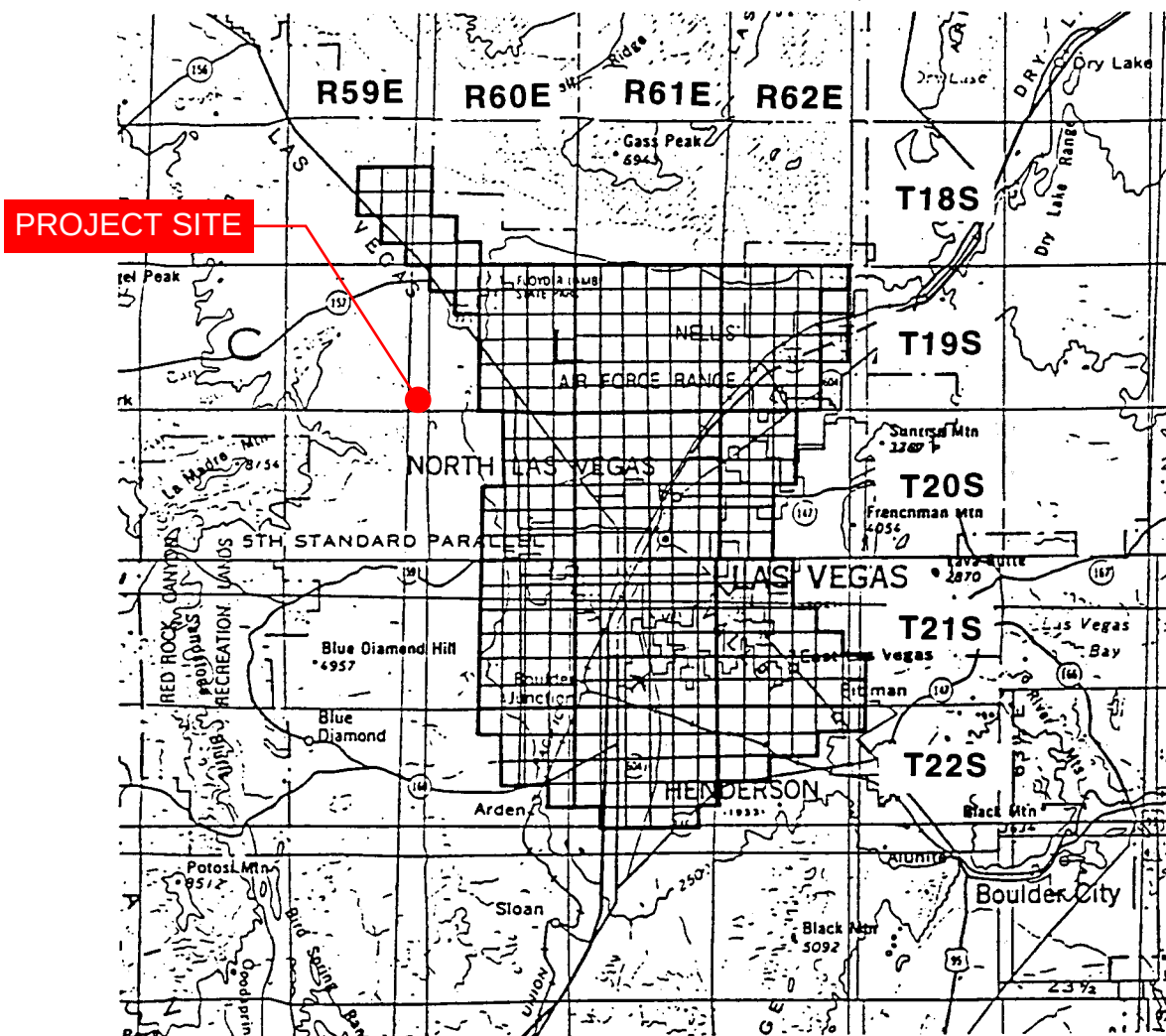


Appendix B – Hydrologic Calculations

- Figure 513 McCarran Airport Rainfall Area
- Figure 506 100-Year 6-Hour Rainfall Depth-Duration-Frequency
- Figure 503 10-Year 6-Hour Rainfall Depth-Duration-Frequency
- Table 501 Precipitation Adjustment Ratios
- Table 502 Six-hour Depth-Area Reduction Factors
- Table 503 Six-hour Storm Distributions
- Table 602 page 1 of 4 Runoff Curve Numbers (Urban Areas)
- Table 602 page 4 of 4 Runoff Curve Numbers (Semiarid Rangelands)
- Table 602A Runoff Curve Numbers-Residential Districts
- Adjusted Precipitation Depth Calculation
- USDA NRCS Custom Soils Resource Report for Las Vegas Valley
- Curve Number Calculations
- Proposed and Ultimate Condition Standard Form 4
- Proposed Condition HEC-1 Output
- Ultimate Condition HEC-1 Output

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

McCARRAN AIRPORT RAINFALL AREA



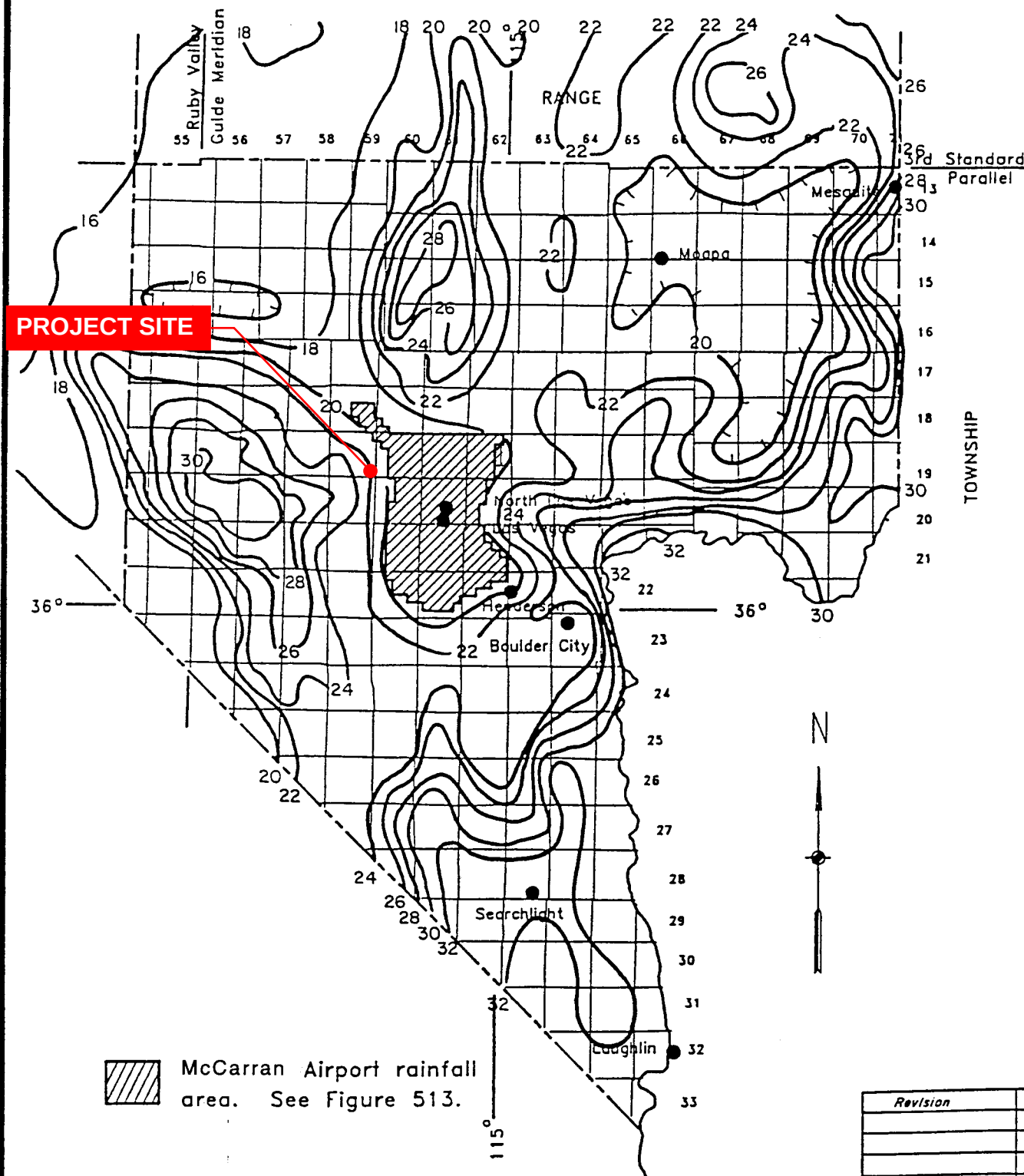
TOWNSHIP	RANGE	SECTIONS	TOWNSHIP	RANGE	SECTIONS
18 South	59 East	13-15,22-26,36	20 South	62 East	4-9,16-20,29-32
18 South	60 East	30-32	21 South	60 East	1-4,9-16,21-28,33-36
19 South	60 East	1-6,8-16,21-28,33-36	21 South	61 East	ALL SECTIONS
19 South	61 East	ALL SECTIONS	21 South	62 East	4-9,15-23, 25-36
19 South	62 East	2-11,14-23,27-34	22 South	60 East	1-4,10-15,24
20 South	60 East	1-3,10-15,21-28,33-36	22 South	61 East	1-24,26-29
20 South	61 East	ALL SECTIONS	22 South	62 East	1-10,17-18

Notes:

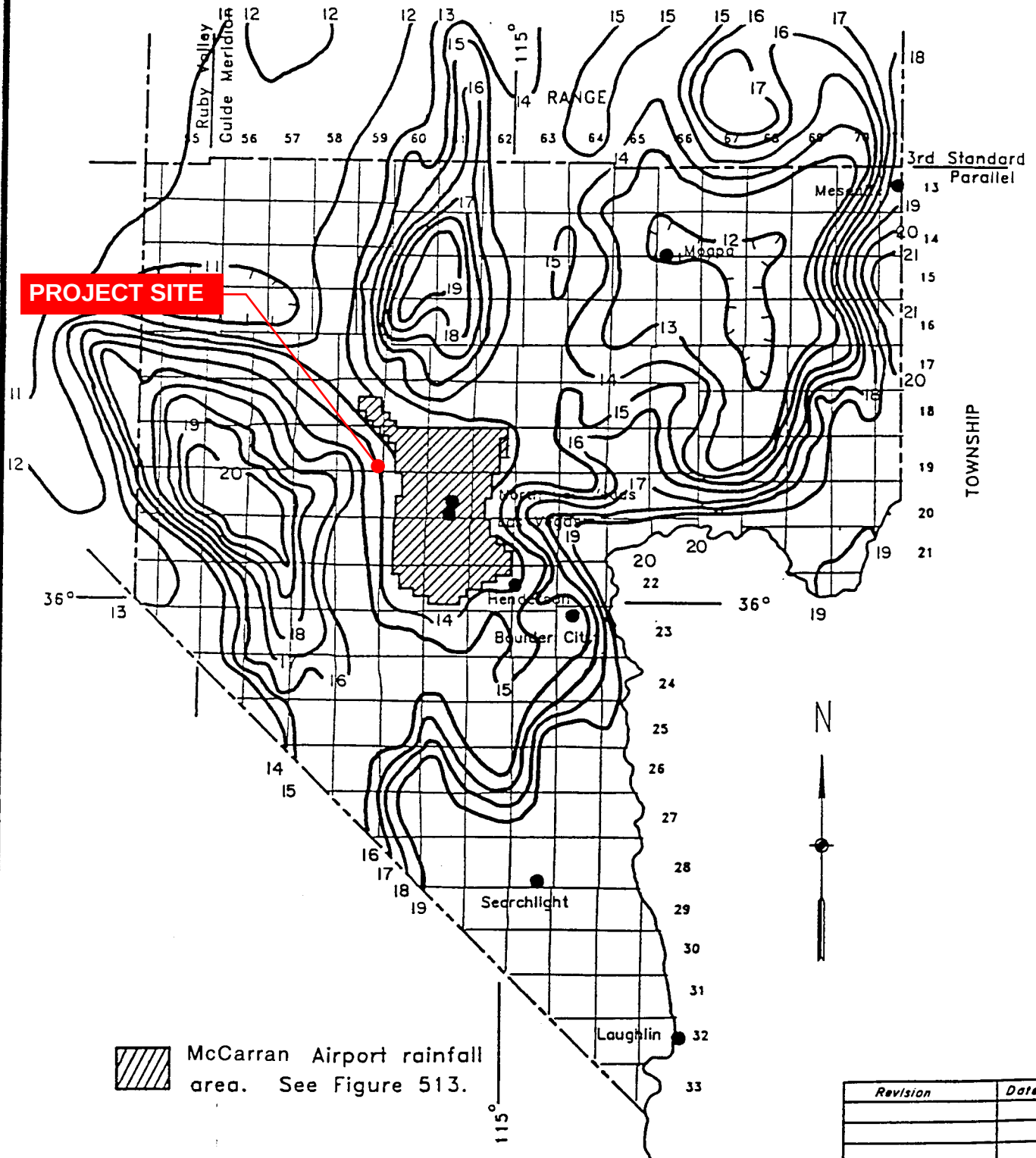
1. Refer to Table 505 and Figure 516 Depth-Duration-Frequency values in the McCarran Airport Rainfall Area.
2. Refer to Table 506 and Figure 517 for Time-Intensity-Frequency values on the McCarran Airport Rainfall Area.

Revision	Date

RAINFALL DEPTH-DURATION-FREQUENCY 100-YEAR, 6-HOUR (DEPTHS IN TENTHS OF INCHES)



RAINFALL DEPTH-DURATION-FREQUENCY 10-YEAR, 6-HOUR (DEPTHS IN TENTHS OF INCHES)



PRECIPITATION ADJUSTMENT RATIOS

<u>Recurrence Interval</u>	<u>Ratio to NOAA Atlas 2</u>
2-year	1.00
5-year	1.16
10-year	1.24
25-year	1.33
50-year	1.39
100-year	1.43

- NOTE: 1. Multiply the values obtained from the NOAA Atlas 2 by the above ratios to obtain the adjusted precipitation values.
2. NOAA Atlas 2 values for use with TR-55 shall not be adjusted by the above ratios.
3. Tables 505 and 506 require no adjustments.

<i>Revision</i>	<i>Date</i>

SIX HOUR DEPTH-AREA REDUCTION FACTORS

<u>Drainage Area (Square Miles)</u>	<u>Six-Hour Depth-Area Reduction Factor</u>
0.0	1.00
0.5	0.98
1.0	0.97
2.0	0.93
4.0	0.91
6.0	0.90
8.0	0.88
10.0	0.86
20.0	0.79
30.0	0.74
50.0	0.68
100.0	0.60
150.0	0.55
200.0	0.51
300.0	0.46
400.0	0.42
500.0	0.39

- NOTES: 1. A graphical representation of these factors is presented in Figure 514.
2. Consult with the local entity and/or the CCRFCD for guidance in using the Depth-Area Reduction Factors for drainage areas greater than 200 square miles.

<i>Revision</i>	<i>Date</i>

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

SIX-HOUR STORM DISTRIBUTIONS

Percent of Total Storm Depth				Percent of Total Storm Depth			
Storm Time (In Minutes)	SDN3	SDN4	SDN5	Storm Time (In Minutes)	SDN3	SDN4	SDN5
0	0.0	0.0	0.0	185	32.2	37.6	43.0
5	2.0	2.0	2.0	190	35.2	41.5	47.7
10	5.7	5.8	5.9	195	40.9	46.2	51.4
15	7.0	7.5	8.0	200	49.9	53.0	56.1
20	8.7	9.9	11.0	205	59.0	61.0	63.0
25	10.8	12.6	14.4	210	71.0	71.0	71.0
30	12.4	13.7	15.0	215	74.4	73.2	72.0
35	13.0	14.5	16.0	220	78.1	75.6	73.1
40	13.0	14.9	16.8	225	81.2	78.2	75.2
45	13.0	15.1	17.1	230	81.9	79.9	77.9
50	13.0	15.5	18.0	235	83.5	81.3	79.0
55	13.0	15.6	18.2	240	85.1	82.3	79.5
60	13.0	15.9	18.7	245	85.6	83.0	80.4
65	13.3	16.2	19.0	250	86.0	83.5	81.0
70	14.0	16.9	19.7	255	86.8	84.4	82.0
75	14.2	17.2	20.2	260	87.6	85.1	82.6
80	14.8	17.9	21.0	265	88.8	86.4	84.0
85	15.8	18.9	22.0	270	91.0	88.5	85.9
90	17.2	20.1	23.0	275	92.6	90.8	88.9
95	18.1	21.1	24.1	280	93.7	92.4	91.0
100	19.0	22.0	25.0	285	95.0	94.4	93.8
105	19.7	22.8	25.9	290	97.0	96.8	96.6
110	19.9	23.2	26.5	295	97.6	97.3	97.0
115	20.0	24.0	28.0	300	98.2	97.8	97.4
120	20.1	24.6	29.0	305	98.5	98.2	97.9
125	20.4	25.2	30.0	310	98.7	98.4	98.1
130	21.4	26.0	30.5	315	98.9	98.6	98.3
135	22.9	26.9	30.9	320	99.0	98.8	98.5
140	24.1	27.6	31.0	325	99.3	99.1	98.9
145	24.9	28.3	31.7	330	99.3	99.2	99.0
150	25.1	28.6	32.1	335	99.4	99.3	99.2
155	25.6	29.2	32.7	340	99.5	99.4	99.3
160	27.0	30.2	33.3	345	99.8	99.7	99.6
165	27.8	31.2	34.6	350	99.8	99.8	99.7
170	28.1	32.1	36.1	355	99.9	99.9	99.9
175	28.3	33.2	38.1	360	100.0	100.0	100.0
180	29.5	35.2	40.8				

- Notes: 1. For drainage areas less than 8 square miles in size, use SDN 3.
 2. For drainage areas greater than or equal to 8 square miles and less than 12 square miles in size, use SDN 4.
 3. For drainage areas greater than or equal to 12 square miles, use SDN 5.
 4. A graphical representation of these values is presented on **Figure 515**.

Revision	Date

REFERENCE:

TABLE 503

RUNOFF CURVE NUMBERS (URBAN AREAS¹)

Cover description		Curve numbers for hydrologic soil group—			
Cover type and hydrologic condition	Average percent impervious area ²	A	B	C	D
<i>Fully developed urban areas (vegetation established)</i>					
Open space (lawns, parks, golf courses, cemeteries, etc.) ³ :					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved: curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved: open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) ⁴ ...		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
See Table 602A					
<i>Developing urban areas</i>					
Newly graded areas (pervious areas only, no vegetation) ⁵		77	86	91	94

1 Average runoff condition, and $I_p = 0.2S$.

2 The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system. Impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using Figure 603.

3 CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

4 Composite CN's for natural desert landscaping should be computed using Figure 603 based on the impervious area percentage (CN #98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

5 Composite CN's to use for the design of temporary measures during grading and construction should be computed using Figure 603 based on the degree of development impervious area percentage) and the CN's for the newly graded pervious areas.

Revision	Date

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

RUNOFF CURVE NUMBERS (SEMIARID RANGELANDS¹)

Cover description		Curve numbers for hydrologic soil group—			
Cover type	Hydrologic condition ²	A ³	B	C	D
Herbaceous—mixture of grass, weeds, and low-growing brush, with brush the minor element.	Poor		80	87	93
	Fair		71	81	89
	Good		62	74	85
Oak-aspen—mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush.	Poor		66	74	79
	Fair		48	57	63
	Good		30	41	48
Pinyon-juniper—pinyon, juniper, or both; grass understory.	Poor		75	85	89
	Fair		58	73	80
	Good		41	61	71
Sagebrush with grass understory.	Poor		67	80	85
	Fair		51	63	70
	Good		35	47	55
Desert shrub—major plants include saltbush, greasewood, creosotebush, blackbrush, bursage, palo verde, mesquite, and cactus.	Poor	63	77	85	88
	Fair	55	72	81	86
	Good	49	68	79	84

¹Average runoff condition, and $I_a = 0.2S$.

²Poor: <30% ground cover (litter, grass, and brush overstory).

Fair: 30 to 70% ground cover.

Good: >70% ground cover.

³Curve numbers for group A have been developed only for desert shrub.

Revision	Date

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

RUNOFF CURVE NUMBERS - RESIDENTIAL DISTRICTS

Average Lot Size or Usage ¹	Percent Impervious ²	Curve Number for Hydrologic Soil Groups			
		A	B	C	D
Apartments/Condos	72	81	88	91	93
Townhouses/6,000 sq ft lots or less ³	69	80	87	90	92
7,000 sq ft lots	63	76	84	89	91
8,000 sq ft lots	58	73	82	88	90
10,000 sq ft lots	38	61	75	83	87
14,000 sq ft lots	30	57	72	81	86
20,000 sq ft lots	25	54	70	80	85
40,000 sq ft lots	20	51	68	79	84
80,000 sq ft lots	12	46	65	77	82

1 Lot size should represent the size of the average lot and not the gross acreage divided by the number of lots.

2 Actual percent impervious value should be compared to selected land use type.

3 In cases where average residential lots are smaller than 6,000 sq ft, commercial/business/industrial land use should be used.

Revision	Date

REFERENCE:

TABLE 602A

**PRECIPITATION DEPTH CALCULATIONS
FOR AREAS OUTSIDE MCCARRAN AIRPORT RAINFALL DATA**

Calculated by:	MSB
Checked by:	MS
Project Name:	ANN & HUALAPAI
Date:	4/6/2021

10-YEAR STORM EVENT

PRECIPITATION DEPTH: REFERENCE (FIGURES & TABLES FROM CCRFCD MANUAL)
1.4 INCHES FIGURE 503

PRECIPITATION ADJUSTMENT:
1.24 TABLE 501

ADJUSTED POINT PRECIPITATION
= 1.45 X 1.24 = **1.74** TABLE 501, NOTE 1

100-YEAR STORM EVENT

PRECIPITATION DEPTH: REFERENCE (FIGURES & TABLES FROM CCRFCD MANUAL)
2.20 INCHES FIGURE 506

PRECIPITATION ADJUSTMENT:
1.43 TABLE 501

ADJUSTED POINT PRECIPITATION
= 2.10 X 1.43 = **3.15** TABLE 501, NOTE 1

HEC-1 10-YEAR RATIO

$$\frac{1.74}{3.15} = \mathbf{\underline{0.55}}$$

HEC-1 100-YEAR RATIO

$$\frac{3.15}{3.15} = \mathbf{\underline{1.00}}$$



United States
Department of
Agriculture

NRCS

Natural
Resources
Conservation
Service

A product of the National
Cooperative Soil Survey,
a joint effort of the United
States Department of
Agriculture and other
Federal agencies, State
agencies including the
Agricultural Experiment
Stations, and local
participants

Custom Soil Resource Report for Las Vegas Valley Area, Nevada, Part of Clark County



March 15, 2021

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (<http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/>) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (<https://offices.sc.egov.usda.gov/locator/app?agency=nrcs>) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

Preface	2
How Soil Surveys Are Made	5
Soil Map	8
Soil Map.....	9
Legend.....	10
Map Unit Legend.....	12
Map Unit Descriptions.....	12
Las Vegas Valley Area, Nevada, Part of Clark County.....	14
190—Dalian very gravelly fine sandy loam, 2 to 4 percent slopes.....	14
Soil Information for All Uses	15
Soil Reports.....	15
Soil Physical Properties.....	15
Engineering Properties (Ann & Hualapai).....	15
References	19

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

Custom Soil Resource Report

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report Soil Map



Custom Soil Resource Report

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features

 Blowout

 Borrow Pit

 Clay Spot

 Closed Depression

 Gravel Pit

 Gravelly Spot

 Landfill

 Lava Flow

 Marsh or swamp

 Mine or Quarry

 Miscellaneous Water

 Perennial Water

 Rock Outcrop

 Saline Spot

 Sandy Spot

 Severely Eroded Spot

 Sinkhole

 Slide or Slip

 Sodic Spot

 Spoil Area

 Stony Spot

 Very Stony Spot

 Wet Spot

 Other

 Special Line Features

Water Features

 Streams and Canals

Transportation

 Rails

 Interstate Highways

 US Routes

 Major Roads

 Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Las Vegas Valley Area, Nevada, Part of Clark County

Survey Area Data: Version 16, Aug 26, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Apr 3, 2019—May 14, 2019

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP LEGEND

MAP INFORMATION

imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
190	Dalian very gravelly fine sandy loam, 2 to 4 percent slopes	140.5	100.0%
Totals for Area of Interest		140.5	100.0%

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Las Vegas Valley Area, Nevada, Part of Clark County

190—Dalian very gravelly fine sandy loam, 2 to 4 percent slopes

Map Unit Setting

National map unit symbol: hrb3
Elevation: 2,200 to 3,400 feet
Mean annual precipitation: 4 to 6 inches
Mean annual air temperature: 61 to 66 degrees F
Frost-free period: 210 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition

Dalian and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Dalian

Setting

Landform: Fan skirts
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Alluvium derived from limestone and dolostone

Typical profile

H1 - 0 to 4 inches: very gravelly fine sandy loam
H2 - 4 to 61 inches: extremely gravelly fine sandy loam

Properties and qualities

Slope: 2 to 4 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 60 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water capacity: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Hydric soil rating: No

Soil Information for All Uses

Soil Reports

The Soil Reports section includes various formatted tabular and narrative reports (tables) containing data for each selected soil map unit and each component of each unit. No aggregation of data has occurred as is done in reports in the Soil Properties and Qualities and Suitabilities and Limitations sections.

The reports contain soil interpretive information as well as basic soil properties and qualities. A description of each report (table) is included.

Soil Physical Properties

This folder contains a collection of tabular reports that present soil physical properties. The reports (tables) include all selected map units and components for each map unit. Soil physical properties are measured or inferred from direct observations in the field or laboratory. Examples of soil physical properties include percent clay, organic matter, saturated hydraulic conductivity, available water capacity, and bulk density.

Engineering Properties (Ann & Hualapai)

This table gives the engineering classifications and the range of engineering properties for the layers of each soil in the survey area.

Hydrologic soil group is a group of soils having similar runoff potential under similar storm and cover conditions. The criteria for determining Hydrologic soil group is found in the National Engineering Handbook, Chapter 7 issued May 2007(<http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba>). Listing HSGs by soil map unit component and not by soil series is a new concept for the engineers. Past engineering references contained lists of HSGs by soil series. Soil series are continually being defined and redefined, and the list of soil series names changes so frequently as to make the task of maintaining a single national list virtually impossible. Therefore, the criteria is now used to calculate the HSG using the component soil properties and no such national series lists will be maintained. All such references are obsolete and their use should be discontinued. Soil properties that influence runoff potential are those that influence the minimum rate of infiltration for a bare soil after prolonged wetting and when not frozen. These properties are depth to a seasonal high water table, saturated hydraulic conductivity after prolonged wetting, and depth to a layer with a very slow water transmission

rate. Changes in soil properties caused by land management or climate changes also cause the hydrologic soil group to change. The influence of ground cover is treated independently. There are four hydrologic soil groups, A, B, C, and D, and three dual groups, A/D, B/D, and C/D. In the dual groups, the first letter is for drained areas and the second letter is for undrained areas.

The four hydrologic soil groups are described in the following paragraphs:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Depth to the upper and lower boundaries of each layer is indicated.

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is 15 percent or more, an appropriate modifier is added, for example, "gravelly."

Classification of the soils is determined according to the Unified soil classification system (ASTM, 2005) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 2004).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to particle-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of particle-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group

Custom Soil Resource Report

index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Percentage of rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

References:

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Custom Soil Resource Report

Absence of an entry indicates that the data were not estimated. The asterisk '*' denotes the representative texture; other possible textures follow the dash. The criteria for determining the hydrologic soil group for individual soil components is found in the National Engineering Handbook, Chapter 7 issued May 2007(<http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba>). Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Engineering Properties—Las Vegas Valley Area, Nevada, Part of Clark County														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			<i>In</i>				<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>
190—Dalian very gravelly fine sandy loam, 2 to 4 percent slopes														
Dalian	100	A	0-4	Very gravelly fine sandy loam	GM	A-1	0- 0- 0	0- 0- 0	30-43-55	25-38-50	20-30-40	10-18-25	0-7 -14	NP
			4-61	Very gravelly sandy loam, extremely gravelly fine sandy loam, very gravelly fine sandy loam	GM, GP-GM	A-1	0- 0- 0	5- 8- 10	30-30-55	25-25-50	20-20-40	10-12-25	0-7 -14	NP

References

- American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.
- American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.
- Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.
- Federal Register. July 13, 1994. Changes in hydric soils of the United States.
- Federal Register. September 18, 2002. Hydric soils of the United States.
- Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.
- National Research Council. 1995. Wetlands: Characteristics and boundaries.
- Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262
- Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577
- Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580
- Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.
- United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.
- United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374
- United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. <http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelpdb1043084>

Custom Soil Resource Report

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

ANN & HUALAPAI
SOILS DESCRIPTION TABLES

DATE:
FILE:
BY:

4/6/2021
CNTABLE.xls
MSB

Hydrologic Soil Group	Newly Graded Areas	Desert Shrub (Poor Condition)	Streets
A	77	63	98
B	86	77	98
C	91	85	94
D	94	88	98
ROCK	94	92	98

SOIL 190 - Dalian very gravelly fine sandy loam, 2 to 4 percent slopes

Description	Type	%	Newly Graded Areas	Desert Shrub (Poor Condition)	Streets
Dalian	A	100%	77	63	98
Composite CN		100%	77	63	98

ANN & HUALAPAI						
WEIGHTED CURVE NUMBERS AND PRECIPITATION VALUES						
PROPOSED CONDITIONS						
Basin	Soil	Percent	CN	LandUse	WCN	PREC
DON1	190	100.0%	57.0	14,000 sf lots	57.0	2.86
ANN1	190	100.0%	98.0	Streets	98.0	2.86
HUA1	190	100.0%	98.0	Streets	98.0	2.86

TIME OF CONCENTRATION / LAG TIME DETERMINATION



ANN & HUALAPAI ANN ROAD AND HUALAPAI WAY PROPOSED & ULTIMATE CONDITIONS

Project No: 192054000
Date: 4/6/21
Calculated by: MB/MS

SUB-BASIN DATA						INITIAL / OVERLAND TIME (Ti)			TRAVEL TIME (Tt)							Tlag	REMARKS
Basin ID	DEV./UNDEV. (D or U)	CN	K	AREA Ac	AREA Mi²	INITIAL LENGTH Feet	SLOPE %	Ti Min	TRAVEL LENGTH Feet	SLOPE %	V1	V2	Tt Min	Tc Min	Tc Check Min	Tlag	
											VELOCITY FPS	VELOCITY FPS				0.6Tc/60	RAINFALL INCHES
	(1)	(2)	(3)	(4)	(5a)	(5b)	(6)	(7)	(8)	(9)	(10)	(10a)	(10b)	(11)	(12)	(13)	(14)
DON1	D	57.0	0.3624	22.51	0.0352	40	2.00	6.7	1830	1.75	2.7	4.0	8.6	15.3	20.4	0.153	3.15
ANN1	D	98.0	0.9036	1.56	0.0024	45	2.00	1.9	995	3.51	3.8	5.7	3.6	5.5	15.8	0.055	3.15
**HUAL1	D	98.0	0.9036	1.28	0.0020	40	2.00	1.8	365	3.00	3.5	5.3	1.7	3.5	12.3	0.050	3.15
**HUAL2	D	98.0	0.9036	2.17	0.0034	40	2.00	1.8	655	1.00	2.0	3.1	5.0	6.7	13.9	0.067	3.15
**Referenced/Revised from the 215 Study (PW# 20-11651)																	
NOTE:																	
(1) Subbasin Name						(7) Initial Slope						(10b) V2 applies to the remaining travel distance;					
(2) Developed or Undeveloped Subbasin						(8) Ti = 1.8 (1.1 - K) L^1/2 / S^1/3						Developed V2 = 30.6*(S/100)^1/2 Undeveloped V2 = 29.4*(S/100)^1/2					
(3) Curve Number (See Subbasin CN Calculations)						(9) Travel Length						(11) Tt = 500/(V1*60)+(Travel Length-500)/(V2*60)					
(4) K = 0.0132 (CN) - 0.39						(10) Slope						(12) Tc = Ti + Tt (15) Rainfall in inches					
(5a) & (5b) Area						(10a) Slope V1 applies to the first 500 feet of travel distance;						(13) Tc Check = L/180+10 (select smaller Tc)					
(6) Initial Length						Developed V1 = 20.2*(S/100)^1/2 Undeveloped V1 = 14.8*(S/100)^1/2						(14) Tlag = 0.6 Tc/60					
REFERENCE: Calculations based on the Clark County Regional Flood Control District HCDDM														STANDARD FORM 4			

```

1*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
*   JUN 1998
*   VERSION 4.1
*
* RUN DATE 02APR21 TIME 11:03:53
*
*****

PRO.OUT

*****
*
* U.S. ARMY CORPS OF ENGINEERS
* HYDROLOGIC ENGINEERING CENTER
* 609 SECOND STREET
* DAVIS, CALIFORNIA 95616
* (916) 756-1104
*
*****

```

```

X X XXXXXX XXXX X
X X X X X XX
X X X X X
XXXXXX XXXX X XXXX X
X X X X X
X X X X X
X X XXXXXX XXXX XXX

```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
 THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
 NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
 DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
 KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT PAGE 1

```

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

*** FREE ***

*DIAGRAM
1 ID
2 ID *****
3 ID *
4 ID * ANN AND HUALAPAI *
5 ID * PROPOSED CONDITION *
6 ID *
7 ID * PROJECT No: _ _ 291448001 *
8 ID * FILE: _ _ _ _ _PRO.H1 *
9 ID * DATE MODELED: _ _ 03/23/21 *
10 ID * MODELED BY: _ _ MSB/MS *
11 ID *
12 ID *****
13 ID
14 ID *****
15 ID * RETURN PERIOD: _ _100- & 10- YEAR *
16 ID * DISTRIBUTION: _ _ 6-HOUR SDN3 *
17 ID *****
18 ID
19 ID JR CARDS CONTAIN DARFS BASED ON THE FOLLOWING VALUES:
20 ID
21 ID AREA (SQUARE MILES) DARF
22 ID
23 ID 0 - 0.5 1.000
24 ID 10YR 0.550
25 ID
26 ID IT 5 0 0 300
27 ID IO 5
28 ID IN 5
29 ID JR PREC 1.00 0.550

30 KK **ANN
31 BA .0070
32 PB 3.15
33 PC .000 .020 .057 .070 .087 .108 .124 .130 .130 .130
34 PC .130 .130 .130 .133 .140 .142 .148 .158 .172 .181
35 PC .190 .197 .199 .200 .201 .204 .214 .229 .241 .249
36 PC .251 .256 .270 .278 .281 .283 .295 .322 .352 .409
37 PC .499 .590 .710 .744 .781 .812 .819 .835 .851 .856
38 PC .860 .868 .876 .888 .910 .926 .937 .950 .970 .976
39 PC .982 .985 .987 .989 .990 .993 .993 .994 .995 .998
40 PC .998 .999 1.00
41 LS 0 98.0
42 UD .120
*

43 KK **OFF1P
44 BA .0075
45 LS 0 88.0
46 UD .108

```

1

HEC-1 INPUT

PAGE 2

LINE	ID	1	2	3	4	5	6	7	8	9	10
47	KK	**CP1									
48	HC	2									
	*										
49	KK	ANN1									
50	BA	.0024									
51	LS	0	98.0								
52	UD	.055									
	*										
53	KK	CP1									
54	HC	2									
	*										
55	KK	**ON2AP									
56	BA	.0432									
57	LS	0	78.2								
58	UD	.181									
	*										
59	KK	**OFF3U									
60	BA	.0035									
61	LS	0	54.0								
62	UD	.125									
	*										
63	KK	**OFF2P									
64	BA	.0143									
65	LS	0	77.3								
66	UD	.106									
	*										
67	KK	**CP2A									
68	HC	3									
	*										
69	KK	**OFF4P									
70	BA	.0314									
71	LS	0	57.1								
72	UD	.153									
	*										
73	KK	**CP2B									
74	HC	2									
	*										
75	KK	**ON1A									
76	BA	.0077									
77	LS	0	57.0								
78	UD	.145									
	*										

1

HEC-1 INPUT

PAGE 3

LINE	ID	1	2	3	4	5	6	7	8	9	10
79	KK	**CP2									
80	HC	2									
	*										
81	KK	**ON1B									
82	BA	.0283									
83	LS	0	57.0								
84	UD	.201									
	*										
85	KK**HUAL-2										
86	BA	.0034									
87	LS	0	98								
88	UD	.067									
	*										
89	KK	**CP3									
90	HC	3									
	*										
91	KK**HUAL-1										
92	BA	.0020									
93	LS	0	98								
94	UD	.050									
	*										
95	KK	DON1									

PRO.OUT

```

96      BA  .0352
97      LS   0   57.0
98      UD  .153
      *

99      KK  DVDON1
100     KM  DIVERT OUT FLOW THAT IS DISCHARGING TO DRAINAGE EASEMENTS
101     DT  DVSD1
102     DI   0     0     7
103     DQ   0     0     3
      *

104     KK   CP2
105     HC   3
      *
106     ZZ

```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

```

INPUT
LINE  (V) ROUTING      (--->) DIVERSION OR PUMP FLOW

NO.    (.) CONNECTOR  (<---) RETURN OF DIVERTED OR PUMPED FLOW

30      **ANN
      .
      .
43      .      **OFF1P
      .
      .
47      **CP1.....
      .
      .
49      .      ANN1
      .
      .
53      .      CP1.....
      .
      .
55      .      **ON2AP
      .
      .
59      .      .      **OFF3U
      .
      .
63      .      .      **OFF2P
      .
      .
67      .      **CP2A.....
      .
      .
69      .      .      **OFF4P
      .
      .
73      .      **CP2B.....
      .
      .
75      .      .      **ON1A
      .
      .
79      .      **CP2.....
      .
      .
81      .      .      **ON1B
      .
      .
85      .      .      **HUAL-2
      .
      .
89      .      **CP3.....
      .
      .
91      .      .      **HUAL-1
      .
      .
95      .      .      .      DON1
      .
      .
101     .      .      .      .      -----> DVSD1
99      .      .      .      DVDON1
      .
      .
104     .      .      .      CP2.....

```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```

1*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
* JUN 1998
* VERSION 4.1

```

```

*****
*
* U.S. ARMY CORPS OF ENGINEERS
* HYDROLOGIC ENGINEERING CENTER
* 609 SECOND STREET

```

PRO.OUT

*
* RUN DATE 02APR21 TIME 11:03:53 *
*

* DAVIS, CALIFORNIA 95616 *
* (916) 756-1104 *
*

*
* ANN AND HUALAPAI *
* PROPOSED CONDITION *
*
* PROJECT No: _ _ _ 291448001 *
* FILE: _ _ _ _ _ PRO.H1 *
* DATE MODELED: _ _ _ 03/23/21 *
* MODELED BY: _ _ _ MSB/MS *
*

*
* RETURN PERIOD: _ 100- & 10- YEAR *
* DISTRIBUTION: _ _ 6-HOUR SDN3 *

JR CARDS CONTAIN DARFS BASED ON THE FOLLOWING VALUES:

AREA (SQUARE MILES) DARF

0 - 0.5 1.000
10YR 0.550

27 IO OUTPUT CONTROL VARIABLES
IPRNT 5 PRINT CONTROL
IPLOT 0 PLOT CONTROL
QSCAL 0. HYDROGRAPH PLOT SCALE

IT HYDROGRAPH TIME DATA
NMIN 5 MINUTES IN COMPUTATION INTERVAL
IDATE 1 0 STARTING DATE
ITIME 0000 STARTING TIME
NQ 300 NUMBER OF HYDROGRAPH ORDINATES
NDDATE 2 0 ENDING DATE
NDTIME 0055 ENDING TIME
ICENT 19 CENTURY MARK

COMPUTATION INTERVAL .08 HOURS
TOTAL TIME BASE 24.92 HOURS

ENGLISH UNITS
DRAINAGE AREA SQUARE MILES
PRECIPITATION DEPTH INCHES
LENGTH, ELEVATION FEET
FLOW CUBIC FEET PER SECOND
STORAGE VOLUME ACRE-FEET
SURFACE AREA ACRES
TEMPERATURE DEGREES FAHRENHEIT

JP MULTI-PLAN OPTION
NPLAN 1 NUMBER OF PLANS

JR MULTI-RATIO OPTION
RATIOS OF PRECIPITATION
1.00 .55

1

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
TIME TO PEAK IN HOURS

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO PRECIPITATION	
				RATIO 1	RATIO 2
				1.00	.55
HYDROGRAPH AT					
+	**ANN	.01	1 FLOW	15.	8.
			TIME	3.50	3.58
HYDROGRAPH AT					
+	**OFF1P	.01	1 FLOW	13.	5.
			TIME	3.50	3.58
2 COMBINED AT					
+	**CP1	.01	1 FLOW	28.	13.
			TIME	3.50	3.58

PRO.OUT

HYDROGRAPH AT +	ANN1	.00	1	FLOW TIME	6. 3.50	3. 3.50
2 COMBINED AT +	CP1	.02	1	FLOW TIME	34. 3.50	16. 3.50
HYDROGRAPH AT +	**ON2AP	.04	1	FLOW TIME	43. 3.58	11. 3.67
HYDROGRAPH AT +	**OFF3U	.00	1	FLOW TIME	0. 3.75	0. .00
HYDROGRAPH AT +	**OFF2P	.01	1	FLOW TIME	16. 3.58	4. 3.58
3 COMBINED AT +	**CP2A	.06	1	FLOW TIME	59. 3.58	15. 3.58
HYDROGRAPH AT +	**OFF4P	.03	1	FLOW TIME	6. 3.67	0. 4.92
2 COMBINED AT +	**CP2B	.09	1	FLOW TIME	64. 3.58	15. 3.58
HYDROGRAPH AT +	**ON1A	.01	1	FLOW TIME	1. 3.67	0. 4.92
2 COMBINED AT +	**CP2	.10	1	FLOW TIME	66. 3.58	15. 3.58
HYDROGRAPH AT +	**ON1B	.03	1	FLOW TIME	5. 3.75	0. 5.00
HYDROGRAPH AT +	**HUAL-2	.00	1	FLOW TIME	9. 3.50	5. 3.50
3 COMBINED AT +	**CP3	.13	1	FLOW TIME	75. 3.58	18. 3.58
HYDROGRAPH AT +	**HUAL-1	.00	1	FLOW TIME	5. 3.50	3. 3.50
HYDROGRAPH AT +	DON1	.04	1	FLOW TIME	7. 3.67	0. 4.92
DIVERSION TO +	DVSD1	.04	1	FLOW TIME	3. 3.67	0. 4.92
HYDROGRAPH AT +	DVDON1	.04	1	FLOW TIME	4. 3.67	0. 4.92
3 COMBINED AT +	CP2	.17	1	FLOW TIME	81. 3.58	20. 3.58

*** NORMAL END OF HEC-1 ***

```

1*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
*   JUN 1998
*   VERSION 4.1
*
* RUN DATE 29MAR21 TIME 15:00:51
*
*****

                                ULT.OUT

*****
*
* U.S. ARMY CORPS OF ENGINEERS
* HYDROLOGIC ENGINEERING CENTER
* 609 SECOND STREET
* DAVIS, CALIFORNIA 95616
* (916) 756-1104
*
*****

```

```

X   X XXXXXXX XXXX   X
X   X X   X   X   XX
X   X X   X   X   X
XXXXXX XXXX X   XXXX X
X   X X   X   X   X
X   X X   X   X   X
X   X XXXXXXX XXXX   XXX

```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
 THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
 NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
 DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
 KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT PAGE 1

```

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

*DIAGRAM

*** FREE ***

1 ID
2 ID *****
3 ID *
4 ID * ANN AND HUALAPAI *
5 ID * ULTIMATE CONDITION *
6 ID *
7 ID * PROJECT No: _ _ _ 291448001 *
8 ID * FILE: _ _ _ _ _ ULT.H1 *
9 ID * DATE MODELED: _ _ 03/29/21 *
10 ID * MODELED BY: _ _ _ MSB/MS *
11 ID *
12 ID *****
13 ID
14 ID *****
15 ID * RETURN PERIOD: _ _100- & 10- YEAR *
16 ID * DISTRIBUTION: _ _ 6-HOUR SDN3 *
17 ID *****
18 ID
19 ID JR CARDS CONTAIN DARFS BASED ON THE FOLLOWING VALUES:
20 ID
21 ID AREA (SQUARE MILES) DARF
22 ID
23 ID 0 - 0.5 1.000
24 ID 10YR 0.550
25 ID
26 ID IT 5 0 0 300
27 ID IO 5
28 ID IN 5
29 ID JR PREC 1.00 0.550

30 KK **ANN
31 BA .0070
32 PB 3.15
33 PC .000 .020 .057 .070 .087 .108 .124 .130 .130 .130
34 PC .130 .130 .130 .133 .140 .142 .148 .158 .172 .181
35 PC .190 .197 .199 .200 .201 .204 .214 .229 .241 .249
36 PC .251 .256 .270 .278 .281 .283 .295 .322 .352 .409
37 PC .499 .590 .710 .744 .781 .812 .819 .835 .851 .856
38 PC .860 .868 .876 .888 .910 .926 .937 .950 .970 .976
39 PC .982 .985 .987 .989 .990 .993 .993 .994 .995 .998
40 PC .998 .999 1.00
41 LS 0 98.0
42 UD .120
43
44 KK **OFF1P
45 BA .0073
46 LS 0 86.7
47 UD .151

```

1

HEC-1 INPUT

PAGE 2

LINE	ID	1	2	3	4	5	6	7	8	9	10
47	KK	**CP1									
48	HC	2									
	*										
49	KK	ANN1									
50	BA	.0024									
51	LS	0	98.0								
52	UD	.055									
	*										
53	KK	CP1									
54	HC	2									
	*										
55	KK	**ON2AP									
56	BA	.0441									
57	LS	0	56.7								
58	UD	.223									
	*										
59	KK	**OFF3U									
60	BA	.0035									
61	LS	0	54.0								
62	UD	.125									
	*										
63	KK	**OFF2P									
64	BA	.0144									
65	LS	0	74.9								
66	UD	.143									
	*										
67	KK	**CP2A									
68	HC	3									
	*										
69	KK	**OFF4P									
70	BA	.0314									
71	LS	0	54.0								
72	UD	.162									
	*										
73	KK	**CP2B									
74	HC	2									
	*										
75	KK	**ON1A									
76	BA	.0077									
77	LS	0	57.0								
78	UD	.145									
	*										

1

HEC-1 INPUT

PAGE 3

LINE	ID	1	2	3	4	5	6	7	8	9	10
79	KK	**CP2									
80	HC	2									
	*										
81	KK	**ON1B									
82	BA	.0283									
83	LS	0	57.0								
84	UD	.201									
	*										
85	KK**HUAL-2										
86	BA	.0047									
87	LS	0	98								
88	UD	.067									
	*										
89	KK	**CP3									
90	HC	3									
	*										
91	KK**HUAL-1										
92	BA	.0020									
93	LS	0	98								
94	UD	.050									
	*										
95	KK	DON1									

ULT.OUT

96 BA .0352
97 LS 0 57.0
98 UD .153
*

99 KK CP2
100 HC 3
*
101 ZZ

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT
LINE (V) ROUTING (--->) DIVERSION OR PUMP FLOW
NO. (.) CONNECTOR (<---) RETURN OF DIVERTED OR PUMPED FLOW

30 **ANN
.
.
43 . **OFF1P
.
.
47 **CP1.....
.
.
49 . ANN1
.
.
53 CP1.....
.
.
55 . **ON2AP
.
.
59 . . **OFF3U
.
.
63 . . . **OFF2P
.
.
67 . **CP2A.....
.
.
69 . . **OFF4P
.
.
73 . **CP2B.....
.
.
75 . . **ON1A
.
.
79 . **CP2.....
.
.
81 . . **ON1B
.
.
85 . . . **HUAL-2
.
.
89 . **CP3.....
.
.
91 . . **HUAL-1
.
.
95 . . . DON1
.
.
99 . CP2.....

(**) RUNOFF ALSO COMPUTED AT THIS LOCATION

1*****
* FLOOD HYDROGRAPH PACKAGE (HEC-1) *
* JUN 1998 *
* VERSION 4.1 *
* RUN DATE 29MAR21 TIME 15:00:51 *

* U.S. ARMY CORPS OF ENGINEERS *
* HYDROLOGIC ENGINEERING CENTER *
* 609 SECOND STREET *
* DAVIS, CALIFORNIA 95616 *
* (916) 756-1104 *

```

*                               *
* ANN AND HUALAPAI            *
* ULTIMATE CONDITION          *
*                               *
* PROJECT No: _ _ _ 291448001 *
* FILE: _ _ _ _ _ ULT.H1      *
* DATE MODELED: _ _ _ 03/29/21 *
* MODELED BY: _ _ _ MSB/MS     *
*                               *
*****

```

```

*****
* RETURN PERIOD: _ 100- & 10- YEAR *
* DISTRIBUTION: _ _ 6-HOUR SDN3    *
*****

```

JR CARDS CONTAIN DARFS BASED ON THE FOLLOWING VALUES:

```

AREA (SQUARE MILES)  DARF
0 - 0.5              1.000
10YR                 0.550

```

```

27 IO  OUTPUT CONTROL VARIABLES
        IPRNT      5  PRINT CONTROL
        IPLOT      0  PLOT CONTROL
        QSCAL      0.  HYDROGRAPH PLOT SCALE

IT      HYDROGRAPH TIME DATA
        NMIN       5  MINUTES IN COMPUTATION INTERVAL
        IDATE      1  0  STARTING DATE
        ITIME      0000 STARTING TIME
        NQ         300 NUMBER OF HYDROGRAPH ORDINATES
        NDDATE     2  0  ENDING DATE
        NDTIME     0055 ENDING TIME
        ICENT      19  CENTURY MARK

        COMPUTATION INTERVAL .08 HOURS
        TOTAL TIME BASE     24.92 HOURS

```

```

ENGLISH UNITS
DRAINAGE AREA      SQUARE MILES
PRECIPITATION DEPTH INCHES
LENGTH, ELEVATION  FEET
FLOW               CUBIC FEET PER SECOND
STORAGE VOLUME     ACRE-FEET
SURFACE AREA       ACRES
TEMPERATURE        DEGREES FAHRENHEIT

```

```

JP      MULTI-PLAN OPTION
        NPLAN      1  NUMBER OF PLANS

```

```

JR      MULTI-RATIO OPTION
        RATIOS OF PRECIPITATION
        1.00      .55

```

1

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
 FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
 TIME TO PEAK IN HOURS

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO PRECIPITATION	
				RATIO 1 1.00	RATIO 2 .55
HYDROGRAPH AT +	**ANN	.01	1 FLOW TIME	15. 3.50	8. 3.58
HYDROGRAPH AT +	**OFF1P	.01	1 FLOW TIME	11. 3.58	4. 3.58
2 COMBINED AT +	**CP1	.01	1 FLOW TIME	26. 3.58	12. 3.58
HYDROGRAPH AT +	ANN1	.00	1 FLOW TIME	6. 3.50	3. 3.50
2 COMBINED AT +	CP1	.02	1 FLOW TIME	31. 3.50	15. 3.50
HYDROGRAPH AT +	**ON2AP	.04	1 FLOW	7.	0.

					TIME	3.75	5.00	ULT.OUT
HYDROGRAPH AT								
+	**OFF3U	.00	1	FLOW	0.	0.		
				TIME	3.75	.00		
HYDROGRAPH AT								
+	**OFF2P	.01	1	FLOW	13.	3.		
				TIME	3.58	3.58		
3 COMBINED AT								
+	**CP2A	.06	1	FLOW	18.	3.		
				TIME	3.67	3.58		
HYDROGRAPH AT								
+	**OFF4P	.03	1	FLOW	4.	0.		
				TIME	3.75	5.83		
2 COMBINED AT								
+	**CP2B	.09	1	FLOW	22.	3.		
				TIME	3.67	3.58		
HYDROGRAPH AT								
+	**ON1A	.01	1	FLOW	1.	0.		
				TIME	3.67	4.92		
2 COMBINED AT								
+	**CP2	.10	1	FLOW	23.	3.		
				TIME	3.67	3.58		
HYDROGRAPH AT								
+	**ON1B	.03	1	FLOW	5.	0.		
				TIME	3.75	5.00		
HYDROGRAPH AT								
+	**HUAL-2	.00	1	FLOW	12.	6.		
				TIME	3.50	3.50		
3 COMBINED AT								
+	**CP3	.13	1	FLOW	33.	8.		
				TIME	3.58	3.50		
HYDROGRAPH AT								
+	**HUAL-1	.00	1	FLOW	5.	3.		
				TIME	3.50	3.50		
HYDROGRAPH AT								
+	DON1	.04	1	FLOW	7.	0.		
				TIME	3.67	4.92		
3 COMBINED AT								
+	CP2	.17	1	FLOW	42.	11.		
				TIME	3.58	3.50		
*** NORMAL END OF HEC-1 ***								