US Army Corps of Engineers ®
Kansas City District

CENWK-EDH-R 21 Aug 2020

MEMORANDUM FOR OD-R

SUBJECT: Monitoring Program for Regulatory Plan for Commercial Dredging Activities on the Kansas River 2019/2020

1. Introduction and Purpose. The purpose of this memorandum is to document changes in the riverbed elevations of the Kansas River for the Monitoring Program as described in C*ommercial Dredging Activities on the Kansas River, Appendix A: Regulatory Plan* (USACE 2018a) and the 2018 Record of Decision (USACE 2018b). Table 1 lists the requested dredging reaches.

Table 1: Requested Dredging Reaches by River Miles

9.4 – 10.4
12.8 – 13.9
15.4 – 16.9
18.65 – 20.15
20.55 – 21.3
26.1 – 27.6
77.1 – 78.6
89.7 – 91

As in previous cycles, cross section measurements of the Kansas River were compared against a baseline survey to allow an assessment of bed elevation change in 5-mile reaches that intersect the authorized dredging reaches. The memo discusses (1) Survey completeness and quality, (2) Updates to the baseline survey, (3) Analysis methods, (4) Cross section results, (5) 5-Mile reach results, (6) Limitations, (7) Conclusion.

2. Survey Completeness and Quality. Landplan Engineering, under contract from the Kansas River dredgers, combined LIDAR (Light Detection and Ranging) data with channel bathymetry to create complete cross sections for analysis. Landplan Engineering submitted 98 cross-sections from RM 4.4 to 32.9 and RM 72.1 to 96.5. EDH-R plotted and inspected the data and found complete coverage (i.e. no large data gaps between the LIDAR and the bathymetry.) The stations for three sections (4.4, 5.9, and 7.3) were flipped or shifted compared to previous years. On request, Landplan reprocessed and submitted those cross sections with stationing consistent with previous years.

3. Baseline Survey Update. The 1992 baseline survey included data from RM 9.4 to 32.9 and RM 72.1 to 96.5. In order to consistently assess degradation for all dredging reaches, the 2018 Record of Decision requested that the area of analysis be extended

down to RM 4.4. Because the 1992 survey did not include data this far downstream, the 2007 survey, which is the oldest available survey after 1992 covering this area of the river, was used as the baseline for this reach. The 2007 survey included cross sections at RM 4.4, 5.9, and 7.3 which were subsequently added to the original 1992 survey to form a composite baseline survey. This survey will henceforth be referred to as the Regulatory Baseline (RBL) Survey. A profile of the average bed elevations in the RBL survey can be found in Figures 1 and 2.

The 2007 survey may be lower than the bed in 1992 at RM 4.4, 5.9, and 7.3. Indeed, the cross sections just upstream degraded significantly, and the downstream Missouri River degraded significantly over this time period. This is discussed in the "Limitations" section.

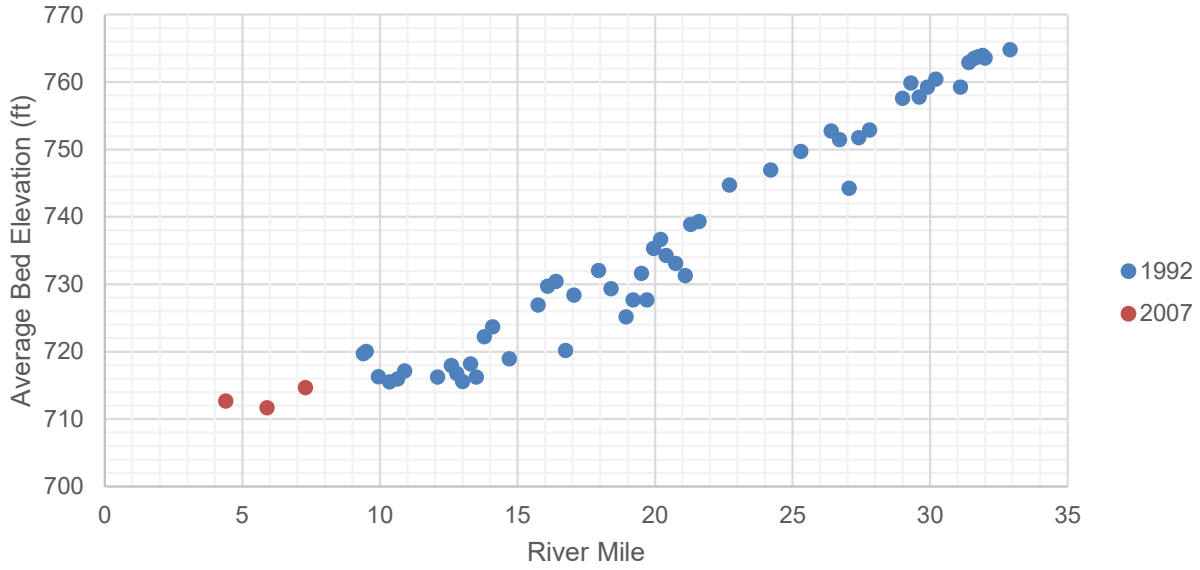

Figure 1: Regulatory Baseline Survey Average Bed Elevation at Individual Cross Sections (from Kansas City to Lawrence).

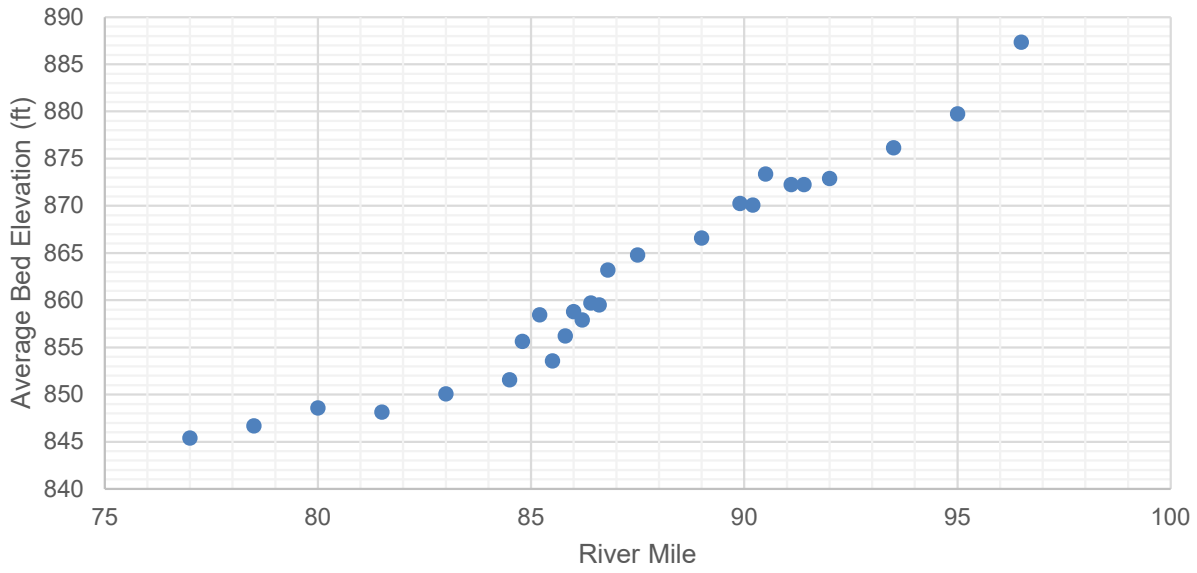

Figure 2: Regulatory Baseline Survey Average Bed Elevation at Individual Cross Sections (near Topeka).

4. Cross Section Change Analysis Methods. In previous cycles, this analysis was performed using CAD and multiple Excel spreadsheets (see *History of Analyses for Kansas River Dredging Monitoring Program*, USACE 2012). This analysis took several days and relied on manipulation of spreadsheets for each individual cross section. Moving forward, this analysis will be facilitated with the Cross Section Viewer software (Shelley and Bailey 2018) to increase efficiency and reduce the possibility of human errors.

The Cross Section Viewer is a computer program developed by the U.S. Army Corps of Engineers and North Arrow Research. It is used to compare cross sections and can compute cross sectional parameters such as the cross sectional area and top width.

Using the Cross Section Viewer, a cross section database was developed with the RBL survey and the 2019 survey. The Cross Section Viewer was then used to calculate the top width at the baseline water surface elevation used in previous cycles and the cross sectional area of the river below the baseline water surface. The computation of average bed change is equivalent to previous years:

Average bed = Z – (A / W)

Where
Z = a predefined elevation (consistent from year to year) which supplies the upper bound for the active channel included in the analysis, feet

A = the cross sectional area measured up to elevation W, square feet

W = the bank to bank channel width (inclusive of any mid-channel islands) at elevation W, feet

The Cross Section Viewer calculated A and W, which in previous years was calculated with individual tabs on spreadsheets. To ensure that the Cross Section Viewer reported equivalent results, the average bed elevation of the 1992 survey was calculated with the Cross Section Viewer and compared with the spreadsheet analysis. This comparison can be seen in Table 2. The average bed calculated with the Cross Section Viewer was nearly identical to the average bed calculated with the spreadsheet in every case except for two. There were two cross sections that yielded differing results between these two methods: RM 15.75 and RM 86.8. These differences were caused by the older analysis of the 1992 survey including the main channel only, not entire channel width. The Cross Section Viewer uses the entire channel width, which is consistent with how recent surveys have been analyzed and therefore allows a better comparison.

Table 2: 1992 Average Bed Comparison (in feet)

RM	Cross Section Viewer	Spreadsheet	RM	Cross Section Viewer	Spreadsheet
9.40	719.68	719.68	**27.80**	752.90	752.90
9.50	720.02	720.02	**29.00**	757.59	757.59
9.95	716.25	716.25	**29.30**	759.88	759.85
10.35	715.53	715.53	**29.60**	757.75	757.75
10.65	715.94	715.94	**29.90**	759.23	759.23
10.90	717.13	717.13	**30.20**	760.45	760.45
12.10	716.22	716.22	**31.10**	759.24	759.24
12.60	717.92	717.92	**31.40**	762.90	762.90
12.80	716.74	716.74	**31.60**	763.50	763.50
13.00	715.56	715.56	**31.75**	763.75	763.75
13.30	718.16	718.16	**31.90**	763.93	763.93
13.50	716.25	716.25	**32.00**	763.57	763.57
13.80	722.19	722.19	**32.90**	764.80	764.80
14.10	723.69	723.69	**77.00**	845.38	845.38
14.70	718.93	719.03	**78.50**	846.69	846.69
15.75*	726.92	727.40	**80.00**	848.58	848.58
16.10	729.72	729.72	**81.50**	848.14	848.14
16.40	730.43	730.43	**83.00**	850.08	850.08
16.75	720.19	720.19	**84.50**	851.56	851.56
17.05	728.38	728.38	**84.80**	855.62	855.62
17.95	732.06	732.06	**85.20**	858.45	858.45
18.40	729.32	729.32	**85.50**	853.57	853.57
18.95	725.17	725.17	**85.80**	856.22	856.22
19.20	727.68	727.68	**86.00**	858.77	858.77
19.50	731.62	731.62	**86.20**	857.89	857.89
19.70	727.67	727.67	**86.40**	859.70	859.70
19.95	735.30	735.30	**86.60**	859.49	859.49
20.20	736.65	736.65	**86.80***	863.19	860.64
20.40	734.26	734.26	**87.50**	864.79	864.79
20.75	733.08	733.08	**89.00**	866.58	866.58
21.10	731.28	731.28	**89.90**	870.26	870.26
21.30	738.87	738.87	**90.20**	870.07	870.07
21.60	739.31	739.31	**90.50**	873.39	873.39
22.70	744.71	744.71	**91.10**	872.26	872.26
24.20	746.97	746.97	**91.40**	872.27	872.27
25.30	749.70	749.70	**92.00**	872.88	872.88
26.40	752.76	752.76	**93.50**	876.14	876.14
26.70	751.47	751.47	**95.00**	879.76	879.76
27.05	744.25	744.25	**96.50**	887.35	887.35
27.40	751.75	751.75			

* Earlier computations for the 1992 baseline inappropriately included or excluded side channel areas compared to later surveys. The Average Bed Elevation in the Cross Section Viewer column represents the best estimate for average bed at these locations.

5. Cross Section Results. Table 3 lists the average bed elevation for the current survey and average bed elevation change with respect to the RBL survey at each cross section. Average bed elevation change varied from -5.05 feet (degradation) to 9.88 feet (aggradation). Bed change with respect to the RBL survey can be seen graphically in Figures 3 and 4.

Table 3: Average Bed Elevations and Bed Elevation Change RBL – 2019/2020 at Individual Cross Sections

RM	Avg Bed Elevation (ft)	Change from RBL (ft)	RM	Avg Bed Elevation (ft)	Change from RBL (ft)	RM	Avg Bed Elevation (ft)	Change from RBL (ft)
4.4	713.15	0.49	19.7	735.46	7.79			-1.9
5.9	712.71	1.01				78.5	844.07	-2.63
			20.2	734.62	-2.03			-1.24
9.4	714.84	-4.84				81.5	848.80	0.66
			20.75	735.47	2.39			1.16
9.95	713.73	-2.52				84.5	853.39	1.83
			21.3	737.70	-1.17			1.49
10.65	714.32	-1.62				85.2	856.72	-1.73
			22.7	743.04	-1.67			1.94
12.1	718.90	2.69				85.8	859.91	3.69
			25.3	747.35	-2.35			2.47
12.8	717.96	1.22				86.2	859.64	1.74
			26.7	749.00	-2.47			-0.1
13.3	717.28	-0.88				86.6	859.80	0.31
			27.4	749.75	-1.99			-2.17
13.8	721.23	-0.96				87.5	865.04	0.25
			29	753.81	-3.78			0.28
14.7	722.70	3.78				89.9	871.95	1.69
			29.6	755.93	-1.82			1.22
16.1	731.17	1.45				90.5	874.14	0.75
			30.2	757.79	-2.66			3.38
16.75	725.71	5.52				91.4	872.25	-0.01
			31.4	759.62	-3.28			0.54
17.95	732.86	0.8				93.5	876.55	0.41
			31.75	761.44	-2.31			1
18.95	735.05	9.88	31.9	759.30	-4.63	96.5	886.76	-0.59
19.2	735.01	7.33	32	761.13	-2.44			
19.5	735.43	3.81	32.9	762.41	-2.4			

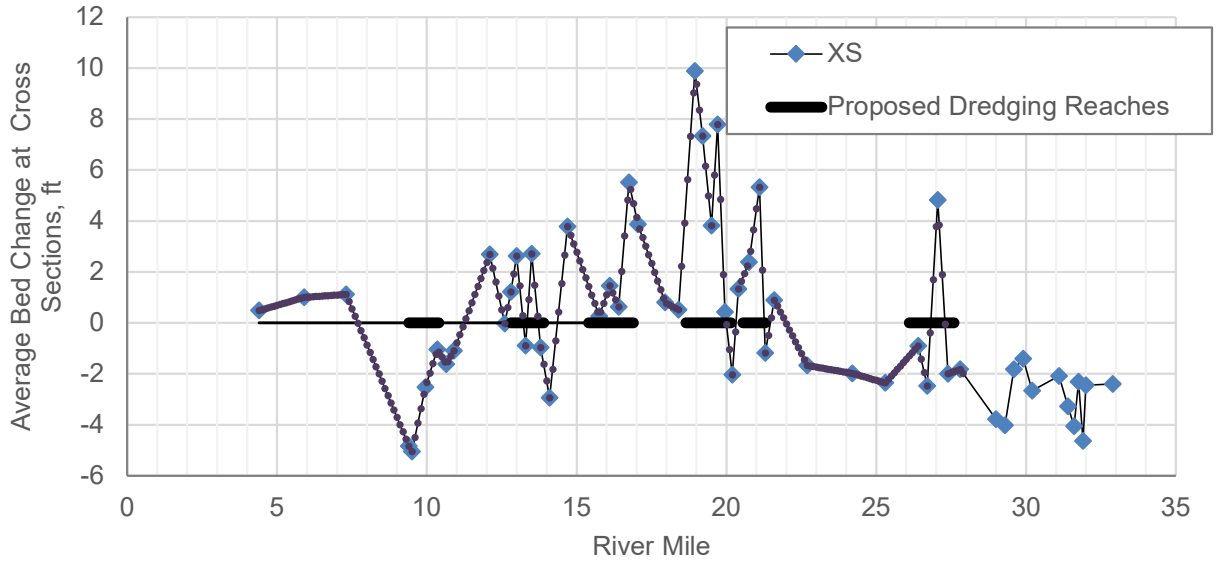

Figure 3: Change in Average Bed Elevation at Individual Cross-Sections from the RBL Survey to 2019/2020 survey (Kansas City to Lawrence)

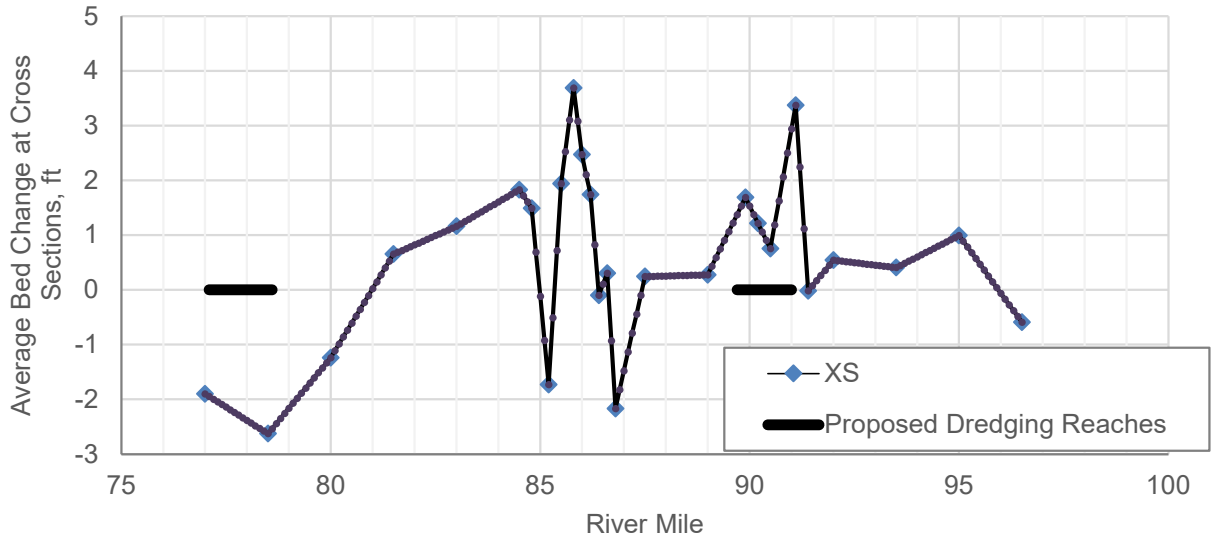

Figure 4: Change in Average Bed Elevation at Individual Cross-Sections from the RBL Survey to 2019/2020 survey (near Topeka)

6. Five-mile Reaches. Per the 2018 Record of Decision, any 5-mile reach that attained at least 2 feet of degradation in the current survey and had attained at least 1.5 feet of degradation in the previous survey would result in immediate termination of dredging in the degraded reach. Any 5-mile reach that attained 2 feet of degradation in the current survey but had attained less than 1.5 feet of degradation in the previous survey would result in termination of dredging in the degraded reach within 1 year.

A rolling average for each 5-mile reach was calculated by interpolating bed change between the measured cross sections at 0.1 mile increments. Encl 1 lists the bed change over each 5-mile reach. Table 4 lists bed change from the RBL to both the 2017/2018 and 2019/2020 surveys in reaches that attained at least 1.5 feet of degradation in the 2019/2020 survey. Yellow cells indicate reaches that degraded at least 1.5 feet but not more than 2 feet. Red cells indicate reaches that degraded more than 2 feet.

As seen in Table 4, the extent of river with at least 2 feet of degradation expanded since the previous cycle. All 5-mile reaches between RM 26.5 to RM 32.9 have attained at least 2 feet of degradation. All reaches attaining 2 feet of degradation had attained at least 1.5 feet of degradation in the previous cycle.

Table 4: 5-Mile Reaches between RM 21.6 and 32.9 for the Current and Previous Survey

	Bed Change Compared to the Regulatory Baseline Survey (ft)			Bed Change Compared to the Regulatory Baseline Survey (ft)	
5-Mile Reach	2018	2019	**5-Mile Reach**	2018	2019
21.6 - 26.6	-1.40	-1.50	**24.8 - 29.8**	-1.53	-1.82
21.7 - 26.7	-1.45	-1.57	**24.9 - 29.9**	-1.54	-1.80
21.8 - 26.8	-1.46	-1.59	**25.0 - 30.0**	-1.55	-1.79
21.9 - 26.9	-1.43	-1.57	**25.1 - 30.1**	-1.56	-1.79
22.0 - 27.0	-1.35	-1.50	**25.2 - 30.2**	-1.57	-1.80
22.1 - 27.1	-1.27	-1.42	**25.3 - 30.3**	-1.58	-1.81
22.2 - 27.2	-1.23	-1.38	**25.4 - 30.4**	-1.59	-1.81
22.3 - 27.3	-1.22	-1.37	**25.5 - 30.5**	-1.60	-1.81
22.4 - 27.4	-1.24	-1.39	**25.6 - 30.6**	-1.60	-1.82
22.5 - 27.5	-1.27	-1.41	**25.7 - 30.7**	-1.62	-1.83
22.6 - 27.6	-1.29	-1.43	**25.8 - 30.8**	-1.63	-1.84
22.7 - 27.7	-1.31	-1.43	**25.9 - 30.9**	-1.64	-1.85
22.8 - 27.8	-1.33	-1.44	**26.0 - 31.0**	-1.66	-1.86
22.9 - 27.9	-1.34	-1.44	**26.1 - 31.1**	-1.67	-1.87
23.0 - 28.0	-1.36	-1.45	**26.2 - 31.2**	-1.70	-1.90
23.1 - 28.1	-1.37	-1.46	**26.3 - 31.3**	-1.74	-1.93
23.2 - 28.2	-1.38	-1.48	**26.4 - 31.4**	-1.80	-1.97
23.3 - 28.3	-1.39	-1.49	**26.5 - 31.5**	-1.86	-2.03
23.4 - 28.4	-1.40	-1.51	**26.6 - 31.6**	-1.90	-2.08
23.5 - 28.5	-1.41	-1.54	**26.7 - 31.7**	-1.91	-2.10
23.6 - 28.6	-1.41	-1.56	**26.8 - 31.8**	-1.92	-2.11
23.7 - 28.7	-1.42	-1.59	**26.9 - 31.9**	-1.99	-2.19
23.8 - 28.8	-1.42	-1.62	**27.0 - 32.0**	-2.08	-2.27
23.9 - 28.9	-1.42	-1.65	**27.1 - 32.1**	-2.20	-2.40
24.0 - 29.0	-1.42	-1.69	**27.2 - 32.2**	-2.32	-2.52
24.1 - 29.1	-1.44	-1.73	**27.3 - 32.3**	-2.40	-2.60
24.2 - 29.2	-1.46	-1.77	**27.4 - 32.4**	-2.44	-2.65
24.3 - 29.3	-1.50	-1.81	**27.5 - 32.5**	-2.44	-2.66
24.4 - 29.4	-1.52	-1.83	**27.6 - 32.6**	-2.44	-2.67
24.5 - 29.5	-1.53	-1.84	**27.7 - 32.7**	-2.44	-2.68
24.6 - 29.6	-1.53	-1.84	**27.8 - 32.8**	-2.43	-2.69
24.7 - 29.7	-1.52	-1.83	**27.9 - 32.9**	-2.42	-2.70

7. Limitations. As stated in Section 3, because the 1992 survey lacked data downstream of RM 9.4, the Regulatory Baseline Survey for RM 4.4, 5.9, and 7.3 is based on the oldest post-1992 survey, which is the 2007 survey. Figure 5 displays the 1992 and 2007 surveys for the lower reach of the Kansas River, as well as bed change on the Missouri River over a similar time frame. As seen, the three cross sections upstream (RM 9.4, 9.5, 9.95) and the Missouri River at the confluence degraded significantly. While the data is lacking, it is reasonable to assume that some amount of degradation occurred at RM 4.4, 5.9, and 7.3 as well. Thus, the Regulatory Baseline survey used for the analysis in this document may perpetually under-predict degradation relative to adjacent areas on the river and lead to an under-prediction bias in the 5-mile reaches that include the cross sections at RM 4.4, 5.9, and 7.3.

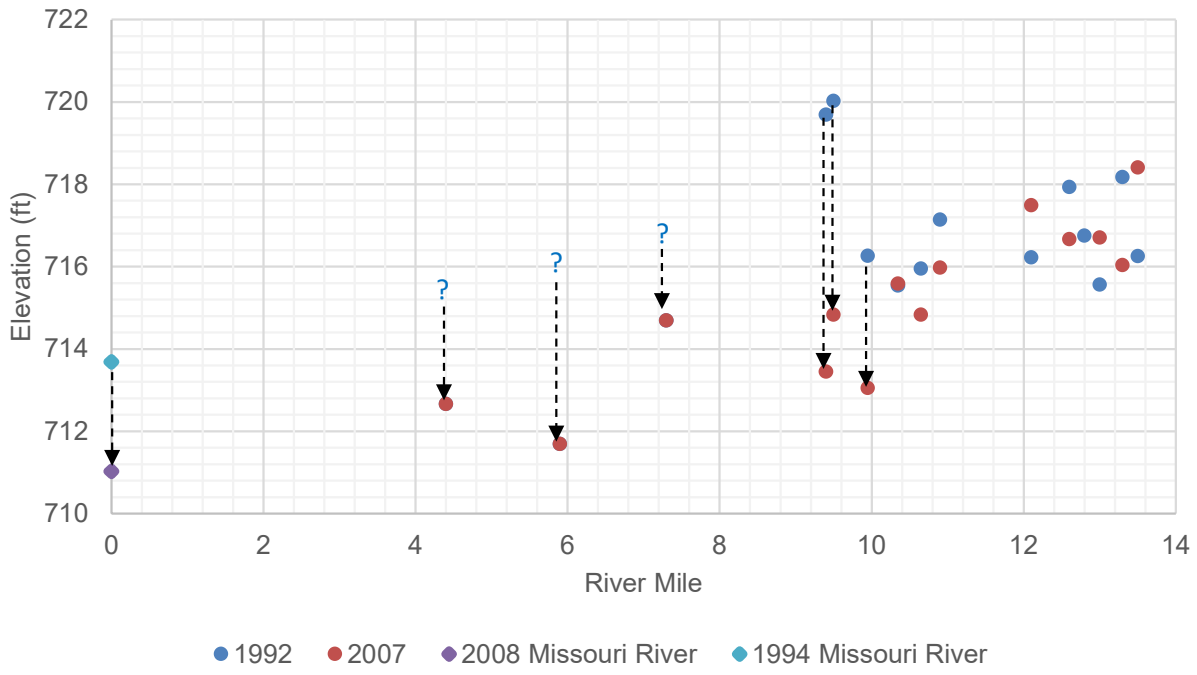

Figure 5. Illustration of a Potential Limitation with Using the 2007 Survey to Fill in the Regulatory Baseline Survey

Another limitation of the analysis presented in this document relates to the river mileage. All analyses since 1992 have utilized the same river miles to define the location of the cross sections. However, over time, portions of the Kansas River have lengthened or shortened such that the original river miles no longer represent the distances between the cross section locations. As with all previous analyses, the

analysis presented in this memo used the original river miles. An assessment with updated river miles will be provided in a separate memo.

8. Conclusion. An updated Regulatory Baseline Survey (RBL) was created by adding three cross sections (RM 4.4, 5.9, and 7.3) from the 2007 survey to the 1992 baseline survey used in previous permit cycles. A survey with 98 cross sections collected in 2019 and 2020 was compared to the RBL using the Cross Section Viewer software. This software gives equivalent results but allows for faster processing, less opportunity for human error, and a more consistent comparison to the baseline for average bed change at individual cross sections. Five mile reaches were averaged using the same procedures as previous permit cycles. As listed in Table 4, additional 5-mile reaches surpassed the 1.5 feet degradation threshold compared to the 2017/2018 survey. The 5-mile reaches from RM 26.5 to 32.9 have degraded 2 or more feet below the Regulatory Baseline and were degraded more than 1.5 feet in the previous survey.

Point of contact for this memorandum is Mr. John Shelley, Hydraulic Engineer, EDH-R, 816-389-2310.

Digitally signed by
SHUMATE.ERIC.D.1271347606
Date: 2020.09.04 12:20:59 -05'00'

Encl

ERIC D. SHUMATE, P.E.
Chief, Hydrologic Engineering Branch
Engineering Division

CENWK-EDH-R
SUBJECT: Monitoring Program for Regulatory Plan for Commercial Dredging Activities on the Kansas River 2019/2020

SHELLEY.JOHN.E.1395403610
Digitally signed by SHELLEY.JOHN.E.1395403610
Date: 2020.08.28 11:31:29 -05'00'

EDH-R
SHELLEY

CHAPMAN.MICHAEL.DARWIN.1231286191
Digitally signed by CHAPMAN.MICHAEL.DARWIN.1231286191
Date: 2020.09.04 10:33:52 -05'00'

EDH-R
CHAPMAN

Digitally signed by SHUMATE.ERIC.D.1271347606
Date: 2020.09.04 12:20:06 -05'00'

EDH
SHUMATE

Enclosure 1-Bed Change from the Regulatory Baseline to the 2019/2020 Survey Averaged Over 5-Mile Reaches

5-Mile Reach	Bed Change from RBL to 2019/2020 (ft)	5-Mile Reach	Bed Change from RBL to 2019/2020 (ft)	5-Mile Reach	Bed Change from RBL to 2019/2020 (ft)	5-Mile Reach	Bed Change from RBL to 2019/2020 (ft)	5-Mile Reach	Bed Change from RBL to 2019/2020 (ft)
4.4 - 9.4	-0.30	9.2 - 14.2	-0.56	13.9 - 18.9	1.99	18.6 - 23.6	1.69	23.3 - 28.3	-1.49
4.5 - 9.5	-0.40	9.3 - 14.3	-0.49	14.0 - 19.0	2.21	18.7 - 23.7	1.58	23.4 - 28.4	-1.51
4.6 - 9.6	-0.50	9.4 - 14.4	-0.39	14.1 - 19.1	2.42	18.8 - 23.8	1.43	23.5 - 28.5	-1.54
4.7 - 9.7	-0.59	9.5 - 14.5	-0.27	14.2 - 19.2	2.62	18.9 - 23.9	1.25	23.6 - 28.6	-1.56
4.8 - 9.8	-0.67	9.6 - 14.6	-0.12	14.3 - 19.3	2.77	19.0 - 24.0	1.03	23.7 - 28.7	-1.59
4.9 - 9.9	-0.74	9.7 - 14.7	0.05	14.4 - 19.4	2.88	19.1 - 24.1	0.81	23.8 - 28.8	-1.62
5.0 - 10.0	-0.79	9.8 - 14.8	0.19	14.5 - 19.5	2.95	19.2 - 24.2	0.61	23.9 - 28.9	-1.65
5.1 - 10.1	-0.85	9.9 - 14.9	0.32	14.6 - 19.6	3.03	19.3 - 24.3	0.43	24.0 - 29.0	-1.69
5.2 - 10.2	-0.89	10.0 - 15.0	0.43	14.7 - 19.7	3.13	19.4 - 24.4	0.26	24.1 - 29.1	-1.73
5.3 - 10.3	-0.93	10.1 - 15.1	0.52	14.8 - 19.8	3.16	19.5 - 24.5	0.13	24.2 - 29.2	-1.77
5.4 - 10.4	-0.97	10.2 - 15.2	0.60	14.9 - 19.9	3.13	19.6 - 24.6	0.01	24.3 - 29.3	-1.81
5.5 - 10.5	-1.01	10.3 - 15.3	0.67	15.0 - 20.0	3.06	19.7 - 24.7	-0.15	24.4 - 29.4	-1.83
5.6 - 10.6	-1.06	10.4 - 15.4	0.72	15.1 - 20.1	2.99	19.8 - 24.8	-0.34	24.5 - 29.5	-1.84
5.7 - 10.7	-1.11	10.5 - 15.5	0.76	15.2 - 20.2	2.90	19.9 - 24.9	-0.48	24.6 - 29.6	-1.84
5.8 - 10.8	-1.15	10.6 - 15.6	0.80	15.3 - 20.3	2.85	20.0 - 25.0	-0.56	24.7 - 29.7	-1.83
5.9 - 10.9	-1.19	10.7 - 15.7	0.84	15.4 - 20.4	2.84	20.1 - 25.1	-0.60	24.8 - 29.8	-1.82
6.0 - 11.0	-1.23	10.8 - 15.8	0.88	15.5 - 20.5	2.85	20.2 - 25.2	-0.63	24.9 - 29.9	-1.80
6.1 - 11.1	-1.25	10.9 - 15.9	0.92	15.6 - 20.6	2.86	20.3 - 25.3	-0.64	25.0 - 30.0	-1.79
6.2 - 11.2	-1.28	11.0 - 16.0	0.96	15.7 - 20.7	2.89	20.4 - 25.4	-0.67	25.1 - 30.1	-1.79
6.3 - 11.3	-1.29	11.1 - 16.1	1.01	15.8 - 20.8	2.94	20.5 - 25.5	-0.74	25.2 - 30.2	-1.80
6.4 - 11.4	-1.30	11.2 - 16.2	1.04	15.9 - 20.9	3.00	20.6 - 25.6	-0.81	25.3 - 30.3	-1.81
6.5 - 11.5	-1.31	11.3 - 16.3	1.06	16.0 - 21.0	3.08	20.7 - 25.7	-0.88	25.4 - 30.4	-1.81
6.6 - 11.6	-1.31	11.4 - 16.4	1.07	16.1 - 21.1	3.16	20.8 - 25.8	-0.96	25.5 - 30.5	-1.81
6.7 - 11.7	-1.30	11.5 - 16.5	1.10	16.2 - 21.2	3.17	20.9 - 25.9	-1.05	25.6 - 30.6	-1.82
6.8 - 11.8	-1.29	11.6 - 16.6	1.15	16.3 - 21.3	3.13	21.0 - 26.0	-1.15	25.7 - 30.7	-1.83
6.9 - 11.9	-1.27	11.7 - 16.7	1.22	16.4 - 21.4	3.10	21.1 - 26.1	-1.26	25.8 - 30.8	-1.84
7.0 - 12.0	-1.24	11.8 - 16.8	1.30	16.5 - 21.5	3.09	21.2 - 26.2	-1.39	25.9 - 30.9	-1.85
7.1 - 12.1	-1.21	11.9 - 16.9	1.36	16.6 - 21.6	3.07	21.3 - 26.3	-1.45	26.0 - 31.0	-1.86
7.2 - 12.2	-1.19	12.0 - 17.0	1.40	16.7 - 21.7	3.01	21.4 - 26.4	-1.44	26.1 - 31.1	-1.87
7.3 - 12.3	-1.18	12.1 - 17.1	1.42	16.8 - 21.8	2.93	21.5 - 26.5	-1.46	26.2 - 31.2	-1.90
7.4 - 12.4	-1.18	12.2 - 17.2	1.44	16.9 - 21.9	2.83	21.6 - 26.6	-1.50	26.3 - 31.3	-1.93
7.5 - 12.5	-1.19	12.3 - 17.3	1.45	17.0 - 22.0	2.74	21.7 - 26.7	-1.57	26.4 - 31.4	-1.97
7.6 - 12.6	-1.20	12.4 - 17.4	1.47	17.1 - 22.1	2.65	21.8 - 26.8	-1.59	26.5 - 31.5	-2.03
7.7 - 12.7	-1.20	12.5 - 17.5	1.50	17.2 - 22.2	2.57	21.9 - 26.9	-1.57	26.6 - 31.6	-2.08
7.8 - 12.8	-1.17	12.6 - 17.6	1.53	17.3 - 22.3	2.49	22.0 - 27.0	-1.50	26.7 - 31.7	-2.10
7.9 - 12.9	-1.13	12.7 - 17.7	1.56	17.4 - 22.4	2.41	22.1 - 27.1	-1.42	26.8 - 31.8	-2.11
8.0 - 13.0	-1.06	12.8 - 17.8	1.57	17.5 - 22.5	2.33	22.2 - 27.2	-1.38	26.9 - 31.9	-2.19
8.1 - 13.1	-1.02	12.9 - 17.9	1.57	17.6 - 22.6	2.26	22.3 - 27.3	-1.37	27.0 - 32.0	-2.27
8.2 - 13.2	-0.99	13.0 - 18.0	1.55	17.7 - 22.7	2.19	22.4 - 27.4	-1.39	27.1 - 32.1	-2.40
8.3 - 13.3	-0.98	13.1 - 18.1	1.51	17.8 - 22.8	2.12	22.5 - 27.5	-1.41	27.2 - 32.2	-2.52
8.4 - 13.4	-0.93	13.2 - 18.2	1.49	17.9 - 22.9	2.06	22.6 - 27.6	-1.43	27.3 - 32.3	-2.60
8.5 - 13.5	-0.84	13.3 - 18.3	1.50	18.0 - 23.0	2.01	22.7 - 27.7	-1.43	27.4 - 32.4	-2.65
8.6 - 13.6	-0.76	13.4 - 18.4	1.53	18.1 - 23.1	1.96	22.8 - 27.8	-1.44	27.5 - 32.5	-2.66
8.7 - 13.7	-0.71	13.5 - 18.5	1.55	18.2 - 23.2	1.91	22.9 - 27.9	-1.44	27.6 - 32.6	-2.67
8.8 - 13.8	-0.67	13.6 - 18.6	1.58	18.3 - 23.3	1.86	23.0 - 28.0	-1.45	27.7 - 32.7	-2.68
8.9 - 13.9	-0.64	13.7 - 18.7	1.66	18.4 - 23.4	1.82	23.1 - 28.1	-1.46	27.8 - 32.8	-2.69
9.0 - 14.0	-0.62	13.8 - 18.8	1.80	18.5 - 23.5	1.77	23.2 - 28.2	-1.48	27.9 - 32.9	-2.70
9.1 - 14.1	-0.60								

Enclosure 1-Bed Change from the Regulatory Baseline to the 2019/2020 Survey Averaged Over 5-Mile Reaches

5-Mile Reach	Bed Change from RBL to 2019/2020 (ft)	5-Mile Reach	Bed Change from RBL to 2019/2020 (ft)	5-Mile Reach	Bed Change from RBL to 2019/2020 (ft)
77.0 - 82.0	-1.26	81.9 - 86.9	1.07	86.8 - 91.8	0.60
77.1 - 82.1	-1.20	82.0 - 87.0	1.02	86.9 - 91.9	0.65
77.2 - 82.2	-1.15	82.1 - 87.1	0.98	87.0 - 92.0	0.70
77.3 - 82.3	-1.09	82.2 - 87.2	0.95	87.1 - 92.1	0.74
77.4 - 82.4	-1.03	82.3 - 87.3	0.92	87.2 - 92.2	0.77
77.5 - 82.5	-0.97	82.4 - 87.4	0.90	87.3 - 92.3	0.80
77.6 - 82.6	-0.91	82.5 - 87.5	0.89	87.4 - 92.4	0.81
77.7 - 82.7	-0.84	82.6 - 87.6	0.88	87.5 - 92.5	0.83
77.8 - 82.8	-0.78	82.7 - 87.7	0.86	87.6 - 92.6	0.83
77.9 - 82.9	-0.71	82.8 - 87.8	0.84	87.7 - 92.7	0.84
78.0 - 83.0	-0.64	82.9 - 87.9	0.83	87.8 - 92.8	0.84
78.1 - 83.1	-0.57	83.0 - 88.0	0.81	87.9 - 92.9	0.84
78.2 - 83.2	-0.50	83.1 - 88.1	0.79	88.0 - 93.0	0.85
78.3 - 83.3	-0.43	83.2 - 88.2	0.77	88.1 - 93.1	0.85
78.4 - 83.4	-0.35	83.3 - 88.3	0.76	88.2 - 93.2	0.85
78.5 - 83.5	-0.27	83.4 - 88.4	0.74	88.3 - 93.3	0.86
78.6 - 83.6	-0.19	83.5 - 88.5	0.71	88.4 - 93.4	0.86
78.7 - 83.7	-0.12	83.6 - 88.6	0.69	88.5 - 93.5	0.86
78.8 - 83.8	-0.04	83.7 - 88.7	0.67	88.6 - 93.6	0.87
78.9 - 83.9	0.04	83.8 - 88.8	0.65	88.7 - 93.7	0.87
79.0 - 84.0	0.11	83.9 - 88.9	0.62	88.8 - 93.8	0.88
79.1 - 84.1	0.19	84.0 - 89.0	0.60	88.9 - 93.9	0.88
79.2 - 84.2	0.26	84.1 - 89.1	0.57	89.0 - 94.0	0.89
79.3 - 84.3	0.34	84.2 - 89.2	0.55	89.1 - 94.1	0.90
79.4 - 84.4	0.41	84.3 - 89.3	0.53	89.2 - 94.2	0.90
79.5 - 84.5	0.48	84.4 - 89.4	0.52	89.3 - 94.3	0.90
79.6 - 84.6	0.55	84.5 - 89.5	0.50	89.4 - 94.4	0.90
79.7 - 84.7	0.61	84.6 - 89.6	0.49	89.5 - 94.5	0.90
79.8 - 84.8	0.67	84.7 - 89.7	0.48	89.6 - 94.6	0.90
79.9 - 84.9	0.71	84.8 - 89.8	0.48	89.7 - 94.7	0.89
80.0 - 85.0	0.73	84.9 - 89.9	0.49	89.8 - 94.8	0.88
80.1 - 85.1	0.74	85.0 - 90.0	0.50	89.9 - 94.9	0.87
80.2 - 85.2	0.73	85.1 - 90.1	0.53	90.0 - 95.0	0.86
80.3 - 85.3	0.74	85.2 - 90.2	0.57	90.1 - 95.1	0.84
80.4 - 85.4	0.77	85.3 - 90.3	0.63	90.2 - 95.2	0.83
80.5 - 85.5	0.82	85.4 - 90.4	0.66	90.3 - 95.3	0.82
80.6 - 85.6	0.88	85.5 - 90.5	0.66	90.4 - 95.4	0.81
80.7 - 85.7	0.95	85.6 - 90.6	0.64	90.5 - 95.5	0.80
80.8 - 85.8	1.03	85.7 - 90.7	0.63	90.6 - 95.6	0.80
80.9 - 85.9	1.10	85.8 - 90.8	0.61	90.7 - 95.7	0.78
81.0 - 86.0	1.15	85.9 - 90.9	0.58	90.8 - 95.8	0.75
81.1 - 86.1	1.19	86.0 - 91.0	0.58	90.9 - 95.9	0.71
81.2 - 86.2	1.22	86.1 - 91.1	0.60	91.0 - 96.0	0.66
81.3 - 86.3	1.23	86.2 - 91.2	0.60	91.1 - 96.1	0.60
81.4 - 86.4	1.22	86.3 - 91.3	0.59	91.2 - 96.2	0.53
81.5 - 86.5	1.21	86.4 - 91.4	0.57	91.3 - 96.3	0.47
81.6 - 86.6	1.20	86.5 - 91.5	0.57	91.4 - 96.4	0.44
81.7 - 86.7	1.17	86.6 - 91.6	0.58	91.5 - 96.5	0.43
81.8 - 86.8	1.12	86.7 - 91.7	0.57		

Note: 5-Mile Reaches that are grayed out include locations that are excluded from the 5-mile average regulation, as per the Revised Regulatory Plan for Commercial Dredging Activities on the Kansas River, Appendix A (January 2018). These include the WaterOne weir (RM 15.0), the Bowersock Dam (RM 51.8), and the city of Topeka water intake weir (RM 87.0).