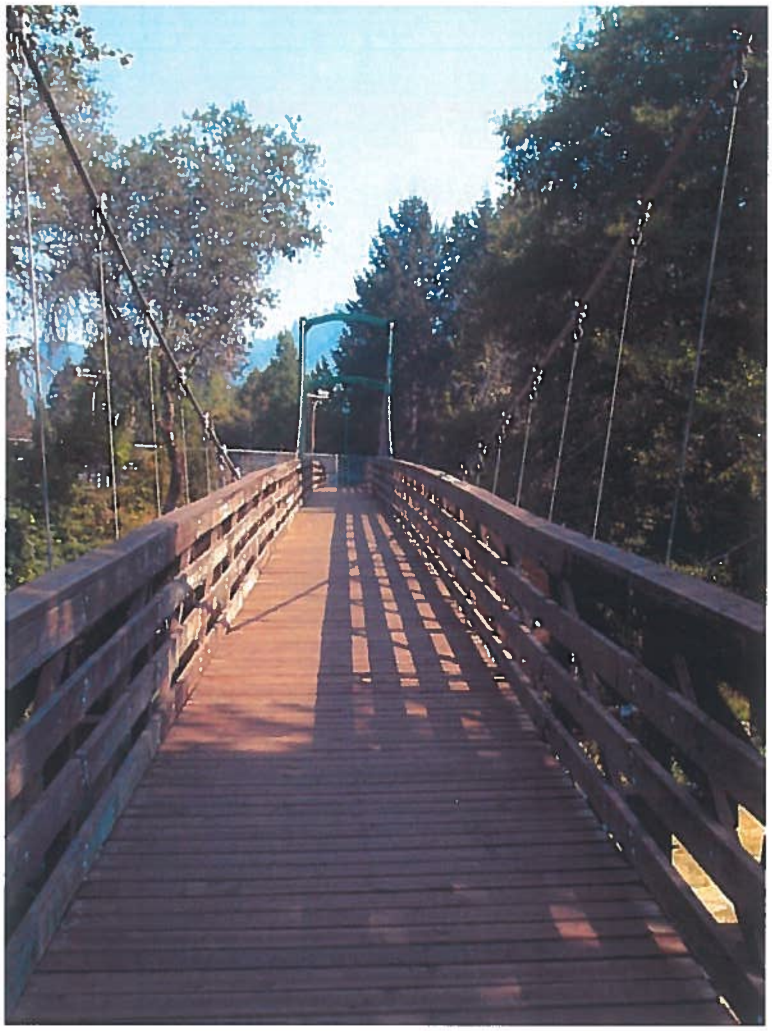
# *City of Rogue River: Stormwater Master Plan*

Volume 2



April 2003

The Dyer Partnership
Engineers & Planners, Inc.
275 Market Avenue
Coos Bay, Oregon. 97420
(541) 269-0732

# STORMWATER MASTER PLAN
## Volume 2

## CITY OF ROGUE RIVER
## JACKSON COUNTY, OREGON

**PROJECT NO. 4510.14**
**APRIL 2003**


Financed In Part By A Grant From
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**PREPARED AS A JOINT EFFORT OF THE DYER PARTNERSHIP, THE ROGUE VALLEY COUNCIL OF GOVERNMENT AND THE CITY OF ROGUE RIVER.**

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# Introduction

## 1.1 Planning Need and Objectives

The City of Rogue River is a growing community in southern Oregon. It is located between the rapidly developing cities of Grants Pass and Medford. While growth provides benefits to the city, it burdens the city's utilities.

In particular, growth increases demand on the existing storm drain system and strains the capacity of the facilities. In anticipation of continued growth, the city wants to ensure that development does not create hydraulic overloads in the storm drainage. A programmed improvements plan and a method of financing is needed.

Consistent with that need, the general objectives of the report are the following:

1. Identify the existing storm drainage flows for the study area.
2. Identify existing system deficiencies and improvements needed.
3. Identify the expected storm drainage flows based on projected development by the year 2020.
4. Identify storm drainage improvements to meet future flows.
5. Identify storm system improvements to meet environmental regulations.
6. Develop construction cost budgets for each improvement.

Together with Volume 1, this document may be used as a Storm Drain Master Plan, to guide the City in future storm water decisions.

## 1.2 Scope of Engineering Services

The June 27, 2002 agreement between The Dyer Partnership, Inc. and the City of Rogue River proposed a scope of services to meet the planning needs. The following approach to will be used to develop a storm water master plan:

### *Task 1. Technical Investigations and Inventory*

RVCOG and Dyer will prepare a technical report describing the natural resource conditions in the city and surrounding area and storm water management implications. The content of the report will be discussed with the City as a first step in the development of a comprehensive Stormwater Master Plan. The report will contain maps produced by Dyer and will include a characterization of the city's drainage basins (watersheds), water quality information, and prioritization of issues to be addressed.

### *Task 2. Planning Analysis and Draft Ordinances*

RVCOG will gather pertinent regulatory and planning information (Task 1) at the same time as the technical assessment is occurring. Development of implementing language and draft ordinances will occur after the initial information-gathering phase, and will require an iterative process in coordination with various departments within the City and State planning bodies, such as the Department of Land Conservation and Development. The implementing language and draft ordinances will be developed after the technical report. (This task is to be completed by RVCOG).

### *Task 3. Engineering Analysis and Capital Improvement Program*

Dyer will reevaluate the recommendations listed in the City's Storm Drain Capital Improvements Plan for inclusion into the Stormwater Master Plan. Specific tasks to be completed include:

1) Perform GPS measurements at key locations around the City to obtain more detailed elevations for evaluation of proposed pipe sizes and locations.
2) Additional analysis of the storm water generation and requirements for the undeveloped areas within the City,
3) Revaluation of the proposed capital improvements to ensure compliance with pertinent, increasingly stringent regulations, and
4) Compilation of revised cost estimates for the proposed improvements. Stormwater Master Plan will contain pipe system improvements, culvert improvements, stream improvements, and non-structural improvements. Capital Improvement Program will contain recommended site-specific improvement projects. A meeting will be held with City officials to review findings and recommendations prior to completing the final report.

Product: Dyer will prepare a draft of the technical sections of the report that incorporates all of the modifications due to additional information that was generated in Task 1 and 2. Maps will be generated to illustrate where the various improvements will be located. All of the improvements costs will be prioritized and categorized as either City or Developer related.

### *Task 4. Preparation of Stormwater Master Plan and Implementing Ordinances*

The key to a successful storm water management program is effective implementation through adoption of ordinances and design of a sustainable storm water program. RVCOG will provide to the City a Stormwater Master Plan and adoption-ready implementing ordinances.

RVCOG will initiate the following steps in the drafting of the Stormwater Master Plan and implementing ordinances:

1. <u>Project future land use change in the watershed and its drainage basins</u>. Use zoning or other measures to forecast future impervious cover in each drainage basin. This analysis will influence the goal setting in Step 3.
2. <u>Set up a structure and process for planning and management</u>. Establish the structure to involve the community and affected planning bodies in the process.
3. <u>Determine goals for the watershed and its drainage basins</u>. Use known information about impacts to the drainage basins, and the goals of larger watersheds to develop goals for the City of Rogue River watersheds. Determine goals for each drainage basin to achieve overall watershed goals.
4. <u>Determine budgetary needs and funding sources</u>. Conduct an analysis to determine what levels of financial resources are available to implement the plan. Determine how to supplement funding if insufficient to achieve planning goals (Step 3).

5. Determine how to adopt and implement the storm water plan. Determine what steps are needed to effectively implement the plan, including ordinances, codes, standards, and changes to current zoning (Task 2).
6. Write codes and ordinances. Complete draft codes and ordinances through an interactive process, revise and finalize, and adopt for implementation (Task 2).
7. Develop a strategy for revisiting and updating the storm water plan. Develop schedule and commitment of the City to periodic updating of the plan based on additional urban development in the watersheds, and results from monitoring data and modeling.

The process described above provides a framework for storm water planning. Each drainage basin in Rogue River will present unique challenges and opportunities, and there will be difficult decisions at many stages of the planning process that will require a balanced approach to meet the needs of all citizens. The goals of protecting natural resources and effectively managing storm water will need to be weighed against political and economic realities in Rogue River. RVCOG will produce up to 15 copies of the Stormwater Master Plan for distribution.

## 1.3 Authorization

The Dyer Partnership, Inc. was authorized by the City Council of Rogue River to prepare the "Storm Water Master Plan" in June 2002.

## 1.4 Funding Acknowledgement

The Storm Water Master Plan was made possible by Southern Oregon Regional Development Inc. and Oregon Economic Development Department Funds.

## 1.5 Acknowledgement

This plan is the result of contributions made by a number of individuals and agencies. We wish to acknowledge the efforts of Mark Reagles, City Administrator, Ken Johnson, Public Works Director, the staff of the City of Rogue River, and Greg Stabach and Craig Harper of the Rogue Valley Council of Governments.

The Dyer Partnership staff that contributed to this report includes: Steve Major, Johnbo Pulver, Janette Kerbo, Aaron Speakman, and Rachel Arbuckle.

## 1.6 Report Content

Volume 2 of the report is comprised of the nine sections described below:

***Section 1 – Introduction*** states the need, scope, and content of the report.

***Section 2 – Study Area*** provides background information on the city.

***Section 3 – Hydrological Analysis*** presents the hydraulic and hydrological assumptions and method used in the analysis.

***Section 4 - Storm Drain Model*** describes the computer representation of the exiting and developed storm drainage.

***Section 5 – Recommended Plan*** lists projects and associated costs for each basin.

***Section 6 – Financing*** describes the financing methods for the storm drainage improvements.

***Section 7 – Regulation and Management*** discusses the planning criteria as codified by regulators and jurisdictional authorities.

***Section 8 – Summary*** presents conclusions and recommendations.

# Study Area

Section 2

Section

2

# Study Area

## 2.1 Location and Definition

The City of Rogue River is located in northwest Jackson County between the cities of Grants Pass and Medford (See Appendix A, Figure 1). The predominant geographical feature is the Rogue River, which flows through the city parallel with Interstate Five.

The study area for the storm water master plan is the Urban Growth Boundary (See Appendix A, Figure 2).

## 2.2 Natural Drainage Courses

The primary natural drainage courses within the study area are the Rogue River, Evans Creek, and Wards Creek. Detailed descriptions of each drainage basin are included in Volume 1.

The Rogue River flows from east to west through the City of Rogue River. The Rogue River originates on the western side of the Cascades near Crater Lake and flows southwesterly to the Pacific Ocean. The city is twelve miles downstream of the abandoned Ray Gold Dam and approximately three miles upstream of the Savage Rapids Dam.

Highest flows of the Rogue River occur in late fall and early spring months. High river flows in the fall are attributed to runoff from heavy precipitation. Flood flows in the spring are related to melting snow pack. Floods can also occur as a consequence of a heavy snowfall followed by a sudden warm rain. A freeze on top of the snow just before the warm rains can further complicate matters by creating very rapid runoff conditions.

Wards Creek and Evans Creek flow from the north to the south through the city. As tributaries to the Rogue River, Wards Creek and Evans Creek, are also subject to periodic flooding primarily from river backwater.

Although man-made, open channels and closed piping of the Grants Pass Irrigation District (GPID) also form a drainage way around the city. During summer months, water is pumped from Savage Rapids Dam and flows by gravity around the City. The return water flows to Ward Creek. During winter months, storm water enters the open channels and the system functions as a drainage way.

## 2.3 Major Drainage Basins

Basin boundaries and runoff patterns were defined from available aerial photography, USGS mapping, and spot elevations from existing plans.

For the purposes of the plan, the urban growth area was divided into twenty-four major drainage basins (See Appendix A, Figure 3). The basins are described in Section 4.

## 2.4 Rainfall

The City of Rogue River is located about 23 miles northwest Medford and about 6 mile east of Grants Pass. It generally has the same climate as Medford, that is, moderate conditions with marked seasonal characteristics. In late fall, winter and early spring, the area is influenced by maritime air with damp, cloudy and cool conditions. The late spring, summer and early fall are typically warm, dry and sunny due to dry continental air.

High mountains in the nearby Siskiyous and Coast Range cause a rain shadow effect. The annual rainfall in the Rogue River area is approximately 32 inches, most of which, occurs in the winter season. Summertime rainfall is usually a result of thunderstorms developing in the surrounding mountains. Snowfall is light and accumulations seldom last more than 24 hours.

For the purposes of the report, a 24-hour synthetic rainfall distribution, Type 1A, was chosen as suggested by the Soils Conservation Service rainfall distribution boundary map (See Appendix B, Figure 1).

The 25-year, 24-hour rainfall and 50-year, 24-hour rainfall totals were chosen as 4 inches and 4.5 inches respectively (See isopluvial charts in Appendix B).

## 2.5 Soils

Rogue River and the surrounding area have four landforms: floodplains, low and high stream terraces, and hill slopes. For the hydrologic analysis used in this report, the soils were assumed to be moderately well drained. A soils map for the area is included in Appendix B.

## 2.6 Population and Land Use

The population of Rogue River is listed as 1847 on the 2000 census, with the certified population estimate for July 2002 calculated as 1850 by the PSU Population Research Center. The year 2020 population of the city is projected to be 3,000. This number is the allocation for the City of Rogue River based on the projected population for Jackson County, prepared by the Office of Economic Analysis, and is about one half of the forecasted population in the 1990 Comprehensive Plan. Population is a consideration of land use planning and is used only indirectly in this report. Land use or zoning is employed for forecasting hydraulic loads in storm drain analysis.

For the storm drain model, aerial photography was used to develop the existing flows. General land use and zoning maps in the 1990 Comprehensive Plan were used for the storm water forecast (See Appendix A, Figure 4). A more detailed zoning map is to be found in the Baseline Resource Inventory by RVCOG.

## 2.7 Storm Drain Inventory

The Rogue Valley Council of governments mapped the existing storm drain system with their geographical information system (GIS). Those GIS files were used to develop the inventory maps in this report (See Appendix, Figures 5A and 5B). The Dyer Partnership field surveyed 113 points to verify elevations at select points of the existing storm drain system (See 6A and 6B). The city staff completed a field survey of existing drainage facilities, however, vertical data was not available. Topographic maps developed from an aerial survey of the City were used to develop vertical data. The information used to develop this plan is general and may not reflect conditions for future individual development.

Present day problems in the storm drain system were identified by discussions with the city staff and through computer modeling the existing system using HydroCad. Section 4.3 ("Basin Descriptions") describes the problem areas. Also see Appendix A, Figure 7 for locations.

# Hydrological Analysis

Section 3

Section

# 3

# Hydrological Analysis

## 3.1 Storm Frequency

An essential part of storm water analysis is selection of the design storm or storm frequency that will be used. Selection of the design storm includes economic and statistical relations. The frequency chosen for a storm depends upon such factors as the existing drainage system, the nature of the contributing areas, and the cost of storm drainage improvements.

The design storm is the total amount of rainfall that will occur over a period of time based on the statistical evaluation of precipitation records. Typical intervals for storm frequencies are 2, 5, 10, 25, 50, and 100 years. A 25-year storm can be expected to occur once within a 25-year period. The 25-year storm could occur any year during a 25-year time span, although each year it only has a 4 percent chance of occurring. The 25-year storm could conceivably occur for several years, or even twice in a given year, even though, statistically, it would not be probable.

Economic factors are considered when selecting the design storm in the engineering analysis. For instance, a drainage system sized for the 100-year storm will result in a larger, more costly drainage system than for a more frequent storm. Conversely, a drainage system designed for the frequent storm, though less costly, may cause property flooding, damage to public facilities, and the potential loss of life. Costs of improvements must be compared to the potential risks.

Selection of the storm frequency for this analysis is based on individual basins and projects. Based on the State of Oregon Department of Transportation Hydraulics Manual, a 50-year recurrent storm should be utilized for facilities draining through state highways and a 25-year storm can be used for smaller city streets. In cases where roadway overtopping is a problem, the 100-year storm, may be used.

Design storm precipitation totals for the City of Rogue River are shown below.

**TABLE 3.1**
**DESIGN STORM RAINFALL TOTALS AND ANALYSIS AREAS**

| DESIGN STORM FREQUENCY | RAINFALL TOTAL | REQUIRED FOR DRAINAGE BASINS |
|---|---|---|
| 25 year storm | 4.0 inches | City Streets and Neighborhoods |
| 50 year storm | 4.5 inches | Major City Streets |

## 3.2 Channelization

As storm water flows downstream, it travels in some type of channel, for example, ditch, culvert, natural creek, and pipes. A common mathematical formula used to characterize the hydraulic behavior of these conduits is the Manning's Equation, which is generally expressed as:

$$Q=(1.49/n)*A*R^{2/3}*S^{1/2}$$

Where: Q=Channel Flow (cfs)
A=Cross-Sectional Area (sf)
R=Hydraulic Radius=A/P (ft)
P=Wetted Perimeter (ft)
S=Channel Slope (ft/ft)
n=Manning's Roughness Coefficient

Channels vary widely in their hydraulic performance. The roughness coefficient, n, is used to describe the texture of the channel in terms of the material of construction. Materials differ in surface friction. If a channel is made up of a rough surface, there is more friction as the water flows through the channel and more energy is used to overcome that friction. The result is lower water velocities and therefore lower flows. Table 3.2 lists some commonly used Manning's "n" values for different pipe and channel surfaces.

**TABLE 3.2**
**TYPICAL MANNING'S ROUGHNESS COEFFICIENTS**

| SURFACE OR MATERIAL | MANNING'S "n" |
|---|---|
| Finished Concrete | 0.012 |
| Unfinished Concrete | 0.014 |
| Plastic Pipe | 0.009 |
| Brick | 0.016 |
| Cast Iron | 0.015 |
| Concrete Pipe | 0.015 |
| Bare Earth | 0.022 |
| Corrugated Metal Flumes | 0.025 |
| Rubble | 0.030 |
| Earth with Stones and Weeds | 0.035 |

## 3.3 Analysis Method

The term "storm water" typically refers to rainfall runoff, snowmelt runoff, and surface runoff and drainage. Effective storm water management includes the accurate sizing of storm water conveyance systems; specifically, culverts, catch basins, detention/retention ponds, and storm drainage pipelines.

Sizing for conveyance systems is generally estimated by using instantaneous peak runoff from a storm of specified frequency.

There are numerous methods for estimating peak runoff. For purposes of this study, the Rational Method and the Soil Conservation Service Runoff Method (TR-20 model) are used to estimate peak runoff values.

While the Rational Method is in common use for engineering analysis of drainage basins, its use is most applicable for analyzing areas with simple drainage systems. For this study, an alternate analysis tool, the SCS Method was used for developed areas with complex drainage system.

The following sections describe the methods in the analysis.

## Rational Method

The Rational Method is based upon the concept of mass balance and relates rainfall intensity to runoff intensity. The Rational Method incorporates the use of the rational formula, which is generally expressed as:

$$Q_p = CIA$$

Where:

$Q_p$ = peak discharge (cfs)
C = runoff coefficient (dimensionless)
I = rainfall intensity (in/hr)
A = watershed area (ac)

Once values for runoff coefficient, rainfall intensity, and watershed area have been determined, peak discharge ($Q_p$) values for drainage basins in the area are calculated. Each of the parameters in the formula are described below.

***Runoff Coefficients***

Values for C, the runoff coefficient, are readily available in most hydrology or engineering handbooks. Some common C values are listed in Table 3.3.

**TABLE 3.3**
**COMMON RUNOFF COEFFICIENTS**

| AREA DESCRIPTION | RUNOFF COEFFICIENT |
|---|---|
| Downtown Business | 0.70 to 0.95 |
| Neighborhood | 0.50 to 0.70 |
| Single Family (Residential) | 0.30 to 0.50 |
| Detached Multi-units (Residential) | 0.40 to 0.60 |
| Attached Multi-units (Residential) | 0.60 to 0.75 |
| Light Industrial | 0.50 to 0.80 |
| Parks, Cemeteries | 0.10 to 0.25 |
| Unimproved | 0.10 to 0.30 |

***Rainfall Intensity***
Rainfall intensity (I) is the intensity (inches per hour) of rainfall for a given design storm at a given time in the storm. Intensity is typically determined from Rainfall Intensity, Duration, Frequency (IDF) curves. IDF curves are used to determine a rainfall intensity associated a specific storm frequency. The IDF curves for Rogue River are provided in Appendix B.

***Time of Concentration***
Rainfall duration in a drainage basin is computed by determining the time of concentration for that drainage basin. Time of concentration ($t_c$) is defined as the longest travel time it takes a particle of water to reach a discharge point in a watershed. While traveling towards a discharge point, a water particle may experience sheet flow, shallow concentrated flow, open channel flow, or a combination of these. Once the drainage route and surfaces have been identified, Manning's equation is used to calculate the travel time of a water particle through a drainage basin.

***Area***
The final variable in the rational formula is the watershed area (A). Watershed area is determined from topographic maps of the area.

## Soil Conservation Service Method

The SCS method, commonly referred to as SCS TR-20, is a more sophisticated storm water analysis tool than the Rational Method. Rather than simply determining the peak discharge, TR-20 utilizes a synthetic rainfall distribution to generate a hydrograph showing the runoff peak and volume. This method provides a more accurate assessment of the runoff volume because it sums the total volume discharged from the basin, rather than just the peak discharge.

The SCS method is based on combining unit hydrographs resulting from bursts of rainfall that vary in magnitude, but occur in a predictable pattern. This pattern is defined by SCS as a rainfall distribution curve. Though variations in the storm intensity are synthetic, runoff generated from the storm is based on local characteristics, such as; regional rainfall totals, soil permeability classifications, intensity of development, drainage slopes, area of impact, and even the time lag created by conveyance of flows through the drainage elements.

The benefits of the SCS method is that areas within a basin, called subbasins, can be simultaneously modeled with other subbasins by combining hydrographs using excess runoff and time to peak runoff. This process allows for a more accurate prediction of the peak discharge and calculation of the total runoff volume.

In comparison, the simplicity of the Rational Method requires the results to be more conservative than the SCS Method. Consequently, using the more complex method smaller pipe may be used if sufficient detail of the basin is available. A brief description of the fundamentals of the SCS method is provided below.

***Synthetic storm distribution***
The basis of the TR-20 Method is the "synthetic storm." This storm is based on SCS research that suggests the intensity of rainfall within a storm occurs in a predictable pattern. The SCS has applied this

to the entire continental United States and developed rainfall mass distributions for four geographic locations. Storms occurring in Rogue River and most of the Pacific Northwest have been classified as type IA storms. A figure of the four rainfall distributions including the type IA storm is provided in the Appendix.

***Soil classification***
The type of soil and ground cover occurring within a basin are used in the SCS Method. This information determines the amount of rainfall retained on the surface and the excess rainfall generating runoff. Soil and ground covers are classified by curve numbers (CN) similar to the coefficient of runoff, C, used with the Rational Method. Typical CN values used for the City of Rogue River are provided below in Table 3.4. Since most of the soil within the City is classified as well draining, curve numbers for soil groups B and C were utilized in the analysis of the city's drainage system.

**TABLE 3.4**
**TYPICAL CN VALUES**

| **GROUND COVER CHARACTERISTICS** | | **CURVE NUMBER FOR SOIL GROUP** | | | |
|---|---|---|---|---|---|
| **Ground Cover Type and Condition** | **Percent Impervious** | **A well drained** | **B moderate** | **C poor** | **D very poor** |
| Streets, Roads, Parking Lots | 100 | 98 | 98 | 98 | 98 |
| Urban Commercial Districts | 85 | 89 | 92 | 94 | 95 |
| Residential: 1/8 acre or less | 65 | 77 | 85 | 90 | 92 |
| Residential: 1/4 acre | 38 | 61 | 75 | 83 | 87 |
| Residential: 1/3 acre | 30 | 57 | 72 | 81 | 86 |
| Residential: □ acre | 25 | 54 | 70 | 80 | 85 |
| Wooded: No Forest Litter | Poor | 45 | 66 | 77 | 83 |
| Wooded: Some Forest Litter | Fair | 36 | 60 | 73 | 79 |
| Wooded: Heavily Forested | Good | 30 | 55 | 70 | 77 |

***Rainfall***
Storm rainfall is determined from the design frequency or design storm as previously mentioned. Total rainfall for the design storm used in Rogue River is based on the National Oceanic and Atmospheric Administration (NOAA) Precipitation Maps for the Western United States. NOAA precipitation maps for Oregon are provided in Appendix B.

***Time of concentration***
As in the Rational Method, the time of concentration is an important parameter in the SCS Method. Unlike the Rational Method, the SCS utilizes $t_c$ to determine the time to peak discharge rather than the time of peak rainfall.

***Unit hydrograph***
Runoff generated from a storm can be described by a hydrograph. A hydrograph is a predicted discharge wave that, similar to a bell curve, starts slowly then increases with time to a peak before decreasing to its pre-storm levels.

A unit hydrograph is a dimensionless hydrograph, hypothetically generated by one inch of excess precipitation resulting from a uniformly distributed storm of uniform duration over a uniform area. The peak discharge (the y ordinate) and the time of peak discharge (the x axis) for the unit hydrograph is plotted as fractions of the peak and time to peak runoff, respectively. This standardized hydrograph is used to generate site-specific hydrographs by combining rainfall and time to the unit values. The calculation, called runoff generation, is performed as described below.

***Runoff Generation***
In order to dimension the unit hydrograph and generate runoff according to TR-20 predictions, rainfall is assumed to fall on an area in a "burst." The burst of rain is assumed to flow downstream where it is collected and discharged from the area over an extended time interval.

The duration of the discharge is extended because not all of the rainfall reaches the discharge at the same time. Some of the flow is retained because of soil characteristics; some is delayed because of distance and velocity of travel.

At the same time that the water from farthest point of the basin reaches the discharge point, the lower areas of drainage are also contributing to the flow. The sum creates the peak discharge, which is shown on the y axis of the hydrograph. The time of the peak is similarly based on the time of travel and plotted as the x axis. Both the discharge and time of travel are utilized to dimension the unit hydrograph.

Once dimensioned, the unit hydrograph provides the runoff from one interval of the storm's duration. To predict the impact from an entire storm, it is necessary to generate and sum hydrographs for each storm interval. Each new hydrograph generated is based on the mass of rainfall occurring at that particular time, as predicted by the SCS synthetic rainfall distribution curve. As each burst of rainfall generates a new runoff hydrograph, it is added to the preceding hydrograph with its axis displaced by the time between bursts. Once the entire storm is summed, a single hydrograph results. This hydrograph depicts the runoff prediction for that subbasin.

***Hydrograph routing.***
Within each basin, there are often several subbasins, each generating a runoff hydrograph. In order to observe the effects of a storm on an entire basin, it is necessary to route each subbasin hydrograph throughout the system. Since each hydrograph is based on the time of concentration, it is possible to add each subbasin hydrograph at its discharge point. The process is repeated until all of the hydrographs have been routed through the entire basin and summed at the point of discharge. This process is called hydrograph routing.

The storm drain analysis was done using HydroCad™, a packaged computer application. Consequently, a large level of detail was applied to establish runoff characteristics. In addition to calculating the peak discharge, the SCS method can also calculate the total quantity of water produced from the storm. This information is useful to determine the extent of downstream flooding or the size ponds to contain and release runoff without creating significant increases in the quantity of discharged water.

# Storm Drain Model

Section 4

Section

4

# Storm Drainage Model

## 4.1 Projecting Developed Conditions

To establish future demands on the storm water system, zoning and land use maps from the 1990 Comprehensive Plan (See Appendix A, Figure 4) were used. The maps provided the basis for storm runoff forecasts. A summary of the curve numbers (CN) for City zoning requirements is provided in Table 4.1.

**TABLE 4.1**
**HYDROLOGIC CURVE NUMBERS FOR**
**FUTURE GROWTH BASED ON LAND USE**

| USE | EXAMPLE | HYDROLOGIC CN* |
|---|---|---|
| Residential | Single Family and<br>Multi-Family Units | 75<br>85 |
| Commercial | Retail Commercial<br>w/ Parking | 92 |
| Industrial | Light Industrial | 88 |
| Open Areas | Timber,<br>Cultivated Areas | 70<br>77 |
| Planned Development | Planned Development<br>RV Parks | 94<br>98 |

* CN reflects fair draining soil characteristics rated as Class B.

## 4.2 Discharge Estimates

Present and future discharge estimates for each drainage basin were developed according to the methodology in Section 3. The HydroCad™ computer model was used to forecast peak storm flows for both existing and urbanized conditions. A summary of the flow projections for existing and fully urbanized land-use in each major basin is provided below in Table 4.2.

**TABLE 4.2**
**CITY OF ROGUE RIVER**
**PREDEVELOPMENT AND POSTDEVELOPMENT PROJECTED PEAK FLOWS**

| BASIN | BASIN | EXISTING Q, FLOWS (cfs) | | POST-DEVELOPMENT Q, FLOWS (cfs) | |
|---|---|---|---|---|---|
| NUMBER | AREA (Ac) | 25-YEAR | 50-YEAR | 25-YEAR | 50-YEAR |
| 1 | 268 | 3.71 | 5.68 | 4.16 | 6.23 |
| 2 | 200 | 3.11 | 4.66 | 4.17 | 5.96 |
| 3 | 188 | 2.30 | 3.61 | 3.25 | 4.78 |
| 4A | 190 | 2.95 | 4.42 | 5.43 | 7.43 |
| 4B | 69 | 4.27 | 7.07 | 10.80 | 15.22 |
| 4C | 81 | 7.59 | 12.12 | 10.05 | 15.09 |
| 5 | 43 | 4.47 | 6.31 | 8.47 | 11.03 |
| 6A | 132 | 1.20 | 2.02 | 2.51 | 3.64 |
| 6B | 101 | 1.92 | 2.79 | 3.10 | 4.20 |
| 7 | 202 | 0.90 | 1.98 | 1.83 | 3.09 |
| 8 | 119 | 2.98 | 4.16 | 3.17 | 4.37 |
| 9 | 310 | 3.31 | 5.33 | 3.79 | 5.94 |
| 10A | 94 | 6.48 | 10.31 | 13.78 | 19.42 |
| 10B | 115 | 2.40 | 3.42 | 4.52 | 5.95 |
| 11 | 290 | 4.50 | 6.75 | 6.05 | 8.64 |
| 12 | 116 | 1.07 | 1.78 | 3.32 | 4.54 |
| 13 | 195 | 2.70 | 4.14 | 5.19 | 7.16 |
| 14 | 108 | 1.68 | 2.52 | 2.06 | 2.98 |
| 15 | 636 | 8.77 | 13.43 | 9.83 | 14.75 |
| 16 | 811 | 7.05 | 12.21 | 8.37 | 13.79 |
| 17A | 312 | 3.33 | 5.37 | 4.84 | 7.25 |
| 17B | 132 | 2.04 | 3.06 | 3.24 | 4.52 |
| 18 | 584 | 5.83 | 9.77 | 7.85 | 12.16 |
| 19 | 611 | 6.36 | 10.42 | 7.37 | 11.62 |

## 4.3 Basin Descriptions

The following subsection describes each basin individually. The description is contained in one page, which contains a summary of the flow conditions, the existing system with present day problems, and the future system with recommended projects. The basin descriptions are intended as a narrative for the mapping in Appendix A.

# Basin No. 1

### Basin Description

Basin No. 1 is located north and east of the most northern portion of the urban grown boundary (UGB). Only about 10 acres of the basin is within the UGB and the impact to the storm system from the storm runoff is minimal. The flow for this basin that is within the UGB is probably routed through a storm drain system in Basin No.2 as part of the high school drainage system.

### Summary

| | |
|---|---|
| Area | 268 acres |
| Approximate area outside UGB | 95% |
| Approximate area within city limits | 0% |
| Existing Condition | |
| General Characterization of Surface | Native, Low Density Residential |
| Weighted Overall Runoff Coefficient | 43 |
| Peak Runoff for 25 Year Storm | 3.7 cfs |
| Peak Runoff for 50 Year Storm | 5.7 cfs |
| Urbanized (Future) Condition | |
| General Characterization of Surface | Native, Low Density Residential |
| Weighted Overall Runoff Coefficient | 44 |
| Peak Runoff for 25 Year Storm | 4.2 cfs |
| Peak Runoff for 50 Year Storm | 6.2 cfs |
| Change in Flows from Existing to Future | |
| 25 Year Storm | 14% |
| 50 Year Storm | 9% |
| Approx. Pipe Size Containing Entire Flow at 0.1% Slope | |
| Existing Peak Runoff for 25 Year Storm | 18" Diameter |
| Existing Peak Runoff for 50 Year Storm | 24" Diameter |
| Future Peak Runoff for 25 Year Storm | 18" Diameter |
| Future Peak Runoff for 50 Year Storm | 24" Diameter |

### Existing System

The general route of runoff appears to be overland surface flow with localized channels, such as, driveway culverts. East Evans Creek Road bisects the basin on a northerly line and approximately 80% of the surface area of the catchment is east and above the road. This water flows across the roadway to Evans Creek. The county maintains the roadway ditches.

### Present Day Problems

No drainage deficiencies are reported in this area.

### Future System

The future storm drain system in this area as it pertains to the city's capital improvement plan is negligible. The basin was considered in the hydrological analysis because a portion of the basin, namely, a portion of the high school site is within the urban growth boundary. The analysis shows that the impact to the city's storm drain system is insignificant and any runoff from the area within the UGB will be contributed to Basin No. 2.

### Recommended Projects

No capital improvement projects are recommended for this area.

# Basin No. 2

### Basin Description

Basin No. 2 is south of and adjacent to Basin No. 1. It is the first basin in the analysis that has significant impact to lands in the urban grown boundary (UGB). Over two thirds of the basin is outside of the UGB, but the runoff may flow past the boundary, across East Evans Creek Road to Evans Creek.

### Summary

| | |
|---|---|
| Area | 200 acres |
| Approximate area outside UGB | 70% |
| Approximate area within city limits | 0% |
| Existing Condition | |
| General Characterization of Surface | Native, Low Density Residential |
| Weighted Overall Runoff Coefficient | 44 |
| Peak Runoff for 25 Year Storm | 3.1 cfs |
| Peak Runoff for 50 Year Storm | 4.7 cfs |
| Urbanized (Future) Condition | |
| General Characterization of Surface | Native, Low Density Residential |
| Weighted Overall Runoff Coefficient | 47 |
| Peak Runoff for 25 Year Storm | 4.2 cfs |
| Peak Runoff for 50 Year Storm | 6.0 cfs |
| Change in Flows from Existing to Future | |
| 25 Year Storm | 35% |
| 50 Year Storm | 22% |
| Approx. Pipe Size Containing Entire Flow at 0.1% Slope | |
| Existing Peak Runoff for 25 Year Storm | 18" Diameter |
| Existing Peak Runoff for 50 Year Storm | 18" Diameter |
| Future Peak Runoff for 25 Year Storm | 18" Diameter |
| Future Peak Runoff for 50 Year Storm | 24" Diameter |

### Existing System

The majority of the area outside of the UGB contains large residential parcels. The storm runoff from this area may be locally collected and routed, however, overland flow is generally directed across the urban growth boundary toward the high school lot. Because of the amount of paved, impervious surface associated with the school, the storm water is channeled and discharged across East Evans Creek Road and through a very short reach, into Evans Creek. The county maintains the roadway ditches.

### Present Day Problems

No drainage deficiencies are reported in this area.

### Future System

The comprehensive plan forecasts this area to generally remain as it is now, that is, "low density residential" with the high school use predominating. Future development will not have significant impact on the storm drain system. When the area is annexed, maintenance of the drainageways will become the responsibility of the city. With future urbanization, a channeled and easily maintained method of routing storm water from East Evans Creek Road to Evans Creek should be developed.

### Recommended Projects

No capital improvement projects are recommended for this area.

# Basin No. 3

## Basin Description

Basin No. 3 is south of and adjacent to Basin No. 2. In the order in which the catchments were analyzed, this is the first basin that contains drainage in the actual city limits. Similar to Basin No. 2, a large portion of the surface runoff is generated on the eastern portion of the basin and flows west across lands in the urban growth boundary, crosses East Evans Creek Road, and then, flows a short distance to Evans Creek.

## Summary

| | |
|---|---|
| Area | 188 acres |
| Approximate area outside UGB | 60% |
| Approximate area within city limits | 10% |
| Existing Condition | |
| General Characterization of Surface | Native, Low Density Residential |
| Weighted Overall Runoff Coefficient | 42 |
| Peak Runoff for 25 Year Storm | 2.3 cfs |
| Peak Runoff for 50 Year Storm | 3.6 cfs |
| Urbanized (Future) Condition | |
| General Characterization of Surface | Native, Low Density Residential |
| Weighted Overall Runoff Coefficient | 45 |
| Peak Runoff for 25 Year Storm | 3.3 cfs |
| Peak Runoff for 50 Year Storm | 4.8 cfs |
| Change in Flows from Existing to Future | |
| 25 Year Storm | 43% |
| 50 Year Storm | 33% |
| Approx. Pipe Size Containing Entire Flow at 0.1% Slope | |
| Existing Peak Runoff for 25 Year Storm | 15" Diameter |
| Existing Peak Runoff for 50 Year Storm | 18" Diameter |
| Future Peak Runoff for 25 Year Storm | 18" Diameter |
| Future Peak Runoff for 50 Year Storm | 24" Diameter |

## Existing System

There is no developed storm drain system in this basin. Flows are locally managed by use of short culverts, roadside ditches, and privately maintained ditches. The southern portion of the basin is within the present city limits, however, the drainage at East Evans Creek Road flows away from the city, north, parallel with the road and then east for a short distance to the creek.

## Present Day Problems

No drainage deficiencies are reported in this area.

## Future System

According to the comprehensive plan, the area within the UGB will be predominately low density residential with a small portion of the southern basin becoming medium density residential. The future development increases the need for channeled and easily maintained drainageways.

## Recommended Projects

No capital improvement projects are recommended for this area.

# Basin No. 4A

## Basin Description

Basin No. 4A is a sub-catchment of a larger basin used in the hydrologic analysis. The basin was subdivided because of the amount of storm runoff that was produced. The subbasin is adjacent to and directly south of Basin No. 3. Storm water flows from the east to the west across Broadway Street and Pine Street and then contributes to Evans Creek. This is the first basin in which all of the generated storm water passes through the city lands.

## Summary

| | |
|---|---|
| Area | 190 acres |
| Approximate area outside UGB | 65% |
| Approximate area within city limits | 25% |
| Existing Condition | |
| General Characterization of Surface | Native, Medium Density Residential |
| Weighted Overall Runoff Coefficient | 44 |
| Peak Runoff for 25 Year Storm | 2.9 cfs |
| Peak Runoff for 50 Year Storm | 4.4 cfs |
| Urbanized (Future) Condition | |
| General Characterization of Surface | Native, Low/Medium Density Residential |
| Weighted Overall Runoff Coefficient | 51 |
| Peak Runoff for 25 Year Storm | 5.4 cfs |
| Peak Runoff for 50 Year Storm | 7.4 cfs |
| Change in Flows from Existing to Future | |
| 25 Year Storm | 86% |
| 50 Year Storm | 68% |
| Approx. Pipe Size Containing Entire Flow at 0.1% Slope | |
| Existing Peak Runoff for 25 Year Storm | 18" Diameter |
| Existing Peak Runoff for 50 Year Storm | 24" Diameter |
| Future Peak Runoff for 25 Year Storm | 24" Diameter |
| Future Peak Runoff for 50 Year Storm | 24" Diameter |

## Existing System

The existing system consists of open ditches, driveway culverts, and short sections of storm drains. However, unlike the previous basins, an open channel drainage system, that is, a ditch traverses the subbasin and collects water from various areas. Roadway ditches with short sections of pipes drain portions of Broadway Street and Pine Street to Evans Creek.

## Present Day Problems

1. Storm water overruns the catch basins on the east side of Broadway Street.
2. A Grants Pass Irrigation District drop box above and to the east of Broadway Street overflows from the canal and flows to the roadway.

## Future System

The existing system appears to be fully utilized at this time. Increased development from the low-density residential areas on the north and east of the basin will generate increased runoff. The future system must provide increased capacity for the new areas and for medium density development in the existing drainage area. The future system must also relieve storm water from the drainage on Broadway Street. The present day problems may be helped by constructing a ditch and field inlets.

## Recommended Projects

Capital improvement Project No. 4A is recommended for this area.

# Basin No. 4B

## Basin Description
Basin No. 4B is another sub-catchment of a larger basin which was refined because of the amount of flow generated by urbanization and the existing developed storm drainage system. Storm water flows from the east to the west across Broadway Street and Pine Street.

## Summary

| | |
|---|---|
| Area | 69 acres |
| Approximate area outside UGB | 0% |
| Approximate area within city limits | 88% |
| Existing Condition | |
| General Characterization of Surface | Commercial, Medium Density Residential |
| Weighted Overall Runoff Coefficient | 61 |
| Peak Runoff for 25 Year Storm | 4.3 cfs |
| Peak Runoff for 50 Year Storm | 7.2 cfs |
| Urbanized (Future) Condition | |
| General Characterization of Surface | Commercial, Medium Density Residential |
| Weighted Overall Runoff Coefficient | 68 |
| Peak Runoff for 25 Year Storm | 10.9 cfs |
| Peak Runoff for 50 Year Storm | 15.4 cfs |
| Change in Flows from Existing to Future | |
| 25 Year Storm | 153% |
| 50 Year Storm | 114% |
| Approx. Pipe Size Containing Entire Flow at 0.1% Slope | |
| Existing Peak Runoff for 25 Year Storm | 24" Diameter |
| Existing Peak Runoff for 50 Year Storm | 24" Diameter |
| Future Peak Runoff for 25 Year Storm | 30" Diameter |
| Future Peak Runoff for 50 Year Storm | 36" Diameter |

## Existing System
Basin No. 4B has a closed channel, i.e., a piped drainage system on each street. The sizes range between 4" and 24" in diameter. The drainage system accepts storm water from other basins identified in this report. The storm water is discharged to Evans Creek.

## Present Day Problems
Storm water overruns the catch basins on the east side of Broadway Street south of Seventh Street.

## Future System
The existing system appears to be at capacity for the 25-year storm at this time. To allow for more development in the basin, the flows in the existing pipes can be intercepted with new pipes to allow increased flow down stream. The present day problem can be solved with a curb system.

## Recommended Projects
Project No. 4B is recommended for this area.

# Basin No. 4C

### Basin Description

Basin No. 4 was subdivided into three basins. The larger basin generally flows from the northeast to the southwest. The Basin No. 4C is the southmost sub-catchment. Unlike the two other subbasins, 4A and 4B, storm water in this catchment naturally flows to both Evans Creek and the Rogue River although Interstate 5 forms a barrier to the natural path.

### Summary

| | |
|---|---|
| Area | 81 acres |
| Approximate area outside UGB | 0% |
| Approximate area within city limits | 100% |
| Existing Condition | |
| General Characterization of Surface | Commercial, Medium Density Residential |
| Weighted Overall Runoff Coefficient | 63 |
| Peak Runoff for 25 Year Storm | 7.6 cfs |
| Peak Runoff for 50 Year Storm | 12.1 cfs |
| Urbanized (Future) Condition | |
| General Characterization of Surface | Commercial, Medium Density Residential |
| Weighted Overall Runoff Coefficient | 65 |
| Peak Runoff for 25 Year Storm | 10.1 cfs |
| Peak Runoff for 50 Year Storm | 15.1 cfs |
| Future Flow as a Percent of Current Flow | |
| 25 Year Storm | 132% |
| 50 Year Storm | 125% |
| Approx. Pipe Size Containing Entire Flow at 0.1% Slope | |
| Existing Peak Runoff for 25 Year Storm | 24" Diameter |
| Existing Peak Runoff for 50 Year Storm | 30" Diameter |
| Future Peak Runoff for 25 Year Storm | 30" Diameter |
| Future Peak Runoff for 50 Year Storm | 36" Diameter |

### Existing System

The existing systems in Basin No. 4C are complicated. The basin's systems not only discharge into both Evans Creek and Wards Creek, but these pipes also transport storm water from other basins.

### Present Day Problems

1. The drainage system at Depot Street and Classick Drive appears to be undersized.
2. The area at the northeast corner of Pine Street and Main Street floods.
3. The flush catch basin and service line at East Main and Oak is undersized.

### Future System

The future system may be developed along Classick Drive between the intersection of Pine Street and Main Street and Wards Creek. The new system will ease existing the systems along Main Street and Pine Street and relieve the intermittent flooding areas.

### Recommended Projects

Capital improvement Project No. 4C is recommended for this area.

# Basin No. 5

### Basin Description

Basin No. 5 is in the center of the city and perhaps has the most impervious area per acre currently and in its projected fully urbanized condition. A slight ridgeline separates it from Basin No. 4. Storm water flows from the north to the south and southeast into Wards Creek.

### Summary

| | |
|---|---|
| Area | 43 acres |
| Approximate area outside UGB | 0% |
| Approximate area within city limits | 100% |
| Existing Condition | |
| General Characterization of Surface | Medium Density Residential |
| Weighted Overall Runoff Coefficient | 67 |
| Peak Runoff for 25 Year Storm | 4.5 cfs |
| Peak Runoff for 50 Year Storm | 6.3 cfs |
| Urbanized (Future) Condition | |
| General Characterization of Surface | Commercial, High/Medium Density Residential |
| Weighted Overall Runoff Coefficient | 75 |
| Peak Runoff for 25 Year Storm | 8.5 cfs |
| Peak Runoff for 50 Year Storm | 11.0 cfs |
| Change in Flows from Existing to Future | |
| 25 Year Storm | 89% |
| 50 Year Storm | 75% |
| Approx. Pipe Size Containing Entire Flow at 0.1% Slope | |
| Existing Peak Runoff for 25 Year Storm | 24" Diameter |
| Existing Peak Runoff for 50 Year Storm | 24" Diameter |
| Future Peak Runoff for 25 Year Storm | 30" Diameter |
| Future Peak Runoff for 50 Year Storm | 30" Diameter |

### Existing System

The north portion of Basin No. 5 has a developed storm drain system with discharges through other basins into Evans Creek. The storm drain system appears to be at capacity during storms. The southern portion of the basin does not have a systematic drain and relies on overland street flow during storms. Water that is not channeled to other basins appears to collect near First Street and Cedar Street and then flows to Ward Creek overland.

### Present Day Problems

The land between the intersection of First Street and Cedar Street and Wards Creek floods during storms.

### Future System

The future system develops a storm drain system within the basin and discharges to Wards Creek. The drainage system also intercepts a portion of the flow from Basin No. 6B and relieves the systems in Basins No. 4B and 4C.

### Recommended Projects

Capital improvement Project No. 5 is recommended for this basin.

# Basin No. 6A

## Basin Description

Basin No. 6A is a sub-catchment of a larger basin. The majority of the basin is outside of the urban growth boundary although the entirety of the storm water flows through UGB lands to Wards Creek. The general flow pattern is north to south.

## Summary

| | |
|---|---|
| Area | 132 acres |
| Approximate area outside UGB | 75% |
| Approximate area within city limits | 0% |
| Existing Condition | |
| General Characterization of Surface | Native |
| Weighted Overall Runoff Coefficient | 40 |
| Peak Runoff for 25 Year Storm | 1.2 cfs |
| Peak Runoff for 50 Year Storm | 2.0 cfs |
| Urbanized (Future) Condition | |
| General Characterization of Surface | Native, Medium Density Residential |
| Weighted Overall Runoff Coefficient | 44 |
| Peak Runoff for 25 Year Storm | 2.5 cfs |
| Peak Runoff for 50 Year Storm | 3.6 cfs |
| Change in Flows from Existing to Future | |
| 25 Year Storm | 108% |
| 50 Year Storm | 80% |
| Approx. Pipe Size Containing Entire Flow at 0.1% Slope | |
| Existing Peak Runoff for 25 Year Storm | 12" Diameter |
| Existing Peak Runoff for 50 Year Storm | 15" Diameter |
| Future Peak Runoff for 25 Year Storm | 18" Diameter |
| Future Peak Runoff for 50 Year Storm | 18" Diameter |

## Existing System

There is no developed storm drain system in this basin. Flows are locally managed by use of short culverts, roadside ditches, and privately maintained ditches.

## Present Day Problems

No drainage deficiencies are reported in this area.

## Future System

The southern third of the basin is on lands proposed for future annexation into the city. According to the comprehensive plan, the area within the UGB will be predominately medium density residential. The future system will drain into Wards Creek.

## Recommended Projects

No capital improvement projects are recommended for this area.

# Basin No. 6B

## Basin Description

Basin No. 6B is a sub-catchment of a larger basin. A subdivision of the major basin was motivated by the development in the area. Basin No. 6B contains smaller parcels and appears to be more urbanized that Basin No. 6A. Storm water flows from the north to the south and contributes to Evans Creek.

## Summary

| | |
|---|---|
| Area | 101 acres |
| Approximate area outside UGB | 20% |
| Approximate area within city limits | 65% |
| Existing Condition | |
| General Characterization of Surface | Native, Low/Medium Density Residential |
| Weighted Overall Runoff Coefficient | 46 |
| Peak Runoff for 25 Year Storm | 1.9 cfs |
| Peak Runoff for 50 Year Storm | 2.8 cfs |
| Urbanized (Future) Condition | |
| General Characterization of Surface | Medium Density Residential |
| Weighted Overall Runoff Coefficient | 52 |
| Peak Runoff for 25 Year Storm | 3.1 cfs |
| Peak Runoff for 50 Year Storm | 4.2 cfs |
| Future Flow as a Percent of Current Flow | |
| 25 Year Storm | 162% |
| 50 Year Storm | 151% |
| Approx. Pipe Size Containing Entire Flow at 0.1% Slope | |
| Existing Peak Runoff for 25 Year Storm | 15" Diameter |
| Existing Peak Runoff for 50 Year Storm | 18" Diameter |
| Future Peak Runoff for 25 Year Storm | 18" Diameter |
| Future Peak Runoff for 50 Year Storm | 24" Diameter |

## Existing System

The majority of the basin is within the present city limits. The drainage system appears to be developed within Prospect subdivision, but the discharge point is the Grants Pass Irrigation District canal. The other developed system is along on Third Street. Approximately half of the water discharges through an open ditch to Wards Creek and the other half discharges into a pipe system which traverses through Basins Nos. 5, 4B, and 4C.

## Present Day Problems

The storm water on the northeast portion of Prospect subdivision overflows from the storm drainage system and sheet flows over the roadway.

## Future System

Downstream improvements will relieve development pressure on half of the existing storm drain system on Third Street. A new culvert between Third Street and Wards Creek near the existing open ditch was recently installed to allow an outlet for increased flows north of Third Street.

## Recommended Projects

Capital improvement Project No. 6B is recommended for this area.

## Basin No. 7

### Basin Description

Basin No. 7 is located east of the most eastern portion of the urban grown boundary (UGB). About 22 acres of the basin is within the UGB and the impact to the storm system from the storm runoff is minimal since storm water does not flow over roadways but directly into Wards Creek.

### Summary

| | |
|---|---|
| Area | 202 acres |
| Approximate area outside UGB | 90% |
| Approximate area within city limits | 0% |
| Existing Condition | |
| General Characterization of Surface | Native, Low Density Residential |
| Weighted Overall Runoff Coefficient | 37 |
| Peak Runoff for 25 Year Storm | 0.9 cfs |
| Peak Runoff for 50 Year Storm | 2.0 cfs |
| Urbanized (Future) Condition | |
| General Characterization of Surface | Native, Low/Medium Density Residential |
| Weighted Overall Runoff Coefficient | 44 |
| Peak Runoff for 25 Year Storm | 3.1 cfs |
| Peak Runoff for 50 Year Storm | 4.7 cfs |
| Change in Flows from Existing to Future | |
| 25 Year Storm | 244% |
| 50 Year Storm | 135% |
| Approx. Pipe Size Containing Entire Flow at 0.1% Slope | |
| Existing Peak Runoff for 25 Year Storm | 12" Diameter |
| Existing Peak Runoff for 50 Year Storm | 15" Diameter |
| Future Peak Runoff for 25 Year Storm | 18" Diameter |
| Future Peak Runoff for 50 Year Storm | 24" Diameter |

### Existing System

Flows appear to be managed locally by use of short culverts, roadside ditches, and privately maintained ditches.

### Present Day Problems

No drainage deficiencies are reported in this area.

### Future System

The future drainage system will discharge directly into Wards Creek.

### Recommended Projects

No capital improvement projects are recommended for this area.

## Basin No. 8

### Basin Description

Basin No. 8 is the most easterly catchment in the study. Only a small portion of the basin is within the urban growth boundary. That portion may be impacted by a disproportionate amount of storm water since it is on the low end of the basin near Wards Creek. The majority of the surface water runs from the southeast to the northwest, across Wards Creek Road and on to Wards Creek.

### Summary

| | |
|---|---|
| Area | 119 acres |
| Approximate area outside UGB | 95% |
| Approximate area within city limits | 0% |
| Existing Condition | |
| General Characterization of Surface | Native, Low Density Residential |
| Weighted Overall Runoff Coefficient | 49 |
| Peak Runoff for 25 Year Storm | 3.0 cfs |
| Peak Runoff for 50 Year Storm | 4.2 cfs |
| Urbanized (Future) Condition | |
| General Characterization of Surface | Native, Low Density Residential |
| Weighted Overall Runoff Coefficient | 50 |
| Peak Runoff for 25 Year Storm | 3.2 cfs |
| Peak Runoff for 50 Year Storm | 4.4 cfs |
| Change in Flows from Existing to Future | |
| 25 Year Storm | 7% |
| 50 Year Storm | 5% |
| Approx. Pipe Size Containing Entire Flow at 0.1% Slope | |
| Existing Peak Runoff for 25 Year Storm | 18" Diameter |
| Existing Peak Runoff for 50 Year Storm | 18" Diameter |
| Future Peak Runoff for 25 Year Storm | 18" Diameter |
| Future Peak Runoff for 50 Year Storm | 18" Diameter |

### Existing System

Flows appear to be managed locally by short culverts, roadside ditches, and privately maintained ditches.

### Present Day Problems

No drainage deficiencies are reported in this area.

### Future System

If the drainage along Ward Creek Road is not shunted to the creek before it reaches the west boundary of the basin, then the water enters city lands. A cutoff route may be appropriate on the west edge of the basin from the roadway to the creek.

### Recommended Projects

No capital improvement projects are recommended for this area.

# Basin No. 9

## Basin Description

Basin No. 9 is located on the east portion of the urban growth boundary. Storm water flows from the east and south in a northern direction across Wards Creek Road to Wards Creek. All of the water passes through the future city lands. Surface runoff is delayed and probably diverted by the roadway.

## Summary

| | |
|---|---|
| Area | 310 acres |
| Approximate area outside UGB | 87% |
| Approximate area within city limits | 0% |
| Existing Condition | |
| General Characterization of Surface | Native, Low Density Residential |
| Weighted Overall Runoff Coefficient | 41 |
| Peak Runoff for 25 Year Storm | 3.3 cfs |
| Peak Runoff for 50 Year Storm | 5.3 cfs |
| Urbanized (Future) Condition | |
| General Characterization of Surface | Native, Low/Medium Density Residential |
| Weighted Overall Runoff Coefficient | 42 |
| Peak Runoff for 25 Year Storm | 3.8 cfs |
| Peak Runoff for 50 Year Storm | 5.9 cfs |
| Future Flow as a Percent of Current Flow | |
| 25 Year Storm | 115% |
| 50 Year Storm | 111% |
| Approx. Pipe Size Containing Entire Flow at 0.1% Slope | |
| Existing Peak Runoff for 25 Year Storm | 18" Diameter |
| Existing Peak Runoff for 50 Year Storm | 24" Diameter |
| Future Peak Runoff for 25 Year Storm | 24" Diameter |
| Future Peak Runoff for 50 Year Storm | 24" Diameter |

## Existing System

Flows appear to be managed locally by short culverts, roadside ditches, and privately maintained ditches.

## Present Day Problems

No drainage deficiencies are reported in this area.

## Future System

About 90% of the drainage in Basin No. 9 will flow across future city lands to Wards Creek. The future system will collect water on the south side of Wards Creek Road and channel it to Wards Creek perhaps by way of the undeveloped Laurel Street right-of-way. The lands on the north side of Wards Creek Road will naturally drain directly to Wards Creek.

## Recommended Projects

No capital improvement projects are recommended for this area.

# Basin No. 10A

### Basin Description

Basin No. 10A spans the open area at the mill site and the shopping center site and is generally the city's industrial area. Storm water flows from the east to the west. The natural direction of drainage appears to be the Rogue River, however, Interstate 5 may form a barrier. All of the drainage in this basin flows across existing city lands.

### Summary

| | |
|---|---|
| Area | 94 acres |
| Approximate area outside UGB | 15% |
| Approximate area within city limits | 70% |
| Existing Condition | |
| General Characterization of Surface | Commercial, Industrial |
| Weighted Overall Runoff Coefficient | 62 |
| Peak Runoff for 25 Year Storm | 6.6 cfs |
| Peak Runoff for 50 Year Storm | 10.6 cfs |
| Urbanized (Future) Condition | |
| General Characterization of Surface | Commercial, Industrial |
| Weighted Overall Runoff Coefficient | 68 |
| Peak Runoff for 25 Year Storm | 14.3 cfs |
| Peak Runoff for 50 Year Storm | 19.9 cfs |
| Change in Flows from Existing to Future | |
| 25 Year Storm | 114% |
| 50 Year Storm | 88% |
| Approx. Pipe Size Containing Entire Flow at 0.1% Slope | |
| Existing Peak Runoff for 25 Year Storm | 24" Diameter |
| Existing Peak Runoff for 50 Year Storm | 30" Diameter |
| Future Peak Runoff for 25 Year Storm | 30" Diameter |
| Future Peak Runoff for 50 Year Storm | 36" Diameter |

### Existing System

The existing collection system consists of a piped system on the north side of North River Road. The southern portion of the system becomes a series of intermittent ditches. The outlet for the North River Road system is a drainage ditch on the Mill property. The ditch flows west to an outlet at Wards Creek.

### Present Day Problems

A Grants Pass Irrigation District drop box overflows during the winter months and spills onto North River Road.

### Future System

The future system must accommodate increased flows from Basin No. 11 as well as the increases within the basin. According to the comprehensive plan, this area will develop industrially. A large diameter pipe will enclose the existing drainage ditch.

### Recommended Projects

Capital improvement Project No. 10A is recommended for this area.

# Basin No. 10B

## Basin Description

Basin No. 10B is located on the eastern portion of the present city limits. Water flows from the southeast to the northwest over Wards Creek Road to Wards Creek. Since about half of the basin area is above Wards Creek Road water appears to be diverted along the roadway system toward the western basins.

## Summary

| | |
|---|---|
| Area | 115 acres |
| Approximate area outside UGB | 10% |
| Approximate area within city limits | 35% |
| Existing Condition | |
| General Characterization of Surface | Commercial, Medium Density Residential |
| Weighted Overall Runoff Coefficient | 47 |
| Peak Runoff for 25 Year Storm | 2.4 cfs |
| Peak Runoff for 50 Year Storm | 3.4 cfs |
| Urbanized (Future) Condition | |
| General Characterization of Surface | Commercial, Low/Medium/High Density Residential |
| Weighted Overall Runoff Coefficient | 56 |
| Peak Runoff for 25 Year Storm | 4.5 cfs |
| Peak Runoff for 50 Year Storm | 6.0 cfs |
| Change in Flows from Existing to Future | |
| 25 Year Storm | 88% |
| 50 Year Storm | 77% |
| Approx. Pipe Size Containing Entire Flow at 0.1% Slope | |
| Existing Peak Runoff for 25 Year Storm | 15" Diameter |
| Existing Peak Runoff for 50 Year Storm | 18" Diameter |
| Future Peak Runoff for 25 Year Storm | 24" Diameter |
| Future Peak Runoff for 50 Year Storm | 24" Diameter |

## Existing System

The east half of the basin consists of undeveloped local systems, such as, ditches and driveway culverts. The west half of the basin has about three developed systems, which discharge into Wards Creek. The largest system drains the lower portion of Wards Creek Road.

## Present Day Problems

No drainage deficiencies are reported in this area.

## Future System

The east half of the basin will be drained with systems that drain directly into Wards Creek. The storm water in the southwestern portion of the basin will be diverted at Wards Creek Road and discharged into Wards Creek by the existing system on East Main Street.

## Recommended Projects

Capital improvement Project No. 10B is recommended for this basin.

# Basin No. 11

## Basin Description

Basin No. 11 is on the south side of the city and the north side of the Rogue River. The natural drainage path is from the east to the west. Interstate 5 and the railroad form barriers to the path. More than two thirds of the basin drains across North River Road. A portion of this water diverts north into Basin No. 10A.

## Summary

| | |
|---|---|
| Area | 290 acres |
| Approximate area outside UGB | 83% |
| Approximate area within city limits | 16% |
| Existing Condition | |
| General Characterization of Surface | Native, Industrial |
| Weighted Overall Runoff Coefficient | 44 |
| Peak Runoff for 25 Year Storm | 4.5 cfs |
| Peak Runoff for 50 Year Storm | 6.8 cfs |
| Urbanized (Future) Condition | |
| General Characterization of Surface | Native, Industrial |
| Weighted Overall Runoff Coefficient | 47 |
| Peak Runoff for 25 Year Storm | 6.1 cfs |
| Peak Runoff for 50 Year Storm | 8.7 cfs |
| Change in Flows from Existing to Future | |
| 25 Year Storm | 37% |
| 50 Year Storm | 28% |
| Approx. Pipe Size Containing Entire Flow at 0.1% Slope | |
| Existing Peak Runoff for 25 Year Storm | 24" Diameter |
| Existing Peak Runoff for 50 Year Storm | 24" Diameter |
| Future Peak Runoff for 25 Year Storm | 24" Diameter |
| Future Peak Runoff for 50 Year Storm | 30" Diameter |

## Existing System

The existing collection system is generally a ditch along North River Road. The lands between North River Road and Interstate 5 appear to drain to the west or to a poorly defined ditch in Basin No. 10A.

## Present Day Problems

A Grants Pass Irrigation District to the east of North River Road overflows and spills water on the roadway.

## Future System

Since Interstate 5 forms a barrier for the water flowing to the west, North River Road probably collect storm water. The outlet for this system will utilize the storm drain in Basin No. 10A and discharge in to Wards Creek.

## Recommended Projects

No projects are recommended for the basin.

# Basin No. 12

### Basin Description
Basin No. 12 is the most southern catchment in the city. The Rogue River Highway, which runs along the south bank of the Rogue River, is the northeast boundary of the basin. Storm water flows northeasterly from the southwest to the river.

### Summary

| | |
|---|---|
| Area | 116 acres |
| Approximate area outside UGB | 80% |
| Approximate area within city limits | 1% |
| Existing Condition | |
| General Characterization of Surface | Native, Low Density Residential |
| Weighted Overall Runoff Coefficient | 40 |
| Peak Runoff for 25 Year Storm | 1.1 cfs |
| Peak Runoff for 50 Year Storm | 1.8 cfs |
| Urbanized (Future) Condition | |
| General Characterization of Surface | Native, Low Density Residential, Commercial, Industrial |
| Weighted Overall Runoff Coefficient | 51 |
| Peak Runoff for 25 Year Storm | 3.3 cfs |
| Peak Runoff for 50 Year Storm | 4.5 cfs |
| Change in Flows from Existing to Future | |
| 25 Year Storm | 200% |
| 50 Year Storm | 150% |
| Approx. Pipe Size Containing Entire Flow at 0.1% Slope | |
| Existing Peak Runoff for 25 Year Storm | 12" Diameter |
| Existing Peak Runoff for 50 Year Storm | 15" Diameter |
| Future Peak Runoff for 25 Year Storm | 18" Diameter |
| Future Peak Runoff for 50 Year Storm | 24" Diameter |

### Existing System
There are no developed storm drains in the basin and flows are managed by local systems. All surface water flows to the roadway and then passes under the highway and directly to the river.

### Present Day Problems
No drainage deficiencies are reported in this area.

### Future System
As the area develops, the amount of runoff will double. The comprehensive plan shows commercial and industrial use of the lands. These uses generally mean large impervious areas, which generate large flows quickly during storms. The roadway ditches probably cannot handle the flows and more cross culverts to the river or a storm drain system collection system will be needed.

### Recommended Projects
No capital improvement projects are recommended for this area.

# Basin No. 13

### Basin Description

Basin No. 13 is the southmost basin in the city. Storm water flows generally from the south to the north over the Rogue River Highway to the Rogue River.

### Summary

| | |
|---|---|
| Area | 195 acres |
| Approximate area outside UGB | 60% |
| Approximate area within city limits | 20% |
| Existing Condition | |
| General Characterization of Surface | Native, Low Density Residential |
| Weighted Overall Runoff Coefficient | 43 |
| Peak Runoff for 25 Year Storm | 2.7 cfs |
| Peak Runoff for 50 Year Storm | 4.1 cfs |
| Urbanized (Future) Condition | |
| General Characterization of Surface | Native, Low Density Residential |
| Weighted Overall Runoff Coefficient | 50 |
| Peak Runoff for 25 Year Storm | 5.2 cfs |
| Peak Runoff for 50 Year Storm | 7.2 cfs |
| Change in Flows from Existing to Future | |
| 25 Year Storm | 93% |
| 50 Year Storm | 76% |
| Approx. Pipe Size Containing Entire Flow at 0.1% Slope | |
| Existing Peak Runoff for 25 Year Storm | 18" Diameter |
| Existing Peak Runoff for 50 Year Storm | 24" Diameter |
| Future Peak Runoff for 25 Year Storm | 24" Diameter |
| Future Peak Runoff for 50 Year Storm | 24" Diameter |

### Existing System

The existing system consists of collections points along the Rogue River Highway. The system is segmental, that is, the system is not developed along the entire length of the roadway within the basin. There are three outlets to the Rogue River, all of which appear to be at capacity in storms.

### Present Day Problems

A Gold Hill Irrigation District drop box at the northern part of the basin overflows and spills on to the roadway.

### Future System

The topography of the basin allows for short discharge pipes to the river. Since the comprehensive plan shows the area developing as a commercial and industrial area, the existing discharge pipes will increase in size and number.

### Recommended Projects

Capital improvement Project No. 13 is recommended for this area.

# Basin No. 14

### Basin Description

Basin No. 14 contains the southwest portion of the city's urban growth boundary. It is bounded on the north by Rogue River. The Rogue River Highway bisects the catchment into a north half and a south half. Surface water flows from the south to the north.

### Summary

| | |
|---|---|
| Area | 108 acres |
| Approximate area outside UGB | 76% |
| Approximate area within city limits | 0% |
| Existing Condition | |
| General Characterization of Surface | Native, Low Density Residential |
| Weighted Overall Runoff Coefficient | 44 |
| Peak Runoff for 25 Year Storm | 2.1 cfs |
| Peak Runoff for 50 Year Storm | 4.9 cfs |
| Urbanized (Future) Condition | |
| General Characterization of Surface | Native, Low Density Residential, Commercial |
| Weighted Overall Runoff Coefficient | 46 |
| Peak Runoff for 25 Year Storm | 3.5 cfs |
| Peak Runoff for 50 Year Storm | 7.9 cfs |
| Change in Flows from Existing to Future | |
| 25 Year Storm | 67% |
| 50 Year Storm | 61% |
| Approx. Pipe Size Containing Entire Flow at 0.1% Slope | |
| Existing Peak Runoff for 25 Year Storm | 15" Diameter |
| Existing Peak Runoff for 50 Year Storm | 24" Diameter |
| Future Peak Runoff for 25 Year Storm | 18" Diameter |
| Future Peak Runoff for 50 Year Storm | 24" Diameter |

### Existing System

There are no developed storm drain systems in the basin. Flows are managed locally through culverts and ditches.

### Present Day Problems

No drainage deficiencies are reported in this area.

### Future System

The comprehensive plan shows commercial growth between the Rogue River Highway and the Rogue River.

### Recommended Projects

No capital improvement projects are recommended for this area.

# Basin No. 15

### Basin Description

Basin No. 15 spans the most western portion of the city's urban growth boundary. Interstate 5 and the Rogue River form the southeast boundary of the basin and all runoff from the northwest to the southeast flows to the river. About half of the basin contributes to the area in the urban growth boundary, however, the freeway drainage system and the Grants Pass Irrigation District canals impact and redirect the storm flows.

### Summary

| | |
|---|---|
| Area | 636 acres |
| Approximate area outside UGB | 88% |
| Approximate area within city limits | 0% |
| Existing Condition | |
| General Characterization of Surface | Native, Low Density Residential |
| Weighted Overall Runoff Coefficient | 43 |
| Peak Runoff for 25 Year Storm | 8.8 cfs |
| Peak Runoff for 50 Year Storm | 13.4 cfs |
| Urbanized (Future) Condition | |
| General Characterization of Surface | Native, Low Density Residential |
| Weighted Overall Runoff Coefficient | 44 |
| Peak Runoff for 25 Year Storm | 9.8 cfs |
| Peak Runoff for 50 Year Storm | 14.8 cfs |
| Future Flow as a Percent of Current Flow | |
| 25 Year Storm | 112% |
| 50 Year Storm | 110% |
| Approx. Pipe Size Containing Entire Flow at 0.1% Slope | |
| Existing Peak Runoff for 25 Year Storm | 30" Diameter |
| Existing Peak Runoff for 50 Year Storm | 30" Diameter |
| Future Peak Runoff for 25 Year Storm | 30" Diameter |
| Future Peak Runoff for 50 Year Storm | 30" Diameter |

### Existing System

The only developed storm drain system in the basin is in the state highway right-of-way. The system is highly under-drained and the discharge points for the system flow to the ditches along Foothills Boulevard. These ditches route water to culverts or overland to the Rogue River.

### Present Day Problems

No drainage deficiencies are reported in this area.

### Future System

Within the urban growth boundary, there is approximately 3,300 feet of ditches along Foothills Boulevard and twice this amount if both sides are considered. This volume of water must drain to the river during storms. The route to the river is important to preserve and the city may consider constructing a channel for ease of maintenance.

### Recommended Projects

No capital improvements projects are recommended for this area.

# Basin No. 16

## Basin Description

Basin No. 16 is the largest storm catchment in the study. Although it contains over 800 acres, it has the lowest runoff discharge per acre of all the basins. Storm water runs over undeveloped lands from the northwest to the southeast toward Interstate 5 and the Rogue River. Water flows across Foothill Boulevard and appears to discharge into a wetland system on the north side of the freeway.

## Summary

| | |
|---|---|
| Area | 811 acres |
| Approximate area outside UGB | 92% |
| Approximate area within city limits | 4% |
| Existing Condition | |
| General Characterization of Surface | Native, Low Density Residential |
| Weighted Overall Runoff Coefficient | 40 |
| Peak Runoff for 25 Year Storm | 7.1 cfs |
| Peak Runoff for 50 Year Storm | 12.2 cfs |
| Urbanized (Future) Condition | |
| General Characterization of Surface | Native, Low/High Density Residential |
| Weighted Overall Runoff Coefficient | 41 |
| Peak Runoff for 25 Year Storm | 8.4 cfs |
| Peak Runoff for 50 Year Storm | 13.8 cfs |
| Future Flow as a Percent of Current Flow | |
| 25 Year Storm | 118% |
| 50 Year Storm | 113% |
| Approx. Pipe Size Containing Entire Flow at 0.1% Slope | |
| Existing Peak Runoff for 25 Year Storm | 24" Diameter |
| Existing Peak Runoff for 50 Year Storm | 30" Diameter |
| Future Peak Runoff for 25 Year Storm | 30" Diameter |
| Future Peak Runoff for 50 Year Storm | 30" Diameter |

## Existing System

The existing system consists of a ditch and culvert collection system on Foothills Boulevard. The water discharges into wetlands between the roadway and Interstate 5.

## Present Day Problems

No drainage deficiencies are reported in this basin.

## Future System

The capacity of the wetlands under storm conditions is not known. The capacity the pipes under Foothills Boulevard appear to be adequate for the areas that they serve. However, future development may increase the number of crossings.

## Recommended Projects

No capital improvements projects are recommended for this area.

# Basin No. 17A

### Basin Description

Basin No. 17A is a portion of a larger basin. A subdivision was made because of the city limits and the amount of urbanization contained in the southern portion of the large catchment. Storm water flows southeasterly from the northwest, across West Evans Creek Road to Evans Creek.

### Summary

| | |
|---|---|
| Area | 312 acres |
| Approximate area outside UGB | 55% |
| Approximate area within city limits | 0% |
| Existing Condition | |
| General Characterization of Surface | Native, Low Density Residential |
| Weighted Overall Runoff Coefficient | 41 |
| Peak Runoff for 25 Year Storm | 3.3 cfs |
| Peak Runoff for 50 Year Storm | 5.4 cfs |
| Urbanized (Future) Condition | |
| General Characterization of Surface | Native, Low Density Residential |
| Weighted Overall Runoff Coefficient | 44 |
| Peak Runoff for 25 Year Storm | 4.8 cfs |
| Peak Runoff for 50 Year Storm | 7.3 cfs |
| Change in Flows from Existing to Future | |
| 25 Year Storm | 46% |
| 50 Year Storm | 35% |
| Approx. Pipe Size Containing Entire Flow at 0.1% Slope | |
| Existing Peak Runoff for 25 Year Storm | 18" Diameter |
| Existing Peak Runoff for 50 Year Storm | 24" Diameter |
| Future Peak Runoff for 25 Year Storm | 24" Diameter |
| Future Peak Runoff for 50 Year Storm | 24" Diameter |

### Existing System

Flows appear to be managed locally by short culverts, roadside ditches, and privately maintained ditches. A developed drainage system is not apparent.

### Present Day Problems

No drainage deficiencies are reported in this area.

### Future System

Basin No. 17A experiences a moderate increase in storm runoff in the urbanized condition. Future development west of West Evans Creek Road must allow for the passage of water from lands outside of the urban growth boundary. West Evans Creek Road will be a storm water collector with short discharge distances to Evans Creek.

### Recommended Projects

No capital improvement projects are recommended for this area.

# Basin No. 17B

### Basin Description

Basin No. 17B is on the west side of the city. Over half of the basin is within the city limits. The general flow of storm water is from the west to the east. The water flows over West Evans Creek Road into Evans Creek. It appears that a portion of the natural drainage path meandered to the south through a wetland and toward the Rogue River. Interstate 5 forms a barrier to southward drainage.

### Summary

| | |
|---|---|
| Area | 132 acres |
| Approximate area outside UGB | 11% |
| Approximate area within city limits | 55% |
| Existing Condition | |
| General Characterization of Surface | Native, Low/Medium Density Residential |
| Weighted Overall Runoff Coefficient | 44 |
| Peak Runoff for 25 Year Storm | 2.1 cfs |
| Peak Runoff for 50 Year Storm | 3.1 cfs |
| Urbanized (Future) Condition | |
| General Characterization of Surface | Native, Low/Medium Density Residential |
| Weighted Overall Runoff Coefficient | 49 |
| Peak Runoff for 25 Year Storm | 3.3 cfs |
| Peak Runoff for 50 Year Storm | 4.5 cfs |
| Change in Flows from Existing to Future | |
| 25 Year Storm | 57% |
| 50 Year Storm | 45% |
| Approx. Pipe Size Containing Entire Flow at 0.1% Slope | |
| Existing Peak Runoff for 25 Year Storm | 15" Diameter |
| Existing Peak Runoff for 50 Year Storm | 18" Diameter |
| Future Peak Runoff for 25 Year Storm | 18" Diameter |
| Future Peak Runoff for 50 Year Storm | 24" Diameter |

### Existing System

The existing system consists of open ditches along West Evans Creek Road and short sections of pipes at the cul-de-sacs near Evans Creek. A system on West Main Street collects storm water and drains to Evans Creek and a wetland to the west.

### Present Day Problems

1. The open ditch system on the west side of West Evans Creek Road does not have an outlet. During substantial storms, the ditch fills to capacity.
2. The Grants Pass Irrigation Canal overflows in the northwest portion of the basin.

### Future System

The future system would provide an outlet for the open ditch and increase the drainage capacity. Two new outlets would be provided to Evans Creek, which allow more water into the existing system.

### Recommended Projects

Capital improvement project No. 17B is recommended for this basin.

# Basin No. 18

### Basin Description

Basin No. 18 is a large basin on the northwest side of the urban growth boundary. About three quarters of the basin is outside of the UGB, however, all of the storm water flows across future city lands. The major flow pattern is from the west to the east across West Evans Creek Road to Evans Creek.

### Summary

| | |
|---|---|
| Area | 584 acres |
| Approximate area outside UGB | 25% |
| Approximate area within city limits | 0% |
| Existing Condition | |
| General Characterization of Surface | Native, Low Density Residential |
| Weighted Overall Runoff Coefficient | 41 |
| Peak Runoff for 25 Year Storm | 6.1 cfs |
| Peak Runoff for 50 Year Storm | 10.0 cfs |
| Urbanized (Future) Condition | |
| General Characterization of Surface | Native, Low Density Residential |
| Weighted Overall Runoff Coefficient | 43 |
| Peak Runoff for 25 Year Storm | 8.0 cfs |
| Peak Runoff for 50 Year Storm | 12.3 cfs |
| Change in Flows from Existing to Future | |
| 25 Year Storm | 31% |
| 50 Year Storm | 23% |
| Approx. Pipe Size Containing Entire Flow at 0.1% Slope | |
| Existing Peak Runoff for 25 Year Storm | 24" Diameter |
| Existing Peak Runoff for 50 Year Storm | 30" Diameter |
| Future Peak Runoff for 25 Year Storm | 24" Diameter |
| Future Peak Runoff for 50 Year Storm | 30" Diameter |

### Existing System

Flows appear to be managed locally by use of short culverts, roadside ditches, and privately maintained ditches. A developed drainage system is not apparent.

### Present Day Problems

No drainage deficiencies are reported in this area.

### Future System

The increase in storm runoff for future urbanization is small. West Evans Creek Road is a barrier to overland flow and the future storm drain system will probably collect water along the roadway and discharge through short culverts into Evans Creek.

### Recommended Projects

No capital improvement projects are recommended for this area.

## Basin No. 19

### Basin Description

Basin No. 19 is in the northwest portion of the hydrologic analysis area. A small portion of the urban growth boundary intersects the southeast area of the catchment. The storm runoff flows from the west to the east. West Evans Creek Road crosses the basin on a north-south line with 95% of the surface area to the west of the roadway. The surface water flows across the road and, along a short reach, into Evans Creek. The majority of the water flows north of the urban growth boundary.

### Summary

| | |
|---|---|
| Area | 611 acres |
| Approximate area outside UGB | 85% |
| Approximate area within city limits | 0% |
| Existing Condition | |
| General Characterization of Surface | Native, Low Density Residential |
| Weighted Overall Runoff Coefficient | 41 |
| Peak Runoff for 25 Year Storm | 6.5 cfs |
| Peak Runoff for 50 Year Storm | 10.5 cfs |
| Urbanized (Future) Condition | |
| General Characterization of Surface | Native, Low Density Residential |
| Weighted Overall Runoff Coefficient | 42 |
| Peak Runoff for 25 Year Storm | 7.4 cfs |
| Peak Runoff for 50 Year Storm | 11.7 cfs |
| Change in Flows from Existing to Future | |
| 25 Year Storm | 14% |
| 50 Year Storm | 11% |
| Approx. Pipe Size Containing Entire Flow at 0.1% Slope | |
| Existing Peak Runoff for 25 Year Storm | 24" Diameter |
| Existing Peak Runoff for 50 Year Storm | 30" Diameter |
| Future Peak Runoff for 25 Year Storm | 24" Diameter |
| Future Peak Runoff for 50 Year Storm | 30" Diameter |

### Existing System

Flows appear to be managed locally by short culverts, roadside ditches, and privately maintained ditches. The county maintains the public drainageways.

### Present Day Problems

No drainage deficiencies are reported in this area.

### Future System

The increase in future runoff is small, especially if only the portion in the UGB is considered. A cutoff route may be appropriate on the south edge of the basin to Evans Creek.

### Recommended Projects

No capital improvement projects are recommended for this area.

# Recommended Plan

Section

5

Section

5

# Recommended Plan

## 5.1 Proposed Storm Drain Improvements

Recommended improvements to the storm drain system are represented in Appendix A. Figures 8 and 9 represent projects to meet current conditions and Figures 10 and 11 detail projects for future development. This section contains the costs for each recommended project, the division of the financial responsibilities between city and development, and the priority of each project. Projects are described below:

### BASIN 4A

The existing storm water system for this basin consists mostly of open ditches with some sections of storm drains. The system is at or over capacity. The recommended improvements include installing about 400 lineal feet of curbs on the east side of Broadway, 1,500 feet of ditch excavation, 50 feet of 12-inch storm drain under Pine Street to replace the existing 10-inch culvert and two catch basins on Broadway to meet current flows.

Recommended improvements to meet future flows include the work recommended above and an additional 1,690 lineal feet of 12-inch to 24-inch storm drains, five manholes, and three additional catch basins. These improvements convey storm water for the areas from the north end of Broadway and west across Pine Street north of Creek View Lane to discharge in Evans Creek.

### BASIN 4B

The existing storm water system is piped and is at capacity. Storm water over runs the catch basins in some locations. Immediate recommendations are to install approximately 500 feet of curb on the east side of Broadway and reconstructing the ditch on 7$^{th}$ Street east of Broadway. The recommended future improvements for this basin include extending an outfall to Evans Creek below 7$^{th}$ to reduce the load on piping downstream. Three additional catch basins and three manholes are recommended for future flows.

### BASIN 4C

The existing storm water system is piped to Evans and Wards Creeks, which flow through this basin to the Rogue River. This basin channels flows from surrounding basins. The existing system is over capacity, contributing to flooding problems. To relieve current flooding conditions, it is recommended that a catch basin and approximately 200 feet of 15-inch storm drain be installed on Pine Street from Main to Classick and the existing storm drain system on the north side of Main Street be tied to this new line at Pine Street.

Recommendations to handle increased development include the new 15-inch line on Gardiner Street plus upsizing the above-mentioned section of 12-inch line on Main Street to 18-inch. Additional recommendations include installing a new 24-inch storm drain and outfall line from the intersection of Pine and Main, south to Classick and east along Classick to Wards Creek. The existing line on Main Street between Pine and Oak would be upsized from a 12-inch line to an 18-inch line and a total of five manholes and seven catch basins would be added to the system.

## BASIN 5

The existing storm drain system covers the northern part of the basin, with overland flow draining the southern portion. The existing piping is at capacity, and the lack of developed drainage causes flooding in the southern portion of the basin. Installing a 15-inch line from Broadway to Wards Creek along 1st Street with catch basins, curbs, and embankments on the east side of Cedar Street would alleviate much of the flooding on the lower portions of Cedar and Broadway.

A more developed drainage system is recommended to address the overland flooding issues in this basin and future needs and includes installing 12-inch laterals on neighborhood streets and a 24-inch outfall to Wards Creek. This alternative would include approximately 500 feet of concrete curbs, 2,850 feet of drainage pipe, 10 catch basins, and seven manholes.

## BASIN 6B

The existing storm drain system covers only the Prospect subdivision and discharges into the Grants Pass irrigation canal. Installation of approximately 450 feet of 12-inch storm drain along Nugget Court to provide an overflow for the Discovery Lane storm drains will help alleviate overflows.

## BASIN 10A

The existing storm drain system consists of piping and catch basins along the north portion of North River Road discharging into a drainage ditch that flows west to Wards Creek. About 60 lineal feet of 12-inch piping would be installed to tie the existing segmented storm drain line together and 500 feet of drainage ditch excavated.

Recommendations for future development for this system include replacing the open drainage ditch with approximately 1,800 feet of 24-inch and 30-inch pipe and adding three catch basins and four manholes to the system. The existing line on North River Road would be extended to the south by about 75 feet.

## BASIN 10B

Most of the existing development in this basin is in the western half, with a piped drainage system discharging into Wards Creek. The eastern half of the basin is lightly developed with ditches and culverts serving for drainage. The recommended work for this basin is to serve future development and consists of installing catch basins and 15-inch pipe along Wards Creek Road from Cluster Drive to Main Street. This would require six catch basins, five manholes and approximately 920 feet of pipe.

## BASIN 11

The existing storm drain system consists of roadside ditches along North River Road. Current improvements consist of cleaning and extending the existing ditch system to improve flow to the existing storm drain system.

## BASIN 13

Properties fronting the Rogue River drain directly to the river with local drainage ditches and pipes draining properties south of the Rogue River Highway to the river. The project recommended for current conditions involves adding a catch basin and manhole, just west of Depot Street, and piping the flows to the Rogue River via 12-inch piping and a drainage ditch.

This area is zoned for industrial development and projects to meet future needs will require larger piping. The recommended project for future needs includes replacing the existing 12-inch outfall to the Rogue River (east of Depot Street) with an 18-inch outfall and installing catch basins and a new 15-inch outfall to serve the area along the Rogue River Highway west of Depot Street.

### BASIN 17B

The subdivisions on Ash, Hickory, and Walnut Streets have storm drains at the end of the cul-de-sacs that pipe directly to Evans Creek. There are open ditches and culverts along West Evans Creek Road, but no outlet for the system. A piped storm drain system runs along Main Street and drains into Evans Creek and a wetland on the south side of Main Street. Current improvements include installing a continuous length of 12-inch drainpipe to tie the drainage system on the south end of West Evans Creek Road to the existing system on Main Street.

Future improvements include installing storm drains from Walnut Drive to Main Street on West Evans Creek Road and replacing the existing 12-inch drainpipe on Main Street from Foothills Boulevard to Evans Creek with 18-inch pipe.

## 5.2 Basis of Cost Estimates

The magnitude cost estimates in the plan have for components: construction costs, engineering costs, legal and administrative costs, and property acquisition costs. The cost estimates are preliminary in nature and are based on large scale planning detail. As projects enter the individual planning stage, that is, closer to being realized, more information will be gathered and the cost estimates will be refined. Actual costs will differ from what is shown here.

### Construction Cost

The magnitude construction costs in this capital improvement plan are based on actual bidding results from similar work, published cost guides, and construction cost experience.

Future changes in the cost of labor, equipment, and materials may be needed as the work is realized. For this reason, common engineering practices usually tie the cost estimates to a particular index that varies with changes in the national economy. The Engineering News Record (ENR) construction cost index is most commonly used. This index is based on the value of 100 for the year 1913. The ENR index for March 2003 was 6,627. Future yearly ENR indices can be used to calculate the cost of projects for their construction year based on the annual growth in the ENR index.

A contingency factor of 15 percent of the construction cost was added to the construction total. Because the cost estimates presented are based on low precision mapping and conceptual layouts, allowances must be made for variations in final quantities, bidding market conditions, adverse construction conditions, and other difficulties which were not included but may occur.

### Engineering Cost

The cost of engineering services for projects typically include special investigations, a pre-design report, surveying, foundation exploration, preparation of contract drawings and specifications, bidding services, construction management, inspection, construction staking, start-up services, and the preparation of operation and maintenance manuals. Depending on the size and type of project, engineering costs may range from 15 to 25 percent of the contract cost when all of the above services are provided. The lower percentage applies to large projects without complicated mechanical systems. The higher percentage applies to small, complicated projects. The engineering costs for design and construction used in this study average 20 percent of the construction cost.

### Legal and Administrative Cost

An allowance of three percent of construction cost was added for legal and administrative services. This allowance is intended to include internal project planning and budgeting.

### Property Acquisition Cost

Costs for property acquisition and easements were not included in the cost estimate. At the beginning of each project, an evaluation of existing easements, both recorded and prescriptive should be made. It may be necessary to purchase easements or properties for routing storm drainage.

## 5.3 Cost Estimates

Magnitude cost estimates were developed for each recommended project. The detailed estimates are in Appendix C and the maps showing the projects can be found in Appendix A, Figures 8 and 9. The individual estimates have two parts: the cost of the total project and the cost to relieve the present day problem, that is, if one exists. The summary of costs in the table below is the cost of the total project, that is, the price of a fully urbanized basin that will successfully drain during significant storms. Included in this cost is the price to relieve present day problems.

**TABLE 5.3**
**TOTAL PROJECT COST**

| BASIN NUMBER | TOTAL PROJECT COST |
|---|---|
| 4A | $341,000 |
| 4B | $163,000 |
| 4C | $517,000 |
| 5 | $490,000 |
| 6B | $93,000 |
| 10A | $389,000 |
| 10B | $166,000 |
| 11 | $10,000 |
| 13 | $172,000 |
| 17B | $469,000 |
| **TOTAL** | $2,810,000 |

## 5.4 Division of Responsibilities

The storm water master plan suggests projects, which either alleviate present day problems or prepare the system for future use. Each project in the plan contains these two parts.

While present day problems may be the result of past development, it is difficult to recuperate the price of patching the problem from the perceived source of the problem. These costs become the city's burden.

This may not be the case with projects that prepare the storm drain system for future use. With proper financial structures in place, for example, systems development charges, the city can recover the costs of the future system from those who benefit from the utility.

The purpose of the table below is to separate these costs. The individual estimates are contained in Appendix C.

**TABLE 5.4**
**DIVISION OF TOTAL PROJECT COST**

| BASIN NUMBER | TOTAL PROJECT COST | DEVELOPMENT PORTION *COST TO INCREASE CAPACITY* | CITY PORTION *COST TO RELIEVE PRESENT DAY PROBLEM* |
|---|---|---|---|
| 4A | $341,000 | $293,000 | $48,000 |
| 4B | $163,000 | $143,000 | $20,000 |
| 4C | $517,000 | $477,000 | $40,000 |
| 5 | $490,000 | $403,000 | $87,000 |
| 6B | $125,000 | $24,000 | $69,000 |
| 10A | $389,000 | $377,000 | $12,000 |
| 10B | $166,000 | $166,000 | $0 |
| 11 | $10,000 | $0 | $10,000 |
| 13 | $172,000 | $126,000 | $46,000 |
| 17B | $469,000 | $432,000 | $37,000 |
| **TOTAL** *PERCENT OF TOTAL* | $2,810,000 *100%* | $2,441,000 *87%* | $369,000 *13%* |

## 5.5 Prioritization

Ten projects were developed to either fix present day problems or increase the capacity the drainage system for development. Since the city cannot realize the projects simultaneously, considerations for prioritization are listed below. A suggested order of construction is presented at the end of the section.

### Correction of Existing Problems

Areas that experience flooding because of existing system problems are given high priority. The priority may be relaxed where impacts are only during very intense storms, for example, the 25-year storm.

## Feasibility of Construction

Some projects are small and may be constructed at a lower cost if the city utilizes public works staff for general construction and contractors only for specialties such as paving.

## ODOT Right of Way Construction

Inevitably, improvements to the storm drainage system will involve ODOT. These projects will generally have higher costs and require a greater level of planning than other projects. Consequently, projects involving the highway have been given a lower priority to allow coordinating storm drainage improvements with other highway-related projects.

## Coordination with Other Projects

Storm water projects that can be coordinated with improvements to city streets should be scheduled to allow simultaneous construction. These projects are given high priority.

## Future Development

Areas of the city that experience development should address storm drainage from the point of origination to the drainage discharge. In certain areas, development should not be permitted until improvements within the basin impacted by the development have been completed. Consequently, future development may require that the city implement storm drainage improvements to meet the needs of a particular development.

## Schedule

Table 5.5 summarizes the projects recommended in this plan and presents them in order of decreasing priority.

**TABLE 5.5**
ORDER OF IMPLEMENTATION

| RECOMMENDED ORDER OF IMPLEMENTATION | PROJECT NUMBER | TOTAL PROJECT COST | DEVELOPMENT PORTION | CITY PORTION |
|---|---|---|---|---|
| 1 | 5 | $490,000 | $403,000 | $87,000 |
| 2 | 4C | $517,000 | $477,000 | $40,000 |
| 3 | 11 | $10,000 | $0 | $10,000 |
| 4 | 10B | $166,000 | $166,000 | $0 |
| 5 | 17B | $469,000 | $432,000 | $37,000 |
| 6 | 4A | $341,000 | $293,000 | $48,000 |
| 7 | 4B | $163,000 | $143,000 | $20,000 |
| 8 | 10A | $389,000 | $377,000 | $12,000 |
| 9 | 6B | $93,000 | $24,000 | $69,000 |
| 10 | 13 | $172,000 | $126,000 | $46,000 |

# Regulation and Management

Section

6

Section

6

# Regulation and Management

This section briefly covers current regulations. Regulations are discussed in more detail in Volume 1.

## 6.1 Federal and State

The Environmental Protection Agency requires permits for some storm water discharges in the National Pollutant Discharge Elimination System (NPDES) program. The permit process is described in 40 CFR 122.26. The purpose of the program is to prevent storm water runoff from polluting public waters. The Department of Environmental Quality administers the federal codes in Oregon.

With respect to the City of Rogue River, permits are not required at this time from incorporated municipalities of populations less than 50,000 when discharges are composed entirely of storm water. Local industrial and commercial facilities may require permits for their particular storm water discharge. These facilities should already be regulated by the DEQ according to CFR regulations. With this exception, clean storm water discharge from the city is not regulated at this time by external agencies.

EPA is implementing Phase II storm water rules for small municipalities in urbanized areas. The storm drain system administered by the City is classified as a small municipal separate storm sewer system (MS4). Phase II regulations cover MS4 systems that are in an urbanized area, or that has a residential population of at least 50,000 or a density of 1,000 people per square mile, or that has designated Phase II by the NPDES permitting authorities. Medford and the surrounding communities fall into this classification, but the City of Rogue River has not been designated a Phase II community. The City could be considered for designation as a Phase II area in the future as part of efforts to improve water quality in the Rogue River basin.

The Rogue River is considered temperature and bacteria limited in the summer months. Storm water runoff from the City of Rogue River is minimal during the summer and is unlikely to have a significant effect on river water quality in the summer. Of more concern is the possibility of sediment entering Evans and Wards Creeks through the storm drain systems. Sedimentation of spawning beds has been noted in Evans Creek (RVCOG 2003). It is likely that efforts to improve anadromous fish populations will spur federal and state requirements to limit sediment discharges from the city storm drains in the future.

At this time, no data is available on the characteristics of storm water discharged into local streams and rivers. It is recommended that the City develop a self-monitoring program of sampling and testing storm water discharges from highly developed areas in order to build a baseline database that may be used to guide future storm water treatment decisions.

Remediation measures would depend on the characteristics of the storm water being discharged and the determination of effect by DEQ personnel. Typical remediation treatment measures include detention basins, filtration catch basins, and constructed wetlands. These measures would be in addition to construction erosion control and Best Management Practices that address potential sediment sources, apart from the storm drain system. Storm drain discharges in areas of potential concern are noted on

Figures 8 and 9 in the Appendix. While sediment discharge treatment is not required at this time, it is recommended that the City take advantage of any opportunities that arise to obtain property or easements in the vicinity of major storm drain outfalls.

Typical sediment remediation measures are presented in Appendix E.

## 6.2 Local

Internally, the City of Rogue River has no direct ordinances pertaining to storm water. Without such regulations, particularly with regard to new developments and subdivisions, protection of downstream properties and planning for upstream urbanization is difficult.

Although the city requires developers to deal with storm water by providing adequate facilities for runoff from the proposed site, the review practice may not adequately address all effected portions of the storm drainage basin.

Consequently, a new development could discharge to an existing storm system regardless of whether the system can handle the flows, even if flooding would likely occur. Similarly, a new development could construct undersized drainage elements, which cause flooding when new, upstream developments increase flows.

## 6.3 Storm Drain Ordinances for Development

Storm drain ordinances ask that developers examine larger drainage issues related to their site. The goal of the ordinances is to provide responsible drainage that deals with upstream and downstream concerns for the present and the future.

Below is an example of a set of drainage ordinances.

***General Provisions***

1. *The review body shall approve a development request only when adequate provisions for storm and floodwater runoff have been made as determined by the City Engineer.*
2. *The storm water drainage system shall be separate and independent of any sanitary sewerage system.*
3. *Where possible, inlets shall be provided; ensuring surface water is not carried across intersections or allowed to flood streets.*
4. *Surface water drainage patterns and proposed storm drainage shall be shown on every development proposal plan.*
5. *All proposed storm sewer plans and systems shall be approved by the City Engineer as part of the tentative plat or site plan review process.*
6. *Ditches will not be allowed without specific approval of the City Engineer. Open natural drainage ways of sufficient width and capacity to provide for flow and maintenance may be permitted. By definition, an open natural drainage way is a natural path, which has the specific function of transmitting natural stream water or storm water run-off from a point of higher elevation to a point of lower elevation.*

***Easements***

*Where a subdivision or development property is traversed by a water course, drainage way, channel or stream, there shall be provided a public storm water easement or drainage right-of-way conforming substantially with the lines of such water course and such further width as the*

*City Engineer determines will be adequate for conveyance and maintenance. Improvements to the drainage way, or streets or parkways parallel to the watercourse may be required.*

***Accommodation of Upstream Drainage***

1. *A culvert or other drainage facility shall be large enough to accommodate potential runoff from its entire upstream drainage area, whether inside or outside of the development.*
2. *The City Engineer shall review and approve the size required of the facility, based on provisions of the Storm Drain Master Plan, and sound engineering principles, assuming conditions of maximum potential watershed development permitted by the Plan.*

***Effect on Downstream Drainage***

*Where it is anticipated by the City Engineer that additional runoff resulting from the development will overload an existing drainage facility, the review body shall withhold approval of the development until provisions have been made for improvement of said potential condition.*

*In many communities, ordinances require developments to ensure that downstream drainage is not impacted by upstream projects. This can either be imposed by requiring the development to ensure adequate drainage throughout the system (including lower areas) or requiring that storm water generated from the post-development conditions be retained and discharged at rates controlled to predevelopment conditions.*

***Drainage Management Practices***

*Development must employ drainage management practices approved by the City Engineer, which minimize the amount and rate of surface water run-off into receiving streams or drainage facilities, or onto adjoining properties. Drainage management practices must include, but are not limited to, one or more of the following:*

1. *Temporary ponding or detention of water;*
2. *Permanent storage basins;*
3. *Minimization of impervious surfaces;*
4. *Emphasis on natural drainage ways;*
5. *Prevention of water flowing from the development in an uncontrolled fashion;*
6. *Stabilization of natural drainage ways as necessary below drainage and culvert discharge points for a distance sufficient to convey the discharge without channel erosion;*
7. *Run-off from impervious surfaces must be collected and transported to a natural drainage facility with sufficient capacity to accept the discharge; and*
8. *Other practices and facilities designed to transport storm water and improve water quality.*

***Design Requirements for New Development.***

*All new development within the City must, where appropriate, make provisions for the continuation or appropriate projection of existing storm sewer lines or drainage ways serving surrounding areas. Extensions may be required through the interior of a property to be developed where the City Engineer determines that the extension is needed to provide service to upstream properties.*

***NPDES Permit Requirements.***

*A National Pollutant Discharge Elimination System (NPDES) permit must be obtained from the Department of Environmental Quality (DEQ) for construction activities including clearing,*

Section 7

# Financing

## 7.4 Local Improvement District

A local improvement district (LID) may be formed by local residents who are responsible for securing and repaying the debt incurred through a project. LID formation requires public hearings and agreement of the local residents of the affected area. A successful LID area results in liens against the LID properties at the end of the project.

An LID could be formed for each basin identified in the study. Equitable distribution of costs would be based on a defined equivalent dwelling unit (EDU) and users in the basin contribute their share of the cost for the recommended improvement.

However, certain areas of the city would not contribute to projects, since not all sections of the city require improvements. Areas of the city with high improvement costs may not approve LID formation, consequently, improvements in these basins could not be constructed with LID funds.

## 7.5 Rural Development Grant/Loans

The United States Department of Agriculture, Rural Development (RD) makes loans to public bodies and non-profit corporations in rural areas to construct or improve essential community facilities, including storm water systems. Grants may also be available to applicants who meet the median household income (MHI) requirements. However, RD grant funding for storm water improvements would probably have a low priority.

Rural Development is a reasonable and practical loan source for storm water improvements. Loan funds acquired through RD would be re-paid through monthly user fees (revenue bonds) which are either added to the city's current sewer user fees or though a storm water utility.

Access to the loan will require the city to secure bonding authority through the formation of the SWM utility (or sewer fees). As a borrower, the city must meet the following stipulations;

1. Be unable to obtain needed funds from other sources at reasonable rates and terms,
2. Have legal capacity to borrow and repay loans, to pledge security for loans and to operate and maintain the facilities or services,
3. Be financially sound and able to manage the facility effectively, and
4. Have a financially sound facility based on taxes, assessments, revenues, fees or other satisfactory sources of income to pay all facility costs, including operation and maintenance, and to retire the indebtedness and maintain a reserve.

If acquired, loan and grant funds may be used for the following;

1. Construct, repair, improve, expand or otherwise modify storm drainage facilities,
2. Legal and engineering costs connected with the development of facilities, and
3. Other costs related to development of the facility including the acquisition of right-of-way and easements and the relocation of roads and other utilities.

The maximum term on Rural Development loans is 40 years. However, no repayment period will exceed any statutory limitation on the organization's borrowing authority nor the useful life of the improvement or facility to be financed. Interest rates are set periodically and are based on current market yields for municipal obligations. The following rates apply for the Rural Development program for the quarter ending June, 2003.

### Market rate

The market rate is paid by those applicants whose median household income (MHI) of the service area is more than the $27,756 (Oregon non-metropolitan MHI). The market rate is currently 4.65 percent.

### Intermediate rate

The intermediate rate is paid by those applicants whose MHI of the service area is less than $27,756. The intermediate rate is currently 4.50 percent (as of November 22, 1996).

### Poverty line rate

The lowest rate is paid by those applicants whose MHI of the service area is below $22,205 (80 percent of the non-metropolitan MHI). The poverty line rate is currently 4.50 percent.

The MHI for the City of Rogue River based on census data for the year 1990 is $15,637. While the 2000 census shows the new MHI for the City of Rogue River as $23,419, Rural Development is currently still using the 1990 data for state averages and individual community MHIs. The expectation is that these numbers will be updated to 2000 census data by July 2003.

## 7.6 Special Assessment/Utility Charges

A special assessment or utility charge would allow the city to charge residents a fee for storm water services. The collected revenue would be dedicated to constructing and maintaining the recommended projects. The term for the special assessment could be set over a limited time period, e.g., ten to 20 years. As funds accumulate, the city allocates them to complete each element of the long-term plan. Through this process, the city does not assume additional long-term debt, or minimizes debt by implementing certain improvements in each year. Special assessments could be collected on a monthly basis using the same methods currently used for collection of existing sewer and water fees, or through the formation of a storm water utility.

## 7.7 Storm Water Management Charges

Storm water management (SWM) utilities are becoming more common as communities search for methods to fund public works projects that involve storm drainage systems. Similar to a sewer and water system, the SWM utility considers the storm drainage system as a public facility that provides a service. One of the first SWM utilities developed in Oregon was in Washington County by the Unified Sewerage Agency (USA). The program was developed to address water pollution concerns in the Tualatin River and assist local communities to fund needed projects.

The formation of the SWM utility allows a city to collect revenue from rate payers and assess new developments. Unlike sewer and water, the rate is not based on use. Instead of consumption, the SWM assesses rates on the basis of runoff generation through impervious areas.

Runoff generation is based on the equivalent dwelling unit (EDU) methodology. One EDU is the impervious area of a typical of residential property, that is, a house with driveway, yard, and storage sheds. Each residential EDU is charged at flat rate for monthly service, while industry, commercial establishments, and institutional facilities are charged in terms of equivalent dwelling units.

Typically, this calculation involves determination of impervious area by aerial photography. If, for example, a shopping center and its parking lot have five times more impervious area than a typical house, then the center would be charged five times the EDU rate.

Once established, a SWM rate system is easily updated since changes to a community's EDU count only occur when a new development is constructed or an old building is destroyed.

There are advantages of a storm water management utility are as follows:

1. The SWM can enforce development standards, set minimum storm drainage requirements for new developments, address litter or storm water pollution, and maintain storm water facilities.
2. Once formed, the SWM utility collects revenue from customers based on the impervious surface EDU methodology.
3. The steady revenue allows the city to acquire loans for large scale improvements using revenue bonds issued by the SWM or by raising rates in preparation of future projects without having to seek loans.
4. New developments impacting the existing drainage system are also addressed by the SWM through system development charges based on an equitable share of costs and services.

Disadvantages of the storm water management utility are:

1. The additional bookkeeping and fund transfers required to keep the SWM independent from other city services.
2. Since the storm drainage system is addressed as an independent service, funds cannot be used for other city services.
3. Rate payers might also view the SWM as another level of government bureaucracy and taxation.

## 7.8 Systems Development Charges

In accordance with Oregon Revised Statutes (ORS) 223.97 through 223.314, system development charges (SDC) can be assessed for improvements directly relating to a development. The new user is considered to be, in effect, "buying in" to the existing system. Presently, the City of Rogue River collects SDC's for water and sewer based on an improvement fee, or fees directly related to improvements specific to the development.

## 7.9 Equivalent Dwelling Unit Generation

Projections for population growth are often utilized to estimate the future demand for city services, such as water and sewer. Typically, future demand is based on the estimated number of residential homes, called average dwelling units that are projected for the planning period. However, single family residences only account for a portion of the future demand. Commercial, industrial, and institutional customers also use services. Their use can be measured with respect to the average dwelling unit. The measurement unit is defined as the equivalent dwelling unit (EDU).

With respect to water usage for example, if a typical residential family requires an average of 200 gallons of water per day while a restaurant requires 1000 gallons of water per day, then the demand for water from the restaurant, is equal to five residential units. In other words, the restaurant usage is five EDU's. By totaling all of the commercial and industrial users in terms of residential units with the total number of residential units in a community, the demand for city services can be established in terms of EDU's.

The total number of EDU's can be used to estimate future demands based on the average household size and the future population. In the example provided above, if the average household consisted of three persons and in twenty years there are 100 households and one restaurant in the community, then the equivalent population of the community would be 315 (300 people for the 100 houses + 15 equivalent people for the restaurant).

Unlike the example above, storm drainage use is not measured by consumption. Rather, an indirect method is employed. Since runoff is a consequence of the surface material and surface area, storm drain usage may be derived from the amount of impervious surface on a tax lot. The impervious surface methodology is used.

## Impervious Surface Methodology

The impervious surface methodology for calculating storm water system EDU'S is based on the impervious surface area for each property. This method is based on the assumption that each residential unit consists of a lot divided into impervious area (roof tops, driveways, sheds, etc.) and non-impervious area (lawns, gardens, etc.). The typical lot size and the amount of impervious surface area are based on the average for the entire community. Determination of the typical residential lot size and impervious surface area can be calculated from a random survey of aerial photography and does not necessarily have to be based on the entire community.

Once established, the base impervious area for residential units is used to rate each commercial and industrial unit according to the amount of impervious area relative to the typical residential unit. As new development occurs, it is assumed that each new residential, commercial, or industrial unit increases storm water runoff proportional to the amount of impervious surface area developed with the respective property. Future residential units are rated as 1 EDU while commercial, multi-family, and industrial developments are rated according to the amount of impervious surface as measured in the field or as shown in the engineering plans. Using this method, future demands for storm system services and future SDC's can be based on estimated population growth rates for residential development with proportional growth in the commercial and industrial sectors.

Since industrial and commercial establishments generally develop larger areas of impervious surface, for example, parking lots and buildings, than residential developments, these sectors place a larger burden on the storm system. Consequently, this method allows for an equitable distribution of costs when evaluating how to finance storm water improvements and system development charges relative to the amount of benefit provided by the service. An example of the impervious surface EDU methodology for storm water system is provided below in Table 7.9

**TABLE 7.9**
**TYPICAL EDU's BASED ON IMPERVIOUS SURFACE METHODOLOGY**

| TYPE OF DEVELOPMENT | TYPICAL LOT SIZE, (SQUARE FEET) | IMPERVIOUS AREA, (SQUARE FEET) | NUMBER OF EDU'S* |
|---|---|---|---|
| Residential | 10,000 | 5,000 | 1 |
| Commercial w/ parking | 10,000 | 9,000 | 2 |
| Industrial w/ parking lot | 20,000 | 15,000 | 3 |

*Rounded to the nearest whole unit.

Several storm water utilities have been established in Oregon based on this methodology. The utility provides a service with benefits based on a fair and equitable accounting method. Since the service received by the customer is directly proportional to the amount of impervious surface area, customers can be charged for the service accordingly.

EDU and impervious surface methodologies are used as an accounting procedure for properties that contribute storm water runoff to a drainage system. The same procedure can be used for developing SDC costs and assessing storm water utility fees.

# Summary

Section

8

Section 8

# Summary

## 8.1 Conclusions

The City of Rogue River is rapidly growing. The expected population in the year 2020 is 3,000, which is about 150% of the present population. The city must accommodate growth with storm drainage system improvements.

The hydrological model, SCS TR 20 was used to forecast future storm water flows using the following conditions:

1. The city is situated on hilly terrain with varying soil types. Most of the soil is classified as fair to moderately well drained.
2. According to the Soil Conservation Service, storms occurring in the Pacific Northwest and the City of Rogue River are classified as Type 1A.
3. A total of 24 major drainage basins were identified within the city limits.
4. The drainage basins were modeled with a 25-year storm and a 50-year storm with rainfall equal to 4.0 inches and 4.5 inches, respectively, falling in a 24-hour period.

The analysis found that drainage systems in ten of the twenty-four basins need improvement. Improvements are estimated to cost approximately $2.8 million.

The improvements can be divided into the following categories:

1. Improvements that relieve present day problems (about 13% of the total improvement cost)
2. Improvements that increase capacity of the system (about 87% of the total improvement cost)

Funding for the capital improvements is not readily available and the city must finance the projects by methods such as systems development charges and user fees. Recommended measures are listed in Table 8.1.

## 8.2 Recommendations

Based on the findings of the storm water plan, we recommend the following actions:

1. Adopt the storm water plan and implement the recommended projects over the next 20 years.
2. Hold Council workshops that consider the following:
   a. Revenue sources, including a storm water utility, for funding the recommended improvements.
   b. Impervious surface methodology for calculation of storm water revenues.
   c. Ordinances that allow the city to enforcement minimum drainage requirements for all future developments.
   d. Design and construction standards for storm drain improvements including sediment control.

3. Implement a storm water SDC that bases the assessment of SDC charges on the impervious surface methodology.
4. Identify stakeholders in the community likely to be affected by the projects or associated fees to fund the projects.
5. Develop and distribute information to stakeholders regarding SDC's, utility rates, and taxes.
6. Adopt ordinances that require developers to address storm drainage from point of origin to the point of discharge.
7. Identify street, sewer, and water construction projects that may be coordinated with storm water improvements. Schedule storm drainage projects with other city service improvements.
8. Require that new storm drain installations be sized for future loads.
9. Budget funds exclusively for a preventative maintenance program for the storm drainage system.
10. Institute a self-monitoring program to build a storm water characteristic database to guide future treatment decisions.
11. Set aside land, where possible, for future storm water retention.

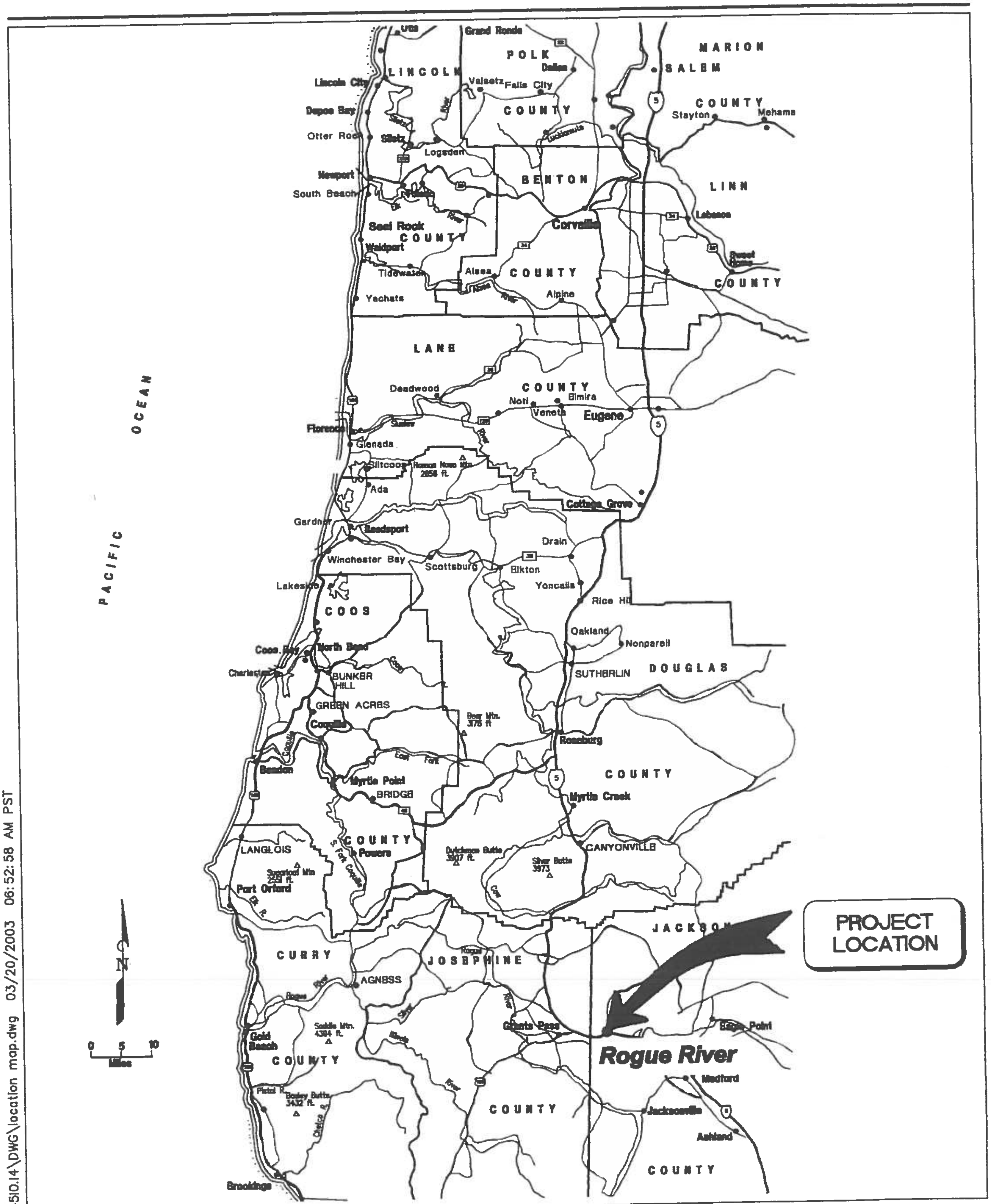
**TABLE 8.1**
**RECOMMENDED MEASURES**

| RECOMMENDED ORDER OF IMPLEMENTATION | PROJECT NUMBER | TOTAL PROJECT COST | DEVELOPMENT PORTION | CITY PORTION |
|---|---|---|---|---|
| 1 | 5 | $490,000 | $403,000 | $87,000 |
| 2 | 4C | $517,000 | $477,000 | $40,000 |
| 3 | 11 | $10,000 | $0 | $10,000 |
| 4 | 10B | $166,000 | $166,000 | $0 |
| 5 | 17B | $469,000 | $432,000 | $37,000 |
| 6 | 4A | $341,000 | $293,000 | $48,000 |
| 7 | 4B | $163,000 | $143,000 | $20,000 |
| 8 | 10A | $389,000 | $377,000 | $12,000 |
| 9 | 6B | $93,000 | $24,000 | $69,000 |
| 10 | 13 | $172,000 | $126,000 | $46,000 |
| **TOTAL** | | $2,810,000 | $2,441,000 | $369,000 |
| *PERCENT OF TOTAL* | | *100%* | *87%* | *13%* |

# Appendix A

Appendix

A

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| | | |
|---|---|---|
| THE DYER PARTNERSHIP<br>ENGINEERS & PLANNERS, INC. | *CITY OF ROGUE RIVER*<br>*STORM WATER MASTER PLAN* | EXHIBIT<br>*1* |
| DATE: APRIL 2003<br>PROJECT NO.: 4510.14 | *LOCATION MAP* | |

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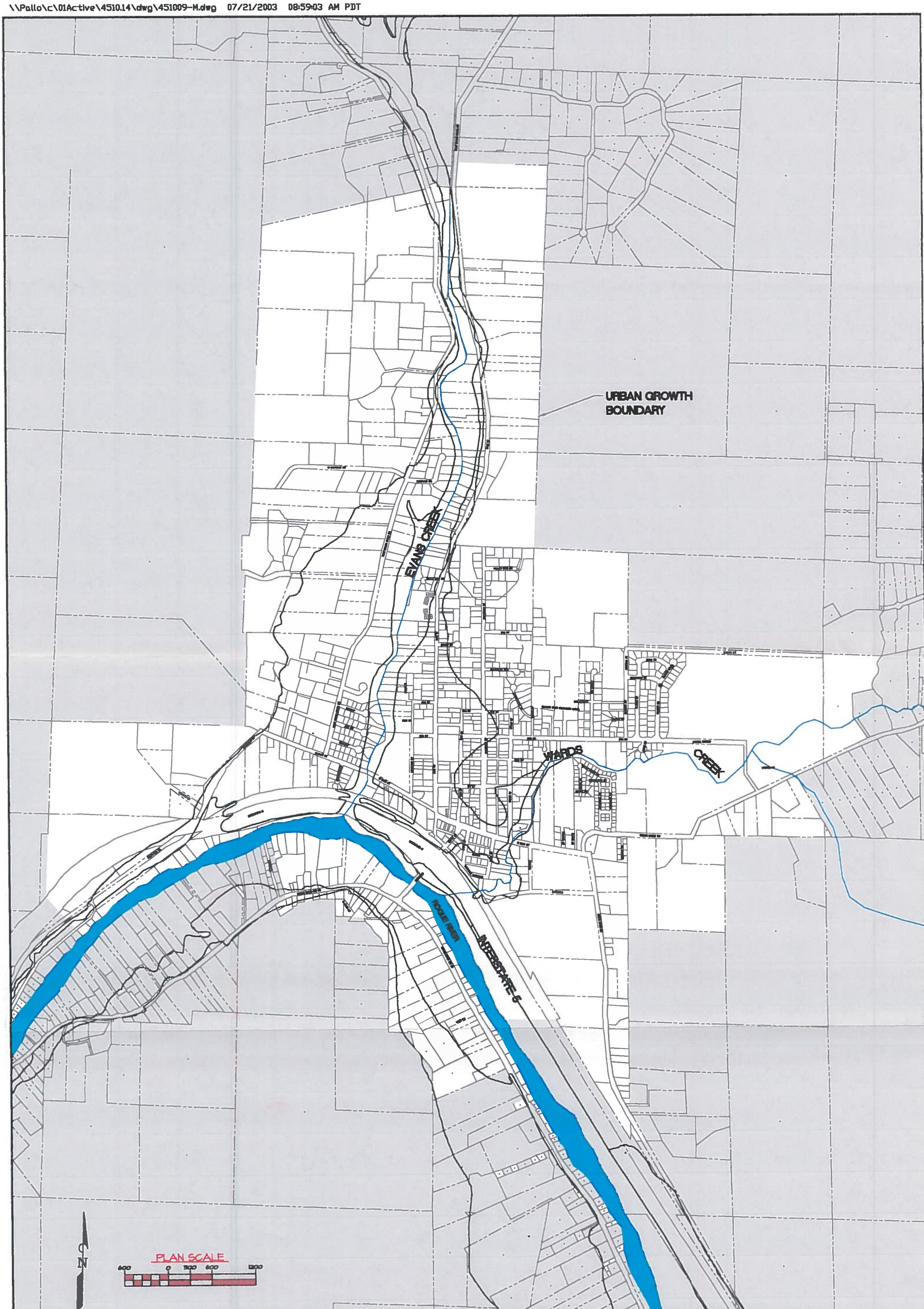


| THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC. | CITY OF ROGUE RIVER STORM WATER MASTER PLAN | FIGURE NO. |
|---|---|---|
| DATE: APRIL 2003 | STUDY AREA | 2 |
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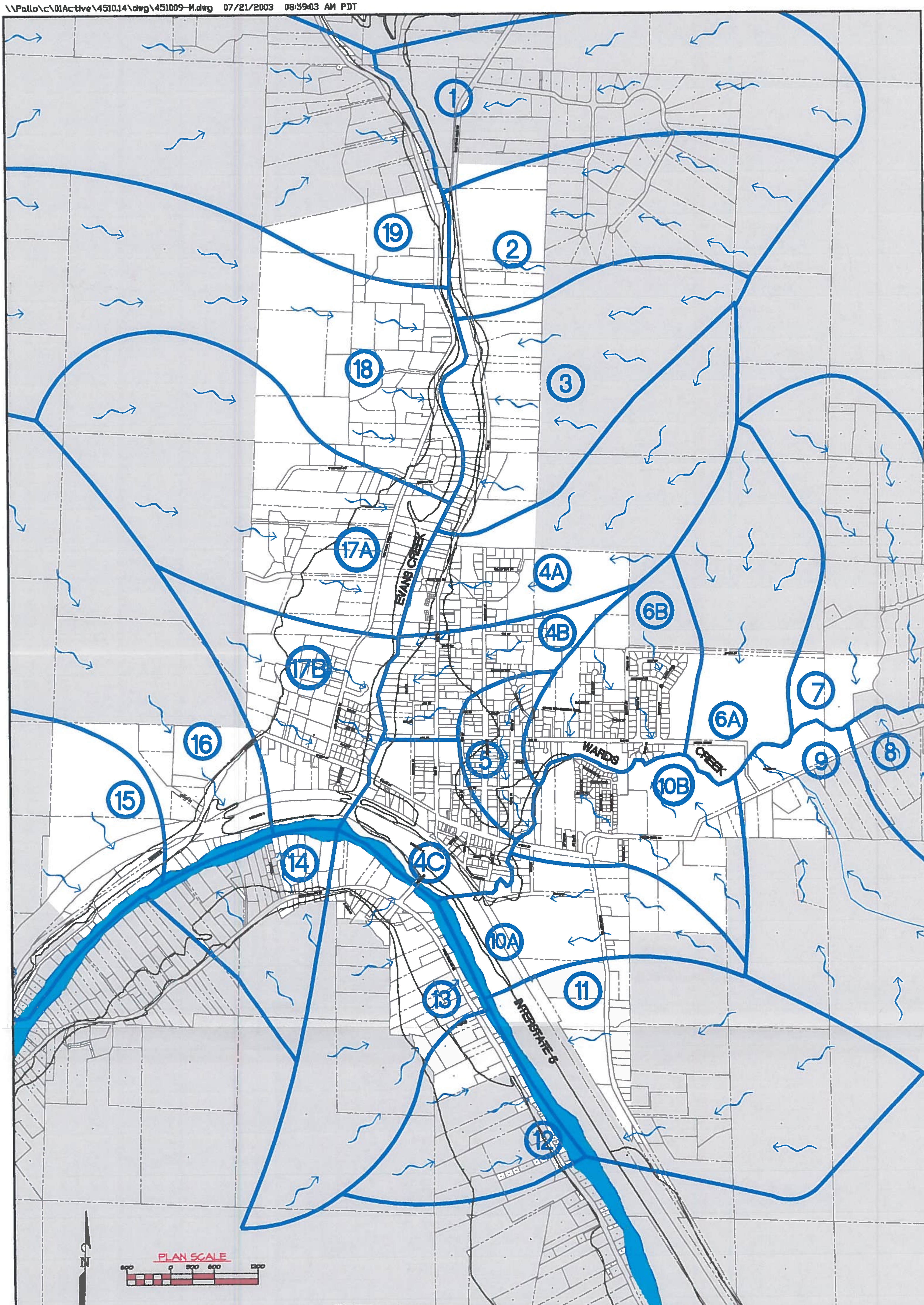
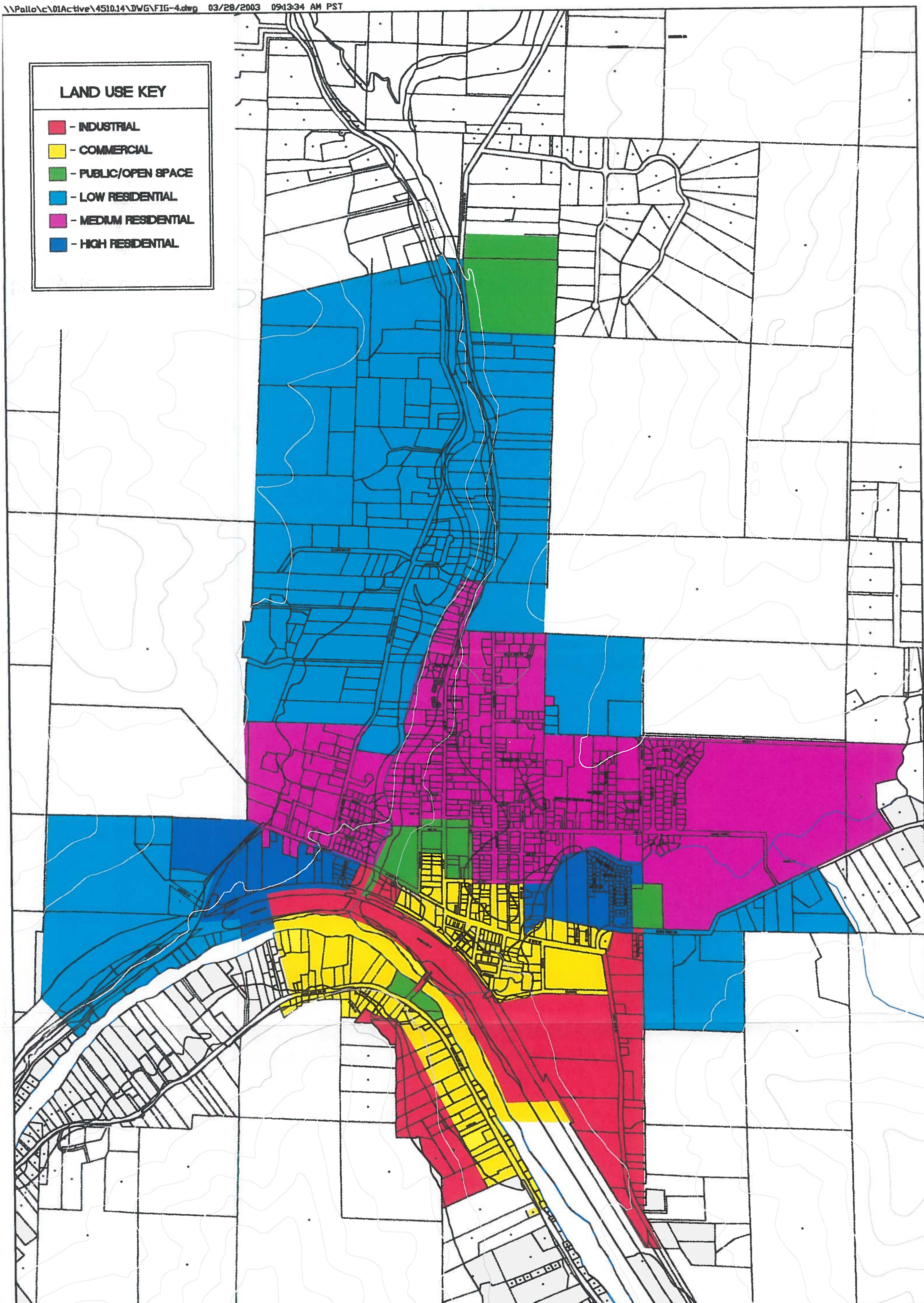



| THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC. | CITY OF ROGUE RIVER STORM WATER MASTER PLAN | FIGURE NO. |
|---|---|---|
| DATE: APRIL 2003 | | 3 |
| PROJECT NO.: 4510.14 | DRAINAGE BASINS AND GENERAL FLOW PATTERNS | |

\\Pallo\c\01Active\4510.14\DWG\FIG-4.dwg 03/28/2003 09:13:34 AM PST

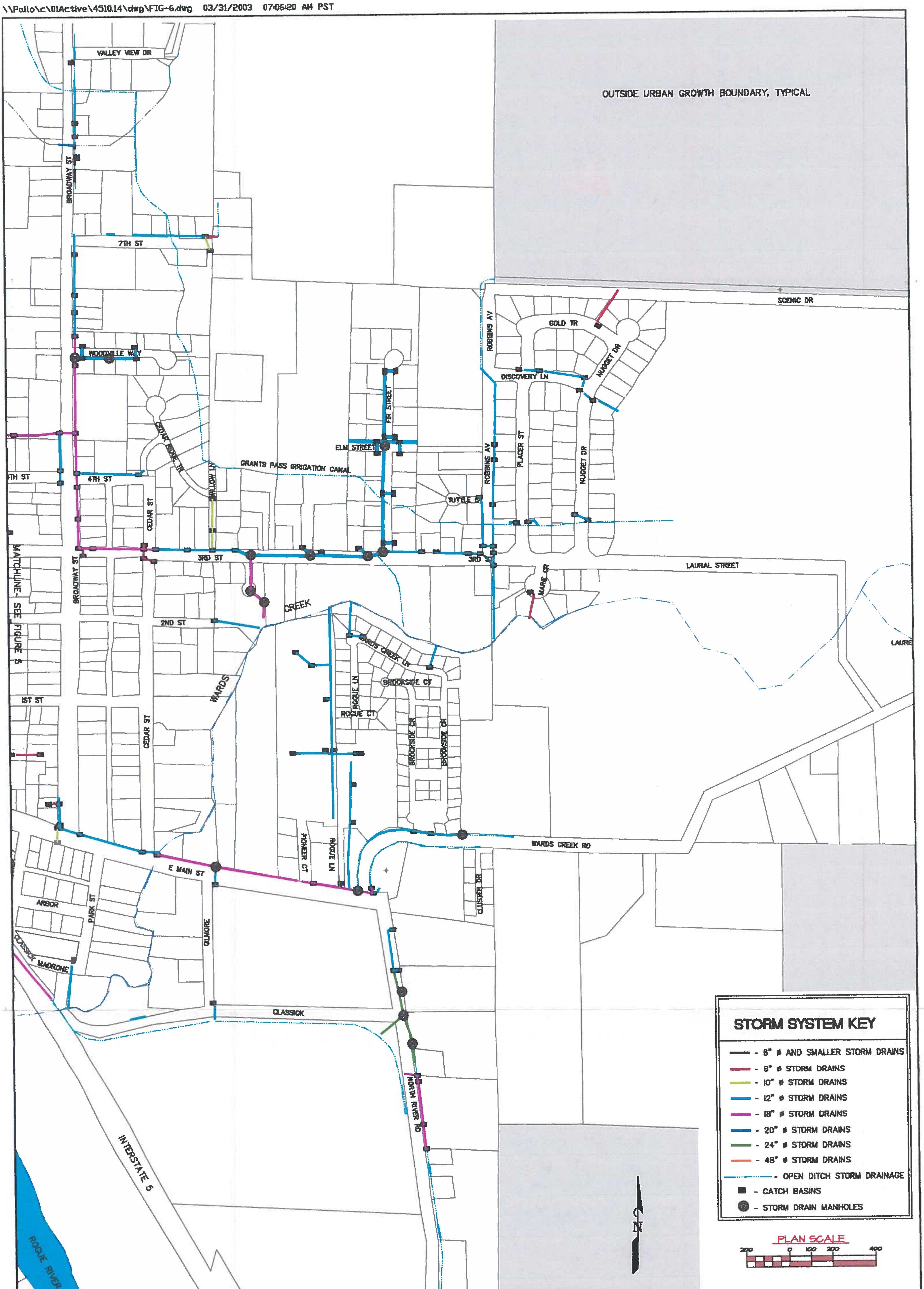



| | | |
|---|---|---|
| THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC. | CITY OF ROGUE RIVER STORM WATER MASTER PLAN | FIGURE NO. |
| DATE: APRIL 2003 | LAND USE DISTRIBUTION | 4 |
| PROJECT NO.: 4510.14 | | |

\\Pallo\c\01Active\4510.14\dwg\FIG-5.dwg 05/05/2003 09:49:43 AM PDT


| THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC. | CITY OF ROGUE RIVER STORM DRAIN WATER MASTER PLAN | FIGURE NO. |
|---|---|---|
| DATE: APRIL, 2003 PROJECT NO.: 4510.14 | STORM DRAIN SYSTEM INVENTORY, 1 OF 2 | 5 |

\\Pallo\c\01Active\4510.14\dwg\FIG-6.dwg 03/31/2003 07:06:20 AM PST




THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.

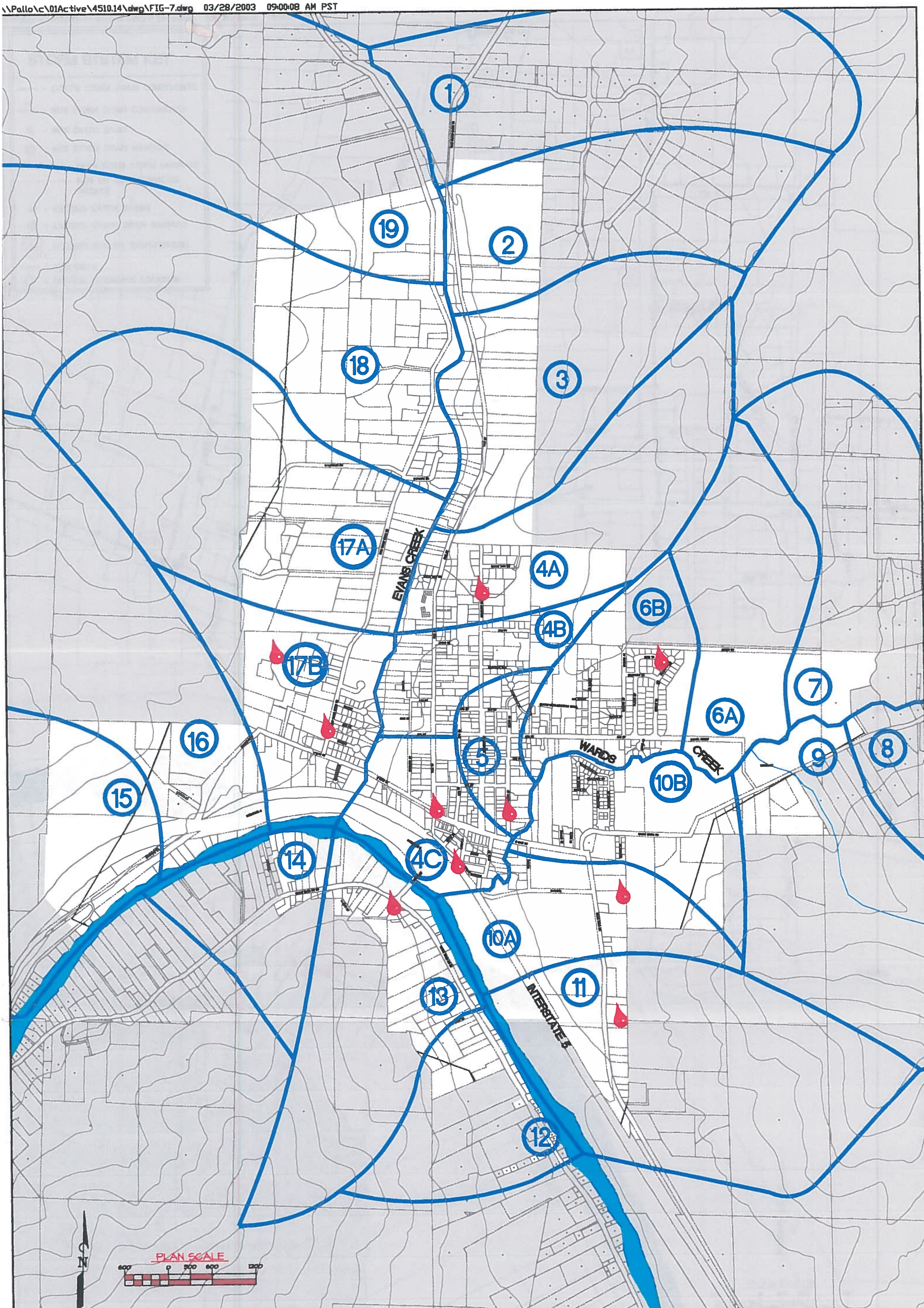
DATE: APRIL, 2003
PROJECT NO.: 4510.14

CITY OF ROGUE RIVER
STORM WATER MASTER PLAN

STORM DRAIN SYSTEM INVENTORY, 2 OF 2

FIGURE NO.
6

\\Pallo\c\01Active\4510.14\dwg\FIG-7.dwg 03/28/2003 09:00:08 AM PST




| THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC. | CITY OF ROGUE RIVER STORM WATER MASTER PLAN | STORM DRAINAGE DEFICIENCIES | FIGURE NO. |
|---|---|---|---|
| DATE: APR., 2003 | | | 7 |
| PROJECT NO.: 4510.14 | STORM DRAIN DEFICIENCIES | | |

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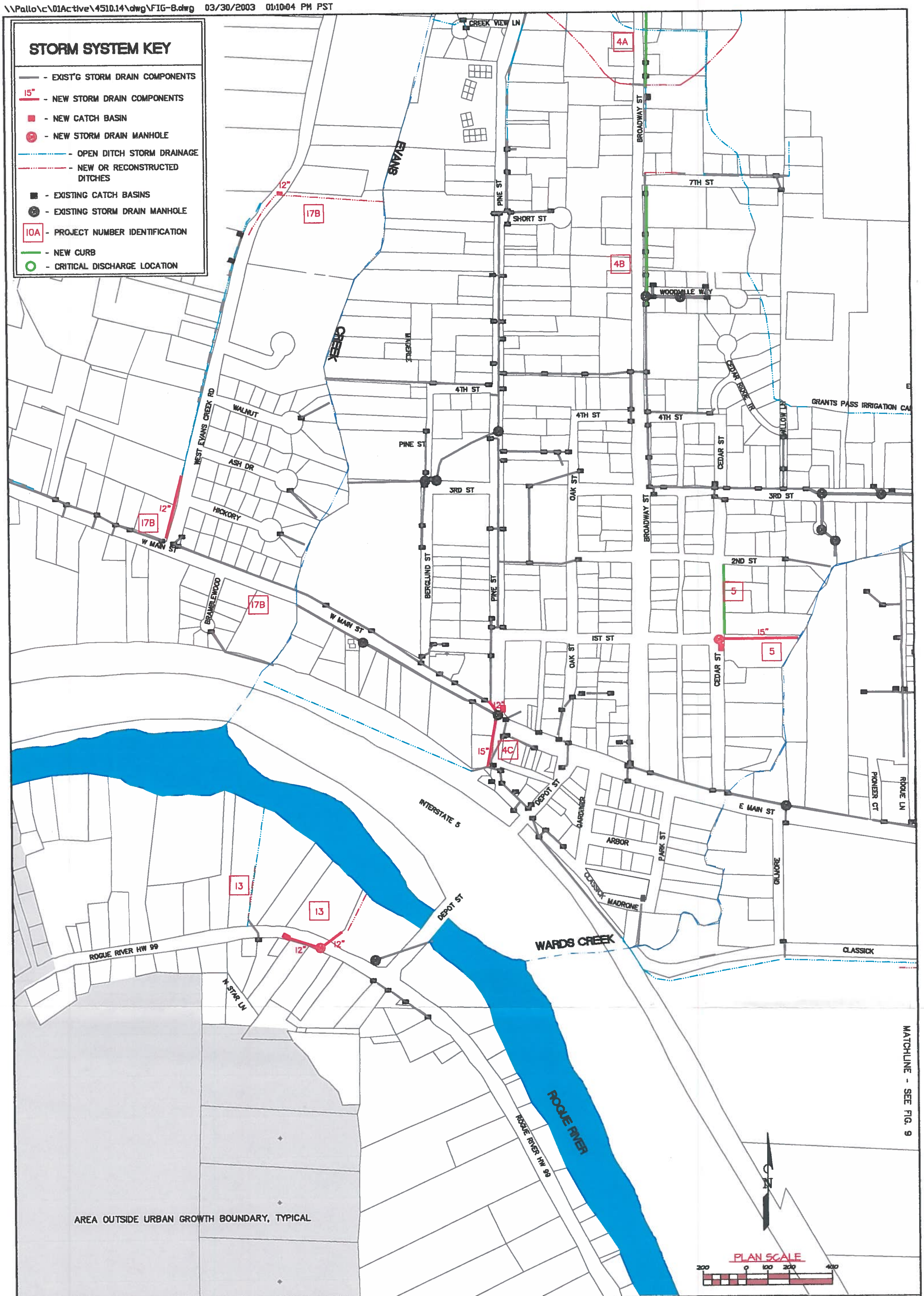



| THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC. | CITY OF ROGUE RIVER STORM WATER MASTER PLAN | FIGURE NO. |
|---|---|---|
| DATE: APRIL, 2003 | CURRENT CONDITION STORM DRAIN IMPROVEMENTS, 1 OF 2 | 8 |
| PROJECT NO.: 4510.14 | | |

\\Pallo\c\01Active\4510.14\dwg\FIG-9.dwg 03/30/2003 01:19:54 PM PST

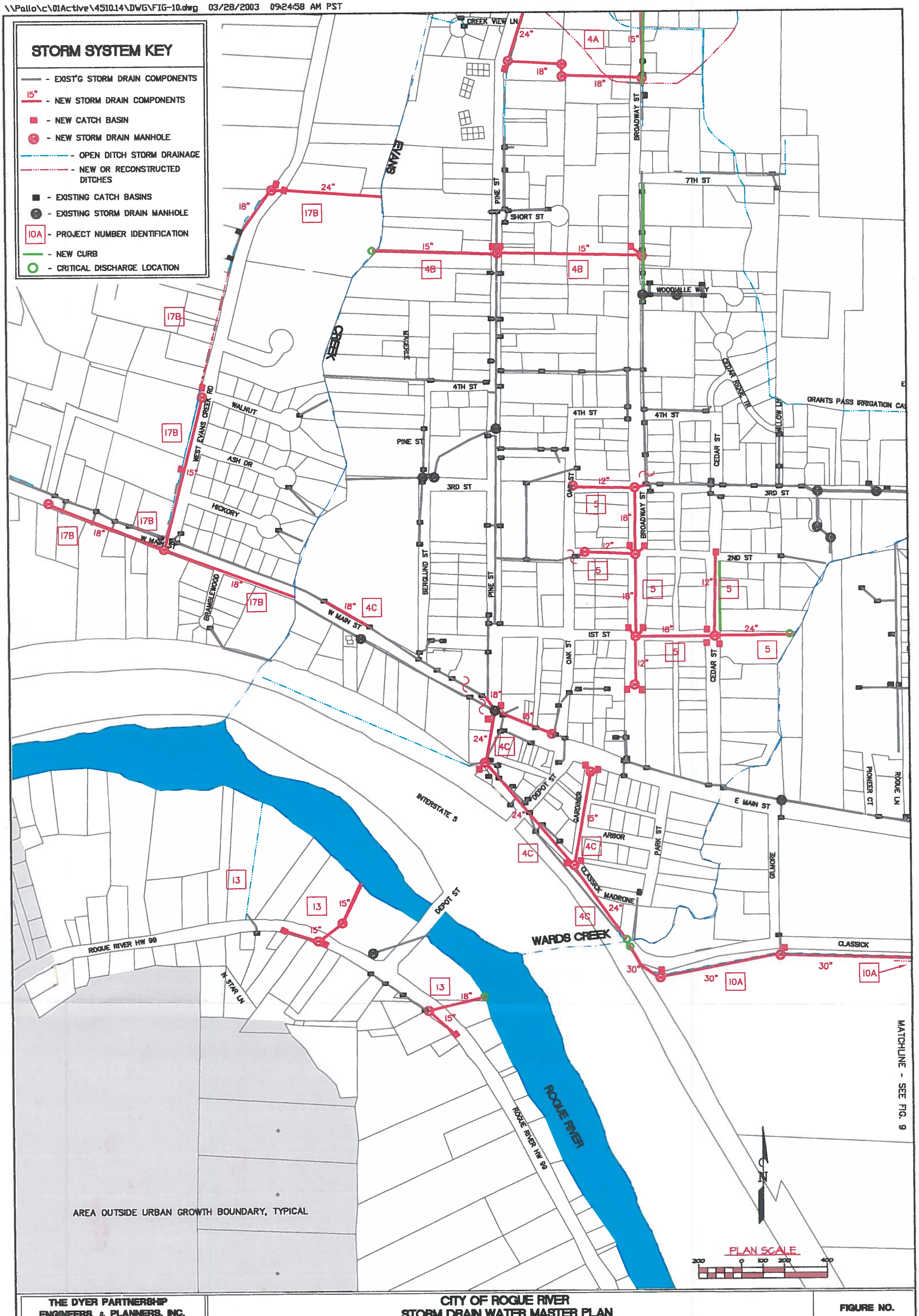

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.
DATE: APRIL, 2003
PROJECT NO.: 4510.14

CITY OF ROGUE RIVER
STORM WATER MASTER PLAN

CURRENT CONDITION STORM DRAIN IMPROVEMENTS, 2 OF 2

FIGURE NO.
9

\\Pallo\c\01Active\4510.14\DWG\FIG-10.dwg 03/28/2003 09:24:58 AM PST




THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.

DATE: APRIL, 2003
PROJECT NO.: 4510.14

CITY OF ROGUE RIVER
STORM DRAIN WATER MASTER PLAN

RECOMMENDED STORM DRAIN IMPROVEMENTS, 1 OF 2

FIGURE NO.
10

\\Pallo\c\01Active\4510.14\DWG\FIG-11.dwg 03/28/2003 09:37:21 AM PST


| THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC. | CITY OF ROGUE RIVER STORM DRAIN WATER MASTER PLAN | FIGURE NO. |
|---|---|---|
| DATE: APRIL, 2003 | | 11 |
| PROJECT NO.: 4510.14 | RECOMMENDED STORM DRAIN IMPROVEMENTS, 2 OF 2 | |

\\Pallo\c\01Active\4510.14\dwg\451009-M.dwg 07/21/2003 08:59:03 AM PDT


| THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC. | CITY OF ROGUE RIVER STORM WATER MASTER PLAN | FIGURE NO. |
| --- | --- | --- |
| DATE: APR., 2003 PROJECT NO.: 4510.14 | STORM DRAIN ELEVATION SURVEY | 12 |

# Appendix B

Appendix

B

# Appendix B: Synthetic rainfall distributions and rainfall data sources

The highest peak discharges from small watersheds in the United States are usually caused by intense, brief rainfalls that may occur as distinct events or as part of a longer storm. These intense rainstorms do not usually extend over a large area and intensities vary greatly. One common practice in rainfall-runoff analysis is to develop a synthetic rainfall distribution to use in lieu of actual storm events. This distribution includes maximum rainfall intensities for the selected design frequency arranged in a sequence that is critical for producing peak runoff.

## Synthetic rainfall distributions

The length of the most intense rainfall period contributing to the peak runoff rate is related to the time of concentration ($T_c$) for the watershed. In a hydrograph created with SCS procedures, the duration of rainfall that directly contributes to the peak is about 170 percent of the $T_c$. For example, the most intense 8.5-minute rainfall period would contribute to the peak discharge for a watershed with a $T_c$ of 5 minutes; the most intense 8.5-hour period would contribute to the peak for a watershed with a 5-hour $T_c$.

Different rainfall distributions can be developed for each of these watersheds to emphasize the critical rainfall duration for the peak discharges. However, to avoid the use of a different set of rainfall intensities for each drainage area size, a set of synthetic rainfall distributions having "nested" rainfall intensities was developed. The set "maximizes" the rainfall intensities by incorporating selected short duration intensities within those needed for longer durations at the same probability level.

For the size of the drainage areas for which SCS usually provides assistance, a storm period of 24 hours was chosen for the synthetic rainfall distributions. The 24-hour storm, while longer than that needed to determine peaks for these drainage areas, is appropriate for determining runoff volumes. Therefore, a single storm duration and associated synthetic rainfall distribution can be used to represent not only the peak discharges but also the runoff volumes for a range of drainage area sizes.

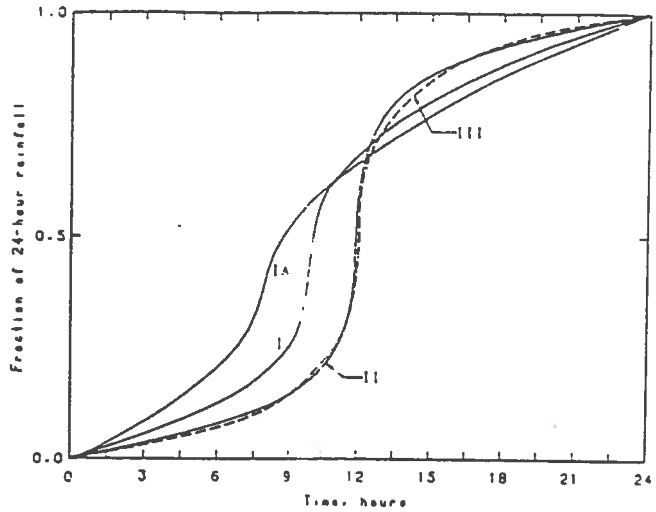
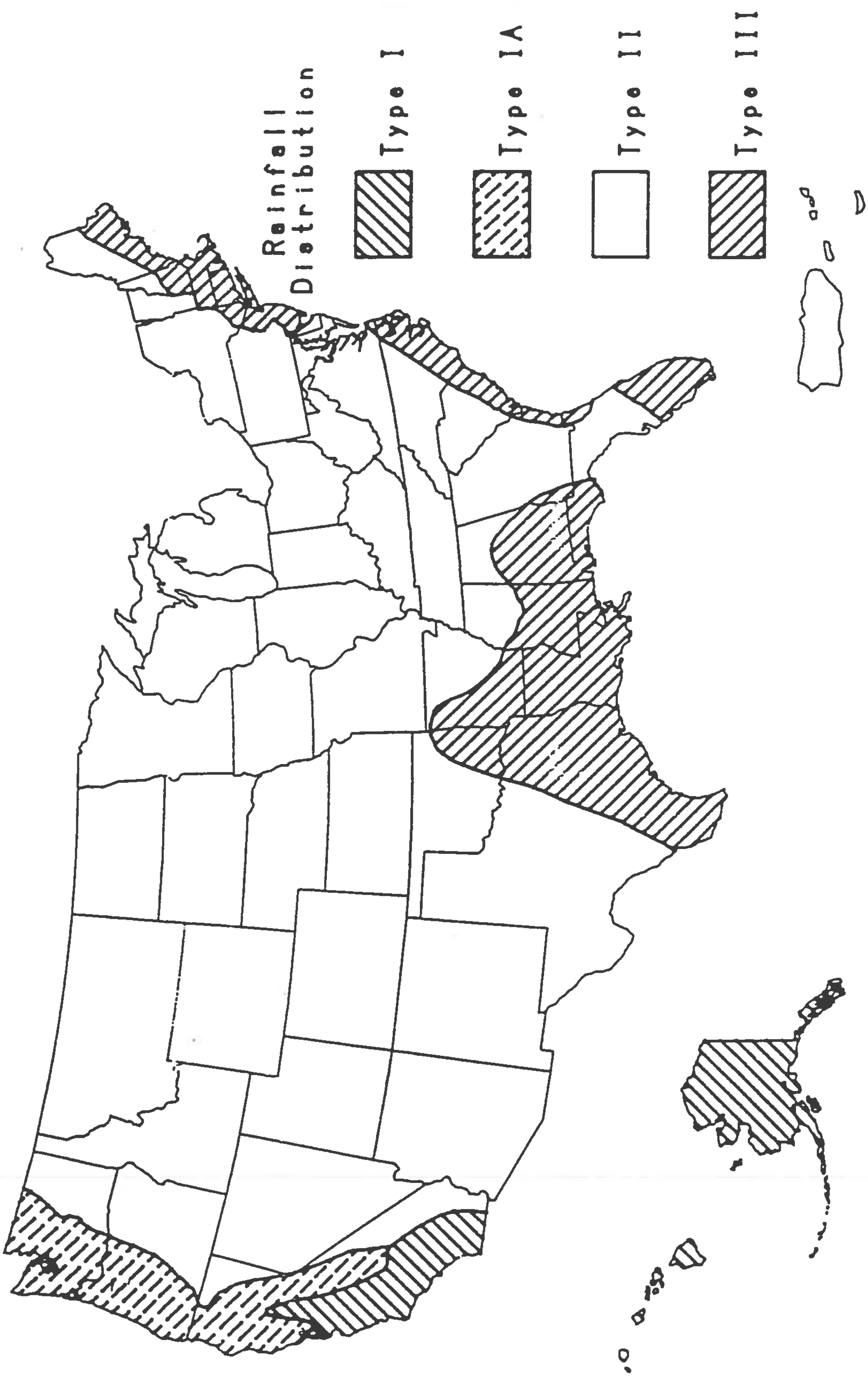



Figure B-1.—SCS 24-hour rainfall distributions.

The intensity of rainfall varies considerably during a storm as well as over geographic regions. To represent various regions of the United States, SCS developed four synthetic 24-hour rainfall distributions (I, IA, II, and III) from available National Weather Service (NWS) duration-frequency data (Hershfield 1961; Frederick et al., 1977) or local storm data. Type IA is the least intense and type II the most intense short duration rainfall. The four distributions are shown in figure B-1, and figure B-2 shows their approximate geographic boundaries.

Types I and IA represent the Pacific maritime climate with wet winters and dry summers. Type III represents Gulf of Mexico and Atlantic coastal areas where tropical storms bring large 24-hour rainfall amounts. Type II represents the rest of the country. For more precise distribution boundaries in a state having more than one type, contact the SCS State Conservation Engineer.

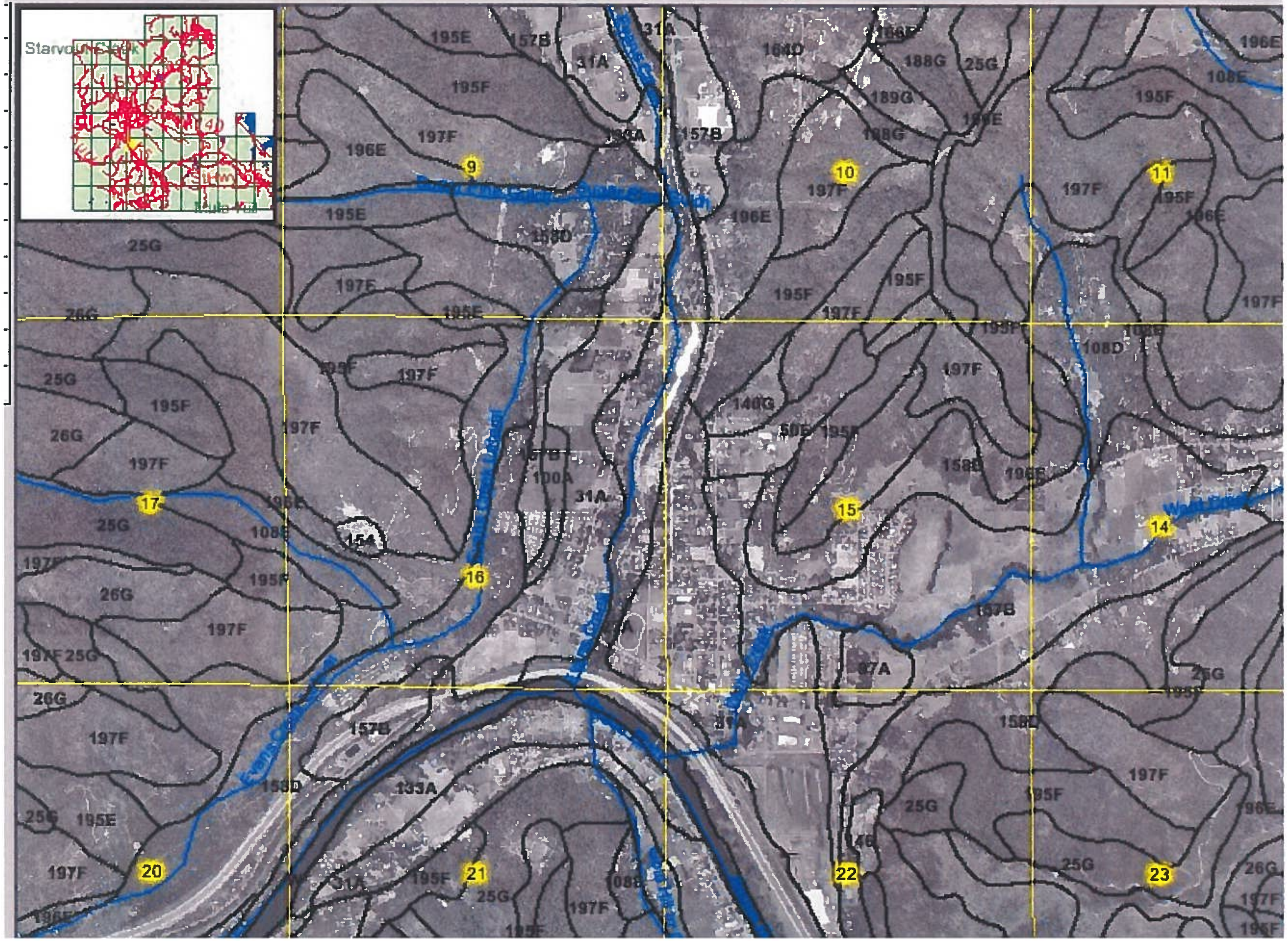
This appendix reprinted from S.C.S. TR-55, revised 1986.

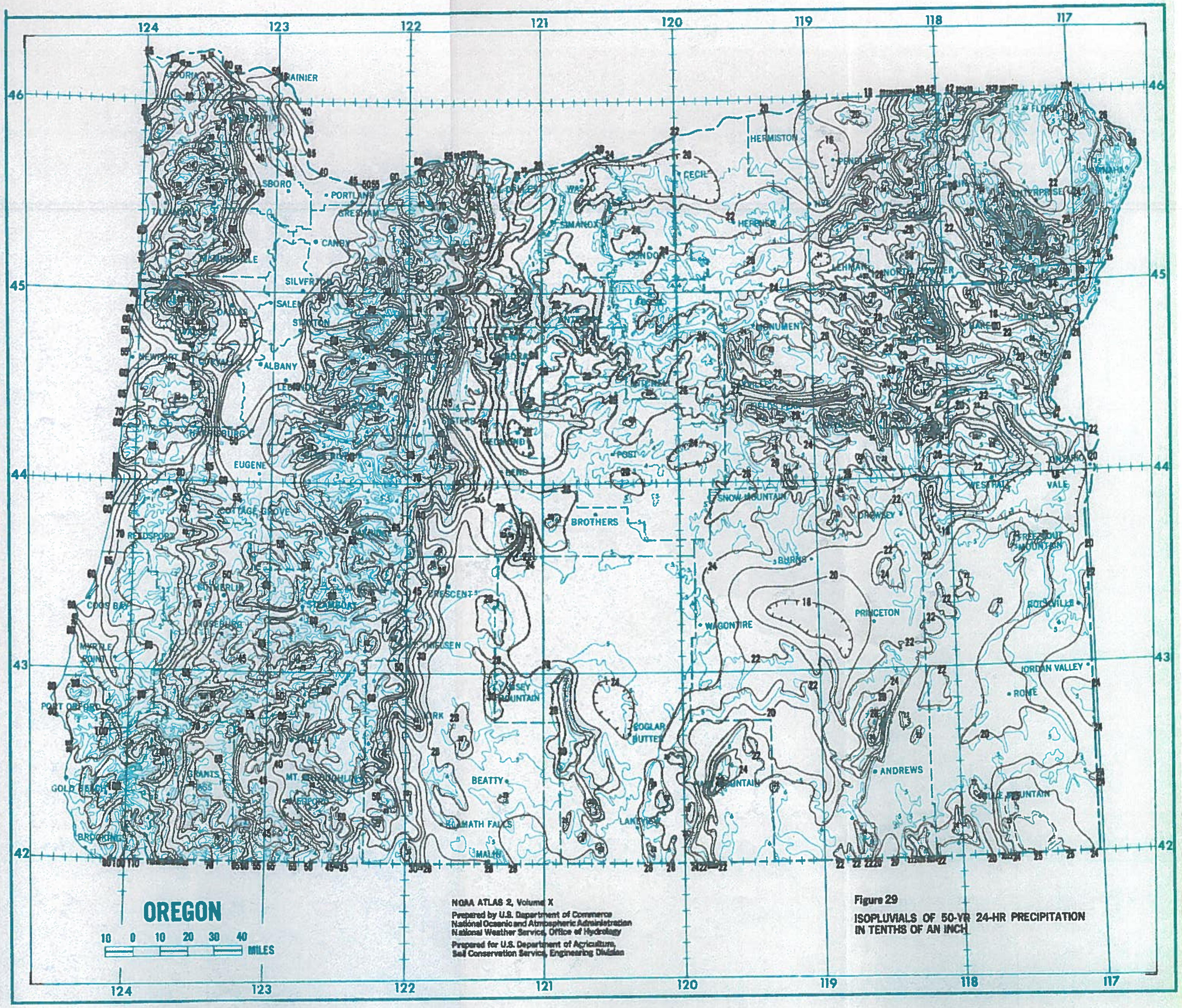



Approximate geographic boundaries for SCS rainfall distributions.

This appendix reprinted from S.C.S. TR-55, revised 1986.

# Soil Survey of Jackson County Area, Oregon





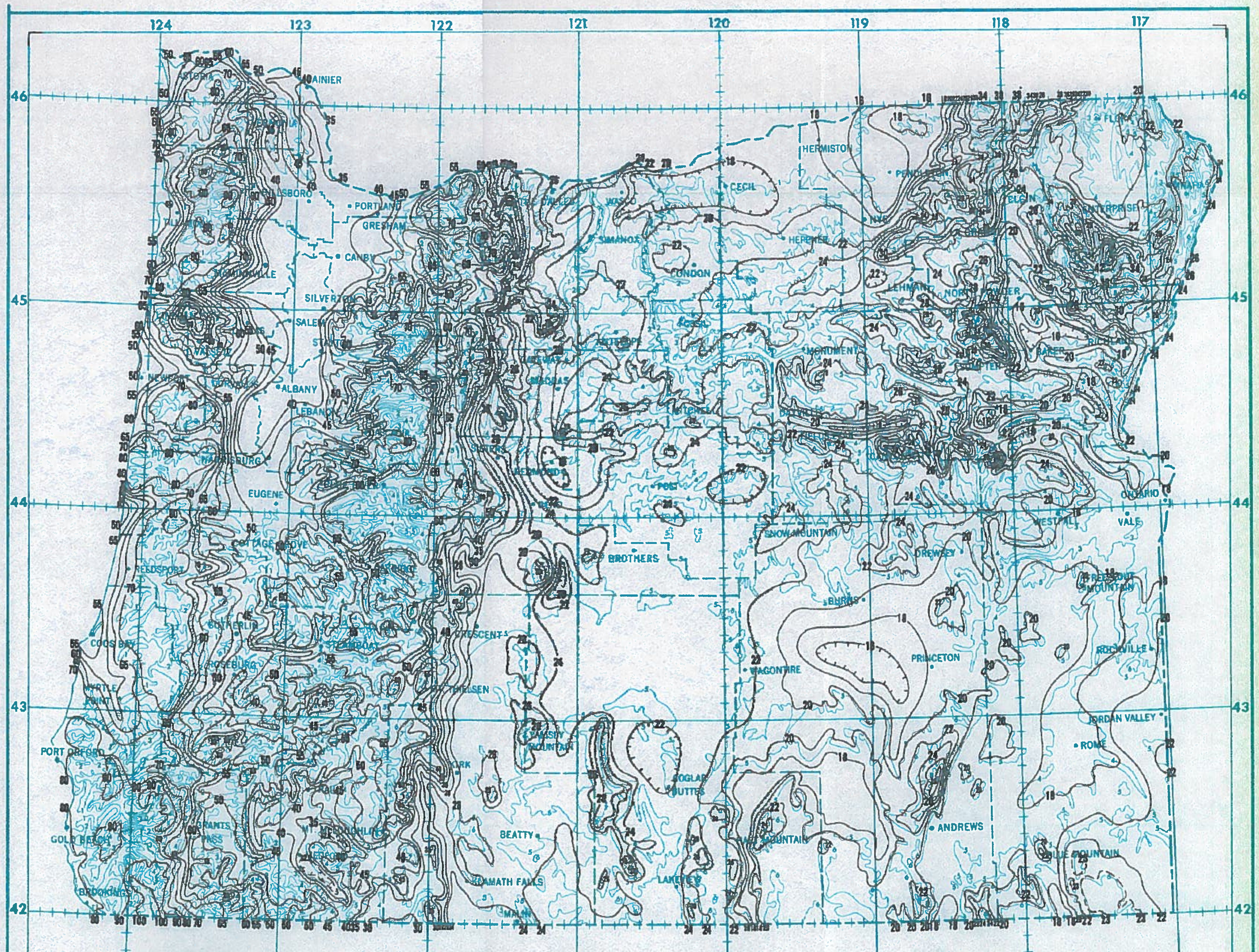

NOAA ATLAS 2, Volume X

Prepared by U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service, Office of Hydrology

Prepared for U.S. Department of Agriculture,
Soil Conservation Service, Engineering Division

Figure 29

ISOPLUVIALS OF 50-YR 24-HR PRECIPITATION IN TENTHS OF AN INCH




NOAA ATLAS 2, Volume X

Prepared by U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service, Office of Hydrology

Prepared for U.S. Department of Agriculture,
Soil Conservation Service, Engineering Division

Figure 28

ISOPLUVIALS OF 25-YR 24-HR PRECIPITATION IN TENTHS OF AN INCH

**Soil Survey of Jackson County Area, Oregon**
**OR632**

| Map Unit Symbol | Map Unit Name |
|---|---|
| 1B | Abegg gravelly loam, 2 to 7 percent slopes |
| 1C | Abegg gravelly loam, 7 to 12 percent slopes |
| 2A | Abin silty clay loam, 0 to 3 percent slopes |
| 3E | Acker dumont complex, 12 to 35 percent north slopes |
| 4E | Acker dumont complex, 12 to 35 percent south slopes |
| 5F | Acker norling complex, 35 to 55 percent north slopes |
| 6B | Agate winlo complex, 0 to 5 percent slopes |
| 7C | Aspenlake whiteface complex, 1 to 12 percent slopes |
| 8A | Barhiskey gravelly loamy sand, 0 to 3 percent slopes |
| 9A | Barhiskey variant gravelly loamy sand, 0 to 3 percent slopes |
| 10B | Barron coarse sandy loam, 0 to 7 percent slopes |
| 10C | Barron coarse sandy loam, 7 to 12 percent slopes |
| 11G | Beekman colestine gravelly loams, 50 to 80 percent north slopes |
| 12G | Beekman colestine gravelly loams, 50 to 75 percent south slopes |
| 13C | Bly royst complex, 1 to 12 percent slopes |
| 13E | Bly royst complex, 12 to 35 percent slopes |
| 14G | Bogus very gravelly loam, 35 to 65 percent north slopes |
| 15C | Bogus skookum complex, 1 to 12 percent slopes |
| 16A | Booth kanutchan variant complex, 0 to 3 percent slopes |
| 17C | Brader debenger loams, 1 to 15 percent slopes |
| 17E | Brader debenger loams, 15 to 40 percent slopes |
| 18C | Bybee loam, 1 to 12 percent slopes |
| 19E | Bybee tatouche complex, 12 to 35 percent north slopes |
| 20E | Bybee tatouche complex, 12 to 35 percent south slopes |
| 21A | Camas sandy loam, 0 to 3 percent slopes |
| 22A | Camas gravelly sandy loam, 0 to 3 percent slopes |
| 23A | Camas newberg evans complex, 0 to 3 percent slopes |
| 24C | Campfour paragon complex, 1 to 12 percent slopes |
| 24E | Campfour paragon complex, 12 to 35 percent slopes |
| 25G | Caris offenbacher gravelly loams, 50 to 80 percent north slopes |
| 26G | Caris offenbacher gravelly loams, 50 to 75 percent south slopes |
| 27B | Carney clay, 1 to 5 percent slopes |
| 27D | Carney clay, 5 to 20 percent slopes |
| 28D | Carney cobbly clay, 5 to 20 percent slopes |
| 28E | Carney cobbly clay, 20 to 35 percent slopes |
| 29D | Carney cobbly clay, high precipitation, 5 to 20 percent slopes |
| 29E | Carney cobbly clay, high precipitation, 20 to 35 percent slopes |
| 30E | Carney tablerock complex, 20 to 35 percent slopes |
| 31A | Central point sandy loam, 0 to 3 percent slopes |
| 32B | Clawson sandy loam, 2 to 5 percent slopes |
| 33A | Coker clay, 0 to 3 percent slopes |
| 33C | Coker clay, 3 to 12 percent slopes |
| 34B | Coleman loam, 0 to 7 percent slopes |
| 35A | Cove clay, 0 to 3 percent slopes |
| 36G | Coyata rock outcrop complex, 35 to 80 percent north slopes |
| 37G | Coyata rock outcrop complex, 35 to 80 percent south slopes |
| 38C | Crater lake alcot complex, 1 to 12 percent slopes |
| 39E | Crater lake alcot complex, 12 to 35 percent north slopes |
| 40E | Crater lake alcot complex, 12 to 35 percent south slopes |
| 41G | Crater lake rock outcrop complex, 35 to 70 percent north slopes |
| 42G | Crater lake rock outcrop complex, 35 to 70 percent south slopes |

| | |
|---|---|
| 77G | Greystoke stony loam, 55 to 75 percent north slopes |
| 78F | Greystoke stony loam, 35 to 55 percent south slopes |
| 79E | Greystoke pinehurst complex, 12 to 35 percent north slopes |
| 80E | Greystoke pinehurst complex, 12 to 35 percent south slopes |
| 81G | Heppsie clay, 35 to 70 percent north slopes |
| 82G | Heppsie mcmullin complex, 35 to 70 percent south slopes |
| 83E | Hobit loam, 12 to 35 percent north slopes |
| 83G | Hobit loam, 35 to 60 percent north slopes |
| 84E | Hobit loam, 12 to 35 percent south slopes |
| 84G | Hobit loam, 35 to 60 percent south slopes |
| 85A | Hoxie silt loam, 0 to 1 percent slopes |
| 86C | Hukill gravelly loam, 1 to 12 percent slopes |
| 87F | Jayar very gravelly loam, 12 to 45 percent north slopes |
| 87G | Jayar very gravelly loam, 45 to 70 percent north slopes |
| 88F | Jayar very gravelly loam, 12 to 45 percent south slopes |
| 89E | Jayar variant very gravelly loam, 5 to 35 percent slopes |
| 90E | Josephine pollard complex, 12 to 35 percent north slopes |
| 91E | Josephine pollard complex, 12 to 35 percent south slopes |
| 92E | Josephine speaker complex, 12 to 35 percent north slopes |
| 92F | Josephine speaker complex, 35 to 55 percent north slopes |
| 93E | Josephine speaker complex, 12 to 35 percent south slopes |
| 94G | Kanid atring very gravelly loams, 50 to 80 percent north slopes |
| 95G | Kanid atring very gravelly loams, 50 to 80 percent south slopes |
| 96B | Kanutchan clay, 1 to 8 percent slopes |
| 97A | Kerby loam, 0 to 3 percent slopes |
| 98A | Kerby loam, wet, 0 to 3 percent slopes |
| 99A | Klamath silt loam, 0 to 1 percent slopes |
| 100A | Kubli loam, 0 to 3 percent slopes |
| 100B | Kubli loam, 3 to 7 percent slopes |
| 101E | Langellain loam, 15 to 40 percent north slopes |
| 102B | Langellain brader loams, 1 to 7 percent slopes |
| 102D | Langellain brader loams, 7 to 15 percent slopes |
| 103E | Langellain brader loams, 15 to 40 percent south slopes |
| 104E | Lettia sandy loam, 12 to 35 percent north slopes |
| 105E | Lettia sandy loam, 12 to 35 percent south slopes |
| 106C | Lobert sandy loam, 0 to 12 percent slopes |
| 107E | Lorella skookum complex, 15 to 35 percent slopes |
| 108B | Manita loam, 2 to 7 percent slopes |
| 108D | Manita loam, 7 to 20 percent slopes |
| 108E | Manita loam, 20 to 35 percent slopes |
| 108F | Manita loam, 35 to 50 percent slopes |
| 109E | Manita vannoy complex, 20 to 40 percent slopes |
| 110E | Mcmullin gravelly loam, 3 to 35 percent slopes |
| 111G | Mcmullin mcnull gravelly loams, 35 to 60 percent south slopes |
| 112F | Mcmullin medco complex, 12 to 50 percent slopes |
| 113E | Mcmullin rock outcrop complex, 3 to 35 percent slopes |
| 113G | Mcmullin rock outcrop complex, 35 to 60 percent slopes |
| 114E | Mcnull loam, 12 to 35 percent north slopes |
| 114G | Mcnull loam, 35 to 60 percent north slopes |
| 115E | Mcnull gravelly loam, 12 to 35 percent south slopes |
| 115G | Mcnull gravelly loam, 35 to 60 percent south slopes |
| 116E | Mcnull mcmullin gravelly loams, 12 to 35 percent south slopes |

## Soil Survey of Jackson County Area, Oregon
## OR632

| | |
|---|---|
| 116G | Mcnull mcmullin gravelly loams, 35 to 60 percent south slopes |
| 117G | Mcnull mcmullin complex, 35 to 60 percent north slopes |
| 118E | Mcnull medco complex, 12 to 50 percent slopes |
| 119F | Mcnull medco complex, high precipitation, 12 to 50 percent slopes |
| 120B | Medco clay loam, 3 to 7 percent slopes |
| 120C | Medco clay loam, 7 to 12 percent slopes |
| 121E | Medco cobbly clay loam, 12 to 50 percent north slopes |
| 122E | Medco cobbly clay loam, 12 to 50 percent south slopes |
| 123F | Medco clay loam, high precipitation, 12 to 50 percent north slopes |
| 124F | Medco clay loam, high precipitation, 12 to 50 percent south slopes |
| 125C | Medco mcmullin complex, 1 to 12 percent slopes |
| 125F | Medco mcmullin complex, 12 to 50 percent slopes |
| 126F | Medco mcnull complex, 12 to 50 percent slopes |
| 127A | Medford silty clay loam, 0 to 3 percent slopes |
| 128B | Medford clay loam, gravelly substratum, 0 to 7 percent slopes |
| 129B | Merlin extremely stony loam, 1 to 8 percent slopes |
| 130E | Musty goolaway complex, 12 to 35 percent slopes |
| 131F | Musty goolaway complex, 35 to 50 percent north slopes |
| 132F | Musty goolaway complex, 35 to 50 percent south slopes |
| 133A | Newberg fine sandy loam, 0 to 3 percent slopes |
| 134F | Norling acker complex, 35 to 55 percent south slopes |
| 135E | Oatman cobbly loam, 12 to 35 percent north slopes |
| 135G | Oatman cobbly loam, 35 to 65 percent north slopes |
| 136E | Oatman cobbly loam, 12 to 35 percent south slopes |
| 137C | Oatman cobbly loam, depressional, 0 to 12 percent slopes |
| 138C | Oatman otwin complex, 0 to 12 percent slopes |
| 139A | Padigan clay, 0 to 3 percent slopes |
| 140G | Pearsoll dubakella complex, rocky, 20 to 60 percent slopes |
| 141A | Phoenix clay, 0 to 3 percent slopes |
| 142C | Pinehurst loam, 3 to 12 percent slopes |
| 143E | Pinehurst loam, 12 to 35 percent north slopes |
| 144E | Pinehurst loam, 12 to 35 percent south slopes |
| 145C | Pinehurst greystoke complex, 1 to 12 percent slopes |
| 146 | Pits, gravel |
| 147C | Pokegema woodcock complex, 1 to 12 percent slopes |
| 148C | Pokegema woodcock complex, warm, 1 to 12 percent slopes |
| 149B | Pollard loam, 2 to 7 percent slopes |
| 149D | Pollard loam, 7 to 20 percent slopes |
| 150E | Provig very gravelly loam, 15 to 35 percent slopes |
| 151C | Provig agate complex, 5 to 15 percent slopes |
| 152B | Randcore shoat complex, 0 to 5 percent slopes |
| 153B | Reinecke coyata complex, 0 to 5 percent slopes |
| 154 | Riverwash |
| 155E | Rogue cobbly coarse sandy loam, 12 to 35 percent north slopes |
| 155G | Rogue cobbly coarse sandy loam, 35 to 80 percent north slopes |
| 156E | Rogue cobbly coarse sandy loam, 12 to 35 percent south slopes |
| 156G | Rogue cobbly coarse sandy loam, 35 to 75 percent south slopes |
| 157B | Ruch silt loam, 2 to 7 percent slopes |
| 158B | Ruch gravelly silt loam, 2 to 7 percent slopes |
| 158D | Ruch gravelly silt loam, 7 to 20 percent slopes |
| 159C | Rustlerpeak gravelly loam, 3 to 12 percent slopes |
| 160E | Rustlerpeak gravelly loam, 12 to 35 percent north slopes |

## Soil Survey of Jackson County Area, Oregon
## OR632

| | |
|---|---|
| 160G | Rustlerpeak gravelly loam, 35 to 65 percent north slopes |
| 161G | Rustlerpeak rock outcrop complex, 35 to 70 percent north slopes |
| 162B | Selmac loam, 2 to 7 percent slopes |
| 162D | Selmac loam, 7 to 20 percent slopes |
| 163A | Sevenoaks loamy sand, 0 to 3 percent slopes |
| 164B | Shefflein loam, 2 to 7 percent slopes |
| 164D | Shefflein loam, 7 to 20 percent slopes |
| 165E | Shefflein loam, 20 to 35 percent north slopes |
| 166E | Shefflein loam, 20 to 35 percent south slopes |
| 167B | Sibannac silt loam, 0 to 7 percent slopes |
| 168G | Siskiyou gravelly sandy loam, 35 to 60 percent north slopes |
| 169G | Siskiyou gravelly sandy loam, 35 to 60 percent south slopes |
| 170C | Skookum very cobbly loam, 1 to 12 percent slopes |
| 171E | Skookum bogus complex, 12 to 35 percent north slopes |
| 172E | Skookum bogus complex, 12 to 35 percent south slopes |
| 173D | Skookum rock outcrop mcmullin complex, 1 to 20 percent slopes |
| 173F | Skookum rock outcrop mcmullin complex, 20 to 50 percent slopes |
| 174G | Skookum rock outcrop rubble land complex, 35 to 70 percent slopes |
| 175F | Snowbrier gravelly loam, 25 to 50 percent north slopes |
| 176F | Snowbrier gravelly loam, 25 to 50 percent south slopes |
| 177C | Snowlin gravelly loam, 3 to 12 percent slopes |
| 178E | Snowlin gravelly loam, 12 to 35 percent north slopes |
| 179F | Speaker josephine complex, 35 to 55 percent south slopes |
| 180G | Steinmetz sandy loam, 35 to 75 percent north slopes |
| 181G | Steinmetz sandy loam, 35 to 75 percent south slopes |
| 182E | Straight extremely gravelly loam, 12 to 35 percent north slopes |
| 183E | Straight extremely gravelly loam, 12 to 35 percent south slopes |
| 184G | Straight shippa extremely gravelly loams, 35 to 70 percent north slopes |
| 185G | Straight shippa extremely gravelly loams, 35 to 60 percent south slopes |
| 186H | Tablerock rock outcrop complex, 35 to 110 percent slopes |
| 187A | Takilma cobbly loam, 0 to 3 percent slopes |
| 188E | Tallowbox gravelly sandy loam, 20 to 35 percent north slopes |
| 188G | Tallowbox gravelly sandy loam, 35 to 70 percent north slopes |
| 189E | Tallowbox gravelly sandy loam, 20 to 35 percent south slopes |
| 189G | Tallowbox gravelly sandy loam, 35 to 60 percent south slopes |
| 190E | Tatouche gravelly loam, 12 to 35 percent north slopes |
| 190G | Tatouche gravelly loam, 35 to 65 percent north slopes |
| 191E | Tatouche gravelly loam, 12 to 35 percent south slopes |
| 191G | Tatouche gravelly loam, 35 to 60 percent south slopes |
| 192A | Terrabella clay loam, 0 to 3 percent slopes |
| 193G | Tethrick sandy loam, 35 to 75 percent north slopes |
| 194G | Tethrick sandy loam, 35 to 75 percent south slopes |
| 195E | Vannoy silt loam, 12 to 35 percent north slopes |
| 195F | Vannoy silt loam, 35 to 55 percent north slopes |
| 196E | Vannoy silt loam, 12 to 35 percent south slopes |
| 197F | Vannoy voorhies complex, 35 to 55 percent south slopes |
| 198A | Winlo very gravelly clay loam, 0 to 3 percent slopes |
| 199C | Wolfpeak sandy loam, 3 to 12 percent slopes |
| 200E | Wolfpeak sandy loam, 12 to 35 percent north slopes |
| 201E | Wolfpeak sandy loam, 12 to 35 percent south slopes |
| 202F | Woodcock stony loam, 35 to 55 percent north slopes |
| 203F | Woodcock stony loam, 35 to 55 percent south slopes |

Appendix
C

# Appendix C

# Magnitude Cost Estimate
## UNIT PRICES

| ITEM | DESCRIPTION | UNIT PRICE |
|---|---|---|
| 1 | Front End Work, Supervision | @ 7% |
| 2 | Temporary Construction | @ 4% |
| 3 | Catch Basin/Field Inlet | $1,200 / each |
| 4 | Manhole | $4,500 / each |
| 5 | Ditch Excavation | $7 / lin ft |
| 6 | Embankment | $7 / lin ft |
| 7 | Concrete Curb | $20 / lin ft |
| 8 | 12" Storm Drain, Paved Areas | $66 / lin ft |
| 9 | 15" Storm Drain, Paved Areas | $78 / lin ft |
| 10 | 18" Storm Drain, Paved Areas | $88 / lin ft |
| 11 | 24" Storm Drain, Paved Areas | $125 / lin ft |
| 12 | 30" Storm Drain, Paved Areas | $135 / lin ft |
| 13 | 36" Storm Drain, Paved Areas | $175 / lin ft |
| 14 | 12" Storm Drain, Native Areas | $33 / lin ft |
| 15 | 15" Storm Drain, Native Areas | $45 / lin ft |
| 16 | 18" Storm Drain, Native Areas | $55 / lin ft |
| 17 | 24" Storm Drain, Native Areas | $85 / lin ft |
| 18 | 30" Storm Drain, Native Areas | $95 / lin ft |
| 19 | 36" Storm Drain, Native Areas | $135 / lin ft |
| 20 | Slope Anchors | $500 / L.S. |
| 21 | Outlet Structure | $6,000 / each |
| 22 | | |
| 23 | | |
| 24 | | |
| 25 | | |
| 26 | Profit | @ 9% |
| 27 | Bond and Insurance @ 3% | @ 3% |
| 28 | Public Works Fee @ 0.1% | @ 0.1% |
| 29 | Contingency @ 15% | @ 15% |
| 30 | Engineering @ 20% | @ 20% |
| 31 | Legal and Administrative @ 3% | @ 3% |

# Magnitude Cost Estimate
## PROJECT NO. 4A

### COST OF TOTAL PROJECT

| ITEM | DESCRIPTION | QUANTITY | UNIT PRICE | EXTENSION |
|---|---|---|---|---|
| 1 | Front End Work, Supervision | 1 each | @ 7% | $13,878 |
| 2 | Temporary Construction | 1 each | @ 4% | $7,930 |
| 3 | Catch Basin/Field Inlet | 5 each | $1,200 / each | $6,000 |
| 4 | Manhole | 5 each | $4,500 / each | $22,500 |
| 5 | Ditch Excavation | 1500 lin ft | $7 / lin ft | $10,500 |
| 6 | Embankment | 500 lin ft | $7 / lin ft | $3,500 |
| 7 | Concrete Curb | 400 lin ft | $20 / lin ft | $8,000 |
| 8 | 12" Storm Drain, Paved Areas | 50 lin ft | $66 / lin ft | $3,300 |
| 9 | 15" Storm Drain, Paved Areas | 400 lin ft | $78 / lin ft | $31,200 |
| 10 | 18" Storm Drain, Paved Areas | 20 lin ft | $88 / lin ft | $1,760 |
| 11 | 24" Storm Drain, Paved Areas | 360 lin ft | $125 / lin ft | $45,000 |
| 12 | 30" Storm Drain, Paved Areas | 0 lin ft | $135 / lin ft | $0 |
| 13 | 36" Storm Drain, Paved Areas | 0 lin ft | $175 / lin ft | $0 |
| 14 | 12" Storm Drain, Native Areas | 0 lin ft | $33 / lin ft | $0 |
| 15 | 15" Storm Drain, Native Areas | 0 lin ft | $45 / lin ft | $0 |
| 16 | 18" Storm Drain, Native Areas | 600 lin ft | $55 / lin ft | $33,000 |
| 17 | 24" Storm Drain, Native Areas | 300 lin ft | $85 / lin ft | $25,500 |
| 18 | 30" Storm Drain, Native Areas | 0 lin ft | $95 / lin ft | $0 |
| 19 | 36" Storm Drain, Native Areas | 0 lin ft | $135 / lin ft | $0 |
| 20 | Slope Anchors | 4 L.S. | $500 / L.S. | $2,000 |
| 21 | Outlet Structure | 1 each | $6,000 / each | $6,000 |
| 22 | | | | |
| 23 | | | | |
| 24 | | | | |
| 25 | | | | |
| | | SUBTOTAL | | $220,069 |
| 26 | | Profit | @ 9% | $19,806 |
| 27 | | Bond and Insurance | @ 3% | $7,196 |
| 28 | | Public Works Fee | @ 0.1% | $247 |
| | | CONSTRUCTION TOTAL | | $247,318 |
| 29 | | Contingency | @ 15% | $37,098 |
| 30 | | Engineering | @ 20% | $49,464 |
| 31 | | Legal and Administrative | @ 3% | $7,420 |
| | | PROJECT TOTAL | | $341,000 |

### COST TO RELIEVE PRESENT DAY PROBLEM

| ITEM | DESCRIPTION | QUANTITY | UNIT PRICE | EXTENSION |
|---|---|---|---|---|
| 1 | Front End Work, Supervision | 1 each | @ 7% | $1,939 |
| 2 | Temporary Construction | 1 each | @ 4% | $1,108 |
| 3 | Catch Basin/Field Inlet | 2 each | $1,200 / each | $2,400 |
| 4 | Manhole | 0 each | $4,500 / each | $0 |
| 5 | Ditch Excavation | 1500 lin ft | $7 / lin ft | $10,500 |
| 6 | Embankment | 500 lin ft | $7 / lin ft | $3,500 |
| 7 | Concrete Curb | 400 lin ft | $20 / lin ft | $8,000 |
| 8 | 12" Storm Drain, Paved Areas | 50 lin ft | $66 / lin ft | $3,300 |
| 9 | 15" Storm Drain, Paved Areas | 0 lin ft | $78 / lin ft | $0 |
| 10 | 18" Storm Drain, Paved Areas | 0 lin ft | $88 / lin ft | $0 |
| 11 | 24" Storm Drain, Paved Areas | 0 lin ft | $125 / lin ft | $0 |
| 12 | 30" Storm Drain, Paved Areas | 0 lin ft | $135 / lin ft | $0 |
| 13 | 36" Storm Drain, Paved Areas | 0 lin ft | $175 / lin ft | $0 |
| 14 | 12" Storm Drain, Native Areas | 0 lin ft | $33 / lin ft | $0 |
| 15 | 15" Storm Drain, Native Areas | 0 lin ft | $45 / lin ft | $0 |
| 16 | 18" Storm Drain, Native Areas | 0 lin ft | $55 / lin ft | $0 |
| 17 | 24" Storm Drain, Native Areas | 0 lin ft | $85 / lin ft | $0 |
| 18 | 30" Storm Drain, Native Areas | 0 lin ft | $95 / lin ft | $0 |
| 19 | 36" Storm Drain, Native Areas | 0 lin ft | $135 / lin ft | $0 |
| 20 | Slope Anchors | 0 L.S. | $500 / L.S. | $0 |
| 21 | Outlet Structure | 0 each | $6,000 / each | $0 |
| 22 | | | | |
| 23 | | | | |
| 24 | | | | |
| 25 | | | | |
| | | SUBTOTAL | | $30,747 |
| 26 | | Profit | @ 9% | $2,767 |
| 27 | | Bond and Insurance | @ 3% | $1,005 |
| 28 | | Public Works Fee | @ 0.1% | $35 |
| | | CONSTRUCTION TOTAL | | $34,554 |
| 29 | | Contingency | @ 15% | $5,183 |
| 30 | | Engineering | @ 20% | $6,911 |
| 31 | | Legal and Administrative | @ 3% | $1,037 |
| | | PROJECT TOTAL | | $48,000 |

| | | |
|---|---|---|
| DEVELOPMENT PORTION OF TOTAL PROJECT COST | $293,000 | ( 86% ) |
| CITY PORTON OF TOTAL PROJECT COST | $48,000 | ( 14% ) |

# Magnitude Cost Estimate
## PROJECT NO. 4B

### COST OF TOTAL PROJECT

| ITEM | DESCRIPTION | QUANTITY | UNIT PRICE | EXTENSION |
|---|---|---|---|---|
| 1 | Front End Work, Supervision | 1 each | @ 7% | $6,619 |
| 2 | Temporary Construction | 1 each | @ 4% | $3,782 |
| 3 | Catch Basin/Field Inlet | 3 each | $1,200 / each | $3,600 |
| 4 | Manhole | 2 each | $4,500 / each | $9,000 |
| 5 | Ditch Excavation | 200 lin ft | $7 / lin ft | $1,400 |
| 6 | Embankment | 150 lin ft | $7 / lin ft | $1,050 |
| 7 | Concrete Curb | 500 lin ft | $20 / lin ft | $10,000 |
| 8 | 12" Storm Drain, Paved Areas | 60 lin ft | $66 / lin ft | $3,960 |
| 9 | 15" Storm Drain, Paved Areas | 100 lin ft | $78 / lin ft | $7,800 |
| 10 | 18" Storm Drain, Paved Areas | 0 lin ft | $88 / lin ft | $0 |
| 11 | 24" Storm Drain, Paved Areas | 0 lin ft | $125 / lin ft | $0 |
| 12 | 30" Storm Drain, Paved Areas | 0 lin ft | $135 / lin ft | $0 |
| 13 | 36" Storm Drain, Paved Areas | 0 lin ft | $175 / lin ft | $0 |
| 14 | 12" Storm Drain, Native Areas | 0 lin ft | $33 / lin ft | $0 |
| 15 | 15" Storm Drain, Native Areas | 1150 lin ft | $45 / lin ft | $51,750 |
| 16 | 18" Storm Drain, Native Areas | 0 lin ft | $55 / lin ft | $0 |
| 17 | 24" Storm Drain, Native Areas | 0 lin ft | $85 / lin ft | $0 |
| 18 | 30" Storm Drain, Native Areas | 0 lin ft | $95 / lin ft | $0 |
| 19 | 36" Storm Drain, Native Areas | 0 lin ft | $135 / lin ft | $0 |
| 20 | Slope Anchors | 0 L.S. | $500 / L.S. | $0 |
| 21 | Outlet Structure | 1 each | $6,000 / each | $6,000 |
| 22 | | | | |
| 23 | | | | |
| 24 | | | | |
| 25 | | | | |
| | | **SUBTOTAL** | | $104,962 |
| 26 | | Profit | @ 9% | $9,447 |
| 27 | | Bond and Insurance | @ 3% | $3,432 |
| 28 | | Public Works Fee | @ 0.1% | $118 |
| | | **CONSTRUCTION TOTAL** | | $117,958 |
| 29 | | Contingency | @ 15% | $17,694 |
| 30 | | Engineering | @ 20% | $23,592 |
| 31 | | Legal and Administrative | @ 3% | $3,539 |
| | | **PROJECT TOTAL** | | $163,000 |

### COST TO RELIEVE PRESENT DAY PROBLEM

| ITEM | DESCRIPTION | QUANTITY | UNIT PRICE | EXTENSION |
|---|---|---|---|---|
| 1 | Front End Work, Supervision | 1 each | @ 7% | $823 |
| 2 | Temporary Construction | 1 each | @ 4% | $470 |
| 3 | Catch Basin/Field Inlet | 0 each | $1,200 / each | $0 |
| 4 | Manhole | 0 each | $4,500 / each | $0 |
| 5 | Ditch Excavation | 100 lin ft | $7 / lin ft | $700 |
| 6 | Embankment | 150 lin ft | $7 / lin ft | $1,050 |
| 7 | Concrete Curb | 500 lin ft | $20 / lin ft | $10,000 |
| 8 | 12" Storm Drain, Paved Areas | 0 lin ft | $66 / lin ft | $0 |
| 9 | 15" Storm Drain, Paved Areas | 0 lin ft | $78 / lin ft | $0 |
| 10 | 18" Storm Drain, Paved Areas | 0 lin ft | $88 / lin ft | $0 |
| 11 | 24" Storm Drain, Paved Areas | 0 lin ft | $125 / lin ft | $0 |
| 12 | 30" Storm Drain, Paved Areas | 0 lin ft | $135 / lin ft | $0 |
| 13 | 36" Storm Drain, Paved Areas | 0 lin ft | $175 / lin ft | $0 |
| 14 | 12" Storm Drain, Native Areas | 0 lin ft | $33 / lin ft | $0 |
| 15 | 15" Storm Drain, Native Areas | 0 lin ft | $45 / lin ft | $0 |
| 16 | 18" Storm Drain, Native Areas | 0 lin ft | $55 / lin ft | $0 |
| 17 | 24" Storm Drain, Native Areas | 0 lin ft | $85 / lin ft | $0 |
| 18 | 30" Storm Drain, Native Areas | 0 lin ft | $95 / lin ft | $0 |
| 19 | 36" Storm Drain, Native Areas | 0 lin ft | $135 / lin ft | $0 |
| 20 | Slope Anchors | 0 L.S. | $500 / L.S. | $0 |
| 21 | Outlet Structure | 0 each | $6,000 / each | $0 |
| 22 | | | | |
| 23 | | | | |
| 24 | | | | |
| 25 | | | | |
| | | **SUBTOTAL** | | $13,043 |
| 26 | | Profit | @ 9% | $1,174 |
| 27 | | Bond and Insurance | @ 3% | $426 |
| 28 | | Public Works Fee | @ 0.1% | $15 |
| | | **CONSTRUCTION TOTAL** | | $14,657 |
| 29 | | Contingency | @ 15% | $2,199 |
| 30 | | Engineering | @ 20% | $2,931 |
| 31 | | Legal and Administrative | @ 3% | $440 |
| | | **PROJECT TOTAL** | | $20,000 |

| | | |
|---|---|---|
| DEVELOPMENT PORTION OF TOTAL PROJECT COST | $143,000 | ( 88% ) |
| CITY PORTON OF TOTAL PROJECT COST | $20,000 | ( 12% ) |

# Magnitude Cost Estimate
# PROJECT NO. 5

## COST OF TOTAL PROJECT

| ITEM | DESCRIPTION | QUANTITY | UNIT PRICE | EXTENSION |
|---|---|---|---|---|
| 1 | Front End Work, Supervision | 1 each | @ 7% | $19,912 |
| 2 | Temporary Construction | 1 each | @ 4% | $11,378 |
| 3 | Catch Basin/Field Inlet | 10 each | $1,200 / each | $12,000 |
| 4 | Manhole | 7 each | $4,500 / each | $31,500 |
| 5 | Ditch Excavation | 200 lin ft | $7 / lin ft | $1,400 |
| 6 | Embankment | 500 lin ft | $7 / lin ft | $3,500 |
| 7 | Concrete Curb | 500 lin ft | $20 / lin ft | $10,000 |
| 8 | 12" Storm Drain, Paved Areas | 1350 lin ft | $66 / lin ft | $89,100 |
| 9 | 15" Storm Drain, Paved Areas | 0 lin ft | $78 / lin ft | $0 |
| 10 | 18" Storm Drain, Paved Areas | 1150 lin ft | $88 / lin ft | $101,200 |
| 11 | 24" Storm Drain, Paved Areas | 0 lin ft | $125 / lin ft | $0 |
| 12 | 30" Storm Drain, Paved Areas | 0 lin ft | $135 / lin ft | $0 |
| 13 | 36" Storm Drain, Paved Areas | 0 lin ft | $175 / lin ft | $0 |
| 14 | 12" Storm Drain, Native Areas | 0 lin ft | $33 / lin ft | $0 |
| 15 | 15" Storm Drain, Native Areas | 0 lin ft | $45 / lin ft | $0 |
| 16 | 18" Storm Drain, Native Areas | 0 lin ft | $55 / lin ft | $0 |
| 17 | 24" Storm Drain, Native Areas | 350 lin ft | $85 / lin ft | $29,750 |
| 18 | 30" Storm Drain, Native Areas | 0 lin ft | $95 / lin ft | $0 |
| 19 | 36" Storm Drain, Native Areas | 0 lin ft | $135 / lin ft | $0 |
| 20 | Slope Anchors | 0 L.S. | $500 / L.S. | $0 |
| 21 | Outlet Structure | 1 each | $6,000 / each | $6,000 |
| 22 | | | | |
| 23 | | | | |
| 24 | | | | |
| 25 | | | | |
| | | SUBTOTAL | | $315,740 |
| 26 | | Profit | @ 9% | $28,417 |
| 27 | | Bond and Insurance | @ 3% | $10,325 |
| 28 | | Public Works Fee | @ 0.1% | $354 |
| | | CONSTRUCTION TOTAL | | $354,835 |
| 29 | | Contingency | @ 15% | $53,225 |
| 30 | | Engineering | @ 20% | $70,967 |
| 31 | | Legal and Administrative | @ 3% | $10,645 |
| | | PROJECT TOTAL | | $490,000 |

## COST TO RELIEVE PRESENT DAY PROBLEM

| ITEM | DESCRIPTION | QUANTITY | UNIT PRICE | EXTENSION |
|---|---|---|---|---|
| 1 | Front End Work, Supervision | 0 each | @ 7% | $3,553 |
| 2 | Temporary Construction | 0 each | @ 4% | $2,030 |
| 3 | Catch Basin/Field Inlet | 1 each | $1,200 / each | $1,200 |
| 4 | Manhole | 1 each | $4,500 / each | $4,500 |
| 5 | Ditch Excavation | 50 lin ft | $7 / lin ft | $350 |
| 6 | Embankment | 500 lin ft | $7 / lin ft | $3,500 |
| 7 | Concrete Curb | 500 lin ft | $20 / lin ft | $10,000 |
| 8 | 12" Storm Drain, Paved Areas | 0 lin ft | $66 / lin ft | $0 |
| 9 | 15" Storm Drain, Paved Areas | 400 lin ft | $78 / lin ft | $31,200 |
| 10 | 18" Storm Drain, Paved Areas | 0 lin ft | $88 / lin ft | $0 |
| 11 | 24" Storm Drain, Paved Areas | 0 lin ft | $125 / lin ft | $0 |
| 12 | 30" Storm Drain, Paved Areas | 0 lin ft | $135 / lin ft | $0 |
| 13 | 36" Storm Drain, Paved Areas | 0 lin ft | $175 / lin ft | $0 |
| 14 | 12" Storm Drain, Native Areas | 0 lin ft | $33 / lin ft | $0 |
| 15 | 15" Storm Drain, Native Areas | 0 lin ft | $45 / lin ft | $0 |
| 16 | 18" Storm Drain, Native Areas | 0 lin ft | $55 / lin ft | $0 |
| 17 | 24" Storm Drain, Native Areas | 0 lin ft | $85 / lin ft | $0 |
| 18 | 30" Storm Drain, Native Areas | 0 lin ft | $95 / lin ft | $0 |
| 19 | 36" Storm Drain, Native Areas | 0 lin ft | $135 / lin ft | $0 |
| 20 | Slope Anchors | 0 L.S. | $500 / L.S. | $0 |
| 21 | Outlet Structure | 0 each | $6,000 / each | $0 |
| 22 | | | | |
| 23 | | | | |
| 24 | | | | |
| 25 | | | | |
| | | SUBTOTAL | | $56,333 |
| 26 | | Profit | @ 9% | $5,070 |
| 27 | | Bond and Insurance | @ 3% | $1,842 |
| 28 | | Public Works Fee | @ 0.1% | $63 |
| | | CONSTRUCTION TOTAL | | $63,308 |
| 29 | | Contingency | @ 15% | $9,496 |
| 30 | | Engineering | @ 20% | $12,662 |
| 31 | | Legal and Administrative | @ 3% | $1,899 |
| | | PROJECT TOTAL | | $87,000 |

| | | |
|---|---|---|
| DEVELOPMENT PORTION OF TOTAL PROJECT COST | $403,000 | ( 82% ) |
| CITY PORTON OF TOTAL PROJECT COST | $87,000 | ( 18% ) |

# Magnitude Cost Estimate
# PROJECT NO. 6B

## COST OF TOTAL PROJECT

| ITEM | DESCRIPTION | QUANTITY | UNIT PRICE | EXTENSION |
|---|---|---|---|---|
| 1 | Front End Work, Supervision | 1 each | @ 7% | $3,796 |
| 2 | Temporary Construction | 1 each | @ 4% | $2,169 |
| 3 | Catch Basin/Field Inlet | 1 each | $1,200 / each | $1,200 |
| 4 | Manhole | 2 each | $4,500 / each | $9,000 |
| 5 | Ditch Excavation | 50 lin ft | $7 / lin ft | $350 |
| 6 | Embankment | 0 lin ft | $7 / lin ft | $0 |
| 7 | Concrete Curb | 0 lin ft | $20 / lin ft | $0 |
| 8 | 12" Storm Drain, Paved Areas | 500 lin ft | $66 / lin ft | $33,000 |
| 9 | 15" Storm Drain, Paved Areas | 60 lin ft | $78 / lin ft | $4,680 |
| 10 | 18" Storm Drain, Paved Areas | 0 lin ft | $88 / lin ft | $0 |
| 11 | 24" Storm Drain, Paved Areas | 0 lin ft | $125 / lin ft | $0 |
| 12 | 30" Storm Drain, Paved Areas | 0 lin ft | $135 / lin ft | $0 |
| 13 | 36" Storm Drain, Paved Areas | 0 lin ft | $175 / lin ft | $0 |
| 14 | 12" Storm Drain, Native Areas | 0 lin ft | $33 / lin ft | $0 |
| 15 | 15" Storm Drain, Native Areas | 0 lin ft | $45 / lin ft | $0 |
| 16 | 18" Storm Drain, Native Areas | 0 lin ft | $55 / lin ft | $0 |
| 17 | 24" Storm Drain, Native Areas | 0 lin ft | $85 / lin ft | $0 |
| 18 | 30" Storm Drain, Native Areas | 0 lin ft | $95 / lin ft | $0 |
| 19 | 36" Storm Drain, Native Areas | 0 lin ft | $135 / lin ft | $0 |
| 20 | Slope Anchors | 0 L.S. | $500 / L.S. | $0 |
| 21 | Outlet Structure | 1 each | $6,000 / each | $6,000 |
| 22 | | | | |
| 23 | | | | |
| 24 | | | | |
| 25 | | | | |
| | | **SUBTOTAL** | | $60,195 |
| 26 | | Profit | @ 9% | $5,418 |
| 27 | | Bond and Insurance | @ 3% | $1,968 |
| 28 | | Public Works Fee | @ 0.1% | $68 |
| | | **CONSTRUCTION TOTAL** | | $67,649 |
| 29 | | Contingency | @ 15% | $10,147 |
| 30 | | Engineering | @ 20% | $13,530 |
| 31 | | Legal and Administrative | @ 3% | $2,029 |
| | | **PROJECT TOTAL** | | $93,000 |

## COST TO RELIEVE PRESENT DAY PROBLEM

| ITEM | DESCRIPTION | QUANTITY | UNIT PRICE | EXTENSION |
|---|---|---|---|---|
| 1 | Front End Work, Supervision | 0 each | @ 7% | $2,793 |
| 2 | Temporary Construction | 0 each | @ 4% | $1,596 |
| 3 | Catch Basin/Field Inlet | 1 each | $1,200 / each | $1,200 |
| 4 | Manhole | 2 each | $4,500 / each | $9,000 |
| 5 | Ditch Excavation | 0 lin ft | $7 / lin ft | $0 |
| 6 | Embankment | 0 lin ft | $7 / lin ft | $0 |
| 7 | Concrete Curb | 0 lin ft | $20 / lin ft | $0 |
| 8 | 12" Storm Drain, Paved Areas | 450 lin ft | $66 / lin ft | $29,700 |
| 9 | 15" Storm Drain, Paved Areas | 0 lin ft | $78 / lin ft | $0 |
| 10 | 18" Storm Drain, Paved Areas | 0 lin ft | $88 / lin ft | $0 |
| 11 | 24" Storm Drain, Paved Areas | 0 lin ft | $125 / lin ft | $0 |
| 12 | 30" Storm Drain, Paved Areas | 0 lin ft | $135 / lin ft | $0 |
| 13 | 36" Storm Drain, Paved Areas | 0 lin ft | $175 / lin ft | $0 |
| 14 | 12" Storm Drain, Native Areas | 0 lin ft | $33 / lin ft | $0 |
| 15 | 15" Storm Drain, Native Areas | 0 lin ft | $45 / lin ft | $0 |
| 16 | 18" Storm Drain, Native Areas | 0 lin ft | $55 / lin ft | $0 |
| 17 | 24" Storm Drain, Native Areas | 0 lin ft | $85 / lin ft | $0 |
| 18 | 30" Storm Drain, Native Areas | 0 lin ft | $95 / lin ft | $0 |
| 19 | 36" Storm Drain, Native Areas | 0 lin ft | $135 / lin ft | $0 |
| 20 | Slope Anchors | 0 L.S. | $500 / L.S. | $0 |
| 21 | Outlet Structure | 0 each | $6,000 / each | $0 |
| 22 | | | | |
| 23 | | | | |
| 24 | | | | |
| 25 | | | | |
| | | **SUBTOTAL** | | $44,289 |
| 26 | | Profit | @ 9% | $3,986 |
| 27 | | Bond and Insurance | @ 3% | $1,448 |
| 28 | | Public Works Fee | @ 0.1% | $50 |
| | | **CONSTRUCTION TOTAL** | | $49,773 |
| 29 | | Contingency | @ 15% | $7,466 |
| 30 | | Engineering | @ 20% | $9,955 |
| 31 | | Legal and Administrative | @ 3% | $1,493 |
| | | **PROJECT TOTAL** | | $69,000 |

| | | |
|---|---|---|
| DEVELOPMENT PORTION OF TOTAL PROJECT COST | $24,000 | ( 26% ) |
| CITY PORTON OF TOTAL PROJECT COST | $69,000 | ( 74% ) |

# Magnitude Cost Estimate
## PROJECT NO. 10B

### COST OF TOTAL PROJECT

| ITEM | DESCRIPTION | QUANTITY | UNIT PRICE | EXTENSION |
|---|---|---|---|---|
| 1 | Front End Work, Supervision | 1 each | @ 7% | $6,735 |
| 2 | Temporary Construction | 1 each | @ 4% | $3,849 |
| 3 | Catch Basin/Field Inlet | 6 each | $1,200 / each | $7,200 |
| 4 | Manhole | 4 each | $4,500 / each | $18,000 |
| 5 | Ditch Excavation | 100 lin ft | $7 / lin ft | $700 |
| 6 | Embankment | 0 lin ft | $7 / lin ft | $0 |
| 7 | Concrete Curb | 0 lin ft | $20 / lin ft | $0 |
| 8 | 12" Storm Drain, Paved Areas | 120 lin ft | $66 / lin ft | $7,920 |
| 9 | 15" Storm Drain, Paved Areas | 800 lin ft | $78 / lin ft | $62,400 |
| 10 | 18" Storm Drain, Paved Areas | 0 lin ft | $88 / lin ft | $0 |
| 11 | 24" Storm Drain, Paved Areas | 0 lin ft | $125 / lin ft | $0 |
| 12 | 30" Storm Drain, Paved Areas | 0 lin ft | $135 / lin ft | $0 |
| 13 | 36" Storm Drain, Paved Areas | 0 lin ft | $175 / lin ft | $0 |
| 14 | 12" Storm Drain, Native Areas | 0 lin ft | $33 / lin ft | $0 |
| 15 | 15" Storm Drain, Native Areas | 0 lin ft | $45 / lin ft | $0 |
| 16 | 18" Storm Drain, Native Areas | 0 lin ft | $55 / lin ft | $0 |
| 17 | 24" Storm Drain, Native Areas | 0 lin ft | $85 / lin ft | $0 |
| 18 | 30" Storm Drain, Native Areas | 0 lin ft | $95 / lin ft | $0 |
| 19 | 36" Storm Drain, Native Areas | 0 lin ft | $135 / lin ft | $0 |
| 20 | Slope Anchors | 0 L.S. | $500 / L.S. | $0 |
| 21 | Outlet Structure | 0 each | $6,000 / each | $0 |
| 22 | | | | |
| 23 | | | | |
| 24 | | | | |
| 25 | | | | |
| | | **SUBTOTAL** | | $106,804 |
| 26 | | Profit | @ 9% | $9,612 |
| 27 | | Bond and Insurance | @ 3% | $3,492 |
| 28 | | Public Works Fee | @ 0.1% | $120 |
| | | **CONSTRUCTION TOTAL** | | $120,029 |
| 29 | | Contingency | @ 15% | $18,004 |
| 30 | | Engineering | @ 20% | $24,006 |
| 31 | | Legal and Administrative | @ 3% | $3,601 |
| | | **PROJECT TOTAL** | | $166,000 |

### COST TO RELIEVE PRESENT DAY PROBLEM

| ITEM | DESCRIPTION | QUANTITY | UNIT PRICE | EXTENSION |
|---|---|---|---|---|
| 1 | Front End Work, Supervision | 0 each | @ 7% | $0 |
| 2 | Temporary Construction | 0 each | @ 4% | $0 |
| 3 | Catch Basin/Field Inlet | 0 each | $1,200 / each | $0 |
| 4 | Manhole | 0 each | $4,500 / each | $0 |
| 5 | Ditch Excavation | 0 lin ft | $7 / lin ft | $0 |
| 6 | Embankment | 0 lin ft | $7 / lin ft | $0 |
| 7 | Concrete Curb | 0 lin ft | $20 / lin ft | $0 |
| 8 | 12" Storm Drain, Paved Areas | 0 lin ft | $66 / lin ft | $0 |
| 9 | 15" Storm Drain, Paved Areas | 0 lin ft | $78 / lin ft | $0 |
| 10 | 18" Storm Drain, Paved Areas | 0 lin ft | $88 / lin ft | $0 |
| 11 | 24" Storm Drain, Paved Areas | 0 lin ft | $125 / lin ft | $0 |
| 12 | 30" Storm Drain, Paved Areas | 0 lin ft | $135 / lin ft | $0 |
| 13 | 36" Storm Drain, Paved Areas | 0 lin ft | $175 / lin ft | $0 |
| 14 | 12" Storm Drain, Native Areas | 0 lin ft | $33 / lin ft | $0 |
| 15 | 15" Storm Drain, Native Areas | 0 lin ft | $45 / lin ft | $0 |
| 16 | 18" Storm Drain, Native Areas | 0 lin ft | $55 / lin ft | $0 |
| 17 | 24" Storm Drain, Native Areas | 0 lin ft | $85 / lin ft | $0 |
| 18 | 30" Storm Drain, Native Areas | 0 lin ft | $95 / lin ft | $0 |
| 19 | 36" Storm Drain, Native Areas | 0 lin ft | $135 / lin ft | $0 |
| 20 | Slope Anchors | 0 L.S. | $500 / L.S. | $0 |
| 21 | Outlet Structure | 0 each | $6,000 / each | $0 |
| 22 | | | | |
| 23 | | | | |
| 24 | | | | |
| 25 | | | | |
| | | **SUBTOTAL** | | $0 |
| 26 | | Profit | @ 9% | $0 |
| 27 | | Bond and Insurance | @ 3% | $0 |
| 28 | | Public Works Fee | @ 0.1% | $0 |
| | | **CONSTRUCTION TOTAL** | | $0 |
| 29 | | Contingency | @ 15% | $0 |
| 30 | | Engineering | @ 20% | $0 |
| 31 | | Legal and Administrative | @ 3% | $0 |
| | | **PROJECT TOTAL** | | $0 |

| | | |
|---|---|---|
| DEVELOPMENT PORTION OF TOTAL PROJECT COST | $166,000 | ( 100% ) |
| CITY PORTON OF TOTAL PROJECT COST | $0 | ( 0% ) |

# Magnitude Cost Estimate
## PROJECT NO. 11

### COST OF TOTAL PROJECT

| ITEM | DESCRIPTION | QUANTITY | UNIT PRICE | EXTENSION |
|---|---|---|---|---|
| 1 | Front End Work, Supervision | 1 each | @ 7% | $392 |
| 2 | Temporary Construction | 1 each | @ 4% | $224 |
| 3 | Catch Basin/Field Inlet | 0 each | $1,200 / each | $0 |
| 4 | Manhole | 0 each | $4,500 / each | $0 |
| 5 | Ditch Excavation | 800 lin ft | $7 / lin ft | $5,600 |
| 6 | Embankment | 0 lin ft | $7 / lin ft | $0 |
| 7 | Concrete Curb | 0 lin ft | $20 / lin ft | $0 |
| 8 | 12" Storm Drain, Paved Areas | 0 lin ft | $66 / lin ft | $0 |
| 9 | 15" Storm Drain, Paved Areas | 0 lin ft | $78 / lin ft | $0 |
| 10 | 18" Storm Drain, Paved Areas | 0 lin ft | $88 / lin ft | $0 |
| 11 | 24" Storm Drain, Paved Areas | 0 lin ft | $125 / lin ft | $0 |
| 12 | 30" Storm Drain, Paved Areas | 0 lin ft | $135 / lin ft | $0 |
| 13 | 36" Storm Drain, Paved Areas | 0 lin ft | $175 / lin ft | $0 |
| 14 | 12" Storm Drain, Native Areas | 0 lin ft | $33 / lin ft | $0 |
| 15 | 15" Storm Drain, Native Areas | 0 lin ft | $45 / lin ft | $0 |
| 16 | 18" Storm Drain, Native Areas | 0 lin ft | $55 / lin ft | $0 |
| 17 | 24" Storm Drain, Native Areas | 0 lin ft | $85 / lin ft | $0 |
| 18 | 30" Storm Drain, Native Areas | 0 lin ft | $95 / lin ft | $0 |
| 19 | 36" Storm Drain, Native Areas | 0 lin ft | $135 / lin ft | $0 |
| 20 | Slope Anchors | 0 L.S. | $500 / L.S. | $0 |
| 21 | Outlet Structure | 0 each | $6,000 / each | $0 |
| 22 | | | | |
| 23 | | | | |
| 24 | | | | |
| 25 | | | | |
| | | **SUBTOTAL** | | $6,216 |
| 26 | | Profit | @ 9% | $559 |
| 27 | | Bond and Insurance | @ 3% | $203 |
| 28 | | Public Works Fee | @ 0.1% | $7 |
| | | **CONSTRUCTION TOTAL** | | $6,986 |
| 29 | | Contingency | @ 15% | $1,048 |
| 30 | | Engineering | @ 20% | $1,397 |
| 31 | | Legal and Administrative | @ 3% | $210 |
| | | **PROJECT TOTAL** | | $10,000 |

### COST TO RELIEVE PRESENT DAY PROBLEM

| ITEM | DESCRIPTION | QUANTITY | UNIT PRICE | EXTENSION |
|---|---|---|---|---|
| 1 | Front End Work, Supervision | 1 each | @ 7% | $392 |
| 2 | Temporary Construction | 1 each | @ 4% | $224 |
| 3 | Catch Basin/Field Inlet | 0 each | $1,200 / each | $0 |
| 4 | Manhole | 0 each | $4,500 / each | $0 |
| 5 | Ditch Excavation | 800 lin ft | $7 / lin ft | $5,600 |
| 6 | Embankment | 0 lin ft | $7 / lin ft | $0 |
| 7 | Concrete Curb | 0 lin ft | $20 / lin ft | $0 |
| 8 | 12" Storm Drain, Paved Areas | 0 lin ft | $66 / lin ft | $0 |
| 9 | 15" Storm Drain, Paved Areas | 0 lin ft | $78 / lin ft | $0 |
| 10 | 18" Storm Drain, Paved Areas | 0 lin ft | $88 / lin ft | $0 |
| 11 | 24" Storm Drain, Paved Areas | 0 lin ft | $125 / lin ft | $0 |
| 12 | 30" Storm Drain, Paved Areas | 0 lin ft | $135 / lin ft | $0 |
| 13 | 36" Storm Drain, Paved Areas | 0 lin ft | $175 / lin ft | $0 |
| 14 | 12" Storm Drain, Native Areas | 0 lin ft | $33 / lin ft | $0 |
| 15 | 15" Storm Drain, Native Areas | 0 lin ft | $45 / lin ft | $0 |
| 16 | 18" Storm Drain, Native Areas | 0 lin ft | $55 / lin ft | $0 |
| 17 | 24" Storm Drain, Native Areas | 0 lin ft | $85 / lin ft | $0 |
| 18 | 30" Storm Drain, Native Areas | 0 lin ft | $95 / lin ft | $0 |
| 19 | 36" Storm Drain, Native Areas | 0 lin ft | $135 / lin ft | $0 |
| 20 | Slope Anchors | 0 L.S. | $500 / L.S. | $0 |
| 21 | Outlet Structure | 0 each | $6,000 / each | $0 |
| 22 | | | | |
| 23 | | | | |
| 24 | | | | |
| 25 | | | | |
| | | **SUBTOTAL** | | $6,216 |
| 26 | | Profit | @ 9% | $559 |
| 27 | | Bond and Insurance | @ 3% | $203 |
| 28 | | Public Works Fee | @ 0.1% | $7 |
| | | **CONSTRUCTION TOTAL** | | $6,986 |
| 29 | | Contingency | @ 15% | $1,048 |
| 30 | | Engineering | @ 20% | $1,397 |
| 31 | | Legal and Administrative | @ 3% | $210 |
| | | **PROJECT TOTAL** | | $10,000 |

| | | |
|---|---|---|
| DEVELOPMENT PORTION OF TOTAL PROJECT COST | $0 | ( 0% ) |
| CITY PORTON OF TOTAL PROJECT COST | $10,000 | ( 100% ) |

# Magnitude Cost Estimate
## PROJECT NO. 13

### COST OF TOTAL PROJECT

| ITEM | DESCRIPTION | QUANTITY | UNIT PRICE | EXTENSION |
|---|---|---|---|---|
| 1 | Front End Work, Supervision | 1 each | @ 7% | $7,001 |
| 2 | Temporary Construction | 1 each | @ 4% | $4,000 |
| 3 | Catch Basin/Field Inlet | 3 each | $1,200 / each | $3,600 |
| 4 | Manhole | 3 each | $4,500 / each | $13,500 |
| 5 | Ditch Excavation | 250 lin ft | $7 / lin ft | $1,750 |
| 6 | Embankment | 0 lin ft | $7 / lin ft | $0 |
| 7 | Concrete Curb | 0 lin ft | $20 / lin ft | $0 |
| 8 | 12" Storm Drain, Paved Areas | 50 lin ft | $66 / lin ft | $3,300 |
| 9 | 15" Storm Drain, Paved Areas | 380 lin ft | $78 / lin ft | $29,640 |
| 10 | 18" Storm Drain, Paved Areas | 65 lin ft | $88 / lin ft | $5,720 |
| 11 | 24" Storm Drain, Paved Areas | 0 lin ft | $125 / lin ft | $0 |
| 12 | 30" Storm Drain, Paved Areas | 0 lin ft | $135 / lin ft | $0 |
| 13 | 36" Storm Drain, Paved Areas | 0 lin ft | $175 / lin ft | $0 |
| 14 | 12" Storm Drain, Native Areas | 0 lin ft | $33 / lin ft | $0 |
| 15 | 15" Storm Drain, Native Areas | 300 lin ft | $45 / lin ft | $13,500 |
| 16 | 18" Storm Drain, Native Areas | 200 lin ft | $55 / lin ft | $11,000 |
| 17 | 24" Storm Drain, Native Areas | 0 lin ft | $85 / lin ft | $0 |
| 18 | 30" Storm Drain, Native Areas | 0 lin ft | $95 / lin ft | $0 |
| 19 | 36" Storm Drain, Native Areas | 0 lin ft | $135 / lin ft | $0 |
| 20 | Slope Anchors | 0 L.S. | $500 / L.S. | $0 |
| 21 | Outlet Structure | 3 each | $6,000 / each | $18,000 |
| 22 | | | | |
| 23 | | | | |
| 24 | | | | |
| 25 | | | | |
| | SUBTOTAL | | | $111,011 |
| 26 | Profit | | @ 9% | $9,991 |
| 27 | Bond and Insurance | | @ 3% | $3,630 |
| 28 | Public Works Fee | | @ 0.1% | $125 |
| | CONSTRUCTION TOTAL | | | $124,757 |
| 29 | Contingency | | @ 15% | $18,714 |
| 30 | Engineering | | @ 20% | $24,951 |
| 31 | Legal and Administrative | | @ 3% | $3,743 |
| | PROJECT TOTAL | | | $172,000 |

### COST TO RELIEVE PRESENT DAY PROBLEM

| ITEM | DESCRIPTION | QUANTITY | UNIT PRICE | EXTENSION |
|---|---|---|---|---|
| 1 | Front End Work, Supervision | 0 each | @ 7% | $1,883 |
| 2 | Temporary Construction | 0 each | @ 4% | $1,076 |
| 3 | Catch Basin/Field Inlet | 1 each | $1,200 / each | $1,200 |
| 4 | Manhole | 1 each | $4,500 / each | $4,500 |
| 5 | Ditch Excavation | 200 lin ft | $7 / lin ft | $1,400 |
| 6 | Embankment | 0 lin ft | $7 / lin ft | $0 |
| 7 | Concrete Curb | 0 lin ft | $20 / lin ft | $0 |
| 8 | 12" Storm Drain, Paved Areas | 300 lin ft | $66 / lin ft | $19,800 |
| 9 | 15" Storm Drain, Paved Areas | 0 lin ft | $78 / lin ft | $0 |
| 10 | 18" Storm Drain, Paved Areas | 0 lin ft | $88 / lin ft | $0 |
| 11 | 24" Storm Drain, Paved Areas | 0 lin ft | $125 / lin ft | $0 |
| 12 | 30" Storm Drain, Paved Areas | 0 lin ft | $135 / lin ft | $0 |
| 13 | 36" Storm Drain, Paved Areas | 0 lin ft | $175 / lin ft | $0 |
| 14 | 12" Storm Drain, Native Areas | 0 lin ft | $33 / lin ft | $0 |
| 15 | 15" Storm Drain, Native Areas | 0 lin ft | $45 / lin ft | $0 |
| 16 | 18" Storm Drain, Native Areas | 0 lin ft | $55 / lin ft | $0 |
| 17 | 24" Storm Drain, Native Areas | 0 lin ft | $85 / lin ft | $0 |
| 18 | 30" Storm Drain, Native Areas | 0 lin ft | $95 / lin ft | $0 |
| 19 | 36" Storm Drain, Native Areas | 0 lin ft | $135 / lin ft | $0 |
| 20 | Slope Anchors | 0 L.S. | $500 / L.S. | $0 |
| 21 | Outlet Structure | 0 each | $6,000 / each | $0 |
| 22 | | | | |
| 23 | | | | |
| 24 | | | | |
| 25 | | | | |
| | SUBTOTAL | | | $29,859 |
| 26 | Profit | | @ 9% | $2,687 |
| 27 | Bond and Insurance | | @ 3% | $976 |
| 28 | Public Works Fee | | @ 0.1% | $34 |
| | CONSTRUCTION TOTAL | | | $33,556 |
| 29 | Contingency | | @ 15% | $5,033 |
| 30 | Engineering | | @ 20% | $6,711 |
| 31 | Legal and Administrative | | @ 3% | $1,007 |
| | PROJECT TOTAL | | | $46,000 |

| | | |
|---|---|---|
| DEVELOPMENT PORTION OF TOTAL PROJECT COST | $126,000 | ( 73% ) |
| CITY PORTON OF TOTAL PROJECT COST | $46,000 | ( 27% ) |

# Magnitude Cost Estimate
# PROJECT NO. 17B

## COST OF TOTAL PROJECT

| ITEM | DESCRIPTION | QUANTITY | UNIT PRICE | EXTENSION |
|---|---|---|---|---|
| 1 | Front End Work, Supervision | 1 each | @ 7% | $19,082 |
| 2 | Temporary Construction | 1 each | @ 4% | $10,904 |
| 3 | Catch Basin/Field Inlet | 4 each | $1,200 / each | $4,800 |
| 4 | Manhole | 4 each | $4,500 / each | $18,000 |
| 5 | Ditch Excavation | 400 lin ft | $7 / lin ft | $2,800 |
| 6 | Embankment | 0 lin ft | $7 / lin ft | $0 |
| 7 | Concrete Curb | 0 lin ft | $20 / lin ft | $0 |
| 8 | 12" Storm Drain, Paved Areas | 0 lin ft | $66 / lin ft | $0 |
| 9 | 15" Storm Drain, Paved Areas | 750 lin ft | $78 / lin ft | $58,500 |
| 10 | 18" Storm Drain, Paved Areas | 1500 lin ft | $88 / lin ft | $132,000 |
| 11 | 24" Storm Drain, Paved Areas | 50 lin ft | $125 / lin ft | $6,250 |
| 12 | 30" Storm Drain, Paved Areas | 0 lin ft | $135 / lin ft | $0 |
| 13 | 36" Storm Drain, Paved Areas | 0 lin ft | $175 / lin ft | $0 |
| 14 | 12" Storm Drain, Native Areas | 0 lin ft | $33 / lin ft | $0 |
| 15 | 15" Storm Drain, Native Areas | 0 lin ft | $45 / lin ft | $0 |
| 16 | 18" Storm Drain, Native Areas | 0 lin ft | $55 / lin ft | $0 |
| 17 | 24" Storm Drain, Native Areas | 450 lin ft | $85 / lin ft | $38,250 |
| 18 | 30" Storm Drain, Native Areas | 0 lin ft | $95 / lin ft | $0 |
| 19 | 36" Storm Drain, Native Areas | 0 lin ft | $135 / lin ft | $0 |
| 20 | Slope Anchors | 0 L.S. | $500 / L.S. | $0 |
| 21 | Outlet Structure | 2 each | $6,000 / each | $12,000 |
| 22 | | | | |
| 23 | | | | |
| 24 | | | | |
| 25 | | | | |
| | | SUBTOTAL | | $302,586 |
| 26 | | Profit | @ 9% | $27,233 |
| 27 | | Bond and Insurance | @ 3% | $9,895 |
| 28 | | Public Works Fee | @ 0.1% | $340 |
| | | CONSTRUCTION TOTAL | | $340,053 |
| 29 | | Contingency | @ 15% | $51,008 |
| 30 | | Engineering | @ 20% | $68,011 |
| 31 | | Legal and Administrative | @ 3% | $10,202 |
| | | PROJECT TOTAL | | $469,000 |

## COST TO RELIEVE PRESENT DAY PROBLEM

| ITEM | DESCRIPTION | QUANTITY | UNIT PRICE | EXTENSION |
|---|---|---|---|---|
| 1 | Front End Work, Supervision | 0 each | @ 7% | $1,498 |
| 2 | Temporary Construction | 0 each | @ 4% | $856 |
| 3 | Catch Basin/Field Inlet | 0 each | $1,200 / each | $0 |
| 4 | Manhole | 0 each | $4,500 / each | $0 |
| 5 | Ditch Excavation | 700 lin ft | $7 / lin ft | $4,900 |
| 6 | Embankment | 0 lin ft | $7 / lin ft | $0 |
| 7 | Concrete Curb | 0 lin ft | $20 / lin ft | $0 |
| 8 | 12" Storm Drain, Paved Areas | 50 lin ft | $66 / lin ft | $3,300 |
| 9 | 15" Storm Drain, Paved Areas | 0 lin ft | $78 / lin ft | $0 |
| 10 | 18" Storm Drain, Paved Areas | 0 lin ft | $88 / lin ft | $0 |
| 11 | 24" Storm Drain, Paved Areas | 0 lin ft | $125 / lin ft | $0 |
| 12 | 30" Storm Drain, Paved Areas | 0 lin ft | $135 / lin ft | $0 |
| 13 | 36" Storm Drain, Paved Areas | 0 lin ft | $175 / lin ft | $0 |
| 14 | 12" Storm Drain, Native Areas | 400 lin ft | $33 / lin ft | $13,200 |
| 15 | 15" Storm Drain, Native Areas | 0 lin ft | $45 / lin ft | $0 |
| 16 | 18" Storm Drain, Native Areas | 0 lin ft | $55 / lin ft | $0 |
| 17 | 24" Storm Drain, Native Areas | 0 lin ft | $85 / lin ft | $0 |
| 18 | 30" Storm Drain, Native Areas | 0 lin ft | $95 / lin ft | $0 |
| 19 | 36" Storm Drain, Native Areas | 0 lin ft | $135 / lin ft | $0 |
| 20 | Slope Anchors | 0 L.S. | $500 / L.S. | $0 |
| 21 | Outlet Structure | 0 each | $6,000 / each | $0 |
| 22 | | | | |
| 23 | | | | |
| 24 | | | | |
| 25 | | | | |
| | | SUBTOTAL | | $23,754 |
| 26 | | Profit | @ 9% | $2,138 |
| 27 | | Bond and Insurance | @ 3% | $777 |
| 28 | | Public Works Fee | @ 0.1% | $27 |
| | | CONSTRUCTION TOTAL | | $26,695 |
| 29 | | Contingency | @ 15% | $4,004 |
| 30 | | Engineering | @ 20% | $5,339 |
| 31 | | Legal and Administrative | @ 3% | $801 |
| | | PROJECT TOTAL | | $37,000 |

| | | |
|---|---|---|
| DEVELOPMENT PORTION OF TOTAL PROJECT COST | $432,000 | ( 92% ) |
| CITY PORTON OF TOTAL PROJECT COST | $37,000 | ( 8% ) |

## DISTRIBUTION OF CAPITAL IMPROVEMENT COSTS

| BASIN NUMBER | TOTAL PROJECT COST | DEVELOPMENT PORTION *COST TO INCREASE CAPACITY* | CITY PORTION *COST TO RELIEVE PRESENT DAY PROBLEM* |
|---|---|---|---|
| 4A | $341,000 | $293,000 | $48,000 |
| 4B | $163,000 | $143,000 | $20,000 |
| 4C | $517,000 | $477,000 | $40,000 |
| 5 | $490,000 | $403,000 | $87,000 |
| 6B | $93,000 | $24,000 | $69,000 |
| 10A | $389,000 | $377,000 | $12,000 |
| 10B | $166,000 | $166,000 | $0 |
| 11 | $10,000 | $0 | $10,000 |
| 13 | $172,000 | $126,000 | $46,000 |
| 17B | $469,000 | $432,000 | $37,000 |
| **TOTAL** | $2,810,000 | $2,441,000 | $369,000 |
| *PERCENT OF TOTAL* | *100%* | *87%* | *13%* |

# Appendix D

SUBCATCHMENT 1 Basin 1

PEAK= 3.71 CFS @ 23.10 HRS, VOLUME= 2.78 AF

| ACRES | CN | |
|---|---|---|
| 190.00 | 43 | wooded areas |
| 35.00 | 30 | grassed areas |
| 43.00 | 51 | large parcel of residential |
| 268.00 | 43 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.0 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=2475' s=.44 '/' | Upper area | 26.4 |
| CURVE NUMBER (LAG) METHOD<br>L=3800' s=.12 '/' | lower area | 71.3 |
| | Total Length= 6275 ft Total Tc= | 97.7 |

SUBCATCHMENT 2 Basin 2

PEAK= 3.11 CFS @ 22.23 HRS, VOLUME= 2.49 AF

| ACRES | CN | |
|---|---|---|
| 140.00 | 43 | wooded areas |
| 20.00 | 51 | large parcel res. |
| 30.00 | 30 | grassed areas, school fields |
| 10.00 | 89 | school/paved areas |
| 200.00 | 44 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.0 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=1985' s=.52 '/' | upper area | 19.9 |
| CURVE NUMBER (LAG) METHOD<br>L=2700' s=.18 '/' | lower area | 43.2 |
| | Total Length= 4685 ft Total Tc= | 63.1 |

SUBCATCHMENT 3 basin 3

PEAK= 2.30 CFS @ 23.09 HRS, VOLUME= 1.60 AF

| ACRES | CN | |
|---|---|---|
| 138.00 | 43 | wooded areas |
| 30.00 | 30 | grassy areas |
| 20.00 | 51 | large parcel res. |
| 188.00 | 42 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.0 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=2300' s=.4 '/' | upper area | 26.9 |
| CURVE NUMBER (LAG) METHOD<br>L=1600' s=.15 '/' | lower area | 32.8 |
| | Total Length= 3900 ft Total Tc= | 59.7 |

SUBCATCHMENT 4 subbasin 4A

PEAK= 2.95 CFS @ 22.60 HRS, VOLUME= 2.36 AF

| ACRES | CN | |
|---|---|---|
| 50.00 | 43 | forest areas |
| 75.00 | 35 | brushy areas |
| 50.00 | 61 | small parcel res. |
| 15.00 | 30 | grassy areas |
| 190.00 | 44 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.0 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=4700' s=.28 '/' | upland areas | 53.9 |
| CURVE NUMBER (LAG) METHOD<br>L=400' s=.06 '/' | midland areas | 16.2 |
| CURVE NUMBER (LAG) METHOD<br>L=1000' s=.12 '/' | lower areas | 23.9 |
| | Total Length= 6100 ft Total Tc= | 94.0 |

SUBCATCHMENT 5 sunbasin 4b

PEAK= 4.27 CFS @ 9.05 HRS, VOLUME= 4.67 AF

| ACRES | CN | |
|---|---|---|
| 10.00 | 89 | commercial areas |
| 40.00 | 61 | small parcel residential |
| 5.00 | 30 | grassed areas |
| 10.00 | 35 | brushy areas |
| 4.00 | 98 | impervious street/parking/areas |
| 69.00 | 61 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.0 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=2700' s=.06 '/' | overland flow | 48.5 |

SUBCATCHMENT 6 subbasin 4c

PEAK= 7.59 CFS @ 8.36 HRS, VOLUME= 6.19 AF

| ACRES | CN | |
|---|---|---|
| 15.00 | 89 | commercial areas |
| 45.00 | 61 | small parcel residential |
| 5.00 | 98 | impervious |
| 16.00 | 35 | grassy areas |
| 81.00 | 63 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.0 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=1300' s=.04 '/' | overland flow | 31.4 |

SUBCATCHMENT 7 basin 5

PEAK= 4.47 CFS @ 9.48 HRS, VOLUME= 4.10 AF

| ACRES | CN | |
|---|---|---|
| 35.00 | 61 | small parcel residential |
| 5.00 | 89 | commercial areas |
| 3.00 | 98 | impervious areas |
| 43.00 | 67 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.0 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=3000' s=.013 '/' | overland flow | 97.0 |

SUBCATCHMENT 8 subbasin 6a

PEAK= 1.20 CFS @ 24.07 HRS, VOLUME= .69 AF

| ACRES | CN | |
|---|---|---|
| 65.00 | 43 | forested areas |
| 40.00 | 40 | grass/grazing area |
| 27.00 | 35 | brushy areas |
| 132.00 | 40 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.0 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=2250' s=.28 '/' | upland areas | 33.3 |
| CURVE NUMBER (LAG) METHOD<br>L=2000' s=.06 '/' | lowland areas | 65.4 |
| | Total Length= 4250 ft Total Tc= | 98.7 |

SUBCATCHMENT 9 subbasin 6b

PEAK= 1.92 CFS @ 21.31 HRS, VOLUME= 1.72 AF

| ACRES | CN | |
|---|---|---|
| 30.00 | 43 | forested areas |
| 20.00 | 35 | brushy areas |
| 30.00 | 61 | small parcel residential |
| 21.00 | 40 | grassy fields/grazing |
| 101.00 | 46 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.0 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=1730' s=.25 '/' | upland areas | 24.3 |
| CURVE NUMBER (LAG) METHOD<br>L=1430' s=.07 '/' | lowland areas | 39.5 |
| | Total Length= 3160 ft Total Tc= | 63.8 |

SUBCATCHMENT 10 basin 7

PEAK= .90 CFS @ 24.44 HRS, VOLUME= .34 AF

| ACRES | CN | | |
|---|---|---|---|
| 100.00 | 43 | wooded areas | SCS TR-20 METHOD |
| 97.00 | 30 | grassed fields/pasturelands | TYPE IA 24-HOUR |
| 5.00 | 51 | large parcel residential | RAINFALL= 4.0 IN |
| 202.00 | 37 | | SPAN= 0-30 HRS, dt=.1 HRS |

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=1800' s=.4 '/' | upper area | 25.3 |
| CURVE NUMBER (LAG) METHOD<br>L=1500' s=.17 '/' | mid area | 33.6 |
| CURVE NUMBER (LAG) METHOD<br>L=1800' s=.06 '/' | lower area | 65.4 |
| | Total Length= 5100 ft Total Tc= | 124.3 |

SUBCATCHMENT 11 Basin 8

PEAK= 2.98 CFS @ 19.99 HRS, VOLUME= 3.01 AF

| ACRES | CN | | |
|---|---|---|---|
| 80.00 | 43 | forested area | SCS TR-20 METHOD |
| 30.00 | 65 | grassed areas | TYPE IA 24-HOUR |
| 11.00 | 51 | large parcel residential | RAINFALL= 4.0 IN |
| 121.00 | 49 | | SPAN= 0-30 HRS, dt=.1 HRS |

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=2300' s=.35 '/' | upper areas | 23.9 |
| CURVE NUMBER (LAG) METHOD<br>L=1800' s=.13 '/' | lower areas | 32.3 |
| | Total Length= 4100 ft Total Tc= | 56.2 |

SUBCATCHMENT 12 basin 9

PEAK= 3.31 CFS @ 23.95 HRS, VOLUME= 2.10 AF

| ACRES | CN | |
|---|---|---|
| 250.00 | 43 | forested area |
| 50.00 | 30 | pasture/grassed area |
| 10.00 | 51 | large parcel residential |
| 310.00 | 41 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.0 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=3600' s=.26 '/' | upper area | 49.0 |
| CURVE NUMBER (LAG) METHOD<br>L=1800' s=.09 '/' | lower area | 47.8 |
| | Total Length= 5400 ft | Total Tc= 96.8 |

SUBCATCHMENT 13 subbasin 10a

PEAK= 6.48 CFS @ 9.02 HRS, VOLUME= 6.77 AF

| ACRES | CN | |
|---|---|---|
| 35.00 | 77 | mill area |
| 15.00 | 89 | commercial and industrial areas |
| 30.00 | 43 | forested areas |
| 14.00 | 35 | brushy areas |
| 94.00 | 62 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.0 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=1850' s=.45 '/' | upland areas | 12.7 |
| CURVE NUMBER (LAG) METHOD<br>L=1800' s=.036 '/' | lowland areas | 44.1 |
| | Total Length= 3650 ft | Total Tc= 56.8 |

SUBCATCHMENT 14 subbasin 10b

PEAK= 2.40 CFS @ 21.20 HRS, VOLUME= 2.24 AF

| ACRES | CN | |
|---|---|---|
| 40.00 | 61 | small parcel residential |
| 40.00 | 40 | grassy grazing |
| 20.00 | 35 | brushy areas |
| 15.00 | 43 | forested areas |
| 115.00 | 47 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.0 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=1800' s=.38 '/' | upland areas | 19.9 |
| CURVE NUMBER (LAG) METHOD<br>L=2100' s=.04 '/' | lowland areas | 69.2 |
| | Total Length= 3900 ft Total Tc= | 89.1 |

SUBCATCHMENT 15 basin 11

PEAK= 4.50 CFS @ 22.20 HRS, VOLUME= 3.61 AF

| ACRES | CN | |
|---|---|---|
| 200.00 | 43 | forested area |
| 25.00 | 81 | industrial/mill area |
| 60.00 | 30 | grassed/light vegetation areas |
| 5.00 | 51 | large parcel residential |
| 290.00 | 44 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.0 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=2800' s=.41 '/' | upper areas | 29.4 |
| CURVE NUMBER (LAG) METHOD<br>L=1800' s=.1 '/' | lower areas | 41.9 |
| | Total Length= 4600 ft Total Tc= | 71.3 |

SUBCATCHMENT 16 basin 12

PEAK= 1.07 CFS @ 23.99 HRS, VOLUME= .60 AF

| ACRES | CN | |
|---|---|---|
| 50.00 | 43 | forested area |
| 30.00 | 35 | brushy areas/light forest |
| 20.00 | 30 | pastureland/grassy areas |
| 16.00 | 51 | large parcel residential |
| 116.00 | 40 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.0 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=1900' s=.48 '/' | upper areas | 22.2 |
| CURVE NUMBER (LAG) METHOD<br>L=1000' s=.04 '/' | lower areas | 46.0 |
| | Total Length= 2900 ft Total Tc= | 68.2 |

SUBCATCHMENT 17 basin 13

PEAK= 2.70 CFS @ 22.74 HRS, VOLUME= 2.02 AF

| ACRES | CN | |
|---|---|---|
| 150.00 | 43 | forested areas |
| 20.00 | 30 | grassy/pasturelands |
| 25.00 | 51 | large parcel residential |
| 195.00 | 43 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.0 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=4100' s=.34 '/' | upper areas | 45.0 |
| CURVE NUMBER (LAG) METHOD<br>L=1000' s=.09 '/' | lower areas | 28.3 |
| | Total Length= 5100 ft Total Tc= | 73.3 |

SUBCATCHMENT 18 basin 14

PEAK= 1.68 CFS @ 22.08 HRS, VOLUME= 1.34 AF

| ACRES | CN | | |
|---|---|---|---|
| 50.00 | 43 | forested areas | SCS TR-20 METHOD |
| 30.00 | 30 | pasture/grassed areas | TYPE IA 24-HOUR |
| 28.00 | 61 | large parcel residential | RAINFALL= 4.0 IN |
| 108.00 | 44 | | SPAN= 0-30 HRS, dt=.1 HRS |

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=1800' s=.47 '/' | upper areas | 19.3 |
| CURVE NUMBER (LAG) METHOD<br>L=1100' s=.036 '/' | lower areas | 47.0 |
| | Total Length= 2900 ft Total Tc= | 66.3 |

SUBCATCHMENT 19 basin 15

PEAK= 8.77 CFS @ 23.87 HRS, VOLUME= 6.60 AF

| ACRES | CN | | |
|---|---|---|---|
| 500.00 | 43 | forested areas/mountians | SCS TR-20 METHOD |
| 10.00 | 88 | wwtp | TYPE IA 24-HOUR |
| 26.00 | 51 | large parcel residential | RAINFALL= 4.0 IN |
| 100.00 | 35 | brushed/grassed areas | SPAN= 0-30 HRS, dt=.1 HRS |
| 636.00 | 43 | | |

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=4350' s=.42 '/' | upper area | 42.5 |
| CURVE NUMBER (LAG) METHOD<br>L=2500' s=.19 '/' | mid area | 40.6 |
| CURVE NUMBER (LAG) METHOD<br>L=2000' s=.08 '/' | lower areas | 52.3 |
| | Total Length= 8850 ft Total Tc= | 135.4 |

SUBCATCHMENT 20 Basin 16

PEAK= 7.05 CFS @ 24.61 HRS, VOLUME= 4.19 AF

| ACRES | CN | |
|---|---|---|
| 500.00 | 43 | forested area |
| 250.00 | 35 | brushy areas in foothills |
| 50.00 | 30 | pastures and grassy areas |
| 11.00 | 51 | large parcel residential |
| 811.00 | 40 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.0 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=5800' s=.31 '/' | upland areas | 67.5 |
| CURVE NUMBER (LAG) METHOD<br>L=3200' s=.13 '/' | mid | 64.8 |
| CURVE NUMBER (LAG) METHOD<br>L=2200' s=.073 '/' | lower | 64.0 |
| | Total Length=11200 ft Total Tc= | 196.3 |

SUBCATCHMENT 21 subbasin 17a

PEAK= 3.33 CFS @ 24.07 HRS, VOLUME= 2.11 AF

| ACRES | CN | |
|---|---|---|
| 200.00 | 43 | forested areas |
| 50.00 | 35 | brushy areas in foothills |
| 40.00 | 30 | pastures and grassed areas |
| 22.00 | 51 | large parcel residential |
| 312.00 | 41 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.0 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=3550' s=.31 '/' | upland areas | 44.3 |
| CURVE NUMBER (LAG) METHOD<br>L=1800' s=.06 '/' | lowland areas | 58.5 |
| | Total Length= 5350 ft Total Tc= | 102.8 |

SUBCATCHMENT 22 Subbasin 17b

PEAK= 2.04 CFS @ 23.31 HRS, VOLUME= 1.64 AF

| ACRES | CN | |
|---|---|---|
| 35.00 | 43 | forested areas |
| 32.00 | 35 | brushy areas |
| 25.00 | 30 | grassy pastureland |
| 40.00 | 61 | small parcel residential |
| 132.00 | 44 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.0 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=2400' s=.45 '/' | upland areas | 24.8 |
| CURVE NUMBER (LAG) METHOD<br>L=1500' s=.01 '/' | lowland | 114.4 |
| | Total Length= 3900 ft Total Tc= | 139.2 |

SUBCATCHMENT 23 basin 18

PEAK= 5.83 CFS @ 24.87 HRS, VOLUME= 3.86 AF

| ACRES | CN | |
|---|---|---|
| 445.00 | 43 | forested areas |
| 50.00 | 30 | grassed areas |
| 30.00 | 51 | large parcel residential |
| 59.00 | 35 | brushy areas |
| 584.00 | 41 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.0 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=4850' s=.35 '/' | upper areas | 53.6 |
| CURVE NUMBER (LAG) METHOD<br>L=4000' s=.1 '/' | mid areas | 85.9 |
| CURVE NUMBER (LAG) METHOD<br>L=1250' s=.01 '/' | lower areas | 107.1 |
| | Total Length=10100 ft Total Tc= | 246.6 |

SUBCATCHMENT 24 basin 19

PEAK= 6.36 CFS @ 24.33 HRS, VOLUME= 4.12 AF

| ACRES | CN | |
|---|---|---|
| 450.00 | 43 | forested areas |
| 75.00 | 35 | brushy areas |
| 60.00 | 30 | pasture/grassy areas |
| 26.00 | 51 | large parcel residential |
| 611.00 | 41 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.0 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=4700' s=.41 '/' | upper area | 48.3 |
| CURVE NUMBER (LAG) METHOD<br>L=3100' s=.16 '/' | mid areas | 55.4 |
| CURVE NUMBER (LAG) METHOD<br>L=1500' s=.03 '/' | low areas | 71.6 |
| | Total Length= 9300 ft Total Tc= | 175.3 |

SUBCATCHMENT 1 Basin 1

PEAK= 5.68 CFS @ 21.80 HRS, VOLUME= 5.05 AF

| ACRES | CN | |
|---|---|---|
| 190.00 | 43 | wooded areas |
| 35.00 | 30 | grassed areas |
| 43.00 | 51 | large parcel of residential |
| 268.00 | 43 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.5 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=2475' s=.44 '/' | Upper area | 26.4 |
| CURVE NUMBER (LAG) METHOD<br>L=3800' s=.12 '/' | lower area | 71.3 |
| | Total Length= 6275 ft Total Tc= | 97.7 |

SUBCATCHMENT 2 Basin 2

PEAK= 4.66 CFS @ 20.87 HRS, VOLUME= 4.34 AF

| ACRES | CN | |
|---|---|---|
| 140.00 | 43 | wooded areas |
| 20.00 | 51 | large parcel res. |
| 30.00 | 30 | grassed areas, school fields |
| 10.00 | 89 | school/paved areas |
| 200.00 | 44 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.5 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=1985' s=.52 '/' | upper area | 19.9 |
| CURVE NUMBER (LAG) METHOD<br>L=2700' s=.18 '/' | lower area | 43.2 |
| | Total Length= 4685 ft Total Tc= | 63.1 |

SUBCATCHMENT 3 basin 3

PEAK= 3.61 CFS @ 21.53 HRS, VOLUME= 3.04 AF

| ACRES | CN | | |
|---|---|---|---|
| 138.00 | 43 | wooded areas | SCS TR-20 METHOD |
| 30.00 | 30 | grassy areas | TYPE IA 24-HOUR |
| 20.00 | 51 | large parcel res. | RAINFALL= 4.5 IN |
| 188.00 | 42 | | SPAN= 0-30 HRS, dt=.1 HRS |

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=2300' s=.4 '/' | upper area | 26.9 |
| CURVE NUMBER (LAG) METHOD<br>L=1600' s=.15 '/' | lower area | 32.8 |
| | Total Length= 3900 ft Total Tc= | 59.7 |

SUBCATCHMENT 4 subbasin 4A

PEAK= 4.42 CFS @ 21.39 HRS, VOLUME= 4.12 AF

| ACRES | CN | | |
|---|---|---|---|
| 50.00 | 43 | forest areas | SCS TR-20 METHOD |
| 75.00 | 35 | brushy areas | TYPE IA 24-HOUR |
| 50.00 | 61 | small parcel res. | RAINFALL= 4.5 IN |
| 15.00 | 30 | grassy areas | SPAN= 0-30 HRS, dt=.1 HRS |
| 190.00 | 44 | | |

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=4700' s=.28 '/' | upland areas | 53.9 |
| CURVE NUMBER (LAG) METHOD<br>L=400' s=.06 '/' | midland areas | 16.2 |
| CURVE NUMBER (LAG) METHOD<br>L=1000' s=.12 '/' | lower areas | 23.9 |
| | Total Length= 6100 ft Total Tc= | 94.0 |

SUBCATCHMENT 5 sunbasin 4b

PEAK= 7.07 CFS @ 8.65 HRS, VOLUME= 6.21 AF

| ACRES | CN | | |
|---|---|---|---|
| 10.00 | 89 | commercial areas | SCS TR-20 METHOD |
| 40.00 | 61 | small parcel residential | TYPE IA 24-HOUR |
| 5.00 | 30 | grassed areas | RAINFALL= 4.5 IN |
| 10.00 | 35 | brushy areas | SPAN= 0-30 HRS, dt=.1 HRS |
| 4.00 | 98 | impervious street/parking/areas | |
| 69.00 | 61 | | |

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=2700' s=.06 '/' | overland flow | 48.5 |

SUBCATCHMENT 6 subbasin 4c

PEAK= 12.12 CFS @ 8.31 HRS, VOLUME= 8.11 AF

| ACRES | CN | | |
|---|---|---|---|
| 15.00 | 89 | commercial areas | SCS TR-20 METHOD |
| 45.00 | 61 | small parcel residential | TYPE IA 24-HOUR |
| 5.00 | 98 | impervious | RAINFALL= 4.5 IN |
| 16.00 | 35 | grassy areas | SPAN= 0-30 HRS, dt=.1 HRS |
| 81.00 | 63 | | |

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=1300' s=.04 '/' | overland flow | 31.4 |

SUBCATCHMENT 7 basin 5

PEAK= 6.31 CFS @ 9.37 HRS, VOLUME= 5.24 AF

| ACRES | CN | | |
|---|---|---|---|
| 35.00 | 61 | small parcel residential | SCS TR-20 METHOD |
| 5.00 | 89 | commercial areas | TYPE IA 24-HOUR |
| 3.00 | 98 | impervious areas | RAINFALL= 4.5 IN |
| 43.00 | 67 | | SPAN= 0-30 HRS, dt=.1 HRS |

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=3000' s=.013 '/' | overland flow | 97.0 |

SUBCATCHMENT 8 subbasin 6a

PEAK= 2.02 CFS @ 23.30 HRS, VOLUME= 1.50 AF

| ACRES | CN | |
|---|---|---|
| 65.00 | 43 | forested areas |
| 40.00 | 40 | grass/grazing area |
| 27.00 | 35 | brushy areas |
| 132.00 | 40 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.5 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=2250' s=.28 '/' | upland areas | 33.3 |
| CURVE NUMBER (LAG) METHOD<br>L=2000' s=.06 '/' | lowland areas | 65.4 |
| | Total Length= 4250 ft Total Tc= | 98.7 |

SUBCATCHMENT 9 subbasin 6b

PEAK= 2.79 CFS @ 20.00 HRS, VOLUME= 2.81 AF

| ACRES | CN | |
|---|---|---|
| 30.00 | 43 | forested areas |
| 20.00 | 35 | brushy areas |
| 30.00 | 61 | small parcel residential |
| 21.00 | 40 | grassy fields/grazing |
| 101.00 | 46 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.5 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=1730' s=.25 '/' | upland areas | 24.3 |
| CURVE NUMBER (LAG) METHOD<br>L=1430' s=.07 '/' | lowland areas | 39.5 |
| | Total Length= 3160 ft Total Tc= | 63.8 |

SUBCATCHMENT 10 basin 7

PEAK= 1.98 CFS @ 24.23 HRS, VOLUME= 1.11 AF

| ACRES | CN | | |
|---|---|---|---|
| 100.00 | 43 | wooded areas | SCS TR-20 METHOD |
| 97.00 | 30 | grassed fields/pasturelands | TYPE IA 24-HOUR |
| 5.00 | 51 | large parcel residential | RAINFALL= 4.5 IN |
| 202.00 | 37 | | SPAN= 0-30 HRS, dt=.1 HRS |

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=1800' s=.4 '/' | upper area | 25.3 |
| CURVE NUMBER (LAG) METHOD<br>L=1500' s=.17 '/' | mid area | 33.6 |
| CURVE NUMBER (LAG) METHOD<br>L=1800' s=.06 '/' | lower area | 65.4 |
| | Total Length= 5100 ft Total Tc= | 124.3 |

SUBCATCHMENT 11 Basin 8

PEAK= 4.16 CFS @ 18.98 HRS, VOLUME= 4.60 AF

| ACRES | CN | | |
|---|---|---|---|
| 80.00 | 43 | forested area | SCS TR-20 METHOD |
| 30.00 | 65 | grassed areas | TYPE IA 24-HOUR |
| 11.00 | 51 | large parcel residential | RAINFALL= 4.5 IN |
| 121.00 | 49 | | SPAN= 0-30 HRS, dt=.1 HRS |

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=2300' s=.35 '/' | upper areas | 23.9 |
| CURVE NUMBER (LAG) METHOD<br>L=1800' s=.13 '/' | lower areas | 32.3 |
| | Total Length= 4100 ft Total Tc= | 56.2 |

SUBCATCHMENT 12 basin 9

PEAK= 5.33 CFS @ 22.64 HRS, VOLUME= 4.24 AF

| ACRES | CN | |
|---|---|---|
| 250.00 | 43 | forested area |
| 50.00 | 30 | pasture/grassed area |
| 10.00 | 51 | large parcel residential |
| 310.00 | 41 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.5 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=3600' s=.26 '/' | upper area | 49.0 |
| CURVE NUMBER (LAG) METHOD<br>L=1800' s=.09 '/' | lower area | 47.8 |
| | Total Length= 5400 ft Total Tc= | 96.8 |

SUBCATCHMENT 13 subbasin 10a

PEAK= 10.31 CFS @ 8.78 HRS, VOLUME= 8.93 AF

| ACRES | CN | |
|---|---|---|
| 35.00 | 77 | mill area |
| 15.00 | 89 | commercial and industrial areas |
| 30.00 | 43 | forested areas |
| 14.00 | 35 | brushy areas |
| 94.00 | 62 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.5 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=1850' s=.45 '/' | upland areas | 12.7 |
| CURVE NUMBER (LAG) METHOD<br>L=1800' s=.036 '/' | lowland areas | 44.1 |
| | Total Length= 3650 ft Total Tc= | 56.8 |

SUBCATCHMENT 14 subbasin 10b

PEAK= 3.42 CFS @ 20.17 HRS, VOLUME= 3.57 AF

| ACRES | CN | |
|---|---|---|
| 40.00 | 61 | small parcel residential |
| 40.00 | 40 | grassy grazing |
| 20.00 | 35 | brushy areas |
| 15.00 | 43 | forested areas |
| 115.00 | 47 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.5 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=1800' s=.38 '/' | upland areas | 19.9 |
| CURVE NUMBER (LAG) METHOD<br>L=2100' s=.04 '/' | lowland areas | 69.2 |
| | Total Length= 3900 ft Total Tc= | 89.1 |

SUBCATCHMENT 15 basin 11

PEAK= 6.75 CFS @ 21.09 HRS, VOLUME= 6.29 AF

| ACRES | CN | |
|---|---|---|
| 200.00 | 43 | forested area |
| 25.00 | 81 | industrial/mill area |
| 60.00 | 30 | grassed/light vegetation areas |
| 5.00 | 51 | large parcel residential |
| 290.00 | 44 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.5 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=2800' s=.41 '/' | upper areas | 29.4 |
| CURVE NUMBER (LAG) METHOD<br>L=1800' s=.1 '/' | lower areas | 41.9 |
| | Total Length= 4600 ft Total Tc= | 71.3 |

SUBCATCHMENT 16 basin 12

PEAK= 1.78 CFS @ 22.87 HRS, VOLUME= 1.32 AF

| ACRES | CN | | |
|---|---|---|---|
| 50.00 | 43 | forested area | SCS TR-20 METHOD |
| 30.00 | 35 | brushy areas/light forest | TYPE IA 24-HOUR |
| 20.00 | 30 | pastureland/grassy areas | RAINFALL= 4.5 IN |
| 16.00 | 51 | large parcel residential | SPAN= 0-30 HRS, dt=.1 HRS |
| 116.00 | 40 | | |

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=1900' s=.48 '/' | upper areas | 22.2 |
| CURVE NUMBER (LAG) METHOD<br>L=1000' s=.04 '/' | lower areas | 46.0 |
| | Total Length= 2900 ft Total Tc= | 68.2 |

SUBCATCHMENT 17 basin 13

PEAK= 4.14 CFS @ 21.44 HRS, VOLUME= 3.68 AF

| ACRES | CN | | |
|---|---|---|---|
| 150.00 | 43 | forested areas | SCS TR-20 METHOD |
| 20.00 | 30 | grassy/pasturelands | TYPE IA 24-HOUR |
| 25.00 | 51 | large parcel residential | RAINFALL= 4.5 IN |
| 195.00 | 43 | | SPAN= 0-30 HRS, dt=.1 HRS |

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=4100' s=.34 '/' | upper areas | 45.0 |
| CURVE NUMBER (LAG) METHOD<br>L=1000' s=.09 '/' | lower areas | 28.3 |
| | Total Length= 5100 ft Total Tc= | 73.3 |

SUBCATCHMENT 18 basin 14

PEAK= 2.52 CFS @ 20.82 HRS, VOLUME= 2.34 AF

| ACRES | CN | | |
|---|---|---|---|
| 50.00 | 43 | forested areas | SCS TR-20 METHOD |
| 30.00 | 30 | pasture/grassed areas | TYPE IA 24-HOUR |
| 28.00 | 61 | large parcel residential | RAINFALL= 4.5 IN |
| 108.00 | 44 | | SPAN= 0-30 HRS, dt=.1 HRS |

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=1800' s=.47 '/' | upper areas | 19.3 |
| CURVE NUMBER (LAG) METHOD<br>L=1100' s=.036 '/' | lower areas | 47.0 |
| | Total Length= 2900 ft Total Tc= | 66.3 |

SUBCATCHMENT 19 basin 15

PEAK= 13.43 CFS @ 22.38 HRS, VOLUME= 11.99 AF

| ACRES | CN | | |
|---|---|---|---|
| 500.00 | 43 | forested areas/mountians | SCS TR-20 METHOD |
| 10.00 | 88 | wwtp | TYPE IA 24-HOUR |
| 26.00 | 51 | large parcel residential | RAINFALL= 4.5 IN |
| 100.00 | 35 | brushed/grassed areas | SPAN= 0-30 HRS, dt=.1 HRS |
| 636.00 | 43 | | |

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=4350' s=.42 '/' | upper area | 42.5 |
| CURVE NUMBER (LAG) METHOD<br>L=2500' s=.19 '/' | mid area | 40.6 |
| CURVE NUMBER (LAG) METHOD<br>L=2000' s=.08 '/' | lower areas | 52.3 |
| | Total Length= 8850 ft Total Tc= | 135.4 |

SUBCATCHMENT 20 Basin 16

PEAK= 12.21 CFS @ 24.33 HRS, VOLUME= 9.17 AF

| ACRES | CN | |
|---|---|---|
| 500.00 | 43 | forested area |
| 250.00 | 35 | brushy areas in foothills |
| 50.00 | 30 | pastures and grassy areas |
| 11.00 | 51 | large parcel residential |
| 811.00 | 40 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.5 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=5800' s=.31 '/' | upland areas | 67.5 |
| CURVE NUMBER (LAG) METHOD<br>L=3200' s=.13 '/' | mid | 64.8 |
| CURVE NUMBER (LAG) METHOD<br>L=2200' s=.073 '/' | lower | 64.0 |
| | | ---------- |
| | Total Length=11200 ft | Total Tc= 196.3 |

SUBCATCHMENT 21 subbasin 17a

PEAK= 5.37 CFS @ 22.90 HRS, VOLUME= 4.27 AF

| ACRES | CN | |
|---|---|---|
| 200.00 | 43 | forested areas |
| 50.00 | 35 | brushy areas in foothills |
| 40.00 | 30 | pastures and grassed areas |
| 22.00 | 51 | large parcel residential |
| 312.00 | 41 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.5 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=3550' s=.31 '/' | upland areas | 44.3 |
| CURVE NUMBER (LAG) METHOD<br>L=1800' s=.06 '/' | lowland areas | 58.5 |
| | Total Length= 5350 ft Total Tc= | 102.8 |

SUBCATCHMENT 22 Subbasin 17b

PEAK= 3.06 CFS @ 22.08 HRS, VOLUME= 2.86 AF

| ACRES | CN | |
|---|---|---|
| 35.00 | 43 | forested areas |
| 32.00 | 35 | brushy areas |
| 25.00 | 30 | grassy pastureland |
| 40.00 | 61 | small parcel residential |
| 132.00 | 44 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.5 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=2400' s=.45 '/' | upland areas | 24.8 |
| CURVE NUMBER (LAG) METHOD<br>L=1500' s=.01 '/' | lowland | 114.4 |
| | Total Length= 3900 ft Total Tc= | 139.2 |

SUBCATCHMENT 23 basin 18

PEAK= 9.77 CFS @ 24.42 HRS, VOLUME= 7.86 AF

| ACRES | CN | |
|---|---|---|
| 445.00 | 43 | forested areas |
| 50.00 | 30 | grassed areas |
| 30.00 | 51 | large parcel residential |
| 59.00 | 35 | brushy areas |
| 584.00 | 41 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.5 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=4850' s=.35 '/' | upper areas | 53.6 |
| CURVE NUMBER (LAG) METHOD<br>L=4000' s=.1 '/' | mid areas | 85.9 |
| CURVE NUMBER (LAG) METHOD<br>L=1250' s=.01 '/' | lower areas | 107.1 |
| | Total Length=10100 ft Total Tc= | 246.6 |

SUBCATCHMENT 24 basin 19

PEAK= 10.42 CFS @ 23.91 HRS, VOLUME= 8.35 AF

| ACRES | CN | |
|---|---|---|
| 450.00 | 43 | forested areas |
| 75.00 | 35 | brushy areas |
| 60.00 | 30 | pasture/grassy areas |
| 26.00 | 51 | large parcel residential |
| 611.00 | 41 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.5 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=4700' s=.41 '/' | upper area | 48.3 |
| CURVE NUMBER (LAG) METHOD<br>L=3100' s=.16 '/' | mid areas | 55.4 |
| CURVE NUMBER (LAG) METHOD<br>L=1500' s=.03 '/' | low areas | 71.6 |
| | Total Length= 9300 ft Total Tc= | 175.3 |

SUBCATCHMENT 1 Basin 1

PEAK= 6.23 CFS @ 21.40 HRS, VOLUME= 5.81 AF

| ACRES | CN | |
|---|---|---|
| 150.00 | 43 | wooded areas |
| 25.00 | 30 | grassed areas |
| 60.00 | 51 | large parcel of residential |
| 20.00 | 35 | Brushy areas |
| 13.00 | 61 | Smaller Parcel Residential |
| 268.00 | 44 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.5 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=2475' s=.44 '/' | Upper area | 25.7 |
| CURVE NUMBER (LAG) METHOD<br>L=3800' s=.12 '/' | lower area | 69.5 |
| | Total Length= 6275 ft Total Tc= | 95.2 |

SUBCATCHMENT 2 Basin 2

PEAK= 5.96 CFS @ 19.67 HRS, VOLUME= 6.21 AF

| ACRES | CN | |
|---|---|---|
| 100.00 | 43 | wooded areas |
| 35.00 | 51 | large parcel res. |
| 35.00 | 30 | grassed areas, school fields |
| 15.00 | 89 | school/paved areas |
| 15.00 | 61 | Small Parcel Residential |
| 200.00 | 47 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.5 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=1985' s=.52 '/' | upper area | 18.4 |
| CURVE NUMBER (LAG) METHOD<br>L=2700' s=.18 '/' | lower area | 39.9 |
| | Total Length= 4685 ft Total Tc= | 58.3 |

SUBCATCHMENT 3 basin 3

PEAK= 4.78 CFS @ 20.24 HRS, VOLUME= 4.64 AF

| ACRES | CN | |
|---|---|---|
| 80.00 | 43 | wooded areas |
| 30.00 | 30 | grassy areas |
| 60.00 | 51 | large parcel res. |
| 18.00 | 61 | small parcel residential |
| 188.00 | 45 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.5 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=2300' s=.4 '/' | upper area | 24.8 |
| CURVE NUMBER (LAG) METHOD<br>L=1600' s=.15 '/' | lower area | 30.3 |
| | Total Length= 3900 ft Total Tc= | 55.1 |

SUBCATCHMENT 4 subbasin 4A

PEAK= 7.43 CFS @ 18.51 HRS, VOLUME= 8.64 AF

| ACRES | CN | |
|---|---|---|
| 50.00 | 43 | forest areas |
| 45.00 | 35 | brushy areas |
| 50.00 | 75 | small parcel res. |
| 15.00 | 30 | grassy areas |
| 30.00 | 61 | light residential |
| 190.00 | 51 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.5 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=4700' s=.28 '/' | upland areas | 45.0 |
| CURVE NUMBER (LAG) METHOD<br>L=400' s=.06 '/' | midland areas | 13.5 |
| CURVE NUMBER (LAG) METHOD<br>L=1000' s=.12 '/' | lower areas | 19.9 |
| | Total Length= 6100 ft Total Tc= | 78.4 |

SUBCATCHMENT 5 sunbasin 4b

PEAK= 15.22 CFS @ 8.39 HRS, VOLUME= 8.81 AF

| ACRES | CN | |
|---|---|---|
| 15.00 | 89 | commercial areas |
| 40.00 | 66 | small parcel residential |
| 5.00 | 30 | grassed areas |
| 5.00 | 35 | brushy areas |
| 4.00 | 98 | impervious street/parking/areas |
| 69.00 | 68 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.5 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=2700' s=.06 '/' | overland flow | 40.4 |

SUBCATCHMENT 6 subbasin 4c

PEAK= 15.09 CFS @ 8.26 HRS, VOLUME= 8.98 AF

| ACRES | CN | |
|---|---|---|
| 17.50 | 89 | commercial areas |
| 45.00 | 61 | small parcel residential |
| 5.00 | 98 | impervious |
| 13.50 | 35 | grassy areas |
| 81.00 | 65 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.5 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=1300' s=.04 '/' | overland flow | 29.9 |

SUBCATCHMENT 7 basin 5

PEAK= 11.03 CFS @ 8.95 HRS, VOLUME= 7.07 AF

| ACRES | CN | |
|---|---|---|
| 35.00 | 70 | small parcel residential |
| 5.00 | 89 | commercial areas |
| 3.00 | 98 | impervious areas |
| 43.00 | 74 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.5 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=3000' s=.013 '/' | overland flow | 80.2 |

SUBCATCHMENT 8 subbasin 6a

PEAK= 3.64 CFS @ 20.39 HRS, VOLUME= 3.67 AF

| ACRES | CN | |
|---|---|---|
| 60.00 | 43 | forested areas |
| 20.00 | 40 | grass/grazing area |
| 17.00 | 35 | brushy areas |
| 35.00 | 61 | medium res. |
| 132.00 | 46 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.5 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=2250' s=.28 '/' | upland areas | 28.4 |
| CURVE NUMBER (LAG) METHOD<br>L=2000' s=.06 '/' | lowland areas | 55.8 |
| | Total Length= 4250 ft Total Tc= | 84.2 |

SUBCATCHMENT 9 subbasin 6b

PEAK= 4.20 CFS @ 17.87 HRS, VOLUME= 4.99 AF

| ACRES | CN | |
|---|---|---|
| 25.00 | 43 | forested areas |
| 10.00 | 35 | brushy areas |
| 56.00 | 61 | small parcel residential |
| 10.00 | 40 | grassy fields/grazing |
| 101.00 | 52 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.5 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=1730' s=.25 '/' | upland areas | 20.9 |
| CURVE NUMBER (LAG) METHOD<br>L=1430' s=.07 '/' | lowland areas | 33.9 |
| | Total Length= 3160 ft Total Tc= | 54.8 |

SUBCATCHMENT 10 basin 7

PEAK= 3.09 CFS @ 23.48 HRS, VOLUME= 2.30 AF

| ACRES | CN | | |
|---|---|---|---|
| 80.00 | 43 | wooded areas | SCS TR-20 METHOD |
| 80.00 | 30 | grassed fields/pasturelands | TYPE IA 24-HOUR |
| 25.00 | 51 | large parcel residential | RAINFALL= 4.5 IN |
| 17.00 | 61 | small parcel residential | SPAN= 0-30 HRS, dt=.1 HRS |
| 202.00 | 40 | | |

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=1800' s=.4 '/' | upper area | 23.3 |
| CURVE NUMBER (LAG) METHOD<br>L=1500' s=.17 '/' | mid area | 30.9 |
| CURVE NUMBER (LAG) METHOD<br>L=1800' s=.06 '/' | lower area | 60.2 |
| | Total Length= 5100 ft Total Tc= | 114.4 |

SUBCATCHMENT 11 Basin 8

PEAK= 4.37 CFS @ 18.56 HRS, VOLUME= 4.96 AF

| ACRES | CN | | |
|---|---|---|---|
| 74.00 | 43 | forested area | SCS TR-20 METHOD |
| 20.00 | 65 | grassed areas | TYPE IA 24-HOUR |
| 25.00 | 60 | large parcel residential | RAINFALL= 4.5 IN |
| 119.00 | 50 | | SPAN= 0-30 HRS, dt=.1 HRS |

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=2300' s=.35 '/' | upper areas | 23.3 |
| CURVE NUMBER (LAG) METHOD<br>L=1800' s=.13 '/' | lower areas | 31.4 |
| | Total Length= 4100 ft Total Tc= | 54.7 |

SUBCATCHMENT 12 basin 9

PEAK= 5.94 CFS @ 22.21 HRS, VOLUME= 5.02 AF

| ACRES | CN | |
|---|---|---|
| 235.00 | 43 | forested area |
| 40.00 | 30 | pasture/grassed area |
| 35.00 | 51 | large parcel residential |
| 310.00 | 42 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.5 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=3600' s=.26 '/' | upper area | 47.7 |
| CURVE NUMBER (LAG) METHOD<br>L=1800' s=.09 '/' | lower area | 46.5 |
| | Total Length= 5400 ft Total Tc= | 94.2 |

SUBCATCHMENT 13 subbasin 10a

PEAK= 19.42 CFS @ 8.51 HRS, VOLUME= 12.00 AF

| ACRES | CN | |
|---|---|---|
| 35.00 | 85 | mill area |
| 20.00 | 89 | commercial and industrial areas |
| 25.00 | 43 | forested areas |
| 10.00 | 35 | brushy areas |
| 4.00 | 61 | medium residential |
| 94.00 | 68 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.5 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=1850' s=.45 '/' | upland areas | 10.9 |
| CURVE NUMBER (LAG) METHOD<br>L=1800' s=.036 '/' | lowland areas | 37.7 |
| | Total Length= 3650 ft Total Tc= | 48.6 |

SUBCATCHMENT 14 subbasin 10b

PEAK= 5.95 CFS @ 16.92 HRS, VOLUME= 7.62 AF

| ACRES | CN | | |
|---|---|---|---|
| 65.00 | 66 | small parcel residential | SCS TR-20 METHOD |
| 20.00 | 40 | grassy grazing | TYPE IA 24-HOUR |
| 10.00 | 35 | brushy areas | RAINFALL= 4.5 IN |
| 10.00 | 43 | forested areas | SPAN= 0-30 HRS, dt=.1 HRS |
| 10.00 | 60 | light residential | |
| 115.00 | 56 | | |

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=1800' s=.38 '/' | upland areas | 15.8 |
| CURVE NUMBER (LAG) METHOD<br>L=2100' s=.04 '/' | lowland areas | 55.1 |
| | Total Length= 3900 ft Total Tc= | 70.9 |

SUBCATCHMENT 15 basin 11

PEAK= 8.64 CFS @ 19.80 HRS, VOLUME= 9.01 AF

| ACRES | CN | | |
|---|---|---|---|
| 160.00 | 43 | forested area | SCS TR-20 METHOD |
| 40.00 | 81 | industrial/mill area | TYPE IA 24-HOUR |
| 50.00 | 30 | grassed/light vegetation areas | RAINFALL= 4.5 IN |
| 30.00 | 51 | large parcel residential | SPAN= 0-30 HRS, dt=.1 HRS |
| 10.00 | 61 | small parcel residential | |
| 0.00 | 0 | 0 | |
| 290.00 | 47 | | |

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=2800' s=.41 '/' | upper areas | 27.2 |
| CURVE NUMBER (LAG) METHOD<br>L=1800' s=.1 '/' | lower areas | 38.7 |
| | Total Length= 4600 ft Total Tc= | 65.9 |

SUBCATCHMENT 16 basin 12

PEAK= 4.54 CFS @ 18.14 HRS, VOLUME= 5.27 AF

| ACRES | CN | |
|---|---|---|
| 40.00 | 43 | forested area |
| 20.00 | 35 | brushy areas/light forest |
| 15.00 | 30 | pastureland/grassy areas |
| 16.00 | 51 | large parcel residential |
| 25.00 | 89 | commercial industrial areas |
| 116.00 | 51 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.5 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=1900' s=.48 '/' | upper areas | 16.7 |
| CURVE NUMBER (LAG) METHOD<br>L=1000' s=.04 '/' | lower areas | 34.5 |
| | Total Length= 2900 ft Total Tc= | 51.2 |

SUBCATCHMENT 17 basin 13

PEAK= 7.16 CFS @ 18.51 HRS, VOLUME= 8.12 AF

| ACRES | CN | |
|---|---|---|
| 130.00 | 43 | forested areas |
| 10.00 | 30 | grassy/pasturelands |
| 25.00 | 51 | large parcel res. |
| 30.00 | 89 | commercial/industrial |
| 195.00 | 50 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.5 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=4100' s=.34 '/' | upper areas | 37.6 |
| CURVE NUMBER (LAG) METHOD<br>L=1000' s=.09 '/' | lower areas | 23.6 |
| | Total Length= 5100 ft Total Tc= | 61.2 |

SUBCATCHMENT 18 basin 14

PEAK= 2.98 CFS @ 20.00 HRS, VOLUME= 3.00 AF

| ACRES | CN | |
|---|---|---|
| 40.00 | 43 | forested areas |
| 30.00 | 30 | pasture/grassed areas |
| 28.00 | 51 | large parcel residential |
| 10.00 | 89 | commercial/industrial |
| 108.00 | 46 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.5 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=1800' s=.47 '/' | upper areas | 18.3 |
| CURVE NUMBER (LAG) METHOD<br>L=1100' s=.036 '/' | lower areas | 44.6 |
| | Total Length= 2900 ft Total Tc= | 62.9 |

SUBCATCHMENT 19 basin 15

PEAK= 14.75 CFS @ 21.80 HRS, VOLUME= 13.79 AF

| ACRES | CN | |
|---|---|---|
| 470.00 | 43 | forested areas/mountians |
| 10.00 | 88 | wwtp |
| 43.00 | 51 | large parcel residential |
| 80.00 | 35 | brushed/grassed areas |
| 33.00 | 61 | small parcel residential |
| 636.00 | 44 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.5 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=4350' s=.42 '/' | upper area | 41.4 |
| CURVE NUMBER (LAG) METHOD<br>L=2500' s=.19 '/' | mid area | 39.5 |
| CURVE NUMBER (LAG) METHOD<br>L=2000' s=.08 '/' | lower areas | 50.9 |
| | Total Length= 8850 ft Total Tc= | 131.8 |

SUBCATCHMENT 20 basin 16

PEAK= 13.79 CFS @ 23.98 HRS, VOLUME= 11.06 AF

| ACRES | CN | |
|---|---|---|
| 495.00 | 43 | forested area |
| 230.00 | 35 | brushy areas |
| 45.00 | 30 | pastures and grassy areas |
| 11.00 | 51 | large parcel residential |
| 30.00 | 61 | small parcel residential |
| 811.00 | 41 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.5 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=5800' s=.31 '/' | upland areas | 65.7 |
| CURVE NUMBER (LAG) METHOD<br>L=3200' s=.13 '/' | midland | 63.0 |
| CURVE NUMBER (LAG) METHOD<br>L=2200' s=.073 '/' | lower | 62.3 |
| | | ---------- |
| | Total Length=11200 ft Total Tc= | 191 |

SUBCATCHMENT 21 subbasin 17a

PEAK= 7.25 CFS @ 21.38 HRS, VOLUME= 6.76 AF

| ACRES | CN | |
|---|---|---|
| 165.00 | 43 | forested areas |
| 30.00 | 35 | brushy areas in foothills |
| 15.00 | 30 | pastures and grassed areas |
| 102.00 | 51 | large parcel residential |
| 312.00 | 44 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.5 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=3550' s=.31 '/' | upland areas | 40.9 |
| CURVE NUMBER (LAG) METHOD<br>L=1800' s=.06 '/' | lowland areas | 54.0 |
| | Total Length= 5350 ft Total Tc= | 94.9 |

SUBCATCHMENT 22 Subbasin 17b

PEAK= 4.52 CFS @ 19.92 HRS, VOLUME= 5.02 AF

| ACRES | CN | |
|---|---|---|
| 25.00 | 43 | forested areas |
| 20.00 | 35 | brushy areas |
| 15.00 | 30 | grassy pastureland |
| 52.00 | 61 | small parcel residential |
| 20.00 | 51 | large parcel res. |
| 132.00 | 49 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.5 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=2400' s=.45 '/' | upland areas | 21.8 |
| CURVE NUMBER (LAG) METHOD<br>L=1500' s=.01 '/' | lowland | 100.5 |
| | Total Length= 3900 ft Total Tc= | 122.3 |

SUBCATCHMENT 23 basin 18

PEAK= 12.16 CFS @ 24.10 HRS, VOLUME= 10.89 AF

| ACRES | CN | |
|---|---|---|
| 445.00 | 43 | forested areas |
| 30.00 | 30 | grassed areas |
| 69.00 | 51 | large parcel residential |
| 40.00 | 35 | brushy areas |
| 584.00 | 43 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.5 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=4850' s=.35 '/' | upper areas | 50.8 |
| CURVE NUMBER (LAG) METHOD<br>L=4000' s=.1 '/' | mid areas | 81.4 |
| CURVE NUMBER (LAG) METHOD<br>L=1250' s=.01 '/' | lower areas | 101.5 |
| | Total Length=10100 ft Total Tc= | 233.7 |

SUBCATCHMENT 24 basin 19

PEAK= 11.62 CFS @ 23.29 HRS, VOLUME= 9.87 AF

| ACRES | CN | |
|---|---|---|
| 425.00 | 43 | forested areas |
| 65.00 | 35 | brushy areas |
| 50.00 | 30 | pasture/grassy areas |
| 71.00 | 51 | large parcel residential |
| 611.00 | 42 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.5 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=4700' s=.41 '/' | upper area | 47.0 |
| CURVE NUMBER (LAG) METHOD<br>L=3100' s=.16 '/' | mid areas | 53.9 |
| CURVE NUMBER (LAG) METHOD<br>L=1500' s=.03 '/' | low areas | 69.7 |
| | Total Length= 9300 ft Total Tc= | 170.6 |

SUBCATCHMENT 1 Basin 1

PEAK= 4.16 CFS @ 22.69 HRS, VOLUME= 3.33 AF

| ACRES | CN | |
|---|---|---|
| 150.00 | 43 | wooded areas |
| 25.00 | 30 | grassed areas |
| 60.00 | 51 | large parcel of residential |
| 20.00 | 35 | Brushy areas |
| 13.00 | 61 | Smaller Parcel Residential |
| 268.00 | 44 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.0 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=2475' s=.44 '/' | Upper area | 25.7 |
| CURVE NUMBER (LAG) METHOD<br>L=3800' s=.12 '/' | lower area | 69.5 |
| | Total Length= 6275 ft Total Tc= | 95.2 |

SUBCATCHMENT 2 Basin 2

PEAK= 4.17 CFS @ 20.62 HRS, VOLUME= 3.90 AF

| ACRES | CN | |
|---|---|---|
| 100.00 | 43 | wooded areas |
| 35.00 | 51 | large parcel res. |
| 35.00 | 30 | grassed areas, school fields |
| 15.00 | 89 | school/paved areas |
| 15.00 | 61 | Small Parcel Residential |
| 200.00 | 47 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.0 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=1985' s=.52 '/' | upper area | 18.4 |
| CURVE NUMBER (LAG) METHOD<br>L=2700' s=.18 '/' | lower area | 39.9 |
| | Total Length= 4685 ft Total Tc= | 58.3 |

SUBCATCHMENT 3 basin 3

PEAK= 3.25 CFS @ 21.65 HRS, VOLUME= 2.75 AF

| ACRES | CN | |
|---|---|---|
| 80.00 | 43 | wooded areas |
| 30.00 | 30 | grassy areas |
| 60.00 | 51 | large parcel res. |
| 18.00 | 61 | small parcel residential |
| 188.00 | 45 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.0 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=2300' s=.4 '/' | upper area | 24.8 |
| CURVE NUMBER (LAG) METHOD<br>L=1600' s=.15 '/' | lower area | 30.3 |
| | | ---------- |
| | Total Length= 3900 ft Total Tc= | 55.1 |

SUBCATCHMENT 4 subbasin 4A

PEAK= 5.43 CFS @ 19.68 HRS, VOLUME= 5.85 AF

| ACRES | CN | |
|---|---|---|
| 50.00 | 43 | forest areas |
| 45.00 | 35 | brushy areas |
| 50.00 | 75 | small parcel res. |
| 15.00 | 30 | grassy areas |
| 30.00 | 61 | light residential |
| 190.00 | 51 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.0 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=4700' s=.28 '/' | upland areas | 45.0 |
| CURVE NUMBER (LAG) METHOD<br>L=400' s=.06 '/' | midland areas | 13.5 |
| CURVE NUMBER (LAG) METHOD<br>L=1000' s=.12 '/' | lower areas | 19.9 |
| | | ---------- |
| | Total Length= 6100 ft Total Tc= | 78.4 |

SUBCATCHMENT 5 sunbasin 4b

PEAK= 10.80 CFS @ 8.42 HRS, VOLUME= 6.93 AF

| ACRES | CN | | |
|---|---|---|---|
| 15.00 | 89 | commercial areas | SCS TR-20 METHOD |
| 40.00 | 66 | small parcel residential | TYPE IA 24-HOUR |
| 5.00 | 30 | grassed areas | RAINFALL= 4.0 IN |
| 5.00 | 35 | brushy areas | SPAN= 0-30 HRS, dt=.1 HRS |
| 4.00 | 98 | impervious street/parking/areas | |
| 69.00 | 68 | | |

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=2700' s=.06 '/' | overland flow | 40.4 |

SUBCATCHMENT 6 subbasin 4c

PEAK= 10.05 CFS @ 8.30 HRS, VOLUME= 6.94 AF

| ACRES | CN | | |
|---|---|---|---|
| 17.50 | 89 | commercial areas | SCS TR-20 METHOD |
| 45.00 | 61 | small parcel residential | TYPE IA 24-HOUR |
| 5.00 | 98 | impervious | RAINFALL= 4.0 IN |
| 13.50 | 35 | grassy areas | SPAN= 0-30 HRS, dt=.1 HRS |
| 81.00 | 65 | | |

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=1300' s=.04 '/' | overland flow | 29.9 |

SUBCATCHMENT 7 basin 5

PEAK= 8.47 CFS @ 8.98 HRS, VOLUME= 5.72 AF

| ACRES | CN | | |
|---|---|---|---|
| 35.00 | 70 | small parcel residential | SCS TR-20 METHOD |
| 5.00 | 89 | commercial areas | TYPE IA 24-HOUR |
| 3.00 | 98 | impervious areas | RAINFALL= 4.0 IN |
| 43.00 | 74 | | SPAN= 0-30 HRS, dt=.1 HRS |

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=3000' s=.013 '/' | overland flow | 80.2 |

SUBCATCHMENT 8 subbasin 6a

PEAK= 2.51 CFS @ 21.61 HRS, VOLUME= 2.24 AF

| ACRES | CN | |
|---|---|---|
| 60.00 | 43 | forested areas |
| 20.00 | 40 | grass/grazing area |
| 17.00 | 35 | brushy areas |
| 35.00 | 61 | medium res. |
| 132.00 | 46 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.0 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=2250' s=.28 '/' | upland areas | 28.4 |
| CURVE NUMBER (LAG) METHOD<br>L=2000' s=.06 '/' | lowland areas | 55.8 |
| | Total Length= 4250 ft Total Tc= | 84.2 |

SUBCATCHMENT 9 subbasin 6b

PEAK= 3.10 CFS @ 18.92 HRS, VOLUME= 3.43 AF

| ACRES | CN | |
|---|---|---|
| 25.00 | 43 | forested areas |
| 10.00 | 35 | brushy areas |
| 56.00 | 61 | small parcel residential |
| 10.00 | 40 | grassy fields/grazing |
| 101.00 | 52 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.0 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=1730' s=.25 '/' | upland areas | 20.9 |
| CURVE NUMBER (LAG) METHOD<br>L=1430' s=.07 '/' | lowland areas | 33.9 |
| | Total Length= 3160 ft Total Tc= | 54.8 |

SUBCATCHMENT 10 basin 7

PEAK= 1.83 CFS @ 24.17 HRS, VOLUME= 1.05 AF

| ACRES | CN | | |
|---|---|---|---|
| 80.00 | 43 | wooded areas | SCS TR-20 METHOD |
| 80.00 | 30 | grassed fields/pasturelands | TYPE IA 24-HOUR |
| 25.00 | 51 | large parcel residential | RAINFALL= 4.0 IN |
| 17.00 | 61 | small parcel residential | SPAN= 0-30 HRS, dt=.1 HRS |
| 202.00 | 40 | | |

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=1800' s=.4 '/' | upper area | 23.3 |
| CURVE NUMBER (LAG) METHOD<br>L=1500' s=.17 '/' | mid area | 30.9 |
| CURVE NUMBER (LAG) METHOD<br>L=1800' s=.06 '/' | lower area | 60.2 |
| | Total Length= 5100 ft Total Tc= | 114.4 |

SUBCATCHMENT 11 Basin 8

PEAK= 3.17 CFS @ 19.63 HRS, VOLUME= 3.31 AF

| ACRES | CN | | |
|---|---|---|---|
| 74.00 | 43 | forested area | SCS TR-20 METHOD |
| 20.00 | 65 | grassed areas | TYPE IA 24-HOUR |
| 25.00 | 60 | large parcel residential | RAINFALL= 4.0 IN |
| 119.00 | 50 | | SPAN= 0-30 HRS, dt=.1 HRS |

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=2300' s=.35 '/' | upper areas | 23.3 |
| CURVE NUMBER (LAG) METHOD<br>L=1800' s=.13 '/' | lower areas | 31.4 |
| | Total Length= 4100 ft Total Tc= | 54.7 |

SUBCATCHMENT 12 basin 9

PEAK= 3.79 CFS @ 23.70 HRS, VOLUME= 2.63 AF

| ACRES | CN | |
|---|---|---|
| 235.00 | 43 | forested area |
| 40.00 | 30 | pasture/grassed area |
| 35.00 | 51 | large parcel residential |
| 310.00 | 42 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.0 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=3600' s=.26 '/' | upper area | 47.7 |
| CURVE NUMBER (LAG) METHOD<br>L=1800' s=.09 '/' | lower area | 46.5 |
| | Total Length= 5400 ft Total Tc= | 94.2 |

SUBCATCHMENT 13 subbasin 10a

PEAK= 13.78 CFS @ 8.54 HRS, VOLUME= 9.44 AF

| ACRES | CN | |
|---|---|---|
| 35.00 | 85 | mill area |
| 20.00 | 89 | commercial and industrial areas |
| 25.00 | 43 | forested areas |
| 10.00 | 35 | brushy areas |
| 4.00 | 61 | medium residential |
| 94.00 | 68 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.0 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=1850' s=.45 '/' | upland areas | 10.9 |
| CURVE NUMBER (LAG) METHOD<br>L=1800' s=.036 '/' | lowland areas | 37.7 |
| | Total Length= 3650 ft Total Tc= | 48.6 |

SUBCATCHMENT 14 subbasin 10b

PEAK= 4.52 CFS @ 17.99 HRS, VOLUME= 5.49 AF

| ACRES | CN | |
|---|---|---|
| 65.00 | 66 | small parcel residential |
| 20.00 | 40 | grassy grazing |
| 10.00 | 35 | brushy areas |
| 10.00 | 43 | forested areas |
| 10.00 | 60 | light residential |
| 115.00 | 56 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.0 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=1800' s=.38 '/' | upland areas | 15.8 |
| CURVE NUMBER (LAG) METHOD<br>L=2100' s=.04 '/' | lowland areas | 55.1 |
| | Total Length= 3900 ft Total Tc= | 70.9 |

SUBCATCHMENT 15 basin 11

PEAK= 6.05 CFS @ 20.79 HRS, VOLUME= 5.65 AF

| ACRES | CN | |
|---|---|---|
| 160.00 | 43 | forested area |
| 40.00 | 81 | industrial/mill area |
| 50.00 | 30 | grassed/light vegetation areas |
| 30.00 | 51 | large parcel residential |
| 10.00 | 61 | small parcel residential |
| 0.00 | 0 | 0 |
| 290.00 | 47 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.0 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=2800' s=.41 '/' | upper areas | 27.2 |
| CURVE NUMBER (LAG) METHOD<br>L=1800' s=.1 '/' | lower areas | 38.7 |
| | Total Length= 4600 ft Total Tc= | 65.9 |

SUBCATCHMENT 16 basin 12

PEAK= 3.32 CFS @ 19.10 HRS, VOLUME= 3.57 AF

| ACRES | CN | |
|---|---|---|
| 40.00 | 43 | forested area |
| 20.00 | 35 | brushy areas/light forest |
| 15.00 | 30 | pastureland/grassy areas |
| 16.00 | 51 | large parcel residential |
| 25.00 | 89 | commercial industrial areas |
| 116.00 | 51 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.0 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=1900' s=.48 '/' | upper areas | 16.7 |
| CURVE NUMBER (LAG) METHOD<br>L=1000' s=.04 '/' | lower areas | 34.5 |
| | Total Length= 2900 ft Total Tc= | 51.2 |

SUBCATCHMENT 17 basin 13

PEAK= 5.19 CFS @ 19.61 HRS, VOLUME= 5.42 AF

| ACRES | CN | |
|---|---|---|
| 130.00 | 43 | forested areas |
| 10.00 | 30 | grassy/pasturelands |
| 25.00 | 51 | large parcel res. |
| 30.00 | 89 | commercial/industrial |
| 195.00 | 50 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.0 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=4100' s=.34 '/' | upper areas | 37.6 |
| CURVE NUMBER (LAG) METHOD<br>L=1000' s=.09 '/' | lower areas | 23.6 |
| | Total Length= 5100 ft Total Tc= | 61.2 |

SUBCATCHMENT 18 basin 14

PEAK= 2.06 CFS @ 21.36 HRS, VOLUME= 1.83 AF

| ACRES | CN | |
|---|---|---|
| 40.00 | 43 | forested areas |
| 30.00 | 30 | pasture/grassed areas |
| 28.00 | 51 | large parcel residential |
| 10.00 | 89 | commercial/industrial |
| 108.00 | 46 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.0 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=1800' s=.47 '/' | upper areas | 18.3 |
| CURVE NUMBER (LAG) METHOD<br>L=1100' s=.036 '/' | lower areas | 44.6 |
| | Total Length= 2900 ft Total Tc= | 62.9 |

SUBCATCHMENT 19 basin 15

PEAK= 9.83 CFS @ 23.22 HRS, VOLUME= 7.91 AF

| ACRES | CN | |
|---|---|---|
| 470.00 | 43 | forested areas/mountians |
| 10.00 | 88 | wwtp |
| 43.00 | 51 | large parcel residential |
| 80.00 | 35 | brushed/grassed areas |
| 33.00 | 61 | small parcel residential |
| 636.00 | 44 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.0 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=4350' s=.42 '/' | upper area | 41.4 |
| CURVE NUMBER (LAG) METHOD<br>L=2500' s=.19 '/' | mid area | 39.5 |
| CURVE NUMBER (LAG) METHOD<br>L=2000' s=.08 '/' | lower areas | 50.9 |
| | Total Length= 8850 ft Total Tc= | 131.8 |

SUBCATCHMENT 20 basin 16

PEAK= 8.37 CFS @ 24.41 HRS, VOLUME= 5.45 AF

| ACRES | CN | |
|---|---|---|
| 495.00 | 43 | forested area |
| 230.00 | 35 | brushy areas |
| 45.00 | 30 | pastures and grassy areas |
| 11.00 | 51 | large parcel residential |
| 30.00 | 61 | small parcel residential |
| 811.00 | 41 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.0 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=5800' s=.31 '/' | upland areas | 65.7 |
| CURVE NUMBER (LAG) METHOD<br>L=3200' s=.13 '/' | midland | 63.0 |
| CURVE NUMBER (LAG) METHOD<br>L=2200' s=.073 '/' | lower | 62.3 |
| | Total Length=11200 ft | Total Tc= 191 |

SUBCATCHMENT 21 subbasin 17a

PEAK= 4.84 CFS @ 22.61 HRS, VOLUME= 3.88 AF

| ACRES | CN | | |
|---|---|---|---|
| 165.00 | 43 | forested areas | SCS TR-20 METHOD |
| 30.00 | 35 | brushy areas in foothills | TYPE IA 24-HOUR |
| 15.00 | 30 | pastures and grassed areas | RAINFALL= 4.0 IN |
| 102.00 | 51 | large parcel residential | SPAN= 0-30 HRS, dt=.1 HRS |
| 312.00 | 44 | | |

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=3550' s=.31 '/' | upland areas | 40.9 |
| CURVE NUMBER (LAG) METHOD<br>L=1800' s=.06 '/' | lowland areas | 54.0 |
| | Total Length= 5350 ft Total Tc= | 94.9 |

SUBCATCHMENT 22 Subbasin 17b

PEAK= 3.24 CFS @ 21.01 HRS, VOLUME= 3.28 AF

| ACRES | CN | | |
|---|---|---|---|
| 25.00 | 43 | forested areas | SCS TR-20 METHOD |
| 20.00 | 35 | brushy areas | TYPE IA 24-HOUR |
| 15.00 | 30 | grassy pastureland | RAINFALL= 4.0 IN |
| 52.00 | 61 | small parcel residential | SPAN= 0-30 HRS, dt=.1 HRS |
| 20.00 | 51 | large parcel res. | |
| 132.00 | 49 | | |

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=2400' s=.45 '/' | upland areas | 21.8 |
| CURVE NUMBER (LAG) METHOD<br>L=1500' s=.01 '/' | lowland | 100.5 |
| | Total Length= 3900 ft Total Tc= | 122.3 |

SUBCATCHMENT 23 basin 18

PEAK= 7.85 CFS @ 24.57 HRS, VOLUME= 5.98 AF

| ACRES | CN | |
|---|---|---|
| 445.00 | 43 | forested areas |
| 30.00 | 30 | grassed areas |
| 69.00 | 51 | large parcel residential |
| 40.00 | 35 | brushy areas |
| 584.00 | 43 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.0 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=4850' s=.35 '/' | upper areas | 50.8 |
| CURVE NUMBER (LAG) METHOD<br>L=4000' s=.1 '/' | mid areas | 81.4 |
| CURVE NUMBER (LAG) METHOD<br>L=1250' s=.01 '/' | lower areas | 101.5 |
| | Total Length=10100 ft Total Tc= | 233.7 |

SUBCATCHMENT 24 basin 19

PEAK= 7.37 CFS @ 24.29 HRS, VOLUME= 5.17 AF

| ACRES | CN | |
|---|---|---|
| 425.00 | 43 | forested areas |
| 65.00 | 35 | brushy areas |
| 50.00 | 30 | pasture/grassy areas |
| 71.00 | 51 | large parcel residential |
| 611.00 | 42 | |

SCS TR-20 METHOD
TYPE IA 24-HOUR
RAINFALL= 4.0 IN
SPAN= 0-30 HRS, dt=.1 HRS

| Method | Comment | Tc (min) |
|---|---|---|
| CURVE NUMBER (LAG) METHOD<br>L=4700' s=.41 '/' | upper area | 47.0 |
| CURVE NUMBER (LAG) METHOD<br>L=3100' s=.16 '/' | mid areas | 53.9 |
| CURVE NUMBER (LAG) METHOD<br>L=1500' s=.03 '/' | low areas | 69.7 |
| | Total Length= 9300 ft Total Tc= | 170.6 |

Appendix E

Appendix E

# Urban Storm Water Sedimentation Control Measures

The effectiveness of these measures depends on the pollutants contained in the storm water, source characteristics, watershed characteristics, and the nature and extent of development. The project flows, budget, land availability, and regulatory authority requirements will greatly affect the type of system chosen.

**Wet Ponds**
Wet ponds are a depression containing water year-round. Usually constructed next to an embankment or road fill, wet ponds tend to be deeper on one end. Average depth is 3 to 10 feet with a surface area of 1 to 10 acres. Treatment is provided by a combination of physical settling of solids and biological treatment provided by wetland vegetation and organisms. Wet ponds provide wildlife and aesthetic value, but may present a drowning risk and require regular maintenance to remove sediment buildups and keep drainage passages clear.

**Sediment Ponds**
Sediment ponds are similar to wet ponds, but are designed to be dry during the low rain months. Sediment ponds are most effective during normal and low intensity storm conditions. Average depth is 3 to 10 feet with a surface area of 0.25 to 10 acres. Sediment ponds require less area than wet ponds and reduce the risk associated with an open body of water in the summer, but remove fewer pollutants than wet ponds.

**Constructed Marsh-Wetland**
A constructed marsh is very similar to a natural wetland. Typical depths are 0.25 to 4 feet with a surface area of 0.5 to 20 acres. Wetland vegetation aids in removing pollutants and sediment from the storm water. Wetlands are sensitive to oil and grease loads and excessive sediment loads, such as impact loads from construction erosion, and a forebay or pretreatment unit is required for protection. Wetlands provide wildlife and aesthetic value, but typically require a large allocation of space.

**Sedimentation Boxes**
Sedimentation boxes are concrete open top basins set with the rim at the floor level of an outfall ditch or swale. Typically 3 to 4 feet deep, 5 to 20 feet wide and 20 to 50 feet long these basins provide bed load deposition for sediments similar to a sediment pond. The advantage of the system is the small land area required and ease of maintenance. The basins are deep enough to provide a drowning hazard.

**Trapped Catch Basins**
Trapped catch basins are deeper than normal catch basins to provide space for sediment settling. A baffle at the outlet helps retain sediment in the basin. These basins are more expensive than normal catch basins and require cleaning at least twice a year to be effective. Space needs are no greater than normal catch basins and they are easily available.

**Sedimentation Manholes**
Utilizing existing manhole components, sedimentation manholes are 4 to 6 feet in diameter and 8 to 12 feet deep with a baffled outlet. These manholes are below ground in the street right of way and so do not usually require land acquisition. Regular sediment removal is required to maintain effectiveness.

**Compost Treatment Units**
These facilities are rectangular prefabricated boxes filled with leaf litter compost and intended to remove certain nutrients. Generally they are not effective at sediment removal, as the sediment plugs the openings in the compost.

**Street Sweeping**
The use of either vacuum or mechanical removal of particles from paved streets prevents the particles from entering the storm system. The disadvantage is the high maintenance cost and the ineffectiveness in fine sediment removal. Advantages are the aesthetic appearance of clean streets and the low impact on fish populations

**Drainage Swales**
A vegetated swale is basically a flat ditch, which changes the drainage flow characteristics from channel flow to sheet flow. The low water velocity and vegetation combine to allow sediment settling and some bioremediation of pollutants. Swales provide wildlife enhancement and are well researched in the Northwest. Land requirements may be high and sediment removal and dry weather mowing contribute to maintenance costs.

**Infiltration Methods**
Infiltration involves returning the storm water to the ground close to the production source through the use of dry wells, infiltration trenches, drain fields, and porous pavements. Care needs to be taken to avoid introducing petroleum products or other pollutants into these systems, where they may pollute the groundwater. These methods are usually restricted to individual site remediation and are not suitable for municipal flows. Ordinances requiring new construction to address site runoff using these or other methods would reduce the load on the city systems.

**Oil – Water Separators**
Oil – water separators are use to remove petroleum products from storm water. Generally the separators are used at industrial sites and are used to pretreat storm water before it is discharged to the municipal system. Conventional separators use a large tank with baffles allowing the floating oil to be trapped for mechanical removal from the tank. Tank size greatly increases with flow, making separators practical only near the pollutant source.