

Rational(50)

R. M. TOWILL CORPORATION		2024 N King Street, Suite 200, Honolulu, Hawaii 96819	
File:		Ph. (808) 842-1133 Fax (808) 842-1937	
Project:		Page	
Location:	H-1 Freeway Kapiolani to Ainakoa	Job No.:	
Prepared by:	RSY	Checked by:	
Date:	8/26/2016	Date:	

ITEM: RATIONAL METHOD, EXISTING CONDITIONS, 50-YEAR RECURRENCE INTERVAL

1. INTRODUCTION

The purpose of this work sheet is to determine the runoff quantities for drainage areas of 100 acres or less under existing conditions.

2. REFERENCES

- 2.1 "Erosion and Sediment Control Guide for Hawaii," U.S. Dept. of Agriculture, Soil Conservation Service, 3/1981 updated table 14 and 15 - Pages 54-58, 7/1993
- 2.2 "Soil Survey of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii," U.S. Dept. of Agriculture, Soil Conservation Service, 8/1972
- 2.3 "Rules Relating to Storm Drainage Standards
- 2.4 "NOAA Atlas 14 Vol 4", NOAA Precipitation Frequency Data Server website, 2011

3. COMPUTATIONS

Per Ref 2.3, 50-yr, 1-hr storm is used for design to account for potential sump and tailwater conditions.
This will apply to all the following calculations in determining rainfall intensity.

Minimum value for time of concentration, Tc, is 5 minutes

Rational Formula: $Q = C I A$

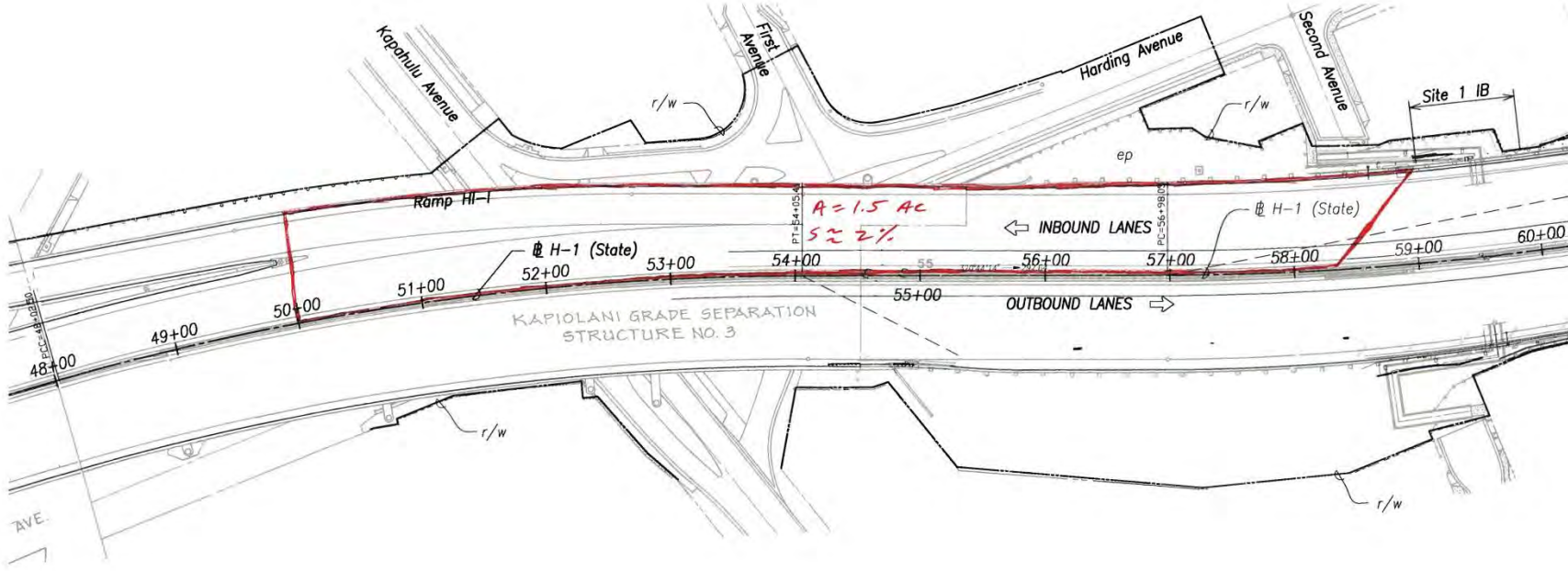
Runoff Coefficient:	Characteristic	Type	C
	concrete		1.00

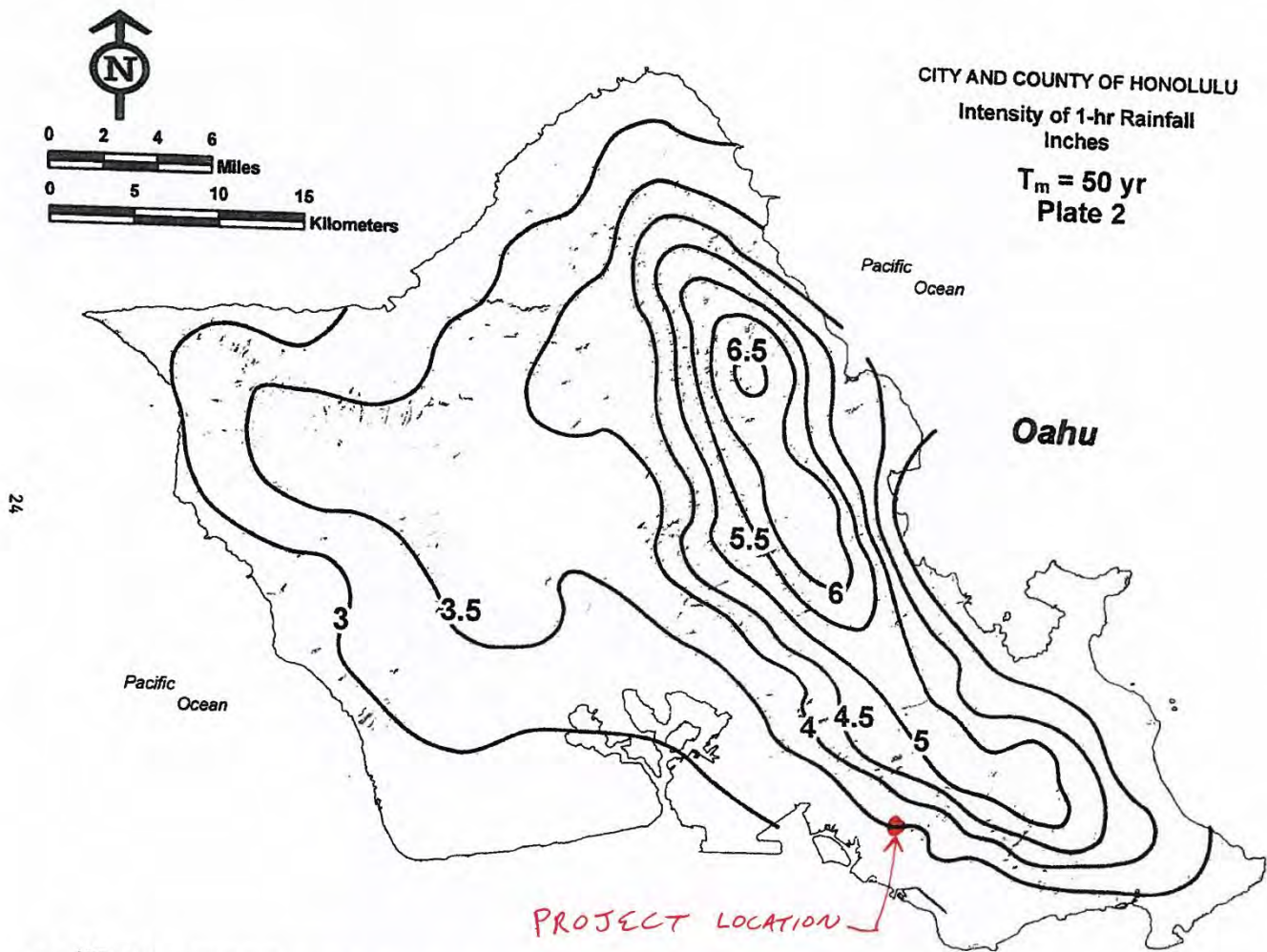
Rainfall Intensity: 50-yr, 1-hr rainfall depth = 3.01" (Ref. 2.4)

Time of Concentration =	9.5	minutes
Rainfall Intensity, I =	3.5	in/hr
correction factor =	2.3	

Drainage Area: A = 1.5 acres

Peak Flow: Q = 12.075 cfs

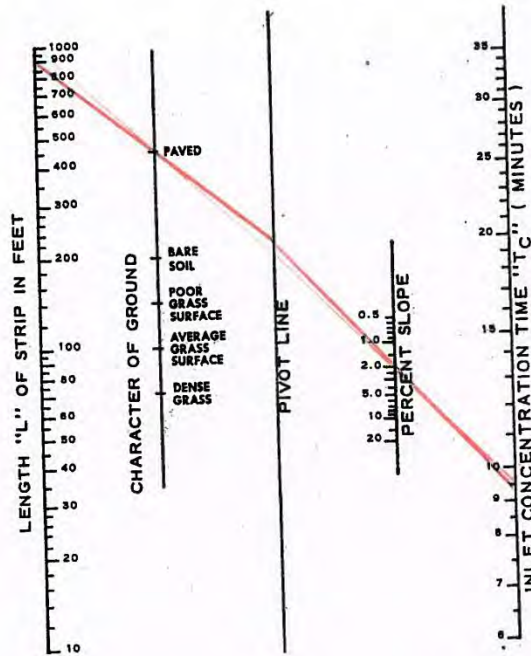




[Eff: APR 08 2011] (Auth: Sec 14-12.31, ROH) (Imp: Sec 14-12.31, ROH)

Source: National Oceanic and Atmospheric Administration (NOAA), National Weather Service, Silver Spring, Maryland, 2009

Plate 3 **Overland Flow Chart**



CORRECTION FACTOR APPLIED TO ONE HOUR RAINFALL IN INCHES
TO OBTAIN RAINFALL INTENSITY OF GIVEN DURATION

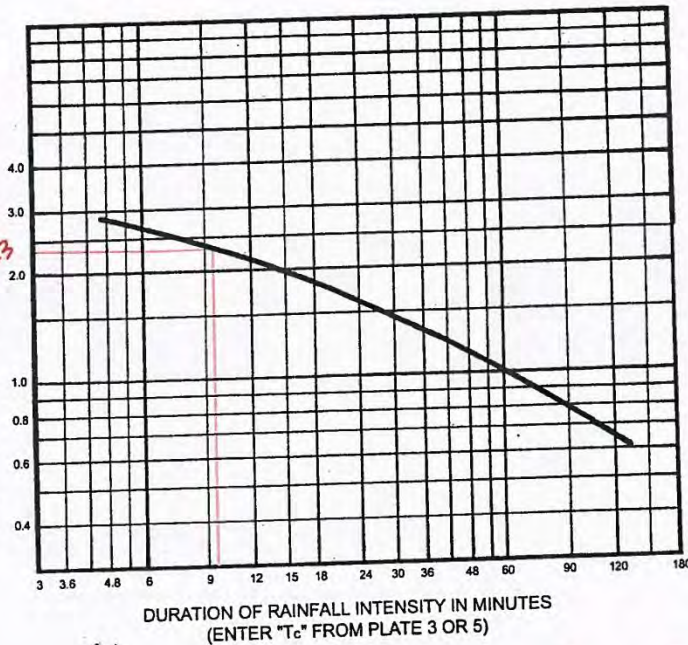


Plate 4

CORRECTION FACTOR
FOR CONVERTING 1 HR. RAINFALL
TO RAINFALL INTENSITY
OF VARIOUS DURATIONS

TO BE USED FOR AREA
LESS THAN 100 ACRES
(See Plate 6 for area
more than 100 acres)

A = 1.15 Ac

Precipitation Frequency Data Server

http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_printpage.html?lat=21.2852&1...



NOAA Atlas 14, Volume 4, Version 3
Location name: Honolulu, Hawaii, US*
Latitude: 21.2852°, Longitude: -157.8116°
Elevation: 43 ft*
* source: Google Maps



POINT PRECIPITATION FREQUENCY ESTIMATES

S. Perica, D. Martin, B. Lin, T. Parzybok, D. Riley, M. Yekta, L. Hiner, L.-C. Chen, D. Brewer, F. Yan, K. Maltara, C. Trypaluk, G. M. Bornin

NOAA, National Weather Service, Silver Spring, Maryland

[PF tabular](#) | [PF graphical](#) | [Maps & aerials](#)

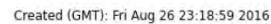
PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches) ¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.288 (0.246-0.329)	0.365 (0.313-0.425)	0.489 (0.416-0.574)	0.594 (0.502-0.697)	0.746 (0.619-0.880)	0.874 (0.713-1.03)	1.01 (0.807-1.20)	1.16 (0.903-1.39)	1.37 (1.03-1.66)	1.55 (1.13-1.89)
10-min	0.427 (0.366-0.488)	0.541 (0.464-0.631)	0.725 (0.617-0.851)	0.881 (0.744-1.03)	1.11 (0.918-1.30)	1.30 (1.06-1.53)	1.50 (1.20-1.78)	1.72 (1.34-2.06)	2.03 (1.53-2.46)	2.30 (1.67-2.81)
15-min	0.537 (0.459-0.613)	0.680 (0.583-0.792)	0.911 (0.775-1.07)	1.11 (0.934-1.30)	1.39 (1.15-1.64)	1.63 (1.33-1.93)	1.88 (1.50-2.24)	2.16 (1.68-2.58)	2.56 (1.92-3.09)	2.89 (2.10-3.52)
30-min	0.755 (0.646-0.863)	0.957 (0.821-1.11)	1.28 (1.09-1.50)	1.56 (1.31-1.83)	1.96 (1.62-2.31)	2.29 (1.87-2.71)	2.65 (2.12-3.15)	3.04 (2.37-3.64)	3.60 (2.70-4.35)	4.06 (2.96-4.96)
60-min	0.994 (0.850-1.14)	1.26 (1.08-1.47)	1.69 (1.44-1.98)	2.05 (1.73-2.40)	2.57 (2.14-3.04)	3.01 (2.46-3.57)	3.48 (2.78-4.14)	3.99 (3.12-4.79)	4.73 (3.56-5.72)	5.35 (3.89-6.52)
2-hr	1.33 (1.14-1.51)	1.72 (1.47-2.00)	2.31 (1.97-2.71)	2.80 (2.37-3.29)	3.52 (2.92-4.16)	4.11 (3.36-4.88)	4.74 (3.80-5.66)	5.43 (4.25-6.52)	6.41 (4.83-7.79)	7.23 (5.28-8.86)
3-hr	1.51 (1.29-1.70)	2.00 (1.72-2.33)	2.70 (2.30-3.16)	3.28 (2.77-3.85)	4.11 (3.41-4.85)	4.80 (3.92-5.70)	5.53 (4.43-6.60)	6.32 (4.94-7.60)	7.46 (5.62-9.05)	8.40 (6.12-10.3)
6-hr	1.94 (1.65-2.21)	2.56 (2.19-2.98)	3.48 (2.96-4.07)	4.23 (3.57-4.97)	5.31 (4.41-6.27)	6.20 (5.06-7.35)	7.14 (5.71-8.51)	8.16 (6.38-9.80)	9.62 (7.24-11.7)	10.8 (7.88-13.2)
12-hr	2.36 (2.01-2.69)	3.14 (2.69-3.66)	4.29 (3.65-5.03)	5.24 (4.42-6.16)	6.59 (5.46-7.78)	7.70 (6.28-9.13)	8.87 (7.08-10.6)	10.1 (7.91-12.1)	11.9 (8.96-14.4)	13.4 (9.72-16.3)
24-hr	2.79 (2.40-3.25)	3.81 (3.27-4.44)	5.28 (4.53-6.16)	6.49 (5.54-7.59)	8.23 (6.97-9.67)	9.66 (8.11-11.4)	11.2 (9.30-13.3)	12.9 (10.6-15.3)	15.2 (12.3-18.4)	17.2 (13.6-20.9)
2-day	3.31 (2.86-3.85)	4.52 (3.90-5.26)	6.24 (5.36-7.26)	7.62 (6.52-8.90)	9.58 (8.12-11.2)	11.2 (9.37-13.1)	12.8 (10.7-15.2)	14.6 (12.0-17.4)	17.1 (13.8-20.6)	19.1 (15.1-23.2)
3-day	3.66 (3.17-4.25)	5.00 (4.33-5.80)	6.88 (5.93-8.01)	8.38 (7.20-9.78)	10.5 (8.92-12.3)	12.2 (10.3-14.3)	13.9 (11.6-16.5)	15.8 (13.0-18.8)	18.4 (14.6-22.1)	20.4 (16.2-24.6)
4-day	4.00 (3.48-4.64)	5.48 (4.75-6.36)	7.52 (6.50-8.75)	9.15 (7.87-10.7)	11.4 (9.72-13.4)	13.2 (11.2-15.5)	15.1 (12.6-17.8)	17.0 (14.0-20.2)	19.7 (15.9-23.6)	21.8 (17.3-26.3)
7-day	4.45 (3.87-5.15)	6.05 (5.26-7.02)	8.29 (7.17-9.64)	10.1 (8.67-11.7)	12.5 (10.7-14.7)	14.5 (12.2-17.0)	16.5 (13.8-19.5)	18.6 (15.4-22.1)	21.5 (17.4-25.8)	23.7 (19.0-28.8)
10-day	4.98 (4.33-5.75)	6.74 (5.86-7.82)	9.20 (7.95-10.7)	11.1 (9.57-13.0)	13.8 (11.7-16.1)	15.8 (13.4-18.6)	18.0 (15.0-21.3)	20.2 (16.7-24.0)	23.2 (18.8-27.9)	25.6 (20.4-31.0)
20-day	6.14 (5.34-7.10)	8.26 (7.18-9.55)	11.1 (9.64-12.9)	13.3 (11.5-15.5)	16.3 (14.0-19.0)	18.6 (15.8-21.8)	20.9 (17.5-24.6)	23.2 (19.2-27.6)	26.4 (21.4-31.6)	28.7 (23.0-34.7)
30-day	7.11 (6.19-8.23)	9.50 (8.25-11.0)	12.7 (11.0-14.7)	15.1 (13.0-17.6)	18.3 (15.6-21.4)	20.7 (17.5-24.3)	23.1 (19.4-27.3)	25.6 (21.1-30.3)	28.7 (23.3-34.4)	31.1 (24.8-37.5)
45-day	8.40 (7.32-9.72)	11.2 (9.70-12.9)	14.8 (12.8-17.1)	17.5 (15.1-20.3)	21.0 (18.0-24.5)	23.7 (20.0-27.7)	26.3 (22.0-30.9)	28.8 (23.8-34.2)	32.1 (26.0-38.5)	34.5 (27.5-41.7)
60-day	9.51 (8.29-11.0)	12.6 (10.9-14.5)	16.5 (14.3-19.1)	19.5 (16.8-22.6)	23.3 (19.9-27.2)	26.1 (22.1-30.6)	28.9 (24.2-34.1)	31.6 (26.1-37.5)	35.1 (28.5-42.1)	37.6 (30.0-45.5)

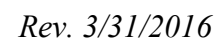
¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates for a given duration and average recurrence interval will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values. Please refer to NOAA Atlas 14 document for more information.

[Back to Top](#)

PF graphical



Small scale terrain



Precipitation Frequency Data Server

http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_printpage.html?lat=21.2852&1...



[Back to Top](#)

US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov
[Disclaimer](#)

site 2 Rational(50)

R. M. TOWILL CORPORATION 2024 N King Street, Suite 200, Honolulu, Hawaii 96819
File: Ph. (808) 842-1133 Fax (808) 842-1937

Project: _____ Page _____
Location: H-1 Freeway Kapiolani to Aiea Job No.: _____
Prepared by: RSY Checked by: _____
Date: 10/24/2016 Date: _____

ITEM: RATIONAL METHOD, EXISTING CONDITIONS, 50-YEAR RECURRENCE INTERVAL

1. INTRODUCTION

The purpose of this work sheet is to determine the runoff quantities for drainage areas of 100 acres or less under existing conditions.

2. REFERENCES

- 2.1 "Erosion and Sediment Control Guide for Hawaii," U.S. Dept. of Agriculture, Soil Conservation Service, 3/1981
updated table 14 and 15 - Pages 54-58, 7/1993
- 2.2 "Soil Survey of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii," U.S. Dept. of Agriculture, Soil Conservation Service, 8/1972
- 2.3 "Rules Relating to Storm Drainage Standards
- 2.4 "NOAA Atlas 14 Vol 4", NOAA Precipitation Frequency Data Server website, 2011

3. COMPUTATIONS

Per Ref 2.3, 50-yr, 1-hr storm is used for design to account for potential sump and tailwater conditions.
This will apply to all the following calculations in determining rainfall intensity.

Minimum value for time of concentration, Tc, is 5 minutes

Rational Formula: $Q = C I A$

Runoff Coefficient:	Characteristic	Type	C
	concrete		1.00

Rainfall Intensity: 50-yr, 1-hr rainfall depth = 3.01" (Ref. 2.4)
Time of Concentration = 10.0 minutes
Rainfall Intensity, I = 3.5 in/hr
correction factor = 2.4

Drainage Area: A = 9.9 acres

Peak Flow: Q = 83.16 cfs

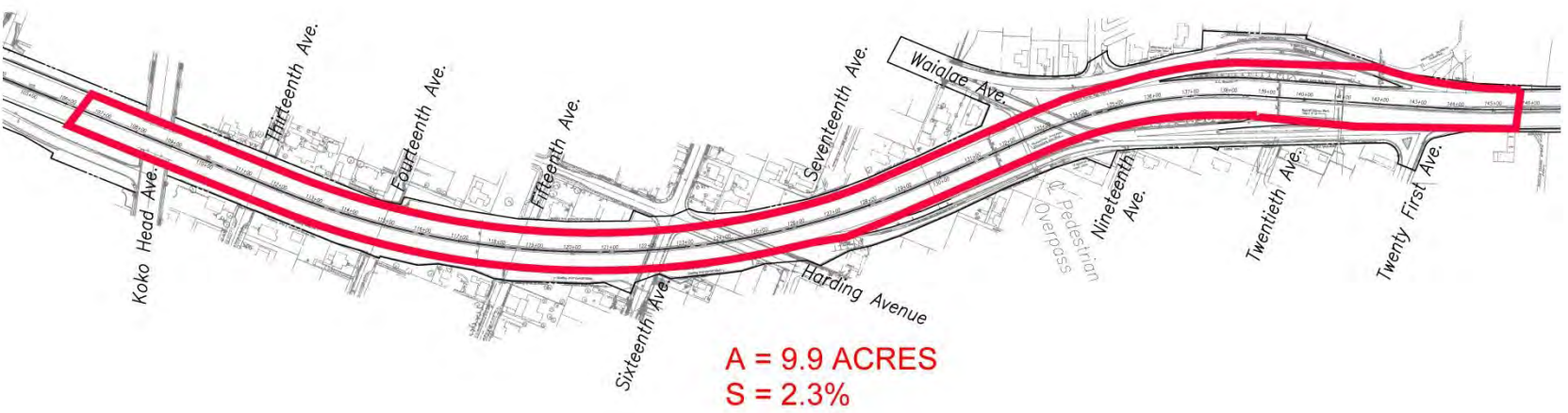
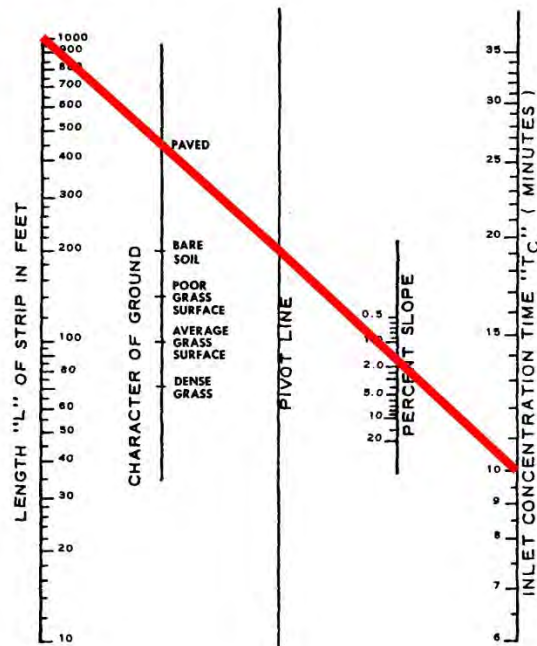


Plate 3 **Overland Flow Chart**



CORRECTION FACTOR APPLIED TO ONE HOUR RAINFALL IN INCHES TO OBTAIN RAINFALL INTENSITY -- GIVEN DURATION

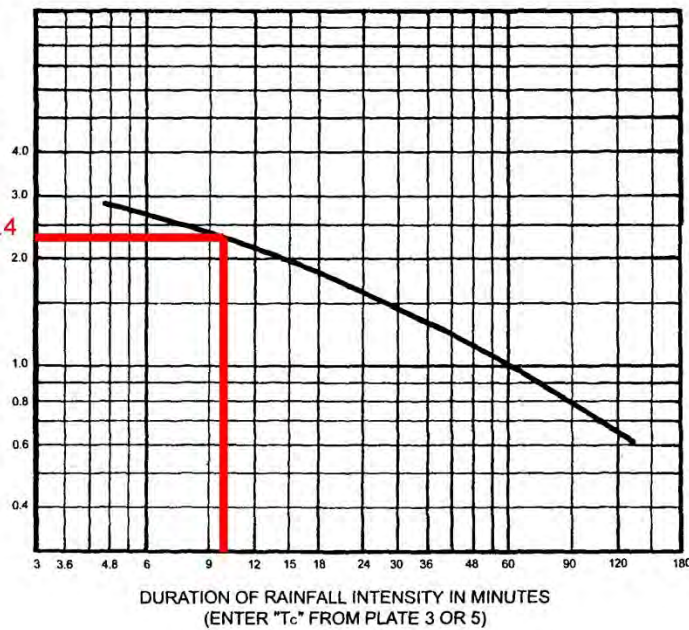
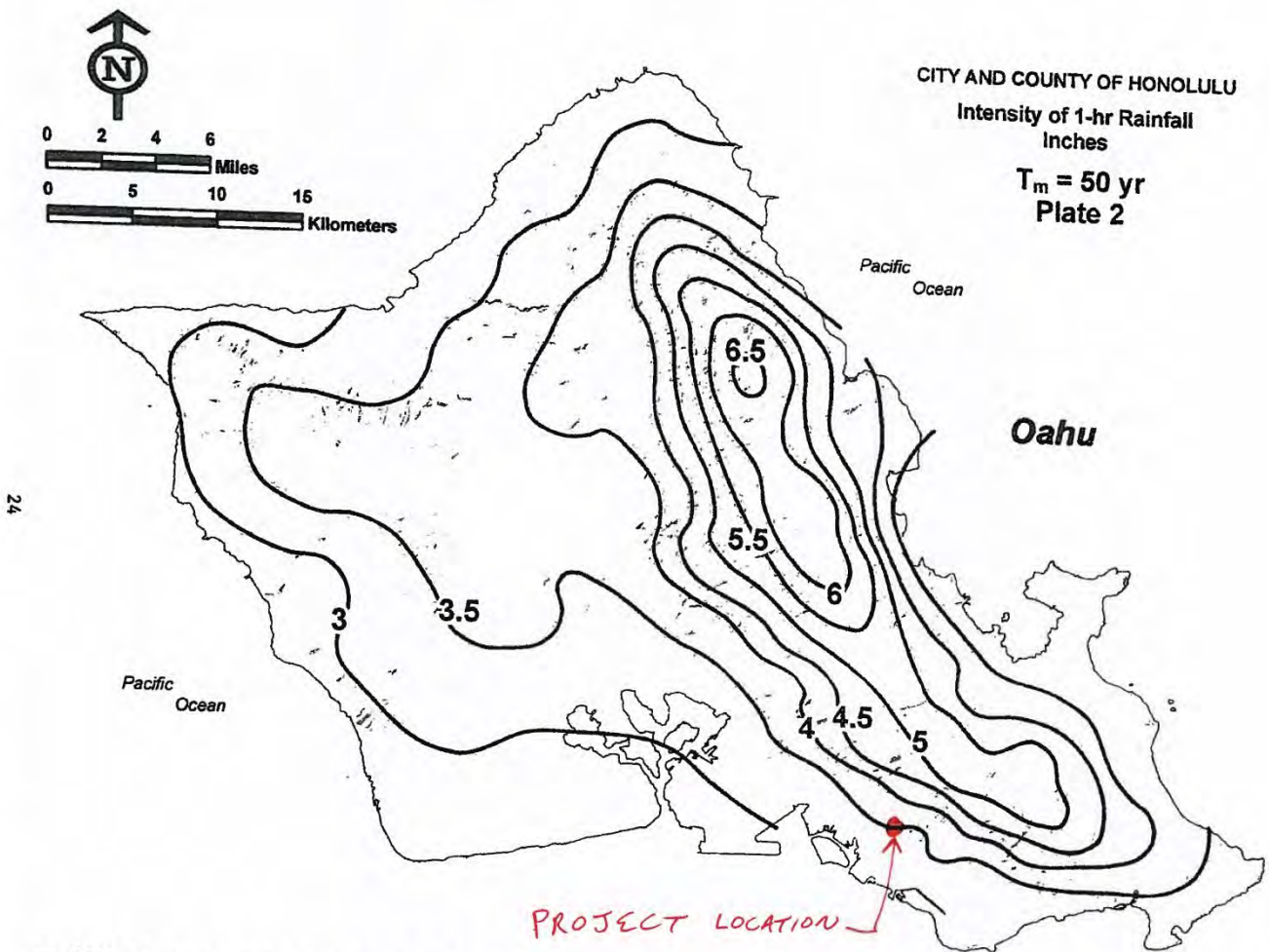


Plate 4

CORRECTION FACTOR
FOR CONVERTING 1 HR. RAINFALL
TO RAINFALL INTENSITY
OF VARIOUS DURATIONS

TO BE USED FOR AREA
LESS THAN 100 ACRES

(See Plate 6 for area
more than 100 acres)



[Eff: APR 08 2011] (Auth: Sec 14-12.31, ROH) (Imp: Sec 14-12.31, ROH)

Source: National Oceanic and Atmospheric Administration (NOAA), National Weather Service, Silver Spring, Maryland, 2009

Precipitation Frequency Data Server

http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_printpage.html?lat=21.2852&l...



NOAA Atlas 14, Volume 4, Version 3
Location name: Honolulu, Hawaii, US*
Latitude: 21.2852°, Longitude: -157.8116°
Elevation: 43 ft*
* source: Google Maps



POINT PRECIPITATION FREQUENCY ESTIMATES

S. Perica, D. Martin, B. Lin, T. Parzybok, D. Riley, M. Yekta, L. Hiner, L.-C. Chen, D. Brewer, F. Yan, K. Matana, C. Trypaluk, G. M. Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

[PF tabular](#) | [PF graphical](#) | [Maps & aeriels](#)

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches) ¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.288 (0.246-0.329)	0.365 (0.313-0.425)	0.489 (0.416-0.574)	0.594 (0.502-0.697)	0.746 (0.619-0.880)	0.874 (0.713-1.03)	1.01 (0.807-1.20)	1.16 (0.903-1.39)	1.37 (1.03-1.66)	1.55 (1.13-1.89)
10-min	0.427 (0.366-0.488)	0.541 (0.464-0.631)	0.725 (0.617-0.851)	0.881 (0.744-1.03)	1.11 (0.918-1.30)	1.30 (1.06-1.53)	1.50 (1.20-1.78)	1.72 (1.34-2.05)	2.03 (1.53-2.46)	2.30 (1.67-2.81)
15-min	0.537 (0.459-0.613)	0.680 (0.583-0.792)	0.911 (0.775-1.07)	1.11 (0.934-1.30)	1.39 (1.15-1.64)	1.63 (1.33-1.93)	1.88 (1.50-2.24)	2.16 (1.68-2.58)	2.56 (1.92-3.09)	2.89 (2.10-3.52)
30-min	0.755 (0.646-0.863)	0.957 (0.821-1.11)	1.28 (1.09-1.50)	1.56 (1.31-1.83)	1.96 (1.62-2.31)	2.29 (1.87-2.71)	2.65 (2.12-3.15)	3.04 (2.37-3.64)	3.60 (2.70-4.35)	4.06 (2.96-4.96)
60-min	0.994 (0.850-1.14)	1.26 (1.08-1.47)	1.69 (1.44-1.98)	2.05 (1.73-2.40)	2.57 (2.14-3.04)	3.01 (2.46-3.57)	3.48 (2.78-4.14)	3.99 (3.12-4.79)	4.73 (3.56-5.72)	5.35 (3.89-6.52)
2-hr	1.33 (1.14-1.51)	1.72 (1.47-2.00)	2.31 (1.97-2.71)	2.80 (2.37-3.29)	3.52 (2.92-4.16)	4.11 (3.36-4.88)	4.74 (3.80-5.66)	5.43 (4.25-6.52)	6.41 (4.83-7.79)	7.23 (5.28-8.86)
3-hr	1.51 (1.29-1.70)	2.00 (1.72-2.33)	2.70 (2.30-3.16)	3.28 (2.77-3.85)	4.11 (3.41-4.85)	4.80 (3.92-5.70)	5.53 (4.43-6.60)	6.32 (4.94-7.60)	7.46 (5.62-9.05)	8.40 (6.12-10.3)
6-hr	1.94 (1.65-2.21)	2.56 (2.19-2.98)	3.48 (2.96-4.07)	4.23 (3.57-4.97)	5.31 (4.41-6.27)	6.20 (5.06-7.35)	7.14 (5.71-8.51)	8.16 (6.38-9.80)	9.62 (7.24-11.7)	10.8 (7.88-13.2)
12-hr	2.36 (2.01-2.69)	3.14 (2.69-3.66)	4.29 (3.65-5.03)	5.24 (4.42-6.16)	6.59 (5.46-7.78)	7.70 (6.28-9.13)	8.87 (7.08-10.6)	10.1 (7.91-12.1)	11.9 (8.96-14.4)	13.4 (9.72-16.3)
24-hr	2.79 (2.40-3.25)	3.81 (3.27-4.44)	5.28 (4.53-6.16)	6.49 (5.54-7.59)	8.23 (6.97-9.67)	9.66 (8.11-11.4)	11.2 (9.30-13.3)	12.9 (10.6-15.3)	15.2 (12.3-18.4)	17.2 (13.6-20.9)
2-day	3.31 (2.86-3.85)	4.52 (3.90-5.26)	6.24 (5.36-7.26)	7.62 (6.52-8.90)	9.58 (8.12-11.2)	11.2 (9.37-13.1)	12.8 (10.7-15.2)	14.6 (12.0-17.4)	17.1 (13.8-20.6)	19.1 (15.1-23.2)
3-day	3.66 (3.17-4.25)	5.00 (4.33-5.80)	6.88 (5.93-8.01)	8.38 (7.20-9.78)	10.5 (8.92-12.3)	12.2 (10.3-14.3)	13.9 (11.6-16.5)	15.8 (13.0-18.8)	18.4 (14.8-22.1)	20.4 (16.2-24.8)
4-day	4.00 (3.48-4.64)	5.48 (4.75-6.36)	7.52 (6.50-8.75)	9.15 (7.87-10.7)	11.4 (9.72-13.4)	13.2 (11.2-15.5)	15.1 (12.6-17.8)	17.0 (14.0-20.2)	19.7 (15.9-23.6)	21.8 (17.3-26.3)
7-day	4.45 (3.87-5.15)	6.05 (5.26-7.02)	8.29 (7.17-9.64)	10.1 (8.67-11.7)	12.5 (10.7-14.7)	14.5 (12.2-17.0)	16.5 (13.8-19.5)	18.6 (15.4-22.1)	21.5 (17.4-25.8)	23.7 (19.0-28.8)
10-day	4.98 (4.33-5.75)	6.74 (5.86-7.82)	9.20 (7.95-10.7)	11.1 (9.57-13.0)	13.8 (11.7-16.1)	15.8 (13.4-18.6)	18.0 (15.0-21.3)	20.2 (16.7-24.0)	23.2 (18.8-27.9)	25.6 (20.4-31.0)
20-day	6.14 (5.34-7.10)	8.26 (7.18-9.55)	11.1 (9.64-12.9)	13.3 (11.5-15.5)	16.3 (14.0-19.0)	18.6 (15.8-21.8)	20.9 (17.5-24.6)	23.2 (19.2-27.6)	26.4 (21.4-31.6)	28.7 (23.0-34.7)
30-day	7.11 (6.19-8.23)	9.50 (8.25-11.0)	12.7 (11.0-14.7)	15.1 (13.0-17.6)	18.3 (15.6-21.4)	20.7 (17.5-24.3)	23.1 (19.4-27.3)	25.6 (21.1-30.3)	28.7 (23.3-34.4)	31.1 (24.8-37.5)
45-day	8.40 (7.32-9.72)	11.2 (9.70-12.9)	14.8 (12.8-17.1)	17.5 (15.1-20.3)	21.0 (18.0-24.5)	23.7 (20.0-27.7)	26.3 (22.0-30.9)	28.8 (23.8-34.2)	32.1 (26.0-38.5)	34.5 (27.5-41.7)
60-day	9.51 (8.29-11.0)	12.6 (10.9-14.5)	16.5 (14.3-19.1)	19.5 (16.8-22.6)	23.3 (19.9-27.2)	26.1 (22.1-30.6)	28.9 (24.2-34.1)	31.6 (26.1-37.5)	35.1 (28.5-42.1)	37.6 (30.0-46.5)

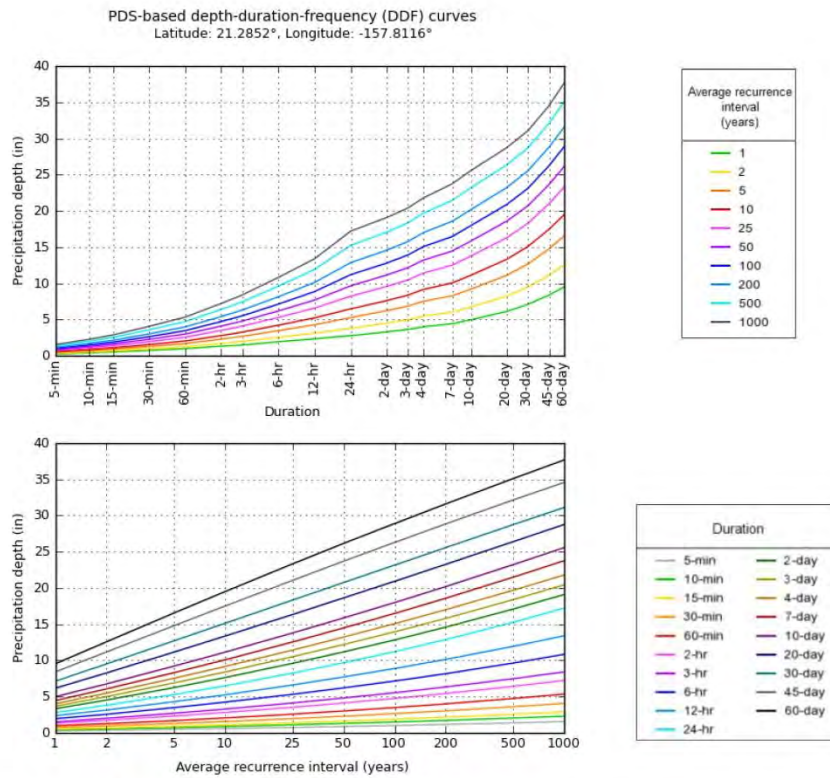
¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values. Please refer to NOAA Atlas 14 document for more information.

[Back to Top](#)

PF graphical

Precipitation Frequency Data Server

http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_printpage.html?lat=21.2852&lon=-157.8116



NOAA Atlas 14, Volume 4, Version 3

Created (GMT): Fri Aug 26 23:18:59 2016

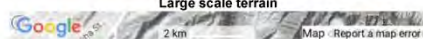
[Back to Top](#)

Maps & aerals

Small scale terrain



Large scale terrain



2 of 3

8/26/2016 1:19 PM

Precipitation Frequency Data Server

http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_printpage.html?lat=21.2852&1...



[Back to Top](#)

US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

[Disclaimer](#)

site 3 Rational(50)

R. M. TOWILL CORPORATION 2024 N King Street, Suite 200, Honolulu, Hawaii 96819
File: Ph. (808) 842-1133 Fax (808) 842-1937

Project: _____ Page _____
Location: H-1 Freeway Kapiolani to Aiea Job No.: _____
Prepared by: RSY Checked by: _____
Date: 10/24/2016 Date: _____

ITEM: RATIONAL METHOD, EXISTING CONDITIONS, 50-YEAR RECURRENCE INTERVAL

1. INTRODUCTION

The purpose of this work sheet is to determine the runoff quantities for drainage areas of 100 acres or less under existing conditions.

2. REFERENCES

- 2.1 "Erosion and Sediment Control Guide for Hawaii," U.S. Dept. of Agriculture, Soil Conservation Service, 3/1981
updated table 14 and 15 - Pages 54-58, 7/1993
- 2.2 "Soil Survey of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii," U.S. Dept. of Agriculture, Soil Conservation Service, 8/1972
- 2.3 "Rules Relating to Storm Drainage Standards
- 2.4 "NOAA Atlas 14 Vol 4", NOAA Precipitation Frequency Data Server website, 2011

3. COMPUTATIONS

Per Ref 2.3, 50-yr, 1-hr storm is used for design to account for potential sump and tailwater conditions.
This will apply to all the following calculations in determining rainfall intensity.

Minimum value for time of concentration, Tc, is 5 minutes

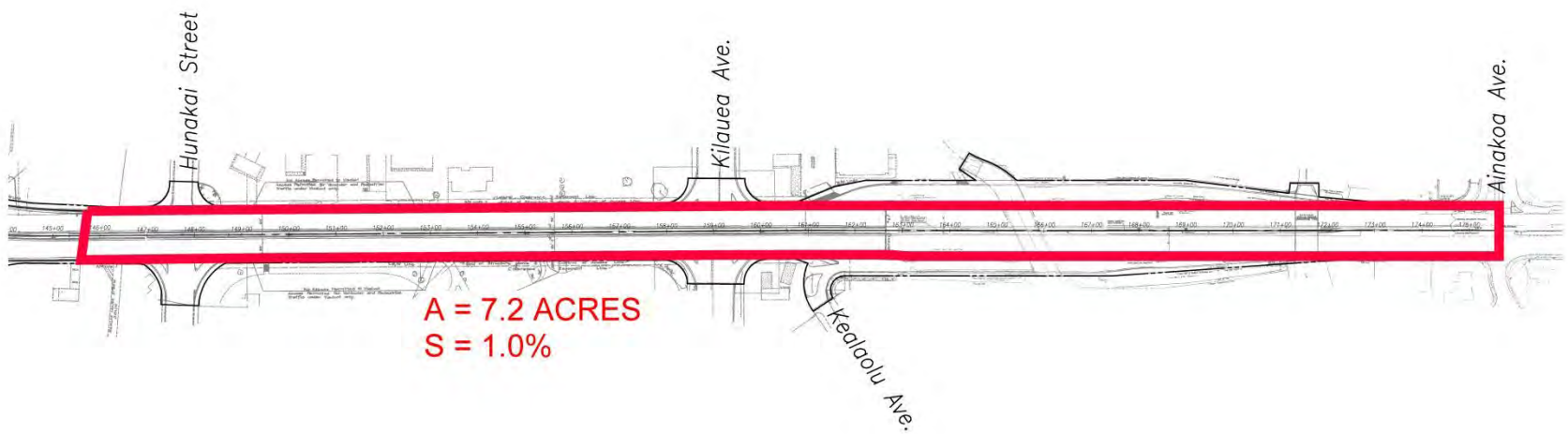
Rational Formula: $Q = C I A$

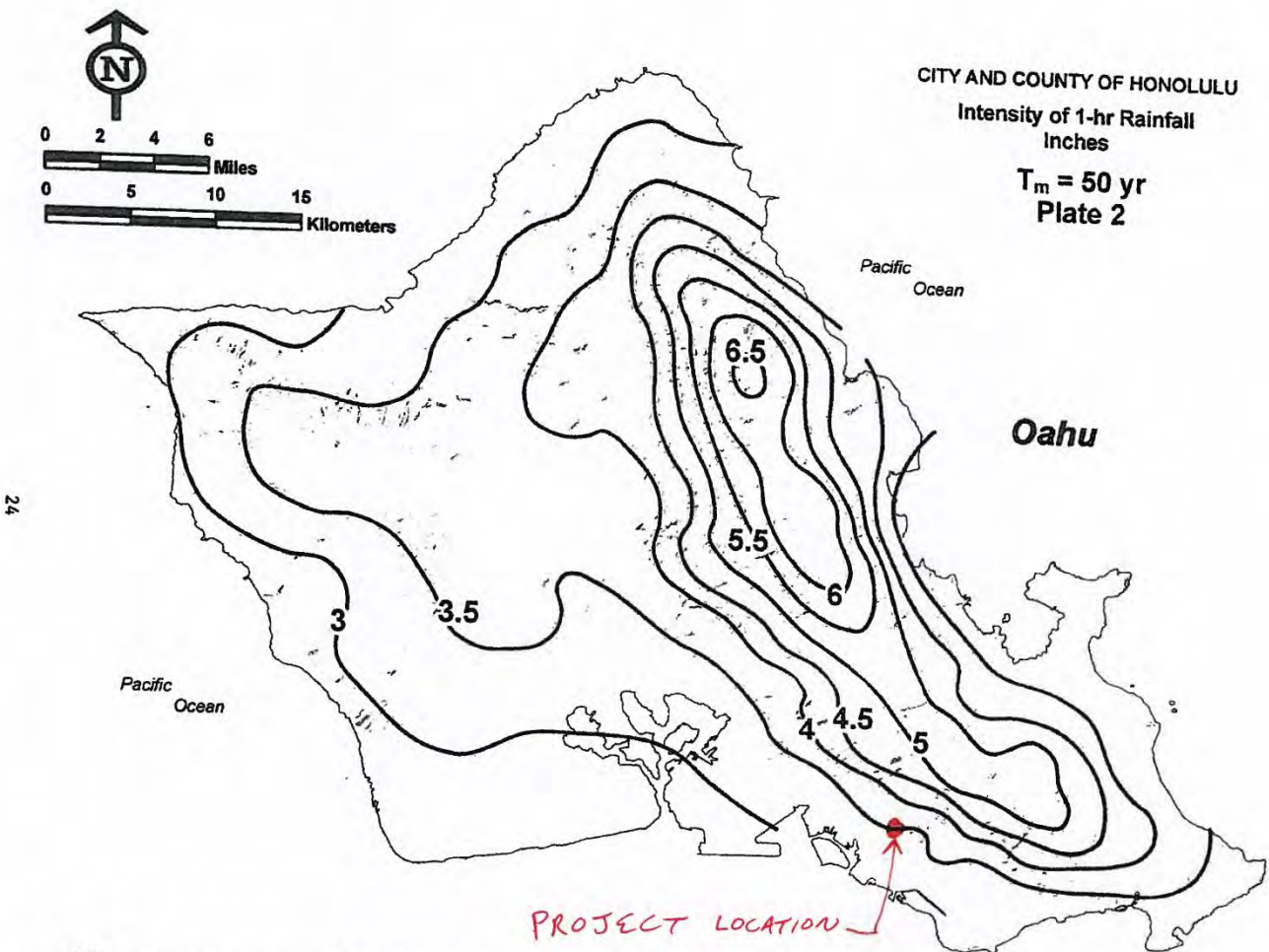
Runoff Coefficient:	Characteristic	Type	C
	concrete		1.00

Rainfall Intensity: 50-yr, 1-hr rainfall depth = 3.01" (Ref. 2.4)
Time of Concentration = 11.0 minutes
Rainfall Intensity, I = 3.5 in/hr
correction factor = 2.3

Drainage Area: A = 7.2 acres

Peak Flow: Q = 57.96 cfs

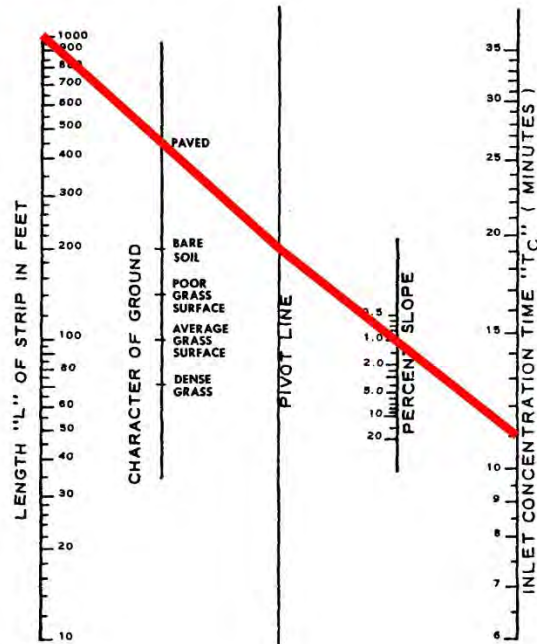




[Eff: APR 08 2011] (Auth: Sec 14-12.31, ROH) (Imp: Sec 14-12.31, ROH)

Source: National Oceanic and Atmospheric Administration (NOAA), National Weather Service, Silver Spring, Maryland, 2009

Plate 3 **Overland Flow Chart**



CORRECTION FACTOR APPLIED TO ONE HOUR RAINFALL IN INCHES
TO OBTAIN RAINFALL INTENSITY AT GIVEN DURATION

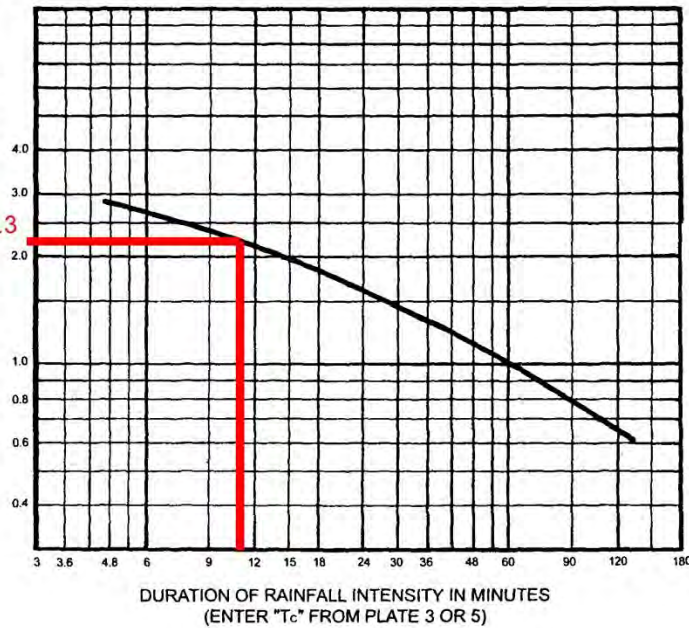


Plate 4

CORRECTION FACTOR
FOR CONVERTING 1 HR. RAINFALL
TO RAINFALL INTENSITY
OF VARIOUS DURATIONS

TO BE USED FOR AREA
LESS THAN 100 ACRES

(See Plate 6 for area
more than 100 acres)

Precipitation Frequency Data Server

http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_printpage.html?lat=21.2852&lon=157.8116



NOAA Atlas 14, Volume 4, Version 3
Location name: Honolulu, Hawaii, US*
Latitude: 21.2852°, Longitude: -157.8116°
Elevation: 43 ft*
* source: Google Maps



POINT PRECIPITATION FREQUENCY ESTIMATES

S. Perica, D. Martin, B. Lin, T. Parzybok, D. Riley, M. Yekta, L. Hiner, L.-C. Chen, D. Brewer, F. Yan, K. Mataria, C. Trysaluk, G. M. Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

[PF tabular](#) | [PF graphical](#) | [Maps & aeriels](#)

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches) ¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.288 (0.246-0.329)	0.365 (0.313-0.425)	0.489 (0.416-0.574)	0.594 (0.502-0.697)	0.746 (0.619-0.880)	0.874 (0.713-1.03)	1.01 (0.807-1.20)	1.16 (0.903-1.39)	1.37 (1.03-1.66)	1.55 (1.13-1.89)
10-min	0.427 (0.366-0.488)	0.541 (0.464-0.631)	0.725 (0.617-0.851)	0.881 (0.744-1.03)	1.11 (0.918-1.30)	1.30 (1.06-1.53)	1.50 (1.20-1.78)	1.72 (1.34-2.06)	2.03 (1.53-2.46)	2.30 (1.67-2.81)
15-min	0.537 (0.459-0.613)	0.680 (0.583-0.792)	0.911 (0.775-1.07)	1.11 (0.934-1.30)	1.39 (1.15-1.64)	1.63 (1.33-1.93)	1.88 (1.50-2.24)	2.16 (1.68-2.58)	2.56 (1.92-3.09)	2.89 (2.10-3.52)
30-min	0.755 (0.646-0.863)	0.957 (0.821-1.11)	1.28 (1.09-1.50)	1.56 (1.31-1.83)	1.96 (1.62-2.31)	2.29 (1.87-2.71)	2.65 (2.12-3.15)	3.04 (2.37-3.64)	3.60 (2.70-4.35)	4.06 (2.96-4.96)
60-min	0.994 (0.850-1.14)	1.26 (1.08-1.47)	1.69 (1.44-1.98)	2.05 (1.73-2.40)	2.57 (2.14-3.04)	3.01 (2.46-3.57)	3.48 (2.78-4.14)	3.99 (3.12-4.79)	4.73 (3.56-5.72)	5.35 (3.89-6.52)
2-hr	1.33 (1.14-1.51)	1.72 (1.47-2.00)	2.31 (1.97-2.71)	2.80 (2.37-3.29)	3.52 (2.92-4.16)	4.11 (3.36-4.88)	4.74 (3.80-5.66)	5.43 (4.25-6.52)	6.41 (4.83-7.79)	7.23 (5.28-8.86)
3-hr	1.51 (1.29-1.70)	2.00 (1.72-2.33)	2.70 (2.30-3.16)	3.28 (2.77-3.85)	4.11 (3.41-4.85)	4.80 (3.92-5.70)	5.53 (4.43-6.60)	6.32 (4.94-7.60)	7.46 (5.62-9.05)	8.40 (6.12-10.3)
6-hr	1.94 (1.65-2.21)	2.56 (2.19-2.98)	3.48 (2.96-4.07)	4.23 (3.57-4.97)	5.31 (4.41-6.27)	6.20 (5.09-7.35)	7.14 (5.71-8.51)	8.16 (6.38-9.80)	9.62 (7.24-11.7)	10.8 (7.88-13.2)
12-hr	2.36 (2.01-2.69)	3.14 (2.69-3.66)	4.29 (3.65-5.03)	5.24 (4.42-6.16)	6.59 (5.46-7.78)	7.70 (6.28-9.13)	8.87 (7.08-10.6)	10.1 (7.91-12.1)	11.9 (8.96-14.4)	13.4 (9.72-16.3)
24-hr	2.79 (2.40-3.25)	3.81 (3.27-4.44)	5.28 (4.53-6.16)	6.49 (5.54-7.59)	8.23 (6.97-9.67)	9.66 (8.11-11.4)	11.2 (9.30-13.3)	12.9 (10.6-15.3)	15.2 (12.3-16.4)	17.2 (13.6-20.9)
2-day	3.31 (2.86-3.85)	4.52 (3.90-5.26)	6.24 (5.36-7.26)	7.62 (6.52-8.90)	9.58 (8.12-11.2)	11.2 (9.37-13.1)	12.8 (10.7-15.2)	14.6 (12.0-17.4)	17.1 (13.8-20.6)	19.1 (15.1-23.2)
3-day	3.66 (3.17-4.25)	5.00 (4.33-5.80)	6.88 (5.93-8.01)	8.38 (7.20-9.78)	10.5 (8.92-12.3)	12.2 (10.3-14.3)	13.9 (11.6-16.5)	15.8 (13.0-18.8)	18.4 (14.8-22.1)	20.4 (16.2-24.8)
4-day	4.00 (3.48-4.64)	5.48 (4.75-6.36)	7.52 (6.50-8.75)	9.15 (7.87-10.7)	11.4 (9.72-13.4)	13.2 (11.2-15.5)	15.1 (12.6-17.8)	17.0 (14.0-20.2)	19.7 (15.9-23.6)	21.8 (17.3-26.3)
7-day	4.45 (3.87-5.15)	6.05 (5.26-7.02)	8.29 (7.17-9.64)	10.1 (8.67-11.7)	12.5 (10.7-14.7)	14.5 (12.2-17.0)	16.5 (13.8-19.5)	18.6 (15.4-22.1)	21.5 (17.4-25.8)	23.7 (19.0-28.8)
10-day	4.98 (4.33-5.75)	6.74 (5.86-7.82)	9.20 (7.95-10.7)	11.1 (9.57-13.0)	13.8 (11.7-16.1)	15.8 (13.4-18.6)	18.0 (15.0-21.3)	20.2 (16.7-24.0)	23.2 (18.8-27.9)	25.6 (20.4-31.0)
20-day	6.14 (5.34-7.10)	8.26 (7.18-9.55)	11.1 (9.64-12.9)	13.3 (11.5-15.5)	16.3 (14.0-19.0)	18.6 (15.8-21.8)	20.9 (17.5-24.6)	23.2 (19.2-27.6)	26.4 (21.4-31.6)	28.7 (23.0-34.7)
30-day	7.11 (6.19-8.23)	9.50 (8.25-11.0)	12.7 (11.0-14.7)	15.1 (13.0-17.6)	18.3 (15.6-21.4)	20.7 (17.5-24.3)	23.1 (19.4-27.3)	25.6 (21.1-30.3)	28.7 (23.3-34.4)	31.1 (24.8-37.5)
45-day	8.40 (7.32-9.72)	11.2 (9.70-12.9)	14.8 (12.8-17.1)	17.5 (15.1-20.3)	21.0 (18.0-24.5)	23.7 (20.0-27.7)	26.3 (22.0-30.9)	28.8 (23.8-34.2)	32.1 (26.0-38.5)	34.5 (27.5-41.7)
60-day	9.51 (8.29-11.0)	12.6 (10.9-14.5)	16.5 (14.3-19.1)	19.5 (16.8-22.6)	23.3 (19.9-27.2)	26.1 (22.1-30.6)	28.9 (24.2-34.1)	31.6 (26.1-37.5)	35.1 (28.5-42.1)	37.6 (30.0-45.5)

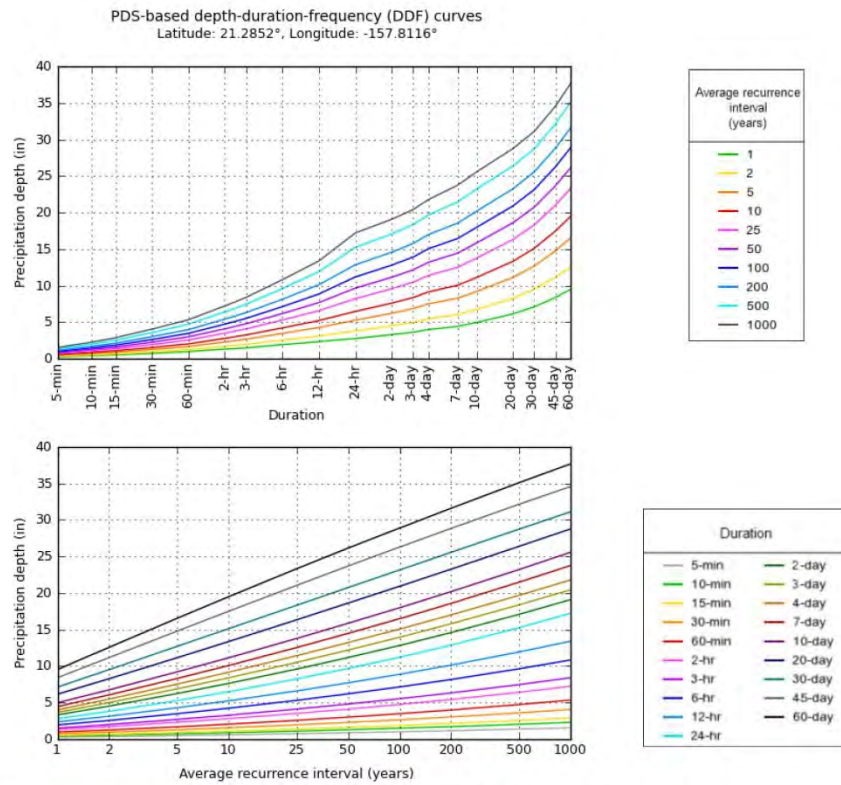
¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.
Please refer to NOAA Atlas 14 document for more information.

[Back to Top](#)

PF graphical

Precipitation Frequency Data Server

http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_printpage.html?lat=21.2852&lon=-157.8116



NOAA Atlas 14, Volume 4, Version 3

Created (GMT): Fri Aug 26 23:18:59 2016

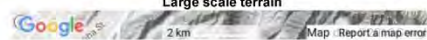
[Back to Top](#)

Maps & aerals

Small scale terrain



Large scale terrain



Precipitation Frequency Data Server

http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_printpage.html?lat=21.2852&l...



[Back to Top](#)

US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

[Disclaimer](#)