APPENDIX J-3

Technical Report on Airport Drainage, Northern Sector – Airport and Ordinance Creek Watershed, Airport Creek Hydrologic Models

Technical Report on Airport Drainage

Appendix J-3: Northern Sector – Airport and Ordinance Creek Watershed

Airport Creek Hydrologic Models

Introduction

A significant aspect of the project is the proposed re-routing of Airport Creek, which currently passes just to the north of the approach ends of Runways 14 and 32. A computer model of Airport Creek (limited to the reach between Skylane Boulevard and the confluence with Windsor Creek), using the same rational method hydrology software (SCWA's HYDRO ver. 2.0) and correctly arranging the drainage tributary definitions found in the record SCWA model of Airport Creek to reflect current existing conditions, has been developed to provide a resource for the design phase of the project and to more precisely represent both the existing Airport/Ordinance creek system as well as evaluate the impacts of proposed changes to Airport Creek within the limits of the proposed project.

Airport Creek System Hydrology – Ultimate Upstream Watershed Build-out Assumed

Computer modeling of creeks in Sonoma County typically reflect channel flow values based on ultimate development of the upstream watershed, so that they may be used as a conservative hydraulic boundary condition for the design of adjacent new development. The standard procedure for establishing flow values for various reaches in these creeks would be to obtain them from reliable source data. Public agency records that were reviewed for this report include the U.S. Army Corps of Engineers (USACE) Flood Insurance Study for Unincorporated Sonoma County (December 2008), the Sonoma County Water Agency (SCWA) Windsor Area Master Drainage Plan (WAMDP, June, 1989) and the Windsor Cumulative Drainage Impact Mitigation Program Update (Boyle Engineering Corp., September, 1999). In addition, drainage studies and calculations submitted with various Sonoma County Airport projects were reviewed, including the Sonoma County Airport Runway 14/32 Safety Area Drainage Improvements Project (Brelje & Race, Carlile/Daugherty/Carlenzoli, December 1985) and the Master Drainage Study – Sonoma County Airport Ordinance Creek Watershed (Brelje & Race, Carlile/Daugherty/Carlenzoli, May 1987). Based on analysis of these references we have elected to accept the land use intensities listed for various tributary sub-areas in the hydrological model contained in the 1999 Windsor Cumulative Drainage Impact Mitigation Program Update report, which revisited the hydrology calculations used for the SCWA WAMDP and updated tributary sub-area "C" values (a representation of ultimate development regional imperviousness) based on more recent editions of the County of Sonoma and Town of Windsor Master Plan Development Mapping. Initial time of concentration was also typically conservative, with t_0 = 15 minutes applied well downstream of the creek headwaters. Although this (Boyle) report was not intended for direct use for project-specific design purposes, the flow and water surface elevations listed in the report are derived from the original SCWA creek cross section geometry overlaid with more recent land use intensity for hydrology calculations. Results of this study have been typically found by the Sonoma County Water Agency to be acceptable values for the valley reaches of the regional creek system for use as a model for Windsor area creeks. It was still necessary, in the case of Airport Creek in and downstream of the County Airport property, to refine the Boyle Engineering model within the local Airport property and to also include a rational method hydrology calculation for the western remnant of Ordinance Creek (tributary area that is not otherwise diverted into Redwood Creek upstream of the Redwood/Airport Creek confluence west of the Airport Wastewater Treatment Plant).

As a part of the effort to prepare a digital hydraulic model of Airport Creek, storm water flow values applicable to the various reaches of Airport, Ordinance and Redwood Creeks from its confluence with Windsor Creek to the upstream limits of the project, were reviewed for use in the calculation of the water surface profiles of the creek. Upon careful examination, existing hydrologic models of the Airport Creek watershed were found to be outdated when compared to the current topological configuration of these creeks within the limits of the Project. In the case of Ordinance Creek, there has been no updated study prepared since 1985, when the tributary areas of the creek east of Runway 1/19 was re-routed north into Redwood Creek, while the balance of the tributary area continues to drain to the remnant of the remaining channel northwest of Runway 1/19. This technical report therefore includes an update of the existing hydrology models of Airport Creek, Ordinance Creek and Redwood Creek, which drain the northern portion of the Sonoma County Airport tributary areas. At that time, while the SCWA hydrology models of Redwood Creek and Airport Creek were updated to reflect the increase in flow contribution at their confluence, the confluence of Airport and Ordinance Creek was not accordingly adjusted to reflect the removal of the eastern portion of the Ordinance Creek tributary area, resulting in a "double-counting" of this area in the calculation of peak flow assigned to the reaches of Airport Creek downstream of the Ordinance Creek confluence. The elimination of "double-counted" tributary area resulted in predicted peak storm event flows downstream of the Airport/Ordinance creek confluence lower than the values shown in the most recently published hydrologic reference for the project location, the 1999 Windsor Cumulative Drainage Impact Mitigation Program Update report, but are equivalent to historic SCWA hydrologic models of Airport Creek.

The resulting updated peak flow values have been appropriately incorporated into a digital hydraulic model of Airport Creek. The updated output of the Airport Creek hydrology, including Redwood Creek and (west) Ordinance Creek, is provided in the format of the SCWA HYDRO (ver. 1.1) software. The update of the hydraulic model of these three creeks is provided in the format of the Army Corps of Engineers' HEC-RAS (ver. 4.1.0) software.

Note Regarding Elevations in the Hydraulic Model Input and Output

Historical references and topographic data used to develop the digital hydrologic models presented in this Appendix consistently assume the use of National Geodedic Vertical Datum (NGVD) 1929 vertical datum to provide direct continuity with current commonly used hydrologic references in Sonoma County. An exception to this are exhibits and maps of the most recent (December 2, 2008) revisions available of the Federal Emergency Management Agency (FEMA) Flood Insurance Study and associated Rate Maps (F.I.R.M.) for Sonoma County, which have switched to the use of the more modern North American Vertical Datum (NAVD) 1988. The difference between the two standards in a given location differs slightly from one location to the next in Sonoma County, but is on average a difference of two feet. Thus water surface and other elevations displayed on the Flood Insurance Rate Maps that display the Sonoma County Airport vicinity are noticeably different, approximately two feet higher in elevation, than those found in the HEC-RAS model output herein for a given point along Airport Creek. Users of this technical report are cautioned to confirm which vertical datum standard has been established for the detailed project design and adjust the data extracted from this report accordingly.

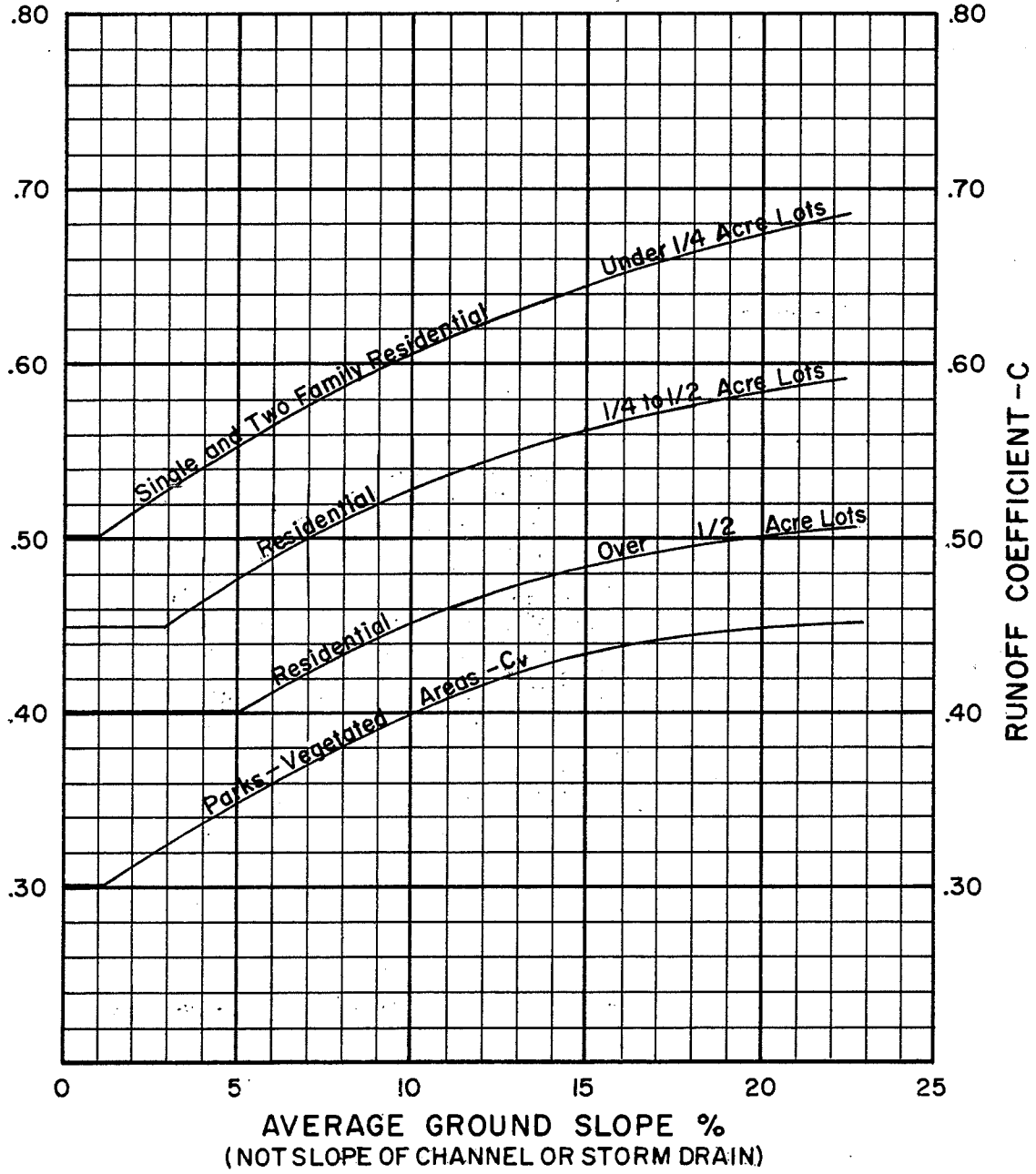
RAINFALL DATA/DESIGN PARAMETERS

Review of the Sonoma County Water Agency (SCWA) Flood Control Design Criteria handbook provides explanation of the following mathematical models and constant values historically used in the hydrologic analysis of Airport and Ordinance Creeks in the reference data:

Rainfall Data/Design Parameters
(assuming ultimate development)

Runoff Coefficient (Plate B-1)	$C_P = 0.90$ (Impervious Surface, roads sidewalks) (generally assumed for Ordinance Creek watershed in referenced hydrologic studies) $C_V = 0.35$ (Vegetated, 5% Average Ground Slope) (generally assumed for local Airport Creek watershed in the vicinity of Sonoma County Airport in referenced hydrologic studies)
Rainfall Intensity (Plate B-2)	$I_{10} = 7.08t_c^{-0.526}$ $I_{25} = 7.90t_c^{-0.516}$ $I_{100} = 10.15\ t_c^{-0.529}$ $I_2 = 0.79I_{10}$
Mean Seasonal Precipitation (Plate B-3)	35 In/Yr
Adjustment "K" Factor (Plate B-4)	K = 35/30 = 1.17

RUNOFF COEFFICIENTS FOR RATIONAL FORMULA



NOTE: Commercial, Industrial & Multiple Residential Areas

$C_P = 0.9$ (Based on paving, roofs, etc.)

When vegetated area exceeds 20% of total, C_V from vegetated curve may be used to reduce above C_P as follows:

$$C_T = C_V \frac{A_V}{A_T} + C_P \frac{A_P}{A_T}$$

SONOMA COUNTY WATER AGENCY

118-2
7/64

PLATE No. B-1

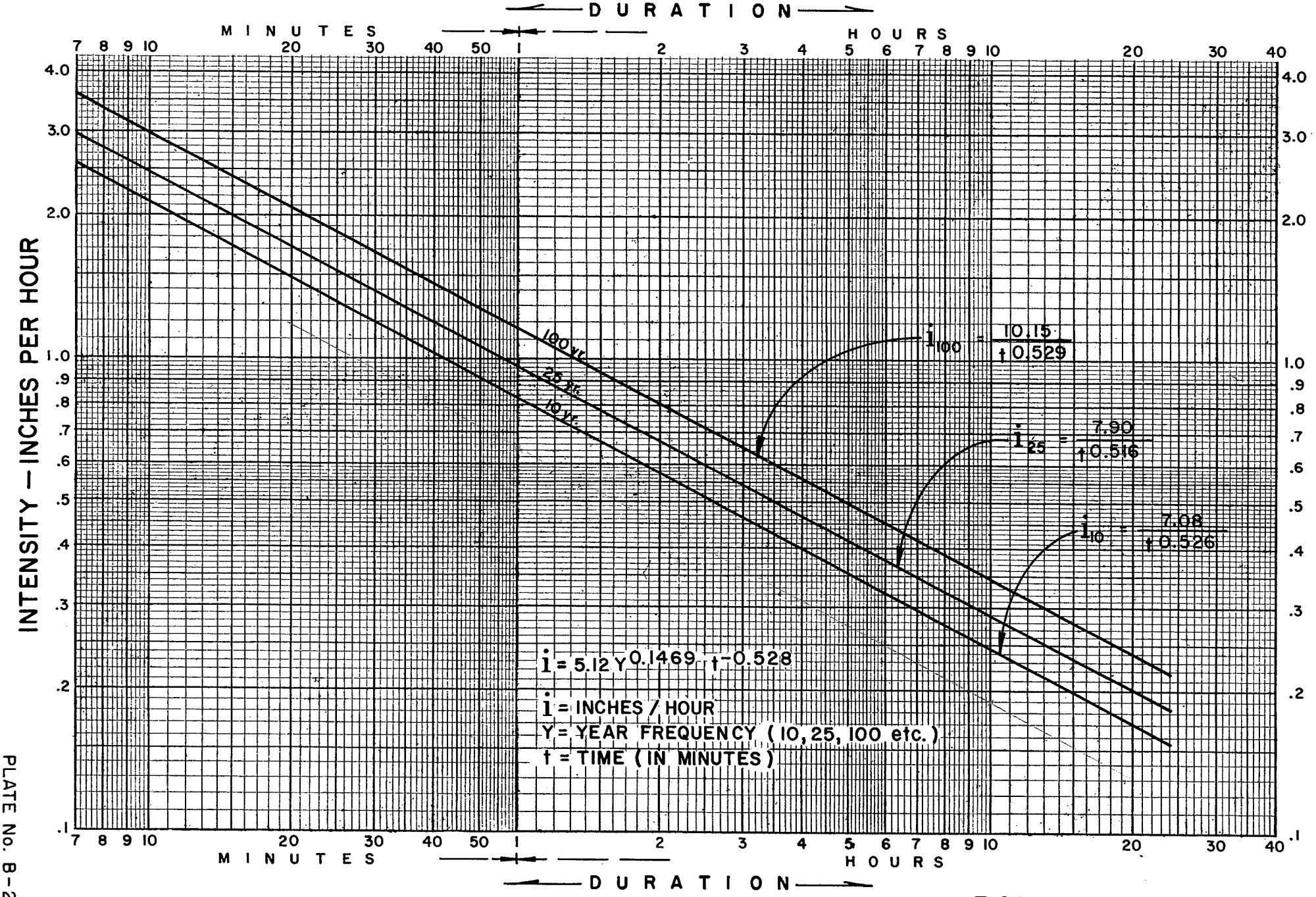
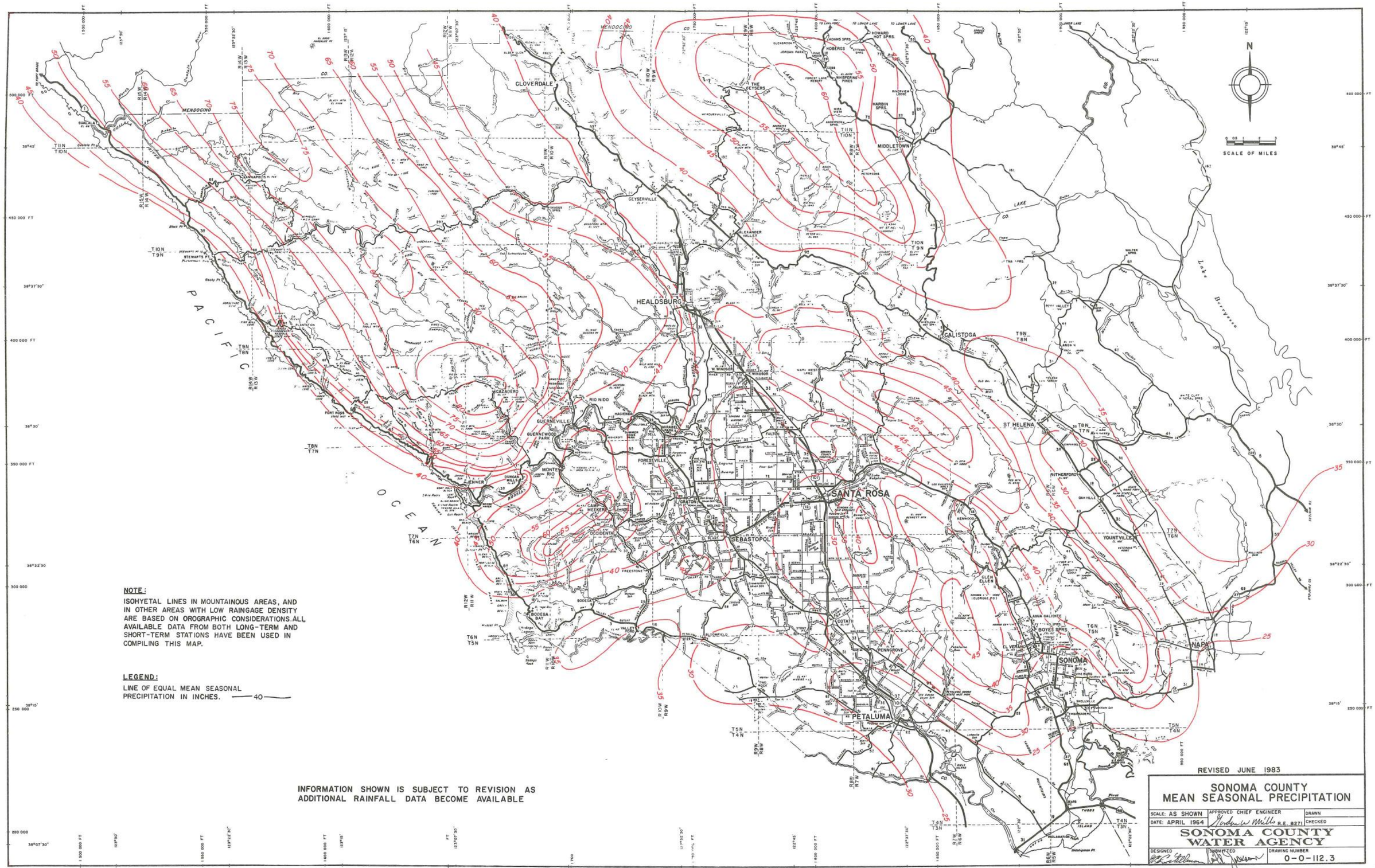


PLATE No. B-2

NOTE: THE INFORMATION SHOWN IS SUBJECT TO ANNUAL REVISION AS ADDITIONAL RAINFALL DATA BECOMES AVAILABLE.

RAINFALL INTENSITY vs. DURATION



NOTE:

ISOHYETAL LINES IN MOUNTAINOUS AREAS, AND IN OTHER AREAS WITH LOW RAINGAGE DENSITY ARE BASED ON OROGRAPHIC CONSIDERATIONS. ALL AVAILABLE DATA FROM BOTH LONG-TERM AND SHORT-TERM STATIONS HAVE BEEN USED IN COMPILING THIS MAP.

LEGEND:

LINE OF EQUAL MEAN SEASONAL PRECIPITATION IN INCHES. ——40——

INFORMATION SHOWN IS SUBJECT TO REVISION AS ADDITIONAL RAINFALL DATA BECOME AVAILABLE

REVISED JUNE 1983

SONOMA COUNTY MEAN SEASONAL PRECIPITATION

SCALE: AS SHOWN	APPROVED CHIEF ENGINEER	DRAWN
DATE: APRIL 1964	R.E. 8271	CHECKED
SONOMA COUNTY WATER AGENCY		
DESIGNED	SUBMITTED	DRAWING NUMBER 0-0-112.3

PLATE No. B-3

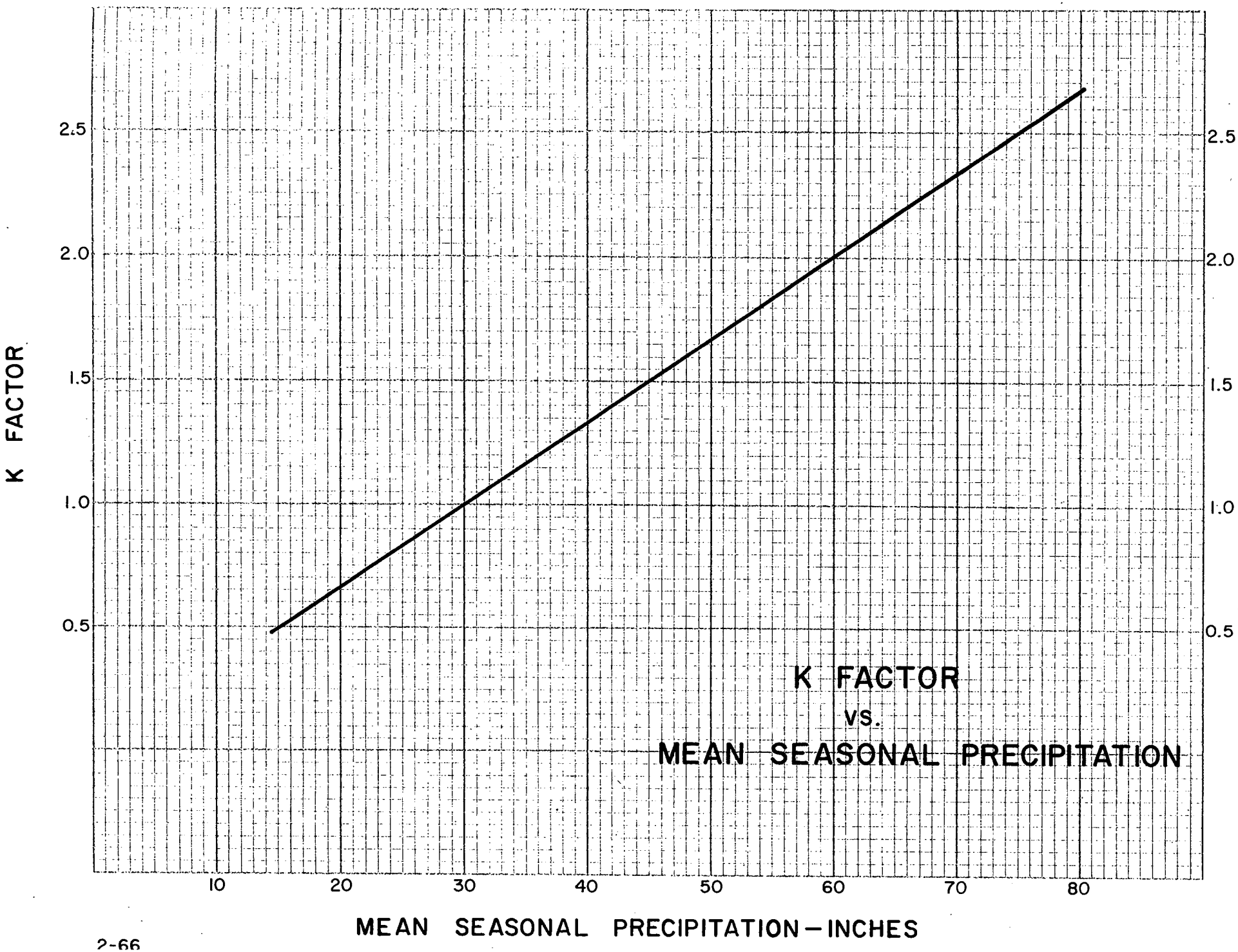


PLATE No. B-4

2-66