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October 7, 2013

Ms. Heidi Schum, Engineering Review Manager
City of Boulder - Engineering Development Review
1739 Broadway
Boulder, CO 80306

RE: Preliminary Stormwater Report
The Wencel Building
1301 Walnut Street
Boulder, CO 80302
JVA No. 2129c

Dear Heidi:

As requested by City of Boulder, JVA has prepared an analysis of the historic and developed drainage patterns for the proposed redevelopment at 1301 Walnut Street. The following stormwater report has been produced in accordance with the "City of Boulder Design & Construction Standards, 2000 Edition" and comply with provisions thereof. It is our understanding that the information provided herein meets the requirements of the City of Boulder for the drainage submission required for this submittal. No further report is anticipated due to the simplicity of this site.

GENERAL LOCATION AND PROJECT DESCRIPTION

The W.W. Reynolds Companies is proposing the demolition and reconstruction of the existing building located at 1301 Walnut Street in the City of Boulder, Colorado. The subject property is approximately 0.46 acres of fully developed land located in the Southwest ¼ of Section 30, Township 1 North, Range 70 West of the 6th Principle Meridian, City of Boulder, County of Boulder, State of Colorado. More specifically, the property is bound by a 20' public alley to the north, a commercial building to the east, Walnut Street to the south, and 13th Street to the west. The existing site contains a multi-story brick building. A vicinity map is included at the end of this letter.

The proposed development will include a three story mixed used building with on-grade covered garage parking and a basement level. The footprint of the proposed building is approximately 17,389 square feet. The entry into the building's covered parking will be access off of Walnut Street. Trash access to the site will be from the alley to the north. The building will have a second floor plaza which will provide water quality for the site. In addition to the building the proposed development will include minor re-grading, sidewalk paving, landscaping, and all associated utility infrastructure.

HISTORIC DRAINAGE

The subject site is generally located between 5346 feet and 5342 feet on the City of Boulder datum. Existing grades generally slope from west to east at approximately 1% to 3%. There are no offsite basin areas tributary to the site. The existing site is currently fully developed and houses an existing brick building and a parking lot.

JVA reviewed FEMA Flood Insurance Rate Map Community Panel Number 08013C0394J, dated December 18, 2012 and determined that no portion of the the site lies within FEMA's Special Flood Hazard Area (Base Flood or 100-year floodplain.) A copy of a portion of the referenced flood map is included in the Appendix.

The site's ultimate outfall is Boulder Creek located to the south of the subject development.

The existing site is shown as one drainage basin. Locations of the existing drainage basin is shown on the Historic Drainage Map (see attached Figure 1). The existing percent imperviousness for the site is 95.1%.

Basin H1 (0.46 acres) houses the entire site. Runoff from the eastern portion of the site is directed east into a drainage pan which travels along the eastern edge of the parking lot. This drainage pan directs runoff into an inlet located at the northeastern corner of the site which directs runoff into a public storm sewer system located in the alley to the north of the site. Runoff to the west of the site is directed into the public storm system in 13th Street. Runoff along the southern edge of the site is directed into Walnut Street where it flows into a public storm system at the intersection of 14th Street and Walnut Street. All three storm system ultimately flow into Boulder Creek.

Historic runoff from the site is calculated to be 0.23 cfs for the minor (5-year) storm event and 4.18 cfs for the major (100-year) storm event. Due to the existing urban nature of the development of the site, no detention facilities are present on the site prior to this project.

DEVELOPED (PROPOSED) DRAINAGE

The developed site has been divided into four drainage basins. Please refer to the Developed Drainage Map (see attached Figure 2). Sub-basin boundaries were established based on outfall location. In general, runoff from the site will follow the historic pattern.

The developed site is composed of three drainage basins, representing the total site area. The basin boundaries were established based on design points corresponding to locations where runoff leaves the property.

Basin R1 (0.26 acres) collects runoff from the eastern portion of the proposed building's roof. Flows from R1 are directed into a roof drain which ties into the existing storm sewer system at the northeast corner of the site.

Basin R2 (0.14 acres) collects runoff from the western portion of the proposed building's roof. Flows from R2 are directed into a roof drain which ties into the existing storm sewer system located within 13th Street.

Basin A1 (0.02 acres) is located to the south of the building and houses a courtyard. Runoff from A1 sheet flows overland into Walnut Street.

Basin B1 (0.04 acres) is located to the north of the building and houses a walkway. Runoff from B1 sheet flows overland into the alley to the north the site.

All runoff from the proposed site will flow into the established street drain system along 13th Street, Walnut Street, and the alley to the north of the site and ultimately flow into Boulder Creek matching the historic drainage pattern. The following Table 1 is a summary of the historic and proposed developed runoff:

Table 1: Runoff Summary

	Area (acres)	Imperviousness (%)	100 Year Flow (cfs)	5 Year Flow (cfs)
H1	0.46	95.5	4.18	2.23
Total**	**0.46**	**95.1**	**4.18**	**2.23**
R1*	0.26	90.0	2.37	1.28
R2*	0.14	90.0	1.22	0.66
A1*	0.02	78.8	0.17	0.08
B1*	0.04	95.3	0.35	0.19
Total**	**0.46**	**90.0**	**4.12**	**2.21**

*Flows Represent Direct Runoff
**Total Flows Represent Routed Runoff

To adhere to Boulder Design and Construction Standards, storm water quality enhancements will be provided onsite to the greatest extent feasible for this small site. Water quality enhancements will be achieved by removing the surface parking lot, thereby preventing oils, sediment and trash from entering the public storm system. The proposed roof top runoff will inherently be of better quality when compared to existing site runoff from the parking lot. In addition, the building will have a second floor plaza with landscape planters. These landscape planters will provide water quality enhancement to approximately 30% of the building's roof drainage. The owner understands that these water quality features will require proper short and long term maintenance to maintain proper water quality enhancement and drainage functionality.

No detention facilities have historically been present on the site due to the developed nature of this urban site. No detention facilities are proposed as a part of this new development due to the negligible changes in runoff flows. Changes to the historic runoff flows and drainage patterns as a result of the proposed development will be negligible and all flows will remain in the street drainage system of 13th Street, Walnut Street, and the alley to the north of the site. Runoff from the site will be improved by removing a parking lot and directing a portion of the site's roof drainage through a water quality landscape planter system.

CONCLUSIONS

The impervious area of the historic site and the proposed site are very similar, with a slight decrease in imperviousness for the proposed development conditions. The water quality landscape planters will reduce storm water runoff and improve the water quality of the flows leaving the site.

No detention facilities have historically been present on the site due to the developed nature of this urban site. No changes to the historic runoff flows and drainage patterns will result from the proposed development and all flows will continue to flow to the street drainage system at 13th Street, Walnut Street, and the alley to the north of the site. All flows from the site ultimately pass into Boulder Creek.

Please note that this stormwater report was prepared under my direct supervision in accordance with the City of Boulder Design and Construction Standards, effective November 16, 2000, and complies with the provisions thereof. It is understood that the City of Boulder does not and will not assume liability for drainage facilities designed by others.

If you have any questions or comments regarding this Preliminary Stormwater Report submission, please feel free to call us to discuss.

JVA, INCORPORATED

Darren N. Stewart, PE #38976
Project Manager

Charles R. Hager, IV, P.E. #37146
Professional Engineer

Attachments:
- Vicinity Map
- FEMA Firm Map
- City of Boulder Floodplain Map
- City of Boulder Tables
- Calculations
- Figure 1 – Historic Drainage Map
- Figure 2 – Developed Drainage Map

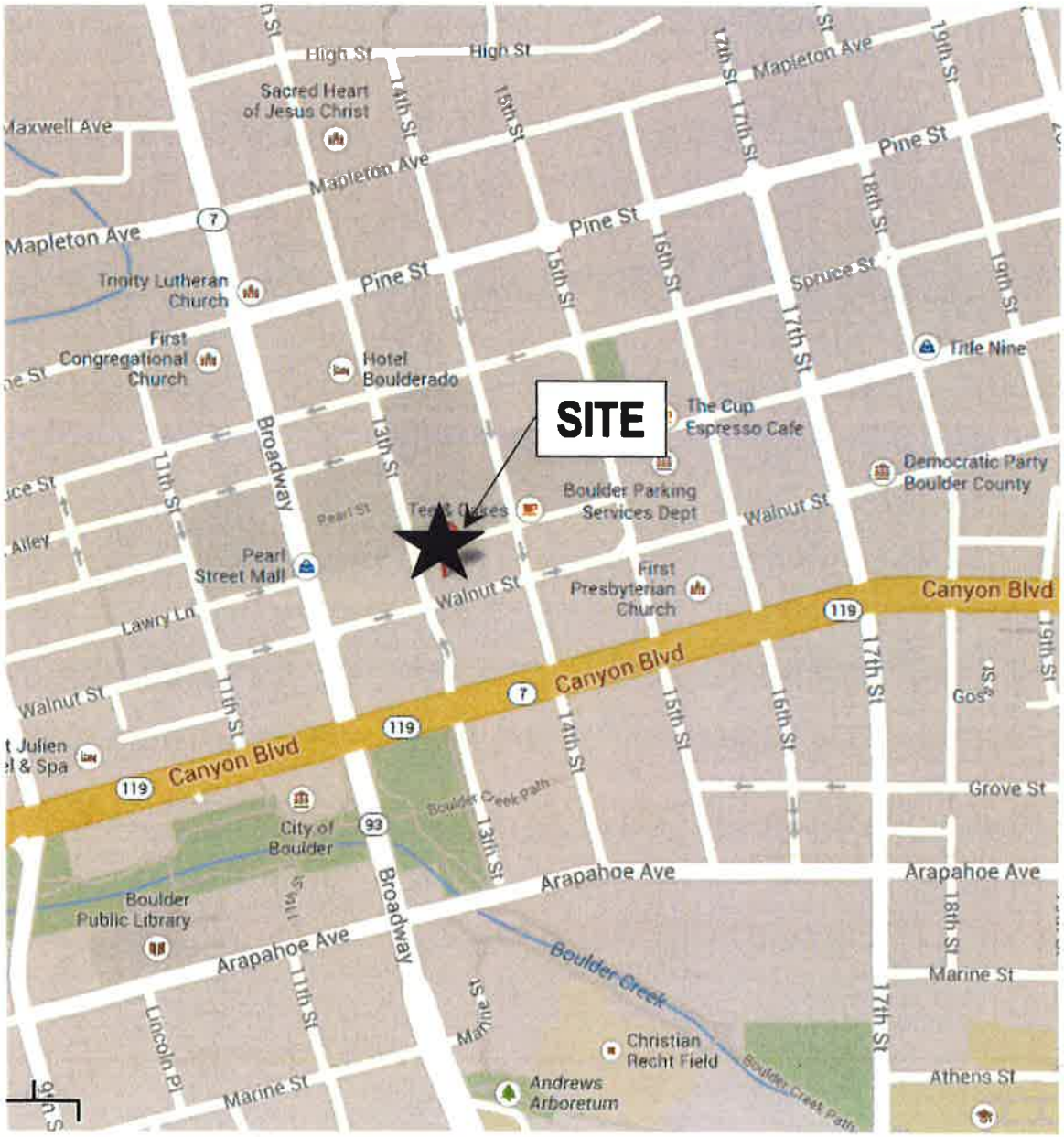
THE WENCEL BUILDING

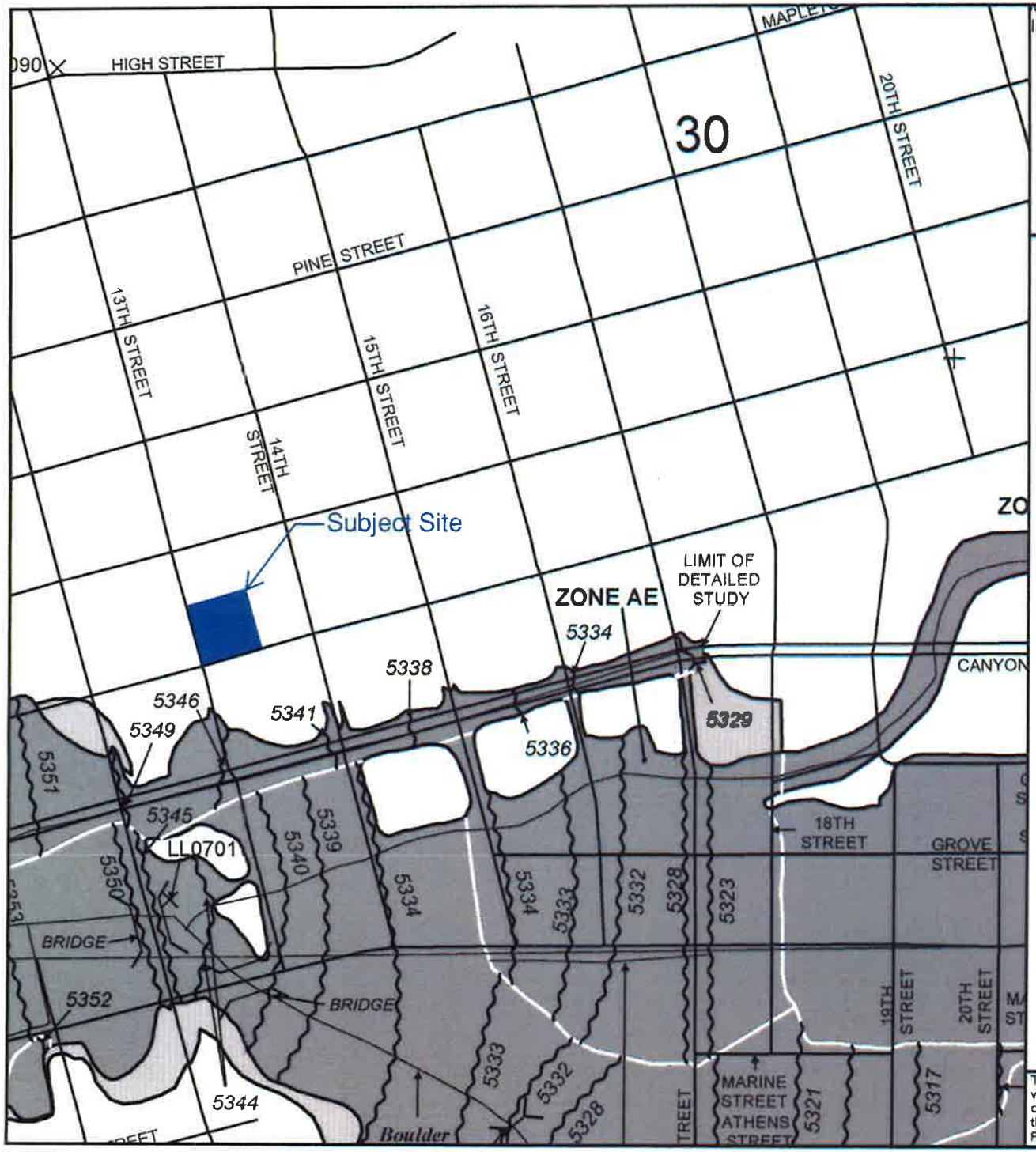
AT

1301 WALNUT STREET

BOULDER, COLORADO 80302

VICINITY MAP – NOT TO SCALE





Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0394J

FIRM

FLOOD INSURANCE RATE MAP

BOULDER COUNTY, COLORADO

AND INCORPORATED AREAS

PANEL 394 OF 615

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
BOULDER, CITY OF	080024	0394	J

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
08013C0394J

MAP REVISED
DECEMBER 18, 2012

Federal Emergency Management Agency

THE WENCEL BUILDING

AT

1301 WALNUT STREET

BOULDER, COLORADO 80302

City of Boulder Floodplain Map

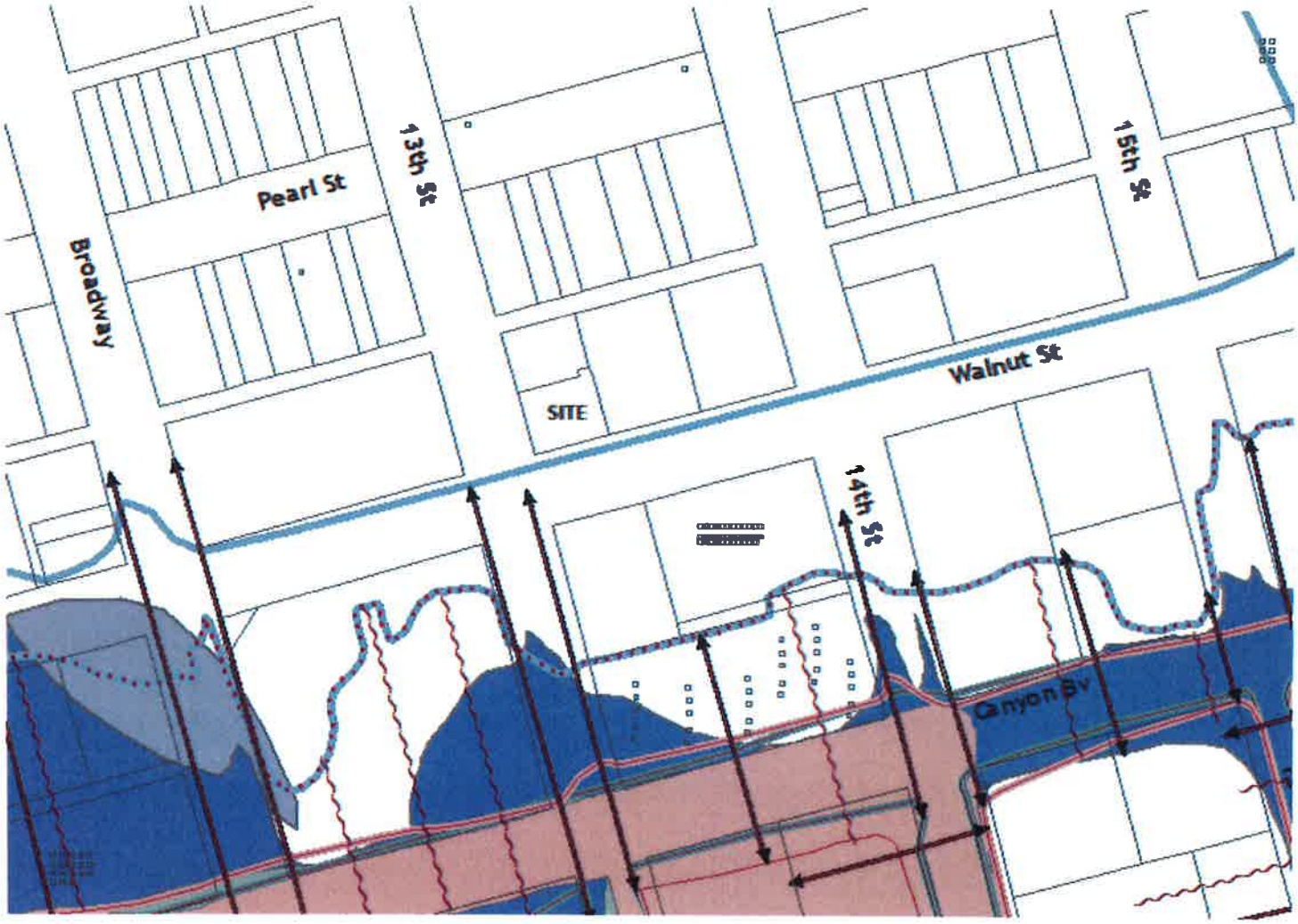


FIGURE 7-1

RAINFALL
INTENSITY-DURATION-FREQUENCY
FOR
CITY OF BOULDER
BOULDER, COLORADO

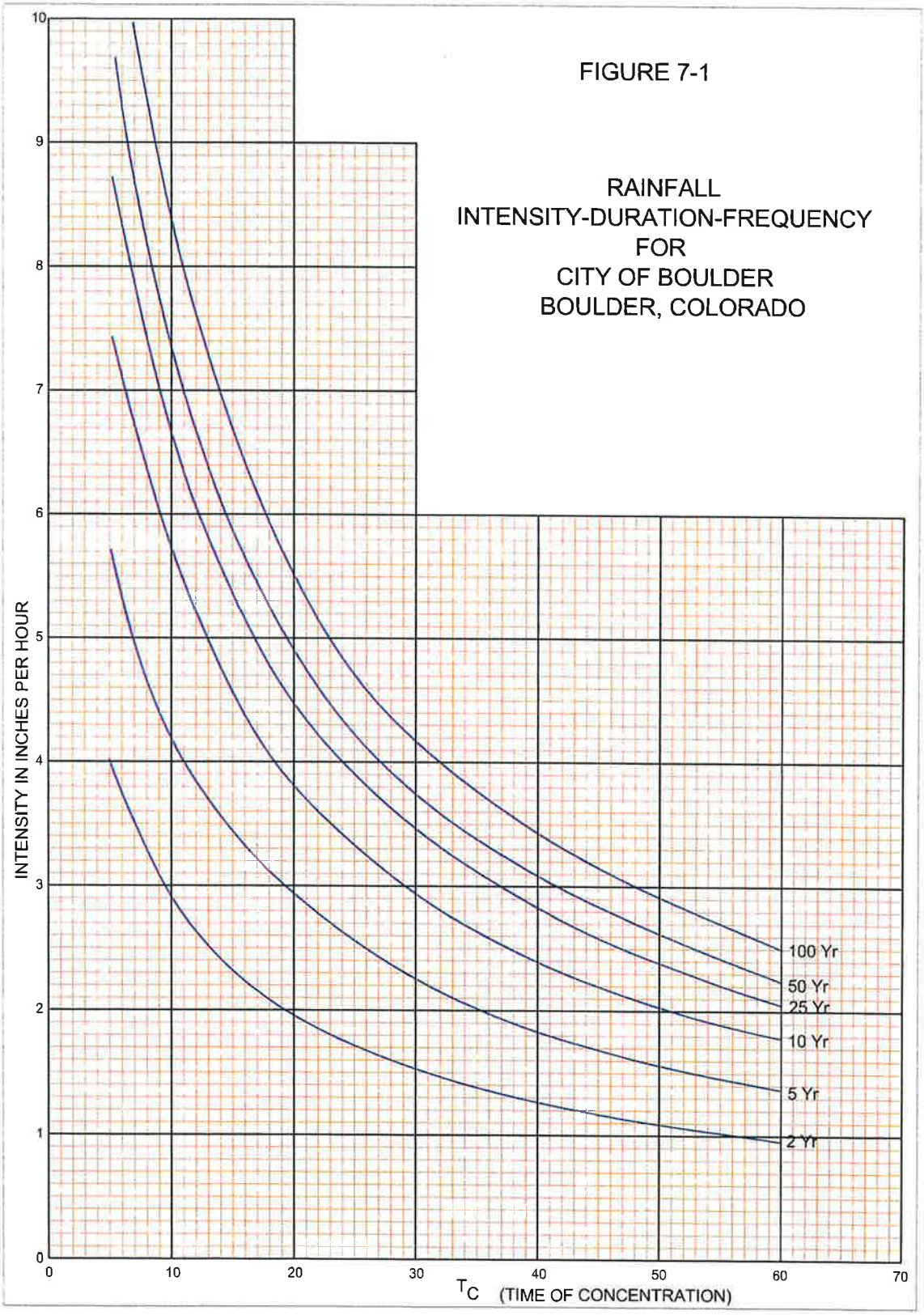


Table 7-2: Runoff Coefficients for the Rational Method

LAND USE OR SURFACE CHARACTERISTICS	PERCENT IMPERVIOUS	STORM FREQUENCY			
		2-Yr	5-Yr	10-Yr	100-Yr
Business:					
Commercial Areas	95	0.87	0.88	0.90	0.93
Neighborhood Areas	65	0.60	0.65	0.70	0.80
Residential:					
Single-Family	40	0.40	0.45	0.50	0.70
Multi-Unit (detached)	50	0.50	0.55	0.60	0.75
Multi-Unit (attached)	70	0.65	0.70	0.70	0.80
½ Acre Lot	30	0.30	0.40	0.45	0.65
Apartments	70	0.65	0.70	0.70	0.80
Industrial:					
Light Areas	80	0.75	0.80	0.80	0.85
Heavy Areas	90	0.80	0.80	0.85	0.90
Parks, Cemeteries:	7	0.15	0.25	0.35	0.60
Playgrounds:	13	0.20	0.30	0.40	0.70
Schools:	50	0.50	0.55	0.60	0.75
Railroad Yard Areas:	40	0.40	0.45	0.50	0.70
Undeveloped Areas:					
Historic Flow Analysis	2	0.10	0.20	0.30	0.60
Greenbelts, Agricultural	-	-	-	-	-
Offsite Flow Analysis (when offsite land use is not defined)	45	0.45	0.50	0.55	0.72
Streets:					
Paved	100	0.87	0.88	0.90	0.93
Gravel	7	0.15	0.25	0.35	0.65
Drives and Walks:	96	0.85	.087	0.90	0.92
Roofs:	90	0.80	0.85	0.90	0.90
Lawns:					
Sandy Soil	0	0.00	0.10	0.20	0.50
Clayey Soil	0	0.10	0.20	0.30	0.60

NOTE: These rational formula coefficients do not apply for larger basins where the time-of-concentration exceeds 60 minutes.

(Source: Urban Drainage and Flood Control District)

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By: DIB

	I%	C2	C5	C10	C100
Streets Paved	100%	0.87	0.88	0.90	0.93
Concrete Drives/Walks	96%	0.85	0.87	0.90	0.92
Roof	90%	0.80	0.85	0.90	0.90
Gravel	7%	0.15	0.25	0.35	0.65
Landscaping (B soil)	0%	0.00	0.10	0.20	0.50
Landscaping (C/D soil)	0%	0.10	0.20	0.30	0.60
Playground	13%	0.20	0.30	0.40	0.70
Artificial Turf	25%	0.28	0.38	0.43	0.62

Wencel Building

Historic Runoff Coefficient & Time of Concentration Calculations

Location: Boulder
Minor Design Storm: 5
Major Design Storm: 100
Soil Type: C/D

Basin Design Data

	I (%) =	100%	96%	90%	7%	13%	25%	0%	0%			I (%)	Runoff Coeff's				Initial Overland Time (t_i) $t_i = 0.395(1.1-C_5)L^{1/2}S^{-1/3}$			Travel Time (t_t) t_t=Length/(Velocity x 60)						t_c Comp	tc Urbanized Check ON		t_c Final
Basin Name	Design Point	$A_{paved\ streets}$ (sf)	$A_{drives/conc}$ (sf)	A_{roof} (sf)	A_{gravel} (sf)	A_{plygnd} (sf)	$A_{art.\ turf}$ (sf)	$A_{lscape\ (B\ soil)}$ (sf)	$A_{lscape\ (C/D\ soil)}$ (sf)	A_{Total} (sf)	A_{Total} (ac)	Imp (%)	C2	C5	C10	C100	Upper most Length (ft)	Slope (%)	t_i (min)	Length (ft)	Slope (%)	Type of Land Surface	C_v	Velocity (fps)	t_t (min)	Time of Conc $t_i + t_t = t_c$	Total Length (ft)	t_c=(L/180)+ 10 (min.)	Min t_c
H1	H1	14,156	818	4,447	0	0	0	0	505	19,926	0.46	95.1%	0.83	0.86	0.88	0.91	105	2.0%	3.6	81	1.0%	Paved areas & shallow paved swales	20	2.0	0.7	4.3	186	11.0	5.0
										0	0.00											Paved areas & shallow paved swales	20				0	10.0	
										0	0.00											Paved areas & shallow paved swales	20				0	10.0	
										0	0.00											Paved areas & shallow paved swales	20				0	10.0	
										0	0.00											Paved areas & shallow paved swales	20				0	10.0	
TOTAL SITE		14,156	818	4,447	0	0	0	0	505	19,926	0.46	95.1%	0.83	0.86	0.88	0.91													

			Runoff Coeff's				Rainfall Intensities (in/hr)				Area		Flow Rates (cfs)			
Basin Name	Design Point	Time of Conc (tc)	C2	C5	C10	C100	2	5	10	100	A_{Total} (sf)	A_{Total} (ac)	Q2	Q5	Q10	Q100
H1	H1	5.0	0.83	0.86	0.88	0.91	4.00	5.70	7.45	10.00	19,926	0.46	1.53	2.23	3.02	4.18
0	0										0	0.00				
0	0										0	0.00				
0	0										0	0.00				
0	0										0	0.00				
										TOTAL SITE	19,926	0.46	1.53	2.23	3.02	4.18

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	I%	C2	C5	C10	C100
Streets Paved	100%	0.87	0.88	0.90	0.93
Concrete Drives/Walks	96%	0.85	0.87	0.90	0.92
Roof	90%	0.80	0.85	0.90	0.90
Gravel	7%	0.15	0.25	0.35	0.65
Landscaping (B soil)	0%	0.00	0.10	0.20	0.50
Landscaping (C/D soil)	0%	0.10	0.20	0.30	0.60
Playground	13%	0.20	0.30	0.40	0.70
Artificial Turf	25%	0.28	0.38	0.43	0.62

Wencel Building

Composite Runoff Coefficient Calculations

Location: Boulder
Minor Design Storm: 5
Major Design Storm: 100
Soil Type: C/D

Basin Design Data

	I (%) =	100%	96%	90%	7%	13%	25%	0%	0%			I (%)	Runoff Coeff's			
Basin Name	Design Point	A_{paved} streets (sf)	$A_{drives/conc}$ (sf)	A_{roof} (sf)	A_{gravel} (sf)	A_{plygnd} (sf)	A_{art_turf} (sf)	$A_{lscape\ (B\ soil)}$ (sf)	$A_{lscape\ (C/D\ soil)}$ (sf)	A_{Total} (sf)	A_{Total} (ac)	Imp (%)	C2	C5	C10	C100
R1	1	0	0	11,492	0	0	0	0	0	11,492	0.26	90.0%	0.80	0.85	0.90	0.90
R2	2	0	0	5,897	0	0	0	0	0	5,897	0.14	90.0%	0.80	0.85	0.90	0.90
A1	3	0	625	89	0	0	0	0	149	862	0.02	78.8%	0.72	0.75	0.80	0.86
B1	4	0	1,478	200	0	0	0	0	0	1,678	0.04	95.3%	0.84	0.87	0.90	0.92
TOTAL SITE		0	2,102	17,677	0	0	0	0	149	19,928	0.46	90.0%	0.80	0.85	0.90	0.90

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Wencel Building

Time of Concentration Calculations

Location:	Boulder
Minor Design Storm:	5
Major Design Storm:	100
Soil Type:	C/D

Sub-Basin Data				Initial Overland Time (t_i)			Travel Time (t_t) t_t=Length/(Velocity x 60)						t_c Comp	tc Urbanized Check ON		t_c Final
Basin Name	Design Point	A_{Total} (ac)	C5	Upper most Length (ft)	Slope (%)	t_i (min)	Length (ft)	Slope (%)	Type of Land Surface	C_v	Velocity (fps)	t_t (min)	Time of Conc $t_i + t_t = t_c$	Total Length (ft)	t_c=(L/180) +10 (min)	Min t_c
R1	1	0.26	0.85	129	2.0%	4.1	0	2.0%	Paved areas & shallow paved swales	20	2.8	0.0	4.1	129	10.7	5.0
R2	2	0.14	0.85	90	2.0%	3.4	0	2.0%	Paved areas & shallow paved swales	20	2.8	0.0	3.4	90	10.5	5.0
A1	3	0.02	0.75	30	2.0%	2.7	0	2.0%	Paved areas & shallow paved swales	20	2.8	0.0	2.7	30	10.2	5.0
B1	4	0.04	0.87	135.4	1.0%	4.9	0	2.0%	Paved areas & shallow paved swales	20	2.8	0.0	4.9	135.4	10.8	5.0

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Wencel Building

Developed Storm Runoff Calculations

Design Storm : **100 Year**

Point Hour Rainfall (P_1) : **2.50**

	Direct Runoff							Total Runoff				Inlets			Pipe					Pipe/Swale Travel Time				
Basin Name	Design Point	Area (ac)	Runoff Coeff	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	Total tc (min)	ΣC*A (ac)	I (in/hr)	Q (cfs)	Inlet Type	Q intercepted	Q carryover	Pipe Size (in) or equivalent	Pipe Material	Slope (%)	Pipe Flow (cfs)	Max Pipe Capacity (cfs)	Length (ft)	Velocity (fps)	tt (min)	Total Time (min)	Notes
R1	1	0.26	0.90	5.00	0.24	10.00	2.37																	
R2	2	0.14	0.90	5.00	0.12	10.00	1.22																	
A1	3	0.02	0.86	5.00	0.02	10.00	0.17																	
B1	4	0.04	0.92	5.00	0.04	10.00	0.35																	
			Total from Site (R1, R2, A1, B1)					5.00	0.41	10.00	4.12													

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Wencel Building

Developed Storm Runoff Calculations

Design Storm : 5 Year

Point Hour Rainfall (P_1) : 1.35

	Direct Runoff							Total Runoff				Inlets			Pipe					Pipe/Swale Travel Time				
Basin Name	Design Point	Area (ac)	Runoff Coeff	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	Total tc (min)	ΣC*A (ac)	I (in/hr)	Q (cfs)	Inlet Type	Q intercepted	Q carryover	Pipe Size (in) or equivalent	Pipe Material	Slope (%)	Pipe Flow (cfs)	Max Pipe Capacity (cfs)	Length (ft)	Velocity (fps)	tt (min)	Total Time (min)	Notes
R1	1	0.26	0.85	5.00	0.22	5.70	1.28																	
R2	2	0.14	0.85	5.00	0.12	5.70	0.66																	
A1	3	0.02	0.75	5.00	0.01	5.70	0.08																	
B1	4	0.04	0.87	5.00	0.03	5.70	0.19																	
			Total from Site (R1, R2, A1, B1)					5.00	0.39	5.70	2.21													