

# Neosho Water Supply Alternatives

Cooperative Glance Session

October 31, 2011

KWO, CDM and U.S. Army Corps of Engineers

# Neosho Water Supply Alternatives

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- Neosho basin identified as one of the highest priority watersheds based on supply v. demand estimates
- Many activities underway to reduce rate of storage loss or increase storage available
- Process of identifying potential reservoir sites now is important b/c of planning and funding

# Reservoir Siting Committee Purpose

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- Evaluate options and develop a plan for the protection of future reservoir sites.
- Four topics for the members to review and provide recommendations:
  - Environmental considerations for future reservoir siting
  - Economic evaluations of future reservoir siting
  - Tools available for preserving future reservoir sites from development
  - Public outreach and education

# Three Phased Approach

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## ○ Phase I

- Topographic Assessment (Complete)

## ○ Phase II

- Environmental, Culture, Economic Assessment Methodology (Committee Task)

## ○ Phase III

- Site Protection (Committee Task)

# Phase I

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Topographic Assessment

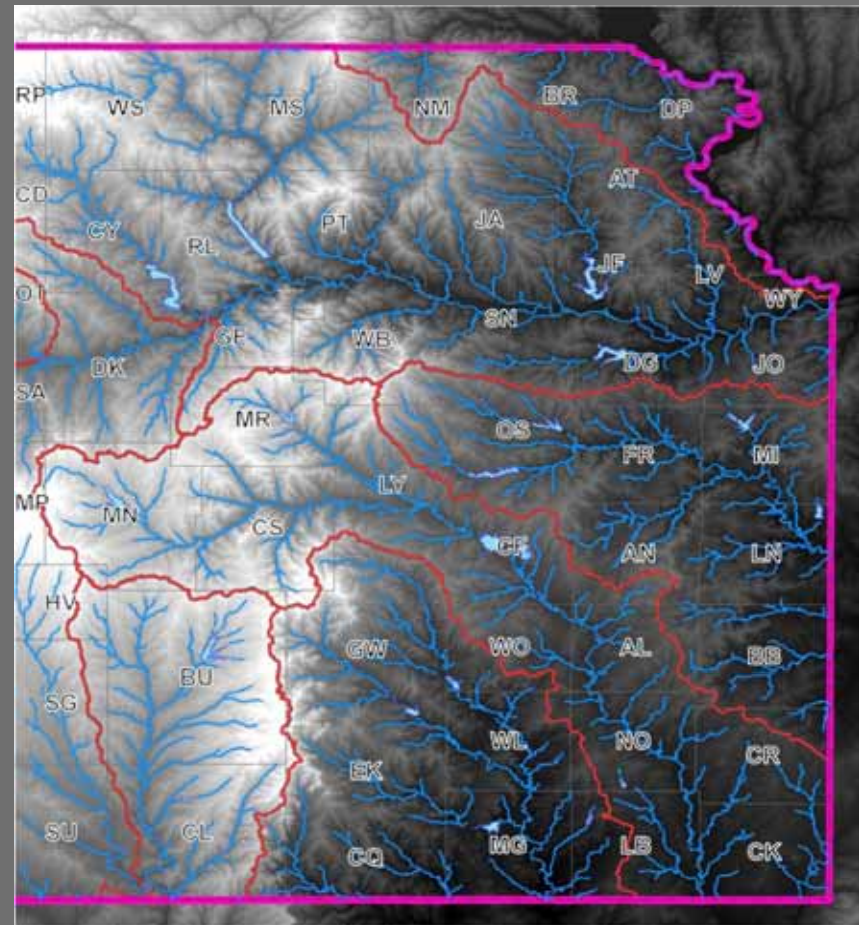
# Rapid Reservoir Siting

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- Minimize Surface Area
  - Minimizes Environmental and Cultural Impact
- Maximize Volume
  - Maximizes Economic Value
- KU-Kansas Biological Survey
- Depth to Flooding technology

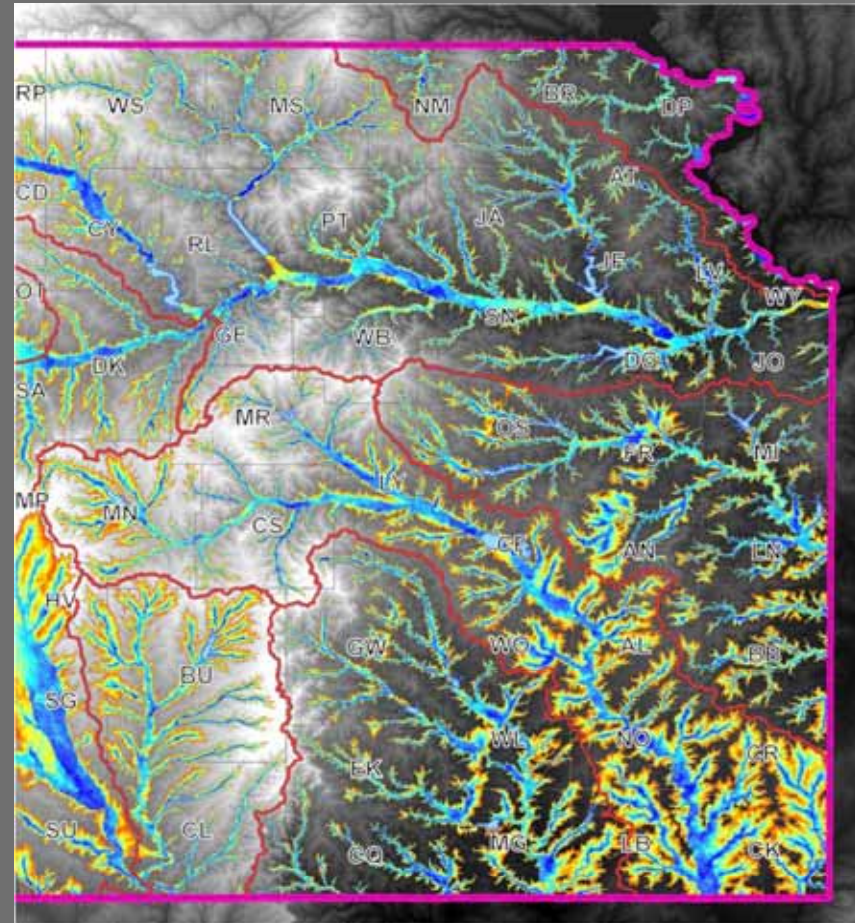
# Rapid Reservoir Siting

- Catchment size greater than 20 sq. mi.
- 2858 – 5km sub-segments processed
- KBS FLDPLN model applied to flood each segment to a maximum depth (stage) of 20m.



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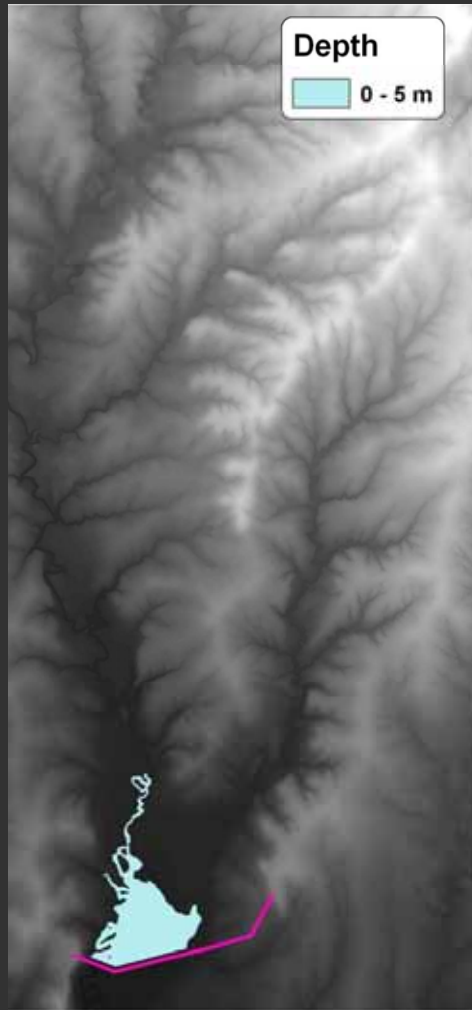
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- From KBS model, KWO identified four sites in the Neosho basin to apply Phase II and seek Advisory Committee feedback
- KWO provided centerline of potential dam to KBS so KBS could create digital model of reservoir

## Example Results from KBS Assessment

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### Maximum Lake Extent Using a 5m Dam

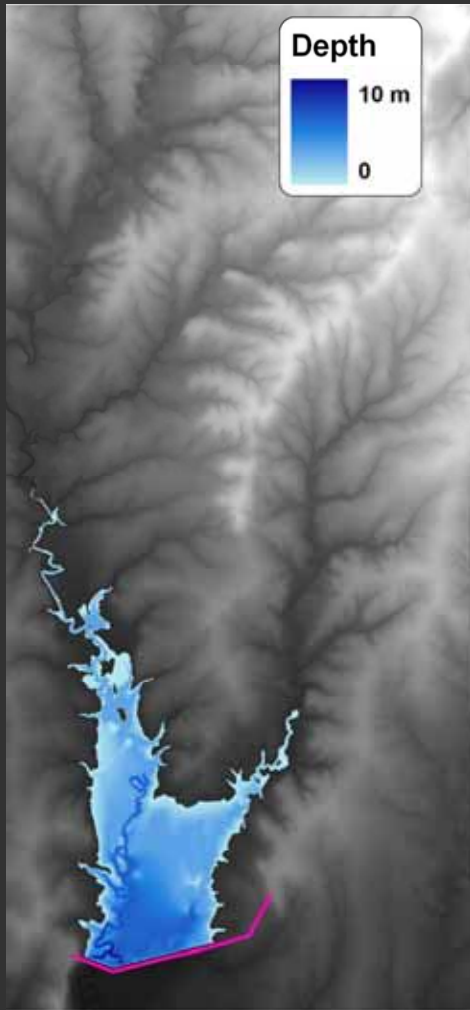


Evaluated change in surface area, volume and perimeter at each dam height.

## Example Results from KBS Assessment

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### Maximum Lake Extent Using a 10m Dam

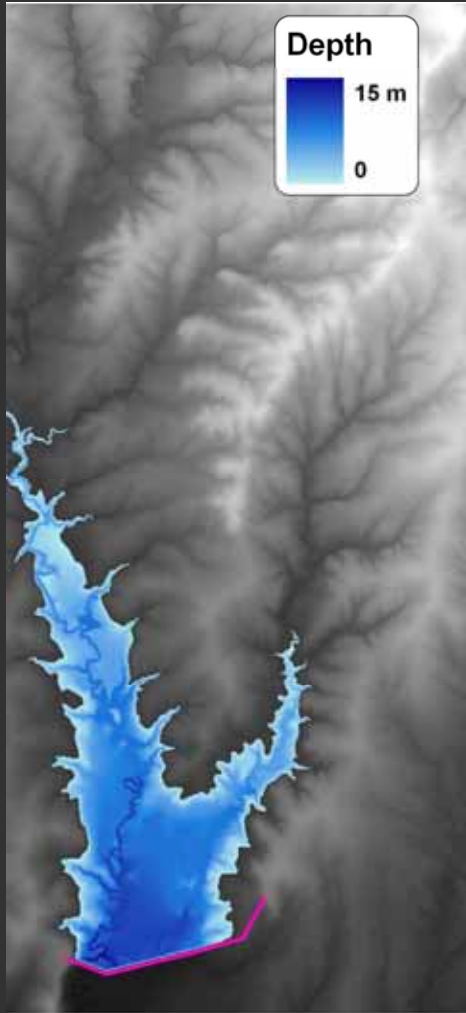


Evaluated change in surface area, volume and perimeter at each dam height.

## Example Results from KBS Assessment

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### Maximum Lake Extent Using a 15m Dam

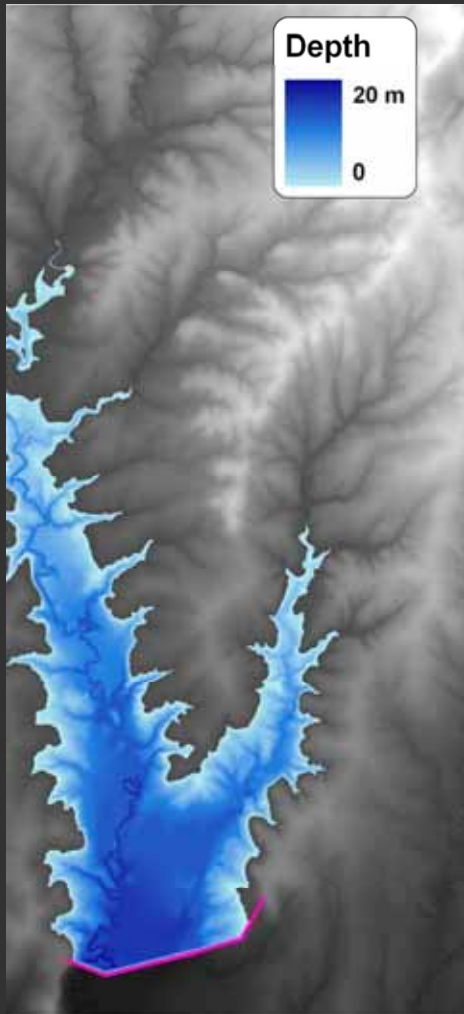


Evaluated change in surface area, volume and perimeter at each dam height.

## Example Results from KBS Assessment

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### Maximum Lake Extent Using a 20m Dam

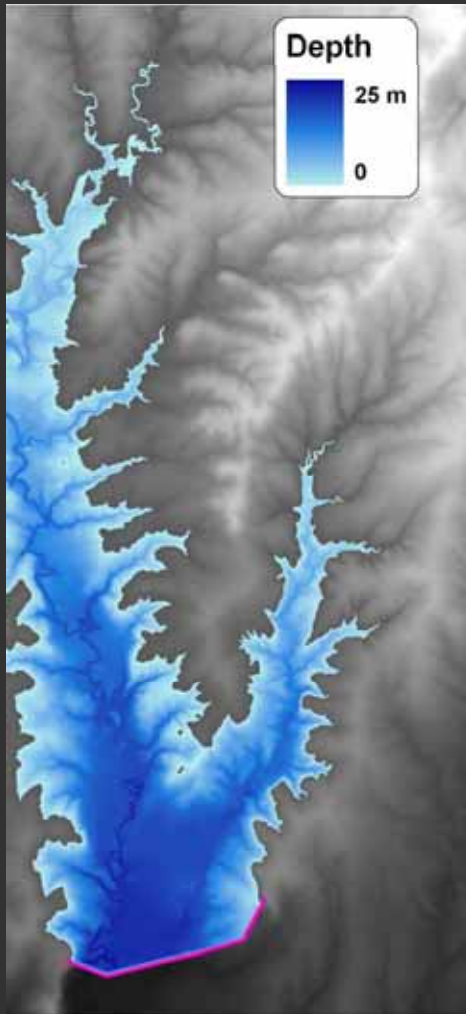


Evaluated change in surface area, volume and perimeter at each dam height.

## Example Results from KBS Assessment

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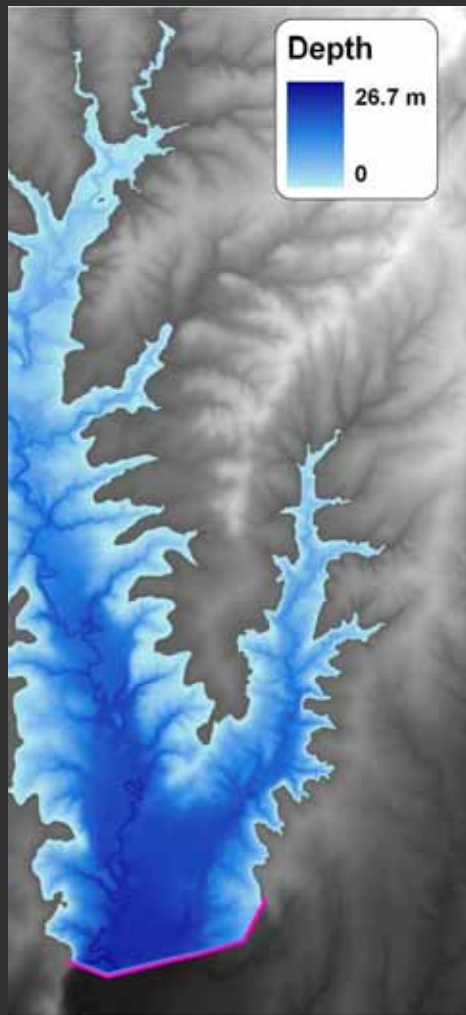
### Maximum Lake Extent Using a 25m Dam



Evaluated change in surface area, volume and perimeter at each dam height.

## Example Results from KBS Assessment

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Maximum Lake Extent  
Using a **>25m** Dam

Evaluated change in surface area, volume and perimeter at each dam height.

# **Phase II**

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**Environmental, Culture, Economic Assessment Methodology  
(Committee Task)**

# Criteria Evaluation

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- KWO and KU Interns (*Nicole Niehues and Oliver Hughes*) evaluated criteria for four example sites using GIS and other tools
- Information shared in general formats, not associated with any designated locations, to allow committee members to provide open feedback

Criteria (units)	Description	Progress	Result			
			Site 1	Site 2	Site 3	Site 4
Sedimentation Rate (AF/Yr)	estimated sedimentation rate for reservoir	Complete	35.4	23.7	50.5	48.3
Railroad (mi)	miles of railroad located within reservoir footprint	Complete	1.83	0	10.9	3.75
Private Drive (mi)	miles of private roads located within reservoir footprint	Complete	3.46	1.86	3.88	2.62
Rural Roads (mi)	miles of rural roads located within reservoir footprint	Complete	26.26	12.8	29	28.5
State Highway (mi)	miles of State highway located within reservoir footprint	Complete	0	0	5.36	0
U.S. Highway (mi)	miles of U.S. highway located within reservoir footprint	Complete	2.74	0	0	0
Gas Transmission Lines (mi)	miles of gas transmission lines located within reservoir footprint	Complete	0	0	1.98	0.69
Elec Transmission Lines (mi)	miles of electrical transmission lines located within reservoir footprint	Complete	1.28	0	3.07	4.20
Incorp Area (Ac)	acres of incorporated area located within reservoir footprint	Complete	0.00	0	0.00	0.00
Homes (#)	number of homes located within reservoir footprint	Complete	38	19	44	38
Outbuildings (#)	number of outbuildings located within reservoir footprint	Complete	69	41	115	87
Gas Fields (Ac)	acres of gas fields within the reservoir footprint	Ongoing	0	0		
Oil Fields (Ac)	acres of oil fields within the reservoir footprint	Ongoing				
Gas Wells (active #)	number of active gas wells located within reservoir footprint	Complete	0	73	0	0
Gas Wells (plugged #)	number of plugged gas wells located with reservoir footprint	Complete	0	15	0	0
Oil/Disposal Wells (active #)	number of active oil or disposal wells located within reservoir footprint	Complete	16	3	0	0
Oil/Disposal Wells (plugged #)	number of plugged oil or disposal wells located within reservoir footprint	Complete	37	1	4	7
Land Use (all types in ac: reservoir)	acres associated with land use types located within the reservoir footprint	Complete	Land Use Data	Land Use Data	Land Use Data	Land Use Data
Land Use (all types in ac: drainage area)	acres associated with land use types located within the reservoir site drainage area	Complete	Land Use Data	Land Use Data	Land Use Data	Land Use Data
Perennial Stream (mi)	perennial stream miles located within the reservoir footprint	Complete	24.63	32.55	48.68	34.36
Intermittent Stream (mi)	intermittent stream miles located with the reservoir footprint	Complete	63.64	26.19	64.84	37.16
Ex Class State Waters (mi)	stream miles of exceptional state waters within reservoir footprint	Complete	0	0	22.4	0
Water Quality (303d)	existing 303(d) listed impairments within stream network to reservoir site	Complete	None	None	Bio	None
Water Quality (mean and 95%ile)	summary information for select water quality parameters	Complete	WQ Data	WQ Data	WQ Data	WQ Data
Ponds (#)	number of ponds located within the reservoir footprint	Complete	50	28	64	110
Drainage Area Pond Density (#/Sq Mi)	Density of ponds within drainage area of reservoir site	Complete	4.38	1.97	2.28	5.38
Drainage Area CAFOs (#)	number of confined animal feeding operations located in drainage area of reservoir site	Complete	3	10	1	1
Drainage Area CAFOs (KS au)	total kansas animal units for confined animal feeding operations located within drainage area of reservoir site	Complete	695	6081	125	28
Drainage Area Controlled by other structures (Sq Mi and %)	total square miles of area within reservoir site drainage area controlled by existing ponds (will also be expressed as % of reservoir site drainage area)	Ongoing				
Viewshed Area (ac)	total acres surrounding reservoir site that would have line of sight to reservoir at multipurpose elevation	Ongoing				
Water Rights	number of water rights and total authorized quantity of rights downstream of reservoir site	Ongoing				
Archeological Interest Sites (#)	number of identified cultural interest sites within reservoir footprint	Ongoing				
Critical Habits	Area/Type of critical habitat within reservoir footprint	Ongoing				

# Transportation Routes

- Railroad (hard to relocate)
- Private Drives
- Rural Roads
- Highways

		Result				
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Rural Roads (mi)	miles of rural roads located within reservoir footprint	Complete	26.26	12.8	29	28.5
State Highway (mi)	miles of State highway located within reservoir footprint	Complete	0	0	5.36	0
U.S. Highway (mi)	miles of U.S. highway located within reservoir footprint	Complete	2.74	0	0	0

# Buildings

- Incorporated Areas
- Homes
- Outbuildings

			Result			
Criteria (units)	Description	Progress	Site 1	Site 2	Site 3	Site 4
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Homes (#)	number of homes located within reservoir footprint	Complete	38	19	44	38
Outbuildings (#)	number of outbuildings located within reservoir footprint	Complete	69	41	115	87

# Phase II

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Economic Evaluation

# Economic Evaluation

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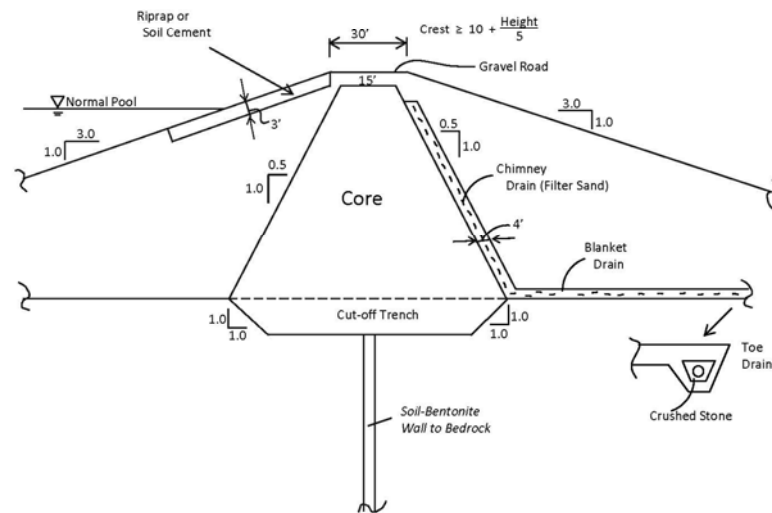
- KWO, through a Public Assistance to States (PAS) agreement with the US Army Corps of Engineers, contracted with CDM to provide general economic evaluations of reservoir construction and related costs
- KWO independently calculated an estimation of mitigation required to offset the loss to aquatic environments resulting from reservoir construction

# Basic Assumptions

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- ◉ No excavation in rock is required
- ◉ 2011 dollars (rounded to 2 significant figures)
- ◉ Planning level estimate – 25% contingency of construction costs
- ◉ Engineering and Design – 10%
- ◉ No property acquisition estimated for replacement of transportation facilities and utilities
- ◉ Dam volume based on volume quantities provided by the Kansas Water Office. Quantities were considered in place volume and factors were applied to indicate compaction
- ◉ An average price of homes and outbuildings from available assessor information was used to estimate property acquisition costs
- ◉ Cost of compensation for the loss of current and future oil and gas production profits were not estimated
- ◉ Values of the rights or extraction of resources were not considered when determining land value
- ◉ Realistic Cost column reflects 25% import of embankment material, Conservative Cost column reflect 100% import of embankment material.

# Typical Dam Cross Section



# Schematic of Example Spillway

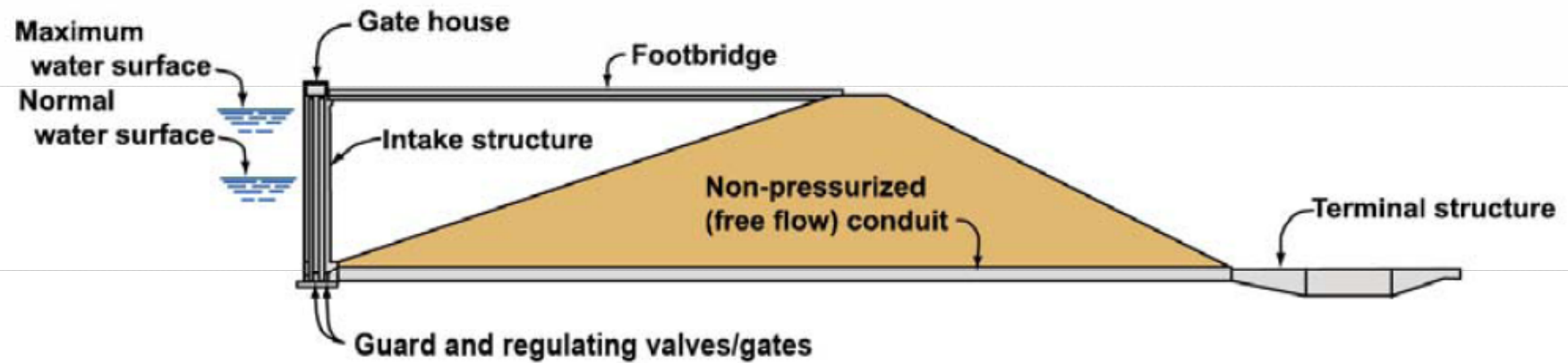


Figure 2 Primary Spillway Configuration for Proposed Reservoirs (adapted from U.S. Department of the Interior Bureau of Reclamation Design Standards No. 14, Draft Phase 3, March 2010)

# Example of Primary Spillway – Hillsdale Reservoir

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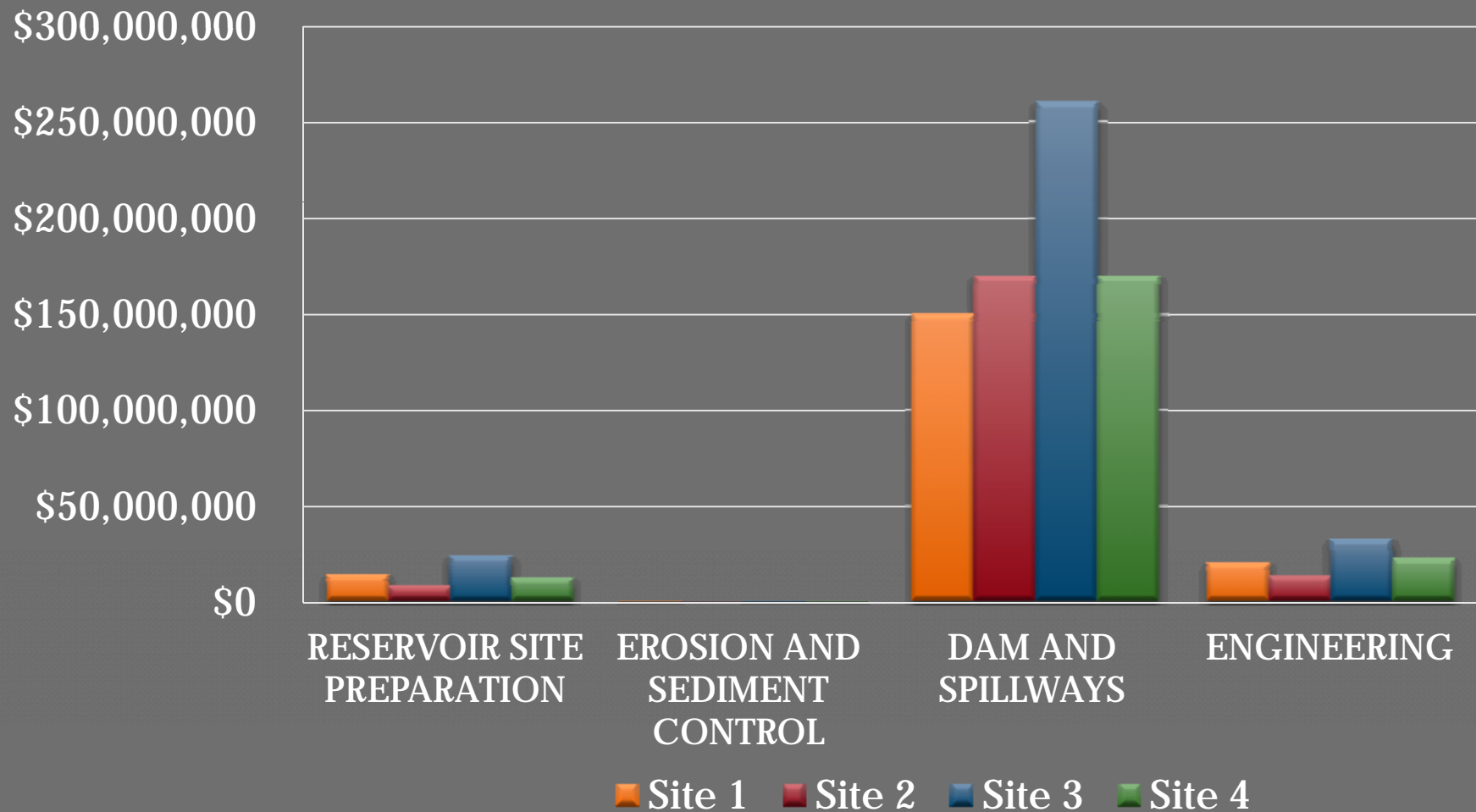


# Planning Level Cost Estimate

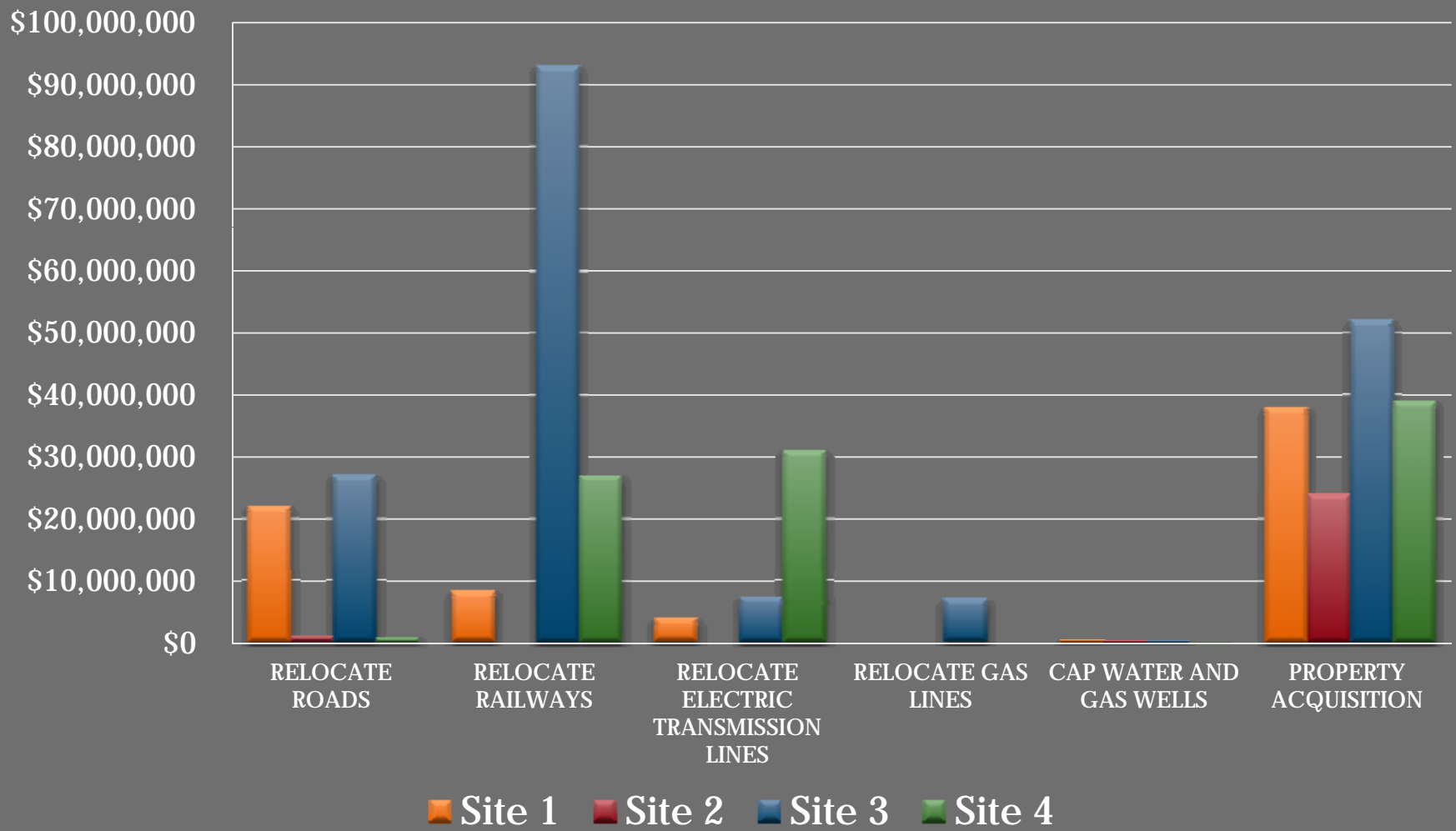
	Site 1	Site 2	Site 3	Site 4
Total Construction Cost	\$220-370 million	\$220-320 million	\$370-520 million	\$240-380 million
Total Other Costs	\$73 million	\$25 million	\$190 million	\$100 million
Total Project Costs	\$290-440 million	\$250-350 million	\$560-710 million	\$340-480 million

Notes: Range shown reflects variance of cost when materials are used on-site (25% import) v. hauled to site (100% import)  
2011 Dollars  
25% Contingency Applied

# Construction Costs



# Other Costs



# Compensatory Mitigation

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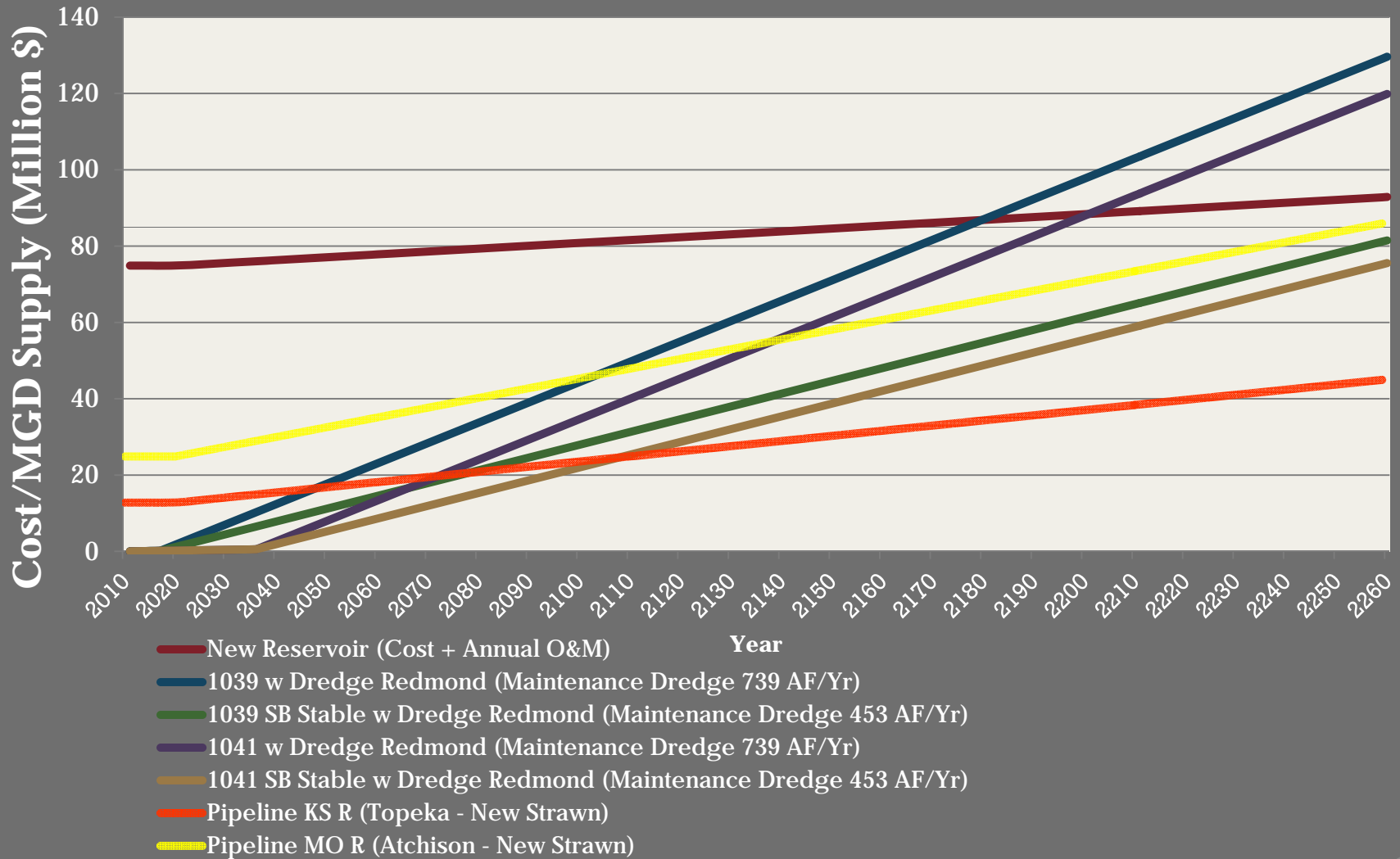
- Clean Water Act, Section 404
- Calculated perennial and intermittent stream miles impacted by reservoir development
- Kansas Stream Mitigation Guidance (KSMG)
- Assumptions
  - Impact 1 (Dam) *Perennial, Primary, Moderately Functional, Permanent, Fill using dam width*
  - Impact 2 (Inundation of Perennial Streams) *Perennial, Primary, Moderately Functional, Permanent, Impound for remaining perennial stream linear feet impacted (not dam)*
  - Impact 3 (Inundation of Intermittent Streams) *Intermittent w/pools, Secondary, Moderately Functional, Permanent, Impound for intermittent stream linear feet impacted*

# Planning Level Cost Estimate with Mitigation

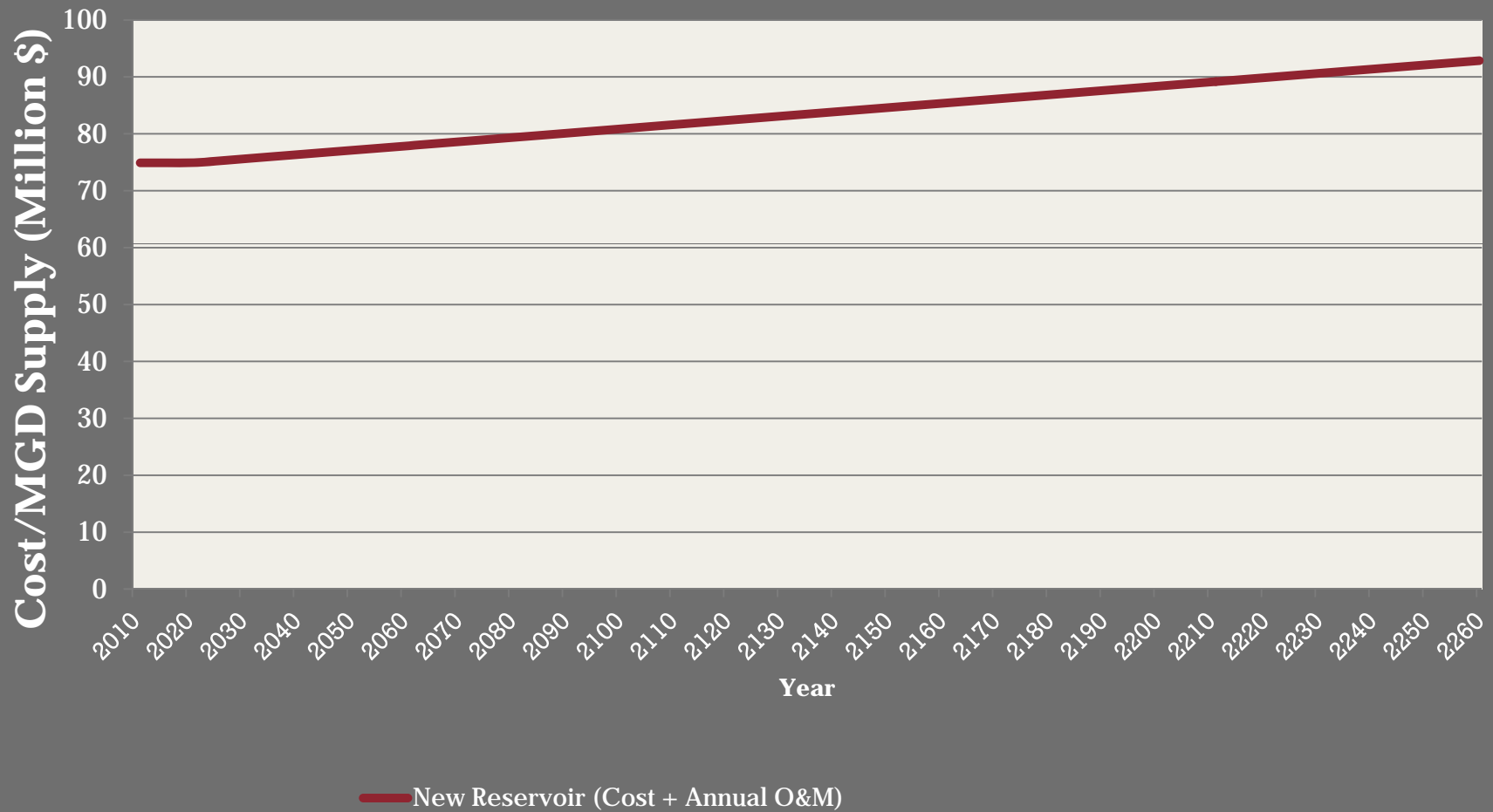
	<b>Site 1</b>	<b>Site 2</b>	<b>Site 3</b>	<b>Site 4</b>
<b>Total Project Costs</b>	\$290,000,000	\$250,000,000	\$560,000,000	\$340,000,000
<b>Stream Mitigation</b>	\$815,099,040	\$316,607,600	\$1,146,540,380	\$458,564,460
<b><i>Total Costs</i></b>	\$1,105,099,040	\$566,607,600	\$1,706,540,380	\$798,564,460

Notes: Construction Costs based on 25% import of materials  
2011 Dollars  
25% Contingency Applied

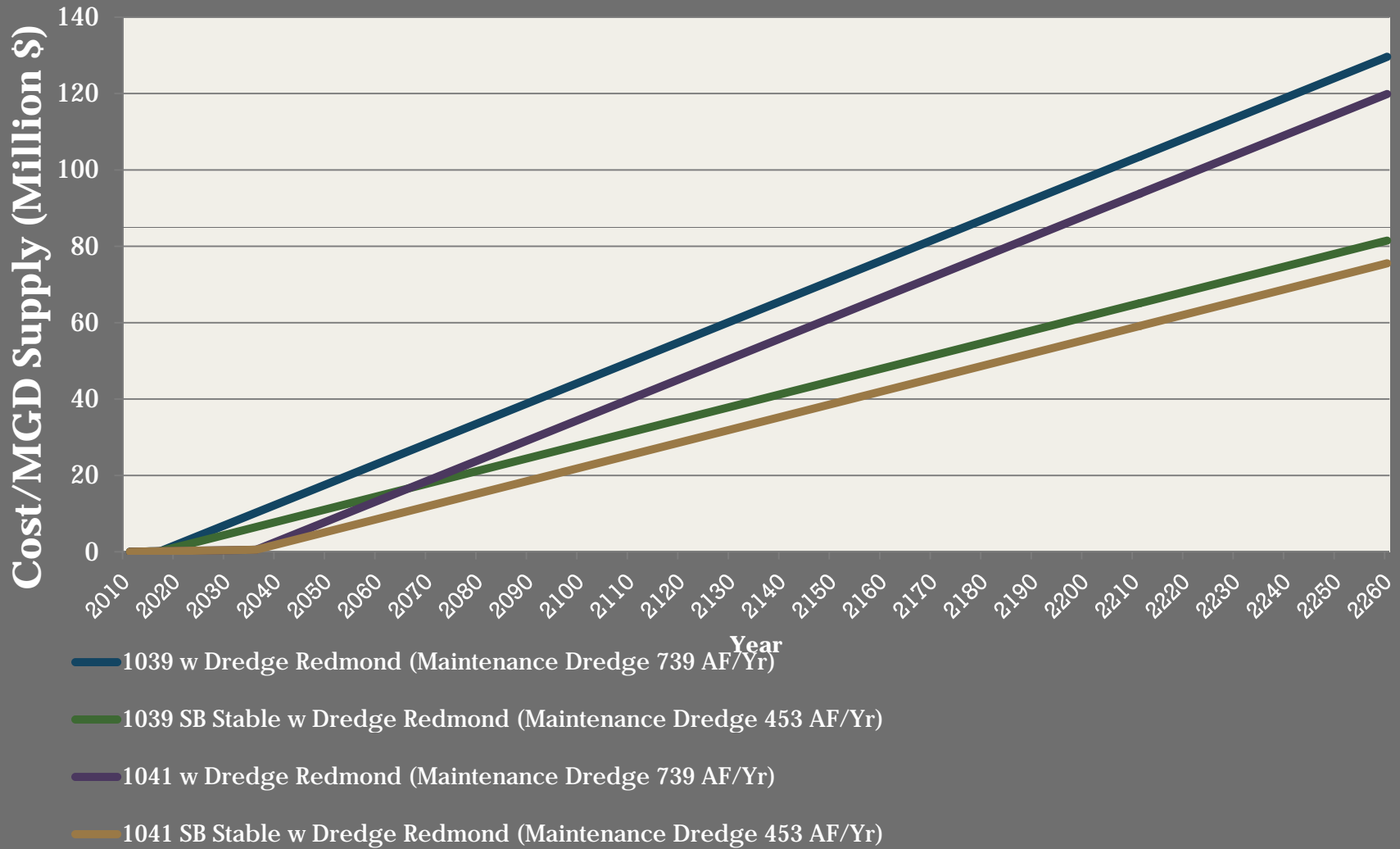
# Cost Comparison



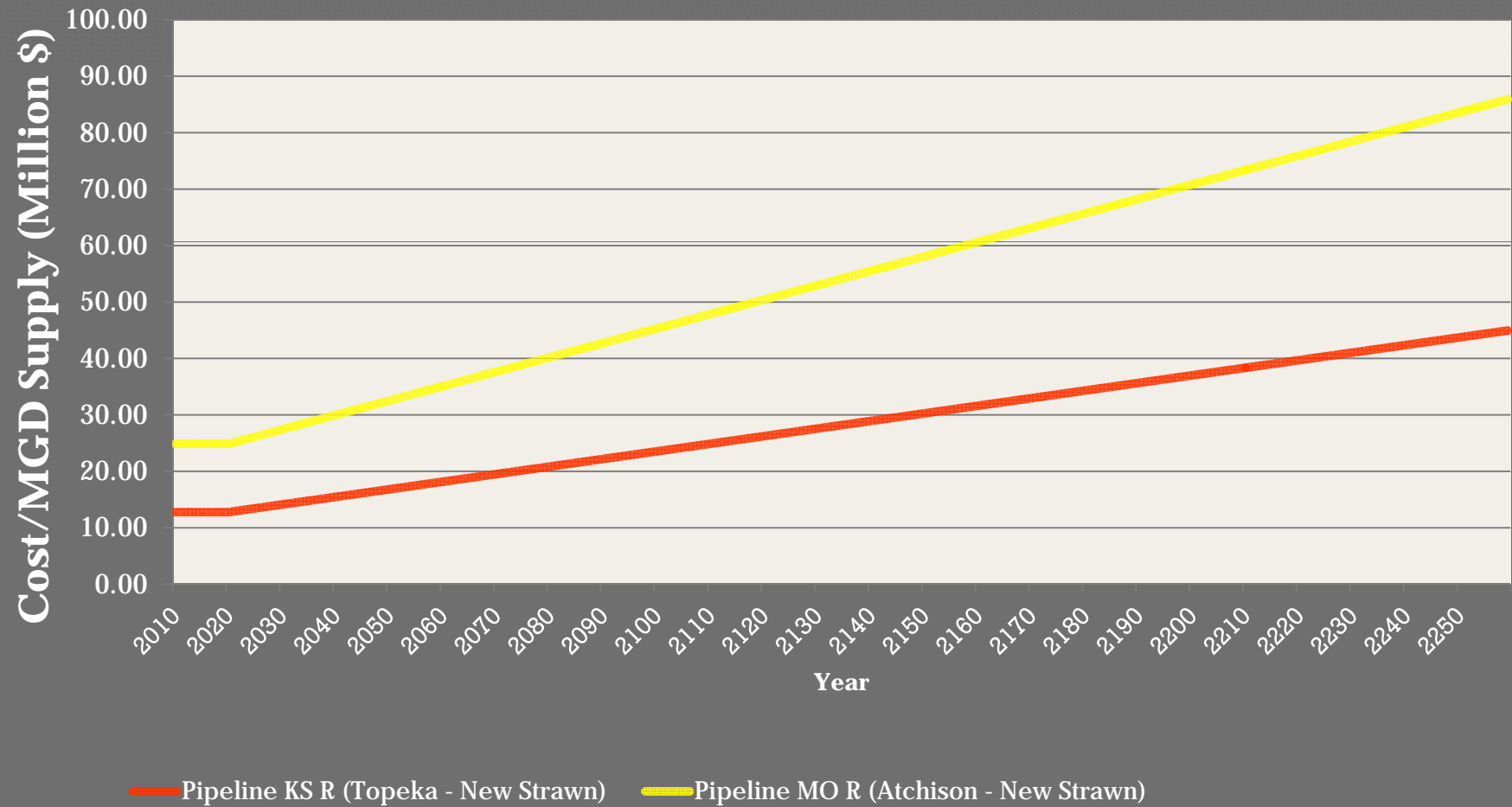
# Cost Comparison



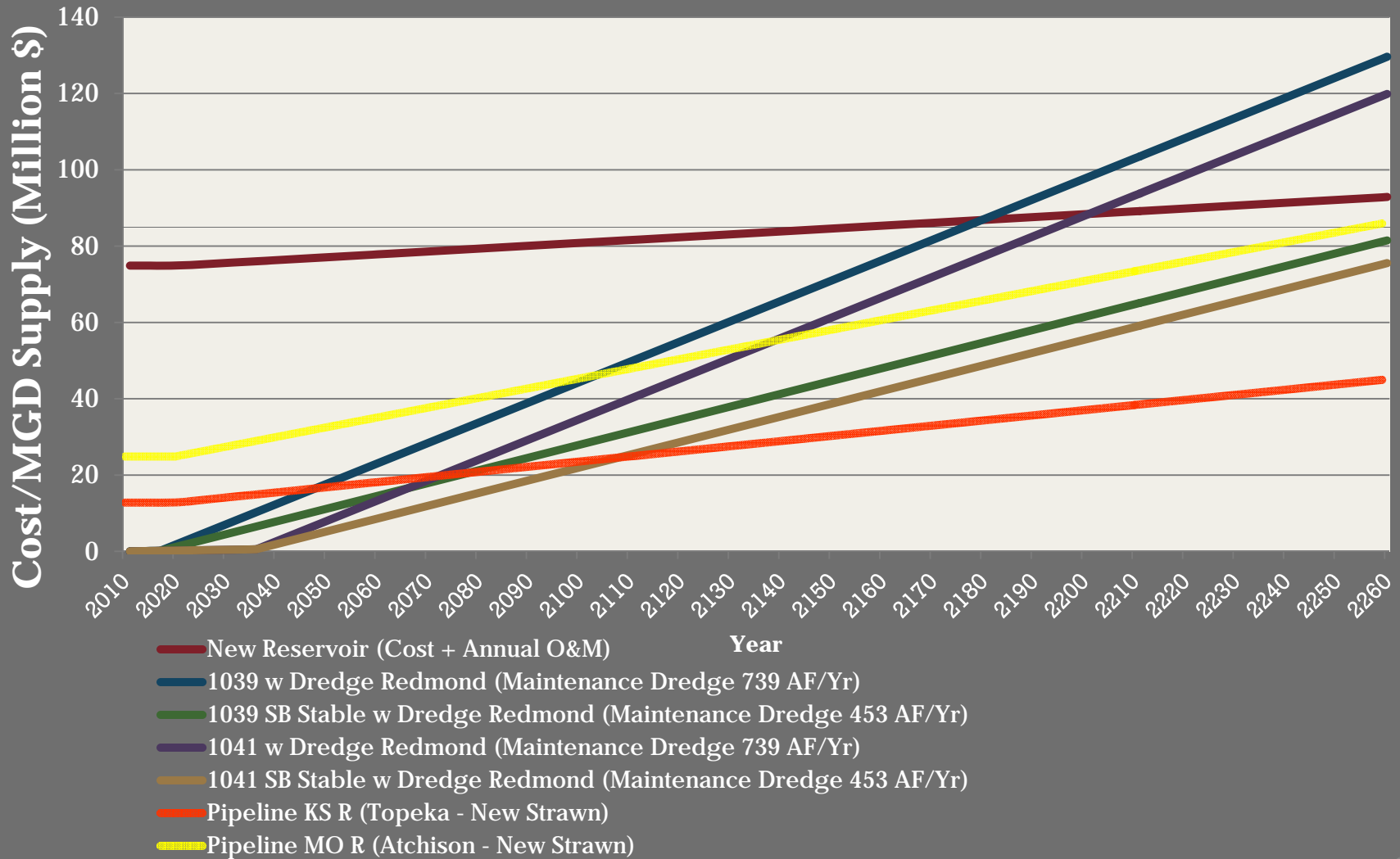
# Cost Comparison



# Cost Comparison



# Cost Comparison



# Neosho PAS

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- Results from Neosho PAS will be used as part of an overall evaluation of water supply alternatives for the Neosho basin
- Thanks to Bryan Taylor, U.S. Army Corps of Engineers – Tulsa District; Project Manager
- Thanks to CDM

# Questions & Discussion

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