



**Environmental
Protection**

New York City's Operations Support Tool (OST)

**Supporting Information for Regulated Flow
Advisory Committee Meeting**

April 7, 2011

Example Calculations from Long-Term Simulation (1927 – 2008)

- 1. OST-FFMP Table Selection
August 1, 2007**

Mass Balance Approach

Today's Total PCN Storage  Current System Status

+ Cumulative PCN Inflows through June 1  Probabilistic Streamflow Forecasts

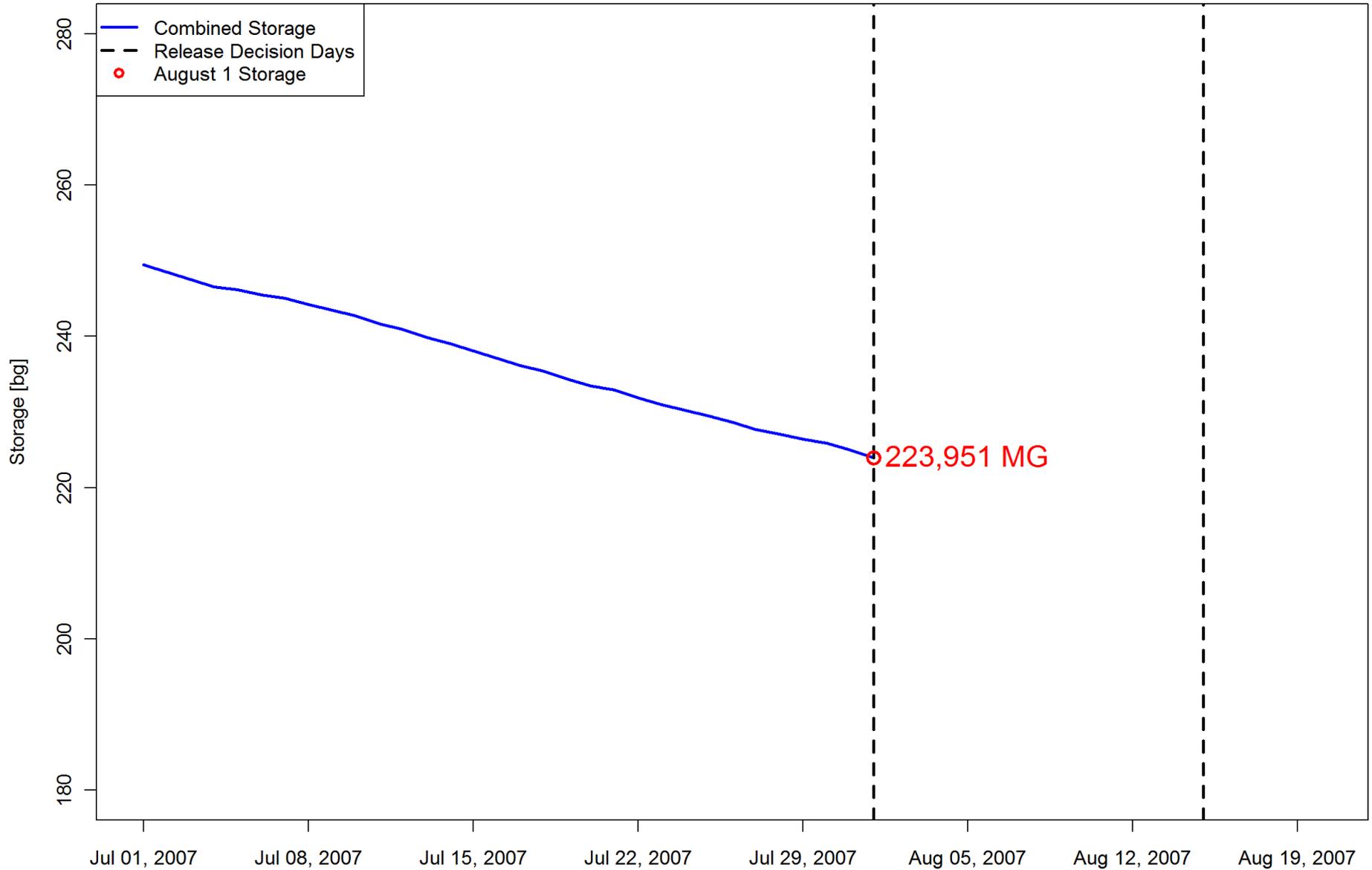
- Cumulative PCN Diversions through June 1  Required to meet NYC Demand

- June 1 Storage Target  98% Usable Storage

= Cumulative **PCN Release Target** through June 1  Distribute over days to June 1 and re-evaluate decision regularly

Today's (August 1, 2007) Total PCN Storage

PCN Storage



Mass Balance Approach

Today's Total PCN Storage \longrightarrow 223,951 MG

+ Cumulative PCN Inflows through June 1 \longrightarrow Probabilistic Streamflow Forecasts

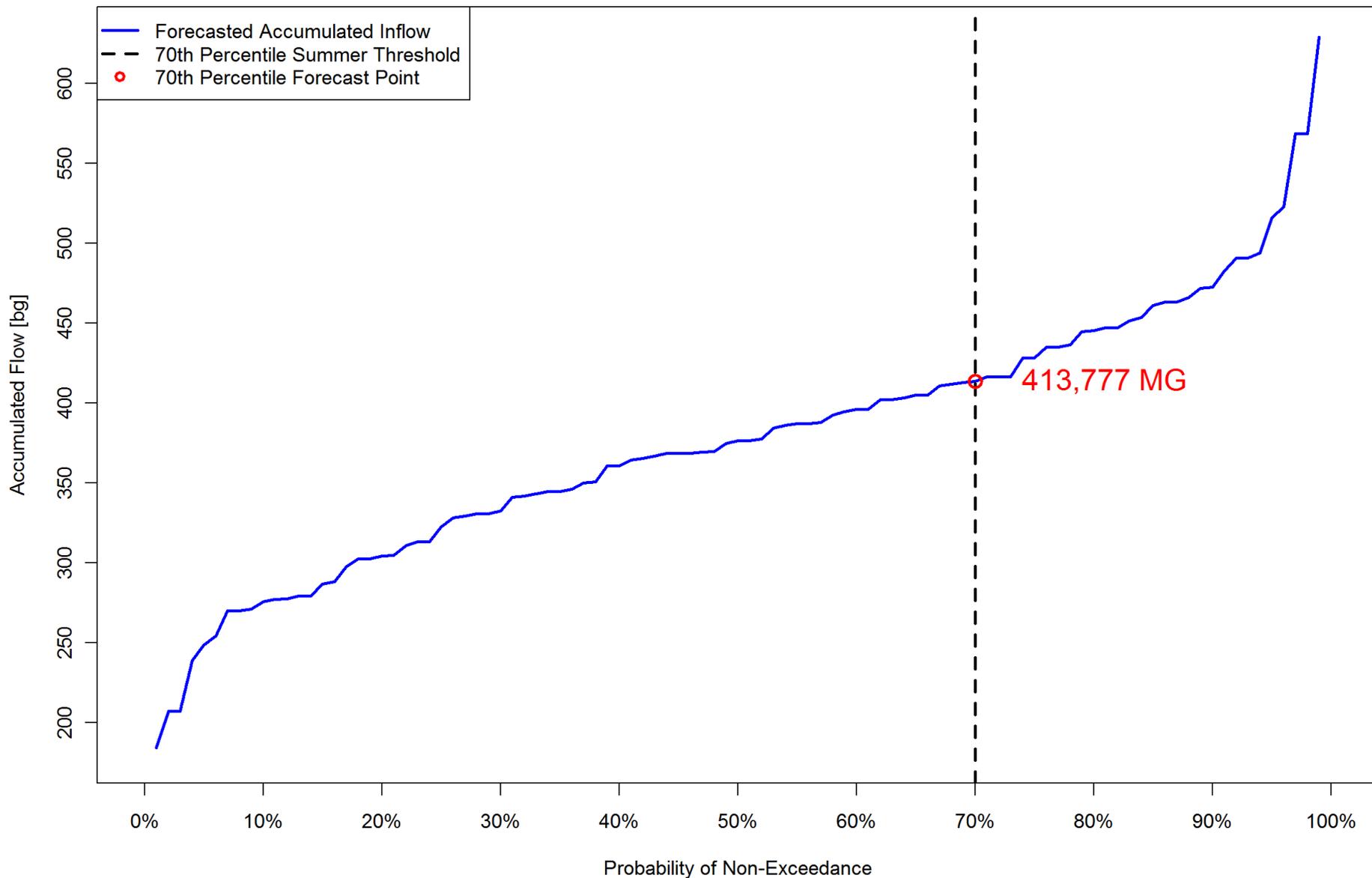
- Cumulative PCN Diversions through June 1 \longrightarrow Required to meet NYC Demand

- June 1 Storage Target \longrightarrow 98% Usable Storage

= Cumulative **PCN Release Target** through June 1 \longrightarrow Distribute over days to June 1 and re-evaluate decision regularly

Cumulative June 1 PCN Inflow Forecast

Distribution of Forecasted Accumulated PCN Inflow from Aug 1, 2007 - Jun 1, 2008

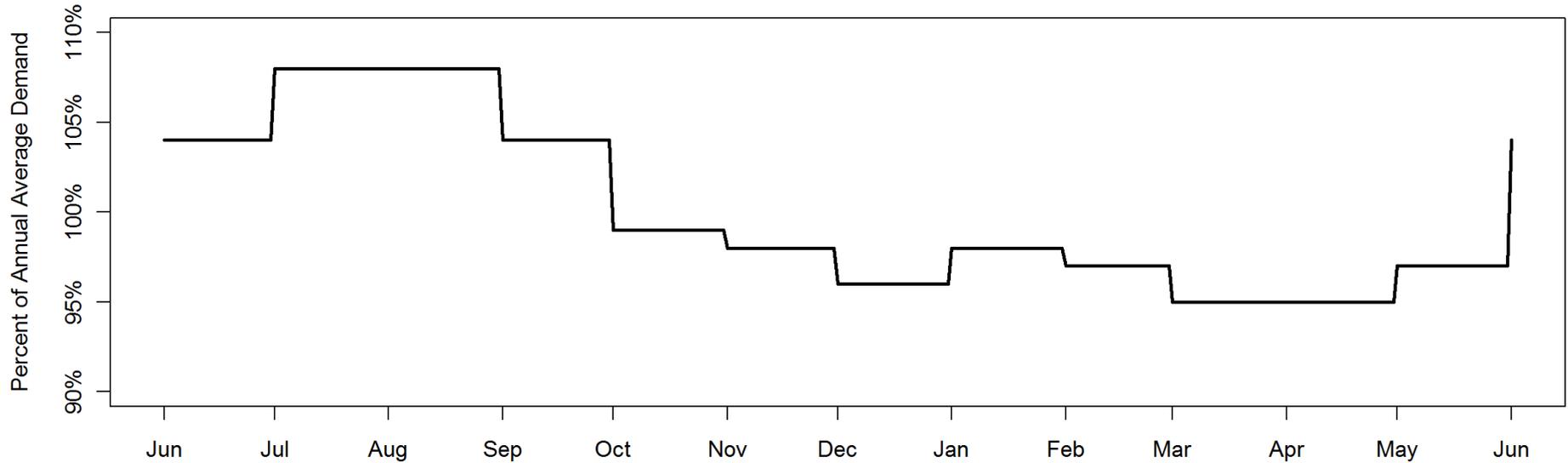


Mass Balance Approach

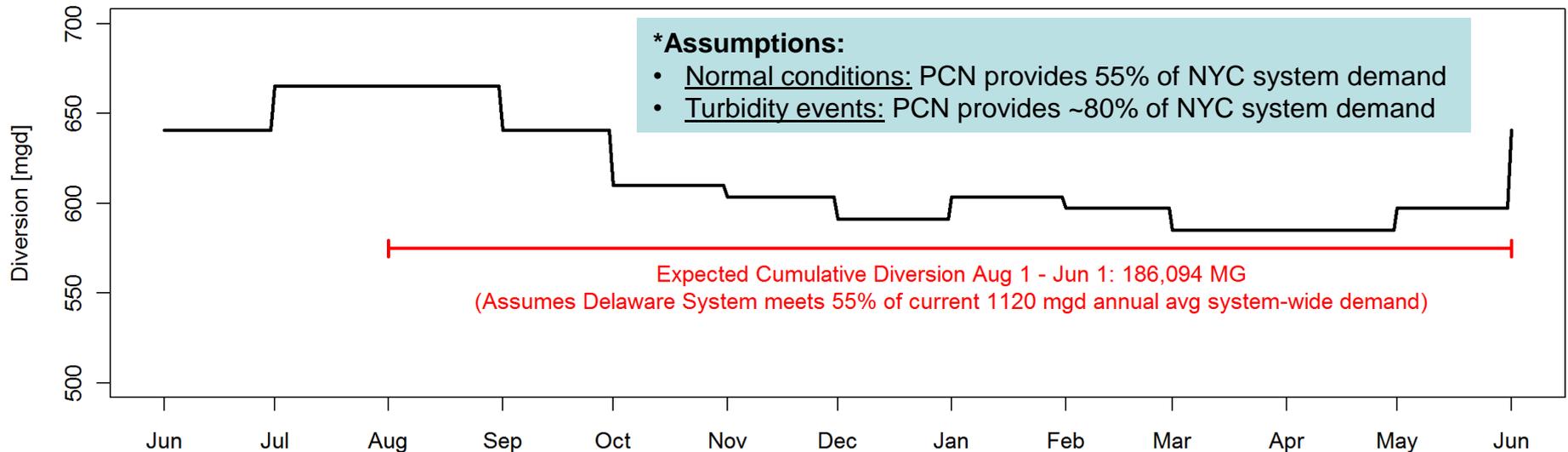
	Today's Total PCN Storage	→	223,951 MG
+	Cumulative PCN Inflows through June 1	→	413,777 MG
-	Cumulative PCN Diversions through June 1	→	Required to meet NYC Demand
-	June 1 Storage Target	→	98% Usable Storage
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=	Cumulative PCN Release Target through June 1	→	Distribute over days to June 1 and re-evaluate decision regularly

Cumulative PCN Diversions through June 1

Seasonal Demand Pattern



Seasonal NYC Delaware Diversion*



Mass Balance Approach

Today's Total PCN Storage \longrightarrow 223,951 MG

+ Cumulative PCN Inflows
through June 1 \longrightarrow 413,777 MG

- Cumulative PCN Diversions
through June 1 \longrightarrow 186,094 MG

- **June 1 Storage Target** \longrightarrow **265,420 MG**

= Cumulative **PCN Release Target** through June 1 \longrightarrow Distribute over days to June 1 and re-evaluate decision regularly

August 1, 2007 Raw Mass Balance

	Today's Total PCN Storage	→	223,951 MG
+	Cumulative PCN Inflows through June 1	→	413,777 MG
-	Cumulative PCN Diversions through June 1	→	186,094 MG
-	June 1 Storage Target	→	265,420 MG
<hr/>			
=	Cumulative PCN Release Target through June 1	→	<u>186,214 MG</u>

Cumulative **PCN Release Target** through June 1



186,214 MG

/

Number of days from August 1 to June 1



306 days

=

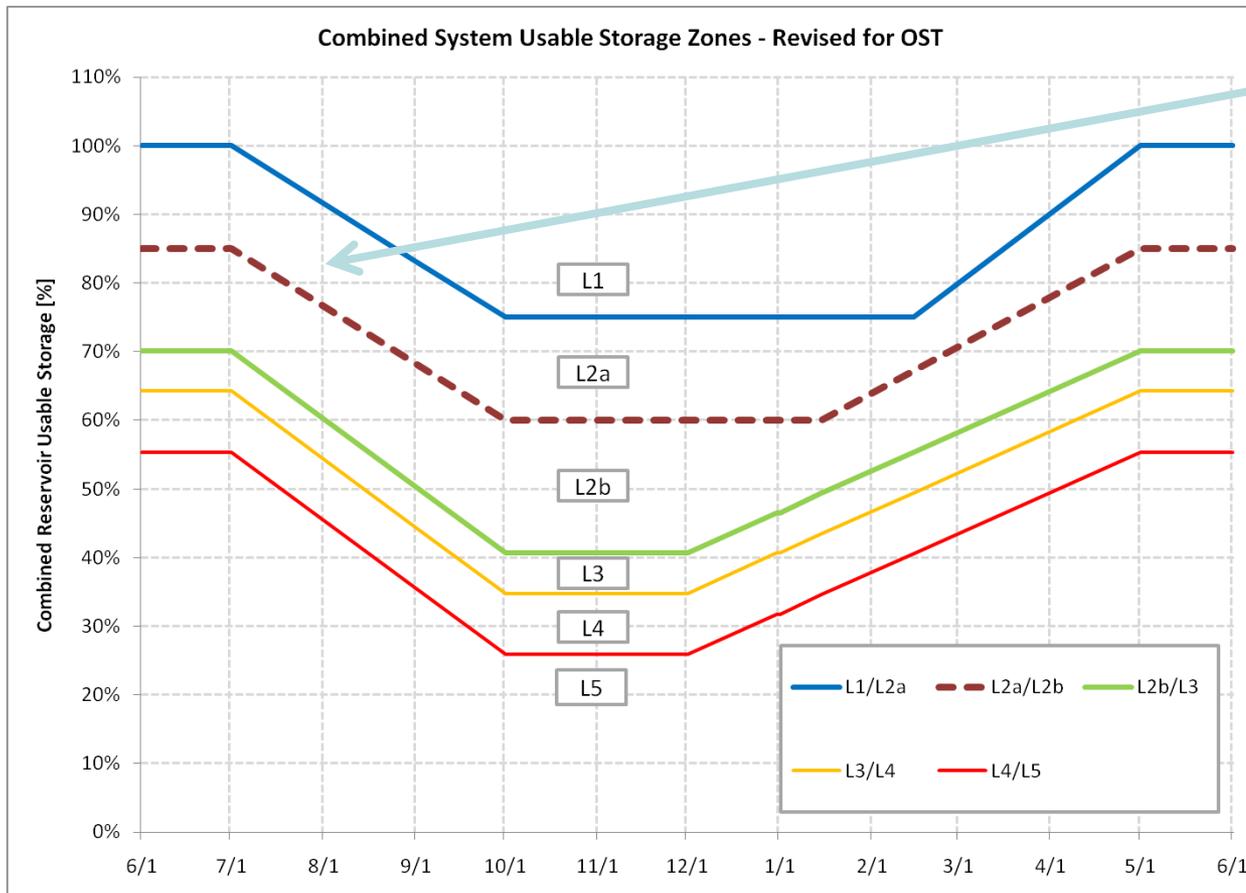
PCN Release Target



609 mgd (~944 cfs)

Determining a Table

- Table based on current storage zone and mass balance PCN release target
- What is our storage zone?
 - Initial storage = 223,951 MG ~ 83% full



83% on Aug 1 →
L2a Zone

Determining a Table

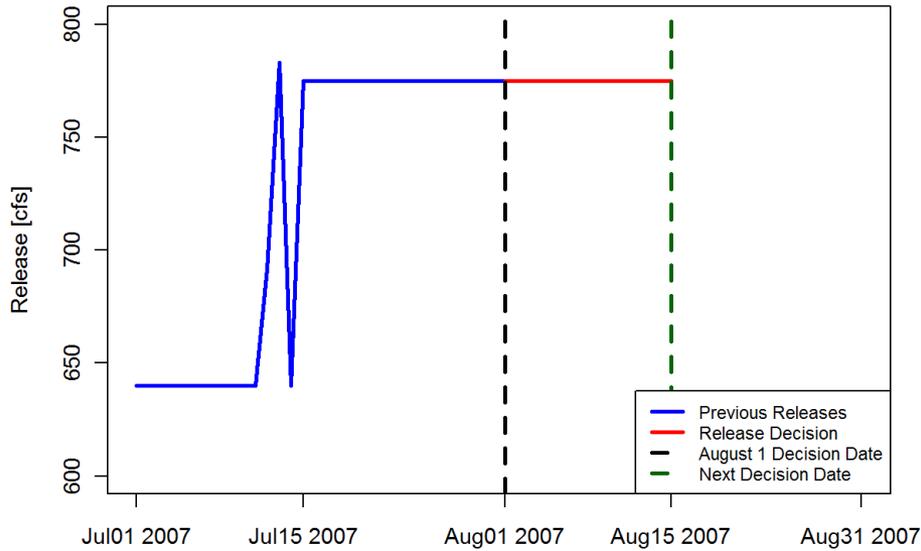
- Which table at L2a storage zone most closely matches 944 cfs release target during August?

OST-FFMP Schedule	L2a Storage Zone Summer: Jul 1 – Aug 31			
	Pepacton	Cannonsville	Neversink	Total
Base	100	225	75	400
A (“10 mgd Available”)	110	245	80	435
B (“20 mgd Available”)	125	275	90	490
C (“35 mgd Available”)	140	325	100	565
D (“50 mgd Available”)	140	400	100	640
E (“75 mgd Available”)	140	525	110	775
F (“100 mgd Available”)	140	525	110	775

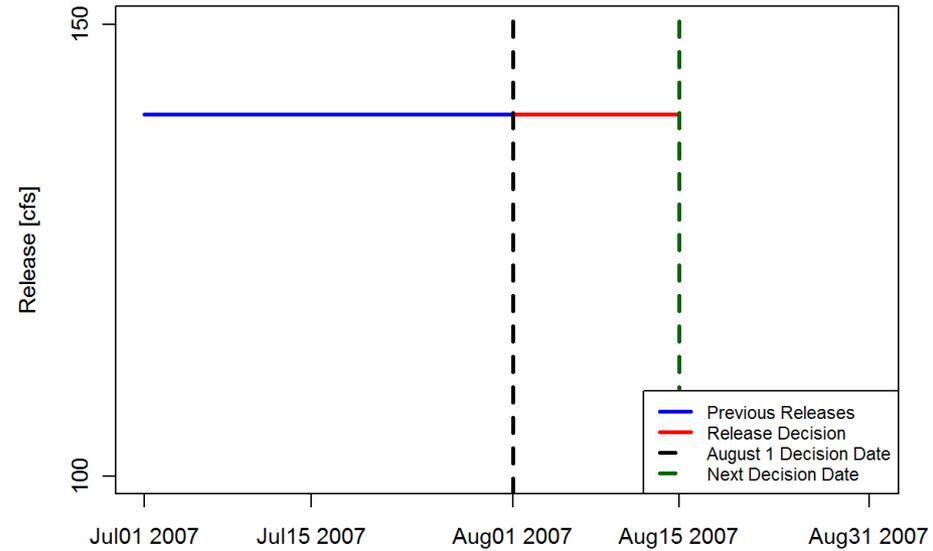
- Note that 944 cfs is greater than Schedule F PCN release
- Max (and min) releases are bounded by the table values

Resulting Releases

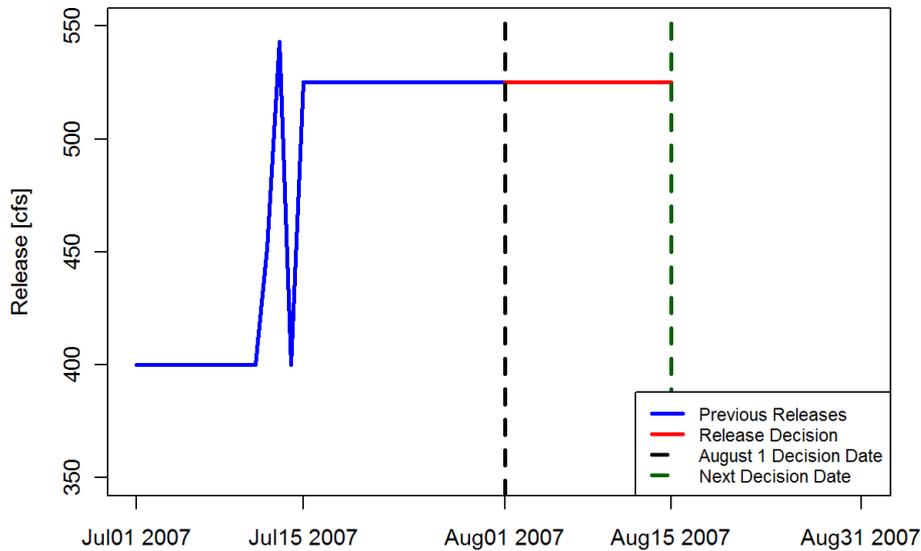
PCN



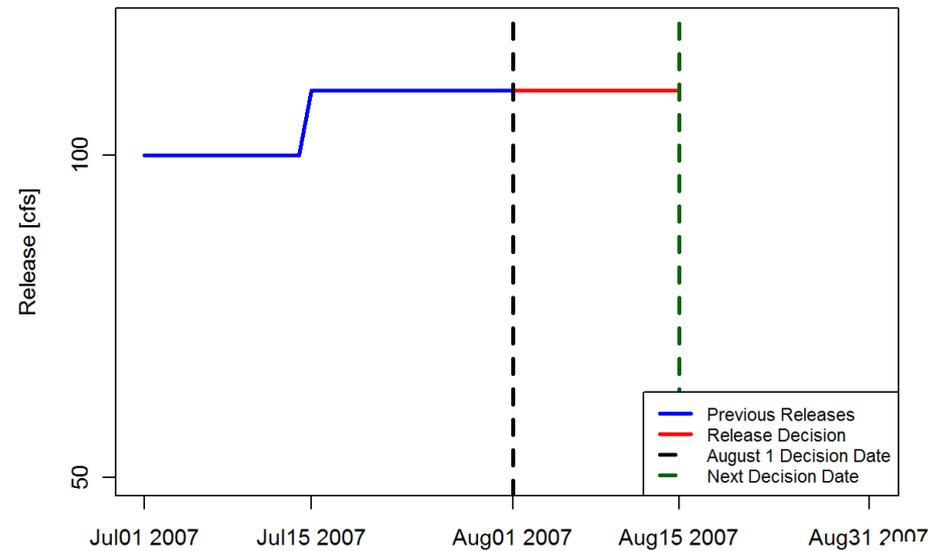
Pepacton



Cannonsville



Neversink



Example Calculations from Long-Term Simulation (1927 – 2008)

2. OST-FFMP Enhanced Flood Mitigation January 1, 2006

Today's Total PCN Storage



Current System Status

+ Cumulative PCN Inflows
over the Next 7 Days



Streamflow Forecasts
(50th Percentile)

- Cumulative PCN Release
over the Next 7 Days



Based on OST-FFMP
Table Selection

- Cumulative PCN Diversions
over the Next 7 Days



Estimated Volume to
Meet NYC Demand

- Conditional Storage
Objective (CSO)



Boundary between L1-b
and L1-c Zones

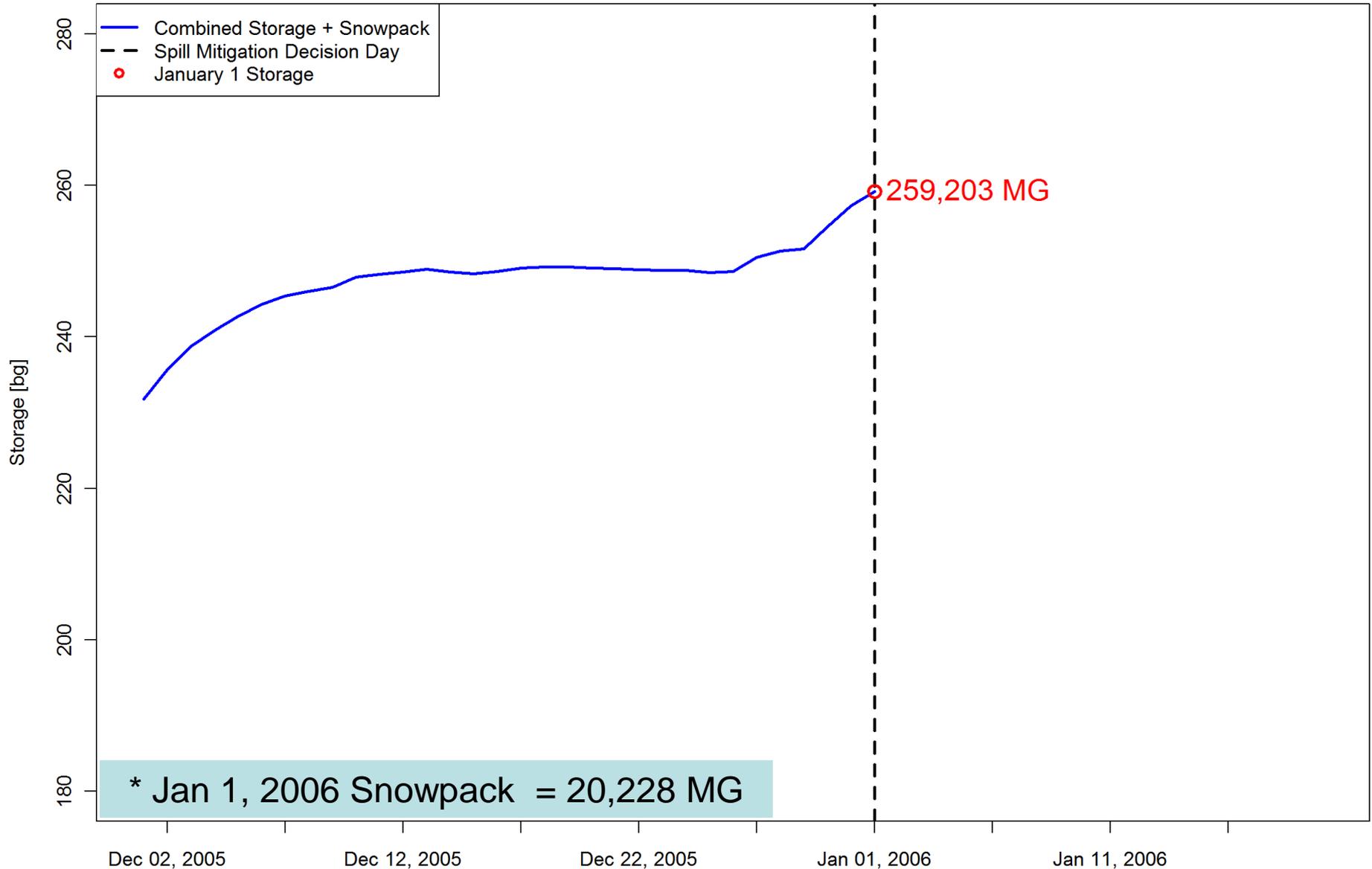
= Predicted 7 Day Storage
Surplus Relative to CSO



Release Estimated
Surplus; Re-Evaluate
Daily

Today's (Jan 1, 2006) Total System Storage

PCN Storage + 50% Snowpack

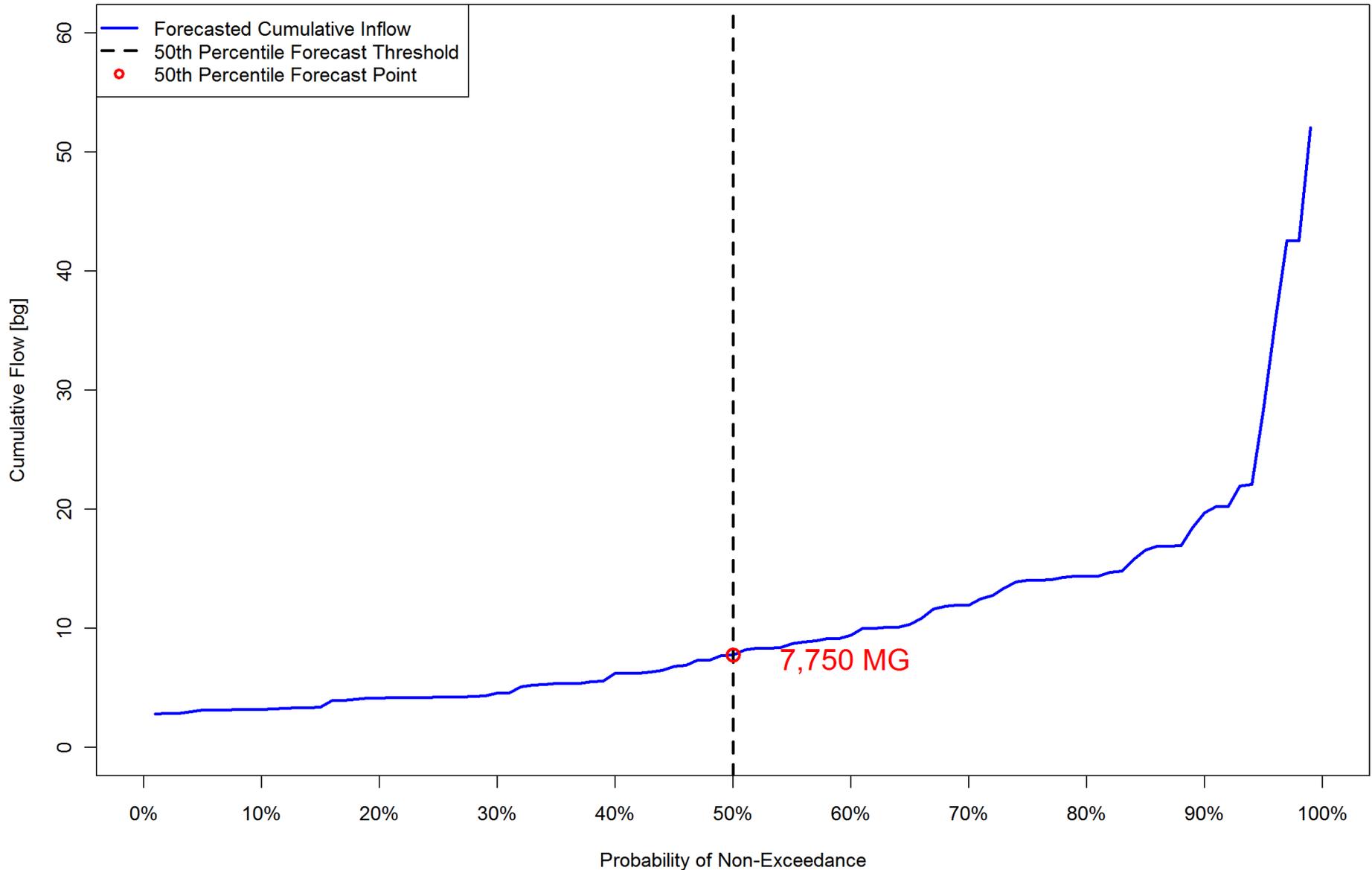


Enhanced Flood Mitigation Rule Mass Balance

	Today's Total PCN Storage	→	259,203 MG
+	Cumulative PCN Inflows over the Next 7 Days	→	Streamflow Forecasts (50th Percentile)
-	Cumulative PCN Release over the Next 7 Days	→	Based on OST-FFMP Table Selection
-	Cumulative PCN Diversions over the Next 7 Days	→	Estimated Volume to Meet NYC Demand
-	Conditional Storage Objective (CSO)	→	Boundary between L1-b and L1-c Zones
<hr/>			
=	Predicted 7 Day Storage Surplus Relative to CSO	→	Release Estimated Surplus; Re-Evaluate Daily

7 Day Cumulative PCN Inflow Forecast

Distribution of Forecasted Cumulative PCN Inflow from Jan 1, 2006 - Jan 7, 2006

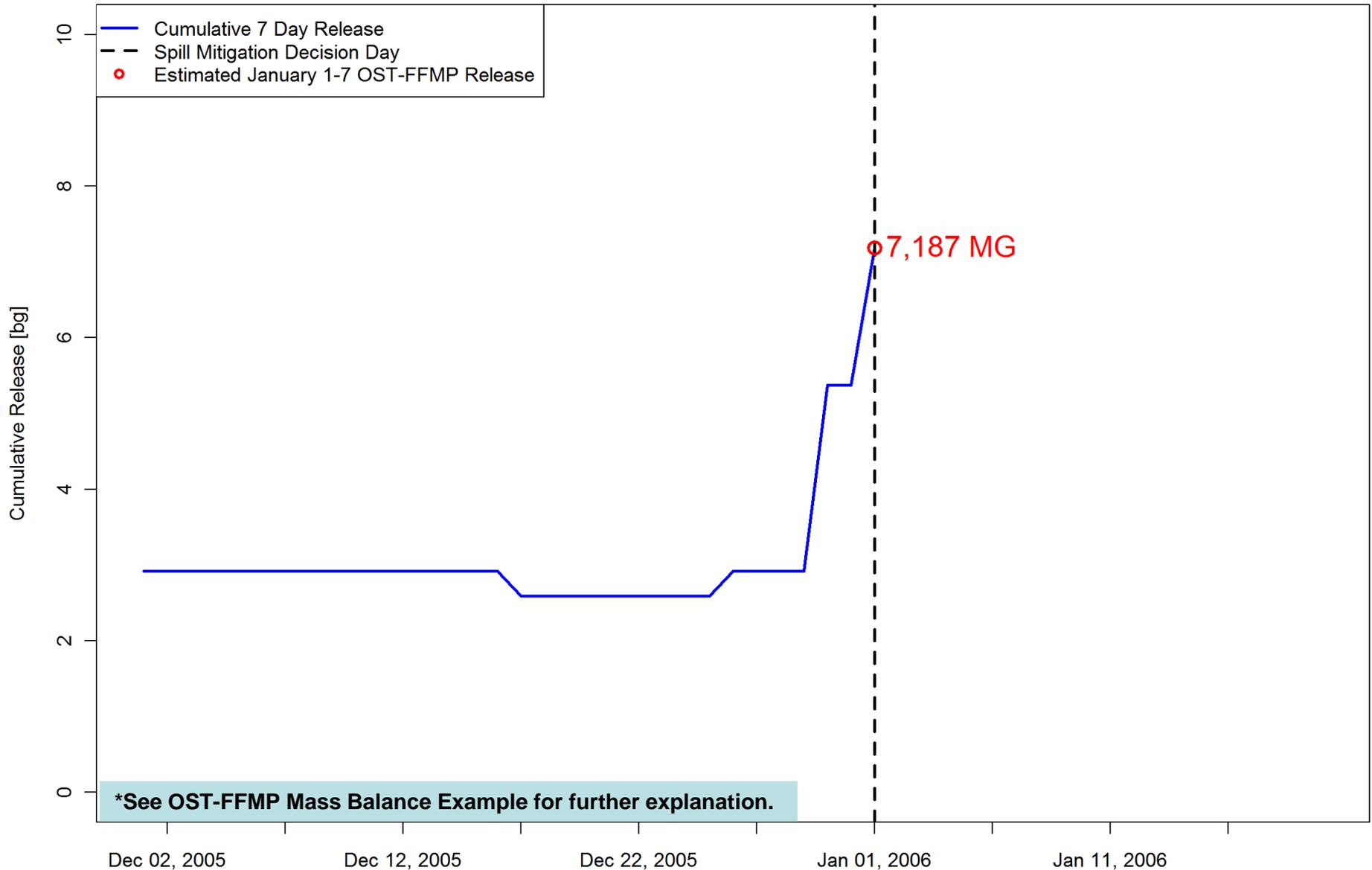


Enhanced Flood Mitigation Rule Mass Balance

	Today's Total PCN Storage	→	259,203 MG
+	Cumulative PCN Inflows over the Next 7 Days	→	7,750 MG
-	Cumulative PCN Release over the Next 7 Days	→	Based on OST-FFMP Table Selection
-	Cumulative PCN Diversions over the Next 7 Days	→	Estimated Volume to Meet NYC Demand
-	Conditional Storage Objective (CSO)	→	Boundary between L1-b and L1-c Zones
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=	Predicted 7 Day Storage Surplus Relative to CSO	→	Release Estimated Surplus; Re-Evaluate Daily

OST-FFMP Release Decision*

Cumulative 7 Day OST-FFMP PCN Release

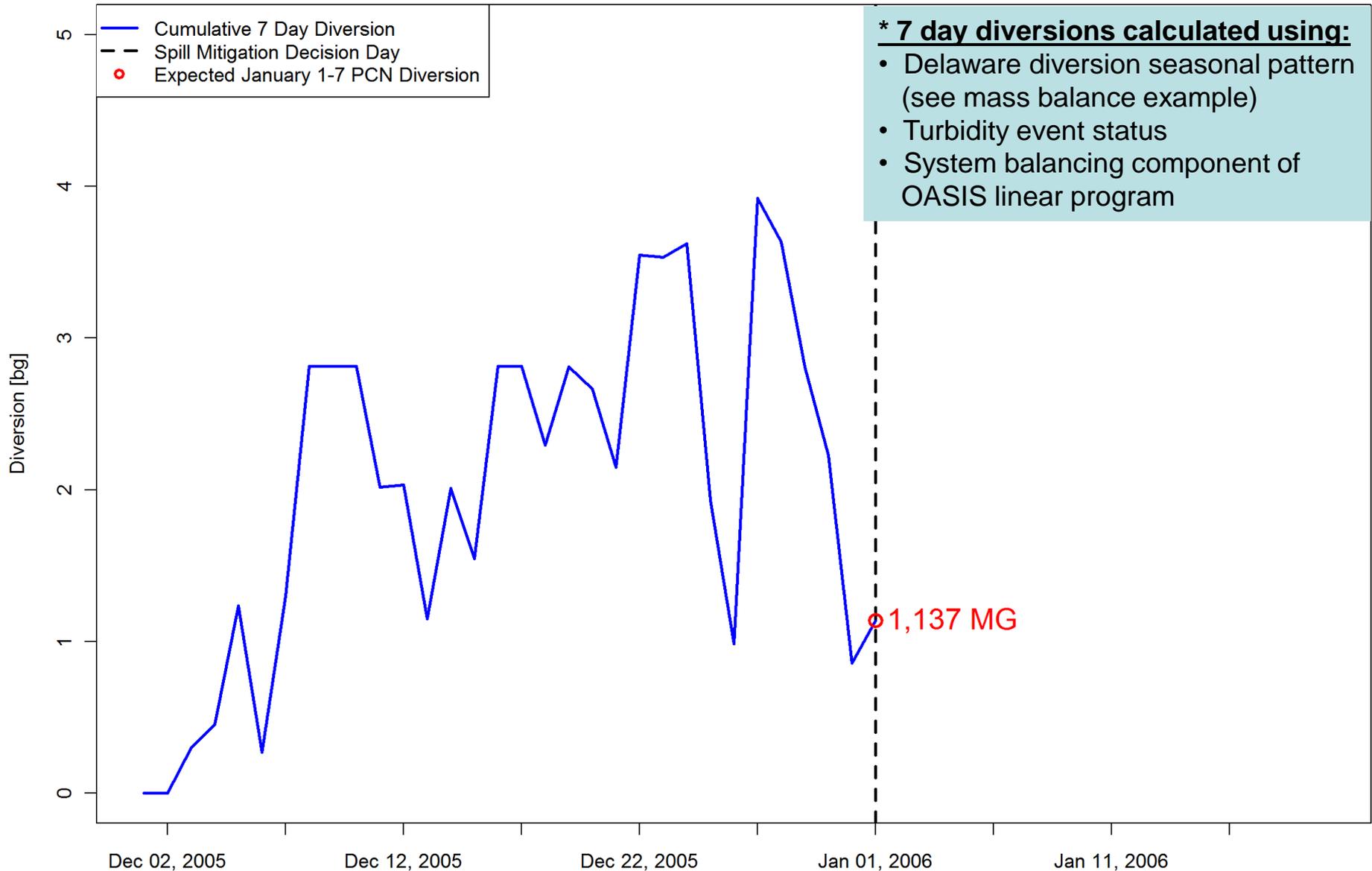


Enhanced Flood Mitigation Rule Mass Balance

	Today's Total PCN Storage	→	259,203 MG
+	Cumulative PCN Inflows over the Next 7 Days	→	7,750 MG
-	Cumulative PCN Release over the Next 7 Days	→	7,187 MG
-	Cumulative PCN Diversions over the Next 7 Days	→	Estimated Volume to Meet NYC Demand
-	Conditional Storage Objective (CSO)	→	Boundary between L1-b and L1-c Zones
<hr/>			
=	Predicted 7 Day Storage Surplus Relative to CSO	→	Release Estimated Surplus; Re-Evaluate Daily

Short-Term Estimation of 7-Day PCN Diversions*

Cumulative 7 Day PCN Diversion

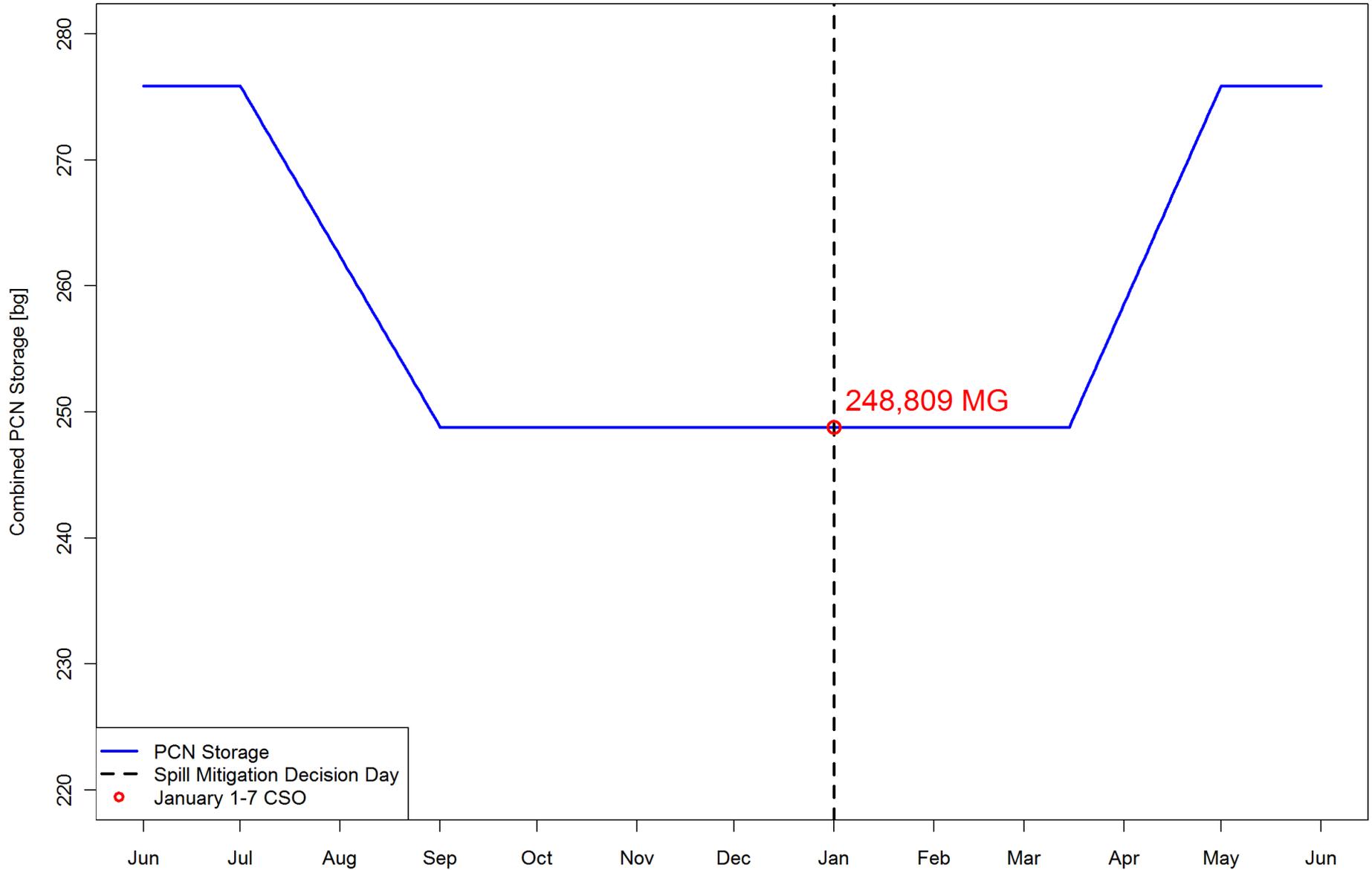


Enhanced Flood Mitigation Rule Mass Balance

	Today's Total PCN Storage	→	259,203 MG
+	Cumulative PCN Inflows over the Next 7 Days	→	7,750 MG
-	Cumulative PCN Release over the Next 7 Days	→	7,187 MG
-	Cumulative PCN Diversions over the Next 7 Days	→	1,137 MG
-	Conditional Storage Objective (CSO)	→	Boundary between L1-b and L1-c Zones
<hr/>			
=	Predicted 7 Day Storage Surplus Relative to CSO	→	Release Estimated Surplus; Re-Evaluate Daily

Conditional Storage Objective

Conditional Storage Objective



Enhanced Flood Mitigation Rule Mass Balance

	Today's Total PCN Storage	→	259,203 MG
+	Cumulative PCN Inflows over the Next 7 Days	→	7,750 MG
-	Cumulative PCN Release over the Next 7 Days	→	7,187 MG
-	Cumulative PCN Diversions over the Next 7 Days	→	1,137 MG
-	Conditional Storage Objective (CSO)	→	248,809 MG
<hr/>			
=	Predicted 7 Day Storage Surplus Relative to CSO	→	<u>9,820 MG</u>

Translating Surplus into Releases

Predicted 7 Day Storage
Surplus Relative to CSO



9,820 MG

+

Cumulative PCN Release
over the Next 7 Days



7,187 MG



7 Days

Ideal PCN Release Target



2,430 MG

Pepacton Release:

$$\text{PCN Release Target} \times \frac{\text{Pepacton Usable Storage}}{\text{PCN Usable Storage}^*}$$

Cannonsville Release:

$$\text{PCN Release Target} \times \frac{\text{Cannonsville Usable Storage}}{\text{PCN Usable Storage}^*}$$

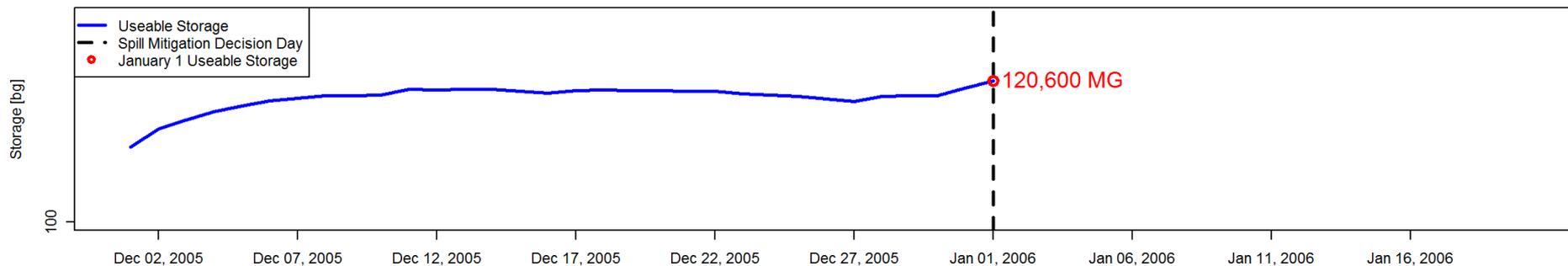
Neversink Release:

$$\text{PCN Release Target} \times \frac{\text{Neversink Usable Storage}}{\text{PCN Usable Storage}^*}$$

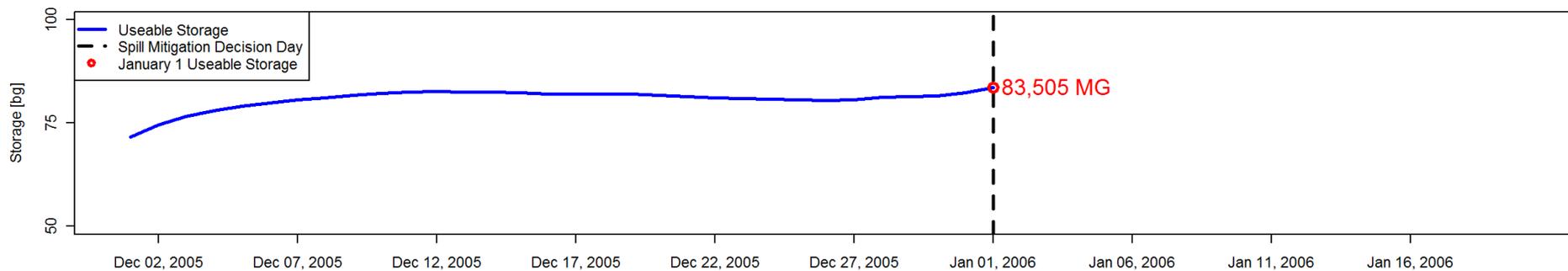
* Not including snowpack (238,975 MG)

Jan 1, 2006 PCN Usable Storage

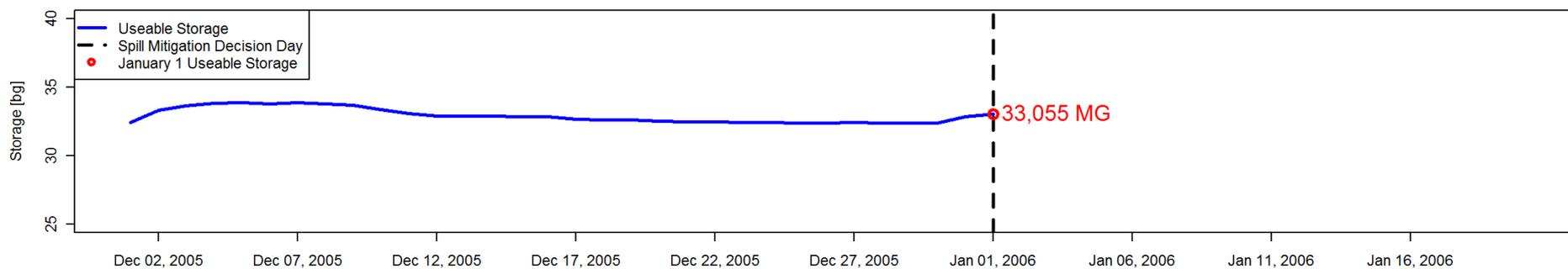
Pepacton



Cannonsville



Neversink



Pepacton Release:

$$2,430 \text{ MG} \times \frac{120,600 \text{ MG}}{238,975 \text{ MG}} \rightarrow 1,226 \text{ MG} \sim 1,900 \text{ cfs}^*$$

\rightarrow 700 cfs

Cannonsville Release:

$$2,430 \text{ MG} \times \frac{83,505 \text{ MG}}{238,975 \text{ MG}} \rightarrow 849 \text{ MG} \sim 1,314 \text{ cfs}$$

\rightarrow 1,314 cfs

Neversink Release:

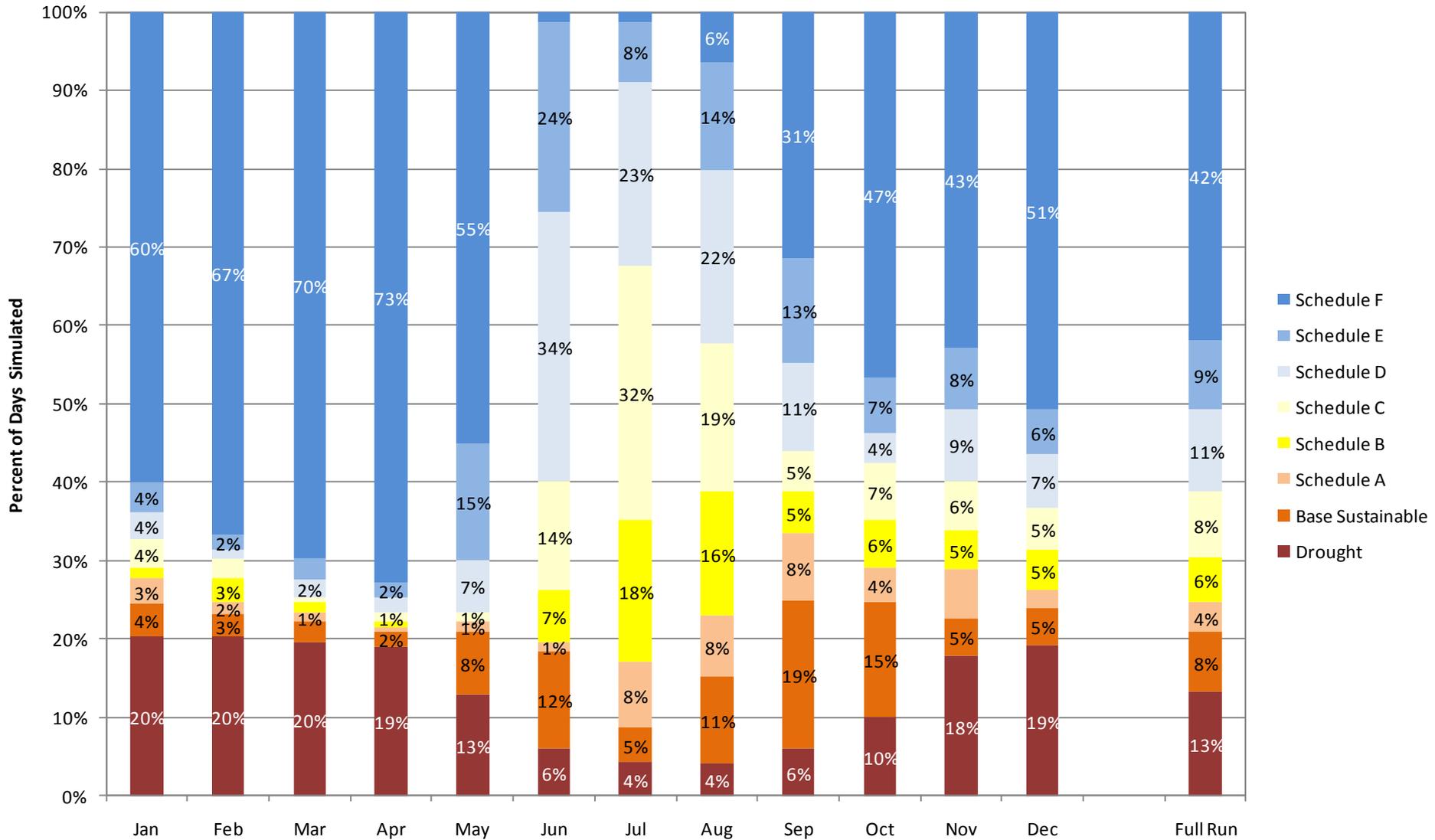
$$2,430 \text{ MG} \times \frac{33,055 \text{ MG}}{238,975 \text{ MG}} \rightarrow 336 \text{ MG} \sim 521 \text{ cfs}^*$$

\rightarrow 190 cfs

OST-FFMP from 3/8 RFAC Mtg

OST-FFMP spends 70% of the time at Sched. C or higher

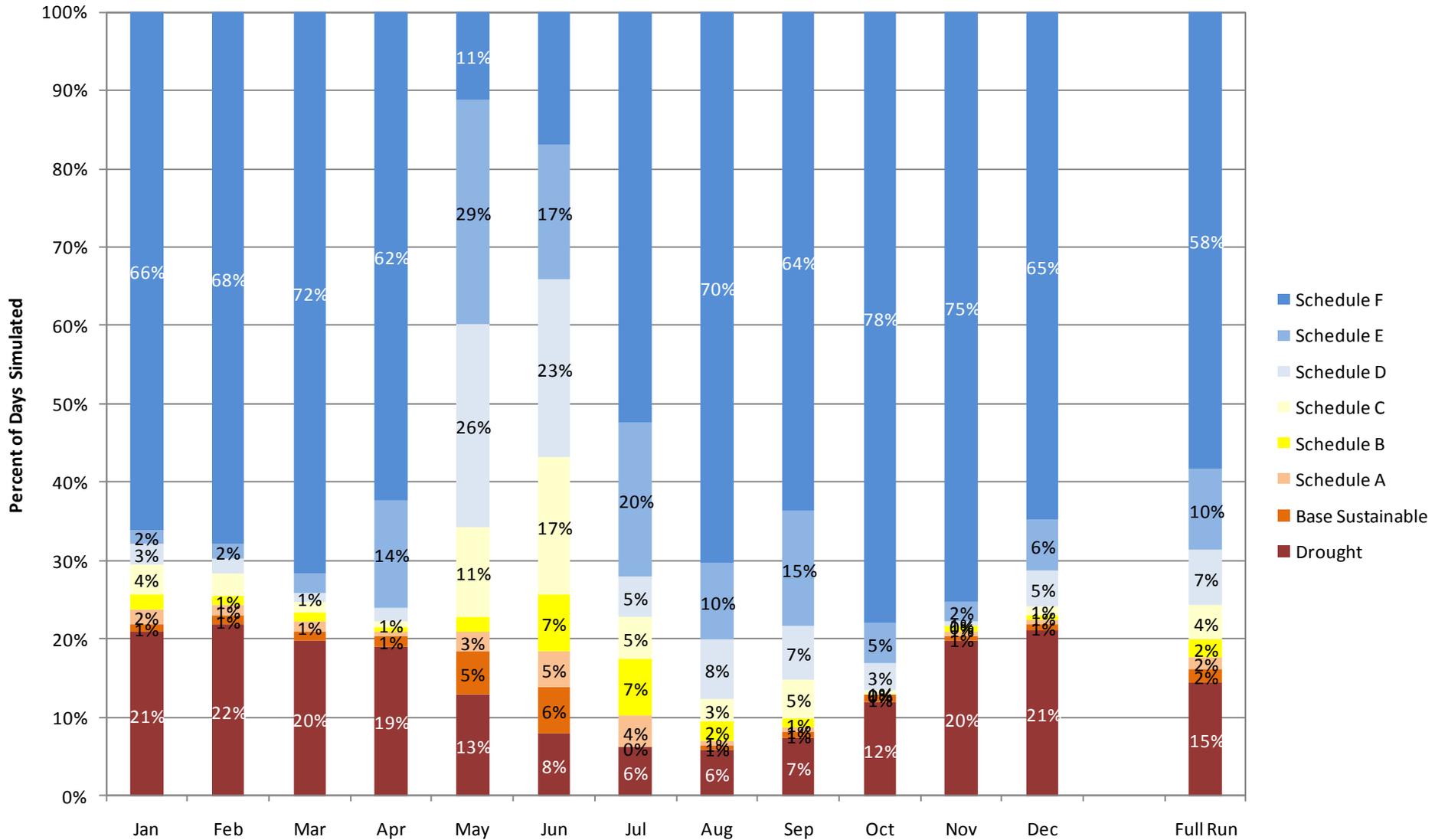
OST-FFMP (3/8/11)



Proposed OST-FFMP

OST-FFMP spends 79% of the time at Sched. C or higher

OST-FFMP

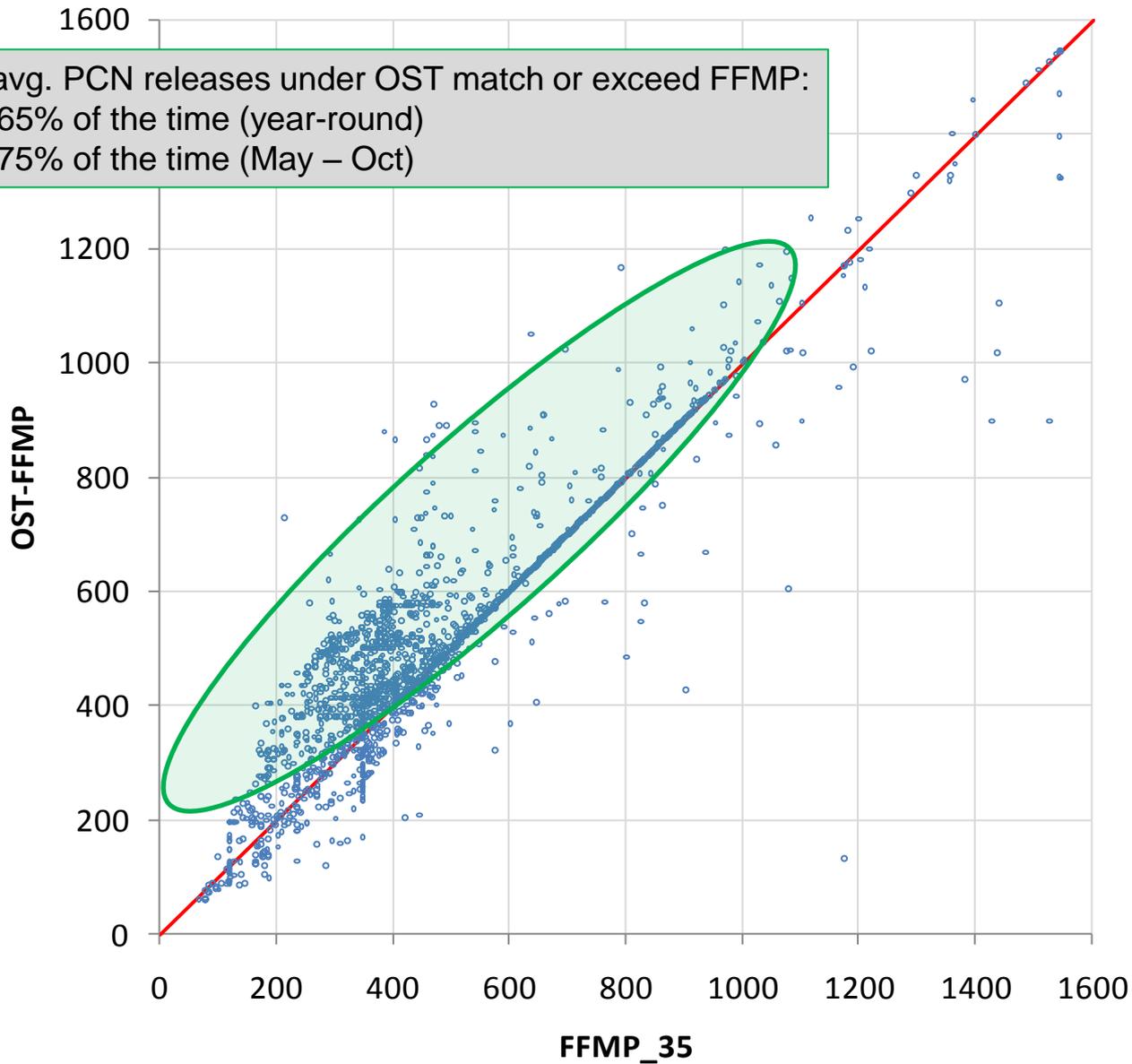


OST-FFMP from 3/8 RFAC Mtg

Weekly Average PCN Release, May-Oct (mgd)

Weekly avg. PCN releases under OST match or exceed FFMP:

- Over 65% of the time (year-round)
- Over 75% of the time (May – Oct)

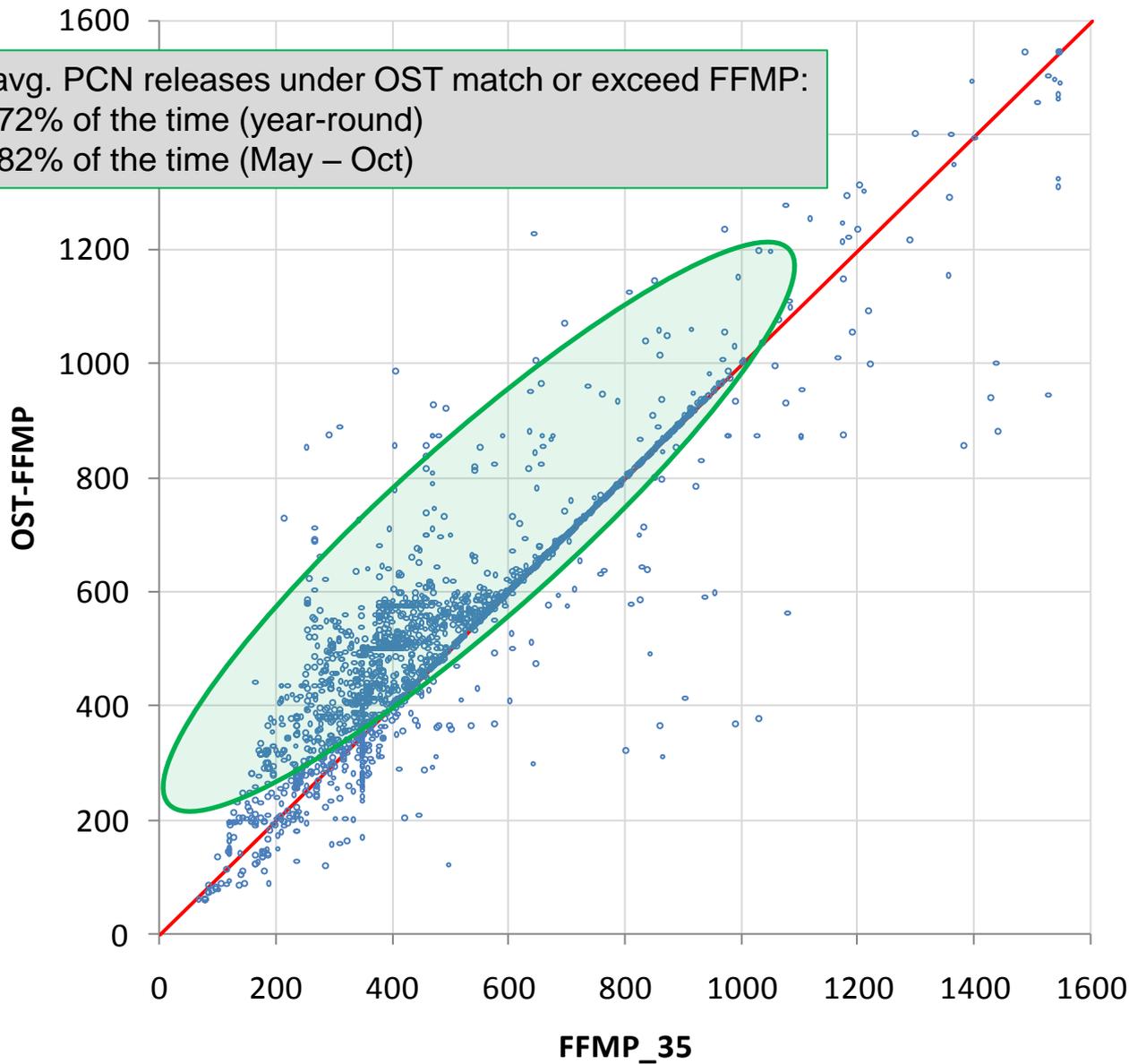


Proposed OST-FFMP

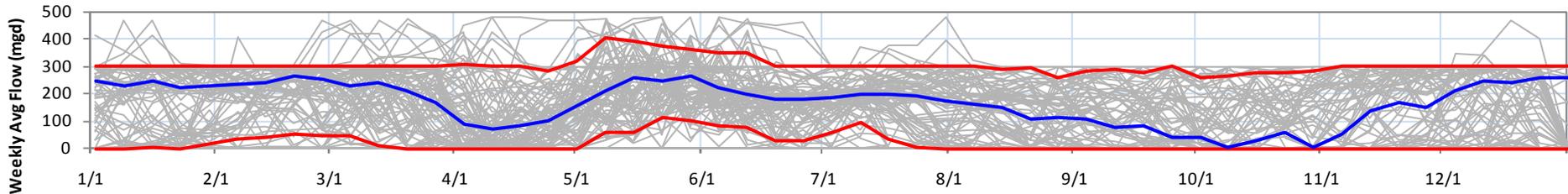
Weekly Average PCN Release, May-Oct (mgd)

Weekly avg. PCN releases under OST match or exceed FFMP:

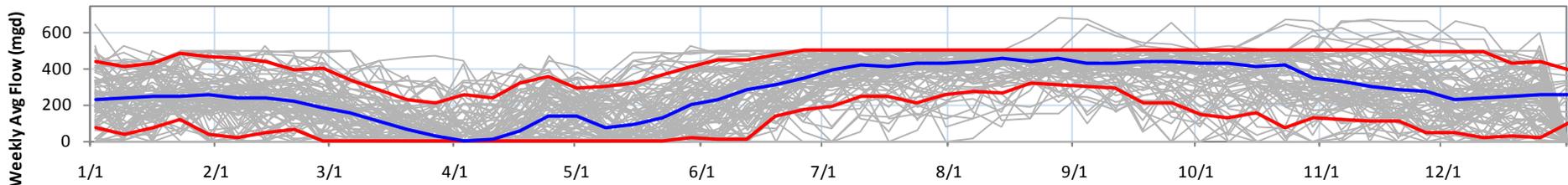
- Over 72% of the time (year-round)
- Over 82% of the time (May – Oct)



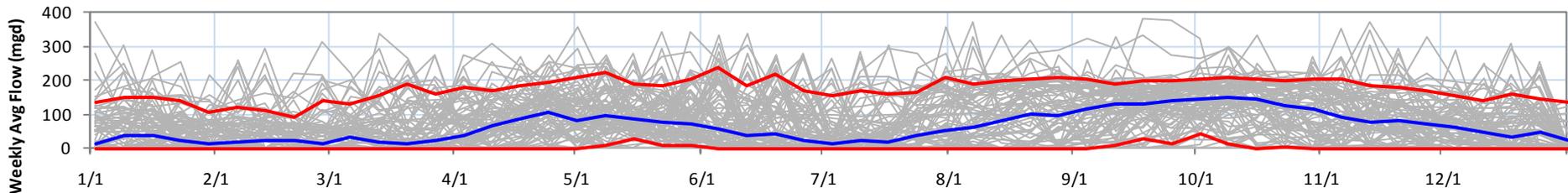
Cannonsville Diversion



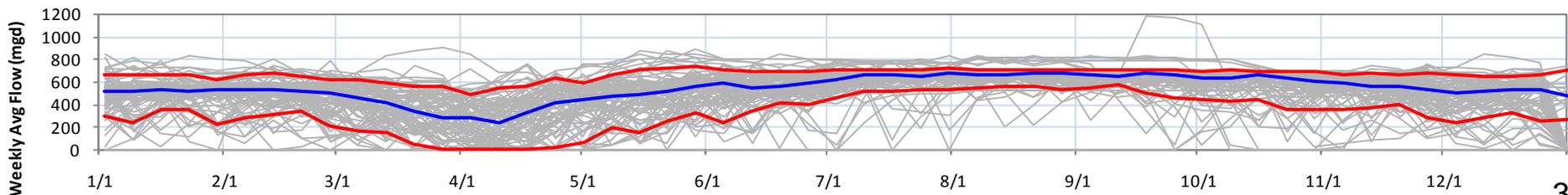
Pepacton Diversion



Neversink Diversion

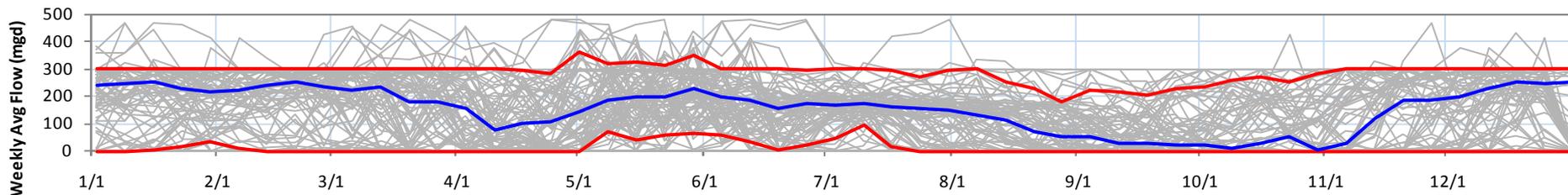


PCN Diversion

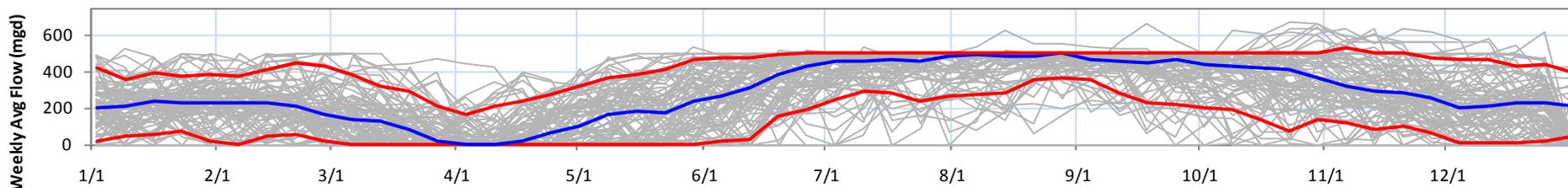


OST-FFMP

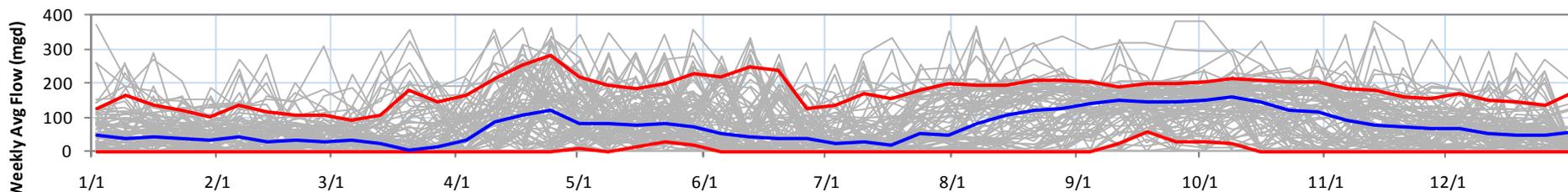
Cannonsville Diversion



Pepacton Diversion



Neversink Diversion



PCN Diversion

