

December 18, 2024

Town of Grand Lake 1026 Park Avenue Grand Lake, CO 80447 970-627-3435

## **Drainage Conformance Letter**

Subject: Drainage Conformance and Culvert Sizing Project Location: The Gateway Inn, 120 Lake Avenue, Grand Lake, CO 80447

Town of Grand Lake,

Bowman Consulting is the Engineer of Record representing The Gateway Inn regarding the improvements located at 120 Lake Avenue, Grand Lake, CO 80447. Our project involves improving the parking lot and stabilizing the drainage flows to avoid rutting and washout issues onto W. Portal Road. To accomplish this, the following work is being proposed:

- 1. Stabilize paving in the drainage area west of the building
- 2. Adjust the rip-rap at the edge of paving at the point of discharge from the pavement area
- 3. Add a culvert at the trail crossing with associated rip-rap at the culvert entrance and exit.

The total contributing drainage area including pavement and roof is 29,680 sf. The direct runoff based on a 100-yr, 1-hour storm event is 3.1 cfs. Based on velocities ranging from 3 fps to 10 fps, the culvert size would range from 0.71' to 1.29' or 12" to 18". Therefore, an 18" CMP culvert is being proposed. Hydrology and calculation worksheets are attached for reference.

The proposed work provides adequate infrastructure to direct runoff to the existing wetland to avoid future rutting and washout towards W. Portal Road while improving the overall hydration of the existing wetland.

Thank you for your attention to this matter. Please feel free to contact us at (303) 801-2905 or <u>hehrsam@bowman.com</u> for any inquiries or discussions related to drainage conformance.

Sincerely, Bowman Consulting Group, Itd 54031 Howard Ehrsam, P.E. Sr Project Manager

Enclosure: Hydrology and Calculation Worksheets

# Table 400 ADJUSTMENT FACTORS TO OBTAIN N-MINUTE ESTIMATES FROM ONE-HOUR VALUES

Duration							
(minutes)	5	10	15	30			
Ratio to 1-Hr							
Depth	0.29	0.45	0.57	0.79			

From NOAA Atlas 2 Vol. III Table 12

## Table 401 ONE-HOUR DESIGN POINT RAINFALL VALUES FOR VARIOUS PARTS OF GRAND COUNTY

	5-YR	10-YR	100-YR
FRASER	0.88	1.01	1.64
GRAND LAKE	0.88	0.99	1.47
GRANBY	0.80	0.95	1.43
KREMMLING	0.78	0.90	1.43

From NOAA Atlas 2 Vol. III Table 11

Engineering discretion should be used when performing analysis outside these areas. All pertinent information concerning the NOAA Atlas should be referenced and applied as site location dictates.

#### POST-DEVELOPMENT C VALUES

				_			Doutreson
Designer:	Howard Ehrsam, P.E.	Global Parameters	Global Parameters <sup>1</sup>			ry	bowman
Company:	BOWMAN	Land Use	% Imp.	]	Total Area (ac)	0.68	CONSULTING
Date:	12/18/2024	Open Space/Landscaping	2	1	Composite Impervious	100.0%	Cells of this color are for required user-input
Project:	Gateway Inn	Hardscape	100				Cells of this color are for optional user-input
Location:	Grand Lake	Roof	100				<sup>1</sup> From Table 6-3 in UDFCD Volme 1
							<sup>2</sup> From Table 6-4 in UDFCD Volme 1
				1			

Subcatchment Name	Area	NRCS Hydrologic Soil Group	Open Space/Landscaping		Hardscape		Roof		% Check	Percent	Runoff Coefficient, C <sup>2</sup>							
	(ac)		Area (ac)	%	Area (ac)	%	Area (ac)	%		Imperviousness	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	
A	0.68	D	0.00	0.0%	0.52	76.8%	0.16	23.2%	100.00%	100.0%	0.83	0.85	0.87	0.88	0.89	0.89	0.90	

### TIME OF CONCENTRATION

Designer:	Howard Eh	rsam, P.E.							r			Bo	vm	an	
Company: Date:	BOWMAN 12/18/2024			-	$t_i = -$	).395(1.1 - S; <sup>0.3</sup>	$-C_5)\sqrt{L_i}$	Computed t <sub>c</sub> =	Computed $t_c = t_i + t_t$ $t_{minimum} = 10 (non-urban)$ Cells of this color are for required user-input						
Project:	Gateway In	n		L_+			L <sub>t</sub>								
Location:	Grand Lake	•		$t_t = \frac{-t}{60K\sqrt{S_t}} = \frac{-t}{60V_t}$			$\overline{60V_t}$	Regional t <sub>c</sub> =	= (26 – 17i)	$+\frac{1}{60(14i+9)}$	$\sqrt{S_t}$ Sel	ected t <sub>c</sub> = max{	(t <sub>minimum</sub> , mi	n(Computed	t <sub>c</sub> , Regional t <sub>c</sub> )}
	Subbasi	n Data		Overland (Initial) Flow Time				Channe	lized (Travel)	Flow Time			Time of C	Concentration	
				Overland	Overland	Overland	Channelized	Channelized	NDCS	Channelized	Channelized				
Sub-Basin	Area	% Impervious	C5	Flow Length L <sub>i</sub> (ft)	Flow Slope S <sub>i</sub> (ft/ft)	Flow Time t <sub>i</sub> (min)	Flow Length L <sub>t</sub> (ft)	Flow Slope S <sub>t</sub> (ft/ft)	Conveyance Factor K	Flow Velocity V <sub>t</sub> (ft/sec)	Flow Time t <sub>t</sub> (min)	Computed t <sub>c</sub> (min)	Regional t <sub>c</sub> (min)	Selected t <sub>c</sub> (min)	
А	0.68	100.0%	0.85	75.00	0.010	3.91	20.00	0.010	20	2.00	0.17	4.08	9.14	5.00	
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#### STORM DRAINAGE SYSTEM DESIGN - 100-YEAR DESIGN STORM

Designer:	Howard Ehrsam, P.E.
Company:	BOWMAN
Date:	12/18/2024
Project:	Gateway Inn
Location:	Grand Lake



Cells of this color are for required user-input Cells of this color are for optional user-input

	STREET/	DIRECT RUNOFF			TOTAL RUNOFF			STREET PIPE			TRAVEL TIME												
DESGIN POINT	CONTRIBUTING	Area	Area	Coeff	Тс	C*A	Т	Q	Тс	Sum Area	Sum C*A	I	Q	Slope	Street Q	Design Q	Slope	PIPE	L	VEL	Tt	Q add'l	Remarks
	BASINS	Design	(ac)	с	(min)	(ac)		(cfs)	(min)	(ca)	(ac)	in/hr	cfs	%	cfs	cfs	%	SIZE	ft	ft/sec	min		
		A	0.68136	0.89	5.0	0.61	4.99	3.0								3.0							

Culvert Siz	Culvert Sizing Calculation							
Q=	3.03	cfs						
V=	2	fs						
A=	1.517	sf						
D-ft=	1.57	ft						
D-in=	18.83	in						
Q=	3.03	cfs						
V=	7	fs						
A=	0.433	sf						
D-ft=	0.84	ft						
D-in=	10.06	in						

Project Description							
Friction Method	Manning Formula						
Solve For	Normal Depth						
Innut Data							
Roughness Coefficient	0.024						
Channel Slope	6.500 %						
Normal Depth	5.6 in						
Diameter	18.0 in						
Discharge	3.03 cfs						





V: 1 H: 1

Untitled1.fm8 12/18/2024 Bentley Systems, Inc. Haestad Methods Solution Center 27 Siemon Company Drive Suite 200 W Watertown, CT 06795 USA +1-203-755-1666 FlowMaster [10.03.00.03] Page 1 of 1