

APPENDIX A

TABLES

Table A-1
Estimated Installation Cost
Site 24, Wakarusa Watershed, Kansas
(Dollars)¹

Installation Cost Item, Structural Measures	PL 83-566 Funds	Other Funds	Total
Structure No. 24	\$1,466,600	\$522,000	\$1,988,600

Notes:

¹ Price base July 2009.

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Table A-2
Cost Allocation and Cost-Sharing Summary 1/
Site 24, Wakarusa Watershed, Kansas
(2009 Dollars)

Item	Installation Costs – Public Law 83-566 3/						Installation Costs – Other Funds 4/								Total Installation Cost
	Const.	Eng.	Real Property	Relocat. Payments	Project Admin.	Total Federal Cost	Const.	Eng.	Real Property	Natural Resource Rights	Relocat. Payments	Required Permits	Project Admin.	Total Non-Federal Cost	
Rehabilitation of dam	\$969,400	\$351,800	\$0	\$0	\$145,400	\$1,466,600	\$203,100	\$0	\$239,900	\$0	\$20,000	\$0	\$59,000	\$522,000	\$1,988,600

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1/ Price Base: July 2009

2/ Total installation costs does not include NRCS planning costs

3/ 65% of total installation cost, not to exceed 100% of construction cost. Federal technical assistance is not cost-shared by the Sponsor

4/ 35% of total installation cost less Federal technical assistance

Table A-3
Structural Data – Dams with Planned Storage Capacity¹
Site 24, Wakarusa Watershed, Kansas

Item	Unit	Site 24
Class of structure		High
Seismic zone		1
Total drainage area	Sq. mi.	3.41
Runoff curve No. (1-day) (AMC II)		80
Time of concentration (T _c)	Hours	1.6
Elevation top dam ²	Feet	903.5
Elevation crest auxiliary spillway	Feet	891.5
Principal spillway crest elevation	Feet	879.4
Auxiliary spillway type		Vegetated
Auxiliary spillway bottom width	Feet	100
Auxiliary spillway exit slope	Percent	7%
Maximum height of dam	Feet	45.5
Volume of fill ⁷	CY	172,220
Total Capacity	Acre-feet	1309
Sediment submerged	Acre-feet	366
Sediment aerated	Acre-feet	0
Floodwater retarding	Acre-feet	929
Surface area		
Sediment pool ³	Acres	52.7
Floodwater retarding pool ⁴	Acres	106.5
Principal spillway design		
Rainfall volume (1-day)	Inches	7.9
Rainfall volume (10-day)	Inches	13.0
Runoff volume (10-day)	Inches	8.12
Capacity at auxiliary spillway crest elevation	CFS	78
Dimension of conduit	Inches	30
Type of conduit		RCP
Frequency operation auxiliary spillway	% chance	1
Auxiliary spillway hydrograph ⁵		
Rainfall volume	Inches	11.4
Runoff volume	Inches	8.87
Storm duration ⁶	Hours	6
Velocity of flow (V _f)	Feet/second	14.4
Maximum reservoir water surface elevation	Feet	894.8
Freeboard hydrograph		
Rainfall volume	Inches	34.5
Runoff volume	Inches	31.67
Storm duration	Hours	24
Maximum reservoir water surface elevation	Feet	903.5
Capacity equivalents		
Principal spillway volume	Inches	2.09
Floodwater retarding volume	Inches	5.11

Notes:

- ¹ Data Compiled: December 2009.
- ² The embankment will be raised approximately 6.1 feet.
- ³ Surface area at principal spillway crest elevation.
- ⁴ Surface area at auxiliary spillway crest elevation.
- ⁵ Auxiliary spillway hydrograph is also known as stability design hydrograph.
- ⁶ The more restrictive 24-hour duration was used for hydraulic evaluation.
- ⁷ Approximately 56,000 cubic yards of the total volume is required for rehabilitation of this structure.

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Table A-4
Estimated Average Annual Costs ^{1/}
Site 24, Wakarusa Watershed, Kansas

Evaluation Unit	Project Outlays		Total
	Amortization of Installation Cost ^{2/}	Operation, Maintenance, and Replacement Cost	
Federal Reconstruction (NED and Recommended Plan)	\$88,200	\$8,000	\$96,200

Notes: Feb-10
^{1/} Price Base: 2009, amortized over 101 years at a discount rate of 4.375 percent (authorized rate)
^{2/} Total installation costs as outlined in Table A-2

Table A-5
Estimated Average Annual Flood Damage Reduction Benefits
Site 24, Wakarusa Watershed, Kansas

	Average Annual Damages				Net Annual Damage Reduction Benefit
	Without Project (FWOP Plan)		With Project (Recommended Plan)		
	Ag	Non-Ag	Ag	Non-Ag	
Floodwater					
Crop and Pasture	\$13,000		\$13,000		\$0
Other Agricultural	\$3,100		\$3,100		\$0
Roads and Bridges		\$400		\$400	\$0
Commercial		\$0		\$0	\$0
Subtotal	\$16,100	\$400	\$16,100	\$400	\$0
Erosion					
Flood Plain Scour	\$500		\$500		\$0
Property Value Benefit					
Lakefront Property		\$70,200		\$70,200	\$0
Total	\$16,600	\$70,600	\$16,600	\$70,600	\$0

Notes: Feb-10
^{1/} Price Base: 2009 - Original plan damages were indexed to 2009 dollars and non-ag damages were calculated (annualized over 101 years at a rate of 4.375%)
^{2/} Net Annual Damage Reduction Benefit compares the difference in benefits provided for this site between the No Federal Action – High Hazard and the Federal Reconstruction Alternative.
^{3/} Floodwater damages would occur in the absence of Site 24.

**Table A-6
Comparison of Benefits and Costs ^{1/}
Site 24, Wakarusa Watershed, Kansas**

Evaluation Unit	Average Annual Benefits ^{2/}					Average Annual Costs ^{6/}	Benefit-Cost Ratio (unity of 1.0)
	Flood Damage Reduction ^{3/}		Non-Ag Property Value Benefits ^{4/}	Non-Ag Construction Cost Avoidance ^{5/}	Total Average Annual Benefits		
	Ag	Non-Ag					
FWRS 24 - Federal Reconstruction (NED and Recommended Plan)	\$0	\$0	\$0	\$67,500	\$67,500	\$96,200	0.7

Notes:

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- 1/ Price Base: 2009
- 2/ Benefits not analyzed above the 100-year frequency flood event.
- 3/ The recommended plan has the same average annual flood damage reduction benefits as the Future Without project of \$27,200 for agriculture related and \$26,200 for other non-agricultural.
- 4/ Property Value Benefit of Lakefront Property - Property value benefits are available if the pool created by the original structure is maintained. Homeowners enjoy living near lakes and ponds because of the aesthetic value. Lakes are visually pleasing and attract wildlife and birds enjoyed by nearby residents. Due to the desirability to live near lakes and ponds, property values for adjacent parcels are greater than those not adjacent to lakes and ponds. The dam currently provides a non-Ag annual property value benefit of \$70,200.
- 5/ The displayed cost avoidance is the annual construction cost of the non-federal (FWOP) avoided by proceeding with the recommended plan (Federal Action)
Clinton Parkway and K-10 were constructed after Site 24 was constructed and the culvert system installed under Clinton Parkway and K-10 was designed with Site 24 in place with smaller peaks from storm events. Therefore, the cost of providing larger culvert structures designed for larger peaks without the dam that is adequate for present day standards is a savings of installing Site 24. The dam currently provides an additional non-Ag construction cost avoidance benefit of \$266,200.
- 6/ From Table A-4