is stopped and the surface and near-surface storage capacity of a natural surface is vastly reduced. 'Full development' runoff rates can be reduced if new development incorporates detention.

Most of the City of Sweet Home has good drainage slope. However, factors within the proposed urban growth boundary that favor the use of detention storage include:

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[4] See Map IV-1

1. Midway bench south of Main Street and east of Mountain View Road can be characterized as flat.
2. Existing restrictions within downtown Sweet Home.
3. New growth will concentrate above existing drainage restrictions. Specific large new developments may substantially raise runoff before downstream improvements are made.

It is concluded that: (1) detention is an available tool which the City may use when downstream conditions warrant its application. (2) Each subdivision application be reviewed by the City Engineer for its impact on downstream properties. Where downstream problems are obvious, the Planning Commission Staff Report shall require that storm drainage be designed in accordance with the City's detention criteria.

Recommended detention criteria for the City of Sweet Home are:

3.4 1. Detention required for sites equal to or greater than four acres.
2. Sites less than four acres are exempt from detention requirements.
3. Hold runoff release rate from developed land equal to peak runoff from 10 year storm on undeveloped land.
4. Provide storage resulting from the difference between the 10 year release rate (item 3 above) and the 10 year storm runoff after development.

Acceptable detention calculations for low risk applications may utilize the Rational Method. Example calculations of this method for Berdell's Addition Subdivision are included in Appendix B. This method utilizes Figure II-5, Rainfall-Intensity-Frequency Curves. For larger detentions and reservoirs, it is desirable to study the routing of storm runoff inflow through the detention area in greater detail. Continuity equations will be employed and the hydrographs in Appendix C and D may be specified as design criteria.

The results of a telephone survey on the use of detention by Willamette Valley cities is given below:

Municipality Greater 10,000 Population	Is On-Site Detention Currently Required?	Is Mandatory On-Site Detention Being Considered
Portland	Depends on downstream conditions	No
Salem	Yes	--
Roseburg	No	?
Corvallis	No	Yes
Oregon City	No	No
Beaverton	Yes	--
McMinnville	Yes	--
Dallas	No	No

HYDROLOGY AND HYDRAULICS

The Storm Water Management Model of the U.S. Environmental Protection Agency is one of the most comprehensive mathematical models for the simulation of storms and combined sanitary systems. This study uses but a small part of the model. Briefly, the portion of the program that is used is a step by step accounting of rainfall, infiltration detention, overland flow and gutter flow. In so doing the fundamental mathematics are Horten's equation for infiltration, Mannings kinematic equation for overland and gutter flows and continuity equations to account for detention and time lag.[5]

Users manuals for SWMM have been given to the City. SWMM data input requirements and the primary source for each input parameter are shown below.

Input Parameter	Source
For channels or pipes:	
diameter or width	field survey
length	topographic maps
slope	topographic maps
side slopes	field survey
resistance	field survey
depth of overflow	field survey
For subcatchments:	
width	topographic maps
area	planimeter topographic maps
per cent impervious	topographic maps and City's Comprehensive Plan
slope	topographic maps
resistance, impervious	default value = .013
resistance, pervious	User's Manual
surface storage, impervious	default value = .062
surface storage, pervious	default value = .184 then adjusted for slope

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5 Bibliography items 15 through 23

Input Parameter	Source
infiltration, maximum	Soil Conservation Service
infiltration, minimum	Soil Conservation Service
decay rate	default value = .00115

Culvert capacities are calculated using the U.S. Department of Commerce, Bureau of Public Roads, HEC 5 and HEC 10, culvert capacity charts.

Where manual calculations were required, the Manning equation was used.

SYNTHETIC DESIGN STORMS

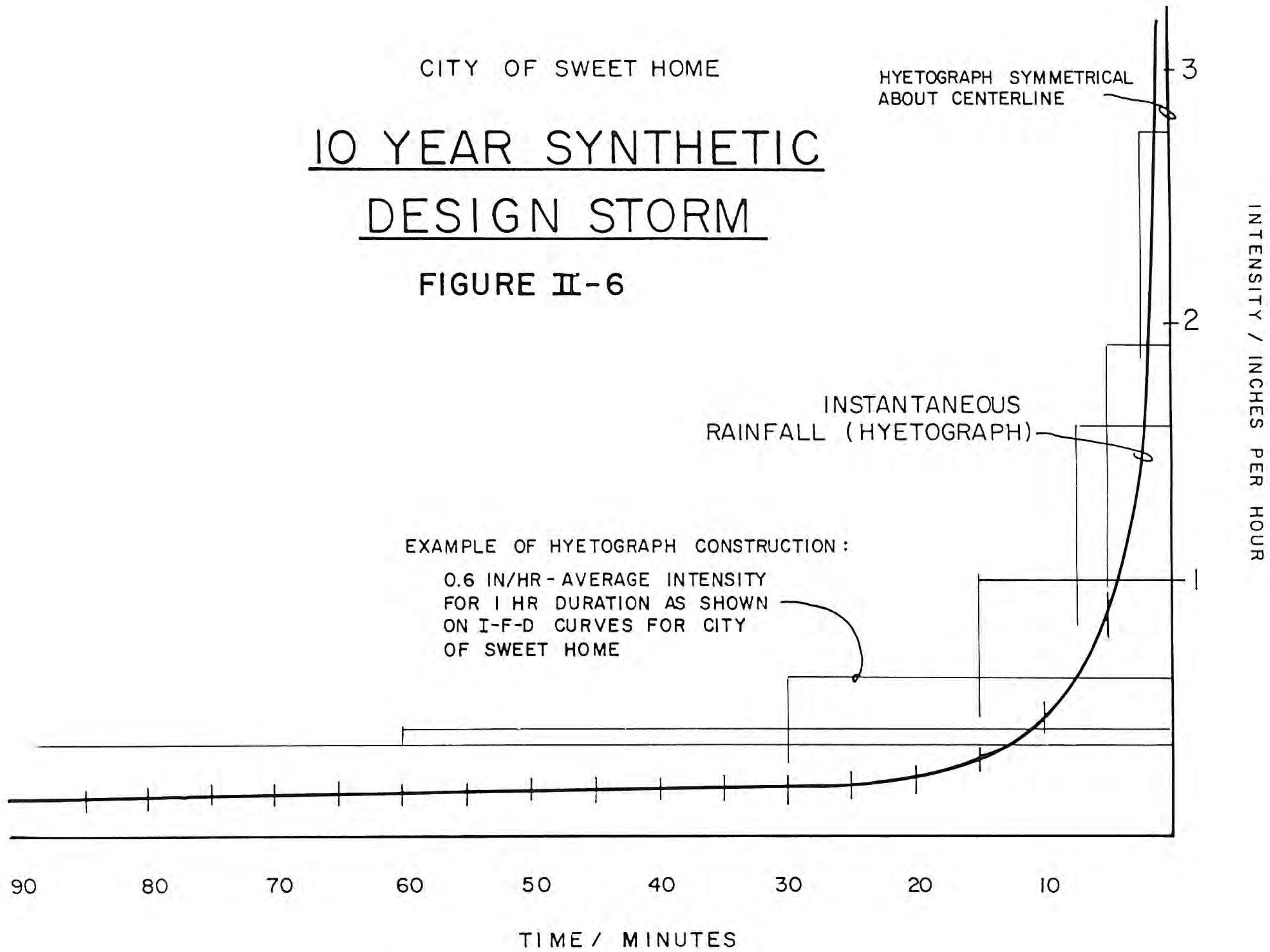
The only recorded gauging of runoff flows in the Sweet Home watershed is on Wiley Creek at mile station 3.8 for the year 1947 through 1973.[6] (In 1973 the gauge was moved to its present location at mile station 1.4.) However, Wiley Creek is excluded from this study because it poses no serious flood damage risks within the City. Since the remainder of the City's watershed is without gauging, it is impossible at this time to calibrate and verify the SWMM model that is now constructed. If undertaken calibration would involve taking an actual storm precipitation record from the National Weather Service measurement station at Foster Dam, inputting this into the SWMM model of Sweet Home, and comparing the SWMM produced runoff with actual gauged runoffs, if necessary, adjusting the parameters within the model to achieve maximum correlation between the calculated and observed runoffs.

6 See Notes and Calculations for annual frequency analysis of this data etc.

CITY OF SWEET HOME

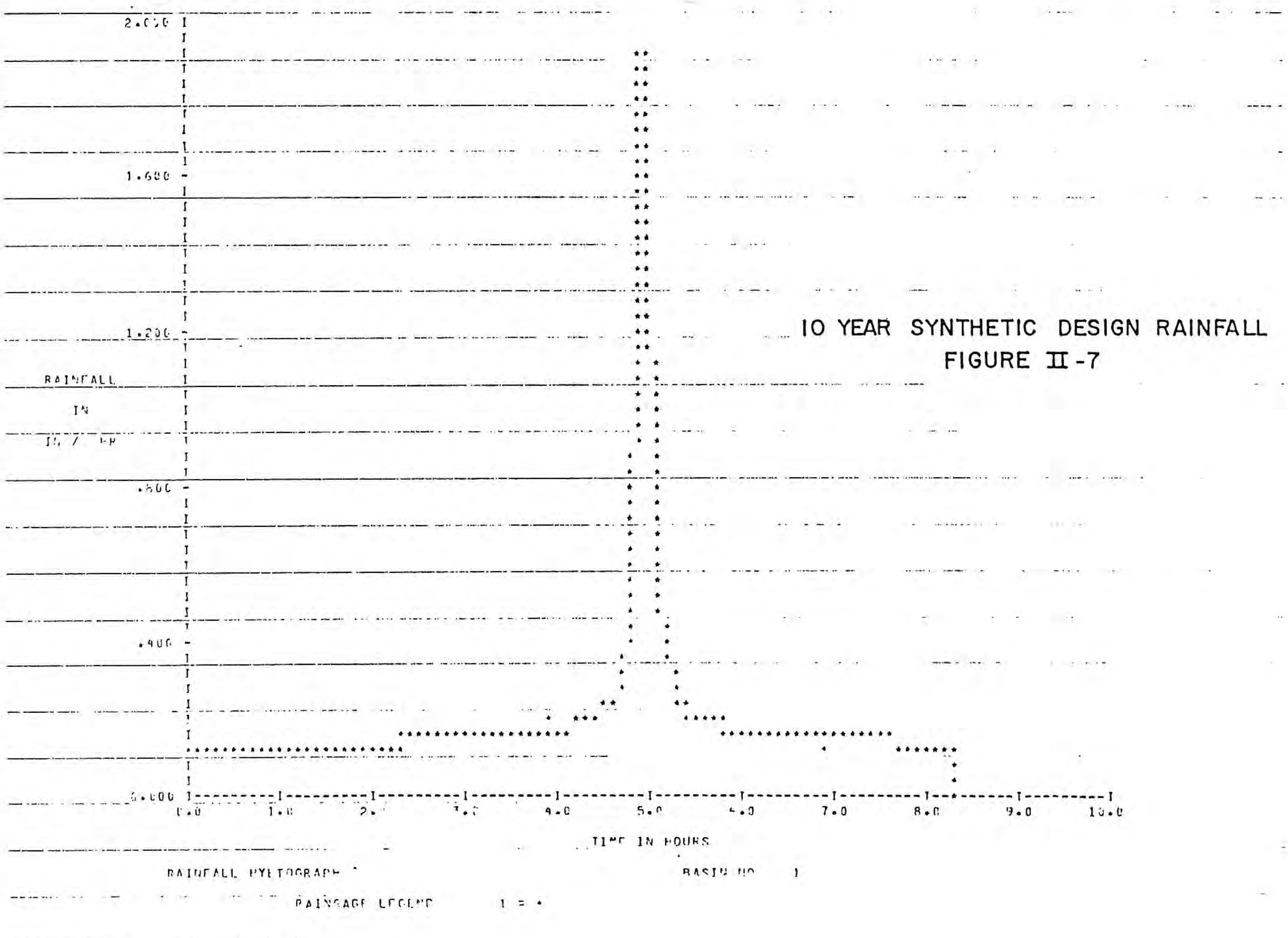
10 YEAR SYNTHETIC DESIGN STORM

FIGURE II-6



10 YEAR SYNTHETIC DESIGN RAINFALL

FIGURE II-7



To produce the deterministic model that exists, synthetic design storm rainfalls (instantaneous hyetographs) were prepared based on the intensity-frequency-duration curves previously prepared for the City. Hyetographs were prepared for the 10, 25 and 100 year storms. Figure II-6 shows construction of the 10 year synthetic design storm rainfall (hyetograph). Figure II-7 is the 10 year synthetic design hyetograph. The 25 and 100 year hyetographs are in Appendix C and D.

OTHER STUDIES

Two studies of significance are currently underway which involve Ames Creek. These are:

1. Federal Flood Insurance study being performed by the Corps of Engineers for the Federal Insurance Agency (FIA) of the Department of Housing and Urban Development.
2. Oregon Department of Transportation preparation of plans and specifications to replace the Mountain View Road bridge on Ames Creek.

The hydrologic investigations of both studies are complete and available for comparison with the Proposed Master Storm Drainage Plan. Agreement between the various studies is acceptable.

	Peak Runoffs (cfs) for 100 year Average Return Period Storm	
	Ames Creek @ Santiam	Ames Creek @ Mt. View Rd.
Proposed Master Drainage Plan	2510[7,8]	1710[7]
FIA Study - Corps of Engineers	2125	-
Oregon Department of Transportation	-	1650[9]
Geological Survey Water Supply Paper #1689[10]	-	1760

Field survey notes of Ames Creek taken by the Corps of Engineers were provided for use in this study and are included in Appendix B.

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7 Includes 50 cfs of winter base flow added to SWMM runoff.

8 Based on 'full development'

9 Based on Oregon State Highway Division, Hydraulics Manual, Page 3-47.

10 Provided for additional comparison. Geological Water Supply Paper 1689, Magnitude and Frequency of Floods in the United States, Part 14, Pacific Slope Basins in Oregon and the Lower Columbia River Basin.

Existing Drainage System

CHAPTER III

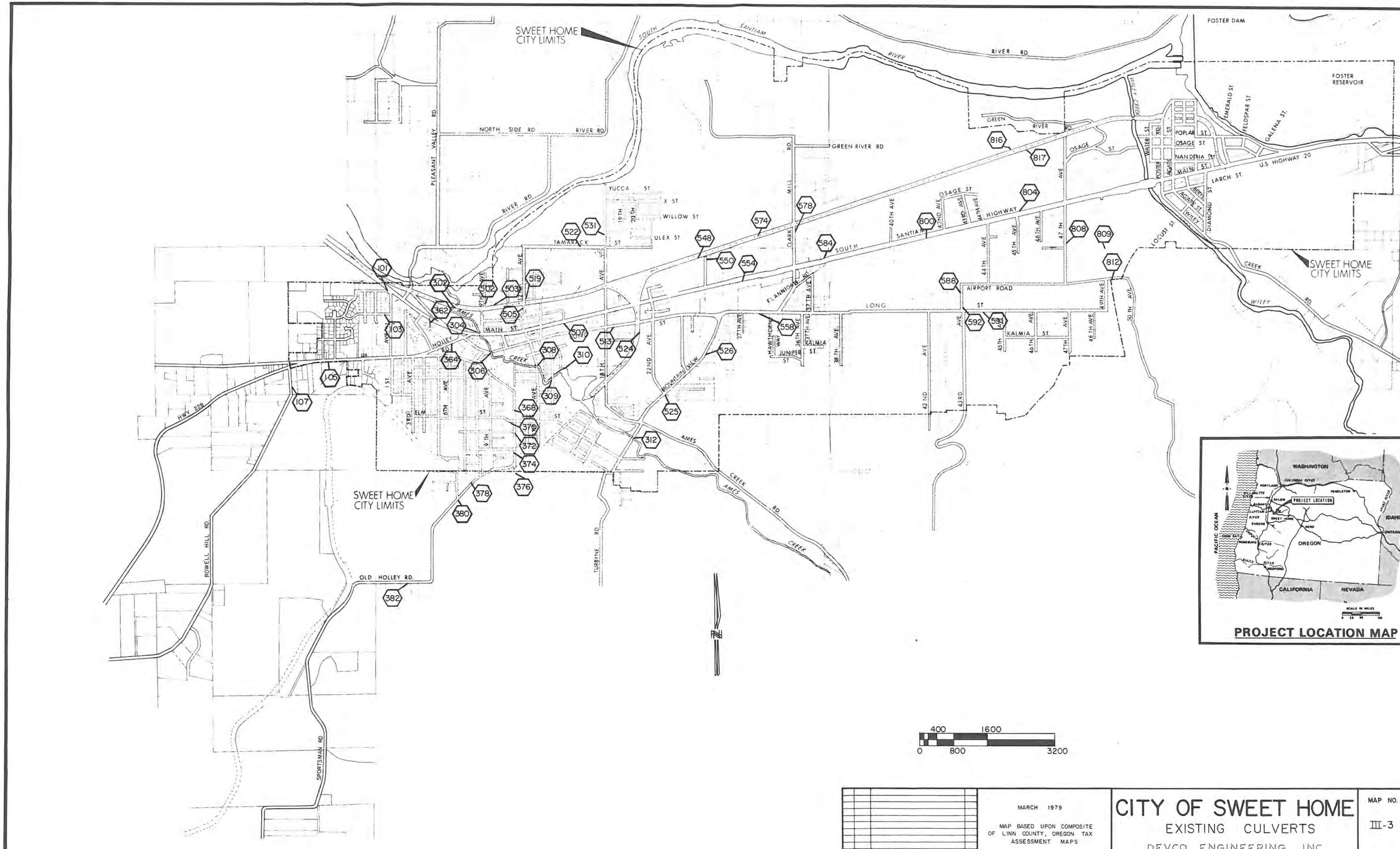
EXISTING DRAINAGE SYSTEM

Creeks, Pipes and Open Channels

Map III-1 (Appendix C) shows the existing drainage system discretized into model subcatchments, pipe segments and existing drainage channel reaches. The area north of the railroad mainline tracks and from Willamette Industries east is not modeled because 1) runoff patterns are not well accumulated or identifiable, 2) the area is reasonably well drained with the close enveloping proximity of the Santiam River, 3) a significant portion of this area is active or abandoned quarry pits and 4) there is only one major drainage entering this area from south of the railroad.

Ashbrook subdivision currently being developed at Mountain View Road and Long Street changes several drainages. Map III-1 was constructed based on what Ashbrook is projected to look like in the spring of 1980.

Runoffs resulting from 10, 25, and 100 year synthetic design storms were computed for every pipe segment and channel reach. Output is in the form of 157 hydrographs which are forwarded separately as Appendix C to this report.


SWEET HOME CITY LIMITS
SOUTH SANTIAM RIVER
RIVER RD
FOSTER DAM
FOSTER RESERVOIR
NORTH SIDE RD
RIVER RD
PLEASANT VALLEY RD
GREEN RIVER RD
U.S. HIGHWAY 20
SOUTH SANTIAM HIGHWAY
LONG ST
AIRPORT ROAD
MAIN ST
HOLLEY RD
AMES CREEK
AMES CREEK RD
WILEY CREEK RD
HWY 228
ROWELL HILL RD
OLD HOLLEY RD.
SPORTSMAN RD
TURBYNE RD
MOUNTAIN VIEW
CLARK MILL RD
YUCCA ST
X ST
WILLOW ST
ULEX ST
TAMARACK ST
OSAGE ST
KALMIA ST
JUNIPER ST
ELM ST
LOCUST ST
POPLAR ST
NANDINA ST
LARCH ST
EMERALD ST
FELDSPAR ST
GALENA ST
DIAMOND ST
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817
400
1600
0
800
3200
PROJECT LOCATION MAP
WASHINGTON
OREGON
IDAHO
CALIFORNIA
NEVADA
PACIFIC OCEAN
PROJECT LOCATION
NO.
DATE
DESCRIPTION OF REVISION
BY
MARCH 1979
MAP BASED UPON COMPOSITE OF LINN COUNTY, OREGON TAX ASSESSMENT MAPS
CITY OF SWEET HOME
EXISTING CULVERTS
DEVCO ENGINEERING INC.
MAP NO.
III-3

TABLE III-4
CAPACITY OF EXISTING CULVERTS

MODEL CULVERT NO.[1]	LOCATION[1]	MATERIAL	ENTRANCE CONDITION	SIZE	I.E. IN	I.E. OUT	LENGTH FEET	ALLOWABLE HEAD[2] AT INLET FEET	APPROX[4] EXISTING CAPACITY CFS	MODEL CHANNEL I.D. NO.	MINIMUM RECOMMENDED DESIGN FREQUENCY (YEARS)	EXISTING STORM FLOW CFS	IS EXISTING CULVERT O.K.?	FULL DEVELOPMENT DESIGN FLOW CFS	IS EXISTING CULVERT O.K.?
101	US 20 @ 1st Ave.	Concrete Box	Wingwall	9'x3.2'	-7.8'		120	6	275	102	25	290	Yes	308	Yes
103	Nandina St. 150' W 1st Ave.	CMP CMP-Arch Asphalt lined & coated	Wingwall Wingwall	30" 6'x3'	-0.15' -0.15'		52 52	4.5 4.5	31 110	104	25	270	No	281	No
105	Hwy 20 near Evergreen Lane	CMP	Projecting	48	+0.1'		64	6.5	100	106	25	222	No	232	No
107	Rowell Hill Rd 400' S Hwy 228	Concrete	Grooved Edge	3-3"Ø	-0.35'		47	4	135	108& 110	25	93	Yes	102	No
302[6]	RR & Ames Creek	(Wood Pile Bridge)			500.3				Much More Than Req'd	702	100	2450	Yes	2510[8]	Yes
304[6]	US 20 & Ames Creek	Concrete Box	Wingwall	2 ea 8'x8' sq.box	513.7	513.7	168	9	1400	704	100	2390	No	2410[8]	No
306[6]	Long St. & Ames Creek	Concrete Bridge	Headwall	11'x20'	517.5		60	9	1400	706	100	2020	Yes	2020[8]	Yes
308[6]	12th Ave. & Ames Creek	CMP-Arch Bolted	Wingwall	9'x 14.3'	529.6	529.2	37	7.5	900	707	100	2010	No	2010[8]	No
309[6]	14th Ave. & Ames Creek	Concrete & wood Bridge	Wingwall	8.8'x 17.3'	532.3		49	8	1150	708	100	2010	No	2010[8]	No
312[6]	Mt. View Rd & Ames Ck	Wood Bridge	Wingwall	6'x26'	550.4		32	6	1130	714	100	1710	No	1710[8]	No

TABLE III-4
CAPACITY OF EXISTING CULVERTS

MODEL [1] CULVERT NO.	LOCATION [1]	MATERIAL	ENTRANCE CONDITION	SIZE	I.E. IN / I.E. OUT	LENGTH FEET	ALLOWABLE HEAD [2] AT INLET FEET	APPROX. [4] EXISTING CAPACITY CFS	MODEL CHANNEL I.D. NO.	MINIMUM RECOMMENDED DESIGN FREQUENCY (YEARS)	EXISTING STORM FLOW CFS	IS EXISTING CULVERT O.K.?	FULL DEVELOPMENT DESIGN FLOW CFS	IS EXISTING CULVERT O.K.?
362	US 20 200' E 4th Ave.	Concrete	Grooved Edge	24	-3.0	260	12	30	316	10	50	No	17 Channel 316 rerouted	Yes
364	Holley Rd between 4th Ave. & US 20	Concrete	Grooved Edge	30	-0.3	68	5	47	316	10	50	Yes	17 Channel 316 rerouted	Yes
368	10th Ave. 300' N of Elm St.	CMP Asphalt Lined	Headwall	40"x 65"	-1.0	37	4	95	340	25	126	No	145	No
370	Elm St. & 10th Ave.	Concrete	Wingwall	42"	-0.7	68	5	80	340	25	126	No	145	No
372	Dogwood St @ 10th Ave	Concrete	Wingwall	42	-1.1	47	5	80	340	25	126	No	145	No
374	Cedar St. @ 10th Ave	Concrete Box	Square Edge	5'x2'	-0.3	50	3.5	70	340	25	126	No	145	No
376	Old RR Bed & 10th Ave	Concrete	Grooved Edge	2-18"	-0.4	29	6	44	342	25	126	No	145	No
378	Old RR Bed &Old Holly Rd	Composite CMP & Concrete	Project-ing	30"	-0.2	43	6	36	336	10	28	Yes	28	Yes
382	Old Holly Rd(Sports-man Rd)	Concrete	Grooved Edge	18"	-1.4	42	5.5	21	½ of 336	10	14	Yes	14	Yes
502	9th Ave. & RR	CMP-Arch	Project-ing	72"x 44"	(S=1.46%)	30	4.7	130	501	25	152	No	185	No
503	RR 150' E of 9th Ave.	CMP	Project-ing	72"	(S=0.49%)	48	7	220	517	25	140	Yes	146	Yes
505	12th Ave. @ RR	Concrete Box Conc	Headwall	4'x6' 48"	(S=1.65%)	91	5	170 100	506	25	135	Yes	149	Yes

TABLE III-4
CAPACITY OF EXISTING CULVERTS

MODEL[1] CULVERT NO.	LOCATION[1]	MATERIAL	ENTRANCE CONDITION	SIZE	I.E. IN	I.E. OUT	LENGTH FEET	ALLOWABLE HEAD[2] AT INLET FEET	APPROX.[4] EXISTING CAPACITY CFS	MODEL CHANNEL I.D. NO.	MINIMUM RECOMMENDED DESIGN FREQUENCY (YEARS)	EXISTING STORM FLOW CFS	IS EXISTING CULVERT O.K.?	FULL DEVELOPMENT DESIGN FLOW CFS	IS EXISTING CULVERT O.K.?
507	US 20 & 15th Ave.	Concrete	Catch Basin	30"	-	-	56	5.5	9	506-523	25	14	-	29	-
513	Long St. 150' E of 18th Ave.	CMP-Arch Asphalt Lined	Wingwall	31"x 50"	539.7	539.4	60	2.5	60	509	25	125	No	116	No
519	12th Ave. N of RR	CMP	Project-ing	54"	-0.6		60	7	140	504	10	19	Yes	40	Yes
522	Tamarack St. 700' W Of 18thAve	Concrete	Grooved Edge	18"	-0.5		38	3.5	14	Over-flow of 532	10	35?	No	15	Yes
524	RR @ 200' S of Long St.	CMP		2-24"	(S=0.7%)		68	2	22	510	10	24	Yes	49	No
525	This is a series of four culverts														
	300' E of Mt. View & 22nd Ave.	CMP	Project-ing	36"	584.8	584.4	26'	3	21	516	10	61	No	29	Yes
	The following three pipes are connected by catch basins and/or manhole														
	120' E of Mt. View @ 22nd Ave.	CMP	Headwall	30"	580.3	575.9	115	2.5	32	516	10	61	No	29	Yes
	Mt. View @ 22nd Ave.	Concrete Box	n/a	30"	575.3	572.3	105	n/a	32	516	10	61	No	29	Yes
	65' W of Mt. View @ 22nd Ave.	Concrete	n/a	30"	572.3	564.6	165	n/a	32	516	10	61	No	29	Yes
526	Mt. View @ Taft St.	Concrete	Grooved Edge	24"	575.9	571.4	110	4.5	31	514	10	27	Yes	44	No
531	18th Ave. 200' N of Tamarack	Concrete	Grooved Edge	2-24'	-0.2		53	2	30	Over-flow of 532	10	35	Yes	5	Yes

TABLE III-4
CAPACITY OF EXISTING CULVERTS

MODEL CULVERT NO.	LOCATION[1]	MATERIAL	ENTRANCE CONDITION	SIZE	I.E. IN	I.E. OUT	LENGTH FEET	ALLOWABLE HEAD[2] AT INLET FEET	APPROX.[4] EXISTING CAPACITY CFS	MODEL CHANNEL I.D. NO.	MINIMUM RECOMMENDED DESIGN FREQUENCY (YEARS)	EXISTING STORM FLOW CFS	IS EXISTING CULVERT O.K.?	FULL DEVELOPMENT DESIGN FLOW CFS	IS EXISTING CULVERT O.K.?
548	RR 150' W of 24th Av	Channel & culvert are blocked with land fill								552	25	26	-	0 (Runoff routed to 572)	
550	24th Ave. @ RR	Concrete	Headwall Culvert is completely submerged in backwater of land fill blocking channel beyond outlet.	2-26"	-0.3		30	5	104	552	25	26	Yes	0 (Runoff routed to 572)	
554	1200' W of Clark Mill Rd on US 20	CMP Asphalt Lined	Project-ing	36"	-1.4		114	5	55	556	25	16	Yes	156	No
558	Long St. 300' W of Clark Mill Rd.	Concrete	Grooved Edge	36"	582.9	581.0	58	7	95	564& 560	25	16	Yes	155	No
559	Clark Mill Rd @ Long St.	Concrete	Grooved Edge	18"	596.7	595.6	90	2.5	12	n/a	10	8	Yes	30	No
574	Under RR 800' W of Clark Mill Rd.	CMP	Square Edge	2-36"	-0.2		110	5	110	576& 552	25	214	No	530	No
578	RR & Clark Mill Rd.	Concrete	Grooved Edge	2-30"	552.0	552.0	50	3	60	576	25	188	No	359	No
584	800' E of Clark Mill Rd. on US 20	CMP Asphalt lined	Project-ing	78"	-1.1		196	11.5	440	586	25	148	Yes	291	Yes
588	43rd Ave. 200' N of Long St.	Concrete	Grooved Edge	1-30" 1-36"	614.8 614.9	614.9 614.9	40 40	4.5 4.5	90	} 586	25	148	No	291	No
591	Long St. between 43rd & 45th Ave	Concrete	Square Edge	2-15"	-0.8		41	2	16	590	25	76	No	100	No

TABLE III-4
CAPACITY OF EXISTING CULVERTS

MODEL[1] CULVERT NO.	LOCATION[1]	MATERIAL	ENTRANCE CONDITION	SIZE	I.E. IN	I.E. OUT	LENGTH FEET	ALLOWABLE HEAD[2] AT INLET FEET	APPROX.[4] EXISTING CAPACITY CFS	MODEL CHANNEL I.D. NO.	MINIMUM RECOMMENDED DESIGN FREQUENCY (YEARS)	EXISTING STORM FLOW CFS	IS EXISTING CULVERT O.K.?	FULL DEVELOPMENT DESIGN FLOW CFS	IS EXISTING CULVERT O.K.?
592	Long St. @ 43rd Ave.	Concrete	Square Edge	18"	-0.7		42	2.4	11	594	25	35	No	139	No
800	500' W of 42nd Ave. on US 20	CMP Asphalt Lined	Project-ing	60"	615.9	615.6	100	5	52 (50% theoretical capacity due to heavy siltation in culvert)	802	10	13	Yes	35	Yes
804	US 20 & 45th St.	CMP Asphalt Lined	Project-ing	60"	615.9	615.9	96	5	100	806	25	94	Yes	116	No
808	47th Ave. @ Airport Lane	Concrete	Grooved Edge	3-24"	628.7	628.7	36	2.5	48	810	25	90	No	110	No
809	1200' S of US 20 on private drive para-llel to proposed 49th St.	CMP-Arch	Project-ing	36"x22"	632.6	633.0	18	4	28	810	25	90	No	110	No
		CMP	Project-ing	30"	632.5	632.6	16	4	30						
812	49th Ave. & Airport Rd.	Concrete	Headwall	1-18"	645.8	645.3	40	3	15	810	25	90	No	110	No
		Concrete	Headwall	1-30"	644.9	644.0	40	4	40						
816	RR below clear lumber	Concrete	Grooved	2-36"	-1.46		82	6	130	818	25	102	Yes	129	Yes
817	RR below Clear Lumber	CMP	Project-ing	1-30"	-1.0		88	7	36						

TABLE III - 4
CAPACITY OF EXISTING CULVERTS

NOTES:

[1] Location shown on Map III-4

[2] At this head, street does not inundate and adjacent property is not extensively damaged by backwater. Estimated velocity head is added to this to obtain "headwater" as used in Hec 5 & Hec 10.

[3] Source: 'Drainage Investigation of Proposed Junior High School Site', CH2M Hill Engineer, Dec. 1960.

[4] Computed using Hydraulic Engineering Circulars No. 5 and No. 10, Bureau of Public Roads, U.S. Department of Commerce and Hydraulic Handbook by King & Brater.

[5] Source: Corps of Engineers Field Notes Dated January 1979.

[6] Source: Map II-6, Design Frequencies. Note, culverts designed for the Oregon Department of Transportation or for Linn County for highways and roads under their jurisdiction may have to be designed to frequencies more severe than these shown.

[7] Culvert flows within 10 per cent of approximate existing culvert capacity are viewed as equivalent. Realistically, the techniques and equations employed are not exact, some tolerance or deviation does exist. Ten per cent is considered reasonable.

[8] 50 cfs ground water flow added to computed Ames Creek flows.

Proposed 'Full Development' Master Storm Drainage Plan

PROPOSED MASTER STORM DRAINAGE PLAN - 'FULL DEVELOPMENT'

Creeks, Pipes and Open Channels

Map IV-1 shows the Proposed Master Storm Drainage Plan discretized into model subcatchments, pipe segments and open channels. Appendix D gives the proposed sizing of all conduits in the Proposed Master Plan as well as a complete list of SWMM input parameters for the Proposed Master Plan. Map IV-3 is the index to 1" = 100' City topographic maps overlaid with the Proposed Master Plan and showing the following:

1. Design flow.
2. Typical conduit cross-sections at 'full development'.
3. Approximate alignment and suggested easements or dedications.
4. Indication of existing conduit cross-sections (if not shown existing cross-section is comparable with cross-section at 'full development').

Runoff for the Proposed Master Plan is based on land use as shown in Sweet Home's Proposed Comprehensive Plan, Map IV-2. This means that this study presumes that the land uses will be completely occupied to the densities shown in the Proposed Comprehensive Plan. 'Full development' of the City's Proposed Comprehensive Plan will accommodate a population of roughly 17,000 and if a compound growth rate of 1½ per cent[11] per year is assumed, 'full development' would occur

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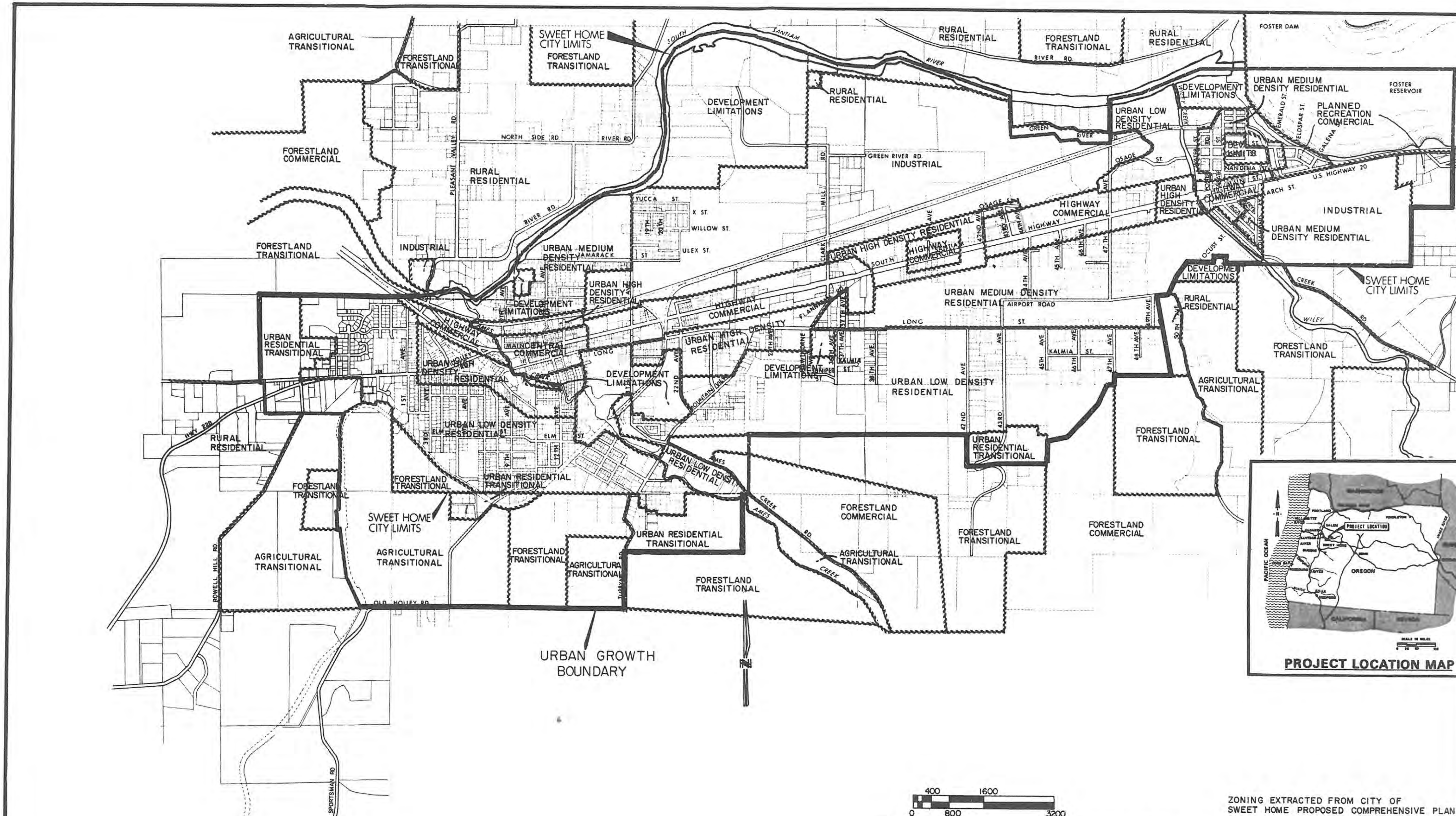
[11] Source: Proposed Sanitary Sewer and Water Plan by Extension of City Services to the Foster-Midway Area, CH2M, 1973


SWEET HOME CITY LIMITS
SOUTH SANTIAM RIVER
RIVER RD.
FOSTER DAM
FOSTER RESERVOIR
NORTH SIDE RD
PLEASANT VALLEY RD
GREEN RIVER RD.
U.S. HIGHWAY 20
SOUTH SANTIAM HIGHWAY
LONG ST.
MAIN ST.
AIRPORT ROAD
AMES CREEK
AMES CREEK RD.
WILEY CREEK
WILEY CREEK RD
HWY 228
OLD HOLLEY RD.
ROWELL HILL RD
SPORTSMAN RD
TURBYNE RD.
PROJECT LOCATION MAP
WASHINGTON
OREGON
IDAHO
CALIFORNIA
NEVADA
PACIFIC OCEAN
PROJECT LOCATION
LEGEND
DRAINAGE AREA BOUNDARY
PIPE
CREEK
OPEN DITCH
DRAINAGE OUTFALL
SUBCATCHMENT
PROPOSED URBAN GROWTH BOUNDARY
SWMM MODEL NUMBER CODES BY GENERAL AREA
100-STRAWBERRY SUB-BASIN GUTTER/PIPES, INLETS & CULVERTS
200-STRAWBERRY SUB-BASIN SUBCATCHMENTS
300-AMES SUB-BASIN GUTTER/PIPES, INLETS & CULVERTS
400-AMES SUB-BASIN SUBCATCHMENTS
500, 600, 800 LONG STREET SUB-BASIN GUTTER/PIPES, INLETS & CULVERTS
600-LONG STREET SUB-BASIN SUBCATCHMENTS
700-AMES CREEK
400 1600
0 800 3200
NO. DATE DESCRIPTION OF REVISION BY
MARCH 1979
MAP BASED UPON COMPOSITE OF LINN COUNTY, OREGON TAX ASSESSMENT MAPS
CITY OF SWEET HOME
"FULL DEVELOPMENT"
CREEKS, OPEN DITCHES AND PIPES
DEVCO ENGINEERING INC.
MAP NO.
IV-1



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0 800 3200

ZONING EXTRACTED FROM CITY OF SWEET HOME PROPOSED COMPREHENSIVE PLAN

NO.	DATE	DESCRIPTION OF REVISION	BY

MARCH 1979

MAP BASED UPON COMPOSITE OF LINN COUNTY, OREGON TAX ASSESSMENT MAPS

CITY OF SWEET HOME

PROPOSED ZONING MAP

DEVCO ENGINEERING INC.

MAP NO. IV-2

somewhere around the year 2035. If, however, future growth over the next decades actually approximates a 3 per cent annual compound rate, 'full development' will occur about the year 2010. Obviously, assigning a design year for 'full development' is highly speculative and this study does not do so. This study provides for the 'full development' of the City as currently envisioned in its Proposed Comprehensive Plan whenever that 'full development' may occur.

To focus the City's implementation of the Proposed Storm Drainage Plan, it is recommended that the following capital improvements in the priority shown. These improvements more than any others will firmly establish the fundamental aspects of the Proposed Plan. They bring attention to the major sub-basins and their outfalls, they improve the outfall reaches to provide for upstream growth, they provide the greatest public vs. local benefit, and they deal with the higher design flows, hence higher risks first.

PRIORITY NO.	MODEL I.D. NO.	LOCATION	DESCRIPTION
1	552,572,576	U.S. 20 @ 27th Avenue thru Willamette Industries	Willamette Industries between Clark Mill Road and 18th St. sits on top of three important drainages (552,576,534). One of these (552) is blocked by land fill and the log pond. This is the drainage flowing north from Ashbrook Subdivision which will carry every higher storm runoff in the near future. This will compound Willamette Industries problems with control of the quantity and quality of its pond discharge. During periods of high storm runoff, this drainage must pass thru the porous

PRIORITY NO.	MODEL I.D. NO.	LOCATION	DESCRIPTION
			land fill, thence into the pond and out its overflow, finally outfalling into the "Old Santiam Channel" immediately north of Willamette Industries. It is proposed to realign this drainage beginning at U.S. 20, thence eastward to join the existing westerly drainage at the railroad tracks, thence thru a new culvert under the railroad tracks and continue in the existing alignment thru the log stacks and outfall in the "Old Santiam Channel". This realignment outlet reach will drain the City south of the railroad between Mountain View Road and approximately 47th Street.
2	518,520,564	Midway area south of Long Street	Future population growth will concentrate here. Storm drainage decisions for this area are needed now if not yesterday. The fundamental solution proposed is to divert as much of the existing westerly flow to the north along the east edge of Ashbrook and avoid the restrictions in the older downtown area. The major drainage (518,520,564) alignment in this Midway area coincides with future collector streets shown in the City's Proposed Comprehensive Plan. It is expected that most of the improvements in the Midway area will be funded and constructed by future subdivision developments.
3	530	18th Ave. north of Tamarack St.	The general area north of the railroad and west of Willamette Industries is poorly drained. The natural topography is a large shallow depression with surface outlet to the southwest. The major drainages entering this depression are a 48" pipe from

PRIORITY NO.	MODEL I.D. NO.	LOCATION	DESCRIPTION
			under Willamette Industries' finished laydown yard and a 24" pipe flowing north under 18th. These come together at a flow diversion structure on 18th 200' north of Tamarack. From here one 30" pipe continues north to the Santiam. Excess water overflows into a flat undersized surface ditch to the southwest. Frequent flooding characterizes this area north of the railroad. It is proposed to redesign the flow diversion and construct a 48" pipe parallel to the existing 30" pipe north under 18th and eliminate all diverted surface flow to the southwest except for the water rights of Lester Shingle Mills (½ cfs to maintain 25.8 ac-ft. long pond).
4	316	Holley Road north of 4th Avenue east to Ames Creek	Storm drainage comes down Holley Road into this swale area at the base of the hill between Long St. and Main St. and backs up as surface flooding because of inadequate major drainage to the northwest under Main St. and along Holliday Mobile Park. It is proposed to reverse the flow direction from northwest to east by constructing 700' of open channel and 500' of 48" pipe under Long St. extending to Ames Creek. Some of the swale can be filled and reclaimed.
5	118,104, 102	Hwy 228 @ Evergreen to US 20 @ 1st Ave.	A) Remove the short length of 42" culvert below culvert #105 at Nandina Street. B) Enlarge open channels and replace culverts as noted in Proposed Plan. C) The 36" pipe under Pine Street is inadequate. It is proposed to construct a bypass under Pine St beginning at Hwy 228, culvert #105, thence eastward within the Hwy 228 right-of-way 1000' thence northward 500' to join the existing drainage.

PRIORITY NO.	MODEL I.D. NO.	LOCATION	DESCRIPTION
6	806	49th Ave. to U.S. 20	Most of this reach is a siphon which appears to perform well for low flows. The overflow channel above this siphon, however, has been encroached on and blocked. This overflow channel must be reconstructed to help eliminate the periodic flooding which occurs between 47th and 49th Aves.

Runoff hydrographs resulting from the 10, 25, and 100 year synthetic design storms were computed for every pipe and channel modeled. These are Appendix D. The peak design flows from these 'full development' runoff hydrographs are tabulated in Table IV-2. It is recommended that all design of major drainage open channel and pipe segments be based on the design flows shown in Table IV-2.

CULVERTS

Map III-3 and Table III-4 locate and list respectively the 49 most significant culverts in the modeled area. Table III-4 compares existing capacities with proposed design flows, identifying the existing culverts which are shown to be inadequate. It can be seen that 28 of the existing culverts are inadequate for 'full development'.

TABLE IV-2

'FULL DEVELOPMENT' DESIGN FLOWS

MODEL NO. GUTTER OR PIPE	LOCATION	DESIGN FREQUENCY	DESIGN FLOW(cfs)
102	Main St. south to W. Nandina	25	309
104	W. Nandina southwest to Pine St.	25	282
106	Hwy 228 southwest to Rowell Hill Road	25	233
108	Rowell Hill Road southwest to Hwy 228	10	53
110	Parallel southwest along Rowell Hill Road	10	10
112	Hwy 228 south towards Sportsmans Road	25	108
114	North of Old Holley Road as it turns south into Sportsman Road	10	32
115	West and east along W. Nandina St.	10	16
118	Pine Street southwest to Hwy 228	25	245
120	Old Holley Road to Pine Street	25	240
300	Ames Creek-Railroad tracks north to South Santiam River	100	2455
316	Between Main Street and railroad tracks at Holley Road	25	114
318	Under Holley Road at 45th Ave.	10	65
320	Along Hwy 228 at 1st Ave. east to Oak Terrace	10	21
322	South on 4th Avenue from Oak Terrace to Ironwood then west to 3rd Ave.	10	38
324	From Holley Road to Oak Terrace south of Long Street	25	54
326	South along 6th Ave. from Oak Terrace to Ironwood, then west on Ironwood to 5th Avenue	10	37

TABLE IV-2

'FULL DEVELOPMENT' DESIGN FLOWS
Continued

MODEL NO. GUTTER OR PIPE	LOCATION	DESIGN FREQUENCY	DESIGN FLOW(cfs)
328	Southeast from Oak Terrace south of Ames Creek	25	36
330	South on 9th Avenue to Old Holley Road	10	51
332	East of Old Holley Road and southwest of 9th Avenue	10	18
336	Southwest on Old Holley Road from Alder St.	10	28
338	Northwest at base of bench from 10th & Elm to Ames Creek	25	232
340	Taylor Creek-south just north of Elm to Old Holley Rd. west of 12th Avenue	25	145
342	South from end of 10th Avenue-Taylor Creek	10	90
344	South of 342 - Taylor Creek	10	66
346	Southwest along 16th Avenue from Ames Creek to Cedar Street	10	11
348	17th Avenue from Cedar Street to Ames Creek	10	4
350	Southwest along 18th Avenue from Ames Creek to Cedar Street	10	4
352	South along Mountain View Road from Ames Creek to Cedar Street	10	16
354	South from Ames Creek east of Turbyne Road	10	119
356	South of 354 east of Turbyne Road	10	98
358	South of 344 - Taylor Creek	10	33
360	South of 356 near Turbyne Road	10	47
501	Northwest of 9th Avenue and railroad intersection to South Santiam River	25	185

TABLE IV-2

'FULL DEVELOPMENT' DESIGN FLOWS
Continued

MODEL NO. GUTTER OR PIPE	LOCATION	DESIGN FREQUENCY	DESIGN FLOW(cfs)
504	Southwest from 18th Avenue across Tamarack St, south to railroad tracks and west to 12th Avenue	10	40
506	Between railroad track and Main Street west from 15th Avenue to 12th Avenue	25	150
508	Northwest from Main and 18th to north of 15th Avenue and south of railroad tracks	25	108
509	Southeast of intersection Main and 18th to Long Street and east of railroad tracks	25	116
510	South of Kalmia Street and railroad tracks to 22nd Avenue	10	49
511	South along 18th Avenue from Main Street to railroad	10	15
512	Southeast from railroad to 22nd Ave.	10	36
514	West from 22nd Ave. to 23rd just north of Mountain View Road	10	44
515	South along 22nd Avenue to across Mountain View Road	10	29
516	East along 22nd Avenue south of Mountain View Road	10	30
517	South of railroad tracks at 9th Avenue east of 12th Avenue	25	146
518	North of Foothills Blvd. south of Hawthorne Way and east along Foothills Blvd.	10	26
520	South of 38th Avenue to Foothills Blvd. then east to 42nd Ave.	10	23

TABLE IV-2

'FULL DEVELOPMENT' DESIGN FLOWS
Continued

MODEL NO. GUTTER OR PIPE	LOCATION	DESIGN FREQUENCY	DESIGN FLOWS(cfs)
521	North of railroad right-of-way from 12th Avenue west to 9th Avenue	10	42
523	North of Main Street west of 18th Avenue	25	121
530	South from South Santiam River along 18th Avenue to "U" Street	10	103
532	Southeast from "U" Street to Tamarack Street	10	73
534	South from Tamarack to rail-road tracks, east of 18th Avenue	10	58
536	South from Tamarack along 18th Avenue to railroad tracks, southeast to Main Street	10	20
538	East of railroad track intersection, north of Nandina Street, east towards 24th Avenue	10	45
540	South from Nandina Street across Main Street to Long Street	10	22
552	East of 24th Avenue, south from railroad tracks to Main Street	25	172
556	South of Main Street, west of Flannigan Road, southeast from Main to Long Street	25	157
560	East of 27th Avenue, south of Long Street, from Long Street to Foothills Blvd.	10	23
564	South along Hawthorne Way, then east to 38th Avenue	25	127
565	South of Long Street, 38th Avenue east to 42nd Avenue	10	37

TABLE IV-2

'FULL DEVELOPMENT' DESIGN FLOWS
Continued

MODEL NO. GUTTER OR PIPE	LOCATION	DESIGN FREQUENCY	DESIGN FLOW (cfs)
566	North of Long Street and east along Long Street to 42nd Ave.	10	40
568	Along west side of 42nd Avenue south then east to 43rd Avenue	10	40
572	North thru Willamette Industries	25	522
576	South of railroad tracks, east along tracks between Clark Mill Road and 24th Avenue	25	360
580	South of railroad track, east along tracks between Clark Mill Road and 40th Avenue	25	102
582	Northwest of South Santiam Hwy to Clark Mill Road at railroad	25	269
584	South of railroad track, south-east between 40th Avenue and 42nd Avenue	10	29
586	South of South Santiam Hwy, south-east between 37th Avenue to 43rd Avenue	25	292
590	North along Long Street from 43rd Avenue to 47th Avenue	25	100
594	South on 43rd Avenue from Long St. to future Foothills Blvd.	10	97
597	South to Long St. on 45th Avenue	10	52
702	Ames Creek, Main Street north to railroad tracks	100	2463
704	Ames Creek, Long Street north to Main Street	100	2362
706	Ames Creek, Long Street south to 12th Avenue	100	1972
707	Ames Creek, 12th Avenue east to 13th Avenue	100	1964

TABLE IV-2

'FULL DEVELOPMENT' DESIGN FLOWS
Continued

MODEL NO. GUTTER OR PIPE	LOCATION	DESIGN FREQUENCY	DESIGN FLOW(cfs)
708	Ames Creek, 13th Avenue southeast to railroad tracks right-of-way	100	1972
710	Ames Creek, railroad track right-of-way southeast to Turbyne Road	100	1914
712	Ames Creek, Turbyne Road south-east to where Ames Creek nearly meets Ames Creek Road	100	1657
802	Southeast from South Santiam Hwy south of 42nd Avenue across 44th Avenue to 47th Avenue	10	35
803	South of railroad tracks north of Osage Street	10	56
806	South of South Santiam Hwy, 45th Avenue across 46th, 47th to 49th Avenue	25	117
810	South of Santiam Hwy along 49th Avenue to Airport Road	25	110
814	East end of Airport Road, south past end of 49th Avenue	10	68
818	East of 44th Avenue, west of 47th Avenue, south of railroad tracks to South Santiam Hwy	25	129

DISCUSSION

This study has produced a planning model of the City's major storm drainage.

Modeling of the City's watershed involves necessary averaging of drainage conduit parameters such as slope, width, overflow depths, etc. A consequence is that detail design of particular drainage segments may differ from the average drainage cross-sections used in the model. Channel changes may result from variable slopes within a reach, energy dissipators to control velocity and erosion, site specific decisions to change open channels to pipes, freeboard added to flow depths shown, etc. The cross-sections shown as overlays on the City topographic maps (see Map IV-3) are only typical of what is necessary to pass the design runoffs.

The design runoffs, Table IV-2 and Appendix D are the most important element of the Proposed Master Storm Drainage Plan. Drainage improvements are to be based on these runoff rates.

DRAINAGEWAY ACCESS

A Master Storm Drainage Plan is of limited value if it cannot be maintained. Something has to be done to reserve to the City the right of access to all major drainages modeled. These drainages are important to the public welfare and safety, and the City's growth. Initially this 'something' could be a policy committing the City to an opportunistic program of acquiring drainage access. It is the right of access that is paramount, the legal form of access, whether dedication or easement is secondary. However, dedication is favored over easement. Such a program could be based on the example future right-of-way needs shown. Existing recorded access rights could be researched and plotted against these example future needs; then public strategies could be formulated to assure the City's ability to reach and care for all the major drainages.

It it clear that, nationwide, litigation resulting from increased storm water runoff is on the rise. Within Oregon the 'civil law rule' doctrine prevails in storm runoff judgements, but court decisions in these cases are not predictable. If there is any trend in these decisions it is towards 'equity' or 'reasonableness'. In this legal climate, possible exposure to a potential liability suit for damages is quite real.

RECOMMENDED ADDITIONAL STUDY

1. Calibrate and Verify SWMM. Why?

   Because the application of SWMM is somewhat more art than science. Calibration and verification permit refinement and checking of the SWMM parameters used to describe the Sweet Home watershed, thereby increasing the confidence in the design flows. A recorded rainfall is input into the SWMM and the SWMM output flows are compared with measured flows in several of the major drainages around town. Differences are minimized by adjusting the model parameters. Three periods of rainfall-runoff are used. This is calibration! To increase the model reliability still further, another set of three rainfall-runoff periods is run through the SWMM,and the SWMM and measured flows are again compared. Good correlation would be expected. This is verification! To do this in Sweet Home, several drainages must be gauged and recorded. Locations must be chosen, as well as the type of gauge, and a gauge rating curve prepared. The easiest locations (control sections) may be found at culverts or at uniform reaches of open channels, but each site must be investigated carefully.

Peak flow and time-of-peak (versus the complete hydrograph) are all that is needed. The U.S. Geological Survey will lend crest chart recorders (if available) to the City at no cost.

Gauge height discharges or rating curves can be compiled theoretically from published culvert capacity tables or if an open channel reach is used for the control section, the Manning equation may be used to define the reaches hydraulic properties.

2. Investigate the feasibility of a large municipal detention on Ames Creek behind 14th Avenue on the site of the Old Mill Pond. Work with the SWMM suggests that a detention basin sufficient to regulate a 100 year runoff is possible. Some of this area is currently designated as City Park which is a very compatible land use with a detention basin. The old pond outlet structure would be useful in the detention design. Regulation of Ames

Creek at this point would reduce the need for downstream improvements. The 100 year flood impact shown in the pending Federal Insurance Agency Flood Insurance Rate Map (FIRM)[12] could be reduced saving 'x' amount of insurance dollars over the life of the structure. Most notably the wide-spread shallow flooding (FIRM Zone B) throughout the downtown area might possibly be eliminated. (The Federal Flood Insurance program does not require mandatory insurance in Zone B.) A careful economic analysis of the alternatives is required. It is recommended that these alternatives be explored before the City approves this land for other uses. The area in question is 400 feet either side of Ames Creek from Carla Place Subdivision downstream to the old pond outlet structure.

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12 'Preliminary' copy made available by the Public Works Department, City of Sweet Home

Recommendations

CHAPTER V

RECOMMENDATIONS

Based on the foregoing, we recommend:

1. That the City of Sweet Home adopt the proposed intensity-frequency-duration curves prepared for the City.

2. That the City adopt the design frequency criteria proposed.

3. That the City adopt the detention concepts and criteria proposed.

4. That the City adopt the Proposed Master Storm Drainage Plan.

5. That the City adopt policies which will reserve to the City, via dedication or easement, the right of access to all drainages modeled herein.

6. That the City Engineer become familiar with the EPA Storm Water Management Model.

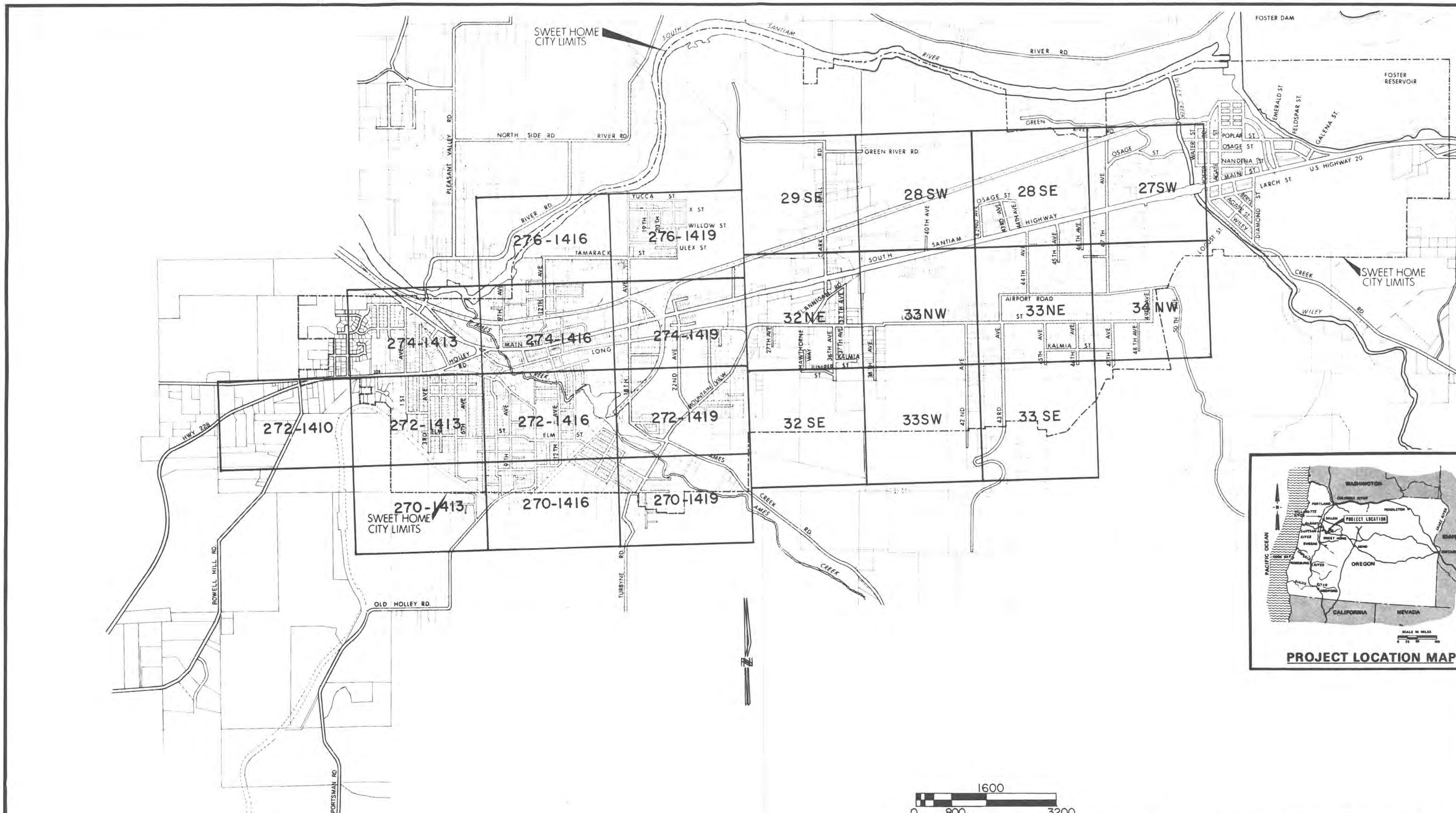
7. That the City install at least one (but preferably 3) runoff measurement gauges this fall and that the storm water model of the City of Sweet Home be calibrated and verified.

8. That the City's as-built records of existing enclosed storm pipe be systematically improved.

9. Investigate feasibility of municipal detention facility on Ames Creek upstream of 14th Avenue before releasing this land to other uses.

MAPS

1" = 100' City Topographical Maps
Overlaid With
Proposed Master Storm Drainage Plan



NO.	DATE	DESCRIPTION OF REVISION	BY

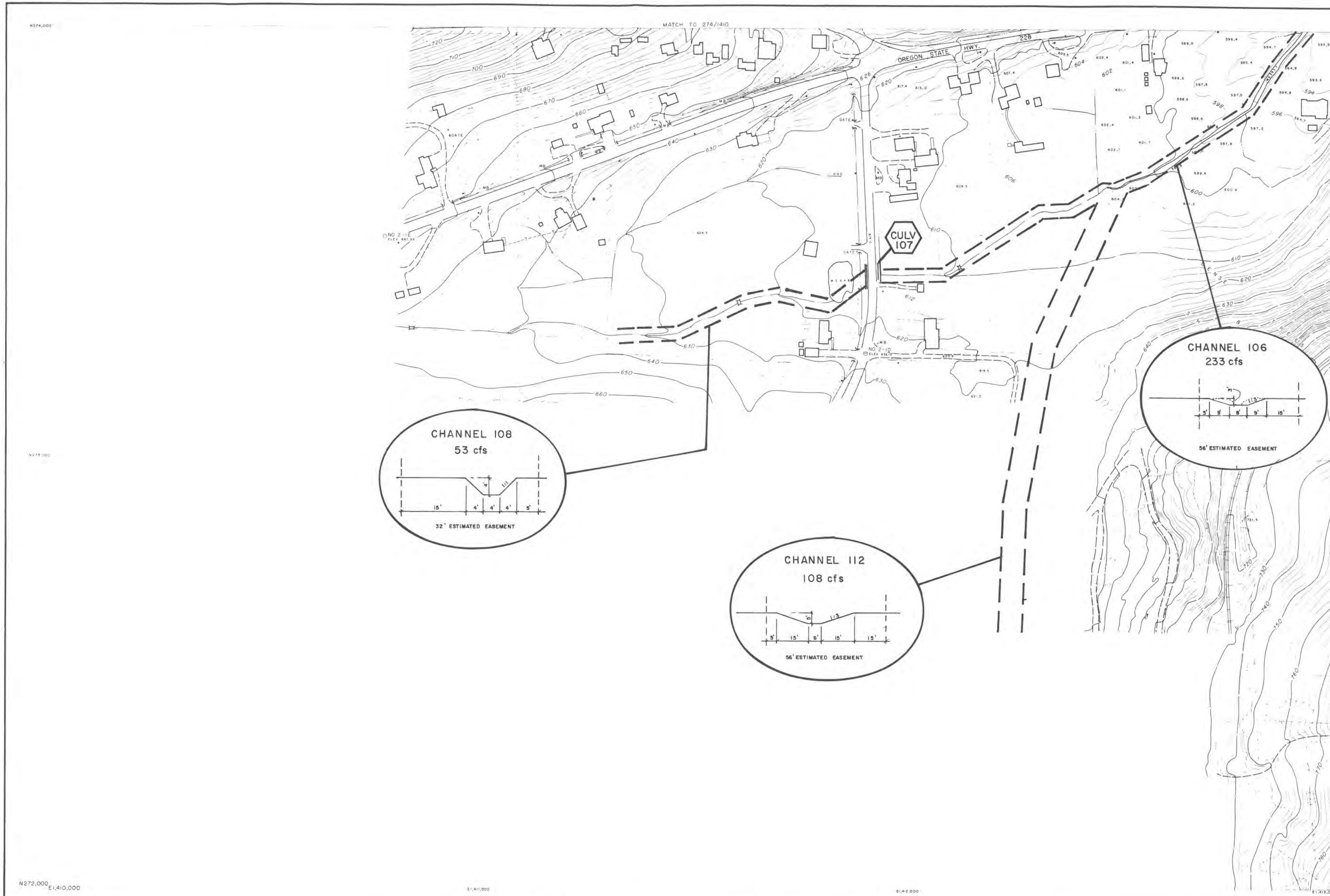
MAPS INDEXED ARE CITY OF SWEET HOME TOPOGRAPHIC MAPS

CITY OF SWEET HOME

MAP INDEX

DEVCO ENGINEERING INC.

MAP NO. IV-3



PREPARED BY CHICKERING-GREEN EMPIRE, INC.
EUGENE, OREGON

COMPILED FROM AERIAL PHOTOGRAPHY DATED 12-17-70 AND 3-19-79

NOTE: DASHED CONTOURS MAY INDICATE LESS THAN STANDARD ACCURACY DUE TO DENSE GROUND COVER AND HEAVY SHADOWS

REV.	BY	DESCRIPTION	DATE

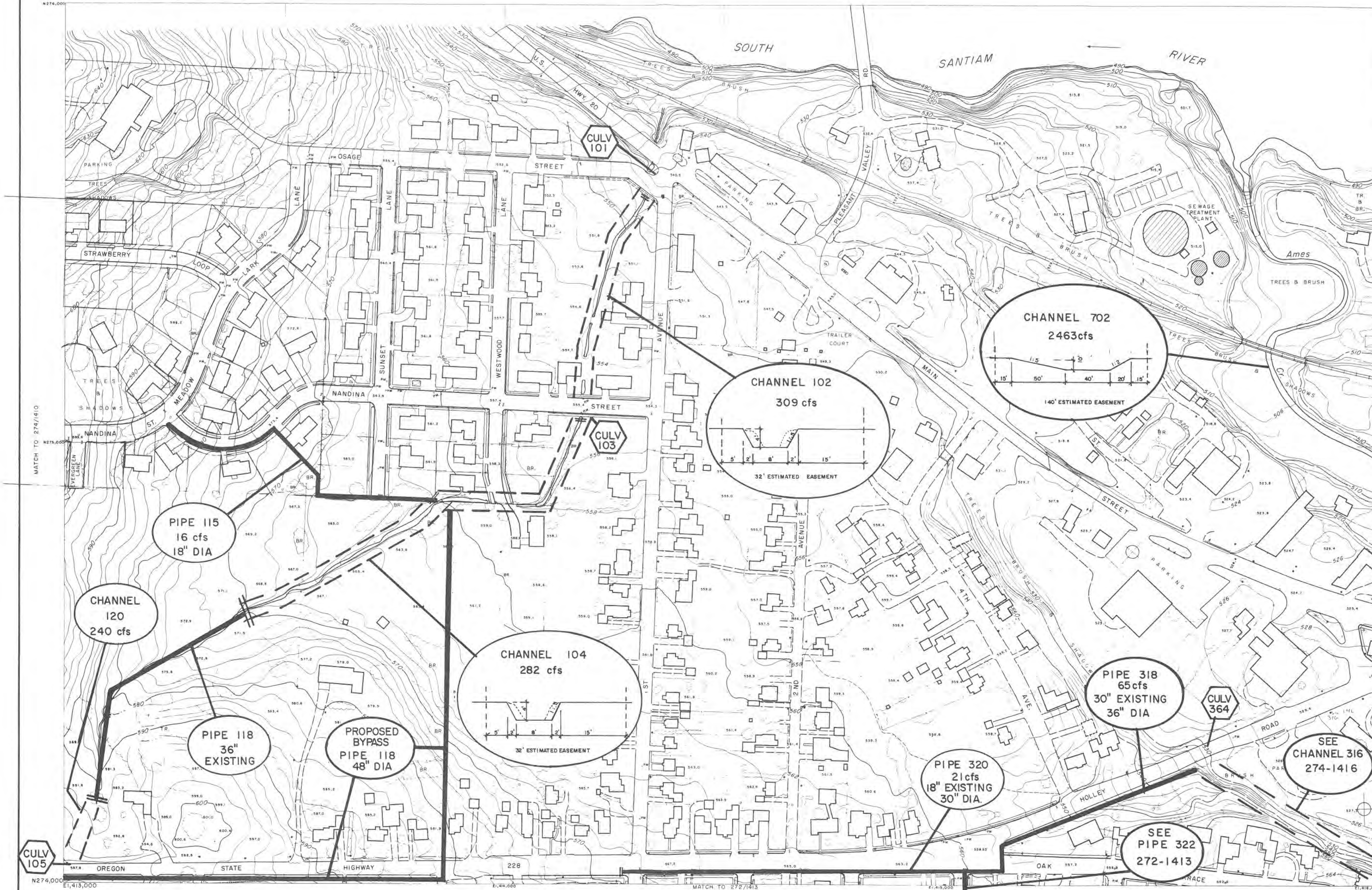
USC & GS DATUM 1947 ADJUSTMENT
GRID BASED ON LAMBERT PROJECTION
OREGON NORTH ZONE

CITY OF SWEET HOME

PUBLIC WORK DEPARTMENT
SWEET HOME, OREGON

SHEET NO. 272/1410

FLAT FILE NO.



PREPARED BY THE OFFICE OF H.G. CHICKERING JR., CONSULTING PHOTOGRAMMETRIST INC. EUGENE, OREGON	REV. / BY / DESCRIPTION / DATE	USC & GS DATUM 1947 ADJUSTMENT GRID BASED ON LAMBERT PROJECTION OREGON NORTH ZONE	CITY OF SWEET HOME PUBLIC WORK DEPARTMENT SWEET HOME, OREGON
COMPILED FROM AERIAL PHOTOGRAPHY DATED 12-17-70	NOTE: DASHED CONTOURS MAY INDICATE LESS THAN STANDARD ACCURACY DUE TO DENSE GROUND COVER AND HEAVY SHADOWS.		SHEET NO. 274/1413 FLAT FILE NO.

PREPARED BY CHICKERING-GREEN EMPIRE, INC. EUGENE, OREGON COMPILED FROM AERIAL PHOTOGRAPHY DATED 12-17-70 AND 3-19-79	NOTE: DASHED CONTOURS MAY INDICATE LESS THAN STANDARD ACCURACY DUE TO DENSE GROUND COVER AND HEAVY SHADOWS	REV. | BY | DESCRIPTION | DATE	USC & GS DATUM 1947 ADJUSTMENT GRID BASED ON LAMBERT PROJECTION OREGON NORTH ZONE

CITY OF SWEET HOME
PUBLIC WORK DEPARTMENT
SWEET HOME, OREGON

SHEET NO. 272/1413

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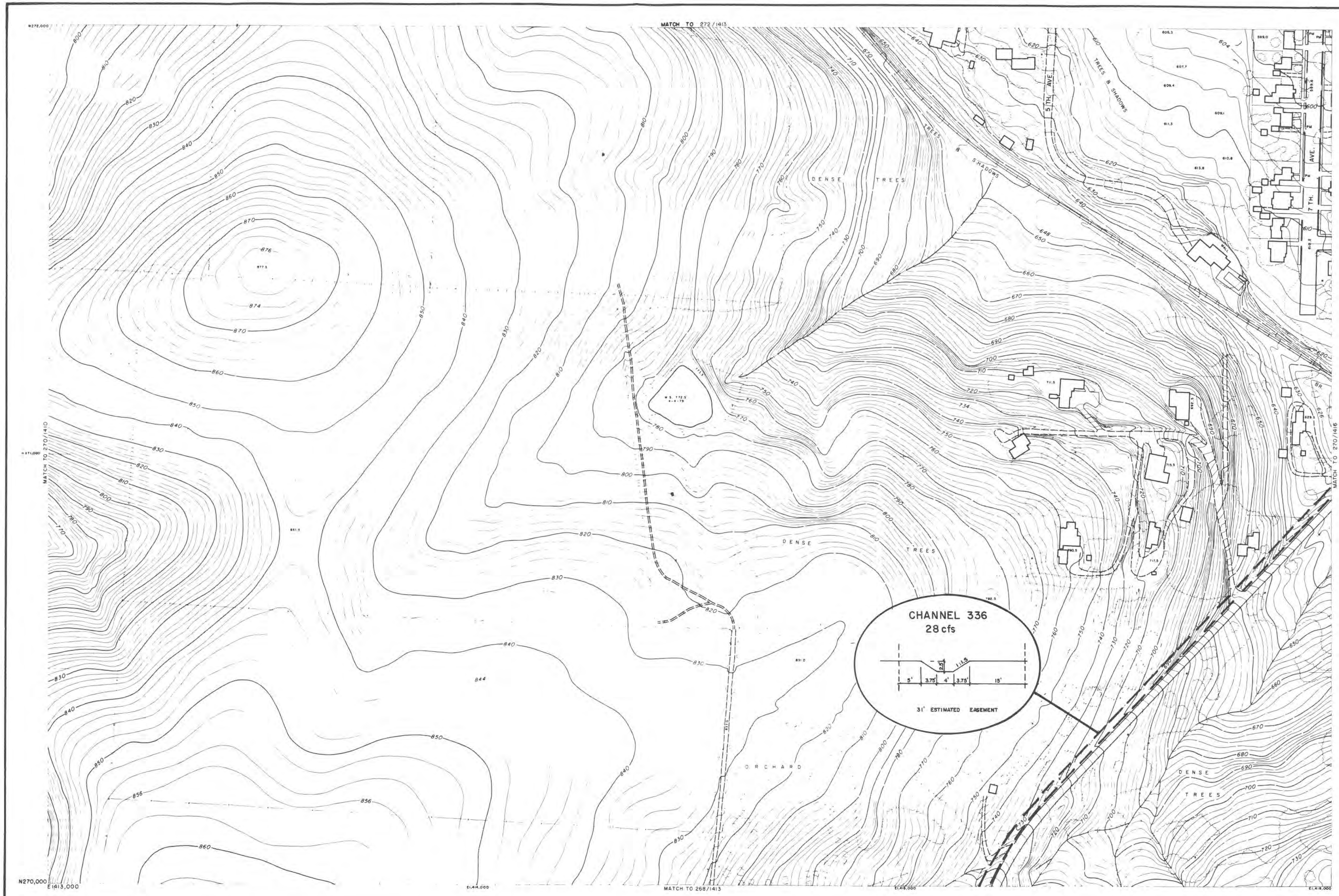

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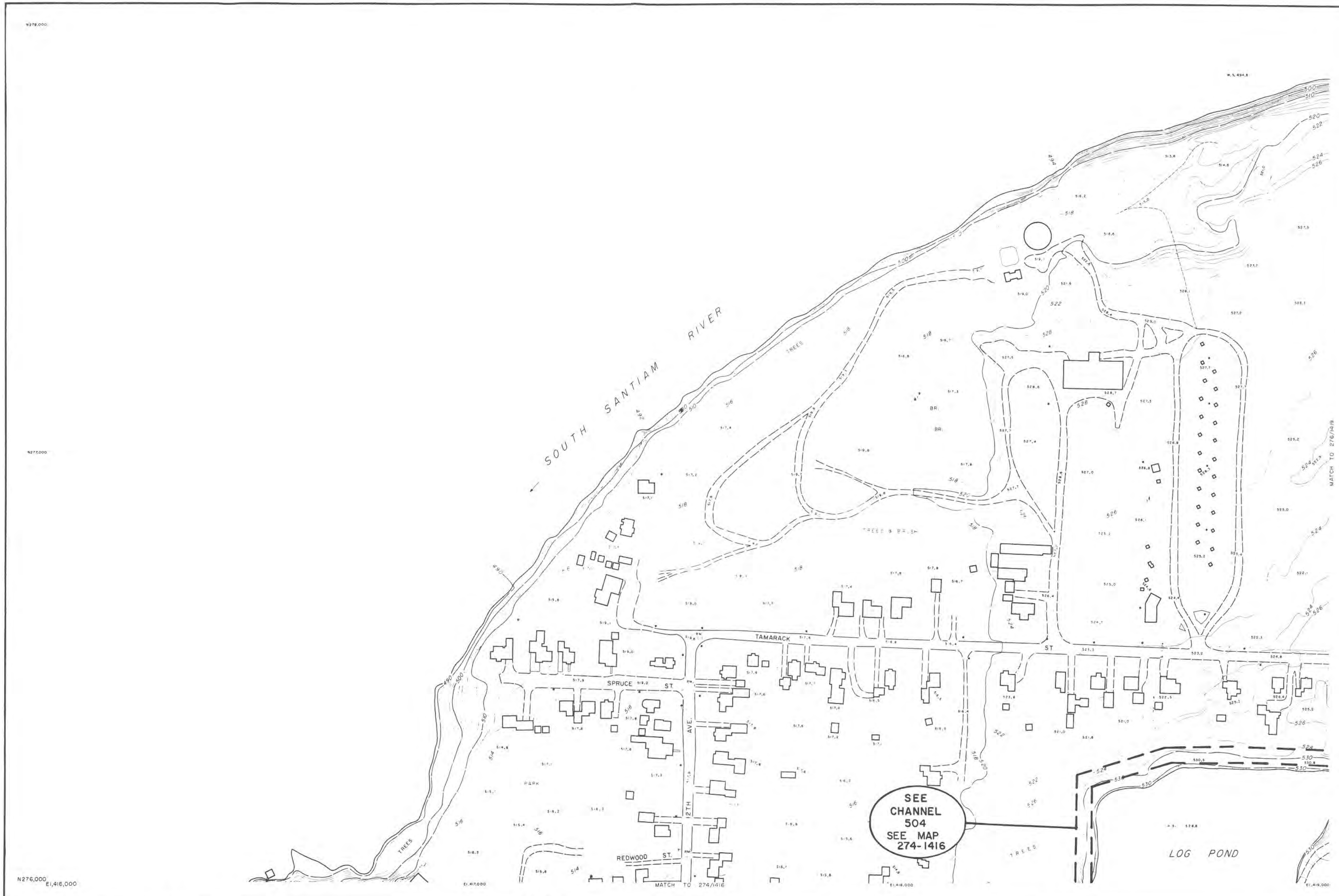
COMPILED FROM AERIAL PHOTOGRAPHY DATED 12-17-70 AND 3-19-79	NOTE: DASHED CONTOURS MAY INDICATE LESS THAN STANDARD ACCURACY DUE TO DENSE GROUND COVER AND HEAVY SHADOWS.						USC & GS DATUM 1947 ADJUSTMENT GRID BASED ON LAMBERT PROJECTION OREGON NORTH ZONE	PUBLIC WORK DEPARTMENT SWEET HOME, OREGON	FLAT FILE NO.



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COMPILED FROM AERIAL PHOTOGRAPHY DATED 12-17-70

NOTE: DASHED CONTOURS MAY INDICATE LESS THAN STANDARD ACCURACY DUE TO DENSE GROUND COVER AND HEAVY SHADOWS.

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USC & GS DATUM 1947 ADJUSTMENT
GRID BASED ON LAMBERT PROJECTION
OREGON NORTH ZONE

CITY OF SWEET HOME
PUBLIC WORK DEPARTMENT
SWEET HOME, OREGON

SHEET NO. 276/1416

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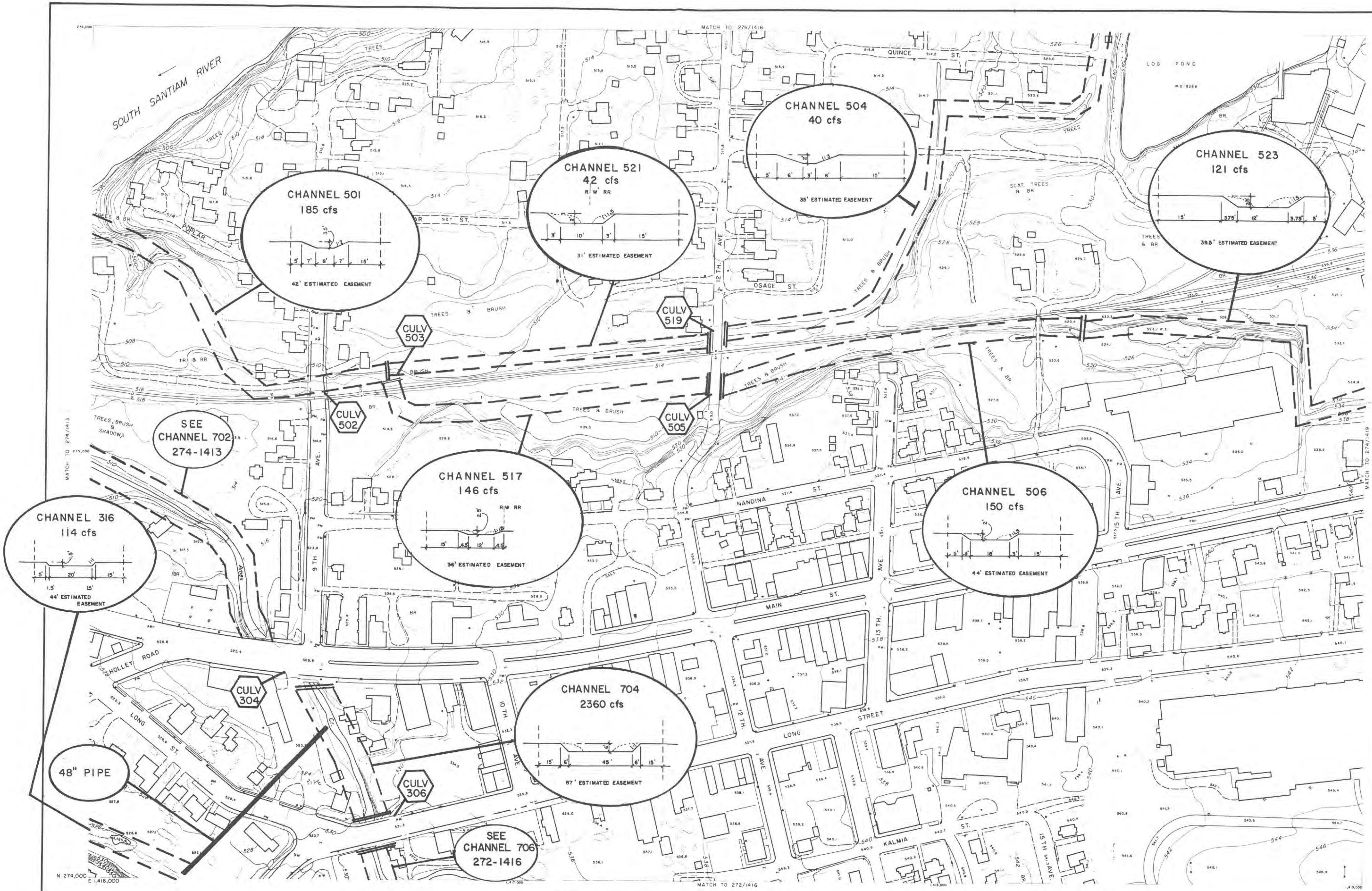

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COMPILED FROM AERIAL PHOTOGRAPHY DATED

REV.	BY	DESCRIPTION	DATE

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OREGON NORTH ZONE

SHEET NO. 274-1416

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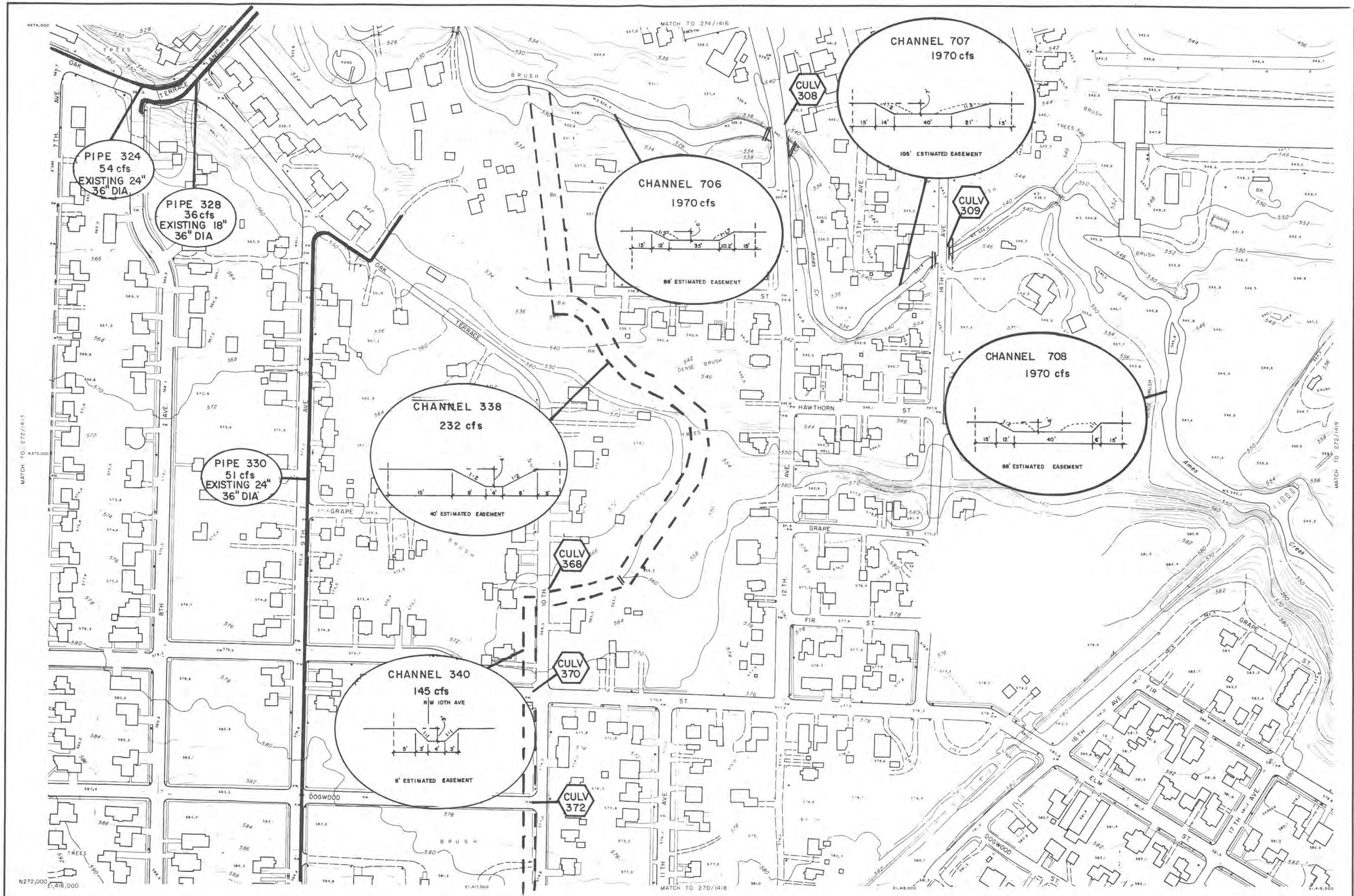

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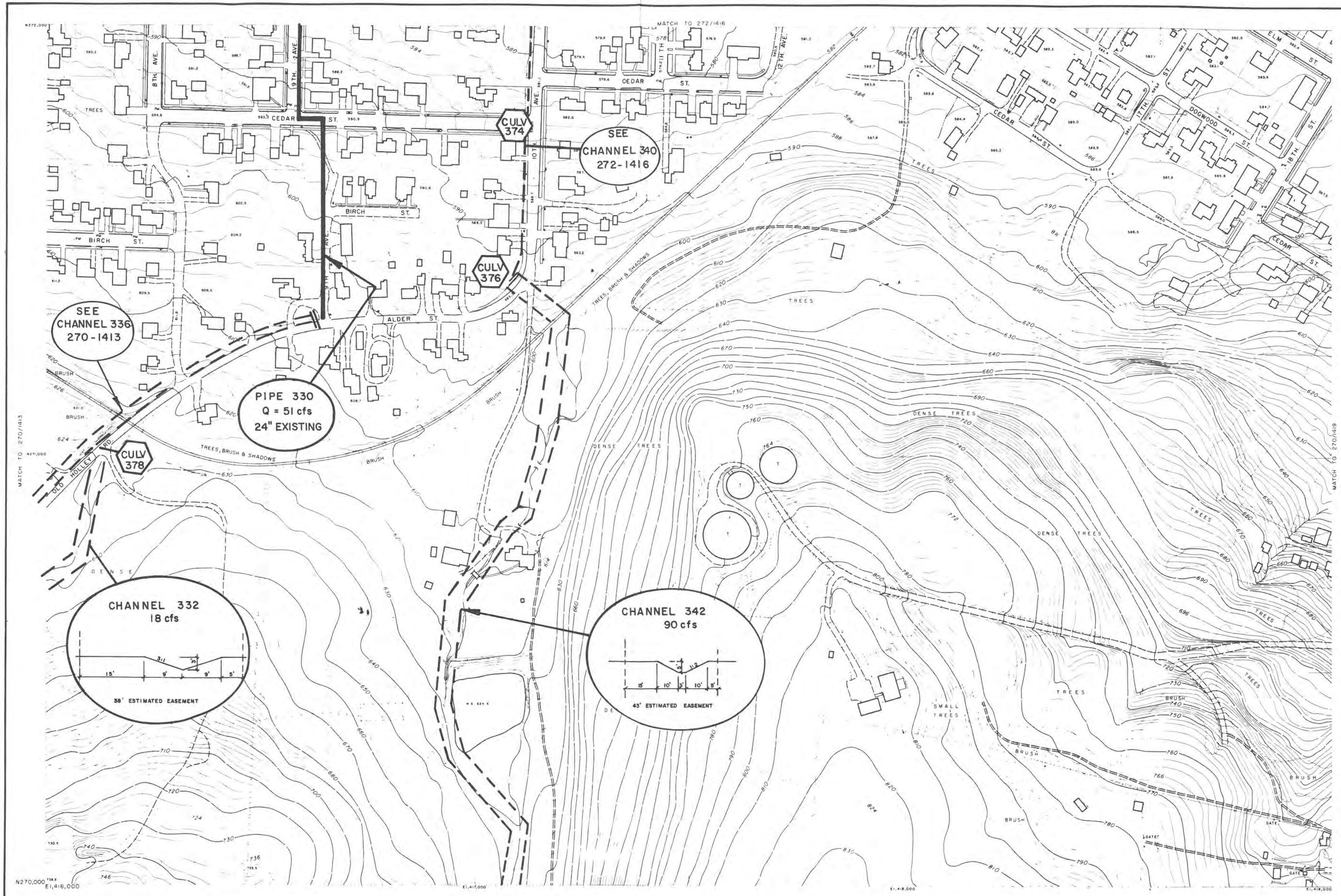

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COMPILED FROM AERIAL PHOTOGRAPHY DATED 12-17-70 AND 3-19-79	NOTE: DASHED CONTOURS MAY INDICATE LESS THAN STANDARD ACCURACY DUE TO DENSE GROUND COVER AND HEAVY SHADOWS.

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OREGON NORTH ZONE

CITY OF SWEET HOME
PUBLIC WORK DEPARTMENT
SWEET HOME, OREGON

SHEET NO. 270/1416

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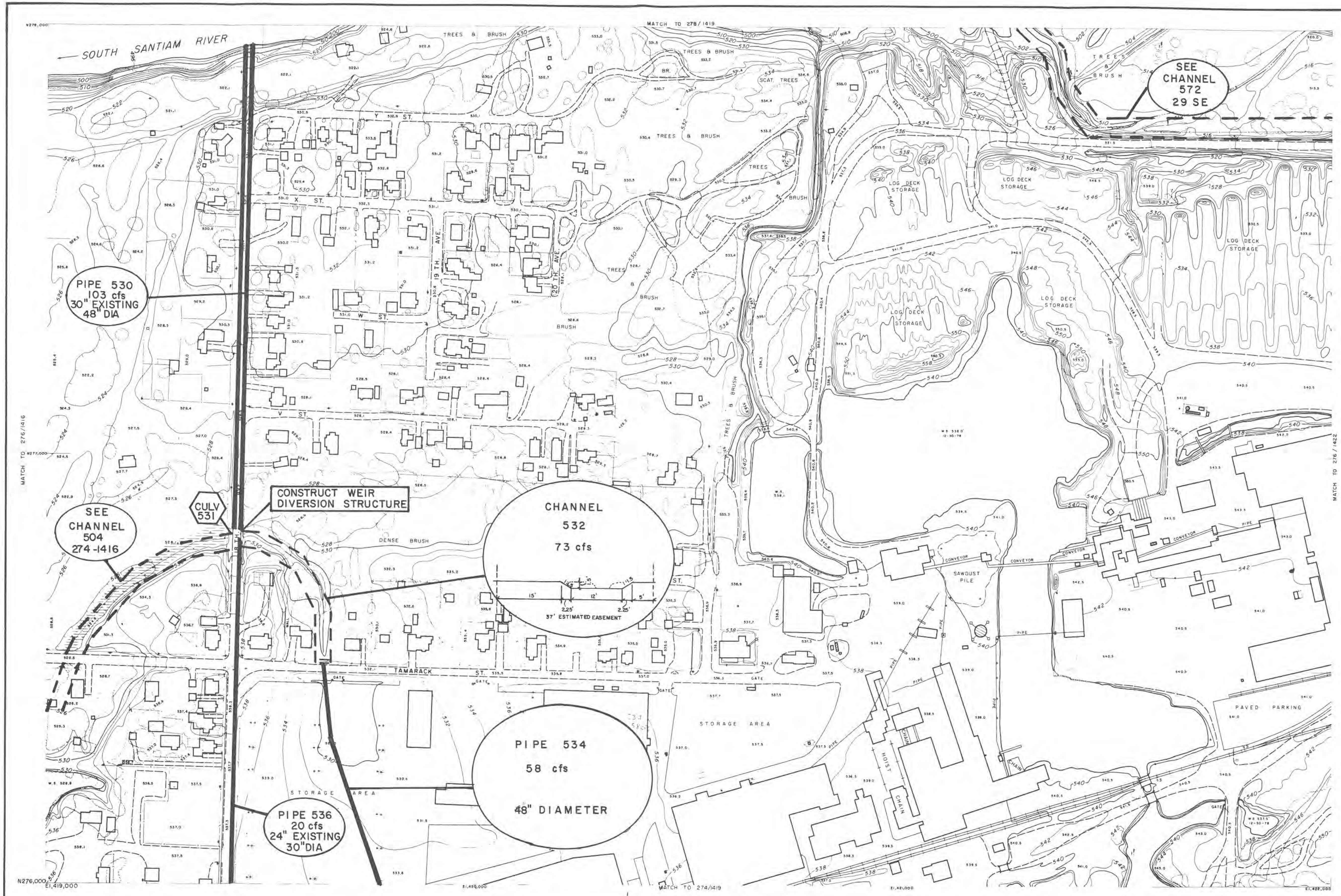

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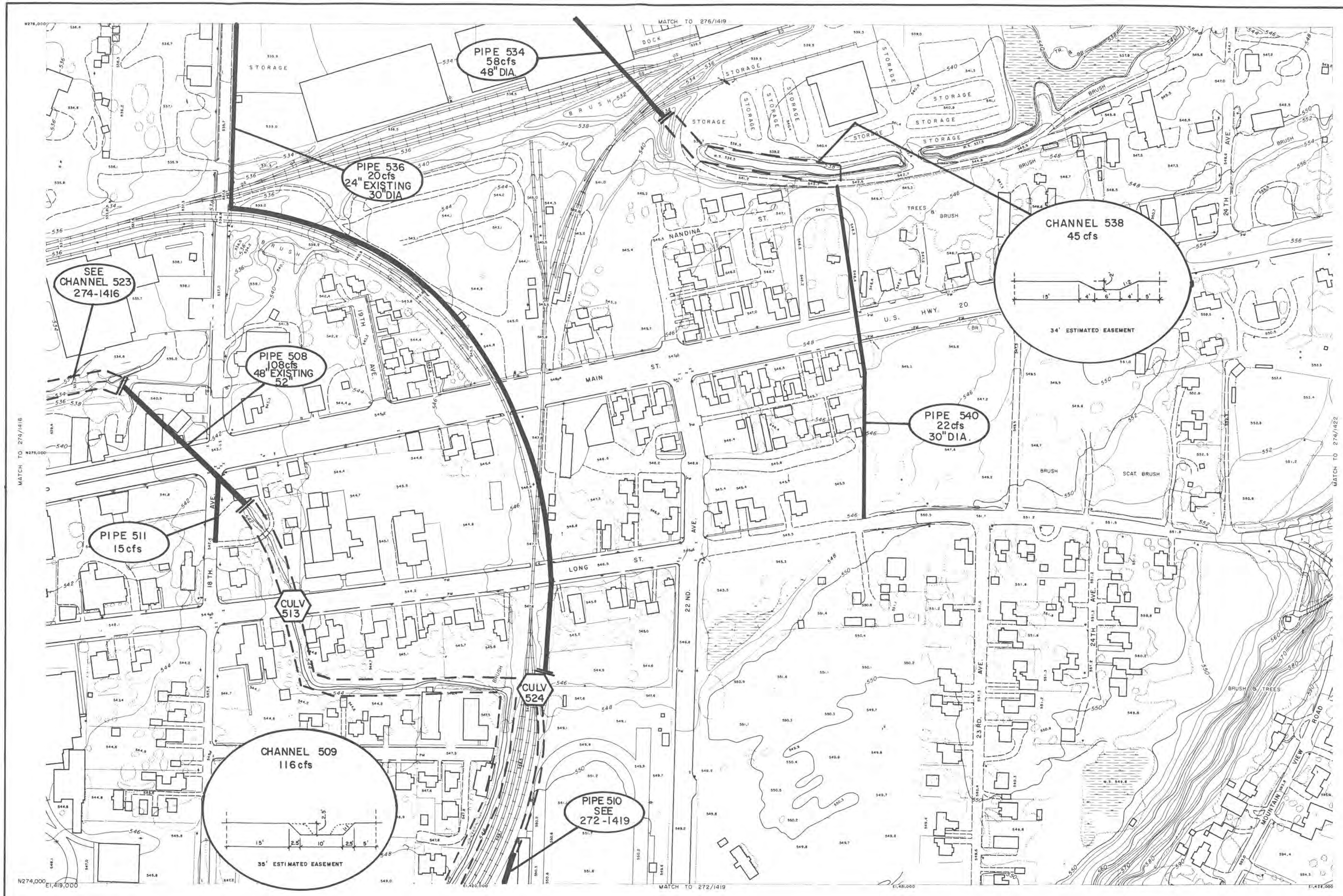

PREPARED BY CHICKERING-GREEN EMPIRE, INC.
EUGENE, OREGON

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USC & GS DATUM 1947 ADJUSTMENT
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OREGON NORTH ZONE

CITY OF SWEET HOME
PUBLIC WORK DEPARTMENT
SWEET HOME, OREGON

SHEET NO. 274/1419

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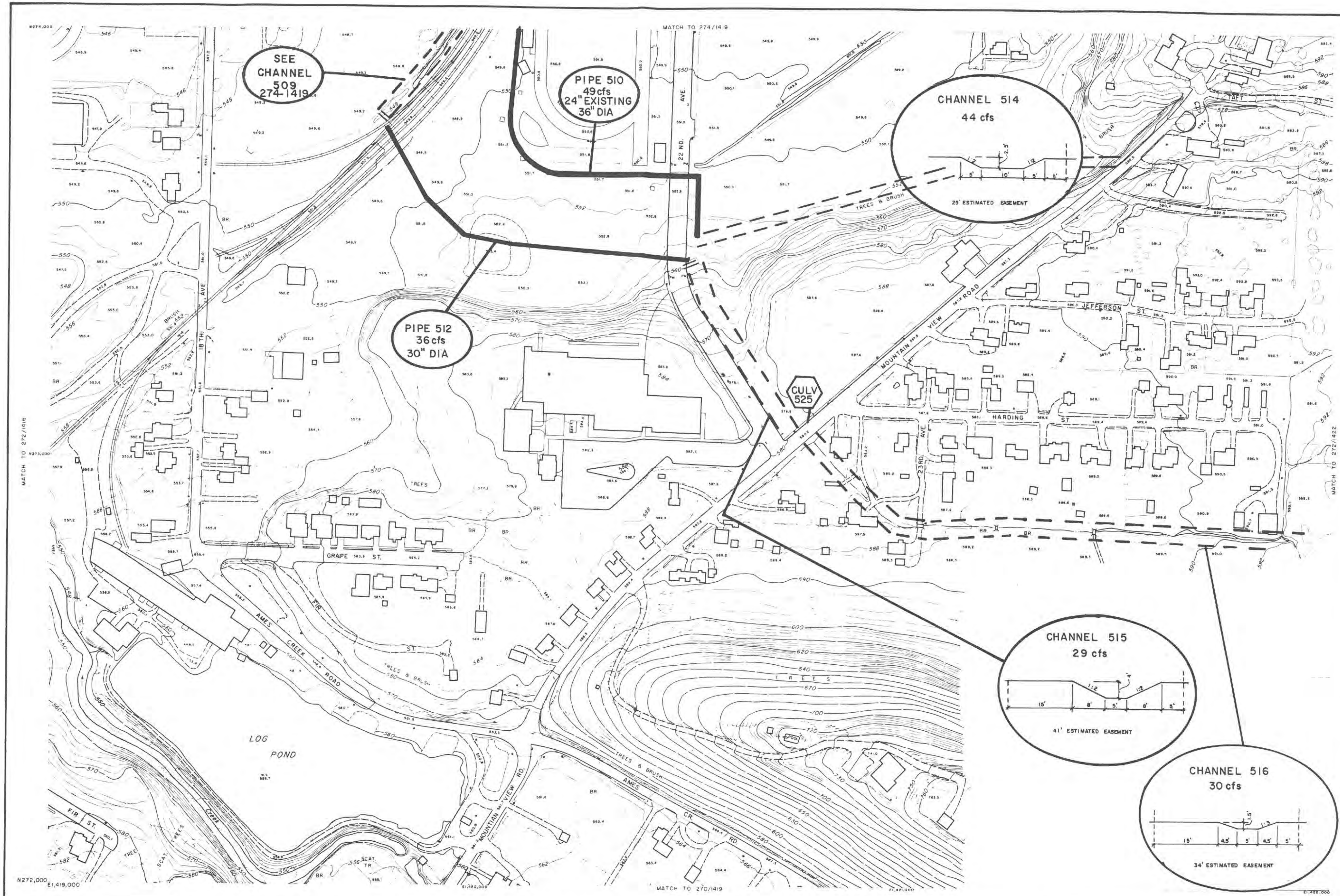

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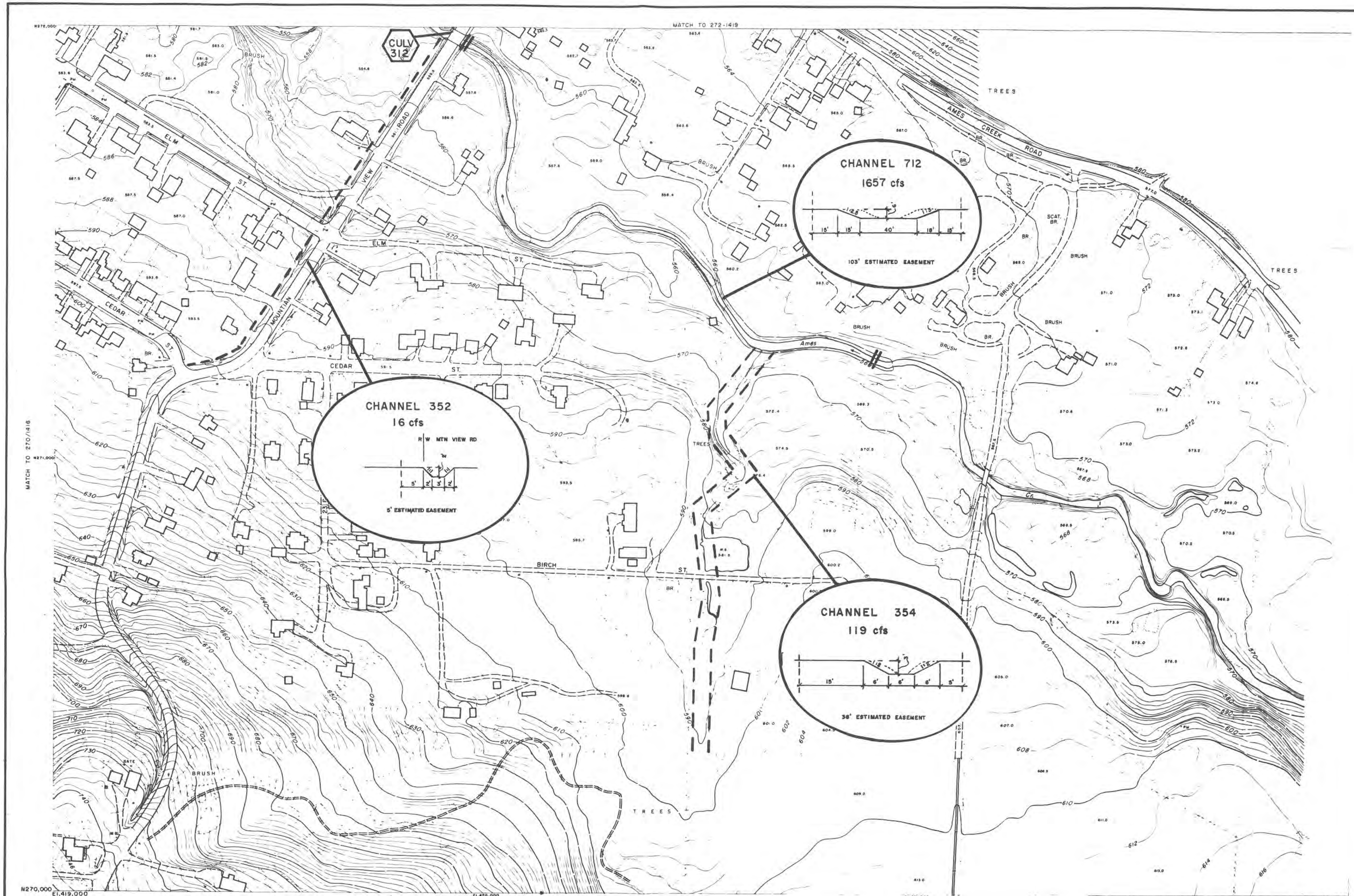

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USC & GS DATUM 1947 ADJUSTMENT
GRID BASED ON LAMBERT PROJECTION
OREGON NORTH ZONE

CITY OF SWEET HOME
PUBLIC WORK DEPARTMENT
SWEET HOME, OREGON

SHEET NO. 270/1419

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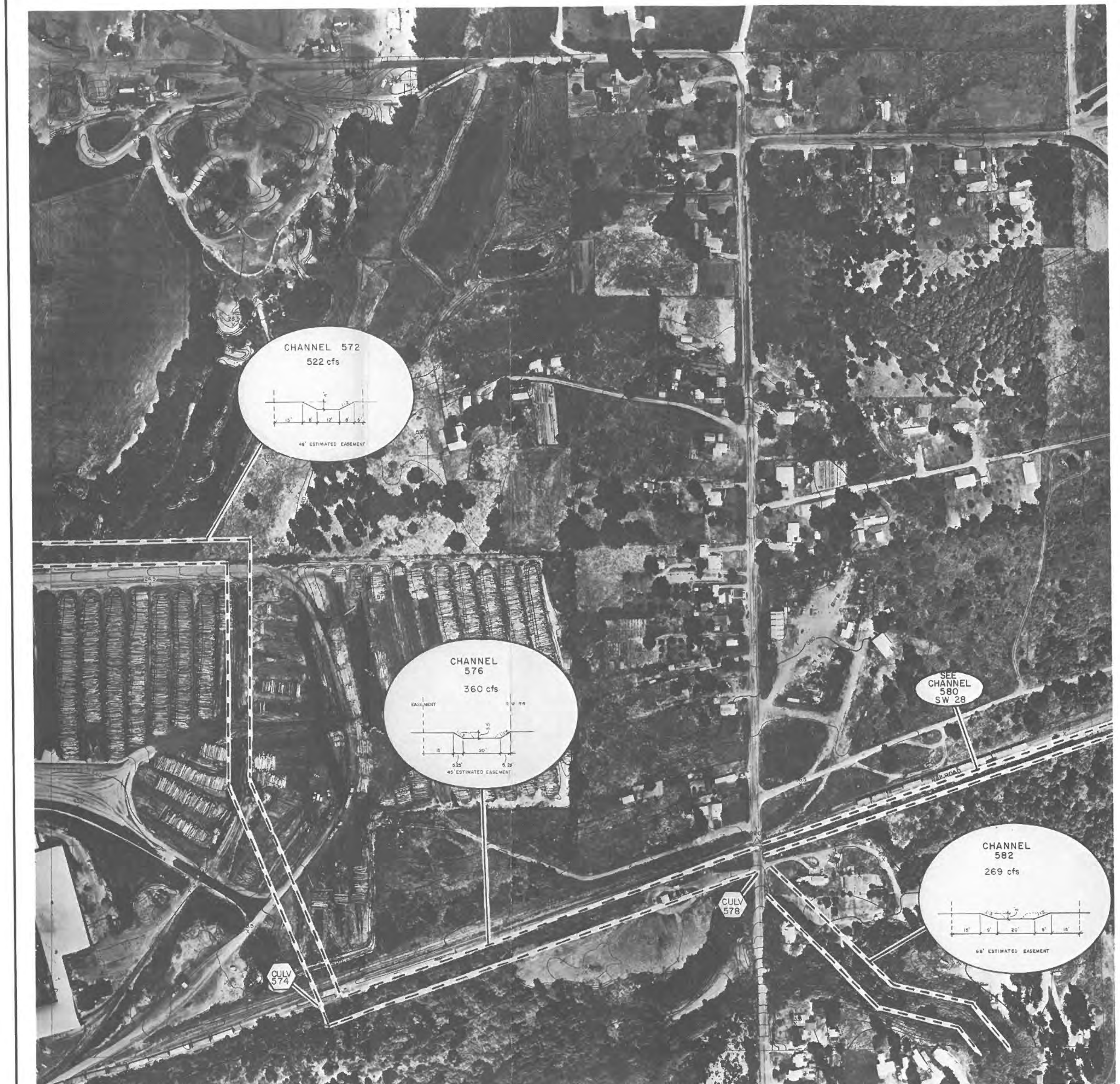

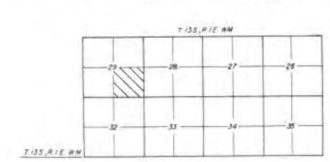

SHEET INDEX

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ORTHOPHOTO COMPILED BY SANTONI ORTHOPHOTO-SIMPLEX

PLANE GRID COORDINATES ARE BASED UPON THE OREGON STATE SYSTEM, NORTH ZONE

CONTROL: CH2M HILL

ORTHOPHOTOCONTOUR MAP

CITY OF SWEET HOME, OREGON

FOSTER-MIDWAY AREA

S.E. 1/4 SECTION 29

T.13S., R.1E., WM

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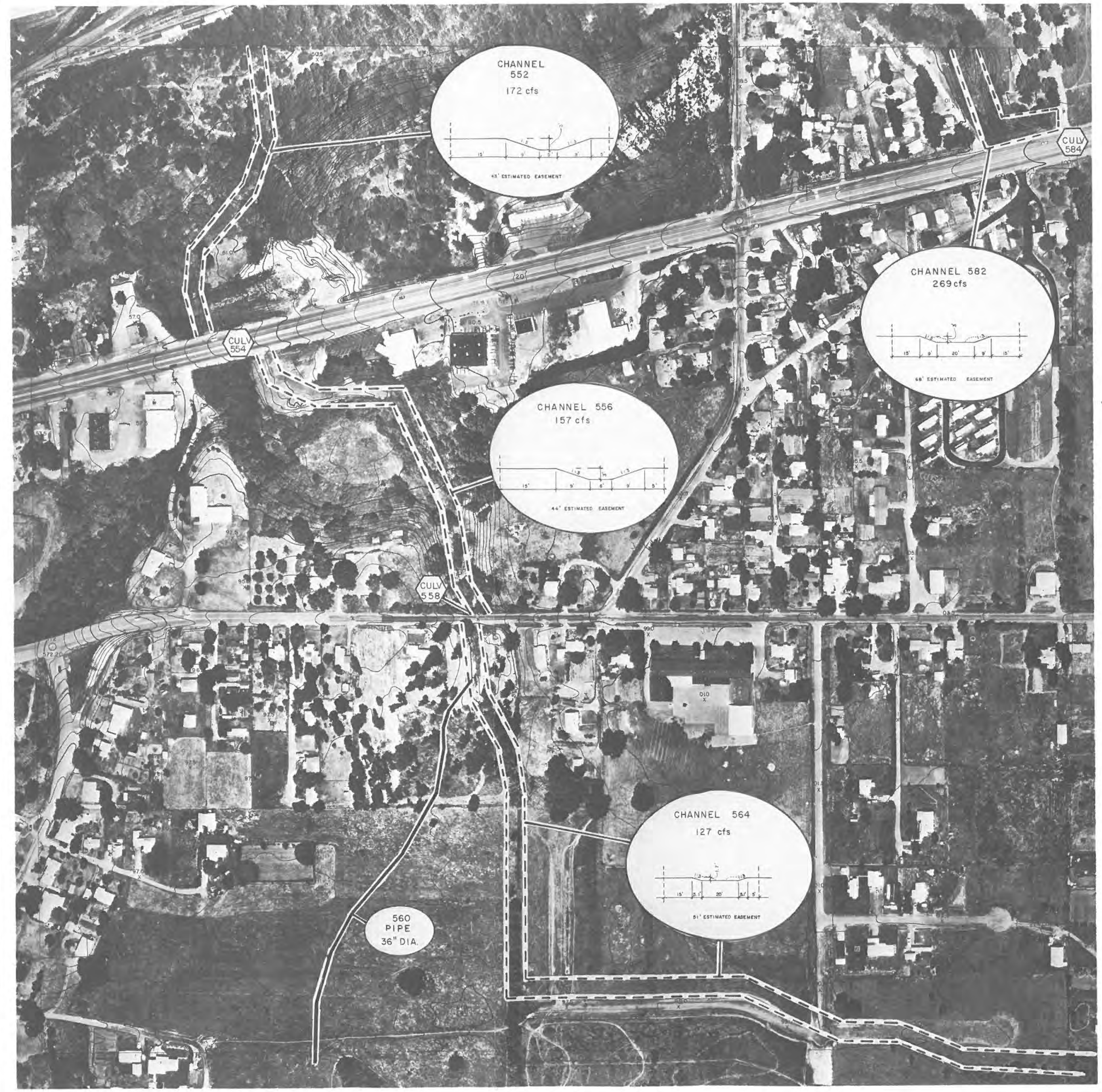
C 8176.A1	AUGUST 1976	



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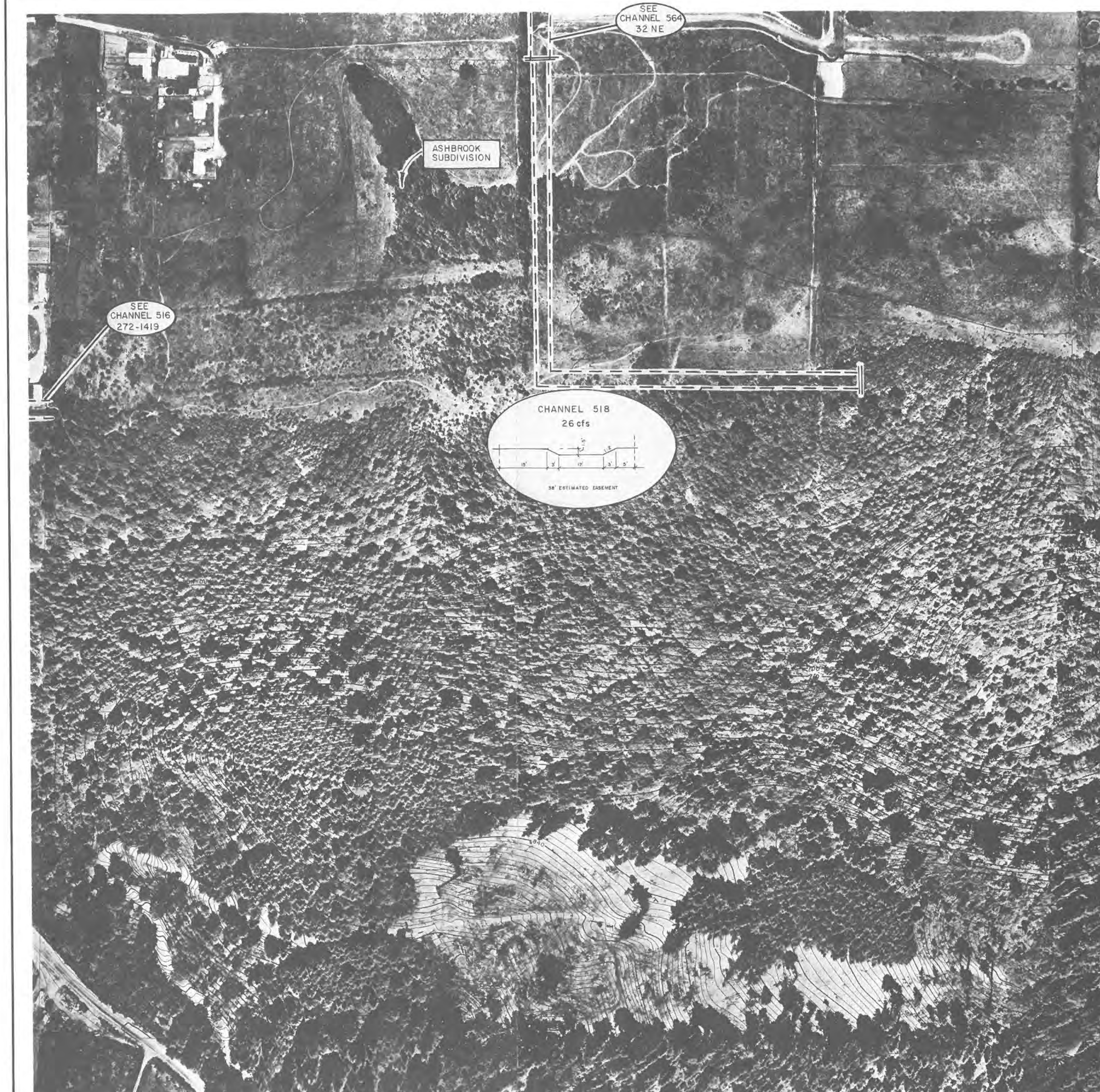
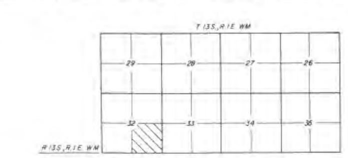




SHEET INDEX

SCALE: 1"=100'

TOPOGRAPHY COMPILED BY PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPHY DATED: JULY 13, 1976

ORTHOPHOTO COMPILED BY SANTONI ORTHOPHOTO-SIMPLEX

PLANE GRID COORDINATES ARE BASED UPON THE OREGON STATE SYSTEM, NORTH ZONE

CONTROL: CH2M HILL

ORTHOPHOTOCONTOUR MAP

CITY OF SWEET HOME, OREGON

FOSTER-MIDWAY AREA

S.E. 1/4 SECTION 32

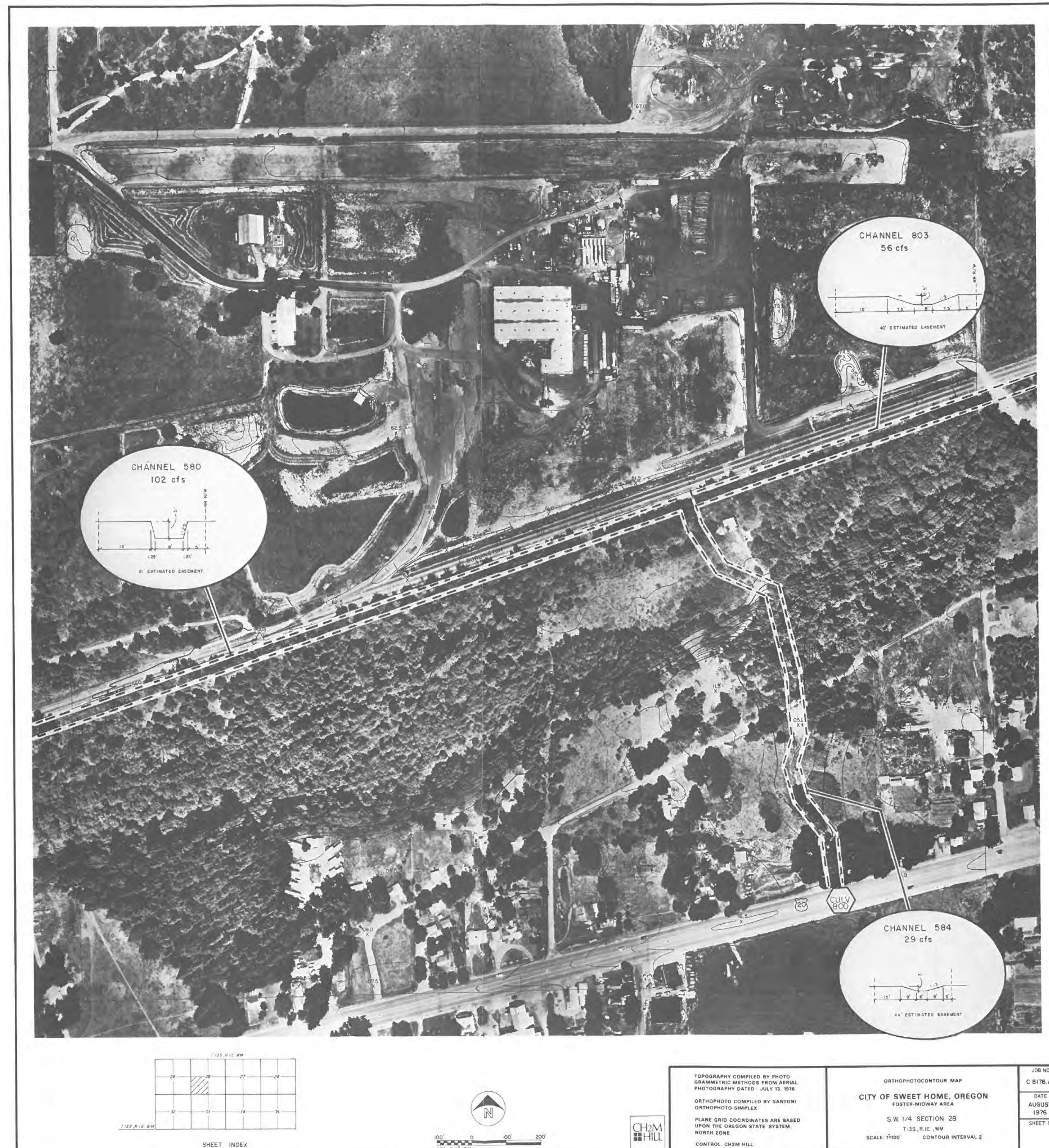
T.13S., R.1E., W.M.

SCALE: 1"=100' CONTOUR INTERVAL 2'

JOB NO. C 8176.B1

DATE JULY 1977

SHEET NO.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56 cfs
40' ESTIMATED EASEMENT
CHANNEL 580
102 cfs
31' ESTIMATED EASEMENT
CHANNEL 584
29 cfs
44' ESTIMATED EASEMENT
CULV 800
20
SHEET INDEX
N
SCALE 1"=100'
CH2M HILL
TOPOGRAPHY COMPILED BY PHOTO-GRAMMETRIC METHODS FROM AERIAL PHOTOGRAPHY DATED: JULY 13, 1976
ORTHOPHOTO COMPILED BY SANTONI ORTHOPHOTO-SIMPLEX
PLANE GRID COORDINATES ARE BASED UPON THE OREGON STATE SYSTEM, NORTH ZONE
CONTROL: CH2M HILL
ORTHOPHOTOCONTOUR MAP
CITY OF SWEET HOME, OREGON
FOSTER-MIDWAY AREA
S.W. 1/4 SECTION 28
T13S., R.1E., WM
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JOB NO.
C 8176.A1
DATE
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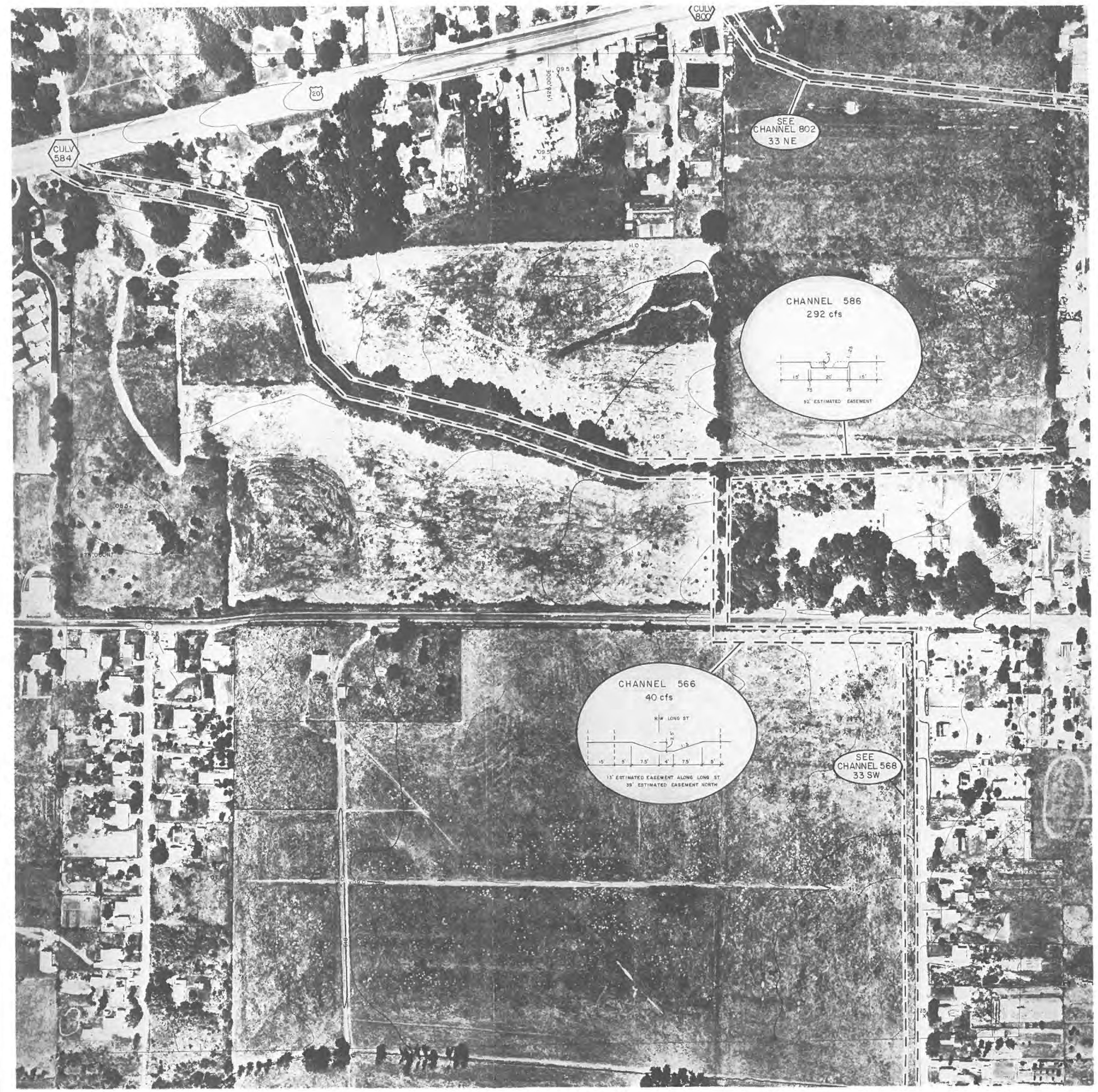
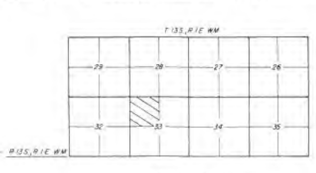
SHEET NO.





SCALE 1"=100'

TOPOGRAPHY COMPILED BY PHOTO-GRAMMETRIC METHODS FROM AERIAL PHOTOGRAPHY DATED: JULY 13, 1976

ORTHOPHOTO COMPILED BY SANTONI ORTHOPHOTO-SIMPLEX

PLANE GRID COORDINATES ARE BASED UPON THE OREGON STATE SYSTEM, NORTH ZONE

CONTROL: CH2M HILL

CH2M HILL

ORTHOPHOTOCONTOUR MAP

CITY OF SWEET HOME, OREGON

FOSTER-MIDWAY AREA

N.W. 1/4 SECTION 33

T.13S., R.1E., WM

SCALE: 1"=100' CONTOUR INTERVAL 2'

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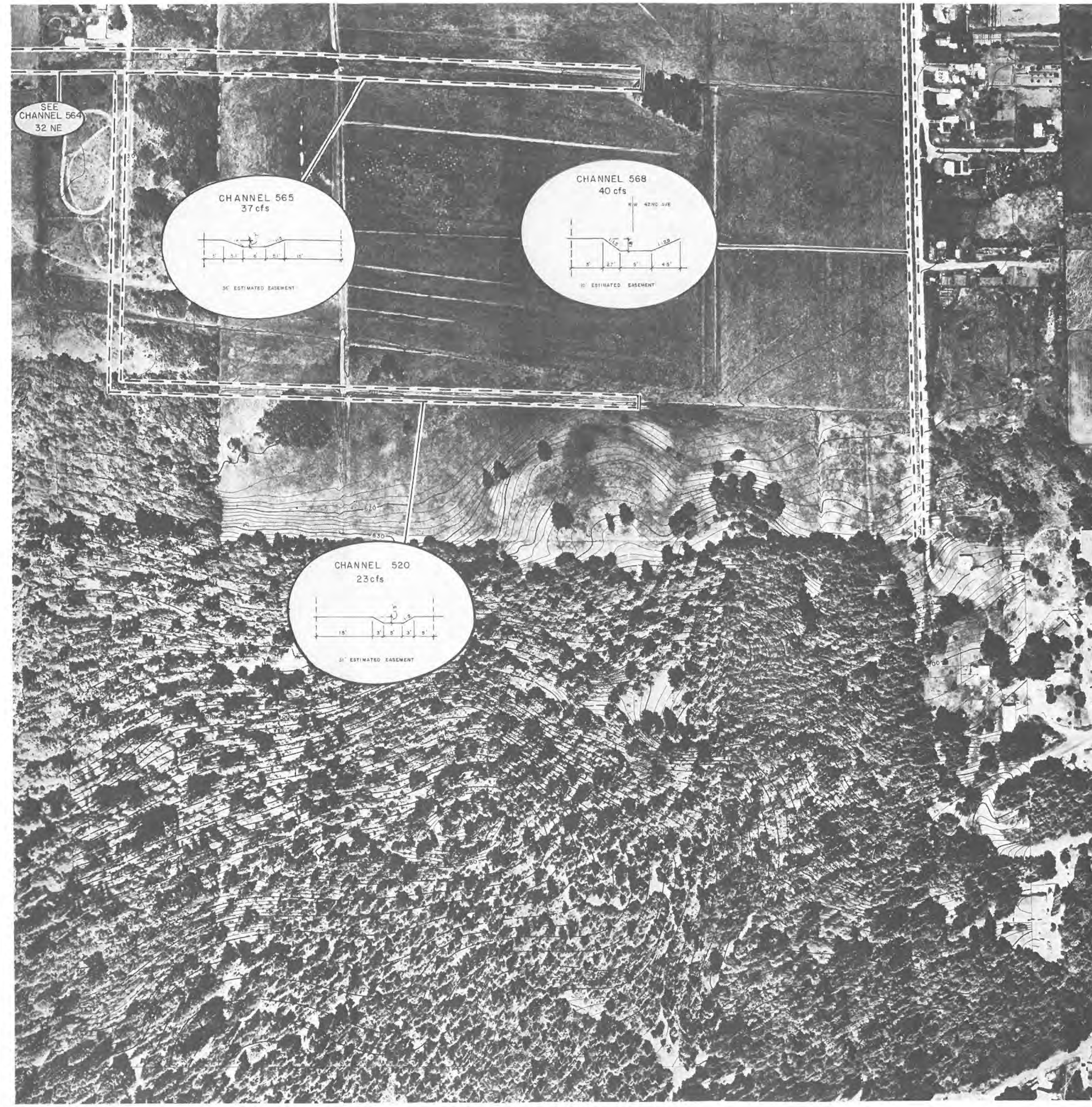
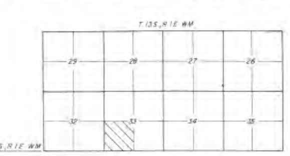
DATE	JULY 1977
SHEET NO.	





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SCALE: 1"=100'

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ORTHOPHOTO COMPILED BY SANTONI ORTHOPHOTO-SIMPLEX

PLANE GRID COORDINATES ARE BASED UPON THE OREGON STATE SYSTEM, NORTH ZONE

CONTROL: CH2M HILL

ORTHOPHOTOCONTOUR MAP

CITY OF SWEET HOME, OREGON
FOSTER-MIDWAY AREA

S.W. 1/4 SECTION 33
T13S., R1E., WM

SCALE: 1"=100' CONTOUR INTERVAL 2

JOB NO.	C 8176.B1
DATE	JULY 1977
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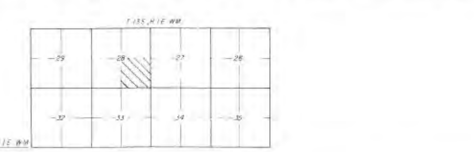

SCALE 1"=100'

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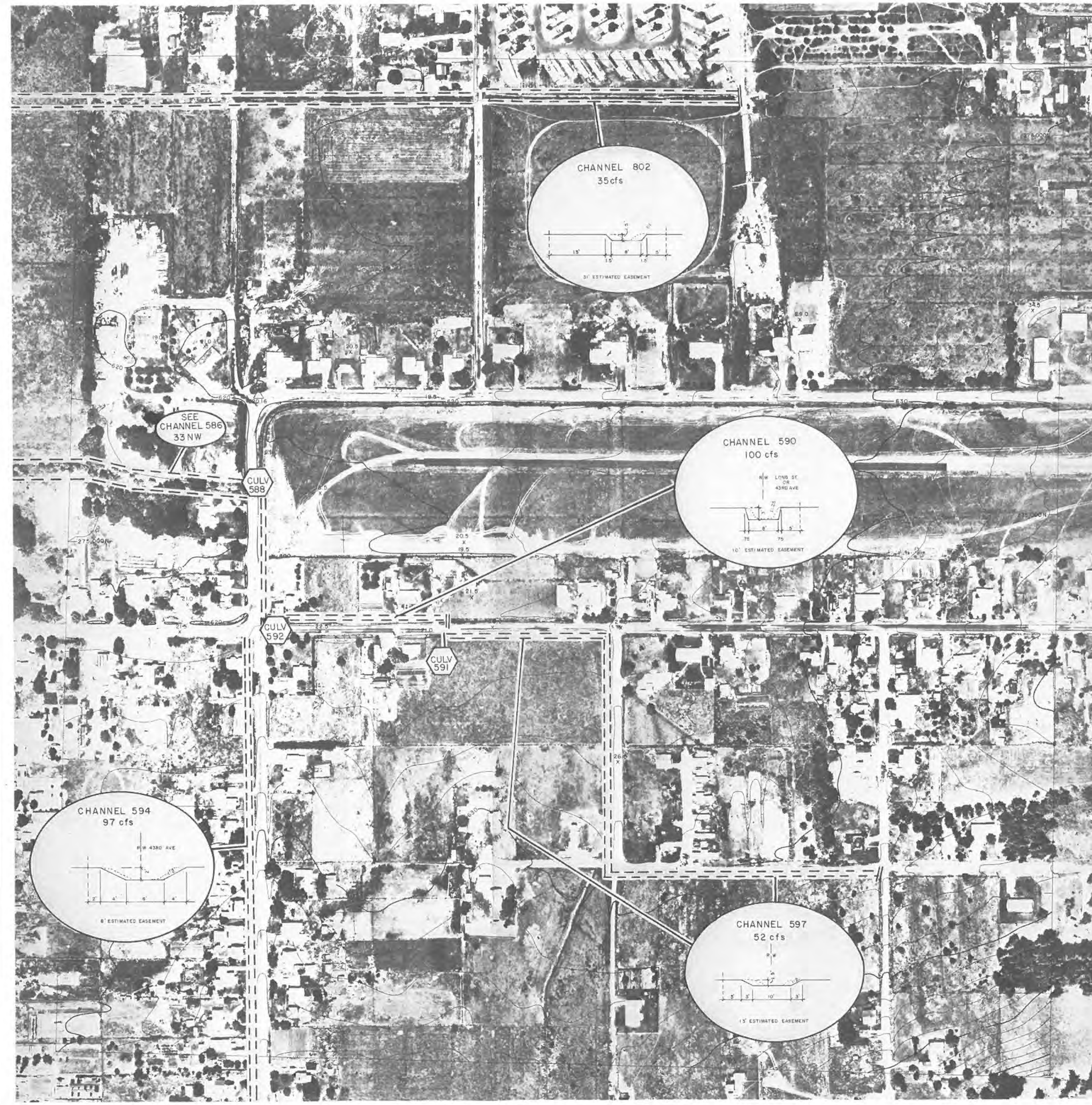

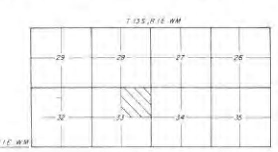

SHEET INDEX

SCALE: 1"=100'

CH2M HILL

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CONTROL: CH2M HILL

ORTHOPHOTOCONTOUR MAP

CITY OF SWEET HOME, OREGON

FOSTER-MIDWAY AREA

N.E. 1/4 SECTION 33

T.13S., R.1E., W.M.

SCALE: 1"=100' CONTOUR INTERVAL 2

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DATE JULY 1977

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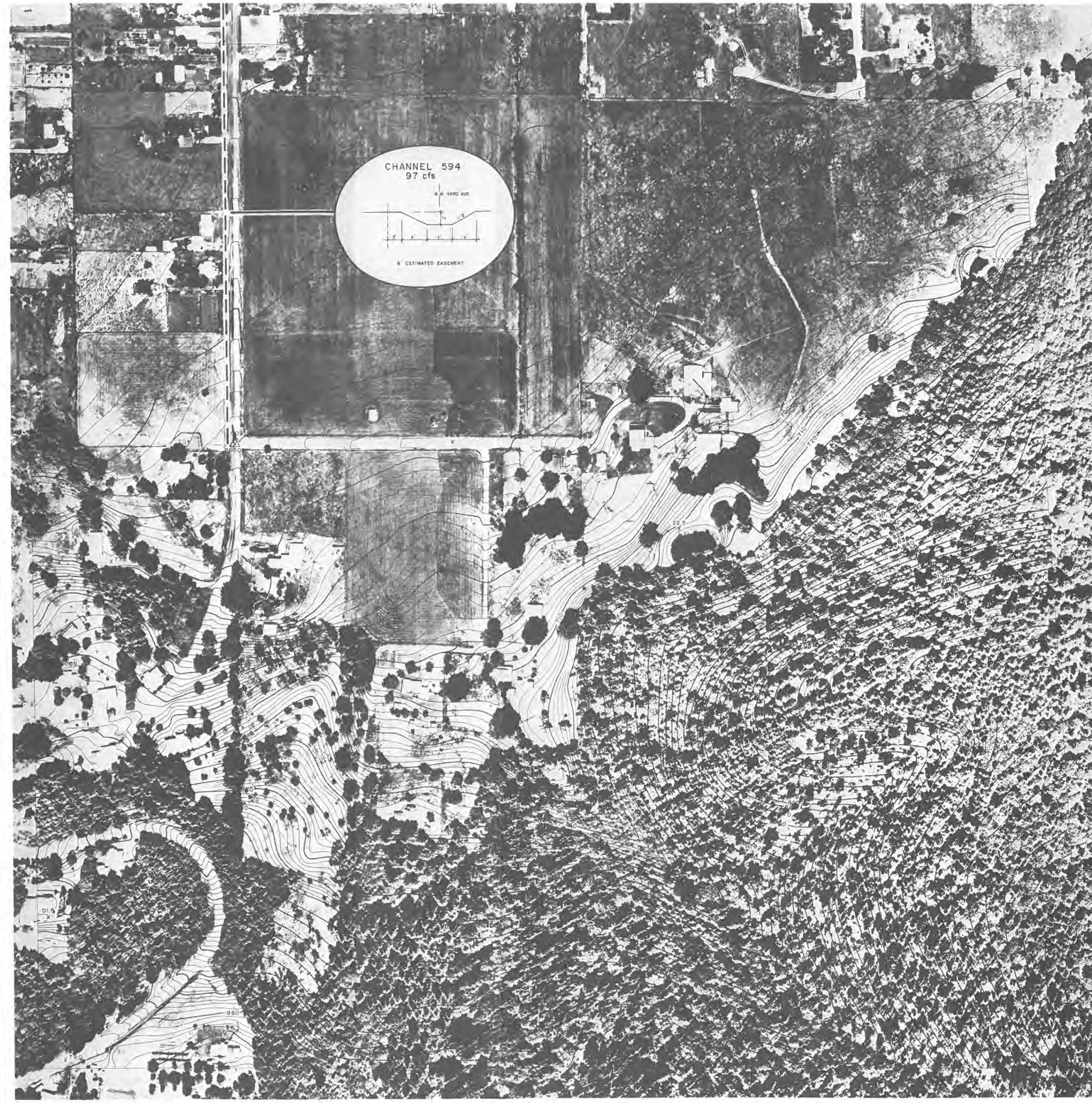

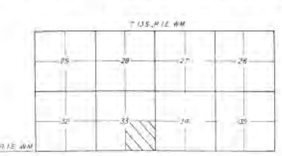

SHEET INDEX

SCALE: 1"=100'

CH2M HILL

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ORTHOPHOTOCONTOUR MAP

CITY OF SWEET HOME, OREGON

FOSTER-MIDWAY AREA

S.E. 1/4 SECTION 33

T13S., R.1E., WM

SCALE: 1"=100' CONTOUR INTERVAL 2'

JOB NO: C 8176.B1

DATE: JULY 1977

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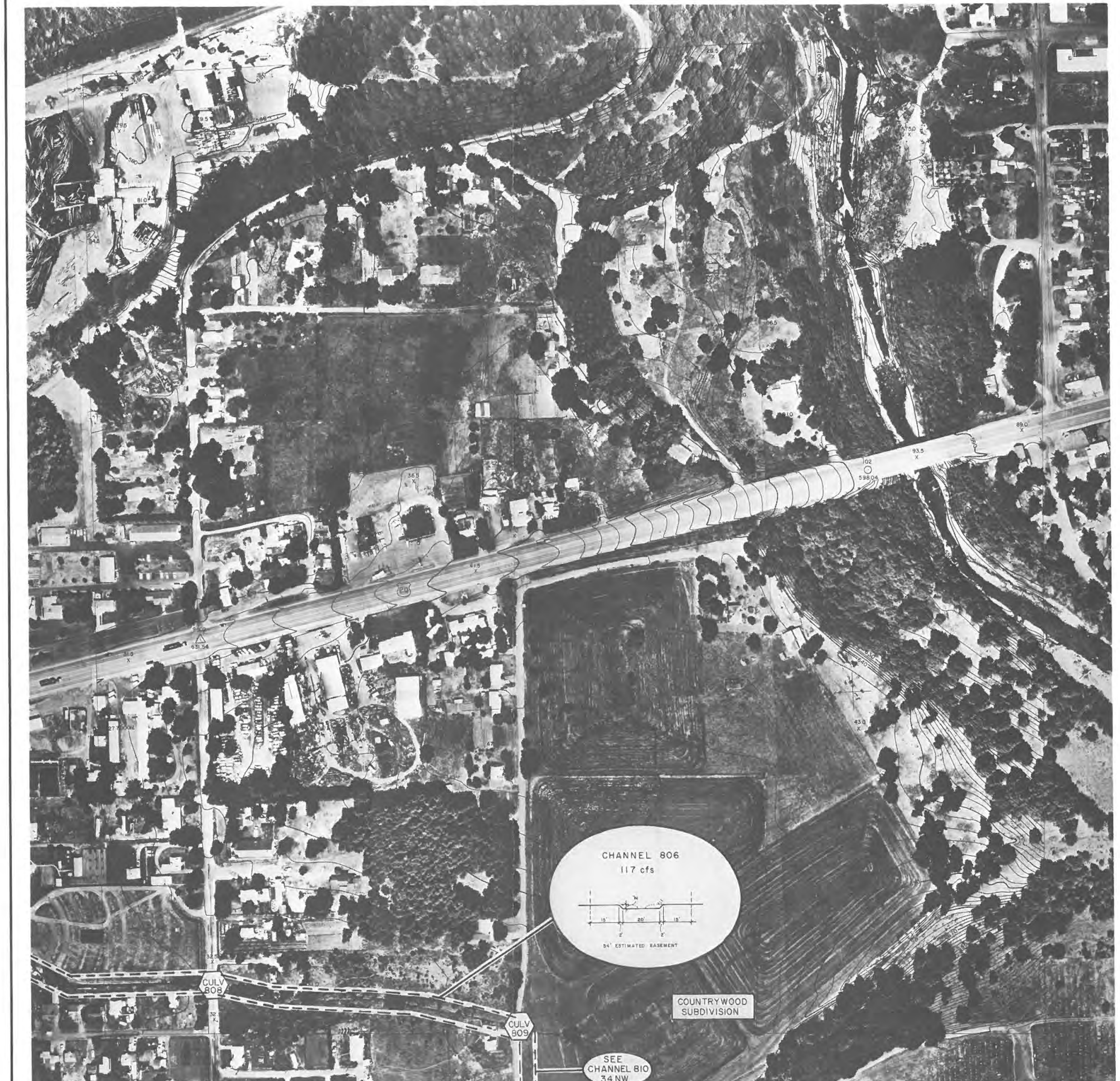

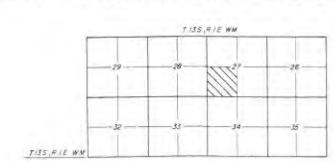

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CONTROL: CH2M HILL

ORTHOPHOTOCONTOUR MAP

CITY OF SWEET HOME, OREGON

FOSTER-MIDWAY AREA

S.W. 1/4 SECTION 27

T.13S., R.1E., WM

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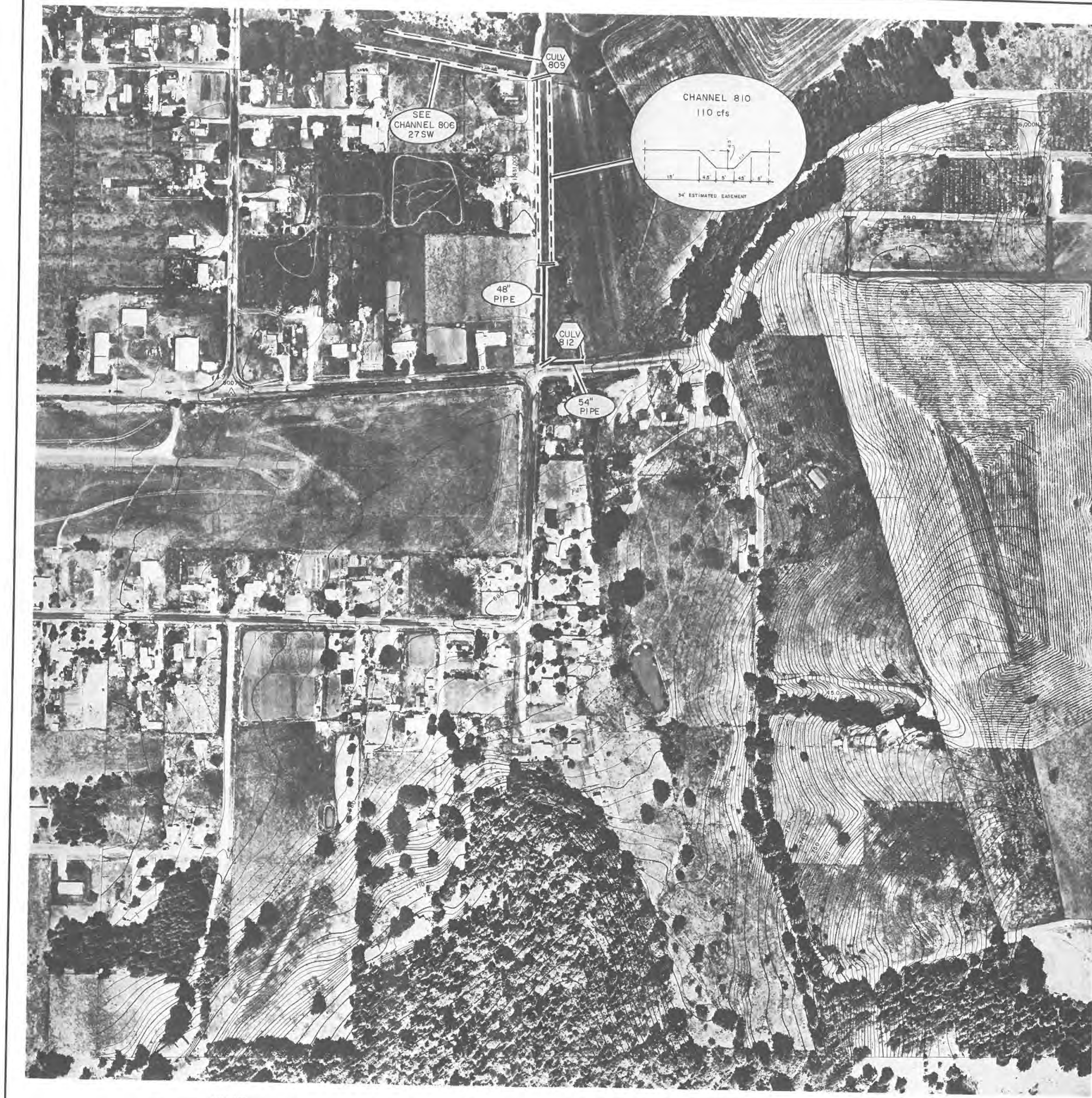

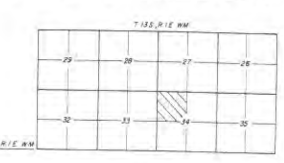

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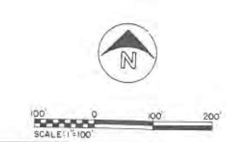

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ORTHOPHOTOCONTOUR MAP

CITY OF SWEET HOME, OREGON

FOSTER-MIDWAY AREA

N.W. 1/4 SECTION 34

T.13S., R.1E., WM

SCALE: 1"=100' CONTOUR INTERVAL 2'

JOB NO. C 8176 B1

DATE JULY 1977

SHEET NO.

APPENDIX

OREGON STATE HIGHWAY DIVISION

HYDRAULICS MANUAL

Subject: DESIGN FREQUENCY	*Page:* 1-2
	Revision:
Approved: Victor D. Wolfe	*Effective Date:* February, 1973

PURPOSE

Flood frequencies for different class highways are established to produce a balance between the cost of the drainage facility and the cost of potential flood damage.

POLICY

All drainage structures shall be sized for the following design flood frequencies as set forth in Federal Highway Administration Instructional Memorandum 20-1-67.

DRAINAGE FACILITY	HIGHWAY CLASSIFICATION	
	A(4),A,B,C	D,E,F
Bridges*	50-year flood or the largest flood of record	25-year flood or the largest flood of record
Culverts*	50-year flood or the largest flood of record	25-year flood
Depressed Roadways	50-year flood	
Channel Changes*	50-year flood or the largest flood of record	25-year flood or the largest flood of record
Storm Sewers	10-year	10-year
Storm Sewers from Sags	50-year	10-year
Ditches, Gutters, and Inlets	10-year	10-year

*Note: Designs should be reviewed to ensure that backwater from 100-year flood or largest flood of record will not cause extensive property damage, result in loss of a bridge, or inundate the highway.

For Class D,E, or F highways, the design should be reviewed to ensure that backwater from the 50-year flood or the largest flood of record will not cause extensive property damage, result in loss of a bridge, or inundate the highway.

SUMMARY OF APPENDIX B

(Appendix B is submitted as a separate document)

List of materials contained in the "Notes and Calculations" submitted separately.

1. 1" = 300' Mylar Mosaics of Sweet Home Topographic drawings.
2. NOAA Atlas 2 values extracted for Sweet Home and Cascadia.
3. Synthetic Design Hyetographs for 10, 25 and 100 year average return periods.
4. Example calculations of detention criteria applied to Berdell's Addition Subdivision.
5. Devco field notes of culvert measurements.
6. Map of SWMM Discretization of Ames Creek Sub-basin above the Urban Growth Boundary.
7. National Weather Service Frequency-Duration-Precipitation Analysis of Cascadia 1940-1973.
8. Annual Data (1948-1973) and Annual Frequency Analysis of Wiley Creek Sub-basin above Old Gauge Site at Mile Station 3.8.
9. Corps of Engineers field notes of Ames Creek profile and cross-sections (33 pages)
10. Sensitivity Analysis of SWMM Subcatchment Parameter "width".
11. Sensitivity Analysis of SWMM Subcatchment Parameter "Per Cent Impervious"
12. Independent nomograph procedure calculations for Ames Creek peak discharge.
13. Computer punch cards of SWMM data for Existing and Full Development models.

APPENDIX C

SWMM Parameters and Hydrographs for
Existing Land Uses

(Submitted as separate document)

APPENDIX C

APPENDIX D

SWMM Parameters and Hydrographs For Land Uses Shown in the Proposed Comprehensive Plan

(Submitted as separate document)

APPENDI

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