

Hydrology Calibration Meeting Minutes

Van Bibber Creek Major Drainageway Plan

Tuesday July 28, 2020

1:00 pm Virtual Meeting on Microsoft Teams

Attendees:

Name	Company	E-mail
John Conn	Jefferson County	jconn@co.jefferson.co.us
Andy Stewart	Arvada	astewart@arvada.org
Brooke Seymour	MHFD	bseymour@udfcd.org
Shea Thomas	MHFD	sthenas@udfcd.org
Amy Gabor	Olsson	agabor@olsson.com
Deb Ohlinger	Olsson	dohlinger@olsson.com
Madison Stewart	Olsson	mstewart@olsson.com

Discussion Items:

The main purpose of the meeting was to discuss the calibration process and results for the Van Bibber Creek watershed peak flows. While this summary is not intended to represent a comprehensive account of the meeting, it is intended to reflect the key points raised and issues for further consideration and to identify the action items resulting from the discussions. The non-bold items comprised the meeting agenda. The bold items resulted from the discussions.

- 1) Introductions
- 2) Upper watershed calibration
 - a. Evaluated full, discretized model upstream of Highway 93 using GARR data
 - b. Evaluated a seven subbasin model upstream of Highway 93 using GARR data

Table 1 – Upper Watershed Comparisons with GARR data

Study	Location	Tributary Area	Peak Flow	Unit Discharge	Peak Flow Percent Difference with 2013 Gage Data
		(acres)	(cfs)	(cfs/acre)	(%)
Draft 2020 MDP Calibration Discretized	DP147 @HWY 93	6096	1135	0.19	51%
Draft 2020 MDP Calibration Seven	DP147 @HWY 93	6096	712	0.12	-5%
September 11-13, 2013 Arvada Flood Event	Van Bibber Creek at Gage 333 Hwy 93	6096	750	0.12	---

- c. Based on results, the discretized model (70 subbasins) over-estimates peak flows in the foothills. Recommend proceeding with seven subbasin model upstream of Highway 93. Lower watershed results are based on utilizing the seven subbasin model.

3) Lower watershed calibration

- a. Compared hydrology models to 1974 Phase A, 1977 Phase B, 1977 Ralston MDP, 1986 MDP, and 2004 Ralston MDP
 - i. Percent imperviousness for each study is similar to the 2020 existing and future conditions models. Comparisons were made to the model that most closely matched the previous study
 - ii. Comparisons based on unit discharge
 - iii. Evaluated models using rainfall values from previous studies
 - iv. Previous studies all similar to each other, but lower than this study, even after accounting for rainfall
 - v. Time to peak was determined to be affecting the peak flows

Table 2 – Previous Studies Comparisons

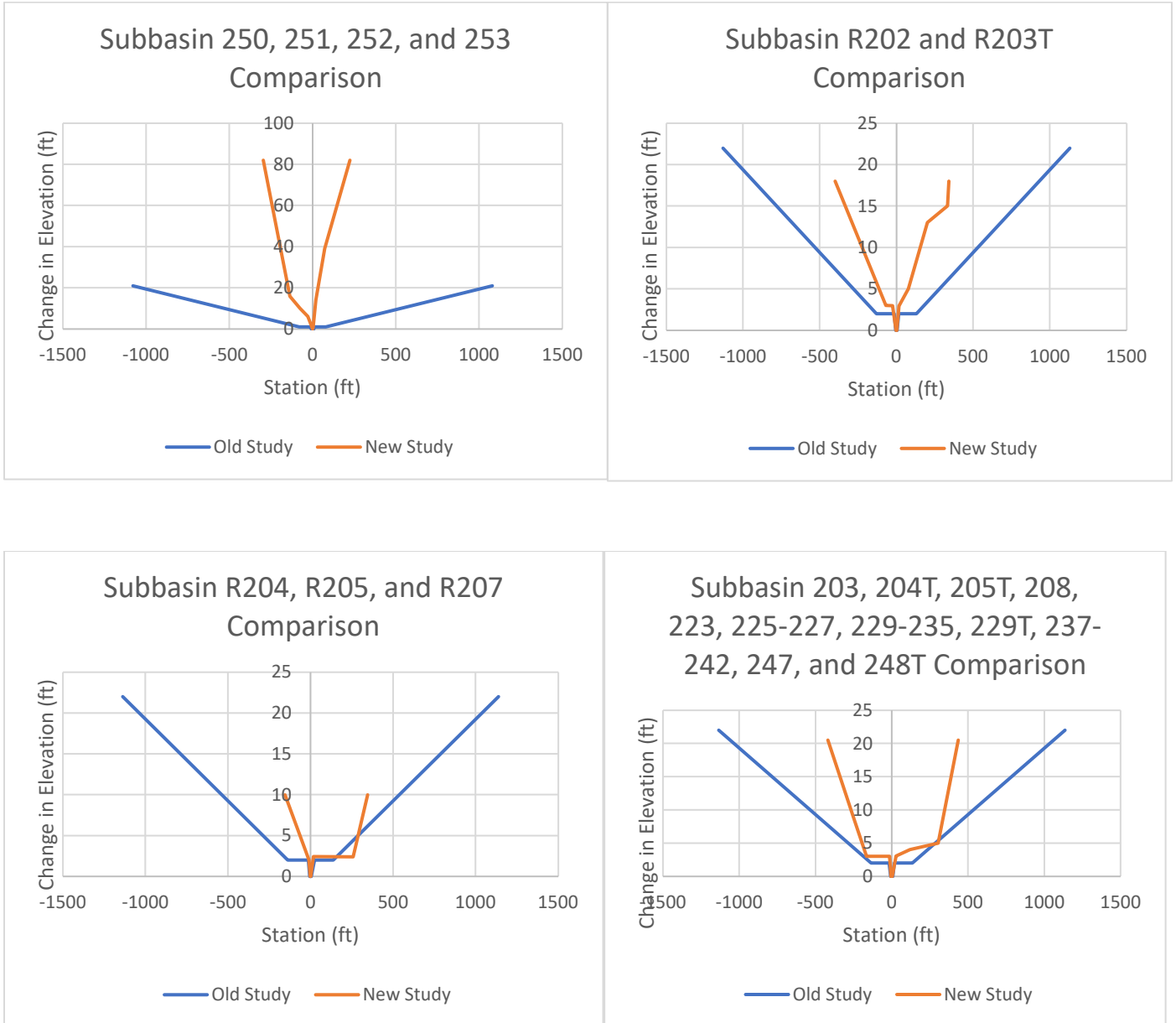
Location	Parameter	1974 Phase A	1977 Phase B	1977 Ralston MDP	1986 MDP	2004 Ralston MDP	2020 Rec EX	2020 Rec FTR	2020 Future with 1974 Phase A Rainfall	2020 Future with 1977 Phase B Rainfall	2020 Existing with 1986 MDP Rainfall
D/S End at Ralston Creek (Design Point 100)	Tributary Area (sm)	17.52	17.52	17.1	17.13	17.67	17.43	17.43	17.43	17.43	17.43
	Imp. (%)	18.49	18.49	8.16	11.36	10.98	11.05	18.32	18.32	18.32	11.05
	100-Year Peak Flow	3480	3450	3400	2700	3157	5046	5237	4421	6702	4822
	Unit Discharge (cfs/ac)	0.31	0.31	0.31	0.25	0.28	0.45	0.47	0.40	0.60	0.43
	Percent Difference to 1974 Phase A	0%	-1%	0%	-21%	-10%	---	51%	28%	---	---
	Percent Difference to 1977 Phase B	1%	0%	1%	-20%	-9%	---	53%	---	95%	---
	Percent Difference to 1977 Ralston MDP	0%	-1%	0%	-21%	-10%	46%	---	---	---	---
	Percent Difference to 1986 MDP	26%	25%	26%	0%	13%	84%	---	---	---	76%
Percent Difference to 2004 Ralston	11%	10%	11%	-12%	0%	62%	---	---	---	---	
Hogback (Design Point 149)	Tributary Area (sm)	8.29	8.29	---	8.03	---	8.31	8.31	8.31	8.31	8.31
	Imp. (%)	10.00	10.00	---	0.00	---	2.16	2.19	2.19	2.19	2.16
	100-Year Peak Flow	2940	1570	---	1800	2833	4207	4208	2537	4017	4401
	Unit Discharge (cfs/ac)	0.55	0.30	---	0.35	---	0.79	0.79	0.48	0.76	0.83
	Percent Difference to 1974 Phase A	0%	-47%	---	-37%	---	---	43%	-14%	---	---
	Percent Difference to 1977 Phase B	87%	0%	---	18%	---	---	167%	---	155%	---
	Percent Difference to 1986 MDP	58%	-16%	---	0%	---	126%	---	---	---	136%

- b. Additional comparisons were made using the 2004 Ralston MDP model, which was similar to all of the previous studies. The 2004 Ralston MDP models were available and could more easily be used for comparisons.
 - i. Several versions of the 2004 Ralston MDP models were used for comparisons
 - 1. Original model
 - 2. Updated CUHP version and rainfall
 - 3. Upper watershed disconnected at the hogback
 - ii. Draft 2020 hydrology was updated to use Manning's n of 0.07 instead of 0.04 and 0.045 for a more similar comparison to previous models
 - iii. 2004 Ralston MDP SWMM link geometries were used in 2020 model – generally good agreement between model

Table 3 – Lower Watershed Comparisons with 2004 Ralston MDP

Location	Parameter	Design Point	2004 Ralston MDP				2020 Recommended Existing			Draft 2020 Geometry, n=0.07		2004 Channel Geometry	
			Orig	Disconnect	Updated CUHP/ Rain	Update and Disconnect	Design Point	Baseline	Disconnect	Baseline	Disconnect	Baseline	Disconnect
Hogback	100-year Peak Flow (cfs)	189 (un)	2728	2728	3629	3629	149	4207	4207	4084	4084	3047	3047
	Unit Discharge (cfs)		0.52	0.52	0.69	0.69		0.69	0.69	0.67	0.67	0.50	0.50
	% Diff to 2004 MDP		0%	0%	33%	33%		34%	34%	30%	30%	-3%	-3%
	% Diff to Updated 2004 MDP		-25%	-25%	0%	0%		1%	1%	-2%	-2%	-27%	-27%
	Time to Peak (min)		100	100	110	110		87	87	91	91	122	122
	Tributary Area (sm)		8.27	8.27	8.27	8.27		9.52	9.52	9.52	9.52	9.52	9.52
	Imperviousness (%)		2	2	2	2		2.16	2.16	2.16	2.16	2.16	2.16
D/S End	100-year Peak Flow (cfs)	181 (a4 - 10-20 sm)	3157	2433	3833	2351	100	5046	3028	5139	3277	3253	2182
	Unit Discharge (cfs)		0.28	0.40	0.34	0.39		0.45	0.60	0.46	0.65	0.29	0.43
	% Diff to 2004 MDP		0%	0%	21%	-3%		62%	48%	65%	60%	4%	7%
	% Diff to Updated 2004 MDP		-18%	3%	0%	0%		33%	53%	36%	66%	-14%	10%
	Time to Peak (min)		195	135	230	195		194	194	188	171	263	220
	Tributary Area (sm)		17.67	9.40	17.67	9.40		17.43	7.90	17.43	7.90	17.43	7.90
	Imperviousness (%)		11.92	20.65	11.92	20.65		11.05	21.76	11.05	21.76	11.05	21.76

- 4) SWMM links in previous study do not accurately portray the channel, resulting in lower peak flows



- 5) Recommended baseline model:
- a. Used seven subbasin model upstream of Highway 93
 - b. Updated baseline SWMM links to add more definition. Previously used trapezoidal sections that generally ignored low flow channel. Typical HEC-RAS cross sections in each reach were simplified and used in the SWMM model.

- c. Updated Manning’s n values in the lower watershed along main channel from 0.04 and 0.045 to 0.08 in low flow and 0.05 above low flow. Middle portion of Ramstetter Tributary, Manning’s n = 0.05. Above Highway 93, used Manning’s n = 0.045.
- d. Results in peak flows lower than draft study, but higher than previous studies

Table 4 – Peak Flow Comparisons at Downstream End (Design Point 100)

Parameter	Previous Studies	2020 Draft EX	2020 Draft FTR	2020 Rec EX	2020 Rec FTR
100-year Peak Flow at Downstream End (Design Point 100)	2,700 – 3,450	7,196	7,618	5,046	5,237

6) Other

- **MHFD has not studied how significant the use of composite channels may be for SWMM models; however, there has been one previous study where geometry was modified during calibration.**
- **Olsson will discuss Manning’s n values with Bill Spitz, who is doing fluvial hazard mapping for the creek and should have good information on existing conditions.**
- **The goal is to use updated hydrology in the FHAD model and understand the differences in the flows between the old studies and this current study. The project team will need to decide if risk is being properly communicated by using new flows or old flows.**

Action Items:

Olsson

- **Recalculate hydrology using combined subbasins downstream of the hogback to see if lower flows can be achieved with a less discretized model in urban areas. The combined subbasins will target 2 square miles. Subbasin size will likely be less than 2 square miles in order to avoid using subbasins that are long and skinny.**

MHFD

- **Confirm what the effective flows are based on and track down the effective model, if available. It appears the flows may be based on the 1977 Phase B Report.**

- **Check with Jefferson County to see if they have as-builts for culvert at Highway 93 and send to Olsson.**
- **Determine which alignment should be used for the HEC-RAS model downstream of Highway 93 (historic or new).**

Please contact Olsson at 303-237-2072 with changes or questions regarding these meeting minutes. These minutes will be considered final unless comments are received within seven days of distribution. Although comments will be incorporated, as appropriate, only major revisions will be redistributed.

Minutes prepared by: Madison Stewart
cc: Attendees, File