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ARMY ENGINEER DISTRICT LOUISVILLE KY
WABASH RIVER BASIN COMPREHENSIVE STUDY COVERING RESERVOIR SITES--ETC(U)
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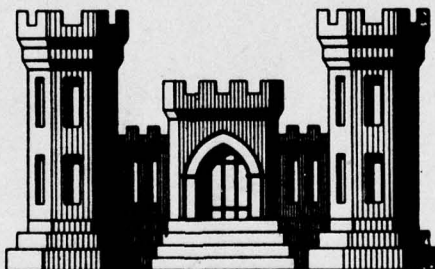
INTERIM REPORT NO. 2

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**WABASH RIVER BASIN
COMPREHENSIVE STUDY
INDIANA, ILLINOIS AND OHIO**



COVERING RESERVOIR SITES
ON
EMBARRASS RIVER, ILLINOIS
AND
CLIFTY CREEK AND PATOKA RIVER, INDIANA



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CORPS OF ENGINEERS

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CLIFTY CREEK AND PATOKA RIVER, INDIANA
Volume II.

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APPENDIX A

See Vol I

DETAILED ESTIMATE OF FIRST COSTS AND ANNUAL COSTS

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APPENDIX A

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TABLE 1
 SUMMARY OF COSTS
 LINCOLN MULTIPLE PURPOSE RESERVOIR PROJECT
 (Based on unit prices prevailing in December 1963)

<u>Item</u>	<u>Cost</u>	<u>Cost With Indirect Costs Distributed</u>
Land and damages	\$ 12,300,000	\$ 12,300,000
Relocations	3,200,000	9,348,000
Reservoir	1,750,000	2,043,000
Dam and appurtenances	3,640,000	4,150,000
General recreation	(3,790,000)	(4,320,000)
Initial	1,790,000	2,040,000
Future increment	2,000,000	2,280,000
Fish and wildlife recreation	125,000	143,000
Buildings, grounds and utilities	100,000	114,000
Permanent operating equipment	70,000	80,000
Engineering and design	1,165,000	
Supervision and administration	<u>1,300,000</u>	<u> </u>
Total Project Cost <u>1/</u>	\$ 33,000,000	\$ 33,000,000
Less Future Recreation Increment		<u>2,280,000</u>
Total Cost Initial Construction		\$ 30,720,000

1/ Preauthorization cost of \$35,000 not included.

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TABLE 2

DETAILED ESTIMATE OF FIRST COST
 LINCOLN MULTIPLE PURPOSE RESERVOIR PROJECT
 (Based on unit prices prevailing in December 1963)

<u>Item</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Amount</u>
LANDS AND DAMAGES				
FLOOD CONTROL				
<u>Fee acquisition</u>				
Homesites	Acre	250	\$ 750.00	\$ 187,500
Leasehold sites (Lake Charleston)	Each	25	1,000.00	25,000
Cropland (Fair)	Acre	8,500	250.00	2,125,000
Cropland (Good)	Acre	11,250	400.00	4,500,000
Pasture	Acre	3,000	60.00	180,000
Woodland, Wasteland, Riverbed & Bank	Acre	12,475	25.00	<u>312,000</u>
Subtotal, Fee Acquisition				\$ 7,329,500
<u>Improvements</u>	Job	1		1,264,500
<u>Severance damages</u>	Job	1		1,235,500
<u>Resettlement costs</u>	Each	145	500.00	72,500
<u>Contingencies</u>				1,565,500
<u>Acquisition costs</u>	Job	1	900.00	<u>472,500</u>
TOTAL, FLOOD CONTROL				\$12,000,000
LANDS AND DAMAGES				
RECREATION				
<u>Fee Acquisition</u>				
Cropland	Acre	1,000	250.00	\$ 250,000
Pasture	Acre	600	60.00	36,000
Woodland	Acre	1,700	25.00	<u>42,500</u>
Subtotal, Fee Acquisition				\$ 328,500

TABLE 2
(Cont'd)

<u>Item</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Amount</u>
<u>Improvements</u>	Job	1	\$ -	\$ 220,000
<u>Severance damages</u>	Job	1	-	30,000
<u>Resettlement costs</u>		35	500.00	17,500
<u>Contingencies</u>				114,000
<u>Acquisition costs</u>				40,000
TOTAL, RECREATION				\$ 800,000
<u>TOTAL, LANDS AND DAMAGES</u>				12,800,000

TABLE 2
(Cont'd)

<u>Item</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Amount</u>	<u>Length (Miles)</u>
RELOCATIONS					
ROADS					
State Roads					
SR-10	Job	1		\$ 475,000	0.53
SR-130	Job	1		940,000	0.66
SR-133	Job	1		206,000	0.28
SR-18 (4 lanes)	Job	1		760,000	0.45
Subtotal, State Roads				2,409,000	1.92
Federal Aid Secondary Roads					
F.A.S. 170	Job	1		\$ 777,000	0.81
F.A.S. 3	Job	1		126,000	0.17
F.A.S. 7	Job	1		48,000	0.32
F.A.S. 170	Job	1		235,000	0.26
Subtotal, Federal Aid Secondary Roads				\$1,186,000	1.56
County Roads					
Bushton Rd., (Main Stem)	Job	1		\$ 266,000	1.02
Polecat Cr.Br.	Job	1		13,000	0.19
Whetstone Cr.Br.	Job	1		83,000	0.17
Barnett Bridge	Job	1		157,000	0.28
County road	Job	1		132,000	0.22
Subtotal, County Roads				\$ 651,000	1.88
Removal of bridges	Job	1		120,000	
SUBTOTAL, ROADS				\$4,366,000	5.36
RAILROADS					
N.Y.C. & St. Louis	Job	1		\$1,865,000	3.03
SUBTOTAL, RAILROAD				\$1,865,000	3.03
CEMETERIES					
Sec. 2, T11N, R9E	Graves	60	200.00	\$ 12,000	
Sec. 20, T11N, R9E	Graves	150	200.00	30,000	
Sec. 14, T11N, R9E	Graves	5	200.00	1,000	
Sec. 22, T14N, R1DE	Graves	225	200.00	45,000	
SUBTOTAL, CEMETERIES				\$ 88,000	

TABLE 2
(Cont'd)

<u>Item</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Amount</u>	<u>Length (Miles)</u>
UTILITIES					
Electric service lines	Job	1	L.S.	\$ 90,000	6.02
Telephone lines	Job	1	L.S.	30,000	6.02
Misc. utility lines	Job	1	L.S.	50,000	
Alterations to Fox Ridge State Park	Job	1	L.S.	100,000	
Bank protection Oakland Water Supply Dam				30,000	
Relocation; Charleston Water Works pump plant	Job	1	L.S.	<u>70,000</u>	
SUBTOTAL, UTILITIES				\$ 370,000	
Subtotal				\$6,689,000	
Contingencies				<u>1,511,000</u>	
<u>TOTAL, RELOCATIONS</u>				\$8,200,000	
<u>RESERVOIR</u>					
Clearing wooded areas	Acre	4,100	350.00	\$1,435,000	
Removal, structures	Job	1	L.S.	<u>20,000</u>	
Subtotal				\$1,455,000	
Contingencies				<u>335,000</u>	
<u>TOTAL, RESERVOIR</u>				\$1,790,000	

TABLE 2
(Cont'd)

<u>Item</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Amount</u>
DAM AND APPURTENANCES				
SPILLWAY				
Clearing and grubbing	Job	1	L.S.	\$ 5,000
Excavation, common	C.Y.	60,400	.55	33,300
Fertilizer and seeding	Acre	6	500.00	3,000
Concrete cutoff sill	Job	1	L.S.	53,100
SUBTOTAL, SPILLWAY				\$ 94,400
DAM				
Diversion	Job	1	L.S.	\$ 50,000
Clearing and grubbing	Job	1	L.S.	13,000
Embankment, compacted impervious fill	C.Y.	1,137,000	0.10	113,700
Embankment, random fill (Includes borrow and placing)	C.Y.	260,000	0.60	156,000
Excavation, cut-off trench	C.Y.	46,300	0.60	27,780
Excavation, stripping	C.Y.	32,700	0.55	17,985
Borrow, impervious	C.Y.	1,253,000	0.45	563,900
Riprap	C.Y.	19,700	10.00	197,000
Bedding	C.Y.	9,800	4.00	39,200
Drain material	C.Y.	27,500	5.00	137,500
Guard rail	L.F.	4,840	2.50	12,100
Roadway surfacing on dam	S.Y.	4,840	4.00	19,360
Drilling and grouting	Job	1	L.S.	100,000
Trash boom	Job	1	L.S.	15,000
Fertilizer and seeding	Job	1	L.S.	3,500
Access road	Job	1	L.S.	25,000
SUBTOTAL, DAM				\$1,491,025
OUTLET WORKS				
Clearing and grubbing	Job	1	L.S.	\$ 1,000
Structural excavation, earth	C.Y.	51,300	1.50	77,700
Structural excavation, rock	C.Y.	10,800	5.00	54,000
Channel excavation, earth	C.Y.	43,000	0.75	32,300
Backfill, compacted	C.Y.	5,200	4.00	20,800

TABLE 2
(Cont'd)

<u>Item</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Amount</u>
OUTLET WORKS (Cont'd)				
Monolithic conc. conduit	L.F.	500	290.00	\$ 145,000
Operating tower, super-structure	Job	1	L.S.	256,000
Operating tower, mechanical	Job	1	L.S.	450,000
Concrete; basin, walls	C.Y.	3,430	60.00	206,800
Reinforcing steel	Lbs.	80,000	0.15	12,000
Electrical work	Job	1	L.S.	18,000
Service bridge	Job	1	L.S.	52,500
SUBTOTAL, OUTLET WORKS				\$1,328,100
Subtotal				2,913,525
Contingencies				<u>726,475</u>
TOTAL, DAM AND APPURTENANCES				\$3,640,000
<u>GENERAL RECREATION</u>				
Initial	Job	1		1,790,000
Future increment	Job	1		<u>2,000,000</u>
TOTAL GENERAL RECREATION				3,790,000 ^{1/}
<u>FISH AND WILDLIFE RECREATION</u>				
Multiple stage, low flow outlets with re-oxygenating facilities	Job	1		\$ 95,000
Park trails	Job	1		1,000
Access facilities	Job	1		<u>4,000</u>
Subtotal				\$ 100,000
Contingencies				<u>25,000</u>
TOTAL, FISH AND WILDLIFE RECREATION				\$ 125,000
<u>BUILDINGS, GROUNDS AND UTILITIES</u>				
Shop building	Job	1		\$ 15,000
Site development, utilities for shop building	Job	1		3,000
Operators quarters	Each	2	20,000	40,000

1/ Includes contingencies

TABLE 2
(Cont'd)

<u>Item</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Amount</u>
<u>BUILDINGS, GROUNDS AND UTILITIES (Cont'd)</u>				
Site development and exterior utilities for quarters	Job	1		\$ 8,000
Miscellaneous, utilities	Job	1		<u>15,000</u>
Subtotal				\$ 81,000
Contingencies				<u>19,000</u>
<u>TOTAL, BUILDINGS, GROUNDS AND UTILITIES</u>				\$ 100,000
<u>PERMANENT OPERATING EQUIPMENT</u>				
Tractor, truck, mower, tools, etc.	Lot	1		\$ 10,000
Radio facilities	Job	1		20,000
Rainfall and discharge stations	Job	1		<u>30,000</u>
Subtotal				\$ 60,000
Contingencies				<u>10,000</u>
<u>TOTAL, PERMANENT OPERATING EQUIPMENT</u>				\$ 70,000

TABLE 3
 DETAILED ESTIMATE OF ANNUAL COSTS
 LINCOLN MULTIPLE PURPOSE RESERVOIR PROJECT

<u>Item</u>	<u>Financial</u>	<u>Economic</u>
INITIAL PROJECT		
a. <u>Total investment</u>		
(1) Recapitulation of project costs		
(a) Total net costs	\$30,720,000	\$30,720,000
(b) Market value of lands	-	9,900,000
(2) Interest during construction		
3% for 1/2 construction period 4 years (5%)	1,843,000	1,843,000
(3) Total gross investment	<u>\$32,563,000</u>	<u>\$32,563,000</u>
(4) Net salvage value	-	-
(5) Total Federal net investment	\$32,563,000	\$32,563,000
b. <u>Annual Costs</u>		
(1) Interest on gross investment		
(a) Financial: (3%)(32,563,000)	977,000	
(b) Economic: (3%)(32,563,000)		977,000
(c) Economic: Adjustment for net loss of land		
(5%-3%)(9,900,000)	-	198,000
(2) Amortization		
(a) Financial: (0.00165)(32,563,000)	54,000	
(b) Economic: (0.00165)(32,563,000)		54,000

TABLE 3
(Cont'd)

<u>Item</u>	<u>Financial</u>	<u>Economic</u>
(3) Maintenance and operation		
(a) Dam and reservoir	\$ 40,000	\$ 40,000
(b) General recreation	104,000	104,000
(c) Fish and Wildlife	0	0
(4) Major replacements		
(a) Dam and reservoir	3,000	3,000
(b) General recreation	18,000	18,000
(5) Total initial annual charges -	\$ 1,196,000	\$ 1,394,000
c. <u>Future Recreation Increment</u>		
(1) Interest on gross investment		
(a) Financial: (3%) (2,280,000)	68,000	-
(b) Economic: (3%) (2,280,000)	-	68,000

TABLE 3
(Cont'd)

<u>Item</u>	<u>Financial</u>	<u>Economic</u>
(2) Amortization		
(a) Financial: (0.00165)(2,280,000)	3,800	
(b) Economic: (0.00165)(2,280,000)		3,800
(3) Maintenance and operation		
(a) Dam and reservoir	-	-
(b) General recreation	140,000	140,000
(4) Major replacements		
(a) Dam and reservoir	-	-
(b) General recreation	19,000	19,000
	<hr/>	<hr/>
Subtotal	\$ 230,800	\$ 230,800
Present worth - 100 yr. accelerated growth @ 3% (.65047)	\$ 150,000	\$ 150,000
ARA economic cost reduction		91,000
	<hr/>	<hr/>
Total annual charges	\$ 1,346,000	\$ 1,453,000

TABLE 4

SUMMARY OF COSTS
 CLIFTY CREEK MULTIPLE PURPOSE RESERVOIR PROJECT
 (Based on unit prices prevailing in December 1963)

<u>Item</u>	<u>Cost</u>	<u>Cost with Indirect Costs Distributed</u>
Lands and damages	\$ 1,810,000	\$ 1,810,000
Relocations	2,250,000	2,600,000
Reservoir	140,000	161,000
Dam and appurtenances	6,350,000	7,357,000
Levees	290,000	334,000
General recreation	(2,870,000)	(3,310,000)
Initial	1,100,000	1,270,000
Future increment	1,770,000	2,040,000
Fish and wildlife recreation	110,000	127,000
Building, ground and utilities	100,000	115,000
Permanent operating equipment	75,000	86,000
Engineering and design	912,000	-
Supervision and administration	963,000	-
Total cost of project ^{1/}	<u>\$15,900,000</u>	<u>\$15,900,000</u>
Less recreation, future increment		<u>2,040,000</u>
Total cost initial construction ^{1/}		<u>\$13,860,000</u>

^{1/} Preauthorization cost of \$35,000 not included.

TABLE 5

DETAILED ESTIMATE OF FIRST COSTS
CLIFTY CREEK MULTIPLE PURPOSE RESERVOIR PROJECT

<u>Item</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Amount</u>
<u>LANDS AND DAMAGES</u>				
<u>FLOOD CONTROL</u>				
<u>Fee acquisition</u>				
Homesites	Each	60	\$ 700	\$ 42,000
Lots	Each	12	500	6,000
Lots	Each	18	300	5,400
Cropland	Acre	1,536	325	499,200
Pasture	Acre	548	90	49,320
Woodland	Acre	924	70	64,680
Waste	Acre	272	25	6,800
Subtotal, Fee acquisition				\$ 673,400
<u>Improvements</u>				
Sets of buildings		25	5,385	\$ 134,625
Dwellings		13	4,375	56,875
Town of Hartsville	Job	1	-	69,000
Subtotal				260,500
<u>Isolation</u>				
6 Tracts including land & improvements				194,000
<u>Valuation of Mineral Rights</u>				
				-0-
<u>Severance damage</u>				
				140,085
<u>Contingencies</u>				
				190,015
<u>Resettlement Costs</u>				
60 family units			\$ 500	30,000
<u>Relocation Costs</u>				
Cemetery-NW section of Hartsville, rights-of-way costs & borrow areas				7,000

TABLE 5
(Cont'd)

<u>Item</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Amount</u>
Hartsville College Cemetery additional cost of land & improvements				\$ 30,000
<u>Acquisition Costs</u>				
110 Tracts			\$ 900	99,000
TOTAL, FLOOD CONTROL				\$1,624,000
<u>LANDS AND DAMAGES</u>				
<u>GENERAL RECREATION</u>				
<u>Fee acquisition</u>				
Cropland	Acre	306	325	\$ 99,450
Pasture	Acre	108	90	9,720
Woodland	Acre	136	70	13,020
Subtotal, Fee Acquisition				\$ 122,190
<u>Improvements</u>	Job	1		16,050
<u>Severance damages</u>	Job	1		20,736
<u>Resettlement costs</u>	Job	1		1,500
<u>Contingencies</u>				22,824
<u>Acquisition costs</u>	Job	1		2,700
TOTAL, GENERAL RECREATION				\$ 186,000
<u>TOTAL, LANDS AND DAMAGES</u>				\$1,810,000

<u>Item</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Amount</u>	<u>Length (Miles)</u>
<u>RELOCATIONS</u>					
<u>ROADS</u>					
<u>State roads</u>					
SR-46	Job	1		\$ 732,400	3.28

TABLE 5
(Cont'd)

<u>Item</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Amount</u>	<u>Length (Miles)</u>
<u>RELOCATIONS (Cont'd)</u>					
<u>ROADS</u>					
SR-635	Job	1		\$ 165,600	0.25
SR-637	Job	1		332,000	0.77
Subtotal, State Roads				\$1,280,000	
<u>County roads</u>					
Bartholomew - Decatur	Job	1		284,000	0.35
<u>Bridge removal</u>	Job	1		52,000	
SUBTOTAL, ROADS				\$1,616,000	5.15
<u>CEMETERIES</u>					
Hartsville College Cemetery	Graves	525	\$200.00	\$ 105,000	
Cemetery; NW Section of Hartsville	Graves	198	200.00	39,600	
SUBTOTAL, CEMETERIES				\$ 144,600	
<u>UTILITIES</u>					
Electric Lines	Job	1		18,000	11.0
Telephone Lines	Job	1		12,000	11.0
SUBTOTAL, UTILITIES				\$ 30,000	
Subtotal				\$1,790,600	
Contingencies				459,400	
<u>TOTAL, RELOCATIONS</u>				\$2,250,000	
<u>RESERVOIR</u>					
Clearing wooded areas	Acre	180	\$350.00	\$ 63,000	
Light clearing & brush, fence rows, etc.	Acre	390	80.00	31,200	

TABLE 5
(Cont'd)

<u>Item</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Amount</u>	<u>Length (Miles)</u>
<u>RESERVOIR (Cont'd)</u>					
Remove structures	Job	1	-	\$ 15,000	
Contingencies				<u>30,800</u>	
<u>TOTAL, RESERVOIR</u>				\$ 140,000	
<u>DAM AND APPURTENANCES</u>					
<u>EARTH SECTION AND DIKE</u>					
Clearing and grubbing	Job	1	L.S.	\$ 10,000	
Diversion and care of river	Job	1	L.S.	10,000	
Stripping for embankment	C.Y.	45,000	0.55	24,750	
Excavation, trench, earth	C.Y.	37,000	0.60	22,200	
Excavation, borrow, impervious	C.Y.	730,000	0.45	328,500	
Compacted fill	C.Y.	690,000	0.10	69,000	
Drain material	C.Y.	45,000	5.00	225,000	
Riprap, dumped	C.Y.	22,000	10.00	220,000	
Bedding	C.Y.	11,000	6.00	66,000	
Seeding	Acre	13	500.00	6,500	
Drilling and grouting dam	Job	1	L.S.	300,000	
Roadway surfacing	S.Y.	17,000	4.00	68,000	
Guard rail	L.F.	21,000	2.50	52,500	
Piezometers	Job	1	L.S.	6,000	
Power and gas to dam site	Job	1	L.S.	6,000	
Trash boom	Job	1	L.S.	30,000	
<u>SUBTOTAL, EARTH SECTION AND DIKE</u>				\$1,444,450	
<u>CONCRETE SECTION</u>					
Clearing work area	Job	1		3,000	
Excavation, common	C.Y.	58,000	0.55	31,900	
Excavation, rock	C.Y.	20,000	1.75	35,000	
Excavation, structural, rock	C.Y.	2,300	10.00	23,000	

TABLE 5
(Cont'd)

<u>Item</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Amount</u>	<u>Length (Miles)</u>
<u>CONCRETE SECTION (Cont'd)</u>					
Backfill, compacted	C.Y.	10,000	2.50	\$ 25,000	
Concrete, bridge deck and parapet	C.Y.	60	80.00	4,800	
Concrete, sills and baffles	C.Y.	400	60.00	24,000	
Concrete, walls and piers	C.Y.	8,500	50.00	425,000	
Concrete, apron slab and keys	C.Y.	2,700	40.00	108,000	
Concrete, mass	C.Y.	79,200	26.00	2,059,200	
Re-inforcing steel	lb.	720,000	0.14	100,800	
Crest gates, complete	Ea.	3	110,000.00	330,000	
Derrick stone, in place	C.Y.	1,500	15.00	22,500	
Spalls, in place	C.Y.	300	7.00	2,100	
Gravel in drains	C.Y.	600	7.00	4,200	
Structural steel	lb.	40,000	0.25	10,000	
Miscellaneous steel and iron	lb.	20,000	0.50	10,000	
Miscellaneous nonferrous metal	lb.	12,000	2.50	30,000	
Water stops	lb.	4,000	2.00	8,000	
Miscellaneous pipe and fittings	lb.	16,000	0.75	12,000	
Drilling and placing anchors	L.F.	1,400	5.00	7,000	
Drilling drainage holes	L.F.	3,000	6.00	18,000	
Bridge railing	L.F.	1,200	7.00	8,400	
Handrail, pipe	L.F.	220	5.00	1,100	
Foundation protective treatment	S.Y.	7,000	2.00	14,000	
Electric system	Job	1	L.S.	100,000	
Staff gages	Job	1	L.S.	5,000	
Pylon and operating building	Job	1	L.S.	50,000	
Sluice gates, complete	Ea.	2	\$60,000.00	120,000	
Emergency bulkheads and guides	lb.	14,000	0.50	7,000	
Misc. pipe and fittings sluices	lb.	12,000	0.75	9,000	
Drilling and grouting				<u>50,000</u>	
SUEOTOTAL, CONCRETE SECTION				\$3,658,000	

TABLE 5
(Cont'd)

<u>Item</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Amount</u>
<u>DAM AND APPURTENANCES (Cont'd)</u>				
<u>CONCRETE SECTION (Cont'd)</u>				
Subtotal				\$5,102,450
Contingencies				<u>1,277,550</u>
<u>TOTAL DAM AND APPURTENANCES</u>				\$6,380,000
<u>HARTSVILLE LEVEE</u>				
Clearing and grubbing	Job	1		\$ 1,000
Stripping and exploration	C.Y.	22,000	0.55	12,100
Embankment	C.Y.	153,000	0.10	15,300
Excavation, borrow	C.Y.	176,000	0.45	79,200
Riprap, dumped	C.Y.	8,200	10.00	82,000
Bedding	C.Y.	4,100	6.00	24,600
Seeding	Acre	9	500.00	4,500
Interior drainage structures	Job	1		<u>13,500</u>
Subtotal, Hartsville Levee				\$ 232,200
Contingencies				<u>57,800</u>
<u>TOTAL, HARTSVILLE LEVEE</u>				\$ 290,000
<u>GENERAL RECREATION</u>				
Initial	Job	1	L.S.	\$1,100,000
Future increment	Job	1	L.S.	<u>1,770,000</u>
<u>TOTAL, GENERAL RECREATION</u>				\$2,870,000 ^{1/}
^{1/} Includes contingencies				
<u>FISH AND WILDLIFE RECREATION</u>				
Multiple-stage low flow outlets with re-oxygenating facilities	Job	1		\$ 35,000
Subtotal				<u>85,000</u>
Contingencies				<u>25,000</u>
<u>TOTAL, FISH AND WILDLIFE RECREATION</u>				\$ 110,000

TABLE 5
(Cont'd)

<u>Item</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Amount</u>
<u>BUILDINGS, GROUNDS AND UTILITIES</u>				
Shop building	Job	1		\$ 20,000
Water and sanitary system	Job	1		30,000
Electric service	Job	1		5,000
Site grading and landscaping	Job	1		5,000
Roads and surfacing	Job	1		5,000
Parking areas	Job	1		15,000
Subtotal				\$ 80,000
Contingencies				20,000
<u>TOTAL, BUILDINGS, GROUNDS AND UTILITIES</u>				\$ 100,000
<u>PERMANENT OPERATING EQUIPMENT</u>				
Tractor, truck, mower tools, etc.	Lot	1		\$ 10,000
Radio facilities	Job	1		20,000
Rainfall and discharge stations	Job	1		30,000
Subtotal				\$ 60,000
Contingencies				15,000
<u>TOTAL, PERMANENT OPERATING EQUIPMENT</u>				\$ 75,000

TABLE 6

DETAILED ESTIMATE OF ANNUAL COSTS
CLIFTY CREEK MULTIPLE PURPOSE RESERVOIR PROJECT

<u>Item</u>	<u>Financial</u>	<u>Economic</u>
a. <u>Total investment - Initial Project</u>		
(1) Recapitulation of project costs		
(a) Total net costs	\$ 13,860,000	\$ 13,860,000
(b) Market value of lands		935,000
(2) Interest during construction		
3.0% for 1/2 construction period		
4 years (6.0%)	832,000	832,000
(3) Total gross investment	14,692,000	14,692,000
(4) Net salvage value	-	-
(5) Total Federal net investment	14,692,000	14,692,000
b. <u>Annual costs</u>		
Initial Project:		
(1) Interest on gross investment		
(a) Financial: (3.0%)(14,692,000)	441,000	
(b) Economic: (3.0%)(14,692,000)	-	441,000
(c) Economic: Adjustment for net loss of land (5%-3.0%) (935,000)	-	19,000
(2) Amortization		
(a) Financial: (0.00165)(14,692,000)	24,200	
(b) Economic: (0.00165)(14,692,000)		24,200
(3) Maintenance and operation		
(a) Dam and reservoir	35,000	35,000
(b) General recreation	58,000	58,000

TABLE 6
(Cont'd)

<u>Item</u>	<u>Financial</u>	<u>Economic</u>
(4) Major replacement		
(a) Dam and reservoir	\$ 7,000	\$ 7,000
(b) General recreation	<u>10,800</u>	<u>10,800</u>
(5) Total initial annual charges	\$ 576,000	\$ 595,000
Future Recreation Increment:		
(6) Interest on gross investment (3.0%) (2,040,000)	\$ 61,000	\$ 61,000
(7) Amortization (0.00165) (2,040,000)	3,000	3,000
(8) Maintenance and operation General recreation	121,000	121,000
(9) Major replacements General recreation	<u>17,000</u>	<u>17,000</u>
<u>Subtotal</u>	\$ 202,000	\$ 202,000
Present worth - 100-year accelerated growth at 3% (.65047)	<u>\$ 131,000</u>	<u>\$ 131,000</u>
<u>Total Annual Charges</u>	\$ 707,000	\$ 726,000

TABLE 7
 SUMMARY OF COSTS
 PATOKA MULTIPLE PURPOSE RESERVOIR PROJECT
 (Based on unit prices prevailing in December 1963)

<u>Item</u>	<u>Cost</u>	<u>Cost with Indirect Cost Distributed</u>
Lands and Damages	\$ 3,060,000	\$ 3,060,000
Relocations	5,150,000	5,923,000
Reservoir	800,000	919,000
Dam and Appurtenances	7,170,000	8,241,000
General Recreation	(4,730,000)	(5,435,000)
Initial	1,630,000	1,875,000
Future Increment	3,100,000	3,560,000
Fish and Wildlife	200,000	228,000
Bldg., Ground and Utilities	100,000	114,000
Permanent Operating Equipment	70,000	80,000
Engineering and Design	1,285,000	
Supervision and Administration	<u>1,435,000</u>	
Total Project Cost	\$24,000,000	\$24,000,000
Less Recreation Future Increment		<u>3,560,000</u>
Total Cost Initial Construction		\$20,440,000

TABLE 8

DETAILED ESTIMATE OF FIRST COST
PATOKA MULTIPLE PURPOSE RESERVOIR PROJECT

<u>Item</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Amount</u>
<u>LANDS AND DAMAGES</u>				
<u>FLOOD CONTROL & CONSERVATION</u>				
Fee acquisition				
<u>Land</u>				
Homesites	Acre	190	\$ 350.00	\$ 66,500
Crop land	Acre	4,940	110.00	543,400
Pasture	Acre	6,270	35.00	219,450
Wood land - Waste	Acre	7,600	15.00	114,000
Subtotal				\$ 943,350
<u>Improvements</u>				
Sets of buildings	Each	126	\$2,700.00	\$ 340,200
Dwellings	Each	13	4,150.00	53,950
St. Joe G.B. Church				5,000
Elon Christian Church				7,000
Newton Stewart Church				4,000
Subtotal				\$ 410,150
<u>Isolation</u>				
Tracts	Each	40	\$3,500.00	\$ 340,000
<u>Valuation of mineral rights</u>				
				0
<u>Severance damage</u>				
				340,000
<u>Resettlement costs</u>				
	Each	160	\$ 500.00	80,000
<u>Contingencies</u>				
				336,500
<u>Acquisition costs</u>				
	Job	1		400,000
TOTAL, FLOOD CONTROL				2,850,000

TABLE C
(Cont'd)

<u>Item</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Amount</u>	<u>Length (Miles)</u>
<u>Federal Aid Secondary Roads</u>					
S-732 Patoka Riv.	Job	1		\$ 133,000	0.23
S-566 S.W. of dam	Job	1		75,300	1.04
S-732 Alstott Cr.	Job	1		45,600	0.15
S-1191 at Elon	Job	1		<u>1,016,000</u>	<u>1.40</u>
Subtotal, Fed. Aid Sec. roads				\$1,269,900	2.82
<u>County roads</u>					
Misc. Co. roads	Job	1		\$ 800,000	<u>4.94</u>
Removal of bridges	Job	1		165,000	
SUBTOTAL, ROADS				\$3,943,400	13.62
CEMETERIES					
Cemeteries (5)	Graves	410	\$200.00	<u>\$ 82,000</u>	
SUBTOTAL, CEMETERIES				\$ 82,000	
RIGHTS OF WAYS					
Borrow areas	Job	1		<u>\$ 30,000</u>	
SUBTOTAL, RIGHTS OF WAYS				\$ 30,000	
UTILITIES					
Telephone lines	Job	1		\$ 13,600	13.62
Electric ser. line	Job	1		21,400	13.62
Power line	Job	1		<u>20,000</u>	<u>2.00</u>
SUBTOTAL, UTILITIES				\$ 63,000	29.24
Subtotal				\$4,110,400	
Contingencies				<u>1,031,600</u>	
<u>TOTAL, RELOCATIONS</u>				\$5,150,000	

TABLE C
(Cont'd)

<u>Item</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Amount</u>
<u>LANDS AND DAMAGES</u>				
<u>GENERAL RECREATION</u>				
<u>Fee acquisition</u>				
Cropland	Acre	500	\$110.00	\$ 65,000
Pasture	Acre	870	35.00	30,450
Wood land	Acre	1,450	15.00	21,750
Subtotal				\$ 116,000
<u>Improvements</u>	Job	1		20,000
<u>Severance damages</u>				20,000
<u>Resettlement costs</u>				3,000
<u>Contingencies</u>				20,000
<u>Acquisition costs</u>				20,000
TOTAL, GENERAL RECREATION				\$ 210,000
<u>TOTAL, LANDS AND DAMAGES</u>				3,060,000

<u>Item</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Amount</u>	<u>Length (miles)</u>
<u>RELOCATIONS</u>					
<u>ROADS</u>					
<u>State roads</u>					
S.R. 145					
Painter Cr.	Job	1		\$ 233,500	0.43
S.R. 145					
Fleming Cr.	Job	1		893,000	3.15
S.R. 104					
Lick Fk. Cr.	Job	1		513,500	2.08
S.R. 104					
Int. w/145	Job	1		60,400	0.20
Subtotal, State roads				\$1,700,500	5.86

TABLE C
(Cont'd)

<u>Item</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Amount</u>	<u>Length (Miles)</u>
<u>Federal Aid Secondary Roads</u>					
S-732 Patoka Riv.	Job	1		\$ 133,000	0.23
S-566 S.W. of dam	Job	1		75,300	1.04
S-732 Alstott Cr.	Job	1		45,600	0.15
S-1191 at Elon	Job	1		<u>1,016,000</u>	<u>1.40</u>
Subtotal, Fed. Aid Sec. roads				\$1,269,900	2.82
<u>County roads</u>					
Misc. Co. roads	Job	1		\$ 800,000	<u>4.94</u>
Removal of bridges	Job	1		165,000	
SUBTOTAL, ROADS				\$3,943,400	13.62
CEMETERIES					
Cemeteries (5)	Graves	410	\$200.00	<u>\$ 82,000</u>	
SUBTOTAL, CEMETERIES				\$ 82,000	
RIGHTS OF WAYS					
Borrow areas	Job	1		<u>\$ 30,000</u>	
SUBTOTAL, RIGHTS OF WAYS				\$ 30,000	
UTILITIES					
Telephone lines	Job	1		\$ 13,600	13.62
Electric ser. line	Job	1		21,400	13.62
Power line	Job	1		<u>20,000</u>	<u>2.00</u>
SUBTOTAL, UTILITIES				\$ 63,000	29.24
Subtotal				\$4,118,400	
Contingencies				<u>1,031,600</u>	
<u>TOTAL, RELOCATIONS</u>				\$5,150,000	

TABLE 8
(Cont'd)

<u>Item</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Amount</u>
<u>RESERVOIR</u>				
Clearing wooded areas	Acre	1,470	\$ 350.00	\$ 514,500
Brush, fence rows, etc.	Acre	6,660	15.00	100,000
Removal, structures	Job	1		<u>30,000</u>
Subtotal				\$ 644,500
Contingencies				<u>155,500</u>
<u>TOTAL, RESERVOIR</u>				\$ 800,000
<u>DAM AND APPURTENANCES</u>				
<u>SPILLWAY</u>				
Clearing and grubbing	Job	1		\$ 1,000
Excavation, common	c.y.	417,800	0.55	229,790
Excavation, rock	c.y.	436,000	1.25	545,000
Guard fence	L.F.	2,600	4.00	10,400
Concrete control sill	Job	1		132,000
Seeding	Acre	20	500.00	10,000
Service road	Job	1		<u>10,000</u>
SUBTOTAL, SPILLWAY				\$ 938,190
<u>DAM</u>				
Stream diversion	Job	1		\$ 25,000
Clearing and grubbing	Job	1		5,000
Excavation, borrow	c.y.	348,000	0.45	156,600
Excavation, stripping	c.y.	100,000	0.55	55,000
Excavation, trenching	c.y.	10,300	0.45	4,635
Drilling and grouting	Job	1		2,000,000
Fill, random rock	c.y.	523,000	0.20	104,640
Fill, impervious	c.y.	288,300	0.15	43,245
Graded drain	c.y.	18,745	5.00	93,725
Graded aggregate	c.y.	18,745	5.00	93,725
Special grouting to hold pool	Job	1		500,000
Riprap, dumped	c.y.	18,800	10.00	188,000
Bedding	c.y.	9,200	6.00	55,200
Guard rail	L.F.	4,680	2.50	11,700
Roadway surfacing	s.y.	5,555	4.00	22,220
Fertilizer and seeding	Acre	8	500.00	4,000
Access road	Job	1		75,000
Relief wells	Job	1		50,000

TABLE 8
(Cont'd)

<u>Item</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Amount</u>
Trash boom	Job	1		\$ 15,000
SUBTOTAL, DAM				\$3,502,690

DIKE

Excavation, stripping	c.y.	12,000	0.45	5,400
Excavation, trenching	c.y.	2,400	0.45	1,080
Excavation, borrow	c.y.	161,000	0.45	69,075
Fill, impervious	c.y.	133,500	0.15	20,025
Guard rail	L.F.	3,120	2.50	7,800
Fertilizer & seeding	Acre	2.3	500.00	1,150
Riprap, dumped	c.y.	6,200	10.00	62,000
Bedding	c.y.	3,100	6.00	18,600
Roadway surfacing	s.y.	1,560	4.00	6,200
SUBTOTAL, DIKE				\$ 191,330

OUTLET WORKS

Clearing and grubbing	Job	1		\$ 2,000
Excavation, structural, earth	c.y.	20,400	1.50	30,600
Excavation, channel, earth	c.y.	106,000	0.75	79,500
Excavation, rock, structural	c.y.	950	6.00	5,700
Backfill, compacted	c.y.	2,800	4.00	11,200
Riprap, dumped	c.y.	200	10.00	2,000
Bedding	c.y.	100	6.00	600
Concrete, basin, walls, etc.	c.y.	2,100	60.00	126,000
Reinforcing steel	lb.	150,000	0.15	22,500
Monolithic conc. conduit	L.F.	430	260.00	111,800
Operating tower, structure	Job	1		250,000
Operating tower, mechanical	Job	1		400,000
Electrical work	Job	1		20,000
Service bridge	Job	1		50,000
SUBTOTAL, OUTLET WORKS				\$1,111,900

TABLE 8
(Cont'd)

<u>Item</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Amount</u>
Subtotal				\$5,744,110
Contingencies				1,425,890
<u>TOTAL, DAM AND APPURTENANCES</u>				<u>\$7,170,000</u>
<u>GENERAL RECREATION</u>				
Initial	Job	1	L.S.	\$1,630,000
Future increment	Job	1		3,100,000
<u>TOTAL, GENERAL RECREATION</u>				<u>\$4,730,000</u> <u>1/</u>
1/ Includes contingencies				
<u>FISH AND WILDLIFE RECREATION</u>				
Multiple stage, low flow outlets with reoxygenating facilities	Job	1		\$ 120,000
Access facilities	Job	1		30,000
Park trails	Job	1		3,000
Signs and markers	Job	1		2,000
Water supply	Job	1		10,000
Subtotal				\$ 165,000
Contingencies				35,000
<u>TOTAL, FISH AND WILDLIFE RECREATION</u>				<u>\$ 200,000</u>
<u>BUILDINGS, GROUNDS AND UTILITIES</u>				
Shop building	Job	1		\$ 10,000
Water and sanitary system	Job	1		15,000
Site grading and landscaping	Job	1		5,000
Utilities for shop and operators quarters	Job	1		5,000
Operators quarters	Job	1		40,000
Subtotal				\$ 75,000
Contingencies				25,000
<u>TOTAL BUILDINGS, GROUNDS AND UTILITIES</u>				<u>\$ 100,000</u>

TABLE 8
(Cont'd)

<u>Item</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Amount</u>
<u>PERMANENT OPERATING EQUIPMENT</u>				
Tractor, truck, mower, etc.	Lot	1		\$ 10,000
Radio facilities	Job	1		20,000
Rainfall discharge stations	Job	1		<u>30,000</u>
Subtotal				\$ 60,000
Contingencies				<u>10,000</u>
<u>TOTAL, PERMANENT OPERATING EQUIPMENT</u>				\$ 70,000

TABLE 9

DETAILED ESTIMATE OF ANNUAL COSTS
PATOKA MULTIPLE PURPOSE RESERVOIR PROJECT

<u>Item</u>	<u>Financial</u>	<u>Economic</u>
<u>a. Total investment - Initial Project</u>		
(1) Recapitulation of project costs		
(a) Total net costs	\$20,440,000	\$20,440,000
(b) Market value of lands		1,400,000
(2) Interest during construction		
3% for 1/2 construction period		
4 years (6%)	1,226,000	1,226,000
(3) Total gross investment		
(4) Net salvage value	-	-
(5) Total Federal net investment	21,666,000	21,666,000
<u>b. Annual costs</u>		
Initial Project:		
(1) Interest on gross investment		
(a) Financial: (3%)(\$21,666,000)	650,000	
(b) Economic: (3%)(\$21,666,000)		650,000
(c) Economic: Adjustment for net loss of land (5%-3%)(\$1,400,000)	-	28,000
(2) Amortization		
(a) Financial: (0.00165)(\$21,666,000)	36,000	
(b) Economic: (0.00165)(\$21,666,000)		36,000
(3) Maintenance and operation		
(a) Dam and reservoir	35,000	35,000
(b) Water Supply and water quality control	10,000	10,000

TABLE 9
(Cont'd)

<u>Item</u>	<u>Financial</u>	<u>Economic</u>
(c) General recreation	\$ 96,000	\$ 96,000
(4) Major replacements		
(a) Dam and reservoir	3,000	3,000
(b) General recreation	<u>16,000</u>	<u>16,000</u>
(5) <u>Total initial annual charges</u>	\$ 846,000	\$ 874,000
c. <u>Annual costs</u>		
Future Recreation Increment		
(1) Interest on gross investment		
(a) Financial: (3%)($\$3,560,000$)	\$ 107,000	
(b) Economic: (3%)($\$3,560,000$)		\$ 107,000
(2) Amortization		
(a) Financial: (0.00165)($\$3,560,000$)	5,900	
(b) Economic: (0.00165)($\$3,560,000$)		5,900
(3) Maintenance and operation		
(a) Dam and reservoir	-	-
(b) General recreation	201,000	201,000
(4) Major replacements		
(a) Dam and reservoir	-	-
(b) General recreation	<u>30,000</u>	<u>30,000</u>
Subtotal	\$ 343,900	\$ 343,900
Present worth - 100 year - accelerated growth at 3% (.65047)	224,000	224,000
A.R.A. Economic Cost Reduction		<u>85,000</u>
Total Annual Charges	<u>\$1,070,000</u>	<u>\$1,013,000</u>

SECTION II - AREA REDEVELOPMENT ACT EFFECTS

a. ARA effects as a reduction in economic costs. The value of wages paid for construction, operation and maintenance of the proposed projects, to persons who would otherwise be unemployed and who live in redevelopment counties within commuting distance of the projects is claimed as a reduction of economic costs. The values computed for the initial phase of construction of the projects were converted to average annual equivalent values by compound interest methods. All ARA wage expenditures for construction, operation and maintenance of the future increment of recreation and for operation and maintenance of the initial increment were discounted, with the assumption that employment opportunities would increase, without the projects, to full employment 20 years after completion of initial construction. These discounted values were then converted to average annual equivalent values by compound interest methods. The value of labor costs and skill requirements is based upon office studies of recent detailed cost estimates of Monroe and Barren Reservoirs. A summary of labor costs and skill requirements is presented in table 10.

TABLE 10

LABOR COSTS AND SKILL REQUIREMENTS FOR CONSTRUCTION
OF BARREN AND MONROE RESERVOIRS

Item	Percent labor of 1st cost	Percent skill requirement		
		Skilled	Semiskilled	Unskilled
Lands & damages	0	-	-	-
Relocations	20	72	12	16
Reservoir & pool preparation	43	12	4	84
Dam & appurtenances	20	56	17	27
General recreation facilities	20	50	25	25
Buildings, ground & utilities	20	56	17	27
Permanent operating equipment	0	-	-	-

Further studies were made to ascertain the ability of the ARA reservoir counties to furnish the necessary skills from the unemployed rolls. Definitive studies are lacking in respect to accurate reporting of the inventory of skills among the unemployed at the county level. For this reason an estimate was prepared, based upon the available published employment data, and discussions with the field coordinators of the Area Redevelopment Program. Pertinent data are summarized in table 11.

TABLE 11
 POPULATION, EMPLOYMENT AND UNEMPLOYED RATES IN ARA RESERVOIR COUNTIES

Project	ARA reservoir counties	ARA Classification	Population ^{1/}	Employment ^{2/}	Construction ^{2/} employment	Percent ^{2/} unemployed
Lincoln	Coles	5b	42,860	16,908	767	6 +
	Cumberland	5b	9,936	3,551	146	6 +
Clifty Creek	-	-	-	-	-	-
Patoka	Crawford	5b	8,379	2,600	163	6 +
	Orange	5b	16,877	6,318	365	5.7

^{1/} 1960 census of population

^{2/} Employment and unemployment estimate, September 1963

The number and type of jobs created by construction of the proposed projects are summarized along with the estimate of utilization of skill requirements from the unemployed pool of the ARA counties in table 12 below.

TABLE 12

SKILL REQUIREMENTS FOR CONSTRUCTION AND UTILIZATION
OF UNEMPLOYED WORKERS FROM ARA COUNTIES

	Job opportunities			Percent filled by ARA counties		
	Skilled	Semi-Skilled	Un-Skilled	Skilled	Semi-Skilled	Un-Skilled
Lincoln	78	23	77	25	50	100
Patoka	77	26	67	25	50	100

It is believed that the utilization of unemployed from ARA counties in construction of the proposed projects is conservatively stated.

Further reduction of unemployment is assumed by operation and maintenance of the proposed projects. For purposes of computation it is assumed that 70 percent of operation and maintenance expenditures are labor cost, that 40 percent of the labor required is skilled, 30 percent semiskilled and 30 percent unskilled. Furthermore it is assumed that skill requirements filled from the unemployed residing in redevelopment counties would be 25 percent of the skilled labor requirement, 50 percent of the semiskilled labor requirement and 100 percent of the unskilled labor requirement.

Computations of the annual values of the reduction of economic costs by ARA effects are presented in tables 13 and 14. The ARA factor is computed by multiplying the expenditure for labor in each skill requirement by the percent utilized from the unemployed rolls of ARA counties.

TABLE 13

ARA EFFECTS TO CONSTRUCTION - LINCOLN RESERVOIR

Item	Total Cost (\$1,000)	Labor Cost	ARA Factor	ARA Cost Offset (\$1,000)
Lands & damages	12,800	-	-	-
Relocations	9,348	1,869	.40	748
Reservoir & pool preparation	2,045	879	.89	782
Dam & appurtenances	4,150	830	.495	411
General Recreation facilities (initial)	2,040	408	.50	204
Fish & Wildlife facilities	143	29	.50	15
Buildings, grounds & utilities	114	23	.495	11
Permanent operating equipment	80	-	-	-
Subtotal, initial	30,720	4,038	.5377	2,171
General recreation facilities (future increment)	2,280	456	.50	(228)
Present value of future increment ^{1/}				52
Total & future increment	33,000	4,494		<u>2,223</u>
Average annual equivalent at this reduction of economic costs				<u>70</u>

^{1/} Present value factor assumes accelerated growth curve with ARA participation declining to 0 after year 20
(factor = $3.054 \times .06722 = 0.2289$)

TABLE 14

ARA EFFECTS TO CONSTRUCTION - PATOKA RESERVOIR

Item	Total Cost (\$1,000)	Labor Cost	ARA Factor	ARA Cost Offset (\$1,000)
Lands & damages	3,060	-	-	-
Relocations	5,923	1,185	.40	474
Reservoir & pool preparation	919	395	.89	352
Dam & appurtenances	8,241	1,648	.495	816
General recreation facilities (initial)	1,875	375	.50	188
Fish & Wildlife facilities	228	46	.50	23
Buildings, ground & utilities	114	23	.495	11
Permanent operating equipment	80	-	-	-
Subtotal initial	20,440	3,672	.5076	1,864
General recreation facilities (future increment)	3,560	712	.50	(356)
Present value of future increment ^{1/}				81
Total initial	24,000	4,384		<u>1,945</u>
Average annual equivalent of this reduction of economic costs (1,945 x 0.03165)				<u>62</u>

^{1/} Present value discount assumes accelerated growth curve with
ARA participation declining to 0 after year 20
(Factor = $3.054 \times .06722 = 0.2289$)

The computations of ARA effects for operation and maintenance of the proposed projects is represented in table 15 below.

TABLE 15

ARA EFFECTS TO OPERATION AND MAINTENANCE EXPENDITURES (\$1,000)

Reservoir	Annual Expenditure	Labor Cost	ARA Wage Expenditure ^{1/}	AAE of ARA Wage Exp. ^{2/}
<u>Lincoln</u>				
Initial	144	101	56	15 ^{2/}
Increment	<u>140</u>	<u>98</u>	<u>54</u>	<u>6 ^{3/}</u>
Total	284	199	110	21
<u>Patoka</u>				
Initial	141	98	54	15 ^{2/}
Increment	<u>201</u>	<u>142</u>	<u>78</u>	<u>8 ^{3/}</u>
Total	342	240	132	23

^{1/} Area Redevelopment Act Labor Cost Factor -0.55

^{2/} Accumulated present worth factor for 20 year period declining from 100% to 0 at end of period (8.53X0.03165)

^{3/} Accumulated present worth factor for 20 year period of an accelerated growth curve with decline from 100% to 0 at end of period (3.054X0.03165)

A summary of Area Redevelopment Act effects used as a reduction of annual economic charges is presented in table 16.

TABLE 16

SUMMARY OF ARA EFFECTS AS REDUCTION OF ANNUAL ECONOMIC COSTS

Reservoir	ARA Wage Expenditure (1,000)		Total
	Construction	Operation and Maintenance	
Lincoln	70 ^{1/}	21 ^{3/}	91
Patoka	62 ^{2/}	23 ^{3/}	85

^{1/} Table 13^{2/} Table 14^{3/} Table 15

b. ARA effects as a reduction in allocated construction costs. The value of wages paid for construction of the proposed projects were included in the allocation of construction costs to each project purpose as a reduction of the allocated construction costs, with the assumption that cost of reducing unemployment is a Federal responsibility. A summary of the ARA effects to construction used to offset allocated construction costs is presented below.

Reservoir	First Cost (\$1,000)	Labor Cost (\$1,000)	ARA Construction Cost Offset		Total (\$1,000)
			Specific Facilities (\$1,000)	Joint Use Facilities (\$1,000)	
Lincoln	33,000	4,494	271	1,952	2,223
Clifty Creek	15,900	2,641	-	-	-
Patoka	24,000	4,384	293	1,652	1,945

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SECTION I - ECONOMIC DEVELOPMENT

1. ECONOMIC HISTORY OF THE WABASH RIVER BASIN

Population growth with its attendant development of economic activities in the Wabash River basin began early in the Nineteenth Century. Emigration of persons from the eastern part of the United States was facilitated by a natural route of travel, the Ohio River. Economic historians report that initially new communities were located along the main stem of the Ohio River, with a subsequent movement and settlement along the Wabash and other tributaries.

While natural waterways provided the major influence and impetus for early growth in the Wabash Basin, there were other factors which contributed to that development in the Nineteenth Century. The National Turnpike, which followed generally the line of Latitude 40, extended from Cumberland, Maryland, to Vandalia, Illinois. Authorized in 1802 as a government project, it was financed out of proceeds from the sale of public lands. Construction was begun in 1811. This road crossed Indiana at about the present location of U. S. Highway 40 and reached Vandalia in 1838. This road provided an east-west approach for the Wabash Basin and facilitated travel and movement of goods to and from the area. Canals also contributed to the economic growth and development of the Basin. The Erie Canal, completed in 1825, permitted travel and movement of goods by water from the Hudson River to Lake Erie. This canal reduced the cost of moving a ton of goods between New York City and Buffalo, New York, from about \$100.00 to less than \$9.00. This facilitated movement of materials to the south shore of Lake Erie. Aided by Federal land grants, the State of Ohio took a lead in the building of canals and in 1825 began the construction of some 800 miles of waterways to connect Lake Erie with the Ohio River. One canal crossed the state from Cleveland to Portsmouth. Another crossed the western portion of the state from Toledo to Cincinnati. The success of

the Lake Erie-Ohio River canals in Ohio, prompted the State of Indiana to plan the construction of the Wabash Canal to provide a waterway from the Ohio River across the state to join the Ohio canal system in northwest Ohio. Completed in 1853, it did not secure the traffic necessary for its continuance and was abandoned between 1900 and 1915.

By the time the Wabash Canal was opened for shipping, the era of railroad building had begun and shippers were attracted to the faster mode of transportation. Between 1850 and 1860 five railroads had been constructed across Indiana from east to west to link the state with terminals in Chicago and St. Louis. These roads had connecting lines to Cincinnati and to Louisville which gave the Wabash Basin a rail access to shipping on the Ohio River. The increase in rail transport between 1860 and the end of the century brought a decline in shipping on the man-made waterways. Public policy providing public assistance for construction of canal systems had shifted support to the building of railroads.

2. DEVELOPMENTAL DIFFERENCES BETWEEN WHITE AND WABASH BASINS

While the White River is actually a part of the Wabash system, as the two streams join at a point near the town of Mt. Carmel, the two basins are developing some economic differences. As indicated in Table 3 the percentage of the population residing in urban areas of the White Basin was 62.1 per cent in 1960, but is projected to increase to 72.8 per cent in 2010. The percentage of the population residing in urban areas of the Wabash Basin was 49.7 per cent in 1960, and is projected to reach a 60.4 per cent share in 2010. This will seemingly occur while the population is increasing about 13.6 per cent per decade in the White Basin compared to a similar growth of about 8.9 per cent for the Wabash Basin. This would indicate that the White Basin is pulling away from the agricultural economic base at a rate somewhat faster than that for the Wabash Basin. That trend is indicated also in the data compiled in Tables 1 and 2. For the total Wabash Basin, i.e., the Wabash and White basins combined, agriculture provided employment for 217,300 persons in 1930, but provided employment for only 97,200 persons in 1960. This occurred at a time when total employment was increasing from 894,200 to 1,159,300. Employment losses in agriculture were more than compensated by increases in other employment classifications, particularly in Trade, Services, and in Manufacturing. Forces in effect today suggest that this trend will continue. Farming, from the standpoint of crop values, will continue to grow in importance in the total Wabash Basin. But as an economic activity providing employment opportunities for an increasing population, it will become relatively less important. Factors influencing this condition would include better seeds, better tillage, greater use of scientific knowledge, and more productivity per farm worker due to more mechanization and improving farm management.

3. POPULATION, PROJECTED GROWTH AND DISTRIBUTION IN THE WABASH BASIN

In total, the population of the Wabash Basin has shown a rather steady growth. From 1930 to 1960, the population increase in absolute numbers was from 2,363,400 to 3,145,300, an increase of 781,900. The population increase during those three decades was at the rate of about 26,063 each year. The percentage increase shown by the 1960 census over the 1930 count is about 33.1 per cent. An examination of the pertinent census data for 1940, and 1950, will indicate that the population increases were not in the form of a steady upward trend. Census records reflect a below normal birth rate during the 1930's with an above normal birth rate for the 1940's. The above normal birth rate continued through the 1950's.

A consideration of the 33.1 per cent growth for the thirty-year period can have value for projection purposes as it tends to level out the effects of the depression and also of World War II. A 33.1 per cent increase for thirty years can be viewed for projection purposes as an increase at the rate of 1.1 per cent each year. National growth projections and other factors indicate that the Wabash Basin population growth during the years ahead should exceed the 1.1 per cent annual rate.

Preliminary projections provided by the A. D. Little study indicate that the population of the Wabash Basin, including the White Basin, will reach a total of 5,454,600 in the year 2010. Straight line projections from a population count of 3,145,300 in 1960 to the projection of 5,454,600 will show a growth by decade as indicated in Table 4. These projections indicate that the Basin will have a population in 2010, some 73.4 per cent greater than the census count in 1960, which can be viewed as an annual growth of 1.47 per cent. It will be noted that the rate of growth of the White River Basin is significantly higher than that of the Wabash River Basin.

On the basis of these projections, the expected annual increase within the total Wabash Basin is 46,186, which is considered to be a conservative projection in the light of other projections that have been made for the total Ohio River Basin, and for the nation as a whole. Preliminary data from the A. D. Little study show a projection for the Ohio River Basin from 19,001,000 in 1960 to 31,713,000 in the year 2010, an increase of 12,712,000 persons. This projection indicates a growth of 70 per cent for the total Ohio River Basin during the fifty-year time period, or an increase at an annual rate of 1.4 per cent. Inasmuch as the total land area of the Ohio River Basin contains sub-areas with lower economic potential than that of the Wabash and White sub-areas, it could be assumed that the Wabash Basin in total will have a greater rate of growth during the fifty-year projection period.

Another preliminary projection furnished by the A. D. Little study indicates that the total population of the United States should increase from 179,800,000 in 1960 to 378,200,000 in 2010, an increase of 110.3 per cent. This increase suggests an annual rate of increase for the nation of 2.2. per cent.

It is well established in economics that communities which can provide increasing employment opportunities, have a population growth potential. In the free enterprise system, factors of production (labor is one such factor) move in response to demand. Communities that can maintain employment opportunities on a continuing and on an increasing basis, will experience an increase in their populations. An increase in population would come then as a direct result of a demand for employment in a given community. While the population in the total Wabash Basin is generally upward as indicated above, the geographical pattern of increase is not a consistent one. Table 5 indicates something of the pattern by considering employment data by counties. Of the 18 counties situated in the State of Illinois, Champaign, Coles, and Vermilion provided almost twenty per cent of the employment in the Sub-Area in 1960. Those three counties also accounted for about twenty per cent of the population in 1960. The proposed Lincoln Reservoir is located in Coles and Cumberland Counties and would also benefit Crawford, Jasper, and Lawrence Counties which have a downstream location.

Among the Wabash Basin counties situated in the State of Indiana, five provided almost 24 percent of the employment in the Sub-Area in 1960. Those counties, Grant, Howard, Kosciusko, Tappcanoe, and Wabash, have also shown gains in employment since 1930. Another county making a significant contribution to the total population as well as employment in the Wabash Sub-Area is Vigo in which the City of Terre Haute is located.

Except for the nine counties mentioned above, employment growth in the Wabash Sub-Area has been somewhat evenly distributed, ranging from about 3,000 to about 8,000 in each county as reported by the 1960 census. There is also a comparable evenness in the distribution of the Sub-Area's population.

In the White Basin Sub-Area, nine counties out of thirty-three accounted for about 70 per cent of the Sub-Area's employment in 1960. Marion County (Indianapolis) contributed 41.4 per cent. Employment in those nine counties in 1960 ranged from a count of 15,200 for Hendricks County to 278,400 for Marion County. Among the other twenty-four counties, the employment count range was from 2,300 in Brown County to 14,500 in Knox County.

The Clifty Creek Project would provide for construction of a dam in Bartholomew County of Indiana. In addition it would have a downstream benefit for Jackson, Lawrence, Martin, Daviess, and Knox Counties in Indiana.

The proposed Patoka Project with location in Dubois County of Indiana, would have a downstream benefit for Pike and Gibson Counties.

4. DEVELOPMENT TRENDS

With respect to economic activities, the Wabash River Basin has been undergoing some significant changes. As reported in the first interim report, the Basin has been primarily an agricultural area. From the standpoint of dollar value for its agricultural production, the Wabash Basin will become increasingly more important to the national economy. From the standpoint of providing employment for the labor force of its growing population, however, agriculture is becoming less important in this area. The following tabulations are indicative of both the importance and the change.

1949 Dollar value of farm production sales

Wabash Basin in State of Illinois	\$ 172,156,000
Wabash Basin in State of Indiana	<u>255,540,000</u>
Total	\$ 427,696,000
White Basin, State of Indiana	\$ <u>245,189,000</u>
Total, Wabash Basin	\$ 672,885,000

Number of employees in Agriculture, Wabash Basin in 1950: 150,900

$$\$672,885,000 \div 150,900 = \text{Average contributions}$$

$$\text{per farm worker} = \$4,459.00$$

1959 Dollar value of farm production sales

Wabash Basin in State of Illinois	\$ 221,523,000
Wabash Basin in State of Indiana	\$ <u>321,596,000</u>
Total	\$ 543,119,000
White Basin, State of Indiana	\$ <u>313,792,000</u>
Total, Wabash Basin	\$ 856,911,000

Number of employees in Agriculture,

Wabash Basin 1960: 97,200

$$\$856,911,000 \div 97,200 = \text{average contributions}$$

$$\text{per farm worker} = \$8,816.00$$

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The foregoing preliminary tabulations are necessarily inexact because of the nature of the data used. The Bureau of the Census conducts an Agriculture Census every fifth year and for the calendar years ending in '4' and '9'. Census data for Agriculture is therefore available for the years, 1949, 1954, and 1959. Population and Housing censuses are taken every ten years, and for the years ending in '0'. Data for the foregoing tabulations were drawn from preliminary reports of Arthur D. Little, Inc., and from compilations resulting from Agriculture Censuses of 1949 and 1959. It is recognized that a comparison of 1949 and 1959 dollar sales with employment counts for 1950 and 1960 is statistically incorrect, but more exact data is not immediately available. The tabulations are presented at this time to indicate a trend.

It is significant that in the economic growth and development of the land area drained by the Wabash and tributary streams, the total value of farm products sold has been increasing while the number of persons accounting for that production has been decreasing.

As indicated in Table 1, both population and employment showed increases between 1930 and 1960. Table 1 indicates also the distribution of employment among ten Standard Industrial Code Classifications. It is to be noted that employment increased in the construction, transportation, trade, finance, services, and manufacturing. The most significant increases were reported in trade, services, and manufacturing. Those activities are conterminous with urban development and presumably will increase in the future as urban population increases. Table 3 indicates the trend toward urban living in the Wabash Basin. In 1960 some 56.7 per cent of the population resided in towns and cities. That percentage is projected upward to 61.9 in 1980 and up to 68.1 in 2010. As indicated in Table 3, the White Basin portion of the Wabash Basin has a faster rate of change in the direction of urban residence. The 2010 preliminary projection indicates that 72.8 per cent of the White Basin population will then be residing in urban areas. The Wabash Basin is in a good position for continued growth and development in trade and in manufacturing. As indicated in Table 1, those employment classifications had a historical record of growth up to 1960.

Another view of the economic activities of the Wabash Basin is provided by census tabulations from which the following schedule has been drawn.

	Value Added by Manu- facturing, 1954 (000)	Value Added by Manu- facturing, 1958 (000)	Total Retail Sales, 1954 (000)	Total Retail Sales, 1958 (000)
Wabash Basin in Illinois	\$171,803	\$215,087	\$506,076	\$579,549
Wabash Basin in Indiana	<u>539,190</u>	<u>674,291</u>	<u>816,421</u>	<u>925,683</u>
	\$710,993	\$889,378	\$1,322,497	\$1,505,232
White Basin, Indiana	<u>1,586,675</u>	<u>1,816,163</u>	<u>1,759,169</u>	<u>1,997,993</u>
Totals, Wabash Basin	\$ 2,297,668	\$ 2,705,541	\$ 3,081,666	\$ 3,503,225

These data help explain the upward trend of economic activities within the Wabash Basin, particularly those of employment in manufacturing and trade. Manufacturing is a basic employment which sets in motion demands that can be served by business activities in construction, transportation, services, and in finance. Growth in retail trade is one indication of a general betterment in the standard of living of the population of the Wabash Basin. It is also an indication of a growing capacity for consumption of goods and services produced in the Basin.

As indicated in the schedule above, the value added by manufacturing in the Basin increased significantly in 1958 over 1954. Out of a total of 77 counties in the Wabash including the White Basin, only 15 had census reports lower for manufacturing in 1958. The counties that did not surpass their 1954 manufacturing outputs were Cumberland, Edgar, Edwards, Richland, and White in Illinois; and Gibson, Lawrence, Morgan, Orange, Washington, Cass, Parke, Pulaski, Tipton, and Vermillion in Indiana.

While there are a few counties that showed slightly lower retail sales in 1958 in relation to 1954, the pattern of increases in consumer purchases was generally upward. The counties that showed a decrease in retail sales in 1958 in relation to 1954 were Edwards and Lawrence in Illinois, and Fulton, Jay, Warren, Wells, Pike and Washington in Indiana. The last two named are situated in the White Basin portion of the Wabash Basin.

From a consideration of pertinent economic data, it can be stated that the Wabash Basin is an agricultural carpet studded with small, medium, and a few large cities. This would appear to be a factor pointing toward the continued economic growth and importance of the Wabash Basin. With an agricultural base permitting the production of a variety of crops, natural resources, adequate transportation potential, available plant sites, proximity to both the industrial developments along the main stem of the Ohio River and the Great Lakes industrial complex, the economic role of the Wabash Basin should increase in importance.

Table 1 Population and Employment in the Wabash and White Basins, 1930, 1940, 1950, and 1960, by Standard Industrial Code Classifications

	1930		1940		1950
	Population	Employment	Population	Employment	Population
Totals for Wabash Basin	2,363,400	894,200	2,484,300	817,400	2,740,100
Wabash Basin, Excluding White	1,130,600	411,500	1,173,700	378,800	1,256,100
White Basin	1,232,800	482,700	1,310,600	438,600	1,484,000

Employment by Standard Industrial Code Classifications

	1930			1940			White	Wal
	White	Wabash	Total	White	Wabash	Total		
Agriculture	93,600	123,700	217,300	73,600	102,000	175,600	61,300	89
Mining	11,000	15,400	26,400	6,600	11,500	18,100	7,500	17
Construction	29,400	20,900	50,300	20,900	17,400	38,300	30,300	24
Transportation	31,100	31,300	62,400	31,700	27,800	59,500	43,500	37
Wholesale and Retail Trade	61,900	48,100	110,000	76,400	60,500	136,900	105,800	81
Finance, Insurance & Real Estate	12,900	7,500	20,400	13,700	7,500	21,200	18,200	9
Services, Business & Personal	81,600	66,500	148,100	76,600	66,800	143,400	93,100	82
Government	12,600	8,700	21,300	16,100	12,500	28,600	21,700	17
Unreported	15,000	14,200	29,200	7,800	6,800	14,600	10,000	7
Manufacturing	133,600	75,400	209,000	115,000	66,300	181,300	182,400	100

Source: Preliminary report, A.D. Little study

and Employment in the Wabash and
ns, 1930, 1940, 1950, and 1960,
d Industrial Code Classifications

Classification	1940		1950		1960	
	Population	Employment	Population	Employment	Population	Employment
	4,300	817,400	2,740,100	1,033,300	3,145,300	1,159,300
	13,700	378,800	1,256,100	459,700	1,362,400	487,800
	10,600	438,600	1,484,000	573,600	1,782,900	671,500

Wabash	1940		1950			1960	
	Wabash	Total	White	Wabash	Total	White	Wabash
102,000	175,600	61,300	89,600	150,900	40,200	57,000	97,200
11,500	18,100	7,500	11,700	19,200	4,000	7,000	11,000
17,400	38,300	30,300	24,500	54,800	34,600	24,200	58,800
27,800	59,500	43,500	37,900	81,400	41,900	33,700	75,600
60,500	136,900	105,800	81,800	187,600	121,300	86,800	208,100
7,500	21,200	18,200	9,000	27,200	26,800	12,700	39,500
66,800	143,400	93,100	82,500	175,600	121,400	103,900	225,300
12,500	28,600	21,700	14,100	35,800	29,600	16,100	45,700
6,800	14,600	10,000	7,900	17,900	29,200	14,700	43,900
66,300	181,300	182,400	100,900	283,300	221,700	131,400	353,100

TABLE 1

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TABLE 2. EMPLOYMENT IN THE WABASH BASIN

	Agriculture				Mining				Construction				Transportation				Wholesale and Retail Trade
	1930	1940	1950	1960	1930	1940	1950	1960	1930	1940	1950	1960	1930	1940	1950	1960	
Persons Employed in Counties of Wabash Basin in the State of Illinois																	
Champaign	6,200	4,900	4,500	3,400	0	0	0	0	1,600	1,700	2,000	2,300	1,800	1,800	2,500	3,500	
Clark	3,000	2,700	2,900	1,300	300	300	400	200	300	300	400	300	300	300	400	600	
Clay	2,700	2,000	1,800	1,000	0	700	700	500	200	300	300	300	400	500	400	500	
Coles	3,400	2,800	2,400	1,500	0	200	200	200	700	600	800	800	1,900	1,800	2,400	1,900	
Greene	2,400	2,300	1,700	1,000	900	600	500	400	300	200	400	500	400	400	600	500	
Hamilton	2,100	1,900	1,700	900	0	0	100	100	200	100	200	100	100	200	200	300	
Lawrence	2,700	2,100	2,000	1,300	0	0	0	0	300	300	400	400	600	600	600	500	
Madison	3,800	3,000	2,600	1,900	0	0	100	0	600	400	600	500	500	500	600	1,000	
Marion	1,400	1,200	1,000	700	0	100	300	300	100	100	200	100	100	200	100	300	
Effingham	2,800	2,600	2,200	1,500	0	400	200	200	300	400	500	600	500	600	500	700	
Hamilton	2,900	2,200	1,700	800	0	100	300	300	100	200	200	200	100	200	200	300	
Jasper	2,800	2,800	2,100	1,300	0	0	100	100	100	100	300	100	100	300	200	300	
Lawrence	2,000	1,900	1,800	800	700	600	500	400	300	0	800	300	300	300	400	600	
Richland	2,100	1,800	1,900	1,000	0	700	700	500	200	300	300	300	200	400	500	500	
Vermillion	5,800	4,000	3,900	2,600	3,400	2,300	500	300	1,900	1,000	1,600	1,900	3,100	2,700	3,200	2,700	
Wabash	1,500	1,100	800	600	100	400	800	500	200	100	300	200	600	500	600	500	
Wayne	3,800	3,100	2,600	1,400	0	500	700	500	200	200	400	300	100	200	300	400	
White	3,200	2,300	1,900	1,200	100	500	1,200	900	300	200	400	300	300	400	500	500	
Total	54,600	44,000	38,100	24,200	5,500	7,400	7,300	5,400	7,900	6,500	10,100	9,500	11,500	11,200	14,300	17,500	
Persons Employed in Counties of Wabash Basin in the State of Indiana																	
Benton	2,100	1,900	1,700	1,400	0	0	100	0	200	200	300	200	300	200	200	400	
Blackford	1,200	1,000	900	900	0	0	0	0	200	200	200	200	200	200	200	600	
Carroll	2,500	2,200	2,100	1,300	0	0	0	0	300	300	400	400	500	500	300	800	
Cass	3,100	2,500	2,200	1,500	100	100	0	0	700	600	700	700	1,400	1,600	2,000	1,700	
Clinton	3,100	2,600	2,300	1,500	0	0	0	0	600	900	600	500	1,000	1,200	1,700	1,100	
Fountain	2,500	2,000	1,700	1,000	100	200	100	0	300	300	400	400	400	300	600	300	
Fulton	2,500	2,200	2,200	1,200	0	0	0	0	300	200	300	300	300	300	400	600	
Grant	3,200	2,700	2,300	1,400	0	0	0	100	900	800	1,000	1,100	900	1,500	1,300	2,400	
Howard	2,400	2,000	1,800	1,100	100	0	0	0	900	500	800	1,000	700	600	900	1,000	
Huntington	2,800	2,600	2,400	1,500	0	0	0	0	500	400	500	500	1,100	800	1,000	900	
Jay	2,900	2,400	2,000	1,100	100	0	0	0	300	300	400	300	200	200	400	300	
Kosciusko	4,000	3,800	3,300	2,100	0	0	0	0	600	500	700	700	500	500	700	1,000	
Miami	2,700	2,400	2,100	1,400	0	0	0	0	500	400	500	500	1,800	1,300	1,900	1,400	
Vermillion	3,400	2,900	2,400	1,600	0	0	0	0	600	500	700	600	500	500	600	500	
Montgomery	2,500	2,000	1,800	1,100	300	300	200	100	200	200	300	300	400	300	400	300	
Parke	2,200	2,200	1,900	1,200	0	0	0	0	200	200	300	300	200	100	300	300	
Pulaski	3,000	1,700	1,700	1,100	2,600	1,200	1,400	600	300	300	400	500	300	300	500	300	
Shelby	3,100	2,600	2,400	1,700	100	0	0	0	1,200	1,000	1,700	1,500	1,400	1,500	2,000	1,800	
Tipton	2,200	1,900	1,600	1,100	0	0	0	0	300	200	300	200	600	300	400	300	
Vermillion	1,600	1,100	900	600	2,500	700	900	200	300	200	300	500	700	500	800	800	
Vigo	3,200	1,900	1,700	1,200	3,900	1,600	1,700	600	2,100	1,600	1,700	1,900	4,100	3,300	4,700	3,700	
Wabash	2,800	2,500	2,500	1,500	0	0	0	0	500	400	500	600	500	400	600	1,000	
Warren	2,000	1,600	1,400	800	0	0	0	0	100	100	200	100	200	100	100	200	
Wells	2,800	2,600	2,100	1,400	100	0	0	0	300	400	400	400	300	400	400	700	
White	2,600	2,400	2,000	1,400	0	0	0	0	300	300	400	400	300	400	400	500	
Whitley	2,700	2,300	2,100	1,100	0	0	0	0	300	300	400	400	300	200	400	600	
Total	69,100	58,000	51,500	32,800	9,900	3,900	4,400	1,600	13,000	10,900	14,400	14,700	19,300	16,600	23,600	30,600	
Persons Employed in Counties of White Basin in the State of Indiana																	
Bartholomew	3,000	2,300	1,700	1,300	0	0	0	0	500	500	700	800	400	500	700	800	
Boone	3,400	3,000	2,700	1,900	0	0	0	0	600	400	600	700	800	400	600	400	
Brown	1,200	800	500	200	0	0	0	0	100	100	200	200	100	100	100	100	
Clay	2,200	1,600	1,500	800	1,200	900	900	400	300	200	400	300	400	300	500	900	
DeWitt	3,300	2,900	2,200	1,500	200	200	300	100	500	300	400	500	800	1,300	1,100	800	
Denton	2,700	2,400	2,000	1,500	200	100	0	100	300	300	400	400	300	400	400	700	
Delaware	3,200	2,500	2,100	1,500	100	0	0	0	1,600	1,100	1,500	1,700	1,400	1,500	2,100	2,300	
Dubois	2,700	2,300	2,200	1,400	100	100	100	100	300	300	500	500	300	300	400	500	
Gibson	3,500	2,600	2,300	1,500	900	900	1,100	600	500	400	500	500	600	900	900	900	
Greene	3,300	2,300	1,900	1,300	2,100	1,200	1,300	500	600	400	500	700	500	700	600	1,000	
Hamilton	3,300	3,000	2,500	1,600	0	0	0	100	500	500	800	900	300	400	600	1,000	
Hancock	2,400	2,000	1,500	1,200	0	0	0	0	400	400	600	700	500	400	500	800	
Hendricks	3,200	2,700	2,300	1,500	0	0	0	0	400	400	600	900	400	300	600	1,400	
Henry	3,300	2,500	2,200	1,500	0	0	0	0	700	600	600	600	500	700	700	1,400	
Jackson	3,100	2,500	2,000	1,200	0	0	0	0	500	400	600	600	500	600	700	900	
Jennings	2,000	1,800	1,500	600	100	0	0	0	300	200	300	300	400	300	400	300	
Johnson	2,800	2,400	1,800	1,200	0	0	0	0	400	300	600	1,100	300	400	600	1,100	
Knox	2,400	2,200	1,800	1,200	1,800	1,200	1,200	400	800	600	1,000	800	700	800	1,100	1,400	
Lawrence	2,400	1,900	1,200	800	1,100	200	200	200	600	300	600	800	700	500	1,300	600	
Madison	3,700	2,800	2,400	1,800	200	0	0	100	1,800	1,100	1,500	1,700	1,500	1,400	1,900	3,600	
Marion	4,000	2,900	2,600	1,800	400	200	200	200	13,400	8,600	12,900	14,100	15,800	16,800	22,800	20,600	
Martin	1,700	1,100	700	400	100	100	100	0	200	200	100	200	100	200	200	200	
Monroe	2,100	1,200	900	600	900	400	600	400	800	500	800	1,300	800	900	1,000	1,200	
Morgan	2,900	2,300	1,800	1,200	0	0	0	0	300	400	600	800	300	600	900	700	
Orange	2,400	1,900	1,500	900	100	0	100	100	300	200	300	400	300	200	300	500	

TABLE 2. EMPLOYMENT BY STANDARD INDUSTRIAL CODE CLASSIFICATIONS BY COUNTIES IN THE WABASH AND WHITE RIVER BASINS FOR 1930, 1940, 1950 AND 1960

Construction				Transportation				Wholesale & Retail Trade				Finance, Insurance and Real Estate				Services, Business and Personal				Government		
1930	1940	1950	1960	1930	1940	1950	1960	1930	1940	1950	1960	1930	1940	1950	1960	1930	1940	1950	1960	1930	1940	1950
1,700	2,000	2,300	1,800	1,800	2,500	3,500	3,400	4,900	7,200	7,100	600	700	800	1,300	6,900	7,200	13,000	18,500	1,300	4,500	2,100	
300	400	300	300	300	400	400	600	800	1,000	1,000	100	100	100	100	800	800	900	900	100	100	200	
200	300	300	400	400	500	500	500	500	800	1,000	100	100	100	100	600	600	800	900	100	100	200	
600	800	800	1,900	1,800	2,400	1,900	1,600	2,400	3,100	3,200	200	300	300	400	2,100	1,400	2,800	3,700	300	300	400	
200	400	500	400	400	600	600	800	800	900	1,200	100	100	100	200	1,000	1,200	1,100	1,300	100	100	200	
100	200	100	200	200	200	200	300	300	400	500	0	0	0	100	500	400	400	500	100	100	100	
300	400	400	600	600	600	600	700	700	1,200	1,100	100	100	100	100	1,000	1,000	1,300	1,200	100	100	200	
400	600	500	500	500	600	600	1,000	1,200	1,600	1,700	0	0	0	100	0	0	400	400	100	100	100	
100	200	100	100	100	200	100	300	300	500	500	100	100	100	200	100	100	1,300	1,300	100	200	200	
400	500	600	500	500	600	500	700	1,100	1,500	1,900	0	0	100	100	400	500	500	400	100	100	100	
200	200	200	100	100	200	200	300	400	500	400	100	0	0	100	100	400	500	400	100	100	100	
100	300	300	300	300	400	400	300	400	600	600	100	100	100	200	900	800	1,000	1,200	100	0	200	
0	300	300	300	300	400	400	600	700	1,100	1,100	100	100	100	100	100	1,000	900	1,200	100	100	100	
300	300	300	200	400	400	500	500	500	1,100	1,100	600	600	700	1,000	5,900	5,600	6,100	6,800	600	700	900	
1,000	1,600	1,900	3,100	2,700	3,200	2,700	4,400	4,900	6,400	6,600	100	100	100	100	600	600	700	1,000	100	100	100	
100	300	600	600	500	600	500	500	700	900	1,000	100	100	100	100	100	600	900	1,200	100	100	200	
200	400	300	100	200	300	400	500	800	1,000	1,100	100	100	100	100	200	700	900	1,200	100	200	200	
200	400	300	300	300	400	500	500	900	1,300	1,300	100	100	100	100	700	900	1,000	1,300	100	100	200	
6,500	10,100	9,500	11,500	11,200	14,300	14,100	17,500	23,300	31,600	32,500	2,700	2,800	3,200	4,600	25,900	27,200	34,200	43,700	3,800	7,100	5,800	
200	300	200	300	200	200	200	400	600	700	700	100	100	100	100	700	500	700	700	100	100	100	
200	200	200	200	200	200	200	200	700	700	1,000	100	100	100	100	600	700	600	600	100	100	100	
300	400	400	500	500	500	500	800	700	700	1,100	200	300	300	400	2,100	2,300	2,400	3,100	400	300	400	
600	700	700	1,900	1,600	2,000	1,700	1,700	2,300	2,700	2,800	200	200	300	400	1,400	1,500	1,400	1,700	200	200	300	
500	600	500	1,000	1,200	1,700	1,200	1,100	1,400	1,800	2,000	100	100	100	100	100	900	1,000	1,000	100	100	200	
300	400	400	400	400	600	600	700	800	1,100	1,100	100	100	100	100	800	900	900	1,000	100	100	200	
200	300	300	300	300	400	300	600	700	1,100	1,100	400	400	500	900	3,300	3,000	4,200	5,600	400	400	600	
800	1,000	1,100	900	1,500	1,300	2,400	2,700	3,900	4,300	4,300	200	300	300	700	2,600	2,300	2,800	3,800	300	300	500	
500	800	1,000	700	600	900	1,000	2,400	2,500	3,700	4,000	200	100	200	200	1,500	1,600	1,800	2,000	200	200	300	
400	500	500	1,100	800	1,000	900	1,100	1,900	2,100	2,100	100	100	100	100	900	1,000	1,000	1,100	100	200	200	
300	400	300	200	400	300	300	800	1,100	1,300	1,300	100	200	200	200	400	1,400	1,500	1,900	200	200	200	
500	700	700	500	500	700	800	1,000	1,400	2,000	2,700	200	200	200	300	1,900	1,900	1,300	1,800	200	200	300	
400	500	500	1,800	1,300	1,900	1,300	1,400	1,400	1,600	2,000	300	300	300	400	1,700	1,600	1,800	2,200	200	200	300	
700	700	700	600	600	600	600	1,200	1,600	2,000	2,000	100	100	100	100	900	900	800	900	100	100	200	
200	300	300	300	300	400	300	300	500	600	900	100	0	100	100	500	500	400	800	100	100	100	
300	400	500	300	300	500	500	300	900	1,100	1,300	100	100	100	200	1,000	1,000	1,000	1,300	100	200	300	
200	300	200	600	300	400	300	500	600	800	800	500	500	700	1,000	4,700	5,300	8,800	12,800	400	500	800	
1,600	1,700	1,900	4,100	3,300	4,700	3,700	6,000	7,100	9,400	9,400	200	100	200	200	1,100	800	900	1,000	100	200	400	
400	500	600	500	400	600	600	1,000	1,300	1,900	2,100	0	0	0	0	400	400	500	500	100	100	100	
100	200	100	200	100	100	100	200	200	400	400	100	100	100	100	200	700	800	1,300	100	100	200	
400	400	400	300	400	400	400	700	900	1,200	1,500	100	100	100	100	700	700	800	1,100	100	100	100	
300	400	400	300	300	400	500	500	800	1,100	1,400	100	100	100	200	700	700	800	1,100	100	100	100	
300	400	400	300	200	400	500	600	800	1,100	1,400	100	100	100	200	700	700	800	1,100	100	100	200	
10,900	14,400	14,700	19,800	16,600	23,600	19,600	30,600	37,200	50,200	54,300	4,800	4,700	5,800	8,100	40,600	39,600	48,300	60,200	4,900	5,400	8,300	
500	700	800	400	500	700	800	1,100	1,400	2,200	2,900	100	100	200	400	1,300	1,200	1,600	2,500	200	200	400	
400	600	700	800	800	600	400	900	1,100	1,700	1,900	200	200	200	400	1,200	1,200	1,300	1,600	200	200	300	
100	200	200	100	100	100	100	100	100	200	300	0	100	100	100	200	200	200	400	0	0	100	
200	400	300	400	400	300	500	900	1,000	1,300	1,500	100	100	100	100	1,100	1,000	1,100	1,500	200	200	300	
300	400	500	800	1,000	1,300	1,100	800	1,100	1,400	1,600	100	100	200	200	1,100	1,000	1,100	1,500	100	200	500	
300	400	400	400	400	400	400	700	900	1,200	1,400	100	100	100	200	800	1,000	1,100	1,200	100	100	200	
1,100	1,500	1,700	1,500	1,500	2,100	2,300	3,300	4,500	6,400	7,500	500	500	800	1,100	4,000	4,100	5,900	8,200	400	500	700	
300	500	500	300	300	400	500	500	500	1,200	1,400	100	100	100	200	800	800	1,200	1,600	100	100	200	
400	500	500	600	900	600	600	900	1,200	1,800	1,800	100	100	200	200	1,300	1,200	1,600	1,700	200	200	200	
400	500	700	500	500	700	600	1,000	1,300	1,500	1,700	200	200	300	700	1,200	1,200	1,500	2,500	100	200	300	
500	800	900	300	400	600	700	1,000	1,300	1,900	3,000	100	100	200	400	900	900	1,000	1,400	200	200	300	
400	600	700	500	400	500	500	800	900	1,300	1,700	200	200	300	700	1,000	1,000	1,500	2,300	200	300	400	
400	600	900	400	300	600	1,400	700	1,000	1,500	2,600	200	200	300	400	2,500	2,500	2,800	2,800	200	300	400	
600	800	800	500	500	700	700	1,400	1,800	2,500	3,000	100	100	200	200	2,100	2,100	2,300	2,600	200	300	400	
400	600	600	500	600	700	600	900	1,100	1,600	1,900	0	0	0	100	500	400	600	1,000	100	100	100	
200	300	300	400	300	400	400	300	400	600	600	200	200	300	300	600	600	800	1,200	100	200	400	
600	800	800	700	800	1,100	1,100	1															

REGISTRATIONS BY COUNTIES
1940, 1950 AND 1960

3

Insurance and Real Estate			Services, Business and Personal				Government				Unreported				Manufacturing			
1940	1950	1960	1930	1940	1950	1960	1930	1940	1950	1960	1930	1940	1950	1960	1930	1940	1950	1960
700	800	1,300	6,900	7,200	13,000	18,500	1,300	4,500	2,100	3,000	900	400	500	1,600	2,100	1,500	2,500	3,400
100	100	100	800	800	900	900	100	100	200	100	200	200	100	200	400	500	600	900
100	100	100	600	600	800	900	100	100	200	200	200	100	100	100	1,100	700	400	800
300	300	400	2,100	1,400	2,800	3,700	300	300	400	300	400	200	300	400	2,700	2,200	3,000	3,600
100	100	200	1,000	1,200	1,100	1,300	100	100	200	200	200	100	200	100	1,000	1,100	1,800	2,300
0	0	100	500	400	400	500	100	100	100	100	100	100	0	200	700	800	1,000	
100	100	100	1,000	1,000	900	1,200	100	100	200	200	200	100	200	200	400	400	500	1,400
200	200	200	1,400	1,400	1,300	1,400	200	200	300	400	100	400	100	400	1,100	900	1,100	1,400
0	100	0	400	500	400	400	100	100	100	100	200	100	0	400	500	400	500	900
100	100	200	900	1,100	1,200	1,300	100	100	100	100	200	100	200	100	900	1,000	1,300	1,400
0	0	100	400	500	500	400	100	100	100	100	100	100	100	100	300	300	300	600
0	0	100	400	500	500	500	100	100	100	100	100	100	100	200	200	200	200	1,300
100	100	200	900	800	1,000	1,200	100	0	200	200	200	200	100	200	1,800	1,100	1,300	1,300
100	100	100	800	1,000	900	1,200	100	100	100	100	100	100	100	100	1,100	900	800	800
600	700	1,000	5,900	5,600	6,100	6,800	600	700	900	1,000	900	400	600	1,000	6,200	4,200	7,600	10,900
100	100	100	600	600	700	1,000	100	100	100	100	100	200	100	700	700	700	700	800
100	100	100	600	900	800	1,200	100	100	200	300	200	100	200	1,100	700	900	1,100	
100	100	200	700	900	1,000	1,300	100	100	200	200	100	100	100	800	600	500	700	
2,800	3,200	4,600	25,900	27,200	34,200	43,700	3,800	7,100	5,800	7,000	5,100	2,700	3,300	4,700	22,500	18,700	25,000	33,400
100	100	100	700	500	600	700	100	100	100	100	200	100	0	100	200	100	300	600
100	100	100	600	700	700	600	100	100	100	100	200	100	100	400	1,700	1,600	2,200	2,400
100	100	200	700	600	700	1,000	100	100	100	100	100	100	100	400	400	400	1,100	1,600
300	300	400	2,100	2,300	2,400	3,100	400	300	400	500	400	200	200	2,000	3,000	3,400	3,700	3,700
200	300	400	1,400	1,300	1,400	1,700	200	200	300	300	300	200	200	2,000	1,600	2,300	3,300	
100	100	100	900	900	1,000	1,000	100	100	200	200	300	200	100	1,000	700	1,300	2,300	
100	100	100	800	900	900	1,000	100	100	200	200	200	100	200	500	600	1,300	1,600	
400	500	900	3,300	3,000	4,200	5,600	400	400	600	600	700	500	600	7,300	6,400	8,700	12,200	
300	500	700	2,800	2,900	2,800	3,800	300	300	500	500	500	300	300	7,400	6,700	10,100	12,000	
100	200	300	1,500	1,600	1,800	2,000	200	200	300	300	300	200	100	500	2,300	4,400	4,800	
100	100	200	900	1,000	1,000	1,100	100	200	200	300	400	200	600	1,900	2,700	3,700	3,700	
200	200	400	1,400	1,500	1,900	2,500	200	200	400	400	200	100	600	1,400	1,700	3,400	5,600	
200	200	300	1,900	1,300	1,300	1,800	200	200	300	300	300	200	300	2,200	1,900	2,700	3,300	
300	300	400	1,700	1,600	1,800	2,200	200	200	400	400	400	100	100	1,900	1,600	2,800	3,900	
100	100	100	900	900	800	900	100	100	200	200	300	100	100	700	200	600	1,000	
0	100	100	500	500	400	800	100	100	100	100	100	100	100	300	200	500	700	
100	100	200	1,000	1,000	1,000	1,300	100	200	300	300	200	100	200	500	300	600	1,300	
500	700	1,000	4,700	5,300	8,800	12,800	400	500	800	900	500	300	300	3,400	3,100	5,700	7,100	
100	100	100	700	700	700	800	100	100	100	200	100	0	100	800	700	1,300	2,000	
100	100	100	1,100	800	900	1,000	100	200	400	200	100	100	100	900	300	1,000	1,500	
800	1,000	1,100	7,300	6,800	8,200	8,200	700	900	1,800	1,700	1,500	400	1,600	9,000	6,000	9,300	10,000	
100	200	200	1,400	1,500	1,800	2,100	200	200	300	300	200	100	400	2,100	2,500	3,900	5,500	
0	0	0	400	400	400	500	100	100	100	100	100	0	0	200	100	400	800	
100	100	200	700	800	1,100	1,300	100	100	200	200	200	100	100	1,200	700	1,800	2,500	
100	100	200	700	700	800	1,100	100	100	200	300	200	200	200	900	600	1,300	1,700	
100	100	200	700	700	900	1,300	100	100	200	200	200	100	200	500	1,500	2,300	2,900	
4,700	5,800	8,100	40,600	39,600	48,300	60,200	4,900	5,400	8,300	9,100	9,100	4,100	4,600	10,000	52,900	47,600	75,900	98,000
100	200	400	1,300	1,200	1,600	2,500	200	200	400	600	300	200	700	2,400	3,100	6,000	7,900	
200	200	400	1,200	1,100	1,300	1,600	200	200	300	400	200	100	300	900	900	1,700	2,700	
100	0	100	200	200	200	400	0	0	100	100	0	200	100	100	100	500	700	
100	100	100	1,100	1,000	1,100	1,500	200	200	300	300	500	100	200	2,300	1,000	1,900	2,700	
100	200	200	1,100	1,000	1,100	1,500	100	200	500	500	400	100	300	1,700	600	1,300	1,500	
100	100	200	800	1,000	1,000	1,200	100	100	200	200	200	100	100	700	500	1,100	1,800	
500	800	1,100	4,000	4,100	5,500	8,200	400	500	700	900	600	300	800	1,300	11,400	11,300	15,200	
100	100	200	800	800	1,200	1,600	100	100	200	200	200	100	400	100	2,000	2,500	2,900	
100	200	300	1,300	1,300	1,600	1,700	200	200	200	300	500	100	400	1,200	800	2,100	2,700	
100	200	200	1,300	1,200	1,200	1,300	200	200	700	800	400	100	200	1,000	600	1,000	1,600	
200	300	700	1,200	1,200	1,500	2,500	100	200	300	300	100	200	600	1,600	1,600	2,800	4,700	
100	200	400	900	900	1,000	1,400	200	200	300	300	200	100	400	1,000	1,000	2,000	3,400	
200	300	700	1,000	1,000	1,500	2,300	200	300	400	900	200	100	200	900	900	1,900	4,400	
200	300	400	2,500	1,900	2,300	2,800	200	300	400	400	200	100	300	4,400	5,300	7,400	8,200	
100	200	200	1,100	1,100	1,300	1,600	200	100	300	300	200	200	400	2,100	2,200	3,300	4,400	
0	0	100	500	400	600	1,000	100	100	100	200	100	100	200	500	500	1,100	1,600	
200	300	600	1,300	1,200	1,500	2,700	100	200	400	700	200	200	600	1,600	1,400	2,800	5,300	
300	300	400	2,200	2,200	2,400	2,800	300	300	500	500	300	300	600	2,600	1,900	2,300	2,700	
200	200	300	1,500	1,400	1,400	1,700	200	300	700	700	300	200	300	3,800	1,800	4,400	4,600	
600	800	1,100	4,400	4,100	5,400													

Table 3 Total and Urban Population Comparisons in the
White and Wabash Basins for 1960, 1980 and 2010

Basin	1960			1980			2010		
	Population	Urban Population	Per Cent Urban	Population	Urban Population	Per Cent Urban	Population	Urban Population	Per Cent Urban
White	1,782,900	1,107,900	62.1	2,312,200	1,532,800	66.3	3,393,300	2,469,600	72.8
Wabash	<u>1,362,400</u>	<u>676,500</u>	<u>49.7</u>	<u>1,541,500</u>	<u>853,100</u>	<u>55.3</u>	<u>2,061,300</u>	<u>1,246,300</u>	<u>60.4</u>
Totals	3,145,300	1,784,400	56.7	3,853,700	2,385,900	61.9	5,454,600	3,715,900	68.1

Table 4 Population Projections for the Wabash Basin for the Years 1970, 1980, 1990, 2000 and 2010, Based on a Preliminary Projection for 2010

Population	Census	Preliminary Projections				Per Cent Increase by 2010	Annual Per Cent Increase	
	1960	1970	1980	1990	2000			2010
White Basin	1,782,900	2,150,000	2,450,000	2,800,000	3,100,000	3,393,300	90.5	1.80
Wabash Basin excluding White	1,362,400	1,500,000	1,600,000	1,750,000	1,880,000	2,061,300	51.3	1.03
Totals for Wabash Basin	3,145,300	3,650,000	4,050,000	4,550,000	4,980,000	5,454,600	73.4	1.47

Table 5 Total Employment by Counties in the Wabash Basin 1930, 1940, 1950, 1960

	1930		1940		1950		1960	
	Number	% of Basin	Number	% of Basin	Number	% of Basin	Number	% of Basin
Champaign	24,900	6.0	27,700	7.3	35,200	7.6	44,100	9.0
Clark	6,200*	1.5	6,100	1.6	6,600	1.4	5,400	1.1
Clay	5,700	1.3	5,900	1.5	5,800	1.2	5,400	1.1
Coles	13,400	3.2	13,200	3.4	15,600	3.3	16,100	3.3
Crawford	7,200	1.7	6,600	1.7	7,800	1.6	7,500	1.5
Cumberland	3,700	0.8	3,900	1.0	3,900	0.8	3,300	0.6
Douglas	6,000	1.4	5,400	1.4	5,900	1.2	6,700	1.3
Edgar	9,200	2.2	7,900	2.0	8,500	1.8	8,100	1.6
Edwards	3,000	0.7	2,700	0.7	3,200	0.6	2,800	0.5
Effingham	6,600	1.6	7,500	1.9	7,900	1.7	7,900	1.6
Hamilton	4,300	1.0	4,100	1.0	4,100	0.8	3,100	0.6
Jasper	4,100	0.9	4,400	1.1	4,200	0.9	3,700	0.7
Lawrence	7,100	1.7	5,500	1.4	6,700	1.4	6,100	1.2
Richland	5,100	1.2	5,900	1.5	6,100	1.3	5,800	1.1
Vermillion	32,800	7.9	26,400	6.9	31,500	6.8	34,700	7.1
Wabash	4,600	1.1	4,300	1.1	5,100	1.1	5,100	1.0
Wayne	6,700	1.6	6,700	1.7	7,000	1.5	6,700	1.3
White	6,400	1.5	6,000	1.5	7,200	1.5	6,700	1.3
Totals	157,000		150,200		172,300		179,200	

Employment in Counties of Wabash Basin in The State of Indiana

Benton	4,200	1.0	3,800	1.0	4,000	0.8	4,200	0.8
Blackford	4,900	1.1	4,700	1.2	5,400	1.1	5,600	1.1
Carroll	5,200	1.2	4,900	1.2	5,900	1.2	6,100	1.2
Cass	12,500	3.0	13,100	3.4	14,200	3.0	14,600	2.9
Clinton	10,000	2.4	9,200	2.4	10,900	2.3	11,400	2.3
Fountain	6,500	1.5	5,500	1.4	6,400	1.3	6,500	1.3
Fulton	5,500	1.3	5,200	1.3	6,600	1.4	6,200	1.2
Grant	19,400	4.7	17,700	4.6	23,300	5.0	28,400	5.8
Howard	17,500	4.2	15,500	4.1	21,300	4.6	25,100	5.1
Huntington	10,300	2.5	9,700	2.5	12,700	2.7	12,900	2.6
Jay	7,600	1.8	8,100	2.1	8,800	1.9	8,900	1.8
Kosciusko	9,800	2.3	10,000	2.6	12,700	2.7	15,800	3.2
Miami	11,200	2.7	9,400	2.4	10,900	2.3	11,500	2.3
Montgomery	10,100	2.4	9,400	2.4	11,000	2.3	11,900	2.4
Parke	5,800	1.4	4,800	1.2	5,300	1.1	4,800	0.9

179,200

172,300

150,200

157,000

Totals

Employment in Counties of Wabash Basin in The State of Indiana

Benton	4,200	1.0	3,800	1.0	4,000	1.0	4,200	0.8
Blackford	4,900	1.1	4,700	1.2	5,400	1.2	5,600	1.1
Carroll	5,200	1.2	4,900	1.2	5,900	1.2	6,100	1.2
Cass	12,500	3.0	13,100	3.4	14,200	3.4	14,600	2.9
Clinton	10,000	2.4	9,200	2.4	10,900	2.4	11,400	2.3
Fountain	6,500	1.5	5,500	1.4	6,400	1.4	6,500	1.3
Fulton	5,500	1.3	5,200	1.3	6,600	1.3	6,200	1.2
Grant	19,400	4.7	17,700	4.6	23,300	4.6	28,400	5.8
Howard	17,500	4.2	15,500	4.1	21,300	4.1	25,100	5.1
Huntington	10,300	2.5	9,700	2.5	12,700	2.5	12,900	2.6
Jay	7,600	1.8	8,100	2.1	8,800	2.1	8,900	1.8
Kosciusko	9,800	2.3	10,000	2.6	12,700	2.6	15,800	3.2
Miami	11,200	2.7	9,400	2.4	10,900	2.4	11,500	2.3
Montgomery	10,100	2.4	9,400	2.4	11,000	2.4	11,900	2.4
Parke	5,800	1.4	4,800	1.2	5,300	1.2	4,800	0.9
Pulaski	4,000	0.9	3,900	1.0	4,400	1.0	4,400	0.9
Sullivan	9,200	2.2	6,000	1.5	7,500	1.5	7,200	1.4
Tippecance	18,600	4.5	18,100	4.7	28,100	4.7	33,500	6.8
Tipton	5,400	1.3	4,600	1.2	5,400	1.2	5,800	1.1
Vermillion	8,400	2.0	4,700	1.2	6,300	1.2	5,900	1.2
Vigo	38,600	9.3	30,400	8.0	39,800	8.6	38,500	7.8
Wabash	9,000	2.1	9,200	2.4	11,700	2.4	13,200	2.7
Warren	3,200	0.7	2,800	0.7	3,000	0.6	2,900	0.5
Wells	6,300	1.5	6,000	1.5	7,500	1.5	8,300	1.7
White	5,500	1.3	5,700	1.5	6,600	1.5	7,000	1.4
Whitley	5,800	1.4	6,100	1.6	7,700	1.6	8,000	1.6
Totals	254,500		228,600		287,400		308,600	

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Employment in Counties of White Basin, State of Indiana

Bartholomew	9,500	1.9	9,400	2.1	13,700	2.3	17,900	2.6
Boone	8,300	1.7	7,400	1.6	9,100	1.5	10,200	1.5
Brown	1,800	0.3	1,600	0.3	1,900	0.3	2,300	0.3
Clay	9,200	1.9	6,500	1.4	8,300	1.4	8,200	1.2
Daviess	8,900	1.8	7,500	1.7	8,900	1.5	8,700	1.2
Decatur	6,200	1.2	5,700	1.2	6,600	1.1	7,200	1.0
Delaware	26,600	5.5	26,300	5.9	35,100	6.1	41,000	6.1
Dubois	7,200	1.4	7,400	1.6	9,100	1.5	9,700	1.4
Gibson	9,800	2.0	8,600	1.9	10,700	1.8	10,400	1.5
Greene	10,500	2.1	8,000	1.8	9,100	1.5	8,800	1.3
Hamilton	8,700	1.8	8,500	1.9	10,900	1.9	15,300	2.2
Hancock	6,400	1.3	6,000	1.3	7,500	1.3	10,200	1.5
Hendricks	7,100	1.4	6,900	1.5	9,200	1.6	15,200	2.2
Henry	13,600	2.8	13,300	3.0	16,500	2.8	18,100	2.6
Jackson	8,600	1.7	8,500	1.9	10,100	1.7	11,400	1.6
Jennings	4,300	0.8	3,900	0.8	4,700	0.8	5,000	0.7
Johnson	7,800	1.6	7,400	1.6	10,000	1.7	16,100	2.3

Wabash	9,200	2.4	11,700	2.5	13,200	2.7
Warren	2,800	0.7	3,000	0.6	2,900	0.5
Wells	6,000	1.5	7,500	1.6	8,300	1.7
White	5,700	1.5	6,600	1.4	7,000	1.4
Whitley	6,100	1.6	7,700	1.6	8,000	1.6
Totals	228,600		287,400		308,600	

Employment in Counties of
White Basin, State of
Indiana

Bartholomew	9,500	1.9	9,400	2.1	13,700	2.3	17,900	2.6
Boone	8,300	1.7	7,400	1.6	9,100	1.5	10,200	1.5
Brown	1,800	0.3	1,600	0.3	1,900	0.3	2,300	0.3
Clay	9,200	1.9	6,500	1.4	8,300	1.4	8,200	1.2
Davless	8,900	1.8	7,500	1.7	8,900	1.5	8,700	1.2
Decatur	6,200	1.2	5,700	1.2	6,600	1.1	7,200	1.0
Delaware	26,600	5.5	26,300	5.9	35,100	6.1	41,000	6.1
Dubois	7,200	1.4	7,400	1.6	9,100	1.5	9,700	1.4
Gibson	9,800	2.0	8,600	1.9	10,700	1.8	10,400	1.5
Greene	10,500	2.1	8,000	1.8	9,100	1.5	8,800	1.3
Hamilton	8,700	1.8	8,500	1.9	10,900	1.9	15,300	2.2
Hancock	6,400	1.3	6,000	1.3	7,500	1.3	10,200	1.5
Hendricks	7,100	1.4	6,900	1.5	9,200	1.6	15,200	2.2
Henry	13,600	2.8	13,300	3.0	16,500	2.8	18,100	2.6
Jackson	8,600	1.7	8,500	1.9	10,100	1.7	11,400	1.6
Jennings	4,300	0.8	3,900	0.8	4,700	0.8	5,000	0.7
Johnson	7,800	1.6	7,400	1.6	10,000	1.7	16,100	2.3
Knox	15,400	3.1	13,200	3.0	14,800	2.5	14,500	2.1
Lawrence	11,900	2.4	7,400	1.6	11,800	2.0	12,000	1.7
Madison	34,300	7.1	30,100	6.8	42,100	7.3	48,600	7.2
Marion	186,500	38.6	175,300	39.9	234,000	40.7	278,400	41.4
Martin	3,400	0.7	2,600	0.5	3,400	0.5	3,300	0.4
Monroe	12,500	2.5	9,400	2.1	17,400	3.0	22,600	3.3
Morgan	7,100	1.4	6,300	1.4	8,500	1.4	11,700	1.7
Orange	6,100	1.2	5,000	1.1	5,700	0.9	6,300	0.9
Owen	4,000	0.8	3,300	0.7	4,000	0.6	3,700	0.5
Pike	5,300	1.0	4,100	0.9	4,500	0.7	4,100	0.6
Putnam	8,400	1.7	6,300	1.4	7,600	1.3	8,500	1.2
Randolph	8,800	1.8	9,300	2.1	10,300	1.7	10,700	1.5
Rush	6,800	1.4	6,300	1.4	7,200	1.2	7,500	1.1
Scott	2,400	0.4	3,100	0.7	3,700	0.6	4,600	0.6
Shelby	9,700	2.0	8,900	2.0	11,300	1.9	13,100	1.9
Washington	5,600	1.1	5,100	1.1	5,900	1.0	6,200	0.9
Totals	482,700		438,600		573,600		671,500	

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Table 6 Value of Farm Products Produced and Sold
In Counties Situated in the Wabash and
White River Basins as Reported by Censuses
of Agriculture for 1949, 1954 and 1958

	1949 ^{a/} \$(000)	1954 \$(000)	1959 \$(000)
<u>Counties of Wabash Basin in the State of Illinois</u>			
Champaign	32,201	37,221	36,431
Clark	8,401	9,167	11,941
Clay	4,578	4,685	7,882
Coles	13,621	12,544	15,194
Crawford	6,496	6,023	8,394
Cumberland	5,333	5,698	9,602
Douglas	13,345	14,738	14,049
Edgar	17,792	19,243	19,588
Edwards	3,719	4,665	4,503
Effingham	6,923	6,629	10,587
Hamilton	3,219	3,941	5,335
Jasper	7,351	7,733	11,425
Lawrence	4,190	4,758	5,731
Richland	3,847	4,697	6,633
Vermilion	25,334	30,930	28,802
Wabash	3,267	4,260	4,733
Wayne	6,368	8,104	11,696
White	6,171	7,656	8,997
	\$ 172,156	\$ 192,692	\$ 221,523

Counties of Wabash Basin
in State of Indiana

Benton	13,425	16,540	15,621
Blackford	3,540	4,614	3,907
Carroll	11,811	15,885	16,487
Cass	11,049	14,457	15,004
Clinton	14,035	17,784	17,201
Fountain	8,106	10,762	10,044
Fulton	8,628	11,428	11,918
Grant	10,991	13,869	13,480
Howard	9,866	12,771	12,854
Huntington	9,521	12,770	11,649
Jay	7,047	9,511	7,650
Kosciusko	15,310	18,966	19,862
Miami	9,338	12,739	13,593
Montgomery	14,168	17,602	17,369
Parke	7,739	9,541	9,013
Pulaski	8,974	12,619	11,818
Sullivan	6,496	7,057	8,747

Table 6 (Cont'd)

	1949 ^{a/} \$(000)	1954 \$(000)	1959 \$(000)
Tippecance	13,660	15,999	16,362
Tipton	9,081	10,964	10,598
Vermillion	5,456	5,955	6,022
Vigo	6,656	9,577	8,214
Wabash	11,491	14,545	15,665
Warren	8,161	10,193	10,228
Wells	9,261	12,427	11,591
White	13,643	17,677	17,498
Whitley	8,087	9,464	9,201
	<u>\$ 255,540</u>	<u>\$ 325,716</u>	<u>\$ 321,596</u>

Counties of White Basin,
State of Indiana

Bartholomew	8,005	7,788	8,977
Boone	13,321	16,506	15,059
Brown	749	791	991
Clay	5,077	7,004	7,963
Daviess	7,914	9,304	12,745
Decatur	9,891	11,342	13,499
Delaware	10,037	11,877	10,269
Dubois	6,337	8,692	11,901
Gibson	8,338	10,583	11,935
Greene	5,896	6,619	8,035
Hamilton	11,605	13,900	12,957
Hancock	7,773	9,389	10,192
Hendricks	12,238	14,812	13,572
Henry	10,271	12,838	13,244
Jackson	6,079	7,530	9,615
Jennings	3,151	3,920	4,037
Johnson	8,753	9,712	10,552
Knox	11,999	13,991	15,626
Lawrence	3,310	3,636	5,280
Madison	11,973	13,929	14,194
Marion	8,740	8,273	7,884
Martin	1,453	1,974	2,608
Monroe	2,196	2,333	3,456
Morgan	6,457	8,286	7,914
Orange	3,536	4,140	4,380
Owen	2,790	3,604	4,212
Pike	3,185	3,525	4,783
Putnam	9,602	10,820	12,460

Table 6 (Cont'd)

	1949 ^{a/} \$(000)	1954 \$(000)	1959 \$(000)
Randolph	11,312	14,074	12,747
Rush	13,698	16,377	15,055
Scott	1,847	2,399	2,788
Shelby	10,298	12,171	13,535
Washington	<u>7,353</u>	<u>9,596</u>	<u>11,327</u>
	\$ 245,189	\$ 291,735	\$ 313,792
	<u> </u>	<u> </u>	<u> </u>

a/ For some counties data
were reported for 1950

Table 7. Manufacturing and Retailing Activities by Counties in the Wabash and White River Basins as Reported by Business Censuses for 1954 and 1958

	Value Added, Mfg. <u>1954</u>	Value Added, Mfg. <u>1958</u>	Total Retail Sales <u>1954</u>	Total Retail Sales <u>1958</u>
<u>Economic Contributions of Counties in the State of Illinois</u>				
Champaign	15,443,000	24,443,000	121,172,000	142,431,000
Clark	5,434,000	N/a	17,075,000	17,386,000
Clay	2,463,000	3,670,000	14,748,000	17,918,000
Coles	18,854,000	29,314,000	46,639,000	55,832,000
Crawford	22,240,000	31,885,000	19,326,000	22,187,000
Cumberland	1,727,000	1,309,000	6,602,000	7,272,000
Douglas	6,408,000	N/a	19,877,000	25,858,000
Edgar	7,246,000	6,382,000	23,539,000	23,948,000
Edwards	1,935,000	964,000	7,273,000	6,311,000
Effingham	6,794,000	8,009,000	25,483,000	35,595,000
Hamilton	901,000	1,133,000	7,621,000	8,246,000
Jasper	276,000	1,429,000	7,241,000	9,358,000
Lawrence	N/a	N/a	16,979,000	16,634,000
Richland	3,287,000	2,040,000	17,211,000	18,660,000
Vermilion	73,468,000	94,100,000	101,620,000	115,768,000
Wabash	3,419,000	8,530,000	15,518,000	15,702,000
Wayne	N/a	N/a	16,412,000	18,219,000
White	1,908,000	1,879,000	21,740,000	22,224,000
	\$171,803,000	\$215,087,000	\$506,076,000	\$579,549,000

Economic Contributions of Counties in the State of Indiana

Benton	663,000	1,892,000	13,288,000	14,693,000
Blackford	8,860,000	14,648,000	14,090,000	15,757,000
Carroll	4,261,000	4,881,000	17,006,000	19,202,000
Cass	21,186,000	20,596,000	42,094,000	48,353,000
Clinton	12,288,000	14,291,000	31,462,000	33,743,000
Fountain	4,880,000	11,278,000	19,294,000	21,397,000
Fulton	5,719,000	7,530,000	17,873,000	17,569,000
Grant	70,316,000	110,041,000	64,814,000	79,166,000
Howard	92,110,000	109,181,000	64,538,000	69,969,000

Table 7 (Cont'd)

	Value Added, Mfg. 1954	Value Added, Mfg. 1958	Total Retail Sales 1954	Total Retail Sales 1958
Huntington	22,373,000	24,468,000	33,262,000	34,640,000
Jay	17,245,000	20,027,000	20,900,000	19,904,000
Kosciusko	22,878,000	30,802,000	42,213,000	54,792,000
Miami	14,271,000	16,618,000	29,591,000	37,322,000
Montgomery	19,085,000	26,319,000	36,351,000	37,080,000
Parke	2,349,000	1,379,000	11,056,000	11,850,000
Pulaski	1,387,000	1,278,000	13,993,000	15,100,000
Sullivan	622,000	2,206,000	16,034,000	17,726,000
Tippecanoe	67,303,000	83,709,000	83,739,000	103,630,000
Tipton	6,436,000	5,373,000	11,507,000	12,285,000
Vermillion	15,276,000	2,840,000	16,144,000	16,952,000
Vigo	75,688,000	93,843,000	119,686,000	137,263,000
Wabash	31,531,000	36,288,000	31,403,000	36,735,000
Warren	34,000	N/a	4,065,000	3,718,000
Wells	7,809,000	11,389,000	21,647,000	20,817,000
White	4,704,000	5,813,000	21,532,000	25,707,000
Whitley	9,916,000	17,395,000	18,789,000	20,308,000
	\$539,190,000	\$674,291,000	\$816,421,000	\$925,683,000

Economic Con-
tributions,
Counties, White
Basin, State of
Indiana

Bartholomew	68,110,000	96,669,000	42,157,000	55,496,000
Boone	11,093,000	16,866,000	24,662,000	31,838,000
Brown	N/a	46,000	2,408,000	3,034,000
Clay	7,240,000	8,673,000	20,332,000	21,814,000
Daviess	5,343,000	6,422,000	21,147,000	23,646,000
Decatur	3,389,000	6,171,000	20,700,000	24,401,000
Delaware	149,534,000	154,829,000	106,146,000	115,790,000
Dubois	15,709,000	22,356,000	26,545,000	28,825,000
Gibson	10,860,000	10,196,000	27,998,000	30,643,000
Greene	4,221,000	7,522,000	22,908,000	25,003,000
Hamilton	15,964,000	17,930,000	26,688,000	30,327,000
Hancock	3,825,000	4,483,000	22,085,000	26,999,000
Hendricks	721,000	1,484,000	22,549,000	28,323,000
Henry	32,558,000	33,095,000	46,859,000	52,103,000
Jackson	18,699,000	24,273,000	28,683,000	29,985,000
Jennings	2,390,000	4,930,000	10,922,000	12,884,000
Johnson	14,835,000	15,294,000	29,005,000	35,853,000
Knot	13,402,000	20,870,000	42,383,000	47,946,000
Lawrence	28,780,000	22,923,000	33,178,000	34,529,000

Table 7 (Cont'd)

	Value Added, Mfg. 1954	Value Added, Mfg. 1958	Total Retail Sales 1954	Total Retail Sales 1958
Madison	206,088,000	214,061,000	121,266,000	134,934,000
Marion	844,783,000	955,259,000	826,931,000	943,202,000
Martin	1,015,000	13,272,000	7,692,000	9,147,000
Monroe	51,700,000	60,794,000	47,655,000	55,899,000
Morgan	4,803,000	3,854,000	22,870,000	26,517,000
Orange	8,060,000	7,995,000	12,843,000	13,759,000
Owen	899,000	1,298,000	7,667,000	8,256,000
Pike	210,000	316,000	10,175,000	9,806,000
Putnam	6,528,000	14,789,000	22,537,000	24,161,000
Randolph	21,974,000	28,897,000	27,596,000	28,658,000
Rush	8,161,000	8,678,000	19,897,000	22,198,000
Scott	7,279,000	N/a	11,260,000	12,682,000
Shelley	11,491,000	27,656,000	30,198,000	36,467,000
Washington	7,011,000	4,262,000	13,227,000	12,868,000
	\$1,586,675,000	1,816,163,000	\$1,759,169,000	\$1,997,993,000

SECTION II - ESTIMATES OF DAMAGES AND BENEFITS

1. GENERAL.

Data used in estimates of flood damages and benefits as presented in this report are based on field surveys conducted after several recent floods and economic studies made for this and other previous reports. Data have been adjusted to reflect changes in economic development and conditions and the effects of local protection projects completed or expected to be complete in the near future. For study purposes, the areas along the various streams considered in this analysis have been divided into reaches and all damages within each area related to a control gage for the reach. Flood damages for each reach and for the various categories of flood losses are studied separately. A description of the derivation of these damages by various types of development are presented in following paragraphs. To avoid duplication of work sample table 2 and plates B-1 through B-5 are taken from Interim Report, Review of Wabash River Basin, March 1963, Appendix B.

2. FLOOD DAMAGES.

a. Wabash River Basin.

(1) Agricultural areas.

(a) General. Damage estimates of crop and non-crop agricultural properties are the result of an accumulation of data gathered over an extended period by field surveys in farming areas and through interviews with county agricultural agents, Soil Conservation Service personnel and agricultural departments of universities. Publications and current digests of agricultural prices, farming practices and farm economics were also consulted in value and damage developments. Methods and general procedures used in development of agricultural damages are given herein.

(b) Crop damages. Development of flood damages to crops involves the use of stage-area inundated data; flood profiles; crop values and distribution data; unit damage tables; and floods of the record period. Stage-area inundated curves were developed by use of flood plain charts and/or topographic maps on which have been placed the limits of several actual or synthetic flood lines throughout the range of flooding. The areas within each of the flow lines were determined and related to the comparable stages at the control gage. Stage-area inundated curves were developed for the unprotected area in each reach and for areas behind each individual effective levee. A sample area curve is presented on plate 1 for Reach W-4, Wabash River. Crop distribution and crop values were developed primarily by systematic strip sampling of agricultural areas and by use of current publications of prices received by farmers for the various

crops. The samples comprised between fifteen and twenty-five percent of the total area in each reach, dependent upon the average farm size and the general use of the area. Woods and wasteland were derived by map measurement. Table 1 presents sample data pertinent to land use, yields and unit crop values for selected reaches within the study area.

TABLE 1
LAND USE AND CROP VALUES
SELECTED STREAM REACHES BELOW STUDIED DAM SITES

Crop	Land use percent of total	Average yield in flood-free years	Unit value (1963)	Value per acre (1963)
<u>Embarrass River - Reach EM-2</u>				
Corn	45.1	79 bu	\$ 1.02	\$81
Soybeans	36.4	32 bu	2.69	86
Wheat	8.6	34 bu	2.02	69
Hay	1.6	2.1 tons	25.80	54
Oats	3.5	49 bu	0.63	31
Pasture	0.5	-	-	40
Unproductive	4.3	-	-	-
<u>East Fork White River - Reach EW-4</u>				
Corn	52.4	84 bu	\$ 0.95	\$80
Soybeans	21.3	31 bu	2.70	84
Wheat	10.0	34 bu	1.98	67
Hay	2.3	2.8 tons	23.80	67
Pasture	4.8	-	-	40
Unproductive	9.2	-	-	-
<u>Patoka River - Reach P-3</u>				
Corn	29.7	83 bu	\$ 0.95	\$79
Soybeans	34.1	31 bu	2.70	84
Wheat	2.8	36 bu	1.98	71
Hay	4.4	2.1 tons	23.80	50
Pasture	4.5	-	-	40
Unproductive	24.5	-	-	-

Unit crop damages were developed by weighing the various factors included in crop production and the effect of flooding on each crop. Several basic factors used in the evaluation are: cost of the separate items of production; time sequence; stage of crop development at various times of the year; reduction in yields resulting from late planting; and the cost and net profit from alternate crops. From these and other factors related to crop damages, unit damage tables were compiled which express damages in percent of crop value, for flooding at various times of the year. (A sample of these unit crop damages for Reach W-4, Wabash River, is given in table 2.) Using the floods through the period of record, damages for each flood for each crop were computed by applying the applicable damage factor for the time of year and the duration and depth of flooding. When more than one flood occurred during a growing season, adjustments were made to eliminate any duplication of flood damages. A summation of these damages for each crop gives the total flood damage through the record period. The average crop damage per acre is obtained by dividing the sum of damages by the sum of the areas inundated for each crop through the period of record. Applying these average damages per acre to stage-area inundated data gives the average crop damage for stage through the range of flooding, and forms the basis of the crop damage curve. Demonstrations of the development of the average damages per acre and average damage for stage are presented on plates B-2 and B-3, respectively, for Reach W-4, Wabash River.

(c) Non-crop damages. The basis of non-crop agricultural losses are data compiled from economic studies and flood damage surveys adjusted to reflect current values. From these data, separate damage curves were prepared for the various items of damageable property as erosion, sanding, fencing, debris removal, etc. These individual curves were composited to obtain the total non-crop damage for stage. Plate B-4 illustrates the individual and composite non-crop damage curves.

TABLE 2
 SAMPLE-UNIT CROP DAMAGES
 REACH W-4 WABASH RIVER

Crop	Crop Damages as percentage of total crop value-per acre											
	Corn		Soybeans		Wheat		Hay		Pasture		Oats	
	0-2	Over 2	0-2	Over 2	0-2	Over 2	0-2	Over 2	0-2	Over 2	0-2	Over 2
Depth-feet	0-48	48+	0-48	48+	0-48	48+	0-48	48+	0-48	48+	0-48	48+
Duration-hours	0-48	48+	0-48	48+	0-48	48+	0-48	48+	0-48	48+	0-48	48+
Time of Flood												
1 Jan - 29 Feb	0.7	0.7	0.1	0.1	5.0	5.0	2.6	10.0	0.0	0.0	1.0	1.0
1 -31 Mar	0.7	0.7	0.1	0.1	12.2	12.2	3.0	10.0	0.0	0.0	3.0	3.0
1-15 Apr	1.3	1.8	0.9	0.9	30.8	30.8	4.4	11.7	10.5	16.5	20.8	30.7
16-30 Apr	2.0	3.0	2.0	2.3	43.8	43.8	5.9	14.5	27.1	42.7	31.6	55.8
1-15 May	6.8	8.3	9.0	11.1	57.8	57.8	8.8	19.9	31.0	48.0	39.3	56.3
16-31 May	20.5	23.0	15.8	21.3	70.0	70.0	14.6	32.5	28.4	43.8	27.0	36.0
1-15 Jun	41.0	50.0	30.5	42.5	70.0	70.0	25.5	68.7	25.5	39.2	27.0	36.8
16-30 Jun	64.0	78.0	51.8	75.3	42.0	42.0	25.0	71.8	23.1	35.0	61.4	81.0
1-15 Jul	38.5	84.8	66.1	86.5	8.5	8.5	13.3	63.5	21.0	32.0	37.5	40.9
16-31 Jul	26.5	86.6	67.3	86.5	0.0	0.0	13.5	61.4	19.0	29.0	7.8	7.8
1-15 Aug	18.0	86.6	67.3	86.5	0.1	0.1	9.3	49.3	17.2	27.1	1.0	1.0
16-31 Aug	21.8	86.6	67.3	86.5	3.0	3.0	6.9	35.5	15.6	25.4	1.0	1.0
1-15 Sep	8.2	85.6	66.1	86.5	8.0	8.0	5.0	22.1	13.6	22.8	1.0	1.0
16-30 Sep	5.9	81.6	58.2	76.1	16.0	16.5	3.9	15.5	11.2	19.6	1.0	1.0
1-15 Oct	4.2	73.0	37.3	51.9	28.0	33.4	2.9	12.3	8.8	15.4	1.0	1.0
16-31 Oct	2.8	51.0	14.6	21.9	45.0	55.0	2.8	10.4	5.4	10.0	1.0	1.0
1-15 Nov	1.8	26.5	3.8	7.0	21.0	28.5	2.2	10.0	1.4	2.7	1.0	1.0
16-30 Nov	1.2	14.0	0.1	0.9	11.4	16.5	2.0	10.0	0.0	0.0	1.0	1.0
1-15 Dec	0.7	6.0	0.0	0.0	6.3	9.8	2.0	10.0	0.0	0.0	1.0	1.0
16-31 Dec	0.7	2.0	0.0	0.0	5.0	7.5	2.0	10.0	0.0	0.0	1.0	1.0

NOTE: Maximum damage is total value of crop minus labor and expenses non-expended at time of flood.

(2) Urban damages. Damage surveys have been made of each urban area within the study area. Data from these surveys were supplemented by economic studies of individual urban areas and adjustments were made, where necessary, to reflect 1963 values and conditions. Estimated flood damages by stream reaches to these urban areas for recurrence in 1963 of the March 1913 and June 1960 floods are presented in tables 3 and 4, respectively. An individual stage damage curve was drawn for each urban area affected and the damage for stage composited into the reach damage curve.

(3) Transportation route damage. Flood damages to transportation routes are based primarily on detailed studies made after the 1943 flood. The data have been supplemented by recent damage surveys in which state and county road officials were consulted for flood damage information. All damage information presented in this report has been adjusted to represent 1963 values and conditions. The transportation route damages for recurrence at present of the March 1913 and June 1960 floods are presented as parts of tables 3 and 4, respectively.

(4) Levee damage. Damage to agricultural levees varies considerable, dependent upon river stages and velocities and the grade and condition of the levee. Many private levees are poorly maintained and have inadequate slopes. During floods, these levees suffer erosion and often lengthy sections are washed out when the levees are overtopped. Levee damage estimates have been developed from actual contract repair costs as modified to reflect present day values and conditions. The estimated levee damages for recurrence of the March 1913 and June 1960 floods are given in tables 3 and 4, respectively.

(5) Damage curves. Using the data described in previous paragraphs, separate stage-damage curves were constructed by stream reaches for all major types of damageable properties in the overflow areas. Examples of these for Reach W-4, Wabash River, are presented on plates B-5a through B-5c. To simplify presentation and computation of average annual damages, all damages within each reach were composited into one curve which represents the actual damage for stage, including damages that would occur to the protected areas above the effective heights of the levees. These damage curves for each reach studied are presented on plates B-6a through B-6r.

TABLE 3
ESTIMATED DAMAGE FOR RECURRENCE OF THE MARCH 1913 FLOOD

Stream and reach	Damage for flood recurrence (1963)				
	Agricultural		Transportation routes (\$1,000)	Urban (\$1,000)	Levee or other (\$1,000)
	Crop (\$1,000)	Non-crop (\$1,000)			
<u>Wabash River</u>					
W-1 Mi. 0.0-40.0	130	1,072	129	65	-
W-2 Mi. 40.0-94.5	155	2,005	1,152	342(1)	102
W-3 Mi. 94.5-124.2	183	770	766	-	11
Total Wabash River	468	3,847	2,047	407	113
<u>Embarrass River</u>					
EM-1 Mi. 0.0-63.8	176	259	268	152	160
EM-2 Mi. 63.8-103.2	42	220	67	-	-
Total Embarrass River	218	479	335	152	160
<u>White River</u>					
WH-1 Mi. 0.0-51.6	71	200	32	139	-
<u>East Fork White River</u>					
EW-1 Mi. 51.6-111.9	91	352	135	88	-
EW-2 Mi. 111.9-146.2	28	143	16	-	-
EW-3 Mi. 146.2-183.7	49	128	110	-	-
EW-4 Mi. 183.7-238.3	256	622	269	824	-
Total East Fork White River	424	1,245	530	912	-
<u>Clifty Creek</u>					
CC-1 Mi. 0.0-18.4	10	50	37	354	-
<u>Patoka River</u>					
P-1 Mi. 0.0-17.5	27	11	-	-	7
P-2 Mi. 17.5-34.6	45	19	21	14	239
P-3 Mi. 34.6-54.8	28	12	-	14	26
P-4 Mi. 54.8-62.2	9	7	6	-	10
P-5 Mi. 62.2-81.1	26	21	74	-	16
P-6 Mi. 81.1-106.0	25	20	60	480	8
P-7 Mi. 106.0-118.3	8	7	3	19	6
Total Patoka River	168	97	164	527	312
Grand total Wabash River and tributaries	1,359	5,918	3,145	2,491	585

(1) Excludes Mt. Carmel, Ill. (local protection anticipated in near future).

TABLE 4

ESTIMATED DAMAGE FOR RECURRENCE OF THE JUNE 1960 FLOOD

Stream and reach	Damage for flood recurrence (1963)				
	Agricultural		Transportation	Urban	Levee or other
	Crop (\$1,000)	Non-crop (\$1,000)	routes (\$1,000)	(\$1,000)	(\$1,000)
<u>Wabash River</u>					
W-1 Mi. 0.0-40.0	1,598	75	-	-	-
W-2 Mi. 40.0-94.5	1,548	114	-	(1)	-
W-3 Mi. 94.5-124.2	310	11	-	-	-
Total Wabash River	3,456	200	-	-	-
<u>Embarrass River</u>					
EM-1 Mi. 0.0-63.8	691	52	41	14	12
EM-2 Mi. 63.8-103.2	372	103	-	-	-
Total Embarrass River	1,063	155	41	14	12
<u>White River</u>					
WH-1 Mi. 0.0-51.6	865	60	-	-	-
<u>East Fork White River</u>					
EW-1 Mi. 51.6-111.9	836	54	14	-	-
EW-2 Mi. 111.9-146.2	230	24	2	-	-
EW-3 Mi. 146.2-183.7	496	51	55	-	-
EW-4 Mi. 183.7-238.3	1,980	170	14	-	-
Total East Fork White River	3,542	299	85	-	-
<u>Clifty Creek</u>					
CC-1 Mi. 0.0-18.4	11	-	-	-	-
<u>Patoka River</u>					
P-1 Mi. 0.0-17.5	210	7	-	-	-
P-2 Mi. 17.5-34.6	162	5	1	-	9
P-3 Mi. 34.6-54.8	159	5	-	-	15
P-4 Mi. 54.8-62.2	7	1	-	-	2
P-5 Mi. 62.2-81.1	93	7	1	-	3
P-6 Mi. 81.1-106.0	87	6	-	16	1
P-7 Mi. 106.0-118.3	35	2	-	-	-
Total Patoka River	758	33	2	16	30
Grand total Wabash River and tributaries	9,695	747	128	30	42

(1) Excludes Mt. Carmel, Ill. (local protection anticipated in near future)

b. Ohio River. Flood damages in areas along the Ohio River below the Wabash River were developed from previously compiled flood damage data obtained during prior surveys and adjusted to reflect current values and conditions of development. Generally, methods and procedures used in developing Wabash River data were also applied to Ohio River areas. Presented in table 5 is a summary of damages expected for recurrence of stages equivalent to the maximum flood of record that occurred in January 1937 and for the March 1945 occurrence.

TABLE 5

FLOOD DAMAGES - OHIO RIVER BELOW THE WABASH RIVER

Reach	Mile to mile	Damage for flood recurrence (1)	
		1937 Stage	1945 Stage
0-1	981.0-920.4	\$ 7,600,000	\$ 1,030,000
0-2	920.4-848.0	<u>10,570,000</u>	<u>1,960,000</u>
	Total	\$ 18,170,000	\$ 2,990,000

(1) 1963 values based on 1961 development

The above estimates exclude flood damages prevented by Federally constructed protection works at Shawneetown, Rosiclare, Golconda, Brookport, Mounds and Mound City, Illinois and Paducah, Kentucky. Flood damage curves for each of these Ohio River reaches were developed from data presented in table 5 and similar data for other flood stages.

c. Average annual damages. Average annual damages were developed by use of the standard method of developing annual flood losses. Average annual damages are obtained from damage-frequency curves on which flood damages are plotted against flood exceedence frequencies. The area under these curves, obtained by planimetry, represents the average annual flood loss when converted to dollar values. Natural flood exceedence frequencies at stream gaging stations influenced by operation of existing reservoirs and those reservoirs under construction were initially modified to reflect reductions afforded by operation of these reservoirs. Average annual flood damages, representing 1963 conditions of development, values, and flow conditions in stream reaches along the Wabash River and tributaries studied for this report, are estimated to be \$7,443,000. Average annual damages along the Ohio River below the Wabash River are estimated to be \$854,000.

A detailed breakdown of average annual flood damages for areas below the studied reservoir sites is presented in table 6.

d. Presentation of data. Average annual flood damages and flood control benefits for stream reaches along the Ohio River, Wabash River and tributaries within the study area were computed by use of the damage-frequency method of obtaining annual flood losses. As this method requires presentation of large amounts of detailed data, the actual and modified computations have been transferred to graphic presentation on frequency-damage curves. These curves for the Wabash River and tributaries are presented on plates B-7a through B-7v. The Ohio River curves are not presented because the relatively small amount of benefits can be illustrated only on a large scale graph. Computed data for all streams and reaches concerned are available in the office of the U. S. Army Engineer District, Louisville, Kentucky.

TABLE 6

ESTIMATED AVERAGE ANNUAL DAMAGES BY STREAM REACHES

Stream and reach	Mile to mile	Average annual damage (1)
<u>Wabash River</u>		
W-1	0.0-40.0	\$ 676,000
W-2	40.0-94.5	583,000
W-3	94.5-124.2	<u>496,000</u>
Total Wabash River		\$ 1,755,000
<u>Embarrass River</u>		
EM-1	0.0-63.8	\$ 938,000
EM-2	63.8-103.2	<u>358,000</u>
Total Embarrass River		\$ 1,296,000
<u>White River</u>		
WH-1	0.0-51.6	\$ 315,000
<u>East Fork White River</u>		
EW-1	51.6-111.9	\$ 206,000
EW-2	111.9-146.2	66,000
EW-3	146.2-183.7	455,000
EW-4	183.7-238.3	<u>1,715,000</u>
Total East Fork White River		\$ 2,442,000
<u>Clifty Creek</u>		
CC-1	0.0-18.4	\$ 37,000
<u>Patoka River</u>		
P-1	0.0-17.5	\$ 158,000
P-2	17.5-34.6	479,000
P-3	34.6-54.8	371,000
P-4	54.8-62.2	57,000
P-5	62.2-81.1	255,000
P-6	81.1-106.0	233,000
P-7	106.0-118.3	<u>45,000</u>
Total Patoka River		\$ <u>1,598,000</u>
Total Wabash River and tributaries		\$ 7,443,000
<u>Ohio River</u>		
O-1	981.0-920.4	\$ 159,000
O-2	920.4-848.0	695,000
Total Ohio River		\$ <u>854,000</u>

(1) 1963 values. Damages are residual to reservoir and levee projects existing, under construction, or in advanced planning stage.

3. FUTURE GROWTH IN POPULATION, LABOR FORCE AND EMPLOYMENT

a. General. The Wabash Basin has a significant share in the population growth projected for the United States and for the Ohio River Basin. Based on preliminary data from the A. D. Little study, the Ohio River Basin population, of which the Wabash population is a part, is projected to increase in rounded numbers from 19.0 million in 1960 to about 31.7 million in 2010, an increase on this basis of 67 percent. A like increase for the next 50 years will project the population of the Ohio River Basin at 52.9 million for the year 2060.

The Wabash Basin, including the White Basin, had a population of 3.1 million in 1960, projected to 5.5 million in 2010, an increase of 77 percent. A like increase for the next 50 years will project the population of the total Wabash Basin at 9.7 million for the year 2060.

b. Population, labor force, and employment growth.

(1) Lincoln Reservoir. The 5 counties that would receive direct benefits from this project have been determined to be: Coles, Crawford, Cumberland, Jasper, and Lawrence, all in Illinois. The population for those 5 counties was 103,400 in 1960, and this has been projected to increase to 175,000 in 2010. If a similar rate of growth is projected for the next 50 years, this group of counties will have attained a population of 297,000 in 2060, an increase in 100 years of 188 percent. During the same period of time the labor force will have increased from 39,000 to 115,000, a growth of 195 percent. Total employment in this 5-county group is projected to increase from 36,700 in 1960, to 112,000 in 2060, a growth of 205 percent.

(2) Clifty Creek Reservoir. The 6 counties that would receive direct benefits from this project have been determined to be: Bartholomew, Jackson, Lawrence, Martin, Daviess, and Knox, all in Indiana. The total population for those 6 counties was 194,200 in 1960, and this has been projected to increase to 590,000 by the year 2060, an increase of 204 percent. During the same period of time the labor force will have increased from 72,100 to 228,000, or an increase of 229 percent. Total employment in this 6-county group is projected to increase from 67,800 to 223,000 in 2060, a growth of 229 percent.

(3) Patoka Reservoir. The 3 Indiana counties that would receive direct benefits from this project have been determined to be: Dubois, Gibson, and Pike. Total population for those 3 counties has been projected to increase from 70,200 in 1960, to 193,000 in 2060, an increase in 100 years of 175 percent. During the same period of time the labor force will have increased from 25,100 to 77,000, or an increase of 207 percent. Total employment in this 3-county group is projected to increase from 24,200 to 70,000, or an increase of 189 percent.

(4) Growth in a larger benefit area. In addition to the 14 counties situated so as to benefit directly from the three proposed reservoirs, are 13 downstream counties that would benefit from the projects. These counties are located in Illinois, Indiana and Kentucky.

Inasmuch as the downstream counties are projected to experience lower rates of growth, their statistical data have a conservative effect upon the total projections. In this total of 27 counties, population has been projected to increase from 558,500 in 1960, to 816,160 in 2010. If a similar rate of growth is projected for the next 50 years, this 27-county area will have attained a population of 1,277,000 in 2060, an increase in 100 years of 129 percent. During the same period of time the labor force will have increased from 203,100 to 498,060, or an increase of 145 percent. Total employment for this area is projected to increase from 190,700 in 1960, to 484,000 in 2060, or an increase of 154 percent.

The projected growth of employment at a higher percent with respect to population growth (154% as compared to 129%) is significant. This indicates a faster rate of growth for economic activities which can provide employment, and this will have a multiplier effect upon the area's total economy. It is considered that these data will support the conservative estimate that a 200 percent growth in the overflow areas of the Basin and a 150 percent growth in the lower Ohio River overflow area would occur during the 100-year project life period, without development of the subject flood control projects.

4. BENEFITS.

a. General. Flood damages prevented by operation of Lincoln, Clifty Creek and Patoka Reservoirs are measured as the difference in annual flood losses with present conditions of flooding and those expected with the reservoir(s) in operation. This measurement is made by use of the damage-frequency method of computing annual flood losses. Initially, natural flood frequency curves were modified, where applicable, to reflect operation of reservoirs existing, under construction, or in the advanced planning stage. These modified curves are considered to be representative of present flood conditions. These curves were further modified by routing floods from the studied reservoirs to control gages in the downstream areas. Stage reductions from these routings were used to develop modified frequency curves. A tabulation of reductions at selected gaging stations for recurrence of the June 1960 and March 1913 floods with these reservoirs in operation is presented in table 7. Data on the development of actual and modified frequency curves are given in Appendix D, Hydrology and Hydraulics.

TABLE 7
STAGE REDUCTIONS AFFORDED BY RESERVOIRS - SELECTED GAGING STATIONS

Stream and gaging station	June 1960 flood			March 1913 flood		
	Natural stage(1) (feet)	Reservoir added		Natural stage(1) (feet)	Reservoir added	
		Stage (feet)	Reduction (feet)		Stage (feet)	Reduction (feet)
<u>Embarrass</u>						
<u>Ste. Marie, Ill.</u>	19.0	15.2	3.8	26.0	22.2	3.8
<u>Wabash</u>						
<u>Mt. Carmel, Ill.</u>	20.4	20.1	0.3	30.5	30.4	0.1
<u>East Fork White and White</u>						
<u>Seymour, Ind.</u>	17.6	17.3	0.3	23.0	23.0	0.0
<u>Shoals, Ind.</u>	23.6	23.0	0.6	41.2	41.2	0.0
<u>Petersburg, Ind.</u>	22.0	21.94	0.06	28.8	28.74	0.06
<u>Wabash</u>						
<u>Mt. Carmel, Ill.</u>	20.4	20.37	0.03	30.5	30.5	0.0
<u>Patoka</u>						
<u>Ellsworth, Ind.</u>	13.0	1.0	12.0	19.2	1.0	18.2
<u>Jasper, Ind.</u>	9.3	6.4	2.9	15.9	12.2	3.7
<u>Winslow, Ind.</u>	21.6	21.2	0.4	28.4	26.8	1.6
<u>Princeton, Ind.</u>	10.1	10.07	0.03	23.5	21.9	1.6
<u>Wabash</u>						
<u>Mt. Carmel, Ill.</u>	20.4	20.38	0.02	30.5	30.45	0.05

(1) Natural stages at Mt. Carmel, Petersburg and Shoals have been modified to reflect operation of reservoirs existing and under construction (1963). Actual stages were: Mt. Carmel-1913 = 31.0, 1960 = 21.2; Petersburg-1913 = 29.2, 1960 = 22.5; Shoals-1913 = 42.2, 1960 = 25.1

b. Flood control. Flood control benefits creditable to operation of Lincoln, Clifty Creek and Patoka Reservoirs are the reductions in flood stages and flood damages in overflow areas along streams below the respective dam sites. These benefits will accrue to portions of areas along seven streams, the Wabash, Embarrass, White, East Fork White, Patoka and Ohio Rivers and Clifty Creek, from operation of the studied reservoirs. Flood control benefits from operation of each of these reservoirs are summarized by stream reaches in table 8 and presented graphically in plates B-7a through B-7v. Using these benefits as a base, the applicable growth factor was applied to reflect the 200 percent and 150 percent future growth expected to occur in the Wabash Basin and lower Ohio River overflow area, respectively, during the 100-year life of the projects. These future growth benefits are presented as a part of table 11.

TABLE 8
ESTIMATE OF PRESENT FLOOD CONTROL BENEFITS (1)

Stream and reach	Mile to mile	Reservoir		
		Lincoln	Clifty Creek	Patoka
<u>Wabash River</u>				
W-1	0.0-40.0	\$ 42,000	\$ 8,000	\$ 6,000
W-2(2)	40.0-94.5	38,000	8,000	6,000
W-3	94.5-124.2	80,000	-	-
Total Wabash River		160,000	16,000	12,000
<u>Embarrass River</u>				
EM-1	0.0-63.8	666,000	-	-
EM-2	63.8-103.2	358,000	-	-
Total Embarrass River		1,024,000	-	-
<u>White River</u>				
WH-1	0.0-51.6	-	9,000	-
<u>East Fork White River</u>				
EW-1	51.6-111.9	-	29,000	-
EW-2	111.9-142.9	-	10,000	-
EW-3	142.9-183.7	-	55,000	-
EW-4	183.7-238.3	-	202,000	-
Total East Fork White River		-	296,000	-
<u>Clifty Creek</u>				
CC-1	0.0-18.4	-	28,000	-
<u>Patoka River</u>				
P-1	0.0-17.5	-	-	1,000
P-2	17.5-34.6	-	-	36,000
P-3	34.6-54.8	-	-	22,000
P-4	54.8-62.2	-	-	10,000
P-5	62.2-81.1	-	-	22,000
P-6	81.1-106.0	-	-	182,000
P-7	106.0-118.3	-	-	45,000
Total Patoka River		-	-	318,000
<u>Ohio River</u>				
O-1	981.0-920.4	3,000	(3)	(3)
O-2	920.4-848.0	13,000	(3)	(3)
Total Ohio River		16,000	-	-
Total Flood Control Benefits		\$1,200,000	\$ 349,000	\$330,000

- (1) 1963 values and conditions of development.
(2) Mt. Carmel, Illinois excluded (construction of local protection anticipated in near future).
(3) Insignificant

c. General recreation. At the request of the District Engineer, the Bureau of Outdoor Recreation made an analysis of the potential visitation at each reservoir site. The results of this report are included in Appendix F as Exhibit F-4. Estimates of attendance, development costs and annual benefits are included in this report. Estimates of benefits for general recreation are computed on the basis of \$1.00 per visitor day. Benefits computed for the future increment are discounted to present value, assuming that this growth would be achieved along an accelerated growth curve over the 100-year economic life of the projects. This discount factor at the three percent interest rate is 0.65195. All lands necessary to support the ultimate development would be purchased during the initial development stage. All future costs associated with the ultimate development are discounted to present value by the investment factor of 0.65047, assuming that the ultimate development will follow the accelerated growth. A summary of the estimated annual attendance and benefits is presented in table 9.

TABLE 9

SUMMARY OF GENERAL RECREATION ATTENDANCE AND ANNUAL BENEFITS

Item	Reservoir		
	Lincoln	Clifty Creek	Patoka
<u>Estimated annual attendance</u>			
Initial	425,000	200,000	400,000
Future increment	<u>675,000</u>	<u>600,000</u>	<u>950,000</u>
Total	1,100,000	800,000	1,350,000
<u>Estimated annual benefits</u>			
Initial	\$ 425,000	\$ 200,000	\$ 400,000
Future increment (1)	<u>440,000</u>	<u>391,000</u>	<u>619,000</u>
Total	\$ 865,000	\$ 591,000	\$ 1,019,000

(1) Discounted to present value (factor = 0.65195).

d. Fish and wildlife recreation. Pursuant to the provisions of the Fish and Wildlife Coordination Act, as amended, and at the request of the District Engineer, the U. S. Fish and Wildlife Service prepared the report included in Appendix F as Exhibit F-3. The report contains discussions of the impact of the reservoir projects on fish and wildlife recreation use of the sites. The benefits are stated as the net increase of fishing and hunting visits to the affected areas. In a further discussion, the report presents recommendations for conservation and development of the fish and wildlife resources at the proposed sites. The recommended proposals are included in the reservoir projects. A summary of the estimated benefits for each of the three reservoirs is presented in table 10.

TABLE 10

SUMMARY OF FISH AND WILDLIFE RECREATION ANNUAL BENEFITS

Reservoir	Increase in annual angler days	Total annual angler benefits	Increase in annual hunter days	Total annual hunter benefits	Total annual F & W benefits
Lincoln	85,000	\$94,500	300	\$4,500	\$ 99,000
Clifty Creek	23,000	26,000	-	-	26,000
Patoka	121,000	130,000	-	-	130,000

e. Water quality control.

(1) General. Benefits credited to storage allocated for water quality control in the proposed reservoir projects were determined as the alternative cost of supplying an equal level of low flow objectives by single purpose reservoirs at or near the proposed reservoir sites. These alternative projects were determined to be feasible, likely to occur in the absence of the proposed multiple purpose projects, and the most economical to be developed for this purpose.

(2) Lincoln Reservoir. The value of storage allocated for water quality control at Lincoln Reservoir was based upon the most economical alternate method of maintaining the low flow objective of 15 cfs at the dam site. While storage of 5,300 acre-feet has been allocated to water quality control and water supply to maintain the combined low flow objective of 25 cfs, a single purpose reservoir with 1,800 acre-feet of storage would maintain

the 15 cfs low flow objective. Therefore, the cost of constructing and operating a single purpose reservoir with 1,800 acre-feet of storage was determined to be the most economical alternative. The average annual equivalent financial charges of this single purpose project were determined to be \$44,000 which is the benefits of the storage allocated to water quality control.

(3) Clifty Creek Reservoir. There is no storage allocated to water quality control at the proposed Clifty Creek Reservoir.

(4) Patoka Reservoir. The value of storage allocated to water quality control at Patoka Reservoir was based upon the most economical alternate method of maintaining the low flow objective of 68 cfs at Jasper. It was determined that a single purpose reservoir with 32,000 acre-feet of storage would maintain the low flow objective. The annual financial cost of construction and operation of a single purpose reservoir was estimated at \$219,000 which is the benefit of the storage allocated to water quality control.

f. Water Supply.

(1) General. The value of the storage allocated to water supply at the proposed reservoir projects is determined as the cost of the most economical alternative source of water supply in the absence of the proposed projects. The alternative projects studied were deemed feasible and likely to occur in the absence of the proposed projects.

(2) Lincoln Reservoir. The value of the storage allocated to water supply at the proposed Lincoln Reservoir was based upon the construction and operation of a single purpose reservoir with a storage capacity of 800 acre-feet twenty-five years after the completion date of the proposed Lincoln Reservoir. While 5,300 acre-feet has been allocated to meet the total of 25 cfs low-flow objective, of which 10 cfs is for water supply and 15 cfs is for water quality control, a single purpose reservoir would require only 800 acre-feet to meet the 10 cfs objective of water supply. The investment and operation costs of the alternative project have been discounted to present value (factor = 0.4776) and converted into average annual equivalent value by compound interest methods. The present average annual value of this alternate cost is \$11,000.

(3) Clifty Creek Reservoir. There is no storage allocated to water supply in the proposed Clifty Creek Reservoir.

(4) Patoka Reservoir. The value of storage allocated to water supply at Patoka Reservoir was based upon the most economical alternate method of maintaining a water supply flow of 130 cubic feet per second at Jasper. It was determined that a single purpose reservoir with 92,000 acre-feet of storage would meet the above flow. The annual financial cost of construction and operation of a single-purpose reservoir was estimated at \$344,000, which is the benefit of the storage allocated to water supply.

g. Summary of Benefits. The average annual benefits credited to each reservoir are summarized in table 11.

TABLE 11

SUMMARY OF ANNUAL BENEFITS
PROPOSED RESERVOIR PROJECTS

Item of benefit	Reservoir benefit (\$1,000)		
	Lincoln	Clifty Creek	Patoka
<u>Flood control</u>			
Present	1,200	349	330
Future growth	<u>690</u>	<u>201</u>	<u>190</u>
Total, Flood control	1,890	550	520
<u>Recreation</u>			
General			
Initial	425	200	400
Future increment (1)	<u>440</u>	<u>391</u>	<u>619</u>
Subtotal, General Recreation	865	591	1,019
Fish and Wildlife	<u>99</u>	<u>26</u>	<u>130</u>
Total Recreation	964	617	1,149
<u>Water supply</u>	11	-	344
<u>Water quality control</u>	44	-	219
TOTAL BENEFITS	2,909	1,167	2,232

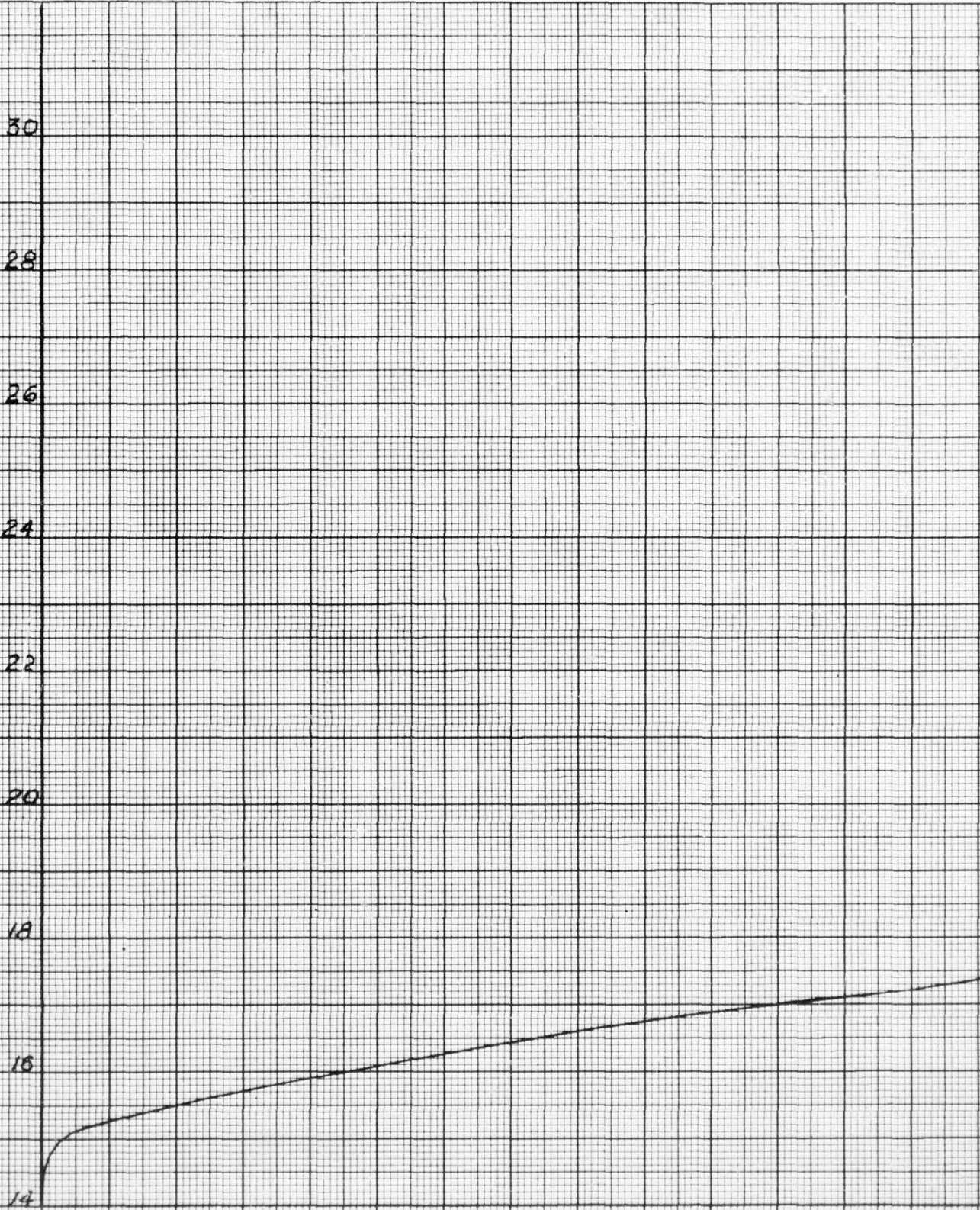
(1) Discounted to present value.

CORPS OF ENGINEERS

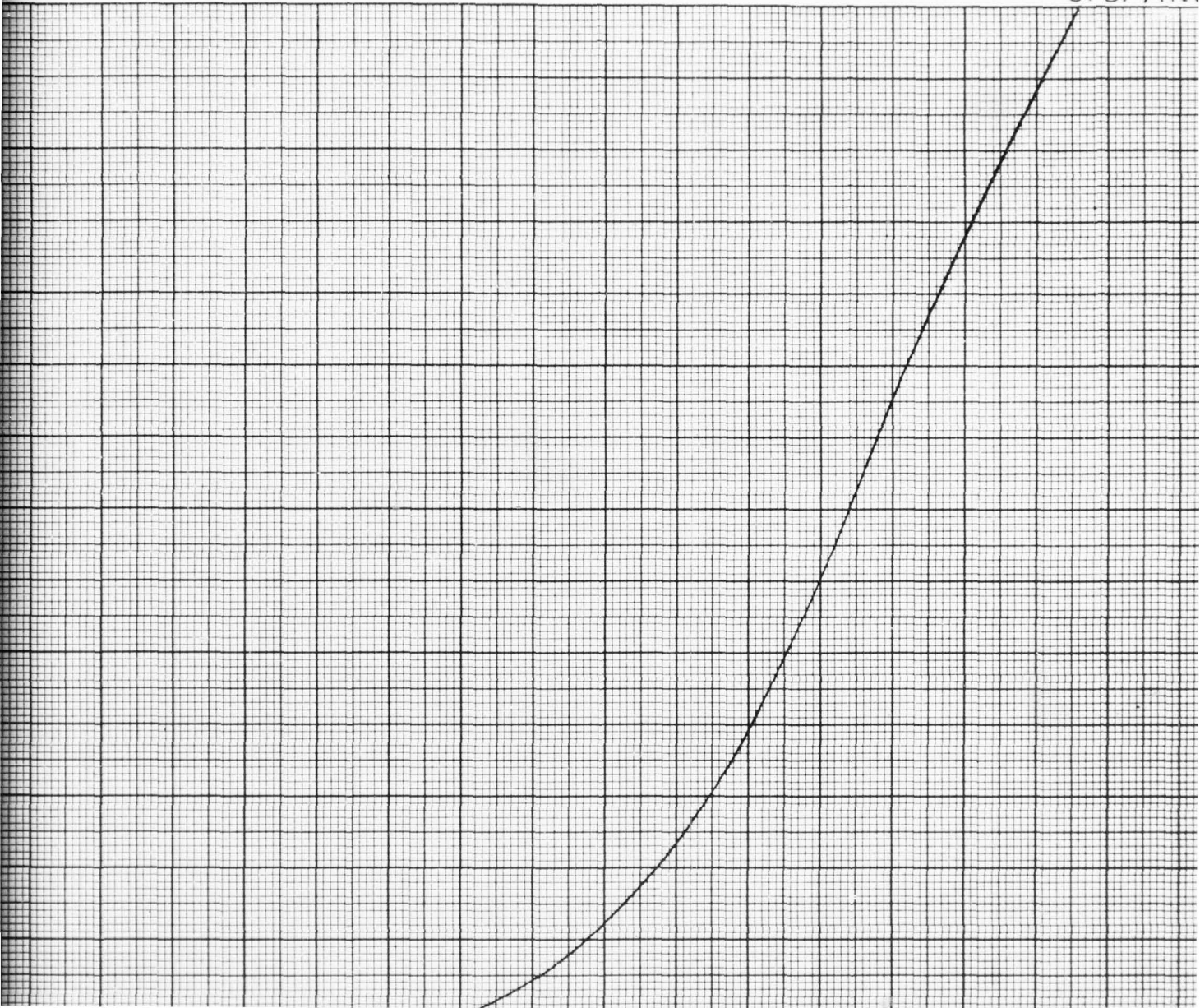
STAGE IN FEET TERRE HAUTE, GAGE

30
28
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14

0 5 10 15 20 25 30 35
AREA INUNDATED IN THOUSAND ACRES



U. S. AR



Sample-Unit Crop Dama

WABASH RIVER REACH W-4				Crop Damage Computation Damage in Dollars - Area in			
Stage	Date of Flood	Duration (Days)	Total Area Inundated	Depth of Flooding	Corn		
					Value \$64 per Acre		
					1'	2'	3'
17.3	1952 Mar 18	15	106,000	Area	14,160	19,380	15,900
				% damage	0.7	0.7	0.7
				Damage	6,340	8,680	7,120
16.8	Jun 18	4	95,000	Area	14,160	19,380	13,670
				% damage	66.0	71.0	72.0
				Damage	598,120	880,630	629,910
16.3	1953 Mar 20	7	81,000	Area	19,380	20,870	0
				% damage	0.7	0.7	
				Damage	8,680	9,350	
15.5	1956 Feb 27	4	54,000	Area	26,840	0	0
				% damage	0.7		
				Damage	12,020		
19.7	1957 Apr 12	18	124,000	Area	2,040	2,830	7,850
				% damage	1.4	1.4	1.4
				Damage	1,830	2,540	7,030
23.0	Jun 30	25	134,400	Area	1,290	1,490	1,890
				% damage	54.0	70.0	81.0
				Damage	(2)42,750	(2)64,210	(2)90,950
27.6	1958 Jun 17	23	145,300	Area	990	990	1,490
				% damage	55.0	56.0	60.0
				Damage	34,850	35,480	57,220
24.9	1959 Feb 15	21	139,000	Area	940	1,340	1,290
				% damage	0.7	0.7	0.7
				Damage	420	600	580
20.6	May 3	18	127,500	Area	1,890	2,040	2,830
				% damage	5.2	5.6	5.8
				Damage	6,290	7,310	10,500
18.9	1960 Jun 25	16	120,500	Area	2,830	7,850	14,160
				% damage	65.0	75.0	78.0
				Damage	117,730	376,800	706,870
21.3	1961 Apr 28	20	129,500	Area	1,890	2,040	2,830
				% damage	4.0	4.1	4.2
				Damage	4,840	5,350	7,610
Total for period of record 1905 thru 1961 (3)				Area	699,220	477,920	482,020
Average damage per Acre				Damage	5,291,060	3,658,530	4,210,980
					7.57	8.67	7.65

- (1) Sample computations cover period 1952 thru 1961 with several minor floods eliminated
- (2) Damages adjusted to allow for previous flooding in cropping year.
- (3) Totals are for total period of record 1905 thru 1961.

AD-A036 532

ARMY ENGINEER DISTRICT LOUISVILLE KY
WABASH RIVER BASIN COMPREHENSIVE STUDY COVERING RESERVOIR SITES--ETC(U)
JAN 64

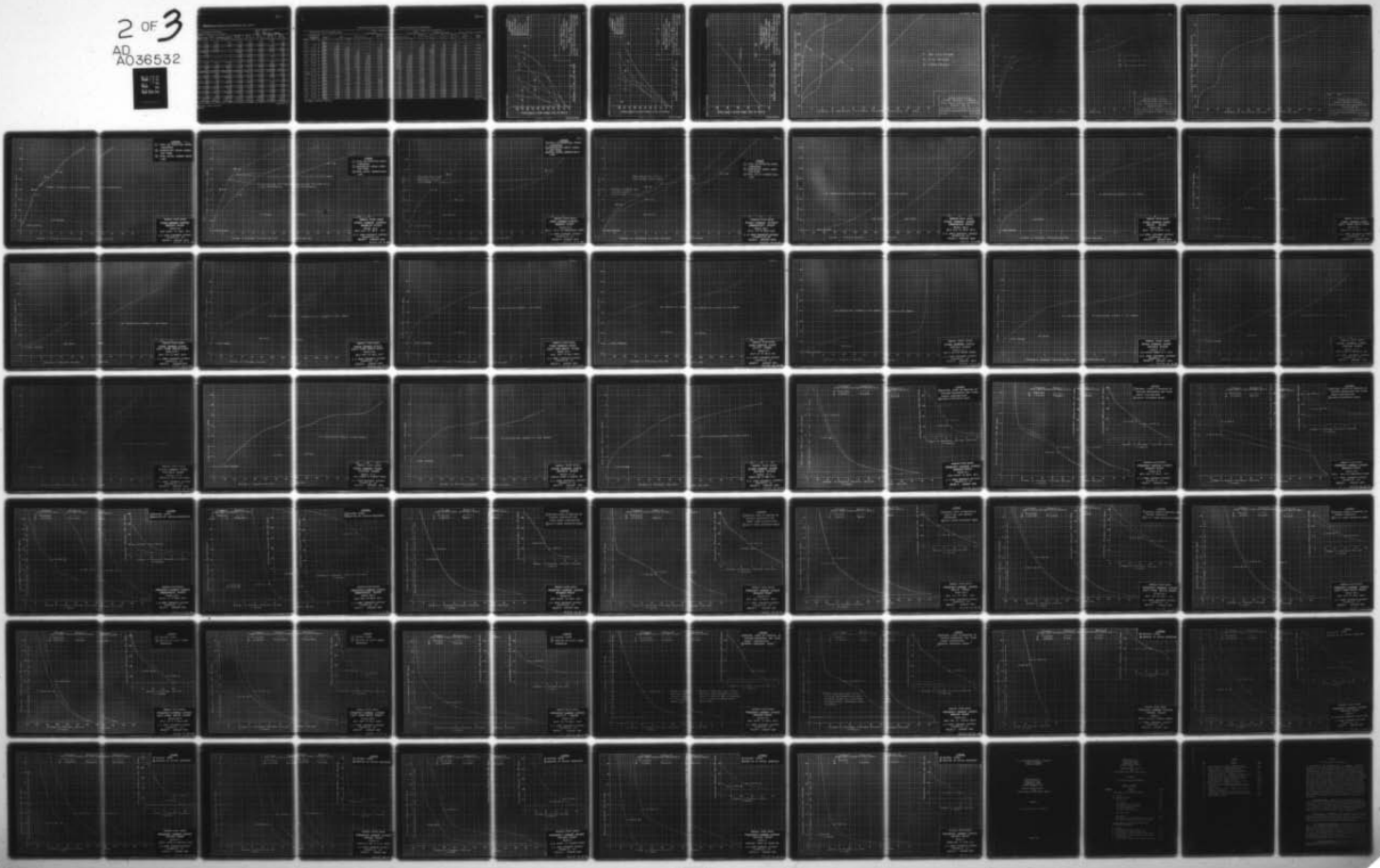
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2 OF 3

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A036532



2

Sample-Unit Crop Damage per Acre Computations 1952 - 1961 (1)

Crop Damage Computations Damage in Dollars - Area in Acres				Stream - Wabash River Reach - W-4 Gage - Terre Haute, Indiana				
Corn			Soybeans	Wheat	Hay	Pasture	Oats	
Land Use 49.7%			Val \$52	Val \$39	Val \$46	Val \$30	Val \$34	
2'	3'	Over 3'	L.U. 14.1%	L.U. 8.8%	L.U. 3.0%	L.U. 2.9%	L.U. 0.2%	
19,380	15,900	3,230	14,950	9,330	3,180	3,070	210	
0.7	0.7	0.7	0.4	16.1	10.0	0	7.0	
8,680	7,120	1,450	3,110	58,580	14,630	-	500	
19,380	13,670	0	13,400	8,360	2,350	2,760	190	
71.0	72.0		57.7	58.0	72.0	36.4	81.1	
880,630	629,910		402,050	189,100	94,390	30,140	5,240	
20,870	0	0	11,420	7,130	2,430	2,350	160	
0.7			0.4	16.1	10.0	0	7.0	
9,350			2,380	44,770	11,180	-	380	
0	0	0	7,610	4,750	1,620	1,570	110	
			0.1	7.3	10.0	0	1.0	
			400	13,520	7,450	-	40	
2,830	7,850	48,900	17,480	10,910	3,720	3,600	250	
1.4	1.4	1.4	0.9	33.0	11.7	16.5	30.7	
2,540	7,030	43,810	8,180	140,410	20,020	17,820	2,610	
1,490	1,890	62,130	18,950	11,830	4,030	3,900	270	
70.0	81.0	81.0	82.8	29.0	71.2	34.0	80.0	
(2)64,210	(2)90,950	(2)3,177,010	(2)807,730	(2)87,660	(2)127,960	(2)21,960	(2)4,730	
990	1,490	68,740	20,490	12,790	4,360	4,210	290	
56.0	60.0	61.0	55.5	75.0	71.2	37.8	40.5	
35,480	57,220	2,683,610	585,790	374,110	142,800	47,740	3,990	
1,340	1,290	65,500	19,600	12,230	4,170	4,030	280	
0.7	0.7	0.7	0.1	7.3	10.0	0	1.0	
600	580	28,340	1,020	34,820	19,180	-	100	
2,040	2,830	56,610	17,980	11,220	3,830	3,700	260	
5.6	5.8	6.0	5.2	58.0	17.8	49.8	61.8	
7,310	10,500	217,380	48,620	253,800	31,360	55,280	5,460	
7,850	14,160	35,040	16,990	10,600	3,620	3,490	240	
75.0	78.0	78.0	70.0	42.0	71.8	35.0	81.0	
376,800	706,870	1,749,200	618,440	173,630	119,560	36,650	6,610	
2,040	2,830	57,060	18,260	11,400	3,890	3,760	260	
4.1	4.2	4.4	3.7	52.8	16.0	51.5	64.7	
5,350	7,610	160,680	35,130	234,750	28,630	58,090	5,720	
477,920	482,020	1,690,390	755,840	495,510	175,520	99,625	11,470	
3,658,530	4,210,980	16,566,440	6,639,580	5,946,120	2,094,885	1,119,060	116,700	
8.67	7.65	9.80	8.78	12.00	11.93	11.23	10.17	

eral minor floods eliminated.
ing year.

Sample Crop Damage Curve Computations

WABASH RIVER REACH W-4 Outside Levees		Stage - Damage Curve Area in Acres						
Stage	Total Area Inundated Acres	Damage per Acre	Corn				Soybeans	W
			1' \$7.57	2' \$8.67	3' \$7.65	3'+ \$9.80	L.U. 14.1% \$8.78	L.U. \$12
14.0	0	Area	0	0	0	0	0	
		Damage	-	-	-	-	-	
15.0	620	Area	310	0	0	0	90	
		Damage	2,350	-	-	-	790	
16.0	10,990	Area	5,150	310	0	0	1,550	
		Damage	38,990	2,690	-	-	13,610	11
17.0	28,610	Area	8,760	5,150	310	0	4,030	2
		Damage	66,310	44,650	2,370	-	35,380	30
18.0	40,690	Area	6,000	8,760	5,150	310	5,740	3
		Damage	45,420	75,950	39,400	3,040	50,400	42
19.0	44,400	Area	1,840	6,000	8,760	5,460	6,260	3
		Damage	13,930	52,020	67,010	53,510	54,960	46
20.0	46,620	Area	1,100	1,840	6,000	14,220	6,570	4
		Damage	8,330	15,950	45,900	139,360	57,680	49
21.0	48,780	Area	1,070	1,100	1,840	20,220	6,880	4
		Damage	8,100	9,540	14,080	198,160	60,410	51
22.0	50,300	Area	760	1,070	1,100	22,060	7,090	4
		Damage	5,750	9,280	8,420	216,190	62,250	53
25.0(1)	52,390	Area	100	410	520	24,100	7,390	4
		Damage	760	3,550	3,980	236,180	64,880	55
26.0	54,460	Area	1,030	100	410	24,620	7,680	4
		Damage	7,800	870	3,140	241,280	67,430	57
27.0	55,620	Area	580	1,030	100	25,030	7,840	4
		Damage	4,390	8,930	770	245,290	68,840	58
28.0	56,760	Area	570	580	1,030	25,130	8,000	4
		Damage	4,310	5,030	7,880	246,270	70,240	59
29.0	57,460	Area	350	570	580	26,160	8,100	5
		Damage	2,650	4,490	4,440	256,370	71,120	60
30.0	58,650	Area	590	350	570	26,740	8,270	5
		Damage	4,470	3,030	4,360	262,050	72,610	61
31.0	60,350	Area	840	590	350	27,310	8,510	5
		Damage	6,360	5,120	2,680	267,640	74,720	63
32.0	61,500	Area	570	840	590	27,660	8,670	5
		Damage	4,310	7,280	4,510	271,070	76,120	64

(1) Stage 23.0 and 24.0 omitted.

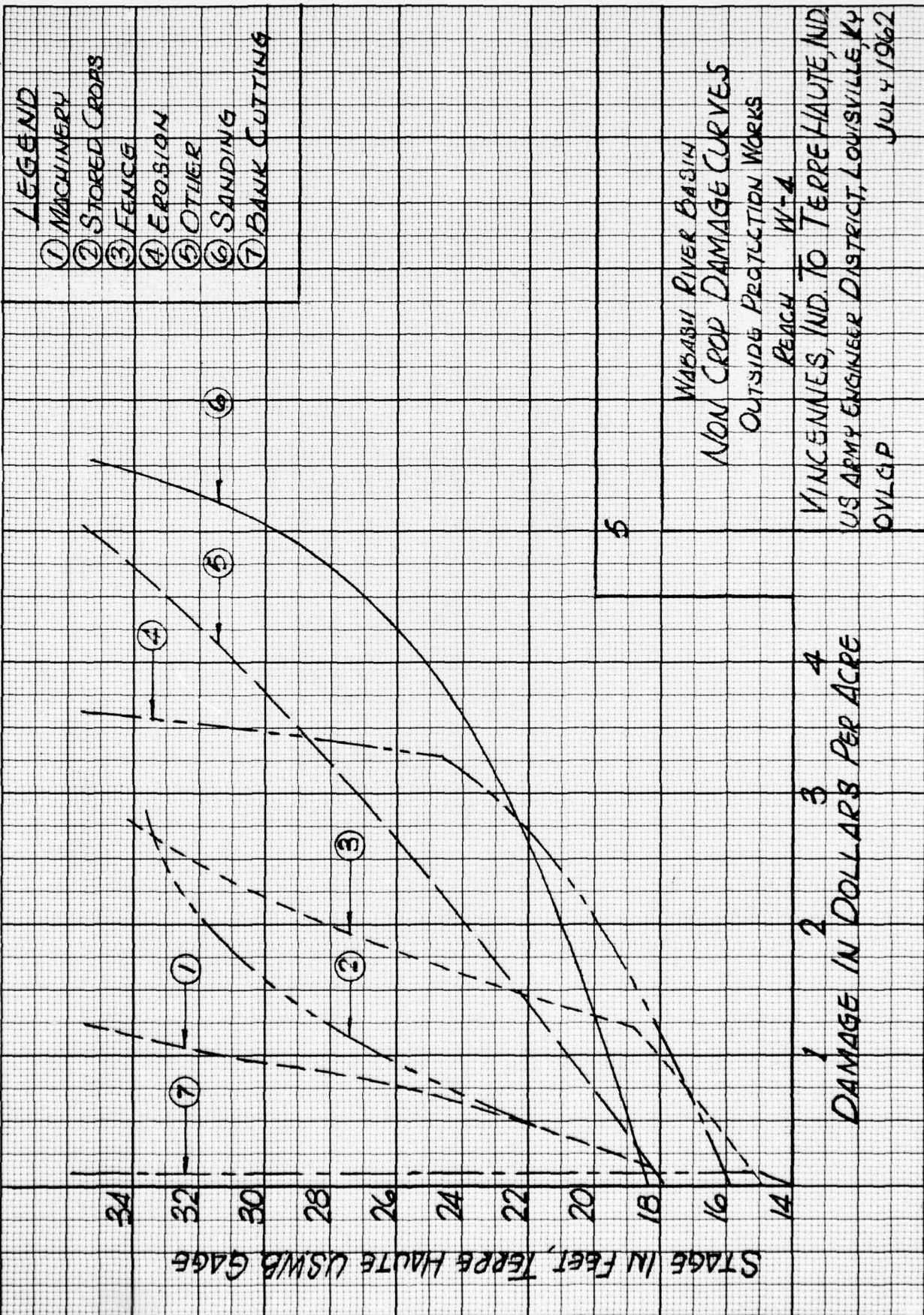
2

Sample Crop Damage Curve Computations

Stage - Damage Curve Computations							
Area in Acres		Damage in Dollars				Gage - Terre Haute, Indiana	
Land Use 49.7%		Soybeans	Wheat	Hay	Pasture	Oats	Damage Total
3' \$7.65	3'+ \$9.80	L.U. 14.1% \$8.78	L.U. 8.8% \$12.00	L.U. 3.0% \$11.93	L.U. 2.9% \$11.23	L.U. 0.2% \$10.17	
0	0	0	0	0	0	0	
-	-	-	-	-	-	-	-
0	0	90	50	20	20	1	
-	-	790	600	240	220	10	4,210
0	0	1,550	970	330	320	22	
-	-	13,610	11,640	3,940	3,590	220	74,680
310	0	4,030	2,520	860	830	57	
2,370	-	35,380	30,240	10,260	9,320	580	199,110
5,150	310	5,740	3,580	1,220	1,180	81	
39,400	3,040	50,400	42,960	14,550	13,250	820	285,790
8,760	5,460	6,260	3,910	1,330	1,290	89	
67,010	53,510	54,960	46,920	15,870	14,490	910	319,620
6,000	14,220	6,570	4,100	1,400	1,350	93	
45,900	139,360	57,680	49,200	16,700	15,160	950	349,230
1,840	20,220	6,880	4,290	1,460	1,410	98	
14,080	198,160	60,410	51,480	17,420	15,830	1,000	376,020
1,100	22,060	7,090	4,430	1,510	1,460	101	
8,420	216,190	62,250	53,160	18,010	16,400	1,030	390,490
520	24,100	7,390	4,610	1,570	1,520	105	
3,980	236,180	64,380	55,320	18,730	17,070	1,070	401,540
410	24,620	7,680	4,790	1,630	1,580	109	
3,140	241,280	67,430	57,480	19,450	17,740	1,110	416,300
100	25,030	7,840	4,890	1,670	1,610	111	
770	245,290	68,840	58,680	19,920	18,080	1,130	426,030
1,030	25,130	8,000	4,990	1,700	1,640	113	
7,880	246,270	70,240	59,880	20,280	18,420	1,150	433,460
580	26,160	8,100	5,060	1,720	1,660	115	
4,440	256,370	71,120	60,720	20,520	18,640	1,170	440,570
570	26,740	8,270	5,160	1,760	1,700	117	
4,360	262,050	72,610	61,920	21,000	19,090	1,190	449,720
350	27,310	8,510	5,310	1,810	1,750	121	
2,680	267,640	74,720	63,720	21,590	19,650	1,230	462,710
590	27,660	8,670	5,410	1,850	1,790	123	
4,510	271,070	76,120	64,920	22,070	20,100	1,250	471,630

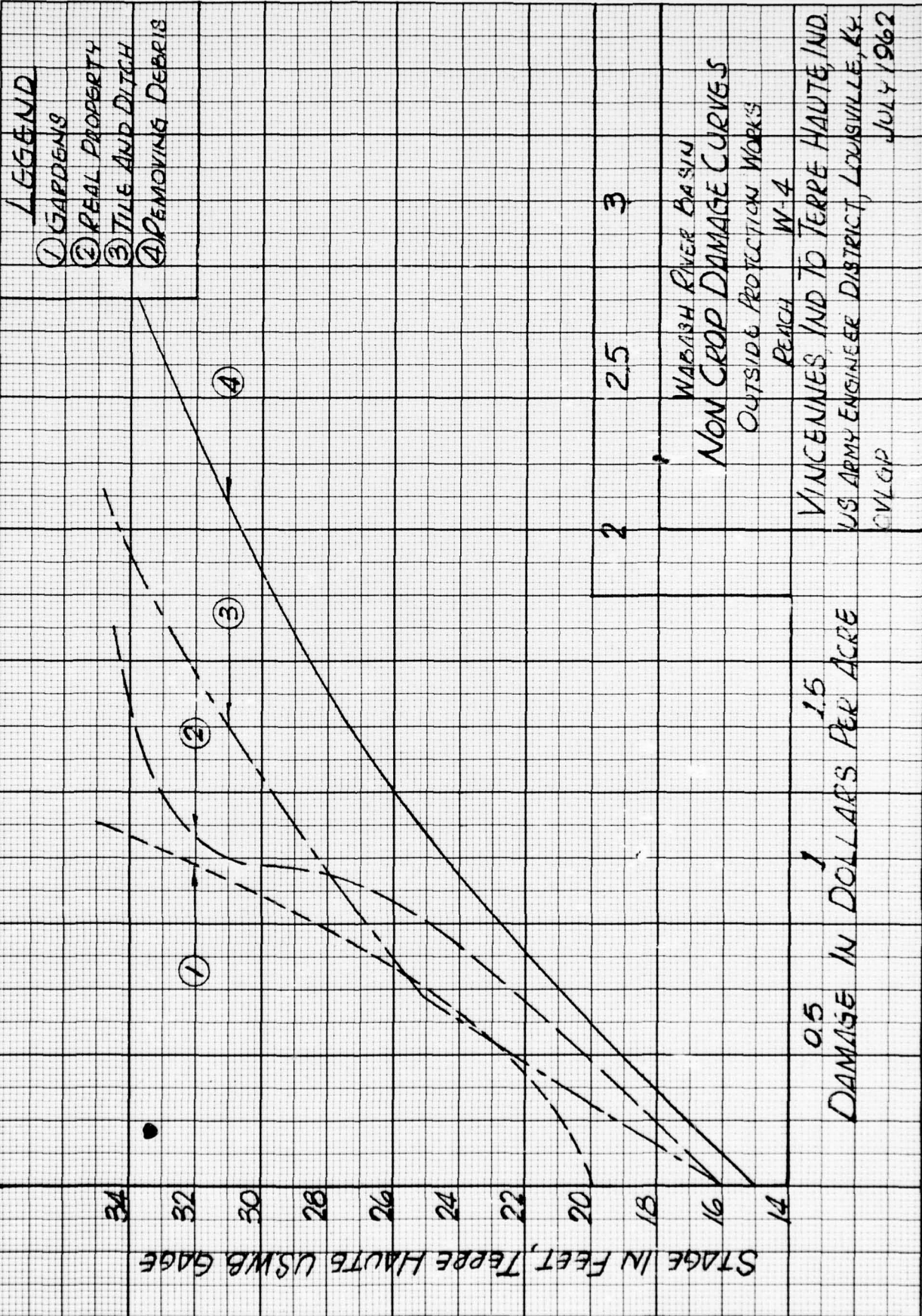
US ARMY

CORPS OF ENGINEERS



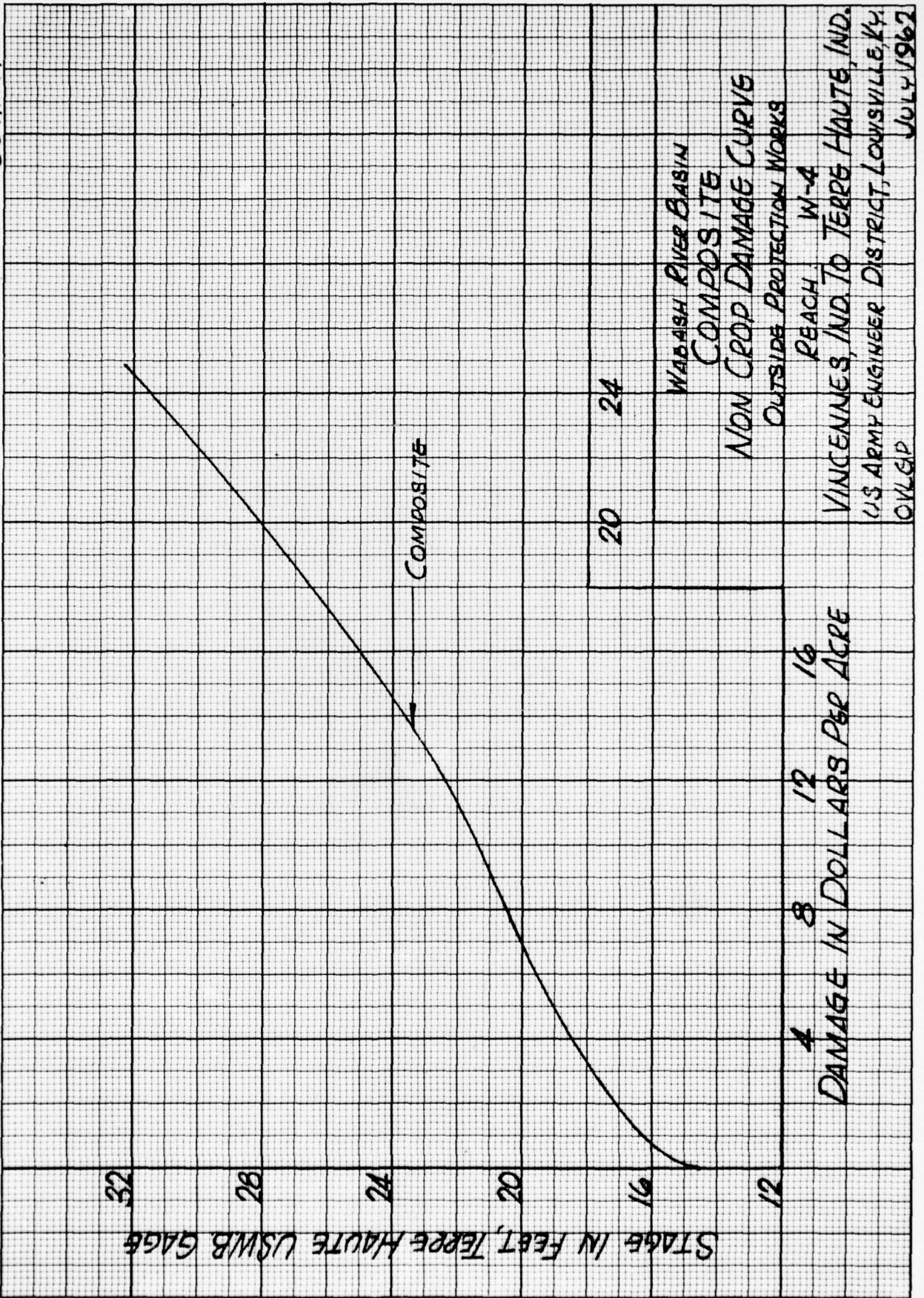
CORPS OF ENGINEERS

US ARMY



US ARMY

CORPS OF ENGINEERS



COMPOSITE

WABASH RIVER BASIN

COMPOSITE

NON CROP DAMAGE CURVE

OUTSIDE PROTECTION WORKS

REACH W-4

VINCENNES, IND. TO TERRE HAUTE, IND.

U.S. ARMY ENGINEER DISTRICT, LOUISVILLE, KY.

OKLGP

JULY 1962

32

28

24

20

16

12

STAGE IN FEET, TERRE HAUTE USWB GAGE

DAMAGE IN DOLLARS PER ACRE

4

8

12

16

CORPS OF ENGINEERS

STAGE IN FEET TERRE HAUTE, U.S.W.B. GAGE

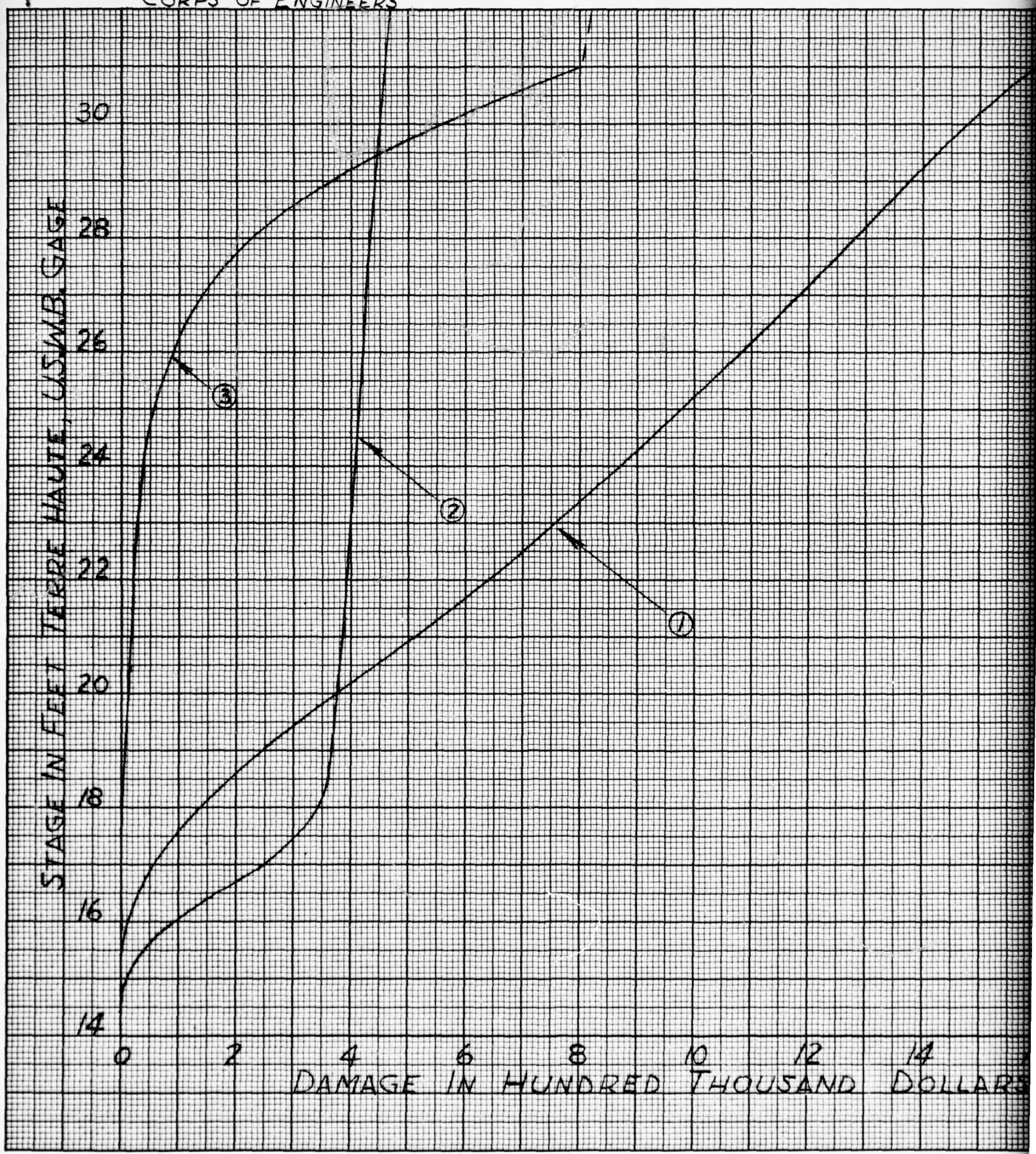
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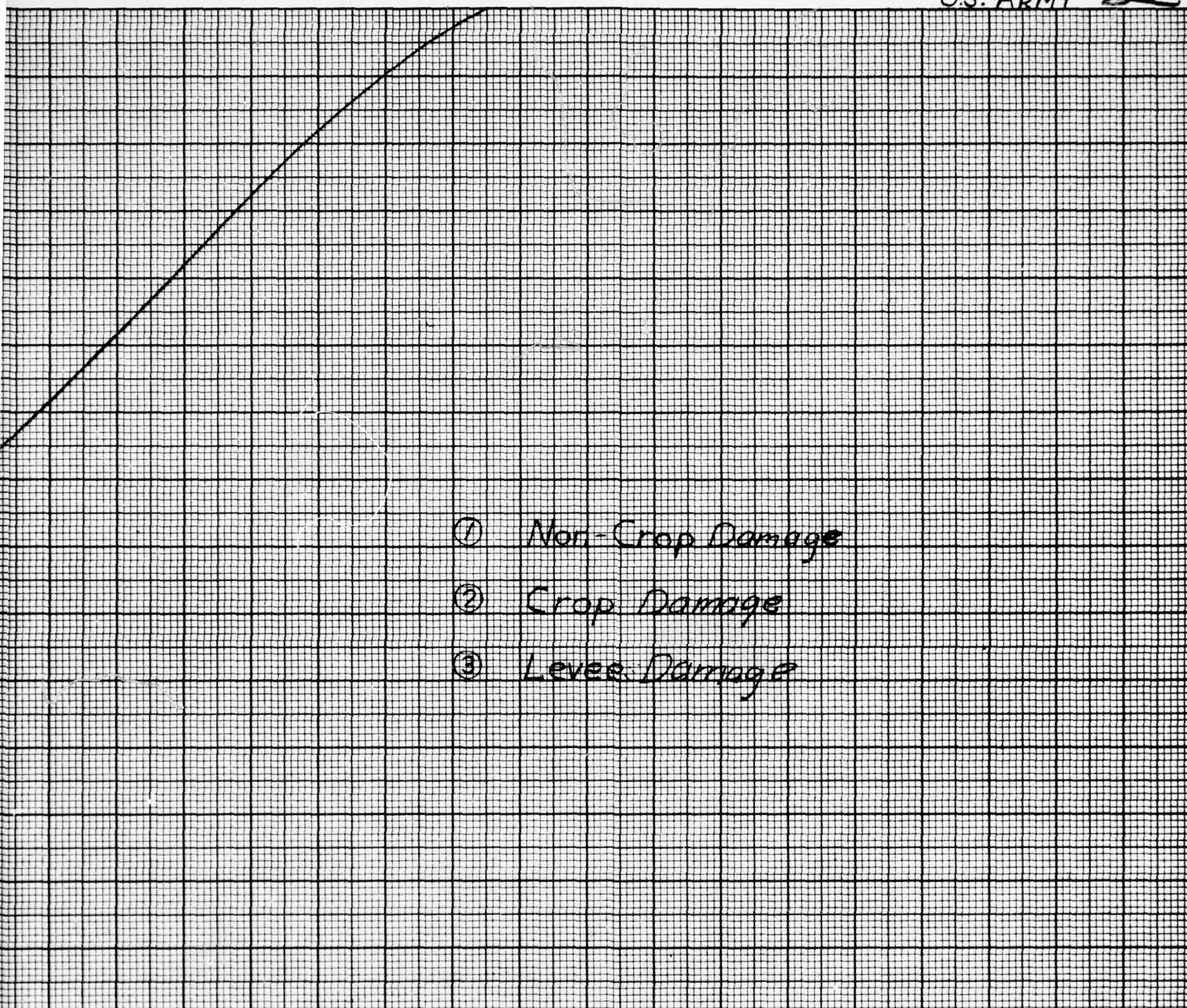
0 2 4 6 8 10 12 14
DAMAGE IN HUNDRED THOUSAND DOLLARS

③

②

①





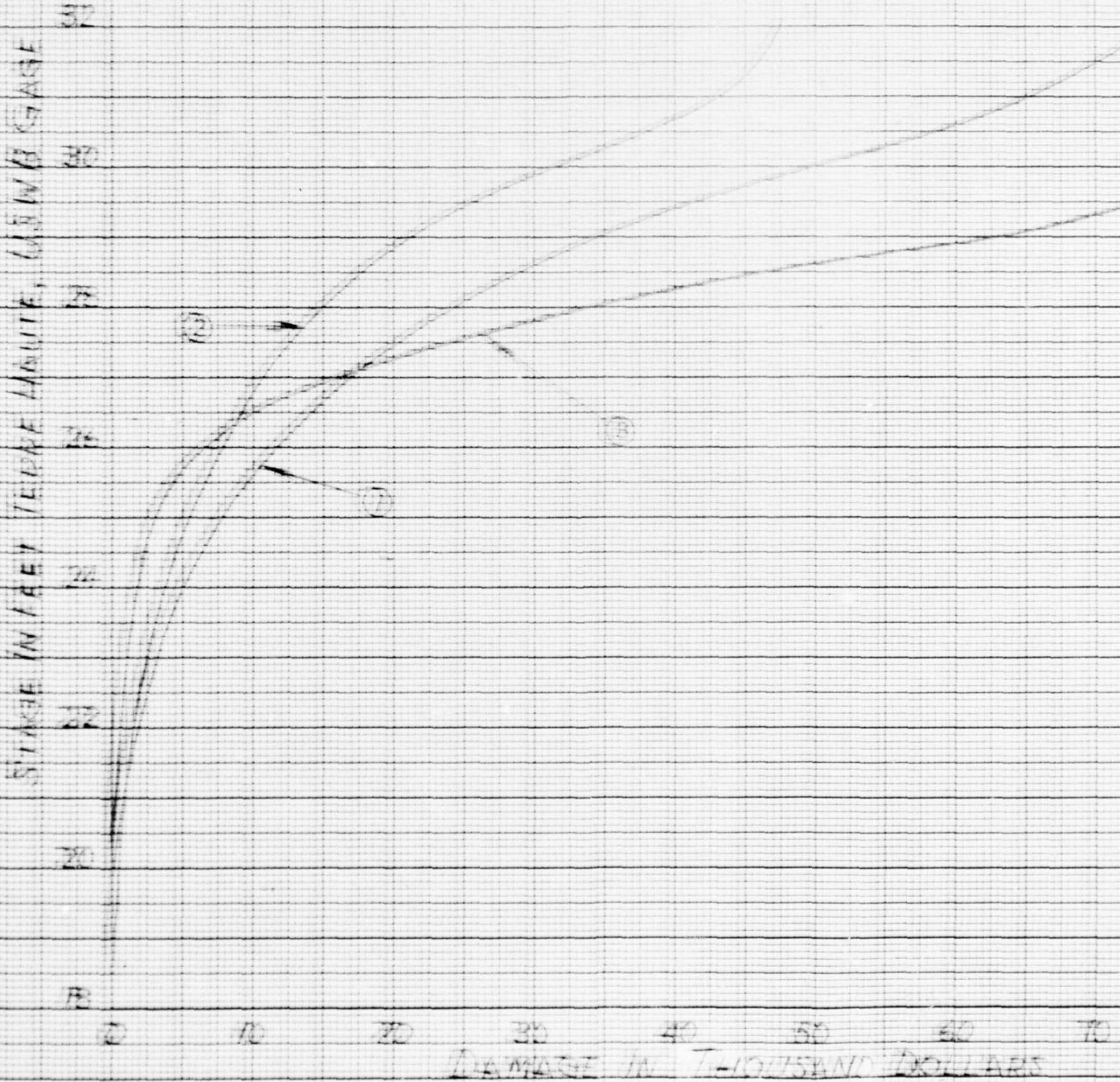
- ① Non-Crop Damage
- ② Crop Damage
- ③ Levee Damage

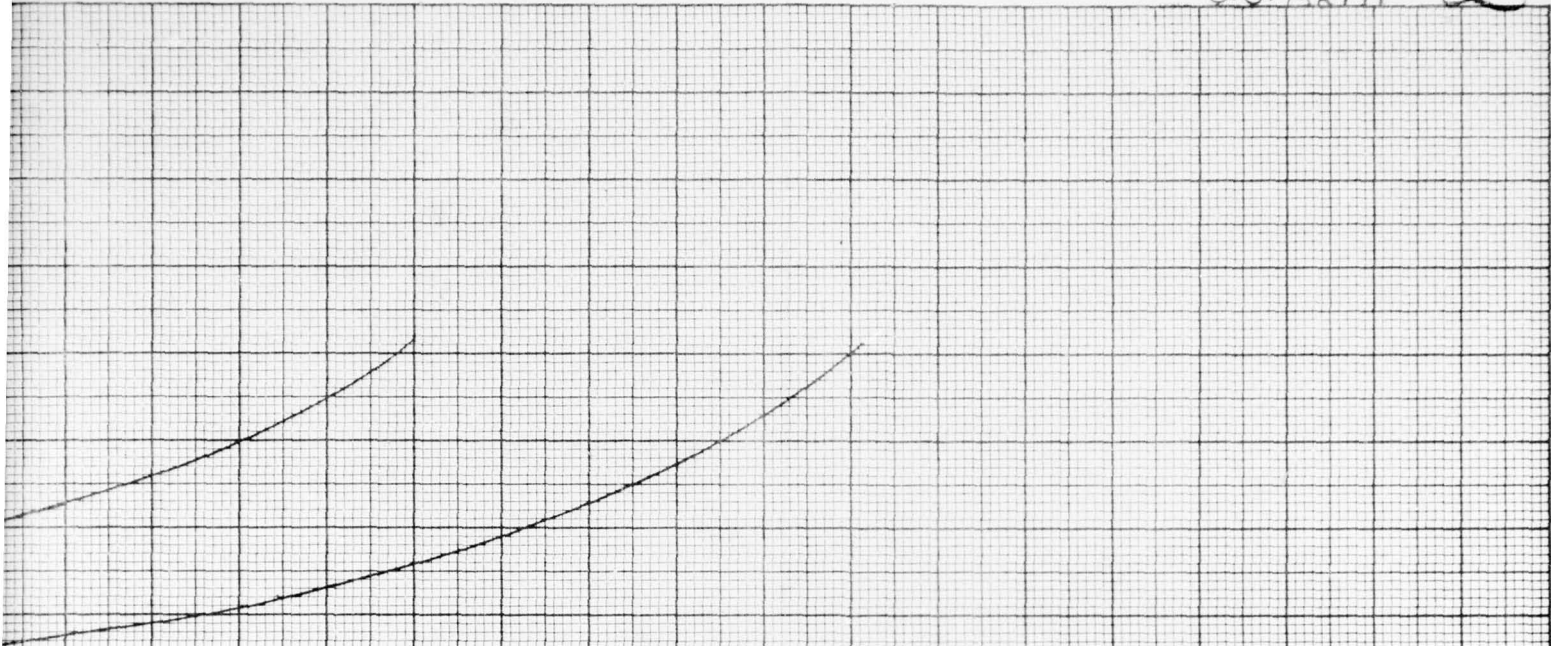
WABASH RIVER BASIN
 STAGE DAMAGE CURVES
 RURAL AREAS OUTSIDE PROTECTION
 REACH W-4

VINCENNES, IND. TO TERRE HAUTE, IND.
 U.S. ARMY ENGINEER DISTRICT, LOUISVILLE, KY
 OVLGP
 JULY 1962

12 14 16 18
 THOUSAND DOLLARS

CORPS OF ENGINEERS





- ① York, Illinois
- ② Hutsonville, Illinois
- ③ Taylorsville, Indiana

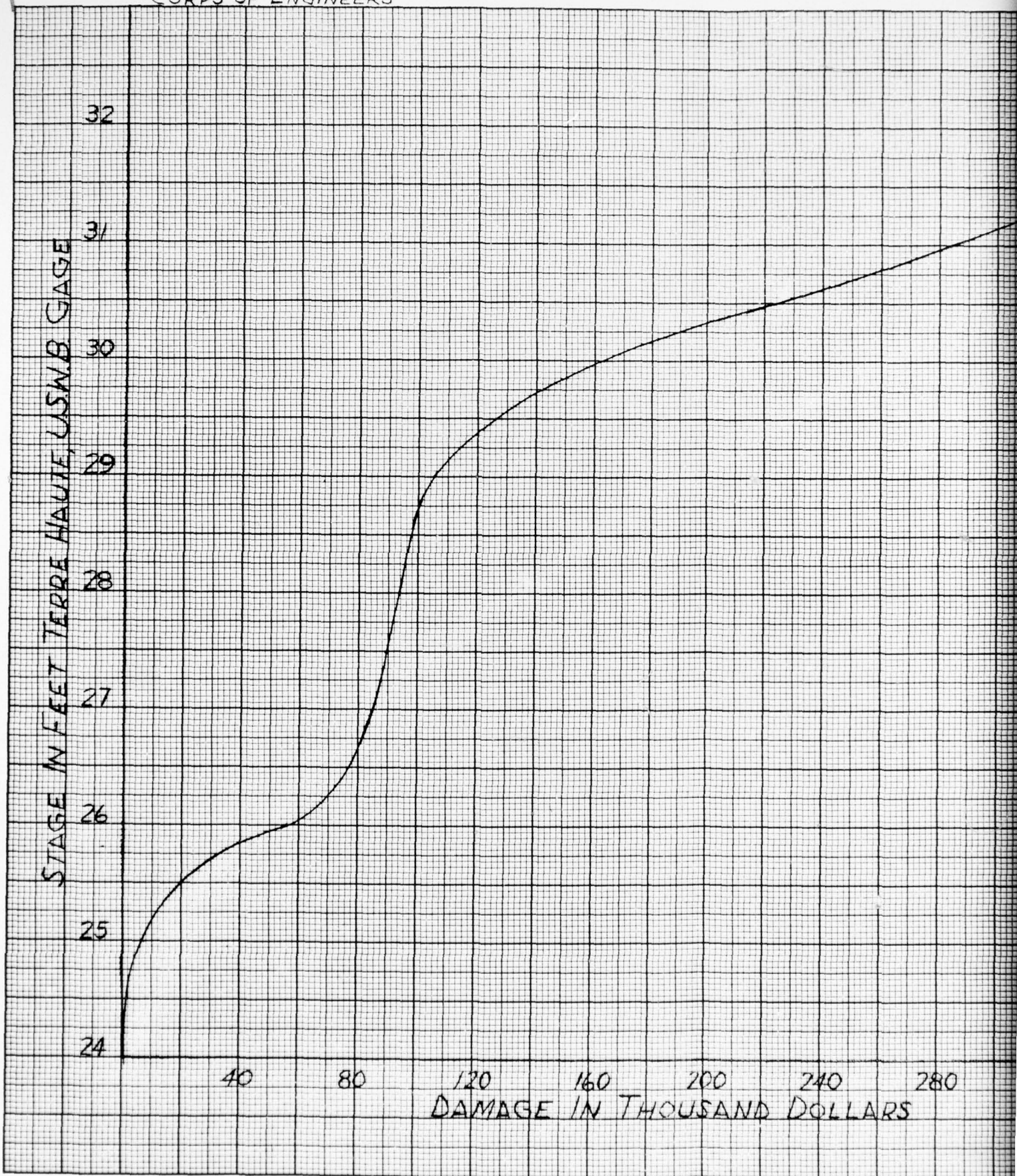
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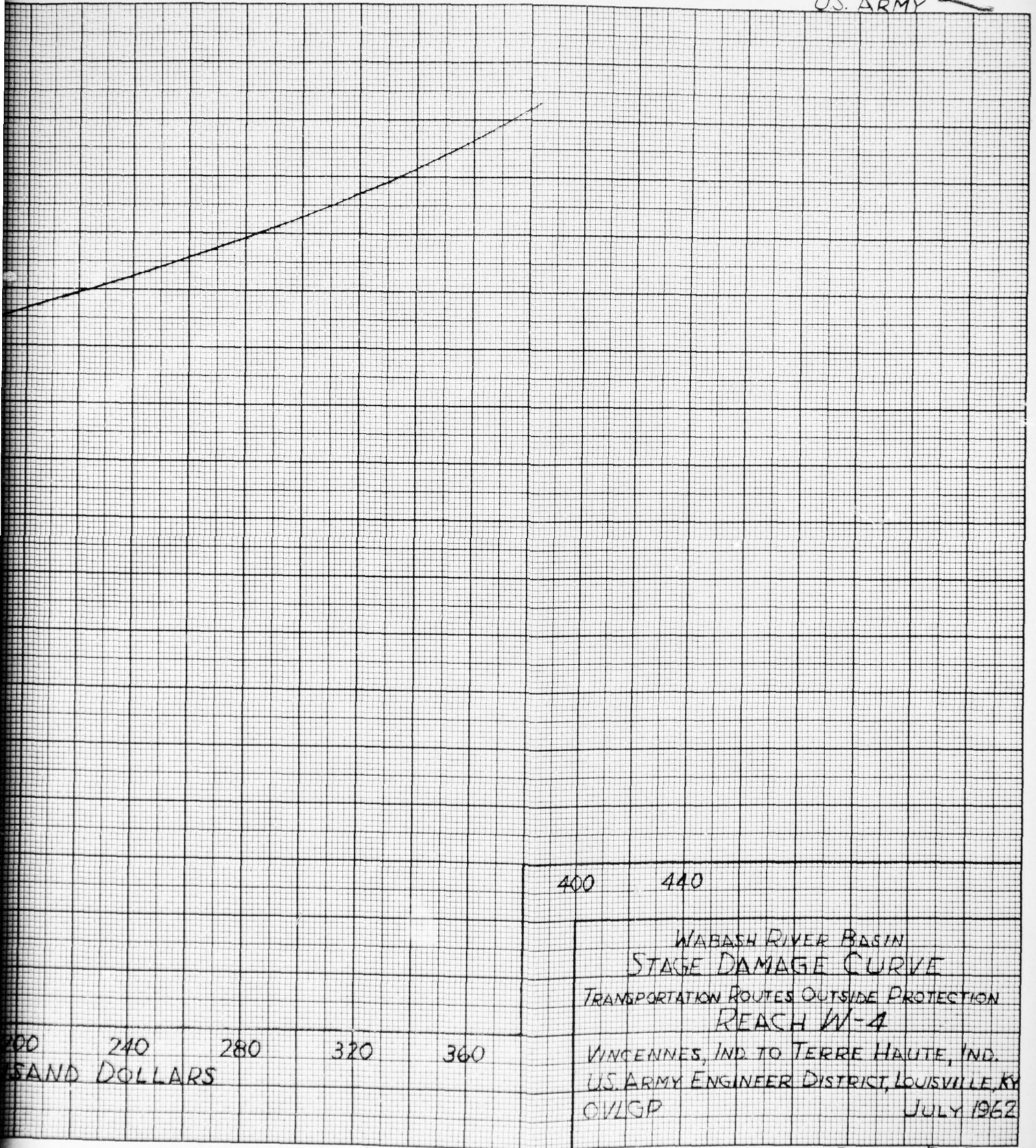
WABASH RIVER BASIN
STAGE DAMAGE CURVES
URBAN AREAS OUTSIDE PROTECTION
REACH W-4

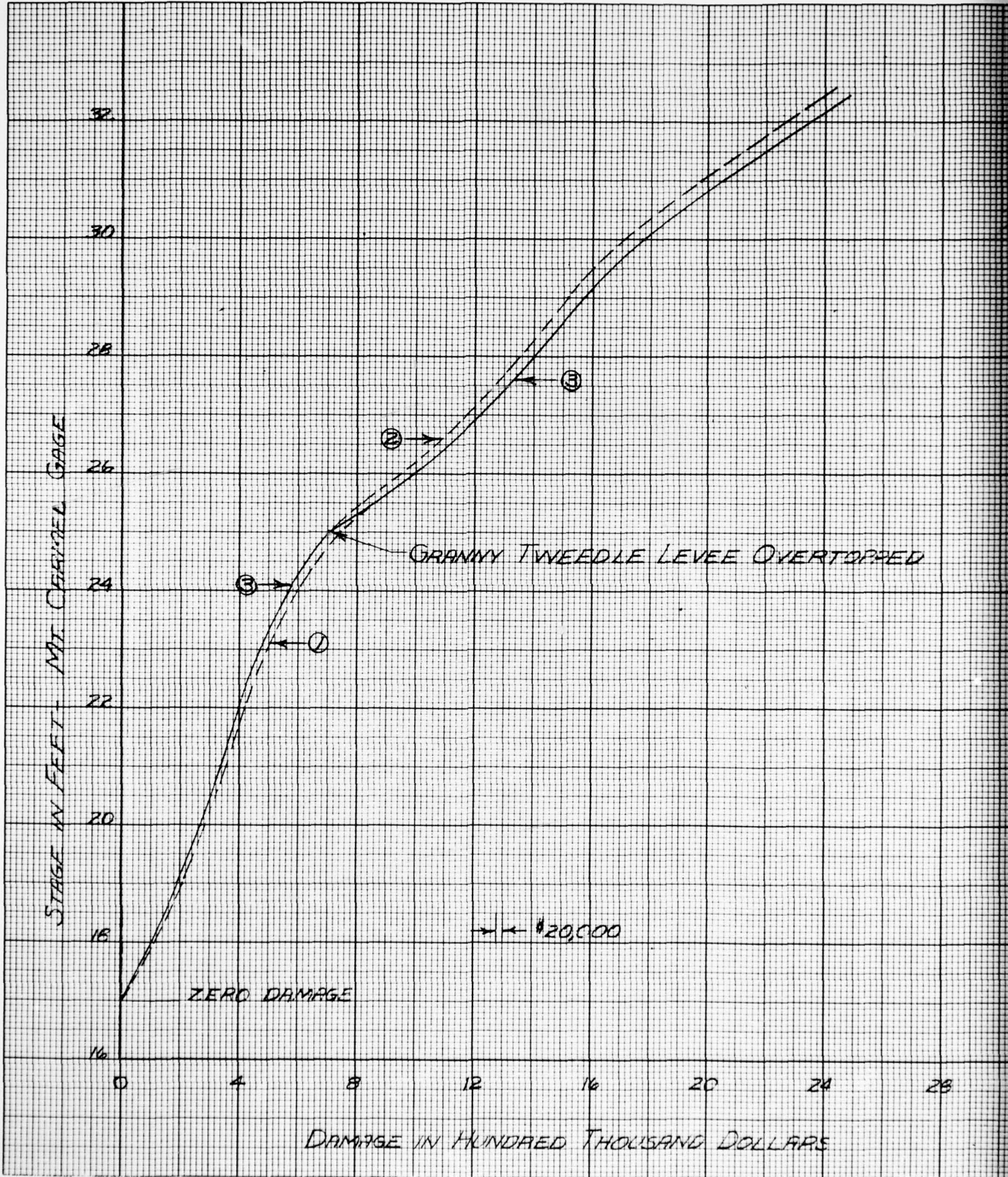
VINCENNES, IND TO TERRE HAUTE, IND.
U.S. ARMY ENGINEER DISTRICT, LOUISVILLE, KY
OVLGP
JULY 1962

60 70 80 90
DOLLARS

CORPS OF ENGINEERS

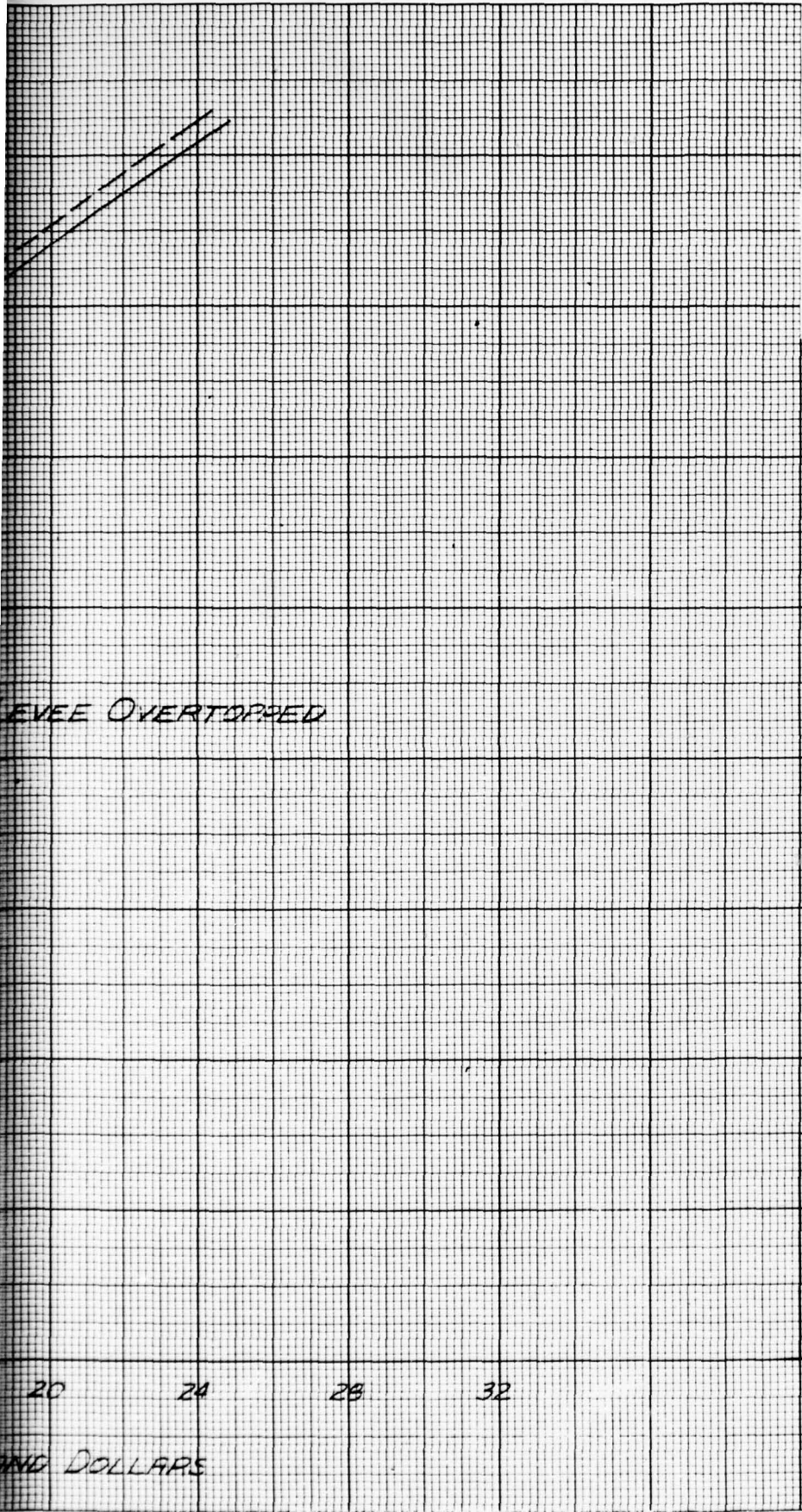






LEGEND 2

- ① TOTAL—NO PROTECTION WORKS CONSIDERED
- ② UNPROTECTED AREAS—URBAN AND RURAL
- ③ TOTAL ACTUAL DAMAGE (SOLID LINE)



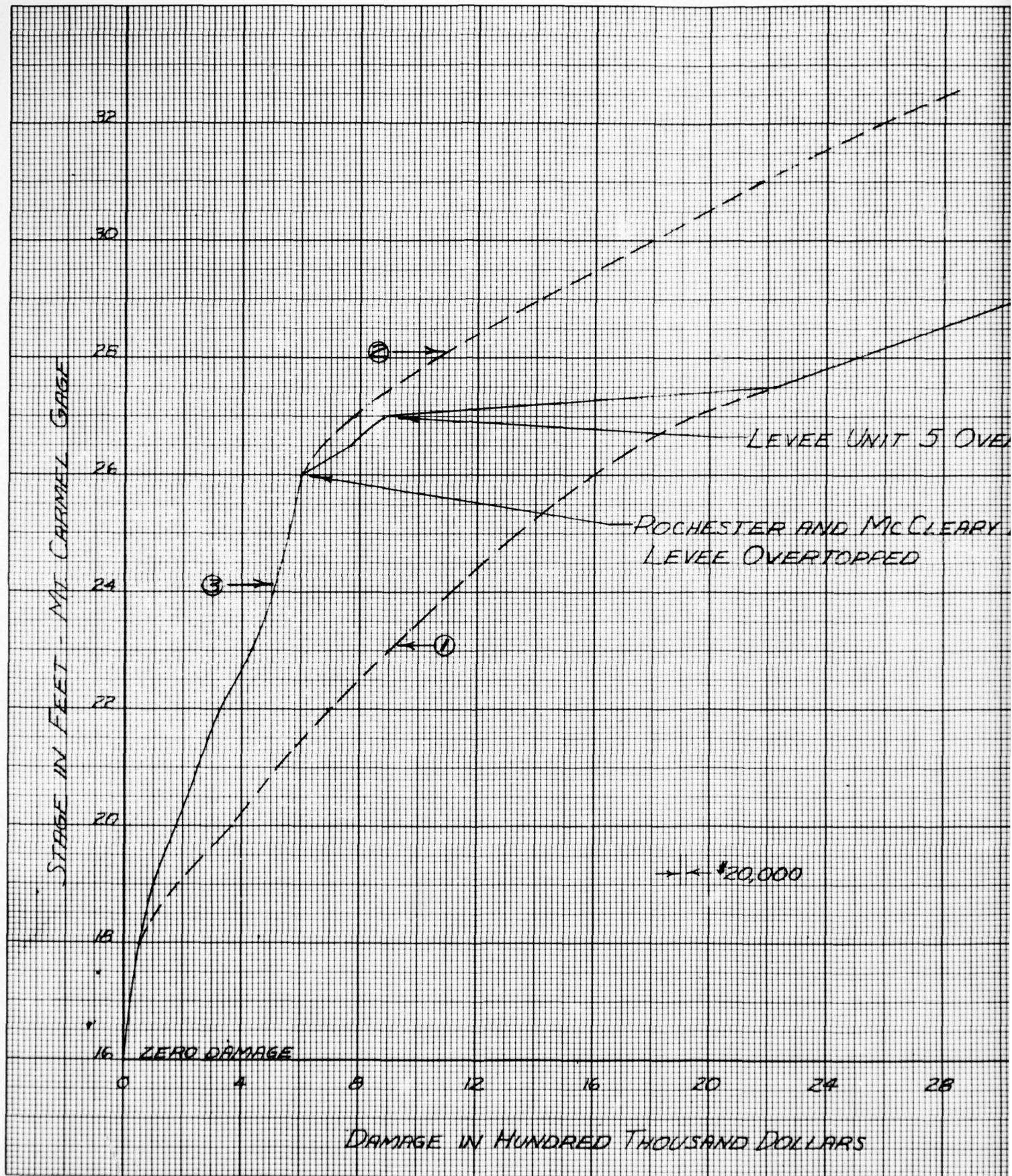
WABASH RIVER BASIN
STAGE DAMAGE CURVES
WABASH RIVER

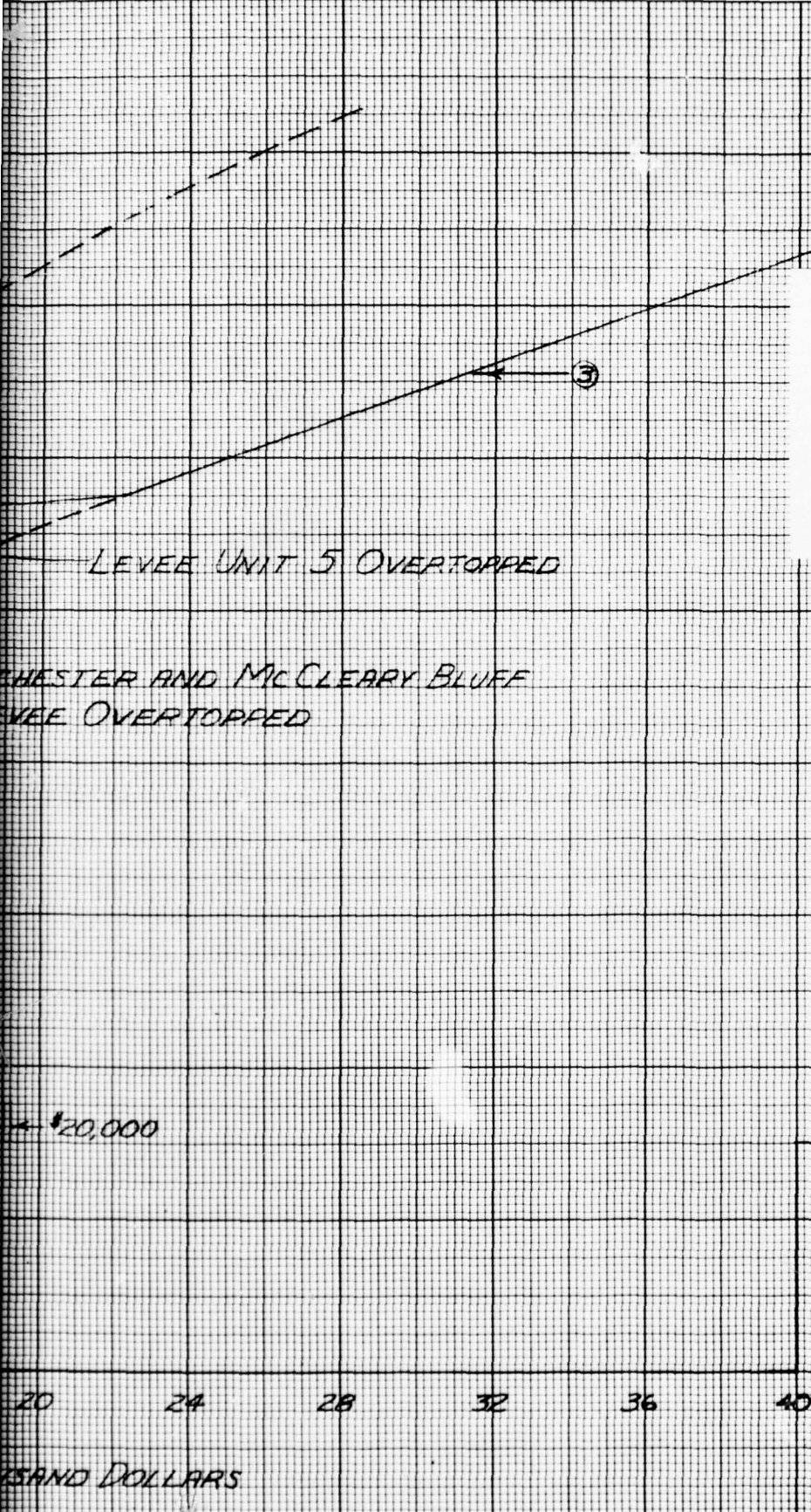
REACH W-1
OHIO RIVER TO MILE 40.0

U. S. ARMY ENGINEER DISTRICT
LOUISVILLE, KY.

ORLED-P JANUARY 1964

PLATE NO. B-63





LEGEND

- ① TOTAL-NO PROTECTION WORKS CONSIDERED
- ② UNPROTECTED AREAS-URBAN AND RURAL
- ③ TOTAL ACTUAL DAMAGE (SOLID LINE)

44 48

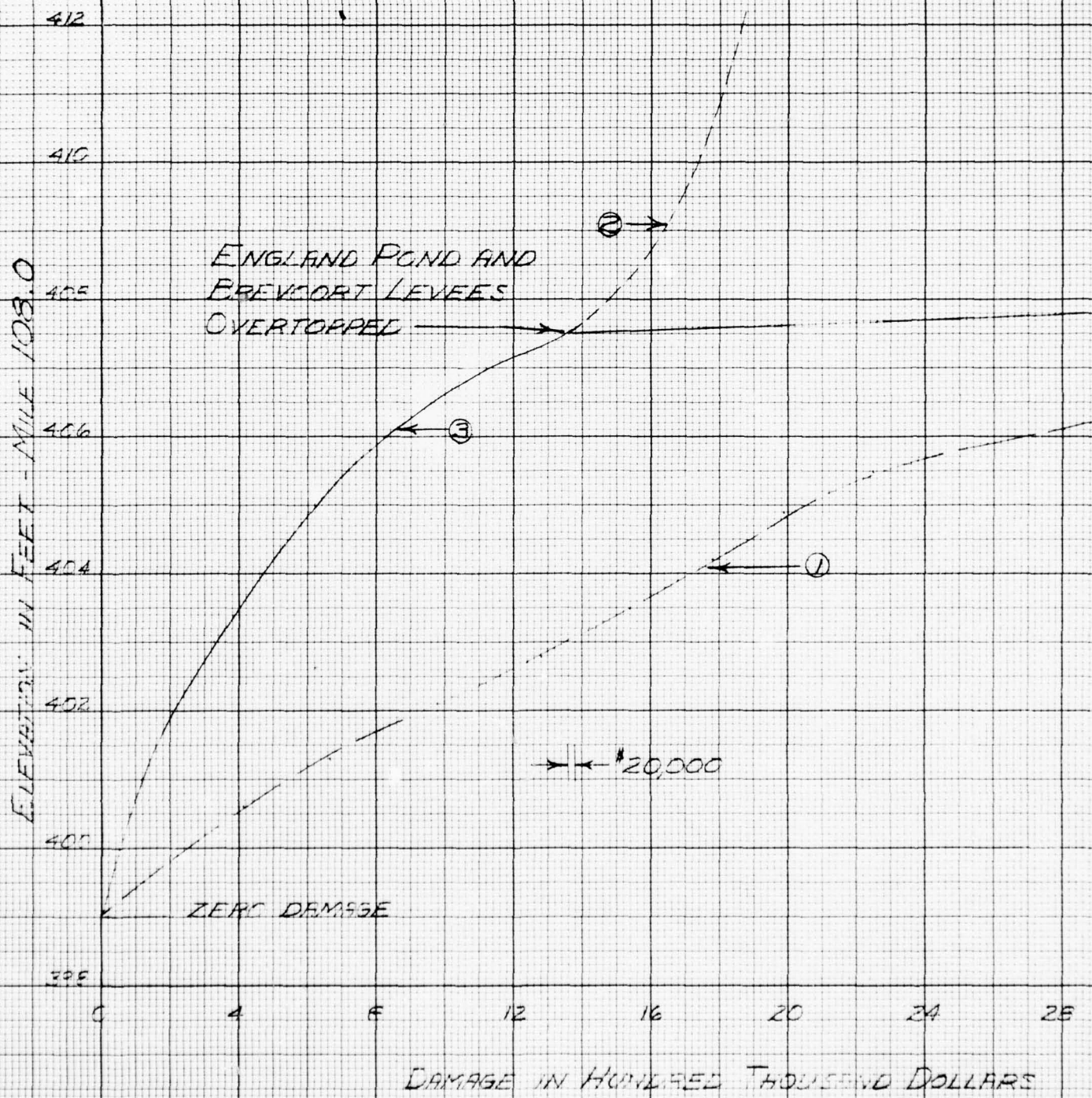
**WABASH RIVER BASIN
STAGE DAMAGE CURVES
WABASH RIVER**

REACH W-2
MILE 40.0 TO MILE 94.5

U. S. ARMY ENGINEER DISTRICT
LOUISVILLE, KY.

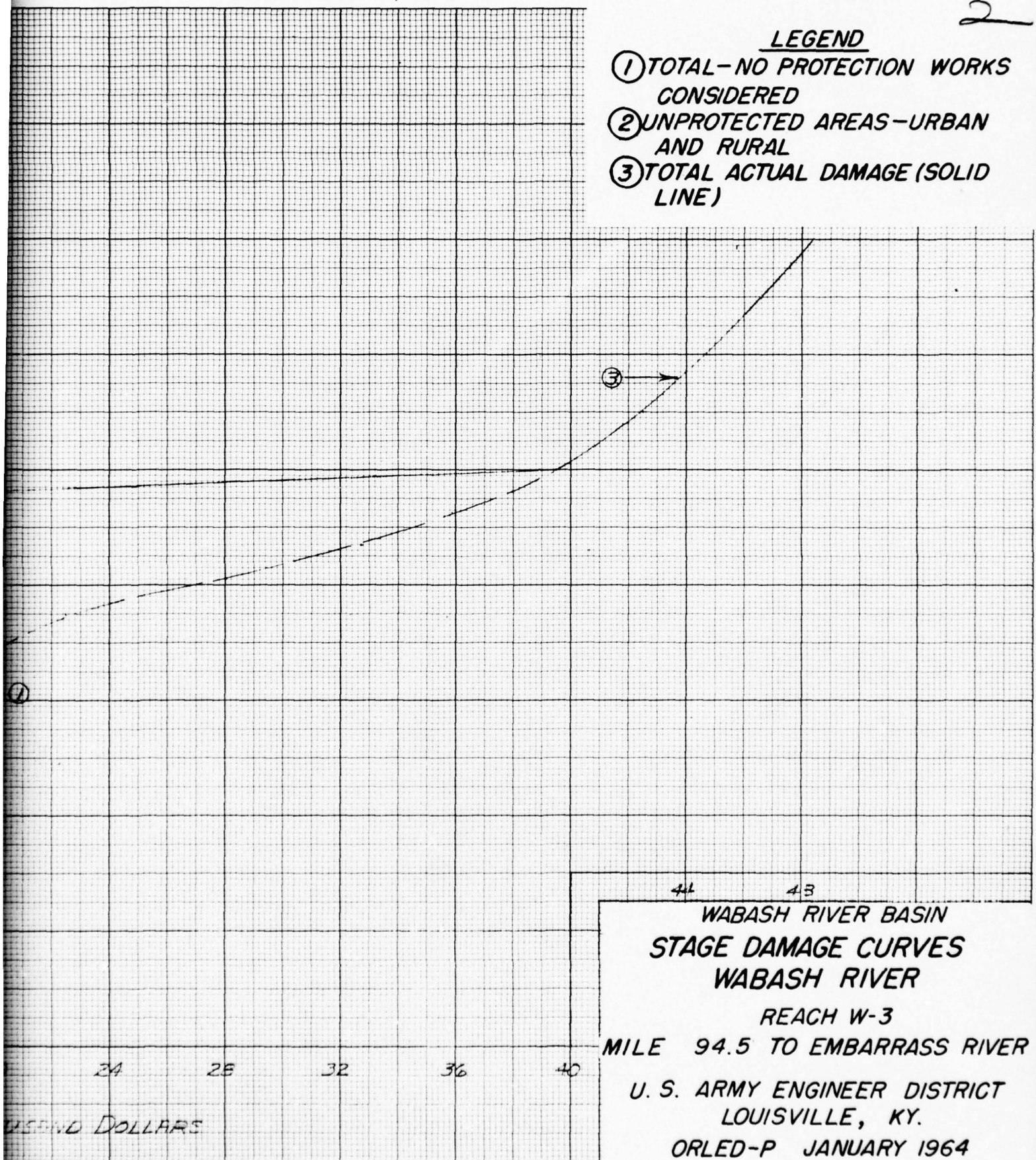
ORLED-P JANUARY 1964

PLATE NO. B-66



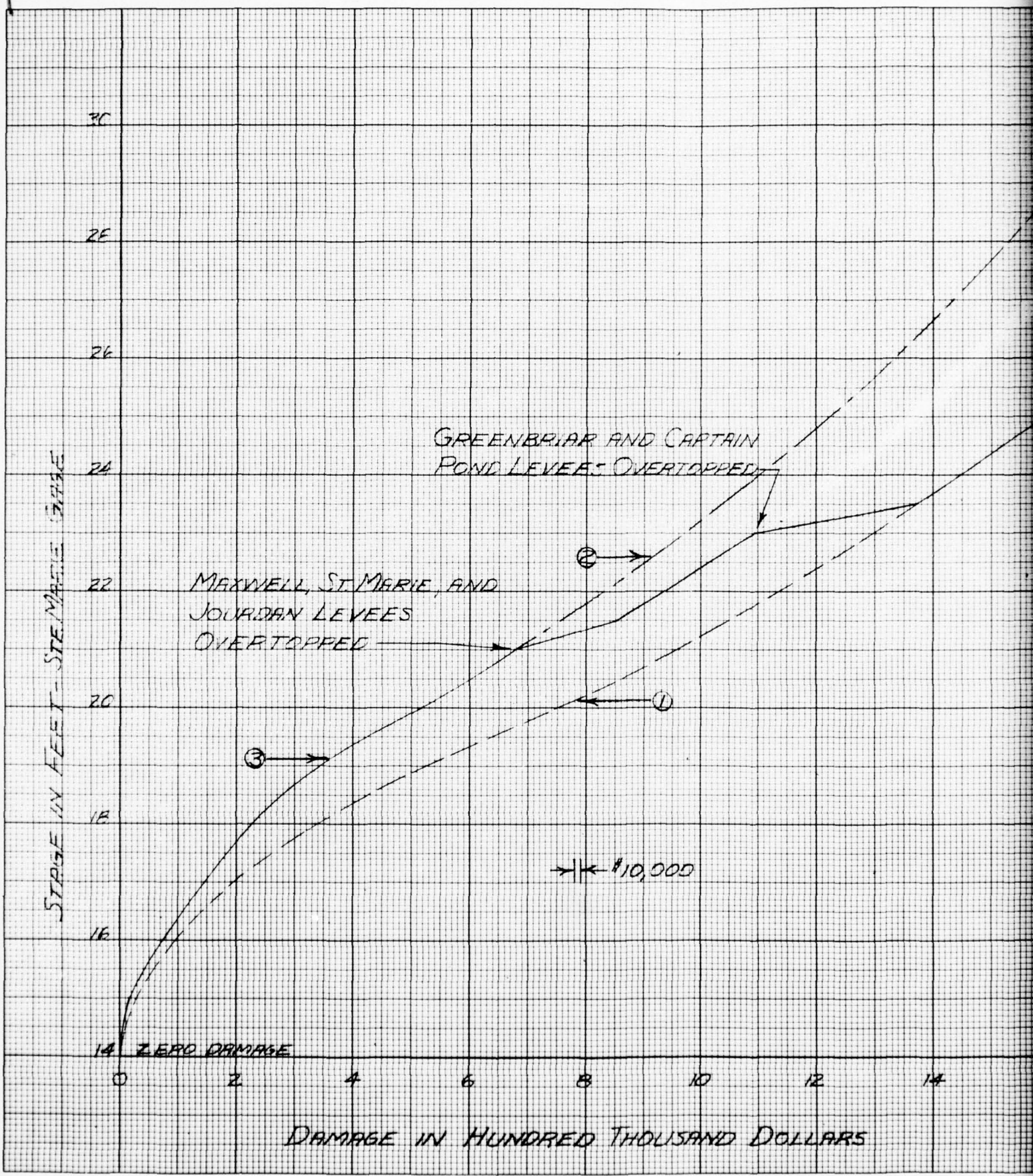
LEGEND

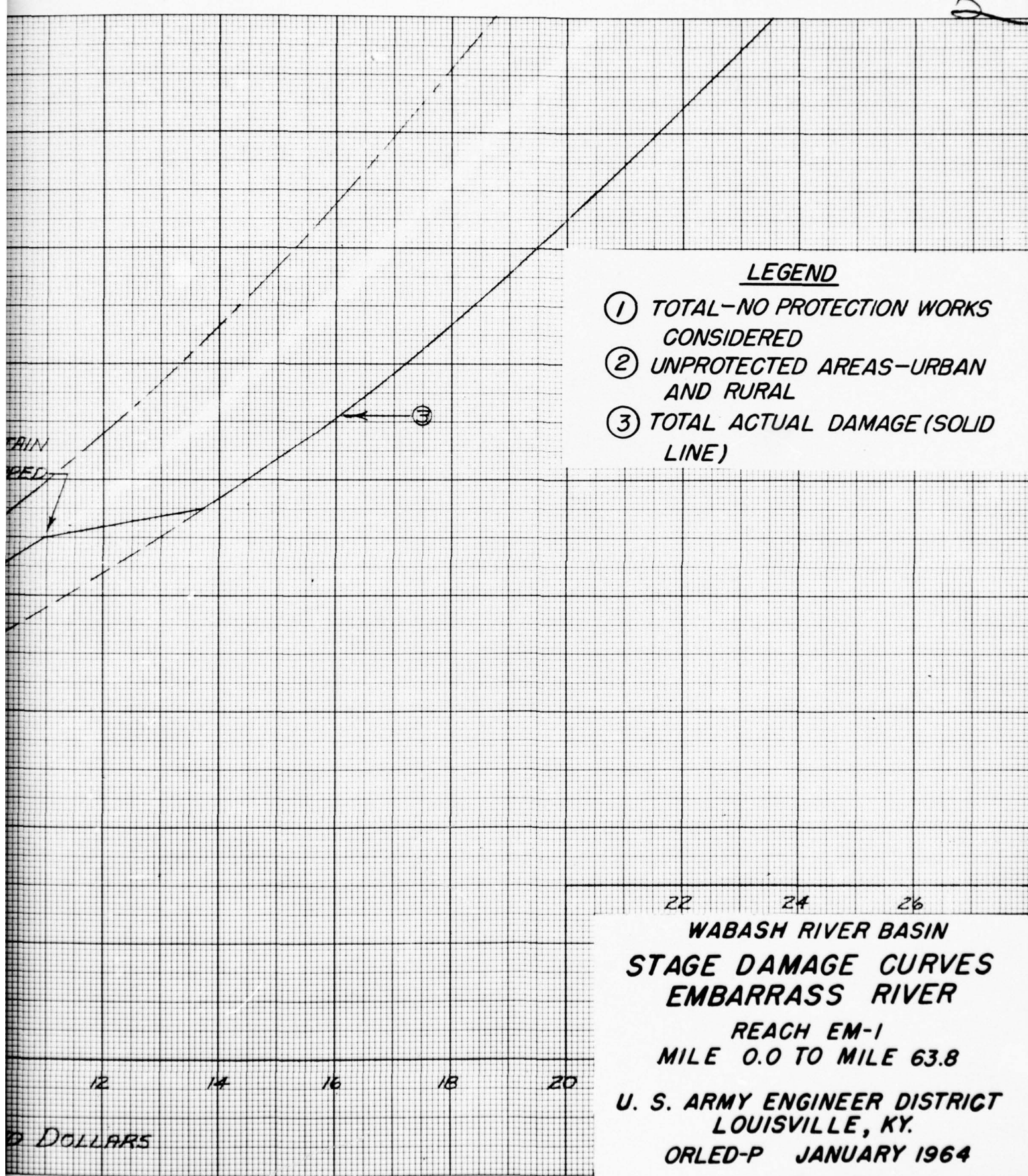
- ① TOTAL-NO PROTECTION WORKS CONSIDERED
- ② UNPROTECTED AREAS-URBAN AND RURAL
- ③ TOTAL ACTUAL DAMAGE (SOLID LINE)



44 48
 WABASH RIVER BASIN
 STAGE DAMAGE CURVES
 WABASH RIVER
 REACH W-3
 MILE 94.5 TO EMBARRASS RIVER
 U. S. ARMY ENGINEER DISTRICT
 LOUISVILLE, KY.
 ORLED-P JANUARY 1964
 PLATE NO. B-6c

THOUSAND DOLLARS





LEGEND

- ① TOTAL-NO PROTECTION WORKS CONSIDERED
- ② UNPROTECTED AREAS-URBAN AND RURAL
- ③ TOTAL ACTUAL DAMAGE (SOLID LINE)

**WABASH RIVER BASIN
STAGE DAMAGE CURVES
EMBARRASS RIVER**

REACH EM-1
MILE 0.0 TO MILE 63.8

U. S. ARMY ENGINEER DISTRICT
LOUISVILLE, KY.

ORLED-P JANUARY 1964

PLATE NO. B-64

ELEVATION IN FEET - MILE 79.9

518
517
516
515
514
513
512
511
510

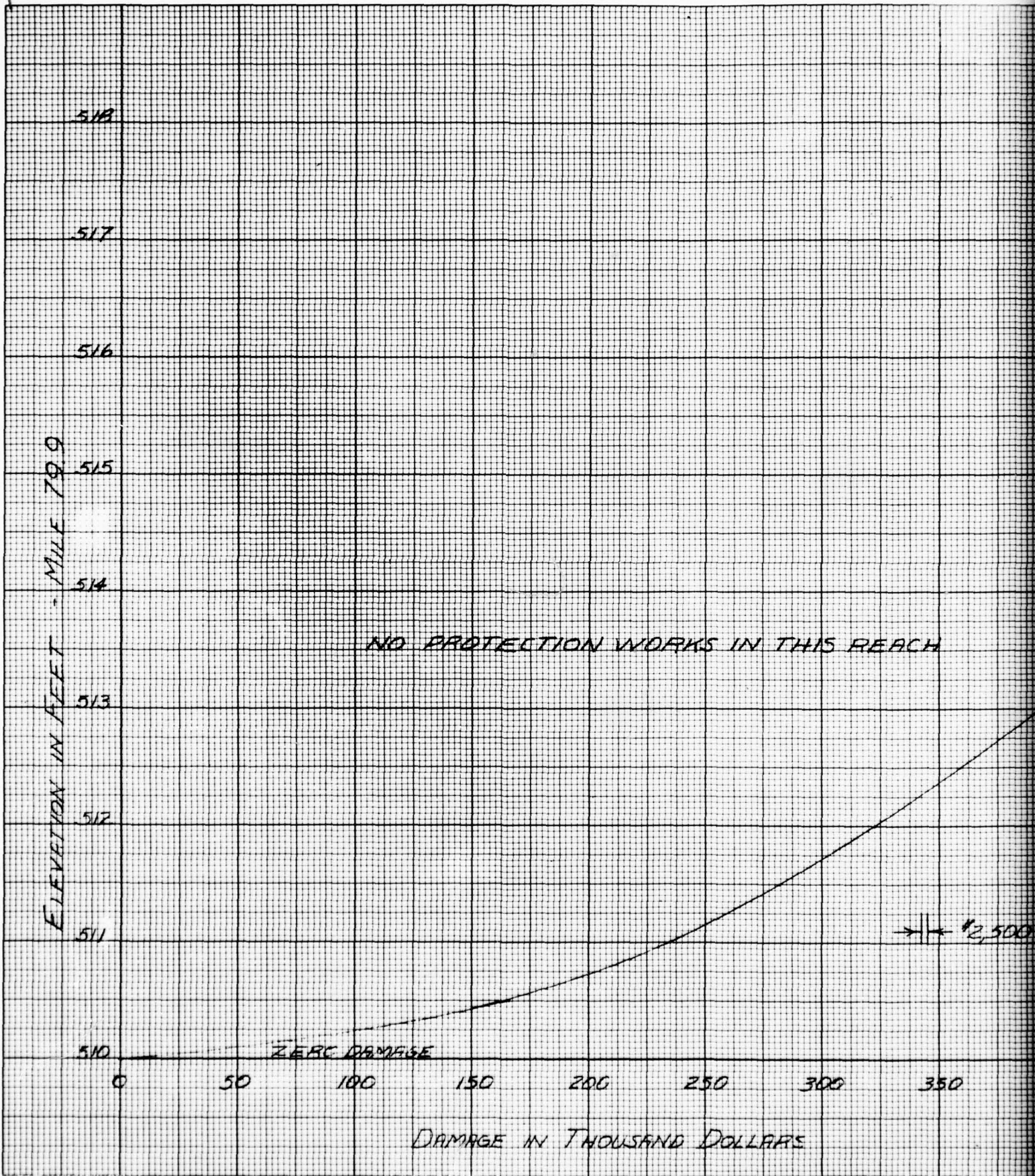
NO PROTECTION WORKS IN THIS REACH

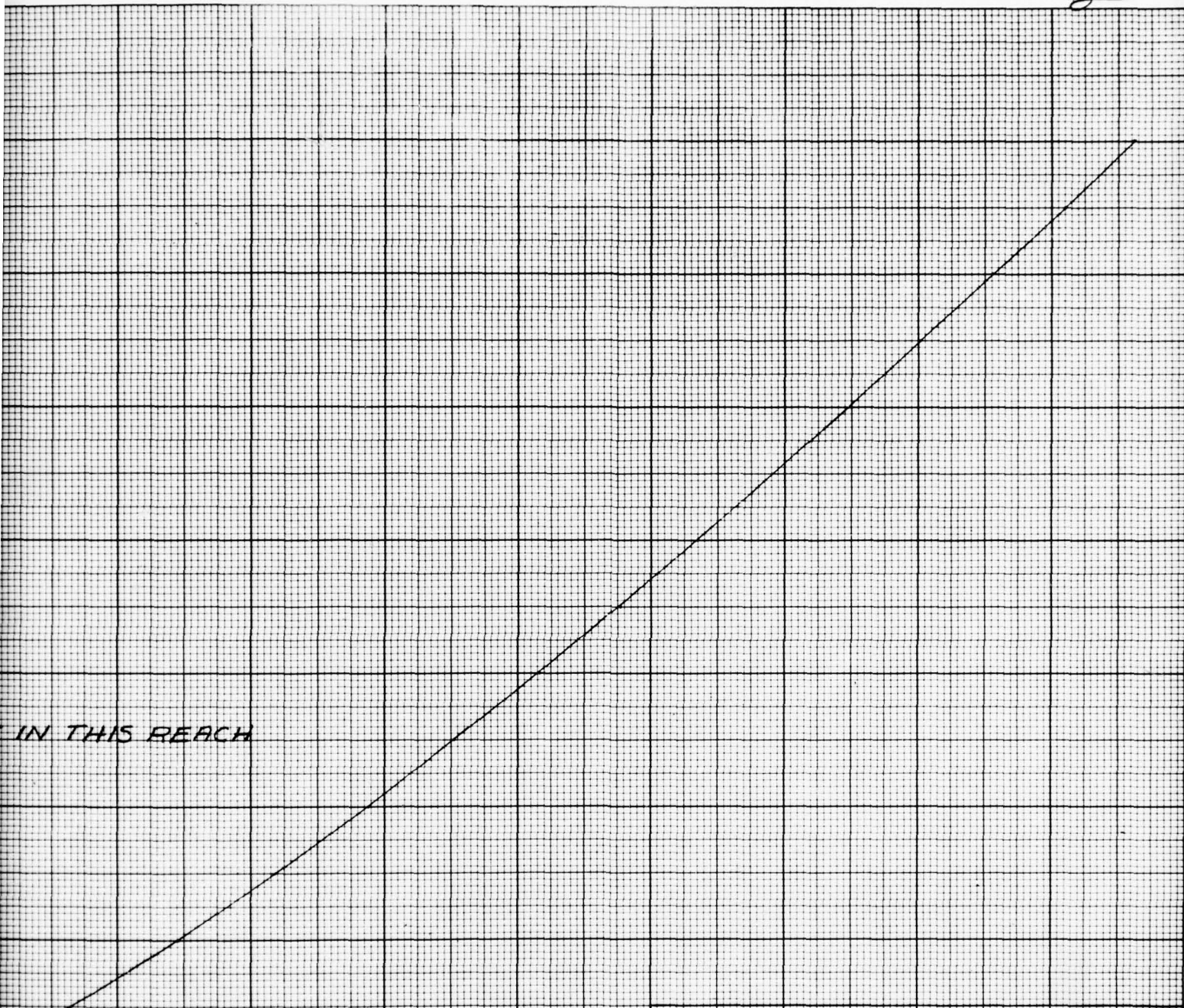
ZERO DAMAGE

→ || ← \$2,500

0 50 100 150 200 250 300 350

DAMAGE IN THOUSAND DOLLARS





IN THIS REACH

→ || ← 2,500

550 600 650

**WABASH RIVER BASIN
 STAGE DAMAGE CURVE
 EMBARRASS RIVER**

**REACH EM-2
 MILE 63.8 TO MILE 103.2**

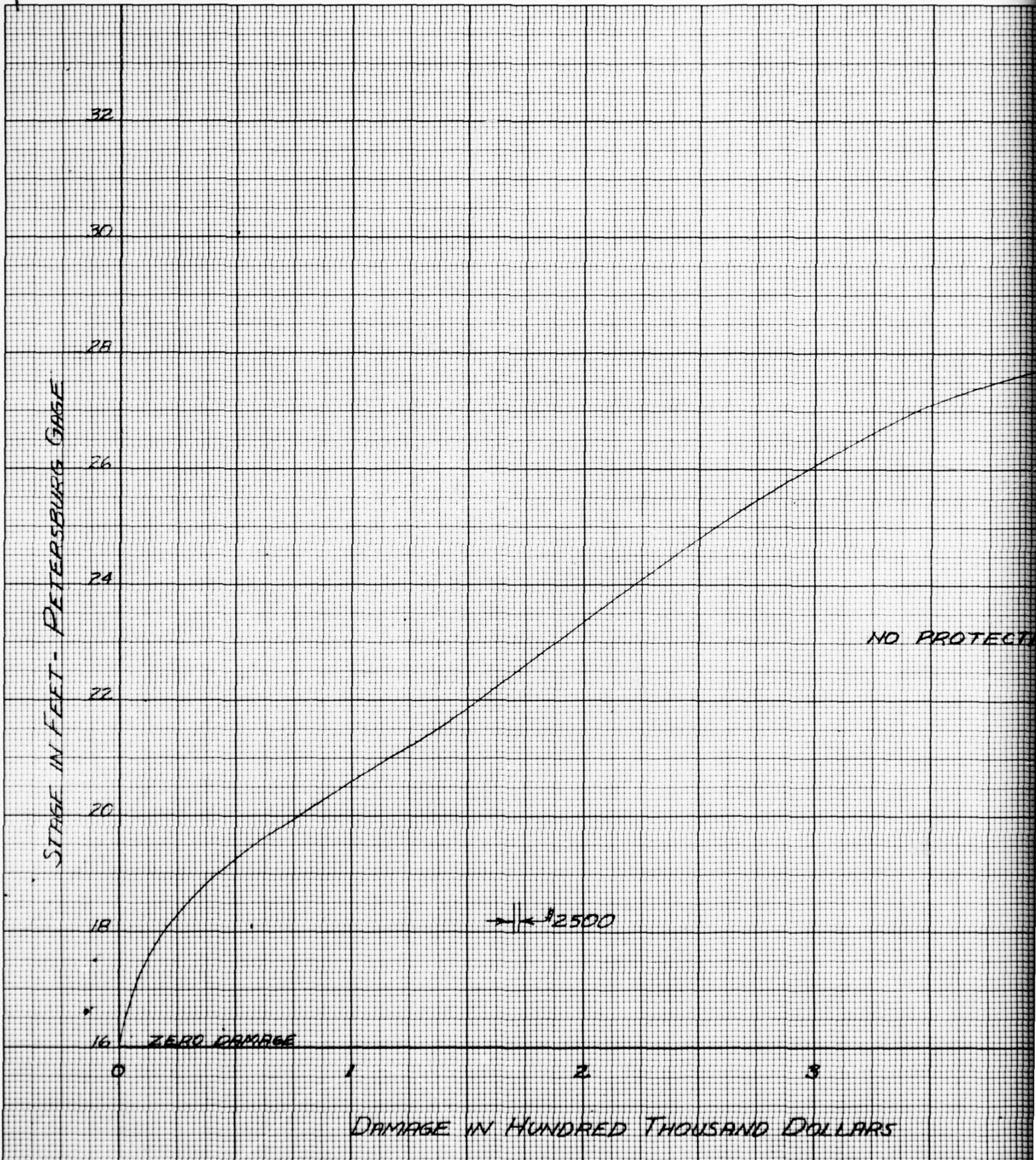
**U. S. ARMY ENGINEER DISTRICT
 LOUISVILLE, KY.**

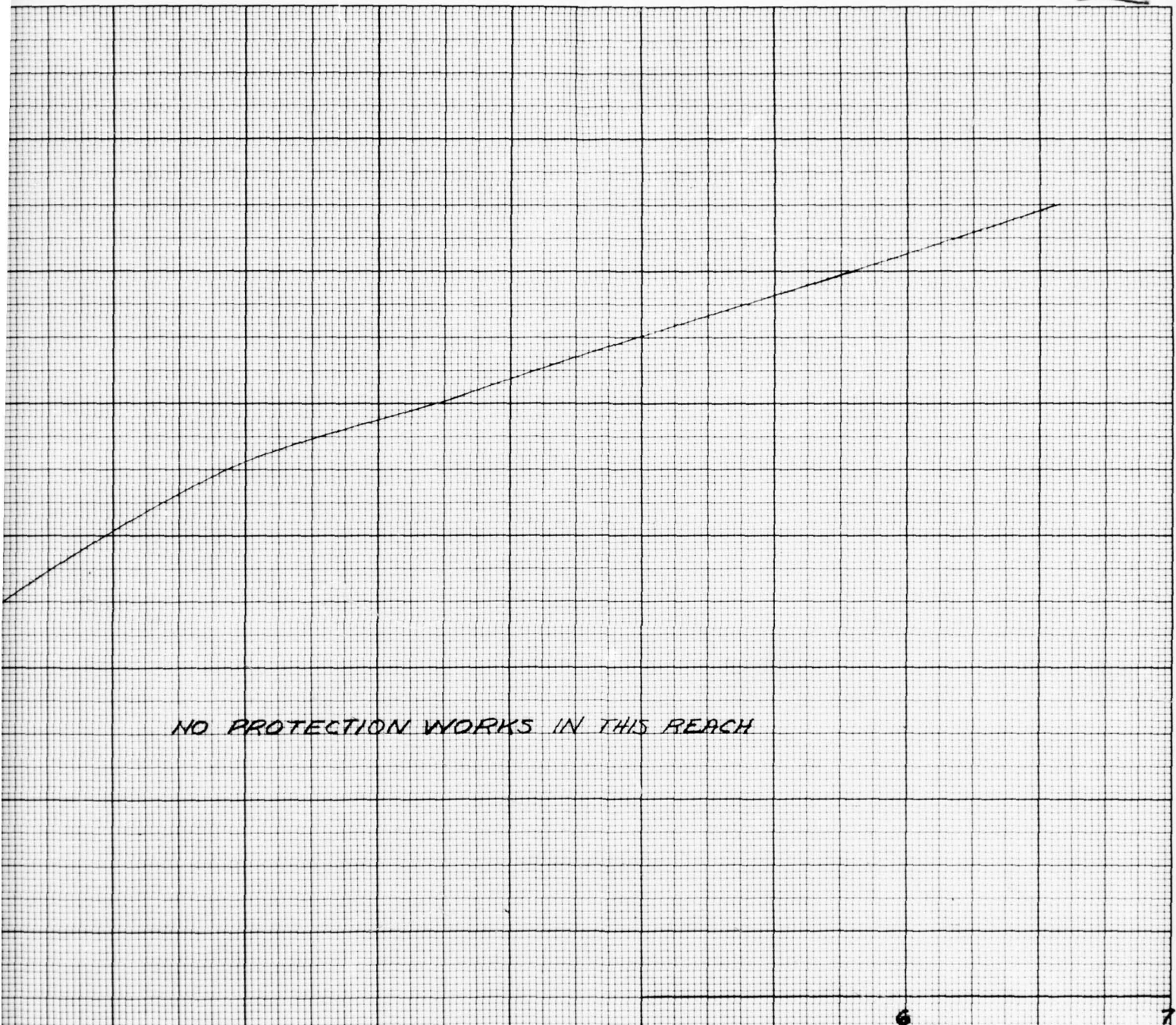
ORLED-P JANUARY 1964

PLATE NO. B-6e

300 350 400 450 500

DOLLARS





WABASH RIVER BASIN
STAGE DAMAGE CURVE
WHITE RIVER
REACH WH-1
MILE 0.0 TO MILE 51.6
U.S. ARMY ENGINEER DISTRICT
LOUISVILLE, KY.
ORLED-P JANUARY 1964
PLATE NO. B-6F

AND DOLLARS

STAGE IN FEET - SHOALS GAGE

44

40

36

32

28

24

20

16

0

1

2

3

4

5

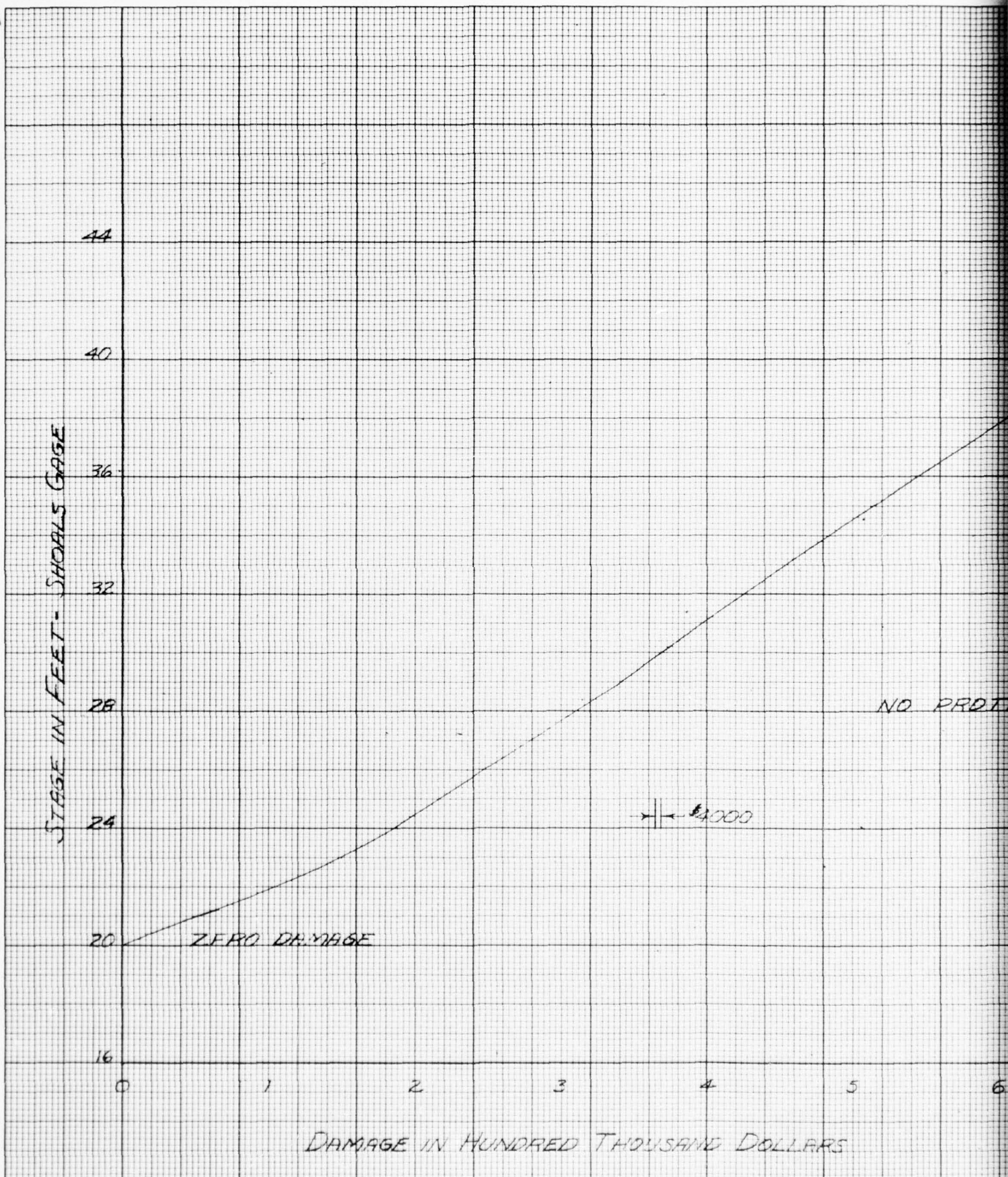
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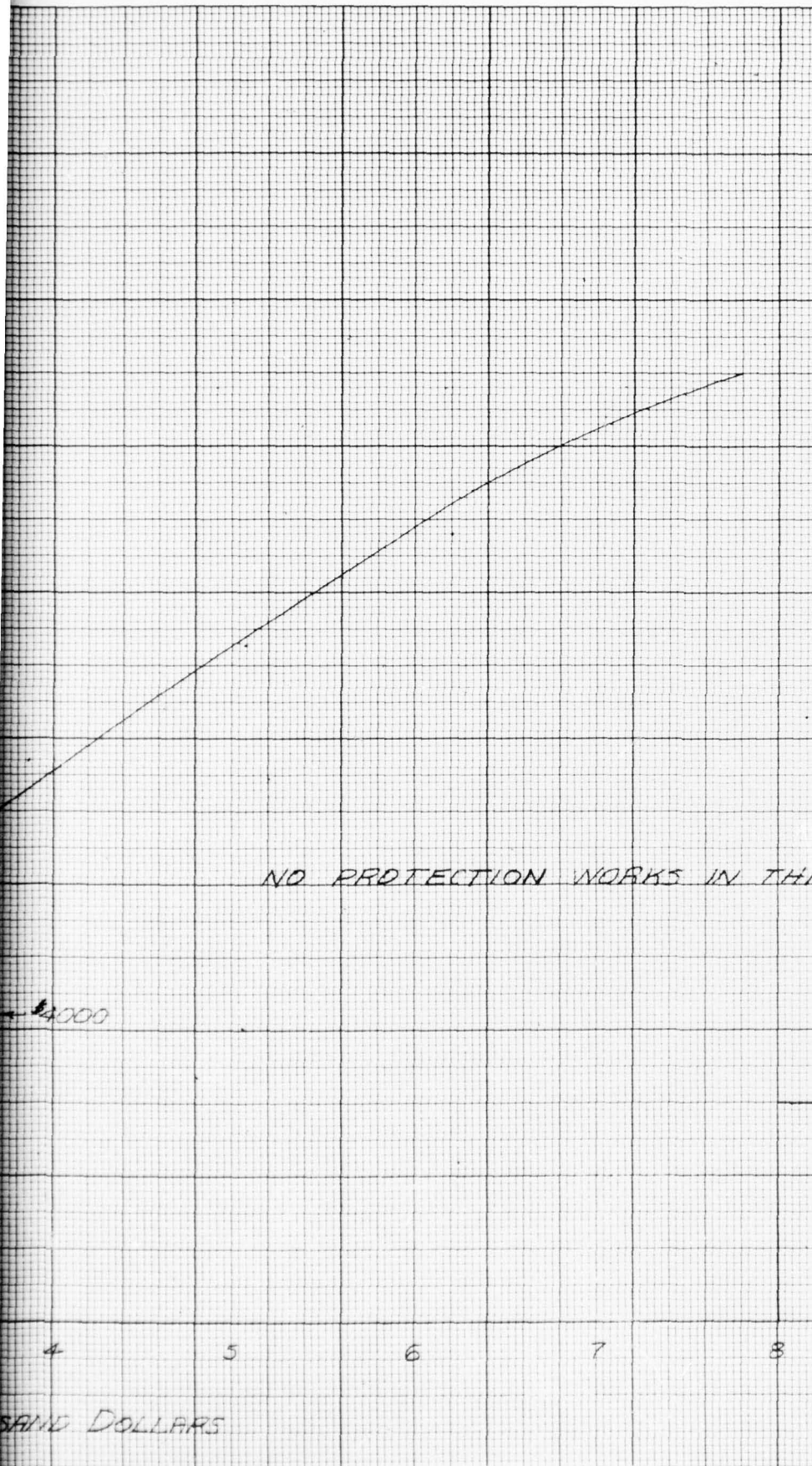
ZERO DAMAGE

→ || ← \$1000

NO PRDT

DAMAGE IN HUNDRED THOUSAND DOLLARS





WABASH RIVER BASIN
 STAGE DAMAGE CURVE
 EAST FORK WHITE RIVER

REACH EW-1
 MILE 51.6 TO MILE 111.9

U. S. ARMY ENGINEER DISTRICT
 LOUISVILLE, KY.

ORLED-P JANUARY 1964

PLATE NO. B-6

STAGE IN FEET - SHORALS GAGE

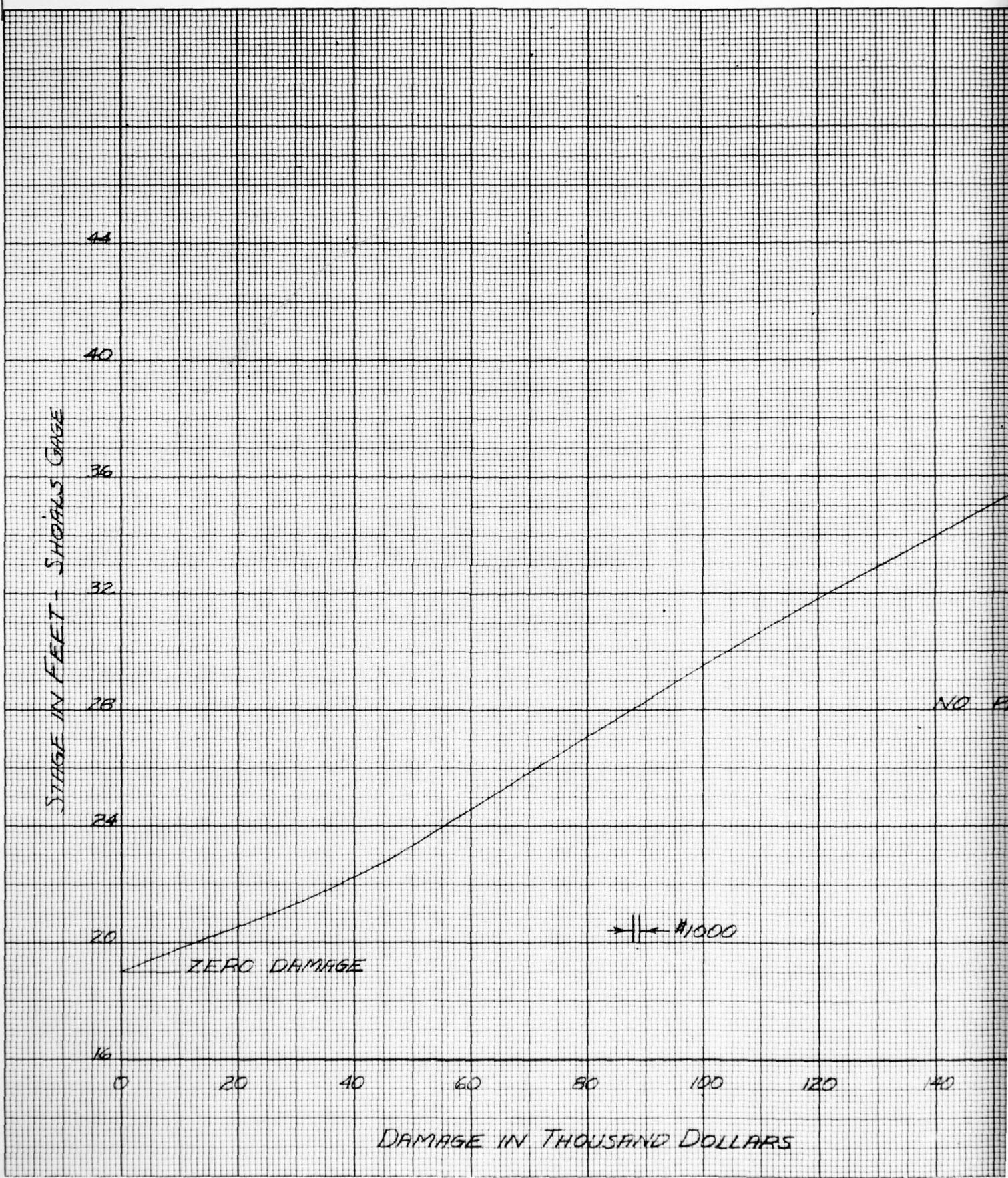
44
40
36
32
28
24
20
16
0 20 40 60 80 100 120 140

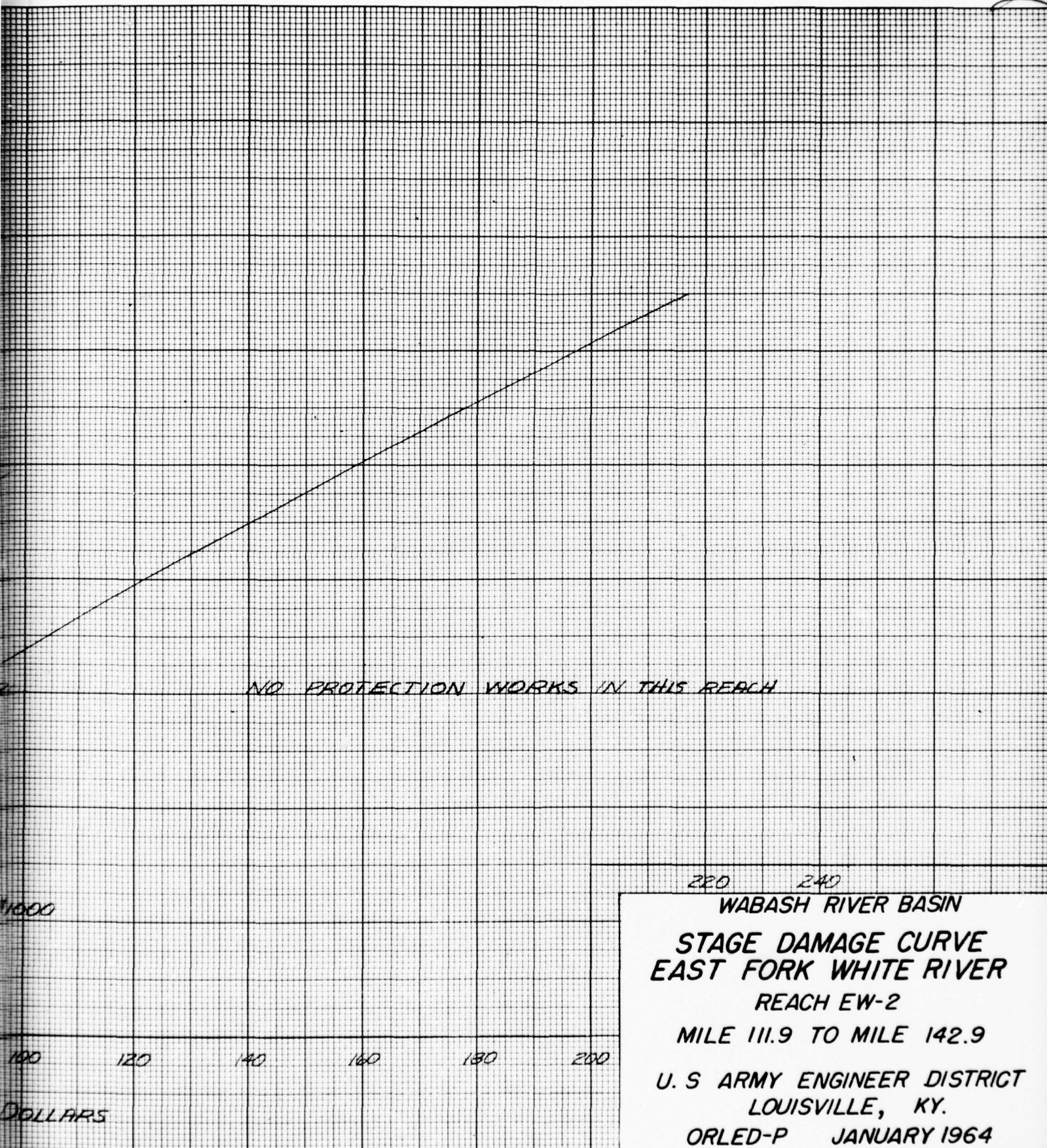
ZERO DAMAGE

→ | ← \$1000

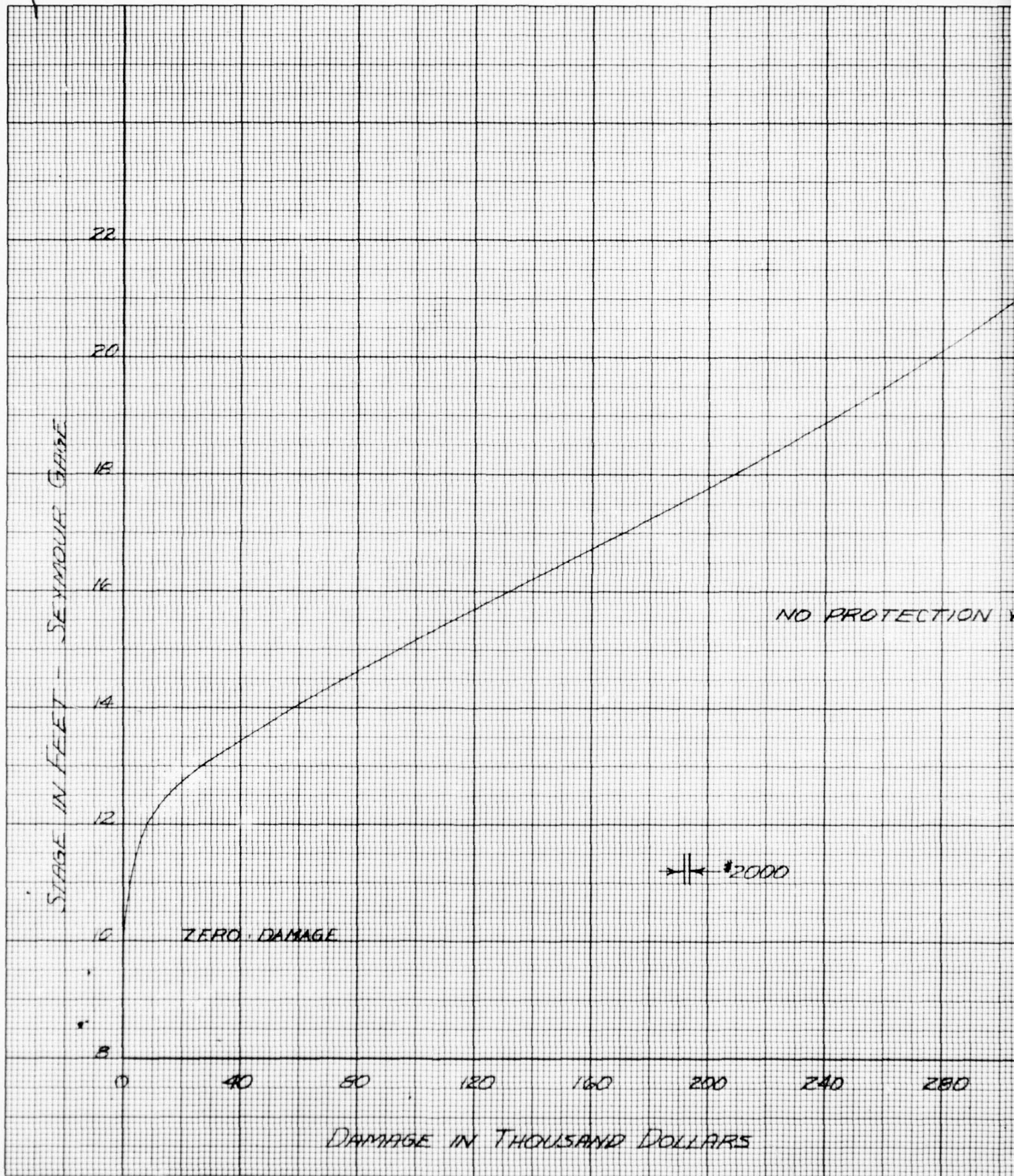
NO P

DAMAGE IN THOUSAND DOLLARS

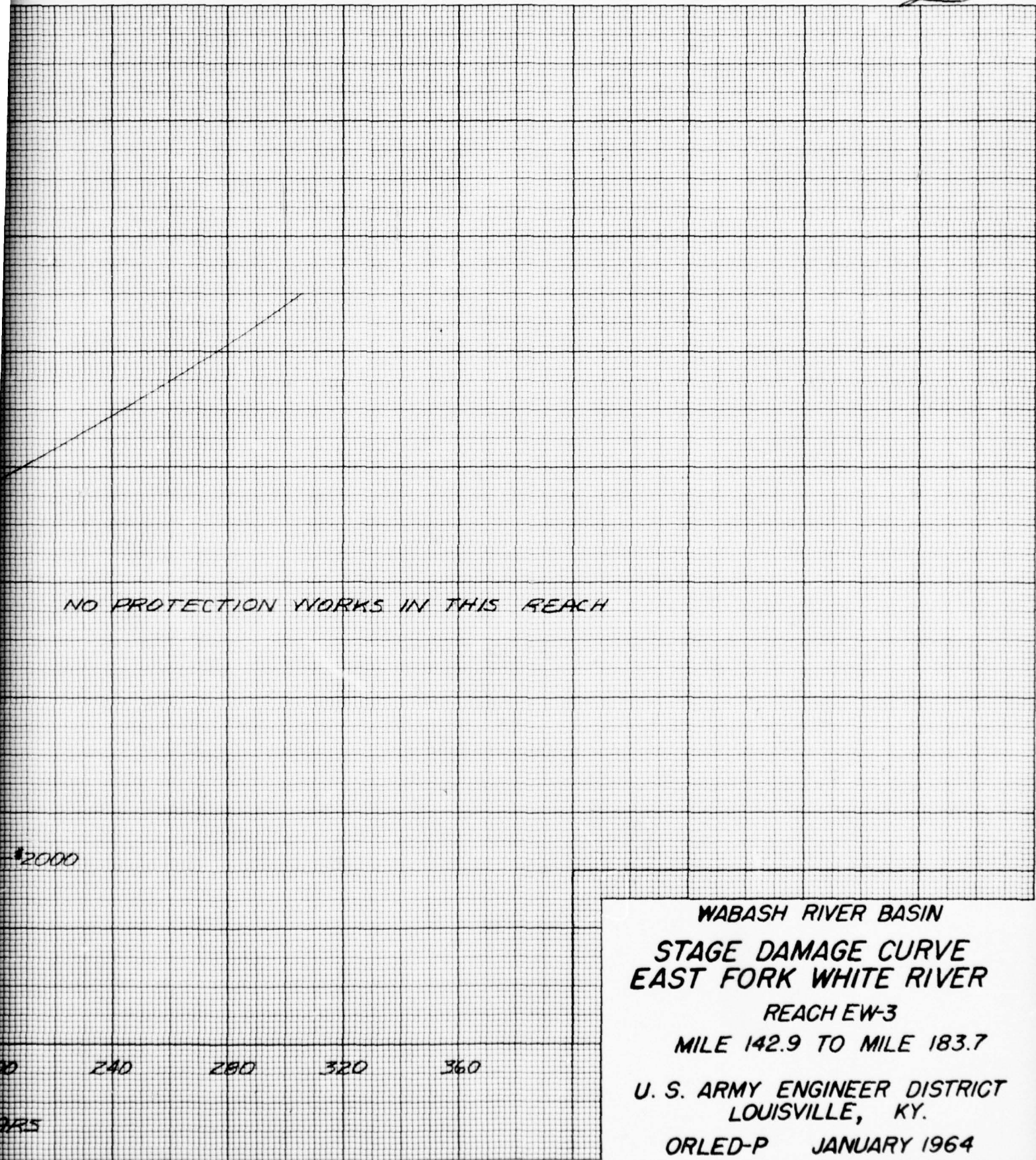




220 240
WABASH RIVER BASIN
STAGE DAMAGE CURVE
EAST FORK WHITE RIVER
REACH EW-2
MILE 111.9 TO MILE 142.9
U. S ARMY ENGINEER DISTRICT
LOUISVILLE, KY.
ORLED-P JANUARY 1964
PLATE NO. 3-6h



2



NO PROTECTION WORKS IN THIS REACH

2000

240 280 320 360

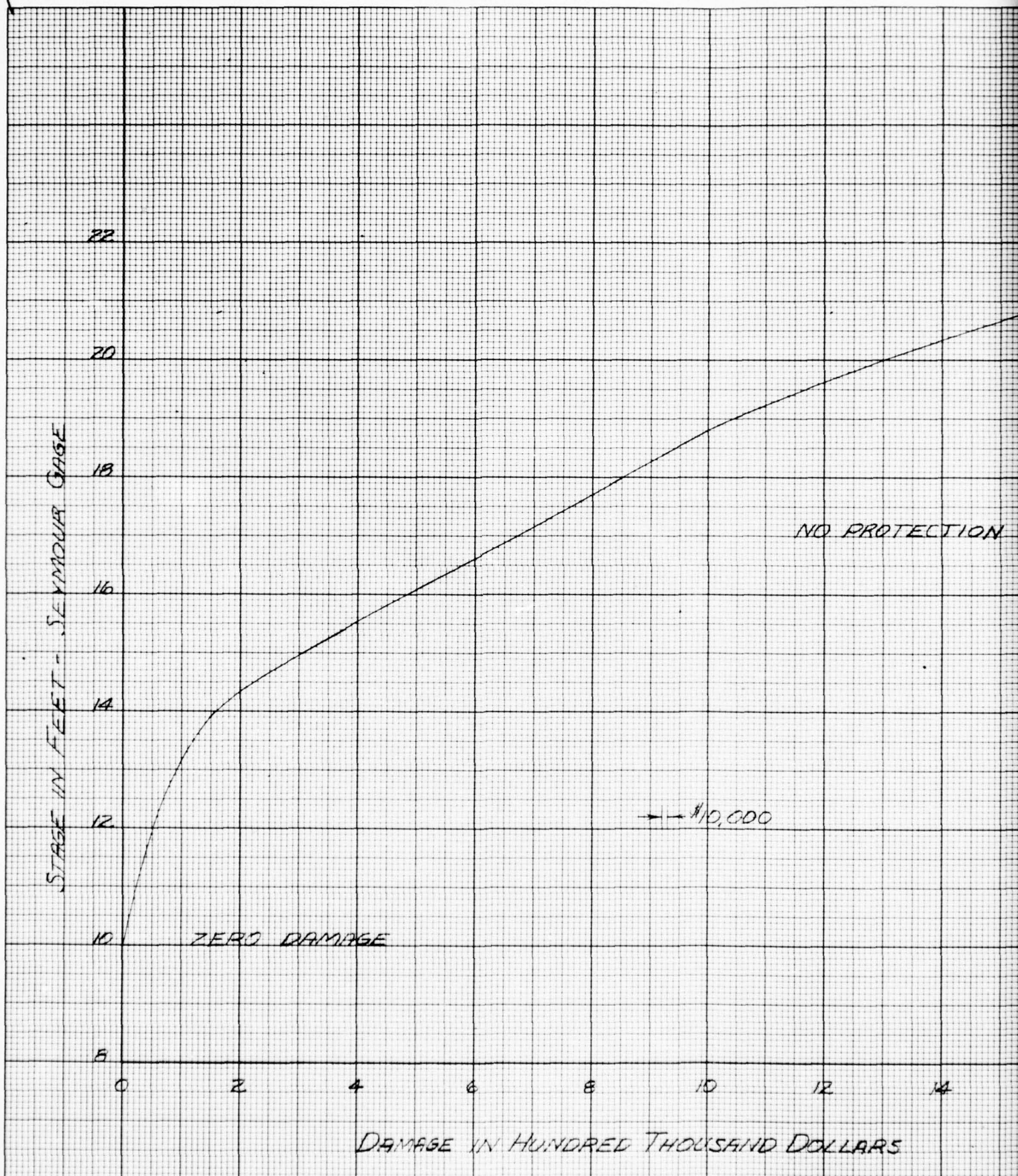
225

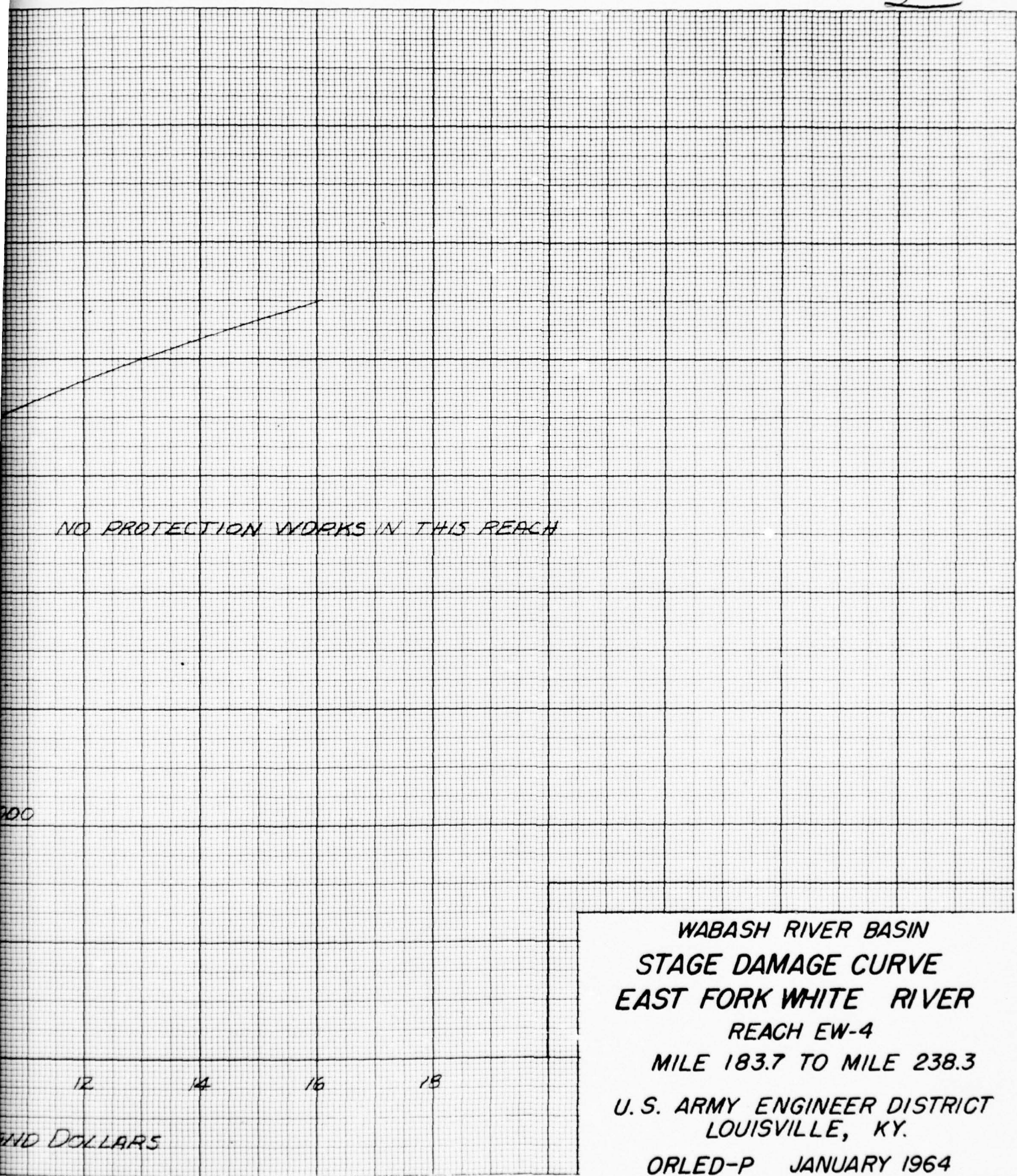
**WABASH RIVER BASIN
STAGE DAMAGE CURVE
EAST FORK WHITE RIVER**

**REACH EW-3
MILE 142.9 TO MILE 183.7**

**U. S. ARMY ENGINEER DISTRICT
LOUISVILLE, KY.**

**ORLED-P JANUARY 1964
PLATE NO. B-62**



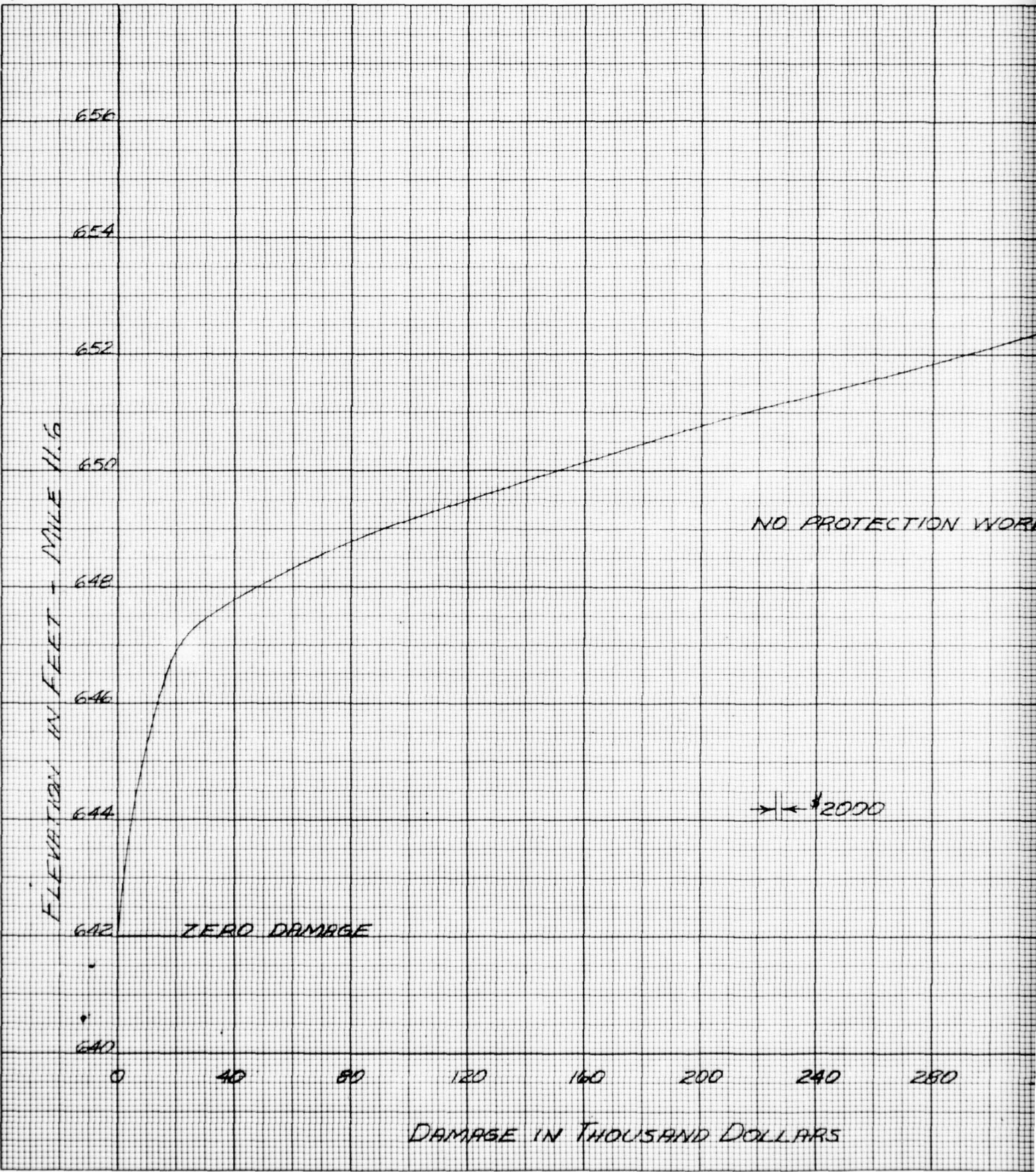


WABASH RIVER BASIN
STAGE DAMAGE CURVE
EAST FORK WHITE RIVER
REACH EW-4
MILE 183.7 TO MILE 238.3
U. S. ARMY ENGINEER DISTRICT
LOUISVILLE, KY.
ORLED-P JANUARY 1964
PLATE NO. B-6j

1000

12 14 16 18

THOUSAND DOLLARS



2

NO PROTECTION WORKS IN THIS REACH

→ ← \$2000

0 240 280 320 360 400

DOLLARS

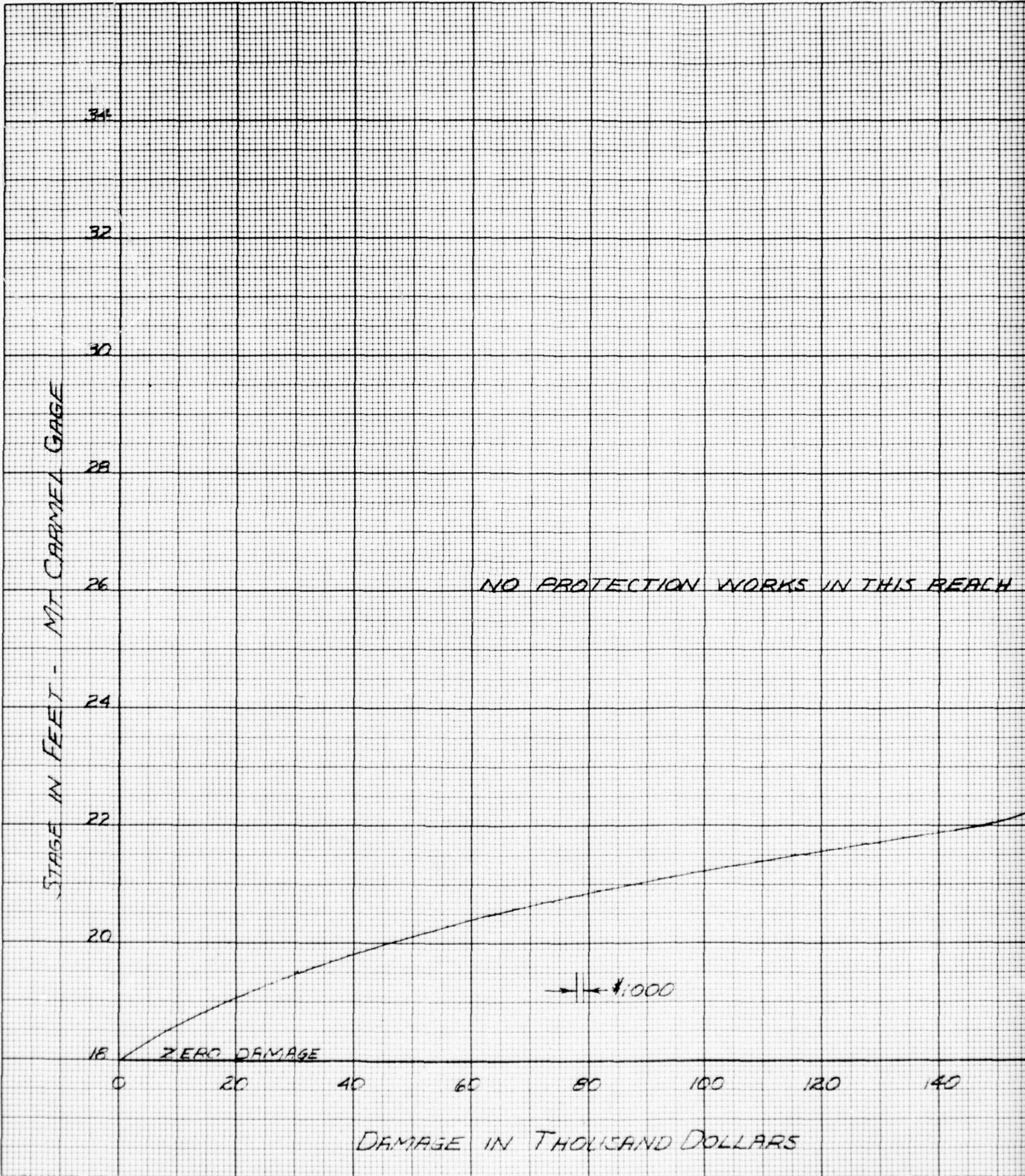
440 480

WABASH RIVER BASIN
STAGE DAMAGE CURVE
CLIFTY CREEK

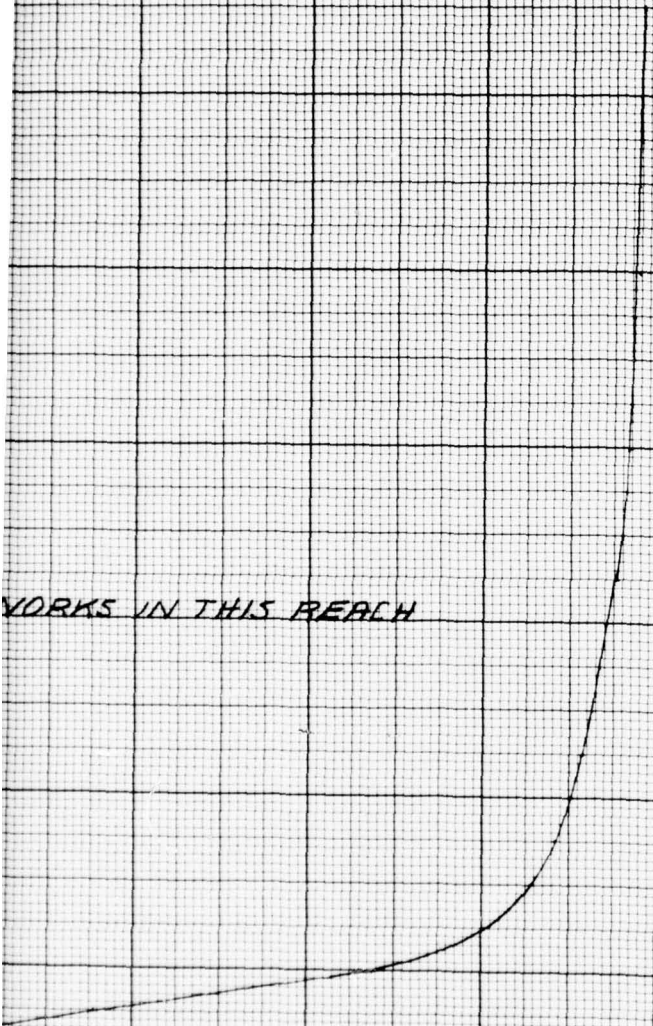
REACH CC-1
MILE 0.0 TO MILE 18.4

U. S. ARMY ENGINEER DISTRICT
LOUISVILLE, KY.

ORLED-P JANUARY 1964
PLATE NO. B-6k

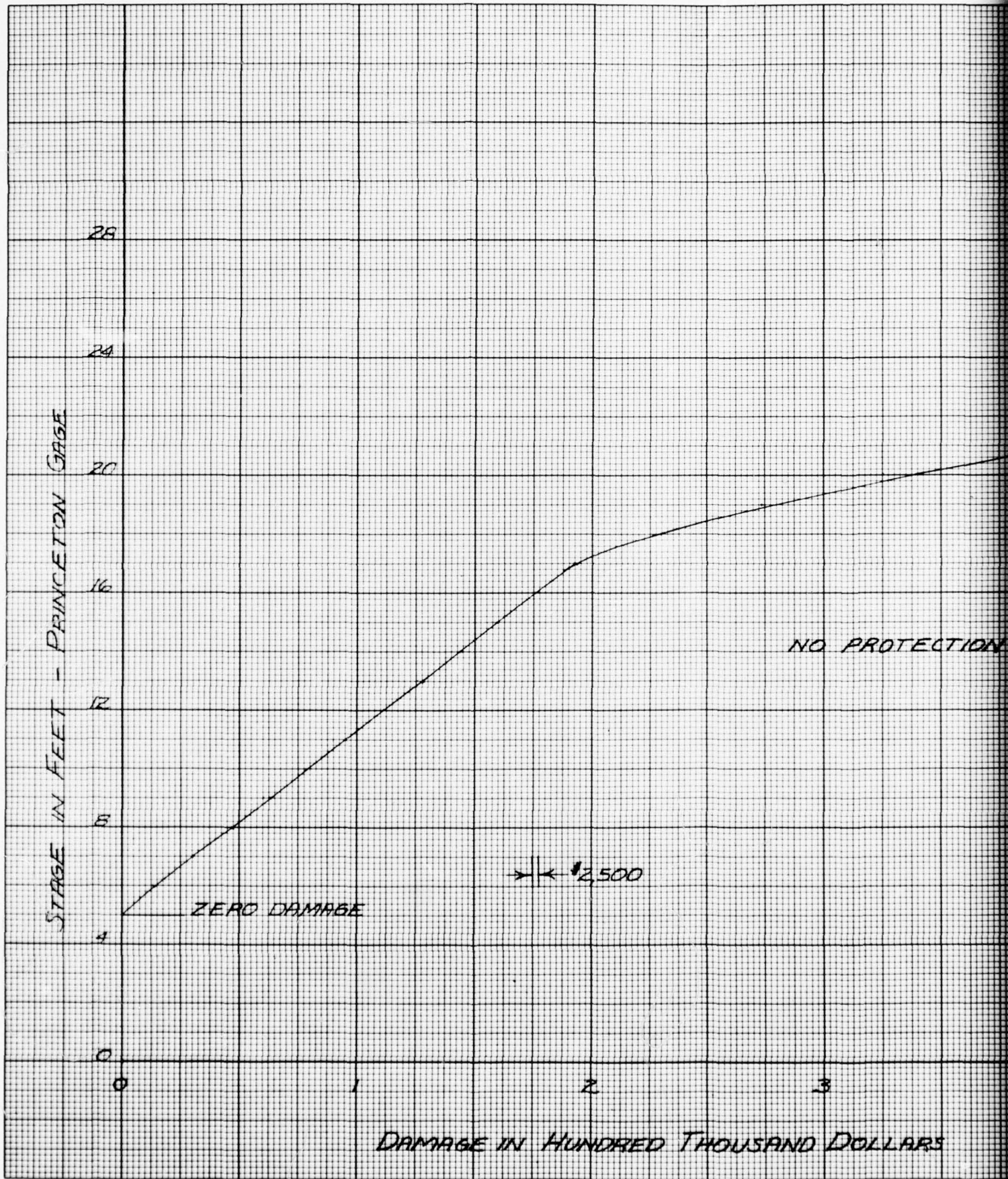


WORKS IN THIS REACH



WABASH RIVER BASIN
STAGE DAMAGE CURVE
PATOKA RIVER
REACH P-1
MOUTH TO U.S. 41 BYPASS BRIDGE
U. S. ARMY ENGINEER DISTRICT
LOUISVILLE, KY.
ORLED-P JANUARY 1964
PLATE NO. 3-6L

120 140 160 180 200
LARS

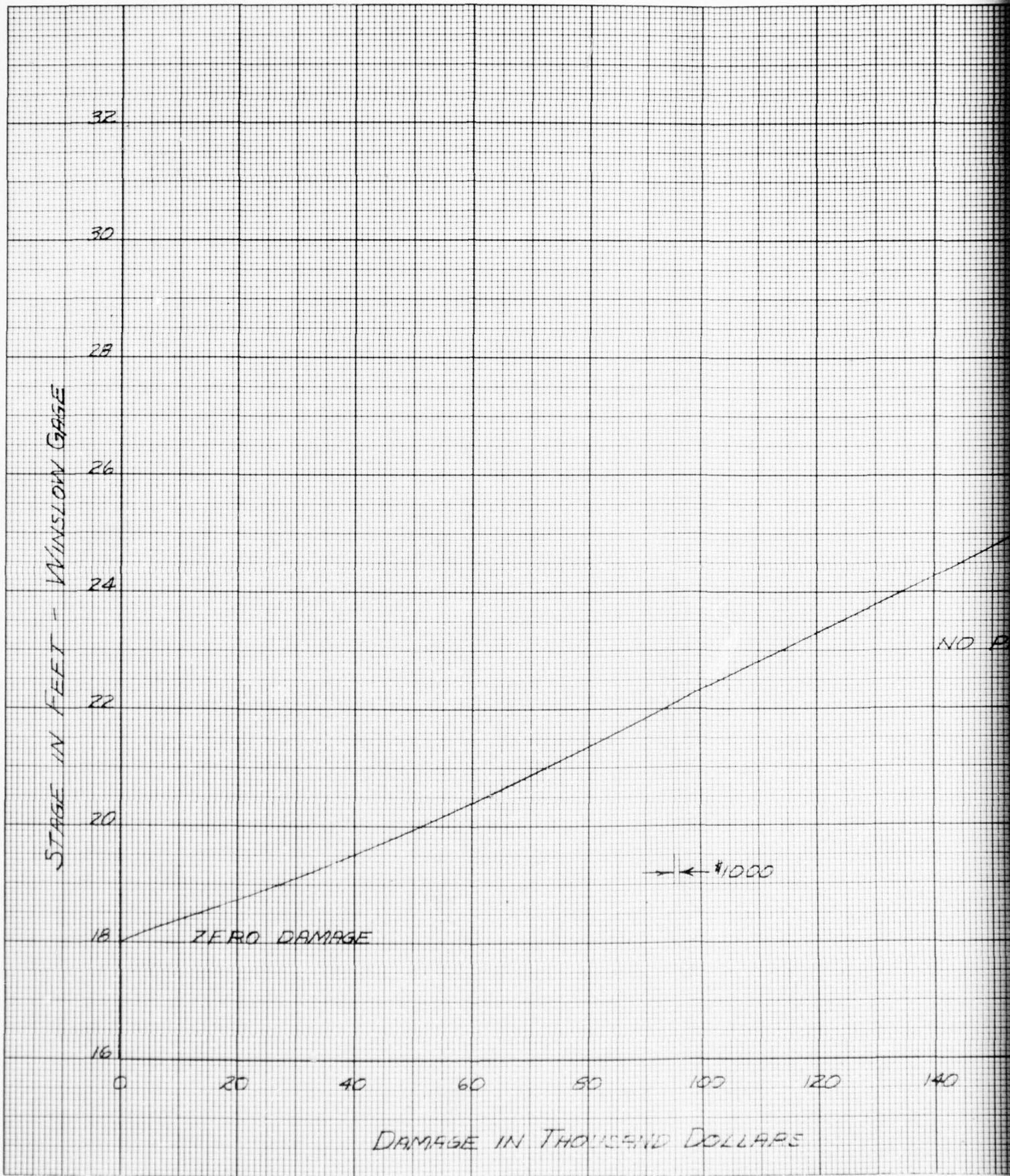


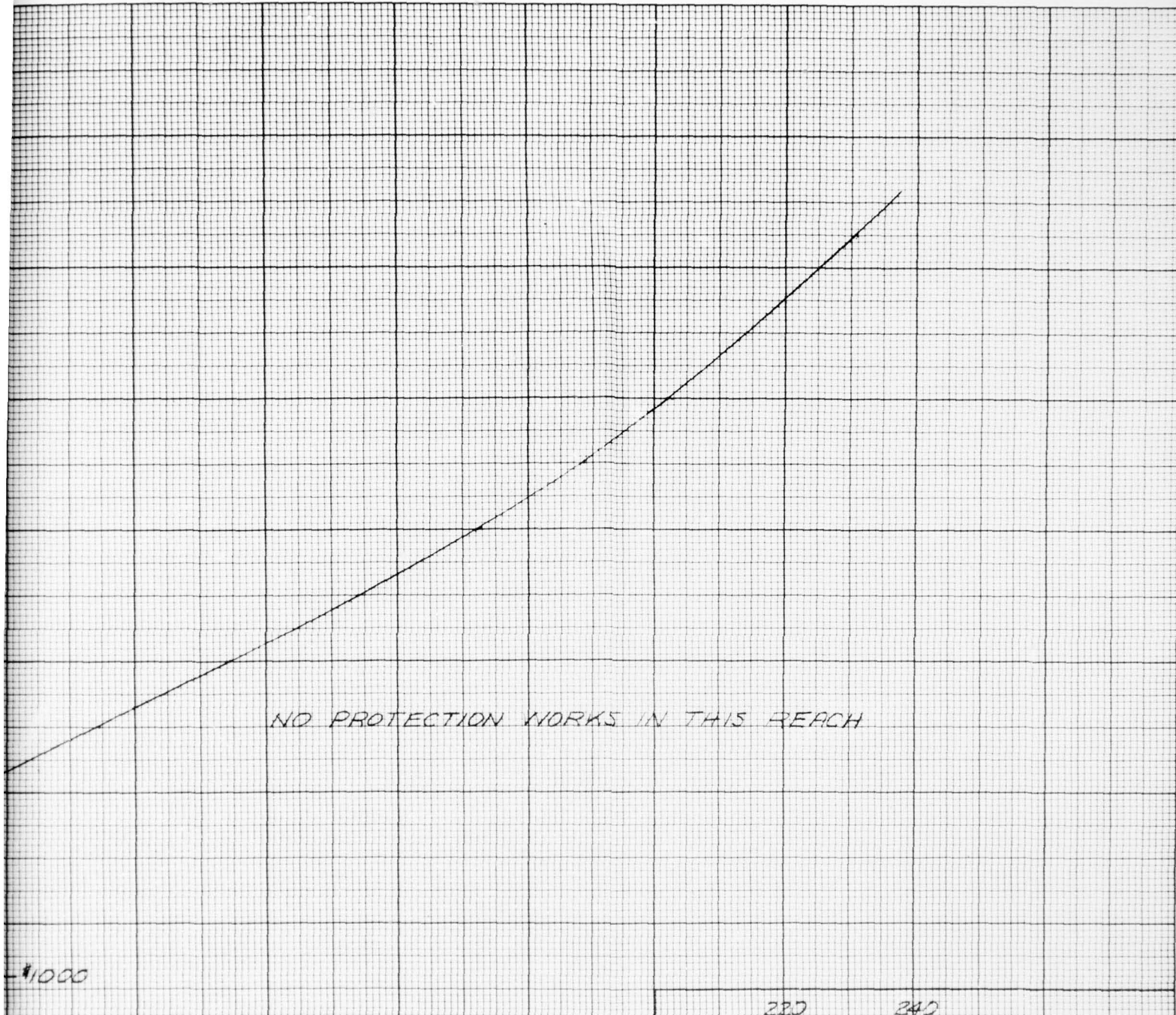
NO PROTECTION WORKS IN THIS REACH

6
WABASH RIVER BASIN
STAGE DAMAGE CURVE
PATOKA RIVER
REACH P-2
U.S. 41 BYPASS BRIDGE TO S. FORK
U.S. ARMY ENGINEER DISTRICT
LOUISVILLE, KY.
ORLED-P JANUARY 1964

2 PLATE NO. B-6m

US AND DOLLARS





NO PROTECTION WORKS IN THIS REACH

1000

220

240

WABASH RIVER BASIN
STAGE DAMAGE CURVE
PATOKA RIVER

REACH P-3
SOUTH FORK TO PIKEVILLE, IND.

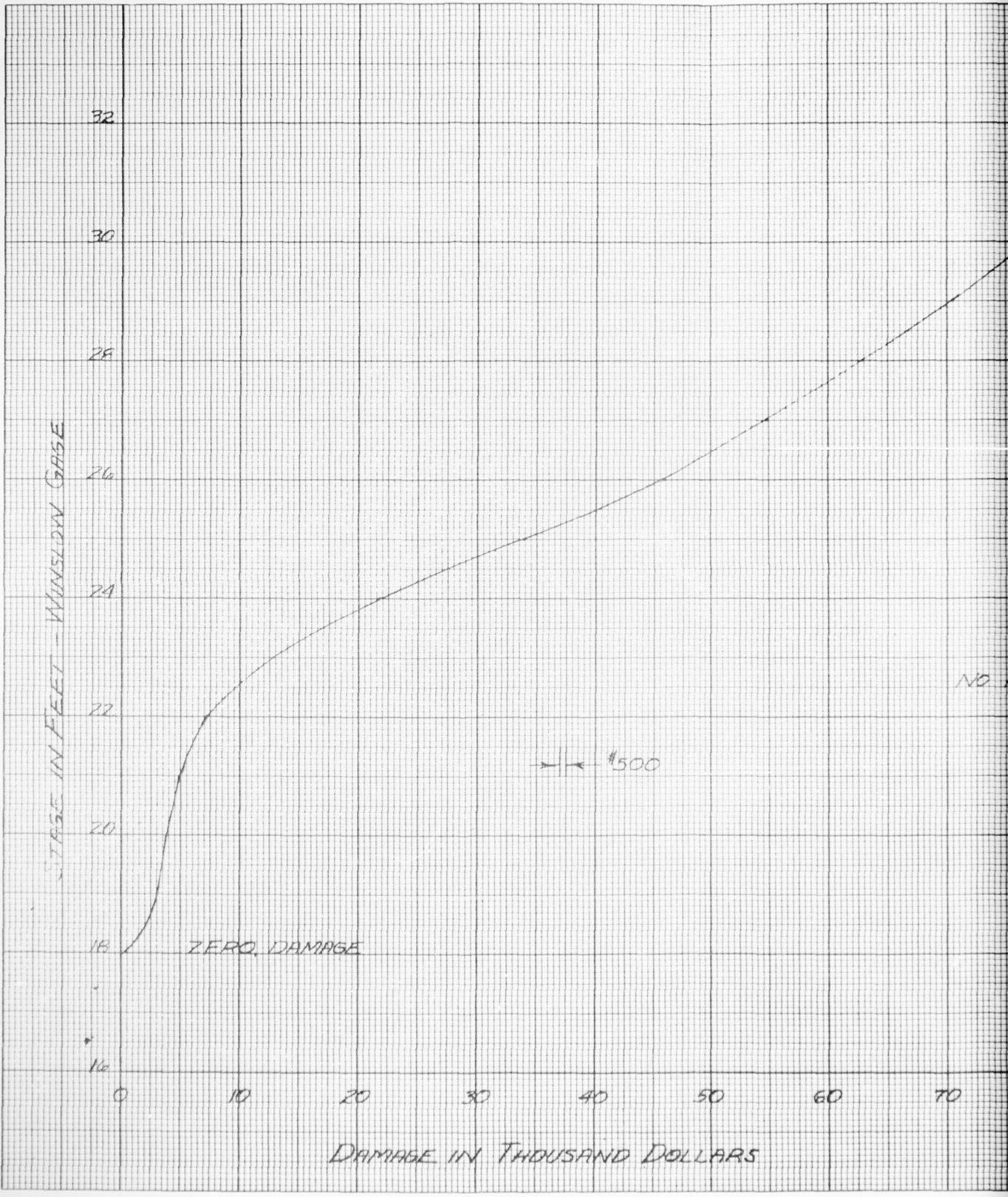
U.S. ARMY ENGINEER DISTRICT
LOUISVILLE, KY.

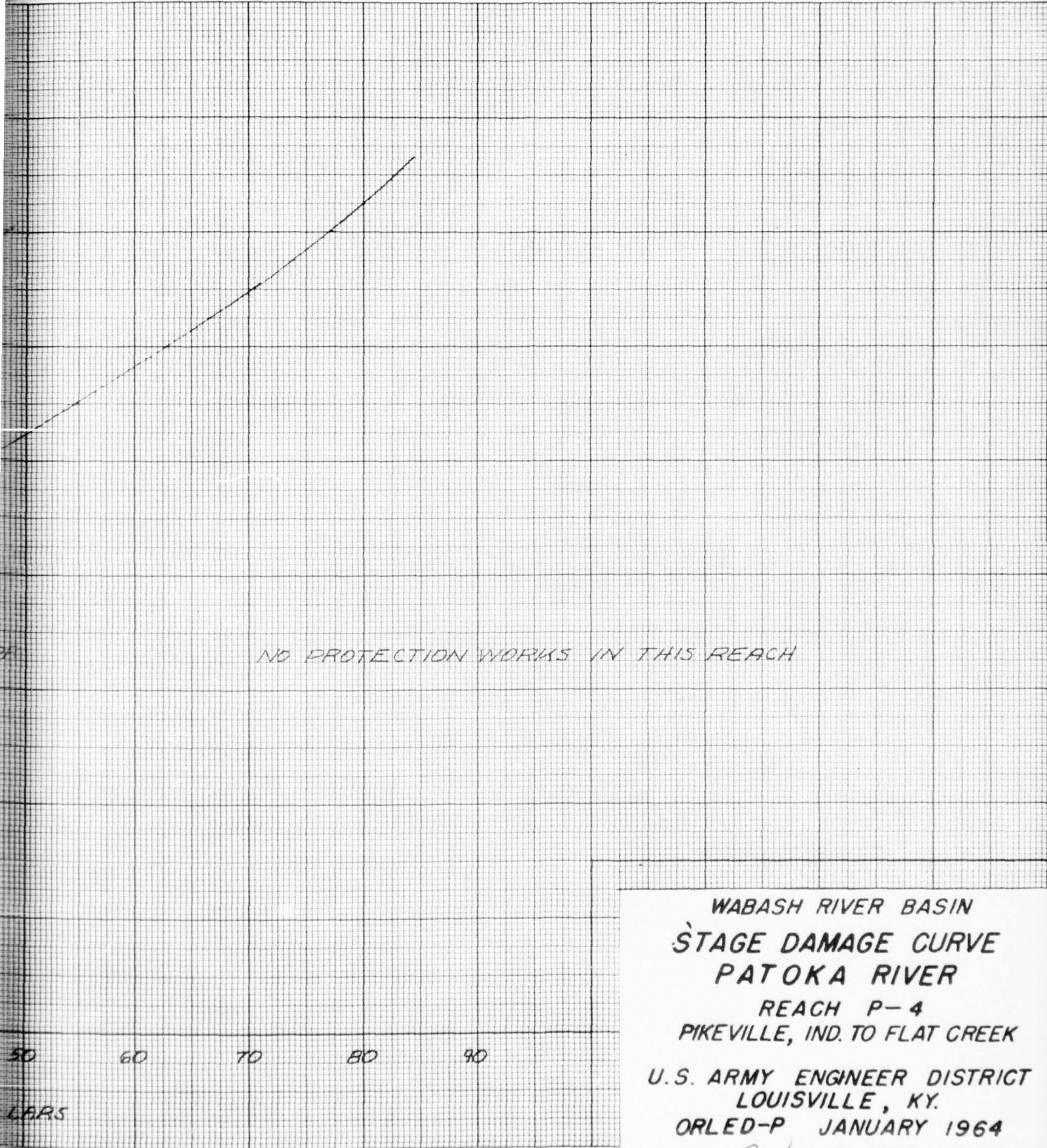
ORLED-P JANUARY 1964

PLATE NO. B-67

120 140 160 180 200

COLLAPSE





NO PROTECTION WORKS IN THIS REACH

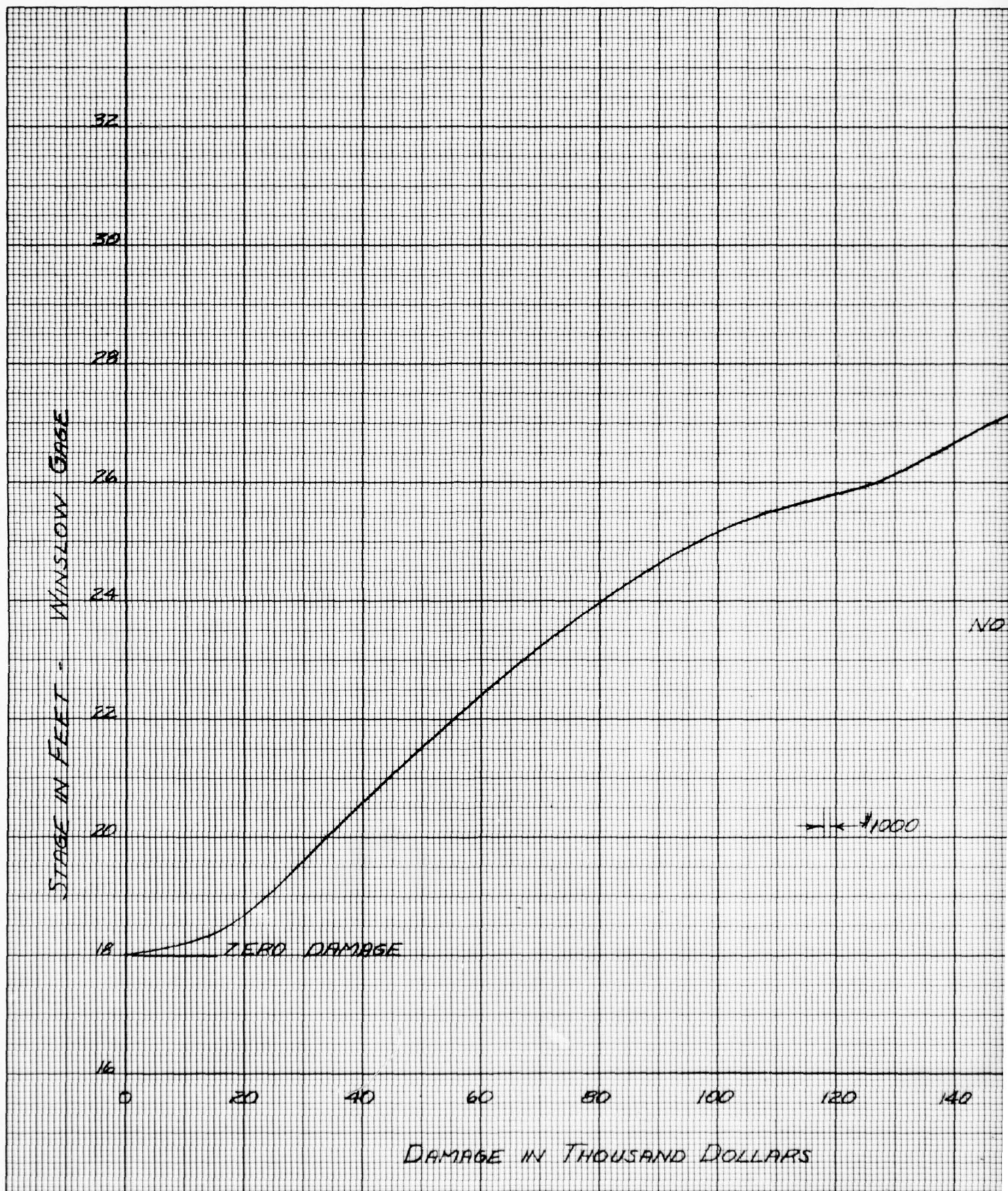
WABASH RIVER BASIN
STAGE DAMAGE CURVE
PATOKA RIVER

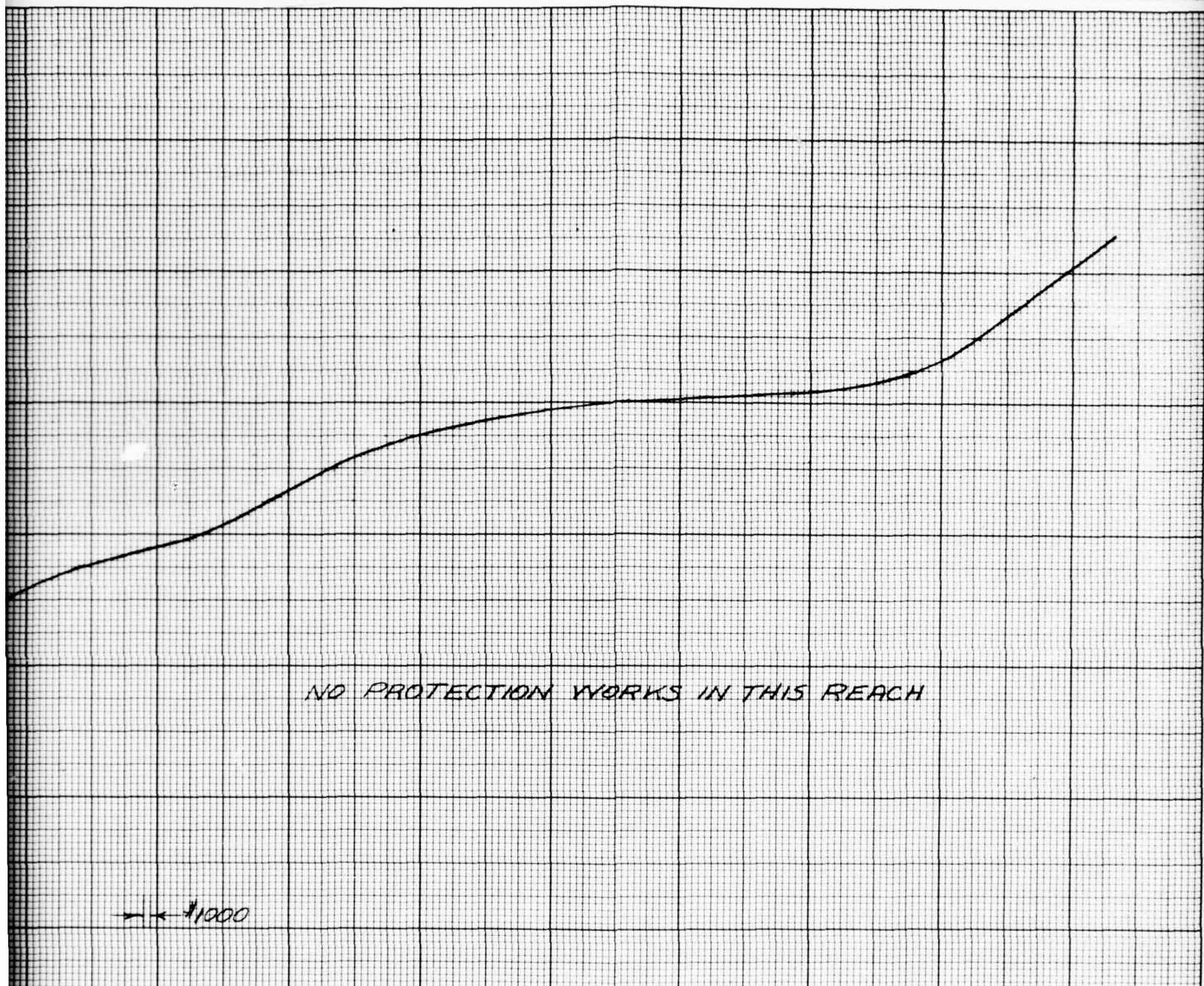
REACH P-4
PIKEVILLE, IND. TO FLAT CREEK

U.S. ARMY ENGINEER DISTRICT
LOUISVILLE, KY.

ORLED-P JANUARY 1964

2 PLATE NO. B-60





NO PROTECTION WORKS IN THIS REACH

← \$1000

100 120 140 160 180 200

DOLLARS

220 240 260

**WABASH RIVER BASIN
STAGE DAMAGE CURVE
PATOKA RIVER**

**REACH P-5
FLAT CREEK TO STRAIGHT RIVER**

**U. S. ARMY ENGINEER DISTRICT
LOUISVILLE, KY.**

ORLED-P JANUARY 1964

PLATE NO. 3-6p

[Handwritten signature]

STAGE IN FEET - JASPER GAGE

18

16

14

12

10

8

6

4

0

80

160

240

320

400

480

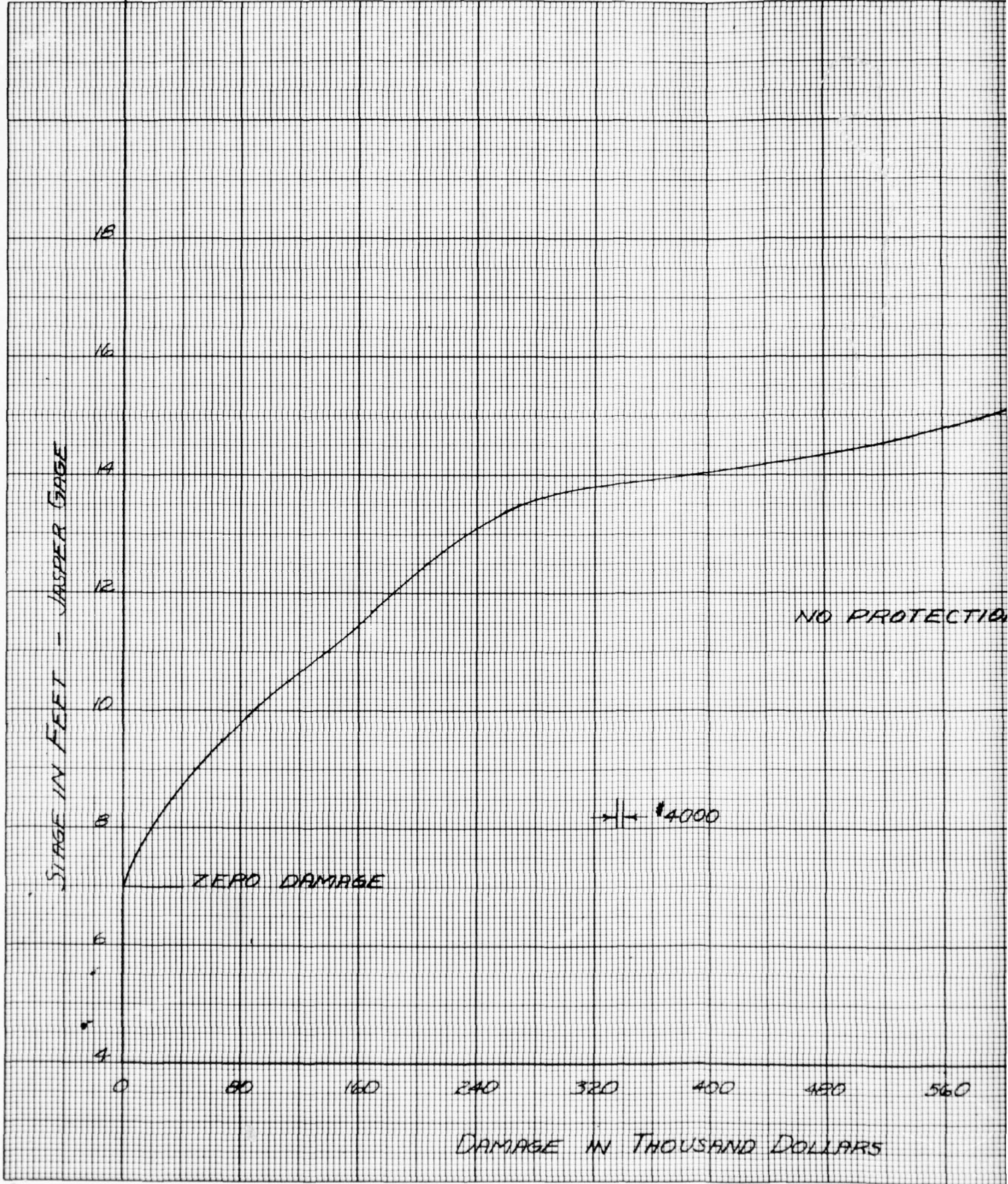
560

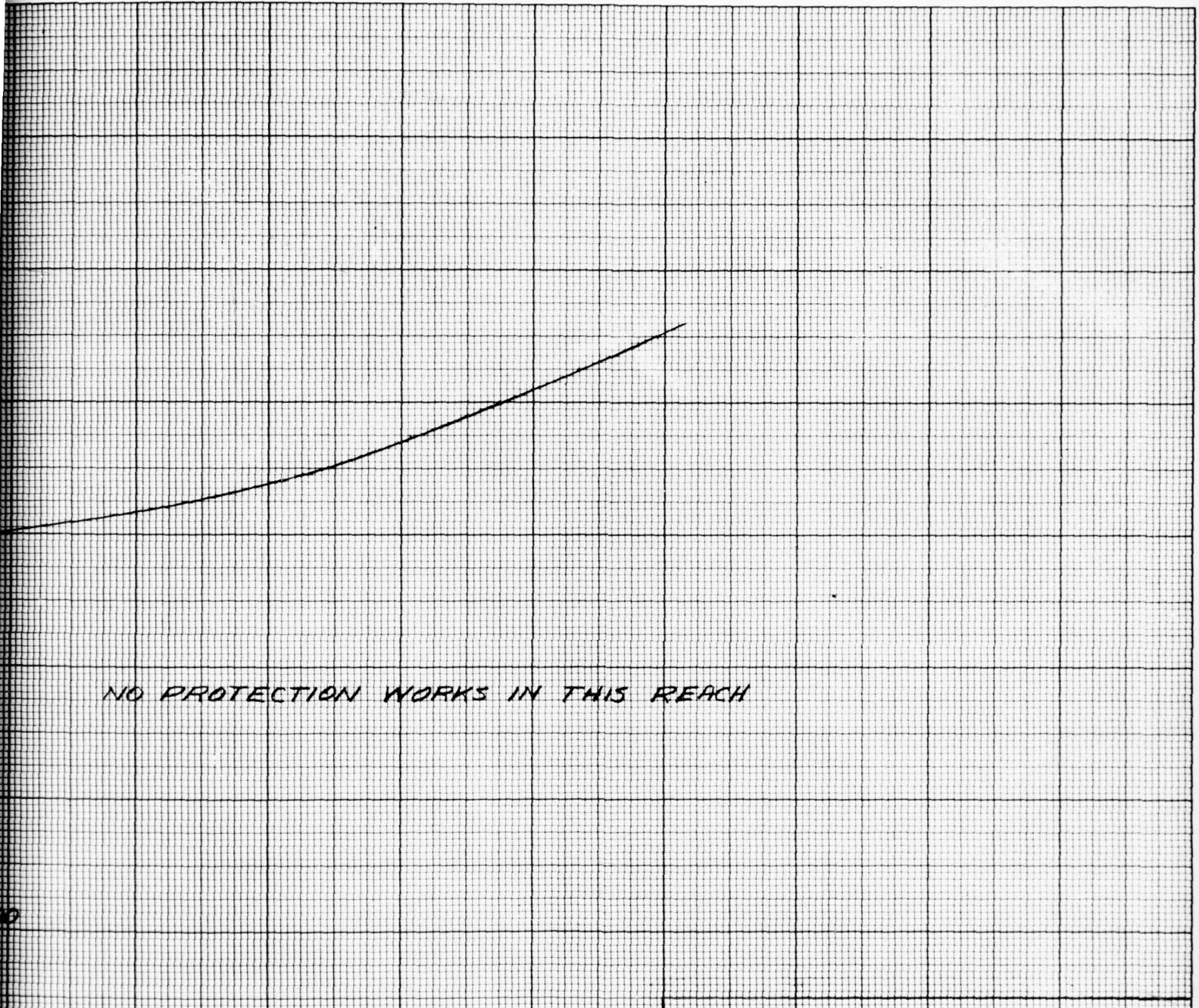
ZERO DAMAGE

→ | ← \$4000

NO PROTECTION

DAMAGE IN THOUSAND DOLLARS





NO PROTECTION WORKS IN THIS REACH

WABASH RIVER BASIN
STAGE DAMAGE CURVE
PATOKA RIVER

REACH P-6
STRAIGHT RIVER TO DUBOIS, IND.

U. S. ARMY ENGINEER DISTRICT
LOUISVILLE, KY.

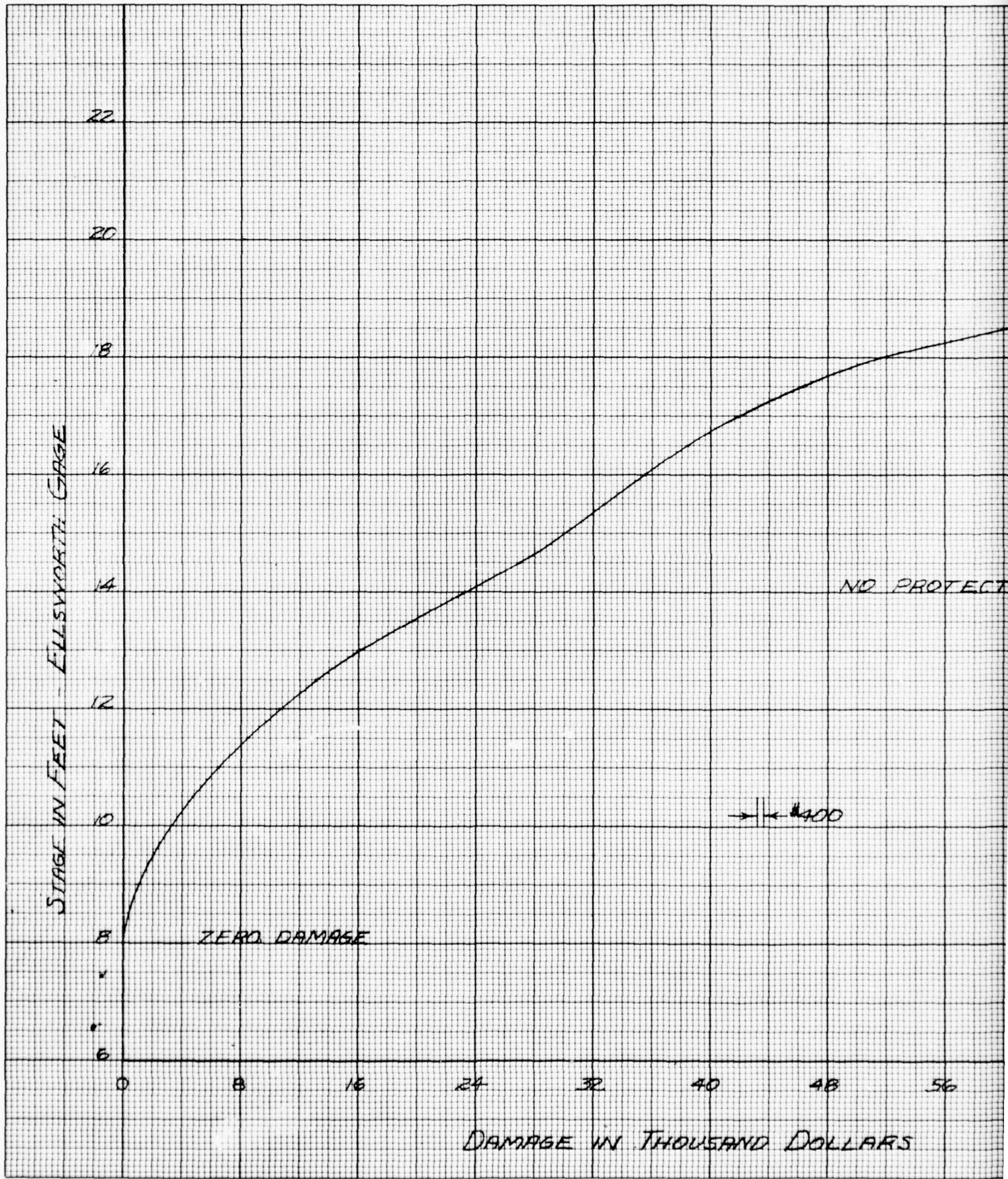
ORLED-P JANUARY 1964

PLATE NO. B-6a

100 480 560 640 720 800

THOUSAND DOLLARS

2



NO PROTECTION WORKS IN THIS REACH

→ ← \$400

48 56 64 72 80

88 96 104

**WABASH RIVER BASIN
STAGE DAMAGE CURVE
PATOKA RIVER**

**REACH P-7
DUBOIS, IND. TO DAM SITE**

**U. S. ARMY ENGINEER DISTRICT
LOUISVILLE, KY.**

ORLED-P JANUARY 1964

PLATE NO. B-6r

AND DOLLARS

EXCEEDENCE FREQUENCY PER 100 YEARS

ADD 3333 TO AREA UNDER CURVES FOR AREA NOT SHOWN

DAMAGES (AREA UNDER CURVES) BENEFITS (DIFF. FROM CURVE 1)

① \$676,000
② 634,000

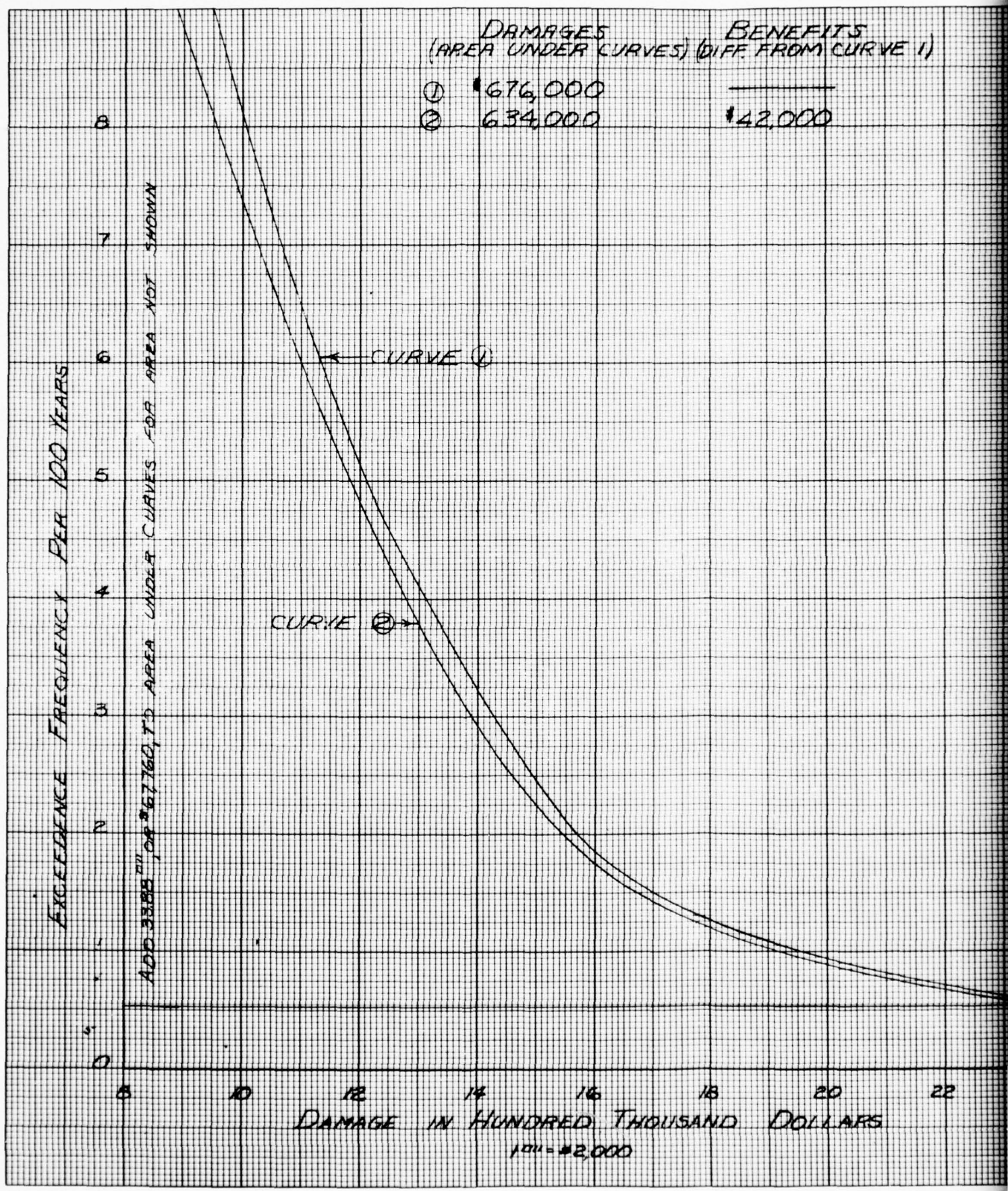
\$42,000

CURVE ①

CURVE ②

DAMAGE IN HUNDRED THOUSAND DOLLARS

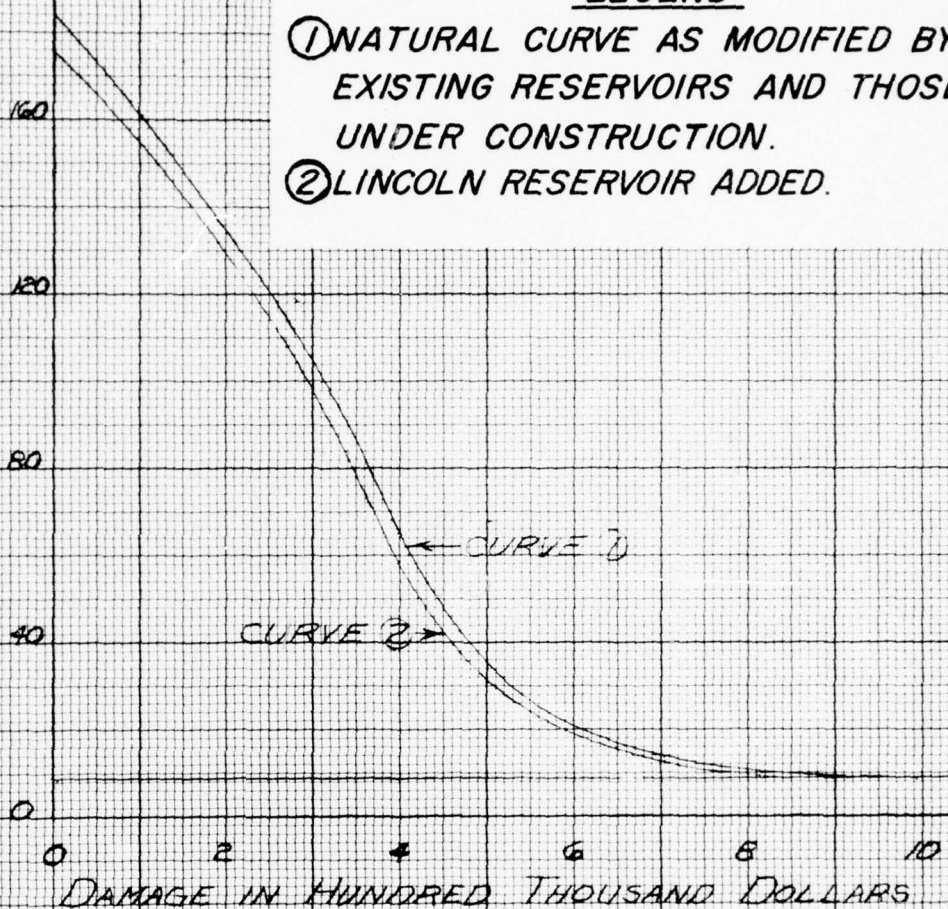
100 = \$2,000



BENEFITS
OFF FROM CURVE 1)

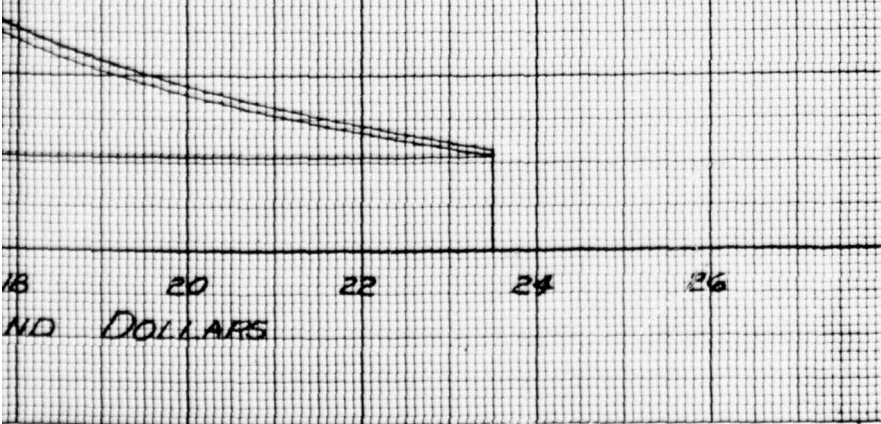
\$42,000

EXCEEDENCE FREQUENCY PER 100 YEARS



- LEGEND
- ① NATURAL CURVE AS MODIFIED BY EXISTING RESERVOIRS AND THOSE UNDER CONSTRUCTION.
 - ② LINCOLN RESERVOIR ADDED.

DAMAGE IN HUNDRED THOUSAND DOLLARS
100 = \$80,000



WABASH RIVER BASIN
FREQUENCY DAMAGE CURVES
WABASH RIVER
REACH W-1
OHIO RIVER TO MILE 40.0
U. S. ARMY ENGINEER DISTRICT
LOUISVILLE, KY.
ORLED-P JANUARY 1964

2

PLATE NO. B-7a

EXCEEDENCE FREQUENCY PER 100 YEARS

EXCEEDENCE FREQUENCY PER 100 YEARS

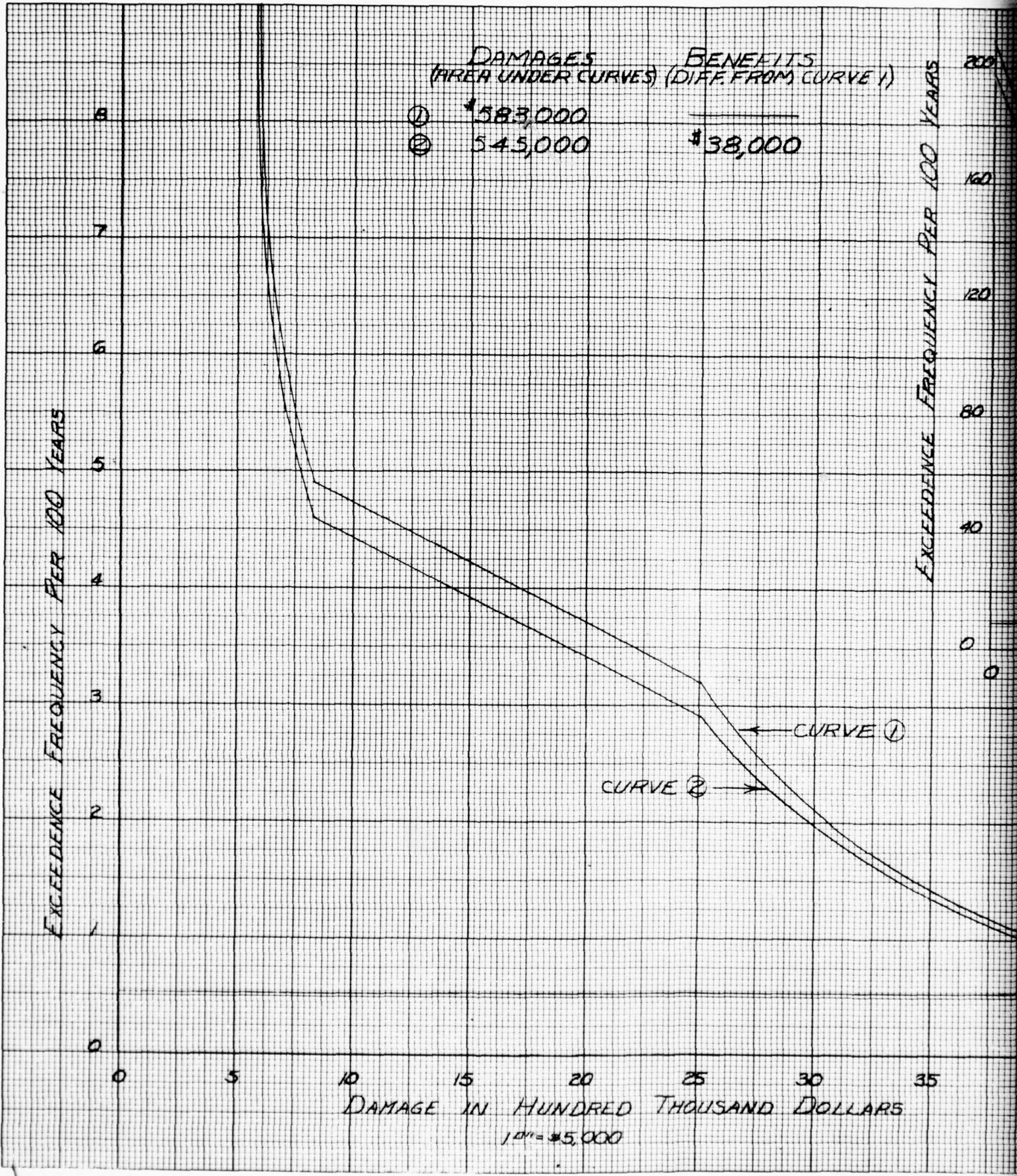
DAMAGES (AREA UNDER CURVES) BENEFITS (DIFF. FROM CURVE 1)

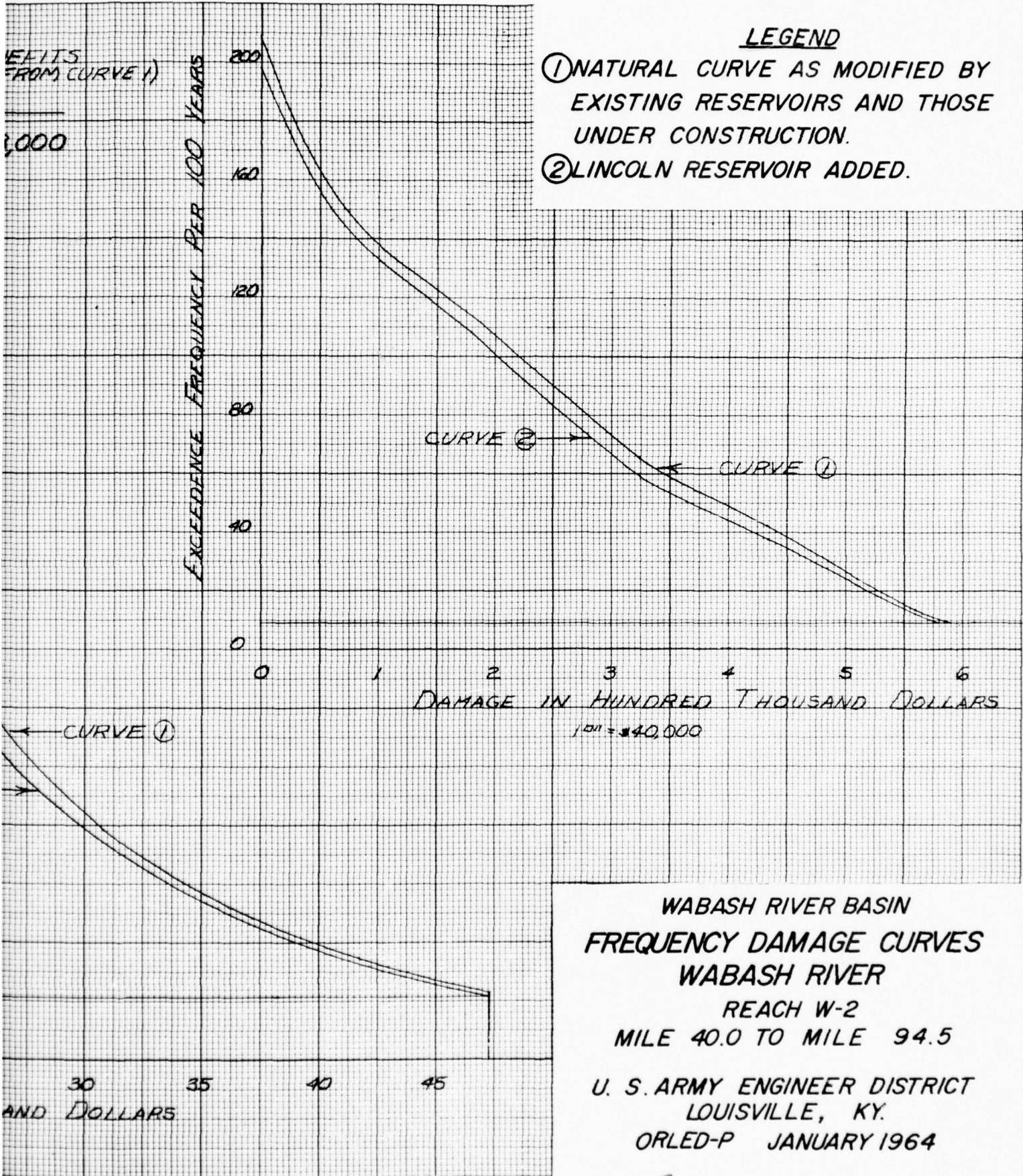
① \$583,000
② 545,000

\$38,000

CURVE ①
CURVE ②

DAMAGE IN HUNDRED THOUSAND DOLLARS
1 DIV = \$5,000





BEFITS FROM CURVE 1)

1,000

EXCEEDENCE FREQUENCY PER 100 YEARS

200
160
120
80
40
0

CURVE ②

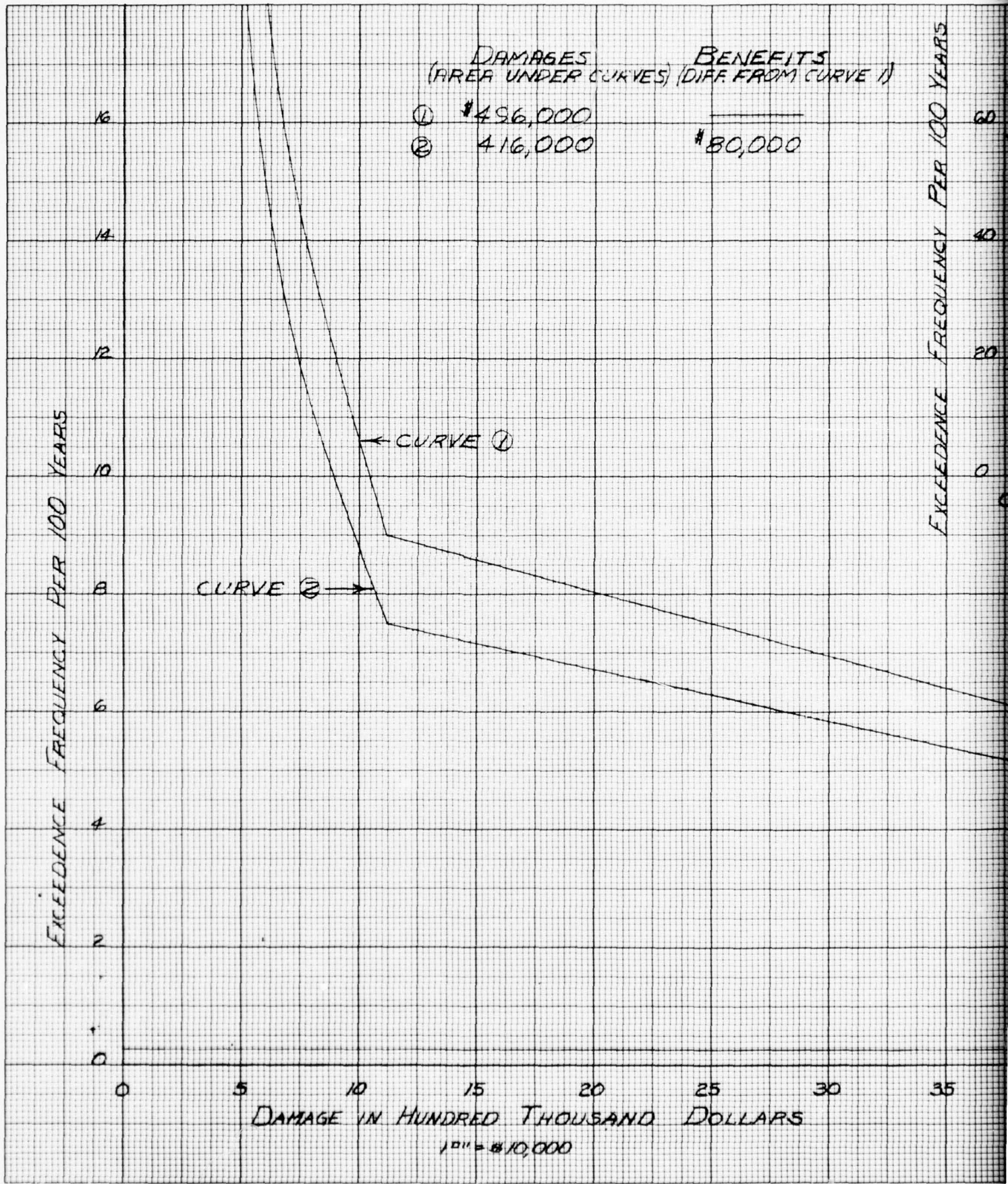
CURVE ①

DAMAGE IN HUNDRED THOUSAND DOLLARS

1 UNIT = \$40,000

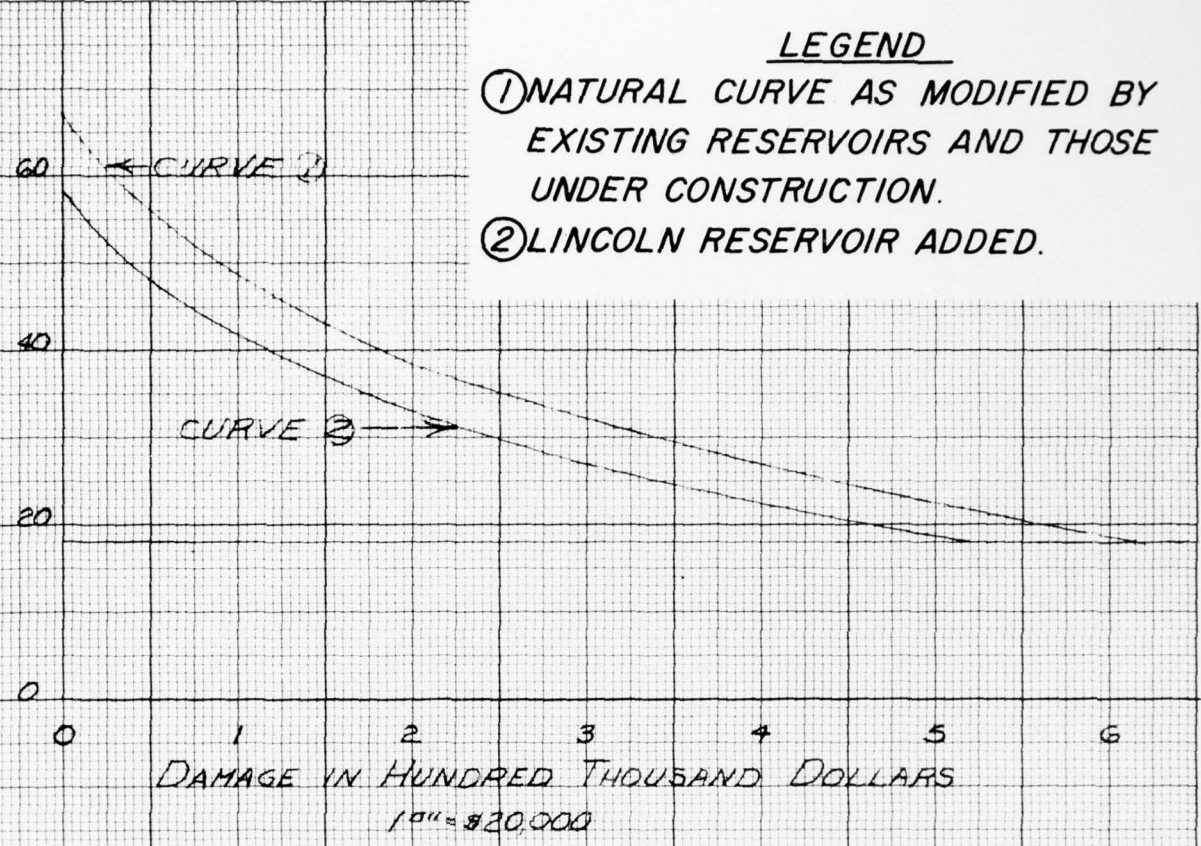
CURVE ①

30 35 40 45
AND DOLLARS



NEETS
FROM CURVE 1)
0,000

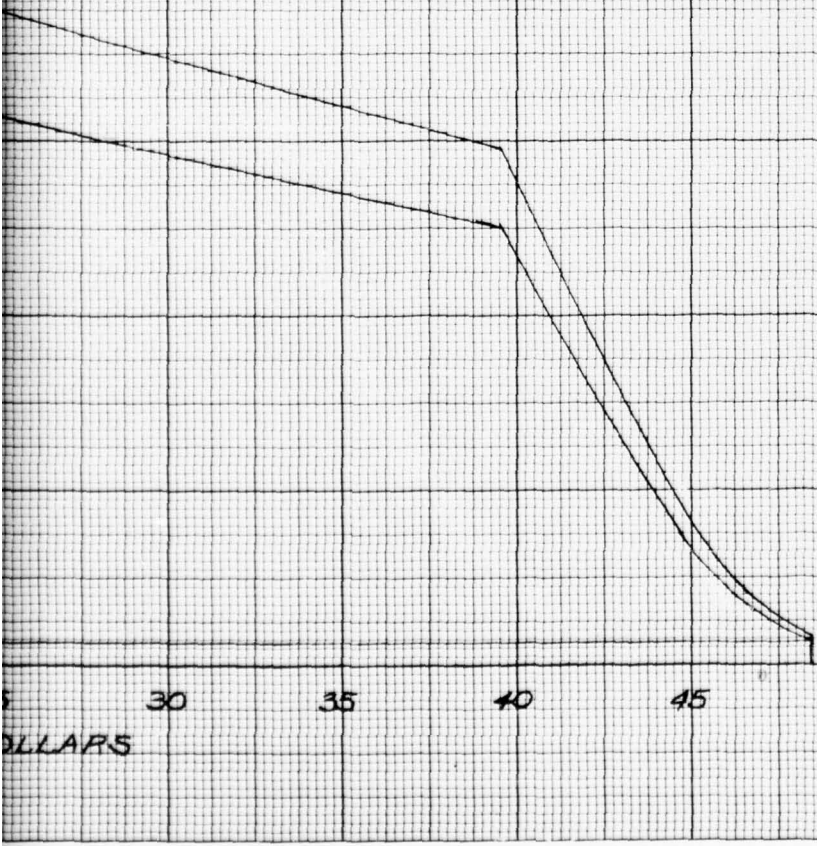
EXCEEDENCE FREQUENCY PER 100 YEARS



LEGEND

- ① NATURAL CURVE AS MODIFIED BY EXISTING RESERVOIRS AND THOSE UNDER CONSTRUCTION.
- ② LINCOLN RESERVOIR ADDED.

DAMAGE IN HUNDRED THOUSAND DOLLARS
1" = \$20,000



WABASH RIVER BASIN
FREQUENCY DAMAGE CURVES
WABASH RIVER
 REACH W-3
 MILE 94.5 TO EMBARRASS RIVER
 U. S. ARMY ENGINEER DISTRICT
 LOUISVILLE, KY.
 ORLED-P JANUARY 1964
 2 PLATE NO. B-7c

EXCEEDENCE FREQUENCY PER 100 YEARS

ADD 1768 "IN" OR 10120, TO AREA UNDER CURVES FOR AREA NOT SHOWN

DAMAGES
(AREA UNDER CURVES)

- ① \$938,000
- ② 272,000

BENEFITS
(DIFF FROM CURVE 1)

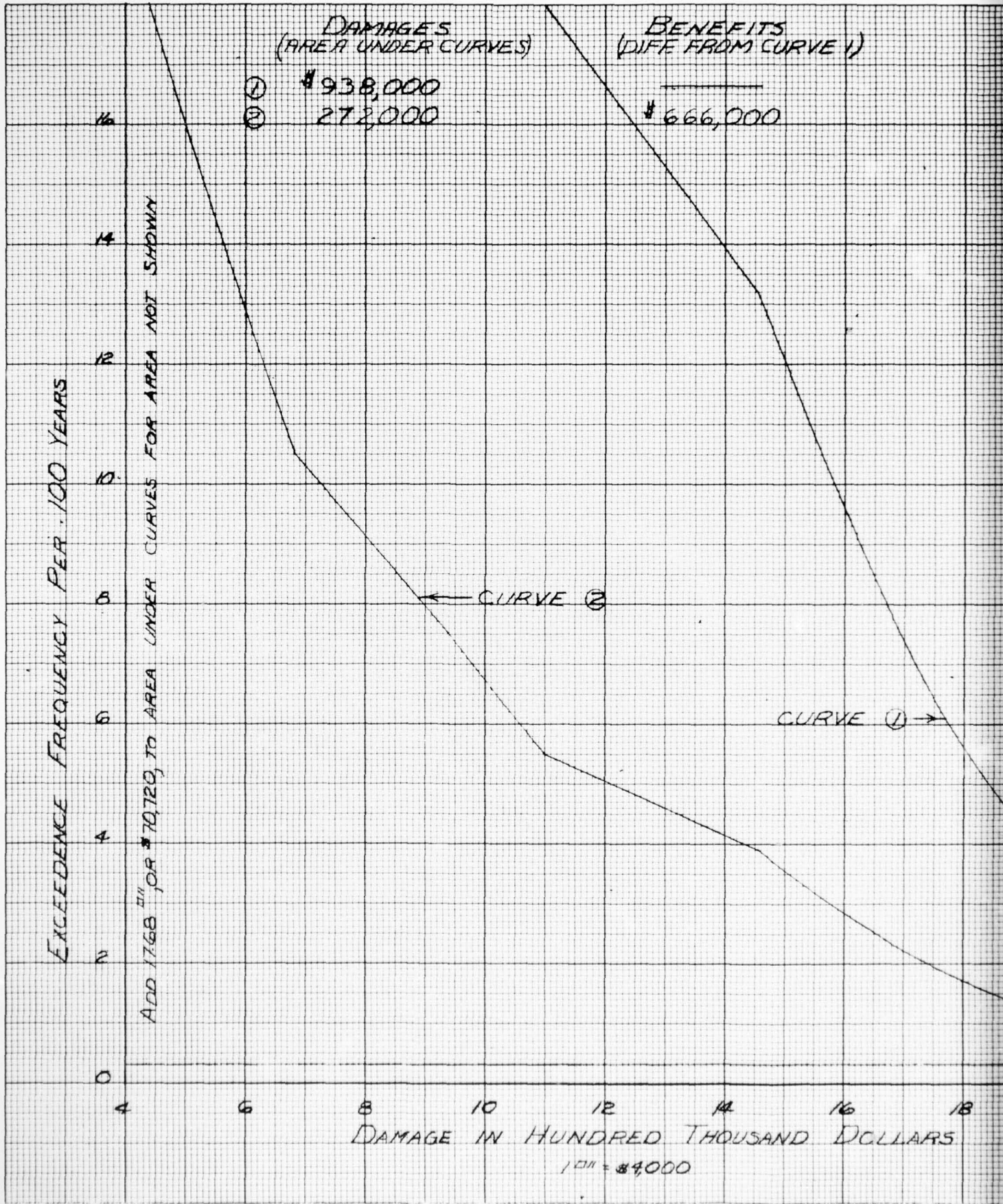
\$666,000

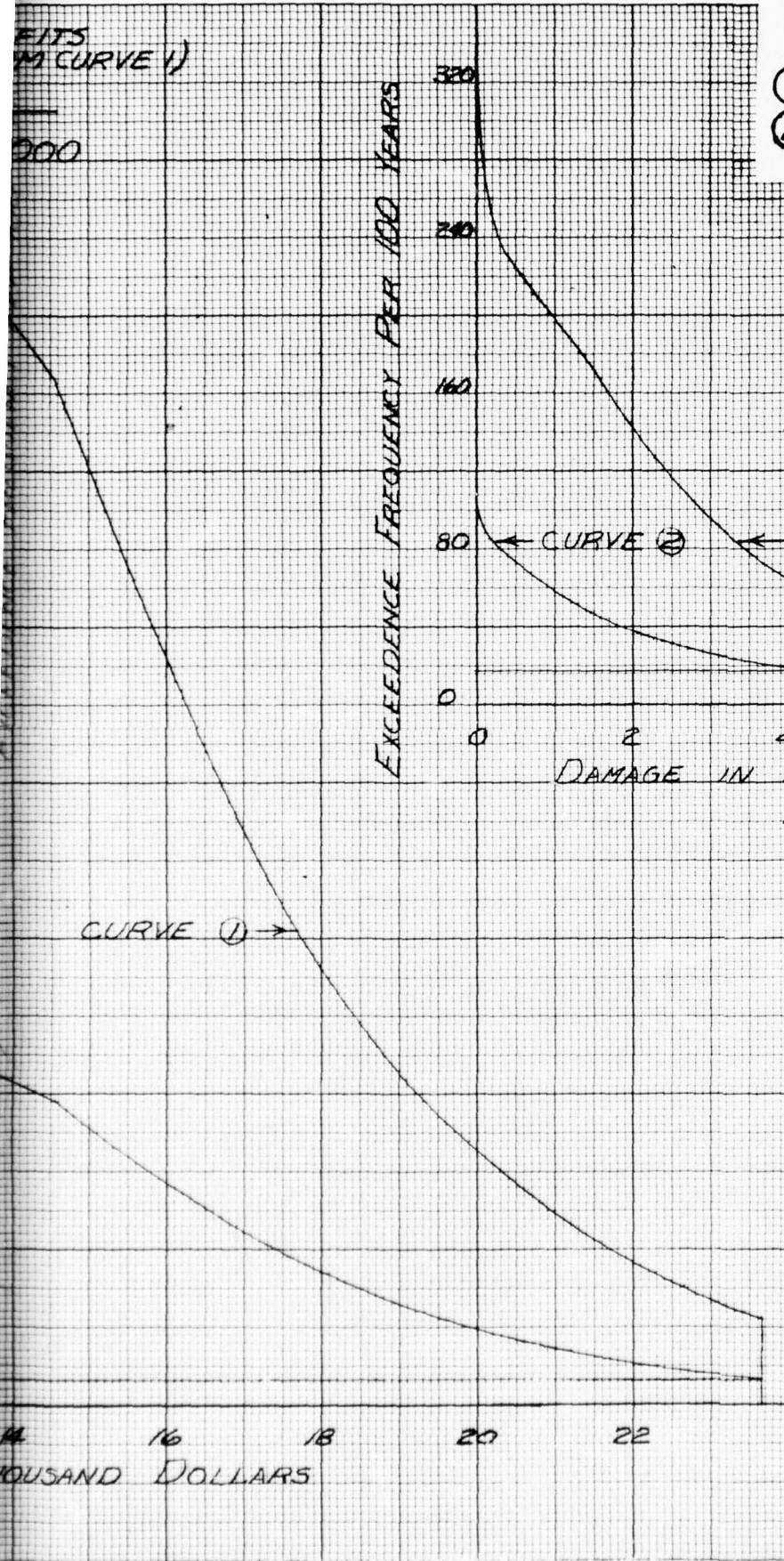
← CURVE ②

CURVE ① →

DAMAGE IN HUNDRED THOUSAND DOLLARS

1" = \$9,000





- LEGEND**
- ① NATURAL CURVE.
 - ② MODIFIED BY LINCOLN RESERVOIR.

WABASH RIVER BASIN
FREQUENCY DAMAGE CURVES
EMBARRASS RIVER
 REACH EM-1
 MILE 0.0 TO MILE 63.8
 U. S. ARMY ENGINEER DISTRICT
 LOUISVILLE, KY.
 ORLED-P JANUARY 1964

DAMAGES (AREA UNDER CURVES), (DIFF FROM CURVE 1)

① \$358,000

② 0

BENEFITS (DIFF FROM CURVE 1)

\$358,000

EXCEEDENCE FREQUENCY PER 100 YEARS

EXCEEDENCE FREQUENCY PER 100 YEARS

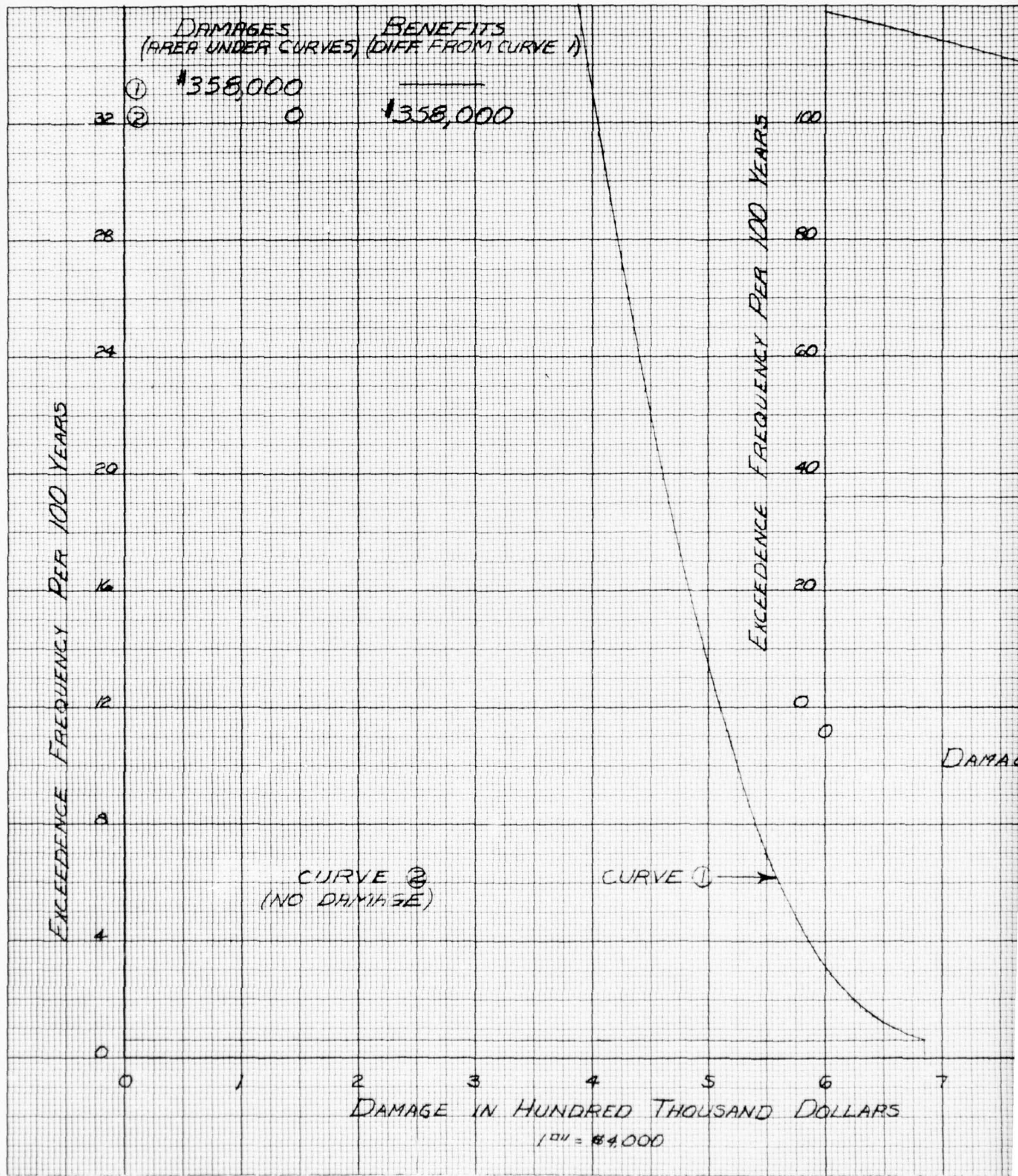
DAMAGE

CURVE ②
(NO DAMAGE)

CURVE ①

DAMAGE IN HUNDRED THOUSAND DOLLARS

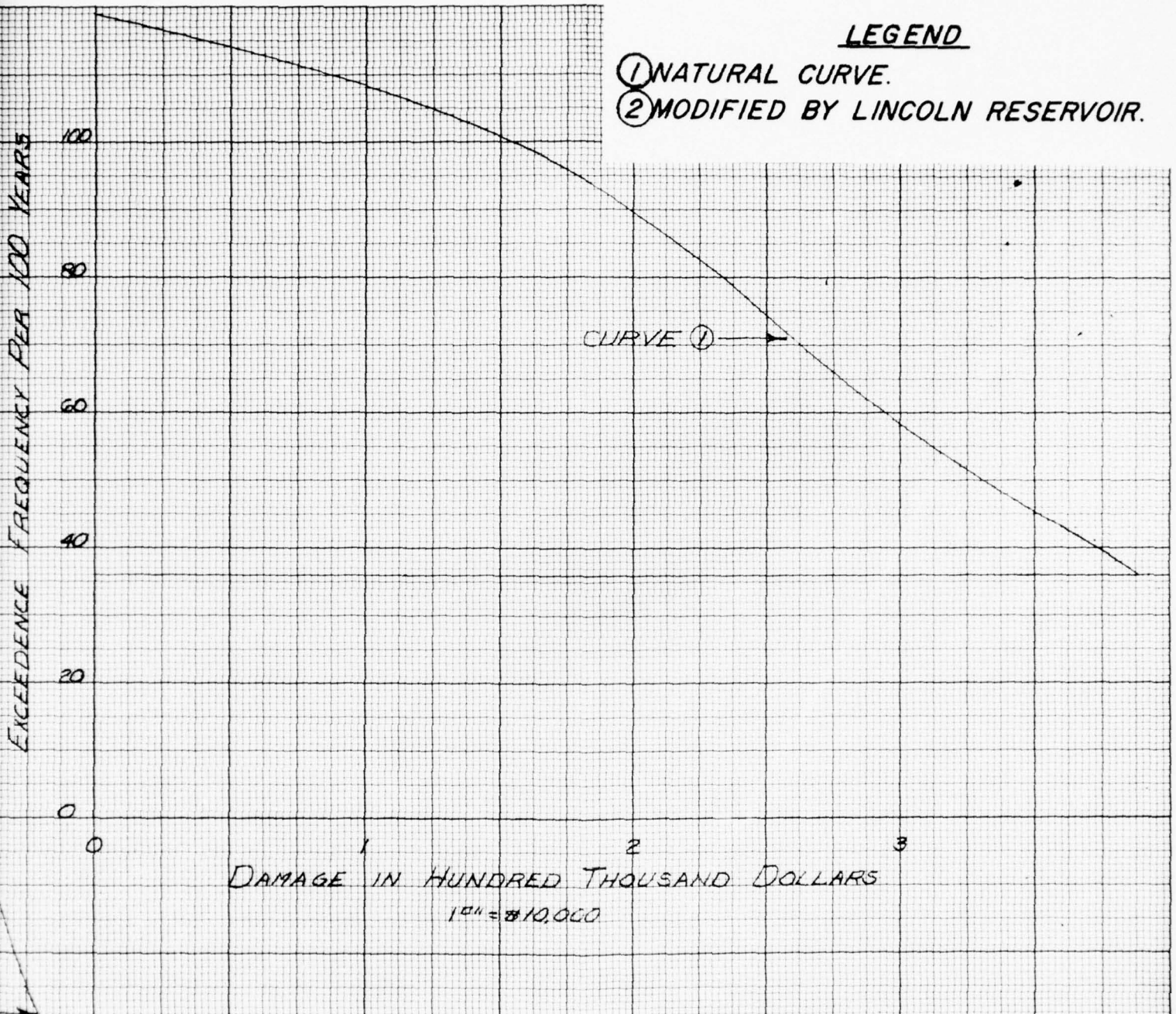
100 = \$4,000



B

LEGEND

- ① NATURAL CURVE.
- ② MODIFIED BY LINCOLN RESERVOIR.



DAMAGE IN HUNDRED THOUSAND DOLLARS
 1" = \$10,000

WABASH RIVER BASIN
 FREQUENCY DAMAGE CURVES
 EMBARRASS RIVER

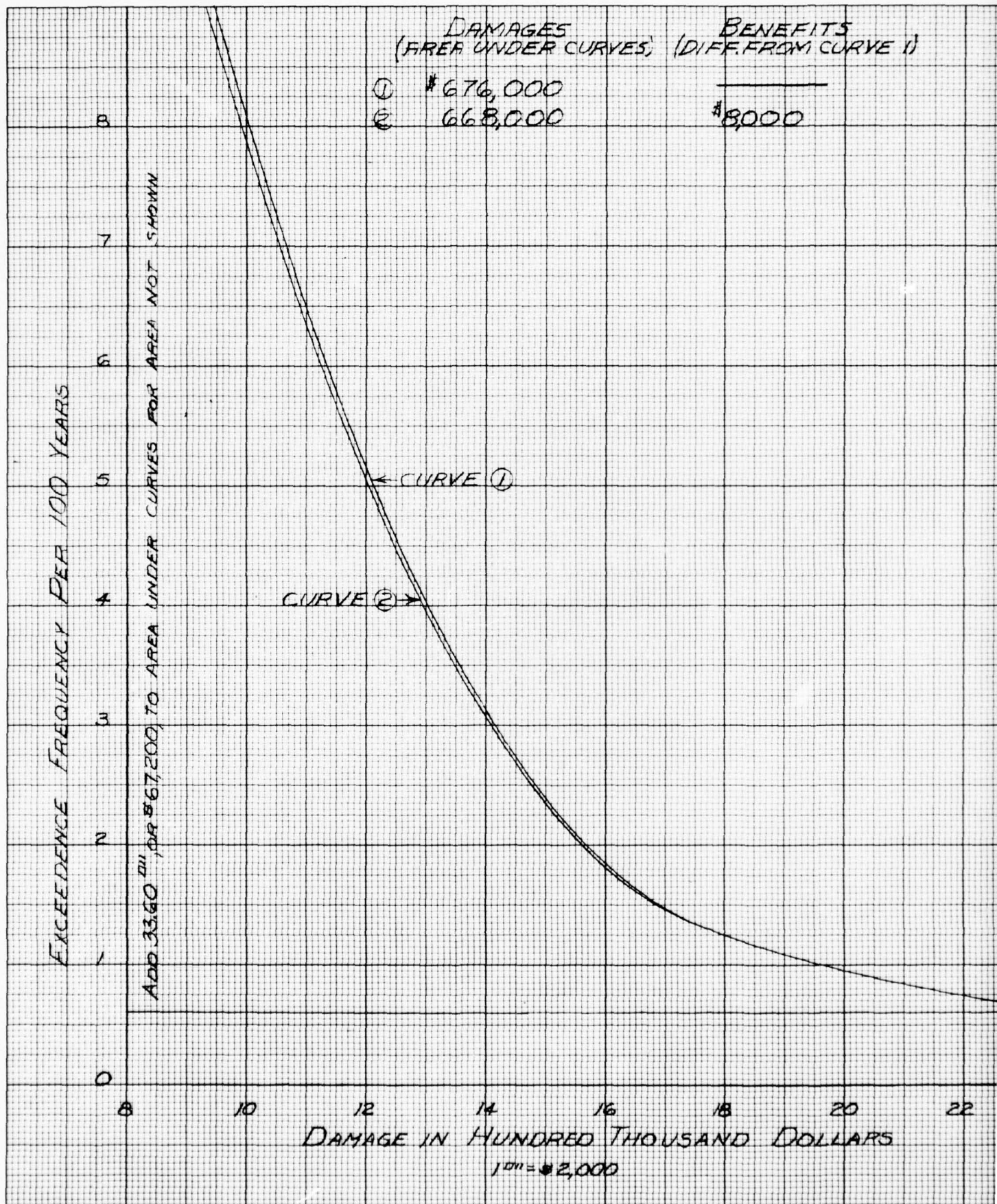
REACH EM-2
 MILE 63.8 TO MILE 103.2

U. S. ARMY ENGINEER DISTRICT
 LOUISVILLE, KY.

ORLED-P JANUARY 1964

2 PLATE NO. B-7e

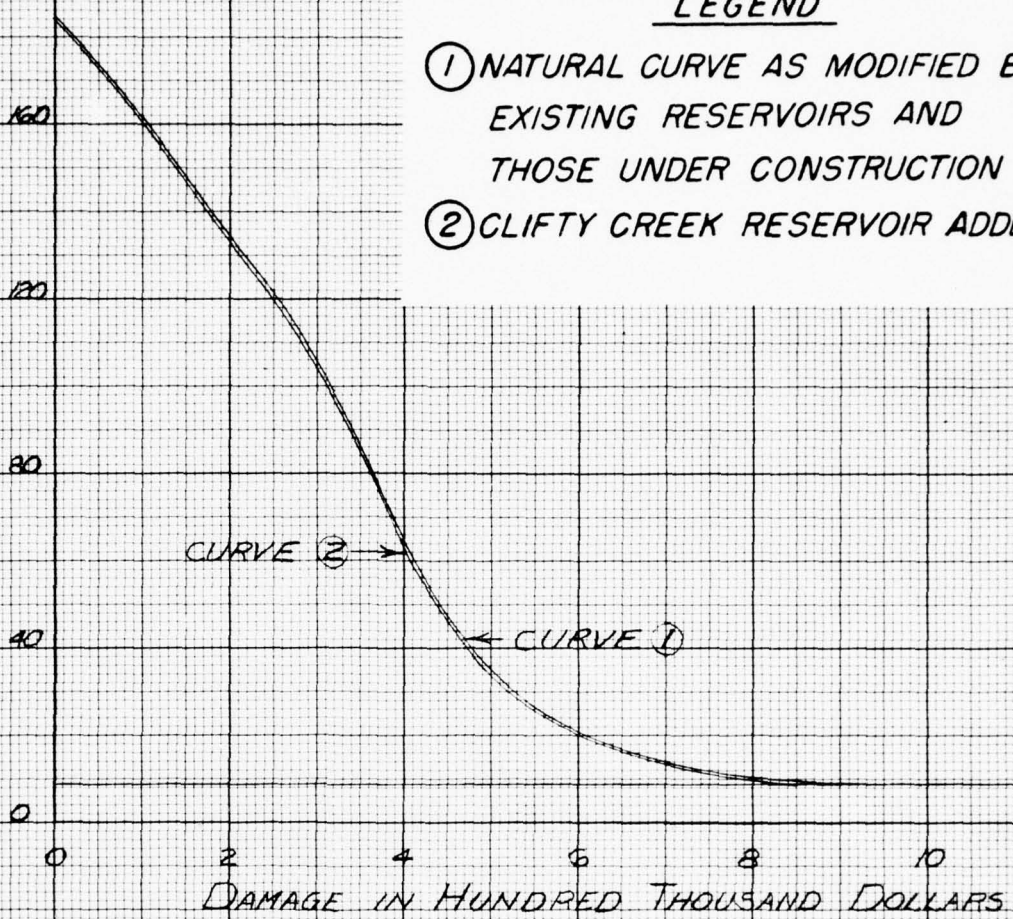
ISAND DOLLARS



BENEFITS FROM CURVE 1)

8000

EXCEEDENCE FREQUENCY PER 100 YEARS



LEGEND

- ① NATURAL CURVE AS MODIFIED BY EXISTING RESERVOIRS AND THOSE UNDER CONSTRUCTION
- ② CLIFTY CREEK RESERVOIR ADDED

DAMAGE IN HUNDRED THOUSAND DOLLARS
100 = \$80,000

**WABASH RIVER BASIN
FREQUENCY DAMAGE CURVES
WABASH RIVER**

REACH W-1
OHIO RIVER TO MILE 40.0

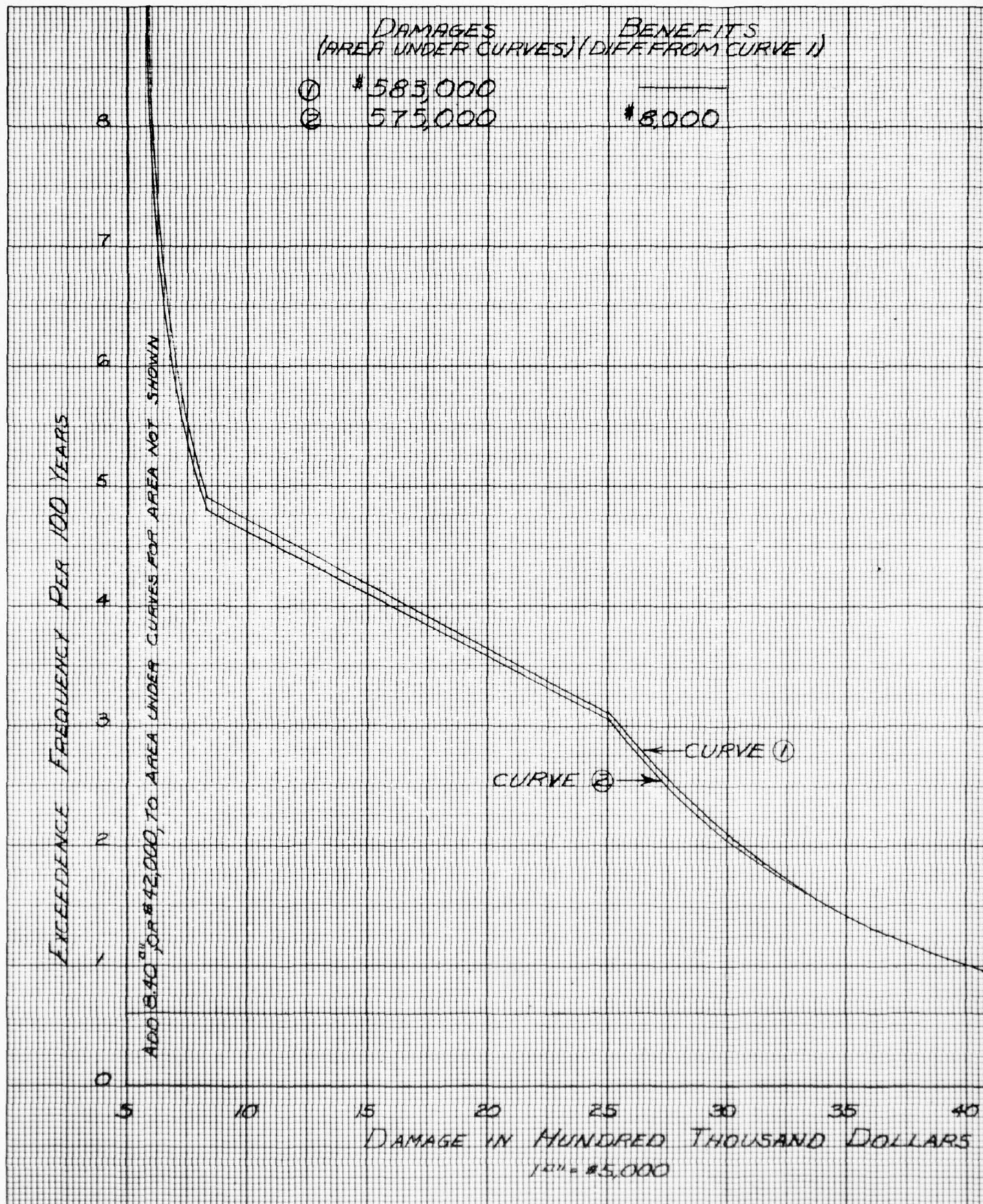
U. S. ARMY ENGINEER DISTRICT
LOUISVILLE, KY.

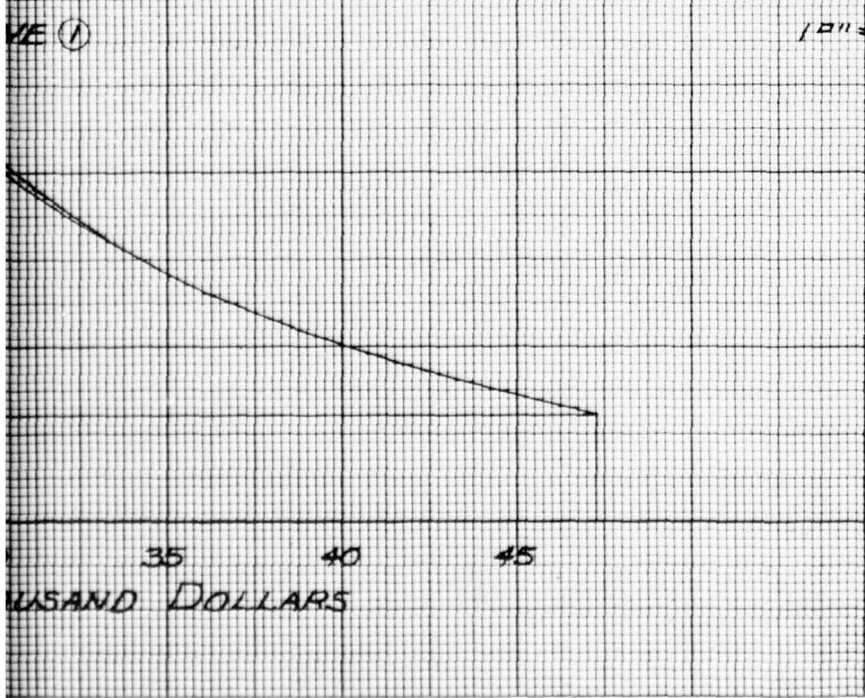
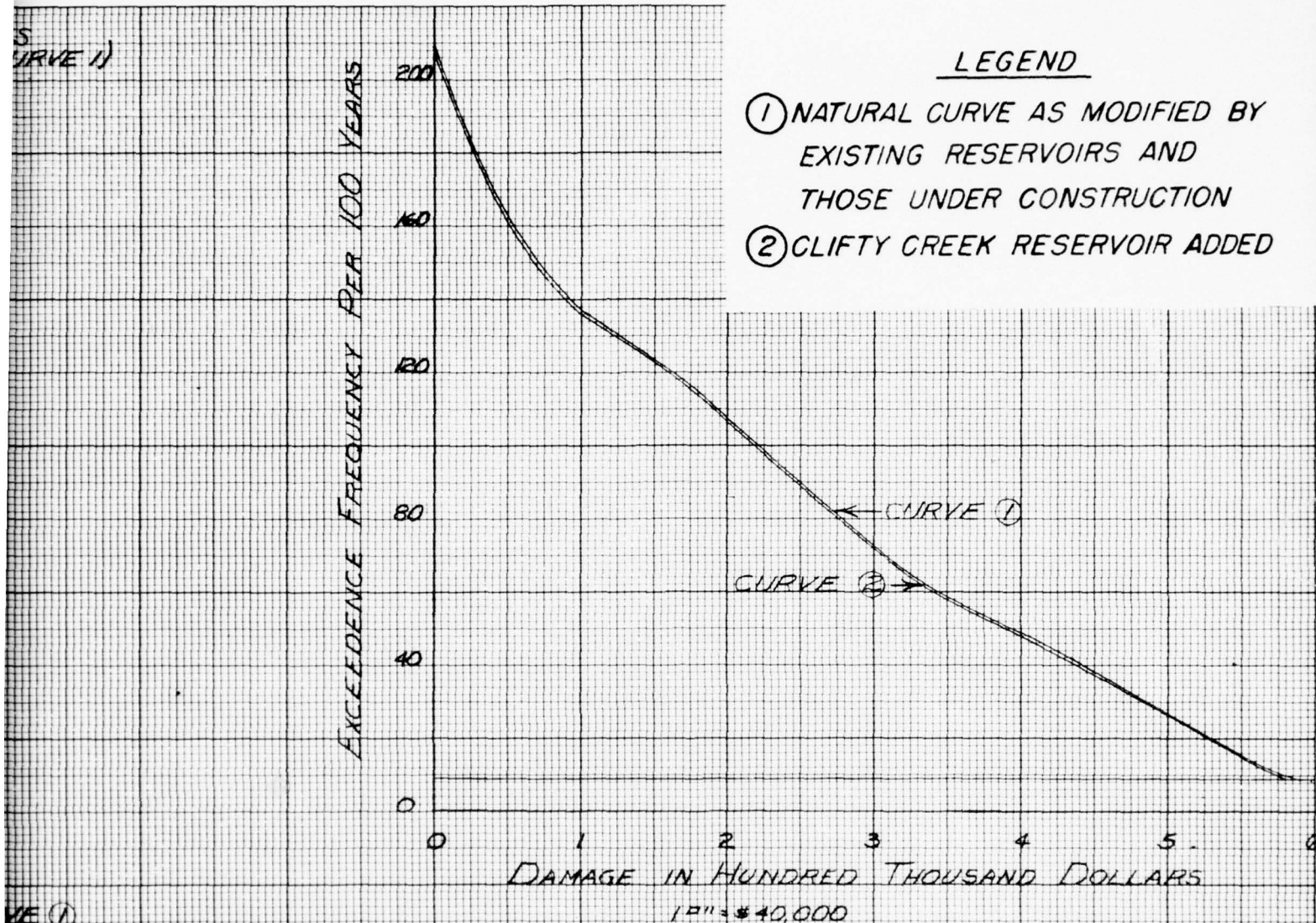
ORLED-P JANUARY 1964

2

PLATE NO. B-7f

20 22 24
DOLLARS





WABASH RIVER BASIN
 FREQUENCY DAMAGE CURVES
 WABASH RIVER

REACH W-2
 MILE 40.0 TO MILE 94.5
 U. S. ARMY ENGINEER DISTRICT
 LOUISVILLE, KY.

ORLED-P JANUARY 1964
 2 PLATE NO. B-7g

EXCEEDENCE FREQUENCY PER 100 YEARS

16
14
12
10
8
6
4
2
0

ADD 34.72 "OR" 34,720 TO AREA UNDER CURVES FOR AREA NOT SHOWN

DAMAGES (AREA UNDER CURVES) (DIFF. FROM CURVE 1)

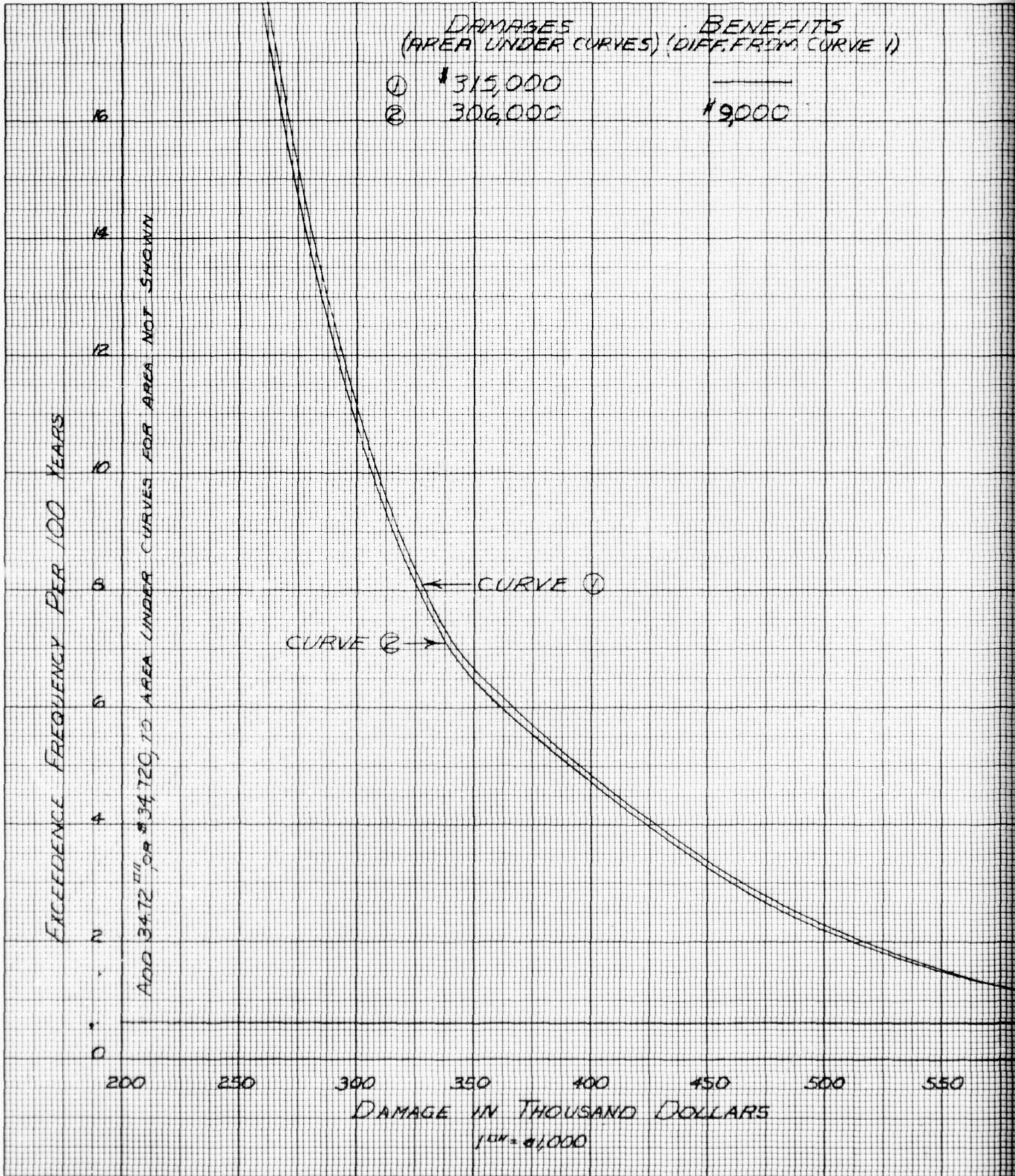
- ① 315,000
- ② 306,000

BENEFITS (DIFF. FROM CURVE 1)
19,000

CURVE ①
CURVE ②

200 250 300 350 400 450 500 550

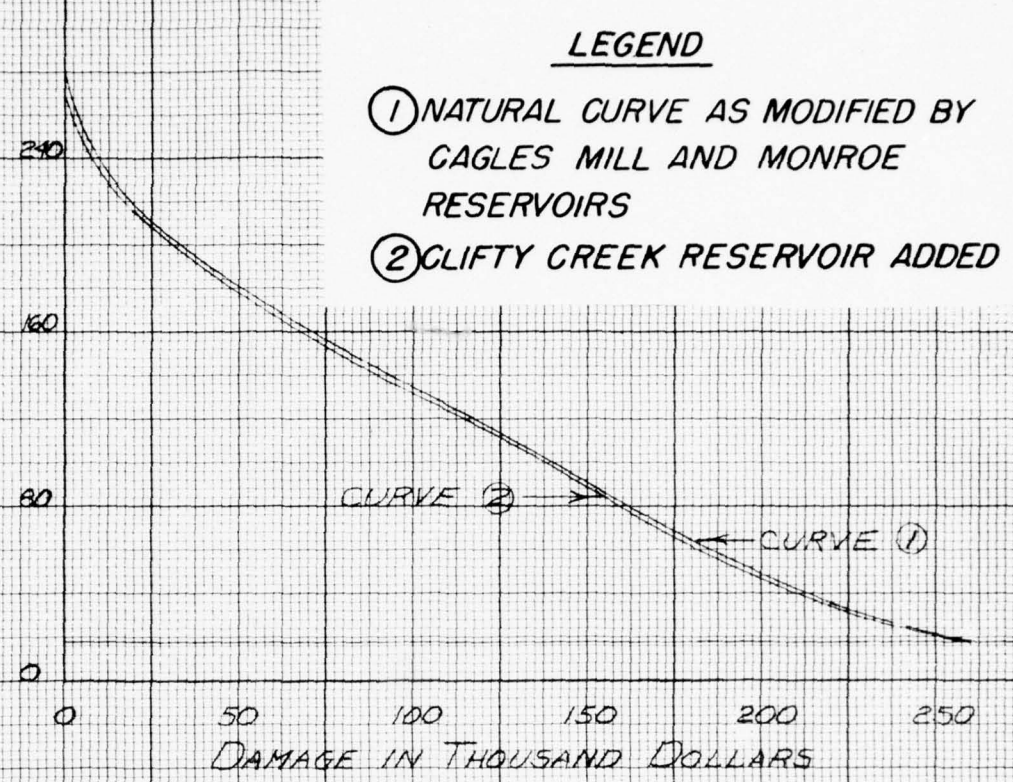
DAMAGE IN THOUSAND DOLLARS
1 UNIT = \$1,000



INFEASIBLE
FROM CURVE 1)

000

EXCEEDENCE FREQUENCY PER 100 YEARS

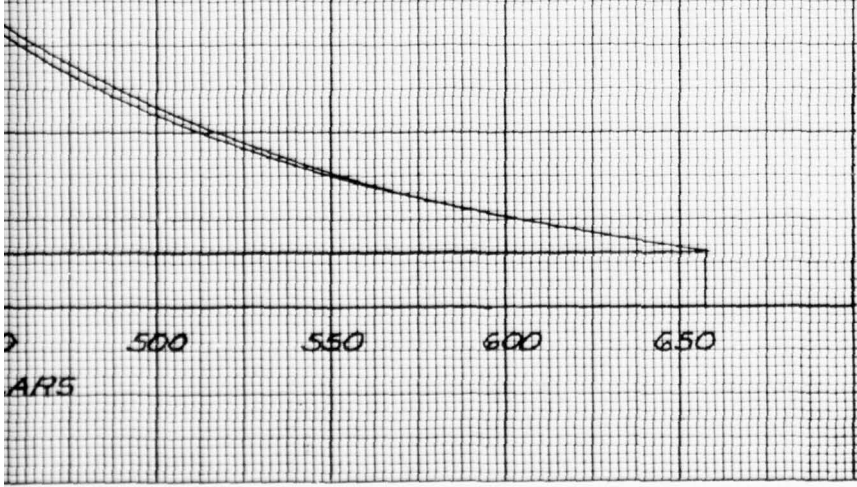


LEGEND

- ① NATURAL CURVE AS MODIFIED BY GABLES MILL AND MONROE RESERVOIRS
- ② CLIFTY CREEK RESERVOIR ADDED

CURVE ② →

← CURVE ①



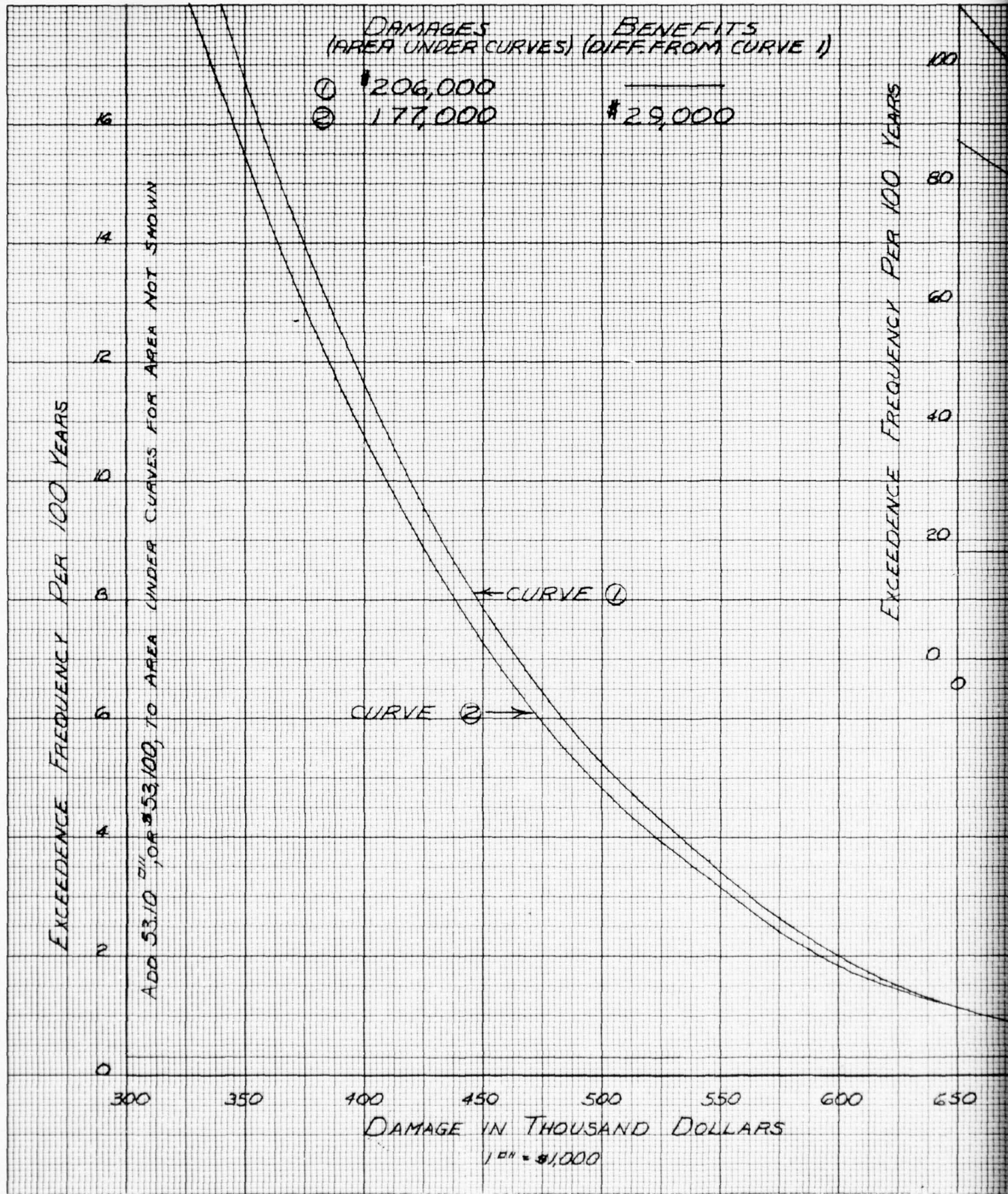
WABASH RIVER BASIN
FREQUENCY DAMAGE CURVES
WHITE RIVER
REACH WH-1

MILE 0.0 TO MILE 51.6

U. S. ARMY ENGINEER DISTRICT
LOUISVILLE, KY.

ORLED-P JANUARY 1964

2 PLATE NO. B-7h



FITS
OM CURVE 1)

200

EXCEEDENCE FREQUENCY PER 100 YEARS

100
80
60
40
20
0

0 50 100 150 200 250 300

DAMAGE IN THOUSAND DOLLARS

1" = \$10,000

LEGEND

- ① NATURAL CURVE AS MODIFIED BY MONROE RESERVOIR
- ② GLIFTY CREEK RESERVOIR ADDED

CURVE ② →

← CURVE ①



**WABASH RIVER BASIN
FREQUENCY DAMAGE CURVES
EAST FORK WHITE RIVER**

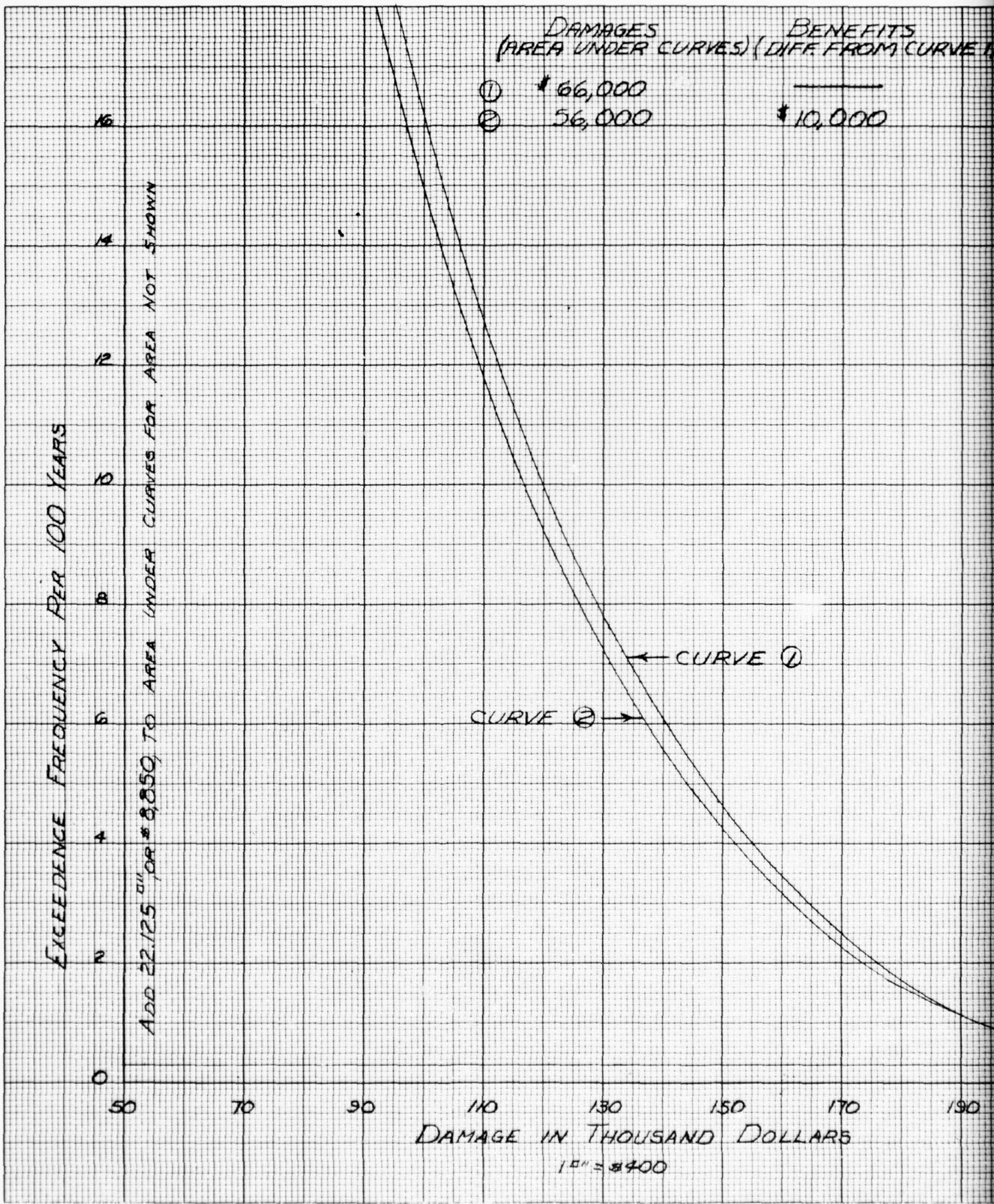
REACH EW-1
MILE 51.6 TO MILE 111.9

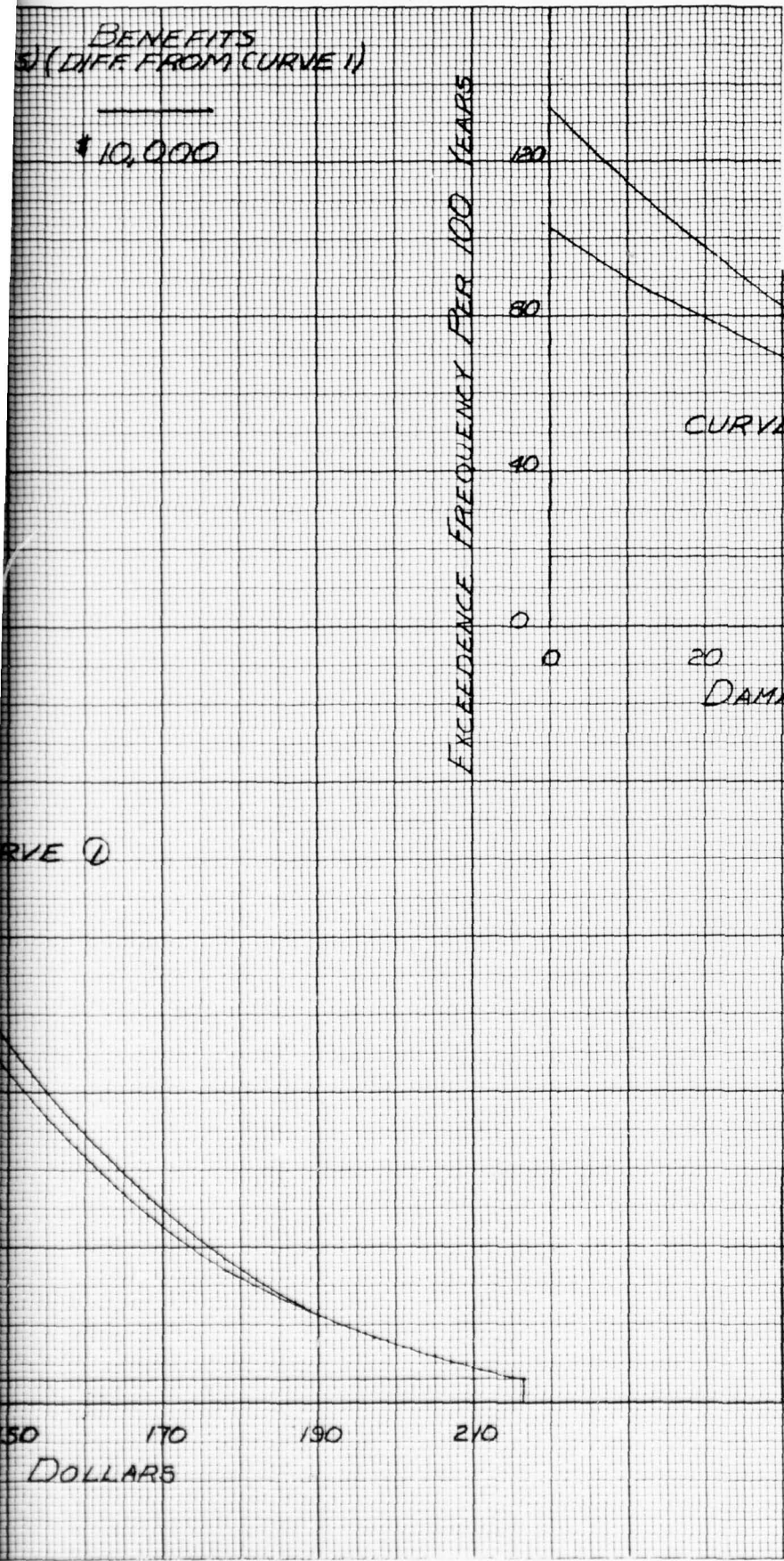
U. S. ARMY ENGINEER DISTRICT
LOUISVILLE, KY.

ORLED-P JANUARY 1964

2

PLATE NO. B-76





- LEGEND
- ① NATURAL CURVE AS MODIFIED BY MONROE RESERVOIR
 - ② CLIFTY CREEK RESERVOIR ADDED

WABASH RIVER BASIN
 FREQUENCY DAMAGE CURVES
 EAST FORK WHITE RIVER
 REACH EW-2
 MILE 111.9 TO MILE 142.9
 U. S. ARMY ENGINEER DISTRICT
 LOUISVILLE, KY.
 ORLED-P JANUARY 1964
 PLATE NO. B-7j

EXCEEDENCE FREQUENCY PER 100 YEARS

32
28
24
20
16
12
8
4
0

ADD 1947th OF \$63,580 TO AREA UNDER CURVES FOR AREA NOT SHOWN

DAMAGES (AREA UNDER CURVES) BENEFITS (DIFF. FROM CURVE 1)

① \$455,000
② 400,000

\$55,000

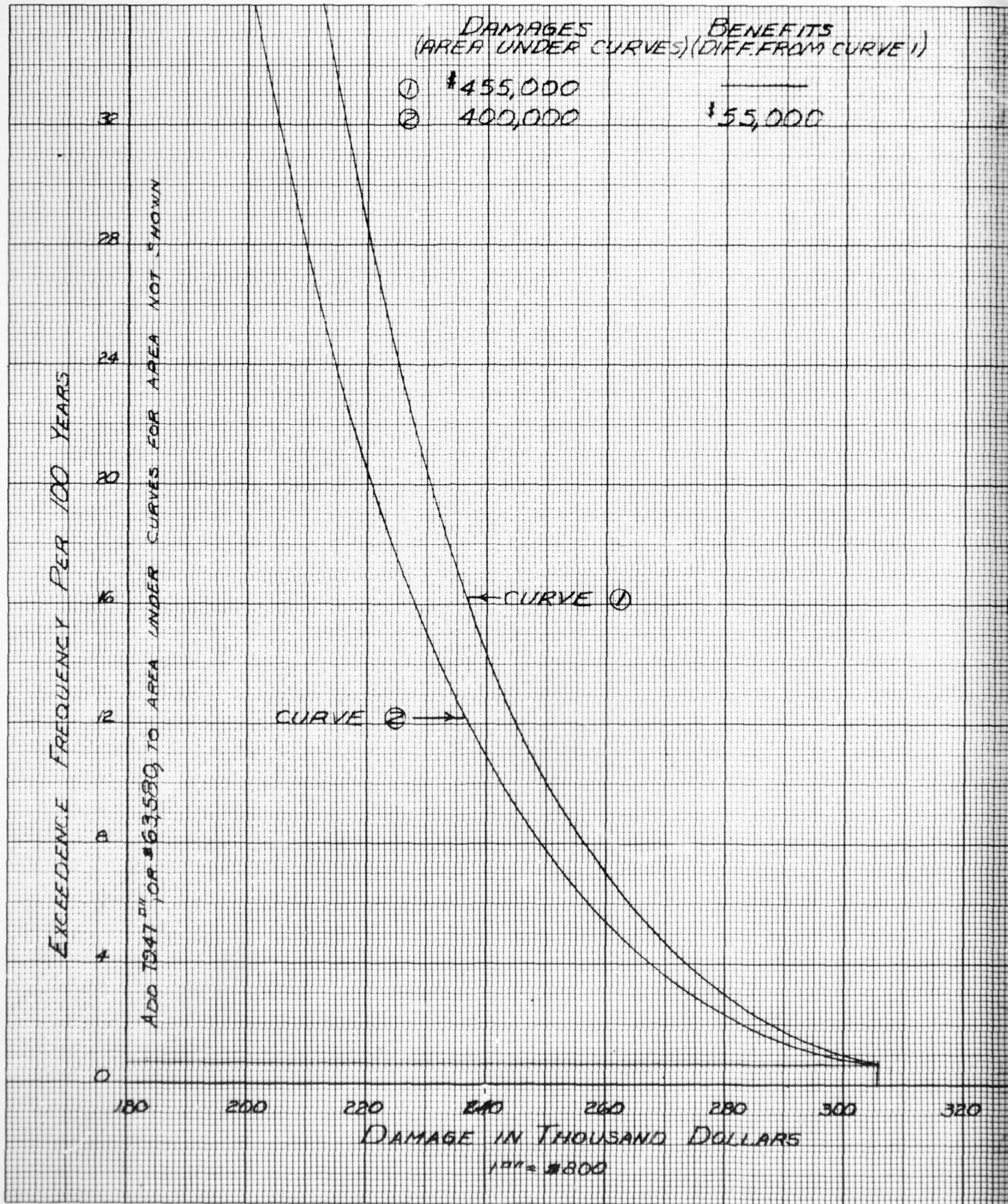
← CURVE ①

CURVE ② →

180 200 220 240 260 280 300 320

DAMAGE IN THOUSAND DOLLARS

1" = \$800



BENEFITS
FROM CURVE 1)

5,000

EXCEEDENCE FREQUENCY PER 100 YEARS

500
400
300
200
100
0

CURVE ② →

← CURVE ①

DAMAGE IN THOUSAND DOLLARS

1" = \$50,000

LEGEND

- ① NATURAL CURVE
- ② MODIFIED BY CLIFTY CREEK RESERVOIR

300 320 340
DOLLARS

**WABASH RIVER BASIN
FREQUENCY DAMAGE CURVES
EAST FORK WHITE RIVER**

REACH EW-3

MILE 142.9 TO MILE 1837

U. S. ARMY ENGINEER DISTRICT
LOUISVILLE, KY.

ORLED-P JANUARY 1964

PLATE NO. B-7K

EXCEEDENCE FREQUENCY PER 100 YEARS

ADD 6174⁰⁰, OR \$246,960, TO AREA UNDER CURVES FOR AREA NOT SHOWN

DAMAGES (AREA UNDER CURVES) (DIFF. FROM CURVE 1)

① \$1,715,000
② 1,513,000

BENEFITS (DIFF. FROM CURVE 1)

\$202,000

32

28

24

20

16

12

8

4

0

7

8

9

10

11

12

13

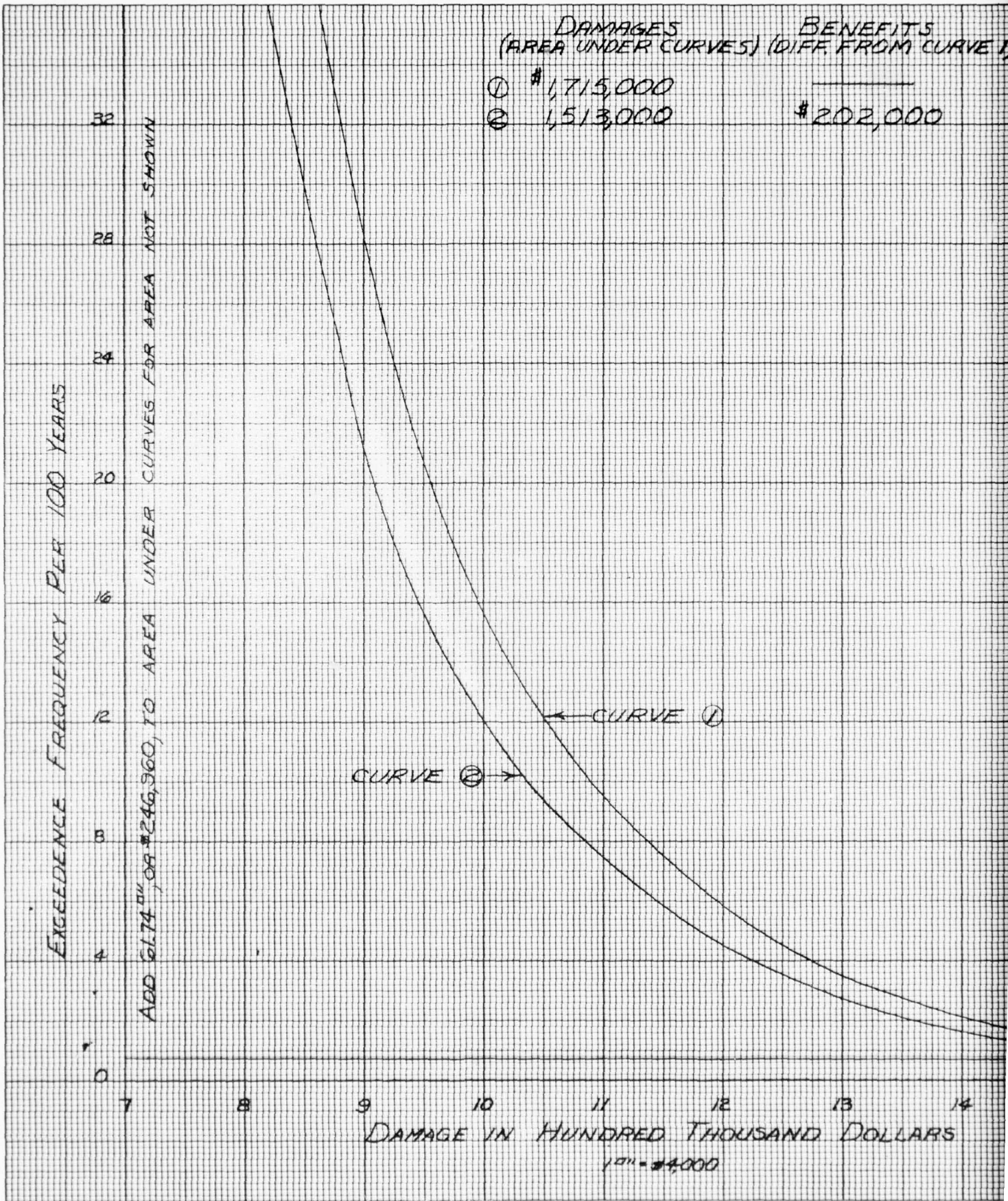
14

DAMAGE IN HUNDRED THOUSAND DOLLARS

1⁰⁰ = \$4,000

CURVE ② →

← CURVE ①



BENEFITS
(5) (DIFF. FROM CURVE 1)

\$202,000

EXCEEDENCE FREQUENCY PER 100 YEARS

500
400
300
200
100
0

DAMAGE IN HUNDRED THOUSAND DOLLARS
1 DIV = \$200,000

CURVE ② →

← CURVE ①

LEGEND

- ① NATURAL CURVE
- ② MODIFIED BY CLIFTY CREEK RESERVOIR

13 14 15 16
HUNDRED DOLLARS

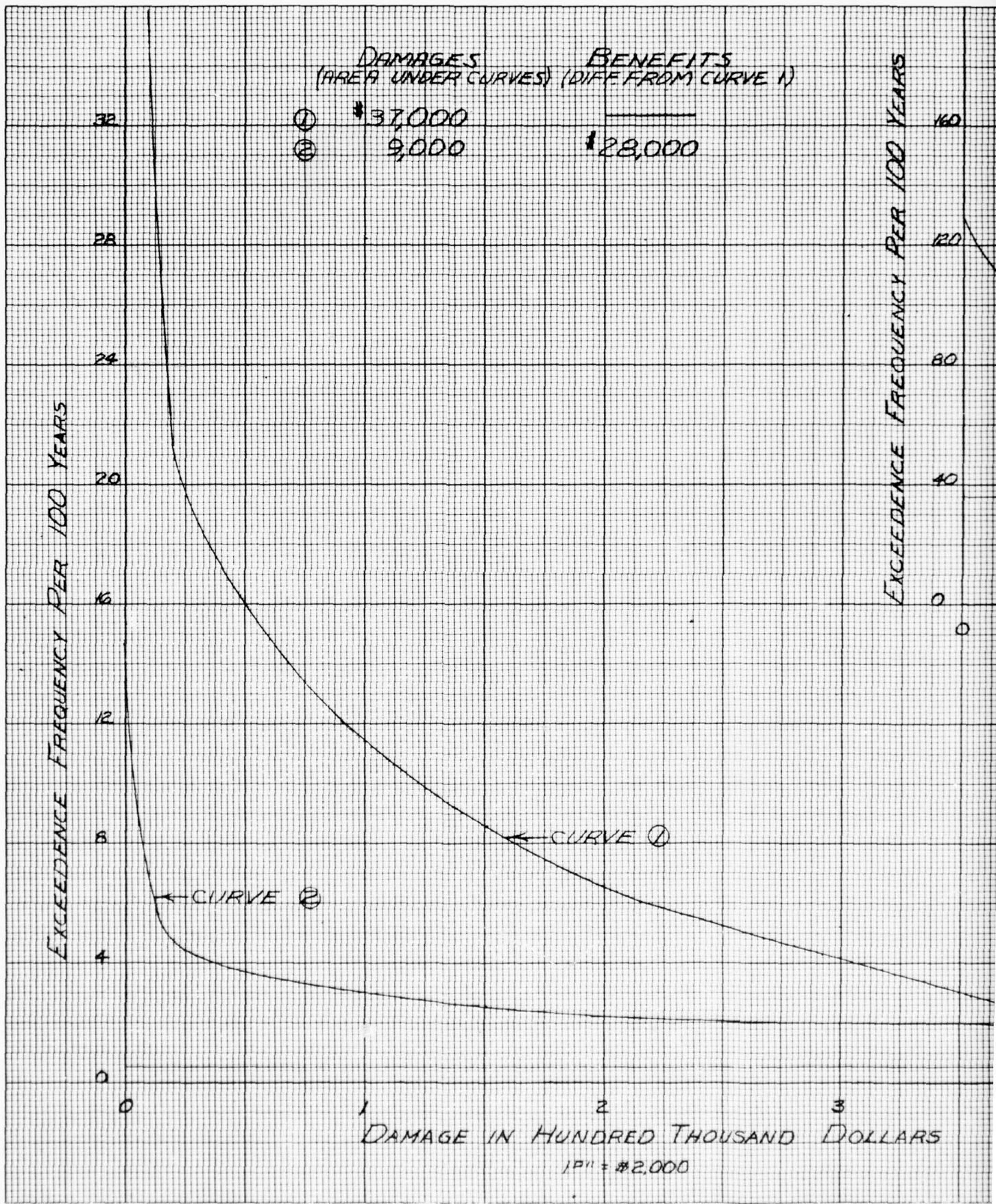
WABASH RIVER BASIN
FREQUENCY DAMAGE CURVES
EAST FORK WHITE RIVER

REACH EW-4
MILE 183.7 TO MILE 238.3

U. S. ARMY ENGINEER DISTRICT
LOUISVILLE, KY.

ORLED-P JANUARY 1964

2 PLATE NO. B-74



EXCEEDENCE FREQUENCY PER 100 YEARS

160
120
80
40
0

DAMAGE IN THOUSAND DOLLARS
1" = \$800

CURVE ①

LEGEND

- ① NATURAL CURVE
- ② MODIFIED BY CLIFTY CREEK RESERVOIR

WABASH RIVER BASIN
 FREQUENCY DAMAGE CURVES
 CLIFTY CREEK

REACH CC-1

MILE 0.0 TO MILE 18.4

U. S. ARMY ENGINEER DISTRICT
LOUISVILLE, KY.

ORLED-P JANUARY 1964

PLATE NO. B-7m

(S
CURVE 1)

THOUSAND DOLLARS

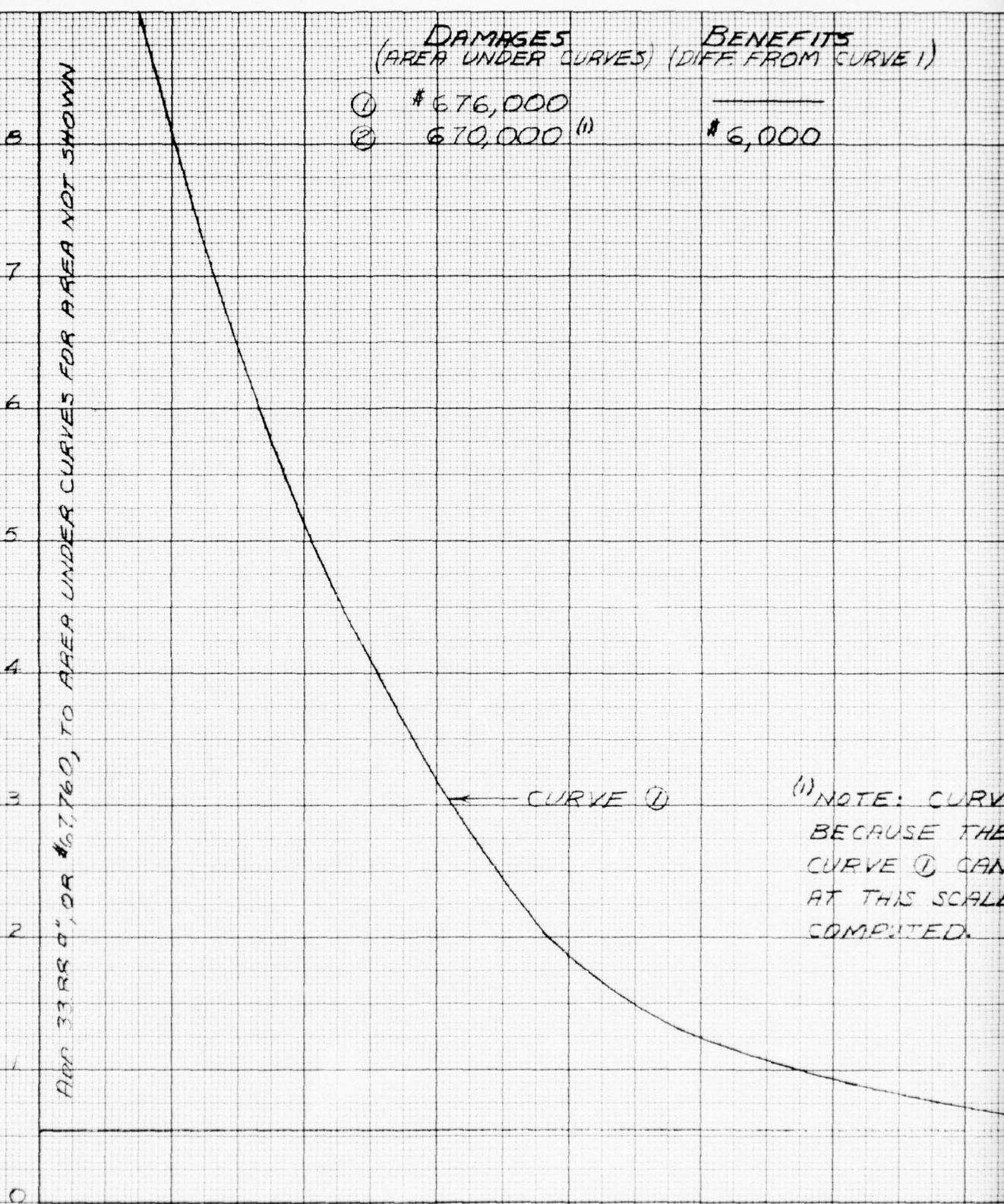
EXCEEDENCE FREQUENCY FOR 100 YEARS

APR 33 RS 9", OR \$6,7760, TO AREA UNDER CURVES FOR AREA NOT SHOWN

DAMAGES (AREA UNDER CURVES) BENEFITS (DIFF. FROM CURVE 1)

① \$676,000
② 670,000 (1)

\$6,000

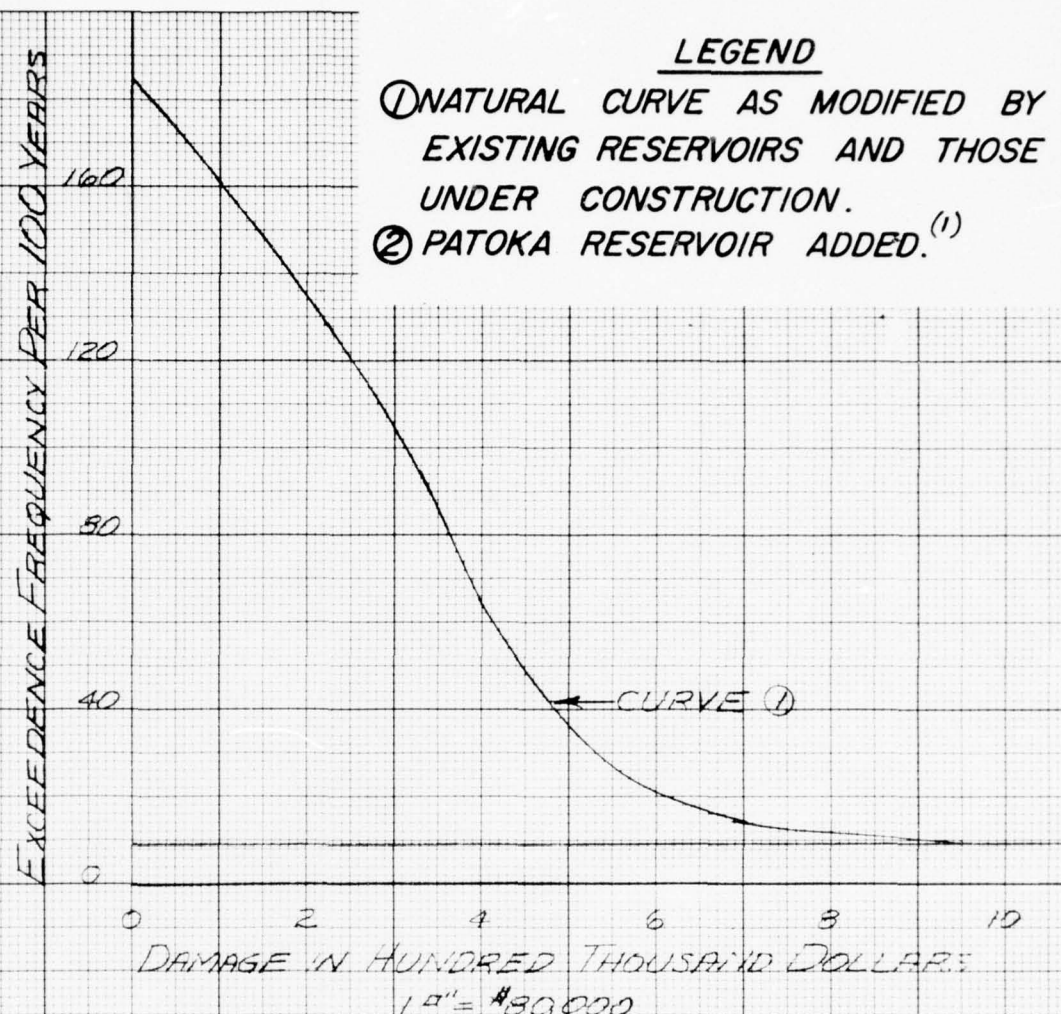


(1) NOTE: CURVE BECAUSE THE CURVE ① CAN AT THIS SCALE COMPUTED.

DAMAGE IN HUNDRED THOUSAND DOLLARS
1.0" = \$2,000

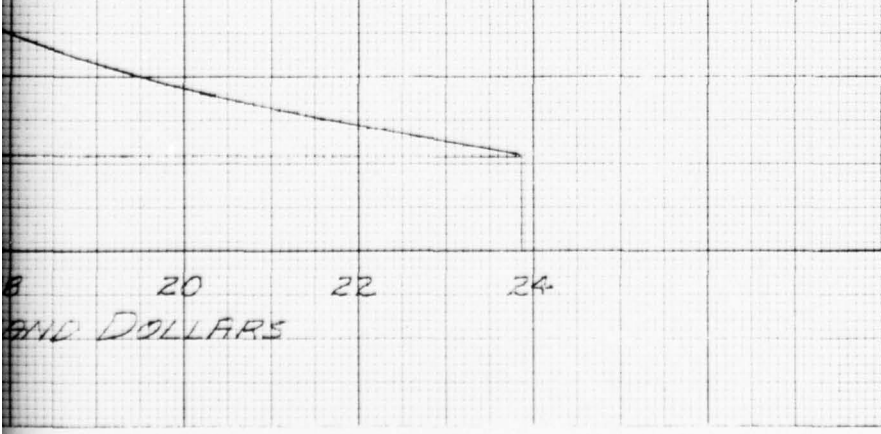
BENEFITS
FF. FROM CURVE 1)

\$6,000

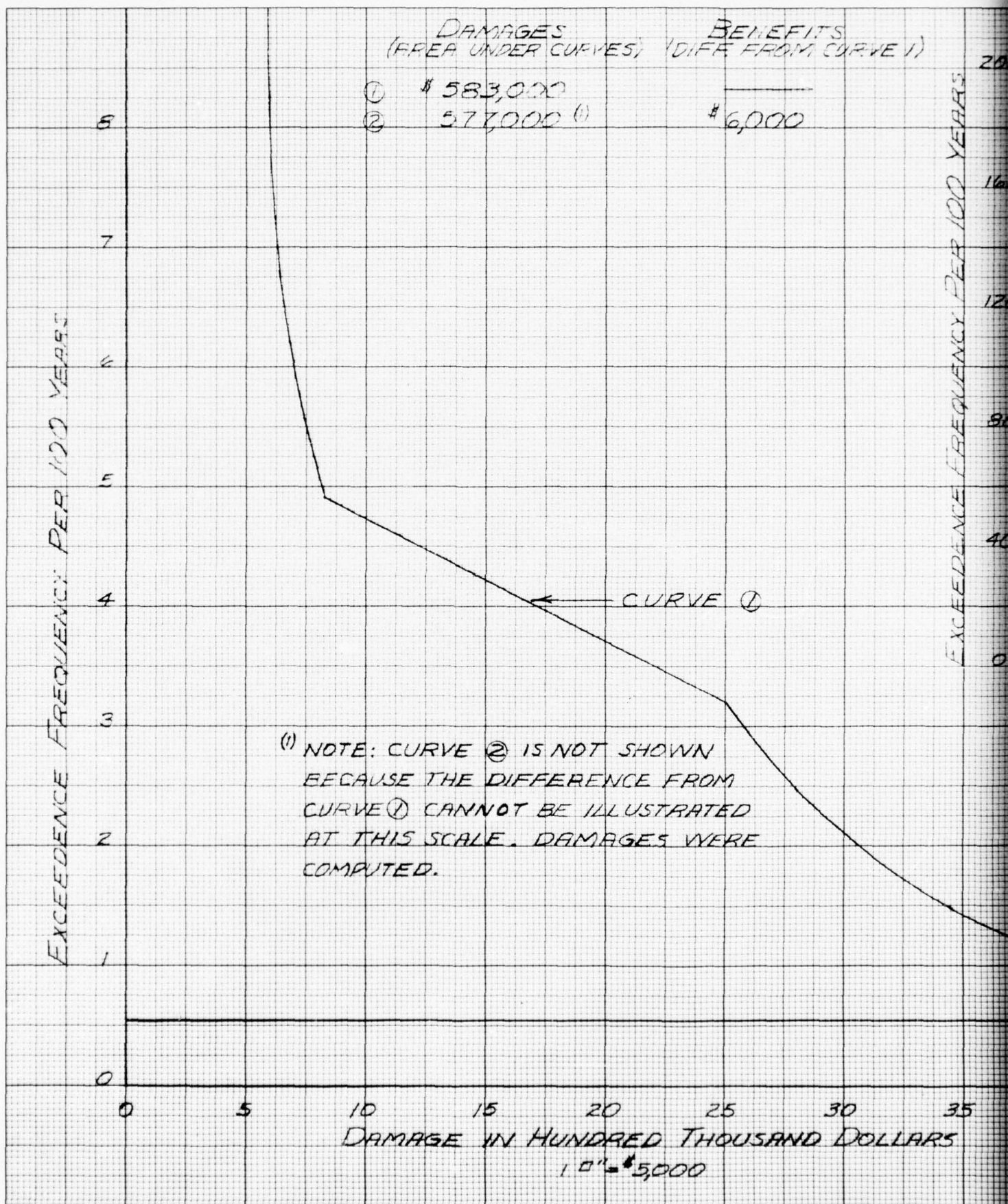


- LEGEND
- ① NATURAL CURVE AS MODIFIED BY EXISTING RESERVOIRS AND THOSE UNDER CONSTRUCTION.
 - ② PATOKA RESERVOIR ADDED. ⁽¹⁾

(1) NOTE: CURVE ② IS NOT SHOWN BECAUSE THE DIFFERENCE FROM CURVE ① CANNOT BE ILLUSTRATED AT THIS SCALE. DAMAGES WERE COMPUTED.



WABASH RIVER BASIN
 FREQUENCY DAMAGE CURVES
 WABASH RIVER
 REACH W-1
 OHIO RIVER TO MILE 40.0
 U. S. ARMY ENGINEER DISTRICT
 LOUISVILLE, KY.
 ORLED-P JANUARY 1964



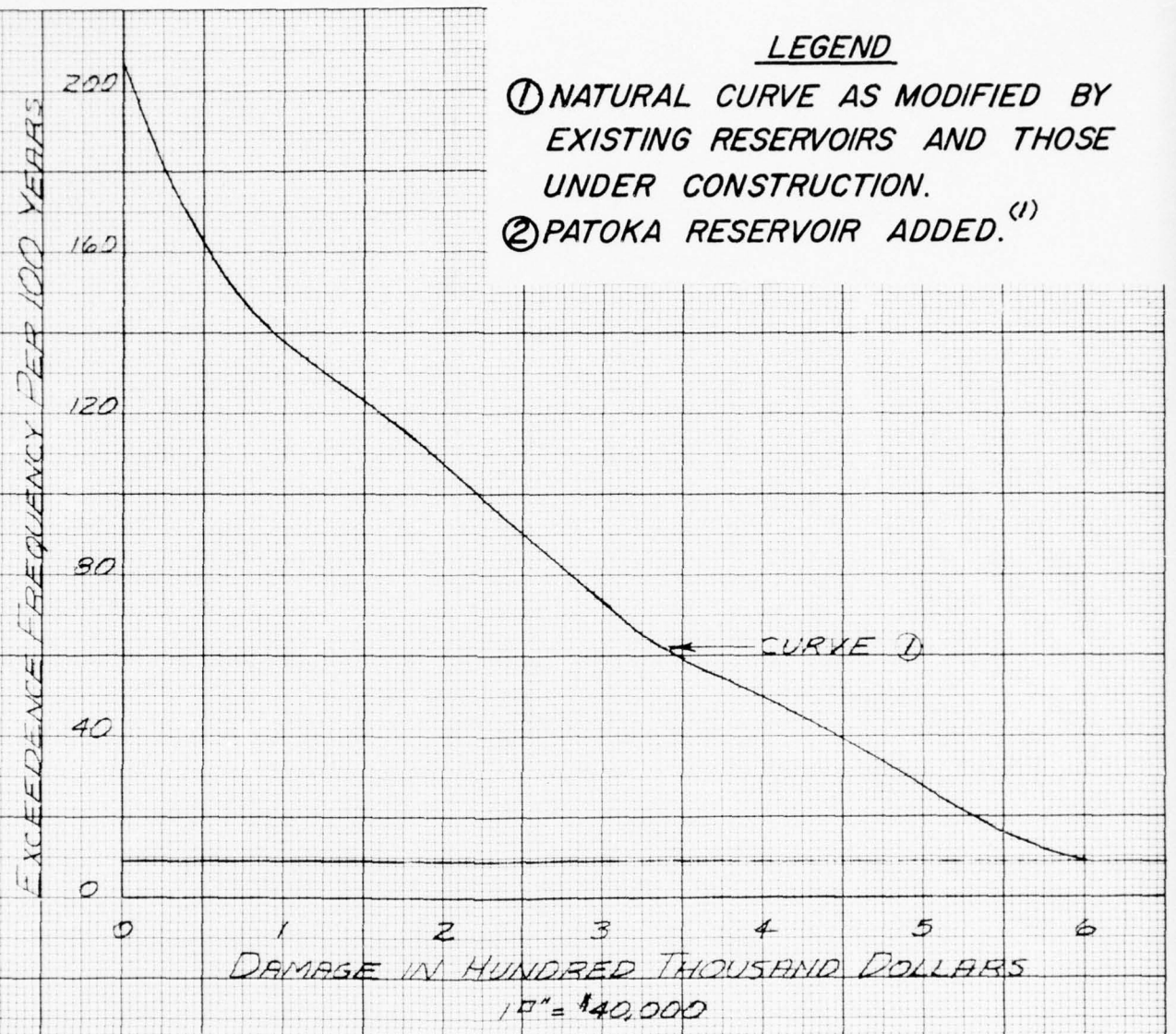
BENEFITS FROM CURVE 1)

5,000

①

D
RE

30 35 40 45
THOUSAND DOLLARS



LEGEND

- ① NATURAL CURVE AS MODIFIED BY EXISTING RESERVOIRS AND THOSE UNDER CONSTRUCTION.
- ② PATOKA RESERVOIR ADDED. ⁽¹⁾

WABASH RIVER BASIN
 FREQUENCY DAMAGE CURVES
 WABASH RIVER
 REACH W-2
 MILE 400 TO PATOKA RIVER
 U. S. ARMY ENGINEER DISTRICT
 LOUISVILLE, KY.

ORLED-P JANUARY 1964

PLATE NO. B-70

EXCEEDENCE FREQUENCY PER 100 YEARS

0
4
8
12
16
20
24
28
32

ADD 349.60 " OR \$55,240 TO AREA UNDER CURVES FOR AREA NOT SHOWN

DAMAGE IN THOUSAND DOLLARS
1" = \$160

DAMAGES (AREA UNDER CURVES) (DIFF FROM CURVE)

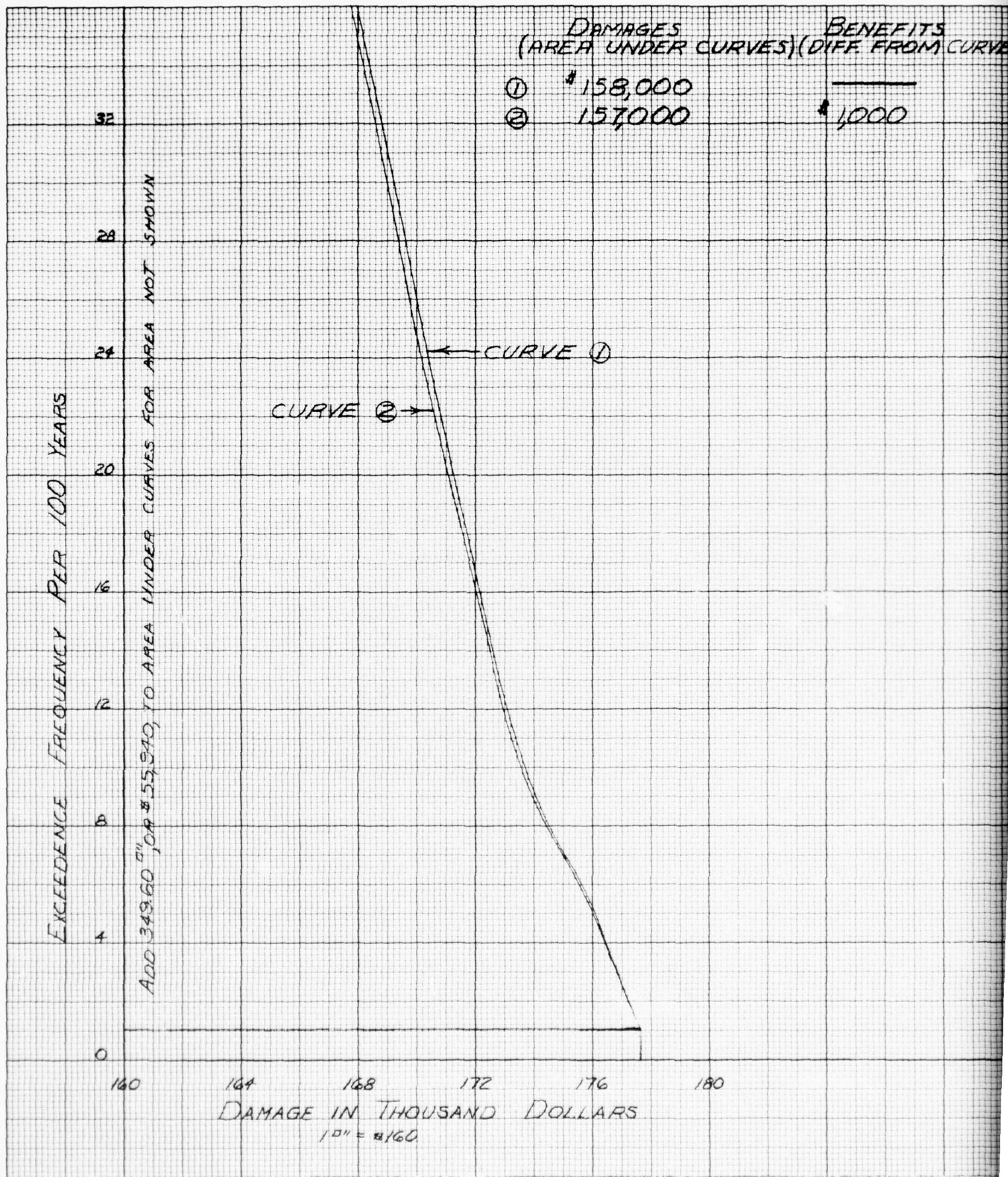
- ① \$158,000
- ② 157,000

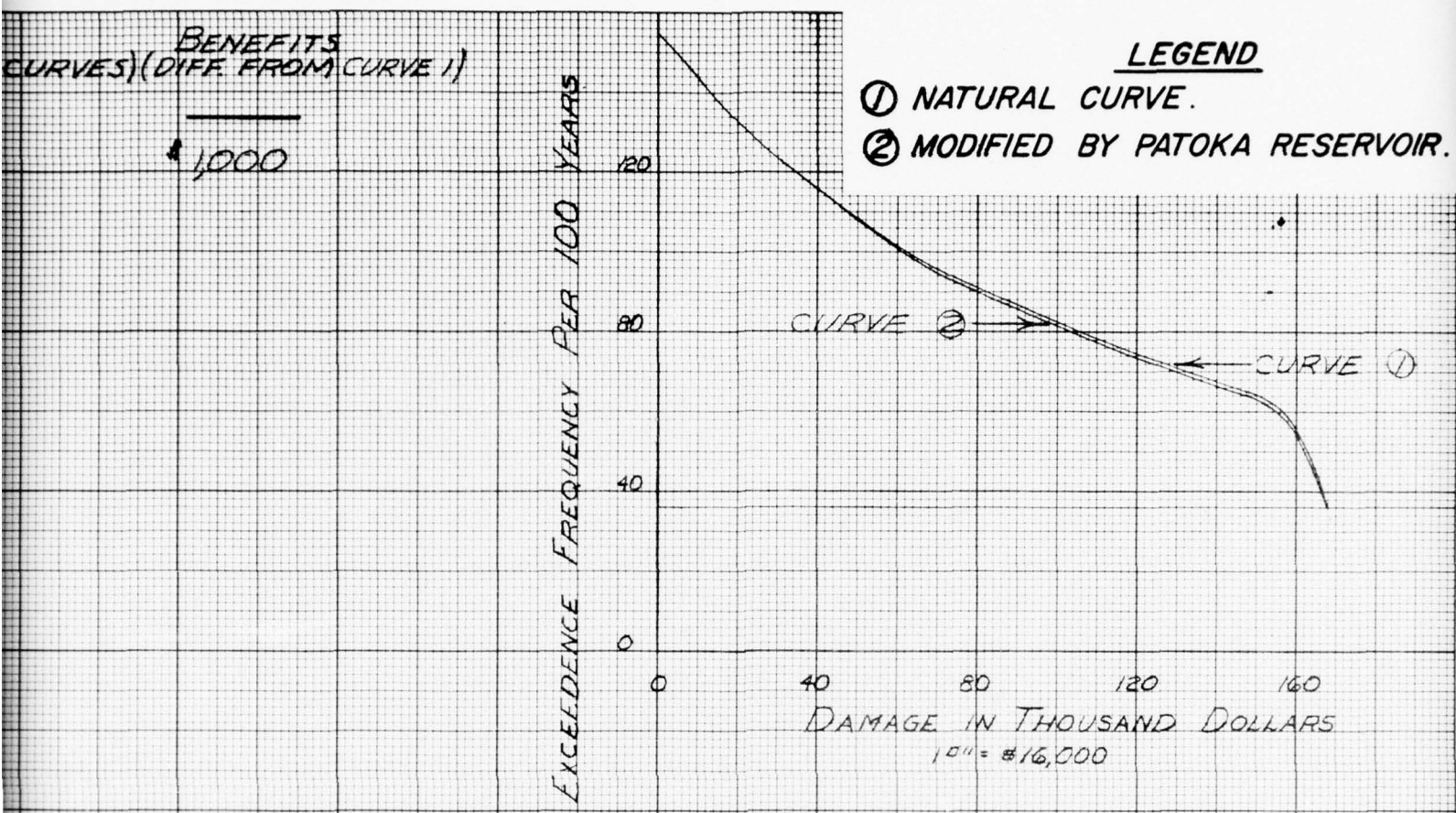
BENEFITS (DIFF FROM CURVE)

\$1,000

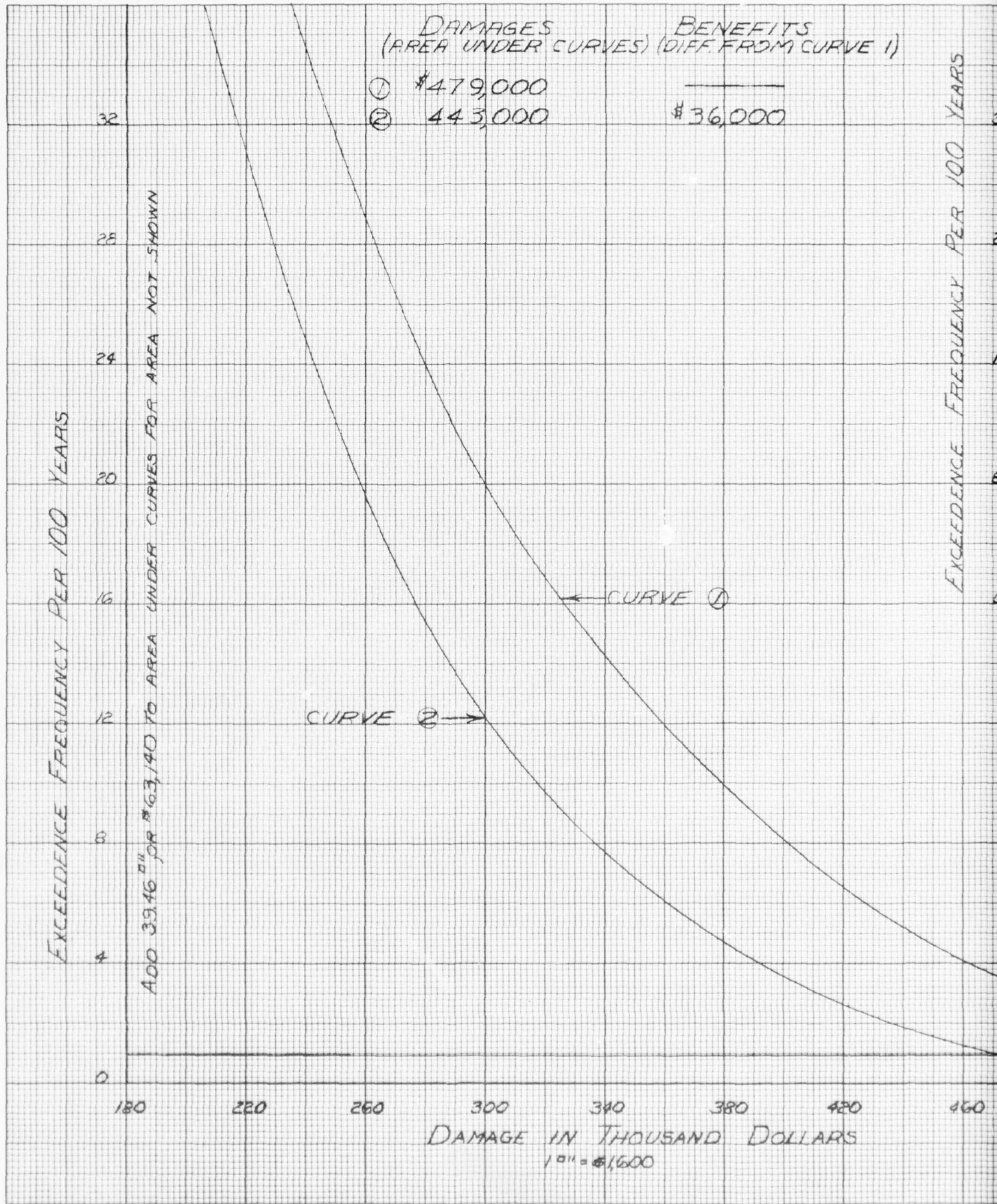
CURVE ② →

← CURVE ①





WABASH RIVER BASIN
 FREQUENCY DAMAGE CURVES
 PATOKA RIVER
 REACH 1
 MOUTH TO US 41 BYPASS BRIDGE
 U. S. ARMY ENGINEER DISTRICT
 LOUISVILLE, KY.
 ORLED-P JANUARY 1964



FITS
DM CURVE 1)

EXCEEDENCE FREQUENCY PER 100 YEARS

320
240
160
80
0

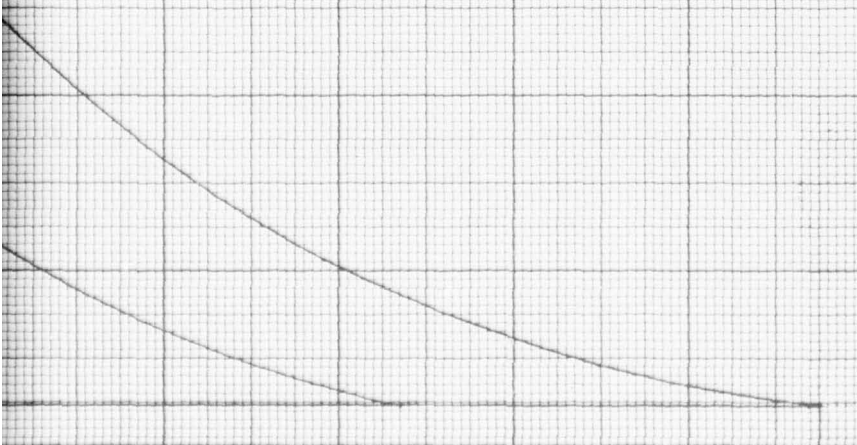
0 40 80 120 160 200 240

DAMAGE IN THOUSAND DOLLARS
1" = \$32,000

- LEGEND
- ① NATURAL CURVE.
 - ② MODIFIED BY PATOKA RESERVOIR.

← CURVE ①

CURVE ② →



420 460 500 540
DOLLARS

WABASH RIVER BASIN
 FREQUENCY DAMAGE CURVES
 PATOKA RIVER
 REACH 2
 US 41 BYPASS BRIDGE TO SOUTH FORK
 U. S. ARMY ENGINEER DISTRICT
 LOUISVILLE, KY.
 ORLED-P JANUARY 1964

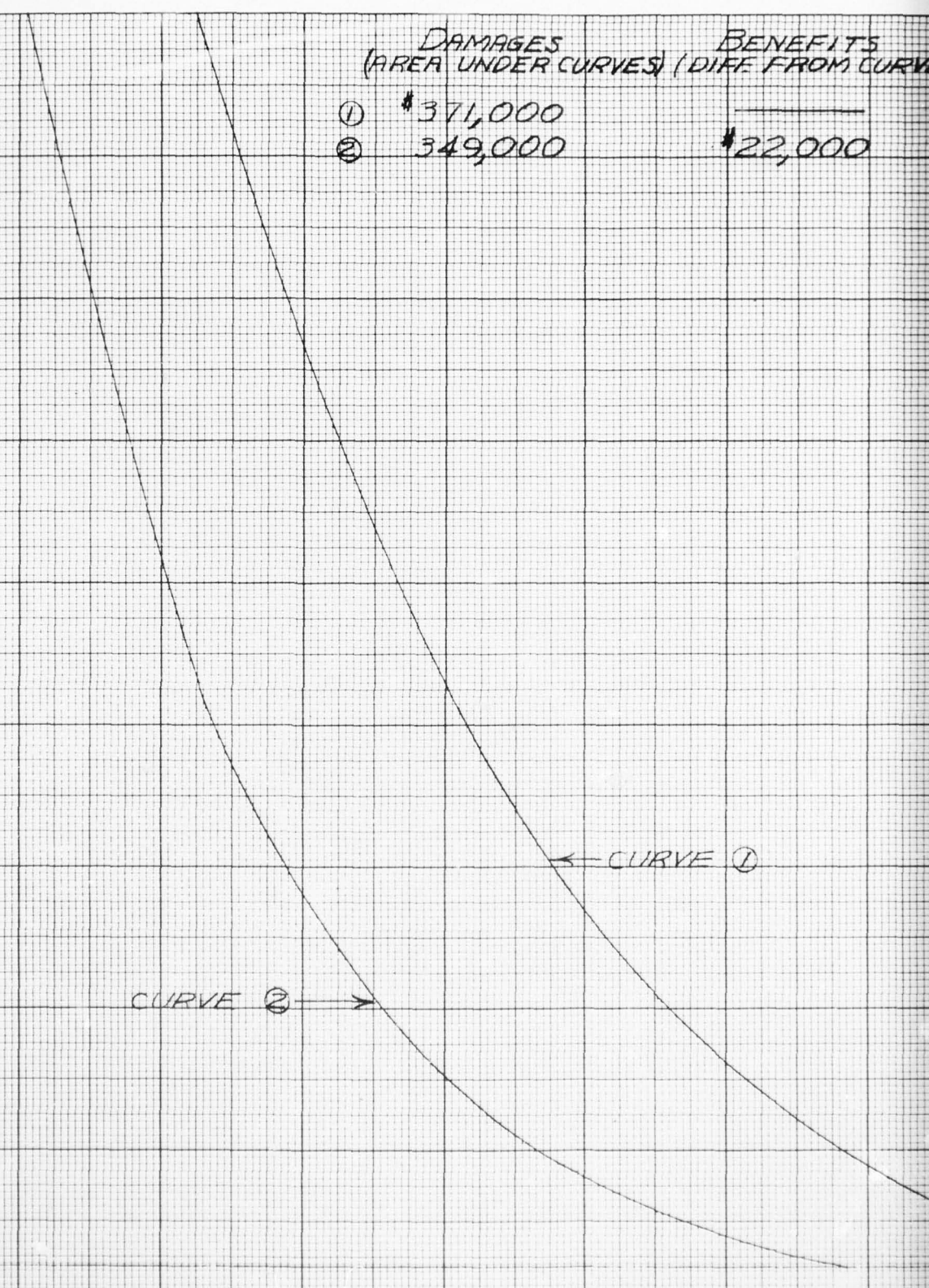
2

PLATE NO. B-70

EXCEEDENCE FREQUENCY PAR 100 YEARS

32
28
24
20
16
12
8
4
0

ADD 12.348 TO AREA UNDER CURVES FOR AREA NOT SHOWN



DAMAGES (AREA UNDER CURVES) BENEFITS (DIFF FROM CURVE 1)

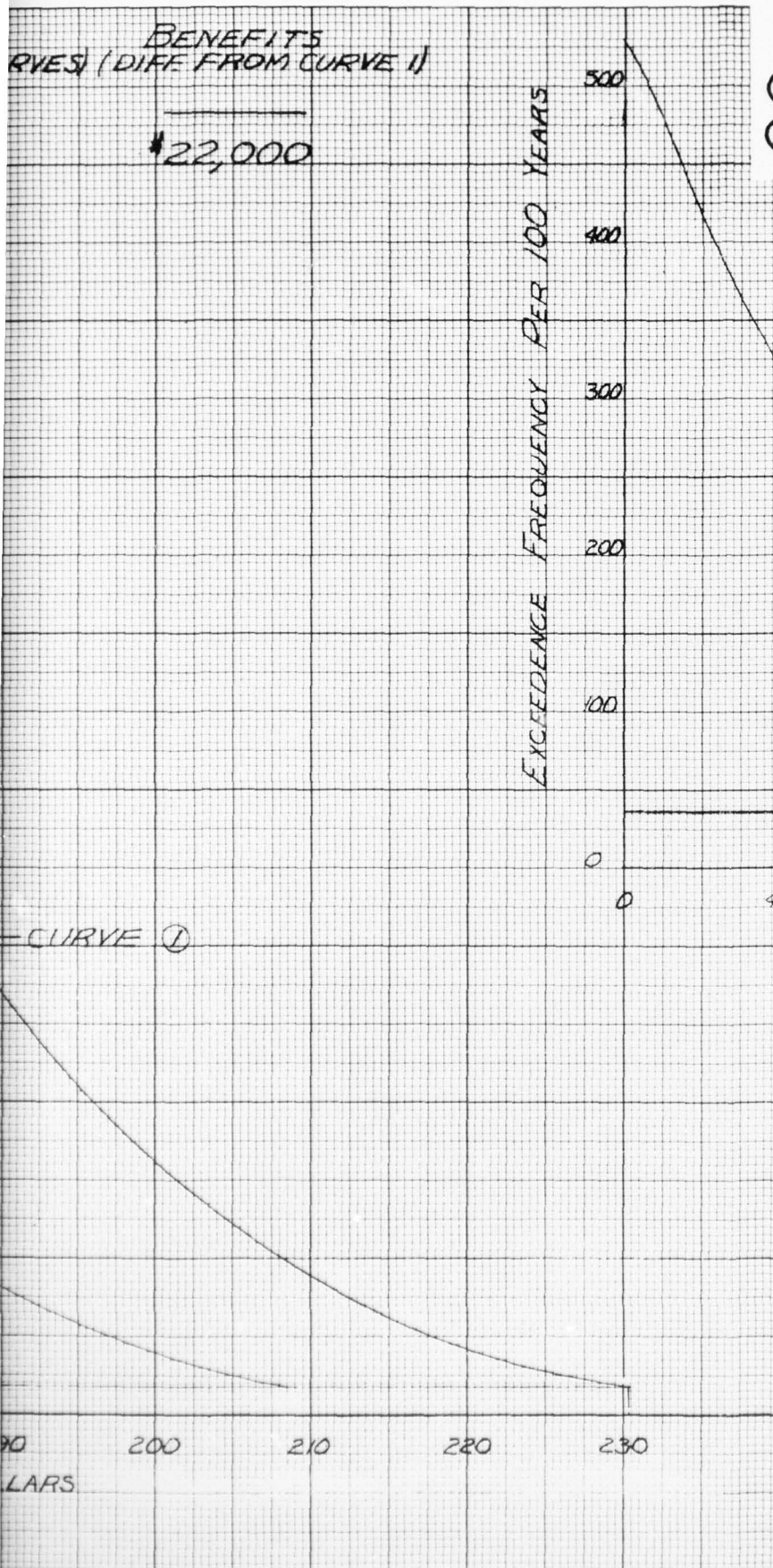
① \$371,000
② 349,000

\$22,000

CURVE 2

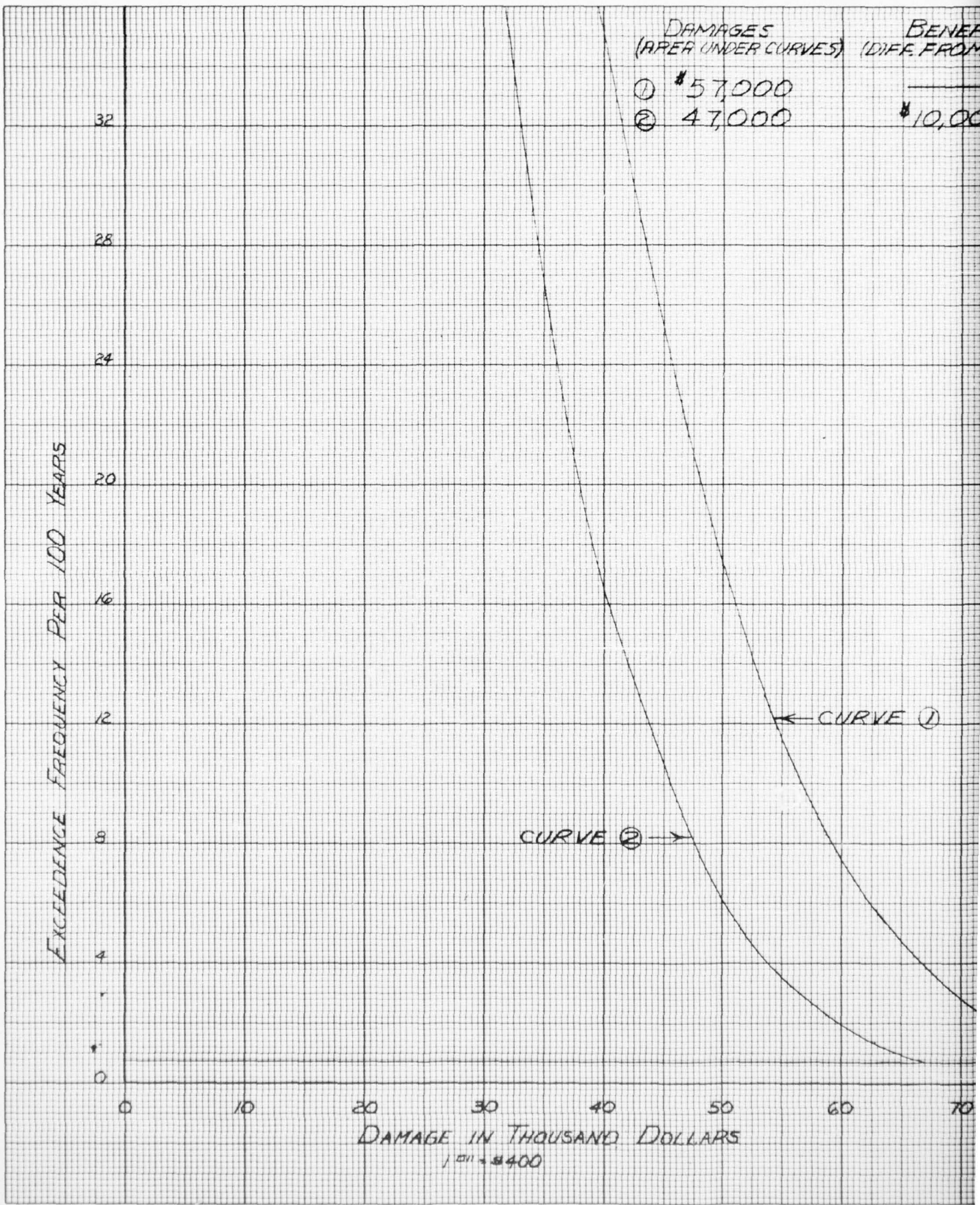
CURVE 1

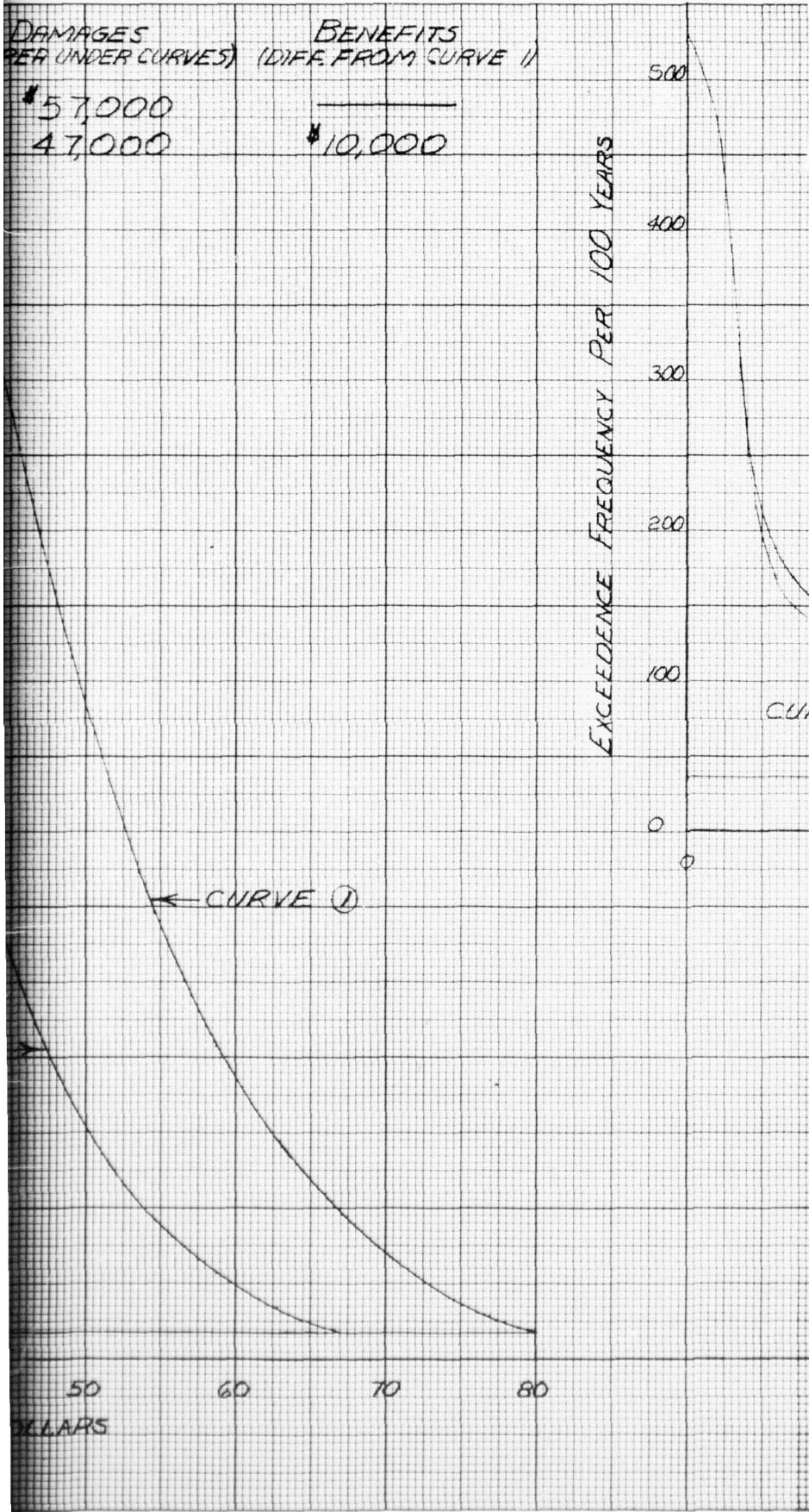
DAMAGE IN THOUSAND DOLLARS
1" = \$400.



- LEGEND**
- ① NATURAL CURVE.
 - ② MODIFIED BY PATOKA RESERVOIR.

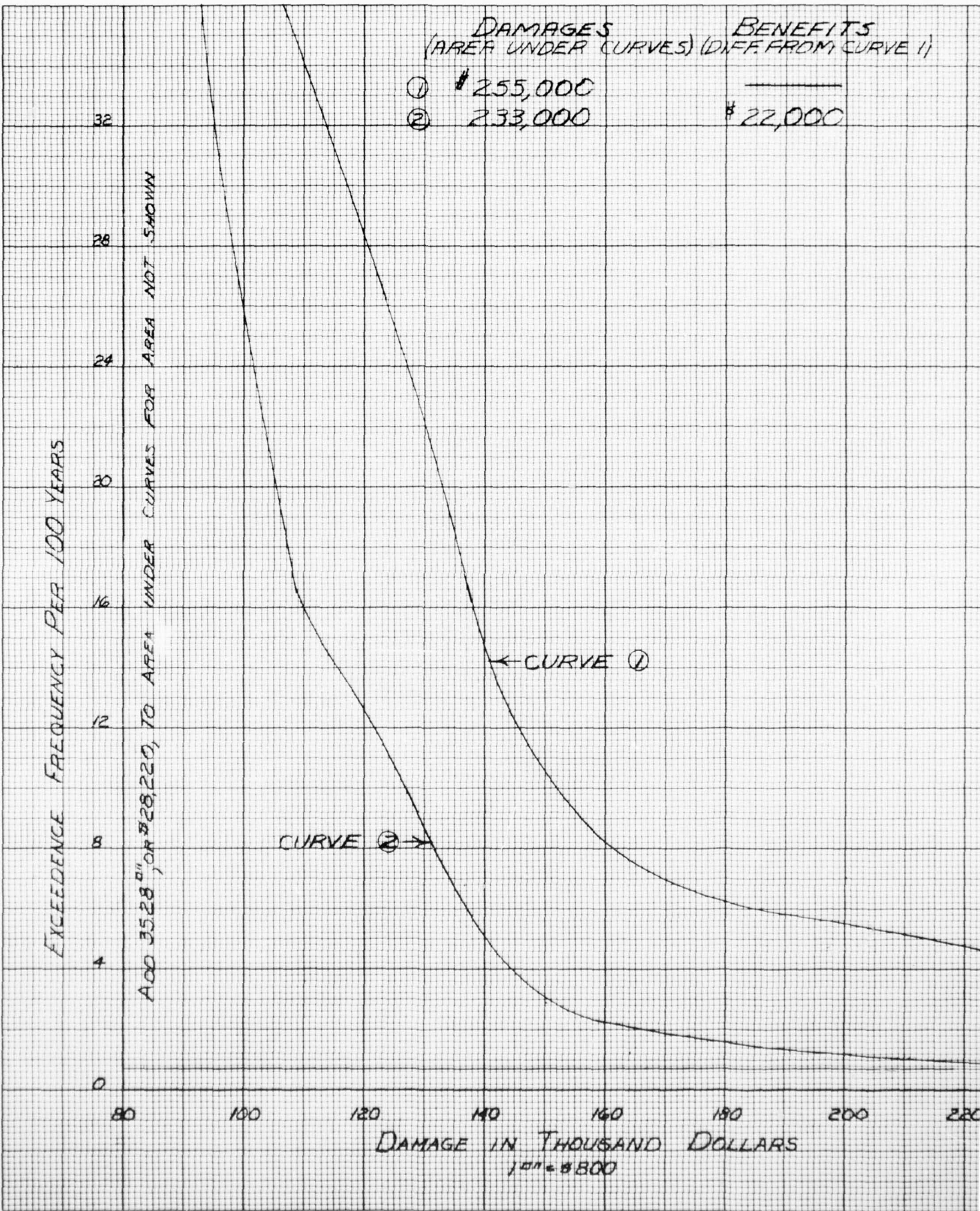
WABASH RIVER BASIN
 FREQUENCY DAMAGE CURVES
 PATOKA RIVER
 REACH 3
 SOUTH FORK TO PIKEVILLE, IND.
 U. S. ARMY ENGINEER DISTRICT
 LOUISVILLE, KY.
 ORLED-P JANUARY 1964





- LEGEND**
- ① NATURAL CURVE.
 - ② MODIFIED BY PATOKA RESERVOIR

WABASH RIVER BASIN
 FREQUENCY DAMAGE CURVES
 PATOKA RIVER
 REACH 4
 PIKEVILLE, IND. TO FLAT CREEK
 U. S. ARMY ENGINEER DISTRICT
 LOUISVILLE, KY.
 ORLED-P JANUARY 1964



BENEFITS
FF FROM CURVE 1)

\$22,000

EXCEEDENCE FREQUENCY PER 100 YEARS

500
400
300
200
100
0

0 20 40 60 80 100

DAMAGE IN THOUSAND DOLLARS
1" = \$20,000

- LEGEND**
- ① NATURAL CURVE.
 - ② MODIFIED BY PATOKA RESERVOIR

CURVE ② →
← CURVE ①

180 200 220 240 260
DOLLARS

**WABASH RIVER BASIN
FREQUENCY DAMAGE CURVE
PATOKA RIVER**

REACH 5

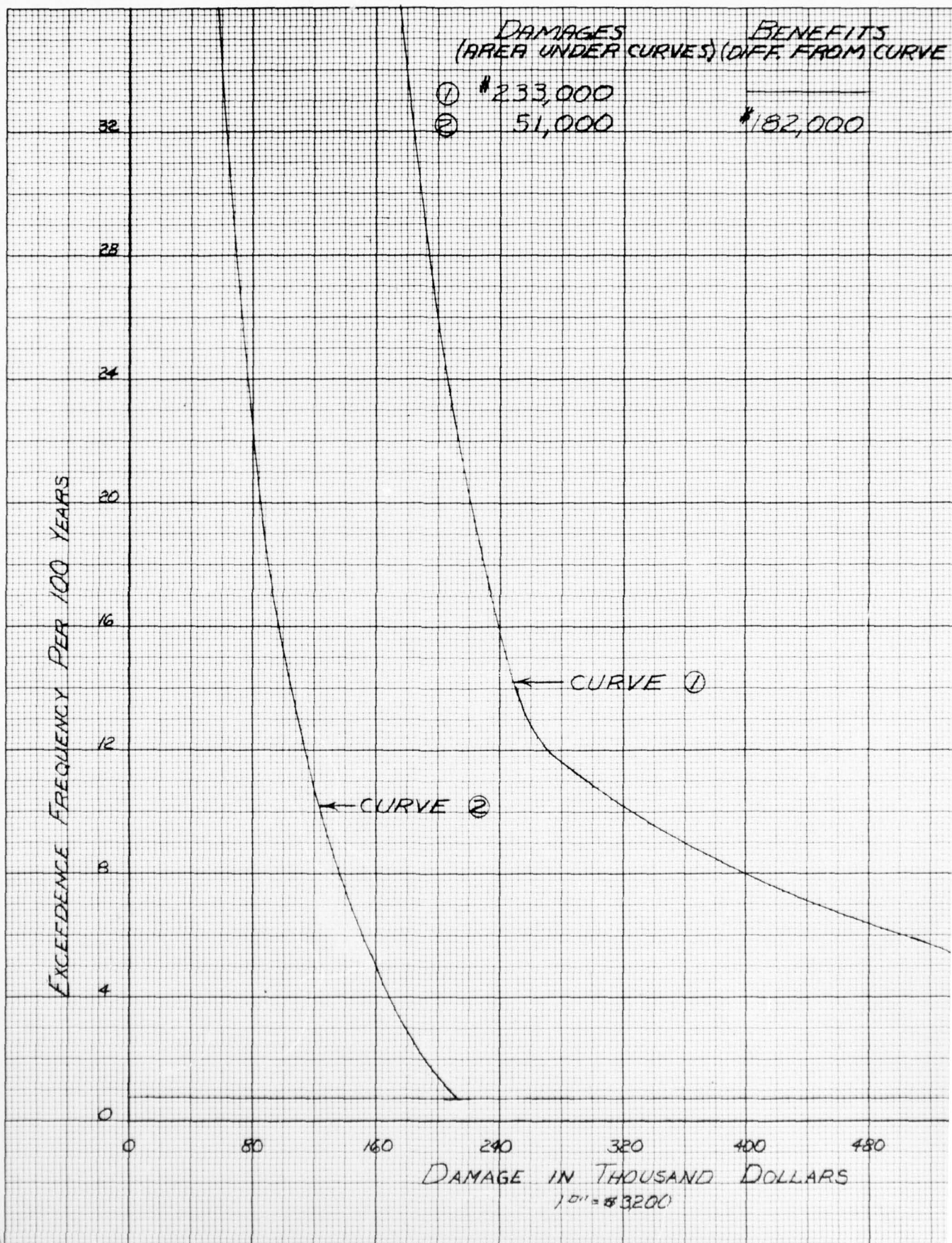
FLAT CREEK TO STRAIGHT RIVER

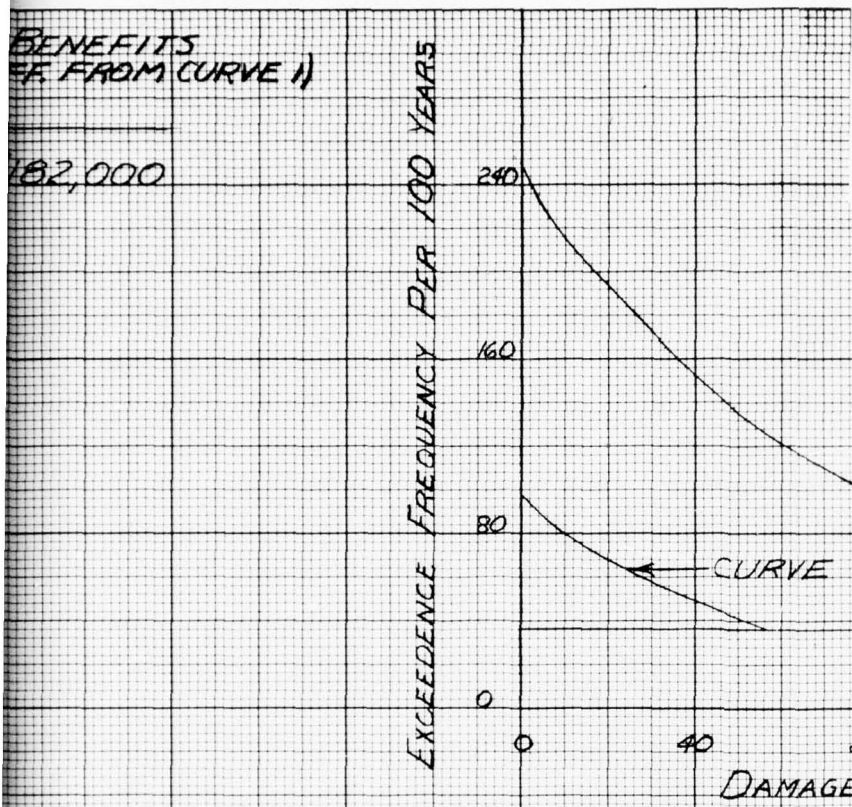
U. S. ARMY ENGINEER DISTRICT
LOUISVILLE, KY.

ORLED-P JANUARY 1964

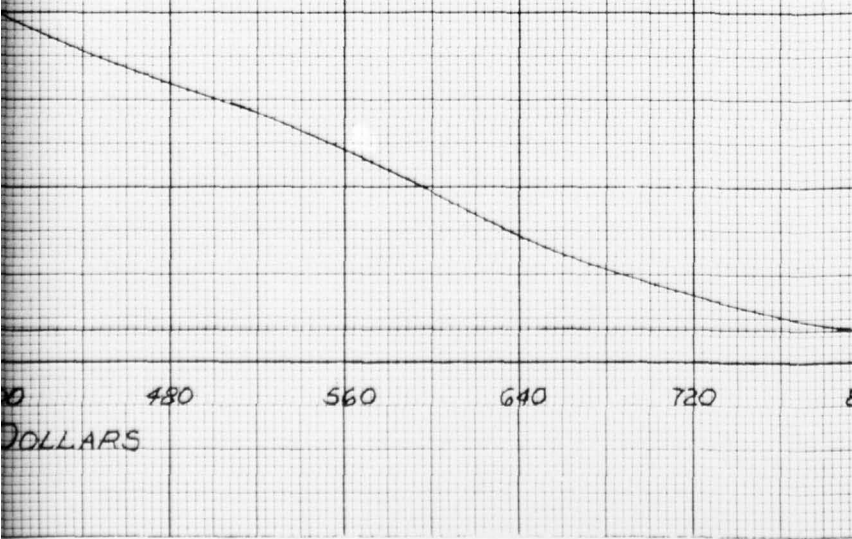
2

PLATE NO. 1





- LEGEND
- ① NATURAL CURVE.
 - ② MODIFIED BY PATOKA RESERV

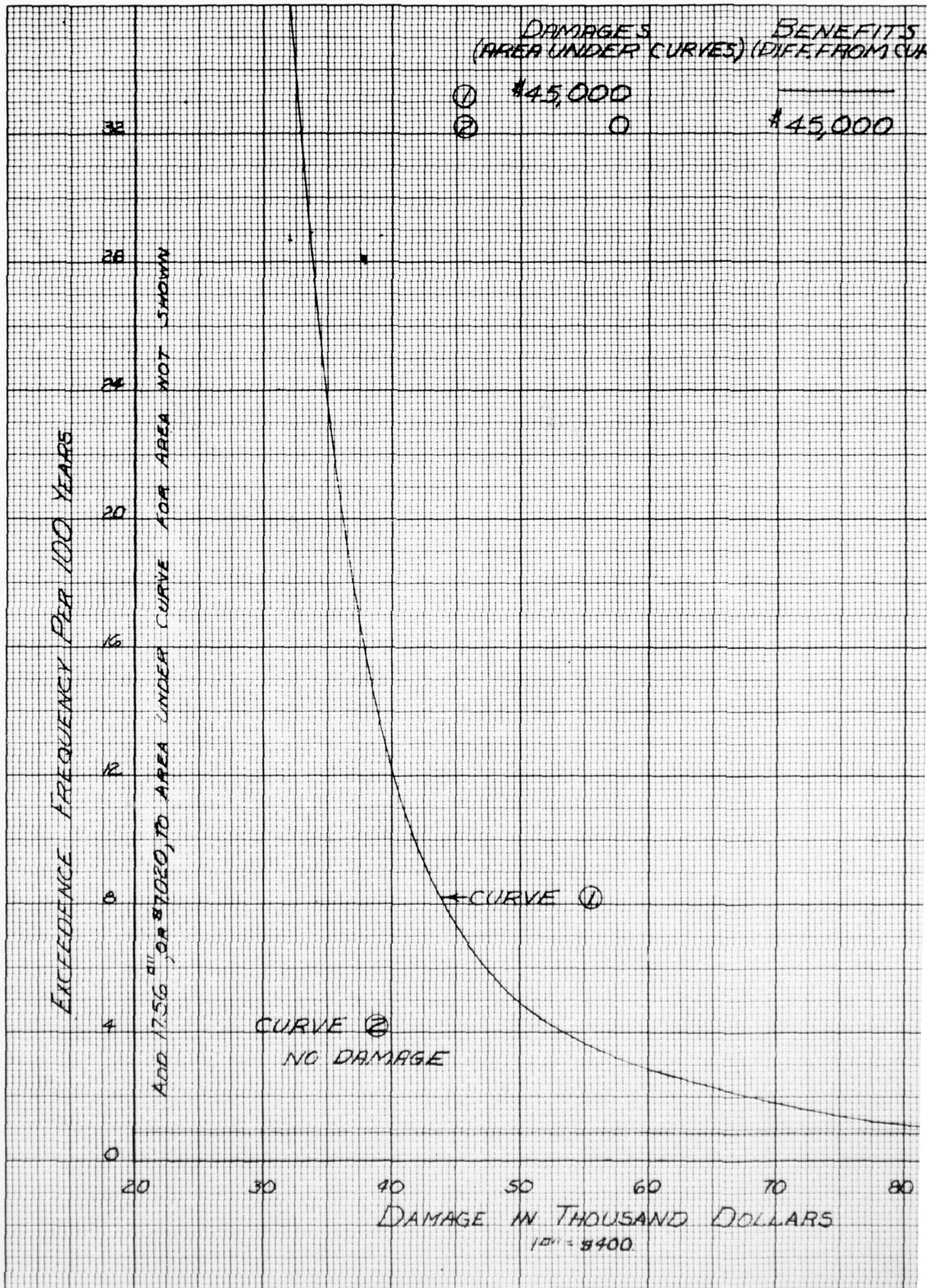


WABASH RIVER BASIN
 FREQUENCY DAMAGE CUR
 PATOKA RIVER
 REACH 6
 STRAIGHT RIVER TO DUBOIS,
 U. S. ARMY ENGINEER DISTRI
 LOUISVILLE, KY.

ORLED-P JANUARY 1964

2

PLATE NO.



IE 1)

BENEFITS
DIFF. FROM CURVE 1)

45,000

EXCEEDENCE FREQUENCY PER 100 YEARS

320
240
160
80
0

- LEGEND**
- ① NATURAL CURVE.
 - ② MODIFIED BY PATOKA RIVER

CURVE ① →

DAMAGE IN THOUSAND DOLLARS
100 = 6,400

90 70 80 90
DOLLARS

WABASH RIVER BASIN
 FREQUENCY DAMAGE
 PATOKA RIVER
 REACH 7
 DUBOIS, IND. TO DAM
 U. S. ARMY ENGINEER
 LOUISVILLE, KY
 CORLED-P JANUARY

2 PLATE

U. S. ARMY ENGINEER DISTRICT, LOUISVILLE
CORPS OF ENGINEERS
LOUISVILLE, KENTUCKY

INTERIM REPORT NO. 2
WABASH RIVER BASIN
COMPREHENSIVE STUDY
COVERING RESERVOIR SITES
ON
EMBARRASS RIVER, ILLINOIS
AND
CLIFTY CREEK AND PATOKA RIVER, INDIANA

APPENDIX C

CCST ALLOCATION AND APPORTIONMENT

JANUARY 1964

INTERIM REPORT NO. 2
WABASH RIVER BASIN
COMPREHENSIVE STUDY
COVERING RESERVOIR SITES
ON
EMBARRASS RIVER, ILLINOIS
AND
CLIFTY CREEK AND PATOKA RIVER, INDIANA

APPENDIX C

COST ALLOCATION AND APPORTIONMENT

Table of Contents

<u>Paragraph</u>	<u>Subject</u>
1	ALLOCATION OF COSTS BETWEEN PURPOSES
	a. General
	b. Investment Costs
	c. Annual Costs
	(1) General
	(2) Interest and Amortization
	(3) Operation and Maintenance
	(4) Major Replacement
	(5) Annual Financial Costs
	d. Alternate Costs
	(1) General
	(2) Alternative Cost of Single Purpose Projects
	(3) Alternate Dual and Tri-Purpose Projects
2	APPORTIONMENT OF COSTS BETWEEN FEDERAL AND NON-FEDERAL INTERESTS
	a. General
	b. Apportionment of Flood Control Costs
	c. Apportionment of Water Supply Costs
	d. Apportionment of Water Quality Control Costs
	e. Apportionment of General and Fish and Wildlife Recreation Costs
	f. Apportionment of Area Redevelopment Act Effects

TABLES

<u>No.</u>	<u>Title</u>
1	Lincoln Reservoir Project - Summary of Costs
2	Lincoln Reservoir - Summary of Investment Costs
3	Lincoln Reservoir - Allocation of Costs Separable Costs - Remaining Benefits Method
4	Clifty Creek Reservoir - Summary of Costs
5	Clifty Creek Reservoir - Summary of Investment Costs
6	Clifty Creek Reservoir - Allocation of Costs Separable Costs - Remaining Benefits Method
7	Patoka Reservoir - Summary of Costs
8	Patoka Reservoir - Summary of Investment Costs
9	Patoka Reservoir - Allocation of Costs
10	Alternative Costs - General and Fish and Wildlife Recreation
11	Summary of Specific Costs - General and Fish and Wildlife Recreation
12	Cost Sharing for Recreation and Fish and Wildlife Enhancement - HR 9032, Section 1(c) 88th Congress
13	Apportionment of Costs

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-17

-17

-17

-18

APPENDIX C

COST ALLOCATION AND APPORTIONMENT

1. ALLOCATION OF COSTS BETWEEN PURPOSES. a. General of costs for each reservoir project was made to obtain a distribution of costs among the purposes served. Purposes are allocated by the separable costs - remaining benefits provides an equitable distribution among purposes b. Separable costs allocated to each purpose from exceeding its individual costs, whichever is lower, (b) requiring each purpose to bear at least its separable cost, and (c) between these limits sharing of the savings resulting from multiple purposes. The separable cost of each project purpose is the difference between the cost of the multiple purpose project and the cost of the project with that purpose omitted. Triple costs are those costs which are shared by the project purposes but not by other purposes in the project. Specific costs are costs of physically identifiable facilities for one purpose. Joint-use costs are for facilities shared by multiple project purposes, such as the dam structure. The costs for each reservoir are presented in tables 1 through 11 and include the initial plus future increments of general development.

b. Investment Costs. Investment costs are the initial costs and the accrued interest during the construction of the project. This interest was computed by multiplying the initial cost of the project by a three percent interest rate over the construction period. The estimated construction period for proposed projects was assumed to be four years. Detailed initial costs of each of the projects are given in Appendix C.

c. Annual Costs. (1) General. For the purposes of allocation and cost allocation studies, investment costs, operation and maintenance and major replacement costs must be reduced to an annual equivalent basis. In allocation of costs for multiple purpose projects an annual equivalent amount was computed in the following manner:

(2) Interest and Amortization. The investment costs were reduced to their average annual equivalent by considering the amortization of the initial investment. An interest rate of three percent and an amortization period of 100 years was used. For the future incremental investment in recreation the interest and amortization was reduced to a present value factor of 0.65047. This was computed on the basis of a necessary investment following the accelerated growth curve by computing the average annual benefits of the future investment.

(3) Operation and Maintenance. Estimated operation and maintenance costs for the dam and reservoir recreation are based upon actual experience in the past.

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ARMY ENGINEER DISTRICT LOUISVILLE KY
WABASH RIVER BASIN COMPREHENSIVE STUDY COVERING RESERVOIR SITES--ETC(U)
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3 OF 3
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END

DATE
FILMED
3-77

District, Louisville, Kentucky. Costs for the future increment of general recreation were discounted to present value by the investment factor 0.65047.

(4) Major Replacement. Certain major components of the dam, such as electrical and mechanical equipment, are considered to require replacement 50 years after the project is completed. General recreation facilities having a cost equal to one-third of the initial costs are considered to require replacement every 25 years. The estimated future costs of these replacements were converted to an average annual equivalent value over the entire project life by compound interest methods.

(5) Annual Financial Costs. The sum of the above items gives the total annual financial costs which differs from the annual economic costs by the amount of the economic cost of the loss of land productivity anticipated during the project life.

d. Alternative Costs. (1) General. Estimates of alternative costs for individual single purpose projects were used in the cost allocation studies as a basis for limiting the benefits and for identification of separable costs. The basis for computing these alternative costs is described in the following paragraphs.

(2) Alternative Cost of Single Purpose Projects. The bases for estimating costs of alternative projects for flood control, water quality control, water supply and general recreation were; (a) that the alternatives would supply the same level of benefits as provided by these purposes in the multiple purpose projects; (b) that the alternatives considered are the most economical projects to be developed for these purposes; and (c) that the alternatives proposed be feasible and even probable in the absence of the proposed projects. The determination of the alternative, or opportunity costs, measures the economic cost foregone by including the purposes in the multiple purpose project. In the case of flood control, these alternate projects were assumed to be at the site of the proposed multiple purpose project. In the case of water supply and water quality control storage included in the Patoka Reservoir, the alternative cost was determined by construction of a single purpose reservoir at the Patoka Reservoir site. The alternative cost of water supply and water quality control storage at the proposed Lincoln Reservoir was computed on the basis of single purpose reservoirs located near the proposed project site. In all cases the alternative cost of general recreation was determined by multiplying the expected number of visitor days, as furnished by the Bureau of Outdoor Recreation, by the value that state park systems have spent and/or are willing to spend for general recreation projects. Alternative costs for general and fish and wildlife recreation are developed in table 10.

(3) Alternate Dual and Tri-Purpose Projects. For the purpose of deriving separable costs, a series of estimates were prepared for each multiple purpose project with one purpose omitted. Each estimate was based on these cost estimates at the site of the proposed multiple purpose project.

TABLE 1
LINCOLN RESERVOIR PROJECT - SUMMARY OF COSTS
(\$1,000)

Item	Alternative Projects			Alternate Tri-Purpose Projects			
	Multiple purpose project	Flood control 1/	Water quality control, 1,800 acre-feet	Recreation 800 acre-feet	Flood control water supply recreation, multiple purpose project less 4,500 acre-feet	Flood control water quality control multiple purpose project less 3,500 acre-feet	Water quality control water supply recreation
Investment							
Lands and damages	12,000	12,000					
Relocations	9,348	9,348					3,234
Reservoir and pool preparation	2,045	2,045					4,700
Dam and appurtenances	4,150	4,150					2,300
General recreation (initial) 2/	2,840						1,250
Fish and wildlife recreation	114	114					2,840
Buildings, grounds and utilities	80	80					143
Permanent operating equipment							114
Total first cost (initial rec.)	30,720	27,737	900	400	30,459 2/	30,517 2/	12,665
Interest during construction	1,843	1,664	27	12	1,828	1,831	760
Subtotal	32,563	29,401	927	412	32,287	32,348	13,425
General Recreation (future)	2,280				2,280	2,280	2,280
Total Investment Costs	34,843	29,401	927	412	34,567	34,628	15,705
Annual Charges							
Initial Recreation							
Interest and amortization	1,031	931	29	13	1,022	1,024	425
O&M - Dam structure	40	35	15	10	40	40	20
- Recreation	104				104	104	104
Major replacement - Dam structure	3	3			3	3	3
- Recreation	18				18	18	18
Subtotal	1,196	969	44	23	1,187	1,189	570
Future Increment 4/							
Interest and amortization	47				47	47	47
O&M	91				91	91	91
Major replacement	12				12	12	12
Subtotal	150				150	150	150
Total Annual Financial Charges	1,346	969	44	11 5/	1,337	1,339	720

1/ Alternative flood control project at site of multiple purpose project.
2/ Includes lands required.
3/ Separable cost based on \$98.00 per acre foot construction cost of Lincoln Reservoir.

4/ Future increment charges discounted to present value by investment factor = 0.65047.
5/ Water supply is future need 25 years after project initiated. Discounted to present value (factor = 0.4776).

TABLE 2
LINCOLN RESERVOIR
SUMMARY OF INVESTMENT COSTS (\$1,000)

Item	Specific costs				Joint use facilities	Total
	Flood control	Water quality control	Water supply	Recreation		
Lands and damages				800	12,000	12,800
Relocations					9,348	9,348
Reservoir and pool preparation					2,045	2,045
Dam and appurtenances					4,150	4,150
General recreation (init.)				2,040		2,040
Fish and wild-life				143		143
Buildings, grounds and utilities					114	114
Permanent operating equipment					80	80
Total initial				2,983	27,737	30,720
Interest during construction				179	1,664	1,843
General recreation (future increment)				<u>2,280</u>		<u>2,280</u>
Total Investment Costs				5,442	29,401	34,843

TABLE 3
LINCOLN RESERVOIR
ALLOCATION OF COSTS (\$1,000)

SEPARABLE COSTS - REMAINING BENEFITS METHOD

Item	Flood control	Water quality control	Water supply	Recrea- tion	Total
1. Benefits	1,890	44	11	964	2,909
2. Alternative costs	969	44	11	722	1,746
3. Benefits limit	969	44	11	722	1,746
4. Separable costs	626	9	7	372	1,014
5. Remaining benefits	343	35	4	350	732
6. Allocated joint costs	155	16	2	159	332
7. Total allocated financial costs	781	25	9	531	1,346

Allocation of Operation, Maintenance and Major Replacement Costs

8. Separable costs	20			225	245
9. Allocated joint costs	11	1		11	23
10. Total allocated costs	31	1		236	268

Allocation of Investment Costs

11. Annual investment costs	750	24	9	295	1,078
12. Capitalized investment costs (increment discounted)	23,687	758	284	9,317	34,046
13. Discount (future increment)	-	-	-	797	797
14. Total capitalized inv. costs	23,687	758	284	10,114	34,843

Allocation of Construction Costs

15. Specific use inv. costs				5,442	5,442
16. Int. during construction				179	179
17. Joint use inv. costs	23,687	758	284	4,672	29,401
18. Int. during construction	1,341	43	16	264	1,664
19. Construction costs of joint use facilities	22,346	715	268	4,408	27,737
20. Construction costs of specific use facilities				5,263	5,263
21. Allocated construction costs	22,346	715	268	9,671	33,000

TABLE 3

(Cont'd)

Item	Flood control	Water quality control	Water supply	Recreation	Total
ARA Cost Offset					
22. Specific use facilities				271	271
23. Ratio (line 19)	(.8056)	(.0258)	(.0097)	(.1589)	(1.0000)
24. Joint use facilities	1,572	50	19	311	1,952
25. Net allocated construction costs	20,774	665	249	9,089	30,777

TABLE 4

CLIFTY CREEK RESERVOIR
SUMMARY OF COSTS (\$1,000)

Item	Multiple purpose project	Alternative projects		Alternate single purpose projects	
		Flood control	Recreation	Flood control	Recreation
<u>Investment</u>					
Lands and damages					
Relocations	1,624	1,624		1,624	
Reservoir and pool preparation	2,600	2,600		2,600	
Dam and appurtenances	161	161		161	
General recreation (initial) ^{2/}	7,357	7,357		7,357	
Fish and wildlife recreation	1,456				
Buildings, grounds and utilities	127				
Permanent operating equipment	115	115		115	
Levees	86	86		86	
	334	334		334	
Total first cost (initial rec.)	13,660	12,277		12,277	7,200
Interest during construction	832	737		737	432
Subtotal	14,692	13,014		13,014	7,632
General recreation (ultimate)	2,040				2,040
Total Investment Cost	16,732	13,014	4,455	13,014	9,672

Q 17

TABLE 4 (CONT'D)

CLIFTY CREEK RESERVOIR

Item	Multiple purpose projects	Alternative projects		Alternate single purpose projects	
		Flood control <u>1/</u>	Recreation	Flood control	Recreation
<u>Annual Charges</u>					
<u>Initial Recreation</u>					
Interest and amortization	465	412		412	242
O&M - Dam structure	35	35		35	15
O&M - Recreation	58				58
Major replacement - Dam structure	7	7		7	3
- Recreation	11				11
Subtotal	576	454	116	454	329
<u>Future Increment</u> <u>2/</u>					
Interest and amortization	42				42
O&M	78				78
Major replacement	11				11
Subtotal	131		203		131
Total Annual Financial Charges	707	454	319	454	460

1/ Alternative flood control project at site of multiple purpose project

2/ Includes lands required

3/ Future increment charges discounted to present value by investment factor = 0.65047

TABLE 5
 CLIFTY CREEK RESERVOIR
 SUMMARY OF INVESTMENT COSTS (\$1,000)

Item	Specific costs		Joint use facilities	Total
	Flood control	Recreation		
Lands and damages		186	1,624	1,810
Relocations			2,600	2,600
Reservoir and pool preparation			161	161
Dam and appurtenances			7,357	7,357
General recreation (initial)		1,270		1,270
Fish and wildlife		127		127
Buildings, grounds and utilities			115	115
Permanent operating equipment			86	86
Levees	334			334
Total initial	334	1,583	11,943	13,860
Interest during construction	20	95	717	832
General recreation (future increment)		2,040		2,040
Total Investment Costs	354	3,718	12,660	16,732

TABLE 6

CLIFTY CREEK RESERVOIR
ALLOCATION OF COSTS (\$1,000)
SEPARABLE COSTS - REMAINING BENEFITS METHOD

Item	Flood control	Recrea- tion	Total
1. Benefits	550	617	1,167
2. Alternative costs	454	319	773
3. Benefits limit	454	319	773
4. Separable cost	247	253	500
5. Remaining benefits	207	66	273
6. Allocated joint costs	157	50	207
7. Total allocated financial costs	404	303	707
Allocation of Operation, Maintenance and Major Replacement Costs			
8. Separable costs	14	158	182
9. Allocated joint costs	24	4	18
10. Total allocated costs	38	162	200
Allocation of Investment Costs			
11. Annual investment costs	366	141	507
12. Capitalized investment costs (increment discounted)	11,564	4,455	16,019
13. Discount (future increment)	-	713	713
14. Total capitalized investment costs	11,564	5,168	16,732
Allocation of Construction Costs			
15. Specific use investment costs	354	3,718	4,072
16. Interest during construction	20	95	115
17. Joint use investment costs	11,210	1,450	12,660
18. Interest during construction	635	82	717
19. Construction costs of joint use facilities	10,575	1,368	11,943
20. Construction costs of specific use facilities	334	3,623	3,957
21. Total allocated construction costs	10,909	4,991	15,900

TABLE 7
PATOKA RESERVOIR - SUMMARY OF COSTS
(\$1,000)

Item	Alternative Single Purpose Projects				Alternate tri-purpose projects				
	Multiple purpose project	Flood control	Water quality control	Water supply	Flood control water supply	Flood control water supply	multiple purpose project less 14,800 acre-feet recreation	multiple purpose project less 14,800 acre-feet recreation	Water quality control water supply recreation
First Cost									
Lands and damages	2,850	1,400			2,850		2,651		1,590
Relocations	5,923	2,154			5,923		5,823		2,794
Reservoir and pool preparation	919	650			919		919		670
Dam and appurtenances	5,241	7,002			8,241		8,100		7,052
Gen. rec. facilities & lands (initial)	2,085	-			-		2,085		2,085
Fish and wildlife	228	-			-		228		2,228
Buildings, grounds and utilities	114	114			114		114		114
Permanent operating equipment	80	80			80		80		80
Subtotal	20,440	11,400	5,800 ^{1/2}	9,200 ^{4/}	18,127	20,000	20,000	14,613	
Interest during construction	1,226	684	174 ^{2/}	552	1,088	1,200	1,200	877	
Subtotal	21,666	12,084	5,974	9,752	19,215	21,200	21,200	15,490	
General Recreation (future)	3,560	-	-	-	19,215	3,560	3,560	3,560	
Total Investment Cost	25,226	12,084	5,974	9,752	19,215	24,760	24,760	19,050	
Annual Charges									
Initial									
Interest and amortization	686	382	189	309	608	671	671	490	
Operation & Maintenance - Dam	45	35	30	35	45	45	45	35	
Operation & Maintenance - Recreation	96	3			3	96	96	96	
Major replacement - Dam - Recreation	16	3			3	3	3	3	
Major replacement - Recreation	16					16	16	16	
Subtotal	846	420	219	344	656	831	831	640	
Future Increment									
Interest & amortization (disc.)	73					73	73	73	
Operation and maintenance	131					131	131	131	
Major replacement	20					20	20	20	
Subtotal	224					224	224	224	
Total Annual Financial Charges	1,070	420	219	344	656	1,055	1,055	864	

1/ Includes required lands.
2/ If water quality control or water supply are removed as project purposes seasonal pool of 536 requires conservation pool of 534. Incremental reduction of construction costs = \$440,000, therefore, 20,440,000 - 440,000 = \$20,000,000 first cost (initial).
3/ From cost curve at site = 32,000 AF = 68 cfs
13,200 AF = Min. pool
45,200 AF
4/ From cost curve at site = 92,000 AF = 130 cfs
13,200 AF = Min. pool
105,200 AF
5/ Construction period = 2 years = 2 x .03 x .5 = .03
6/ Table 10, Appendix C.

TABLE 8
 PATOKA RESERVOIR
 SUMMARY OF INVESTMENT COSTS (\$1,000)

Item	Specific costs ^{1/} Recreation	Joint costs	Total
Lands and damages	210	2,850	3,060
Relocations	-	5,923	5,923
Reservoir and pool preparation	-	919	919
Dam and appurtenances	-	8,241	8,241
General recreation (initial)	1,875	-	1,875
Fish and wildlife	228	-	228
Buildings, grounds and utilities	-	114	114
Permanent operating equipment	-	80	80
Total initial	2,313	18,217	20,440
Interest during construction	139	1,087	1,226
General recreation (future increment)	3,560		3,560
Total Investment	6,012	19,214	25,226

^{1/} There are no specific costs for Water Supply or Water Quality Control

TABLE 9
PATOKA RESERVOIR
ALLOCATION OF COSTS (\$1,000)

Item	Flood control	Water quality control	Water supply	Recrea- tion	Total
1. Benefits	520	219	344	1,149	2,232
2. Alternative costs	420	219	344	821	1,804
3. Benefit limit	420	219	344	821	1,804
4. Separable cost	206	15	15	414	650
5. Remaining benefits	-	204	329	407	(940)
6. Allocated triple costs ^{1/}	-	45	72	89	206
7. Separable cost after allocated triple costs	206	60	87	503	856
8. Remaining benefits	214	159	257	318	948
9. Allocated joint cost	48	36	58	72	214
10. Total allocated financial costs	254	96	145	575	1,070
Allocation of Operation, Maintenance and Major Replacement Costs					
11. Separable costs	10			263	273
12. Allocated joint costs	9	6	10	13	38
12. Total costs	19	6	10	276	311
Allocation of Investment Costs					
14. Allocated investment costs	235	90	135	299	759
15. Capitalized investment costs (increment dis- counted)	7,425	2,844	4,266	9,447	23,982
16. Discount (future increment)				1,244	1,244
17. Total capitalized in- vestment cost	7,425	2,844	4,266	10,691	25,226
Allocation of Construction Costs					
18. Specific use invest- ment cost				6,012	6,012
19. Interest during con- struction				139	139
20. Joint use investment cost	7,425	2,844	4,266	4,679	19,214
21. Interest during con- struction	420	161	241	265	1,087
22. Construction cost of joint facilities	7,005	2,683	4,025	4,414	18,127
23. Construction cost of specific facilities				5,873	5,873
24. Total allocated con- struction costs	7,005	2,683	4,025	10,287	24,000

TABLE 9 (Cont'd)

PATOKA RESERVOIR

Item	Flood control	Water quality control	Water supply	Recreation	Total
ARA Construction Cost Offset					
25. Specific use facilities				292	292
26. Ratio of joint use facilities construction cost	.3864	.1480	.2220	.2436	1.000
27. Joint use facilities	638	245	367	403	1,653
28. Net allocated construction cost	6,367	2,438	3,658	9,592	22,055

1/ Allocated triple costs equal residual separable costs of storage allocated to water quality control, water supply and recreation. The incremental cost of adding these purposes to the flood control project at the site are:

Annual costs of multiple purpose project	\$1,070
less annual costs of flood control project	<u>420</u>
Triple separable cost of water quality control, water supply, and recreation	650
less assigned separable cost of water quality control, water supply and recreation (line 4) (15 + 15 + 414)	<u>444</u>
Equals residual triple costs to be allocated (line 6)	206

TABLE 10
 ALTERNATIVE COSTS
 GENERAL AND FISH AND WILDLIFE RECREATION

Item	Reservoir		
	Lincoln	Clifty Creek	Patoka
<u>Recreational Area-Acres</u>			
Lands	5,000	600	4,000
Seasonal Pool	6,760	919	8,880
Total Recreational Area	<u>11,760</u>	<u>1,519</u>	<u>12,880</u>
<u>Annual Attendance</u>			
General Recreation-			
Initial ^{1/}	425,000	200,000	400,000
Fish and Wildlife ^{2/}	85,000	23,000	121,000
Sub Total- Initial	<u>510,000</u>	<u>223,000</u>	<u>521,000</u>
Future Increment ^{1/}	<u>675,000</u>	<u>600,000</u>	<u>950,000</u>
Total Recreation Attendance	1,186,000	823,000	1,473,000
<u>Attendance Per Acre</u>			
	101	243 ^{3/}	114
<u>Annual Cost Per Visitor Day ^{4/}</u>			
	0.76	0.52	0.72
<u>Alternate Annual Cost</u>			
Initial Attendance	\$388,000	\$116,000	\$375,000
Future Increment (discounted) ^{5/}	<u>334,000</u>	<u>203,000</u>	<u>446,000</u>
Total Alternate Annual Costs	\$722,000	\$319,000	\$821,000

- ^{1/} BOR Estimate - Appendix F
- ^{2/} Fish and Wildlife Bureau - Appendix F
- ^{3/} Based on all project lands
- ^{4/} Based on average costs of State park systems
- ^{5/} Discount factor for future increment 0.65195

TABLE 11

SUMMARY OF SPECIFIC COSTS
GENERAL AND FISH AND WILDLIFE RECREATION (\$1,000)

Item	Reservoir		
	Lincoln	Clifty Creek	Patoka
<u>Investment</u>			
General recreation - Initial			
Lands	800	186	210
Facilities	2,040	1,270	1,875
Fish and Wildlife	<u>143</u>	<u>127</u>	<u>228</u>
Total first cost - Initial recreation	2,983	1,583	2,313
Interest during construction ^{1/}	<u>179</u>	<u>95</u>	<u>139</u>
Sub-total - Initial recreation	3,162	1,678	2,452
General recreation - Future increment	<u>2,280</u>	<u>2,040</u>	<u>3,560</u>
Total investment cost- recreation	5,442	3,718	6,012
<u>Annual Charges</u>			
Initial recreation			
Interest and amortization	100	53	77
Operation and maintenance	104	58	96
Major replacement	<u>18</u>	<u>11</u>	<u>16</u>
Sub-total - Initial recreation	222	122	189
Future increment ^{2/}			
Interest and amortization	47	42	73
Operation and maintenance	91	78	131
Major replacement	<u>12</u>	<u>11</u>	<u>20</u>
Sub-total future recreation	<u>150</u>	<u>131</u>	<u>224</u>
Total Annual Charges	372	253	413

^{1/} Interest during construction -- $\frac{1}{2}$ of 4 year period @
3 per cent on initial recreation only

^{2/} Future increment discounted to AAE (0.65047)

2. APPORTIONMENT OF COSTS BETWEEN FEDERAL AND NON-FEDERAL INTERESTS.

a. General. In accordance with general policy expressed in applicable legislation, the allocated costs for project features incorporated in the multiple-purpose reservoirs have been apportioned to Federal and non-Federal interests to permit a practical and efficient plan of development of the proposed reservoirs. Descriptions of the apportionments are presented in the following paragraphs.

b. Apportionment of Flood Control Costs. All costs allocated to flood control in the three proposed reservoir projects are apportioned to the Federal Government in accordance with flood control law. Construction costs of \$38,294,000 and annual operation, maintenance and major repair costs of \$86,000 are allocated to flood control and apportioned to the Federal Government.

c. Apportionment of Water Supply Costs. All costs allocated to present and future water supply storage in the proposed reservoir projects have been apportioned to non-Federal interests in accordance with provisions contained in the Water Supply Act of 1958 (Title III of Public Law 85-500). The amounts allocated to non-Federal interest for water supply at Lincoln and Patoka Reservoirs are summarized in the following tabulation. For details of these data refer to Tables 3 and 9, this Appendix.

Item	Reservoir	
	Lincoln ^{1/}	Patoka ^{1/}
Total construction costs	\$ 33,000,000	\$ 24,000,000
Allocated non-Federal costs	249,000	3,658,000 ^{2/}
Non-Federal construction cost as percent of total construction costs	0.75	15.24
Annual operation, maintenance and major replacement costs	0	10,000

^{1/} Current values

^{2/} After Area Redevelopment Act cost offset adjustment

d. Apportionment of Water Quality Control Costs. Water quality control is included as a project purpose at the proposed Lincoln and Patoka Reservoirs. Because of the widespread benefits to be realized from water quality control releases from the reservoirs, all costs for storage for water quality control in the proposed Lincoln and Patoka Reservoirs have been apportioned to the Federal Government according to the provision of the Federal Water Pollution Control Act, Amendments of 1961. These costs are summarized as follows.

Item	Reservoir	
	Lincoln	Patoka
Construction costs	\$ 665,000	\$2,438,000
Operation, maintenance and major replacement costs, annual	1,000	6,000

e. Apportionment of General and Fish and Wildlife Costs. In accordance with the provisions of the new "Change in Cost-Sharing Policy for Recreation and Fish and Wildlife in Survey Reports", established by Section 1(c) HR 9032, 88th Congress, all costs for general and fish and wildlife recreation have been allocated to the Federal Government, and no cost sharing is required for inclusion of these measures at the three reservoirs. Details on the determination of this conclusion are given in Table 12 of this Appendix.

f. Apportionment of Area Redevelopment Act Effects. The value of wages paid for construction of the proposed Lincoln and Patoka Reservoirs, to persons who would otherwise be unemployed and who live in ARA reservoir counties within commuting distance of the reservoir projects is apportioned to the Federal Government and thereby reduces the construction costs allocated to the various features included in the projects. A detailed summary of these payments is included in Section II of Appendix A.

A summary of apportioned construction costs and annual operation, maintenance and major replacement costs to Federal and non-Federal interests is presented in table 13.

TABLE 12

COST SHARING FOR RECREATION AND
FISH AND WILDLIFE ENHANCEMENT
HR. 9032, Sec. 1(c) 88th Congress

Item	Reservoir (\$1,000)		
	Lincoln	Clifty Creek	Patoka
<u>1. Joint use costs (Lands and facilities)</u>			
a. Total construction costs	\$ 33,000	\$ 15,900	\$ 24,000
b. Total, specific lands and facilities	<u>5,263</u>	<u>3,957</u>	<u>5,873</u>
c. Total joint-use lands and facilities	27,737	11,943	18,127
<u>2. Allocated Construction Costs of Lands and Facilities for Recreation and Fish and Wildlife Enhancement</u>			
a. Specific costs	5,263	3,623	5,873
b. Joint costs	4,221	1,368	3,719
c. Other costs	<u>0</u>	<u>0</u>	<u>0</u>
d. Total	9,484	4,991	9,592
<u>3. Cost Sharing Under HR 9032</u>			
a. Non-reimbursable Federal costs			
(1) Specific costs	5,263	3,623	5,873
(2) Joint costs	4,263	1,368	3,719
(3) Limit on joint costs	5,148	2,791	3,719
(4) Other costs	0	0	00
(5) Limit on other costs	<u>5,000</u>	<u>2,791</u>	<u>4,532</u>
(6) Total non-reimbursable Federal costs	9,484	4,991	9,592
b. Reimbursable Non-Federal Costs			
(1) Excess of joint costs over limit	0	0	0
(2) Excess of other costs over limit	<u>0</u>	<u>0</u>	<u>0</u>
(3) Total reimbursable non-Federal costs	0	0	0

TABLE 13

APPORTIONMENT OF COSTS

Item	Federal Costs				Non-Federal water supply	Total allocated costs
	Flood control	Water quality control	General & F&W recreation	ARA cost offset		
	<u>Construction Costs (\$1,000)</u>					
Lincoln Reservoir	20,775	665	9,089	2,223	249	33,000
Clifty Creek Reservoir	10,909	-	4,991	-	-	15,900
Patoka Reservoir	6,367	2,433	9,592	1,945	3,658	24,000
Totals	38,050	3,103	24,672	4,168	3,907	72,900
	<u>Annual Operation, Maintenance and Major Replacement Costs (\$1,000)</u>					
Lincoln Reservoir	32	1	236	-	-	268
Clifty Creek Reservoir	36	-	162	-	-	200
Patoka Reservoir	19	6	276	-	10	311
Totals	88	7	674	-	10	779

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