

CO-OP Drought Monitoring & Triggers

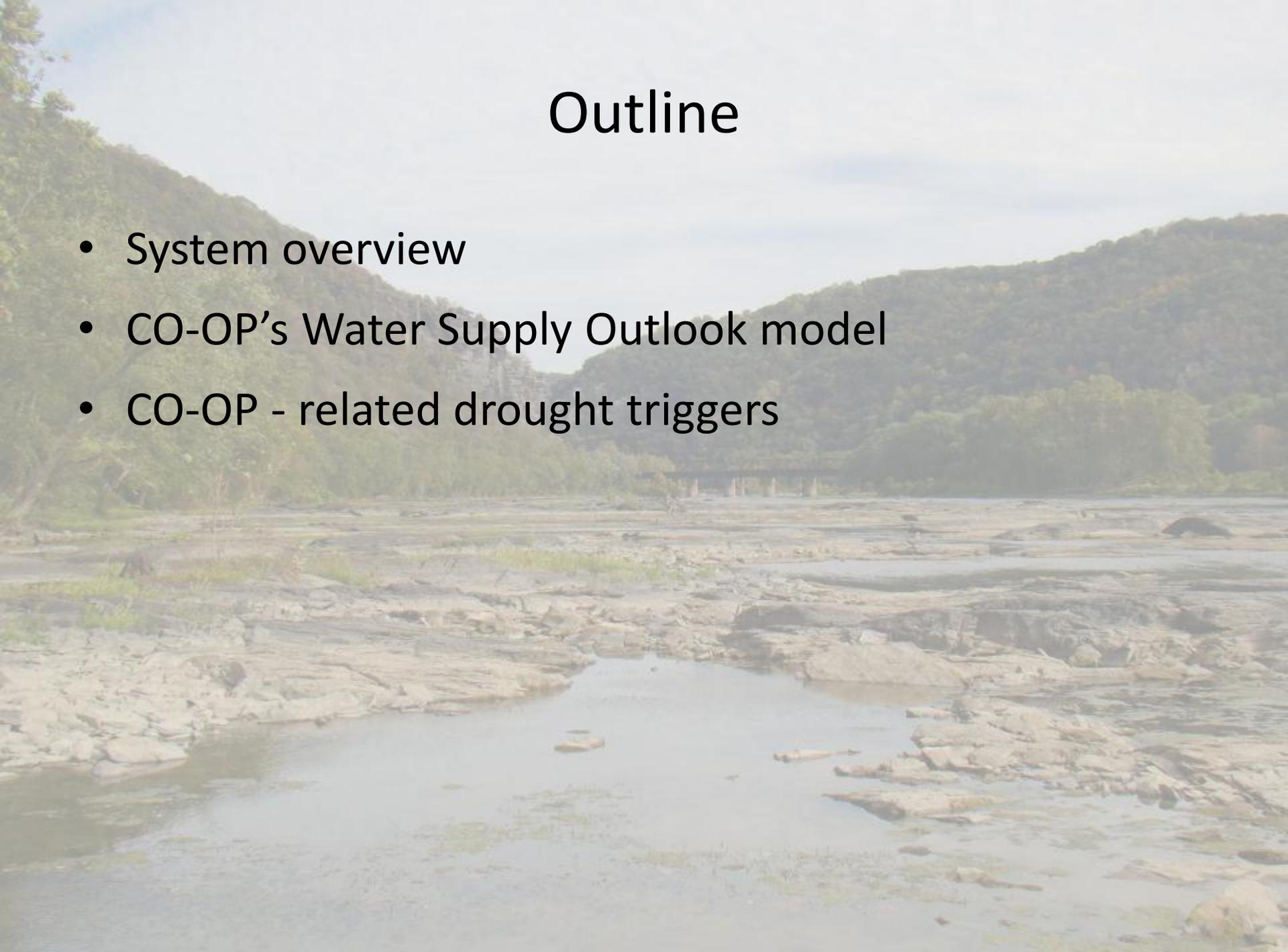


Metropolitan Washington Council of Governments
April 4, 2013

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Interstate Commission on the Potomac River Basin

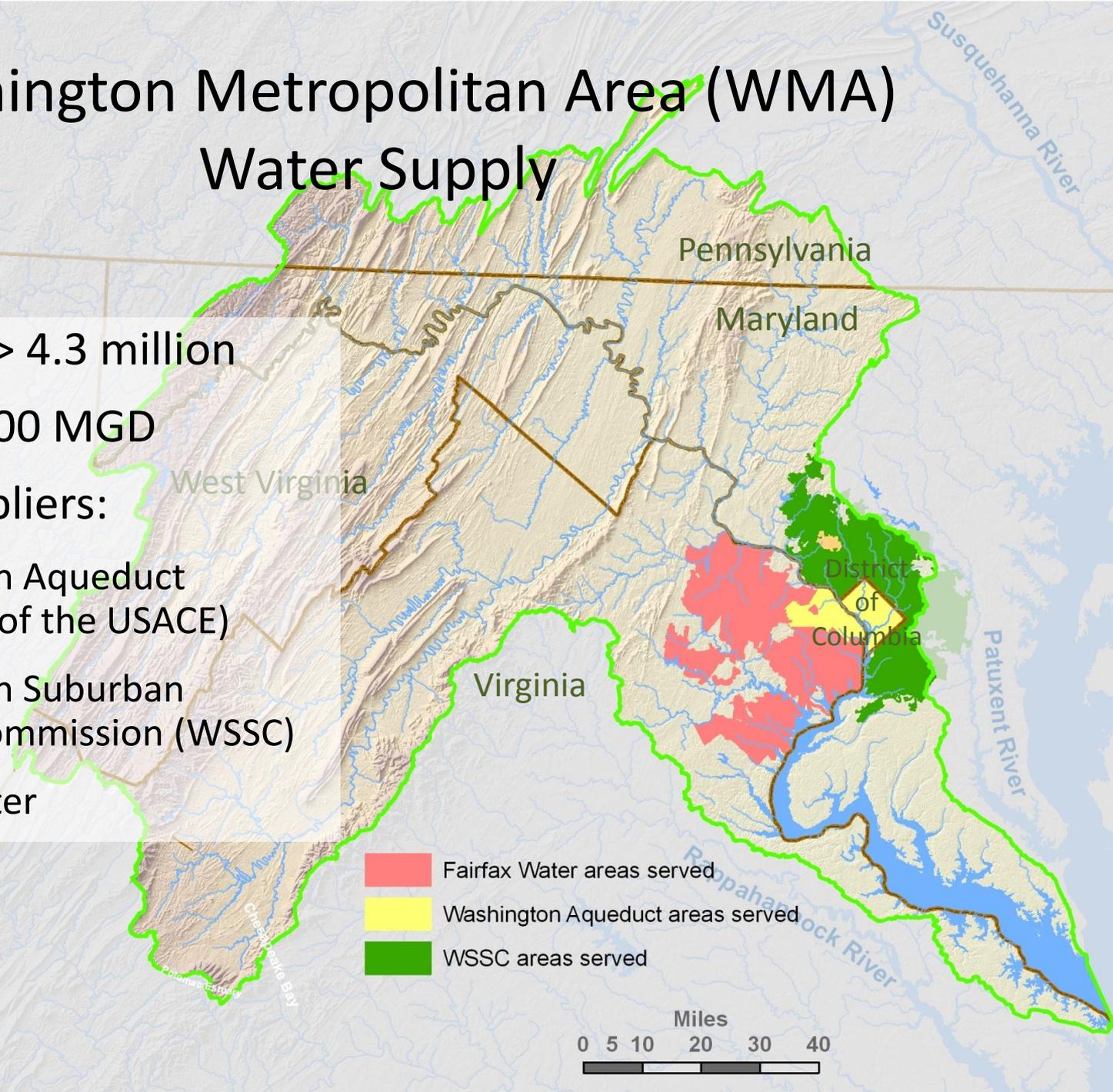
Outline

- System overview
- CO-OP's Water Supply Outlook model
- CO-OP - related drought triggers



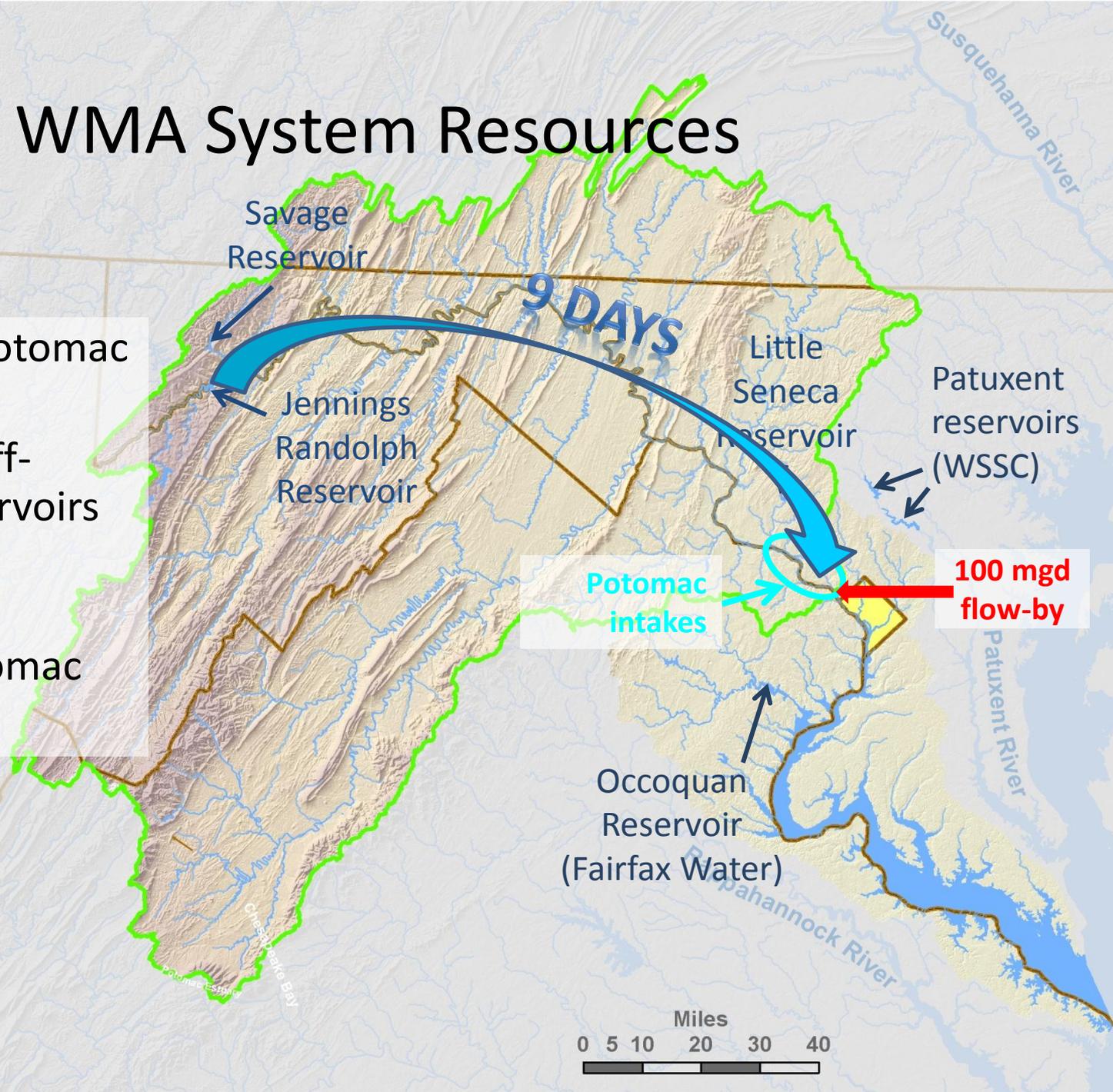
Washington Metropolitan Area (WMA) Water Supply

- Population: > 4.3 million
- Demand ~ 500 MGD
- 3 major suppliers:
 - Washington Aqueduct (a Division of the USACE)
 - Washington Suburban Sanitary Commission (WSSC)
 - Fairfax Water



WMA System Resources

- ~ 75% from Potomac River
- ~ 25% from off-Potomac reservoirs
- 3 upstream reservoirs to augment Potomac flow



Role of ICPRB's CO-OP Section

- Daily monitoring – and reporting, of flows and withdrawals
- Drought operations – assisting in cooperative management of system
 - Determining need for releases from upstream reservoirs
 - Recommending withdrawal targets for off-Potomac reservoirs
- Drought exercises – held annually
- Demand and resource availability forecast – every 5 years
- *Water Supply Outlook* – published April thru October

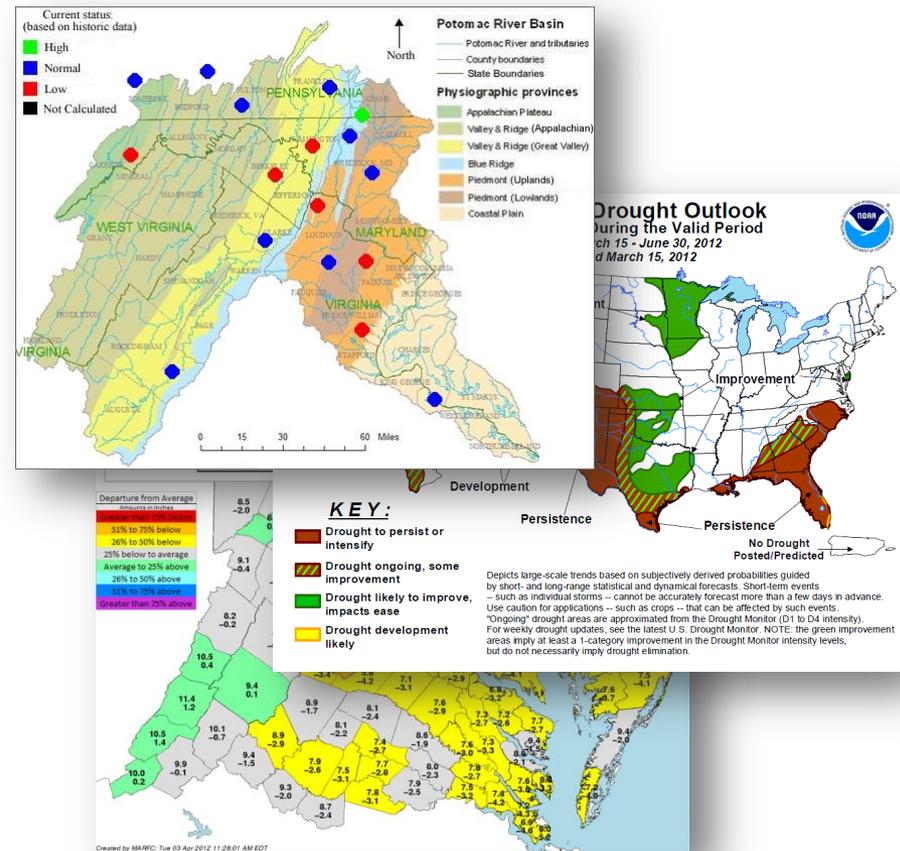
Most Significant Potomac Low-Flow Periods

- 1930 – drought of record for WMA system
- 1966 – drought of record for Potomac River
- 1999 – 1st releases from upstream reservoirs
- 2002 – 2nd releases from upstream reservoirs



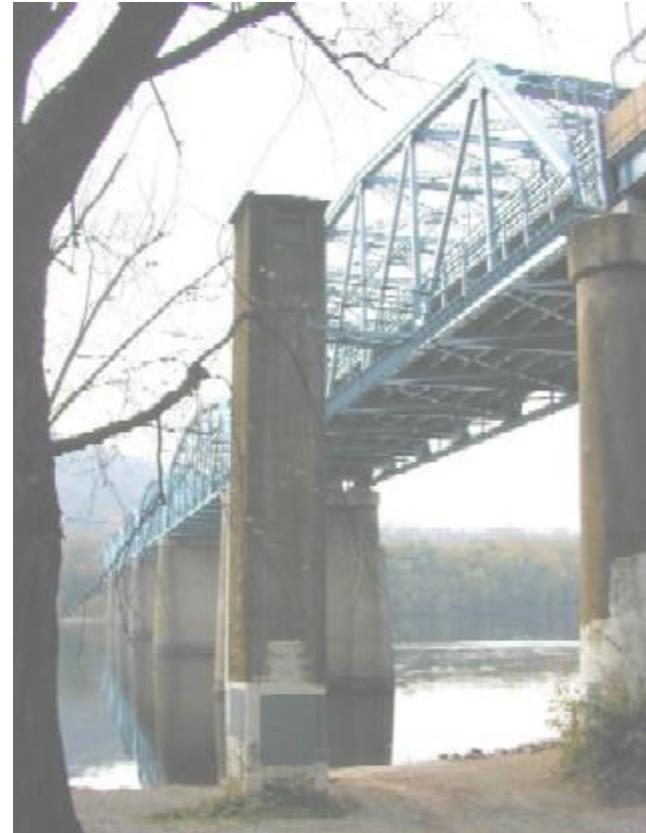
CO-OP's Water Supply Outlook (WSO)

- Outlook for WMA water supply system
- Published Apr – Oct
- Provides
 - Current Potomac basin conditions
 - Forecasts of meteorological conditions – NWS sources
 - Forecasts of Potomac River flows – ICPRB's WSO model



Original ICPRB WSO Model

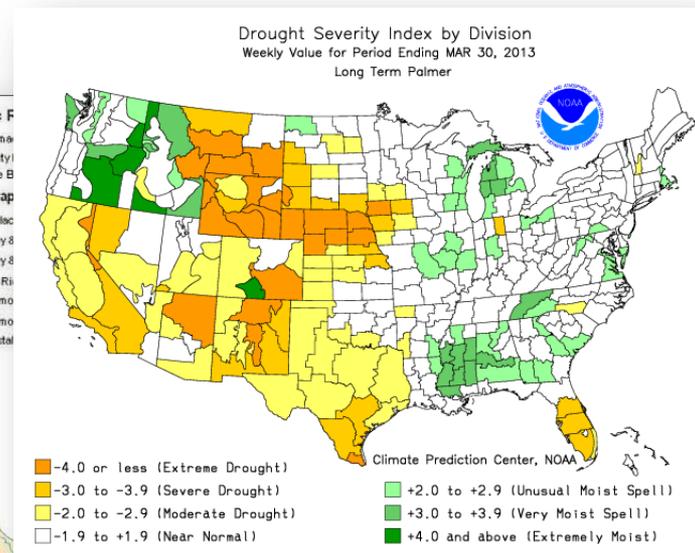
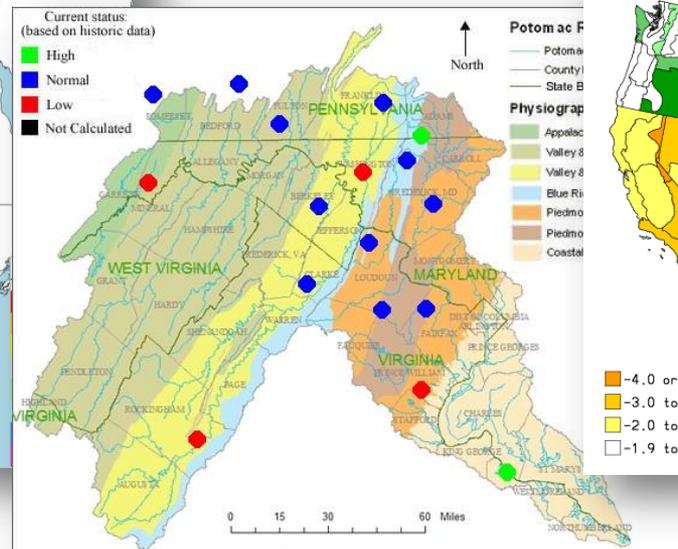
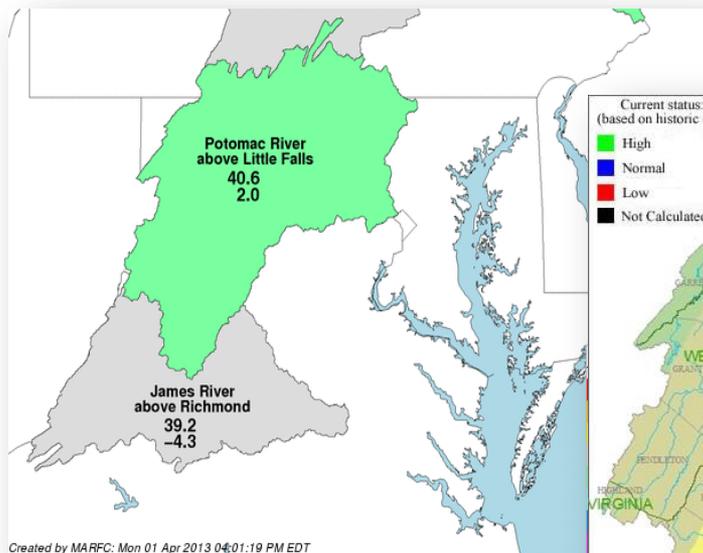
- Non-parametric regression model developed by J. Smith (1991)
- Predictor variable: past 30-day minimum daily flow at Point of Rocks
- Forecast variable: conditional probability that flow $< T$ will occur sometime in coming release season ($T = 600$ mgd, 700 mgd, 800 mgd, ...)
- Model time step is monthly



See J. A. Smith, 1991. Long-range streamflow forecasting using nonparametric regression, *Water Resources Bulletin*, Vol. 27, No. 1, pp. 39-46.

WSO Model Changes

- Now use 4 separate predictor variables:
 - Past 30-day minimum “natural” flow at Little Falls
 - Past 12-month total mean basin precipitation
 - Weighted & normalized average of current basin ground water levels
 - Weighted average of most recent Palmer Drought Severity Index



Model's Low-Flow Forecasts

- Historical summertime water demands (Jun, Jul, Aug, Sep; 1995-2008)
 - System monthly averages: 513 – 552 mgd
 - Potomac monthly averages: 405 – 434 mgd
 - Potomac monthly maximums: 533 – 608 mgd

Outlook for Potomac River at Little Falls as of April 2, 2013			
Low flow threshold (MGD)	Low flow threshold (cfs)	Historical probability of lower flow April 1 through December 31	Conditional probability of lower flow April 1 through December 31
1200	1858	68%	63%
1000	1548	49%	42%
800	1238	25%	19%
700	1084	15%	7%
600	929	8%	2%

CO-OP - Related Drought Triggers

- Water Supply Coordination Agreement (1982)
 - CO-OP daily monitoring (88% probability in any given year)
 - CO-OP drought operations
- Low Flow Allocation Agreement (1978)
 - Alert Stage
 - Restriction Stage
 - Emergency Stage (has never occurred)

CO-OP – Related Drought Triggers

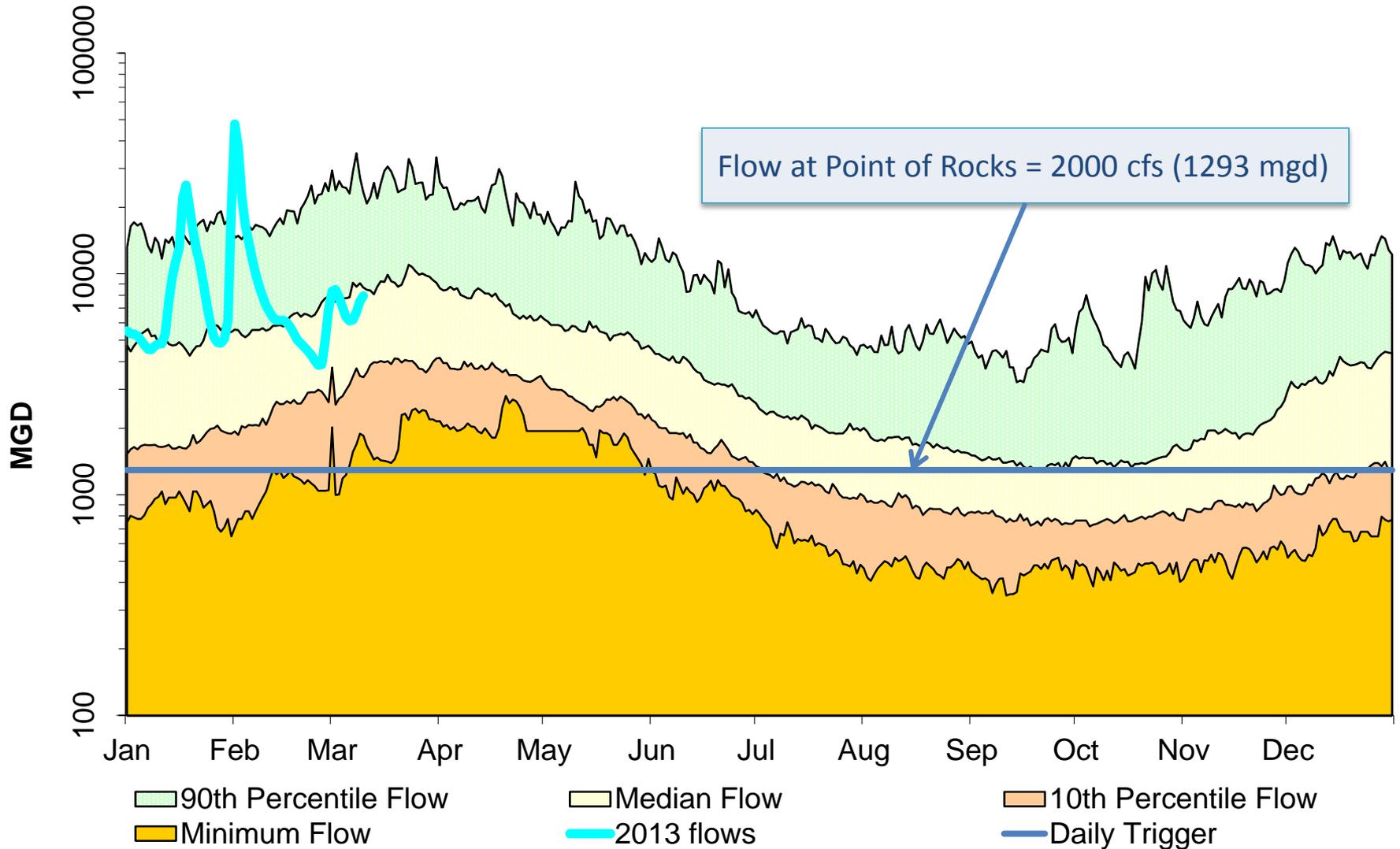
Event	Trigger	Units
CO-OP daily monitoring	Flow at Point of Rocks < 2000	cfs
CO-OP drought ops	$Q_{adj} < 2 \times W + FB$	mgd
LFAA Alert Stage ¹	$Q_{adj} < 2 \times W$	mgd
LFAA Restriction Stage ^{1, 2}	$Q_{adj} < 1.25 \times (W + FB)$	mgd
LFAA* Emergency Stage ^{1, 2}	$Q_{adj} < W + FB$ (forecast for next 5 days)	mgd

Q_{adj} = “Adjusted” Potomac River flow at Little Falls
 = the flow that would occur in the absence of withdrawals, W
 W = withdrawals downstream of Seneca pool
 FB = environmental flow-by at Little Falls dam = 100 mgd

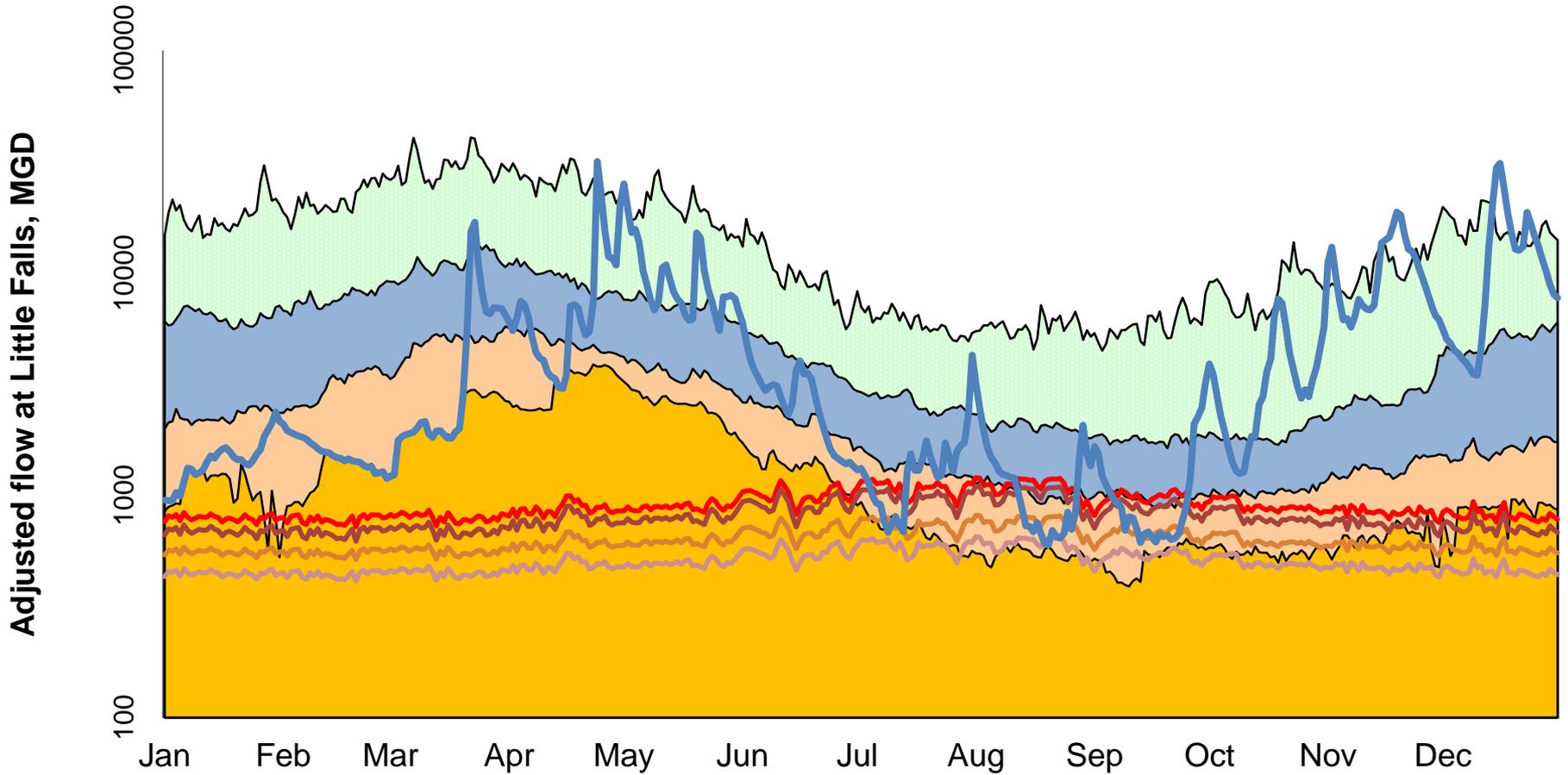
¹LFAA Stage declarations at the discretion of Washington Aqueduct, in consultation with other CO-OP suppliers, by LFAA Modification No. 2, January 11, 1978.

²Formula as modified by the Memorandum of Intent, from Drake Wilson, Acting Secretary of Civil Works, to James A. Joseph, Under Secretary of the Interior, July 19, 1978.

Daily Monitoring Trigger at Point of Rocks



2002 Little Falls Adjusted Flows and Triggers



- 50th to 90th Percentile Flows
- 10th to 50th Percentile Flows
- Historical Minimum to 10th Percentile Flows
- Zero to Historical Minimum Flows

- Adjusted flow
- Drought Ops
- Alert Stage
- Restriction Stage
- Emergency Stage

Some Trigger Implications

	CO-OP	MDE	VADEQ
Daily Monitoring	Monitor & report flows & withdrawals		
Drought Ops	Monitor & forecast flows, withdrawals & storage; make operational recommendations		May require reduced upstream Potomac withdrawals, in consultation with CO-OP
LFAA Alert Stage			
LFAA Restriction Stage		May require reduced upstream withdrawals	May require reduced upstream Potomac withdrawals, in consultation with CO-OP
LFAA Emergency Stage	Suppliers use LFAA allocation formula		